Appendices

Water System Comprehensive Plan Update

List of Appendices

Appendix A

WATER FACILITIES INVENTORY FORM (WFI)

WATER FACILITIES INVENTORY (WFI) FORM

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

ONE FORM PER SYSTEM

Quarter: 1
Updated: 01/17/2013
Printed: 2/5/2013
WFI Printed For: On-Demand
Submission Reason: Pop/Connect

RETURN TO: Southwest Regional Office, PO Box 47823, Olympia, WA, 98504

1. SYSTEM ID NO.	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
43500 Y	LACEY WATER DEPARTMENT	THURSTON	A	Comm

6. PRIMARY CONTACT NAME & MAILING ADDRESS	7. OWNER NAME & MAILING ADDRESS	8. Owner Number 003131
PETER C. BROOKS [MANAGER] 420 COLLEGE ST SE LACEY, WA 98503-1238	LACEY, CITY OF TERRY R. CARGIL 420 COLLEGE ST SE LACEY, WA 98503-1238	TITLE: MANAGER
STREET ADDRESS IF DIFFERENT FROM ABOVE	STREET ADDRESS IF DIFFERENT FROM ABOVE	
ATTN ADDRESS CITY STATE ZIP	ATTN ADDRESS CITY	STATE ZIP

9. 24 HOUR PRIMARY CONTACT INFORMATION	10. OWNER CONTACT INFORMATION
Primary Contact Daytime Phone: (360) 438-2675	Owner Daytime Phone: (360) 413-4395
Primary Contact Mobile/Cell Phone: (360) 878-0303	Owner Mobile/Cell Phone:
Primary Contact Evening Phone: (xxx) xxx-xxxx	Owner Evening Phone: (xxx) xxx-xxxx
Fax:(360) 456-7799 | E-mail: XXXXXX	Owner Fax Phone: | E-mail: XXXXXX

WAC 246-290-420(9) requires that water systems provide 24-hour contact information for emergencies.

11. SATELLITE MANAGEMENT AGENCY - SMA (check only one)

- [x] Not applicable (Skip to #12)
- [ ] Owned and Managed SMA NAME: ____________ SMA Number:
- [ ] Managed Only
- [ ] Owned Only

12. WATER SYSTEM CHARACTERISTICS (mark all that apply)

[ ] Agricultural	[x] Hospital/Clinic	[x] Residential
[x] Commercial / Business	[x] Industrial	[x] School
[x] Day Care	[x] Licensed Residential Facility	[ ] Temporary Farm Worker
[x] Food Service/Food Permit	[x] Lodging	[x] Other (church, fire station, etc.): ____________
[x] 1,000 or more person event for 2 or more days per year	[x] Recreational / RV Park	

13. WATER SYSTEM OWNERSHIP (mark only one)				14. STORAGE CAPACITY (gallons)
[ ] Association	[ ] County	[ ] Investor	[ ] Special District	
[x] City / Town	[ ] Federal	[ ] Private	[ ] State	12,847,000

- SEE NEXT PAGE FOR A COMPLETE LIST OF SOURCES -

WATER FACILITIES INVENTORY (WFI) FORM - Continued

1. SYSTEM ID NO.	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
43500 Y	LACEY WATER DEPARTMENT	THURSTON	A	Comm

15	16 SOURCE NAME	17 INTERTIE	18 SOURCE CATEGORY										19 USE			20	21 TREATMENT						22 DEPTH	23	24 SOURCE LOCATION			
Source Number	LIST UTILITY'S NAME FOR SOURCE AND WELL TAG ID NUMBER. Example: WELL #1 XYZ456 IF SOURCE IS PURCHASED OR INTERTIED, LIST SELLER'S NAME Example: SEATTLE	INTERTIE SYSTEM ID NUMBER	WELL	WELL FIELD	WELL IN A WELL FIELD	SPRING	SPRING FIELD	SPRING IN SPRING FIELD	SEA WATER	SURFACE WATER	RANNEY / INF. GALLERY	OTHER	PERMANEANT	SEASONAL	EMERGENCY	SOURCE METERED	NONE	CHLORINATION	FILTRATION	FLUORIDATION	IRRADIATION (UV)	OTHER	DEPTH TO FIRST OPEN INTERVAL IN FEET	CAPACITY (GALLONS PER MINUTE)	1/4, 1/4 SECTION	SECTION NUMBER	TOWNSHIP	RANGE
S01	College & 32nd AAA936		X										X			Y		X					100	600	NW SW	28	18N	01W
S02	College & 32nd AAB878 WW				X								X			Y	X						194	600	NW SW	28	18N	01W
S03	College & 32nd AAA935 WW				X								X			Y	X						187	200	NW SW	28	18N	01W
S04	Golf Club Estates AAA932		X										X			Y		X				X	66	1100	SW NW	04	17N	01W
S05	InAct 02/01/1988 Stanfield & 35th		X										X				X						100	0	NW SE	27	18N	01W
S06	Judd Hill AAA940		X										X			Y		X					190	600	SE SW	21	18N	01W
S07	Fire Station AAA930		X										X			Y		X				X	428	1700	NW NE	21	18N	01W
S08	InAct 12/13/1990 Tanglewilde East		X										X				X						300	520	SW NW	12	18N	01W
S09	Little Prairie AAB880		X										X			Y		X					224	800	SW SW	33	18N	01W
S10	Mt Greens AAB881		X										X			Y		X					177	1100	SW SW	33	18N	01W
S11	InAct 02/01/1988 Panorama		X										X				X						82	0	NW SE	20	18N	01W
S13	InAct 01/01/1990 Meridian Acres #1		X										X				X						242	250	SE SE	12	18N	01W
S14	InAct 11/20/2006 Meridian Acres #2		X										X			Y	X						272	250	SE SE	12	18N	01W
S15	Beachcrest #1 AAA941 WW				X								X			Y	X						115	165	SE SW	25	19N	01W
S16	Beachcrest AAA942 WW				X								X			Y	X						113	350	SE SW	25	19N	01W
S17	WF (S015 & 16) Beachcrest			X									X			Y		X					115	515	SE SW	25	19N	01W
S18	WF(S02 & 3)College & 32nd			X									X			Y		X					187	800	NW SW	28	18N	01W
S19	Hawks Prairie Well #1 AAB877		X										X			Y		X	X			X	585	800	SE NE	35	19N	01W
S20	McAllister AAY302		X										X			Y		X					180	700	NE SE	24	18N	01W
S21	Madrona 1 ABY233 WW				X								X			Y	X						263	1600	NE NW	24	18N	01W
S22	Madrona 2 ACR769 WW				X								X			Y	X						265	1600	NE NW	24	18N	01W
S23	WF (S21 & 22) Madrona			X									X			Y		X					259	3200	NE NW	24	18N	01W
S24	Lacey Nisq S01 Well #19A AAA938		X										X			Y		X					98	70	NW SW	09	18N	01E
S25	Lacey Nisq SO2 Well #19C AAA937		X										X			Y		X					58	250	NW SW	09	18N	01E
S26	InAct 12/03/2007 495681/Capital City		X											X		Y	X						100	350	SW NE	04	17N	01W
S27	Evergreen Est Well #24 AGP478		X										X			Y		X					256	700	NE NW	25	18N	01W
S28	Madrona 3 AEC883		X										X			Y		X					259	1600	NW NW	24	18N	01W
S29	Betti AEC941		X										X			Y		X					297	1000	NW SW	02	18N	01W
S30	63450/Olympia, City of(Pacific Ave)	63450 6											X			Y	X							1388	SW SE	14	18N	01W
S31	Pre-Active 12/13/2011 Hawks Prairie		X										X			Y		X	X			X	585	800	NW SW	35	19N	01W

WATER FACILITIES INVENTORY (WFI) FORM - Continued

1. SYSTEM ID	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
43500 Y	LACEY WATER DEPARTMENT	THURSTON	A	Comm

	ACTIVE SERVICE CONNECTIONS	DOH USE ONLY! CALCULATED ACTIVE CONNECTIONS	DOH USE ONLY! APPROVED CONNECTIONS
25. SINGLE FAMILY RESIDENCES (How many of the following do you have?)	0	27106	Unspecified
A. Full Time Single Family Residences (Occupied 180 days or more per year)	20968		
B. Part Time Single Family Residences (Occupied less than 180 days per year)	0		
26. MULTI-FAMILY RESIDENTIAL BUILDINGS (How many of the following do you have?)			
A. Apartment Buildings, condos, duplexes, barracks, dorms	840		
B. Full Time Residential Units in the Apartments, Condos, Duplexes, Dorms that are occupied more than 180 days/year	6138		
C. Part Time Residential Units in the Apartments, Condos, Duplexes, Dorms that are occupied less than 180 days/year	0		
27. NON-RESIDENTIAL CONNECTIONS (How many of the following do you have?)			
A. Recreational Services and/or Transient Accommodations (Campsites, RV sites, hotel/motel/overnight units)	0	0	
B. Institutional, Commercial/Business, School, Day Care, Industrial Services, etc.	858	858	
28. TOTAL SERVICE CONNECTIONS		27964	

29. FULL-TIME RESIDENTIAL POPULATION

A. How many residents are served by this system 180 or more days per year? 67482

30. PART-TIME RESIDENTIAL POPULATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
A. How many part-time residents are present each month?												
B. How many days per month are they present?												

31. TEMPORARY & TRANSIENT USERS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
A. How many total visitors, attendees, travelers, campers, patients or customers have access to the water system each month?	760	760	760	760	760	1200	1200	1200	760	760	760	1200
B. How many days per month is water accessible to the public?	31	28	31	30	31	30	31	31	30	31	30	31

32. REGULAR NON-RESIDENTIAL USERS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
A. If you have schools, daycares, or businesses connected to your water system, how many students daycare children and/or employees are present each month?	5400	5400	5400	5400	5400	4620	4620	4620	5400	5400	5400	5400
B. How many days per month are they present?	31	28	31	30	31	30	31	31	30	31	30	31

33. ROUTINE COLIFORM SCHEDULE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	80	80	80	80	80	80	80	80	80	80	80	80

35. Reason for Submitting WFI:

☐ Update - Change ☐ Update - No Change ☐ Inactivate ☐ Re-Activate ☐ Name Change ☐ New System ☐ Other ________________

36. I certify that the information stated on this WFI form is correct to the best of my knowledge.

SIGNATURE: ____
DATE: ________________________________

PRINT NAME: ____
TITLE: ________________________________

WS ID	WS Name
43500	LACEY WATER DEPARTMENT

Total WFI Printed: 1

Appendix B

DEPARTMENT OF HEALTH WATER SYSTEM PLAN CHECKLIST

Appendix II
Plan Content Checklist

The following checklist summarizes the topics which are discussed in each section of this handbook. It is intended to serve as a checklist for the purveyor, assuring that key topics are included in the draft WSP. DOH will use this checklist during the plan review process.

Water System Planning Handbook Chapter	**WSP Chapter (If Applicable)**	**WSP Page (If Applicable)**
Chapter 1 - Description of Water System		
Ownership and Management	1	
System Name	1	
Type of Ownership	1	
Management Structure	1	
Water Facilities Inventory Report Form	App A	
System Background	1	
History of Water System Development and Growth	1	
Geography	1	
Neighboring/Adjacent Purveyors	1	
Ordinances/By Laws	2	
Inventory of Existing Facilities	1	
Description of Facilities and Major Components	1	
Number of Service Connections (Existing and Approved)	3	
Existing Interties	1	
Related Plans	1	
List of Related Plans	1	
Comments From Agencies and Adjacent Purveyors	App C	
Responses to Comments	App C	
Existing Service Area and Characteristics	1	
Existing Service Area Map	1	
Zoning and Land Use	1	
Future Service Area	1	
Future Service Area Map	1	
Zoning and Land Use	1	
Service Area Agreements	App G	
Service Area Policies	2	
Satellite Management	2	
Condition of Service Policies	2	

Chapter 1 - Description of Water System (Cont.)	WSP Chapter (If Applicable)	WSP Page (If Applicable)
Complaints	9	
Policy	9	
Recordkeeping	9	
Chapter 2 - Basic Planning, Data and Water Demand Forecasting		
Current Population, Service Connections, Water Use, and Equivalent Residential Units	3	
Current Population	3	
Total Service Connections	3	
Water Use Data Collection	3	
Equivalent Residential Units	3	
Projected Land Use, Future Population, and Water Demand	3	
Projected Land Use	3	
Projected Population	3	
Projected Non-Residential Water Needs	3	
Projected Non-Revenue Water	3	
Water Rates and Rate Impacts on Water Demand	3	
Water Demand Forecasting	3	
Chapter 3 - System Analysis		
System Design Standards	2	
Water Quality Analysis	7	
Historical Review of Trends	7	
Future Requirements	7	
System Description and Analysis	8	
Source	4	
Water Treatment	7	
Storage	8	
Distribution System/Hydraulic Analysis	8	
Identification of System Improvements	8	
Assessment of Alternatives	10	
Prioritizing Improvements	10	
Selection of Alternatives	10	
Chapter 4 - Conservation Program, Water Right Analysis, System Reliability and Interties		
Conservation Program Development and Implementation	5	

	WSP Chapter (If Applicable)	WSP Page (If Applicable)
Wellhead Protection Area Information	6	
Chapter 5 - Source Water Protection (Cont.)		
Delineation of Wellhead Protection Area(s)	6	
Contaminant Source Inventory	6	
Notification of Findings	6	
Contingency Plan	6	
Spill Response Plan	6	
Regional Implementation Efforts	6	
Implementation Strategies	6	
Watershed Control Program	6	
Watershed Description/Characteristics	6	
Identification of Activities/Land Uses Detrimental to Water Quality	6	
Watershed Management and Control Measures	6	
Monitoring Program	6	
System Operations	6	
Periodic Watershed Evaluations/Updates	6	
Identification of System Improvements	App M	
Assessment of Alternatives	App M	
Prioritizing Improvements	App M	
Selection of Alternatives	App M	
Chapter 6 - Operation and Maintenance Program		
Water System Management and Personnel	9	
Operator Certification	9	
System Operations and Control	9	
Identification of Major System Components	9	
Routine System Operation	9	
Preventative Maintenance Program	9	
Equipment, Supplies and Chemical Listing	9	
Comprehensive Monitoring (Regulatory Compliance) Plan	7	
Monitoring Plan Elements	7	
Source	7	
Distribution	7	
Treatment	7	
Adjustments to Monitoring Programs	7	
Emergency Response Program	App T	

	WSP Chapter (If Applicable)	WSP Page (If Applicable)
Past Financial Status	N/A	
Chapter 9 - Financial Program (Cont.)		
Improvement Program Financing	N/A	
Financial Viability Test	N/A	
Rate Structure Analysis	N/A	
Water Systems Regulated by UTC	11	
Historical Financial Information	11	
Future Financial Planning Information	11	
Chapter 10 - Miscellaneous Documents		
Supportive Documents		
State Environmental Policy Act		
Other Documents		
Agreements		
Comments on WSP from County	App C	
Comments on WSP from Adjacent Utilities	App C	

Appendix C
ADOPTING RESOLUTION AND COMMENT LETTERS

STATE OF WASHINGTON
DEPARTMENT OF HEALTH
SOUTHWEST DRINKING WATER REGIONAL OPERATIONS
PO Box 47823, Olympia, Washington 98504-7823
TDD Relay 1-800-833-6388

May 30, 2013

Peter Brooks
Lacey Water Department
Post Office Box 3400
Lacey, Washington 98509-3400

Subject: Lacey Water Department, ID #43500Y, Thurston County; Water System Plan, ODW Project #11-1202

Dear Peter Brooks:

The Water System Plan (WSP) received by the Office of Drinking Water (ODW) on December 1, 2011, along with subsequent submittals received on February 28, 2013, and May 28, 2013, have been reviewed and are **APPROVED**.

Approval of this WSP is valid as it relates to current standards outlined in WAC 246-290 revised April 30, 2012, WAC 246-293 revised September 1997, and RCW 70.116 (Municipal Water Law) effective September 2003, and is subject to the qualifications herein. Future changes in the rules and statutes may be more stringent and require facility modification or corrective action.

An approved update of this WSP is required on or before May 30, 2019, unless ODW requests an update or plan amendment pursuant to WAC 246-290-100(9).

APPROVED NUMBER OF CONNECTIONS

Based on the information supplied in the WSP, you have demonstrated adequate capacity to meet the growth projections for the identified six-year planning period. The Office of Drinking Water will reflect this condition by noting on your water facilities inventory form and your operating permit an "unspecified" designation for your system's approved number of connections.

Based on the analysis presented in this document, this water system demonstrates service capacity to adequately serve a total of 41,154 Equivalent Residential Units (ERUs). The limiting factor described in the approved water system plan is the source pumping capacity.

You are responsible for permitting the addition of new service connections to your water system in a manner consistent with the approved document. We expect you to maintain a process, which recognizes all new connections added to the water system, and the water demands associated with each connection. Your process must assure that physical capacity and water right limitations are not exceeded.

LOCAL GOVERNMENT CONSISTENCY

Dave Burns, Principal Planner, City of Lacey signed the local consistency statement on April 30, 2013. Tony Kantas, Associate Planner, Thurston County signed the local consistency statement on May 1, 2013. This meets local government consistency requirements for WSP approval pursuant to RCW 90.03.386 and RCW 43.20.

SERVICE AREA AND DUTY TO SERVE

Pursuant to RCW 90.03.386(2), the service area identified in this WSP service area map may now represent an expanded "place of use" for this system's water rights. Changes in service area should be made through a WSP amendment.

The City of Lacey has a duty to provide new water service within its retail service area. This WSP includes service policies to describe how your system plans to provide new service within your retail service area.

WATER RESOURCES

This approval does not provide any guarantee and should not be considered to provide any guarantee concerning legal use of water or any subsequent water right decisions by the Department of Ecology (Ecology). A copy of this document was sent to Ecology on December 2, 2011. As of the date of this letter, comments have not been received from Ecology. ODW is making this approval based upon the water system's water right analysis.

WATERSHED PLANNING

Ecology has not provided "not inconsistent" determinations with approved or adopted watershed plans for WRIA 13-the Deschutes Watershed and WRIA 11-the Nisqually Watershed. Please contact Ecology for more information.

We recognize the significant effort and resource commitment involved in the preparation of this WSP. Thank you for your cooperation.

If you have any questions, please contact Corina Hayes at (360) 236-3031 or Virpi Salo-Zieman at (360) 236-3037.

Sincerely,

Corina Hayes
Office of Drinking Water, Regional Planner

Virpi Salo-Zieman, P.E.
Office of Drinking Water, Regional Engineer

cc: Thurston County Health Department
Thurston County Planning Department
Tammy Hall, Department of Ecology

ORDINANCE NO. 1413

CITY OF LACEY

AN ORDINANCE OF THE CITY OF LACEY, WASHINGTON, ADOPTING THE CITY OF LACEY WATER SYSTEM COMPREHENSIVE PLAN UPDATE 2013 AS PART OF THE LACEY COMPREHENSIVE PLAN IDENTIFIED IN SECTION 16.03.015 OF THE LACEY MUNICIPAL CODE AND APPROVING A SUMMARY FOR PUBLICATION.

WHEREAS, the City Council in 2003 adopted the existing City of Lacey Water Comprehensive Plan, and

WHEREAS, said plan has been reviewed and recommendations have been made for updating and modification, and

WHEREAS, the City Council finds that the updating and modification of said plan will be in the public interest, NOW, THEREFORE,

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF LACEY, WASHINGTON, as follows:

Section 1. That certain document entitled City of Lacey Water System Comprehensive Plan Update 2013 is hereby adopted as part of the City of Lacey Comprehensive Plan.

Section 2. Section 16.03.015 of the Lacey Municipal Code is hereby amended to read as follows:

Section 16.03.015 Lacey Comprehensive Land Use Plan. That certain series of documents identified as City of Lacey and Thurston County Land Use Plan for the Lacey Urban Growth Area, Housing Element for the City of Lacey and the Lacey Urban Growth Area, Environmental Protection and Resource Conservation Plan for the City of Lacey, City of Lacey Transportation Plan, College Street Improvements Final Report, City of Lacey Capital Facilities Plan, Utilities Element for the Lacey Comprehensive Plan, Comprehensive

Plan for Outdoor Recreation, City of Lacey Water System Comprehensive Plan Update 2013 ~~for City of Lacey~~, City of Lacey 2005 Wastewater Comprehensive Plan Update, Lacey Urban Forest Management Plan, and Economic Development Element for the City of Lacey together with the Comprehensive Plan Downtown Element as supplemented by the City of Lacey Woodland District Guidelines and the Northeast Area Plan constitutes the Lacey Comprehensive Plan and all regulatory and zoning ordinances of the city shall be construed to be consistent with said plan as adopted or hereafter amended.

Section 3. The Summary attached hereto is hereby approved for publication.

PASSED BY THE CITY COUNCIL OF THE CITY OF LACEY, WASHINGTON, at a regularly-called meeting thereof, held this 23 day of MAY, 2013.

CITY COUNCIL

By [signature]
Mayor

Approved as to form:

[signature]
Asst. City Attorney

Attest:

Carol Litten
City Clerk

SUMMARY FOR PUBLICATION

ORDINANCE NO. 1413

CITY OF LACEY

The City Council of the City of Lacey, Washington, passed on May 23, 2013, Ordinance No. 1414, entitled "AN ORDINANCE OF THE CITY OF LACEY, WASHINGTON, ADOPTING THE CITY OF LACEY WATER SYSTEM COMPREHENSIVE PLAN UPDATE 2013 AS PART OF THE LACEY COMPREHENSIVE PLAN IDENTIFIED IN SECTION 16.03.015 OF THE LACEY MUNICIPAL CODE AND APPROVING A SUMMARY FOR PUBLICATION."

The main points of the Ordinance are described as follows:

1. The Ordinance adopts the document entitled City of Lacey Water System Comprehensive Plan Update 2013 as part of the City of Lacey Comprehensive Plan.

2. The Ordinance approves this Summary for publication.

A copy of the full text of this Ordinance will be mailed without charge to any person requesting the same from the City of Lacey.

Published: May 27, 2013.

RESOLUTION NO. 994

CITY OF LACEY

A RESOLUTION RESCINDING RESOLUTION 917 UPON APPROVAL BY THE DEPARTMENT OF HEALTH OF THE CITY OF LACEY WATER SYSTEM COMPREHENSIVE PLAN UPDATE 2013.

WHEREAS, Resolution 917 was approved by the Lacey City Council on December 21, 2006, and

WHEREAS, Resolution 917 instituted policies limiting the availability of water for future water customers, and

WHEREAS, Resolution 917 was necessitated by a limited water rights portfolio and the fast pace of growth at that time, and

WHEREAS, the City of Lacey now has sufficient water rights and a funded Capital Improvement Plan which will allow it to meet the current and future water demands of its designated service area, and

WHEREAS, The Washington State Department of Health has reviewed the City of Lacey Water System Comprehensive Plan Update 2013 (the "Plan") and the Department has indicated that it is prepared to approve the Plan with a water system designation of "Unspecified" once an Ordinance adopting the Plan is received, and

WHEREAS, a water system designation of "Unspecified" will not limit the number of connections the water system can serve, and

WHEREAS, On May 23, 2013 the Lacey City Council passed Ordinance 1413 which adopted the Plan, NOW, THEREFORE,

BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF LACEY, WASHINGTON, that Resolution 917 shall be rescinded effective upon the approval by the Washington State Department of Health of the City of Lacey Water System Comprehensive Plan Update 2013 with a water system designation of "Unspecified."

PASSED BY THE CITY COUNCIL OF THE CITY OF LACEY, WASHINGTON, this 23rd day of May, 2013.

CITY COUNCIL

By ______________________
Mayor

Attest:

Carol Litten
____
City Clerk

Approved as to form:

____
Asst. City Attorney

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

Local Government Consistency Review Checklist

Water System Name: Lacey Water Department PWS ID: 43500Y

Planning/Engineering Document Title: Water System Comprehensive Plan Update Plan Date: February 2013

Local Government with Jurisdiction: Thurston County

WAC 246-290-108 Consistency with local plans and regulations:

Consistency with local plans and regulations applies to planning and engineering documents under WAC 246-290-106, 246-290-107, and 246-290-110(4)(b (ii).

1) Municipal water suppliers must include a consistency review and supporting documentation in its planning or engineering document describing how it has addressed consistency with **local plans and regulations**. This review must include specific elements of local plans and regulations, as they reasonably relate to water service as determined by Department of Health (DOH). Complete the table below and see instructions on back.

Local Government Consistency Statement	Page(s) in Planning Document	Yes – No – Not Applicable
a) The water system service area is consistent with the adopted land use and zoning within the applicable service area.	Pg. 1-20	yes
b) The six-year growth projection used to forecast water demand is consistent with the adopted city/county's population growth projections. If a different growth projection is used, provide an explanation of the alternative growth projection and methodology.	Pg. 1-20 Pg. 1-21 Pg. 3-12	yes
c) Applies to cities and towns that provide water service: All water service area policies of the city or town are consistent with the utility service extension ordinances of the city or town.		N/A
d) Service area policies for new service connections are consistent with the adopted local plans and adopted development regulations of all jurisdictions with authority over the service area [City(ies), County(ies)].		N/A
e) Other relevant elements related to water supply are addressed in the water system plan, if applicable; Coordinated Water System plans, Regional Wastewater plans, Reclaimed Water plans, Groundwater Area Management plans, and Capital Facilities Element of Comprehensive plans.	Chapter 6 Chapter 10	yes

I certify that the above statements are true to the best of my knowledge and that these specific elements are consistent with adopted local plans and development regulations.

Signature: [signature] Date: 5-1-13

Printed Name, Title, & Jurisdiction: Tony Kantas, Associate Planner Thurston County

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

Local Government Consistency Review Checklist

Water System Name: Lacey Water Department PWS ID: 43500Y

Planning/Engineering Document Title: Water System Comprehensive Plan Update Plan Date: February 2013

Local Government with Jurisdiction: City of Lacey

WAC 246-290-108 Consistency with local plans and regulations:
Consistency with local plans and regulations applies to planning and engineering documents under WAC 246-290-106, 246-290-107, and 246-290-110(4)(b (ii).

1) Municipal water suppliers must include a consistency review and supporting documentation in its planning or engineering document describing how it has addressed consistency with **local plans and regulations**. This review must include specific elements of local plans and regulations, as they reasonably relate to water service as determined by Department of Health (DOH). Complete the table below and see instructions on back.

Local Government Consistency Statement	Page(s) in Planning Document	Yes – No – Not Applicable
a) The water system service area is consistent with the adopted land use and zoning within the applicable service area.	Pg 1-20 to Pg 1-24	Yes
b) The six-year growth projection used to forecast water demand is consistent with the adopted city/county's population growth projections. If a different growth projection is used, provide an explanation of the alternative growth projection and methodology.	Pg 3-13 to Pg 3-19	Yes
c) Applies to cities and towns that provide water service: All water service area policies of the city or town are consistent with the utility service extension ordinances of the city or town.	Chapter 2 Appendix Y	Yes
d) Service area policies for new service connections are consistent with the adopted local plans and adopted development regulations of all jurisdictions with authority over the service area [City(ies), County(ies)].	Pg 2-2 to Pg 2-6	Yes
e) Other relevant elements related to water supply are addressed in the water system plan, if applicable; Coordinated Water System plans, Regional Wastewater plans, Reclaimed Water plans, Groundwater Area Management plans, and Capital Facilities Element of Comprehensive plans.	Appendix H, M, and K	Yes

I certify that the above statements are true to the best of my knowledge and that these specific elements are consistent with adopted local plans and development regulations.

Signature 4/30/2013
Date

Dave Burns, Principal Planner, City of Lacey
Printed Name, Title, & Jurisdiction

Consistency Review Guidance

For Use by Local Governments and Municipal Water Suppliers

This checklist may be used to meet the requirements of WAC 246-290-108. When using an alternative format, it must describe all of the elements; 1a), b), c), d), and e), when they apply.

For **water system plans (WSP)**, a consistency review is required for the retail service area and any additional areas where a municipal water supplier wants to expand its water right's place of use.

For **small water system management programs**, a consistency review is only required for areas where a municipal water supplier wants to expand its water right's place of use. If no water right place of use expansion is requested, a consistency review is not required.

For **engineering documents**, a consistency review is required for areas where a municipal water supplier wants to expand its water right's place of use (water system plan amendment is required). For non-community water systems, a consistency review is required when requesting a place of use expansion. All engineering documents must be submitted with a service area map per WAC 246-290-110(4)(b)(ii).

A) Documenting Consistency: Municipal water suppliers must document all of the elements in a consistency review per WAC 246-290-108.

1 a) Provide a copy of the adopted **land use/zoning** map corresponding to the service area. The uses provided in the WSP should be consistent with the adopted land use/zoning map. Include any other portions of comprehensive plans or development regulations that are related to water supply planning.

1 b) Include a copy of the **six-year growth projections** that corresponds to the service area. If the local population growth rate projections are not used, provide a detailed explanation on why the chosen projections more accurately describe the expected growth rate. Explain how it is consistent with the adopted land use.

1c) Include water service area policies and show that they are consistent with the **utility service extension ordinances** within the city or town boundaries. This applies to cities and towns only.

1 d) Include all **service area policies** for how new water service will be provided to new customers.

1 e) **Other relevant elements** related to water supply planning as determined by the department (DOH). See Local Government Consistency – Other Relevant Elements, Policy B.07, September 2009.

B) Documenting an Inconsistency: Please document the inconsistency, include the citation from the comprehensive plan or development regulation, and provide direction on how this inconsistency can be resolved.

C) Documenting Lack of Consistency Review by Local Government: Where the local government with jurisdiction did not provide a consistency review, document efforts made and the amount of time provided to the local government for their review. Please include: name of contact, date, and efforts made (letters, phone calls, and e-mails). In order to self-certify, please contact the DOH Planner.

Local Government Consistency Review Checklist

Water System Name: LACEY WATER DEPARTMENT PWS ID: 43500 Y

Planning/Engineering Document Title: WATER SYSTEM COMPREHENSIVE PLAN UPDATE Plan Date: JUNE 2011

Local Government with Jurisdiction: THURSTON COUNTY

WAC 246-290-108 Consistency with local plans and regulations:
Consistency with local plans and regulations applies to planning and engineering documents under WAC 246-290-106, 246-290-107, and 246-290-110(4)(b (ii).

1) Municipal water suppliers must include a consistency review and supporting documentation in its planning or engineering document describing how it has addressed consistency with **local plans and regulations**. This review must include specific elements of local plans and regulations, as they reasonably relate to water service as determined by Department of Health (DOH). Complete the table below and see instructions on back.

Local Government Consistency Statement	Page(s) in Planning Document	Yes – No – Not Applicable
a) The water system service area is consistent with the adopted land use and zoning within the applicable service area.	Pg. 1-20	yes
b) The six-year growth projection used to forecast water demand is consistent with the adopted city/county's population growth projections. If a different growth projection is used, provide an explanation of the alternative growth projection and methodology.	Pg. 1-20 Pg. 1-21 Pg. 3-12	yes
c) Applies to cities and towns that provide water service: All water service area policies of the city or town are consistent with the utility service extension ordinances of the city or town.		N/A
d) Service area policies for new service connections are consistent with the adopted local plans and adopted development regulations of all jurisdictions with authority over the service area [City(ies), County(ies)].		N/A
e) Other relevant elements related to water supply are addressed in the water system plan, if applicable; Coordinated Water System plans, Regional Wastewater plans, Groundwater Area Management plans, and Capital Facilities Element of Comprehensive plans.	Chapter 6 Chapter 10	yes

I certify that the above statements are true to the best of my knowledge and that these specific elements are consistent with adopted local plans and development regulations.

Signature _______ Date 7/18/12

Tony Kantas, Associate Planner, Thurston County
Printed Name, Title, & Jurisdiction

Consistency Review Guidance

This checklist may be used to meet the requirements of WAC 246-290-108. When using an alternative format, it must describe all of the elements; 1a), b), c), d), and e), when they apply.

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CITY OF LACEY
Shaping our community together
420 COLLEGE STREET SE
LACEY, WA 98503-1238

February 27, 2013

RECEIVED
FEB 28 2013
Department Of Health
SW Drinking Water Operations

Darin Klein
Washington State Department of Health
Southwest Office of Drinking Water
PO Box 47823
Olympia, WA 98504-7823

SUBJECT: City of Lacey Water System Plan

Dear Mr. Klein,

Please find the enclosed City of Lacey revised Water System Plan and the attached responses to your office's comments detailed in your February 29, 2012 letter. The City has addressed and/or incorporated all comments from your previous letter as well as those recommendations made during a meeting between Lacey staff and the ODW in August 2013.

Significant changes to the City's retail water service area have been made in that the previously proposed future water service area has been entirely incorporated into the currently proposed retail service area. The City has also incorporated an additional three years of planning and water usage data, and has revised its water demand projections accordingly. Several newly acquired water rights have been included in the plan as detailed in the City's source of supply strategy. Some scheduling changes have been made to the capital improvement plan and additional supporting information has been added to the appendices (i.e. Water Rate and Charge Study, Capital Facilities Plan). While the forecasted water demands have been revised, the City has elected to not revise hydraulic modeling of the water system. Reasons for this decision are that the near term demand projections have been reduced from those originally modeled, with long term projections being nearly equal to those previously forecasted. It is the City's stance that the near term scenarios used for the hydraulic are now slightly conservative when compared to the revised demand projections and revisions to the model would only serve to potentially delay those projects addressing demand related deficiencies. The storage analysis has been updated independently of the hydraulic model and a detailed system analysis will be a significant component of the pre-design process for the City's proposed storage improvements beginning in 2014.

TDD Relay 1-800-833-6388 | City Council (360) 491-3214 | City Manager (360) 491-3214 | City Attorney (360) 491-1802 | Community Development (360) 491-5642 | Finance (360) 491-3212 | Park & Recreation (360) 491-0857 | Police (360) 459-4333 | Public Work (360) 491-5600 | Fax # (360) 438-2669

The City has greatly appreciated the guidance and cooperation the Department of Health has afforded us throughout the development of our Water System Plan and welcomes any questions or comments you may have during your review.

Sincerely,

Brandon McAllister
City of Lacey
420 College Street SE
Lacey, WA 98503
360-413-4386

Attachments (1)- Comment Responses

Enclosures (1)- City of Lacey Water System Plan, February 2013

COMMENTS/RESPONSES

1. **This WSP must me stamped and signed by a professional engineer licensed in the State of Washington.**

   Response- The final WSP has been stamped and signed by the professional engineers who directed this plan.

2. **Please provide documentation showing The City Council has adopted the revised final WSP.** If you prefer, once ODW is ready to approve this WSP, we can contact you and you can then schedule a date for adoption.

   Response- The City requests that ODW notify City staff when all comments have been satisfactorily addressed and the department is ready to approve the WSP. The final WSP will then be adopted by the Lacey City Council at its next regular meeting.

3. Municipal Water Suppliers must provide a consistency review and supporting documentation showing how it has addressed consistency with local plans and regulations. **Please provide a signed and dated local Government Consistency checklist form from Thurston County (enclosed).**

   Response- A copy of the completed checklist is included in Appendix C.

4. **Please provide a limiting capacity analysis with the existing facilities to allow a determination of this system's current service capacity.**

   This WSP currently indicates that Lacey has met its capacity limitations (water rights annual withdrawal limit and current storage deficiency) and cannot support any additional connections. However, as we discussed in our February 27, 2012, meeting Lacey has obtained additional legal capacity not reflected in the analysis. **Please revise the WSP to reflect current available capacity.**

To continue qualifying for the unspecified designation, this system must:

- Show adequate legal capacity to meet the demand projections for the next six-year planning period.
- Include standard specifications for water main installation in the WSP.

- Demonstrate adequate physical capacity for the planning period or present a creditable Capital Improvements Plan (CIP) with a budget showing how funds will be provided to resolve the physical capacity limitations.

Please provide these if you would like to obtain the unspecified designation.

Response- *The City has acquired six significant water rights from the Department of Ecology (DOE) since the WSP was first submitted to ODW. Appendix 'I' has been updated with revised water right self-assessment tables reflecting the City's recently acquired water right permits. Portions of chapter 4 (Water Supply Analysis) have also been updated to include the new water right permits, and to clarify that Lacey intends to continue purchasing water from the City of Olympia through its wholesale agreement which has been extended through 2016. The wholesale water will ensure that sufficient supply is available as the City prepares to begin using its newly acquired water rights. Additionally, the storage analysis has been updated to reflect the extension of the wholesale agreement and a clarification of the City's standby storage policies; a limiting capacity analysis is included in Appendix 'S'. The limiting capacity analysis shows that instantaneous pumping capacity compared to MDD is the City's physical limiting factor and that the City's currently installed pumping capacity is able to support 41,154 ERU's, while the City anticipates serving 42,772 ERU's in the year 2019. Adding well S31 (Hawks Prairie #2), which is currently in construction, will increase the number of ERU's that the City can serve by 2,220; exceeding the 6-year projections. The CIP has been revised to coordinate with both the supply strategy (chapter 4), a water utility rate study that the City has conducted in order to fully fund the CIP presented, and the City's Capital Facilities Plan (CFP). A spreadsheet detailing each project and timing of expenditures is included, as well as the water utility rate study (Appendix Z) which outlines the projected rate increases, issuances of debt, and capital spending. The City Council adopted the proposed 5-year water rate increases with the passage of ordinance 1402. The City will also be pursing Public Works Trust Fund loans as an alternative to bonds.*

The City's standard specifications for water main installation can be found in the City's Development Guidelines and Public Works Standards. This document is updated on an as-needed basis and is adopted by the City Council; it was last updated in 2009. Applicable sections included in Appendix Y.

Chapter 1

5. **Please provide copies of the contracts for the emergency interties with the City of Olympia, Thurston Public Utility District, Pattison, and the Meadows water systems** (WAC 246-290-132) (page 1-35 or 1-36).

   Response- Conditions of use regarding the intertie with the Meadows water system are outlined in a service area purchase and sale agreement in 1995 (Appendix G). The remaining emergency interties have no formal contract or agreement for their operation. It is mutually understood by the parties that they are only to be operated under "emergency" conditions and only with the consent of all parties involved. Each emergency intertie consists of a simple isolation valve between water systems and is unmetered. Because there are no pump stations installed at these locations and the Lacey water system typically operates at a higher HGL than the surrounding water systems, Lacey is the source of supply in most instances. There has never been a case of abuse or misuse that would necessitate a formal agreement and the emergency interties are provided solely as a point of "mutual aid". Clarifying text has been added.

6. **Please provide copies of the wholesale agreements for Claudia's Mobile Home Park 1-46 (ID #13390), Claudia's Mobile Home Park 42-100 (ID #08032), and Omicron (ID #05244).**

   Response- The City does not distinguish these water systems from its retail customers with regard to the sale of water. Both Claudia's Mobile Home Parks are considered standard Mobile Home water accounts, where each system has a single meter and the owner is billed for usage as a retail customer, Omicron is considered a standard commercial account. The only distinctions the City makes is that these are separate distribution systems beyond the meter, that are responsible for their own maintenance and monitoring, and must be isolated from the City's system with an appropriate back-flow protection device. Clarifying text has been added.

Chapter 2

7. Page 2-15. Based on Page 8-8, Lacey's policy defines standby storage as volume equaling two days of average day demand (ADD) minus the reliable supply capacity. **For consistency, please include this in chapter 2 as well.** Please also note if this is the policy, then you can use that as the basis of determining the adequacy of this system's storage capacity instead of the more conservative approach taken (largest of the common approaches, which came to be 200 gpcd).

   Response- The City does intend to define standby storage as the volume equaling two days of ADD minus the reliable supply capacity, and chooses to use that definition in the evaluation of the system's storage capacity. Chapter 2 text has been revised, chapter 8 (system analysis) and appendix 'S' (storage calculations) also reflect the City's standby storage policy.

Chapter 3

8. Page 3-1. **Please clarify the meaning of a mobile account.** Does this include the master-metered communities that no longer are active water systems?

   Response- Yes, these are master-metered communities, where the individual tenants are not direct customers of the City. Many of these are inactive water systems that own and maintain their own distribution system beyond the City's meter. Text has been revised to clarify that these accounts are mobile home parks.

9. Page 3-1 and 3-2. **Please clarify how the wholesale customers that are public water systems (Omicron, Claudia's Mobile Home Park 1 and 2) were accounted for in the demand analysis and future growth projections.**

   Response- The City does not distinguish between customers who are also water systems themselves, and those who are not. In this case Omicron is counted as one of the many commercial accounts and their metered usage from Lacey is included in the overall usage for commercial accounts. Similarly, Claudia's Mobile Home Parks 1 and 2 are considered to be mobile home park (mobile) accounts. However, because Claudia's is divided into two water systems, with one Lacey water connection per system, they are counted as two mobile accounts, with their metered usage included in the overall usage for that category throughout chapter 3. Since these connections are counted the same as all other connections, they are embedded in the overall number of accounts and overall consumption, which is then carried throughout the demand analysis and future projections.

10. Page 3-2. **Please clarify how the master metered communities have been accounted for in the demand analysis.**

Response- The demand analysis counts each meter as one physical connection, regardless of dwelling units, type of usage, or volume of usage. So a master meter is counted as a single connection, and is grouped with similar types of accounts (mobile home accounts in this case). Taking the total metered usage of all connections in this category divided by the total number of meters gives us an average usage per connection, which is then converted to equivalent residential units (ERU's). Table 3.13 summarizes these results, showing that each mobile (master metered mobile home parks) connection consumes an equivalent volume of water as approximately 72 single family residences. The number of connections is then inflated according to the additional number of dwelling units for that category predicted by TRPC, this is used to estimate the future number of master metered communities, which is then multiplied by the number of ERU's/connection for that account type, and then by the overall ERU value of 191 gpd/ERU to determine the resulting demand. This process is repeated for each customer type.

11. If you would like to obtain the project report and construction document submittal exception for new distribution mains, please include standard construction specifications for distribution mains in the WSP. These are also required if Lacey is seeking an unspecified designation in the approved number of connections as mentioned above. **Please clarify the intent of Lacey to receive these benefits.**

Response- Lacey is requesting both the submittal exception for new distribution mains and an unspecified designation. The City utilizes both WSDOT standard specifications and AWWA standards for the installation of water main and all other water utility related projects. The City also maintains a document titled Development Guidelines and Public Works Standards, which is intended to reiterate, amend, and supplement WSDOT standard specifications and AWWA standards to meet the City's specific needs. The Development Guidelines and Public Works Standards was last updated in 2009, the relevant sections are included in Appendix Y to the WSP.

Appendix A

12. **Please provide estimates for temporary and transient users and regular non-residential users on Lacey's Water Facilities Inventory (WFI) form.**

    Response- Estimates for temporary/transient users and regular non-residential users were added to sections 31 and 32 of the WFI (Appendix A).

13. **Please clarify how the master-metered communities that used to be active water systems are accounted for in Lacey's number of connections served.** Please note that each mobile home in a master-metered mobile home park that is no longer an active water system must be counted as a single-family residence in Lacey's WFI.

    Response- The number of mobile home units (physical dwelling units) were moved from 26A and 26B (where they were previously counted) to be included with the single family residences in 25A. The total number of dwellings is estimated from aerial photos, record drawings, and other property records. The WFI has been updated for the number of active connections and population served as of 12-31-2012.

Appendix I

14. Water Rights Self-Assessment. **Please provide a six-year water demand forecast.**

    Response- A water right self-assessment table has been included for the 6-year water demand. All tables in appendix 'I' have been updated and revised to reflect the City's recent water right acquisitions and to more accurately depict how each source will be used.

Appendix P- Coliform Monitoring Plan

15. Page 2 states, "some of the PRV stations are designed for reverse flow...while this is a rare occurrence, it is possible." Which PRV stations can have reverse flow? **Please include this information along with how you will address it in the triggered source monitoring plan.**

    Response- A list of PRV's having a potential for reverse flow has been added to section 1.3 of the Coliform monitoring Plan. Revisions to section 2.2.2 have been made to clarify how the potential for reverse flow is evaluated.

16. Page 2. If Lacey has a positive routine coliform, they are required to contact the City of Olympia (the wholesaler) within 24 hours. Olympia must sample any groundwater sources that were "in use" and supplied water to the area where the unsatisfactory sample was collected. The term "In use" is broadly defined as a source that pumped, had water in distribution, or had water in storage. **Please include the coordination of this in the triggered source monitoring plan.**

    Response- Clarifying text has been added to the triggered source monitoring section 2.2.2 , a clarifying description of Olympia's supply sources has also been added. Currently, Olympia only supplies water from its surface water source through the wholesale intertie. Olympia does, however, plan to move its surface water source to a ground water source around the year 2014.

17. Table 7, Page 7. Sandy Brentlinger's phone number is (360) 236-3044. **Please revise.**

    Response- Revision made.

18. **Since Source 10 has not been approved for meeting CT6 level of disinfection, please include the source in the triggered source monitoring plan.**

    Response- Source 10 is included as a source subject to triggered monitoring requirements. Please see the section of the triggered monitoring plan regarding the 337 pressure zone in ground water sources supplying pressure zones, and foot note number 1 for additional information.

19. Pages 10 and 16. If an unsatisfactory coliform sample is collected in any of the consecutive systems to Lacey, Lacey is required to sample the sources that could have contributed to that sample. Sampling a distribution location as suggested in the triggered source monitoring plan is not meeting this requirement. The only time you do not need to sample the contributing source is if the source is treated for 4-log virus removal/inactivation and you are doing Compliance Monitoring for the Ground Water Rule. **Please revise.**

    Response- Revisions made, consecutive systems will be handled in the same manner as samples taken from Lacey's distribution system.

20. **Please discuss why a 48-hour timeline was chosen for defining which source could have contributed to an unsatisfactory coliform sample in the distribution system.** Please note, the water age in the distribution reservoirs must be considered.

Response- The timeline will be revised to four weeks to account for water age and frequency of sampling. See verifying normal system operation under section 2.2.2.

21. Page 10. Lacey has nine pressure zones. No coliform samples are collected (no sample stands) in zones 422 (Ridge Street), 211 (Salmon Lane), and 275 (Lower Beachcrest). These pressure zones are supplied by 337 and 440 pressure zones where Lacey's main population is. **Please clarify why at least one sample station was not included in the currently un-sampled zones.**

Response- Section 2.1.1 has been revised to further describe these pressure zones. A sample station will be installed in the 275 zone as part of a currently proposed residential development. The 422 zone has nearby sample stations in the 337 zone that are representative of the water entering the zone and the skyridge booster pump station which serves this zone is equipped with a low pressure alarm which would alert City staff if conditions where to develop that could allow back-flow conditions. The 211 zone serves 6 connections and also has a nearby sample station in the 400 zone that is representative of the water entering the zone.

22. Page 15 - #3. If a triggered source sample is fecal indicator positive (EC+), a Tier 1 advisory must be issued within 24 hours unless the sample is invalidated by ODW. Corrective action will be required based on this one EC+ sample unless ODW requests five additional source samples to be collected within 24 hours. In this case, if one or more of these five samples are EC+ then EC+ contamination is confirmed at the source and corrective action will be required. **Please revise the narrative and the flow chart.**

Response- Narrative and flow chart have been revised.

RECOMMENDATIONS AND OTHER OBSERVATIONS

1. Page 2-2. Please consider implementing a more detailed description of Lacey's service area policies. This should describe how you respond to requests for new water service including a timeframe for response to new service requests, how existing system capacity is evaluated, and customer appeal process.

   Response- The City's Development Guidelines and Public Works Standards (DG&PWS) contain considerable detail relating to the process of obtaining water service (as well as other utilities) from project initiation through completion. The chapter related specifically to water is included in Appendix Y, however some policies that are common to several of public works services are found in other chapters (available on the City's website). Many of these items are located in the DG&PWS because the policy or procedure applies to more than one utility, the DG&PWS are more frequently updated and more commonly read and referenced than the Water System Plan, and because having the same items addressed in multiple documents greatly increases the potential for inconsistencies.

2. Page 9-4. Lacey is currently required to have six certified operators on staff: two WDM4s, one WTP02, and two WTPO1s. This WSP states different requirements.

   Response- Text has been revised to include two WDM4's, one WTPO2, and two WTPO1's.

3. Appendix M, Page 61. You should correct the address listed under Regulatory Agencies and Local Governments for the Washington State Department of Health, Southwest Regional Operations office to 243 Israel Road SE, Tumwater, WA 98501. The 2411 Pacific Avenue is incorrect.

   Response- Contact information has been updated.

4. Appendix M, Page 61. You should correct the Department of Health, Southwest Regional Engineer contact name and phone number to Virpi Salo-Zieman (360) 236-3037.

   Response- Contact information has been updated.

5. Appendix Q Disinfectant and Disinfection By-Product Monitoring Plan. Please note we have reviewed and will approve the stage 2 DBP plan as part of this WSP.

   Response- No response/action needed.

6. Appendix R Inorganic and Organic Monitoring Plan. ODW Chemical Source Monitoring Specialist, Sophia Petro, reviewed this monitoring plan and noted several areas that need attention. Please consider the following list of comments and revise the plan as needed. Please note that ODW is working on a new waiver model that will change a significant amount of the information presented on pages 7 and 8 of this monitoring plan. If you have any questions, please contact Sophia at (360) 236-3046.

   Response- The Inorganic and Organic Monitoring Plan has been revised to address the following comments.

   a. Page 4, the Chemical Source Monitoring Specialist is Sophia Petro and the Regional Engineer is Virpi Salo-Zieman, (360) 236-3037.

   b. Table 1. Source 04 has a high susceptibility rating due to nitrate being detected above 5 milligrams per liter (mg/L).

   c. Table 2. Gross Alpha in addition to Radium 228 testing is required for all community water systems in regular intervals. This monitoring is not included in this table.

   d. Page 8, New source monitoring. Please note that for source approval, the water must be tested for volatile organic chemicals (VOC), inorganic chemicals (IOC), pesticides, herbicides, Radium 228, gross alpha, and fumigants if in the identified area. Fumigant monitoring is only required if the source is located in the bottom halfofT18 N, R1E or R1W or the top halfofT17N, R1E or R1W. You may want to include this in the plan.

   e. Please revise the Table 3 source monitoring required for new sources as follows:

      i. All new sources need three complete IOCs for the first three three-year compliance intervals after which they are eligible for an IOC waiver.

      ii. Gross Alpha (alpha particles) and Radium 228 are required to be sampled quarterly, but if the results of the first two samples are less than state reporting level, then the following two quarters of sampling is waived and the system will start standard monitoring.

      iii. Gross alpha results can be used as a substitute for alpha emitter radium 226, only if the combined result of the Gross Alpha and Radium 228 is less than 5 pCi/L.

f. Page 9, section 2.1.5. Quarterly monitoring is required for nitrate and nitrite if there is a detection at 50 percent of the maximum contaminant level (MCL). For other analytes with primary MCLs, quarterly monitoring is required only if the MCL is exceeded. Increased monitoring is not triggered by an exceedance of a secondary MCL. A violation occurs when the running annual average (RAA) exceeds the MCL or if the result of one sample is so high that it would make the RAA exceed the MCL.

g. Page 9 and 10, 2.2.2, Lead and Copper Monitoring Plan. You are required to prioritize sampling to houses constructed after 1982 and prior to the lead ban in this state (1986). Please include this in the plan. You should also update the plan to include the certification form that you must submit to ODW certifying that you have provided the results of the sampling to all the customers who participated.

h. Page 14, Consumer Confidence Report (CCR). Please note that you are required to report all results of detected analytes when testing of those analytes is required. Furthermore, if there was a detection, the result must be presented in the CCR every year (up to five years) until a subsequent sample from that source provides more updated information on the water being served.

i. Page 14 Consumer Confidence Report. Only chronic chemicals are calculated with a RAA. Nitrate is an acute contaminant.

j. Appendix 1, Page 16. The MCLG for Arsenic is zero, not seven.

STATE OF WASHINGTON
DEPARTMENT OF HEALTH
SOUTHWEST DRINKING WATER REGIONAL OPERATIONS
PO Box 47823, Olympia, Washington 98504-7823
TDD Relay 1-800-833-6388

February 29, 2012

Peter Brooks
Lacey Water Department
Post Office Box 3400
Lacey, Washington 98509-3400

Subject: Lacey Water Department, ID #43500Y, Thurston County; Water System Plan, ODW Project #11-1202

Dear Peter Brooks:

Thank you for submitting the Lacey Water Department (Lacey) Water System Plan (WSP) received by the Office of Drinking Water (ODW) on December 1, 2011. We have reviewed this WSP and have the following comments. The comments are grouped into two categories; comments that require a response prior to approval of this WSP, and recommendations and observations for revisions that do not require a response.

COMMENTS

1. **This WSP must me stamped and signed by a professional engineer licensed in the State of Washington.**
2. **Please provide documentation showing The City Council has adopted the revised final WSP**. If you prefer, once ODW is ready to approve this WSP, we can contact you and you can then schedule a date for adoption.
3. Municipal Water Suppliers must provide a consistency review and supporting documentation showing how it has addressed consistency with local plans and regulations. **Please provide a signed and dated local Government Consistency checklist form from Thurston County (enclosed).**
4. **Please provide a limiting capacity analysis with the existing facilities to allow a determination of this system's current service capacity**.

   This WSP currently indicates that Lacey has met its capacity limitations (water rights annual withdrawal limit and current storage deficiency) and cannot support any additional connections. However, as we discussed in our February 27, 2012, meeting

Lacey has obtained additional legal capacity not reflected in the analysis. **Please revise the WSP to reflect current available capacity.**

To continue qualifying for the unspecified designation, this system must:

- Show adequate legal capacity to meet the demand projections for the next six-year planning period.
- Include standard specifications for water main installation in the WSP.
- Demonstrate adequate physical capacity for the planning period or present a creditable Capital Improvements Plan (CIP) with a budget showing how funds will be provided to resolve the physical capacity limitations.

Please provide these if you would like to obtain the unspecified designation.

Chapter 1

5. **Please provide copies of the contracts for the emergency interties with the City of Olympia, Thurston Public Utility District, Pattison, and the Meadows water systems** (WAC 246-290-132) (page 1-35 or 1-36).
6. **Please provide copies of the wholesale agreements for Claudia's Mobile Home Park 1-46 (ID #13390), Claudia's Mobile Home Park 42-100 (ID #08032), and Omicron (ID #05244).**

Chapter 2

7. Page 2-15. Based on Page 8-8, Lacey's policy defines standby storage as volume equaling two days of average day demand (ADD) minus the reliable supply capacity. **For consistency, please include this in chapter 2 as well.** Please also note if this is the policy, then you can use that as the basis of determining the adequacy of this system's storage capacity instead of the more conservative approach taken (largest of the common approaches, which came to be 200 gpcd).

Chapter 3

8. Page 3-1. **Please clarify the meaning of a mobile account.** Does this include the master-metered communities that no longer are active water systems?
9. Page 3-1 and 3-2. **Please clarify how the wholesale customers that are public water systems (Omicron, Claudia's Mobile Home Park 1 and 2) were accounted for in the demand analysis and future growth projections.**
10. Page 3-2. **Please clarify how the master metered communities have been accounted for in the demand analysis.**

Chapter 9

11. If you would like to obtain the project report and construction document submittal exception for new distribution mains, please include standard construction specifications for distribution mains in the WSP. These are also required if Lacey is seeking an unspecified designation in the approved number of connections as mentioned above. **Please clarify the intent of Lacey to receive these benefits.**

Appendix A

12. **Please provide estimates for temporary and transient users and regular non-residential users on Lacey's Water Facilities Inventory (WFI) form.**
13. **Please clarify how the master-metered communities that used to be active water systems are accounted for in Lacey' s number of connections served.** Please note that each mobile home in a master-metered mobile home park that is no longer an active water system must be counted as a single-family residence in Lacey's WFI.

Appendix I

14. Water Rights Self-Assessment. **Please provide a six-year water demand forecast.**

Appendix P- Coliform Monitoring Plan

15. Page 2 states, "some of the PRV stations are designed for reverse flow...while this is a rare occurrence, it is possible." Which PRV stations can have reverse flow? **Please include this information along with how you will address it in the triggered source monitoring plan.**
16. Page 2. If Lacey has a positive routine coliform, they are required to contact the City of Olympia (the wholesaler) within 24 hours. Olympia must sample any groundwater sources that were "in use" and supplied water to the area where the unsatisfactory sample was collected. The term "In use" is broadly defined as a source that pumped, had water in distribution, or had water in storage. **Please include the coordination of this in the triggered source monitoring plan.**
17. Table 7, Page 7. Sandy Brentlinger's phone number is (360) 236-3044. **Please revise.**
18. **Since Source 10 has not been approved for meeting CT6 level of disinfection, please include the source in the triggered source monitoring plan.**
19. Pages 10 and 16. If an unsatisfactory coliform sample is collected in any of the consecutive systems to Lacey, Lacey is required to sample the sources that could have contributed to that sample. Sampling a distribution location as suggested in the triggered source monitoring plan is not meeting this requirement. The only time you do not need to sample the contributing source is if the source is treated for 4-log virus

removal/inactivation and you are doing Compliance Monitoring for the Ground Water Rule. **Please revise.**

20. **Please discuss why a 48-hour timeline was chosen for defining which source could have contributed to an unsatisfactory coliform sample in the distribution system.** Please note, the water age in the distribution reservoirs must be considered.
21. Page 10. Lacey has nine pressure zones. No coliform samples are collected (no sample stands) in zones 422 (Ridge Street), 211 (Salmon Lane), and 275 (Lower Beachcrest). These pressure zones are supplied by 337 and 440 pressure zones where Lacey's main population is. **Please clarify why at least one sample station was not included in the currently un-sampled zones.**
22. Page 15 - #3. If a triggered source sample is fecal indicator positive (EC+), a Tier 1 advisory must be issued within 24 hours unless the sample is invalidated by ODW. Corrective action will be required based on this one EC+ sample unless ODW requests five additional source samples to be collected within 24 hours. In this case, if one or more of these five samples are EC+ then EC+ contamination is confirmed at the source and corrective action will be required. **Please revise the narrative and the flow chart.**

RECOMMENDATIONS AND OTHER OBSERVATIONS

1. Page 2-2. Please consider implementing a more detailed description of Lacey's service area policies. This should describe how you respond to requests for new water service including a timeframe for response to new service requests, how existing system capacity is evaluated, and customer appeal process.
2. Page 9-4. Lacey is currently required to have six certified operators on staff: two WDM4s, one WTPO2, and two WTPO1s. This WSP states different requirements.
3. Appendix M, Page 61. You should correct the address listed under Regulatory Agencies and Local Governments for the Washington State Department of Health, Southwest Regional Operations office to 243 Israel Road SE, Tumwater, WA 98501. The 2411 Pacific Avenue is incorrect.
4. Appendix M, Page 61. You should correct the Department of Health, Southwest Regional Engineer contact name and phone number to Virpi Salo-Zieman (360) 236-3037.
5. Appendix Q Disinfectant and Disinfection By-Product Monitoring Plan. Please note we have reviewed and will approve the stage 2 DBP plan as part of this WSP.
6. Appendix R Inorganic and Organic Monitoring Plan. ODW Chemical Source Monitoring Specialist, Sophia Petro, reviewed this monitoring plan and noted several areas that need attention. Please consider the following list of comments and revise the plan as needed. Please note that ODW is working on a new waiver model that will change a significant amount of the information presented on pages 7 and 8 of this monitoring plan. If you have any questions, please contact Sophia at (360) 236-3046.

a. Page 4, the Chemical Source Monitoring Specialist is Sophia Petro and the Regional Engineer is Virpi Salo-Zieman, (360) 236-3037.

b. Table 1. Source 04 has a high susceptibility rating due to nitrate being detected above 5 milligrams per liter (mg/L).

c. Table 2. Gross Alpha in addition to Radium 228 testing is required for all community water systems in regular intervals. This monitoring is not included in this table.

d. Page 8, New source monitoring. Please note that for source approval, the water must be tested for volatile organic chemicals (VOC), inorganic chemicals (IOC), pesticides, herbicides, Radium 228, gross alpha, and fumigants if in the identified area. Fumigant monitoring is only required if the source is located in the bottom half of T18 N, R1E or R1W or the top half of T17N, R1E or R1W. You may want to include this in the plan.

e. Please revise the Table 3 source monitoring required for new sources as follows:

   i. All new sources need three complete IOCs for the first three three-year compliance intervals after which they are eligible for an IOC waiver.

   ii. Gross Alpha (alpha particles) and Radium 228 are required to be sampled quarterly, but if the results of the first two samples are less than state reporting level, then the following two quarters of sampling is waived and the system will start standard monitoring.

   iii. Gross alpha results can be used as a substitute for alpha emitter radium 226, only if the combined result of the Gross Alpha and Radium 228 is less than 5 pCi/L.

f. Page 9, section 2.1.5. Quarterly monitoring is required for nitrate and nitrite if there is a detection at 50 percent of the maximum contaminant level (MCL). For other analytes with primary MCLs, quarterly monitoring is required only if the MCL is exceeded. Increased monitoring is not triggered by an exceedance of a secondary MCL. A violation occurs when the running annual average (RAA) exceeds the MCL or if the result of one sample is so high that it would make the RAA exceed the MCL.

g. Page 9 and 10, 2.2.2, Lead and Copper Monitoring Plan. You are required to prioritize sampling to houses constructed after 1982 and prior to the lead ban in this state (1986). Please include this in the plan. You should also update the plan to include the certification form that you must submit to ODW certifying that you have provided the results of the sampling to all the customers who participated.

h. Page 14, Consumer Confidence Report (CCR). Please note that you are required to report all results of detected analytes when testing of those analytes is required. Furthermore, if there was a detection, the result must be presented in the CCR every year (up to five years) until a subsequent sample from that source provides more updated information on the water being served.

i. Page 14 Consumer Confidence Report. Only chronic chemicals are calculated with a RAA. Nitrate is an acute contaminant.

j. Appendix 1, Page 16. The MCLG for Arsenic is zero, not seven.

DEPARTMENT OF ECOLOGY

On December 2, 2011, a copy of this WSP was sent to the Department of Ecology (Ecology). ODW has not received comments from Ecology regarding this system's water rights. Please note, ODW's approval of this WSP will not provide any guarantee and should not be considered to provide any guarantee concerning legal use of water or subsequent water rights decisions by Ecology. Depending on Ecology's future actions on Lacey's water rights, additional planning or other submittals may be required by ODW.

Ecology has not provided "not inconsistent" determinations with approved or adopted watershed plans for WRIA 13 - the Deschutes Watershed and WRIA 11 - the Nisqually Watershed. Please contact Ecology for more information.

To expedite the review of the revised WSP, please summarize how the comments were addressed and where each revision is located (page numbers, appendices, and so on). **Please provide three copies of any responses**.

Regulations establishing a schedule of fees for review of planning, engineering, and construction documents were adopted August 3, 2007 (WAC 246-290-990). An invoice for $5,484 is enclosed.

If you have any comments or questions concerning our review, please contact Darin Klein at (360) 236-3038 or Virpi Salo-Zieman at (360) 236-3037.

Sincerely,

Darin Klein
Office of Drinking Water, Regional Planner

Virpi Salo-Zieman, P.E.
Office of Drinking Water, Regional Engineer

Enclosures

cc: Thurston County Health Department
Thurston County Planning Department
Amy Nielson, Department of Ecology

July 14, 2011

[Click **here** to type name and address]

Dear [Click **here** to type salutation]:

The City of Lacey is currently in the process of updating its Water System Plan pursuant to Washington Administrative Code (WAC) 246-290. The City's Water System Plan is now in its final review stages and we would like to give your organization this opportunity to review and comment on the document. Enclosed, you will find a c.d. containing the final review draft of Lacey's Water System Plan with appendixes. If your organization chooses to comment, they must be made in writing and directed to myself at the address below. All comments must be received on or before August 19, 2011. Please contact me directly if you have any questions, we appreciate your participation in this matter.

Sincerely,

Brandon McAllister
Utility Engineer
P.O. Box 3400
Lacey, WA 98509-3400
Phone: (360) 413-4386
E-mail: bmcallis@ci.lacey.wa.us

Enclosed: City of Lacey Draft Water System Plan June 2011 (compact disk)

Cc: File

Recipients

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PROJECT COMMENT AND RESPONSE FORM

DATE: 11-17-11

PROJECT: Lacey Water System Plan

Item #	Page # or Section	Topic	Reviewer	COMMENT	RESPONSE
1	Sec 1.13.5 Pg 1.27	Description of LOTT	LOTT	*Suggest revising the first paragraph as follows: The LOTT Clean Water Alliance (LOTT) is a nonprofit corporation formed by the Cities of Lacey, Olympia, and Tumwater, and Thurston County. LOTT provides wastewater treatment and reclaimed water production for the urban area of north Thurston County, including the three cities and their urban growth areas. The City is an active participant in all LOTT-related activities.* *In the list of reclaimed water uses in paragraph two, you might want to also add some other examples, such as decorative fountains and ponds, and groundwater recharge.* *Suggest adding one more paragraph to the end of that section: "Through their efforts to reduce wastewater flows, LOTT funds an active regional water conservation program. Staff from the water utilities of Lacey, Olympia, and Tumwater, along with LOTT staff, form the Water Conservation Coordinating Committee (WC3). This group meets regularly to implement a variety of indoor water conservation projects for residential and commercial customers within LOTT's service area boundaries. The Water Conservation Coordination Plan guides the group's efforts and is updated every six years." Paragraph four – although "Chambers Prairie" was the original identification used for a future satellite plant in the southeast area, the current name we're using is Mullen Road Reclaimed Water Plant.*	Text will be revised in the final plan.
2	Sec 1.14.1.3 Pg 1-35	Reclaimed Water	LOTT	*Do you want to mention the purple pipe you're installing in Carpenter Road?*	Text will be revised to include plans to use reclaimed water for mitigation purposes.
3	Sec 4.2.4 Pg 4-10	Reclaimed Water	LOTT	*1st paragraph – change the LOTT reference to say The LOTT (Lacey, Olympia, Tumwater, & Thurston County) Clean Water Alliance, the local wastewater treatment and reclaimed water production utility, …. 2nd paragraph – Change "the Hawks Prairie Recharge Basins" to "LOTT uses." [The volume reserved for LOTT purposes includes uses at the satellite plant and the Martin Way Pump Station as well as at the Ponds/Recharge site.]*	Text will be revised in the final plan.
4	Table 4.6	Reclaimed Water	LOTT	*Change "LOTT Hawks Prairie Recharge Basins" to "LOTT Reserve"*	Change will be made in final plan.

PROJECT COMMENT AND RESPONSE FORM

Item #	Page # or Section	Topic	Reviewer	COMMENT	RESPONSE
5	Sec 5.5 Pg 5-3	Water use efficiency	LOTT	*Last sentence, first paragraph, suggest instead "Regional programs are implemented in the urbanized areas of north Thurston County and are managed collaboratively by the Cities of…"*	Text will be revised in the final plan.
6	Sec 5.5.1 Pg 5-3	Regional WUE	LOTT	*Mid-paragraph, suggest instead "…Projects are ~~proposed~~ identified and implemented collaboratively to through utility and LOTT staff representation on a Water Conservation Coordinating Committee (WC3). The WC3 evaluates current and potential measures every six years as part of updates to the Water Conservation Coordination Plan. Several water conservation projects have been offered since…"*	Text will be revised in the final plan.
7	Sec 5.5.1.1 Pg 5-4	Residential water savings	LOTT	*Bullets, suggest delete bullets about flapper valves and composting toilets and add one bullet for HET program "- Distribution of free high-efficiency toilets for LOTT customers replacing older toilets that use 3.5 or more gallons per flush." The savings from the recent HET program is missing from the table. Here is the data, and numbers for 2010, in case you want to add it in:* *Washing Machine Rebates* *2010 HH# 489 # Distributed 489 Savings 10,768* *Water Saving Kits* *2010 HH# 474 # Distributed 596 Savings 7,502* *HETs 2009 # Dis 110 Savings 4070* *2010 #Dis 147 Savings 5439*	This plan is based on data through 2009. Text and table 5.2 will be revised and 2009 data will be included, 2010 data will be used in future updates.
8	Sec 5.5.1.2 Pg 5-4	ICI water savings	LOTT	*Second paragraph, suggest updated numbers "…To date, this program has a total regional water savings estimated at (25,784 gpd if using 2009 number OR 37,802 gpd if using 2010 number). For Lacey customers, this program has an estimated water savings of (10,076 gpd if using 2009 number OR 14,345 gpd if using 2010 number). LOTT recently…* *…Since 2003, these ICI projects have saved an estimated (44,276 gpd if using 2009 number OR 49,180 gpd if using 2010 number) of indoor water use from the City's ICI customers, as seen in Table 5.3"*	This plan is based on data through 2009. Text will be revised and 2009 data will be included, 2010 data will be used in future updates.
9	Table 5.3	ICI water savings	LOTT	*Change HET "2007" to "2008"* *If you want to add 2010 info:* *HETs 2010 Number 118 Savings 4269 gpd* *WaterSmart 2010 Number 1 Savings 635 gpd*	Text will be revised, 2010 data will be used in future updates.
10	Sec 5.6.4	Water recycling / reuse	LOTT	*Paragraph 3 – Change wording of "Hawks Prairie Recharge Ponds" to Hawks Prairie Reclaimed Water Ponds and Recharge Basins."* *Paragraph 4 – Suggest rewriting this paragraph as follows: Groundwater recharge basins serve as the ultimate destination for any of the reclaimed water not drawn off for other uses. Once recharge, reclaimed water infiltrates to the underground*	Text will be revised in the final plan.

PROJECT COMMENT AND RESPONSE FORM

Item #	Page # or Section	Topic	Reviewer	COMMENT	RESPONSE
				aquifer. Through interlocal agreements with its partner governments, LOTT has committed to transferring the reclaimed water to its partner water utilities who will use and/or purvey the water to other users.	
11	Sec 4.1	GMA	Lacey Planning Commission (LPC)	In section 4.1 reference the findings sent to CTED in 2009 considering Lacey's need for water rights to meet obligations under GMA to accommodate forecasted growth and provide these findings as an appendix to the Plan.	City of Lacey resolution 952 will be included in appendix "X" and will be referenced in sections 1.12.4 and 4.1.
12	Chapter 4	FWSA supply strategy	LPC	Provide a chart similar to those provided for the RWSA that looks at the need for water rights to service the FWSA and the UGA given capacity and demand in a time frame. This chart will likely show if we did not reduce the RWSA and used the FWSA to comply with the GMA Plan we would be out of water today or at some time in the near future.	A figure showing information from table 4.10 will be added to the final plan and clarifying text in section 4.4.2 will be added.
13	Sec 1.12.4	Retail service area	LPC	Eliminate the statements that the RWSA is not expected to change over the next 6 years or qualify it to say unless DOE releases the necessary water rights it cannot change.	Clarifying text will be added to the final plan.
14	Sec 4.4.2	Future service area	LPC	Clarify the statement that the focus of serving the FWSA will be beyond 2029. This implies we have no interest in serving the FWSA until that date. Under the GMA plan we should be servicing this area today.	Clarifying text will be added to the final plan.
15	Sec 4.1	Service areas	LPC	Provide more robust description in 4.1 regarding resolution of the existing problem with water rights and merging of the RWSA with the FWSA or UGA.	Text will be revised in the final plan.
16	Sec 11	Financial Plan	Lacey Council	The Capital Financing Plan does not match the current 2011 Budget and proposed 2012 Budget, particularly the planed issuance of debt in 2011. It should be noted that the City is currently preparing a detailed water rate study that will supersede the information presented in chapter 11 once completed in 2012.	The financial plan was drafted using data available at the time (financial statements through 2009 and 2010 projections). Because of the financial challenges facing the utility, this chapter is intended as a starting point for a broader discussion concerning the utility's finances. The City has already initiated a separate study to be completed in 2012 and will address these issues in detail. Clarifying text will be added to the final plan and the Water Rate and Charge Study will be submitted as an amendment to the Water System Plan when complete.

PROJECT COMMENT AND RESPONSE FORM

Item #	Page # or Section	Topic	Reviewer	COMMENT	RESPONSE

LACEY WATER SYSTEM PLAN PROPOSED CHANGES:

- **Comment #1-**

1.13.5 LOTT Clean Water Alliance (page 1-27)

Suggest revising the first paragraph as follows:

The LOTT Clean Water Alliance (LOTT) is a nonprofit corporation formed by the Cities of Lacey, Olympia, and Tumwater, and Thurston County. LOTT provides wastewater treatment and reclaimed water production for the urban area of north Thurston County, including the three cities and their urban growth areas. The City is an active participant in all LOTT-related activities.

In the list of reclaimed water uses in paragraph two, you might want to also add some other examples, such as decorative fountains and ponds, and groundwater recharge.

Suggest adding one more paragraph to the end of that section:
"Through their efforts to reduce wastewater flows, LOTT funds an active regional water conservation program. Staff from the water utilities of Lacey, Olympia, and Tumwater, along with LOTT staff, form the Water Conservation Coordinating Committee (WC3). This group meets regularly to implement a variety of indoor water conservation projects for residential and commercial customers within LOTT's service area boundaries. The Water Conservation Coordination Plan guides the group's efforts and is updated every six years."

Paragraph four – although "Chambers Prairie" was the original identification used for a future satellite plant in the southeast area, the current name we're using is Mullen Road Reclaimed Water Plant.

  - **Response-** Text will be revised as follows:

1.13.5 LOTT Clean Water Alliance

The LOTT Clean Water Alliance (LOTT) ~~consists of~~ is a nonprofit corporation formed by the Cities of Lacey, Olympia, and Tumwater, and Thurston County. ~~and~~ LOTT provides wastewater treatment and reclaimed water production for the urban area of north Thurston County, including the three cities and their urban growth areas~~for the region~~. The City is an active participant in all LOTT-related activities.

LOTT has made a commitment to the production and use of Class A Reclaimed Water for the next 20 years and beyond. Class A Reclaimed Water has nearly unrestricted uses, including public contact, but is not considered suitable for human consumption. Uses for Class A Reclaimed Water include irrigation, decorative ponds and water features, constructed wetlands, natural wetland or stream flow enhancement, groundwater recharge, and a variety of commercial or industrial uses.

Though LOTT's primary intent is to reduce wastewater flows and delay wastewater treatment plant expansion, the production of Class A Reclaimed Water effectively makes LOTT a wholesale water purveyor. LOTT does not intend to sell reclaimed water as a commodity, but rather to provide the resource to the partner utilities for distribution and beneficial use. The reclaimed water can then be sold to customers through a reclaimed water piping, or "purple pipe," network to reduce potable water needs, or to enhance stream flows and mitigate new and transferred water rights for potable use.

The Hawks Prairie Reclaimed Water Satellite, the first large satellite reclaimed water facility, has been constructed in the City of Lacey's service area. The City is currently planning several infrastructure projects to access reclaimed water for distribution. It is anticipated that the City of Lacey will also have access to reclaimed water from a portion of the flow from a future ~~Chambers Prairie~~Mullen Road satellite plant or expansion of the Martin Way plant. Chapter 4 Water Supply Analysis provides further detail on the reclaimed water available to the City.

Through their efforts to reduce wastewater flows, LOTT funds an active regional water conservation program. Staff from the water utilities of Lacey, Olympia, and Tumwater, along with LOTT staff, form the Water Conservation Coordinating Committee (WC3). This group meets regularly to implement a variety of indoor water conservation projects for residential and commercial customers within LOTT's service area boundaries. The Water Conservation Coordination Plan guides the group's efforts and is updated every six years.

- **Comment #2-**

1.14.1.3 Reclaimed Water (p 1-35) – Do you want to mention the purple pipe you're installing in Carpenter Road?

  - **Response-** Text will be revised as follows:

1.14.1.3 Reclaimed Water

The LOTT Alliance completed construction of the Hawks Prairie Reclaimed Water Satellite within the Lacey City limits in 2006. The satellite treatment system includes the Martin Way Reclaimed Water Plant (MWRWP), the Hawks Prairie Reclaimed Water Ponds/ Recharge Basins, and distribution piping connecting the two facilities. These facilities and supply quantities are discussed further in Chapter 4 - Water Supply Analysis. As of preparing this report, reclaimed water is not being used to augment supply. The City has installed some sections of reclaimed water distribution main near the Regional Athletic Center and the Gateway development; however, the City is still in the planning phases of purchasing property and constructing facilities to ~~utilize this source~~make reclaimed water available to its customers. The City does have immediate plans to utilize reclaimed water for groundwater recharge as part of its water rights mitigation strategy (Capital Improvements Plan, project WS-8).

➢ **Comment #3-**

4.2.4 Reclaimed Water (p 4-10)

1st paragraph – change the LOTT reference to say The LOTT (Lacey, Olympia, Tumwater, & Thurston County) Clean Water Alliance, the local wastewater treatment and reclaimed water production utility, ….

2nd paragraph – Change "the Hawks Prairie Recharge Basins" to "LOTT uses." [The volume reserved for LOTT purposes includes uses at the satellite plant and the Martin Way Pump Station as well as at the Ponds/Recharge site.]

- ➢ **Response-** Text will be revised as follows:

4.2.4 Reclaimed Water

The City is planning on a future supply source from reclaimed water produced at the Martin Way Reclaimed Water Plant (MWRWP). The LOTT (Lacey, Olympia, Tumwater, & Thurston County) Clean Water Alliance, the local ~~sewerage agency~~wastewater treatment and reclaimed water production utility, owns and operates the Hawks Prairie Reclaimed Water Satellite within the Lacey City limits. The satellite treatment system includes the MWRWP, the Hawks Prairie Reclaimed Water Ponds/ Recharge Basins, and distribution piping connecting the two facilities.

With an initial design capacity of 2 mgd, the MWRWP is planned for expansion in 1-mgd increments up to a maximum of 8 mgd. According to City staff, as each incremental increase in capacity occurs, the LOTT partners will negotiate how to best allocate the additional reclaimed water. Table 4.6 presents the current allocation of reclaimed water. As seen in the table, reclaimed water is first allocated to ~~the Hawks Prairie Recharge Basins~~LOTT uses, and the remainder is divided amongst the Cities of Lacey and Olympia.

➢ **Comment #4-**

Table 4.6 – Change "LOTT Hawks Prairie Recharge Basins" to "LOTT Reserve"

➢ **Response-** Text will be revised as follows:

Table 4.6 2009 Reclaimed Water Allocation

Allocation	Quantity(1) (mgd)		
	First mgd(2)	Second mgd	Total
LOTT ~~Hawks Prairie Recharge Basins~~ Reserve	0.25	0.00	0.25
City of Olympia	0.30 (40%)	0.00 (0%)	0.30
City of Lacey	0.45 (60%)	1.00 (100%)	1.45

Notes:
(1) Reclaimed Water allocations are as defined in Reclaimed Water Distribution Agreement No. 1.
(2) 0.25 mgd of the first million gallons per day of provided capacity is allocated to LOTT; the remainder is allocated to Olympia and Lacey as shown.

➢ **Comment #5-**

5.5 Existing Water Use Efficiency Program (page 5-3)

Last sentence, first paragraph, suggest instead "Regional programs are implemented in the urbanized areas of north Thurston County and are managed collaboratively by the Cities of..."

➢ **Response-** Text will be revised as follows:

5.5 EXISTING WATER USE EFFICIENCY PROGRAM

The City currently serves 67,175 water customers through approximately 22,000 service connections. The WUE policy requires a water utility of this size to evaluate at least nine water conservation measures. Currently, through both local and regional programs, the City is implementing fifteen WUE measures, as described in detail below. Local programs are implemented only within the City's service area and are managed by City staff. Regional programs are implemented ~~throughout~~ in the urbanized areas of north Thurston County and are managed collaboratively by the Cities' of Lacey, Olympia, and Tumwater, and the LOTT Clean Water Alliance.

The following sections describe the existing WUE measures in place, both regionally, and in the City.

➢ **Comment #6-**

5.5.1 Regional WUE Program

Mid-paragraph, suggest instead "...Projects are ~~proposed~~ identified and implemented collaboratively to through utility and LOTT staff representation on a Water Conservation Coordinating Committee (WC3). The WC3 evaluates current and potential measures every six years as part of updates to the Water Conservation Coordination Plan. Several water conservation projects have been offered since..."

➢ **Response-** Text will be revised as follows:

5.5.1 Regional WUE Program

The wholesale provider of regional wastewater treatment services, the LOTT Clean Water Alliance (LOTT), helps preserve and protect public health, the environment, and water resources by providing wastewater management services for the urbanized area of north Thurston County. In an effort to reduce flows and maximize capacity at the LOTT Wastewater Treatment Plant, LOTT provides funding for indoor water conservation measures. Projects are ~~proposed by the individual LOTT Partner utilities and coordinated~~ identified and implemented through utility and LOTT staff representation on a Water Conservation Coordinating Committee (WC3) ~~to serve their common interests~~. The WC3 evaluates current and potential measures every six years as part of updates to the Water Conservation Coordination Plan. Several water conservation projects have been offered since 1997. These projects are grouped into Residential, and Institutional, Commercial, and Industrial (ICI) users.

➢ **Comment #7-**

5.5.1.1 Residential Water Savings Projects (page 5-4)

Bullets, suggest delete bullets about flapper valves and composting toilets and add one bullet for HET program "- Distribution of free high-efficiency toilets for LOTT customers replacing older toilets that use 3.5 or more gallons per flush."

The savings from the recent HET program is missing from the table. Here is the data, and numbers for 2010, in case you want to add it in:

Washing Machine Rebates		*2010*	*HH# 489*	*# Distributed 489*		*Savings 10,768*
Water Saving Kits		*2010*	*HH# 474*	*# Distributed 596*		*Savings 7,502*
HETs	*2009*	*# Dis 110*	*Savings 4070*	*2010*	*# Dis 147*	*Savings 5439*

➢ **Response-** This plan is primarily based on data collected through the end of 2009, data provided for the calendar year 2010 will be used in subsequent updates, 2009 data will be added. Text will be revised as follows:

5.5.1.1 Residential Water Savings Projects

Since 2003, Residential projects have included:

- Distribution of indoor water saving kits that include a low-flow shower head, faucet aerators, and leak detection tablets;
- Distribution of ~~replacement toilet flapper valves for recipients of low-flow toilets through previous LOTT toilet programs~~free high-efficiency toilets for LOTT customers replacing older toilets that use 3.5 gallons per flush or more;
- Rebates for residential customers for purchasing water-efficient washing machines (WashWise Program); and
- ~~Rebates for purchasing composting toilets.~~

Since 2003, these residential projects combined have saved an estimated ~~63,712~~67,782 gpd of indoor water use from Lacey residents, as seen in Table 5.2.

Table 5.2 LOTT Residential Water Savings Projects

Project & Year	City of Lacy		
	Number of Households	**Number Distributed**	**Water Savings (gpd)**
Washing Machine Rebates			
2003	170	170	3,744
2004	182	182	4,008
2005	253	253	5,571
2006	315	315	6,937
2007	428	428	9,425
2008	467	467	10,284
2009	537	537	11,825
TOTAL			**51,794**
Water Savings Kits			
2003	93	167	2,102
2004	55	93	1,170
2005	109	215	2,706
2006	36	69	868
2007	93	143	1,800
2008	104	177	2,228
2009	73	83	1,044
TOTAL			**11,918**

HETs			
2009	-	110	4,070
TOTAL			**4,070**
		Total Water Savings (gpd)	**~~63,712~~67,782**

Comment #8-

5.5.1.2 ICI Water Saving Projects

Second paragraph, suggest updated numbers "...To date, this program has a total regional water savings estimated at (25,784 gpd if using 2009 number OR 37,802 gpd if using 2010 number). For Lacey customers, this program has an estimated water savings of (10,076 gpd if using 2009 number OR 14,345 gpd if using 2010 number). LOTT recently...

...Since 2003, these ICI projects have saved an estimated (44,276 gpd if using 2009 number OR 49,180 gpd if using 2010 number) of indoor water use from the City's ICI customers, as seen in Table 5.3"

- **Response-** This plan is primarily based on data collected through the end of 2009, data provided for the calendar year 2010 will be used in subsequent updates, 2009 data will be added. Text will be revised as follows:

5.5.1.2 ICI Water Savings Projects

Since 2003, ICI projects have included:

- Distribution of High Efficiency Toilets (HETs), and
- Rebates up to 75 percent for upgrading machines or fixtures to water efficient models (WaterSmart and LaundryWise Programs). This includes ice machines, cooling systems, faucets, toilets, kitchen spray heads, etc.

In 2008, LOTT implemented a direct-install HET program for commercial customers. LOTT covers the cost of the new toilets, disposal of the old toilets, and the install costs for the customers. To date, this program has a total regional water savings estimated at ~~7,304~~25,784 gpd. For Lacey customers, this program has an estimated water savings of ~~3,388~~10,076 gpd. LOTT recently extended the program to include owners of multi-family residences.

Since 2003, these ICI projects have saved an estimated 44,276 gpd of indoor water use from the City's ICI customers, as seen in Table 5.3.

➢ **Comment #9-**

Table 5.3

Change HET "2007" to "2008"

If you want to add 2010 info:

HETs 2010 Number 118 Savings 4269 gpd

WaterSmart 2010 Number 1 Savings 635 gpd

- ➢ **Response-** This plan is primarily based on data collected through the end of 2009, data provided for the calendar year 2010 will be used in subsequent updates. Text will be revised as follows:

Table 5.3 LOTT ICI Water Saving Projects			
Projects	**City of Lacey**		
	Year Installed	**Number of Participants or Number Replaced**	**Water Savings (gpd)**
WaterSmart Rebates	2006	1	600
Spray heads	2005-2006	156	33,600
High Efficiency Toilets	2008~~7~~	77	3,388
High Efficiency Toilets	2009	152	6,688
		Total Water Savings (gpd)	**44,276**

Both residential and ICI water conservation projects mentioned above will continue, and the City will be a partner of this conservation program for the foreseeable future.

➢ **Comment #10-**

5.6.4 Recycling/Reuse

Paragraph 3 – Change wording of "Hawks Prairie Recharge Ponds" to Hawks Prairie Reclaimed Water Ponds and Recharge Basins."

Paragraph 4 – Suggest rewriting this paragraph as follows: Groundwater recharge basins serve as the ultimate destination for any of the reclaimed water not drawn off for other uses. Once recharge, reclaimed water infiltrates to the underground aquifer. Through interlocal agreements with its partner governments, LOTT has committed to transferring the reclaimed water to its partner water utilities who will use and/or purvey the water to other users.

- **Response-** Text will be revised as follows:

5.6.4 Recycling/Reuse

The four government partners that form LOTT (Lacey, Olympia, Tumwater and Thurston County) have made a commitment to the production and use of Class A Reclaimed Water over the next twenty years and beyond.

Class A Reclaimed Water is the highest quality of reclaimed water as defined by the Washington State Departments of Ecology and Health. Class A Reclaimed Water has nearly unrestricted uses, including public contact, but is not considered suitable for human consumption. Using reclaimed water for such purposes as irrigation, constructed wetlands, natural wetland or stream flow enhancement, and a variety of commercial or industrial uses will help save potable water resources.

LOTT is currently operating a reclaimed water facility at the Budd Inlet Treatment Plant in Olympia and the Hawks Prairie Reclaimed Water Satellite Facility in Lacey. The Hawks Prairie facility consists of the Martin Way Reclaimed Water Plant and the Hawks Prairie ~~Recharge~~ Reclaimed Water Ponds and Recharge Basins, and will expand in 1.0-MGD increments to accommodate growth. Additional satellite facilities will be constructed over time throughout the partner jurisdictions.

~~LOTT views the satellite plants as an "outfall," or discharge point for a portion of the wastewater flow, and has no interest in purveying the reclaimed water as a commodity. LOTT has expressed its intent to transfer interest in the excess reclaimed water to the partner water utilities. The water utilities of the partner jurisdictions, which contribute flows to each of the satellite plants, will then have the opportunity to "salvage" the treated water and put it to use for a variety of purposes.~~Groundwater recharge basins serve as the ultimate destination for any of the reclaimed water not drawn off for other uses. Recharge basins allow excess reclaimed water to be infiltrated to the local aquifer system. Through interlocal agreements with its partner governments, LOTT has committed to transferring the reclaimed water to its partner water utilities who will use and/or purvey the water to other users.

Reclaimed water can be used for a variety of purposes, including in-stream flow enhancement, irrigation supply, and industrial water supply. Customers will be added to the "purple pipe," or reclaimed water piping network, over time as additional increments of reclaimed water become available for use, if such use is determined to be economically viable. The decisions about new capacity, while still being driven primarily by the need to provide wastewater treatment, can also be environmentally opportunistic and allow multiple benefits from each new wastewater management investment.

The Reclaimed Water Policies Task Force was formed in 2001 and includes representatives from Lacey, Olympia and Tumwater, Thurston County and LOTT. Work of the Task Force will help to determine the quantity and timing of reclaimed water that will be available for use by the City of Lacey and the economic viability of purveying that water.

➢ **Comment #11-**

In section 4.1 reference the findings sent to CTED in 2009 considering Lacey's need for water rights to meet obligations under GMA to accommodate forecasted growth and provide these findings as an appendix to the Plan.

- ➢ **Response-** City of Lacey resolution 952 will be included in appendix "X" and will be referenced in sections 1.12.4 and 4.1. See comment #13 and #15 for text revisions.

➢ **Comment #12-**

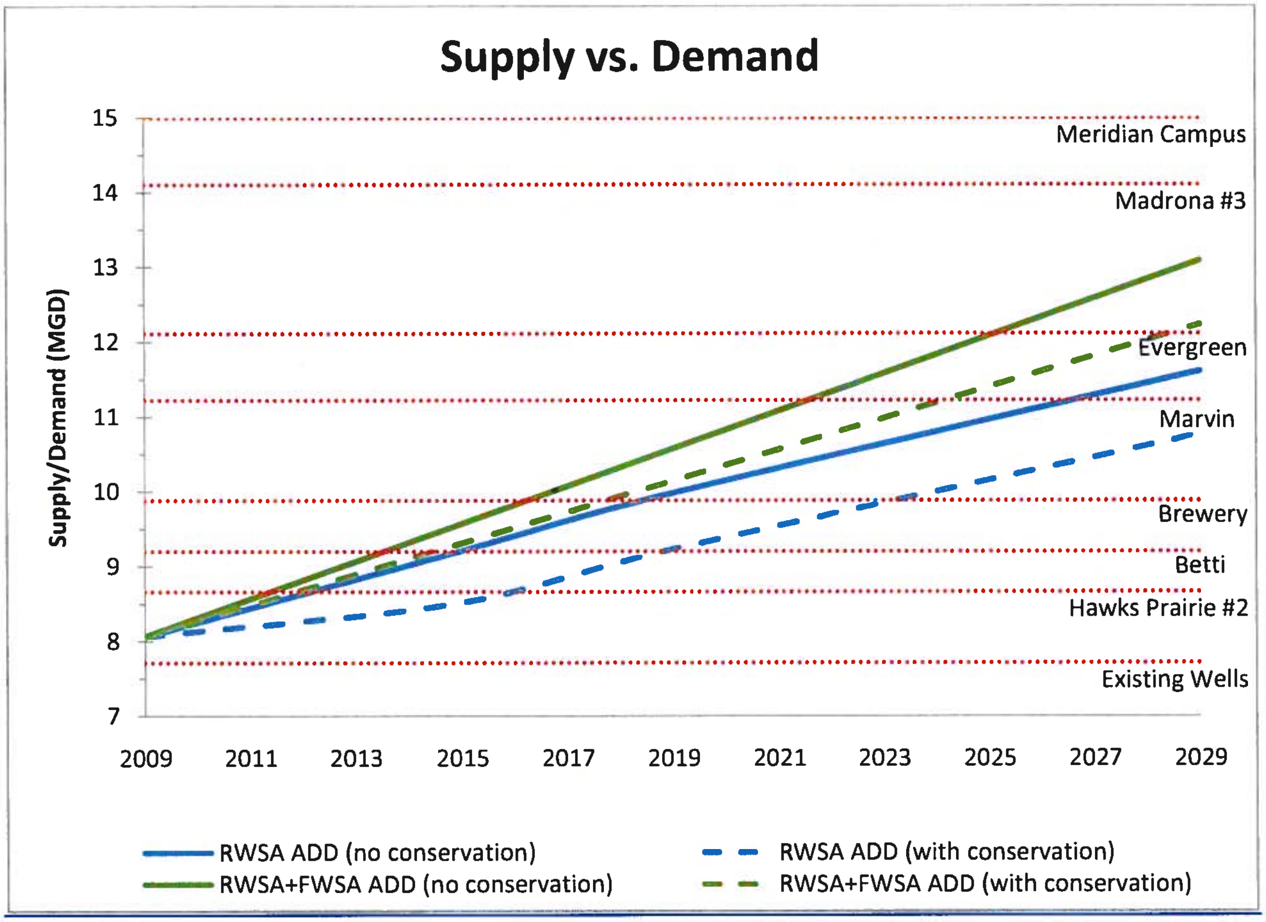
Provide a chart similar to those provided for the RWSA that looks at the need for water rights to service the FWSA and the UGA given capacity and demand in a time frame. This chart will likely show if we did not reduce the RWSA and used the FWSA to comply with the GMA Plan we would be out of water today or at some time in the near future.

- ➢ **Response-** A figure showing information from table 4.10 will be added to the final plan and clarifying text in section 4.4.2.

4.2.2 Pending Water Rights

Between 1994 and 2006, the City filed eleven applications for groundwater rights with Ecology for meeting future demands at full build-out of the Urban Growth Area (UGA). Prioritized applications have been included in a Mitigation Plan for identifying actions to mitigate the impacts of the additional water withdrawals. Additionally, some applications were included in a Cost Reimbursement Agreement with Ecology, as recommended by Ecology to help expedite approval.

These pending rights are presented in Table 4.5 in order of priority. The City has prioritized the top six water right applications according to ease of processing and providing mitigation. These rights are labeled as Priority "A," "B," and "C" in the table. Processing of Priority A and B applications started in 2011. Application G2-30248 is for withdrawing from a drilled well at the Hawks Prairie area; the City anticipates treating water from this well at the new Hawks Prairie Water Treatment Facility. Application G2-30249 is an application for additional Qa at the existing Well S29 (Betti Well). Priority "A" water rights are needed to serve projected demands over the short-term planning period, while Priority "B" and "C" water rights are needed to serve projected demands of the RWSA and FWSA over the long-term planning period, respectively.



➢ **Comment #13-**

Eliminate the statements that the RWSA is not expected to change over the next 6 years or qualify it to say unless DOE releases the necessary water rights it cannot change.

➢ **Response-** Text will be revised as follows:

1.12.4 Retail Water Service Area

The City of Lacey Retail Water Service Area (RWSA) is delineated as shown in Figure 1.9. The RWSA is smaller than the Future Water Service Area (FWSA) due to a limitation in available water rights, as described in Resolutions 917 and 952 (Appendix X). It encompasses the majority of the City boundary, and expands into the UGA in areas where water service is currently being provided. Several small water systems exist within the RWSA boundary that are not part of the Lacey RWSA. Additionally, the RWSA expands beyond the UGA in three areas: 1) near the Nisqually River to the east of the City, 2) adjacent to Steilacoom Road SE, and 3) just northeast of 46th Avenue NE and Hilton Road NE; these areas are remnants of water systems that have been acquired over the years.

The currently delineated RWSA is not anticipated to change over the six-year planning horizon, other than potentially acquiring independent water systems within the RWSA border (see Chapter 2 - Policies & Criteria for conditions of service) unless the water supply strategy presented in chapter 4 of this document can be accelerated and a sufficient amount of the City's currently pending water right applications are approved within the short-term planning horizon. The City will reevaluate the RWSA during each 6-year planning cycle and will incorporate portions of the FWSA as adequate resources and system capacity become available. For the analyses contained in~~purposes of~~ this plan, it is assumed that the RWSA will not change for future planning purposes. Rather, supply and demand projections are provided separately for the RWSA and the FWSA to facilitate a more adaptive approach for the planning and scheduling of growth related capital projects.

- **Comment #14-**

Clarify the statement that the focus of serving the FWSA will be beyond 2029. This implies we have no interest in serving the FWSA until that date. Under the GMA plan we should be servicing this area today.

  - **Response-** Text will be revised as follows:

4.4.2 Future Water Service Area Supply Strategy

The City plans to work towards securing water rights and sources of supply that will eventually allow extending the boundaries of the RWSA to coincide with the City's FWSA and to comply with the Growth Management Act (GMA). The water supply strategy to service the FWSA focuses on the additional ~~providing~~ supply needed to meet projected demands through~~beyond~~ the year 2029. To meet these demands it is recommended that the City consider pursuing additional supply sources including incorporating reclaimed water, pursuing additional water rights, and purchasing existing water systems. It is assumed that any existing system the City does purchase (or agree to acquire) will include sufficient water rights to serve its associated service area.

As discussed above, reclaimed water is planned to be a source of irrigation and other non-potable water in the future for the Lacey Gateway development and the Regional Athletic Center. At this time, it is difficult to predict the quantity of reclaimed water that will be available to the City; LOTT will need to determine the appropriate allocation of water among the LOTT agencies as the MWRWP production capacity increases. It is recommended that the City continue to plan for use of reclaimed water, and incorporate supply quantities in the water supply strategy as they become available.

The City's Priority C water right applications are G2-29165 (Madrona Wellfield) and G2-30250 (Meridian Campus). Combined, these two rights would provide an additional Qa and Qi of 3,226 AFY (2.88 mgd) and 2,800 gpm (4.03 mgd), respectively. To meet demands for the FWSA, the City may also need to continue pursuing the Priority D applications. Consisting of water right applications G2-29305, G2-29306, G2-30252, and G2-30253, the Priority D applications could provide an additional 4,558 AFY (4.07 mgd) of Qa and 5,798 gpm (8.35 mgd) of Qi.

Lastly, it is recommended that the City pursue purchasing existing water systems within the City's Future Water Service Area, especially systems with excess, unused water rights to increase the Qa and Qi.

- **Comment #15-**

Provide more robust description in 4.1 regarding resolution of the existing problem with water rights and merging of the RWSA with the FWSA or UGA.

- **Response-** Text will be revised as follows:

4.1 INTRODUCTION

The City of Lacey (City) is an expanding water system, which is recognized in the North Thurston County Coordinated Water System Plan (CWSP). As noted in Chapter 1, the City has restricted water availability for new customers in certain areas of its service area resulting from a limitation in water rights. This has resulted in a Retail Water Service Area (RWSA) that is smaller than the City's Future Water Service Area (FWSA) and its full service area identified in the CWSP. The RWSA is currently defined as those areas inside the Lacey City Limits not being served by another group "A" system and those areas outside the Lacey City Limits where Lacey water service is currently being provided. The FWSA is defined as those areas inside the "City of Lacey" service area as shown on the North Thurston County Coordinated Water System Plan Water Service Areas map (August 1999), and not already part of the RWSA. While many group "A" and "B" water systems are mapped as independent water systems and are not specifically shown as part of Lacey's RWSA or FWSA, it is the intent of the City to eventually serve its full service area as defined by the CWSP. Further, it is the City's intent to eventually serve all areas within any of these defined service areas or its UGA, including those areas currently served by another purveyor.

The City is working towards securing water rights and sources of supply that will eventually allow extending the boundaries of the RWSA to coincide with the City's FWSA and to comply with the Growth Management Act (GMA). However, even in the short term, as the number of customers grows within the RWSA, new groundwater sources will need to be developed to meet water system demands. The City has eleven water right applications pending, the oldest dating back to 1994, for a total of 12,956 AFY in new appropriations. These applications are needed to serve both the immediate and long-term needs of the City and its UGA. Since the timing of application processing is beyond the control of the City, it has been forced to limit water availability to some areas of its UGA which negatively impacts growth and economic development in those areas. This in turn has affected the City's ability to fully comply with GMA requirements as described in Resolutions 917 and 952 (Appendix X).

The City is evaluating multiple avenues to secure new water supplies to meet projected increases in demand. The purpose of this chapter is to review existing supplies, evaluate future supplies, and provide a recommended strategy for securing sufficient supplies to meet future demands.

Documents relating to the City's Water Supply Analysis include the following:

- Department of Health (DOH) Existing and Future Water Rights Tables 3 & 4 (Appendix I).

- Washington State Department of Ecology (Ecology) Cost Recovery Agreement (Appendix J).
- City of Lacey Comprehensive Water Rights Mitigation Plan.
- Source of Supply Analysis Technical Memorandum (Appendix L).
- Water Shortage Response Plan (Appendix U).

➢ **Comment #16-**

The Capital Financing Plan does not match the current 2011 Budget and proposed 2012 Budget, particularly the planed issuance of debt in 2011. It should be noted that the City is currently preparing a detailed water rate study that will supersede the information presented in chapter 11 once completed in 2012.

➢ **Response-** The financial plan was drafted using data available at the time (financial statements through 2009 and 2010 projections). Because of the financial challenges facing the utility, this chapter is intended as a starting point for a broader discussion concerning the utility's finances. The City has already initiated a separate study to be completed in 2012 and will address these issues in detail. The Water Rate and Charge Study will be submitted as an amendment to the Water System Plan when complete. Text will be revised as follows:

11.1 INTRODUCTION

The objective of the financial plan is to identify the total cost of providing water service and to present a financial program that allows the water utility to remain financially viable during execution of the Capital Improvement Program (CIP) identified in Chapter 10. This viability analysis considers the historical financial condition of the utility, the sufficiency of utility revenues to meet current and future financial and policy obligations, and the financial impact of executing the CIP. Furthermore, the plan provides a review of the utility's current rate and general facility charge structure with respect to rate adequacy, equity, promotion of water conservation, and customer affordability.

The City's Capital Financing Plan published in this document was based on actual revenue and expenditure data through 2009 and the projected 2010 budget. While this study suggested that the City issue debt in 2011 to fully fund its Capital Program, it should be noted that the actual timing of capital improvements and the expenses incurred can have a significant impact on the cash needs of the utility from year to year. Information provided during the early stages of this abbreviated report led the City to begin preparing a thorough Rate and Charge Study that will evaluate the City's financing options and capital project scheduling to help minimize its dept exposure while meeting the needs of the utility. When completed in 2012, the detailed Rate and Charge Study will provide a multi-year Financing Plan and will supersede the findings presented here.

11.3.1 Capital Funding Plan

The Capital Improvement Plan developed for the six-year (2010-2015) planning horizon is estimated at $38.3 million ($42.9 million escalated). Costs are estimated in 2010 dollars and escalated to the year of planned spending at an annual inflation rate of 4 percent.[5] Additional operations and maintenance expenses associated with capital improvement projects are considered separately as obligations of the operating fund.

Significant projects (presented in escalated dollars) for the six-year CIP include the 337 Zone Reservoir ($6.5 million); ATEC Treatment Facility Particulates Removal and Disposal ($3.4 million); the Brewery Wellfield Development/Reactivation ($3.7 million) and Pump Station ($1.9 million); as well as the replacement of Wells S15 and S16 ($2.5 million). These six projects total $18 million, nearly half of the total estimated value of the CIP. In addition, $1.89 million of capital improvements were completed in 2010.[6]

A capital funding plan is developed to identify the total resources available to meet the CIP funding needs and to determine if new debt financing will be required. Actual General facility charge (GFC) collections for 2010 were $1.9 million. GFC revenue in subsequent years is forecasted at roughly $1.6 million a year assuming annual customer growth of 1.25 percent and the updated GFC schedule.

For the six-year planning horizon, this funding plan includes $485,000 in grant funding, $23.0 million in revenue bond proceeds, and $18 million in capital fund reserves.[7] Funding from capital reserves includes a portion of total GFC revenue remaining after scheduled repayments to the wastewater construction fund.[8] Table 11.3 summarizes the annual capital costs and capital funding associated with the six-year 2010-2015 CIP. Also presented are the 10-year and 20-year CIP and capital funding forecasts. All figures are escalated to the year of construction. Annual additions to O&M expenses are accounted for separately as part of the financial forecast.

Table 11.3 Capital Financing Plan

Capital Funding		2010	2011	2012	2013	2014	2015	Total 6 Year
Total Capital Projects	**2010 Dollars:**	**1,889,781**	**7,517,886**	**8,375,126**	**4,608,286**	**9,045,286**	**6,894,000**	**38,330,365**
	Escalated:	**1,889,781**	**7,818,601**	**9,058,536**	**5,183,695**	**10,581,705**	**8,387,605**	**42,919,924**
Grant Proceeds		-	485,000	-	-	-	-	485,000
Revenue Bond Proceeds		-	8,450,000	-	2,261,060	7,264,893	5,041,289	23,017,242
Use of / (Addition to) Capital Fund Balance		1,889,781	(1,116,399)	9,058,536	2,922,635	3,316,812	3,346,316	19,417,682
Total Funding Sources		**1,889,781**	**7,818,601**	**9,058,536**	**5,183,695**	**10,581,705**	**8,387,605**	**42,919,924**

Capital Funding		Total 10 Year	Total 20 Year
Total Capital Projects	**2010 Dollars:**	**56,463,365**	**80,247,365**
	Escalated:	**66,394,593**	**106,929,274**
		-	
Grant Proceeds		485,000	485,000
Revenue Bond Proceeds		35,670,433	47,716,892
Use of / (Addition to) Capital Fund Balance		30,239,160	58,727,381
Total Funding Sources		**66,394,593**	**106,929,274**

11.4 AVAILABLE CIP FUNDING ASSISTANCE AND FINANCING RESOURCES

Feasible long-term capital funding strategies should be defined to ensure adequate resources are available to fund the CIP identified in this Plan. In addition to the water utility resources such as accumulated cash reserves, capital revenues, and general facility charges, capital needs can also be met from outside sources such as grants, low-interest loans, and bond financing. The following is a summary of Utility Resources and Outside Resources.

~~[7] The first bond issue of $8.5 million is assumed for 2011 and covers capital needs for the year 2011 and 2012. Bond proceeds not utilized in the year of issuance are available as capital fund reserves in the following year.~~

[8] Repayment of the interfund loan from the wastewater construction fund will be made from GFC revenue. Total GFC revenue over the 6-year planning horizon is forecasted to be $10.0 million. Repayments to the wastewater construction fund over this period are forecasted to be $3.3 million.

RESOLUTION NO. 952

CITY OF LACEY

A RESOLUTION RELATED TO BUILDABLE LANDS CONSISTENCY REVIEW.

WHEREAS, pursuant to state statute, the Thurston Regional Planning Council prepared a Buildable Lands Report for the County and timely submitted the same to the State Office of Community Trade and Development for review, and

WHEREAS, state law requires that after the preparation of such report each jurisdiction needs to compare the development trends demonstrated in the report with the expectations of that jurisdiction's comprehensive land use plan, and

WHEREAS, the Community Development Department of the City has conducted its review and submitted the same to the Planning Commission, and

WHEREAS, the Planning Commission has studied the matter and returned Findings and Conclusions for the Buildable Land Consistency Review, and

WHEREAS, the City Council has studied the results of such review,

NOW, THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF LACEY, WASHINGTON, AS FOLLOWS:

1. The Council hereby adopts the Findings and Conclusions for the Buildable Land Consistency Review forwarded to it by the City's Planning Commission and attached hereto as Exhibit A.

2. Based upon such Findings and Conclusions, the Council declares that, with the exception of the issue described in Section 3 hereof, the Comprehensive Plan and policies of the City are consistent with the Buildable Lands Report.

3. The one exception to consistency is the fact that the City has not been granted sufficient water rights to allow water service outside of the city limits and within the growth management boundary to meet the population projections under the Growth Management Act. There are no reasonable measures the City, itself, can take to cure the problem of lack of water rights other than the conservation policies in effect, the water delivery infrastructure improvements which have been made and the water rights applications that have been submitted. However, the City will continue to cooperate with the Washington State Department of Ecology to secure the grant of additional water rights and will exert its best efforts to bring to the attention of the legislature the conflict between those state statutes governing the granting of water rights and the mandatory provisions of the Growth Management Act.

PASSED BY THE CITY COUNCIL OF THE CITY OF LACEY, WASHINGTON, this 19 day of NOVEMBER, 2009.

CITY COUNCIL

By ______________________
Mayor

Attest:

____
City Clerk

Approved as to form:

____
City Attorney

Findings and Conclusions for the Buildable Land Consistency Review:

1. The Buildable Lands Report for Thurston County dated September 2007 has documented growth rates and density statistics for the City of Lacey and the Lacey Urban Growth Area.

2. This report shows Lacey led all three of the largest cities in Thurston County with residential permits in 2005, 2006 and the portion of 2007 recorded.

3. This report and internal review shows Lacey achieved urban densities across the full range of its residential zones including ; Low Density Residential 0-4, Low Density Residential 3-6, Moderate Density residential and high density residential;

4. This report and internal review shows Lacey achieved urban densities across the full range of its mixed use zones and commercial zones that accommodate residential use including the Mixed Use High Density Corridor, The Moderate Density Corridor, the Village Center designations, and the Central Business District;

5. The data collected in this report and internal review demonstrates opportunities provided in Lacey's Planning legislation have been successfully utilized to develop a full range of housing types and styles to accommodate projected growth. This mirrors expectations of the Lacey Comprehensive Land Use Plan and requirements of GMA to achieve urban densities for the full range of Lacey's demographic profile;

6. The only outstanding issue identified as an obstacle to achieving GMA objectives is obtaining water rights necessary to provide water service for Lacey's projected growth over the long term;

7. The State's existing policy and process for allocation and management of water rights lacks sufficient definition to provide for the functional and timely review, and issuance of water rights. Lacey has been diligently pursuing "new" water rights for over 15 years and has yet to obtain "new" water rights. This has placed Lacey in a position of not having sufficient water rights to serve the entire UGA which in turn has necessitated the termination of issuance of water availability letters out side of the City Limits.

8. Lacey is not currently meeting the demands of GMA due to lack of water rights. At the same time, state regulation continues to allow exemptions for private wells thereby indirectly encouraging non urban densities both inside and outside the UGA served by private well.

9. During discussion at the Buildable Lands Technical Advisory Committee meetings, representatives of the development community stated the unavailability of municipal water to support urban density and the availability of exemptions for private wells is promoting development outside Lacey's UGA.

10. Restrictions on water rights for Lacey while promoting rural development on private wells is working against the concept of consolidation of growth in Lacey's designated UGA to provide more efficient urban services. This is in conflict with GMA goals and smart growth principals that require municipalities to be able to provide water to designated urban areas.

11. This situation has resulted in an inability to utilize buildable land capacity in the UGA for urban development. Additionally, some of Lacey's buildable land capacity in the UGA that is designated Low Density 0-4 is at risk of being compromised by the development of large non urban lots to obtain water via private well exemptions;

12. No amendments Lacey can make to its Land Use Plan or enabling legislation will resolve the issue of water being unavailable to serve its designated growth area. There are no "reasonable measures" Lacey can implement to remedy the water situation. Lacey and other municipalities are dependant upon the Department of Ecology for allocation of water rights.

13. Lacey is under mandate by GMA to accommodate the projected growth determined by the state and yet is not provided the water resources to accommodate this growth in a timely fashion. If water resources have been over allocated in this region the limitations on this necessary resource for growth needs to be made clear to the legislature and GMA expectations for accommodation of growth need to be adjusted accordingly.

14. If water rights are available for appropriation permits need to be issued to promote GMA goals for environmentally friendly smart growth development within designated urban growth areas.

Appendix D
SEPA CHECKLIST AND DNS (DETERMINATION OF NON-SIGNIFICANCE)

DETERMINATION OF NONSIGNIFICANCE

Proponent: City of Lacey

Description of Proposal: Development of a Comprehensive water plan to serve the water needs of the City of Lacey and its associated growth area as identified in the Lacey Comprehensive Land Use Plan under the State growth Management Act.

Location of Proposal: Applies to all of the property currently within the incorporated City of Lacey, Lacey's UGA and areas within Lacey's retail water service area.

Lead Agency: Community Development Department

The lead agency for this proposal has determined that it does not have a probable significant adverse impact upon the environment. An Environmental Impact Statement is not required under RCW 43.21C.030(2)(C). This decision was made after review by the lead agency of a completed environmental checklist and other information on file with the lead agency. This information is available to the public upon request.

There is a 14-day comment period on this DNS as it is for a GMA action.

This DNS is issued under 197-11-340(2); the lead agency will not act on this proposal for 14 days from the date below. No action will be taken on this proposal until the comment period has expired.

Assigned Staff Person: David R. Burns, AICP, Lacey Principal Planner

Responsible Official: Rick Walk, AICP, Community Development Director.

Date of Issuance: June 9, 2011

Comment Deadline: June 24, 2011

David R. Burns, AICP, Principal Planner
Community Development Department
P.O. Box 3400
Lacey, WA 98509-3400
(360) 491-5642

Water system Plan

RCW 197-11-960 ENVIRONMENTAL CHECKLIST

PURPOSE OF CHECKLIST:

The State Environmental Policy Act (SEPA), Chapter 43.21C RCW. requires all governmental agencies to consider the environmental impacts of a proposal before making decisions. An Environmental Impact Statement (EIS) must be prepared for all proposals with probable significant adverse impacts on the quality of the environment. The purpose of this checklist is to provide information to help you and the agency identify impacts from your proposal (and to reduce or avoid impacts from the proposal, if it can be done) and to help the agency decide whether an EIS is required.

INSTRUCTIONS FOR APPLICANTS:

This Environmental Checklist asks you to describe some basic information about your proposal. Governmental agencies use this checklist to determine whether the environmental impacts of your proposal are significant, requiring preparation of an EIS. Answer the questions briefly, with the most precise information known, or give the best description you can.

You must answer each question accurately and carefully, to the best of your knowledge. In most cases, you should be able to answer the questions from your own observations or project plans without the need to hire experts. If you really do not know the answer, or if a question does not apply to your proposal, write "do not know" or "does not apply." Complete answers to the questions now may avoid unnecessary delays later.

Some questions ask about governmental regulations, such as zoning, shoreline, and landmark designations. Answer these questions if you can. If you have problems, the governmental agencies can assist you.

The checklist questions apply to all parts of your proposal, even if you plan to do them over a period of time or on different parcels of land. Attach any additional information that will help describe your proposal or its environmental effects. The agency to which you submit this checklist may ask you to explain your answers or provide additional information reasonably related to determining if there may be significant adverse impacts.

USE OF CHECKLIST FOR NONPROJECT PROPOSALS:

Complete this checklist for nonproject proposals, even though questions may be answered "does not apply." IN ADDITION, complete the SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS (part D).

For nonproject actions, the references in the checklist to the words "project", "applicant", and "property or site", should be read as "proposal", "proposer", and "affected geographic area", respectively.

A. BACKGROUND

1. Name of proposed project, if applicable:

Water System Plan; Non project action concerning Development of a "Water System Comprehensive Plan Update" (Water System Plan) to serve Lacey's water needs under GMA Planning.

2. Name of applicant:

City of Lacey

3. Address and phone number of applicant and contact person:

David Burns, AICP, Principal Planner
P. O. Box 3400
Lacey, WA 98503

4. Date checklist prepared:

June 2011

5. Agency requesting checklist:

City of Lacey

6. Proposed timing or schedule (including phasing, if applicable):

Planning Commission consideration in June of 2011, Council adoption following Washington State Department of Health Approval (2011). Individual projects are proposed throughout the 20-year planning period.

7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.

Provision of water service to developing population will be an ongoing effort requiring periodic updates in planning and programmed expansion of infrastructure to service increased demand. Changes to both short and long range plans and infrastructure may be necessary to address developing issues and concerns. All such changes will require an analysis an additional environmental work if applicable.

8. List any environmental information you know about that has been prepared, or will be

prepared, directly related to this proposal.

Impacts that are most relevant to planning provision of water utility are in the context of the utilities relationship with planned land use. This Plan is based upon land use planning and is anticipated to influence land use consistent with the dispersion, form and density that has been planned. The Water System Plan is expected to help implement planned land use. As such, environmental documents that have reviewed expected impacts from the City's Comprehensive Land Use Plan are representative of the impacts that Lacey's planning under GMA will be expected to have.

General impacts expected from implementation of Lacey's GMA Plan as well as general urbanization under GMA have been identified in a number of environmental documents. These include an environmental impact statement prepared in 1987 to address Lacey's downtown element, an environmental impact statement prepared on the original GMA plan and associated growth strategies in 1994, an expanded environmental checklist prepared on the Land Use Plans update in 2003 and more recently an Impact statement prepared on the Gateway project in 2008. All of these documents looked at general impacts expected from urbanization, planned land use strategies and implementation of smart growth concepts required under GMA.

All of these documents are available at Lacey City Hall.

In addition, there have been a couple of environmental reviews specifically focused on the water Plan. One environmental analysis was done in 2003, and dealt with a Water System Plan update. The most recent environmental analysis was done in March of 2011, to review the application to DOE for water rights.

9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain.

   This is a non project action. There is no one specific property the Water System Plan will impact. Water infrastructure will take place throughout the City and its designated growth area to service development planned under GMA. As individual development projects occur individual site specific impacts will be evaluated and mitigated.

   The City of Lacey does have several water right applications pending DOE approval. These applications are outlined in the Water System Plan and the outcome of these applications will affect the City's ability to implement the plan.

10. List any government approvals or permits that will be needed for your proposal, if known.

   Planning Commission and City Council approvals. Also, environmental review approval is required from the responsible official. Review and approval of the Water System Plan is required by the state Department of Health.

11. Give a brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page.

Development of a Comprehensive Water System Plan to serve the water needs of the City of Lacey and its associated growth area as identified in the Lacey Comprehensive Land Use Plan.

This plan includes and/or considers the following items:

- Current and historical information about the water system,
- Water system policies,
- Growth and water use projections,
- Water quality regulations,
- Analysis of water rights, storage, source, and infrastructure needs,
- Hydraulic analysis,
- Water use efficiency,
- Wellhead protection,
- Capital improvements,
- Financial analysis,
- Operation and maintenance.

Projects originating as a result of this plan will be completed on a project specific basis in compliance with all local, state, and federal regulations.

12. Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.

The area includes the incorporated City of Lacey, its urban growth area and area in its designated water service areas, which generally coincides with the City or the UGA boundaries, but because of historical commitments extends beyond the UGA in several locations; **see maps attached to the draft document**.

TO BE COMPLETED BY APPLICANT

B. ENVIRONMENTAL ELEMENTS

1. EARTH

This is a non project action. Projects taking place as a result of the Water System Plan will occur and may have an impact to this element of the environment. However, each project will be required to develop an independent environmental evaluation based upon site specific impacts in a programmatic approach. Projects will be conditioned to mitigate impacts at the time of project application and will be based upon impacts identified for the specific site.

a. General description of the site (circle one): Flat, rolling, hilly, steep slopes, mountainous, other: The property contains flat, rolling, and steep slopes.

This is a non project action. Not applicable.

b. What is the steepest slope on the site (approximate slope)?

Not applicable.

c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any prime farmland.

Not applicable.

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.

Not applicable.

e. Describe the purpose, type, and approximate quantities of any filling or grading proposed. Indicate source of fill.

Not applicable.

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.

Not applicable

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?

No impervious surfaces will be covered with this proposal since this is a non-project action.

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:

Not applicable. .

2. AIR

This is a non project action. Projects taking place as a result of the Water System Plan will occur and may have an impact to this element of the environment. However, each project will be required to develop an independent environmental evaluation based upon site specific impacts in a programmatic approach. Projects will be conditioned to mitigate impacts at the time of project application and will be based upon impacts identified for the specific site.

a. What types of emissions to the air would result from the proposal (i.e., dust, automobile, odors, industrial wood smoke) during construction and when the project is completed? If any, generally describe and give approximate quantities if known.

Because this is a non-project action, the air will not be affected by this proposal.

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.

Not applicable.

c. Proposed measures to reduce or control emissions or other impacts, if any:

Not applicable.

3. WATER

a. Surface:

This is a non project action. Projects taking place as a result of the Water System Plan will occur and may have an impact to this element of the environment. However, each project will be required to develop an independent environmental evaluation based upon site specific impacts in a programmatic approach. Projects will be conditioned to mitigate impacts at the time of project application and will be based upon impacts identified for the specific site.

Lacey's primary source of water to serve the water needs of its citizens is ground water. The Water System Plan reviews the needs of the City over the long term and provides a Plan to provide the water necessary to meet the needs of current and future citizens according to the Planning requirements of the State Growth Management Act and Lacey's Comprehensive Land Use Plan. This includes significant ground water withdrawal. Studies have reviewed the anticipated impact this will have to aquifer capacity over the long term and the potential impact to surface water. These findings are included in the City of Lacey Comprehensive Water Rights Mitigation Plan. See appendix "K" of the Water System Comprehensive Plan Update.

1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetland)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.

Yes. Lacey has a number of lakes within its incorporated boundary and within the designated growth boundary.

2) Will the project require any work over, in, or adjacent to (within 200 feet) the described water? If yes, please describe and attach available plans.

Not applicable. This is a non project action. Projects taking place as a result of the Water System Plan will occur and may have an impact to this element of the environment. However, each project will be required to develop an independent environmental evaluation based upon site specific impacts in a programmatic approach. Projects will be conditioned to mitigate impacts at the time of project approval and based upon impacts identified for the specific site and project.

3) Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.

Not applicable.

4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.

Not applicable.

5) Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.

Not applicable.

6) Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.

Not applicable.

b. Ground:

1) Will ground water be withdrawn, or will water be discharged to ground water? Give general description, purpose and approximate quantities if known.

Lacey's primary source of water to serve the water needs of its citizens is ground water. The Water System Plan reviews the needs of the City over the long term and provides a Plan to provide the water necessary to meet the needs of current and future citizens according to the Planning requirements of the State Growth Management Act and Lacey's Comprehensive Land Use Plan. This includes significant ground water withdrawal. Studies have reviewed the anticipated impact this will have to aquifer capacity over the long term and the potential impact to surface water. These findings are included in the City of Lacey Comprehensive Water Rights Mitigation Plan. See appendix "K" of the Water System Plan.
The department of Ecology is working with Lacey in review of mitigation plans designed to mitigate ground water withdrawal impacts as a separate matter.

2) Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: Domestic sewage; industrial, containing the following chemicals..., agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number

of animals or humans the system(s) are expected to serve.

Not applicable.

c. Water Runoff (including storm water):

1) Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other water? If so describe.

Not applicable.

2) Could waste materials enter ground or surface waters? If so, generally describe.

Not applicable.

d. Proposed measures to reduce or control surface, ground, and runoff water impacts, if any:

The Water System Plan includes water use efficiency measures to reduce overall water use. See also, discussion above under **b) Groundwater**.

4. PLANTS

This is a non project action. Projects taking place as a result of the Water System Plan will occur and may have an impact to this element of the environment. However, each project will be required to develop an independent environmental evaluation based upon site specific impacts in a programmatic approach. Projects will be conditioned to mitigate impacts at the time of project approval and based upon impacts identified for the specific site and project.

a. Check or circle types of vegetation found on the site:
____deciduous tree: alder, maple, aspen, other
____evergreen tree: fir, cedar, pine, other
____shrubs
____grass
____pasture
____crop or grain
____wet soil plants: cattail, buttercup, bulrush, skunk cabbage, other
____water plants: water lily, eelgrass, milfoil, other
____other types of vegetation

b. What kind and amount of vegetation will be removed or altered?

No vegetation shall be removed or altered with this proposal as it is a non-project action.

c. List threatened or endangered species known to be on or near the site.

Not applicable.

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:

Not applicable.

5. ANIMALS

a. Circle any birds and animals which have been observed on or near the site or are known to be on or near the site:

Not applicable this is a non project action.

birds: hawk, heron, eagle, songbirds, other:..........
mammals: deer, bear, elk, beaver, other:..............
fish: bass, salmon, trout, herring, shellfish, other...

b. List any threatened or endangered species known to be on or near the site.

Not applicable.

c. Is the site part of a migration route? If so, explain.

Not applicable.

d. Proposed measures to preserve or enhance wildlife, if any:

Not applicable.

6. ENERGY AND NATURAL RESOURCES

This is a non project action. Projects taking place as a result of the Water System Plan will occur and may have an impact to this element of the environment. However, each project will be required to develop an independent environmental evaluation based upon site specific impacts in a programmatic approach. Projects will be conditioned to mitigate impacts at the time of project approval and based upon impacts identified for the specific site and project.

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

Not applicable.

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

Not applicable.

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

Not applicable.

7. ENVIRONMENTAL HEALTH

This is a non project action. Projects taking place as a result of the Water System Plan will occur and may have an impact to this element of the environment. However, each project will be required to develop an independent environmental evaluation based upon site specific impacts in a programmatic approach. Projects will be conditioned to mitigate impacts at the time of project approval and based upon impacts identified for the specific site and project.

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste, that could occur as a result of this proposal? If so, describe.

1) Describe special emergency services that might be required.

Not applicable.

2) Proposed measures to reduce or control environmental health hazards, if any:

The Water System Plan addresses the City's Wellhead Protection Program and its Spill Response Plan which relate to environmental and public health hazards.

b. Noise

This is a non project action. Projects taking place as a result of the Water System Plan will occur and may have an impact to this element of the environment. However, each project will be required to develop an independent environmental evaluation based upon site specific impacts in a programmatic approach. Projects will be conditioned to mitigate impacts at the time of project approval and based upon impacts identified for the specific site and project.

1) What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other?)

Not applicable.

2) What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.

Not applicable.

3) Proposed measures to reduce or control noise impacts, if any:

Not applicable.

8. LAND AND SHORELINE USE

Impacts that are most relevant to planning provision of water utility are in the context of the utilities relationship with planned land use. The Water System Plan is based upon the city's land use planning and is anticipated to influence land use consistent with the dispersion, form and density that has been planned under the City's GMA Comprehensive Land Use Plan. The Water System Plan is expected to help implement planned land use.

General impacts expected from implementation of Lacey's GMA Plan as well as general urbanization under GMA have been identified in a number of environmental documents. These include an environmental impact statement prepared in 1987 to address Lacey's downtown element, an environmental impact statement prepared on the original GMA plan and associated growth strategies in 1994, an expanded environmental checklist prepared on the land use plans update in 2003 and more recently an Impact statement prepared on the Gateway project in 2008. All of these documents looked at general impacts expected from urbanization, planned land use strategies and implementation of smart growth concepts required under GMA.

The Water System Plan is a non project action. Projects taking place as a result of the Water System Plan will occur and may have an impact to this element of the environment. However, each project will be required to develop an independent environmental evaluation based upon site specific impacts in a programmatic approach. Projects will be conditioned to mitigate impacts at the time of project approval and based upon impacts identified for the specific site and project.

a. What is the current use of the site and adjacent properties?

This is a non project action applying to the entire City and its urban growth area. Not applicable.

b. Has the site been used for agriculture? If so describe.

Not applicable.

c. Describe any structures on the site.
Not applicable.

d. Will any structures be demolished? If so what?

Not applicable.

e. What is the current zoning classification of the site?

Not applicable.

f. What is the current comprehensive plan designation of the site?

Not applicable.

g. If applicable, what is the current shoreline master program designation of the site?

Not applicable.

h. Has any part of the site been classified as an "environmentally sensitive" area? If so, specify.

Not applicable. However the amendments focus on regulation of sites with wetlands.

i. Approximately how many people would reside or work in the completed project?

Not applicable.

j. Approximately how many people would the completed project displace?

Not applicable.

k. Proposed measures to avoid or reduce displacement impacts, if any:

Not applicable.

l. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:

Not applicable.

9. HOUSING

This is a non project action. Projects taking place as a result of the Water System Plan will occur and may have an impact to this element of the environment. However, each project will be required to develop an independent environmental evaluation based upon site specific impacts in a programmatic approach. Projects will be conditioned to mitigate impacts at the time of project approval and based upon impacts identified for the specific site and project.

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low income housing.

Not applicable.

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low income housing.

Not applicable.

c. Proposed measures to reduce or control housing impacts, if any:

Not applicable.

10. AESTHETICS

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed.

Not applicable.

b. What views in the immediate vicinity would be altered or obstructed?

Not applicable.

c. Proposed measures to reduce or control aesthetic impacts if any:

Not applicable.

11. LIGHT AND GLARE

This is a non project action. Projects taking place as a result of the Water System Plan will occur and may have an impact to this element of the environment. However, each project will be required to develop an independent environmental evaluation based upon site specific impacts in a programmatic approach. Projects will be conditioned to mitigate impacts at the time of project approval and based upon impacts identified for the specific site and project.

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?

Not applicable.

b. Could light or glare from the finished project be a safety hazard or interfere with view?

Not applicable.

c. What existing off-site sources of light or glare may affect your proposal?

Not applicable.

d. Proposed measures to reduce or control light and glare impacts, if any:

Not applicable.

12. RECREATION

This is a non project action. Projects taking place as a result of the Water System Plan will occur and may have an impact to this element of the environment. However, each project will be required to develop an independent environmental evaluation based upon site specific impacts in a programmatic approach. Projects will be conditioned to mitigate impacts at the time of project approval and based upon impacts identified for the specific site and project.

a. What designated and informal recreational opportunities are in the immediate vicinity?

Not applicable.

b. Would the proposed project displace any existing recreational uses? If so describe.

Not applicable.

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:

Not applicable.

13. HISTORIC AND CULTURAL PRESERVATION

This is a non project action. Projects taking place as a result of the Water System Plan will occur and may have an impact to this element of the environment. However, each project will be required to develop an independent environmental evaluation based upon site specific impacts in a programmatic approach. Projects will be conditioned to mitigate impacts at the time of project approval and based upon impacts identified for the specific site and project.

a. Are there any places or objects listed on, or proposed for, national, state, or local preservation registers known to be on or next to the site? If so, generally describe.

Not applicable.

b. Generally describe any landmarks or evidence of historic, archaeological, scientific, or cultural importance known to be on or next to the site.

Not applicable.

c. Proposed measures to reduce or control impacts, if any:

Not applicable.

14. TRANSPORTATION

This is a non project action. Projects taking place as a result of the Water System Plan will occur and may have an impact to this element of the environment. However, each project will be required to develop an independent environmental evaluation based upon site specific impacts in a programmatic approach. Projects will be conditioned to mitigate impacts at the time of project approval and based upon impacts identified for the specific site and project.

a. Identify public streets and highways serving the site, and describe proposed access to the existing street system. Show on site plans if any.

Not applicable.

b. Is site currently served by public transit? If not, what is the approximate distance to the nearest transit stop?

Not applicable.

c. How many parking spaces would the completed project have? How many would the project eliminate?

Not applicable.

d. Will the proposal require any new roads or streets, or improvements to existing road or streets, not including driveways? If so, generally describe (indicate whether public or private).

Not applicable.

e. Will the project use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.

Not applicable.

f. How many vehicular trips per day would be generated by the completed project? If known, indicate when peak volumes would occur.

Not applicable.

g. Proposed measures to reduce or control transportation impacts, if any:

Not applicable.

15. PUBLIC SERVICES

This is a non project action. Projects taking place as a result of the Water System Plan will occur and may have an impact to this element of the environment. However, each project will be required to develop an independent environmental evaluation based upon site specific impacts in a programmatic approach. Projects will be conditioned to mitigate impacts at the time of project approval and based upon impacts identified for the specific site and project.

a. Would the project result in an increased need for public services (for example: fire protection, police protection, health care, school, other)? If so, generally describe.

Not applicable.

b. Proposed measures to reduce or control direct impacts on public services, if any.

Not applicable.

16. UTILITIES

This is a non project action. Projects taking place as a result of the Water System Plan will occur and may have an impact to this element of the environment. However, each project will be required to develop an independent environmental evaluation based upon site specific impacts in a programmatic approach. Projects will be conditioned to mitigate impacts at the time of project approval and based upon impacts identified for the specific site and project.

The Water System Plan deals with provision of the water service to Lacey citizens over the long term. This has been done under consideration of what population Lacey expects to need to accommodate over the next 20 year period. From this standpoint the Water System Plan can be considered one big mitigation effort to provide this service to Lacey. Without the Plan and effort being made to implement its concepts the future citizens of Lacey would not have a water utility.

a. Circle utilities currently available at the site: electricity, natural gas, water, refuse service, telephone, sanitary sewer, septic system, other.

b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed.

Not applicable.

C. SIGNATURE

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature: ....

Date submitted: 4/1/2011 ....

D. SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS
(do not use this sheet for project actions)

Because these questions are very general, it may be helpful to read them in conjunction with the list of the elements of the environment.

When answering these questions, be aware of the extent the proposal, or the types of activities likely to result from the proposal, would affect the item at a greater intensity or at a faster rate than if the proposal were not implemented. Respond briefly and in general terms.

1. How would the proposal be likely to increase discharge to water, emissions to air, production, storage, or release of toxic or hazardous substances, or production of noise?

   Not applicable. This is a non project action. Projects taking place as a result of the Water System Plan will occur and may have an impact to this element of the environment. However, each project will be required to develop an independent environmental evaluation based upon site specific impacts in a programmatic approach. Projects will be conditioned to mitigate impacts at the time of project approval and based upon impacts identified for the specific site and project.

Proposed measures to avoid or reduce such increases are:

   This is a non project action. Projects taking place as a result of the Water System Plan will occur and may have an impact to this element of the environment. However, each project will be required to develop an independent environmental evaluation based upon site specific impacts in a programmatic approach. Projects will be conditioned to mitigate impacts at the time of project approval and based upon impacts identified for the specific site and project.

2. How would the proposal be likely to affect plants, animals, fish or marine life?

   This is a non project action. Projects taking place as a result of the Water System Plan will occur and may have an impact to this element of the environment. However, each project will be required to develop an independent environmental evaluation based upon site specific impacts in a programmatic approach. Projects will be conditioned to mitigate impacts at the time of project approval and based upon impacts identified for the specific site and project.

Proposed measures to protect or conserve plants, animals, fish, or marine life are:

See response above.

3. How would the proposal be likely to deplete energy or natural resources?

This is a non project action. However, the Plan involves the use of ground water for the potable water needs of population accommodated under GMA Planning. Lacey's primary source of water to serve the water needs of its citizens is ground water. The Water System Plan reviews the needs of the City over the long term and provides a Plan to provide the water necessary to meet the needs of current and future citizens according to the Planning requirements of the State Growth Management Act and Lacey's Comprehensive Land Use Plan. This includes significant ground water withdrawal. Studies have reviewed the anticipated impact this will have to aquifer capacity over the long term and the potential impact to surface water. These findings are included in the City of Lacey Comprehensive Water Rights Mitigation Plan. See appendix "K" of the Water System Plan.

Proposed measures to protect or conserve energy and natural resources are:

Overall, conservation of water resources is a major component of Lacey's water program. The Water System Plan includes water use efficiency measures to reduce overall water use. The department of Ecology is working with Lacey in review of mitigation plans designed to mitigate ground water withdrawal impacts as a separate matter.

In addition, projects taking place as a result of the Water System Plan will occur and may have an impact to this element of the environment. However, each project will be required to develop an independent environmental evaluation based upon site specific impacts in a programmatic approach. Projects will be conditioned to mitigate impacts at the time of project approval and based upon impacts identified for the specific site and project.

4. How would the proposal be likely to use or affect environmentally sensitive areas or areas designated (or eligible or under study) for governmental protection, such as parks, wilderness, wild and scenic rivers, threatened or endangered species habitat, historic or cultural sites, wetland, floodplains, or prime farmlands?

This is a non project action. Projects taking place as a result of the Water System Plan will occur and may have an impact to this element of the environment. However, each project will be required to develop an independent environmental evaluation based upon site specific impacts in a programmatic approach. Projects will be conditioned to mitigate impacts at the time of project approval and based upon impacts identified for the specific site and project.

Proposed measures to protect such resources or to avoid or reduce impacts are:

This is a non project action. Projects taking place as a result of the Water System Plan will occur and may have an impact to this element of the environment. However, each project will be required to develop an independent environmental evaluation based upon site specific impacts in a programmatic approach. Projects will be conditioned to mitigate impacts at the time of project approval and based upon impacts identified for the specific site and project.

5. How would the proposal be likely to affect land and shoreline use, including whether it would allow or encourage land or shoreline uses incompatible with existing plans?

Land use impacts that are most relevant to planning provision of water utility are in the context of the utilities relationship with planned land use. The Water System Plan is based upon the city's land use planning and is anticipated to influence land use consistent with the dispersion, form and density that has been planned under the City's GMA Comprehensive Land Use Plan. The Water System Plan is expected to help implement planned land use.

General impacts expected from implementation of Lacey's GMA Plan as well as general urbanization under GMA have been identified in a number of environmental documents. These include an environmental impact statement prepared in 1987 to address Lacey's downtown element, an environmental impact statement prepared on the original GMA plan and associated growth strategies in 1994, an expanded environmental checklist prepared on the land use plans update in 2003 and more recently an Impact statement prepared on the Gateway project in 2008. All of these documents looked at general impacts expected from urbanization, planned land use strategies and implementation of smart growth concepts required under GMA.

The Water System Plan is a non project action. Projects taking place as a result of the Water System Plan will occur and may have an impact to this element of the environment. However, each project will be required to develop an independent environmental evaluation based upon site specific impacts in a programmatic approach. Projects will be conditioned to mitigate impacts at the time of project approval and based upon impacts identified for the specific site and project.

Proposed measures to avoid or reduce shoreline and land use impacts are:

The amendment can be considered an implanting tool for the Comprehensive Land Use Plan.

6. How would the proposal be likely to increase demands on transportation or public services and utilities?

   Not applicable.

Proposed measures to reduce or respond to such demand(s) are:

   Not applicable.

7. Identify, if possible, whether the proposal may conflict with local, state, or other requirements for the protection of the environment.

   This is a non project action. Projects taking place as a result of the Water System Plan will occur and may have an impact to this element of the environment. However, each project will be required to develop an independent environmental evaluation based upon site specific impacts in a programmatic approach. Projects will be conditioned to mitigate impacts at the time of project approval and based upon impacts identified for the specific site and project.

ENVNE:cd

Appendix E
THURSTON COUNTY ENDANGERED SPECIES

Thurston County Endangered Species List

IMPORTANT NOTE – These are the species and habitats identified for Thurston County. This list of species and habitats was developed using the distribution maps found in the Priority Habitat and Species (PHS) List (see http://wdfw.wa.gov/hab/phslist.htm). Species distribution maps depict counties where each priority species is known to occur as well as other counties where habitat primarily associated with the species exists. Two assumptions were made when developing distribution maps for each species:

· There is a high likelihood a species is present in a county, even if it has not been directly observed, if the habitat with which it is primarily associated exists.
· Over time, species can naturally change their distribution and move to new counties where usable habitat exists.

Distribution maps in the PHS List were developed using the best information available. As new information becomes available, known distribution for some species may expand or contract. WDFW will periodically review and update the the distribution maps in PHS list.

Thurston County Endangered Species List

Species/ Habitats

Habitats	Aspen Stands
	Biodiversity Areas & Corridors
	Herbaceous Balds
	Old-Growth/Mature Forest
	Oregon White Oak Woodlands
	West Side Prairie
	Riparian
	Freshwater Wetlands & Fresh Deepwater
	Instream
	Puget Sound Nearshore
	Caves
	Cliffs
	Snags and Logs
	Talus
Fishes	Pacific Lamprey
	River Lamprey
	Olympic Mudminnow
	Pacific Herring
	Longfin Smelt
	Surfsmelt
	Bull Trout/ Dolly Varden
	Chinook Salmon
	Chum Salmon
	Coastal Res./ Searun Cutthroat
	Coho
	Pink Salmon
	Rainbow Trout/ Steelhead/ Inland Redband Trout
	Sockeye Salmon
	Pacific Cod
	Pacific Hake
	Walleye Pollock
	Brown Rockfish
	Copper Rockfish
	Quillback Rockfish
	Lingcod
	Pacific Sand Lance
	English Sole
	Rock Sole
Amphibians	Cascade Torrent Salamander
	Van Dyke's Salamander
	Oregon Spotted Frog
	Western Toad

Thurston County Endangered Species List

Reptiles	Western Pond Turtle
Birds	Common Murre
	Marbled Murrelet
	Western grebe
	W WA nonbreeding concentrations of: Loons, Grebes, Cormorants, Fulmar, Shearwaters, Storm-petrels, Alcids
	W WA breeding concentrations of: Cormorants, Storm-petrels, Terns, Alcids
	Great Blue Heron
	Brant
	Cavity-nesting ducks: Wood Duck, Barrow’s Goldeneye, Common Goldeneye, Bufflehead, Hooded Merganser
	Western Washington nonbreeding concentrations of: Barrow's Goldeneye, Common Goldeneye, Bufflehead
	Harlequin Duck
	Waterfowl Concentrations
	Bald Eagle
	Golden Eagle
	Peregrine Falcon
	Mountain Quail
	Sooty Grouse
	Wild Turkey
	W WA nonbreeding concentrations of: Charadriidae, Scolopacidae, Phalaropodidae
	Band-tailed Pigeon
	Yellow-billed Cuckoo
	Spotted Owl
	Vaux’s Swift
	Pileated Woodpecker
	Oregon Vesper Sparrow
	Purple Martin
	Streaked Horned Lark
Mammals	Dall's Porpoise
	Harbor Seal
	Orca (Killer Whale)
	Pacific Harbor Porpoise
	Roosting Concentrations of: Big-brown Bat, Myotis bats, Pallid Bat
	Townsend’s Big-eared Bat
	Western Pocket Gopher
	Fisher
	Marten
	Columbian Black-tailed Deer
	Elk

Thurston County Endangered Species List

Invertebrates	Geoduck
	Butter Clam
	Native Littleneck Clam
	Manila Clam
	Olympia Oyster
	Pacific Oyster
	Dungeness Crab
	Pandalid shrimp (Pandalidae)
	Beller's Ground Beetle
	Pacific Clubtail
	Leschi's Millipede
	Mardon Skipper
	Puget Blue
	Valley Silverspot
	Taylor's Checkerspot

Appendix F

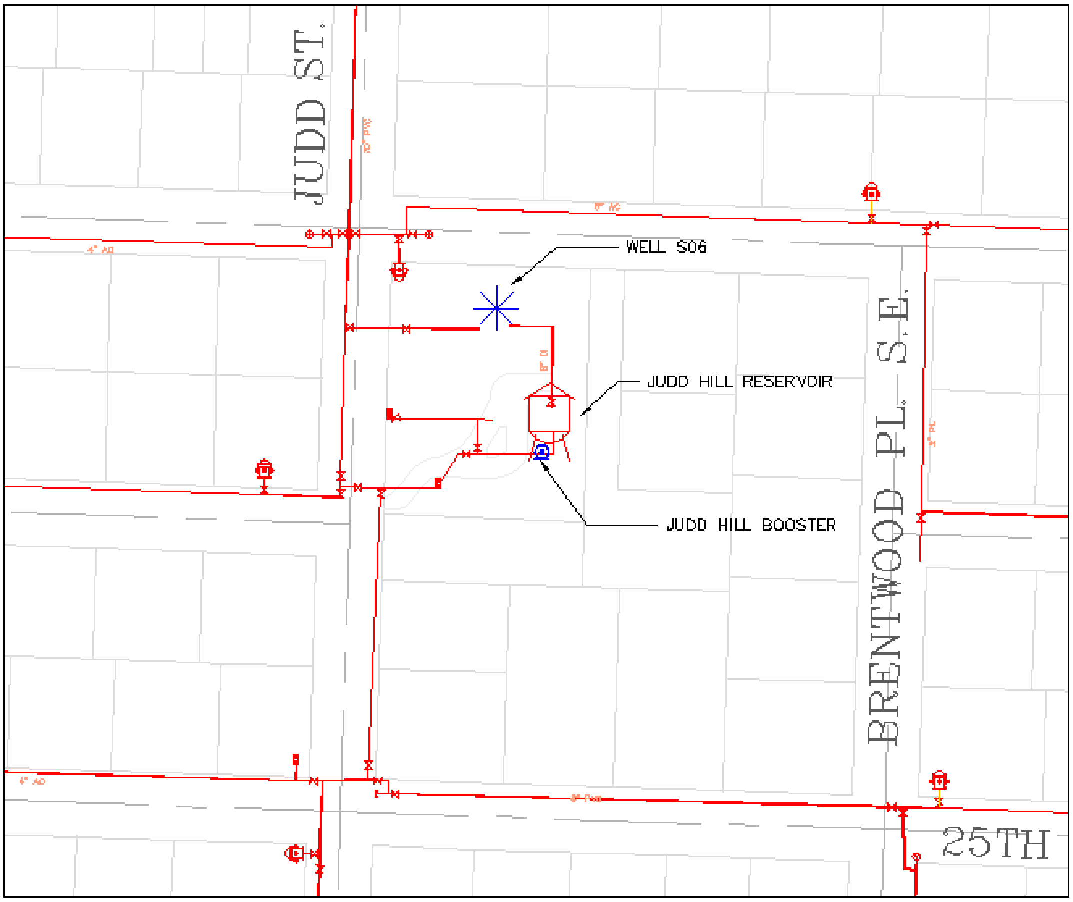
DETAILED FACILITY DATA SHEETS AND PRODUCTION WELL LOGS

Judd Hill Reservoir

Facility Information

Description	Comments
Address	2400 Judd St. SE
Year Constructed	1964
Type	Above Ground Stand Pipe
Tank Construction	Welded Steel
Capacity (MG)	0.5
Gallons/Foot	6,791
Diameter (ft)	34
Base Elevation (ft)	236.41
Overflow Elevation (ft)	311
Shell Height (ft)	75
Pressure Zone	337
Roof	Single column supported cone roof; 3/4":12" roof slope
Floor	1/4" plate; crowned 0.33'
Foundation	42" concrete ring wall
Anchorage	Anchor straps
Inlet/Outlet Pipe	8" separate inlet/outlet
Roof Vent	20" Ø
Roof Access	1 - square access hatch, 24"x24"
Shell Access	1 - 24" Ø manhole
Overflow Pipe	4" pipe, day lighted on-site
Interior Ladder	Basic ladder
Exterior Ladder	"Saf-T-Climb" device
Inlet/Outlet Vault	None
Altitude Valve	6" 210G-17ABCS
Meter	Meter in booster station
Design Standards	Unknown
Mixing System	None
Minimum Water Level (ft)	10 (booster pump lock-out)
Dead Storage (MG)	0.07
Notes	Tank drains directly to Judd Hill Booster Station. Altitude valve located in S06 well house. Tank fills from S06 directly, can also fill from the distribution system by manual operation.

Judd Hill Reservoir

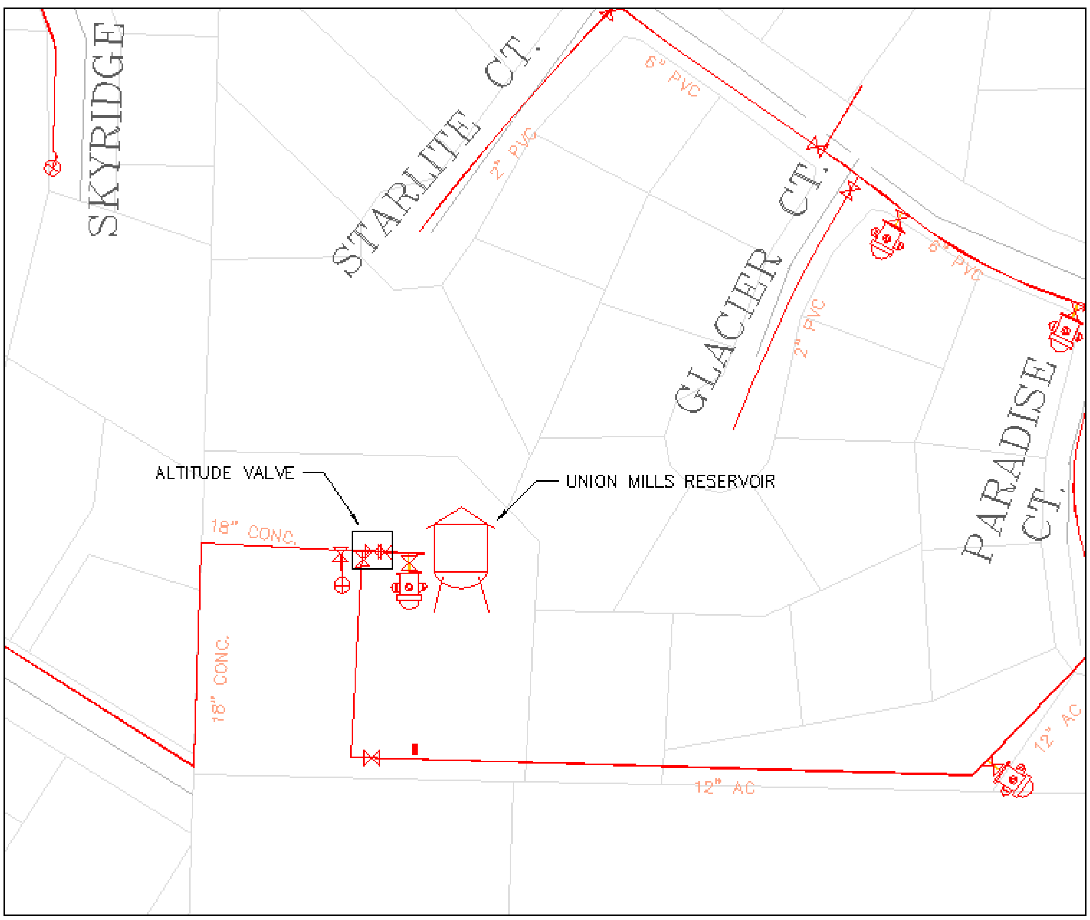


Union Mills Reservoir

Facility Information

Description	Comments
Address	1349 Paradise Ct. SE
Year Constructed	1969
Type	Above Ground Stand Pipe
Tank Construction	Welded Steel
Capacity (MG)	2.2
Gallons/Foot	33,933
Diameter (ft)	76
Base Elevation (ft)	271.62
Overflow Elevation (ft)	337.5
Shell Height (ft)	56.5
Pressure Zone	337
Roof	Ellipsoidal, 20' high
Floor	1/4" plate; crowned 0.5'
Foundation	Concrete ring wall
Anchorage	1/2" annular floor plate
Inlet/Outlet Pipe	18" common pipe
Roof Vent	36" Ø
Roof Access	1 - square access hatch, 42"x42"
Shell Access	1 - 36" Ø manhole 1 - 24" Ø manhole
Overflow Pipe	8" exterior pipe
Interior Ladder	Ladder to interior platform
Exterior Ladder	"Saf-T-Climb", cage at upper most 16'
Inlet/Outlet Vault	None
Altitude Valve	16" 210G-65ABC (in separate valve vault)
Meter	None
Design Standards	Unknown
Mixing System	None
Minimum Water Level (ft)	39
Dead Storage (MG)	1.31
Notes	

Union Mills Reservoir

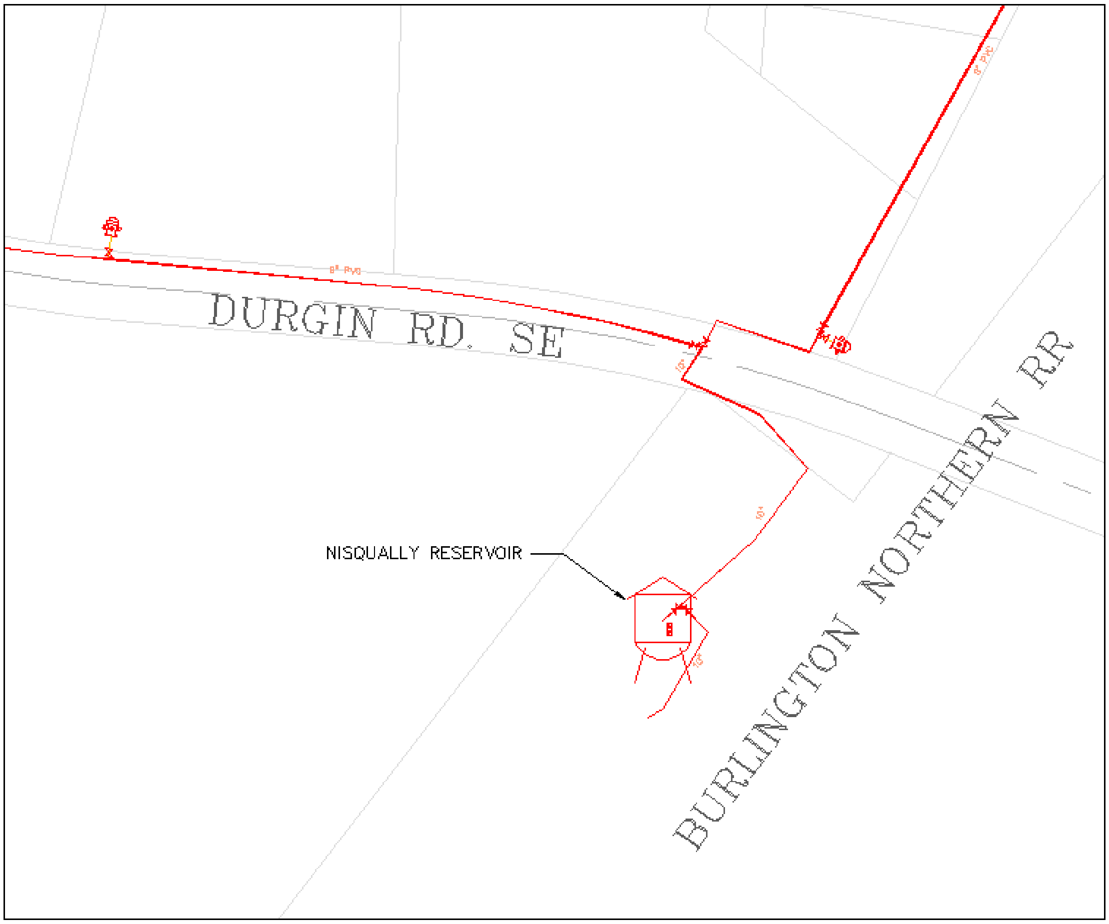


Nisqually Reservoir

Facility Information

Description	Comments
Address	11155 Durgin Rd.SE
Year Constructed	1977
Type	Above Ground Stand Pipe
Tank Construction	Welded Steel
Capacity (MG)	0.15
Gallons/Foot	5,465
Diameter (ft)	30.5
Base Elevation (ft)	162.20
Overflow Elevation (ft)	189
Shell Height (ft)	28
Pressure Zone	188
Roof	Single column supported cone roof; 3/4":12" roof slope
Floor	1/4" plate; crowned
Foundation	Concrete ring wall
Anchorage	N/A
Inlet/Outlet Pipe	10" common pipe
Roof Vent	12"
Roof Access	1 - square access hatch
Shell Access	1 - 36" Ø manholes
Overflow Pipe	6" exterior; 4" drain to atmosphere
Interior Ladder	Basic ladder
Exterior Ladder	Ladder with safety climb
Inlet/Outlet Vault	None
Altitude Valve	None
Meter	None
Design Standards	Unknown
Mixing System	None
Minimum Water Level (ft)	0
Dead Storage (MG)	0
Notes	

Nisqually Reservoir

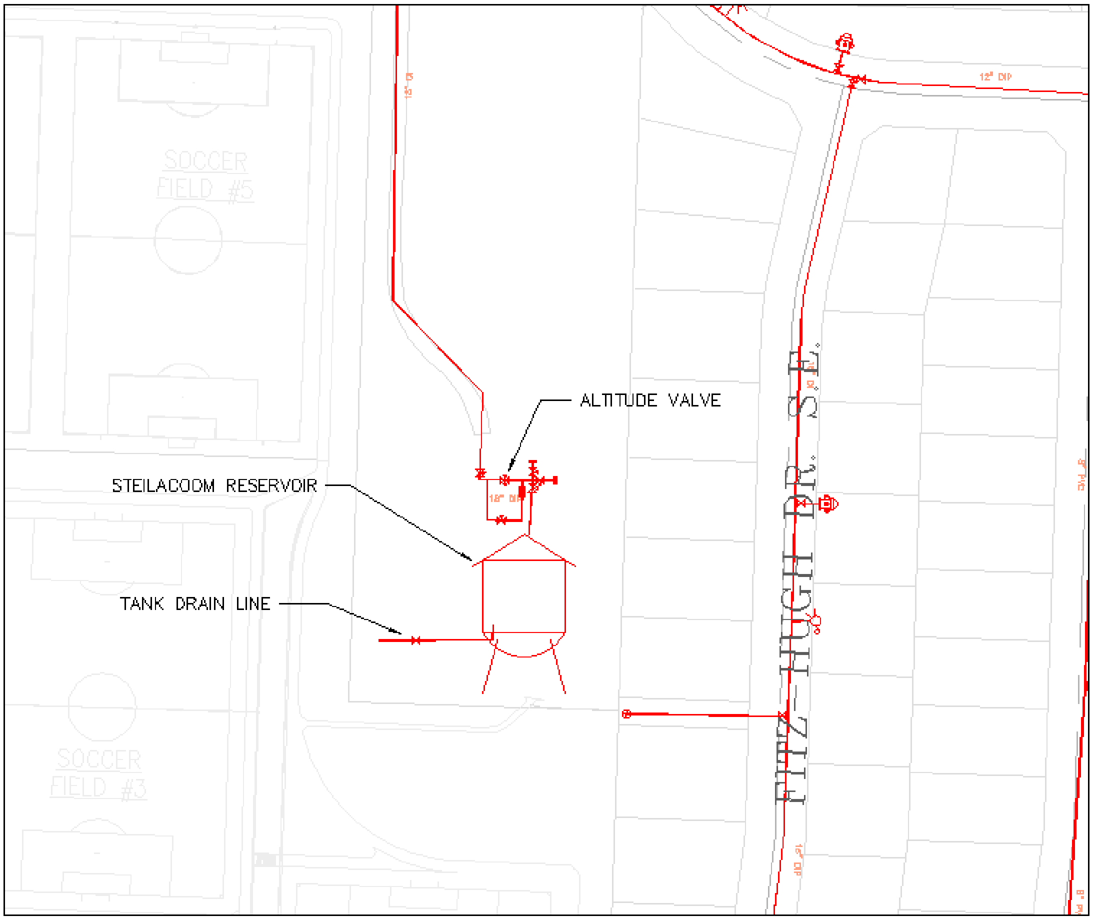


Steilacoom Reservoir

Facility Information

Description	Comments
Address	8705 Steilacoom Rd. SE
Year Constructed	1986
Type	Above Ground Stand Pipe
Tank Construction	Welded Steel
Capacity (MG)	3.0
Gallons/Foot	41,452
Diameter (ft)	84
Base Elevation (ft)	264.85
Overflow Elevation (ft)	337.5
Shell Height (ft)	71
Pressure Zone	337
Roof	Single column supported cone roof; 3/4":12" roof slope; 30" knuckle
Floor	1/4" plate; crowned 0.5'
Foundation	24" ring wall, on 7'-6" spread footing
Anchorage	Welded anchor straps
Inlet/Outlet Pipe	18" common pipe
Roof Vent	24" Ø
Roof Access	1 - square access hatch, 36"x36"
Shell Access	2 - 36" Ø manholes
Overflow Pipe	12" pipe to detention pond
Interior Ladder	Basic ladder
Exterior Ladder	"Saf-T-Climb" device
Inlet/Outlet Vault	None
Altitude Valve	16" 210G (in separate valve vault)
Meter	None
Design Standards	Unknown
Mixing System	None
Minimum Water Level (ft)	45
Dead Storage (MG)	1.87
Notes	

Steilacoom Reservoir

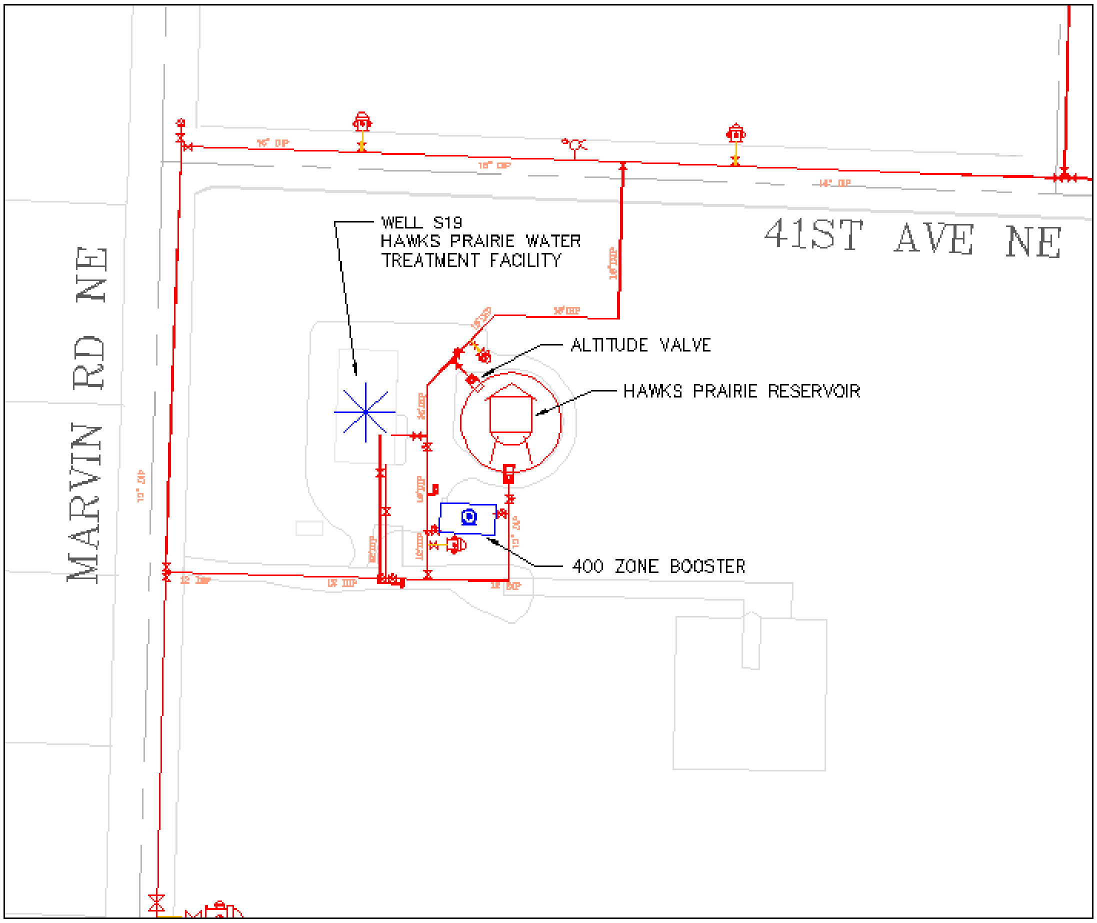


Hawks Prairie Reservoir

Facility Information

Description	Comments
Address	4040 Marvin Rd. NE
Year Constructed	1995
Type	Above Ground Stand Pipe
Tank Construction	Welded Steel
Capacity (MG)	4.0
Gallons/Foot	47,586
Diameter (ft)	90
Base Elevation (ft)	294.87
Overflow Elevation (ft)	380
Shell Height (ft)	88
Pressure Zone	400
Roof	Single column supported cone roof; 3/4":12" roof slope
Floor	1/4" plate; crowned 1.0'
Foundation	30" ring wall, 6'-0" high on 14' spread footing, 5'-0" thick
Anchorage	2-1/2" Ø @ 4' o.c.
Inlet/Outlet Pipe	12" with 90° base elbow in vault
Roof Vent	30"
Roof Access	2-rectangular access hatches, 36"x30"
Shell Access	2 - 36" Ø manholes
Overflow Pipe	12" Steel, piped to detention pond
Interior Ladder	"Saf-T-Climb" device
Exterior Ladder	Stairway
Inlet/Outlet Vault	13.75' x 7.0' x 6.5'
Altitude Valve	12" 210G-09BD
Meter	10" magnetic
Design Standards	AWWA D100-84 (1996); Seismic Zone 3; 25 psf snow load; 100 mph wind load-exposure B
Mixing System	Tideflex
Minimum Water Level (ft)	10 (booster pump lock-out)
Dead Storage (MG)	0.48
Notes	Separate inlet and outlet piping. Typically drains directly to the 400 Zone booster station, but can also drain to the distribution system via check-valve. Altitude valve controls fill cycle via pressure sustaining feature.

Hawks Prairie Reservoir

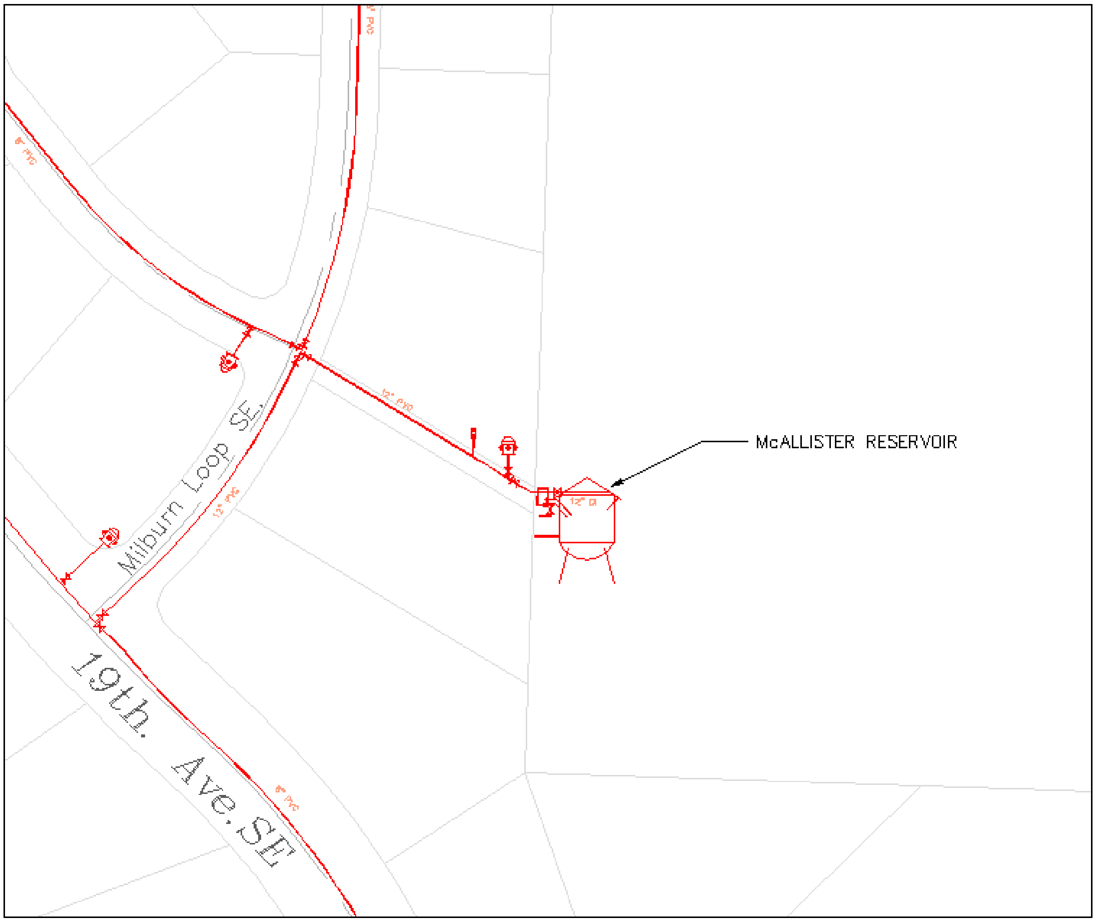


McAllister Reservoir

Facility Information

Description	Comments
Address	9707 Piper Hill Dr. SE
Year Constructed	1998
Type	Above Ground Stand Pipe
Tank Construction	Welded Steel
Capacity (MG)	1.2
Gallons/Foot	11,896
Diameter (ft)	45
Base Elevation (ft)	300.26
Overflow Elevation (ft)	400
Shell Height (ft)	102
Pressure Zone	400
Roof	Cone roof; 3/4":12" roof slope
Floor	1/4" plate; crowned 0.7'
Foundation	Reinforced concrete mat, 66' Ø x 4'-6" thick, 0.7' center crown
Anchorage	2 1/2" Ø @ 4' o.c.
Inlet/Outlet Pipe	12" with 90° elbow cast in concrete
Roof Vent	2'-6" Ø, AWWA type
Roof Access	2 - rectangular access hatches, 38"x30"
Shell Access	2 - 36" Ø manholes
Overflow Pipe	12" with 60° and 45° elbows, piped to storm sewer
Interior Ladder	"Saf-T-Climb" device
Exterior Ladder	Stairway
Inlet/Outlet Vault	None
Altitude Valve	12" 210G-09BDS (in separate valve vault)
Meter	None
Design Standards	AWWA D100-96; Seismic Zone 3; 25 psf snow load; 100 mph wind load-exposure B
Mixing System	None
Minimum Water Level (ft)	56
Dead Storage (MG)	0.67
Notes	

McAllister Reservoir

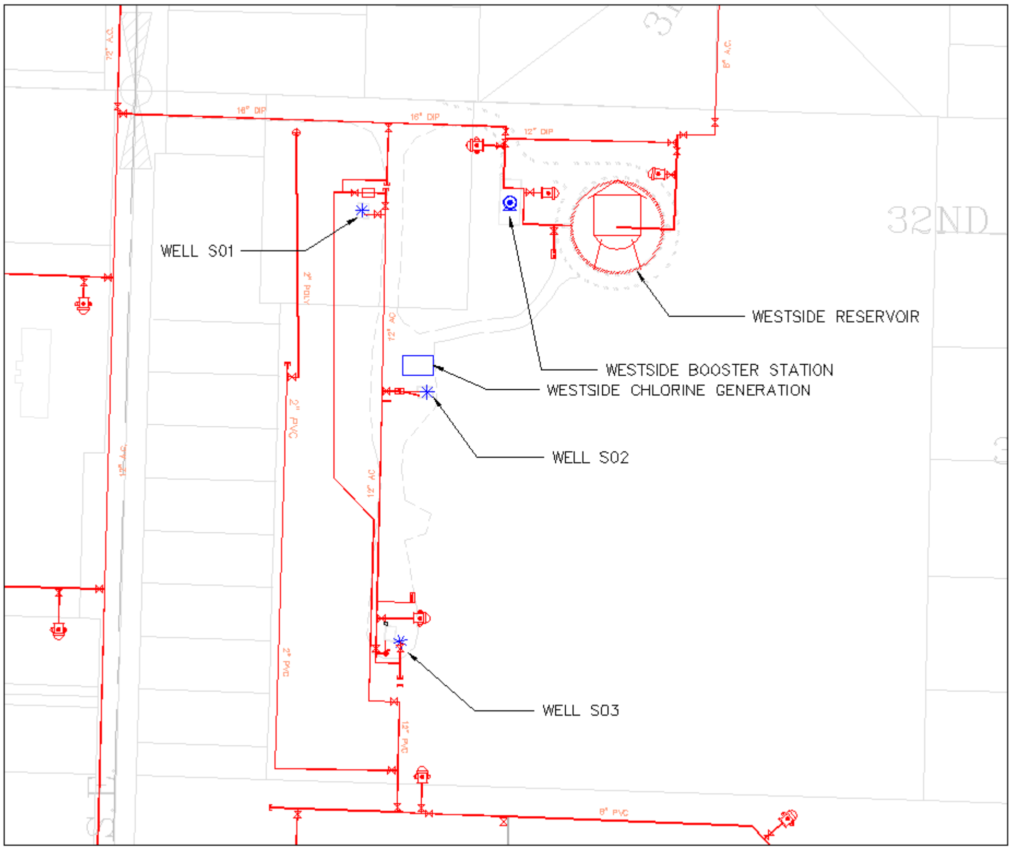


Westside Reservoir

Facility Information

Description	Comments
Address	3140 College St. SE
Year Constructed	2002
Type	Above Ground Stand Pipe
Tank Construction	Welded Steel
Capacity (MG)	2.0
Gallons/Foot	47,586
Diameter (ft)	90
Base Elevation (ft)	232.53
Overflow Elevation (ft)	274.5
Shell Height (ft)	45
Pressure Zone	337
Roof	Single column supported cone roof; 3/4":12" roof slope
Floor	1/4" plate; crowned 0.5'
Foundation	24" concrete ring wall
Anchorage	3/8" annular plate
Inlet/Outlet Pipe	12" with 90° elbow
Roof Vent	24" Ø, AWWA type
Roof Access	2 - rectangular access hatches, 36"x30"
Shell Access	2 - 36" Ø manholes
Overflow Pipe	12" exterior pipe to detention pond
Interior Ladder	"Saf-T-Climb" device
Exterior Ladder	Stairway
Inlet/Outlet Vault	16'-0" x 7'-0" x 5'-8"
Altitude Valve	12" 100G-103
Meter	Inlet – 8" magnetic Outlet – 12" magnetic
Design Standards	AWWA D100-96; Seismic Zone 3; 25 psf snow load; 100 mph wind load-exposure B
Mixing System	None
Minimum Water Level (ft)	10 (booster pump lock-out)
Dead Storage (MG)	0.48
Notes	Drains directly to the Westside booster station.

Westside Reservoir

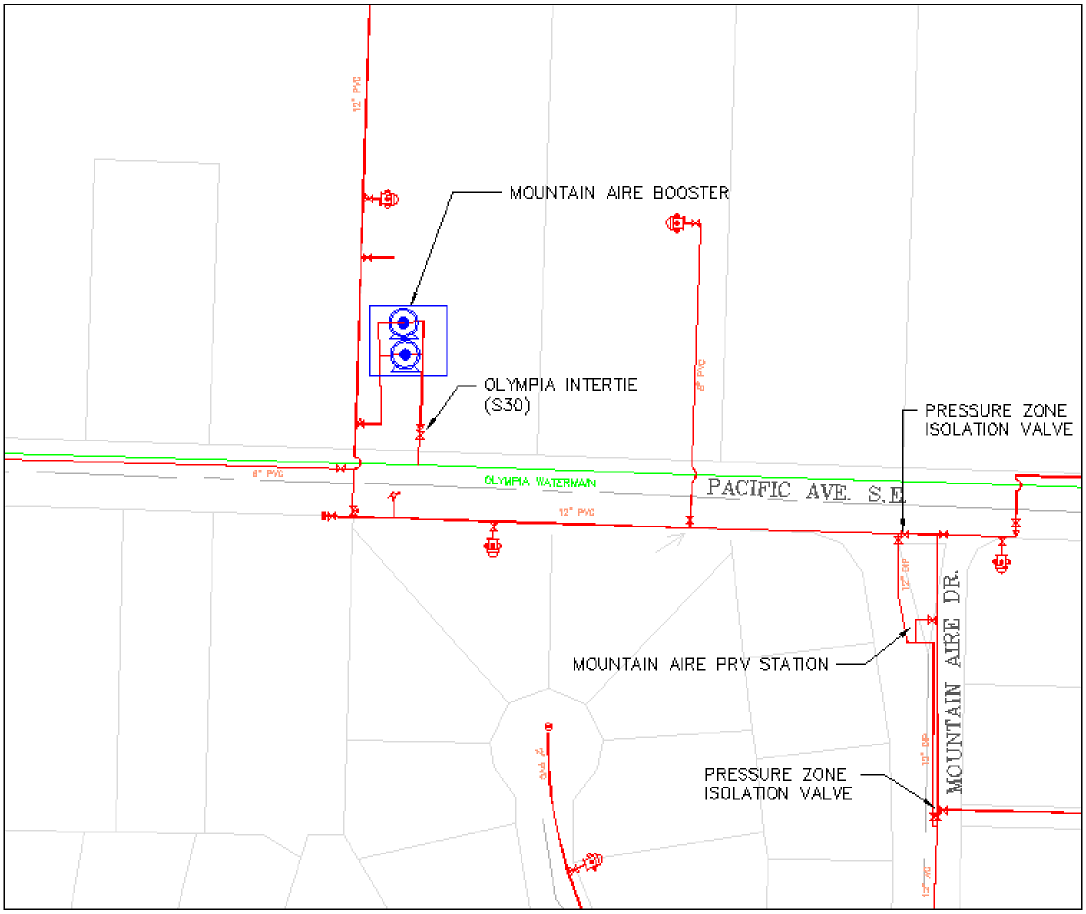


Mountain Aire Booster

Facility Information

Description	Pump #1	Pump #2
Address	8002 Pacific Ave. SE	
Year Constructed	1988	
Pressure Zone	337	
Floor Elevation	204.06	
Source	City of Olympia (S30)	
Pump Type	In-line Centrifugal	
Pump Manufacturer	Paco	Paco
Pump Model	16-50957-140101-1852 VL	16-50957-140101-1852 VL
Pump Serial #	RXB 87A01039A	RXB 87A01039B
Control Valves	None	None
Settings	None	None
Pressure Relief	None	
Motor Manufacturer	GE	GE
Motor Model	256-JM	256-JM
Horsepower (hp)	20	20
Speed (rpm)	1750	1750
Shutoff Head (ft)	97	97
Design Head (ft)	70	70
Design Flow (gpm)	750	750
Total Design Flow (gpm)	1500	
Meter	14” magnetic	
Notes	Pumps directly from City of Olympia transmission main to the 337 Zone. Starts controlled by reservoir level.	

Mountain Aire Booster

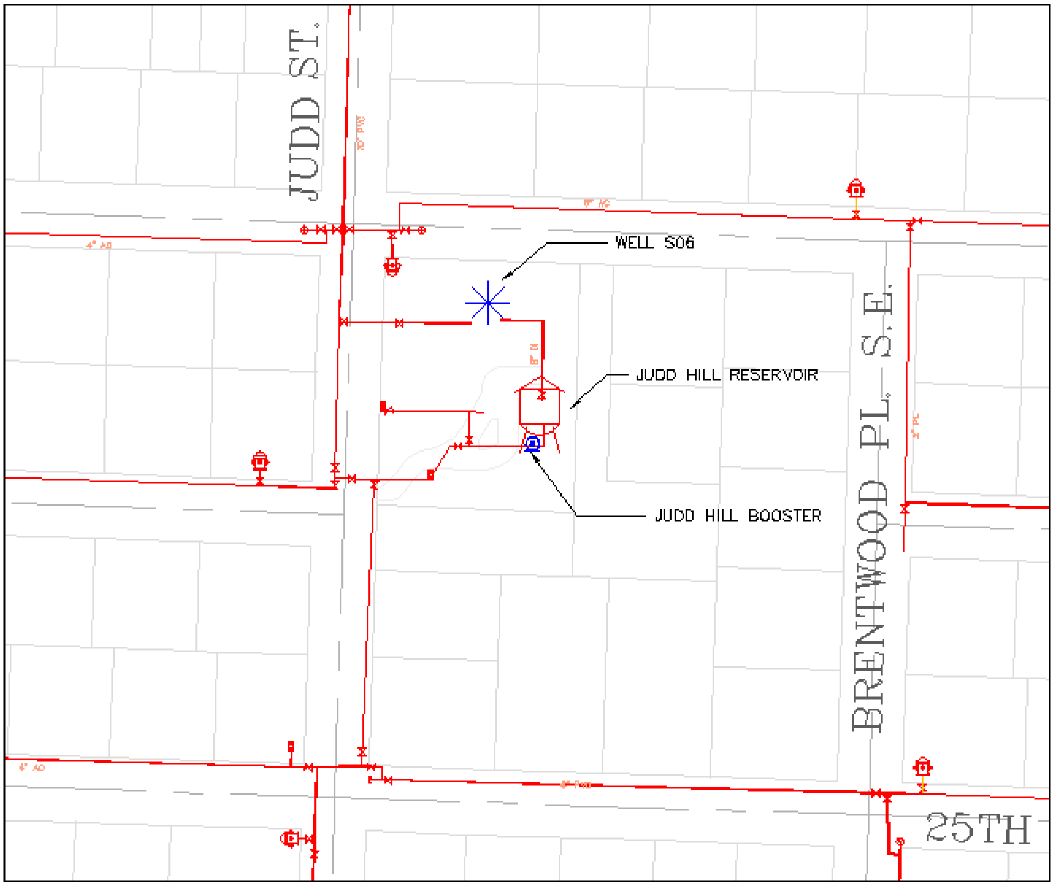


Judd Hill Booster

Facility Information

Description	Pump #1
Address	2400 Judd St. SE
Year Constructed	1993
Pressure Zone	337
Floor Elevation	236.37
Source	Judd Hill Reservoir
Pump Type	End suction
Pump Manufacturer	Paco
Pump Model	10-40127-1A0001-1872 LC
Pump Serial #	STG-92A000923
Control Valves	6" 92G-02BD
Settings	CRD: 46 psi
Pressure Relief	None
Motor Manufacturer	US Electric
Motor Model	U74TE
Horsepower (hp)	25
Speed (rpm)	1765
Shutoff Head (ft)	112
Design Head (ft)	58
Design Flow (gpm)	1200
Total Design Flow (gpm)	1200
Meter	Mechanical
Notes	Pumps directly from the Judd Hill Reservoir to the 337 Zone. Starts controlled by timer or local pressure.

Judd Hill Booster

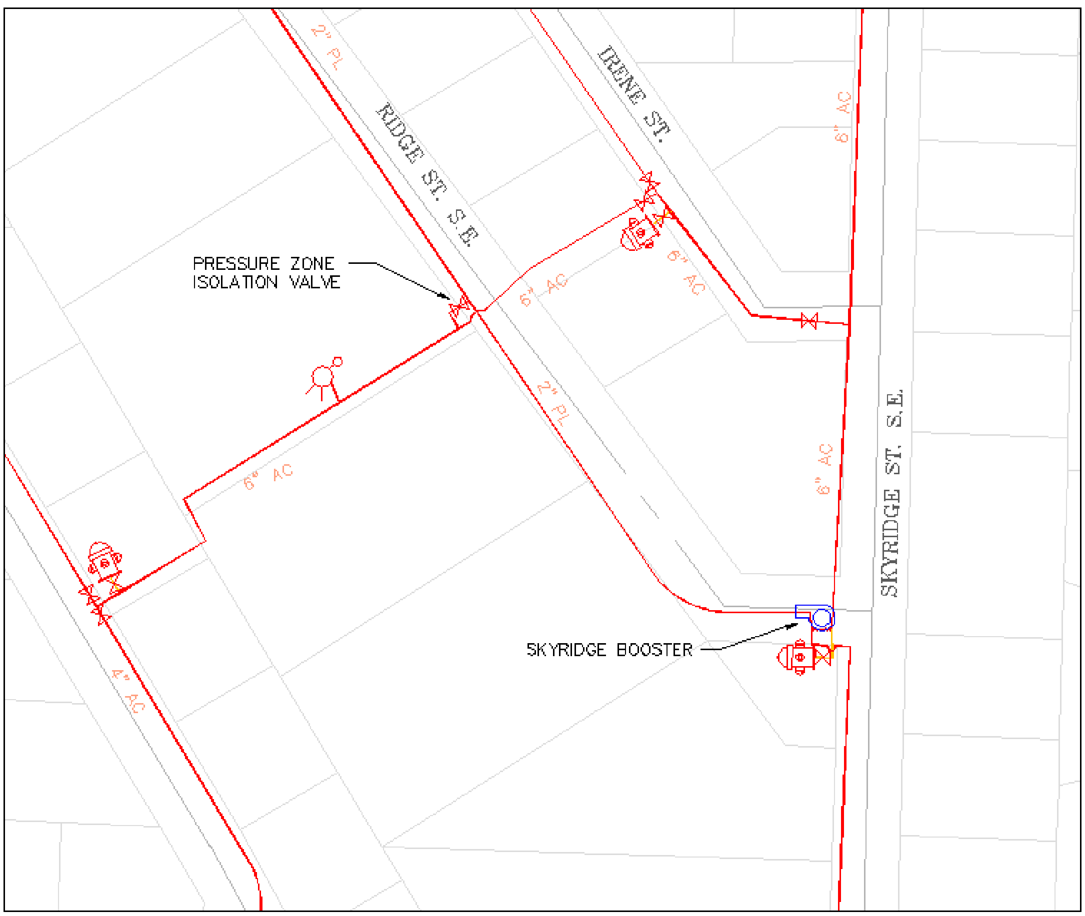


Skyridge Booster

Facility Information

Description	Pump #1	Pump #2
Address	1223 Ridge St. SE	
Year Constructed	2001	
Pressure Zone	422	
Floor Elevation	235.47	
Source	337 Zone	
Pump Type	End suction	
Pump Manufacturer	Peerless (Aqua-pac)	Peerless (Aqua-pac)
Pump Model	610-5 (DAP-1-5)	610-5 (DAP-1-5)
Pump Serial #	562451-A	562451-B
Control Valves	None	None
Settings	VFD set-point 80 psi	VFD set-point 80 psi
Pressure Relief	None	
Motor Manufacturer	US Motor	US Motor
Motor Model	5073A	5073A
Horsepower (hp)	5	5
Speed (rpm)	3500 (VFD)	3500 (VFD)
Shutoff Head (ft)	128	128
Design Head (ft)	104	104
Design Flow (gpm)	110	110
Total Design Flow (gpm)	110	
Meter	None	
Notes	Pumps from the 337 Zone to the 422 Zone for domestic pressure only. Starts controlled by local pressure. Single pump operation only.	

Skyridge Booster

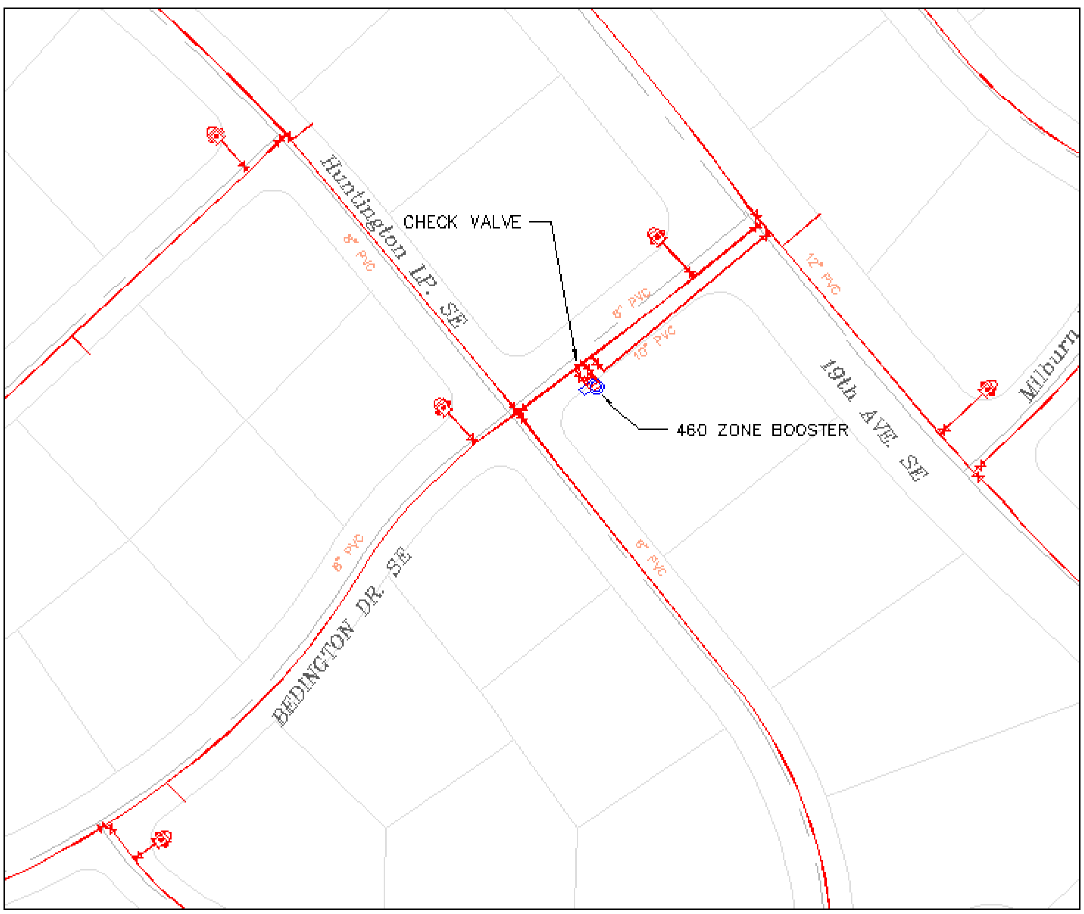


460 Zone Booster

Facility Information

Description	Pump #1	Pump #2
Address	2040 Huntington Lp. SE	
Year Constructed	2002	
Pressure Zone	460	
Floor Elevation	280.90	
Source	400 Zone	
Pump Type	In-line Centrifugal	
Pump Manufacturer	Grundfos	Grundfos
Pump Model	ME CRE 45-1	ME CRE 45-1
Pump Serial #	N/A	N/A
Control Valves	None	None
Settings	VFD set-point 70 psi	VFD set-point 70 psi
Pressure Relief	None	
Motor Manufacturer	N/A	N/A
Motor Model	N/A	N/A
Horsepower (hp)	7.5	7.5
Speed (rpm)	3450 (VFD)	3450 (VFD)
Shutoff Head (ft)	122	122
Design Head (ft)	80	80
Design Flow (gpm)	250	250
Total Design Flow (gpm)	250	
Meter	None	
Notes	Pumps from the 400 Zone to the 460 Zone for domestic pressure only. Starts controlled by local pressure. Check valve by-pass at pump station.	

460 Zone Booster

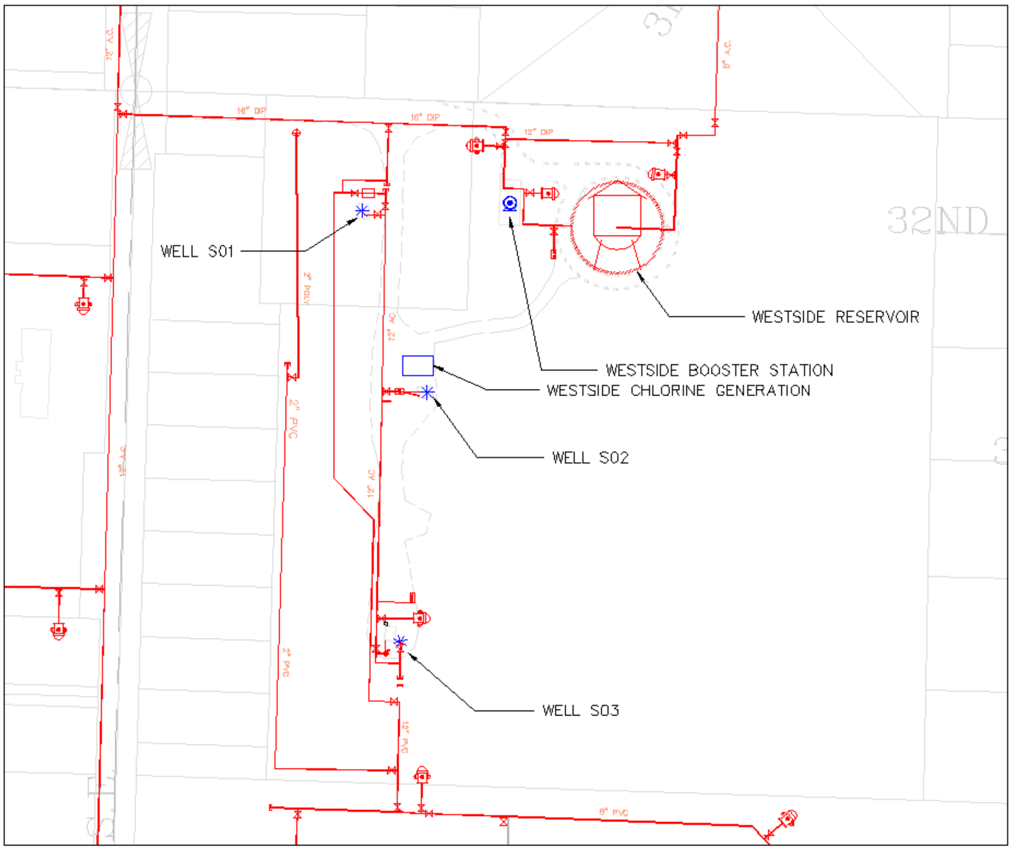


Westside Booster

Facility Information

Description	Pump #1 (Jockey)	Pump #2	Pump #3	Pump #4
Address	3140 College St. SE			
Year Constructed	2002			
Pressure Zone	337			
Floor Elevation	232.58			
Source	Westside Reservoir			
Pump Type	Horizontal split case			
Pump Manufacturer	Peerless	Peerless	Peerless	Peerless
Pump Model	5AE14N	6AE14G	6AE14G	6AE14G
Pump Serial #	581441	581440B	581440A	581440C
Control Valves	8" 692G-01YBCSDKC	10" 692G-01YBCSDKC	10" 692G-01YBCSDKC	10" 692G-01YBCSDKC
Settings	CRL: 79 psi CRD: 54 psi	CRL: 79 psi CRD: 54 psi	CRL: 79 psi CRD: 54 psi	CRL: 79 psi CRD: 54 psi
Pressure Relief	6" 52G-03BKC CRL: 59 psi CRA: 25 psi			
Motor Manufacturer	US Electric	US Electric	US Electric	US Electric
Motor Model	326TS	405TS	405TS	405TS
Horsepower (hp)	50	100	100	100
Speed (rpm)	1775	1780	1780	1780
Shutoff Head (ft)	175	175	175	175
Design Head (ft)	145	145	145	145
Design Flow (gpm)	700	1900	1900	1900
Total Design Flow (gpm)	4500			
Meter	Reservoir Outlet: 12” magnetic Bypass: 6” magnetic			
Notes	Pumps directly from the Westside Reservoir to the 337 Zone. Starts controlled by timer, local pressure, or remote pressure.			

Westside Booster

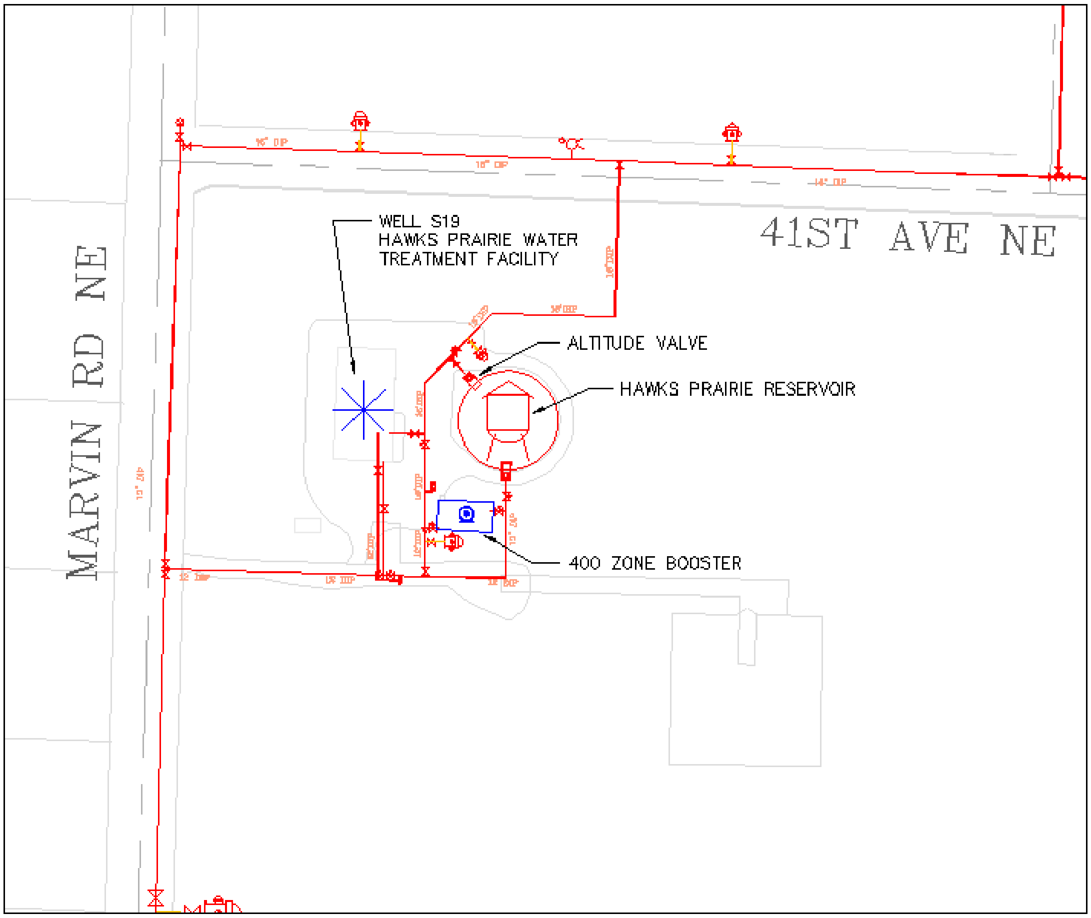


400 Zone Booster

Facility Information

Description	Pump #1	Pump #2	Pump #3	Pump #4
Address	4040 Marvin Rd. NE			
Year Constructed	2008			
Pressure Zone	400			
Floor Elevation	296.48			
Source	Hawks Prairie Reservoir			
Pump Type	Horizontal split case			
Pump Manufacturer	Peerless	Peerless	Peerless	Peerless
Pump Model	6AE11	6AE11	8AE15G	8AE15G
Pump Serial #	732492A	732492B	726611A	726611B
Control Valves	None	None	None	None
Settings	VFD set-point 41 psi	VFD set-point 41 psi	VFD set-point 41 psi	VFD set-point 41 psi
Pressure Relief	6" 50G-01BDKC			
Motor Manufacturer	GE	GE	GE	GE
Motor Model	326T	326T	365T	365T
Horsepower (hp)	50	50	75	75
Speed (rpm)	1780 (VFD)	1780 (VFD)	1780 (VFD)	1780 (VFD)
Shutoff Head (ft)	122	122	125	125
Design Head (ft)	105	105	105	105
Design Flow (gpm)	850	850	2000	2000
Total Design Flow (gpm)	3700			
Meter	Reservoir Outlet: 10” magnetic Bypass: 6” magnetic			
Notes	Pumps directly from the Hawks Prairie Reservoir to the 400 Zone. Starts controlled by local pressure.			

400 Zone Booster

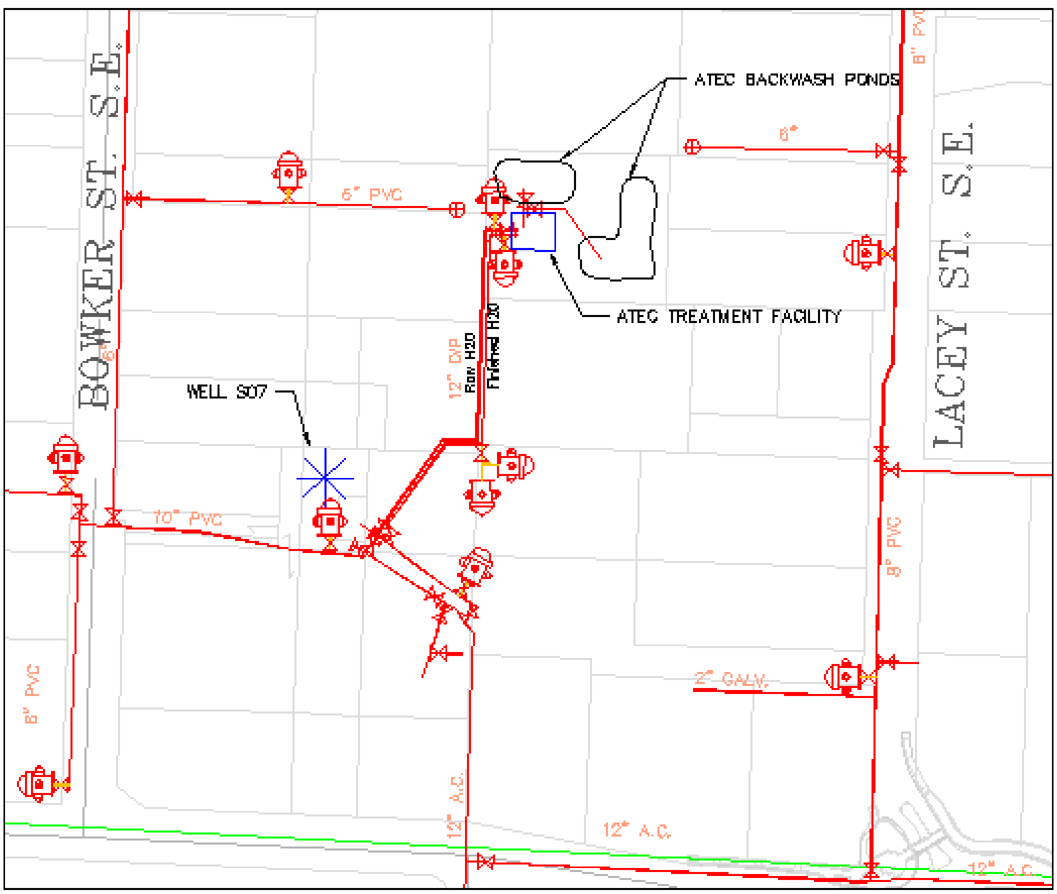


ATEC Water Treatment Facility

Facility Information

Description	Comments
Address	831 Lacey St. SE
Year On-Line	2002
Pressure Zone	337
Floor Elevation	181.80
Housing	Wood
Source Water	S07
Source Water Quality	Elevated Iron and Manganese
Oxidation	Potassium Permanganate injection at Well S07 Sodium Hypochlorite injection at ATEC facility
Filter Vessels	14 – ATEC skid mounted vessels 60” shell height (48” media depth)
Filter Media	20-40 mesh Pyrolusite (manganese dioxide)
Treatment Capacity (gpm)	1700
Chlorine Generator	Clortec 24lb/day Sodium Hypochlorite
Chlorine Feed Pump	Aldos KM25367
Sodium Hypochlorite Storage	500 gal
Chlorine Concentration	0.8%
Chlorine Analyzer	2 – Capital Controls Group series 1770
Backwash Disposal	2 – Infiltration ponds (20’ x 80’)
Distribution Pumps	None
Pump Type	N/A
Pump Model	N/A
Pump Shaft Diameter (in)	N/A
Column Diameter/Length	N/A
Pump Serial #	N/A
Pump Capacity (gpm)	N/A
Motor Model	N/A
Motor Serial #	N/A
Motor Speed (rpm)	N/A
Horsepower	N/A
Control Valves	N/A
PSV Setting	N/A
PRV Setting (psi)	N/A
Notes	Backwash ponds require regular cleaning to remove accumulated solids and to maintain infiltration rates.

ATEC Water Treatment Facility

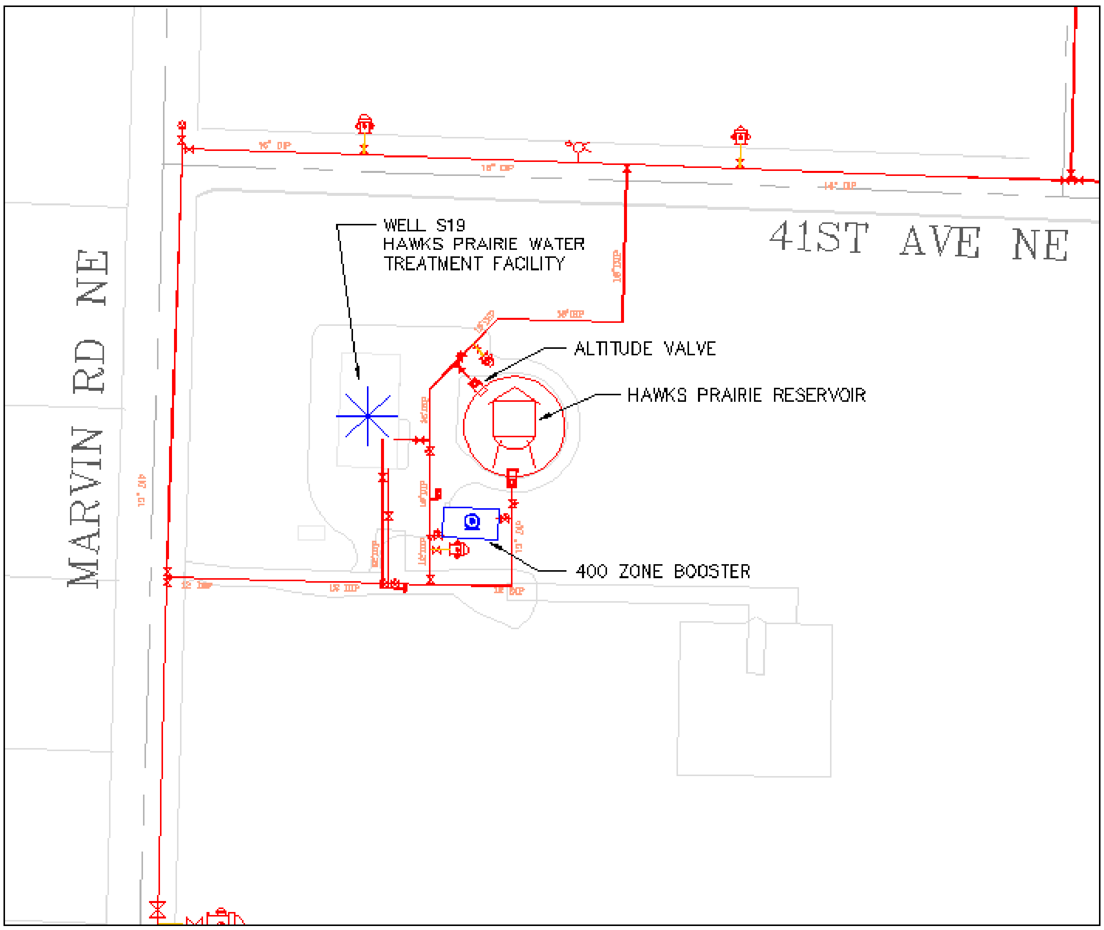


Hawks Prairie Water Treatment Facility

Facility Information

Description	Comments
Address	4040 Marvin Rd. NE
Year On-Line	2008
Pressure Zone	400
Floor Elevation	299.50
Housing	CMU
Source Water	S19
Source Water Quality	Elevated Iron, Manganese, Ammonia, Sulfide
Oxidation	Aeration Sodium Hypochlorite injection
Filter Vessels	2 – Loprest greensand vessels (144” x 80”) 2 – Loprest activated carbon vessels converted to greensand (144” x 90”)
Filter Media	0.60 – 0.80 mm anthracite 0.30 – 0.35 mm greensand (manganese dioxide)
Treatment Capacity (gpm)	2000
Chlorine Generator	US Filter B1-150 OSEC 125lb/day Sodium Hypochlorite
Chlorine Feed Pump	4 - Premia 75 mega
Sodium Hypochlorite Storage	3900 gal
Chlorine Concentration	0.8%
Chlorine Analyzer	5 – Prominent DMT series
Backwash Disposal	Concrete basin for recycle or discharge to sewer
Distribution Pumps	2
Pump Type	Turbine
Pump Model	Peerless M12LD – 2 stage
Pump Shaft Diameter (in)	1.00
Column Diameter/Length	8” column, 16’
Pump Serial #	N/A
Pump Capacity (gpm)	1100
Motor Model	GE L326TP #V3220
Motor Serial #	N/A
Motor Speed (rpm)	1775
Horsepower	50
Control Valves	10” 50G-01BDS
PSV Setting	70 psi @ 800 gpm
PRV Setting (psi)	None
Notes	Chlorine contact basin for Ammonia conversion.

Hawks Prairie Water Treatment Facility

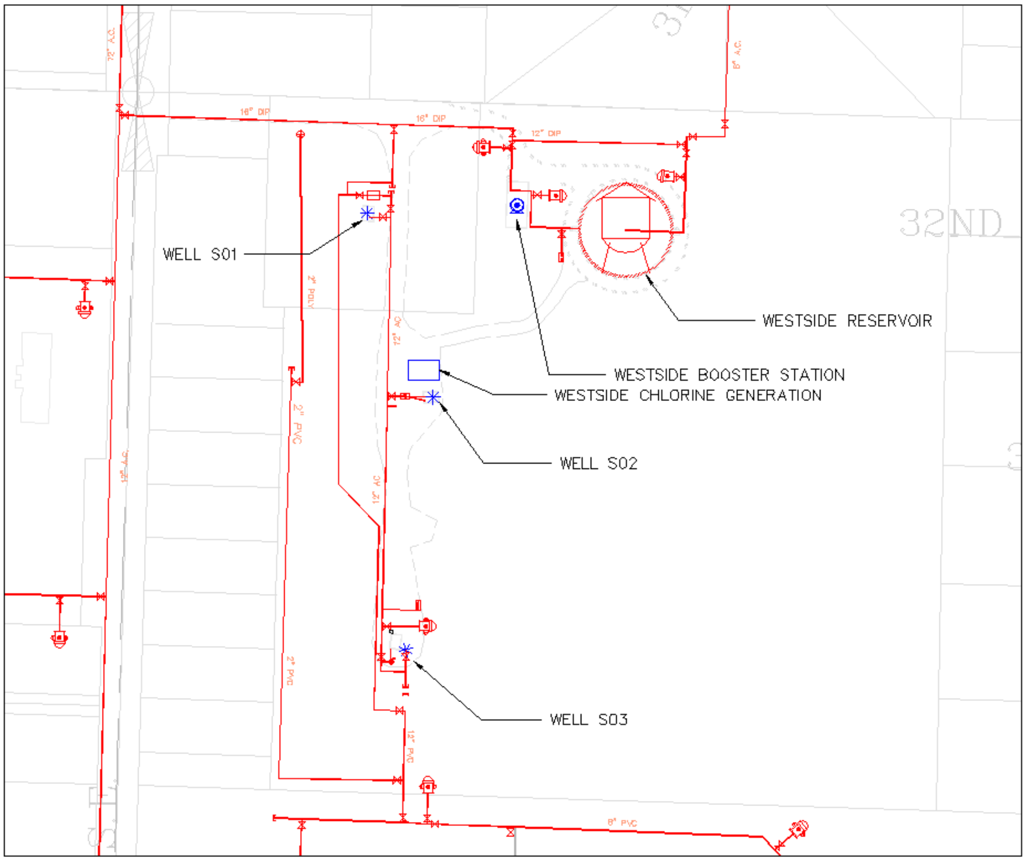


Westside Chlorine Generation Facility

Facility Information

Description	Comments
Address	3140 College St. SE
Year On-Line	2007
Pressure Zone	337
Floor Elevation	232.20
Housing	CMU
Chlorine Generator	US Filter B1-150 OSEC 180lb/day Sodium Hypochlorite
Brine Tank Storage	800 gal
Sodium Hypochlorite Storage	2850 gal
Chlorine Concentration	0.8%
Water Softener	Kinetico #CC208s
Brine Pump	Encore 700 series, 2” diaphragm, pulley drive 6.0 - 24 gph
Transfer Pump	Finish Thompson #DB11V-T-M219
Chlorine Analyzer	Prominent DC1 series
Chlorine Feed Pumps	1 – Prominent Sigma/1 #12035 PVT
Notes	

Westside Chlorine Generation Facility

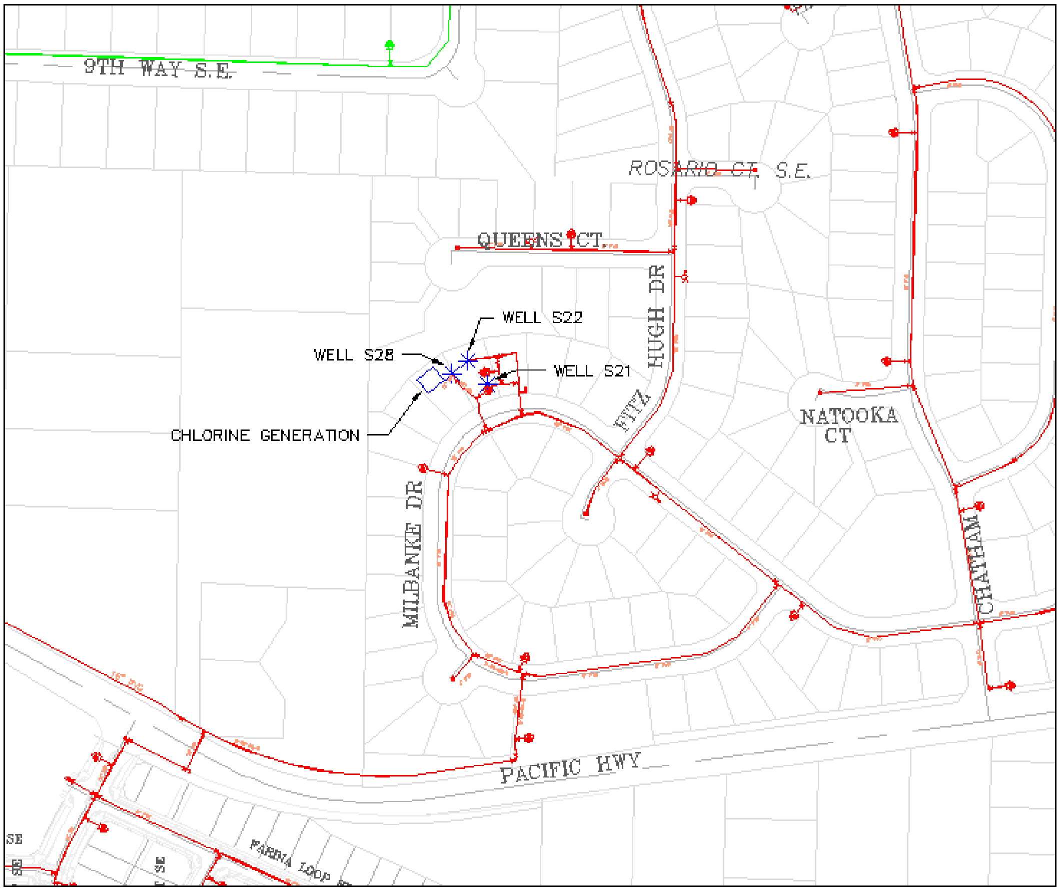


Madrona Chlorine Generation Facility

Facility Information

Description	Comments
Address	8824 Milbanke Dr. SE
Year On-Line	2007
Pressure Zone	400
Floor Elevation	259.00
Housing	CMU
Chlorine Generator	US Filter B1-150 OSEC 180lb/day Sodium Hypochlorite
Brine Tank Storage	800 gal
Sodium Hypochlorite Storage	2 - 2500 gal
Chlorine Concentration	0.8%
Water Softener	Kinetico #CC208s
Brine Pump	Encore 700 series, 2” diaphragm, pulley drive 6.0 - 24 gph
Transfer Pump	Finish Thompson #DB11V-T-M219
Chlorine Analyzer	Prominent DC1 series
Chlorine Feed Pumps	1 – Prominent Sigma/1 #12035 PVT 1 – Prominent Sigma/1 #07065 PVT
Notes	

Madrona Chlorine Generation Facility

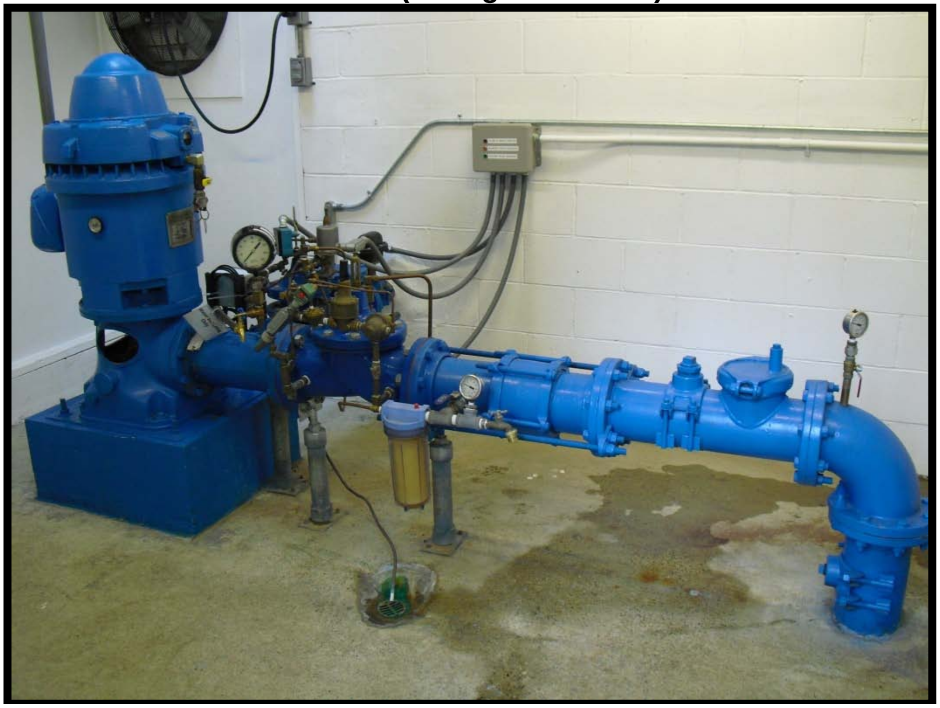


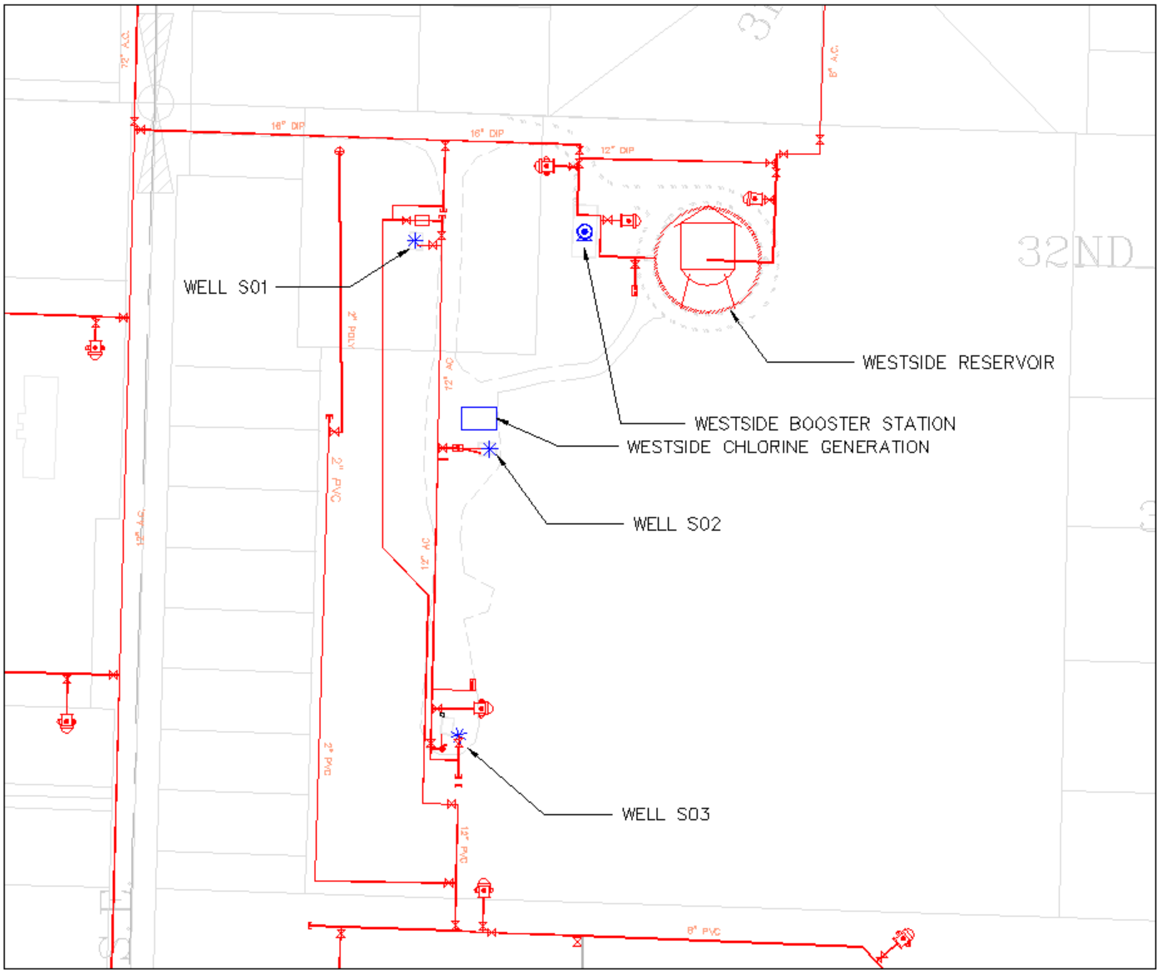
Well S01
(College St. Well No. 1)

Facility Information

Description	Comments
Source #	S01
Address	3300 College St. SE
Year On-Line	1965
Pressure Zone	337
Floor Elevation	232.13
Housing	CMU
Pump Type	Turbine
Pump Model	Jacuzzi 10MCAd T-520, WRB-27
Pump Shaft Diameter (in)	1.021
Column Diameter/Length	6" column, 90'
Pump Serial #	N/A
Pump Depth (ft)	90
Pump Capacity (gpm)	650
Motor Model	US Electric HR1025460
Motor Serial #	HR1025460
Motor Speed (rpm)	1800
Horsepower	50
Casing Diameter (in)	10
Well Depth (ft)	122
Casing Depth (ft)	95
Screen	10-inch: 85-slot (100-122 ft)
Screen Capacity (gpm)	1100
Aquifer	Qva
Control Valves	3" 61-21ABX105 6" 692-07ABCDS-X101
PSV Setting	Summer: 100psi @ 300gpm Winter: 61psi @ 590gpm
PRV Setting (psi)	54
Flow to Waste Setting	Summer: 120psi @ 145gpm Winter: 85psi @ 500gpm
Flow to Waste Duration (sec)	180
Well Capacity (gpm)	600-320 (seasonal)
Chlorine Dose (mg/L)	0.82
Reliable Capacity (gpm)	300
Notes	Seasonal aquifer levels limit well capacity; 320 gpm April-September, 600 gpm October-March. Local pressures can limit the simultaneous operation of wells 1, 2, and 3.

Well S01 (College St. Well 1)





STATE OF WASHINGTON
DEPARTMENT OF CONSERVATION
AND DEVELOPMENT Appli. #7746

WELL LOG No........./..........-..........

Date Oct. 5, 1965
Record by Driller
Source Driller's Record

Location: State of WASHINGTON
County Thurston
Area 225' E and 175' S of
Map W¼ corner
NW ¼ SW ¼ sec. 28 T. 18 N., R. 1 E./W.

Diagram of Section

Drilling Co. Kincy Hardware
Address 512 E. 4th, Olympia, Washington
Method of Drilling Cable Date Oct. 4, 1965
Owner Huntamer Water Service, Inc.
Address 4700 Lacey Blvd., Olympia, Washington
Land surface, datum .... ft. above / below

File number 18/1W-28L

CORRELATION	MATERIAL	From (feet)	To (feet)
	Municipal use		
	DIMS: 10" x 122'		
	Clay and gravel	0	4
	Gravel and clay (compact)	4	10
	Clay and gravel	10	18
	Gravel, sand and clay	18	30
	Gravel and sand	50	53
	Clay and sand	53	66
	Sand and gravel	66	73
	Sand	73	80
	Clay, brown	80	80½
	Gravel, large, sand & clay	80½	86
	Gravel, large, gravel & sand	86	99
	Gravel and sandy	99	123
	Gravel and clay sand	123	125

(Transcribe driller's terminology literally but paraphrase as necessary, in parentheses. If material water-bearing, so state and record static level if reported. Give depths in feet below land-surface datum unless otherwise indicated. Correlate with stratigraphic column, if feasible. Following log of materials, list all casings, perforations, screens, etc.)

Turn up Sheet ...... of ...... sheets

WELL LOG.—Continued No............/..........-..........

CORRELATION	MATERIAL	THICKNESS (feet)	DEPTH (feet)
	Depth forward	————	
	Casing: 10" from 0-103'		
	Screen installed from 102 to 122'		
	SWL: 54'6" on Oct. 4. 1965.		
	Yield: 500 gpm with 14' DD after 4 hrs. 961 gpm with 20' DD after 10 min.		
	Pump: 40 h.p. Jacuzzi 600 gpm 5 stage 9¼" bowl line-shaft turbine		

S. F. No. 7449—OS—6-61—2M.

HUNTAMER PROPERTY WELLS

Four wells have been drilled at this location.

Abandoned Well (18/1W - 28M1) - This well was abandoned sometime between 1969 and 1974.

Well No.1 (18/1W - 28M2) - Drilled by Kincy Hardware, October 1965.

Well Log:

Clay and gravel	0	4	4
Gravel and clay	4	10	6
Clay and gravel	10	18	8
Gravel, sand and clay	18	35	17
Gravel and sand	35	37	2
Gravel, sand and clay	37	50	13
Gravel and sand	50	53	3
Clay and sand	53	66	13
Sand and gravel	66	69	
Sand	69	70	
Sand and gravel	70	73	
Sand	73	80	
Brown clay	80	80 1/2	.5
Cobbles, gravel, sand and clay	80 1/2	86	
Gravel, sand	86	89	
Gravel	89	90	
Sand and gravel	90	92	
Gravel and sand	92	99	
Gravel and sand	99	119	
Fine gravel and sand	119	122	
Gravel, sand and some clay	122	123	
Gravel and clay	123	125	

Well constructed with 10-inch casing to about 103 feet below the surface. A 10-inch telescoping, stainless steel, wire wound, 85 slot screen placed between 100 and 122 feet.

Static water level was 55 1/2 feet when the well was drilled.

The well was originally test pumped at 500 gpm for 4 hours with 14 feet of drawdown. This results in a specific capacity of 35 gpm per foot of drawdown.

During the 1969 tests of Lacey Well No.2 and Well No.3, it was noted that the well had a pumping level of 78.5 feet with a reported yield of 600 gpm. When Well No.1 was turned off, the static level in Well No.2 dropped about 0.1 foot. The reason for this unexpected reversal is not clear but the event appears to demonstrate that there is a positive hydraulic seal between the upper aquifer of Well No.1 and the lower aquifer of Wells No.2 and No.3. The two zones should have no appreciable interference between them.

Well No.1 was test pumped in June 1974, utilizing the existing production equipment. The well was pumped at 710 gpm for two hours resulting in a draw-down to 81.6' (projected to 24 hours). Water level at the start of the test was 66.6 feet and still recovering. The tested specific capacity is 47 gpm per foot of drawdown. Water levels for the past year taken at various times of pumping and non-pumping show a range of 63 feet to 86 feet.

As compared to the 1965 construction records, the well's capacity has not decreased but the static water level has been lowered through withdrawal.

Well No.2 (18/1W - 28M3) - Well drilled by Kincy Hardware in October 1969.

Well Log:

Brown clay and gravel	0	3	Qa
Light brown clay and gravel	3	17	
Brown clay with gravel streaks. Some water	17	35	Qvr
Brown loose sand and gravel. No water	35	59	
Brown sand and gravel. Water	59	69	
Brown tight sand and gravel	69	73	Qa?
Brown tight sand. Little water	73	75	
Brown medium sand and gravel	75	76	Qva

Qvt revised 3/23/94

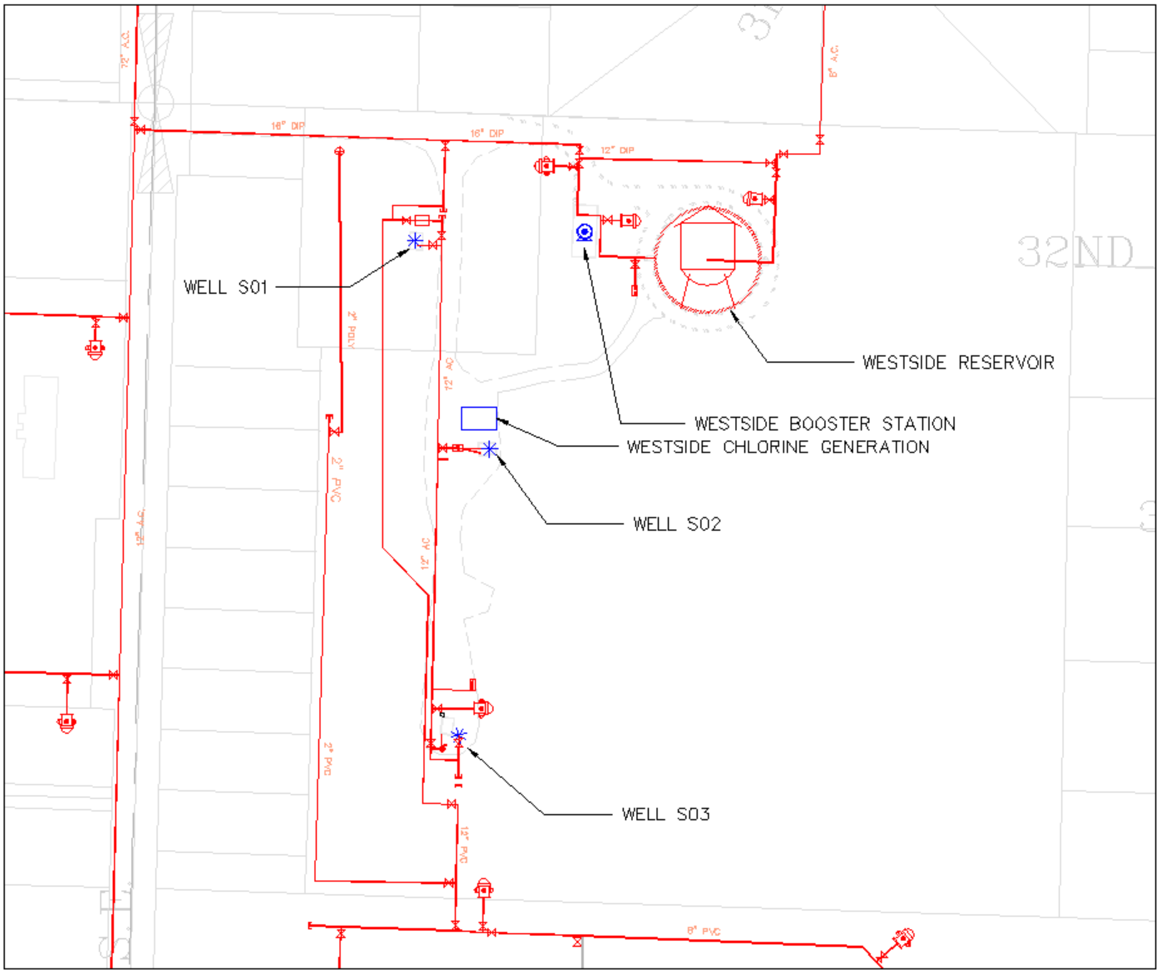
Well S02

(College St. Well No. 2)

Facility Information

Description	Comments
Source #	S02
Address	3300 College St. SE
Year On-Line	1969
Pressure Zone	337
Floor Elevation	233.26
Housing	CMU
Pump Type	Submersible
Pump Model	Crown 8M-7003A
Pump Shaft Diameter (in)	N/A
Column Diameter/Length	8" column, 160'
Pump Serial #	N/A
Pump Depth (ft)	180
Pump Capacity (gpm)	700
Motor Model	Hitachi A326UP
Motor Serial #	N/A
Motor Speed (rpm)	1775
Horsepower	75
Casing Diameter (in)	16
Well Depth (ft)	217
Casing Depth (ft)	189
Screen	16-inch: 35-slot (187-203 ft), 95-slot (203-217 ft)
Screen Capacity (gpm)	1550
Aquifer	Qpg
Control Valves	3" 61G-02 4" 92EG-07ABCDS
PSV Setting	52psi @ 550gpm
PRV Setting (psi)	66
Flow to Waste Setting	80psi @ 500gpm
Flow to Waste Duration (sec)	90
Well Capacity (gpm)	665
Chlorine Dose (mg/L)	0.79
Reliable Capacity (gpm)	600
Notes	Local pressures can limit the simultaneous operation of wells 1, 2, and 3.

Well S02 (College St. Well 2)



Well #1

GWR-9994
GWP-9767

STATE OF WASHINGTON
DEPARTMENT OF CONSERVATION
DIVISION OF WATER RESOURCES

WELL LOG

Record by

Source

Location: State of WASHINGTON

County Thurston

Area

Map

NW ¼ SW ¼ sec. 28 T. 18 N., R. 1 E. W.

Diagram of Section: 28, ⊙ #1

Drilling Co.

Address

Method of Drilling Date , 19

Owner City of Lacey

Address

Land surface, datum 233 ft. above ~~below~~ Sea Level

SWL: 66'5" Date June 6, 1969 Dims.: 16" X 188'

File number 18/1E-28M

Correlation	Material (Municipal)	From (feet)	To (feet)
	(Transcribe driller's terminology literally but paraphrase as necessary, in parentheses. If material water-bearing, so state and record static level if reported. Give depths in feet below land-surface datum unless otherwise indicated. Correlate with stratigraphic column, if feasible. Following log of materials, list all casings, perforations, screens, etc.)		
	Clay, Brown & Gravel	0	3
	Clay, Light Brown & Gravel	3	17
	Clay, Brown & Gravel, Streaks of Water	17	35
	Sand, Loose Brown & Gravel	35	59
	Sand, Brown & Gravel, Water	59	69
	Sand, Brown Tite, & Gravel	69	73
	Sand, Brown Tite & Little Water	73	75
	Sand, Brown Med. & Gravel	75	76
	Gravel, Brown Large & Sand	76	94
	Sand, Brown Med. & Gravel	94	102
	Clay, Brown & Gravel	102	109
	Sand, Brown Large & Gravel Water	109	111
	Continued		

Turn up

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WELL LOG.—Continued No........./..........

CORRELATION	MATERIAL	From (feet)	To (feet)
	Depth forward	——	
	Dirt, Brown, Sand, Med. & Gravel	111	119
	Dirt, Brown & Sand, Med.-Fine & Streaks of gravel	119	162
	Clay, Brown & Gravel	162	166
	Gravel, Brown Large & 0-8" Clay	166	174
	Gravel, Dark Brown, Med-Large	174	178
	Gravel, Dark Brown & Streaks of Clay	178	188
	Gravel, Dark Brown, Large Water	188	198
	Gravel, Dark Brown, Small-Med	198	202
	Sand, Brown Large, Gravel, Med	202	208
	Sand, Brown Large & Gravel	208	214
	Sand, Brown Large & Gravel	214	217
	Clay, Brown	217	
	Casing: 16" from 0 to 188'		
	Screens: Johnson. Everdure Stainless Diam. 16; Slot size 35 from 188' to 203 and Slot size 95 from 203' to 217'		
	Pump: Jacuzzi, Turbine 700 GPM, 75HP		
	Well Tests: 444 gpm, 23'DD, 1 Hr.		
	560 gpm, 39' DD, 2 Hr.		
	776 gpm, 100' DD, 5 Hr.		
	Recovery Data		
	5:28 – 120' 5:35 78'		
	5:30 – 87' 5:41 76.5		
	5:31 – 85 5:50 75.0		

S. F. No. 7449—OS—12-65.

Kincy Hardware and Well Drilling Co.

#2 #2

CONSTRUCTION RECORD

Date Oct 20 - 1969 408 # ~~11~~ Total Depth 219' 5"

1. WELL OWNER
   Name City of Kincy
   Address

2. LOCATION
   R1W T18N Sec 28
   N.W. Corner
   ON Henson Rd

3. TYPE OF WORK
   New Well X Deeping ___ Bailing ___
   Setting Screen ___ Developing ___

4. PROPOSED USE
   Domestic ___ Industrial ___ Municipal X
   Irrigation ___ Test Well ___ Other ___

5. CASING INSTALLED
   Above Ground 3' Below Ground 186' 9"
   Threaded ___ Welded X
   16" dia. from 0 ft. to 189' 9" ft. ga. 30
   ___ dia. from ___ ft. to ___ ft. ga. ___
   ___ dia. from ___ ft. to ___ ft. ga. ___
   ___ dia. from ___ ft. to ___ ft. ga. ___

6. PERFORATIONS
   Yes ___ No X
   From ___ to ___ size ___ x ___
   From ___ to ___ size ___ x ___
   From ___ to ___ size ___ x ___

7. SCREEN INSTALLED
   Yes X No ___
   Make Johnson Total Length 30' 4"
   Amount Exposed 27' 8" Fittings Welded
   Metal Stainless Ext. Piece NO
   Dia. 16" Slot Size 35 from ~~88~~ to 15.6
   Slot Size 95 from ___ to 14.4
   Slot Size ___ from ___ to ___
   Slot Size ___ from ___ to ___
   Slot Size ___ from ___ to ___
   6" Lead Packer

8. CONSTRUCTION
   Gravel Packed. Yes ___ No X
   Gravel Placed From ___ to ___ Size ___

9. WATER LEVELS
   State Water Level Mon June 9 1969 | 61½ ft
   Flowing NO Rate ___

10. PUMP TEST
    Yes X No ___ Bail Tested ___
    2 p.m. 700 Draw Down 150' 8"
    Hours Pumped 3 Bailed ___

11. PUMPS INSTALLED
    Make Jacuzzi
    Type Turbine
    Setting 160' GPM 700
    HP 75 Phase 3 Pipe Size 8"

12. CHEMICAL ANALYSIS
    Iron ___ ppm.
    P.H. ___ ppm.
    Hardness ___ gr.
    Odor - Yes ___ No ___

13. DRILLERS NOTES

14. DRILLER R. Kincy

(over)

Static water level was 55 1/2 feet when the well was drilled.

The well was originally test pumped at 500 gpm for 4 hours with 14 feet of drawdown. This results in a specific capacity of 35 gpm per foot of drawdown.

During the 1969 tests of Lacey Well No.2 and Well No.3, it was noted that the well had a pumping level of 78.5 feet with a reported yield of 600 gpm. When Well No.1 was turned off, the static level in Well No.2 dropped about 0.1 foot. The reason for this unexpected reversal is not clear but the event appears to demonstrate that there is a positive hydraulic seal between the upper aquifer of Well No.1 and the lower aquifer of Wells No.2 and No.3. The two zones should have no appreciable interference between them.

Well No.1 was test pumped in June 1974, utilizing the existing production equipment. The well was pumped at 710 gpm for two hours resulting in a draw-down to 81.6' (projected to 24 hours). Water level at the start of the test was 66.6 feet and still recovering. The tested specific capacity is 47 gpm per foot of drawdown. Water levels for the past year taken at various times of pumping and non-pumping show a range of 63 feet to 86 feet.

As compared to the 1965 construction records, the well's capacity has not decreased but the static water level has been lowered through withdrawal.

Well No.2 (18/1W - 28M3) - Well drilled by Kincy Hardware in October 1969.

Well Log:

Brown clay and gravel	0	3
Light brown clay and gravel	3	17
Brown clay with gravel streaks. Some water	17	35
Brown loose sand and gravel. No water	35	59
Brown sand and gravel. Water	59	69
Brown tight sand and gravel	69	73
Brown tight sand. Little water	73	75
Brown medium sand and gravel	75	76

Qrt revised 3/23/94

Well Log (continued):

Brown large gravel, some sand ------	76	94	
Brown medium sand, some gravel ----	94	102	
Brown clay and gravel. No water ---	102	109	
Brown large sand and gravel. Water --	109	111	
Brown dirty medium sand and gravel --	111	119	
Brown dirty medium to fine sand with streaks of gravel ----------------	119	162	
Brown clay and gravel. No water ----	162	166	
Brown large gravel 0" to 8" size. clay present --------------------	166	174	Ok
Dark brown medium to large gravel, very good ----------------------	174	178	
Dark brown gravel with clay streaks. No water -----------------------	178	188	
Dark brown large gravel. Water -----	188	198	
Dark brown small to medium gravel, very good ----------------------	198	202	
Brown large sand, medium gravel ----	202	208	
Brown large sand, very little gravel --	208	214	
Brown large sand and gravel .050" size	214	217	
Brown clay -----------------------	217		

Well constructed with 16-inch casing to depth of 187 feet. Sixteen inch telescoping stainless-steel, wire wound screen, placed between 187 feet and 217 feet. The upper 15.6 feet of screen is 35 slot and the lower 14.7 feet is 95 slot.

Well was pump tested at time of construction by the driller at 750 and 700 gpm for 8 hours. The drawdown was 90 feet below a static water level of 61.5 feet, resulting in a specific capacity of 8.3 gpm per foot of drawdown.

A Robinson and Noble pumping test in 1969 showed similar results. The well was pumped at 740 gpm for 4 hours resulting in 85 feet of drawdown below a static water level of 64 feet. This results in an 8.7 gpm per foot of drawdown specific capacity.

Pump tested again by Robinson and Noble in June 1974, the water level was 70 feet below surface. The well was pumped at 760 gpm for 2 1/2 hours resulting in 62 feet of drawdown (projected to 24 hours). This results in a specific capacity of 12.2 gpm per foot of drawdown. Water level range, at various stages of pumping and non-pumping was 65' to 120' for the past year.

The well's capacity appears to be better than when drilled.

The static water level has possibly declined 5 feet or so since 1969.

Well No.3 (18/1W - 28M4) - Well drilled by Kincy Hardware during October 1969.

Well Log:

Top soil ----------------------------	0	2
Gray brown hardpan ---------------	2	29
Gray brown tight sand and gravel ---	29	60
Gray brown medium sand and gravel. Water -------------------------	60	70
Gray brown fine to medium sand ----	70	76
Gray brown medium sand and gravel -	76	80
Gray brown large gravel and sand 0" to 3" size. Good -------------	80	84
Gray brown large to medium gravel, little sand ----------------------	84	97
Brown clay and gravel. No water ----	97	103
Brown sand and small gravel. Water -	103	116
Brown medium sand dirty with some gravel streaks ------------------	116	157
Brown medium sand and gravel -----	157	162
Brown large gravel and clay 0" to 6" size. No water ----------------	162	166
Brown clay and gravel. Had to drill up --------------------------	166	191
Brown sand and gravel tight, some clay. Little water -------------	191	193
Brown gravel, and sand large 0" to 3" Good ------------------------	193	226
Gray large sand and gravel, tight --	226	227
Gray silts ------------------------	227	238

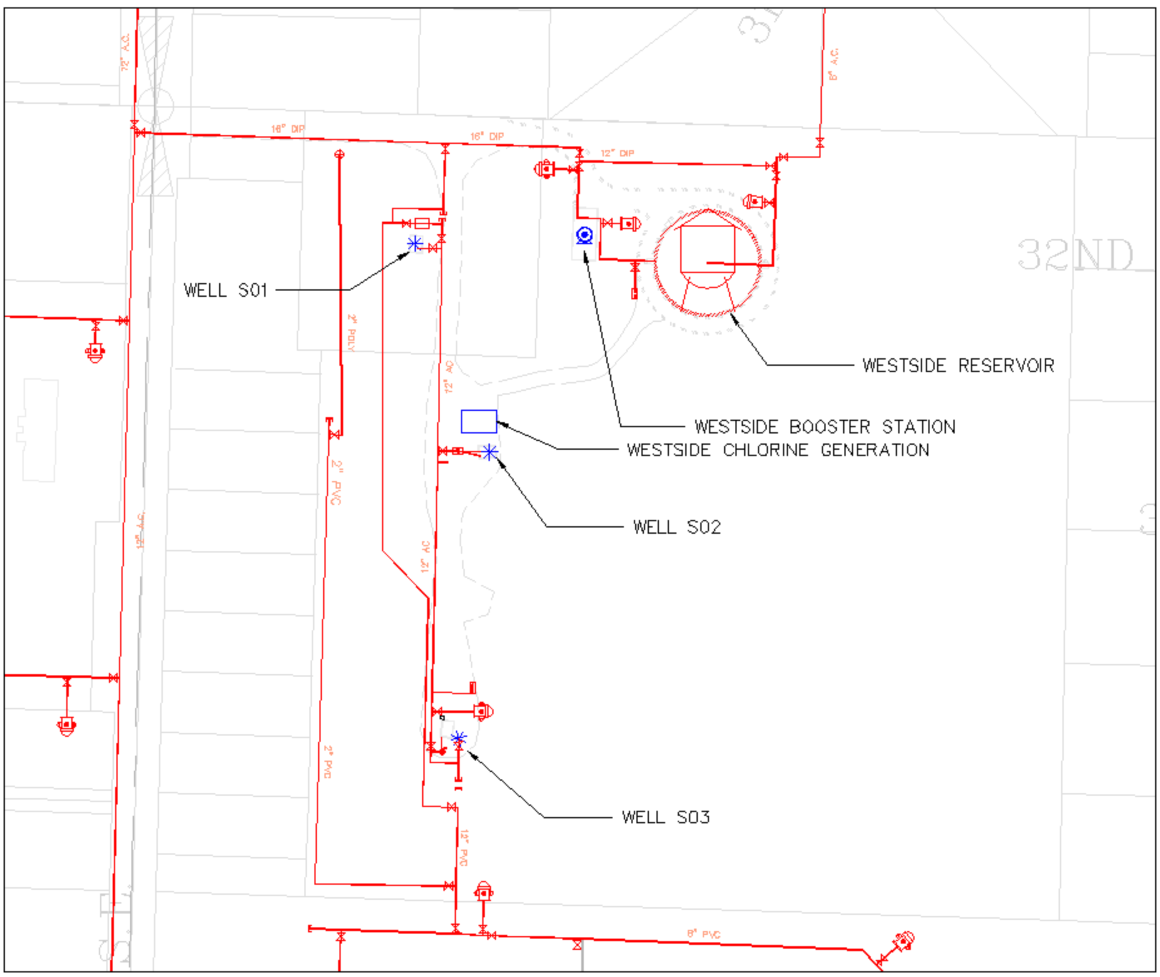
Well S03

(College St. Well No. 3)

Facility Information

Description	Comments
Source #	S03
Address	3300 College St. SE
Year On-Line	1969
Pressure Zone	337
Floor Elevation	231.63
Housing	CMU
Pump Type	Turbine
Pump Model	Jacuzzi 8MCALL WUI
Pump Shaft Diameter (in)	1.005
Column Diameter/Length	6" column, 177'
Pump Serial #	N/A
Pump Depth (ft)	185
Pump Capacity (gpm)	275
Motor Model	US Electric A326UP
Motor Serial #	HR177401269
Motor Speed (rpm)	1720
Horsepower	30
Casing Diameter (in)	16
Well Depth (ft)	225
Casing Depth (ft)	197
Screen	16-inch: 30-slot (194-202 ft), 40-slot (202-214 ft), 50-slot (214-222 ft)
Screen Capacity (gpm)	1100
Aquifer	Qpg
Control Valves	3" 61G-21B 6" 692G-07ABCDS
PSV Setting	62psi @ 230gpm
PRV Setting (psi)	54
Flow to Waste Setting	84psi @ 165gpm
Flow to Waste Duration (sec)	60
Well Capacity (gpm)	220
Chlorine Dose (mg/L)	0.69
Reliable Capacity (gpm)	230
Notes	Local pressures can limit the simultaneous operation of wells 1, 2, and 3.

Well S03 (College St. Well 3)



GWA-9994
GWP-9767

STATE OF WASHINGTON
DEPARTMENT OF CONSERVATION
DIVISION OF WATER RESOURCES

WELL LOG

Record by: Unk.
Source: Well Report

Location: State of WASHINGTON
County: Thurston
Area:
Map:
NW 1/4 SW 1/4 sec. 28 T. 18 N., R. 1 ~~E.~~ W.

Diagram of Section: 28 O#2

Drilling Co.: Unknown
Address:
Method of Drilling: Date: , 19
Owner: City of Lacey
Address:
Land surface, datum 233 ft. above ~~below~~ Sea Level
SWL: 61.5' Date June 6, 1969 Dims.: 16" X 227

File number 18N/01W-28L01

Corre-lation	Material	From (feet)	To (feet)
	(Transcribe driller's terminology literally but paraphrase as necessary, in parentheses. If material water-bearing, so state and record static level if reported. Give depths in feet below land-surface datum unless otherwise indicated. Correlate with stratigraphic column, if feasible. Following log of materials, list all casings, perforations, screens, etc.)		
	Top Soil	0	2
	Hardpan, Gray Brown	2	29
	Sand, Brown Tite & Gravel	29	60
	Sand, Brown Med. & Gravel	60	70
	Water		
	Sand, Brown Fine to med.	70	76
	Sand, Brown, Med & Gravel	76	80
	Gravel, Brown C to 3 large	80	84
	& Sand, good		
	Gravel, Brown Large Med. &	84	97
	little Sand		
	Clay, Brown & Gravel	97	103
	Sand, Brown & Gravel, small	103	116
	Water		
	Sand, Brown, Med. (Dirty	116	157
	w/some gravel streaks		

Turn up

over

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WELL LOG.—Continued

No.........../...........

CORRELATION	MATERIAL	From (feet)	To (feet)
	Depth forward		
	Sand, Brown Med. & Gravel	157	162
	Gravel, Brown Large 0-6: size & Clay	162	166
	Clay, Brown & Gravel, Hard, Had to drill up	166	191
	Sand, Brown, Gravel, Tite Clay, Some Water	191	193
	Gravel, Brown, Sand, Large 0-6" good	193	226
	Sand, Gray, Large, Gravel Tite	226	227
	Silts, Gray, Drilled to 238	227	238
	Screens: Johnson, Stainless		
	Diam. 16 Size 30 from 197' to 207'		
	Size 40 from 207' to 219'		
	Size 50 from 219' to 227'		
	Pump: Jacuzzi, Turbine 200 GPM, 30 HP		
	Well Test: 350 GPM, 94'DD, 4 Hr.		

S. F. No. 7449—OS—12-65.

Kincy Hardware and Well Drilling Co. #3 #3

CONSTRUCTION RECORD

Date 10-20-69 409 #~~2~~ Total Depth 225' 5 1/4"

1. WELL OWNER

Name City of Lacey

Address

2. LOCATION

R1W T18N NW Corner of Sec 28 on Herman Rd

3. TYPE OF WORK

New Well X Deeping ____ Bailing ____

Setting Screen ____ Developing ____

4. PROPOSED USE

Domestic ____ Industrial ____ Municipal X

Irrigation ____ Test Well ____ Other ____

5. CASING INSTALLED

Above Ground 2' 4" Below Ground 194

Threaded ____ Welded X

16" dia. from 0 ft. to 197 ft. ga. 30

____ dia. from ____ ft. to ____ ft. ga. ____

____ dia. from ____ ft. to ____ ft. ga. ____

____ dia. from ____ ft. to ____ ft. ga. ____

6. PERFORATIONS

Yes ____ No X

From ____ to ____ size ____ x ____

From ____ to ____ size ____ x ____

From ____ to ____ size ____ x ____

7. SCREEN INSTALLED

Yes X No ____

Make Johnson Total Length 30' 5 1/4

Amount Exposed 28' 5 1/4" Fittings welded

Metal Stainless Ext. Piece NO

Dia. 16 Slot Size ____ from ____ to ____

Lead Top Slot Size — from 6 3/4" to ____

Top Slot Size 30 from 10' to ____

Middle Slot Size 40 from 12' to ____

Bottom Slot Size 50 from 8' to ____

8. CONSTRUCTION

Gravel Packed. Yes ____ No X

Gravel Placed From ____ to ____ Size ____

9. WATER LEVELS

State Water Level 61' 6"

Flowing NO Rate ____

10. PUMP TEST

Yes X No ____ Bail Tested ____

2 p.m. 350 Draw Down 159

Hours Pumped 2 Bailed ____

11. PUMPS INSTALLED

Make Jacuzzi

Type Turbine

Setting 180 GPM 300

HP 30 Phase 3 Pipe Size 5"

12. CHEMICAL ANALYSIS

Iron ____ ppm.

P.H. ____ ppm.

Hardness ____ gr.

Odor - Yes ____ No ____

13. DRILLERS NOTES

~~Was~~ Well was Tested Between 60 To 97 ft And And did 400 GPM

14. DRILLER R Kincy

(over)

Pump tested again by Robinson and Noble in June 1974, the water level was 70 feet below surface. The well was pumped at 760 gpm for 2 1/2 hours resulting in 62 feet of drawdown (projected to 24 hours). This results in a specific capacity of 12.2 gpm per foot of drawdown. Water level range, at various stages of pumping and non-pumping was 65' to 120' for the past year.

The well's capacity appears to be better than when drilled.

The static water level has possibly declined 5 feet or so since 1969.

Well No.3 (18/1W - 28M4) - Well drilled by Kincy Hardware during October 1969.

Well Log:

Top soil ----------------------------------	0	2
Gray brown hardpan ----------------	2	29
Gray brown tight sand and gravel ---	29	60
Gray brown medium sand and gravel. Water --------------------------	60	70
Gray brown fine to medium sand ----	70	76
Gray brown medium sand and gravel -	76	80
Gray brown large gravel and sand 0" to 3" size. Good --------------	80	84
Gray brown large to medium gravel, little sand -----------------------	84	97
Brown clay and gravel. No water ----	97	103
Brown sand and small gravel. Water -	103	116
Brown medium sand dirty with some gravel streaks -------------------	116	157
Brown medium sand and gravel -----	157	162
Brown large gravel and clay 0" to 6" size. No water ----------------	162	166
Brown clay and gravel. Had to drill up ---------------------------	166	191
Brown sand and gravel tight, some clay. Little water -------------	191	193
Brown gravel, and sand large 0" to 3" Good -------------------------	193	226
Gray large sand and gravel, tight --	226	227
Gray silts --------------------------	227	238

Qt revised 1/9/92

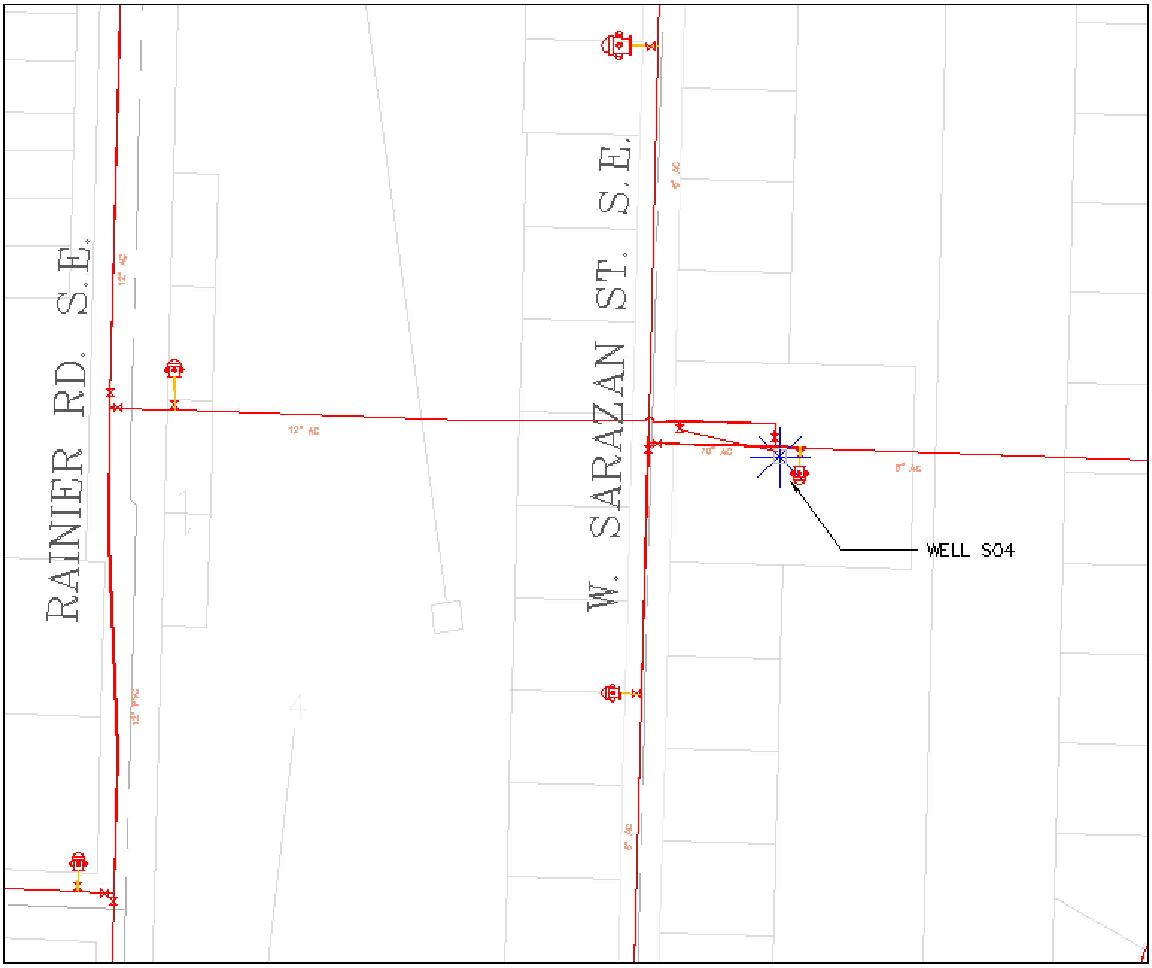
Qt revised 3/24/93

Well S04
(Golf Club Estates)

Facility Information

Description	Comments
Source #	S04
Address	6100 Sarazan SE
Year On-Line	1973
Pressure Zone	337
Floor Elevation	211.27
Housing	CMU
Pump Type	Submersible
Pump Model	Goulds 10RLC
Pump Shaft Diameter (in)	N/A
Column Diameter/Length	6" column, 64'
Pump Serial #	N/A
Pump Depth (ft)	66
Pump Capacity (gpm)	1100
Motor Model	Hitachi
Motor Serial #	N/A
Motor Speed (rpm)	3470
Horsepower	75
Casing Diameter (in)	16
Well Depth (ft)	84
Casing Depth (ft)	65
Screen	14-inch: 80-slot (65-66 ft), 100-slot (66-67 ft), 150-slot (67-80 ft)
Screen Capacity (gpm)	1000
Aquifer	Qva
Control Valves	6" 61G-21B 10" 92G-01BCSD
PSV Setting	74psi @ 1060gpm
PRV Setting (psi)	67
Flow to Waste Setting	95psi @ 700gpm
Flow to Waste Duration (sec)	300
Well Capacity (gpm)	1400
Chlorine Dose (mg/L)	0.62
Reliable Capacity (gpm)	750
Notes	Local pressures can limit the simultaneous operation of wells 4, 9, and 10. This well is typically low in the call order due to low pH. Sand has been reported at flow rates above 950 gpm.

Well S04 (Golf Club Estates)



Well Inspection Video

KLEINFELDER

Well Graphics

Well	Well 4	**Insp. no.**	5
		Insp. date	5/12/2008

Video		**Photos**	2
Video start	00:00:09	**Well depth [ft]**	84.00
Video end	00:38:03	**Inspection length [ft]**	82.90

Scale 1/ 764 **Graphics page 1**

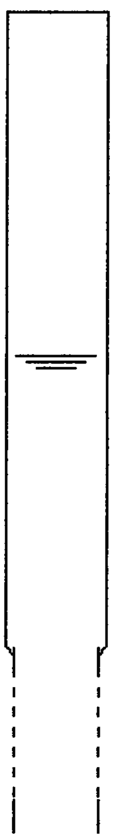
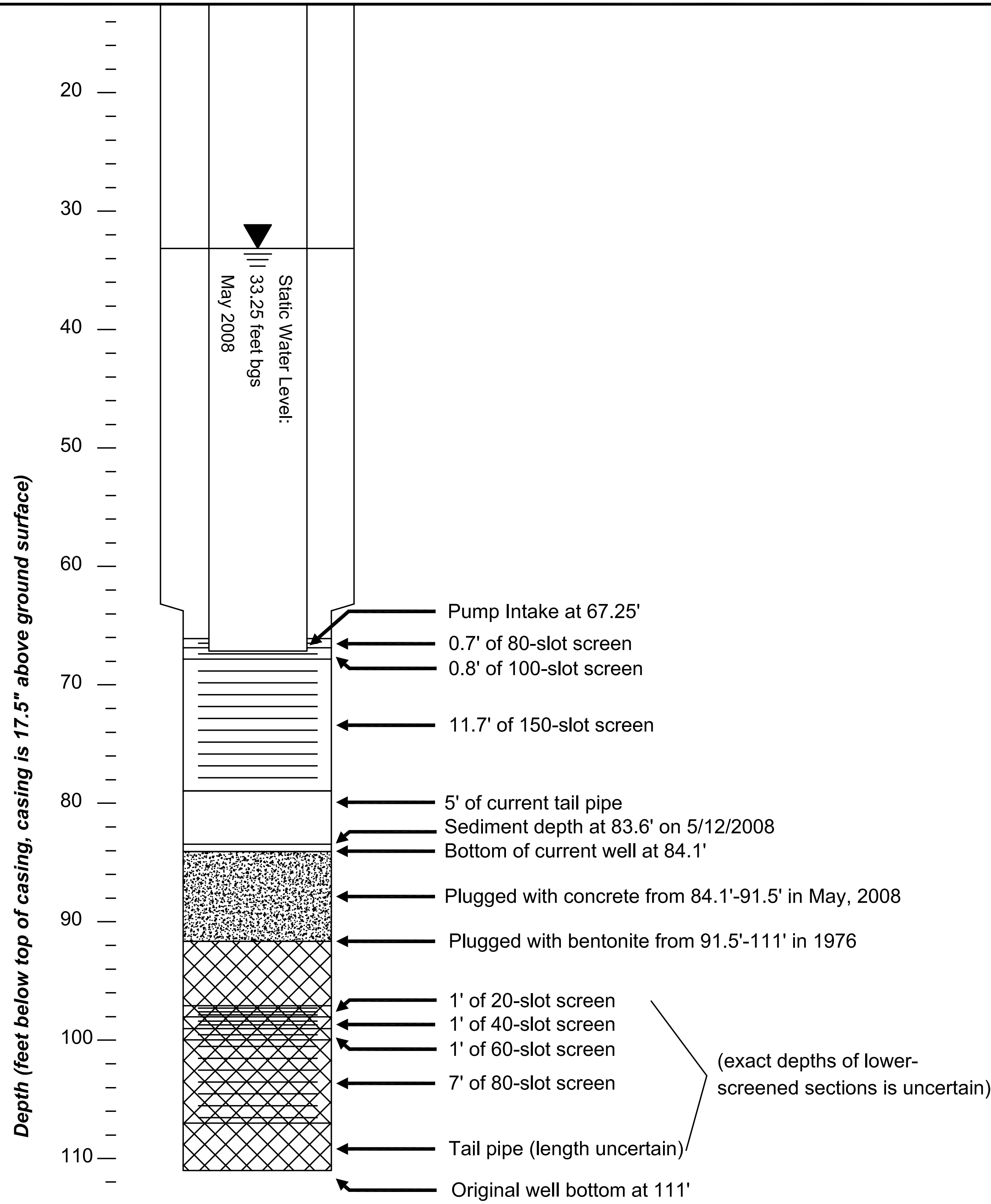


Photo	Video	Depth/ft	Condition	Description
	00:00:09	0.00	TOC	Top of Casing; 0ft
	00:02:10	8.90	CJ	Casing Joint; 8.9ft
	00:03:40	18.10	CJ	Casing Joint; 18.1ft
	00:05:19	27.60	CJ	Casing Joint; 27.6ft
	00:07:04	35.30	SWL	Static water level; 32.9ft
	00:14:16	64.00	CR	Casing reduction; 63.8ft
	00:16:31	64.30	RE	Remark; K-packer top
	00:22:36	66.20	TOS	Top of screen interval; 66.2ft; K-packer bottom
001	00:26:18	68.10	RE	Remark; Loose sand observed on screen opening 68.1
002	00:32:57	79.60	BOS	Bottom of screen interval; 79.6ft
	00:38:03	82.90	SFD	Sediment fill depth; 83.6ft



Notes

Screen type: 14-inch stainless steel
(13.125 - inch inner diameter)

Information compiled from multiple inspections/documents

Well 4 Screen Assembly Detail

Well 4 Construction
City of Lacey, Washington

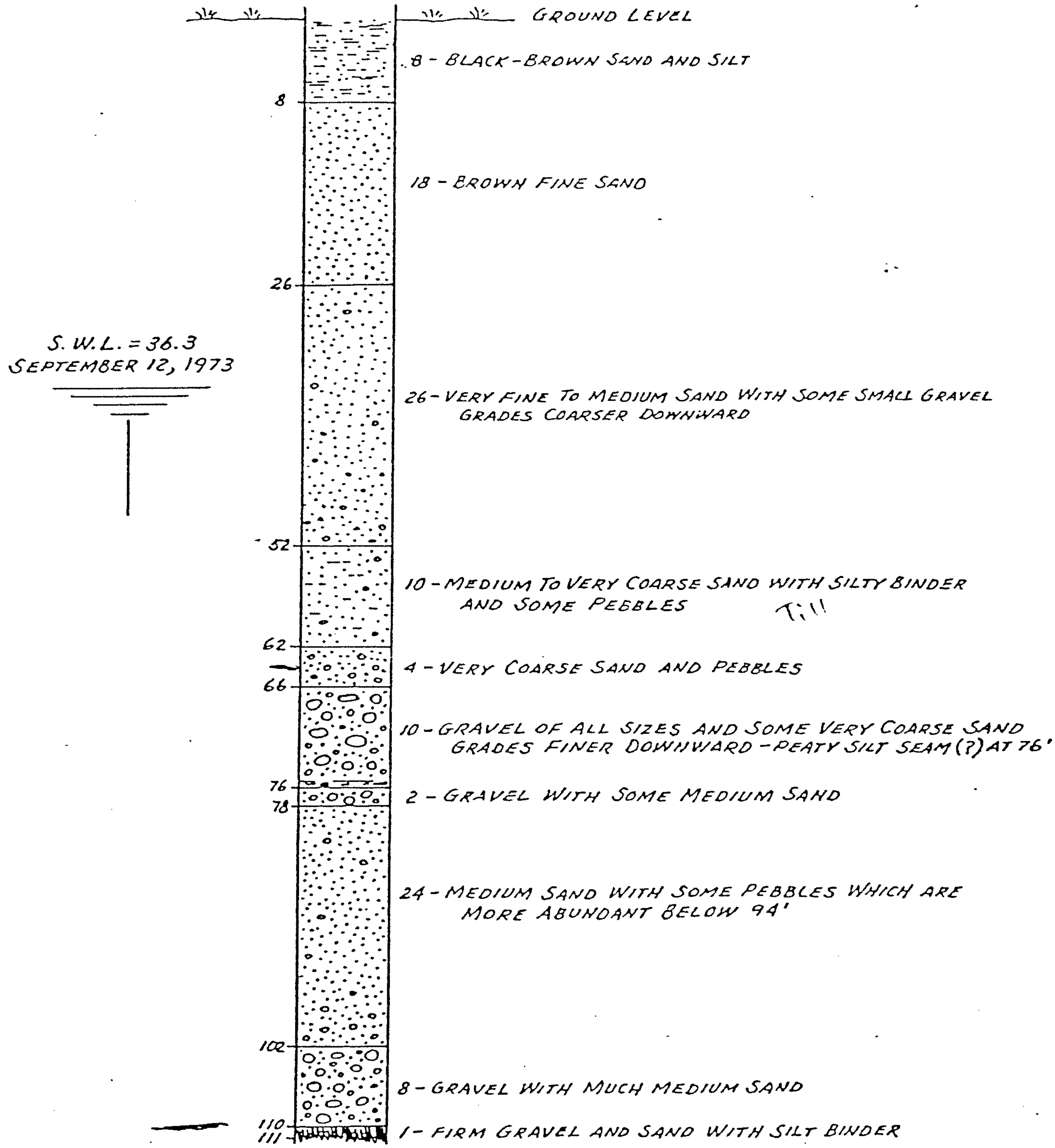
NORTHWEST Land & Water, INC.

D:\Projects\Lacey\2006 Test Well Program\Monitoring-WaterLevel&Flow\StepRate Tests\Well 4\Well4detail.dwg
version 8/26/08

FIG. 1

Western well

CITY OF LACEY GOLF COURSE WELL – 1973



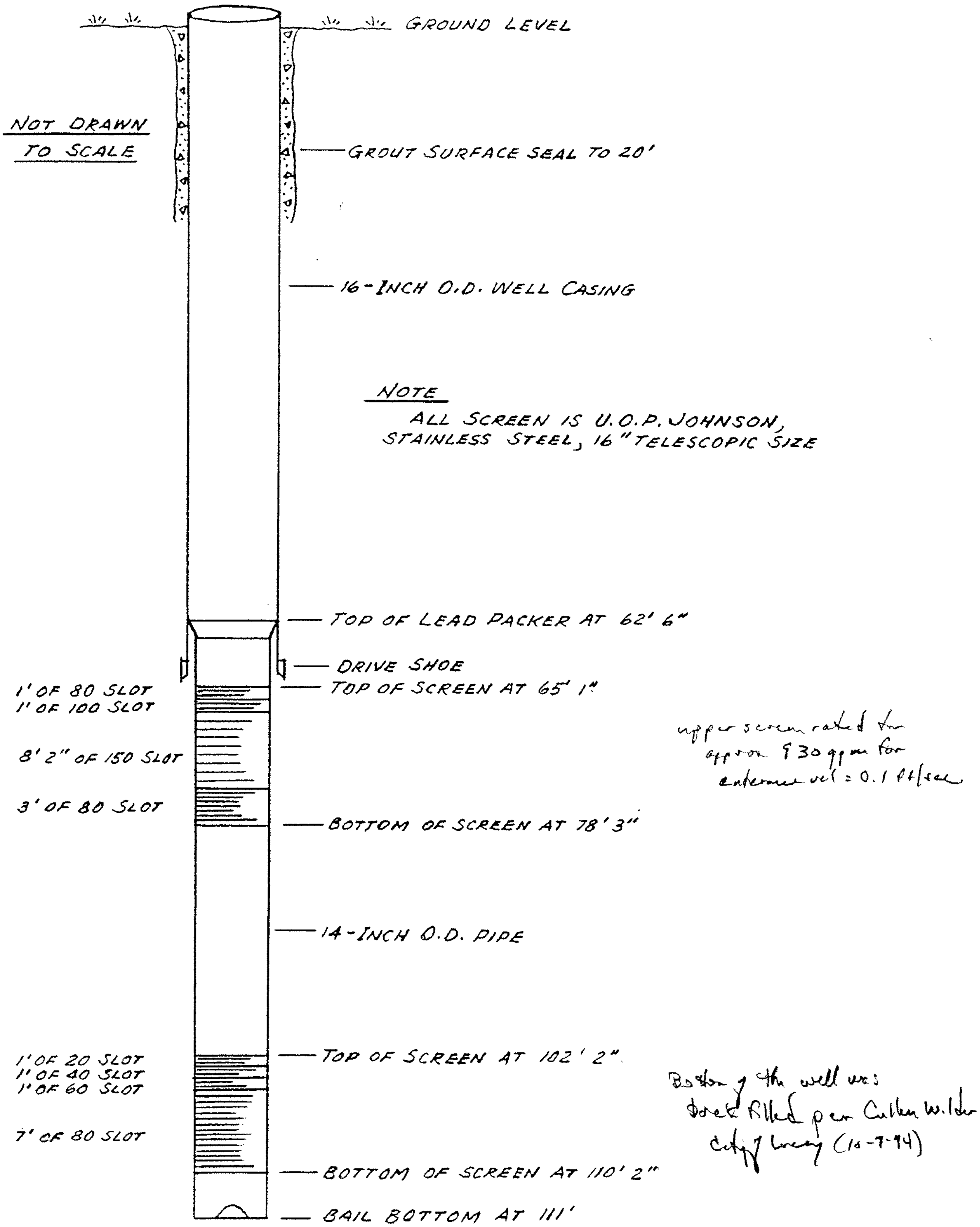
HOLE BOTTOMED AT 111

CITY OF LACEY WASHINGTON	ROBINSON AND NOBLE, INC. GROUND WATER GEOLOGISTS TACOMA, WASHINGTON	SEPT. 15, 1973 DRAWN BY H. N.

FIG. 2

GOLF COURSE WELL - 1973

CASING AND SCREEN DETAILS



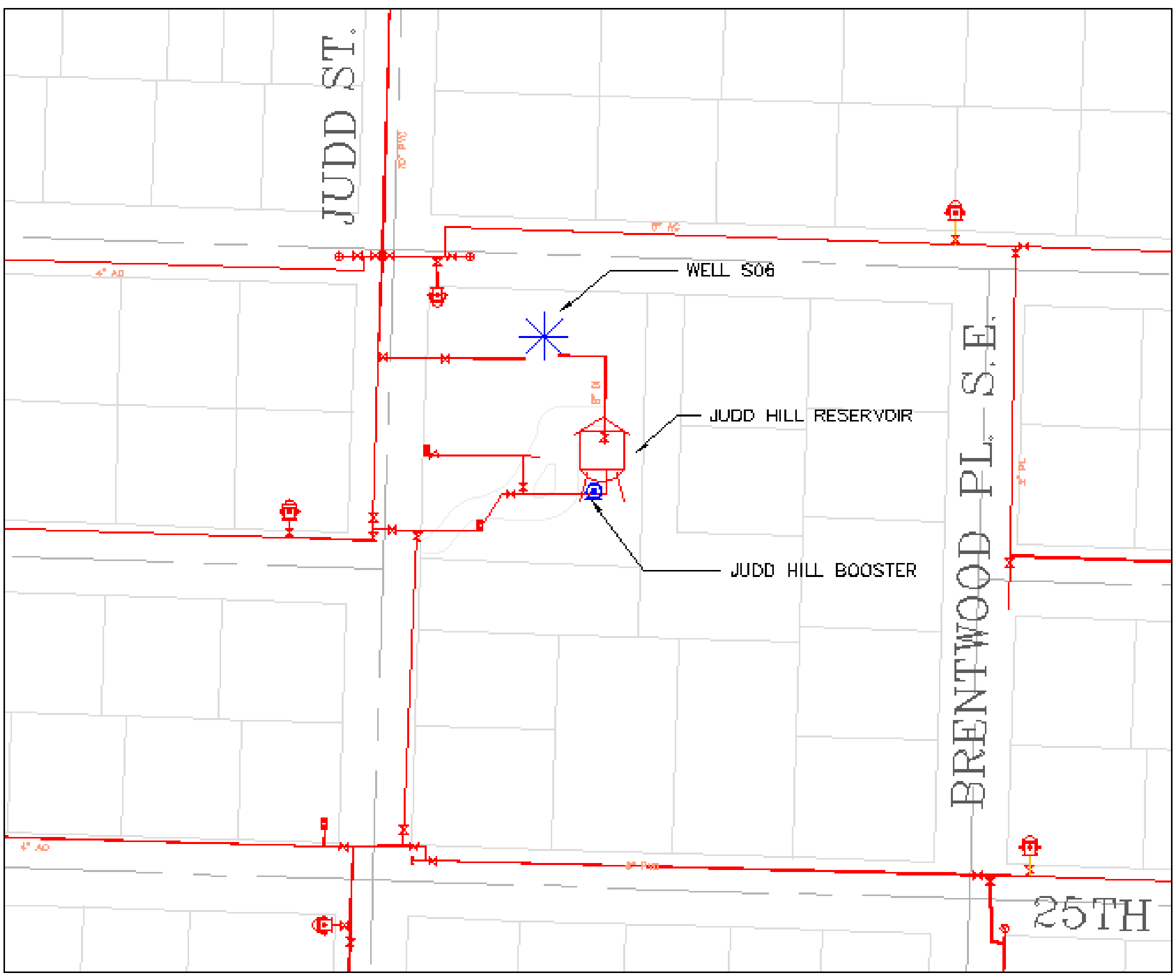
CITY OF LACEY WASHINGTON	ROBINSON AND NOBLE, INC. GROUND WATER GEOLOGISTS TACOMA, WASHINGTON	SEPT. 15, 1973 DRAWN BY H.N.

Well S06
(Judd Hill)

Facility Information

Description	Comments
Source #	S06
Address	2400 Judd St. SE
Year On-Line	1993
Pressure Zone	337
Floor Elevation	235.51
Housing	CMU
Pump Type	Submersible
Pump Model	Peerless 8LB - 3 Stage
Pump Shaft Diameter (in)	N/A
Column Diameter/Length	6" column, 168'
Pump Serial #	N/A
Pump Depth (ft)	168
Pump Capacity (gpm)	600
Motor Model	Hitachi
Motor Serial #	N/A
Motor Speed (rpm)	3470
Horsepower	75
Casing Diameter (in)	16
Well Depth (ft)	385
Casing Depth (ft)	190
Screen	10-inch: 40-slot (190-200, 223-238 ft), 60-slot (325-340, 352-367, 375-380 ft)
Screen Capacity (gpm)	1850
Aquifer	Qpg - TQu
Control Valves	4" 61G-21AB 8" 92G-02BD 2-1/2" 50G-01BD 8" 136EG-03ABCS
PSV Setting	100psi @ 530gpm
PRV Setting (psi)	60
Flow to Waste Setting	123psi @ 220gpm
Flow to Waste Duration (sec)	120
Well Capacity (gpm)	550
Chlorine Dose (mg/L)	N/A
Reliable Capacity (gpm)	400
Notes	Declining specific capacity, frequent low aquifer alarms.

Well S06 (Judd Hill)



SC-014204

File Original and First Copy with Department of Ecology
Second Copy—Owner's Copy
Third Copy—Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. ~~[illegible]~~

Water Right Permit No. 62-27373 A

(1) OWNER: Name City of Lacey Address

(2) LOCATION OF WELL: County Thurston SW ¼ SW ¼ Sec. 21 T. 18 N., R. 1 W W.M.

(2a) STREET ADDDRESS OF WELL (or nearest address) Corner of Judd St. + 23rd Ave SE

(3) PROPOSED USE: ☐ Domestic ☐ Irrigation ☐ DeWater Industrial ☐ Test Well ☐ Municipal ☒ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) Judd Hill 6 C - VW
Abandoned ☐ New well ☒ Deepened ☐ Reconditioned ☐ Method: Dug ☐ Cable ☒ Rotary ☐ Bored ☐ Driven ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 16 inches.
Drilled 403 feet. Depth of completed well 195 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 16 " Diam. from +2 ft. to 195 ft.
Welded ☒ " Diam. from ft. to ft.
Liner installed ☐
Threaded ☐ " Diam. from ft. to ft.

Perforations: Yes ☐ No ☒
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson
Type 304 Model No.
Diam. 10 Slot size 60 from 190 ft. to 200 ft.
Diam. 10 Slot size 60 from 223 ft. to 238 ft.

Gravel packed: Yes ☒ No ☐ Size of gravel Aqua #1
Gravel placed from 400 ft. to 177 ft.

Surface seal: Yes ☒ No ☐ To what depth? 20 ft.
Material used in seal Cement
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level ft.
Static level 98 ft. below top of well Date
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☐ If yes, by whom?
Yield: 630 gal./min. with 57 ft. drawdown after 24 hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test
Bailer test gal./min. with ft. drawdown after hrs.
Airtest gal./min. with stem set at ft. for hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes ☒ No ☐

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
Sand	0	5
Gray + brown sand + gravel	5	45
Gray to brown sand	45	95
Sand some gravel layers of silt water bearing	95	403

10" - 60 slot 325 - 340
10" 60 slot 353 - 368
10" 60 slot 375 - 380

Work started 7-23-1988 Completed 9-2 1988

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME Holt Drilling Inc (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)

Address 10621 Todd Rd E

(Signed) [signature] (WELL DRILLER) License No. 1099

Contractor's Registration No. HOLT DI 1360G Date 10-1, 1988

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20 (10/87) -1329-

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

Boring Log and Construction Data for Judd Hill Well 6C

Geologic Log

Ground Surface Elevation in Feet 234.6

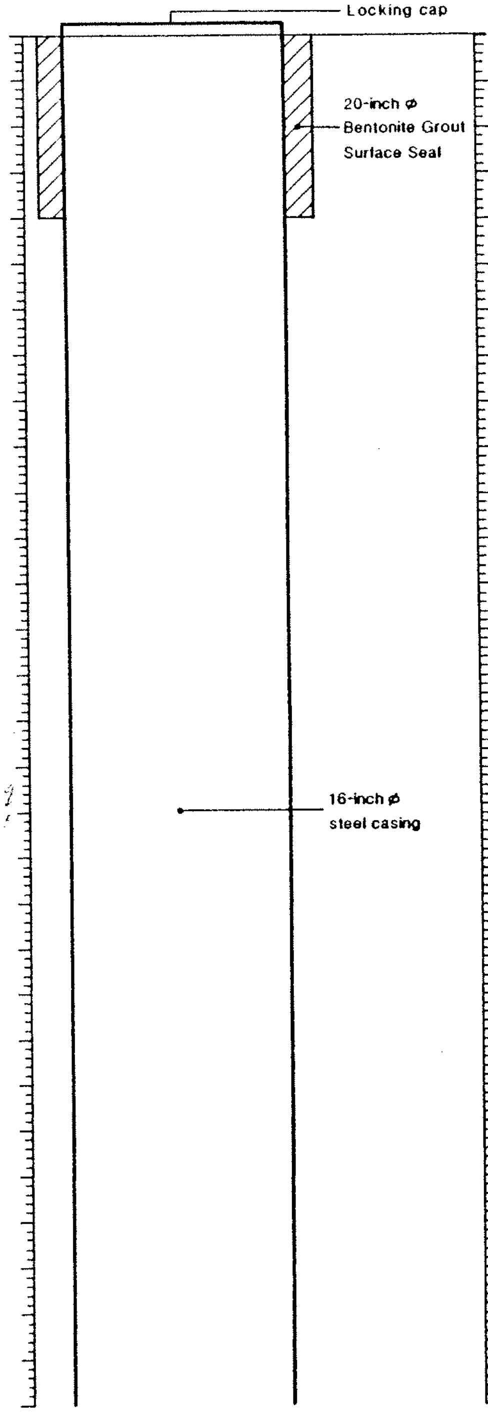
Depth in Feet	Geologic Log	Sample
0	Brown, silty SAND (TOPSOIL).	
10	Gray to brown, gravelly SAND.	
30	Cobbles.	
50	Gray to brown, fine to medium SAND.	
60	Gray to brown, very gravelly SAND.	
70	Slightly gravelly, fine to medium SAND.	
80	Brown, slightly silty to silty, medium to fine SAND.	
90		∇ 8/25/88
95	As above, saturated.	
105	Brown, very gravelly, fine to medium SAND.	
110	Brown, very sandy GRAVEL with cobbles.	
130		B.T.=7.0 gpm/ft.
135	Gravel content decreases. Very gravelly SAND with cobbles.	
145	Brown, gravelly SAND with interbedded SILT.	

Sample — Lab

Well Design

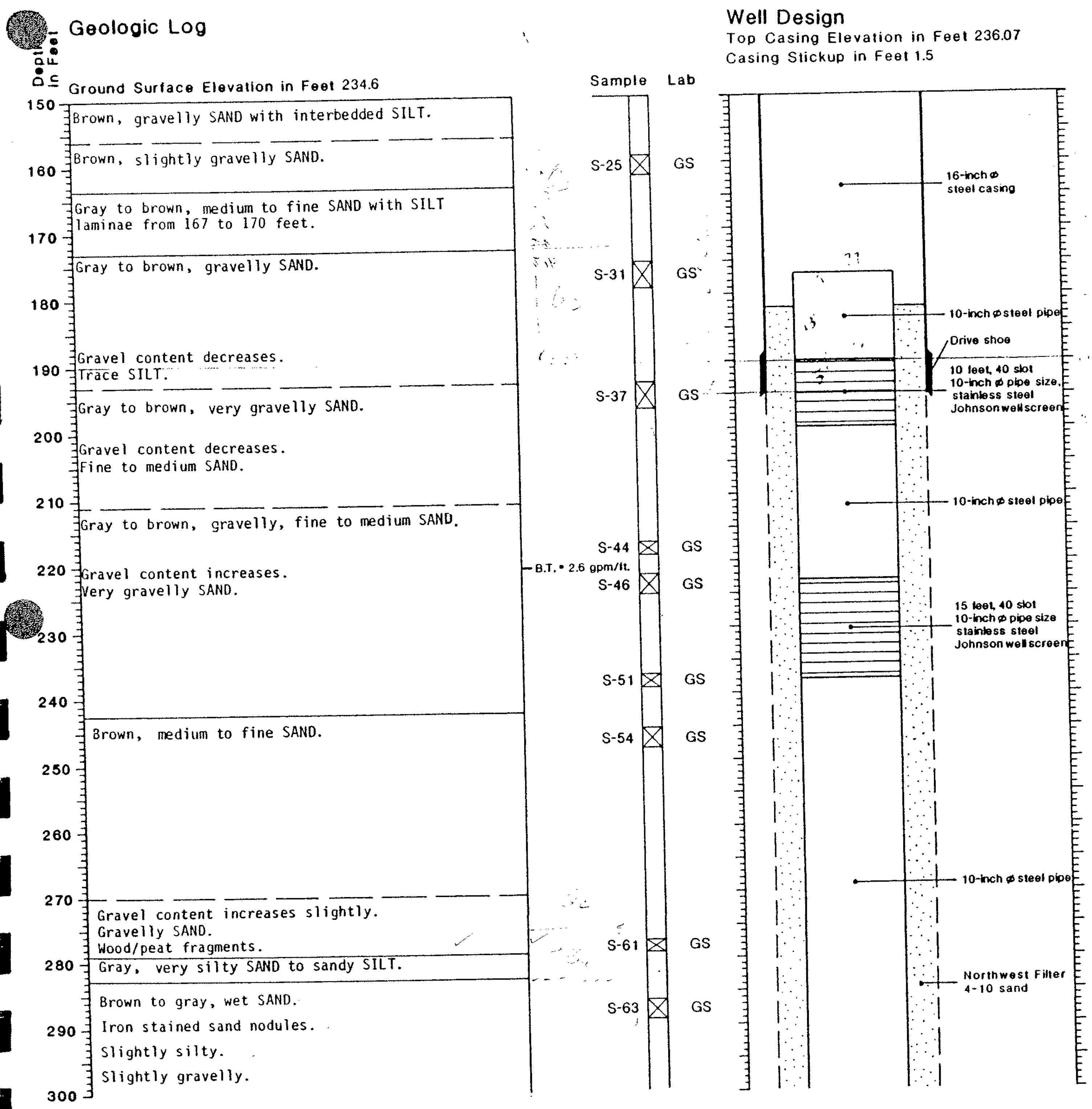
Top Casing Elevation in Feet 236.07
Casing Stickup in Feet 1.5

236.07



J-2111 August 1988
HART-CROWSER & associates, inc.
Sheet 1 of 3 Figure A-2

Boring Log and Construction Data for Judd Hill Well 6C

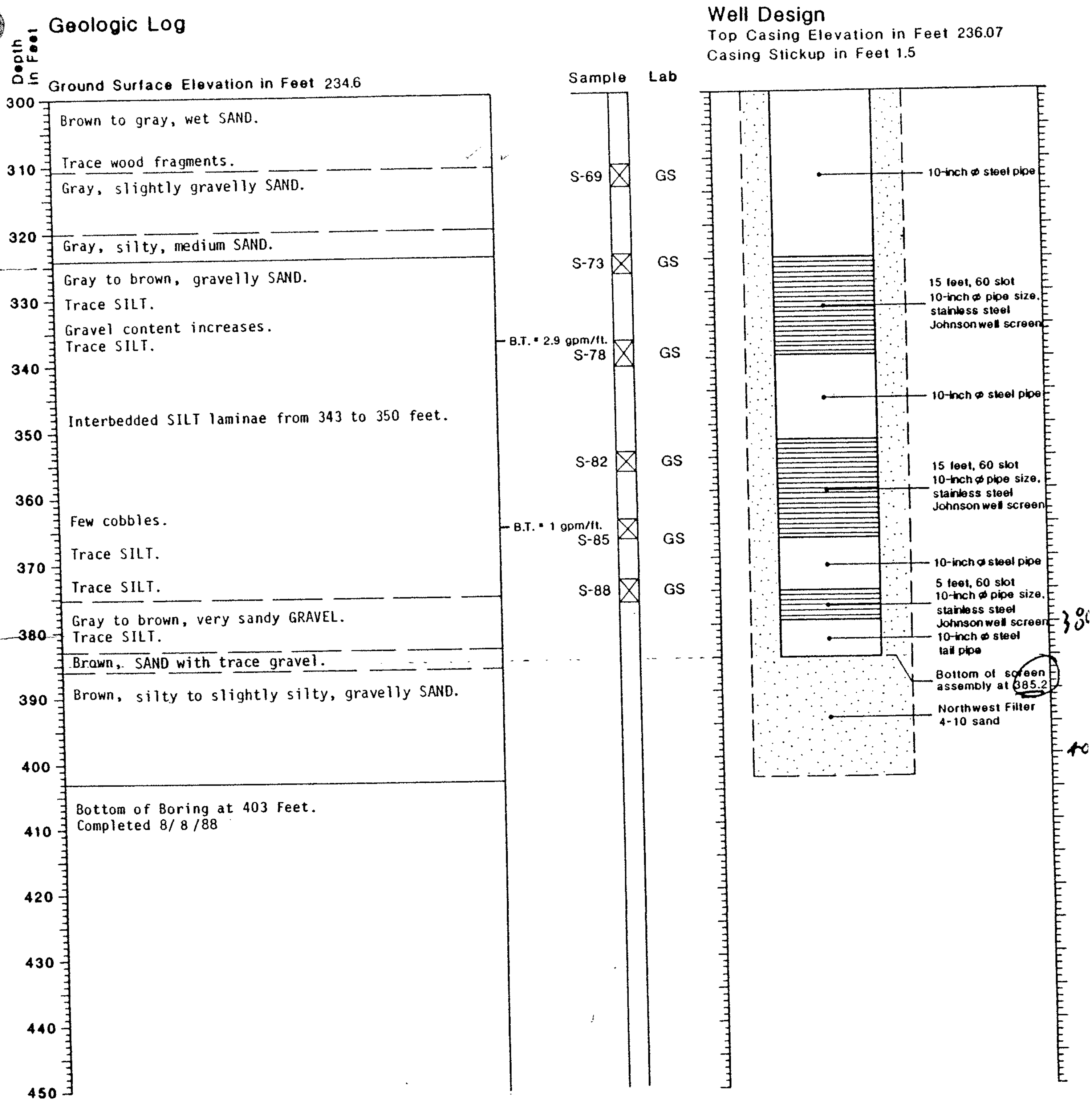


J-2111 August 1988

HART-CROWSER & associates, inc.

Sheet 2 of 3 Figure A-2

Boring Log and Construction Data for Judd Hill Well 6C



NOTES:
1. Soil description for samples collected between 0 and 128 feet and in a few cases, at other intervals, are based on samples obtained by Holt Drilling. Depths of changes in soil types represent our interpretation of the driller's log. At other depths soil descriptions were interpreted by our on-site field person from bail samples.
2. Water Level ∇ is for date indicated and may vary with time of year.
3. B.T. indicates Bail Test.
4. GS indicates a laboratory mechanical grain size analysis was performed on sample.

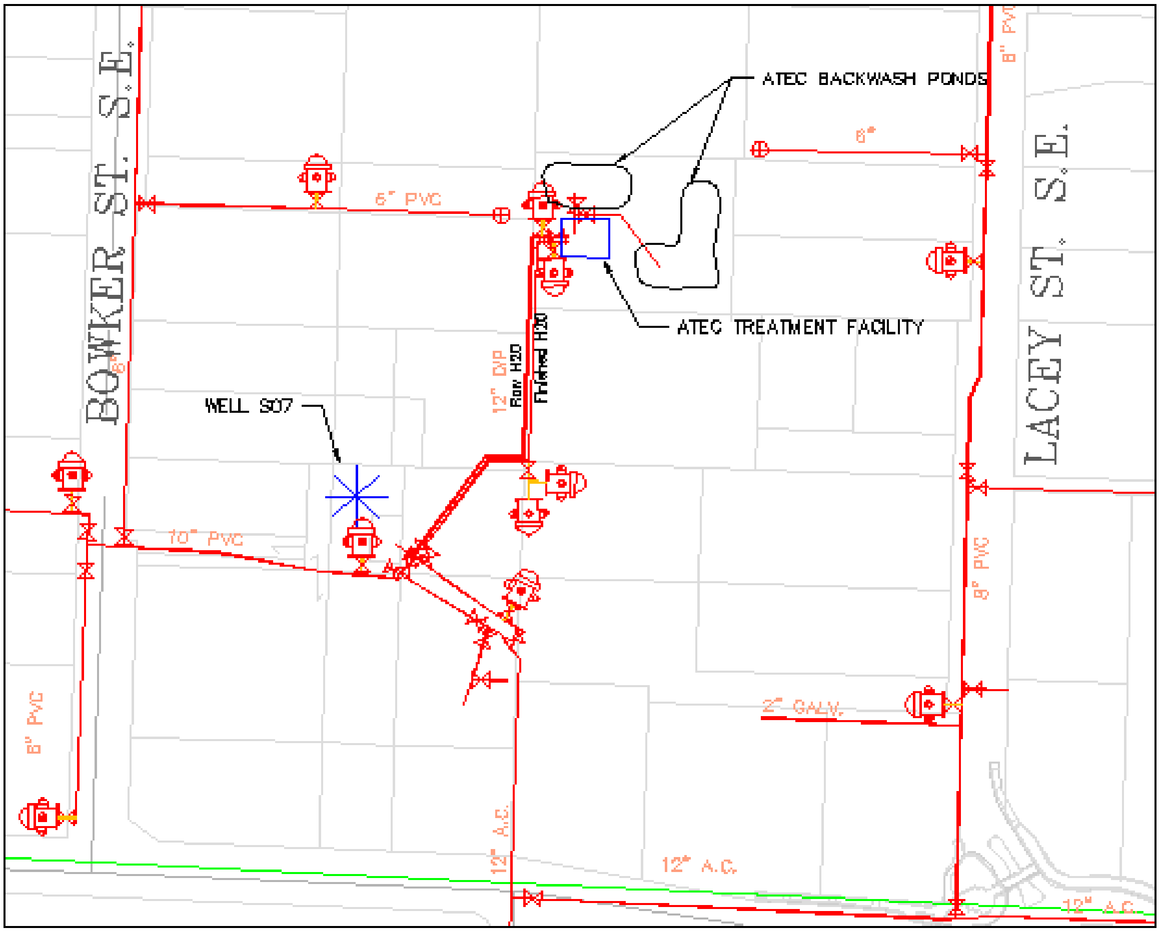
J-2111 August 1988
HART-CROWSER & associates, inc.
Sheet 3 of 3 Figure A-2

Well S07
(Fire Station)

Facility Information

Description	Comments
Source #	S07
Address	5606 Pacific Ave. SE
Year On-Line	1976
Pressure Zone	337
Floor Elevation	182.26
Housing	CMU
Pump Type	Turbine
Pump Model	Jacuzzi 12T/C-624 12x1-1
Pump Shaft Diameter (in)	1.54
Column Diameter/Length	10" column, 190'
Pump Serial #	6F722126
Pump Depth (ft)	200
Pump Capacity (gpm)	1800
Motor Model	US Electric
Motor Serial #	C-2694-03-931
Motor Speed (rpm)	1775
Horsepower	200
Casing Diameter (in)	12
Well Depth (ft)	479
Casing Depth (ft)	430
Screen	8-inch: 80-slot (428-477 ft) with sand pack
Screen Capacity (gpm)	1950
Aquifer	TQu
Control Valves	6" 61G-21B 12" 692G-07ABCDS
PSV Setting	88psi @ 1840gpm
PRV Setting (psi)	85
Flow to Waste Setting	120psi @ 1180gpm
Flow to Waste Duration (sec)	120
Well Capacity (gpm)	2150
Chlorine Dose (mg/L)	N/A
Reliable Capacity (gpm)	1800
Notes	Flows directly to ATEC treatment facility (iron/manganese). Sand production and water chemistry unknown at rates above 1800 gpm.

Well S07 (Fire Station)



File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Application No. G2-24351
Permit No. ....

(1) OWNER: Name City of Lacey Address

(2) LOCATION OF WELL: County Thurston NW ¼ NE ¼ Sec. 21 T. 18 N., R. 1 W W.M.

Bearing and distance from section or subdivision corner 1500' WEST AND 700' SOUTH FROM NE COR. SEC. 21

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☒ Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) Lots
New well ☐ Method: Dug ☐ Bored ☐
Deepened ☒ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 12 inches.
Drilled 488 ft. Depth of completed well 479' ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 12 " Diam. from 0 ft. to 430' ft.
Threaded ☐ " Diam. from ft. to ft.
Welded ☒ " Diam. from ft. to ft.

Perforations: Yes ☐ No ☒
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson
Type Stainless Model No.
Diam. 8 Slot size 80 from 430 4/6 to 481 5/6
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☒ No ☐ Size of gravel: Traction Sand
Gravel placed from ft. to ft.

Surface seal: Yes ☒ No ☐ To what depth? 50' ft.
Material used in seal Cement
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name Jacuzzi
Type: Turbine H.P. 200

(8) WATER LEVELS: Land-surface elevation above mean sea level....
Static level 53.5 ' 6" ft. below top of well Date 8-14-76
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? Kincy
Yield: gal./min. with ft. drawdown after hrs.
2000 " To' 134'5" " 4 "
" " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
		None			

Date of test
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes ☒ No ☐

(10) WELL LOG:

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Kincy Well Files City Lacey #410	0	300
Brown Fine Silty Sand	300	325
Gray Fine To Medium Silty Sand	325	355
Gray Fine Silts	355	365
Gray Medium Sand	365	367
Gray Medium Dirty Sand	367	374
Gray Med. Fine Silty Sand Wood	374	380
Gray Med. Fine Sand Small Gravel	380	382
Gray Medium Sand	382	398
Gray Fine Med Sand Small Gravel	398	405
Gray Fine Med Silty Sand Wood	405	419
Gray Fine Med Sand Small Gravel	419	423
Gray Small Med. Gravel and Sand	423	437
Gray Corse Med Sand Some Gravel	437	461
Gray Med. Small Gravel Large Sand	461	465
Gray Med Sand Gravel	465	467
Gray Fine Med Sand	467	469
Gray Medium Sand and Gravel	469	473
Gray Med Gravel Sand Very Good	473	476
Gray Fine Med Sand Gravel	476	481
Gray Fine Med Sand Little Gravel	481	483
Gray Fine Med Silty Sand	483	488

RECEIVED
OCT 28 1976
DEPARTMENT OF ECOLOGY
SOUTHWEST REGIONAL OFFICE

Work started 19 . Completed 19 .

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Kincy Hardware (Person, firm, or corporation) (Type or print)

Address 512 East 4th Ave Oly

[Signed] Rick Kincy (Well Driller)

License No. C-65 Date 8-14- 1976

OK 1/10/77

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

Started 2-3-76

#680

Kincy Hardware and Well Drilling Co.

CONSTRUCTION RECORD

Well #7

Date 8-14-76

Total Depth ~~48?~~ 479'

1. WELL OWNER

Name City Kacey

Address

2. LOCATION

Well in Back of fire Dept. T18N R1W NE Corner of Sec 21 Green with Strip Flag

3. TYPE OF WORK

New Well X Deeping ___ Bailing ___

Setting Screen ___ Developing ___

4. PROPOSED USE

Domestic ___ Industrial ___ Municipal X

Irrigation ___ Test Well ___ Other ___

5. CASING INSTALLED Total Casing 430' 4½

Above Ground 2' Below Ground 428' 4½"

Threaded ___ Welded X

12" dia. from 0 ft. to TC ft. ga. Sea 30

___ dia. from ___ ft. to ___ ft. ga. ___

___ dia. from ___ ft. to ___ ft. ga. ___

___ dia. from ___ ft. to ___ ft. ga. ___

6. PERFORATIONS

Yes ___ No X

From ___ to ___ size ___ x ___

From ___ to ___ size ___ x ___

From ___ to ___ size ___ x ___

7. SCREEN INSTALLED

Yes X No ___

Make Johnson Total Length 49' 1"

Amount Exposed 51' 1" Fittings Welded

Metal Stainless Ext. Piece 8" Pipe 31' 6⅜"

Dia. 8 Slot Size ___ from ___ to ___

Coupling Slot Size ___ from ___ to ___

Slot Size BLANK from 396 5/8 428

Slot Size 80 from 428 to 477

Slot Size BLANK from 477 to 479

8. CONSTRUCTION

Gravel Packed. Yes X No ___

Gravel Placed From ___ to ___ Size ___

9. WATER LEVELS

State Water Level 52' 6"

Flowing ___ Rate ___

10. PUMP TEST

Yes X No ___ Bail Tested ___

G.P.M. 2000 Draw Down To 134' 5"

Hours Pumped 4 Bailed ___

11. PUMPS INSTALLED

Make Jacuzzi

Type Turbine

Setting ___ GPM 2,000

HP 200 Phase 3 Pipe Size ~~8~~" 10"

12. CHEMICAL ANALYSIS

Iron ___ ppm.

P.H. ___ ppm.

Hardness ___ gr.

Odor - Yes ___ No ___

13. DRILLERS NOTES

This was Grouted To 50' or more with Cement Grout.

Screen capacity 49 ft x 153 in²/ft = 2324 gpm

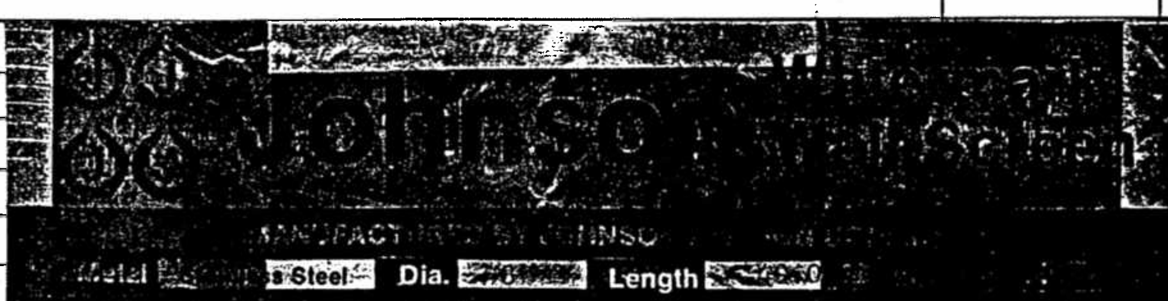
0.31 x 49

14. DRILLER Reid Kincy

(over)

15. FORMATIONS

Material	From	To
Formations Are on Well File # 410	0	300
Brown Fine Silty Sand	300	325
Gray Fine To Medium Silty Sand	325	355
Gray Fine Silts	355	365
Gray Medium Sand	365	367
Gray Medium Dirty Sand	367	374
Gray Medium To Fine Silty Sand with wood	374	380
Gray Medium To Fine Sand with Some Small Gravel	380	382
Gray Medium Sand	382	398
Gray Fine To Medium Sand and Small Gravel	398	405
Gray Fine To Medium Silty Sand and wood	405	419
Gray Fine To Medium Sand Some Small Gravel	419	423
Gray Small To Medium Gravel and Sand	423	437
Gray Corse To Medium Sand and Some Gravel	437	461
Gray Medium To Small Gravel and Large Sand	461	465
Gray Medium Sand and Gravel	465	467
Gray Fine To Medium Sand	467	469
Gray Medium Sand and Gravel	469	473
Gray Medium Gravel and Sand very Good	473	476
Gray Fine To Medium Sand and Gravel	476	481
Gray Fine To Medium Sand Little Gravel	481	483
Gray Fine To Medium Silty Sand	483	488

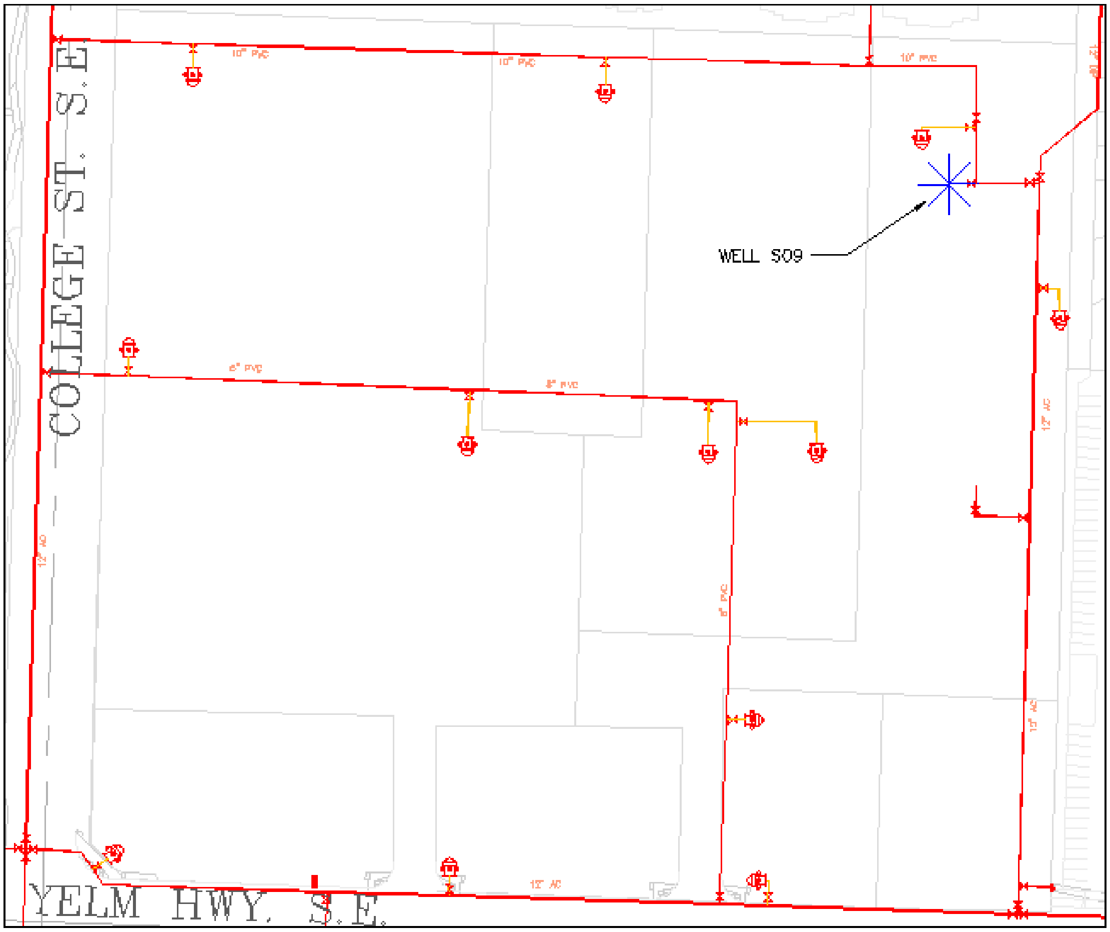


Well S09
(Little Prairie)

Facility Information

Description	Comments
Source #	S09
Address	4890 Yelm Hwy SE
Year On-Line	1981
Pressure Zone	337
Floor Elevation	192.19
Housing	CMU
Pump Type	Submersible
Pump Model	Crown 8M-700STD
Pump Shaft Diameter (in)	N/A
Column Diameter/Length	6" column, 187'
Pump Serial #	4410
Pump Depth (ft)	193
Pump Capacity (gpm)	900
Motor Model	Hitachi
Motor Serial #	B96/G8962303H
Motor Speed (rpm)	1750
Horsepower	100
Casing Diameter (in)	16
Well Depth (ft)	290
Casing Depth (ft)	218
Screen	8-inch: 30-slot (223-253 ft), 60-slot (254-284 ft) filter pack (aqua #8)
Screen Capacity (gpm)	2000
Aquifer	TQu
Control Valves	6" 61G-21 8" 692G-07ABCSDKC 2-1/2" 50A-01
PSV Setting	66psi @ 790gpm
PRV Setting (psi)	74
Flow to Waste Setting	90psi @ 850gpm
Flow to Waste Duration (sec)	120
Well Capacity (gpm)	1400
Chlorine Dose (mg/L)	1.49
Reliable Capacity (gpm)	650
Notes	Well 9 is used sparingly due to poor water quality, elevated iron and manganese have a history of contributing to local “brown water” occurrences. Distribution mains in the vicinity of well 9 are flushed annually to remove manganese deposits from the pipes. Local pressures may limit simultaneous operation of wells 4, 9, and 10 as they are located in relatively close proximity. Well 9 has been known to produce sand at rates above 900 gpm.

Well S09 (Little Prairie)



File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Application No. ....
Permit No. ....

(1) OWNER: Name City of Lacey Address P.O. Drawer "B", Lacey, WA.

(2) LOCATION OF WELL: County Thurston — SW ¼ SW ¼ Sec. 33 T. 18 N., R. 1 W.M.

Bearing and distance from section or subdivision corner 680 ft. North and 764.5 ft. East of the S.W. corner of Section 33.

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☒ Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) No. 9
New well ☐ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 16 inches.
Drilled 440 ft. Depth of completed well 285 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 16" Diam. from 0 ft. to 222 ft.
Threaded ☐ ....." Diam. from ..... ft. to ..... ft.
Welded ☒ ....." Diam. from ..... ft. to ..... ft.

Perforations: Yes ☐ No ☒
Type of perforator used .....
SIZE of perforations ..... in. by ..... in.
..... perforations from ..... ft. to ..... ft.
..... perforations from ..... ft. to ..... ft.
..... perforations from ..... ft. to ..... ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson
Type Telescoping Stainless Steel Model No. .....
Diam. 12 Slot size 30 from 223 ft. to 253 ft.
Diam. 12 Slot size 60 from 253 ft. to 283 ft.

Gravel packed: Yes ☐ No ☒ Size of gravel: .....
Gravel placed from ..... ft. to ..... ft.

Surface seal: Yes ☒ No ☐ To what depth? 18 ft.
Material used in seal Concrete Grout
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? ..... Depth of strata .....
Method of sealing strata off .....

(7) PUMP: Manufacturer's Name .....
Type: ..... H.P. .....

(8) WATER LEVELS: Land-surface elevation above mean sea level.... 200 ft.
Static level 22 ft. below top of well Date 10/19/81
Artesian pressure ..... lbs. per square inch Date .....
Artesian water is controlled by ..... (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? Hart-Crowser
Yield: 1100 gal./min. with 136 ft. drawdown after 24 hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
Transmissivity	estimated to be	29,700 gpd/ft			

Date of test 8/19/81
Bailer test ..... gal./min. with ..... ft. drawdown after ..... hrs.
Artesian flow ..... g.p.m. Date .....
Temperature of water ..... Was a chemical analysis made? Yes ☒ No ☐

(10) WELL LOG:

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
Sand and gravel water bearing	0	50
Dirty sand some gravel	50	65
Dirty sand-water bearing	65	83
Brown sand and gravel	83	92
Dark gray gravel	92	122
Cemented gravel and boulder	122	168
Sand and gravel- waterbearing	168	196
Boulders and sand	196	200
Sand and gravel	200	203
Blue sticky clay	203	221
Dirty sand and gravel	221	249
Gravel with some sand	249	287
Fine sand	287	310
Sticky silty clay	310	314
Blue clay with layers of peat	314	336
Dirty sand and gravel	336	341
Sand and gravel	341	358
Brown claybound gravel	358	360
Brown silty clay	360	366
Gray silty sand and gravel	366	374
Blue clay	374	429
Dirty sand - water bearing	429	440

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DEPARTMENT OF ECOLOGY
SOUTHWEST REGIONAL OFFICE

Work started 8/6/ , 19 81 Completed 10/21 , 19 81

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Stary and Dodge Drilling (Person, firm, or corporation) (Type or print)

Address Graham, Washington

[Signed] Edgar D. Stary (Well Driller)

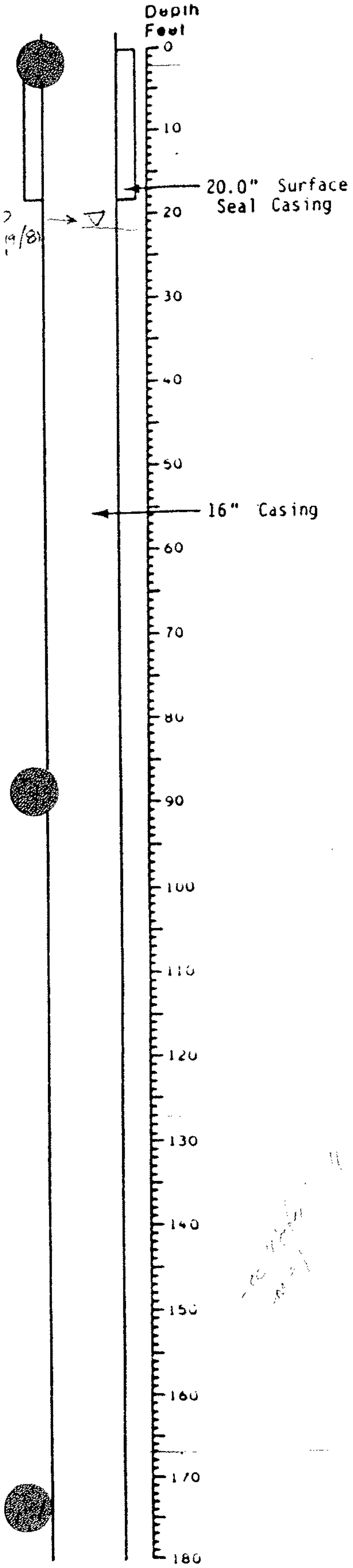
License No. 0492 Date 12/22, 19 81

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

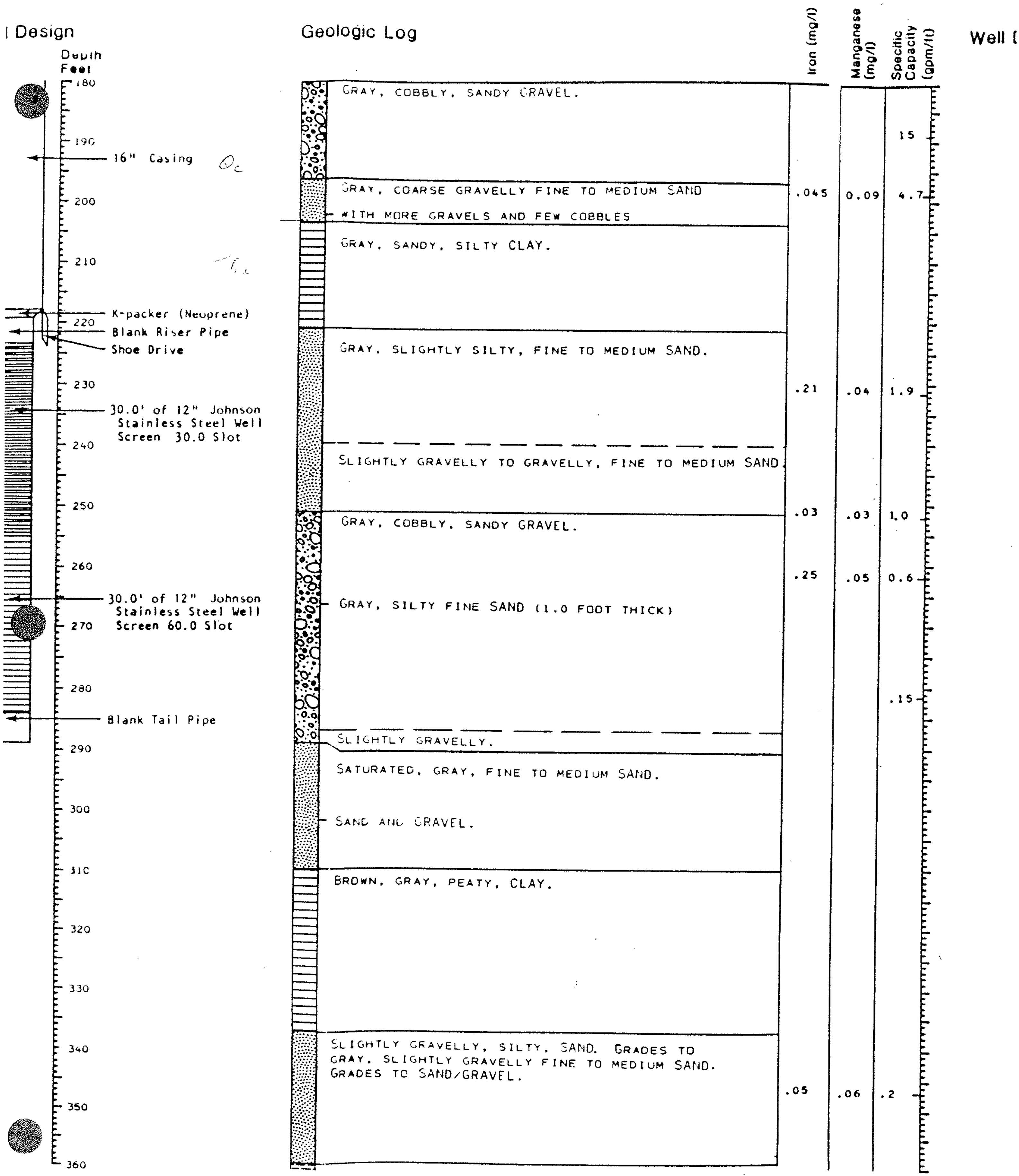
Well Boring and Construction Information

Well Design

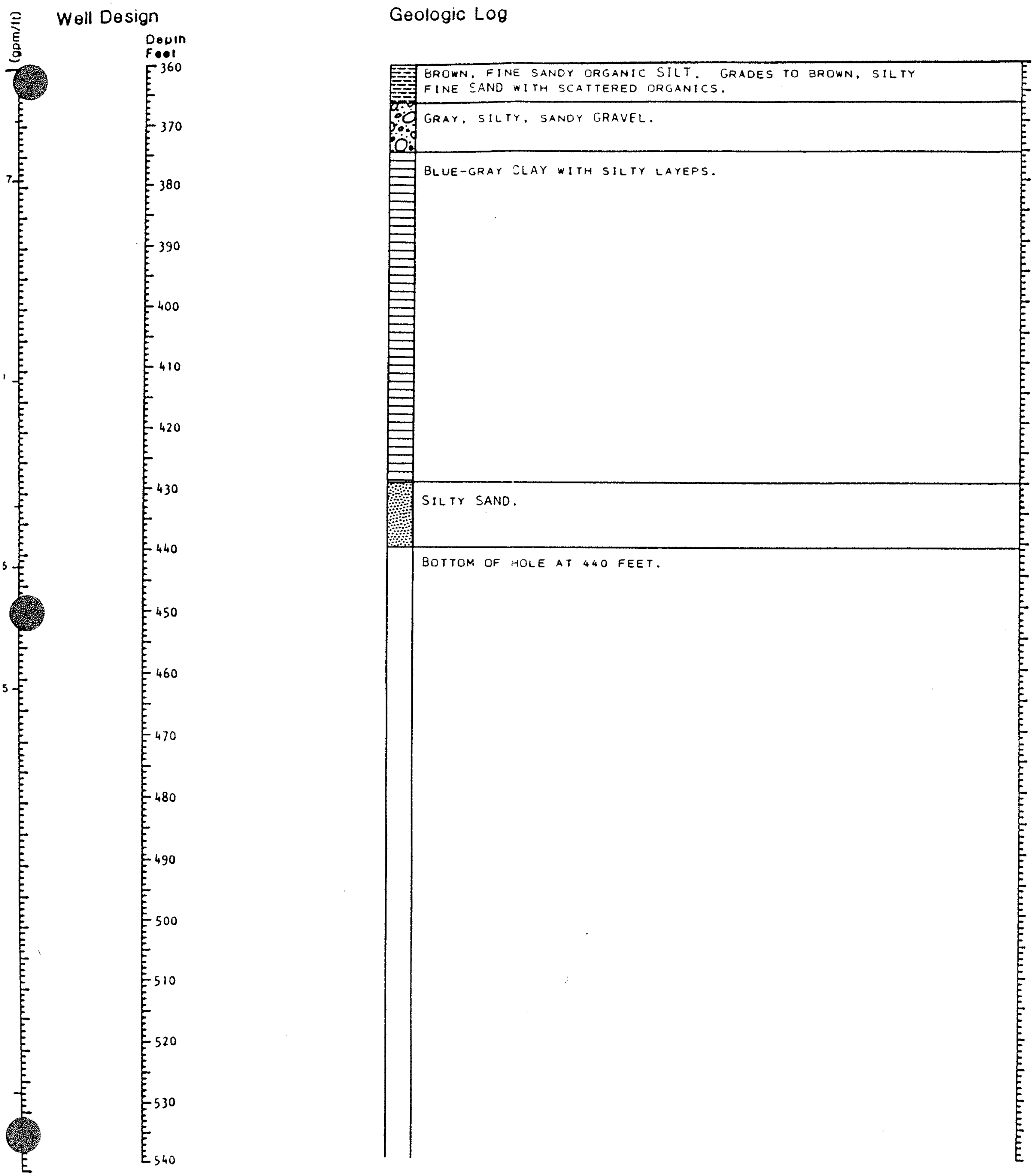


Geologic Log Production Well No. 9

Geologic Log	Iron (mg/l)	Manganese (mg/l)	Specific Capacity (gpm/ft)
DARK BROWN, SILTY FINE TO MEDIUM SAND WITH SUBSTANTIAL ORGANICS.			
GRAY, CLEAN, FINE TO MEDIUM SAND WITH SCATTERED GRAVEL.			
GRAY, CLEAN SANDY GRAVEL TO GRAVELLY SAND.			
GRAY, FINE TO MEDIUM SAND.			
BROWNISH GRAY TO GRAYISH BROWN, SANDY GRAVEL TO GRAVELLY SAND WITH SCATTERED COBBLES.			
	1.9	.050	2.7
COLOR CHANGE TO GRAY			
	1.4	.080	3.7
NUMBEROUS COBBLES	.20	.060	3.1
NUMEROUS SCATTERED COBBLES.	.12	.060	9.4
	.14	.058	12.9
GREENISH-GRAY, SILTY FINE SAND.			
GRAY, SANDY GRAVEL.			
GRAY, SILTY, GRAVELLY COBBLE WITH OCCASIONAL BOULDER. GRADES TO SILTY SANDY GRAVEL WITH COBBLES.			
GRAY, FINE TO COARSE SANDY, SILTY, GRAVEL.			
GRAY, COBBLY SANDY GRAVEL.	1.3	.05	9.0



| Design
Geologic Log
Well [
Depth Feet
180
190
200
210
220
230
240
250
260
270
280
290
300
310
320
330
340
350
360
16" Casing
K-packer (Neoprene)
Blank Riser Pipe
Shoe Drive
30.0' of 12" Johnson Stainless Steel Well Screen 30.0 Slot
30.0' of 12" Johnson Stainless Steel Well Screen 60.0 Slot
Blank Tail Pipe
Iron (mg/l)
Manganese (mg/l)
Specific Capacity (gpm/ft)
GRAY, COBBLY, SANDY GRAVEL.
15
GRAY, COARSE GRAVELLY FINE TO MEDIUM SAND
WITH MORE GRAVELS AND FEW COBBLES
.045
0.09
4.7
GRAY, SANDY, SILTY CLAY.
GRAY, SLIGHTLY SILTY, FINE TO MEDIUM SAND.
.21
.04
1.9
SLIGHTLY GRAVELLY TO GRAVELLY, FINE TO MEDIUM SAND.
.03
.03
1.0
GRAY, COBBLY, SANDY GRAVEL.
.25
.05
0.6
GRAY, SILTY FINE SAND (1.0 FOOT THICK)
.15
SLIGHTLY GRAVELLY.
SATURATED, GRAY, FINE TO MEDIUM SAND.
SAND AND GRAVEL.
BROWN, GRAY, PEATY, CLAY.
SLIGHTLY GRAVELLY, SILTY, SAND. GRADES TO GRAY, SLIGHTLY GRAVELLY FINE TO MEDIUM SAND. GRADES TO SAND/GRAVEL.
.05
.06
.2



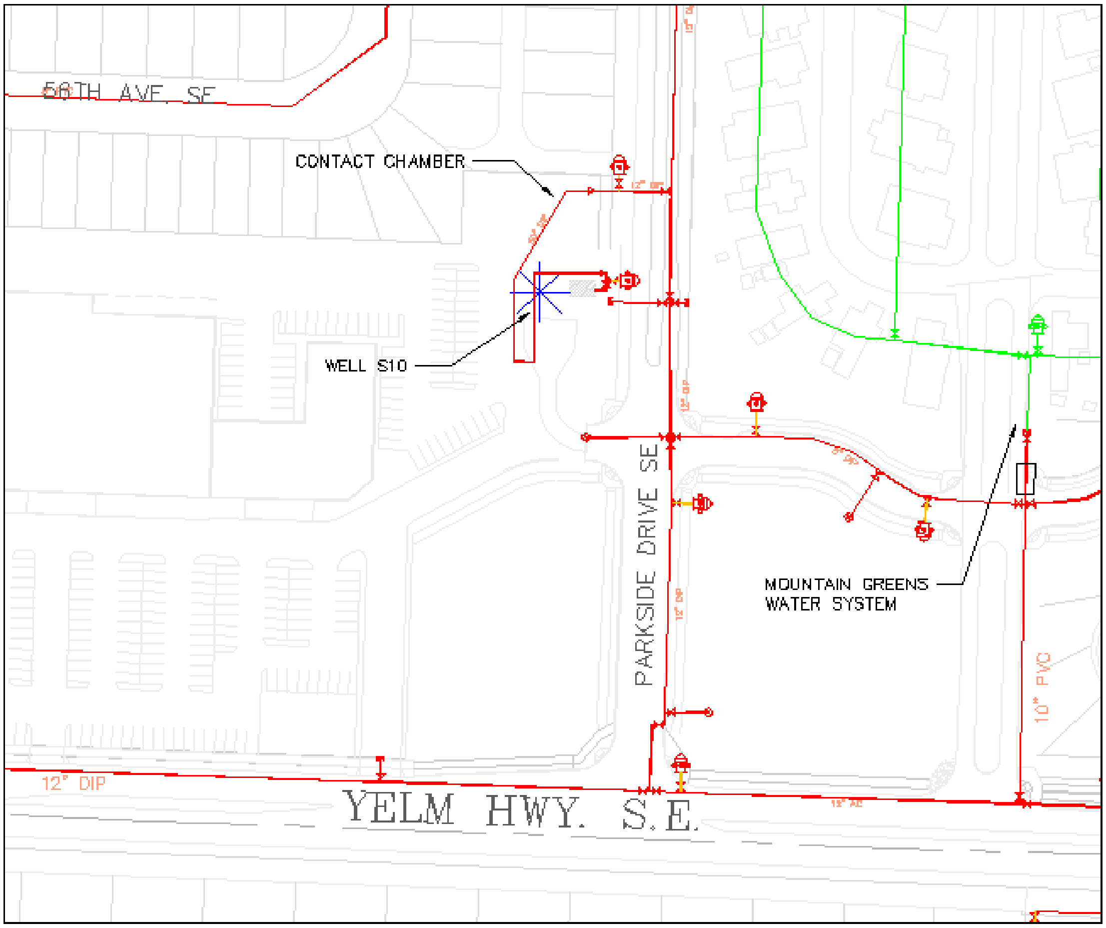
J-859-04 November 1981
HART-CROWSER & associates inc.
Figure 3

Well S10
(Mountain Greens)

Facility Information

Description	Comments
Source #	S10
Address	5138 Yelm Hwy SE
Year On-Line	1981
Pressure Zone	337
Floor Elevation	194.94
Housing	CMU
Pump Type	Turbine
Pump Model	Worthington 12HH 220, 7-stage
Pump Shaft Diameter (in)	1.6875
Column Diameter/Length	10" column, 140'
Pump Serial #	R1001346M
Pump Depth (ft)	155
Pump Capacity (gpm)	1400
Motor Model	US Electric 445TP WPI
Motor Serial #	R-6349-07-353
Motor Speed (rpm)	1770
Horsepower	200
Casing Diameter (in)	16
Well Depth (ft)	212
Casing Depth (ft)	170
Screen	16-inch: 80-slot (178-208 ft)
Screen Capacity (gpm)	2050
Aquifer	Qpg
Control Valves	6" 61G-21B 10" 692G-07ABCDS 3" 50A-01
PSV Setting	82psi @ 1100gpm
PRV Setting (psi)	74
Flow to Waste Setting	106psi @ 900gpm
Flow to Waste Duration (sec)	180
Well Capacity (gpm)	1600
Chlorine Dose (mg/L)	0.68
Reliable Capacity (gpm)	1000
Notes	Well 10 is typically high in the call order due to its location and water quality.

Well S10 (Mountain Greens)



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Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Application No. G2-25778
Permit No.

(1) OWNER: Name City of Lacey Address P.O. Drawer "B" Lacey, WA

(2) LOCATION OF WELL: County Thurston SE ¼ SW ¼ Sec. 33 T. 18 N., R. 1 W.M.
Bearing and distance from section or subdivision corner 480'N & 1700'E of SW Corner of Sec 33

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☒ Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) No. 10
New well ☐ Deepened ☐ Reconditioned ☐
Method: Dug ☐ Bored ☐ Cable ☒ Driven ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 16 inches.
Drilled 216 ft. Depth of completed well ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 16 " Diam. from 0 ft. to 178 ft.
Threaded ☐ " Diam. from ft. to ft.
Welded ☒ " Diam. from ft. to ft.

Perforations: Yes ☐ No ☒
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson
Type Telescoping Stainless Steel Model No.
Diam. 16 Slot size 80 from 178 ft. to 208 ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☒ Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes ☒ No ☐ To what depth? 20 ft.
Material used in seal concrete grout
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level 195 ft.
Static level 17 ft. below top of well Date 7/23/81
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? Hart-Crowser
Yield: 1400 gal./min. with 48 ft. drawdown after 6.6 hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
Transmissivity		estimated to be		48,600 gpd/ft.	

Date of test 7/23/81
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes ☒ No ☐

(10) WELL LOG:

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
Sand	6	10
Dirty Sand & Gravel	10	53
Blue Clay	53	72
Sand and Gravel with Cobbles	72	77
Silty Gravelly Sand	77	84
Sandy Gravel	89	91
Sandy Gravel with Silty Layers	91	124
Silty Sand and Gravel	124	140
Cemented Gravel	140	169
Dirty Sand and Gravel	169	180
Brown Sand and Gravel	180	211
Blue Clay	211	216

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NOV 5 1981
DEPARTMENT OF ECOLOGY
SOUTHWEST REGIONAL OFFICE

Work started 5-13, 1981. Completed 6/16, 1981

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Story and Dodge Drilling (Person, firm, or corporation) (Type or print)
Address Graham, Washington
[Signed] Edgar J. Story (Well Driller)
License No. 0492 Date 11/3/, 1981

OK (W) 12-17-81

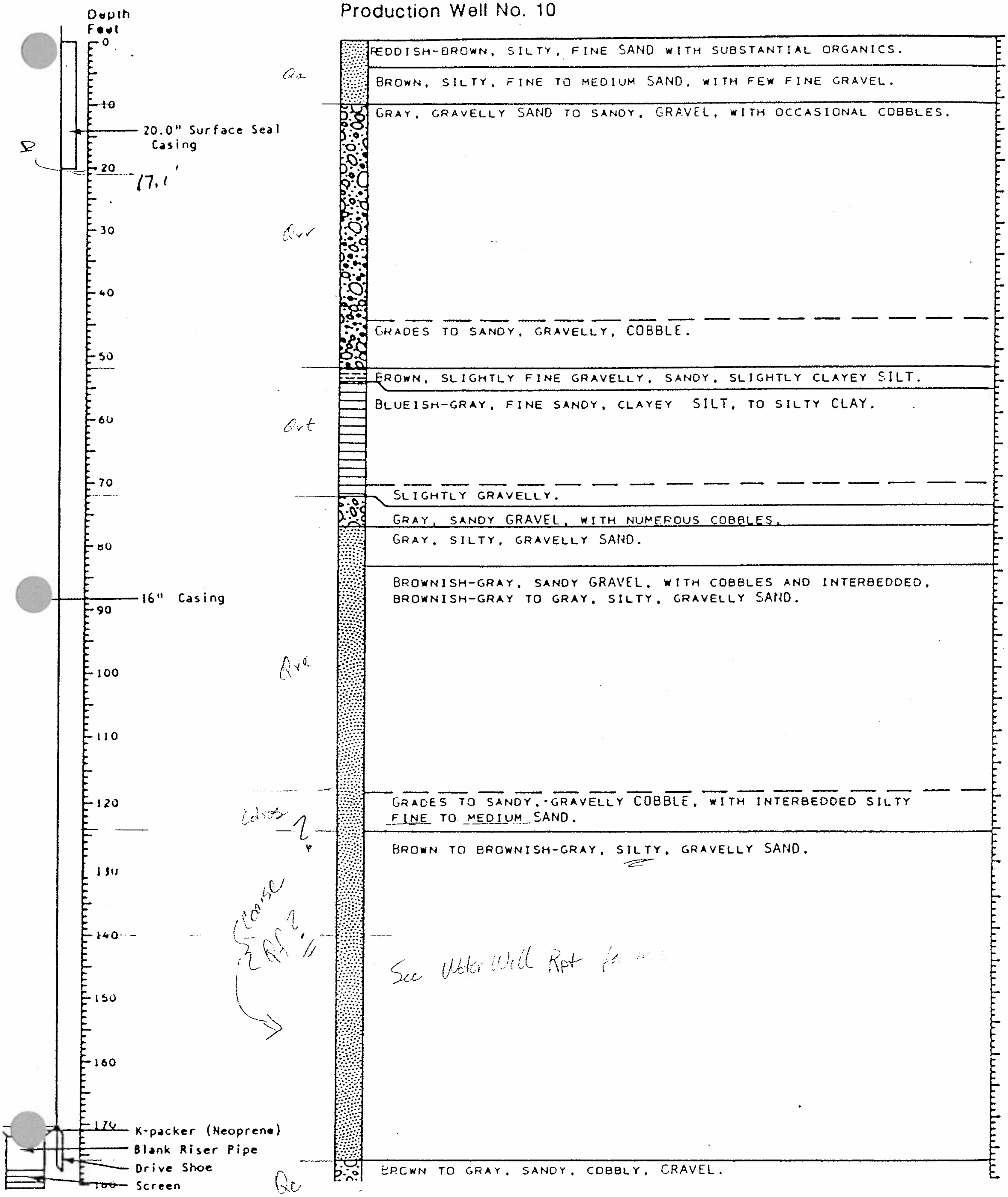
(USE ADDITIONAL SHEETS IF NECESSARY)

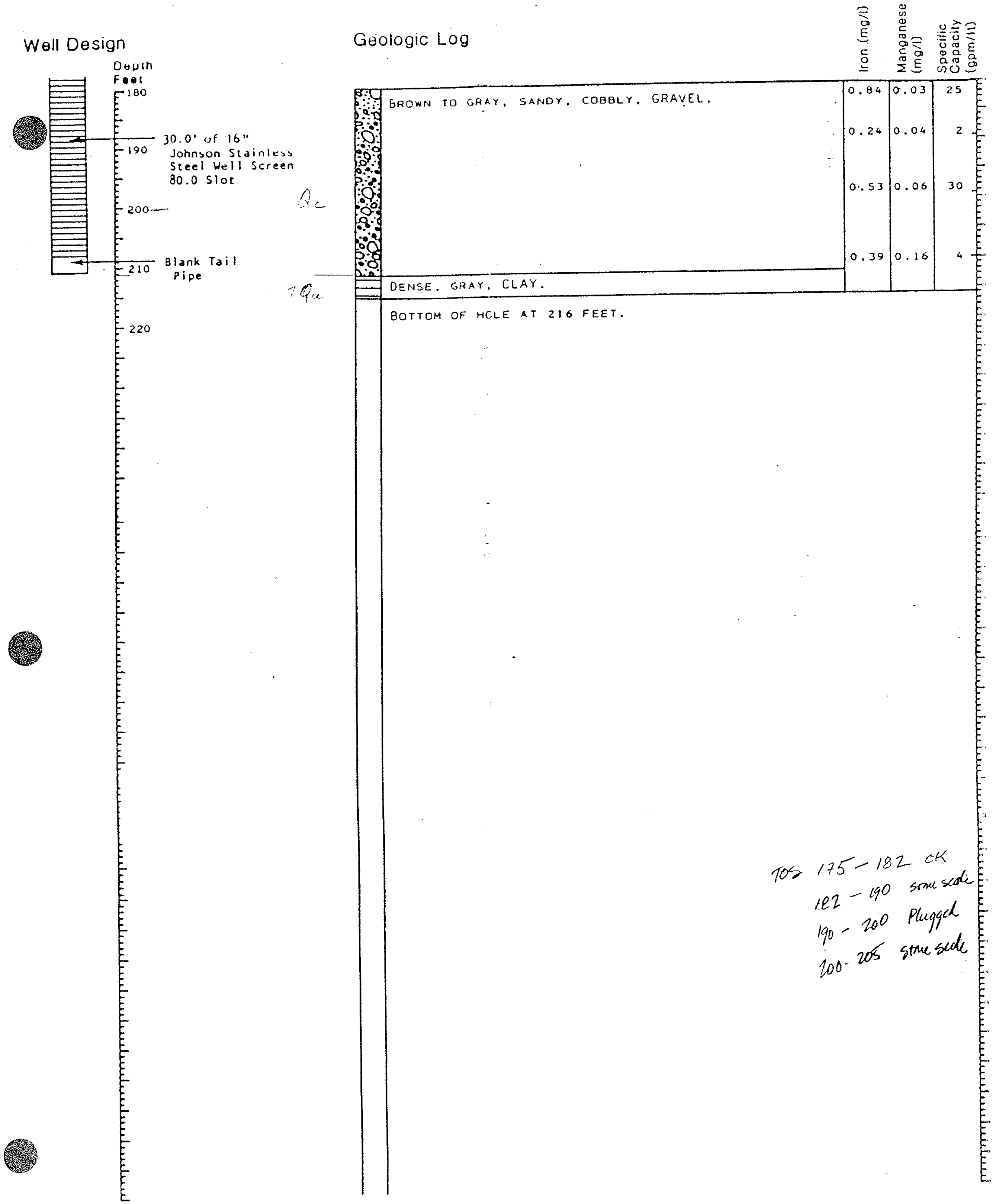
ECY 050-1-20

Vell Boring and Construction Information

ell Design

Geologic Log
Production Well No. 10





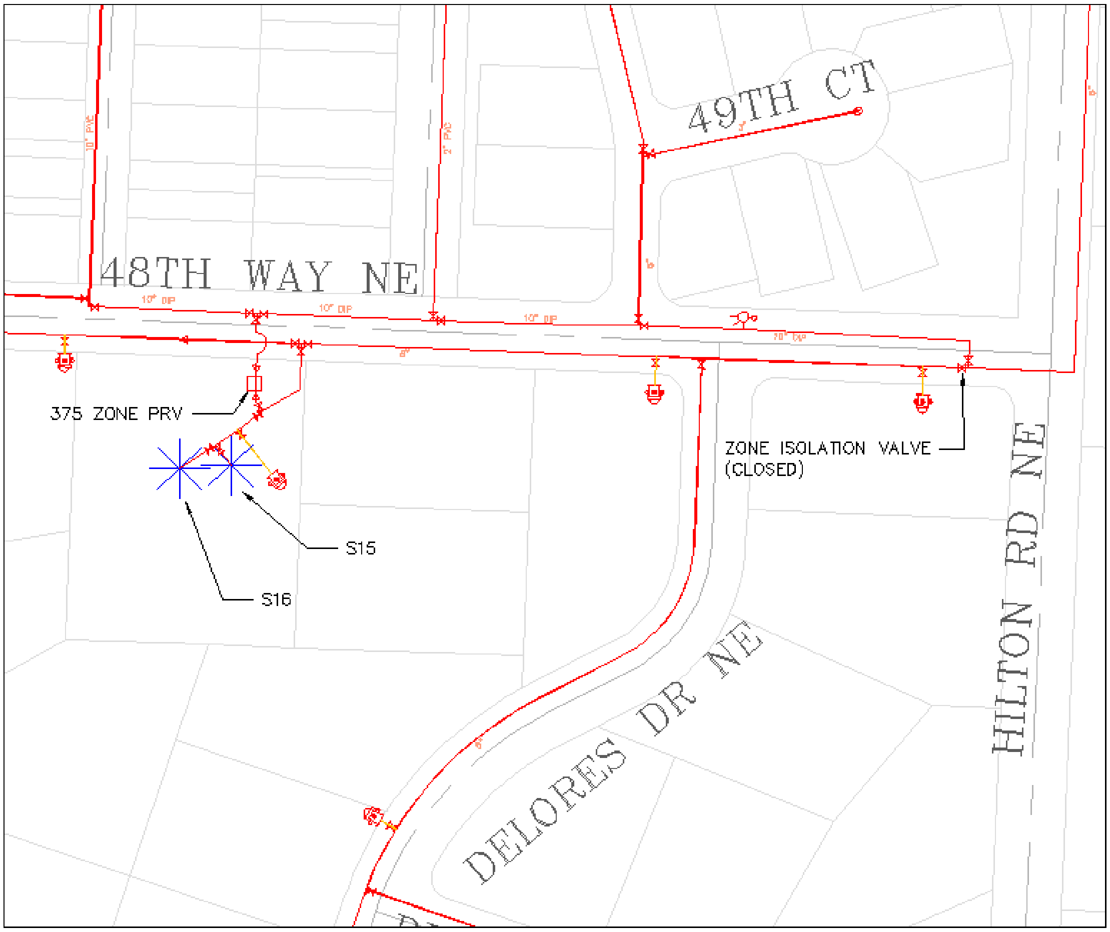
J-859-04 November 1981
HART-CROWSER & associates inc.
Figure 2

Well S15
(Beachcrest #1)

Facility Information

Description	Comments
Source #	S15
Address	8905 48th Way NE
Year On-Line	1976
Pressure Zone	400
Floor Elevation	230.21
Housing	Wood
Pump Type	Submersible
Pump Model	Peerless 6LB - 5 stage
Pump Shaft Diameter (in)	N/A
Column Diameter/Length	4" column, 120'
Pump Serial #	4605262
Pump Depth (ft)	117
Pump Capacity (gpm)	180
Motor Model	Franklin Electric
Motor Serial #	2366158120
Motor Speed (rpm)	3450
Horsepower	25
Casing Diameter (in)	12
Well Depth (ft)	140
Casing Depth (ft)	115
Screen	12-inch: 25-slot (115-140 ft)
Screen Capacity (gpm)	N/A
Aquifer	Qva
Control Valves	3" 61G-02
PSV Setting	88psi @ 185gpm
PRV Setting (psi)	None
Flow to Waste Setting	None
Flow to Waste Duration (sec)	0
Well Capacity (gpm)	220
Chlorine Dose (mg/L)	0.68 (S15 and S16 combined)
Reliable Capacity (gpm)	180
Notes	Seasonal low aquifer levels.

Well S15 (Beachcrest #1)



(e Original and First Copy with Department of Ecology; Second Copy — Owner's Copy; Third Copy — Driller's Copy)

WATER WELL REPORT
STATE OF WASHINGTON

Application No. ....
Permit No. ....

(1) OWNER: Name Hilton Sjoborn Address 336 PO Box

(2) LOCATION OF WELL: County ____ ¼ ____ ¼ Sec. 25 T. 19 N., R. 1 W.M.

Bearing and distance from section or subdivision corner

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☒ Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) #1

New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 12 inches.
Drilled 140 ft. Depth of completed well 140' 10" ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 12 " Diam. from 0 ft. to 115'6" ft.
Threaded ☐ ____ " Diam. from ____ ft. to ____ ft.
Welded ☒ ____ " Diam. from ____ ft. to ____ ft.

Perforations: Yes ☐ No ☒
Type of perforator used ____
SIZE of perforations ____ in. by ____ in.
____ perforations from ____ ft. to ____ ft.
____ perforations from ____ ft. to ____ ft.
____ perforations from ____ ft. to ____ ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson
Type Stainless Model No. ____
Diam. 12 Slot size 25 from 115'6" ft. to 140'10" ft.
Diam. ____ Slot size ____ from ____ ft. to ____ ft.

Gravel packed: Yes ☐ No ☒ Size of gravel: ____
Gravel placed from ____ ft. to ____ ft.

Surface seal: Yes ☒ No ☐ To what depth? 18 ft.
Material used in seal Cement Grout
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? ____ Depth of strata ____
Method of sealing strata off ____

(7) PUMP: Manufacturer's Name ____
Type: ____ H.P. ____

(8) WATER LEVELS: Land-surface elevation above mean sea level.... ____ ft.
Static level 77 ft. below top of well Date 6-28-76
Artesian pressure ____ lbs. per square inch Date ____
Artesian water is controlled by ____ (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? Kincy
Yield: gal./min. with ft. drawdown after hrs.
250 " 112 " 4 "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
		None			

Date of test ____
Bailer test ____ gal./min. with ____ ft. drawdown after ____ hrs.
Artesian flow ____ g.p.m. Date ____
Temperature of water ____ Was a chemical analysis made? Yes ☒ No ☐

(10) WELL LOG: Beachcrest #1 ?

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
Brown Clay, Sand, Gravel	0	6
Brown Hard Pan	6	48
Brown Sand, Clay and Gravel	48	63
Brown Hard Pan	63	83
Brown Med Sand to 3" Gravel	83	94
Brown Fine Sand to 3" Gravel	94	97
Brown Med Sand to 3" Gravel	97	100
Brown Gravel and Sand	100	104
Red Med. Sand to 3" Gravel	104	126
Brown Med Sand and Gravel	126	139
Brown Hard Clay	139	

Qva
Qvt
Qva
Qvt

Work started ____ 19__ Completed ____ 19__

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Kincy Hardware (Person, firm, or corporation) (Type or print)

Address 512 East 4th Ave

[Signed] Ken Walton (Well Driller)

License No. C-65 Date 6-28 1976

(USE ADDITIONAL SHEETS IF NECESSARY)

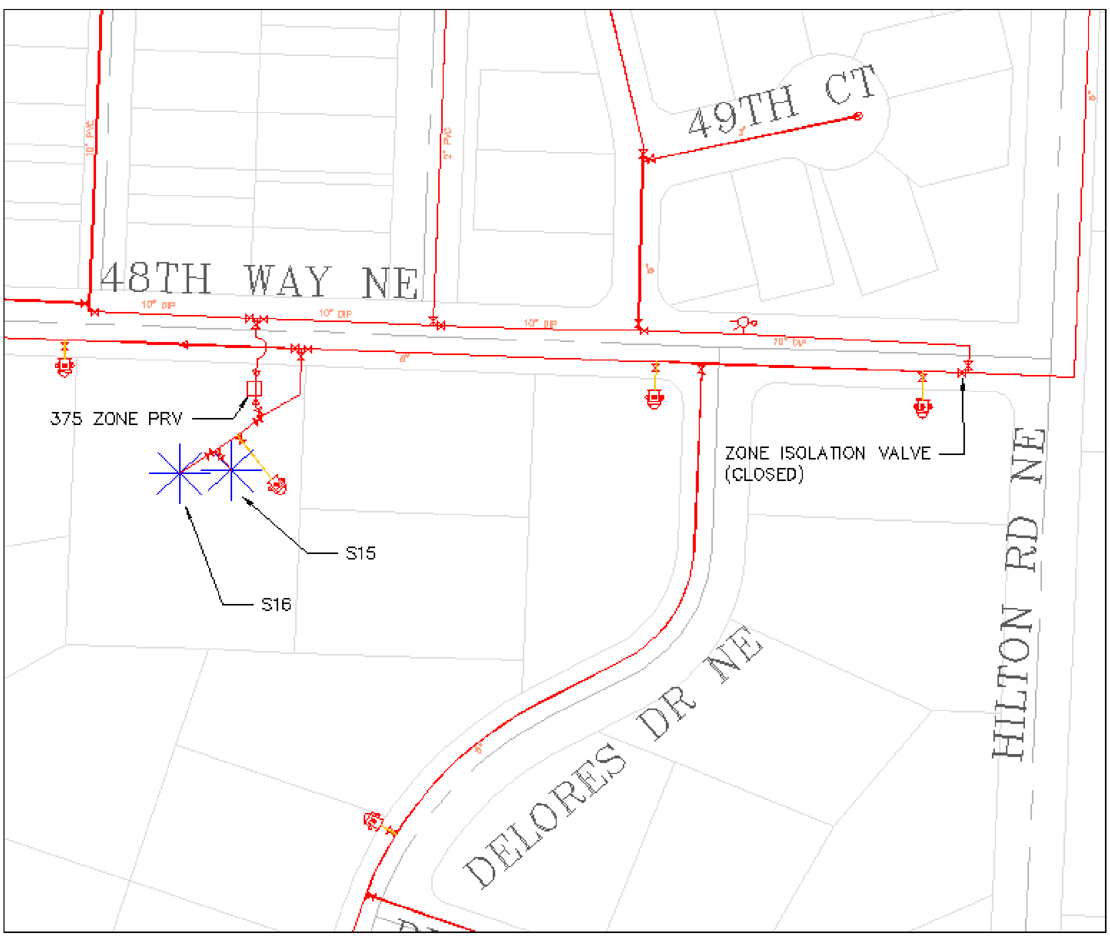
ECY 050-1-20 (Rev. 4-71)

Well S16
(Beachcrest #2)

Facility Information

Description	Comments
Source #	S16
Address	8905 48th Way NE
Year On-Line	1979
Pressure Zone	400
Floor Elevation	232.82
Housing	Wood
Pump Type	Submersible
Pump Model	Peerless 6HXB - 6 stage
Pump Shaft Diameter (in)	N/A
Column Diameter/Length	6" column, 109'
Pump Serial #	N/A
Pump Depth (ft)	112
Pump Capacity (gpm)	230
Motor Model	N/A
Motor Serial #	N/A
Motor Speed (rpm)	3450
Horsepower	30
Casing Diameter (in)	10
Well Depth (ft)	138
Casing Depth (ft)	113
Screen	10-inch: 40-slot (113-118, 133-138 ft), 50-slot (118-123 ft), 60-slot (123-133 ft)
Screen Capacity (gpm)	N/A
Aquifer	Qva
Control Valves	4" 65001BDS
PSV Setting	94psi @ 180gpm
PRV Setting (psi)	None
Flow to Waste Setting	None
Flow to Waste Duration (sec)	0
Well Capacity (gpm)	225
Chlorine Dose (mg/L)	0.68 (S15 and S16 combined)
Reliable Capacity (gpm)	170
Notes	Seasonal low aquifer levels.

Well S16 (Beachcrest #2)



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Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No. G2-24547
Permit No. G2-24547-P

(1) OWNER: Name M & R Cons. & Utilities Address P.O. Box 3772 Lacey, Wa. 98503

(2) LOCATION OF WELL: County Thurston — SE ¼ SW ¼ Sec. 25 T. 19 N., R. 1W W.M.

Bearing and distance from section or subdivision corner 650' W & 1120' N. from the S¼ corner of Sec. 25

(3) PROPOSED USE: Domestic ☒ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☐ Other ☐
Community

(4) TYPE OF WORK: Owner's number of well (if more than one) 2
New well ☒ Deepened ☐ Reconditioned ☐
Method: Dug ☐ Bored ☐ Cable ☒ Driven ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 10 inches.
Drilled 141 ft. Depth of completed well 138 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 10" Diam. from 0 ft. to 113 ft.
Threaded ☐ " Diam. from ft. to ft.
Welded ☒ " Diam. from ft. to ft.

Perforations: Yes ☐ No ☒
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson Well
Type Stainless steel Model No.

Diam.	Slot size	from	to
10	40	113	118 ft.
10	50	118	123 ft.
10	60	123	133
10	40	133	138

Gravel packed: Yes ☐ No ☒ Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes ☒ No ☐ To what depth? 20 ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name Jacuzzi Bros.
Type: 20-ms-8a6 H.P. 20

(8) WATER LEVELS: Land-surface elevation above mean sea level ft.
Static level 84 ft. below top of well Date 4-23-79
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? Driller
Yield: 275 gal./min. with 31 ft. drawdown after 4 hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test 4-23-79
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes ☒ No ☐

(10) WELL LOG:

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Loose sand & gravel	0	5
Loose sand & gravel	5	9
Cemented sand & gravel	9	20
Cemented sand & gravel	20	40
Cemented sand & gravel	40	56
Dirty sand & gravel alittle seepage	56	61
Cemented sand & gravel	61	65
Hardpan	65	71
Cemented sand & gravel	71	73
Hardpan	73	80
Hardpan	80	96
Dirty sand & gravel some seepage	96	100
Dirty wet sand & gravel	100	107
Sand & gravel	107	124
Sand & gravel	124	141
Dark brown clay	141	

RECEIVED
AUG 23 1979
DEPARTMENT OF ECOLOGY
SOUTHWEST REGIONAL OFFICE

Work started 3-30, 19 79. Completed 4-23, 19 79

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Richardson Well Drilling Co. (Person, firm, or corporation) (Type or print)

Address P.O. Box 44408 Tacoma, Wa. 98444

[Signed] (Well Driller)

License No. 223-02-6500 Date 8-21, 19 79

(USE ADDITIONAL SHEETS IF NECESSARY)

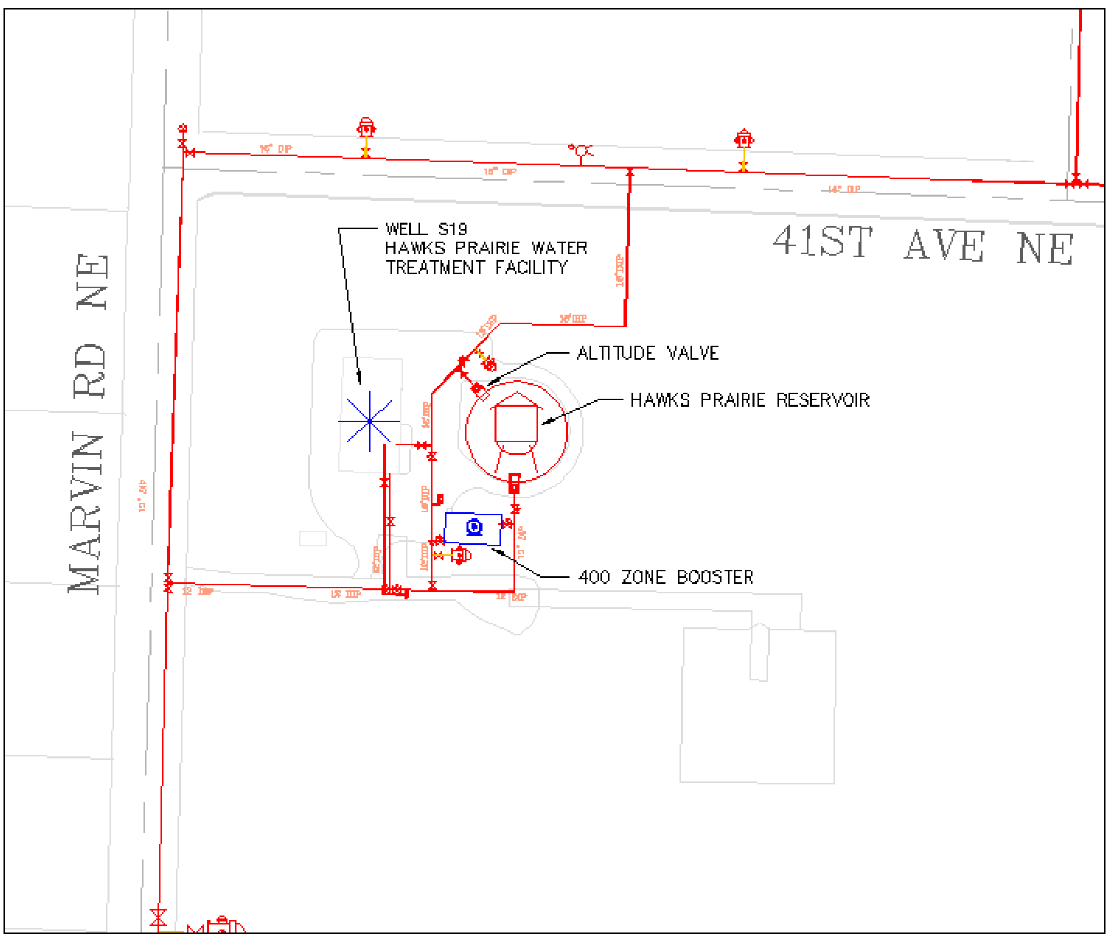
Well S19

(Hawks Prairie #1)

Facility Information

Description	Comments
Source #	S19
Address	4040 Marvin Rd. NE
Year On-Line	1994
Pressure Zone	400
Floor Elevation	299.50
Housing	CMU
Pump Type	Turbine
Pump Model	Byron Jackson 11MQL125 - 12 stage
Pump Shaft Diameter (in)	N/A
Column Diameter/Length	8" column, 528'
Pump Serial #	94W-S-002600
Pump Depth (ft)	528
Pump Capacity (gpm)	800
Motor Model	US Electric GB4787
Motor Serial #	GB478Z
Motor Speed (rpm)	1770
Horsepower	150
Casing Diameter (in)	12
Well Depth (ft)	646
Casing Depth (ft)	580
Screen	12-inch: 10-slot (585-592 ft), 12-slot (603-608 ft), 70-slot (623-632 ft), 30-slot (632-643 ft)
Screen Capacity (gpm)	970
Aquifer	TQu
Control Valves	4" 61G-21 8" 92G-01BCDS
PSV Setting	45psi @ 690gpm
PRV Setting (psi)	N/A
Flow to Waste Setting	125psi @ 300 gpm
Flow to Waste Duration (sec)	400
Well Capacity (gpm)	800
Chlorine Dose (mg/L)	N/A
Reliable Capacity (gpm)	750
Notes	Poor water quality, elevated iron, manganese, ammonia, and sulfides. Flows directly to the Hawks Prairie Water Treatment Facility. Produces sand at flow rates above 750 gpm.

Well S19 (Hawks Prairie #1)



The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

File Original and First Copy with Department of Ecology
Second Copy—Owner's Copy
Third Copy—Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. ~~[illegible]~~ 014203

Water Right Permit No. ______

(1) OWNER: Name City of Lacey Address ______

(2) LOCATION OF WELL: County Thurston NW ¼ SW ¼ Sec 35 T. 19 N., R. 1W W.M.

(2a) STREET ADDDRESS OF WELL (or nearest address) Hawks Prairie Well

(3) PROPOSED USE: ☐ Domestic ☐ Irrigation ☐ DeWater Industrial ☐ Test Well ☐ Municipal ☒ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) ______
Abandoned ☐ New well ☒ Deepened ☐ Reconditioned ☐ Method: Dug ☐ Cable ☒ Rotary ☐ Bored ☐ Driven ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 16 x 12 inches.
Drilled 667 feet. Depth of completed well 646 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 16" Diam. from 0 ft. to 406 ft.
Welded ☒ 12" Diam. from +2 ft. to 585 ft.
Liner installed ☐
Threaded ☐ ______" Diam. from ______ ft. to ______ ft.

Perforations: Yes ☐ No ☒
Type of perforator used ______
SIZE of perforations ______ in. by ______ in.
______ perforations from ______ ft. to ______ ft.
______ perforations from ______ ft. to ______ ft.
______ perforations from ______ ft. to ______ ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson
Type 10" 10 588 Model No. 592
Diam. ______ Slot size 12 from 603 ft. to 608 ft.
Diam. ______ Slot size 70 from 623 ft. to 633 ft.
Gravel packed: Yes ☐ No ☒ Size of gravel 50 633 643
Gravel placed from ______ ft. to ______ ft.

Surface seal: Yes ☒ No ☐ To what depth? 20 ft.
Material used in seal Cement
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? ______ Depth of strata ______
Method of sealing strata off ______

(7) PUMP: Manufacturer's Name ______
Type: ______ H.P. ______

(8) WATER LEVELS: Land-surface elevation above mean sea level ______ ft.
Static level 261 ft. below top of well Date ______
Artesian pressure ______ lbs. per square inch Date ______
Artesian water is controlled by ______ (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? Driller
Yield: 860 gal./min. with 145 ft. drawdown after 24 hrs.
" " " "
" " " "
Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)
Time Water Level Time Water Level Time Water Level

Date of test ______
Bailer test ______ gal./min. with ______ ft. drawdown after ______ hrs.
Airtest ______ gal./min. with stem set at ______ ft. for ______ hrs.
Artesian flow ______ g.p.m. Date ______
Temperature of water ______ Was a chemical analysis made? Yes ☒ No ☐

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
Brown sandy loam	0	3
Gray + brown silty sand + gravel	3	51
Dry loose sand + gravel	51	153
Sand + gravel making some water	153	202
Gray silt some gravel + peat	202	247
Gray silt	247	300
Fine sand + gravel silt binder water	300	313
Gray silt layered sand + gravel	313	333
Sand + gravel some silt water	333	355
Silt bound sand + gravel	355	359
Brown sand silt seams	359	401
Gray green brown silt	401	455
Silty sand some gravels heaving	455	477
tight silty sand	477	482
Gray-green silt	482	488
Black sand some gravels	488	525
Gray green silt sand layers	525	560
Gray sand some gravels	560	575
clean sand some gravels	575	610
tight sand layers silt	610	619
Sand + gravels	619	646
Clay fine sand some gravels	646	651
Silt bound sand + gravel	651	667

RECEIVED FEB -9 PM 3:33

Work started 9-21-88 19__. Completed 12-13-88 19__.

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME Holt Drilling Inc (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address 10621 Todd Rd E
(Signed) Rudy Holt (WELL DRILLER) License No. 1099
Contractor's Registration No. HO-LT*13606 Date 1-30, 1989

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20 (10/87) -1329-

TOP CASING -
Well Casing 294.8
1.6

Boring Log and Construction Data for Hawks Prairie Test/Production Well

Geologic Log

Depth in Feet

Ground Surface Elevation in Feet 294.8

Sample

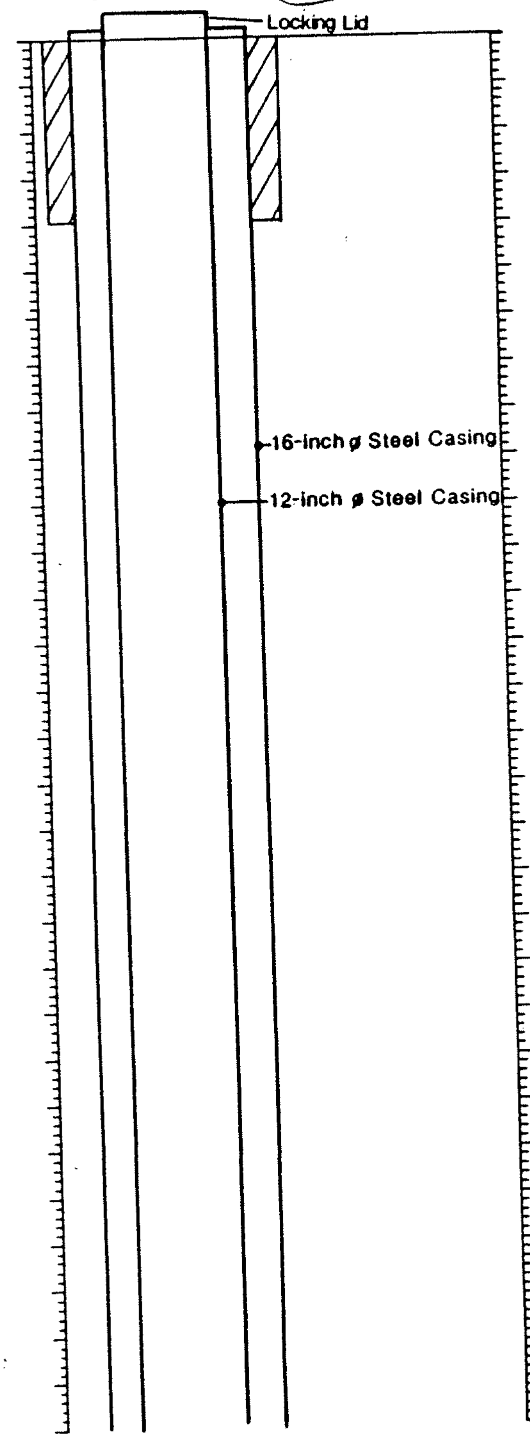
Depth in Feet	Description
0	Organic-rich, very sandy SILT.
1.5–35	Brown, slightly gravelly, sandy SILT.
35–150	Gray-brown, gravelly SAND with cobbles and thin silt interbeds.

Depth scale: 0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150

Well Design

Top Casing Elevation in Feet ~~328 ft~~ 296.4

Casing Stickup in Feet 1.7 ft



Boring Log and Construction Data for Hawks Prairie Test/Production Well

Geologic Log

Depth in Feet

Ground Surface Elevation in Feet

Sample

Well Design

Top Casing Elevation in Feet
Casing Stickup in Feet

150

Saturated, gray-brown, gravelly SAND with thin silt interbeds.

160
170
180

16-inch ø Steel Casing

12-inch ø Steel Casing

190 Iron stains

200

Layered gray/lavender/green SILT with abundant peat fragments.

210
220
230
240
250
260

12/15/88

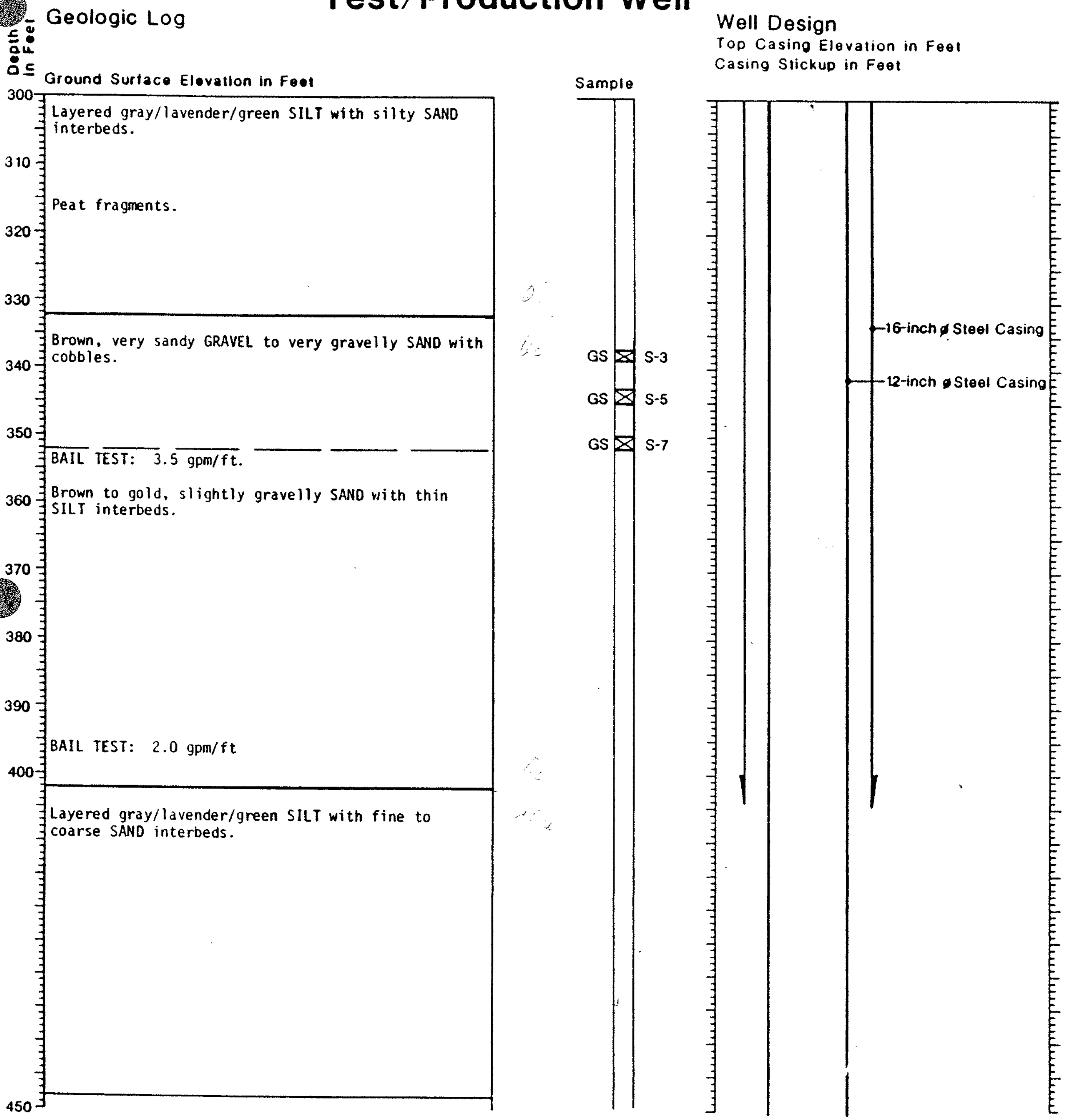
270

Peat layered gray/lavender/green SILT with silty SAND interbeds.

280
290
300

J-2111 October 1988
HART-CROWSER & associates inc.
Sheet 2 of 5 Figure A-2

Boring Log and Construction Data for Hawks Prairie Test/Production Well

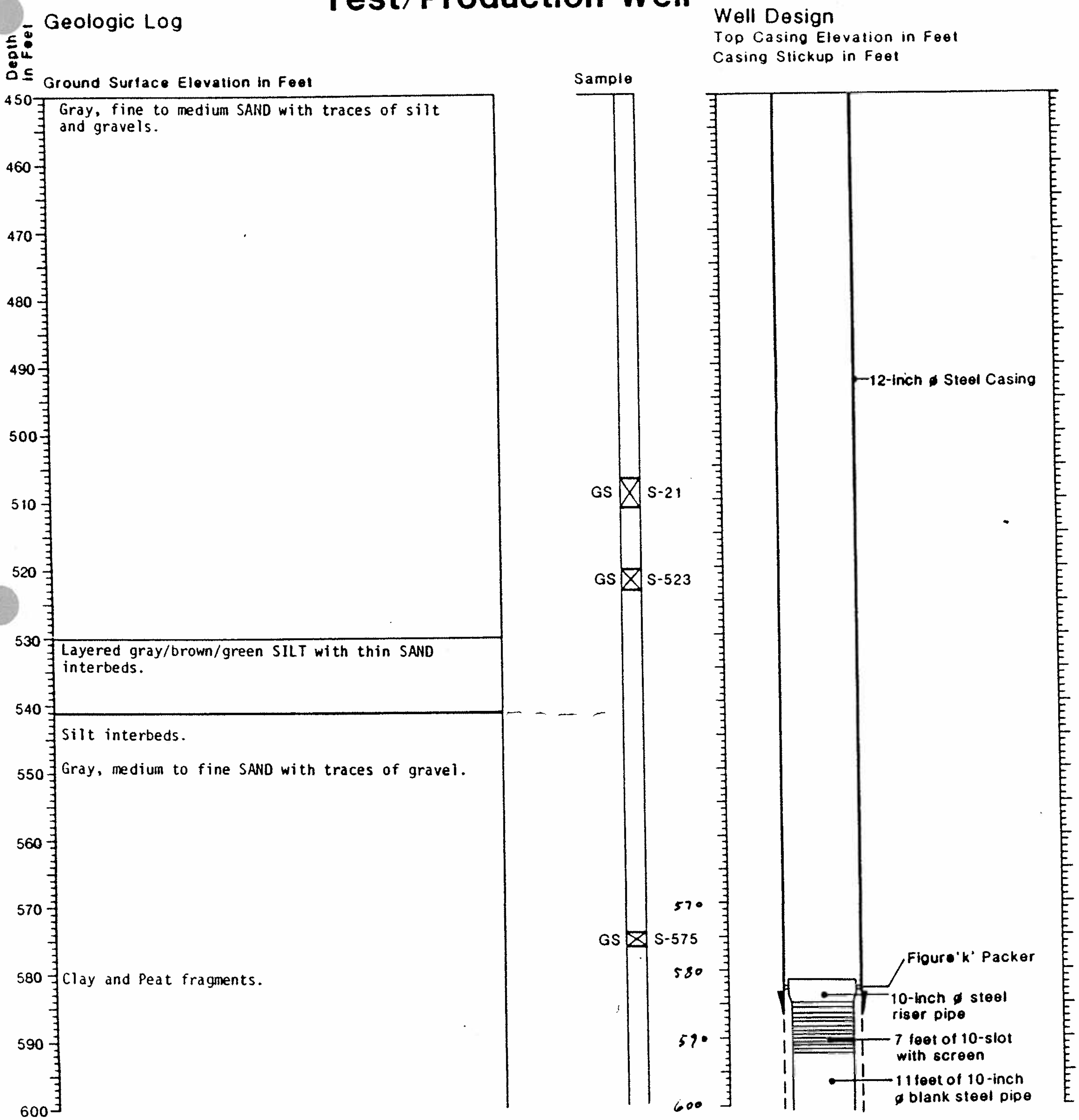


J-2111 October 1988

HART-CROWSER & associates inc.

Sheet 3 of 5 Figure A-2

Boring Log and Construction Data for Hawks Prairie Test/Production Well



J-2111 October 1988
HART-CROWSER & associates inc.
Sheet 4 of 5 Figure A-2

Boring Log and Construction Data for Hawks Prairie Test/Production Well

Geologic Log

Depth in Feet

Ground Surface Elevation in Feet

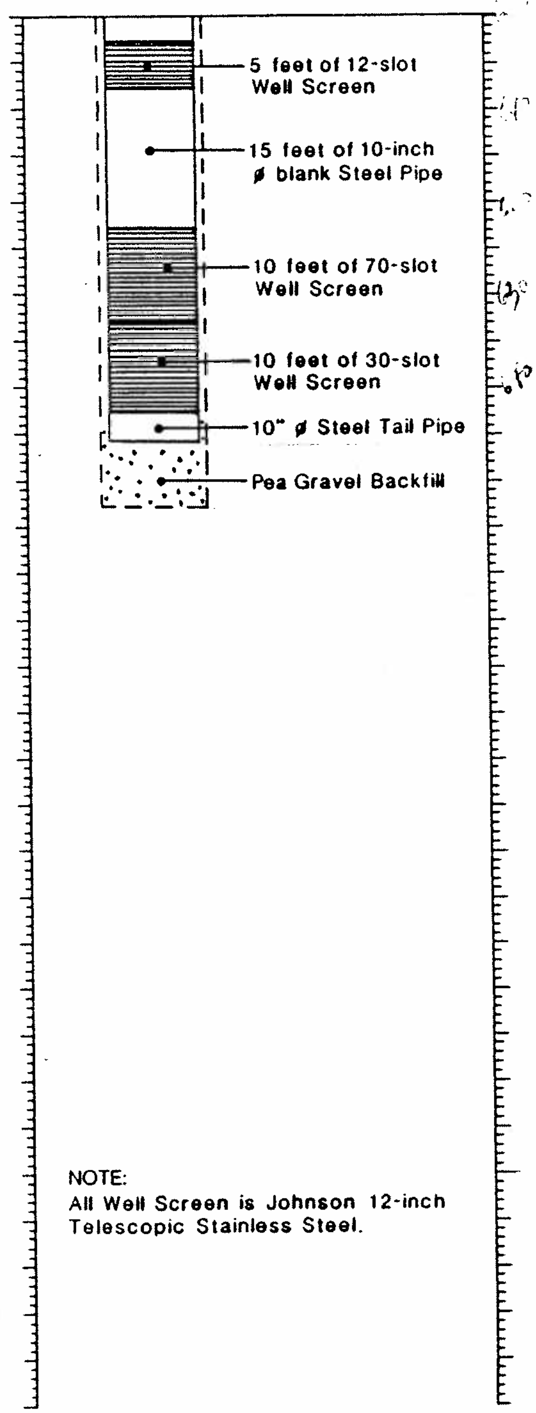
Depth (ft)	Description	Sample
600	Gray, medium to fine SAND with traces of gravel.	GS S-26
610	Gray, medium to fine SAND with SILT interbeds.	
620	BAIL TEST: 2 gpm/ft	GS S-621; GS S-40
	Peat.	GS S-42
630	Gray, very gravelly SAND.	GS S-44
640	Silt interbed.	GS S-45
	Gray CLAY interbedded with fine SAND.	
650	Bottom of Boring at 653.0 Feet. Completed 10/27/88.	

Depth scale: 600, 610, 620, 630, 640, 650, 660, 700, 750

Well Design

Top Casing Elevation in Feet

Casing Stickup in Feet



NOTES: 1. Soil descriptions are often based on samples collected by the driller and our interpretation of the driller's log. Changes in material type are interpretive and actual changes may be gradual.
2. Water Level ∇ is for date indicated and may vary with time of year.
3. B.T. indicates Bail Test.
4. GS indicates a laboratory mechanical grain size analysis was performed on sample.

J-2111 October 1988

HART-CROWSER & associates inc.

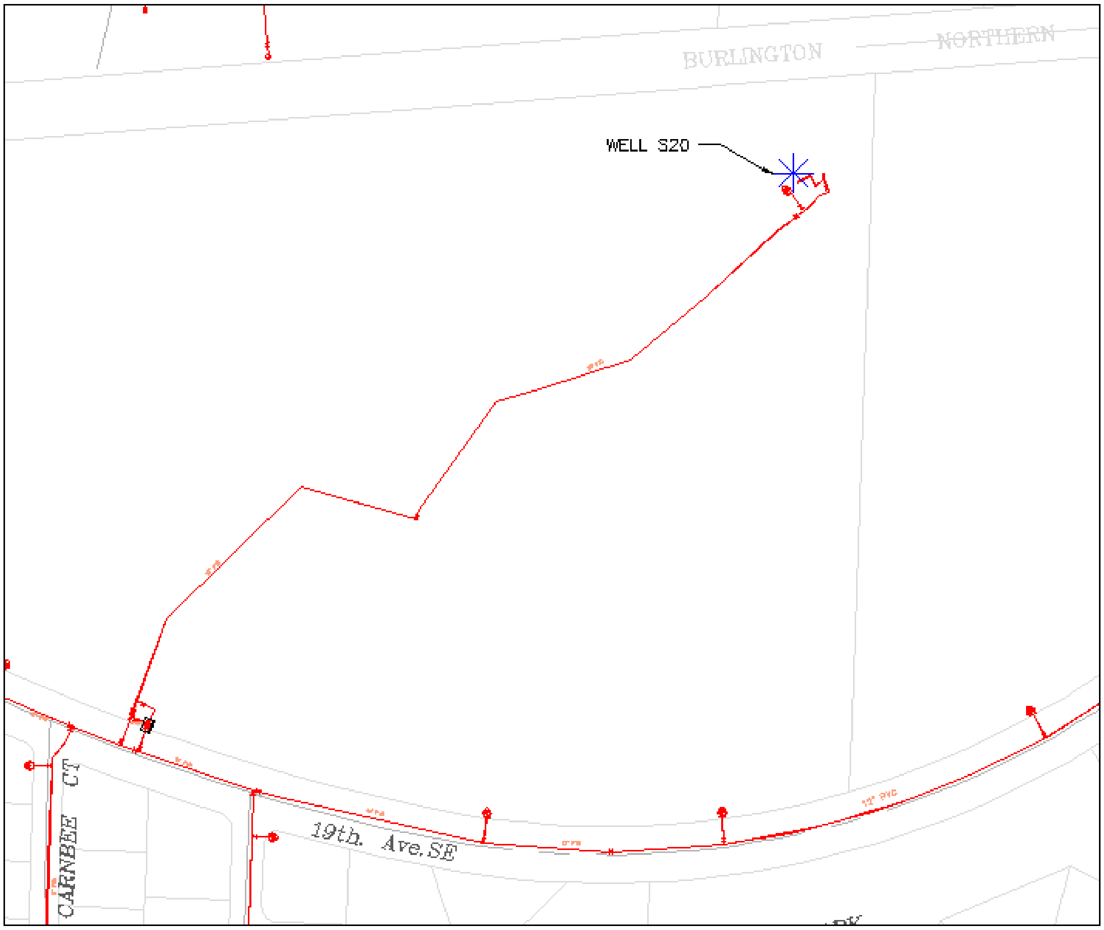
Sheet 5 of 5 Figure A-2

Well S20
(McAllister Park)

Facility Information

Description	Comments
Source #	S20
Address	8500 19th Ave. SE
Year On-Line	1995
Pressure Zone	400
Floor Elevation	175.98
Housing	CMU
Pump Type	Submersible
Pump Model	Pleuger 10EM - 3 stage, 7.64 in
Pump Shaft Diameter (in)	N/A
Column Diameter/Length	8" column, 165'
Pump Serial #	N/A
Pump Depth (ft)	165
Pump Capacity (gpm)	960
Motor Model	Pleuger 10
Motor Serial #	N/A
Motor Speed (rpm)	3450
Horsepower	150
Casing Diameter (in)	16
Well Depth (ft)	214
Casing Depth (ft)	180
Screen	14-inch: 150-slot (180-185 ft), 80-slot (193-198 ft), 100-slot (198-208 ft)
Screen Capacity (gpm)	1300
Aquifer	Qpg
Control Valves	4" 61G-21 10" 692G-01BD 2-1/2" 50G-01
PSV Setting	165psi @ 680gpm
PRV Setting (psi)	110
Flow to Waste Setting	180psi @ 530gpm
Flow to Waste Duration (sec)	180
Well Capacity (gpm)	580
Chlorine Dose (mg/L)	0.54
Reliable Capacity (gpm)	580
Notes	Seasonal low aquifer levels, not enough available draw-down to operate at full capacity. Casing is out of alignment/plumb, which is hard on line shaft pumps.

Well S20 (McAllister Park)



The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. W 16276
UNIQUE WELL I.D. #
Water Right Permit No. G2-29165

(1) OWNER: Name City of Lacey Address P.O Box "B" Lacey, WA 98503-0987

(2) LOCATION OF WELL: County Thurston - NE 1/4 SW 1/4 Sec 24 T. 18 N., R 1W W.M.

(2a) STREET ADDRESS OF WELL (or nearest address) ~2,600 ft east of Marvin Rd and ~1,500 ft South of Pacific Hwy SE

(3) PROPOSED USE: ☐ Domestic ☐ Irrigation ☐ DeWater Industrial ☐ Test Well ☐ Municipal ☑ Other ☐

(4) TYPE OF WORK: Owner's number of well (If more than one) WELL B
Abandoned ☐ New well ☑ Deepened ☐ Reconditioned ☐
Method: Dug ☐ Cable ☑ Rotary ☐ Bored ☐ Driven ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 16 inches.
Drilled 239 feet. Depth of completed well 213.5 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 16" Diam. from +2 ft. to 179.5 ft.
Welded ☐ Liner installed ☐ Threaded ☐ — " Diam. from — ft. to — ft.
— " Diam. from — ft. to — ft.

Perforations: Yes ☐ No ☑
Type of perforator used
SIZE of perforations — in. by — in.
— perforations from — ft. to — ft.
— perforations from — ft. to — ft.
— perforations from — ft. to — ft.

Screens: Yes ☑ No ☐
Manufacturer's Name
Type 14-inch pipe size stainless steel Model No.
Diam. 14 Slot size 150 from 180 ft. to 185 ft.
Diam. 14 / 14 Slot size 80 / 100 from 193 / 198 ft. to 198 / 208 ft.

Gravel packed: Yes ☐ No ☐ Size of gravel
Gravel placed from — ft. to — ft.

Surface seal: Yes ☑ No ☐ To what depth? 87 ft.
Material used in seal Quik Grout
Did any strata contain unusable water? Yes ☐ No ☑
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level 175 ft msl (approx) ft.
Static level 135.5 ft. below ~~top of well~~ 4.5 Date 3/1/95
Artesian pressure — lbs. per square inch Date
Artesian water is controlled by — (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☑ No ☐ If yes, by whom? PGG / Holt
Yield: 908 gal./min. with 27.4 ft. drawdown after 31.5 hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Transmissivity = 93,500 gpd/ft
Storage coeff = 0.00026

Date of test
Bailer test — gal./min. with — ft. drawdown after — hrs.
Airtest — gal./min. with stem set at — ft. for — hrs.
Artesian flow — g.p.m. Date
Temperature of water — Was a chemical analysis made? Yes ☑ No ☐

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
silt-bound SAND: GRAVEL; thin	0	25
zones of water start @ 12 ft		
Gray, silty SAND; some gravel	25	28
Gray SAND: GRAVEL; water bearing	28	41
Gray-green, sandy SILT - silty SAND; dry 41-54 ft, some water 54-58	41	58
Gray-green, silty SAND: GRAVEL, water	58	66
Gray-green, sandy SILT	66	71
Gray-green, silty SAND: GRAVEL; some water	71	81
Gray-brown, sandy SILT; some gravel	81	91
Gray-brown to brown, sandy SILT + GRAVEL	91	111
Dark brown, SAND - SILT; minor gravel	111	124
Brown silty SAND: GRAVEL	124	148
Light brown, silty SAND; minor gravel; small amount of water	148	157
Brown, silty SAND: GRAVEL; tight fm, some water	157	172
Brown, silt bound SAND: GRAVEL	172	180
Brown to gray, clean, sandy GRAVEL; water	180	185
Gray, m-c SAND; some silt-bnd zones; water	185	192
Brown to gray, sandy GRAVEL; some silt-bnd zones; water	192 / 202	202 / 207
Gray, gravelly, m-c SAND; water	207	209
Brown to gray, silty, m-c SAND; water	209	217
Brown to gray, very silty, fine SAND; water	217	233
Brown-gray, sandy SILT	233	239

(Log Prepared by Pacific Groundwater Group)

Work Started — , 19. Completed 3/2 , 1995

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME Holt Drilling Inc. (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address 10621 Todd Rd. E. Puyallup
(Signed) Tony Fichtel (WELL DRILLER) License No. 1094
Contractor's Registration No. HOLTTI087OJ Date 4-2, 1995

(USE ADDITIONAL SHEETS IF NECESSARY)

Ecology is an Equal Opportunity and Affirmative Action employer. For special accommodation needs, contact the Water Resources Program at (206) 407-6600. The TDD number is (206) 407-6006.

ECY 050-1-20 (9/93)

Geologic Log and Well Construction Details

McAllister Park (Well 20)

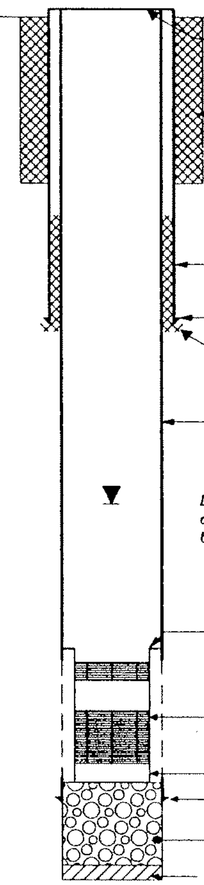
Ground Surface Elevation: approx. 175 ft msl

GEOLOGIC LOG	Geologic Unit
Soil	
Gray, silt-bound SAND and GRAVEL; thin zones of water start at 12 feet	Qvt
Gray, silty SAND with some gravel	
Gray SAND and GRAVEL; water bearing	
Gray-green sandy SILT and silty SAND; dry from 41 to 54 feet and some water 54 to 58 feet	Qva
Gray-green, silty SAND and GRAVEL; water	
Gray-green, sandy SILT	
Gray-green, silty SAND and GRAVEL; some water	
Gray-brown, sandy SILT; some GRAVEL	
Gray-brown to brown, sandy SILT and GRAVEL	Qk
Dark brown SAND and SILT; minor gravel	
Brown, silty SAND and GRAVEL	
Light brown, silty SAND; minor GRAVEL; seepage	
Brown, silty SAND and GRAVEL; tight formation; some water	
Brown, silt-bound SAND and GRAVEL	
Brown to gray, clean, sandy GRAVEL; water	Qc
Gray, medium to coarse SAND; some silt-bound zones; water	
Brown to gray, sandy GRAVEL; some silt-bound zones; water	
Brown to gray, sandy GRAVEL; water	
Gray, gravelly, medium to coarse SAND; water	
Brown to gray, silty, medium to coarse SAND; water	
Brown to gray, very silty, fine SAND; water	
Brown-gray, sandy SILT	Qu
BOTTOM OF BORING	

DEPTH (ft): 0, 25, 50, 75, 100, 125, 150, 175, 200, 225, 250, 275, 300, 325, 350, 375, 400

Saturated Formation

WELL CONSTRUCTION DETAILS



PROJECT NAME: Lacey Groundwater Devel. Program
WELL IDENTIFICATION NUMBER: WELL B
LOCATION: NE ¼ SW ¼ Sec. 24 T.18N, R.1W
CONSULTING FIRM: Pacific Groundwater Group
REPRESENTATIVE: Jim Mathieu
DATUM: MSL

WATER LEVEL ELEVATION: 39.5 feet msl (approx.)
WATER LEVEL DATE: 3/1/95
START CARD NO.: W16276
UNIQUE WELL ID NO.: AAY 302
DRILLING METHOD: Cable Tool
FIRM: Holt Testing, Inc.

Well Screen As-Built

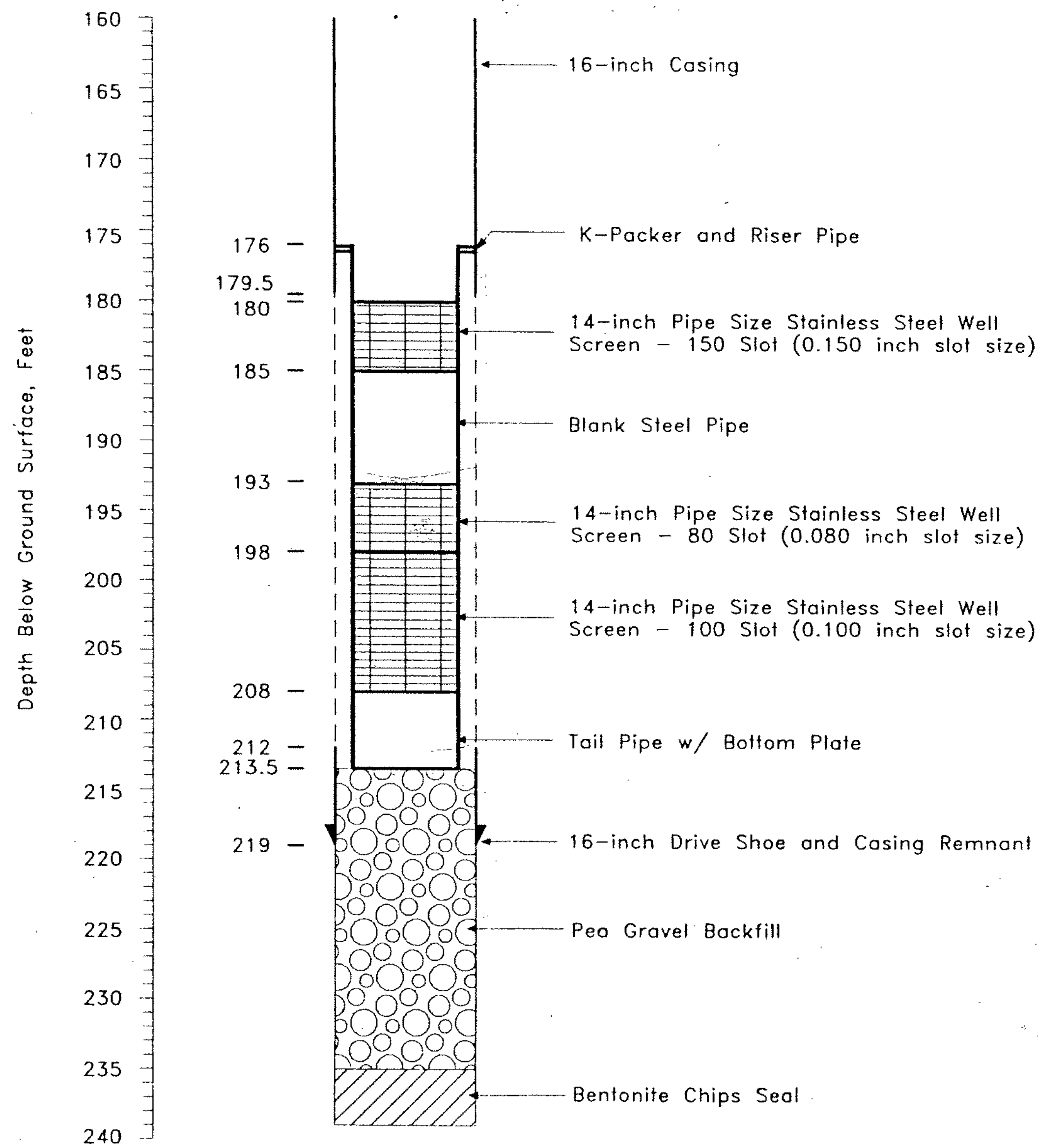


FIGURE 2
GEOLOGIC LOG AND WELL DESIGN FOR WELL B

Lacey Groundwater Development Program

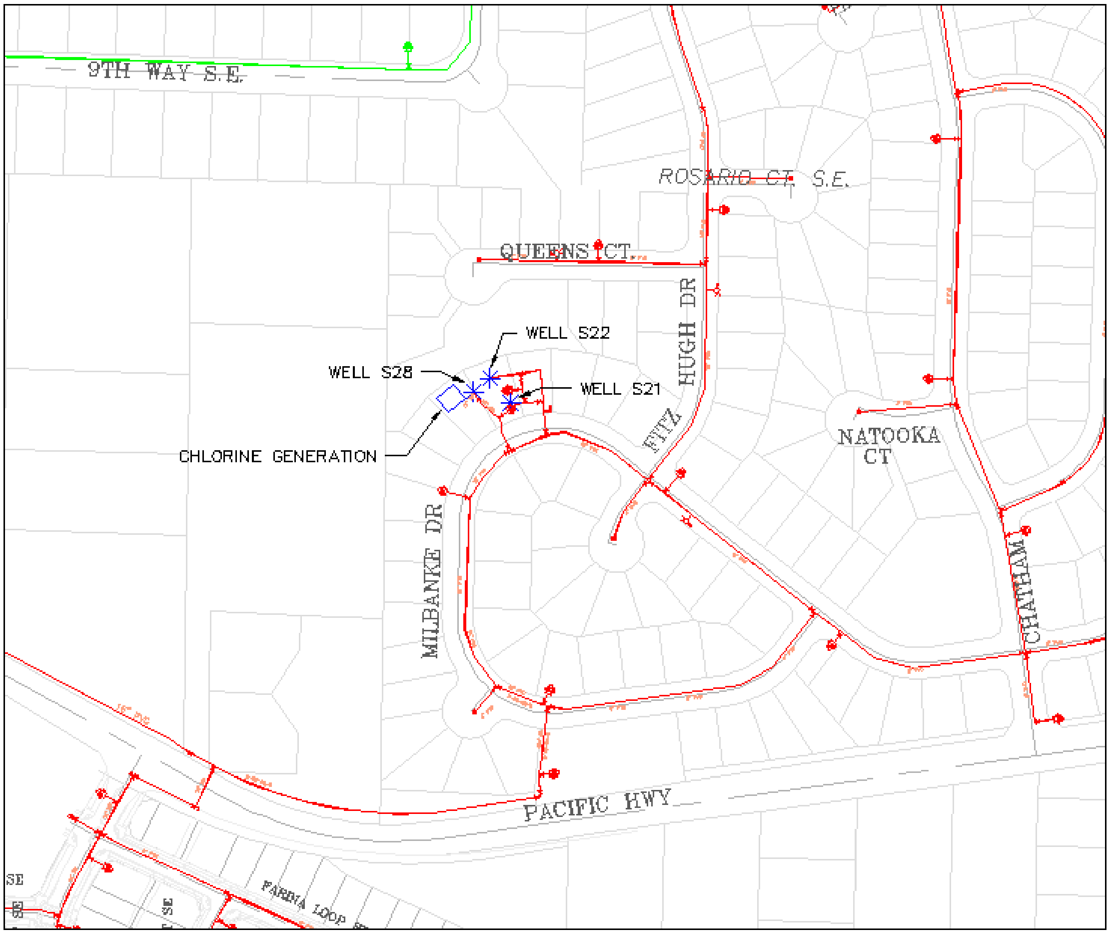
Pacific Groundwater Group

Well S21
(Madrona #1)

Facility Information

Description	Comments
Source #	S21
Address	8824 Milbanke Dr. SE
Year On-Line	1997
Pressure Zone	400
Floor Elevation	259.04
Housing	CMU
Pump Type	Turbine
Pump Model	Goulds VIT 14 RJMC
Pump Shaft Diameter (in)	1.93
Column Diameter/Length	10" column, 256'
Pump Serial #	375864
Pump Depth (ft)	256
Pump Capacity (gpm)	1600
Motor Model	US Electric 445TPA
Motor Serial #	H06071/Z0721160905R-1
Motor Speed (rpm)	1770
Horsepower	250
Casing Diameter (in)	16
Well Depth (ft)	329
Casing Depth (ft)	263
Screen	14-inch: 100-slot (263-271 ft), 80-slot (280-287 ft), 150-slot (287-293 ft), 120-slot (313-319 ft), 30-slot (319-324 ft)
Screen Capacity (gpm)	1950
Aquifer	Qpg
Control Valves	6" 61G-21 10" 692EG-07BDS 2-1/2" 50G-01
PSV Setting	100psi @ 1460gpm
PRV Setting (psi)	72
Flow to Waste Setting	150psi @ 400gpm
Flow to Waste Duration (sec)	180
Well Capacity (gpm)	1600
Chlorine Dose (mg/L)	0.58 (S21 and S22 combined)
Reliable Capacity (gpm)	1460
Notes	Local pressures limit simultaneous operation of wells S21, S22, and S28.

Well S21 (Madrona #1)



The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. 16280
UNIQUE WELL I.D. # ABY 233
Water Right Permit No. G2-29165

(1) OWNER: Name City of Lacey Address P.O. Box "B", Lacey, WA 98503-0987

(2) LOCATION OF WELL: County Thurston - NW 1/4 NW 1/4 Sec 24 T. 18 N., R 1W W.M.

(2a) STREET ADDRESS OF WELL (or nearest address) 1200 ft east and 500 ft south of the NW corner of Section 24

(3) PROPOSED USE: ☐ Domestic ☐ Irrigation ☐ DeWater Industrial ☐ Test Well ☐ Municipal ☑ Other ☐

(4) TYPE OF WORK: Owner's number of well (If more than one) Well A
Abandoned ☐ New well ☑ Deepened ☐ Reconditioned ☐ Method: Dug ☐ Cable ☑ Rotary ☐ Bored ☐ Driven ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 16 inches.
Drilled 334 feet. Depth of completed well 329 ft.

(6) CONSTRUCTION DETAILS:
Casing Installed: 16" Diam. from +6 ft. to 263 ft.
Welded ☑ ___" Diam. from ___ ft. to ___ ft.
Liner installed ☐ ___" Diam. from ___ ft. to ___ ft.
Threaded ☐

Perforations: Yes ☐ No ☑
Type of perforator used ___
SIZE of perforations ___ in. by ___ in.
___ perforations from ___ ft. to ___ ft.
___ perforations from ___ ft. to ___ ft.
___ perforations from ___ ft. to ___ ft.

Screens: Yes ☑ No ☐
Manufacturer's Name Johnsons
Type 14" pipe size stainless steel Model No. ___
Diam. ___ Slot size (see detail on right) ft. to ___ ft.
Diam. ___ Slot size ___ from ___ ft. to ___ ft.

Gravel packed: Yes ☐ No ☑ Size of gravel ___
Gravel placed from ___ ft. to ___ ft.

Surface seal: Yes ☑ No ☐ To what depth? 125 ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes ☐ No ☑
Type of water? ___ Depth of strata ___
Method of sealing strata off ___

(7) PUMP: Manufacturer's Name ___
Type: ___ H.P. ___

(8) WATER LEVELS: Land-surface elevation above mean sea level 254 ft.
Static level 216.5 ft. below top of well Date 3/1/96
Artesian pressure ___ lbs. per square inch Date ___
Artesian water is controlled by ___ (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☑ No ☐ If yes, by whom? PGG
Yield: 1,050 gal./min. with 2.3 ft. drawdown after 9 hrs.
" Transmissivity ~ 2,000,000 gpd/ft "
" Storage coefficient ~ 3x10^{-6} "
Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test ___
Bailer test ___ gal./min. with ___ ft. drawdown after ___ hrs.
Airtest ___ gal./min. with stem set at ___ ft. for ___ hrs.
Artesian flow ___ g.p.m. Date ___
Temperature of water 50°F Was a chemical analysis made? Yes ☑ No ☐

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
Tan, silt-bound Gravels	0	29
Brown & grey, silt-bound Gravels	29	50
Silty Gravels with sand	50	77
Brown, silty Sand & Gravel	77	85
Brown, silty Sand & Gravel, some water	85	95
Sand & Gravel, water	95	117
Blue and brown Clay	117	125
Tan, silt-bound Sand	125	145
Tan, slightly silty Sand with some gravel	145	188
Yellow-brown, silty to v. silty fine Sand	188	202
Yellowish-gray brown, siltbound slightly sandy Gravel	202	217
Olive grey, silt-bound Sand & Gravel	217	229
Gray, silt-bound, slightly gravelly, coarse Sand	229	235
Yellow-brown, silty fine-med Sand	235	244
Yellow-brown, slightly silty Sand and Gravel w/ cobbles	244	265
Yellow-brown, Sand & Gravel w/ cobbles	265	270
Yellow-brown & olive grey, interbedded siltbound Gravel and gravelly fine Sand	270	283
Greyish-brown, very silty Sand and Gravel	283	291
Greyish-brown siltbound Sand & Gravel w/ cobbles	291	314
Olive grey, slightly silty Sand & Gravel	314	320
Yellow-brown, slightly silty fine Sand	320	327
Olive grey, silty fine Sand	327	334

(Log prepared by Pacific Groundwater Group)

Screen details:

Dia	slot size	Top	Bottom
14"	100	263 ft	271 ft
14"	80	279.5	286.5
14"	150	286.5	292.5
14"	120	313	319
14"	80	319	324

Work Started 12/1/95, 19. Completed 3/4/96, 19

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME Holt Drilling Inc (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address 10621 Todd Rd E Puyallup
(Signed) Randy Holt (WELL DRILLER) License No. 1099
Contractor's Registration No. HOLTTIX087OJ Date 3-27, 1996

(USE ADDITIONAL SHEETS IF NECESSARY)

ECL 050-1-20 (2/93)

Geologic Log and Well Construction Details

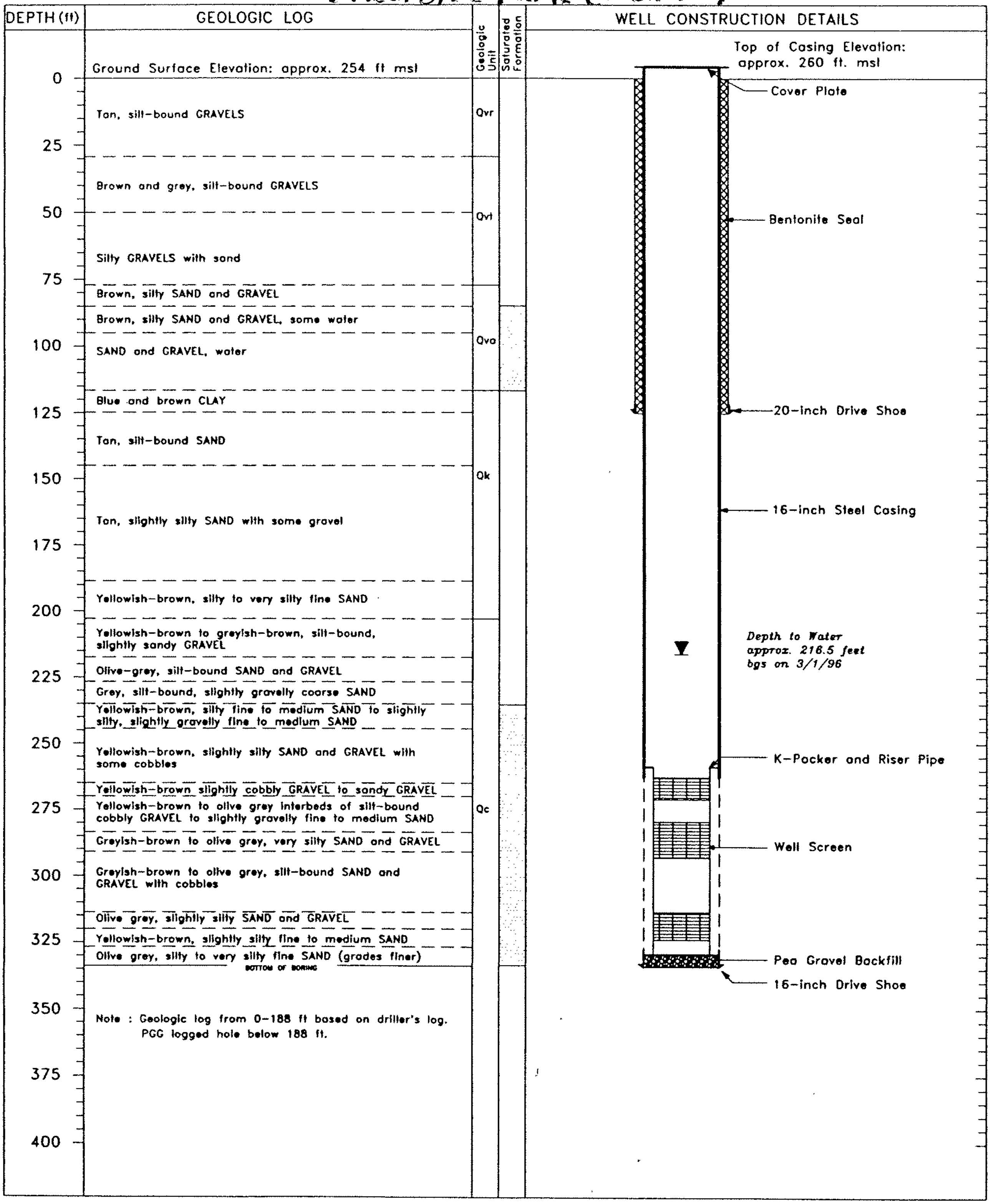
Madrona Park (Well 21)

Ground Surface Elevation: approx. 254 ft msl

GEOLOGIC LOG	Geologic Unit
Tan, silt-bound GRAVELS	Qvr
Brown and grey, silt-bound GRAVELS	Qvt
Silty GRAVELS with sand	
Brown, silty SAND and GRAVEL	Qva
Brown, silty SAND and GRAVEL, some water	
SAND and GRAVEL, water	
Blue and brown CLAY	Qk
Tan, silt-bound SAND	
Tan, slightly silty SAND with some gravel	
Yellowish-brown, silty to very silty fine SAND	
Yellowish-brown to greyish-brown, silt-bound, slightly sandy GRAVEL	Qc
Olive-grey, silt-bound SAND and GRAVEL	
Grey, silt-bound, slightly gravelly coarse SAND	
Yellowish-brown, silty fine to medium SAND to slightly silty, slightly gravelly fine to medium SAND	
Yellowish-brown, slightly silty SAND and GRAVEL with some cobbles	
Yellowish-brown slightly cobbly GRAVEL to sandy GRAVEL	
Yellowish-brown to olive grey interbeds of silt-bound cobbly GRAVEL to slightly gravelly fine to medium SAND	
Greyish-brown to olive grey, very silty SAND and GRAVEL	
Greyish-brown to olive grey, silt-bound SAND and GRAVEL with cobbles	
Olive grey, slightly silty SAND and GRAVEL	
Yellowish-brown, slightly silty fine to medium SAND	
Olive grey, silty to very silty fine SAND (grades finer)	

BOTTOM OF BORING

Note : Geologic log from 0-188 ft based on driller's log. PGG logged hole below 188 ft.



PROJECT NAME: Lacey Groundwater Devel. Program
WELL IDENTIFICATION NUMBER: WELL A
LOCATION: NW¼ NW¼ Sec. 24 T.18N, R.1W
CONSULTING FIRM: Pacific Groundwater Group
REPRESENTATIVE: Jim Mathieu
DATUM: MSL

WATER LEVEL ELEVATION: 37.5 feet msl (approx.)
WATER LEVEL DATE: 3/1/96
START CARD NO.: 16280
UNIQUE WELL ID NO.: ABY233
DRILLING METHOD: Cable Tool
FIRM: Holt Testing, Inc.

Well Screen As-Built

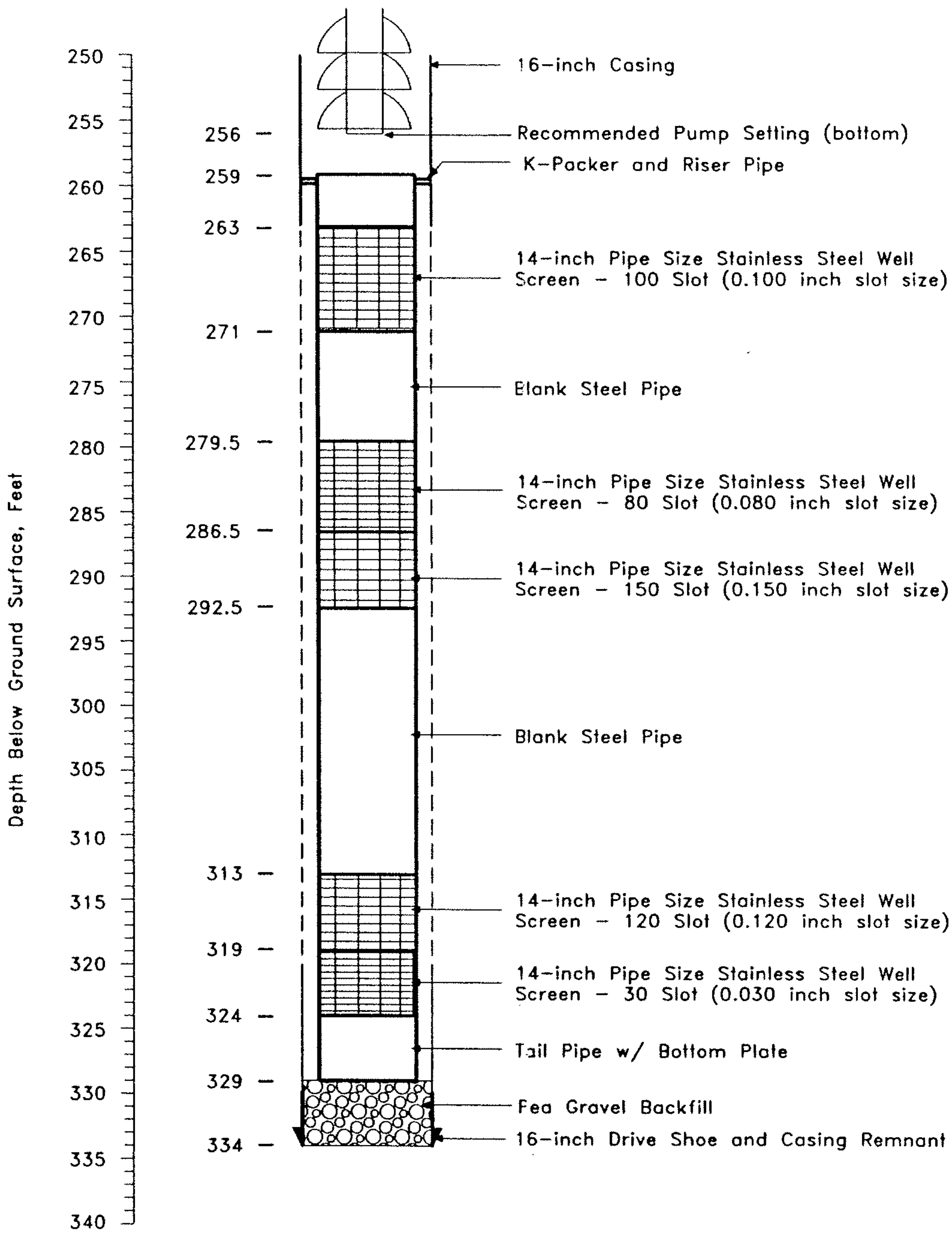


FIGURE 2
GEOLOGIC LOG AND WELL DESIGN FOR WELL A

Lacey Groundwater Development Program

Pacific Groundwater Group

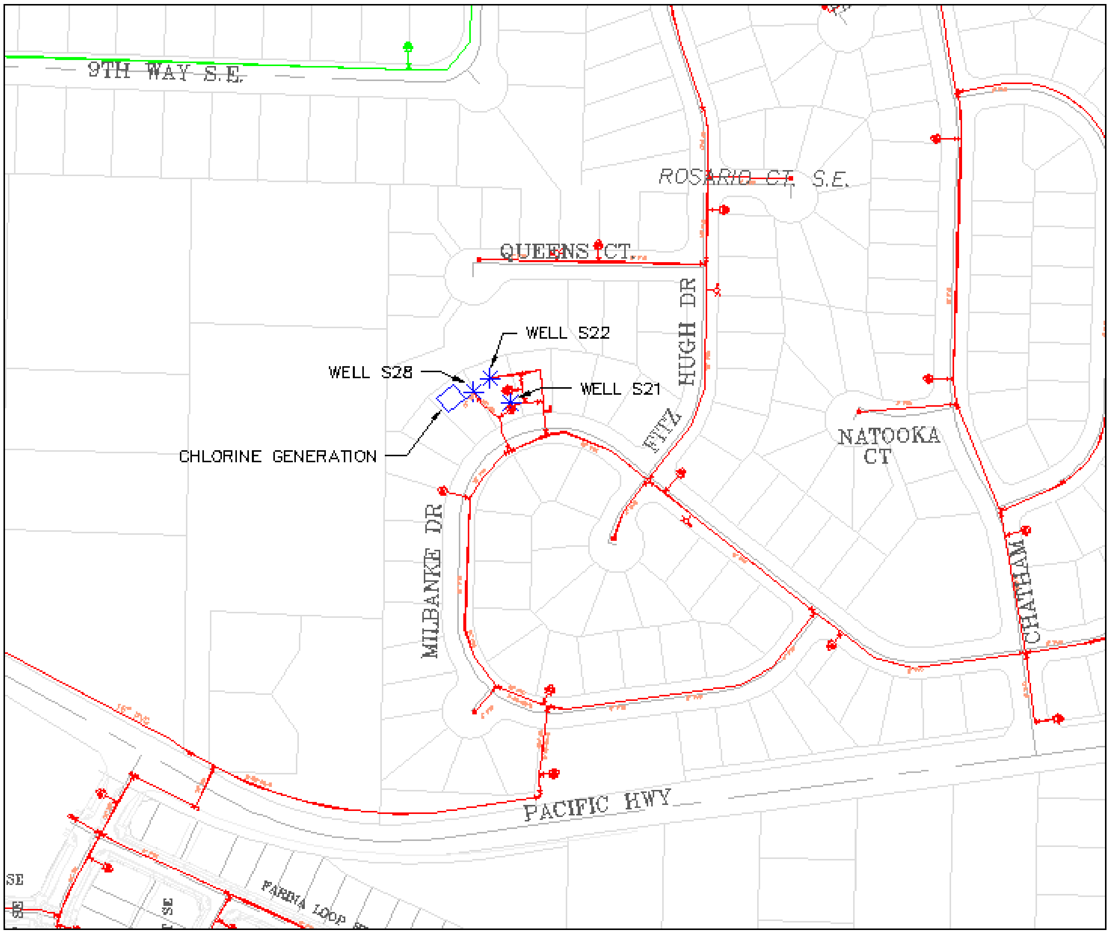
Well S22

(Madrona #2)

Facility Information

Description	Comments
Source #	S22
Address	8824 Milbanke Dr. SE
Year On-Line	1998
Pressure Zone	400
Floor Elevation	259.51
Housing	CMU
Pump Type	Turbine
Pump Model	Goulds VIT 14 RJMC-6 stage, 9.31 in
Pump Shaft Diameter (in)	1.93
Column Diameter/Length	10" column, 250'
Pump Serial #	458067
Pump Depth (ft)	256
Pump Capacity (gpm)	1600
Motor Model	US Electric 445TPA
Motor Serial #	B0597051101-001R-1
Motor Speed (rpm)	1770
Horsepower	250
Casing Diameter (in)	16
Well Depth (ft)	334
Casing Depth (ft)	265
Screen	14-inch: 150-slot (265-277, 294-306, 313-320 ft), 120-slot (277-282 ft), 100-slot (320-326)
Screen Capacity (gpm)	3220
Aquifer	Qpg
Control Valves	6" 61G-21 10" 692EG-07ABCDS 2-1/2" 50G-01
PSV Setting	108psi @ 1640gpm
PRV Setting (psi)	72
Flow to Waste Setting	150psi @ 1020gpm
Flow to Waste Duration (sec)	120
Well Capacity (gpm)	1600
Chlorine Dose (mg/L)	0.58 (S21 and S22 combined)
Reliable Capacity (gpm)	1600
Notes	Local pressures limit simultaneous operation of wells S21, S22, and S28.

Well S22 (Madrona #2)



The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. W11448
UNIQUE WELL I.D. # ACR 769
Water Right Permit No. Appl. G2-29165 - Prelim Permit

(1) **OWNER:** Name CITY OF LACEY Address P.O.Box 3400, 420 College St. Lacey, WA 98509-~~3400~~

(2) **LOCATION OF WELL:** County Thurston - NW 1/4 NW 1/4 Sec 24 T. 18 N., R. 1W W.M.

(2a) **STREET ADDRESS OF WELL** (or nearest address) MADRONA PARK SUBDIVISION

(3) **PROPOSED USE:** ☐ Domestic ☐ Irrigation ☐ DeWater Industrial ☐ Test Well ☐ Municipal ☒ Other ☐

(4) **TYPE OF WORK:** Owner's number of well (If more than one) "C"
Abandoned ☐ New well XX Deepened ☐ Reconditioned ☐
Method: Dug ☐ Cable XX Rotary ☐ Bored ☐ Driven ☐ Jetted ☐

(5) **DIMENSIONS:** Diameter of well 16 inches.
Drilled 334 feet. Depth of completed well 333 ft.

(6) **CONSTRUCTION DETAILS:**
Casing Installed: 16 " Diam. from +2 ft. to 265 ft.
Welded ☒ ___ " Diam. from ___ ft. to ___ ft.
Liner installed ☐ ___ " Diam. from ___ ft. to ___ ft.
Threaded ☐

Perforations: Yes ☐ No ☒
Type of perforator used ___
SIZE of perforations ___ in. by ___ in.
___ perforations from ___ ft. to ___ ft.
___ perforations from ___ ft. to ___ ft.
___ perforations from ___ ft. to ___ ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Westco
Type Stainless steel Model No. ___
Diam. 14" Slot size 150/120 from 265 ft. to 282 ft.
Diam. 14" Slot size 150 from 294 ft. to 306 ft.
14" 150/100 313 326

Gravel packed: Yes ☐ No ☒ Size of gravel ___
Gravel placed from ___ ft. to ___ ft.

Surface seal: Yes ☒ No ☐ To what depth? 130 ft.
Material used in seal ~~XXXXXXXXXX~~ Quick Grout
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? ___ Depth of strata ___
Method of sealing strata off ___

(7) **PUMP:** Manufacturer's Name ___
Type: ___ H.P. ___

(8) **WATER LEVELS:** Land-surface elevation above mean sea level ___ ft.
Static level 219.53 ft. below top of well Date 6/4/97
Artesian pressure ___ lbs. per square inch Date ___
Artesian water is controlled by ___ (Cap, valve, etc.)

(9) **WELL TESTS:** Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? Hokkaido
Yield: 1025 gal./min. with 2.01 ft. drawdown after 1 hrs.
" 1025 " 2.00 " 2 "
" 1025 " 2.21 " 4.23 "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
0	221.75	10m	219.77	120m	219.7
1 min.	219.69	30m	219.76		
5 min.	219.81	60m	219.70		

Date of test 6/4/97
Bailer test ___ gal./min. with ___ ft. drawdown after ___ hrs.
Airtest ___ gal./min. with stem set at ___ ft. for ___ hrs.
Artesian flow ___ g.p.m. Date ___
Temperature of water ___ Was a chemical analysis made? Yes ☒ No ☐

(10) **WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION**

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
Brown gray sandy till, hard	0'	10'
Gray brown sandy till w/cobbles	10'	69'
Dirty sand and gravel, moist	69'	76'
Brown gray till	76'	79'
Brown clay with gravel	79'	87'
Brown waterbearing sand & gravel	87'	121'
Brown silty sand with gravel	121'	123'
Blue gray clay	123'	133'
Brown silty sand, H_2O	133'	153'
Brown silty sand with clay and gravel, H_2O	153'	163'
Brown sandy silt with gravel, H_2O	163'	195'
Yellowish Sand & Gravel with binder, waterbearing	195'	306'
Brown Sand and gravel with clay lenses	306'	328'
Brown, fine to medium sand with gravel	328'	331'
Brown silty sand with binder	331'	334'
Bottom hole	334'	

'97 JUN 25 A10:18
RECEIVED

Work Started March 21, 1997 Completed June 11, 1997

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME HOKKAIDO DRILLING & DEVELOPING CORP. (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address P.O. BOX 100, GRAHAM, WA 98338-0100
(Signed) ___ (WELL DRILLER) License No. 1146
Contractor's Registration No. HOKKADD178D3 Date JUNE 24, 1997

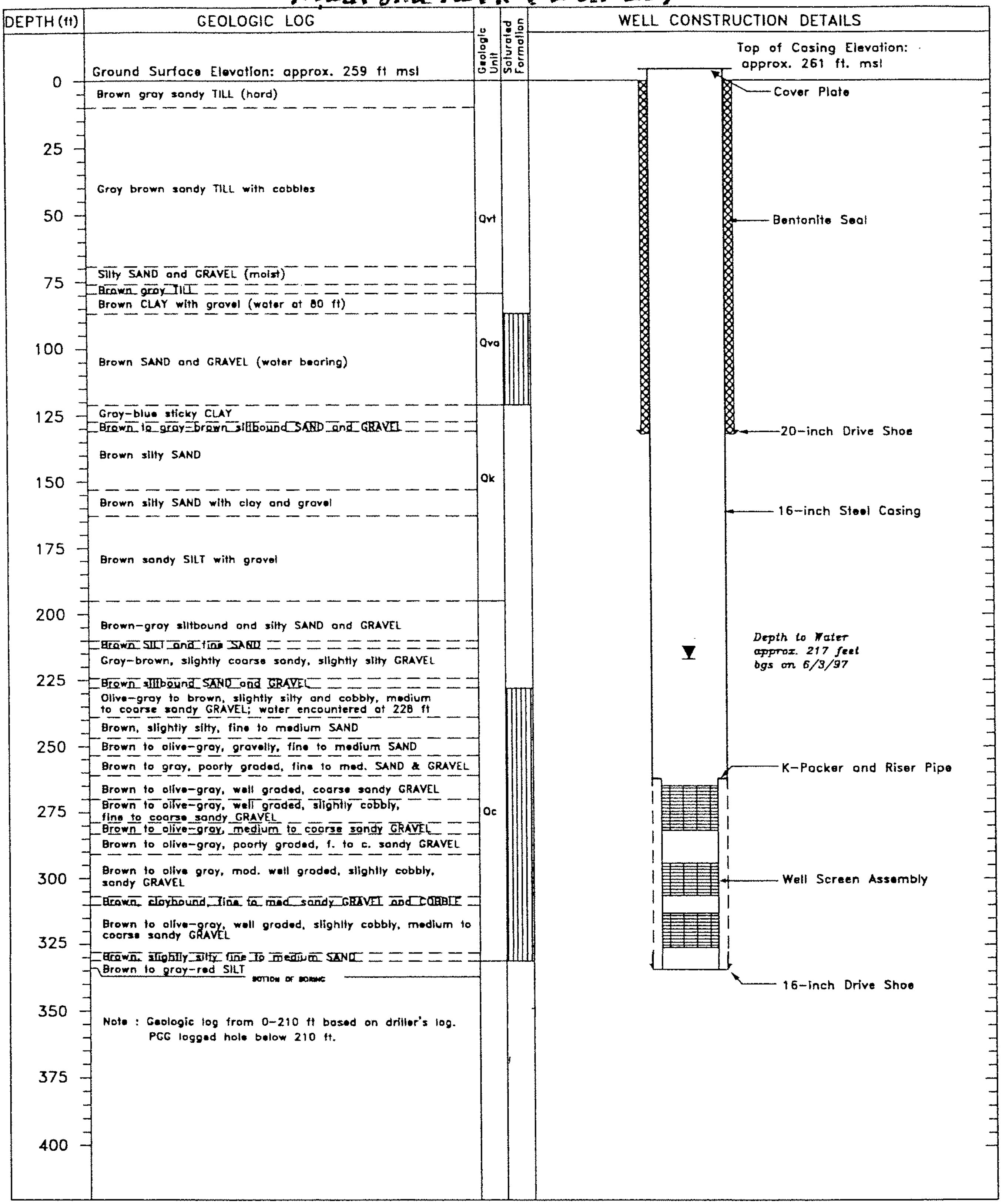
(USE ADDITIONAL SHEETS IF NECESSARY)

Ecology is an Equal Opportunity and Affirmative Action employer. For special accommodation needs, contact the Water Resources Program at (206) 407-6600. The TDD number is (206) 407-6006.

ECY 050-1-20 (9/93) * * f

Geologic Log and Well Construction Details

Madrona Park (Well 22)



PROJECT NAME: Lacey Groundwater Devel. Program
WELL IDENTIFICATION NUMBER: WELL C
LOCATION: NW¼ NW¼ Sec. 24 T.18N, R.1W
CONSULTING FIRM: Pacific Groundwater Group
REPRESENTATIVE: Jim Mathieu
DATUM: MSL

WATER LEVEL ELEVATION: 42 feet msl (approx.)
WATER LEVEL DATE: 6/3/97
START CARD NO.: W11448
UNIQUE WELL ID NO.: ACR769
DRILLING METHOD: Cable Tool
FIRM: Hokkaido Drilling & Development Corp.

Well Screen As-Built

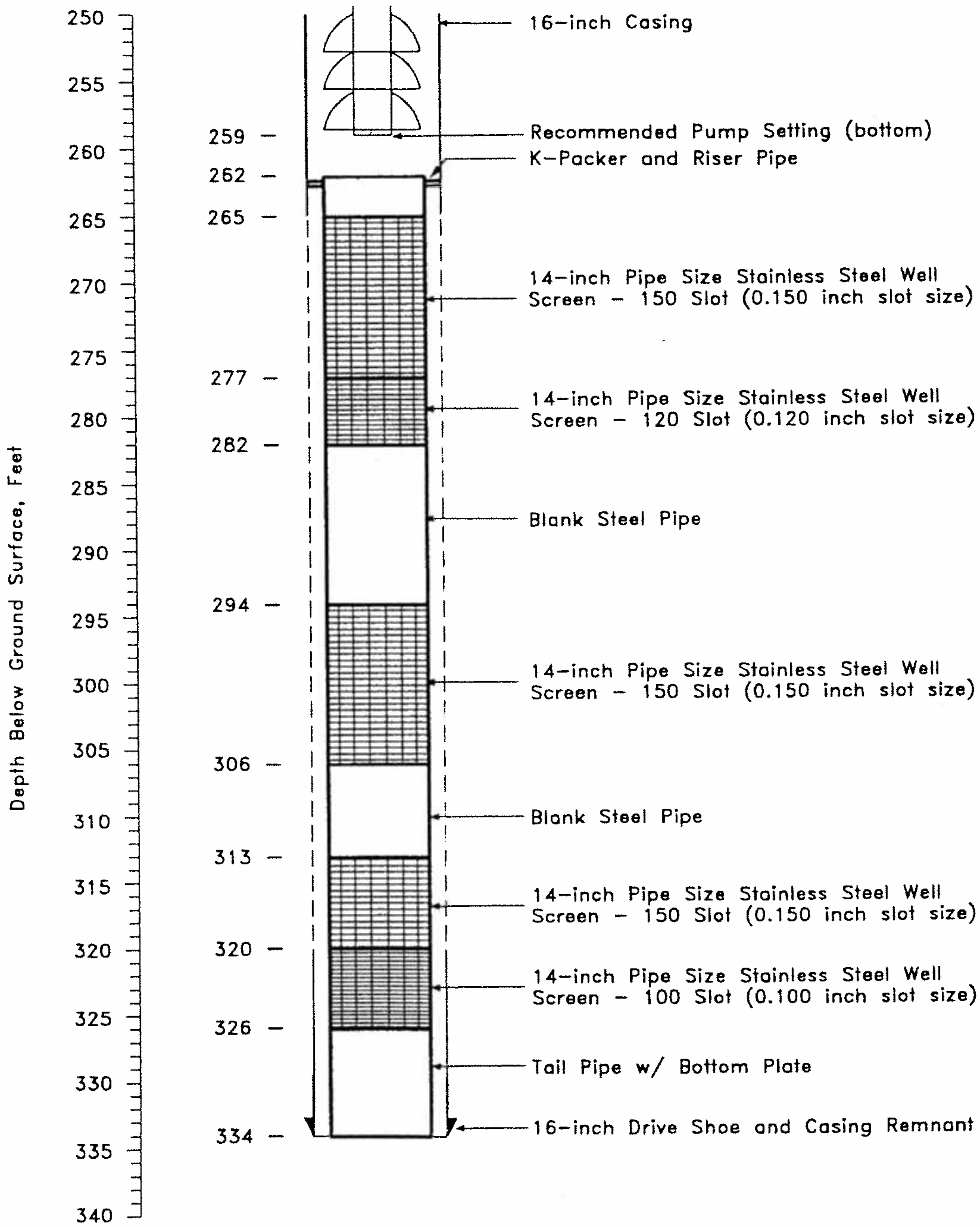


FIGURE 2
GEOLOGIC LOG AND WELL DESIGN FOR WELL C

Lacey Groundwater Development Program

Pacific Groundwater Group

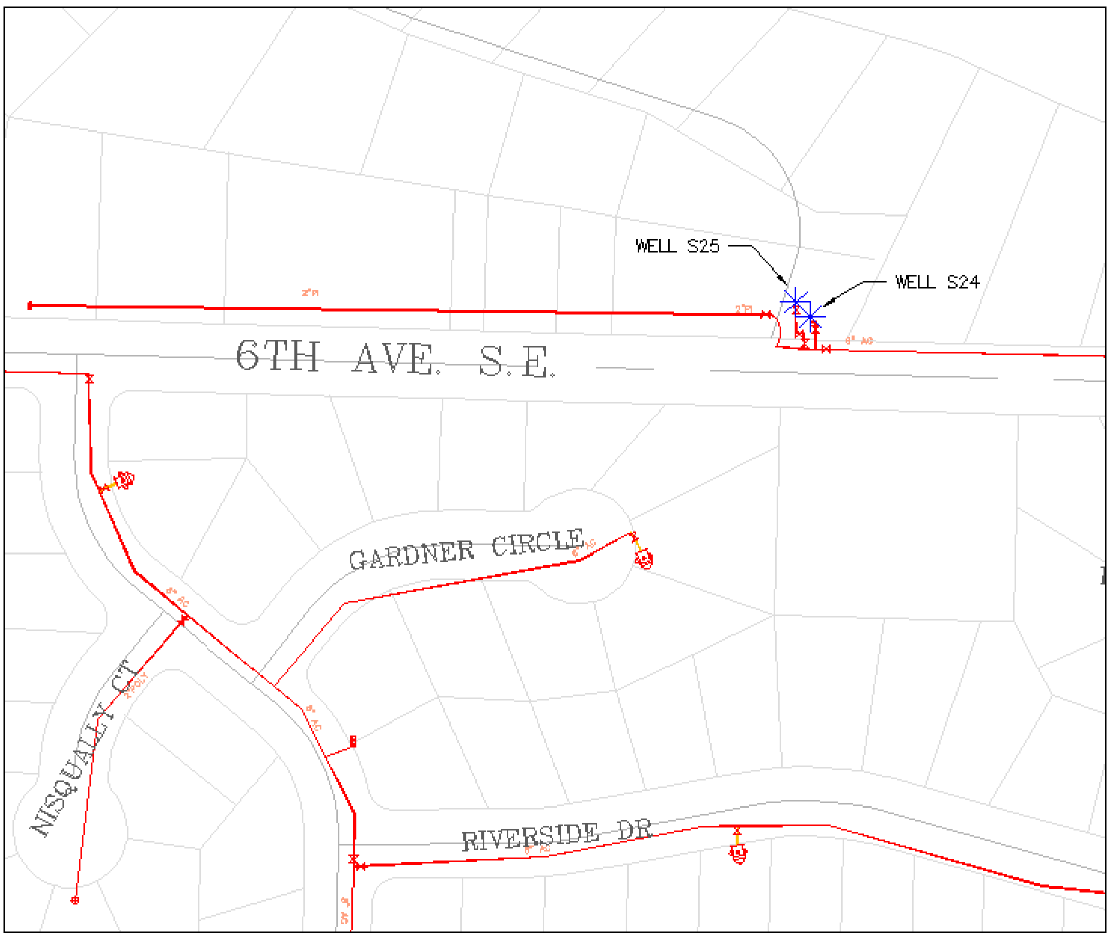
Well S24

(Nisqually 19A)

Facility Information

Description	Comments
Source #	S24
Address	11544 6th Ave. SE
Year On-Line	1986
Pressure Zone	188
Floor Elevation	25.00
Housing	CMU
Pump Type	Submersible
Pump Model	FNW-5LC00744C
Pump Shaft Diameter (in)	N/A
Column Diameter/Length	2" column, 85'
Pump Serial #	2554755-A
Pump Depth (ft)	85
Pump Capacity (gpm)	70
Motor Model	Franklin 2343185202
Motor Serial #	00M1801-3515
Motor Speed (rpm)	3450
Horsepower	7.5
Casing Diameter (in)	6
Well Depth (ft)	107
Casing Depth (ft)	98
Screen	6-inch: 18-slot (98-107 ft)
Screen Capacity (gpm)	N/A
Aquifer	Qpg
Control Valves	None
PSV Setting	N/A
PRV Setting (psi)	N/A
Flow to Waste Setting	60 gpm
Flow to Waste Duration (sec)	120
Well Capacity (gpm)	N/A
Chlorine Dose (mg/L)	0.57
Reliable Capacity (gpm)	70
Notes	

Well S24 (Nisqually 19A)



File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Application No. ....
Permit No. ....

(1) **OWNER:** Name CITY OF LACEY Address 6TH AVE SE - NISQUALLY

(2) **LOCATION OF WELL:** County THURSTON — W1/2 SW 1/4 Sec. 9 T. 18N N., R. 1E W.M.

Bearing and distance from section or subdivision corner

(3) **PROPOSED USE:** Domestic ☒ Industrial ☐ Municipal ☒ Irrigation ☐ Test Well ☐ Other ☐

(4) **TYPE OF WORK:** Owner's number of well (if more than one) 2
New well ☐ Deepened ☒ Reconditioned ☐
Method: Dug ☐ Bored ☐ Cable ☐ Driven ☐ Rotary ☐ Jetted ☐

(5) **DIMENSIONS:** Diameter of well 6 inches.
Drilled 108 ft. Depth of completed well 107 ft.

(6) **CONSTRUCTION DETAILS:**
Casing installed: 6 " Diam. from +1 ft. to 98 ft.
Threaded ☐ ...." Diam. from .... ft. to .... ft.
Welded ☒ ...." Diam. from .... ft. to .... ft.

Perforations: Yes ☐ No ☒
Type of perforator used ....
SIZE of perforations .... in. by .... in.
.... perforations from .... ft. to .... ft.
.... perforations from .... ft. to .... ft.
.... perforations from .... ft. to .... ft.

Screens: Yes ☒ No ☐
Manufacturer's Name JOHNSON
Type .... Model No. ....
Diam. 6 Slot size 18 from 107 ft. to 98 ft.
Diam. .... Slot size .... from .... ft. to .... ft.

Gravel packed: Yes ☐ No ☒ Size of gravel: ....
Gravel placed from .... ft. to .... ft.

Surface seal: Yes ☐ No ☐ To what depth? .... ft.
Material used in seal NO
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? .... Depth of strata ....
Method of sealing strata off ....

(7) **PUMP:** Manufacturer's Name BERKLEY
Type: SUB H.P. 7 1/2

(8) **WATER LEVELS:** Land-surface elevation above mean sea level .... +20 ft.
Static level 13'-6 ft. below top of well Date 5/20
Artesian pressure .... lbs. per square inch Date ....
Artesian water is controlled by .... (Cap, valve, etc.)

(9) **WELL TESTS:** Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? TIM
Yield: 110 gal./min. with 20'1" ft. drawdown after 4 hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
0	33'-7"				
30 sec	17-9"	— TOO FAST FOR GOOD			
60 sec	14-1"	MEASUREMENTS			

Date of test ....
Bailer test .... gal./min. with .... ft. drawdown after .... hrs.
Artesian flow .... g.p.m. Date ....
Temperature of water .... Was a chemical analysis made? Yes ☒ No ☐

(10) **WELL LOG:**

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
UNKNOWN	0	63
WB SAND - GRAVEL	63	68
SAND - GRAVEL - CLAY	68	88
CEMENTED SAND - GRAVEL	88	94
WB Sand	94	96
WB Sand - gravel	96	107
Purple Sand - WB	107	108

RECEIVED
JUN 12 1986
DEPARTMENT OF ECOLOGY
SOUTHWEST REGIONAL OFFICE

Work started 5, 1986 Completed 5, 1986

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME TIMS WELL DRILLING (Person, firm, or corporation) (Type or print)
Address 6246 LIBBY RD NE

[Signed] Jim R Hrafy (Well Driller)

License No. 0832 Date 5/29, 1986

(USE ADDITIONAL SHEETS IF NECESSARY)

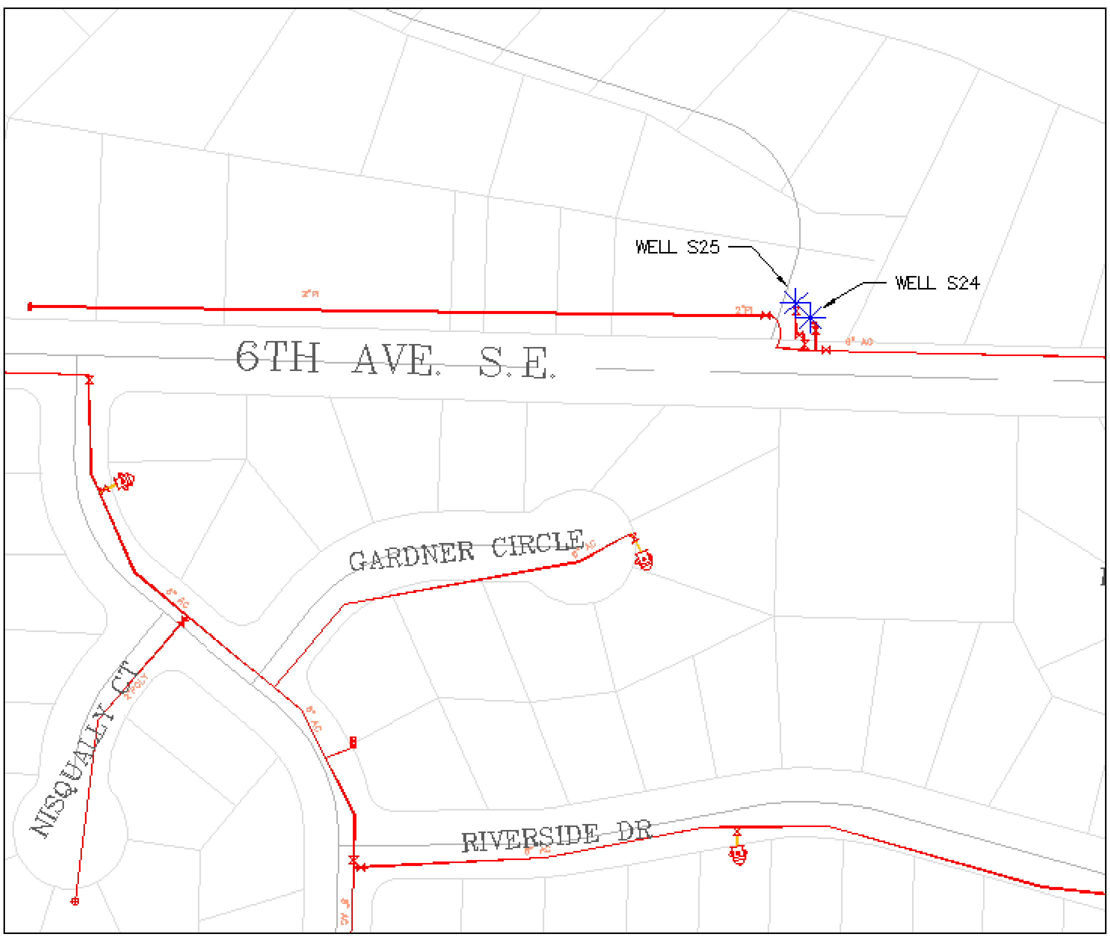
ECY 050-1-20

Well S25
(Nisqually 19C)

Facility Information

Description	Comments
Source #	S25
Address	11544 6th Ave. SE
Year On-Line	1972
Pressure Zone	188
Floor Elevation	24.46
Housing	CMU
Pump Type	Turbine
Pump Model	Jacuzzi 6 B/T 624 6x6x1
Pump Shaft Diameter (in)	1.93
Column Diameter/Length	6" column, 75'
Pump Serial #	375864
Pump Depth (ft)	75
Pump Capacity (gpm)	250
Motor Model	US Electric 445TPA
Motor Serial #	H06071/Z0721160905R-1
Motor Speed (rpm)	1770
Horsepower	30
Casing Diameter (in)	10
Well Depth (ft)	79
Casing Depth (ft)	58
Screen	10-inch: 100-slot (58-73 ft)
Screen Capacity (gpm)	N/A
Aquifer	Qpg
Control Valves	3" 61G-02
PSV Setting	N/A
PRV Setting (psi)	N/A
Flow to Waste Setting	230 gpm
Flow to Waste Duration (sec)	120
Well Capacity (gpm)	N/A
Chlorine Dose (mg/L)	0.81
Reliable Capacity (gpm)	230
Notes	

Well S25 (Nisqually 19C)



Well #9C

File Original and First Copy with the Division of Water Resources
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Application No. G1220104
Permit No. G2-20104P

(1) OWNER: Name CITY OF LACEY Address P.O. Drawer B, Lacey, Wn. 98503

(2) LOCATION OF WELL: County THURSTON SW¼ SW¼ Sec. 9 T. 18 N., R. 1E W.M.

Bearing and distance from section or subdivision corner N 45°E, 300 FT FROM S.W. 1/16 COR

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☒ Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) ____
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 10 inches.
Drilled 79 ft. Depth of completed well 73 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 10 " Diam. from 0 ft. to 58 ft.
Threaded ☐ ____ " Diam. from ____ ft. to ____ ft.
Welded ☒ ____ " Diam. from ____ ft. to ____ ft.

Perforations: Yes ☐ No ☒
Type of perforator used ____
SIZE of perforations ____ in. by ____ in.
____ perforations from ____ ft. to ____ ft.
____ perforations from ____ ft. to ____ ft.
____ perforations from ____ ft. to ____ ft.

Screens: Yes ☒ No ☐
Manufacturer's Name JOHNSON
Type ST. STEEL Telescope Model No. ____
Diam. 10" Slot size .100 from 58 ft. to 73 ft.
Diam. ____ Slot size ____ from ____ ft. to ____ ft.

Gravel packed: Yes ☐ No ☒ Size of gravel: ____
Gravel placed from ____ ft. to ____ ft.

Surface seal: Yes ☒ No ☐ To what depth? 30 ft.
Material used in seal CONCRETE
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? ____ Depth of strata ____
Method of sealing strata off ____

(7) PUMP: Manufacturer's Name ____
Type: ____ H.P. ____

(8) WATER LEVELS: Land-surface elevation above mean sea level 20 ft.
Static level 15 ft. below top of well Date 7-12-72
Artesian pressure ____ lbs. per square inch Date ____
Artesian water is controlled by ____ (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? DRILLER
Yield: 450 gal./min. with 11.5 ft. drawdown after 4 hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
.00	26.5				
.01	20.8				
.02	15.0				

Date of test 7-12-72
Bailer test ____ gal./min. with ____ ft. drawdown after ____ hrs.
Airtest ____ gal./min. with stem set at ____ ft. for ____ hrs.
Artesian flow ____ g.p.m. Date ____
Temperature of water ____ Was a chemical analysis made? Yes ☒ No ☐

(10) WELL LOG:

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
SAND, SOME SILTY CLAY BINDER	0	19
SAND & GRAVEL	19	32
SAND & GRAVEL (TIGHT)	32	43
SAND & GRAVEL, (CEMENTED IN CLAY TILL)	43	49
SAND & GRAVEL (TIGHT & DIRTY)	49	55
SAND & GRAVEL LOOSE (WATER DRIVE & BAIL)	55	58
SAND & GRAVEL (WATER DRIVE & BAIL)	58	73
SAND & GRAVEL (TIGHT VERY DIRTY NO WATER)	73	75
SAND & GRAVEL (CEMENTED)	75	79

RECEIVED
OCT 4 1973
DEPARTMENT OF ECOLOGY
SOUTHWEST REGIONAL OFFICE

Work started 6-29 1972. Completed 7-1 1972

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Stoney-Armstrong Drilling Inc. (Person, firm, or corporation) (Type or print)

Address 514½ River Road

[Signed] John E. Armstrong (Well Driller)

License No. ____ Date 9-10- 1972

OK/WHT 10-12-73

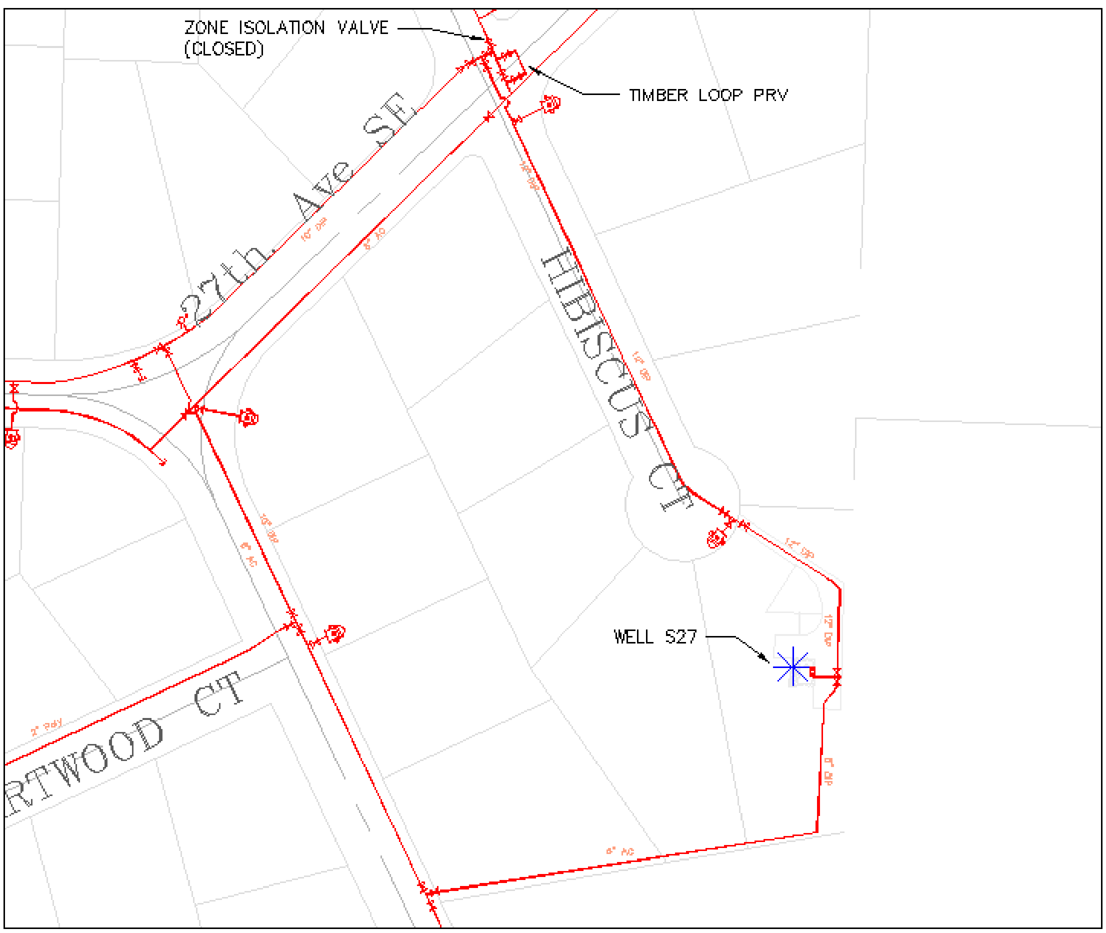
(USE ADDITIONAL SHEETS IF NECESSARY)

Well S27
(Evergreen Estates)

Facility Information

Description	Comments
Source #	S27
Address	2814 Hibiscus Ct. SE
Year On-Line	2003
Pressure Zone	400
Floor Elevation	256.57
Housing	CMU
Pump Type	Turbine
Pump Model	Byron Jackson 12 MQLX - 8 stages
Pump Shaft Diameter (in)	1.5
Column Diameter/Length	8" column, 240'
Pump Serial #	N/A
Pump Depth (ft)	252
Pump Capacity (gpm)	1100
Motor Model	US Motor VHS 444TP BF76
Motor Serial #	N/A
Motor Speed (rpm)	1785
Horsepower	150
Casing Diameter (in)	16
Well Depth (ft)	282
Casing Depth (ft)	256
Screen	14-inch: 150-slot (256-266 ft), 200-slot (266-276 ft)
Screen Capacity (gpm)	1750
Aquifer	Qpg
Control Valves	6" 61G-21ABKC 8" 692EG-07ABCSDKC 2-1/2" 50G-01
PSV Setting	147psi @ 770gpm
PRV Setting (psi)	80
Flow to Waste Setting	180psi @ 430gpm
Flow to Waste Duration (sec)	240
Well Capacity (gpm)	1100
Chlorine Dose (mg/L)	0.51
Reliable Capacity (gpm)	700
Notes	Limited by water right.

Well S27 (Evergreen Estates)



The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

File Original with Department of Ecology
Second Copy - Owner's Copy
Third Copy - Driller's Copy

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WATER WELL REPORT
STATE OF WASHINGTON

Notice of Intent W166611
UNIQUE WELL I.D. # AGP-478
Water Right Permit No G2-20883C

(1) OWNER: Name City of Lacey Address PO Box 3400, Lacey, WA 98509-3400

(2) LOCATION OF WELL: County Thurston NE 1/4 NW 1/4 Sec 25 T 18 N.R 1W WM

(2a) STREET ADDRESS OF WELL: (or nearest address) 2800 Hibyscus Court, Lacey, WA

TAX PARCEL NO. 46780004600

(3) PROPOSED USE: ☐ Domestic ☐ Industrial ☒ Municipal ☐ Irrigation ☐ Test Well ☐ Other ☐ DeWater

(4) TYPE OF WORK: Owner's number of well (if more than one) Well 24
Replacement well
☒ New Well ☐ Deepened ☐ Reconditioned ☐ Decommission
Method ☐ Dug ☐ Cable ☐ Rotary ☐ Bored ☐ Driven ☐ Jetted

(5) DIMENSIONS: Diameter of well 16 inches
Drilled 290 feet. Depth of completed well 282 ft

(6) CONSTRUCTION DETAILS
Casing Installed:
☒ Welded 16 " Diam from +2 ft to 256 ft
☐ Liner installed ____ " Diam. from ____ ft. to ____ ft
☐ Threaded ____ " Diam from ____ ft to ____ ft

Perforations: ☐ Yes ☒ No
Type of perforator used ____
SIZE of perforations ____ in by ____ in
____ perforations from ____ ft to ____ ft.

Screens: ☒ Yes ☐ No ☐ K-Pac Location 252 ft
Manufacturer's Name Johnsons
Type 304 Stainless Model No ____
Diam 14 PS Slot Size 150 from 256 ft. to 266 ft.
Diam 14 PS Slot Size 200 from 266 ft to 276 ft

Gravel/Filter packed: ☐ Yes ☒ No ☐ Size of gravel/sand ____
Material placed from ____ ft. to ____ ft

Surface seal: ☒ Yes ☐ No To what depth? 168 ft
Material used in seal Bentonite
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? ____ Depth of strata ____
Method of sealing strata off ____

(7) PUMP: Manufacturer's Name ____
Type: ____ H.P. ____

(8) WATER LEVELS: Land-surface elevation above mean sea level 258 ft
Static level 214.4 ft below top of well Date 11/26/02
Artesian pressure ____ lbs per square inch Date ____
Artesian water is controlled by ____ (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? ☒ Yes ☐ No If yes, by whom? PGG / Holt
Yield 900 gal./min with 11 ft drawdown after 2.5 hrs
Yield ____ gal./min with ____ ft drawdown after ____ hrs.
Yield. ____ gal./min with ____ ft drawdown after ____ hrs
Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
0	225.4	5	214.60	27	214.56
1	214.57	11	214.59	45	214.53
3	214.61	17	214.58	95	214.50

Date of test 11/26/02
Bailer test ____ gal./min. with ____ ft drawdown after ____ hrs
Airtest ____ gal./min with ____ ft. drawdown after ____ hrs.
Artesian flow ____ g.p.m Date ____
Temperature of water 50 °F Was a chemical analysis made? ☒ Yes ☐ No

ECY 050-1-20 (11/98) Transmissivity ~ 1,250,000 gpd/ft
Storage Coef ~ 0.2

(10) WELL LOG or DECOMMISSIONING PROCEDURE DESCRIPTION
Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. Indicate all water encountered

MATERIAL	FROM	TO
Brown Sand & Gravel	0	5
Brown silty, cobbly Sand & Gravel	5	27
Brown sand & Gravel	27	58
Brown, silty Sand & Gravel	58	88
Reddish-brown, silty, sand Gravel	88	109
Reddish-brown, silty, sandy Gravel w/ tan silt layers	109	129
Brown, silty Sand w/ some gravel	129	152
Brown Sand & Gravel	152	158
Brown Silt	158	163
Brown, siltbound Sand & Gravel	163	192
Brown, siltbound, cobbly, Sand & Gravel	192	203
Brown Sand & Gravel	203	210
Brown siltbound Sand & Gravel	210	225
Brown cobbly, Sand & Gravel	225	235
Brown to olive brown, silty, cobbly, Sand & Gravel	235	245
Brown cobbly sand & Gravel	245	248
Brown to olive-brown, silty, cobbly Sand & Gravel	248	257
Brown cobbly Sand & Gravel	257	278
grayish-brown Silt and gray silty fine Sand	278	290

Work Started 9/5/02 Completed 12/12/02

WELL CONSTRUCTION CERTIFICATION:

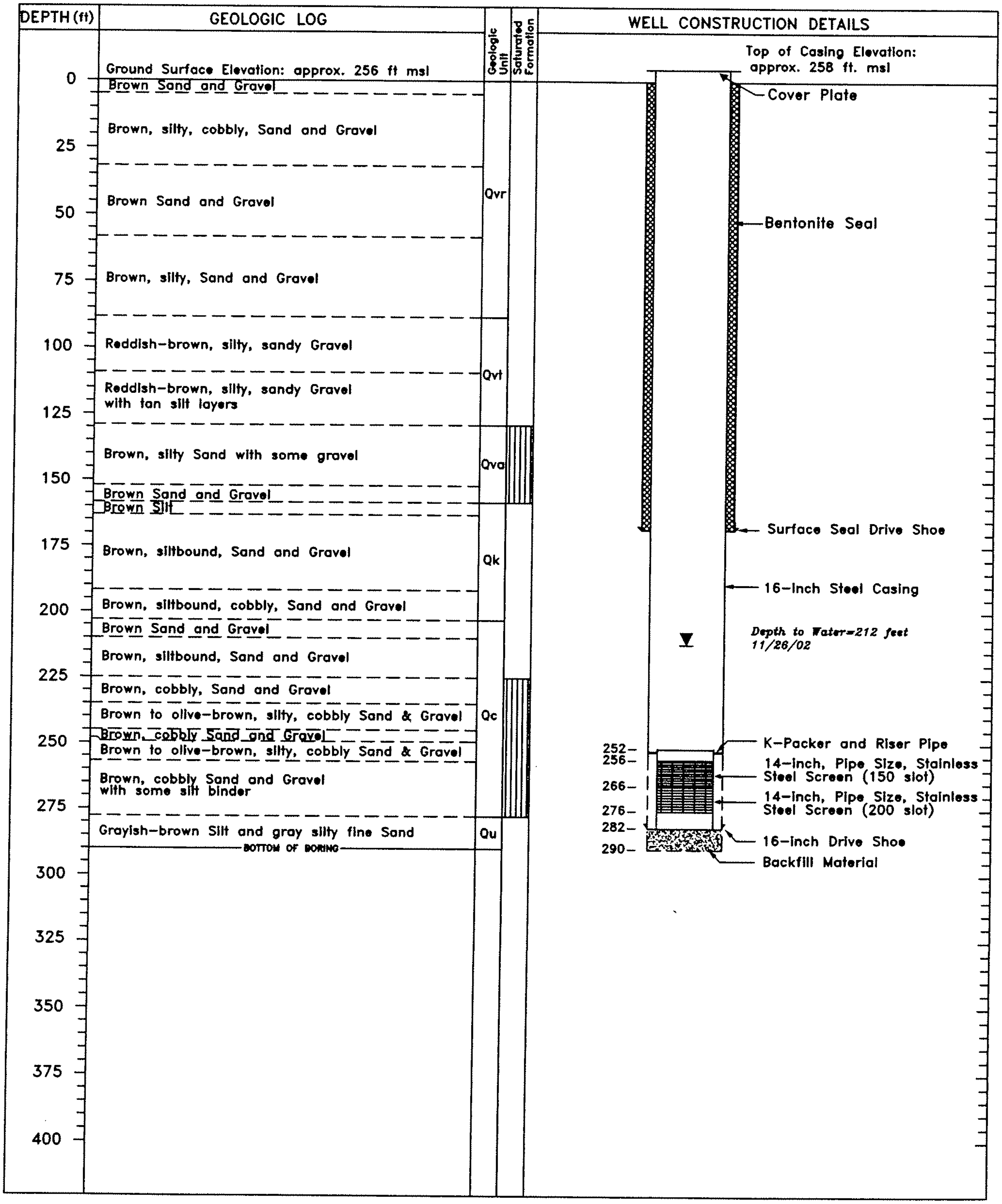
I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief

Type or Print Name Wade Iverson License No 597 (Licensed Driller/Engineer)
Trainee Name Mike Polly License No ____
Drilling Company Holt Drilling Inc
(Signed) [signature] License No ____ (Licensed Driller/Engineer)
Address PO Box 1890
Contractor's Registration No HOLTDI*136OG Date 12/5, 02

(USE ADDITIONAL SHEETS IF NECESSARY)

Ecology is an Equal Opportunity and Affirmative Action employer. For special accommodation needs, contact the Water Resources Program at (360) 407-6600 The TDD number is (360) 407-6006.

Figure 2 Well Log and Construction Details for Lacey Well 24



PROJECT NAME: Lacey Groundwater Devel. Program
WELL IDENTIFICATION NUMBER: Well 24
LOCATION: NE ¼ NW¼ Sec. 25 T.18N, R.1W
CONSULTING FIRM: Pacific Groundwater Group
REPRESENTATIVE: Dan Matlock
DATUM: MSL

WATER LEVEL ELEVATION: 44 feet msl
WATER LEVEL DATE: 11/26/02
START CARD NO.: W166611
UNIQUE WELL ID NO.: AGP-478
DRILLING METHOD: Cable Tool
FIRM: Holt Drilling

Pacific Groundwater Group

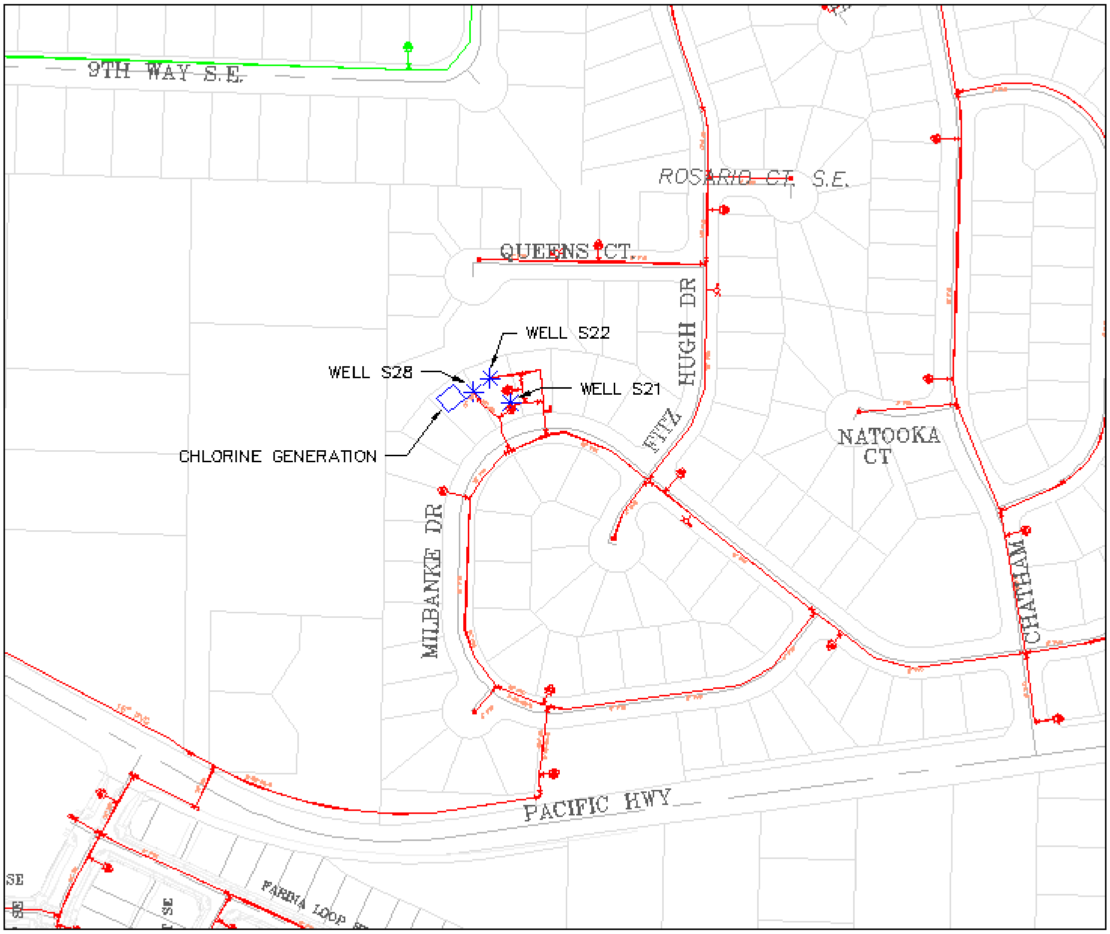
Well S28

(Madrona #3)

Facility Information

Description	Comments
Source #	S28
Address	8824 Milbanke Dr. SE
Year On-Line	2004
Pressure Zone	400
Floor Elevation	259.50
Housing	CMU
Pump Type	Turbine
Pump Model	Peerless 14MC - 7 stages
Pump Shaft Diameter (in)	1.9375
Column Diameter/Length	10" column, 249'
Pump Serial #	N/A
Pump Depth (ft)	256
Pump Capacity (gpm)	1600
Motor Model	US Motor H445TPA BF84
Motor Serial #	N/A
Motor Speed (rpm)	1780
Horsepower	250
Casing Diameter (in)	20
Well Depth (ft)	330
Casing Depth (ft)	262
Screen	18-inch: 120-slot (262-265, 272-277 ft), 80-slot (265-272, 286-292 ft), 150-slot (292-325 ft)
Screen Capacity (gpm)	4380
Aquifer	Qpg
Control Valves	6" 61G-21 10" 692EG-07ABCDS 2-1/2" 50G21
PSV Setting	112psi @ 1570gpm
PRV Setting (psi)	72
Flow to Waste Setting	150psi @ 960gpm
Flow to Waste Duration (sec)	120
Well Capacity (gpm)	3200
Chlorine Dose (mg/L)	0.67
Reliable Capacity (gpm)	1600
Notes	Local pressures limit simultaneous operation of wells S21, S22, and S28.

Well S28 (Madrona #3)



File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. W124732
UNIQUE WELL I.D. # AEC 883
Water Right Permit No. 62-29304

(1) OWNER: Name City of Lacey Address P.O Box "B" Lacey, WA 98503-0987

(2) LOCATION OF WELL: County Thurston - NW 1/4 NW 1/4 Sec 24 T. 18 N., R 1W W.M.

(2a) STREET ADDRESS OF WELL (or nearest address) 8824 Milbank Rd, Lacey, WA

(3) PROPOSED USE: ☐ Domestic ☐ Irrigation ☐ DeWater Industrial ☐ Test Well ☐ Municipal ☒ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) Well 23
Abandoned ☐ New well ☒ Deepened ☐ Reconditioned ☐ Method: Dug ☐ Cable ☒ Rotary ☐ Bored ☐ Driven ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 20 inches.
Drilled 338 feet. Depth of completed well 330.5 ft.

(6) CONSTRUCTION DETAILS:
Casing Installed: 20" Diam. from -2 ft. to 262.5 ft.
Welded ☐ ___" Diam. from ___ ft. to ___ ft.
Liner installed ☐ ___" Diam. from ___ ft. to ___ ft.
Threaded ☐

Perforations: Yes ☐ No ☒
Type of perforator used ___
SIZE of perforations ___ in. by ___ in.
___ perforations from ___ ft. to ___ ft.
___ perforations from ___ ft. to ___ ft.
___ perforations from ___ ft. to ___ ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson
Type Stainless Steel Model No. ___
Diam. ___ Slot size See below from ___ ft. to ___ ft.
Diam. ___ Slot size ___ from ___ ft. to ___ ft.

Gravel packed: Yes ☐ No ☒ Size of gravel ___
Gravel placed from ___ ft. to ___ ft.

Surface seal: Yes ☒ No ☐ To what depth? 137 ft.
Material used in seal ___
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? ___ Depth of strata ___
Method of sealing strata off ___

(7) PUMP: Manufacturer's Name ___
Type: ___ H.P. ___

(8) WATER LEVELS: Land-surface elevation above mean sea level ~~2?~~ 259 ft.
Static level 220.8 ft. below top of well Date 6/5/00
Artesian pressure ___ lbs. per square inch Date ___
Artesian water is controlled by ___ (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? PG6/Driller
Yield: 1680 gal./min. with 2.4 ft. drawdown after 4 hrs.
" " "
" " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
0.0	223.2	6.0	221.16	50.0	221.06
2.0	221.19	10.0	221.13		
4.0	221.18	20.0	221.10		

Date of test ___
Bailer test ___ gal./min. with ___ ft. drawdown after ___ hrs.
Airtest ___ gal./min. with stem set at ___ ft. for ___ hrs.
Artesian flow ___ g.p.m. Date ___
Temperature of water ___ Was a chemical analysis made? Yes ☒ No ☐

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
Brown Till	0	35
Brown siltbound Sand & Gravel	35	58
Brown Sandy Gravel	58	63
Brown siltbound, slightly sandy Gravel	63	83
Brown silty Sand & Gravel	83	97
Brown Sand & Gravel (water)	97	123
Gray-blue sticky clay	123	129
Brown-grayish brown, siltbound Sand and Gravel	129	137
Brown silty Sand	137	162
Brown silty Sand with clay	162	173
Brown silty Sand	173	197
Brown siltbound, slightly sandy Gravel	197	207
Tan silty clay and Gravel	207	215
Brown silty Sand & Gravel	215	229
Brown slightly silty Sand & Gravel	229	242
Brown slightly silty to silty f-m Sand and slightly silty to silty Sand & Gravel	242	257
Tan Clay	257	259
Brown, wellgraded, slightly cobbly, fine to coarse sandy Gravel	259	277
Brown f-m Sand and siltbound Sand & Gravel	277	281
Brown to olive gray, cobbly Sand & Gravel	281	293
Brown, siltbound, cobbly Sand & Gravel	293	295
Brown, well graded, coarse sandy, cobbly Gravel	295	316
Brown slightly silty gravelly, f-m Sand	316	333
	333	338

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18-inch; 120 slot; 262.5 - 265.5'
18-inch; 80 slot; 265.5 - 272.5'
18-inch; 120 slot; 272.5 - 277.5
18-inch; 80 slot; 286.5 - 292.5
18-inch; 150 slot 292.5 - 320.5

Work Started 2/22/2000 Completed 6/9/2000

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME Arcadia Drilling Inc. (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address 170 SE Walker Park Rd Shelton, WA985[illegible]
(Signed) Duane H Knapp (WELL DRILLER) License No. 1706
Contractor's Registration No. ARCADDI083K1 Date 7-13-00, 19___

(USE ADDITIONAL SHEETS IF NECESSARY)

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

ECL 050-1-20 (2/93)

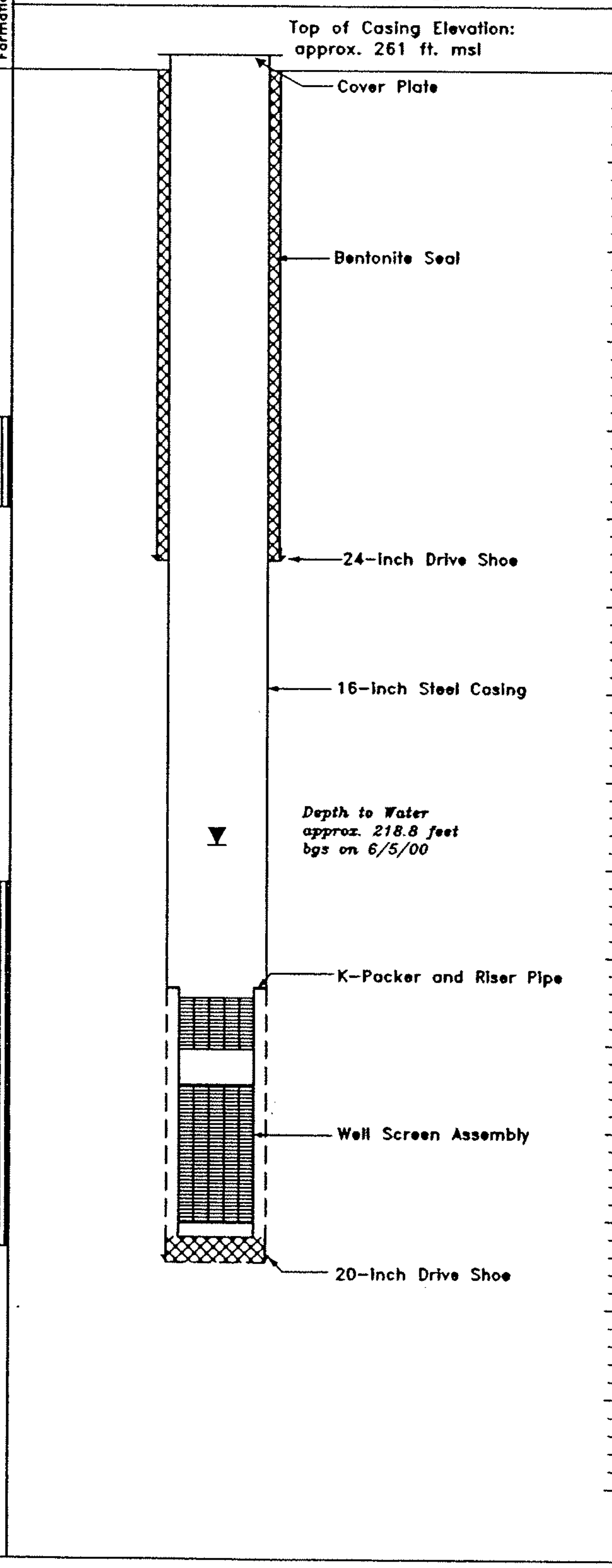
Geologic Log and Well Construction Details

Madrona Park (Well 23)

DEPTH (ft)	GEOLOGIC LOG	Geologic Unit	Saturated Formation
0	Ground Surface Elevation: approx. 259 ft msl		
	Brown TILL (hard)	Qvt	
	Brown siltbound SAND and GRAVEL	Qvt	
	Brown sandy GRAVEL	Qvt	
	Brown siltbound, slightly sandy GRAVEL	Qvt	
	Brown silty SAND and GRAVEL	Qva	
	Brown SAND and GRAVEL (water bearing)	Qva	
	Gray-blue sticky CLAY	Qk	
	Brown to gray-brown siltbound SAND and GRAVEL	Qk	
	Brown silty SAND	Qk	
	Brown silty SAND with clay	Qk	
	Brown silty SAND	Qk	
	Brown siltbound slightly sandy GRAVEL	Qc	
	Tan silty CLAY and GRAVEL	Qc	
	Brown silty SAND and GRAVEL	Qc	
	Brown slightly silty SAND and GRAVEL	Qc	
	Brown slightly silty to silty f-m SAND and slightly silty to silty SAND and GRAVEL	Qc	
	Tan CLAY	Qc	
	Brown well graded, slightly cobbly, fine to coarse sandy GRAVEL, some siltbound material between 266 and 268 ft	Qc	
	Brown f-m SAND and siltbound SAND and GRAVEL	Qc	
	Brown to olive-gray, cobbly SAND and GRAVEL	Qc	
	Brown, siltbound, cobbly SAND and GRAVEL	Qc	
	Brown, well graded, coarse sandy, cobbly GRAVEL	Qc	
	Brown, slightly silty, gravelly, f-m SAND	Qc	
	Grayish-tan SILT	Qc	
	BOTTOM OF BORING		

Note : Geologic log from 0-250 ft based on driller's log. PGG logged hole below 250 ft.

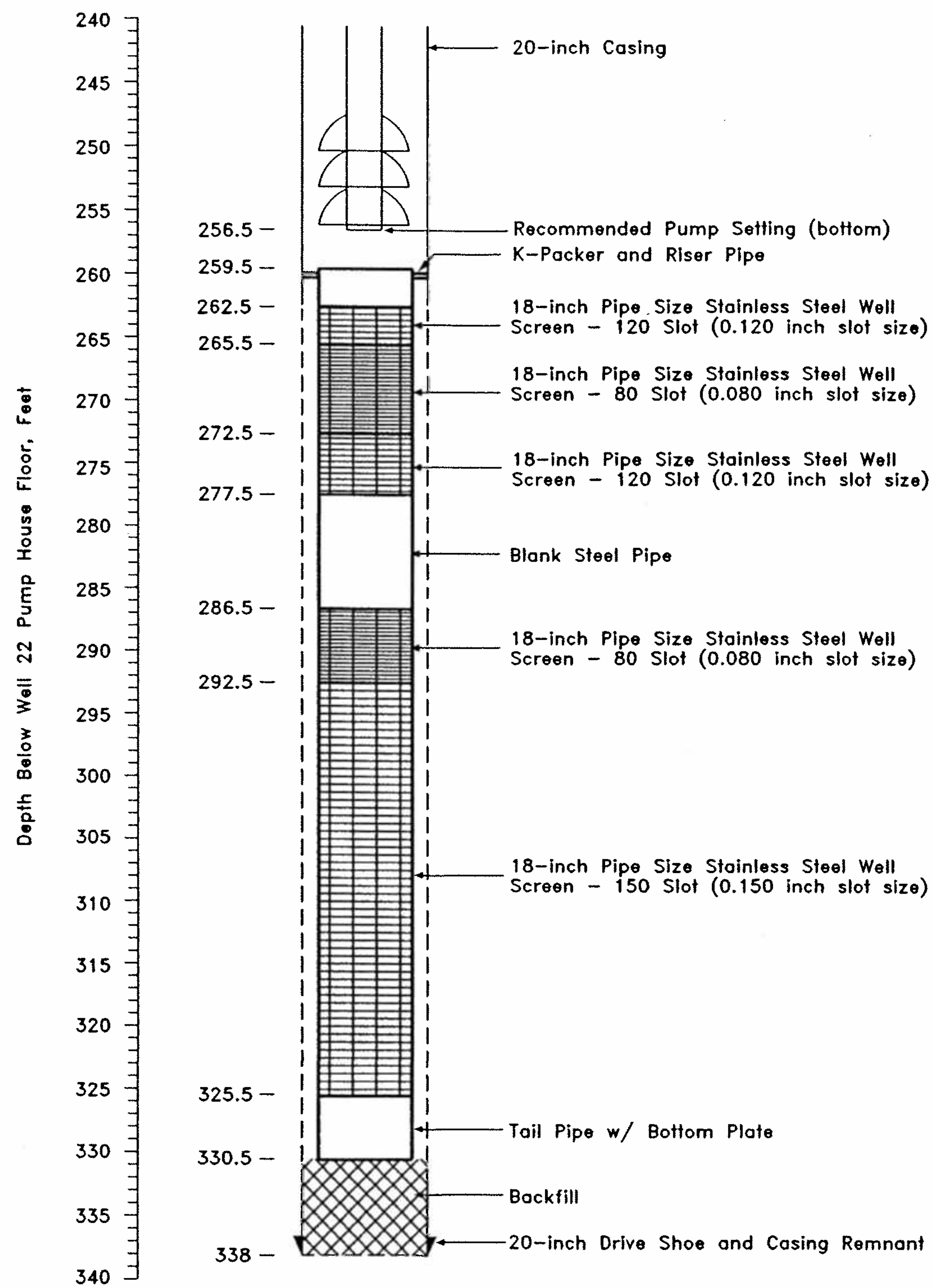
WELL CONSTRUCTION DETAILS



PROJECT NAME: Lacey Groundwater Devel. Program
WELL IDENTIFICATION NUMBER: WELL 23
LOCATION: NW¼ NW¼ Sec. 24 T.18N, R.1W
CONSULTING FIRM: Pacific Groundwater Group
REPRESENTATIVE: Dan Matlock
DATUM: MSL

WATER LEVEL ELEVATION: 40.2 feet msl (approx.)
WATER LEVEL DATE: 6/5/00
START CARD NO.: W124732
UNIQUE WELL ID NO.: AEC-883
DRILLING METHOD: Cable Tool
FIRM: Arcadia Drilling

Well Screen As-Built



Note:
All screen assembly depths are referenced to the floor elevation of Well 22

FIGURE 3
GEOLOGIC LOG AND WELL DESIGN FOR MADRONA PARK WELL 23

Lacey Groundwater Development Program

Pacific Groundwater Group

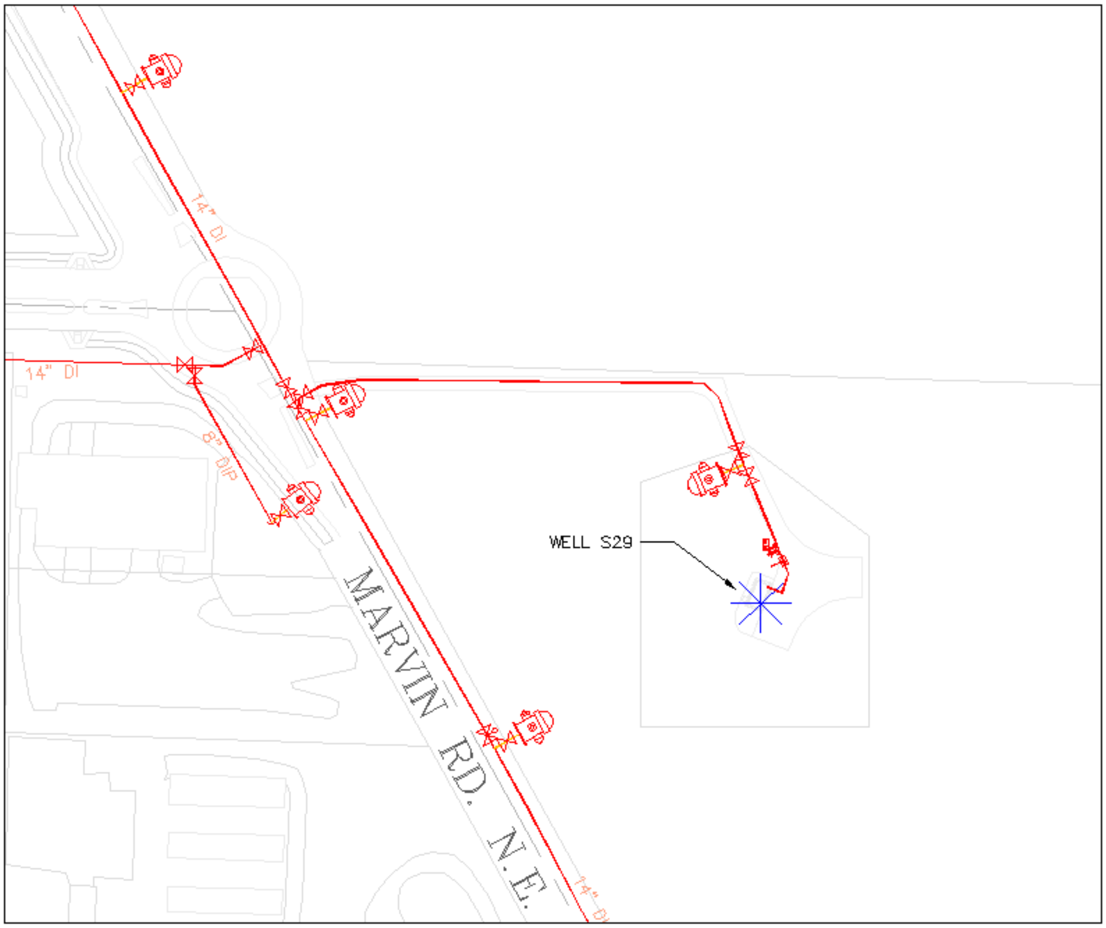
Well S29

(Betti)

Facility Information

Description	Comments
Source #	S29
Address	2950 Marvin Rd. NE
Year On-Line	2005
Pressure Zone	400
Floor Elevation	224.98
Housing	CMU
Pump Type	Turbine
Pump Model	Byron Jackson 11MQH - 10 stages
Pump Shaft Diameter (in)	1.5
Column Diameter/Length	8" column, 280'
Pump Serial #	N/A
Pump Depth (ft)	297
Pump Capacity (gpm)	1000
Motor Model	US Motor VHS 445TP
Motor Serial #	N/A
Motor Speed (rpm)	1770
Horsepower	200
Casing Diameter (in)	20
Well Depth (ft)	390
Casing Depth (ft)	300
Screen	12-inch: 35-slot (293-310, 332-348 ft), 20-slot (354-377 ft), 8x12 Colorado Silica sand
Screen Capacity (gpm)	1098
Aquifer	Qpg
Control Valves	6" 61G-21ABKC 8" 692EG-07ABCSDKC 2-1/2" 50G-01
PSV Setting	110psi @ 1000gpm
PRV Setting (psi)	86
Flow to Waste Setting	156psi @ 765gpm
Flow to Waste Duration (sec)	180
Well Capacity (gpm)	1000
Chlorine Dose (mg/L)	0.82
Reliable Capacity (gpm)	1000
Notes	

Well S29 (Betti)



File Original with Department of Ecology
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Third Copy - Driller's Copy

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WATER WELL REPORT

STATE OF WASHINGTON

Notice of Intent W106926 (Revised)

UNIQUE WELL I.D. # AEC 941

Water Right Permit No. G2-27007

(1) OWNER: Name City of Lacey Address PO Box 3400 Lacey, WA 98509

(2) LOCATION OF WELL: County Thurston NE 1/4 SW 1/4 Sec 2 T 18 N.R. 1 W WM

(2a) STREET ADDRESS OF WELL: (or nearest address) Marvin Rd E. - Lacey

TAX PARCEL NO.:

(3) PROPOSED USE: ☐ Domestic ☐ Industrial ☒ Municipal ☐ Irrigation ☐ Test Well ☐ Other ☐ DeWater

(4) TYPE OF WORK: Owner's number of well (if more than one)
☒ New Well ☐ Deepened ☐ Reconditioned ☐ Decommission
Method: ☐ Dug ☐ Bored ☒ Cable ☐ Driven ☐ Rotary ☐ Jetted

(5) DIMENSIONS: Diameter of well 20" inches
Drilled 394 feet. Depth of completed well 392 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 20" Diam. from +2 ft. to 300 ft.
Welded ☒ Liner installed ☐ 16" Diam. from 243.5 ft. to 293.6 ft.
Threaded ☐ " Diam. from ft. to ft.

Perforations: Yes ☐ No ☒
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☒ No ☐
Manufacturer's Name ALLOY
Type 304 SS Model No.
Diam. 12" Slot size 35 from 293.6 ft. to 309.25 ft.
Diam. 12" Slot size 35 / 30 from 332.1 / 354.9 ft. to 347.9 / 375 ft.
Gravel packed: Yes ☒ No ☐ Size of gravel
Gravel placed from 275 ft. to 392 ft.

Surface seal: ☒ Yes ☐ No To what depth? 80 ft.
Material used in seal bentonite
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name NA
Type: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level 233 ft.
Static level 170 ft. below top of well Date 3/18/05
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? ☒ Yes ☐ No If yes, by whom? Driller; Robinson Noble
step test { Yield: 400 gal./min. with 70 ft. drawdown after 1/2 hrs.
Yield: 800 gal./min. with 40 ft. drawdown after 1/2 hrs.
Yield: 1200 gal./min. with 66 ft. drawdown after 24 hrs.
Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
10min	173.5	84min	170.7		
19min	172.5				
29min	171.6				

Date of test 3/18/05
Bailer test na gal./min. with ft. drawdown after hrs.
Airtest gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water 49.9°F Was a chemical analysis made? ☒ Yes ☐ No

(10) WELL LOG or DECOMMISSIONING PROCEDURE DESCRIPTION
Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. Indicate all water encountered.

MATERIAL	FROM	TO
Topsoil	0	4
Gray Brown till	4	16
Dense gray clay bound gravel w/silty sand	16	190
Medium brown silty sand w/occasional gravel	190	306
Brown medium sand w/some gravel	306	312
Brown sandy silt	312	333
Brown medium sand w/silt layers and some gravel	333	357
Brown sand & gravel	357	382
Brown silt + sand	382	394

12/15/04 - 3/22/05

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Washington State Department of Ecology

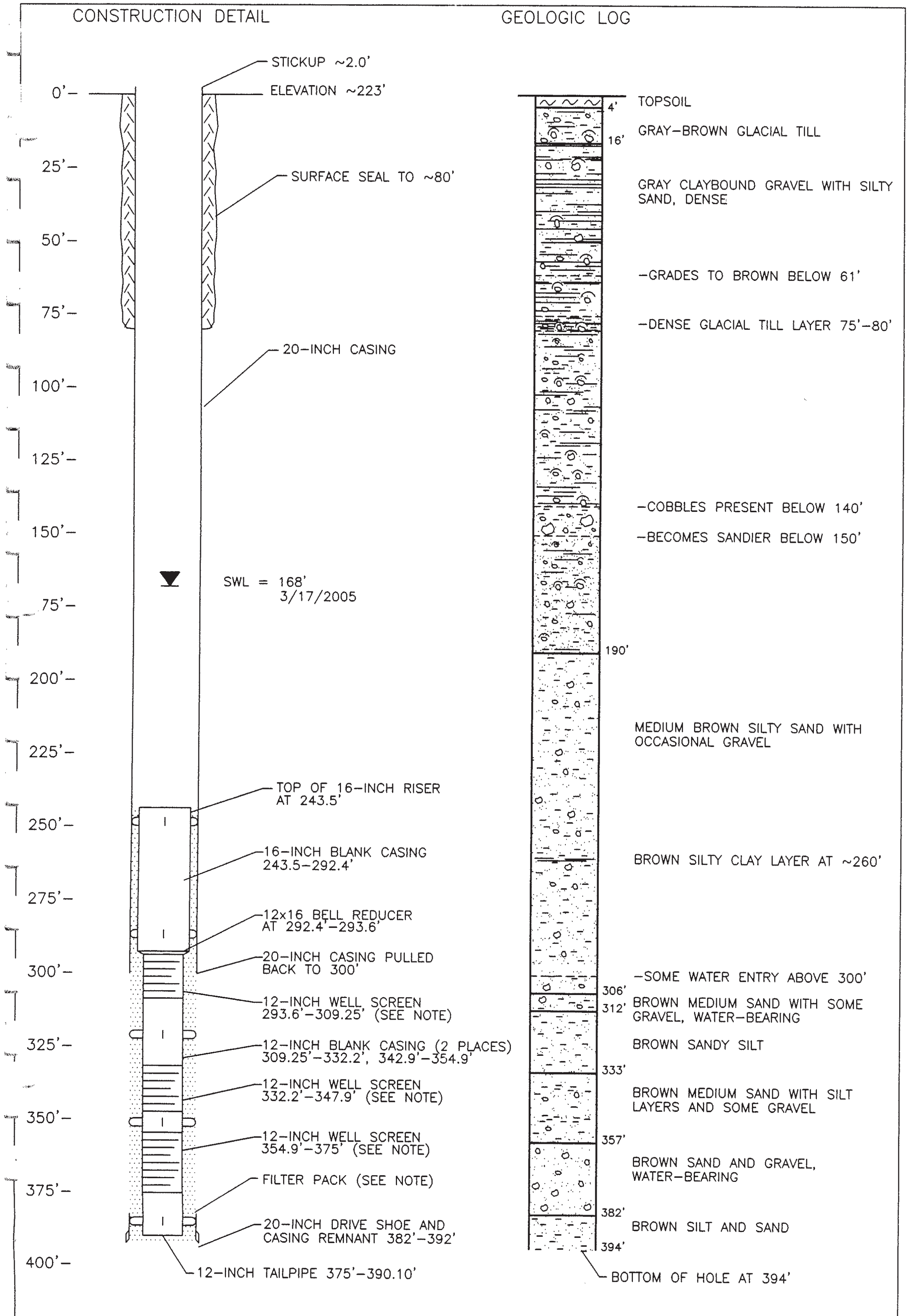
Work Started 12/15/04 Completed 3/22/05

WELL CONSTRUCTION CERTIFICATION:
I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

Type or Print Name Dave Charon License No. 1190 (Licensed Driller/Engineer)
Trainee Name na License No. —
Drilling Company Charon Drilling, Inc
(Signed) Dave Charon License No. 1190 (Licensed Driller/Engineer)
Address 12719-224 St E. Graham, WA 98338
Contractor's Registration No. CHARODI133NF Date 4/15/05

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20 (11/98)



NOTES:
WELL SCREENS AT 293'-310', 332'-348' ARE 35-SLOT (0.035-INCH OPENING) WELL SCREEN AT 354'-377' IS 20-SLOT (0.020-INCH OPENING) ALL ARE 12-INCH PIPE SIZE, STANDARD STAINLESS STEEL, STRENGTH.

FILTER PACK IS 8X12 COLORADO SILICA SAND PRODUCT.

ROBINSON NOBLE SALTBUSH INC.
GROUNDWATER & ENVIRONMENTAL SCIENTISTS

PM: CE
T 18 N/R 1 W - 2
1518-006A
May 2005

Figure 3
Construction Detail and Geologic Log for the Betti Production Well
City of Lacey

Appendix G

OLYMPIA INTERIE AGREEMENT
MEADOWS INTERTIE AGREEMENT

Peter

INTERGOVERNMENTAL AGREEMENT FOR SALE OF WATER

THIS AGREEMENT is made and entered into this 1st day of May, 2007, by and between, the City of Olympia, a Washington municipal corporation ("Olympia"), and the City of Lacey, a Washington municipal corporation ("Lacey"), collectively referred to herein as "the Parties."

WHEREAS, Olympia owns and operates a municipal water supply system; and

WHEREAS, pursuant to RCW 35.92.170, RCW 35.92.200, and RCW 39.34, Olympia is authorized to enter into contracts with another municipality for the supply of water; and

WHEREAS, Olympia and Lacey are parties to an Intergovernmental Agreement for Sale of Water, dated May 4, 1987, under which Olympia provides water to Lacey, and the agreement will expire on June 30, 2007; and

WHEREAS, Lacey desires to continue to purchase wholesale water from Olympia; and

NOW THEREFORE, THE PARTIES AGREE AS FOLLOWS:

Section 1. Termination of Intergovernmental Agreement for Sale of Water

The Intergovernmental Agreement for Sale of Water entered into on May 4, 1987, shall terminate on the date of execution of this agreement, but no later than June 30, 2007.

Section 2. Agreement to Sell Water

Olympia agrees to sell to Lacey and Lacey agrees to purchase from Olympia, an amount of potable water for Lacey, as follows:

A. During the term of the Agreement, Olympia shall supply up to two million gallons per day of water to Lacey during the months of November through June, and up to one million gallons per day of water during the months of July through October.

B. The delivery point at which Olympia will deliver and Lacey will receive said water shall be at the discharge flanges of the meter used to measure the water delivered to Lacey at the system intertie at Pacific Avenue and Mountainaire Road, west of Marvin Road ("Lacey intertie"). Lacey may construct, at its sole expense, additional or alternate delivery points, subject to approval by Olympia and Lacey's demonstration to Olympia that creation of an alternate or additional delivery point will not adversely affect Olympia's supply system.

C. All water provided by Olympia to Lacey will be metered through a master meter owned by the City of Olympia. Olympia will maintain and read the meter for billing purposes under this agreement. The Parties shall have access to the meter for reading purposes and Lacey shall have access to Olympia's meter maintenance records. The existing master meter was installed in 1999. If determined necessary during the term of this agreement, Olympia may purchase and install a replacement meter at its expense. If additional or alternate delivery points are installed under section 2.B, Lacey will purchase and install a master meter at each location that meets a specification provided by Olympia.

D. Lacey shall at its own expense maintain any pump stations necessary to provide water purchased from Olympia to Lacey customers in the Lacey Water System.

E. Olympia may temporarily interrupt or reduce delivery of water to Lacey in event of a loss of supply emergency at Olympia's McAllister Springs or any point upstream of the Lacey intertie, and, if Olympia, acting in good faith, determines that system emergencies or maintenance and repair so require supply interruption. Except for in emergencies, Olympia shall provide Lacey reasonable written notice of interruption or reduction, the reason therefore, and the likely duration thereof at least 8 weeks prior to the anticipated event to allow adequate time for Lacey and Olympia to schedule the curtailment. In the event of any emergency, Olympia will notify Lacey of the need for immediate supply interruption as soon as reasonably possible. For the purposes of this agreement, a loss of supply emergency is defined as any unforeseen supply disruption that will take longer than two (2) hours to resolve. Olympia shall make a good faith effort to perform routine maintenance when system usage is the lowest.

F. The quality of water supplied to Lacey pursuant to this Agreement shall meet or exceed all applicable federal and state rules and regulations governing water quality for Group A water systems. Olympia shall treat the water supplied to Lacey to meet or exceed current and future standards required by State adopted limits.

G. Lacey shall use water purchased under this Agreement solely for subsequent retail sale to customers within the Lacey Water System retail service area as approved by the Washington State Department of Health.

H. If through meter readings Lacey is found to be drawing more that 2 million gallons of water per day during the months of November through June, or more than 1 million gallons per day of water during the months of July through October ("daily maximum") from Olympia's Water System, Olympia may charge Lacey its current retail irrigation customer rate for any use above the daily maximum. If following notice to correct by Olympia, Lacey continues to use more than the daily maximum, Olympia shall have the option to immediately terminate this Agreement.

Section 3. <u>Rate Components</u>

A. The rates for water supply services to be paid by Lacey to Olympia in 2007 shall be a fixed monthly charge of $18,876 plus volume charges of $0.193 per ccf (hundred cubic feet) consumed. These rates have been established to incorporate allocated operating expenses (including city utility tax), capital recovery costs, and a capacity rental charge of 15 percent.

B. For a period of three years following the conclusion of each calendar year, Lacey shall have the right to audit Olympia's cost records associated with this Agreement. Lacey shall retain the consultant and pay the consultant costs associated with performance of any such audits. Olympia shall maintain appropriate accounting records and make them available for inspection by Lacey's auditors.

C. Beginning in 2008 and each calendar year throughout the term of the Agreement, Olympia has the right to annually increase the fixed and volume charges in paragraph A at the same rate as the published Seattle consumer price index.

D. Olympia shall bill Lacey the fixed monthly charge and the calculated volume charges each month, and Lacey shall remit to the City the billed amount within thirty (30) days of the date of the billing. Olympia shall provide Lacey with the actual source meter readings which indicate the exact amount of usage (in ccf) for the month being billed.

Section 4. <u>Review of Rate Components</u>

Olympia shall be responsible for performing future rate studies to adjust Capital Costs, O&M Costs and cost allocation. The Parties agree to amend the fixed charge, volume charge, and capacity rental charge components in Section 3 based on the findings of an updated cost of service study to be completed by Olympia in 2008 or later. The new rates and costs will be effective the calendar year following the completion of the cost of service study. For each calendar year subsequent to such an amendment, section 3 D continues to be applicable.

Section 5. <u>General Conditions</u>

A. No separate legal entity is created by this agreement.

B. No joint organization whatsoever is created.

C. No common budget is to be established.

D. No personal or real property is to be jointly acquired or held.

E. This agreement shall be recorded with the Thurston County Auditor's Office prior to being effective.

F. Each party shall be responsible for its own finances and for its own personal and real property.

G. All lawsuits whatsoever in regards to this agreement shall be brought in Thurston County Superior Court. The governing law shall be the laws of Washington State.

H. The Contract Administrator for Olympia shall be the Director of Water Resources of the City of Olympia, Department of Public Works. The Contract Administrator for Lacey shall be the Water Resources Manager, City of Lacey, Public Works Department.

I. All notices with regard to this agreement shall be sent in addition to any other legal requirement to:

<u>City of Olympia:</u>

Department of Public Works
Attn: Director of Water Resources
Re: Wholesale Water Agreement with City of Lacey
PO Box 1967
Olympia, WA 98507

<u>City of Lacey:</u>

Contract Administrator for City of Lacey
Attn: Water Resources Manager
Re: Wholesale Water Agreement with City of Olympia
P.O, Box 3400
Lacey, WA 98509-3400

J. Lacey shall not assign or convey its interests or obligations under this Agreement without the written consent of Olympia.

Section 6. <u>Indemnification</u>

A. Each of the parties shall indemnify, defend and hold the other party harmless from any loss, claim or liability arising from or out of the negligent or tortuous actions or inactions of the indemnifying party's employees or officers, including the reasonable costs of defense by counsel of the indemnified party's own choosing. Liability shall be apportioned among the parties or other defendants in accordance with the laws of the State of Washington. This paragraph shall survive expiration or termination of this Agreement.

Section 7. <u>Effective Date and Termination</u>

This agreement shall become effective on July 1, 2007, and shall run for a term of 2 years from that date, unless terminated earlier by mutual agreement of the Parties or by Olympia in accordance with Section 2, paragraph H. Lacey shall have the option to renew this agreement for a period of two additional years by providing notice to Olympia at least six months prior to the end of the term.

DATED this 1st day of May, 2007.

CITY OF OLYMPIA

Laura L. Ware

~~Mark Foutch, Mayor~~ Mayor Pro Tem

ATTEST:

Jane Ragland Kirkemo

Jane Ragland Kirkemo, City Clerk

APPROVED AS TO FORM:

Thomas C. Morrill

Tom Morrill, Interim City Attorney

CITY OF LACEY

Greg J. Cuoio

Greg J. Cuoio, City Manager

APPROVED AS TO FORM:

Kenneth R. Ahlf, City Attorney

AMENDMENT No. 1 TO INTERGOVERNMENTAL AGREEMENT FOR SALE OF WATER

THIS AMENDMENT is made and entered into this 1st day of May, 2010 by and between the City of Olympia, a Washington municipal corporation (the "City"), and the City of Lacey, Inc., a Washington municipal corporation ("Lacey"), collectively referred to herein as "the Parties."

Whereas, the Parties entered into an Intergovernmental Agreement for the Sale of Water ("Agreement") on May 1, 2007; and

Whereas, the agreement became effective July 1, 2007; and

Whereas, the Agreement provides in Section 7 that Lacey shall have the option to renew the agreement for a period of two additional years beyond the July 1, 2009 date, by providing notice to Olympia at least six months prior, and they have exercised that option; and

Whereas, under the renewed agreement period, the agreement expires on July 1, 2011; and

Whereas, the City completed a cost of service study in 2008 as required under Section 4 and adjusted rates according to the study effective January 1, 2009 with agreement from Lacey; and

Whereas, the City intends to conduct another cost of service study as part of their next Water System Plan update in 2014; and

Whereas, the Parties have agreed on new terms to be added to sections to Sections 3, 4 and 7 related to Rates, Review of Rate Components, and Effective Date and Termination.

NOW, THEREFORE, The Parties agree that the Intergovernmental Agreement for Sale of Water is **HEREBY** amended as follows:

1. Section 3 of the Agreement, is hereby amended to read as follows:

Section 3. Rate Components

A. The rates for water supply services to be paid by Lacey to Olympia in ~~2007~~ 2010 shall be a fixed monthly charge of ~~$18,876~~ $15,279.13 plus volume charges of ~~$0.193~~ $0.200 per ccf (hundred cubic feet) consumed. These rates have been established to incorporate allocated operating expenses (including city utility tax), capital recovery costs, and a capacity rental charge of 15 percent.

2. Section 4 of the Agreement, is hereby amended to read as follows:

Section 4. Review of Rate Components

Olympia shall be responsible for performing future rate studies to adjust Capital Costs, O&M Costs and cost allocation. The Parties agree to amend the fixed charge, volume charge, and capacity rental charge components in Section 3 based on the findings of an updated cost of service study to be completed by Olympia in ~~2008~~ 2014 or later. The new rates and costs will be effective the calendar year following the completion of the cost of service study. For each calendar year subsequent to such an amendment, section 3 continues to be applicable.

3. Section 7 of the Agreement, is hereby amended to read as follows:

Section 7. Effective Date and Termination

This agreement shall become effective on July 1, 2007, and shall run ~~for a term of 2 years from that date~~ until December 31, 2016, unless terminated earlier by mutual agreement of the Parties or by Olympia in accordance with Section 2, paragraph H. ~~Lacey shall have the option to renew this agreement for a period of two additional years by providing notice to Olympia at least six months prior to the end of the term.~~ In addition to the mutual termination provision, Lacey shall have the option to terminate the agreement before the end of this term with 1 year notice in writing to Olympia.

All remaining provisions of the *Intergovernmental Agreement for Sale of Water* dated May 1, 2007, and not here amended or supplemented shall remain as written in said Agreement, and shall continue in full force and effect.

IN WITNESS WHEREOF, the City and Lacey have executed this **Amendment No. 1** of the Agreement as of the date and year written above.

CITY OF OLYMPIA

By:______________________

Doug Mah
Mayor
P.O. Box 1967
Olympia, WA 98507-1967

APPROVED AS TO FORM:

Tom Morrill, City Attorney

CITY OF LACEY

By:

Greg J. Cuoio
City Manager

APPROVED AS TO FORM:

Ken Ahlf, City Attorney

Shaping our community together

CITY OF LACEY

POST OFFICE BOX 3400
LACEY, WA 98509-3400

May 28, 2009

Steve Hall
City of Olympia
P.O. Box 1967
Olympia, WA 98507-1967

Dear Steve,

As you may recall, the Lacey/Olympia Intergovernmental Agreement for Sale of Water authorizes a two year extension at Lacey's request. Rich Hoey and Peter Brooks discussed Lacey's intent to renew this Agreement several months ago. Rich provided a letter earlier this year establishing rates for 2009 (copy attached). This letter is intended to officially confirm our request for renewal of the Agreement through June, 2011.

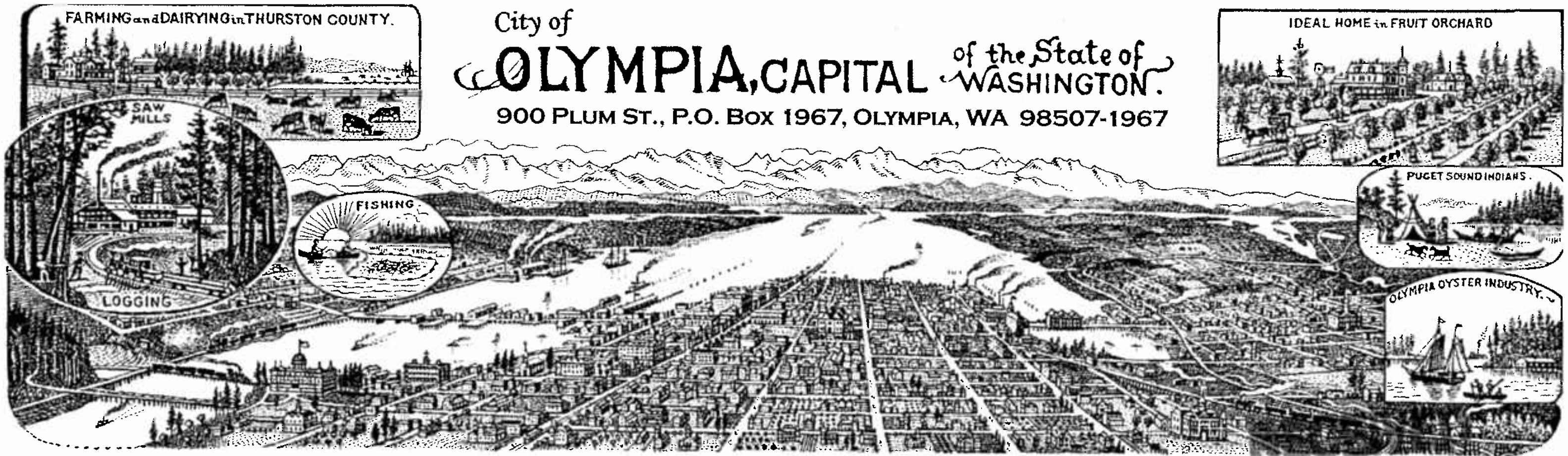
It is my understanding that this letter of intent and a letter of acknowledgement from Olympia are sufficient to extend the Agreement. If you have any questions about this matter, please do not hesitate to contact me at (360) 438-2629.

Sincerely,

G Cuoio

Greg Cuoio
City Manager

Cc:	Rich Hoey,	Olympia Water Resources Manager
	Ken Ahlf,	Lacey City Attorney
	Scott Egger,	Lacey Public Works Director
	Peter Brooks,	Lacey Water Resources Manager



City of OLYMPIA, CAPITAL of the State of WASHINGTON.
900 PLUM ST., P.O. BOX 1967, OLYMPIA, WA 98507-1967

This letterhead is a replica of 1899 City of Olympia letterhead, which we are using in commemoration of the City's 150th Anniversary.

RECEIVED
JUN 24 2009
PUBLIC WORKS

June 18, 2009

Greg Cuoio
City of Lacey
420 College Street
P.O. Box 3400
Lacey WA 98509-3400

Dear Greg:

This letter acknowledges receipt of your May 28, 2009 letter requesting a two-year extension of the Lacey/Olympia Intergovernmental Agreement for Sale of Water (Agreement) through June 2011. Your request is provided for in the Agreement and will be implemented by the City of Olympia such that the Agreement will be extended through June of 2011. Thank you for your cooperation earlier this year in establishing rates for 2009.

Sincerely,

Steven R. Hall
City Manager

SH:TM:kap

cc: Rich Hoey, Olympia Water Resources Manager
Ken Ahlf, Lacey City Attorney
Scott Egger, Lacey Public Works Director
Peter Brooks, Lacey Water Resources Manager

sh09-36c

PURCHASE AND SALE AGREEMENT
FOR THE WATER SERVICE AREA, WELL SITE, EASEMENTS AND WATER RIGHTS

THIS AGREEMENT is made and entered into this 30th day of Nov. 1995, by and between the City of Lacey, a municipal corporation, hereinafter called "Lacey" and the Meadows Water Company, Inc., a Washington corporation, hereinafter called "Meadows".

BACKGROUND

Lacey and Meadows agree the following recitals are material to the understanding of this agreement:

A. Meadows maintains a water service area designated in the Thurston County Coordinated Water System Plan (See Exhibit "A"). This area includes substantially all of the area encompassed by the preliminary plat of Madrona Park (See Exhibit "B") and is subject to the conditions of service described by Meadows in a letter to the developer dated April 29, 1994 (See Exhibit "C").

B. Meadows does not own any property rights in the area encompassed by the Madrona Park preliminary plat except those rights and responsibilities it has as a designated water purveyor pursuant to the Thurston County Coordinated Water System Plan, the Public Water System Coordination Act, RCW 70.116, and the Thurston County preliminary plat approval for Madrona Park, Case No. 524.

C. Lacey has drilled a test well in the Madrona Park preliminary plat area and has found the site has the potential for one or two wells each with a production capacity of 500 to 1,000 gallons per minute. In addition, the Madrona Park preliminary plat area is approved for about 400 lots and a school site and Lacey will be entitled to charge general facility charges for each water hookup during the development of Madrona Park after this area is transferred to the Lacey water service area.

D. Meadows owns a non-operating well hereinafter called "Well No. 7" which is located in Open Space/Community Area Tract "A" of the plat of the Ridge, Division 2, as approximately shown in the attached plat map (See Exhibit "D"). This well site is subject to a 100-foot radius protective covenant that is recorded under Thurston County Auditor File No. 9202030154 (See Exhibit "E").

E. Lacey wishes to purchase the Well No. 7 well site from Meadows and certain waterline easements to allow Lacey to connect Well No. 7 to its existing watermain on Steilacoom Road. It is anticipated Well No. 7 will produce at least 440 gallons per minute (gpm) which will be determined by Lacey at its cost prior to closing. As part of the installation of the permanent well by Lacey, Lacey shall install a meter to measure the water withdrawn from said well. Meadows shall have the right to monitor such meter, however, Meadows shall not protest any production from said well which exceeds that production covered by the water right purchased herein, the water right purchased as a result of the option granted herein, or production that is possible because of additional water rights obtained by Lacey from sources other than the Meadows unless Meadows can scientifically demonstrate that such additional production will detrimentally impact production from wells owned by Meadows which exist on the date of this agreement and are used to supply the service area designated for Meadows.

F. It is not intended by either party that the sale of the Well No. 7 well site will in any way change the Meadows service area. Lacey will not negotiate any agreement with Janette Wentjar and/or her successors in interest in order to obtain a waterline easement that will be conditioned upon said property being changed from the Meadows to the Lacey Water Service Area.

G. Meadows owns the following property rights in the Ridge, Division 2, as established in the plat of the Ridge, Division 2 recorded under Thurston County Auditor File No. 9202210021:

> The water distribution system in this subdivision is owned by the Meadows Water Company, Inc., its successors and assigns. A perpetual, non-exclusive easement is granted to the Meadows Water Company, Inc., it successors and assigns, over, under and across all of the following designated areas on the final plat of the Ridge, Division 2: "Open Space/Community Area" tracts; "Park Area" tracts; "Street", Right-of-Ways; and "Drainage", "Path", and "Sanitary Sewer" easement premises for the purpose of constructing, installing, operating, maintaining and replacing water lines, mains, wells, pumps, hydrants and all other water system appurtenances necessary for the proper operation of a municipal type water system. All water rights in this subdivision are owned by the Meadows Water Company, Inc.

H. Lacey desires easement rights for a waterline to connect Well No. 7 with its existing watermain on Steilacoom Road. Meadows will provide a 15-foot wide waterline easement from Well No. 7 to Deerbrush Drive and the north boundary of the Ridge, Division 2, subdivision within the "Open Space/Community Area Tract A" of the Ridge, Division 2 and "Open Space/Community Area Tract A" of the Meadows, Division 3-D, to Well No. 7 as legally described in the attached Exhibit "F".

I. Meadows owns the following property rights in"Open Space/Community Tract A" of the Meadows, Division 3-D, recorded under Thurston County Auditor File No. 8502050091 and 8502080050 respectively:

> <u>AF #8502050091</u>
> Easement rights granted to the Meadows Water Supply Company for the maintenance, operation and construction of water facilities.
>
> <u>AF #8502080050</u>
> All water rights to the properties. All improvements and facilities built or to be built by the Meadows Water System for whatever purpose deemed necessary by the Grantor (i.e. Hodges Homes, Inc., whose successor is Meadows Water Company, Inc. per Deed filed under Thurston County Auditor File No. 8709300032). An easement for the maintenance, repair, operation and construction of improvements

and water facilities for the benefit of the Meadows Water System as deemed necessary by the Grantor (i.e. Hodges Homes, Inc., whose successor is Meadows Water Company, Inc. per Deed filed under Thurston County Auditor File No. 8709300032.)

J. In addition to the easement rights for a waterline to connect Well No. 7 as described above, Meadows will provide Lacey a "construction license" for the period from the date closing of this agreement until May 1, 1997 to use open space areas described above for the purpose of making Well No. 7 operable and constructing and installing the necessary waterlines and other necessary appurtenances to connect Well No. 7 to its existing water system. This "construction license" shall not exceed the scope of rights granted to the Meadows for use of the open space areas and Lacey agrees to indemnify and hold Meadows harmless from any claims, suits, actions, damages or liability whatsoever which relates to work that will be done by Lacey and/or its agents on these open space areas and agrees to reimburse the Meadows for any damages to its facilities and/or equipment caused by Lacey and/or its agents. Further, Lacey shall indemnify and hold the Meadows and the fee owners of the open space areas from and against any mechanic's or other liens or claims that may be filed or asserted against the properties or Meadows or the fee owners of the properties by any actions taken by Lacey and/or its agents in connection with its use of the properties.

K. Meadows desires an 8" waterline intertie between its water system and the water distribution system that will be installed in the Madrona Park plat. This intertie shall be installed as part of the construction of the Madrona Park distribution system and at no cost to Meadows adjacent watermain at Shadberry Drive. The purpose of this intertie will be to provide emergency water supplies to either system and to allow for the sale of water from either Lacey or the Meadows to the other. This intertie is material to this agreement because it assures Meadows it will have immediate access to water in the event Lacey's use of Well No. 7 reduces the water supply to the wells used by Meadows to supply its customers. Lacey agrees it will sell water on an emergency basis to the Meadows in the event Meadows requires this water due to a scientifically demonstrated reduction in its water supply as a result of Lacey's use of Well No. 7 or on a temporary basis not exceeding ten (10) days to allow Meadows to maintain its system. The rate charged in such case shall be in accordance with rates charged by Lacey to other water purveyors. Upon mutual agreement, both parties may use the intertie to sell water or purchase water, as the case may be.

AGREEMENT

Lacey and Meadows agree:

1. Meadows agrees to sell and Lacey agrees to purchase the following assets of the Meadows Water Company, Inc.:

   A. That certain well and well site known as Well No. 7 and located within "Open Space/Community Area Tract A" of the Ridge, Division 2 (See Exhibit "D"). Said well site shall include a well site protection easement lying within a circle having a radius of 100 feet, with the center of said circle being the actual well (See Exhibit "E"). Said center point shall be the well as it exists at the date of this agreement or as it shall be relocated by Lacey within 20 feet of its current location. (Note: To ensure a 100 foot radius the well must be relocated either directly north or directly south of the existing well.) The easement shall include a restriction against the storage, disposal or application in the easement area of any source of contamination without the written permission of Lacey.

B. Distribution easements from Well No. 7 to Deerbrush Drive and to the north boundary of the Ridge, Division 2 subdivision. A construction license from Meadows to Lacey described in and subject to the terms and conditions in paragraph "J" above. Legal descriptions of the real property constituting the well site, the well protection easement and easements for distribution lines shall be attached hereto as Exhibit "F".

C. Rights of the Meadows to withdraw water associated with Well No. 7 to the extent of 440 gallons per minute (gpm) but no more than 132 acre feet of water per year represented under Water Rights Permit No. G 2-26623 P issued by the Department of Ecology with a priority date of November 29, 1984.

D. All service area rights granted to or designated for the Meadows Water Company, Inc. over the real property within the Preliminary Plat of Madrona Park. Said real property is legally described on Exhibit "B", attached hereto and made a part hereof.

2. Meadows shall, upon closing, convey said assets to Lacey by bill of sale, warranty deed, assignment or appropriate instrument either directly or by other appropriate parties, conveying clear title to all assets free of any encumbrances, taxes, whether assessed now or in the future for periods of time prior to closing and any other lien or encumbrance against the assets whatsoever. In addition, the Meadows shall provide any necessary approvals to the assignment of easements, franchises, water rights or other assets to be conveyed or assigned. Meadows shall provide title insurance insuring that the title to said assets is free and clear as set forth in this paragraph and by signing this agreement, authorizes Lacey to order preliminary commitment for said title insurance.

3. The purchase price shall be Three Hundred Seventy-Five Thousand Dollars ($375,000), which sum shall be paid by Lacey to Meadows upon closing. The purchase price shall be full compensation for all assets purchased herein and for all commitments and agreement made by Meadows as part of this agreement with exception of the option granted to Lacey for the purchase of additional water rights as set forth subsequent hereto.

4. Meadows shall not protest, object to or in any other manner hinder the granting to Lacey of a permit or permits for the withdrawal of water from wells located or to be located within the preliminary plat of Madrona Park, more fully described on Exhibit "B" provided the withdrawals do not exceed 2,000 gpm and 1,200 acre feet of water per year.

5. Lacey shall not protest, object to or in any other manner hinder the granting to the

Meadows of a permit or permits for the withdrawal of water from wells located or to be located within the Meadows Service Area, excluding the Madrona Park Preliminary Plat Area, more fully described in Exhibit "A" unless Lacey can scientifically demonstrate that such additional production will detrimentally impact production from Well No. 7 being purchased by Lacey pursuant to this agreement. Provided, however, the total of such withdrawal or withdrawals shall not exceed 2000 gpm and 630 acre feet of water per year reduced by the amount of the "gpm" and "acre feet" of water right purchased under this agreement by Lacey.

6. Lacey, as a condition of service of providing water to the area encompassed by the preliminary plat of Madrona Park, shall require the owners or developers of the property to install an eight inch (8") waterline intertie to the existing Meadows watermain adjacent to Madrona Park at Shadberry Drive. The intertie will be installed at no cost to Meadows and shall contain a gate valve and meter and be used for the purposes described above in paragraph "K".

7. This agreement is contingent upon the following:

   A. The testing of Well No. 7 by Lacey resulting in at least 440 gpm capacity for said well and water quality sufficient to pass Washington State Department of Health potable water standards without treatment;

   B. The testing of Well No. 7 by Lacey indicating to Meadows that production of 440 gpm from Well No. 7 will not detrimentally impact other existing Meadows' wells; and

   C. A grant of permission by Puget Sound Power and Light for Lacey to construct a well house upon said Well No. 7 and under power lines belonging to Puget Power.

   D. The obtaining by Meadows of a written release of liability signed by the owners and/or developers of Madrona Park releasing the Meadows and Lacey from any liability as a result of the transfer of the Madrona Park Service Area from the Meadows to Lacey.

8. Meadows further grants unto Lacey the option to purchase up to an additional 200 gpm of water rights under existing Water Rights Permit or Permits held by Meadows and issued by the Department of Ecology. Such permitted water rights shall be capable of being utilized by Lacey in conjunction with production from Well No. 7. Said option shall be exercised by Lacey within one year after the date of closing of the purchase and sale called for herein by mailing a letter exercising the option to Meadows Water Company, Inc., c/o Nick Adams at 7852 Delphi Rd S.W., Olympia, Washington 98512-2158. Within 10 days of exercising said option, Lacey shall pay to Meadows a sum of $125.00 for each gallon per minute of withdrawal rights purchased which exceeds the original 440 gpm purchase called for in this agreement. Each one (1) gpm purchased will be subject to a three-tenths (3/10) of one acre feet

of water per year production limit or a maximum of sixty (60) acre feet of water per year in the event 200 gpm are purchased. At time of payment, Meadows shall provide Lacey the appropriate instruments of transfer for said asset free of any encumbrances and taxes, including any necessary governmental approvals for said transfer.

9. The date of closing of the purchase and sale set forth herein shall occur within thirty (30) days after the contingencies set forth in paragraph 7 are met. If said contingencies have not been satisfied prior to March 1, 1996, or otherwise waived by Lacey or Meadows, as the case may be, this agreement shall be null and void. In the event the closing date is scheduled prior to January 1, 1996 under the terms herein, Meadows shall be entitled to extend closing to on or before January 15, 1996.

DATED the day and date first above written

CITY OF LACEY:

~~BY:~~ ______________________
City Manager

Approved as to form:

BY: ______________________
Lacey City Attorney

MEADOWS WATER COMPANY, INC.:

BY: *James W. Hodges*
James W. Hodges, President

BY: *Nicholas Adams*
Nicholas Adams, Secretary

STATE OF WASHINGTON)
) ss.
County of Thurston)

On this day personally appeared before me JAMES W. HODGES and NICHOLAS ADAMS, to me known to be the President and Secretary, respectively, of the corporation that executed the within and foregoing instrument, and acknowledged the said instrument to be the free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned, and on oath stated that they were authorized to execute the said instrument.

GIVEN under my hand and official seal this 30th day of November, 1995.

____

____
NOTARY PUBLIC in and for the State of Washington, residing at Olympia
My Commission Expires: 9/1/99

Addendum to
PURCHASE AND SALE AGREEMENT
for the
WATER SERVICE AREA, WELL SITE, EASEMENTS AND WATER RIGHTS
1-11-96

THIS ADDENDUM is made January 11, 1996 by and between the MEADOWS WATER COMPANY, INC., JAMES W. HODGES and KEITH HODGES, as the seller, and the CITY OF LACEY, as the purchaser, for a certain water service area, well site, easements and water rights described in an agreement signed November 30, 1995 by the officers of the Meadows Water Company, Inc. (attached hereto as Exhibit "A" and incorporated herein by reference).

This addendum incorporates and ratifies the above referenced agreement in Exhibit "A" (hereinafter referred to as the "agreement") but modifies it as follows:

1. The ownership of certain assets listed in said agreement as owned by the Meadows Water Company, Inc. are in fact owned by James W. Hodges and Keith Hodges. These assets include the following:

   a. Rights of the Meadows to withdraw water associated with Well No. 7 to the extent of 440 gallons per minute (gpm) but no more than 132 acre feet of water per year represented under Water Rights Permit No. G2-26623 P issued by the Department of Ecology with a priority date of November 29, 1984 (see item "C" on page of 4 of the agreement).

   b. All service area rights granted to or designated for the Meadows Water Company, Inc. over the real property within the Preliminary Plat of Madrona Park. Said real property is legally described on Exhibit "B" of the agreement (see item "D" on page 4 of the agreement).

   c. Rights to an additional 200 gpm of water rights under existing Water Rights Permit or Permits held by the Meadows Water Company, Inc. and issued by the Department of Ecology (see item "8" on page 8 of the agreement).

2. The purchase price of the assets described in the agreement, including items "a" and "b" above, shall be $375,000.00, which sum shall be paid by Lacey to the Meadows Water Company, Inc., James W. Hodges and Keith Hodges upon closing. Said price shall be allocated as follows:

Well No. 7	-	$ 12,500 (payable to the Meadows)
Item "a" above	-	$ 55,000 (payable to J.W. and K. Hodges)
Well No. 7 Easements	-	$ 1,500 (payable to the Meadows)
Item "b" above	-	$306,000 (payable to J.W. and K. Hodges)
		$375,000

3. In the event Lacey exercises its option described in item "8" on page 5 of the agreement for the purchase of up to an additional 200 gpm of water rights at the rate of $125.00 per 1 gpm of water rights, the purchase price shall be paid to J.W. Hodges and K. Hodges.

4. All other terms and conditions of the agreement shall remain the same and in force.

CITY OF LACEY:

BY: ______________________
City Manager

Approved as to form:

BY: ______________________
Lacey City Attorney

MEADOWS WATER COMPANY, INC.

BY: ______________________
Keith Hodges, President

BY: ______________________
Nicholas Adams, Secretary

James W. Hodges By Keith Hodges As his Attorney in fact
James W. Hodges

____
Keith Hodges

MWCagrad.016

Transfer of Water Rights & Service Area

THIS INSTRUMENT is made this 11th day of July, 1996, by and between **JAMES W. HODGES**, hereinafter called "JWH", **KEITH HODGES**, hereinafter called "KH" and the **CITY OF LACEY**, a municipal corporation, hereinafter called "Lacey".

The following recitals of fact are a material part of this instrument:

A. On January 1, 1995, the Meadows Water Company, Inc. transferred the ownership of certain properties known as "Water Rights for Well No. 7" and "Madrona Park Water Service Area" to its stockholders James W. Hodges and Keith Hodges. The property transferred is described as follows:

Water Rights for Well No. 7:

Rights of the Meadows to withdraw water associated with Well No. 7 to the extent of 440 gallons per minute (gpm) but no more than 132 acre feet of water per year represented under Water Rights Permit No. G2-26623 P issued by the Department of Ecology with a priority date of November 29, 1984. Plus, rights to an additional 200 gpm of water rights, subject to a maximum of sixty (60) acre feet of water per year production, for use at Well No. 7, under existing Water Rights Permit or Permits held by the Meadows Water Company, Inc. and issued by the Department of Ecology.

Madrona Park Water Service Area:

All service area rights granted to or designated for the Meadows Water Company, Inc. as a designated water purveyor pursuant to the Thurston County Coordinated Water System Plan, the Public Water System Coordination Act, RCW 70.116, and the Thurston County preliminary plat for Madrona Park, Case No. 524, over the real property within the Preliminary Plat of Madrona Park.

B. Pursuant to a "Purchase and Sale Agreement for the Water Service Area, Well Site, Easements and Water Rights", dated November 30, 1995, and "Addendum to Purchase and Sale Agreement for the Water Service Area, Well Site, Easements and Water Rights" dated January 11, 1996, between Lacey, as purchaser, and Meadows, JWH and KH, as sellers, it was agreed JWH and KH would sell to Lacey the water rights (440 gpm) associated with Well No. 7 and the water service area for the Madrona Park Preliminary Plat and that the Meadows would sell a portion of its easement rights in Tract A of the Ridge, Division 2, Tract A of the Meadows, Division 3-D and Lot 211 of the Meadows, Division 3-A and the well site in the "Open Space/Community Area Tract "A" of the Ridge, Division 2 known as "Well No. 7". Also included was a 100 foot radius well protection covenant area surrounding "Well No. 7" in the Ridge Open Space Property.

NOW, THEREFORE, in consideration of the above and other valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the following transfers are made:

AGREEMENT

1. TRANSFER OF WATER RIGHTS. JWH and KH hereby quit claim, grant, sell, transfer and deliver to Lacey, its successors and assigns, the following:

> Water Rights for Well No. 7:
>
> Rights of the Meadows Water Company, Inc. to withdraw water associated with Well No. 7 to the extent of 440 gallons per minute (gpm) but no more than 132 acre feet of water per year represented under Water Rights Permit No. G2-26623 P issued by the Department of Ecology with a priority date of November 29, 1984.

JWH and KH represent that they are the lawful owners of the above water rights and that they have good right to sell said rights and will warrant and defend the rights against lawful claims and demands of all persons.

2. TRANSFER OF WATER SERVICE AREA. JWH and KH hereby quit claim, grant, sell, transfer and deliver to Lacey, its successors and assigns, the following:

> Madrona Park Water Service Area:
>
> All service area rights granted to or designated for the Meadows Water Company, Inc. as a designated water purveyor pursuant to the Thurston County Coordinated Water System Plan, the Public Water System Coordination Act, RCW 70.116, and the Thurston County preliminary plat for Madrona Park, Case No. 524, over the real property within the Preliminary Plat of Madrona Park.

JWH and KH represent that they are the lawful owners of the above water service area and that they have good right to sell said service area and will warrant and defend the right against lawful claims and demands of all persons.

3. CONSTRUCTION. The rule of strict construction does not apply to this instrument. The transfer of title and rights and other provisions of this instrument shall be given a reasonable construction so that the intention of the parties herein is carried out.

4. SURVIVAL OF PURCHASE AND SALE AGREEMENT AND ADDENDUM THERETO. Except as this instrument partially fulfills that certain Purchase and Sale Agreement for the Water Service Area, Well Site, Easements and Water Rights between the parties dated November 30, 1995 and the Addendum to Purchase and Sale Agreement for the Water Service Area, Well Site, Easements, and Water Rights dated January 11, 1996, said Agreement, the Addendum thereto, and the rights and obligations set forth therein, shall remain valid and binding and shall survive the closing and transfer contemplated by this instrument.

IN WITNESS WHEREOF, the undersigned, are parties to this instrument.

MEADOWS WATER COMPANY, INC.*

By: Keith Hodges
Its President

By: Nicholas Adams
Its Secretary

CITY OF LACEY

By: [signature]
Its City Manager

Approved as to form:

By: [signature]
Its City Attorney

HODGES HOMES, INC.*

By: Keith Hodges
Its President

By: Nicholas Adams
Its Secretary

JAMES W. HODGES

James W. Hodges
Seller

KEITH HODGES

Keith Hodges
Seller

* These parties confirm and ratify the ownership of James W. Hodges and Keith Hodges of the properties transferred by JWH and KH to Lacey in this instrument.

MWCwater.066

STATE OF WASHINGTON)
)SS:
COUNTY OF THURSTON)

ON this 11th day of July, before me, the undersigned, a Notary Public in and for the State of Washington, duly commissioned and sworn, personally appeared Keith Hodges and Nicholas Adams, to me known (or proven on the basis of satisfactory evidence) to be the President and Secretary, respectively of Meadows Water Co Inc, a Washington corporation, the corporation that executed the within and foregoing instrument, and acknowledged said instrument to be the free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned, and on oath stated they were authorized to execute said instrument and that the seal affixed, if any, is the corporate seal of said corporation.

Given under my hand and official seal this 11th day of July, 1996.

Terecia A Hart
Notary Public in and for the State of Washington, residing at Olympia
Print Name: Terecia A. Hart
My Commission Expires 9/1/99

STATE OF WASHINGTON)
)SS:
COUNTY OF THURSTON)

ON this 11th day of July, before me, the undersigned, a Notary Public in and for the State of Washington, duly commissioned and sworn, personally appeared Keith Hodges and Nicholas Adams, to me known (or proven on the basis of satisfactory evidence) to be the President and Secretary, respectively of Hodges Homes Inc, a Washington corporation, the corporation that executed the within and foregoing instrument, and acknowledged said instrument to be the free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned, and on oath stated they were authorized to execute said instrument and that the seal affixed, if any, is the corporate seal of said corporation.

Given under my hand and official seal this 11th day of July, 1996.

Terecia A Hart
Notary Public in and for the State of Washington, residing at Olympia
Print Name: Terecia A. Hart
My Commission Expires 9/1/99

STATE OF WASHINGTON)
)SS:
COUNTY OF THURSTON)

ON this 23rd day of July, before me, the undersigned, a Notary Public in and for the State of Washington, duly commissioned and sworn, personally appeared Greg J. Cuoio and —, to me known (or proven on the basis of satisfactory evidence) to be the City Manager ~~and~~ _____, ~~respectively~~ of The City of Lacey, a municipal corporation, the corporation that executed the within and foregoing instrument, and acknowledged said instrument to be the free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned, and on oath stated ~~they were~~ he was authorized to execute said instrument and that the seal affixed, if any, is the corporate seal of said corporation.

Given under my hand and official seal this 23rd day of July.

Notary Public ~~in and~~ for the State of Washington, residing at ~~Olympia~~ Lacey
Print Name: Kenneth D. Hall
My Commission Expires 8-27-96

STATE OF WASHINGTON)
) ss.
County of Thurston)

On this 11th day of July, before me, the undersigned, a Notary Public in and for the State of Washington, duly commissioned and sworn, personally appeared James W. Hodges
to me known to be the individual_ described in and who executed the foregoing instrument, and acknowledged to me that _he_ signed and sealed this said instrument as his free and voluntary act and deed for the uses and purposes therein mentioned.

Given under my hand and official seal this 11th day of July, 1996

Notary Public in and for the State of Washington residing at Olympia
My commission expires 9/1/99.

STATE OF WASHINGTON)
) ss.
County of Thurston)

On this 11th day of July, before me, the undersigned, a Notary Public in and for the State of Washington, duly commissioned and sworn, personally appeared Keith Hodges
to me known to be the individual_ described in and who executed the foregoing instrument, and acknowledged to me that _he_ signed and sealed this said instrument as his free and voluntary act and deed for the uses and purposes therein mentioned.

Given under my hand and official seal this 11th day of July, 1996.

Notary Public in and for the State of Washington residing at Olympia.
My commission expires 9/1/99.

Appendix H

THURSTON COUNTY COORDINATED WATER SYSTEM PLAN AND AREA WIDE SUPPLEMENT

THURSTON METROPOLITAN AREA

COORDINATED WATER SYSTEM PLAN FOR WATER SUPPLY RESERVATION

MAY 1982

ECONOMIC AND ENGINEERING SERVICES INC.

THURSTON METROPOLITAN AREA

Coordinated Water System Plan for Water Supply Reservation

April 1982

Prepared for

City of Lacey

Don Hertzog - City Engineer
Doug Zenor - Public Works Director

City of Olympia

Len Esteb - Utilities Director
Tom Frare - Assistant Utilities Director

City of Tumwater

John Cunningham - City Engineer
Doug Johnston - Assistant City Engineer

Prepared By

ECONOMIC & ENGINEERING SERVICES, INC.
P. O. Box 976
Olympia, WA 98507
(206) 352-5090

ECONOMIC AND ENGINEERING SERVICES, INC.
Management Consultants
P.O. Box 976 • 2617 12th Court S.W.
Olympia, Washington 98507
(206) 352-5090

April 13, 1982

File No.

Mayor Mark Brown, City of Lacey
Mayor Lyle Watson, City of Olympia
Mayor Wesley Barcliff, City of Tumwater
Chairman Karen Fraser, Thurston County Commissioners

Subject: Coordinated Water System Plan for Thurston Metropolitan Area

Gentlemen:

Economic and Engineering Services, Inc. (EES) is pleased to present this report and Petition for Reservation of Public Waters for the Thurston County Metropolitan Area. The report represents the first petition to reserve water for future public water supply needs under the provisions of the Water Resources Act of 1971.

The three cities of Lacey, Olympia, and Tumwater, in cooperation with Thurston County, have taken a significant and far-reaching action which will ensure that the future water supply needs of the urban area will be met in a cost-effective manner. When completed, this reservation process will become an integral part of the urban area utility support and resource management program essential to the economic future of the area. The administrative system provided for in the Public Water System Coordination Act will guide the formulation of the essential interlocal water utility management system that now needs to be developed to complement the reservation process.

EES is pleased to have participated in the development of this project and to be a part of this progressive step by the three major water utilities in the Thurston Metropolitan Area.

Sincerely,

R.L. Wubbena

R. L. Wubbena, P.E.
President

RLW:slc

Enclosure

ACKNOWLEDGEMENTS

In addition to representatives from the Cities of Lacey, Olympia, and Tumwater, the following organizations and individuals provided valuable information and were key participants in the evaluation and review processes during the development of this report.

Department of Ecology

Walter Bergstrom
Jerry Louthain
Bill Miller
Gene Wallace

Department of Social & Health Services

Jim Hudson
Alan Rowe
Rich Siffert

Thurston County Human Services Department

Don Leaf

Thurston County Public Works

Jerry Hendricks
Al Williams

Thurston County Regional Planning Council

Linda Hoffman

CERTIFICATE OF ENGINEER

COORDINATED
WATER SYSTEM PLAN
FOR
WATER SUPPLY RESERVATION

May 1982

The technical material and data contained in this report were prepared under the supervision and direction of the undersigned. Economic and Engineering Services, Inc. is licensed to practice as professional engineers as attested by the seals affixed below.

ROBERT L. WUBBENA
STATE OF WASHINGTON
11752
REGISTERED
PROFESSIONAL ENGINEER

Robert L. Wubbena, P.E.
President
ECONOMIC AND ENGINEERING
SERVICES, INC.

JOHN M. MAXWELL
STATE OF WASHINGTON
REGISTERED
PROFESSIONAL ENGINEER · 17925

John M. Maxwell, P.E.
Vice President
ECONOMIC AND ENGINEERING
SERVICES, INC.

Robert J. McCabe, E.I.T.
Senior Engineer
ECONOMIC AND ENGINEERING
SERVICES, INC.

Thurston Metropolitan Area
Coordinated Water System Plan
for
Water Supply Reservation

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SECTION I

SECTION I

SUMMARY AND RECOMMENDATIONS

1. Introduction

The Thurston Metropolitan Area of Lacey, Olympia, and Tumwater (Tri-Cities) is located in the north-central portion of Thurston County (County), at the southernmost tip of Puget Sound. The County in general, and Thurston Metropolitan Area in particular, have experienced significant growth in the recent past due to the attractive economic, climatological, and geographical characteristics of the area. This growth trend is expected to continue in the future.

Due to this anticipated growth, the Cities of Lacey, Olympia, and Tumwater have undertaken numerous planning and management activities to better accommodate growth when it occurs. This report concerns the reservation of water for future public water supply in the Thurston Metropolitan Area. Each city owns and operates a municipal water system within its corporate boundaries in addition to various County areas. As such, each is concerned with assuring that they will be able to obtain necessary water rights in the future.

This report has been prepared in conformance with the necessary "Supplementary Provisions" for water supply reservation as specified by the Department of Social and Health Services. The report also fulfills the requirements of WAC 173-590 "Procedures Relating to the Reservation of Water for Future Public Water Supply."

2. Authorization

This report has been prepared for, and in conjunction with, the Cities of Lacey, Olympia, Tumwater, and Thurston County in accordance with an agreement between the City of Olympia, acting as the lead agency, and Economic and Engineering Services, Inc. The preparation of this report was coordinated through the City of Olympia Utilities Department. Meetings and discussions were held with the Cities of Lacey, Olympia, and Tumwater, and the County at key points in the report preparation process in order to ensure that the document was consistent with other planning activities.

On April 30, 1982, a meeting of all the smaller public water systems in the Reservation Area was held to present the final draft of this report and solicit comments. The impact on and benefits to these systems as a result of the reservation process was presented. These were no comments received which would require modification of the report contents.

3. Purpose of Study

The Water Resources Act of 1971, RCW 90.54, set forth the fundamentals of water resource policy designed to ensure that the waters of the State will be protected and fully utilized to the greatest benefit to the people of the State of Washington. The Act directed the Department of Ecology (DOE) to develop and implement a water resources program which provides a process for making decisions on future water resource allocations and use. Pursuant to this Act, DOE adopted WAC 173-590, outlining procedures for the reservation of water for future public water supply. A copy of WAC 173-590 is included as Appendix IV-1 of this report.

Any individual, municipality, public or private entity who operates a public water supply system, or who contemplates such an operation, may request that the Department of Ecology reserve a certain amount of surface or groundwater, within a given geographical area. Therefore, in order to assure that the Thurston Metropolitan Area has an adequate future water supply, the Cities of Lacey, Olympia, and Tumwater have agreed to jointly pursue the reservation of public water supply for an area projected to be within their general service areas or areas of influence, within the next 50 years.

4. Background

In order to apply for a reservation of future public water supply, it is necessary to submit to DOE the following items:

- An approved Coordinated Water System Plan
- A satisfactorily completed "Petition for Reservation of Public Waters".

The term Coordinated Water System Plan (CWSP) has been used to describe a document which is designed to fulfill the requirements of two, separate legislative actions. The first, the "Public Water System Coordination Act", RCW 70.116, was enacted to achieve better coordination between water utilities in the same geographic region. Specifically, the purpose of the CWSP relative to RCW 70.116 is to outline procedures to prevent the following types of occurrences:

- Proliferation of small systems
- Inconsistent design
- Overlapping service areas
- Conflicts between land use and water system plans
- Duplication of facilities

The second, the Water Resources Act of 1971, RCW 90.54, was enacted to promote better management of the State's water resources. "Procedures Relating to the Reservation of Water for Public Water Supply" are outlined in WAC 173-590, and provide the procedure for the reservation of a portion of the State's waters for future public water supply. The CWSP in this case is intended to present the information necessary to justify the future need for additional water rights for purposes of public water supply. The purpose of the CWSP for water supply reservation is to document three primary items:

- The quantity and quality of water which will be needed in the geographical area for future public water supply uses.
- Existence of a program for efficient future use of the water resource for public supply available to the geographical area.
- Cooperation and appropriate coordination between the water utilities within the geographical area.

As indicated, both RCW 70.116 and RCW 90.54 (WAC 173-590) require the preparation of a CWSP, however the specific requirements of each are separate and distinct. The basic differences between the two are the level of detail involved and the requirements (of RCW 70.116) to develop administrative procedures and agreements between utilities and county government.

This report, in conjunction with the individual water system plans for the Cities of Lacey, Olympia, and Tumwater, is intended to fulfill the necessary requirements of a Coordinated Water System Plan for Water Supply Reservation as specified by the Department of Social and Health Services (DSHS), and the Department of Ecology (DOE). A separate Coordinated Water System Plan will be prepared for the Thurston Metropolitan Area to fulfill the requirements of the Public Water System Coordination Act when implemented.

In addition to the provision for a Coordinated Water System Plan, a Petition for Reservation of Public Waters must be filed by anyone who wishes to reserve water for future public water supply. This Petition is included as Section VI of this report. The completed Petition, along with the Coordinated Water System Plan, is to be submitted to the Water Resources Management Section of DOE. Potential surrounding impacts of the proposal are investigated by DOE. If the results of this investigation are favorable, DOE, with assistance from DSHS, will develop a regulation to withdraw or reserve waters in the reservation area for future public use. The effective date of the reservation will then be the effective date of the regulation.

There are numerous difficulties involved in establishing not only the actual future water demands for any particular reservation area but also the available water supply in that area. Because of this the water resource program and Coordinated Water System Plan for water supply reservation are to be reviewed and changed as necessary at least every 10 years, as provided under WAC 173-590. All interested parties are to be consulted prior to any modification of an established water supply reservation.

5. Previous Studies

The Cities of Lacey, Olympia, and Tumwater have each prepared water system plans which will serve as the basis for this report and Petition for Water Supply Reservation. These and other documents which were used during the preparation of this report are listed below:

- City of Olympia Water System Plan, Economic & Engineering Services, Inc., July 1980
- City of Lacey Water System Comprehensive Plan Amendments, City staff, September 1977
- Groundwater Development - Lacey Water System, Hart, Crowser & Associates, Inc., February 1980
- City of Tumwater Comprehensive Plan: Water System Improvements - Update 1979-1989, J. W. Morrissette & Associates
- Deschutes River Basin Instream Resources Protection Program, including Proposed Administrative Rules, June 1980
- Nisqually River Basin Instream Resources Protection Program, including Proposed Administrative Rules

- Preliminary Assessment for the Greater Olympia Area, March 1980.

- Comprehensive Plan Coordination Project Volume I, Urban Growth Management Program for Lacey, Olympia, Tumwater, Thurston County, June 1981.

- Comprehensive Plan Coordination Project Volume II, Urban Development Requirements and Standards: Inventory, Evaluation and Recommendations, June 1981.

- Water Supply Bulletin No. 10, Geology and Ground-Water Resources of Thurston County, Washington, Volume 1, 1961, Volume 2, 1966.

Each of these documents are incorporated by reference into this report, and should be considered as an element of this Coordinated Water System Plan. Pertinent portions of selected documents are summarized as appropriate in this report. When additional information to that provided in the text is desired, the reader may refer either to the Appendices, which contain selected extracts from some of these documents, or to the original documents.

6. Findings and Recommendations

This Coordinated Water System Plan for Water Supply Reservation identifies the water supply needs for public use in the Thurston Metropolitan Area to the year 2030. The findings and recommendations contained in this report will provide the documentation necessary to allow the Department of Ecology to develop a regulation for the reservation of water for purposes of future public water supply. The following is a summary of the major findings and recommendations contained in this report:

A. Findings:

(1) A Reservation Area boundary was selected, as presented in Figure II-1, as agreed to by representatives from DOE, DSHS, Thurston County, and the Cities of Lacey, Olympia, and Tumwater. This boundary was selected as the area which the Tri-Cities anticipated they would be serving or have a signficant influence on in the next 50 years, based on various geographical and political constraints.

(2) A review of the water systems operated by each city revealed that each system is well operated and maintained. Planning efforts to date for these systems have established various needs for future improvements, with the need for additional source capacity as a primary concern. Water System Plans for each utility have identified the need for source development in areas geographically separate from existing source sites. This need has been identified in order to provide a source of supply in closer proximity to the demand and/or ensure the overall reliability of the systems.

(3) Within the Reservation Area, there are 115 water utilities which serve 10 or more customers. It is estimated that these utilities serve a total of about 6,800 customers, excluding the customers served by Lacey, Olympia, and Tumwater. Within the next 50 years, it is anticipated that the majority of these customers will be served by one of the Tri-City water systems.

(4) Of the 121,047 people residing in Thurston County in 1980 (1980 census), it was estimated that 100,560 people reside within the Reservation Area. Of this total, approximately 63,306 people were served by the Tri-Cities.

(5) Population increases were projected using data from the Washington State Office of Financial Management and the Bonneville Power Administration, as presented in Table III-4. Year 2030 populations of about 346,800 and 288,100 for the County and Reservation Area, respectively, resulted from this analysis. This population was distributed between Lacey, Olympia, Tumwater, and the remainder of the Reservation Area, as presented in Table III-6.

(6) The Department of Ecology issues water rights according to both instantaneous and annual withdrawal quantities. Instantaneous withdrawals are issued in quantities of gallons/minute (gpm) from groundwater sources, or cubic feet/second (cfs) for surface water diversions. Annual withdrawal quantities are specified in acre-feet/year from both surface and groundwater sources. In contrast, water utilities commonly refer to total system consumption in terms of million gallons/day

(MGD). In an effort to accommodate the needs of all parties concerned, each method of stating quantities is employed throughout this report.

(7) The Department of Ecology issues both prime water rights and supplemental water rights. Prime rights are additive and relate the total instantaneous and/or annual withdrawal quantities for which water rights are held. In contrast, supplemental rights are assigned to certain sources to permit their use when other sources in an area are not being utilized to their total righted capacity. Supplemental rights do not increase the total quantity of withdrawals allowed, they merely allow flexibility in water system operation.

(8) Water demand in 1980 for the Reservation Area, as presented in Table III-6, was estimated to be about 14.7 MGD average day (16,500 acre-feet/year) and 40.4 MGD peak day (28,000 gpm). Water demand for the year 2030 was projected to be about 43.3 MGD (48,500 acre-feet/year) and about 117.6 MGD peak day (82,000 gpm).

(9) At present, the three cities have prime water rights totaling about 49,600 gpm and 56,500 acre-feet/year. Certain of these rights are associated with sources which have been abandoned, such as the City of Olympia's Moxlie Creek wells, or have water quality problems, such as the City of Lacey's Fire Station well. In consideration of these sources, it is anticipated that in the future, the total existing prime rights associated with utilized sources will be an amount of about 41,100 gpm and 48,200 acre-feet/year.

(10) Eight separate areas within the Reservation Area have been identified as probable locations for future source development. These locations were selected based on a combination of proximity to future development, apparent availability of significant quantities of water, likelihood of acceptable quality of water, and compatibility with existing water systems. These areas are delineated on Figure V-1 and include, where appropriate, areas of anticipated high groundwater yield.

(11) Based on an analysis of existing water rights and the projected year 2030 water demand, a shortfall of about 40,600 gpm in instantaneous water rights

was identified. An estimate of the portion of this quantity which will be provided from each of the eight source locations, plus the remaining portions of the Reservation Area, is presented in Table V-2.

(12) Requested water right reservation quantities are summarized in Table I-1 by area, totaling about 40,600 gpm in instantaneous withdrawals. A complete analysis of the requested reservation is presented in Table V-3, along with references on supporting documentation of source potential. Also presented are alternate sources which would be drawn upon in the event the primary source is ultimately revealed to have insufficient yield potential or is not developed to yield the capacities for which reservation is requested.

(13) A meeting of all public water systems in the Reservation Area was held to present the findings of this report and outline the reservation program. No suggested modifications to the draft report was submitted. It was apparent from this meeting that there was general support for the reservation process.

B. Recommendations

(1) It is recommended that DOE develop a regulation which provides for the reservation of the requested amounts, as outlined in Table V-3, or 40,589 gpm for the year 2030. Based on available information, sufficient source data are available to support the requested reservation quantities for the general area.

(2) Subsequent to adoption of a regulation for reservation of water for public use, DOE should establish a procedure for providing a continuous accounting of water rights granted which are applied against the reservation quantity. This accounting of water rights should be made available to the participants in the reservation process on an annual basis. The Cities of Lacey, Olympia, and Tumwater should participate in the evaluation of any water right request which represents more than 10 percent of the remaining reservation quantity.

(3) In accordance with WAC 173-590, this report and the reservation quantity should be reviewed and updated at least every 10 years.

(4) The Public Water System Coordination Act should be implemented in the Tri-City area to establish the administrative procedures outlined in this report and ensure the efficient management of the area's water supply services.

(5) All water utilities in the Reservation Area should be requested to update their water system plans to reflect the findings of this report.

TABLE I-1

Summary of Water Right Reservation Request (1)

Source Location	Requested Reservation Quantity, gpm
Airport	2,500
Allison Springs	2,000
Black Lake	2,000
Deschutes Valley	1,969
Hawks Prairie	7,000
McAllister Springs	2,000 (2)
Mottman Industrial Park	2,000
Southeast	14,426
Remainder of Res. Area	6,694
Total	40,589

(1) See Table V-3 for a more detailed presentation of reservation request.

(2) 4.5 cfs

Thurston County

Coordinated Water System Plan

Areawide Supplement

APPROVED JANUARY, 1986

THURSTON COUNTY

COORDINATED WATER SYSTEM PLAN

AREA-WIDE SUPPLEMENT

JANUARY 1986

THURSTON COUNTY

COORDINATED WATER SYSTEM PLAN

AREA-WIDE SUPPLEMENT

JANUARY 1986

PREPARED FOR: THURSTON COUNTY WATER UTILITY COORDINATING COMMITTEE

PREPARED BY: WARREN CONSULTANTS, INC.
SEATTLE, WASHINGTON

THURSTON COUNTY PLANNING DEPARTMENT

THURSTON COUNTY

COORDINATED WATER SYSTEM PLAN

AREA-WIDE SUPPLEMENT

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THURSTON COUNTY

COORDINATED WATER SYSTEM PLAN

AREA-WIDE SUPPLEMENT

CONSULTANT'S CERTIFICATION

This Area-Wide Supplement portion of the Thurston County Coordinated Water System Plan was prepared under the technical supervision of the undersigned. The contents reflect actions by and positions of the County, the Water Utility Coordinating Committee, County staff, and the undersigned.

RICHARD E. WARREN, P.E.
President
Warren Consultants, Inc.

THURSTON COUNTY

COORDINATED WATER SYSTEM PLAN

AREA-WIDE SUPPLEMENT

ABSTRACT

This report details the findings and recommendations of a study of water system coordination conducted by Thurston County under the provisions of the Public Water System Coordination Act (RCW 70.116) for the urban area of North Thurston County designated as the Urban Water Supply Service Area (UWSSA).

This report comprises the Area-Wide Supplement portion of a Coordinated System Plan (CWSP) for the UWSSA as specified in the Act. The remaining portions of the CWSP are the individual water system plans prepared by each water system that plans to expand in the future.

This Area-Wide Supplement addresses the following issues:

Designation of the UWSSA	Chapter 1
Water System Service Areas	Chapter 2
Water System Development Standards	Chapter 3
Utility System Review and Approval Process	Chapter 4
Water Rights Reservation	Chapter 5
Joint Facility Potential	Chapter 6
Implementation	Chapter 7

When adopted and implemented, the policies and recommendations contained in this Area-Wide Supplement will encourage the effective coordination and development of water systems capable of meeting the domestic and fire protection water requirements of the property owners and residents of the North Thurston urban area.

THURSTON COUNTY

COORDINATED WATER SYSTEM PLAN

AREA-WIDE SUPPLEMENT

FUNDING ACKNOWLEDGEMENT

The preparation of this Area-Wide Supplement was funded in part by a grant from the State of Washington, Department of Social and Health Services under the Referendum 38 program.

The cities of Lacey, Olympia, and Tumwater provided funding for the preparation of the 1982 Water Supply Reservation Plan which is incorporated into the Area-Wide Supplement by reference.

THURSTON COUNTY

COORDINATED WATER SYSTEM PLAN

AREA-WIDE SUPPLEMENT

ACKNOWLEDGEMENTS

A great many people from the County, the three cities, and the water purveyors within the Urban Water Supply Service Area have participated in the preparation of this Area-Wide Supplement. As called for in state law, the County appointed a Water Utility Coordinating Committee comprised of representatives of these organizations and others with an interest in water supply to serve as an advisory group to the County during the planning process. The Committee met more than 35 times during the course of the study and their influence on this final plan has been significant.

A listing of the most active study participants is included below. Their helpful participation and contribution to the development of this supplement is gratefully acknowledged.

ALVA WILLIAMS, JR., P.E., Chairman
Water Utility Coordinating Committee

Richard E. Warren, Warren Consultants, Inc.
Harvey Mayse, Meridian Acres, Beachcrest, Seasons
Evelyne Betti, Betti Industrial Farm
Randy Galivan, Capital Utilities
Tom Clement, Clearwater Utilities
John D. Swift, Marvin Road Water Company
Nick Adams, Meadows Water System
Cliff Casebolt, Pattison Water Company
John Robischon, South Sound Utility
Moe Loveless, Trails End Utility
Dick Blinn, City of Tumwater
Tom Frare, City of Olympia
Patti Ingersoll/Don Hertzog, City of Lacey
Linda Hoffman, Thurston County Planning Department
Phil Brinker, Thurston County Environmental Health Department
Rich Siffert, Department of Social and Health Services
Bill Maibauer/Ethan Moseng, Department of Social and Health Services
Tom Miller, Thurston County Fire Marshal
Mel Lowe, Fire District #6 and Fire District Commissioners
Gerry Peterson, South Sound Utility
Len Esteb, City of Olympia
Len Smith, City of Tumwater
Ex-Officio: Jan Teague, Olympia Master Builders

THURSTON COUNTY COORDINATED WATER SYSTEM PLAN

AREA-WIDE SUPPLEMENT

1. SUMMARY AND IMPLEMENTATION

1.1 Purpose of Study

The Cities of Lacey, Olympia, and Tumwater have been concerned regarding the impact of existing policy on future annexations and water system consolidations and the potential added costs to the water system users. Consequently, the cities requested the County to lead a coordination study under the provisions of the Public Water System Coordination Act (RCW 70.116). The Thurston County Coordinated Water System Planning Study was undertaken by Thurston County in order to develop policies and procedures to improve existing water system development practices in the unincorporated areas of the North Thurston Urban area. In particular, the proliferation of small, inadequate water systems serving individual land development projects was of concern. Many of these systems are built to less than acceptable urban water system standards and are unable to offer fire protection to the properties they serve.

This report details the findings of the study conducted by the County under the provisions of the Public Water System Coordination Act and is the Area-Wide Supplement portion of a Coordinated Water System Plan. A Coordinated Water System Plan (CWSP) consists of two elements:

1. Area-Wide Supplement. A set of provisions applying to all public water systems within a Urban Water Supply Service Area (UWSSA) establishing guidelines for the development and coordination of those systems. The designation of service areas for all water systems is part of the supplement.

2. Individual Water System Plans. Prepared by all water systems required to do so by law, and in particular by all water systems within the UWSSA which plan on expanding their service to new areas in the future. The establishment of recognized future service areas is part of these water system plans.

   The water systems which have indicated their intent to expand are Lacey, Olympia, Tumwater, Capital Utilities, Marvin Road Water Company, South Sound Utility, Beachcrest, Meridian Acres, Seasons, Pattison, Meadows, Trails End, and Alderbrook Trailer Park.

   All water systems within the UWSSA which plan to expand have been notified of their requirement for the preparation of water system plans. These plans are proceeding. The plans will be developed following the policy and guidelines established in this Area-Wide Supplement and DSHS regulations.

1.2 Study Process

Following a preliminary assessment, which was prepared by the Department of Social and Health Services (DSHS), the Thurston County Commissioners passed a motion declaring their intention of implementing the Public Water System Coordination Act within a broad area including all of the urbanizing area of North Thurston County. As called for in the Act, Thurston County was the sponsoring agency for the development of the Coordinated Water System Plan.

Thurston County, following the guidelines of the Act, appointed a Water Utility Coordinating Committee (WUCC) composed of representatives of all water systems within the North Thurston area having 50 or more users.

The county, together with the WUCC, began the study process by interviewing and selecting a consultant to assist in the preparation of the Area-Wide Supplement. Warren Consultants, Inc. of Seattle was chosen to be the prime consultant and the County also contracted with the Thurston Regional Planning Council for local staff support to provide local information and coordination to the Consultant during the conduct of the study.

The first step by the Consultant and the county staff was to develop a work program for preparing the Area-Wide Supplement. Using this, together with the activities of the WUCC and others involved in water supply in the area, a grant application was prepared and submitted to the Department of Social and Health Services for a 50 percent matching grant to fund the preparation of the Area-Wide Supplement. This grant was approved by DSHS on March 13, 1984 and the study began.

The investigative work of the study was performed by Warren Consultants, Inc. and County Planning staff who developed a series of recommendations regarding each of the study elements which were submitted to the WUCC for discussion and the development of policies. Through a series of more than 35 meetings, WUCC developed policy positions on each of the various study elements, outlined below, and submitted these recommendations to the Thurston County Commissioners for their action.

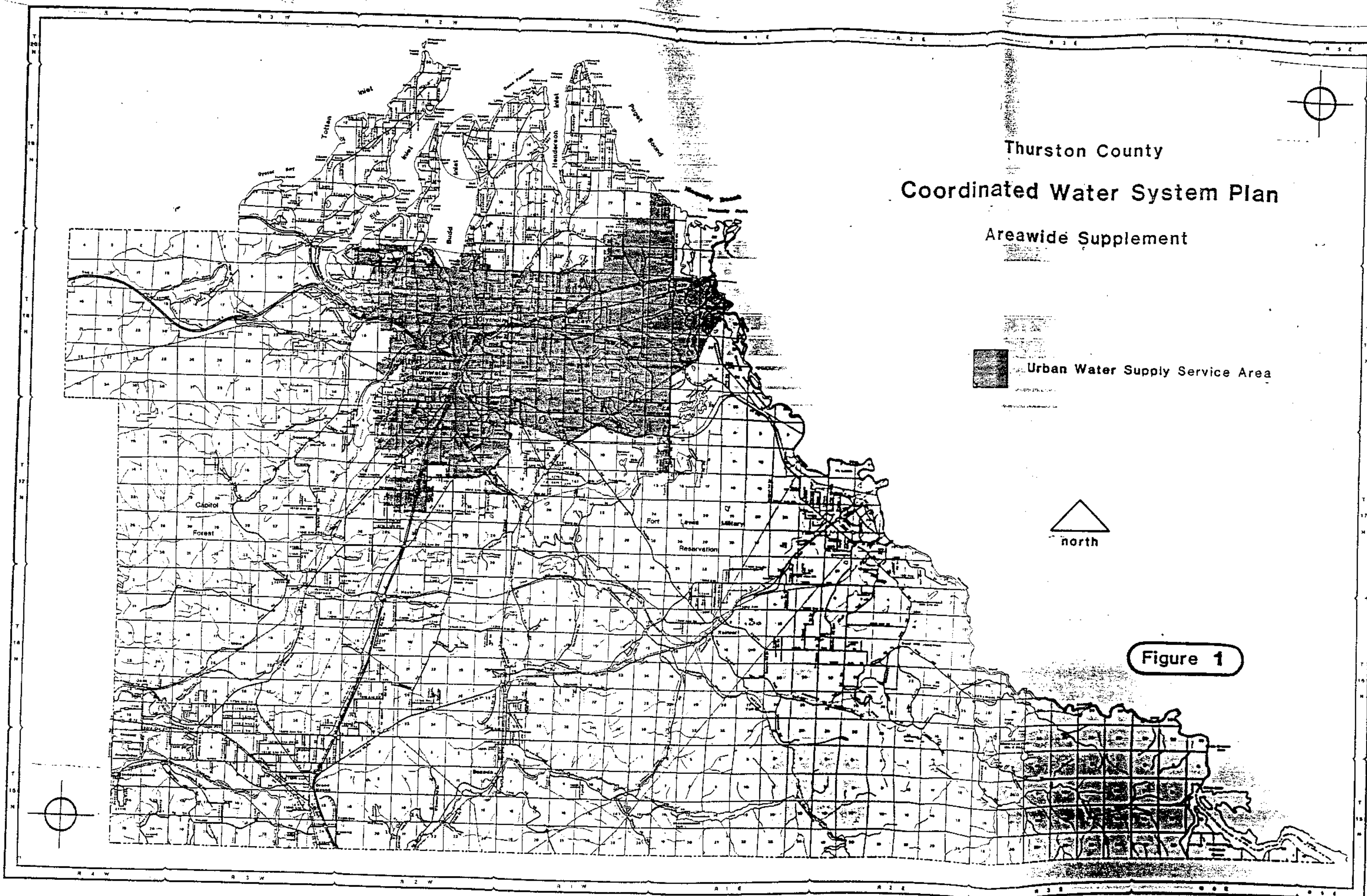
The open public meetings of the WUCC provided a forum for the thorough discussion of issues prior to their presentation to the County Commissioners. This, together with regular mailings to all affected water systems within the study area and the later Urban Water Supply Service Area (UWSSA), ensured that all water systems would have an opportunity to participate in the development of the Area-Wide Supplement and the overall Coordinated Water System Plan.

Throughout the study every effort was made to incorporate the prior planning and land use determinations of the County and the other jurisdictions within the study area. In particular, the work developed during the 701 study program was of significant value to the development of this Area-Wide Supplement for water system coordination.

1.3 Major Study Elements and Findings

The Water System Coordination Act (RCW 70.116) and the subsequent DSHS administrative regulations (WAC 248-56) provide for specific issues to be addressed in preparing a Coordinated Water System Plan and the Area-Wide Supplement portion thereof. This study addressed each of the issues required by the Act and regulations in their logical sequence. The consensus of the WUCC and the action by the County Commissioners on each of the major issues were as follows:

1.31 Boundaries of the Urban Water Supply Service Area. One of the first requirements for an Area-Wide Supplement or a Coordinated Water System Plan is the establishment of specific legal boundaries for what is known in the Act as the Urban Water Supply Service Area (UWSSA) (WAC 248-56-510, 600). This is the area in which all of the other requirements of the Act will be applied. After a thorough review of a number of planning area options, the WUCC recommended a set of boundaries to the County Commissioners for the UWSSA. The County Commissioners modified the recommended boundary and on October 23, 1984, the County Commissioners adopted a boundary that was the Urban Growth Management Planning Area boundary from the Memorandum of Understanding on Urban Growth Management plus those areas where existing water systems currently provided service beyond this boundary. Figure 1 shows the adopted UWSSA boundary. This boundary was determined to best meet the boundary criteria set forth in WAC 248-56-610. Most importantly, it encompasses the existing and planned urban area and the area with the most coordination needs.


Thurston County
Coordinated Water System Plan
Areawide Supplement
Urban Water Supply Service Area
north
Figure 1
Totten Inlet
Eld Inlet
Budd Inlet
Henderson Inlet
Puget Sound
Olympia
Lacey
Tumwater
Capitol Forest
Fort Lewis Military Reservation
Tenino
Bucoda

1.32 Service Areas. All water systems within the UWSSA were asked to identify their existing service areas. They were given the opportunity to project and indicate areas where they would plan for and provide water service in the future. Each of the larger water systems having more than 50 users was contacted and interviewed to discuss their existing and potential future boundaries. Following the interview process, all systems within the UWSSA were formally notified of the requirement of the Act and asked to submit maps and descriptions of their existing service and any future boundaries they wish to serve. Where the responses from the water systems indicated that conflict existed with other adjacent water systems, each system was notified of the requirement of the Act that they meet and resolve these conflicts before being awarded a future service area. Twelve systems were identified as having conflicts, including each of the three cities. The process of resolving conflict areas has proceeded throughout the study leading to the Area-Wide Supplement and is expected to continue for a short time after the supplement is prepared.

The County has indicated to each of the water systems with conflict that they have until October, 1985 to resolve their conflicts and submit a signed agreement of service area to the County or the County will ask DSHS to adjudicate the boundary conflicts under the provisions of WAC 248-59.

1.33 Water System Standards. The Preliminary Assessment identified the lack of water system design and development standards within the urban area as one of the most important issues needing coordination. The three cities--Lacey, Olympia and Tumwater--had over the years, through their own voluntary coordination process, developed very similar standards in terms of pipe sizing, fire hydrant placement, and other water system design elements. The cities apply these standards to all development connected to their systems. The problem, however, has been that the majority of water systems developed in the urban area during the past two decades, have not been connected to a city system and have been able to be constructed using only DSHS minimum water system standards without any provisions for fire protection. The Coordination Act requires that the provision of fire flows by all water systems within the UWSSA be addressed; therefore, it was essential that water system development standards meeting this goal be prepared and adopted for use throughout the UWSSA.

After an extensive review by the WUCC, standards were recommended to the county for the design and construction of all water systems within the UWSSA. After public hearings, standards were adopted by the Thurston County Commissioners on August 5, 1985 as a seprate action but part of the Coordinated Water System Plan.

1.34 Utility System Review and Approval Process. Important to the success of the Coordinated Water System Planning process is a system to discourage the proliferation of small and inadequate water systems within the UWSSA and to coordinate the orderly growth of existing systems.

A utility system review and approval process was developed and adopted by the WUCC following extensive study. The recommended process involves the Thurston County Environmental Health Division to a much greater extent than in the past. The County Hearings Examiner was designated to hear requested appeals from decisions of the County staff regarding the regulation of service areas, standards, and other water-related issues.

1.35 <u>Water Rights Reservation</u>. The provision for future water for domestic use in the UWSSA is another important part of the Coordination Act planning process. Prior to development of the current study, the three cities had elected to proceed with a Water Rights Reservation petition to the Department of Ecology under the provisions of RCW 90.54. The three cities jointly funded a study by Economic and Engineering Services, Inc. of Olympia for the preparation of the Water Rights Reservation petition. The petition has been filed and the study by EES dated May 1982 has been reviewed as part of this program and was found to be complete and adequate to serve as this element of the Area-Wide Supplement. Its findings are incorporated in this report and include:

1. The North Thurston urban area is expected to grow to a population of approximately 288,100 by the year 2030. The 1980 census population for the area was 100,560.

2. Ground water will continue to be the primary source of public water supply through the year 2030.

3. Additional water rights must be reserved through the Department of Ecology to insure the availability of the estimated 43.3 MGD required in the year 2030.

4. Ground water quality must be protected if this source is to continue as the primary domestic water supply for the area.

1.36 Coordination With Other Planning. The Coordinated Water System Planning Study was fully coordinated with all relevant current local planning including:

1. The County Urban Growth Management (701) Planning Study
2. Local Zoning and Land Use Plans
3. Individual Water System Comprehensive Plans
4. The Coordinated Water System Plan for Water Rights Reservation for North Thurston County
5. The LOTT, Phase II Sewerage Study.

Since water supply is not a growth limiting factor in the planning area, water system planning is based on land use decisions.

1.4 Actions to Implement Study Findings

Prior action by the Board of County Commissioners has established the Urban Water Supply Service Area boundaries and adopted new water system design standards. The remaining actions required to fully implement the Coordinated Water System Plan are:

1. The adoption of the Area-Wide Supplement plan contained herein, pursuant to the necessary hearings and environmental determinations required by state and local law.

2. Development of any needed internal administrative rules to implement the review and approval process contained herein.

3. Completion of the service area agreements for all water systems within the UWSSA that plan to expand.

4. Completion of the water system plans by all water systems planning to expand.

With the adoption of the Area-Wide Supplement portion of the plan (item "1" above), the County will put in motion the completion of the other three remaining actions. Monitoring of the service area agreements and water system plans will be by the County staff following the guidelines established in this Area-Wide Supplement. Time frames established by the Act and DSHS call for the completion of all planning by October 1986 or DSHS could be required to invoke its regulatory powers separate from the county's. It is anticipated that the remaining elements of the Coordinated Water System Plan will be completed in a timely manner and that the County will be in control of the process in the future.

1.5 Future Activity Related to the Coordinated Water System Plan

The County should continue the Water Utility Coordinating Committee and should keep them informed of the progress of resolving service area agreements and obtaining completed water system plans. A meeting of the WUCC should be held annually to review the implementation of the recommendations of the Area-Wide Supplement and to determine whether or not any changes or additions are required.

Beginning the fifth year (1990) after adoption of the plan, the County is required by the Act to reconvene the WUCC and determine whether or not any portions of the Coordinated Water System Plan and the resulting implementation regulations should be modified, eliminated, or revised. This formal review and update is a requirement of the Act and will allow the Coordinated Water System Plan to continue to be effective in achieving the goals of the Act and of the County.

Individual water systems must also update their water system plans every five years and these revisions must comply with any changes to the Coordinated Water System Plan.

Appendix I

DOH TABLES 1, 2, AND 3
WATER RIGHTS CERTIFICATES AND APPLICATIONS

6/14/2012

Department of Health Table 1, Existing Water Right(s) Status

Permit Certificate or Claim #	Name of Rightholder or Claimant	Priority Date	Source Name/ Number	Primary or Supplemental	Existing District Water Rights: Maximum Instantaneous Flow Rate (Qi)	Existing District Water Rights: Maximum Annual Volume (Qa)	Existing Consumption (2010): Maximum Instantaneous Flow Rate	Existing Consumption (2010): Maximum Annual Volume (Qa)	Current Water Right Status (Deficiency): Maximum Instantaneous Flow rate (Qi)	Current Water Right Status (Deficiency): Maximum Annual Volume (Primary Qa)
Permits/ Certificates					gpm	AF	gpm	AF	gpm	AF
C-4578-A	Huntamer's Water Service, Inc.	4/26/1962	S01	P	215	344	300	82	365	262
G2-20880C	City of Lacey	3/20/1973		S	450	240				
C-5655-A	Huntamer's Water Service, Inc.	8/19/1965	S02	P	600	960	600	455	0	505
C-7450-A	City of Lacey	2/3/1969	S02, S03	P	206	330	206	84	0	246
C-55-A (B)	City of Lacey	9/19/1946	S04	P	1,800	623	750	232	1,650	391
G2-23191C	City of Lacey	9/19/1974		S	600	320				
G2-27373P (A)	City of Lacey	8/13/1986	S06	P	600	918	400	84	200	834
				S		49				
G2-24351C	City of Lacey	11/22/1976	S07	P	2,150	0	1,800	969	350	(969)
				S		2,775				
G2-25779C	City of Lacey	2/10/1981	S09	P	1,300	21	650	67	650	(46)
				S		1,027				
G2-25778A	City of Lacey	2/10/1981	S10	P	1,200	22	1,000	829	200	(807)
				S		1,650				
G2-23963C	City of Lacey	9/19/1975	S15	P	250	212	180	96	70	116
G2-24547C	City of Lacey	5/12/1977	S15, S16	P	250	90	170	93	100	5
				S		212				
G2-00767C	City of Lacey	2/22/1971	S15, S16	P	20	8				
G2-27371P	City of Lacey	8/13/1986	S19, S31	P	800	1,026	750	567	50	459
				S		264				
G2-23743C	City of Lacey	3/3/1975	S20	S	500	400	580	398	220	(241)
G2-26685	City of Lacey	4/18/1985		P	300	157				
C-1288-A	City of Lacey	2/2/1951	S21 S22 S23 S28	P	55	30				
C-1777-A	City of Lacey	8/6/1953		P	300	432				
C-3654-A	City of Lacey	3/30/1959		P	283	453				
C-3823-A	City of Lacey	7/13/1960		P	300	480				
C-6320-A	City of Lacey	3/19/1968		P	150	108				
G2-20879	City of Lacey	3/20/1973		S	300	160				
G2-25778(B)	City of Lacey	2/10/1981		S	1,050	1,288				
G2-20878C	City of Lacey	3/20/1973		S	200	107				
G2-26623B	City of Lacey	11/29/1984		P	440	132				
C-7450(B)	City of Lacey	2/3/1969		P	920	1,320				
G2-27373P(B)	City of Lacey	8/13/1986		S	200	323				
G2-25802C	City of Lacey	2/24/1981		P	250	130				
C-3718A	City of Lacey	4/4/1956		P	350	112				
G2-29165	City of Lacey	12/16/1994		P	0	2,226	4,660	1,286	138	4,137
G2-20104C	City of Lacey	4/6/1972	S24	P	350	270	70	38	280	232
G2-20882C	City of Lacey	3/20/1973	S25[A]	S	250	270	230	152	20	(152)
G2-20883C	City of Lacey	3/20/1973	S27	S	700	374				
G2-29304	City of Lacey	9/20/1995		P	400	1,000	700	204	400	796
G2-27007P	City of Lacey	8/13/1987	S29	P	1,000	468				
G2-30249	City of Lacey	8/13/1986		P	0	600	1,000	365	0	703
G2-30248	City of Lacey	8/131986	S31	P	800	1,066	0	0	800	1,066
G2-30251	City of Lacey	5/6/2005	Marvin Road	P	1,000	1,500	0	0	1,000	1,500
G2-30250	City of Lacey	5/3/2005	Meridian Campus	P	800	1,000	0	0	800	1,000
785-D	Olympia Brewery	7/20/1936	Brewery Wellfield (under development); Shared with Cities of Olympia and Tumwater	P	203	328				
784-D	Olympia Brewery	7/15/1937		P	200	323				
34-A	Olympia Brewery	5/22/1946		P	500	800				
453-A	Olympia Brewery	3/23/1950		P	700	228				
4587-A	Olympia Brewery	1/22/1960		S	2,250	1,723				
G2-01073C	Olympia Brewery	1/23/1967		S	900	1,440				
G2-01072C	Olympia Brewery	4/22/1971		S	900	1,440				
G2-20844C	Olympia Brewery	3/13/1973		S	862	1,379				
G2-26058C	Olympia Brewery	1/12/1982		P	0	604				
				S	1,500	604	0	0	2,172	761
TOTAL *(includes only 1/3 of the Olympia Brewery rights, Lacey's share)*					**23,511**	**16,799 (Primary)**	**14,046**	**6,001**	**9,465**	**10,798**

Intertie Name/Identifier	Name of Purveyor Providing Water	Existing Limits on Intertie Water Use: Maximum Instantaneous Flow rate (Qi)	Existing Limits on Intertie Water Use: Maximum Annual Volume (Qa)	Existing Consumption Through Intertie: Maximum Instantaneous Flow rate (Qi)	Existing Consumption Through Intertie: Maximum Annual Volume (Qa)	Current Intertie Supply Status (Deficiency): Maximum Instantaneous Flow rate (Qi)	Current Intertie Supply Status (Deficiency): Maximum Annual Volume (Qa)
Olympia Intertie	City of Olympia	2 mgd	1.5 mgd	1.5 mgd	0.67 mgd	0.5 mgd	0.83 mgd
TOTAL		2 mgd	1.5 mgd	1.5 mgd	0.67 mgd	0.5 mgd	0.83 mgd

Pending Water Right Application	Name on Permit	Date Submitted	Primary or Supplemental	Pending Water Rights: Maximum Instantaneous Flow Rate (Qi) Requested (gpm)	Pending Water Rights: Maximum Annual Volume (Qa) Requested (AF)
G2-29305	Meadows #7	9/20/1995	P	2,200	1,000
G2-29306	Madrona #4 ("Well C")	9/20/1995	P	1,800	1,456
G2-30252	Pleasant Glade	5/6/2005	P	800	608
G2-30253	Beachcrest #3	5/6/2005	P	1,000	1,500
G2-30385	Meridian Campus (alternative	1/25/2007	P	800	1000

Notes

A: S25 is entirely supplemental to S24 (not the system)

11/9/2012

Department of Health Table 2, Forecasted Water Right(s) Status-6 Year Forecast

Permit Certificate or Claim #	Name of Rightholder or Claimant	Priority Date	Source Name/ Number	Primary or Supplemental	Existing Water Rights		Forecasted Water Use from Sources (6 Year Demand)		Forecasted Water Right Status (Excess/Deficiency - 6 Yr. Demand in Water Right)	
					Maximum Instantaneous Flow rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow rate (Qi)	Maximum Annual Volume (Qa)
Permits/ Certificates					gpm	AF	gpm	AF	gpm	AF
C-4578-A	Huntamer's Water Service, Inc.	4/26/1962	S01	P	215	344	300	219	365	125
G2-20880C	City of Lacey	3/20/1973		S	450	240				
C-5655-A	Huntamer's Water Service, Inc.	8/19/1965	S02	P	600	960	600	722	0	238
C-7450-A	City of Lacey	2/3/1969	S02, S03	P	206	330	206	216	0	114
C-55-A (B)	City of Lacey	9/19/1946	S04	P	1,800	623	750	757	1,650	(134)
G2-23191C	City of Lacey	9/19/1974		S	600	320				
G2-27373P (A)	City of Lacey	8/13/1986	S06	P	600	918	600	174	0	744
				S		49				
G2-24351C	City of Lacey	11/22/1976	S07	P	2,150	0	1,800	1,286	350	(1,286)
				S		2,775				
G2-25779C	City of Lacey	2/10/1981	S09	P	1,300	21	650	200	650	(179)
				S		1,027				
G2-25778A	City of Lacey	2/10/1981	S10	P	1,200	22	1,000	1,167	200	(1,145)
				S		1,650				
G2-23963C	City of Lacey	9/19/1975	S15	P	250	212	250	131	0	81
G2-24547C	City of Lacey	5/12/1977	S15, S16	P	250	90	270	135	0	(38)
				S		212				
G2-00767C	City of Lacey	2/22/1971		P	20	8				
G2-27371P	City of Lacey	8/13/1986	S19, S31	P	800	1,026	750	637	50	389
				S		264				
G2-23743C	City of Lacey	3/3/1975	S20	S	500	400	580	557	220	(400)
G2-26685	City of Lacey	4/18/1985		P	300	157				
C-1288-A	City of Lacey	2/2/1951	S21 S22 S23 S28	P	55	30				
C-1777-A	City of Lacey	8/6/1953		P	300	432				
C-3654-A	City of Lacey	3/30/1959		P	283	453				
C-3823-A	City of Lacey	7/13/1960		P	300	480				
C-6320-A	City of Lacey	3/19/1968		P	150	108				
G2-20879	City of Lacey	3/20/1973		S	300	160				
G2-25778(B)	City of Lacey	2/10/1981		S	1,050	1,288				
G2-20878C	City of Lacey	3/20/1973		S	200	107				
G2-26623B	City of Lacey	11/29/1984		P	440	132				
C-7450(B)	City of Lacey	2/3/1969		P	920	1,320				
G2-27373P(B)	City of Lacey	8/13/1986		S	200	323				
G2-25802C	City of Lacey	2/24/1981		P	250	130				
C-3718A	City of Lacey	4/4/1956		P	350	112				
G2-29165	City of Lacey	12/16/1994		P	0	2,226	4,660	2,265	138	3,158
G2-20104C	City of Lacey	4/6/1972	S24	P	350	270	70	21	280	249
G2-20882C	City of Lacey	3/20/1973	S25[A]	S	250	270	230	83	20	(83)
G2-20883C	City of Lacey	3/20/1973	S27	S	700	374	700	403	400	597
G2-29304	City of Lacey	9/20/1995		P	400	1,000				
G2-27007P	City of Lacey	8/13/1987	S29	P	1,000	468	1,000	1,068	0	0
G2-30249	City of Lacey	8/13/1986		P		600				
G2-30248	City of Lacey	8/131986	S31	P	800	1,066	800	680	0	386
G2-30251	City of Lacey	5/6/2005	Marvin Road	P	1,000	1,500	0	0	1,000	1,500
G2-30250	City of Lacey	5/3/2005	Meridian Campus	P	800	1,000	0	0	800	1,000
785-D	Olympia Brewery	7/20/1936	Brewery Wellfield; Shared with Cities of Olympia and Tumwater	P	203	328				
784-D	Olympia Brewery	7/15/1937		P	200	323				
34-A	Olympia Brewery	5/22/1946		P	500	800				
453-A	Olympia Brewery	3/23/1950		P	700	228				
4587-A	Olympia Brewery	1/22/1960		S	2,250	1,723				
G2-01073C	Olympia Brewery	1/23/1967		S	900	1,440				
G2-01072C	Olympia Brewery	4/22/1971		S	900	1,440				
G2-20844C	Olympia Brewery	3/13/1973		S	862	1,379				
G2-26058C	Olympia Brewery	1/12/1982		P	0	604				
				S	1,500	604	0	0	2,172	761
TOTAL *(includes only 1/3 of the Olympia Brewery rights, Lacey's share)*					**23,511**	**16,799 (Primary)**	**15,216**	**10,721**	**8,295**	**6,078**
Projected 6-year demand (2019)							***14,035***	***10,721***		

Intertie Name/Identifier	Name of Purveyor Providing Water	Existing Limits on Intertie Water Use		Existing Consumption Through Intertie		Current Intertie Supply Status (Excess/Deficiency)	
		Maximum Instantaneous Flow rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow rate (Qi)	Maximum Annual Volume (Qa)
None							
TOTAL							

Pending Water Right Application	Name on Permit	Date Submited	Primary or Supplemental	Pending Water Rights		Forecasted Water Use from Sources (6 Year Demand)		Forecasted Water Right Status (Excess/Deficiency - 6 Yr. Demand in Water Right)	
				Maximum Instantaneous Flow Rate (Qi) Requested (gpm)	Maximum Annual Volume (Qa) Requested (AF)	Maximum Instantaneous Flow rate (Qi) (gpm)	Maximum Annual Volume (Qa) (AF)	Maximum Instantaneous Flow rate (Qi) (gpm)	Maximum Annual Volume (Qa) (AF)
G2-29305	Meadows #7	9/20/1995	P	2,200	1,000	0	0	2,200	1,000
G2-29306	Madrona #4 ("Well C")	9/20/1995	P	1,800	1,456	0	0	1,800	1,456
G2-30252	Pleasant Glade	6/5/2005	P	800	608	0	0	800	608
G2-30253	Beachcrest #3	6/5/2005	P	1,000	1,500	0	0	1,000	1,500
G2-30385	Meridian Campus (alternative location)	1/25/2007	P	800	1,000	0	0	800	1,000
TOTAL				**6,600**	**5,564**	**0**	**0**	**6,600**	**5,564**

Notes

A: S25 is entirely supplemental to S24 (not the system)

Department of Health Table 3, Forecasted Water Right(s) Status-20 Year Forecast

Permit Certificate or Claim #	Name of Rightholder or Claimant	Priority Date	Source Name/ Number	Primary or Supplemental	Existing Water Rights		Forecasted Water Use from Sources (20 Year Demand)		Forecasted Water Right Status (Excess/Deficiency - 20 Yr. Demand in Water Right)	
					Maximum Instantaneous Flow rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow rate (Qi)	Maximum Annual Volume (Qa)
Permits/ Certificates					**gpm**	**AF**	**gpm**	**AF**	**gpm**	**AF**
C-4578-A	Huntamer's Water Service, Inc.	4/26/1962	S01	P	215	344	300	219	365	125
G2-20880C	City of Lacey	3/20/1973		S	450	240				
C-5655-A	Huntamer's Water Service, Inc.	8/19/1965	S02	P	600	960	600	722	0	238
C-7450-A	City of Lacey	2/3/1969	S02, S03	P	206	330	206	216	0	114
C-55-A (B)	City of Lacey	9/19/1946	S04	P	1,800	623	750	757	1,650	(134)
G2-23191C	City of Lacey	9/19/1974		S	600	320				
G2-27373P (A)	City of Lacey	8/13/1986	S06	P	600	918	600	174	0	744
				S		49				
G2-24351C	City of Lacey	11/22/1976	S07	P	2,150	0	1,800	1,286	350	(1,286)
				S		2,775				
G2-25779C	City of Lacey	2/10/1981	S09	P	1,300	21	650	431	650	(410)
				S		1,027				
G2-25778A	City of Lacey	2/10/1981	S10	P	1,200	22	1,000	1,167	200	(1,145)
				S		1,650				
G2-23963C	City of Lacey	9/19/1975	S15	P	250	212	250	131	0	81
G2-24547C	City of Lacey	5/12/1977	S15, S16	P	250	90	270	135	0	(38)
				S		212				
G2-00767C	City of Lacey	2/22/1971		P	20	8				
G2-27371P	City of Lacey	8/13/1986	S19, S31	P	800	1,026	750	1,026	50	0
				S		264				
G2-23743C	City of Lacey	3/3/1975	S20	S	500	400	580	557	220	(400)
G2-26685	City of Lacey	4/18/1985		P	300	157				
C-1288-A	City of Lacey	2/2/1951	S21	P	55	30				
C-1777-A	City of Lacey	8/6/1953	S22	P	300	432				
C-3654-A	City of Lacey	3/30/1959	S23	P	283	453				
C-3823-A	City of Lacey	7/13/1960	S28	P	300	480				
C-6320-A	City of Lacey	3/19/1968		P	150	108				
G2-20879	City of Lacey	3/20/1973		S	300	160				
G2-25778(B)	City of Lacey	2/10/1981		S	1,050	1,288				
G2-20878C	City of Lacey	3/20/1973		S	200	107				
G2-26623B	City of Lacey	11/29/1984		P	440	132				
C-7450(B)	City of Lacey	2/3/1969		P	920	1,320				
G2-27073P(B)	City of Lacey	8/13/1986		S	200	323				
G2-25802C	City of Lacey	2/24/1981		P	250	130				
C-3718A	City of Lacey	4/4/1956		P	350	112				
G2-29165	City of Lacey	12/16/1994		P	0	2,226	4,660	2,762	138	2,661
G2-20104C	City of Lacey	4/6/1972	S24	P	350	270	70	21	280	249
G2-20882C	City of Lacey	3/20/1973	S25[A]	S	250	270	230	83	20	(83)
G2-20883C	City of Lacey	3/20/1973	S27	S	700	374	1,100	500	0	500
G2-29304	City of Lacey	9/20/1995		P	400	1,000				
G2-27007P	City of Lacey	8/13/1987	S29	P	1,000	468	1,000	731	0	337
G2-30249	City of Lacey	8/13/1986		P		600				
G2-30248	City of Lacey	8/131986	S31	P	800	1,066	800	1,066	0	0
G2-30251	City of Lacey	5/6/2005	Marvin Road	P	1,000	1,500	1,000	250	0	1,250
G2-30250	City of Lacey	5/3/2005	Meridian	P	800	1,000	0	0	800	1,000
785-D	Olympia Brewery	7/20/1936	Brewery Wellfield; Shared with Cities of Olympia and Tumwater	P	203	328				
784-D	Olympia Brewery	7/15/1937		P	200	323				
34-A	Olympia Brewery	5/22/1946		P	500	800				
453-A	Olympia Brewery	3/23/1950		P	700	228				
4587-A	Olympia Brewery	1/22/1960		S	2,250	1,723				
G2-01073C	Olympia Brewery	1/23/1967		S	900	1,440				
G2-01072C	Olympia Brewery	4/22/1971		S	900	1,440				
G2-20844C	Olympia Brewery	3/13/1973		S	862	1,379				
G2-26058C	Olympia Brewery	1/12/1982		P	0	604				
				S	1,500	604	2,172	761	0	0
***TOTAL** (includes only 1/3 of the Olympia Brewery rights, Lacey's share)*					**23,511**	**16,799 (Primary)**	**18,788**	**12,995**	**4,723**	**3,804**
Projected 20-year demand (2029)							***17,014***	***12,995***		

Intertie Name/Identifier	Name of Purveyor Providing Water	Existing Limits on Intertie Water Use		Existing Consumption Through Intertie		Current Intertie Supply Status (Excess/Deficiency)	
		Maximum Instantaneous Flow rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow rate (Qi)	Maximum Annual Volume (Qa)
None							
TOTAL							

Pending Water Right Application	Name on Permit	Date Submited	Primary or Supplemental	Pending Water Rights		Forecasted Water Use from Sources (20 Year Demand)		Forecasted Water Right Status (Excess/Deficiency - 20 Yr. Demand in Water Right)	
				Maximum Instantaneous Flow Rate (Qi) Requested (gpm)	Maximum Annual Volume (Qa) Requested (AF)	Maximum Instantaneous Flow rate (Qi) (gpm)	Maximum Annual Volume (Qa) (AF)	Maximum Instantaneous Flow rate (Qi) (gpm)	Maximum Annual Volume (Qa) (AF)
G2-29305	Meadows #7	9/20/1995	P	2,200	1,000	0	0	2,200	1,000
G2-29306	Madrona #4 ("Well C")	9/20/1995	P	1,800	1,456	0	0	1,800	1,456
G2-30252	Pleasant Glade	5/6/2005	P	800	608	0	0	800	608
G2-30253	Beachcrest #3	5/6/2005	P	1,000	1,500	0	0	1,000	1,500
G2-30385	Meridian Campus (alternative location)	1/25/2007	P	800	1,000	0	0	800	1,000
TOTAL				**6,600**	**5,564**	**0**	**0**	**6,600**	**5,564**

Notes

A: S25 is entirely supplemental to S24 (not the system)

Appendix J
COST RECOVERY AGREEMENT WITH ECOLOGY

cc: Peter & me.
Original to Carol.

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

June 8, 2006

City of Lacey
Dennis Ritter/Peter Brooks
P.O. Box 3400
Lacey, WA 98504

RE: City of Lacey Water Right Project No.9R48

Dear Mr. Ritter:

Enclosed you will find a signed original Cost Reimbursement Agreement for your records. Please notice that there has been a project number assigned to the agreement. It is No.9R48. A work assignment for this project is being drafted and the project should begin quickly. The consultant, Aspect Consulting may be in contact with you. Please contact me if you have any comments or questions.

Jim Roth

Financial Services/Contracts
Dept. of Ecology
PO Box 47600
Olympia, WA 98504-7600
Pone: 360-407-7036
Fax: 360-407-7153
JROT461@ECY.WA.GOV

Washington State Department of Ecology Cost-Reimbursement Agreement (CRA)

Between the
Washington State Department of Ecology
and
City of Lacey

CRA Project No.9R48

PART A
SPECIAL TERMS AND CONDITIONS AND SCOPE OF WORK

Current For: FY 2005-06

Contents:

I. Applicant Information

Project Manager/Primary Point of Contact	Billing Address
Name: Dennis Ritter/Peter Brooks	Name: SAME
Address: P.O. Box 3400	Address:
City, State: Lacey, WA.	City, State:
Zip Code: 98509-3400	Zip Code:
Telephone: 360-438-2649	Telephone:
E-mail: pbrooks@ci.lacey.wa.us	E-Mail:
Fax:	Fax:

II. Ecology Information

Project Manager/Primary Point of Contact:

Name:	Jim Roth
Address:	PO Box 47615
City, State, Zip:	Olympia, WA, 98504-7615
Telephone #:	360-407-7036
E-mail:	JROT461@ECY.WA.GOV
Fax:	360-407-7153

III. Performance Security

Performance Security Option Selected, Dollar Amount, And, If Applicable, Holding Institution (Pursuant To Section II.B.6. Of Part B — General Terms And Conditions):

Performance Security Option -Prepayment $ 16,324

IV. Scope Of Work – *Tasks, Budget Detail, Schedule*

The City of Lacey has requested the use of groundwater from five different points of withdrawal in the Hawks Prairie area. Table 1 (below) presents the details of each application. The applications are requesting instantaneous withdrawals (Qi) between 800 and 1,000 gallons per minute (gpm) and specified annual quantities (Qa) between 600 and 1,500 acre-feet per year (afy). The purpose of the withdrawals is Municipal Supply.

Consistent with the provisions of Part B — General Terms and Conditions as well as the provisions of RCW 43.21A.690 and RCW 90.03.265, the following describes the specific tasks, budget detail, and schedule for the scope of work to be performed by Ecology and its consultant, Aspect Consulting, LLC, to be subsequently reimbursed by the Applicant pursuant to this CRA. Accordingly, the Parties signatory to this Agreement agree:

Phase I
Reimbursable Tasks with Associated Budget Detail and Schedule

Task 1 – Review materials and conduct necessary field visit in order to make recommendation to Ecology on the "source" of water requested by the Applicant.

The Phase I investigation will be based on existing information, including multiple studies and technical documents produced to support the watershed planning process, the *WRIA 13 Watershed Assessment*, and the *Draft WRIA 13 Watershed Plan*. Other relevant documents include the *North Thurston County Coordinated Water System Plan*, pertinent well completion and testing reports, and Ecology's water well database to confirm the hydrogeologic conditions in the vicinity of the requested point(s) of withdrawal.

Aspect Consulting (Aspect) will conduct a field visit to determine how each particular point of withdrawal relates to the hydrogeologic setting and its relation to other pending applications, as well as examine the points of withdrawal. Following the site visit, Aspect will discuss their findings in a telephone conference with a hydrogeologist from Ecology to reach a consensus on the hydrogeologic setting and the "source" of the requested water for each application. The delineation of the source of water will be documented in a draft Phase I report which will include maps identifying relevant information related to the project. The Phase I report will also incorporate findings and recommendations from Tasks 2 and 3. Ecology's review comments on the draft Phase I report will be addressed and a final copy submitted.

Task 2 – Determine senior water right applications competing for same source of water, to be processed in conjunction with the Applicant's.

A list of water right applications that are senior to the City of Lacey's applications will be developed by comparing priority date, the location within the watershed, and Ecology's Water Rights Tracking System (WRTS) database. Aspect will evaluate each of the applications to verify whether the requested water is in the "same source" as the subject applications as defined by Task 1. Aspect will then make a recommendation of which water right applications should be included and excluded in Phase II of the project and the corresponding rationale. To accomplish this, Aspect will review the water rights file for each pertinent application. For those applications requesting withdrawals from existing wells, well logs will be evaluated to assess aquifer completion zones relative to the defined hydrogeologic setting. For those applications requesting surface water withdrawals, the location and source of the surface water will be placed within the hydrogeologic setting defined in Task 1. Findings will be summarized in the Phase I report to Ecology, listing which applications are recommended for processing.

Task 3 – Develop Phase II Scope of Work and Cost to Develop Reports of Examination

Aspect will prepare a work scope and cost estimate to process and develop Reports of Examination for each of the City of Lacey's five applications and any senior applications identified in Task 2. The scope of the Phase II processing will include evaluation of each of the applications relative to the four-part criteria (resource availability, beneficial use, potential for impairment of existing rights, and public welfare). Each Report of Examination will include a description of the proposed water supply, results of impairment/hydraulic continuity investigations, analysis of the four-part test and a recommended decision based on the analysis. Findings and recommendations from Tasks 1 through 3 will be presented to Ecology in a Phase I report. Maps identifying relevant information related to the project will be included.

For cost estimating purposes, Aspect has assumed the Phase I effort will require identifying senior competing applications for two sources of water related to the five individual applications and corresponding points of withdrawal. Additional effort may be required beyond the requested authorization if additional source evaluations are required to identify senior competing applications.

Coordination with Ecology will occur throughout the project; however, Aspect anticipates one meeting with Ecology will be sufficient and has budgeted accordingly. Aspect's cost estimate includes one site visit. Projected costs for travel and expenses are included in the estimated cost. Aspect anticipates that the entire phase will be completed within a 12-week period.

If the scope of work for Phase 1 includes analysis for more than two water sources, or any other changes in either Ecology or consultant scoping assumptions, the City of Lacey's Phase 1 costs will increase. If there is a cost increase, Ecology and the City of Lacey will agree to the changes and sign a written amendment for that increase.

Estimated Number of Consultant Hours and Cost for Phase I:

- Estimated Consultant Hours = 126 Hours
- Estimated Consultant Cost= $ 12,949
- Estimated Phase 1 Completion Date = 12 Weeks From Effective Date of signed work assignment from Ecology to consultant.

Estimated Ecology Staff and Backfill Cost:

- Estimated Number of Ecology Hours to be Billed to Applicant for Direct Work on Project = 25 Hours

- Estimated Ecology Costs to be Billed to Applicant for Direct Work on Project = $ 1,375

- Estimated Backfill Dollars Available for Backfill Consultant Cost = $2,000(25 hours x $135/hr average consultant rate = [$3,375- $1,375 (Ecology direct cost)] = $2,000.

Phase 1
Informational Task, Budget, and Schedule Summary

Tasks	Budget	Schedule
Phase I Consultant Budget	$ 12,949	August 31, 2006
Ecology Staff Costs	$ 1,375	
Ecology Backfill	$ 2,000	

Notes:

1. Total Budget $ 16,324.00
2. Completion Date = June 30, 2007
3. Informational task, budget, and schedule summary presented here is for informational purposes only. Ecology tracks and manages task, budget, and schedule.
4. A formal written and signed amendment to this CRA is required to extend the total project budget amount or final completion date stated herein.

V. Effective Date

The effective date of this CRA, as well as any formal written and signed amendment, is the date of signature by the Washington State Department of Ecology.

VI. Entire Agreement And Signatures

The Parties hereto have agreed to the tasks, budget detail, and schedule described herein Part A. This entire agreement, consisting of Part A — Special Terms and Conditions and Scope of Work, Part B — General Terms and Conditions, and any formal written and signed amendment, can only be modified by a subsequent formal written and signed amendment as described in Section II.E.3. of Part B — General Terms and Conditions.

Applicant's Authorized Official:	Ecology's Authorized Official:
By: G. Cuoio	By: Kenny Loranger
Title: City Manager	Title: 6-06-06
Date: 5-25-06	Date: Section Manager
Address: P.O. Box 3400	Address: P.O. Box 4 7600
City, State, Zip: Lacey Wa 98509	City, State, Zip: Lacey, WA 98503
Telephone #: 360-491-3214	Telephone #: 360-407-6000
E-mail: gcuoio@ci.lacey.wa.us	E-mail:
Fax: 360-412-3186	Fax: 360-507-7153

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
PO Box 47600 • Olympia, WA 98504-7600 • 360-407-6000
TTY 711 or 800-833-6388 (for the speech or hearing impaired)

June 12, 2007

City of Lacey
Peter Brooks
P.O. Box 3400
Lacey, WA 98504

RE: City of Lacey Water Right Project No.9R48

Dear Mr. Brooks:

Enclosed you will find a signed original Cost Reimbursement Agreement amendment for your records. A work assignment for this project is being drafted and the project should resume quickly. Please contact me if you have any comments or questions.

Jim Roth
Financial Services/Contracts
Dept. of Ecology
PO Box 47615
Olympia, WA 98504-7615
Pone: 360-407-7036
Fax: 360-407-7153
JROT461@ECY.WA.GOV

Washington State Department of Ecology
Cost-Reimbursement Agreement (CRA)

Between the
Washington State Department of Ecology
and
City of Lacey

CRA Project No. 9R48
Lacey Water Right Applications
Phase II

PART A
SPECIAL TERMS AND CONDITIONS AND SCOPE OF WORK

Current For: FY 2007-08

Contents:

I. Applicant Information

Project Manager/Primary Point of Contact	Billing Address
Name: Peter Brooks	Name: SAME
Address: P.O. Box 3400	Address:
City, State: Lacey, WA.	City, State:
Zip Code: 98504	Zip Code:
Telephone: 360-438-2675	Telephone:
E-mail: pbrooks@ci.lacey.wa.us	E-Mail:
Fax: 360-456-7799	Fax:

II. Ecology Information

Project Manager/Primary Point of Contact:

Name: Jim Roth
Address: PO Box 47615
City, State, Zip: Olympia, WA, 98504-7615
Telephone #: 360-407-7036
E-mail: JROT461@ECY.WA.GOV
Fax: 360-407-7153

III. Performance Security

Performance Security Option Selected, Dollar Amount, And, If Applicable, Holding Institution (Pursuant To Section II.B.6. Of Part B — General Terms and Conditions):

Performance Security Option-Prepayment $ 76,018.46
Prepayment is the amount of Phase II estimate minus the balance of the Phase I prepayment $ 3,060.54.

IV. Terms of Agreement

Consistent with the provisions of Part B — General Terms and Conditions as well as the provisions of RCW 43.21A.690 and RCW 90.03.265, the following describes the specific tasks, budget detail, and schedule for the scope of work to be performed by Ecology and its consultant Aspect Consulting (Aspect) to be subsequently reimbursed by the Applicant pursuant to this CRA. Accordingly, the Parties signatory to this Agreement agree:

Aspect will investigate and prepare five Reports of Examination (ROE) for the City of Lacey water right applications, G2-30248, G2-30249, G2-30250, G2-30251, and G2-30253 based on the four tests including water availability.

If Ecology determines that a permit can be granted for the full annual quantity requested in application G2-30250, were Groundwater Permit G2-27372 relinquished or cancelled, the City of Lacey shall submit a request to Ecology to voluntarily cancel Groundwater Permit G2-27372.

Under Phase I of this agreement, Aspect and Ecology have determined that there are no other senior applications that need to be processed prior to these applications.

Phase II will include:

- Determination of availability of water to appropriate;
- Analysis of potential impairment to existing water rights and instream flows;
- One round of review and comment on proposed mitigation plans for the City of Lacey's applications, if any; and

- Investigation and preparation of draft ROEs for the City of Lacey's five subject applications.

Additional Phase II scope adjustments may be required based on initial discussions with the Squaxin and Nisqually Tribes, and the Washington Department of Fish and Wildlife.

Aspect will compile the results of the water right applications in draft Reports of Examination and will submit the rough draft Reports of Examination to Ecology for review. Aspect will then prepare the final Reports of Examination incorporating comments by Ecology.

Ecology will post the Draft Reports of Examination on it's website for 30 days prior to formally issuing the decisions.

Consultant Phase II Costs-

Phase II – Information Review and Associated Tasks:

Estimated Number of Consultant Hours = 698 Hours

- Estimated Consultant Cost = $ 75,029.00
- Estimated Phase II Completion Date = 6 months From Effective Date of Work Assignment

Ecology Direct and Phase II Staff Replacement Costs–

- Estimated Number of Ecology Hours to be Billed to Applicant for Direct Work on Project = 30 Hours
- Estimated Ecology Costs to be Billed to Applicant for Direct Work on Project = $ 1,650.00
- Staff Replacement Cost = $ 2,400.00

Phase II
Informational Task, Budget, and Schedule Summary

	Phase II Budget Estimate	Schedule
Consultant Costs	$75,029.00	6 months from Ecology Signature of Work Assignment
Ecology Direct Costs	$1,650.00	
Staff Replacement Cost	$2,400.00	
Budget Subtotal:	**$79,079.00**	

Budget Summary

Phase I Estimated Costs $ 16,324.00

Phase II Estimate $ 79,079.00
Total Estimated Budget Phase I & II $ 95,403.00

Informational task, budget, and schedule summary presented here is for informational purposes only. Ecology tracks and manages costs at the total project level. A formal written and signed amendment to this CRA is required to increase the total project budget amount or extend the completion date. This budget estimate does not include potential costs associated with appeals following issuance of the final decision.

V. Effective Date

The effective date of this CRA is the date of signature by the Washington State Department of Ecology. The end date of this agreement is June 30, 2008.

VI. Entire Agreement and Signatures

The Parties hereto have agreed to the tasks, budget detail, and schedule described herein Part A. This entire agreement, consisting of Part A — Special Terms and Conditions and Scope of Work, Part B — General Terms and Conditions, and any formal written and signed amendment, can only be modified by a subsequent formal written and signed amendment as described in Section II.E.3. of Part B — General Terms and Conditions.

Applicant's Authorized Official:

By: [signature]
Title: City Manager
Date: 5-16-07
Address:
City, State, Zip:
Telephone #:
E-mail:
Fax:

Ecology's Authorized Official:

By: [signature]
Title: Program Manager
Date: 6/1/07
Address: P.O. Box 47600
City, State, Zip: Olympia, WA 98504
Telephone #: 360-407-6000
E-mail:
Fax: 360-407-7153

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
PO Box 47600 • Olympia, WA 98504-7600 • 360-407-6000
711 for Washington Relay Service • Persons with a speech disability can call 877-833-6341

RECEIVED
JUL 03 2008
PUBLIC WORKS

July 1, 2008

City of Lacey
Peter Brooks
P.O. Box 3400
Lacey, WA 98504

RE: City of Lacey Water Right Project No.9R48

Dear Mr. Brooks:

Enclosed you will find a signed original Cost Reimbursement Agreement Phase II Amendment 1 for your records. Please contact me if you have any comments or questions.

Jim Roth
Financial Services/Contracts
Dept. of Ecology
PO Box 47615
Olympia, WA 98504-7615
Pone: 360-407-7036
Fax: 360-407-7153
JROT461@ECY.WA.GOV

Washington State Department of Ecology
Cost-Reimbursement Agreement (CRA)

Between the
Washington State Department of Ecology
and
City of Lacey

CRA Project No. 9R48
Lacey Water Right Applications

Phase II

Amendment 1

PART A
SPECIAL TERMS AND CONDITIONS AND SCOPE OF WORK

Current For: FY 2009-10

The purpose of this amendment is to extend the cost reimbursement agreement end date. All other terms and conditions of the original agreement and prior amendments remain in full force and effect. There is no budget change.

Effective Date and End Date

The effective date of this amendment is July 1, 2008. The revised end date of this agreement is June 30, 2009.

The parties sign this amendment.

Applicant's Authorized Official:	Ecology's Authorized Official:
By:	By:
Title: City Manager	Title: Program Manager
Date: 6-25-08	Date: 6/30/08
Address: P.O. Box 3400	Address: P.O. Box 47600
City, State, Zip: Lacey, WA 98504	City, State, Zip: Olympia, WA. 98504
Telephone #:360-438-2675	Telephone #: 360-407-6000
E-mail:	E-mail:
Fax: 360-456-7799	Fax: 360-407-7153

Washington State Department of Ecology
Cost-Reimbursement Agreement (CRA)

Between the
Washington State Department of Ecology
and
City of Lacey

CRA Project No. 9R48
Lacey Water Right Applications
Phase II
Amendment 5

PART A
SPECIAL TERMS AND CONDITIONS AND SCOPE OF WORK

Current For: FY 2011-12

The purpose of this amendment is to modify the scope of work performed by Ecology's consultant. At the request of the City, Ecology's consultant will not process Application G2-30253 (Beachcrest) but will now prepare Reports of Examination for two additional applications, G2-29304 (Evergreen Estates) and G2-29165 (Madrona Wellfield).

Ecology's consultant has informed Ecology that they can perform this work within the budget originally submitted.

The end date of this agreement is June 30, 2012.

The parties sign this amendment.

Applicant's Authorized Official:

By: ____________________
Title: City Manager
Date: 10/11/2011
Address: P.O. Box 3400
City, State, Zip: Lacey, WA 98504
Telephone #: 360-438-2675
E-mail: ____________________

Ecology's Authorized Official:

By: ____________________
Title: ____________________
Date: ____________________
Address: P.O. Box 47600
City, State, Zip: Olympia, WA. 98504
Telephone #: 360-407-6000
E-mail: ____________________

Appendix K
CAPITAL FACILITIES PLAN – WATER

Water

Background

The City of Lacey provides water service to approximately 68,000 people within its corporate City limits and adjacent urban areas. Groundwater is the primary supply source to the system and Olympia's McAllister Springs facility provides additional supply. Lacey's water service area abuts the City of Olympia's service area and a number of smaller privately owned water systems, many of which lie within Lacey's city limits. Lacey's system is challenged with replacing deteriorated facilities and mains, and installing growth-related source, storage, and transmission to meet demands as they occur.

Lacey's water system improvements are guided by the 2011 Water Comprehensive Plan. The plan, which serves as the basis for water-related capital projects and this capital facilities plan element, covers the following:

1) Evaluated the current capabilities and limitations of Lacey's existing water systems;

2) Projected future demands in Lacey's current and long-term service areas; and

3) Established a schedule of system repairs, improvements, and expansion necessary to assure adequate supply and delivery of water to those service areas.

System repair and improvement projects listed in this capital facilities plan include replacement and upgrades of distribution piping, development of new water sources and storage capacity, water quality improvements, and other items that will lead to more effective use of existing water resources and facilities.

The exact timing of water-related projects in this area are outlined in this Capital Facilities Plan. This Capital Facilities Plan will be reviewed as needed and as future comprehensive plan updates occur.

It is important to note that this Capital Facilities Plan's purpose is to demonstrate how the City will implement the Water Comprehensive Plan. Readers wishing more detailed explanations of methodologies and findings are encouraged to review the full 2011 Water Comprehensive Plan. Copies are available in the Reports and Plans Library on the City of Lacey's web-site.

Water System Planning Goals and Objectives

Planning goals and objectives as established by Lacey's Comprehensive Water Plan are:

1) Provide sufficient supply to meet increasing water system demands and complete water right mitigation projects in order to utilize new water rights. The development of increased water supply includes maximizing capacity from existing sources and the development of new sources.

2) Provide a safe, consistent, and efficient supply of high quality water to the customers.

3) Increase source reliability to meet DOH recommended design criteria.

4) Construct water supply, distribution, transmission and storage improvements to meet City wide water demands.

5) Upgrade and replace aging water mains and facilities.

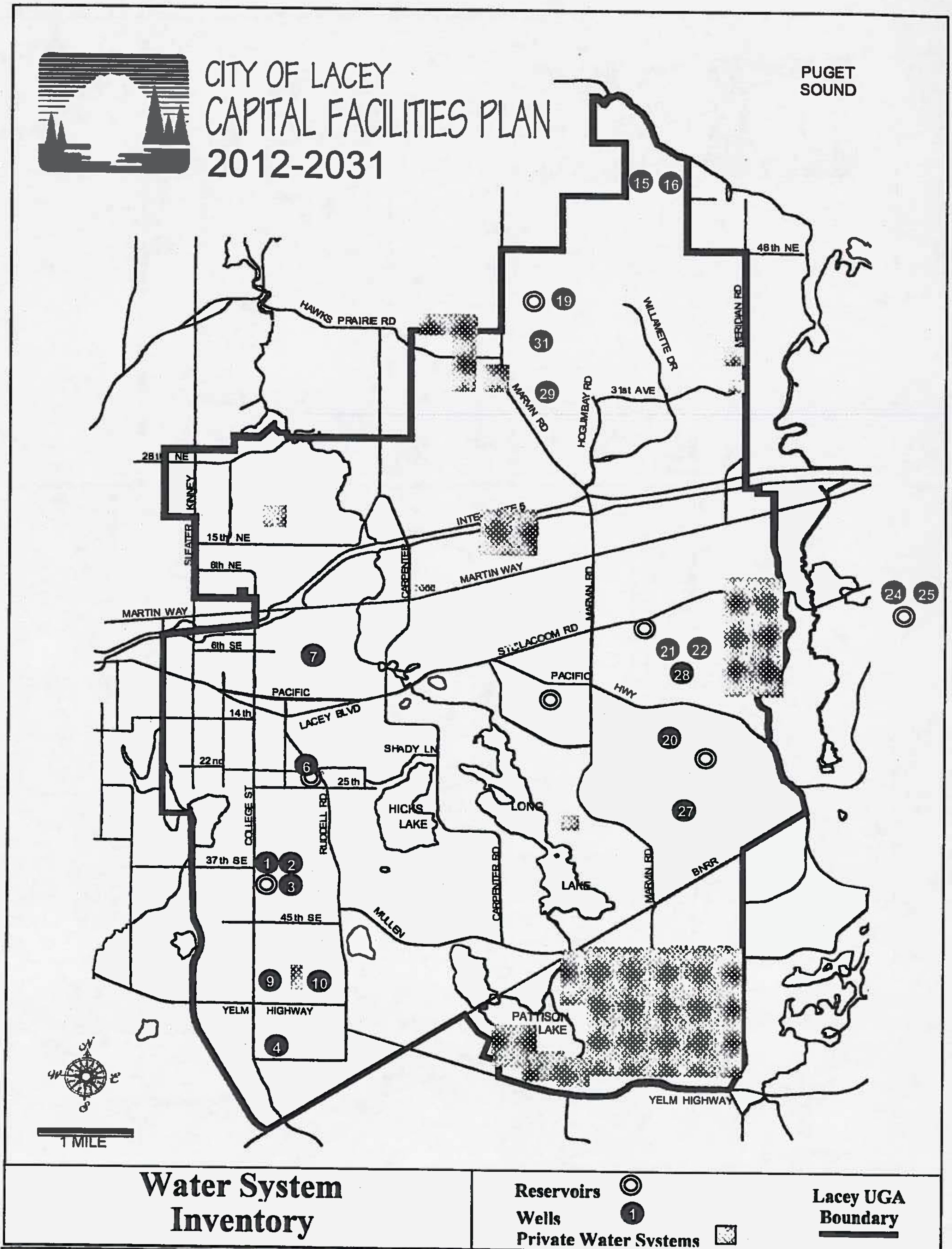
6) Provide a financing plan for the Capital Improvement Program to meet projected growth and water system needs.

Meeting Demands of Population Growth

In 2005, it became necessary to place restrictions on new water system connections in the Urban Growth Area (UGA), pending additional water right authorizations from the Department of Ecology. Per Resolution 917, new connections inside the city limits are currently allowed; however, connections outside city limits must provide water rights sufficient for their development. Since adoption of this resolution and publication of the 2011 Comprehensive Water Plan, the City has acquired additional annual water rights and is now authorized to withdraw up to 23,511 gpm and 16,798.2 Acre-feet per year. Mitigation is required to fully use the water rights acquired in 2012. The City is currently reviewing the timing on rescinding or amending Resolution 917.

While recent growth rates have slowed, the water utility continues to anticipate strong long-term residential and commercial growth. This could drive average daily water demands as high as 13.08 million gallons by the year 2029, a 62% increase. Now that the City has acquired several new water rights, the focus of the utility shifts to developing the infrastructure needed to meet those future demands. Many of the projects listed in this plan are critical to achieving that goal.

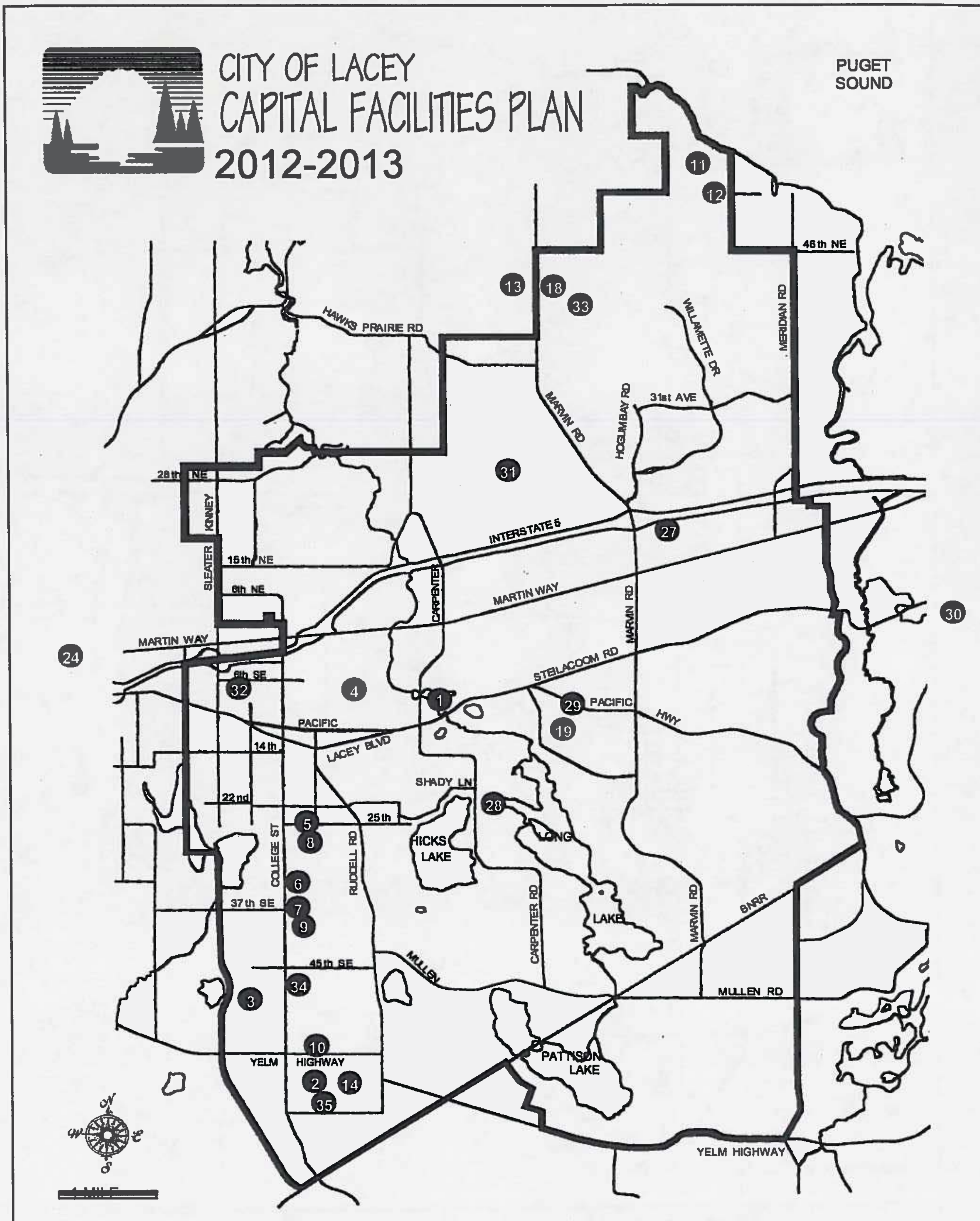
The financing plan for the first six years of the Water Element of this Capital Facilities Plan is illustrated on page 8-5.



Water System Inventory

Reservoirs
Wells
Private Water Systems

Lacey UGA Boundary



Water Projects

Project Numbers 1

Lacey UGA Boundary

CITY OF LACEY 2012-2031 CAPITAL FACILITIES PLAN

WATER PROJECTS SUMMARY SHEET

	Prior Years	2012	2013	2014	2015	2016	2017	6-Year Total	%	Future Years
FUNDING SOURCES										
General Revenue										
Voted G.O. Bonds										
Non-Voted G.O. Bonds										
Revenue Bonds										14,100,000
Utility Rates / Fees	1,553,594	2,236,716	1,563,000	2,074,000	1,480,000	1,350,000	1,600,000	10,303,716	28%	10,163,000
GFC Revenue	532,175	3,042,220	2,812,000	260,000	880,000	935,000	2,230,000	10,159,220	28%	13,144,000
LID / ULID										
Arterial Street Fund										
PWTF Loan Total		269,000	3,773,000	3,258,000	5,830,000	450,000	1,300,000	14,880,000	41%	120,000
Interfund Loan										
Grants										
SEPA / LTA										
Developer Financing										
Other	33,575	80,290	868,000					948,290	3%	
TOTAL	2,119,344	5,628,226	9,016,000	5,592,000	8,190,000	2,735,000	5,130,000	36,291,226	100%	37,527,000
EXPENDITURES BY CATEGORY										
Planning			8,400					8,400	0%	
Preliminary Design	219,472	70,914	290,950	17,500		429,750	265,000	1,074,114	3%	28,200
Design & Engineering	1,116,509	2,103,557	1,328,150	1,555,000	770,000	930,250	1,011,000	7,697,957	21%	5,101,300
Land / ROW Acquisition		250,000		110,000				360,000	1%	
Construction	783,363	3,203,755	7,388,500	3,909,500	7,420,000	1,375,000	3,854,000	27,150,755	75%	32,397,500
Other										
TOTAL	2,119,344	5,628,226	9,016,000	5,592,000	8,190,000	2,735,000	5,130,000	36,291,226	100%	37,527,000
EXPENDITURES BY PROJECT										
Water- 1 Woodland Creek Reclaimed Infiltration	154,724	370,000	4,000,000					4,370,000	12%	
Water- 2 Groundwater Monitoring Wells			168,000					168,000	0%	
Water- 3 New 3.2 MG Reservoir in 337 Zone			150,000	800,000	4,650,000			5,600,000	15%	
Water- 4 ATEC Facility Particulate Removal	113,352	440,914	1,250,000					1,690,914	5%	
Water- 5 Well S06 Replacement	200,089	15,000	300,000	1,378,000				1,693,000	5%	
Water- 6 Generator for Westside Facilities			150,000					150,000	0%	
Water- 7 Install VFDs at Westside Booster			23,000	230,000				253,000	1%	
Water- 8 Overflow for Judd Hill Reservoir				350,000				350,000	1%	
Water- 9 Well S01 Replacement						250,000	300,000	550,000	2%	1,200,000
Water- 10 Capital City Golf Course Fire flow						200,000	1,000,000	1,200,000	3%	1,029,000
Water- 11 Wells S15 and S16 Replacement			400,000	500,000	1,180,000			2,080,000	6%	
Water- 12 48th/50th Ave Fire flow Improvements										564,000
Water- 13 Marvin Road Well Development		250,000						250,000	1%	2,200,000
Water- 14 Well S04 Corrosion Control	520,718	1,920,235						1,920,235	5%	
Water- 15 Comprehensive Water System Update	530,079	29,729			200,000	200,000		429,729	1%	800,000
Water- 16 Telemetry Data - SCADA Upgrade		91,000						91,000	0%	
Water- 17 Annual Pipeline Replacement	390,898	10,000	1,000,000	100,000	1,100,000	1,100,000	1,100,000	4,410,000	12%	13,200,000
Water- 18 Hawks Prairie Well S31 Construction	141,746	1,200,000						1,200,000	3%	
Water- 19 Union Mills Altitude Valve	8,652	441,348						441,348	1%	
Water- 20 Rate Study	39,086	40,000						40,000	0%	
Water- 21 Telemetry Controls at PRV Stations		220,000	200,000	200,000	80,000			700,000	2%	
Water- 22 Transportation/Development Projects	10,000	140,000		200,000				340,000	1%	
Water- 23 Critical Valves Program	10,000	90,000	100,000	100,000	100,000			390,000	1%	
Water- 24 Brewery Wellfield Development		150,000	300,000			500,000	1,000,000	1,950,000	5%	1,150,000
Water- 25 Annual Pipeline Improvements		160,000	880,000	160,000	880,000	160,000	880,000	3,120,000	9%	6,000,000
Water- 26 Biennial Well Rehab/Replacement		60,000		50,000		50,000		160,000	0%	300,000
Water- 27 Skokomish Way Water main			95,000	1,045,000				1,140,000	3%	
Water- 28 20th Avenue SE Fire flow				245,000				245,000	1%	
Water- 29 Overflow for Union Mills Reservoir				152,000				152,000	0%	
Water- 30 Overflow for Nisqually Reservoir				82,000				82,000	0%	
Water- 31 Reclaimed Water Facilities						150,000	350,000	500,000	1%	7,800,000
Water- 32 New 3.2 MGD Pump Station						125,000	500,000	625,000	2%	1,000,000
Water- 33 Willamette Drive Velocity Improvement										134,000
Water- 34 College Street Pressure Improvement										350,000
Water- 35 Well S04 Improvements										1,800,000
TOTAL	2,119,344	5,628,226	9,016,000	5,592,000	8,190,000	2,735,000	5,130,000	36,291,226	100%	37,527,000

Notes: Project funding and expenditure amounts shown in the future years column are preliminary estimates for planning purposes. Identification of specific revenue sources and expenditures will be made as the project moves into the 6-year planning window.

Planning Period: 2012-2031
Project Title: Woodland Creek Reclaimed Infiltration
Location: Woodland Creek Community Park

File Number: wtr001.xls
UGA Planning Area: Area-Wide
Water Plan Project: WS-8

CFP Project: Water- 1
Department: Public Works

Project Description: This project is to construct the Woodland Creek Regional Reclaimed Water infiltration Facility.

100% Expansion

Upgrade/Replacement

Project Justification: The Woodland Creek Regional Reclaimed Water infiltration Facility is intended to recharge groundwater in the Woodland Creek Basin to mitigate impacts resulting from additional groundwater withdrawals by the cities of Lacey and Olympia.

Policy Basis: Utility Management Practices

Current Project Status: Design

Land Status: City Owned

PROJECT FUNDING SOURCES AND EXPENDITURES

	Prior Years	2012	2013	2014	2015	2016	2017	6-Year Total	%	Future Years
FUNDING										
General Revenue										
Voted G.O. Bonds										
Non-Voted G.O. Bonds										
Revenue Bonds										
Utility Rates / Fees										
GFC Revenue	121,149	289,710	1,632,000					1,921,710	44%	
LID / ULID										
Arterial Street Fund										
PWTF Loan Total			1,500,000					1,500,000	34%	
Interfund Loan										
Grants										
SEPA /LTA										
Developer Financing										
Other - Olympia (21.7%)	33,575	80,290	868,000					948,290	22%	
TOTAL FUNDING	154,724	370,000	4,000,000					4,370,000	100%	
EXPENDITURES										
Planning										
Preliminary Design										
Design & Engineering	154,724	370,000						370,000	8%	
Land / ROW Acquisition										
Construction			4,000,000					4,000,000	92%	
Other										
TOTAL EXPENDITURES	154,724	370,000	4,000,000					4,370,000	100%	

Notes:

Planning Period: 2012-2031
Project Title: Groundwater Monitoring Wells
Location: Area Wide

File Number: wtr002.xls
UGA Planning Area: Area Wide
Water Plan Project: WQ-3

CFP Project: Water- 2
Department: Public Works

Project Description: Install three monitoring wells, expand water quality and well head protection for source wells.

Expansion 100% Upgrade/Replacement

Project Justification: The Wellhead Protection Report recommends the additional wells and monitoring

Policy Basis: Utility Management Practices

Current Project Status: Planning

Land Status: None Required

PROJECT FUNDING SOURCES AND EXPENDITURES

	Prior Years	2012	2013	2014	2015	2016	2017	6-Year Total	%	Future Years
FUNDING										
General Revenue										
Voted G.O. Bonds										
Non-Voted G.O. Bonds										
Revenue Bonds										
Utility Rates / Fees			168,000					168,000	100%	
GFC Revenue										
LID / ULID										
Arterial Street Fund										
PWTF Loan										
Interfund Loan										
Grants										
SEPA / LTA										
Developer Financing										
Other										
TOTAL FUNDING			168,000					168,000	100%	
EXPENDITURES										
Planning			8,400					8,400	5%	
Preliminary Design			16,800					16,800	10%	
Design & Engineering			16,800					16,800	10%	
Land / ROW Acquisition										
Construction			126,000					126,000	75%	
Other										
TOTAL EXPENDITURES			168,000					168,000	100%	

Notes:

Planning Period: 2012-2031
Project Title: New 3.2 MG Reservoir in 337 Zone
Location: South College Street

File Number: wtr003.xls
UGA Planning Area: Horizons
Water Plan Project: ST-2

CFP Project: Water- 3
Department: Public Works

Project Description: Construct a new 3.2 MG reservoir to meet a forecasted storage deficiency.

100% Expansion Upgrade/Replacement

Project Justification: 3.2 MG of additional storage is needed to serve the projected growth over the next 20 years.

Policy Basis: 2011 Water Comprehensive Plan

Current Project Status: Planning

Land Status: City Owned

PROJECT FUNDING SOURCES AND EXPENDITURES

	Prior Years	2012	2013	2014	2015	2016	2017	6-Year Total	%	Future Years
FUNDING										
General Revenue										
Voted G.O. Bonds										
Non-Voted G.O. Bonds										
Revenue Bonds										
Utility Rates / Fees										
GFC Revenue										
LID / ULID										
Arterial Street Fund										
PWTF Loan			150,000	800,000	4,650,000			5,600,000	100%	
Interfund Loan										
Grants										
SEPA / LTA										
Developer Financing										
Other										
TOTAL FUNDING			150,000	800,000	4,650,000			5,600,000	100%	
EXPENDITURES										
Planning										
Preliminary Design			150,000					150,000	3%	
Design & Engineering				800,000	450,000			1,250,000	22%	
Land / ROW Acquisition										
Construction					4,200,000			4,200,000	75%	
Other										
TOTAL EXPENDITURES			150,000	800,000	4,650,000			5,600,000	100%	

Notes:

Planning Period: 2012-2031
Project Title: ATEC Facility Particulate Removal
Location: Lacey Street

File Number: wtr004.xls
UGA Planning Area: Central Lacey
Water Plan Project: WQ-1

CFP Project: Water- 4
Department: Public Works

Project Description: Construct a filter backwash and particulates removal and disposal system at the ATEC facility.

Expansion 100% Upgrade/Replacement

Project Justification: The ATEC facility experiences plugging of the infiltration ponds due to particulates produced during the filter backwash.

Policy Basis: 2011 Water Comprehensive Plan

Current Project Status: Design

Land Status: Easements Required

PROJECT FUNDING SOURCES AND EXPENDITURES

	Prior Years	2012	2013	2014	2015	2016	2017	6-Year Total	%	Future Years
FUNDING										
General Revenue										
Voted G.O. Bonds										
Non-Voted G.O. Bonds										
Revenue Bonds										
Utility Rates / Fees	113,352	171,914						171,914	10%	
GFC Revenue										
LID / ULID										
Arterial Street Fund										
PWTF Loan		269,000	1,250,000					1,519,000	90%	
Interfund Loan										
Grants										
SEPA / LTA										
Developer Financing										
Other										
TOTAL FUNDING	113,352	440,914	1,250,000					1,690,914	100%	
EXPENDITURES										
Planning										
Preliminary Design	113,352	40,914						40,914	2%	
Design & Engineering		400,000						400,000	24%	
Land / ROW Acquisition										
Construction			1,250,000					1,250,000	74%	
Other										
TOTAL EXPENDITURES	113,352	440,914	1,250,000					1,690,914	100%	

Notes:

Planning Period: 2012-2031
Project Title: Well S06 Replacement
Location: Judd Street

File Number: wtr005.xls
UGA Planning Area: Central Lacey
Water Plan Project: WS-10

CFP Project: Water- 5
Department: Public Works

Project Description: Explore options and implement improvements to utilize existing water rights and provide water to the 337 PZ College Street Corridor.

Expansion 100% Upgrade/Replacement

Project Justification: Well S06 has instantaneous capacity has declined . Despite multiple rehabilitation s, the well continues to have declining specific capacity. To perfect the water right and provide water in a high water demand area of the water system, the well needs to be replaced or other improvements made.

Policy Basis: 2011 Water Comprehensive Plan

Current Project Status: Design

Land Status: City Owned

PROJECT FUNDING SOURCES AND EXPENDITURES

	Prior Years	2012	2013	2014	2015	2016	2017	6-Year Total	%	Future Years
FUNDING										
General Revenue										
Voted G.O. Bonds										
Non-Voted G.O. Bonds										
Revenue Bonds										
Utility Rates / Fees	200,089	15,000						15,000	1%	
GFC Revenue										
LID / ULID										
Arterial Street Fund										
PWTF Loan			300,000	1,378,000				1,678,000	99%	
Interfund Loan										
Grants										
SEPA / LTA										
Developer Financing										
Other										
TOTAL FUNDING	200,089	15,000	300,000	1,378,000				1,693,000	100%	
EXPENDITURES										
Planning										
Preliminary Design										
Design & Engineering	40,089	15,000	300,000					315,000	19%	
Land / ROW Acquisition										
Construction	160,000			1,378,000				1,378,000	81%	
Other										
TOTAL EXPENDITURES	200,089	15,000	300,000	1,378,000				1,693,000	100%	

Notes:

Planning Period:	2012-2031	File Number:	wtr006.xls	CFP Project:	Water- 6
Project Title:	Generator for Westside Facilities	UGA Planning Area:	Horizons	Department:	Public Works
Location:	College Street	Water Plan Project:	PS-2		

Project Description: install an on-site generator for the Westside Booster Station , Wells and Chlorination Generation Facility on College Street.

Expansion 100% Upgrade/Replacement

Project Justification: A 300 -kW generator is needed at this site to provide power in the event of a power outage.

Policy Basis: 2011 Water Comprehensive Plan

Current Project Status: Planning

Land Status: City Owned

PROJECT FUNDING SOURCES AND EXPENDITURES

	Prior Years	2012	2013	2014	2015	2016	2017	6-Year Total	%	Future Years
FUNDING										
General Revenue										
Voted G.O. Bonds										
Non-Voted G.O. Bonds										
Revenue Bonds										
Utility Rates / Fees										
GFC Revenue										
LID / ULID										
Arterial Street Fund										
PWTF Loan			150,000					150,000	100%	
Interfund Loan										
Grants										
SEPA / LTA										
Developer Financing										
Other										
TOTAL FUNDING			150,000					150,000	100%	
EXPENDITURES										
Planning										
Preliminary Design			7,500					7,500	5%	
Design & Engineering			30,000					30,000	20%	
Land / ROW Acquisition										
Construction			112,500					112,500	75%	
Other										
TOTAL EXPENDITURES			150,000					150,000	100%	

Notes:

Planning Period:	2012-2031	File Number:	wtr007.xls	CFP Project:	Water- 7
Project Title:	Install VFDs at Westside Booster	UGA Planning Area:	Horizons	Department:	Public Works
Location:	College Street	Water Plan Project:	PS-1		

Project Description: Replace the two constant speed motors at the westside booster station with variable frequency drive motors.

Expansion 100% Upgrade/Replacement

Project Justification: Installing variable speed drives will Improve operations and pumping efficiency at the site.

Policy Basis: 2011 Water Comprehensive Plan

Current Project Status: Planning

Land Status: City Owned

PROJECT FUNDING SOURCES AND EXPENDITURES

	Prior Years	2012	2013	2014	2015	2016	2017	6-Year Total	%	Future Years
FUNDING										
General Revenue										
Voted G.O. Bonds										
Non-Voted G.O. Bonds										
Revenue Bonds										
Utility Rates / Fees										
GFC Revenue										
LID / ULID										
Arterial Street Fund										
PWTF Loan			23,000	230,000				253,000	100%	
Interfund Loan										
Grants										
SEPA / LTA										
Developer Financing										
Other										
TOTAL FUNDING			23,000	230,000				253,000	100%	
EXPENDITURES										
Planning										
Preliminary Design			12,650					12,650	5%	
Design & Engineering			10,350	40,250				50,600	20%	
Land / ROW Acquisition										
Construction				189,750				189,750	75%	
Other										
TOTAL EXPENDITURES			23,000	230,000				253,000	100%	

Notes:

Planning Period:	2012-2031	File Number:	wtr008.xls	CFP Project:	Water- 8
Project Title:	Overflow for Judd Hill Reservoir	UGA Planning Area:	Central Lacey	Department:	Public Works
Location:	Judd Street	Water Plan Project:	ST-4		

Project Description: Construct an overflow pond at the Judd Hill Reservoir.

Expansion 100% Upgrade/Replacement

Project Justification: This site does not have a detention pond or other means of collecting and disposing of water during an overflow event.

Policy Basis: 2011 Water Comprehensive Plan

Current Project Status: Planning

Land Status: Additional Land May be Required

PROJECT FUNDING SOURCES AND EXPENDITURES

	Prior Years	2012	2013	2014	2015	2016	2017	6-Year Total	%	Future Years
FUNDING										
General Revenue										
Voted G.O. Bonds										
Non-Voted G.O. Bonds										
Revenue Bonds										
Utility Rates / Fees										
GFC Revenue										
LID / ULID										
Arterial Street Fund										
PWTF Loan				350,000				350,000	100%	
Interfund Loan										
Grants										
SEPA / LTA										
Developer Financing										
Other										
TOTAL FUNDING				350,000				350,000	100%	
EXPENDITURES										
Planning										
Preliminary Design				17,500				17,500	5%	
Design & Engineering				70,000				70,000	20%	
Land / ROW Acquisition				110,000				110,000	31%	
Construction				152,500				152,500	44%	
Other										
TOTAL EXPENDITURES				350,000				350,000	100%	

Notes:

Planning Period:	2012-2031	File Number:	wtr009.xls	CFP Project:	Water- 9
Project Title:	Well S01 Replacement	UGA Planning Area:	Horizons	Department:	Public Works
Location:	College Street	Water Plan Project:	WS-12		

Project Description: Replace the S01 Well with a new well.

Expansion 100% Upgrade/Replacement

Project Justification: The well is declining in it's ability to provide the needed capacity.

Policy Basis: 2011 Water Comprehensive Plan

Current Project Status: Planning

Land Status: City-owned

PROJECT FUNDING SOURCES AND EXPENDITURES

	Prior Years	2012	2013	2014	2015	2016	2017	6-Year Total	%	Future Years
FUNDING										
General Revenue										
Voted G.O. Bonds										
Non-Voted G.O. Bonds										
Revenue Bonds										
Utility Rates / Fees										1,200,000
GFC Revenue										
LID / ULID										
Arterial Street Fund										
PWTF Loan						250,000	300,000	550,000	100%	
Interfund Loan										
Grants										
SEPA / LTA										
Developer Financing										
Other										
TOTAL FUNDING						250,000	300,000	550,000	100%	1,200,000
EXPENDITURES										
Planning										
Preliminary Design						87,500		87,500	16%	
Design & Engineering						162,500	187,500	350,000	64%	
Land / ROW Acquisition										
Construction							112,500	112,500	20%	1,200,000
Other										
TOTAL EXPENDITURES						250,000	300,000	550,000	100%	1,200,000

Notes:

Planning Period:	2012-2031	File Number:	wtr010.xls	CFP Project:	Water- 10
Project Title:	Capital City Golf Course Fire flow	UGA Planning Area:	Horizons	Department:	Public Works
Location:	Yelm Highway	Water Plan Project:	P-1		

Project Description: Replace aging mains and improve fire flow in the Capital City Golf Course area by upsizing pipes.

Expansion 100% Upgrade/Replacement

Project Justification: Several small diameter pipes exist which are limiting fire flow. This project will upsize pipes and improve fire flow.

Policy Basis: 2011 Water Comprehensive Plan

Current Project Status: Planning

Land Status: Easements

PROJECT FUNDING SOURCES AND EXPENDITURES

	Prior Years	2012	2013	2014	2015	2016	2017	6-Year Total	%	Future Years
FUNDING										
General Revenue										
Voted G.O. Bonds										
Non-Voted G.O. Bonds										
Revenue Bonds										
Utility Rates / Fees										1,029,000
GFC Revenue										
LID / ULID										
Arterial Street Fund										
PWTF Loan						200,000	1,000,000	1,200,000	100%	
Interfund Loan										
Grants										
SEPA / LTA										
Developer Financing										
Other										
TOTAL FUNDING						200,000	1,000,000	1,200,000	100%	1,029,000
EXPENDITURES										
Planning										
Preliminary Design						111,000		111,000	9%	
Design & Engineering						89,000	357,250	446,250	37%	
Land / ROW Acquisition										
Construction							642,750	642,750	54%	1,029,000
Other										
TOTAL EXPENDITURES						200,000	1,000,000	1,200,000	100%	1,029,000

Notes:

Planning Period:	2012-2031	File Number:	wtr011.xls	CFP Project:	Water- 11
Project Title:	Wells S15 and S16 Replacement	UGA Planning Area:	Hawks Prairie	Department:	Public Works
Location:	Beachcrest Subdivision	Water Plan Project:	WS-11		

Project Description: Replace the two Beachcrest wells with a single large-diameter well.

Expansion 100% Upgrade/Replacement

Project Justification: The two wells are housed in deteriorating structures and are unable to produce their full instantaneous water right.

Policy Basis: 2011 Water Comprehensive Plan

Current Project Status: Planning

Land Status: City owned

PROJECT FUNDING SOURCES AND EXPENDITURES

	Prior Years	2012	2013	2014	2015	2016	2017	6-Year Total	%	Future Years
FUNDING										
General Revenue										
Voted G.O. Bonds										
Non-Voted G.O. Bonds										
Revenue Bonds										
Utility Rates / Fees										
GFC Revenue										
LID / ULID										
Arterial Street Fund										
PWTF Loan			400,000	500,000	1,180,000			2,080,000	100%	
Interfund Loan										
Grants										
SEPA / LTA										
Developer Financing										
Other										
TOTAL FUNDING			400,000	500,000	1,180,000			2,080,000	100%	
EXPENDITURES										
Planning										
Preliminary Design			104,000					104,000	5%	
Design & Engineering			296,000	120,000				416,000	20%	
Land / ROW Acquisition										
Construction				380,000	1,180,000			1,560,000	75%	
Other										
TOTAL EXPENDITURES			400,000	500,000	1,180,000			2,080,000	100%	

Notes:

Planning Period: 2012-2031
Project Title: 48th/50th Ave Fire flow Improvements
Location: 48th and 50th Avenues NE

File Number: wtr012.xls
UGA Planning Area: Hawks Prairie
Water Plan Project: P-2

CFP Project: Water- 12
Department: Public Works

Project Description: Replace existing 6-inch pipe with 10-inch pipe to improve fire flow.
Expansion 100% Upgrade/Replacement

Project Justification: Fire flow deficiencies require the pipe size increase.

Policy Basis: 2011 Water Comprehensive Plan
Current Project Status: Planning
Land Status: County ROW

PROJECT FUNDING SOURCES AND EXPENDITURES

	Prior Years	2012	2013	2014	2015	2016	2017	6-Year Total	%	Future Years
FUNDING										
General Revenue									#####	
Voted G.O. Bonds									#####	
Non-Voted G.O. Bonds									#####	
Revenue Bonds									#####	
Utility Rates / Fees									#####	
GFC Revenue									#####	444,000
LID / ULID									#####	
Arterial Street Fund									#####	
PWTF Loan									#####	120,000
Interfund Loan									#####	
Grants									#####	
SEPA / LTA									#####	
Developer Financing									#####	
Other									#####	
TOTAL FUNDING									#####	564,000
EXPENDITURES										
Planning									#####	
Preliminary Design									#####	28,200
Design & Engineering									#####	112,800
Land / ROW Acquisition									#####	
Construction									#####	423,000
Other									#####	
TOTAL EXPENDITURES									#####	564,000

Notes:

Planning Period:	2012-3031	File Number:	wtr013.xls	CFP Project:	Water- 13
Project Title:	Marvin Road Well Development	UGA Planning Area:	Hawks Prairie	Department:	Public Works
Location:	Marvin Road	Water Plan Project:	WS-4		

Project Description: Purchase land for future development of a new 1,000 gpm well.

100% Expansion Upgrade/Replacement

Project Justification: This well Is part of the long term water supply strategy. A test well has been completed at the site..

Policy Basis: 2011 Water Comprehensive Plan

Current Project Status: Planning, Land Purchase Pending

Land Status: Land Required

PROJECT FUNDING SOURCES AND EXPENDITURES

	Prior Years	2012	2013	2014	2015	2016	2017	6-Year Total	%	Future Years
FUNDING										
General Revenue										
Voted G.O. Bonds										
Non-Voted G.O. Bonds										
Revenue Bonds										
Utility Rates / Fees										
GFC Revenue		250,000						250,000	100%	2,200,000
LID / ULID										
Arterial Street Fund										
PWTF Loan										
Interfund Loan										
Grants										
SEPA / LTA										
Developer Financing										
Other										
TOTAL FUNDING		250,000						250,000	100%	2,200,000
EXPENDITURES										
Planning										
Preliminary Design										
Design & Engineering										362,500
Land / ROW Acquisition		250,000						250,000	100%	
Construction										1,837,500
Other										
TOTAL EXPENDITURES		250,000						250,000	100%	2,200,000

Notes:

Planning Period: 2012-2031
Project Title: Well S04 Corrosion Control
Location: Yelm Highway

File Number: wtr014.xls
UGA Planning Area: Horizons
Water Plan Project: WQ-2

CFP Project: Water- 14
Department: Public Works

Project Description: A new corrosion control facility that includes a chemical feed facility and replaces the existing well house.

47% Expansion 53% Upgrade/Replacement

Project Justification: Corrosion control is needed at the Well S04 site.

Policy Basis: 2011 Water Comprehensive Plan

Current Project Status: Construction

Land Status: City Owned

PROJECT FUNDING SOURCES AND EXPENDITURES

	Prior Years	2012	2013	2014	2015	2016	2017	6-Year Total	%	Future Years
FUNDING										
General Revenue										
Voted G.O. Bonds										
Non-Voted G.O. Bonds										
Revenue Bonds										
Utility Rates / Fees	275,981	1,017,725						1,017,725	53%	
GFC Revenue	244,737	902,510						902,510	47%	
LID / ULID										
Arterial Street Fund										
PWTF Loan										
Interfund Loan										
Grants										
SEPA / LTA										
Developer Financing										
Other										
TOTAL FUNDING	520,718	1,920,235						1,920,235	100%	
EXPENDITURES										
Planning										
Preliminary Design	106,120							106,120	5%	
Design & Engineering	137,773	287,080						287,080	14%	
Land / ROW Acquisition										
Construction	276,825	1,633,155						1,633,155	81%	
Other										
TOTAL EXPENDITURES	520,718	1,920,235						2,026,355	100%	

Notes:

Planning Period:	2012-2031	File Number:	wtr015.xls	CFP Project:	Water- 15
Project Title:	Comprehensive Water System Update	UGA Planning Area:	All	Department:	Public Works
Location:	All	Water Plan Project:	G-5		

Project Description: Update of the Water Comprehensive Plan

Expansion 100% Upgrade/Replacement

Project Justification: Updates are required every six years by the Department of Health.

Policy Basis: 2011 Comprehensive Water Plan

Current Project Status: Planning

Land Status: N/A

PROJECT FUNDING SOURCES AND EXPENDITURES

	Prior Years	2012	2013	2014	2015	2016	2017	6-Year Total	%	Future Years
FUNDING										
General Revenue										
Voted G.O. Bonds										
Non-Voted G.O. Bonds										
Revenue Bonds										
Utility Rates / Fees	530,079	29,729			200,000	200,000		429,729	100%	800,000
GFC Revenue										
LID / ULID										
Arterial Street Fund										
PWTF Loan										
Interfund Loan										
Grants										
SEPA / LTA										
Developer Financing										
Other										
TOTAL FUNDING	530,079	29,729			200,000	200,000		429,729	100%	800,000
EXPENDITURES										
Planning										
Preliminary Design										
Design & Engineering	530,079	29,729			200,000	200,000		429,729	100%	800,000
Land / ROW Acquisition										
Construction										
Other										
TOTAL EXPENDITURES	530,079	29,729			200,000	200,000		429,729	100%	800,000

Notes:

Planning Period:	2012-2031	File Number:	wtr016.xls	CFP Project:	Water- 16
Project Title:	Telemetry Data - SCADA Upgrade	UGA Planning Area:	All	Department:	Public Works
Location:	System Wide	Water Plan Project:	G-1		

Project Description: This project will entail purchase of software and hardware , setting up the new databases, and converting the existing databases.

Expansion 100% Upgrade/Replacement

Project Justification: The existing database is cumbersome, confusing and a new system is needed to provide real-time information on water and wastewater facilities.

Policy Basis: 2011 Comprehensive Water Plan

Current Project Status: Design

Land Status: N/A

PROJECT FUNDING SOURCES AND EXPENDITURES

	Prior Years	2012	2013	2014	2015	2016	2017	6-Year Total	%	Future Years
FUNDING										
General Revenue										
Voted G.O. Bonds										
Non-Voted G.O. Bonds										
Revenue Bonds										
Utility Rates / Fees		91,000						91,000	100%	
GFC Revenue										
LID / ULID										
Arterial Street Fund										
PWTF Loan										
Interfund Loan										
Grants										
SEPA / LTA										
Developer Financing										
Other										
TOTAL FUNDING		91,000						91,000	100%	
EXPENDITURES										
Planning										
Preliminary Design										
Design & Engineering		91,000						91,000	100%	
Land / ROW Acquisition										
Construction										
Other										
TOTAL EXPENDITURES		91,000						91,000	100%	

Notes:

Planning Period:	2012-2031	File Number:	wtr017.xls	CFP Project:	Water- 17
Project Title:	Annual Pipeline Replacement	UGA Planning Area:	All Areas	Department:	Public Works
Location:	System Wide	Water Plan Project:	P-8		

Project Description: This is an annual program of water main replacement.

Expansion 100% Upgrade/Replacement

Project Justification: Replacement of lines reduces water loss and repair of broken lines.

Policy Basis: 2011 Comprehensive Water Plan

Current Project Status: On-going Design and Construction

Land Status: City and County ROW

PROJECT FUNDING SOURCES AND EXPENDITURES

	Prior Years	2012	2013	2014	2014	2015	2016	6-Year Total	%	Future Years
FUNDING										
General Revenue										
Voted G.O. Bonds										
Non-Voted G.O. Bonds										
Revenue Bonds										6,200,000
Utility Rates / Fees	390,898	10,000	1,000,000	100,000	1,100,000	1,100,000	1,100,000	4,410,000	100%	7,000,000
GFC Revenue										
LID / ULID										
Arterial Street Fund										
PWTF Loan										
Interfund Loan										
Grants										
SEPA / LTA										
Developer Financing										
Other										
TOTAL FUNDING	390,898	10,000	1,000,000	100,000	1,100,000	1,100,000	1,100,000	4,410,000	100%	13,200,000
EXPENDITURES										
Planning										
Preliminary Design										
Design & Engineering	44,360	10,000	250,000	100,000	100,000	100,000	100,000	660,000	15%	1,200,000
Land / ROW Acquisition										
Construction	346,538		750,000		1,000,000	1,000,000	1,000,000	3,750,000	85%	12,000,000
Other										
TOTAL EXPENDITURES	390,898	10,000	1,000,000	100,000	1,100,000	1,100,000	1,100,000	4,410,000	100%	13,200,000

Notes:

Planning Period:	2012-2031	File Number:	wtr018.xls	CFP Project:	Water- 18
Project Title:	Hawks Prairie Well S31 Construction	UGA Planning Area:	Hawks Prairie	Department:	Public Works
Location:	Marvin Road	Water Plan Project:	WS-1		

Project Description: This project will install the necessary pump, electrical and mechanical equipment and a small structure to equip the well.

100% Expansion Upgrade/Replacement

Project Justification: This project will enable the city to utilize water rights in the project area.

Policy Basis: 2011 Water Comprehensive Plan Current Project Status: Construction Land Status: City Owned

PROJECT FUNDING SOURCES AND EXPENDITURES

	Prior Years	2012	2013	2014	2015	2016	2017	6-Year Total	%	Future Years
FUNDING										
General Revenue										
Voted G.O. Bonds										
Non-Voted G.O. Bonds										
Revenue Bonds										
Utility Rates / Fees										
GFC Revenue	141,746	1,200,000						1,200,000	100%	
LID / ULID										
Arterial Street Fund										
PWTF Loan										
Interfund Loan										
Grants										
SEPA / LTA										
Developer Financing										
Other										
TOTAL FUNDING	141,746	1,200,000						1,200,000	100%	
EXPENDITURES										
Planning										
Preliminary Design										
Design & Engineering	141,746	251,900						251,900	21%	
Land / ROW Acquisition										
Construction		948,100						948,100	79%	
Other										
TOTAL EXPENDITURES	141,746	1,200,000						1,200,000	100%	

Notes:

Planning Period:	2012-2031	File Number:	wtr019.xls	CFP Project:	Water- 19
Project Title:	Union Mills Altitude Valve	UGA Planning Area:	Tanglewide/	Department:	Public Works
Location:	Marvin Rd & Pacific Avenue	Water Plan Project:	ST-1		

Project Description: This project modifies the existing altitude valve and vault at the Union Mills reservoir.

Expansion 100% Upgrade/Replacement

Project Justification: The current valve cannot be accessed for maintenance or repair. Failure of this valve would severely affect the water system.

Policy Basis: 2011 Comprehensive Water Plan

Current Project Status: Design

Land Status: City owned

PROJECT FUNDING SOURCES AND EXPENDITURES

	Prior Years	2012	2013	2014	2015	2016	2017	6-Year Total	%	Future Years
FUNDING										
General Revenue										
Voted G.O. Bonds										
Non-Voted G.O. Bonds										
Revenue Bonds										
Utility Rates / Fees	8,652	441,348						441,348	100%	
GFC Revenue										
LID / ULID										
Arterial Street Fund										
PWTF Loan										
Interfund Loan										
Grants										
SEPA / LTA										
Developer Financing										
Other										
TOTAL FUNDING	8,652	441,348						441,348	100%	
EXPENDITURES										
Planning										
Preliminary Design										
Design & Engineering	8,652	103,848						103,848	24%	
Land / ROW Acquisition										
Construction		337,500						337,500	76%	
Other										
TOTAL EXPENDITURES	8,652	441,348						441,348	100%	

Notes:

Planning Period:	2012-2031	File Number:	wtr020.xls	CFP Project:	Water- 20
Project Title:	Rate Study	UGA Planning Area:	All Areas	Department:	Public Works
Location:	System Wide	Water Plan Project:	N/A		

Project Description: This project will fund a water rate study to ensure that the rates are set to accommodate costs associated with the utility.

50% Expansion 50% Upgrade/Replacement

Project Justification: It is important that rates are set fairly and allow for the operation of the water utility

Policy Basis: 2011 Comprehensive Water Plan

Current Project Status: Design

Land Status: N/A

PROJECT FUNDING SOURCES AND EXPENDITURES

	Prior Years	2012	2013	2014	2015	2016	2017	6-Year Total	%	Future Years
FUNDING										
General Revenue										
Voted G.O. Bonds										
Non-Voted G.O. Bonds										
Revenue Bonds										
Utility Rates / Fees	19,543	20,000						20,000	50%	
GFC Revenue	19,543	20,000						20,000	50%	
LID / ULID										
Arterial Street Fund										
PWTF Loan										
Interfund Loan										
Grants										
SEPA / LTA										
Developer Financing										
Other										
TOTAL FUNDING	39,086	40,000						40,000	100%	
EXPENDITURES										
Planning										
Preliminary Design										
Design & Engineering	39,086	40,000						40,000	100%	
Land / ROW Acquisition										
Construction										
Other										
TOTAL EXPENDITURES	39,086	40,000						40,000	100%	

Notes:

Planning Period:	2012-2031	File Number:	wtr021.xls	CFP Project:	Water- 21
Project Title:	Telemetry Controls at PRV Stations	UGA Planning Area:	All	Department:	Public Works
Location:	System Wide	Water Plan Project:	PRV-1		

Project Description: This project would install telemetry controls at PRV stations to allow for remote control of the PRV set points.

Expansion 100% Upgrade/Replacement

Project Justification: Small changes in the PRV set points have significant impacts on the distribution systems ability to move supply from one pressure zone to another especially during demand periods. Improves efficiency in making adjustments.

Policy Basis: 2011 Comprehensive Water Plan

Current Project Status: Design

Land Status: City and County ROW

PROJECT FUNDING SOURCES AND EXPENDITURES

	Prior Years	2012	2013	2014	2015	2016	2017	6-Year Total	%	Future Years
FUNDING										
General Revenue										
Voted G.O. Bonds										
Non-Voted G.O. Bonds										
Revenue Bonds										
Utility Rates / Fees		220,000	200,000	200,000	80,000			700,000	100%	
GFC Revenue										
LID / ULID										
Arterial Street Fund										
PWTF Loan										
Interfund Loan										
Grants										
SEPA / LTA										
Developer Financing										
Other										
TOTAL FUNDING		220,000	200,000	200,000	80,000			700,000	100%	
EXPENDITURES										
Planning										
Preliminary Design		30,000						30,000	4%	
Design & Engineering		190,000	20,000	20,000	10,000			240,000	34%	
Land / ROW Acquisition										
Construction			180,000	180,000	70,000			430,000	61%	
Other										
TOTAL EXPENDITURES		220,000	200,000	200,000	80,000			700,000	100%	

Notes:

Planning Period:	2012-2031	File Number:	wtr022.xls	CFP Project:	Water- 22
Project Title:	Transportation/Development Projects	UGA Planning Area:	All	Department:	Public Works
Location:	System Wide	Water Plan Project:	N/A		

Project Description: Project funding for those projects that are driven by other improvements in transportation and private development.

50% Expansion 50% Upgrade/Replacement

Project Justification: Water improvements can be triggered by other projects that are on-going in the areas of transportation and private development

Policy Basis: Best Management Practices

Current Project Status: Planning

Land Status: N/A

PROJECT FUNDING SOURCES AND EXPENDITURES

	Prior Years	2012	2013	2014	2015	2016	2017	6-Year Total	%	Future Years
FUNDING										
General Revenue										
Voted G.O. Bonds										
Non-Voted G.O. Bonds										
Revenue Bonds										
Utility Rates / Fees	5,000	70,000		100,000				170,000	50%	
GFC Revenue	5,000	70,000		100,000				170,000	50%	
LID / ULID										
Arterial Street Fund										
PWTF Loan										
Interfund Loan										
Grants										
SEPA / LTA										
Developer Financing										
Other										
TOTAL FUNDING	10,000	140,000		200,000				340,000	100%	
EXPENDITURES										
Planning										
Preliminary Design										
Design & Engineering	10,000	5,000		20,000				25,000	7%	
Land / ROW Acquisition										
Construction		135,000		180,000				315,000	93%	
Other										
TOTAL EXPENDITURES	10,000	140,000		200,000				340,000	100%	

Notes:

Planning Period:	2012-2031	File Number:	wtr023.xls	CFP Project:	Water- 23
Project Title:	Critical Valves Program	UGA Planning Area:	All	Department:	Public Works
Location:	System Wide	Water Plan Project:	P-12		

Project Description: This program will install isolation valves along the major transmission corridors.

Expansion 100% Upgrade/Replacement

Project Justification: There are not sufficient valves in the major corridors to facilitate shut-downs and reduce customer impacts.

Policy Basis: 2011 Comprehensive Water Plan

Current Project Status: Design

Land Status: City and County ROW

PROJECT FUNDING SOURCES AND EXPENDITURES

	Prior Years	2012	2013	2014	2015	2016	2017	6-Year Total	%	Future Years
FUNDING										
General Revenue										
Voted G.O. Bonds										
Non-Voted G.O. Bonds										
Revenue Bonds										
Utility Rates / Fees	10,000	90,000	100,000	100,000	100,000			390,000	100%	
GFC Revenue										
LID / ULID										
Arterial Street Fund										
PWTF Loan										
Interfund Loan										
Grants										
SEPA / LTA										
Developer Financing										
Other										
TOTAL FUNDING	10,000	90,000	100,000	100,000	100,000			390,000	100%	
EXPENDITURES										
Planning										
Preliminary Design										
Design & Engineering	10,000		10,000	10,000	10,000			30,000	8%	
Land / ROW Acquisition										
Construction		90,000	90,000	90,000	90,000			360,000	92%	
Other										
TOTAL EXPENDITURES	10,000	90,000	100,000	100,000	100,000			390,000	100%	

Notes:

Planning Period:	2012-2031	File Number	wtr024.xls	CFP Project:	Water- 24
Project Title:	Brewery Wellfield Development	UGA Planning Area:	N/A	Department:	Public Works
Location:	Brewery Wellfield	Water Plan Project:	WS-2		

Project Description: Project will identify an initial facility Inventory at the brewery wellfield , identify improvements to make the site supply water, and complete improvements necessary to bring the well field on-line.

100% Expansion Upgrade/Replacement

Project Justification: Improvements are needed to take advantage of the water rights that were purchased by the three cities. Costs represent Lacey's proportional share.

Policy Basis: 2011 Comprehensive Water Plan

Current Project Status: Planning

Land Status: Lacey, Tumwater & Olympia Owned

PROJECT FUNDING SOURCES AND EXPENDITURES

	Prior Years	2012	2013	2014	2015	2016	2017	6-Year Total	%	Future Years
FUNDING										
General Revenue										
Voted G.O. Bonds										
Non-Voted G.O. Bonds										
Revenue Bonds										
Utility Rates / Fees							500,000	500,000		
GFC Revenue		150,000	300,000			500,000	500,000	1,450,000		1,150,000
LID / ULID										
Arterial Street Fund										
PWTF Loan										
Interfund Loan										
Grants										
SEPA / LTA										
Developer Financing										
Other										
TOTAL FUNDING		150,000	300,000			500,000	1,000,000	1,950,000		1,150,000
EXPENDITURES										
Planning										
Preliminary Design										
Design & Engineering		150,000	300,000			175,000		625,000		
Land / ROW Acquisition										
Construction						325,000	1,000,000	1,325,000		1,150,000
Other										
TOTAL EXPENDITURES		150,000	300,000			500,000	1,000,000	1,950,000		1,150,000

Notes:

Planning Period:	2012-2031	File Number:	wtr25.xls	CFP Project:	Water- 25
Project Title:	Annual Pipeline Improvements	UGA Planning Area:	All	Department:	Public Works
Location:	System Wide	Water Plan Project:	P-9		

Project Description: Annual funding allocation to make improvements to pipelines in the water system.

100% Expansion Upgrade/Replacement

Project Justification: Annual funding allows staff to prioritize replacements to fix problems with fire flow and pressure deficiencies in the system

Policy Basis: 2011 Water Comprehensive Plan

Current Project Status: Planning

Land Status: City ROW

PROJECT FUNDING SOURCES AND EXPENDITURES

	Prior Years	2012	2013	2014	2015	2016	2017	6-Year Total	%	Future Years
FUNDING										
General Revenue										
Voted G.O. Bonds										
Non-Voted G.O. Bonds										
Revenue Bonds										
Utility Rates / Fees										
GFC Revenue		160,000	880,000	160,000	880,000	160,000	880,000	3,120,000		6,000,000
LID / ULID										
Arterial Street Fund										
PWTF Loan										
Interfund Loan										
Grants										
SEPA / LTA										
Developer Financing										
Other										
TOTAL FUNDING		160,000	880,000	160,000	880,000	160,000	880,000	3,120,000		6,000,000
EXPENDITURES										
Planning										
Preliminary Design										
Design & Engineering		160,000		160,000		160,000		480,000		480,000
Land / ROW Acquisition										
Construction			880,000		880,000		880,000	2,640,000		5,520,000
Other										
TOTAL EXPENDITURES		160,000	880,000	160,000	880,000	160,000	880,000	3,120,000		6,000,000

Notes:

Planning Period:	2012-2031	File Number:	wtr026.xls	CFP Project:	Water- 26
Project Title:	Biennial Well Rehab/Replacement	UGA Planning Area:	All	Department:	Public Works
Location:	System Wide	Water Plan Project:	WS-9		

Project Description: Biennial funding to support the well rehabilitation program.

Expansion 100% Upgrade/Replacement

Project Justification: This program funds a program to identify wells that are underperforming and finds solutions to bring wells back to production levels expected.

Policy Basis: 2011 Water Comprehensive Plan

Current Project Status: Planning

Land Status: None required

PROJECT FUNDING SOURCES AND EXPENDITURES

	Prior Years	2012	2013	2014	2015	2016	2017	6-Year Total	%	Future Years
FUNDING										
General Revenue										
Voted G.O. Bonds										
Non-Voted G.O. Bonds										
Revenue Bonds										300,000
Utility Rates / Fees		60,000		50,000		50,000		160,000	100%	
GFC Revenue										
LID / ULID										
Arterial Street Fund										
PWTF Loan										
Interfund Loan										
Grants										
SEPA / LTA										
Developer Financing										
Other										
TOTAL FUNDING		60,000		50,000		50,000		160,000	100%	300,000
EXPENDITURES										
Planning										
Preliminary Design										
Design & Engineering										
Land / ROW Acquisition										
Construction		60,000		50,000		50,000		160,000	100%	300,000
Other										
TOTAL EXPENDITURES		60,000		50,000		50,000		160,000	100%	300,000

Notes:

Planning Period:	2012-2031	File Number:	wtr027.xls	CFP Project:	Water- 27
Project Title:	Skokomish Way Water main	UGA Planning Area:	Meadows	Department:	Public Works
Location:	Skokomish Way	Water Plan Project:	P-7		

Project Description: This project replaces pipe in the Skokomish Way from Queets Drive NE to Quinault Drive NE.

Expansion 100% Upgrade/Replacement

Project Justification: This project is needed to make necessary system improvements in the area.

Policy Basis: 2011 Water Comprehensive Plan

Current Project Status: Planning

Land Status: County ROW

PROJECT FUNDING SOURCES AND EXPENDITURES

	Prior Years	2012	2013	2014	2015	2016	2017	6-Year Total	%	Future Years
FUNDING										
General Revenue										
Voted G.O. Bonds										
Non-Voted G.O. Bonds										
Revenue Bonds										
Utility Rates / Fees			95,000	1,045,000				1,140,000	100%	
GFC Revenue										
LID / ULID										
Arterial Street Fund										
PWTF Loan										
Interfund Loan										
Grants										
SEPA / LTA										
Developer Financing										
Other										
TOTAL FUNDING			95,000	1,045,000				1,140,000	100%	
EXPENDITURES										
Planning										
Preliminary Design										
Design & Engineering			95,000	95,000				190,000	17%	
Land / ROW Acquisition										
Construction				950,000				950,000	83%	
Other										
TOTAL EXPENDITURES			95,000	1,045,000				1,140,000	100%	

Notes:

Planning Period:	2012-2031	File Number:	wtr028.xls	CFP Project:	Water- 28
Project Title:	20th Avenue SE Fire flow	UGA Planning Area:	Lakes	Department:	Public Works
Location:	20th Avenue SE	Water Plan Project:	P-4		

Project Description: This project will upsize pipes in the area of 20th Avenue SE near Carpenter Road which are undersized.

Expansion 100% Upgrade/Replacement

Project Justification: This project will address fire flow issues in the area and reduce water line breaks in the area.

Policy Basis: 2011 Water Comprehensive Plan

Current Project Status: Planning

Land Status: City ROW

PROJECT FUNDING SOURCES AND EXPENDITURES

	Prior Years	2012	2013	2014	2015	2016	2017	6-Year Total	%	Future Years
FUNDING										
General Revenue										
Voted G.O. Bonds										
Non-Voted G.O. Bonds										
Revenue Bonds										
Utility Rates / Fees				245,000				245,000	100%	
GFC Revenue										
LID / ULID										
Arterial Street Fund										
PWTF Loan										
Interfund Loan										
Grants										
SEPA / LTA										
Developer Financing										
Other										
TOTAL FUNDING				245,000				245,000	100%	
EXPENDITURES										
Planning										
Preliminary Design										
Design & Engineering				61,250				61,250	25%	
Land / ROW Acquisition										
Construction				183,750				183,750	75%	
Other										
TOTAL EXPENDITURES				245,000				245,000	100%	

Notes:

Planning Period:	2012-2031	File Number:	wtr029.xls	CFP Project:	Water- 29
Project Title:	Overflow for Union Mills Reservoir	UGA Planning Area:	Tanglewide/	Department:	Public Works
Location:	Marvin Road and Pacific Ave	Water Plan Project:	ST-3		

Project Description: This project will construct an overflow pond at the Union Mills reservoir.

Expansion 100% Upgrade/Replacement

Project Justification: Overflow ponds are recommended for collecting and disposing of water during an overflow event.

Policy Basis: 2011 Comprehensive Water Plan

Current Project Status: Planning

Land Status: City Owned

PROJECT FUNDING SOURCES AND EXPENDITURES

	Prior Years	2012	2013	2014	2015	2016	2017	6-Year Total	%	Future Years
FUNDING										
General Revenue										
Voted G.O. Bonds										
Non-Voted G.O. Bonds										
Revenue Bonds										
Utility Rates / Fees				152,000				152,000		
GFC Revenue										
LID / ULID										
Arterial Street Fund										
PWTF Loan										
Interfund Loan										
Grants										
SEPA / LTA										
Developer Financing										
Other [1]										
TOTAL FUNDING				152,000				152,000		
EXPENDITURES										
Planning										
Preliminary Design										
Design & Engineering				38,000				38,000	25%	
Land / ROW Acquisition										
Construction				114,000				114,000	75%	
Other [2]										
TOTAL EXPENDITURES				152,000				152,000		

Notes: 1 & 2 Project funding and expenditure amounts shown in the future years column are preliminary estimates for planning purposes. Identification of specific revenue sources and expenditures will be made as the project moves into the 6-year planning window.

Planning Period:	2012-2031	File Number:	wtr030.xls	CFP Project:	Water- 30
Project Title:	Overflow for Nisqually Reservoir	UGA Planning Area:	N/A	Department:	Public Works
Location:	Nisqually	Water Plan Project:	St-5		

Project Description: This project will construct an overflow pond at the Nisqually reservoir.

Expansion 100% Upgrade/Replacement

Project Justification: Overflow ponds are recommended for collecting and disposing of water during an overflow event.

Policy Basis: 2011 Comprehensive Water Plan

Current Project Status: Planning

Land Status: City Owned

PROJECT FUNDING SOURCES AND EXPENDITURES

	Prior Years	2012	2013	2014	2015	2016	2017	6-Year Total	%	Future Years
FUNDING										
General Revenue										
Voted G.O. Bonds										
Non-Voted G.O. Bonds										
Revenue Bonds										
Utility Rates / Fees				82,000				82,000		
GFC Revenue										
LID / ULID										
Arterial Street Fund										
PWTF Loan										
Interfund Loan										
Grants										
SEPA / LTA										
Developer Financing										
Other [1]										
TOTAL FUNDING				82,000				82,000		
EXPENDITURES										
Planning										
Preliminary Design										
Design & Engineering				20,500				20,500	25%	
Land / ROW Acquisition										
Construction				61,500				61,500	75%	
Other [2]										
TOTAL EXPENDITURES				82,000				82,000		

Notes: 1 & 2 Project funding and expenditure amounts shown in the future years column are preliminary estimates for planning purposes. Identification of specific revenue sources and expenditures will be made as the project moves into the 6-year planning window.

Planning Period:	2012-2031	File Number:	wtr031.xls	CFP Project:	Water- 31
Project Title:	Reclaimed Water Facilities	UGA Planning Area:	All	Department:	Public Works
Location:	System Wide	Water Plan Project:	WS-5		

Project Description: Constructs reclaimed water facilities to include three storage facilities, two pump stations and additional transmission piping.

100% Expansion   Upgrade/Replacement

Project Justification: The city plans to utilize reclaimed water and needs the infrastructure to store and distribute water.

Policy Basis: 2011 Comprehensive Water Plan   Current Project Status: Planning   Land Status: To be determined

PROJECT FUNDING SOURCES AND EXPENDITURES

	Prior Years	2012	2013	2014	2015	2016	2017	6-Year Total	%	Future Years
FUNDING										
General Revenue										
Voted G.O. Bonds										
Non-Voted G.O. Bonds										
Revenue Bonds										4,800,000
Utility Rates / Fees										
GFC Revenue						150,000	350,000	500,000		3,000,000
LID / ULID										
Arterial Street Fund										
PWTF Loan										
Interfund Loan										
Grants										
SEPA / LTA										
Developer Financing										
Other										
TOTAL FUNDING						150,000	350,000	500,000		7,800,000
EXPENDITURES										
Planning										
Preliminary Design						150,000	265,000	415,000	83%	
Design & Engineering							85,000	85,000	17%	1,575,000
Land / ROW Acquisition										
Construction										6,225,000
Other										
TOTAL EXPENDITURES						150,000	350,000	500,000		7,800,000

Notes: *** Projects will be financed by development. Costs have not been determined.

Planning Period:	2012-2031	File Number:	wtr032.xls	CFP Project:	Water- 32
Project Title:	New 3.2 MGD Pump Station	UGA Planning Area:	Central	Department:	Public Works
Location:	Pacific Avenue	Water Plan Project:	PS-3		

Project Description: A new pump station is required to access water from the Brewery Wellfield through Olympia's water system.

100% Expansion Upgrade/Replacement

Project Justification: The existing intertie at Mt Aire is not large enough to accommodate the additional water flow. Placing the new pump station on the west side of the city will improve water distribution and provide adequate capacity .

Policy Basis: 2011 Comprehensive Water Plan

Current Project Status: Planning

Land Status: To be determined

PROJECT FUNDING SOURCES AND EXPENDITURES

	Prior Years	2012	2013	2014	2015	2016	2017	6-Year Total	%	Future Years
FUNDING										
General Revenue										
Voted G.O. Bonds										
Non-Voted G.O. Bonds										
Revenue Bonds										1,000,000
Utility Rates / Fees										
GFC Revenue						125,000	500,000	625,000		
LID / ULID										
Arterial Street Fund										
PWTF Loan										
Interfund Loan										
Grants										
SEPA / LTA										
Developer Financing										
Other [1]										
TOTAL FUNDING						125,000	500,000	625,000		1,000,000
EXPENDITURES										
Planning										
Preliminary Design						81,250		81,250	13%	
Design & Engineering						43,750	281,250	325,000	52%	
Land / ROW Acquisition										
Construction							218,750	218,750	35%	1,000,000
Other [2]										
TOTAL EXPENDITURES						125,000	500,000	625,000		1,000,000

Notes: 1 & 2 Project funding and expenditure amounts shown in the future years column are preliminary estimates for planning purposes. Identification of specific revenue sources and expenditures will be made as the project moves into the 6-year planning window.

Planning Period:	2012-2031	File Number:	wtr033.xls	CFP Project:	Water- 33
Project Title:	Willamette Drive Velocity Improvement	UGA Planning Area:	Hawks Prairie	Department:	Public Works
Location:	Willamette Drive	Water Plan Project:	P-3		

Project Description: This pipe project address water velocities over eight fps in the 41st Ave./Marvin Road area and installs a parallel 16-inch diameter pipe to solve the problem.

Expansion 100% Upgrade/Replacement

Project Justification: This project solves the velocity issue in the area. Since fire flow is not an Issue, the project is slated for future years.

Policy Basis: 2011 Comprehensive Water Plan

Current Project Status: Planning

Land Status: City ROW

PROJECT FUNDING SOURCES AND EXPENDITURES

	Prior Years	2012	2013	2014	2015	2016	2017	6-Year Total	%	Future Years
FUNDING										
General Revenue										
Voted G.O. Bonds										
Non-Voted G.O. Bonds										
Revenue Bonds										
Utility Rates / Fees										134,000
GFC Revenue										
LID / ULID										
Arterial Street Fund										
PWTF Loan										
Interfund Loan										
Grants										
SEPA / LTA										
Developer Financing										
Other [1]										
TOTAL FUNDING										134,000
EXPENDITURES										
Planning										
Preliminary Design										
Design & Engineering										33,500
Land / ROW Acquisition										
Construction										100,500
Other [2]										
TOTAL EXPENDITURES										134,000

Notes: 1 & 2 Project funding and expenditure amounts shown in the future years column are preliminary estimates for planning purposes. Identification of specific revenue sources and expenditures will be made as the project moves into the 6-year planning window.

Planning Period:	2012-2031	File Number:	wtr034.xls	CFP Project:	Water- 34
Project Title:	College Street Pressure Improvement	UGA Planning Area:	Horizons	Department:	Public Works
Location:	College Street	Water Plan Project:	P-5		

Project Description: This project address high velocities and pressure deficiencies in the College Street area. An additional 12-inch pipe would be installed from 32nd Lane to 37th Avenue SE.

100% Expansion Upgrade/Replacement

Project Justification: This project will improve the pressure in the area and reduce velocities in the pipelines.

Policy Basis: 2011 Comprehensive Water Plan

Current Project Status: Planning

Land Status: City ROW

PROJECT FUNDING SOURCES AND EXPENDITURES

	Prior Years	2012	2013	2014	2015	2016	2017	6-Year Total	%	Future Years
FUNDING										
General Revenue										
Voted G.O. Bonds										
Non-Voted G.O. Bonds										
Revenue Bonds										
Utility Rates / Fees										
GFC Revenue										350,000
LID / ULID										
Arterial Street Fund										
PWTF Loan										
Interfund Loan										
Grants										
SEPA / LTA										
Developer Financing										
Other [1]										
TOTAL FUNDING										350,000
EXPENDITURES										
Planning										
Preliminary Design										
Design & Engineering										87,500
Land / ROW Acquisition										
Construction										262,500
Other [2]										
TOTAL EXPENDITURES										350,000

Notes: 1 & 2 Project funding and expenditure amounts shown in the future years column are preliminary estimates for planning purposes. Identification of specific revenue sources and expenditures will be made as the project moves into the 6-year planning window.

Planning Period: 2012-2031	File Number: wtr035.xls	CFP Project: Water- 35	
Project Title: Well S04 Improvements	UGA Planning Area: Horizons	Department: Public Works	
Location: Yelm Highway	Water Plan Project: WS-3		

Project Description: This project will install a new pump and resolve well capacity to it's full water right.

100% Expansion   Upgrade/Replacement

Project Justification: This well is unable to supply It's full water right capacity due to transmission, pump and well capacity issues . It produces unacceptable amounts of sand when operating near capacity. Improvements are needed to solve this issues.

Policy Basis: 2011 Comprehensive Water Plan   Current Project Status: Planning   Land Status: City Owned

PROJECT FUNDING SOURCES AND EXPENDITURES

	Prior Years	2012	2013	2014	2015	2016	2017	6-Year Total	%	Future Years
FUNDING										
General Revenue										
Voted G.O. Bonds										
Non-Voted G.O. Bonds										
Revenue Bonds										1,800,000
Utility Rates / Fees										
GFC Revenue										
LID / ULID										
Arterial Street Fund										
PWTF Loan										
Interfund Loan										
Grants										
SEPA / LTA										
Developer Financing										
Other [1]										
TOTAL FUNDING										1,800,000
EXPENDITURES										
Planning										
Preliminary Design										
Design & Engineering										450,000
Land / ROW Acquisition										
Construction										1,350,000
Other [2]										
TOTAL EXPENDITURES										1,800,000

Notes: 1 & 2 Project funding and expenditure amounts shown in the future years column are preliminary estimates for planning purposes. Identification of specific revenue sources and expenditures will be made as the project moves into the 6-year planning window.

Appendix L
SOURCE OF SUPPLY ANALYSIS TM

City of Lacey

Source of Supply Analysis

Technical Memorandum No. 4A

FINAL
October 2010

CITY OF LACEY

SOURCE OF SUPPLY ANALYSIS

TECHNICAL MEMORANDUM
NO. 4A

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SOURCE OF SUPPLY ANALYSIS

1.0 INTRODUCTION

The City of Lacey (City) has requested that Carollo Engineers prepare an initial Source of Supply Analysis (SOSA) reviewing potential supply sources for the City to meet future water demands. This analysis is supplemental to the City's Comprehensive Plan Water System update (Plan) to be performed by Carollo Engineers.

As the City continues to wait for additional water rights to be approved by the Washington Department of Ecology (Ecology), the City's water demands continue to increase. Meeting demand has become increasingly difficult, resulting in additional conditions of service for providing water to new development outside the City limits (Resolution 917).

To date, the City's water supply strategy has been to pursue water rights for both deep and shallow wells. The purpose of the current evaluation is to identify other potential sources of supply and evaluate whether the City should adjust its long-term water supply strategy.

This analysis provides a conceptual-level comparison of current and additional sources of supply, and presents a recommended plan for long-term utilization of available sources.

2.0 APPROACH

In discussions with City staff, the following sources of supply were identified for analysis:

- Additional shallow wells
- Additional deep wells (requiring treatment for heavy metals)
- Reclaimed water (as provided by LOTT Alliance)
- Desalination of Puget Sound water
- Purchasing water from the City of Olympia
- Purchasing water systems within the City's Water Service Area

New groundwater sources have been divided between shallow and deep wells due to the higher impacts to surface water bodies of shallow wells, and greater treatment requirements of deeper wells.

The following sections discuss each option in detail, including development of conceptual-level capital and annual costs for each option, expressed as a cost per acre-ft/year (AFY) and 1,000 gallons per year (Kgal/yr) of added capacity. The sources are then compared based on a net present worth (NPW) evaluation, as well as an evaluation of non-financial criteria.

Finally, based on the cost and non-financial evaluations, a recommended long-term water supply strategy is recommended.

2.1 Assumptions

Assumptions for this analysis include the following:

- Cost estimates are conceptual level only and are used to provide a reasonable comparison between options. Estimated costs should not be used for budgetary planning purposes.
- Supply requirements are considered for the entire system, not per pressure zone.
- Cost estimates are presented in 2009 dollars using an Engineering News Record (ENR) Construction Cost Index (CCI) of 8547.
- Capital and Operational and Maintenance (O&M) costs per thousand gallons are rounded to the nearest cent.
- NPW cost comparison uses a discount rate of 3 percent and a 30-year planning horizon.
- Annual costs include pumping and chemical costs only.
- Pumping costs are estimated based on a unit power cost of $0.0625/kilowatt-hour (kWh).
- Chemical costs are estimated at $0.25/pound (lb) sodium bisulfite, $1.20/lb sodium hypochlorite.

2.2 Supply Requirements

The City currently owns and operates 19 groundwater wells to supply the water service area. Supply from these wells is limited by the instantaneous and annual water right, and by the ability to pump from the wells. Given the estimated projected demands developed in the Plan, the City anticipates needing approximately an additional 4 million gallons per day (mgd) of annual supply (4,480 AFY) and 6 mgd of instantaneous supply over the next 20 years.

3.0 SOURCES

3.1 Shallow Wells

The City is already pursuing additional shallow wells to increase supply. Of the eleven current water right applications submitted to Ecology, six have been included in the Comprehensive Water Rights Mitigation Plan Phase 1 (Mitigation Plan) due to their high priority for the City. Three of the water right applications included in the Mitigation Plan are considered shallow wells (totaling 3,826 AFY).

3.1.1 Mitigation

In the Mitigation Plan, the six water rights are extensively evaluated for impacts to adjacent water bodies. The plan summarizes the impacts of each individual water right and provides specific mitigation methods to offset the impacts. Mitigation efforts requiring substantial financial investment were identified from the report and are summarized in Table 4A.1, with estimated costs provided by the City, unless otherwise noted.

As seen in the table, the total mitigation effort is anticipated to cost approximately $4,240,000 for the six water rights in the mitigation plan. For comparison purposes, this cost is allocated between the shallow and deep well applications based on the amount of impact the shallow versus deep wells are anticipated to have. Considering all impacts to all water bodies, as presented in the Mitigation Plan, the sum of the shallow wells are anticipated to have an impact of 2.95 cubic feet per second (cfs) or 75 percent of all impacts. Thus the capital and annual costs of mitigation for the three shallow wells alone is assumed to be approximately $3,180,000 and $66,000, respectively, or $1,060,000 and $22,000 per well.

3.1.2 Shallow Well Cost Estimate

The cost of developing shallow wells as a source of supply was assumed to be the sum of the water rights acquisition cost, the water rights mitigation cost (summarized in Section 2.3.1 and Table 4A.1) and the well installation cost.

The cost per well for water rights acquisition was calculated using the total cost of consulting and administration associated with the water rights applications included in the mitigation plan ($1,360,000 as provided by the City for a total deep and shallow well capacity of 7,392 AFY or $184 per AFY). The assumed cost for water rights acquisition for the three wells (totaling 3,826 AFY) was $707,000 or $236,000 per well.

For estimating purposes, an average shallow well was considered to be 300 feet deep, 16 inches in diameter, with a pump capacity of 1,000 gallons per minute (gpm) and an 80-hp pump. Drilling costs were estimated using the cost for drilling the Hawks Prairie Well 2 scaled down to the shallow well criteria and expressed in 2009 dollars. Costs for equipping the well and other site improvements were based directly on the costs for similar work for the Betti Well installation. Treatment costs assume a small disinfection treatment facility for

Table 4A.1 Mitigation Methods
Water Comprehensive Plan - Source of Supply Analysis
City of Lacey

Mitigation Method	Capital Costs		Annual Costs	
	Item	Cost[1]	Item	Cost[1]
In-stream Flow Augmentation[2]	Dechlorination Facility	$200,000	Sodium Bisulfite	$1,000
			Pumping Costs	$4,000
Woodland Creek Infiltration Basin[3]	Land & Construction	$2,580,000	Basin O&M	$32,000
Riparian & Habitat Restoration[4],[5]	Property Acquisition	$1,317,000	Annual Allocation	$50,000
Purchase Deschutes Basin water rights (with Yelm, Olympia)[6]	WR Purchase	$93,000		N/A
Decommission Nisqually Wells 19A & 19C.	Decommission Wells	$50,000		N/A
Total Mitigation Costs		**$4,240,000**		**$88,000**
Total Shallow Well Mitigation Cost		$3,180,000		$66,000
Total Deep Well Mitigation Cost		$1,060,000		$22,000

Notes:

(1) All costs provided by City except where noted.

(2) Assumes pumping from City system and other City-owned irrigation wells. Includes two outfall structures, one dechlorination facility: 260 gpm for 3 months, 140 gpm for 3 months, inactive for six months. Small, prefabricated structure, chemical storage, pump system, civil & electrical costs. Chemical costs assume 1 milligrams per liter (mg/L) residual Cl_2 and $0.25/lb of sodium bisulfite.

(3) Cost estimates based on baseline cost estimates provided in Water Right Mitigation Strategy for Woodland Creek Flow Depletion Using Reclaimed Water (Technical Memorandum dated May 9, 2007). Includes cost of converting parkland to area for infiltration.

(4) Capital cost includes estimated amount for land purchase

(5) Annual costs based on City plan to allocate $500,000 over the next 10 years for riparian and habitat restoration.

(6) Estimate of $198,000 for purchase split between Lacey, Olympia, and Yelm.

each well. A summary of the capital and annual cost estimates for a 1,000 gpm well are included in Table 4A.2. The estimated total capital cost for the installation of a 1,000 gpm well is $1,816,000 and the annual cost is $58,000. By assuming a constant unit capital cost of $1,126/AFY and a constant unit annual cost of $36/AFY, the estimated cost of installing the total shallow well capacity of 3,826 AFY is $4,307,000 for capital costs and $138,000/year for annual costs.

Cost estimates for developing shallow well supplies are summarized in Table 4A.3. Costs are expressed in terms of cost per AFY and Kgal/year. Costs are based on a total added annual capacity of all the shallow well sources of 3,826 AFY, or 3.4 mgd. As seen in Table 4A.3, the total capital and annual costs for 1000 gal/year of shallow wells capacity are approximately $6.59 and $0.16, respectively. These values are used in the NPW cost comparison in Section 4.

Table 4A.2 Shallow Well Installation Cost Estimate (1,000 gpm well)
Water Comprehensive Plan - Source of Supply Analysis
City of Lacey

Item	Cost per 1,000 gpm well
Capital Costs	
Land Acquisition[(1)]	$500,000
Drilling[(2)]	$177,000
Equipping/Site Work[(3)]	$620,000
Chlorination Facility	$100,000
Engineering/Legal/Administrative (30%)	$419,000
Total Installation Cost	**$1,816,000**
Annual Costs	
Pumping Costs	$32,000 / year
Chemical Costs for Disinfection	$26,000 / year
Total Annual Costs	**$58,000 / year**

Notes:

(1) Assuming one acre at $500,000/acre.

(2) Costs based on Hawks Prairie Well 2 drilling. See explanation in text above.

(3) Equipping/Site work costs based on costs for Betti Well.

Table 4A.3 Shallow Well Costs Water Comprehensive Plan - Source of Supply Analysis City of Lacey		
Item	**Total Cost (for 3,826 AFY)**	**Cost per AFY ($/Kgal/yr)**
Capital Costs		
Water Right Acquisition(1)	$707,000	$185 ($0.57)
Mitigation(2)	$3,180,000	$831 ($2.55)
Well Installation	$4,307,000	$1,126 ($3.46)
Total Capital Cost	**$8,213,000**	**$2,147 ($6.59)**
Annual Costs		
Mitigation(2)	$66,000	$17 ($0.05)
Pumping Costs	$76,000	$20 ($0.06)
Chemical Costs for Disinfection	$62,000	$16 ($0.05)
Total Annual Costs	**$205,000**	**$53 ($0.16)**

Notes:

(1) Total cost for six water right applications of $1.36M multiplied percentage of capacity added by three shallow wells.

(2) See Table 4A.1 for specific mitigation estimates.

3.2 Deep Wells

Of particular interest to the City is the cost comparison of pursuing deep wells that have less impact on surface water bodies, but require more extensive treatment. Of the six critical water rights applications, three of the applications involve deep wells, providing a capacity of 3,566 AFY. For this analysis, these wells were used as examples of deep wells requiring a water right application, mitigation, and treatment. Cost estimates for these wells are described below.

3.2.1 Mitigation

As discussed above, the total mitigation cost for all the wells in the Mitigation Plan is allocated between the shallow and deep well applications based on the amount of impact the shallow versus deep wells are anticipated to have. Considering all impacts to all water bodies, as presented in the Mitigation Plan, the sum of the deep wells are anticipated to have an impact of 0.96 cfs or 25 percent of all impacts. Thus the capital and annual costs of mitigation for the three deep wells are approximately $1,060,000 and $22,000, respectively, or $350k and $7,300 per well.

3.2.2 Deep Well Cost Estimate

The cost of developing deep wells as a source of supply was assumed to be the sum of the water rights acquisition cost, the water rights mitigation cost (summarized in Section 2.3.1 and Table 4A.1) and the installation cost and the well treatment cost as described below.

Similarly to shallow wells, the cost for water right applications for deep wells was calculated using the total cost of consulting and administration associated with the water rights applications included in the mitigation plan ($1,360,000 as provided by the City for a total deep and shallow well capacity of 7,392 AFY) or $184 per AFY. The assumed cost for water rights acquisition for the three deep wells (totaling 3,566 AFY) was $656,000 or $218,000 per well.

For estimating purposes, an average deep well was considered to be 650 feet deep, 16-inches in diameter, with a pump capacity of 1,000 gpm and a 205-hp pump. Drilling costs were estimated using the cost for drilling the Hawks Prairie Well 2 scaled down to a pumping rate of 1,000 gpm, and a 16-inch diameter well, and expressed in 2009 dollars. Costs for equipping the well and other site improvements were based directly on the costs for similar work for the Betti Well installation. A summary of the capital and annual cost estimates for a 1,000 gpm well are included in Table 4A.4. The estimated total capital cost for the installation of a 1,000 gpm well is $2,148,000 and the annual cost is $85,000. By assuming a constant unit capital cost of $1,331/AFY and a constant unit annual cost of $53/AFY, the estimated cost of installing the total deep well capacity of 3,566 AFY is $4,748,000 for capital costs and $188,000/year for annual costs.

To provide cost estimates for treatment, recent treatment facilities installed by the City were reviewed for applicability. As recommended by the City, this analysis uses the capital and annual costs of the Hawks Prairie Treatment Facility for estimating purposes. Given a total cost of $11,000,000 in 2007 and providing treatment for 2,000-gpm flows, the cost for a 1,000-gpm facility in 2009 dollars, adjusting for economies of scale, is estimated to be $8,100,000. By assuming a constant unit capital cost of $5,000/AFY and a constant unit annual cost of $127/AFY, the estimated cost of treating the total deep well capacity of 3,566 AFY is $17,834,000 for capital costs and $453,000/year for annual costs.

Estimated capital and annual costs for deep well supplies are shown in Table 4A.5. As seen in Table 4A.5, the total capital and annual costs per 1,000 gallons per year for deep wells amounts to approximately $20.90 and $0.57, respectively. These values are used in the NPW cost comparison in Section 4.

Table 4A.4 Deep Well Installation Cost Estimate (1,000 gpm well)
Water Comprehensive Plan - Source of Supply Analysis
City of Lacey

Item	Cost per 1,000 gpm well
Capital Costs	
Land Acquisition(1)	$750,000
Drilling(2)	$281,000
Equipping/Site Work(3)	$621,000
Engineering/Legal/Administrative (30%)	$496,000
Total Installation Cost	**$2,148,000**
Annual Costs	
Pumping Costs	$85,000 / year
Total Annual Costs	**$85,000 / year**

Notes:

(1) Assuming 1.5 acres at $500,000/acre.

(2) Costs based on Hawks Prairie Well 2 drilling. See explanation in text above.

(3) Equipping/Site work costs based on costs for Betti Well.

Table 4A.5 Deep Well Costs
Water Comprehensive Plan - Source of Supply Analysis
City of Lacey

Item	Total Cost (for 3,566 AFY)	Cost per AFY ($/Kgal/yr)
Capital Costs		
Water Right Acquisition(1)	$656,000	$184 ($0.56)
Mitigation(2)	$1,060,000	$292 ($0.90)
Well Installation	$4,748,000	$1,331 ($4.09)
Treatment Facility	$17,834,000	$5,001 ($15.35)
Total Capital Cost	**$24,279,000**	**$6,809 ($20.90)**
Annual Costs		
Mitigation(2)	$22,000	$6 ($0.02)
Pumping Costs	$188,000	$53 ($0.16)
Treatment Facility O&M	$453,000	$127 ($0.39)
Total Annual Costs	**$663,000**	**$186 ($0.57)**

Notes:

(1) Total cost for six water right applications of $1.36M multiplied by percentage of added capacity from deep wells.

(2) See Table 4A.1 for specific mitigation estimates.

3.3 Reclaimed Water

Reclaimed water is an available supply to the City from the Lacey Olympia Tumwater Thurston County (LOTT) wastewater agency. LOTT recently completed the Hawks Prairie Reclaimed Water Satellite facility, comprised of the Martin Way Reclaimed Water Plant (MWRWP) and the Hawks Prairie Reclaimed Water Ponds and Recharge Basins. The MWRWP has a current design capacity of 2.0 mgd. Of this amount, 0.25 mgd is allocated to the LOTT recharge basins, 0.30 mgd is allocated for use by the City of Olympia, and the remainder of production is allocated to the City of Lacey.

Additionally, the City is actively preparing for use of reclaimed water to supply the Gateway Development and the Regional Athletic Center (RAC). These developments will require 1.9 mgd of reclaimed water on average, with build-out expected to occur in 2050. The 2008 Reclaimed Water Study for Lacey Gateway and Surrounding Areas provides a detailed description of the infrastructure and associated costs for utilizing reclaimed water at these facilities. The reclaimed water evaluation in this analysis generally uses the costs described in the 2008 report, with updates from City staff, and the added capacity of 1.9 mgd to express costs in terms of cost per 1,000 gallons per year.

Table 4A.6 provides a summary of the costs associated with using reclaimed water a source of supply. The phases of the project can be summarized as follows:

- Phase 1 - Construction of Gateway 1.5-million gallons (MG) storage reservoir, pump station, distribution system piping.
- Phase 2 - RAC I-5 Crossing.
- Phase 3 - RAC 600,000-gal storage reservoir, booster pump station, small treatment facility.
- Phase 4 - Additional Gateway 850,000-gallon storage reservoir.

As seen in Table 4A.6, the total capital and annual costs per 1,000 gallons per year for reclaimed water are approximately $25.80 and $0.13, respectively. These values reflect the fairly high capital cost for new infrastructure associated with reclaimed water. These values are used in the NPW cost comparison in Section 4.

Table 4A.6 Reclaimed Water Costs Water Comprehensive Plan - Source of Supply Analysis City of Lacey			
Item	**Cost (for 1.9 mgd)**	**Total Cost (for 1.9 mgd)**	**Cost per AFY ($/Kgal/yr)**
Capital Costs			
Phase 1			
Construction	$5,800,000		
Engineering/Legal/Administrative	$800,000		
Land Acquisition	$300,000		
Phase 1 Total Costs		$6,900,000	
Phase 2			
Construction	$1,000,000		
Engineering/Legal/Administrative	$250,000		
Land Acquisition	$150,000		
Phase 2 Total Costs		$1,400,000	
Phase 3			
Construction	$3,750,000		
Engineering/Legal/Administrative	$750,000		
Land Acquisition	N/A		
Phase 3 Total Costs		$4,500,000	
Phase 4			
Construction	$3,825,000		
Engineering/Legal/Administrative	$765,000		
Land Acquisition	$500,000		
Phase 3 Total Costs		$5,090,000	
Total Capital Cost		**$17,890,000**	**$8,407 ($25.80)**
Annual Costs			
Gateway Pump Station		$30,000	
RAC Booster Pump Station		$60,000	
Total Annual Costs		**$90,000**	**$42 ($0.13)**

Notes:
Costs based on an added capacity of 1.9 mgd.

3.4 Desalination of Puget Sound Water

Due to the proximity of Lacey to the Puget Sound, this analysis includes an evaluation of desalination of seawater as a potential source of supply for the City. Desalination is often seen as a last resort as a source of supply due to its heavy permitting requirements, high capital costs, and high operating costs. However, technologies are improving for desalination, including improvements in energy efficiency of the treatment process.

Representatives from Carollo Engineers, the United States Bureau of Reclamation, and several other agencies and corporations have created the Affordable Desalination Collaboration with a mission to reduce costs of Seawater Reverse Osmosis (SWRO). Through this effort, a cost estimating model was created to approximate the capital and operating costs for checking the feasibility of SWRO treatment systems of various sizes. This model was used for estimating the potential costs of desalination of 4 mgd of Puget Sound water for the City of Lacey. These costs are shown in Table 4A.7.

This analysis includes the following elements and assumptions for desalination of Puget Sound water:

- **Quantity of withdrawal is 8.9 mgd.** Given an average 45 percent recovery rate for a SWRO process and providing a new supply of 4 mgd, desalination will require 8.9 mgd of raw seawater.

- **Puget Sound Intake/Outfall.** The intake structure would consist of an intake pipe with appropriate screening to prevent entrainment or impingement of marine life. The outfall structure would consist of an outfall pipe with a diffuser system. The intake and outfall would share a Caisson tunnel.

- **SWRO Treatment Plant.** The plant would include a large building housing the strainers, filters, RO equipment, chemical storage/feed system, and controls/instrumentation, various pumps, and a 1-MG storage tank.

- **Operation & Maintenance (O&M).** O&M of a desalination plant includes energy requirements for general building, pumping, and chemical feed systems, solids handling, membrane replacement, and sampling. Staffing has been excluded from this analysis.

- **Permitting.** Permitting a desalination plant in the Puget Sound area will likely require coordination and approval from the Departments of Health, Ecology, Fish and Wildlife, and the National Oceanic and Atmospheric Administration (NOAA). Efforts will require a study and mitigation plan for impacts to marine life, consistent with the new EPA Clean Water Act 316(b) Phase II rule for power plants. Costs for permitting are included in the overall Engineering/Legal Costs and Contingencies, which comprise 35 percent of the total planning level cost estimate.

As shown in Table 4A.7, the total capital and annual costs per 1,000 gallons per year for a desalination facility are approximately $63.70 and $3.10, respectively. These values are used in the NPW cost comparison in Section 4.

Table 4A.7 Estimated Costs for a 4-mgd Desalination Treatment Plant
Water Comprehensive Plan - Source of Supply Analysis
City of Lacey

	Estimated Cost (for 4 mgd)	Cost per AFY ($/Kgal/yr)
Capital Cost		
Treatment Plant/Intake/Outfall	$68,910,000	
Engineering/Legal Costs, Contingencies (35%)	$24,120,000	
Total Capital Costs	**$93,020,000**	**$20,762**
		($63.70)
Annual Cost		
Operation and Maintenance	$4,530,000	
Total Annual Costs	**$4,530,000**	**$1,010**
		($3.10)

Notes:
Costs based on an added capacity of 4 mgd.

3.5 Purchase of Olympia Water

The City currently purchases water from the City of Olympia to supplement City supply. The City does not anticipate Olympia to continue to provide supply to the system indefinitely. However, an analysis of this source of supply is included herein as a comparison to other sources.

The agreement with Olympia allows the City of Lacey to use a maximum of 2 mgd in the months of November to June and 1 mgd in the months of July to October (1,866 AFY). Table 4A.8 provides a summary of costs associated with purchasing water from the City of Olympia. As seen in the table, the estimated initial and annual costs for purchasing water from Olympia are $0.07 and $0.57, respectively.

Table 4A.8 Estimated Costs for Olympia Water Purchase Water Comprehensive Plan - Source of Supply Analysis City of Lacey		
	Estimated Cost(1)	**Cost per AFY ($/Kgal/yr)**
Initial IGA Fee	$40,000	
Total Initial Cost	**$40,000**	**$24 ($0.07)**
Monthly Fee	$15,000	$8 ($0.30)
Usage Fee ($0.199/ccf)	$162,000	$87 ($0.27)
Total Annual Costs	**$344,000**	**$116 ($0.57)**

Notes:
(1) Costs based on an added capacity of 2 mgd for 8 months and 1 mgd for 4 months.

3.6 Purchasing Water Systems

The last source of supply evaluated in this analysis includes the potential for the City to acquire additional water systems existing within the Urban Growth Area. These systems can only be considered a source of supply if the existing source has excess capacity above meeting the demands of current users connected to the system. The City has identified several potential systems with excess supply including Rolling Firs Evergreen Terrace, Meadows LLC, Ostroms, Nutriom, Thurston County PUD #1, and the Pattison Water system.

Costs for these systems are estimated based on the cost of purchasing a portion of the Meadows water system as described in the 2003 Water Comprehensive Master Plan, and are presented in Table 4A.9. Costs for purchasing infrastructure assume that all upgrades to meet City standards will be paid for by the seller prior to purchase. This is consistent with the City policy to only acquire systems that meet City water system standards. The City does not intend to pay for existing customers, but only for undeveloped portions of the new service area. Additionally, a capital cost of 20 percent is applied for legal and administrative costs associated with purchase negotiations and fees from potential legal or financial consultants.

Annual costs assume the same treatment costs estimated for shallow wells, and use the average of estimated shallow and deep well pumping costs.

As seen in the table, the estimated initial and annual costs for purchasing water systems are $19.67 and $0.16, respectively. These values are used in the NPW analysis in Section 4.

Table 4A.9 Costs for Purchasing Water Systems
Water Comprehensive Plan - Source of Supply Analysis
City of Lacey

Item	Cost per AFY ($/Kgal/yr)
Capital Costs	
Water Right Purchase	$1,750 ($5.37)
Service Area Purchase	$3,450 ($10.59)
Infrastructure	$140 ($0.43)
Legal & Admin (20%)	$1,069 ($3.28)
Total Capital Cost	**$6,408 ($19.67)**
Annual Costs	
Pumping Costs	$36 ($0.11)
Chemical Costs for Disinfection	$16 ($0.05)
Total Annual Costs	**$52 ($0.16)**

4.0 NET PRESENT WORTH COST COMPARISON

The capital and annual costs for each potential source of supply were evaluated in a NPW comparison, based on a discount rate of 3 percent and a 30-year evaluation period. The results of the NPW are presented in Table 4A.10.

Given the level of accuracy of the costs developed in this evaluation, the NPW costs form three groups:

- **Low Cost Options.** The two low cost options are shallow wells (least expensive) and purchasing water from Olympia.
- **Moderate Cost Options.** The three moderate cost options, in order of increasing NPW cost, are purchasing water systems, reclaimed water, and deep wells.
- **High Cost Option.** The highest cost option is seawater desalination, with a cost more than three times as much as the next highest option.

Table 4A.10 NPW Cost Comparison Water Comprehensive Plan - Source of Supply Analysis City of Lacey			
Source	**Capital Cost per 1,000 gal/yr**	**Annual Cost per 1,000 gal**	**NPW(1)**
Shallow Wells	$6.6	$0.2	$9
Deep Wells	$20.9	$0.6	$30
Reclaimed Water	$25.8	$0.1	$27
Desalination	$64.7	$3.1	$117
Purchase of Olympia Water	$0.1	$0.6	$10
Purchase Water Systems	$19.7	$0.2	$22

Notes:
(1) NPW = net present worth. Sum of capital and operating costs assuming a 30 year planning period and a discount rate of 3% per year. Capital costs assumed to occur in 2009 and annual costs occur each year for 30 years at a discount rate of 3% per year.

5.0 NON-FINANCIAL EVALUATION

In addition to the NPW comparison, each source of supply has been evaluated against a set of criteria established by the City, as presented in Appendix A. Each source is given a score of -, 0, or + depending on how the source meets the criteria. A brief description of the rationale for each score is also provided in Appendix A. Based on the evaluation of non-financial criteria, the supply options form four groups:

- **Highly Favorable.** Purchasing water from Olympia and purchasing existing water systems rank as the best options to pursue, both with a scores of 4.
- **Favorable.** Shallow wells are the next most favorable water supply option, with a score of 3.
- **Acceptable.** Deep wells and reclaimed water are also acceptable, though with a greater number of potential concerns and impacts, with a score of 0.
- **Poor.** Seawater desalination ranks as the least favorable option, due to its extensive permitting requirements and operational complexity, with a score of -5.

6.0 SUMMARY

The NPW and non-financial rankings for the six supply options are summarized in Table 4A.11. An overall ranking was then determined based on the average ranking of the NPW and non-financial evaluations. The supply options are shown in order of increasing overall rank.

Table 4A.11 Ranking of Supply Options
Water Comprehensive Plan - Source of Supply Analysis
City of Lacey

Source	NPW Ranking	Non-Financial Ranking	Overall Ranking
Purchase of Olympia Water	2	1	1
Shallow Wells	1	3	2
Purchase Water Systems	3	1	2
Reclaimed Water	4	4	4
Deep Wells	5	4	5
Desalination	6	6	6

A summary discussion of the various supply options is provided herein. The recommendations are summarized in a decision tree, shown in Figure 4A.1. The long-term supply options, in order of decreasing favorability are:

- **Purchase of Water From City of Olympia.** As shown in the table, purchase of water from Olympia is the most favorable overall option. Though, purchase water from Olympia is likely not a viable long-term supply. It is recommended that the City work with Olympia to renew the current agreement and maintain a supply agreement as long as possible. As such, purchase of water from Olympia is included as part of the "baseline" in the attached decision tree.

- **Purchasing Water Systems.** Purchasing water systems is tied for the second most favorable option with developing shallow wells. We recommend the City continue to pursue purchase of water systems with excess water rights, as they are available. As such, purchase of water systems is included as part of the "baseline" in the decision tree.

- **Shallow Wells.** The shallow well option is contingent on both obtaining sufficient water rights from Ecology, as well as finding sufficient additional mitigation opportunities to support those rights. As shown in the decision tree, we recommend the City continue to pursue shallow wells as long as water rights and mitigation opportunities are available.

- **Reclaimed Water.** The City already has a plan in place to implement reclaimed water as a source of supply. As this source is cost competitive with other sources of supply and the source is readily available, we recommend the City implement the reclaimed water supply as planned. As such, reclaimed water is included as part of the "baseline" in the decision tree.

- **Deep Wells.** The deep well option is ranked lower than other options both due to its moderately high cost, as well as its greater complexity. However, as all options are generally limited in potential capacity, it is likely that deep wells will be part of the City's long-term water supply strategy. One of the key reasons for pursuing shallow wells instead of deep wells is cost. However, as deep wells generally have less impact on surface water bodies, and less required mitigation, costs for deep well mitigation is less than for shallow wells. As the cost of mitigation rises for shallow wells, at some point, it will be more reasonable to invest in treatment facilities of deep wells than to pursue shallow wells. Given the costs per 1,000 gallons outlined in this analysis, if the cost of mitigation for shallow wells exceeds approximately $17 per 1,000 gallons, pursuing deep wells will be more cost effective. Compared to the current cost of mitigation for shallow wells ($2.55/1,000 gal/yr), it appears that pursuing shallow wells as opposed to deep wells is a reasonable choice for the City at this time.

- **Desalination.** Desalination is the lowest rank option in terms of both cost and non-financial criteria, due to the complexity of required intake, treatment, outfall, and distribution facilities. Based on these significant disadvantages, we do not recommend pursuit of desalination at this time. However, this option may become viable in the future if technology advances significantly reduce costs. Regulatory approval would remain a barrier, but would be lessened if the City were to participate in a regional supply project, or if other desalination projects were first implemented in the state.

The above recommendations are summarized in the decision tree shown in Figure 4A.1. This decision tree is based on the baseline assumptions that the City will: (1) continue the Olympia supply as long as possible; (2) purchase water systems with excess water rights as they become available; and (3) implement the existing reclaimed water plan. We then recommend the City pursue shallow wells, then deep wells, as long as water rights and mitigation opportunities are available. Once all other options are exhausted, we recommend the City reevaluate desalination as an option, as well as considering additional reclaimed water use and further conservation measures.

It is important to note that the recommendations in this report are based on very conceptual level costs and assumptions. While useful for this analysis, the precision of cost data provided in this report reflects the conceptual nature of this analysis. Small adjustments to minor costs do not have a significant impact on the final comparison. However, every effort has been made to ensure a reasonable cost comparison is provided.

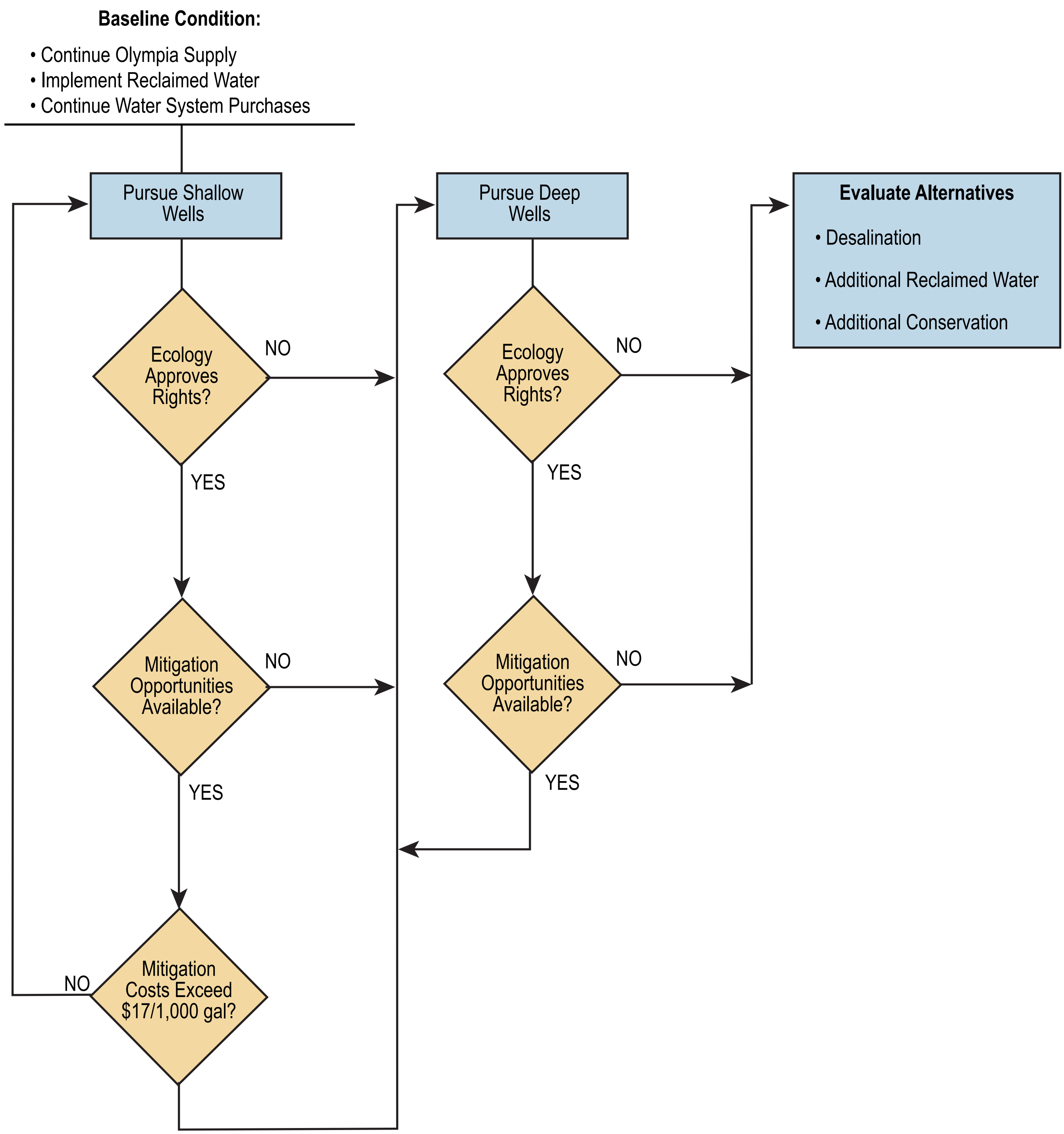

Figure 4A.1

SOURCE OF SUPPLY ANALYSIS

CITY OF LACEY

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APPENDIX A

NON-FINANCIAL CRITERIA DEFINITIONS

Non-Financial Criteria Definitions
Water Comprehensive Plan - Source of Supply Analysis
City of Lacey

Criterion	Source of Supply					
Net Present Worth Costs (per 1,000 gal)	**Shallow Wells** $8	**Deep Wells** $31	**Reclaimed Water** $27	**Desalination** $117	**Purchase Olympia Water** $10	**Purchase Water Systems** $22
Ease of Permitting/Water Rights Approval	– Extensive effort to acquire WR permit	– Extensive effort to acquire WR permit	+ Reclaimed water is part of a regional plan; fairly simple permitting	– Extensive permitting required; anticipate difficulty with discharge to Puget Sound	+ No Permitting	- Difficulty anticipated in initial purchase
Implementation Complexity	+ Relatively easy to implement	0 Treatment Facilities add complexity to implementation	0 Requires additional storage, pumping, and distribution infrastructure	– Extensive design and construction; intake/outfall in sensitive Puget Sound	+ No additional infrastructure required	+ Source and distribution system should already meet City standards
Operational Complexity	+ Relatively easy to operate	0 Treatment facilities add complexity to operations	0 Additional independent supply system requiring management	– Requires highly-trained operators and facility management	+ Low O&M requirements	+ Similar to shallow wells
Partnering Complexity	0 Partnering on mitigation can reduce cost but increase complexity.	0 Partnering on mitigation can reduce cost but increase complexity.	– Multiple partners; potential challenges with allocation of RW	-/0 Potential to partner with adjacent purveyors - adding complexity	– Supply depends on City of Olympia	+ After initial negotiations, partnering is not applicable
Public Acceptance	0 Some public resistance to drilling wells & maximizing aquifers	0 Some public resistance to drilling wells & maximizing aquifers	0 Some public concern for water quality; some public acceptance of innovative method	– Much public resistance anticipated for entrainment of marine life in intake system; discharge of brine to Puget Sound	+ No public resistance	0 May or may not be a financial burden to upgrade system to meet standards.
Community Impacts	+ Impacts can be mitigated	0 Treatment facilities require land and affect public aesthetics	0 Additional storage and pump stations	– Treatment facilities require land; intake/outfall piping impacts to shoreline	0 Little control over water quality	+ No public impact
Proven Technology	+ Familiarity with system; ease of operation	+ Familiarity with system	0 Relatively new technology	0 New technology to the City; more complex than well treatment	+ N/A	+ Similar to shallow wells
Total Score	**3**	**0**	**0**	**-5**	**4**	**4**

Appendix M
WELLHEAD PROTECTION PLAN, MONITORING WELL LOGS, AND NOTIFICATIONS

FINAL REPORT

CITY OF LACEY

Wellhead Protection Report
for the Water System Plan Update 2011

Submitted To: Carollo Engineers
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May 3, 2011 **083-93334**

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Golder Associates

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ABBREVIATIONS

afy	acre-feet per year
amsl	above mean sea level
AKART	All Known Available Reasonable forms of Treatment
BMP	Best Management Practice
BNRR	Burlington Northern Railroad
CAO	Critical Areas Ordinance
CARA	Critical Aquifer Recharge Area
cfs	cubic feet per second
City	City of Lacey
CSI	Contaminant Source Inventory
DBCP	dibromochloropropane
DOH	Washington State Department of Health
Ecology	Washington State Department of Ecology
EDB	ethylene dibromide
ft/day	feet per day
ft/mile	feet per mile
gpd	gallons per day
gpd/ft	gallons per day per foot
gpm	gallons per minute
in/yr	inches per year
LMC	Lacey Municipal Code
MCL	Maximum Contaminant Levels
mgd	millions of gallons per day
mg/l	milligrams per liter
NLW	Northwest Land & Water, Inc.
NTU	nephelometric turbidity unit
PAH	polyaromatic hydrocarbons
PCE	Tetrachloroethylene
PGG	Pacific Groundwater Group
Qga	Vashon Advance Outwash Aquifer
Qgt	Vashon Till

Qpg	Pre-Vashon Gravel
Qgr	Vashon Recessional Outwash Aquifer
RM	river mile
sq.ft/day	square feet per day
TQu	Tertiary Undifferentiated Aquifer
UGA	Urban Growth Area
USGS	U.S. Geological Survey
µg/L	micrograms per liter
µmhos/cm	micro Siemens per centimetre
USEPA	United States Environmental Protection Agency
VOC	volatile organic compounds
WAC	Washington Administrative Code
WADNR	Washington Department of Natural Resources
WFI	water facility inventory
WHPA	wellhead protection area
WPMP	wellhead protection monitoring program
WSDOT	Washington State Department of Transport

Common Unit Conversions

1 cfs	= 448.9 gpm
1mgd	= 694 gpm
1 acre-feet	= 43,560 cubic feet
1 sq.ft/day	= 7.481 gpd/ft

1.0 INTRODUCTION

1.1 Regulatory Background

The City of Lacey (the City) relies on multiple groundwater sources to provide a safe and reliable potable water supply. The City is committed to protecting the environment and preventing groundwater contamination through a proactive wellhead protection program. Wellhead protection programs are required by the United States Environmental Protection Agency (USEPA) and the Washington State Department of Health (DOH). For a groundwater-supplied water system, the folling elements are required:

- A discussion of the hydrogeologic characteristics of the area;
- A susceptibility assessment for the sources;
- Delineation of wellhead protection areas (WHPAs);
- A contaminant source inventory within defined WHPAs;
- A contingency plan;
- Notification to owners/operators of potential contamination sources;
- Notification to regulatory agencies and local governments of WHPA boundaries and contaminant source inventory findings, and;
- Notification to local emergency responders of WHPA boundaries, results of the susceptibility assessment and contaminant source inventory, and contingency plan.

The City started implementing its Wellhead Protection Program (WPP) in 1995, and was last updated in 2003 (Gray and Osbourne, 2003). In addition to the required elements listed above, over the years the WPP has also included several additional elements, including land use restrictions, review of development/ redevelopment proposals, site inspections of small quantity generators, groundwater monitoring, and public education.

Since the last WHP update in 2003, a number of changes within the city needed to be addressed in this update, including new sources, wells inactivated since the last update, updated average pumping rates, and some large vacant parcels within wellhead protection areas that have been developed.

1.2 City's Production Wells

Figure 1-1 shows the study area that has been defined for the purpose of characterizing the hydrogeologic conditions, delineating wellhead protection areas for the supply wells, indentifying potential contaminant sources and assessing risks to the quality of the City's groundwater sources. Table 1-1 summarizes the construction details for the City's 19 currently active wells. For the purposes of this report, we have grouped the wells into four areas:

TABLE 1-1

Existing Municipal Supply Wells – Construction Details and Reliable Pumping Rates

Source Number	Alternative Name	Well Depth (ft)	Aquifer	Screen Intervals (ft bgs)	Reliable Capacity [(1)] (gpm)	Casing Diameter (in)	Year Installed
College Street Area							
S01	Well 1	122	Qga	100-122	300	10	1965
S02	Well 2	217	Qpg	187-217	600	16	1969
S03	Well 3	225	Qpg	194-222	230	16	1969
S04	Well 4	84	Qga	65-80	750	16	1973 (backfilled)
S06	Well 6	385	Qpg-TQu	190-200; 223-238; 325-340; 352-367; 375-380	400	16	1988
S07	Well 7	479	TQu	428-477	1,800	12	1976
S09	Well 9	290	TQu	223-284	650	16	1981
S10	Well 10	212	Qpg	178-208	1,000	16	1981
East Lacey Area							
S20	McAllister Park	214	Qpg	180-185; 193-208	580	16	1995
S21	Madrona Park No.1	329	Qpg	263-271; 279-292; 313-324	1,460	16	1996
S22	Madrona Park No.2	334	Qpg	265-282; 294-306; 313-326	1,600	16	1997
S28	Madrona Park No.3	330	Qpg	286-325; 286-325	1,600	20	2000
S27	Evergreen Estates	282	Qpg	256-276	700	16	2002
Hawks Prairie Area							
S15	Beachcrest No.1	140	Qga	140-155	180	12	1976
S16	Beachcrest No.2	138	Qga	113-138	170	10	1979
S29	Betti (Well 29)	390	Qpg	294-309; 332-348; 355-375	1,000	20	2005
S19	Hawks Prairie No.1	646	TQu	585-592; 603-608; 623-643	750	12	1988
Nisqually Wells							
S24	Nisqually 19A	107	Qpg	98-107	70	6	1986 (deepened)
S25	Nisqually 19C	79	Qpg	58-73	230	6	1972

Notes: (1) – as defined by City of Lacey. Qga - Vashon Advance Outwash; Qgp – Pre-Vashon Gravel; TQu – Tertiary Undifferentiated.

- The College Street area wells – consisting of the City's eight legacy production wells;
- The East Lacey area wells – consisting of the three Madrona wells, the McAllister well and Evergreen Estates well;
- The Hawks Prairie area wells - which includes the Hawks Prairie well, the Betti well, and the two shallow Beachcrest wells; and
- The Nisqually area – which consist of the two shallow wells located close to the Nisqually River.

The City inactivated the Meridian Acres well (formerly Well S14) in 2006, and disconnected its intertie with the Capitol City Golf Club well (formerly Well S26) in 2007. These wells have not been included in the new WHPA assessment. In 2007, the City commenced a groundwater resource exploration project in the Hawks Prairie Area which included drilling four new test wells. The City has applied for water rights for each of these wells and further development will occur once water rights are obtained.

1.3 Report Overview

This report is organized as follows:

- Section 2 – Presents the current understanding and characterization of hydrogeologic conditions in the City of Lacey's wellfield areas. A substantial amount of field testing and analysis has occurred in these areas, and this report references much of this previous work. No additional field work or testing was performed specifically for the purpose of developing this report.
- Section 3 - Presents the new WHPAs. This task involved using a groundwater flow and transport model to determine the 6-month, 1-year, 5-year and 10-year time of travel capture areas of the City's active and planned future wells.
- Section 4 – Susceptibility and Contaminant Source Inventory Assessment. This is based on using the City's most recent survey of land use and potentially hazardous waste operations in the Lacey area, and assessing the risk these activities and contaminants have to the supply sources
- Section 5 – Presents the Wellhead Protection Monitoring Program. This includes details of the current groundwater monitoring program and provides recommendations for new monitoring wells and future monitoring schedule.
- Section 6 – Summary and Recommendations. The final section of the report provides concluding statements and recommendations.

2.0 HYDROGEOLOGIC CONDITIONS

2.1 General Physical Setting

The City of Lacey is situated within the northern part of Thurston County. The region, which borders the southern extent of Puget Sound, the Nisqually River to the east and the Deschutes River to the west, is also home to the cities of Olympia, Yelm and Tumwater, as well as large unincorporated areas (Figure 2-1).

The present day land surface is largely the result of erosion and deposition processes that have operated since the last (Frasier Glaciation) glaciation occurred. This event, known as the Vashon Stade, dated from about 15,000 years before present. The landscape is generally low-lying, with the topography ranging from mean sea level (msl) along the shoreline of the Puget Sound to more than 360 feet above msl (amsl) to the south near Fort Lewis Military Reservation and above 460 feet above msl at Tumwater Hill. This glacial-drift plain is dissected by two regional rivers (the Nisqually and Deschutes), numerous small tributary streams, glacial lakes, ponds, wetlands and springs. Large portions of the region are rural and vegetation consists of coniferous forests and open prairies, as well as urban areas.

2.2 Climate and Precipitation

The climate of northern Thurston County is typical mid-latitude, West Coast marine, characterized by warm dry summers and cool wet winters. During the winter months, rainfall is usually light to moderate intensity. Figure 2-2 shows the average annual precipitation isohyets for the region (from Drost et. al, 1999), with the annual precipitation increasing westwards from 40 inches near the Nisqually Delta to 50 inches in East Olympia.

Figure 2-3 shows the annual (by water year, October-September) precipitation record for the Olympia Regional Airport station between 1948 and 2008. This station (located about three miles south of downtown Olympia; see Figure 2-2) has the longest period of record in the northern Thurston County area. The station is managed by the National Oceanographic and Atmospheric Administration (NOAA). The 60-year average annual rate (by water year, October-September) is 50.9 inches, with a minimum and maximum range from 31.7 inches (in 2000-01) to 72.6 inches (in 1998-99). Based on the isohyets shown in Figure 2-2, the long-term annual average within the City of Lacey is expected to be up to 7.5 inches lower than at the Airport station (or 43.4 in/yr). The driest month historically is July (an average of 0.73 inch) and the wettest month is November (an average of 8.31 inches) (Figure 2-4). About 80 percent of the annual precipitation occurs during the six months from October to March, inclusive.

Figure 2-5 shows the annual cumulative departure from the long-term mean for the Airport station. This chart indicates periods of time during which the region was experiencing prolonged drier than average periods (as indicated by the red “cumulative departure” line trending downwards) and wetter than average periods (where the red line trends upwards). The 34-year period from 1949 to 1983 was characterized by relatively short wet and dry periods, with the overall total greater than the long-term average. A significant drier period (of about ten years) occurred after the mid-1980s. The subsequent four years were relatively wet.

Several other inter-local climate stations are maintained in northern Thurston County, and the data are provided on the Thurston County website (locations are shown on Figure 2-2). These are:

- The Waste and Recovery Center in the Nisqually-McAllister Basin (record period from August 2002 to present);
- Thurston County Fairgrounds (record period from April 2002 to present);
- Henderson-Woodland Creek Watershed (record period from April 2002 to present); and
- Eaton Creek in the Lake St. Clair Basin (record period from August 2003 to present).

Infiltration of precipitation is the primary recharge source for the groundwater system in the region. In general, that portion of the precipitation that is not evaporated, transpired or subject to surface run-off and overland flow is available to replenish the shallowest aquifer at the water table. Identification of historical precipitation trends is important to understand how the groundwater system works, and how it may change in response to future climatic conditions.

2.3 Surface Hydrology

Figure 2-6 shows the main surface hydrology features in the area. Many of the rivers, creeks, springs and lakes shown are believed to be at least partially in hydraulic contact with shallow groundwater.

2.3.1 Woodland Creek

The main surface water basin in the Lacey area is Woodland Creek. The creek initiates at the outflow from Long Lake, which is connected to Hicks and Pattison Lakes via a shallow channel and wetlands areas. Collectively, these lakes are referred to informally as the Tri-lakes. Woodland Creek discharges into Henderson Inlet.

2.3.1.1 USGS Flow Data

In August 1988, the United State Geological Survey (USGS) recorded flows in the creek at five locations between the Long Lake outlet and Pleasant Glade Road (Drost et al, 1999). These flow rates are as follows (upstream to downstream):

At Pacific Avenue	0.43 cfs
At Lois Lake outlet	dry
At Martin Way	dry
At Draham Road	8.0 cfs
At Pleasant Glade Road	12.0 cfs

These data suggest that, in summer, the creek receives a relatively small amount of discharge from the lakes. Stream flow decreases between the outlet and Martin Way, where the creek loses flow to the shallow aquifer. The creek receives groundwater seepage north of Draham Rd., and flow increases to Henderson Inlet.

2.3.1.2 Thurston County Water and Waste Management Data

Figures 2-7, 2-8 and 2-9 show measured flow rates (measured by Thurston County Water and Waste Management, WWM) at Pleasant Glade Road from 1988 to 1996, August 2002 to July 2003, and May 2007 to January 2008, respectively. These measurements indicate the following:

- Between 1988 and 1996, fall low flows were between 10 and 14 cfs. The average annual rainfall at the City of Olympia Airport Station during this period was 46.8 inches (or 4.1 inches less than the long-term average at the station).
- Between August 2002 and July 2003, the fall low flows were between 2 and 3 cfs. These flows are significantly lower than during the fall between 1988 and 1996. The average annual rainfall at the City of Olympia Airport Station for 2002-03 was 39.3 inches (or 11.6 inches below the long-term average).
- During 2007, the fall flows typically averaged about 15 cfs. The average annual rainfall at the City of Olympia Airport Station during 2006-07 was 62.3 inches.

Based on these data, the baseflow to the creek during the recorded periods responds primarily to precipitation patterns.

2.3.2 Tri-lakes

Thurston County WWM has recorded the stage levels in Long, Hicks and Pattison Lakes since 1988 (Figures 2-10, 2-11 and 2-12). In all three lakes, levels generally declined between 1990 and 1994, increased between 1994 and 1997, declined between 1997 and 2002-03, and increased between 2002-03 and 2008. The lowest lake levels during the period of record were measured in 1994-95. The lakes levels also fluctuated seasonally, ranging between 1 and 6 feet. Seasonal lows typically occur in October and seasonal high levels occur around March and April.

The stage in Hicks Lake has been consistently 3 to 6 feet higher than in Pattison and Long Lakes. The seasonal fluctuations in Hicks Lake stage have also been greater than in the two other lakes. Hicks Lake is effectively at the head of the chain of lakes, which may account for the higher stage level. However, there is also evidence that Hicks Lake may be directly underlain by till, whereas the other two lakes may have a more direct connection to higher permeable soils beneath the till unit. Long and Pattison Lakes may therefore be acting as recharge sources for shallow groundwater.

2.4 Regional Geology and Hydrogeology

This section describes the local geology, the principal aquifers and the groundwater flow patterns of the Lacey area. The understanding of the regional geology and hydrogeology has evolved during the last 40 years as the need to better manage Thurston County’s water resources has increased. The application of new and improved investigation and analytical techniques has greatly improved our understanding of the area. The majority of the information presented in this section has been collected from earlier hydrogeologic studies and reports.

2.4.1 Geology

The rocks that are exposed in the Northern Thurston County area range in age from lower-middle Eocene (approximately 50 million years ago) to Recent. Eocene-age rocks form the bedrock for a sequence of unconsolidated and semi-consolidated sediments of both glacial and non-glacial (continental) origin.

The regional bedrock consists of sedimentary (sandstones, siltstones and conglomerates) and volcanic basalt (of the Crescent formation). However, bedrock is not exposed within the Lacey area; the closest outcrops are in the West Olympia area where they form the prominent Black Hills (maximum elevation of 807 feet amsl), Bush Mountain (maximum elevation of 500 feet amsl) and Tumwater Hill (maximum elevation of 461 feet amsl).

The depth to bedrock in the region was estimated by Jones (1996) to range from land surface, generally increasing towards the northeast to a maximum depth of about 1,500 feet near the Nisqually delta (Figure 2-13). In 2007, Walsh re-evaluated the bedrock geometry and estimated the thickness based on new information. The result was a generally shallower bedrock towards the northeast than previously thought (unpublished; Figure 2-14). Overall, the overlying sediments in the Lacey area are interpreted to be between 150 and 600 feet thick based on the most recent interpretation.

Figure 2-15 shows the surficial geology of the area as interpreted by the Washington Department of Natural Resources (WA DNR) for the quad sheets Lacey and Nisqually; Walsh, et al, 2003). The surficial geology within the Lacey area consists mainly of Vashon Recessional Outwash and some Vashon Glacial Till in the northeast close to the McAllister Valley bluff. Along the middle reach of the Woodland Creek channel, Vashon Advance Outwash is present. This area is slightly north of that reach of Woodland Creek that appears to lose surface water to the shallow aquifer system (described in Section 2.3.1). Therefore, it is possible that this area where Vashon Advance Outwash is present at land surface extends further south than has been mapped by WA DNR.

2.4.2 Hydrostratigraphy

The understanding of the stratigraphy of the unconsolidated and semi-consolidated sediments has evolved significantly over the past decade. The earliest comprehensive attempt to characterize the hydrogeology was conducted in the mid-1960s by the Washington Dept. of Conservation (Water Resources Division) (see Wallace and Molenaar, 1961; Noble and Wallace, 1966). The hydrogeologic sequence was described as relatively straightforward, though more recent characterization indicates that subsurface conditions are complex. A brief overview of the earlier understanding is presented here, followed by a description of the current understanding to illustrate the recent interpretation changes. We expect that the understanding of the hydrostratigraphy will continue to evolve as more data becomes available and these data are examined in greater detail.

2.4.2.1 Previous Hydrostratigraphy Nomenclature

The unconsolidated sediments have historically been characterized as being composed of (from surface to depth):

- Surficial alluvial sediments (Q_{al});
- Vashon glacial sequence: Recessional Outwash (Q_{vr}); Till (Q_{vt}) and Advance Outwash (Q_{va});
- Continental, fine-grained sediments - historically referred to as the Kitsap Formation (Q_f);
- An older glacial sequence - commonly referred to as the "Sea Level Aquifer" (Qc) of the Penultimate Glaciation (Q_c); and
- Older undifferentiated sediments of both glacial and non-glacial origin (TQ_u).

Also, an additional hydrogeologic unit referred to as the McAllister Gravel exists in the McAllister area, and is an important aquifer supplying water for the City of Olympia at the McAllister Springs. This aquifer is outside the Lacey area, but has a significant influence on regional groundwater conditions.

Lacey's previous wellhead protection plans assigned the Nisqually wells to the McAllister Gravels. The model used in previous version had less detail than the current model. Because this portion of the Sea Level Aquifer where these wells were assigned is very near the margin of the McAllister Gravels, and the observed production rates are lower than other McAllister Gravel wells, these wells were more realistically assigned to the Qpg unit.

2.4.2.2 Modern Hydrostratigraphy Nomenclature

This transitional understanding of the stratigraphic sequence has been the generally accepted model, and was simple in that the strata were considered to be relatively laterally continuous across the region, with the few exceptions being in the major river valleys. More recent reinterpretations of the hydrostratigraphy have resulted in the recommended discontinuation of the Kitsap Formation as a formal unit (Borden and Troost, 2001). Also, several Vashon Recessional Outwash channels have been found to have locally eroded the Vashon Till unit. Some examples in East Olympia are along Spurgeon Creek, and near the Indian Summer Golf Course and Country Club. These can have an important influence on local groundwater conditions and act as pathways for the enhanced downward migration of shallow groundwater and potential contaminants.

The following provides details for the various hydrostratigraphic units under the current interpretation:

- <u>Post-Vashon (Holocene) Alluvial and Deltaic Sediments:</u> These sediments exist along the shallow valley bottoms of the main streams, and therefore have relatively limited areal extent. These units have minimal regional significance in storing or transmitting groundwater.

- Vashon Recessional Outwash (Qgo, Qgos): This unit consists of poorly to moderately sorted, permeable sand and gravel deposited by streams emanating from the melting and receding glacier. They make up the unconfined water table aquifer in large parts of the region where perched by underlying till, but may not always contain groundwater. This unit is laterally extensive, although absent in several areas (notably in the upland areas), and ranges in thickness up to 40 feet. Locally, it supports kettle lakes in hummocky terrain where underlain by end moraine deposits. It is mostly unconfined, and supports wells for mostly small, domestic use where sediments are coarse-grained.

- Vashon Glacial Till (Qgt): This unit consists of unsorted sand, gravel and boulders encased in a silt-clay matrix. It is characteristically compact (well drillers commonly refer to the materials as "hardpan") where laid down beneath heavy glacial mass. It is, however, less compact where formed by ice melting. The till is exposed in many parts of the region, notably above incised stream valleys and in upland areas. In general, it acts as an extensive confining bed with occasional permeable windows. The unit thickness is typically between 20 and 60 feet.

- Vashon Advance Outwash (Qga): This unit consists of fine- to coarse-grained sand and gravel grading upward to poorly to moderately sorted. It was deposited at the front and sides of the Vashon glacier ice mass as it advanced to the southwest. It is laterally extensive in the region, but exposed only along steep river and Puget Sound bluff faces. It forms the first water-bearing unit of economic value, and as well as being the main aquifer for most small-scale, private wells, it also supplies several larger-yielding municipal and industrial wells. It is generally confined by the Qgt unit. The unit has a thickness in the range between 10 and 65 feet. The City currently operates several wells that are completed in this aquifer, including two in the College Street area and the two Beachcrest wells further north.

- Pre-Vashon Glaciolacustrine Deposits (Qpf): This unit consists of laminated clayey and silty sediments deposited in proglacial lakes. The soils have a low permeability, and act as a confining unit between the overlying Vashon and underlying pre-Vashon aquifer.

- Pre-Vashon Gravel (Qpg): This unit consists of coarse, stratified sand and gravel deposited during a pre-Vashon glaciation. It is laterally extensive, exposed along the bottom of the Nisqually River between the confluence with the McAllister Valley and Muck Creek. Although rarely more than 50 feet thick (between 15 and 70 feet), this unit forms the principal economic (mostly confined) aquifer in the area tapped by wells. A combination of the Salmon Springs, penultimate, and other formations, this is a widely-used aquifer, and is the primary supply source for the City's Madrona, McAllister and Evergreen Estate wells in East Lacey.

- Undifferentiated Quaternary and Tertiary Deposits (TQu): This unit consists of fine- to coarse-grained unconsolidated sediments extending to bedrock, and is of glacial and non-glacial origin. The base of this unit ranges from about 300 feet amsl in the southeast to more than 1,500 feet below msl along the Puget Sound. It consists of a sequence of aquifers and confining beds; tapped by only a few water wells locally. The City has several active wells that produce from this aquifer, and have recently installed several new deep test wells in the Hawks Prairie area into this unit.

As mentioned above, the Tertiary (Miocene-Eocene) bedrock consists of sedimentary sandstone, siltstone and claystone, and some igneous bodies of andesite and basalt. Although some private wells produce groundwater from these units, the bedrock is considered to be relatively impermeable and does not contribute significantly to the regional groundwater flow system.

2.4.3 Hydrogeologic Sections

Figure 2-16 shows the locations of seven hydrogeologic sections that have been developed through Lacey's wellfield areas.

- Figures 2-17, 2-18 and 2-19 are reproductions of three sections generated in 2008 by Northwest Land & Water (NLW) for the City as part of the recent development of the new Hawks Prairie area test wells (NWL, 2008d).
- Figures 2-20 and 2-21 are two north-south trending sections generated by Pacific Groundwater Group (PGG) as part of the previous Water System Plan (PGG, 2003).
- Figure 2-22 and 2-23 are two new west-east sections (F-F' and G-G') through the southern part of the Lacey area that we have developed for this report.

Section F-F' (Figure 2-22) shows the presence of a relatively thick and extensive Qgo unit in the College Street and Yelm Highway areas, and the static water table less than 50 feet bgs. The till beneath the Qgo unit, however, is intermittent, indicating that the Qgo unit and Qga aquifer are well connected at this scale. Also, no discernible fine-grained Pre-Vashon unit exists between the Qga and Qpg aquifers near Wells S09 and S10. This indicates that the Qpg is relatively vulnerable to surficial contamination in this area. Further east, Long Lake (stage level of 150 to 153 feet amsl; Figure 2-10) appears to be perched above the Qga aquifer which has a piezometric level that is several feet lower than the lake stage in this area. In the East Lacey area, the Qpg aquifer (from which Well S27 pumps) is well protected from surface contaminants by a 40-foot thick till and 30 feet of fine-grained Pre-Vashon sediments.

Along Section G-G' (Figure 2-23), the Qgo unit is notably thinner in all areas than along section F-F', and particularly so near Wells S01, S02 and S03 (where the till unit is less than 20 feet from land surface) and at the three Madrona wells (where no Qgo unit exists). However, the till is sufficiently thick to provide some confining protection for the three College Street area wells. Wells S21, S22 and S28 appear to be screened across the lower part of the Qpg aquifer. The relatively low static piezometric level in these wells (25 to 30 feet amsl) suggests that the Qpg and underlying TQu aquifer are in good hydraulic continuity in this area.

2.5 Aquifer Properties

Table 2-1 summarizes the aquifer properties that have been collated from the available driller's logs and well test reports. The results are grouped by aquifer (Qga, Qpg and TQu). These data indicate the following:

- The transmissivity of the Qga aquifer in the College Street area (Wells S01 and S04) is significantly higher than in the Hawks Prairie area (Beachcrest wells). This suggests that Wells S01 and S04 are completed in a relatively coarse part of the Advance Outwash deposit.
- The transmissivity of the Qpg aquifer in the East Lacey area (Wells S20, S21, S22, and S28) is consistently greater than 200,000 sq.ft/day, and is significantly higher than the transmissivity of the Qpg aquifer in the College Street area (Wells S02, S03 and S10).

- Of the eight wells completed either entirely or partially in the TQu aquifer, the transmissivity at Well S07 is significantly higher than at the other wells. The median hydraulic conductivity in these seven wells is 61 ft/day.

TABLE 2-1

Interpreted Aquifer Properties – Existing and New Test Wells

Aquifer	Well No.	Well Depth (ft)	Transmissivity (sq.ft/d)	Specific Capacity (gpm/ft)	Total Screen Length (ft)	Average Conductivity (ft/d)
Qga Aquifer	Well S01	122	12,600	47	22	570
	Well S04	84	40,100	78 - 158	21	1,910
	Well S15	140	600	2.2	15.5	40
	Well S16	138	2,380	8.9	25	95
Qpg Aquifer	Well S02	217	9,350	35	30	310
	Well S03	225	3,260	12.2	28	-
	Well S10	210	6,500	29.2	35	186
	Well S20	214	12,500	33.1	20	625
	Well S21	329	239,100 - 592,800	-	34	7,030 - 17,400
	Well S22	334	220,400 - 474,300	460	29	7,600 - 16,360
	Well S28	330	230,000	706	54	4,260
	Well S27	282	35,290 - 167,160	62 - 212	21	1,680 - 7,960
	Well S29	390	3,150	11.8	67	47
	Well S24	107	1,470	5.5	9	163
	Well S25	79	-	-	25	-
Qpg-TQu	Well S06	385	2,950	11	50	59
TQu Aquifer	Well S07	479	25,400	33.2 - 33.9	49	518
	Well S09	290	3,970	8.1	65	61
	Well S19	646	1,580	5.9	55	29
	TW-HP2	656	2,400 - 9,360	15.9 - 20.1	71	34 - 132
	TW-MR	629	4,540 - 9,490	20.8	60	76 - 158
	TW-MC	667	2,540 - 4,010	14	66	38 - 61
	TW-BC3	555	600 - 1,270	4.5	59	10 - 22

Pumping tests conducted at wells S21, S22 and S28 indicated storativity values in the range of 3 $x10^{-6}$ to 7.2 x 10^{-6} (PGG, 2002).

Table 2-2 presents the horizontal hydraulic conductivity values that are simulated in the McAllister Groundwater Flow Model for the main aquifers in the Lacey area. The modeled ratio of horizontal to vertical conductivity is 10 for the Qga and Qpg aquifers, and is 25 for the TQu aquifer.

TABLE 2-2

Simulated Hydraulic Conductivity in Lacey Area

Aquifer	Hydraulic Conductivity (ft/day)			
	College Street Area	East Lacey Area	Hawks Prairie Area	Nisqually Area
Qga	252	252	60	not present
Qpg	200	640	640	100
TQu	75	75	75	75

Source: Golder, 2008

2.6 Groundwater Recharge

2.6.1 Precipitation-Derived Recharge

The primary regional source of groundwater recharge is infiltration of precipitation. In general, the amount of recharge can be determined from the following relationship:

Recharge = Precipitation – (Evaporation + Transpiration) – Surface Run-off

The USGS developed a relationship to estimate regional-scale recharge (Bauer and Vaccaro, 1987). This regression model consists of two relationships – one each for the areas where the surficial soils consist of till (lower rate) or Vashon outwash materials (a higher rate). This model was incorporated in to the USGS Thurston County Model (Drost et al., 1999) and later into the McAllister Wellfield Model (CDM, 2001). The annual recharge rate in the Lacey area in the McAllister model ranges from 23 to 30 in/yr (Figure 2-24). A reduction in the overall recharge amount to the aquifers can occur if land development increases the amount of paved or housed area (unless the precipitation is re-routed to infiltration facilities). Reduction in infiltration can reduce the dilution of non-point contaminants that may be occurring under current conditions.

2.6.2 Other Recharge Sources

Locally, seepage from rivers, streams and lakes also provide a source of groundwater where surficial soils are sufficiently permeable to allow the vertical movement of water to the water table. Also, some relatively minor return flow of groundwater pumped by individual private wells occurs via septic system in areas that are not sewered. Inflow of groundwater into the Lacey area also occurs from the south of the Fort Lewis area; this groundwater is primarily recharged in the southern part of Thurston County. The amount of subsurface flow is difficult to determine due to the complex groundwater gradients and number of aquifers.

2.7 Groundwater Discharge

The main discharge of groundwater in the Lacey area occurs as subsurface outflow to Puget Sound, seepage to support the main lakes and streams, and groundwater pumping. Other than groundwater pumping, these flows are non-point in nature and are therefore difficult to measure directly.

2.7.1 Groundwater Pumping

The City maintains monthly pumping records for their currently- and recently-active production wells (see Table 1-1; Figure 2-1). Figure 2-25 shows the volume of groundwater pumped from Lacey wells annually (by calendar year) between 1993 and 2008. Some variability in annual pumped volume is related to occasional incorporation of water from other systems through interties. Lacey acquires nearly all of its water from groundwater supply wells with the exception of the relatively small fraction that is purchased from the city of Olympia (McAllister Springs).

Figure 2-26 shows the average production by month for the 16-year period (1993-2008). These results indicate that the City's pumping distribution is highly seasonal, with 48 percent of the annual total being pumped during the four months from June to September (on average).

The City of Olympia owns three production wells in their East Olympia wellfield area, located west of the Lacey city limits. Only one of these wells (the shallow Shana Park well [Well 11]) has been operational in recent years. The two remaining wells (the Hoffman and Indian Summer wells [Wells 3 and 20]) went on-line during 2009. These wells are close enough to the City's College Street area wells that, depending on the future pumping rates, hydraulic interference may occur that could affect the wellhead protection zones for the City's wells.

2.7.2 Other Discharge

The largest discharge of groundwater from the Lacey area aquifers is base flow to Puget Sound. As with groundwater inflow into the area, this quantity is difficult to determine. As discussed in Section 2.3, some interchange of surface and groundwater occurs within the Woodland Creek basin. Some interchange of water also occurs between Long, Hicks and Pattison Lakes (and their inter-lake wetlands) and shallow groundwater.

2.8 Groundwater Flow

Regional groundwater flow occurs in the three primary aquifers (Qga, Qpg and TQu), whereas local flow occurs in the mostly perched Qgo unit. Where present, the intervening till and fine-grained lacustrine units act to hydraulically separate the aquifers, resulting in piezometric head differences of more than 150 feet between the water table and TQu aquifers in some parts of the Lacey area. Regionally, groundwater flows from the upland recharge areas in the southern part of the Thurston County toward the north, where groundwater discharges to Puget Sound, the main rivers (the Nisqually and Deschutes), natural springs and seeps, numerous shallow lakes and streams. Groundwater elevations higher than 400 feet amsl occur in the area south of the cities of Rainier and Yelm. Conversely, groundwater levels are as low as a few feet amsl along the Puget Sound and less than 20 feet amsl in the upper part of the McAllister Valley. The regional flow pattern is disrupted in several areas where local groundwater mounds exist due to shallower till units, and local convergence of groundwater occurs due to higher permeable units (such as in the McAllister area).

Figures 2-27, 2-28 and 2-29 show the interpreted groundwater contours and flow direction in the Lacey area for the three principal aquifers. The data on which these figures are based were derived from a number of sources, including (1) the USGS' study (Drost, et al, 1999), (2) the previous PGG study and (3) recent water levels collected by the City. The accuracy of the USGS data is variable, as many levels were based on well reference levels estimated from surface topography mapping. Many of these measurements were made during August 1988 at the time of the USGS field study.

2.8.1 Qga Aquifer

Groundwater in the Qga aquifer flows toward the north-northeast with a steepening gradient to the northeast toward the Puget Sound (Figure 2-27). The hydraulic gradient appears to be relatively flat in the area of the Tri-lakes, with average groundwater levels in the range of 150 to 175 feet amsl. Flow occurs towards the McAllister Valley in the northeastern part of the City, where it discharges as springs and seeps along the east-facing bluff or is intercepted by shallow wells.

2.8.2 Qpg Aquifer

Groundwater flow in the Qpg aquifer is generally toward the north-northeast with levels ranging between 25 feet amsl (near the Hawks Prairie area wells) and 150 ft amsl near Lake Pattison (Figure 2-28). Near the Madrona and McAllister wells in East Lacey, the level in the Qpg aquifer is similar to that in the underlying TQu aquifer, suggesting a relatively high degree of continuity between these two units. However, the level in the Qpg aquifer is more than 100 feet below the level in the Qga aquifer, indicating a relatively high degree of hydraulic separation.

2.8.3 TQU Aquifer

Groundwater flows in the TQu aquifer are also generally toward the north and northeast, with levels ranging between 25 (near the Hawks Prairie wells) and 150 ft amsl (south of Lake Pattison) (Figure 2-29). Based on the available data, a prominent north-south trending flow divide occurs near the center of the City, with flow diverging eastwards towards the McAllister Valley, west to the Deschutes Valley and north to Puget Sound.

2.8.4 Groundwater Hydrographs

2.8.4.1 Monitoring Wells

Figures 2-30 and 2-31 are hydrographs showing manually-measured water levels in the City's six dedicated monitoring wells (MW-1 through MW-6) between 1993 and 2008. The depths of the six wells are similar (between 75 and 110 feet), and all are completed in the Qga aquifer. These hydrographs show:

- The levels in the three wells located close to production Well 4 (MW-1, MW-3 and MW-5) followed a very similar trend with levels ranging between 165 to 185 feet amsl.
- The levels in the three wells located near production Well 1 (MW-2, MW-4 and MW-6) also followed a similar trend with levels ranging between 145 to 175 feet amsl.

2.8.4.2 Production Wells

Figures 2-32 through 2-38 are hydrographs for static water levels (that is, measurements taken manually after pumping has ceased) for the City's production wells. Each figure shows data for wells located in the same general area and, on some figures, data for wells that are completed in different aquifers. Therefore, these figures show the relative potentiometric levels between aquifers and provide a sense of the local vertical hydraulic gradient. These hydrographs show:

- Water levels generally rose between 1993 and 1999, followed by a decline until 2005, and a gradual rise until 2009.
- In the College Street area, water levels in the wells completed in the Qga aquifer tend to be between 15 and 25 feet higher than in the nearby wells that are completed in the Qpg aquifer (Figures 2-32 and 2-33). This suggests that a relatively competent confining layer exists between these two aquifers in this area.
- The recorded water levels in the East Lacey area wells (between 20 and 40 feet amsl) completed in the Qpg aquifer (Wells S20, S21, S22 and S28) are lower than would be expected (Figure 2-35). This suggests that the hydraulic separation between the Qpg and TQu aquifers in this area is not as competent as in the Hawks Prairie area, where a significant water level difference occurs between Wells S29 and the deeper HP well (Figure 2-38).
- In the Qga aquifer, the overall change in water levels during this 16-year period ranged from a net 5 foot loss (Well S01) to zero change (in Wells S04, S15 and S16). Seasonal fluctuations in these wells ranged up to 15 feet.
- In the Qpg aquifer, the seasonal fluctuations in the College Street area wells (Wells S02, S03 and S10) were significantly greater than in the East Lacey area Qpg wells (Wells S20, S21, S22, S27,and S28).
- The seasonal groundwater level fluctuations in Well S09 (which is screened in the upper part of the TQu aquifer) were typically greater than those observed in the nearby Well S10 (screened in the Qpg aquifer; Figure 2-33). However, the springtime (annual high) groundwater levels measured in these two wells were fairly similar.
- In the TQu aquifer in the College Street area, no apparent overall change in water levels occurred during this period based on the recorded levels in Wells S06 and S07 (Figure 2-34). (Well S06 is screened in both the Qpg and TQu aquifers). However, in the Hawks

Prairie area, groundwater levels in the TQu aquifer declined by 15 feet between 1995 and 2005 (Well S19), but increased by 10 feet between 2005 and 2008.

2.9 Groundwater Chemistry

2.9.1 General Considerations

The regional quality of the groundwater is considered good, and has been characterized as calcium-magnesium bicarbonate (Noble and Wallace, 1966). The USGS sampled water quality from 356 wells in Thurston County in 1989 and also characterized the regional water chemistry as good, with 94% of the samples classified as soft or moderately hard (Drost et al., 1998). The study found that the major cations were calcium and magnesium, and the major anion was bicarbonate. Differences in water chemistry were noted between shallow aquifers (Qgo, Qgt and Qga) and deeper aquifers (Qpg and TQu), with the deeper aquifers typically having higher levels of bicarbonate (AGI, 2001).

Water chemistry issues have been identified in the region, both as a result of background conditions and human land-use activities. Background, or natural, water quality issues that exist include:

- Iron and Manganese. Elevated levels of iron and manganese have been reported in numerous wells in the area, particularly in wells completed in the TQu aquifer. All of the City's production wells in the TQu aquifer (Wells S07, S09 and S19) have elevated iron and manganese levels. Both Wells S07 and S19 have treatment systems for iron and manganese removal.
- Total dissolved solids (TDS).

Human-land use activities have led to water quality degradation in specific areas of the study area. Human caused water quality issues include:

- Chloride. Due to the proximity to Puget Sound, the groundwater in the deeper aquifers that are in continuity with the saltwater body is at risk from seawater intrusion should pumping levels be excessively lowered. Elevated chloride concentrations, the most common indicator of advancing saline waters, have been found in coastal areas near the Johnson Point, Boston Harbor and Cooper Point peninsulas (Drost et al., 1998). Although none of the City's wells have exhibited elevated chlorides, this risk should continue to be considered as groundwater development increases in the region. In particular, the Beachcrest and Hawks Prairie wells are potentially at risk from seawater impact if over-pumped due to their proximity to Puget Sound.
- Nitrates. The principal sources of nitrates to groundwater in the regions are associated with livestock, fertilizer application and septic systems discharges. The highest nitrate concentrations measured by the USGS in 1989 were south of the cities of Lacey and Tumwater, in areas with high housing densities and septic tank use, and the detergent concentrations correlated well with nitrate concentrations (Drost et al., 1998). The City of Olympia has also conducted several nitrate source studies in their wellhead areas (for example, the 2005 study performed by Robinson, Noble & Saltbush in the Shana Park area).

  Nitrate concentrations in Lacey's Well S04 and Olympia's Shana Park well (Well 11), which are both screened in the Qga aquifer and are located in the southern parts of

Lacey's and Olympia's urban growth areas (UGAs), have shown elevated nitrates in the last several years. The increase in nitrate concentrations appears to coincide with large-scale residential development in these areas.

- Pesticides and soil fumigants, ethylene dibromide (EDB) and dibromochloropropne (DBCP). Agricultural activities may be responsible for the presence of pesticides and soil fumigants in groundwater samples collected by Thurston Country in the vicinity of Pattison Lake. Although none of the City's monitoring wells have contained elevated levels of EDB, DOH requires the City sample the shallow production wells for this constituent.

2.9.2 Water Quality Results

Since 1993, the City has sampled groundwater from their six dedicated monitoring wells shown in Figure 3-1. Three of the wells (MW-1, MW-3 and MW-5) are located close to production Well S04, and three wells (MW-2, MW-4 and MW-6) are near production Well S01. The City has tested samples for the following constituents:

- Common ions;
- Volatile organic compounds (VOCs);
- Nitrate;
- Bacterial – total and fecal coliform;
- General field parameters – temperature, pH, specific conductance, total dissolved solids; and
- Synthetic organic compounds (SOCs) – targeted herbicides and pesticides

Figures 2-39 through 2-46 show the measured electrical conductivity, nitrates, iron and manganese concentrations for the City's six dedicated monitoring wells between 1993 and 2008. The notable trends are as follows:

- Conductivity (Figures 2-39 and 2-40). A gradual increase apparent through the 15 year record period is evident in all six wells. However, the highest level of 250 µmhos/cm (which is equivalent to a total dissolved solids (TDS) concentration of 170 mg/L) is still well below the drinking water MCL for TDS of 250 mg/L.
- Nitrate (Figures 2-41 and 2-42). The data indicate an apparent increase in nitrate levels in the three wells close to Well S01 since 1993. The highest concentration (3 mg/L in MW-4 in 2008) is below the MCL of 10 mg/L. Near Well S04, the nitrate concentrations in the three monitoring wells have remained below 1 mg/L since 1993 despite a sharp increase in nitrate concentrations at Well S04 that started in 2006, reached a peak of 6.7 mg/L in June 2007 and continued to be higher than pre-2006 levels.
- Iron (Figures 2-43 and 2-44). In 1993, elevated iron concentrations were reported in several of the monitoring wells (up to 7 mg/L in MW-1). Between 1993 and 2003, levels have generally been below the secondary MCL of 0.3 mg/L, the exception being in MW-1. More recent iron data are not available.
- Manganese (Figures 2-45 and 2-46). As with the iron levels, samples from several wells contained elevated manganese concentrations in 1993 (up to 0.42 mg/L in MW-1). Since then, levels declined and only samples from wells MW-1 and MW-3 (located near

production Well S04) were above the secondary MCL of 0.05 mg/L. More recent manganese data are not available.

No other significant water quality issues have been reported in the City's monitoring wells.

2.9.3 Chambers Creek Basin

Chambers Creek basin consists a kettle lake, and a creek that emanates from the eastern arm of Chambers Lake and drains southward in a broad, shallow valley. A significant amount of urban development has occurred in the area during the last 20 years. A comprehensive drainage plan was developed in the 1990's for the Chambers Creek basin to resolve problems associated with flooding, erosion, and diminishing water quality and aquatic/wildlife habitat.

Thurston County has monitored surface water flow and quality near the mouth of Chambers Creek since 1991 (Thurston County, 2006). The nitrate concentrations in the creek have ranged between 1 and 3 mg/L. The highest concentrations typically occurred during summer (when creek flow rates were lowest) and the lowest concentrations were in winter (during high flow periods). Creek water conductivity has ranged from 60 to 170 µmhos/cm during the period of record, with highest levels also occurring in summer and lowest during winter. A distinct long-term increasing trend occurred, and the average annual conductivity increased from 95 to 130 µmhos/cm between 1991 and 2006.

Although the water quality is generally considered to be fair to good (Thurston County, 2006), Chambers Creek failed the Part II fecal coliform test standard (not more than 10 percent of samples exceeding 200 cfu/100 mL) in 2001, 2003, 2004 and 2005. The Thurston County report noted the expected rapid growth in development with the basin and the threat to water quality. The City's shallow source Well S01 is located less than 2,000 feet east of the creek, though the revised modeling work does not indicate it lies downgradient or is likely to interact with surface water.

2.10 Recent Hawks Prairie Hydrogeologic Well Testing and Studies

2.10.1 Test and Production Wells

During 2007 and 2008, Northwest Land & Water, Inc. (NWL) conducted a groundwater exploration project for the City in the Hawks Prairie area (see Table 2-3). The results of the program are included in a series of four reports (one for each of the four new test and production wells installed) and a summary report that includes an analysis of wellhead capture areas for the wells plus an assessment of the potential for seawater intrusion to occur under a series of operational conditions (NLW, 2008d). The four wells are as follows:

- Marvin Road Test Well (TW-MR) (NWL, 2008a);
- Hawks Prairie 2 Production Well (TW-HP2) (NWL, 2008b);
- Meridian Campus Test Well (TW-MC) (NWL, 2008c); and

- Beachcrest Test Well (TW-BC3) (NWL, 2009).

All new wells were completed in the TQu aquifer, with total completed depths ranging from 545 to 660 feet bgs. NLW identified several productive zones within the TQu unit, and each well was completed with two-four screened sections.

TABLE 2-3

New Test Wells – Construction Details and Estimated Pumping Rates

Well ID	Alternative Name	Well Depth (ft)	Aquifer	Screen Intervals (ft bgs)	Estimated Capacity (gpm)	Casing Diameter (in)	Year Installed
TW-HP2	Hawks Prairie No.2	656	TQu	498-525; 573-598; 629-648	1,700	20	2008
TW-MR	Marvin Road	629	TQu	507-527; 566-586.5 601-611; 616-624	1,000	8	2008
TW-MC	Meridian Campus	667	TQu	497-533; 564-574 607-617; 647-657	1,000	8	2008
TW-BC3	Beachcrest No.3	555	TQu	447-472; 523-530; 540-547	600	8	2008

Notes: TQu – Tertiary Undifferentiated.

2.10.2 Study Findings

The results and conclusions from the well development and aquifer testing are summarized as follows:

- The aquifer transmissivities for the TW-HP2, TW-MR and TW-MC wells are generally similar (ranging from 3,740 to 4,680 sq.ft/day), which translates to an average hydraulic conductivity for the screened zones of between 47.7 and 66 ft/day.
- The tested transmissivity for TW-BC3 is significantly lower (680 sq.ft/day), indicating a lower potential well yield than the other three wells.
- No discernible hydraulic response to pumping was observed in the overlying Qpg aquifer during the pumping tests in the TQu aquifer. NWL concluded that leaky-type conditions do not exist in the deep aquifers in the Hawks Prairie area.
- The report included three hydrogeologic sections through the Hawks Prairie area. These sections are shown in this report (see Figures 2-17, 2-18 and 2-19).
- The Qpg aquifer may locally provide groundwater seepage to streams.
- A geochemical analysis indicated a “subtle” distinction between the groundwater chemistry in the Qpg and TQu aquifers. Stable isotope analyses indicated that the TQu aquifer groundwater is recharged by distant, high-elevation precipitation, whereas the Qpg aquifer groundwater is recharged by more local, low-elevation precipitation.
- Groundwater modeling of seven pumping operational scenarios (using both high- and low-end aquifer transmissivity) indicated a high potential for seawater intrusion only for the case where pumping occurs at the four new wells simultaneously. Seawater intrusion is more likely to occur if the low-end aquifer transmissivity is prevalent in the area.

- The modeling also predicted drawdown at two senior water rights wells (Glacier Park and Silver Hawk) to range from 6 to 22 feet (for the high transmissivity case) and from 19 to 37 feet (for low transmissivity case). The highest drawdown represents approximately 10 percent of the available drawdown at the two private wells.

- One-year, 5-year and 10-year time-of-travel capture zones were determined for the four new wells using the analytical flow model assuming (1) pumping from these wells only at their intended peak and (2) as (1) but also pumping from the City's existing HP1 well and the privately-owned Glacier Park and Silver Hawk wells. Figure 2-47 shows the predicted capture zones for these wells developed by Northwest Land and Water. Though similar to the revised capture zones presented in the following section (Figure 3-12), a more realistic regional gradient (consistent with the updated Baseline) elongate the capture zones slightly, and a 6-month time-of-travel capture zone were added.

3.0 WELLHEAD PROTECTION AREA DELINEATION

3.1 Overview

This report section presents the quantitative analyses performed to delineate time-of-travel based wellhead protection areas (WHPAs) for the City's current and planned supply wells. The analysis was conducted using the most up-to-date version of the McAllister Groundwater Model (Golder, 2008c), hereafter referred to as the Lacey WHPA model. The Lacey WHPA model uses the groundwater flow code *MODFLOW-SURFACT* (HydroGeoLogic, 1996) and the advective transport code *MODPATH* (Pollock, 1994). *MODPATH* is a companion program to *MODFLOW-SURFACT* that is used to model contaminant transport problems and can be used to delineate time-of-travel zones to wells or other discharge points.

3.2 Previous WHPAs

WHPAs were originally delineated in 1992 for the City's active source wells using the USEPA Wellhead Protection Analysis semi-analytical model. The WHPAs were updated in 1995 for the City's first Wellhead Protection Plan (EES, 1995). The 2003 update to the City's Wellhead Protection Plan added delineations for new sources (such as the Madrona, McAllister and Evergreen Estates wells) (Grey and Osborne, 2003). These delineations were generated using the software program GFLOW-2000 (Haitjema, 2000). Figure 3-1 shows the 2003 WHPAs for the 18 production wells that the City operated at that time. It should be noted that these WHPAs, as shown, appear to overlap. In practice, this is not possible; the overlap reflects the fact that many adjacent wells are completed in different aquifers, and the water recharging these wells would be withdrawn from similar surface areas but not the same aquifers at the same depth.

Since 2003, the understanding of the hydrogeology in these areas and the individual future pumping rates has changed. Also, the McAllister Groundwater Model has become the primary tool for evaluating groundwater protection and development projects in northern Thurston County.

3.3 Modeling Approach

3.3.1 Lacey WHPA Model

The Lacey WHPA model (the model) was used to develop the new time-based capture zones for the City's supply wells. The model is based on the latest version of the McAllister Groundwater Model. Figure 3-2 shows the model domain and major hydrogeologic features. The McAllister Groundwater Model was originally developed by the city of Olympia to assess possible hydrologic impacts of a planned 19 mgd wellfield to be located close to McAllister Springs (CDM, 2001). The McAllister Groundwater Model was subsequently updated, improved and used by the City of Lacey to evaluate a set of water right applications (Golder, 2006). The McAllister Groundwater Model underwent a further series of updates in late 2007 mainly to improve the representation of the lower Deschutes River valley. Several future pumping scenarios for Lacey were repeated using this version of the model (Golder 2007, 2008a, 2008b, 2008d). The McAllister Groundwater Model has received thorough peer and stakeholder review during its development and during the various updates, and Washington State Department of Ecology (Ecology) has accepted the model and its results. The model is therefore an established and best available tool to quantitatively predict groundwater flow conditions in the area.

3.3.2 Model Updates

The primary change that Golder made to create the Lacey WHPA model for this project was the refinement of the grid in the Lacey area. Figure 3-3 shows the previous model grid layout. The model calculates groundwater levels and flows for each active cell. The grid arrangement consisted of a highly-variable cell size, and many cells had high aspect ratios. Although this grid is computationally correct, it does limit the accuracy for simulating groundwater pumping and defining capture areas where cells are large (such as in the Hawks Prairie area). Figure 3-4 shows the revised model grid in the same area. The cells in the study area are generally smaller and have more uniform dimensions than previously. As a result of the grid changes, it was also necessary to ensure that the overall and hydrologic feature-specific boundary condition water budgets (such as the Tri-lakes and Woodland Creek) were consistent with previous model results. Some relatively small changes were made to these features in the model to maintain consistency between versions.

3.3.3 Capture Zone Analysis Approach

Capture zones represent the extent of the aquifer from which a well (or another discharge point) obtains groundwater over time. The capture zone of a discharge point increases with time as water moves through the groundwater system from the point of recharge to the point of discharge. The size and shape of a capture zone are influenced by the aquifer transmissivity, the ambient groundwater gradient and the pumping rate. Narrower and more elongate capture zones occur in lower transmissive aquifers with steep hydraulic gradients than in higher transmissive aquifers with relatively flat hydraulic gradients.

The general approach using the Lacey WHPA model in each case was as follows:

- Assign a steady-state pumping rate to each well. The City requested that the rate be based on the maximum possible use of each individual well as defined by its annual water rights, represented as an average annual pumping rate (Table 3-1). A new steady-state flow field was generated with all wells pumping simultaneously at these rates.
- Insert a circle of discrete particles surrounding each well at elevations adjacent to the well screen (or model layer to which the pumping flux was assigned). The particle circle radius was set depending on the local model cell dimensions, but typically ranged between 75 and 125 feet.
- Use the MODPATH transport code to backtrack these particles upstream from the well in the new steady-state flow field for ten years using a 10-day time step increment for

calculation purposes. The effective porosity assigned to the model layers was uniformly 0.25 for aquifers and 0.15 for aquitards.

- Simulate particle pathlines for travel times from the well at 6 months, 1 year, 5 years and 10 years. These pathlines were then exported as GIS-format shapefiles for interpretation and inclusion in this report.

The 17 wells analyzed are completed in at least one of the three main production aquifers (Qga, Qpg and TQu). Wells S24 and S25 are located along the model's eastern boundary (the Nisqually River). Because they are close to the model boundary, the model is unable to evaluate their WHPA and the original (1992) WHPAs have been carried forward for these two wells.

TABLE 3-1

Well Details and Simulated Pumping Rates for WHPA Delineation – Existing Wells

Well	Aquifer	Model Layer(s)	Reliable Well Capacity (gpm)	Modeled Pumping Rate (based on Qa water right)		Remarks
				gpm	AFY(1)	
Well S01	Qga	3	300	213.3	344	Primary only
Well S02	Qpg	5,6	600	595.2	960	
Well S03	Qpg	5,6	230	204.6	330	
Well S04	Qga	3	750	584.7	943	Primary plus supplemental
Well S06	Qpg, TQu	6,8	400	600	967.4	Primary plus supplemental
Well S07	TQu	8	1,800	1,720.4	2775	Supplemental only
Well S09	TQu	8	650	649.8	1,048	Primary plus supplemental
Well S10	Qpg	5,6	1,000	1,036.5	1,671.75	Primary plus supplemental
Well S15	Qga	3	180	131.3	211.7	Beachcrest wells, simulated as a single well
Well S16	Qga	3	170			
Well S24	Qpg	NM	70	-	270	Used original 1992 WHPAs for this report
Well S25	Qpg	NM	230			
Well S20	Qpg	5,6	580	345.3	557	McAllister well. Primary plus supplemental.
Well S21	Qpg	5,6	1,460	1,982	3,196.8	Madrona wells, simulated as a single well. Primary only.
Well S22	Qpg	5,6	1,600			
Well S28	Qpg	5,6	1,600			
Well S27	Qpg	5,6	700	231.9	374	Supplemental only
Well S29	Qpg	5,6	1,000	290.3	468.3	
Well S19	TQu	8	750	800	1,290	Primary plus supplemental.

Notes: (1) – Annual water right (Qa). NM – not modeled; Qga – Vashon Outwash aquifer; Qpg – Pre-Vashon Gravel aquifer; TQU – Tertiary Undifferentiated aquifer. gpm – gallons per minute; AFY – acre-feet per year.

3.4 WHPA Modeling Results

3.4.1 Modeled Groundwater Levels

Figures 3-5, 3-6 and 3-7 show the model-simulated average annual groundwater levels in the Lacey area in the Qga, Qpg and TQu aquifers with the Lacey wells pumping at the rates listed in Table 3-1.

3.4.1.1 Qga Aquifer

In the Qga aquifer, the predicted groundwater gradient upgradient from the Beachcrest wells (well S15 and S16) is relatively flat, with the water level between these two wells and the Tri-lakes decreasing by no more than 10 feet over a four mile distance (Figure 3-5). The model predicts groundwater discharging to the lower reach of Woodland Creek (north of Interstate 5), to the bluff springs along the lower McAllister Valley and to the McAllister Gravel unit south of the McAllister Springs complex.

3.4.1.2 Qpg Aquifer

In the Qpg aquifer, the model predicts groundwater flow occurring generally to the north, and discharging to the Nisqually Delta and to the McAllister Valley to the east of the five East Lacey wells (Madrona, McAllister and Evergreen Estates) (Figure 3-6). A groundwater divide occurs to the west of the City limits, close to where the City of Olympia will operate its Indian Summer well in the future.

3.4.1.3 TQu Aquifer

In the TQu aquifer, groundwater flow is also generally to the north, discharging to Puget Sound and the Nisqually delta (Figure 3-7). The model simulates a significant groundwater divide, whose north-south axis is located to the east of the three College Street area wells completed in this aquifer (wells S06, S07 and S09).

3.4.2 New WHPAs for Existing Wells

Figures 3-8, 3-9 and 3-10 show the predicted time-of-travel capture zone (6 months, 1-year, 5-years and 10-years) for the Lacey wells in the Qga, Qpg and TQu aquifers, respectively. These WHPAs were developed using the particle tracking applied to the steady-state groundwater flow fields shown in Figures 3-5, 3-6 and 3-7.

These new capture zones vary slightly from the previous modeling work shown in Figure 3-1. Several changes account for the differences:

- Pumping rates were revised; some increasing, others decreasing, and some remaining unchanged.
- A more realistic regional gradient (consistent with the updated Baseline) elongate the capture zones slightly, and a 6-month time-of-travel capture zone were added.

- Although little construction detail is known about the previous model, the current model represents an improved distribution of transmissivity and appropriate layering to reflect observed hydrostratigraphy.

Consequently, the revised capture zones should be viewed as more representative of actual conditions, despite being sometimes smaller than those depicted previously.

3.4.2.1 Qga Aquifer

Due to their close proximity, the new WHPAs for the two Beachcrest wells (Wells S15 and S16) are combined as if a single wells (Figure 3-8). For these wells and Well 4, no 10-year zone is predicted as the groundwater that supplies these wells at the designated pumping rates is recharged in less than ten years. The 10-year zone for Well 1 is also relatively small. These results indicate that these shallow wells are vulnerable to mobile surface contaminants within a relatively short timeframe. Groundwater recharge that occurs outside the defined capture zones will not be discharged at the production well and as such, land activities in these outer areas will not risk groundwater quality at the well.

3.4.2.2 Qpg Aquifer

The WHPAs for the five East Lacey area wells completed in the Qpg aquifer form a single, relatively large area that extends across the Tri-lakes region (Figure 3-9). The new WHPAs for College Street Wells S02 and S03 form a single area due to their close proximity. The orientation of the WHPAs for Well S29 is more west-east than the other wells in the Qpg aquifer.

The combined WHPA (previously analytically calculated) for the two Nisqually area wells (Wells S25 and S26) are those produced in 1992 using the calculated fixed-radius method (PGG, 1992). It is unlikely that the true capture area for these wells is circular, as groundwater naturally flows from west to east, discharging to the river. The actual WHPA shape is likely to be more elliptical and oriented west-east rather than shown here.

3.4.2.3 TQu Aquifer

The WHPAs for the four active area wells completed in the TQu aquifer all trend roughly north-south and are elliptical in shape (Figure 3-10). This simulation produces WHPA's for Well S07 and the S19 wells that are larger than estimated previously, whereas the new WHPA for Well S09 is smaller than before.

3.4.3 WHPAs for Future Supply Sources

To determine future WHPAs for pumping associated with planned future groundwater supply, Golder used the model to simulate steady-state pumping rates shown in Table 3-2. These rates are based on maximizing the full quantity of annual water rights requested for these sources, recognizing that these quantities have not yet been approved by Ecology. (Note that the City is requesting additional water rights for some existing source wells that have pumping capacity that exceeds current water rights).

These wells are completed in either the Qpg or TQu aquifer. Therefore, no changes were assumed to occur to the WHPAs for the wells completed in the Qga aquifer.

TABLE 3-2

Well Details and Simulated Pumping Rates for WHPA Delineation – Future Supply Sources

Well	Aquifer	Model Layer(s)	Estimated Well Capacity (gpm)	Modeled Pumping Rate		Remarks
				gpm	Total AFY(1)	
Well S21	Qpg	5,6	1,600	3,362	5,422.8	Increased Madrona pumping by 1,380 gpm to match request for adding 2,226 AFY to existing primary right.
Well S22	Qpg	5,6	1,600			
Well S28	Qpg	5,6	1,600			
Well S27	Qpg	5,6	1,000+	852	1,374	Increase by 620.1 gpm to match request for adding 1,000 AFY to existing supplemental right.
Well S29	Qpg	5,6	1,000	662	1,068.3	Increase by 371.7 gpm to match request for adding 600 AFY to existing primary right.
Well TW-HP2	TQu	8	800+	661	1,066	New well
TW-MR	TQu	8	1,000+	930	1,500	New well
TW-MC	TQu	8	800+	620	1,000	New well
TW-BC3	TQu	8	600	930	1,500	New Beachcrest well

Notes: Pumping for all other wells unchanged from Table 3-1. (1) – Annual water right (Qa). Qga – Vashon Outwash aquifer; Qpg – Pre-Vashon Gravel aquifer; TQU – Tertiary Undifferentiated aquifer. gpm – gallons per minute; AFY – acre-feet per year.

3.4.3.1 Qpg Aquifer

Figure 3-11 shows the WHPAs delineated for the East Lacey area wells with the new application pumping rates at the Madrona and Evergreen Estates wells. The WHPA is significantly larger than that predicted for the current pumping rates for these wells (Figure 3-9). The WHPA for Well S29 is also larger than predicted earlier, reflecting the doubling of the pumping rate.

3.4.3.2 TQu Aquifer

Figure 3-12 shows the WHPAs delineated for the Hawks Prairie wells for the new application pumping rates (Table 3-2) in the TQu aquifer.

3.5 City of Olympia WHPAs near College Street

Figures 3-13, 3-14 and 3-15 show the City of Lacey's new WHPAs for the College Street wells and for the City of Olympia's East Olympia area and planned Briggs wells (Golder, 2008c) for the Qga, Qpg and TQu aquifer, respectively. The Olympia WHPAs were developed using the McAllister Groundwater Model.

The WHPAs for (1) Lacey's Well S04 and Olympia's Well 11 (Figure 3-13), and for (2) Lacey's Well S10 and Olympia's Well 20 (Figure 3-14) overlap. In practice, that cannot happen as groundwater can only flow to one well. These results are due to the fact that Olympia's WHPAs were delineated in 2008, and at the time the model included Lacey's average pumping rates from 1998-2005, not water right-based WHP pumping rates. If the same pumping rates for Lacey had been used for both Lacey's and Olympia's delineations, the shape and extent of both sets of WHPAs would be different, and the boundaries between the sets would be distinct. It is unlikely that the new WHPA for Lacey's Wells S06, S07 and S09 (Figure 3-15) would be significantly different if the latest model simulation had included the planned pumping rate for Olympia's Well 3.

4.0 SUSCEPTIBILITY AND CONTAMINANT SOURCE INVENTORY

4.1 Susceptibility Assessment

Aquifer susceptibility is the relative ease with which contaminants can move from the land surface to a production aquifer and impact a supply well. Susceptibility is not related to the type of activities and operations that occur locally or the types of chemicals that are used and/or stored. Susceptibility assessments are an important initial step in selecting appropriate delineation methods to define the WHPA boundaries. The primary factors influencing well susceptibility include:

- Well construction techniques;
- The integrity of the well structure;
- Well depth;
- Local hydrogeologic conditions;
- Aquifer (and overlying aquitard) material;
- Aquifer recharge source area; and
- Pumping rate.

For example, a relatively deep confined aquifer is less susceptible to contamination than a shallow, unconfined aquifer (all else being equal). Wells that have been poorly constructed or have been improperly cased are highly susceptible to contaminants, even if the well is relatively deep and the aquifer is confined. Based on the DOH guidelines, the susceptibility of a well is rated as high, moderate or low. The Lacey well results are summarized in Table 4-1.

Two of the City's wells (Wells S01 and S04) are considered to have high susceptibility. This is due to their relatively shallow depth and age (both were installed more than 30 years ago) that may relate to the viability of the well seals. The local hydrogeology indicated that, although both are completed in a confined (Qga) aquifer, the degree of protection from the surface is relatively low. The "high" rankings for these two wells are also higher than those assigned by DOH ("moderate") for the City's water facility inventory (WFI). All other wells are considered to have either moderate or low susceptibility. All wells completed in the deep TQu aquifer have the lowest level of susceptibility.

TABLE 4-1

Relative Risk Ranking in the City's Source Wells

Well Name	Susceptibility Ranking	Comments
Current Wells		
Well S01	High	Old well, shallow aquifer
Wells S02 & S03	Mod	Wellfield (S18)
Well S04	High	Old well, shallow aquifer
Well S06	Low	Deep well
Well S07	Low	Deep well
Well S09	Low	Deep well
Well S10	Mod	Old well, middle aquifer
Wells S15 & S16	Mod	Shallow wells. Wellfield (S17)
Well S19	Low	Deep well (Hawks Prairie)
Well S20	Mod	McAllister well
Wells S21&S22	Mod	Wellfield (S23)
Well S28	Mod	Madrona well
Well S24	Mod	Nisqually well
Well S25	Mod	Nisqually well
Well S27	Mod	Evergreen Estates well
Well S29	Low	New, deep well. Betti well.
Future Supply Wells		
TW-HP2	Low	New, deep well. Hawks Prairie.
TW-BC3	Mod	Deep well, but close to Puget Sound. Beachcrest well.
TW-MR	Low	New, deep well. Marvin Road.
TW-MC	Low	New, deep well. Meridian Campus.

For the risk, **High** = the risk is distributed throughout the drinking water protection area and/or the potential threat to groundwater is great. **Low** = Both the distribution of the risk and potential threat to groundwater are minimal.

4.2 Vulnerability Assessment

4.2.1 Overview

Aquifer vulnerability considers both the susceptibility and land-use activities. The land use activities that are considered as having the potential to contaminate groundwater are listed as follows:

- Industrial and commercial activity;
- Hazardous material storage, use and discharge;
- Onsite septic systems;
- Underground storage tanks (USTs);
- Stormwater facilities;
- Dry, unused, and improperly constructed wells;
- Agriculture and animal wastes;
- Golf courses and cemeteries;
- Landfills;
- Transportation spills;
- Seawater intrusion; and

- Wastewater reuse and surface infiltration.

Not all land use types occur within the Lacey WHPAs. However, this list acted as a basis for preparing the Contaminant Source Inventory (CSI).

Controlling future development in WHPAs through land use regulations is an important tool used by the City and Thurston County to reduce the risk of groundwater contamination that can rapidly reach municipal supply wells. The Lacey Municipal Code (LMC) is also the City's primary mode of enforcement and regulation of activities within WHPAs. Title 16 (Zoning) of the LMC provides details of the land use restriction (http://www.ci.lacey.wa.us/lmc/lmc_main_page.html).

4.2.2 Industrial and Commercial Activity

Industrial and commercial activity poses a potential threat to groundwater quality due to the potential use of hazardous materials within these areas. Examples of these activities include gasoline service stations and auto repair shops (petroleum fuels, heavy metals), dry cleaners (dry cleaning solvents), printers and publishers (solvents, inks, and dyes), and metal plating shops (cyanides and heavy metals). Typically, industrial or commercial activity may be regulated by the State, but only for industrial/commercial specific functions. However, there are no general industrial or commercial regulations regarding potential groundwater contamination. One option is to take measures to avoid locating these types of facilities within WHPAs.

In May 1991. tetrachloroethylene (PCE) was detected in Thurston County Water District No. 2 Well No. 1, a community domestic supply well that is completed at 132 feet bgs and is near Lacey's Well S07. The PCE was initially detected at levels above 50 µg/L. Remedial action to remove the contaminated soils on the former Lacey Laundromat site occurred in summer 2000. Follow-up groundwater samples collected from the contaminated well have shown that the PCE levels have declined. The most recent sample from March 2010 was below the state reporting limit of 5 µg/L. PCE has not been detected in Well S07, most likely due to the direction of groundwater flow and the presence of a protective confining layer between the contaminated aquifer and the TQu aquifer that supplies Well S07.

4.2.3 Hazardous Material Storage, Use and Discharge

Hazardous material storage is a common activity associated with industrial and commercial land uses. Spilled or inappropriate disposal of chemicals poses a significant threat to groundwater quality. Solvents that leak downwards from the surface or subsurface are a major threat to water supplies, as a small quantity can affect a large portion of an aquifer or surface water body. Risk from spilled chemicals can be mitigated by implementing proper handling methods and spill prevention measures. At the Federal level, hazardous material storage, use and discharge is regulated through the Resource Conservation and Recovery Act (RCRA) (CFR 40, Parts 240 to 280). RCRA sites are not necessarily contaminated, but since significant amounts of hazardous materials are handled at RCRA sites the potential exists for contamination if a spill, leak or discharge should occur. At the State level, these activities are regulated by Ecology's Dangerous Waste Regulations (WAC 173- 303). The State maintains a database of dangerous waste generators, which can be searched by county. However, generators of small quantities of dangerous waste (<220 lbs/month) are not included in the database.

Under the Model Toxics Control Act (MTCA), Cleanup Regulations, WAC 173-340, Ecology is responsible for ensuring that all hazardous waste sites are properly remediated, including confirmed and suspected sites of contamination and LUSTs. A separate inventory for each is maintained by Ecology, which includes the status of cleanup efforts. A list of confirmed and suspected contaminated sites is available at Ecology's Integrated Site Information System (ISIS) https://fortress.wa.gov/ecy/tcpwebreporting/reports.aspx)

Thurston County maintains a Business Pollution Prevention Program that works with small quantity generators within WHPAs. This program is intended to minimize risk to public groundwater by ensuring proper storage and disposal of hazardous wastes.

LMC 14.36 requires review of all planned activities that use, handle, store or dispose of hazardous materials within a 10-year WHPA. The review is conducted by the water purveyor and the local health authority. The Thurston County Health Officer has the authority to deny applications if it determines that adequate protection of the source water supply is not ensured. LMC 14.36 also requires all existing, expanding existing and new uses that meet or exceed threshold quantities of hazardous materials to provide documentation that All Known Available Reasonable forms of Treatment (AKART) are applied to prevent contamination of groundwater. The threshold limits are listed as follows:

(1) =160 lbs (or 20 gallons) of substances regulated under the Uniform Fire Code (e.g., chlorinated solvents).

(2) =800 lbs (or 100 gallons), with no individual package exceeding 55 gallons, of cleaning substances used either for janitorial use or retail sale.

(3) *=2.2 lbs (cumulative) of "P" chemicals listed in WAC 773-303-9903.*

4.2.4 Onsite Septic Systems

Contaminants associated with septic tank effluent include pathogenic organisms, toxic substances and various nitrogen compounds (such as ammonia and nitrate) that are highly soluble in water. Most septic drain fields discharge effluent to the unsaturated zone above unconfined aquifers, and contaminants can percolate to the saturated zone and contaminate groundwater. Pharmaceuticals and personal care products are also an increasing concern in wastewater recharged to drinking water aquifers although there should be similar concern from septic systems which provide less treatment before effluent is discharged.

A properly designed septic system can provided reasonable protection to groundwater from contamination by pathogenic organisms. Nitrate and ammonia discharging from septic systems are generally small enough amounts and have adequate dilution in the groundwater not to present a problem. However, an improperly designed septic tank drain field in highly porous soils can allow pathogens to reach groundwater unimpeded. Evidence of this type of septic system failure is not readily visible since drainage from these systems does not cause ponding or odor problems. Two practical ways to protect against this type of problem are to:

- Ensure that all new septic systems going into areas of excessively draining soils in the WHPAs are carefully designed and properly installed; and
- Ensure that all water supply wells withdraw water from beneath a protective confining (low permeability) layer such as till.

Relatively old septic systems, constructed under less stringent standards compared to those currently used, pose a high contaminant risk to groundwater. Many of these older systems were constructed for entire neighborhoods and are in soils that drain adequately but do not provide sufficient treatment. The City supports septic conversions in concept; however, the City does not have a mechanism for financing septic conversions. As the wastewater utility is currently financed through new and existing customers, those property owners wanting septic conversions must form a local utility district.

Another common threat from septic systems is from their improper use. Septic systems are not designed for removing all chemicals. Solvents, fuels, waste oil, photo chemicals and a wide variety of other wastes pass through septic systems without any effective treatment before discharging to groundwater. High concentration of solutions can be transmitted through low permeability geologic strata. The most effective approaches in a WHPA to reduce the amount of inappropriate materials being discharged into septic systems include public education, assistance with appropriate toxic waste disposal and enforcement authority over improper disposal.

Onsite septic systems can also contaminate groundwater when not adequately maintained and are in high density within a region. Th7e majority of Lacey is connected to the sanitary sewer system. The density of sewer connections is shown in Figure 4-1. Portions of the City's water service area are not connected to the City sewer facilities, and a high reliance on onsite septic systems is inferred. Developed areas with a low density of sewer connections include near the Capitol City golf course, Beachcrest, the lakeshore areas, Nisqually Valley, and Evergreen Estates (in the vicinity of S27). Un-sewered areas exist near several of the City's shallow wells: S04, S15, S16, S24 and S25 (Figure 4-1). The WHPAs for some other wells also contain un-sewered areas.

Thurston County is implementing a septic system inspection program within the Henderson Inlet Shellfish Protection District, an area that includes the north part of the College Street corridor and may include some areas within the newly-defined WHPAs. In the late 1990's a small water system serving the Woodland Creek Estates area (located north of 15th Avenue and Draham Road) experienced contamination associated with on-site septic systems. This resulted in the abandonment of the local water system and subsequent connection to Lacey's water system.

With the exception of the Wells S24 and S25 (located near the Nisqually river), the WHPAs are predominantly within the City's UGA. The City has an ultimate goal of providing sewer to the entire UGA which would significantly reduce the water supply contamination risks associated with onsite septic tanks. However, the City's goal to sewer the UGA will not reduce the impact of septic systems in areas of the water service area that lie outside the UGA boundary.

Thurston County holds workshops for proper use and maintenance of septic systems. Although these workshops are geared more for protecting surface water quality, they also indirectly benefit groundwater protection. Also, as part of the shellfish protection program in the Henderson Inlet watershed, Thurston County requires septic system inspections every three years in the Henderson Watershed Protection Area. This area is within WHPAs for the City's Madrona wellfield (Wells S21, S22 and S28) and Betti well (Well S29). This program went into effect January 1, 2007 and will end December 31, 2016 unless renewed by the County Board of Health. The requirement is included in Article IV of Thurston County Code, in the section addressing septic system regulations.

4.2.5 Underground Storage Tanks

Underground storage tanks (USTs), and in particular leaking USTs, are a significant threat to groundwater quality. Most petroleum products stored in USTs are less dense than water and tend to "float" on the top of an aquifer (or the water table in an unconfined aquifer) when released in the unsaturated zone or directly in groundwater. However, dissolved-phase groundwater plumes can also develop. Petroleum products and impurities found in them tend to be relatively mobile in aquifers with generally increasing mobility with decreasing organic content in soils. The greatest amount of petroleum contaminant movement is in the lightest hydrocarbons (e.g. gasoline) with the greatest solubility in water.

Common causes of UST leaks are structural failure, corrosion, improper fittings and improper installation. Ecology regulates USTs in the State under WAC 173-360. The regulations require owners and operators of nonexempt USTs to comply with the regulations for notification, reporting, record keeping, performance standards and operating closure requirements, registration and licensing, and financial responsibility. The WAC allows a number of exemptions including tanks whose capacity is 110 gallons or less, farm and residential tanks with less than 1,100 gallons, heating oil tanks less than 1,100 gallons per premises, and septic tanks. Owners and operators of all existing nonexempt USTs must have a permit from Ecology. A valid permit is a requirement for delivery of regulated substances and must be updated annually. All existing nonexempt USTs must provide cathodic protection and spill and overflow containment.

Complete remediation of contamination from USTs constructed under old standards, and the increasing popularity of unattended gas stations are also major issues. Although not formalized in LMC, the City strongly discourages unattended gas stations within WHPAs.

Since the City's last WHPA update in 2003, some new laws have passed regarding USTs aimed at reducing the threat they pose to groundwater quality. The State's UST rule is rewritten for increased clarity, and complies with new requirements signed into federal law via the Federal Energy Policy Act of 2005. Among many other things, this federal law requires the US EPA and delegated state agencies to adopt new requirements for their UST programs, such as:

- Conducting more frequent routine compliance inspections of USTs;
- Developing a UST operator training program;
- Implementing a delivery prohibition process;
- Requiring secondary containment for new or replacement UST components (double walled tanks and piping and under dispenser containment sumps); and
- Providing reports to the US EPA and the public.

4.2.6 Stormwater

Stormwater is rain that runs off hard surfaces on developed land. Impervious surfaces such as rooftops, streets and parking lots generate stormwater which can then pick up and transport pollutants such as oil, pesticides, and household and animal wastes. Untreated stormwater discharges have been identified as major sources of contamination to surface water throughout the state of Washington, and also can contribute to contamination of groundwater in areas where surficial soils provide insufficient treatment for contaminants or where direct conduits to the aquifer occur.

The City has approval authority for the construction of stormwater systems within City limits. Treatment of stormwater and on-site infiltration of generated runoff are required for all development projects where practically feasible. New stormwater systems must follow requirements outlined in the City's stormwater manual, which identifies drainage design criteria and water quality best management practices (BMPs) for treating stormwater as required by the Western Washington Phase II Municipal Stormwater Permit. The City requires a high level of treatment within critical aquifer recharge areas (CARAs), which encompass the majority of land within City's UGA. The stormwater manual and development guidelines also restrict stormwater infiltration near source groundwater supply wells. Within the unincorporated areas of Lacey's UGA, Thurston County oversees construction of stormwater systems (although Lacey staff also reviews project proposals and designs). Despite recent improvements in requirements related to stormwater treatment and management, challenges remain in how to address older stormwater systems and the continued creation of new impervious surfaces from increasing urban density.

4.2.7 Dry, Unused and Improperly Constructed Wells

Abandoned and improperly sealed or secured wells can act as direct conduits for contaminants to reach groundwater. This situation can occur either through improper well construction or through abandoned wells that have not been properly capped and sealed. Existing unused wells are required to be decommissioned when new development occurs. Wells developed prior to the adoption of WAC 173-160 (Minimum Standards for Construction and Maintenance of Wells) generally have no surface seal. Many private wells were installed before drilling standards, and therefore, may be improperly constructed.

The City addresses the issue of unused and (to a lesser extent) abandoned wells primarily through redevelopment projects, especially for unused wells. The Wellhead Protection section of the 2009 City of Lacey Development Guidelines and Public Works Standards states that existing private wells within the City limits must comply with Ecology standards. These standards include the requirement for owners to decommission unused wells that meet the definition of “abandoned”.

Where practical, the City should continue to extend water service to owners of wells constructed before 1973, and require the decommissioning of these wells as part of the service connection charge. The City should continue to maintain an internal record of old wells within the WHPAs that could be a risk to groundwater quality.

Ecology has delegated oversight authority for well drilling and decommissioning to Thurston County Department of Environmental Health. The City should encourage this County agency to place priority on decommissioning wells within WHPAs to protect the groundwater supply.

4.2.8 Agriculture

Agricultural activities are a concern because there are areas zoned for agriculture near the City’s WHPAs, and there are a number of hobby farms located within the City’s UGA. Although the number of hobby farms continues to decrease in the Lacey area, they are becoming more prevalent outside the UGA. Commercial agriculture, mostly turf farms, remains along Yelm Highway.

Agricultural activities can cause several types of water quality problems, mostly resulting from fertilizers, pesticides or manure/wastes. In northern Thurston County, the most notable groundwater contamination problem from agriculture was the EDB, DBCP and DCP contamination near Pattison Lake and Lake St. Clair.

Animal wastes contain bacteria, urea and chloride, all of which can be transported to groundwater. Urea is of most concern because it is converted to nitrate, which is highly mobile in groundwater. Although the

USGS concluded that elevated nitrate concentrations to the east and southeast of Lacey are more likely due to septic systems than agricultural activities, elevated nitrates in monitoring wells on the west shore of Pattison Lake and along Yelm Highway were attributed to some large farms with poor fertilizer, pesticide, and livestock practices. More recent testing indicates that nitrate levels have decreased or remained constant over the past few years. Thurston County indicates that this is a result of better farming and livestock practices brought about through education, and through the re-development of agriculture lands into residential housing.

The Thurston County Conservation District provides technical assistance to land owners and includes fertilizer application rates, pesticide use, appropriate animal density, animal waste disposal and utilization, and other applications. In many cases, such as when a farm is located within a 1-year WHPA, the Conservation District requires “Farm Plans” to ensure BMPs are in place. The Conservation District also provides cost sharing for a number of agriculture-related BMP projects.

4.2.9 Pesticide and Fertilizer Use

Fertilizers and pesticide use within the City area ranges from larger-scale applications and restricted-used pesticides applied by USDA-certified pesticide applicators (e.g., by landscape services) to homeowner use for yard maintenance and home pest control. Fertilizers usually contain nitrogen in the form of ammonia or nitrate. Although nitrate is the form most readily taken up by plants, ammonia is usually converted to nitrite, and then nitrate, by bacteria in soils. Nitrate is highly mobile in groundwater, so fertilizer application in excess of plant uptake can result in surplus nitrate being transported to groundwater. Fertilizers typically contain other chemicals that could migrate to groundwater, including potassium, sulfate and phosphorus, but their impact to water quality is generally not at the same magnitude as the impact from nitrate. Not all pesticides are mobile in groundwater, and not all pesticides are stable or persistent in the environment. Consequently, the potential for pesticides to migrate to groundwater, degrade or transform into other chemical compounds, or persist long enough to contaminate groundwater, varies between individual pesticides and classes of pesticides.

Regulation of larger-scale fertilizer and pesticide use is primarily through the County’s Non-point Source Pollution Ordinance, although this ordinance does not address use provided by landscaping services. The Non-point Source Pollution Ordinance is applicable throughout the county and within the City Limits. This ordinance is applicable for businesses that store fertilizers and pesticides within WHPAs, including the amounts stored in relation to the relative need for those quantities. For extensive fertilizer and pesticide use in WHPAs that extend beyond City Limits, the County has the authority to require chemical management plans or to require protective covenants for subdivisions in critical areas. The City plans to work more closely with the County to require chemical management plans or covenants, as appropriate, for land uses within the City’s WHPAs. Chemical management plans, when required, should include as much as possible the specific pesticide products proposed for use on site as well as their persistence and mobility through groundwater. Homeowner use of fertilizers and pesticides in WHPAs should be addressed through public education efforts.

4.2.10 Golf Courses and Cemeteries

There are four local golf courses within or near the City Limits. Three of these golf courses are partially within the WHPAs for Lacey's current sources, and all are partially within the expanded WHPAs delineated for Lacey's future sources of supply. The Vicwood Golf Links and the Meriwood Golf Course are adjacent to each other in the Hawks Prairie area. Vicwood is within the WHPA for Wells S15 and S16 (Figure 3-8) and both golf courses are within the expanded WHPA for future Beachcrest well (TW-BC3) (Figure 3-12). The Indian Summer Golf Course and the Capitol City Golf Club are adjacent to each other south of Yelm Highway, near the City's College Street wells. The Indian Summer Golf Course is within the WHPA for Well S10. The City of Olympia also has a production well (Well 20) located within the golf course property. Capitol City Golf Course is within the WHPAs for Lacey wells S04, S09 and S10, and the City of Olympia's Well 11.

Turf areas on golf courses and cemeteries generally receive a high level of maintenance that includes frequent fertilization, pest management and irrigation. Whereas professionals in turf management now try to minimize the waste of expensive fertilizers and pesticides by avoiding over-application, golf courses in particular are more likely to store large quantities of fertilizers and pesticides, including restricted-use products, and to maintain and clean application equipment on-site. Well S04 is located at the Capitol City Golf Course and does not restricted access to its 100-foot sanitary set-back. Due to its high susceptibility, it is critically important that activities at the Capitol City Golf Course prevent any form of contamination or pollution.

Thurston County's Business Pollution Prevention Program completed an inspection campaign of all local golf courses, including the ones in the Lacey area. In 2009 all were in compliance with the county's Nonpoint Source Ordinance.

Woodlawn Funeral Home is the only cemetery located in the Lacey area. Although its location was inside the previously-delineated WHPAs, it is not located within the 2009 revised WHPAs developed in this 2011 plan. Cemeteries also often use fertilizers and pesticides that can leach into the groundwater supply. Cemeteries can also leach arsenic. The Woodlawn Funeral Home has a private well on site that is used for irrigation. Because embalming is not done on-site, most of the potential for groundwater contamination would be from internments and turf management.

4.2.11 Transportation Spills

The major highways and arterials in Lacey include Pacific Avenue SE, Steilacoom Road SE, Yelm Highway SE, Interstate 5, Marvin Road, College Street and Martin Way. Hazardous chemicals are transported daily on such highways. Inadvertent chemical spills or discharges through accidents can result in contamination to groundwater. The Burlington Northern Railroad runs southwest to northeast from the southwest corner of the City Limits and passes close to Wells S24 and S25. Historically, the majority of transportation spills have been along the major highways and arterials. As part of required WHPA notification, first responders will receive the updated WHPA delineations (see Section 3).

4.2.12 Wastewater Reuse and Surface Infiltration

The City is a member of the LOTT (Lacey-Olympia-Tumwater-Thurston County) alliance that manages wastewater and water reuse in the northern Thurston County region. LOTT's Hawks Prairie satellite reclaimed water facility (with 2 mgd capacity) is located on Martin Way within the City limits. Class A reclaimed wastewater is infiltrated at a 41-acre site that includes surface ponds on Hogum Bay Road within the Woodland Creek basin.

According to the City's *Development Guidelines and Public Works Standards,* wastewater treatment facilities (including wastewater reclamation facilities) are prohibited within designated 1-year time-of-travel WHPAs. Infiltration of reclaimed water for the purposes of disposal or groundwater augmentation, which does not include irrigation at agronomic rates, is also prohibited within designated 1-year WHPAs.

In 2010, Ecology issued an updated draft rule for planning, design and construction of reclaimed water projects in the state of Washington (Chapter 173-219 WAC). This rule also includes operating permit procedures and technical standards for treatment and operation. Operating permit requirements include specific compliance water quality monitoring for land applications (such as groundwater recharge and wetland mitigation projects) that are intended to protect groundwater quality.

4.3 Contaminant Source Inventory

An essential element of a wellhead protection program is an updated evaluation of potential sources of groundwater contamination in and around the delineated WHPAs. The purpose of the evaluation is to identify past, present and proposed activities that may pose a threat to a water supply source and to consider these activities during the pollution threat inventory and analysis. Other purposes for identifying potential contaminant sources are to help plan management strategies, establish a mailing list to notify potential contaminant sources located within the WHPAs, and to notify regulatory agencies regarding inventory findings.

The City completed a contaminant source inventory (CSI) as part of the 2011 Water System Plan update. Table 4-2 summarizes the findings, with the number of sites identified for each of the time-of-travel zones for each active and planned production well.

TABLE 4-2

Number of Confirmed CSI Sites in Each Wellhead Protection Area

Well Name	6-month	1-year	5-year	10-year
Current Wells				
Well S01	1	1	0	1
Wells S02 and S03	3	1	0	1
Well S04	1	0	0	0
Well S06	1	1	1	0
Well S07	7	5	5	6
Well S09	1	0	1	0
Well S10	1	1	2	0
Wells S15 & S16	0	0	0	0
Well S19	0	0	0	0
Well S20	0	0	1	2
Wells S21, S22 & S28	1	0	2	3
Wells S24 & S25	0	0	0	0
Well S27	0	0	0	0
Well S29	0	0	1	0
Future Wells and Pumping Rates				
Wells S21, S22 & S28	1	1	6	9
Well S27	0	0	0	0
Well S29	0	2	2	0
TW-HP2	0	0	0	1
TW-MR (Marvin Road)	0	0	0	0
TW-MC (Meridian Center)	0	0	0	0
TW-BC3 (Beachcrest No.3)	0	0	0	1

For the purpose of this assessment, the list of 99 sites has been grouped into the following seven categories:

- Hazardous Waste Generators (19 sites);
- UST/LUST sites (29 sites);
- RCRA facilities (5 sites);
- State Clean-up Program sites (9 sites)
- Toxicity Characteristic sites (17 sites);
- Other miscellaneous sites (8 sites); and
- Unknown site type (12 sites).

Figures 4-2, 4-3 and 4-4 show the locations of the sites in relation to the new WHPAs for the College Street, East Lacey and Hawks Prairie areas, respectively. Figures 4-5 and 4-6 show the locations of the CSI sites for the WHPAs that were developed for the East Lacey and Hawks Prairie areas under the water rights applications pumping conditions (Table 3-2).

4.3.1 College Street Area

The WHPAs for Well 7 contain the most (13) CSI sites in the Lacey system, including seven within the 6-month zone (Figure 4-2). However, Well S07 is completed in the highly-confined TQu aquifer and is screened below a depth of 428 feet which limits its vulnerability. Of the CSI sites located in the other 6-month WHPAs in the College Street area, the most significant is the UST site (located in this zone for the relatively shallow Well S01, which is screened at a depth of 100 feet bgs) and the dry cleaners located near Well S04 (which is screened to a depth of 65 feet bgs). If leaks and/or accidental discharges were to occur from these facilities, the groundwater quality for Wells S01 and S04 could be impaired relatively quickly.

4.3.2 East Lacey Area

Of the nine CSI sites that lie within the combined WHPA for the five East Lacey wells, only one site is situated within the 6-month zone (for Wells S21, S22 and S28; Figure 4-3). The remaining eight sites are located in the 5- and 10-year zones for the Madrona and McAllister well. Four of these sites maintain USTs, but none are listed as leaking USTs. All five wells are completed in the Qpg aquifer, and have uppermost screen depths ranging from 180 feet bgs (Well 20) to 286 feet bgs (Well S22). Therefore, the vulnerability of these wells to existing sites is moderate.

Under future pumping conditions, eight additional CSI sites fall within the now larger WHPA for these five wells (Figure 4-5). These sites include one within the one-year zone (which was previously in the 5-year zone).

4.3.3 Hawks Prairie Area

Only one CSI site is located within the new WHPAs for the four Hawks Prairie wells (Figure 4-4). This site contains a UST, and is situated with the 5-year zone for Well S29. As this well is screened below a depth of 294 feet bgs, and is relatively well protected from shallow contamination, the risk to this well from a release at the UST is not higher than moderate. For future pumping, one CSI site falls within each of the 10-year zones for deep test wells TW-HP2 and TW-BC3 (Figure 4-6).

5.0 WELLHEAD PROTECTION PROGRAM

The key elements of a wellhead protection program include a management strategy, a spill response plan, a contingency plan and recommended improvements. The key management strategies include monitoring and data management, land use, regional coordination, and public education and notification programs. This chapter presents the management strategies the City currently employs, and recommendations for updates to the part of the program.

5.1 Groundwater Monitoring and Data Management

5.1.1 Overview

This section of the report presents an assessment of the City's current wellhead protection monitoring program (WPMP), and provides recommendations to update the program in light of new hydrogeologic data, the updated WHPA delineations and the City's plans for new production wells to help meet future groundwater demand.

The City has maintained a WPMP for groundwater levels and water quality since 1995. The program was designed to detect potential contaminants directly or indirectly through indicator parameters, before contaminants reach source wells. This "early warning" monitoring network allows sufficient time for the City to implement contingency plans in the event that source wells or entire aquifers are contaminated.

The report titled *Wellhead Protection Program Guidance Document* published by the DOH (April 1995) is the primary reference for developing and implementing wellhead protection monitoring programs for Group A public systems. Although this document includes a chapter dedicated to the development and implementation of wellhead protection strategies (such as pollution prevention planning, best management practices and community involvement), it does not include specific details of groundwater monitoring options. The document titled *Implementation Guidance for the Ground Water Quality Standards,* published by Ecology (October 2005), explains and interprets standards aimed at protecting groundwater quality, and includes a chapter dedicated to developing and implementing a monitoring plan. These two documents have been used to develop this new WPMP.

5.1.2 Current Monitoring Program

The City currently monitors groundwater quality in six dedicated monitoring wells. Figure 5-1 shows the locations of these wells, and Table 5-1 summarizes the available construction details. The City has been implementing a WPMP that has not changed appreciably since it was initiated following a recommendation in the 1995 Wellhead Protection Plan (EES, 1995).

The six monitoring wells that constitute the monitoring network are located along the College Street corridor. The network was designed to focus on the supply sources that are most susceptible to contamination from urban land use activities and the monitoring wells were located at the edge of the one-year WHPAs for the original delineations. Monitoring well MW-1 is located upgradient of Well S10. Monitoring wells MW-2 and MW-4 are located to the south and to the east, respectively, of Wells S01, S02 and S03. Monitoring well MW-6 is located upgradient of Well S06. MW-3 and MW-5 are located south (upgradient) of Lacey's Well S04, which is located on the Capitol City Golf Course outside the City limits. All six monitoring wells are completed in the relatively shallow Qga aquifer. Only source wells S01 and S04 are also screened in the Qga aquifer.

TABLE 5-1
Summary of Existing Groundwater Monitoring Wells

Well ID	Approx. Surface Elevation (ft amsl)	Total Well Depth (feet)	Approx. Screened Depths (ft bgs)	Aquifer
MW-1	199	75	70 - 75	Qga
MW-2	235.5	87.5	77.5 - 87.5	Qga
MW-3	193.5	75	65 - 75	Qga
MW-4	218.5	95	85 - 95	Qga
MW-5	208.5	85	75 – 85	Qga
MW-6	236	110	100 -110	Qga

Notes: ft amsl – feet above mean sea level; ft bgs – feet below ground surface

The original recommendations for long-term monitoring included the following:

- Water level – quarterly;
- Nitrate – biannually;
- Common ions and field parameters – biannually;
- VOCs – annually; and
- Targeted Pesticides and Herbicides – biannually at Well S04 and the Capitol City Golf Course well.

The WPMP encouraged review of results after 3 to 5 years of monitoring and adjusting the schedule, as necessary. The City currently monitors under the following schedule:

- Water levels (manual) – quarterly;
- Nitrate – quarterly at monitoring wells MW-1, MW-3 and MW-5; annually at monitoring wells MW-2, MW-4 and MW-6;
- Field measurements (temperature, pH, specific conductance, total dissolved solids) – whenever nitrate samples are collected;
- VOCs – annually;
- Targeted Herbicides – annually; and

- Total coliform bacteria – quarterly at wells MW-1, MW-3 and MW-5.

The results of the monitoring program since 1993 are presented in Sections 2.8 and 2.9 of this report. These include hydrographs for groundwater levels and water quality results for the six monitoring wells. Nitrate concentrations in the three monitoring wells near Well S01 (MW-2, MW-4 and MW-6) have gradually increased since 2002 (Figure 2-42). However, no similar trend has been reported for the nitrate level in Well S01. Conversely, nitrate levels in the three monitoring wells near source Well S04 (MW-1, MW-3 and MW-5) have remained below 1 mg/L while the nitrate levels in Well S04 have increased since 2006. Well S04 is located on the Capitol Golf Course, and monitoring well MW-5 is located at the southern (upgradient) edge of the golf course. This indicates that MW-5 is not ideally situated to detect contaminants that likely originate within the 1-year WHPA at the golf course (an area of septic systems) and have been detected in Well S04.

5.1.3 General Considerations for New Monitoring Wells

The overall objective of the program is to establish a groundwater monitoring network area that provides a reasonable level of protection for the supply source against known and potential future groundwater contamination. The networks will consist of existing wells and new wells that are strategically located and designed for the intended purpose. The general guidelines upon which the recommendations are based are:

- Well depth and target aquifer - monitoring should occur in the same aquifer in which a production well is completed, or in shallower aquifers near potential contamination sources for deeper production wells (for example, if there are water quality concerns associated with surface water bodies);
- Well location – either directly close to a supply well, or at the edge of a specified WHPA (6-month, one-year, etc);
- Monitoring schedule (analytes and frequency) - consistency with the City’s existing program, or a different schedule for specific wells based on local conditions and historical results; and
- Potential contaminant type - monitoring for the effects from a specific, known point source (such as a leaking UST or landfill) or for specific non-point source contaminants (such as nitrates emanating from agricultural and septic systems).

In addition, other factors to be considered include (1) cost and schedule, (2) number of wells required, (3) the well’s ability to detect a contaminant release soon enough to employ remedial actions, and (4) land ownership and access.

5.1.4 Recommended Monitoring Program

Figures 5-1, 5-2 and 5-3 show the locations of the recommended new groundwater monitoring wells for the College Street, East Lacey and Hawks Prairie areas, respectively. Monitoring wells were placed at upgradient locations predicted to be at the 1-year time-of-travel based on previous modeling work. In general, the updated model that better reflects actual pumping rates, hydrostratigraphy, and regional groundwater gradients indicates that the observation wells remain useful to monitor the risk of contaminants impacting the City's wells. Exceptions are:

- Many of the WHPA's became elongate as a result of establishing more realistic groundwater gradients. Though this shifted the position of the 1-year time of travel to the south and southwest, the differences are slight and observation wells remain in position to meet original objectives.
- MW-3 no longer appears to be within the capture zone of wells 4, 9, and 10, though well MW-5 remains in position to monitor upgradient groundwater quality.

The following is a list of wells and recommended sampling schedules in each area.

5.1.4.1 College Street Area

The primary contaminant concerns to the existing eight supply wells in the College Street Area are numerous CSI sites and septic systems, many of which are located within the new 1-year WHPAs.

- New Monitoring Well MW-9

It is recommended that the City install one new monitoring well (MW-9) southwest (up-gradient) of Well S01, near the 1-year and 5-year boundary to provide coverage for a potential release from the CSI site located up-gradient of Well S01, and any nutrients that may be associated with surface water to the west (though modeling does not indicate that surface water lies within the WHPA). This new well should be completed at a depth of 100 to 125 feet bgs, and be completed in the same aquifer (the Qga aquifer) in which Well S01 in screened. By locating the new monitoring well near the 1-year and 5-year WHPA boundary, the City should have sufficient warning to respond in the event that a point-source contaminant release occurs from the CSI, or if non-point source contaminants occur along Chambers Creek or from nearby septic systems (Figure 4-1).

For the first year, this new well should be sampled quarterly for nitrate, total coliform bacteria and field measurements, and annually for VOCs and targeted herbicides. The sampling schedule should be reviewed after the first year based on the initial results. Groundwater levels should be measured quarterly.

- New Monitoring Well MW-10

To provide coverage for potential nitrate contamination emanating from Indian Summer Golf Course area, the City should install one new well (MW-10) to the northwest of Well S04. This new well should be located less than 1,000 feet from Well S04 and be completed at a depth of 100 to 125 feet bgs (in the Qga aquifer). The primary threat to Well S04 appears to be from non-point sources associated with nearby golf courses and septic systems.

For the first year, this new well should be sampled quarterly for nitrate, total coliform bacteria and field measurements, and annually for VOCs and targeted herbicides. The sampling schedule should be reviewed after the first year based on the initial results. Groundwater levels should be measured quarterly.

- Existing Monitoring Wells MW-2, MW-4 and MW-6

The City should continue to monitor and sample wells MW-2, MW-4 and MW-6 to provide protection for groundwater quality for Wells S01, S02, S03 and S06. The current sampling schedule for these wells should remain unchanged.

- Existing Monitoring Wells MW-1, MW-3 and MW-5

The City should continue to monitor and sample wells MW-1, MW-3 and MW-5 to provide protection for water quality for Wells S04, S09 and S10. The current sampling schedule for these wells should remain unchanged, apart from sampling for nitrate and total coliform annually (rather than quarterly) as elevated levels of these constituents have not been detected in these three wells to date.

5.1.4.2 East Lacey Area

At present, the City does not monitor groundwater quality in non-supply wells the East Lacey area. Two changes to the current program are recommended.

- Rolling Firs Wells

To improve monitoring coverage for the CSI sites in the area near the City's wells S21, S22 and S28, the City should include the existing Rolling Firs Wells (Nos. 1 and 2) into the monitoring program. The Rolling Firs system (operated by Washington Water Service Company) has 194 connections and a combined capacity of 325 gpm. The two supply wells are located approximately 1,600 feet northwest of the City's three Madrona wells. The two Rolling Firs wells are approximately 254 and 286 feet deep, and are also completed in the Qpg aquifer. The source water quality data are available at the DOH drinking water Sentry website, and include inorganic, microbial and VOC reports. The use of the Rolling Firs well would preclude the City from drilling a new dedicated monitoring well at this time and would provide an indication of upgradient groundwater quality.

- Use Exiting Monitoring Well MW-8

The City should incorporate existing monitoring well MW-8 into the sampling program, if possible. The construction details and water levels are currently unavailable for this well. If appropriately constructed, this well would provide protection for the three Madrona wells from the CSI sites located along Pacific Avenue, and improve the characterization local groundwater flow conditions even though it is on the margin of the predicted WHPA. For the first year, this well should be sampled annually for nitrate, total coliform bacteria, field measurements, VOCs and targeted herbicides. The sampling schedule should be reviewed after the first year based on the initial results. Groundwater levels should be measured quarterly.

Currently, no groundwater monitoring occurs in the WHPAs of the City's Wells S20 and S27, and no monitoring or other types of wells exist that could be used for monitoring purposes. As there are no current CSIs within the 6-month and 1-year zones for these two wells, the risk to these wells appears to be relatively low. Therefore, we do not recommend installing new monitoring wells at this time.

5.1.4.3 Hawks Prairie Area

- New Monitoring Well MW-11

To improve monitoring coverage for the CSI sites in this area, the City should install one new well (MW-11) to the south (up-gradient) of Well S29, near the 1-year and 5-year boundary, on the east side of Marvin Road. This well should be completed at a depth of 125 to 150 feet bgs, and completed in the Qga aquifer. This well would also be used to improve the characterization local groundwater flow conditions in this area.

For the first year, this well should be sampled quarterly for nitrate, total coliform bacteria and field measurements, and annually for VOCs and targeted herbicides. The sampling schedule should be reviewed after the first year based on the initial results. Groundwater levels should be measured quarterly.

- Seawater Intrusion Risk Monitoring at the Beachcrest Wells

Based on existing information, it does not currently appear that the existing or planned production wells in the Hawks Prairie area are at risk from contaminants released from the known CSI sites. However, the City should consider monitoring both groundwater levels and quality in the recently-installed TW-BC3 (which is screened to 315 feet below msl) to monitor for seawater intrusion. Seawater intrusion could potentially impact this well if the planned pumping rate is excessively high, resulting in the inland migration of the freshwater-seawater interface in the TQu aquifer. Until this well is fully permitted to go on-line, the City should establish baseline conditions in the TQu aquifer against which water level and quality data can be compared after start-up. As this well is at minimal risk from surface contaminants, the City should initially sample this well only for field measurements and inorganic compounds biannually.

- Water Level Monitoring at TW-MR

This recommendation carries over from previous work, intended to monitor the TQu in the Hawks Prairie area to assess the ability of the aquifer to support additional pumping as new wells are developed.

5.1.5 Groundwater Reporting

At present, the City does not produce a formal report documenting the results of the WPMP. According to City staff, the generated groundwater level and quality data stored in an MS-Access database.

We recommend the City formalize the data using tables and charts and produce an annual monitoring report. The report should include a summary of activities, data and trends, and recommendations for the following year. The report should be completed before the end of the first quarter of the follow calendar year, and be made available for other City staff and summarized for the public.

5.2 Land Use and Regulatory Control

Controlling future development in WHPAs through land use regulations is an important tool used by the City and Thurston County to reduce the risk of groundwater contamination. The Lacey Municipal Code (LMC) is the City's primary mode of enforcement and regulation of activities within the WHPAs.

5.2.1 City Land Use and Regulatory Control

LMC 14.36 (http://www.ci.lacey.wa.us/lmc/lmc_main_page.html) specifically addresses building, construction, and land use within WHPAs, and prohibits the following activities within the 1-year time of travel WHPA:

- Land spreading disposal facilities;
- Animal operations with over 200 animal units;
- Gas stations and other petroleum related activities;
- Automobile wrecking yards;
- Wood waste landfills; and
- Dry cleaners.

LMC 14.36 prohibits the following activities within the 1-year, 5-year and 10-year WHPAs:

- Landfills;
- Hazardous waste transfer, storage and disposal facilities;
- Wood and wood products preserving; and
- Chemical manufacturing.

LMC 14.36 also prohibits the expansion of pre-existing facilities that practice the previously mentioned activities within WHPAs. LMC 14.36 also gives the Thurston County Health Officer the authority to deny permitting to any pre-existing businesses that require a pollution prevention plan or are identified as a pollution or hazardous material source. The City is also entitled to enforce criminal or civil penalties under LMC 14.36.

Two recommendations for improved land use control for the City are:

- Revising LMC 14.36.140 to reference wellhead protection areas as existing in the City's Wellhead Protection Plan; and
- Revising LMC 14.36.120 to reference the City's Stormwater Design manual for stormwater generated by new development, redevelopment and transportation projects within the City Limits.

5.2.2 Thurston County Land Use and Regulatory Control

Thurston County takes the lead on determining land use activities within WHPAs located outside the City Limits. Thurston County has adopted a Nonpoint Source Pollution Ordinance which in part targets small quantity generators within WHPAs within Thurston County. The purpose of this ordinance is to minimize environmental impacts from hazardous materials. The County also implements a Business Pollution Prevention Program to provide education and technical assistance inspections for small quantity generators. This program is sponsored by the Thurston County Hazardous Waste Program and addresses activities such as proper storage, use, floor washing activities, incidental dumping, abandoned materials, and intentional ground disposal of hazardous wastes.

The County's primary mechanism for controlling land use within WHPAs is the Critical Areas Ordinance (CAO). Functions of the CAO include controlling types of land use and residential densities within hydrogeologically-sensitive areas. The County also requires:

- Turf Management Plans and Integrated Pest Management Plans to identify potential sources of groundwater contamination.
- Farm Plans for agriculture located within 1-year capture zones.

Improvements to County Land Use can be encouraged by the City, but are ultimately out of the City's control. In 2005, Thurston County updated its CARA section of the Critical Areas Ordinance (http://www.co.thurston.wa.us/planning/critical_areas/criticalareas_draftreg.htm). However, these changes have not been adopted at this time.

5.3 Public Education and Notifications

5.3.1 Public Education

Public education and voluntary action are critical to protecting public and private drinking water supplies. Public participation in the groundwater protection planning and management strategies increases awareness and ownership of the program. Public education is also an important component of non-regulatory wellhead protection strategies which rely on homeowners and residents to properly maintain private wells and correctly dispose of household hazardous wastes. Public education can be accomplished in a number of ways, including brochures, mailers, utility bill inserts, press releases, booths at special events, meetings and workshops.

Public education programs focused on wellhead/groundwater protection can emphasize the following issues:

- Proper use of household chemicals, especially lawn chemicals such as fertilizers and pesticides. Many homeowners fail to use lawn chemicals in accordance with the label, and chemical over-use, especially when combined with over-watering, can lead to impacts to groundwater supplies. Educate homeowners about the importance of following the manufacturer's instructions when using lawn and household chemicals.

- Correct disposal of household hazardous wastes including waste oils, paint, lawn chemicals, and other household hazardous materials. Inappropriate disposal of these substances, including pouring chemicals on the ground or down the drain into a septic system, can create a threat to groundwater quality. The implementation of periodic no-cost hazardous waste collection days can be an effective tool for encouraging proper disposal, especially when paired with public education efforts.
- Appropriate maintenance of private wells and septic systems. Public education efforts to encourage correct maintenance of septic systems and private wells can include making resources available on a website, flyers, or brochures.
- Increase awareness of residents and business owners/operators located in wellhead protection areas. Hand-on learning and technical assistance opportunities for households, business owners, teachers and students can help develop knowledge, teach new skills and ultimately change the attitudes, practices and behaviors of those living in wellhead protection areas.

In 2001, the City participated in a campaign to educate residents within Madrona WHPA as part of a Regional Groundwater Program. However, this education program is no longer active. Despite this, the City should increase public education efforts in the future, and should provide the public with information concerning its groundwater protection program.

5.3.2 Notifications

The minimum requirements for WHPAs include notification to owners and operators of potential sources of contamination, to regulatory agencies and local governments, and to local emergency incident responders.

5.3.2.1 Notification to Owners of Potential Sources of Contamination

Potential sources of contamination are discussed in Section 4.2 of this report. These include industrial and commercial activities, hazardous materials storage, septic tanks, stormwater, USTs, accidental spills and confirmed and suspected contamination sites. Developed properties within the WHPAs that use septic tanks should be considered potential contamination sites. Figure 4-1 shows sewer connections in the Lacey area. Developed areas without a significant density of sewer connections are inferred to rely on septic systems, resulting in increased potential for impacts to shallow groundwater. Some septic tank owners will have other potential sources of contamination such as industrial and commercial activities, hazardous materials storage and USTs. A property owner could also have an accidental spill or could discover that they have a contamination site. Typically, sites that should be identified for special attention in the notification process include auto shops, registered UST owners and hazardous materials handlers.

Some business owners mentioned on the list of potential contaminant sources are notified through the Thurston County Business Pollution Prevention Program. Material distributed to business owners includes a letter stating that their property is inside a WHPA. The letter includes a map of the WHPA and states that the activities of their business may be a potential source for groundwater contamination. The letter also includes the Thurston County fact sheet "*Doing Business in a Wellhead Protection Area*." This

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brochure includes advice on where chemicals can be disposed of safely, and provides references where businesses can go to get further advice on how to manage wastes to protect groundwater.

The Thurston County Business Pollution Prevention Program provides technical assistance and hazardous waste education to businesses within the City's WHPAs. The program includes a prioritization of businesses based on the activities and hazardous waste produced, and technical assistance visits on a rotating basis every six years.

5.3.2.2 Notification to Regulatory Agencies and Local Governments

A list of appropriate regulatory agencies that should be notified after any changes are made to WHPAs is included in Appendix B.

5.3.2.3 Notification to Local Emergency Incident Responders

Regulations require that documentation of coordination with incident responders be provided. The list of incident responders to be contacted and provided with information regarding the City's WHPAs is included in Appendix B.

5.4 Spill Response

5.4.1 Overview

Spill response planning is an important aspect of both an emergency management plan and a wellhead protection program. Specific response procedures for WHPAs should be in place before contamination occurs. The information obtained as a result of the susceptibility assessment and the WHPA inventory can be used to determine what types of spill response measures are necessary for the protection of drinking water sources.

The City has coordinated with the incident responders on the WHPA and susceptibility assessment updates presented in this document. For spill response procedures to be effectively executed, effective coordination, cooperation and communication among the responding agencies, organizations and individuals is essential. Depending on the magnitude and type of the release, any of the following organizations may be involved in a spill response within a WHPA:

- Department of Ecology - Ecology's 24-hour Spill Response can be contacted at (360) 407-6300.
- United States Environmental Protection Agency (US EPA)
- Department of Health (DOH)
- Department of Transportation (WSDOT)
- Washington State Patrol
- Lacey Fire District 3

- Pierce County HAZMAT Team

The City's general spill response procedures are as follows:

- Initial response to a spill is likely to be provided by Lacey Fire District 3. If possible, the fire department will contain the spill or HAZMAT fire. Lacey Fire District 3 will then be responsible for contacting Ecology, the Washington State Patrol, the City of Lacey, and if necessary, the Pierce County HAZMAT Team.
- The Washington State Patrol is the agency in charge until the spill has been contained. Once contained, Ecology is responsible for arranging and overseeing clean up.
- If the HAZMAT incident cannot be contained by the first responder, the first responder will request a HAZMAT Team from Pierce County dispatch. The closest HAZMAT Team is located at Fort Lewis (just north of the City limits). The responding HAZMAT Team should be made aware if the spill is located within a Wellhead Protection Area.

To reduce the likelihood of groundwater contamination in WHPAs, examples of simple measures that can be implemented during a spill/incident response include:

- Attempts to contain hazardous spills on the ground and use of absorbents on liquid to reduce infiltration into the ground, and
- Disallow the routing of spills into dry wells for clean up.

5.4.2 City's Hazardous Materials Spill Response Plan

Typically, the City is first notified of a spill after it has been reported to the fire department, police department or to Public Works. The City responds to requests for support from citizens and/or other agencies requesting assistance on hazardous material spills located within the incorporated City limit. A response will be limited to the right-of-way and City owned property. The City only responds to spills that occur outside of the City limit that potentially impact City-owned infrastructure or property. The City does not clean up spills on private property. In case of a spill on private property that threatens City-owned infrastructure or property, City crews will stand by and provide technical assistance and oversight to the property owner and his/her designated clean-up firm. If a material from the spill enters or impacts a City-owned property or interest, the role of City crews will be to ensure that the clean-up effort is satisfactory. City crews will not clean up spills that contain biohazards.

In the event of a large spill and under the direction of an incident commander or division supervisor, City staff may be asked to perform an immediate, specific emergency support task at the site such as dumping a load of gravel, digging a trench, or some other support type function. These employees are designated as Skilled Support Personnel and receive an initial briefing before participating in the response activities.

It is recommended that the City's Response Plan include a requirement to identify whether the spill has occurred inside a WHPA, and that this information should be communicated to the incident responders.

6.0 SUMMARY AND CONCLUSIONS

6.1 Summary

Golder has prepared this report to update the Wellhead Protection Plan for the City of Lacey's groundwater supply as part of the 2011 Water System Plan update. The study featured the following:

- Updating the hydrogeologic understanding of the Lacey area, including developing:
  - Surficial geology;
  - Developing new hydrostratigraphy;
  - Updating groundwater pumping;
  - Groundwater hydrographs and interpreted water level maps for the principal aquifers;
  - Surface water conditions; and
  - Groundwater chemistry.
- Using the 2009 Lacey WHPA model to simulate current groundwater pumping for the City's active wells, and proposed pumping for these and new wells under new water right applications. The model was used to define new time-of-travel wellhead protection areas for these wells.
- The source susceptibility assessment, based on a qualitative assessment of local hydrogeologic and well conditions.
- Aquifer vulnerability assessment, accounting for the susceptibility and contaminant source inventory conducted by the City in 2009.
- Provided recommendations for new monitoring wells, in light of the findings, to improve the source supply protection.
- Provided details and contact information for local regulatory agencies and emergency spill response efforts.

6.2 Recommendations

- Adopt new WHPAs. To continue to protect the valuable groundwater resource, the City should use the newly-defined WHPAs to enforce land use restrictions on certain high-risk activities. The City should also engage in discussions with the operators of potential non-point source contaminants, such as golf courses and farmers, to establish and apply best management practices to reduce the risk of impacting the source waters.
- Install new Groundwater Protection Monitoring Wells. In several of the WHPAs, we recommend that the City install new dedicated monitoring wells to improve the coverage for groundwater quality from existing CSI sites and improve the understanding of the local groundwater conditions. These wells are as follows:
  - Install two new monitoring wells (MW-9 and MW-10) in the College Street area to provide water quality data and source protection for the two production well clusters (Wells S01, S02 and S03, and Wells S04, S09 and S10).
  - Incorporate the water quality data for the Rolling Firs wells (Nos. 1 and 2) into the City's WPMP. These wells are located near the three Madrona wells (Wells S21, S22 and S28) and act as indicators of groundwater quality within the 5-year WHPA. The data are available on the DOH Sentry web site.

- Install one new monitoring well (MW-11) near Well S29 to provide protection from a potential contaminant release along Marvin Road in the Hawks Prairie area.

- Monitor Existing Wells
  - Monitor and sample existing wells MW-8 and MW-18A to provide protection for the Madrona and Evergreen Estates wells, respectively.
  - Monitor and sample the City's test well TW-B03 to provide baseline groundwater level and quality data in the deep (TQu) aquifer in the Beachcrest area in the case that future pumping of this well induces seawater intrusion.
- The City should continue its ongoing efforts to locate and abandon test wells that could potentially act as vertical pathways for shallow groundwater contamination to deeper aquifers and impact production wells.
- The data and results of the groundwater monitoring and sampling should be analyzed annually, and hydrographs and water quality plots updated to show trends. These results should be incorporated into a summary report, which should be completed before during the first quarter following the calendar year. The report findings should be used to refine the annual monitoring program for the following year.
- Lacey Municipal Code. The City should revise the existing code for land use control to formally reference the City's (1) wellhead protection areas, and (2) stormwater design manual for stormwater generated by new development, redevelopment and transportation projects.
- Spill Response Plan. The City should revise the plan to require identification that a hazardous materials spill has occurred inside a WHPA, and that this information should be communicated to the incident responders.

With these actions, it is our opinion that the City of Lacey will both comply with State regulations, and continue to ensure that the long-term supply of high-quality drinking water remains available to its residents.

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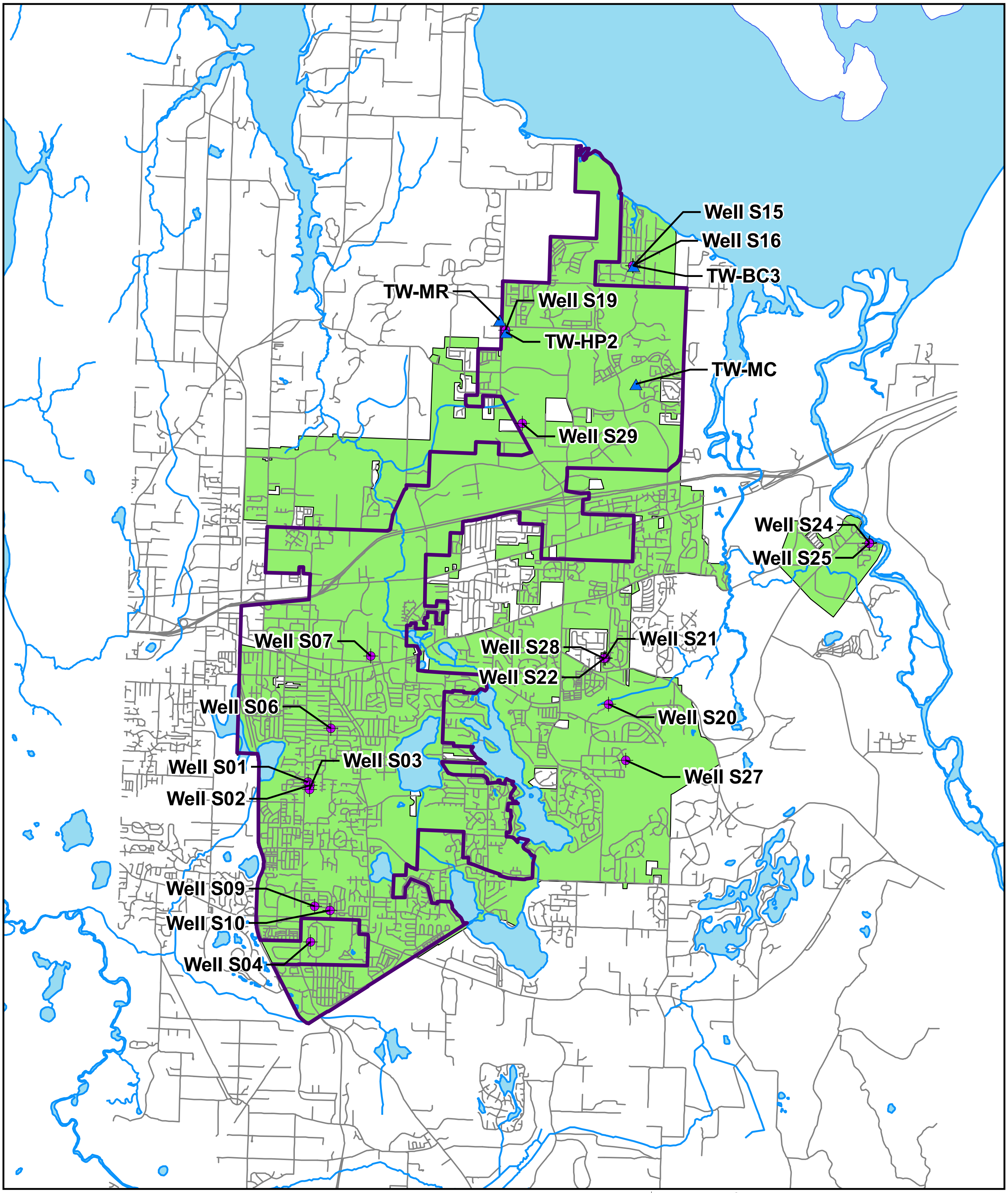
FIGURES



LEGEND

Production Well

Test Well

Lacey City Limit

City of Lacey Water Service Area

0 8000

Scale in Feet

Map Projection:
Washington State Plane
South Zone NAD 1983

Source:
Carollo, WA DNR,
Golder Associates Inc.

N

This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

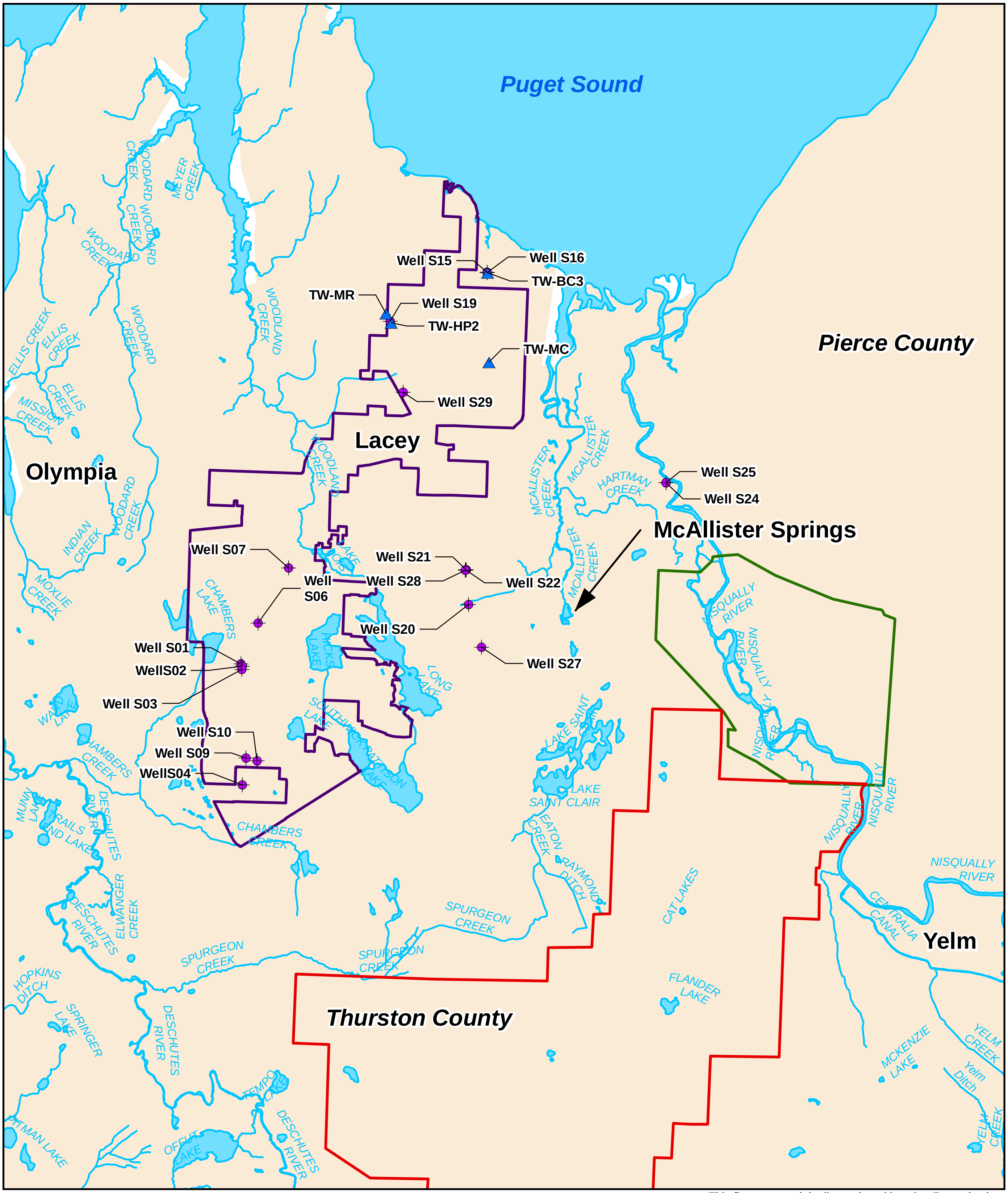
FIGURE **1-1**

CITY OF LACEY PRODUCTION AND TEST WELL LOCATIONS

WELLHEAD PROTECTION WSP UPDATE/WA

08393334F35_WellLocations.mxd | 3/15/2010 | THAMMOND

Golder Associates



LEGEND

- Production Well
- Test Well
- Lacey City Limit
- Fort Lewis
- Nisqually Indian Reservation

0 2 Miles

Scale in Feet

N

Map Projection:
Washington State Plane
South Zone NAD 1983

Source: USGS, Thurston County,
WSDOE, Golder Associates, Inc.

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FIGURE **2-1**

REGIONAL SETTING

WELLHEAD PROTECTION WSP UPDATES/WA

08393334F36_LocationMap.mxd | 3/15/2010 | THAMMOND

Golder Associates

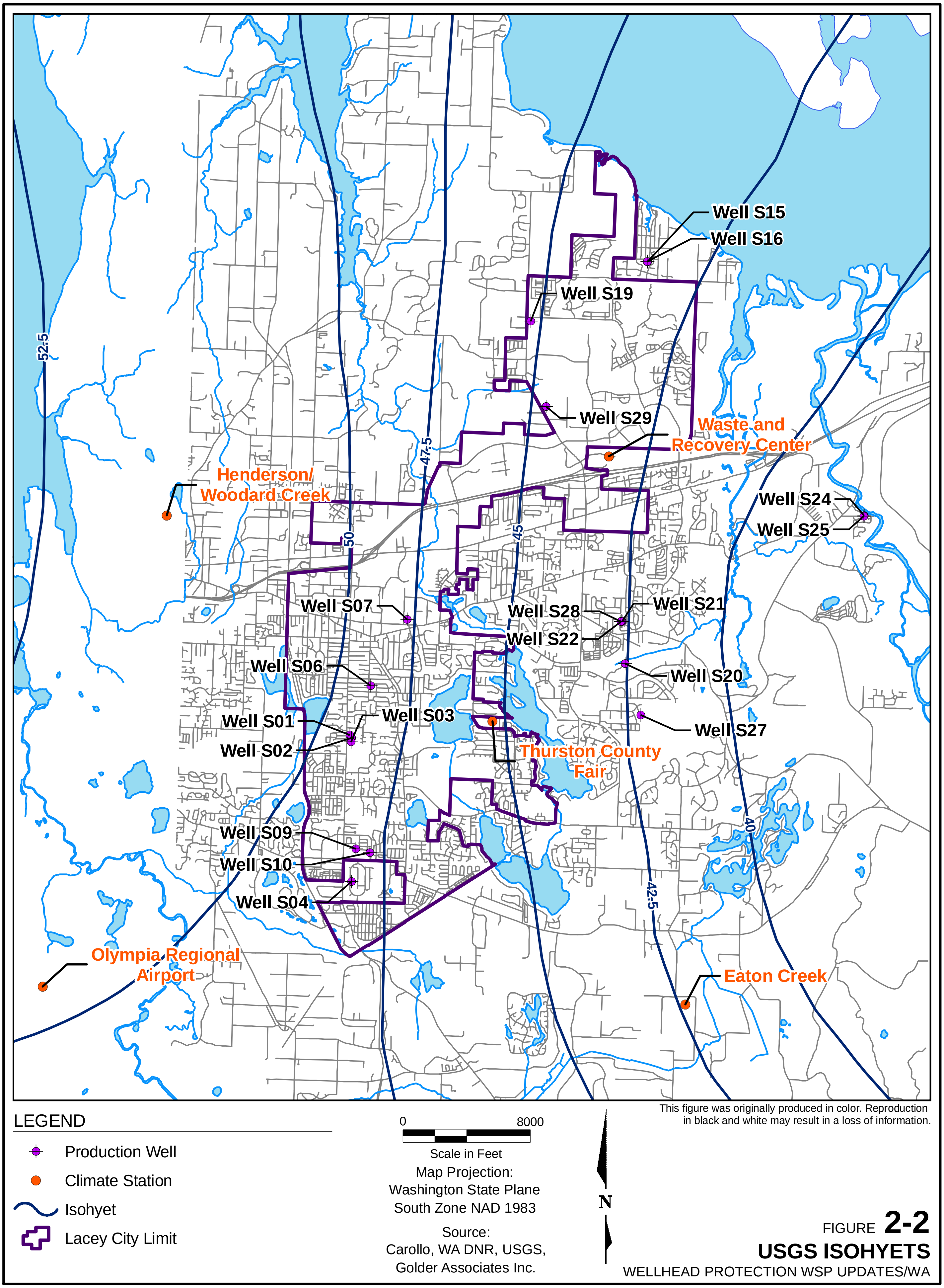

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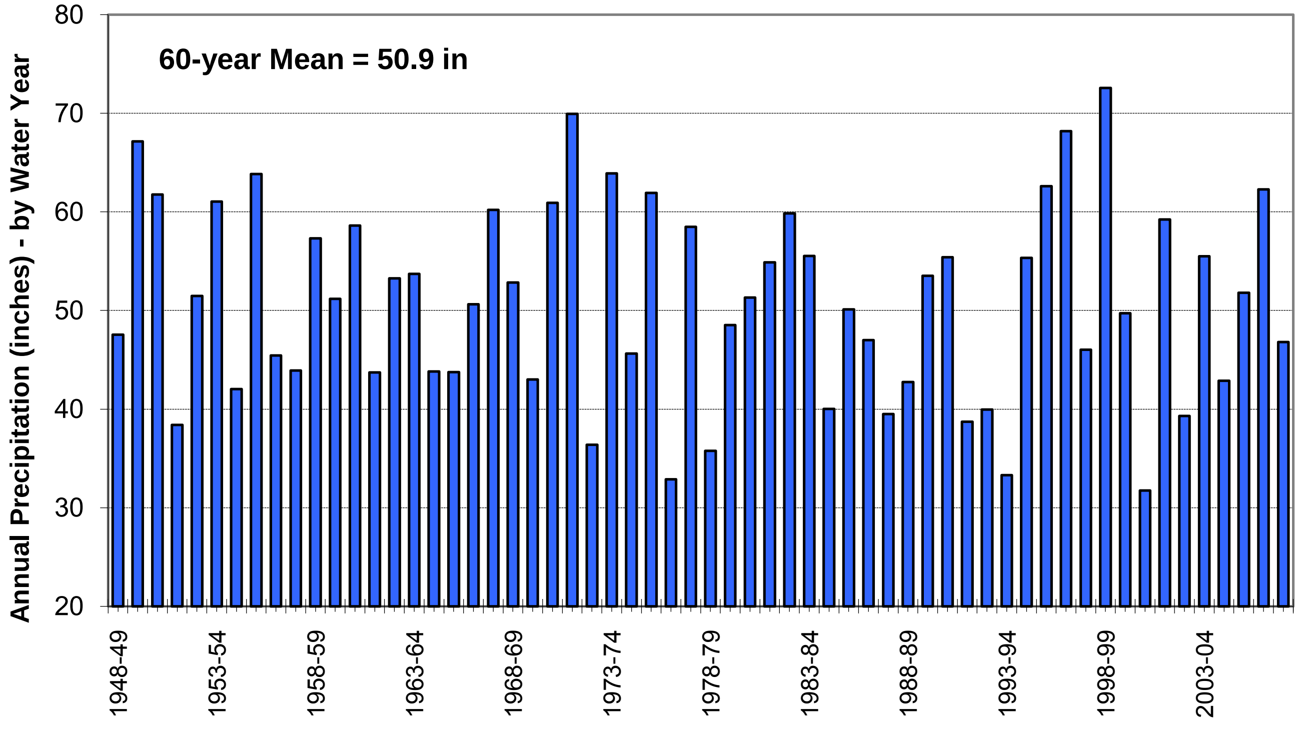
FIGURE **2-2**

USGS ISOHYETS

WELLHEAD PROTECTION WSP UPDATES/WA

08393334F37_USGSIsoyets.mxd | 3/15/2010 | THAMMOND

Golder Associates



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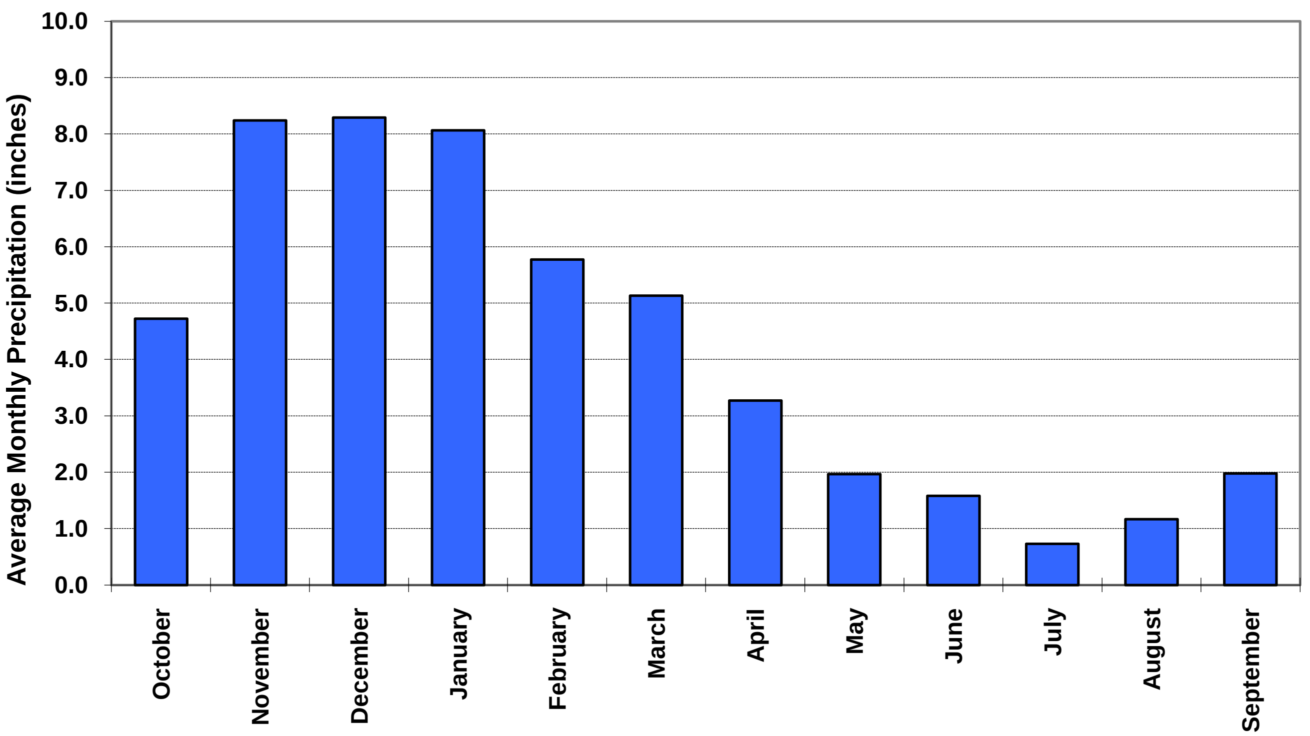
TITLE **Annual Precipitation at Olympia Airport – 1948-2008**

City of Lacey - Water System Plan Update 2009

DRAWN	SDT	DATE	5/14/10	PROJECT No.	083.93334
CHECKED	EA	SCALE		DWG No.	
REVIEWED	PAB	FILE No.	Sec2_port.ppt	FIGURE No.	2-3

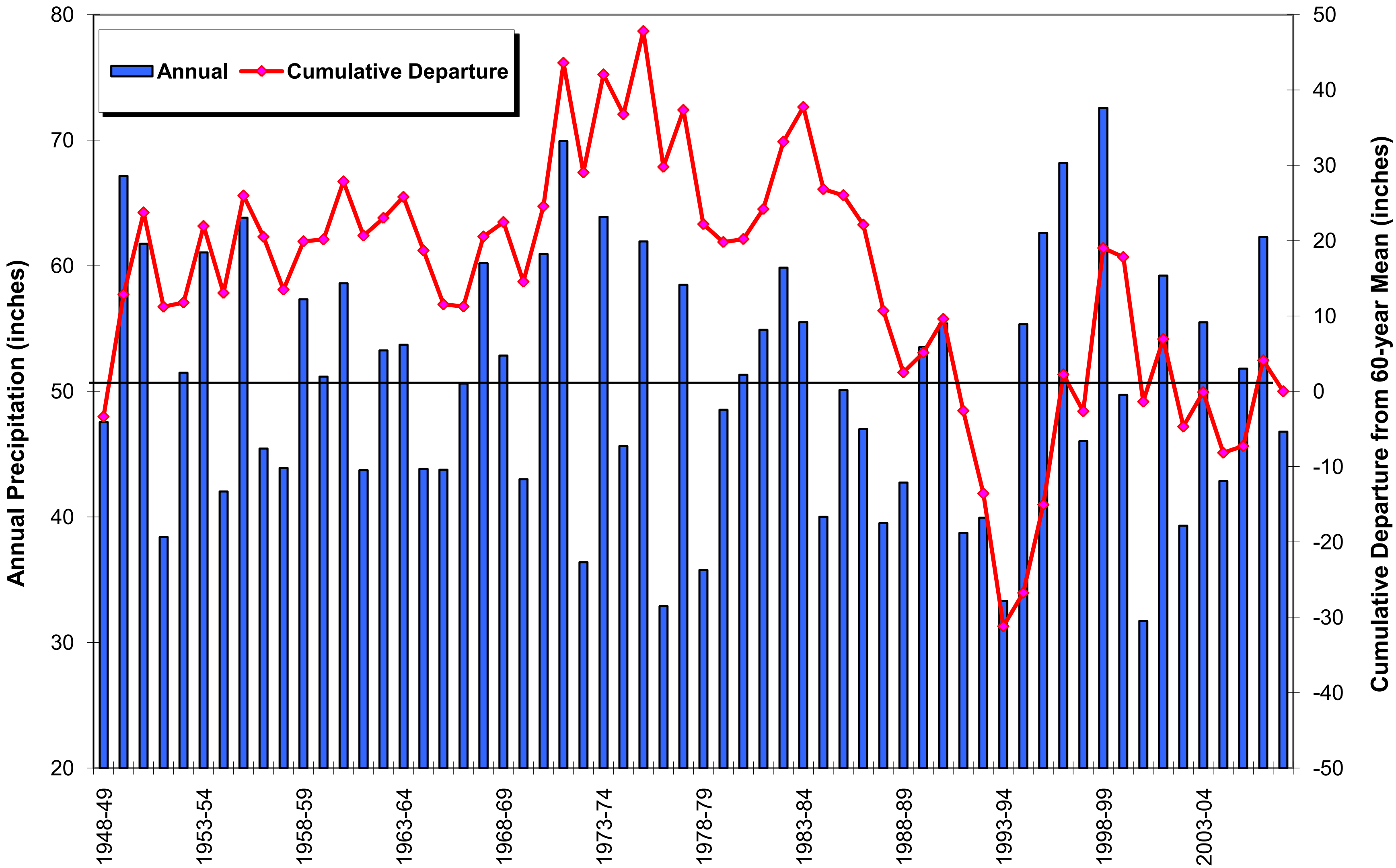


Golder Associates

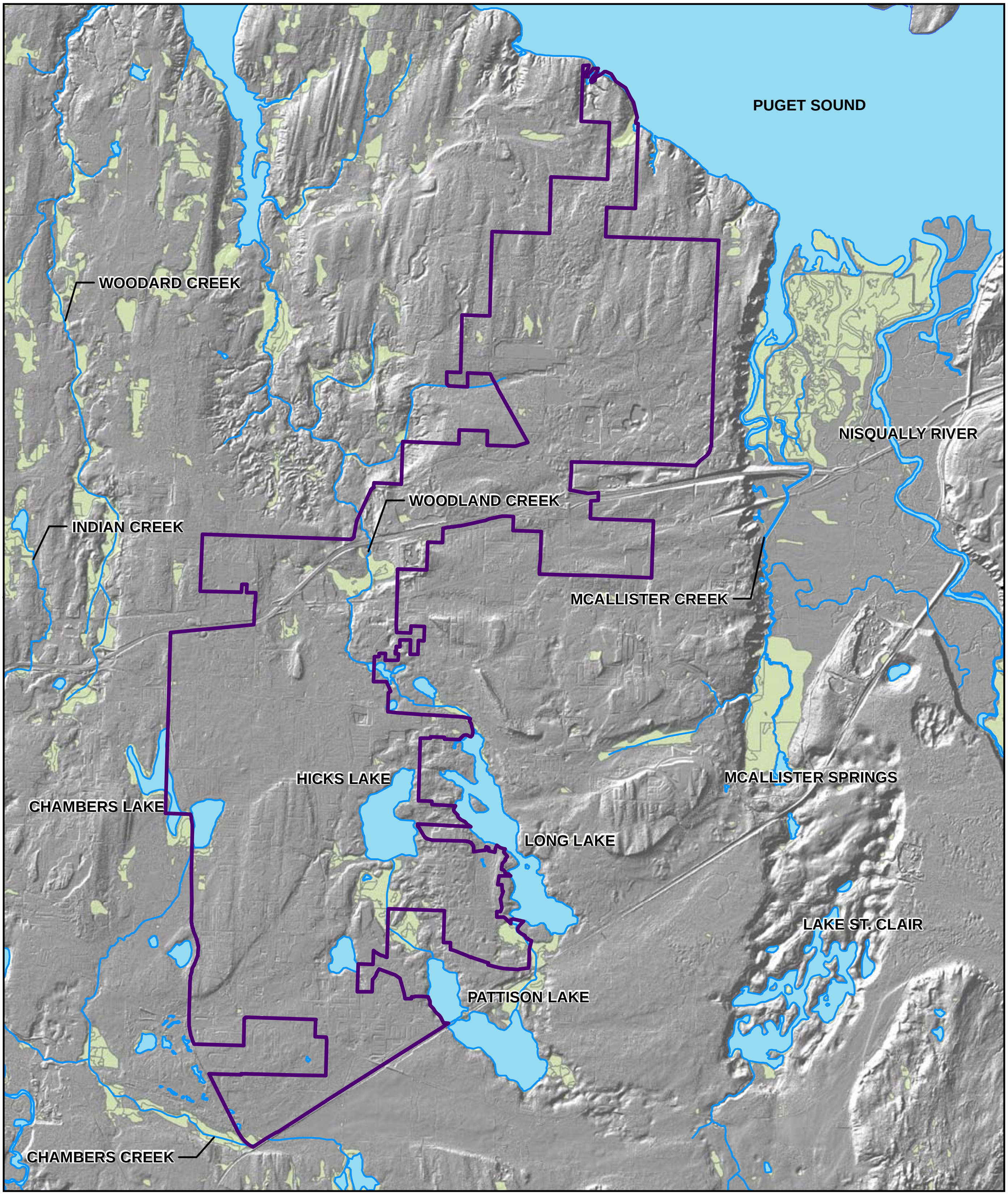
TITLE **Average Monthly Precipitation at Olympia Airport – 1948-2008**

City of Lacey - Water System Plan Update 2009

DRAWN	SDT	DATE	5/14/10	PROJECT No.	083.93334
CHECKED	EA	SCALE		DWG No.	
REVIEWED	PAB	FILE No.	Sec2_port.ppt	FIGURE No.	2-4



Golder Associates	TITLE	Cumulative Departure from the Long-term Average Precipitation at Olympia Airport Station – 1948-2008		
City of Lacey - Water System Plan Update 2009	DRAWN SDT	DATE 4/22/10	PROJECT No. 083.93334	
	CHECKED	SCALE	DWG No.	
	REVIEWED	FILE No.	FIGURE No. 2-5	



This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

LEGEND

Lacey City Limit

Wetland

0 6500

Scale in Feet

Map Projection:
Washington State Plane
South Zone NAD 83

Source: PSLC,
Golder Associates Inc.

N

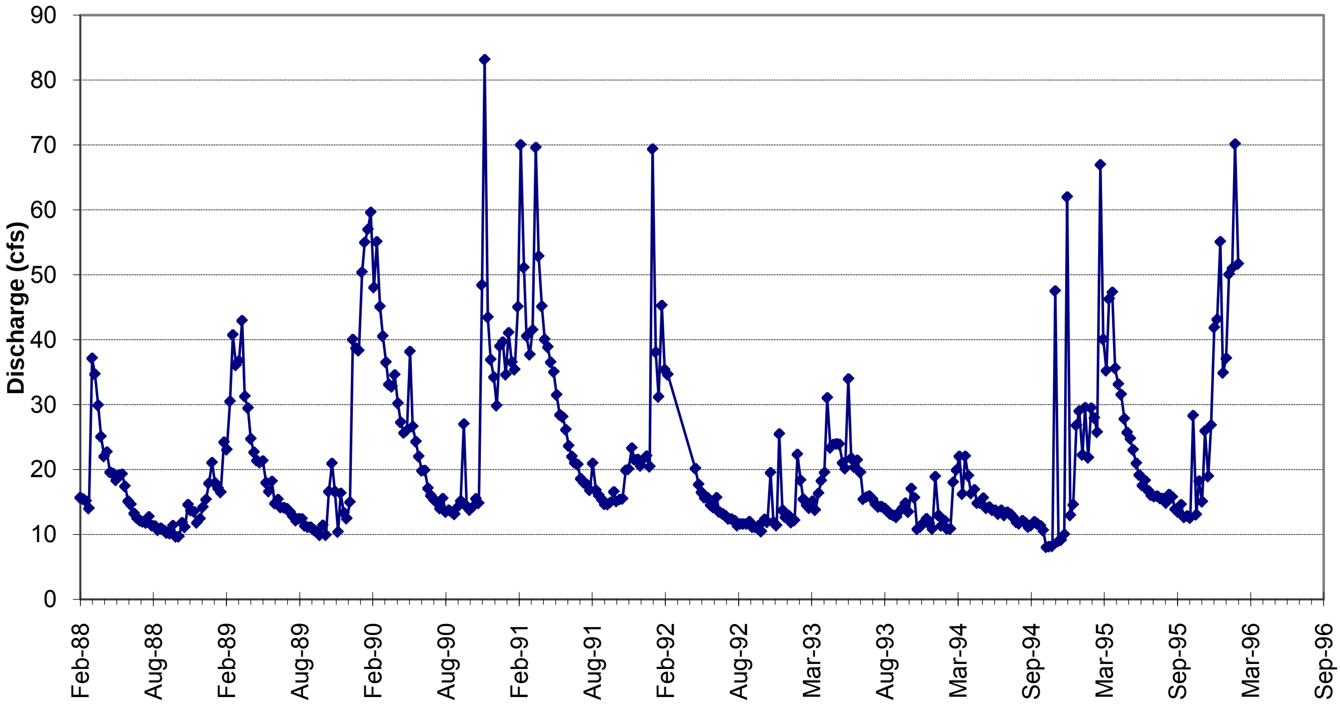
FIGURE **2-6**

MAIN SURFACE WATER FEATURES AND SHADED RELIEF MAP

WELLHEAD PROTECTION WSP UPDATE/WA

08393334F38_SurfaceWaterShadedRelief.mxd | 3/15/2010 | THAMMOND

Golder Associates

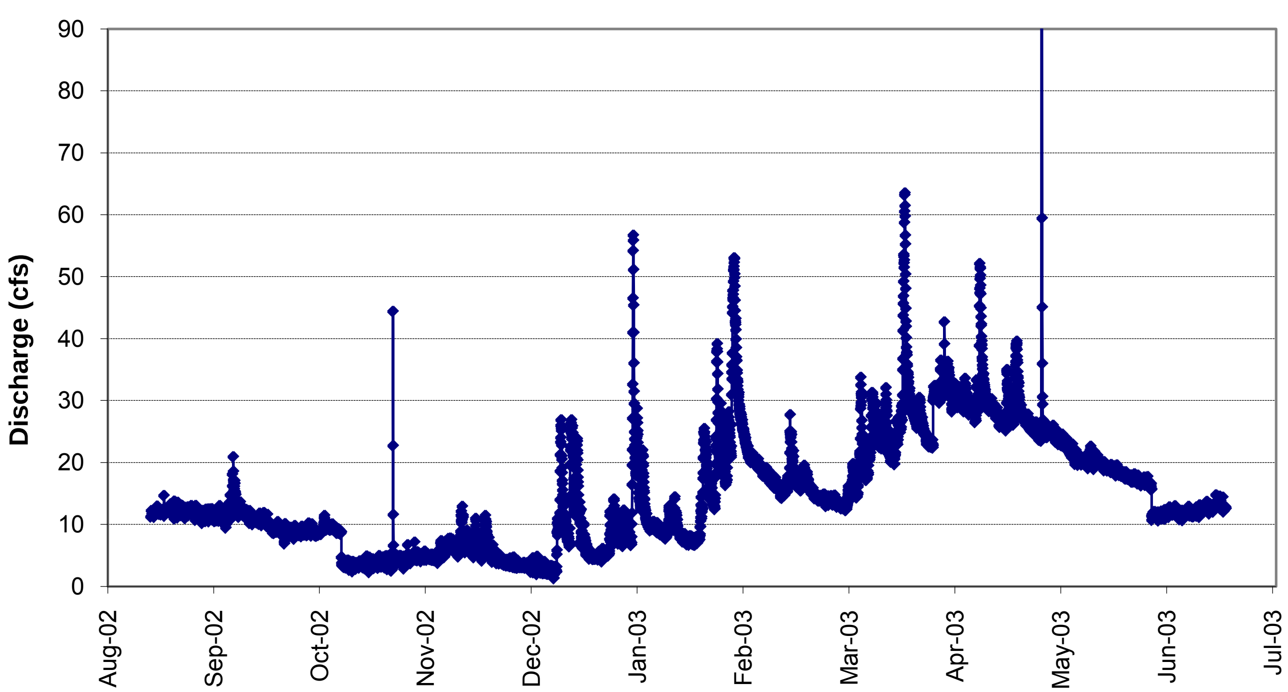


Golder Associates

TITLE **Woodland Creek Discharge at Pleasant Glade Road – 1988-1996**

City of Lacey - Water System Plan Update 2009

DRAWN	SDT	DATE	5/14/10	PROJECT No.	083.93334
CHECKED	EA	SCALE		DWG No.	
REVIEWED	PAB	FILE No.	Sec2_port.ppt	FIGURE No.	2-7

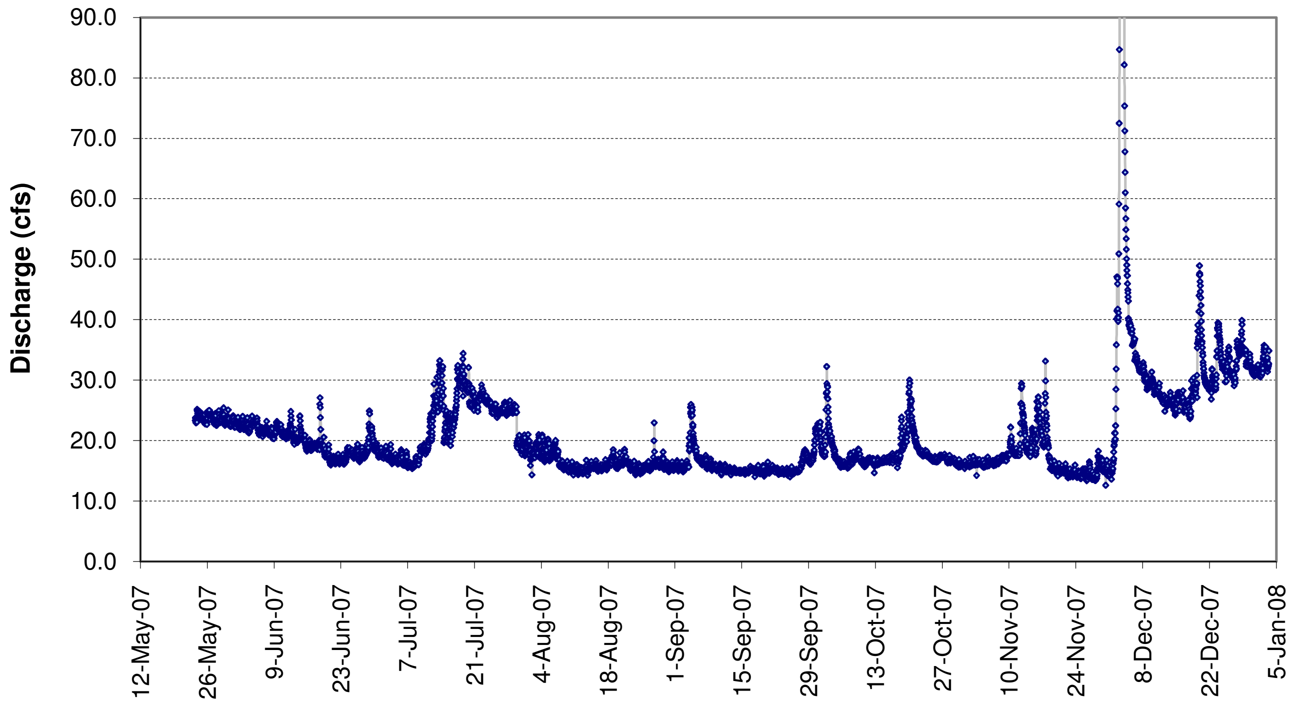


Golder Associates

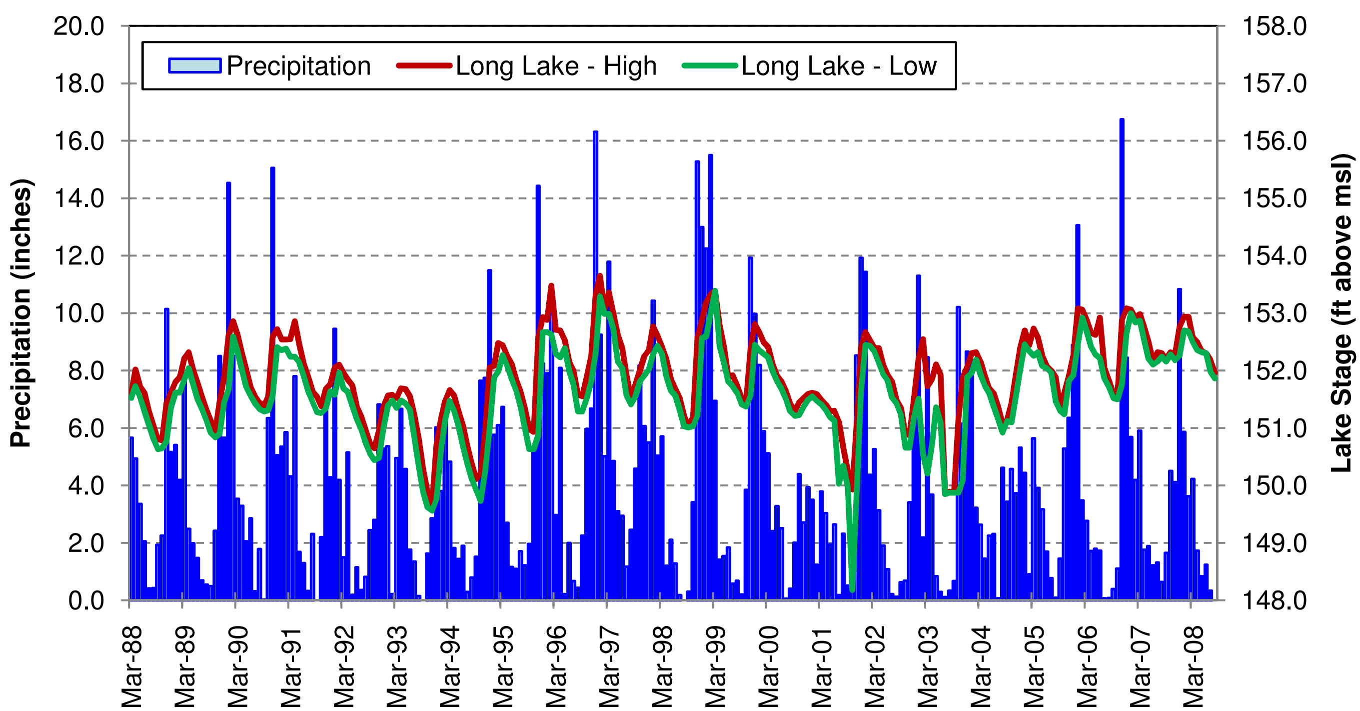
TITLE **Woodland Creek Discharge at Pleasant Glade Road – 2002-2003**

City of Lacey - Water System Plan Update 2009

DRAWN	SDT	DATE	5/14/10	PROJECT No.	083.93334
CHECKED	EA	SCALE		DWG No.	
REVIEWED	PAB	FILE No.	Sec2_port.ppt	FIGURE No.	2-8

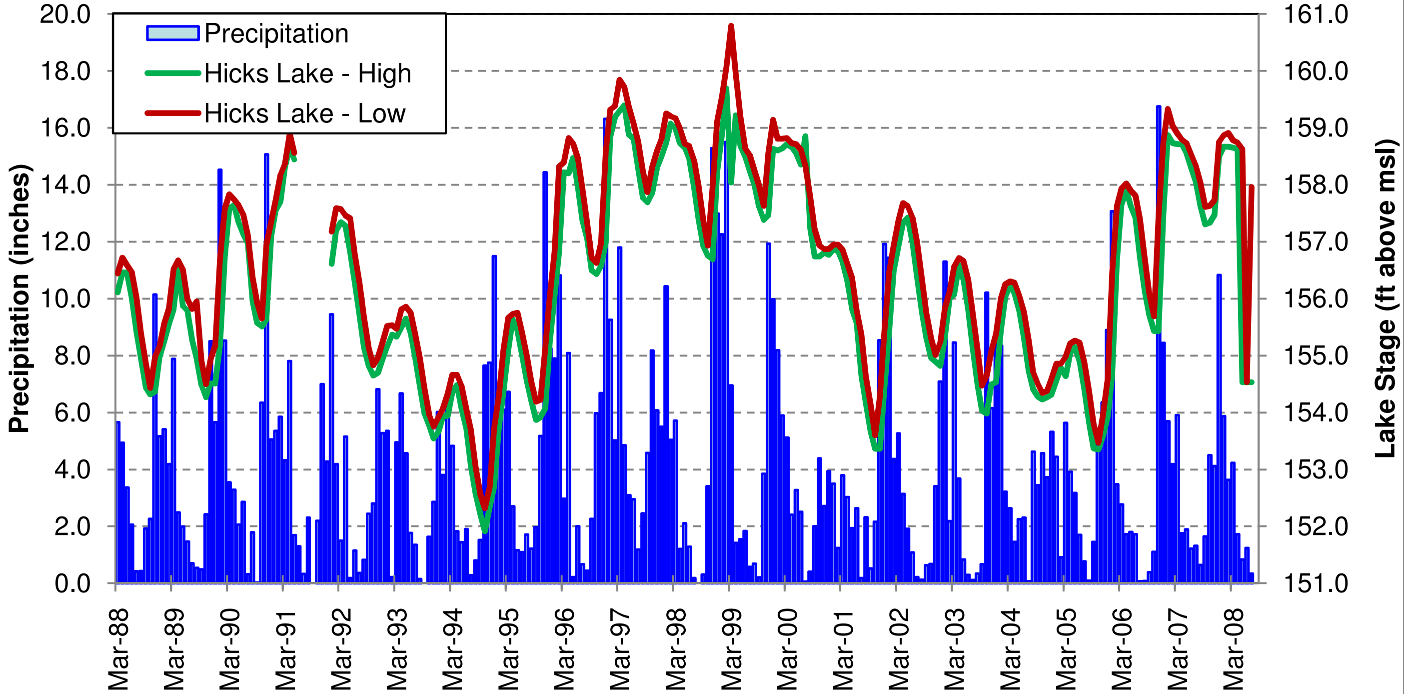


Golder Associates	TITLE **Woodland Creek Discharge at Pleasant Glade Road – 2007-2008**		
City of Lacey - Water System Plan Update 2009	DRAWN SDT	DATE 5/14/10	PROJECT No. 083.93334
	CHECKED EA	SCALE	DWG No.
	REVIEWED PAB	FILE No. Sec2_port.ppt	FIGURE No. **2-9**



Source: City o f Lacey, 2010

Golder Associates	TITLE **Recorded Stage Levels in Long Lake and Monthly Precipitation – 1988-2008**		
City of Lacey - Water System Plan Update 2009	DRAWN SDT	DATE 5/14/10	PROJECT No. 083.93334
	CHECKED EA	SCALE	DWG No.
	REVIEWED PAB	FILE No. Sec2_port.ppt	FIGURE No. **2-10**



Source: City of Lacey, 2010

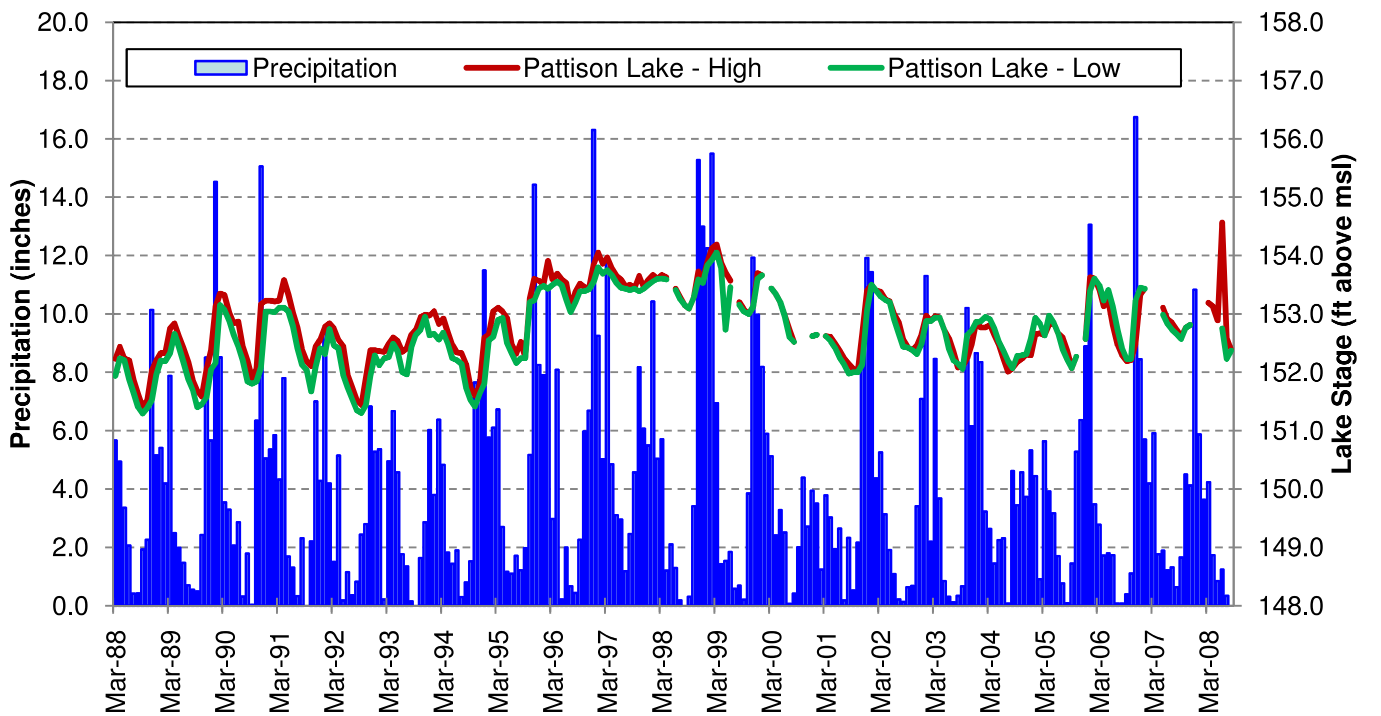
Golder Associates

TITLE

Recorded Stage Levels in Hicks Lake and Monthly Precipitation - 1988-2008

City of Lacey - Water System Plan Update 2009

DRAWN	SDT	DATE	5/14/10	PROJECT No.	083.93334
CHECKED	EA	SCALE		DWG No.	
REVIEWED	PAB	FILE No.	Sec2_port.ppt	FIGURE No.	2-11



Source: City of Lacey, 2010

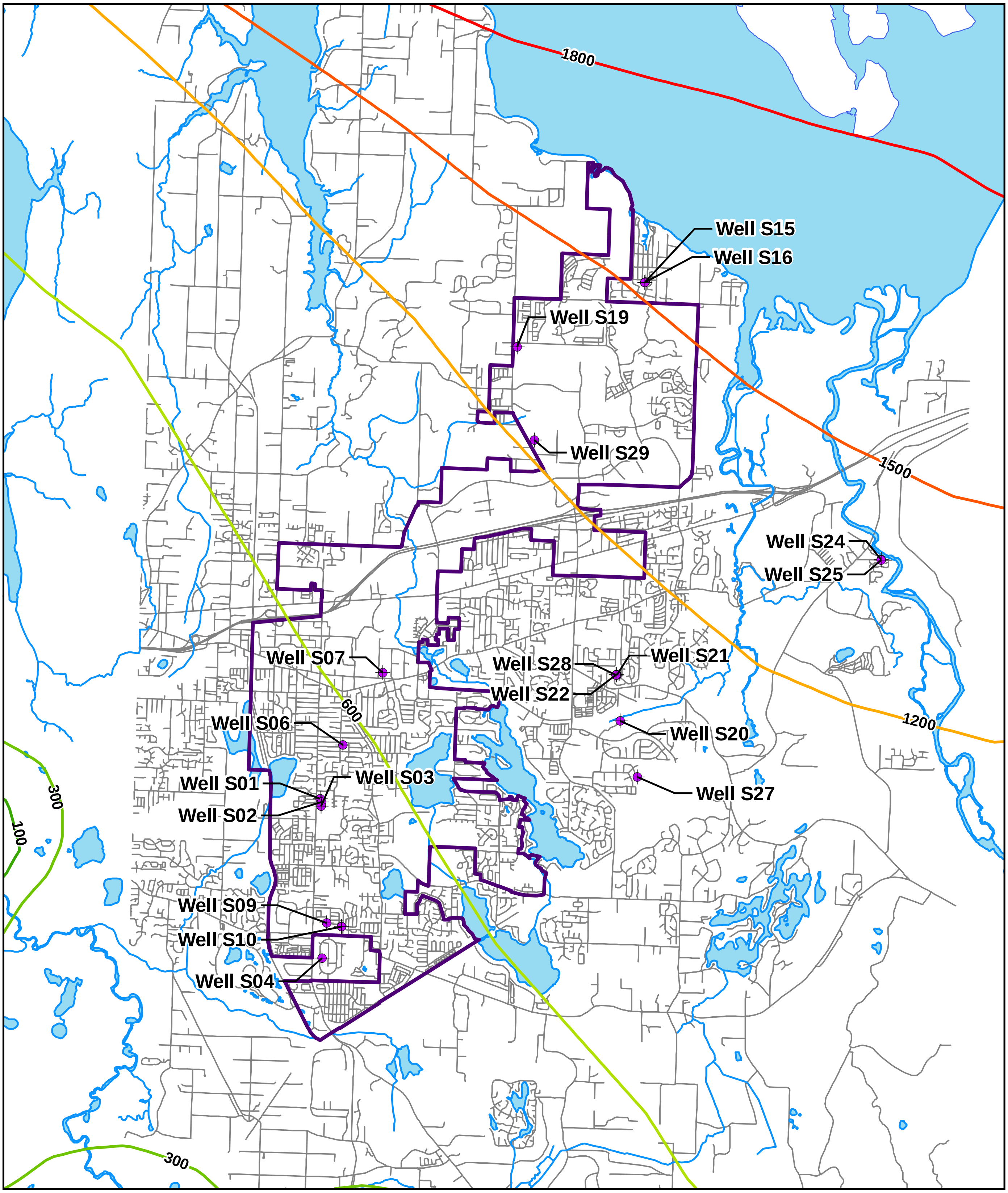
Golder Associates

TITLE

Recorded Stage Levels in Pattison Lake and Monthly Precipitation – 1988-2008

City of Lacey - Water System Plan Update 2009

DRAWN	SDT	DATE	5/14/10	PROJECT No.	083.93334
CHECKED	EA	SCALE		DWG No.	
REVIEWED	PAB	FILE No.	Sec2_port.ppt	FIGURE No.	2-12



This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

LEGEND

Production Well

Lacey City Limit

Isopach Sediments (Feet)

100 1200
300 1500
600 1800

0 8000

Scale in Feet

N

Map Projection:
Washington State Plane
South Zone NAD 83

Source: Carollo, WA DNR, Golder Associates Inc.

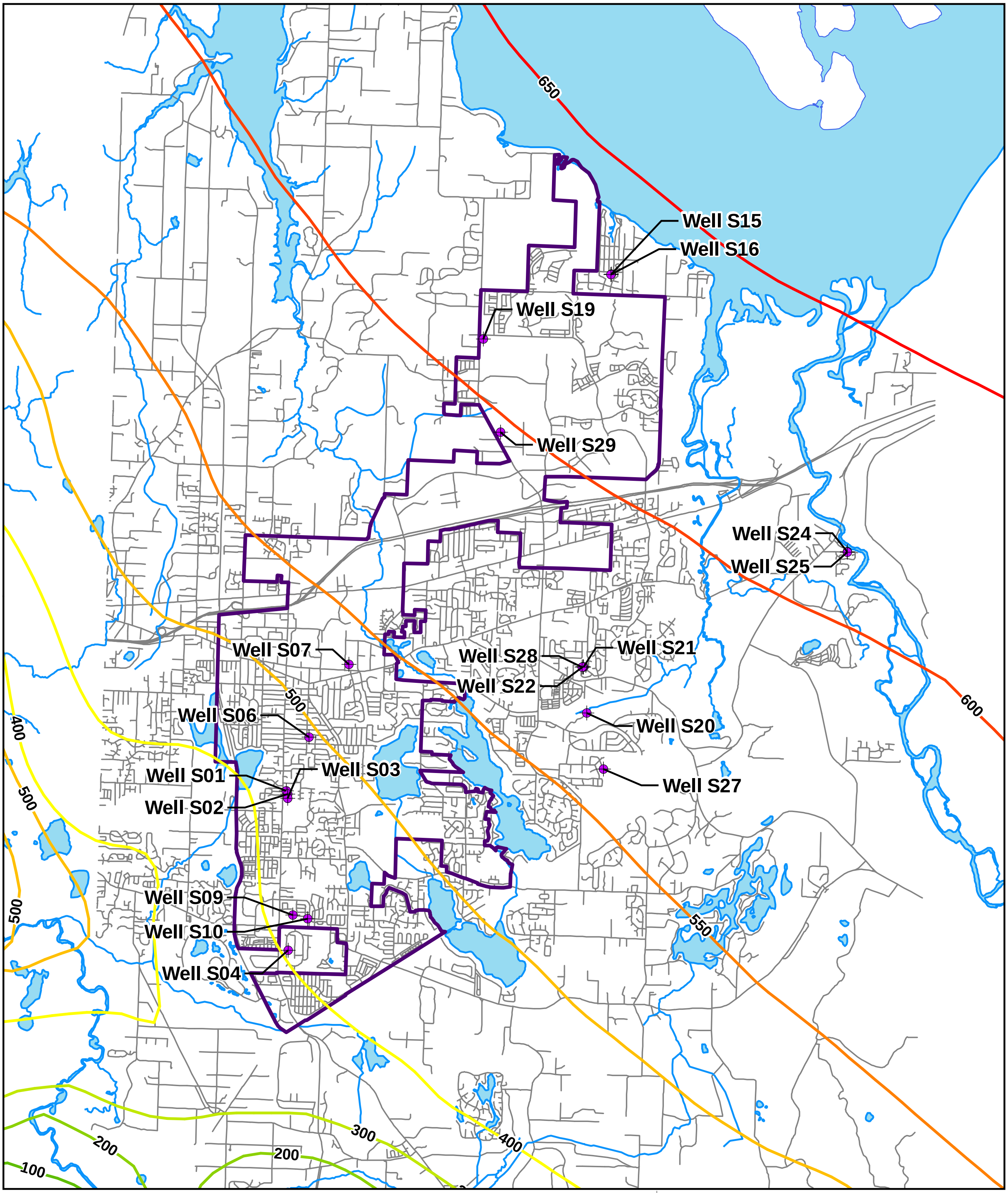
FIGURE **2-13**

SEDIMENT ISOPACHS - JONES 1996

WELLHEAD PROTECTION WSP UPDATE/WA

08393334F39_SedimentIsopachs_Jones.mxd | 3/15/2010 | THAMMOND

Golder Associates



LEGEND

Production Well

Lacey City Limit

Isopach Sediments (Feet)

0, 100, 200, 300, 500, 550, 600, 650

0 8000

Scale in Feet

Map Projection:
Washington State Plane
South Zone NAD 1983
Source:
Carollo, WA DNR,
Golder Associates Inc.

N

This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

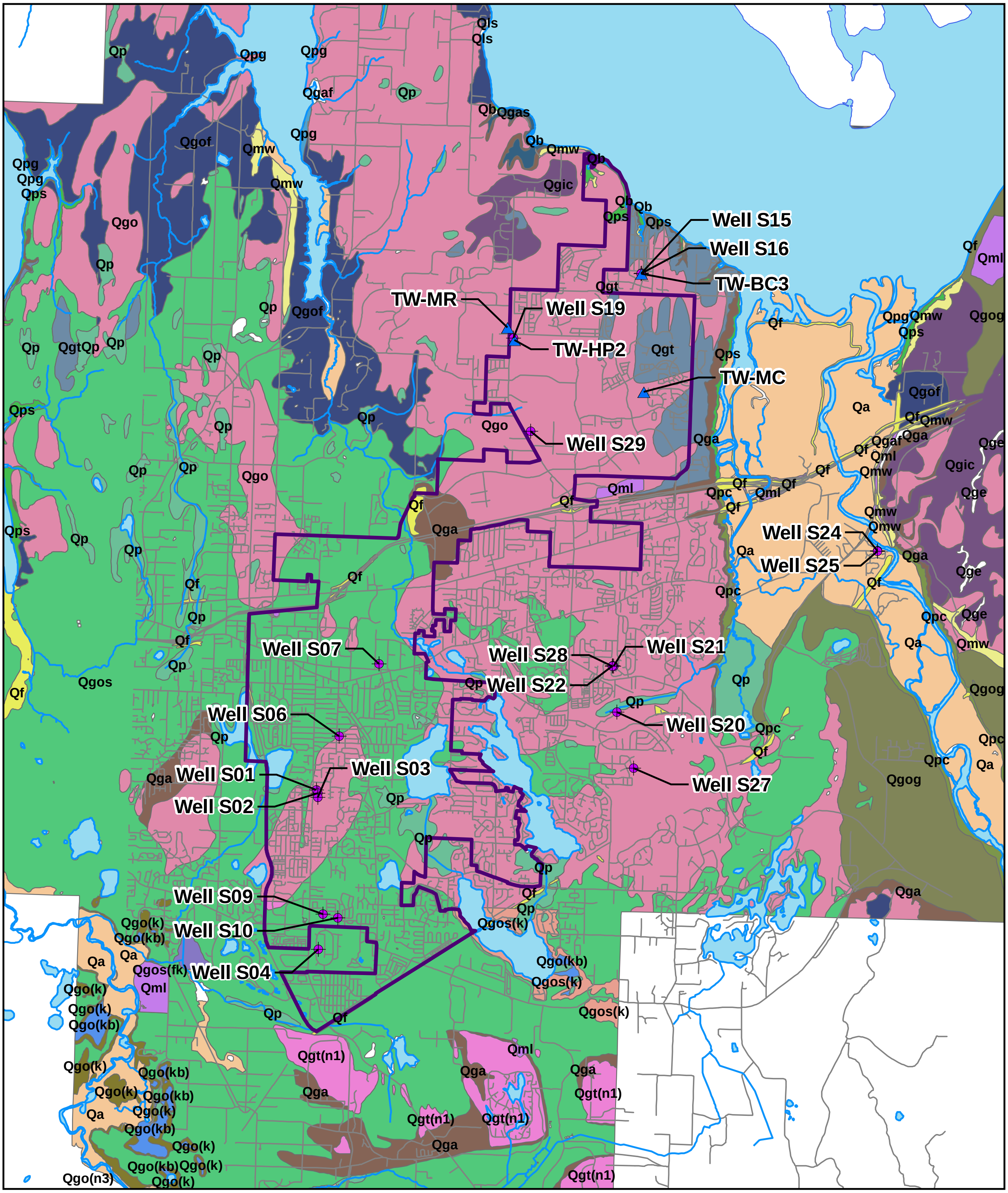
FIGURE **2-14**

SEDIMENT ISOPACHS - WALSH 2007

WELLHEAD PROTECTION WSP UPDATE/WA

08393334F40_SedimentIsopachs_Walsh.mxd | 3/15/2010 | THAMMOND

Golder Associates



This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

LEGEND

- Production Well
- Test Well
- Lacey City Limit

Geologic Units

Qa	Qgo(kb)	Qml
Qb	Qgof	Qmw
Qf	Qgog	Qp
Qga	Qgos	Qpc
Qgas	Qgos(fk)	Qpg
Qgic	Qgos(k)	Qps
Qgo	Qgt	Qpt
Qgo(k)	Qgt(n1)	

0 8000

Scale in Feet

Map Projection:
Washington State Plane
South Zone NAD 1983
Source:
Carollo, WA DNR,
Golder Associates Inc.

N

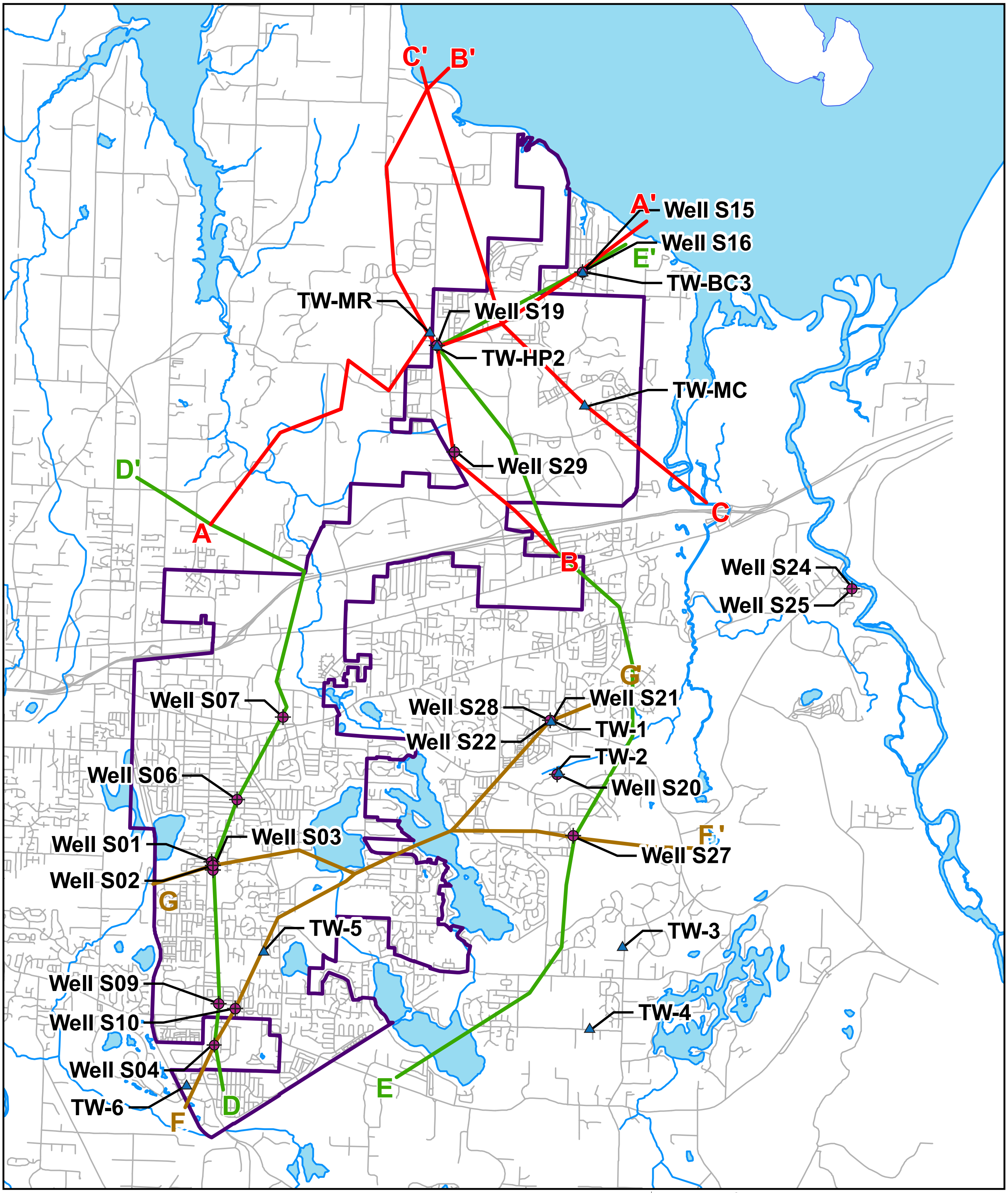
FIGURE **2-15**

SURFICIAL GEOLOGY

WELL PROTECTION WSP UPDATE/WA

08393334F41_SurficialGeology.mxd | 3/15/2010 | THAMMOND

Golder Associates



LEGEND

- Production Well
- Test Well
- Golder, 2009
- NLW, 2008
- PGG, 2003
- Lacey City Limit

0 7000

Scale in Feet

N

Map Projection:
Washington State Plane
South Zone NAD 1983

Source: PGG (2003), NLW (2008),
Golder Associates Inc.

This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

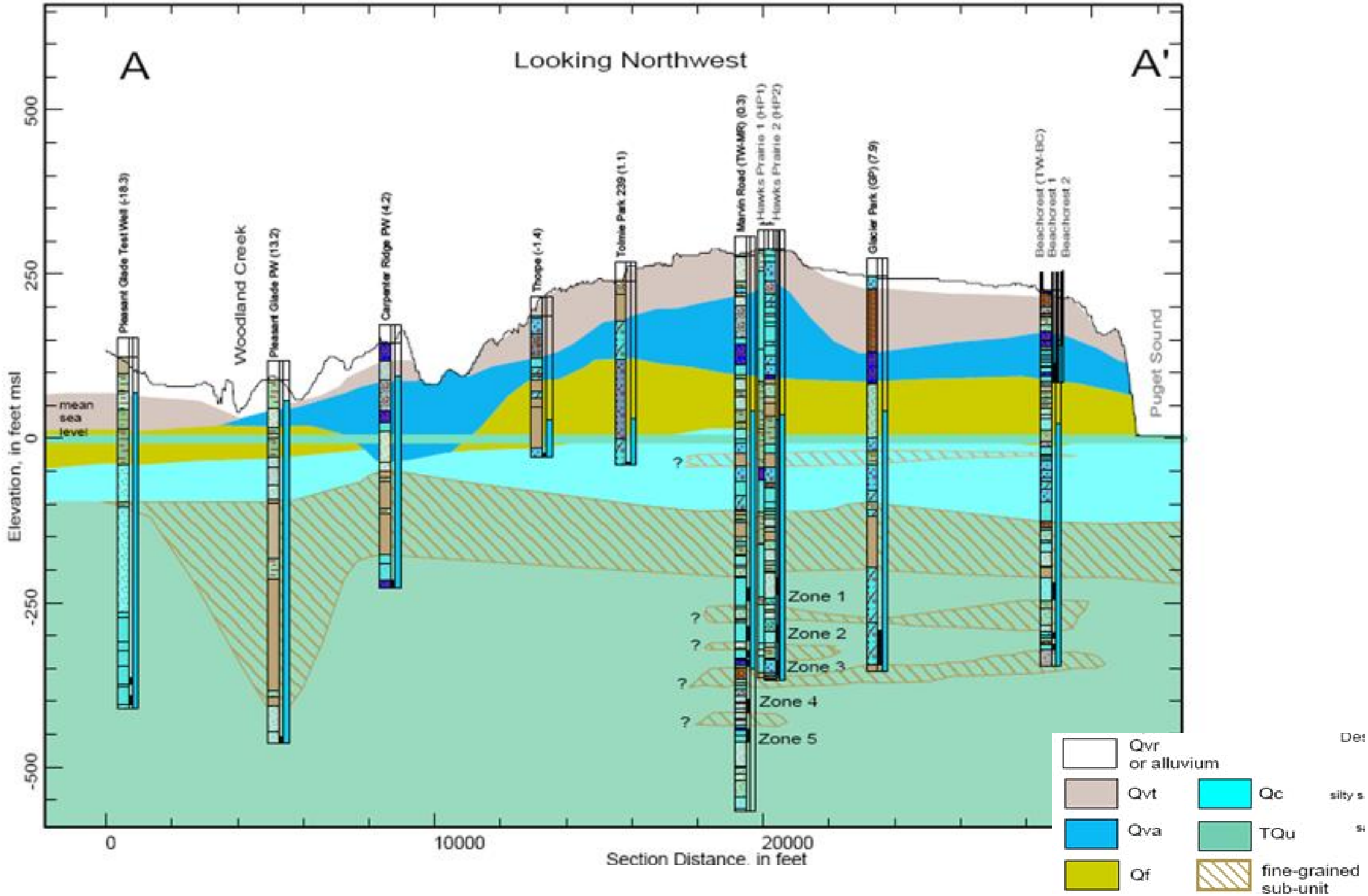
FIGURE **2-16**

HYDROGEOLOGIC SECTION LINES

WELLHEAD PROTECTION WSP UPDATE/WA

Golder Associates

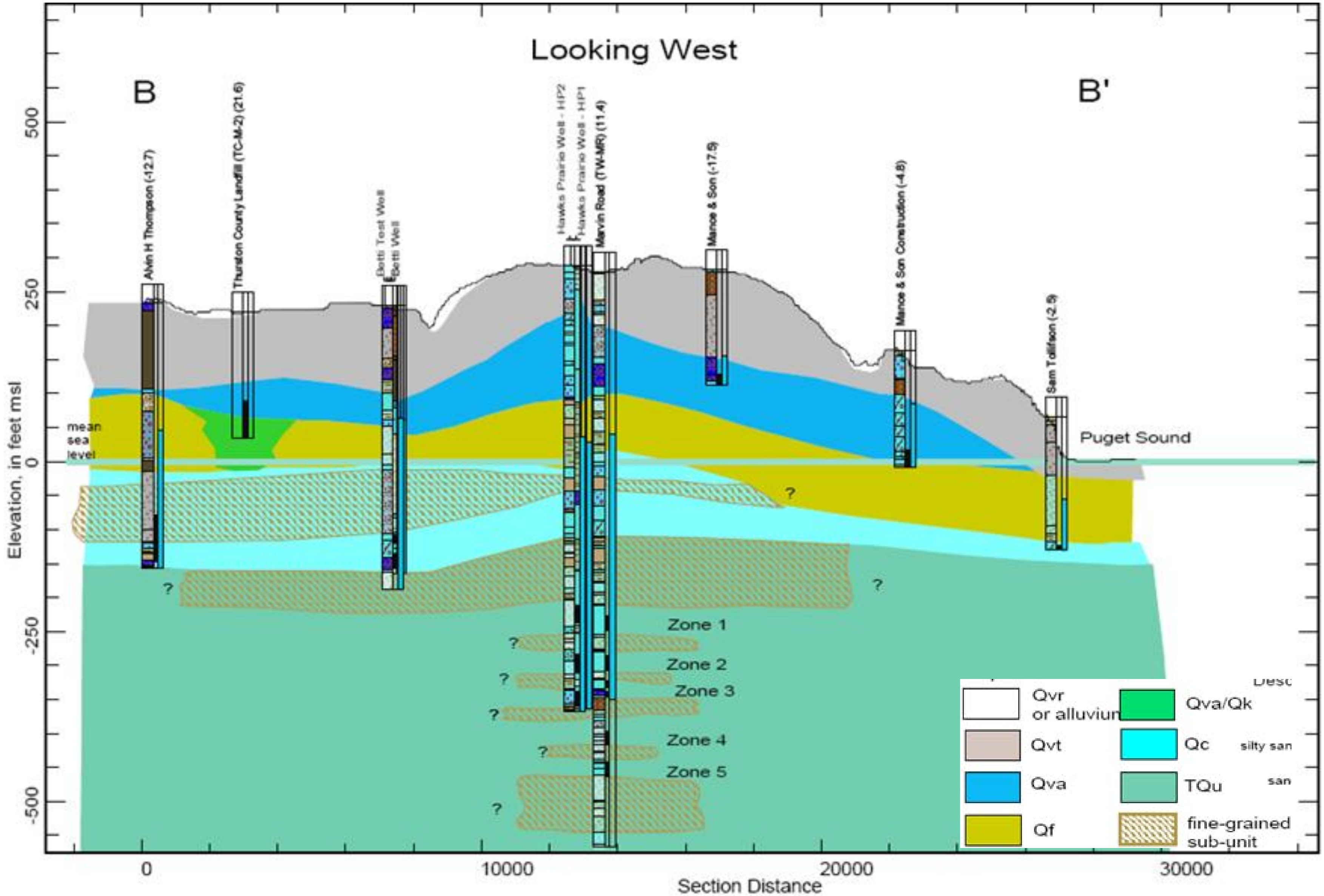
08393334F42_HydrogeologicSectionLines.mxd | 3/15/2010 | THAMMOND



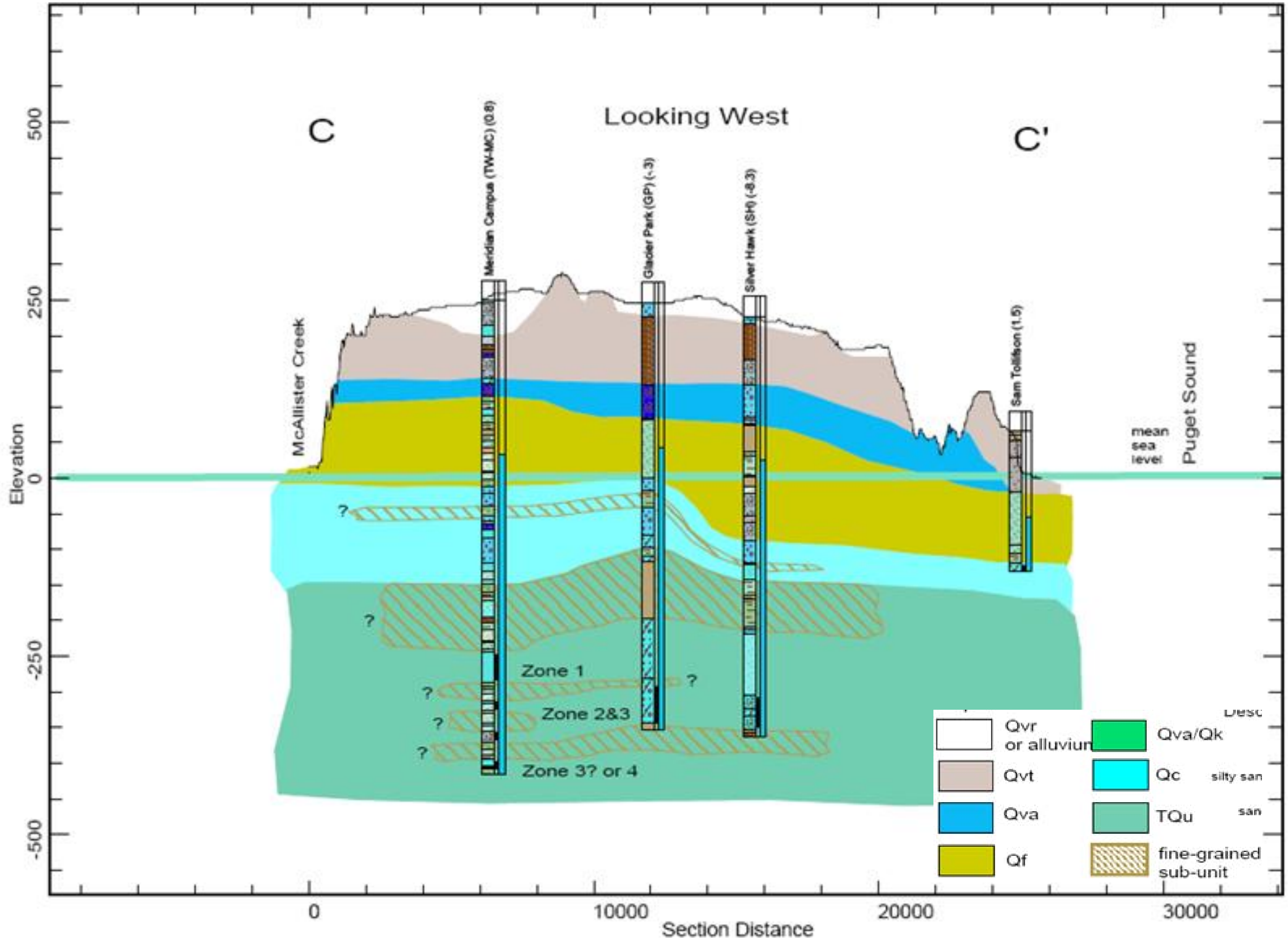
Golder Associates

City of Lacey - Water System Plan Update 2009

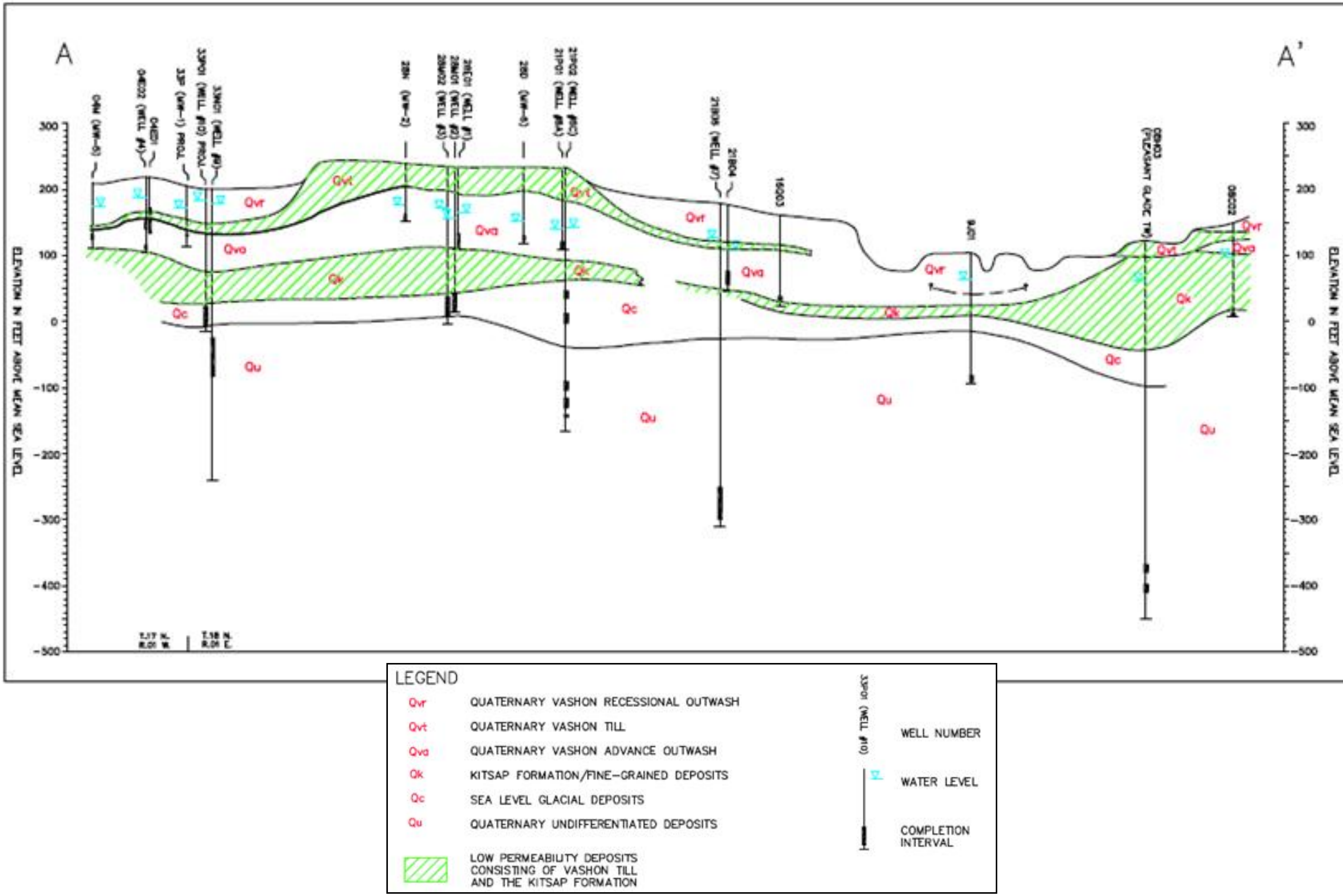
TITLE	Hydrogeologic Section A-A' (NLW, 2008)				
DRAWN	SDT	DATE	4/22/10	PROJECT No.	083.93334
CHECKED		SCALE		DWG No.	
REVIEWED		FILE No.		FIGURE No.	2-17



Golder Associates	TITLE Hydrogeologic Section B-B' (NLW, 2008)		
City of Lacey - Water System Plan Update 2009	DRAWN SDT	DATE 4/22/10	PROJECT No. 083.93334
	CHECKED	SCALE	DWG No.
	REVIEWED	FILE No.	FIGURE No. 2-18



Golder Associates	TITLE **Hydrogeologic Section C-C' (NLW, 2008)**		
City of Lacey - Water System Plan Update 2009	DRAWN **SDT**	DATE **4/22/10**	PROJECT No. **083.93334**
	CHECKED	SCALE	DWG No.
	REVIEWED	FILE No.	FIGURE No. **2-19**

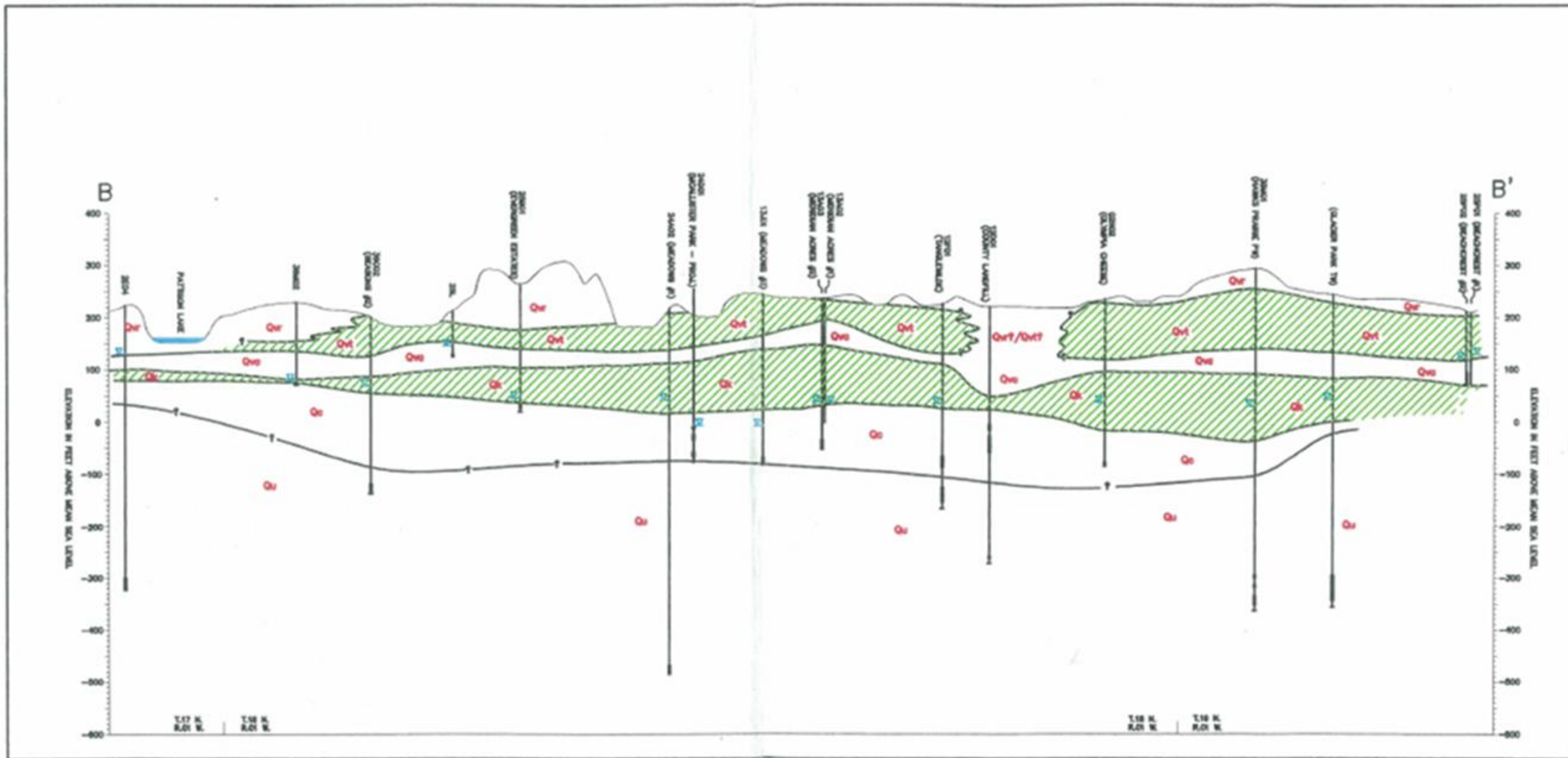


Golder Associates

City of Lacey - Water System Plan Update 2009

TITLE **Hydrogeologic Section D-D' (PGG, 2003)**

DRAWN SDT	DATE 4/22/10	PROJECT No. 083.93334
CHECKED	SCALE	DWG No.
REVIEWED	FILE No.	FIGURE No. 2-20



LEGEND

Qvr	QUATERNARY VASHON RECESSIONAL OUTWASH
Qvt	QUATERNARY VASHON TILL
Qva	QUATERNARY VASHON ADVANCE OUTWASH
Qk	KITSAP FORMATION/FINE–GRAINED DEPOSITS
Qc	SEA LEVEL GLACIAL DEPOSITS
Qu	QUATERNARY UNDIFFERENTIATED DEPOSITS
	LOW PERMEABILITY DEPOSITS CONSISTING OF VASHON TILL AND THE KITSAP FORMATION

33P01 (WELL #10) — WELL NUMBER

WATER LEVEL

COMPLETION INTERVAL

Golder Associates

City of Lacey - Water System Plan Update 2009

TITLE **Hydrogeologic Section E-E' (PGG, 2003)**

DRAWN	SDT	DATE	4/22/10	PROJECT No.	083.93334
CHECKED		SCALE		DWG No.	
REVIEWED		FILE No.		FIGURE No.	2-21

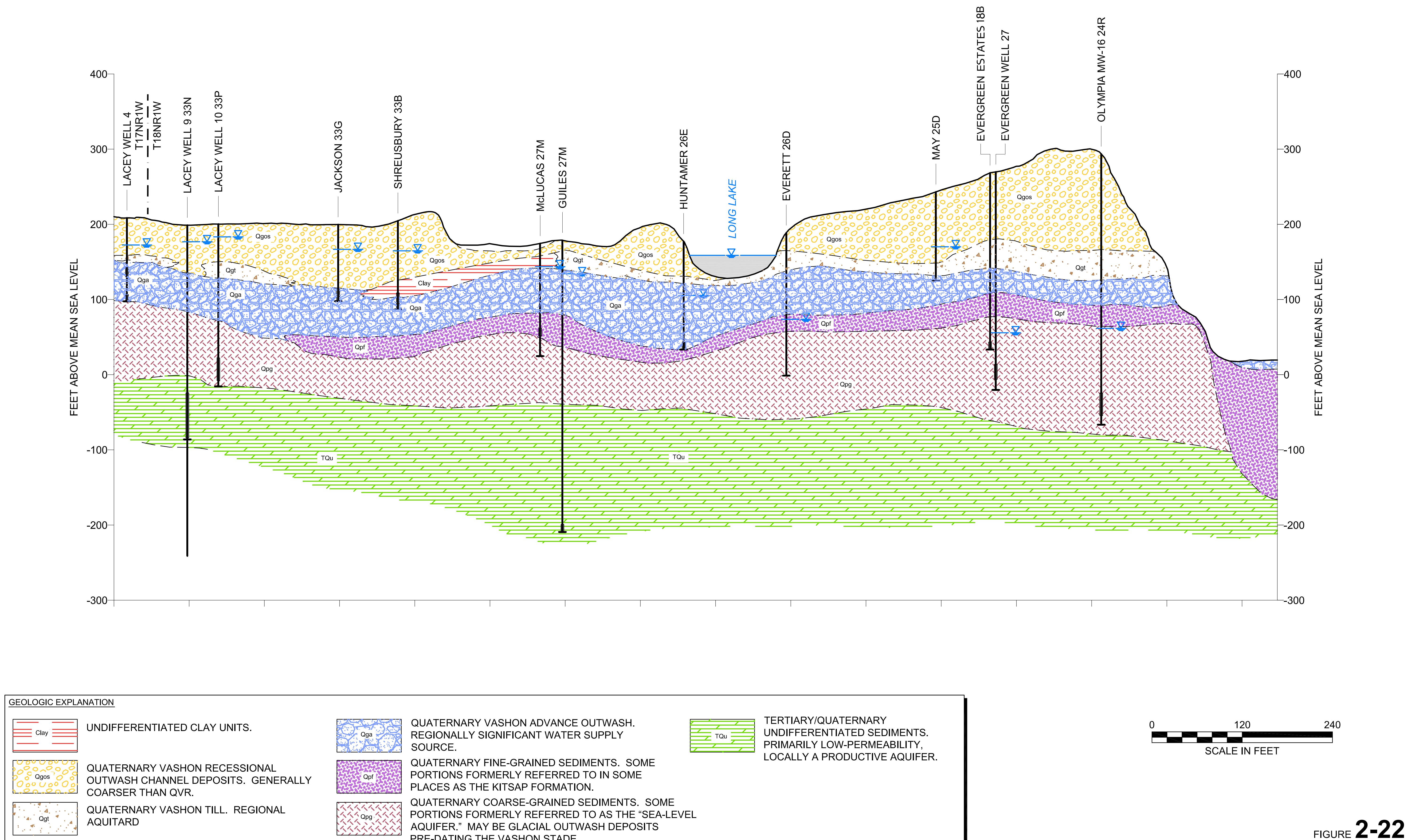


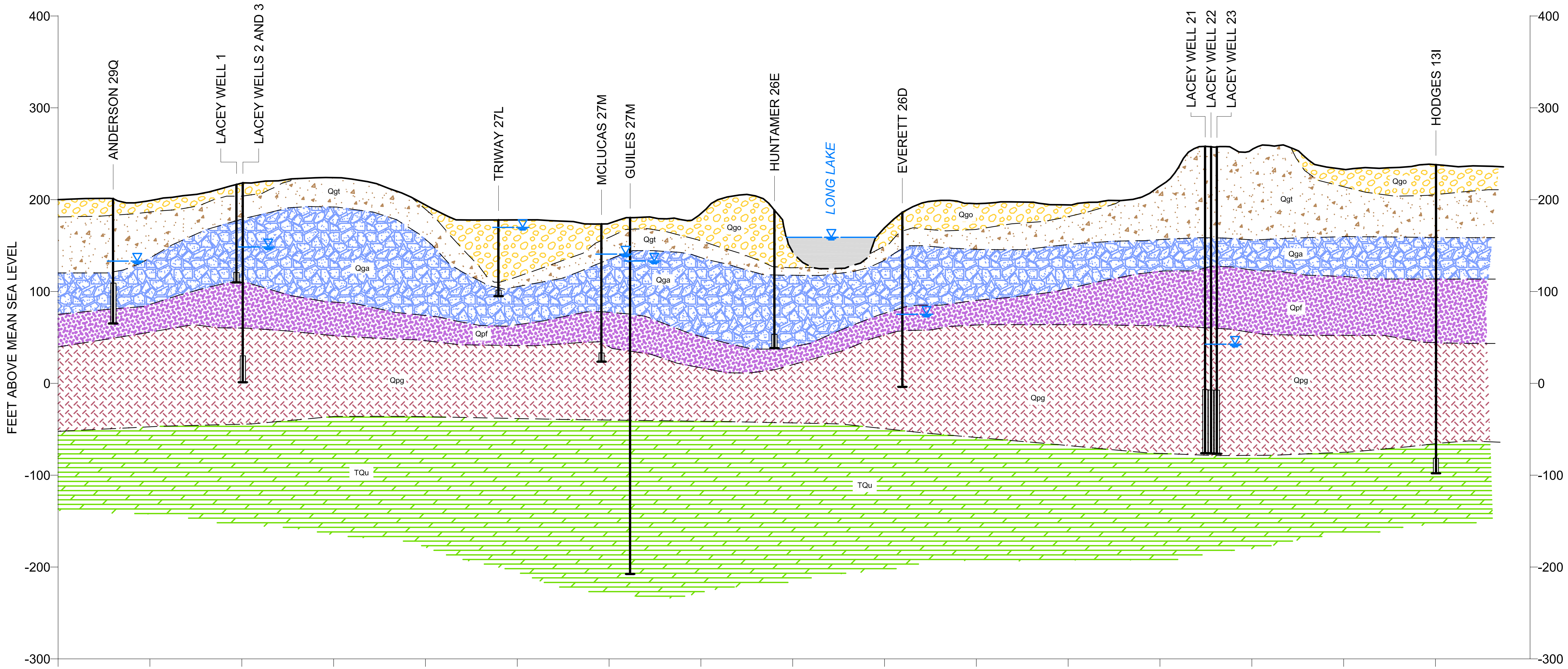
FIGURE **2-22**

NEW HYDROGEOLOGIC SECTION F-F'

WELLHEAD PROTECTION WSP UPDATE/WA (US) \ HYDROGEOLOGIC ASSESSMENT

K:\CAD\Projects\2008\08393334\2\083933342-SECs F-Gr2.dwg | Sec F-F | Mod: 04/22/2010, 14:13 | Plotted: 04/22/2010, 14:14 | aforcier

Golder Associates



GEOLOGIC EXPLANATION

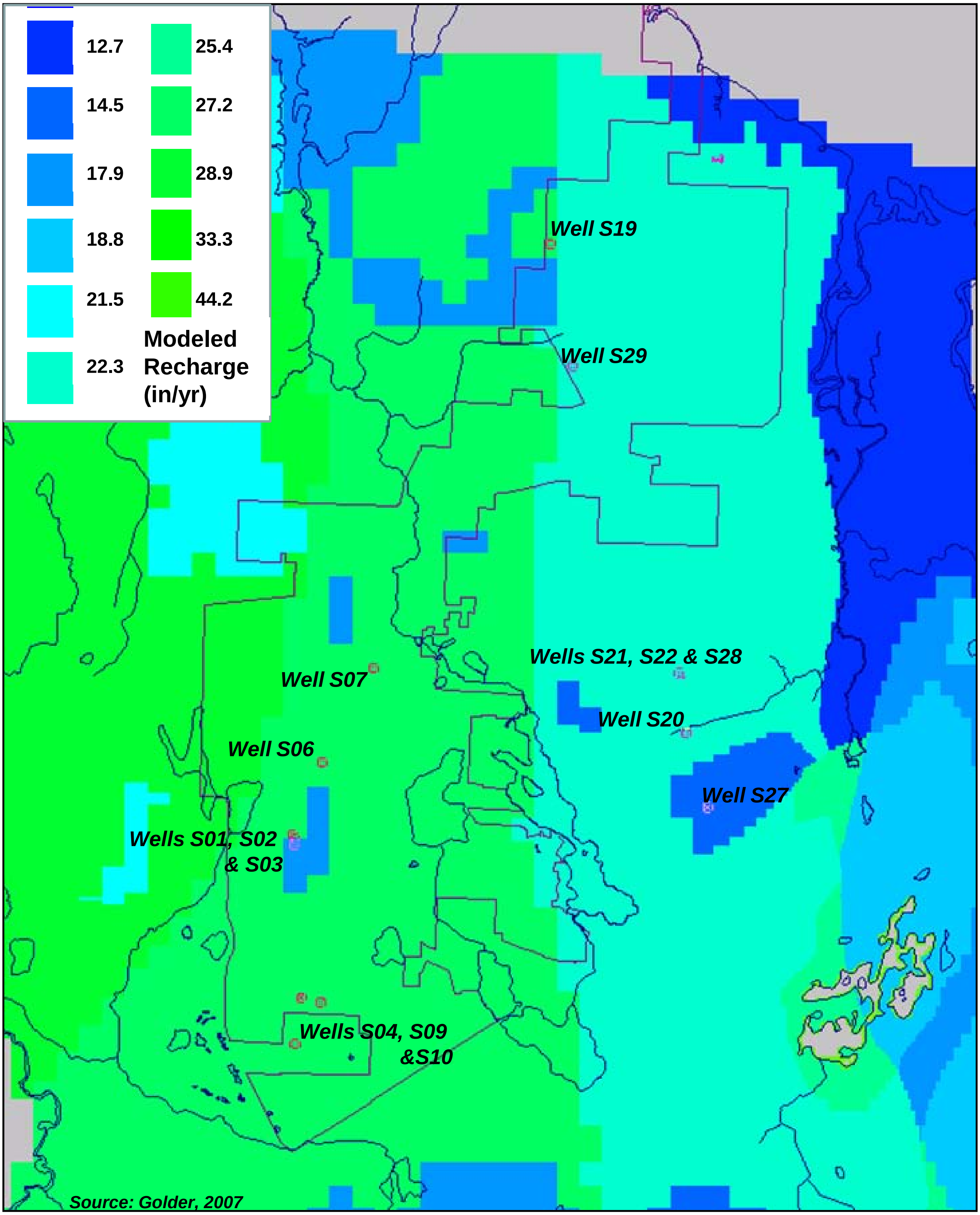
Clay	UNDIFFERENTIATED CLAY UNITS.
Qgos	QUATERNARY VASHON RECESSIONAL OUTWASH CHANNEL DEPOSITS. GENERALLY COARSER THAN QVR.
Qgt	QUATERNARY VASHON TILL. REGIONAL AQUITARD
Qga	QUATERNARY VASHON ADVANCE OUTWASH. REGIONALLY SIGNIFICANT WATER SUPPLY SOURCE.
Qpf	QUATERNARY FINE-GRAINED SEDIMENTS. SOME PORTIONS FORMERLY REFERRED TO IN SOME PLACES AS THE KITSAP FORMATION.
Qpg	QUATERNARY COARSE-GRAINED SEDIMENTS. SOME PORTIONS FORMERLY REFERRED TO AS THE "SEA-LEVEL AQUIFER." MAY BE GLACIAL OUTWASH DEPOSITS PRE-DATING THE VASHON STADE.
TQu	TERTIARY/QUATERNARY UNDIFFERENTIATED SEDIMENTS. PRIMARILY LOW-PERMEABILITY, LOCALLY A PRODUCTIVE AQUIFER.

0 120 240
SCALE IN FEET

FIGURE **2-23**

NEW HYDROGEOLOGIC SECTION G-G'

WELLHEAD PROTECTION WSP UPDATE/WA (US) \ HYDROGEOLOGIC ASSESSMENT

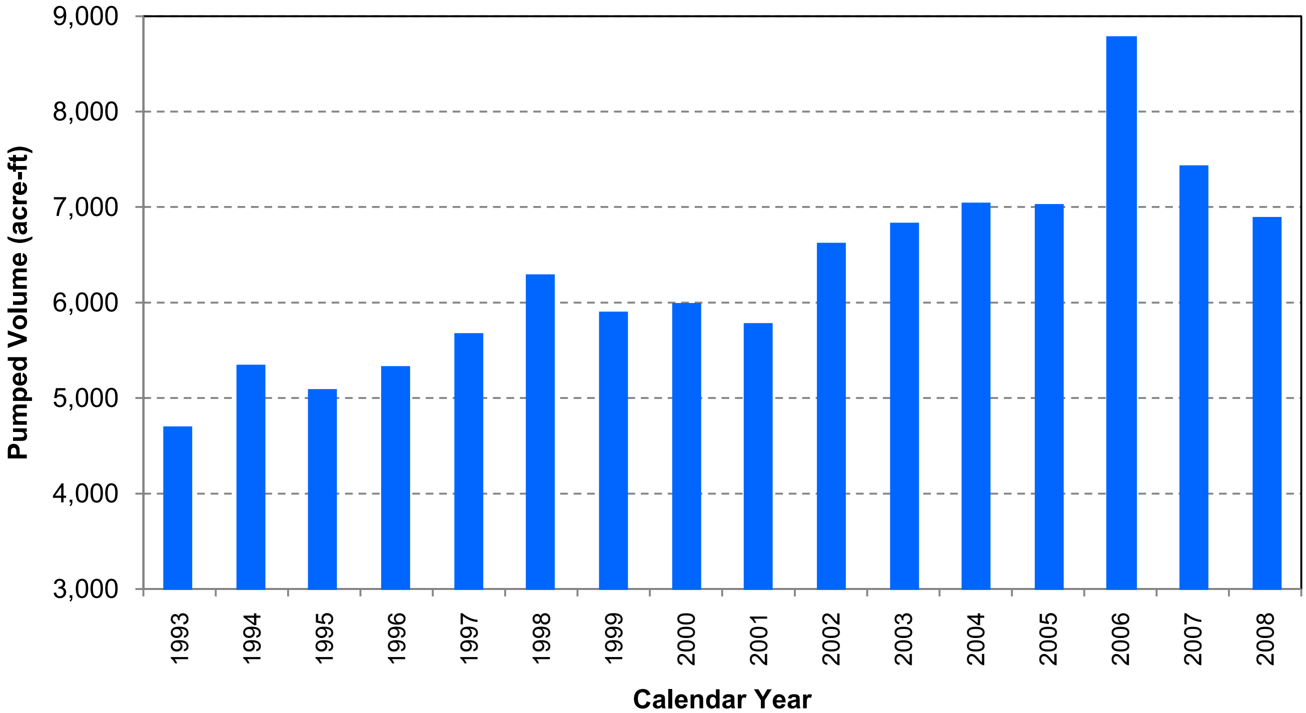


Golder Associates

TITLE **Simulated Groundwater Recharge from Precipitation in the Lacey Area**

City of Lacey - Water System Plan Update 2009

DRAWN	SDT	DATE	5/14/10	PROJECT No.	083.93334
CHECKED	EA	SCALE		DWG No.	
REVIEWED	PAB	FILE No.	Sec2_port.ppt	FIGURE No.	2-24

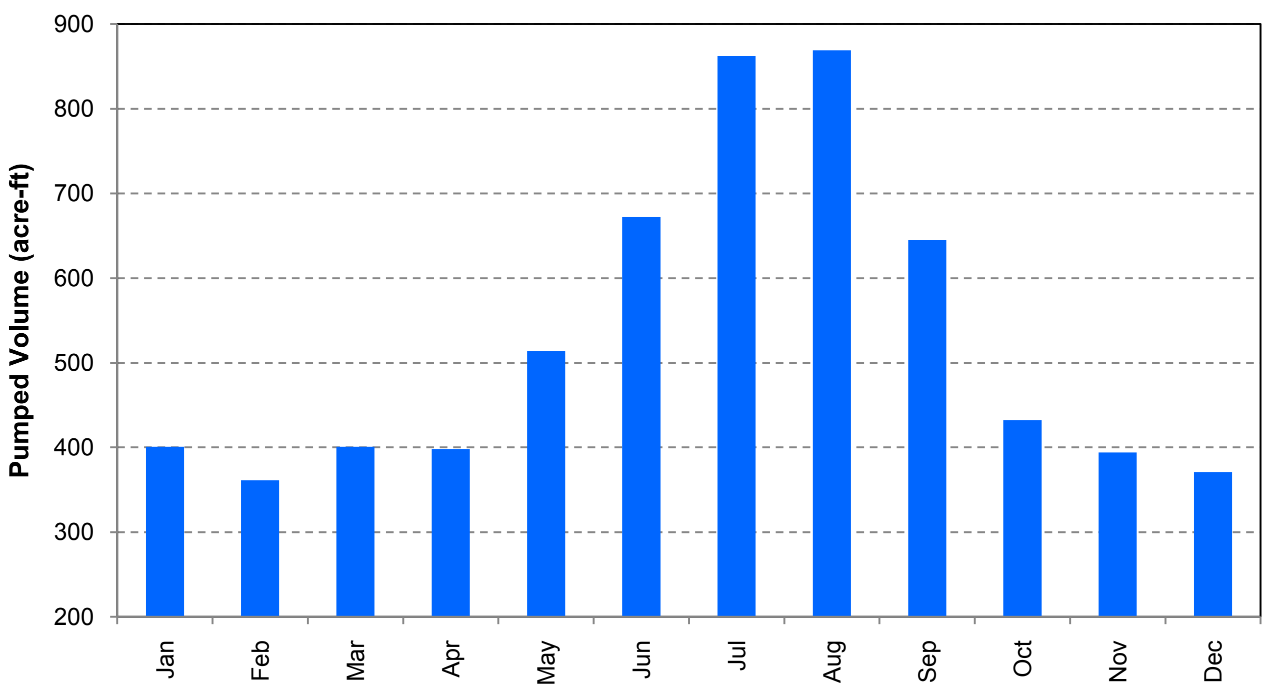


Golder Associates

City of Lacey - Water System Plan Update 2009

TITLE
Annual Groundwater Production – 1993-2008

DRAWN SDT	DATE 5/14/10	PROJECT No. 083.93334
CHECKED EA	SCALE	DWG No.
REVIEWED PAB	FILE No. Sec2_port.ppt	FIGURE No. 2-25

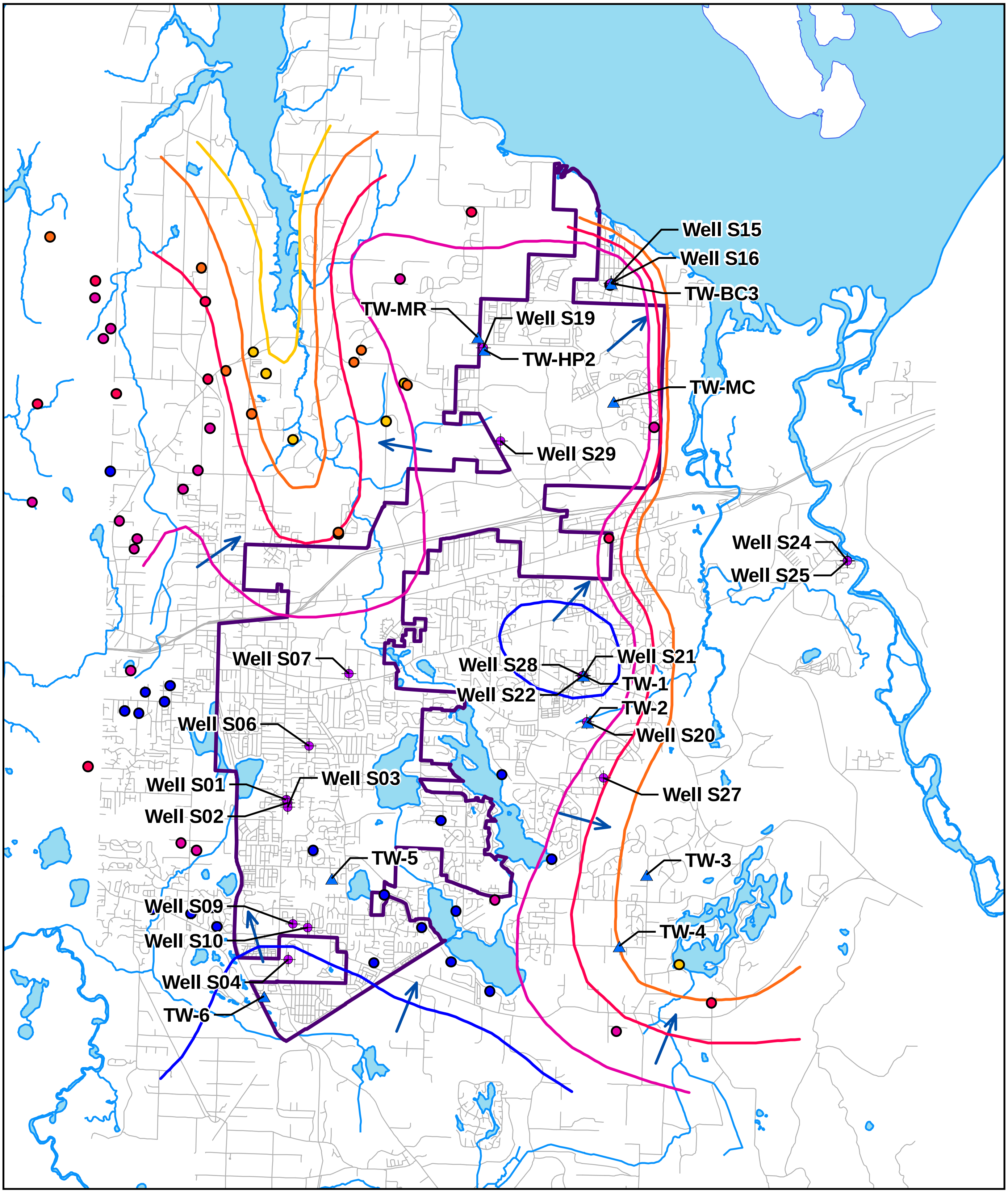


Golder Associates

City of Lacey - Water System Plan Update 2009

TITLE
Average Monthly Groundwater Production – 1993-2008

DRAWN SDT	DATE 5/14/10	PROJECT No. 083.93334
CHECKED EA	SCALE	DWG No.
REVIEWED PAB	FILE No. Sec2_port.ppt	FIGURE No. 2-26



This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

LEGEND

Production Well
Test Well
Groundwater Flow Direction
Lacey City Limit

Observed Groundwater Elevation (ft msl)	Groundwater Contour (ft msl)
26 - 75	75
75 - 100	100
100 - 125	125
125 - 150	150
150 - 175	175

0 8000
Scale in Feet

N

Map Projection:
Washington State Plane
South Zone NAD 1983
Source:
Carollo, WA DNR,
Golder Associates Inc.

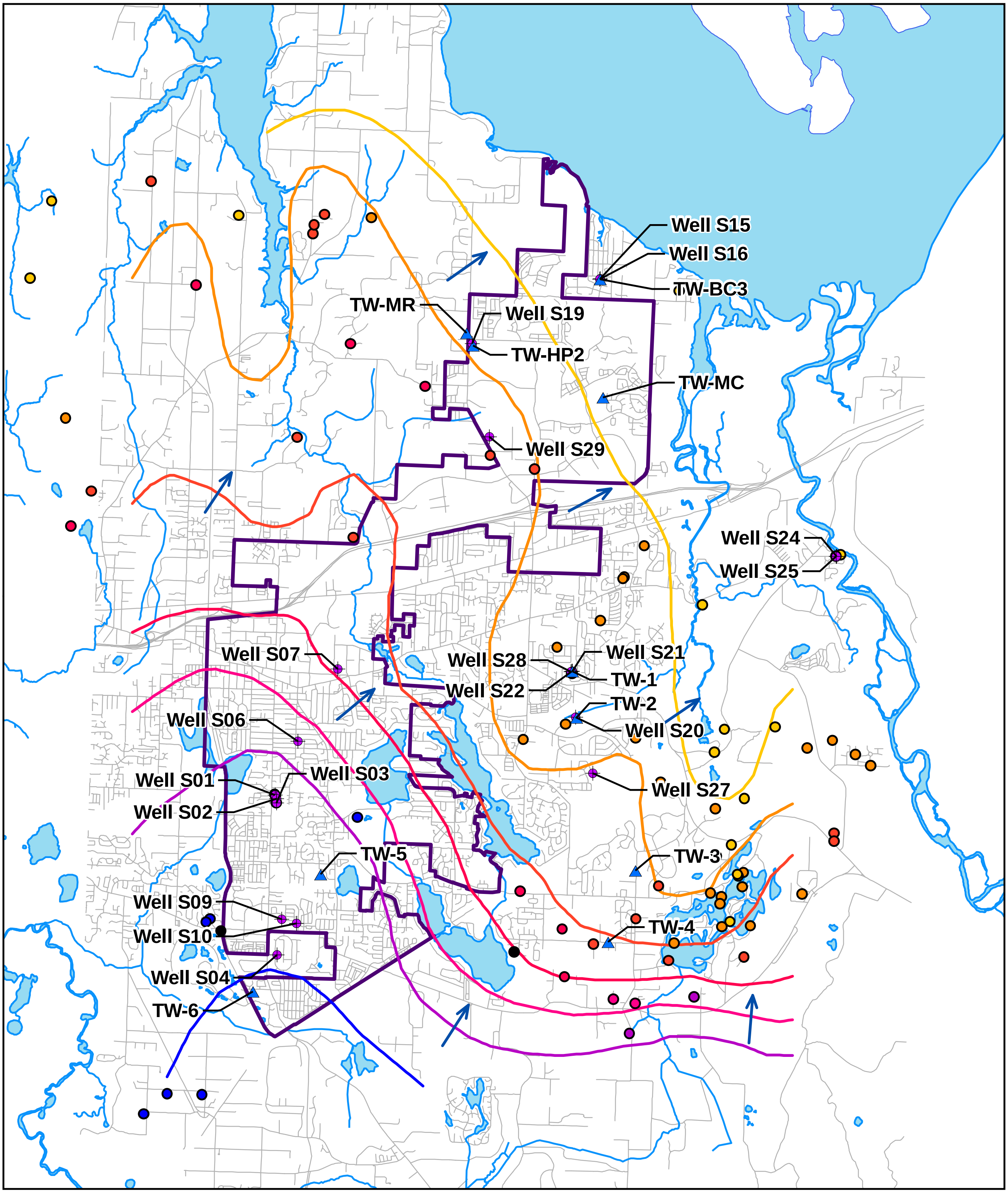
FIGURE **2-27**

INTERPRETED GROUNDWATER CONTOURS - QGA AQUIFER

WELLHEAD PROTECTION WSP UPDATE/WA

08393334F43_GroundwaterContours_QGA.mxd | 3/15/2010 | THAMMOND

Golder Associates



LEGEND

Production Well
Test Well
Groundwater Flow Direction
Lacey City Limit

Observed Groundwater Elevation (ft msl)	Groundwater Contour (ft msl)
0 - 25	25
25 - 50	50
50 - 75	75
75 - 100	100
100 - 125	125
125 - 150	150
150 - 175	175

0 8000
Scale in Feet

N

Map Projection:
Washington State Plane
South Zone NAD 1983

Source:
Carollo, WA DNR,
Golder Associates Inc.

This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

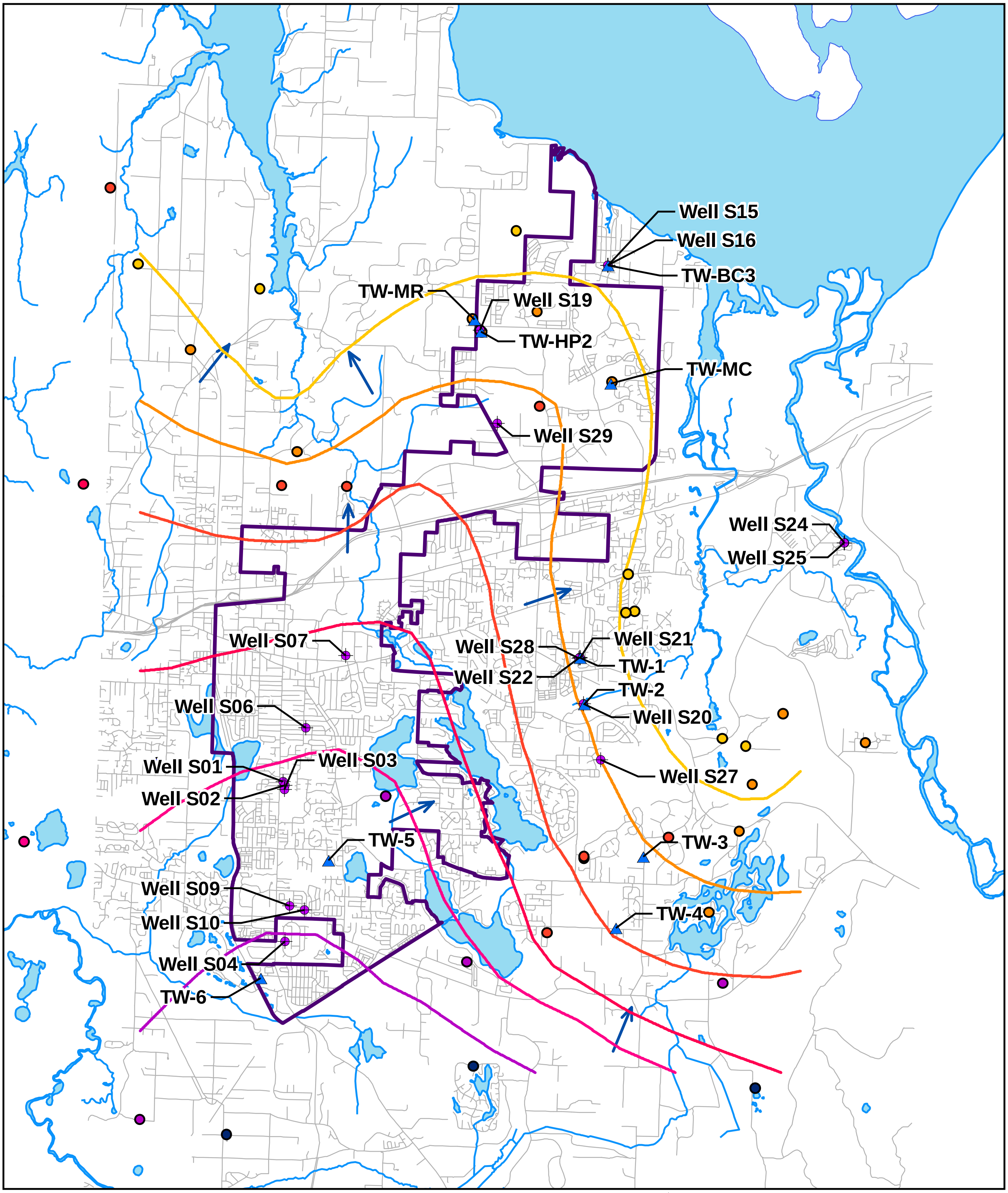
FIGURE **2-28**

INTERPRETED GROUNDWATER CONTOURS - QPG AQUIFER

WELLHEAD PROTECTION WSP UPDATE/WA

08393334F44_GroundwaterContours_QPG.mxd | 3/15/2010 | THAMMOND

Golder Associates



LEGEND

Production Well
Test Well
Groundwater Flow Direction
Lacey City Limit

Observed Groundwater Elevation (ft msl)	
0 - 25	125 - 150
25 - 50	150 - 175
50 - 75	175 - 200
75 - 100	200 - 300
100 - 125	300 - 400

Groundwater Contour (ft msl)
25
50
75
100
125
150

0 8000
Scale in Feet

Map Projection:
Washington State Plane
South Zone NAD 1983

Source:
Corollo, WA DNR,
Golder Associates Inc.

N

This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

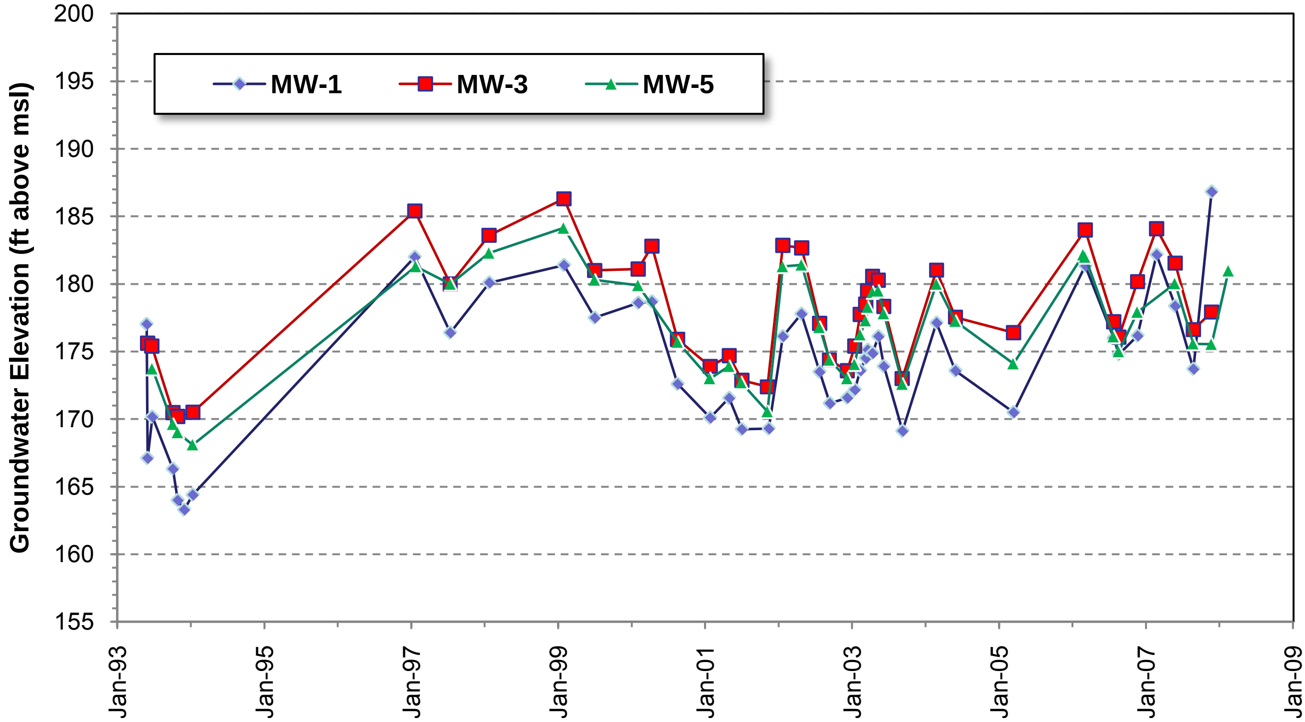
FIGURE **2-29**

INTERPRETED GROUNDWATER CONTOURS - TQU AQUIFER

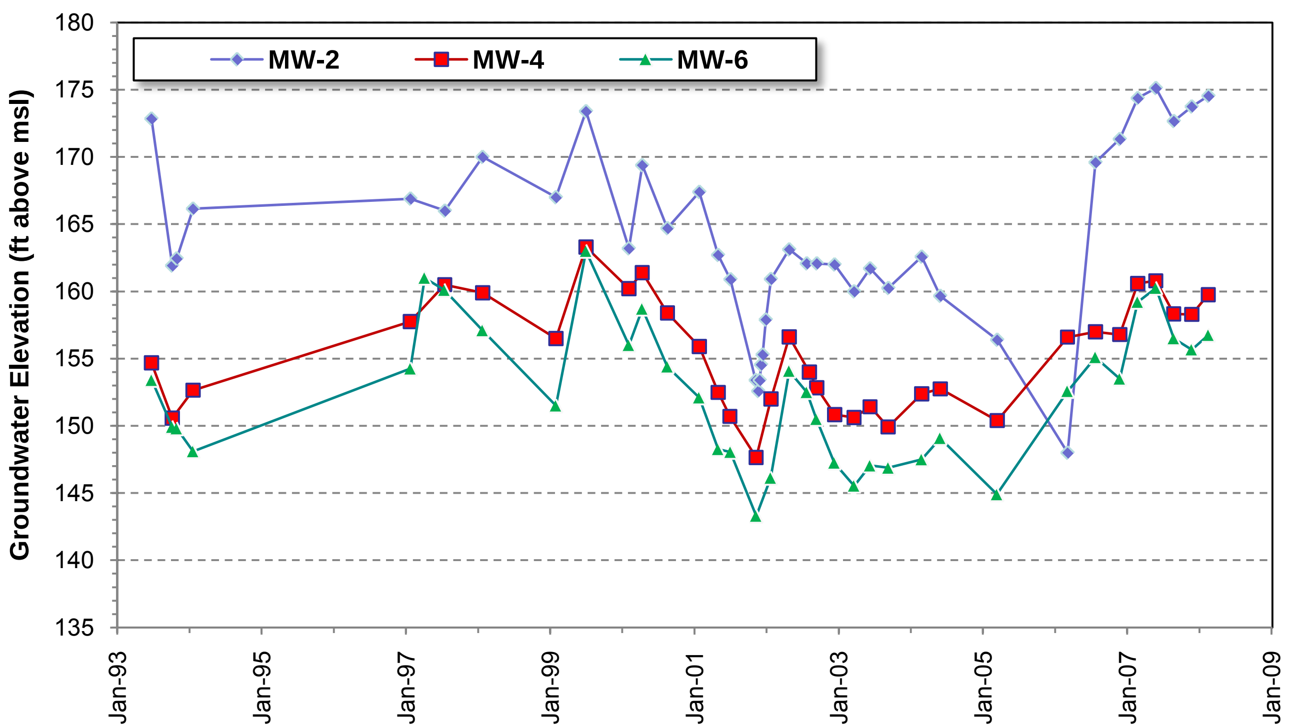
WELLHEADS PROTECTION WSP UPDATE/WA

08393334F45_GroundwaterContours_TQU.mxd | 3/15/2010 | THAMMOND

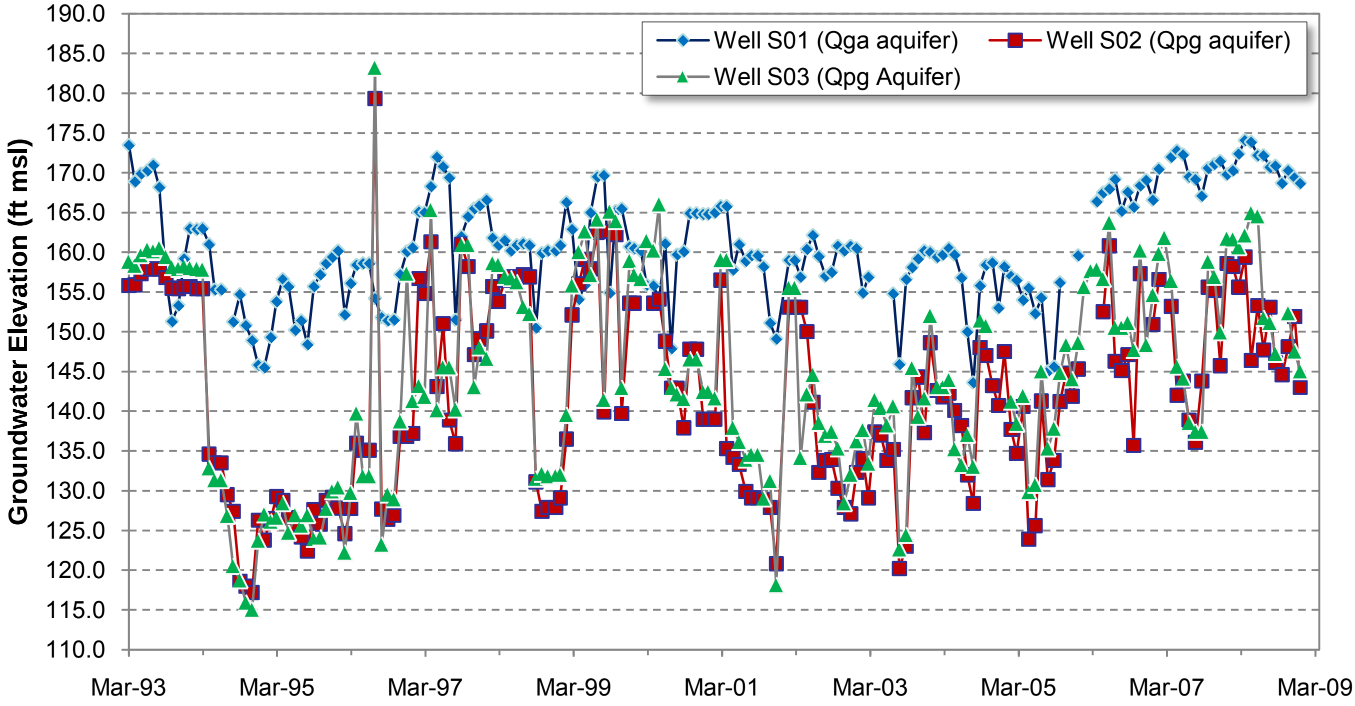
Golder Associates



Golder Associates	TITLE Groundwater Levels in Lacey Monitoring Wells MW-1, MW-3 and MW-5 – 1993-2008				
City of Lacey - Water System Plan Update 2009	DRAWN SDT	DATE 5/14/10	PROJECT No. 083.93334		
	CHECKED EA	SCALE	DWG No.		
	REVIEWED PAB	FILE No. Sec2_port.ppt	FIGURE No. 2-30		



Golder Associates	TITLE Groundwater Levels in Lacey Monitoring Wells MW-2, MW-4 and MW-6 – 1993-2008				
City of Lacey - Water System Plan Update 2009	DRAWN SDT	DATE 5/14/10	PROJECT No. 083.93334		
	CHECKED EA	SCALE	DWG No.		
	REVIEWED PAB	FILE No. Sec2_port.ppt	FIGURE No. 2-31		

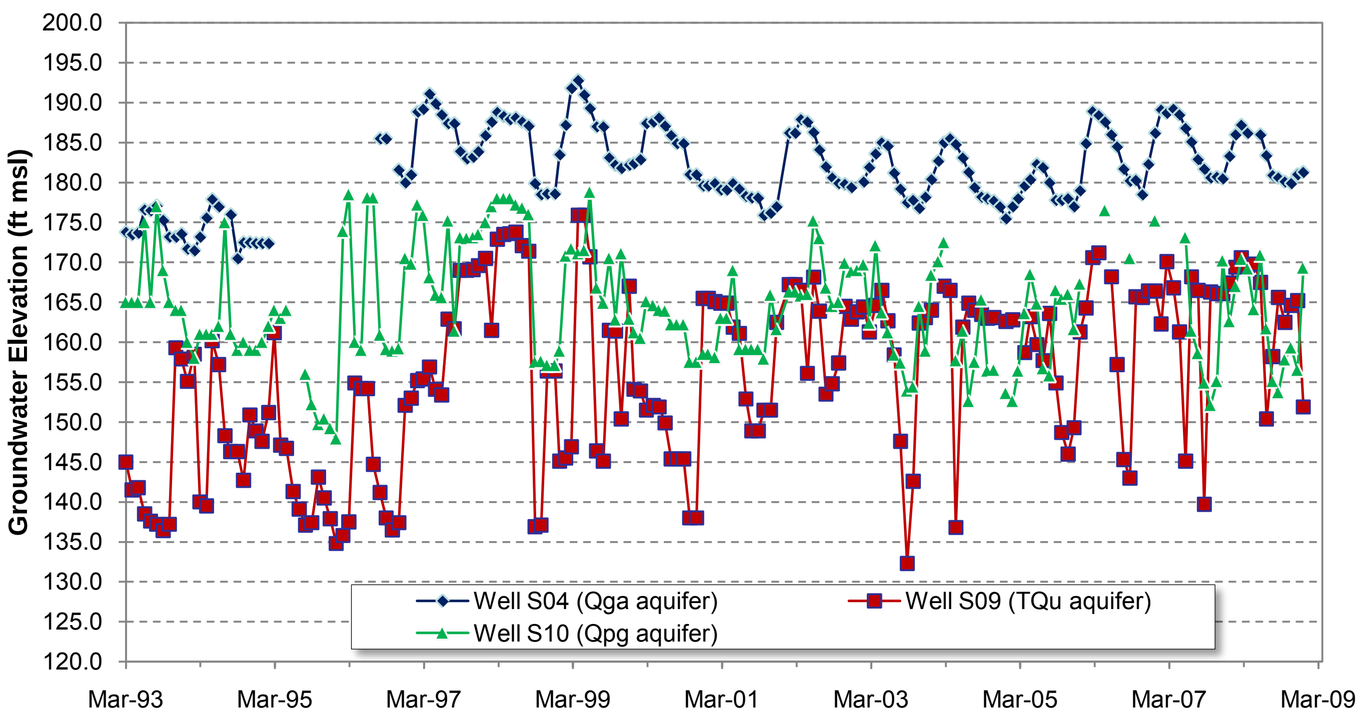


Golder Associates

TITLE **Static Groundwater Levels in Lacey Production Wells S01, S02 & S03 – 1993-2008**

City of Lacey - Water System Plan Update 2009

DRAWN	SDT	DATE	5/14/10	PROJECT No.	083.93334
CHECKED	EA	SCALE		DWG No.	
REVIEWED	PAB	FILE No.	Sec2_port.ppt	FIGURE No.	2-32

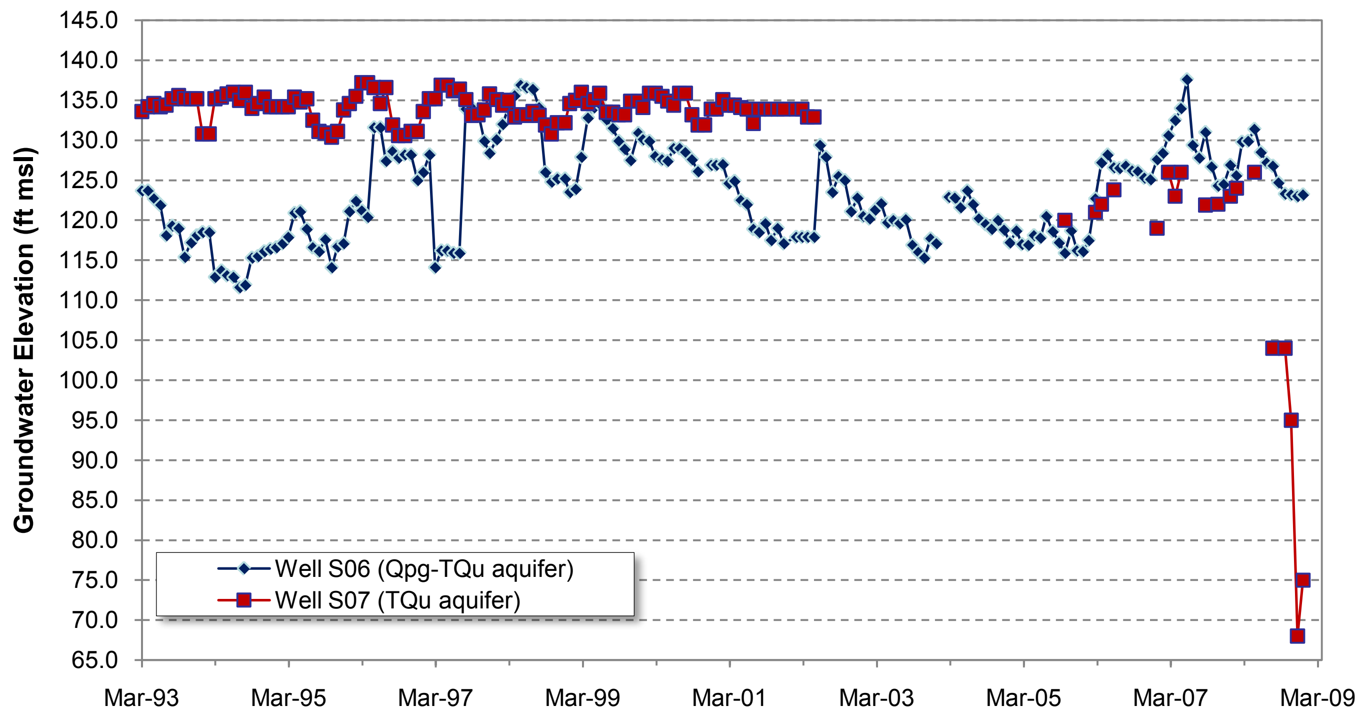


Golder Associates

TITLE **Static Groundwater Levels in Lacey Production Wells S04, S09 & S10 – 1993-2008**

City of Lacey - Water System Plan Update 2009

DRAWN	SDT	DATE	5/14/10	PROJECT No.	083.93334
CHECKED	EA	SCALE		DWG No.	
REVIEWED	PAB	FILE No.	Sec2_port.ppt	FIGURE No.	2-33

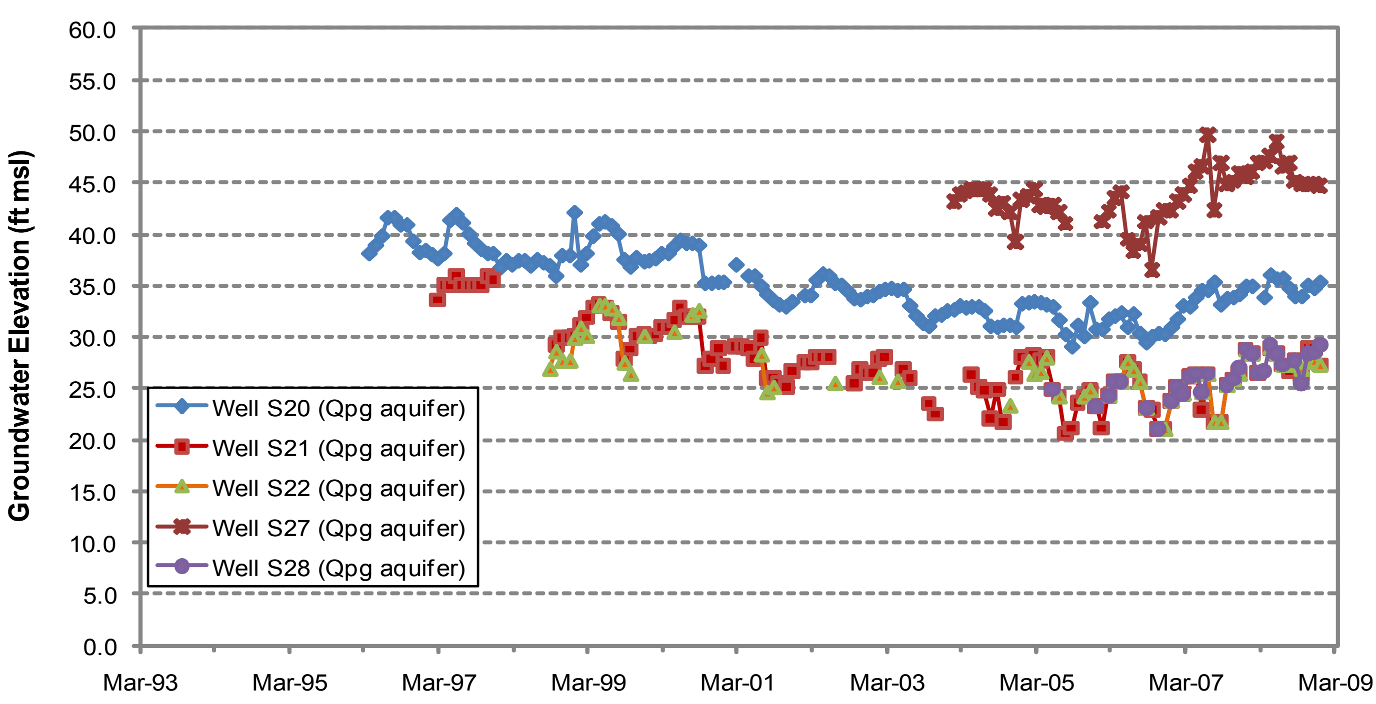


Golder Associates

TITLE **Static Groundwater Levels in Lacey Production Wells S06 & S07 – 1993-2008**

City of Lacey - Water System Plan Update 2009

DRAWN	SDT	DATE	5/14/10	PROJECT No.	083.93334
CHECKED	EA	SCALE		DWG No.	
REVIEWED	PAB	FILE No.	Sec2_port.ppt	FIGURE No.	2-34

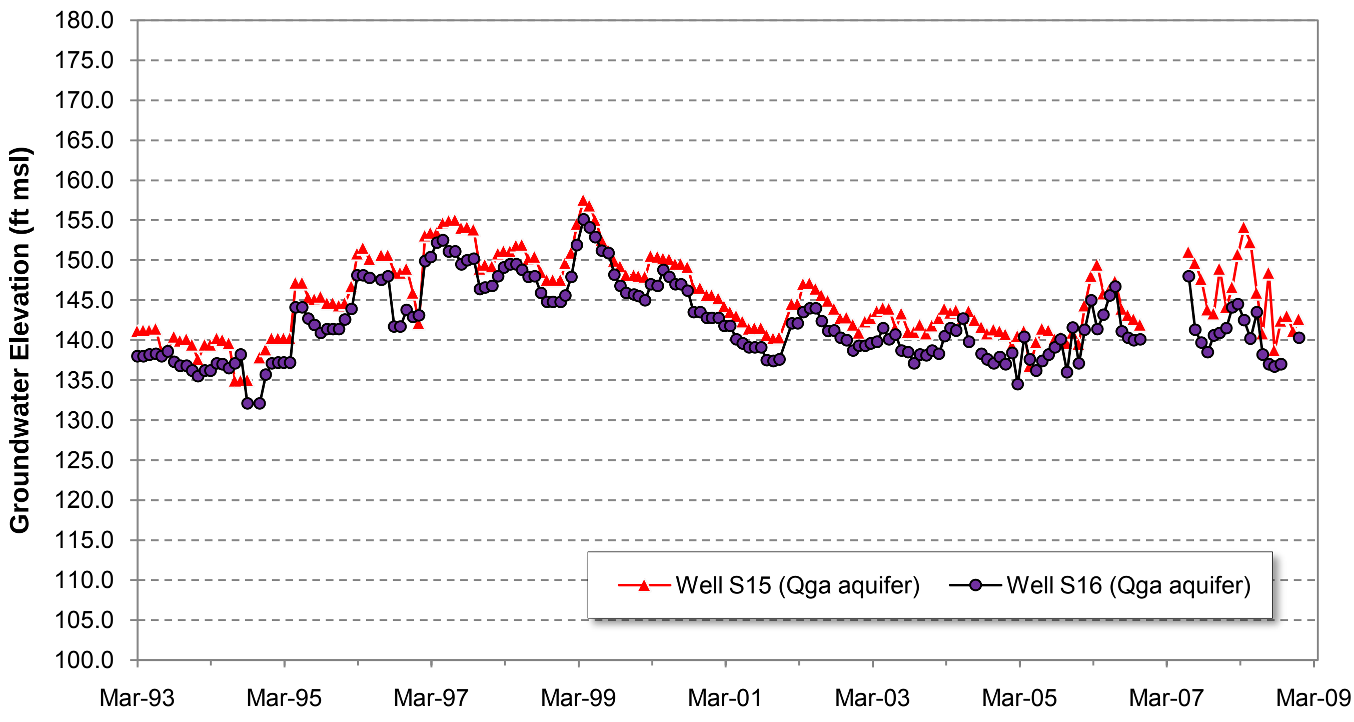


Golder Associates

TITLE **Static Groundwater Levels in Production Wells S20, S21, S22 S27 & S28 – 1993-2008**

City of Lacey - Water System Plan Update 2009

DRAWN	SDT	DATE	5/14/10	PROJECT No.	083.93334
CHECKED	EA	SCALE		DWG No.	
REVIEWED	PAB	FILE No.	Sec2_port.ppt	FIGURE No.	2-35



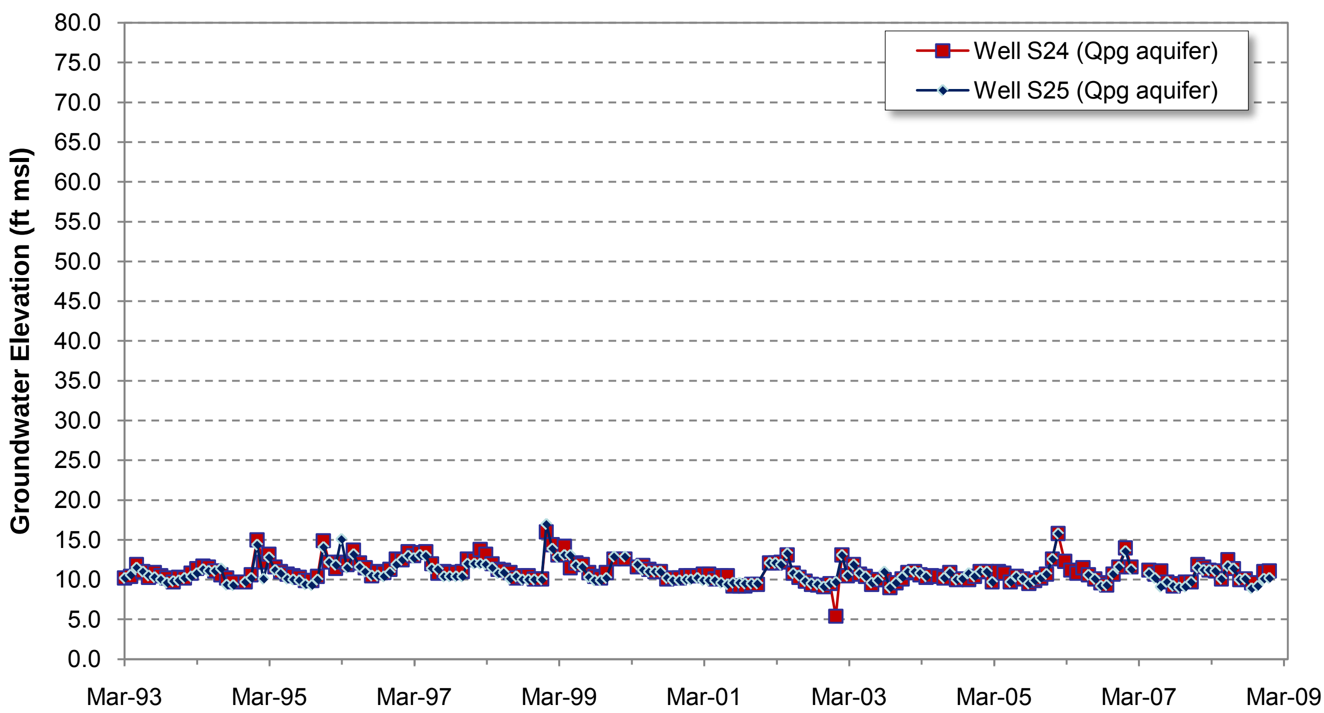
Golder Associates

TITLE

Static Groundwater Levels in Production Wells S15 & S16 – 1993-2008

City of Lacey - Water System Plan Update 2009

DRAWN	SDT	DATE	5/14/10	PROJECT No.	083.93334
CHECKED	EA	SCALE		DWG No.	
REVIEWED	PAB	FILE No.	Sec2_port.ppt	FIGURE No.	2-36



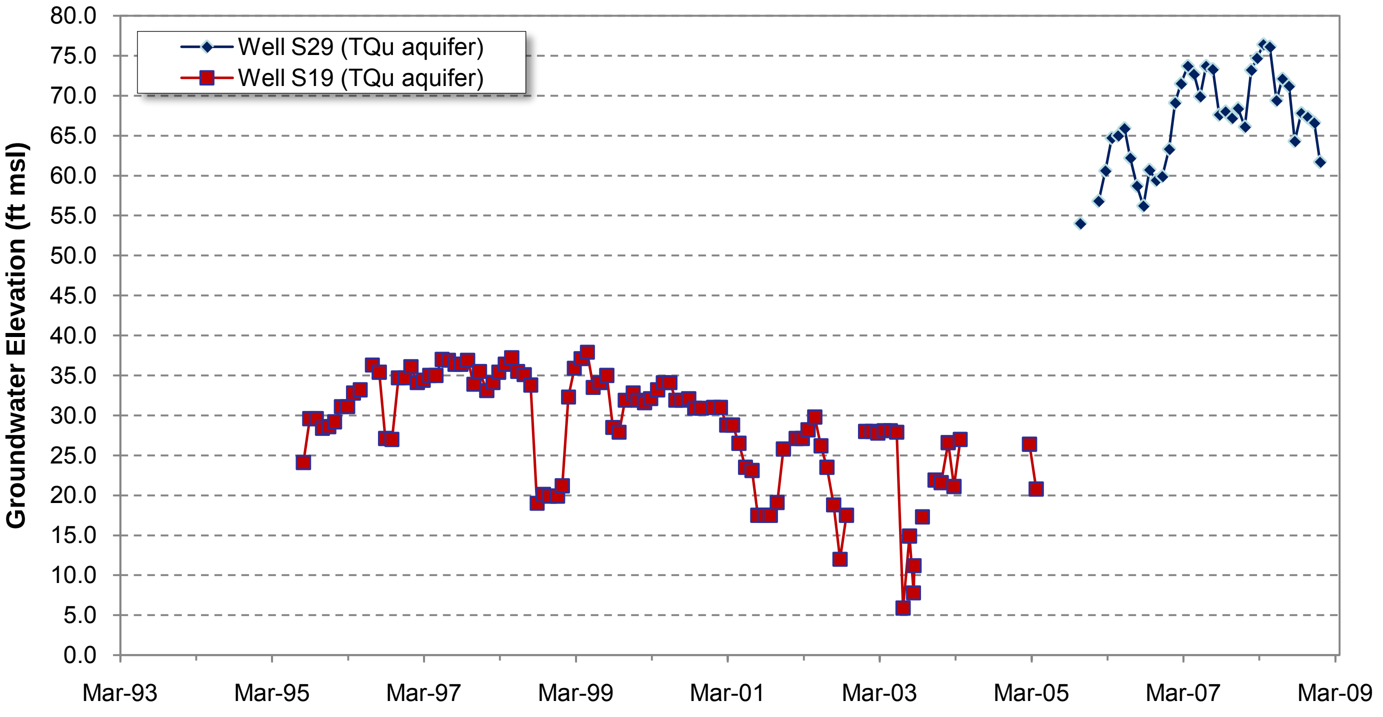
Golder Associates

TITLE

Static Groundwater Levels in Production Wells S24 & S25 – 1993-2008

City of Lacey - Water System Plan Update 2009

DRAWN	SDT	DATE	5/14/10	PROJECT No.	083.93334
CHECKED	EA	SCALE		DWG No.	
REVIEWED	PAB	FILE No.	Sec2_port.ppt	FIGURE No.	2-37



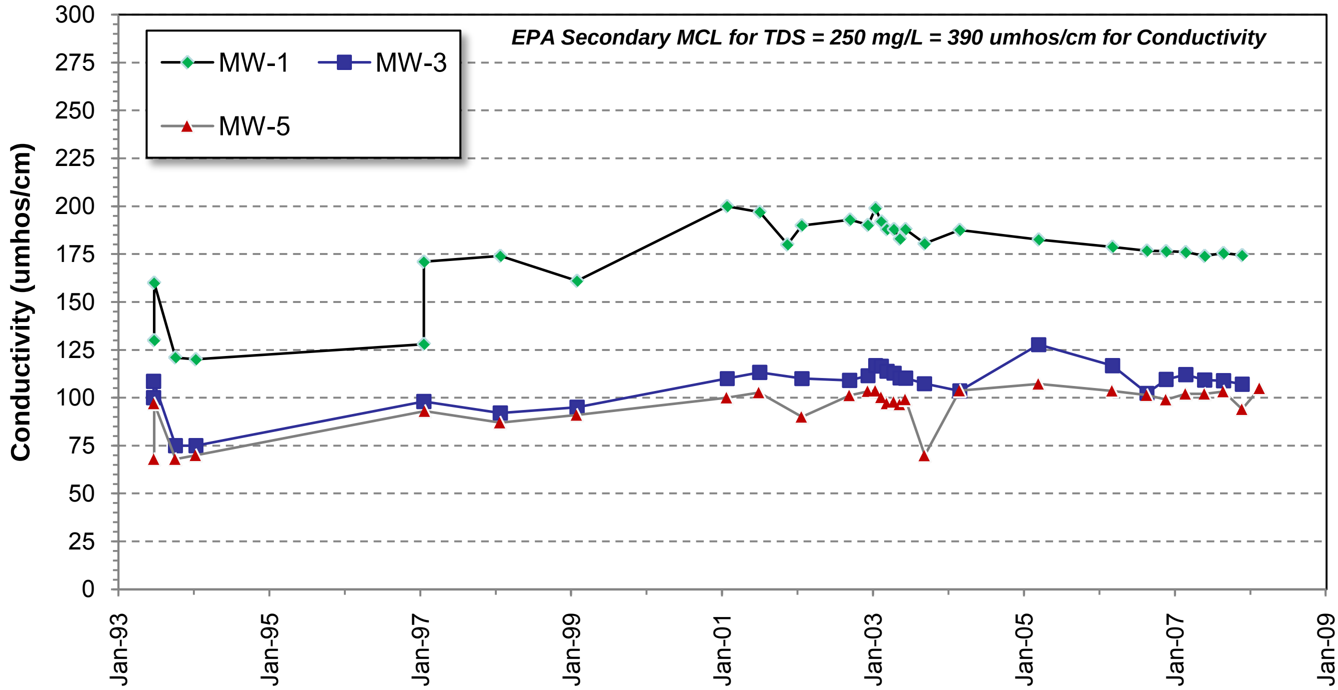
Golder Associates

TITLE

Static Groundwater Levels in Production Wells S19 & S29 – 1993-2008

City of Lacey - Water System Plan Update 2009

DRAWN	SDT	DATE	5/14/10	PROJECT No.	083.93334
CHECKED	EA	SCALE		DWG No.	
REVIEWED	PAB	FILE No.	Sec2_port.ppt	FIGURE No.	2-38



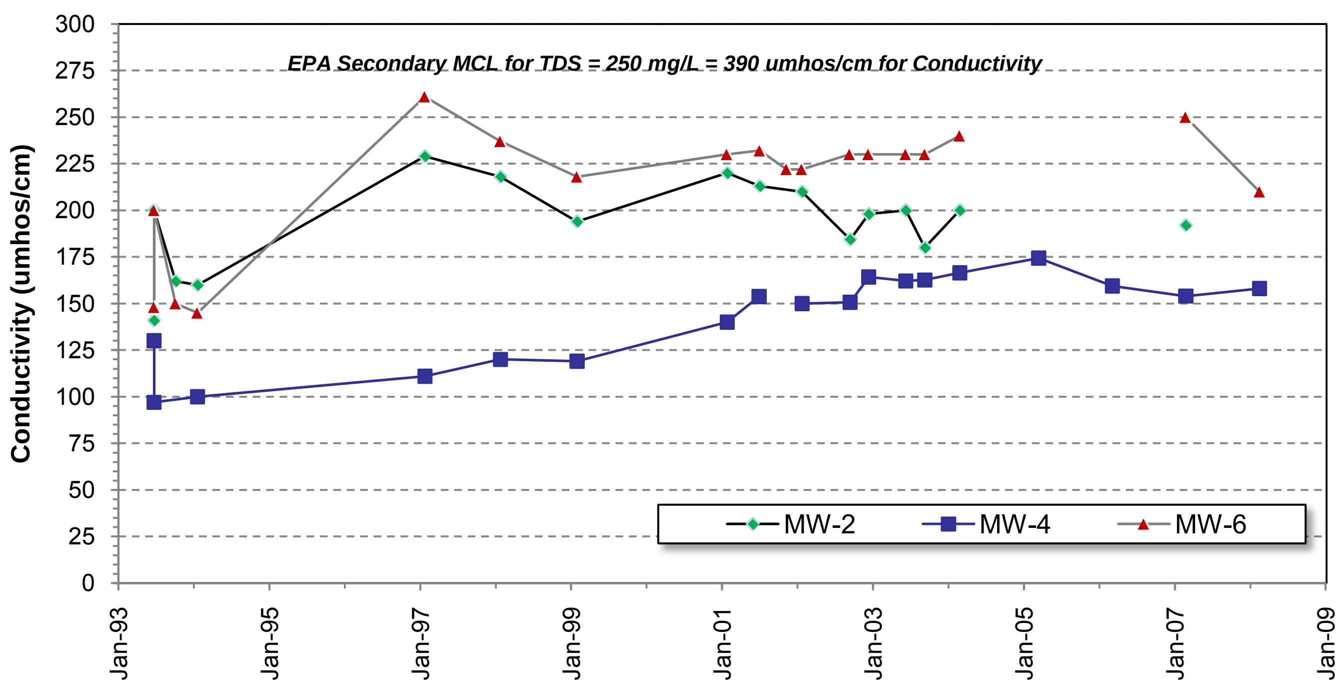
TITLE

Conductivity in Lacey Monitoring Wells MW-1, MW-3 & MW-5 – 1993-2008

Golder Associates

City of Lacey - Water System Plan Update 2009

DRAWN	SDT	DATE	5/14/10	PROJECT No.	083.93334
CHECKED	EA	SCALE		DWG No.	
REVIEWED	PAB	FILE No.	Sec2_port.ppt	FIGURE No.	2-39



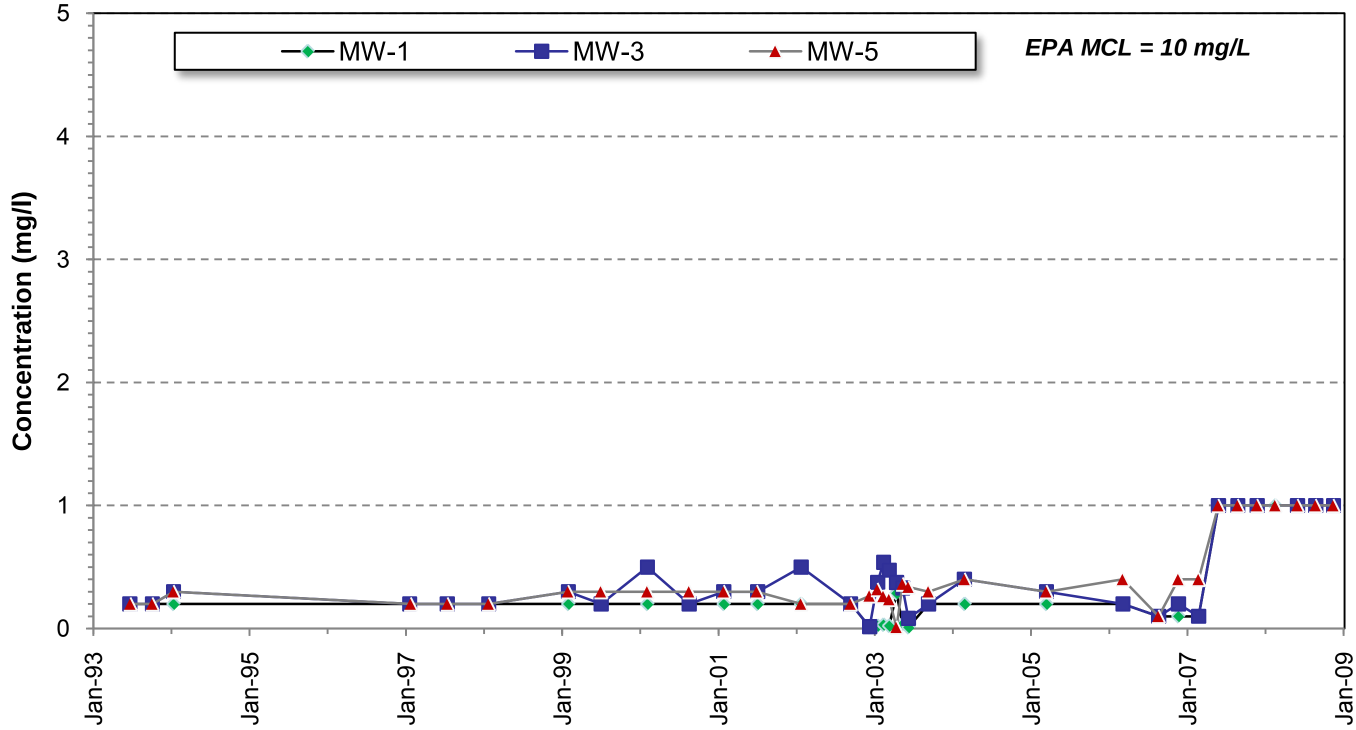
TITLE

Conductivity in Lacey Monitoring Wells MW-2, MW-4 & MW-6 - 1993-2008

Golder Associates

City of Lacey - Water System Plan Update 2009

DRAWN	SDT	DATE	5/14/10	PROJECT No.	083.93334
CHECKED	EA	SCALE		DWG No.	
REVIEWED	PAB	FILE No.	Sec2_port.ppt	FIGURE No.	2-40



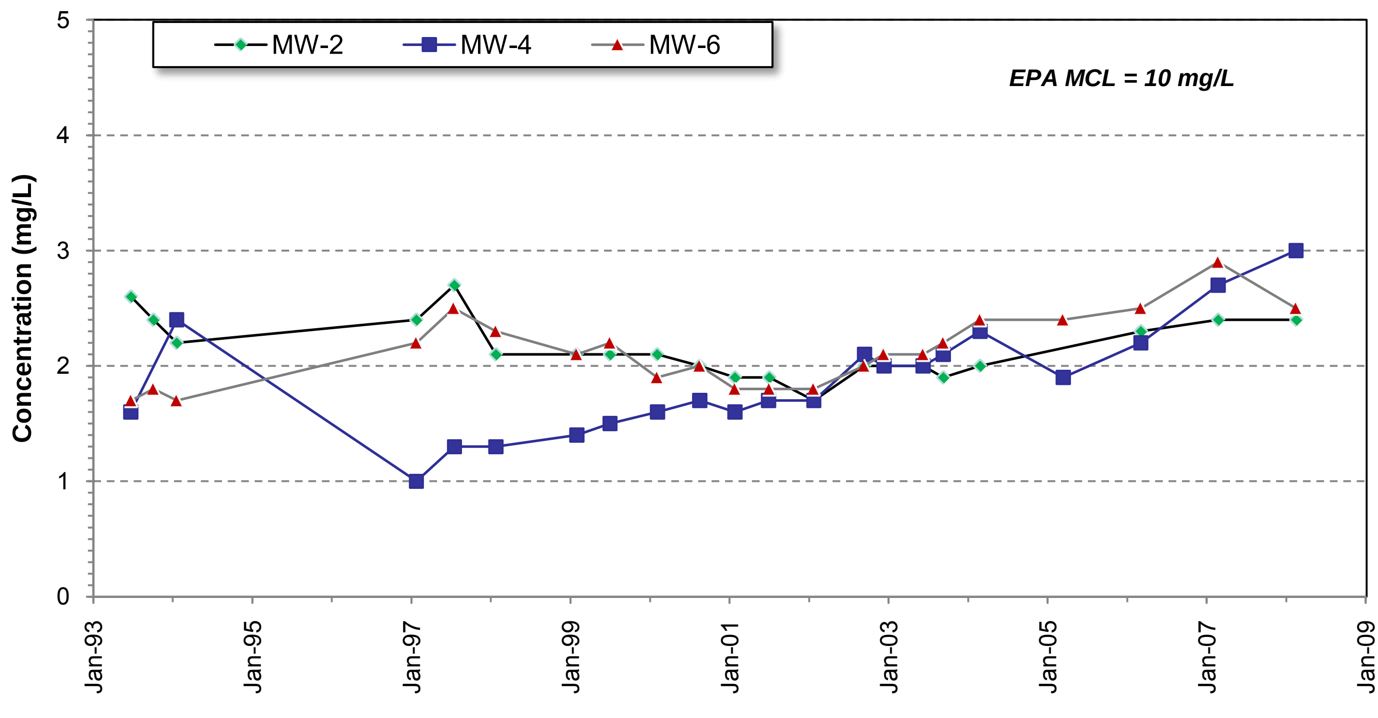
Golder Associates

TITLE

Nitrate Concentrations in Lacey Monitoring Wells MW-1, MW-3 & MW-5 - 1993-2008

City of Lacey - Water System Plan Update 2009

DRAWN	SDT	DATE	5/14/10	PROJECT No.	083.93334
CHECKED	EA	SCALE		DWG No.	
REVIEWED	PAB	FILE No.	Sec2_port.ppt	FIGURE No.	2-41



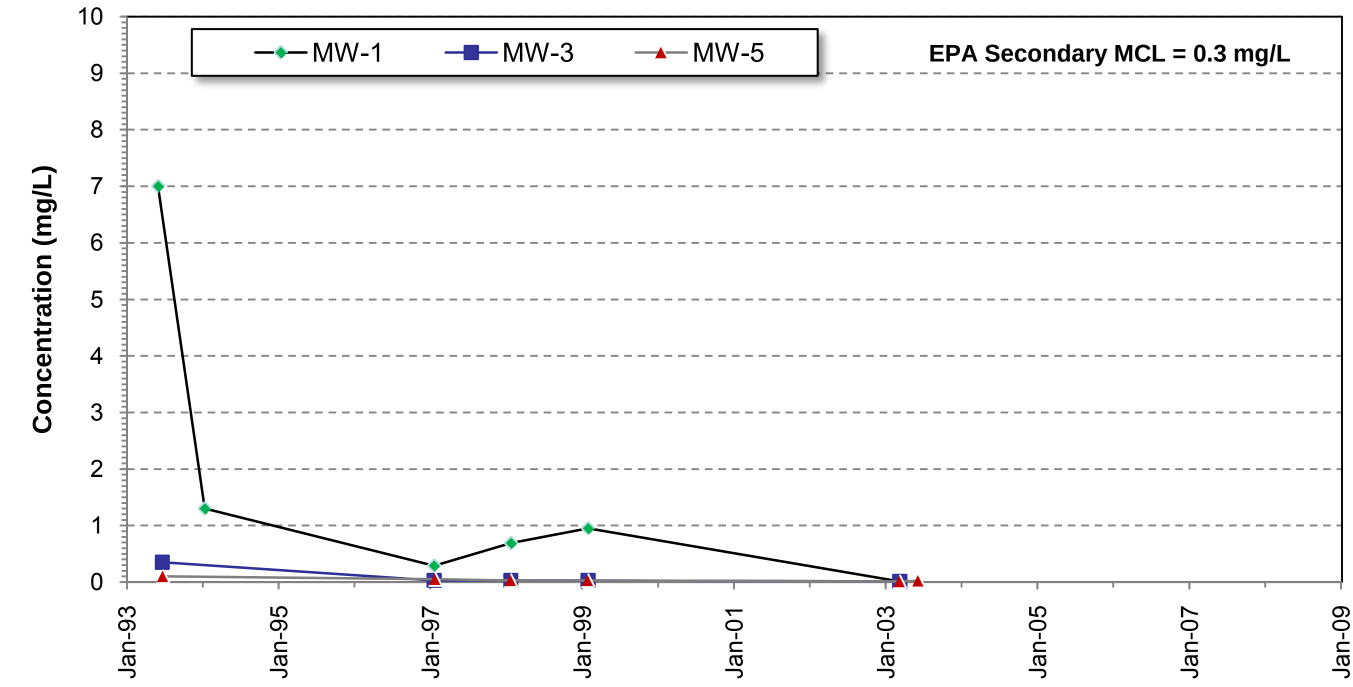
Golder Associates

TITLE

Nitrate Concentrations in Lacey Monitoring Wells MW-2, MW-4 & MW-6- 1993-2008

City of Lacey - Water System Plan Update 2009

DRAWN	SDT	DATE	5/14/10	PROJECT No.	083.93334
CHECKED	EA	SCALE		DWG No.	
REVIEWED	PAB	FILE No.	Sec2_port.ppt	FIGURE No.	2-42



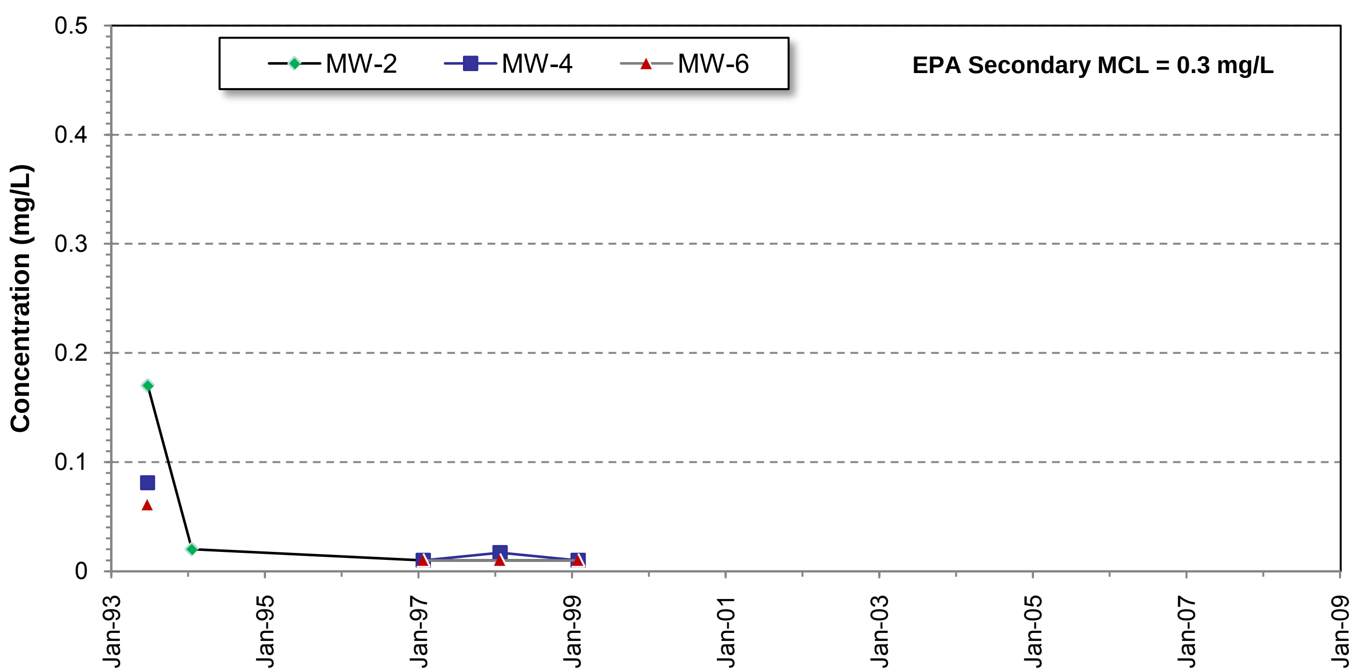
Golder Associates

City of Lacey - Water System Plan Update 2009

TITLE

Iron Concentrations in Lacey Monitoring Wells MW-1, MW-3 & MW-5 – 1993-2008

DRAWN	SDT	DATE	5/14/10	PROJECT No.	083.93334
CHECKED	EA	SCALE		DWG No.	
REVIEWED	PAB	FILE No.	Sec2_port.ppt	FIGURE No.	2-43



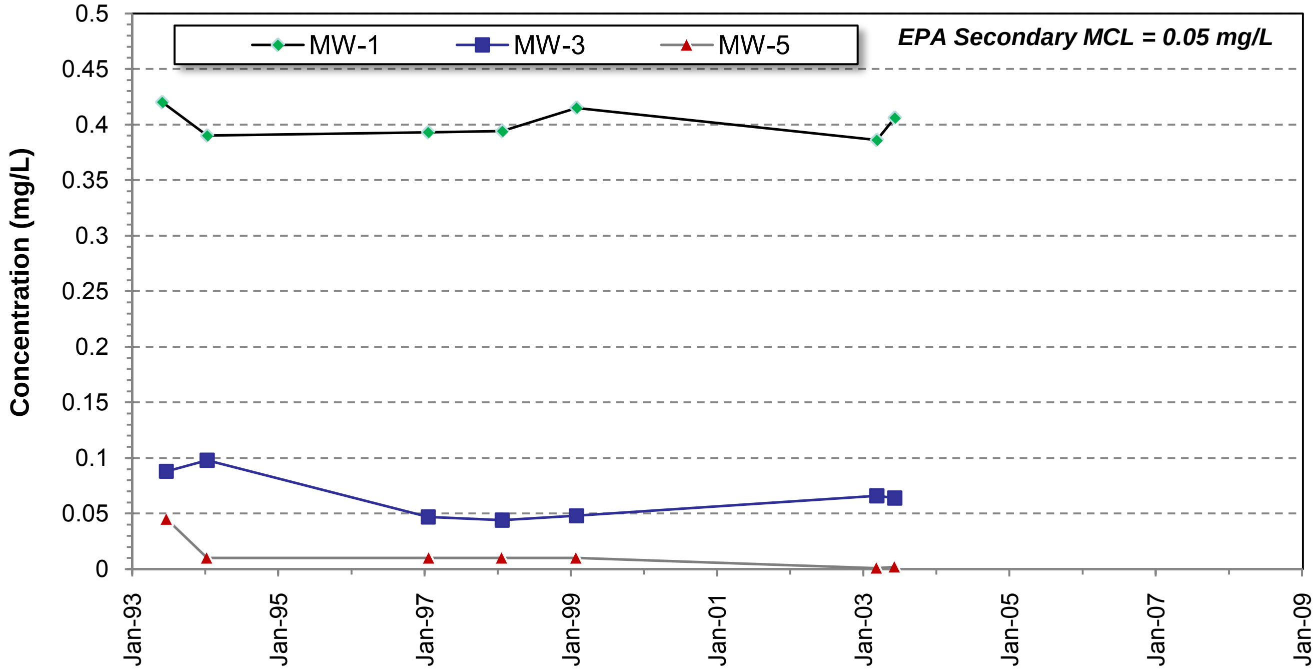
Golder Associates

City of Lacey - Water System Plan Update 2009

TITLE

Iron Concentrations in Lacey Monitoring Wells MW-2, MW-4 & MW-6 – 1993-2008

DRAWN	SDT	DATE	5/14/10	PROJECT No.	083.93334
CHECKED	EA	SCALE		DWG No.	
REVIEWED	PAB	FILE No.	Sec2_port.ppt	FIGURE No.	2-44



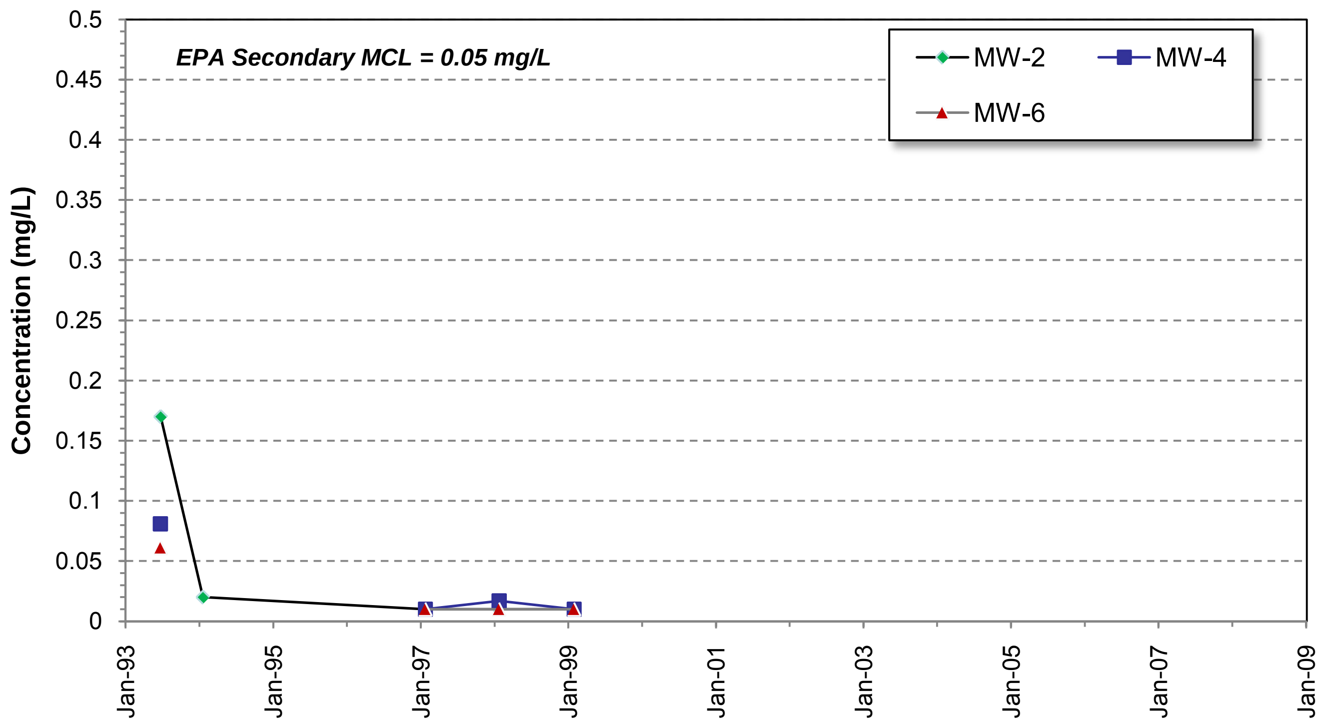
Golder Associates

TITLE

Manganese Concentrations in Lacey Monitoring Wells MW-1, MW-3 & MW-5 – 1993-2008

City of Lacey - Water System Plan Update 2009

DRAWN	SDT	DATE	5/14/10	PROJECT No.	083.93334
CHECKED	EA	SCALE		DWG No.	
REVIEWED	PAB	FILE No.	Sec2_port.ppt	FIGURE No.	2-45



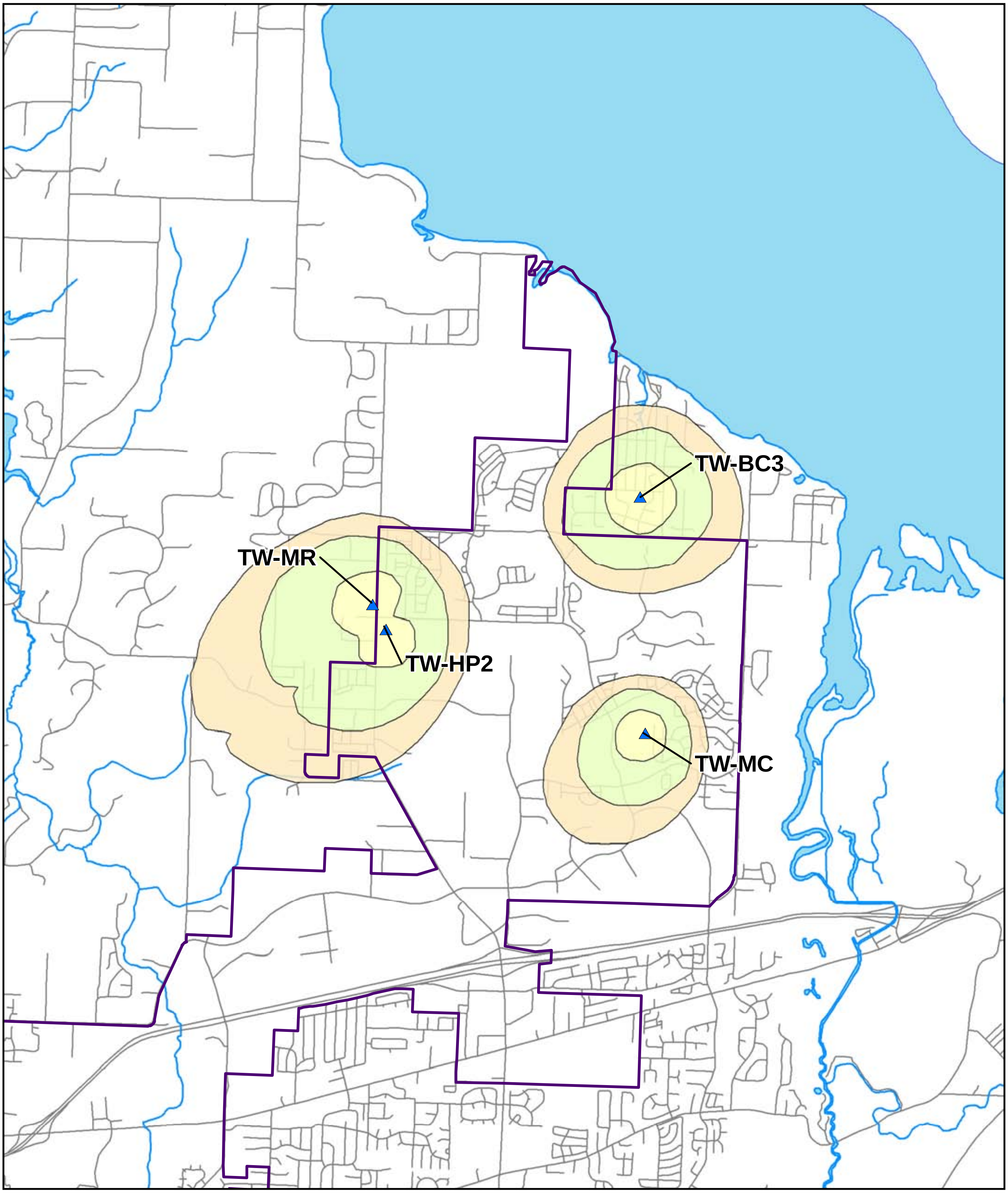
Golder Associates

TITLE

Manganese Concentrations in Lacey Monitoring Wells MW-2, MW-4 & MW-6 – 1993-2008

City of Lacey - Water System Plan Update 2009

DRAWN	SDT	DATE	5/14/10	PROJECT No.	083.93334
CHECKED	EA	SCALE		DWG No.	
REVIEWED	PAB	FILE No.	Sec2_port.ppt	FIGURE No.	2-46



LEGEND

- Test Well
- Lacey City Limit

WHPAs

- 1 yr
- 5 yr
- 10 yr

0 4000

Scale in Feet

Map Projection:
Washington State Plane
South Zone NAD 1983

Source:
Carollo, WA DNR, USGS, NLW 2009,
Golder Associates Inc.

This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

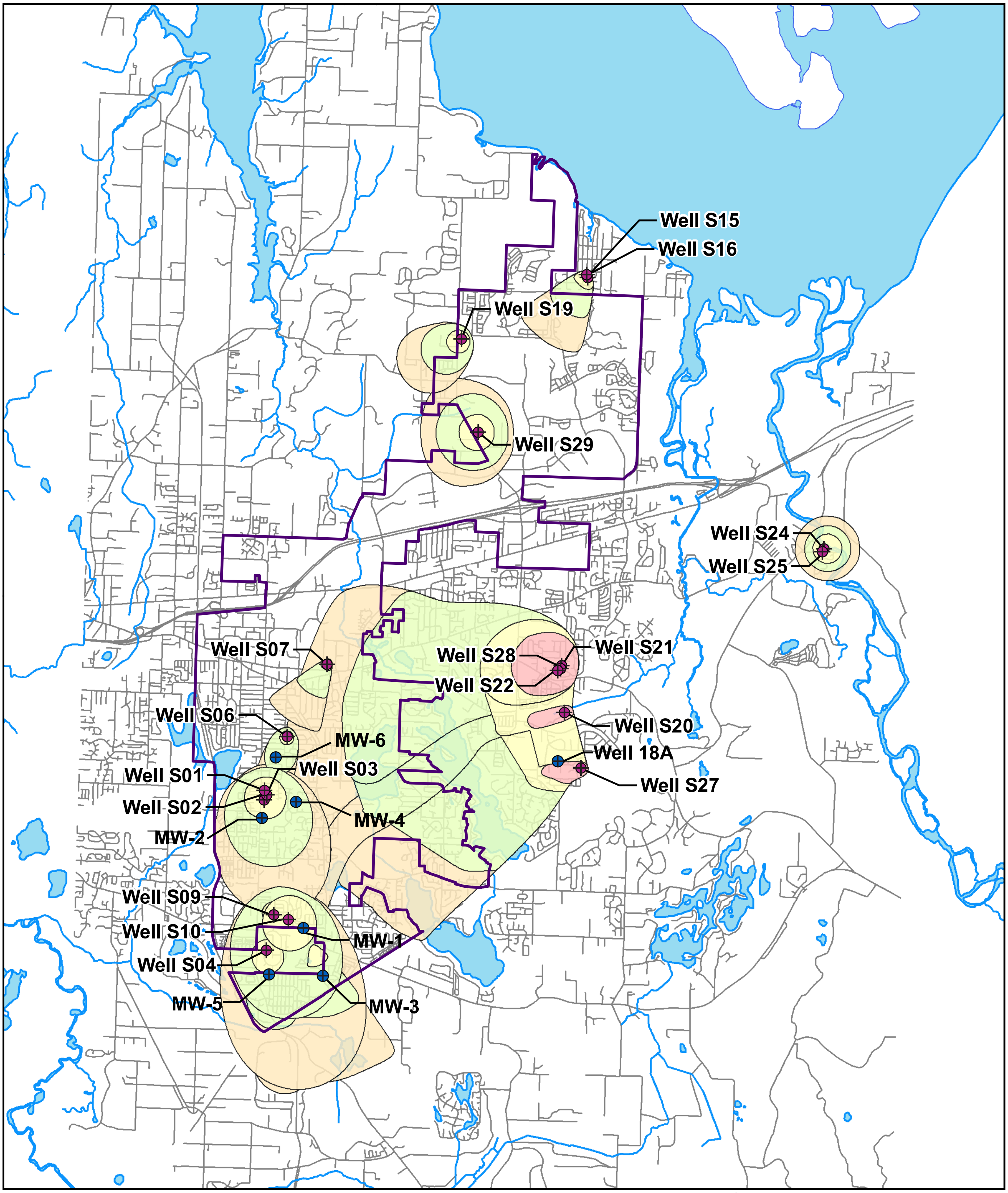
FIGURE **2-47**

PREDICTED WHPAs FOR NEW HAWKS PRAIRIE TEST WELLS (BY NLW, 2008)

WELLHEAD PROTECTION WSP UPDATES/WA

08393334F46_PredictedWHPANewHawksPrairie.mxd | 3/15/2010 | THAMMOND

Golder Associates



LEGEND

Production Well

Lacey City Limit

Monitoring Well

WHPAs

6 months

1 yr

5 yr

10 yr

0 8000

Scale in Feet

Map Projection:
Washington State Plane
South Zone NAD 1983

Source:
Carollo, WA DNR, USGS, PGG 2003,
Golder Associates Inc.

N

This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

FIGURE **3-1**

2003 WELLHEAD PROTECTION AREAS

WELLHEAD PROTECTION WSP UPDATES/WA

08393334F47_2003WellHeadProtectionAreas.mxd | 3/16/2010 | THAMMOND

Golder Associates

This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

LEGEND

- Production Well
- Test Well
- McAllister Model Boundary
- Fort Lewis
- Nisqually Indian Reservation

0 3 Miles

Scale in Feet

N

Map Projection:
Washington State Plane
South Zone NAD 1983

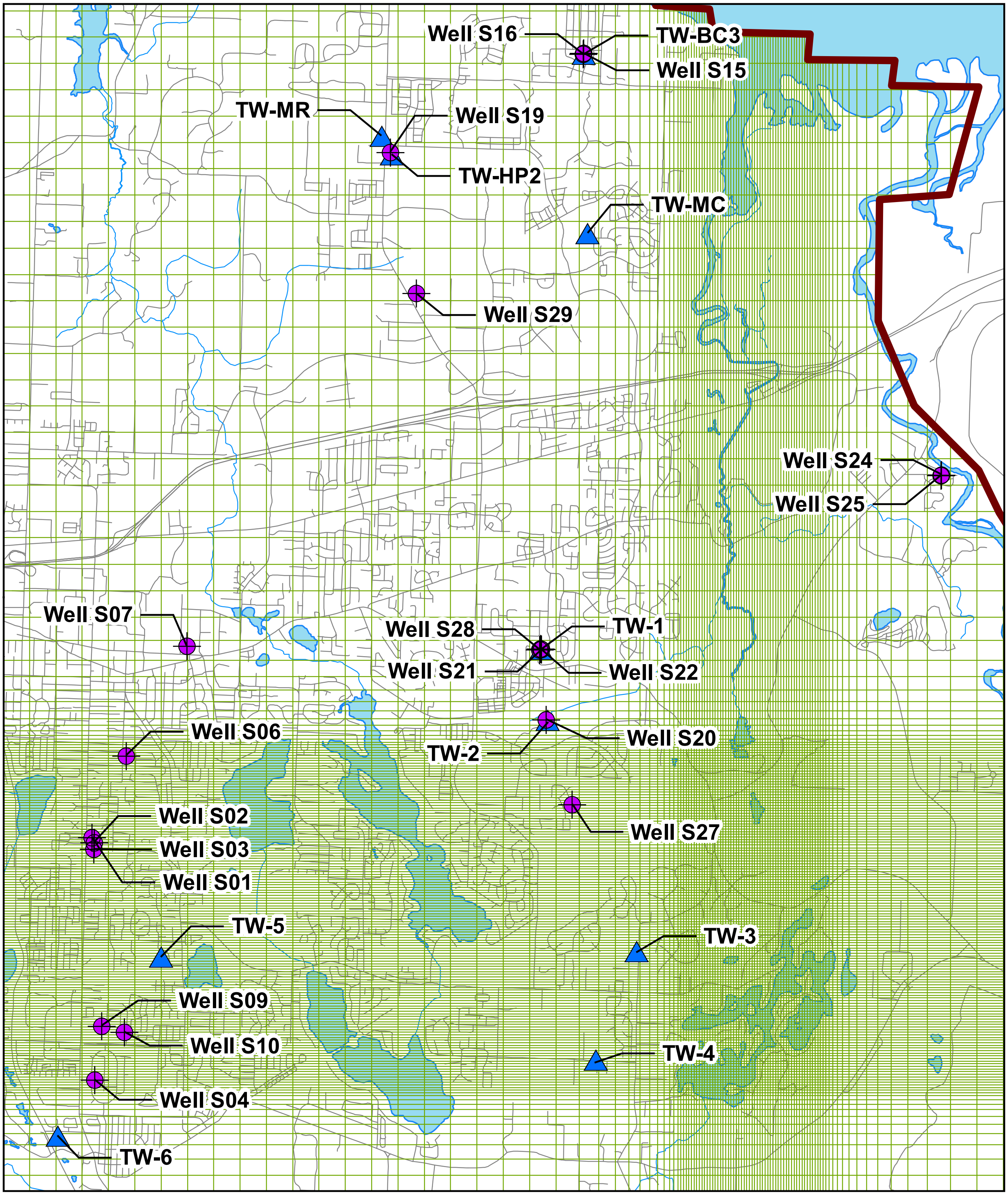
Source: USGS, Thurston County, WSDOE, Golder Associates, Inc.

FIGURE **3-2**

MCALLISTER GROUNDWATER MODEL DOMAIN

WELLHEAD PROTECTION WSP UPDATES/WA

Golder Associates



This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

LEGEND

- Production Well
- Test Well
- Model Grid
- Model Boundary

0 1
Scale in Miles

N

Map Projection:
Washington State Plane
South Zone NAD 1983

Source:
Carollo, WA DNR,
Golder Associates Inc.

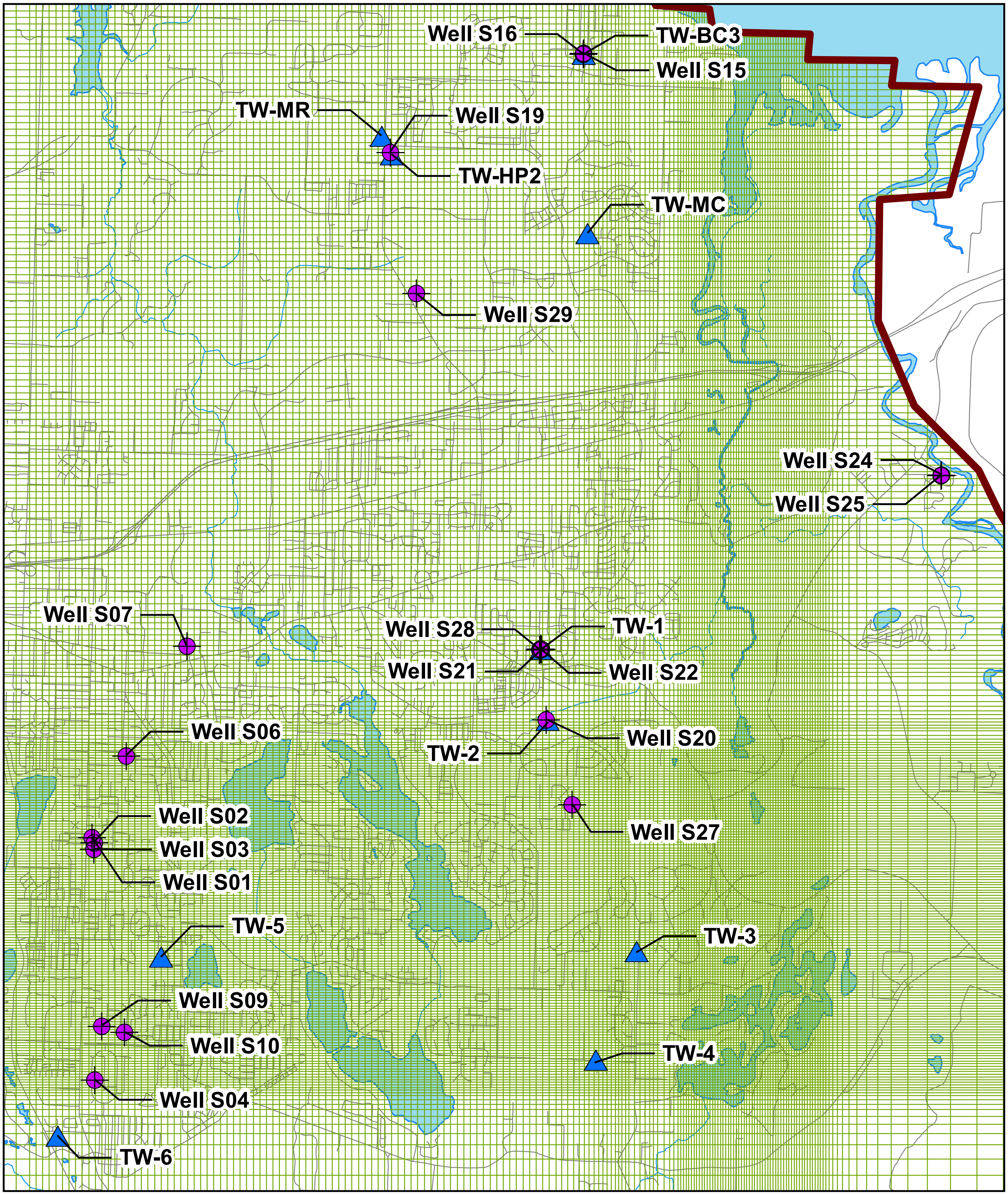
FIGURE **3-3**

McALLISTER EXISTING MODEL GRID

WELLHEAD PROTECTION WSP UPDATE/WA

08393334F49_ExistingModelGrid.mxd | 5/24/2010 | THAMMOND

Golder Associates



This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

LEGEND

- Production Well
- Test Well
- Model Grid
- Model Boundary

0 1

Scale in Miles

Map Projection:
Washington State Plane
South Zone NAD 1983

Source:
Carollo, WA DNR,
Golder Associates Inc.

N

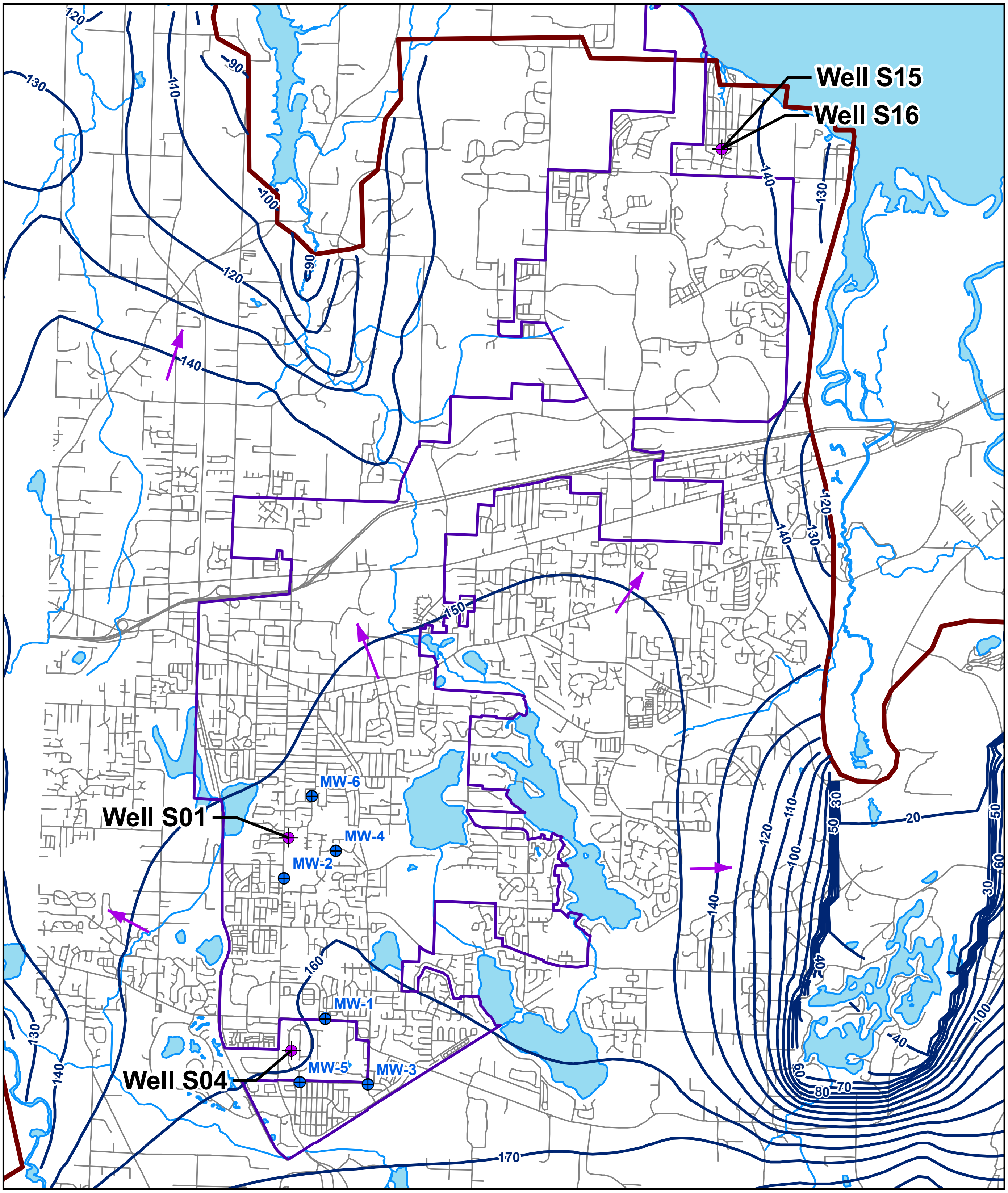
FIGURE **3-4**

LACEY WHPA MODEL GRID

WELLHEAD PROTECTION WSP UPDATE/WA

08393334F50_RevisedModelGrid.mxd | 5/24/2010 | THAMMOND

Golder Associates



LEGEND
- Production Well
- Monitoring Well
- Lacey City Limit
- Modeled Potentiometric Level (ft msl)
- Model Boundary
- Modeled Flow Direction

0 6000
Scale in Feet

Map Projection:
Washington State Plane
South Zone NAD 1983

Source:
Carollo, WA DNR, USGS,
Golder Associates Inc.

N

This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

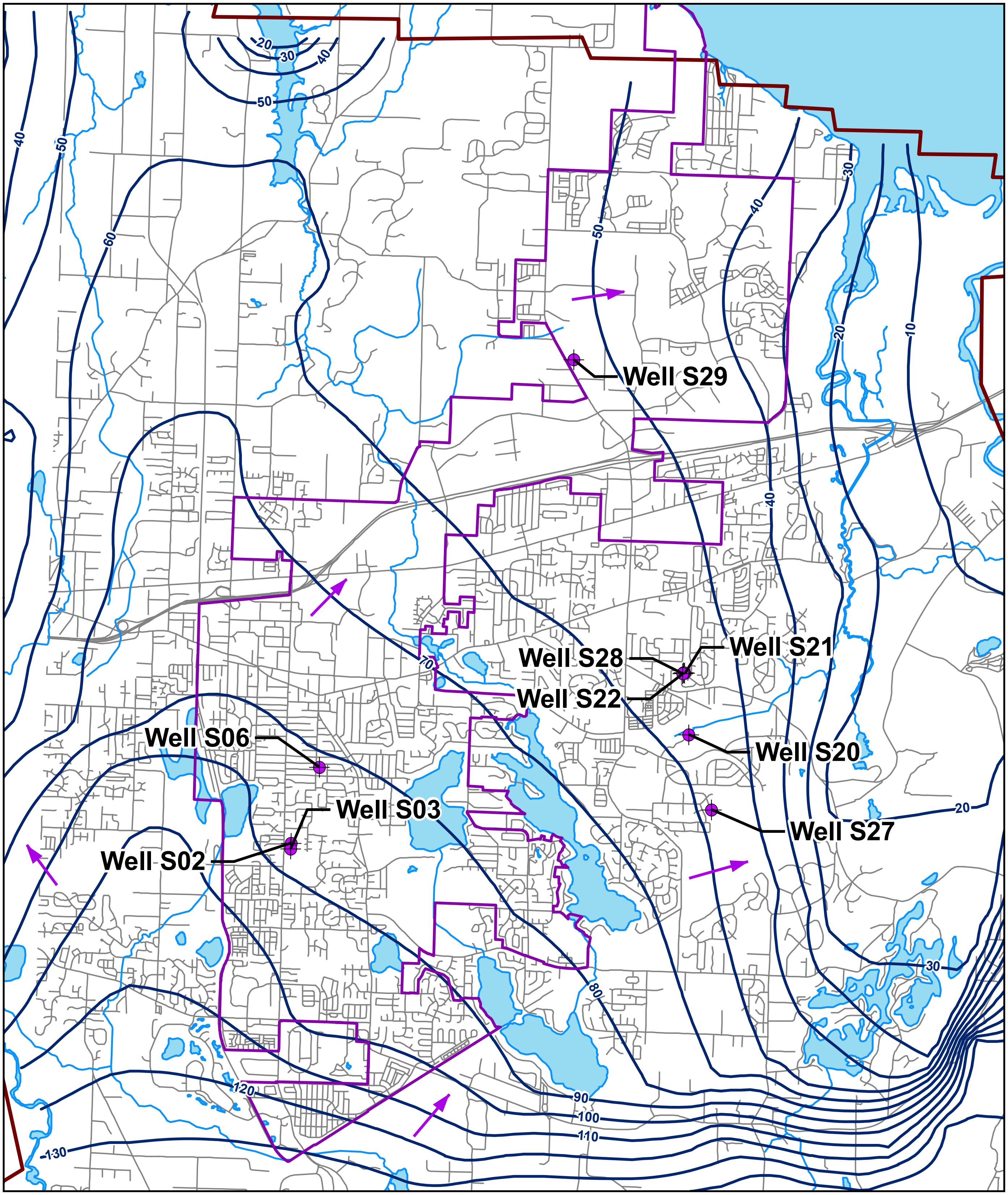
FIGURE **3-5**

MODELED POTENTIOMETRIC LEVELS - QGA AQUIFER

WELLHEAD PROTECTION WSP UPDATES/WA

08393334F51_QGA_Potentiometric.mxd | 3/18/2010 | THAMMOND

Golder Associates



LEGEND

Production Well

Lacey City Limit

Modeled Potentiometric Level (ft msl)

Modeled Flow Direction

Model Boundary

0 6000

Scale in Feet

Map Projection:
Washington State Plane
South Zone NAD 1983

Source:
Carollo, WA DNR, USGS,
Golder Associates Inc.

N

This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

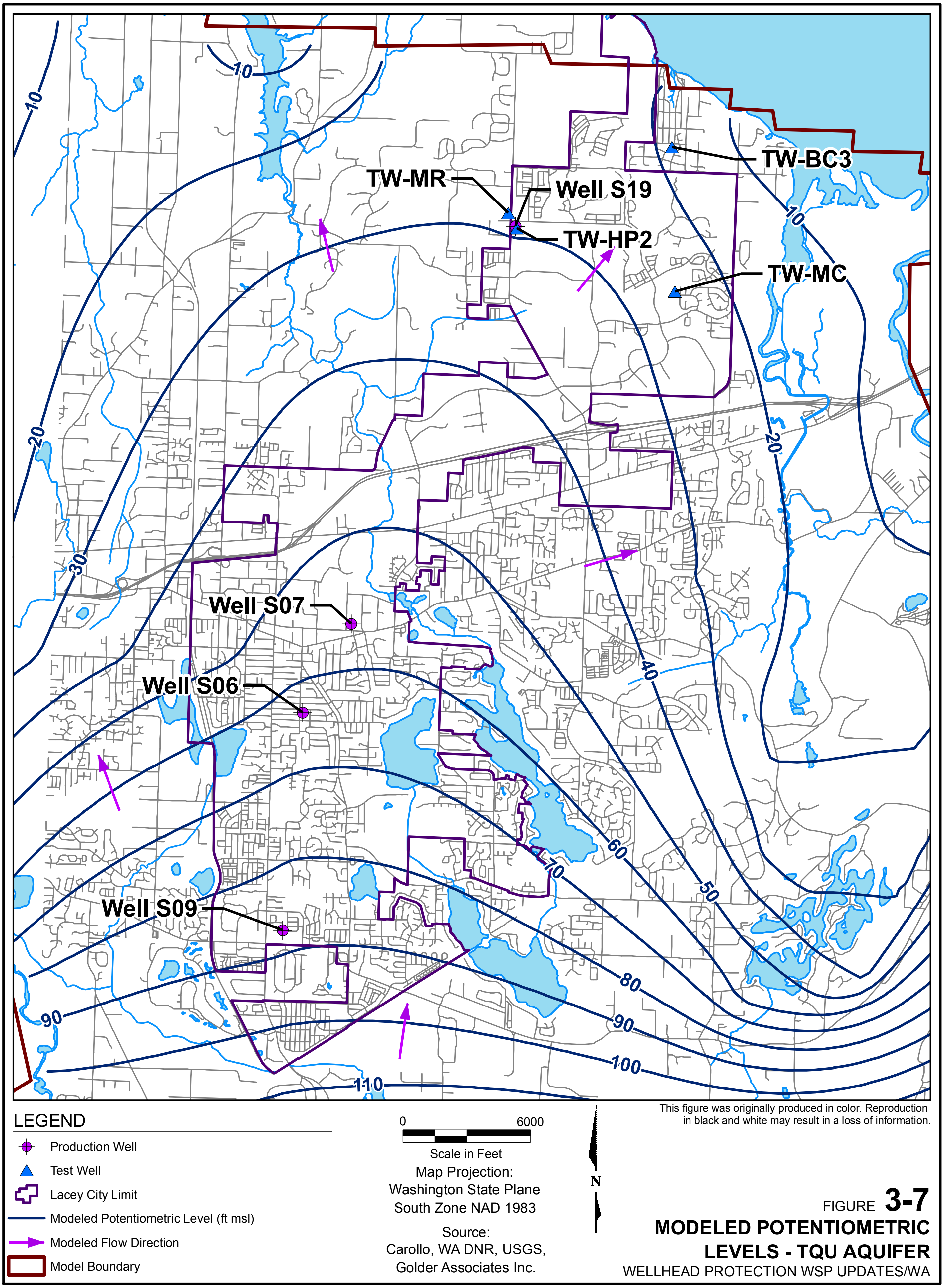
FIGURE **3-6**

MODELED POTENTIOMETRIC LEVELS - QPG AQUIFER

WELLHEAD PROTECTION WSP UPDATES/WA

08393334F52_QPG_Potentiometric.mxd | 5/24/2010 | THAMMOND

Golder Associates



Map Projection:
Washington State Plane
South Zone NAD 1983

Source:
Carollo, WA DNR, USGS,
Golder Associates Inc.

This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

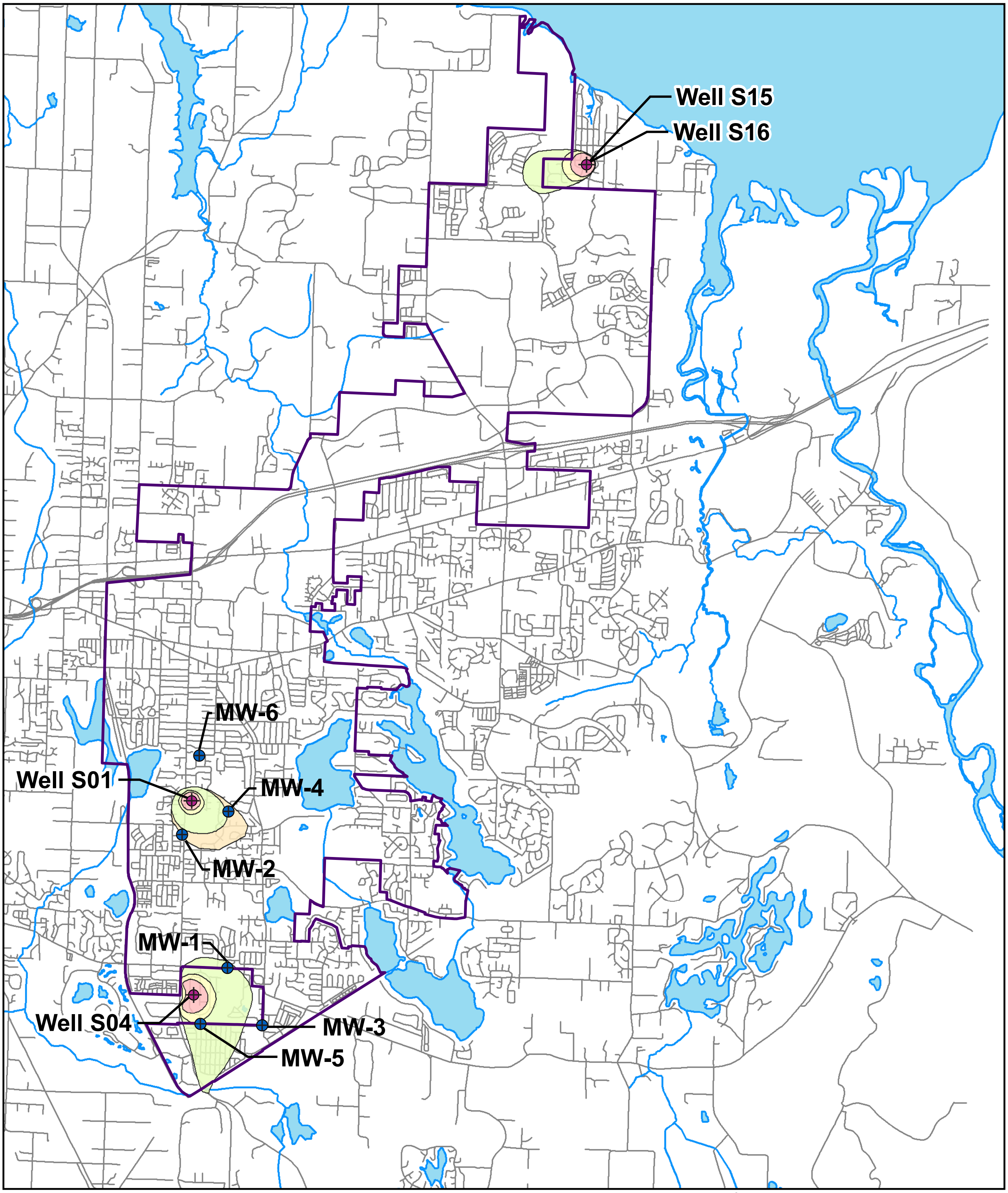
FIGURE **3-7**

MODELED POTENTIOMETRIC LEVELS - TQU AQUIFER

WELLHEAD PROTECTION WSP UPDATES/WA

08393334F53_TQU_Potentiometric.mxd | 3/18/2010 | THAMMOND

Golder Associates



LEGEND

Production Well

Lacey City Limit

Monitoring Well

New WHPAs

6 months

1 yr

5 yr

10 yr

0 6500

Scale in Feet

Map Projection:
Washington State Plane
South Zone NAD 1983

Source:
Carollo, WA DNR, USGS,
Golder Associates Inc.

N

This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

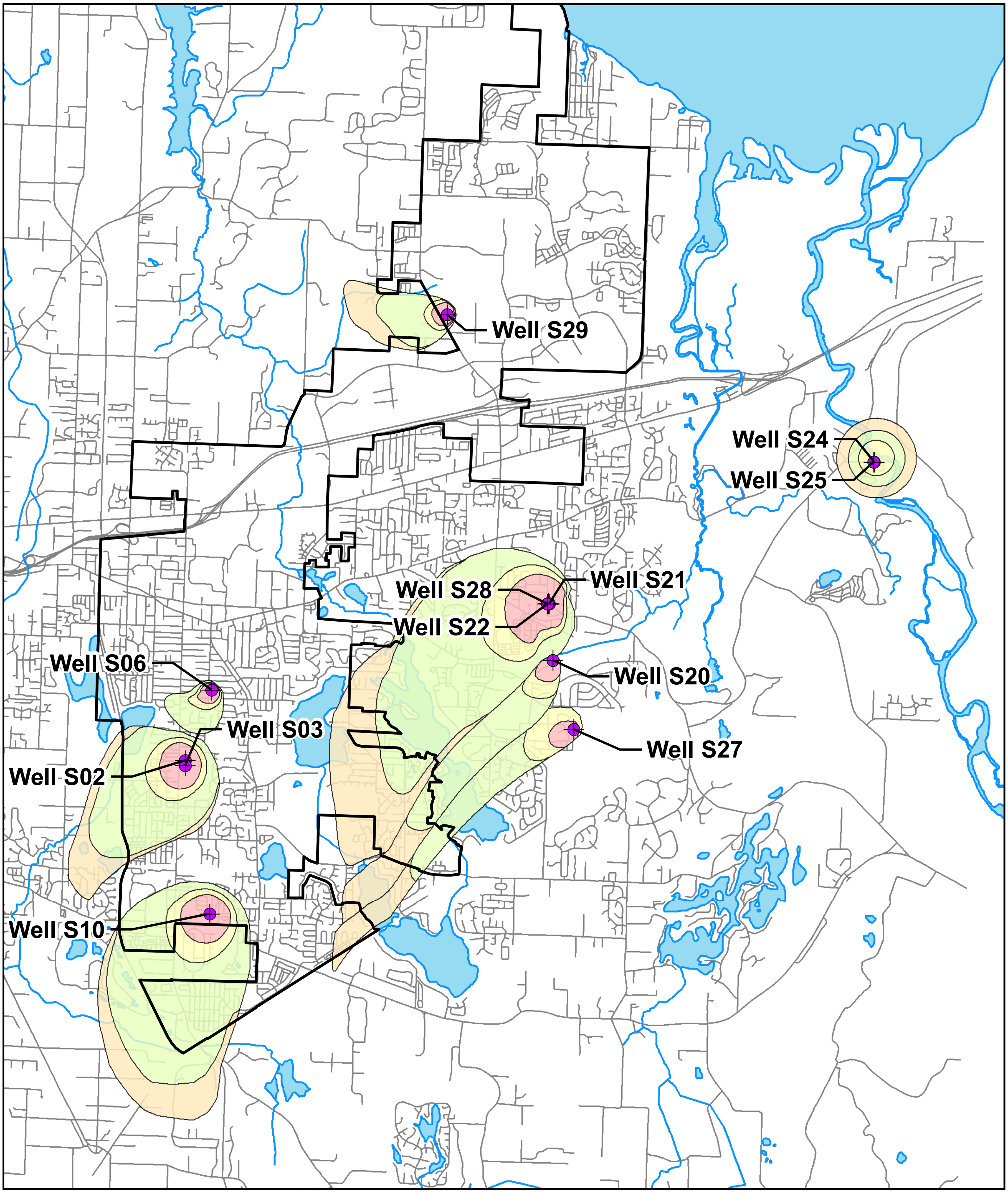
FIGURE **3-8**

NEW WHPAs - EXISTING WELLS COMPLETED IN THE QGA AQUIFER

WELLHEAD PROTECTION WSP UPDATES/WA

08393334F54_QGA_AquiferWHPAs.mxd | 3/19/2010 | THAMMOND

Golder Associates



LEGEND

TYPE

Production Well

Lacey City Limit

WHPAs

6 months

1 yr

5 yr

10 yr

0 6500

Scale in Feet

Map Projection:
Washington State Plane
South Zone NAD 1983

Source:
Carollo, WA DNR, USGS,
Golder Associates Inc.

N

This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

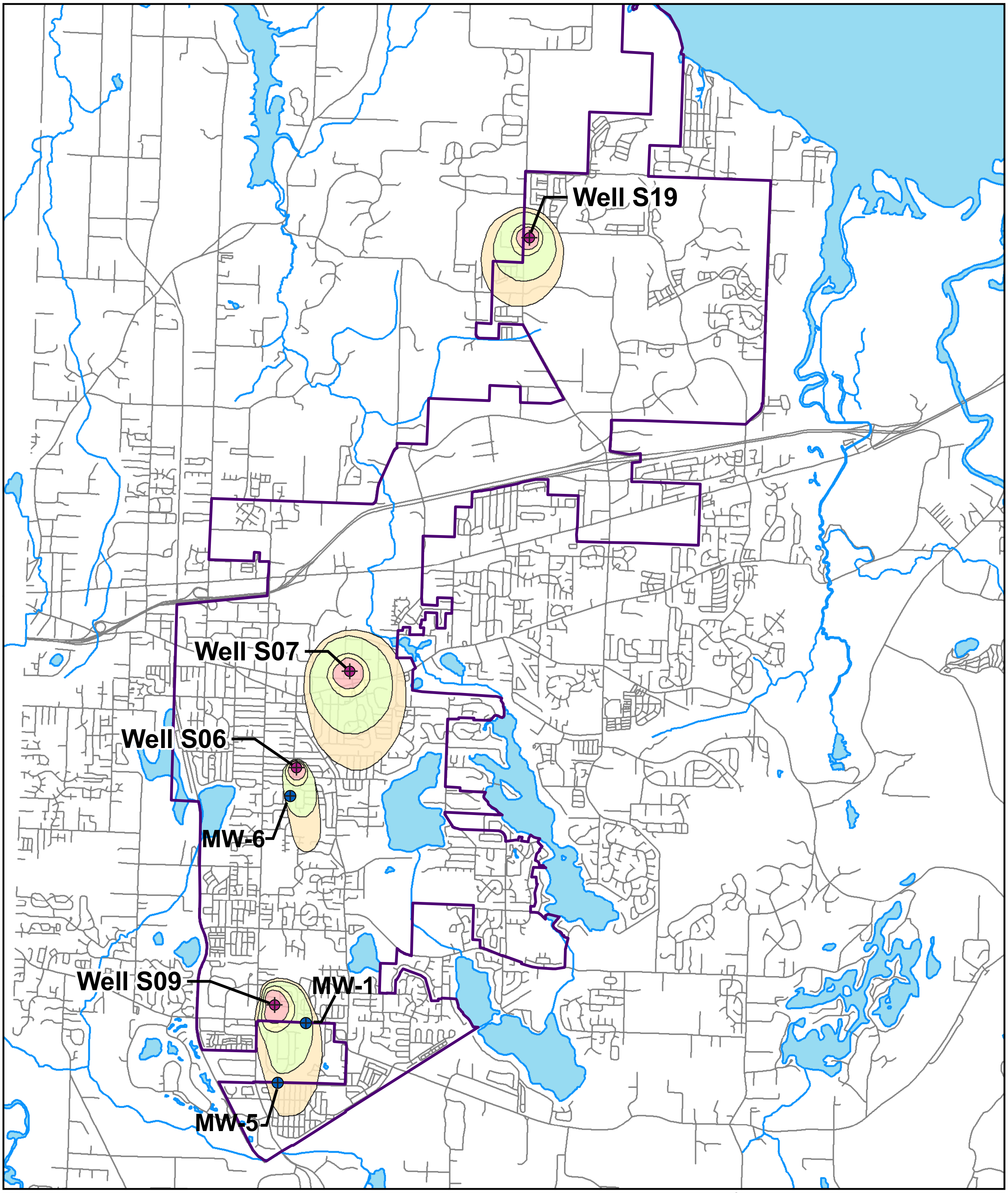
FIGURE **3-9**

NEW WHPAs - EXISTING WELLS COMPLETED IN THE QPG AQUIFER

WELLHEAD PROTECTION WSP UPDATES/WA

08393334F55_QPG_AquiferWHPAs.mxd | 3/19/2010 | THAMMOND

Golder Associates



LEGEND

TYPE

Production Well

Lacey City Limit

Monitoring Well

New WHPAs

6 months

1 yr

5 yr

10 yr

0 6000

Scale in Feet

Map Projection:
Washington State Plane
South Zone NAD 1983

Source:
Carollo, WA DNR, USGS,
Golder Associates Inc.

N

This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

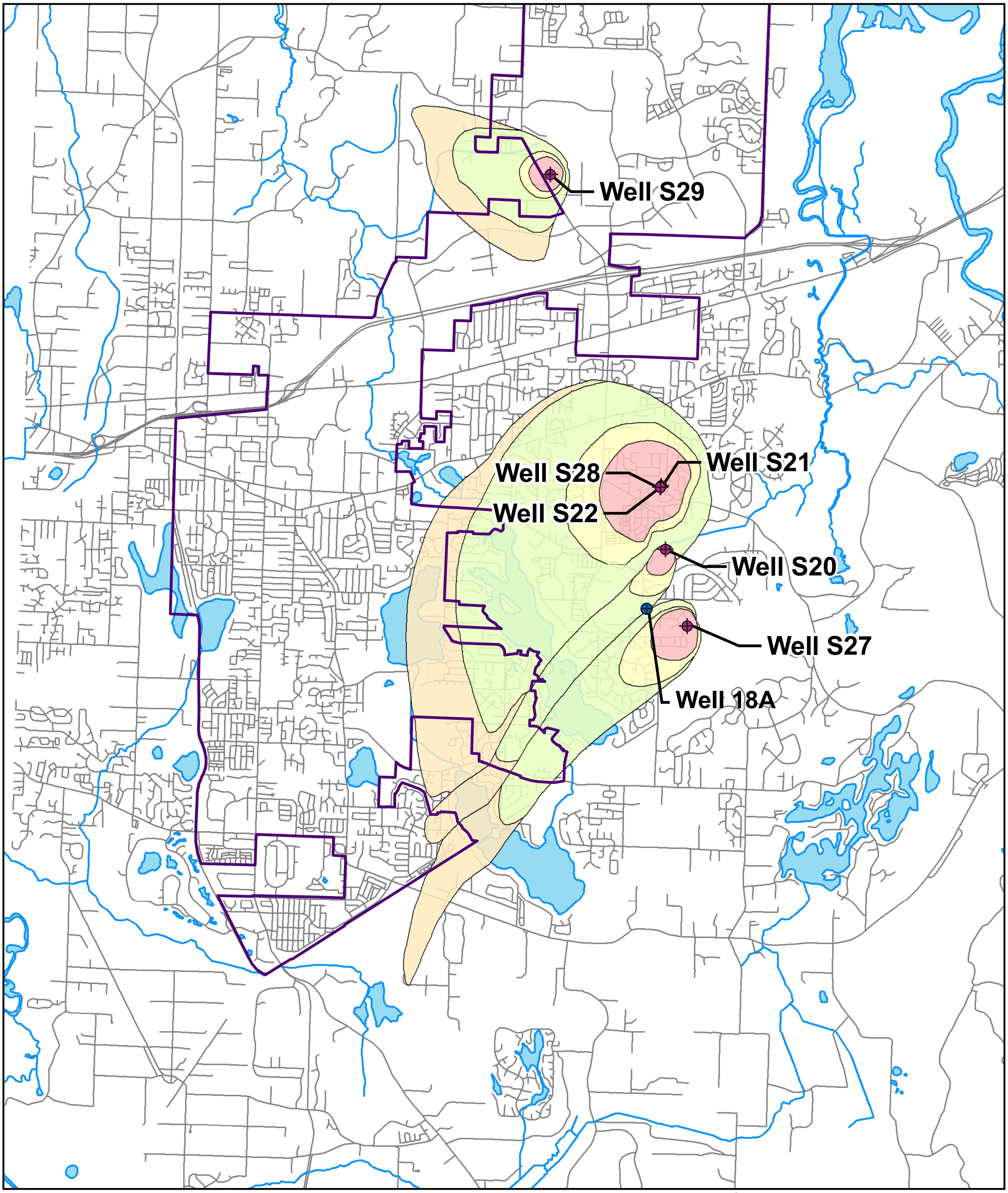
FIGURE **3-10**

NEW WHPAs - EXISTING WELLS COMPLETED IN THE TQU AQUIFER

WELLHEAD PROTECTION WSP UPDATES/WA

08393334F56_TQU_AquiferWHPAs.mxd | 3/19/2010 | THAMMOND

Golder Associates



LEGEND

TYPE

- Production Well
- Lacey City Limit
- Monitoring Well

WHPAs

- 6 months
- 1 yr
- 5 yr
- 10 yr

0 6000

Scale in Feet

Map Projection:
Washington State Plane
South Zone NAD 1983

Source:
Carollo, WA DNR, USGS,
Golder Associates Inc.

N

This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

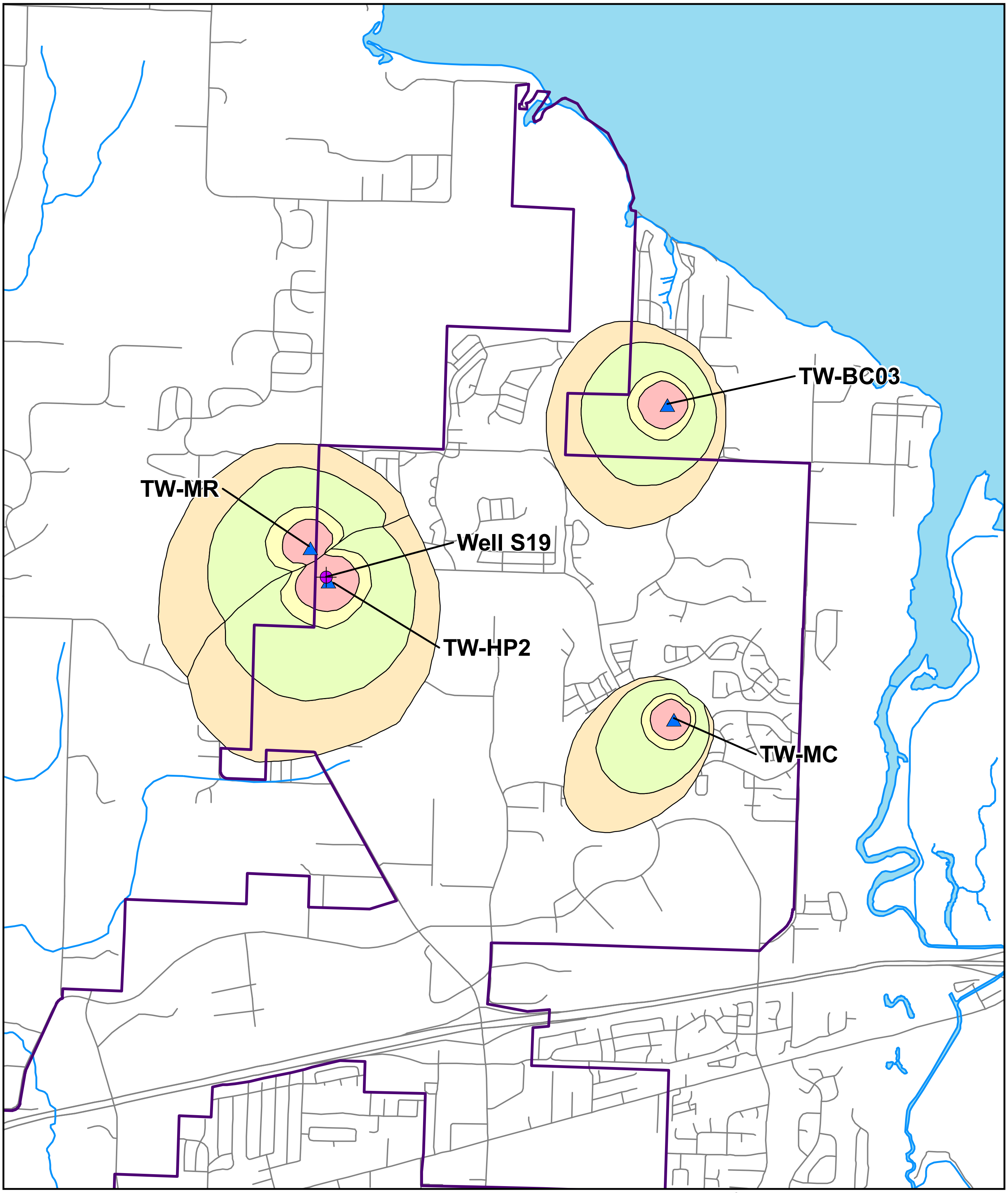
FIGURE **3-11**

WHPAs FOR FUTURE SUPPLY WELLS
QPG AQUIFER

WELLHEAD PROTECTION WSP UPDATES/WA

08393334F57_QPG_AquiferWHPAsFutureSupplyWells.mxd | 3/19/2010 | THAMMOND

Golder Associates



LEGEND

Production Well
Test Well
Lacey City Limit

WHPAs
6 months
1 yr
5 yr
10 yr

0 3000
Scale in Feet

Map Projection:
Washington State Plane
South Zone NAD 1983

Source:
Carollo, WA DNR, USGS,
Golder Associates Inc.

N

This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

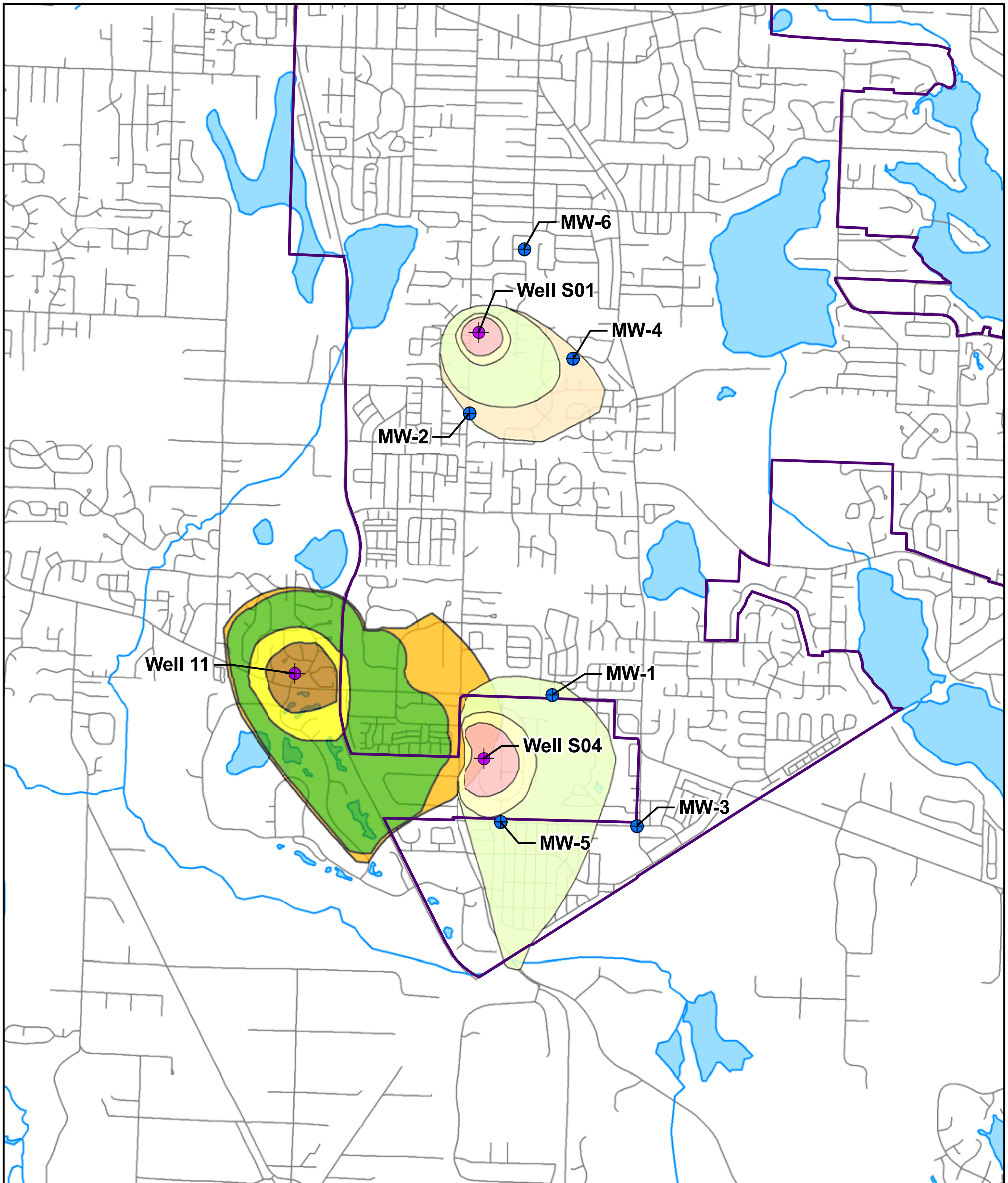
FIGURE **3-12**

WHPAs FOR FUTURE SUPPLY WELLS
TQU AQUIFER

WELLHEAD PROTECTION WSP UPDATES/WA

08393334F58_TQU_AquiferWHPAsFutureSupplyWells.mxd | 3/19/2010 | THAMMOND

Golder Associates



LEGEND

	Lacey WHPAs	Olympia Wells
Production Well	6 months	6 months
Monitoring Well	1 yr	1 yr
Lacey City Limit	5 yr	5 yr
	10 yr	10 yr

0 3000
Scale in Feet

Map Projection:
Washington State Plane
South Zone NAD 1983

Source:
Carollo, WA DNR, USGS, CSI 2007,
Golder Associates Inc.

N

This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

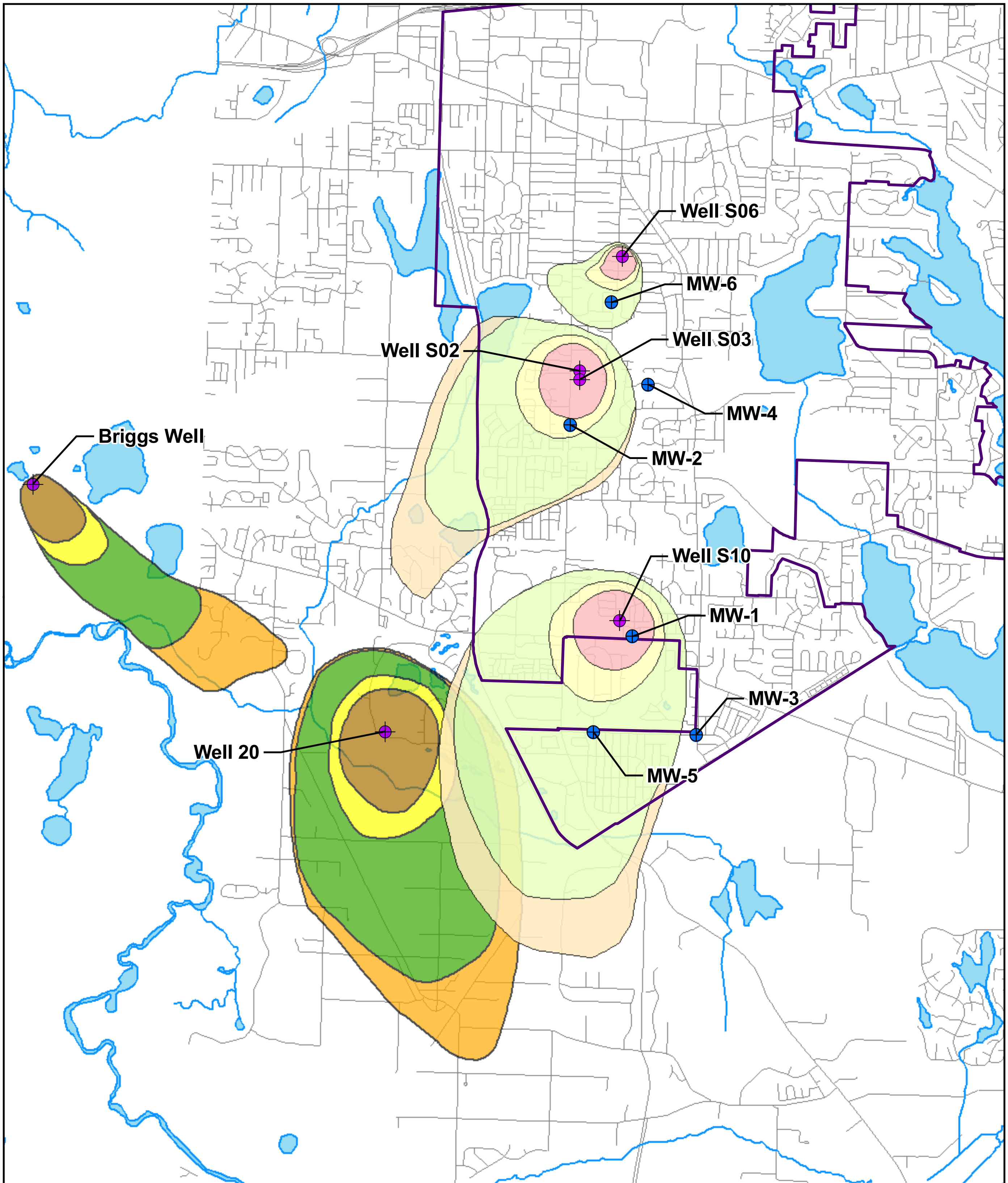
FIGURE **3-13**

NEW LACEY AND OLYMPIA WHPAs IN THE COLLEGE STREET AREA - Qga AQUIFER

WELLHEAD PROTECTION WSP UPDATES/WA

08393334F59_QGA_AquiferCollegeStreetArea.mxd | 5/24/2010 | THAMMOND

Golder Associates



LEGEND

	Lacey WHPAs		Olympia WHPAs	
Production Well		6 months		6 monts
Monitoring Well		1 yr		1 yr
Lacey City Limit		5 yr		5 yr
		10 yr		10 yr

0 4000
Scale in Feet

Map Projection:
Washington State Plane
South Zone NAD 1983

Source:
Carollo, WA DNR, USGS,
Golder Associates Inc.

N

This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

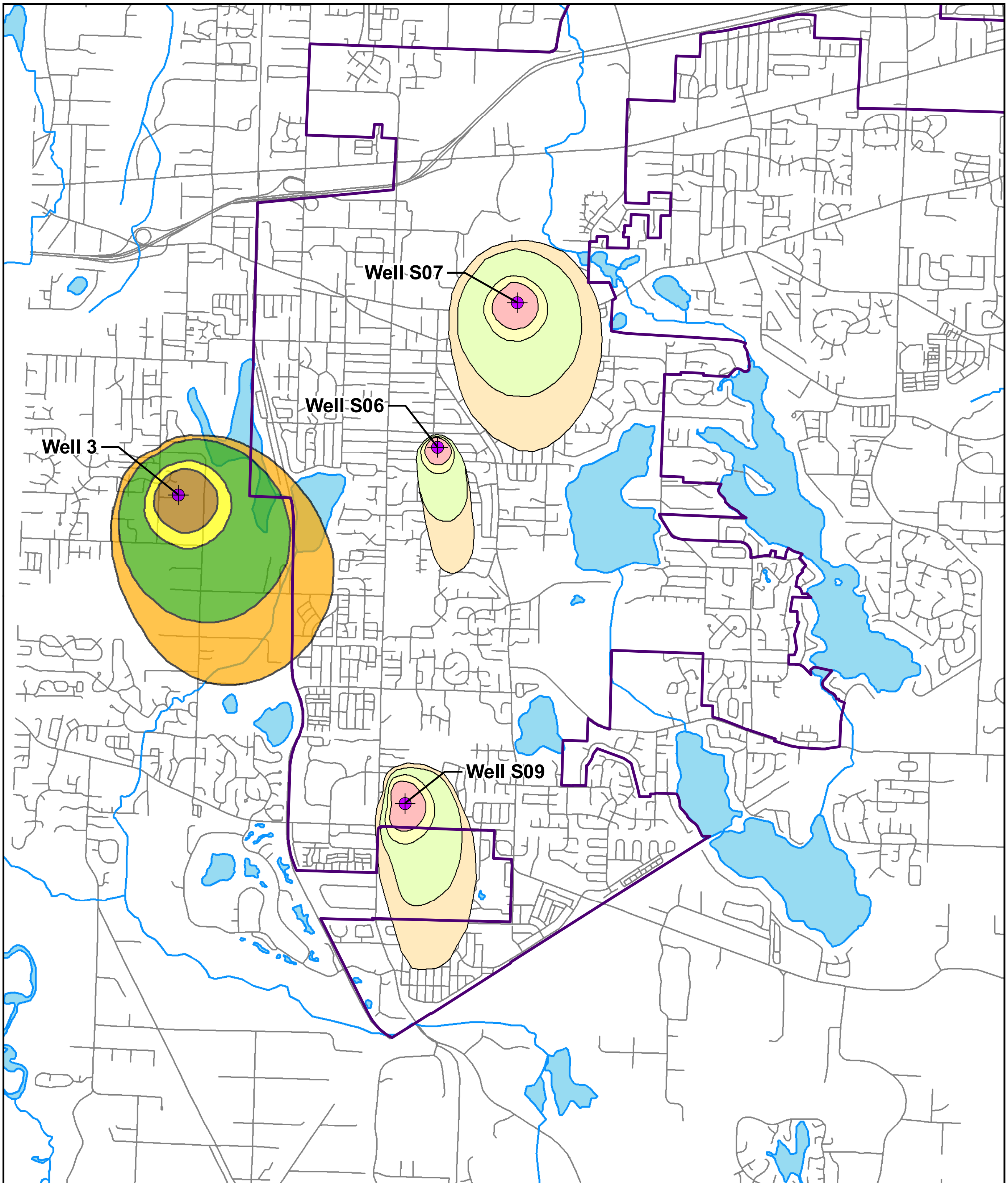
FIGURE **3-14**

NEW LACEY AND OLYMPIA WHPAs IN THE COLLEGE STREET AREA - Qpg AQUIFER

WELLHEAD PROTECTION WSP UPDATES/WA

08393334F60_Qpg_AquiferCollegeStreetArea.mxd | 5/24/2010 | THAMMOND

Golder Associates



LEGEND

	Lacey Wells	Olympia WHPAs
Production Well	6 months	6 monts
Lacey City Limit	1 yr	1 yr
	5 yr	5 yr
	10 yr	10 yr

0 4000

Scale in Feet

Map Projection:
Washington State Plane
South Zone NAD 1983

Source:
Carollo, WA DNR, USGS, CSI 2007,
Golder Associates Inc.

N

This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

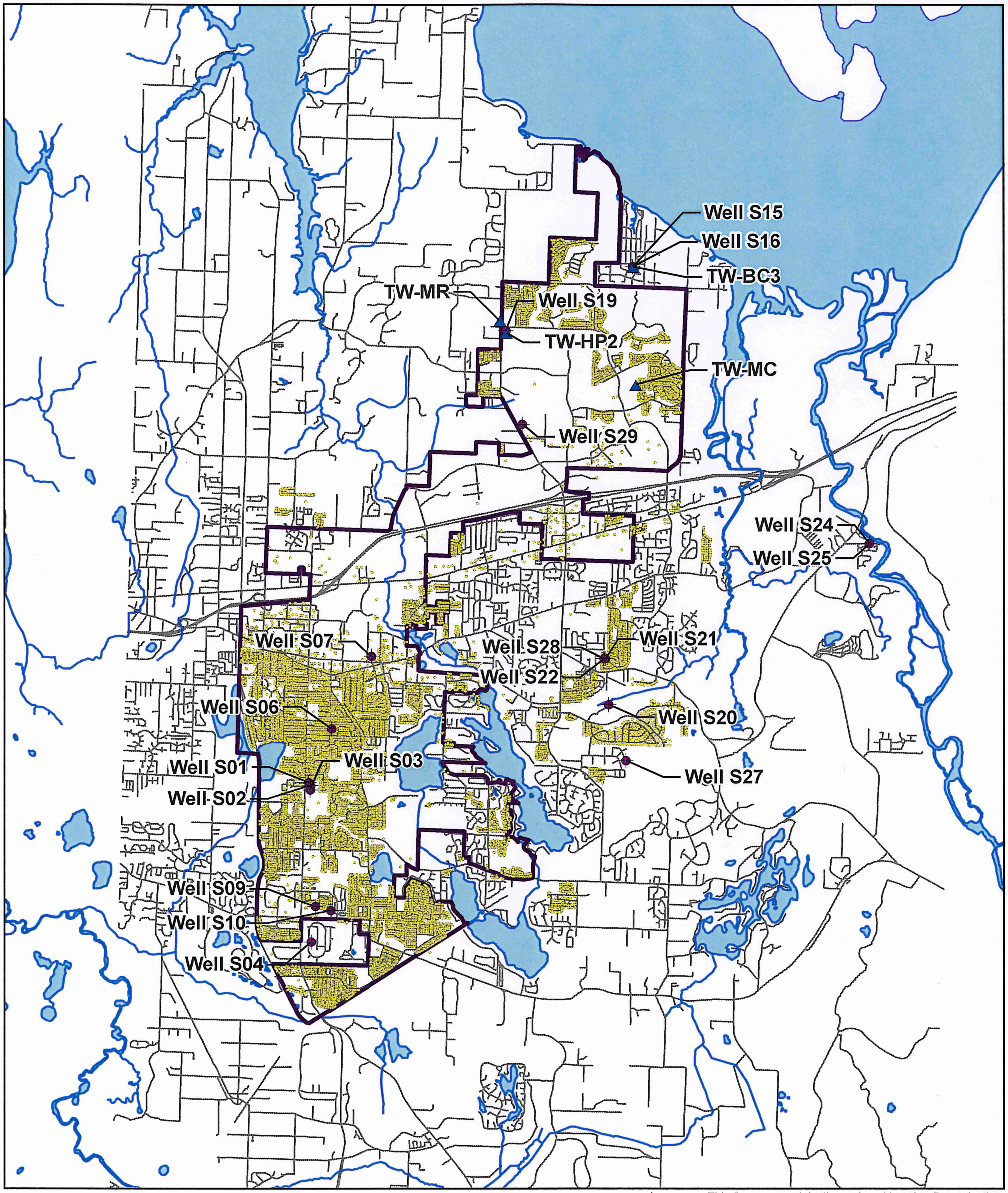
FIGURE **3-15**

NEW LACEY AND OLYMPIA WHPAs IN THE COLLEGE STREET AREA - TQu AQUIFIER

WELLHEAD PROTECTION WSP UPDATES/WA

08393334F61_TQu_AquiferCollegeStreetArea.mxd | 3/19/2010 | THAMMOND

Golder Associates



This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

LEGEND

- Production Well
- Test Well
- Lacey Waste Water Service Areas
- Lacey City Limit

0 8000

Scale in Feet

Map Projection:
Washington State Plane
South Zone NAD 1983

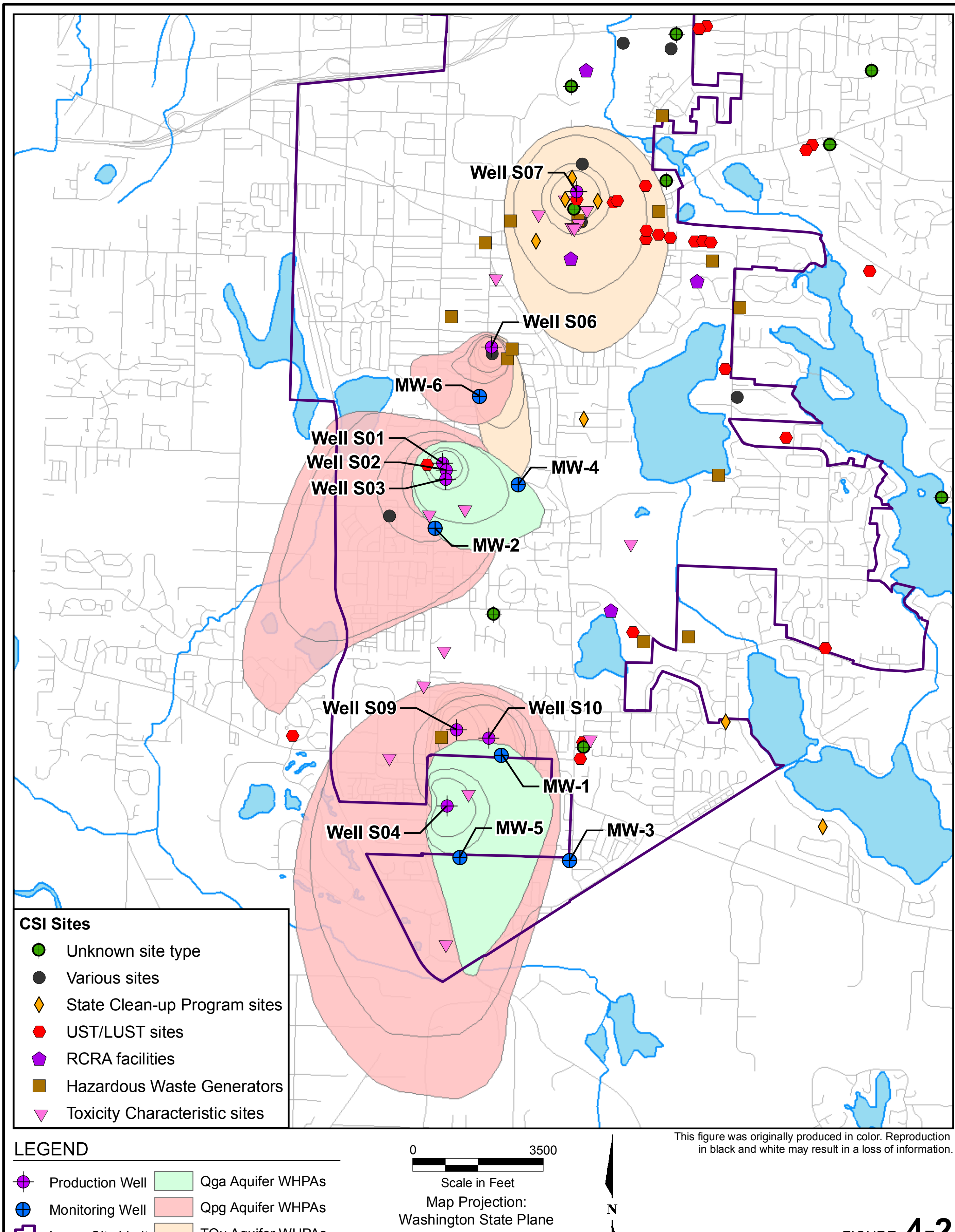
Source:
Carollo, WA DNR,
Golder Associates Inc.

N

FIGURE **4-1**
SEWER CONNECTION DENSITY MAP
WELLHEAD PROTECTION WSP UPDATE/WA

08393334F35_WellLocationsR01.mxd | 5/25/2010 | THAMMOND

Golder Associates



Map Projection:
Washington State Plane
South Zone NAD 1983

Source:
Carollo, WA DNR, USGS,
Golder Associates Inc.

This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

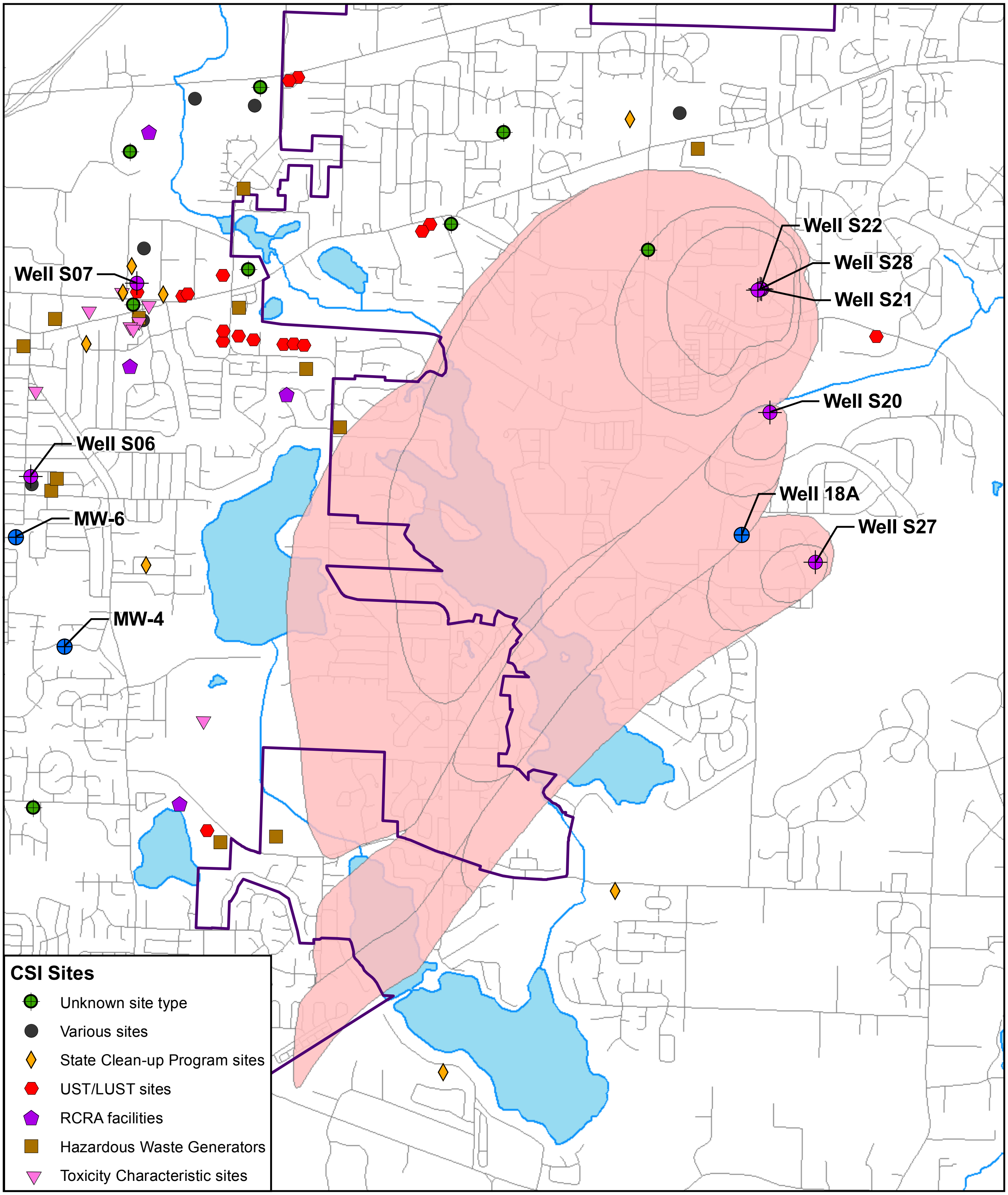
FIGURE **4-2**

LOCATION OF CSI AND WHPAs - COLLEGE STREET AREA

WELLHEAD PROTECTION WSP UPDATES/WA

08393334F62_CollegeStreetWHPAsR01.mxd | 5/24/2010 | THAMMOND

Golder Associates



LEGEND

Production Well

Monitoring Well

Lacey City Limit

Qpg Aquifer WHPAs

0 3000

Scale in Feet

Map Projection:
Washington State Plane
South Zone NAD 1983

Source:
Carollo, WA DNR, USGS,
CSI 2007, Golder Associates Inc.

N

This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

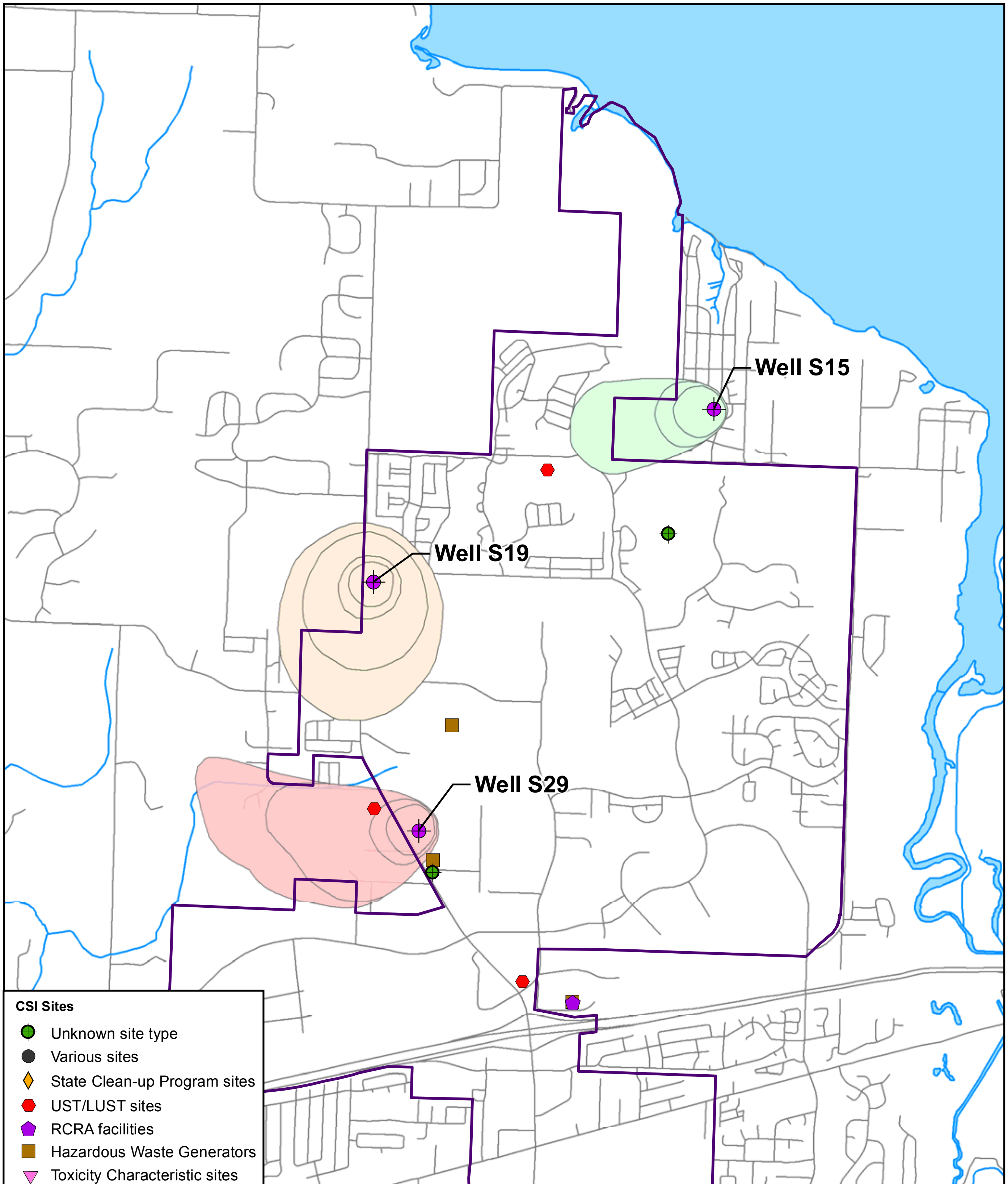
FIGURE **4-3**

LOCATION OF CSI AND WHPAs - EAST LACEY AREA

WELLHEAD PROTECTION WSP UPDATES/WA

08393334F63_EastLaceyWHPAs.mxd | 5/24/2010 | THAMMOND

Golder Associates



This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

LEGEND

- Production Well
- Lacey City Limit
- TQu Aquifer WHPAs
- Qga Aquifer WHPAs
- Qpg Aquifer WHPAs

0 3000

Scale in Feet

N

Map Projection:
Washington State Plane
South Zone NAD 1983

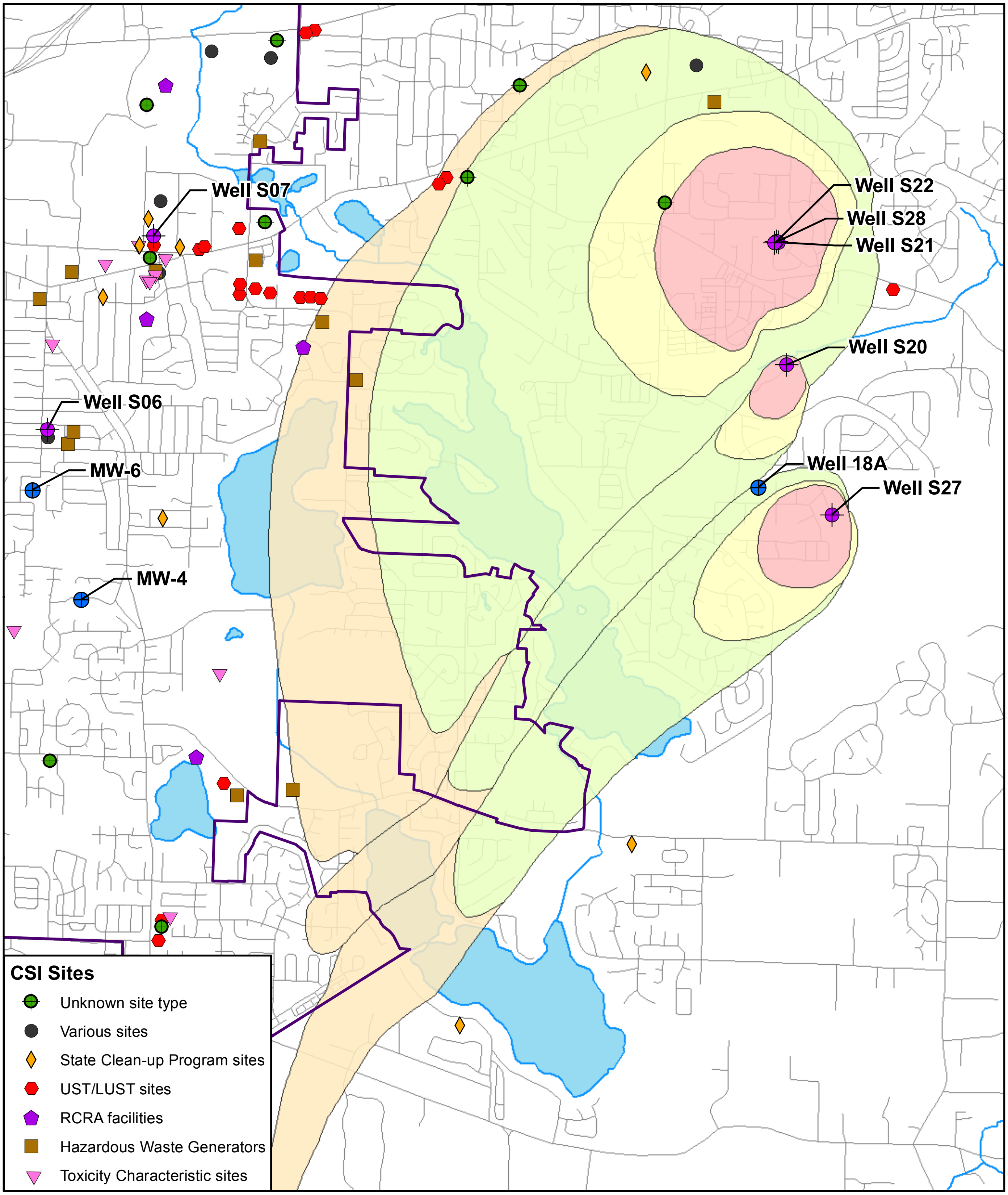
Source:
Carollo, WA DNR, USGS, CSI 2007,
Golder Associates Inc.

FIGURE **4-4**

LOCATION OF CSI AND WHPAs - HAWKS PRAIRIE AREA

WELLHEAD PROTECTION WSP UPDATES/WA

Golder Associates



LEGEND

Production Well
Monitoring Well
Lacey City Limit

WHPAs
6 months
1 yr
5 yr
10 yr

0 3000
Scale in Feet

Map Projection:
Washington State Plane
South Zone NAD 1983

Source:
Carollo, WA DNR, USGS,
CSI 2007, Golder Associates Inc.

N

This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

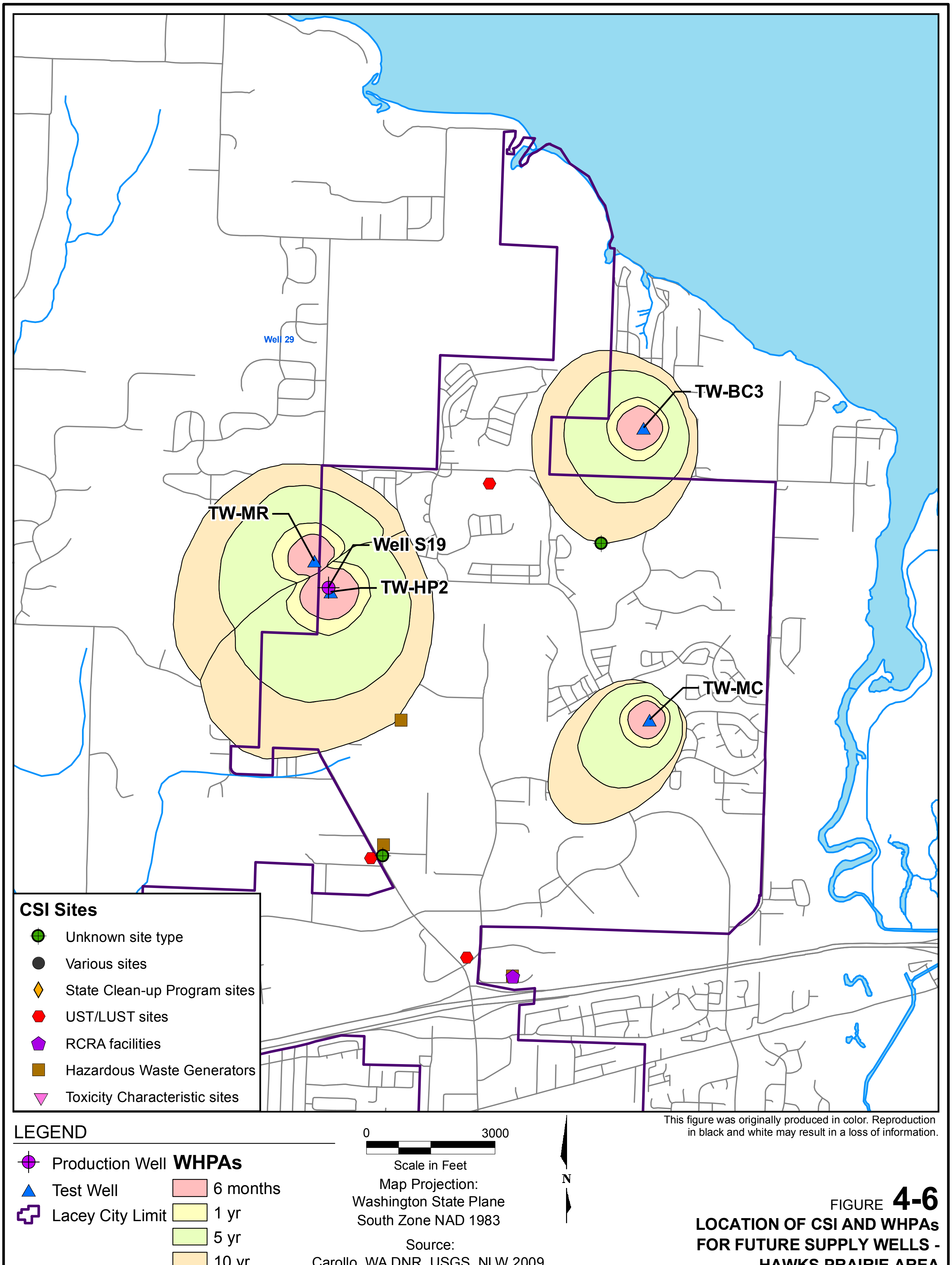
FIGURE **4-5**

LOCATION OF CSI AND WHPAs FOR FUTURE SUPPLY WELLS - EAST LACEY AREA

WELLHEAD PROTECTION WSP UPDATES/WA

08393334F65_EastLaceyFutureSupplyWells.mxd | 5/24/2010 | THAMMOND

Golder Associates



Map Projection:
Washington State Plane
South Zone NAD 1983

Source:
Carollo, WA DNR, USGS, NLW 2009,
CSI 2007, Golder Associates Inc.

This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

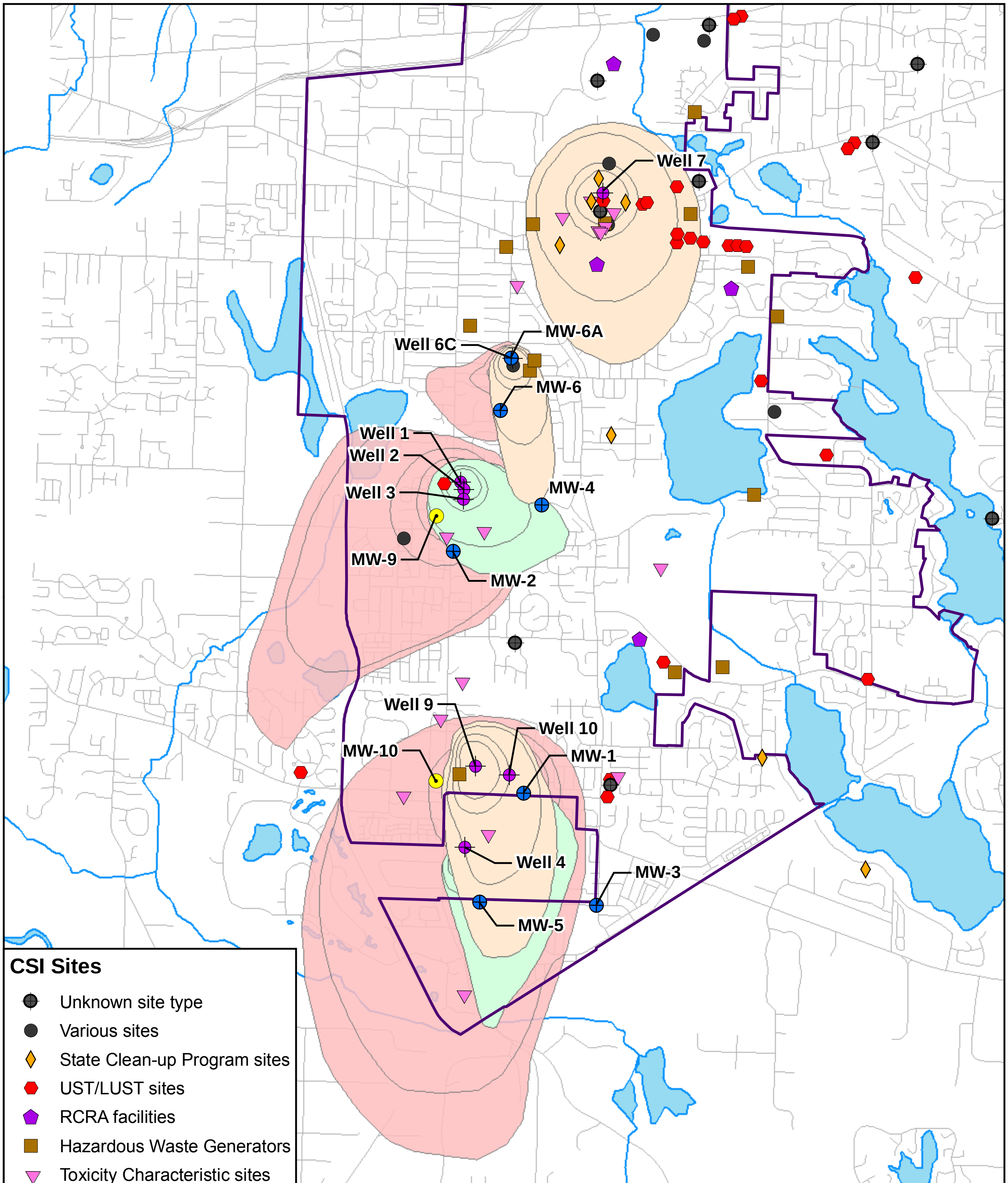
FIGURE **4-6**

LOCATION OF CSI AND WHPAs FOR FUTURE SUPPLY WELLS - HAWKS PRAIRIE AREA

WELLHEAD PROTECTION WSP UPDATES/WA

08393334F66_HawksPrairieFutureSupplyWells.mxd | 5/24/2010 | THAMMOND

Golder Associates



LEGEND

- Recommended Monitoring Wells
- Production Well
- Monitoring Wells
- Lacey City Limit
- TQu Aquifer WHPAs
- Qga Aquifer WHPAs
- Qpg Aquifer WHPAs

0 3500

Scale in Feet

Map Projection:
Washington State Plane
South Zone NAD 1983

Source:
Carollo, WA DNR, USGS,
Golder Associates Inc.

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This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

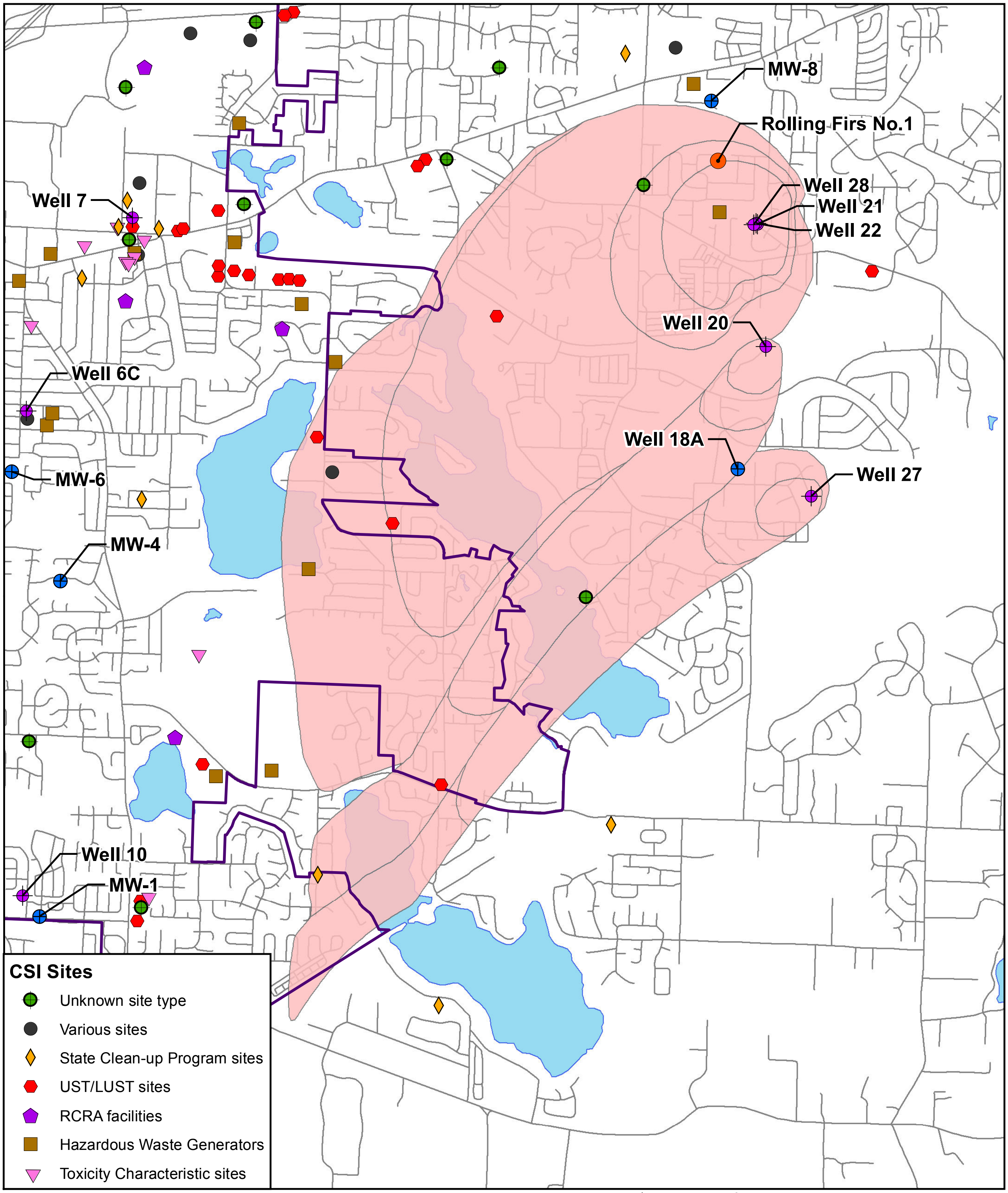
FIGURE **5-1**

RECOMMENDED MONITORING WELLS - COLLEGE STREET AREA

WELLHEAD PROTECTION WSP UPDATES/WA

08393334F25R01.mxd | 8/19/2009 | THAMMOND

Golder Associates



LEGEND

- Recommended Monitoring Well
- Monitoring Well
- Production Well
- Private Well
- Lacey City Limit
- Qpg Aquifer WHPAs

0 3000

Scale in Feet

Map Projection:
Washington State Plane
South Zone NAD 1983

Source:
Carollo, WA DNR, USGS,
CSI 2007, Golder Associates Inc.

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This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

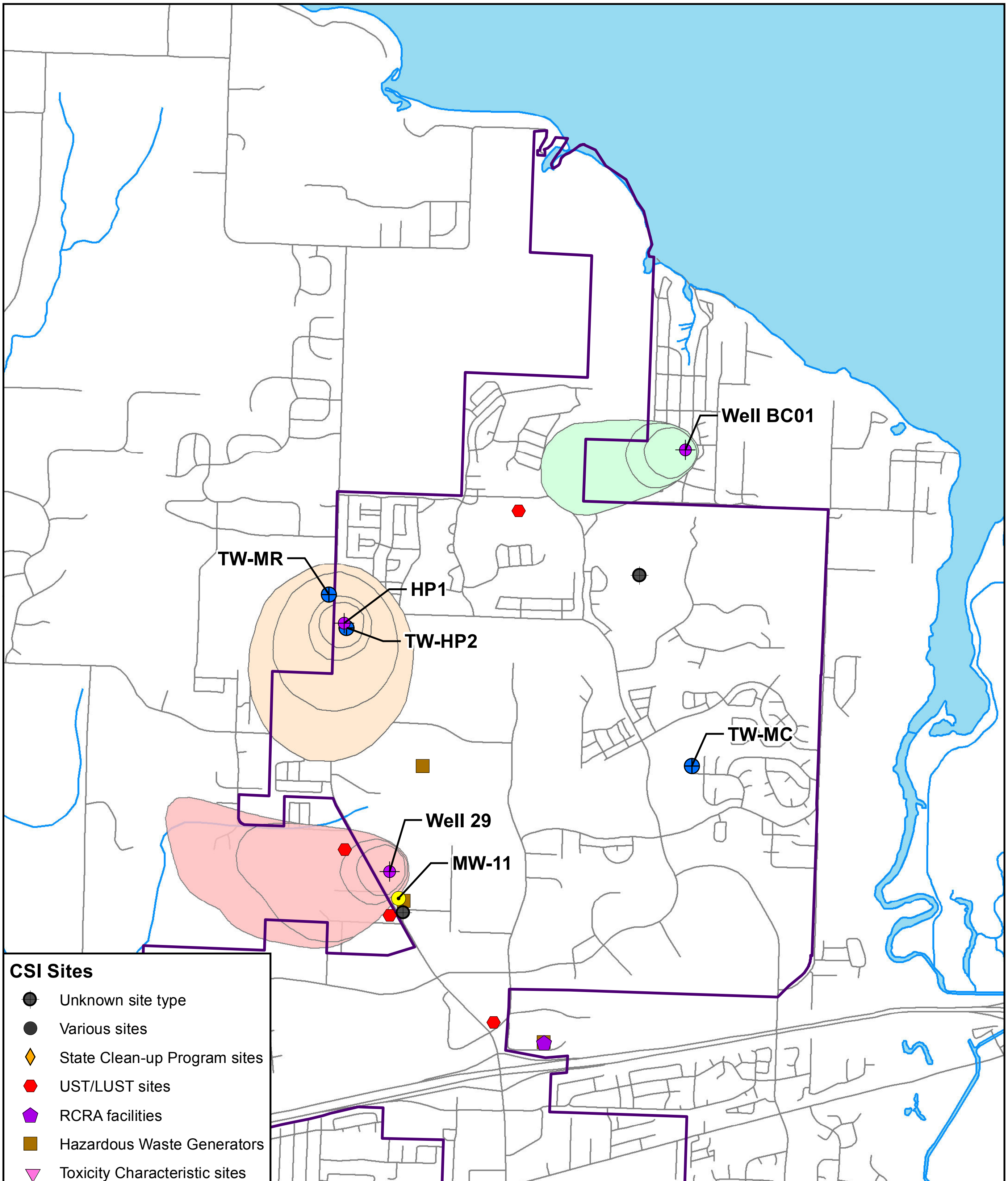
FIGURE **5-2**

RECOMMENDED NEW MONITORING WELLS - EAST LACEY AREA

WELLHEAD PROTECTION WSP UPDATES/WA

08393334F26R05.mxd | 6/14/2010 | THAMMOND

Golder Associates



LEGEND

Recommended Monitoring Well
Production Well
Monitoring Well
Lacey City Limit
TQu Aquifer WHPAs
Qpg Aquifer WHPAs
Qga Aquifer WHPAs

0 3000
Scale in Feet

Map Projection:
Washington State Plane
South Zone NAD 1983

Source:
Carollo, WA DNR, USGS, NLW 2009,
CSI 2007, Golder Associates Inc.

N

This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

FIGURE **5-3**

RECOMMENDED NEW MONITORING WELLS - HAWKS PRAIRIE AREA

WELLHEAD PROTECTION WSP UPDATES/WA

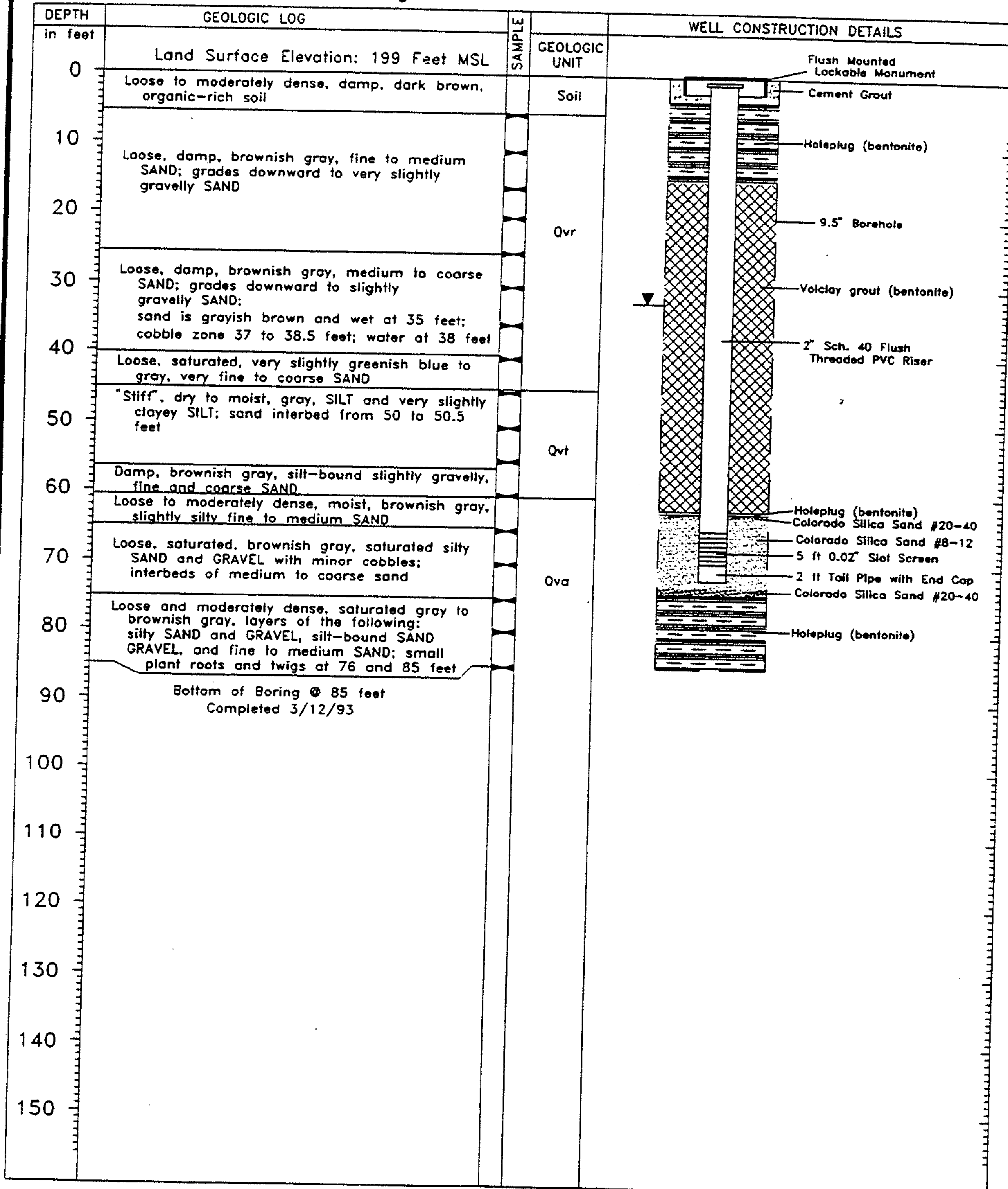
08393334F27R03.mxd | 6/14/2010 | THAMMOND

Golder Associates

APPENDIX A

FIGURE A-1 WELL LOG AND AS-BUILT FOR MW-1

Lacey Wellhead Protection Program



PROJECT NAME: Lacey WHP Program
WELL INDENTIFICATION NUMBER: MW-1
DRILLING METHOD: Hollow Stem Auger
DRILLER: Jeff Kelley
FIRM: Tacoma Pump & Drilling
CONSULTING FIRM: Pacific Groundwater Group, Inc.
REPRESENTATIVE: Jim Mathieu

LOCATION: SE ¼ SW ¼ Sec. 33, T18N, R1W, W.M.
DATUM: MSL
WATER LEVEL ELEVATION: 169.97 Feet MSL
WATER LEVEL DATE: June 24, 1993
INSTALLED: March 15, 1993
DEVELOPED: May 21, 1993

Pacific Groundwater Group

c:\jm9202\logs\mw1.dwg, 03/94

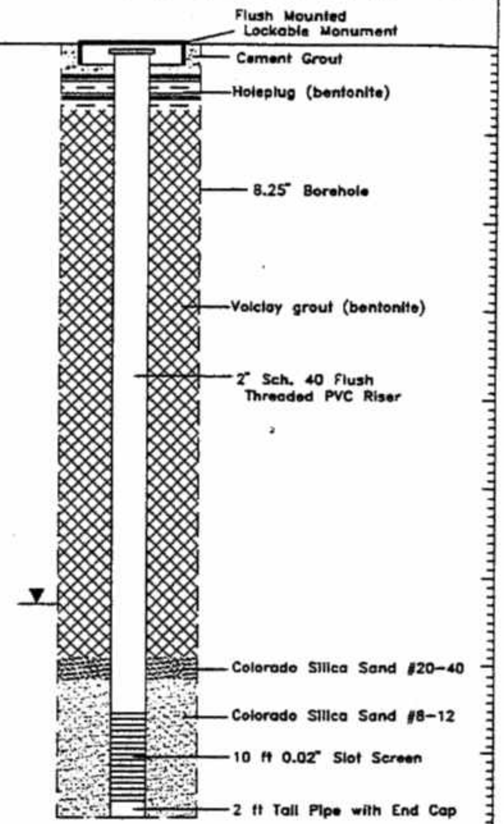
FIGURE A-2 WELL LOG AND AS-BUILT FOR MW-2

Lacey Wellhead Protection Program

Land Surface Elevation: 235.5 Feet MSL

DEPTH in feet	GEOLOGIC LOG	GEOLOGIC UNIT
0	TOPSOIL / FILL; abundant plant roots; fill is presumeably from College St. construction	Fill
10	Moderately dense, damp to moist, brownish gray, clay- and silt-bound sandy GRAVEL, and silt-bound fine to medium SAND; interbed of moderately loose, damp, silty fine to medium sand from 16.5 to 22.5 feet	Qvt
30	Dense, grayish brown, SILT; lenses of fine sand and clay-bound fine sand	Qvt
	Loose, damp, brownish gray, slightly silty, slightly gravelly, fine to medium SAND	Qva
40	Moderately dense, damp, grayish brown, slightly silt-bound fine SAND	Qva
50	Moderately dense to loose, moist, grayish brown to brownish gray, gravelly, silty, fine to coarse SAND; grades downward to loose, dry to damp, well sorted, fine to medium SAND (has salt and pepper appearance); silt laminations at 60 feet; water encountered at 64 feet	Qva
70	Loose, saturated, brownish gray, silty, sandy GRAVEL; grades downward to silty, gravelly, fine to coarse SAND; cobble zone (?) at 81 and 84 feet	Qva
90	Bottom of Boring @ 87.5 feet Completed 5/6/93	
100		
110		
120		
130		
140		
150		

WELL CONSTRUCTION DETAILS



PROJECT NAME: Lacey WHP Program
WELL INDENTIFICATION NUMBER: MW-2
DRILLING METHOD: Hollow Stem Auger
DRILLER: Bill Brun
FIRM: Holt Testing
CONSULTING FIRM: Pacific Groundwater Group, Inc.
REPRESENTATIVE: Jim Mathieu

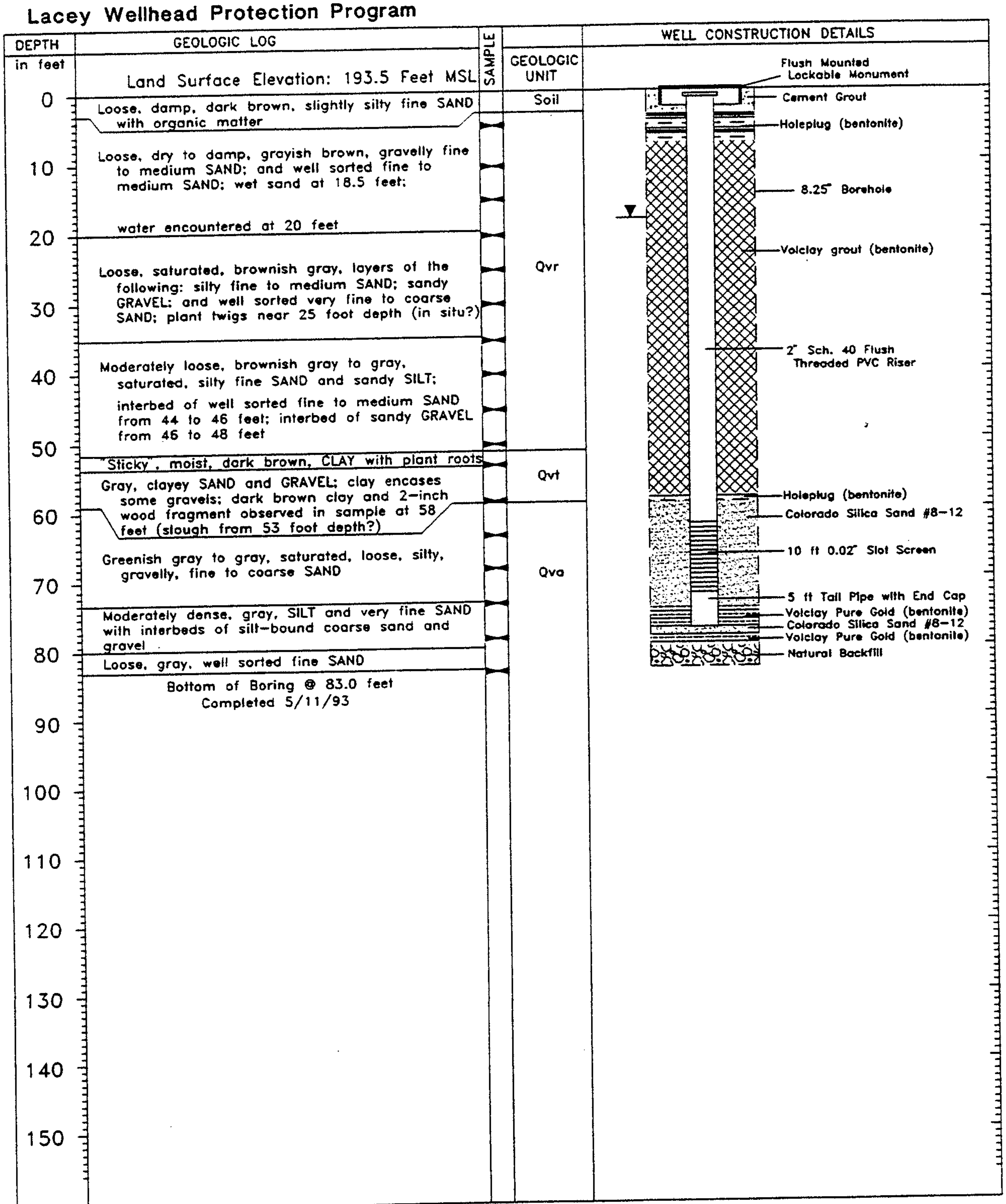
LOCATION: SW¼ SW¼ Sec. 28, T18N, R1W, W.M.
DATUM: MSL
WATER LEVEL ELEVATION: 172.56 Feet MSL
WATER LEVEL DATE: June 23, 1993
INSTALLED: May 6, 1993
DEVELOPED: May 25 1993

Pacific Groundwater Group

c:\jm9202\logs\mw2.dwg, 03/94

FIGURE A-3 WELL LOG AND AS-BUILT FOR MW-3

Lacey Wellhead Protection Program



PROJECT NAME: Lacey WHP Program
WELL INDENTIFICATION NUMBER: MW-3
DRILLING METHOD: Hollow Stem Auger
DRILLER: Bill Brun
FIRM: Holt Testing
CONSULTING FIRM: Pacific Groundwater Group, Inc.
REPRESENTATIVE: Jim Mathieu

LOCATION: NW¼ SE¼ Sec. 04, T17N, R1W, W.M.
DATUM: MSL
WATER LEVEL ELEVATION: 175.29 Feet MSL
WATER LEVEL DATE: June 21, 1993
INSTALLED: May 11, 1993
DEVELOPED: May 21, 1993

Pacific Groundwater Group

c:\jm9202\logs\mw3.dwg, 03/94

FIGURE A-4 WELL LOG AND AS-BUILT FOR MW-4

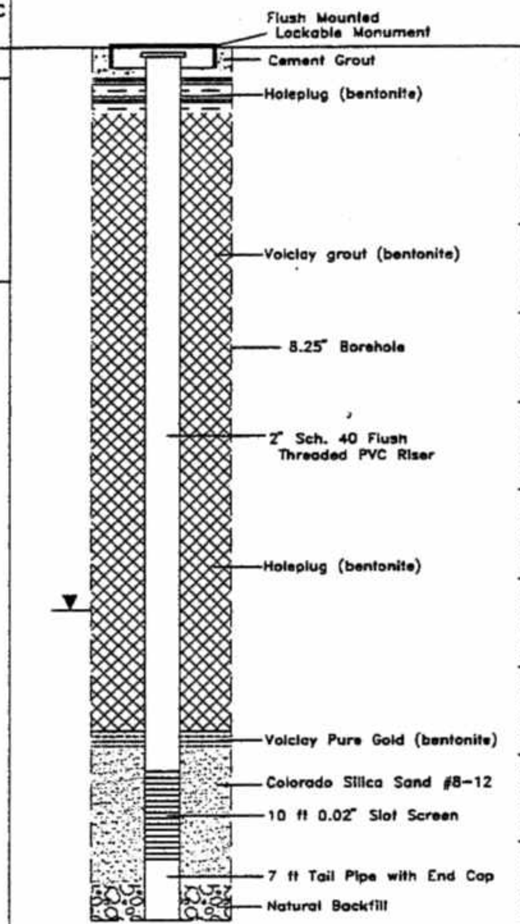
Lacey Wellhead Protection Program

DEPTH in feet: 0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150

GEOLOGIC LOG — Land Surface Elevation: 218.5 Feet MSL	GEOLOGIC UNIT
Brown, organic-rich SOIL	Soil
Moderately dense to dense, dry to damp, brownish gray to grayish brown, silt- and clay-bound SAND and GRAVEL; interbed of loose, well sorted fine sand from 9.5 to 13 feet, and 14.5 to 16.5 feet; dark brown organic matter (?) at 19 feet	Qvl
Loose, dry, grayish brown, fine SAND (salt and pepper apperance)	Qva
Moderately dense, moist, brownish gray, silt-bound very fine SAND, and slightly clayey SILT	
Loose to moderately loose, dry to damp, browish gray to grayish brown, slightly silty very fine to fine SAND; laminations and cross-bedding	
Loose, dry to saturated, browish gray to gray, well sorted, fine SAND; some siltly sand lenses; wet sand at 64 feet; water encountered at 66 feet	
Dense, damp to moist, grayish brown to gray, slightly clayey SILT; dark brown, 1-mm, sub-rounded mineral deposits or organic matter (?)	
Loose, saturated, brownish gray, silty sandy GRAVEL; silt-bound sandy gravel ooccurs from 75.5 to 76, and 84.5 to 85 feet	
Loose, saturated, brownish gray to grayish brown, slightly silty gravelly SAND; silt-bound gravelly sand occurs from 89.5 to 90 feet	
Loose, saturated, brownish gray, very slightly silty and gravelly fine SAND; moderately well sorted	

Bottom of Boring @ 99.0 feet
Completed 5/12/93

WELL CONSTRUCTION DETAILS



PROJECT NAME: Lacey WHP Program
WELL INDENTIFICATION NUMBER: MW-4
DRILLING METHOD: Hollow Stem Auger
DRILLER: Bill Brun
FIRM: Holt Testing
CONSULTING FIRM: Pacific Groundwater Group, Inc.
REPRESENTATIVE: Jim Mathieu

LOCATION: NE ¼ SW ¼ Sec. 28, T18N, R1W, W.M.
DATUM: MSL
WATER LEVEL ELEVATION: 154.47 Feet MSL
WATER LEVEL DATE: June 23, 1993
INSTALLED: May 12, 1993
DEVELOPED: May 25, 1993

Pacific Groundwater Group

c:\jm9202\logs\mw4.dwg, 03/94

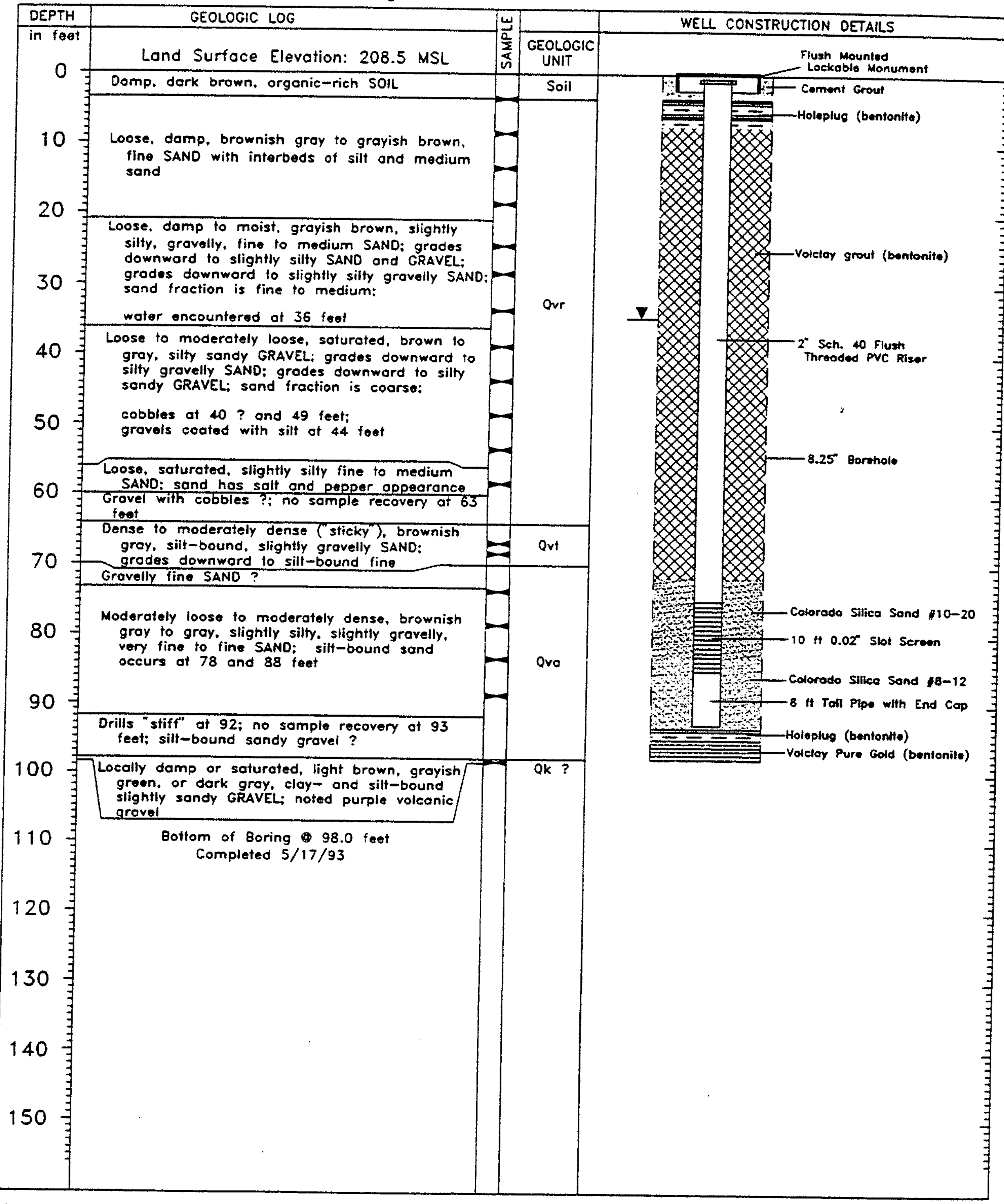
FIGURE A-5 WELL LOG AND AS-BUILT FOR MW-5

Lacey Wellhead Protection Program

Land Surface Elevation: 208.5 MSL

GEOLOGIC LOG	GEOLOGIC UNIT
Damp, dark brown, organic-rich SOIL	Soil
Loose, damp, brownish gray to grayish brown, fine SAND with interbeds of silt and medium sand	Qvr
Loose, damp to moist, grayish brown, slightly silty, gravelly, fine to medium SAND; grades downward to slightly silty SAND and GRAVEL; grades downward to slightly silty gravelly SAND; sand fraction is fine to medium; water encountered at 36 feet	Qvr
Loose to moderately loose, saturated, brown to gray, silty sandy GRAVEL; grades downward to silty gravelly SAND; grades downward to silty sandy GRAVEL; sand fraction is coarse; cobbles at 40 ? and 49 feet; gravels coated with silt at 44 feet	Qvr
Loose, saturated, slightly silty fine to medium SAND; sand has salt and pepper appearance	Qvr
Gravel with cobbles ?; no sample recovery at 63 feet	Qvr
Dense to moderately dense ("sticky"), brownish gray, silt-bound, slightly gravelly SAND; grades downward to silt-bound fine	Qvt
Gravelly fine SAND ?	Qva
Moderately loose to moderately dense, brownish gray to gray, slightly silty, slightly gravelly, very fine to fine SAND; silt-bound sand occurs at 78 and 88 feet	Qva
Drills "stiff" at 92; no sample recovery at 93 feet; silt-bound sandy gravel ?	Qva
Locally damp or saturated, light brown, grayish green, or dark gray, clay- and silt-bound slightly sandy GRAVEL; noted purple volcanic gravel	Qk ?

Bottom of Boring @ 98.0 feet
Completed 5/17/93



PROJECT NAME: Lacey WHP Program
WELL INDENTIFICATION NUMBER: MW-5
DRILLING METHOD: Hollow Stem Auger
DRILLER: Bill Brun
FIRM: Holt Testing
CONSULTING FIRM: Pacific Groundwater Group, Inc.
REPRESENTATIVE: Jim Mathieu

LOCATION: NW¼ SW¼ Sec. 04, T17N, R1W, W.M.
DATUM: MSL
WATER LEVEL ELEVATION: 173.98 Feet MSL
WATER LEVEL DATE: June 24, 1993
INSTALLED: May 17, 1993
DEVELOPED: May 21, 1993

Pacific Groundwater Group

c:\jm9202\logs\mw5.dwg, 03/94

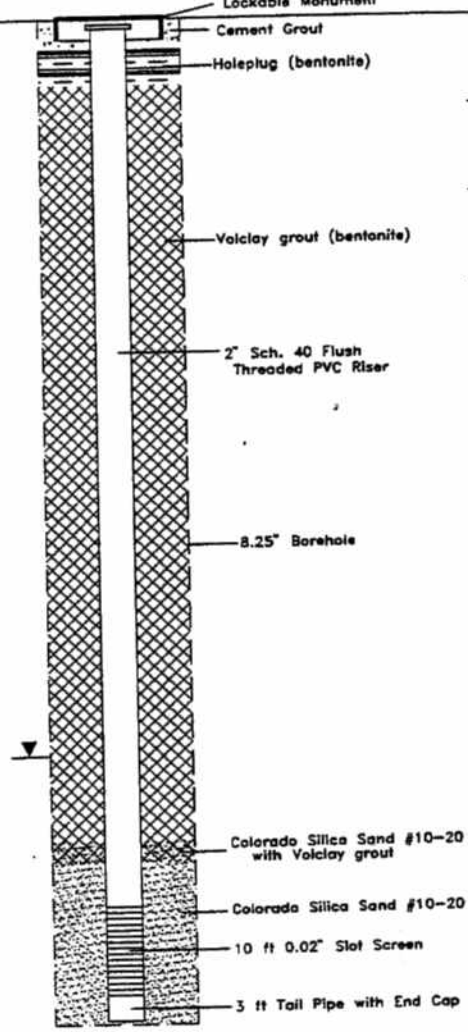
FIGURE A-6 WELL LOG AND AS-BUILT FOR MW-6

Lacey Wellhead Protection Program

Land Surface Elevation: 236 Feet MSL

DEPTH in feet	GEOLOGIC LOG	GEOLOGIC UNIT
0	Dry to damp, dark brown to brown, slightl sandy, gravelly SILT with organic matter	Soil
10	Dry, brownish greenish gray to gray, silt-bound slightly sand GRAVEL; coarse gravel and cobbles at 10 feet	Qvt
20	Loose, damp to dry, brownish gray to grayish, brown, slightly silty fine to medium SAND; grades downward to silty slightly silty fine SAND; saturated sand encountered at 23 feet	Qvt
30	Moderately loose to moderately dense, saturated gray to brownish gray, silty very fine to fine SAND; grades downward to sandy SILT	Qvt
40	Loose, damp, grayish brown to brownish gray, moderately well sorted, very slightly silty fine to medium SAND; sand has salt and pepper appearance	Qva
50	Loose, dry to damp, grayish brown slightly silty, gravelly fine to coarse SAND; cobbles at 55 ft	Qva
60	Loose, damp, grayish brown, well sorted, fine to medium SAND; sand has salt and pepper appearance	Qva
70	Loose, dry to damp, grayish brown, very slightly silty, gravelly, fine to medium SAND	Qva
80	Loose, brownish gray, slightly silty, fine to medium SAND; water encountered at 84 feet	Qva
90	Moderately loose to moderately dense, brownish gray to grayish brown, SILT; and slightly silt-bound, fine to medium SAND	Qva
	Loose, greenish gray, sandy GRAVEL; sand fraction is coarse	Qva
100	Loose, brownish gray and gray, well sorted, medium SAND; grades downward to greenish gray, very slightly silty, slightly gravelly, medium to coarse SAND (salt and pepper)	Qva
110	Moderately dense, moist, brown, SILT and silt-bound very fine to fine SAND	Qk ?
120	Bottom of Boring @ 114.0 feet Completed 5/18/93	
130		
140		
150		

WELL CONSTRUCTION DETAILS



PROJECT NAME: Lacey WHP Program
WELL INDENTIFICATION NUMBER: MW-6
DRILLING METHOD: Hollow Stem Auger
DRILLER: Bill Brun
FIRM: Holt Testing
CONSULTING FIRM: Pacific Groundwater Group, Inc.
REPRESENTATIVE: Jim Mathieu

LOCATION: NW¼ NW¼ Sec. 28, T18N, R1W, W.M.
DATUM: MSL
WATER LEVEL ELEVATION: 153.40 Feet MSL
WATER LEVEL DATE: June 24, 1993
INSTALLED: May 18, 1993
DEVELOPED: May 18, 1993

Pacific Groundwater Group

c:\jm9202\logs\mw6.dwg, 03/94

APPENDIX B

Regulatory Agencies and Local Governments

Washington State Department of Ecology - Water Resources Division
Southwest Regional Office, PO Box 47775, Olympia, WA 98504-7775
Phone: (360) 407-0281, Igor Vern

Washington State Department of Health - Division of Drinking Water
Southwest Regional Office, 243 Israel Road SE, PO Box 47823, Tumwater, WA 98501
Phone: (360) 664-0768

Thurston County Public Health and Social Services Department
Environmental Health Division – Drinking Water
2000 Lakeridge Drive SW, Olympia, WA 98503
Phone: (360) 786-5490

Local Emergency Incident Responders

City of Lacey
Scott Egger, Director; 420 College Street SE, Lacey, WA 98503
Business: (360) 491-5600

Lacey Fire District 3
Jim Broman, Chief, 1231 Franz Street SE, Lacey, WA 98503
Emergency: 911; Business: (360) 491-2410

Department of Health - Southwest Regional Office
P.O. Box 47823, Olympia, WA 98504-7823
Chemical Compliance: Sophia Petro. Business: (253) 236-3046
Regional Engineer: Virpi Salo-Zieman; Business: (360) 236-3037

Fire Protection Bureau - Washington State Patrol
Mike Matlick, State Fire Marshall;
Administration Building, PO Box 42600, Olympia, WA 98504-2600
Emergency: 911; Business: (360) 753-0404

Ft. Lewis Fire and Emergency - Services (HAZMAT Team)
Public Works AFZH-PWF MS-17
Building 2014 Box 339500, Ft. Lewis, WA 98433
Emergency: (253) 967-5859

Emergency Response, Washington - State Department of Transportation, Traffic Management Center
2501 112th St E., Tacoma, WA 98445-5104
Business: (24 hr) (253) 536-6089

Lacey Police Department - Chief of Police
420 College Street SE, Lacey , WA 98509-3400
Business: (360) 459-4333; Emergency: 911

Thurston County Public Works Road Division - Road Maintenance and Operations
9605 Tilley Rd SW Olympia, WA 98512
Business: (360) 786-5495.

Thurston County Emergency Management
2703 Pacific Avenue SE, Ste B, Olympia, WA 98501
Business: (360) 754-3360

Thurston County Sheriff
Dan Kimball, Sheriff, 2000 Lakeridge Drive SW, Olympia, WA 98502
Emergency: 911; Business: (360) 786-5500

Spill Response Program - Washington Department of Ecology
PO Box 47775, Olympia, WA 98504-7775
Business: (24 hrs) (360) 407-6300, (800) 258-5990

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CITY OF LACEY
POST OFFICE BOX 3400
LACEY, WA 98509-3400

LETTER OF NOTIFICATION – LACEY WELLHEAD PROTECTION AREAS

June 13, 2011

Dear Business Owner/Operator:

The Wellhead Protection Program for the Lacey Water System has recently been updated as required by the Washington State Department of Health. The purpose of wellhead protection is to prevent contamination of the drinking water supply through a comprehensive management program that includes monitoring, spill response planning, land use regulation, regional coordination, and public education and notification. This letter is part of the public notification element of Lacey's wellhead protection program.

Lacey's water supply comes from 19 wells, and each of these wells has a defined "wellhead protection area" where activities on the land surface can influence the quality of the drinking water supply. An updated map of Lacey's wellhead protection areas is attached, and shows wellhead protection areas for wells that are currently in use.

Our records indicate that your business is located within a wellhead protection area for one or more City of Lacey wells. As shown on the enclosed map, large areas around Lacey are within wellhead protection areas. One of the goals of this plan is to raise public awareness about the vulnerability of groundwater in our area to contamination. This letter is to serve as a reminder that, although everyone needs to be careful about the use of hazardous materials, their use within wellhead protection areas requires additional caution because spills or discharges onto the ground or in septic systems has the potential to contaminate groundwater.

To avoid contaminating groundwater, hazardous materials should only be used and disposed of according to manufacturers label instructions. General considerations on the use of hazardous materials include:

- Proper disposal of waste fuels, cleaners, paints, solvents and similar fluids. Overall, the goal is to prevent disposal of these materials onto the ground or into stormwater systems.
- Secondary containment and leak detection systems for storage tanks.
- Spill plans, spill supplies and training for staff to be able to respond to spills if they do occur.

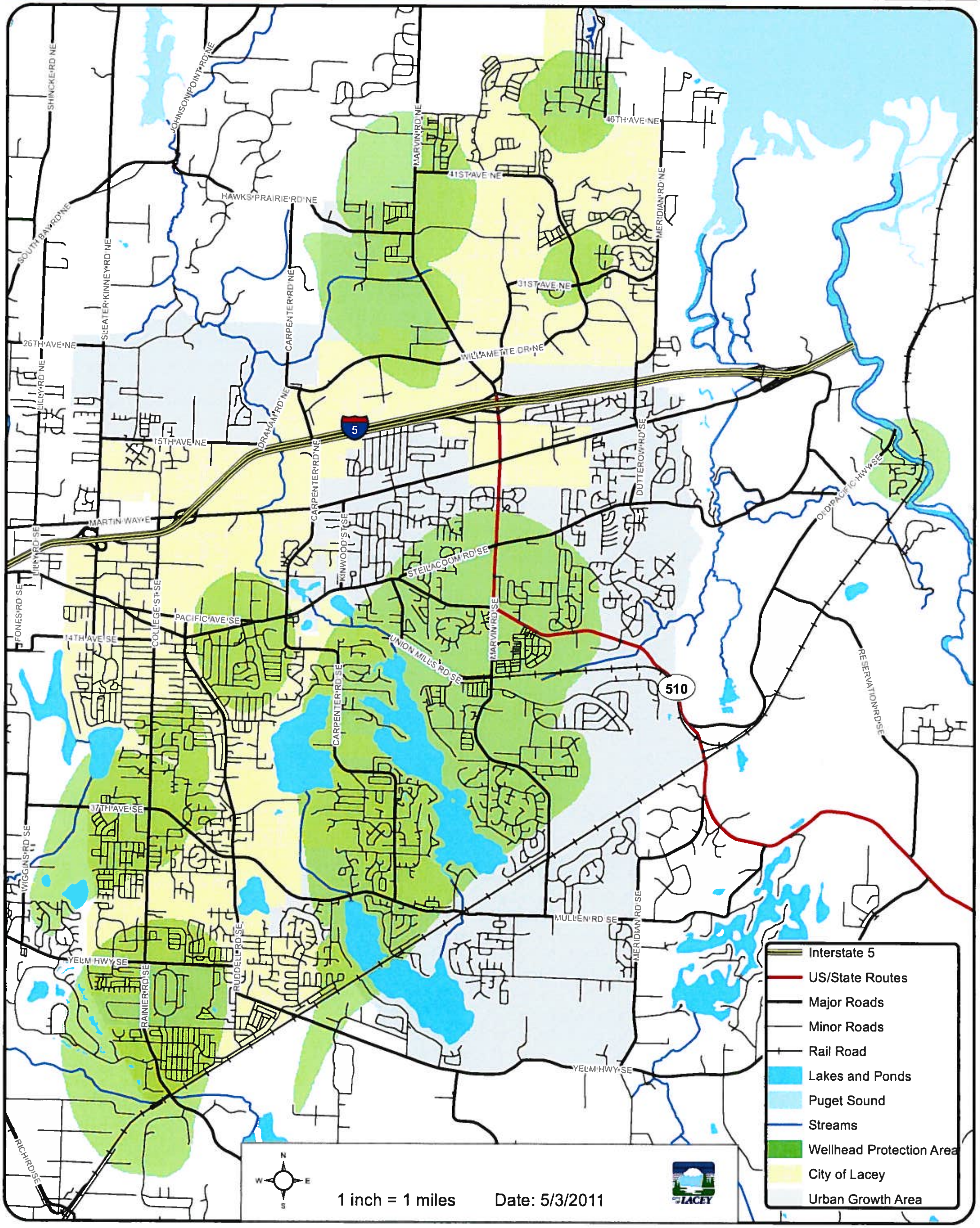
Because everyone plays a role in the protection plan, residents and other Lacey water customers are receiving similar information in our annual water quality report for the water system. Overall we are fortunate to have a good supply of high quality drinking water here in Lacey that we all have an interest in protecting. If you have any questions about Lacey's wellhead protection program, please feel free to contact me at 493-2410, or at jrector@ci.lacey.wa.us.

Sincerely,

Julie Rector

Julie Rector
City of Lacey Water Resources

2011 Wellhead Protection Areas: City of Lacey



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CITY OF LACEY

POST OFFICE BOX 3400
LACEY, WA 98509-3400

LETTER OF NOTIFICATION – LACEY WELLHEAD PROTECTION AREAS

June 13, 2011

Dear Government Agency or Emergency Responder:

The Wellhead Protection Program for the Lacey Water System has recently been updated as required by the Washington State Department of Health. As part of this program, the water system must provide wellhead protection information to regulatory agencies and emergency responders responsible for incident and spill response procedures. In this letter, we are providing the susceptibility rating for each source, and maps showing the updated wellhead protection areas for current source wells and potential sources of contamination. With this updated information, local emergency responders may evaluate whether changes in incident/spill response procedures are needed to better protect groundwater within wellhead protection areas.

Lacey's water supply comes from 19 wells that vary in depth and surrounding land use, which affects each well's susceptibility to groundwater contamination. Susceptibility ratings for each well are shown below. The "high" susceptibility ratings are found at older, shallower wells.

Source Well	Address	Susceptibility Rating
Well S01	3300 College St	High
Wells S02 & S03	3300 College St	Mod
Well S04	6100 W Sarazan SW	High
Well S06	2400 Judd St	Low
Well S07	5608 Pacific Ave	Low
Well S09	4830 Yelm Highway	Low
Well S10	5138 Yelm Highway	Mod
Wells S15 & S16	8905 48th Way	Mod
Well S19	4040 Marvin Rd NE	Low
Well S20	2020 Marvin Rd (off 19th)	Mod
Well S21	8826 Milbanke Dr SE	Mod
Well S22	8826 Milbanke Dr SE	Mod
Well S28	8826 Milbanke Dr SE	Mod
Well S24	11544 6th Ave	Mod
Well S25	11544 6th Ave	Mod
Well S27	2800 Hibiscus Ct	Mod
Well S29	2950 Marvin Rd	Low

Maps of Lacey's wellhead protection areas and potential contaminant sources are enclosed for your information. Please note that in these maps, wellhead protection areas overlap for several wells. The shallowest wells, shown with light blue wellhead protection areas, have the highest susceptibility to contamination. The deepest wells, shown with beige wellhead protection areas, have the lowest susceptibility to contamination.

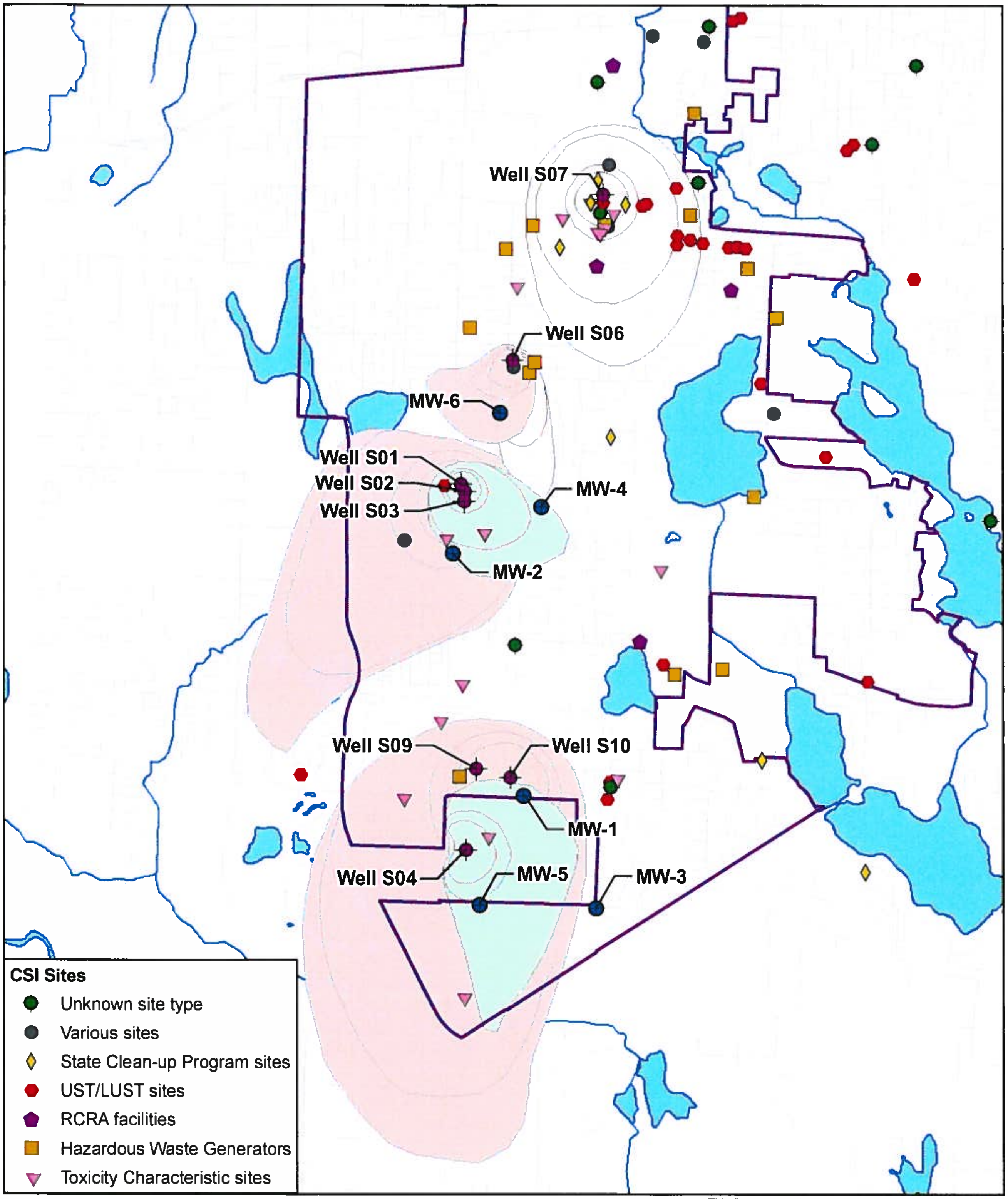
Thank you for your attention in this matter. An acknowledgement of receipt of this information or a response from your office is not required as part of the wellhead protection plan documentation. If you have any questions about the plan, please feel free to contact me at 493-2410, or at jrector@ci.lacey.wa.us.

Sincerely,

Julie Rector

Julie Rector
City of Lacey Water Resources

In Washington state, the wellhead protection area for each public water supply well consists of the sanitary control area (the 100-foot radius around each well), the 1, 5, and 10 year time-of-travel capture zones, and a buffer zone, if needed. The time-based capture zones estimate the distance water moves through an aquifer to a pumping well over each specified time period. These capture zones are used to identify the surface area of influence around each well where careful management of land uses can reduce the risk of contaminating groundwater (the "wellhead protection area"). Defining these wellhead protection areas, identifying potential sources of groundwater contamination within these areas, and assessing the susceptibility of each well to groundwater contamination are all critical components of wellhead protection.



LEGEND

Production Well
Monitoring Well
Lacey City Limit
Qga Aquifer WHPAs (shallow wells)
Qpg Aquifer WHPAs
TQu Aquifer WHPAs (deep wells)

WHPA = wellhead protection area

0 3500
Scale in Feet

Map Projection:
Washington State Plane
South Zone NAD 1983

Source:
Carollo, WA DNR, USGS,
Golder Associates Inc.

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This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

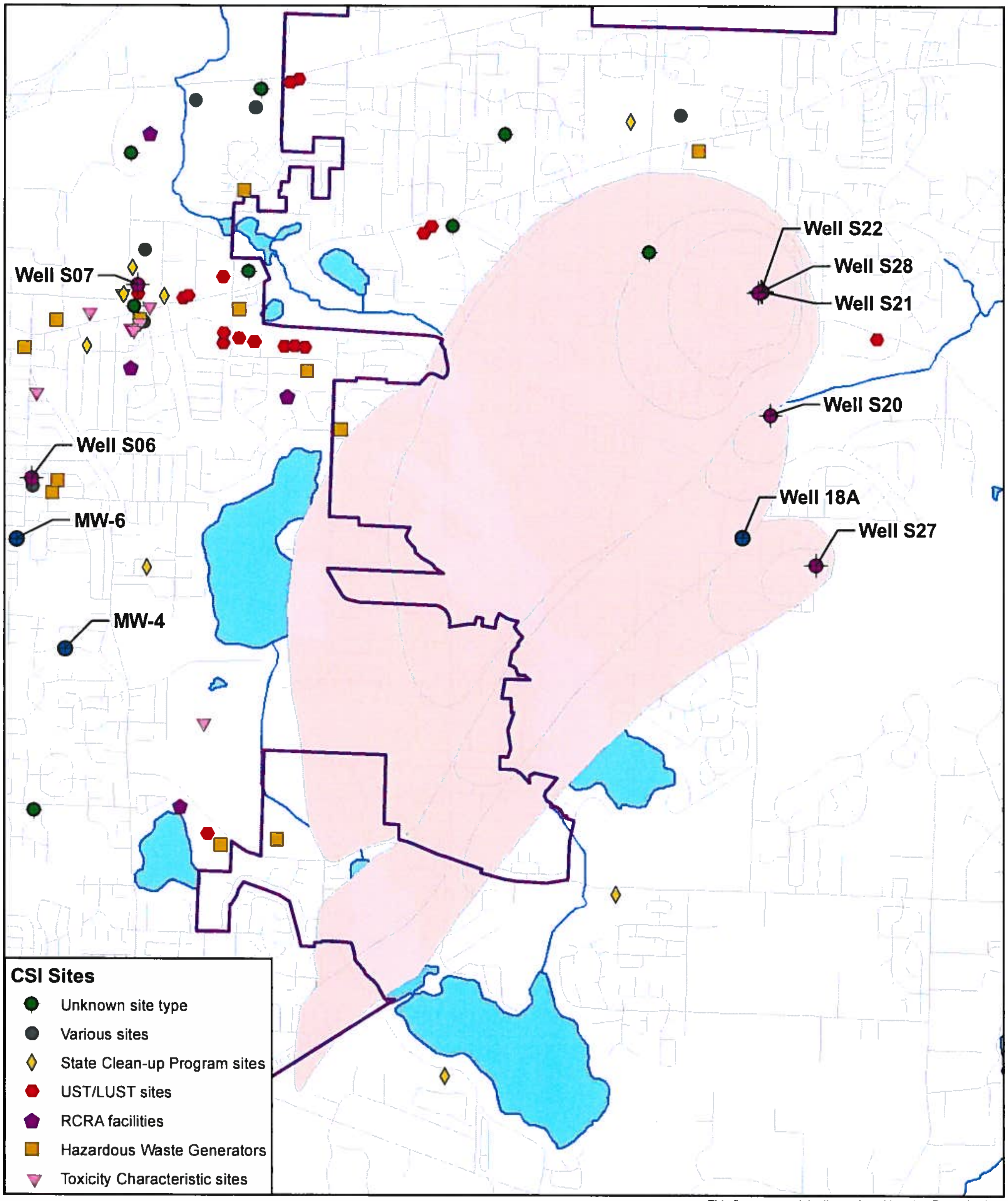
FIGURE **4-2**

LOCATION OF CSI AND WHPAs - COLLEGE STREET AREA

WELLHEAD PROTECTION WSP UPDATES/WA

08393334F62_CollegeStreetWHPAsR01.mxd | 5/24/2010 | THAMMOND

Golder Associates



LEGEND

Production Well

Monitoring Well

Lacey City Limit

Qpg Aquifer WHPAs — well head protection area

0 3000

Scale in Feet

Map Projection:
Washington State Plane
South Zone NAD 1983

Source:
Carollo, WA DNR, USGS,
CSI 2007, Golder Associates Inc.

N

This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

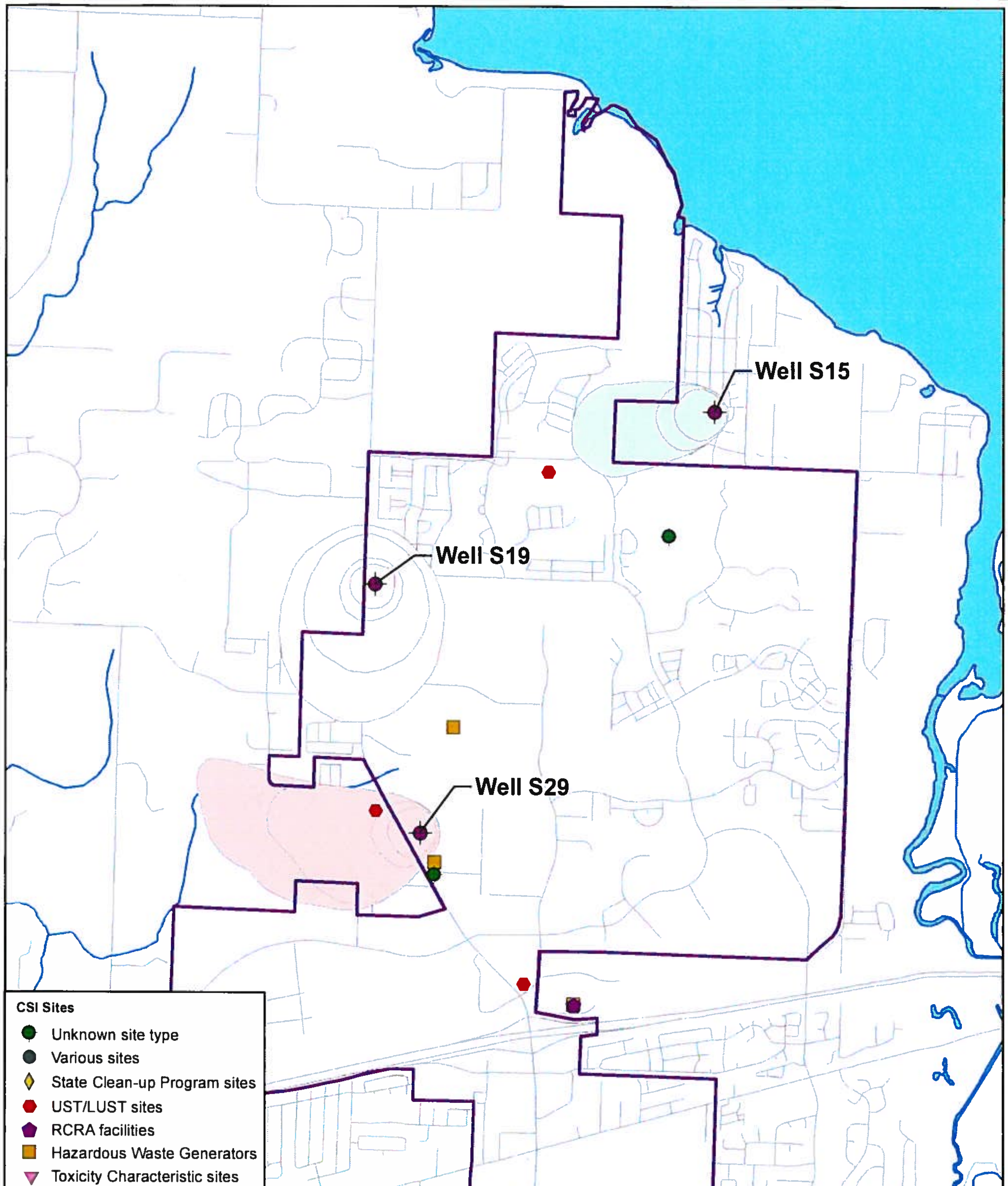
FIGURE **4-3**

LOCATION OF CSI AND WHPAs - EAST LACEY AREA

WELLHEAD PROTECTION WSP UPDATES/WA

08393334F63_EastLaceyWHPAs.mxd | 5/24/2010 | THAMMOND

Golder Associates



LEGEND

- Production Well
- Lacey City Limit
- TQu Aquifer WHPAs (deep wells)
- Qga Aquifer WHPAs
- Qpg Aquifer WHPAs (shallow wells)

WHPA = wellhead protection area

0 3000

Scale in Feet

N

Map Projection:
Washington State Plane
South Zone NAD 1983

Source:
Carollo, WA DNR, USGS, CSI 2007,
Golder Associates Inc.

This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

FIGURE **4-4**

**LOCATION OF CSI AND WHPAs-
HAWKS PRAIRIE AREA**

WELLHEAD PROTECTION WSP UPDATES/WA

08393334F64_HawksPrairieWHPAs.mxd | 5/24/2010 | THAMMOND

Golder Associates

2011 Wellhead Protection Area Letter Recipients

Business Name	# Address	Street	City State	Zip
A.G. El Dorado Jewelry	5707	Lacey Blvd SE	Lacey, WA	98503
Albertsons 0480	6100	Pacific Ave SE	Lacey, WA	98503
Aspenlieder Home (Billington)	8542	Pacific HWY SE	Lacey, WA	98503
Blackhills Truck Equip Inc	2907	Marvin Rd NE	Lacey, WA	98503
Brentwood Faith Home	2416	Brentwood PL SE	Lacey, WA	98503
Buddies Grocery & Deli	6501	Martin Way E	Lacey, WA	98503
Capitol City Golf Club	5225	Yelm Hwy SE	Lacey, WA	98513
Carpet Exchange (R E Carpet Prtnrshp)	5700	Lacey Blvd SE	Lacey, WA	98503
Cash Northwest	5910	Pacific Ave SE	Lacey, WA	98503
Chambers Center Chevron	5700	Ruddell Rd	Lacey, WA	98503
Chiropractic Care Center	5600	Pacific Ave SE	Lacey, WA	98503
City of Lacey: Scott Egger, Public Works Director	420	College St SE	Lacey, WA	98509
City Of Olympia (Shana Park well site)		PO Box 1967	Olympia	98507-1967
D & D Overhead Door Inc (Holmes Garage Door)	6410	Carpenter Rd SE	Lacey, WA	98503
Dennehy DDS	1607	Ruddell Rd SE	Lacey, WA	98503
Department of Health, Southwest Regional Office	P.O. Box 47823		Olympia, WA	98504
Don's Golf Car Sales (Gary Stolz Auto Experts)	5709	Lacey Blvd SE	Lacey, WA	98503
Emergency Response, Washington - state Department of Transportation, Traffic Management Center	2501	112th St E.	Tacoma	98445-5104
FedEx Express OLM	7820	29th AVE NE	Lacey, WA	98516
Fire Protection Bureau - Washington State Patrol: Chuck Duff, state Fire Marshal	P.O. Box 42600		Olympia, WA	98504
First Choice Automotive (or Tru Truss Inc or Enterprise Rent-A-Car #4528)	1219	Carpenter RD SE	Lacey, WA	98503
Ft. Lewis Fire and Emergency - Services HAZMAT Team, public Works AFZH-PWF MS-17	Building 2014 Box 339500		Ft. Lewis, WA	98433
Funeral Alternatives of Washington	5711	Lacey Blvd SE 306	Lacey, WA	98503
Harold Yates (Conwell, Mark & Teresa A)	2415	Carpenter Rd SE	Lacey, WA	98503
Hawk's Prairie Golf LLC	9051	46th AVE NE	Lacey, WA	98516
Holy Family School	2606	Carpenter RD SE	Lacey, WA	98503
Hughes Transport Hw (Barrett, Kathy)	6011	Mullen Rd SE	Lacey, WA	98503
Idalis, Inc.	3613	College St SE	Lacey, WA	98503
Indian Summer Golf Course	4009	Yelm Hwy SE	Lacey, WA	98501
Interlake Grocery	7446	Mullen Rd SE	Lacey, WA	98503
John Ketola Painting Inc	5711	Lacey Blvd 305	Lacey, WA	98503
Kohouts Automotive	6537	Martin WAY E	Lacey, WA	98503
Komachin Middle School	3650	College St SE	Lacey	98503
L C Livingood Trucking Inc	3201	College St SE	Lacey, WA	98503
Lacey Collision Center Inc	1215	Carpenter Rd SE	Lacey, WA	98503
Lacey Fire Dist 3 Station 31 (HQ)	1231	Franz St SE	Lacey, WA	98503

Lacey Fire Dist 3 Station 33	6500 Mullen Rd SE	Lacey, WA	98503
Lacey Fire Dist 3 Station 34	8407 Steilacoom	Lacey, WA	98513
Lacey Fire District 3: Jim Broman, Chief	1231 Franz Street SW	Lacey, WA	98503
Lacey Medical	5602 Ruddell Rd SE	Lacey, WA	98513
Lacey Police Department - Chief of Police: Dusty Pierpoint	240 College St. SE	Lacey, WA	98509-3400
Lakes Elementary School (NTPS)	6211 Mullen Rd SE	Lacey	98503
Lakeside Industries	2416 Hogum Bay Rd NE	Lacey, WA	98503
LOTT Martin Way Reclaimed Water	6121 Martin Way E	Lacey, WA	98503
Mark's Drywall	1930 Carpenter RD SE	Lacey, WA	98503
Memorial Clinic (Pioneer Family Practice)	5130 Corporate Center Ct SE	Lacey, WA	98503
Mountain View Veterinary Hospital	4620 Whitman Ln SE	Lacey, WA	98513
MT VIEW ELEMENTARY SCHOOL	1900 College St SE	Lacey	98503
Natural Medicines & Fmly Pract	1315 Ruddell Rd SE	Lacey, WA	98503
NISQUALLY MIDDLE SCHOOL	8100 Steilacoom Rd SE	Lacey	98503
North Thurston Public Schools	305 College St NE	Lacey	98516
North Thurston Public Schools (Bus Barn)	6620 Carpenter Rd SE	Lacey, WA	98503
Olsen Tree Farm (Olson, Richard A & Charlotte A)	7219 Rainier Rd SE	Lacey, WA	98513
Olympic Arms Inc	624 Old Pacific Hwy SE	Lacey, WA	98503
Ostrom Mushroom Co, Inc	8322 Steilacoom Rd SE	Lacey, WA	98513
Pacific Electronics	5711 Lacey Blvd SE	Lacey, WA	98503
Pacific Mini Mart	9139 Pacific Ave	Lacey, WA	98503
Panorama City	1751 Circle Ln SE	Lacey, WA	98503
Prestige Painting & Collision	1124 Carpenter RD SE	Lacey, WA	98503
Quest Environmental Group (Hales, Kenneth M & Normandie F)	6511 Sierra Dr SE	Lacey, WA	98503
Rainier Pacific Supply Inc (PKMM Inc.)	3005 Marvin Rd NE	Lacey, WA	98503
Ricks Service Center	5916 Pacific Ave SE	Lacey, WA	98503
Ritz Cleaners Inc	4730 Yelm HWY SE	Lacey, WA	98503
Roo-Lan Healthcare Center	1505 Carpenter RD SE	Lacey, WA	98503
Ruddell Road General Store	5726 Ruddell Rd SE Ste B	Lacey, WA	98503
Southland Corp (Lacey Chevron 9 6219)	6125 Pacific Ave SE	Lacey, WA	98503
Spill response Program - Washington Department of Ecology	P.O. Box 47775	Olympia, WA	98504
St Martins	5500 Pacific Ave SE	Lacey, WA	98503
St Peter Chemical Dependence (Sisters of Providence in WA)	4800 College St SE	Lacey, WA	98503
Sunbelt Rentals	7851 29th Ave NE	Lacey, WA	98516
Sunset Air	5210 Lacey Blvd SE	Lacey, WA	98503
Tam's Gardening	3407 College St SE	Lacey, WA	98503
Target Import Warehouse T600	3500 Marvin Rd NE	Lacey, WA	98503
THURSTON CNTY WATER & WASTE MGMT	2420 Hogum Bay Rd	Lacey, WA	98503
Thurston County Emergency Management	2703 Pacific Ave. SE, Ste B	Olympia, WA	98501
Thurston County Fairgrounds	3054 Carpenter RD	Lacey, WA	98503

Thurston County Public Health and Social Services Department, Environmental Health Division	2000 Lakeridge Dr. SW	Olympia, WA	98503
Thurston County Public Works Road Division - Road Maintenance and Operations	9605 Tilley Rd. SW	Olympia, WA	98512
Thurston County Sheriff: John Snaza, Sheriff	2000 Lakeridge Dr. SW	Olympia, WA	98502
Timberline High School (Schoo District #3)	6120 Mullen Rd SE	Lacey	98503
Union Mills Grocery (Han, Yong S)	7431 Pacific Ave SE	Lacey, WA	98503
Veneer Service Inc	7225 Pacific Ave SE	Lacey, WA	98503
Veterinarian Companion Hospital	5710 Ruddell Rd SE	Lacey, WA	98513
Washington State Department of Ecology	300 Desmond Dr SE	Lacey, WA	98503
Washington State Department of Ecology - Water Resources Division, Southwest Region Office	P.O. Box 47775	Olympia, WA	98504-7775
Washington State Department of Health - Division of Drinking Water, Southwest Regional Office	P.O. Box 47823	Olympia, WA	98504-7822
Weyerhaeuser Co Box Plant	7727 Union Mills Rd SE	Lacey, WA	98503
Woodlawn Funeral Home (Southwick Inc)	5930 Mullen Rd SE	Lacey, WA	98503

Appendix N

DEPARTMENT OF HEALTH WATER QUALITY MONITORING REPORT FOR 2011

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

Water Quality Monitoring Report for the Year 2011

System: LACEY WATER DEPARTMENT **PWSID:** 43500 Y **Report Date:** 03/02/2011
Contact: PETER BROOKS **Group:** A - Comm **County:** THURSTON **Region:** SOUTHWEST

Part 1: List of Active Sources with Water Quality Monitoring Requirements

DOH Source#	Name	Type	Use	Susceptibility Rating
S01	COLLEGE ST 32ND AAA936	Well	Permanent	Moderate
S04	GOLF CLUB ESTATES AAA934	Well	Permanent	High
S06	JUDD HILL AAA940	Well	Permanent	Unknown
S07	FIRE STATION AAA930	Well	Permanent	Low
S09	LITTLE PRAIRIE AAB880	Well	Permanent	Low
S10	MT GREENS AAB881	Well	Permanent	Low
S17	WF (S015, 16)	Well Field	Permanent	Unknown
S18	WF (S02 & 3)	Well Field	Permanent	Unknown
S19	HAWKS PRAIRIE AAB877	Well	Permanent	Low
S20	MCALLISTER AAY 302	Well	Permanent	Moderate
S23	WF (S21, S22)	Well Field	Permanent	Low
S24	LACEY NISQ S01 WELL 19A AAA938	Well	Permanent	Moderate
S25	LACEY NISQ SO2 WELL 19C AAA937	Well	Permanent	High
S27	EVERGREEN EST WELL 24 AGP478	Well	Permanent	Low
S28	MADRONA 3 AEC883	Well	Permanent	Low
S29	BETTI AEC941	Well	Permanent	Low

Part 2: Sampling Schedule for the Year 2011

Coliform Sampling (Routine)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
	70	70	70	70	70	70	70	70	70	70	70	70

* Indicates the requirement is an exception from WAC 246-290.

- If the coliform (bacteriological) sampling schedule listed at the bottom of the current Water Facilities Inventory (WFI) form for your system is different from the schedule listed above, follow the schedule on the current WFI.
- Samples must be collected from representative points throughout the distribution system.
- Repeat samples are required following an unsatisfactory sample. In addition, collect a sample from each operating groundwater source.
- A minimum of 5 routine samples are required the month following one or more unsatisfactory samples in accordance with your system's Coliform Monitoring Plan.

Water Quality Monitoring Report for the Year 2011

Lead and Copper Distribution Sampling

- Lead and copper samples must be collected from indoor faucets within the distribution system after the water has sat unused in the pipes for at least 6 hours but no more than 12 hours.
- Sample faucets should be flushed with cold water the evening prior to collecting the sample.
- Part 2 indicates the month in which samples should be collected. Part 4 indicates the total number of sample required.
- If you are required to sample annually or once every 3 years, samples must be collected between June and September.

Chlorine Residual Sampling

- Systems that use continuous chlorination must take chlorine residual measurements daily (or at a reduced frequency approved by the department), and at the same time and location as routine and repeat coliform samples.

Disinfection Byproducts Sampling

- Systems that use continuous chlorination treatment must collect samples for total trihalomethanes (TTHM) and for haloacetic acids (HAA5) for each chlorination treatment facility identified in your individual disinfection byproducts (DBP) monitoring plan. Collect the samples from the distribution system at the frequency and locations identified in your DBP monitoring plan.

Chemical Sampling Requirements

- Source water chemical samples must be taken from a location as near to the source as possible, but after all treatment, and before entering the distribution system.
- Nitrate, nitrite and arsenic are included as part of a complete IOC.

Month	Source	Monitoring Requirement	Test Panel
January		*No source chemical sampling required this month*	
February		*No source chemical sampling required this month*	
March		*No source chemical sampling required this month*	
April		*No source chemical sampling required this month*	
May	S01	NITRATE	NITRATE
May	S04	NITRATE Req'd for May	NITRATE
May	S18	NITRATE	NITRATE
May	S19	NITRATE	NITRATE
May	S20	NITRATE	NITRATE
June		HALO-ACETIC ACIDS / trihalomethane ? our approved Stage 2 is Jan, Apr, July, Oct	HAA5 / THM
July	S07	NITRATE	NITRATE
July	S17	NITRATE	NITRATE
July	S28	NITRATE	NITRATE
August	S06	NITRATE	NITRATE
August	S09	NITRATE	NITRATE
August	S10	NITRATE	NITRATE

Water Quality Monitoring Report for the Year 2011

Month	Source	Monitoring Requirement	Test Panel
August	S23	NITRATE	NITRATE
August	S24	NITRATE	NITRATE
August	S25	NITRATE	NITRATE
August	S27	NITRATE	NITRATE
August	S29	NITRATE	NITRATE
September		HALO-ACETIC ACIDS / trihalomethane	HAA5 /THM
September		LEAD / COPPER	LCR
October		HALO-ACETIC ACIDS / trihalomethane	HAA5 / THM
November		*No source chemical sampling required this month*	
December		*No source chemical sampling required this month*	

Part 3: State Waivers

- Automatically granted to all sources based on DOH assessment of conditions within the state.
- No waiver application, or fee required.
- State waivers granted for the 2011 - 2013 compliance period are listed in Part 4.

Part 4: Water Quality Monitoring Frequency

*Radionuclides Not Listed

- Although waivers may be granted for your system, there may be some monitoring required as a condition of the waiver your system was granted.

Monitoring Group	Test Panel	Sample Location	Schedule/Status
Asbestos	ASB	Distribution	Collect 1 Asbestos sample in 2019
Bacteriological	Coli	Distribution	See routine sample schedule in part 2
Dioxin	Dioxin	All sources	State Waiver Thru Dec 2013
Endothall	Endo	All sources	State Waiver Thru Dec 2013
EDB and other soil fumigants	Fumigant	S01	2 sample(s) between Jan 2011 – Dec 2013
EDB and other soil fumigants	Fumigant	S04	2 sample(s) between Jan 2011 – Dec 2013
EDB and other soil fumigants	Fumigant	S06	2 sample(s) between Jan 2011 – Dec 2013 → ? State Waived last WQM
EDB and other soil fumigants	Fumigant	S07	State Waiver Thru Dec 2013
EDB and other soil fumigants	Fumigant	S09	State Waiver Thru Dec 2013
EDB and other soil fumigants	Fumigant	S10	State Waiver Thru Dec 2013
EDB and other soil fumigants	Fumigant	S17	State Waiver Thru Dec 2013
EDB and other soil fumigants	Fumigant	S18	2 sample(s) between Jan 2011 – Dec 2013
EDB and other soil fumigants	Fumigant	S19	State Waiver Thru Dec 2013
EDB and other soil fumigants	Fumigant	S20	2 sample(s) between Jan 2011 – Dec 2013
EDB and other soil fumigants	Fumigant	S23	State Waiver Thru Dec 2013

Water Quality Monitoring Report for the Year 2011

Monitoring Group	Test Panel	Sample Location	Schedule/Status
EDB and other soil fumigants	Fumigant	S24	State Waiver Thru Dec 2013
EDB and other soil fumigants	Fumigant	S25	State Waiver Thru Dec 2013
EDB and other soil fumigants	Fumigant	S27	State Waiver Thru Dec 2013
EDB and other soil fumigants	Fumigant	S28	2 sample(s) between Jan 2011 – Dec 2013 → ? state waiver on last WQM
EDB and other soil fumigants	Fumigant	S29	State Waiver Thru Dec 2013
Glyphosphate	Glyphs	All sources	State Waiver Thru Dec 2013
Halo-Acetic Acids	HAA5	Distribution	1 sample per treatment plant every 3 months
Herbicides	Herbs	S01	2 sample(s) between Jan 2011 – Dec 2013
Herbicides	Herbs	S04	2 sample(s) between Jan 2011 – Dec 2013
Herbicides	Herbs	S06	2 sample(s) between Jan 2011 – Dec 2013
Herbicides	Herbs	S07	2 sample(s) between Jan 2011 – Dec 2013
Herbicides	Herbs	S09	2 sample(s) between Jan 2011 – Dec 2013
Herbicides	Herbs	S10	2 sample(s) between Jan 2011 – Dec 2013
Herbicides	Herbs	S17	2 sample(s) between Jan 2011 – Dec 2013
Herbicides	Herbs	S18	2 sample(s) between Jan 2011 – Dec 2013
Herbicides	Herbs	S19	2 sample(s) between Jan 2011 – Dec 2013
Herbicides	Herbs	S20	2 sample(s) between Jan 2011 – Dec 2013
Herbicides	Herbs	S23	2 sample(s) between Jan 2011 – Dec 2013
Herbicides	Herbs	S24	2 sample(s) between Jan 2011 – Dec 2013
Herbicides	Herbs	S25	2 sample(s) between Jan 2011 – Dec 2013
Herbicides	Herbs	S27	2 sample(s) between Jan 2011 – Dec 2013
Herbicides	Herbs	S28	2 sample(s) between Jan 2011 – Dec 2013
Herbicides	Herbs	S29	2 sample(s) between Jan 2011 – Dec 2013
Insecticides	Insect	S01	2 sample(s) between Jan 2011 – Dec 2013
Insecticides	Insect	S04	2 sample(s) between Jan 2011 – Dec 2013
Insecticides	Insect	S06	2 sample(s) between Jan 2011 – Dec 2013
Insecticides	Insect	S07	2 sample(s) between Jan 2011 – Dec 2013
Insecticides	Insect	S09	2 sample(s) between Jan 2011 – Dec 2013
Insecticides	Insect	S10	2 sample(s) between Jan 2011 – Dec 2013
Insecticides	Insect	S17	2 sample(s) between Jan 2011 – Dec 2013
Insecticides	Insect	S18	2 sample(s) between Jan 2011 – Dec 2013
Insecticides	Insect	S19	2 sample(s) between Jan 2011 – Dec 2013
Insecticides	Insect	S20	2 sample(s) between Jan 2011 – Dec 2013
Insecticides	Insect	S23	2 sample(s) between Jan 2011 – Dec 2013
Insecticides	Insect	S24	2 sample(s) between Jan 2011 – Dec 2013
Insecticides	Insect	S25	2 sample(s) between Jan 2011 – Dec 2013

Water Quality Monitoring Report for the Year 2011

Monitoring Group	Test Panel	Sample Location	Schedule/Status
Insecticides	Insect	S27	2 sample(s) between Jan 2011 – Dec 2013
Insecticides	Insect	S28	2 sample(s) between Jan 2011 – Dec 2013
Insecticides	Insect	S29	2 sample(s) between Jan 2011 – Dec 2013
Inorganic Contaminants	IOC	S01	1 sample between Jan 2011 - Dec 2013
Inorganic Contaminants	IOC	S04	1 sample between Jan 2011 - Dec 2013
Inorganic Contaminants	IOC	S06	1 sample between Jan 2011 - Dec 2013
Inorganic Contaminants	IOC	S07	1 sample between Jan 2011 - Dec 2013
Inorganic Contaminants	IOC	S09	1 sample between Jan 2011 - Dec 2013
Inorganic Contaminants	IOC	S10	1 sample between Jan 2011 - Dec 2013
Inorganic Contaminants	IOC	S17	1 sample between Jan 2011 - Dec 2013
Inorganic Contaminants	IOC	S18	1 sample between Jan 2011 - Dec 2013
Inorganic Contaminants	IOC	S19	1 sample between Jan 2011 - Dec 2013
Inorganic Contaminants	IOC	S20	1 sample between Jan 2011 - Dec 2013
Inorganic Contaminants	IOC	S23	1 sample between Jan 2011 - Dec 2013
Inorganic Contaminants	IOC	S24	1 sample between Jan 2011 - Dec 2013
Inorganic Contaminants	IOC	S25	1 sample between Jan 2011 - Dec 2013
Inorganic Contaminants	IOC	S27	1 sample between Jan 2011 - Dec 2013
Inorganic Contaminants	IOC	S28	1 sample between Jan 2011 - Dec 2013
Inorganic Contaminants	IOC	S29	1 sample between Jan 2011 - Dec 2013
Lead/Copper *	LCR	Distribution	LCR 1 Set of 30 samples between Jan 2009 - Dec 2011
Nitrate *	NIT	S01	Collect 1 sample(s) every 1 year
Nitrate *	NIT	S04	Collect 1 sample(s) every 1 year
Nitrate *	NIT	S06	Collect 1 sample(s) every 1 year
Nitrate *	NIT	S07	Collect 1 sample(s) every 1 year
Nitrate *	NIT	S09	Collect 1 sample(s) every 1 year
Nitrate *	NIT	S10	Collect 1 sample(s) every 1 year
Nitrate *	NIT	S17	Collect 1 sample(s) every 1 year
Nitrate *	NIT	S18	Collect 1 sample(s) every 1 year
Nitrate *	NIT	S19	Collect 1 sample(s) every 1 year
Nitrate *	NIT	S20	Collect 1 sample(s) every 1 year
Nitrate *	NIT	S23	Collect 1 sample(s) every 1 year
Nitrate *	NIT	S24	Collect 1 sample(s) every 1 year
Nitrate *	NIT	S25	Collect 1 sample(s) every 1 year
Nitrate *	NIT	S27	Collect 1 sample(s) every 1 year
Nitrate *	NIT	S28	Collect 1 sample(s) every 1 year
Nitrate *	NIT	S29	Collect 1 sample(s) every 1 year

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

Not listed in 2010 WQM

Water Quality Monitoring Report for the Year 2011

Monitoring Group	Test Panel	Sample Location	Schedule/Status
General Pesticides	Pest1	S01	2 sample(s) between Jan 2011 – Dec 2013
General Pesticides	Pest1	S04	2 sample(s) between Jan 2011 – Dec 2013
General Pesticides	Pest1	S06	2 sample(s) between Jan 2011 – Dec 2013
General Pesticides	Pest1	S07	2 sample(s) between Jan 2011 – Dec 2013
General Pesticides	Pest1	S09	2 sample(s) between Jan 2011 – Dec 2013
General Pesticides	Pest1	S10	2 sample(s) between Jan 2011 – Dec 2013
General Pesticides	Pest1	S17	2 sample(s) between Jan 2011 – Dec 2013
General Pesticides	Pest1	S18	2 sample(s) between Jan 2011 – Dec 2013
General Pesticides	Pest1	S19	2 sample(s) between Jan 2011 – Dec 2013
General Pesticides	Pest1	S20	2 sample(s) between Jan 2011 – Dec 2013
General Pesticides	Pest1	S23	2 sample(s) between Jan 2011 – Dec 2013
General Pesticides	Pest1	S24	2 sample(s) between Jan 2011 – Dec 2013
General Pesticides	Pest1	S25	2 sample(s) between Jan 2011 – Dec 2013
General Pesticides	Pest1	S27	2 sample(s) between Jan 2011 – Dec 2013
General Pesticides	Pest1	S28	2 sample(s) between Jan 2011 – Dec 2013
General Pesticides	Pest1	S29	2 sample(s) between Jan 2011 – Dec 2013
Diquat	Diquat	All sources	State Waiver Thru Dec 2013
Total Trihalomethane	THM	Distribution	1 sample per treatment plant every 3 months
Volatile Organic Contaminants	VOC	S01	1 sample between Jan 2011 - Dec 2013
Volatile Organic Contaminants	VOC	S04	1 sample between Jan 2011 - Dec 2013
Volatile Organic Contaminants	VOC	S06	1 sample between Jan 2011 - Dec 2013
Volatile Organic Contaminants	VOC	S07	1 sample between Jan 2011 - Dec 2013
Volatile Organic Contaminants	VOC	S09	1 sample between Jan 2011 - Dec 2013
Volatile Organic Contaminants	VOC	S10	1 sample between Jan 2011 - Dec 2013
Volatile Organic Contaminants	VOC	S17	1 sample between Jan 2011 - Dec 2013
Volatile Organic Contaminants	VOC	S18	1 sample between Jan 2011 - Dec 2013
Volatile Organic Contaminants	VOC	S19	1 sample between Jan 2011 - Dec 2013
Volatile Organic Contaminants	VOC	S20	1 sample between Jan 2011 - Dec 2013
Volatile Organic Contaminants	VOC	S23	1 sample between Jan 2011 - Dec 2013
Volatile Organic Contaminants	VOC	S24	1 sample between Jan 2011 - Dec 2013
Volatile Organic Contaminants	VOC	S25	1 sample between Jan 2011 - Dec 2013
Volatile Organic Contaminants	VOC	S27	1 sample between Jan 2011 - Dec 2013
Volatile Organic Contaminants	VOC	S28	1 sample between Jan 2011 - Dec 2013
Volatile Organic Contaminants	VOC	S29	1 sample between Jan 2011 - Dec 2013

** These contaminant monitoring groups do not have waiver options under the SDWA.*

Water Quality Monitoring Report for the Year 2011

Part 5: Regional Water Quality Monitoring Contact

Southwest Regional Office

For Further information call the Southwest Regional Office Sophia Petro Phone: (360) 236-3046

For questions regarding Disinfection ByProducts (DBP) monitoring, contact: Regina Grimm, p.e. (360) 236-3035

Special Note

For Group A Community Systems Only: Your Consumer Confidence Report, summarizing the results of your 2010 water quality monitoring requirements is due before July 1, 2011 . For further information visit www.doh.wa.gov/ehp/dw/Our_Main_Pages/consumer.htm or contact the CCR Coordinator at your Regional Office.

Julie

~~PETER BROOKS~~
LACEY WATER DEPARTMENT
PO BOX 3400
LACEY WA 98509-3400

RECEIVED
MAR 28 2011
PUBLIC WORKS

Water Quality Monitoring Report for the Year 2011

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Appendix O
DRINKING WATER REPORTS (2003 – 2011)

Water Conservation: Important Year-Round

It seems every summer we hear that it is important to conserve water. It's good for the environment, right? But on a rainy winter day in western Washington, the need to conserve water might not be so clear. Here are some of the reasons why conserving water is important year-round, even here in the wet Pacific Northwest!

The leading cause of septic system failure is overloading the system with water. The more water-saving fixtures in your home, the less likely you'll overload your system.

If you are on sewer service, conserving water helps postpone the need to develop additional wastewater treatment capacity - meaning that the expense of adding that capacity may be put off til later.

The same holds true for development of new water supplies - conserving water means that the need to develop additional supplies (and the expense) may be postponed.

You'll save money on your water bill since you'll be paying for less water. Even if you don't pay a water bill directly, those costs generally are passed on to you through rental fees.

Water is a precious resource we all share. Conserving water helps to preserve the high quality of our water supplies and ensure that the resource will be available for future generations.

Water conservation is easy for Lacey water customers by participating in the programs listed below:

Indoor Water Saving Kits are FREE to Lacey water customers. Interested customers can obtain an indoor water-saving kit at the Public Works counter in Lacey City Hall.

Outdoor Watering Kits are FREE to Lacey water customers. These kits can be obtained at the Public Works counter at Lacey City Hall.

WashWise Washing Machines save water and money, with a $100 rebate for LOTT sewer customers.

Composting Toilets don't use water to flush! LOTT sewer customers who purchase and install an approved model are eligible for a rebate of $350.

Water Smart Technology programs provide commercial and institutional LOTT customers with rebates to retrofit outdated or inefficient appliances and equipment using water efficient models.

Need outdoor water conservation tips? Pick up the booklet "How to Water Your Garden" by Sunset Magazine FREE at the Public Works Counter in City Hall. For more water saving ideas, check out the City's web site: www.wa.gov/lacey which links to www.h2ouse.org. For information on any of these programs or for more water saving ideas, call Lacey Water Resources at 438-2687.

For More Information...

...About Lacey's distribution system or to report problems, call the Lacey Maintenance Service Center at 491-5644.

...About your utility bill, call Lacey Utility Billing at 491-5616.

...About drinking water safety, call the EPA Safe Drinking Water Hotline at 1-800-426-4791 or visit the EPA Homepage at www.epa.gov/OW.

To Get Involved...

...Join us for a Utilities Committee meeting on the fourth Thursday of each month at 4:30 p.m. at Lacey City Hall, 420 College Street S.E. in Lacey. The committee discusses a variety of issues regarding our stormwater, drinking water, and wastewater utilities.

...Lacey's draft updated Water System Plan is scheduled for review by the Lacey City Council this fall. Public attendance at Council meetings is welcome. Call 438-2620 to check the agenda of upcoming meetings.

Shaping our community together

CITY OF LACEY

Water Resources
P.O. Box 3400
Lacey, WA 98509-3400

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2002 Drinking Water Quality Report

2002 Drinking Water Report

What We Look For In Your Drinking Water...

The sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally-occurring minerals and in some cases, radioactive material, and can pick up substances resulting from the presence of animals or from human activity.

Contaminants that may be present in source water include:

- **Microbial contaminants**, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.
- **Inorganic contaminants**, such as salts and metals, which can be naturally-occurring or result from urban stormwater runoff, industrial or domestic wastewater discharges, oil and gas production, mining, or farming.
- **Pesticides and herbicides**, which may come from a variety of sources such as agriculture, urban stormwater runoff, and residential uses.
- **Organic chemical contaminants**, including synthetic and volatile organic chemicals, which are byproducts of industrial processes and petroleum production, and can also come from gas stations, urban stormwater runoff, and septic systems.
- **Radioactive contaminants**, which can be naturally-occurring or be the result of oil and gas production and mining activities.

In order to ensure that tap water is safe to drink, EPA prescribes regulations which limit the amount of certain contaminants in water provided by public water systems, such as Lacey's water system. Food and Drug Administration regulations establish limits for contaminants in bottled water which must provide the same protection for public health.

The purpose of this report is to let you know which substances have been found in your drinking water and what implications, if any, exist for you and your family.

Printed in June 2003

Drinking Water Report

Lacey, Washington **for 2002**

It's Time Again For Lacey's Annual Drinking Water Report!

This report is federally mandated by the 1996 amendments to the Safe Drinking Water Act. In it, you will find information about the source and quality of your drinking water.

Lacey Water: What Does It Really Take to Bring Water To Your Tap?

You turn on your tap and it's there - safe, delicious drinking water. But it is more than magic that brings the water to your tap. Your water utility is working diligently to provide high-quality water when and where you need it. In this report, we'll explain more about how your utility is managed. Have you ever wondered...

- What does it really take to bring water to my tap?
- How is my utility dollar put to use?
- What steps are being taken to plan for future needs?
- Why is water conservation important?
- What are the opportunities for public involvement?
- Is the quality of the water high?

The answer to the final question is a resounding YES. **The 2002 test results show that the quality of Lacey's drinking water remains high -- exceeding state and federal regulations established for drinking water.** Water quality is monitored by testing our water supply regularly for the presence of contaminants. Inside, you'll find a table listing the levels of each substance detected in the water, as well as the acceptable levels and likely sources for each substance.

Ensuring that Lacey water continually meets all drinking water standards is a job your utility takes quite seriously. We hope that this report will provide a glimpse of how your water utility continues to deliver drinking water of the highest quality to your home or business.

For more information regarding any of the information presented in this report, please call Lacey Water Resources at 491-5600. We look forward to hearing from you!

Bringing Water to Your Tap: Many Steps Along the Way

Lacey water comes from underground aquifers -- porous rock formations below ground that hold water. These aquifers are replenished by rainwater that seeps through the ground and is filtered by the soil. The aquifers that supply Lacey's water are located at different depths below the surface and are surrounded by varying types of rock. Soil and rock layers above the aquifers protect the water from surface contamination.

Lacey's water system draws water from these aquifers through a series of 19 wells. Water composition at each of these wells varies slightly and is dependent on the depth of the well and the minerals present in the geology surrounding each well. Water from each well is monitored regularly for the presence of contaminants and mineral levels. (The results of this testing are presented in the following table.)

Due to the excellent quality of our source water, we are able to deliver water to your tap with minimal treatment. Where treatment is needed, it is customized to the source. At Well 7, water is treated by temporarily adding chlorine to the water to remove iron and manganese (the chlorine is removed before the water enters the distribution system). Water from the Hawk's Prairie well is aerated before being blended in the distribution system.

The distribution system is managed to optimize aesthetic characteristics of the water and provide reliable pressures. A telemetry system allows real time, centralized control of the quantity of water entering the system from each well and reservoir. Operations staff monitor and control distribution in this way, dispatching crews to adjust system components as needed.

Notice Changes In Your Water?
From time to time, normal operations may be temporarily disrupted due to system requirements such as new well construction, water line replacement, routine system repair, or heavy water demand. You may notice a difference in your water service during these situations, which are generally short-lived. We appreciate hearing from you when you notice changes from your normal water quality. Call Lacey Water Resources at 491-5600 to report any changes.

Maintaining the systems's components - wells, reservoirs, pipes, booster stations, etc. - is a BIG job. As part of this job, the Operations & Maintenance staff:

S Produce over 2,000,000,000 gallons of water
S Maintain 301 miles of water distribution pipe
S Inspect 19 production wells, 8 reservoirs and 7 booster stations weekly
S Monitor water levels in 8 reservoirs daily
S Monitor and service 50 remote telemetry stations continuously
S Inspect, adjust, repair and/or replace 10,000 water valves as needed
S Service pumps, electrical components and other equipment as needed
S Paint and service 2,375 fire hydrants on a 3 to 5 year rotating schedule
S Adjust and repair 80 pressure regulating valves as needed
S Accomplish all this with very efficient staffing and diligent management!

Important Terms

Maximum Contaminant Level (MCL): the highest level of a contaminant that is allowed in drinking water.

Maximum Contaminant Level Goal (MCLG): the contaminant level in drinking water below which there is no known or expected risk to health.

Action Level (AL): Action level is the concentration of a contaminant which, if exceeded, triggers treatment or other requirement which the water system must follow.

Primary Standard: the MCL for these substances is set primarily for health reasons.

Secondary Standard: the MCL for these substances is set primarily for non-health reasons such as color, taste, or fixture staining or indirect health concerns when levels are too high.

NTU: Nephelometric Turbidity Unit is the standard unit to measure the amount of material suspended in water.

PPM: Parts per million is equivalent to milligrams per liter (mg/l). One ppm is approximately equal to 1 drop in 22 gallons of water.

PPB: Parts per billion. One ppb is approximately equal to 1 drop in 22,000 gallons of water.

PPT: Parts per trillion. One ppt is approximately equal to 1 drop in 22,000,000 gallons of water.

pCi/l: Picocuries per liter is the unit of measure used to describe an amount of radiation.

umhos/cm: Micromhos per centimeter is the unit of measure used to describe conductivity.

Water Quality Table -- What Was Detected Last Year?

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the EPA's Safe Drinking Water Hotline (1-800-426-4791).

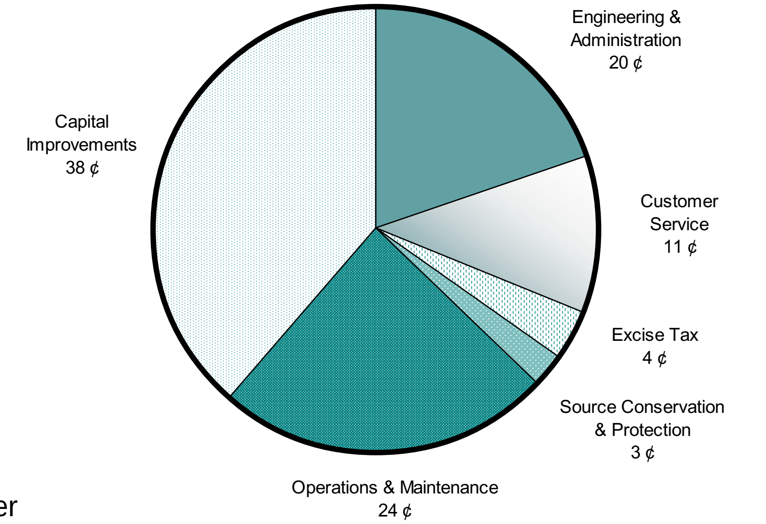
Lacey's water meets all state and federal drinking water standards set for health reasons. The table below lists the 19 substances detected in Lacey's water during the year 2002 or on the most recent date that testing was required. An additional 200 inorganic compounds (IOCs), volatile organic compounds (VOCs) and synthetic organic compounds (SOCs) were tested for and not detected. Samples are taken at each of the City's water supply wells. Results below reflect the highest and lowest levels detected at any one of the sample locations, providing the range of detections from all sample locations.

Substance	Highest Level Allowed (MCL)	Goal Not to Exceed (MCLG)	Highest Level Detected	Sampling Date of Highest Level Detected	Lowest Level Detected	Potential Sources of Contaminant
PRIMARY STANDARDS REGULATED BY EPA						
Fluoride[t]	4 ppm	4 ppm	0.2 ppm	8/24/00	< 0.2 ppm	geology, natural weathering
Nitrate-nitrogen	10 ppm	10 ppm	4.3 ppm	6/19/02	< 0.2 ppm	septic systems, fertilizer, animal wastes
Radionuclide-alpha emitters	15 pCi/l	N/A	3 pCi/l	2/08/00	< 2 pCi/l	decay of natural deposits
Radionuclide-beta emitters	50 pCi/l	N/A	3 pCi/l	2/08/00	< 2 pCi/l	decay of natural deposits
SECONDARY STANDARDS REGULATED BY EPA						
Chloride	250 ppm	N/A	15 ppm	5/20/02	1 ppm	geology, natural weathering
Iron	300 ppb	N/A	410 ppb[v v]	11/28/01	< 30 ppb	geology, natural weathering
Manganese	50 ppb	N/A	432 ppb[v v]	1/24/01	< 10 ppb	geology, natural weathering
Sulfate	250 ppm	N/A	11 ppm	5/08/02	2 ppm	geology, natural weathering
REGULATED BY THE STATE						
Conductivity	700 umhos/cm	N/A	220 umhos/cm	8/24/02	73 umhos/cm	geology, natural weathering
UNREGULATED BY EPA						
Alkalinity	N/A	N/A	65 ppm	3/06/00	36.8 ppm	geology, natural weathering
Calcium	N/A	N/A	28 ppm	2/17/00	10 ppm	geology, natural weathering
Chloroform	N/A	N/A	800 ppt	1/14/2003	< 500 ppt	chlorine use for treatment or well disinfection
Copper	N/A	1300 ppb	50 ppb	2/1/99	< 2 ppb	geology, natural weathering
Hardness	N/A	N/A	104 ppm	8/24/00	30 ppm	geology, natural weathering
Perchlorate[⦿⦿]	N/A	N/A	9 ppb	7/22/02	< 4 ppb	rocket propellants and explosives
Radon [✖]	N/A	N/A	670 pCi/l	7/25/00	190 pCi/l	geology, natural weathering
Sodium	N/A	20 ppm[**]	13 ppm	5/20/02	5 ppm	geology, natural weathering
Turbidity	N/A	N/A	1.5 NTU	5/08/02	0.1 NTU	natural erosion
REGULATED BY THE STATE AT THE CONSUMER'S TAP			**90th Percentile**			
Copper	1300 ppb (AL)	N/A	920 ppb	9/10/02	1 site exceeded the Action Level	geology, corrosion of household plumbing
Lead	15 ppb (AL)	N/A	8 ppb	9/10/02	0 sites exceeded the Action Level	geology, leaching of household plumbing

t Fluoride is not added to Lacey's water supply. These results indicate the presence of naturally-occurring fluoride in our groundwater.
v v Concentrations listed above were measured in Well 7 before the treatment plant was installed. Well 7 water is now treated to remove iron and manganese. From other sources, the highest detected concentrations were 170 ppb iron and 48 ppb manganese.
⦿⦿ Sampled in all sources in 2002-03 as required by the Federal Unregulated Contaminant Monitoring Rule. Although perchlorate was detected in two wells in July 2002, it was not detected in any wells when follow-up sampling was conducted in January 2003.
✖ At this time, radon in tap water is not regulated. However, EPA has proposed allowing an MCL of 4000 pCi/l in water if other sources of radon in indoor air are minimized. The greatest health risk from radon is breathing indoor air that contains radon. Most radon in indoor air comes from the breakdown of uranium in soils beneath homes. The risk from breathing or ingesting radon originating in tap water is considerably lower.
** This is the highest level recommended by EPA.

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice from their health care providers. EPA/CDC guidelines on appropriate means to lessen the risk of infection by Cryptosporidium and other microbial contaminants are available from the Safe Drinking Water Hotline (1-800-426-4791).

Your Water Utility Dollar



The fees you pay for water service are used to support the broad variety of activities necessary to bring water to your tap. The following provides a brief overview of how your water utility dollar is used to support this essential service.

Customer Service

S Utility billing staff distribute over 148,000 utility bills each year and process payments received for each bill
S Meter readers read over 14,300 meters each month and replace and/or repair about 300 meters a year
S Utility billing staff handle an average of 1,000 customer calls/inquiries each week
S Water resources staff make over 200 field visits each year to address customer concerns and questions
S Cross-connection control outreach and assistance helps protect the water system and individual customers

Operations & Maintenance

S See the article "Bringing Water to Your Tap" for information about Operation & Maintenance activities

Capital Improvements

S The 2003 Water Line Replacement Program will result in removal and replacement of 5,000 feet of aging pipe
S Completion of engineering designs will allow for an additional 5,000 feet of water line replacement in 2004
S Upgrade of the Evergreen well will increase production volumes to provide 1 million gallons of water a day and improve pressures in the south eastern portion of the system
S Evaluation of the Hawk's Prairie well will provide an assessment of whether or not additional treatment is needed
S Water level sensors being installed in several supply wells will improve our ability to monitor conditions
S Completion of well design for the Madrona 3 well will ensure timely construction to increase water production capabilities (pending approval of water right transfers and applications)

Source Conservation & Protection

S Water quality samples are taken from over 60 sites each month to meet state and federal monitoring requirements
S A study of water system vulnerability is being conducted to protect the water system from natural and human-caused threat
S On-going wellhead protection programs provide outreach and technical assistance to over 1,000 residents each year
S Conservation outreach and incentives provide customers with tools to use water wisely and help meet our 1% per year conservation goal

Engineering & Adminstration

S Update of the Comprehensive Water System Plan has been completed and will be reviewed by the City Council for adoption in Fall 2003
S On-going water system modeling helps to assess existing conditions and determine future capacity needs
S Water rights applications, transfers and purchases are being pursued to meet our community's growing water demand
S Engineering of system repairs and upgrades is completed throughout the year to keep the system operating optimally

Excise Tax

S Taxes on water sales are paid at a rate of 5.029% to the Washington State Department of Revenue

2003 Drinking Water Report

Lacey, Washington

Lacey Water: Monitored Closely

Lacey's water utility supplies over 2 billion gallons of water per year to over 50,000 customers. Nineteen wells are used to draw water from underground aquifers - porous rock formations below ground that hold water. Water composition at each of these wells varies slightly and is dependent on the minerals present in the geology surrounding each well. Soil and rock layers above the aquifers protect the water from surface contamination.

Ensuring that Lacey water continually meets state and federal drinking water standards is a job your utility takes quite seriously. Water from each well is monitored regularly for the presence of over 200 potential contaminants, as well as mineral levels. Each month in 2003, we collected 40 samples from the distribution system to test for the presence of bacteria. This rigorous monitoring program provides information about the quality of water at the source, in the distribution system and at the tap.

Inside, you'll find a table listing the sampling results for those substances that were detected in the water in 2003, as well as the acceptable levels and likely sources for each of those substances. For more information regarding any of the information presented in this report, please call Lacey Water Resources at 491-5600. We look forward to hearing from you!

It's Time Again For Lacey's Annual Drinking Water Report!

This report is federally mandated by the 1996 amendments to the Safe Drinking Water Act. In it, you will find information about the source and quality of your drinking water.

Total Coliform Results for 2004

As required by federal law, the table included in this document reflects testing results for water quality in 2003 only. The table does not include testing results for 2004. In both February and May of 2004, total coliform bacteria were found to be present in the water system. In response to the most recent occurrence in May, the affected portion of the water system has been isolated and will be temporarily chlorinated to eliminate the coliform. More information about this effort will be mailed to customers in the affected area prior to chlorination and is available on our web site at www.ci.lacey.wa.us.

Important Terms

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NTU: Nephelometric Turbidity Unit is the standard unit to measure the amount of material suspended in water.

PPM: Parts per million is equivalent to milligrams per liter (mg/l). One ppm is approximately equal to 1 drop in 22 gallons of water.

PPB: Parts per billion. One ppb is approximately equal to 1 drop in 22,000 gallons of water (equivalent to about 1 drop in a small swimming pool).

PPT: Parts per trillion. One ppt is approximately equal to 1 drop in 22,000,000 gallons of water (equivalent to about 1 drop in Long's Pond).

pCi/l: Picocuries per liter is the unit of measure used to describe an amount of radiation.

umhos/cm: Micromhos per centimeter is the unit of measure used to describe conductivity.

Water Quality Table -- What Was Detected Last Year?

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the EPA's Safe Drinking Water Hotline (1-800-426-4791).

The table below lists substances detected in Lacey's water during the year 2003 or on the most recent date that testing was required. Results below reflect the highest and lowest levels detected at any one of the sample locations, providing the range of detections from all sample locations. An additional 200 inorganic compounds (IOCs), volatile organic compounds (VOCs) and synthetic organic compounds (SOCs) were tested for and not detected. In 2003, Lacey's water met all state and federal drinking water standards, with the exception of total coliform for the month of September and iron and manganese levels in Well 7, which receives treatment under normal circumstances.

Substance	Highest Level Allowed (MCL)	Goal Not to Exceed (MCLG)	Highest Level Detected	Sampling Date of Highest Level Detected	Lowest Level Detected	Potential Sources of Contaminant
PRIMARY STANDARDS REGULATED BY EPA						
Arsenic	50 ppb [1]	N/A	3 ppb	2/12/03	< 2 ppb	geology, natural weathering
Fluoride [2]	4 ppm	4 ppm	0.3 ppm	10/30/03	< 0.2 ppm	geology, natural weathering
Nitrate-nitrogen	10 ppm	10 ppm	3.3 ppm	6/25/03	< 0.2 ppm	septic systems, fertilizer, animal wastes
Total coliform bacteria [3]	2 samples/ month	0 samples/ month	3 samples	9/03	0 samples	naturally present in environment
SECONDARY STANDARDS REGULATED BY EPA						
Chloride	250 ppm	N/A	6 ppm	10/30/03	2 ppm	geology, natural weathering
Iron [4]	300 ppb	N/A	460 ppb	8/13/03	< 30 ppb	geology, natural weathering
Manganese [4]	50 ppb	N/A	472 ppb	8/13/03	< 10 ppb	geology, natural weathering
Sulfate	250 ppm	N/A	12 ppm	10/27/03	2 ppm	geology, natural weathering
REGULATED BY THE STATE						
Conductivity	700 umhos/cm	N/A	237 umhos/cm	10/30/03	84 umhos/cm	geology, natural weathering
UNREGULATED BY EPA						
Alkalinity	N/A	N/A	73 ppm	8/13/03	36.8 ppm	geology, natural weathering
Calcium	N/A	N/A	41 ppm	7/15/03	14 ppm	geology, natural weathering
Chloroform	N/A	N/A	800 ppt	1/14/2003	< 500 ppt	chlorine use for treatment or well disinfection
Hardness	N/A	N/A	115 ppm	10/30/03	31 ppm	geology, natural weathering
Lead	N/A	15 ppb [6]	3 ppb	10/30/03	< 2 ppb	lead solder in plumbing
Radon [5]	N/A	N/A	540 pCi/l	11/27/02	190 pCi/l	geology, natural weathering
Sodium	N/A	20 ppm [6]	9 ppm	2/13/03	5 ppm	geology, natural weathering
Turbidity	N/A	N/A	1.9 NTU	10/30/03	0.03 NTU	natural erosion
REGULATED BY THE STATE AT THE CONSUMER'S TAP			90th Percentile			
Copper	1300 ppb (AL)	N/A	920 ppb	9/10/02	1 site exceeded the Action Level	geology, corrosion of household plumbing
Lead	15 ppb (AL)	N/A	8 ppb	9/10/02	0 sites exceeded the Action Level	geology, leaching of household plumbing

1. EPA plans to lower the MCL for arsenic from 50 ppb to 10 ppb, effective 1/23/06.
2. Fluoride is not added to Lacey's water supply. These results indicate the presence of naturally-occurring fluoride in our groundwater.
3. See the sidebar for more information about the total coliform monitoring results.
4. Concentrations listed above were measured in Well 7 at a time when the treatment plant, which removes iron and manganese, was off line due to mechanical problems. From other sources, the highest detected concentration was 260 ppb iron and 60 ppb manganese.
5. At this time, radon in tap water is not regulated. However, EPA has proposed allowing an MCL of 4000 pCi/l in water if other sources of radon in indoor air are minimized. The greatest health risk from radon is breathing indoor air that contains radon. Most radon in indoor air comes from the breakdown of uranium in soils beneath homes. The risk from breathing or ingesting radon originating in tap water is considerably lower.
6. This is the highest level recommended by EPA.

Total Coliform Results

In September 2003, three routine water quality samples tested positive for total coliform. *Coliforms are bacteria that are normally present in the environment and are used as an indicator that other, potentially harmful, bacteria may be present.* The samples, however, were immediately tested for the presence of harmful bacteria such as fecal coliform or *E. coli*, and test results showed that these bacteria were not present in the water system. Further testing showed that the coliform presence was limited to a small, isolated area of the distribution system. In response to the incident, a notice was placed in The Olympian newspaper, several water sampling stations were disinfected and water lines in the vicinity were cleaned. Follow-up testing indicated that the issue had been resolved by the end of the month. Routine samples taken during the remaining months of 2003 were in compliance with the standard.

For More Information...

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- About your utility bill, call Lacey Utility Billing at 491-5616.
- About drinking water safety, call the EPA Safe Drinking Water Hotline at 1-800-426-4791 or visit the EPA Homepage at www.epa.gov/OW.

To Get Involved...

- Join us for a Utilities Committee meeting on the fourth Thursday of each month at 4:00 p.m. at Lacey City Hall, 420 College Street S.E. in Lacey. The committee discusses a variety of issues regarding our stormwater, drinking water, and wastewater utilities.
- Public attendance at City Council meetings is also welcome. Call 438-2620 to check the agenda of upcoming meetings or check our web site at www.ci.lacey.wa.us.

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice from their health care providers. EPA/CDC guidelines on appropriate means to lessen the risk of infection by Cryptosporidium and other microbial contaminants are available from the Safe Drinking Water Hotline (1-800-426-4791).

2003 Drinking Water Report

What We Look For In Your Drinking Water...

The sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally-occurring minerals and in some cases, radioactive material, and can pick up substances resulting from the presence of animals or from human activity.

Contaminants that may be present in source water include:

- **Microbial contaminants**, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.
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- **Radioactive contaminants**, which can be naturally-occurring or be the result of oil and gas production and mining activities.

In order to ensure that tap water is safe to drink, EPA prescribes regulations which limit the amount of certain contaminants in water provided by public water systems, such as Lacey's water system. Food and Drug Administration regulations establish limits for contaminants in bottled water which must provide the same protection for public health.

The purpose of this report is to let you know which substances have been found in your drinking water and what implications, if any, exist for you and your family.

Printed in June 2004

2003 Drinking Water Quality Report

Water Resources
P.O. Box 3400
Lacey, WA 98509-3400

CITY OF LACEY

Shaping our community together

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Water – Use It Wisely

Every summer, Lacey water customers nearly ***triple*** their water use — mostly for outdoor activities such as watering the lawn and garden, car washing and sidewalk cleaning. Of course, we all like to be active outdoors when the weather is warm and sunny! However, our outdoor activities lead to peak water demands that put a substantial stress on Lacey's water supply system.

This year, drought conditions are expected to complicate matters further. We depend on rainfall to replenish our groundwater supplies, but the unseasonably dry winters we've been enjoying result in rainfall levels that lag behind normal levels. The impact of this may not be immediately evident in our groundwater supplies, but we need to be prepared.

There are many ways to conserve water in and around our homes and businesses. The City of Lacey has several programs in place to help water customers do just that:

FREE **indoor water saving kits** are available for Lacey water customers. These kits include a water efficient showerhead, kitchen and bath faucet aerators, toilet leak detection tablets and plumber's tape to install these water-saving fixtures. Interested customers can obtain an indoor water-saving kit at the Public Works counter in Lacey City Hall.

FREE **outdoor watering kits** are available for Lacey water customers. These kits include a hose nozzle, hose repair kit and a rain gauge to measure the amount of water being applied to the lawn. These kits can be obtained at the Public Works counter at Lacey City Hall.

LOTT sewer customers are eligible for a $100 rebate on **WashWise washing machines**. These models use less water, energy and detergent than traditional top-loading washing machines. Customers of PSE are also eligible for a $35 rebate on water and energy efficient washing machines.

Commercial and institutional customers with LOTT sewer service also are eligible for rebates to **retrofit outdated or inefficient appliances and fixtures** with water efficient models. For example, restaurants and hotels can replace water-cooled ice machines with more efficient air-cooled models. Laundromats can replace older water-hogging washing machines with coin-operated water-saving models. Retrofits for other appliances and fixtures may also be eligible for rebates.

Lacey water customers with an irrigation account may be eligible for a FREE **irrigation system evaluation**. An expert in irrigation efficiency will visit the site and identify opportunities for improvements that can save substantial amounts of water and make a big dent in the water bill.

For more information on any of these programs and details about upcoming workshops on water-efficient landscaping, call Lacey Water Resources at 360-438-2687. For tips and ideas for conserving water, check out these informative web sites:

www.h2ouse.org
www.bewatersmart.net
www.wateruseitwisely.com
www.GreatPlantPicks.org
www.gardening.wsu.edu/nwnative

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- **Inorganic contaminants**, such as salts and metals, which can be naturally-occurring or result from urban stormwater runoff, industrial or domestic wastewater discharges, oil and gas production, mining, or farming.
- **Pesticides and herbicides**, which may come from a variety of sources such as agriculture, urban stormwater runoff, and residential uses.
- **Organic chemical contaminants**, including synthetic and volatile organic chemicals, which are byproducts of industrial processes and petroleum production, and can also come from gas stations, urban stormwater runoff, and septic systems.
- **Radioactive contaminants**, which can be naturally-occurring or be the result of oil and gas production and mining activities.

In order to ensure that tap water is safe to drink, EPA prescribes regulations which limit the amount of certain contaminants in water provided by public water systems, such as Lacey's water system. Food and Drug Administration regulations establish limits for contaminants in bottled water which must provide the same protection for public health.

The purpose of this report is to let you know which substances have been found in your drinking water and what implications, if any, exist for you and your family.

Printed in April 2005

2004 Drinking Water Report

Lacey, Washington

It's Time Again For Lacey's Annual Drinking Water Report!

This report is federally mandated by the 1996 amendments to the Safe Drinking Water Act. In it, you will find information about the source and quality of your drinking water.

2004 Brings Big Changes for Lacey Water Utility

Lacey supplies over 2 billion gallons of drinking water a year to over 50,000 customers. For many years, the Lacey water utility has enjoyed the status of being the largest non-disinfected water system in the State of Washington. This will change in 2005 as Lacey prepares to permanently chlorinate its drinking water.

Total coliform bacteria were repeatedly detected in the water system between September 2003 and October 2004. A comprehensive effort to identify and eliminate the source of the bacteria was undertaken, including extensive flushing of water lines, investigation of illegal cross connections, and temporary chlorination in portions of the distribution system. These efforts were simply not enough to resolve the problem. In early 2005, the City Council determined that permanent disinfection throughout the system is necessary to ensure that the water system and our customers are adequately protected.

Over 35,000 water customers are already receiving chlorinated drinking water as a result of the temporary chlorination effort begun in October 2004. The remainder of Lacey's water customers will receive chlorinated drinking water as early as May 1, 2005.

We appreciate the patience of our water customers as we have worked to resolve this issue over the last year. We recognize that permanent chlorination represents a significant change for our customers, but we believe that the safeguards provided by a permanently chlorinated water system far outweigh any drawbacks.

For more information on the total coliform detections, please see the table and sidebar inside this report. Lacey water customers with additional questions regarding chlorination can call Lacey Water Resources at 360-491-5600 or visit the City of Lacey website at www.ci.lacey.wa.us. Customers may also contact the Department of Health's Office of Drinking Water, Southwest Regional Operations at 360-664-0768.

Please Read On...

Ensuring that Lacey water continually meets state and federal drinking water standards is a job your utility takes quite seriously. Inside, you'll find a table listing water quality sampling results for 2004, as well as additional information about chlorination, water conservation and more. For more details regarding the information presented in this report, please call Lacey Water Resources at 360-491-5600. We look forward to hearing from you!

Total Coliform Results

A total coliform violation occurs when more than 5% of water samples taken during a month test positive for the presence of coliform bacteria. During 2004, monthly water samples in February, May and October exceeded the 5% limit for coliform detections, which signified non-acute violations for each of those months. *Coliforms are bacteria that are normally present in the environment and are used as an indicator that other, potentially harmful, bacteria may be present. Coliforms were found in more samples than allowed and this was a warning of potential problems.* The samples, however, were immediately tested for the presence of harmful bacteria such as fecal coliform or *E. coli*, and test results showed that these bacteria were **not** present in the water system.

In response to these occurrences, water customers in the affected areas were notified, select water lines were flushed, several reservoirs were disinfected, a cross connection investigation was initiated, and a large portion of the water system was temporarily chlorinated from May to September 2004. Chlorination was reinstated in that portion of the water system in October and will be conducted on a permanent basis for the entire water system as soon as May 1, 2005.

For More Information...

- About Lacey's distribution system or to report problems, call the Lacey Maintenance Service Center at 360-491-5644.
- About your utility bill, call Lacey Utility Billing at 360-491-5616.
- About drinking water safety, call the EPA Safe Drinking Water Hotline at 1-800-426-4791 or visit the EPA Homepage at www.epa.gov/OW.

To Get Involved...

- Join us for a Utilities Committee meeting on the fourth Thursday of each month at 4:00 p.m. at Lacey City Hall, 420 College Street S.E. in Lacey. The committee discusses a variety of issues regarding our stormwater, drinking water, and wastewater utilities.
- Public attendance at City Council meetings is also welcome. The Council generally meets the second & fourth Thursday of the month January through October and the first & third Thursdays of November and December. Meetings begin at 7:00 p.m. at Lacey City Hall.
- Call 360-438-2620 to check the agenda of upcoming meetings or check our web site at www.ci.lacey.wa.us.

Important Terms

Maximum Contaminant Level (MCL): the highest level of a contaminant that is allowed in drinking water.

Maximum Contaminant Level Goal (MCLG): the contaminant level in drinking water below which there is no known or expected risk to health.

Action Level (AL): Action level is the concentration of a contaminant which, if exceeded, triggers treatment or other requirements which the water system must follow.

Primary Standard: the MCL for these substances is set primarily for health reasons.

Secondary Standard: the MCL for these substances is set primarily for non-health reasons such as color, taste, or fixture staining or indirect health concerns when levels are too high.

NTU: Nephelometric Turbidity Unit is the standard unit to measure the amount of material suspended in water.

PPM: Parts per million is equivalent to milligrams per liter (mg/l). One ppm is approximately equal to 1 drop in 22 gallons of water.

PPB: Parts per billion. One ppb is approximately equal to 1 drop in 22,000 gallons of water (equivalent to about 1 drop in a small swimming pool).

PPT: Parts per trillion. One ppt is approximately equal to 1 drop in 22,000,000 gallons of water (equivalent to about 1 drop in Long's Pond).

pCi/l: Picocuries per liter is the unit of measure used to describe an amount of radiation.

µmhos/cm: Micromhos per centimeter is the unit of measure used to describe conductivity.

Water Quality Table -- What Was Detected Last Year?

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the EPA's Safe Drinking Water Hotline (1-800-426-4791).

The table below lists substances detected in Lacey's water during the year 2004 or on the most recent date that testing was required. Results below reflect the highest and lowest levels detected at any one of the sample locations, providing the range of detections from all sample locations. An additional 200 inorganic compounds (IOCs), volatile organic compounds (VOCs) and synthetic organic compounds (SOCs) were tested for and not detected. In 2004, Lacey's water met all state and federal drinking water standards, with the exception of total coliform for the months of February, May and October. Manganese levels, last tested in December 2003, were above the MCL at Well 9.

Substance	Highest Level Allowed (MCL)	Goal Not to Exceed (MCLG)	Highest Level Detected	Sampling Date of Highest Level	Lowest Level Detected	Potential Sources of Contaminant
PRIMARY STANDARDS REGULATED BY EPA						
Arsenic	50 ppb [1]	N/A	3 ppb	2/12/03	< 2 ppb	geology, natural weathering
Fluoride	4 ppm	4 ppm	0.3 ppm	10/30/03	< 0.2 ppm	geology, natural weathering
Nitrate-nitrogen	10 ppm	10 ppm	3.3 ppm	6/25/03	< 0.2 ppm	septic systems, fertilizer, animal wastes
Total coliform bacteria [2]	5% samples/ month	0% samples/ month	25% samples	5/04	0 samples	naturally present in environment
Total trihalomethanes	80 ppb	N/A	3.8 ppb	12/16/04	< 0.5 ppb	reaction of chlorine with naturally occurring organic matter
Total haloacetic acids	60 ppb	N/A	1.8 ppb	12/16/04	< 0.5 ppb	reaction of chlorine with naturally occurring organic matter
SECONDARY STANDARDS REGULATED BY EPA						
Iron	300 ppb	N/A	250 ppb	12/16/03	< 30 ppb	geology, natural weathering
Manganese [3]	50 ppb	N/A	60 ppb	12/16/03	< 10 ppb	geology, natural weathering
REGULATED BY THE STATE						
Conductivity	700 µmhos/cm	N/A	237 µmhos/cm	10/30/03	84 µmhos/cm	geology, natural weathering
UNREGULATED BY EPA						
Lead	N/A	15 ppb [4]	3 ppb	10/30/03	< 2 ppb	plumbing material
Radon [5]	N/A	N/A	540 pCi/l	11/27/02	190 pCi/l	geology, natural weathering
REGULATED BY THE STATE AT THE CONSUMER'S TAP			**90th Percentile**			
Copper	1300 ppb (AL)	N/A	920 ppb	9/10/02	1 site exceeded AL	geology, corrosion of household plumbing
Lead	15 ppb (AL)	N/A	8 ppb	9/10/02	0 sites exceeded AL	geology, leaching of household plumbing

1. EPA plans to lower the MCL for arsenic from 50 ppb to 10 ppb, effective 1/23/06.
2. See the sidebar for more information about the total coliform monitoring results.
3. Water from Well 9 has naturally elevated levels of manganese and is blended with other sources of water in the distribution system.
4. This is the highest level recommended by EPA.
5. At this time, radon in tap water is not regulated. However, EPA has proposed allowing an MCL of 4000 pCi/l in water if other sources of radon in indoor air are minimized. The greatest health risk from radon is breathing indoor air that contains radon. Most radon in indoor air comes from the breakdown of uranium in soils beneath homes. The risk from breathing or ingesting radon originating in tap water is considerably lower.

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice from their health care providers. EPA/CDC guidelines on appropriate means to lessen the risk of infection by Cryptosporidium and other microbial contaminants are available from the Safe Drinking Water Hotline (1-800-426-4791).

Frequently Asked Questions...

1. Where does our water come from?

Nineteen wells are used to draw Lacey's water from underground aquifers - porous rock formations below ground that hold water. Soil and rock layers above the aquifers protect the water from surface contamination.

In 2004, some water was purchased from the Olympia water system to help meet demand in the portion of the system that was chlorinated from May to September. Olympia's water comes from McAllister Springs and several groundwater wells. Water quality data from Olympia is listed in the table below.

2. Why did the utility choose to use chlorine as a disinfectant?

Throughout the world, chlorine is the most commonly used drinking water disinfectant. Chlorine has many benefits as a disinfectant. It kills or inactivates bacteria and many disease-causing organisms. It is simple to use and relatively inexpensive. It also provides "residual" benefits, since chlorine remains at low levels in the water as it travels through the distribution system, fighting against potential contamination all the way to the customers' taps.

3. How can I minimize the chlorine taste in my water?

Customers not accustomed to chlorine may notice a change in the taste and smell of their water. Let an open pitcher of water sit overnight and/or try pouring water from one pitcher to another. Both options allow the chlorine to dissipate into the air.

4. How do I protect my aquarium fish from chlorine?

Because chlorine has adverse effects for fish and aquatic life, Lacey water customers should treat water for use in aquariums and fish ponds with a dechlorinating conditioner, available at many locations where pet supplies are sold.

5. What is a cross connection?

A cross connection is any plumbing arrangement that allows potable (i.e. drinking quality) water to mix with non-potable water. Backflow prevention devices protect our water system from cross connections by blocking flow of non-potable water (i.e. from a puddle, lake or an irrigation system) back into pipes carrying potable water.

Water Quality Results for Olympia's McAllister Springs Source Water

The Lacey Water Utility utilized this water as an additional source from June 23 to September 3, 2004, and must include water quality data from this source in this report for your information.

Substance	Highest Level Allowed (MCL)	Goal Not to Exceed (MCLG)	Highest Level Detected	Sampling Date of Highest Level	Lowest Level Detected
PRIMARY STANDARDS REGULATED BY EPA					
Nitrate-nitrogen	10 ppm	10 ppm	1.39 ppm	1/21/04	< 0.2 ppm
Total trihalomethanes	80 ppb	N/A	6.8 ppb	8/18/04	< 0.5 ppb
Total haloacetic acids	60 ppb	N/A	1.1 ppb	11/19/04	< 0.5 ppb
Chlorine residual	4 ppm	N/A	0.72 ppm	9/27/04	0.10 ppm
REGULATED BY THE STATE					
Conductivity	700 µmhos/cm	N/A	183 µmhos/cm	8/26/04	183 µmhos/cm
UNREGULATED BY EPA					
Radon	N/A	N/A	250 pCi/l	12/1/04	250 pCi/l

- See table at left for Potential Sources of Contamination for each substance listed here.

Conservation-Oriented Water Rates Adopted

Conservation-oriented water rates were adopted as part of the 2006 City budget process. The new rate structure adds two additional tiers to the rate structure, which will be phased in beginning in 2007. The goal of the new rate structure is to encourage water conservation by incorporating consumption-based rates.

The new rate structure groups customers by their water usage patterns: Group 1 and Group 2. Group 1 customers use significantly more water during the summer months than they do in the winter and will be subject to all four tiers. Group 2 customers use a constant amount of water all year long, and will be subject to Tiers 1 and 2.

Group 1 (all tiers apply): single-family residential, duplexes, and irrigation accounts.

Group 2 (capped at tier 2): mobile home parks, multi-family residential, commercial, and public held property such as city parks and school grounds.

Water Rates for utility customers **within** the City are as follows:

		2006 Rates	2007 Rates	2008 Rates
Base Rate	**Volume in Cubic Ft.**	$8.41	$8.75	$9.10
Tier 1	First 600	$0.70	$0.73	$0.76
Tier 2	601-1200	$1.64	$1.71	$1.78
Tier 3	1201-2400	$1.64	$2.18	$2.27
Tier 4	> 2400	$1.64	$2.18	$3.03

Water Rates for utility customers **outside** the City are as follows:

		2006 Rates	2007 Rates	2008 Rates
Base Rate	**Volume in Cubic Ft.**	$10.93	$10.94	$10.92
Tier 1	First 600	$0.91	$0.91	$0.91
Tier 2	601-1200	$2.14	$2.14	$2.13
Tier 3	1201-2400	$2.14	$2.73	$2.73
Tier 4	> 2400	$2.14	$2.73	$3.64

Please refer to your water bills to determine how much water you consume. In the coming months, Lacey Water Resources will be providing information on how you can modify your landscaping and improve irrigation practices so that you can use water more wisely and save money. For some immediate ideas see the water saving websites below.

This report is federally mandated by the 1996 amendments to the Safe Drinking Water Act. In it, you will find information about the source and quality of your drinking water.

For ideas on how to conserve water check out these web sites:
www.ci.lacey.wa.us
www.h2ouse.org
www.bewatersmart.net
www.wateruseitwisely.com
www.GreatPlantPicks.org
http://gardening.wsu.edu/NWnative

Shaping our community together

CITY OF LACEY

Water Resources
P.O. Box 3400
Lacey, WA 98509-3400

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2005 Drinking Water Quality Report

2005 Drinking Water Report

What We Look For In Your Drinking Water...

The sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally-occurring minerals and in some cases, radioactive material, and can pick up substances resulting from the presence of animals or from human activity.

Contaminants that may be present in source water include:

- **Microbial contaminants**, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.
- **Inorganic contaminants**, such as salts and metals, which can be naturally-occurring or result from urban stormwater runoff, industrial or domestic wastewater discharges, oil and gas production, mining, or farming.
- **Pesticides and herbicides**, which may come from a variety of sources such as agriculture, urban stormwater runoff, and residential uses.
- **Organic chemical contaminants**, including synthetic and volatile organic chemicals, which are byproducts of industrial processes and petroleum production, and can also come from gas stations, urban stormwater runoff, and septic systems.
- **Radioactive contaminants**, which can be naturally-occurring or be the result of oil and gas production and mining activities.

In order to ensure that tap water is safe to drink, EPA prescribes regulations which limit the amount of certain contaminants in water provided by public water systems, such as Lacey's water system. Food and Drug Administration regulations establish limits for contaminants in bottled water which must provide the same protection for public health.

The purpose of this report is to let you know which substances have been found in your drinking water and what implications, if any, exist for you and your family.

Printed in June 2005

2005 Drinking Water Report

Lacey, Washington

Change a Continuing Theme for Lacey Water Utility in 2005

2005 marks the first year Lacey's water utility was a completely disinfected water system. In the process, the Lacey Water Utility learned a lot from converting over a non-disinfected system to a system using chlorine. Your patience and understanding through this process of transition is much appreciated.

The change to a disinfected system and the continuing growth in the number of water accounts creates a need for capital projects. Plans are currently being drafted for the construction of new facilities to more efficiently chlorinate the water supply. When it was decided that the water supply would be chlorinated, water utility staff responded quickly and installed an interim system. Replacement facilities are currently under design and will be more reliable and reduce operational costs.

The advent of chlorination also brings additional challenges for the Lacey water utility. Several of our water sources have elevated concentrations of naturally occurring minerals, such as iron and manganese. These dissolved metals are not harmful, but can cause an objectionable taste and produce a yellow to dark brown color when the water is chlorinated. This in turn can stain fixtures, such as toilets and dishwashers, and can also stain laundry. Prior to chlorination, water from a well with higher iron and manganese was blended with water from other sources with much lower metal concentrations. This dilution process addressed the taste concerns. However, even this diluted water has enough iron and manganese to cause it to discolor in the presence of chlorine. A significant effort on the part of your utility will be to incorporate treatment facilities in the water system and provide our customers with the highest quality drinking water.

Another big part of the utility's efforts is keeping up with growth within the water utility service area. This summer the water utility will be investigating where to construct new sources of water and new wells in the Hawks Prairie area. In addition, the water utility is working with the Washington State Department of Ecology to obtain new water rights for those wells. The water utility expects to have decisions on these water rights applications before the end of 2006. The Lacey water utility continually strives to deliver high quality water to our customers in the most reliable and cost-efficient manner.

Please Read On...

Ensuring that Lacey water continually meets state and federal drinking water standards is a job your utility takes quite seriously. Inside, you'll find a table listing water quality sampling results for 2005, as well as additional information about chlorination, water conservation and more. For more details regarding the information presented in this report, please call Lacey Water Resources at 360-491-5600. We look forward to hearing from you!

ODD/EVEN Outdoor Watering

Recently, the Lacey Water Utility adopted an alternate day outdoor watering schedule. The Lacey City Council approved the new water policy in an effort to reduce peak water demand during the summer months and conserve this valuable resource. Water usage during the summer months is almost 3 times the winter usage—15.4 million gallons per day compared with six million gallons per day in the winter. The new irrigation/watering schedule is based on each property's street address.

Addresses ending with an **ODD** number can irrigate:	Addresses ending with an **EVEN** number can irrigate:
Saturday	**Sundays**
Mondays	**Tuesdays**
Wednesdays	**Thursdays**

This schedule is for outdoor watering such as lawns and grass, flowerbeds, gardens, and other landscaping, which is regularly watered.Water used for other purposes (i.e., car washing, pressure washing, swimming pool filling, etc.) is not regulated by this policy at this time. The new alternate watering day policy will apply each year during the months of June, July, August, and September. There are a few policy exemptions: (1) newly seeded lawns and landscape, (2) plants inside green-houses, and (3) publicly-owned facilities with active playfields (i.e. soccer fields at parks). Water customers failing to schedule outdoor water use could ultimately have their water service discontinued. For more information regarding the wise use of water, call Lacey Water Resources at (360) 491-5600.

For More Information...

- About Lacey's distribution system or to report problems, call the Lacey Maintenance Service Center at 360-491-5644.
- About your utility bill, call Lacey Utility Billing at 360-491-5616.
- About drinking water safety, call the EPA Safe Drinking Water Hotline at 1-800-426-4791 or visit the EPA Homepage at www.epa.gov/OW.

To Get Involved...

- Join us for a Utilities Committee meeting on the third Thursday of each month at 4:00 p.m. at Lacey City Hall, 420 College Street S.E. in Lacey. The committee discusses a variety of issues regarding our stormwater, drinking water, and wastewater utilities.
- Public attendance at City Council meetings is also welcome. The Council generally meets the second & fourth Thursday of the month January through October and the first and third Thursdays for November and December. Meetings begin at 7:00 p.m. at Lacey City Hall.
- Call 360-491-3214 to check the agenda of upcoming meetings or check our web site at www.ci.lacey.wa.us.

Important Terms

Maximum Contaminant Level (MCL): the highest level of a contaminant that is allowed in drinking water.

Maximum Contaminant Level Goal (MCLG): the contaminant level in drinking water below which there is no known or expected risk to health.

Action Level (AL): Action level is the concentration of a contaminant which, if exceeded, triggers treatment or other requirements which the water system must follow.

Primary Standard: the MCL for these substances is set primarily for health reasons.

Secondary Standard: the MCL for these substances is set primarily for non-health reasons such as color, taste, or fixture staining or indirect health concerns when levels are too high.

NTU: Nephelometric Turbidity Unit is the standard unit to measure the amount of material suspended in water.

ppm: Parts per million is equivalent to milligrams per liter (mg/l). One ppm is approximately equal to 1 drop in 22 gallons of water.

ppb: Parts per billion. One ppb is approximately equal to 1 drop in 22,000 gallons of water (equivalent to about 1 drop in a small swimming pool).

ppt: Parts per trillion. One ppt is approximately equal to 1 drop in 22,000,000 gallons of water (equivalent to about 1 drop in Long's Pond).

pCi/l: Picocuries per liter is the unit of measure used to describe an amount of radiation.

µmhos/cm: Micromhos per centimeter is the unit of measure used to describe conductivity.

Water Quality Table -- What Was Detected Last Year?

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the EPA's Safe Drinking Water Hotline (1-800-426-4791).

The table below lists substances detected in Lacey's water during the year 2005 or on the most recent date that testing was required. Results below reflect the highest and lowest levels detected at any one of the sample locations, providing the range of detections from all sample locations. An additional 200 inorganic compounds (IOCs), volatile organic compounds (VOCs) and synthetic organic compounds (SOCs) were tested for and not detected. In 2005, Lacey's water met all state and federal drinking water standards. Manganese levels, last tested in December 2003, were above the MCL at Well 9.

Substance	Highest Level Allowed (MCL)	Goal Not to Exceed (MCLG)	Highest Level Detected	Sampling Date of Highest Level	Lowest Level Detected	Potential Sources of Contaminant
PRIMARY STANDARDS REGULATED BY EPA						
Arsenic	10 ppb	0 ppb	3 ppb	2/12/03	< 2 ppm	geology, natural weathering
Chlorine Residual	4 ppm	4 ppm	1.09 ppm	5/4/05	0.09 ppm [1]	Lacey has added chlorine system-wide as a disinfectant since May 2005
Chloroform	80 ppb	N/A	1.5 ppb	7/14/05	N/D	reaction of chlorine with naturally occurring organic matter
Fluoride	4 ppm	4 ppm	0.3 ppm	10/30/03	< 0.2 ppm	geology, natural weathering
Nitrate-nitrogen	10 ppm	10 ppm	4.3 ppm	6/19/02	< 0.2 ppm	septic systems, fertilizer, animal wastes
Radium 228	5 pCi/l	N/A	[2]	N/A	[2]	geology, natural weathering
Total coliform bacteria	5% samples/ month	0% samples/ month	0% samples	N/A	0% samples	naturally present in environment
Total trihalomethanes	80 ppb	N/A	0.65 ppb [3]	7/14/05	Range: N/D – 5.6 ppb	reaction of chlorine with naturally occurring organic matter
Total haloacetic acids	60 ppb	N/A	0.59 ppb [3]	7/14/05	Range: N/D – 4.4 ppb	reaction of chlorine with naturally occurring organic matter
SECONDARY STANDARDS REGULATED BY EPA						
Iron	300 ppb	N/A	260 ppb	5/8/02	< 30 ppb	geology, natural weathering
Manganese	50 ppb	N/A	65 ppb [4]	3/21/03	< 10 ppb	geology, natural weathering
REGULATED BY THE STATE						
Conductivity	700 µmhos/cm	N/A	444 µmhos/cm	3/18/05	84 µmhos/cm	geology, natural weathering
UNREGULATED BY EPA						
Lead	N/A	15 ppb [5]	3 ppb	10/30/03	< 2 ppb	plumbing material
Radon [6]	N/A	N/A	540 pCi/l	11/27/02	190 pCi/l	geology, natural weathering
REGULATED BY THE STATE AT THE CONSUMER'S TAP			**90th Percentile**			
Copper	1300 ppb (AL)	N/A	950 ppb	11/23/04	1 site exceeded AL	geology, corrosion of household plumbing
Lead	15 ppb (AL)	N/A	4 ppb	9/20/05	0 sites exceeded AL	geology, leaching of household plumbing

1. Level reported here is the lowest level detected after full chlorination was achieved throughout the system.
2. Samples were collected in July 2005. Test results are not available at this time but will be reported in the 2006 Drinking Water Report.
3. These represent running annual averages.
4. Water from Well 9 has naturally elevated levels of manganese and is blended with other sources of water in the distribution system.
5. This is the highest level recommended by EPA.
6. At this time, radon in tap water is not regulated. However, EPA has proposed allowing an MCL of 4000 pCi/l in water if other sources of radon in indoor air are minimized. The greatest health risk from radon is breathing indoor air that contains radon. Most radon in indoor air comes from the breakdown of uranium in soils beneath homes. The risk from breathing or ingesting radon originating in tap water is considerably lower.

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice from their health care providers. EPA/CDC guidelines on appropriate means to lessen the risk of infection by Cryptosporidium and other microbial contaminants are available from the Safe Drinking Water Hotline (1-800-426-4791).

Frequently Asked Questions...

1. Where does our water come from?

Twenty one wells are used to draw Lacey's water from underground aquifers - porous rock formations below ground that hold water. Soil and rock layers above the aquifers protect the water from surface contamination.

During the summer of 2005, some water was purchased from the Olympia water system to help meet demand in the Lacey water system. Olympia's water comes from McAllister Springs and several groundwater wells. Water quality data from Olympia is listed in the table below.

2. Why do I sometimes see utility workers flowing water into the street?

During the non-peak watering season (i.e. Fall, Winter, Spring), utility staff flush water lines to remove sediment and debris that accumulates in the water pipes. Removing this material in a controlled manner reduces the likelihood of "brown water" episodes.

3. How can I minimize the chlorine taste in my water?

Customers not accustomed to chlorine may notice a taste and smell to the water. Let an open pitcher of water sit overnight and/or try pouring water from one pitcher to another. Both options allow the chlorine to dissipate into the air. Carbon based water filters will also remove chlorine from the water.

4. What is a cross connection?

A cross connection is any plumbing arrangement that allows potable (i.e. drinking quality) water to mix with non-potable water. Backflow prevention devices protect our water system from cross connections by blocking flow of non-potable water (i.e. from a puddle, lake or an irrigation system) back into pipes carrying potable water. All inground irrigation systems must have a backflow prevention device.

Water Quality Results for Olympia's McAllister Springs Source Water

The Lacey Water Utility utilized this water as an additional source, and must include water quality data from this source in this report for your information.

Substance	Highest Level Allowed (MCL)	Goal Not to Exceed (MCLG)	Olympia Water Amount Detected	Range of Detection (Low – High)	Testing Frequency	Typical Source of Contamination
PRIMARY STANDARDS REGULATED BY EPA						
Total coliform bacteria	95% of samples must have zero detections	Zero	No samples had confirmed detections	Zero	60 times per month at a minimum	Soil bacteria and fecally contaminated water
Chlorine residual	4.0 ppm	Detectable amount of 0.05 ppm	0.15 – 0.80 ppm	0.15 – 0.80 ppm	Metered continuously	Chlorine is used as a disinfectant in the water treatment process

Substance	Highest Level Allowed (MCL)	Goal Not to Exceed (MCLG)	McAllister Springs Amount Detected
PRIMARY STANDARDS REGULATED BY EPA			
Arsenic	10 ppb	10 ppb	N/D
Fluoride	4 ppm	2 ppm	0.2 ppm
Nitrates	10 ppm	5 ppm	1.4 ppm
SECONDARY STANDARDS REGULATED BY EPA			
Iron	0.3 ppm	0.3 ppm	N/D
Manganese	50 ppb	50 ppb	N/D

CITY OF LACEY

Lacey Water Utility
Drinking Water Report

Lacey Drinking Water Supply: Quality and Confidence

I am pleased to provide you with the City of Lacey's Annual Drinking Water Quality Report. This report summarizes the water quality testing that Lacey Water Utility staff performed on our water supply through 2006. Each year, all public water systems are required by the Federal Safe Drinking Water Act to provide their customers with reports on the quality of their drinking water. I am happy to inform you that our water not only meets, but exceeds the strict guidelines set by the Environmental Protection Agency.

The Lacey Water Utility has made considerable strides regarding water quality in recent years. Due to the detection of coliform bacteria in the water system in late 2003, the utility implemented a system wide disinfection program that eliminated any detectable levels of this contaminant. Furthermore, the Lacey Water Utility implemented an ongoing line flushing program that over the past two years has greatly improved the aesthetic quality of our water. Lacey Water Utility employees take great pride in providing you with the best water possible, and will continue to strive for excellence in delivering this resource to you.

You can have confidence in the fact that the City of Lacey operates a first-class water system. As one of its customers, it is important that you know your drinking water meets or exceeds all government standards. The information in this report will allow all of our customers, especially those with special health needs, to make informed decisions regarding their drinking water.

Drinking water quality is a complex subject and some of the information is technical in nature. This report was designed to present this important information in a way that is easy to understand. If you have questions regarding your drinking water or this report, please contact your Lacey Water Utility at 360-491-5600.

Sincerely,

Virgil B. Clarkson

Mayor Virgil Clarkson

Published March, 2007

Water: A Precious Resource

Here in the rainy northwest, it's easy to take our water supply for granted. But communities are now realizing that quality, reliable sources of drinking water are not in endless supply.

By using water wisely, we can delay the need for costly water system upgrades, reduce water and utility costs, and protect fish and wildlife that depend on clean, abundant sources of water.

Conserve Water Inside Your Home:

- Repair leaky toilets and faucets
- Take shorter showers
- Run washing machines and dishwashers only when you have a full load
- Replace old, inefficient water fixtures with low-flow models

Conserve Water Outside Your Home:

- Choose drought tolerant plants
- Reduce the amount of turf in your landscape that needs irrigation
- Always use a properly functioning nozzle when using a hose.
- If you must water, do so late at night or early in the morning to reduce evaporation. Apply only about 1 inch of water per week (including rainfall).

Free Kits Help You Conserve Water and Reduce Utility Bills

The City of Lacey, in cooperation with the LOTT Alliance, is offering free water conservation kits to its water customers. Indoor kits include a low-flow showerhead, faucet aerators for kitchen and bathroom, and toilet leak detection tablets. Outdoor kits contain a precipitation gauge, hose repair kit, hose nozzle and gaskets. Hose bib timers are also available. Conservation kits are available at the Public Works counter at Lacey City Hall.

Outdoor Watering Policy

In 2006, the Lacey Water Utility adopted an alternate day outdoor watering policy in an effort to conserve water and reduce peak demand during summer when usage is almost 3 times that of winter. The approach successfully reduced peak demand last summer and will be implemented again in 2007. The schedule is based on your property's street address.

Outdoor Watering Schedule *(Jun-Sep)*

If your address ends with an **EVEN** number, irrigate **Sun/Tue/Thu**

If your address ends with an **ODD** number, irrigate **Sat/Mon/Wed**

The policy covers regular outdoor watering of lawns, flowerbeds, gardens, and other landscaping. Water used for other purposes (i.e., car washing, pressure washing, swimming pool filling, etc.) is not regulated by this policy.

Exemptions include: (1) newly seeded lawns and landscape, (2) greenhouse plants, and (3) public-owned facilities with active sports playfields.

All water customers are required to participate in the watering schedule, and your cooperation is vital. In addition to helping Lacey meet peak water demands, the schedule ensures that the fire department has the available water it needs to effectively respond to fires.

For more information on wise water use, or to register for an exemption, call Lacey Water Resources at 360-491-5600.

Cross Connections and Drinking Water Safety

The City of Lacey strives for excellence in delivering high quality drinking water to your home. But customers also play a role in safeguarding our drinking water. Once water passes through the meter and enters your property, you need to properly protect and maintain your cross connections.

Residential "cross connections" are defined as actual or potential links between the potable water supply and any non-drinkable liquid, solid or gas. Typical residential cross connections include irrigation systems, boilers, swimming pools, and fertilizer sprayers that connect to hoses.

In unprotected cross connections, changes in water pressure can create backflow – a hazardous condition that can allow contaminants to enter the drinking water supply system.

Lacey's Cross Connection Program helps protect our drinking water by working with water customers to ensure that cross connections have properly installed and maintained backflow prevention assemblies.

If you have any questions or concerns about backflow, or the City of Lacey's Cross Connection Control Program, please call Lacey Water Resources at 360-491-5600.

Important Drinking Water Terms:

Maximum Contaminant Level (MCL): the highest allowable level of a given contaminant.

Maximum Contaminant Level Goal (MCLG): the level of a contaminant below which there are no known or expected health risks.

Action Level (AL): the concentration of a contaminant which, if exceeded, triggers treatment or other water system requirements.

Primary Standard: the MCL for these substances is set primarily for health reasons.

Secondary Standard: the MCL for these substances is set primarily for non-health reasons such as color, taste, fixture staining or indirect health concerns.

ppm (parts per million): equivalent to milligrams per liter (mg/l). One ppm equals approximately 1 drop in 22 gallons of water.

ppb (parts per billion): one ppb equals approximately 1 drop in 22,000 gallons of water (about 1 drop in a small swimming pool).

ppt (parts per trillion): one ppt equals approximately 1 drop in 22,000,000 gallons of water.

pCi/l (picocuries per liter): the unit of measure used to describe an amount of radiation.

umhos/cm (micromhos per centimeter): the unit of measure used to describe conductivity.

Conservation-Oriented Water Rates Now in Effect

As part of the 2006 budget process, the City, in an effort to encourage water conservation, adopted a consumption-based water rate structure. The new rates became effective in January of this year.

Customers are grouped by their water use patterns and two new rate tiers were added. The third rate tier became effective January 1, 2007. A fourth tier becomes effective in January of 2008.

Group 1 (subject to tiers 1 thru 4):
Single-family residential, duplexes, and irrigation accounts.

Group 2 (subject to tiers 1 and 2):
Multi-family residential, mobile home parks, commercial, and public-owned properties such as city parks and schools.

Water Utility Rates

Customers Inside the City Limits		2007 Rates	2008 Rates
Base Rate	Volume in Cubic Ft*	$8.83	$9.27
Tier 1	First 600	0.735	0.7718
Tier 2	601-1200	1.7253	1.8116
Tier 3	1201-2400	2.2051	2.3154
Tier 4†	> 2400	2.2051	3.0918

* *1 Cubic Foot = 7.48 Gallons*
† *Tier 4 becomes effective January 1, 2008*

Looking for Leaks? Use Your Meter!

Use your water meter to check your plumbing system for leaks. First, turn off all indoor and outdoor water faucets and appliances. Then write down the numbers on the face of your water meter. (Most meters in Lacey's system have a face that looks like the odometer on a car.) Refrain from using any water for at least one hour and then read the meter again. If the numbers match, you're leak-free. If not, subtract the first reading from the second to determine how much water is leaking from your system.

If you determine that there is a leak on your property, please contact Lacey Water Resources for guidance on locating and repairing the leak.

Dripping or leaking faucets can waste hundreds of gallons of water a year.

City of Lacey Water Quality Monitoring Summary

During 2006, Lacey's water met all state and federal drinking water standards. The City of Lacey tests its water for over 200 different substances – both regulated and non-regulated. The chart below lists the highest and lowest levels regulated substances detected at any one of the sample locations, providing the range of detections from all sample locations.

Health Related (Primary) Standards: Primary standards are intended to protect the public from substances that may be harmful to humans if consumed over long periods of time. EPA standards are set at levels that protect our most sensitive population, such as infants and the elderly.

Substance	Highest Level Allowed (MCL)	Goal Not to Exceed (MCLG)	Highest Level Detected	Lowest Level Detected	Sample Date of Highest Level	In Compliance?	Typical Sources
Arsenic	10 ppb	0 ppb	3 ppb	< 2 ppm	2/12/2003	Yes	geology, natural weathering
Nitrate	10 ppm	10 ppm	5.1 ppm	<0.2 ppm	12/28/2006	Yes	septic systems, fertilizer, animal waste
Total Coliform Bacteria	5% samples/month	0% samples/month	0% of samples	0% of samples	––	Yes	naturally present in environment
Total Trihalomethanes	80 ppb	N/A	1.64 ppb	Range: nd - 12.3 ppb (running annual average)	10/26/2006	Yes	reaction of chlorine with naturally-occuring organic matter
Total Haloacetic acids	60 ppb	N/A	0.28 ppb	Range: nd - 0.7 ppb (running annual average)	10/26/2006	Yes	reaction of chlorine with naturally-occuring organic matter
Chlorine Residual	4 ppm	4 ppm	1.0 ppm	0.2 ppm	4/23/2006	Yes	chlorine has been added to the entire Lacey water system since May 2005
Radium 228	5 pCi/L	N/A	1 pCi/L	0.318 pCi/L	9/6/2005	Yes	geology, natural weathering
Chloride	250 ppm	––	44 ppm	2 ppm	3/18/2005	Yes	geology, natural weathering
Fluoride	4 ppm	4 ppm	0.3 ppm	<0.2 ppm	10/30/2003	Yes	geology, natural weathering

Aesthetic (Secondary) Standards & Other Characteristics: Secondary standards ensure aesthetic qualities of water such as taste, odor and clarity. These standards govern substances that may influence consumer acceptance of water, rather than health related effects.

Substance	Highest Level Allowed (MCL)	Goal Not to Exceed (MCLG)	Highest Level Detected	Lowest Level Detected	Sample Date of Highest Level	In Compliance?	Typical Sources
Iron	300 ppb	N/A	26 ppb	<30 ppb	5/8/2002	Yes	geology, natural weathering
Manganese	50 ppb	N/A	30 ppb	<10 ppb	11/9/2006	Yes	geology, natural weathering
Sulfate	250 ppm	––	12 ppm	2 ppm	12/27/2003	Yes	geology, natural weathering
Conductivity	700 µmhos/cm	––	444 µmhos/cm	84 µmhos/cm	3/18/2005	Yes	geology, natural weathering

Lead and Copper Monitoring Results: Taken at the customer's tap.

Substance	State Action Level	Goal Not to Exceed (MCLG)	90% Percentile	# Samples Over State Action Level	Sample Date of Highest Level	In Compliance?	Typical Sources
Copper	1300 ppb	N/A	950 ppb	1 sample	11/23/2004	Yes	Corrosion of household plumbing or erosion of natural deposits
Lead	15 ppb	N/A	4 ppb	0 samples	9/20/2005	Yes	Corrosion of household plumbing or erosion of natural deposits

Unregulated Contaminants: These substances are disinfection by-products that must be monitored but have no MCL or AL. EPA requires additional monitoring for a number of unregulated contaminants that have no MCL or AL. Utilities are required to report any detected concentrations in their annual report.

Substance	Highest Level Allowed (MCL)	Goal Not to Exceed (MCLG)	Highest Level Detected	Lowest Level Detected	Sample Date of Highest Level	In Compliance?	Typical Source
Chloroform	N/A	––	1.9 ppb	< 0.5 ppb	10/26/2006	Yes	Byproduct of disinfection. Concentration is included in Total Trihalomethanes.

Lacey Drinking Water Sources

The City of Lacey uses twenty one wells to draw its water from three underground aquifers. The water is pumped to stations throughout the city and delivered to customers through a common distribution system.

Additional water is periodically purchased from Olympia's water system to help meet peak demand. Olympia's water comes from McAllister Springs and several groundwater wells. Water quality data from Olympia is listed in the chart below.

What Is An Aquifer?

Aquifers are natural, underground water sources that carry and store significant amounts of groundwater within layers of gravel, rocks and sand. Aquifers are resupplied or "recharged" as water slowly filters down through the soil layers.

What Kinds of Substances Can Contaminate Drinking Water?

Sources for drinking water include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or flows underground through aquifers, it dissolves salts, minerals and in some cases radioactive material, and picks up substances caused by the presence of animals and human activity.

Contaminants May Include:

- Microbial contaminants, such as viruses and bacteria, can come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.
- Inorganic contaminants, such as salts and metals (naturally-occurring or from urban stormwater runoff, industrial or domestic wastewater discharge, oil and gas production, mining, or farming).
- Pesticides and herbicides from agriculture, urban stormwater runoff, residential use, and other sources.
- Synthetic and volatile organic chemical contaminants are by-products of industrial processes and petroleum production can also come from gas stations, urban stormwater runoff, and septic systems.
- Radioactive contaminants (naturally-occurring or the result of oil and gas production and mining activities).

Who Sets the Standards for Water Quality?

The City of Lacey continually monitors its water supply to meet strict standards set by the Environmental Protection Agency. EPA regulations protect public health by limiting the amount of allowable contaminants in public water systems. Food and Drug Administration regulations require the same protection for bottled water.

The City of Lacey periodically purchases water from the City of Olympia to help meet peak demand. Olympia's water comes from McAllister Springs. Water quality data from this source must be provided in this report for your information.

Health Related (Primary) Standards: Primary standards are intended to protect the public from substances that may be harmful to humans if consumed over long periods of time. EPA standards are set at levels that protect our most sensitive population, such as infants and the elderly.

Substance	Highest Level Allowed (MCL)	Goal Not to Exceed (MCLG)	Olympia Water Amount Detected	Range of Detection (Low/High)	Testing Frequency	Typical Sources of Contamination
Total Coliform Bacteria	95% of samples must have zero detections	Zero	No samples had confirmed detections	Zero	60 times per month minimum	Soil bacteria and fecally-contaminated water
Chlorine Residual	4.0 ppm	Detectable amount of 0.05 ppm	0.13 - 0.83 ppm	0.13 - 0.83 ppm	Metered continuously	Chlorine is used as a disinfectant in the water treatment process
Haloacetic Acids	60 ppb	Zero	1.1 ppb	0.0 - 1.1 ppb	Quarterly	Disinfection by-products caused by a chemical reaction between chlorine and naturally-occurring organic matter in water
Total Trihalomethanes	80 ppb	Zero	5.7 ppb	1.2 - 5.7 ppb		

Other Primary Standards:

Substance	(MCL)	(MCLG)	McAllister Springs
Arsenic	10 ppb	10 ppb	2.0 (2006)
Fluoride	4 ppm	2 ppm	0.2 (2005)
Nitrates	10.0 ppm	5.0 ppm	2.66 (2006)

Aesthetic (Secondary) Standards & Other Characteristics: Secondary standards ensure aesthetic qualities of water such as taste, odor and clarity. These substances influence consumer acceptance of water, rather than health-related effects.

Substance	(MCL)	(MCLG)	McAllister Springs
Iron	0.3 ppm	0.3 ppm	None Detected
Manganese	50 ppb	50 ppb	None Detected

How Can I Learn More?

• For questions about Lacey's distribution system or to report problems, call the Lacey Maintenance Service Center at 360-491-5644.

• For questions about your utility bill, call Lacey Utility Billing, 360-491-5616.

• For questions about drinking water safety, call the EPA Safe Drinking Water Hotline, 1-800-426-4791, or visit the EPA Homepage at www.epa.gov/OW.

How Can I Get Involved?

• Join us for a Utilities Committee meeting on the third Thursday of each month at 4pm at Lacey City Hall, 420 College Street SE in Lacey. The committee discusses issues regarding our stormwater, drinking water, and wastewater utilities.

• Attend a City Council meeting on the second & fourth Thursday of the month January through October and the first and third Thursdays for November and December. Meetings begin at 7pm at Lacey City Hall.

• Call 360-491-3214 to check the agenda of upcoming meetings or check our web site at www.ci.lacey.wa.us.

Some people may be more vulnerable to contaminants in drinking water than the general population. Most commonly at risk are immunocompromised individuals such as those undergoing chemotherapy, people who have had organ transplants, those with HIV/AIDS or other immune system disorders, as well as some elderly adults and infants. These individuals should seek advice about drinking water from their health care providers. The Environmental Protection Agency/Center for Disease Control provide guidelines for reducing the risk of infection by Cryptosporidium and other microbial contaminants. Call the Safe Drinking Water Hotline at 800-426-4791.

Nitrate in drinking water at levels above 10 ppm is a health risk for infants of less than six months of age. High nitrate levels in drinking water can cause blue-baby syndrome. Nitrate levels may rise quickly for short periods of time because of rain-fall or agricultural activity. If you are caring for an infant, you should ask for advice from your health care provider.

CITY OF LACEY

Water Resources
PO Box 3400
Lacey, WA 98509-3400

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Lacey Water Utility 2006
Drinking Water Report

Sources of Lacey's Drinking Water

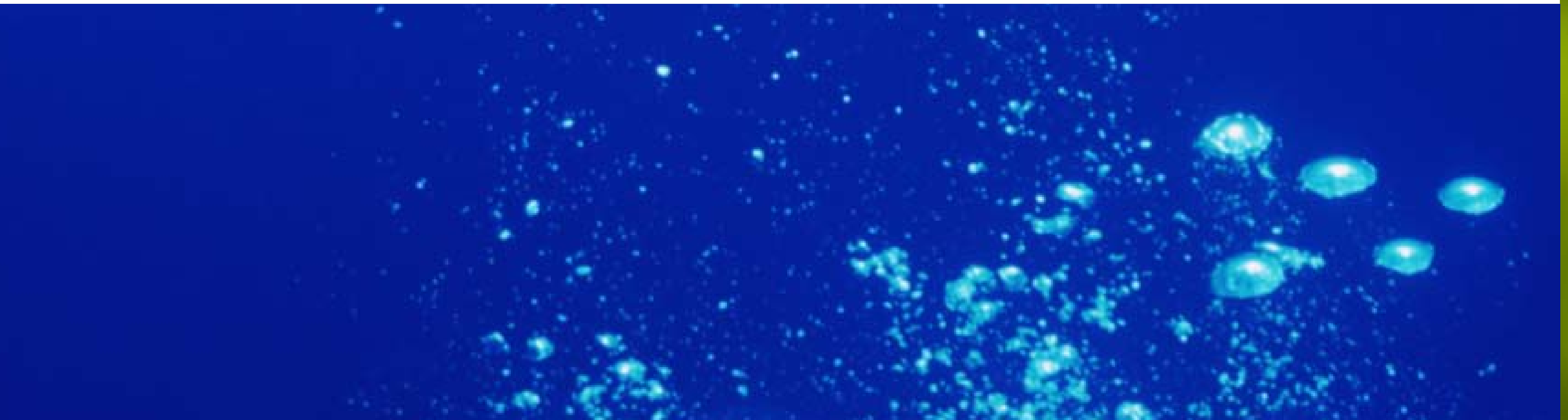
Nineteen wells are used to draw Lacey's water from underground aquifers. Additional water is purchased periodically from the Olympia water system to help meet peak demand. The water purchased from Olympia comes from McAllister Springs. Water quality data from Olympia is listed in this report.

What is an aquifer?

An aquifer is an underground layer of unconsolidated rock or sand that is saturated with usable amounts of water. Aquifers, which store and carry water, form significant natural water supplies. Recharge areas are important to a healthy aquifer. In a recharge area, water is able to filter slowly into the earth and down to the aquifer, helping to re-supply the resource.

The sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally-occurring minerals and in some cases, radioactive material, and can pick up substances resulting from the presence of animals or from human activity.

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the EPA's Safe Drinking Water Hotline (1-800-426-4791).



Contaminants that may be present in source water include:

- *Microbial contaminants,* such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.
- *Inorganic contaminants,* such as salts and metals, which can be naturally-occurring or result from urban stormwater runoff, industrial or domestic wastewater discharges, oil and gas production, mining, or farming.
- *Pesticides and herbicides,* which may come from a variety of sources such as agriculture, urban stormwater runoff, and residential uses.
- *Organic chemical contaminants,* including synthetic and volatile organic chemicals, which are byproducts of industrial processes and petroleum production, and can also come from gas stations, urban stormwater runoff, and septic systems.
- *Radioactive contaminants,* which can be naturally-occurring or be the result of oil and gas production and mining activities.

In order to ensure that tap water is safe to drink, EPA prescribes regulations which limit the amount of certain contaminants in water provided by public water systems, such as Lacey's water system. Food and Drug Administration regulations establish limits for contaminants in bottled water which must provide the same protection for public health.

For More Information...

...About Lacey's distribution system or to report problems, call the Lacey Maintenance Service Center at 360-491-5644.

...About your utility bill, call Lacey Utility Billing at 360-491-5616.

...About drinking water safety, call the EPA Safe Drinking Water Hotline at 1-800-426-4791 or visit the EPA Homepage at www.epa.gov/OW.

CITY OF LACEY

Water Quality Report 2008

From water quality data collected in 2007

Water Resources
P.O.Box 3400
Lacey, WA 98509-3400

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Postal Customer

PWSID #43500Y

A Message from the Mayor

It is my pleasure to provide you with the City of Lacey's annual Drinking Water Quality Report. It is important that the City's drinking water customers know that they, their families and businesses receive the highest quality drinking water. This report summarizes the water quality testing that Lacey Water Utility staff performed on our water supply through 2007. It is indeed my pleasure to inform you that our water not only meets, but exceeds the strict guidelines set by the Environmental Protection Agency.

City of Lacey staff goes to great lengths to protect your water supply through repetitive monitoring, treatment, investment and long-term planning. When you go to your tap, you can have confidence in the fact that the City of Lacey operates a first-class water system, and that your water is safe and reliable.

The information in this report will allow all of our customers, especially those with special health needs, to make informed decisions regarding their drinking water. Although this report is designed to present important information in a way that is easy to understand, drinking water quality is a complex subject and much of the information is technical in nature. If you have questions regarding your drinking water or this report, please contact your Lacey Water Utility at 360-491-5600.

Sincerely,

Graeme Sackrison

Mayor Graeme Sackrison

New Water System Upgrades in Hawks Prairie Area

2008 will be an exciting year for upgrades to the Lacey Water Utility, with two major projects scheduled for completion this spring and summer. The new Hawks Prairie Well Treatment Facility, scheduled for startup in June, will treat water from the existing Hawks Prairie well, and, in addition, has the capacity to treat water from a future well proposed for the area. The facility will provide high quality water to the Hawks Prairie area and into the Carpenter Road area.

Also, a new water pump station will be completed and begin operation in June. The pump station will provide higher and more consistent water pressures to customers north and south of I-5, while ensuring adequate water pressure and volume during fire events and peak demand periods. The new pump station will also provide a backup water source when other wells throughout the system undergo routine maintenance. In the short term, customers may notice slight changes in the aesthetic quality of their water supply. This will be temporary and not result in any health risk.

To Get Involved...

...Join us for a Utilities Committee meeting on the second Thursday of each month at 8:00 a.m. at Lacey City Hall, 420 College Street S.E. in Lacey. The committee discusses a variety of issues regarding our stormwater, drinking water, and wastewater utilities.

...Public attendance at City Council meetings is also welcome. The Council generally meets the second & fourth Thursday of the month January through October and the first and third Thursdays for November and December. Meetings begin at 7:00 p.m. at Lacey City Hall.

...Call 360-491-3214 to check the agenda of upcoming meetings or check our web site at www.ci.lacey.wa.us.

Drinking Tap Water Saves You $$$

Your tap water from the Lacey Water Utility not only undergoes a higher degree of testing and reporting than bottled water, it is also less expensive. Additionally, bottled water comes with a high price tag for the environment. It is estimated that the production of the 29 billion water bottles used each year in the U.S. requires 17.6 million barrels of oil. That's enough oil to supply fuel to 1 million vehicles for a full year. Here is how Lacey tap water fares against typical bottled water.

Bottled Water

16.9 ounces per bottle, 35 bottles/4.62 gallons per case at $6.99 per case = $ 1.51 per gallon

Lacey Tap Water

About $ 0.77 per 748 gallons = 0.103 of a penny per gallon. Less than 1 cent per case!

Are You Sending Money Down the Drain?

Did you know that on the average, nearly 10% of the water that passes through residential meters is wasted due to plumbing leaks? Over time, this can add up to serious money. Even if you think that your plumbing system is in good shape, chances are there are areas where you are leaking water, and a quick 30 minute test can determine your water loss. Your water meter can be an important tool in checking for leaks. Most water meters used within the City of Lacey's water system have a face that looks like the odometer on a car. To utilize the meter to check for leaks, first make sure that all indoor and outdoor water faucets and appliances are off. Take an initial reading by writing all of the numbers on the face of the meter down. Wait as long as possible, at least 30 minutes, and again record the numbers on the meter. Simply subtract the first reading from the second to determine the amount of water that is leaking from your system.

The most common culprits for water loss are leaking toilets and dripping faucets. Many toilets leak water from the tank into the bowl without being flushed, and the water loss, although barely noticeable, can result in thousands of gallons of wasted water annually.

How to Test for Toilet Leaks:

1. Lift the lid off the toilet tank and put 5-10 drops of food coloring into the tank.

2. Wait five minutes and then look in the bowl. If you see food coloring in the bowl, you have a leak.

In most cases, replacing the toilet flapper and/or the filling mechanism will correct the problem. For help in determining if you have a leak, call your Lacey Water Utility at 360-491-5600.

Irrigation Systems and Drinking Water Safety

If you have an in-ground sprinkler system or private irrigation well, Washington State law requires you to install, maintain and schedule yearly inspections of the backflow prevention device. Backflow occurs when water flows in the opposite direction than intended, resulting in potential contamination of the drinking water supply. Under the law, annual inspection and testing of the backflow device must be performed by a licensed tester.

Properly installed and maintained backflow prevention assemblies will stop the backflow of contaminated water into the drinking water supply. If you have any questions or concerns about backflow or the City of Lacey's Cross Connection Control Program, please call Lacey Water Resources at 360-491-5600.

Outdoor Watering Policy

During the months of June through September, Lacey Water Utility customers are required to adhere to the following schedule for outdoor watering. Water usage during the summer months is almost 3 times the winter usage, and the peak demand associated with outdoor watering can seriously affect our system's ability to provide fire protection and essential services during these times. The Odd/Even approach has shown to be successful in reducing peak demand, and will again be implemented in 2008. The irrigation/watering schedule is based on each property's street address.

All Addresses Ending with an Odd Number:

Saturday • Monday • Wednesday

All Addresses Ending with an Even Number:

Tuesday • Thursday • Sunday

The policy covers regular outdoor watering of lawns, flowerbeds, gardens, and other landscaping. Water used for other purposes (i.e., car washing, pressure washing, swimming pool filling, etc.) is not regulated by this policy.

Exemptions may include: (1) newly seeded lawns and landscape, (2) greenhouse plants, and (3) publicly-owned facilities with active sports playfields.

All water customers are required to participate in the watering schedule, and your cooperation is vital. In addition to helping Lacey meet peak water demands, the schedule ensures that the fire department has the available water it needs to effectively respond to fires.

For more information on the outdoor watering policy, or to register for an exemption, call Lacey Water Resources at 360-491-5600.

2007 Water Quality Results for Lacey's Source Wells

PWSID #43500Y

Primary Standards Regulated by EPA

Contaminant	Highest Level Allowed (MCL)	Goal Not to Exceed (MCLG)	Highest Level Detected	Lowest Level Detected	Sample Date of Highest Level	Typical Source of Contamination
Arsenic	10 ppb	0 ppb	2 ppb	< 2 ppm	10/16/07	geology, natural weathering
Nitrate*	10 ppm	10 ppm	6.7 ppm	<0.2 ppm	6/6/07	septic systems, fertilizer, animal waste
Total Coliform Bacteria	5% samples/ month	0% samples/ month	0% of samples	0% of samples		naturally present in environment
Total Trihalomethanes**	80 ppb	NA	12.1 ppb	<0.5 ppb	10/23/07	reaction of chlorine with naturally-occurring organic matter
Total Haloacetic acids***	60 ppb	NA	2.0 ppb	<0.5 ppb	7/23/07	reaction of chlorine with naturally-occurring organic matter
Chlorine Residual	4 ppm	4 ppm	1.1 ppm	0.05 ppm	4/11/07	chlorine has been added to the entire Lacey water system since May 2005
Radium 228	5 pCi/L	N/A	1.01 pCi/L	< 0.2 pCi/L	5/9/07	geology, natural weathering

Secondary Standards

Contaminant	Highest Level Allowed (MCL)	Goal Not to Exceed (MCLG)	Highest Level Detected	Lowest Level Detected	Sample Date of Highest Level	Typical Source of Contamination
Chloride	250 ppm		29 ppm	2 ppm	11/9/06	geology, natural weathering
Fluoride†	4 ppm	4 ppm	<0.2 ppm	<0.2 ppm		geology, natural weathering
Iron	300 ppb	NA	16 ppb	<30 ppb	10/23/07	geology, natural weathering
Lead	N/A	15 ppb	9 ppb	< 2 ppb	10/23/07	plumbing material
Manganese	50 ppb	NA	10 ppb	<10 ppb	10/16/07	geology, natural weathering
Sulfate	250 ppm		12 ppm	3 ppm	10/16/07	geology, natural weathering

Regulated by the State

Contaminant	Highest Level Allowed (MCL)	Goal Not to Exceed (MCLG)	Highest Level Detected	Lowest Level Detected	Sample Date of Highest Level	Typical Source of Contamination
Conductivity	700 μmhos/cm	NA	444 μmhos/cm	84 μmhos/cm	3/18/05	geology, natural weathering

Regulated by the State at the Consumer's Tap

Contaminant	State Action Level	Goal Not to Exceed (MCLG)	90% Percentile	# Samples over state action level	Sample Date of Highest Level	Typical Source of Contamination
Copper	1300 ppb	N/A	950 ppb	1 sample	11/23/04	Corrosion of household plumbing or erosion of natural deposits
Lead	15 ppb	NA	4 ppb	0 samples	9/20/05	Corrosion of household plumbing or erosion of natural deposits

next copper and lead compliance samples from customers to be collected in 2008

* Nitrate in drinking water at levels above 10ppm is a health risk for infants of less than six months of age. High nitrate levels in drinking water can cause blue baby syndrome. Nitrate levels may rise quickly for short periods of time because of rainfall or agricultural activity. If you are caring for an infant, you should ask for advice from your health care provider.

**Highest running annual average was 1.91 ppb ***Highest running annual average was 0.45 ppb †Lacey does not add Fluoride to our water

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. Environmental Protection Agency/Centers for Disease Control guidelines on appropriate means to lessen the risk of infection by Cryptosporidium and other microbial contaminants are available from the Safe Drinking Water Hotline at (800-426-4791).

2007 Water Quality Results for Olympia's McAllister Springs Source Water

Contaminant (Units)	MCL	MCLG	McAllister Springs Water Amount Detected	Range of Results (Low - High)	Testing Frequency	Typical Source of Contamination
Cryptosporidium	N/A		Zero	N/A	Once a month	Fecally contaminated water
Giardia Lamblia	99.9% removal		Zero	N/A	Once a month	Fecally contaminated water
Fecal Coliform Bacteria (# of bacteria per 100 ml of water)	90% of samples must have fewer than 20 bacteria per 100 ml of water	Zero	100% of samples had fewer than 20 bacteria per 100 ml of water	0 - 2 organisms	5 times a week	Fecally contaminated water
Total Coliform Bacteria (# of bacteria per 100 ml of water)	90% of samples must have fewer than 20 bacteria per 100 ml of water	Zero	99.6% of samples had fewer than 100 bacteria per 100 ml of water	0 - 101 organisms	5 times a week	Soil bacteria and fecally contaminated water
Turbidity (NTU)	5 NTU	1 NTU	0.33-0.520 NTU	0.022 - 0.53 NTU	Metered continuously	Soil runoff

Water Supply System (or Tap Water) After Chlorination

Contaminant (Units)	MCL	MCLG	City of Olympia Water Amount Detected	Range of Results (Low - High)	Testing Frequency	Typical Source of Contamination
Total Coliform Bacteria	90% of samples must have zero detections	Zero	No samples had confirmed detections	Zero	60 times per month at a minimum	Soil bacteria and fecally contaminated water
Chlorine residual (ppm)	4.0 ppm	Detectable amount of 0.05 ppm	0.09-1.56 ppm	0.09 -1.56 ppm	Metered continuously	Chlorine is used as a disenfectant in the water treatment process

Important Drinking Water Terms:

Maximum Contaminant Level (MCL): the highest level of a contaminant that is allowed in drinking water.

Maximum Contaminant Level Goal (MCLG): the contaminant level in drinking water below which there is no known or expected risk to health.

Action Level (AL): Action level is the concentration of a contaminant which, if exceeded, triggers treatment or other requirements which the water system must follow.

Primary Standard: the MCL for these substances is set primarily for health reasons.

Secondary Standard: the MCL for these substances is set primarily for non-health reasons such as color, taste, or fixture staining or indirect health concerns when levels are too high.

NTU: Nephelometric Turbidity Unit is the standard unit to measure the amount of material suspended in water.

ppm: Parts per million is equivalent to milligrams per liter (mg/l). One ppm is approximately equal to 1 drop in 22 gallons of water.

ppb: Parts per billion. One ppb is approximately equal to 1 drop in 22,000 gallons of water (equivalent to about 1 drop in a small swimming pool).

ppt: Parts per trillion. One ppt is approximately equal to 1 drop in 22,000,000 gallons of water (equivalent to about 1 drop in Long's Pond).

pCi/l: Picocuries per liter is the unit of measure used to describe an amount of radiation.

μmhos/cm: Micromhos per centimeter is the unit of measure used to describe conductivity.

Secondary Standard: the MCL for these substances is set primarily for non-health reasons such as color, taste, or fixture staining or indirect health concerns when levels are too high.

Water Quality Report
2009

From water quality
data collected through 2008

CITY OF LACEY

A Message from the Mayor

I am pleased to provide you with the City of Lacey's annual Drinking Water Quality Report. This report summarizes the water quality testing that Lacey Water Utility staff performed on our water supply through 2008. The City of Lacey's water not only meets, but exceeds the strict guidelines set by the Environmental Protection Agency.

Overlooking the Nisqually Valley

It is important that the City's drinking water customers know that they, their families and businesses receive the highest quality drinking water. When you go to your tap, you can have confidence in the fact that the City of Lacey operates a reliable, first-class water system.

The information in this report will allow all of our customers, especially those with special health needs, to make informed decisions regarding their drinking water. Please take the opportunity to read and learn about the quality of your community's drinking water. If you have questions regarding your drinking water or this report, please contact your Lacey Water Utility at 360-491-5600.

Sincerely,

Mayor Graeme Sackrison

For More Information

- About Lacey's distribution system or to report problems, call the Lacey Maintenance Service Center at 360-491-5644.
- About your utility bill, call Lacey Utility Billing at 360-491-5616.
- About drinking water safety, call the EPA Safe Drinking Water Hotline at 1-800-426-4791 or visit the EPA Homepage at www.epa.gov/OW.

To Get Involved

- Join us for a Utilities Committee meeting on the first Tuesday of each month at 11:00 a.m. at Lacey City Hall, 420 College Street S.E. in Lacey. The committee discusses a variety of issues regarding our stormwater, drinking water, and wastewater utilities.
- Public attendance at City Council meetings is also welcome. The Council generally meets the second & fourth Thursday of the month January through October and the first and third Thursdays for November and December. Meetings begin at 7:00 p.m. at Lacey City Hall.
- Call 360-491-3214 to check the agenda of upcoming meetings or check our web site at www.ci.lacey.wa.us .

Justin and Scott after a long day working on Lacey's water lines.

Contractor tapping one of Lacey's water lines.

Sources of Lacey's Drinking Water

The majority of Lacey's water supply comes from 19 wells that withdraw groundwater from three aquifers.

An aquifer is an underground layer of unconsolidated rock or sand that is saturated with usable amounts of water. Aquifers, which store and carry water, form significant natural water supplies. Recharge areas are important to a healthy aquifer. In a recharge area, water is able to filter slowly into the earth and down to the aquifer, helping to re-supply the resource.

Additional water is purchased periodically from the Olympia water system to help meet peak demand. The water purchased from Olympia comes from McAllister Springs. Water quality data from Olympia is listed in this report.

The sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally-occurring minerals and in some cases, radioactive material, and can pick up substances resulting from the presence of animals or from human activity.

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the EPA's Safe Drinking Water Hotline (1-800-426-4791).

Contaminants that may be Present in Source Water Include:

• ***Microbial contaminants***, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.

• ***Inorganic contaminants,*** such as salts and metals, which can be naturally-occurring or result from urban stormwater runoff, industrial or domestic wastewater discharges, oil and gas production, mining, or farming.

• ***Pesticides and herbicides,*** which may come from a variety of sources such as agriculture, urban stormwater runoff, and residential uses.

• ***Organic chemical contaminants,*** including synthetic and volatile organic chemicals, which are byproducts of industrial processes and petroleum production, and can also come from gas stations, urban stormwater runoff, and septic systems.

• ***Radioactive contaminants,*** which can be naturally-occurring or be the result of oil and gas production and mining activities.

In order to ensure that tap water is safe to drink, EPA prescribes regulations which limit the amount of certain contaminants in water provided by public water systems, such as Lacey's water system. Food and Drug Administration regulations establish limits for contaminants in bottled water which must provide the same protection for public health.

Hawks Prairie Water Treatment Facility

Drinking Tap Water Saves You $$$

Your tap water from the Lacey Water Utility not only undergoes a higher degree of testing and reporting than bottled water, it is also substantially less expensive. Additionally, bottled water comes with a high price tag for the environment. It is estimated that the production of the 29 billion water bottles used each year in the U.S. requires 17.6 million barrels of oil. That's enough oil to supply fuel to 1 million vehicles for a full year. Here is how Lacey tap water fares against typical bottled water.

Bottled Water

16.9 ounces per bottle, 35 bottles/4.62 gallons per case at $6.99 per case = $ 1.51 per gallon

Lacey Tap Water

About $ 0.77 per 748 gallons = 0.103 of a penny per gallon. Less than 1 cent per case!

Are You Sending Money Down the Drain?

Did you know that on the average, nearly 10% of the water that passes through residential meters is wasted due to plumbing leaks? Over time, this can add up to a substantial amount of money. Even if you think that your plumbing system is in good shape, chances are there are areas where you are leaking water, and a quick 30 minute test can determine your water loss. Your water meter can be an important tool in checking for leaks. Most water meters used within the City of Lacey's water system have a face that looks like the odometer on a car.

To utilize the meter to check for leaks, first make sure that all indoor and outdoor water faucets and appliances are off. Take an initial reading by writing all of the numbers on the face of the meter down. Wait as long as possible, at least 30 minutes, and again record the numbers on the meter. Subtract the first reading from the second to determine the amount of water (in cubic feet) that is leaking from your system.

The most common culprits for water loss are leaking toilets and dripping faucets. Many toilets leak water from the tank into the bowl without being flushed, and the water loss, although barely noticeable, can result in thousands of gallons of wasted water annually.

How to Test for Toilet Leaks:

1. Lift the lid off the toilet tank and put 5-10 drops of food coloring into the tank.

2. Wait five minutes and then look in the bowl. If you see food coloring in the bowl, you have a leak.

In most cases, replacing the toilet flapper and/or the filling mechanism will correct the problem. For help in determining if you have a leak, call your Lacey Water Utility at 360-491-5600.

Want a New Toilet that Doesn't Guzzle Water?

If you have a toilet that uses more than 3 gallons per flush, you may be eligible for a brand new high efficiency toilet (HET)! HETs are a new generation of toilets that use 20% less water than a standard low-flow toilet. Depending on which services the City of Lacey provides to your home (water, sewer or both) and the type of toilet you currently have, you may qualify for a free or reduced cost high efficiency toilet. If you are a City of Lacey water or sewer customer, contact Lacey Water Resources at 360-491-5600 to see if your toilet qualifies for an upgrade.

Is Your Sprinkler System up to Code?

If you have an in-ground sprinkler system or private irrigation well, Washington State law requires you to install, maintain and schedule yearly inspections of the backflow prevention assembly. Backflow occurs when water flows in the opposite direction than intended, resulting in potential contamination of the drinking water supply. Under the law, annual inspection and testing of the backflow assembly must be performed by a licensed tester. Properly installed and maintained backflow prevention assemblies will stop the backflow of contaminated water into the drinking water supply. If you have questions about backflow or the City of Lacey's Cross Connection Control Program, please call Lacey Water Resources at 360-491-5600.

Mandatory Odd/Even Outdoor Watering Schedule began June 1, 2009 for all Lacey Water Customers

All Addresses Ending with an Odd Number, 1, 3, 5, 7 or 9 can irrigate on :

Saturdays • Monday • Wednesdays

All Addresses Ending with an Even Number 0, 2, 4, 6 or 8 can irrigate on:

Tuesdays • Thursdays • Sundays

During the summer months, mainly due to outdoor watering, Lacey Water Utility customers consume three times as much water as in the winter. Alternating outdoor watering is necessary to meet peak daily demands. It also reduces the city's construction and maintenance costs associated with demands, thereby saving our water customers money.

Mandatory odd/even watering will remain in effect from June 1 through September 30. All water customers are required to participate in the watering schedule, and your cooperation is vital. The Odd/Even approach has shown to be successful in reducing peak demand and helps ensure that the fire department has the available water needed to effectively respond to fires.

2008 Water Quality Results for City of Lacey PWSID #43500Y

Primary Standards Regulated by EPA to protect public health

Contaminant	Highest Level Allowed (MCL)	Goal Not to Exceed (MCLG)	Highest Level Detected	Lowest Level Detected	Sample Date of Highest Level	Typical Source of Contamination
Arsenic	10 ppb	0 ppb	2 ppb	< 2 ppb	10/16/07	geology, natural weathering
Nitrate*	10 ppm	10 ppm	5.6 ppm	<0.2 ppm	6/24/08	septic systems, fertilizer, animal waste
Total Coliform Bacteria	5% samples/ month	0% samples/ month	0% of samples	0% of samples		naturally present in environment
Total Trihalomethanes**	80 ppb	N/A	15 ppb	<0.5 ppb	8/27/08	reaction of chlorine with naturally-occurring organic matter
Total Haloacetic acids***	60 ppb	N/A	4.6 ppb	<0.5 ppb	10/24/08	reaction of chlorine with naturally-occurring organic matter
Chlorine Residual	4 ppm	4 ppm	0.95 ppm	0.24 ppm	6/12/08	added as a disinfectant to the water system
Radium 228	5 pCi/L	N/A	1.01 pCi/L	< 0.2 pCi/L	5/9/07	geology, natural weathering

Secondary Standards regulated by the EPA for aesthetics

Contaminant	Highest Level Allowed (MCL)	Goal Not to Exceed (MCLG)	Highest Level Detected	Lowest Level Detected	Sample Date of Highest Level	Typical Source of Contamination
Chloride	250 ppm		29 ppm	2 ppm	11/9/06	geology, natural weathering
Fluoride†	4 ppm	4 ppm	<0.2 ppm	<0.2 ppm		geology, natural weathering
Iron	300 ppb	N/A	16 ppb	<30 ppb	10/23/07	geology, natural weathering
Lead	N/A	15 ppb	9 ppb	< 2 ppb	10/23/07	plumbing material
Manganese	50 ppb	N/A	10 ppb	<10 ppb	10/16/07	geology, natural weathering
Sulfate	250 ppm		12 ppm	3 ppm	10/16/07	geology, natural weathering

Regulated by the State

Contaminant	Highest Level Allowed (MCL)	Goal Not to Exceed (MCLG)	Highest Level Detected	Lowest Level Detected	Sample Date of Highest Level	Typical Source of Contamination
Conductivity	700 µmhos/cm	N/A	245 µmhos/cm	84 µmhos/cm	10/23/07	geology, natural weathering

Regulated by the State at the Consumer's Tap

Contaminant	State Action Level	Goal Not to Exceed (MCLG)	90% Percentile	# Samples over state action level	Sample Date of Highest Level	Typical Source of Contamination
Copper	1300 ppb	N/A	960 ppb	1 sample	9/10/08	Corrosion of household plumbing or erosion of natural deposits
Lead	15 ppb	N/A	10 ppb	0 samples	9/10/08	Corrosion of household plumbing or erosion of natural deposits

* Nitrate in drinking water at levels above 10 ppm is a health risk for infants of less than six months of age. High nitrate levels in drinking water can cause blue baby syndrome. Nitrate levels may rise quickly for short periods of time because of rainfall or agricultural activity. If you are caring for an infant, you should ask for advice from your health care provider.
**Highest running annual average was 2.6 ppb ***Highest running annual average was 0.90 ppb †Lacey does not add Fluoride to our water

For more information on the outdoor watering policy, or to request an exemption, call Lacey Water Resources at 360 491-5600 or visit www.ci.lacey.wa.us and click on "Lacey Water Resources".

Important Information about Your Water

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/CDC guidelines on appropriate means to lessen the risk of infection by Cryptosporidium and other microbial contaminants are available from the Safe Drinking Water Hotline (1-800-426- 4791). If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. The City of Lacey is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead in your drinking water, you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at http://www.epa.gov/safewater/lead.

2008 Water Quality Results for City of Olympia Source Water

TABLE 1 - McAllister Springs (Surface Water Source) Before Chlorination

Contaminant (Units)	MCL	MCLG	McAllister Springs Water Amount Detected	Range of Results (Low - High)	Testing Frequency	Typical Source of Contamination
Cryptosporidium	N/A		Zero	N/A	Once a month	Fecally contaminated water
Giardia Lamblia	99.9% removal		Zero	N/A	Once a month	Fecally contaminated water
Fecal Coliform Bacteria (# of bacteria per 100 ml of water)	90% of samples must have fewer than 20 bacteria per 100 ml of water	Zero	100% of samples had fewer than 20 bacteria per 100 ml of water	0 - 5 organisms	5 times a week	Fecally contaminated water
Total Coliform Bacteria (# of bacteria per 100 ml of water)	90% of samples must have fewer than 100 bacteria per 100 ml of water	Zero	99.6% of samples had fewer than 100 bacteria per 100 ml of water	0 - 88 organisms	5 times a week	Soil bacteria and fecally contaminated water
Turbidity (NTU)	5 NTU	1 NTU	0.33-0.520 NTU	0.024 - 0.189 NTU	Metered continuously	Soil runoff

TABLE 2 - Water Supply System (or Tap Water) After Chlorination

Contaminant (Units)	MCL	MCLG	City of Olympia Water Amount Detected	Range of Results (Low - High)	Testing Frequency	Typical Source of Contamination
Total Coliform Bacteria	95% of samples must have zero detections	Zero	No samples had confirmed detections	Zero	60 times per month at a minimum	Soil bacteria and fecally contaminated water
Chlorine residual (ppm)	4.0 ppm	Detectable amount of 0.05 ppm	0.09-1.56 ppm	0.09 -1.56 ppm	Metered continuously	Chlorine is used as a disenfectant in the water treatment process
Disinfection By-Products						
Haloacetic Acids (HAA) (ppb)	60 ppb	N/A	1.5 ppb	0.0 - 1.5 ppb	Quarterly	Disinfection by-products are caused by a chemical reaction between chlorine and naturally occurrring organic matter in water
Total Trihalomethanes (TTHM) (ppb)	80 ppb	N/A	5.0 ppb	0 - 5.0 ppb		

TABLE 3 - Lead & Copper (taken at customer tap) Results from 2006

Contaminant (Units)	MCL	City of Olympia Water Amount Detected	Number of Sites Found Above the AL	Range of Results (Low - High)	Testing Frequency	Typical Source of Contamination
Copper (ppm)	Action Level (AL) 1.3 ppm	90% of the homes tested had copper levels less than 0.985 ppm	Zero sites above AL out of 35 sites sampled	<0.059 -1.2 ppm	Once every 3 years	Corrosion of household plumbing
Lead (ppb)	Action Level (AL) 15 ppb	90% of the homes tested had lead levels less than 3 ppb	Zero sites above AL out of 35 sites sampled	<1 - 5 ppb	Once every 3 years	Corrosion of household plumbing

Action Level for Copper: 90% of the homes tested must have levels less than 1.3 ppm detected
Action Level for Lead: 90% of the homes tested must have levels less than 15 ppb detected

Important Drinking Water Terms:

Maximum Contaminant Level (MCL): the highest level of a contaminant that is allowed in drinking water.

Maximum Contaminant Level Goal (MCLG): the contaminant level in drinking water below which there is no known or expected risk to health.

Action Level (AL): Action level is the concentration of a contaminant which, if exceeded, triggers treatment or other requirements which the water system must follow.

Primary Standard: the MCL for these substances is set primarily for health reasons.

Secondary Standard: the MCL for these substances is set primarily for non-health reasons such as color, taste, or fixture staining or indirect health concerns when levels are too high.

NTU: Nephelometric Turbidity Unit is the standard unit to measure the amount of material suspended in water.

ppm: Parts per million is equivalent to milligrams per liter (mg/l). One ppm is approximately equal to 1 drop in 22 gallons of water.

ppb: Parts per billion. One ppb is approximately equal to 1 drop in 22,000 gallons of water (equivalent to about 1 drop in a small swimming pool).

pCi/l: Picocuries per liter is the unit of measure used to describe an amount of radiation.

µmhos/cm: Micromhos per centimeter is the unit of measure used to describe conductivity.

City of Lacey, Washington

Water Quality Report

Shaping our community together

CITY OF LACEY

Mayor's message:

The City of Lacey works every day of the year to ensure its customers receive the highest quality drinking water possible. To maintain this standard, the Lacey Water Utility conducts a comprehensive analysis of our community's water supply each year and reports a summary of the test results in Lacey's Annual Water Quality Report. For 2009, Lacey's drinking water met or exceeded all regulations and mandates established by the Environmental Protection Agency.

Please take the opportunity to read and learn about the quality of our community's drinking water, the importance of conserving water, and some tips for how you can help keep our water supply free from contaminants. Information contained in this report will also allow Lacey water customers, specifically those with special health considerations, to make informed decisions regarding the water we use every day.

If you have questions regarding the community's drinking water or with information contained in this report, please contact your Lacey Water Utility at (360) 491-5600.

Sincerely,

Tom Nelson

Mayor Tom Nelson

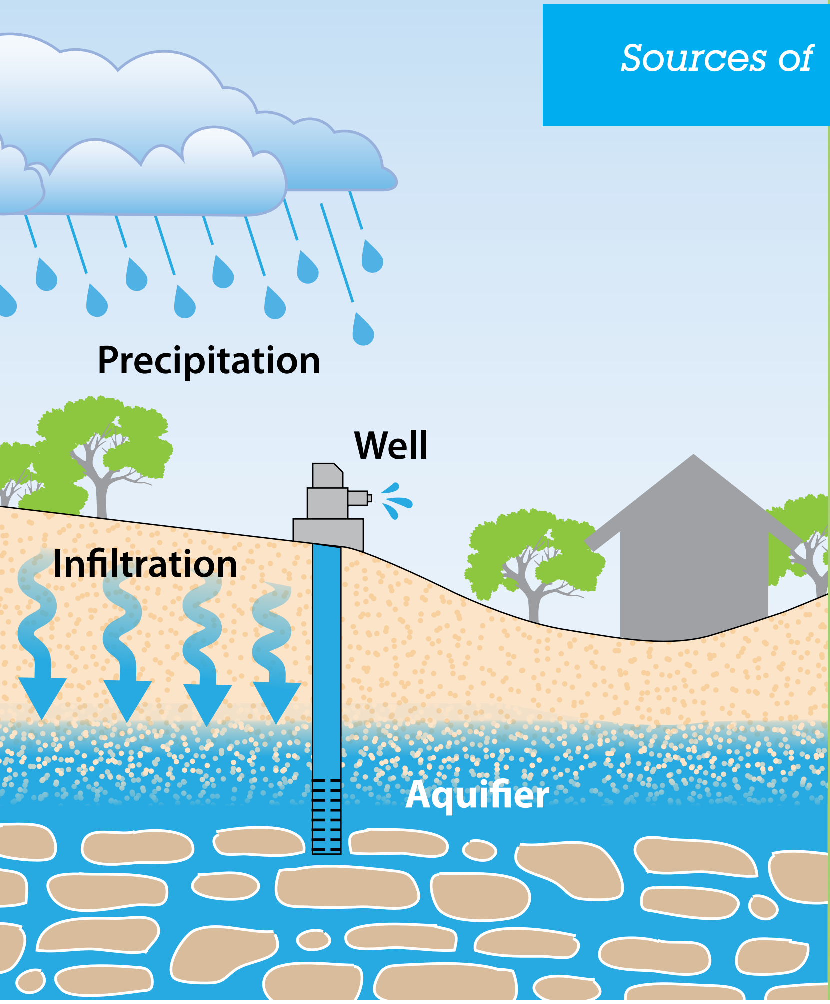
For More Information

- About Lacey's distribution system or to report problems, call the Lacey Maintenance Service Center at 360-491-5644.
- About your utility bill, call Lacey Utility Billing at 360-491-5616.
- Attend a Utilities Committee meeting or City Council meeting and discuss important community issues. Meeting dates, location and agendas are available at www.ci.lacey.wa.us or call 360-491-3214

Is Your Sprinkler System up to Code?

If you have an in-ground sprinkler system or private irrigation well, Washington State law requires you to install, maintain and schedule yearly inspections of the backflow prevention assembly. Backflow occurs when water flows in the opposite direction than intended, resulting in potential contamination of the drinking water supply. Under the law, annual inspection and testing of the backflow assembly must be performed by a licensed tester. Properly installed and maintained backflow prevention assemblies will stop the backflow of contaminated water into the drinking water supply. If you have questions about backflow or the City of Lacey's Cross Connection Control Program, please call Lacey Water Resources at 360-491-5600.

Sources of Lacey's Drinking Water



The majority of Lacey's water supply comes from 19 wells that withdraw groundwater from three aquifers. Additional water is purchased from the Olympia water system. The water purchased from Olympia comes from McAllister Springs. The water quality data collected in 2009 from all of Lacey's drinking water sources, including Olympia's McAllister Springs source, can be found within this report.

An aquifer is an underground layer of rock or sand that is filled with water. Aquifers must be refilled or "recharged" with non-polluted water to remain healthy and available for use. Since most of Lacey's drinking water is withdrawn from aquifers, it is important to keep recharge areas as free from pollutants as possible. Lacey relies on its residents to keep our drinking water sources clean by fixing oil leaks in their cars, minimizing the use of chemicals on their yards, keeping their septic systems pumped and inspected, and their pet waste bagged and placed in the garbage.

FREE indoor and outdoor water saving kits*

Indoor kits include: water efficient showerhead, faucet aerators, and toilet leak detection tablets

Outdoor kits include: heavy duty adjustable hose nozzle, hose repair kit, and a "1-inch-a- week" watering gauge

FREE Hose Timers*

Have you ever turned on your sprinkler and forgot about it? A hose timer is an automatic shut off device for those who water their lawns with a hose and sprinkler. These hose timers are simple to use and connect to any standard hose and outdoor hose bib.

FREE Soil Moisture Sensors*

Over watering your lawn not only wastes water, it can also cause disease. A soil moisture sensor is a device that will show you when the soil is dry to prevent over watering your lawn.

FREE Rain Sensors*

If you have an in-ground irrigation system and are tired of seeing your sprinklers come on in the rain, these small devices easily connect to your existing programmable irrigation controller and automatically overrides your system to save you water and money!

FREE High Efficiency Toilet!

Replace your old, water-guzzling toilet (most toilets installed BEFORE 1993 qualify) with a high efficiency toilet for FREE.

Supplies are limited. *Wastewater customers: visit www.lottonline.org and click on "offers and rebates" for app or call 360-664-2333 x1107. Water customers on septic visit www.ci.lacey.wa.us and click on "Lacey Water Resources" for app or call 360-491-5600*

**Available ONLY to Lacey Water or Wastewater Customers. Visit Lacey City Hall, 420 College St SE: Monday – Friday 8am-5pm to start saving water today.*

Which days will you be watering your yard this summer?

Mandatory Outdoor Watering Schedule begins June 1, 2010 for all Lacey Water Customers.

If you have a newly seeded lawn or landscaped area, you can request a temporary exemption from the City. Potted plants and plants inside greenhouses are also exempt from this policy. For more information on the outdoor watering policy, or to request a variance or exemption, call Lacey Water Resources at 360 491-5600 or visit www.ci.lacey.wa.us and click on "Lacey Water Resources".

Did you know that Lacey water customers use THREE TIMES as much water in the summer than in the winter? In order to meet the high demand during these peak months, the Lacey Water Utility enforces a mandatory outdoor watering schedule between June and September. The watering schedule for your outdoor watering needs will depend on your address:

0 2 4 6 8

Addresses ending in EVEN numbers water: **Sundays, Tuesdays, and Thursdays**

1 3 5 7 9

Addresses ending in ODD numbers water: **Saturdays, Mondays, and Wednesdays**

FRIDAY is a non-watering day for ALL Lacey water customers!

Where Does Lacey's Water Go?

90%	City customers with water meters	2.3 billion gallons
0.7%	Non-metered authorized uses*	18.9 million gallons
9.3%	Distribution System Leakage**	240 million gallons

Last year, the City reduced the distribution system leakage by 4.7% from 2008 through a continued effort which includes a state-of-the-art leak detection program, city-wide automated meter reading technology, efficient theft elimination processes and dedication to improving the accuracy of its source meters.

** Authorized uses include: street sweeping, water line flushing, treatment facility maintenance, and other activities related to new construction.*

*** Distribution system leakage (DSL) refers to all water that could not be accounted for, and is attributed to water main breaks, theft of water and other unknown water losses. The state requires that utilities of Lacey's size maintain a DSL of less than 10%.*

Three EASY steps to a healthy yard:

Our yards often become an extension of our home, a shady retreat after a warm sunny day, a place to relax with our families, or a place to throw a ball for our dog. Our desires to have the "perfect" yard can sometimes lead us down an un-healthy path of harsh chemicals and water-guzzling landscapes. As the ground begins to warm back up this year and our landscapes begin to green, we want to share some really easy tips for maintaining the perfect yard, without wasting water or using a ton of chemicals that can harm our families and poison our streams and water supplies.

1 Water deep… and less often

Watering your lawn everyday not only puts your lawn at risk for disease, but it also wastes water—costing YOU money! Most lawns here in Lacey only need about an inch of water a week (including rain) to stay green. So how much water is an inch? To find out, place a few tuna cans around your yard, once they are filled, you have your one inch for the week. It's that simple!

Watering deeply (only once or twice a week), instead of every day, encourages your lawn's roots to grow deeper, creating a large, sturdy root system—which helps crowd out the weeds. On the flip side, when your lawn receives only a small amount of water every day, the roots never have to grow deep. This will cause the roots to become weak and more susceptible to the effects of drought and also more welcoming to weeds.

2 Mow high and let it lie!

It is very important to: (1) adjust your lawn mower to mow your grass high (2 inches), (2) mow often, and (3) remove and sharpen the blade a few times this summer for a nice clean cut. Mowing high also encourages your lawn's roots to grow stronger making for lush, green lawns that help to shade out weeds.

"Grass-cycling" is the FREE way to provide nutrients to your lawn. Simply leave the grass clippings on your lawn when you mow. The grass clippings serve as nutrients as well as a means for storing water and keeping your soil nice and cool.

3 Fertilizers? Use natural or slow-release!

Fertilizers can provide your lawn with the nutrients it needs to be healthy. If you plan to fertilize your lawn, make sure to purchase a fertilizer that says "slow-release" or "natural" on the bag. Slow release and natural fertilizers allow the nutrients to feed your lawn over long periods of time, just as nature intended. The "quick-greening" formula fertilizers force feed your lawn all at once, but do not address the problems that are causing poor lawn health.

2009 WATER QUALITY RESULTS FOR THE CITY OF LACEY PWSID #43500Y

Contaminant	Highest Level Allowed (MCL)*	Goal Not to Exceed (MCLG)*	Highest Level Detected	Lowest Level Detected	Date of Highest Level Detected	Typical Source of Contaminant
Nitrate[1] (ppm)*	10	10	7	<1	5/26/2009	septic systems, fertilizer, animal wastes
Total Coliform Bacteria	5% samples/ month	0% samples/ month	0% of samples	0% of samples	--	naturally present in environment
Total Trihalomethanes (ppb)**	80	NA	20	<0.5	10/7/2009	reaction of chlorine with naturally-occurring organic matter
Total Haloacetic acids (ppb)***	60	NA	9	<0.5	4/20/2009	reaction of chlorine with naturally-occurring organic matter
Chlorine Residual (ppm)*	4	4	1.04	0.2	12/17/2009	Added as a disinfectant to the water system
SECONDARY STANDARDS REGULATED BY EPA FOR AESTHETICS						
Chloride (ppm)*	250		23	3	8/17/2009	geology, natural weathering
Fluoride (ppm)*	4	4	0.3	<0.2	8/17/2009	geology, natural weathering
Iron (ppb)*	300	NA	20	<10	9/9/2009	geology, natural weathering
Lead (ppb)*	N/A	15	9	< 2	10/23/2007	plumbing material
Manganese (ppb)*	50	NA	80	<2	8/17/2009	geology, natural weathering
Sulfate (ppm)*	250		12	3	8/17/2009	geology, natural weathering
Conductivity (μmhos/cm)*	700	NA	249 μmhos/cm	84 μmhos/cm	8/17/2009	geology, natural weathering

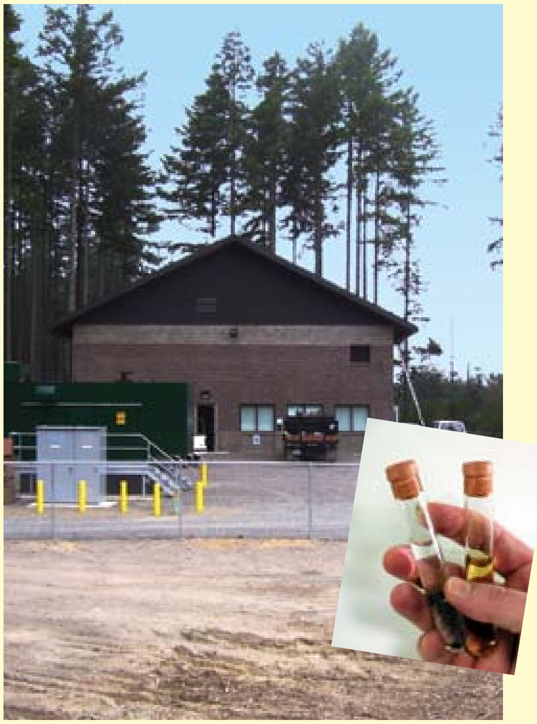
REGULATED BY THE STATE AT THE CONSUMER'S TAP

Contaminant	State Action Level	Goal Not to Exceed (MCLG)*	90% percentile	# samples over state action level	Sample Date of Highest Level	Typical Source of Contaminant
Copper † (ppb)*	1300	N/A	960	1 sample	9/10/2008	Corrosion of household plumbing or erosion of natural deposits
Lead † (ppb)*	15	NA	10	0 samples	9/10/2008	Corrosion of household plumbing or erosion of natural deposits

[1] Nitrate in drinking water at levels above 10 ppm is a health risk for infants of less than six months of age. High nitrate levels in drinking water can cause blue baby syndrome. Nitrate levels may rise quickly for short periods of time because of rainfall or agricultural activity. If you are caring for an infant, you should ask advice from your health care provider.

Highest running average in 2009 was 4.4 ppb. * Highest running average in 2009 was 2.4 ppb. †Copper and lead are measured every 3 years. Next routine sampling will be in 2011.

Lacey does not add fluoride



*Important Drinking Water Definitions

MCLG Maximum Contaminant Level Goal: The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.

MCL Maximum Contaminant Level: The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.

TT Treatment Technique: A required process intended to reduce the level of a contaminant in drinking water.

AL Action Level: The concentration of a contaminant which, if exceeded, triggers treatment or other requirements which a water system must follow.

MRDLG Maximum residual disinfection level goal. The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants.

MRDL MRDL: Maximum residual disinfectant level. The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.

MNR MNR: Monitored Not Regulated

MPL MPL: State Assigned Maximum Permissible Level

pCi/L Picocuries per liter (a measure of radioactivity)

* **ppm** (Parts per Million), **ppb** (Parts per Billion), **mg/L** (Milligrams per Liter), **NA** (Not Applicable), **ND** (Not Detected), **NR** (Monitoring not required)

2009 WATER QUALITY RESULTS FOR THE CITY OF OLYMPIA WATER SOURCE, MCALLISTER SPRINGS

Contaminant (units)	MCL*	MCLG*	McAllister Springs Water Amount Detected	Range of Results (Low - High)	Testing Frequency	Typical Source of Contamination
Cryptosporidium	N/A		Zero	N/A	Once a month	Fecally contaminated water
Giardia Lamblia	99.9% removal		Zero	N/A	Once a month	Fecally contaminated water
Fecal Coliform Bacteria (# of bacteria per 100 milliliter of water)	90% of samples had fewer than 20 bacteria per 100 milliliters of water	Zero	100% of samples had fewer than 20 bacteria per 100 milliliters of water	0-4 organisms	5 times a week	Fecally contaminated water
Total Coliform Bacteria (# of bacteria per 100 milliliter of water)	90% of samples must have fewer than 100 bacteria per 100 milliliters of water	Zero	99.6% of samples had fewer than 100 bacteria per 100 milliliters of water	0-276 organisms	5 times a week	Soil bacteria and fecally contaminated water
Turbidity (NTU)*	5	1	0.014-2.63	0.014-2.63	Metered continously	Soil runoff

WATER SUPPLY SYSTEM (OR TAP WATER) AFTER CHLORINATION

Contaminant (units)	MCL*	MCLG*	City of Olympia Water Amount Detected	Range of Results (Low - High)	Testing Frequency	Typical Source of Contamination
Total Coliform Bacteria	95% of samples must have zero detections	Zero	No samples had confirmed detections	Zero	60 times per month at a minimum	Soil bacteria and fecally contaminated water
Chlorine residual (ppm)*	4.0	Detectable amount of 0.05	0.08-1.92	0.08-1.92	Metered continuously	Chlorine is used as a disinfectant in the water treatment process
DISINFECTION BY-PRODUCTS						
Haloacetic Acids (HAA) (ppb)*	60	Zero	7.2	<1.0 - 7.2	Quarterly	Disinfection by-products are caused by a chemical reaction between chlorine and naturally occurring organic matter in water
Total Trihalomethanes (THM) (ppb)*	80	Zero	8.0	<0.5 - 8.0		
INORGANIC COMPOUNDS						
Radium 228 (pCi/L)*	5	Zero	1.21	0-1.21	Once every 3 years	Naturally occurs in some drinking water sources. May occur due to contamination from facilities using or producing radioactive materials.
Gross Beta (pCi/L)*	50	Zero	1.57	0-1.57		

LEAD & COPPER (TAKEN AT CUSTOMER TAP) RESULTS FROM 2009

Contaminant (unit)	MCL*	City of Olympia Water Amount Detected	Number of sites found above the AL	Range of Results (Low - High)	Testing Frequency	Typical Source of Contamination
Copper (ppm)*	Action Level 1.3	90% of the homes tested had copper levels less than 0.907 ppm	Zero sites above AL out of 35 sites sampled	0.027-1.005	Once every 3 years	Corrosion of household plumbing
Lead (ppb)*	Action Level 15	90% of the homes tested had lead levels less than 6 ppb	Zero sites above AL out of 35 sites sampled	0 - 25	Once every 3 years	Corrosion of household plumbing

Action Level for Copper: 90% of the homes tested must have levels less than 1.3 ppm detected. **Action Level for Lead:** 90% of the homes tested must have levels less then 15 ppb detected.

Health information about your water. What you should know.

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the EPA's Safe Drinking Water Hotline (1-800-426-4791).

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/CDC guidelines on appropriate means to lessen the risk of infection by Cryptosporidium and other microbial contaminants are available from the Safe Drinking Water Hotline (1-800-426- 4791).

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. The City of Lacey is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead in your drinking water, you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at http://www.epa.gov/safewater/lead.

More information about contaminants and potential health effects can be obtained by calling the EPA's Safe Drinking Water Hotline (1-800-426-4791), or by visiting the EPA's Safe Drinking Water Hotline Page online at: www.epa.gov/safewater/hotline.

City of Lacey, Washington

Water Quality Report

Mayor's message:

Each year, the Lacey Water Utility conducts a comprehensive analysis of the community's water supply and reports a summary of the test results in Lacey's annual Water Quality Report. You will be pleased to know that Lacey's drinking water met or exceeded all regulations and mandates established by the Environmental Protection Agency for 2010.

It is important to me that Lacey water customers not only receive the highest quality drinking water, but that they also become a part of the community-wide effort to conserve and protect our water resources. With everyone's involvement, we can ensure that Lacey's drinking water will be maintained at the highest level for the present and foreseeable future.

Please take the opportunity to read and learn about the quality of our community's drinking water, the importance of conserving water and some tips for how you can help keep our drinking water supplies free from pollution. Information contained in this report allows Lacey's water customers, specifically those with special health considerations, to make informed decisions about the water they use every day.

If you have any questions regarding the community's drinking water, or the information contained in this report, please contact your Lacey Water Utility at 360-491-5600.

Sincerely,

Tom Nelson

Mayor Tom Nelson

Shaping our community together

CITY OF LACEY

For More Information

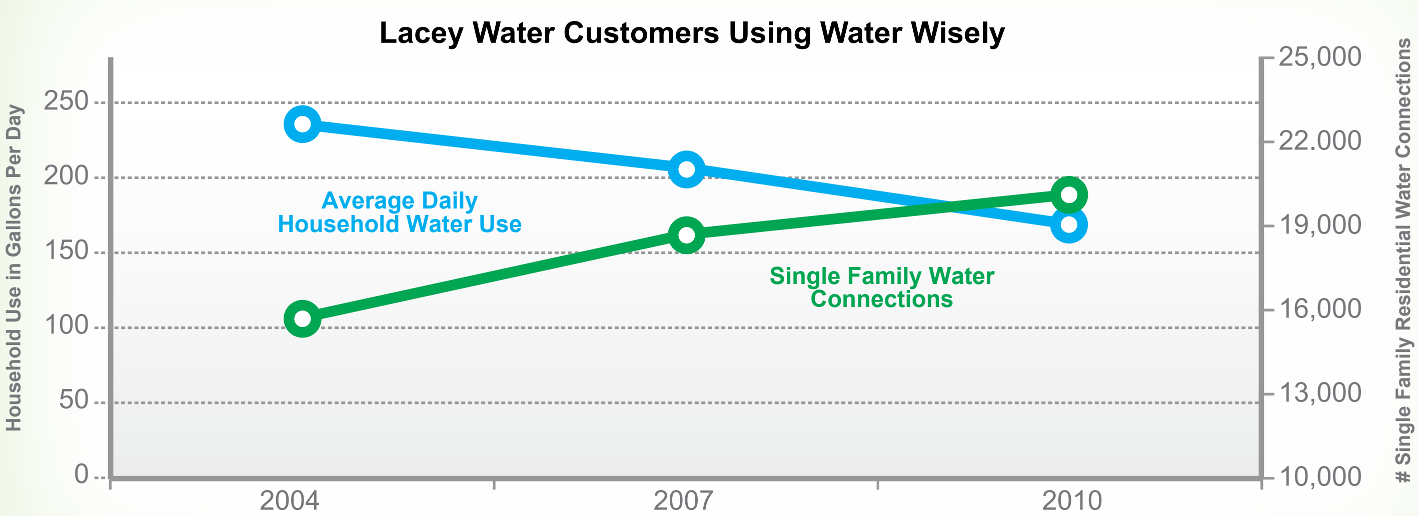
- About Lacey's distribution system or to report problems, call the Lacey Maintenance Service Center at 360-491-5644.
- About your utility bill, call Lacey Utility Billing at 360-491-5616.
- About drinking water safety, call the EPA Safe Drinking Water Hotline at 1-800-426-4791 or visit the EPA Homepage at www.epa.gov/OW.

To Get Involved

- Join us for a Utilities Committee meeting on the first Tuesday of each month at 11:00 a.m. at Lacey City Hall, 420 College Street S.E. in Lacey. The committee discusses a variety of issues regarding our stormwater, drinking water, and wastewater utilities.
- Public attendance at City Council meetings is also welcome. The Council generally meets the second & fourth Thursday of the month January through October and the first and third Thursdays for November and December. Meetings begin at 7:00 p.m. at Lacey City Hall.
- Call 360-491-3214 to check the agenda of upcoming meetings or check our web site at www.ci.lacey.wa.us/video. Meetings are now video recorded and available online *(live and archived).*

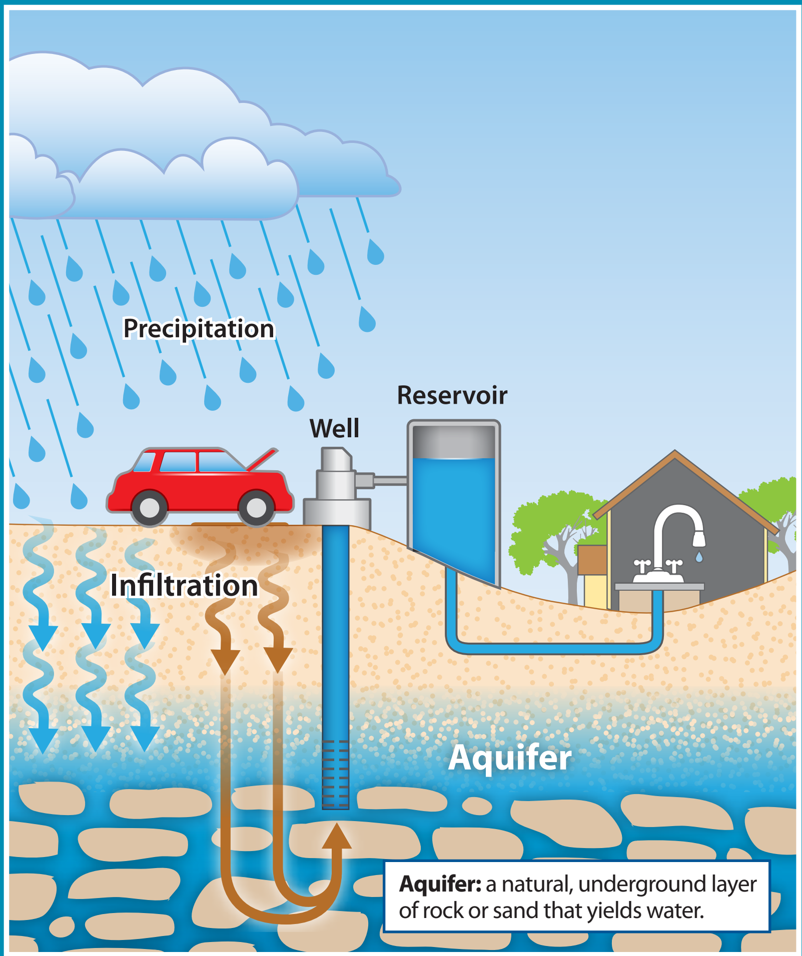
Lacey Water Customers Using Water Wisely

The City of Lacey's Water Use Efficiency Program has seen amazing results over the past 10 years. The City's current Water Use Efficiency Goal is to reduce residential water use by 1% per year through 2014. Our efforts toward that goal over the past three years have put us on the path to surpass that goal.



Lacey water customers are achieving these amazing water savings by using water wisely and taking advantage of all the great water saving programs available to them. To learn more about Lacey's Water Use Efficiency Program and how you can save water in your home, visit www.ci.lacey.wa.us/water-conservation.

Take Action Now to Prevent Water Pollution!



Most of the water that you use in your home comes from 19 different wells that withdraw groundwater from three underground aquifers. Additional water is purchased from the City of Olympia's water system to help meet high demands. The water purchased from Olympia comes from McAllister Springs.

An aquifer is a natural, underground layer of rock or sand that yields water. Groundwater is found in the spaces between the rock and sand.

Groundwater is highly susceptible to pollution from our actions at home and in our neighborhoods. Since all of Lacey's drinking water comes from groundwater, the City relys on its residents to fix oil leaks in their cars, minimize use of chemicals on their yards, keep their septic systems inspected and pumped, and safely dispose of household and yard care chemicals instead of storing them at home.

(See below for more information about disposing of household chemicals)*

More information about contaminants and potential health effects can be obtained by calling the EPA's Safe Drinking Water Hotline (1-800-426-4791), or by visiting the EPA's Safe Drinking Water Hotline Page online at: www.epa.gov/safewater.

In Your Yard: Only use fertilizers that say "slow release" or "natural" on the bag. Dispose of unused yard chemicals at HazoHouse*.

With your Car: Fix oil leaks in your car promptly and in the meantime use cardboard under your car when parked. Periodically dispose of the used cardboard at HazoHouse*.

In your home: Choose natural cleaning products. Also avoid using products that say "Poison" or "Danger". Dispose of unused oil-based paint, motor oil, glue, solvents and cleaning supplies at HazoHouse*.

If you have a septic system, inspect it annually and have it pumped every 3-5 years as necessary. For more information, visit www.co.thurston.wa.us/health/ehoss

***HazoHouse is FREE** for residential residents and open Friday through Tuesday, 8 a.m. - 5 p.m. HazoHouse is located at the Hawks Prairie Waste and Recovery Center, 2418 Hogum Bay Rd NE in Lacey.

To learn more about what types of materials can be disposed of at HazoHouse, visit www.co.thurston.wa.us/solidwaste/hazardous/haz-hazohouse.htm

Taking these small actions will help keep our drinking water supplies cleaner and will also help protect Woodland Creek and Puget Sound from stormwater pollution. To learn more about protecting Woodland Creek and Puget Sound visit www.pugetsoundstartshere.org.

Puget Sound Starts Here

Mandatory Outdoor Watering Schedule for ALL LACEY WATER CUSTOMERS

Addresses ending in EVEN numbers

0 2 4 6 8

water: **Sundays, Tuesdays, and Thursdays**

Addresses ending in ODD numbers

1 3 5 7 9

water: **Saturdays, Mondays, and Wednesdays**

FRIDAY is a non-watering day for ALL Lacey water customers!

For more information on the outdoor watering policy, or to request a variance or exemption, call Lacey Water Resources at 360 491-5600 or visit www.ci.lacey.wa.us/odd-even

Where Does Lacey's Water Go?

93.7%	City customers with water meters	2,061 million gallons
0.9%	Authorized City uses*	20 million gallons
5.4%	Distribution System Leakage**	118 million gallons

Since 2008, the City of Lacey has reduced the Distribution System Leakage** by 8.6% through a continued effort which includes a state-of-the-art leak detection program, city-wide automated meter reading technology, efficient theft elimination processes, dedication to improving the accuracy of its source meters, and a proactive water line replacement program.

*Authorized uses include: street sweeping, water line flushing, treatment facility maintenance and other related activities.

**Distribution System Leakage (DSL) refers to all water that could not be accounted for, and is attributed to water main breaks, theft of water and other unknown water losses. The state requires that utilities of Lacey's size maintain a DSL of less than 10%.

Make Sure to Get Your FREE Conservation Materials!

FREE indoor and outdoor water saving kits*

Indoor kits include: high efficiency shower head, faucet aerators and toilet leak detection tablets. *Limit 3 per household.*

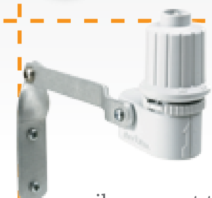
Outdoor kits include: heavy duty adjustable hose nozzle, hose repair kit and a "1-inch-a-week" watering gauge. *Limit 2 per Household.*

FREE Hose Timers*

Have you ever turned on your sprinkler and forgot about it? For those who water their lawns with a hose and sprinkler, these hose timers will shut off automatically to save you water and money. They are simple to use and connect to any standard outdoor hose bib. *Limit 2 per household.*

FREE Soil Moisture Sensors*

Overwatering your lawn not only wastes water, it can also cause disease. A soil moisture sensor is a device that will show you when the soil is ready to be watered to prevent overwatering and wasting money. *Limit 1 per household.*



FREE Rain Sensors*

If you have an in-ground irrigation system with a programmable irrigation controller and are tired of seeing your sprinklers come on in the rain, these small devices easily connect to your existing controller unit and automatically override your system in the rain to save you water and money. *Limit 1 per household.*

FREE Smart Watering DVD*

Are you ready to become sprinkler savvy? Beautiful Landscapes Though Smart Watering will walk you though several easy tips for maintaining the beautiful yard you desire, while also keeping your water bill to a minimum. *Limit 1 per household.*

OTHER WATER SAVING PROGRAMS:

WashWise Program:** The City of Lacey and the LOTT Clean Water Alliance are offering a $50 to qualifying customers rebate for purchasing a qualifying high-efficiency washing machine.

High Efficiency Toilet Program:** The City of Lacey and the LOTT Clean Water Alliance are offering FREE High Efficiency Toilets (HETs) to replace older, water guzzling models (most installed before 1994 qualify).

*Available ONLY to Lacey water or wastewater customers while supplies last. To pick up your water saving supplies , YOU MUST BRING A COPY OF YOUR WATER BILL to Lacey City Hall, 420 College St SE: Monday-Friday 8am – 5pm ** To learn more about these programs and find out if you are eligible, visit www.ci.lacey.wa.us/water-conservation

2010 WATER QUALITY RESULTS FOR THE CITY OF LACEY PWSID #43500Y

Contaminant	Highest Level Allowed (MCL)*	Goal Not to Exceed (MCLG)*	Highest Level Detected	Lowest Level Detected	Date of Highest Level Detected	Typical Source of Contaminant
Nitrate[1] (ppm)*	10	10	5	<1	8/3/10	Septic systems, fertilizer, animal wastes
Total Coliform Bacteria	5% samples/ month	0% samples/ month	0% of samples	0% of samples	--	Naturally present in environment
Total Trihalomethanes (ppb)**	80	NA	23	<0.5	10/13/10	Reaction of chlorine with naturally-occurring organic matter
Total Haloacetic acids (ppb)***	60	NA	8	<0.5	04/13/10	Reaction of chlorine with naturally-occurring organic matter
Chlorine Residual (ppm)*	4	4	1.16	0.14	1/25/10	Added as a disinfectant to the water system
SECONDARY STANDARDS REGULATED BY EPA FOR AESTHETICS						
Chloride (ppm)*	250		23	5	8/17/09	Geology, natural weathering
Fluoride[2] (ppm)*	4	4	0.3	<0.2	8/17/09	Geology, natural weathering
Iron (ppb)*	300	NA	120	<10	8/13/10	Geology, natural weathering
Lead (ppb)*	N/A	15	4	< 2	7/21/10	Plumbing material
Manganese (ppb)*	50	NA	80	<2	8/17/09	Geology, natural weathering
Sulfate (ppm)*	250		12	3	8/17/09	Geology, natural weathering
Conductivity (µmhos/cm)*	700	NA	249	84	8/17/2009	Geology, natural weathering

REGULATED BY THE STATE AT THE CONSUMER'S TAP

Contaminant	State Action Level	Goal Not to Exceed (MCLG)*	90% percentile	# samples over state action level	Sample Date of Highest Level	Typical Source of Contaminant
Copper † (ppb)*	1300	N/A	960	1 sample	9/10/08	Corrosion of household plumbing or erosion of natural deposits
Lead † (ppb)*	15	NA	10	0 samples	9/10/08	Corrosion of household plumbing or erosion of natural deposits

UNREGULATED CONTAMINANTS WITH REQUIRED MONITORING BY EPA

Contaminant	State Action Level	Goal Not to Exceed (MCLG)*	Average of Detected Concentrations	Average of Detected Concentrations	Sample Date of Highest Level	Typical Source of Contaminant
N-Nitrosodimethylamine (ppt)*	N/A	N/A	1.5	<2 - 8.2	4/19/10	Disinfection byproduct

Every 5 years, EPA requires public water systems to sample for contaminants to determine if they need to be regulated in the future. Any detected contaminants must be included in this report. The same sites were sampled again in October 2010, and all results were <2ppt.

[1] Nitrate in drinking water at levels above 10 ppm is a health risk for infants of less than six months of age. High nitrate levels in drinking water can cause blue baby syndrome. Nitrate levels may rise quickly for short periods of time because of rainfall or agricultural activity. If you are caring for an infant, you should ask for advice from your health care provider.

[2] Lacey does not add fluoride

Highest running average in 2010 was 4.3 ppb. * Highest running average in 2010 was 1.6 ppb. †Copper and lead are measured every 3 years. Next routine sampling will be in 2011.

*Important Drinking Water Definitions

ppb (Parts per Billion), **ppm** (Parts per Million), **ppt** (Parts per Thousand) **mg/L** (Milligrams per Liter), **µmhos/cm** (Micromhos per Centimeter), **NA** (Not Applicable)

MCLG Maximum Contaminant Level Goal: The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.

MCL Maximum Contaminant Level: The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.

TT Treatment Technique: A required process intended to reduce the level of a contaminant in drinking water.

AL Action Level: The concentration of a contaminant which, if exceeded, triggers treatment or other requirements which a water system must follow.

MRDLG Maximum residual disinfection level goal. The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants.

MRDL MRDL: Maximum residual disinfectant level. The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.

MNR MNR: Monitored Not Regulated

MPL MPL: State Assigned Maximum Permissible Level

pCi/L Picocuries per liter (a measure of radioactivity)

2010 WATER QUALITY RESULTS FOR THE CITY OF OLYMPIA WATER SOURCE, MCALLISTER SPRINGS

Contaminant (units)	MCL*	MCLG*	McAllister Springs Water Amount Detected	Range of Results (Low - High)	Testing Frequency	Typical Source of Contamination
Cryptosporidium	N/A		Zero	N/A	Quarterly	Fecally contaminated water
Giardia Lamblia	99.9% removal		Zero	N/A	Quarterly	Fecally contaminated water
Fecal Coliform Bacteria (# of bacteria per 100 milliliter of water)	90% of samples had fewer than 20 bacteria per 100 milliliters of water	Zero	100% of samples had fewer than 20 bacteria per 100 milliliters of water	0-2 organisms	5 times a week	Fecally contaminated water
Total Coliform Bacteria (# of bacteria per 100 milliliter of water)	90% of samples must have fewer than 100 bacteria per 100 milliliters of water	Zero	100% of samples had fewer than 100 bacteria per 100 milliliters of water	0-49 organisms	5 times a week	Naturally occuring in the environment
Turbidity (NTU)*	5	1	0.863	0.020-0.863	Metered continously	Soil runoff
WATER SUPPLY SYSTEM (OR TAP WATER) AFTER CHLORINATION						
Contaminant (units)	**MCL***	**MCLG***	**City of Olympia Water Average Amount Detected**	**Range of Results (Low - High)**	**Testing Frequency**	**Typical Source of Contamination**
Total Coliform Bacteria	95% of samples must have zero detections	Zero	Zero	Zero	70 times per month at a minimum	Naturally occuring in the environment
Chlorine residual (ppm)*	4	0.05	0.86	0.13-1.88	Metered continuously	Disinfectant in the water treatment process
DISINFECTION BY-PRODUCTS - RUNNING ANNUAL AVERAGE (RAA)						
Haloacetic Acids (HAA) (ppb)*	60	Zero	1.5	<1.0 - 4.6	Quarterly	By-product of drinking water chlorination
Total Trihalomethanes (THM) (ppb)*	80	Zero	5.8	<0.5 - 15.9		
INORGANIC COMPOUNDS						
Ntrates (ppm)*	10	5	1.43	<0.1-3.02	Yearly	Naturally occuring and human activities

LEAD & COPPER (TAKEN AT CUSTOMER TAP) RESULTS FROM 2009

Contaminant (unit)	MCL*	City of Olympia Water Amount Detected	Number of sites found above the AL	Range of Results (Low - High)	Testing Frequency	Typical Source of Contamination
Copper (ppm)*	Action Level (AL) 1.3	90% of the homes tested had copper levels less than 0.907 ppm	Zero sites above AL out of 35 sites sampled	0.027-1.005	Once every 3 years	Corrosion of household plumbing
Lead (ppb)*	Action Level (AL) 15	90% of the homes tested had lead levels less than 6 ppb	Zero sites above AL out of 35 sites sampled	0 - 25	Once every 3 years	Corrosion of household plumbing

Action Level for Copper: 90% of the homes tested must have levels less than 1.3 ppm detected. **Action Level for Lead:** 90% of the homes tested must have levels less then 15 ppb detected.

Health information about your water. What you should know.

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the EPA's Safe Drinking Water Hotline (1-800-426-4791).

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/CDC guidelines on appropriate means to lessen the risk of infection by Cryptosporidium and other microbial contaminants are available from the Safe Drinking Water Hotline (1-800-426- 4791).

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. The City of Lacey is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead in your drinking water, consider having a commercial water laboratory analyze a water sample from your tap. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at http://www.epa.gov/safewater/lead.

More information about contaminants and potential health effects can be obtained by calling the EPA's Safe Drinking Water Hotline (1-800-426-4791), or by visiting the EPA's Safe Drinking Water Hotline Page online at: www.epa.gov/safewater.

Mandatory Outdoor Watering Schedule for ALL LACEY WATER CUSTOMERS

Addresses ending in EVEN numbers

0 2 4 6 8

water: **Sundays, Tuesdays, and Thursdays**

Addresses ending in ODD numbers

1 3 5 7 9

water: **Saturdays, Mondays, and Wednesdays**

FRIDAY is a non-watering day for ALL Lacey water customers!

For more information on the outdoor watering policy, or to request a variance or exemption, call Lacey Water Resources at 360 491-5600 or visit www.ci.lacey.wa.us/odd-even

CITY OF LACEY

Shaping our community together

Water Resources 420 College St. S.E. Lacey, WA 98503

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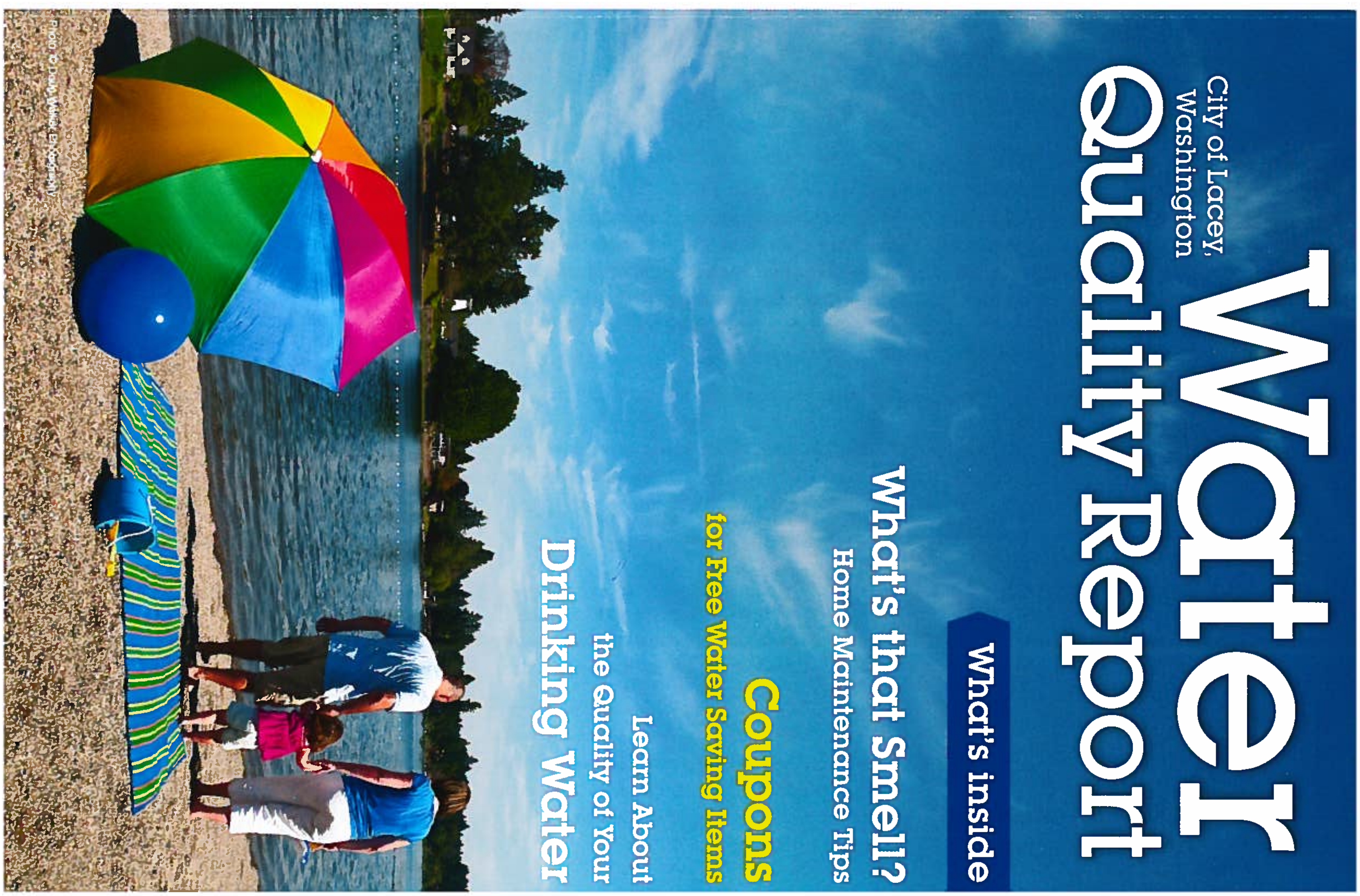
ECRWSS

Postal Customer



A Message From the Mayor:

I am pleased to announce that Lacey's drinking water met or exceeded all regulations and mandates established by the Environmental Protection Agency for 2011. Lacey water customers receive the highest quality drinking water, while also becoming part of the community-wide effort to conserve and protect our water resource. I am proud to be part of such an important effort.

Please take the opportunity to read and learn about the quality of our community's drinking water, the importance of conserving water and some tips for maintaining the plumbing and fixtures in your home. Information contained in this report allows Lacey's water customers, specifically those with special health considerations, to make informed decisions about the water they use every day.

If you have any questions regarding the community's drinking water, or the information contained in this report, please contact your Lacey Water Utility at 360-491-5600.

Sincerely,

Mayor Virgil Clarkson

Shaping our community together

CITY OF LACEY

FOR MORE INFORMATION

- About Lacey's distribution system or to report problems, call the Lacey Maintenance Service Center at 360-491-5644.
- About your utility bill, call Lacey Utility Billing at 360-491-5616.
- About drinking water safety, call the EPA Safe Drinking Water Hotline at 1-800-426-4791 or visit www.epa.gov/safewater.

TO GET INVOLVED

- Join us for a Utilities Committee meeting on the first Tuesday of each month at 11:00 a.m. at Lacey City Hall, 420 College Street S.E. in Lacey. The committee discusses a variety of issues regarding our stormwater, drinking water, and wastewater utilities.
- Public attendance at City Council meetings is also welcome. The Council generally meets the second & fourth Thursday of the month January through October and the first and third Thursdays for November and December. Meetings begin at 7:00 p.m. at Lacey City Hall.
- Call 360-491-3214 to check the agenda of upcoming meetings or check our web site at www.ci.lacey.wa.us/video. Meetings are also video recorded and available online (live and archived).

FREE Hose Timers*

Have you ever turned on your sprinkler and forgot about it? For those who water their lawns with a hose and sprinkler, these hose timers will shut off automatically to save you water and money. They are simple to use and connect to any standard outdoor hose bib.

Limit 1 per household. Bring your bill or account # to Lacey City Hall. See below for more info.

FREE Soil Moisture Sensors*

Overwatering your lawn not only wastes water, it can also cause disease. A soil moisture sensor is a device that will show you when the soil is ready to be watered to prevent overwatering and wasting money.

Limit 1 per household. Bring your bill or account # to Lacey City Hall. See below for more info.

FREE Smart Watering DVD*

(for irrigation systems)

Are you ready to become sprinkler savvy? Beautiful Landscapes Though Smart Watering will walk you though several easy tips for maintaining the beautiful yard you desire, while also keeping your water bill to a minimum.

Limit 1 per household. Bring your bill or account # to Lacey City Hall. See below for more info.

Indoor and Outdoor Water Saving Kits*

Indoor kits include: High efficiency shower head, faucet aerators and toilet leak detection tablets.

Outdoor kits include: Heavy duty adjustable hose nozzle and hose repair kit.

Limit 1 kit of each type, per household. Bring your bill or account # to Lacey City Hall. See below for more info.

OTHER WATER SAVING PROGRAMS:

High Efficiency Toilet Program*:

City of Lacey water customers could be eligible for FREE High Efficiency Toilets (HETs) to replace older, water guzzling models (most installed before 1994 qualify).

Visit www.ci.lacey.wa.us/water-conservation for more info.

WashWise Program*:

The City of Lacey and the LOTT Clean Water Alliance are offering a $50 rebate for purchasing a qualifying high-efficiency washing machine.

Visit www.ci.lacey.wa.us/water-conservation for more info.

To learn more about these programs and find out if you are eligible, visit www.ci.lacey.wa.us/water-conservation

*Available ONLY to Lacey water or wastewater customers while supplies last. Redeem your coupons by bringing your bill or account number to Lacey City Hall, 420 College St SE: Monday-Friday 8am – 5pm and start saving water today.

WHAT'S TH

On your clothes

If your clothes seem to smell a little funky after they come out of the washer and dryer, the foul odor is likely coming from your washing machine, and not the water! High efficiency washing machines are so air-tight that water gets trapped in them between washes and bacteria begins to thrive, which can stink up your clean clothes.

TIP! ALWAYS leave the door cracked open after a wash has finished (for at least several hours or more) to allow the moisture to escape the machine.

More is NOT better with detergent.

Using too much detergent can also leave terrible smells in your washing machine and on your clothes. If you have a high efficiency washing machine, make sure you choose a detergent with the high efficiency logo on it and use the lowest recommended amount.

TIP! Run an empty load with hot water using ½ cup of vinegar poured directly into the drum. Repeat this at least every couple months to keep your washing machine fresh.

Flush What?

Your hot water heater! An improperly maintained hot water tank can lead to hot water that smells foul (sometimes like rotten eggs), tastes funny and comes out of the tap looking a little brown or even black.

AT SMELL?

Near your sink

If the water coming out of your tap seems to emit a foul odor, it is most likely your drains, and not the water! Kitchen drains are a common source of odor due to food particles building up and creating a "bacteria haven" in your pipes.

TIP! Note: You can use this method for any sink, bathtub or shower drain in your home.

1. Remove the sink stoppers from your drain (wash these stoppers often with the rest of your dishes to keep bacteria from living on them, too)
2. Pour 1/2 - 1 cup of baking soda down each drain
3. Wait about 15 minutes, then pour 1/2 cup of white vinegar down each drain. Cover drain with rag for added effectiveness. While you wait, remove and clean the faucet screens.
4. Wait for a minute to let the fizzy reaction die down, then flush each drain with hot water for at least 30 seconds.

Note: If you are unsure about flushing your hot water tank, the user's manual will have detailed instructions for how to drain and refill your tank properly. If you don't have the manual, you can often find a copy online for your model or you can call a licensed plumber.

TIP! Flush your hot water tank regularly; once a year should be about right.

2011 WATER QUALITY RESULTS FOR THE CITY OF LACEY WATER SOURCES PUBLIC WATER SYSTEM ID #43500Y

Contaminant	Highest Level Allowed (MCL)*	Goal Not to Exceed (MCLG)*	Highest Level Detected	Lowest Level Detected	Date of Highest Level Detected	Typical Source of Contaminant
Nitrate[1] (ppm)*	10	10	7	<1	9/7/11	Septic systems, fertilizer, animal waste
Total Coliform Bacteria	5% samples/ month	0% samples/ month	0% of samples			Naturally occurring in environment
Fluoride[2] (ppm)*	4	4	0.3	<0.2	8/17/09	Geology, natural weathering
Total Trihalomethanes[3] (ppb)*	80	NA	15	<0.5	10/6/11	Reaction between chlorine and organic matter in drinking water
Total Haloacetic acids[4] (ppb)*	60	NA	11	<0.5	4/6/11	
Chlorine Residual (ppm)*	4	4	.97	.20	9/14/11	Added as a disinfectant to the water system

[1] Nitrate in drinking water at levels above 10 ppm is a health risk for infants of less than six months of age. High nitrate levels in drinking water can cause blue baby syndrome. Nitrate levels may rise quickly for short periods of time because of rainfall or agricultural activity. If you are caring for an infant, you should ask for advice from your health care provider.

[2] Lacey does not add fluoride. [3] Running annual average for total trihalomethanes in 2011 was 3.9 ppb. [4] Running annual average for total haloacetic acids in 2011 was 1.6 ppb

SECONDARY STANDARDS REGULATED BY EPA FOR AESTHETICS (TASTE, SMELL OR COLOR, FOR EXAMPLE)

Contaminant	Highest Level Allowed (MCL)*	Goal Not to Exceed (MCLG)*	Highest Level Detected	Lowest Level Detected	Date of Highest Level Detected	Typical Source of Contaminant
Chloride (ppm)*	250		24	5	1/25/11	Geology, natural weathering
Iron (ppb)*	300	NA	200	<10	3/19/11	
Manganese (ppb)*	50	NA	80	<2	8/17/09	
Sulfate (ppm)*	250		13	3	7/18/11	
Conductivity (µmhos/cm)*	700	NA	363	84	10/4/11	

REGULATED BY THE STATE AT THE CUSTOMER'S TAP (RESULTS FROM 2011)

Contaminant	Action Level	Goal Not to Exceed (MCLG)*	90% percentile	# samples over action level	Sample Date of Highest Level	Typical Source of Contaminant
Copper (ppb)*	1300	1300	843	0 samples	9/20/11	Corrosion of household plumbing
Lead (ppb)*	15	0	4	1 samples	9/20/11	

LEAD: If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. The City of Lacey is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead in your drinking water, consider having a commercial water laboratory analyze a water sample from your tap. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at www.epa.gov/safewater/lead.

Health information about your water. What you should know.

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the EPA's Safe Drinking Water Hotline (1-800-426-4791).

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/CDC guidelines on appropriate means to lessen the risk of infection by Cryptosporidium and other microbial contaminants are available from the Safe Drinking Water Hotline (1-800-426-4791).

The sources of all drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. City of Lacey tap water is pumped from underground wells. As water travels over the surface of the land or through the ground, it dissolves naturally occurring minerals and, in some cases, radioactive material, and can pick up substances resulting from the presence of animals or from human activity.

For these reasons, the City of Lacey continually monitors our drinking water before it is delivered to your tap. The City also treats your drinking water with chlorine to help ensure that you are receiving the highest quality possible.

Contaminants that may be present in source water include:

- Microbial contaminants, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.
- Inorganic contaminants, such as salts and metals, which can be naturally-occurring or result from urban stormwater runoff, industrial or domestic wastewater discharges, oil and gas production, mining, or farming.
- Pesticides and herbicides, which may come from a variety of sources such as agriculture, urban stormwater runoff, and residential uses.
- Organic chemical contaminants, including synthetic and volatile organic chemicals, which are byproducts of industrial processes and petroleum production, and can also come from gas stations, urban stormwater runoff, and septic systems.
- Radioactive contaminants, which can be naturally-occurring or be the result of oil and gas production and mining activities. In order to ensure that tap water is safe to drink, EPA prescribes regulations which limit the amount of certain contaminants in water provided by public water systems. Food and Drug Administration regulations establish limits for contaminants in bottled water which must provide the same protection for public health.

More information about contaminants and potential health effects can be obtained by calling the EPA's Safe Drinking Water Hotline (1-800-426-4791), or by visiting the EPA's Safe Drinking Water Hotline Page online at: www.epa.gov/safewater.

***IMPORTANT DRINKING WATER DEFINITIONS**

ppb (Parts per Billion), **ppm** (Parts per Million), **µmhos/cm** (Micromhos per Centimeter), **NA** (Not Applicable)

MCLG: Maximum Contaminant Level Goal: The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.

MCL: Maximum Contaminant Level: The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.

AL: Action Level: The concentration of a contaminant which, if exceeded, triggers treatment or other requirements which a water system must follow.

NTU: Nephelometric Turbidity Units

2011 WATER QUALITY RESULTS FOR THE CITY OF OLYMPIA WATER SOURCE, MCALLISTER SPRINGS

Contaminant	Highest level allowed (MCL)*	Goal Not to Exceed (MCLG)*	McAllister Springs Water Amount Detected	Range of Results (Low - High)	Typical Source of Contamination
Cryptosporidium	N/A		Zero	N/A	Fecally contaminated water
Giardia Lamblia	99.9% removal		Zero	N/A	
Fecal Coliform Bacteria	90% of samples had fewer than 20 bacteria per 100 milliliters of water	Zero	100% of samples had fewer than 20 bacteria per 100 milliliters of water	0 organisms	
Total Coliform Bacteria	90% of samples must have fewer than 100 bacteria per 100 milliliters of water	Zero	100% of samples had fewer than 100 bacteria per 100 milliliters of water	0-36 organisms	Naturally occurring in the environment
Turbidity (NTU)*	5	1	0.863	.010-1.28	Soil runoff

WATER SUPPLY SYSTEM (OR TAP WATER) AFTER CHLORINATION

Contaminant	MCL*	MCLG*	City of Olympia Water Average Amount Detected	Range of Results (Low - High)	Typical Source of Contamination
Total Coliform Bacteria	95% of samples must have zero detections	Zero	Zero	Zero	Naturally occurring in the environment
Chlorine residual (ppm)*	4	0.05	0.86	0.32-1.74	Added as a disinfectant to the water system
Haloacetic Acids (ppb)*	60	Zero	1.15	<1.0 - 5.9	Reaction between chlorine and organic matter in drinking water
Total Trihalomethanes (ppb)*	80	Zero	4.54	<0.5 - 14.7	

INORGANIC COMPOUNDS

Contaminant	MCL*	MCLG*	City of Olympia Water Average Amount Detected	Range of Results (Low - High)	Typical Source of Contamination
Nitrates (ppm)*	10	5	1.0	<0.1-2.41	Septic systems, fertilizer, animal wastes
Arsenic (ppb)*	10	10	1.0	N/A	Naturally occuring and human activities
Barium (ppb)*	2,000	2,000	3.0	N/A	Naturally occuring in the environment

REGULATED BY THE STATE AT THE CUSTOMER'S TAP (RESULTS FROM 2009)

Contaminant (unit)	Action Level*	City of Olympia Water Amount Detected	Number of sites found above the AL	Range of Results (Low - High)	Typical Source of Contamination
Copper (ppm)*	1.3	90% of the homes tested had copper levels less than 0.907 ppm	Zero sites above AL out of 35 sites sampled	0.027-1.005	Corrosion of household plumbing
Lead (ppb)*	15	90% of the homes tested had lead levels less than 6 ppb	Zero sites above AL out of 35 sites sampled	0 - 25	

Action Level for Copper: 90% of the homes tested must have levels less than 1.3 ppm detected. **Action Level for Lead:** 90% of the homes tested must have levels less then 15 ppb detected.

Where Does Lacey's Water Come From?

Most of the water that you use in your home comes from 19 different wells found across the City that withdraw groundwater from three underground aquifers. An aquifer is a natural, underground layer of rock or sand that yields water. Groundwater is found in the spaces between the rock and sand. Additional water is purchased from the City of Olympia's water system to help meet high demands. The water purchased from Olympia comes from McAllister Springs, which is a surface water source.

Where Did Lacey's Water Go?

95.3%	**CITY CUSTOMERS WITH METERS**	**2.1 billion gal.**
1.6%	**AUTHORIZED CITY USES***	**36.5 million gal.**
3.1%	**DISTRIBUTION SYSTEM LEAKAGE**	**70 million gal.**

*Authorized uses include: street sweeping, water line flushing, treatment facility maintenance and other related activities.

**Distribution System Leakage (DSL) refers to all water that could not be accounted for, and is attributed to water main breaks, theft of water and other unknown water losses. The state requires that utilities of Lacey's size maintain a DSL of less than 10%.

Residents in South Lacey May Notice a Change in Water This Summer

The City of Lacey's Water Utility is finishing the construction of a new drinking water treatment facility for a well located in Capital City Golf Club Estates. The treatment facility was constructed to increase the pH of the water to be similar to other wells in the vicinity, and will reduce the potential for water from this well to react with your home plumbing. If you live in south Lacey or along Yelm Highway, you will likely receive water from this treatment facility when it becomes functional in early summer. Most residents should not notice any change in the water, but those with home or commercial water treatment systems, or chemically treat water for uses such as hot tubs or fish tanks, are advised to check whether a change in water pH will affect your treatment. If you have any questions, please contact Lacey Public Works at (360) 491-5600.

Appendix P

COLIFORM MONITORING REPORT

City of Lacey
Coliform Monitoring Plan

Lacey Water Department, PWSID # 43500Y
Thurston County

Plan Preparation Information

System Name:	Lacey Water Department, PWSID# 43500Y
Date:	**January 2013**
Date Last Review:	**February 2003**
Name of Plan Preparer:	Julie Rector, Water Quality Analyst
Daytime Phone:	(360) 493-2410

State Reviewer: ____________________________

Water System compliance monitoring requirements for the City of Lacey Water System are addressed in three planning documents: the *City of Lacey Coliform Monitoring Plan*, the *City of the Inorganic and Organic Monitoring Plan*, and the *City of Lacey Disinfectants and Disinfection Byproducts Monitoring Plan*.

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Tables

Figures

Attachments

1. System Information

1.1 Sources

The City of Lacey system is supplied primarily by 19 wells owned and operated by the city. The system also purchases water regularly from the City of Olympia, which delivers water from an intertie that supplies water from McAllister Springs, a surface water source. All of Lacey's sources are shown below.

Table 1. Lacey Sources

DOH ID	Well Name(s)	Address	Completed Depth (ft)	TRS	Status
S01	Well 1	3300 College St	122	18N/01W-28E01	active
S02	Well 2	3300 College St	217	18N/01W-28M01	active
S03	Well 3	3300 College St	225	18N/01W-28M02	active
S04	Well 4; Golf Club Estates	6100 W Sarazan SW	84	17N/01W-04E02	Active/treated
S06	Well 6C; Judd Hill	2400 Judd St	385	18N/01W-21P02	active
S07	Well 7; fire station	5608 Pacific Ave	479	18N/01W-21B06	active/treated
S09	Well 9; Little Prairie	4830 Yelm Hwy	290	18N/01W-33N01	active
S10	Well 10; Mountain Greens	5138 Yelm Hwy	212	18N/01W-21P01	active/treated
S15	Beachcrest 1	8905 48th Ave	140	19/01W-25P01	active
S16	Beachcrest 2	8905 48th Ave	138	19/01W-25P02	active
S17	Wellfield for Beachcrest 1 & 2	8905 48th Ave	140	19N/01W-25	(wellfield)
S18	Wellfield for Wells 2 & 3	3300 College St	225	19N/01W-28	(wellfield)
S19	Well 18; Hawks Prairie	4040 Marvin Rd NE	646	19N/01W-35M01	active
S20	Well 21; McAllister	2020 Marvin Rd (off	214	18N/01W-24L02	active
S21	Madrona 1	8826 Milbanke Dr SE	329	18N/01W-24D04	active
S22	Madrona 2	8826 Milbanke Dr SE	334	18N/01W-24D05	active
S23	Wellfield for Madrona 1 & 2	8826 Milbanke Dr SE	330	18N/01W-24	(wellfield)
S24	Nisqually Well 19A	11544 6th Ave	107	18N/01E-09M01	active
S25	Nisqually Well 19C	11544 6th Ave	79	18N/01E-09M02	active
S27	Well 27; Evergreen Estates	2800 Hibiscus Ct	282	18N/01W-25	active
S28	Madrona 3	8826 Milbanke Dr SE	334	18N/01W-24	active
S29	Well 29; Betti well*	2950 Marvin Road NE	390	18N/01W-02	active
S30	City of Olympia Intertie				active/treated
S31	Hawks Prairie Well 2	4040 Marvin Rd NW	656	19N/01W/-35	Pending source approval

1.2 Storage

Lacey currently has 13.1 MG in storage capacity. Note that the Beachcrest Reservoir was inactivated in 2007, when most of Beachcrest was incorporated into the 400 zone.

Table 2. Storage Reservoirs

Reservoir	Capacity (MG)	Construction	Year Built	Location
Judd Hill	0.51	Steel	1964	2400 Judd Street
Union Mills	2.20	Steel	1969	1349 Paradise Court
Nisqually	0.15	Steel	1977	11500 Durgin Rd SE
Steilacoom	3.00	Steel	1986	8635 Steilacoom Rd
Hawks Prairie	4.04	Steel	1986	4040 Marvin Rd
McAllister	1.19	Steel	1998	Bedington Lp and 19th Ave SE
Westside	2.00	Steel	2002	3300 College St SE
Total	**13.09**			

1.3 Pressure Zones

The Lacey water system currently has nine pressure zones (Figure 1). The two main pressure zones, the 337 zone and the 400 zone, supply smaller pressure zones that are identified below in Table 3. Additional information on Lacey's pressure zones are in Chapter 1.14.5.2 of Lacey's Water Comprehensive Plan.

Table 3. Pressure Zones

Pressure Zone	Geographic Area	Service Pressure Control
337 224 422	Main Lacey Woodland Creek Estates Ridge Street	Steilacoom and Union Mills Reservoirs Woodland Creek PRV Skyridge Booster
400 375 275 211	North and East Lacey Upper Beachcrest Lower Beachcrest Salmon Lane	McAllister Reservoir, 400 Zone booster station 48th Avenue PRV 50th Avenue PRV Nisqually PRV
460	Upper McAllister Park	460 Booster station
188	Nisqually	Nisqually Reservoir

Pressures are maintained by 13 pressure-reducing stations, and 6 booster stations (Figure 1). Some of the PRV stations are designed for reverse flow, where the downstream zone is able to feed the upstream zone. This is rare, though, and has not occurred since the consolidation of the 380 pressure zone into the 400 pressure zone in 2008. PRVs that are capable of reverse flow include Britton Parkway, Galaxy, Peregrine, Steilacoom, Mountainaire, Marvin Road, and Mugho.

Booster stations fall into three categories: transmission boosters, storage boosters, and supply boosters. The individual booster stations are discussed in detail in Chapter 1.15.5.4 of Lacey's Water Comprehensive Plan.

1.4 Interties

Table 4 shows Lacey's interties with neighboring water systems. The intertie with the City of Olympia on Pacific Avenue at the Mountainaire booster station is the only non-emergency intertie and Lacey is currently supplied water through this intertie on a year-round basis. The remaining interties are for emergency supply only. Intertie agreements with Olympia and Thurston PUD No. 1 are included in Appendix E of Lacey's Water Comprehensive Plan. The seasonal intertie with the Capitol City Golf Course (former source S26) was disconnected from the Lacey system in June 2007.

Table 4. Interties

PWSID	Source/Location	Source Category	Source Use
063450	Olympia/8002 Pacific Avenue	purchased-treated	year-round
063450	Olympia/Sleater Kinney & Pacific	intertie	emergency
063450	Olympia/Sleater Kinney & I-5	intertie	emergency
063450	Olympia/Sleater Kinney & 6th Ave	intertie	emergency
063450	PUD (Olympia)/Steilacoom & Pamela Dr.	intertie	emergency
063450	PUD (Olympia)/6739 Kinwood	intertie	emergency
063450	PUD (Olympia)/Kinwood & 5th	intertie	emergency
063450	PUD (Olympia)/3rd Avenue	intertie	emergency
877840	Meadows Water Co./1101 Rockress Dr SE.	intertie	emergency
66578	Pattison Water Co/Mullen Rd	intertie	emergency

1.5 Connections and Population Served

In the most recent WFI update submitted December 2012, Lacey had 28,511 residential water service connections (including master-metered mobile homes as individual connections) serving a full-time residential population of approximately 67,482.

The regular non-residential population includes employees and students who regularly commute into Lacey's water service area. The number of non-residential workers was estimated from employee data provided by Thurston Regional Planning Council, adjusted downward to account for State agency office buildings that were vacated in 2012. Transient populations include non-Lacey residents using restaurants, pop machines, and hotels served by the Lacey water system. Although the transient population served will be highly variable (and difficult to identify accurately), numbers were estimated using the number of hotel rooms adjusted for seasonal occupancy, and conservative estimates of non-residential use of restaurants and pop machines.

Despite uncertainty in estimating non-residential and transient use of Lacey water, including these populations assures that the population served by the Lacey water system is greater than 70,000. As of January 2013, the number of monthly routine samples increased from 70 to 80 samples per month.

Most of the growth within the service area is occurring within the 400 and 337 zones. Table 5 provides an estimate of population served in each pressure zone at the end of 2009.

Table 5. Water Service Connections[1] and Population Served by Pressure Zone, end of 2009

Pressure Zone	**Water meters**	**Estimated Population**
188/211	213	639
337/224/354	15,513	48,090
400N, 375, 275	2,951	8,853
400S/460	2,695	8,085
Total	**21,372**	**65,667**

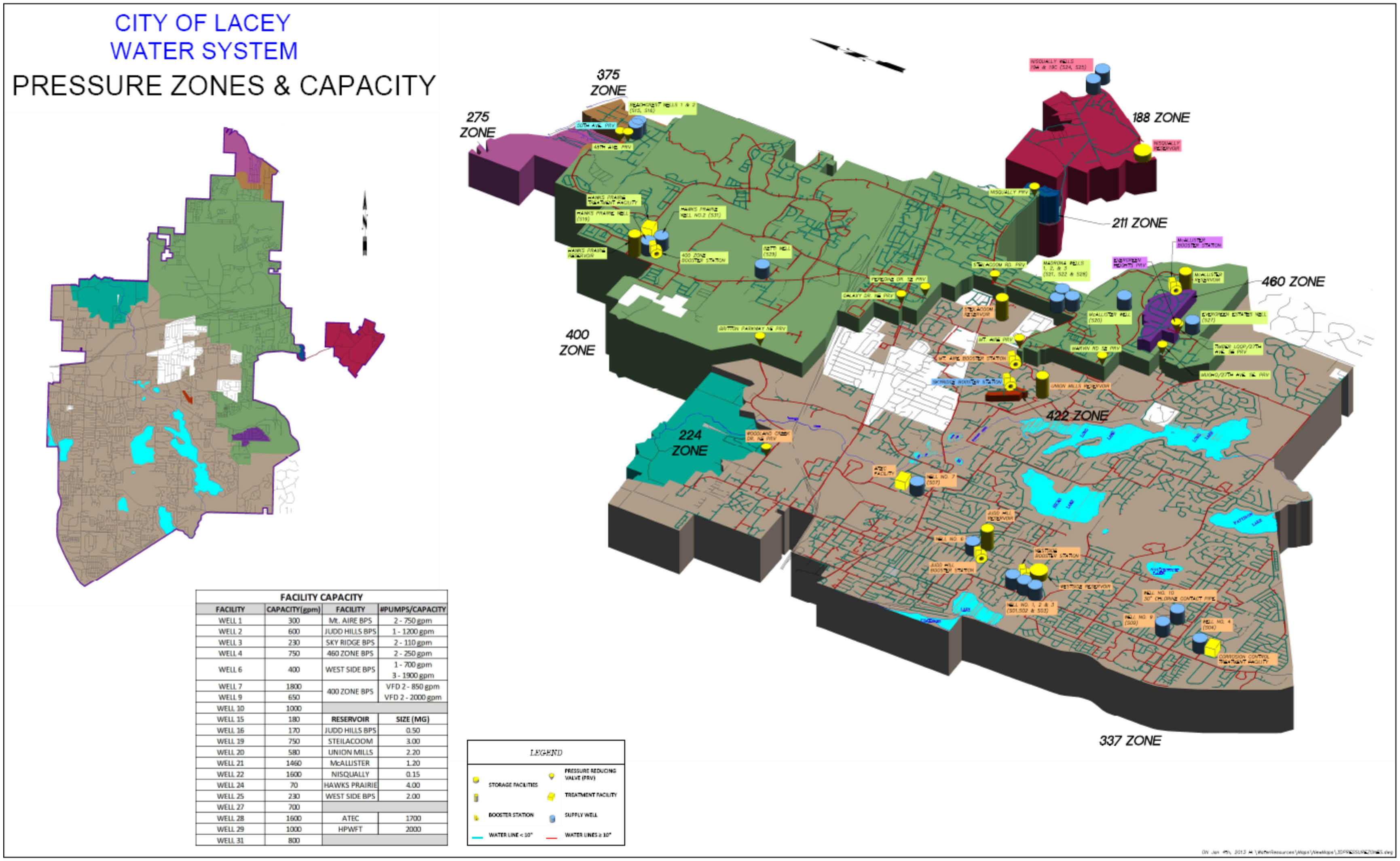
[1] potable connections only; excludes irrigation accounts

1.6 Consecutive Systems Served by Lacey

There are three active consecutive systems served by Lacey, although the two Claudias Mobile Home Park systems are the only ones that serve residential populations. In addition, there are several small water systems that replaced their existing sources with service from Lacey (Table 6). Lacey now serves these systems through master meters but does not own or maintain their distribution systems. All of these water systems have been granted “inactive” system status by the Department and consequently they are not required to collect routine samples. However, as was the case with Claudia’s MHP systems, if problems arise within the distribution systems then the Department may re-active and regulate their systems. Note that Table 6 does not include all master meter accounts; just those from former water systems.

Table 6. Consecutive Systems Served by Lacey

PWSID	System	Location	Status
13390	Claudias Mobile Home Park (1-46)	Kuhlman Rd	Active
08032	Claudias Mobile Home Park (47-100)	Kuhlman Rd	Active
05244	Omicron (Nutriom LLC)	Hogum Bay Rd	Active
01810	Alonda Villa Mobile Home Park	15th NE	Inactive
07509	Blue Moon Trailer Court	7838 Martin Way	Inactive
25141	Fir Lane Mobile Home Park	1501 Golf Club Rd	Inactive
56725	Mountain Greens Mobile Home Park	Yelm Highway	Inactive
02374	Rainier Vista Mobile Home Park	8530 Steilacoom Rd	Inactive
96884	Wildwood Mobile Home Park	8510 Martin Way	Inactive



FACILITY CAPACITY

FACILITY	CAPACITY(gpm)	FACILITY	#PUMPS/CAPACITY
WELL 1	300	Mt. AIRE BPS	2 - 750 gpm
WELL 2	600	JUDD HILLS BPS	1 - 1200 gpm
WELL 3	230	SKY RIDGE BPS	2 - 110 gpm
WELL 4	750	460 ZONE BPS	2 - 250 gpm
WELL 6	400	WEST SIDE BPS	1 - 700 gpm 3 - 1900 gpm
WELL 7	1800	400 ZONE BPS	VFD 2 - 850 gpm VFD 2 - 2000 gpm
WELL 9	650		
WELL 10	1000		
WELL 15	180	**RESERVOIR**	**SIZE (MG)**
WELL 16	170	JUDD HILLS BPS	0.50
WELL 19	750	STEILACOOM	3.00
WELL 20	580	UNION MILLS	2.20
WELL 21	1460	McALLISTER	1.20
WELL 22	1600	NISQUALLY	0.15
WELL 24	70	HAWKS PRAIRIE	4.00
WELL 25	230	WEST SIDE BPS	2.00
WELL 27	700		
WELL 28	1600	ATEC	1700
WELL 29	1000	HPWFT	2000
WELL 31	800		

Figure 1. Water System Pressure Zones

1.7 Treatment

Treatment in the Lacey system consists of distribution system-wide chlorination, and individual treatment at three city-operated sources. The city is also supplied by the City of Olympia water system, which provides treated surface water via an intertie with Lacey. Distribution and source treatment are discussed below.

1.7.1 Distribution System Chlorination

The city has been chlorinating the entire water system since May 2005, following several non-acute coliform violations that occurred in 2003-2004. The purpose of chlorination is to maintain a disinfectant residual in the distribution system at around 0.5 mg/L. This is achieved by injecting 0.8% sodium hypochlorite solution at each individual well or wellfield site. The hypochlorite solution is produced by three chlorine generators operated by the City, and is trucked to wellsites on a regular basis by City staff. Since system-wide chlorination began, there has been no confirmation of total coliforms in the distribution system based on routine sampling. Chlorination is discussed further in the *City of Lacey Disinfectant and Disinfection Byproduct Monitoring Plan*.

1.7.2 Well 7 Iron and Manganese Removal

Untreated source S07 water contains approximately 0.4 mg/L iron and 0.4 mg/L manganese, which exceed the secondary MCLs for these contaminants. Use of this untreated source impacted water customers with ongoing fixture staining, episodes of brown water, and other nuisances related to the growths of iron and sulfur-reducing bacteria. During summer 2001, an ATEC Systems oxidation/filtration treatment system was installed. The treatment involves oxidizing raw water first with potassium permanganate and then sodium hypochlorite, and filtering the water through pyrolox (manganese dioxide) media. Customer complaints related to the use of well 7 have plummeted since this system became fully operational.

1.7.3 Well 10 Disinfection

To address the presence of coliforms that were first detected in early 2006, the city installed a contact time chamber at well S10 so that the source can meet disinfection requirements. Source S10 was put back online with disinfection starting in May 2007.

Even though the well has been in use since 1981, the presence of coliforms was not detected until early 2006, after the well was rehabilitated to address diminishing capacity. After the pump was re-installed, a number of samples collected over a period of several months tested positive for total coliforms, even after repeated attempts to disinfect the well. An MPA test conducted in February 2007 result showed a 0 (zero) risk factor from surface interactions. All subsequent samples of untreated S10 water have been absent for total coliforms, indicating that the presence of total coliforms in well 10 water is unpredictable.

Disinfection of well 10 water affects regulatory requirements for the entire system. According to current regulatory requirements for source disinfection, when well 10 is in use chlorine residual must be detectable at all times in all active areas of the distribution system. Chlorine residual must be monitored daily at representative sites in the distribution system. Lacey has approval from the Department of Health to reduce monitoring to weekdays only.

At this time the city has not requested the Department to evaluate whether S10 meets 4-log inactivation of viruses and consequently this source would not be eligible for compliance monitoring under the Ground Water Rule. Triggered monitoring for Groundwater Rule compliance is discussed further in Section 2.2.2.

1.7.4 Hawks Prairie Wells 1 and 2 Iron and Manganese Removal

Both Hawks Prairie wells 1 and 2 (sources S19 and S31) have elevated iron and manganese, as well as hydrogen sulfide and ammonia, in untreated water. Manganese concentrations average 0.08 mg/L at S19, and 0.09 mg/L at S31. Iron concentrations average about 0.17 mg/L at S19, and 0.38 mg/L in S31. Source S19, which has been in use since 1994, was originally treated by blending with system water (i.e., from other sources) within the 4 MG Hawks Prairie Reservoir. The purpose of blending was to dilute manganese concentrations below the secondary MCL level of 0.05 mg/L, and to remove hydrogen sulfide by aerating water into the reservoir. When the city started chlorinating the entire system, water leaving the Hawks Prairie Reservoir was discolored due to the accumulation of oxidized manganese and other constituents from the Hawks Prairie well. Use of the well was then discontinued in July 2005 until a treatment system was constructed. The Hawks Prairie Water Treatment Facility went online in August 2008. Treatment consists of aerating and chlorinating raw water, filtering through manganese greensand, and then providing contact time for completing breakpoint chlorination. Treatment allows for sending water from this source directly into the distribution system as well as into the Hawks Prairie Reservoir. Capacity of the treatment plant was designed to also treat source S31, which is anticipated to be online in early 2013.

1.7.5 Source S04 Corrosion Control Treatment

Lacey source S04 has low pH, and the city has generally minimized use of this source in order to minimize impacts to water customers. Although the water system is in compliance with Action Levels for lead and copper, the city elected to design and install a pH adjustment facility in order to be able to maximize use of this source. The facility, which came online in December 2012, utilizes 25% caustic soda to raise pH to approximately 7.5 prior to entry to the distribution system. This treatment will not affect routine coliform monitoring.

1.7.6 Purchased Treated Surface Water from the City of Olympia

This is listed as source S30 on Lacey's WFI. Internally the intertie is also referred to as the "Mountain-Aire booster station" located on Pacific Avenue. This intertie was originally constructed as a supplementary water source for Lacey for meeting peak demand. The current wholesale water agreement with Olympia allows Lacey to purchase up to 2MGD from November 1 through June 30, and up to 1 MGD from July 1 through October 31. The term of the agreement has been extended to December, 2016.

Currently the source of water supplied through the Olympia intertie is McAllister Springs, which is regulated as a surface water source with a limited alternative to filtration. Regulatory requirements associated with use of this source include: 1) ensuring that chlorine residual is detectable in at least 95% of samples collected each month; 2) ensuring that all chlorinated sources maintain a 0.2 mg/L chlorine residual at their entry points into the distribution system; 3) reporting chlorine residuals in a monthly Chlorine Monitoring Report to the Department of Health; and 4) increasing the number for disinfection byproduct (DBP) samples that must be collected for Stage 1 and Stage 2 monitoring. Olympia is planning to replace its McAllister Springs source with the McAllister wellfield in 2014. Changing Olympia's McAllister source from surface water to groundwater will mainly affect Lacey's Triggered Monitoring Plan, which is provided in Section 2.2.2, required DBP monitoring, and sampling required for the Unregulated Contaminants Rule. DBP sampling requirements are discussed in detail in the *City of Lacey Disinfectants and Disinfection Byproducts Monitoring Plan*.

2. Coliform Monitoring Program

Table 7. Contacts for Monitoring and Compliance

City of Lacey—		
Primary System Contact and Water System Operator	Peter Brooks, P.E. Water Resources Mgr	(360) 438-2675
Water System Operator	Terry Cargil	(360) 412-9297
Sample Collection	Bob Burreson	(360) 413-4341
Backup sampler	Rick McBroom	(360) 412-2895
Compliance monitoring program and data requests	Julie Rector	(360) 493-2410
Laboratories—		
Thurston Co. Environmental Health Lab	Erik Iverson	(360) 867-2631
Dragon Analytical Laboratory	Robert Lewis	(360) 866-0543
Water Management Laboratories, Inc.		(253) 531-3121
State Department of Health, Southwest Region–		
Tracking of Coliform Monitoring and Compliance	Sandy Brentlinger	(360) 236-3044
Regional Engineer	Virpi Salo-Zieman	(360) 236-3037

2.1 Coliform Sample Number and Sites

Lacey started collecting 80 routine samples per month in January 2013. Currently there are 97 sample stands located throughout out the distribution system (Table 8), plus additional stands used for sampling entry points to the distribution system from reservoirs and source wells. To utilize most of Lacey's existing sampling stations throughout the distribution system, sampling sites are assigned to two "rounds" (see Attachment 1, and Table 10). Generally 15-25 samples are collected each week. Most sites are sampled all months, but some sites are sampled only on alternate months. The locations of these sites are shown in the large enclosed map included as Attachment 4.

Ever since Lacey started chlorinating the water system, total and free chlorine has been measured when routine samples are collected, and the measurements are recorded on the lab forms that are sent to the Department. The city also measures chlorine residual on weekdays at one representative site in the distribution system, and reports results from one sample/day in a monthly Chlorination Monitoring Report to the Department. The city developed its own form to send to the Department (see Attachment 2). Disinfectant monitoring is discussed in more detail in the *City of Lacey Disinfectant and Disinfection Byproduct Monitoring Plan.*

Table 8. Sample Stands in Lacey Water System

Station	Station Address
SS01	4601 8th Ave NE
SS02	5817 19th Ct SE
SS03	2606 College St. SE
SS04	9126 Skokomish Way NE
SS05	8304 Hawksridge Dr SE
SS06	3804 Oxford Loop SE
SS07	4536 Early Spring Dr SE
SS08	4906 25th AveSE
SS09	6828 41st Ave SE
SS10	6139 E Sarazan St SE
SS11	Westlake Dr & 21st Ave SE
SS12	9229 Northwood Dr SE
SS13	1303 Mountain Aire Dr SE
SS14	6485 5th Way SE
SS15	5003 Atchinson Dr SE
SS16	Hicks Lake Rd & Hazelwood Ln
SS17	32nd Ave & Shorewood Ct SE
SS18	3901 Long Lake Dr SE
SS19	8258 28th Ct NE
SS20	5230 Hilton Ln NE
SS21	7834 48th Loop SE
SS22	5746 Turf Lane SE
SS24	5550 Komachin Loop SE
SS25	4119 Ingleside Dr SE
SS26	1300 Golf Club Rd SE
SS27	4748 Lakeshore Ln SE
SS28	4028 Stikes Dr SE
SS29	5806 Huntamer Ln SE
SS30	9305 Fairhill Dr NE
SS31	7146 Holmes Island Rd SE
SS32	8930 Bedington Dr SE
SS33	9226 24th Ct SE
SS36	4117 Campus Green Dr NE
SS37	9023 Deni Dr NE
SS38	9632 Regency Lp SE
SS39	3830 Koala St SE
SS40	6602 Sierra Dr SE
SS41	4704 Lacey Blvd SE
SS42	921 Pacific Park Dr SE
SS43	1836 Carpenter Rd NE
SS44	4403 Marvin Rd SE
SS45	4806 Beverly Dr NE
SS46	8620 Sebastian Dr NE
SS47	25th Ave & Shirley St SE
SS48	6708 33rd Ave SE
SS49	8575 Commerce Pl NE
SS50	1529 Woodland Creek St NE
SS51	8825 Tallon Ln NE
SS53	8824 Milbanke Dr SE
SS54	646 Memory Ct SE
SS55	Durgin Rd & Old Pacific Hwy SE
SS56	3818 12th Ave SE
SS57	4216 6th Ave SE
SS58	4500 10th Ave SE
SS59	640 Woodland Sq Ln SE
SS60	6200 Pacific Ave SE (Safeway)
SS61	McAllister Tank
SS62	8615 27th Ave SE
SS63	43rd Ln & Glen Terra Dr SE
SS64	54th Ave SE & Ivy Hill Dr SE
SS65	4775 Whitman Ln SE (QFC)
SS67	15th Ave NE & Sweetbriar Lp SE
SS68	4608 17th Ln NE
SS69	7250 14th Ave SE
SS71	6613 Steamer Dr SE
SS74	6832 26th SE
SS75	Chambers Lk Dr & Leisure Wy SE
SS77	4529 26th Ave SE
SS78	4942 41st Ln SE
SS79	7337 39th Ct SE
SS80	Britton Pky NE/Gateway Blvd
SS82	8911 Martin Way E
SS83	1124 Milbanke Dr
SS86	2600 Willamette Dr NE
SS87	5330 Corporate Center Lp SE
SS89	6800 Martin Way E
SS90	5423 22nd Ave NE
SS91	2433 Mayes Rd SE
SS92	400 52nd Ln SE (Mtn Greens)
SS93	8122 Martin Wy/LA Fitness
SS94	702 Nisqually Park Lp
SS95	11034 Kuhlman Rd SE
SS96	Walthew Dr & Spinnaker Ln SE
SS97	8129 Sweetbrier Ln SE, Bldg I
SS99	Target Center- Marvin Rd
SS100	1140 Loyola St NE
SS101	848 Avalon Ct SE
SS102	2030 Seaton Ct
SS104	Fitz Hugh Dr & 8th Way
SS105	2837 22nd NE (Betti system)
SS107	Orion Dr /Willamette Dr NE
SS108	9303 Orion Dr (home Depot)
SS110	815 Union Mills Rd SE
SS111	4706 Prk Ctr Ave NE
SS112	Well 1 (S01)
SS114	Well 6 (S06)
SS115	Well 9 (S09)
SS116	Well 20 (S20)
SS117	Well 19A (S24)
SS118	Well 19C (S25)
SS119	Evergreen Estates (S27)
SS120	Betti Well (S29)
SS121	Westside Reservoir
SS122	Judd Hill Reservoir
SS123	Union Mills Reservoir
SS124	Steilacoom Reservoir
SS125	Hawks Prairie Reservoir
SS126	Nisqually Reservoir
SS 127	3901 Hogum Bay Rd NE
SS 128	6520 9th Ln SE (Farm Bureau)
SS 129	3946 Amelia Ct NE

2.1.1 Sample Stations within Each Pressure Zone

As discussed in section 1.7.1, most of Lacey's population is located in the 337 and 400 pressure zones. At present there are no routine sample stations located in the 422, 211, or 275 pressure zones although nearby sample stands are used to represent the quality of water delivered to these pressure zones. Sample station 38 is near the 211 pressure zone, and represents the quality of water from the 400 zone that is delivered to this pressure zone via the Nisqually PRV. This pressure zone is small, and currently serves only 6 water connections. Sample stations 13 and 110 represent the quality of water supplied to the 422 pressure zone by the Sky Ridge booster station. In addition, the booster station has a low pressure alarm which would alert city staff if pressures drop in this pressure zone. Sample stations 20 and 45 represent the quality of water that supplies the 275 pressure zone via the 50th Ave PRV. Most of the 275 pressure zone is currently undeveloped, although a major residential development has been proposed in this area. A sample station will be installed in this pressure zone as part of this development and will be added to Lacey's coliform monitoring plan in the future.

Table 9. Sample Stations within Each Pressure Zone

Pressure Zone	Geographic Area	Sample Stations
337	Main Lacey	1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 18, 21, 22, 24, 25, 26, 27, 28, 29, 31, 39, 40, 41, 42, 43, 44, 47, 48, 56, 57, 58, 59, 60, 63, 64, 65, 68, 69, 71, 74, 75, 76, 77, 78, 79, 87, 89, 91, 92, 96, 100, 110, 111
460	Upper McAllister Park	32, 33
400	Hawks Prairie, Northeast Lacey and McAllister Park	4, 12, 30, 36, 37, 38, 45, 46, 49, 51, 62, 67, 80, 82, 83, 86, 93, 97, 101, 102, 104, 105, 107, 108, 127, 128, 129
188	Nisqually	54, 55, 94, 95
375	Beachcrest	20
224	Woodland Creek	50, 90

2.2 Procedures Followed When Coliform Presence is Detected

Upon notification by the lab that a routine sample tests positive for total coliforms, fecal coliform or *E. Coli*, actions to be taken will follow the flowchart shown in Figure 2. These actions include those in the Total Coliform Rule, as well as those required by the federal Groundwater Rule (discussed in section 2.2.2).

2.2.1 Repeat Samples

One set of three "repeat" samples will be collected for each routine sample that tests positive for coliforms. Repeat samples will represent the initial routine sample site, and locations "upstream" and "downstream" from the sample station. Samples will be collected within 24h of notification by the lab, and will be collected at locations specified in Table 10.

Results from repeat samples are used to confirm the presence or absence of coliform bacteria in the water system. The lab will analyze repeat samples for E. Coli or fecal coliform bacteria if any of the samples appear to confirm the presence of coliform bacteria. Repeat samples that do not show a presence of coliforms indicate that the original positive sample was not confirmed.

There are three consecutive water systems supplied by Lacey. If a routine sample from a consecutive system tests positive for total coliforms, the SMA for the system will contact the City and request a sample be collected from a city main near the entry to the consecutive system. This sample will be the "upstream" sample for the consecutive system's repeat samples.

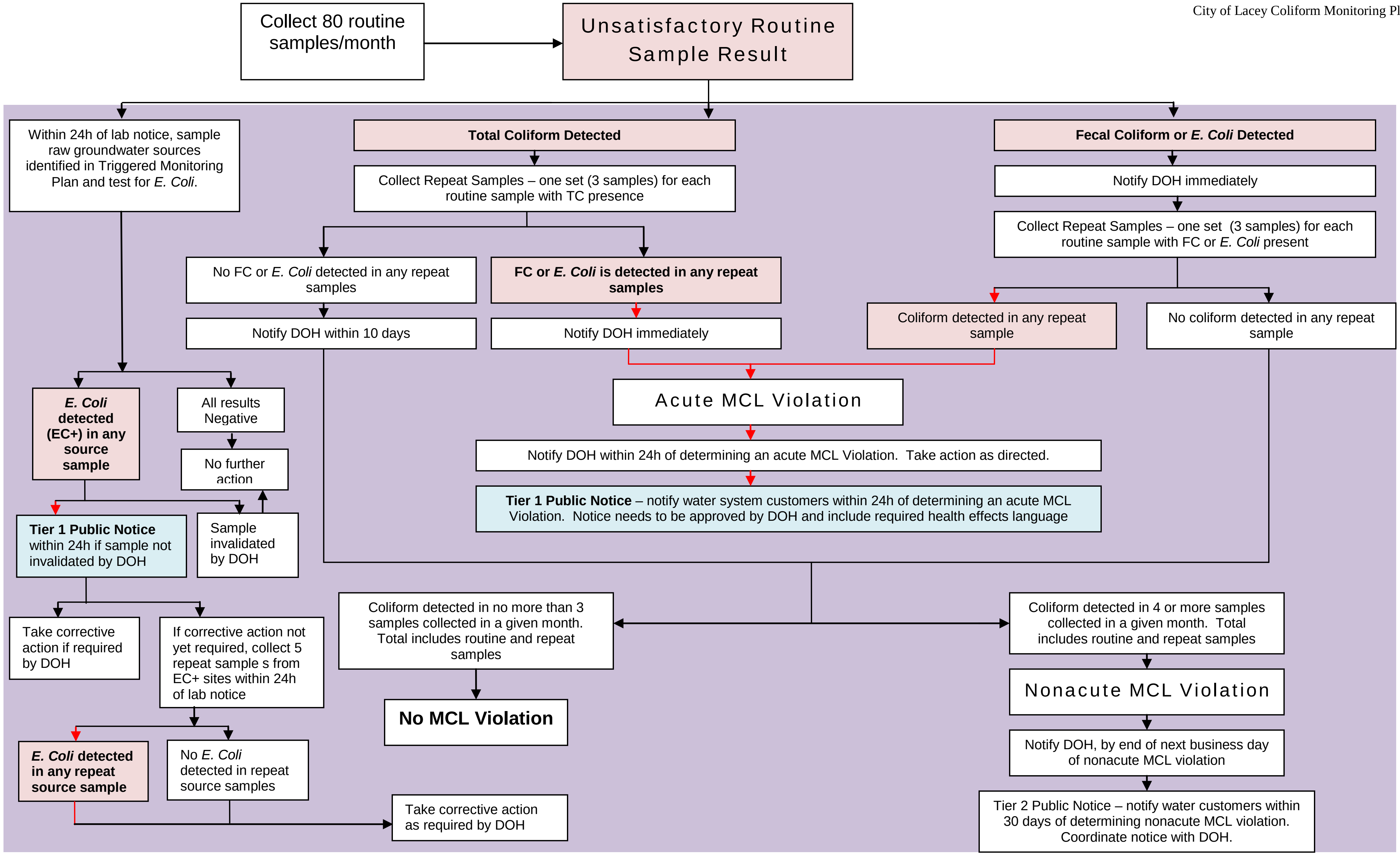


Figure 2. Procedure for When a Routine Sample is Coliform-Positive

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Table 10. Repeat Sample Sites

Station	Rounds	Address Adjacent to Station	"Upstream" Repeat site	"Downstream" Repeat Site
SS01	A, B	4601 8th Ave NE	4601 8th Ave NE	4609 8th Ave NE
SS02	A, B	5817 19th Ct SE	5803 19th Ct SE	5817 19th Ct SE
SS03	B	2606 College St.	2606 College St SE	2626 College St SE
SS04	A, B	9126 Skokomish Way	9126 Skokomish Way	9132 Skokomish Way
SS05	A, B	8304 Hawksridge Dr	8302 Hawksridge Dr	8306 Hawksridge Dr
SS06	A, B	3804 Oxford Loop SE	3745 Oxford Lp SE	3804 Oxford Lp SE
SS07	A, B	4536 Early Spring Dr SE	4528 Early Spring Dr	4547 Early Spring Dr
SS08	B	4906 25th Ave SE	4906 25th Ave SE	5006 25th Ave SE
SS09	A, B	6828 41st Ave SE	6828 41st Ave SE *	6823 41st Ave SE *
SS10	A, B	6139 E Sarazan St SE	6123 Sarazan St SE	6209 Sarazan St SE
SS11	A, B	West Lake Dr & 21st Ave	2125 Chambers Lk Ln	2023 West Lake Dr
SS12	A, B	9229 Northwood Dr SE	9229 Northwood Dr	9303 3rd Ave SE
SS13	A, B	1303 Mountain Aire Dr SE	1310 Mountain Aire Dr	1309 Scenic Ct SE
SS14	A, B	6485 5th Way	6479 Green Ct	6501 5th Way
SS15	A, B	5003 Atchinson Rd	4940 Atchinson Dr	5003 Atchinson Dr
SS16	A, B	Hicks Lake & Hazelwood Ln	2930 Hicks Lk Rd SE	2728 Hazelwood Ln
SS17	A, B	32nd Ave & Shorewood Ct	7504 32nd Ave SE	3134 Shorewood Ln
SS18	A, B	3901 Long Lake Dr SE	3836 Long Lk Dr SE	3919 Long Lk Dr SE
SS20	A, B	5230 Hilton Ln NE	5144 Hilton Ln NE	5215 Hilton Ln NE
SS21	A, B	7834 48th Loop	7834 48th Lp SE	7830 48th Lp SE
SS22	A, B	5746 Turf Lane	Turf Apts #62	5746 Turf Ln
SS24	A, B	5550 Komachin Lp	5554 Komachin Lp	5544 Komachin Lp
SS25	A, B	Park on Avonlea Div 1	4109 Ingleside Lp SE	4119 Ingleside Lp SE
SS26	A, B	1300 Golf Club Rd	1314 Golf Club Rd	1213 Golf Club Rd
SS27	A	4748 Lake Shore Ln	4732A LakeShore Ln	4736B LakeShore Ln
SS28	A, B	4028 Stikes Dr SE	4024 Stikes Dr	5100 41st Ave SE
SS29	A, B	5806 Huntamer Ln	824 Lacey St SE	5800 Huntamer Ln
SS30	A, B	9305 Fairhill Dr NE	9305 Fairhill Dr NE	99245 Fairhill Dr NE
SS31	A, B	7146 Holmes Island Rd	7316 Holmes Isl. Rd	7204 Holmes Isl. Rd
SS32	A, B	8930 Bedington Dr SE	8905 Bedington Dr	8942 Bedington Dr
SS33	A, B	9226 24th Ct SE	9214 24th Ct SE	2023 Huntington Lp
SS36	A, B	4117 Campus Green Dr NE	4117 Campus Green Dr	4125 Campus Green Dr
SS37	A, B	9023 Deni Dr NE	9023 Deni Dr NE	9035 Deni Dr NE
SS38	A, B	9632 Regency Lp SE	9632 Regency Lp SE	9628 Regency Lp SE
SS39	A	3830 Koala St SE	5504 Koala St SE	5423 39th Ave SE
SS40	A, B	6602 Sierra Dr SE	6601 Sierra Dr SE	6609 Sierra Ct SE
SS41	B	4704 Lacey Blvd	Old Lacey Shop	4625 Lacey Blvd
SS42	A, B	921 Pacific Park Dr SE	7037 9th Ave SE	921 Pacific Pk Dr SE
SS43	A, B	1836 Carpenter Rd NE	1220 Carpenter Rd	1547 Carpenter Rd
SS44	B	4403 Marvin Rd SE	8708 44th Ave SE	4603 Marvin Rd SE
SS45	A, B	4806 Beverly Dr NE	4804 Beverly Dr NE	4805 Beverly Dr NE
SS46	A, B	8620 Sebastian Dr NE	8616 Sebastian Dr	8624 Sebastian Dr
SS47	A, B	25th Ave & Shirley St SE	2410 Shirley St SE	2508 Shirley St SE
SS48	A, B	6708 33rd Ave	6519 33rd Ave SE	6616 33rd Ave SE
SS49	B	8575 Commerce Pl NE	8605 Commerce Pl	8575 Commerce Pl
SS50	A, B	1529 Woodland Cr. St NE	1503 Woodland Cr St	1605 Woodland Cr St

Station	Rounds	Address Adjacent to Station	"Upstream" Repeat site	"Downstream" Repeat Site
SS51	A, B	8825 Tallon Ln NE*	8830 Tallon Lane NE	8705 Wallingford Ln NE
SS54	A, B	646 Memory Ct SE	646 Memory Ct SE	10825 7th Ave SE
SS55	A, B	Durgin Rd & Old Pacific Hwy	Texaco Stn, Pacific Hwy	11012 Durgin Rd SE
SS56	A, B	3818 12th Ave SE	3815 12th Ave SE	3819 12th Ave SE
SS57	B	4216 6th Ave SE	Office Depot	Rowe Six
SS58	A, B	4500 10th Ave SE	4500 10th Ave SE	4450 10th Ave SE
SS59	A	640 Woodland Sq Ln SE	640 Woodland Sq (DSHS)	4565 7th Ave (WA Gambling commission)
SS60	B	6200 Pacific Ave SE (Safeway)	6200 Pacific (Safeway)	6125 Pacific (7-11)
SS62	A, B	8615 27th Ave SE	2704 Acacia Ct	8705 27th Ave SE
SS63	A, B	4510 Glen Terra Dr SE	4510 Glen Terra Dr	7024 46th Ln SE
SS64	B	54th Ave SE & Ivy Hill Dr SE	5900 54th-Puget Snd HS	5324 Ivy Hill Ln SE
SS65	A, B	4775 Whitman Ln (QFC)	QFC (4775 Whitman)	Schucks (4740 Whitman)
SS67	A, B	15th and Sweetbriar Lp	8303 15th Ave SE	8314 15th Ave SE
SS68	A, B	4608 17th Ln NE	4608 17th Ln NE	4614 17th Ln NE
SS69	A	7224 14th Ave SE	7250 14th Ave SE	7260 14th Ave SE
SS71	A, B	6613 Steamer Dr SE	6607 Steamer Dr	6619 Steamer Dr
SS75	A, B	Chambers Lk Dr & Leisure Way	4111 Chambers Lake Dr SW	2240 Leisure Way SE
SS77	A	4529 26th Ave SE	2609 College St SE	4525 26th Ave SE
SS79	A	7337 39th Ct SE	7337 39th Ct SE	7330 39th Ct SE
SS80	A, B	Britton Parkway	2400 Callison Rd NE	Cabella's
SS82	B	8911 E Martin Way	8911 E Martin Way	220 River Ridge Dr SE
SS83	A, B	1124 Milbanke Dr SE	1128 Milbanke Dr SE	8933 Rockcress Dr
SS86	A	2605 Willamette Dr NE	2600A Willamette Dr	2604 Willamette Dr
SS87	A, B	5330 Corporate Center Lp	5330 Corporate Ctr	5130 Corporate Ctr
SS89	A, B	6800 Martin Way	6700 Ste 200 Martin	6800 Martin Way
SS90	A, B	5423 22nd Ave NE	2113 Mark St NE	5423 22nd Ave NE
SS91	A, B	Mayes Rd SE & 25th Ave	2433 Mayes Rd SE	7807 25th Ave SE
SS92	A, B	Mtn Greens Ln/52nd Ln**	5240 52nd Ln SE	5244 52nd Ln SE
SS93	A, B	Hawks Prairie Mall	Safeway	Schuck's
SS94	A	702 Nisqually Park Lp	639 Nisqually Park Dr	707 Nisqually Park Dr
SS95	A, B	11034 Kuhlman Rd	11025 Kuhlman Rd	11033 Kuhlman Rd
SS96	A, B	Walthew & Spinnaker Ln	8510 Oxford Dr SE	8436 Spinnaker Ln
SS97	A, B	Village at Union Mills Bldg I – 8129 Sweetbrier Ln SE	Bldg E Sweetbrier Ln	Bldg F – 8136 Sweetbrier Ln
SS100	A, B	1140 Loyola St NE	1139 Loyola St NE	1142 Loyola St NE
SS101	A, B	848 Avalon Ct SE	839 Avalon Ct SE	849 Avalon Ct SE
SS102	A, B	2030 Seaton Ct SE	9402 Piperhill Dr SE	2020 Seaton Ct SE
SS104	A, B	Fitz Hugh Dr SE / 8th Way	1227 Fitz Hugh Dr	1220 Fitz Hugh Dr SE
SS105	A, B	2833 22nd NE	2911 22nd NE	2913 22nd NE
SS107	A, B	8925 Orion Dr NE	Lumberman's	Lacey Business Park
SS108	A	9303 Orion Dr NE	Lacey Business Park	Home Depot
SS110	A, B	815 Union Mills Rd	721-B Union Mills Rd	936 Union Mills Rd
SS111	A, B	4706 Park Ctr Ave NE	305 College St NE	4710 Park Ctr Ave NE
SS129	A, B	3946 Amelia Ct NE	3942 Amelia Ct NE	3952 Amelia Ct NE

* Station on dead end. Repeat Sites are both "upstream"

** Station is also on dead end and both repeat sites are "upstream." This may change if the waterline is extended along Parkside Dr. Note that adjacent homes on Mountain Greens Ln are served by a separate distribution system that is <u>not</u> connected to the line that serves 52nd Ln. (See system map)

2.2.2 Triggered Source Monitoring Plan

The federal Groundwater Rule took effect December 1, 2009. This rule builds on the Coliform Rule by identifying actions that must be taken when a routine sample from a groundwater-supplied system tests positive for total coliforms, and the sequence of actions that must be taken if any triggered source sample tests positive for fecal indicators. As of November 2010, the Washington State DOH has primacy authority for this rule.

The Lacey water system is primarily supplied by Lacey's wells which will be subject to the triggered monitoring requirements in the Groundwater Rule. However, the Lacey system is also supplemented through the intertie with the City of Olympia, which currently supplies water to Lacey from a regulated surface water supply (McAllister Springs) that is not comingled with Olympia's other sources. As a surface water source, it is not subject to the requirements of the Groundwater Rule. However, Olympia is planning to replace its McAllister Springs source with a groundwater wellfield in approximately 2014. If the intertie is still in use by Lacey at the time Olympia starts using its McAllister wellfield, source S30 will be included in triggered monitoring. Steps that would be taken in that event are included in this Triggered Monitoring Plan.

This Triggered Monitoring Plan identifies actions Lacey will take when a routine sample tests positive for total coliforms, and also identifies situations when it would be appropriate to reduce the number of sources sampled for triggered source monitoring. Lacey has 19 wells that supply the system, yet not all sources are able to serve the entire water system under normal operation of the system. Which sources must be sampled will be based on which routine sampling station tested positive, and which sources could have supplied the pressure zone serving that sampling station.

Routine Sample stations located in each Pressure Zone

Source monitoring is "triggered" when a routine sample tests positive for total coliforms. For evaluating the potential for reduced monitoring, routine sample stations were grouped to show which zones they are located in, and are served by (Table 11).

Lacey has nine pressure zones (337, 400, 188, 224, 375, 275, 460, 422, and 211). Note that Lacey does not have routine sampling stations in all the pressure zones shown in Figure 1.

Table 11. Sample Stations Grouped by Supplying Pressure Zone

Pressure Zone	**Geographic Area**	**Sample Stations**
337	Main Lacey	1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 18, 21, 22, 24, 25, 26, 27, 28, 29, 31, 39, 40, 41, 42, 43, 44, 47, 48, 56, 57, 58, 59, 60, 63, 64, 65, 68, 69, 71, 74, 75, 76, 77, 78, 79, 87, 89, 91, 92, 96, 100, 110, 111
224	Woodland Creek	50, 90
400	North and East Lacey	4, 12, 30, 36, 37, 38, 45, 46, 49, 51, 62, 67, 80, 82, 83, 86, 93, 97, 101, 102, 104, 105, 107, 108, 127, 129
460	Upper McAllister Park	32, 33
375	Beachcrest	20
188	Nisqually	54, 55, 94, 95

Groundwater Sources Supplying Pressure Zones

The following summarize which sources supply the pressure zones listed in Table 11 under normal operation of the system. .

188 zone: This zone serves the Nisqually Valley, and under normal operation this zone is supplied primarily by wells S24 and S25. There is no booster station for pumping these wells into the rest of the Lacey system, so water supplied by these wells is completely isolated to this zone. When additional supply is needed in the 188 zone, it is supplied by the 400 zone.

224 zone: This zone serves Woodland Creek Estates and can be supplied by either the 337 zone or the 400 zone.

337 zone: The 337 zone serves the Lacey core area. Wells that pump direct into these zones are S01, S02, S03, S04, S06, S07, S09, and S10[1]. However, the 337 zone is also regularly supplied by the 400 zone, so sources listed above for the 400 zone will also supply the 337 zone. Source 30 (the intertie with the City of Olympia) also serves this zone. Currently the intertie supplies treated surface water, which is not subject to triggered monitoring requirements in the Groundwater Rule. However, Olympia is planning to replace McAllister Springs with the McAllister wellfield in approximately 2014; when that occurs, this source will be included in triggered monitoring.

375 zone: This zone serves the northern Beachcrest areas and is supplied by the 400 zone.

400 zone: the wells supplying this zone are S15, S16, S19, S20, S21, S22, S27, S28, S29, and future source S31.

460 zone: this zone is primarily supplied from the McAllister Reservoir, which is filled by sources in the 400 zone.

Wells Representative of Other Wells in Same Hydrogeologic Setting

The Lacey water system currently has three wellfields designated on its Water Facility Inventory. Wellfield S17 consists of wells S15 and S16, and wellfield S18 consists of wells S02 and S03. Wellfield S23 consists of wells S21 and S22. However, a third well at the wellfield site, S28, is constructed to the same depths and captures the same water as the other two wells.

Each of these three wellfield sites consist of adjacent wells with similar construction and water chemistry characteristics. Consequently, a single well from each wellfield will be representative of potential contamination of the aquifer supplying the wellfield.

Attachment 5 provides supporting information for using one well from each of these wellfields for Triggered Monitoring. Attachment 4 is excerpted from "**Determination of Lacey Wells that draw**

[1] Source S10 is Lacey's only disinfected groundwater source. The city could request DOH to determine whether disinfection at well 10 meets 4-log inactivation of viruses. A confirmation of 4-log inactivation would make this source eligible for compliance monitoring and reporting, which would then allow the city to exclude well 10 from triggered source monitoring if a routine sample tests positive for total coliforms. Given that compliance monitoring would require continuous residual monitoring, programming the monitoring to record the lowest daily value, and reporting the lowest daily value on a monthly basis to the Department, Lacey is opting to just collect a sample from well 10 if source monitoring is triggered by a positive routine sample.

from a Single Aquifer" which is Appendix 5 of Lacey's Stage 1 Disinfectants and Disinfection Byproducts Plan that was approved by the Department in 2007.

The wells in each wellfield, and the designated Triggered Monitoring well are as follows. In the event that the designated well is not operational when Triggered Monitoring is required, the other wellfield well will be sampled.

Wellfield	wells	Designated Triggered Monitoring Well
S17	S15 and S16	S15
S18	S02 and S03	S02
S23	S21, S22 and S28	S22

Well S31 has recently been constructed adjacent to source S19, and both wells are completed at similar depths and have similar water quality. Both sources will be treated for iron and manganese removal at the Hawks Prairie Water Treatment Facility which means that the wells will have a common entry to the distribution system. Lacey will request a wellfield designation for sources S19 and S31 when requesting source approval for Source S31 in early 2013. Once approved as a wellfield, the designated triggered monitoring well will be Source S19.

Verifying "Normal Operation" of the System

Upon receiving notice of a coliform-positive routine sample, Water Resources staff will contact Lance Sponberg (Senior Controls Technician, Water) or Ed Andrews (Quality Control Technician) at the Maintenance Shop and determine whether anything unusual occurred in the system within four weeks of collecting the coliform-positive routine sample. Four weeks is conservative in that although water age can exceed this in parts of the system, including reservoirs, 70 routine water samples are collected every month throughout the entire water system and deficiencies in the system would likely be indicated by more than a single coliform-positive sample. In particular, verify the following:

- There were no fires, waterline breaks, fire flow tests, or other events that would have significantly altered system pressures, potentially causing reverse flow in some PRVs;
- Whether and where crews have been flushing waterlines for the UDF program, and that system pressure was monitored and measured at least 20 psi during flushing;
- There no PRV problems or irregularities that would have affected the system;
- Whether any sources were recently brought back online after being out of use (in particular, due to significant repairs, water quality complaints, low aquifer levels, or yield issues) or whether any interties with other water systems were activated;
- There were no major sources off line that would have required system adjustments for moving water between pressure zones; and
- There were no other coliform-positive samples collected within the last 4 weeks.

Conditions When Reduced Monitoring is Appropriate

After verifying that the system was operating under normal conditions, reduced monitoring can be determined based on where the coliform-positive sample was collected and which sources were pumping into the system at the time the coliform-positive sample was collected. Table 12 describes the process to be used when evaluating which sources should be sampled under triggered monitoring:

Table 12. Decision Matrix for Determining Reduced Triggered Monitoring Sites*

Location of coliform-positive routine sample	Actions
188 pressure zone	• Sample all sources in the 188 zone and 400 zone : S24, S25, S15, S19, S20, S22, S27, and S29.
337 or 224 pressure zones	• Sample all sources, except S24 and S25. If the Olympia intertie is still supplied by McAllister Springs, triggered monitoring is not required for this source.
400, 375 or 460 pressure zones	• Sample all sources that supply the 400 zone: S15, S19, S20, S22, S27, and S29.

* After verifying the system was operating under "normal operating conditions"

Procedure for Triggered Monitoring

The following procedure will be followed for Triggered Monitoring:

1. Upon notification of a coliform-positive sample, Water Resources will determine which sources will be sampled for Triggered Monitoring.
    a. First, verify whether the system was operating under "normal operating conditions." If this can be verified, sources to be sampled will be determined from Table 12 based on the location of the coliform-positive sample.
    b. If the system was not operating under "normal operating conditions," all sources will be sampled.
2. Source samples identified for sampling must be collected within 24h of receiving notification from the lab. Samples must be collected at the wellhead (i.e., raw water) and tested for *E. Coli*. The lab slips will clearly indicate that the samples are raw water, and will note in the comments sections *"Groundwater source sample – test for E. Coli."*
3. If source S30 (Olympia intertie) is a treated groundwater source at the time of the coliform-positive sample, the City of Olympia will be contacted and, as the wholesaler, Olympia must sample all groundwater sources that supply water to Lacey from the intertie.

If any initial triggered source water sample is positive for *E. Coli* (EC+), a Tier 1 public advisory must be issued within 24 hours unless the sample is invalidated by DOH. In addition, DOH could require corrective action based on this one EC+ sample. If corrective action is not required, five additional repeat source water samples must be collected over the next 24 hours for each of the sites that was initially fecal indicator-positive. If any of these repeat samples are EC+, then EC+ contamination is confirmed at the source and corrective action will be required.

Consecutive Systems with Coliform-Positive Results

Under the Groundwater Rule, a coliform-positive routine sample collected by one of Lacey's consecutive systems would also trigger sampling Lacey's groundwater sources, even if routine samples from the Lacey Water System do not test positive for coliforms. As shown in Table 6, Lacey has three active consecutive systems that collect routine samples. These systems are Claudia's Mobile Home Park (regulated as two separate systems), and Omicron/Nutriom LLC (an NTNC system). Background information and a proposed triggered monitoring process for each of these systems is described below.

Claudia's Mobile Home Park (PWSID # 13390 and # 08032)
Claudia's Mobile Home Park is located in the 188 pressure zone in the Nisqually Valley and their SMA collects 1 sample/month within each of the distribution systems. Lacey started supplying the mobile home park in 1989 because of water quality problems with the park's source well.

The current SMA for Claudia's systems is Clearwater Utility Services, LLC. Following notification from Claudia's SMA of a coliform-positive sample, the Procedure for Triggered Monitoring will be followed, including reduced monitoring (if appropriate) for a site in the 188 pressure zone. Sample results will be provided to Clearwater Utility Services.

Omicron/Nutriom LLC (PWSID # 05244)
This system is located in the 400 zone north of I-5 and collects one sample/month within its distribution system. Lacey has been supplying potable water to this site since 1989. An on-site well is also used by this system for industrial purposes, so Lacey's Cross Connection Control Program requires premise isolation of this system with an RPBA.

Following notification by Omicron of a coliform-positive sample, the Procedure for Triggered Monitoring will be followed, including reduced monitoring (if appropriate) for a site located in the 400 zone. Sample results will be provided to Omicron.

2.2.3 Notifications
If an acute violation is confirmed from routine and repeat samples, the Department of Health must be notified immediately for followup action. Tier 1 notification is required to notify water system customers within 24h of determining the acute violation. The public notice needs to be approved by DOH and include required health effects language.

If a nonacute total coliform violation occurs, DOH must be notified the next business day of the violation. Tier 2 notification will be required within 30 days of determining the violation.

If a triggered source sample is positive for a fecal indicator (*E. Coli*), Tier 1 notification is required within 24 hours unless the sample is invalidated by the Department.

Public notification is coordinated by the Water Resources Specialist and the City spokesperson. Examples of a City Public Notification Notice and Boil Water Notice are provided in Attachment 3. Electronic versions of these forms are stored on the City's network, at *H:/WR/public notification forms*.

2.2.4 Month Following Unsatisfactory Samples
Regulations require a minimum of 5 routine samples in the month following an unsatisfactory routine sample. Because the City collects 80 routine samples/month, the routine monitoring network will satisfy this requirement.

Attachment 1. Routine Sample Rounds A and B

Routine Samples Round A: Jan., Mar., May, July, Sept., Nov

Station	Address	Date	Temp °C	Total Cl^- mg/L	Free Cl^- mg/L
SS #01	**4601 8th Ave. NE**				
SS #90	**5423 22nd Ave. NE**				
SS #46	**8620 Sebastian Dr.**				
SS #45	**4806 Beverly Dr. NE**				
SS #108	**9303 Orion (Home Depot)**				
SS #12	**9229 Northwood Dr. SE**				
SS #94	**702 Nisqually Pk. Lp.**				
SS #67	**15th Ave./Sweetbrier Lp.**				
SS #32	**8930 Bedington Dr. SE**				
SS #07	**4536 Early Spring Dr. SE**				
SS #21	**7834 48th Lp. SE**				
SS #17	**32nd & Shorewood Ct. SE**				
SS #48	**6708 33rd Ave. SE**				
SS #18	**3901 Long Lk Dr SE**				
SS #24	**5550 Komachin Lp.**				
SS #71	**6613 Steamer Dr. SE**				
SS #69	**7250 14th Ave. SE**				
SS #14	**6485 5th Way SE**				
SS #87	**5330 Corporate Center Lp.**				
SS #39	**3830 Koala St SE**				
SS #02	**5817 19th Ct. SE**				
SS #26	**1300 Golf Club Rd. SE**				
SS #86	**2600 Willamette Dr. NE**				
SS #105	**2837 22nd NE (Betti)**				
SS #37	**9023 Deni Dr. NE**				
SS #20	**5230 Hilton Ln. NE**				
SS #04	**9126 Skokomish Way**				
SS #38	**9632 Regency Lp. SE**				
SS #54	**646 Memory Ct. SE**				
SS #05	**8304 Hawksridge Dr. SE**				
SS #13	**7807 Mt. Aire Dr. SE**				
SS #102	**2030 Seaton Ct. SE**				
SS #62	**8615 27th Ave. SE**				
SS #91	**Mayes Rd. & 25th Ave. SE**				
SS #06	**3804 Oxford Loop**				
SS #27	**4748 Lake Shore Ln. SE**				
SS #63	**4510 Glen Terra Dr SE**				
SS #22	**5746 Turf Ln. SE**				
SS #65	**4775 Whitman Ln (QFC)**				
SS #25	**4119 Ingleside (Parkside)**				

Attachment 1, cont.

Routine Samples Round A: Page 2

Station	Address	Date	Temp °C	Total Cl^- mg/L	Free Cl^- mg/L
SS #77	**4529 26th Ave. SE**				
SS# 75	**2600 Leisure Way SE**				
SS #40	**6602 Sierra Dr. SE**				
SS #42	**921 Pacific Park Dr. SE**				
SS #59	**640 Woodland Sq. Ln. SE**				
SS #111	**4706 Park Center Ave NE**				
SS #68	**4608 17th Ln. NE**				
SS #50	**1529 Woodland Cr St. SE**				
SS #89	**6800 Martin Way E.**				
SS #43	**1836 Carpenter Rd. NE**				
SS #36	**4117 Campus Gr Dr. NE**				
SS #30	**9305 Fairhill Dr. NE**				
SS #55	**Durgin Rd., Old Pacific Hw**				
SS #51	**8825 Tallon Ln. NE**				
SS #93	**Hawks Prairie Mall**				
SS #104	**Fitz Hugh Dr. SE/8th Way**				
SS #110	**815 Union Mills Rd. SE**				
SS #33	**9226 24th Ct. SE**				
SS #96	**Walthew Dr., Spinnaker Ln**				
SS #15	**5003 Atchinson Rd**				
SS #79	**7337 39th Ct. SE**				
SS #09	**6828 41st Ave. SE**				
SS #10	**6139 E. Sarazan St. SE**				
SS #92	**Mtn Greens Ln/52nd Ln**				
SS #28	**4028 Stikes Dr. SE**				
SS #16	**Hicks Lake Dr. Hazelwood Ln.**				
SS #47	**25th Ave. & Shirley St. SE**				
SS #11	**Westlake Dr. & 21st Ave.SE**				
SS #56	**3818 12th Ave. SE**				
SS #29	**5806 Huntamer Ln. SE**				
SS #31	**7236 Holmes Island Rd. SE**				
SS #100	**1140 Loyola St NE**				
SS #80	**Britton Parkway**				
SS# 107	**8926 Orion Dr NE**				
SS #129	**3946 Amelia Ct NE**				
SS #95	**11034 Kuhlman Rd SE**				
SS #101	**848 Avalon Ct SE**				
SS #83	**1124 Milbanke Dr SE**				
SS #97	**Village at Union Mills Bldg 1**				
SS #58	**4500 10th Ave SE**				

Attachment 1, cont.

Routine Samples Round B: Feb.,Apr., Jun., Aug., Oct., Dec..

Station	Address	Date	Temp °C	Total Cl^- mg/L	Free Cl^- mg/L
SS #01	**4601 8th Ave NE**				
SS #90	**5423 22nd Ave. NE**				
SS #107	**Orion Dr./Willamette Dr.**				
SS #45	**4806 Beverly Dr. NE**				
SS #04	**9126 Skokomish Way NE**				
SS #12	**9229 Northwood Dr. SE**				
SS #55	**Durgin Rd., Old Pacific Hwy.**				
SS #101	**848 Avalon Ct. SE**				
SS #93	**Hawk's Prairie Mall**				
SS #67	**15th Ave. SE, Sweetbriar Lp**				
SS #33	**9226 24th Ct. SE**				
SS #91	**Mayes Rd., 25th Ave. SW**				
SS #44	**4403 Marvin Rd. SE**				
SS #71	**6613 Steamer Dr. SE**				
SS #63	**4510 Glen Terra Dr. SE**				
SS #48	**6708 33rd Ave. SE**				
SS #60	**6200 Pacific Ave. SE**				
SS #14	**6485 5th Way**				
SS #89	**6800 Martin Way E**				
SS #65	**4775 Whitman Ln. (QFC)**				
SS #25	**4119 Ingleside (park side)**				
SS #08	**4906 25th Ave. SE**				
SS #58	**4500 10th Ave. SE**				
SS #50	**1529 Woodland Cr St. NE**				
SS #43	**1836 Carpenter Rd. NE**				
SS #105	**2837 22nd NE (Betti)**				
SS #20	**5230 Hilton Ln. NE**				
SS #37	**9023 Deni Dr. NE**				
SS #05	**8304 Hawksridge Dr**				
SS #95	**11034 Kuhlman Rd. SE**				
SS #38	**9632 Regency Lp. SE**				
SS #104	**Fitz Hugh Dr. SE/8th Way**				
SS #97	**Village at Union Mills- Bldg I**				
SS #102	**2030 Seaton Ct. SE**				
SS #13	**7807 Mountain Aire Dr. SE**				
SS #42	**921 Pacific Park Dr. SE**				
SS #40	**6602 Sierra Dr. SE**				
SS #47	**25th Ave & Shirley St SE**				
SS #17	**32nd Ave. & Shorewood Ct.**				
SS #15	**5003 Atchinson Rd. SE**				

Attachment 1, cont.

Routine Samples Round B: Page 2

Station	Address	Date	Temp °C	Total Cl^- mg/L	Free Cl^- mg/L
SS #87	**5330 Corporate Ctr Lp SE**				
SS #64	**54th Ave. SE & Ivy Hill Dr.**				
SS #22	**5746 Truf Ln SE**				
SS #28	**4028 Stikes Dr. SE**				
SS #03	**2606 College St. SE**				
SS #11	**W. Lake Dr & 21st Ave SE**				
SS #41	**4704 Lacey Blvd. SE**				
SS #111	**4706 Park Center Ave NE**				
SS #68	**4608 17th Ln NE**				
SS #80	**Britton Parkway NE**				
SS #49	**8605 Commerce Place NE**				
SS #36	**4117 Campus Gr Dr.NE**				
SS #51	**8825 Tallon Ln. NE**				
SS #82	**8911 Martin Way E.**				
SS #83	**1124 Milbanke Dr. SE**				
SS #32	**8930 Bedington Dr. SE**				
SS #06	**3804 Oxford Lp. SE**				
SS #09	**6828 41st Ave SE**				
SS #18	**3901 Long Lake Dr. SE**				
SS #24	**5550 Komachin Lp. SE**				
SS #31	**7236 Holmes Island Rd. SE**				
SS #110	**815 Union Mills Rd. SE**				
SS #29	**5806 Huntamer Ln. SE**				
SS #02	**5817 19th Ct. SE**				
SS #16	**Hicks Lk Rd., Hazelwood Ln.**				
SS #10	**6139 E. Sarazan St. SE**				
SS #92	**Mtn Greens Ln/52nd Ln**				
SS #75	**Chambers Lake Dr.,Leisure Wy**				
SS #56	**3818 12th Ave. SE**				
SS #57	**4216 6th Ave. SE**				
SS #100	**1140 Loyola St. NE**				
SS #46	**8620 Sebastian Dr NE**				
SS #129	**3946 Amelia Ct NE**				
SS #30	**9305 Fairhill Dr NE**				
SS #54	**646 Memory Ct SE**				
SS #62	**8615 27th Ave SE**				
SS #96	**8437 Spinnaker Ln SE**				
SS #07	**4536 Early Spring Dr SE**				
SS #21	**7834 48th Lp SE**				
SS #26	**1300 Golf Club Rd SE**				

Attachment 2. Chlorination Report Form

Chlorination Report Form
Lacey is approved for reduced monitoring; samples are collected weekdays only

System Name:	Lacey Water Department	**ID#:** 43500Y	**County:** Thurston
Mailing Address *(street)***:**	PO Box 3400	**Month:**	
city, zip	Lacey, WA 98509	**Source #** (i.e., S01, S02)**:**	ALL
Manager:	Terry Cargil	**Source Name:**	ALL

Day	Sample Location	Total Cl ppm	Free Cl ppm	Initial
3	8620 Sebastian Dr NE			
4	5606 Pacific Ave SE			
5	4117 Campus Green Dr NE			
6	646 Memory Ct SE			
7	5423 22nd Ave NE			
8	Mayes Rd SE & 25th Ave SW			
9	6708 33rd Ave SE			
10	4117 Campus Green Dr NE			
11	5423 22nd Ave NE			
12	8620 Sebastian Dr NE			
13	Mayes Rd SE & 25th Ave SW			
14	5423 22nd Ave NE			
15	9305 Fairhill Dr NE			
16	5550 Komachin Loop			
18	5550 Komachin Loop			
20	5230 Hilton Ln NE			
21	646 Memory Ct SE			
22	5817 19th Ct SE			
23	8304 Hawksridge Dr SE			
24	4117 Campus Green Dr NE			
25	5550 Komachin Loop			
26	5550 Komachin Loop			
27	Mayes Rd SE & 25th Ave SW			
28	8930 Bedington Dr SE			
29	6708 33rd Ave SE			
30	5230 Hilton Ln NE			
31	5230 Hilton Ln NE			

Approved by Certified Operator (signature)______________________________________

Keep copy for Records.
Send Report by the 10th of the following month to:

Washington State Department of Health
Southwest Drinking Water Operations
PO Box 47823
Olympia, WA 98504-7823

Attachment 3

Public Notification Templates
and
City of Lacey Public Notice Case Study

Tier 1 Notices must be delivered using broadcast media, hand delivery, or posting within 24 hours of confirmation of problem. Notices should be approved by DOH first.

1. DOH Tier 1 Template -- Boil Water Notice for Acute Violation of *E. Coli* or Fecal Coliforms
2. EPA Tier 1 Spanish Language Template -- Boil Water Notice for *E. Coli* or Fecal Coliforms
3. EPA Tier 1 Template -- Waterborne Disease Outbreak Notice

Tier 2 Public Notification Notices must be delivered within 30 days of confirmation of the problem.

4. DOH Tier 2 Template -- Non-acute violation due to Coliform MCL

Followup Notices and Certification of Public Notice

5. DOH Template for Certification of Public Notice
6. DOH Template -- Drinking Water Problem Corrected

Electronic versions of these templates can be found on H:\WR\Public Notification Forms

City of Lacey Public Notice Case Studies -- excerpts from EPA Public Notification Guidebook (EPA 816-R-00-010. June 2000)

1. DOH Tier 1 Notification Template - - Acute Violation due to *E. Coli* or Fecal Coliform

DRINKING WATER WARNING

The City of Lacey Water System, ID # 43500Y located in Thurston County, is contaminated with fecal / *E. coli* bacteria.

Fecal / *E. coli* bacteria were detected confirmed in the water supply on __(date)____. These bacteria can make you sick and are a particular concern for people with weakened immune systems.

DO NOT DRINK THE WATER WITHOUT BOILING IT FIRST. Bring all water to a boil, let it boil 3 – 5 minutes, and let it cool before using. Boiled or purchased bottled water should be used for drinking, making ice, brushing teeth, washing dishes, and food preparation until *further notice*. Boiling kills bacteria and other organisms in the water.

Fecal coliforms and E. coli are bacteria whose presence indicates that the water may be contaminated with human or animal wastes. Microbes in these wastes can cause short-term effects, such as diarrhea, cramps, nausea, headaches, or other symptoms. They may pose a special health risk for infants, young children, some of the elderly, and people with severely compromised immune systems.

The symptoms above are not caused only by organisms in drinking water. If you experience any of these symptoms and they persist, you may want to seek medical advice. People at increased risk should seek advice about drinking water from their health care provider.

What happened? What is the suspected or known source of contamination?

The following is being done to correct the problem:

We will consult with the State Department of Health about this incident. We will provide you written notification when you no longer need to boil the water. We anticipate resolving the problem by ____(date)_____.

For more information contact: __(owner or operator)___ at (   )_______-___________ or at _______(address)_______.

General information about this incident is also available from the State Department of Health at (360) 236-3030 and/or the Thurston County Health Department at (360) 786-5581.

Please share this notice with all the other people who drink this water, especially those who may not have received this notice directly (for example, people in apartments, nursing homes, schools, and businesses). You can do this by posting this notice in a public place or distributing copies by hand or mail.

This notice is sent to you by the City of Lacey Water System on _____/______/_______

2. EPA Tier 1 Spanish Language Notice - - Acute Violation due to *E. Coli* or Fecal Coliform

AVISO SOBRE SU AGUA POTABLE

El Agua del Sistema [system name] esta contaminado con [bacterias coliformes fecales/*E. coli*]

HIERVAN EL AGUA ANTES DE USARLA

Bacterias coliformes fecales (o *E. coli*) fueron encontradas en su servicio de agua el dia [date of violation in Spanish (day-month-year)]. Estas bacterias pueden enfermarle, y son especialmente peligrosas para personas con las defensas bajas o sistemas imunológicos débiles.

¿Que debo hacer?

- **NO BEBA EL AGUA SIN ANTES HERVIRLA**. Hierva toda el agua, déjela hervir por 3-5 minutos, y déjela reposar antes de usarla, o utilize agua embotellada. Agua hervida o embotellada debe ser usada para beber, hacer hielo, lavarse los dientes, lavar los platos y para preparar la comida hasta próximo aviso. Hierviendo morta a bacteria y otros organismos en el agua.

- *Coliformes fecales o E. coli son bacterias cuya presencia indica que el agua esta contaminada con desechos humanos o de animales. Microbios de esos desechos pueden causar diarrhea, cólicos, nausea, dolores de cabeza u otros síntomas. Pueden representar un peligro para la salud de bebés, niños y niñas de corta edad y personas con sistemas immunológicos en alto riesgo.*

- Los síntomas descritos arriba no ocurren solamente debido a los microbios. También pueden ser causados por otros motivos. Si usted siente estos síntomas y estos persisten, usted puede optar por hacer una consulta con su médico. Personas en situaciones de alto riesgo deben consultar con sus proveedores de servicios médicos.

¿Qué pasó? ¿Qué se está haciéndo al respecto?

Contaminación bacteriana puede ocurrir cuando exceso de aguas rebasan sus cauces y entran a las fuentes de agua potable (por ejemplo, luego de una lluvia fuerte). También pueden ocurrir cuando se rompe un sistema de recolección de aguas negras, o cuando hay una falla en el tratamiento de agua.

[Describe corrective action in Spanish] Le informaremos cuando las pruebas demuestren que no hay bacterias y que usted ya no necesita hervir su agua. Anticipamos que resolveremos el problema el [date of expected resolution in Spanish day-month-year]. Para mayor información, por favor póngase en contacto con [contact name] al [phone number] o escribiendo a [mailing address].

Por favor comparta esta información con otros que pueden tomar de esta agua, colocando este aviso en lugares visibles, o remitiéndolo por correo, o entregandolo manualmente. Es de particular interés *distribuir este aviso ampliamente si usted lo recibe representando un negocio, un hospital u hogar de infantes u hogar de ancianos o comunidad residencial.*

Este aviso ha sido enviado a usted por [system]. Numero de Identificación : ___________. Fecha de distribución: ___________

3. EPA Tier 1 Notification Template - - Acute Violation due to Waterborne Disease Outbreak

DRINKING WATER WARNING

BOIL YOUR WATER BEFORE USING

Disease-causing organisms have entered [system's] water supply.

These organisms are causing illness in people served by [system]. We learned of a waterborne disease outbreak from [agency] on [date].

What should I do?

• **DO NOT DRINK THE WATER WITHOUT BOILING IT FIRST.** Bring all water to a boil, let it boil for one minute, and let it cool before using, or use bottled water. Boiled or bottled water should be used for drinking, making ice, brushing teeth, washing dishes, and food preparation until further notice. Boiling kills bacteria and other organisms in the water.

• [Describe symptoms of the waterborne disease.] If you experience one or more of these symptoms and they persist, contact your doctor. People with severely compromised immune systems, infants, and some elderly may be at increased risk. These people should seek advice about drinking water from their health care providers.

What happened? What is being done?

[Describe the outbreak, corrective action, and when the outbreak might end.]
We will inform you when you no longer need to boil your water.

For more information, please contact [name of contact] at [phone number] or [mailing address]. General guidelines on ways to lessen the risk of infection by microbes are available from the EPA Safe Drinking Water Hotline at 1(800) 426-4791.

Please share this information with all the other people who drink this water, especially those who may not have received this notice directly (for example, people in apartments, nursing homes, schools, and businesses). You can do this by posting this notice in a public place or distributing copies by hand or mail.

This notice is being sent to you by [system]. State Water System ID#: ___________. Date distributed:

4. DOH Template for Tier 2 Notification - - Non-Acute Violation due Coliform MCL

IMPORTANT NOTICE ABOUT YOUR WATER SYSTEM
Coliform Maximum Contaminant Level (MCL) Exceeded: Non-Acute MCL

The City of Lacey water system, ID # 43500Y in Thurston County routinely monitors for the presence of total coliform bacteria and in (month/year)____ this type of bacteria was detected. Although this incident was not an emergency, as our customer, you have a right to know what happened and what we did or are doing to correct the situation.

Coliforms are bacteria which are naturally present in the environment and are used as an indicator that other, potentially-harmful, bacteria may be present. Coliforms were found in more samples than allowed and this was a warning of potential problems. The samples that showed the presence of coliform were further tested to see if other bacteria of greater concern, such as fecal coliform or E.coli were present. **None of these bacteria were found**.

You do not need to boil your water. People with severely compromised immune systems, infants, and some elderly may at be an increased risk and may want to contact their health care provider for additional guidance.

What happened? What is the suspected or known source of contamination?

At this time:

☐ The problem is resolved. Additional samples collected were found to be free of coliform bacteria.

☐ We anticipate resolving the problem by ____/____/____.

☐ Other ____.

For more information, please contact _______________ at ( ) ___-_____ or at ______________________.
(owner or operator) (phone number) (address)

Please share this notice with all the other people who drink this water, especially those who may not have received this notice directly (for example, people in apartments, nursing homes, schools, and businesses). You can do this by posting this notice in a public place or distributing copies by hand or mail.

This notice is sent to you by ___________________________________ Water System on __/__/__

(This section must be completed by Water System. Signature below indicates notice contained all required elements.)

Complete the following items (check all that apply):

☐ Notice mailed to all water customers on ____ / ____/____.

☐ Notice hand delivered to all water customers on ___ / ___ /___.

☐ Notice published in newspaper (attach copy)

☐ Notice posted at ____________________________ on ___ / ___ /____. (***By Department Approval Only***)

_______________________________ ___________________ ____________________
Signature of owner or operator Position Date

Send copy of completed notification and certification to: Southwest Drinking Water Operations, PO Box 47823, Olympia WA 98504or fax to (360) 664-8058.

5. DOH Template -- Drinking Water Problem Corrected

DRINKING WATER PROBLEM CORRECTED

Customers of [system] were notified on [date] of a problem with our drinking water and were advised to [describe recommended action]. We are pleased to report that the problem has been corrected and that it is no longer necessary to [describe recommended action]. We apologize for any inconvenience and thank you for your patience.

[Add further details here when appropriate.]

As always, you may contact [contact name] at [phone number] or [mailing address] with any comments or questions.

Please share this information with all the other people who drink this water, especially those who may not have received this notice directly (for example, people in apartments, nursing homes,schools, and businesses). You can do this by posting this notice in a public place or distributing copies by hand or mail.

This notice is being sent to you by [system]. State Water System ID#: ___________. Date distributed:

6. DOH Template for Certification of Public Notice

CERTIFICATION OF PUBLIC NOTICE

After you provide notice to your water users you must, *within 10 days*, send a copy of each type of notice you distribute (hand-delivered notices, press releases, newspaper articles, etc.) to the appropriate regional office. You must also complete and send a certification that you have met all the public notification requirements. You must send certifications for both initial and any repeat notices. *When you certify, you are also stating that you will meet future requirements for notifying new billing units of the violation or situation.*

Name of Water System ID # County
Violation Date _____ / _____ / _____
Violation Type:

The public water system indicated above hereby affirms that public notice has been provided to water users in accordance with the delivery, content, and formal requirements and deadlines as required.

Complete the following items:

Yes No

☐ ☐ Did you consult with the Department of Health? If yes, on what date? ____ / ____/ ____.

☐ ☐ Distribution was completed on ___ / ___ /____. Check all that apply:

- ☐ Hand delivery,
- ☐ Press release (TV, radio, newspaper, etc.),
- ☐ Posting at (by DOH approval only),
- ☐ Other (by DOH approval only).

☐ ☐ Were the water users notified within 24 hours from the time the problem was identified?

☐ ☐ Did the notice contain all the required elements?

_______________________________ ____________________ ______________
Signature of owner or operator Position Date

Please mail a copy of the Health Warning and the Certification to:

Southwest Drinking Water Operations
2411 Pacific Avenue
PO Box 47823
Olympia WA 98504 -7823

The Health Warning and Certification can also be faxed to (360) 664-8058

From: EPA Public Notification Guidebook. EPA 816-R-00-010. June 2000.

Case Study
City of Lacey, Washington

To alert residents of an *E. coli* violation, the City of Lacey and the Washington State Department of Health issued a joint press release. (The City also hand-delivered notices in the affected neighborhood.) Co-issuing the notice gave the press release greater credibility and showed that the City and State were giving out consistent information. At the same time, the City contacted Seattle and Tacoma television and radio stations and newspapers. The local newspaper also interviewed system personnel daily. While Lacey received positive feedback on its efforts within the affected neighborhood, it also learned an important lesson about working with the media. Many unaffected consumers were unnecessarily alarmed because lengthy television interviews were edited to short sound bites, some of which did not mention that only 450 homes in the system's 40,000-person distribution area were affected. Lacey addressed the misperception through the local newspaper and a special consumer hotline. This taught the City the importance of prioritizing information for the press.

Case Study
City of Lacey, Washington

Throughout the course of an *E. coli* violation, the City of Lacey water system maintained close contact with the lab, seeking its insight on tests, protocols, and ramifications. This enabled the system to make timely decisions or at least prepare for likely outcomes. The system could then anticipate and initiate the next outreach or public awareness piece. As soon as it became evident that repeat samples for *E. coli* would be positive, the water system mobilized city employees to conduct an early evening door-to-door notification to about 450 homes in the affected area. Employees rang doorbells to talk to residents and provided door hangers that included a boil water order, health effects language on *E. coli*, and information on a community meeting to be held the next day. City employees also staffed a hotline for consumers. Lacey set up a temporary bulletin board in the affected neighborhood to post updates. The electronic and print media also ran stories on the situation. When the boil water order was lifted, the system held another meeting and again hand-delivered door hangers, which included customer evaluation forms. Ninety percent of the respondents gave Lacey a rating of satisfactory or higher for its handling of the event, citing the City's proactive outreach effort as the reason for the solid rating.

Attachment 5. Excerpts from **Determination of Lacey Wells that draw from a Single Aquifer** (Appendix 5 of *City of Lacey Disinfectant and Disinfection Byproduct Monitoring Plan* dated 08/15/07, pages 19 – 24)

Description of Hydrogeology in the Lacey Area

A number of reports have summarized the hydrogeology of the Lacey area. The primary source of information is *Hydrology and Quality of Ground Water in Northern Thurston County, Washington* (Drost et al., 1998). Additional information about the McAllister Gravels has been reported by AGI Technologies (1999) and CDM (2002).

Most of the Lacey area is part of a broad, rolling outwash plain that ranges in elevation between 220 and 300 feet above mean sea level (msl) that is mantled by Vashon recessional (Qvr) outwash ranging in thickness from 25 to 75 feet. Vashon Glacial Till (Qvt) deposits occur below the Qvr, and consist of variably compact sand and gravel in a mix of silt and clay. This is generally a confining layer, with the compacted nature of the till resulting from overburden pressure of the Vashon glacier. The thickness of the Qvr layer is variable, being absent in some areas and being up to 100 feet thick on the eastern end of the plain that terminates at the McAllister Valley. In the tri-lakes area west of Long Lake and between Hicks and Southwick lakes, the till layer is absent and consequently the Qvr layer in these areas is mostly unconfined and unsaturated. The till layer is exposed west of McAllister Springs and north of Lacey on the Johnson Point peninsula.

The Vashon Advance (Qva) outwash occurs below Qvt, or below Qvr where the till is absent, and is generally 50 to 75 feet thick, although the layer is relatively thin or absent immediately west of McAllister Springs. The saturated portions of the Qva comprise one of the principal aquifer systems in the area, and the aquifer is typically confined except when windows in the Qvt, or the thickness of the Qva deposits, result in unconfined conditions. The Qva becomes unsaturated near Puget Sound, and along McAllister Valley and the Woodland Creek valley. Lacey wells S01, S04, S15, and S16 are completed in the Qa aquifer.

The Kitsap formation (Qf) occurs below the Qva, and is generally less than 100 feet thick. The Qf is thin, between 20 and 55 feet thick, and consists of an assemblage of fine-grained clay and silt with minor sand, gravel, peat, and wood. These sediments were deposited in shallow lakes and wetlands during an interglacial period. The deposits are laterally extensive and act as a confining unit throughout much of the Lacey area, although there is one major window beneath the tri-lakes area.

Below the Qf are the Sea Level glacial (Qc) deposits. The Qc unit ranges in thickness from 25 to 75 feet, and consists of coarse sand and gravel deposited by glacial meltwater. The Qc aquifer is the most prolific aquifer in north Thurston County. The Qc aquifer is generally confined by overlying Qf deposits and underlying low permeability undifferentiated deposits, although the Qf may be absent or relatively permeable in places. The unit is recharged by downward flow from overlying aquifers (where present) and by direct infiltration of rainfall elsewhere. The highest fluxes of downward flow are likely to occur where the Qf is absent or permeable. Lacey wells S02, S03, S10, S20, S21, S22, S27, S28, and S29 are drilled entirely in the Qc aquifer. Well S06 is drilled partially in this aquifer.

Below the Qc are undifferentiated deposits (TQu). The unit is found throughout the area and consists of all glacial and non-glacial sediments below the Qc unit from a depth of about -50 feet to locally deeper than -550 feet msl. The unit consists of sand and gravel with interbedded clay and silt, and minor peat, wood, and volcanic ash. The unit is a layered sequence of water-bearing zones and confining layers. Groundwater in the TQu aquifers is typically confined by overlying and underlying silt and/or clay layers. The lateral extent and thickness of the TQu is uncertain due to the relatively few wells constructed in the TQu aquifer. AGI (1999) concluded because the TQu discharges seaward in the vicinity of the Sea Level Aquifer System, this flow should act as a barrier to seawater intrusion for withdrawals from Lacey's Madrona wellfield. Lacey wells S07, S09, and S19 are all completed in the TQu aquifer. Well S06 is drilled partially in this aquifer.

To the east of the Lacey upland area are the McAllister and Nisqually Valleys, which converge just south of the Nisqually Delta. The valley floor of the McAllister Valley lies between sea level and 10 feet elevation, and the Nisqually Valley ranges in elevation from 10 to 80 above msl. The McAllister Valley is mostly mantled by poorly drained alluvium, although the wetlands of the upper valley are mantled by organic depression fill.

Within the McAllister Valley is a thick (up to 400 feet) layer of McAllister Gravel (MG), which consists of pebble- and boulder-sized sediments that were deposited as channel fill from the ancestral Nisqually River. The channels were cut after the Kitsap formation was deposited. The unit extends below McAllister Springs to at least 250 feet below sea level, is very narrow, and continues beneath the kame and kettle landscape to the Nisqually River delta, where it joins the Nisqually Valley aquifer system. The MG aquifer occurs in the saturated portions of the MG deposits in the McAllister Valley, and is considered to be unconfined with local low permeability zones of silt and clay. McAllister Springs is a natural discharge point for the unit, and the springs provide the principal source of water supply for the city of Olympia. The MG aquifer is recharged by infiltration of rainfall at the land surface, and receives lateral flow from the Qc aquifer and possibly from the Qva aquifer. The aquifer is in hydrologic contact with the Qvr, Qva, Qc, and TQu aquifers. Lacey wells S24 and S25 are completed in the MG aquifer.

Discussion of Treatment Plants #2, #7, #8, and #11

Treatment Plant #2

Treatment Plant #2 consists of Lacey wells S02 and S03, which are regulated as a wellfield that is identified as S18 by the Washington State Department of Health. These wells are located approximately 250 feet apart on a fenced-in land parcel that includes three City of Lacey wells, a reservoir, and a chlorine generation/chlorination facility. Except for these facilities, the parcel is forested. Adjacent land use is residential to the south, west, and east. There is a middle school on the property south of the wellfield.

A hydrogeologic profile (Attachment A) shows that both wells are fully screened through the Qc aquifer. The wells are completed at 14 ft and 6 ft (msl), and the depths to the first screened intervals are 38 ft and 45 ft (msl). As would be expected given their proximities and similar depths, water quality at both wells is very similar, as shown below.

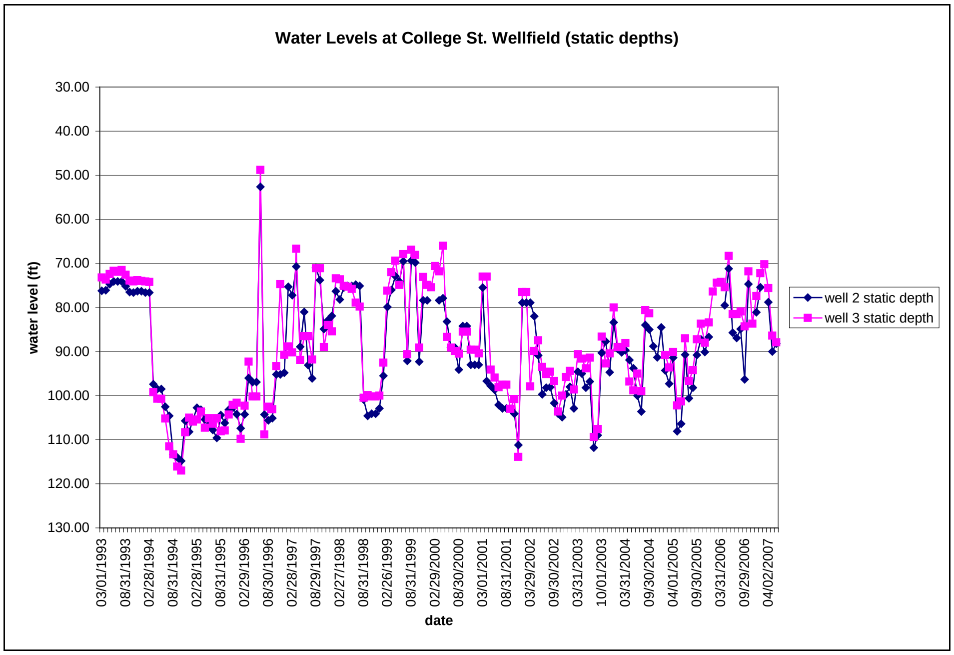
well	Temperature (°C)	pH	Conductance (μmhos/cm)	Fe (mg/L)	Mn (mg/L)	Alkalinity (mg/L $CaCO_3$)	Chloride (mg/L)
S02	9.6 – 10.7	6.6 – 7.1	165	<0.03	<0.01	59 - 62	3 - 5
S03	9.6 – 10.8	6.5 – 7.0	154 – 163	<0.03	<0.01	60	3 - 5

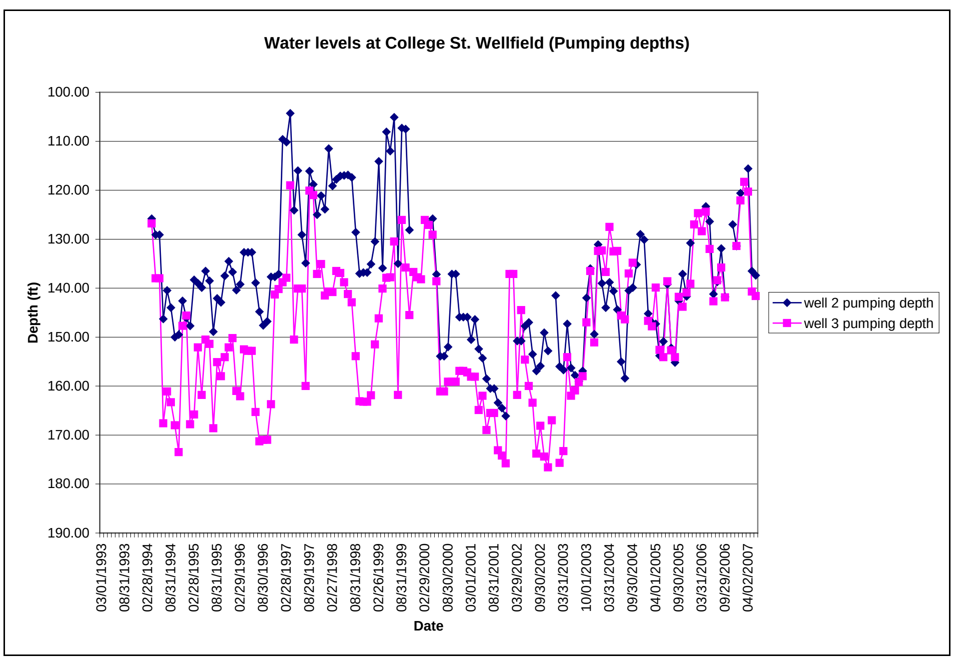
Jar tests completed for wells S02 and S03, completed just prior to Lacey initiating system chlorination, showed that 95-hour chlorine demand at each well was 0.16 mg/L (Gray and Osborn, 2004).

Furthermore, all results for THM and HAA5 samples collected within the area served by these wells are very low, and most are below the analytical detection limits. The highest DBPs detected in this area of the water system was 3.1 μg/L total THMs, and 1.3 μg/L HAA5.

As shown in these figures, water levels are also very similar, especially after the wells were rehabilitated in 1997 (S03) and 1999 (S02).

In aggregate, the water quality and water level data indicate that these wells pump from the same aquifer, and that water samples from these wells react similarly in the presence of chlorine.





Treatment Plant #7

Treatment Plant #7 consists of Lacey wells S20, S21, S22, S28, and S27.

Sources S21, S22, and S28 are in Lacey's Madrona wellfield. Wells S21 and S22 are located approximately 30 feet from each other, and well S28 is located approximately 60 feet from well S22. Washington State Department of Health regulates S21 and S22 as wellfield source S23, but S28 is not included because it has a separate conveyance to the distribution system. McAllister Well S20 is located approximately 2,600 feet south of the Madrona wellfield. Evergreen Estates well S27 is located approximately 3,200 feet south of S20.

All five wells are completed in the Qc aquifer, with completed depths ranging from -25 to -75 ft (msl). Depths to the first screened interval range from 0 to -5 ft (msl). As shown in the hydrogeologic profile in Attachment B, all five wells capture water from approximately the same depths within the Qc aquifer. In this portion of the East Lacey aquifer, the direction of groundwater flow is to the east – northeast.

Land use around all five wells is predominately residential, although there are large tracts of undeveloped land adjacent to S20 and S27. Residences near S20 and the Madrona wellfield (wells S21, S22, and S28) are connected to sewer. Residences surrounding S27 use septic systems.

The water quality at all five wells is very good, and these wells produce some of the highest-quality water for the Lacey water system. Nitrate concentrations in this vicinity of the Qc aquifer are elevated in comparison to other city of Lacey wells completed in the Qc aquifer, indicating similar response to historic loading and surrounding land use. Data for water chemistry indicator parameters are shown below.

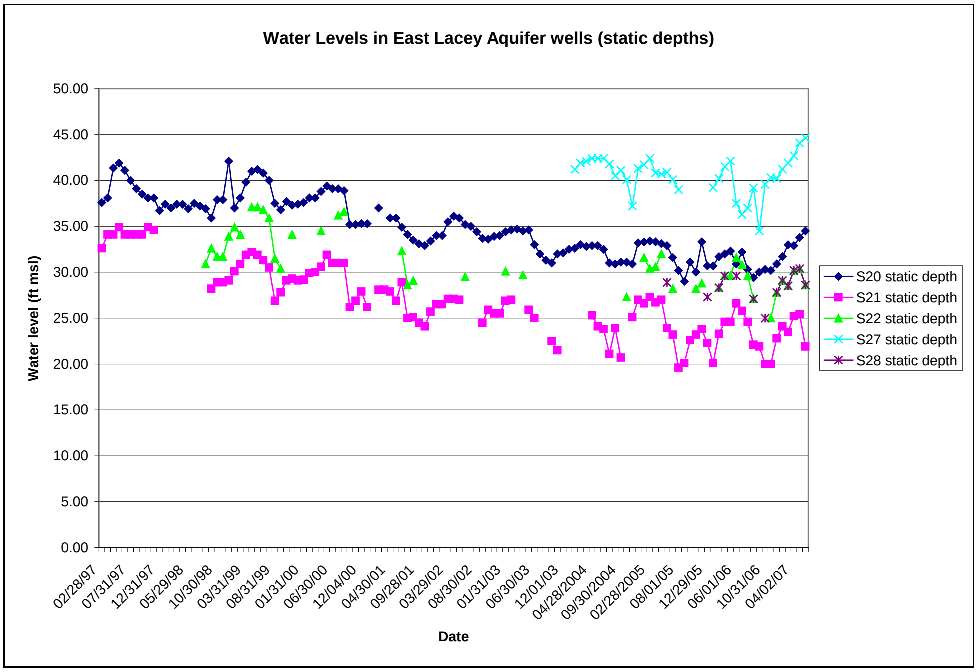
well	Temperature (°C)	pH	Conductance (μmhos/cm)	Fe (mg/L)	Mn (mg/L)	Alkalinity (mg/L CaCO3)	Chloride (mg/L)	Nitrate (mg/L)
S20	10.6 – 11.6	6.8 – 7.3	178	<0.03	<0.01	54	5	2.3 - 2.7
S21	10.1 – 11.4	6.8 – 7.2	170	<0.03	<0.01	54	5	2.2 – 3.5
S22	10.3 – 11.0	6.8 – 7.1	165	<0.03	<0.01	--	4	2.2 – 2.9
S28	10.3 – 11.5	6.9 – 7.2	163	<0.03	<0.01	55	5	2.4 - 3.8
S27	10.5 – 11.3	6.9 – 7.3	180	<0.03	<0.01	55	4 - 5	2.6 - 3.1

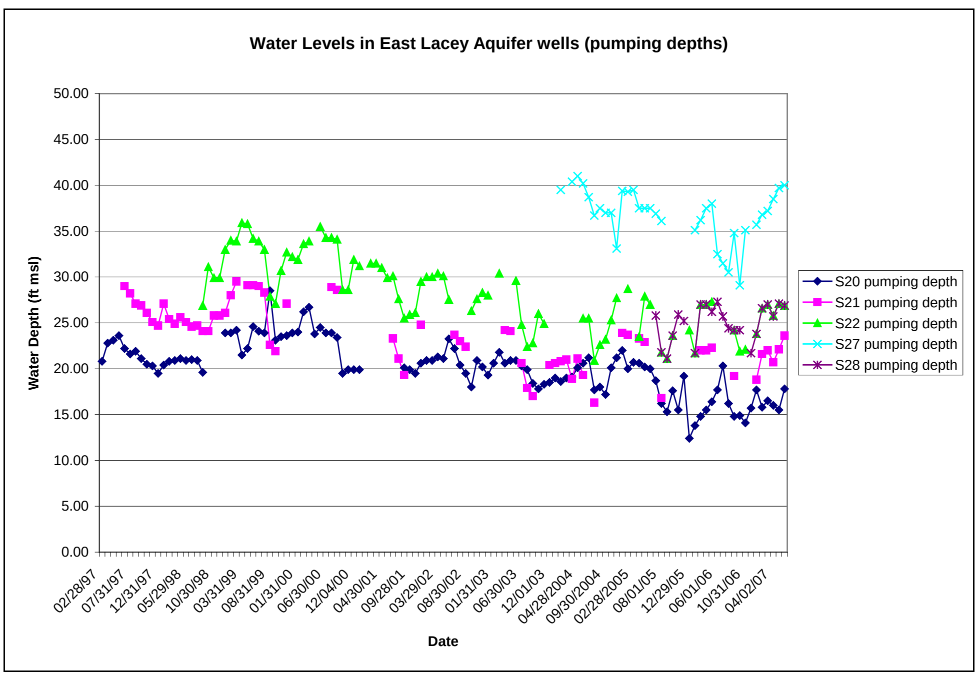
Jar tests completed for the wells, completed just prior to Lacey initiating system chlorination, showed that 24-hour chlorine demand at the wells ranges from 0.08 – 0.14 mg/L (Gray and Osborn, 2004; City of Lacey 2005). Furthermore, all results for THM and HAA5 samples collected within the area served by these wells are very low, and most are below the analytical detection limits. The highest DBPs detected in this area of the water system was 4.7 μg/L total THMs, and 1.0 μg/L HAA5.

Water levels at all five wells respond similarly to changes in recharge and pumping in the aquifer (see figures, below). Even though Lacey's use of these five wells has increased the amount of water produced annually from the aquifer from 2003 – 2007, water levels at each well have remained relatively stable. The decrease in water levels from 2001 – 2003, when only S20, S21, SS22 were online, was due to reduced recharge from drought conditions in the region. The relationship between recharge and aquifer levels in this area of the Qc aquifer was reported in the construction report for S28, *Hydrogeologic Evaluation of Lacey Production Well 23 at Madrona Park* (Pacific Groundwater Group 2002).

According to this report, water levels in several monitoring wells in the Qc aquifer in the area east of Lacey were more responsive to changes in precipitation patterns than pumping (PGG 2002).

In aggregate, the water quality and water level data indicate that these wells pump from the same aquifer, and that water samples from these wells react similarly in the presence of chlorine.





Treatment Plant #8

Treatment Plant #8 consists of Lacey wells S15 and S16. These wells are located approximately 90 feet from each other within a fenced area of a city-owned land parcel. The wells are regulated as a wellfield that is identified as S17 by the Washington State Department of Health.

A hydrogeologic profile (Attachment C) shows that the wells are both screened in the Qa aquifer. The wells are completed at 75 ft and 80 ft (msl), and the depths to the first screened intervals are 100 ft and 102 ft (msl).

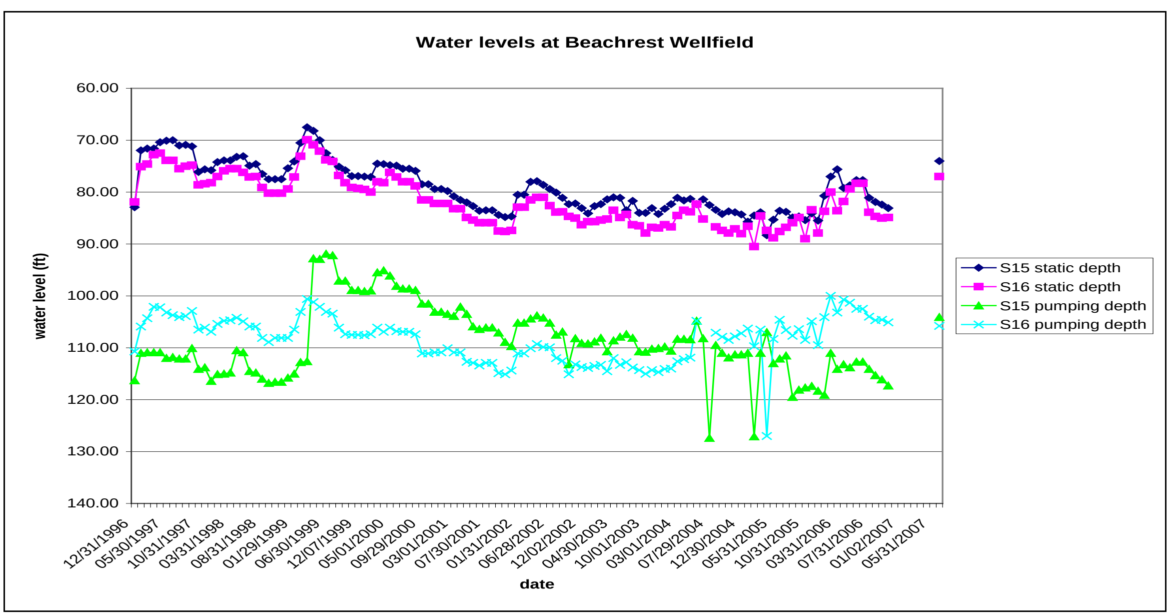
As would be expected given their proximities and similar depths, water quality at both wells is very similar, as shown below.

well	Temperature (°C)	pH	Conductance (µmhos/cm)	Fe (mg/L)	Mn (mg/L)	Alkalinity (mg/L CaCO3)	Chloride (mg/L)
S15	10.3 – 11.1	6.9 – 7.2	200	<0.03	<0.01	73	4 - 7
S16	10.3 – 11.2	6.7 – 7.1	240	<0.03	<0.01	76	5 - 8

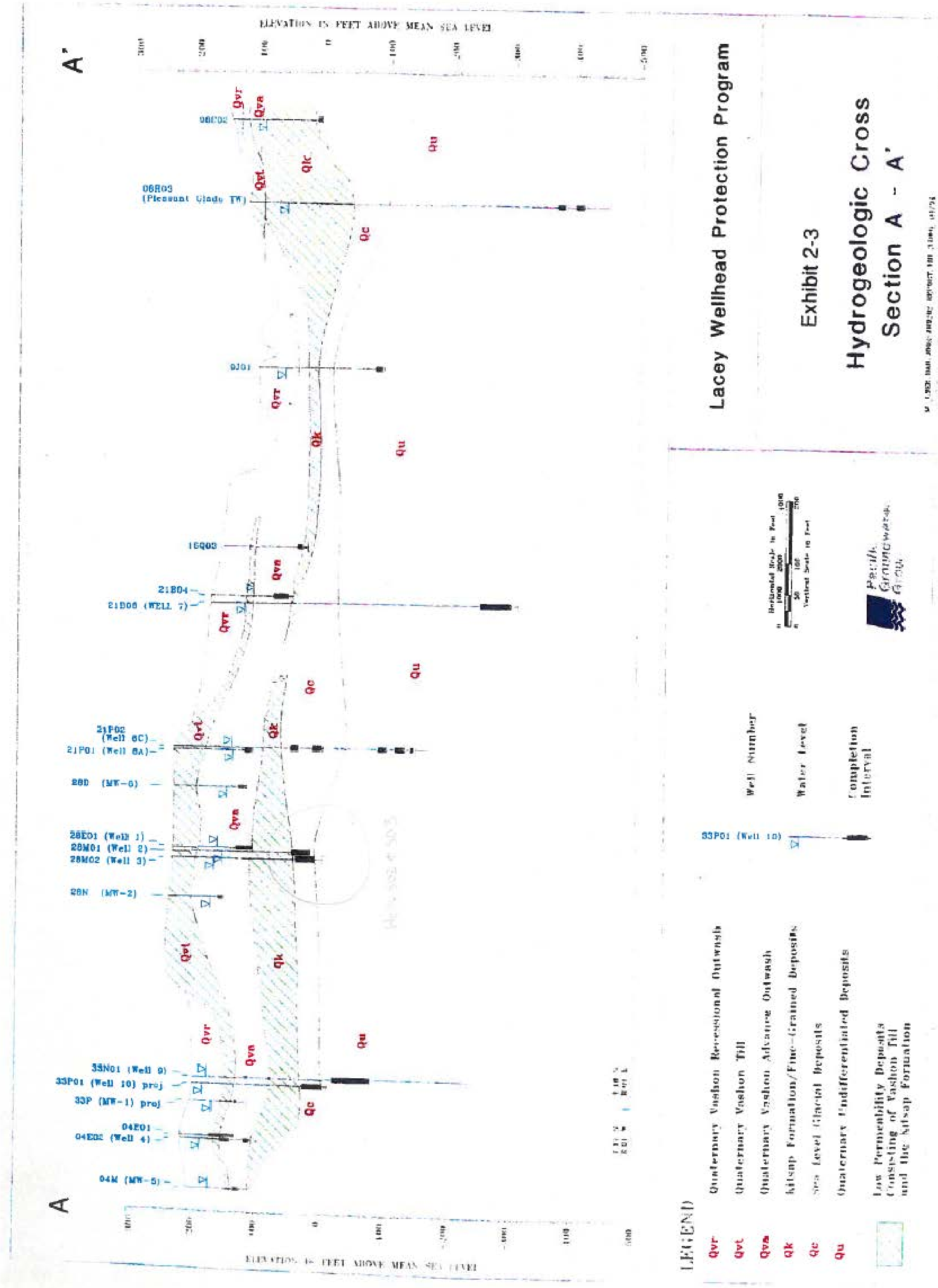
Jar tests completed for the wells, completed just prior to Lacey initiating system chlorination, showed that 24-hour chlorine demand was 0.19 mg/L at S15, and was 0.29 mg/L at S16 (City of Lacey 2005). Furthermore, all results for THM and HAA5 samples collected within the area served by these wells are very low, although they generally are higher than in areas served by other Lacey sources. The highest DBPs detected in this area of the water system was 13.9 µg/L total THMs, and 4.4 µg/L HAA5.

Water levels are also very similar, as illustrated in this figure of static and pumping water levels.

In aggregate, the water quality and water level data indicate that these wells pump from the same aquifer, and that water samples from these wells react similarly in the presence of chlorine.



Attachment A. Hydrogeologic Profile and Well Logs for S02 and S03


Lacey Wellhead Protection Program
Exhibit 2-3
Hydrogeologic Cross Section A - A'
A
A'
ELEVATION IN FEET ABOVE MEAN SEA LEVEL
LEGEND
Qvr Quaternary Vashon Recessional Outwash
Qvt Quaternary Vashon Till
Qva Quaternary Vashon Advance Outwash
Qk Kitsap Formation/Fine-Grained Deposits
Qc Sea Level Glacial Deposits
Qu Quaternary Undifferentiated Deposits
Low Permeability Deposits Consisting of Vashon Till and the Kitsap Formation
Well Number
Water Level
Completion Interval
33P01 (Well 10)
21D06 (WELL 7)
06R03 (Pleasant Glade TW)
04M (MW-5)
28N (MW-2)
28D (MW-6)

502

File Original and First Copy with the Division of Water Management
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Application No. 9994
Permit No. 9767

(1) OWNER: Name City of Lacey Address

(2) LOCATION OF WELL: County Thurston — NW ¼ Sec. 29 T. 18 N., R. 1W W.M.

Bearing and distance from section or subdivision corner 250 East—300' South from East 1/4 of section 28. #1

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal X Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) New well ☑ Method: Dug ☐ Bored ☐ Deepened ☐ Cable ☐ Driven ☐ Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 16 inches. Drilled ft. Depth of completed well ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 16" Diam. from 0 ft. to 188 ft. Threaded ☐ " Diam. from ft. to ft. Welded ☒ " Diam. from ft. to ft.

Perforations: Yes ☐ No X
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes X No ☐
Manufacturer's Name Johnson
Type Everdure Stainless Model No.
Diam. 16 Slot size 35 from 188 ft. to 203 ft.
Diam. 16 Slot size 95 from 203 ft. to 217 ft.

Gravel packed: Yes ☐ No X Size of gravel
Gravel placed from ft. to ft.

Surface seal: Yes ☐ No X To what depth? ft.
Material used in seal
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name Jacucci
Type: turbine 700 GPM H.P. 75

(8) WATER LEVELS: Land-surface elevation above mean sea level 233 ft.
Static level 66'-5" ft. below top of well Date Jun 6,1969
Artesian pressure none lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes X No ☐ If yes, by whom? Kincey

Yield (gal./min.)	with ft. drawdown	after hrs.
444	23	1
560	39	2
776	100	5

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
5:28	120'	5:35	78		
5:30	87'	5:41	76.5		
5:31	85	5:50	75		

Date of test June 9, 1969
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes X No ☐

(10) WELL LOG:

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
0 -3 Brown Clay and Gravel		
3 -17 Light Brown Clay & Gravel		
17 -35 Brown Clay w/Gravel Streaks of water		
35-59 Loose Brown Sand, Gravel nowater		
59 -59 Brown Sand & Gravel water		
69 -73 Brown Tite Sand, Gravel		
73 -75 Brown Tite Sand, little water		
75 -76 Brown Med Sand, Gravel		
76 -94 Brown Large Gravel, Some sand		
94 -102 Brown Med sand Some Gravel		
102-109 Brown Clay & Gravel, no water		
109-111 Brown Large Sand, Gravel, Water		
111-119 Brown Dirt, med sand gravel		
119-162 Brown Dirt med to fine sand with streads of gravel		
162-166 Brown Clay and Gravel, no water		
166-174 Brown large gravel 0-8" clay present		
174-178 Dark Brown, med to large gravel, very good		
178-188 Dark Brown gravel with streaks clay, no water		
188-198 Dark Brown, large gravel, water		
198-202 Dark Brown small to med gravel very good		
202-208 Brown Large sand, med gravel		
208-214 Brown large sand very little gravel good		
214-217 Brown Large sand, gravel		
217 Stop Brown Clay		

Work started 19 Completed 19

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME (Person, firm, or corporation) (Type or print)

Address

[Signed] (Well Driller)

License No. Date 19

ckgn

(USE ADDITIONAL SHEETS IF NECESSARY)

S. F. No. 7356—OS—Rev. 3-69—3-69

File Original and First Copy with the Division of Water Management
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT S03
STATE OF WASHINGTON

Application No. 9994
Permit No. 9767

(1) OWNER: Name City of Lacey Address

(2) LOCATION OF WELL: County Thurston — ¼ ¼ Sec. T. N., R. W.M.
Bearing and distance from section or subdivision corner [illegible]

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one)....
New well ☐ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 16 inches.
Drilled ft. Depth of completed well ft.

(6) CONSTRUCTION DETAILS:

Casing installed: " Diam. from ft. to ft.
Threaded ☐ " Diam. from ft. to ft.
Welded ☐ " Diam. from ft. to ft.

Perforations: Yes ☐ No ☐
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☑ No ☐
Manufacturer's Name Johnson
Type Everdure Stainless Model No.
Diam. 18 Slot size 30 from 127 ft. to 207 ft.
Diam. 15 Slot size 40 from 207 ft. to 219 ft.
16 50 219 227

Gravel packed: Yes ☐ No ☐ Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes ☐ No ☐ To what depth? ft.
Material used in seal
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name Jacuzzi
Type: [illegible] 200 [illegible] H.P. [illegible]

(8) WATER LEVELS: Land-surface elevation above mean sea level.... 233 ft.
Static level 61.5 ft. below top of well Date Jun 6, 196[illegible]
Artesian pressure [illegible] lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☐ If yes, by whom?
Yield: 350 gal./min. with [illegible] ft. drawdown after 4 hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
[illegible]	[illegible]	5:15	62.2		
[illegible]	77.1				
[illegible]	67.1				

Date of test
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes ☐ No ☐

(10) WELL LOG:

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
→ 16" Well [illegible] 3		
0 2 Top Soil		
2 20 Gray brown hard pan		
20 60 Brown tite sand and gravel		
60 70 Brown med sand, gravel, water		
70 76 [illegible]		
76 80 Brown Med sand & gravel		
80 91 Brown [illegible] large gravel & sand, good		
91 97 Brown large and gravel, little sand		
97 103 Brown clay and gravel, no water		
103 116 Brown Sand and small gravel, water		
116 157 Brown, med sand, dirty with some gravel streaks		
157 162 Brown Med Sand & gravel		
162 166 Brown large gravel 0-6" size & clay, no water		
166 191 Brown clay & gravel hard, had to drill up		
191-193 Brown sand gravel, tite clay, some water		
193 226 Brown gravel sand large 0-6" good		
226 227 Gray large sand gravel tite		
227 Gray silts drilled to 230		

Work started , 19 . Completed , 19

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME (Person, firm, or corporation) (Type or print)
Address
[Signed] (Well Driller)
License No. Date , 19

S. F. No. 7356—OS—(Rev. 5-69)—5-69.

(USE ADDITIONAL SHEETS IF NECESSARY)

Attachment B. Hydrogeologic Profile and Well Logs for S20, S21,, S22, S28, and S27

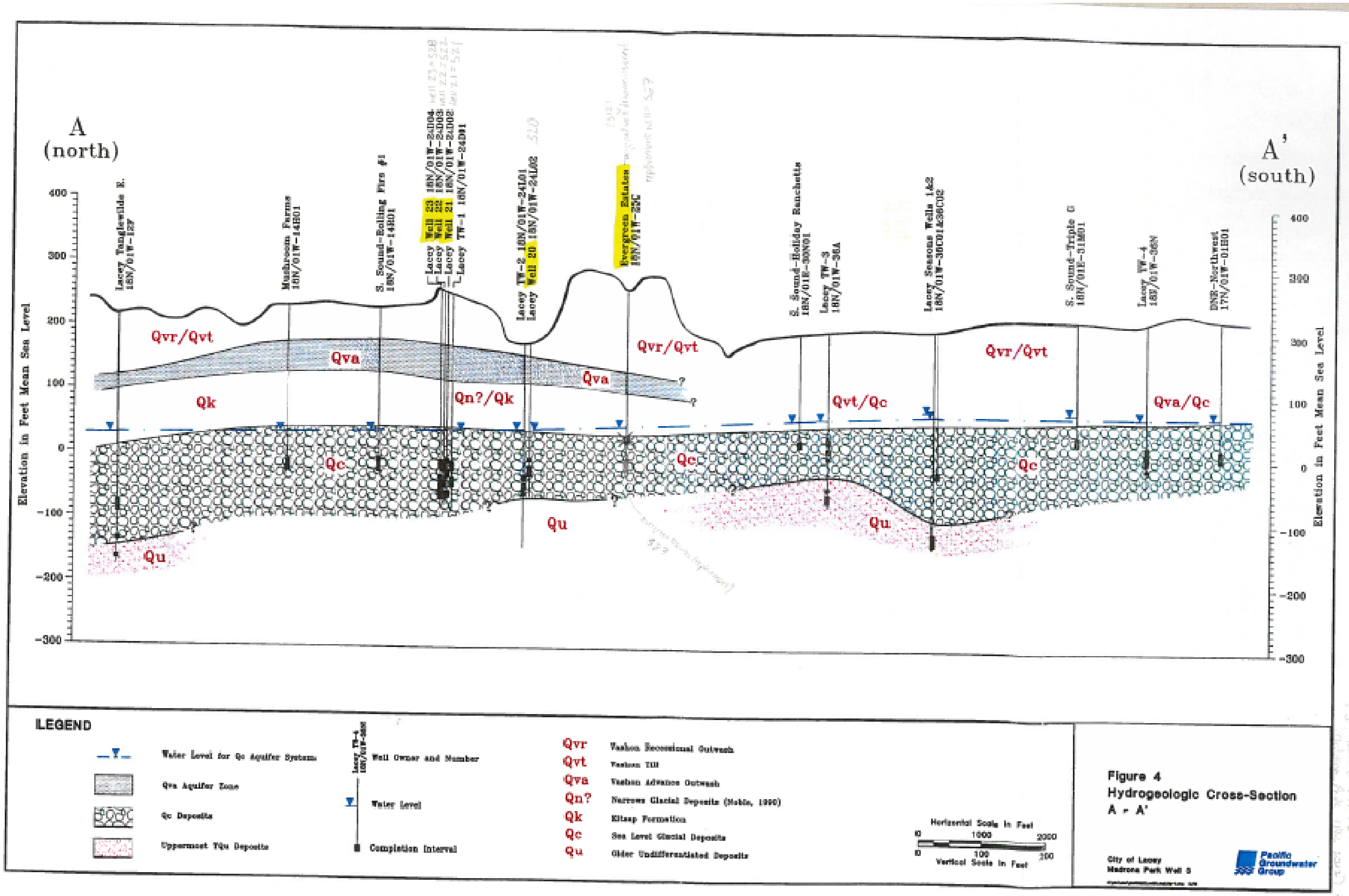


Figure 4
Hydrogeologic Cross-Section A - A'

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File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. 16280
UNIQUE WELL I.D. # ABY233
Water Right Permit No. G2-29165

(1) OWNER: Name City of Lacey Address P.O. Box "B", Lacey, WA 98503-0987

(2) LOCATION OF WELL: County Thurston NW 1/4 NW 1/4 Sec 24 T. 18 N., R 1W W.M.

(2a) STREET ADDRESS OF WELL (or nearest address) 1200 ft east and 500 ft south of the NW corner of Section 24

(3) PROPOSED USE: ☐ Domestic ☐ Irrigation ☐ DeWater Industrial ☐ Test Well ☐ Municipal ☑ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) Well A
Abandoned ☐ New well ☑ Deepened ☐ Reconditioned ☐ Method: Dug ☐ Cable ☑ Rotary ☐ Bored ☐ Driven ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 16 inches.
Drilled 334 feet. Depth of completed well 329 ft.

(6) CONSTRUCTION DETAILS:
Casing Installed: 16" Diam. from +6 ft. to 263 ft.
Welded ☑ " Diam. from ___ ft. to ___ ft.
Liner installed ☐ " Diam. from ___ ft. to ___ ft.
Threaded ☐

Perforations: Yes ☐ No ☑
Type of perforator used ___
SIZE of perforations ___ in. by ___ in.
___ perforations from ___ ft. to ___ ft.
___ perforations from ___ ft. to ___ ft.
___ perforations from ___ ft. to ___ ft.

Screens: Yes ☑ No ☐
Manufacturer's Name Johnsons
Type 14" pipe size stainless steel Model No. ___
Diam. ___ Slot size (see detail on right) ft. to ___ ft.
Diam. ___ Slot size ___ from ___ ft. to ___ ft.

Gravel packed: Yes ☐ No ☑ Size of gravel ___
Gravel placed from ___ ft. to ___ ft.

Surface seal: Yes ☑ No ☐ To what depth? 125 ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes ☐ No ☑
Type of water? ___ Depth of strata ___
Method of sealing strata off ___

(7) PUMP: Manufacturer's Name ___
Type: ___ H.P. ___

(8) WATER LEVELS: Land-surface elevation above mean sea level 254 ft.
Static level 216.5 ft. below top of well Date 3/1/96
Artesian pressure ___ lbs. per square inch Date ___
Artesian water is controlled by ___ (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☑ No ☐ If yes, by whom? PGG
Yield: 1,050 gal./min. with 2.3 ft. drawdown after 9 hrs.
" Transmissivity ~ 2,000,000 gpd/ft "
" Storage coefficient ~ 3x10⁻⁶ "
Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test ___
Bailer test ___ gal./min. with ___ ft. drawdown after ___ hrs.
Airtest ___ gal./min. with stem set at ___ ft. for ___ hrs.
Artesian flow ___ g.p.m. Date ___
Temperature of water 50°F Was a chemical analysis made? Yes ☑ No ☐

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
Tan, silt-bound Gravels	0	29
Brown & grey, silt-bound Gravels	29	50
Silty Gravels with sand	50	77
Brown, silty Sand & Gravel	77	85
Brown, silty Sand & Gravel, some water	85	95
Sand & Gravel, water	95	117
Blue and brown clay	117	125
Tan, silt-bound Sand	125	145
Tan, slightly silty Sand with some gravel	145	188
Yellow-brown, silty to v. silty fine Sand	188	202
Yellowish-grey brown, siltbound slightly Sandy Gravel	202	217
Olive grey silt-bound Sand & Gravel	217	229
Grey, silt-bound, slightly gravelly, coarse Sand	229	235
Yellow-brown, silty fine-med Sand	235	244
Yellow-brown, slightly silty Sand and Gravel w/ cobbles	244	265
Yellow-brown, Sand & Gravel w/ cobbles	265	270
Yellow-brown & olive grey, interbedded siltbound Gravel and gravelly fine Sand	270	283
Greyish-brown, very silty Sand and Gravel	283	291
Greyish-brown siltbound Sand & Gravel w/ cobbles	291	314
Olive grey slightly silty Sand & Gravel	314	320
Yellow-brown, slightly silty fine Sand	320	327
Olive grey, silty fine Sand	327	334

(Log prepared by Pacific Groundwater Group)

Screen details:

Dia	slot size	Top	Bottom
14"	100	263 ft	271 ft
14"	80	271.5	286.5
14"	150	286.5	292.5
14"	120	318	319
14"	80	319	324

Work Started 12/1/95, 19. Completed 3/4/96, 19

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME Holt Drilling Inc (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address 10621 Todd Rd E Puyallup
(Signed) Randy Holt (WELL DRILLER) License No. 1099
Contractor's Registration No. HOLTTIX0870J Date 3-27, 1996

(USE ADDITIONAL SHEETS IF NECESSARY)

ECL 050-1-20 (2/93)

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

522

Start Card No. W11448

UNIQUE WELL I.D. # ACR 769

Water Right Permit No.

(1) OWNER: Name CITY OF LACEY Address P.O.Box 3400, 420 College St. Lacey, WA 98

(2) LOCATION OF WELL: County Thurston NW 1/4 NW 1/4 Sec 24 T. 18 N., R. 1W

(2a) STREET ADDRESS OF WELL (or nearest address) MADRONA PARK SUBDIVISION

(3) PROPOSED USE: ☐ Domestic ☐ Irrigation ☐ DeWater ☐ Industrial ☐ Test Well ☒ Municipal ☐ Other

(4) TYPE OF WORK: Owner's number of well (If more than one) "C" (well 22)
☐ Abandoned XX New well ☐ Deepened ☐ Reconditioned
Method: ☐ Dug ☒ Cable ☐ Rotary ☐ Bored ☐ Driven ☐ Jetted

(5) DIMENSIONS: Diameter of well 16 inches.
Drilled 334 feet. Depth of completed well 333 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 16" Diam. from +2 ft. to 265 ft.
☒ Welded ☐ Liner installed ☐ Threaded
Perforations: Yes ☐ No ☒
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
Screens: Yes ☒ No ☐
Manufacturer's Name Westco
Type Stainless steel Model No.
Diam. 14" Slot size 150/120 from 265 ft. to 282 ft.
Diam. 14" Slot size 150 from 294 ft. to 306 ft.
14" 150/100 313 328
Gravel packed: Yes ☐ No ☒ Size of gravel
Gravel placed from ft. to ft.
Surface seal: Yes ☒ No ☐ To what depth? 120 ft.
Material used in seal ~~XXXXXXXXXXX~~ Quick Grout
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level ft.
Static level 219.53 ft. below top of well Date 6/4/97
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? Hokkaido
Yield: 1025 gal./min. with 2.01 ft. drawdown after 1 hrs.
" 1025 " 2.00 " 2 "
" 1025 " 2.21 " 4.23 "
Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
0	221.75	10m	219.77	120m	219.7
1 min.	219.69	30m	219.76		
5 min.	219.81	60m	219.70		

Date of test 6/4/97
Bailer test gal./min. with ft. drawdown after hrs.
Airtest gal./min. with stem set at ft. for hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes ☒ No ☐

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION
Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
Brown gray sandy till, hard	0'	10
Gray brown sandy till w/cobbles	10'	69
Dirty sand and gravel, moist	69'	76
Brown gray till	76'	79
Brown clay with gravel	79'	87
Brown waterbearing sand & gravel	87'	121
Brown silty sand with gravel	121'	123
Blue gray clay	123'	133
Brown silty sand, H_2O	133'	153
Brown silty sand with clay and gravel, H_2O		
Brown sandy silt with gravel, H_2O	153'	163
Yellowish Sand & Gravel with binder, waterbearing	163'	195
Brown Sand and gravel with clay lenses	195'	306'
Brown, fine to medium sand with gravel	306'	328'
Brown silty sand with binder	328'	331'
Bottom hole	331'	334'
	334'	

Work Started March 21, 1997 Completed June 11, 1997

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME HOKKAIDO DRILLING & DEVELOPING CORP. (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address P.O. BOX 100, GRAHAM, WA 98338-0100
(Signed) (WELL DRILLER) License No. 1146
Contractor's Registration No. HOKKAD017803 Date JUNE 24, 1997

(USE ADDITIONAL SHEETS IF NECESSARY)

Ecology is an Equal Opportunity and Affirmative Action employer. For special accommodation needs, contact the Water Resources Program at (206) 407-6600. The TDD number is (206) 407-6006.

ECY 050-1-20 (9/90)

21-1900 03:07

528

P.03

2nd First Copy with ... of Ecology
... Copy — Owner's Copy
... Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. W124732
UNIQUE WELL I.D. # AEC 883
Water Right Permit No. 62-29304

OWNER: Name City of Lacey — Address P.O. Box "B" Lacey, WA 98503-0987

(2) LOCATION OF WELL: County Thurston — NW 1/4 NW 1/4 Sec 24 T. 18 N., R. 1W W.M.

(2a) STREET ADDRESS OF WELL (or nearest address) 8824 Milbank Rd Lacey, WA

(3) PROPOSED USE: ☐ Domestic ☐ Industrial ☒ Municipal ☐ Irrigation ☐ Test Well ☐ Other ☐ DeWater

(4) TYPE OF WORK: Owner's number of well (if more than one) Well 23
☐ Abandoned ☒ New well ☐ Deepened ☐ Reconditioned
Method: ☐ Dug ☐ Bored ☒ Cable ☐ Driven ☐ Rotary ☐ Jetted

(5) DIMENSIONS: Diameter of well 20 inches. Drilled 338 feet. Depth of completed well 330.5 ft.

(6) CONSTRUCTION DETAILS:
Casing Installed: 20" Diam. from -2 ft. to 262.5 ft.
☐ Welded ☐ Liner installed ☐ Threaded — Diam. from ___ ft. to ___ ft.; Diam. from ___ ft. to ___ ft.

Perforations: Yes ☐ No ☒
Type of perforator used ___
SIZE of perforations ___ in. by ___
___ perforations from ___ ft. to ___ ft.
___ perforations from ___ ft. to ___ ft.
___ perforations from ___ ft. to ___ ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson Stainless Steel
Type ___ Model No. ___
Diam. ___ Slot size See below from ___ ft. to ___ ft.
Diam. ___ Slot size ___ from ___ ft. to ___ ft.

Gravel packed: Yes ☐ No ☒ Size of gravel ___
Gravel placed from ___ ft. to ___ ft.

Surface seal: Yes ☒ No ☐ To what depth? 137 ft.
Material used in seal ___
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? ___ Depth of strata ___
Method of sealing strata off ___

PUMP: Manufacturer's Name ___
Type: ___ H.P. ___

WATER LEVELS: Land-surface elevation above mean sea level ~~249.8~~ 259 ft.
Static level 220.8 ft. below top of well Date 6/5/00
Artesian pressure ___ lbs. per square inch Date ___
Artesian water is controlled by ___ (Cap, valve, etc.)

WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? PGG/Driller
Yield: 1680 gal./min. with 2.4 ft. drawdown after 4 hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
	223.2	6.0	221.16	50.0	221.06
	221.19	10.0	221.13		
	221.18	20.0	221.10		

Date of test ___
Bailer test ___ gal./min. with ___ ft. drawdown after ___ hrs.
Air test ___ gal./min. with stem set at ___ ft. for ___ hrs.
Artesian flow ___ g.p.m. Date ___

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
Brown Till	0	35
Brown siltbound Sand & Gravel	35	58
Brown Sandy Gravel	58	63
Brown siltbound, slightly sandy Gravel	63	83
Brown silty Sand & Gravel	83	97
Brown Sand & Gravel (water)	97	123
Gray-blue sticky clay	123	129
Brown-grayish brown siltbound Sand and Gravel	129	137
Brown silty Sand	137	162
Brown silty Sand with clay	162	173
Brown silty Sand	173	197
Brown siltbound, slightly sandy Gravel	197	207
Tan silty clay and Gravel	207	215
Brown silty Sand & Gravel	215	229
Brown slightly silty Sand & Gravel	229	242
Brown slightly silty to silty f-m Sand and slightly silty to silty Sand & Gravel	242	257
Tan Clay	257	259
Brown, wellgraded, slightly cobbly, fine to coarse sandy Gravel	259	277
Brown f-m Sand and siltbound Sand & Gravel	277	281
Brown to olive gray cobbly Sand & Gravel	281	293
Brown, siltbound, cobbly Sand & Gravel	293	295
Brown well graded coarse sandy cobbly Gravel	295	316
Brown, slightly silty gravelly, f-m Sand	316	333
Grayish-tan silt	333	338

Screens:
18-inch: 120 slot; 262.5 - 265.5'
18-inch: 80 slot; 265.5 - 272.5'
18-inch: 120 slot; 272.5 - 277.5
18-inch: 80 slot; 286.5 - 292.5
18-inch: 150 slot; 292.5 - 325.5

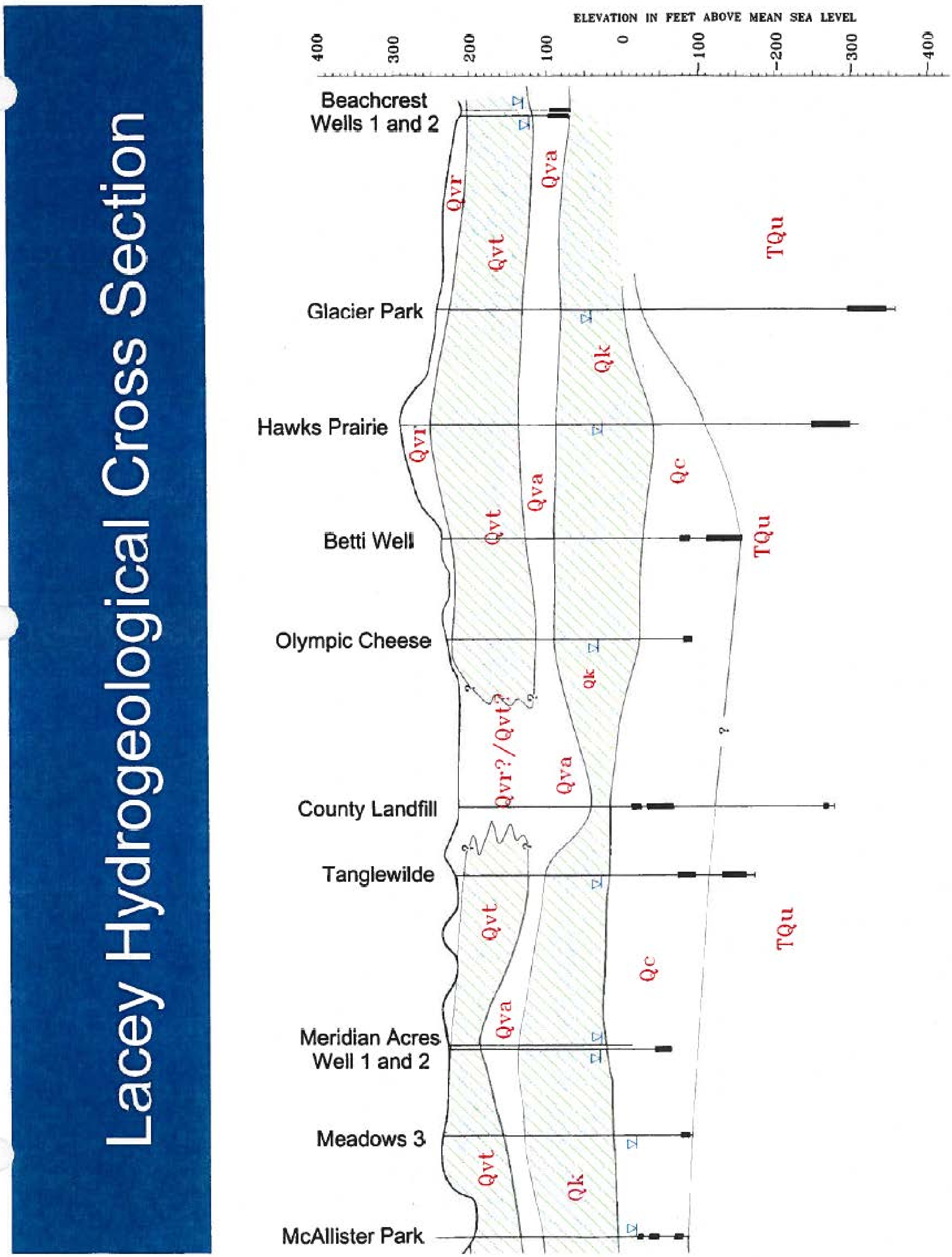
Work Started 2/22/2000 Completed 6/9/2000

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME Arcadia Drilling Inc. (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address 170 SE Walker Park Rd Shelton, WA985
(Signed) Duane H Knapp (WELL DRILLER) License No. 1706
Contractor's Registration No. ARCADDI0931 Date 7-13-00, 19___

Attachment C. Hydrogeologic Profile and Well Logs for S15 and S16


Lacey Hydrogeological Cross Section
ELEVATION IN FEET ABOVE MEAN SEA LEVEL
400
300
200
100
0
-100
-200
-300
-400
Beachcrest Wells 1 and 2
Glacier Park
Hawks Prairie
Betti Well
Olympic Cheese
County Landfill
Tanglewilde
Meridian Acres Well 1 and 2
Meadows 3
McAllister Park
Qvr
Qvt
Qva
Qk
Qc
TQu
Qvr?/Qvt?

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Application No. ....
Permit No. ....

(1) OWNER: Name Hilton Sjoboen Address 336 P.O. Box

(2) LOCATION OF WELL: County .... — ¼ ¼ Sec. 25 T. 19 N., R. 1 W.M.

ng and distance from section or subdivision corner

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☒ Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one).... #1
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 12 inches.
Drilled 140 ft. Depth of completed well 140' 10" ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 12" Diam. from 0 ft. to 115'6" ft.
Threaded ☐ ...." Diam. from .... ft. to .... ft.
Welded ☒ ...." Diam. from .... ft. to .... ft.

Perforations: Yes ☐ No ☒
Type of perforator used ....
SIZE of perforations .... in. by .... in.
.... perforations from .... ft. to .... ft.
.... perforations from .... ft. to .... ft.
.... perforations from .... ft. to .... ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson
Type Stainless Model No. ....
Diam. 12 Slot size 25 from 115'6" ft. to 140'10" ft.
Diam. .... Slot size .... from .... ft. to .... ft.

Gravel packed: Yes ☐ No ☒ Size of gravel: ....
Gravel placed from .... ft. to .... ft.

Surface seal: Yes ☒ No ☐ To what depth? 18 ft.
Material used in seal Cement Grout
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? .... Depth of strata ....
Method of sealing strata off ....

(7) PUMP: Manufacturer's Name ....
Type: .... H.P. ....

(8) WATER LEVELS: Land-surface elevation above mean sea level.... ft.
Static level 77 ft. below top of well Date 6-28-76
Artesian pressure .... lbs. per square inch Date ....
Artesian water is controlled by .... (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? Kincy
Yield: gal./min. with 75 ft. drawdown after hrs.
" 250 " 112 " 4 "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
		None			

Date of test ....
Bailer test .... gal./min. with .... ft. drawdown after .... hrs.
Artesian flow .... g.p.m. Date ....
Temperature of water .... Was a chemical analysis made? Yes ☒ No ☐

(10) WELL LOG:

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Brown Clay Sand Gravel	0	6
Brown Hard Pan	6	48
Brown Sand Clay and Gravel	48	63
Brown Hard Pan	63	83
Brown Med Sand to 3" Gravel	83	94
Brown Fine Sand To 3" Gravel	94	97
Brown Med Sand To 3" Gravel	97	100
Brown Gravel and Sand	100	104
Red Med Sand To 3" Gravel	104	126
Brown Med Sand and Gravel	126	139
Brown Hard Clay	139	

Work started ...., 19.... Completed ...., 19....

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Kincy Hardware (Person, firm, or corporation) (Type or print)

Address 512 East 4th Ave

[Signed] Ken Wiltsie (Well Driller)

License No. C-65 Date 6-28, 1976

(USE ADDITIONAL SHEETS IF NECESSARY)

S. F. No. 7356—OS—(Rev. 4-71).

516

The Department of Ecology does NOT Warranty Data and/or the Information on this Well Report

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Application No. G2-24547
Permit No. G2-24547-P

(1) OWNER: Name M. & R Cons. & Utilities Address P.O. Box 3772 Lacey, Wa. 98503

(2) LOCATION OF WELL: County Thurston — SE ¼ SW ¼ Sec. 25 T. 19 N., R. 1W W.M.
Bearing and distance from section or subdivision corner 650' W & 1120' N. from the S¼ corner of Sec. 25

(3) PROPOSED USE: Domestic ☒ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☐ Other ☐
Community

(4) TYPE OF WORK: Owner's number of well (if more than one) 2
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 10 inches
Drilled 141 ft. Depth of completed well 138 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 10" Diam. from 0 ft. to 113 ft.
Threaded ☐ " Diam. from ft. to ft.
Welded ☒ " Diam. from ft. to ft.

Perforations: Yes ☐ No ☒
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson Well
Type Stainless steel Model No.
Diam. 10 Slot size 40 from 113 ft. to 118 ft.
Diam. 10 Slot size 50 from 118 ft. to 123 ft.
10 40 133 138

Gravel packed: Yes ☐ No ☒ Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes ☒ No ☐ To what depth? 20 ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name Jacuzzi Bros.
Type 20-ms-8a6 H.P. 20

(8) WATER LEVELS: Land-surface elevation above mean sea level ft.
Static level 84 ft. below top of well Date 4-23-79
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? Driller
Yield: 275 gal./min. with 31 ft. drawdown after 4 hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test 4-23-79
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes ☒ No ☐

(10) WELL LOG:
Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Loose sand & gravel	0	5
Loose sand & gravel	5	9
Cemented sand & gravel	9	20
Cemented sand & gravel	20	40
Cemented sand & gravel	40	56
Dirty sand & gravel, alittle seepage	56	61
Cemented sand & gravel	61	65
Hardpan	65	71
Cemented sand & gravel	71	73
Hardpan	73	80
Hardpan	80	96
Dirty sand & gravel some seepage	96	100
Dirty wet sand & gravel	100	107
Sand & gravel	107	124
Sand & gravel	124	141
Dark brown clay	141	

RECEIVED
AUG 23 1979
DEPARTMENT OF ECOLOGY
SOUTHWEST REGIONAL OFFICE

Work started 3-30, 19 79. Completed 4-23, 19 79

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

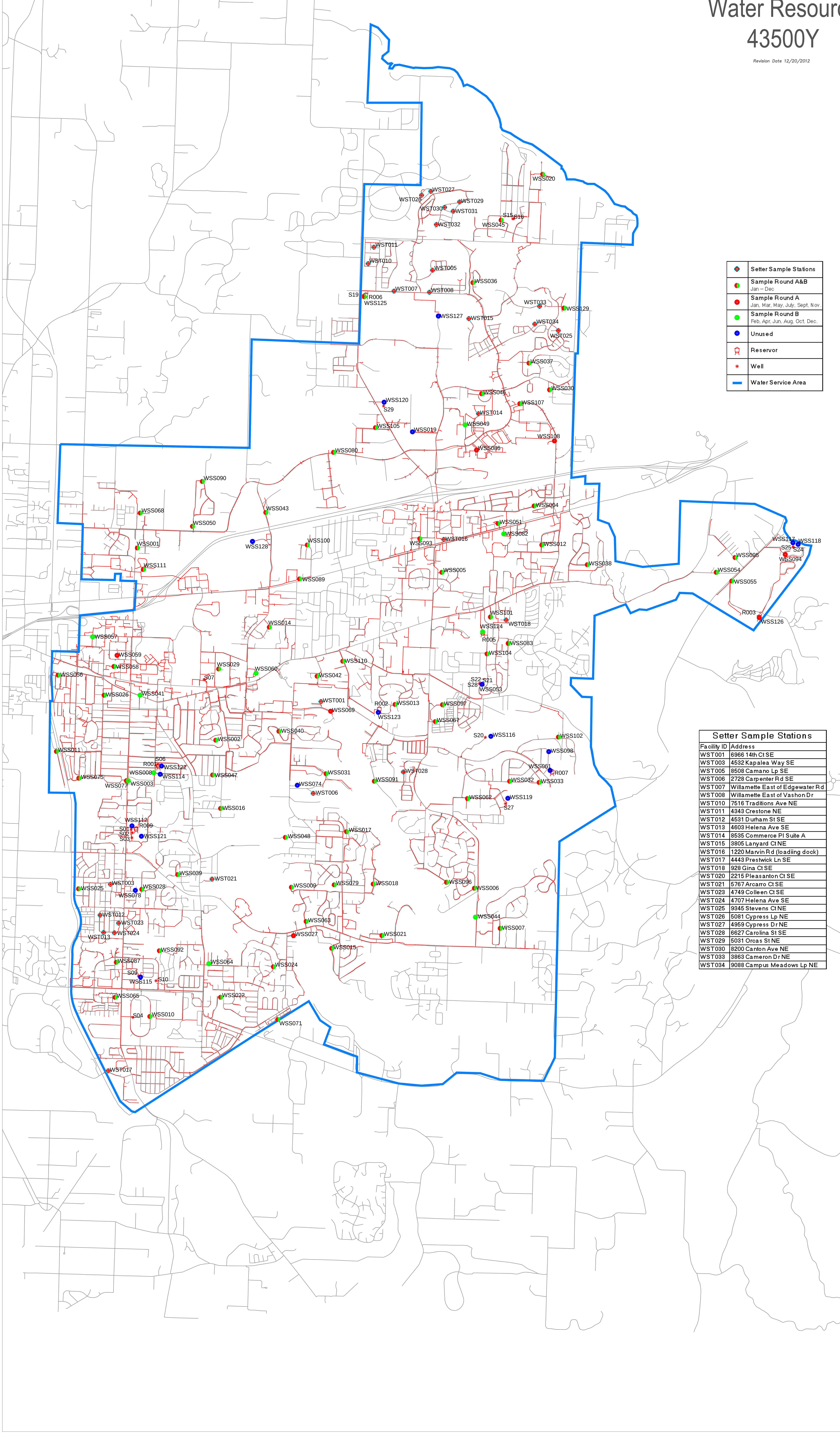
NAME Richardson Well Drilling Co. (Person, firm, or corporation) (Type or print)
Address P.O. Box 44408 Tacoma, Wa. 98444
[Signed] (Well Driller)
License No. 223-02-6500 Date 8-21, 19 79

(USE ADDITIONAL SHEETS IF NECESSARY)

Coliform Monitoring Plan

City of Lacey
Water Resource
43500Y

Revision Date 12/20/2012



Setter Sample Stations

Facility ID	Address
WST001	6966 14th Ct SE
WST003	4532 Kapalea Way SE
WST005	8508 Camano Lp SE
WST006	2728 Carpenter Rd SE
WST007	Willamette East of Edgewater Rd
WST008	Willamette East of Vashon Dr
WST010	7516 Traditions Ave NE
WST011	4343 Crestone NE
WST012	4531 Durham St SE
WST013	4603 Helena Ave SE
WST014	8535 Commerce Pl Suite A
WST015	3805 Lanyard Ct NE
WST016	1220 Marvin Rd (loadiing dock)
WST017	4443 Prestwick Ln SE
WST018	928 Gina Ct SE
WST020	2215 Pleasanton Ct SE
WST021	5767 Arcarro Ct SE
WST023	4749 Colleen Ct SE
WST024	4707 Helena Ave SE
WST025	9345 Stevens Ct NE
WST026	5081 Cypress Lp NE
WST027	4959 Cypress Dr NE
WST028	6627 Carolina St SE
WST029	5031 Orcas St NE
WST030	8200 Canton Ave NE
WST033	3863 Cameron Dr NE
WST034	9088 Campus Meadows Lp NE

Water Sample Stations

Facility ID	Address
WSS001	4601 8th Ave NE
WSS002	5817 19th Ct SE
WSS003	2606 College St SE
WSS004	9126 Skokomish Way NE
WSS005	8304 Hawksridge Dr SE
WSS006	3804 Oxford Lp SE
WSS007	4536 Early Spring Dr SE
WSS008	4906 25th Ave SE
WSS009	6828 41st Ave SE
WSS010	6139 E Sarazan St SE
WSS011	3928 21st Ave SE
WSS012	9229 Northwood Dr SE
WSS013	1316 Mountain Aire Lp SE
WSS014	6485 5th Way SE
WSS015	5003 Atchinson Dr SE
WSS016	Hicks Lake Rd SE & Hazelwood Ln SE
WSS017	32nd Ave SE & Shorewood Ln SE
WSS018	3901 Long Lake Dr E
WSS019	8258 28th Ct NE
WSS020	5230 Hilton Ln NE
WSS021	7834 48th Lp SE
WSS022	5746 Turf Ln SE
WSS024	5550 Komachin Lp SE
WSS025	4119 Ingeside Dr SE
WSS026	1300 Golf Club Rd SE
WSS027	4748 Lakeshore Ln SE
WSS028	4028 Stikes Dr SE
WSS029	5806 Huntamer Ln SE
WSS030	9305 Fairhill Dr NE
WSS031	7146 Holmes Island Rd SE
WSS032	8930 Beddington DR SE
WSS033	9226 24th Ct SE
WSS036	4117 Campus Green Dr NE
WSS037	9023 Deni Dr NE
WSS038	9632 Regency Lp SE
WSS039	3830 Koala St SE
WSS040	6602 Sierra Dr SE
WSS041	4704 Lacey Blvd SE
WSS042	921 Pacific Park Dr SE
WSS043	1836 Carpenter Rd NE
WSS044	4403 Marvin Rd SE
WSS045	4806 Beverly Dr NE
WSS046	8620 Sebastian Dr NE
WSS047	2409 Shirley St SE
WSS048	6708 33rd Ave SE
WSS049	8575 Commerce Pl NE
WSS050	1529 Woodland Creek St NE
WSS051	8825 Tallon Ln NE
WSS053	8824 Milbanke Dr SE
WSS054	646 Memory Ct SE
WSS055	746 Old Pacific Hwy SE
WSS056	3816 12th Ave SE
WSS057	4216 6th Ave SE
WSS058	4500 10th Ave SE
WSS059	640 Woodland Square Lp SE
WSS060	6200 Pacific Ave SE (Safeway)
WSS061	9346 Milburn Lp SE (McAllister Res)
WSS062	8615 27th Ave SE
WSS063	43rd LN &GLEN Terra DR SE
WSS064	54th Ave SE & Ivy Hill Dr SE
WSS065	4775 Whitman Ln SE
WSS067	8307 15th Ave SE (across street)
WSS068	4608 17th Ln NE
WSS069	7250 14th Ave SE
WSS071	6613 Steamer Dr SE
WSS074	6832 26th Ct SE
WSS075	2600 Leisure Way SE
WSS077	4529 26th Ave SE
WSS078	4924 41st Ln SE
WSS079	7337 39th Ct SE
WSS080	Britton Parkway NE, E of Gateway Blvd NE
WSS082	8911 Martin Way E
WSS083	1124 Milbanke Dr SE
WSS086	2600 Willamette Dr NE
WSS087	5330 Corporate Center Lp SE
WSS089	6800 Martin Way E
WSS090	5423 22nd Ave NE
WSS091	2433 Mayes Rd SE
WSS092	400 52nd LN SE
WSS093	8122 Martin Way E (Safeway)
WSS094	702 Nisqually Park Lp SE
WSS095	11034 Kuhlman Rd SE
WSS096	8437 Spinnaker Ln SE
WSS097	Village at Union Mills-Apts Bldg I
WSS098	9310 Milburn Lp SE
WSS100	1140 Loyola St NE (across street)
WSS101	848 Avalon Ct SE
WSS102	2030 Seaton Ct SE
WSS104	1221 Fitz Hugh Dr SE (across street)
WSS105	2837 29th Ln NE
WSS107	8925 Orion Dr NE
WSS108	9303 Orion Dr (Home Depot)
WSS110	815 Union Mills Rd SE
WSS111	4706 Park Center Ave NE
WSS112	3300 College St SE (Well 1)
WSS114	2400 Judd St SE (Well 6)
WSS115	4830 Yelm Hwy SE (WELL 9)
WSS116	1810 Marvin Rd SE (Well 20)
WSS117	11544 6th Ave SE (Well 19A)
WSS118	11544 6th Ave SE (Well 19C)
WSS119	2814 Hibiscus Ct SE (Evergreen Estates)
WSS120	2950 Marvin Rd NE (Betti Well)
WSS121	3300 College St SE (Westside Res)
WSS122	2400 Judd St SE (Judd Hill Res)
WSS123	1349 Paradise Ct SE (Union Mills Res)
WSS124	8705 Steilacoom Rd SE (Steilacoom Res)
WSS125	4040 Marvin Rd NE (Hawks Prairie Res)
WSS126	11503 Durgin Rd SE (Nisqually Res)
WSS127	3901 Hogum Bay NE
WSS128	6250 9th Ln NE
WSS129	3946 Amelia Ct NE

DN 12/20/2012 H:\WaterResources\Maps\ViewMaps\ColiformSample2012.dwg

Appendix Q
DISINFECTANT AND DISINFECTION BY-PRODUCT MONITORING PLAN

STATE OF WASHINGTON
DEPARTMENT OF HEALTH
SOUTHWEST DRINKING WATER REGIONAL OPERATIONS
PO Box 47823, Olympia, Washington 98504-7823
TDD Relay 1-800-833-6388

RECEIVED
SEP 18 2012
PUBLIC WORKS

September 14, 2012

Peter Brooks
Lacey Water Department
420 College Street Southeast
Lacey, Washington 98503

Subject: Lacey Water Department, ID #43500, Thurston County; Stage 2 Disinfection Byproducts Rule Monitoring Plan Approval

Dear Peter Brooks:

Thank you for submitting the Stage 2 Disinfection Byproduct Rule (Stage 2 DBPR) compliance monitoring plan (CMP), received on December 1, 2011, as part of the latest Water System Plan update. I have reviewed the Stage 2 DBP monitoring plan separately because it must be approved prior to October 1, 2012, and the water system planning process will not be completed by that time.

As a surface water system with a population between 50,000 and 249,000, the standard and reduced monitoring requirements are as follows:

	Sampling Requirements	***Frequency***
Standard Compliance Monitoring	8 Dual Sample Sets • Locations are specified in the approved CMP	Per Quarter
Reduced Monitoring	4 Dual Sample Sets • The locational running annual average (LAA) must be evaluated to qualify. • LAA for TTHM < 0.040 mg/L • LAA for HAA5 < 0.030 mg/L • Annual average TOC results must be < 4.0 mg/L. Use quarterly TOC results from the City of Olympia's McAllister Springs source. • Reduced monitoring locations should be the sites with highest LAAs for TTHM and HAA5.	Per Quarter

With the issuing of this letter the Lacey Water Department's Stage 2 DBP compliance monitoring plan is approved. If you have any questions about complying with the DBP requirements, please contact me at (360) 236-3035.

Sincerely,

Regina Nicole Grimm

Regina N. Grimm, P.E.
Office of Drinking Water, Disinfection Byproducts Lead

cc: Julie Rector, Lacey Water Department
Thurston County Health Department

City of Lacey
Disinfectant and Disinfection Byproduct Monitoring Plan

Stage 1 and Stage 2

Plan Preparation Information

System Name:	Lacey Water Department, PWSID# 43500Y
Date Plan Completed:	**December 2010**
Dates Modified:	06/05, 08/07, 01/09
Name of Plan Preparer:	Julie Rector, Water Quality Analyst
Daytime Phone:	(360) 493-2410

State Reviewer:	______________________
Date Last Review:	January 2008

Table of Contents

Tables

Appendices

1. Background and Source Information

Water System compliance monitoring requirements for the City of Lacey Water System are addressed in three planning documents: the *City of Lacey Coliform Monitoring Plan*, the *City of the Inorganic and Organic Monitoring Plan*, and this plan, the *City of Lacey Disinfectants and Disinfection Byproducts Monitoring Plan*.

Monitoring for disinfectants and disinfection byproducts (DBPs) is still relatively new to the city of Lacey because the system was not chlorinated prior to 2004. Following a series of non-acute violations that started in late 2003, the city started chlorinating the 337 zone and a portion of the 400 zone from June through September 2004. Permanent chlorination in the 337 zone began in November 2004, and the rest of the system was chlorinated starting in early May 2005.

This plan addresses monitoring requirements specified in the Stage 1 Disinfectants and Disinfection Byproducts Rule, as well as applicable disinfectant monitoring requirements associated with surface water treatment and disinfected groundwater sources. At this time disinfectant monitoring and monitoring required under Stage 1 of the disinfection byproducts rule monitoring are overseen by the Washington State Department of Health (DOH) Office of Drinking Water. Initial planning and site studies required for Stage 2 of the disinfection byproducts rule are still under the oversight of EPA's Office of Ground Water and Drinking Water.

Table 1. Contacts for Monitoring and Compliance

City of Lacey—		
Water System Operators	Terry Cargil	(360) 413-4395
	Peter Brooks, P.E.	(360) 438-2675
Sample Collection	Bob Burreson	(360) 413-4341
Backup samplers	Rick McBroom	(360) 412-2895
	Julie Rector	(360) 493-2410
	Ed Andrews	(360) 413-4356
City contact for DOH compliance/ Monitoring Program oversight/data requests	Julie Rector	(360) 493-2410
Laboratory—		
Water Management Lab, Inc.	Christa Holme	(253) 531-3121
Thurston Co. Environmental Health Lab (coliform and nitrate samples only)	Mike Clark	(360) 786-5465
State Department of Health, Southwest Region–		
WQ Monitoring Compliance Tracking	Sophia Petro	(360) 236-3046
Regional Engineer	Regina Grimm, P.E.	(360) 586-4689

1.2 Source Information

The Lacey main water system is supplied primarily by 19 city-owned wells (Table 1). Supply is also supplemented by a year-round intertie with the City of Olympia, which supplies treated surface water that is regulated as having "a limited alternative to filtration." A map showing locations of Lacey's sources, facilities, and pressure zones is in Appendix 1.

The only disinfected sources supplying the Lacey system are well 10 (S10) and the city of Olympia intertie. Two of Lacey's sources, well 7 (S07) and the Hawks Prairie well (S19), are treated to remove iron and manganese, and chlorine is used as an oxidant prior to filtration. The rest of Lacey's sources are not treated per se and instead chlorine is injected prior to entry to the distribution system with the intent of maintaining a detectable residual throughout the distribution system. The target concentration is 0.5 mg/L free chlorine.

Table 2. Sources, Location of Chlorine Injection, and Normal Operating Periods

DOH ID	Source Name(s)	Address	Cl^- Injection Location	Normal Operation Periods
S01	Well 1	3300 College St	Well	Year-round
S02	College WF well 2	3300 College St	Well	Year-round
S03	College WF well 3	3300 College St	Well	Year-round
S04	Well 4	6100 W Sarazan SW	Well	Year-round
S06	Well 6C; Judd Hill	2400 Judd St	Well	Year-round
S07	Well 7	5608 Pacific Ave	Treatment Plant[1]	Year-round
S09	Well 9	4830 Yelm Hwy	Well	Year-round
S10	Well 10	5138 Yelm Hwy	Well	Year-round
S15	Beachcrest WF 1	8905 48th Ave	Well	Year-round
S16	Beachcrest WF 2	8905 48th Ave	Well	Year-round
S19	Hawks Prairie	4040 Marvin Rd NE	Treatment Plant[2]	Year-round
S20	McAllister	2020 Marvin Rd	Well	Year-round
S21	Madrona WF well 1	8826 Milbanke Dr SE	Well	Year-round
S22	Madrona WF well 2	8826 Milbanke Dr SE	Well	Year-round
S24	Nisqually Well 19A	11544 6th Ave	Well	Year-round
S25	Nisqually Well 19C	11544 6th Ave	Well	Year-round
S27	Evergreen Estates	2800 Hibiscus Ct	Well	Year-round
S28	Madrona WF well 3	8826 Milbanke Dr SE	Well	Year-round
S29	Betti well	2950 Marvin Rd	Well	Year-round
S30	Intertie: City of Olympia	Pacific Avenue	Oly treatment plant	Year-round

[1] Chlorine is injected as a second oxidant prior to filtration through pyrolox filters that remove iron and manganese. Potassium permanganate is injected ahead of the chlorine.
[2] Chlorine is injected after aeration and filtration through GAC filters that remove hydrogen sulfide, and prior to greensand filters that remove iron and manganese.

2. Disinfectant Monitoring Program

Disinfectant monitoring is required when a chemical disinfectant is added to a water system. The only disinfectant introduced by the Lacey system is 0.8% sodium hypochlorite. Water purchased from the city of Olympia is currently disinfected with chlorine gas.

2.1 Disinfectant Monitoring Requirements

Because Lacey adds sodium hypochlorite the water system , the minimum monitoring requirement is to measure chlorine residuals at representative points in the distribution system on a daily basis, and at the same time and location of routine and repeat samples (WAC 246-290-451(7)). By an email dated 11/07/07, Lacey received approval to reduce the daily disinfectant monitoring to weekdays, meaning 5 days per week (see Appendix 2).

City staff uses DPD test kits with digital readout meters (Hach Pocket Colorimeter II) for measuring chlorine residuals within the distribution system.

2.2 Determining Compliance with Disinfectant Residual MRDL

The maximum residual disinfectant level (MRDL) is 4.0 mg/L. Compliance is based on a running annual arithmetic average of chlorine residuals measured with all routine and repeat samples. The running annual average is calculated quarterly by averaging monthly residual measurements for each month, adding the 12 consecutive monthly averages together, and dividing by 12. The Department calculates compliance.

To date, no single sample from the Lacey system has exceeded 4.0 mg/L and there have been no exceedances of the MRDL. The City generally adjusts the chlorination systems when detectable free chlorine residual exceeds 1.0 mg/L in the distribution system.

2.3 Determining Compliance with Disinfection Treatment Technique

Because a disinfectant is added to Lacey's groundwater-fed system, chlorine residuals need to be detectable in all active parts of the distribution system, as required under WAC 246-290-451(7)(b). In addition, when Lacey uses Olympia source water, WAC 246-290-692(5)(a) requires that chlorine residuals must be detectable in at least 95% of routine samples taken each calendar month. Lacey also needs to ensure that all water entering the distribution system contains a minimum chlorine residual of 0.2 mg/L at all times the system serves water to the public (WAC 246-290-692(3)(a)). Because of this, the city strives to maintain a minimum of residual of 0.2 mg/L throughout the system at all times.

The City of Olympia tracks minimum disinfectant residuals at the point of entry to their distribution system. If a treatment technique violation occurs, Olympia is required to notify their consecutive systems, including Lacey.

2.4 Reporting and Public Notification Requirements

The state must be notified within 48 hours if there is any violation of the MRDL for chlorine, which is 4.0 mg/L. In addition to state notification, Tier 2 public notification of customers is required within 30 days of the violation.

Failure to collect required chlorine residual samples is a monitoring violation that triggers Tier 3 notification. This requires notification of customers within 1 year of the monitoring violation.

Using treated surface water from the City of Olympia also triggers a requirement to report results from the daily distribution system residuals monitoring to the Department of Health by the 10th of every month (WAC 246-290-696(4)). Data are reported to the Department on the Chlorination Report Form, shown in Appendix 3.

The annual CCR must report the range of detected residuals, as well as the dates of the highest and lowest results.

3. Stage 1 Disinfection Byproducts Monitoring

Lacey started adding chlorine to its distribution system on a permanent basis in May 2005, although the city started collecting DBP samples when temporary chlorination started in 2004. Despite very low concentrations of detected DBPs, timing for the start of system chlorination did not allow the city to qualify for waivers. The Stage 1 compliance period ends September 31, 2012.

3.1 Sample Number

The required sample number under Stage 1 is based on the number of “treatment plants”, the population served, and source type. Initially Lacey collected 22 samples per quarter to satisfy the requirement for a Subpart H system, which requires 4 samples, per treatment plant, per quarter.

Starting in 2008 the city began collecting 12 sets of TTHM/HAA5 samples per quarter under a reduced monitoring schedule. Reduced monitoring for a sub-part H system is 1 sample (representing maximum residence time) per treatment plant, per quarter. The approval letter for reduced DBP monitoring is shown in Appendix 4. Approval was based on the city’s history of extremely low DBP results and an assessment of existing sources that withdraw similar water for the purpose of determining the appropriate number of “treatment plants” (See Appendix 5).

In the period between January 2009 – October 2012, the number of required TTHM/HAA5 samples depends on whether the Lacey stops using the Olympia intertie, and whether the city adds new groundwater sources to the system. If either of these changes occur, this plan will need to be amended to address the appropriate number of DBP samples that must be collected each quarter. For example, if Lacey stops using the Olympia intertie as a seasonal or year-round source, reduced monitoring for a groundwater-only system serving over 10,000 persons is one sample per treatment plant per year, at locations representing the maximum residence time during the month of the warmest temperature.

3.2 Treatment Plants and TTHM/HAA5 Monitoring Locations

Monitoring locations approved under Lacey's request for reduced monitoring are shown in Table 3. In addition to representing the "treatment plants" for the system, these sites provide broad geographic coverage for monitoring throughout the distribution system and include sites with the highest detectable (albeit low) concentrations of disinfection byproducts.

3.3 DBP Monitoring Schedule

Samples will be collected quarterly during the months of **January**, **April**, **July**, and **October**.

Qtr 1. January - March
Qtr 2. April - June
Qtr 3. July - September
Qtr 4. October - December

3.4 Determining Compliance with Stage 1 MCLs for TTHMs/HAA5

The MCL for total trihalomethanes (TTHMs) is 0.080 mg/L (80 µg/L), and the MCL for haloacetic acids 5 (HAA5) is 0.060 mg/L (60 µg/L). Compliance is based on a running annual arithmetic average, which is the arithmetic average of four consecutive quarters. Compliance is tracked in spreadsheet w:\DBP Compliance Calcs.xls.

Many results have been below the analytical detection limit. We could not find any guidance from EPA that addresses calculating DBP compliance when there are missing data points. Consequently, we follow the lead of the Washington State Department of Ecology's Environmental Assessment Program, which assigns ½ the analytical detection limit to missing data points for results that are below the detection limit. Lacey uses Water Management Laboratory, Inc. for DBP sample analyses. Their detection limits for both TTHM and HAA5 is 0.5 µg/L, so 0.25 µg/L is entered into w:\DBP Compliance Calcs.xls when results are below the detection limit.

All results and running averages to date have been well below the MCLs. The most current RAA result for TTHMs is 4.3 µg/L and for HAA5 is 1.3 µg/L.

Results are low because all sources that feed Lacey's system are low in organic carbon, including Olympia's McAllister Springs source. In 2007 the running annual average for TOC in McAllister Springs was 0.6 µg/L. Olympia provides approximately 5% of the total production in Lacey's system.

Table 3. Stage 1 Reduced Monitoring DBP Monitoring Locations*

Treatment Plant #	Wells within each "Treatment Plant"	Aquifer	Sample Location Max residence time
1	S01 Well 1	Qva	SS11
2	S18: wells S02 and S03	Qc	SS11
3	S04 Well 4	Qa/Qc	SS07
4	S06 Well 6C	Qc/TQu	SS68
5	S07 Well 7	TQu	SS90
6	S09 Well S09	TQu	SS24
7	S20 McAllister S23: wells S21 and S22 S28 Madrona 3 S27 Evergreen Estates	Qc	SS36
8	S17: wells S15 and S16	Qva	SS19
9	S19 Hawks Prairie	TQu	SS20
10	S29 Betti	Qc	SS01
11	S24 Nisqually Well 19A S25 Nisqually Well 19C	MG	SS55
12	Well 10	Qc	SS91
13	S30 **Intertie: City of Olympia**	**(Surface water)**	SS105

* as "Sub-Part H" System

3.5 Reporting and Public Notification Requirements under Stage 1

Results from all quarterly samples are sent directly to the Department by Water Management Lab. At this time the Department is performing calculations to determine whether the MCLs are exceeded, in lieu of having Lacey report this information (see CFR 141.134(b)).

The Stage 1 DDBP Rule requires that the state must be notified within 48 hours if there is any violation of an MCL for TTHM or HAA5 or an MRDL for chlorine. In addition to state notification, Tier 2 public notice customers is required within 30 days. A violation of a TTHM, HAA5, or chlorine monitoring requirement (i.e., failure to take a required sample) requires notification of customers within 1 year.

Although compliance monitoring under the Stage 2 DBP Rule does not take effect until October 2012, the city's annual CCR must include results of the IDSE monitoring study conducted from 2006 – 2007. The individual sample results collected for the IDSE must be included when determining the range of TTHM and HAA5 results to be reported in the CCR for the calendar years that the IDSE samples were taken. The city has included all detected DBP constituents from Stage 1 and IDSE monitoring in its CCR reports.

Lacey provides annual DDBP monitoring results to the active consecutive system that prepares a CCR (Claudia's Mobile Home Park). Because Lacey purchases wholesale water from Olympia, Olympia is responsible notifying Lacey of analytical results and violations related to their DDBP monitoring. Any results received from Olympia, if any, would be reported in Lacey's CCR. Olympia has a 40/30 waiver from the Department.

4. Planning for Stage 2 Disinfection Byproducts Monitoring

The City of Lacey is a Schedule 2 system. Under Stage 2 of the Disinfectants and Disinfection Byproducts Rule, a schedule 2 system is required to:

- Submit Individual Distribution System Evaluation (IDSE) Plan by April 1, 2007
- Start collecting samples as required under approved Plan by April 1, 2008
- Submit an IDSE Report by July 1, 2009
- Submit a Stage 2 DBPR Monitoring Plan by October 1, 2012
- Start Stage 2 Compliance Monitoring in October, 2012

Lacey's IDSE Plan used a system specific study (SSS) to identify locations with high TTHMs and HAA5. The IDSE Plan and approval letter from EPA is in Appendix 7. Lacey completed SSS monitoring in October 2007, and submitted its IDSE Report to EPA in January 2009 (Appendix 8). The IDSE Report uses the IDSE study and Stage 1 monitoring results to identify monitoring locations for Stage 2 monitoring. The IDSE Report was approved by EPA on May 21, 2009 (the approval letter is in Appendix 9), and the monitoring locations and schedule will be used in the Stage 2 DBPR Monitoring Plan to be submitted in October 2012. Lacey will continue Stage 1 monitoring until the Stage 2 monitoring compliance schedule begins in the third week of October 2012.

4.1 Sample Number

The required sample number for Stage 2 DDBP Monitoring is based on 1) the size of population served, 2) whether Lacey is still a Subpart H system by 2012, and 3) whether or not Lacey qualifies for Stage 2 reduced monitoring. At the time of the preparation of the IDSE Plan and IDSE report, Lacey was purchasing water from Olympia and had not qualified for Stage 2 reduced monitoring, so unless these change Lacey will be required to collect 8 sets of TTHM/HAA5 samples per quarter.

If the wholesale water agreement with Olympia is not extended beyond October 2012, Lacey would revert to a groundwater-only system. As a groundwater-only system, the city would be required to collect only 4 samples per quarter, and this Stage 2 monitoring plan will need to be revised.

The city may also be able to qualify for reduced monitoring under Stage 2. For reduced Stage 2 monitoring, a Subpart H system would be required to collect 4 sets of TTHM and HAA5 samples per quarter, and a groundwater-only system would be required to collect 2 sets of samples per year. To qualify for reduced monitoring the city would have to be able to maintain LRAAs for TTHM and HAA5 of no more than 0.040 mg/L and 0.030 mg/L, respectively, at all monitoring locations. Although the city could qualify for reduced monitoring under Stage 2 because of its history of low TTHM and HAA5 results, as a Subpart H system the city would have to start a TOC monitoring program for each of its "treatment plants" to demonstrate that concentrations remain below 4.0 mg/L. Each "treatment plant" would have to be sampled for TOC every 30 days to qualify for reduced monitoring, and then sampled every 90 days to remain on reduced monitoring. Since it is possible that the city may not be a Subpart H system in 2012, the city will wait until 2011 to decide whether it would be prudent to start a TOC monitoring program.

4.2 Monitoring Locations

The eight Stage 2 sample locations identified in Lacey's SSS Report are: SS19, SS105, SS100, SS90, SS01, SS36, SS07, and SS11. These sites represent locations with the highest TTHM and HAA5 LRAAs, and also include 3 sites selected to improve representation of sources and the geographic coverage of the distribution system. However, no samples from the Nisqually valley (Lacey's 188 pressure zone) were included in the plan because results from DBPs in the Nisqually Valley have been mostly below detection limits. This is probably because there is very short contact time with chlorine in this area compared to other parts of the city.

EPA guidance notes that system changes that could alter DBP formation could include: significantly changing or expanding conveyance, adding or removing sources, adding reservoirs or booster stations, and adding or changing treatment. As a growing water system, Lacey has been, and will continue to be, making significant changes to its system on an almost annual basis. For example, in the year after Lacey's IDSE Plan was submitted in March 2007, the Hawks Prairie Treatment Plant went online, the Hawks Prairie booster station was constructed, and the 380 zone was eliminated. Although some changes in DBP sample results were noticed in 2008 following these major changes, results remain well below the MCLs. In the next few years, Lacey also anticipates adding new source wells and constructing a corrosion control facility at Lacey source well 4 (S04). It will be important for Lacey to closely track DBP results from 2009 – 2012 to determine whether the Stage 2 monitoring plan needs to be revised prior to the start of the Stage 2 monitoring compliance period. New sample locations, if needed, will be located at areas where high TTHM or HAA5 formation is expected.

4.3 Monitoring Schedule

Lacey must collect DBP samples during July, which is the month identified as having peak historical water temperatures in the distribution system.

Furthermore, the monitoring schedule submitted in the IDSE Report requires more specific identification of the sample schedule than was required under Stage 1. As specified in the IDSE Report, quarterly samples will be collected during:

- Qtr 1. third week of January
- Qtr 2. third week of April
- Qtr 3. third week of July
- Qtr 4. third week of October

4.4 Determining Compliance under Stage 2

Whereas compliance under Stage 1 was determined from the running annual average of system-wide sample results, compliance under Stage 2 will be determined from the locational running annual average (LRAA) for each monitoring location. Lacey started tracking its locational running annual averages (LRAA) for TTHMs and HAA5 in w:\jrector\WQ Monitoring Programs and Forms\Stage2Calcs.xls. The LRAA is calculated as the running average of four quarters of data.

For calculating compliance with Stage 2, results that are below analytical detection limits will be entered as a zero. This is a departure from methods used for calculating compliance with Stage 1, but because results are so low, compliance will not be affected. An example of calculating LRAA is shown in Table 4.

Table 4. Example of Calculating LRAA

Sample Station SS01		
THMs µg/L	date	LRRA µg/L
3.4	07/26/2006	3.4
4.1	10/26/2006	3.8
3.5	01/29/2007	3.7
1.9	04/23/2007	3.2
1.9	07/23/2007	2.9
0.5	10/23/2007	2.0
1.5	03/13/2008	1.5
1.6	06/09/2008	1.4
4.3	08/27/2008	2.0
4.8	10/24/2008	3.1
6.8	01/12/2009	4.4
5.8	04/20/2009	5.4
2.7	07/15/2009	5.0
2.2	10/07/2009	4.4
3.2	01/13/2010	3.5
8.6	04/13/2010	4.2
3	07/21/2010	4.3
0.6	10/13/2010	3.9

4.5 Reporting and Public Notification Requirements under Stage 2

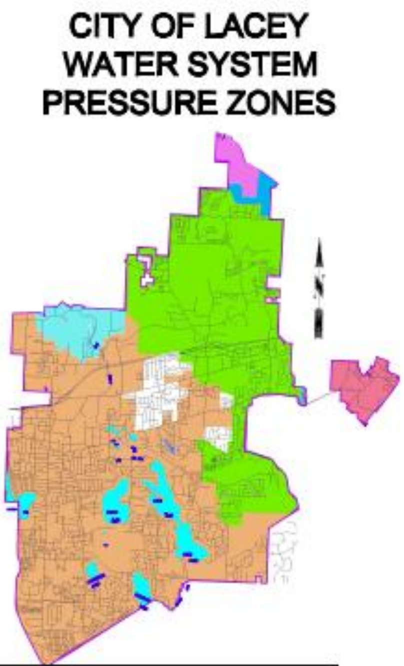
Reporting and Public Notification Requirements for Washington State will be specified when the Washington State Department of Health adopts the Stage 2 DPB Rule into WAC 246-290.

All Stage 2 results and MCL violations must be reported to the State within 10 days of the end of any quarter in which monitoring is required. It is anticipated that as with Stage 1, the Department will continue to perform calculations for determining compliance based on results submitted directly by the certified laboratory.

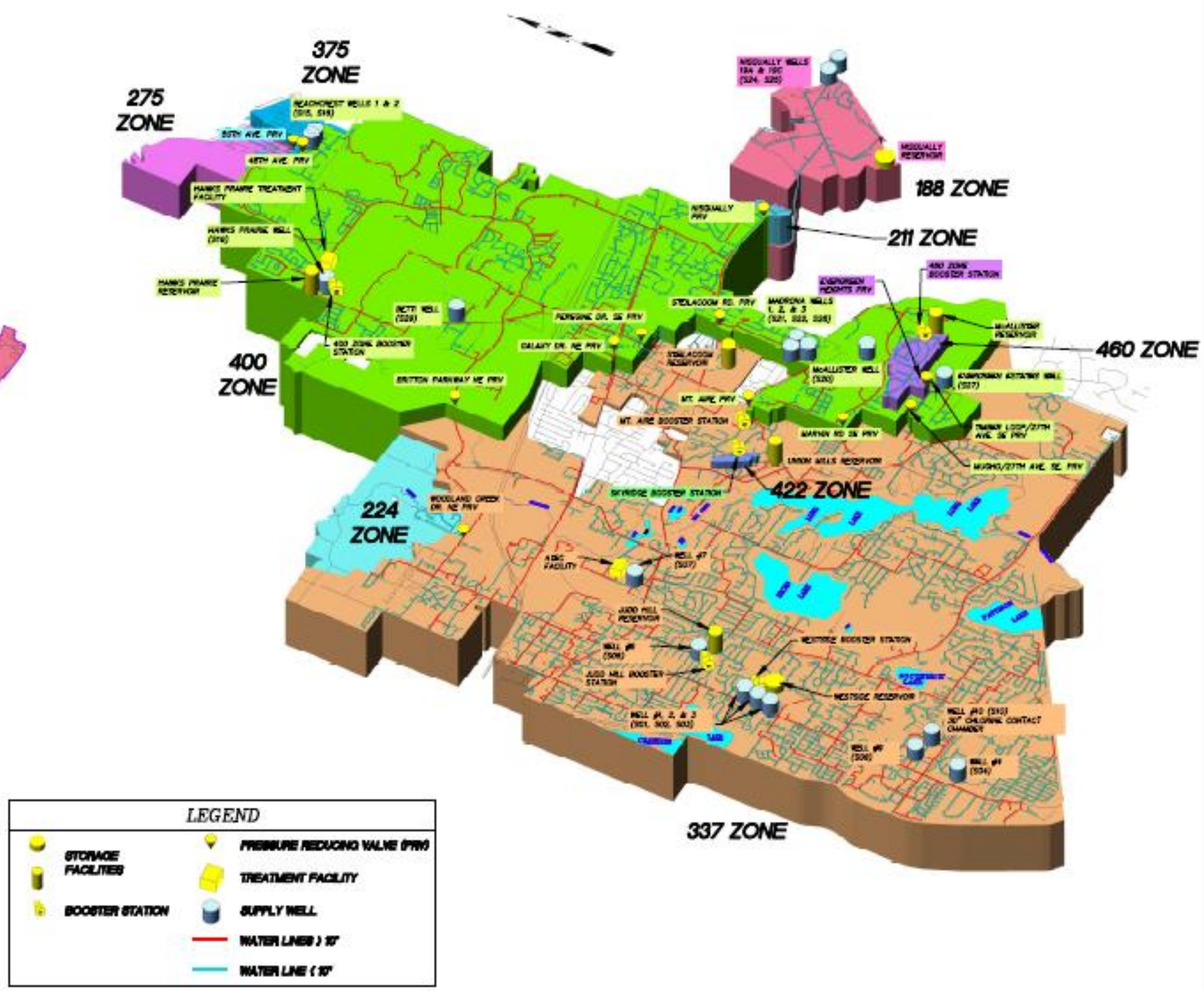
Reporting in the annual CCR must include any DBP contaminants that are detected. For Stage 2 EPA has incorporated minimum reporting level (MRL) requirements into the laboratory certification program for DBPs and these MRLs are the minimum concentrations that must be reported in the CCR. The CCR must also report the highest LRAA for TTHM and HAA5 and the range of individual sample results for all sampling points expressed in the same units as the MCL. If more than one site exceeds the MCL, the system must include the LRAA for all sites that exceed the MCL. In addition, Tier 3 public notification (e.g., public notification in the city’s annual CCR) would be required for any failure to monitor for TTHM or HAA5 in accordance with the schedule in the monitoring plan.

Appendices

Appendix 1. Lacey Water System Pressure Zones



FACILITY CAPACITY			
FACILITY	CAPACITY	FACILITY	#PUMPS/CAPACITY
WELL 1	300	MT. AIRE BPS	2 – 750 gpm
WELL 2	600	JUDD HILL BPS	1 – 1200 gpm
WELL 3	230	SKY RIDGE BPS	2 – 110 gpm
WELL 4	750	460 ZONE BPS	2 – 250 gpm
WELL 6	400	WEST SIDE BPS	1 – 700 gpm 3 – 1900 GPM
WELL 7	1800	400 ZONE BPS	VFD 2 – 850 gpm VFD 2 – 2000 gpm
WELL 9	650		
WELL 10	1000		
WELL 15	180	RESERVOIR	SIZE (MG)
WELL 16	170	JUDD HILL	0.50
WELL 19	750	STEILACOOM	3.00
WELL 20	580	UNION MILLS	2.20
WELL 21	1480	McALLISTER	1.20
WELL 22	1800	NISQUALLY	0.15
WELL 24	70	HAWKS PRAIRIE	4.00
WELL 25	230	WEST SIDE	2.00
WELL 27	700		
WELL 28	1800	ATEC	1700
WELL 29	1000	HPWFT	2000



Julie Rector

From: Grimm, Regina (DOH) [Regina.Grimm@DOH.WA.GOV]
Sent: Wednesday, November 07, 2007 9:31 AM
To: Julie Rector
Cc: Groeneveld, Katie (DOH)
Subject: Reduced Monitoring of Lacey Chlorine Residuals

Dear Julie,
I reviewed your letter dated October 1, 2007 requesting reduced monitoring and I believe that Lacey substantially meets the requirements for allowing reduced monitoring. I am sending this email to document my approval of reduced monitoring of Lacey WD's chlorine residuals. Lacey WD can reduce their monitoring of the distribution chlorine residuals to 5 days per week (weekdays).

If you have any questions or comments please contact me.

Sincerely,

Regina Grimm, P.E.
Regional Engineer, DOH Division of Environmental Health
Office of Drinking Water, Southwest Regional Office
Ph: 360-236-3035 Fax: 360-664-8058
Physical Address: 243 Israel Road Southeast, Tumwater
Mailing Address: PO Box 47823, Olympia 98504-7823
http://www.doh.wa.gov/ehp/dw/

Appendix 3. Chlorination Report Form

Chlorination Report Form

System Name: Lacey Water Department		**ID#:** 43500Y	**County:** Thurston
Mailing Address *(street)***:** PO Box 3400		**Month:**	
city, zip Lacey, WA 98509		**Source #** (i.e., S01, S02)**:** ALL	
Manager: Terry Cargil		**Source Name:** ALL	

Day	Sample Location	Total Cl ppm	Free Cl ppm	Initial
1	6708 33rd Ave SE			
2	5817 19th Ct SE			
3	5230 Hilton Ln NE			
4	4117 Campus Green Dr NE			
5	5230 Hilton Ln NE			
6	5423 22nd Ave NE			
7	5550 Komachin Loop			
8	15th & Sweetbriar Lp SE			
9	5550 Komachin Loop			
10	646 Memory Ct SE			
11	8304 Hawksridge Dr SE			
12	5817 19th Ct SE			
13	5230 Hilton Ln NE			
14	15th & Sweetbriar Lp SE			
15	2400 Judd St SE			
16	5550 Komachin Loop			
17	6708 33rd Ave SE			
18	5423 22nd Ave NE			
19	8304 Hawksridge Dr SE			
20	646 Memory Ct SE			
21	5817 19th Ct SE			
22	646 Memory Ct SE			
23	5550 Komachin Loop			
24	5230 Hilton Ln NE`			
25	9305 Fairhill Dr NE			
26	8930 Bedington Dr SE			
27	5550 Komachin Loop			
28	4117 Campus Green Dr NE			
29	8930 Bedington Dr SE			
30	Covington CT			
31	5817 19th Ct SE			

Approved by Certified Operator (signature)____

Keep copy for Records.
Send Report by the 10th of the following month to:

Washington State Department of Health
Southwest Drinking Water Operations
PO Box 47823
Olympia, WA 98504-7823

Appendix 4. Approval for Reduced DBP Monitoring

STATE OF WASHINGTON
DEPARTMENT OF HEALTH
SOUTHWEST DRINKING WATER REGIONAL OPERATIONS
PO Box 47823, Olympia, Washington 98504-7823
TDD Relay 1-800-833-6388

RECEIVED
JAN 03 2008
PUBLIC WORKS

December 27, 2007

Julie Rector
Lacey Water Department
420 College Street Southeast
Lacey, Washington 98509

Subject: Lacey Water Department Water System, ID #43500, Thurston County; D/DBP Monitoring Plan Review, ODW Project #07-0912

Dear Julie Rector:

The Office of Drinking Water (ODW) has completed the review of the Lacey Water Department's monitoring plan for Disinfectants/Disinfection Byproducts received September 5, 2007.

In accordance with the provisions of WAC 246-290, this document is **APPROVED**. The approval issued herein is based on conformance with current standards outlined in WAC 246-290, effective July 1, 2004. Future changes in the rules may be more stringent and require facility modifications or corrective action.

This project has been reviewed as a Group A water system project submittal in accordance with WAC 246-290.

In addition to the monitoring plan approval, Lacey Water Department's request for reduced DBP monitoring is approved. The reduced monitoring schedule is one sample (representing maximum residence time) per treatment plant per quarter.

Regulations establishing a schedule of fees for review of planning, engineering, and construction documents were adopted July 1, 2004 (WAC 246-290-990). An itemized invoice for $456 is enclosed.

Julie Rector
December 27, 2007
Page 2

If you have any questions, please contact me at (360) 236-3035.

Sincerely,

Regina Nicole Grimm

REGINA N. GRIMM, P.E.
Office of Drinking Water Regional Engineer

Enclosures

cc: Jim Goode, Thurston County Environmental Health
Katie Groeneveld, ODW

Appendix 5.

Technical Memorandum

FROM: Julie Rector, Water Quality Analyst, Lacey Water Resources

SUBJECT: **Determination of Lacey Wells that draw from a Single Aquifer**

DATE: August 15, 2007

This analysis is provided to determine the number of "treatment plants" for the purposes of disinfection byproduct monitoring. DBP sampling for sub-part H systems requires 4 samples per treatment plant per quarter. With 19 sources currently supplying the Lacey system, the rule would require collecting up to 76 samples per quarter. However, fewer samples may be collected if it can be shown that sources withdraw similar water quality that would not be expected to react differently to chlorine. Also, some distribution system monitoring sites may be counted for more than one source. Both of these approaches were used to reduce the required number of samples to 22 samples per quarter. This number meets the intent of the rule for protecting public health, while minimizing monitoring costs to the city. This monitoring plan costs the city approximately $33,000/year.

Lacey's monitoring requirements in its Disinfectant and Disinfection Byproduct Monitoring Plan is based on thirteen "treatment plants." This number was determined by grouping wells that capture water from the same aquifer and have similar water chemistry. As shown Table 1, Treatment Plants #2, 7, 8, and 11 are comprised of wells with similar water chemistry that would be expected to react similarly in the presence of chlorine. Each of these four treatment plants is discussed in this memorandum. Their locations are shown in Figure 1.

Background

The Lacey main water system is primarily supplied by 19 city-owned wells. Since May 2005 supply has also been supplemented by a year-round intertie with the City of Olympia, which is regulated as a surface water source with "a limited alternative to filtration." When City of Olympia water is used, the Lacey water system is regulated as a "sub-part H" system for disinfectants and disinfection byproducts.

Lacey has only been chlorinating its system on a permanent basis since May 2005. Chlorination was initiated to address recurring detections of total coliforms in the distribution system. Because source wells were not the sources of coliforms in the distribution system, the purpose of chlorination is to maintain a residual in the distribution system. Lacey's only source requiring disinfection is well 10 (S10), which has been meeting disinfection requirements since May 2007.

Prior to permanent chlorination, Lacey was not required to monitor for disinfection byproducts. However, prior to permanent chlorination DBP samples were collected when City of Olympia water was used on a temporary basis. These samples, and Stage 1 samples collected since May 2005, show that concentrations of disinfection byproducts are very low throughout the Lacey system. For the year July 2006 – July 2007, the running annual averages are 1.34 µg/L TTHM, and 0.45 µg/L HAA5.

Table 1. City of Lacey "Treatment Plants" for Disinfection Byproduct Monitoring

Treatment Plant #	Wells within each "Treatment Plant"	Aquifer	Depth of completed well (ft)	Depth to first screened interval (ft)
1	S01 Well 1	Qva	122 (108 msl)	100 (130 msl)
2	S02 Well 2 S03 Well 3	Qc	218 (14 msl) 226 (6 msl)	194 (38 msl) 187 (45 msl)
3	S04 Well 4	Qva	84 (134 msl)	66 (152 msl)
4	S06 Well 6C	Qc/TQu	385.2 (-150.2 msl)	190 (40 msl)
5	S07 Well 7	TQu	479 (-301 msl)	428 (-250 msl)
6	S09 Well 9	TQu	285 (-88 msl)	224 (-27 msl)
7	S20 McAllister S21 Madrona 1 S22 Madrona 2 S28 Madrona 3 S27 Evergreen Est.	Qc	213.5 (-38.5 msl) 329 (-75 msl) 333 (-74 msl) 334 (-75 msl) 282 (-24 msl)	180 (-5 msl) 263 (-9 msl) 265 (-6 msl) 259 (0 sml) 256 (2 msl)
8	S15 Beachcrest 1 S16 Beachcrest 2	Qva	140 (75 msl) 135 (80 msl)	115 (100 msl) 113 (102 msl)
9	S19 Hawks Prairie	TQu	667 (-372 msl)	585 (-290 msl)
10	S29 Betti	Qc	392 (-159 msl)	297 (-64 msl)
11	S24 Nisqually 19A S25 Nisqually 19C	MG	107 (-82 msl) 96 (-71 msl)	98 (-73 msl) 58 (-33 msl)
12	S10 Well 10	Qc	208 (-10 msl)	177 (21 msl)
13	S30 **Intertie: City of Olympia**	**(Surface water)**		

Description of Hydrogeology in the Lacey Area

A number of reports have summarized the hydrogeology of the Lacey area. The primary source of information is *Hydrology and Quality of Ground Water in Northern Thurston County, Washington* (Drost et al., 1998). Additional information about the McAllister Gravels has been reported by AGI Technologies (1999) and CDM (2002).

Most of the Lacey area is part of a broad, rolling outwash plain that ranges in elevation between 220 and 300 feet above mean sea level (msl) that is mantled by Vashon recessional (Qvr) outwash ranging in thickness from 25 to 75 feet. Vashon Glacial Till (Qvt) deposits occur below the Qvr, and consist of variably compact sand and gravel in a mix of silt and clay. This is generally a confining layer, with the compacted nature of the till resulting from overburden pressure of the Vashon glacier. The thickness of the Qvr layer is variable, being absent in some areas and being up to 100 feet thick on the eastern end of the plain that terminates at the McAllister Valley. In the tri-lakes area west of Long Lake and between Hicks and Southwick lakes, the till layer is absent and consequently the Qvr layer in these areas is mostly unconfined and unsaturated. The till layer is exposed west of McAllister Springs and north of Lacey on the Johnson Point peninsula.

The Vashon Advance (Qva) outwash occurs below Qvt, or below Qvr where the till is absent, and is generally 50 to 75 feet thick, although the layer is relatively thin or absent immediately west of McAllister Springs. The saturated portions of the Qva comprise one of the principal aquifer systems in the area, and the aquifer is typically confined except when windows in the Qvt, or the thickness of the Qva deposits, result in unconfined conditions. The Qva becomes unsaturated near Puget Sound, and along McAllister Valley and the Woodland Creek valley. Lacey wells S01, S04, S15, and S16 are completed in the Qa aquifer.

The Kitsap formation (Qf) occurs below the Qva, and is generally less than 100 feet thick. The Qf is thin, between 20 and 55 feet thick, and consists of an assemblage of fine-grained clay and silt with minor sand, gravel, peat, and wood. These sediments were deposited in shallow lakes and wetlands during an interglacial period. The deposits are laterally extensive and act as a confining unit throughout much of the Lacey area, although there is one major window beneath the tri-lakes area.

Below the Qf are the Sea Level glacial (Qc) deposits. The Qc unit ranges in thickness from 25 to 75 feet, and consists of coarse sand and gravel deposited by glacial meltwater. The Qc aquifer is the most prolific aquifer in north Thurston County. The Qc aquifer is generally confined by overlying Qf deposits and underlying low permeability undifferentiated deposits, although the Qf may be absent or relatively permeable in places. The unit is recharged by downward flow from overlying aquifers (where present) and by direct infiltration of rainfall elsewhere. The highest fluxes of downward flow are likely to occur where the Qf is absent or permeable. Lacey wells S02, S03, S10, S20, S21, S22, S27, S28, and S29 are drilled entirely in the Qc aquifer. Well S06 is drilled partially in this aquifer.

Below the Qc are undifferentiated deposits (TQu). The unit is found throughout the area and consists of all glacial and non-glacial sediments below the Qc unit from a depth of about -50 feet to locally deeper than -550 feet msl. The unit consists of sand and gravel with interbedded clay and silt, and minor peat, wood, and volcanic ash. The unit is a layered sequence of water-bearing zones and confining layers. Groundwater in the TQu aquifers is typically confined by overlying and underlying silt and/or clay layers. The lateral extent and thickness of the TQu is uncertain due to the relatively few wells constructed in the TQu aquifer. AGI (1999) concluded because the TQu discharges seaward in the vicinity of the Sea Level Aquifer System, this flow should act as a barrier to seawater intrusion for withdrawals from Lacey's Madrona wellfield. Lacey wells S07, S09, and S19 are all completed in the TQu aquifer. Well S06 is drilled partially in this aquifer.

To the east of the Lacey upland area are the McAllister and Nisqually Valleys, which converge just south of the Nisqually Delta. The valley floor of the McAllister Valley lies between sea level and 10 feet elevation, and the

Nisqually Valley ranges in elevation from 10 to 80 above msl. The McAllister Valley is mostly mantled by poorly drained alluvium, although the wetlands of the upper valley are mantled by organic depression fill.

Within the McAllister Valley is a thick (up to 400 feet) layer of McAllister Gravel (MG), which consists of pebble- and boulder-sized sediments that were deposited as channel fill from the ancestral Nisqually River. The channels were cut after the Kitsap formation was deposited. The unit extends below McAllister Springs to at least 250 feet below sea level, is very narrow, and continues beneath the kame and kettle landscape to the Nisqually River delta, where it joins the Nisqually Valley aquifer system. The MG aquifer occurs in the saturated portions of the MG deposits in the McAllister Valley, and is considered to be unconfined with local low permeability zones of silt and clay. McAllister Springs is a natural discharge point for the unit, and the springs provide the principal source of water supply for the city of Olympia. The MG aquifer is recharged by infiltration of rainfall at the land surface, and receives lateral flow from the Qc aquifer and possibly from the Qva aquifer. The aquifer is in hydrologic contact with the Qvr, Qva, Qc, and TQu aquifers. Lacey wells S24 and S25 are completed in the MG aquifer.

Discussion of Treatment Plants #2, #7, #8, and #11

Treatment Plant #2

Treatment Plant #2 consists of Lacey wells S02 and S03, which are regulated as a wellfield that is identified as S18 by the Washington State Department of Health. These wells are located approximately 250 feet apart on a fenced-in land parcel that includes three City of Lacey wells, a reservoir, and a chlorine generation/chlorination facility. Except for these facilities, the parcel is forested. Adjacent land use is residential to the south, west, and east. There is a middle school on the property south of the wellfield.

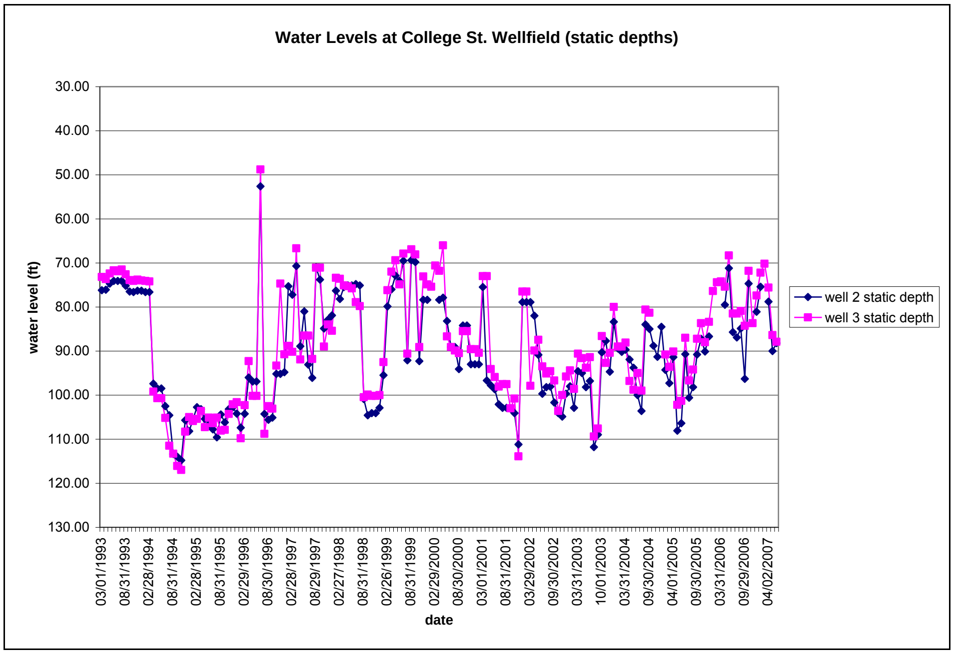
A hydrogeologic profile (Attachment A) shows that both wells are fully screened through the Qc aquifer. The wells are completed at 14 ft and 6 ft (msl), and the depths to the first screened intervals are 38 ft and 45 ft (msl). As would be expected given their proximities and similar depths, water quality at both wells is very similar, as shown below.

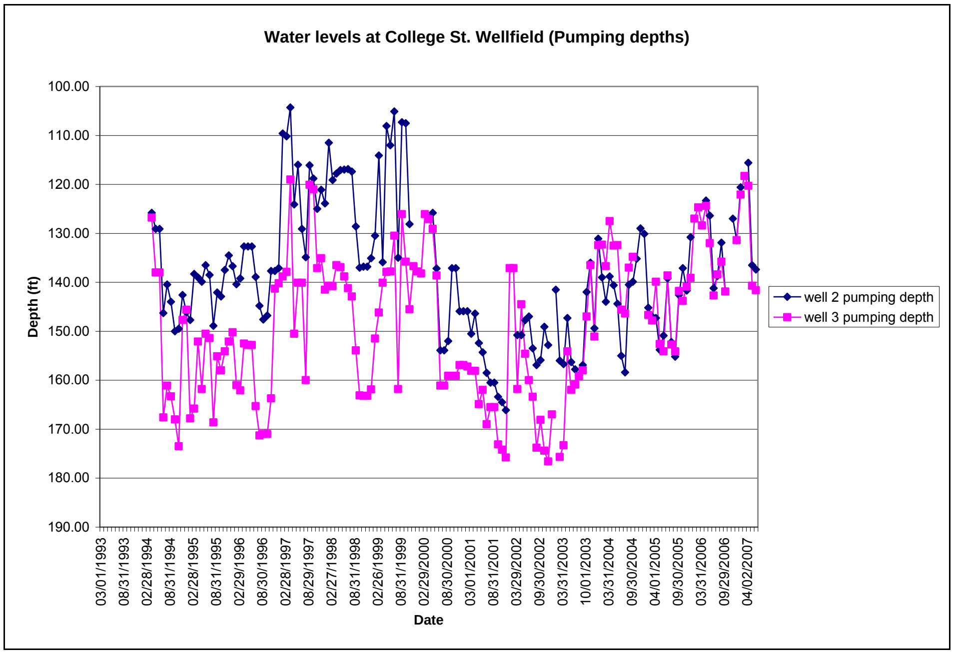
well	Temperature (°C)	pH	Conductance (µmhos/cm)	Fe (mg/L)	Mn (mg/L)	Alkalinity (mg/L $CaCO_3$)	Chloride (mg/L)
S02	9.6 – 10.7	6.6 – 7.1	165	<0.03	<0.01	59 - 62	3 - 5
S03	9.6 – 10.8	6.5 – 7.0	154 – 163	<0.03	<0.01	60	3 - 5

Jar tests completed for wells S02 and S03, completed just prior to Lacey initiating system chlorination, showed that 95-hour chlorine demand at each well was 0.16 mg/L (Gray and Osborn, 2004). Furthermore, all results for THM and HAA5 samples collected within the area served by these wells are very low, and most are below the analytical detection limits. The highest DBPs detected in this area of the water system was 3.1 µg/L total THMs, and 1.3 µg/L HAA5.

As shown in these figures, water levels are also very similar, especially after the wells were rehabilitated in 1997 (S03) and 1999 (S02).

In aggregate, the water quality and water level data indicate that these wells pump from the same aquifer, and that water samples from these wells react similarly in the presence of chlorine.





Treatment Plant #7

Treatment Plant #7 consists of Lacey wells S20, S21, S22, S28, and S27.

Sources S21, S22, and S28 are in Lacey's Madrona wellfield. Wells S21 and S22 are located approximately 30 feet from each other, and well S28 is located approximately 60 feet from well S22. Washington State Department of Health regulates S21 and S22 as wellfield source S23, but S28 is not included because it has a separate conveyance to the distribution system. McAllister Well S20 is located approximately 2,600 feet south of the Madrona wellfield. Evergreen Estates well S27 is located approximately 3,200 feet south of S20.

All five wells are completed in the Qc aquifer, with completed depths ranging from -25 to -75 ft (msl). Depths to the first screened interval range from 0 to -5 ft (msl). As shown in the hydrogeologic profile in Attachment B, all five wells capture water from approximately the same depths within the Qc aquifer. In this portion of the East Lacey aquifer, the direction of groundwater flow is to the east – northeast.

Land use around all five wells is predominately residential, although there are large tracts of undeveloped land adjacent to S20 and S27. Residences near S20 and the Madrona wellfield (wells S21, S22, and S28) are connected to sewer. Residences surrounding S27 use septic systems.

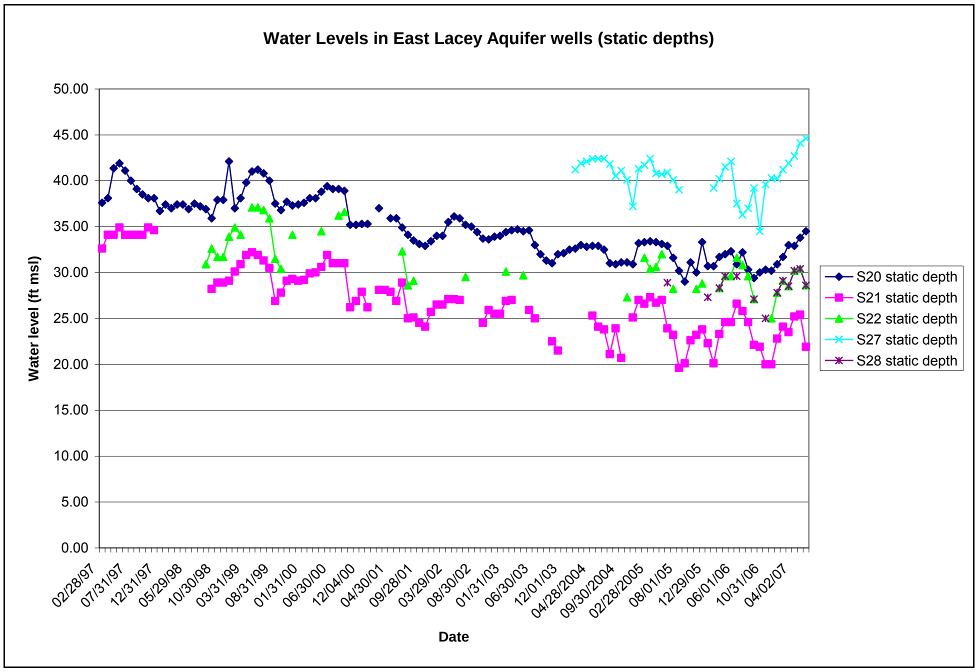
The water quality at all five wells is very good, and these wells produce some of the highest-quality water for the Lacey water system. Nitrate concentrations in this vicinity of the Qc aquifer are elevated in comparison to other city of Lacey wells completed in the Qc aquifer, indicating similar response to historic loading and surrounding land use. Data for water chemistry indicator parameters are shown below.

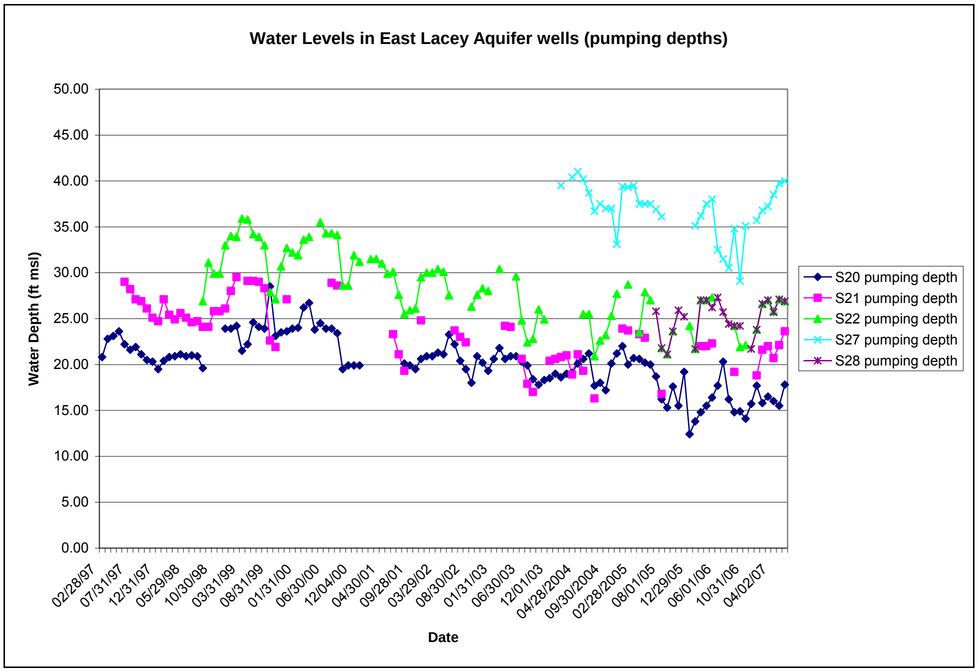
well	Temperature (°C)	pH	Conductance (μmhos/cm)	Fe (mg/L)	Mn (mg/L)	Alkalinity (mg/L CaCO3)	Chloride (mg/L)	Nitrate (mg/L)
S20	10.6 – 11.6	6.8 – 7.3	178	<0.03	<0.01	54	5	2.3 - 2.7
S21	10.1 – 11.4	6.8 – 7.2	170	<0.03	<0.01	54	5	2.2 – 3.5
S22	10.3 – 11.0	6.8 – 7.1	165	<0.03	<0.01	--	4	2.2 – 2.9
S28	10.3 – 11.5	6.9 – 7.2	163	<0.03	<0.01	55	5	2.4 - 3.8
S27	10.5 – 11.3	6.9 – 7.3	180	<0.03	<0.01	55	4 - 5	2.6 - 3.1

Jar tests completed for the wells, completed just prior to Lacey initiating system chlorination, showed that 24-hour chlorine demand at the wells ranges from 0.08 – 0.14 mg/L (Gray and Osborn, 2004; City of Lacey 2005). Furthermore, all results for THM and HAA5 samples collected within the area served by these wells are very low, and most are below the analytical detection limits. The highest DBPs detected in this area of the water system was 4.7 μg/L total THMs, and 1.0 μg/L HAA5.

Water levels at all five wells respond similarly to changes in recharge and pumping in the aquifer (see figures, below). Even though Lacey's use of these five wells has increased the amount of water produced annually from the aquifer from 2003 – 2007, water levels at each well have remained relatively stable. The decrease in water levels from 2001 – 2003, when only S20, S21, SS22 were online, was due to reduced recharge from drought conditions in the region. The relationship between recharge and aquifer levels in this area of the Qc aquifer was reported in the construction report for S28, *Hydrogeologic Evaluation of Lacey Production Well 23 at Madrona Park* (Pacific Groundwater Group 2002). According to this report, water levels in several monitoring wells in the Qc aquifer in the area east of Lacey were more responsive to changes in precipitation patterns than pumping (PGG 2002).

In aggregate, the water quality and water level data indicate that these wells pump from the same aquifer, and that water samples from these wells react similarly in the presence of chlorine.





Treatment Plant #8

Treatment Plant #8 consists of Lacey wells S15 and S16. These wells are located approximately 90 feet from each other within a fenced area of a city-owned land parcel. The wells are regulated as a wellfield that is identified as S17 by the Washington State Department of Health.

A hydrogeologic profile (Attachment C) shows that the wells are both screened in the Qa aquifer. The wells are completed at 75 ft and 80 ft (msl), and the depths to the first screened intervals are 100 ft and 102 ft (msl).

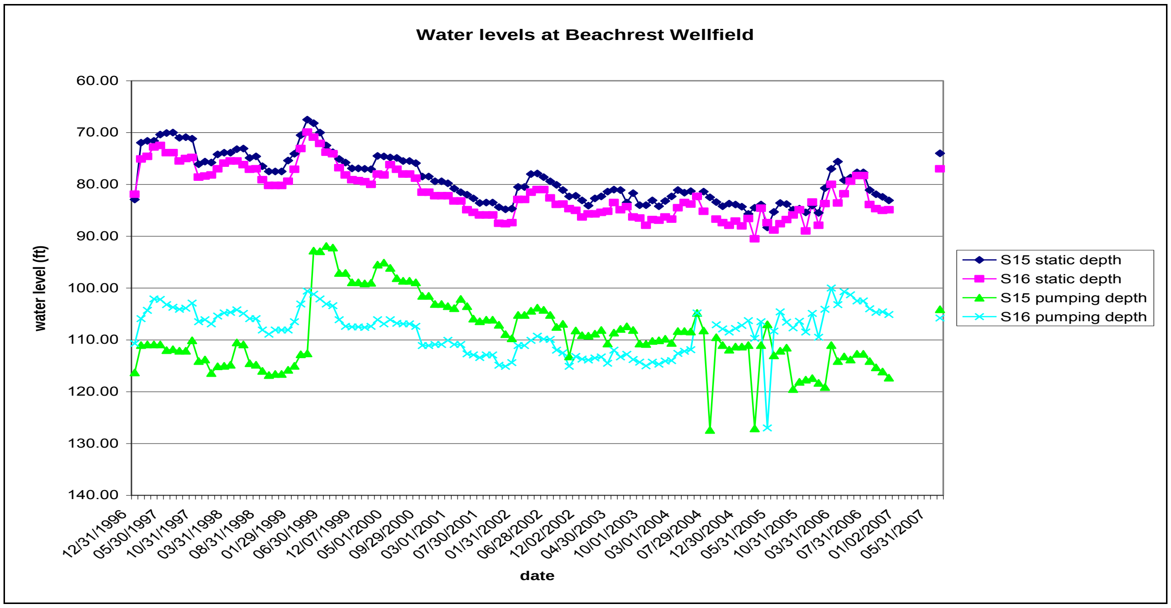
As would be expected given their proximities and similar depths, water quality at both wells is very similar, as shown below.

well	Temperature (°C)	pH	Conductance (μmhos/cm)	Fe (mg/L)	Mn (mg/L)	Alkalinity (mg/L CaCO3)	Chloride (mg/L)
S15	10.3 – 11.1	6.9 – 7.2	200	<0.03	<0.01	73	4 - 7
S16	10.3 – 11.2	6.7 – 7.1	240	<0.03	<0.01	76	5 - 8

Jar tests completed for the wells, completed just prior to Lacey initiating system chlorination, showed that 24-hour chlorine demand was 0.19 mg/L at S15, and was 0.29 mg/L at S16 (City of Lacey 2005). Furthermore, all results for THM and HAA5 samples collected within the area served by these wells are very low, although they generally are higher than in areas served by other Lacey sources. The highest DBPs detected in this area of the water system was 13.9 μg/L total THMs, and 4.4 μg/L HAA5.

Water levels are also very similar, as illustrated in this figure of static and pumping water levels.

In aggregate, the water quality and water level data indicate that these wells pump from the same aquifer, and that water samples from these wells react similarly in the presence of chlorine.



Treatment Plant #11

Treatment Plant #11 consists of Lacey wells S24 and S25. These wells are located within 20 feet of each other in a fenced-in parcel owned by the city of Lacey. Land use in the immediate vicinity of the wells is rural residential, although there is active agricultural use in the Nisqually value in areas to the west and to the south of the wells.

The wells are completed at -87 ft and -59 ft (msl), and depths to the first screened intervals are at -78 ft and -38 ft (msl). The well logs are in Attachment D. The well log for well S24 is for a deepened well; the original well was drilled by a different owner, and is not available. Both wells withdraw water from the McAllister Gravels unit. As noted in the hydrogeology summary, the McAllister Gravels are in hydrologic contact with the Qvr, Qva, Qc, and TQu aquifers.

Water quality for both wells is very similar, as shown below.

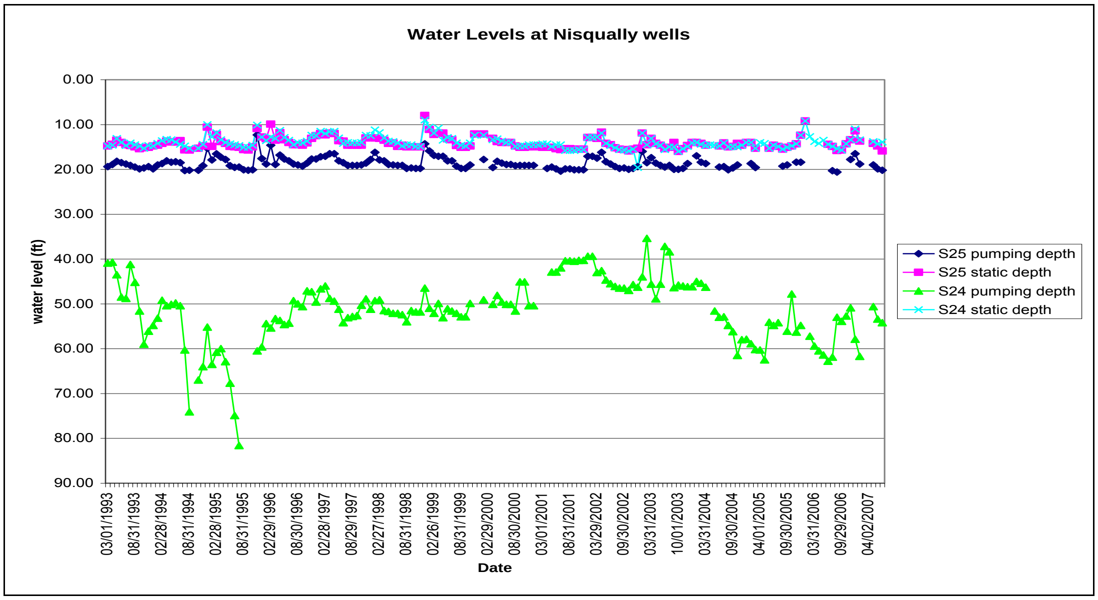
well	Temperature (°C)	pH	Conductance (μmhos/cm)	Fe (mg/L)	Mn (mg/L)	Hardness (mg/L CaCO3)	Chloride (mg/L)	TDS (mg/L)
S24	10.6 – 11.6	6.9 – 7.4	120	<0.03	<0.01	40 - 60	3 - 5	61.3

S25	10.7 – 11.5	6.6 – 7.3	119	<0.03	<0.01	40 - 62	3 - 5	59.4

Jar tests completed for the wells, completed just prior to Lacey initiating system chlorination, showed that 24-hour chlorine demand was 0.13 mg/L at S24, and was 0.18 mg/L at S25 (City of Lacey 2005). Furthermore, all results for THM and HAA5 samples collected within the area served by these wells are very low, with most below the analytical detection limits. The highest DBPs detected in this area of the water system was 3.7 µg/L total THMs. All results for HAA5 samples have been below the analytical detection limits.

Static water levels are also very similar, as illustrated in this figure of static and pumping water levels. The difference in pumping levels is due to the age and construction of S24.

In aggregate, the water quality and water level data indicate that these wells pump from the same aquifer, and that water samples from these wells react similarly in the presence of chlorine.



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CDM, 2002. Interim Report, Model Construction and Steady-State Calibration, McAllister Wellfield Numerical Model. Prepared for the City of Olympia Public Works Department. April 2002.

Drost, B.W., G.L. turney, N.P. Dion, and M.A. Jones. 1998. Hydrology and Quality of Ground Water in Northern Thurston County, Washington. U.S. Geological Survey Water-Resources Investigations Report 92-4109 (Revised).

Gray and Osborn, Inc., 2004. City of Lacey Disinfection Pre-design Report. November 2004.

Pacific Groundwater Group, 2002. Hydrogeologic Evaluation of Lacey Production Well 23 at Madrona Park. January 29, 2002.

Attachment A. Hydrogeologic Profile and Well Logs for S02 and S03

Attachment B. Hydrogeologic Profile and Well Logs for S20, S21,, S22, S28, and S27

Attachment C. Hydrogeologic Profile and Well Logs for S15 and S16

Attachment D. Well Logs for S24 and S25

Appendix 6. DBP Monitoring Field Form.

Reduced Monitoring Approved 12/27/07
Total TTHM/HAA5s

Samples to be collected January, April, July, and October

Sources in the 13 “Treatment Plants”

Sources	S01	S18	S04	S06	S07	S09	S10	S17	S19	S20	S23	S24	S25	S27	S29	Oly
On/off																

Comments____

Total THM/HAA5 Samples

Site	Date	Time	Total Cl-	Free Cl-
SS01				
SS68				
SS90				
SS105				
SS19				
SS36				
SS20				
SS55				
SS91				
SS07				
SS24				
SS11				

IDSE Plan / System Specific Study
(Submitted to EPA 03/28/07)

And

Approval Letter from EPA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

Julie Rector
1200 College Street
Lacey, WA 98503

PWSID: WA5343500

RE: Stage 2 Disinfectants and Disinfection Byproduct Rule (Stage 2 DBPR)
Approval of System Specific Study Plan using Existing Data

Dear Ms. Rector:

This letter is to provide confirmation that the System Specific Study using existing data for the City of Lacey has been approved.

According to the submitted plan, the City of Lacey should have completed all additional monitoring to meet the minimum number of monitoring sites and samples required for the System Specific Study by October 2007.

The next requirement for compliance is to submit an IDSE report, which is due no later than July 1, 2009. This report should contain the remaining monitoring data for your system specific study, as well as recommendations and justifications for the City of Lacey's Stage 2 DBPR compliance monitoring locations and the proposed Stage 2 DBPR compliance monitoring schedule.

If you have questions regarding this letter, please contact us by sending an email to stage2mdbp@epa.gov. For more information regarding this rule and the IDSE report that you are required to submit by July 1, 2009 visit the Stage 2 DBPR website at www.epa.gov/safewater/disinfection/stage2.

Form 2: Existing Monitoring Results SSS Plan
Page 1 of 18

I. GENERAL INFORMATION

A. PWS Information

PWSID: 43500 Y or WA5343500

PWS Name: City of Lacey

PWS Address: 1200 College St

City: Lacey State: WA Zip:98503

Population Served: 60,853

B. Date Submitted

March 28, 2007

System Type:	Source Water Type:	Buying / Selling Relationships:
_X_ CWS	_X_ Subpart H	_X_ Consecutive System
___ NTNCWS	___ Ground	___ Wholesale System
		___ Neither

C. PWS Operations

Residual Disinfectant Type: _X_ Chlorine ___ Chloramines ___ Other

Number of Disinfected Sources: 1 Surface 0 GWUD 20 Ground 2 Purchased

The City of Lacey provides groundwater through 19 wells. The City also purchases surface water through an intertie from the City of Olympia on an intermittent basis, and is therefore considered a Subpart H system. The City also purchases water through an intertie (S26) with a ground water system.

D. Contact Person

Name: Julie Rector

Title: Water Quality Analyst

Phone #: 360-493-2410 Fax #:360-456-7799

E-mail: jrector@ci.lacey.wa.us

II. SSS REQUIREMENTS

A. Minimum Number of Monitoring Locations 24

B. Minimum Number of Required Samples

144 TTHM 144 HAA5

C. IDSE Schedule

___ Schedule 1 _X_ Schedule 2 ___ Schedule 3 ___ Schedule 4

Form 2: Existing Monitoring Results SSS Plan

III. PEAK HISTORICAL MONTH

A. Peak Historical Month July

B. If Multiple Sources, Source Used to Determine Peak Historical Month (write "N/A" if only one source in your system) Blended groundwater and surface water temperature data from coliform sites in the distribution system.

C. Peak Historical Month Based On (check as many as needed)

__High TTHM   __ High HAA5   _x_ Warmest Water temperature

If you used other information to select your peak historical month, explain here
(attach additional sheets if needed)

See Attachment A.

IV. PREVIOUSLY COLLECTED MONITORING RESULTS

A. Where were your TTHM and HAA5 samples analyzed?

__ In-House

Is your in-house laboratory certified?   __Yes
__ No

X Certified Laboratory

Name of certified laboratory: Water Management Laboratories (Tacoma, WA)

B. What method(s) was used to analyze your TTHM and HAA5 samples?

TTHM	HAA5
__ EPA 502.2	__ EPA 552.1
X EPA 524.2	X EPA 552.2
__ EPA 551.1	__ EPA 552.3
	__ SM 6251 B

Form 2: Existing Monitoring Results SSS

IV. PREVIOUSLY COLLECTED MONITORING RESULTS

C: TTHM Results

Site ID[1]	12-Month Period	Data Qualifies (yes/no)	Data Type	TTHM (ug/L)				LRAA
SS01	Jan – Dec 2004	No	Sample Date	8/25/04				
			Sample Result	0				0
	Jan – Dec 2006	Yes	Sample Date	7/26/06	10/26/06			
			Sample Result	3.4	4.1			3.8
	Jan – Dec 2007	Yes	Sample Date	1/29/07				
			Sample Result	3.5				3.5
SS05	Jan – Dec 2004	No	Sample Date	8/24/04				
			Sample Result	0				0
	Jan – Dec 2005	No	Sample Date	7/14/05				
			Sample Result	1.9				1.9
	Jan – Dec 2006	Yes	Sample Date	5/01/06	7/26/06	10/30/06		
			Sample Result	0	3.8	0		1.3
	Jan – Dec 2007	Yes	Sample Date	1/29/07				
			Sample Result	0				0
SS07	Jan – Dec 2004	No	Sample Date	08/24/2004	12/16/2004			
			Sample Result	0	0			0
	Jan – Dec 2006	Yes	Sample Date	05/01/2006	07/26/2006	10/30/2006		
			Sample Result	0	0	0		0
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	0				0
SS100	Jan – Dec 2004	No	Sample Date	08/24/2004	12/16/2004			
			Sample Result	1.7	1.7			1.7
	Jan – Dec 2005	No	Sample Date	07/14/2005				
			Sample Result	0				0
	Jan – Dec 2006	Yes	Sample Date	05/01/2006				
			Sample Result	2.7				2.7

[1] *Verify that site IDs match the site IDs on your distribution system schematic.*

Notes: Qualifying data begins January 2006 because the City of Lacey added a new disinfected well - S29 - in August 2005. As required, all DBP results are shown, although 2004 and 2005 results are clearly identified as 'not qualified.'

TTHM and HAA levels of 0= Non-detect (ND);

Form 2: Existing Monitoring Results SSS

IV. PREVIOUSLY COLLECTED MONITORING RESULTS

C: TTHM Results

Site ID[1]	12-Month Period	Data Qualifies (yes/no)	Data Type	TTHM (ug/L)				LRAA
SS105	Jan – Dec 2006	Yes	Sample Date	07/26/2006	10/26/2006			
			Sample Result	9.2	3.6			6.4
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	0				0
SS11	Jan – Dec 2006	Yes	Sample Date	07/26/2006	10/31/2006			
			Sample Result	2.5	0			1.3
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	1.9				1.9
SS19	Jan – Dec 2005	No	Sample Date	07/14/2005				
			Sample Result	2.9				2.9
	Jan – Dec 2006	Yes	Sample Date	07/26/2006	10/26/2006			
			Sample Result	13.9	12.3			13.1
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	10.9				10.9
SS20	Jan – Dec 2005	No	Sample Date	07/14/2005				
			Sample Result	5.6				5.6
	Jan – Dec 2006	Yes	Sample Date	05/01/2006	07/26/2006	10/26/2006		
			Sample Result	0	1.1	0		0.4
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	5.3				5.3
SS21	Jan – Dec 2004	No	Sample Date	08/24/2004	12/16/2004			
			Sample Result	0	0			0
	Jan – Dec 2005	No	Sample Date	07/18/2005				
			Sample Result	0				0
	Jan – Dec 2006	Yes	Sample Date	05/01/2006	07/26/2006	10/30/2006		
			Sample Result	0	0	0		0
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	0				

Notes: Qualifying data begins January 2006 because the City of Lacey added a new disinfected well - S29 - in August 2005. As required, all DBP results are shown, although 2004 and 2005 results are clearly identified as 'not qualified.'
TTHM and HAA levels of 0= Non-detect (ND);

Form 2: Existing Monitoring Results SSS

IV. PREVIOUSLY COLLECTED MONITORING RESULTS

C: TTHM Results

Site ID[1]	12-Month Period	Data Qualifies (yes/no)	Data Type	TTHM (ug/L)				LRAA
SS24	Jan – Dec 2004	No	Sample Date	08/24/2004	12/16/2004			
			Sample Result	0	0			0
	Jan – Dec 2006	Yes	Sample Date	05/01/2006	07/26/2006	10/30/2006		
			Sample Result	2.7	0.5	0		1.1
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	0				0
SS25	Jan – Dec 2006	Yes	Sample Date	07/26/2006	10/30/2006			
			Sample Result	0	1.7			0.9
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	0				0
SS28	Jan – Dec 2004	No	Sample Date	08/25/2004				
			Sample Result	0.6				0.6
	Jan – Dec 2006	Yes	Sample Date	05/01/2006				
			Sample Result	0				0
SS32	Jan – Dec 2005	No	Sample Date	07/18/2005				
			Sample Result	0				0
SS36	Jan – Dec 2005	No	Sample Date	07/14/2005				
			Sample Result	0				0
	Jan – Dec 2006	Yes	Sample Date	07/26/2006	10/26/2006			
			Sample Result	1.3	0			0.7
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	4.7				4.7
SS39	Jan – Dec 2006	Yes	Sample Date	07/26/2006	10/30/2006			
			Sample Result	0	3.1			1.6
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	0.5				0.5

[1] Verify that site IDs match the site IDs on your distribution system schematic.
Notes: Qualifying data begins January 2006 because the City of Lacey added a new disinfected well - S29 - in August 2005. As required, all DBP results are shown, although 2004 and 2005 results are clearly identified as 'not qualified.'
TTHM and HAA levels of 0= Non-detect (ND);

Form 2: Existing Monitoring Results SSS

IV. PREVIOUSLY COLLECTED MONITORING RESULTS

C: TTHM Results

Site ID[1]	12-Month Period	Data Qualifies (yes/no)	Data Type	TTHM (ug/L)				LRAA
SS42	Jan – Dec 2004	No	Sample Date	08/24/2004	12/16/2004			
			Sample Result	0	0			0
	Jan – Dec 2005	No	Sample Date	07/18/2005				
			Sample Result	0				0
	Jan – Dec 2006	Yes	Sample Date	05/01/2006	07/26/2006	10/30/2006		
			Sample Result	0	0	0.6		0.2
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	0.7				0.7
SS46	Jan – Dec 2006	Yes	Sample Date	05/01/2006	07/26/2006	10/26/2006		
			Sample Result	2.6	0.5	2.7		1.9
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	2.2				2.2
SS47	Jan – Dec 2004	No	Sample Date	08/25/2004				
			Sample Result	0.5				0.5
	Jan – Dec 2006	Yes	Sample Date	07/26/2006	10/30/2006			
			Sample Result	0.5	0			0.3
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	0				0
SS48	Jan – Dec 2004	No	Sample Date	08/24/2004	12/16/2004			
			Sample Result	0	0			0
SS54	Jan – Dec 2005	No	Sample Date	07/14/2005				
			Sample Result	0				0
	Jan – Dec 2006	Yes	Sample Date	05/01/2006	07/26/2006	10/26/2006		
			Sample Result	0	2.6	0.7		1.1
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	0				0
SS55	Jan – Dec 2006	Yes	Sample Date	07/26/2006	10/30/2006			
			Sample Result	3.7	0			1.9

Notes: Qualifying data begins January 2006 because the City of Lacey added a new disinfected well - S29 - in August 2005. As required, all DBP results are shown, although 2004 and 2005 results are clearly identified as 'not qualified.'
TTHM and HAA levels of 0= Non-detect (ND);

Form 2: Existing Monitoring Results SSS

IV. PREVIOUSLY COLLECTED MONITORING RESULTS

C: TTHM Results

Site ID[1]	12-Month Period	Data Qualifies (yes/no)	Data Type	TTHM (ug/L)				LRAA
Cont… SS55	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	0				0
SS60	Jan – Dec 2004	No	Sample Date	08/25/2004				
			Sample Result	0				0
SS62	Jan – Dec 2005	No	Sample Date	07/18/2005				
			Sample Result	0				0
SS66	Jan – Dec 2005	No	Sample Date	07/18/2005				
			Sample Result	0				0
SS67	Jan – Dec 2004	No	Sample Date	08/24/2004				
			Sample Result	0				0
SS68	Jan – Dec 2006	Yes	Sample Date	05/01/2006	07/26/2006	10/26/2006		
			Sample Result	3.9	4.1	2.1		3.4
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	1.6				1.6
SS69	Jan – Dec 2004	No	Sample Date	08/25/2004				
			Sample Result	0.5				0.5
	Jan – Dec 2006	Yes	Sample Date	05/01/2006	07/26/2006	10/30/2006		
			Sample Result	0	1.5	0		0.5
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	0				0
SS90	Jan – Dec 2004	No	Sample Date	08/24/2004	12/16/2004			
			Sample Result	3.2	3.8			3.5
	Jan – Dec 2005	No	Sample Date	07/14/2005				
			Sample Result	0				0
	Jan – Dec 2006	Yes	Sample Date	05/01/2006	07/26/2006	10/26/2006		
			Sample Result	5.2	6.5	3.6		5.1

[1] Verify that site IDs match the site IDs on your distribution system schematic.
Notes: Qualifying data begins January 2006 because the City of Lacey added a new disinfected well - S29 - in August 2005. As required, all DBP results are shown, although 2004 and 2005 results are clearly identified as 'not qualified.'
TTHM and HAA levels of 0= Non-detect (ND);

Form 2: Existing Monitoring Results SSS

IV. PREVIOUSLY COLLECTED MONITORING RESULTS

C: TTHM Results

Site ID[1]	12-Month Period	Data Qualifies (yes/no)	Data Type	TTHM (ug/L)				LRAA
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	3.7				3.7
SS91	Jan – Dec 2004	No	Sample Date	08/24/2004				
			Sample Result	0				0
	Jan – Dec 2006	Yes	Sample Date	07/26/2006	10/30/2006			
			Sample Result	1.6	0			0.8
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	0				0
SS94	Jan – Dec 2006	Yes	Sample Date	07/26/2006	10/30/2006			
			Sample Result	1.9	1.4			1.7
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	0				0

[1] Verify that site IDs match the site IDs on your distribution system schematic.
Notes: Qualifying data begins January 2006 because the City of Lacey added a new disinfected well - S29 - in August 2005. As required, all DBP results are shown, although 2004 and 2005 results are clearly identified as 'not qualified.'
TTHM and HAA levels of 0= Non-detect (ND);

Form 2: Existing Monitoring Results SSS

IV. PREVIOUSLY COLLECTED MONITORING RESULTS

C: HAA5 Results

Site ID[1]	12-Month Period	Data Qualifies (yes/no)	Data Type	HAA5 (ug/L)				LRAA
SS01	Jan – Dec 2004	No	Sample Date	8/25/04				
			Sample Result	0				0
	Jan – Dec 2006	Yes	Sample Date	7/26/06	10/26/06			
			Sample Result	0.5	0.7			0.6
	Jan – Dec 2007	Yes	Sample Date	1/29/07				
			Sample Result	0.5				0.5
SS05	Jan – Dec 2004	No	Sample Date	8/24/04				
			Sample Result	0				0
	Jan – Dec 2005	No	Sample Date	7/14/05				
			Sample Result	0.5				0.5
	Jan – Dec 2006	Yes	Sample Date	5/01/06	7/26/06	10/30/06		
			Sample Result	0	0	0		0
	Jan – Dec 2007	Yes	Sample Date	1/29/07				
			Sample Result	0				0
SS07	Jan – Dec 2004	No	Sample Date	08/24/2004	12/16/2004			
			Sample Result	0	1.5			0.8
	Jan – Dec 2006	Yes	Sample Date	05/01/2006	07/26/2006	10/30/2006		
			Sample Result	0	0	0		0
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	0				0
SS100	Jan – Dec 2004	No	Sample Date	08/24/2004	12/16/2004			
			Sample Result	1.3	1.8			1.6
	Jan – Dec 2005	No	Sample Date	07/14/2005				
			Sample Result	0				0
	Jan – Dec 2006	Yes	Sample Date	05/01/2006				
			Sample Result	0				0

[1] Verify that site IDs match the site IDs on your distribution system schematic.
Notes: Qualifying data begins January 2006 because the City of Lacey added a new disinfected well - S29 - in August 2005. As required, all DBP results are shown, although 2004 and 2005 results are clearly identified as 'not qualified.'
TTHM and HAA levels of 0= Non-detect (ND);

Form 2: Existing Monitoring Results SSS

IV. PREVIOUSLY COLLECTED MONITORING RESULTS

C: HAA5 Results

Site ID[1]	12-Month Period	Data Qualifies (yes/no)	Data Type	HAA5 (ug/L)				LRAA
SS105	Jan – Dec 2006	Yes	Sample Date	07/26/2006	10/26/2006			
			Sample Result	0.9	0.6			0.8
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	0				0
SS11	Jan – Dec 2006	Yes	Sample Date	07/26/2006	10/31/2006			
			Sample Result	0	0			0
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	0				0
SS19	Jan – Dec 2005	No	Sample Date	07/14/2005				
			Sample Result	0.9				0.9
	Jan – Dec 2006	Yes	Sample Date	07/26/2006	10/26/2006			
			Sample Result	0	0.6			0.3
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	0.5				0.5
SS20	Jan – Dec 2005	No	Sample Date	07/14/2005				
			Sample Result	4.4				4.4
	Jan – Dec 2006	Yes	Sample Date	05/01/2006	07/25/2006	10/26/2006		
			Sample Result	0	0	0		0
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	0.8				0.8
SS21	Jan – Dec 2004	No	Sample Date	08/24/2004	12/16/2004			
			Sample Result	0	1.5			0.8
	Jan – Dec 2005	No	Sample Date	07/18/2005				
			Sample Result	0				0
	Jan – Dec 2006	Yes	Sample Date	05/01/2006	07/26/2006	10/30/2006		
			Sample Result	0	0	0		0
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	0				0

Notes: Qualifying data begins January 2006 because the City of Lacey added a new disinfected well - S29 - in August 2005. As required, all DBP results are shown, although 2004 and 2005 results are clearly identified as 'not qualified.'
TTHM and HAA levels of 0= Non-detect (ND);

Form 2: Existing Monitoring Results SSS

IV. PREVIOUSLY COLLECTED MONITORING RESULTS

C: HAA5 Results

Site ID[1]	12-Month Period	Data Qualifies (yes/no)	Data Type	HAA5 (ug/L)				LRAA
SS24	Jan – Dec 2004	No	Sample Date	08/24/2004	12/16/2004			
			Sample Result	0.5	1.5			1
	Jan – Dec 2006	Yes	Sample Date	05/01/2006	07/26/2006	10/30/2006		
			Sample Result	0.5	0	0		0.2
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	0				0
SS25	Jan – Dec 2006	Yes	Sample Date	07/26/2006	10/30/2006			
			Sample Result	0	0			0
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	0				0
SS28	Jan – Dec 2004	No	Sample Date	08/25/2004				
			Sample Result	0.7				0.7
	Jan – Dec 2006	Yes	Sample Date	05/01/2006				
			Sample Result	0				0
SS32	Jan – Dec 2005	No	Sample Date	07/18/2005				
			Sample Result	0				0
SS36	Jan – Dec 2005	No	Sample Date	07/14/2005				
			Sample Result	0				0
	Jan – Dec 2006	Yes	Sample Date	07/26/2006	10/26/2006			
			Sample Result	0	0			0
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	0.8				0.8
SS39	Jan – Dec 2006	Yes	Sample Date	07/26/2006	10/30/2006			
			Sample Result	0	0			0
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	0				0

[1] Verify that site IDs match the site IDs on your distribution system schematic.

Notes: Qualifying data begins January 2006 because the City of Lacey added a new disinfected well - S29 - in August 2005. As required, all DBP results are shown, although 2004 and 2005 results are clearly identified as 'not qualified.'

TTHM and HAA levels of 0= Non-detect (ND);

Form 2: Existing Monitoring Results SSS

IV. PREVIOUSLY COLLECTED MONITORING RESULTS

C: HAA5 Results

Site ID[1]	12-Month Period	Data Qualifies (yes/no)	Data Type	HAA5 (ug/L)				LRAA
SS42	Jan – Dec 2004	No	Sample Date	08/24/2004	12/16/2004			
			Sample Result	0	0.6			0.3
	Jan – Dec 2005	No	Sample Date	07/18/2005				
			Sample Result	0.5				0.5
	Jan – Dec 2006	Yes	Sample Date	05/01/2006	07/26/2006	10/30/2006		
			Sample Result	0	0	0		0
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	0				0
SS46	Jan – Dec 2006	Yes	Sample Date	05/01/2006	07/26/2006	10/26/2006		
			Sample Result	0.8	0	0.5		0.4
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	0.5				0.5
SS47	Jan – Dec 2004	No	Sample Date	08/25/2004				
			Sample Result	0.5				0.5
	Jan – Dec 2006	Yes	Sample Date	07/26/2006	10/30/2006			
			Sample Result	0	0			0
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	0				0
SS48	Jan – Dec 2004	No	Sample Date	08/24/2004	12/16/2004			
			Sample Result	0	1.3			0.7
SS54	Jan – Dec 2005	No	Sample Date	07/14/2005				
			Sample Result	0				0
	Jan – Dec 2006	Yes	Sample Date	05/01/2006	07/26/2006	10/26/2006		
			Sample Result	0	0	0		0
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	0				0
SS55	Jan – Dec 2006	Yes	Sample Date	07/26/2006	10/30/2006			
			Sample Result	0	0			0

[1] Notes: Qualifying data begins January 2006 because the City of Lacey added a new disinfected well - S29 - in August 2005. As required, all DBP results are shown, although 2004 and 2005 results are clearly identified as 'not qualified.'
TTHM and HAA levels of 0= Non-detect (ND);

Form 2: Existing Monitoring Results SSS

IV. PREVIOUSLY COLLECTED MONITORING RESULTS

C: HAA5 Results

Site ID[1]	12-Month Period	Data Qualifies (yes/no)	Data Type	HAA5 (ug/L)				LRAA
Cont… SS55	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	0				0
SS60	Jan – Dec 2004	No	Sample Date	08/25/2004				
			Sample Result	0				0
SS62	Jan – Dec 2005	No	Sample Date	07/18/2005				
			Sample Result	0.6				0.6
SS66	Jan – Dec 2005	No	Sample Date	07/18/2005				
			Sample Result	0.3				0.3
SS67	Jan – Dec 2004	No	Sample Date	08/24/2004				
			Sample Result	0				0
SS68	Jan – Dec 2006	Yes	Sample Date	05/01/2006	07/26/2006	10/26/2006		
			Sample Result	1.2	0	0.6		0.6
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	0.6				0.6
SS69	Jan – Dec 2004	No	Sample Date	08/25/2004				
			Sample Result	0				0
	Jan – Dec 2006	Yes	Sample Date	05/01/2006	07/26/2006	10/30/2006		
			Sample Result	0	0	0		0
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	0				0
SS90	Jan – Dec 2004	No	Sample Date	08/24/2004	12/16/2004			
			Sample Result	0.5	1.6			1.1
	Jan – Dec 2005	No	Sample Date	07/14/2005				
			Sample Result	0				0
	Jan – Dec 2006	Yes	Sample Date	05/01/2006	07/26/2006	10/26/2006		
			Sample Result	1.3	1.3	0.6		1.1

[1] Verify that site IDs match the site IDs on your distribution system schematic.

Notes: Qualifying data begins January 2006 because the City of Lacey added a new disinfected well - S29 - in August 2005. As required, all DBP results are shown, although 2004 and 2005 results are clearly identified as 'not qualified.'

TTHM and HAA levels of 0= Non-detect (ND);

Form 2: Existing Monitoring Results SSS

IV. PREVIOUSLY COLLECTED MONITORING RESULTS

C: HAA5 Results

Site ID[1]	12-Month Period	Data Qualifies (yes/no)	Data Type	HAA5 (ug/L)				LRAA
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	0.5				0.5
SS91	Jan – Dec 2004	No	Sample Date	08/24/2004				
			Sample Result	0				0
	Jan – Dec 2006	Yes	Sample Date	07/26/2006	10/30/2006			
			Sample Result	0	0			0
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	0				0
SS94	Jan – Dec 2006	Yes	Sample Date	07/26/2006	10/30/2006			
			Sample Result	0	0			0
	Jan – Dec 2007	Yes	Sample Date	01/29/2007				
			Sample Result	0				0

[1] Verify that site IDs match the site IDs on your distribution system schematic.
Notes: Qualifying data begins January 2006 because the City of Lacey added a new disinfected well - S29 - in August 2005. As required, all DBP results are shown, although 2004 and 2005 results are clearly identified as 'not qualified.'
TTHM and HAA levels of 0= Non-detect (ND);

Form 2: Existing Monitoring Results SSS Plan

V. CERTIFICATION OF DATA

I hereby certify that:

- The reported monitoring results include all compliance and non-compliance results generated during the time period beginning with the first reported result and ending with the most recent Stage 1 DBPR results.
- The samples are representative of the entire distribution system.
- Treatment and the distribution system have not changed significantly since the qualifying samples were collected beginning January 2006. For more information see footnotes under Form 2 part IV. *Previously Collected Monitoring Results.*

Signature:

Date: March 28, 2007

VI. PROPOSED SSS MONITORING SCHEDULE

Skip if you are submitting your IDSE Report at the same time as your plan

Lacey currently has qualifying data from 22 sites, for a total of 77 qualifying samples. Lacey will conduct 3 additional rounds of monitoring and will add 2 new sites to reach the 24 Site, 144 Sample minimum requirements. By the end of October, 2007, Lacey will have a total of 24 sites and 149 samples.

SSS Site ID (from map) [1]	Projected Sampling Date (date or week) [2]					
	period 1	period 2	period 3	period 4	period 5	period 6
SS01	Week of 4/23/07	Week of 7/23/07	Week of 10/22/07			
SS05	Week of 4/23/07	Week of 7/23/07	Week of 10/22/07			
SS07	Week of 4/23/07	Week of 7/23/07	Week of 10/22/07			
SS100[3]	Week of 4/23/07	Week of 7/23/07	Week of 10/22/07			
SS105	Week of 4/23/07	Week of 7/23/07	Week of 10/22/07			

[1] *Verify that site IDs match IDs on your distribution system schematic (See Section VII of this form). Attach additional copies of this sheet if necessary.*

[2] *period = monitoring period. Can list exact date or week (e.g., week of 7/9/07)*

VI. PROPOSED SSS MONITORING SCHEDULE

Skip if you are submitting your IDSE Report at the same time as your plan

Lacey will conduct 3 additional rounds of monitoring and will add 2 new sites to reach the 24 Site, 144 Sample minimum requirements. By the end of October, 2007, Lacey will have a total of 24 sites and 149 samples.

SSS Site ID (from map) [1]	Projected Sampling Date (date or week) [2]					
	period 1	period 2	period 3	period 4	period 5	period 6
SS11	Week of 4/23/07	Week of 7/23/07	Week of 10/22/07			
SS19	Week of 4/23/07	Week of 7/23/07	Week of 10/22/07			
SS20	Week of 4/23/07	Week of 7/23/07	Week of 10/22/07			
SS21	Week of 4/23/07	Week of 7/23/07	Week of 10/22/07			
SS24	Week of 4/23/07	Week of 7/23/07	Week of 10/22/07			
SS25	Week of 4/23/07	Week of 7/23/07	Week of 10/22/07			
SS36	Week of 4/23/07	Week of 7/23/07	Week of 10/22/07			
SS39	Week of 4/23/07	Week of 7/23/07	Week of 10/22/07			
SS42	Week of 4/23/07	Week of 7/23/07	Week of 10/22/07			
SS96[3]	Week of 4/23/07	Week of 7/23/07	Week of 10/22/07			
SS46	Week of 4/23/07	Week of 7/23/07	Week of 10/22/07			
SS47	Week of 4/23/07	Week of 7/23/07	Week of 10/22/07			
SS54	Week of 4/23/07	Week of 7/23/07	Week of 10/22/07			
SS55	Week of 4/23/07	Week of 7/23/07	Week of 10/22/07			
SS68	Week of 4/23/07	Week of 7/23/07	Week of 10/22/07			

[1] Verify that site IDs match IDs on your distribution system schematic (See Section VII of this form). Attach additional copies of this sheet if necessary.

[2] period = monitoring period. Can list exact date or week (e.g., week of 7/9/07)

[3] New sites added to bring total monitoring sites to 24

VI. PROPOSED SSS MONITORING SCHEDULE

Skip if you are submitting your IDSE Report at the same time as your plan

Lacey will conduct 3 additional rounds of monitoring and will add 2 new sites to reach the 24 Site, 144 Sample minimum requirements. By the end of October, 2007, Lacey will have a total of 24 sites and 149 samples.

SSS Site ID (from map) [1]	Projected Sampling Date (date or week) [2]					
	period 1	period 2	period 3	period 4	period 5	period 6
SS69	Week of 4/23/07	Week of 7/23/07	Week of 10/22/07			
SS90	Week of 4/23/07	Week of 7/23/07	Week of 10/22/07			
SS91	Week of 4/23/07	Week of 7/23/07	Week of 10/22/07			
SS94	Week of 4/23/07	Week of 7/23/07	Week of 10/22/07			

[1] *Verify that site IDs match IDs on your distribution system schematic (See Section VII of this form). Attach additional copies of this sheet if necessary.*

[2] *period = monitoring period. Can list exact date or week (e.g., week of 7/9/07)*

[3] *New sites added to bring total monitoring sites to 24*

Form 2: Existing Monitoring Results SSS Plan

VII. DISTRIBUTION SYSTEM SCHEMATIC

ATTACH a schematic of your distribution system.

Distribution system schematics are not confidential and should not contain information that poses a ***security risk*** to your system. EPA recommends that you use one of two options:

Option 1: Distribution system schematic with no landmarks or addresses indicated. Show locations of sources, entry points, storage facilities, operational monitoring locations, and Stage 1 compliance monitoring locations (required). Also include pressure zone boundaries and locations of pump stations. Provide map scale.

Option 2: City map without locations of pipes indicated. Show locations of sources, entry points, storage facilities, operational monitoring locations, and Stage 1 compliance monitoring locations (required). Also include boundaries of the distribution system, pressure zone boundaries and locations of pump stations. Provide map scale.

VIII. ATTACHMENTS

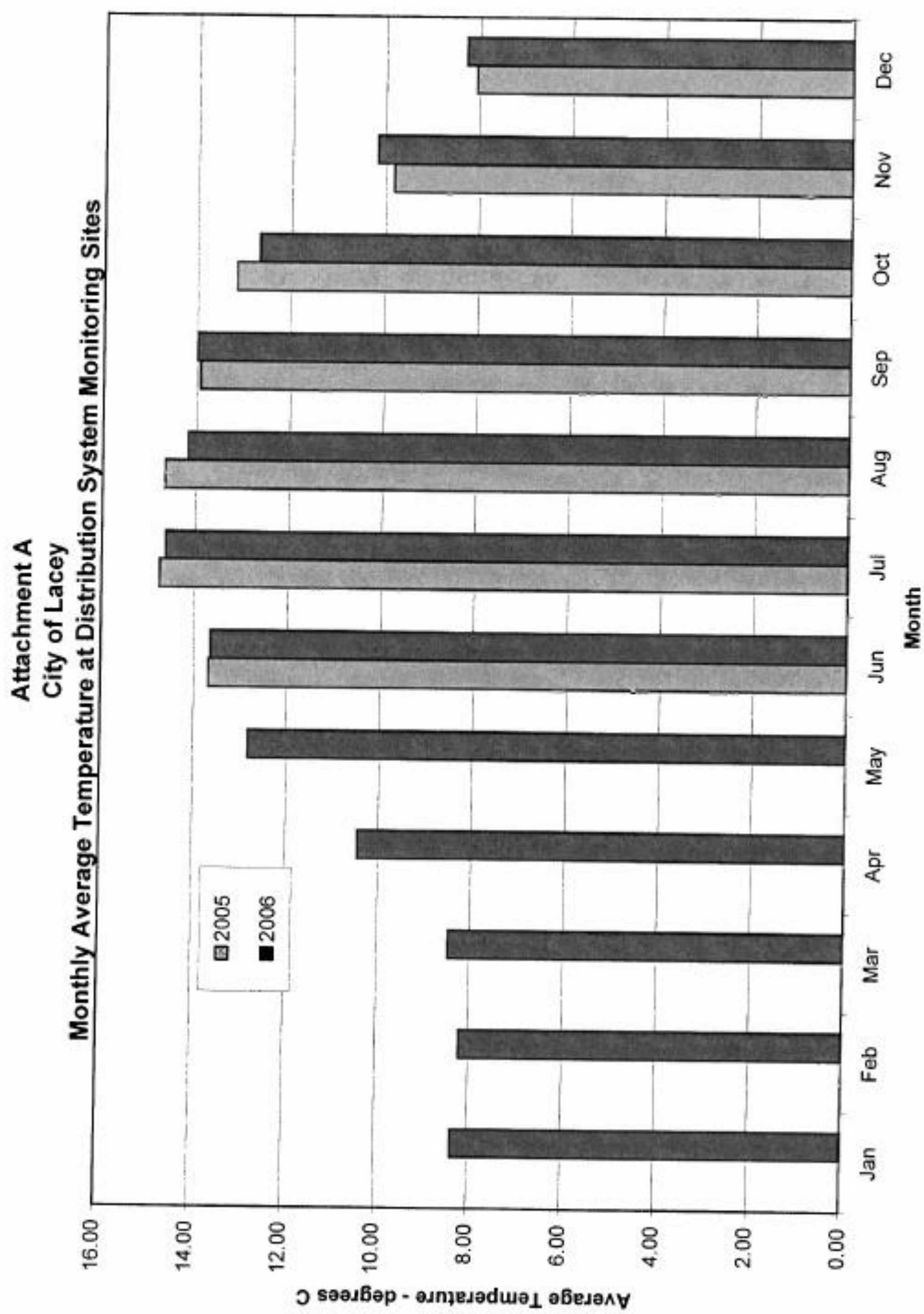
_X_ Additional sheets for explaining how you selected the peak historical month (Section III). **Attachment A (1 page)**.

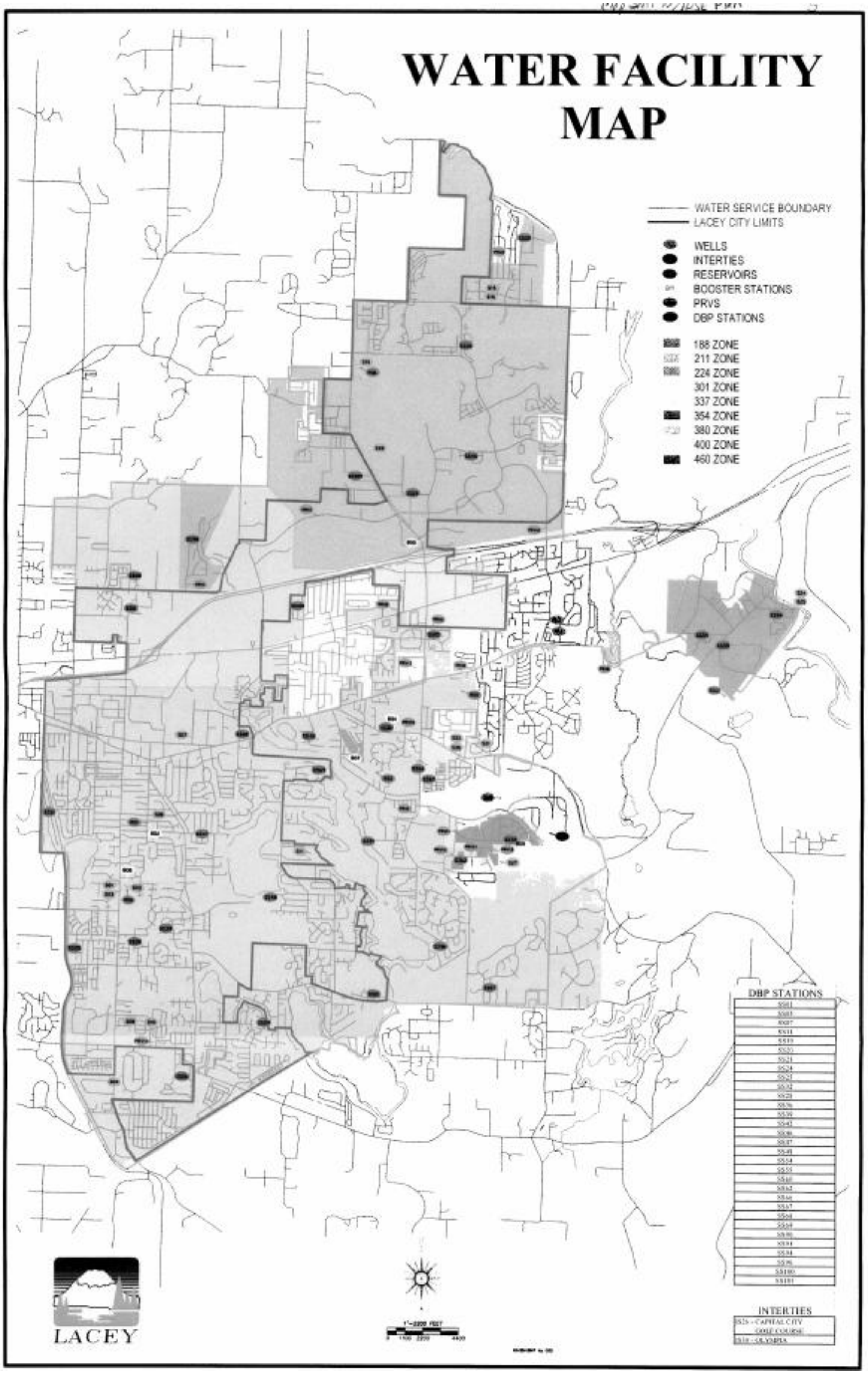
___ Additional sheets for previously collected monitoring results (Section IV).

___ Additional sheets for proposed monitoring dates (Section VI).

_X_ Distribution system schematic (Section VII). **Attachment B (1 page).**

Total Number of Pages in Your Plan: 20 (including attachments)


Attachment A
City of Lacey
Monthly Average Temperature at Distribution System Monitoring Sites
2005
2006
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
Average Temperature - degrees C
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month


WATER FACILITY MAP
WATER SERVICE BOUNDARY
LACEY CITY LIMITS
WELLS
INTERTIES
RESERVOIRS
BOOSTER STATIONS
PRVS
DBP STATIONS
188 ZONE
211 ZONE
224 ZONE
301 ZONE
337 ZONE
354 ZONE
380 ZONE
400 ZONE
460 ZONE
DBP STATIONS
INTERTIES
CAPITAL CITY
GOLF COURSE
LACEY

Appendix 8

IDSE Report
(Submitted to EPA 01/08/09)

And Approval Letter from EPA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue, Suite 900
Seattle, Washington 98101-3140

RECEIVED
MAY 22 2009
PUBLIC WORKS

May 21, 2009

Julie Rector
City of Lacey
P.O. Box 3400
Lacey, Washington 98509

RE: Approval of Stage 2 Disinfection Byproducts Rule (Stage 2 DBPR)
Initial Distribution System Evaluation (IDSE) System Specific Study Report
Lacey Water Department ID # 43500Y – Thurston County

Dear Ms. Rector

I am writing to inform you that the Stage 2 DBPR IDSE system specific study report for the Lacey Water Department has been approved.

Before you begin Stage 2 DBPR compliance monitoring you must prepare and submit to the **Washington Department of Health** (DOH) a Stage 2 DBPR monitoring plan. The monitoring plan must include the monitoring locations identified in your IDSE report; monitoring dates, also identified in your IDSE report; monitoring plans for any other systems in your combined distribution system if DOH is allowing reduced monitoring for the systems in the combined distribution system (check with DOH regarding this requirement); and compliance calculation procedures, also included in your IDSE report. The state will provide you with more detailed information regarding their expectations for the Stage 2 DBPR monitoring plan in the future.

Stage 2 DBPR compliance monitoring will begin the fourth quarter of 2012. As described in your IDSE report, that would be the third week of October 2012. Until Stage 2 DBPR compliance monitoring begins you must continue to conduct Stage 1 DBPR compliance monitoring on the schedule required by the State.

If you have any questions, please contact me at (206) 553-1890 or marshall.wendy@epa.gov.

Sincerely,

Wendy Marshall

Wendy Marshall
Environmental Scientist

cc: Ethan Moseng - DOH

Printed on Recycled Paper

Form 3: IDSE Report for an Existing Monitoring Results SSS

I. GENERAL INFORMATION

(*Skip this section if you are submitting the plan and report at the same time*)

A. PWS Information*

B. Date Submitted* _Jan 8, 2009___

PWSID: 43500Y or WA5343500

PWS Name: City of Lacey

PWS Address: P.O. Box 3400

City: Lacey State: WA Zip: 98509

Population Served: 64,527

System Type:	Source Water Type:	Buying / Selling Relationships:
X CWS	X Subpart H	X Consecutive System
☐ NTNCWS	☐ Ground	☐ Wholesale System
		☐ Neither

C. PWS Operations

Residual Disinfectant Type: X Chlorine ☐ Chloramines ☐ Other ____________

Number of Disinfected Sources: _1_Surface _0_GWUDI _19_Ground _1_Purchased

The City of Lacey provides groundwater from 19 wells. The City also purchases surface water through an intertie from the City of Olympia and is therefore a subpart H system.

D. Contact Person*

Name: Julie Rector

Title: Water Quality Analyst

Phone #: (360) 493-2410 Fax #: (360) 456-7799

E-mail: Jrector@ci.lacey.wa.us

II. STAGE 2 DBPR REQUIREMENTS*

A. Number of Required Stage 2 DBPR Compliance Monitoring Sites _8___ TOTAL

___3____ Highest TTHM ____2___ Stage 1 DBPR ____3___ Highest HAA

Form 3: IDSE Report for an Existing Monitoring Results SSS

II. STAGE 2 DBPR REQUIREMENTS (continued)*

B. IDSE Schedule

☐ Schedule 1

X Schedule 2

☐ Schedule 3

☐ Schedule 4

C. Required Stage 2 DBPR Compliance Monitoring Frequency

☐ During peak historical month (1 monitoring period)

X Every 90 days (4 monitoring periods)

III. ADDITIONAL SSS AND STAGE 1 COMPLIANCE MONITORING RESULTS*

(Skip this section if you are submitting the plan and report at the same time)

A. **Where were your TTHM and HAA5 samples analyzed?**

☐ In-House

Is your in-house laboratory certified? ☐ Yes ☐ No

X Certified Laboratory

Name of certified laboratory: Water Management Laboratories, Inc. (Tacoma, WA)

B. **What method(s) was used to analyze your TTHM and HAA5 samples?**

TTHM	HAA5
☐ EPA 502.2	☐ EPA 552.1
X EPA 524.2	X EPA 552.2
☐ EPA 551.1	☐ EPA 552.3
	☐ SM 6251 B

Form 3: IDSE Report for an Existing Monitoring Results SSS

III. ADDITIONAL SSS AND STAGE 1 DBPR MONITORING RESULTS (Continued)*

C. TTHM Results

Site ID[1]	12-Month Period	Data Quali ies (yes/no)	Data Type	TTHM (µg/L)				LRAA (µg/L)
SS01	Jan – Dec 2007	Yes	Sample Date	01/29/2007	04/23/2007	07/23/2007	10/23/2007	
			Sample Result	3.5	1.9	1.9	0.5	2.0
SS01	Jan – Dec 2008	No	Sam□le□Date	03/13/2008	06/09/2008	08/27/2008	10/24□2008	
			Sample Result	1.5	1.6	4.3	4.8	3.1
SS05	Jan – Dec 2007	Yes	Sample Date	01/29/2007	04/23/2007	07/23/2007	10/23/2007	
			Sample Result	0	4.1	0.7	1.2	1.5
SS07	Jan – Dec 2007	Yes	Sample Date	01/29/2007	04/23/2007	07/23/2007	10/23/2007	
			Sample Result	0	0	0	0	0.0
SS07	Jan – Dec 2008	No	Sample Date	03/13/2008	06/09/2008	08/27/2008	10/24/2008	
			Sample Result	0	1.8	1.2	1.5	1.1
SS100	Jan – Dec 2007	Yes	Sample Date		04/23/2007	07/23/2007	10/23/2007	
			Sample Result		1.4	0	2.2	1.2
SS105	Jan – Dec 2007	Yes	Sample Date	01/29/2007	04/23/2007	07/23/2007	10/23/2007	
			Sample Result	0	0	0	0	0.0
SS105	Jan – Dec 2008	No	Sample Date	03/13/2008	06/09/2008	08/27/2008	10/24/2008	
			Sample Result	0.6	0.6	5.2	5	2.9
SS11	Jan – Dec 2007	Yes	Sample Date	01/29/2007	04/25/2007	07/23/2007	10/23/2007	
			Sample Result	1.9	0	0	0.7	0.7
SS11	Jan – Dec 2008	No	Sample Date	03/13/2008	06/09/2008	08/27/2008	10/24/2008	
			Sample Result	0	0	2.8	2.3	1.3

[1] *Verify that site IDs match the site IDs in your SSS Plan.*

Note: The City's approved IDSE plan specifies SSS sampling through Dec 2007. Data from Jan 2007 were already reported in the SSS Plan, but are also included here for showing the 2007 LRAA. Results from 2008 do not qualify because samples were not collected during July, the peak historical month for temperature.

Form 3: IDSE Report for an Existing Monitoring Results SSS

III. ADDITIONAL SSS AND STAGE 1 DBPR MONITORING RESULTS (Continued)*

C: TTHM Results

Site ID[1]	12-month period	Data Qualifies (yes/no)	Data Type	TTHM (µg/L)				LRAA (µg/L)
SS19	Jan – Dec 2007	Yes	Sample Date	01/29/2007	04/23/2007	07/23/2007	10/23/2007	
			Sample Result	10.□	4.1	5.□	12.1	8.2
SS19	Jan – Dec 2008	No	Sample Date	03/□3/2008	06/09/2008	08/27/2008	10/24/2008	
			Sample Result	3.2	7.9	14.1	15	10.1
SS20	Jan – Dec 2007	Yes	Sample Date	01/29/2007	04/23/2007	07/23/2007	10/23/2007	
			Sample Result	5.3	3.7	0	0	2.3
SS20	Jan – Dec 2008	No	Sample Date	03/13/2008	06/09/2008	08/27/2008	10/24/2008	
			Sample Result	2.1	0.5	0	1.7	1.1
SS21	Jan – Dec 2007	Yes	Sample Date	01/29/2007	04/23/2007	07/23/2007	10/23/2007	
			Sample Result	0	0	0	0	0.0
SS24	Jan – Dec 2007	Yes	Sample Date	01/29/2007	04/23/2007	07/23/2007	10/23/2007	
			Sample Result	0	0	0	0	0.0
SS24	Jan – Dec 2008	No	Sample Date	03/13/2008	06/09/2008	08/27/2008	10/24/2008	
			Sample Result	0	1.8	1.7	1.1	1.2
SS25	Jan – Dec 2007	Yes	Sample Date	01/29/2007	04/25/2007	07/23/2007	10/23/2007	
			Sample Result	0	0.5	0	1.8	0.6
SS36	Jan – Dec 2007	Yes	Sample Date	01/29/2007	04/23/2007	07/23/2007	10/23/2007	
			Sample Result	4.7	3.5	0	1.5	2.4
SS36	Jan – Dec 2008	No	Sample Date	03/13/2008	06/09/2008	08/27/2008	10/24/2008	
			Sample Result	0.5	1.5	2.6	4.5	2.3

[1] *Verify that site IDs match the site IDs in your SSS Plan.*

Note: The City's approved IDSE plan specifies SSS sampling through Dec 2007. Data from Jan 2007 were already reported in the SSS Plan, but are also included here for showing the 2007 LRAA. Results from 2008 do not qualify because samples were not collected during July, the peak historical month for temperature.

Form 3: IDSE Report for an Existing Monitoring Results SSS

III. ADDITIONAL SSS AND STAGE 1 DBPR MONITORING RESULTS (Continued)*

C. TTHM Results

Site ID[1]	12-month period	Data Qualifies (yes/no)	Data Type	TTHM (µg/L)				LRAA (µg/L)
	Jan – Dec		Sample Date	01/29/2007	04/23/2007	07□23/2007	10/23/2007	
SS39	2007	Yes	Sample Result	0.5	0	0	□	0.1
	Jan – Dec		Sample Date	01/29/2007	04/23/2007	07/23/2007	10/23/2007	
SS42	2007	Yes	Sample Result	0.7	1.6	0	0	0.6
	Jan – Dec		Sample Date	01/29/2007	04/23/2007	07/23/2007	10/23/2007	
SS46	2007	Yes	Sample Result	2.2	1.4	0	0	0.9
	Jan – Dec		Sample Date	01/29/2007	04/25/2007	07/23/2007	10/23/2007	
SS47	2007	Yes	Sample Result	0	0	0.7	0	0.2
	Jan – Dec		Sample Date	01/29/2007	04/23/2007	07/24/2007	10/23/2007	
SS54	2007	Yes	Sample Result	0	0	0.7	1.1	0.5
	Jan – Dec		Sample Date	01/29/2007	04/23/2007		10/23/2007	
SS55	2007	No	Sample Result	0	0		0	0.0
	Jan – Dec		Sample Date	03/13/2008	06/09/2008	08/27/2008	10/24/2008	
SS55	2008	No	Sample Result	0.7	0	0	0	0.2
	Jan – Dec		Sample Date	01/29/2007	04/23/2007	07/23/2007	10/23/2007	
SS68	2007	Yes	Sample Result	1.6	2.1	0.6	0.6	1.2
	Jan – Dec		Sample Date	03/13/2008	06/09/2008	08/27/2008	10/24/2008	
SS68	2008	No	Sample Result	0	2	4.2	4.8	2.8
	Jan – Dec		Sample Date	01/29/2007	04/23/2007	07/23/2007	10/23/2007	
SS69	2007	Yes	Sample Result	0	0.5	1.2	0	0.4

[1] *Verify that site IDs match the site IDs in your SSS Plan.*

Note: The City's approved IDSE plan specifies SSS sampling through Dec 2007. Data from Jan 2007 were already reported in the SSS Plan, but are also included here for showing the 2007 LRAA. Results from 2008 do not qualify because samples were not collected during July, the peak historical month for temperature.

Form 3: IDSE Report for an Existing Monitoring Results SSS

III. ADDITIONAL SSS AND STAGE 1 DBPR MONITORING RESULTS (Continued)*

C. TTHM Results

Site ID[1]	12-month period	Data Qualifies (yes/no)	Data Type	TTHM (µg/L)				LRAA (µg/L)
	Jan – Dec		Sample Date	01/29/2□07	04/2□/2007	07/23/2007	10/23/2007	
SS90	2007	Yes	Sa□ple Result	0.5	0.9	0	0	0.4
	Jan – Dec		Sample Date	03/13/2008	06/09/2008	08/27/2008	10/24/2008	
SS90	2008	No	Sample Result	2.5	3.2	4.6	4.7	3.8
	Jan – Dec		Sample Date	01/29/2007	04/23/2007	07/23/2007	10/23/2007	
SS91	2007	Yes	Sample Result	0	0.5	0	0	0.1
	Jan – Dec		Sample Date	03/13/2008	06/09/2008	08/27/2008	10/24/2008	
SS91	2008	No	Sample Result	0	1.5	0.5	1.2	0.8
	Jan – Dec		Sample Date	01/29/2007	04/23/2007	07/24/2007	10/23/2007	
SS94	2007	Yes	Sample Result	0	0	0	0	0.0
	Jan – Dec		Sample Date			07/24/2007		
SS95	2007	Yes	Sample Result			0		0.0
	Jan – Dec		Sample Date		04/23/2007	07/24/2007	10/23/2007	
SS96	2007	Yes	Sample Result		1.5	0	0	0.5

[1] *Verify that site IDs match the site IDs in your SSS Plan.*

Note: The City's approved IDSE plan specifies SSS sampling through Dec 2007. Data from Jan 2007 were already reported in the SSS Plan, but are also included here for showing the 2007 LRAA. Results from 2008 do not qualify because samples were not collected during July, the peak historical month for temperature.

Form 3: IDSE Report for an Existing Monitoring Results SSS

III. ADDITIONAL SSS AND STAGE 1 DBPR MONITORING RESULTS (Continued)*

C. HAA5 Results

Site ID[1]	12-month period	Data Qualifies (yes/no)	Data Type	HAA5 (µg/L)				LRAA (µg/L)
SS01	Jan – Dec 2007	Yes	Sample Date	01/29/2007	04/23/2007	07/23/2007	10/23/2007	
			Sample Result	0.5	0.7	1	0	0.6
SS01	Jan – Dec 2008	No	Sample Date	03/13/2008	06/09/2008	08/27/2008	10/24/2008	
			Sample Result	0	0	0.8	4.6	1.4
SS05	Jan – Dec 2007	Yes	Sample Date	01/29/2007	04/23/2007	07/23/2007	10/23/2007	
			Sample Result	0	0.8	0	0	0.2
SS07	Jan – Dec 2007	Yes	Sample Date	01/29/2007	04/23/2007	07/23/2007	10/23/2007	
			Sample Result	0	0	0	0	0.0
SS07	Jan – Dec 2008	No	Sample Date	03/13/2008	06/09/2008	08/27/2008	10/24/2008	
			Sample Result	0	0	0	0	0.0
SS100	Jan – Dec 2007	Yes	Sample Date		04/23/2007	07/23/2007	10/23/2007	
			Sample Result		0.6	1.4	0	0.7
SS105	Jan – Dec 2007	Yes	Sample Date	01/29/2007	04/23/2007	07/23/2007	10/23/2007	
			Sample Result	0	0	0	0	0.0
SS105	Jan – Dec 2008	No	Sample Date	03/13/2008	06/09/2008	08/27/2008	10/24/2008	
			Sample Result	0	0	3.4	4.4	2.0
SS11	Jan – Dec 2007	Yes	Sample Date	01/29/2007	04/25/2007	07/23/2007	10/23/2007	
			Sample Result	0	0	1.3	0.6	0.5
SS11	Jan – Dec 2008	No	Sample Date	03/13/2008	06/09/2008	08/27/2008	10/24/2008	
			Sample Result	0	0	0.6	0	0.2

[1] *Verify that site IDs match the site IDs in your SSS Plan.*

Note: The City's approved IDSE plan specifies SSS sampling through Dec 2007. Data from Jan 2007 were already reported in the SSS Plan, but are also included here for showing the 2007 LRAA. Results from 2008 do not qualify because samples were not collected during July, the peak historical month for temperature.

Form 3: IDSE Report for an Existing Monitoring Results SSS

III. ADDITIONAL SSS AND STAGE 1 DBPR MONITORING RESULTS (Continued)*

D. HAA5 Results

Site ID[1]	12-month period	Data Qualifies (yes/no)	Data Type	HAA5 (µg/L)				LRAA (µg/L)
SS19	Jan – Dec 2007	Yes	Sample Date	01/29/2007	04/23/2007	07/23/2007	10/23/2007	
			Sample Result	0.5	0.9	2	0.6	1.0
SS19	Jan – Dec 2008	No	Sample Date	03/13/2008	06/09/2008	08/27/2008	10/24/2008	
			Sample Result	0	0	0.8	1.7	0.6
SS20	Jan – Dec 2007	Yes	Sample Date	01/29/2007	04/23/2007	07/23/2007	10/23/2007	
			Sample Result	0.8	0.8	0	0	0.4
SS20	Jan – Dec 2008	No	Sample Date	03/13/2008	06/09/2008	08/27/2008	10/24/2008	
			Sample Result	0.5	0	0	1.7	0.6
SS21	Jan – Dec 2007	Yes	Sample Date	01/29/2007	04/23/2007	07/23/2007	10/23/2007	
			Sample Result	0	0	0	0	0.0
SS24	Jan – Dec 2007	Yes	Sample Date	01/29/2007	04/23/2007	07/23/2007	10/23/2007	
			Sample Result	0	0	0	0	0.0
SS24	Jan – Dec 2008	No	Sample Date	03/13/2008	06/09/2008	08/27/2008	10/24/2008	
			Sample Result	0	0	0	0	0.0
SS25	Jan – Dec 2007	Yes	Sample Date	01/29/2007	04/25/2007	07/23/2007	10/23/2007	
			Sample Result	0	0.5	0	1	0.4
SS36	Jan – Dec 2007	Yes	Sample Date	01/29/2007	04/23/2007	07/23/2007	10/23/2007	
			Sample Result	0.8	1	0	0	0.5
SS36	Jan – Dec 2008	No	Sample Date	03/13/2008	06/09/2008	08/27/2008	10/24/2008	
			Sample Result	0	0	2.8	3.7	1.6

[1] *Verify that site IDs match the site IDs in your SSS Plan.*

Note: The City's approved IDSE plan specifies SSS sampling through Dec 2007. Data from Jan 2007 were already reported in the SSS Plan, but are also included here for showing the 2007 LRAA. Results from 2008 do not qualify because samples were not collected during July, the peak historical month for temperature.

Form 3: IDSE Report for an Existing Monitoring Results SSS

III. ADDITIONAL SSS AND STAGE 1 DBPR MONITORING RESULTS (Continued)*

E. HAA5 Results

Site ID[1]	12-month period	Data Qualifies (yes/no)	Data Type	HAA5 (µg/L)				LRAA (µg/L)
SS39	Jan – Dec 2007	Yes	Sample Date	01/29/2007	04/23/2007	07/23/2007	10/23/2007	
			Sample Result	0	0	0	0	0.0
SS42	Jan – Dec 2007	Yes	Sample Date	01/29/2007	04/23/2007	07/23/2007	10/23/2007	
			Sample Result	0	0.8	0.8	0	0.4
SS46	Jan – Dec 2007	Yes	Sample Date	01/29/2007	04/23/2007	07/23/2007	10/23/2007	
			Sample Result	0.5	0.6	0	0	0.3
SS47	Jan – Dec 2007	Yes	Sample Date	01/29/2007	04/25/2007	07/23/2007	10/23/2007	
			Sample Result	0	0	0.9	0	0.2
SS54	Jan – Dec 2007	Yes	Sample Date	01/29/2007	04/23/2007	07/24/2007	10/23/2007	
			Sample Result	0	0	0	0	0.0
SS55	Jan – Dec 2007	No	Sample Date	01/29/2007	04/23/2007		10/23/2007	
			Sample Result	0	0		0	0.0
SS55	Jan – Dec 2008	Yes	Sample Date	03/13/2008	06/09/2008	08/27/2008	10/24/2008	
			Sample Result	0.6	0	0	0	0.2
SS68	Jan – Dec 2007	Yes	Sample Date	01/29/2007	04/23/2007	07/23/2007	10/23/2007	
			Sample Result	0.6	0.8	1	0	0.6
SS68	Jan – Dec 2008	No	Sample Date	03/13/2008	06/09/2008	08/27/2008	10/24/2008	
			Sample Result	0	0	2.2	2.7	1.2
SS69	Jan – Dec 2007	Yes	Sample Date	01/29/2007	04/23/2007	07/23/2007	10/23/2007	
			Sample Result	0	0	0	0	0.0

[1] *Verify that site IDs match the site IDs in your SSS Plan.*

Note: The City's approved IDSE plan specifies SSS sampling through Dec 2007. Data from Jan 2007 were already reported in the SSS Plan, but are also included here for showing the 2007 LRAA. Results from 2008 do not qualify because samples were not collected during July, the peak historical month for temperature.

Form 3: IDSE Report for an Existing Monitoring Results SSS

III. ADDITIONAL SSS AND STAGE 1 DBPR MONITORING RESULTS (Continued)*

F. HAA5 Results

Site ID[1]	12-month period	Data Qualifies (yes/no)	Data Type	HAA5 (µg/L)				LRAA (µg/L)
SS90	Jan – Dec 2007	Yes	Sample Date	01/29/2007	04/23/2007	07/23/2007	10/23/2007	
			Sample Result	0.5	0.7	1.5	0	0.7
SS90	Jan – Dec 2008	No	Sample Date	03/13/2008	06/09/2008	08/27/2008	10/24/2008	
			Sample Result	0	0	1.8	2.5	1.1
SS91	Jan – Dec 2007	Yes	Sample Date	01/29/2007	04/23/2007	07/23/2007	10/23/2007	
			Sample Result	0	0	0	0	0.0
SS91	Jan – Dec 2008	No	Sample Date	03/13/2008	06/09/2008	08/27/2008	10/24/2008	
			Sample Result	0	0	0	0	0.0
SS94	Jan – Dec 2007	Yes	Sample Date	01/29/2007	04/23/2007	07/24/2007	10/23/2007	
			Sample Result	0	0	0	0	0.0
SS95	Jan – Dec 2007	Yes	Sample Date			07/24/2007		
			Sample Result			0		0.0
SS96	Jan – Dec 2007	Yes	Sample Date		04/23/2007	07/23/2007	10/23/2007	
			Sample Result		0.6	0	0	0.2

[1] *Verify that site IDs match the site IDs in your SSS Plan.*

Note: The City's approved IDSE plan specifies SSS sampling through Dec 2007. Data from Jan 2007 were already reported in the SSS Plan, but are also included here for showing the 2007 LRAA. Results from 2008 do not qualify because samples were not collected during July, the peak historical month for temperature.

Form 3: IDSE Report for an Existing Monitoring Results SSS

IV. JUSTIFICATION OF STAGE 2 DBPR COMPLIANCE MONITORING SITES*

Stage 2 Compliance Monitoring Site ID	Site Type	Justification
SS19	X Highest TTHM ☐ Highest HAA5 ☐ Stage 1 DBPR	Highest LRAA (0.0131mg/L) and highest individual result (0.0150 mg/L) for TTHM.
SS105	☐ Highest TTHM X Highest HAA5 ☐ Stage 1 DBPR	Highest LRAA for HAA5 (0.002 mg/L).
SS100	☐ Highest TTHM ☐ Highest HAA5 X Stage 1 DBPR	This site was selected to improve the geographic coverage of monitoring within the distribution system and to better represent the one surface water source that supplies the system. Both TTHM and HAA5 have been detected at this site.
SS90	X Highest TTHM ☐ Highest HAA5 ☐ Stage 1 DBPR	Second highest LRAA for TTHMs (0.0051 mg/L)
SS01	X Highest TTHM ☐ Highest HAA5 ☐ Stage 1 DBPR	Third highest LRAA for TTHMs (0.0038 mg/L).
SS36	☐ Highest TTHM X Highest HAA5 ☐ Stage 1 DBPR	Second highest LRAA for HAA5 (0.0016 mg/L).
SS07	☐ Highest TTHM ☐ Highest HAA5 X Stage 1 DBPR	This site was selected to improve the geographic coverage of monitoring within the distribution system and to better represent sources in the south part of the system. This site had some elevated results for TTHM in 2008.
SS11	☐ Highest TTHM X Highest HAA5 ☐ Stage 1 DBPR	Although other sites had higher LRAAs, they are near sites already selected. When these sites were removed, this site had the next highest LRAA. This site improves the geographic coverage of monitoring within the distribution system, and represents sources from the mid-337 zone.

Form 3: IDSE Report for an Existing Monitoring Results SSS

V. PEAK HISTORICAL MONTH

A. Peak Historical Month* __July__________

B. Is Your Peak Historical Month the Same as in Your SSS Plan?

X Yes ☐ No

If no, explain how you selected your new peak historical month *(attach additional sheets if needed)*:

VI. PROPOSED STAGE 2 DBPR COMPLIANCE MONITORING SCHEDULE*

Stage 2 Compliance Monitoring Site ID	Projected Sampling Date (date or week)[1]			
	period 1	period 2	period 3	period 4
SS19	3rd week of Jan	3rd week of Apr	3rd week of Jul	3rd week of Oct
SS105	3rd week of Jan	3rd week of Apr	3rd week of Jul	3rd week of Oct
SS100	3rd week of Jan	3rd week of Apr	3rd week of Jul	3rd week of Oct
SS90	3rd week of Jan	3rd week of Apr	3rd week of Jul	3rd week of Oct
SS01	3rd week of Jan	3rd week of Apr	3rd week of Jul	3rd week of Oct
SS36	3rd week of Jan	3rd week of Apr	3rd week of Jul	3rd week of Oct
SS07	3rd week of Jan	3rd week of Apr	3rd week of Jul	3rd week of Oct
SS11	3rd week of Jan	3rd week of Apr	3rd week of Jul	3rd week of Oct

[1] period = monitoring period. Complete for the number of monitoring periods from Section II.C.

Attach additional copies of this sheet if you need more room.

Form 3: IDSE Report for an Existing Monitoring Results SSS

VII. DISTRIBUTION SYSTEM SCHEMATIC*
(Skip this section if you are submitting the plan and report at the same time)

ATTACH a schematic of your distribution system if it has changed since you submitted your Existing Monitoring Results SSS Plan (Form 2).

VIII. ATTACHMENTS

☐ Additional sheets for Additional SSS Monitoring Results (Section III).

☐ Additional sheets for Stage 2 DBPR Monitoring Sites (Section IV). **REQUIRED if you are a subpart H system serving more than 249,999 people**.

☐ Additional sheets for explaining how you selected the peak historical month (Section V).

☐ Additional sheets for proposed compliance monitoring dates (Section VI). **REQUIRED if you are a subpart H system serving more than 249,999 people**.

☐ Explanation of deviations from approved study plan.

X Distribution system schematic* (Section VII). **REQUIRED if it has changed from your approved SSS plan**.

X Compliance calculation procedures (for Stage 2 Compliance Monitoring Plan).
Please see Attachment A for calculation procedures

Total Number of Pages in Your Report: 15

Note: Fields with an asterisk(*) are required by the Stage 2 DBPR.

Attachment A. Calculation Procedures from Stage 2 Compliance Monitoring Plan

Determining Compliance under Stage 2

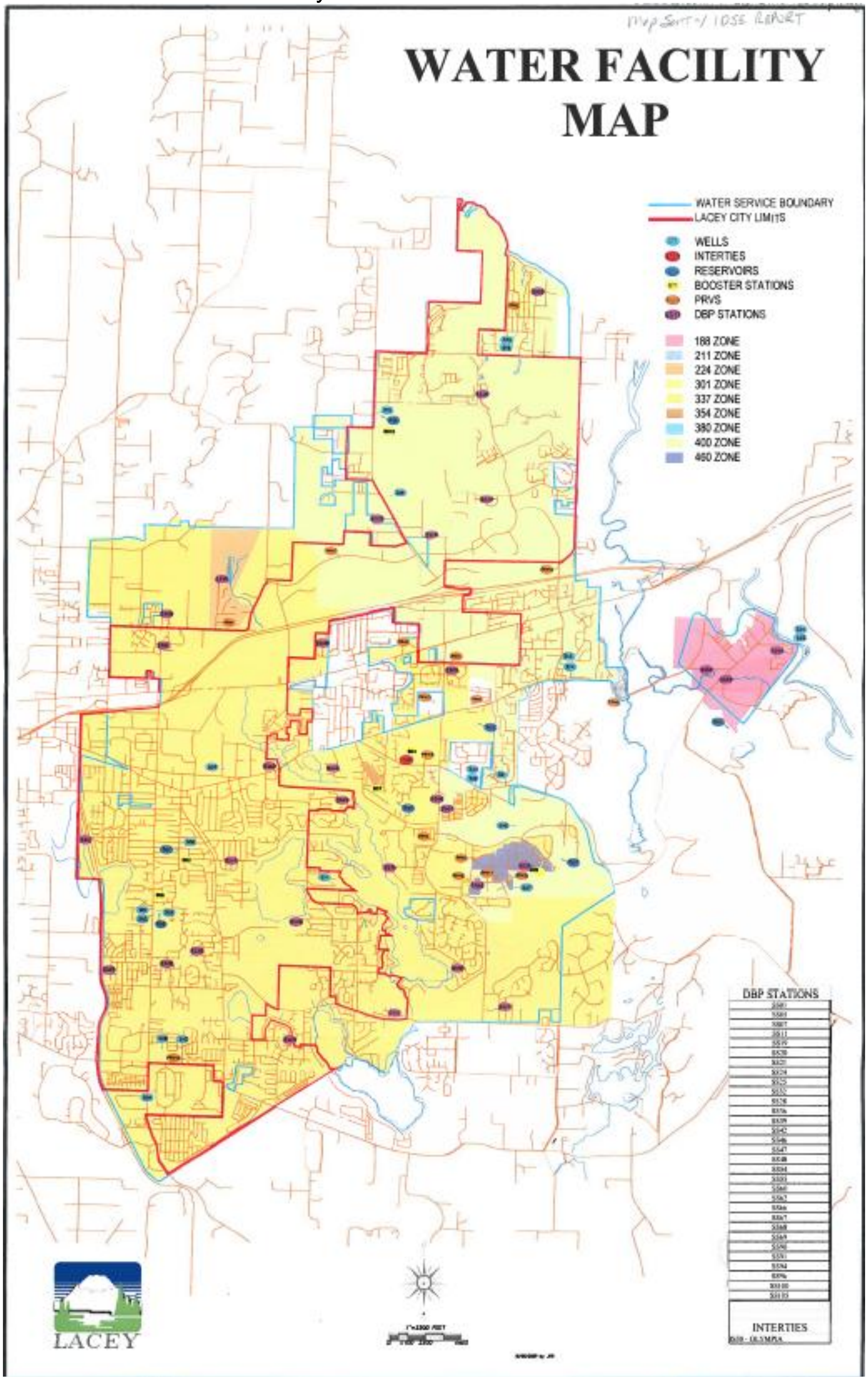
Whereas compliance under Stage 1 was determined from the running annual average of system-wide sample results, compliance under Stage 2 will be determined from the locational running annual average (LRAA) for each monitoring location. Lacey started tracking its locational running annual averages (LRAA) for TTHMs and HAA5 in w:\jrector\WQ Monitoring Programs and Forms\Stage2Calcs.xls. The LRAA is calculated as the running average of four quarters of data.

For calculating compliance with Stage 2, results that are below analytical detection limits will be entered as a zero. This is a departure from methods used for calculating compliance with Stage 1, but because results are so low for the entire Lacey system, compliance should not be affected.

An example of calculating LRAA is shown below:

Sample Station SS100		
THM µg/L	date	LRAA µg/L
6	03/13/2008	6.0
0.6	06/09/2008	3.3
5.2	08/27/2008	3.9
5	10/24/2008	4.2

Attachment B. Distribution System Schematic



Appendix R
INORGANIC ORGANIC MONITORING PLAN

City of Lacey
Inorganic / Organic Contaminant
Monitoring Plan

Plan Preparation Information

System Name:	Lacey Water Department, PWSID# 43500Y
Date Plan Completed:	**03/08/2012**
Dates Modified:	
Name of Plan Preparer:	Julie Rector, Water Quality Analyst
Daytime Phone:	(360) 493-2410

Contents

<u>Tables</u>

1. Introduction and Planning Information

Water System compliance monitoring requirements for the City of Lacey Water System are addressed in three planning documents: the *City of Lacey Coliform Monitoring Plan*, the *City of the Lacey Disinfectants and Disinfection Byproducts Monitoring Plan*, and this plan, the *City of Lacey Inorganic and Organic Monitoring Pla*n.

This plan describes source and distribution system monitoring that is required for compliance with the Safe Drinking Water Act, and includes requirements outlined in the National Primary Drinking Water Regulations, the Arsenic Rule, the Radionuclides Rule, the Lead and Copper Rule, and the Unregulated Contaminant Monitoring Rule (UCMR).

Whereas most drinking water regulations originate from EPA's Office of Ground Water and Drinking Water, EPA has delegated authority for overseeing most drinking water compliance programs to state primacy agencies. In Washington, the Washington State Department of Health (DOH) has primacy authority and implements drinking water programs through the DOH Office of Drinking Water.

1.1 Contacts for Monitoring and Compliance

City of Lacey—		
Water System Operators	Terry Cargil	(360) 413-4395
	Peter Brooks, P.E.	(360) 438-2675
Sample Collection	Bob Burreson	(360) 413-4341
Backup samplers	Rick McBroom	(360) 412-2895
	Ed Andrews	(360) 413-4356
City contact for monitoring compliance, monitoring plans, and data requests	Julie Rector	(360) 493-2410
Laboratory—		
Water Management Lab, Inc.	Christa Holme	(253) 531-3121
Thurston Co. Environmental Health Lab (nitrates only)	Mike Clark	(360) 786-5465
State Department of Health, Southwest Region–		
WQ Monitoring Compliance Tracking	Sophia Petro	(360) 236-3046
Regional Engineer	Virpi Salo-Zieman	(360) 236-3037

1.2. Source Information

The Lacey system is primarily supplied by groundwater, from 19 wells owned and operated by the City. Although chlorine is injected at each source well or wellfield in order to maintain a chlorine residual within the distribution system, only three of Lacey's sources receive treatment. The city also purchases water from the City of Olympia, and is supplied through an intertie that conveys treated water from Olympia's McAllister Springs treatment plant. This source is regulated as surface water with limited alternative for filtration.

DOH assigns susceptibility ratings for each source, and these ratings are used in part to determine monitoring frequency and waiver eligibility for various contaminants. Source, treatment, and susceptibility ratings are shown in Table 1.

Table 1. Sources, Treatment, and Normal Operating Periods

DOH ID	Source Name(s)	Address	Source Treatment	Suscepti-bility Rating	Normal Operation Periods
S01	Well 1	3300 College St	None	Moderate	Year-round
S02	College well 2	8826 Milbanke Dr SE	None	Moderate*	Year-round
S03	College well 3	3300 College St	None	Moderate*	Year-round
S04	Well 4	6100 W Sarazan SW	None	High	Year-round
S06	Well 6C; Judd Hill	2400 Judd St	None	Low	Year-round
S07	Well 7	5608 Pacific Ave	Pyrolusite filtration (for Fe, Mn)	Low	Year-round
S09	Well 9	4830 Yelm Hwy	None	Low	Year-round
S10	Well 10	5138 Yelm Hwy	Disinfection	Low	Year-round
S15	Beachcrest well 1	8905 48th Ave	None	Moderate*	Year-round
S16	Beachcrest well 2	8905 48th Ave	None	Moderate*	Year-round
S19	Hawks Prairie	4040 Marvin Rd NE	GAC & Greensand filtration (for Fe, Mn)	Low	Year-round
S20	McAllister	2020 Marvin Rd	None	Moderate	Year-round
S21	Madrona well 1	8826 Milbanke Dr SE	None	Low*	Year-round
S22	Madrona well 2	8826 Milbanke Dr SE	None	Low*	Year-round
S24	Nisqually Well 19A	11544 6th Ave	None	Moderate	Year-round
S25	Nisqually Well 19C	11544 6th Ave	None	Moderate	Year-round
S27	Evergreen Estates	2800 Hibiscus Ct	None	Low	Year-round
S28	Madrona WF well 3	8826 Milbanke Dr SE	None	Low	Year-round
S29	Betti well	2950 Marvin Rd	None	Low	Year-round
S30	Intertie: City of Olympia	Pacific Avenue	Disinfected by supplier		Year-round
S17	Wellfield designation for S15 and S16	8905 48th Ave		Moderate	
S18	Wellfield designation for S02 and S03	8826 Milbanke Dr SE		Moderate	
S23	Wellfield designation for S21 and S22	8826 Milbanke Dr SE		Low	

* source within a wellfield – susceptibility is assigned to the wellfield

2. Sampling to Determine Compliance with Drinking Water Standards

Most compliance samples for inorganic and organic contaminants are collected from the sources, but also include samples for lead and copper collected from customer's taps.

2.1 Source Samples Collected for Compliance with Drinking Water Standards

A summary of all compliance samples required for Lacey's source wells is provided in Table 2. Source water samples are required to verify compliance with primary and secondary drinking water standards. Primary drinking water standards have been established for nitrate, inorganic contaminants (IOCs), organic contaminants (sub-grouped into volatile organic and synthetic organic contaminants), and radionuclides. The individual contaminants that are regulated under the National Drinking Water Regulations are listed in Appendices 1, 2, and 3. The standards for these contaminants are established to protect public health, and are enforceable limits. Secondary contaminants are listed in Appendix 4. EPA has established non-enforceable guidelines for these contaminants. The Washington State Department of Health has also established secondary limits for color, specific conductance, and total dissolved solids. These contaminants are sampled at the same time IOC samples are collected from source wells.

When new drinking water standards take effect, compliance samples need to be collected the first year that they are in effect even if a waiver was requested. For example, water systems were required to collect arsenic samples from all sources during the first year the Arsenic Rule was in effect, even if they had purchased inorganics waivers.

2.1.1 Sample Locations

All samples are collected after treatment and/or after chlorine injection, and prior to entry into the distribution system. Most sources have a dedicated sampling station located outside of the wellhouses. Sites that do not have external sampling stations include wellfields S17, S18, and S23, and well 4 – these sites are sampled within their chlorination buildings, at a sample port located near the chlorine analyzers. Sources S07 and S19 are both sampled within their respective treatment plant buildings, at dedicated faucets for final treated water that is leaving the treatment plants.

2.1.2 Sample Timing

The DOH summarizes source monitoring requirements for the Lacey system in an annual Water Quality Monitoring Report. The report lists when samples should be collected within the calendar year, as well as samples that must collected within the 3-year compliance period. Because the report is based on DOH's database used for compliance tracking, any errors in the report, or changes in the status of a source that may affect compliance monitoring, should be reported to DOH so that they can enter notes or corrections to their database. New sources will be subject to additional sampling that is discussed below in section 2.1.4.

2.1.3 Waivers

DOH has the authority to grant monitoring waivers, and bases eligibility on source susceptibility and the history of monitoring results. Depending on the contaminant and minimum monitoring frequencies required by EPA, waivers can reduce required monitoring frequencies so that no samples, or just fewer samples, must be collected during each 3-year compliance period.

Table 2. Source Monitoring Required for the National Primary and Secondary Drinking Water Regulations

Source	Nitrate	IOC	VOC 524.2	SOC 515.2 Herbicides	SOC 531.2 Insecticides	SOC 525.2 Gen. Pest.	SOC 504 EDB and soil fumigants	Gross Alpha & Radium 228	SOC 548.1 Endothall	SOC 1613 Dioxin	SOC 549.2 Diquat	SOC 547.1 Gly-phosate
S01	1 sample each yr (1)	1 sample every 3 yrs	1 sample every 3 yrs	Purchased waiver (2)	Purchased waiver 2	Purchased waiver 2	2 samples every 3 yrs	2 samples every 3 yrs	State waiver	State waiver	State waiver	State waiver
S04	1 sample each yr , in May (3)	1 sample every 3 yrs	1 sample every 3 yrs (4)	Purchased waiver 2	Purchased waiver 2	Purchased waiver 2	State waiver	2 samples every 3 yrs	State waiver	State waiver	State waiver	State waiver
S06	1 sample each yr (1)	1 sample every 3 yrs	Purchased waiver 2	Purchased waiver 2	Purchased waiver 2	Purchased waiver 2	State waiver	2 samples every 3 yrs	State waiver	State waiver	State waiver	State waiver
S07	1 sample each yr (1)	1 sample every 3 yrs	Purchased waiver 2	Purchased waiver 2	Purchased waiver 2	Purchased waiver 2	State waiver	2 samples every 3 yrs	State waiver	State waiver	State waiver	State waiver
S09	1 sample each yr (1)	1 sample every 3 yrs	Purchased waiver 2	Purchased waiver 2	Purchased waiver 2	Purchased waiver 2	State waiver	2 samples every 3 yrs	State waiver	State waiver	State waiver	State waiver
S10	1 sample each yr (1)	1 sample every 3 yrs	Purchased waiver 2	Purchased waiver 2	Purchased waiver 2	Purchased waiver 2	State waiver	2 samples every 3 yrs	State waiver	State waiver	State waiver	State waiver
S17 (5)	1 sample each yr (1)	1 sample every 3 yrs	1 sample every 3 yrs	Purchased waiver 2	Purchased waiver 2	Purchased waiver 2	State waiver	2 samples every 3 yrs	State waiver	State waiver	State waiver	State waiver
S18 (5)	1 sample each yr (1)	1 sample every 3 yrs	1 sample every 3 yrs	Purchased waiver 2	Purchased waiver 2	Purchased waiver 2	2 samples every 3 yrs	2 samples every 3 yrs	State waiver	State waiver	State waiver	State waiver
S19	1 sample each yr (1)	1 sample every 3 yrs	Purchased waiver 2	Purchased waiver 2	Purchased waiver 2	Purchased waiver 2	State waiver	2 samples every 3 yrs	State waiver	State waiver	State waiver	State waiver
S20	1 sample each yr (1)	1 sample every 3 yrs	1 sample every 3 yrs	Purchased waiver 2	Purchased waiver 2	Purchased waiver 2	2 samples every 3 yrs	2 samples every 3 yrs	State waiver	State waiver	State waiver	State waiver
S23 (5)	1 sample each yr (1)	1 sample every 3 yrs	Purchased waiver 2	Purchased waiver 2	Purchased waiver 2	Purchased waiver 2	State waiver	2 samples every 3 yrs	State waiver	State waiver	State waiver	State waiver
S24	1 sample each yr (1)	1 sample every 3 yrs	1 sample every 3 yrs	Purchased waiver 2	Purchased waiver 2	Purchased waiver 2	State waiver	2 samples every 3 yrs	State waiver	State waiver	State waiver	State waiver
S25	1 sample each yr (1)	1 sample every 3 yrs	1 sample every 3 yrs	Purchased waiver 2	Purchased waiver 2	Purchased waiver 2	State waiver	2 samples every 3 yrs	State waiver	State waiver	State waiver	State waiver
S27	1 sample each yr (1)	1 sample every 3 yrs	1 sample every 3 yrs (4)(2)	Purchased waiver 2	Purchased waiver 2	Purchased waiver 2	State waiver	2 samples every 3 yrs	State waiver	State waiver	State waiver	State waiver
S28	1 sample each yr (1)	1 sample every 3 yrs	1 sample every 3 yrs (4)(2)	Purchased waiver 2	Purchased waiver 2	Purchased waiver 2	State waiver	2 samples every 3 yrs	State waiver	State waiver	State waiver	State waiver
S29	1 sample each yr (1)	1 sample every 3 yrs	1 sample every 3 yrs (4)(2)	Purchased waiver 2	Purchased waiver 2	Purchased waiver 2	State waiver	2 samples every 3 yrs	State waiver	State waiver	State waiver	State waiver

1 Nitrate is included with IOCs, and doesn't need to be collected the same year IOCs are collected

2 DOH will be updating the waiver model; waiver purchases beyond 2010 will depend on new model.

3 Required by DOH. Intent is to sample during month of highest reported concentration to ensure that nitrate remains below 8 mg/L.

4 This is a reduced monitoring schedule granted with a purchased waiver

5 Wellfield Sample

For each contaminant group, there is a maximum number of compliance periods for which "no sampling required" is allowed, which complicates determining the minimum sampling requirements for organic contaminants. This makes the DOH water quality monitoring report all the more helpful for specifying sample requirements.

Waivers must be requested in writing, and DOH simplifies this process considerably by sending forms showing waiver eligibility for each source, and the required number of samples that must be collected with, and without, a waiver. Lacey indicates on the forms which waivers will be requested. DOH does charge for processing waiver requests, but the lower cost of the waivers compared to the lab tests is the primary reason that Lacey requests waivers.

State waivers have been issued for Dioxin, Endothall, Diquat, and Glyphosate. In addition, state waivers for EDB and Soil Fumigants apply to all Lacey sources except S01, S18, and S20.

As of early 2012, DOH has been working on a new waiver model that is expected to change how waivers are used for compliance monitoring. This section, and Table 2, will be updated after the new waiver model and process take effect.

2.1.4 New Source Monitoring

The Lacey water system is still expanding and is planning for constructing new wells. All new sources have specific monitoring requirements that are summarized in Table 3. New sources are not eligible for waivers until after initial samples are collected.

Table 3. Source Monitoring Required for New Sources

Parameter/Group	Sampling Requirements
Nitrate	Sample annually (separate sample does not need to be collected same year as IOC)
IOC	1 sample each 3-year compliance period for three compliance periods, after which the source may be eligible for a waiver[1].
VOC 524.2	Quarterly samples for 1 year; then could be eligible for a waiver. (Without waiver, sample annually for 3 yrs; then could be eligible to sample every 3 years[2])
SOCs (includes 515.2 Herbicides, 531.2 Insecticides, and 525.2 Gen. Pesticides	Collect a minimum of 1 sample in initial year, then could be eligible for a waiver. Coordinate sampling expectations with DOH when source is approved. DOH could require quarterly samples in initial year if site is not low risk for SOCs.
SOC 504 EDB	Fumigant monitoring is only required if the source is located in the south half of T18N, R01W, or the north half of T18N, R01E or R01W. Sources in these sections will be required to collect quarterly samples for 1 year, and then be required to collect 2 samples every 3 years before being eligible for standard monitoring.
Alpha particles	Quarterly for one year, starting within first quarter of initiating use of source. If results of the first two samples are less than the state reporting level, the following two quarters of sampling is waived and standard monitoring can begin.
Beta particles and photon emitters	DOH has not required Lacey to collect beta particle samples from new sources; they have the authority to determine which systems are at low risk
Uranium	Gross alpha results can substitute for uranium if gross alpha is < 15 pCi/L
Radium 226	Gross alpha results can substitute for Radium 226 if combined results of gross alpha and Radium 228 is < 5 pCi/L
Radium 228	Quarterly for one year. If results of the first two samples are less than the state reporting level, the following two quarters of sampling is waived and standard monitoring can begin.
SOC 548.1 Endothall	State Waiver granted for all sources
SOC 1613 Dioxin	State Waiver granted for all sources
SOC 549.2 Diquat	State Waiver granted for all sources
SOC 547.1 Glyphosate	State Waiver granted for all sources

[1] 40 CFR 141.23(c)(1)
[2] 40 CFR 141.24(f)(4) – (7)

2.1.5 Determining Compliance with Primary and Secondary Standards

Any time a single sample exceeds a primary standard, a confirmation sample should be collected within 24h of learning of the violation. Failure to collect a confirmation sample for nitrate, in particular, will constitute a monitoring violation that is likely to trigger public notification (see section 5).

Compliance with primary and secondary standards is determined by the running annual average at each sampling point. For all analytes with primary MCLs (except nitrate and nitrite), quarterly monitoring is triggered if the MCL is violated. For nitrate and nitrite, quarterly monitoring is triggered when there is a detection that exceeds 5.0 mg/L (50% of the MCL). After completing one year of quarterly sampling, a violation would be confirmed if the running annual average, or one of the quarterly samples, exceeds the MCL.
Lacey has one source – source S04, for nitrate – where quarterly monitoring was triggered in recent years. Quarterly monitoring was required by the DOH from August 2006 through July 2008 after nitrate concentrations suddenly increased above 5.0 mg/L in March 2006. Concentrations peaked at 6.7 mg/L, but have been below 6 mg/L since September 2007 and appear to be continuing to decline. The DOH has approved reduced frequency for compliance monitoring to one sample/year now, but has stipulated that the annual sample must be collected in May, to coincide with the month with the highest concentration detected. Even with reduced monitoring approved, Lacey has been collecting monthly engineering samples since August 2006, and will likely continue this practice until nitrate concentrations in well 4 drop and remain below 4 mg/L.

2.2 Distribution System Sampling for Lead and Copper

Lead and Copper sampled from customer’s taps are regulated as national primary standards, though no MCLs have been established. Instead, Action Levels are used to trigger additional actions to protect customer health.

2.2.1 Sample Number and Frequency

Lacey must collect 30 samples very 3 years under an approved reduced monitoring schedule. The most recent set of samples was collected during September 2011.

2.2.2 Sample Sites

The Lead and Copper Rule primarily addresses the effects of corrosive water on older plumbing that was installed after 1982 and prior to1986, when lead solder was banned from use on plumbing fixtures. The Rule was originally written to have water systems survey plumbing materials in the water system, and to collect distribution samples from homes constructed prior to 1978. The Rule also specifies that the same locations must be sampled during successive compliance periods, although homes where the plumbing has been upgraded need to be replaced in the sampling program with another older home. Addresses sampled each compliance period are in w:\jrector\WQ Monitoring Programs and Forms\Lead and Copper\CU_PB_Monitoring.mdb.

2.2.3 Sampling Approach and Methods

The Lead and Copper Rule allows samples to be collected by residents, as long as they are provided with complete instructions for properly collecting samples and they certify that they followed the instructions. For the last few rounds of sampling, sampling kits have been delivered to customer homes that include an introductory letter, sampling instructions, certification form, and a sample bottle with rubber band all in a plastic city of Lacey door hanger bag. The instructions request each customer to collect the sample the next morning, and then leave the sample with the certification form on their front porch. An intern picks up the samples that morning, fills out the laboratory forms, and delivers the samples to the lab. Generally the city delivers about 35 kits in order to get the required sample number, and has had good success with this approach. Letters, instructions, and certification forms are in w:\jrector\WQ Monitoring Programs and Forms\Lead and Copper\Lead and Copper Testing Procedures2.doc.

Residents who collect samples receive lead and copper results by letter within 2 weeks of the city's receipt of the lab results. Sharing results with the participants is now a requirement under the latest revisions to the Lead and Copper Rule, but has been part of Lacey's program for many compliance periods.

2.2.4 Determining Compliance / No Need for Further Action

Compliance is based on the 90th percentile calculated from all distribution system samples collected during the compliance period, including samples collected for studies or to respond to customer complaints. The system is in compliance if the calculated 90th percentiles are less than the Action Levels for lead and copper (meaning, no more than 10% of individual results exceed the Action Levels). The Action Levels are 0.015 mg/L lead, and 1.3 mg/L copper. Exceeding an Action Level could trigger additional requirements, including water quality parameter monitoring, source water monitoring and treatment, corrosion control treatment, and public education.

Notification requirements for lead and copper sampling took effect October 2011.   These requirements are discussed in more detail in section 5.4.

Though Lacey has been in compliance with the Lead and Copper Rule, the city has a history of customer complaints about blue copper staining in the south part of the 337 zone in the vicinity of well 4. Well 4 has the lowest pH of all of Lacey's source wells, and the city intends to install corrosion control for this well. Project approval was received from DOH, and final facility design has been in progress since 2008.

2.3 Asbestos Monitoring

Because more than 10% of Lacey's waterlines are asbestos concrete, the water system is not eligible for a waiver from asbestos monitoring. Currently the system is required to collect one sample from the distribution system every nine years or as directed by DOH.

The most recent asbestos sample was collected November 9, 2010. The result was less than the detection limit of 0.129 million fibers/liter (MFL). The MCL for asbestos is 7 MFL greater than 10 microns in length.

3. Monitoring Required for Water Treatment Facilities

Treated sources have additional monitoring requirements that are for ensuring treatment effectiveness. By ensuring treatment effectiveness, these monitoring requirements also ensure compliance with drinking water standards by showing compliance with MCLs or treatment techniques.

Currently the City has four treated sources: well 7 (S07), well 10 (S10), Hawks Prairie well (S19), and wholesale water purchased from the City of Olympia (S30). Additional monitoring requirements for these sources are discussed below. Monitoring requirements for disinfectants are addressed here as well as in *Lacey's Disinfectants and Disinfection Byproducts Monitoring Plan.*

3.1 Well 7 "ATEC" facility and the Hawks Prairie Water Treatment Plant

An ATEC water treatment system was constructed in 2001 to remove iron and manganese from well 7 water. Treatment consists of oxidizing raw water first with potassium permanganate and then chlorine, and then filtering through pyrolusite (manganese dioxide) media. Treated water consistently meets the treatment goals of <0.15 mg/L iron, and <0.025 mg/L manganese.

Hawks Prairie Well #1 also exceeds the secondary MCL for manganese. In addition, the well has been known to have objectionable taste and odor due to the presence of hydrogen sulfide. Initially when the well was brought on-line in 1996 the city diluted water from this source in the 4 MG Hawks Prairie reservoir that is located at the well site. However, dilution limited the city's ability to maximize use of this well and its water right so the city built a treatment facility on the same site in 2008. The treatment process involves aerating raw water, filtering it through GAC filters to remove hydrogen sulfide, injecting chlorine, filtering through green sand filters to remove iron and manganese, flowing through a chlorine contact chamber to ensure breakpoint chlorination, and boosting the chlorine concentration as needed to achieve the target residual.

Applicable monitoring requirements for chemical contaminant treatment systems are in WAC 246-290-455. The minimum requirement for monitoring is to collect finished drinking water samples at a point directly downstream of the treatment plant prior to the first consumer on a monthly basis. There are no requirements for routinely submitting monitoring data to the Department of Health, although records can be requested at any time. Under WAC 246-290-480, data records for monitoring the treatment system are required to be maintained for a minimum of 3 years.

For the purposes of tracking the performance of the treatment systems, water system operators collect and analyze samples each weekday that the treatment plants are in operation. Raw and finished water are tested for iron and manganese. Total chlorine is measured by analyzers in finished water. Hardcopy results will be retained for a minimum of 3 years, but all data will also be maintained in electronic files that will be retained for the life of the facility.

Filters at both treatment plants are backwashed to remove accumulated material. At this time there are no specific requirements associated with residuals management for treatment plants that remove secondary contaminants. However, the city is aware that EPA is considering new regulations that address residuals management.

3.2 Disinfection of Well 10 Water

Well 10 is Lacey's only source that is disinfected. Disinfection was provided in 2007 after the well was offline for a period for rehabilitation and other work, and a number of follow-up bacteria samples tested positive for total coliforms. However, samples of raw well 10 water collected since disinfection was constructed show have been absent of coliforms.

Coliform bacteria is regulated under the national primary standards, and applicable monitoring requirements for source disinfection are listed in WAC 246-290-451(6). There is no requirement to sample treated well 10 water prior to entry to the distribution system. Instead, compliance with disinfection of the source is based on meeting the required contact time, and by showing that a detectable chlorine residual is maintained in all active parts of the distribution system. The WAC requires chlorine residuals to be sampled at representative points in the distribution on a daily basis, unless reduced monitoring is approved. In November 2007 Lacey received approval from DOH to reduce disinfection residual monitoring to weekdays only. Monitoring requirements related to the use of chlorine are discussed more detail in the *City of Lacey Disinfectants and Disinfection Byproducts Monitoring Plan*.

3.3 Intertie with the City of Olympia

This intertie is located on Pacific Avenue and supplies treated surface water that is regulated as having a "limited alternative to filtration." Olympia must ensure that water entering the distribution system contains a chlorine residual of at least 0.2 mg/L at all times. Monitoring requirements associated with disinfected surface water sources are in WAC 246-290-692(5) and WAC 246-290-694(8) and are discussed in the *City of Lacey Coliform Monitoring Plan* and *City of Lacey Disinfectants and Disinfection Byproducts Monitoring Plan.*

Olympia is planning to replace its surface water source, McAllister Springs, with a wellfield. For Lacey, Olympia's future change from a surface water to groundwater source of supply will mainly affect Triggered Source monitoring required under the Groundwater Rule, as well as disinfection byproduct monitoring.

4. Unregulated Contaminants

EPA uses data collected from the unregulated contaminants programs to determine whether or not to regulate these contaminants in the future for the protection of human health. Under the Unregulated Contaminants Monitoring Rule (UCMR), community water systems are responsible for collecting samples, having them analyzed for specific contaminants by certified labs, ensuring that data are reported to EPA's central data exchange (CDX) database, and notifying the public of the results.

For UCMR1, Lacey collected List 1 samples in July 2002, and January 2003. Because several of the analytes could be analyzed using VOC or SOC methods, Lacey did not purchase waivers for that compliance period and arranged with the laboratory to have the samples analyzed for UCMR1 as well as contaminants regulated under the National Primary Standards. This saved the city a significant amount of money, although UCMR1 did cost the city approximately $9,500 for analytes not covered by other tests.

For UCMR2, Lacey was required to sample for both List 1 and List 2 contaminants. Because it was not possible to combine sampling with other compliance sampling as with UCMR 1, UCMR 2 sampling cost Lacey approximately $44,000. Lacey collected List 1 samples in 2008 and List 2 samples in October 2009 and April 2010.

EPA is required to publish a new contaminant monitoring list every five years, and as data become available, List 2 contaminants may move up to List 1, and List 3 contaminants may move up to List 2. Because of this, Lacey will probably have to monitor modified List 1 contaminants every 5 years.

5. Reporting and Public Notification Requirements

The following description is not meant to be an all-encompassing description of reporting and public notice requirements for the Lacey Water System. Instead, this is intended to identify when compliance monitoring results will trigger public notification requirements, and the timing of notification required for those situations.

Generally, the Department of Health should be notified as soon as possible whenever monitoring data indicate a violation of a drinking quality standard. For most constituents, the violation will also trigger public notification, investigating the source of the problem, and taking corrective action as directed by DOH. However, this should all be done under consultation with the Department.

Most public notice and reporting requirements discussed below are in WAC 246-290-71001, Public notification. Public notice requirements have been divided into three tiers which are based on the seriousness of the violation or situation, and the potential risks to public health. Public notice for Tier 1 and Tier 2 violations should be done in consultation with the Department.

5.1 Tier 1 Notification

Tier 1 notification must be provided to customers as soon as possible, but no later than 24 hours after learning of the violation. The Department of Health must also be notified immediately.

Violations that would trigger Tier 1 notification could include:

- an acute violation for total coliforms in the distribution system (i.e., a confirmed presence of total coliforms with the presence of fecal coliform or E. coli in any of the samples)
- a violation of the MCL for nitrate from a source, or a failure to take a confirmation sample within 24h of receipt of a sample showing a violation of the nitrate MCL
- an outbreak of waterborne disease that is likely to result from the water system

5.2 Tier 2 Notification

Tier 2 Notification must be provided to customers as soon as practical, but no later than 30 days after learning of the violation. The notice must be repeated every 3 months as long as the violation persists, unless the Department determines that prolonged notice is not required.

Violations that would trigger Tier 2 notification could include:

- a nonacute violation for total coliforms in the distribution system
- any violation of an MCL, MRDL, and treatment technique requirement that does not require Tier 1 notification

5.3 Tier 3 Notification

Tier 3 Notification must be provided to customers no later than one year after the violation occurs. Typically Tier 3 notification can be provided via the annual Consumer Confidence Report.

Violations that would trigger Tier 3 notification could include:

- monitoring violations that do not require Tier 1 notification
- availability of unregulated contaminant monitoring results
- exceedance of the fluoride secondary MCL

5.4 Lead and Copper Consumer Notification

Effective October 2011, water systems must provide notification of sample results to water users where lead and copper samples are collected. This notification must provide specific language regarding health effects of lead and copper. Certification of public notice must also be provided to the Department after sampling is completed. Templates for public notification and certification of public notice are provided in Appendices 5 and 6.

5.5 Consumer Confidence Reports

CCRs must be delivered to customers by July 1 of each year. The reports are required to contain information on the quality of the water delivered by the systems and characterize the risks (if any) from exposure to contaminants detected in the drinking water in an accurate and understandable manner. The CCR must report detected results for all contaminants for which monitoring is required. For reporting purposes, an analyte is "detected" when results are at or above the levels prescribed in 40 CFR 141.23 (inorganic contaminants), 40 CFR 141.24 (for organic contaminants), or 40 CFR 141.25(c) (radioactive contaminants).

The data must be derived from the most recent data collected to comply with EPA and state monitoring requirements, and results for detected analytes must be reported in the CCR every year until a subsequent sample from that source provides more updated information. . If regulated contaminants are sampled less than once a year, the table(s) must include the date and results of the most recent sampling and the report must include a brief statement indicating that the data presented in the report are from the most recent testing done in accordance with the regulations. No data older than five years need be included.

For most contaminants that are sampled annually or less frequently, report the highest detected level at any sampling point and the range of detected levels. For contaminants evaluated on a system-wide basis by calculating a running annual average of all samples at all sampling points (e.g., disinfection byproducts under Stage 1), report the running annual average and the range of individual results expressed in the same units as the MCL. For lead and copper, report the 90th percentile value of the most recent round of sampling and the number of sampling sites exceeding the action level. For total coliform, report the highest monthly percentage of positive samples.

The table(s) must clearly identify any data indicating violations of MCLs, MRDLs, or treatment techniques. Explanations of violations must be clear and understandable, and must include the length of the violation, the potential adverse health effects, and actions taken by the system to address the violation. To describe the potential health effects, the system must use the relevant language of WAC 246-290-72012.

When nitrate is detected at levels above 5 mg/l, but below the MCL of 10 mg/L, the CCR must include the following language unless alternative language is approved by the Department:

> Nitrate in drinking water at levels above 10 ppm is a health risk for infants of less than six months of age. High nitrate levels in drinking water can cause blue-baby syndrome. Nitrate levels may rise quickly for short periods of time because of rainfall or agricultural activity. If you are caring for an infant, you should ask for advice from your health care provider.

EPA also amended required notification language for all CCRs regarding lead, effective Ocotober 2011. The following is EPA's language:

> If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. The Lacey Water System is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for thirty seconds to two minutes before using water for drinking or cooking. If you are

concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at http://www.epa.gov/safewater/lead

For detected unregulated contaminants for which monitoring is required, the table(s) must contain the average and range at which the contaminant was detected. The report may include a brief explanation of the reasons for monitoring for unregulated contaminants.

By April 1 of each year, CCR data need to be provided to water systems that purchase water. Lacey currently supplies CCR data to Claudia's water system, and receives data from the city of Olympia.

Appendix 1 – Inorganic Chemicals regulated by the National Drinking Water Regulations

Primary Standards -- Inorganic Chemicals

Contaminant	MCLG (mg/L)	MCL or TT (mg/L)
Antimony	0.006	0.006
Arsenic	0	0.01
Asbestos	7 million fibers per liter	7 MFL
Barium	2	2
Berlyllium	0.004	0.004
Cadmium	0.005	0.005
Chormium (total)	0.1	0.1
Copper	1.3	TT Action Level = 1.3
Cyanide (as free)	0.2	0.2
Fluoride	4	4
Lead	zero	TT Action Level = 15
Mercury (inorganic)	0.002	0.002
Nitrate (as N)	10	10
Nitrite (as N)	1	1
Selenium	0.05	0.05
Thallium	0.0005	0.002

Appendix 2 -- Organic Chemicals regulated by the National Drinking Water Regulations

Primary Drinking Water Regulations -- Organic Chemicals		
Contaminant	MCLG (mg/L)	MCL or TT (mg/L)
Acrylamide	zero	TT
Alachlor	zero	0.002
Atrazine	0.003	0.003
Benzene	zero	0.005
Benzo(a)pyrene (PAHs)	zero	0.0002
Carbofuran	0.04	0.04
Carbon tetrachloride	zero	0.005
Chlordane	zero	0.002
Chlorobenzene	0.1	0.1
2,4-D	0.07	0.07
Dalapon	0.2	0.2
1,2-Dibromo-3-chloropropane (DBCP)	zero	0.0002
o-Dichlorobenzene	0.6	0.6
p-Dichlorobenzene	0.075	0.075
1,2-Dichloroethane	zero	0.005
1,1-Dichloroethylene	0.007	0.007
cis-1,2-Dichloroethylene	0.07	0.07
trans-1,2-Dichloroethylene	0.1	0.1
Dichloromethane	zero	0.005
1,2-Dichloropropane	zero	0.005
Di(2-ethylhexyl) adipate	0.4	0.4
Di(2-ethylhexyl) phthalate	zero	0.006
Dinoseb	0.007	0.007
Dioxin (2,3,7,8-TCDD)	zero	3E-08
Diquat	0.02	0.02
Endothall	0.1	0.1
Endrin	0.002	0.002
Epichlorohydrin	zero	TT
Ethylbenzene	0.7	0.7
Ethylene dibromide	zero	0.00005
Glyphosate	0.7	0.7
Heptachlor	zero	0.0004
Heptachlorepoxide	zero	0.0002
Hexachlorobenzene	zero	0.001
Hexachlorocyclepentadiene	0.05	0.05
Lindane	0.0002	0.0002
Methoxychlor	0.04	0.04
Oxamyl (Vydate)	0.2	0.2
Polychlorinated biphenyls (PCBs)	zero	0.0005
Pentachlorophenol	zero	0.001
Picloram	0.5	0.5
Simazine	0.004	0.004
Styrene	0.1	0.1
Tetrachloroethlene	zero	0.005
Toluene	1	1
Toxaphene	zero	0.003
2,4,5-TP (Silvex)	0.05	0.05
1,2,4-Trichlorobenzene	0.07	0.07
1,1,1-Trichloroethane	0.2	0.2
1,1,2-Trichloroethane	0.003	0.005
Trichloroethylene	zero	0.005
Vinyl chloride	zero	0.002
Xylenes (total)	10	10

Appendix 3 – Radionuclides regulated by the Radionuclides Rule

Primary Drinking Water Regulations -- Radionuclides

Contaminant	MCLG (mg/L)	MCL or TT (mg/L)
Alpha particles	none ---------- zero	15 picocuries per Liter (pCi/L)
Beta particles and photon emitters	none ---------- zero	4 millirems per year
Radium 226 and Radium 228 (combined)	none ---------- zero	5 pCi/L
Uranium	zero	30 ug/L as of 12/08/03

Appendix 4 – Secondary Contaminants that are not Enforced by EPA, but have been adopted as enforceable standards by WA DOH

Secondary Standards -- Inorganic Chemicals

Contaminant	Secondary Standard
Aluminum	0.05 to 0.2 mg/L
Chloride	250 mg/L
Color	15 (color units)
Copper	1.0 mg/L
Corrosivity	noncorrosive
Fluoride	2.0 mg/L
Foaming Agents	0.5 mg/L
Iron	0.3 mg/L
Manganese	0.05 mg/L
Odor	3 threshold odor number
pH	6.5-8.5
Silver	0.10 mg/L
Sulfate	250 mg/L
Total Dissolved Solids	500 mg/L
Zinc	5 mg/L

Appendix 5 – DOH Lead and Copper Consumer Notice Template

CONSUMER NOTICE
Lead and Copper Water Sample Results

The ____ Water System, I.D. ____________________ , is providing you with the lead and copper test results on the water sample collected at your location. Please share this notice with everyone who uses or drinks the water.

The results at ____

are: **lead ____________________ mg/L and copper _______________ mg/L.**

The maximum contaminant level goal (MCLG) is the level of a contaminant in drinking water below which there are no known or expected risks to health. MCLGs allow for a margin of safety. The action level is the concentration of a contaminant that, if exceeded, triggers treatment requirements or actions a water system must follow.

- The MCLG for lead is "0" and the action level is 15 ppb (or .015 mg/L).
- The MCLG and action level for copper is 1,300 ppb (or 1.3 mg/L).

The water system's compliance with the Lead and Copper Rule (LCR) is calculated by using sample results collected from sites in our sampling pool. Your location's lead or copper results may be higher or lower than the compliance calculation for the overall water system and does not reflect our water system's compliance with the LCR. We will notify all water users if the lead or copper results from our water system exceed the action level.

For more information, please contact: ____
(owner or operator)

at (   )   -   or ____
(phone number)   (address)

This notice is sent to you by ___________________________ Water System on ___/___/_____

How Lead Gets Into Water

Lead in drinking water most often comes from water distribution lines or household plumbing rather than from the water system source. Plumbing sources can include lead pipes, lead solder, faucets, valves, and other components made of brass. Lead from other sources (such as lead-based paint and contaminated dust or soil) can increase a person's overall exposure, which adds to the effects of lead in water.

Potential Health Effects of Lead

The greatest risk of lead exposure is to infants, young children, and pregnant women. Lead can cause serious health problems if too much enters the body. Lead is stored in the bones and can be released later in life. Lead can cause damage to the brain and kidneys, interfere with production of red blood cells that carry oxygen, and may result in lowered IQ in children. During pregnancy, the child receives lead from the mother's bones, which may affect brain development. Low levels of lead can affect adults with high blood pressure or kidney problems.

How Copper Gets Into Water

Copper is a mineral and natural component in soils. In the correct amounts, it is an essential nutrient for humans and plants. In Washington State, most copper in drinking water comes from corrosion of household plumbing. Plumbing sources can include copper pipe and brass fixtures. Copper from plumbing corrosion can accumulate overnight.

Potential Health Effects of Copper

Although copper is an essential mineral in the diet, too much copper can cause health problems. Copper is widely distributed within the tissues of the body, but accumulates primarily in the liver and kidneys. A single dose of 15 mg of copper can cause nausea, vomiting, diarrhea, and intestinal cramps. Severe cases of copper poisoning have led to anemia and to disruption of liver and kidney functions. Individuals with Wilson's or Menke's diseases are at higher risk from copper exposure.

How you can reduce exposure:

- When your water has been sitting for several hours, flush the pipe by running the cold-water tap until the water is noticeably colder before using the water for drinking or cooking. **(The longer water has been sitting in the pipes, the more dissolved metals it may contain).**
- Use only cold water for drinking, cooking, and making baby formula. Hot water may contain higher levels of lead or copper.
- Frequently clean the filter screens and aerators in faucets to remove captured particles.
- If building or remodeling, only use "lead free" or low lead piping and materials. Avoid using copper piping or brass fixtures for locations where water will be consumed or used in food preparation (such as kitchen or bathroom sinks).

Appendix 6 – Lead and Copper Consumer Notice Certification form

Lead and copper consumer notice and certification form

All Group A water systems that conduct lead and copper monitoring must provide individual sampling results to the persons at each sample location. You must also submit the form below to the Washington State Department of Health (DOH) to verify that you completed the notification. You should select all sites for lead and copper sampling from your current lead and copper sampling pool.

Notification of Results: The water system must provide the consumer notice as soon as possible, but no later than 30 days after learning the results.

> **Community water systems:** You must provide individual sampling results to all residences where you collected lead and copper samples. In multi-unit structures, notify only each unit tested.
>
> **Nontransient noncommunity water systems (NTNCs):** You must notify all consumers who use water from the sample tap, even if they do not receive a water bill. With prior approval from DOH, NTNC water systems can post the notice in public areas.

Certification to the state: DOH must receive a sample copy of one consumer notice and a signed certification form (below) within 90 days after the monitoring period ends.

To meet this reporting requirement, you may:

- Use the DOH Consumer Notice Template.
- Use the applicable EPA Consumer Notice template.
- Prepare your own Consumer Notice in conjunction with the state.

If you choose to produce your own Consumer Notice, it must include all of the following:

1. The sample results of the tap tested.
2. An explanation of the health effects of lead.
3. Steps consumers can take to reduce exposure to lead in drinking water.
4. The water system's contact information.
5. The maximum contaminant level goal (MCLG) and action level for lead, and the definitions of these two terms.

Lead and Copper Results: Consumer Notification Certification Form

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

The water system must complete this section. The signature below certifies that the notice contains all required elements.

Complete the following items (check all that apply):

☐ Results received from lab on ____ / ____/____.
☐ Notice mailed to water users at each sample site location on ____ / ____/____.
☐ Notice hand delivered to water users at each sample site location on ___ / ___ /___.
☐ Notice posted at ____________________________ on ___ / ___ / ____.
(***By Department Approval Only***)

_______	___________________________	______________________	_______________
PWS ID	Signature of owner or operator	Position	Date

Within 90 days after the monitoring period ends, send a copy of the completed notice and this certification form to: Washington State Department of Health, Office of Drinking Water, Water Quality Section, PO Box 47822, Olympia WA 98504-7822 or fax to (360) 236-2252.

Appendix S
STORAGE ANALYSIS

TABLE 1 - RESERVOIR VOLUME CALCULATIONS

Reservoir	Service Area	Base Elevation ft	Overflow Elevation ft	Height ft	Diameter ft	Cross-Sectional Area sf	Volume MG	Previous Plan Volume MG	Notes
Westside	337 Zone	232.50	274.50	42.00	90.00	6,362	2.00	2.00	
Judd Hill	337 Zone	236.50	311.00	74.50	34.00	908	0.51	0.50	
Union Mills	337 Zone	271.50	337.50	66.00	76.00	4,536	2.20	2.00	Volume provided by City staff.
Steilacoom	337 Zone	265.00	337.50	72.50	84.00	5,542	3.01	3.00	
McAllister	400S Zone	300.00	400.00	100.00	45.00	1,590	1.19	1.20	
Hawks Prairie	400N Zone	295.00	380.00	85.00	90.00	6,362	4.04	4.00	
Nisqually	188 Zone	162.00	189.00	27.00	30.50	731	0.15	0.15	
Total							13.09	12.85	

TABLE 2 - DEAD VOLUME CALCULATIONS

Reservoir	Service Area	Base Elevation ft	Max Served Elevation ft	Minimum Pressure psi	Min Tank Elevation Required ft	Height above Base Elevation ft	Height above base for Booster Pump "Off" ft	Dead Volume MG	Available Storage MG	Notes
Westside	337 Zone	232.5	264.00	20	310	78	10	0.48	1.52	Reservoir is pumped.
Judd Hill	337 Zone	236.5	264.00	20	310	74	10	0.07	0.44	Reservoir is pumped.
Union Mills	337 Zone	271.5	264.00	20	310	39		1.31	0.89	
Steilacoom	337 Zone	265.0	264.00	20	310	45		1.87	1.13	
McAllister	400S Zone	300.0	310.00	20	356	56		0.67	0.52	
Hawks Prairie	400N Zone	295.0	292.00	20	338	43	10	0.48	3.57	Reservoir is pumped.
Nisqually	188 Zone	162.0	30.00	20	76	0		0.00	0.15	
Total								4.87	8.22	

TABLE 3 - OPERATIONAL STORAGE CALCULATIONS

Reservoir	Service Area	Operating Band ft	Operating Band MG	Notes
Westside	337 Zone	2.00	0.10	
Judd Hill	337 Zone	0.00	0.00	Not called on by supply wells; no operating band
Union Mills	337 Zone	2.00	0.06	Operational volume provided by City staff
Steilacoom	337 Zone	2.00	0.08	
McAllister	400S Zone	2.00	0.02	
Hawks Prairie	400N Zone	2.00	0.10	
Nisqually	188 Zone	2.00	0.01	
Total			0.36	

TABLE 4 - INSTANTANEOUS SUPPLY CAPACITY (MGD)

Source	Planning Year that Source is Online	Service Level			Total System	Back up Power?	
		188	337	400			
S01	2009		0.43		**0.43**	Yes	125-kw
S02	2009		0.86		**0.86**	No	
S03	2009		0.30		**0.30**	Yes	125-kw
S04	2009		1.08		**1.08**	No	
S06	2009		0.58		**0.58**	Yes	125-kw
S07	2009		2.59		**2.59**	No	
S09	2009		0.94		**0.94**	No	
S10	2009		1.44		**1.44**	No	
S15	2009			0.26	**0.26**	No	
S16	2009			0.24	**0.24**	No	
S19	2009			1.08	**1.08**	Yes	Onsite Generator (800-kW)
S20	2009			0.84	**0.84**	No	
S21	2009			2.10	**2.10**	Yes	
S22	2009			2.30	**2.30**	Yes	500-kw
S28	2009			2.30	**2.30**	Yes	
S24	2009	0.10			**0.10**	No	
S25	2009	0.33			**0.33**	No	
S27	2009			1.01	**1.01**	Yes	500-kW
S29	2009			1.44	**1.44**	Yes	500-kW
Olympia Intertie (S30)	2009		1.00		**1.00**	Yes	125-kW
G2-30248 (HP)	2014			1.15	**1.15**	Yes	
G2-30249 (Betti)	2014			0.00	**0.00**	Yes	
Olympia Brewery	2020		3.13		**3.13**	Yes	
G2-29304 (Evergreen)	2017			0.58	**0.58**	Yes	
S04 Improvements	2029		2.38		**2.38**	Yes	
S01 Improvements	2029		0.53		**0.53**	Yes	
G2-30251 (Marvin)	2021			1.44	**1.44**	Yes	

TABLE 4 - INSTANTANEOUS SUPPLY CAPACITY (MGD) (continued)

	188	337	400	System	Notes
2009 Planning Year					
Total Supply Capacity	0.43	9.22	11.58	21.23	
Sources without Power	0.43	6.91	1.34	8.68	
Reliable Supply Capacity	0.00	2.31	10.24	12.55	Reliable = Sources with back-up power
Largest Supply Source	0.33	2.59	2.30	2.59	
Firm Supply Capacity	0.10	6.63	9.28	18.64	Firm = Total minus largest source
2015 Planning Year					
Total Supply Capacity	0.43	9.22	12.73	22.38	
Sources without Power	0.43	6.91	1.34	8.68	
Reliable Supply Capacity	0.00	2.31	11.39	13.70	
Largest Supply Source	0.33	2.59	2.30	2.59	
Firm Supply Capacity	0.10	6.63	10.43	19.79	
2019 Planning Year					
Total Supply Capacity	0.43	8.22	13.31	21.96	Olympia Supply is offline in 2017
Sources without Power	0.43	6.91	1.34	8.68	
Reliable Supply Capacity	0.00	1.31	11.97	13.28	
Largest Supply Source	0.33	2.59	2.30	2.59	
Firm Supply Capacity	0.10	5.63	11.01	19.37	
2029 Planning Year					
Total Supply Capacity	0.43	11.34	14.75	26.52	Not including improvements to well 1 or well 4
Sources without Power	0.43	6.91	1.34	8.68	
Reliable Supply Capacity	0.00	4.43	13.41	17.84	
Largest Supply Source	0.33	3.13	2.30	3.13	
Firm Supply Capacity	0.10	8.21	12.45	23.39	

Storage Analysis

400 Zone		2012	2015	2019	2029	
DEMAND SUMMARY						
400 Zone Demands						
Projected ADD	mgd	2.22	2.57	3.06	4.10	
	gpm	1,540	1,781	2,123	2,849	
Projected MDD	mgd	4.68	5.41	6.45	8.66	
	gpm	3,250	3,759	4,480	6,012	
Projected PHD	mgd	7.62	8.79	10.45	13.98	
	gpm	5,292	6,106	7,260	9,711	
Number of ERUs		9915	11466	13667	18339	
SUPPLY CAPACITY						
Total Supply Capacity	mgd	11.58	12.73	13.31	14.75	
	gpm	8,040	8,840	9,240	10,240	
Reliable Supply Capacity	mgd	10.24	11.39	11.97	13.41	
	gpm	7,110	7,910	8,310	9,310	
Largest Supply Source	mgd	2.30	2.30	2.30	2.30	Well S22 or S28
	gpm	1,600	1,600	1,600	1,600	
Firm Supply Capacity	mgd	9.27	10.43	11.00	12.44	Total - Largest Source
	gpm	6,440	7,240	7,640	8,640	
OFFSITE DEMANDS						
Offsite Demands - Total						
Required Capacity for 400 Service Level	mgd	7.62	8.79	10.45	13.98	PHD
	gpm	5,292	6,106	7,260	9,711	
Supply Capacity Available to other Service	mgd	3.96	3.94	2.85	0.76	Total Capacity - PHD for 400 Service Level
	gpm	2,748	2,734	1,980	529	
Supply to 188 Service Level	mgd	0.07	0.07	0.07	0.07	
	gpm	47	47	47	47	
Supply to 337 Service Level	mgd	3.89	3.87	2.78	0.69	
	gpm	2,701	2,687	1,933	482	
Total offsite demands	mgd	3.96	3.94	2.85	0.76	
	gpm	2,748	2,734	1,980	529	
Supply Capacity Remaining for 400 Service	mgd	7.62	8.79	10.45	13.98	Check
	gpm	5,292	6,106	7,260	9,711	
Offsite Demands - Reliable						
Required Capacity for 400 Service Level	mgd	4.44	5.13	6.12	8.21	2*ADD
	gpm	3,081	3,563	4,247	5,699	
Remaining Reliable Capacity	mgd	5.80	6.26	5.85	5.20	Available for other zones
	gpm	4,029	4,347	4,063	3,611	
Supply to 188 Service Level	mgd	0.22	0.22	0.22	0.22	
	gpm	152	152	152	152	
Supply to 337 Service Level	mgd	5.58	6.04	5.63	4.98	Available after supplying to 188 Zone
	gpm	3,877	4,195	3,912	3,460	
Total offsite demands	mgd	5.80	6.26	5.85	5.20	
	gpm	4,029	4,347	4,063	3,611	
Reliable Supply Capacity Remaining for 400 Service Level	mgd	4.44	5.13	6.12	8.21	Check
	gpm	3,081	3,563	4,247	5,699	
REQUIRED STORAGE						
Operational	MG	0.12	0.12	0.12	0.12	2.00 ft band in McAllister and Hawks Prairie
Equalizing	MG	0.00	0.00	0.00	0.00	Equalizing Storage = (PHD - Capacity 400 Service Level) * 150 minutes
Fireflow/Standby (Nested)						
Fireflow	MG	0.96	0.96	0.96	0.96	4000 gpm for 4 hours from "Fire Flow
Standby (DOH Method 1)	MG	1.98	2.29	2.73	3.67	Minimum of 200 gpd/ERU
Standby (DOH Method 2)	MG	0.00	0.00	0.00	0.00	2*ADD - Firm Capacity*1day
Standby (City Policy)	MG	0.00	0.00	0.00	0.00	2*ADD - Reliable Capacity*1day
Required Standby	MG	0.00	0.00	0.00	0.00	Use 2*ADD-Reliable Capacity only
Maximum Required Fireflow/Standby	MG	0.96	0.96	0.96	0.96	Fire-flow storage controls
Total Required Storage	MG	1.08	1.08	1.08	1.08	Sum of required storage numbers
EXISTING STORAGE						
McAllister Reservoir	MG	0.52	0.52	0.52	0.52	Total volume - dead volume
Hawks Prairie Reservoir	MG	3.57	3.57	3.57	3.57	Total volume - dead volume
Total Existing Storage	MG	4.09	4.09	4.09	4.09	Sum of existing storage volumes
EXCESS (DEFICIT) EXISTING STORAGE	MG	3.01	3.01	3.01	3.01	Total Existing Storage - Total Required
Storage Required for 188 Zone	MG	0.02	0.02	0.02	0.02	
Excess Storage Remaining	MG	2.99	2.99	2.99	2.99	
Storage for 337 Zone	MG	0.12	0.55	2.99	2.97	
400 Zone Excess (Deficit)	MG	2.87	2.44	0.00	0.03	

188 Zone	2012	2015	2019	2029	
DEMAND SUMMARY					
Projected ADD mgd	0.11	0.11	0.11	0.11	
gpm	76	76	76	76	
Projected MDD mgd	0.23	0.23	0.23	0.23	
gpm	160	160	160	160	
Projected PHD mgd	0.50	0.50	0.50	0.50	
gpm	347	347	347	347	
Number of ERUs	488	488	488	488	
SUPPLY CAPACITY					
Total Supply Capacity mgd	0.43	0.43	0.43	0.43	
gpm	300	300	300	300	
Reliable Supply Capacity mgd	0.00	0.00	0.00	0.00	
gpm	0	0	0	0	
Largest Supply Source mgd	0.33	0.33	0.33	0.33	Well S25
gpm	230	230	230	230	
Firm Source Capacity mgd	0.10	0.10	0.10	0.10	
gpm	70	70	70	70	
Total Supply Capacity with 400 Service Area Storage					
Supply Required from 400 Service Level mgd	0.07	0.07	0.07	0.07	PHD - Total Capacity
gpm	47	47	47	47	
Reliable Supply Capacity with 400 Service Area Storage					
Supply Required from 400 Service Level mgd	0.22	0.22	0.22	0.22	2*ADD - Reliable Capacity
gpm	152	152	152	152	
Reliable Supply from 400 Service Level mgd	0.22	0.22	0.22	0.22	
gpm	152	152	152	152	
REQUIRED STORAGE					
Operational MG	0.01	0.01	0.01	0.01	2.00 ft band in Nisqually Reservoir
Equalizing MG	0.01	0.01	0.01	0.01	Equalizing Storage = (PHD - Total Supply 150 minutes
Fireflow/Standby (Nested)					
Fireflow MG	0.15	0.15	0.15	0.15	1,250 gpm for 2 hours from "Fire Flow
Standby (DOH Method 1) MG	0.10	0.10	0.10	0.10	Minimum of 200 gpd/ERU
Standby (DOH Method 2) MG	0.12	0.12	0.12	0.12	2*ADD - Firm Capacity*1day
Standby (City Policy) MG	0.00	0.00	0.00	0.00	2*ADD - Reliable Capacity*1day
Required Standby MG	0.00	0.00	0.00	0.00	
Maximum Required Fireflow/Standby MG	0.15	0.15	0.15	0.15	FF storage controls
Total Required Storage MG	0.17	0.17	0.17	0.17	Sum of Operational, Equalizing, and Fireflow/Standby
EXISTING STORAGE					
Nisqually Reservoir MG	0.15	0.15	0.15	0.15	Total volume - dead volume
Total Existing Storage MG	0.15	0.15	0.15	0.15	
EXCESS (DEFICIT) EXISTING STORAGE MG	(0.02)	(0.02)	(0.02)	(0.02)	Total Existing Storage - Total Required
Required Storage from 400 Zone Reservoirs MG	0.02	0.02	0.02	0.02	
EXCESS (DEFICIT) EXISTING STORAGE MG	0.00	0.00	0.00	0.00	

337 Zone

	2012	2015	2019	2029	
DEMAND SUMMARY					
Projected ADD mgd	5.58	5.95	6.40	7.39	
gpm	3,873	4,134	4,446	5,130	
Projected MDD mgd	11.77	12.56	13.51	15.59	
gpm	8,172	8,722	9,382	10,824	
Projected PHD mgd	18.96	20.23	21.75	25.07	
gpm	13,166	14,047	15,102	17,411	
Number of ERUs	24927	26605	28618	33019	
SUPPLY CAPACITY					
Total Supply Capacity mgd	9.22	9.22	8.22	11.34	
gpm	6,401	6,401	5,706	7,878	
Reliable Supply Capacity mgd	2.31	2.31	1.30	4.43	
gpm	1,601	1,601	906	3,078	
Largest Supply Source mgd	2.59	2.59	2.59	3.13	Well S07 in 2009 and 2015 and Brewery in
gpm	1,800	1,800	1,800	2,172	
Firm Supply Capacity mgd	6.63	6.63	5.62	8.22	Total - Largest Source
gpm	4,601	4,601	3,906	5,706	
Total Supply Capacity with 400 Service Area Storage					
Required Supply from 400 Zone mgd	9.74	11.01	13.53	13.73	PHD - Total Capacity
gpm	6,765	7,646	9,396	9,533	
Available Supply from 400 Zone mgd	3.89	3.87	2.78	0.69	
gpm	2,701	2,687	1,933	482	
Total Supply Capacity mgd	13.11	13.09	11.00	12.04	
gpm	9,102	9,088	7,639	8,360	
Largest Supply Source mgd	2.59	2.59	2.59	3.13	Largest Source is in 337 Service Level for all
gpm	1,800	1,800	1,800	2,172	
Firm Supply Capacity mgd	10.51	10.49	8.41	8.91	Firm Supply Available to 337 Zone
gpm	7,302	7,288	5,839	6,188	
Reliable Supply Capacity with 400 Service Area Storage					
Required Supply from 400 Zone mgd	8.85	9.60	11.50	10.34	2* ADD - Reliable Capacity
gpm	6,145	6,666	7,987	7,182	
Available Reliable Supply from 400 Zone mgd	5.58	6.04	5.63	4.98	
gpm	3,877	4,195	3,912	3,460	
Total Reliable Supply Capacity mgd	7.89	8.35	6.94	9.41	Reliable Capacity + Reliable from 400 Zone
gpm	5,478	5,796	4,818	6,538	
REQUIRED STORAGE					
Operational MG	0.24	0.24	0.24	0.24	2.00 ft band in Westside, Steilacoom, and
Equalizing MG	0.61	0.74	1.12	1.36	Equalizing Storage = (PHD - Total Supply
Fireflow/Standby (Nested)					
Fireflow MG	0.96	0.96	0.96	0.96	4000 gpm for 4 hours from "Fire Flow Amounts.doc"
Standby (DOH Method 1) MG	4.99	5.32	5.72	6.60	Minimum of 200 gpd/ERU
Standby (DOH Method 2) MG	0.64	1.41	4.40	5.86	2*ADD - Firm Capacity*1day
Standby (City Policy) MG	3.26	3.56	5.87	5.36	2*ADD - Reliable Capacity*1day (Revised)
Required Standby MG	3.26	3.56	5.87	5.36	
Maximum Required Fireflow/Standby MG	3.26	3.56	5.87	5.36	SB storage controls
Total Required Storage MG	4.11	4.54	7.23	6.96	Sum of required storage numbers
EXISTING STORAGE					
Westside Reservoir MG	1.52	1.52	1.52	1.52	Total volume - dead volume
Judd Hill Reservoir MG	0.44	0.44	0.44	0.44	Total volume - dead volume
Union Mills Reservoir MG	0.89	0.89	0.89	0.89	Total volume - dead volume
Steilacoom Reservoir MG	1.14	1.14	1.14	1.14	Total volume - dead volume
Total Existing Storage MG	3.99	3.99	3.99	3.99	Sum of existing storage volumes
EXCESS (DEFICIT) EXISTING STORAGE MG	(0.12)	(0.55)	(3.24)	(2.97)	Total Existing Storage - Total Required Storage
Required Storage MG	0.12	0.55	3.24	2.97	
Available Storage from 400 Zone Reservoirs MG	2.99	2.99	2.99	2.99	
Used Storage from 400 Zone Reservoirs MG	0.12	0.55	2.99	2.97	
EXCESS (DEFICIT) EXISTING STORAGE MG	0.00	0.00	(0.24)	0.00	
Useable Storage Remaining in 400 Zone	**2.87**	**2.44**	**0.00**	**0.03**	**Remaining storage available to all pressure zones.**

TABLE 8 - 460 ZONE DEMANDS

ERU Value	210		gpcd
Leakage %	10%		
Authorized Uses %	2%		
MDD Peaking Factor	2.2		
PHD Peaking Factor	1.6		
Year	**2010**	**2029**	
SFR Parcels	153	157	
ERUs	153	157	
Demands			
Service Connections	32,130	32,970	gpd
Leakage (10%)	3,570	3,663	gpd
Other Authorized Uses (2%)	656	673	gpd
Total Demands	**36,356**	**37,306**	gpd
ADD	0.04	0.04	mgd
MDD	0.09	0.09	mgd
PHD	0.14	0.14	mgd

Demand Summary

	ADD		MDD		PHD	
	gpm	mgd	gpm	mgd	gpm	mgd
2010	25	0.04	62	0.09	97	0.14
2029	26	0.04	62	0.09	97	0.14

Limiting Capacity Analysis

Water System Demands (see WSP Chapter 3 & Appendix I)											
2011			2015			2019			2029		
ADD:	7.66	MGD	ADD:	8.63	MGD	ADD:	9.57	MGD	ADD:	11.60	MGD
MDD:	16.19	MGD	MDD:	18.22	MGD	MDD:	20.21	MGD	MDD:	24.50	MGD
PHD:	26.03	MGD	PHD:	29.29	MGD	PHD:	32.47	MGD	PHD:	39.33	MGD
ERU's:	34,253		ERU's:	38,555		ERU's:	42,772		ERU's:	51,845	

Physical Source Capacity (see WSP Chapter 4)						
Instantaneous Capacity					ADD V_A	MDD $[(Q_i)*(t_d)]$
DOH Eq's 6-3, 6-4					(MG/year)	(MGD)
Ground Water Wells	Q_a (based on water right)		Q_i (based on ability to pump)			
S01	0.31	MGD	0.43	MGD	113.15	0.39
S02	0.86	MGD	0.86	MGD	313.90	0.79
S03	0.29	MGD	0.30	MGD	105.85	0.28
S04	0.56	MGD	1.08	MGD	204.40	0.99
S06	0.82	MGD	0.58	MGD	299.30	0.53
S07	0.00	MGD	2.59	MGD	0.00	2.37
S09	0.02	MGD	0.94	MGD	7.30	0.86
S10	0.02	MGD	1.44	MGD	7.30	1.32
S15	0.20	MGD	0.26	MGD	73.00	0.24
S16	0.08	MGD	0.24	MGD	29.20	0.22
S19	0.92	MGD	1.08	MGD	335.80	0.99
S20	0.14	MGD	0.84	MGD	51.10	0.77
S21	0.95	MGD	2.10	MGD	346.75	1.93
S22	0.95	MGD	2.30	MGD	346.75	2.11
S24	0.24	MGD	0.10	MGD	87.60	0.09
S25	0.00	MGD	0.33	MGD	0.00	0.30
S27	0.00	MGD	1.01	MGD	0.00	0.93
S28	0.95	MGD	2.30	MGD	346.75	2.11
S29	0.42	MGD	1.44	MGD	153.30	1.32
Interties						
S30	1.25	MGD	1.00	MGD	456.25	0.92
Future (Under Construction, not in total)						
S31 (Hawks Prairie well #2, online in 2014)	0.95	MGD	1.15	MGD	346.75	1.05
S29 (Additional Water Rights, online in 2014)	0.54	MGD	0.00	MGD	197.10	0.00
S27 (Additional Water Rights, online in 2014)	0.89	MGD	0.58	MGD	324.85	0.53
Additional N (ERU's): using 2011 demand relationships					10,912	3,355
System Total:	8.98	MGD	21.22	MGD	3,277.70	19.45

Based on 2011 Values	$(365)*(ADD_{2011})/(ERU's_{2011})$	7.96E-02	$(MDD_{2011})/(ERU's_{2011})$	4.73E-04
	N (ERU's):	**41,171**	**N (ERU's):**	**41,154**

Storage Capacity (see Appendix S)			
Equalizing Storage		Standby Storage	
DOH Eq 6-6		DOH Eq 6-7	
N=(1/C)*[(1440/ERU)* ((ES/150) + Qs - 18) - F]		SB_t (MG)=	7.24
		SB_i (gpd)=	(ADD- (1/2)*reliable capacity)/ ERU's
C=	1.60		
MDD_{2011} (gpd)=	472.66	ADD (MGD)	7.66
N_{2011}=	34,253	ADD (gpd)	7,660,000
F=	225.00	Reliable Capacity (MGD)=	12.55
Qs (MGD)=	21.22	Reliable Capacity (gpd)=	12,550,000
Qs (gpm)=	14,736	t_d (days)=	2.00
S_T (MG)=	13.09	SBi (gpd)=	40.43
S_o (MG)=	0.37	**N (ERU's)=**	**89,528**
S_d (MG)=	4.86	Total Storage	
$S_{f/sb}$ (MG)=	4.37	DOH Eq 6-8	
S_e (MG)=	0.62	N=[CRS+150*[Q_s-(MDD/1440)*(F)]-2700]/	
$ES_{available}$ (MG)=	3.49	[150*(MDD-1440)*(C)+(SB_i)*(t_d)]	
$ES_{available}$ (gal)=	3,490,000	CRS=	S_T-S_o-S_d
		CRS (gal)=	7,860,000
N (ERU's)=	**72,187**	**N (ERU's)=**	**62,994**

Storage volume between S_d and < 30 psi is 2.09 MG which is less than $S_{f/sb}$; therefore ES is not pressure dependent.

t_d = 22 hrs/day

Appendix T
WATER SYSTEM EMERGENCY RESPONSE PLAN: TABLE OF CONTENTS

CITY OF LACEY

WATER SYSTEM
EMERGENCY RESPONSE PLAN

2004

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Appendix U

WATER SHORTAGE RESPONSE PLAN

CITY OF LACEY

WATER SHORTAGE RESPONSE PLAN

CITY OF LACEY

Plan Updated: July 2010

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Background

This Water Shortage Response Plan (WSRP) provides operating procedures to be implemented by the City of Lacey Water Utility in the event of a weather-related water shortage, natural or human-caused disaster, or other water system operating emergency.

The objective of the WSRP is to establish procedures for managing water supply and demand in times of shortage. The WSRP identifies the range of demand reduction actions that are available and defines the mechanism(s) by which decisions will be made during a shortage event. Since each situation has unique characteristics, the WSRP cannot address all of the possible scenarios, or all of the supply and demand management actions that are appropriate to a given situation. For this reason, the WSRP is intended as a framework of actions that will be tailored to meet the specific needs of a shortage situation. It is the goal of the WSRP to maintain essential public health and safety services, and minimize adverse impacts on the local economy, the environment, and the lifestyle of the City's water customers.

Overview

The City of Lacey's water supplies are derived entirely from groundwater sources. For this reason, our water system is not highly vulnerable to short-term drought conditions. Summer drought conditions are a normal part of our annual weather cycle, and measures to meet annual summer demand are addressed in the City's Water Comprehensive Plan and Water Conservation Plan.

This WSRP establishes procedures intended for use during unexpected periods of water shortage. There are several scenarios that could result in such a shortage and impair the ability of the City's water supplies to meet demand.

Drought conditions resulting in less than average fall/winter precipitation may decrease recharge to local aquifers. Because of the lag time between drought conditions, recharge and groundwater withdrawal, impacts from this scenario may not be immediately evident. Impacts may become evident in shallow aquifers 6 months to 1 year following below-average rainfall, and would likely be evident following a 1-2 year period of below-average precipitation. In deeper aquifers, it may take years before the impacts of below-normal precipitation were observed.

Unusually warm and dry weather sustained over the summer months also holds the potential to impact water supplies if our usual period of peak demand extends in duration. Effects from this scenario would be immediate.

Finally, unexpected failure of water system components, natural or human-caused disaster, or contamination of some portion of the water supply also might necessitate implementation of the WSRP. Any combination of these scenarios could prove problematic and require implementation of the WSRP. Specific criteria triggering WSRP implementation are discussed later.

Coordination

The Water/Wastewater Maintenance Supervisor and Senior Utilities Control Maintenance Technician have primary responsibility for identifying water system supply and demand conditions that may lead to a water shortage. However, data that reflect daily water demand and current system production potential is routed to other Operations and Water Resources staff as well, any of which may notice conditions of concern. Once a trigger has been identified, a **Water Shortage Response Work Group (WSRWG)** led by the Water/Wastewater Maintenance Supervisor and including the Senior Utilities Control Maintenance Technician, Water Resources Specialist, Water Quality Analyst and Senior Utility Engineer will meet to develop recommendations regarding whether the WSRP should be implemented. If a decision is made to implement the WSRP, the Work group will then hold a meeting with the **Water Shortage Response Plan Team (WSRP Team)**, consisting of Water Resources Manager, Operations Manager, Director of Public Affairs and the Director of Public Works. The WSRP Team will decide what WSRP stage, if any, should be implemented and will carry their recommendation forward to the City Manager. The City Council will be updated regularly as to the status of the situation and may elect to pass a resolution or adopt ordinances to facilitate implementation of the WSRP.

The WSRP Team will consider a variety of factors in their decision-making, including:

- Total supply availability, including interties and groundwater rights
- Operational status of City wells, reservoirs, pressure zones and other facilities
- Rate of decline in aquifer levels compared with normal operating levels
- Time required to implement supply-side enhancements and quantities to be gained
- Weather conditions derived from short- and long-term weather forecasts and modeling of the National Weather Service
- Water demand forecasts identifying normal consumption levels and projected consumption patterns based on available historical data for previous drought periods
- Time required to implement demand reduction measures and quantities expected to be saved
- Estimated margin of safety provided by the demand reduction compared with the level of risk assumed if no action is taken
- Actions to be taken by neighboring jurisdictions (Cities of Olympia and Tumwater) that influence the situation
- Ultimate cost to City customers and equity in demand reduction between customer classes
- Consultation with elected officials, state resource agencies, the county, and other interested parties
- Customer response

Once WSRP implementation has been approved, the WSRP Team will coordinate as necessary with the WSRWG and other departments and staff to implement the Plan.

Water Shortage Response Plan Stages

The plan involves four stages of phased response, to be implemented as conditions warrant, in an effort to manage water demand when supplies become limited. Stages will be implemented progressively, if timing and conditions allow, to provide internal staff, cooperating agencies and the public with reasonable warning that the next stage of response is needed. However, conditions may warrant immediate implementation of an advanced stage without first moving through initial stages. The four stages include a variety of communications, internal operations, and supply-side actions and demand management strategies as appropriate. Supply-side actions are actions that are taken internally to increase or better leverage water supply, e.g. adjusting pressure zones or well call order to better leverage supply or activating the intertie with the Olympia water system. Demand management strategies are actions that encourage or require water customers to use less water. The stages are characterized as follows:

- **Stage 1: Advisory Stage** – Internal evaluation of conditions and coordination are initiated to determine the likelihood of shortage and facilitate next steps. The public is reminded that the WSRP is in place and seasonal or other conditions may warrant its implementation. The public is encouraged to use water wisely.
- **Stage 2: Internal Action Stage** – If supply conditions worsen, the plan moves to the internal action stage. During this stage, the City will implement demand and supply-side actions.
- **Stage 3: Mandatory Stage** – If the internal action stage does not result in needed demand reduction or if conditions worsen, the mandatory stage is implemented. During this stage, the City will implement more aggressive supply-side actions and will limit or prohibit certain uses of water by customers. This stage may involve an enforcement component with fines for non-compliance.
- **Stage 4: Emergency Stage**– This stage is implemented when supply conditions worsen and/or previous demand-reduction actions are not sufficient. Emergency curtailment addresses the most severe need for demand reduction and includes emergency restrictions.

Equation for Stage Triggers

Water Shortage Response Plan triggers involve a comparison of current water demand to potential production. Triggers are marked when current demand reaches certain percentages of potential production. In that case, the WSRP Team would evaluate whether or not to implement the corresponding stage of the Plan. Meeting or exceeding the trigger is not the sole variable to be considered and alone, may not necessitate implementation of the corresponding plan stage.

Definitions for the trigger equation variables follow:

Useable Source: A source of potable water supply that can be relied upon to pump water into the system at a moment's notice. Tanks can be drawn down only a certain amount without affecting area pressures. Pumping time is limited by the amount of drawdown within the tanks, thus all well pumps within the water system do not pump for 24 hours. For the purpose of this plan, a pumping time of 22 hours for each useable source will be utilized. (Note: Sources can become unusable due to mechanical/electrical failure, the well water level being too low to the pump, or if water quality concerns render the water unusable.)

Present Possible Production (P3) means: The maximum well pumping time of 22 hours per day which is based on the available standby and operational reservoir storage capacity of the water system, expressed in MGD units. The P3 will be reevaluated by the WSRP Team annually prior to June 1st, and the adopted P3 value shall be inserted as Appendix G of this plan.

Current Demand (CD): The values reported daily on the revised Weekly Water Log. These values consider water pumped from wells and used from storage the previous day.

Triggers:

Stage 1: Advisory
Every summer

Stage 2: Internal Action Stage
STEP 1 CD = 80% of P3 for 1 day
STEP 2 CD = 90% of P3 for 1 day

Stage 3: Mandatory Stage
CD = 95% of P3 for 3 consecutive days; or
CD = 97% of P3 for 1 day

Stage 4: Emergency Stage
CD = 100% of P3 for 1 day

Stage 1: Advisory Stage

Objectives

- Evaluate water supply and demand conditions to determine if further implementation of the WSRP is warranted.
- Initiate internal coordination to evaluate conditions and facilitate further implementation.
- Prepare City staff for a potential water shortage, thereby allowing adequate time for planning and coordination.
- Remind the public to use water wisely. Remind them also that a WSRP exists and can be implemented if it becomes necessary.

Triggers

Every summer

Advisory Stage Actions

Coordination

- The Senior Utilities Control Maintenance Technician will compile data on a revised Daily Water Production Report and route the report via email to members of the WSRWG and WSRP Team to keep them informed of current demand and supply conditions.
- The Senior Utilities Control Maintenance Technician or other staff will inform the Water/Wastewater Maintenance Supervisor if a trigger has been met or exceeded.
- If a trigger has been met, the Water/Wastewater Maintenance Supervisor will assemble a meeting of the WSRWG to develop a recommendation on whether to implement the WSRP and arrange a meeting with the WSRP Team to present their recommendation. The WSRP Team will decide if further implementation of the WSRP is needed.

Public Outreach

- The Water Resources Specialist will develop and distribute a press release reminding the public that summer weather leads to increases in water demands and encouraging conservation. The message should include a reminder that the City has adopted a WSRP that can be implemented if necessary.

- The Water Resources Specialist will develop a fact sheet outlining the WSRP and provide it to City customer service staff and the public, as requested, to allow for uniform, consistent dissemination of information to the public.
- The Water Resources Specialist will include information regarding relative efficiencies of various irrigation systems and equipment in water conservation messages. The public will be reminded that use of less efficient equipment may be restricted or prohibited in the case of a water shortage.
- Ask the public to follow these specific watering guidelines:
  - Apply no more than one inch of water to landscaping each week.
  - Limit all landscape watering (turf and/or ornamental) to **no more than** three days per week. Residents with odd numbered addresses should water only on Monday, Wednesday and/or Saturday. Residents with even numbered addresses should water only on Tuesday, Thursday and/or Sunday.

Stage 2: Internal Action Stage

Objectives

- Reduce water use to accommodate supply limitations through internal actions
- Forestall or minimize the need for more stringent demand or supply management actions
- Minimize the disruption/inconvenience to customers while meeting demand reduction goals
- Maintain the highest water quality standards throughout the shortage

Triggers

STEP 1: 80% of P3 for 1 day
STEP 2: 90% of P3 for 1 day

Internal Action Stage Actions

Internal Action Step 1

Coordination

- Establish regular meetings for the WSRP Team and systematic communications with the City Manager and City Council.
- WSRP Team to establish regular communications with all City departments and staff to keep them up to date on conditions, goals, and City actions.
- WSRP Team will consider current and projected supply conditions and seasonal demand and set demand reduction goals that may be revised as necessary.
- WSRP Team will coordinate use of emergency interties with neighboring water suppliers to increase emergency supply availability and communicate with neighboring water suppliers (Cities of Olympia and Tumwater), state resource agencies, the county, and other interested parties to gauge regional status of supply.
- Contact the Lacey Fire Department to inform them of the situation and request implementation of actions listed in Appendix C.
- Implement staffing reassignments as needed and that may be needed for the Mandatory stage, including staff to enforce mandatory restrictions. See Appendix E for suggested staffing assignments. Initiate planning and preparation for the Mandatory stage.

Public Outreach

- The Water Resources Specialist will begin additional, targeted outreach to commercial customers to remind them to adhere to the watering schedule listed above and/or prepare and implement a curtailment plan that reduces their water use by at least 10%.
- Ask commercial customers to plan ahead for possible implementation of the Mandatory stage. During that stage, they would be required reduce irrigation water use by 25%.

Internal Operating Actions

- The Water Resources Specialist will begin close monitoring of the City's top 20 commercial irrigation consumers for compliance with the odd-even watering schedule.
- Increase water quality monitoring actions as necessary.
- Reduce all operating system water uses (flushing, truck washing, etc.) to essential levels.
- Reduce irrigation at City-owned and managed landscapes. Reduce or eliminate seasonal plantings. See Appendix D for more details regarding management of City parks and landscapes during the Voluntary stage.

Internal Action Stage Actions

Internal Action Step 2

Coordination

- Technical WSR Team staff will meet to discuss potential supply-side actions based on water supply and demand.

Internal Operating Actions

- Operations staff will implement recommended changes based on the technical WSR Team staff meeting

Stage 3: Mandatory Stage

Objectives

- Achieve targeted demand reduction goals by restricting defined water uses.
- Ensure that adequate water supply will be available during the duration of the water shortage to protect public health and safety.
- Minimize the disruption to customers' lives and businesses while meeting target demand reduction goals.
- Promote equity among customers by establishing clear restrictions that affect all customers.
- Ensure water quality remains at the highest level possible.

Triggers

95% of P3 for 3 consecutive days; or
97% of P3 for 1 day

Mandatory Stage Actions

Coordination

- The WSRT, with approval from the Public Works Director, will recommend to the City Manager, the move to the Mandatory stage, and adopt mandatory

- Implement water use restrictions, as developed by the WSRT. The following list serves as the baseline for water use restrictions. The exact restrictions used will depend on the situation and may change as the severity of the situation changes. However, this list should be used as the starting point, with additional, more stringent restrictions put in place as necessary:
    - Limit outdoor watering to 2 days per week, based on customer address:
        - Odd address: can water WEDNESDAY and SATURDAY only
        - Even address: can water THURSDAY and SUNDAY only
        - No watering on MONDAY, TUESDAY or FRIDAY
- Prohibit all watering during the warmest hours of the day, between 9 am and 7 pm.
- Prohibit use of outdoor ornamental fountains using potable water.
- Prohibit car washing except at commercial car wash facilities that recycle water.
- Prohibit washing of sidewalks, streets, decks or driveways. Only waterless means of cleaning these areas are allowed during this stage.
- Limit pressure washing of buildings to situations that require it as part of a scheduled building rehabilitation project (e.g. painting).
- Prohibit water waste, including untended hoses without shutoff nozzles, obvious leaks, and water running to waste, such as sprinkler/irrigation water hitting paved areas.
- Exemptions from restrictions might include:
    - Ballfields and playfields may be watered at the minimum rate necessary for safety purposes and dust control.
    - Landscapes installed within the previous 12 months are exempt from watering bans if such bans would result in significant property damage.
    - Customers with special medical needs, such as home dialysis, will be exempted from any emergency restrictions, provided these customers are included on the City's dialysis notification list or they notify the City of such a need. Their exemption will not apply to outdoor water use.
- Implement the process for receiving, recording and responding to reported violations of restrictions. Enforcement procedures will be implemented to assess fines where mandatory restrictions are not followed (see Appendix B). The WSRT will review and process all requests for exemptions from mandatory requirements. See Appendix F for recommended process.
- Increase enforcement actions in accordance with the applicable ordinance approved by City Council.
- Notify the Police Department regarding enforcement of curtailment actions and coordinate with them regarding the need for additional enforcement assistance.
- Work with the Lacey Fire Department to ensure that their operations and maintenance activities are consistent with actions listed in Appendix C for the Mandatory stage.
- Restrict hydrant usage to essential purposes, including recall of hydrant meters previously issued. Require use of best management practices to reduce water use, meet operational needs, and provide for dust control.
- Work with the City's Community Planning and Development Department to defer landscape installation requirements until the shortage is over.

- Evaluate resources and plans for moving into the Emergency Curtailment stage. As appropriate, begin preparations.

Public Outreach

- The public will be notified immediately using one or more of the methods listed below. The WSRT will decide which method(s) will be most appropriate and effective based upon the specific situation:
  - Automated phone calls using the City's choice of automated phone call services
  - Directed phone calls to the City's highest water users
  - Hand deliver pamphlets to households
  - Use Public Works Reader Boards on College St, Martin Way, and Pacific Avenue
- When feasible, include some or all of the following information when communicating the restrictions to the public:
  - Scope and nature of mandatory restrictions
  - Reasons for imposing restrictions
  - Demand reduction goals and ways to achieve those goals
  - Pending additional restrictions if goals not met
  - Enforcement mechanisms and fines
  - Projections for how long restrictions will be in place
- Provide area landscape management and property management companies directly with water use restriction information.
- Contact irrigation customers using potable water and inform them that the City may shut off their irrigation meters in the event of an extreme water shortage situation.
- Post updated status reports on the City web site
- Establish a "Customer Hotline" or similar for residents to report violations of restrictions

Internal Operations Actions

- City-owned property irrigation will be restricted as proposed in Appendix D and will meet or exceed irrigation reduction goals being asked of the public.
- Enhance water quality monitoring actions as necessary.
- Fleet vehicles will be washed only at commercial facilities that recycle water and only when deemed necessary for public health and safety reasons. Notify vehicle washing staff at the maintenance center and the police department that this restriction is in place.

Stage 4: Emergency Stage

Objectives

- Ensure that throughout the water shortage, an adequate water supply exists to protect public health and safety.
- Sharply reduce water demand.
- Restrict certain defined water uses in order to meet demand reduction goals.
- Ensure water quality remains at the highest level possible.

Triggers

In this stage, triggers indicate that a critical water situation exists and that without additional significant curtailment actions, a shortage of water for public health and safety would be imminent.

100% of P3 for 1 day

Emergency Stage Actions

Coordination

- The WSRT will define the water shortage as an emergency and work through the City Manager to implement procedures to formally declare a Water Shortage Emergency.
- The WSRT will recommend to the City Manager a list of water use restrictions, prohibitions and exemptions for consideration. Restrictions and prohibitions may include any of the following:

  Emergency – Step 1

  - Residential customers are allowed to water only 1 day per week:

    1 day per week

    - Addresses ending in 0, 2 can water: SUNDAY
    - Addresses ending in 1 or 3 can water: MONDAY
    - Addresses ending in 4 or 6 can water: TUESDAY
    - Addresses ending in 5 or 7 can water: WEDNESDAY
    - Addresses ending in 8 can water: THURSDAY
    - Addresses ending in 9 can water: SATURDAY

  - Commercial/large irrigators are allowed to water only one day per week or implement a plan that would reduce irrigation water use by at least 50%.
  - Exemption for new landscapes would remain in effect.
  - Prohibit use of any ornamental fountains using potable water for operation
  - Prohibit car washing except at commercial car wash facilities that recycle water
  - Rescind all hydrant meters
  - Prohibit washing of sidewalks, streets, decks and driveways
  - Prohibit use of potable water for pressure washing of buildings
  - Prohibit filling or adding potable water to swimming pools at public and private facilities
  - Prohibit the use of water in training exercises and flushing activities by the Fire Department until the emergency is over

  Emergency – Step 2

  - Prohibit all lawn/turf irrigation
  - Prohibit all irrigation of gardens and ornamental landscapes
  - Prohibit irrigation of new landscapes as well (exemption for landscapes <12 months of age no longer in effect).
  - Prohibit use of any ornamental fountains using potable water for operation
  - Prohibit car washing except at commercial car wash facilities that recycle water
  - Rescind all hydrant meters
  - Prohibit washing of sidewalks, streets, decks and driveways
  - Prohibit use of potable water for pressure washing of buildings

- Prohibit filling or adding potable water to swimming pools at public and private facilities
- Prohibit the use of water in training exercises and flushing activities by the Fire Department until the emergency is over

- Exemptions may include:
  - If dust control is required to comply with air quality standards and dust control and other hydrant uses are determined to be necessary to meet essential health and safety requirements, water may be applied to construction or other areas at the minimum rate necessary to achieve the desired result, provided that all appropriate best management practices are being employed.
  - Customers with special medical needs, such as home dialysis, will be exempted from any emergency restrictions, provided these customers are included on the City's dialysis notification list or they notify the City of such a need. Their exemption will not apply to outdoor water use.
- Increase enforcement actions in accordance with the applicable ordinance approved by City Council.
- Provide training for staff and deploy additional "Water Watcher" patrols.
- Notify the Police Department regarding enforcement of curtailment actions and coordinate with them regarding the need for additional enforcement assistance.
- The WSRT will increase the frequency of reports to the City Manager and City Council. Reports will provide detail on the implementation of the Emergency Curtailment Stage and customer response data.

Public Outreach

- The public will be notified immediately using one or more of the methods listed below. The WSRT will decide which method(s) will be most appropriate and effective based upon the specific situation:
  - Automated phone calls using the City's choice of automated phone call services
  - Directed phone calls to the City's highest water users
  - Hand deliver pamphlets to households
  - Use Public Works Reader Boards on College St, Martin Way, and Pacific Avenue
- When feasible, include some or all of the following information when communicating the restrictions to the public:
  - Scope and nature of mandatory restrictions
  - Reasons for imposing restrictions
  - Demand reduction goals and ways to achieve those goals
  - Pending additional restrictions if goals not met
  - Enforcement mechanisms and fines
  - Projections for how long restrictions will be in place
- Clearly identify and communicate exemptions from water use curtailment, such as for medical facilities and other public health situations.
- Inform customers about possible pressure reductions and problems this may cause.
- Provide area landscape firms with water use curtailment information to facilitate their compliance and ability to explain the need for compliance to their customers.
- Provide contractors and landscape firms with information on locations to obtain reclaimed water for street cleaning, construction projects, landscape irrigation, dust control, etc. if available.

- Post updated status reports on the City website.

Appendix A: City of Lacey Shortage Response Contact List

A working list of contacts for easy reference should be developed and regularly updated by Water Resources staff. In the event of a water shortage caused by a drought, the following will be contacted directly. They will be apprised of the situation, and their support and cooperation in reducing demand will be requested.

Other Public Agencies
- City of Olympia
- City of Tumwater
- Thurston County
- North Thurston School District
- State Department of Ecology
- State Department of Health
- Thurston County PUD #1

Intertied Water Systems
- City of Olympia
- Capital City Golf Course

High Water Use Customers
- List Updated Annually

Landscape Interests
- WSU/Thurston County Cooperative Extension
- Local nurseries
- Local landscape contractors
- The Irrigation Association
- Washington Association of Landscape Professionals
- Washington State Nursery and Landscape Association

Business Groups
- Thurston County Chamber of Commerce
- Lacey/Olympia Chamber of Commerce
- Rotary Clubs of Thurston County
- Master Builders Association

Appendix B: Mandatory Restrictions – Enforcement Procedural Checklist

_____ Violations of the water use restrictions constitute civil violations, as explained in LMC 14.40. Upon determination by the Director of Public Works that a violation has occurred, a written notice, allowing for voluntary correction, as described in 14.40.030 will be issued. All subsequent offenses will be charged using the same schedule provided in LMC 14.40.040, as follows:

♦ 1st day of each violation:	$100 fine
♦ 2nd day of each violation:	$200 fine
♦ 3rd day of each violation:	$300 fine
♦ 4th day of each violation:	$400 fine
♦ Each additional day of violation beyond four days:	$500/day

_____ Assign and train staff with customer service and communication experience to "Water Watch", providing an explanation to the customer regarding the violation, suggestions for correcting the problem, and a reminder that further offenses result in fines.

_____ Print self-duplicating "Notice of Violation" forms: one copy for location where violation occurred, one to report violation to Utility Billing to enter into HTE, one to send out with the bill, and one for internal records. Print violations and fines on the Notice of Violation.

_____ Track violations in HTE. When violations with corresponding fines (1stnd, 2nd, 3rd, 4th and subsequent offenses) are entered, HTE will add the infraction fine directly to the water bill.

_____ Establish "due process" to consistently collect and document evidence of violations. Violations must be documented by a Water Watcher in the following way:

1. Record date, time, location, type of violation on a Notice of Violation form.
2. Take a photograph of the offense.
3. Note corroboration from any witnesses to the violation.
4. If the violation is not witnessed first-hand by a Water Watcher and a photograph is not obtained, the suspected violator can be issued only a warning.

_____ Establish a "hotline" for customers to report violations. To help avoid frivolous complaints, recorded message should note that only complaints with name and address of complainant will be pursued.

Appendix C: Lacey Fire Department Shortage Response

The Fire Department uses water in a variety of ways. These uses include:
- Fire flow pressure testing
- Vehicle washing
- Washing of drill pad
- Training (evolution/wet training)
- Irrigation

The following explains how these water uses might be affected during the four stages of drought response.

Advisory Stage
At this stage, we would be communicating a possible water supply shortage to our customers. It may make sense to schedule any line flushing or wet training for earlier in the season in case restrictions are in place.

Internal Action Stage
In this stage, we would be asking our internal City staff to reduce their water use by a certain amount (generally about 10 percent). The Fire Department may change their water use at this stage in the following ways:

- Vehicle washing: Currently, several of the vehicles washed or at least rinsed daily. Washing is more frequent during the wet season, when vehicles are muddy. During this stage, vehicles would only be washed if they have mud on them but could continue to be rinsed each evening.

- Drill pad washing: The pad is now washed twice during the summer. If the voluntary stage occurs during summer months, a sweeper from the Public Works Department would be brought in to sweep the pad instead of washing it.

- Fire flow testing: Testing could still occur at this stage.

- Training: Scheduled training could still occur at this stage. However, the need for the training should be weighed carefully against the water use.

- Irrigation: Irrigation of landscape should be slightly reduced at this stage.

Mandatory Stage
At this stage, we would acknowledge a serious water supply shortage. Water use restriction would be enforced with fines. The Fire Department may alter their water use in the following way at this stage:

- Vehicle washing: As in the Voluntary Stage, vehicles would only be washed or rinsed if there is mud on them.
- Drill pad washing: As in the Voluntary Stage, the sweeper would be used instead of water.

- Fire flow testing: Testing should be postponed during this stage.

- Training: Scheduled training should not occur at this stage. If this stage continues for more than one month, limited training exercises would resume.

- Irrigation: Irrigation of landscape should be reduced at this stage.

Emergency Stage
At this stage, the utility would be faced with a critical water supply shortage. The goal would be to provide enough water to provide for our customers' health and safety during the duration of the emergency. No outdoor irrigation would be allowed for any of our customers. At this stage, the Fire Department would need to change their water uses in the following ways:

- Vehicle washing: Vehicles would only be washed if there is mud on them. No rinsing could occur. Vehicles that can fit in commercial washes must be washed only at facilities that recycle water.

- Drill pad washing: As in the Voluntary Stage, the sweeper would be used instead of water.

- Fire flow testing: Testing may not occur during this stage.

- Training: Scheduled training may not occur at this stage.

- Irrigation: Irrigation of landscape may not occur at this stage.

Appendix D: Lacey Parks Department Alternative Irrigation Plan

This plan will provide for reductions in irrigation water usage that meet thresholds provided for each of the stages of the Water Shortage Response Plan. The plan reduces water use at City-owned parks, streetscapes and other facilities by shifting irrigation schedules and prioritizing City facilities based on the age of landscaping, watering needs and public use.

In Stage 2, the Internal Action Stage, water use consumed through non-exempt meters will be reduced by 10%. Stage 3, the Mandatory Stage, provides for water use reduction of 25%. In Stage 4, the Emergency Stage – Step 1, provides for water use reduction of 50%, which would also be required for playfields. During the Emergency Stage – Step 2, all outdoor watering at City-owned facilities would cease, to comply with the severity of the situation and related restrictions.

Appendix E: Water Watcher Staffing Assignments

- All City staff will watch for violations when in the field as they go about their usual business
- During voluntary stage, meter readers would watch for obvious waste and hang reminder door hangers where appropriate
- During mandatory and emergency stages, Water Watchers would respond to calls (information about suspected violations will be left by the public on a "hotline") about violations. Staff available for duty may include: Water Quality Technician, Water Resources Specialist, Water Resources Manager, Public Works Inspectors, Senior Patrols.
- Water Watchers would investigate complaints, interact with customers for 1st offenses (friendly encounters), gather evidence for all offenses.
- Police Officers would deliver civil violation notices for subsequent offenses involving fines. It is expected that there will be very few civil violations. Police officers could complete this task as time allows, since the evidence will have been gathered previously by the Water Watchers and the fines will be included on the water bills.

Appendix F: Procedure for Exemptions

- Customers may request exemption for the following water uses:
  - irrigating new landscapes installed within the past 12 months
  - irrigating ballfields used regularly by community sports teams
  - water use for dust suppression to meet air quality standards
- Customers will submit exemption request to Public Works
- If approved, Utility Billing will flag customer account in billing system
- Customer will be provided a sign for posting to indicate exemption has been granted

Appendix G: Present Possible Production (P3)

Last updated: July 13, 2010

For the period beginning June 1, 2010 and ending May 31, 2011, unless modified by the WSRP Team at a sooner date, the P3 value, and corresponding triggers are identified as:

P3:	**17.2 million gallons per day (MGD)**
Stage 1 Trigger:	Every summer
Stage 2 Trigger:	13.8 MGD or greater for 1 day
Stage 3 Trigger:	16.3 MGD or greater for 3 days, or 16.7 MGD or greater for 1 day
Stage 4 Trigger:	17.2 MGD for 1 day

The P3 value for this period was determined by the WSRP Team and is summarized below:

Source 1 (Well 1)	300 gpm
Source 2 (Well 2)	600 gpm
Source 3 (Well 3)	230 gpm
Source 4 (Well 4)	750 gpm
Source 6 (Well 6)	400 gpm
Source 7 (Well 7)	1800 gpm
Source 9 (Well 9)	650 gpm
Source 10 (Well 10)	1000 gpm
Source 15 (BC 1)	180 gpm
Source 16 (BC 2)	0gpm
Source 19 (HP)	700 gpm
Source 20 (McAllister)	580 gpm
Source 21 (Madrona 1)	1460 gpm
Source 22 (Madrona 2)	1600 gpm
Source 24 (Nisqually 19A)	70 gpm
Source 25 (Nisqually 19c)	230 gpm
Source 27 (Evergreen)	700 gpm
Source 29 (Betti Well)	1000 gpm
Sub-Total	12,250 gpm
	x 60 min/hour
	x 22 hour/day
	= 16.2 MGD
Olympia Mnt Aire Intertie	+ 1.0 MGD

P3 = 17.2 MGD

Appendix H: Water Shortage Response Plan Summary

P3 (Present Possible Production)

The maximum well pumping time of **22 hours per day** which is based on the available standby and operational reservoir storage capacity of the water system, expressed in MGD units.

For the period beginning June 1, 2010 and ending May 31, 2011, unless modified by the water shortage response team at a sooner date;

P3 = 17.2 MGD

Stage 1
Advisory Stage

TRIGGER

Every summer

PUBLIC MESSAGE

"Please use water wisely."

- This stage affects ALL water customers.
- A press release will remind the public to use water wisely, and contain tips for water wise yard care.

TRIGGERS

Stage 1—**Advisory**: Every summer

Stage 2—**Internal Action**:

STEP 1 80% of P3 for 1 day

STEP 2 90% of P3 for 1 day

Stage 3—**Mandatory**: 95% of P3 for 3 days or 97% of P3 for 1 day

Stage 4—**Emergency**: 100% of P3 for 1 day

Stage 2
Internal Action Stage

STEP 1

TRIGGER

13.8 MGD for 1 day

COORDINATION

- Maintain regular, systematic communication between the WSR Team and all City departments including the City Manager.
- Lacey Fire will be notified and requested to follow a specific set of actions to reduce water consumption.
- Assigned staff will "tag" observed water waste with a Water Waste Notice, reminding customers of the need to reduce water waste.
- Begin additional outreach to commercial irrigation customers

INTERNAL OPERATIONS ACTIONS

- Begin to closely monitor consumption for the top 20 commercial irrigation customers for compliance with the odd-even watering schedule
- Reduce irrigation at City-owned/managed non-exempt class landscapes by 10%.
- Reduce washing of all City fleet vehicles.

STEP 2

TRIGGER

HP online: 15.5 MGD for 1 day

COORDINATION

- Technical WSR Team staff will meet to discuss potential supply-side actions based on water supply and demand.

INTERNAL OPERATIONS ACTIONS

- Operations staff will implement recommended changes based on the technical WSR Team staff meeting

Stage 3
Mandatory Stage

TRIGGER

> 16.3 MGD for 3 days or **16.7** MGD for 1 day

PUBLIC MESSAGE

"In order to ensure that an adequate supply of water is available to maintain public health and safety, it is necessary to impose mandatory water use restrictions."

- This stage affects ALL water customers.
- Provide customers with water use restrictions, which may include:
  - Prohibit all watering between 9am and 7pm or
  - Limit watering to assigned weekdays only
- Establish "Customer Hotline" (or similar) for residents to report violations of restrictions.

COORDINATION

- The Water Shortage Response Team, with approval from the Public Works Director, will recommend to the City Manager, the move to the Mandatory Stage, and adopt mandatory restrictions.
- Implement process for receiving, recording, and responding to reported violations of restrictions.

INTERNAL OPERATIONS ACTIONS

- Reduce irrigation at City-owned/managed landscapes by 25%.
- All City fleet vehicles will be washed only at facilities that recycle water.

Stage 4
Emergency Stage

TRIGGER

HP online: 17.2 MGD for 1 day

PUBLIC MESSAGE

"A water supply emergency exists. Severe restrictions on water use are necessary to maintain adequate water supplies essential for basic health and safety."

- This stage affects ALL water customers.
- Provide customers with water use restrictions, that will be strictly enforced, which may include:
  - Residential watering limited to one day per week ***or*** prohibit all lawn/turf irrigation.
  - Rescind all hydrant meters.
  - Prohibit filling of swimming pools.
  - Prohibit all use of water for cleaning sidewalks or driveways.
- Restrictions may be grouped by: ***Emergency Level 1*** or ***Emergency Level 2***

COORDINATION

- The Water Shortage Response Team will define the water shortage as an emergency and work through the City Manager to implement procedures to formally declare a Water Shortage Emergency.

INTERNAL OPERATIONS ACTIONS

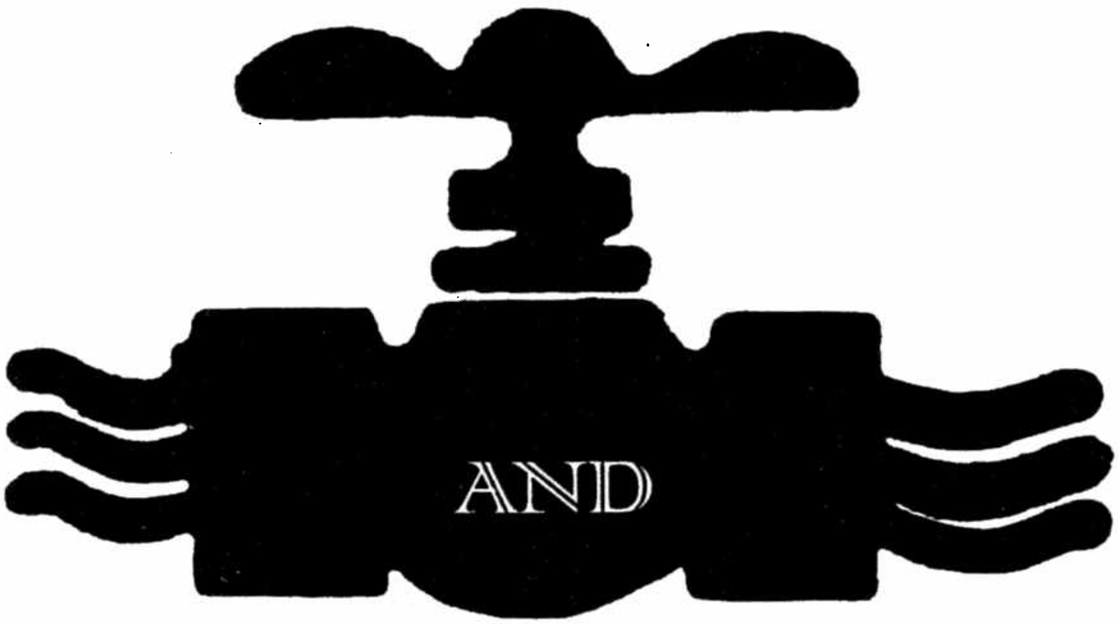
- Reduce irrigation at City-owned/managed landscapes by 50%.

Appendix V

CROSS-CONNECTION CONTROL MANUAL

CITY OF LACEY

CROSS CONNECTION



BACKFLOW PREVENTION MANUAL

CITY OF LACEY

Adapted: February, 1992

Revised: October, 1995

CITY OF LACEY

Water Resources Management

TABLE OF CONTENTS

TABLES

I. Definitions

A. Approved -- Accepted by the Director of Public Works as meeting an applicable specification stated or cited in this regulation

B. Auxiliary Water Supply -- Any water supply to the premises other than the City's approved public potable water supply.

C. Backflow -- The flow of water or other liquids, mixtures or substances, under positive or reduced pressure in the distribution pipes of a potable water supply from any source other than its intended source.

D. Backflow Preventer -- A device or means designed to prevent backflow or back siphonage. Most commonly categorized as air gap, atmospheric vacuum breaker, double check valve assembly, pressure vacuum breaker, and reduced pressure device.

D.1. Air Gap -- A physical separation sufficient to prevent backflow between the free-flowing discharge end of the potable water system and any other system. Physically defined as a distance equal to twice the diameter of the supply side pipe diameter but never less than one inch.

D.2 Atmospheric Vacuum Breaker -- A device which prevents back siphonage by creating an atmospheric vent when there is either a negative pressure or sub-atmospheric pressure in a water system.

D.3 Double Check Valve Assembly -- An assembly of two independently operating spring loaded check valves with tightly closing shut off valves on each side of the check valves, plus properly located test cocks for the testing of each check valve.

D.4 Pressure Vacuum Breaker -- A device containing one or two independently operated spring loaded check valves and an independently operated spring loaded air inlet valve located on the discharge side of the check or checks. Device includes tightly closing shut-off valves on each side of the check valves and properly located test cocks for the testing of the check valve(s).

D.5 Reduced Pressure Backflow Assembly -- An assembly consisting of two independently operating approved check valves with an automatically operating differential relief valve located between the two check valves, tightly closing shut-off valves on each side of the check valves, plus properly located test cocks for the testing of the check valves and the relief valve.

E. Backpressure -- A condition in which the owners system pressure is greater than the supplier's system pressure.

F. Back Siphonage -- The flow of water or other liquids, mixtures or substances into the distribution pipes of a potable water supply system from any source other than its intended source caused by the sudden reduction of pressure in the potable water supply system.

G. City -- The City of Lacey or their duly authorized representative.

H. Containment -- A method of backflow prevention which requires a backflow protection device at the water service entrance to effectively isolate the premise from the distribution system.

I. Contaminant -- A substance that will impair the quality of the water to a degree that it creates a health hazard to the public leading to poisoning, the spread of disease or a violation of water quality standards.

I. Definitions (cont.)

J. Cross-Connection -- Any actual or potential connection between the public water supply and a source of contamination or pollution.

K. Owner -- Any person who has legal title to, or license to operate or occupy, a property upon which a cross-connection inspection will be made or upon which a cross-connection is present.

L. Director -- The Director, or his delegated representative in charge of the City of Lacey, Department of Public Works.

M. Person -- Any individual, partnership, company, public or private corporation, political subdivision or agency of the State or the United States or any other legal entity.

N. Permit -- A document issued by the City which allows the use of a backflow preventer.

O. Pollutant -- A foreign substance that will degrade water quality and would constitute a moderate hazard, or impair the usefulness or quality of the water to a degree that is not a hazard to the public health but which does adversely and unreasonably affect such water for domestic use.

P. Water Service Entrance -- That point in the owner's water system beyond the sanitary control of the City; generally considered to be the outlet end of the water meter and always before any unprotected branch.

II. Purpose and Scope

This manual establishes minimum standards for the City to protect the public potable water supply from possible contamination of pollution due to backflow or back siphon from a customer's private internal system into the public potable water system.

This manual establishes minimum cross-connection control operating policies, provides guidelines and requirements for installation, testing, and maintenance of approved backflow devices and establishes permitting and inspection requirements for existing and new backflow protection devices.

III. Authority

A. The Federal Safe Drinking Water Act of 1974 and the statues of the State of Washington Title 43 RCW and Chapter 246-290-490 WAC require purveyors to "protect public water systems from contamination due to cross connections".

B. City of Lacey Municipal Code, Chapter 13.48.070 prohibits the presence of cross-connections.

C. The City Water System Plan adopted by Resolution 605 includes cross-connection program requirements.

IV. Responsibility

The Director shall be responsible for the protection of the public potable water distribution system from contamination or pollution due to the backflow or back siphonage of contaminants or pollutants through water service connections.

If the Director determines a backflow device is required at any customer's premises, the Director, or his delegated agent, shall give notice to said customer to install an approved backflow prevention device at one or more locations to his premises. Installation of requested backflow protection devices shall be a condition of continued water service from the City.

Upon installation, the customer shall contact the City requesting inspection and testing of said device or devices. The customer shall be subject to all applicable inspection and testing fees as may be established.

V. Failure to Comply

Any person, firm or corporation who willfully violates any of the provisions of this manual or Lacey Municipal Code, Chapter 13.48.070, "Cross-Connection and Private Supply", is guilty of a misdemeanor further;

Any person, firm or corporation who willfully violates any provisions and requirements of this manual shall be subject to discontinuance of supply of City water to the premise. Discontinuance of the City potable supply to the premise shall remain in effect until corrective action as required by the Director is completed, tested and approved.

VI. Requirements

A. General

The City will operate a cross-connection control program which fulfills the requirements of the State of Washington Cross-Connection Regulations and is approved by the City of Lacey.

The owner shall allow their property to be inspected for possible cross-connection and shall follow the provisions of the City's program if a cross-connection is permitted.

If the City requires that the public supply be protected by containment, the owner shall be responsible for water quality beyond the outlet end of the containment device and should utilize fixture outlet protection for that purpose. Fixture outlet devices shall be installed in accordance with the Uniform Plumbing Code. A plumbing permit and inspections may be required.

B. City of Lacey

On new installations, the City will provide on-site evaluation and/or inspection of plans in order to determine the type of backflow preventer, if any, that will be required, will issue permits and perform inspection and testing. In any case, a minimum of a meter setter check valve will be required on any new construction.

For premises existing prior to the start of this program, the City will perform evaluations and inspections of plans and/or premises and inform the owner by letter of any corrective action deemed necessary, the method of achieving the correction, and the time allowed for the correction to be made. Ordinarily, 60 days will be allowed; however, this time period may be shortened depending upon the degree of hazard involved and the history of the device(s) in question.

Premises will be inspected on or after the expiration date of required action to correct a cross-connection. Premises that have failed to comply with the City's request shall receive written notice that water service to the premise will be terminated within a period not to exceed seven calendar days. In the event the owner informs the City of extenuating circumstances as to why the correction has not been completed, the City may grant a time extension up to, but not exceeding, 30 days.

B. City of Lacey (cont.)

The City will not allow any cross-connection to remain unless it is protected by an approved backflow preventer for which a permit has been issued and which will be regularly tested to ensure satisfactory operation.

If the City determines at any time that a serious threat to the public health exists, the water service will be terminated immediately.

The City shall perform all inspection and testing for all backflow devices. Testing and inspection shall include the initial installation, on-site reviews of existing installations, after any repairs or maintenance, after any relocation, and the annual testing requirement.

When an initial installation or annual test identifies a backflow device is not properly functioning, the owner shall correct the malfunction as directed by the City. The owner shall contact the City after correcting the malfunction for inspection and retesting of the device(s).

C. Owner

The owner shall be responsible for the elimination or protection of all cross-connections on their premises.

The owner, after having been informed by a letter from the City shall, at their expense, install any and all backflow preventers requested.

The owner shall correct any malfunction of the backflow preventer which is revealed by periodic City testing.

The owner shall inform the City of any proposed or modified cross-connections and also any existing cross-connections of which the owner is aware but has not been found by the City.

The owner shall install only backflow preventers approved by the City.

Any owner having a private well or other private water source shall not cross-connect to the City's system.

The owner shall provide access to premises to the City at the City's request. Failure to provide access to inspect facilities shall be grounds for termination of water service.

The owner shall be responsible for the payment of all fees for permits, annual or semi-annual device testing, re-testing in the case that the device fails to operate correctly, and any re-inspections for noncompliance with City requirements. Permits and fee schedules shall be specified in the applicable sections of development fees of the City.

VII. Applicability

The provisions of this manual are applicable to all connections to the City's domestic water supply. The City recognizes there are varying degrees of risk associated with different types of uses and will consider this when determining if a cross-connection exists and applicable backflow prevention devices. Table 1 lists common backflow devices that may be required. NOTE: The following Tables 1, 2, 3 and 4 are derived from the latest edition of the American Water Works Association Cross Connection Control Manual and the Lacey Cross Connection Control Program.

Table 1: Abbreviations

Abbreviation	Description	Level of Protection
AG	Air Gap	1
RPBA	Reduced Pressure Backflow Assembly	2
RPDA	Reduced Pressure Detector Assembly	2
DCVA	Double Check Valve Assembly	3
DCDA	Double Check Detector Assembly	3
PVAB	Pressure Vacuum Breaker Assembly	4
AVB	Atmospheric Vacuum Breaker	5

Note: Lower numbers in the Level of Protection column indicate higher levels of protection

There are premises which require mandatory premise isolation. These types of premises and minimum protection requirements are show in Table 2. Table 2 is not considered to include all premises. The City may require backflow protection of any facility it deems appropriate and a risk to the domestic system. Table 3 lists the type of facilities the City may require backflow protection devices.

Table 2: Premises Requiring Mandatory Service Protection

Premises	Protection
Beverage bottling plants	RPBA
Car washes	RPBA
Chemical plants	RPBA
Fire sprinkler services	DCVA
Food processing plants	DCVA
Hospitals, medical centers and clinics	RPBA
Laboratories	RPBA
Master meter	DCVA
Metal plating industries	RPBA
Mortuaries	RPBA
Nursing homes	RPBA
Petroleum processing or storage plants	RPBA
Piers and docks	RPBA
Radioactive material processing plants or nuclear reactors	RPBA
Sewage lift stations	RPBA
Sewage pump stations	RPBA
Sewage treatment plants	RPBA
Tall buildings (over 30 feet, domestic water)	DCVA
Unapproved auxiliary supply	RPBA

Facilities Requiring Backflow Prevention	
Battery manufacturing or repair facilities	RPBA
Boat marinas	RPBA
Canneries	DCVA
Cold storage plants	RPBA
Commercial laundries	RPBA
Concrete mixing plants	DCVA
Dairies	DCVA
Dry cleaners	RPBA
Dry docks	RPBA
Farms	DCVA
Film processing facilities	RPBA
Ice manufacturing plants	RPBA
Mobile home parks	DCVA
Packing houses (slaughter houses)	RPBA
Paper product plants	RPBA
Parks and playgrounds	DCVA
Plasma centers	RPBA
Sand and gravel plants	DCVA
Ship repair facilities	RPBA
Shopping centers	DCVA

In addition to mandatory backflow protection for certain types of premises there are numerous fixtures, equipment areas, or other common use areas which could have cross connection and backflow potential. These fixtures, equipment areas and other areas must be inspected and analyzed to determine potential risk to the system. Table 4 lists typical fixtures, equipment areas and other areas that may or may not require backflow protection devices.

Table 4: Fixtures, Equipment and Areas with Backflow Potential

Fixtures, Equipment and Areas	Minimum Protection
Air compressors (water cooled)	RPBA
Air conditioning systems	RPBA
Air washers	RPBA
Aquarium make-up water	AG / RPBA
Aspirators, medical	AG / RPBA
Aspirators, weedicide, herbicide and pesticide	AG / RPBA
Autoclaves	RPBA
Autopsy tables	RPBA
Baptismal founts	AG / RPBA
Bathtub, below rim filler	Not Allowed
Bedpan washers	AVB
Beverage dispensers using CO2	RPBA
Bidets	AG – Internal

Table 4: Fixtures, Equipment and Areas with Backflow Potential (cont.)

Fixtures, Equipment and Areas	Minimum Protection
Boat lifts	RPBA
Boiler feed lines	AG / RPBA
Bottle washing equipment	RPBA
Box hydrants	PVBA / DCVA
Brine tanks	AG / DCVA
Can washing equipment	AG / PVBA
Chemical feeder tanks	AG / RPBA
Chilled water systems	RPBA
Chlorinators	RPBA
Coffee urns	AG / AVB
Computer cooling lines	AG / RPBA
Condensate tanks	AG / RPBA
Cooking kettles	AG / AVB
Cooling towers	AG / RPBA
Decorating ponds	AG / RPBA
Degreasing equipment	RPBA
Demineralized water systems	RPBA
Dental cuspidors	RPBA
Detergent dispensers	AG / RPBA
Dialysis equipment	RPBA
Dishwashers, commercial (chemical injected)	AG / RPBA
Etching tanks	AG / RPBA
Fermenting tanks	AG / RPBA
Fertilizer injection equipment	RPBA
Film processors	RPBA
Fire sprinkler systems	DCVA
Floor drains	AG
Flushing floor drains	AVB
Foamite systems	RPBA
Fountains, ornamental	AG / RPBA
Fume hoods (chemical injected)	RPBA
Garbage can washers	AVB / PVBA
Garbage disposals	AVB
Heat exchangers	RPBA
Heat pumps	RPBA
High pressure washers	DCVA
Hose bibs	AVB
Hoses, kitchen rinse	AVB
Hot tubs	AG / RPBA
Hot water heating systems	RPBA
Hot water boilers	RPBA
Humidifier tanks and boxes	AG
Hydraulically operated equipment	DCVA
Hydrotherapy baths	AVB
Ice makers (with integral air gap to reservoir)	AG

Table 4: Fixtures, Equipment and Areas with Backflow Potential (cont.)

Fixtures, Equipment and Areas	Minimum Protection
Intertied (looped) water systems	DCVA
Irrigation systems	DCVA
Irrigation systems (reclaimed water)	RPBA
Janitor sinks	AVB
Kitchen equipment	AVB
Laboratory equipment	RPBA
Laundry machines, commercial	RPBA
Lavatories	AVB
Livestock drinking tanks	AG
Make-up tanks	AG / RPBA
Perchlorethylene reclaim	RPBA
Pesticide applicator trucks	AG / RPBA
Photo developing tanks and sinks	RPBA
Photostat equipment	RPBA
Pipette washers	AVB
Potato peelers	AVB
Poultry feeders	RPBA
Private hydrants	AVB
Processing tanks	AG / RPBA
Pump seal water	AG
Pumps, pneumatic ejector	RPBA
Pump prime lines	DCVA
Pumps, water operated ejector	RPBA
Recreational vehicle dump stations	RPBA
Serrated faucets	AVB
Service sinks	AVB
Sewer connection equipment	AG
Sewer flushing	AG
Shampoo basins / hose rinse	AVB
Showers, telephone	AVB
Sitz baths	AVB
Soap mixing tanks	AG / RPBA
Solar heating systems	RPBA
Solution tanks	AG / RPBA
Spas	AG / RPBA
Specimen tanks	AG / RPBA
Starch tanks	AG / RPBA
Stream-air sprays	RPBA
Steam cleaners	RPBA
Steam ejectors	RPBA
Steam generating facilities	RPBA
Sterilizers	RPBA
Stills	RPBA
Sumps	AG
Swimming pools (chemical injected)	AG / RPBA
Swimming pools (fill with hose bib)	AVB
Toilets (internal)	AG

Table 4: Fixtures, Equipment and Areas with Backflow Potential (cont.)

Fixtures, Equipment and Areas	Minimum Protection
Trap primers	AG
Ultrasonic baths	AG
Urinals (internal)	AG
Used water systems	RPBA
Wall hydrants	AVB
Wash basins	AG / AVB
Wash-up sinks	AG / AVB
Washing pools	AG / RPBA
Wastewater lines	AG
Water-air sprays	DCVA
Water closets (internal)	AG
Water cooled equipment	RPBA
Water ejectors	RPBA
Water recirculating systems	DCVA
Water settling	DCVA
Water treatment tanks	AG / RPBA
Water trucks	AG
Wet vacuum systems	RPBA
Whirlpool baths	AG / RPBA
X-ray processors	RPBA

VIII. Installation and Testing

Installation and testing of all backflow protection devices shall be in accordance with Cross Connection Control Manual Accepted Procedures and Practice produced by the American Water Works Association. The latest edition shall be used. Copies can be purchased from the State Department of Health Drinking Water Section.

In addition, all backflow protection devices shall be installed at a location that is easily accessible for inspection and testing. Devices located in vaults shall have adequate clearances and depths to allow the City to inspect and test. Devices that cannot be easily and readily inspected shall be required to be relocated and replumbed as required by the City. The owner shall contact the City for applicable installation requirements and standards.

IX. Existing Backflow Protection Devices

Any existing backflow device in use can continue to be used providing:

1. The devices are functioning properly based on inspection and test by the City.

2. The degree of protection is satisfactory for protection of the City's domestic system as determined by the Director.

Backflow devices that do not meet the above conditions shall be removed and installed with new approved devices.

Appendix W
SAMPLE WORK ORDER

WF0112823 / 001 CITY OF LACEY PAGE 1

REQ. DATE: 02/24/10 02/24/10 6:34:10
CREW: Water Facilities WA2
LOCATION: 3300 COLLEGE ST SE LOC ID: 54262
SUBDIVISION: LOC. ZIP: 98503
GEN. LOC.: COMP DATE: 03/03/10
REQ DEPT: PRIORITY: Preventive Maintenance
REQUESTOR: Water Production/Storage ORIGIN: City Staff
REQ USER: RDICKINS AUTH USER: WRK TYPE:Preventive Maintenance
Buildings & Vaults Annual

****

JOB ORDER GENERAL INFORMATION

CB 3/3/11

STD. TASK: Buildings & Vaults Annual BVA
CATEGORY: Water Prod and Storage WPS
TASK: Buildings & Vaults BV **READY**
SCHED START: 03/03/10 SCHED COMPLETION: 03/03/10

JOB ORDER INSTRUCTIONS

Clean gutters. Inspect and comment on structure co
ndition. Jet wash and cauum valve vaults and vacuu
m vault gutters. Pressure wash extrior of structur
es. Inspect roof and covers of structures.

FACILITY	SEG	FACILITY DESCRIPTION	FACILITY ADDRESS	ACT
W003		Well #3 S03 (tag#AAA935)	3300 College St SE	M

START DATE: 9/23/10 COMPLETION DATE: 9/23/10
UNIT OF PRODUCTION: QUANTITY:

****

JOB ORDER RESULT COMMENTS

WORK REQUEST RESULT COMMENTS

Completed

Appendix X

RESOLUTION 917
RESOLUTION 952

RESOLUTION NO. 917

CITY OF LACEY

A RESOLUTION RELATING TO THE PROVIDING OF SERVICES BY THE CITY'S WATER UTILITY SYSTEM.

WHEREAS, the City of Lacey has, and intends to continue to manage its water resources in a manner which will protect environmental quality, provide for the public health, protect fish and other aquatic habitat, provide for a vibrant local economy and account for anticipated growth mandated by the State Growth Management Act, and

WHEREAS, the City has set goals for reducing per capita water usage by adopting a tiered water rate schedule, mandating limitations on summer watering schedules, providing for the use of reclaimed water, providing water conservation services and water audits to its customers and establishing a leak detection program and a pipe replacement program, and

WHEREAS, the City has promoted water quality by acquiring land along the Woodland Creek corridor, consistently expending funds for habitat enhancement along Woodland Creek, entering into a lengthy process to eliminate untreated discharges of stormwater into service water bodies within the City's jurisdiction, adopting a low impact development ordinance and engaging in other activities designed to enhance water quality and salmon restoration, and

WHEREAS, the City has been an active participant in the preparation and implementation of the WRIA 11 Nisqually River Watershed Management Plan and the planning efforts of the WRIA 13 Deschutes River Watershed Management Plan, and has entered into partnerships with the LOTT Alliance and the partner jurisdictions of such Alliance for a Water Conservation Coordination Plan, supported the efforts of the inter-jurisdictional Stream Team and Project Green and cooperated with the City of Olympia for joint mitigation of potential impacts of water supply production, and

WHEREAS, the City has filed applications with the Washington State Department of Ecology for additional water rights and water right transfers and is engaged jointly with the Cities of Olympia and Tumwater in an attempt to acquire and transfer for municipal use existing water rights formerly held by the Brewery located in the City of Tumwater, and

Whereas, the City has secured over one-half of its existing water rights by purchase from private parties within and adjacent to the City's water service area, however, the availability of additional rights to purchase is nearly exhausted, and

WHEREAS, despite the efforts described in the previous recitals, the City has been unable to secure water rights and water to provide for the health and safety of an expanding population mandated by the Washington State Growth Management Act and therefore the City staff, with the approval of the City Council, has instituted policies limiting the availability of water for future water customers and the City Council desires to officially adopt such policies,

NOW, THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF LACEY, WASHINGTON, as follows:

Section 1. Subject to the provisions of Section 2, hereof, the following policies shall govern the decisions of the City regarding the availability of services from the City's Water Utility System:

A. The City shall only commit to providing future water services pursuant to the provisions of Subsection B of this Section. Provided, however, that water services to properties located within the City shall be provided if both water rights and water production is available at the time that buildings located upon such properties are connected to the City's System.

B. Commitments for future water services shall be made by the City only if one of the following conditions applies:

(1) Sufficient water production is available and the owner or developer of the property provides water rights to the City sufficient to serve such property and the transfer of such water rights for municipal use is approved by the State Department of Ecology.

(2) The owner or developer of the property provides water rights to the City and facilitates an acceptable water supply agreement with another qualified water purveyor for furnishing to the City sufficient water to serve the subject property.

(3) The owner or developer of the property enters into an agreement acceptable to the City which commits such owner or developer to use reclaimed water for all irrigation and toilet flushing within the development and, in addition, where feasible and allowed by state law and regulation, use for other purposes within the development. The City shall not approve such an agreement unless a sufficient supply of reclaimed water beyond that needed for water right mitigation is available in the area in question and the agreement makes provision for the installation or advanced payment for the infrastructure necessary to store, distribute and convey such reclaimed water from LOTT reclaimed water facilities to the development.

C. The City Manager is authorized to enter into such agreements as may be necessary pursuant to the Coordinated Water System Plan for Thurston County for the providing of temporary water service by other public water purveyors or water purveyors meeting the requirements of the Washington State Department of Health and regulated by the Washington State Utilities and Transportation Commission to properties which are located within the City's service area but cannot currently be served by the City under the policies adopted herein.

Section 2. The policies set forth in Section 1, hereof, shall be reviewed by the City Council on an annual, or, if necessary, a more frequent basis to determine whether such policies can or should be modified.

ADOPTED BY THE CITY COUNCIL OF THE CITY OF LACEY, WASHINGTON, this 21at day of DECEMBER, 2006.

CITY COUNCIL

By ______________________
Mayor

Attest:

____
City Clerk

Approved as to form:

____
City Attorney

RESOLUTION NO. 952

CITY OF LACEY

A RESOLUTION RELATED TO BUILDABLE LANDS CONSISTENCY REVIEW.

WHEREAS, pursuant to state statute, the Thurston Regional Planning Council prepared a Buildable Lands Report for the County and timely submitted the same to the State Office of Community Trade and Development for review, and

WHEREAS, state law requires that after the preparation of such report each jurisdiction needs to compare the development trends demonstrated in the report with the expectations of that jurisdiction's comprehensive land use plan, and

WHEREAS, the Community Development Department of the City has conducted its review and submitted the same to the Planning Commission, and

WHEREAS, the Planning Commission has studied the matter and returned Findings and Conclusions for the Buildable Land Consistency Review, and

WHEREAS, the City Council has studied the results of such review,

NOW, THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF LACEY, WASHINGTON, AS FOLLOWS:

1. The Council hereby adopts the Findings and Conclusions for the Buildable Land Consistency Review forwarded to it by the City's Planning Commission and attached hereto as Exhibit A.

2. Based upon such Findings and Conclusions, the Council declares that, with the exception of the issue described in Section 3 hereof, the Comprehensive Plan and policies of the City are consistent with the Buildable Lands Report.

3. The one exception to consistency is the fact that the City has not been granted sufficient water rights to allow water service outside of the city limits and within the growth management boundary to meet the population projections under the Growth Management Act. There are no reasonable measures the City, itself, can take to cure the problem of lack of water rights other than the conservation policies in effect, the water delivery infrastructure improvements which have been made and the water rights applications that have been submitted. However, the City will continue to cooperate with the Washington State Department of Ecology to secure the grant of additional water rights and will exert its best efforts to bring to the attention of the legislature the conflict between those state statutes governing the granting of water rights and the mandatory provisions of the Growth Management Act.

PASSED BY THE CITY COUNCIL OF THE CITY OF LACEY, WASHINGTON, this 19 day of NOVEMBER, 2009.

CITY COUNCIL

By ______________________
Mayor

Attest:

____
City Clerk

Approved as to form:

____
City Attorney

Findings and Conclusions for the Buildable Land Consistency Review:

1. The Buildable Lands Report for Thurston County dated September 2007 has documented growth rates and density statistics for the City of Lacey and the Lacey Urban Growth Area.

2. This report shows Lacey led all three of the largest cities in Thurston County with residential permits in 2005, 2006 and the portion of 2007 recorded.

3. This report and internal review shows Lacey achieved urban densities across the full range of its residential zones including ; Low Density Residential 0-4, Low Density Residential 3-6, Moderate Density residential and high density residential;

4. This report and internal review shows Lacey achieved urban densities across the full range of its mixed use zones and commercial zones that accommodate residential use including the Mixed Use High Density Corridor, The Moderate Density Corridor, the Village Center designations, and the Central Business District;

5. The data collected in this report and internal review demonstrates opportunities provided in Lacey's Planning legislation have been successfully utilized to develop a full range of housing types and styles to accommodate projected growth. This mirrors expectations of the Lacey Comprehensive Land Use Plan and requirements of GMA to achieve urban densities for the full range of Lacey's demographic profile;

6. The only outstanding issue identified as an obstacle to achieving GMA objectives is obtaining water rights necessary to provide water service for Lacey's projected growth over the long term;

7. The State's existing policy and process for allocation and management of water rights lacks sufficient definition to provide for the functional and timely review, and issuance of water rights. Lacey has been diligently pursuing "new" water rights for over 15 years and has yet to obtain "new" water rights. This has placed Lacey in a position of not having sufficient water rights to serve the entire UGA which in turn has necessitated the termination of issuance of water availability letters out side of the City Limits.

8. Lacey is not currently meeting the demands of GMA due to lack of water rights. At the same time, state regulation continues to allow exemptions for private wells thereby indirectly encouraging non urban densities both inside and outside the UGA served by private well.

9. During discussion at the Buildable Lands Technical Advisory Committee meetings, representatives of the development community stated the unavailability of municipal water to support urban density and the availability of exemptions for private wells is promoting development outside Lacey's UGA.

10. Restrictions on water rights for Lacey while promoting rural development on private wells is working against the concept of consolidation of growth in Lacey's designated UGA to provide more efficient urban services. This is in conflict with GMA goals and smart growth principals that require municipalities to be able to provide water to designated urban areas.

11. This situation has resulted in an inability to utilize buildable land capacity in the UGA for urban development. Additionally, some of Lacey's buildable land capacity in the UGA that is designated Low Density 0-4 is at risk of being compromised by the development of large non urban lots to obtain water via private well exemptions;

12. No amendments Lacey can make to its Land Use Plan or enabling legislation will resolve the issue of water being unavailable to serve its designated growth area. There are no "reasonable measures" Lacey can implement to remedy the water situation. Lacey and other municipalities are dependant upon the Department of Ecology for allocation of water rights.

13. Lacey is under mandate by GMA to accommodate the projected growth determined by the state and yet is not provided the water resources to accommodate this growth in a timely fashion. If water resources have been over allocated in this region the limitations on this necessary resource for growth needs to be made clear to the legislature and GMA expectations for accommodation of growth need to be adjusted accordingly.

14. If water rights are available for appropriation permits need to be issued to promote GMA goals for environmentally friendly smart growth development within designated urban growth areas.

Appendix Y

DEVELOPMENT GUIDELINES AND PUBLIC WORKS STANDARDS 2009

CHAPTER 6

6.000 WATER

6.010 General

Any extension of the Lacey Water System must be approved by the Department of Public Works (DPW), and all extensions must conform to Department of Health (DOH) and the Coordinated Water System Plan, City of Lacey Water System Plan, and the City of Lacey Fire Code Official's requirements.

In designing and planning for any development, it is the developer's responsibility to see that adequate water for both domestic use and fire protection is attainable. The developer must show in the proposed plans how water will be supplied and, as required by the City, whether adequate water pressure and volume will be available to meet fire flow requirements. An analysis of the system shall be required to confirm that fire flow requirements will be met.

All new homes and businesses constructed within the corporate City limits or the City of Lacey's Urban Growth Area shall connect to water provided that the structure originates within 200 feet of a public water main. In the case of private residential or commercial development where the developed property abuts a right-of-way in which a public water main is located or where a service connection is otherwise provided, all structures requiring water shall be required to connect to City water regardless of distance from the public water system.

Anyone who wishes to extend or connect to the City's water system shall contact the Department of Public Works for appropriate approvals and a connection fee estimate. This fee estimate is an estimate of the costs due the City for a waterline extension or connection. A copy of the estimate form may be found in Appendix C.

Prior to the release of any water meters, all Public Works improvements must be completed and approved including granting of right-of-way or easements and Special Power of Attorney for Annexation if required, and all applicable fees must be paid. For Exceptions to this policy see section 3.080 C.2.

Issuance of building permits for new construction shall not occur until final Public Works approval is given. As an exception to this policy, building permits may be issued upon completion and acceptance of the required fire protection facilities and the requirements as outlined in 3.080 C.2 have been met. **The certificate of occupancy will not be issued until final Public Works approval is given for all improvements.**

6.020 Design Standards

The design of any water extension/connection shall conform to City Standards and any applicable standards as set forth herein and in Chapters 3.010 and 3.040. Mains and fittings shall be located on the north or east side six feet off of centerline of the roadway, drive aisle, private drive or easement. On boulevards and arterial roadways, the location of the watermain and fittings shall be located as directed by the City, see chapter 4 street details.

The layout of extensions shall provide for the future continuation and/or "looping" of the existing system. Specific looping requirements shall be determined during plan review by the City. Dead end mains shall only be installed if looping is impractical due to topography, geology or as determined by the City. At a minimum, two connection points on separate mains to provide dual feeds for the development shall be required. In addition, main extensions shall be extended as required in Chapter 3.130.

In order to prevent transient water conditions and increased pressure losses, water main velocities shall not exceed 8 feet per second during peak and fire flow conditions.

The General Notes on the following page shall be included on any plans dealing with water system design.

6.024 Water Modeling

Water modeling shall be required to adequately size and loop mains in order to achieve fire flow and peak hour demands. Modeling will be completed by the City Water Resources Engineer after a request and adequate information has been received.

Peak hour demand modeling will only be completed when requested by the applicant or required by the City Engineer.

Fire flow (flow and pressure) will be determined through modeling under conditions specified by the City. A physical fire flow test will not replace the requirement for modeling.

GENERAL NOTES (WATER MAIN INSTALLATION)

1. All workmanship and material shall be in accordance with City of Lacey standards and the most current copy of the *WSDOT/APWA Standard Specifications for Road, Bridge and Municipal Construction*. In cases of conflict, the most stringent standard shall apply.

2. The contractor shall be in compliance with all safety standards and requirements as set forth by OSHA, WISHA and the Washington State Department of Labor and Industries.

3. The contractor shall be responsible for all traffic control in accordance with the *WSDOT/APWA Standard Plans for Road, Bridge and Municipal Construction* (all applicable “K” plans) and/or the *Manual on Uniform Traffic Control Devices* (MUTCD). Prior to disruption of any traffic, a traffic control plan shall be prepared and submitted to the City for approval. No work shall commence until all approved traffic control is in place.

4. All approvals and permits required by the City of Lacey shall be obtained by the contractor prior to the start of construction.

5. If construction is to take place in the County right-of-way, the contractor shall notify the County and obtain all the required approvals and permits.

6. A pre-construction meeting shall be held with the City of Lacey Construction Inspector prior to the start of construction.

7. The contractor shall be fully responsible for the location and protection of all existing utilities. The contractor shall verify all utility locations prior to construction by calling the Underground Locate line at 1-800-424-5555 a minimum of 48 hours prior to any excavation.

8. It shall be the responsibility of the contractor to have a copy of an approved set of plans on the construction site at all times.

9. All surveying and staking shall be performed per the corresponding chapter of the *City of Lacey Development Guidelines and Public Works Standards*.

10. Temporary erosion control/water pollution measures shall be required in accordance with Section 1-07.15 of the WSDOT/APWA Standard Specifications for Road, Bridge and Municipal Construction and the Drainage Design and Erosion Control Manual for Lacey. At no time will silts and debris be allowed to drain into an existing or newly installed facility unless special previsions have been designed.

11. Water mains up to 10" shall be AWWA C900 Class 200 or ductile iron standard pressure class rating 350. Water mains larger than 10” shall be ductile iron standard pressure class rating 350. See Chapter 6.030B for more detailed pipe specifications.

12. Gate valves shall be resilient wedge, NRS (Non Rising Stem) with O-ring seals. Valve ends shall be mechanical joint or ANSI flanges. Valves shall conform to AWWA C-515 latest revision. Valves shall be Mueller, M & H, Kennedy, Clow R/W, Waterous Series 2500, or American AVK.

13. **Existing valves shall be operated by City employees only.**

14. Hydrants shall be City approved as specified on the hydrant details and shall be bagged until the system is approved.

15. The contractor shall install, chlorinate, and flush all water lines. The lines shall be chlorinated and tested in conformance with the above referenced specification (Note 1) and Chapter 6. 200 of *the Development Guidelines and Public Works Standards*. After flushing chlorinated water from disinfected lines, the contractor shall measure chlorine residual to verify that flushing is complete. This will be completed prior to the City requesting microbiological samples.

16. All pipe and services shall be installed with continuous tracer tape installed 12" to 18" under the final ground surface. The marker shall be plastic non-biodegradable, metal core backing marked “water” which can be detected by a standard metal detector. Tape shall be Terra Tape "D" or approved equal. In addition to tracer tape, install direct bury, U.S.E.14 gauge blue coated copper wire, wrapped around or taped to the pipe, as shown on detail. Low voltage grease-type splice kits shall be used on tracer wire. Continuity testing of the wire will be done by the City.

17. All service line locations shall be marked on the top or face of the curb with an embossed "W" 3 inches high and 1/4 inch into concrete.

18. The City will be given 72 hours notice prior to scheduling a shutdown. Where connections require "field verification", connection points shall be exposed by the contractor and fittings verified 72 hours prior to distributing shut-down notices.

19. Separation between water and sewer shall be maintained per DOE standards. See Development Guideline Chapter 6.130 for more information.

20. A concrete pad per detail shall be installed around all valve boxes and blow-offs that are not in a pavement area.

21. At any connection to an existing line where a new valve is not installed, the existing valve must be pressure tested to City standards prior to connection. If an existing valve fails to pass the test, the contractor shall make the necessary provisions to test the new line prior to connection to the existing system or install a new valve.

22. The minimum burial depth of all water lines shall be 42 inches.

23. It shall be the contractor’s responsibility to field verify the location and depth of the existing main and provide the fittings required to make the connection to the existing main.

24. At the City's request, the contractor shall install a temporary 2 inch brass blow off for flushing and sampling on the existing and/or new water main. The blow off shall be constructed with a standard 2 inch tapping saddle and Ford brass corporation stop with 2 inch brass pipe extended up to finished grade. When flushing and sampling are completed, the 2 inch pipe shall be removed. The corporation stop shall be shut off and capped tight with threaded brass cap.

25. When an existing City water main is to be abandoned, it shall be the developer's responsibility to coordinate and abandon the existing main. It shall also be the developer's responsibility to install and transfer existing water services to the new main.

26. Sand shall be placed around and under service lines by hand to a height of 6 inches above and 4 inches below the line(s). Excavation for the meter box shall be an additional one foot around the entire box and backfilled with sand per City detail.

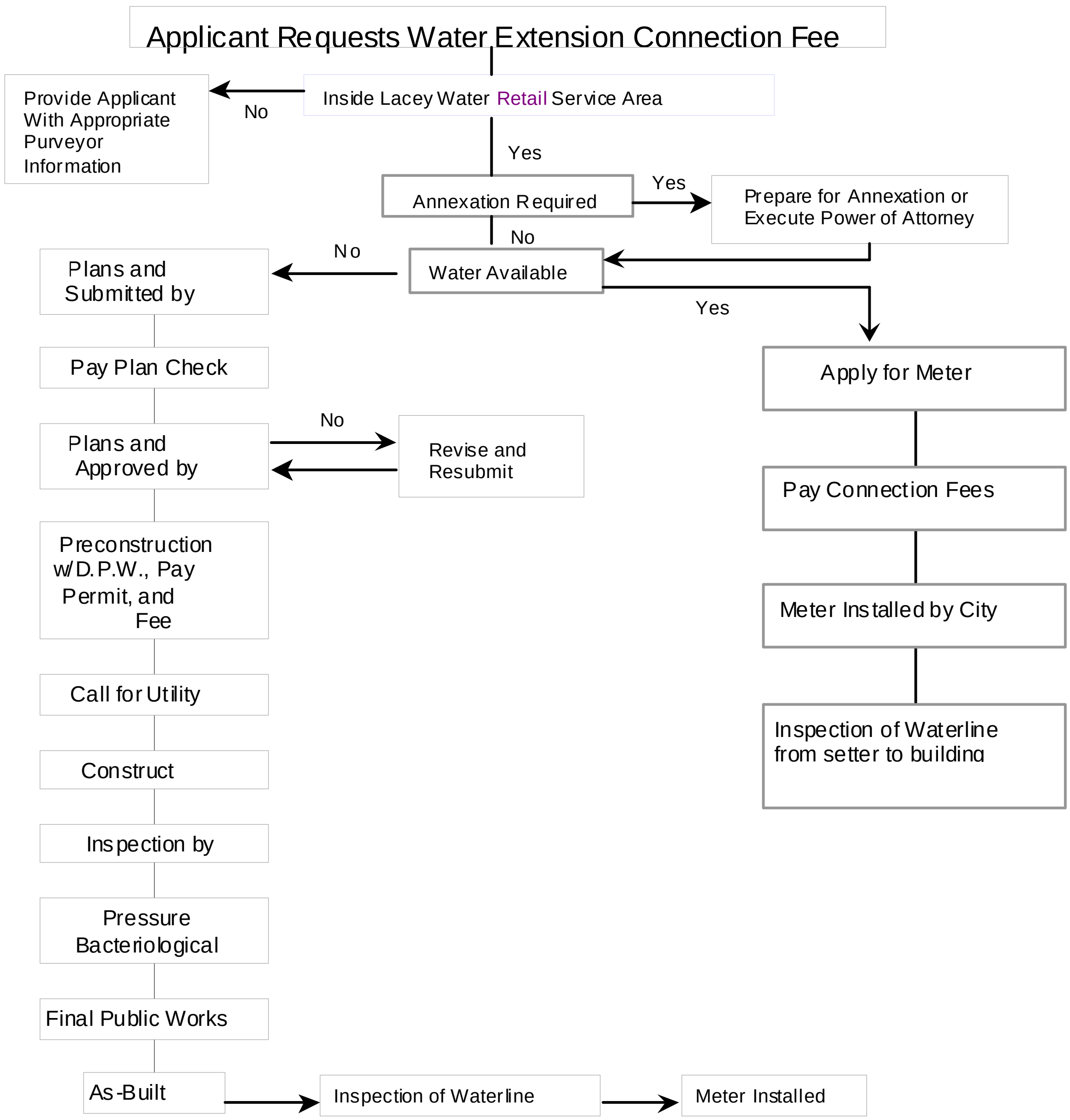
27. Meters 3 inches or larger in size must be ordered by the contractor/developer a minimum of 10 weeks in advance of installation.

28. All valve box, blow-off and manhole lids shall be clean and clear of asphalt or concrete before scheduling a walk through.

29. The water main and appurtenances and service connections to the meter setter shall be tested in sections of convenient lengths under a hydrostatic pressure equal to 150 psi in excess of that under which it will operate. In no case shall the test pressure be less than 225 psi.

Revised: 09/2009

PROCESS TO OBTAIN WATER SERVICE



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6.025 Wellhead Protection Areas

The wellhead protection area designated for each of the City's wells is an irregular boundary determined by topography, water flow patterns (both above and below ground), soil types, flow rates and other criteria. Please contact the Public Works plan review staff or the Water Resources Department to determine whether your project is situated within a wellhead protection area. In order to protect the public water supply, all applicable portions of the Critical Aquifer Recharge Areas Protection ordinance as specified in LMC 14.36 and the following criteria shall apply to any project or portion of a project which is partially or completely located within a wellhead protection area.

- ♦ Existing private wells within the City of Lacey shall comply with Department of Ecology standards.

- ♦ The drilling of new exempt wells, or redevelopment of existing exempt wells, shall be prohibited within the City's critical aquifer recharge areas except where use of such wells is for the purpose of City of Lacey water supply, or resource protection, environmental monitoring or remediation of contamination.

- ♦ All storm water shall be directed away from the well's 100 foot sanitary setback. Storm water shall not penetrate the same aquifer supplying the well within the well's 1-year time-of-travel zone.

- ♦ A storm and erosion control plan requiring treatment of stormwater is required. Depending on the individual characteristics of the project, and the susceptibility of the particular wellhead to contamination, more stringent treatment requirements than those required in the *Drainage Design and Erosion Control Manual for Lacey* may be imposed by the City.

- ♦ If the project is to be platted, it must be noted within the covenants of the plat and in the General Notes of any engineering plans that the project is located within the one, five, or ten year time-of-travel zone wellhead protection area.

- ♦ All garbage bins and dumpsters, except in single family subdivisions, shall be covered in a manner that prevents rainwater from entering the containers. A sanitary drain shall be provided for compaction-style dumpsters that may generate leachate.

- ♦ In commercial projects, where hazardous products are stored or used, a spill and containment plan shall be implemented. Depending on the nature of a project, more stringent spill and containment requirements than those required in the *Drainage Design and Erosion Control Manual for Lacey* may be imposed by the City.

- ♦ Integrated pest management shall be utilized in choosing landscaping. This is required to minimize the use of pesticides, fertilizers, etc. Contact

Thurston County Environmental Health for the most current Integrated Pest Management standards.

- Land spreading disposal facilities (as defined by WAC 13-304 and WAC 173-308) are prohibited within the designated one-year time-of-travel zone.

- Wastewater treatment facilities, including wastewater reclamation facilities, are prohibited within designated one-year time-of-travel zones. Infiltration of reclaimed water for the purposes of disposal or groundwater augmentation, which does not include irrigation at agronomic rates, is also prohibited within designated one-year time-of- travel zones.

- Animal operations with over 200 animal units shall be prohibited within the designated one-year time-of-travel zone. LMC 14.36.215. Examples of prohibited animal operations within the one-year time-of-travel include, but are not limited to, dairies, stables, horse boarding/training, auction facilities, feedlots, and poultry raising.

- Gas stations, petroleum products refinement, reprocessing, and storage (except underground storage of heating oil or agricultural fueling in quantities less than 1,100 gallons for consumptive use on the parcel where stored), and liquid petroleum products pipelines are prohibited within the designated one-year time-of-travel zone. LMC 14.36.215. Examples of prohibited petroleum storage within the one-year time-of-travel zone includes maintenance/fueling facilities for municipal, county, state, school district, transit, airports, railroads and buses. Gas stations without an attendant are prohibited within designated one-, five- and ten year time-of-travel zones.

- Automobile wrecking yards and junk, scrap, or salvage yards are prohibited within the designated one-year time-of-travel zone. LMC 14.36.215.

- Wood waste landfills shall be prohibited within the designated one-year time-of-travel zone. LMC 14.36.215.

- Dry cleaners, excluding drop-off only facilities are prohibited within the designated one-year time-of-travel zone. LMC 14.36.215.

- Landfills (municipal sanitary solid waste and hazardous waste) are prohibited within the designated one-, five-, and ten-year time-of-travel zones. LMC 14.36.215.

- Hazardous waste transfer, storage and disposal facilities are prohibited within the designated one-, five,- and ten-year time-of-travel zones. LMC 14.36.215.

- Wood and wood products preserving are prohibited within the designated one-, five- and ten-year time-of-travel zones. LMC 14.36.215.

- Chemical manufacturing is prohibited within the designated one-, five- and ten-year time-of-travel zones. LMC 14.36.215.

- For any use proposed within the designated one-, five- and ten-year time-of-travel zones which uses, stores, handles or disposes of hazardous materials, refer to LMC 14.36 for appropriate specifications.

6.030 Main Line

A. Water mains shall be sized to provide adequate domestic flow plus fire flow at the required residual pressure. Fire flow requirements will be determined by the City of Lacey Fire Code Official however, the quantity of water required will in no case be less than 750 GPM at 20 psi residual pressure for single family and duplex occupancies (IBC R3) and a cumulative 1500 gpm at 20 psi residual for all other occupancies except IBC Group U. Check with City of Lacey Fire Code Official for Group U requirements. Fire hydrants shall be located on water mains 6 inches diameter and larger.

The minimum water main size for standard distribution mains shall be 8 inches diameter. The minimum water main size for commercial and industrial applications shall be 12 inch. Larger size mains are required in specific areas as outlined in the Water Comprehensive Plan. Nothing shall preclude the City from requiring the installation of a larger sized main if the City determines a larger size is needed to meet fire protection requirements or for future service.

Public mains serving cul-de-sacs or non-extendible, dead end areas may not be less than two inches in diameter.

B. All pipe for water mains shall comply with one of the following types:

Ductile Iron Pipe: Ductile iron pipe may be used on mains up to ten inches diameter. Ductile iron pipe shall be used on mains over ten inches in diameter. Ductile iron pipe shall conform to AWWA C 151 standard pressure class rating 350 and have a cement mortar lining conforming to AWWA C 104. All pipes shall be joined using non-restrained joints which shall be rubber gaskets, push on type or mechanical joint, conforming to AWWA conforming to AWWA C 111.

For pipes with less than 42 inches of cover, ductile iron pipe shall be used. The pressure class shall be no less than 350.

PVC Pipe: PVC pipe may be used on mains four inches through 10 inches in diameter with a minimum of 42 inches of cover. All PVC pipe shall conform to the latest revision of AWWA C900 Class 200 standards.

Two Inch Pipe: All two inch pipe shall be blue, class 200 polyethylene plastic pipe manufactured from all virgin material, category 5, grade P34, class C high density polyethylene ID ASTM D2239-SDR7 PE 3408; cell classification 335434C to 355434C from Philips Driscopipe, Eagle Pacific (3408), Superlon Plastics, U.S. Poly or approved equal.

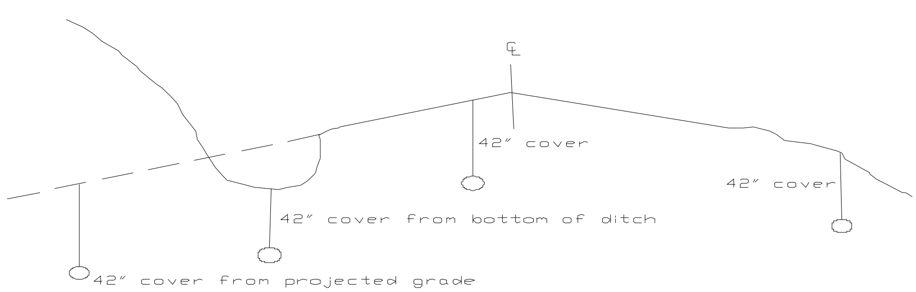
C. All fittings shall be ductile iron compact fittings conforming to AWWA C 153. All shall be cement mortar lined conforming to AWWA C 104. Plain end fittings shall be ductile iron if mechanical joint retainer glands are installed on the plain ends. All fittings shall be connected by flanges or mechanical joints. All retaining follower glands shall be ductile iron.

D. All pipe and services shall be installed with continuous tracer tape installed 12 to 18 inches under the final ground surface. The marker shall be plastic non-biodegradable, metal core or backing which can be detected by a standard metal detector. Tape shall be Terra Tape "D" or approved equal. In addition to tracer tape, install 14 gauge, direct bury, U.S.E. blue coated copper wire, wrapped around or taped to the top of pipe, brought up and tied off at valve body as shown on detail.

E. The minimum cover for all water mains from top of pipe to finish grade shall be 42 inches unless otherwise approved. If the pipe is offset to the edge of the road, the actual roadway cross grade shall be projected out and used to measure cover to top of pipe. This will require more fill over the pipe in a fill section but allows the pipe adequate cover in the event of future roadway cuts or widening. If the pipe is located under a ditch, or on the "downhill" slope of the roadway cross section, the minimum cover over the pipe shall be 42 inches regardless of projected grades.

F. When minimum cover of the water main is in conflict with other utilities, the engineer shall be required to provide the top and bottom elevations of the pipes in conflict. The adjustment of elevation when the minimum cover cannot be met shall be as directed by the City.

G. When designing a water main through an unimproved area, the engineer shall provide a future design of the area to prevent design/construction of shallow mains. The design shall include elevations of the top of pipe at 25 foot intervals. All pipe installed in unimproved areas shall be ductile iron.



6.040 Connection To Existing Water Main

If a tap or cut-in is being made by anyone other than the City, the City Inspector shall have the contractor sign the Verification of Disinfected Equipment Form.

The existing or new valve against the new connection or the tapping valve shall be pressure tested prior to any new connection.

After the contractor installs the new main, the contractor shall be responsible for disinfecting and flushing it per specifications in Chapter 6.200 of the *City of Lacey Development Guidelines and Public Works Standards* and AWWA guidelines.

The developer's engineer shall be responsible for determining the scope of work for connection to existing water mains. See detail. Cut-in tees may be allowed only with the approval of the Director of Public Works.

At the City’s request the contractor shall install a temporary 2 inch brass blow off for flushing and sampling on the existing and/or new water main. The blow off shall be constructed with a standard 2 inch tapping saddle and Ford brass corporation stop with 2 inch brass pipe extended up to finished grade. When flushing and sampling are completed the 2 inch pipe shall be removed. The corporation stop shall be shut off and capped with threaded brass cap.

It shall be the Contractor's responsibility to field verify the location and depth of the existing main and the fittings required to make the connections to the existing mains.

No tap shall be made to an existing main on a Friday without Public Works approval.

A City representative shall be present throughout the entire connection or tapping procedure.

PO Box 3400
Lacey, WA 98509-3400
(360) 491-5600

Verification of Disinfected Equipment

Warning: The City of Lacey maintains a chlorinated public water supply. Care shall be taken to reduce the risk of contamination.

Date:	City Representative:		
Location:			Size:
Project Name:		Public Works File Number:	
Type of Connection Being Made Check One: ☐ Connection/extension ☐ Tap ☐ Cut-in			
Contractor or Tapping Company Information Name: Address:			
City:		State:	Zip:
Phone Number: ( )			
Contractor:			

Only tapping machines equipped with a "flow-through" release bib shall be allowed.

The contractor listed above hereby certifies that the equipment being used to tap or cut into the City of Lacey's public water supply has been properly disinfected. The contractor listed above also certifies that this equipment, including blades, has only and solely been used on a potable water supply.

Print Name: ____

Signed: ____ Date: _____________________

6.050 Service Interruption

The contractor shall give the City a minimum of 72 hours notice of any planned connection to an existing pipeline. This includes all cut-ins, live taps and extensions. Notice is required so any disruptions to existing services can be scheduled. The City will notify customers involved or affected by the water service interruption. The contractor shall make every effort to schedule water main construction with a minimum interruption of water service. In certain situations, the City may dictate scheduling of water main shutdowns so as not to impose unnecessary shutdowns during specific periods to existing customers.

6.060 Hydrants

A. Existing hydrants within the construction project shall be upgraded to current standards or replaced as determined by the City.

B. The lead from the service main to the fire hydrant shall be as specified on detail.

C. Fire hydrants shall have two, 2-1/2 inch outlets and one 4-1/2 inch pumper port outlet fitted with a 5 inch Storz adapter. All outport threads shall be National Standard thread. The hydrant operating nut shall always open counter-clockwise. The valve opening shall be 5-1/4 inch diameter. The hydrant shall have a positive and automatic barrel drain. Hydrant shall be of the "safety" or break-away style.

D. Hydrant leads shall not exceed 60 feet. If a hydrant is required 60 feet or more from the main, the main shall be extended, a tee shall be installed and the hydrant lead shall commence from the second tee. The lead from the service main to the fire hydrant up to 19 feet shall be megalugged. For installations exceeding 19 feet, either megaluggs or field lock gaskets shall be required. Hydrant extensions shall use restrained joints from the main to the hydrant.

   Approved hydrants are as shown on the hydrant detail. All hydrants shall be bagged by the contractor until system is approved.

E. The Department of Public Works and City of Lacey Fire Code Official work together to insure that adequate hydrant spacing and installation are achieved.

   Unless otherwise required by the City of Lacey, the following guidelines shall apply for hydrant number and location:

   1. On arterials or boulevards, hydrants may be required on both sides of the roadway as determined by the Director of Public Works.

   2. At least one hydrant shall be installed at all intersections.

3. Hydrant spacing of 330 feet shall be required in all areas except single family and duplex residential areas.

4. Hydrant spacing of 660 feet shall be required for single family and duplex residential areas.

5. A hydrant shall be located at the end of all mains six inches or larger if the end of the line is more than 200 feet from the previous hydrant.

6. Hydrants located in cul-de-sac or dead end areas which, either by design, topographic or manmade feature, prohibit straight line distance measurement, shall be located to serve no more than 120,000 square feet or have a maximum travel distance of 330 feet. Where a cul-de-sac or dead end exceeds 330 feet, a hydrant shall be required.

7. When any portion of a proposed commercial building is in excess of 400 feet from a fire hydrant on a public street, on-site hydrants may be required by City of Lacey Fire Code Official. Such hydrants shall be located per City of Lacey Fire Code Official and easements for such hydrants shall be granted to the City.

8. An additional fire hydrant may be required at a commercial, institutional, industrial, or converted business if an existing structure is enlarged, altered, repaired, or moved when the floor area exceeds 500 square feet and/or when structural additions, alterations and/or repairs to any portion of an existing structure within any 12 month period exceeds 25 percent of the value of the structure over 500 square feet.

9. Buildings or structures having a water flow requirement of 1,500 gpm or more shall be supplied by looped 12 inch or larger water mains around the building with hydrants spaced per the International Fire Code. Internal looping will be confirmed using water modeling.

10. Hydrants shall be a minimum 40 feet from any building.

11. A two-way, blue reflective hydrant marker per the striping detail shall be required perpendicular to each hydrant. Hydrant markers shall be placed four inches from the centerline on the same side of the road as the hydrant.

12. For additional hydrant installation requirements, see Section 14.07, International Fire Code of the Lacey Municipal Code.

A scaled down plan view of the proposed water system shall be included on the plans. The scale shall be appropriate to show the entire proposed system. This plan view shall show the location of all the proposed hydrants plus the location of the appropriate existing hydrants adjoining the project. If the project only includes the addition of one or two new hydrants, the locations of at least 3 existing hydrants in the project vicinity need to be shown on the plan view.

F. Fire hydrants shall be set as shown on the hydrant detail.

G. For requirement regarding use, size and location of a fire department connection (FDC) and/or post indicator valve contact City of Lacey Fire Code Official. Location of FDC shall be shown on water plans.

H. Where needed, the Department of Public Works or City of Lacey Fire Code Official may require hydrants to be protected by two or more bollards. See detail and per IFC section 508.5.6.

I. Fire hydrants meeting required fire flow must be installed, tested, and accepted prior to the issuance of a building permit.

6.062 Hydrant Meters

Hydrant meters may be obtained by completing the required paperwork with Public Works at the Maintenance Service Center (1200 College St SE). A deposit is required. Once the deposit is made, the meter may be picked up by the applicant. A daily fee and charges for the amount of water used is billed on a monthly basis. Also, any damages incurred and final billing are assessed upon returning the meter to the Maintenance Service Center. Those fees are subtracted from the deposit paid and a refund check is mailed to the applicant.

The contractor shall insure that measures to prevent backflow, cross connections and contamination of the City system comply with AWWA standards. When using the hydrant meter to fill a vehicle, the vehicle must be equipped with an approved anti-siphon air gap. The air gap shall be at least twice the diameter of the inlet pipe. See Detail.

6.065 Fire Sprinkler Underground Line

This chapter refers to building fire sprinkler lines, not irrigation or landscape sprinkler lines.

City of Lacey Fire Code Official will witness the test of the sprinkler underground line and obtain the certificate for underground piping. The sprinkler underground line shall be tested per N.F.P.A. pamphlet # 24 standards. The sprinkler underground line shall not be tested until Public Works has tested and approved the distribution main up to the City valve. A microbiological sample shall be obtained from the fire sprinkler main between the City's main line valve and the backflow prevention assembly (BPA). The City's main line valve shall not be opened before a satisfactory test result has been returned. See drawing 6-25 for a map clarifying the location of the City valve and the sprinkler underground line.

If a BPA is not located in a public right-of-way, easements shall be required. The sprinkler underground line shall be that portion of the line located behind the City valve.

In no instance shall domestic or irrigation service connections be made to the sprinkler underground line.

See Chapter 6.110, Backflow Prevention, for additional information.

6.070 Valves

All valves and fittings shall be ductile iron with ANSI flanges or mechanical joint ends. **All existing valves shall be operated by City employees only.**

Valves shall be installed in the distribution system at sufficient intervals to facilitate system repair and maintenance, but in no case shall there be less than one valve every 1000 feet. There shall be three valves on each tee (excluding hydrant tees) and four valves on each cross. Valves installed with tees and crosses shall be flanged together. All valves shall open counter-clockwise. Additional valves and valve spacing may be required by the City during plan review.

A. Gate Valves, 2 inch to 12 inch: The design, materials and workmanship of all gate valves shall be Ductile Iron Body resilient wedge valves conforming to AWWA C515 latest revision. Gate valves shall be resilient wedge non-rising stem (NRS) with two internal O-ring stem seals. Gate valves shall be Mueller, M & H, Kennedy, Clow R/W, Waterous Series 2500 or American AVK.

B. Butterfly Valves: Butterfly valves shall only be permitted under special circumstances as determined during review by the Director of Public Works. Butterfly valves shall be used on all lines 14 inches and larger except when a tapping valve is required. Butterfly valves shall conform to AWWA C504, Class 150B, with cast iron short body, O-ring stem seals, geared operator designed for underground installation, and a 2 inch square operating nut. Butterfly valves shall be Mueller, Linseal III, Kennedy, M & H, Pratt Groundhog, or Allis Chalmers.

C. Valve Box: All valves shall have a standard East Jordan Iron Works or an Olympic Foundry VB-950 water valve box set to grade with a 6 inch ASTM 3034 SDR 35 PVC riser from valve to within 4 to 6 inches of valve box top. If valves are not set in paved area, a concrete pad shall be set around each valve box at finished grade. In areas where valve box falls in road shoulder, the ditch and shoulder shall be graded before placing asphalt or concrete pad. See detail.

D. Valve marker Post: Valve marker posts shall be 4 inch x 4 inch reinforced concrete or schedule 40 steel posts 5 feet long stamped with "W" and distance to valve in blue. Post shall be painted with 1 base coat and 2 coats white oil base enamel. The need for valve marker posts will be determined during plan review. See detail.

6.075 Bend Markers

Bend markers are required when water lines are located outside the right-of-way. When the direction of a main changes due to a bend, a bend marker is required. See bend marker details.

6.080 Casing

The casing shall be as follows: one quarter inch steel casing pipe or ductile iron class 52. In special cases C-900 class 200 PVC pipe may be allowed. Casing spacers are required. A minimum of three sets of spacers are required per 20 feet of pipe. Spacers shall be as manufactured by Uni-Flange®, Calpico Inc. or approved equal. No more than one inch of clearance is allowed per set of spacers or insulators.

All pipe within casings shall be ductile iron class 52.

The joints of the transmission pipe within the casing pipe shall be restrained with a Restrained Casing Spacer made by Uni-Flange®, or if using Calpico Inc. insulators, the pipe joints shall be restrained with a restraint system approved by the City of Lacey. Restrained joints shall be required on the transmission line one pipe length past either end of the casing pipe. Additional restraints may be required by the City.

6.090 Air and Vacuum Release Valve

Air and vacuum release valves (ARV) shall be installed on the same side of the street (water north & east) as the main, behind the sidewalk on the property corner (residential applications). For mains up to 12 inches diameter ARV's shall be as shown on the detail. The engineer shall size the ARV for mains 14 inches diameter and larger.

ARV's must be installed so as not to create a cross connection situation. Measures to prevent backflow, cross connections, and contamination of the City system shall comply with AWWA standards.

The installation shall be set at the high point of the line when required. ARV's shall not be installed in areas subject to high ground water or flooding. Where possible, pipes are to be graded to prevent the need for an air release valve.

6.100 Blow-off Assembly

For water mains less than 6 inches in diameter a blow-off shall be located at the end of the main. The blow-off assembly shall be as shown on the details at the end of this Chapter. The pressure rating for blow-off assemblies shall be 200 psi. If located in cul-de-sacs, the blow-off assembly shall be placed near the center of the cul-de-sac. See Chapter 6.060 (D4) for hydrant requirements at the end of 6 inch and larger mains.

6.110 Backflow Prevention

A. General

The installation of required backflow assemblies is necessary to protect the public water system from possible contamination. All water system connections to serve newly constructed and existing buildings or properties with domestic potable water, fire sprinkler systems or irrigation systems shall comply with the minimum backflow prevention requirements as established by the Department of Health (DOH), the American Water Works Association (AWWA) and the City of Lacey's Cross Connection Control & Backflow Manual.

Real or potential cross connections with the City of Lacey water system shall be prohibited under all circumstances.

Please refer to Chapter 6.065 for additional information regarding sprinkler underground lines.

Please refer to Chapter 6.060H for requirements when filling vehicles with a hydrant meter.

B. Definitions Related to Cross Connection Control

"Backflow" -- The undesirable reversal of flow of water or other substances through a cross connection into the public water system or consumer's potable water system.

"Backflow Assembly Tester (BAT)" -- A person holding a valid BAT certificate issued in accordance with chapter 246-292 WAC.

"Cross Connection" -- Any actual or potential physical connection between a public water system or the consumer's water system and any source of nonpotable liquid, solid or gas that could contaminate the potable supply by backflow.

"Double Check Valve Assembly (DCVA)" -- The term "double check valve assembly" will mean an assembly composed of two independently acting, approved check valves, including tightly closing shut-off valves attached to each end of the assembly and fitted with properly located test cocks. This assembly will only be used to protect against a non-health hazard.

"Double Check Detector Assembly (DCDA)" -- The term " double check detector assembly" will mean a specially designed assembly composed of a line sized approved double check valve assembly with a specific bypass water meter and a meter sized approved double check valve assembly. The meter will register accurately for only very low rates of flow and will show a registration for all rates of flow. This assembly will only be used to protect against a non-health hazard. This assembly is designed for use on fire protection services rated as a low-health hazard, (no chemical addition).

“High health hazard” -- A cross connection which could impair the quality of potable water and create an actual public health hazard through chemical or radiological poisoning, the spread of disease, or physical hazard.

“In-Premises or Fixture Isolation” -- A method of protection for the health of consumers served by the consumer’s potable water system. The installation of an approved air gap or backflow prevention assembly within the property lines of the consumer’s premises at, or near, the point of hazard.

“Low health hazard” -- A cross connection that could cause an impairment of the quality of potable water to a degree that does not create a hazard to the public health, but does adversely and unreasonably affect the aesthetic qualities of such potable waters for domestic use.

“Premises Isolation” -- A method of protecting a public water system by installation of approved air gaps or approved backflow prevention assemblies at or near the service connection or an alternative location acceptable to the purveyor; to isolate the consumer’s entire water system from the public water system.

“Reduced Pressure Backflow Assembly (RPBA)” -- The term " reduced pressure backflow assembly" will mean an assembly containing two independently acting approved check valves together with a hydraulically operating, mechanically independent pressure differential relief valve located between the check valves and at the same time, below the first check valve. The unit will include properly located test cocks and tightly closing shut off valves at each end of the assembly. This assembly is designed to protect against a high health hazard.

“Reduced Pressure Detector Assembly (RPDA)” -- The term " reduced pressure detector assembly" will mean a specially designed assembly composed of a line-size approved reduced pressure principle backflow prevention assembly with a specific bypass water meter and a meter size approved reduced pressure principle backflow prevention assembly. This assembly is designed for use on fire protection services rated as a high health hazard (with chemical addition).

"Unapproved Auxiliary Water Supply" -- A water supply (other than the purveyor's water supply) on or available to the consumer's premises that is either not approved for human consumption by the health agency having jurisdiction, or is not otherwise acceptable to the purveyor.

"Uniform Plumbing Code" -- The code adopted under RCW 19.27.031(4) and amended under chapter 51-46 WAC. This code establishes statewide minimum plumbing standards applicable within the property lines of the consumer's premises.

C. Design and Installation Requirements

1. Any backflow prevention assembly must be installed in full compliance with all relevant aspects of the uniform plumbing code (UPC).

2. When a backflow prevention assembly is required, plans must be submitted to the City of Lacey for review and approval prior to installation.

3. Premise isolation assemblies must be installed at the point of delivery of the water supply, before any branch in the line, downstream of any pressure reducing valve on private property, in a location approved by the Director of Public Works.

4. Backflow prevention assemblies and air release valves shall never be submerged in water, or installed in any area subject to flooding. If installed in a vault or basement, adequate drainage shall be provided.

5. Assemblies must be protected from freezing and other severe weather conditions.

6. If assemblies are to be vertically oriented, the type and model specified shall be approved by DOH for vertical installation in that orientation.

7. All assemblies require a minimum clearance for routine maintenance and testing. Assemblies 2 inches and smaller shall have a least 6 inches clearance on all sides of the assembly. All assemblies larger than 2 inches shall have a minimum clearance of 12 inches on the back side, 24 inches on the test cock side, and 12 inches below the assembly. All RPBA's shall have at least 12 inches clearance below the drain opening.

8. Support and stability of all assemblies shall be given prime consideration. All assemblies shall be suitably braced to prevent movement.

9. The piping on the inlet side of the assembly shall be rigid brass or copper. Galvanized piping shall not be allowed.

10. When trap primers are required in buildings, a proper air gap (a minimum of two times the supply pipe diameter) is required between the potable water supply and the sewer connection.

11. Backflow assemblies for fire protection shall have approved integrated shut-off valves as part of the assembly and shall be separate from any post indicator valve installed on the sprinkler underground line.

12. When a RPBA is located inside a building or structure, it shall be installed in a location where the occasional spitting from the relief valve and the possible constant discharge in the event of a fouled check valve will not be objectionable. An approved air gap funnel assembly, provided by the manufacturer or fabricated for the specific installation, may be installed to handle the occasional spitting of the relief valve due to pressure fluctuations. A line from the funnel assembly may be run to an adequately sized floor drain of equal or greater size. Check with the manufacturer for the relief valve discharge rates to determine size of drain.

13. Drains shall be sized to carry the full-rated flow of the assembly and shall be double screened and double banded on both ends.

14. Any backflow assembly installed more than 4 feet above floor or ground level must have a platform under it. The platform must comply with all applicable safety standards and codes.

15. Assemblies may not be installed above electrical panels or motors.

16. The access to a device located inside a building or structure must have minimum accessible entrance of three feet wide by five feet high. There shall be no obstacles or structures interfering with these dimensions that may prevent access to the assembly.

When installation is complete, a Washington state certified Backflow Assembly Tester (BAT) shall inspect and test the assembly to insure proper installation and operation. Certificate of Occupancy and water service shall not be issued until the testing certificate is received, reviewed and approved by the City of Lacey.

D. Applicability

Backflow prevention assemblies shall be installed at the expense of the property owner, either at the service connection or within the premises. A backflow prevention assembly shall be installed at any premise or fixture where installation is deemed necessary to accomplish the purpose of these regulations in the judgment of a certified cross connection specialist or the Director of Public Works. Situations where a backflow assembly will be required include, but are not limited to:

1. If the nature and extent of any activity on a premises, the materials used in connection with any activity on a premises, or the materials stored on the premises, could in any way contaminate or pollute the potable water supply.

2. If the building is for commercial purposes.

3. When existing internal cross connections are not correctable, or intricate plumbing arrangements make it impractical to ascertain whether or not a cross connection exists.

4. If entry is restricted such that inspections for cross connections cannot be made with sufficient frequency or with sufficient notice.

5. If materials of toxic, objectionable or hazardous nature, either liquids, solids or gases are being used such that, if back siphonage or back pressure should occur, a health hazard could result.

6. On any mobile apparatus that connects to or takes water from the City's water system.

7. When an in-ground irrigation system is connected to the public water system.

8. Whenever any unapproved alternative water source is present or available for use on the premise.

9. Any customer with a recognized real or potential cross connection shall be required to install an appropriate backflow prevention assembly, commensurate with the degree of hazard and the backflow conditions. Failure on the part of any customer to properly protect the public water system from contamination is sufficient cause for the immediate discontinuance of public water service to the premise. At it's discretion the City may elect to install the appropriate backflow prevention assembly at the owner's expense.

E. Follow-up Testing

All backflow assemblies must be tested on an annual basis, to insure proper operation. Annual testing is required at the user's expense. The results of the annual testing shall be submitted to the City of Lacey Public Works Department.

A list of certified backflow assembly testers (BAT's) who have registered with the City of Lacey Water Resources Division and are in good standing, is available upon request. The tester shall hold a current Washington State Department of Health Backflow Assembly Tester (BAT) Certification and possess documentation insuring their test gauge is properly calibrated.

Any BAT who knowingly submits false documents or a false test report shall be removed from the City's list of BAT's in good standing. If the City determines the false report was malicious and/or could have resulted in illness or death, a report will be made to the Washington Department of Health and proceedings to suspend or revoke the BAT's certificate shall be initiated.

All assemblies found not functioning properly shall be promptly repaired or replaced by the water user. If any such assembly is not promptly repaired or replaced, the City may deny or discontinue water to the premise until the correction is made. All testing and repairs are the financial responsibility of the water user.

Existing backflow assemblies that are no longer on the DOH approved list of assemblies will be allowed to remain in service provided they pass the annual testing requirements. Backflow assemblies that are no longer approved and do not pass the required testing shall be replaced with an approved assembly commensurate with the degree of hazard.

The City of Lacey has the authority to perform regular inspections on all backflow assemblies used to protect the City's water system and shall be provided reasonable access to the premises for inspection purposes. If reasonable access cannot be provided, a reduced pressure backflow assembly must be installed at the service connection to that premises.

6.120 Service Connection

A. All service connections relating to new development shall be installed by the developer at the time of mainline construction. Services shall not be connected to a hydrant lead or the sprinkler underground line. The City will install a water meter after the application has been made and all applicable fees have been paid. Water meters will be set only after the system is inspected and approved. The use of construction bibs or "cheaters" is prohibited.

B. When water is desired to a parcel fronting an existing main but not served by an existing setter, an application must be made to the City. Upon approval of the application and payment of all applicable fees, the City will tap the main, and install the meter, box, and setter. If the main is on the opposite side of the road from the parcel needing service, it shall be the developer's responsibility to provide a casing under the roadway. The contractor installing the casing shall coordinate with the City of Lacey for depth location and size of casing. Each end of the casing shall be capped and marked. The minimum casing size shall be 4 inch polyethylene. For larger casing requirements refer to Chapter 6.080.

Service taps larger than 2 inches, connecting to an existing main, shall be made by the contractor per Chapter 6.040. Service taps that require crossing an arterial street in excess of two lane widths shall be made by the contractor. These types of services shall be denoted on the plans.

Domestic or irrigation meters 3 inch or larger in size must be ordered through the City by the contractor/developer 10 weeks in advance of the installation date.

A casing is required when a new service is to be connected to an existing water main and it crosses the centerline of the roadway. The applicant is responsible for this work. Outside of the Lacey City limits, contact Thurston County for the required right-of-way permit(s) and restoration requirements, if any. If Thurston County allows trenching, a casing shall be required.

C. Service lines shall be as specified herein. No glued joints will be accepted. Service lines shall be installed perpendicular to and 22½° above horizontal of the main. Tracer tape and wire wrapped around the pipe shall be installed on all service lines. When connecting to an existing system where the roadway cannot be cut, a casing shall be required.

One and one-half to two inch diameter service lines shall be blue in color pressure class 200, polyethylene plastic tubing manufactured from all virgin material category 5, grade P34, class C high density weight polyethylene OD ASTM D2737-SDR7 PE3408 or ASTM D2239-SDR7 PE3408; cell classification 335434C to 355434C, from Philips Driscopipe, Eagle Pacific (3408), Superlon Plastics, U.S. Poly or approved equal.

Service saddles with stainless steel straps shall be as shown on the details or approved equal. All clamps shall have rubber gasket and iron pipe threaded outlets.

Corporation stops shall be as shown on the appropriate detail or approved equal with iron pipe threads conforming to AWWA C 800. Stainless steel inserts shall be used with pack joints and polyethylene pipe.

D. With the exception of public and private school sites, new installation of master meters will not be allowed.

E. After January 1, 2007, when connection to the public water system is desired by a customer connected to a well exempt from the provisions of RCW 90.44.050, the “exempt” well must be properly decommissioned per DOE standards prior to making the connection. When connection to the public water system is desired by a customer connected to an existing well that has a water right issued by the Washington Department of Ecology, a physical disconnect between the well and the public water system must be made and maintained. This is necessary to assure that an unapproved auxiliary water supply (the customer’s well) will not contaminate the City’s water supply. Provided it is in compliance with DOE setback standards and purpose of use restrictions on the customers water right for said well, the customer’s “permitted” well may be kept serviceable for irrigation purposes only. In addition, if a well is to be used for irrigation, an RPBA shall be required and installed as premise isolation at the public water supply service connection. If an existing well is not to be used for irrigation purposes, it must be decommissioned per DOE standards. No water meter will be installed until the RPBA is installed and a cross connection inspection has been completed to the satisfaction of the City.

F. Lots or pads created by plats, replats, short plats, or binding site plans shall have a water service installed as required below.

In single family subdivisions, (including mobile home and manufactured home subdivisions) a service shall be provided to each lot or pad, including open tracts and landscaping in the right-of-way. If a domestic and an irrigation meter are desired at a particular lot or tract, additional services shall be installed.

Duplexes shall have a separate service installed for each living unit regardless of how many duplexes are on a single lot. Example: One duplex on one lot shall have two services; two duplexes on one lot shall have four services and so on. A subdivision of duplexes shall have at least one service installed at all open tracts.

Multi-family and commercial complexes shall have at least one meter installed per separate building and a separate irrigation meter(s) if an irrigation system is installed. Additional meters to a multi-family or commercial building may be installed if desired. At least one service shall be installed at all open tracts. Master meters shall meet the criteria as outlined in 6.120D above.

G. Sample stations may be required per the City detail. The requirement for the location and type of the sample station will be determined by the City during the plan review. Sample stations shall be located behind the walk on a property line, in an open space, or in a utility easement whenever possible and shall generally be centrally located in the project at a low point if possible.

H. Service configuration shall be as shown on details at the end of this Chapter. Meters 3 inches and larger shall not be placed in a traffic bearing location. For services larger than 3 inches, the engineer shall submit a detail for approval that addresses the following:

- meter type (turbine, compound, etc.) and size,
- a valve shall be located on both sides of the meter,
- a lockable bypass is required,
- check valves shall be required on the bypass and the meter,
- supports (jack stands) are required under the meter and bypass,
- the vault specified shall provide an 18” clear space from the vault wall to the closest edge of the meter, valves, or pipe,
- the vault shall have a double lid with a reader lid insert,

- the distance from the top of the meter to the bottom of the lid shall be 24 inches minimum and 30 inches maximum,
- a ladder shall be provided in the vault,
- drainage must be provided for the meter pit.
- the inside depth of the vault shall not exceed four feet from the top finish grade to the inside floor elevation.

6.121 Water Meter Purchasing

In an effort to eliminate unaccounted water, the use of construction bibs or other devices used to obtain water without a water meter shall not be permitted. Water meters shall be purchased and installed prior to building permit issuance.

The following requirements shall apply to projects located within the Lacey water service area.

Residential and Commercial Projects Within the City limits:

1. The installation of a water meter prior to issuing the residential building permit is required. The applicant will pay for the water meter (s) (not the related water and sewer general facility charges, LOTT Capitol Development charge and the stormwater charge) prior to the building permit issuance.

2. The Building Official will ensure a meter is in place at the time of the first inspection. Public Works Inspectors, Meter Readers and the Operations staff will report any construction bibs or connections other than City of Lacey meters as they transit construction projects. Utility Billing staff will monitor AMR (automated meters) to detect abuse/damage through the use of error reports.

3. Prior to scheduling the final building inspection, the sewer, water, and storm connection fees will be paid by the builder/applicant. Final inspection will not be scheduled until all required fees have been paid.

Residential and Commercial Projects Within the Urban Growth Area:

1. The builder/applicant will be required to purchase a meter and pay **all** connection fees prior to the issuance of a building permit.

Irrigation Meters:

1. The developer is required to purchase and install irrigation meters prior to the final plat document being recorded or Final Public Works construction approval being provided.

2. Operations staff will be responsible to verify that irrigation meters are installed at the time of the walk through inspection.

General Water Meter Requirements:

1. For all projects that receive City of Lacey water, builders/developers will be billed for the cost of replacement or repair of all damaged meters.

2. When devices other than City of Lacey water meters are found in violation of City policy, violators shall be charged with a misdemeanor.

3. Any project that has received a building permit prior to the 2009 Development Guidelines approval are vested and allowed to utilize construction water (for 90 days) as previously permitted; however all are encouraged to purchase their meters at the earliest date possible.

6.125 Marking Service Lines

The location of all service lines shall be marked on the face or top of the cement concrete curb with a "W" 3 inches in height and 1/4 inch into the concrete.

6.130 Water Main/Sanitary Sewer and Reclaimed Water Crossings

The Contractor shall maintain a minimum of 18 inches of vertical separation between sanitary sewers/reclaimed water and water mains. To accommodate crossings, the minimum cover for water main of 42 inches may be reduced to 24 inches upon approval by the City to provide for as much vertical separation as possible. When a reduced depth is allowed, ductile iron piping and/or casings may be required. See 6.080 for casing specifications.

Pressure sewers/reclaimed water shall only be installed under water lines. The vertical separation of 18 inches shall be at a minimum of 10 feet on either side of the crossing. The longest standard length of water pipe shall be installed so that the joints will fall equidistant from any sewer crossing. In some cases where minimum separation cannot be maintained, it may be necessary to encase the water pipe and/or the sewer/reclaimed water service per DOE standards.

6.140 Water Main / Sanitary Sewer / Reclaimed water in Parallel

Refer to the City of Lacey details for water main/ reclaimed water and sanitary sewer in parallel installation.

6.150 Staking

All surveying and staking shall be performed by an engineering or surveying firm capable of performing such work. The surveyor directing such work shall be licensed as a Professional Land Surveyor by the State of Washington.

A preconstruction meeting shall be held with the City prior to commencing staking. All construction staking shall be inspected by the City prior to construction.
The minimum staking of waterlines shall be as directed by the City Engineer or as follows:

A. Stake centerline alignment every 50 feet with cut or fill to invert of pipe maintaining 42 inches of cover over pipe.

B. Stake alignment of all fire hydrants, tees, water meters, setters and other fixtures and mark cut or fill to hydrant flange finished grade.

6.160 Trench Excavation

A. Clearing and grubbing where required shall be performed within the easement or public right-of-way as permitted by the City and/or governing agencies. Debris resulting from the clearing and grubbing shall be disposed of by the owner or contractor in accordance with the terms of all applicable permits.

B. Trenches shall be excavated to the line and depth designated by the City to provide a minimum of 42 inches of cover over the pipe. Except for unusual circumstances where approved by the City, the trench sides shall be excavated vertically and the trench width shall be excavated only to such widths as are necessary for adequate working space as allowed by the governing agency. The trench shall be kept free from water until joining is complete. Surface water shall be diverted so as not to enter the trench. The owner shall maintain sufficient pumping equipment on the job to insure that these provisions are carried out.

C. The contractor shall perform all excavation. Whatever obstructions are encountered shall be removed or cut out to the width of the trench or roadway section to a depth 6 inches below water main grade. Where materials are removed from below water main grade, the trench shall be backfilled to grade with material satisfactory to the City and thoroughly compacted.

D. Trenching and shoring operations shall be in conformance with Washington Industrial Safety and Health Administration (WISHA), Washington Department of Labor and Industries (L & I) and the Office of Safety and Health Administration (OSHA) Safety Standards.

6.165 Thrust Blocking

Location of thrust blocking shall be shown on plans. Thrust blocks shall comply with the City thrust blocking details. The addition of restrained joint fittings may not eliminate the need for thrust blocking.

6.170 Bedding and Backfilling

Bedding material per the City bedding detail shall be placed and compacted around and 4 inches under the water mains by hand tools and to a height of 6 inches above the top of the water main. The remaining fill shall be compacted to 95 percent of the maximum density. Where governmental agencies other than the City have jurisdiction over roadways, the fill and compaction shall be done to the satisfaction of the agency having jurisdiction. If suitable material, as determined by the City, is not available from trenching operations, the City may order the placing of imported fill conforming to 9-03.12(3) around the water main and gravel base conforming with Section 9-30.15 of the *WSDOT/APWA Standard Specifications for Road, Bridge and Municipal Construction* for backfilling the trench. Bedding and backfilling shall be required per the detail.

6.175 Street Patching and Restoration

See Chapter 4B.170 and 4B.180 and trench restoration details for requirements regarding street patching and trench restoration.

6.190 Hydrostatic Tests

After the water main and appurtenances and service connections to the meter setter have been installed, filled and sterilized, the system shall be tested in sections not to exceed 1,500 feet in length. The test shall be conducted under a hydrostatic pressure equal to 150 psi in excess of that under which it will operate. In no case shall the test pressure be less than 225 psi for 15 minutes. Any leaks or imperfections developing under said pressure shall be remedied by the contractor. All valves within the system shall be tested. Insofar as possible, no hydrostatic pressure shall be placed against the opposite side of the valve being tested. Test pressure shall be maintained while the entire installation is inspected.

The contractor shall provide all necessary equipment and shall perform all work connected with the tests. The test pump shall be clean and disinfected and shall only be used on potable water supplies. Tests shall be made after all connections have been made and the roadway section is constructed to subgrade. This is to include any and all connections as shown on the plan. The contractor shall perform the test to assure that the equipment to be used for the test is adequate and in good operating condition and the air in the line has been released before requesting the City to witness the test.

6.200 Sterilization and Flushing

A. Prior to the acceptance of the work, sterilization of water mains shall be accomplished by the contractor in accordance with the AWWA standard for disinfecting water mains. Testing and sampling shall take place after all underground utilities are installed and compaction of the trench to sub-grade or finish grade is complete.

1. The City inspector will open the water valves to fill the new main at the request of the contractor. A minimum chlorine concentration of 50 mg/L shall be established throughout the line. After the main is filled, the valves shall be closed by the City inspector and the line left undisturbed for 24 hours. A minimum free chlorine residual of 10 mg/L shall remain following this period.

2. After the main has been filled, hydrostatic pressure testing shall be conducted by the contractor in the presence of the City inspector.

3. After the 24-hour contact time has passed, the contractor shall thoroughly flush the disinfected water main to the sewer or an approved receptacle under the supervision of the City inspector. Flushing mains larger than six inches may require the assistance of City staff to ensure adequate flush velocities are achieved. All water discharged from mains must be accounted for in total gallons. Flushing will not be complete until chlorine levels in the new main are representative of residuals within the City main system. It will be the contractor's responsibility to measure chlorine residuals during flushing using a method that is accepted by the Washington State Department of Health for drinking water samples. At no time shall chlorinated water from a new main be flushed directly or indirectly into a body of fresh water. This is to include lakes, rivers, streams, drainage ways, and any and all other waters where fish or other natural aquatic life can be expected.

4. After the main has been thoroughly flushed, water samples shall be taken. Only the City inspector will close the water valves to ensure that the new section is isolated. The City inspector will request microbiological samples to be collected by City staff. For approval by the local health agency, samples will be collected by the City no sooner than 24 hours after flushing is completed. The valves are to remain closed until microbiological samples for all the connection are satisfactory.

B. Subsequent action will be taken based on initial results of microbiological tests.

1. If coliform bacteria are absent in all new main samples, the City will open valves to the new and the existing system. At that time, the

testing process for the new section of main shall be considered complete.

2. If coliform bacteria are present in one new main sample, but there is absence of fecal coliforms or E. Coli., the contractor shall take action as directed by the City inspector, including re-flushing the water main. The City shall then re-sample the new main to ensure that the entire section was adequately sterilized as determined by the results of microbiological sample (s) collected following the process in A.3 above.

3. If coliform bacteria are present in more than 1 sample collected from the new section, or from a second sample collected under step B.2., or if fecal coliforms or E. Coli were detected in any of the new main samples, the City shall ensure that a microbiological sample is collected from the existing water system "upstream" of the project. If the "upstream" sample(s) indicate(s) that coliforms are present in the City water system, go to "C" below. If the "upstream" sample indicates an absence of coliforms in the City water system, the contractor shall re-disinfect the new mains with sodium hypochlorite solution using the continuous feed method as described in the AWWA Standard for Disinfecting Water Mains, and then proceed with steps A.1., A.2 and A.3 above. To demonstrate that the new water main was adequately sterilized, two sets of microbiological samples, collected at least 24 hours apart with no flushing in between must indicate an absence of coliform bacteria in the new main.

C. If an "upstream" sample indicates the presence of coliform bacteria in the City water system, the City shall follow State Department of Health regulations and guidance for addressing the presence of coliforms in the distribution system. The City will calculate system compliance for coliform bacteria and take appropriate action per the City of Lacey Coliform Monitoring Plan under the supervision of the City of Lacey Water Resources Division. Follow-up actions may include, but are not limited to: identifying and correcting the likely source(s) of contamination, flushing, testing, and/or public notification. Disinfection and testing of the new main(s) shall not resume until the City water supplying the project tests free of coliforms. At that time, the contractor shall take action as directed by the City inspector, including re-flushing the water main prior to the City requesting another set of microbiological samples.

If the initial treatment results in an unsatisfactory bacteriological test, the original chlorination procedure shall be repeated by the contractor until satisfactory results are obtained.

6.210 Irrigation

All irrigation systems located within the public right-of-way shall be designed by a State of Washington registered landscape architect or City approved design firm. Parts lists shall be submitted with each project.

Prior to submitting the design, the contractor/engineer/landscape architect shall hire an independent Certified Landscape Irrigation Auditor, as certified by The Irrigation Association, to review and approve the proposed design.

After the irrigation system is installed, the contractor shall provide an irrigation audit to be performed on the new system by an independent Certified Landscape Irrigation Auditor (CLIA), as certified by the Irrigation Association, prior to final field observation by the Engineer. The CLIA shall test for proper coverage as determined by the Landscape Irrigation Auditor Handbook, most recent edition. The CLIA shall provide written certification that the irrigation system installed provides proper coverage as provided in the handbook.

The General Notes on the following pages are required on all plans for City operated or maintained irrigation systems or on any owner association operated or maintained irrigation systems located within the public right-of-way.

Irrigation systems shall be installed with an approved backflow prevention assembly in accordance with Chapter 6.110 of this manual.

A separate irrigation meter shall be provided for irrigation systems. Medians shall require a separate meter. The irrigation system shall be installed after the area has been properly prepared. See Chapter 4B.125 for soil preparation requirements. The pipe trenches shall be no wider than is necessary to lay the pipe or install equipment.

The median system shall be a completely separate system with its own separate appurtenances.

Irrigation sprinklers shall be situated so as to not wet any public street or sidewalk. Spray heads shall not be used in planters less than 3 feet wide. Drip irrigation methods shall be employed in areas less than 3 feet wide to prevent overspray. Turf heads shall be placed at finished grade as measured from the top of the sprinkler. Shrub heads shall be 12 inch pop up type placed at finished grade unless otherwise specified. Drip irrigation emitters shall be installed in accordance with the manufacturer's recommendations.

Installation and maintenance of irrigation systems in roadway planter strips shall be as shown in the table below. The system maintainer shall be responsible for the on-going water and power expenses incurred.

	Single Family Residential Zones	**Multi-Family & All Other Zones**
Arterial Boulevard	Developer installs, Homeowners Association maintains or a Community Facilities District may be established per LMC 3.46	Developer installs. Owner or Owners Association maintains or a Community Facilities District may be established per LMC 3.46
Arterials	Developer installs, Homeowners Assn. maintains. If the association doesn't maintain, a Community Facilities District may be established at the City's discretion per LMC 3.46.	Developer installs. Owner or Owners Association maintains (the City will maintain where existing covenants don't address this issue)
Collectors	Developer installs, Homeowners Assn. maintains	Developer installs, Owners Association maintains
Residential	Developer installs & Homeowners Assn. maintains	Owner installs, owner maintains

GENERAL NOTES (IRRIGATION SYSTEMS)

1. All workmanship, material and testing shall be in accordance with the City of Lacey Development Guidelines, the National Electrical Code and the most current copy of the *WSDOT/APWA Standard Specifications for Road, Bridge and Municipal Construction* unless otherwise specified below. In cases of conflict, the most stringent standard shall apply.

2. The contractor shall be in compliance with all safety standards and requirements as set forth by OSHA, WISHA and the Washington State Department of Labor and Industries.

3. The contractor shall be responsible for all traffic control in accordance with the *WSDOT/APWA Standard Plans for Road, Bridge and Municipal Construction* (all applicable “K” plans) and/or the *Manual on Uniform Traffic Control Devices* (MUTCD). Prior to disruption of any traffic, a traffic control plan shall be prepared and submitted to the City for approval. No work shall commence until all approved traffic control is in place.

4. All approvals and permits required by the City of Lacey shall be obtained by the contractor prior to the start of construction.

5. If construction is to take place in the County right-of-way, the contractor shall notify the County and obtain all the required approvals and permits.

6. If deemed necessary, a pre-construction meeting shall be held with the City of Lacey Construction Inspector prior to the start of construction.

7. The contractor shall be fully responsible for the location and protection of all existing utilities. The contractor shall verify all utility locations prior to construction by calling the Underground Locate line at 1-800-424-5555 a minimum of 48 hours prior to any excavation.

8. It shall be the responsibility of the contractor to have a copy of an approved set of the landscaping plans signed by the Director of Public Works on the construction site at all times.

9. Temporary erosion control/water pollution measures shall be required in accordance with section 1-07.15 of the *WSDOT/APWA Standard Specifications for Road, Bridge and Municipal Construction* and the *Drainage Design and Erosion Control Manual for Lacey*. At no time will silts and debris be allowed to drain into an existing or newly installed facility unless special provisions have been designed.

10. Electrical permits and inspections are required for all irrigation services within the City of Lacey. The contractor is responsible for obtaining permits prior to any type of actual construction. Prior to installation of any materials, the irrigation contractor shall submit for approval by the City, five copies of material catalog cuts,

specifications, shop drawings and/or wiring diagrams. Any materials purchased or labor performed prior to such approval shall be at the contractor's own risk.

11. A clearly marked service disconnect shall be provided for every automatic irrigation installation unless otherwise stated on a City approved set of plans. The location and installation of the disconnect shall conform to the National Electrical Code (NEC) and City of Lacey standards. The service disconnect shall be City approved.

12. All low voltage wire shall be a minimum size of #14 UF from each control valve to the terminal interface.

13. All low voltage splices shall be of a type equal to a Spears DS 400 or a City approved equal. All splices shall be done in valve control boxes. Direct burial splicing will not be allowed.

14. The automatic controller components shall be as specified in Chapter 6.210F of the Development Guidelines.

15. The City will be given 72 hours notice prior to scheduling a shutdown. Where connections require "field verification", connection points will be exposed by the contractor and the fittings verified 48 hours prior to distributing shut-down notices.

16. All materials specifications from Section G Material Specifications of this paragraph shall be shown on the plans.

17. A separate irrigation meter shall be provided for irrigation systems. Medians shall require a separate meter. The irrigation system shall be installed after the area has been properly prepared. See Chapter 4B.125 for soil preparation requirements. Pipe trenches shall be no wider than is necessary to lay the pipe or install equipment. The top 6 inches of topsoil shall be kept separate from the subsoil and shall be replaced as the top layer when backfill is made.

18. The median system shall be a completely separate system with its own separate appurtenances for City owned medians.

19. All irrigation lines to be installed under existing pavement or areas to be paved shall be installed within a casing. The casing shall be a minimum 4 inch diameter or twice the diameter of the encased pipe. The casing shall be steel casing (minimum schedule 40) or C900 Class 200 PVC pipe. The irrigation casing shall extend a minimum of 1 foot beyond the structure under which casing is being jacked or bored.

20. Upon final acceptance of the work, the contractor shall submit two as-builts per Chapter 3.065.

21. Privately owned sprinkler heads built along slopes in excess of 2 percent shall contain check valves.

A. Layout of Irrigation System

The contractor shall stake all irrigation heads and mark all proposed trenches within the irrigation system per the approved plans prior to installing the system. Alterations in layout may be expected, i.e., to conform to ground conditions and to obtain full and adequate coverage to the landscaping. However, no alterations shall be made without prior authorization by the City.

B. Excavation

All soil shall be prepared as specified in 4B.125 prior to trenching. Trenches shall be no wider at any point than is necessary to lay pipe or install equipment. Trench bottoms shall be of relatively smooth sand 4 inches below and 6 inches above the pipe.

Detectable marking tape shall be placed in the trench 6 inches directly above, parallel to, and along the entire length of all nonmetallic water line and nonmetallic conduit. The width and depth of the tape shall be as recommended by the manufacturer or the City.

C. Piping

The irrigation main line is the line containing the supply usually situated between the irrigation meter and the irrigation control valves. The irrigation lateral lines are the lines between the irrigation control valves and the connections to the irrigation heads. Swing joints, thick walled poly pipe, flexible risers, rigid pipe risers, and associated fittings are not considered part of the lateral line but incidental components of the irrigation heads.

All water lines shall be a minimum of 18 inches below finished grade as measured from the top of the pipe. Where possible, mains and laterals or section piping shall be placed in the same trench.

All irrigation lines to be installed under existing pavement or areas to be paved, shall be installed within a minimum 4 inch diameter or twice the diameter of the encased pipe. The casing shall be steel casing (minimum schedule 40) or C900 Class 200 PVC pipe. The irrigation casing shall extend a minimum of 1 foot beyond the structure under which casing is being jacked or bored.

D. Valve boxes

Valve boxes shall be installed flush to grade outside of play and high vehicular and pedestrian traffic areas.

Valve boxes shall have filter fabric underlayment installed at the bottom to prevent rodent intrusion and sediment builds up.

Valve boxes shall be supported with bricks or concrete blocks as approved by the City to prevent settlement.

E. Pipe Connections

During construction, pipe ends shall be plugged or capped to prevent entry of dirt, rocks, or other debris.

PVC pipe, couplings and fittings shall be handled and installed with care and in accordance with the manufacturer's recommendation. For gasketed connections, the outside of the PVC pipe shall be chamfered to a minimum of 1/16 inch at approximately 22 degrees. For all other connections, pipe and fittings shall be joined by solvent welding. Solvents used must penetrate the surface of both pipe and fittings which will result in complete fusion at the joint. The solvent and cement shall be of a type recommended by the pipe manufacturer.

Threaded PVC joints shall be assembled using Teflon tape as recommended by the pipe manufacturer.

On plastic to metal connections, work the metal connection first. Use a non-hardening compound on threaded connections. Connections between metal and plastic are to be threaded utilizing female threaded PVC adapters with a threaded schedule 80 PVC nipple only.

F. Electrical Wire Installation

The electrical controller shall be located in an open space or in a utility easement whenever possible.

All control wires shall be labeled at the controller, splice boxes and at the valves in the field.

Wiring between the automatic controller and the automatic valves shall be direct burial, #14 and may share a common neutral. A minimum of two spare # 14 UF yellow wires shall be installed from the controller to the furthest valve in each direction, looping through each control valve box. There shall be a 2 foot loop left in each control valve box. Separate control conductors shall be run from the automatic controller to each valve. When more than one automatic controller is required, a separate common neutral shall be provided for each controller and the automatic valve which it controls. Wire shall be installed adjacent to or beneath the irrigation pipe. Plastic tape or nylon ty-wraps shall be used to bundle wires together at 10 foot intervals, and the wire shall be "snaked" from side to side in the trench. When necessary to run wire separate from the irrigation pipe, the wire shall be bundled and placed under detectable marking tape. When lateral pipe lines have less than 18 inches of cover, direct burial wire shall be installed below the pipe at a minimum depth of 18 inches from finished grade.

Wiring placed under pavement and walls or through walls, shall be placed in irrigation casing. See 6.210 Section C.

Splices will be permitted only at junction boxes, valve boxes, or at control equipment. A minimum of 2 feet of excess conductor wire shall be left at all splices and terminal and control valves to facilitate inspection and future splicing.

G. Material Specifications

As a means of keeping the City's parts inventory to a minimum and maintenance personnel familiarized and knowledgeable about product operation, the following is a list of approved products to be used on all jobs in which the City will be responsible for maintenance and operations. Requests for approved equals need to be submitted to the City of Lacey Public Works Department, Development Review section.

Description	Approved Device
Pop Up Spray Heads	Rainbird 1800 PRS SAM • minimum of 4" pop up • installed on Toro Funny Pipe
Gear Driven Rotary Heads	Hunter I-20 and I-40 Series • installed on prefabricated O-Ring PVC Swing Joints • check valves on all heads
Remote Control Valve and Master Valve	Weathermatic 21000DW series installed with isolation ball valve and double union. A master valve shall be installed directly after the DCVA.
Quick Coupling Valves	West Ag 4V100-R-Y or Rainbird 44RC • installed at point of connection and at the furthest valve at the far end of the main line • installed on prefabricated O-Ring PVC Swing Joints
Double Check Backflow Preventer	Febco 850U or approved DOH equal with schedule 80 PVC unions.

Flow Sensing Device	Data Industrial IR series • installed with master control valve • wiring between flow sensor and irrigation controller shall be a twisted pair direct burial 2-conductor shielded 18 AWG or larger stranded copper wire with appropriate ratings for distance of run. Wire shall be a single run with no splices. • master control valve shall be the same valve as the remote control valve
Automatic Controller (for City owned and maintained systems)	Toro Sentinel with stainless steel cabinet and full surge protection • shall be grounded conforming to NEC specifications
Valve Boxes	• Carson 910-12B for Quick Coupler • Carson 1419B for remote control valve • Other boxes shall be sized accordingly
Shut-Off Valves	Wilkins 215 ball valve or approved equal

H. Flushing

All main supply lines shall receive two fully open flushings to remove debris that may have entered the line during construction. The first flushing shall be completed prior to installing valves or testing.

All lateral lines shall receive one full-open flushing prior to placement of sprinkler heads, emitters, and drain valves. Note, drain valves on main lines are not recommended. Quick couplers shall be installed on the down stream side at the cross connection device and at each terminus of the main line from the cross connection device. The flushing shall be of sufficient duration to remove any dirt and debris that have entered the lateral lines during construction.

I. Testing

All gauges used for testing water pressure shall be certified correct by an independent testing laboratory immediately prior to use on the project. Gauges shall be retested when ordered by the inspector.

Automatic controllers shall be tested by actual operation for a period of two weeks under normal operating conditions. Should adjustments be required, the Contractor shall do so according to the manufacturer's recommendation or under the City's direction until the operation is satisfactory to the City.

All main lines shall be purged of air and tested with a minimum static water pressure of 150 psi for 60 minutes without introduction of additional service or pumping pressure. Testing shall be done with one pressure gauge installed on the line in a location determined by the City inspector. Lines which show loss of pressure exceeding 5 psi after 60 minutes will be rejected.

All lateral lines shall be purged of air and tested in place at operating line pressure with a pressure gauge and with all fittings capped or plugged. The operating line pressure shall be maintained for 30 minutes with valves closed and without introduction of additional pressure. Lines which show leaks or loss of pressure exceeding 5 psi at the end of specified test period will be rejected.

The contractor shall correct rejected installations and retest for leaks as specified herein.

J. Backfill

Backfill shall not be started until all piping has been inspected, tested and approved by the City inspector, after which, backfilling shall be completed as soon as possible. All backfill material placed within 6 inches of the pipe shall be free of rocks, roots, or other objectionable material which might cut or otherwise damage the pipe.

Backfill from the bottom of the trench to approximately 6 inches above the pipe shall be by continuous compacting in a manner that will not damage pipe or wiring and shall proceed evenly on both sides of the pipe. The remainder of the backfill shall be thoroughly compacted, except that heavy equipment shall not be used within 18 inches of any pipe. The top 6 inches of the backfill shall be of topsoil material.

K. Adjusting System

Before final inspection, the contractor shall adjust and balance all sprinklers to provide adequate and uniform coverage. Spray patterns shall be balanced by adjusting individual sprinkler heads with the adjustment screws or replacing nozzles to produce a uniform pattern.

L. System Operation

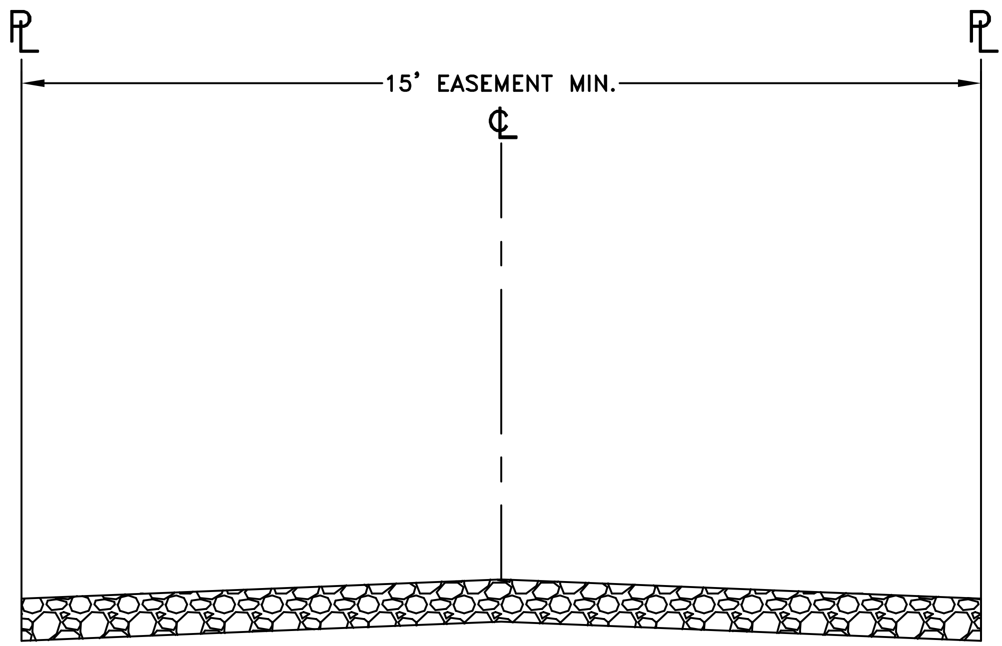
The irrigation system shall be completely installed, tested and operable prior to planting unless otherwise specified in the plans or as approved by the City. The contractor shall be responsible for all maintenance, repair, and testing, inspecting and automatic operation of the system until all work is considered complete as determined by the final inspection.

M. As-Built Plans

Upon final acceptance of the work, the contractor shall submit two as-builts per Chapter 3.065.

LIST OF DRAWINGS

CHAPTER 6 WATER



GENERAL NOTES:

1. ACCESS ROADS SHALL BE INSTALLED THE FULL WIDTH OF THE EASEMENT. ADDITIONAL EASEMENT MAYBE REQUIRED FOR TURNING RADIUS, DRAINAGE REQUIREMENTS OR AS DEEMED NECESSARY BY THE CITY.
2. A "NO PARKING" SIGN SHALL BE MANUFACTURED AND INSTALLED BY THE CITY AT THE OWNERS EXPENSE. THE SIGN SHALL BE INCLUDED WITH THE SIGN REQUEST.
3. ACCESS TO THE EASEMENT SHALL BE MADE WITH A DRIVEWAY CUT.
4. ACCESS ROAD CROSS SLOPES SHALL BE DESIGNED BY THE ENGINEER AND APPROVED BY THE CITY.
5. THE ACCESS ROAD SHALL HAVE A GATE INSTALLED TO LIMIT ENTRANCE TO THE SITE. A PARKING AREA IN FRONT OF THE GATE SHALL BE PROVIDED FOR CITY VEHICLES.
6. THE ACCESS ROAD STRUCTURE REQUIREMENTS SHALL BE PER DETAIL 4-6.1.
7. PAVING OF THE ACCESS ROAD SHALL BE AS DIRECTED BY THE CITY.
8. AN ACCESS ROAD SHALL BE INSTALLED IN AN EASEMENT WHENEVER VALVES, BLOW-OFFS, FUTURE MAIN EXTENSIONS, ETC. ARE PROPOSED IN THAT EASEMENT.

CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

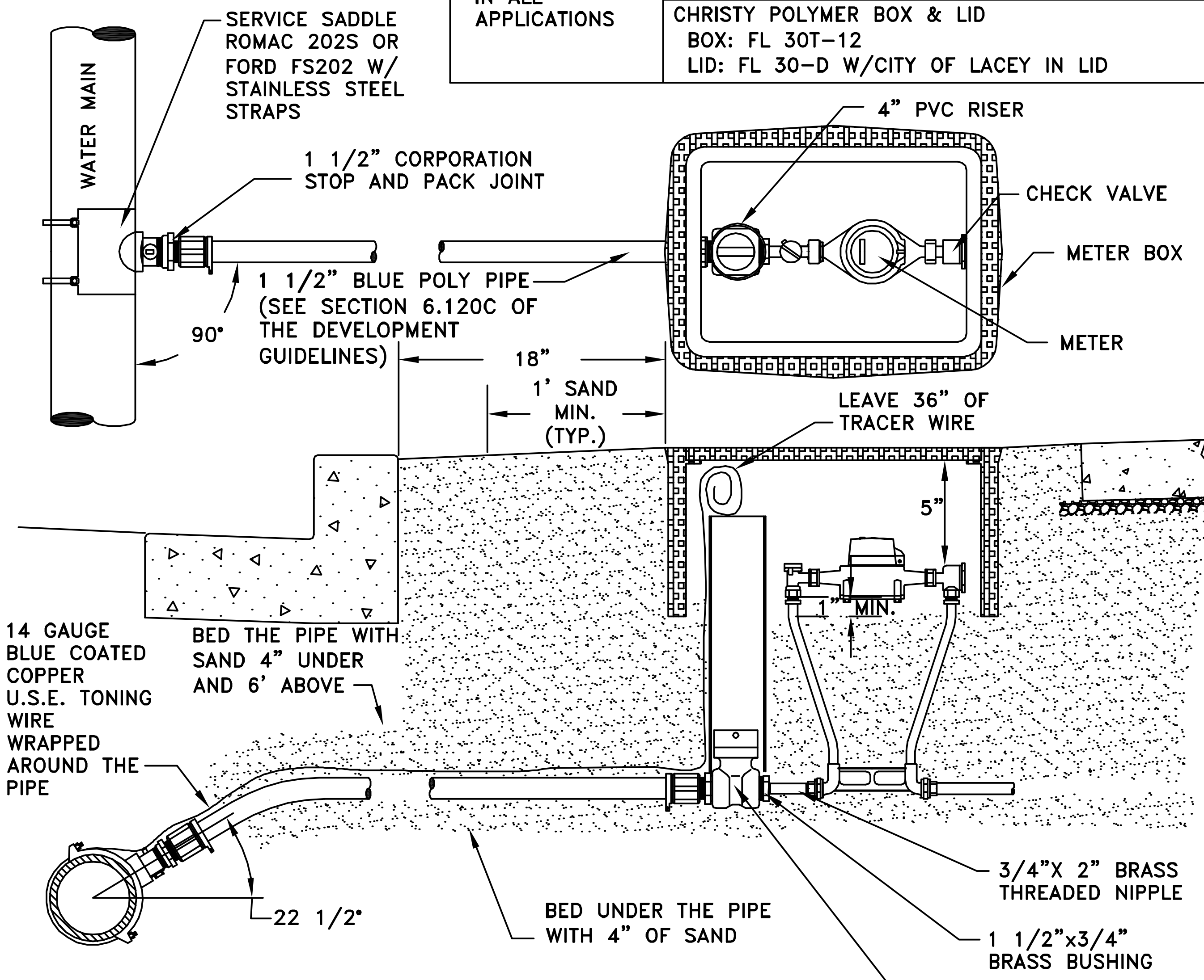
ACCESS ROAD

APPROVED			DWG. NO.
Ross A Schoessel CITY ENGINEER			6-0
DES WHO	DWN WHO	CKD RAS	DATE 8/27/09

DG6-0.DWG

THE WATER MAIN IS LOCATED 6' FROM THE CENTERLINE OF ROAD ON THE NORTH OR EAST SIDES.

ENVIRONMENT	METER BOX
TO BE USED IN ALL APPLICATIONS	MIDSTATES/CARSON BOX & LID BOX: BCF 1324 12B LID: BRCHFL30DSW W/ CITY OF LACEY IN LID
	CHRISTY POLYMER BOX & LID BOX: FL 30T-12 LID: FL 30-D W/CITY OF LACEY IN LID



GENERAL NOTES:

1. METER BOXES SHALL NOT BE INSTALLED IN CONCRETE OR CONCRETE DRIVEWAYS. WHEN NECESSARY CREATE PLANTERS FOR METER BOX INSTALLATION.
2. STAINLESS STEEL INSERTS ARE REQUIRED FOR ALL PACK JOINTS.
3. ALL SERVICE SADDLES SHALL HAVE RUBBER GASKETS AND I.P. THREADS.
4. ALL METER APPURTENANCES SHALL BE 1-1/2" IN DIAMETER AND BRASS.
5. THE ANGLE STOP DEPTH SHALL BE 1" ABOVE THE BOTTOM OF THE METER BOX.
6. FILL THE ENTIRE AREA AROUND THE METER BOX WITH 1' OF SAND.
7. METER SETTERS: FORD VBH 72-15W, AY-McDONALD 20-215WCDD-33 OR MUELLER B2404-R2EF15. BALL VALVE: FORD B-61-666G, AY-McDONALD M6102-33 OR MUELLER E25171.
8. CORP. STOP: FORD FB 11016G, AY-McDONALD M4704B-33, MUELLER E25029.
9. BRANCH PIECE: FORD U-88-43, AY-McDONALD 08UMM OR MUELLER H15364.

DG6-1.DWG

CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

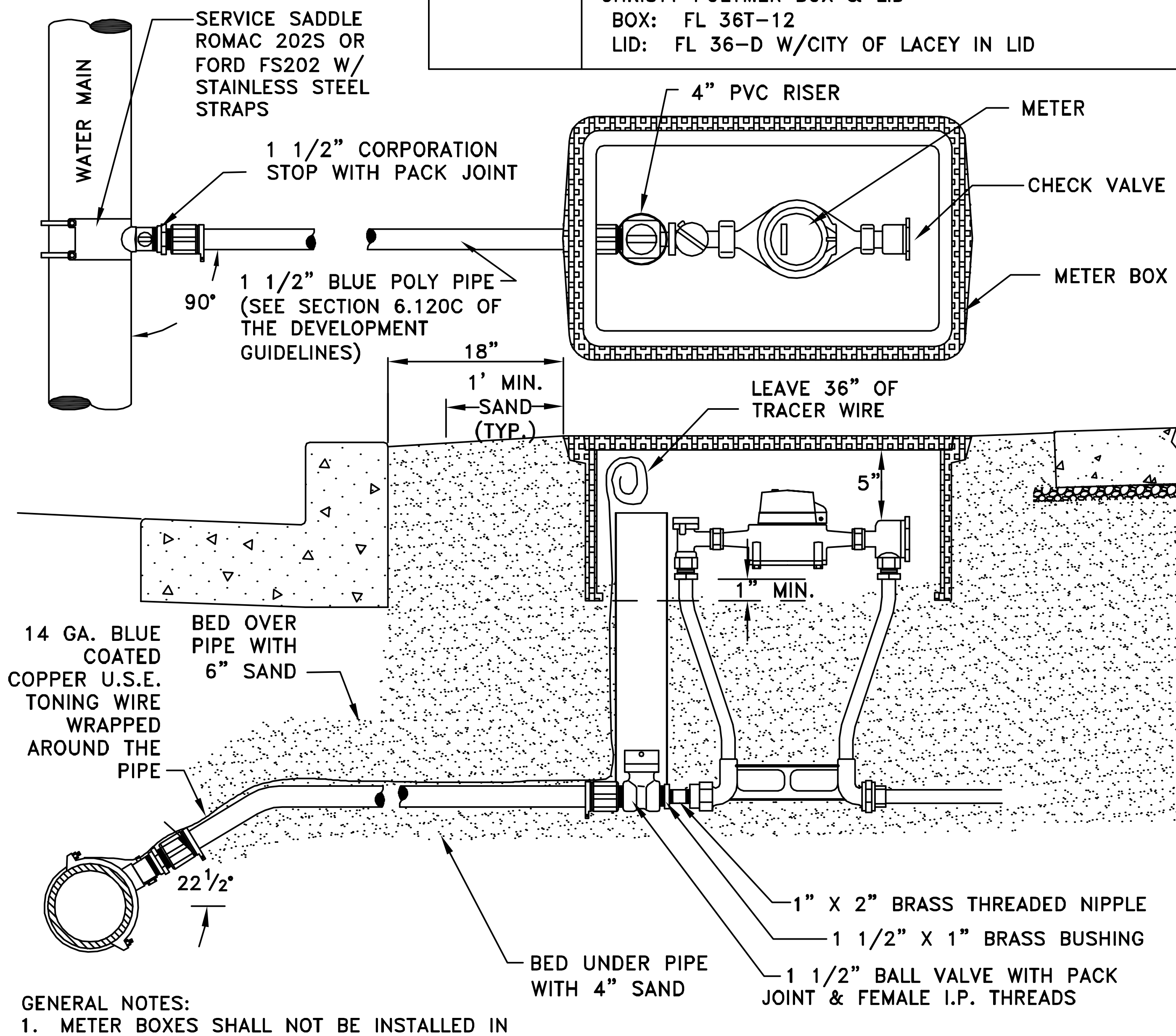
5/8" SINGLE METER SERVICE TYPE 1

APPROVED	DWG. NO.
Ron A Schoessel CITY ENGINEER	6-1

DES.	DWN.	CKD.	DATE
WHO	WHO	RAS	8/27/09

THE WATER MAIN IS LOCATED 6' FROM THE CENTERLINE OF ROAD ON THE NORTH OR EAST SIDES.

ENVIRONMENT	METER BOX
TO BE USED IN ALL APPLICATIONS	MIDSTATES/CARSON BOX & LID (NO READER WINDOW) BOX: BCF 1527 12B LID: BCPC1527SW W/CITY OF LACEY IN LID
	CHRISTY POLYMER BOX & LID BOX: FL 36T-12 LID: FL 36-D W/CITY OF LACEY IN LID



GENERAL NOTES:
1. METER BOXES SHALL NOT BE INSTALLED IN CONCRETE OR CONCRETE DRIVEWAYS. WHEN NECESSARY CREATE PLANTERS FOR THE METER BOX INSTALLATION.
2. STAINLESS STEEL INSERTS ARE REQUIRED FOR ALL PACK JOINTS.
3. ALL SERVICE SADDLES SHALL HAVE RUBBER GASKETS AND I.P. THREADS.
4. ALL METER APPURTENANCES SHALL BE 1 1/2" IN DIAMETER AND BRASS.
5. THE ANGLE STOP DEPTH SHALL BE 1" ABOVE THE BOTTOM OF THE METER BOX.
6. FILL THE ENTIRE AREA AROUND THE METER BOX WITH 1' (MIN.) OF SAND.
7. METER SETTERS: FORD VBH 72-15W, AY-McDONALD 20-415WCDD44 OR MUELLER B2404-R2AG15.
8. 1 1/2" BALL VALVE: FORD B61-666G, AY-McDONALD M6102-33 OR MUELLER E25171.
9. CORP. STOP: FORD FB-11016G, AY-McDONALD M4704B-33, MUELLER E25029.

DG61.1.DWG

CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

1" SINGLE METER SERVICE IN DRIVEWAYS TYPE 1

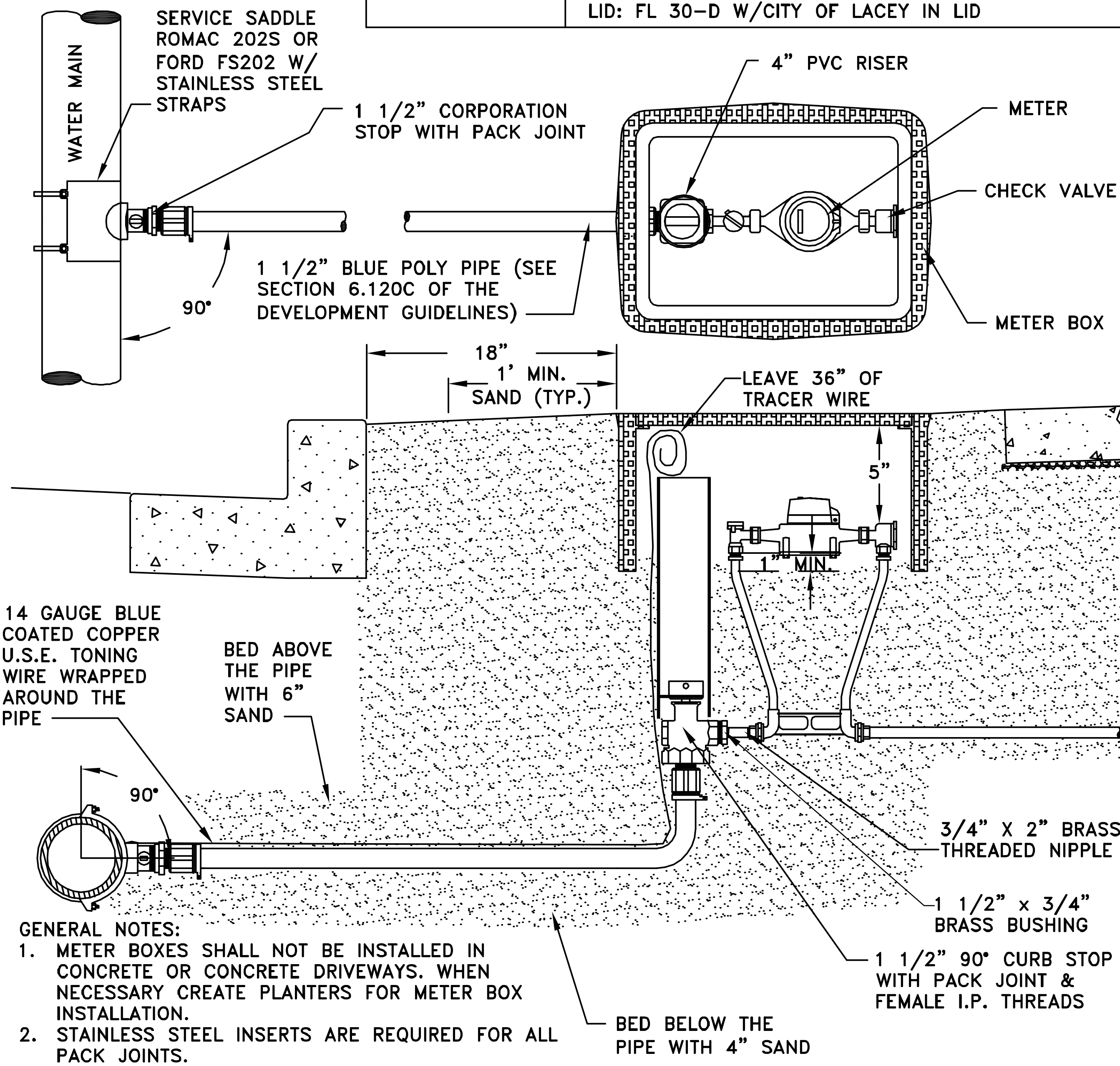
APPROVED
Ron A Schoessel
CITY ENGINEER

DWG. NO. 6-1.1

DES.	DWN.	CKD.	DATE
WHO	WHO	RAS	8/27/09

ENVIRONMENT	METER BOX
TO BE USED IN ALL APPLICATIONS	MIDSTATES/CARSON BOX & LID (NO READER WINDOW) BOX: BCF 1324 12B LID: BRCHFL30DSW W/CITY OF LACEY IN LID
	CHRISTY POLYMER BOX & LID BOX: FL 30T-12 LID: FL 30-D W/CITY OF LACEY IN LID

THE WATER MAIN IS LOCATED 6' FROM THE CENTERLINE OF ROAD ON THE NORTH OR EAST SIDES.



GENERAL NOTES:

1. METER BOXES SHALL NOT BE INSTALLED IN CONCRETE OR CONCRETE DRIVEWAYS. WHEN NECESSARY CREATE PLANTERS FOR METER BOX INSTALLATION.
2. STAINLESS STEEL INSERTS ARE REQUIRED FOR ALL PACK JOINTS.
3. ALL SERVICE SADDLES SHALL HAVE RUBBER GASKETS AND I.P. THREADS.
4. ALL METER APPURTENANCES SHALL BE 1-1/2" IN DIAMETER AND BRASS.
5. THE ANGLE STOP DEPTH SHALL BE 1" ABOVE THE BOTTOM OF THE METER BOX.
6. FILL THE ENTIRE AREA AROUND THE METER BOX WITH 1' (MIN.) OF SAND.
7. METER SETTERS: FORD VBH 72-15W, AY-McDONALD 20-215WCDD33 OR MUELLER B2404-R2EF15.
8. CURB STOP: FORD BA 61-444W.
9. CORP. STOP: FORD FB 1106G, AY-McDONALD M4704B-33, MUELLER E25029.
10. BRANCH PIECE: FORD U-88-43, AY-McDONALD 08UMM OR MUELLER H15364.

DG6-1.2.DWG

CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

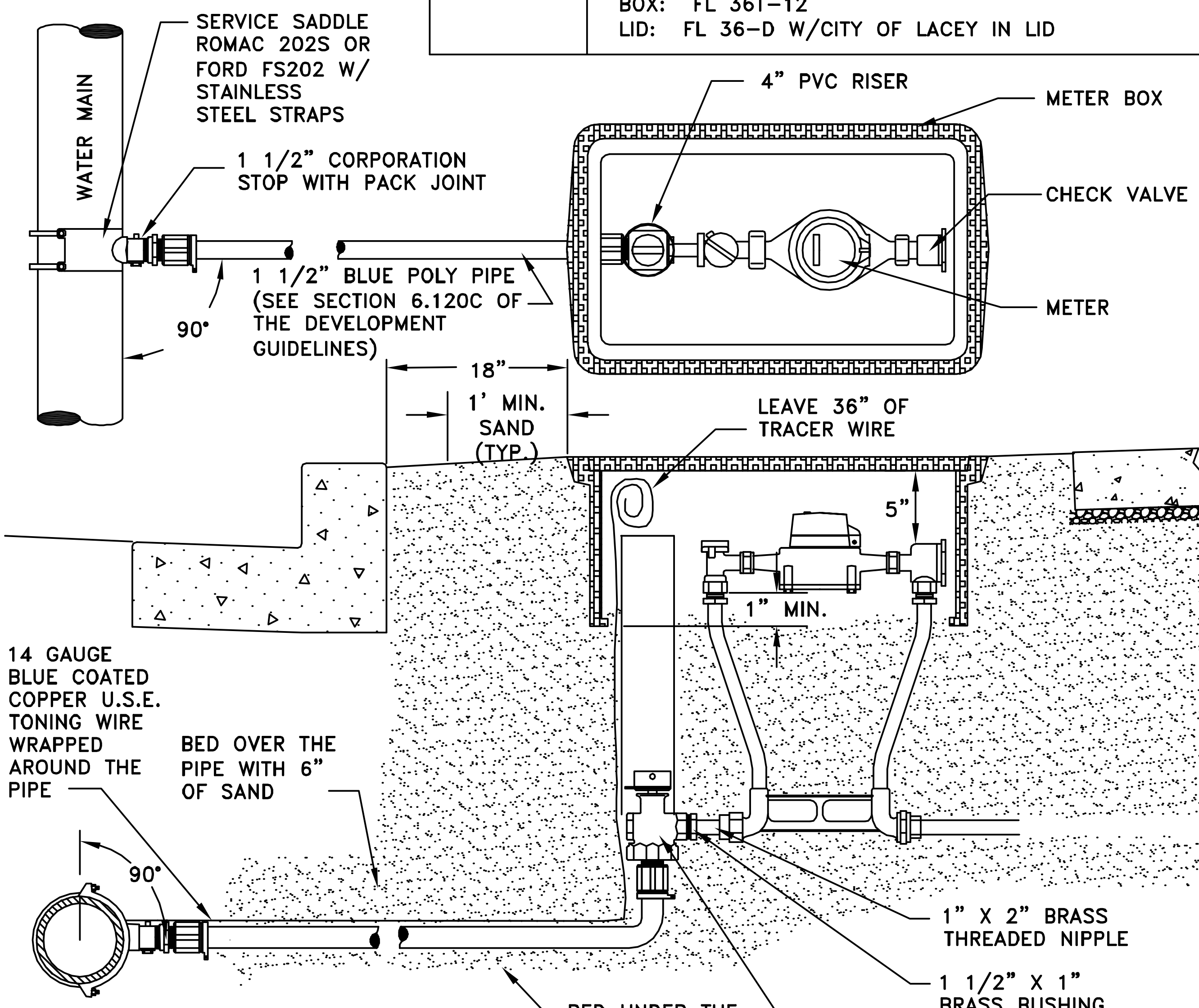
5/8" SINGLE METER SERVICE TYPE 2

APPROVED	DWG. NO.
Ron A Schoessel CITY ENGINEER	6-1.2

DES.	DWN.	CKD.	DATE
WHO	WHO	RAS	8/27/09

THE WATER MAIN IS LOCATED 6' FROM THE CENTERLINE OF ROAD ON THE NORTH OR EAST SIDES.

ENVIRONMENT	METER BOX
TO BE USED IN ALL APPLICATIONS	MIDSTATES/CARSON BOX & LID (NO READER WINDOW) BOX: BCF 1527 12B LID: BCPC1527SW W/CITY OF LACEY IN LID
	CHRISTY POLYMER BOX & LID BOX: FL 36T-12 LID: FL 36-D W/CITY OF LACEY IN LID



GENERAL NOTES:
1. METER BOXES SHALL NOT BE INSTALLED IN CONCRETE OR CONCRETE DRIVEWAYS. WHEN NECESSARY CREATE PLANTERS FOR METER BOX INSTALLATION.
2. STAINLESS STEEL INSERTS ARE REQUIRED FOR ALL PACK JOINTS.
3. ALL SERVICE SADDLES SHALL HAVE RUBBER GASKET AND I.P. THREADS.
4. THE ANGLE STOP DEPTH SHALL BE 1" ABOVE THE BOTTOM OF THE METER BOX.
5. FILL THE ENTIRE AREA AROUND THE METER BOX WITH 1' (MIN.) OF SAND.
6. METER SETTERS: FORD VBH 74-15W, AY-McDONALD 20-412WCDD44 OR MUELLER B2404-R2AG15.
7. CURB STOP: FORD BA 61-666G, AY-McDONALD M6102-33 OR MUELLER E25171.
8. CORP. STOP: FORD FB-11016G, AY-McDONALD M4704B-33, MUELLER E25029.

DG6-1.3.DWG

CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

1" SINGLE METER SERVICE TYPE 2

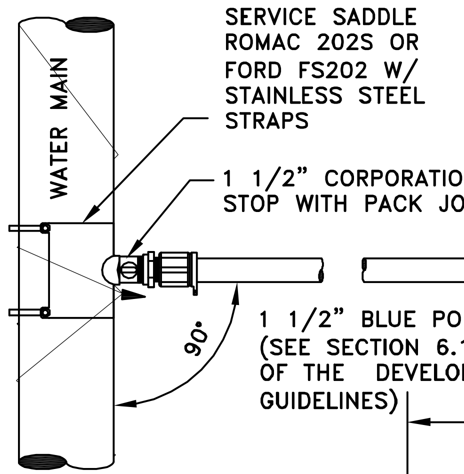
APPROVED
Roger A Schoessel
CITY ENGINEER

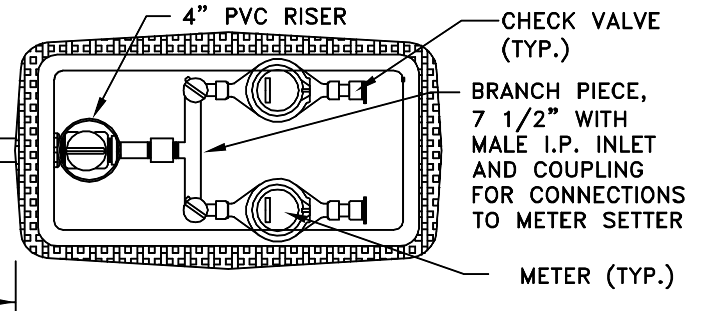
DWG. NO. 6-1.3

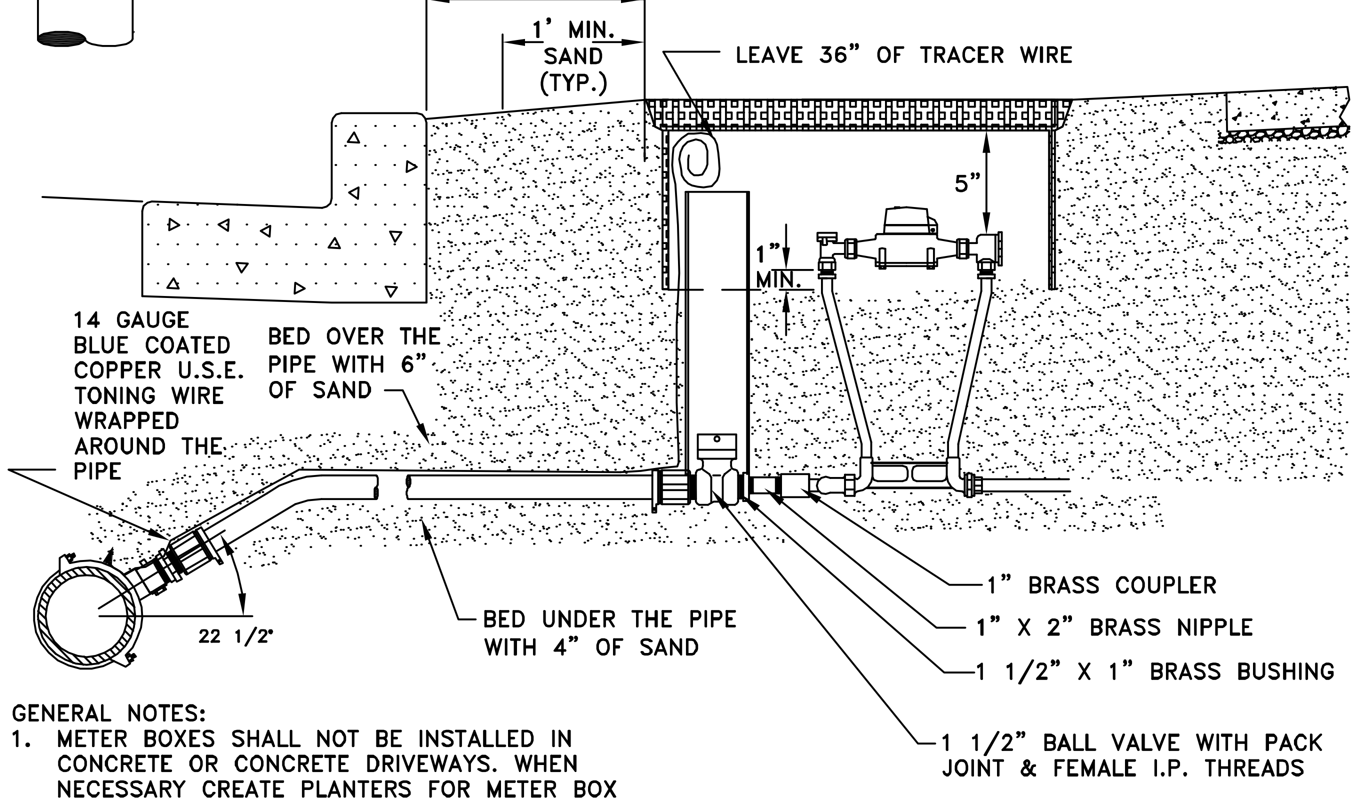
DES.	DWN.	CKD.	DATE
WHO	WHO	RAS	8/27/09

THE WATER MAIN IS LOCATED 6' FROM THE CENTERLINE OF THE ROAD ON THE NORTH OR EAST SIDES

ENVIRONMENT	METER BOX
TO BE USED IN ALL APPLICATIONS	MIDSTATES/CARSON BOX & LID (NO READER WINDOW) BOX: BCF 1527 12B LID: BCPC1527SW W/CITY OF LACEY IN LID
	CHRISTY POLYMER BOX & LID BOX: FL36T-12 LID: FL36-D W/CITY OF LACEY IN LID







GENERAL NOTES:

1. METER BOXES SHALL NOT BE INSTALLED IN CONCRETE OR CONCRETE DRIVEWAYS. WHEN NECESSARY CREATE PLANTERS FOR METER BOX INSTALLATION.
2. STAINLESS STEEL INSERTS ARE REQUIRED FOR ALL PACK JOINTS.
3. ALL SERVICE SADDLES SHALL HAVE RUBBER GASKETS AND I.P. THREADS.
4. ALL METER APPURTENANCES SHALL BE 1 1/2" DIAMETER AND BRASS.
5. THE ANGLE STOP DEPTH SHALL BE 1" ABOVE THE BOTTOM OF THE METER BOX.
6. FILL THE ENTIRE AREA AROUND THE METER BOX WITH 1' (MIN.) OF SAND.
7. METER SETTERS: FORD VBH 72-15W, AY-McDONALD 20-215WCDD44 OR MUELLER B2404-R2AG15.
8. BALL VALVE: FORD B61-666G, AYMCDONALD M6102-33 OR MUELLER E25171.
9. CORP. STOP: FORD FB11016G, AY-McDONALD M4704B-33 OR MUELLER E25029.
10. BRANCH PIECE: FORD U-88-43, AY-McDONALD 08UMM OR MUELLER H15364.

DG6-2.DWG

CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

5/8" DOUBLE METER SERVICE TYPE 1

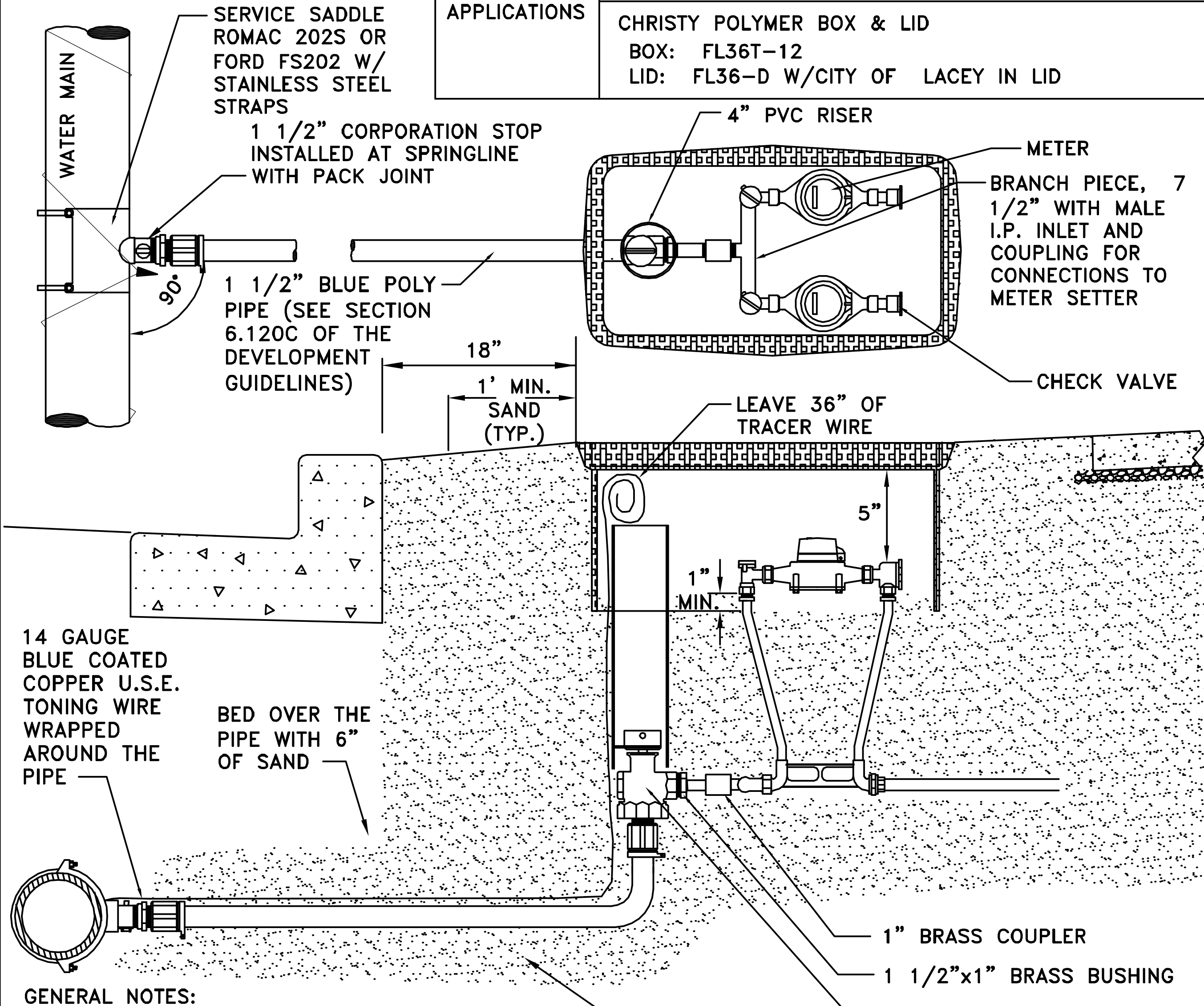
APPROVED
Ron A Schoessel
CITY ENGINEER

DWG. NO. 6-2

DES.	DWN.	CKD.	DATE
WHO	WHO	RAS	8/27/09

THE WATER MAIN IS LOCATED 6' FROM THE CENTERLINE OF THE ROAD ON THE NORTH OR EAST SIDE

ENVIRONMENT	METER BOX
TO BE USED IN ALL APPLICATIONS	MIDSTATES/CARSON BOX & LID (NO READER WINDOW) BOX: BCF 1527 12B LID: BCPC1527SW W/CITY OF LACEY IN LID
	CHRISTY POLYMER BOX & LID BOX: FL36T-12 LID: FL36-D W/CITY OF LACEY IN LID



GENERAL NOTES:

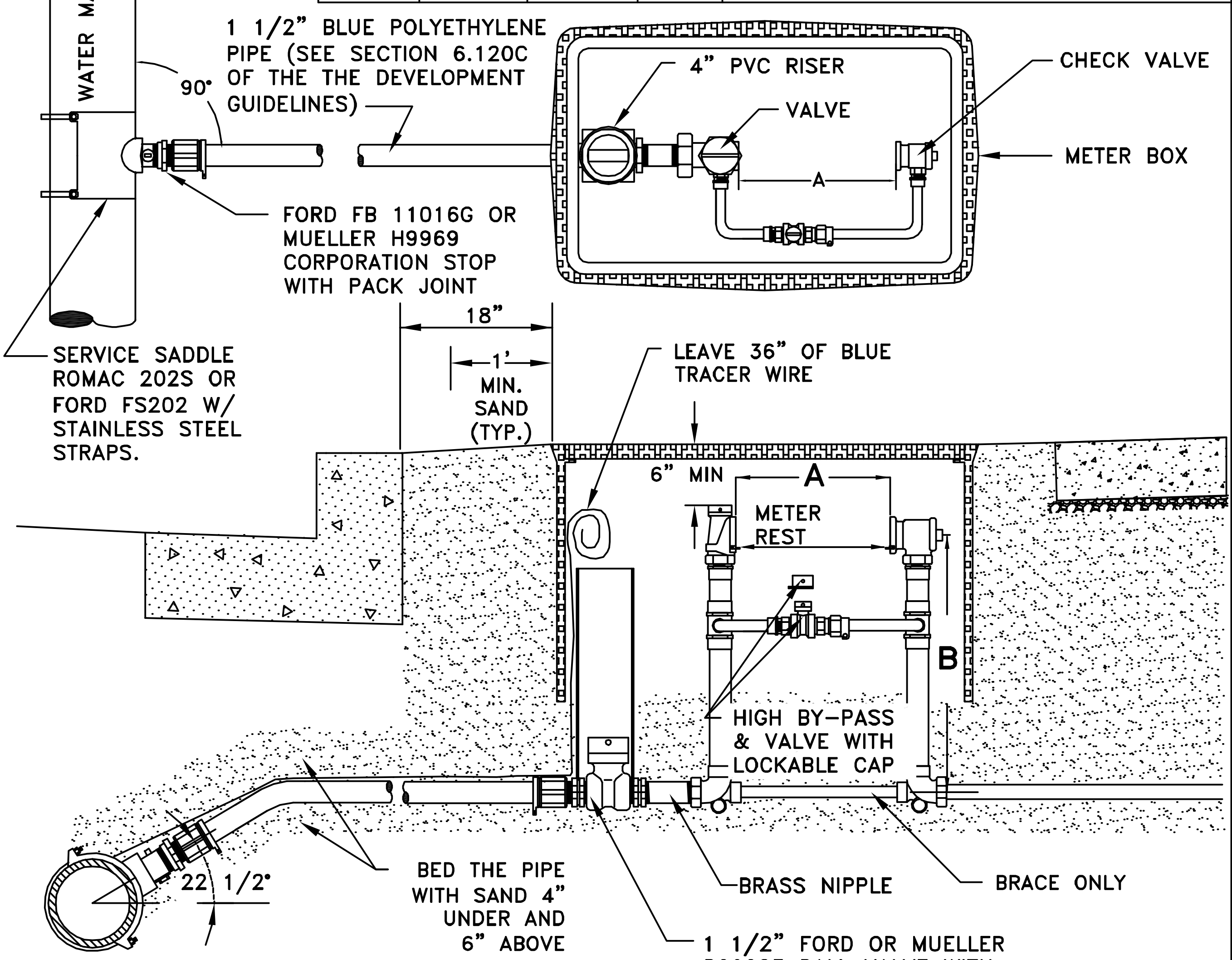
1. METER BOXES SHALL NOT BE INSTALLED IN CONCRETE OR CONCRETE DRIVEWAYS. WHEN NECESSARY CREATE PLANTERS FOR METER BOX INSTALLATION.
2. STAINLESS STEEL INSERTS ARE REQUIRED FOR ALL PACK JOINTS.
3. ALL SERVICE SADDLES SHALL HAVE RUBBER GASKETS AND I.P. THREADS.
4. ALL METER APPURTENANCES SHALL BE 1 1/2" IN DIAMETER AND BRASS.
5. THE ANGLE STOP DEPTH SHALL BE 1" ABOVE THE BOTTOM OF THE METER BOX.
6. FILL THE ENTIRE AREA AROUND THE METER BOX WITH 1' (MIN.) OF SAND.
7. METER SETTERS: FORD VBH 72-15W, AY-McDONALD 20-215WCDD33 OR MUELLER B2404-R2EF15.
8. CURB STOP: FORD BA 61-444W.
9. CORP. STOP: FORD FB11016G, AY-McDONALD M4704B-33 OR MUELLER E25029.
10. BRANCH PIECE: FORD U-88-43, AY-McDONALD 08UMM OR MUELLER H15364.

DG6-2.1.DWG

CITY OF LACEY, WASHINGTON DEPT. OF PUBLIC WORKS			
5/8" DOUBLE METER SERVICE TYPE 2			
APPROVED Ron A Schoessel CITY ENGINEER			DWG. NO. 6-2.1
DES. WHO	DWN. WHO	CKD. RAS	DATE 8/27/09

THE WATER MAIN IS LOCATED 6' FROM THE CENTERLINE OF THE ROAD ON THE NORTH OR EAST SIDES.

METER SIZE	LINE SIZE	A	B	METER BOX IN PLANTER ONLY
1 1/2"	1 1/2"	13 1/4"	15"	MIDSTATES/CARSON BOX & LID BOX: BCF 1730 18B LID: BRCHSL36DSW W/CITY OF LACEY IN LID
1 1/2"	1 1/2"	13 1/4"	15"	CHRISTY POLYMER BOX & LID BOX: FL 36T-18 LID: FL 36-D W/CITY OF LACEY IN LID



GENERAL NOTES:

1. METER BOXES SHALL NOT BE INSTALLED IN CONCRETE OR CONCRETE DRIVEWAYS. WHEN NECESSARY CREATE PLANTERS FOR METER BOX INSTALLATION.
2. STAINLESS STEEL INSERTS ARE REQUIRED FOR ALL PACK JOINTS.
3. ALL SERVICE SADDLES SHALL HAVE RUBBER GASKETS AND I.P. THREADS.
4. FILL THE ENTIRE AREA AROUND THE METER BOX WITH 1' OF SAND.
5. CHECK VALVES ARE REQUIRED ON ALL SETTERS.
6. THE CITY OF LACEY STANDARD FOR COPPER SETTER IS: 1 1/2" FORD VBH 76-15HB, MUELLER B2423-29900015-15 OR AY-McDONALD 20R615WDFF665 WITH HIGH BY-PASS.
7. THE BOTTOM OF THE BY-PASS SHALL BE 1" ABOVE THE BOTTOM OF THE METER BOX.

DG6-3.DWG

CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

1 1/2" METER SERVICE W/HIGH BYPASS

APPROVED

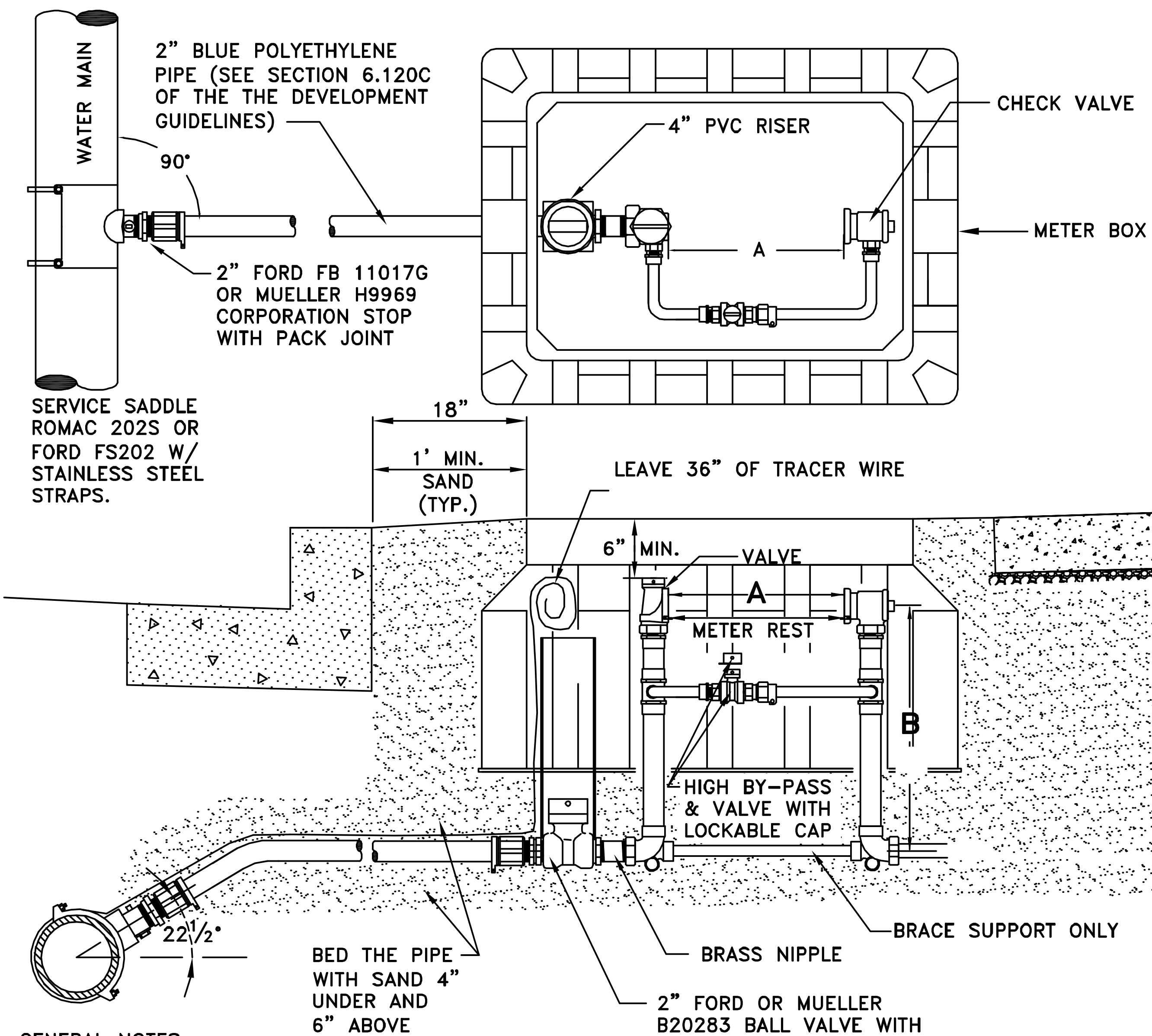
Ron A Schoessel

CITY ENGINEER

DWG. NO. 6-3

DES.	DWN.	CKD.	DATE
WHO	WHO	RAS	8/27/09

THE WATER MAIN IS LOCATED 6' FROM THE CENTERLINE OF THE ROAD ON THE NORTH OR EAST SIDES.	METER SIZE	LINE SIZE	A	B	METER BOX IN PLANTER ONLY
	2"	2"	17 1/4"	15"	CHRISTY POLYMER BOX & LID BOX: SYN2436T-18 LID: SYN2436T W/CITY OF LACEY IN LID



GENERAL NOTES:
1. METER BOXES SHALL NOT BE INSTALLED IN CONCRETE OR CONCRETE DRIVEWAYS. WHEN NECESSARY CREATE PLANTERS FOR METER BOX INSTALLATION.
2. STAINLESS STEEL INSERTS ARE REQUIRED FOR ALL PACK JOINTS.
3. FILL THE ENTIRE AREA AROUND THE METER BOX WITH 1' OF SAND.
4. ALL SERVICE SADDLES SHALL HAVE RUBBER GASKETS AND I.P. THREADS.
5. CHECK VALVE REQUIRED ON ALL SETTERS.
6. ALL COPPER SETTERS SHALL BE 2" AND SHALL BE FORD VBH 77-15HB, MUELLER B2423-29900015-2, AY-McDONALD 20R715WDFF775 ALL WITH HIGH BYPASS.
7. THE BOTTOM OF THE BY-PASS SHALL BE 1" ABOVE THE BOTTOM OF THE METER BOX.

DG6-3.1.DWG

CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

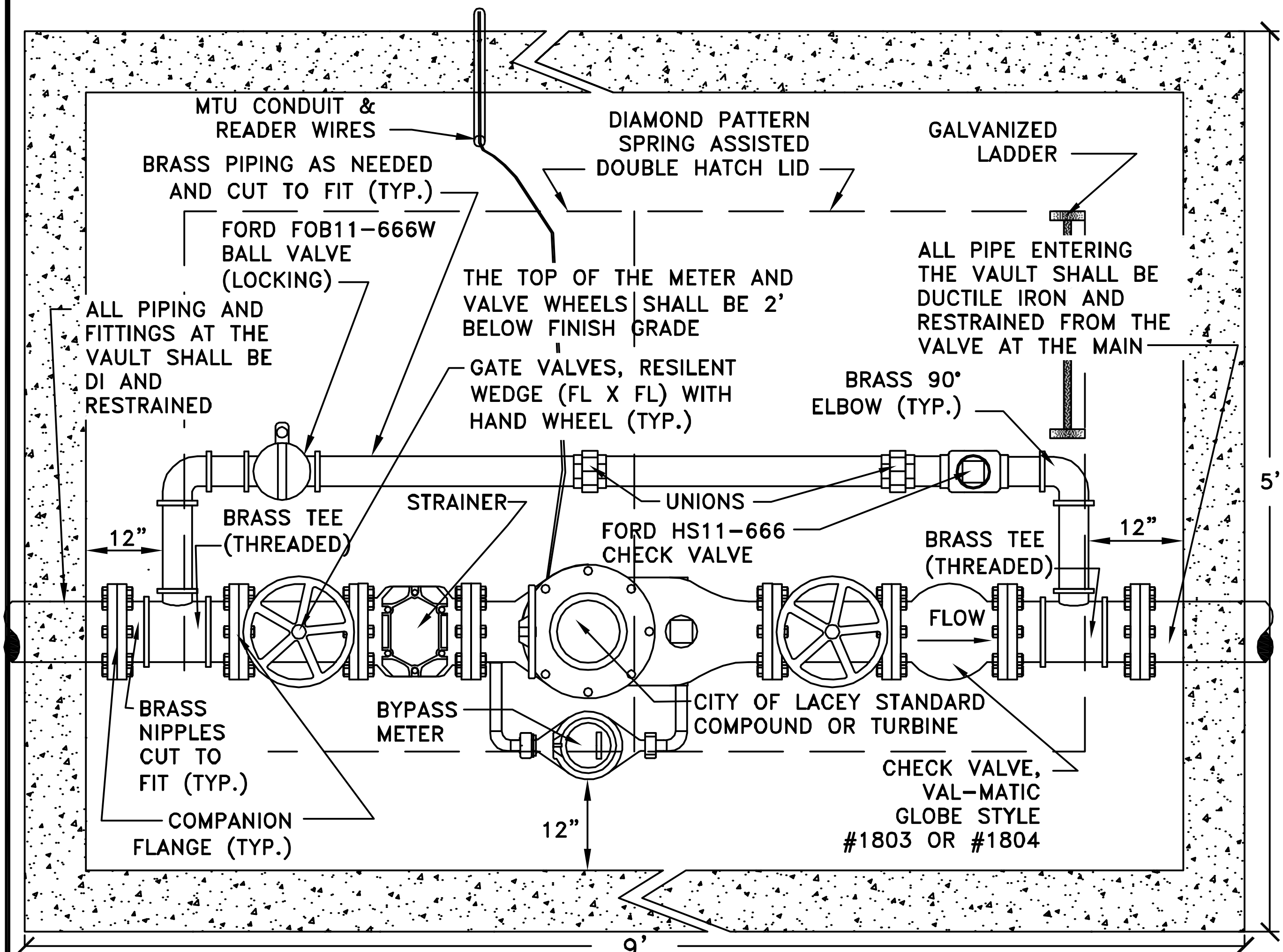
2" METER SERVICE W/HIGH BYPASS

APPROVED

CITY ENGINEER

DWG. NO. 6-3.1

DES.	DWN.	CKD.	DATE
WHO	WHO	RAS	8/27/09



PLAN VIEW

GENERAL NOTES:

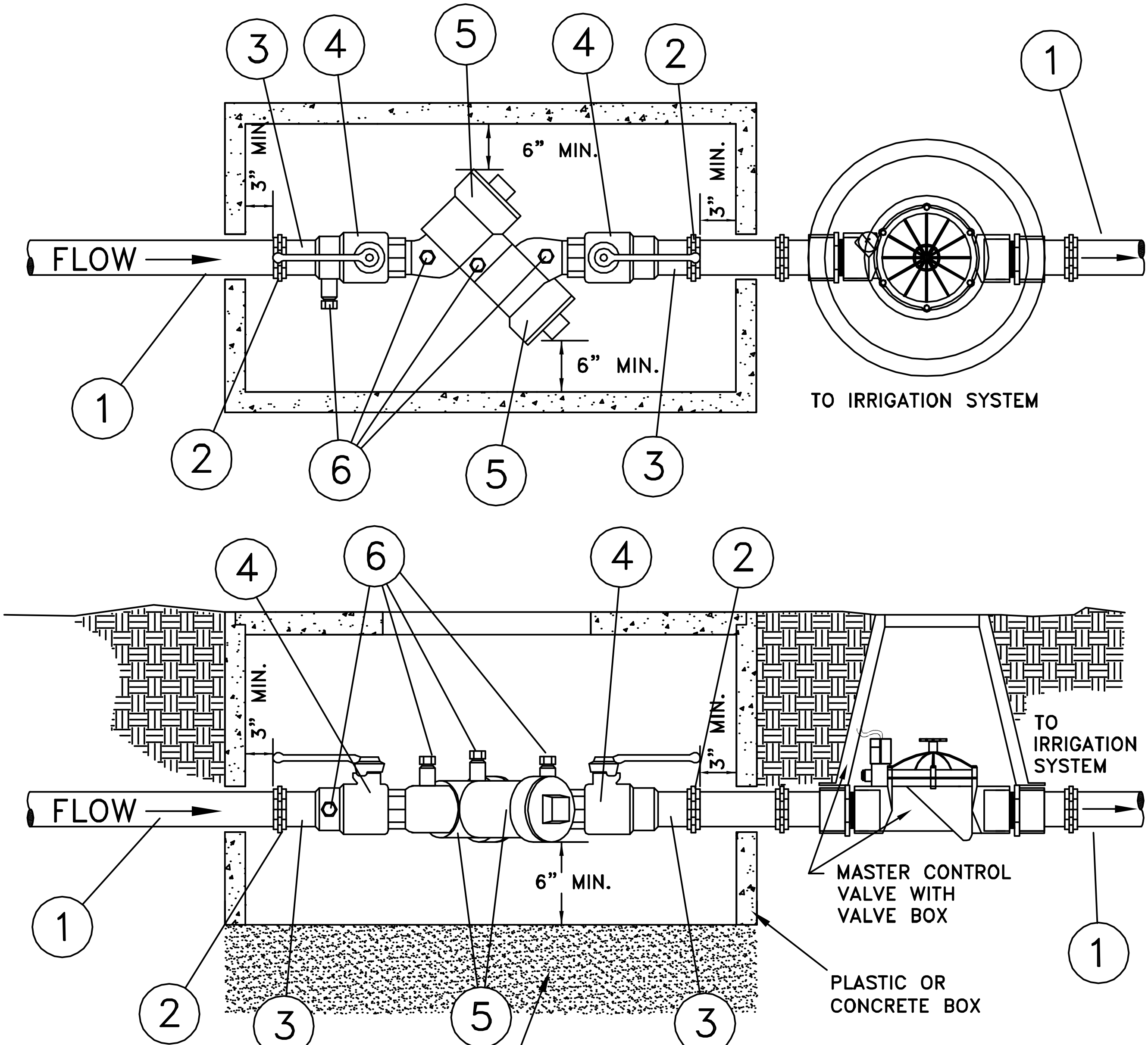
1. 3" METERS SHALL HAVE 3" PLUMBING AND 1 1/2" BYPASS PLUMBING.
2. 4" METERS SHALL HAVE 4" PLUMBING AND 2" BYPASS PLUMBING.
3. A MINIMUM OF 10 PIPE DIAMETERS OF STRAIGHT UNOBSTRUCTED PIPE SHALL BE REQUIRED UPSTREAM OF THE INSTALLED METER.
4. THE METER BOX PIT SHALL BE BEDDED WITH 6" OF CRUSHED ROCK.
5. USE CONCRETE UTILITY VAULT SIZED ACCORDINGLY WITH SPRING ASSISTED TRAFFIC RATED HINGED ACCESS (DOUBLE HATCH) AND READER LID. THE VAULT SHALL HAVE CONCRETE BOTTOM WITH A DRAIN HOLE. THE INSIDE DEPTH SHALL NOT EXCEED 4'.
6. BYPASS AND GLOBE STYLE CHECK VALVE IS NOT REQUIRED FOR IRRIGATION ONLY INSTALLATION.
7. ALL PLUMBING SHALL BE SUPPORTED BY ADJUSTABLE JACK STANDS. THESE STANDS SHALL BE PLACED IN FOUR LOCATIONS TO PROVIDE THE INSTALLATION WITH A FIRM SUPPORT.
8. THE MTU CABINET SHALL BE ALLIED MOLDED PRODUCTS #1056 W/READER WINDOW AND INSTALLED ON A 1 1/2"UNISTRUT IN CONCRETE 3' ABOVE THE FINISH GRADE AND WITHIN 10' OF THE VAULT.
9. A 1" ELECTRICAL CONDUIT SHALL EXTEND FROM THE REMOTE READER BOX TO 6" INSIDE THE VAULT.
10. THE VAULT SHALL BE INSTALLED IN A PLANTER OR IN A PLANTER ISLAND AND SHALL NOT BE ALLOWED IN ANY DRIVING SURFACE. WHEN PLANS ARE ALTERED A PLANTER ISLAND SHALL BE CREATED TO INSTALL THE VAULT IN.
11. METER LENGTH FOR A 3" COMPOUND METER IS 17" AND THE STRAINER LENGTH IS 6". THE 4" COMPOUND METER LENGTH IS 20" AND THE STRAINER LENGTH IS 7 1/2". THE 3" TURBINE METER LENGTH IS 12" AND THE STRAINER LENGTH IS 6" AND THE 4" TURBINE METER LENGTH IS 14" AND THE STRAINER LENGTH IS 7 1/2".

DG6-3.2.DWG

CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

STANDARD PLUMBING CONFIGURATION FOR 3" & 4" METERS

APPROVED			DWG. NO.
Ron A Schoessel — CITY ENGINEER		DATE	6-3.2
DES	DWN	CKD	DATE
WHO	WHO	RAS	8/27/09



12" THICK PEA GRAVEL OR
1 1/2" MINUS WASHED ROCK

MATERIAL LIST:
1. SERVICE LINE
2. UNION
3. NIPPLE
4. SHUT–OFF VALVE
5. CHECK VALVE (D.S.H.S. APPROVED)
6. TESTS COCKS

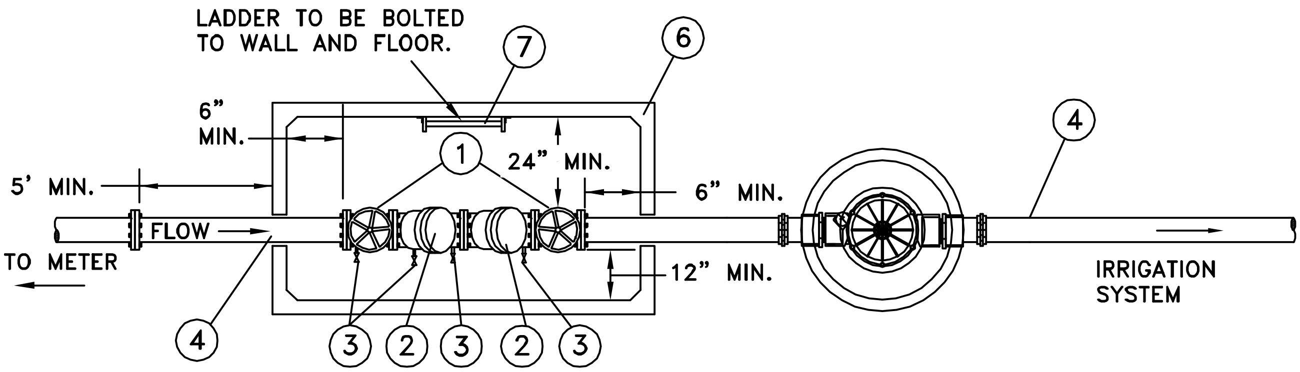
GENERAL NOTES:
1. THOROUGHLY FLUSH THE LINES PRIOR TO INSTALLING DCVA.
2. DIAMETER OF PIPE AND FITTINGS =
3. REFER TO DEVELOPMENT GUIDELINES SECTION 6.110 FOR FURTHER INFORMATION.
4. IF THE IRRIGATION SYSTEM IS TAPPED OFF OF THE DOMESTIC SERVICE LINE, A LOCKABLE SERVICE VALVE MUST BE INSTALLED IN A PIT BOX 18" FROM THE DOWN STREAM SIDE OF THE DOUBLE CHECK VALVE ASSEMBLY. SEE DETAIL 6–4.6.
5. THE DEPTH OF THE VAULT SHALL NOT EXCEED 3.5'.
6. A MASTER CONTROL VALVE WITH UNIONS ON BOTH SIDES SHALL BE INSTALLED WITHIN 5' OF THE DCVA.

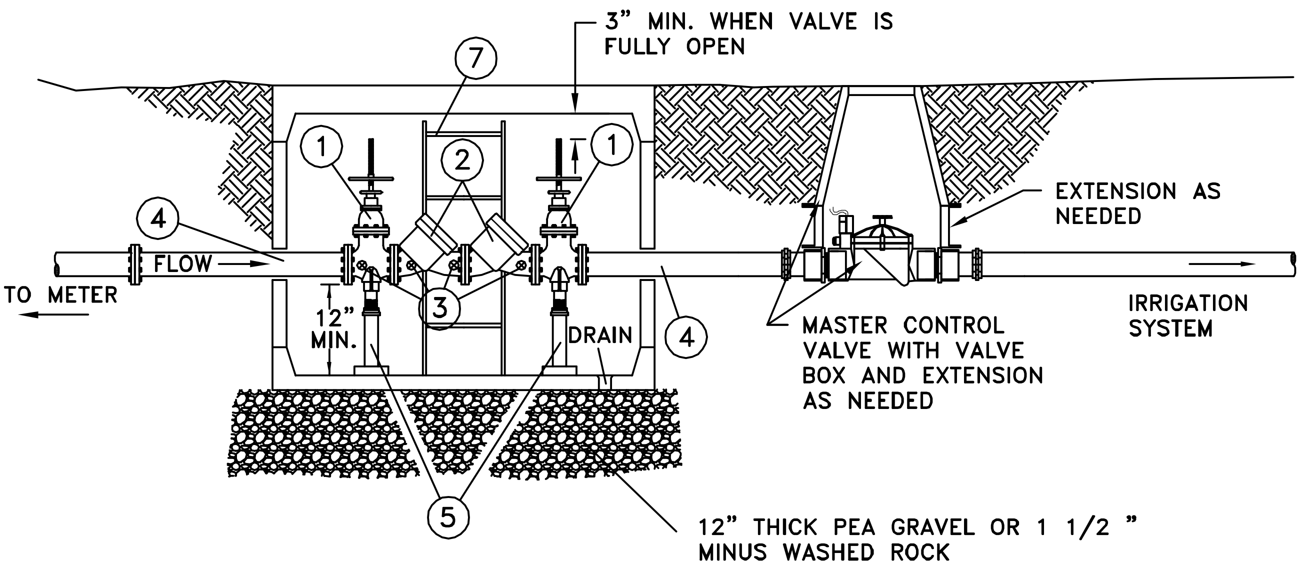
DG6–4.2.DWG

CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

DOUBLE CHECK VALVE ASSEMBLY FOR 2" OR SMALLER IRRIGATION

APPROVED			DWG. NO.
Ron A Schoessel (signature) CITY ENGINEER			6–4.2
DES. CM	DWN. WHO	CKD. RAS	DATE 8/27/09





GENERAL NOTES:

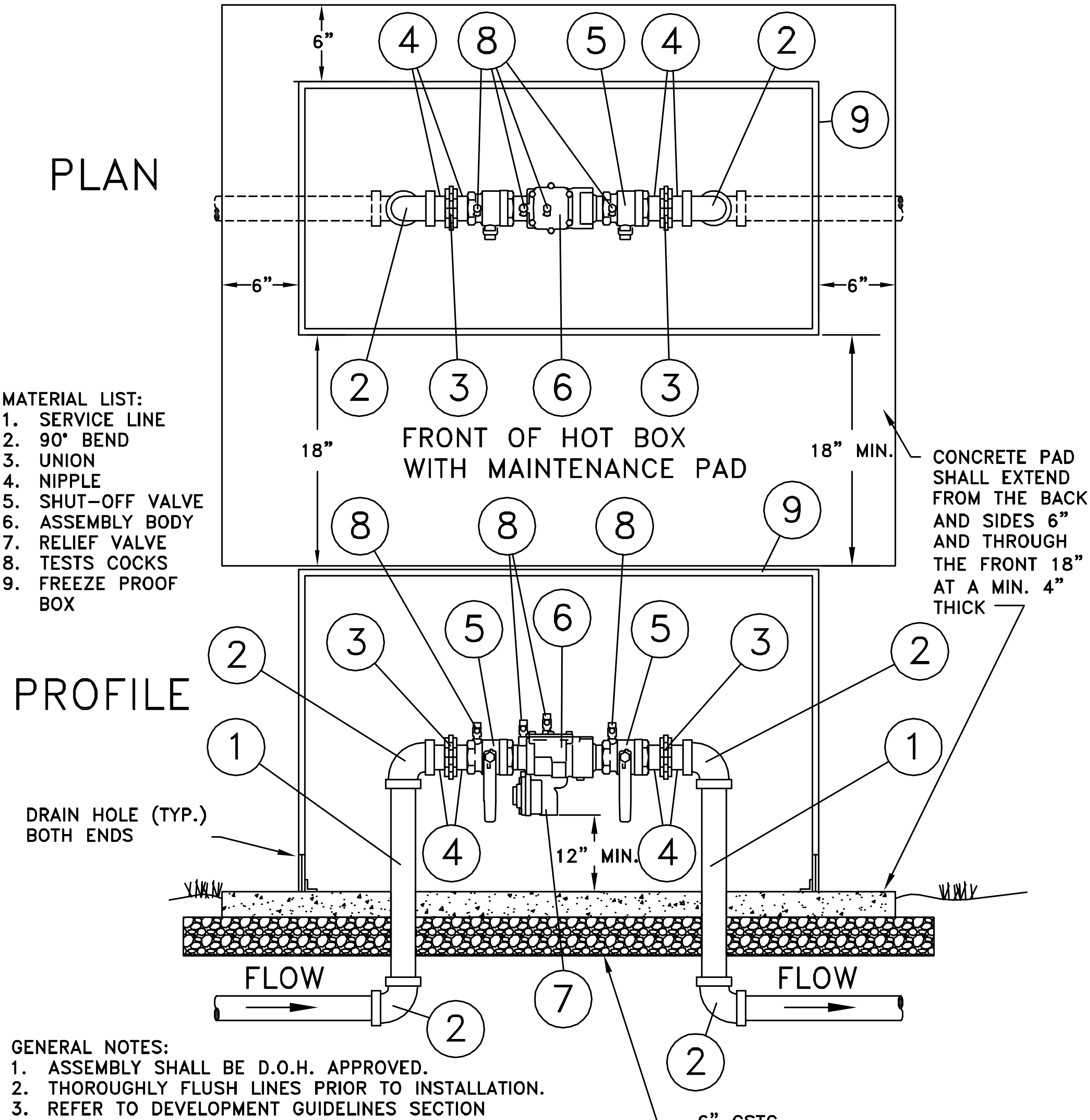
1. THOROUGHLY FLUSH THE LINES PRIOR TO INSTALLING BACK FLOW ASSEMBLY.
2. WHERE PIPING PASSES THROUGH CONCRETE WALL PROVIDE 2" CLEARANCE W/ WATERPROOF MASTIC OR FLEXIBLE SEALANT
3. DIAMETER OF PIPE AND FITTINGS =
4. REFER TO DEVELOPMENT GUIDELINES SECTION 6.110 FOR FURTHER INFORMATION.
5. ALL VAULTS MUST BE EQUIPPED WITH A DRAIN OR INSTALLED ABOVE GROUND.
6. ALL IRRIGATION LINES UP TO THE FIRST VALVE ON THE DCVA SHALL BE DISINFECTED, PRESSURE TESTED, FLUSHED AND TESTED FOR PURITY PER THE CITY OF LACEY STANDARDS.
7. A MASTER CONTROL VALVE WITH UNIONS ON BOTH SIDES SHALL BE INSTALLED WITHIN 5' OF THE DCVA.

MATERIAL LIST:

1. OS&Y GATE VALVE W/HANDWHEEL FL X FL
2. DSHS APPROVED CHECK VALVE FL X FL
3. TEST COCK – 4 REQUIRED
4. PVC C900 OR CLASS 52 DI WALL PIPE FL X FL
5. VALVE STANDS
6. VAULT FOR 3" OR 4" DCV ASSEMBLYS–USE PIPE INC. VAULT NO. 448402 W/L.W. HATCH NO. HDSA 3' X 3' DOUBLE DOOR OR APPROVED EQUAL.
7. LADDER

CITY OF LACEY, WASHINGTON DEPT. OF PUBLIC WORKS			
DOUBLE CHECK VALVE ASSEMBLY FOR 3" & UP IRRIGATION			
APPROVED Ron A Schoessel CITY ENGINEER			DWG. NO. 6–4.3
DES. WHO	DWN. WHO	CKD. RAS	DATE 8/27/09

DG6–4.3.DWG



MATERIAL LIST:
1. SERVICE LINE
2. 90° BEND
3. UNION
4. NIPPLE
5. SHUT-OFF VALVE
6. ASSEMBLY BODY
7. RELIEF VALVE
8. TESTS COCKS
9. FREEZE PROOF BOX

GENERAL NOTES:
1. ASSEMBLY SHALL BE D.O.H. APPROVED.
2. THOROUGHLY FLUSH LINES PRIOR TO INSTALLATION.
3. REFER TO DEVELOPMENT GUIDELINES SECTION 6.110 FOR FURTHER INFORMATION.
4. DO NOT INSTALL IN AREA SUBJECT TO FLOODING.
5. ALL RPBA SHALL BE INSTALLED IN A HOT BOX EQUIPPED WITH ELECTRICAL COMPONENTS (CONDUITS, WIRING, ETC.) AND POWER SUPPLIED BY THE OWNER TO PREVENT THE UNIT FROM FREEZING.
6. ALL PIPE AND FITTINGS SHALL BE BRASS.
7. DRAIN HOLE OPENINGS SHALL BE 1 1/2 TIMES THE DIAMENTER OF SUPPLY LINE.
8. THE PLACEMENT OF THE HOT BOX SHALL BE IN AN AREA FREE FROM OBSTACLES SUCH AS GATES, ETC. THAT MAY CAUSE DAMAGE TO IT.
9. THE HOT BOX SHALL BE NEUTRAL BEIGE.
10. ALL CITY OF LACEY COLLECTION SITES SHALL BE EQUIPPED WITH A FACTORY HEATED HOT BOX, AN 1 1/2" CONDUIT AND WIRED FROM THE CONTROL CABINET TO THE HOT BOX AND THERMOSTAT.

DG6-4.4.DWG

CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

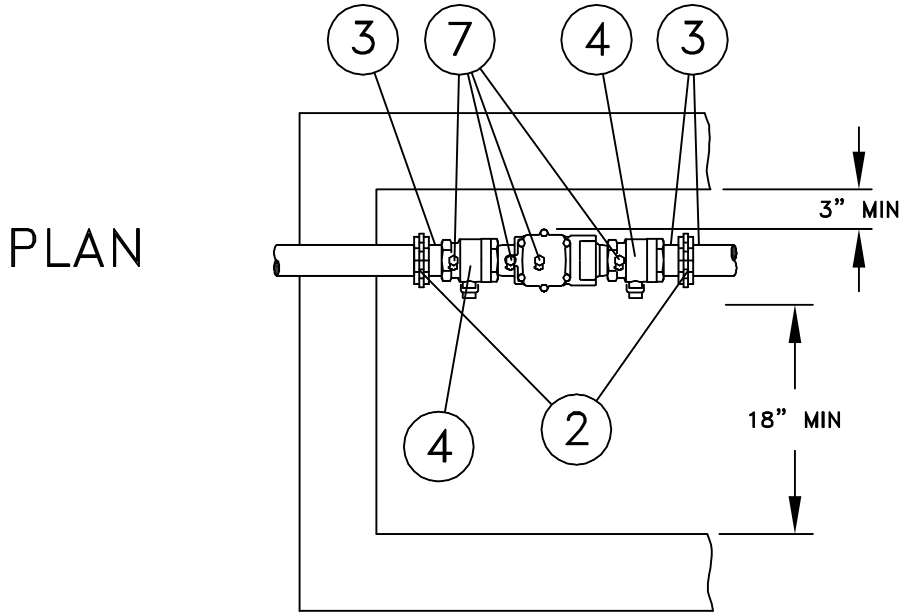
REDUCED PRESSURE BACKFLOW ASSEMBLY FOR 2" OR SMALLER (OUTDOOR APPLICATION)

APPROVED

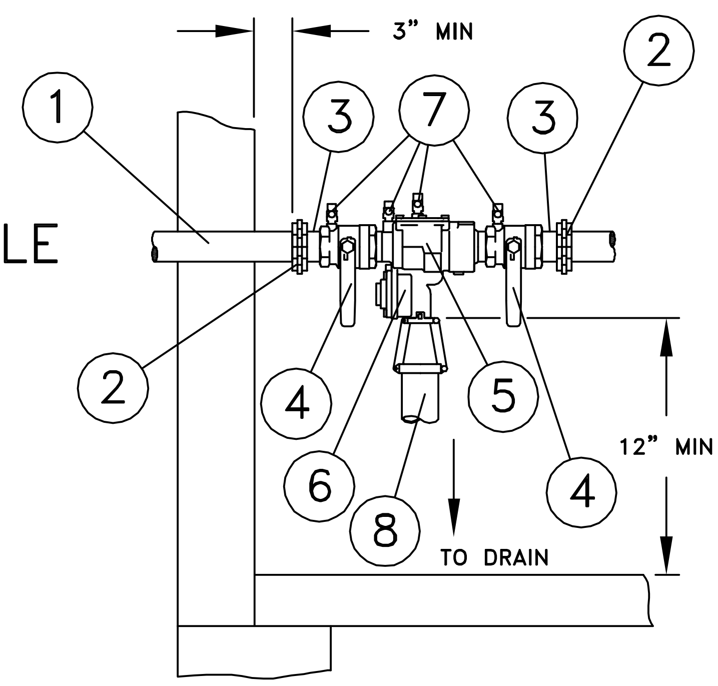
CITY ENGINEER

DWG. NO. 6-4.4

DES.	DWN.	CKD.	DATE
JC	WHO	RAS	8/27/09



PROFILE



MATERIAL LIST:

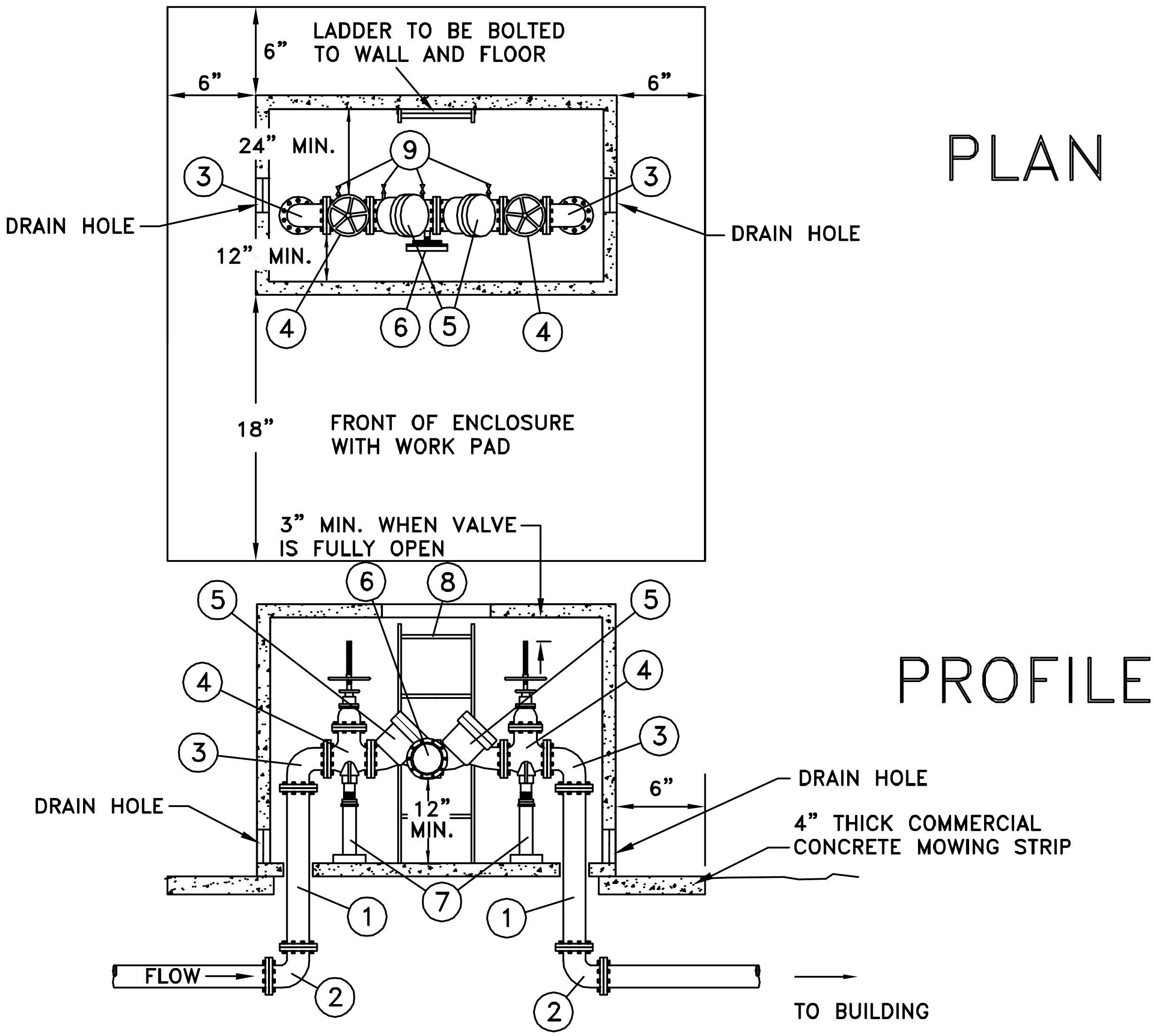
1. SERVICE LINE
2. UNION
3. NIPPLE
4. SHUT-OFF VALVE
5. ASSEMBLY BODY
6. RELIEF VALVE
7. TESTS COCKS
8. DRAIN LINE

GENERAL NOTES:

1. ASSEMBLY SHALL BE D.S.H.S. APPROVED.
2. THOROUGHLY FLUSH LINES PRIOR TO INSTALLATION.
3. REFER TO DEVELOPMENT GUIDELINES SECTION 6.110 FOR FURTHER INFORMATION.
4. DRAIN LINE SHALL BE 1.5 TIMES THE DIAMETER OF SERVICE LINE AND BE SCREENED AT THE OUTFALL.
5. All RPBA SHALL BE INSTALLED IN A HOT BOX EQUIPPED WITH ELECTRICAL COMPONENTS (CONDUIT, WIRING, ETC.) AND POWER SUPPLIED BY THE OWNER TO PREVENT THE UNIT FROM FREEZING.
6. ALL FITTINGS SHALL BE BRASS.

DG6-4.41.DWG

CITY OF LACEY, WASHINGTON DEPT. OF PUBLIC WORKS			
REDUCED PRESSURE BACKFLOW ASSEMBLY FOR 2" OR SMALLER (INDOOR APPLICATION)			
APPROVED Ron A Schoessel CITY ENGINEER			DWG. NO. 6-4.41
DES. JC	DWN. WHO	CKD. RAS	DATE 8/27/09



MATERIAL LIST:
1. PVC C900 OR CLASS 52 D.I. WALL PIPE FL X FL
2. 90° BEND FL X MEGALUG
3. 90° BEND FL X FL
4. OS&Y GATE VALVE W/HANDWHEEL FL X FL
5. D.S.H.S. APPROVED CHECK VALVE FL X FL
6. RELIEF VALVE FL
7. SUPPORT STANDS
8. LADDER
9. TEST COCKS – 4 REQUIRED

GENERAL NOTES:
1. WHERE PIPING PASSES THROUGH THE VAULT WALL, PROVIDE WATERPROOF MASTIC OR FLEXIBLE SEALANT.
2. DIAMETER OF PIPE AND FITTINGS TO BE DETERMINED BY A CERTIFIED SPRINKLER DESIGNER.
3. REFER TO DEVELOPMENT GUIDELINES SECTION 6.110 FOR FURTHER INFORMATION.
4. THOROUGHLY FLUSH LINES PRIOR TO INSTALLING BACKFLOW ASSEMBLY.
5. DRAIN HOLES SHALL BE 1.5 TIMES THE DIAMETER OF THE SERVICE LINE AND INCLUDE SCREENING.
6. DO NOT INSTALL IN AREAS SUBJECT TO FLOODING.
7. ALL IRRIGATION LINES UP TO THE FIRST VALVE ON THE DCVA SHALL BE DISINFECTED, PRESSURE TESTED, FLUSHED AND TESTED FOR PURITY PER THE CITY OF LACEY STANDARDS.
8. THE PLACEMENT OF THE HOT BOX SHALL BE IN AN AREA WHERE OBSTACLES SUCH AS GATES, ETC. WILL NOT DAMAGE IT.
9. PVC PIPE AND FITTINGS SHALL NOT BE ALLOWED.

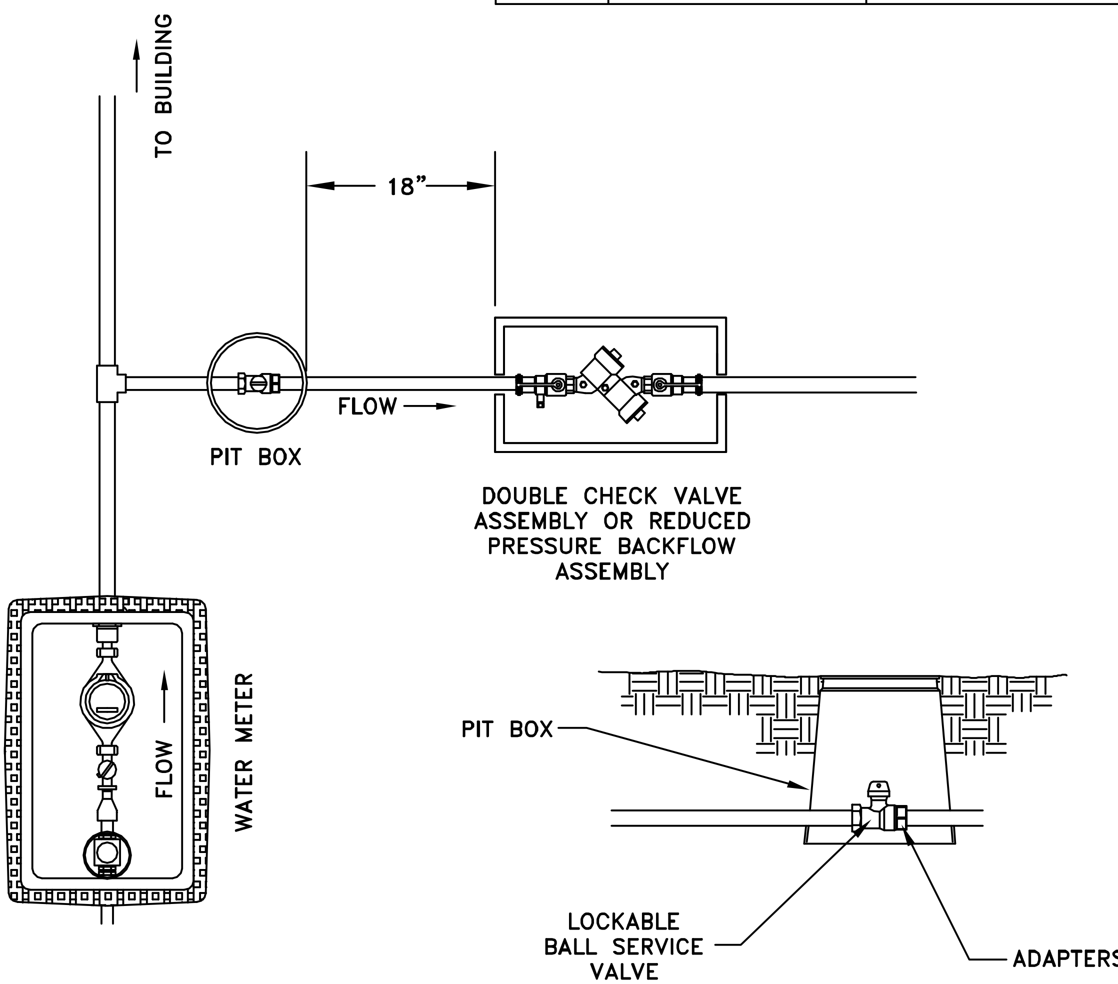
DG6–4.5.DWG

CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

REDUCED PRESSURE BACKFLOW ASSEMBLY FOR 3" & GREATER

APPROVED			DWG. NO.
Ron A Schoessel — CITY ENGINEER			6–4.5
DES.	DWN.	CKD.	DATE
WHO	WHO	RAS	8/27/09

LINE SIZE	BALL VALVE	VALVE BOX
3/4"	FORD FOB11-333W	CARSON MODEL 910-12
1"	FORD FOB11-444W	
1 1/2"	FORD FOB11-666W	
2"	FORD FOB11-777W	
2 1/2"	FORD FOB11-788W	



GENERAL NOTES:
1. THIS CONFIGURATION IS REQUIRED IF THE IRRIGATION SYSTEM DOES NOT HAVE IT'S OWN SEPARATE WATER METER.
2. DO NOT INSTALL IN AREAS SUBJECT TO FLOODING.
3. IF R.P. DEVICE IS USED, BOX MUST BE FREE DRAINING.

CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

IRRIGATION FOR RESIDENTIAL DOMESTIC SERVICE TYPE I

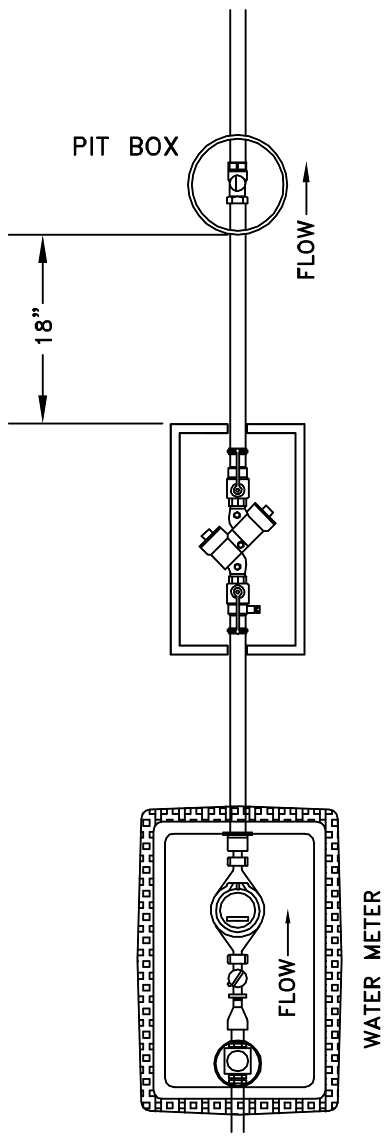
APPROVED
Ron A Schoessel
CITY ENGINEER

DWG. NO. 6-4.6

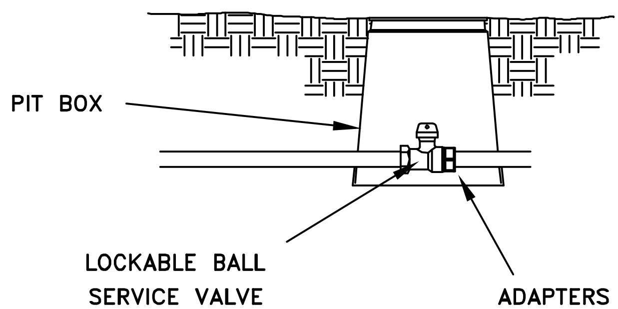
DES.	DWN.	CKD.	DATE
CM	WHO	RAS	8/27/09

DG6-4.6.DWG

LINE SIZE	BALL VALVE	VALVE BOX
3/4"	FORD FOB11-333W	CARSON MODEL 910-12
1"	FORD FOB11-444W	
1 1/2"	FORD FOB11-666W	
2"	FORD FOB11-777W	
2 1/2"	FORD FOB11-788W	



PIT BOX DETAIL



GENERAL NOTES:
1. THIS CONFIGURATION IS REQUIRED FOR IRRIGATION SYSTEMS THAT HAS IT'S OWN WATER METER SUCH AS COMMERCIAL SITES.
2. DO NOT INSTALL IN AREAS SUBJECT TO FLOODING.

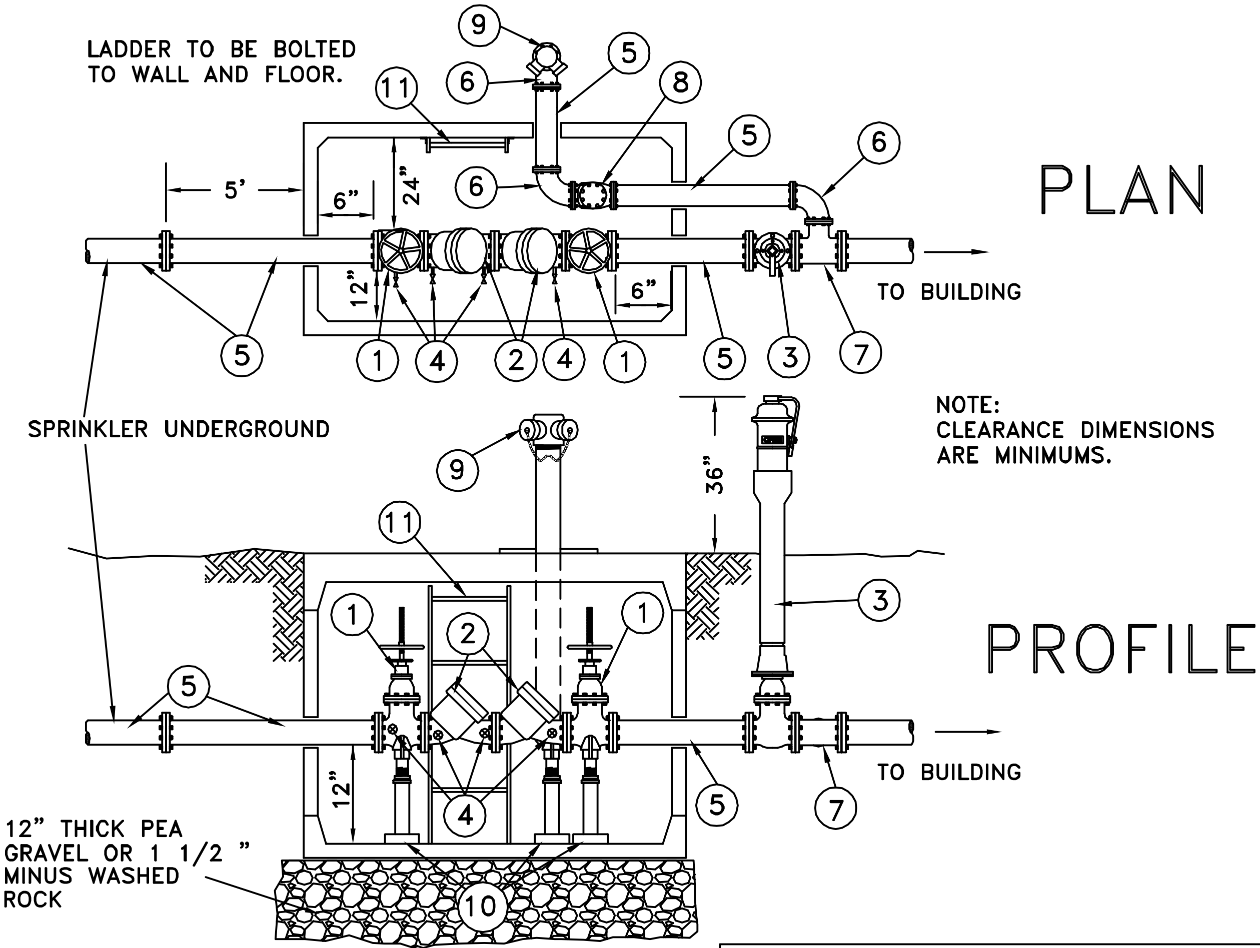
CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

IRRIGATION SERVICE FOR COMMERICAL SITES TYPE II

APPROVED	DWG. NO.
Roger A Schoessel CITY ENGINEER	6-4.7

DES.	DWN.	CKD.	DATE
WHO	WHO	RAS	8/27/09

DG6-4.7.DWG



MATERIAL LIST:

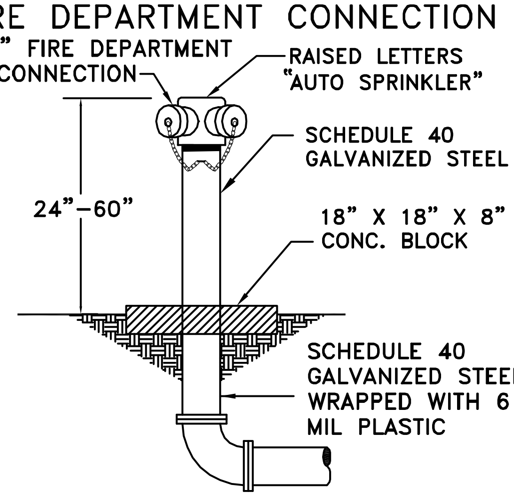
1. OS&Y GATE VALVE W/HANDWHEEL FL X FL
2. DSHS APPROVED CHECK VALVE FL X FL
3. POST INDICATOR VALVE
4. TEST COCK – 4 REQUIRED
5. CLASS 52 DI WALL PIPE FL X FL
6. CLASS 52 DI 90° BEND FL X FL
7. CLASS 52 DI TEE FL X FL
8. SWING CHECK VALVE W/BALL DRIP ASSEMBLY
9. FIRE DEPARTMENT CONNECTION
10. VALVE STANDS
11. LADDER

GENERAL NOTES:

1. THOROUGHLY FLUSH LINES PRIOR TO INSTALLING BACK FLOW ASSEMBLY.
2. PIPE FROM VAULT TO BUILDING SHALL BE CLASS 52 DI.
3. TAMPER SWITCHES SHALL BE INSTALLED ON 1 AND 3 CONNECTED TO BUILDING FIRE ALARM SYSTEM.
4. WHERE PIPING PASSES THROUGH CONCRETE WALL PROVIDE 2" CLEARANCE W/ WATERPROOF MASTIC OR FLEXIBLE SEALANT.
5. DIAMETER OF PIPE AND FITTINGS TO BE DETERMINED BY CERTIFIED SPRINKLER DESIGNER.
6. ALL PIPING SHALL BE A MINIMUM OF 4" DIAMETER AS PER NFPA13.
7. ALL VAULTS SHALL BE EQUIPPED WITH A DRAIN OR BE INSTALLED ABOVE GROUND.
8. ALL FIRE SPRINKLER LINES UP TO THE FIRST VALVE ON THE DCDA SHALL BE DISINFECTED, PRESSURE TESTED, FLUSHED AND TESTED FOR PURITY PER THE CITY OF LACEY STANDARDS.

DG6–5.1.DWG

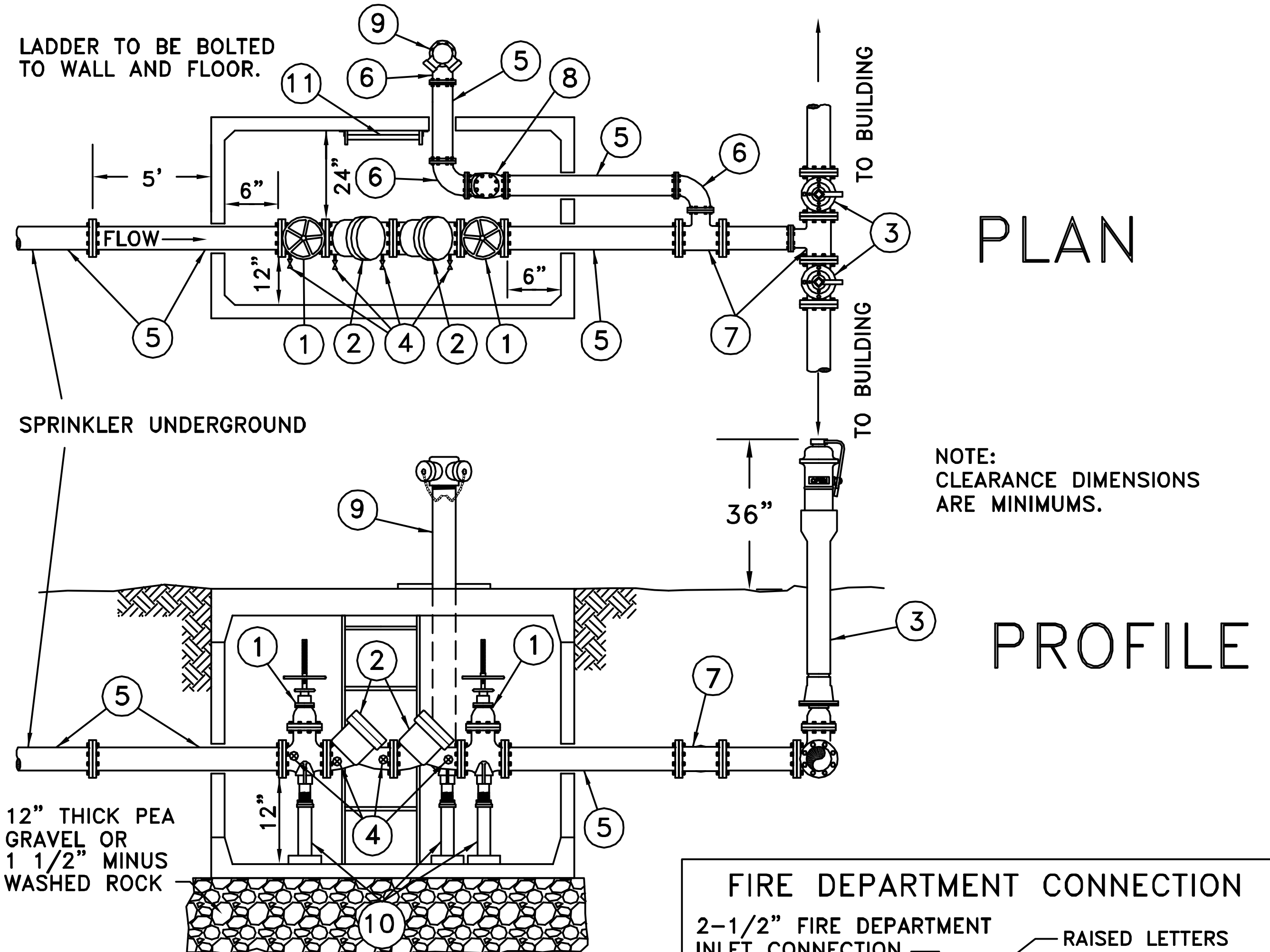
FIRE DEPARTMENT CONNECTION



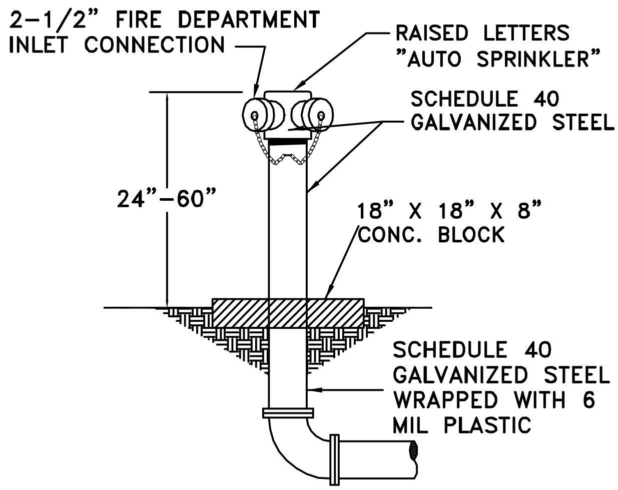
CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

SINGLE SERVICE DOUBLE CHECK DETECTOR (DCDA) VALVE ASSEMBLY W/FDC

APPROVED			DWG. NO.
Ross A Schoessel (signature) — CITY ENGINEER			6–5.1
DES.	DWN.	CKD.	DATE
WHO	WHO	RAS	8/27/09



FIRE DEPARTMENT CONNECTION



MATERIAL LIST:

1. OS&Y GATE VALVE W/HANDWHEEL FL X FL
2. DSHS APPROVED CHECK VALVE FL X FL
3. POST INDICATOR VALVE
4. TEST COCK – 4 REQUIRED
5. CLASS 52 DI WALL PIPE FL X FL
6. CLASS 52 DI 90° BEND FL X FL
7. CLASS 52 DI TEE FL X FL
8. SWING CHECK VALVE W/BALL DRIP ASSEMBLY
9. FIRE DEPARTMENT CONNECTION
10. VALVE STANDS
11. LADDER

GENERAL NOTES:

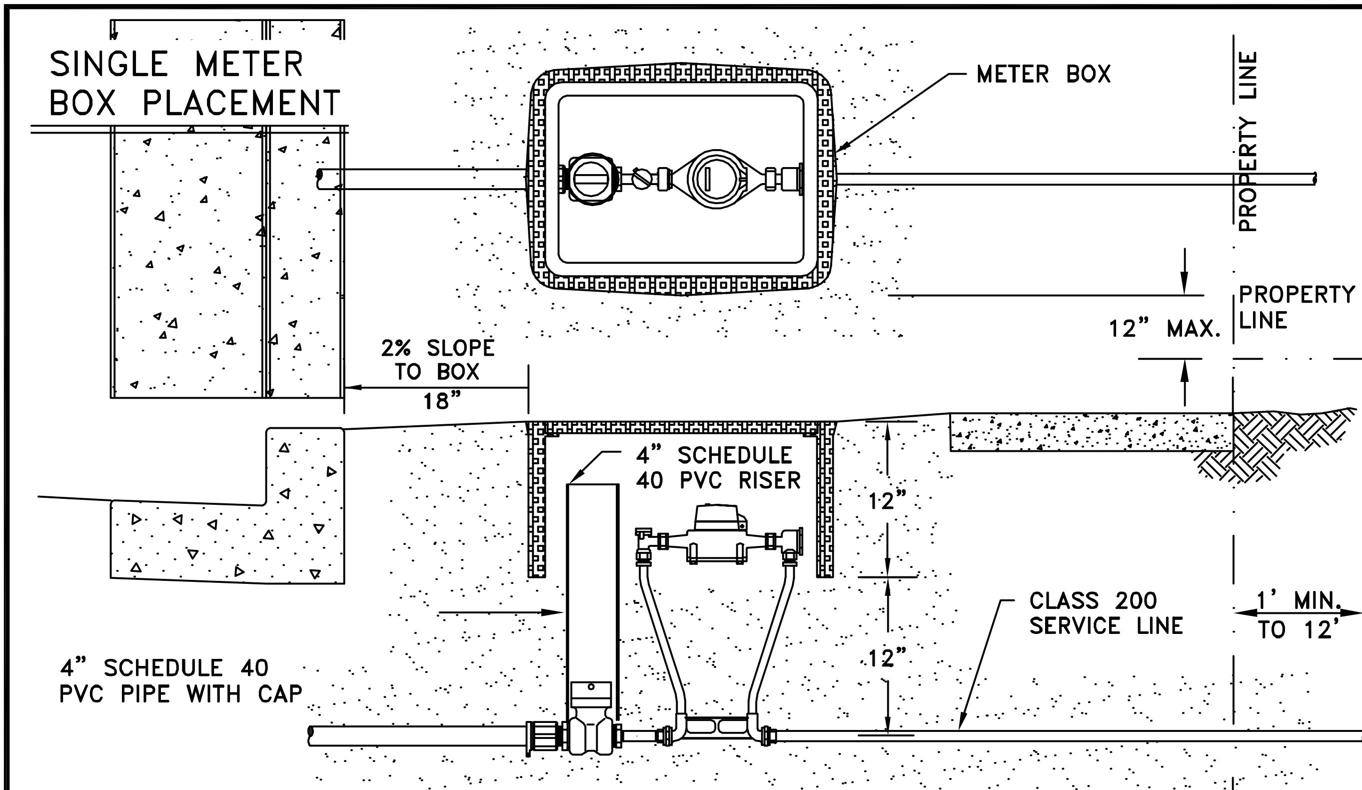
1. THOROUGHLY FLUSH LINES PRIOR TO INSTALLING BACK FLOW ASSEMBLY.
2. PIPE FROM VAULT TO BUILDING SHALL BE CLASS 52 DI.
3. TAMPER SWITCHES SHALL BE INSTALLED ON 1 AND 3 CONNECTED TO BUILDING FIRE ALARM SYSTEM.
4. WHERE PIPING PASSES THROUGH CONCRETE WALL PROVIDE 2" CLEARANCE W/ WATERPROOF MASTIC OR FLEXIBLE SEALANT.
5. DIAMETER OF PIPE AND FITTINGS TO BE DETERMINED BY CERTIFIED SPRINKLER DESIGNER.
6. ALL PIPING SHALL BE A MINIMUM OF 4" DIAMETER AS PER NFPA13.
7. ALL VAULTS SHALL BE EQUIPPED WITH A DRAIN OR BE INSTALLED ABOVE GROUND.
8. ALL FIRE SPRINKLER LINES UP TO THE FIRST VALVE ON THE DCDA SHALL BE DISINFECTED, PRESSURE TESTED, FLUSHED AND TESTED FOR PURITY PER THE CITY OF LACEY STANDARDS.

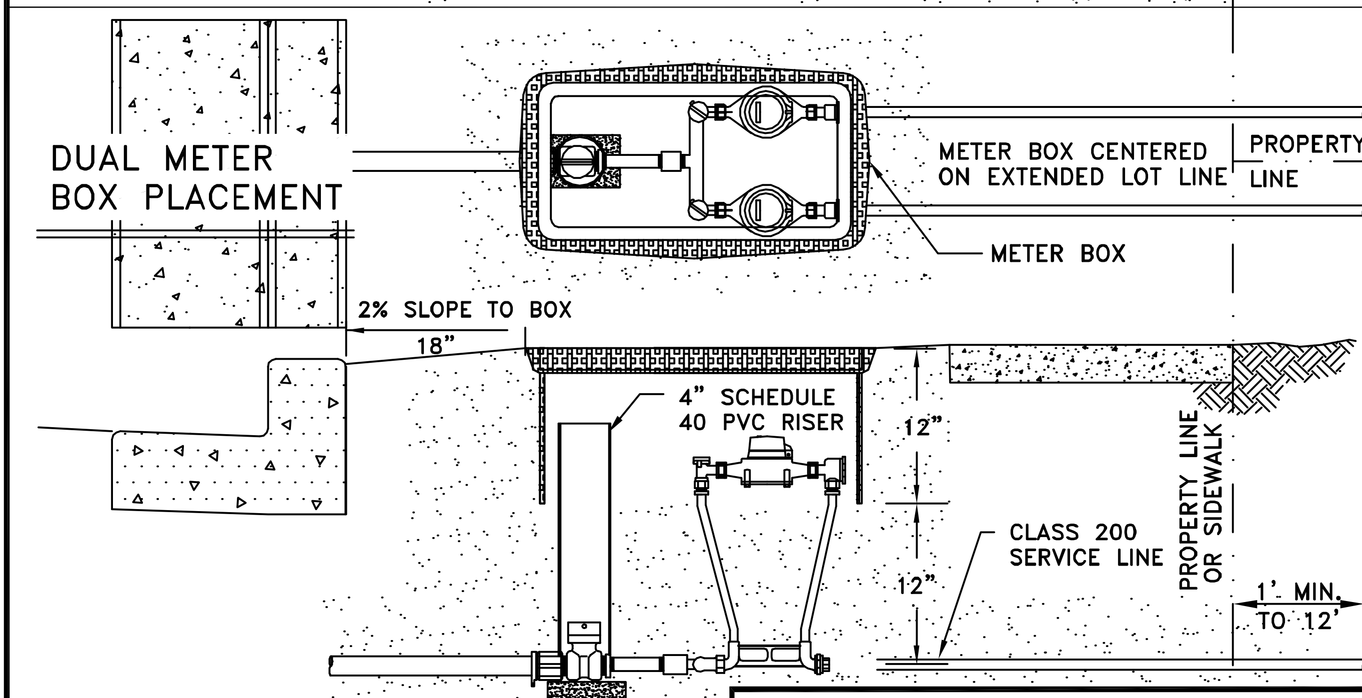
DG6-5.2.DWG

CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

DUAL SERVICE DOUBLE CHECK DETECTOR (DCDA) VALVE ASSEMBLY W/FDC

APPROVED			DWG. NO.
Roe A Schoessel CITY ENGINEER			6-5.2
DES.	DWN.	CKD.	DATE
LRW	WHO	RAS	8/27/09





GENERAL NOTE:

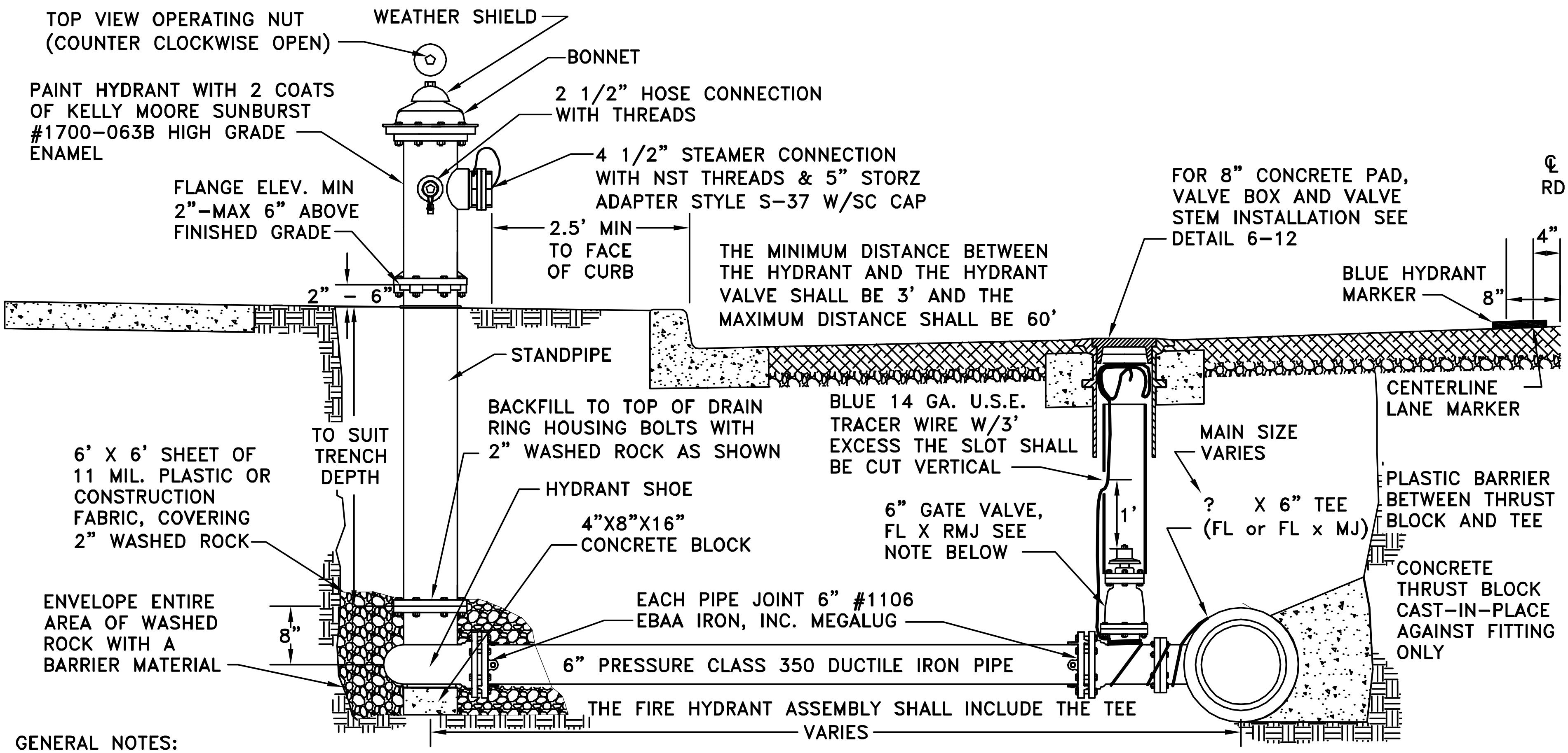
1. METER BOXES SHALL NOT BE INSTALLED IN CONCRETE OR CONCRETE DRIVEWAYS. WHEN NECESSARY CREATE PLANTERS FOR METER BOX INSTALLATION.
2. SAND SHALL BE 4" UNDER AND 6" ABOVE THE PIPE.
3. SAND SHALL BE PLACED AT A MINIMUM 1' AROUND THE ENTIRE METER BOX OR BOXES FROM 6" ABOVE THE PIPE TO THE FINISH GRADE OF THE METER BOX.
4. EXTEND THE PIGTAIL 1' BEYOND THE SIDEWALK OR 12' TO CLEAR THE JOINT UTILITY TRENCH.

DG6-7.DWG

CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

TYPICAL METER PLACEMENT

APPROVED			DWG. NO.
Roger A Schoessel (signature) — CITY ENGINEER			6-7
DES. WHO	DWN. WHO	CKD. RAS	DATE 8/27/09



GENERAL NOTES:

1. A MINIMUM FIVE FOOT RADIUS OF UNOBSTRUCTED WORKING AREA SHALL BE PROVIDED AROUND ALL HYDRANTS. THE UNOBSTRUCTED AREA SHALL INCLUDE BUT NOT BE LIMITED TO TREES, SCHRUBS, PLANTS, VAULTS, FDC AND METERS.
2. HYDRANT SHALL BE WATEROUS PACER, M & H RELIANT STYLE 929, AMERICAN AVK, KENNEDY K-81, MUELLER CENTURION, OR CLOW MEDALLION.
3. GATE VALVES SHALL BE RESILIENT WEDGE NRS WITH O-RING SEALS. VALVE ENDS SHALL BE MECHANICAL JOINT BY ANSI FLANGES. VALVES SHALL CONFORM TO AWWA 509-80. VALVES SHALL BE MUELLER, M&H, KENNEDY, CLOW R/W OR WATEROUS SERIES 500.
4. REMOVE FACTORY CHAINS HOLDING CAPS.
5. WHEN DISTANCE BETWEEN HYDRANT AND VALVE EXCEED 20 FEET, FIELDLOK GASKETS SHALL BE ALLOWED.
6. INSTALLATION OF THE TYPE 2E TWO WAY BLUE REFLECTIVE HYDRANT MARKER SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
7. THE TYPE 2E TWO WAY BLUE REFLECTIVE HYDRANT MARKER SHALL BE ALIGNED WITH THE OUTSIDE EDGE OF THE LANE MARKER OR 8" FROM THE CENTER OF THE RPM TO THE CENTER LINE OF THE ROADWAY. SEE DETAIL 4-27

DG6-8.DWG

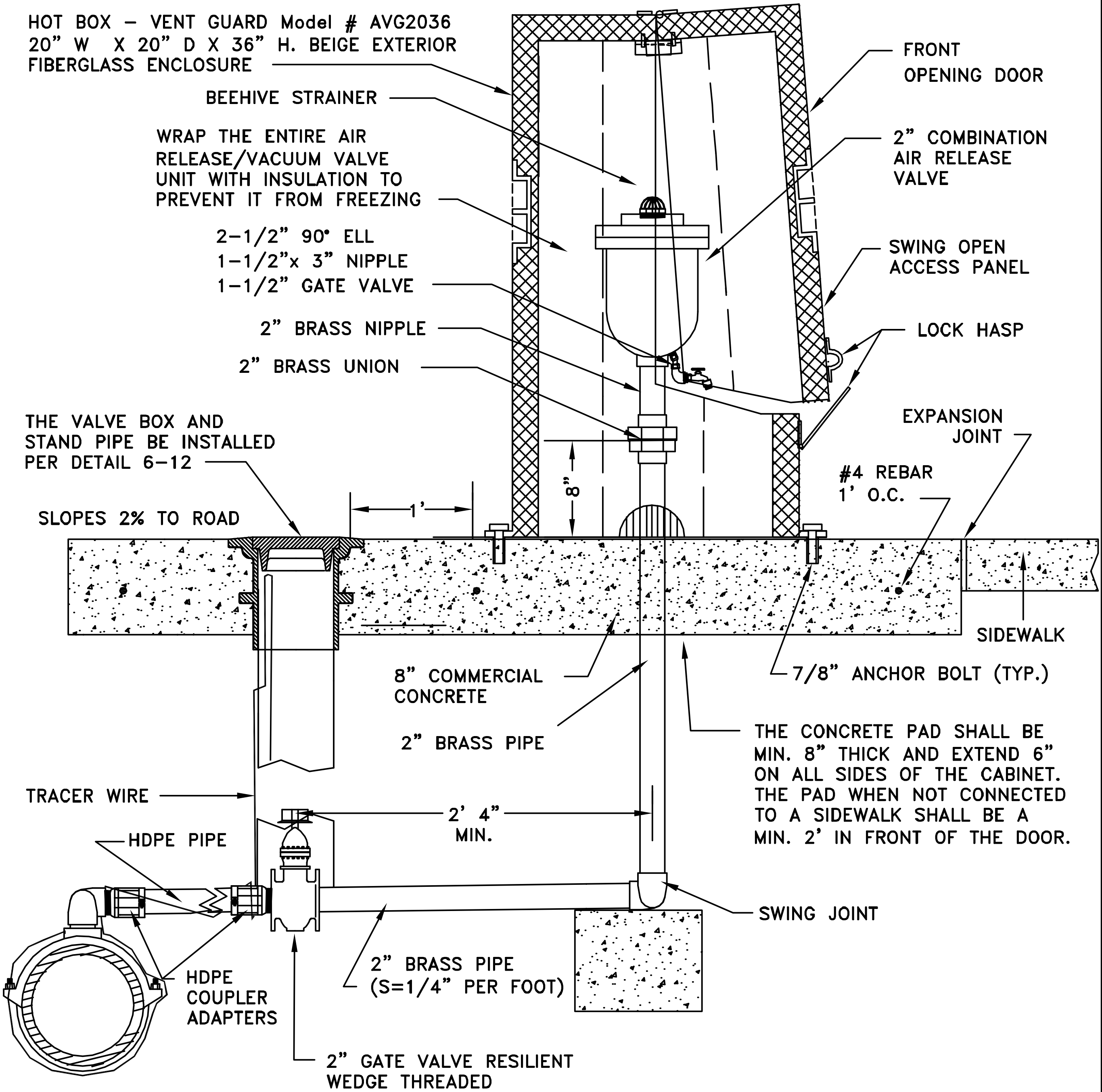
CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

FIRE HYDRANT ASSEMBLY

APPROVED
Ron A Schoessel
CITY ENGINEER

DWG. NO. 6-8

DES	DWN	CKD	DATE
WHO	WHO	RAS	8/27/09



GENERAL NOTES:

1. VALVE ASSEMBLY SHALL BE SET AT THE HIGH POINT OF THE LINE.
2. ALL AIR/VACUUM RELEASE VALVES SHALL BE INSTALLED BEHIND THE SIDEWALK AT THE NEAREST PROPERTY CORNER AND NOT IN FRONT OF A RESIDENCE.
3. AIR RELEASE VALVES SHALL BE 2" APCO 145C, VAL MATIC 202C OR CRISPIN UL-20, ARI D-040 W/THERMO PROTECTION ENCASEMENT.
4. ALL FITTINGS AND PIPING SHALL BE BRASS.
5. CABINET SHALL OPEN TOWARDS SIDEWALK.
6. WRAP THE AIR/VACUUM RELEASE VALVE UNIT AND PIPING W/INSULATION TO PREVENT IT FROM FREEZING.

CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

2" AIR AND VACUUM RELEASE VALVE

APPROVED
Ron A Schoessel
CITY ENGINEER

DWG. NO. 6-9

DES.	DWN.	CKD.	DATE
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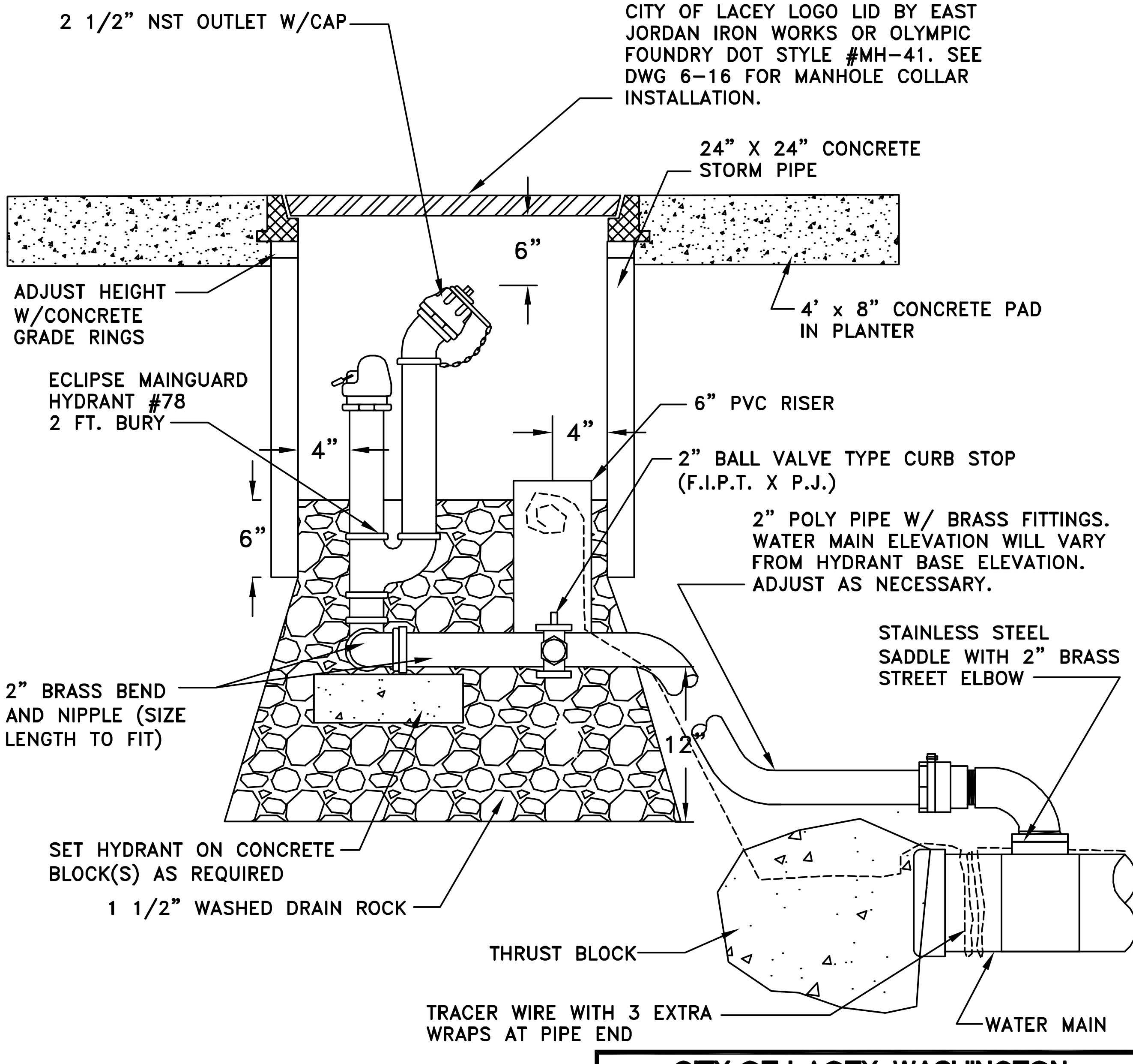
DG6-9.DWG

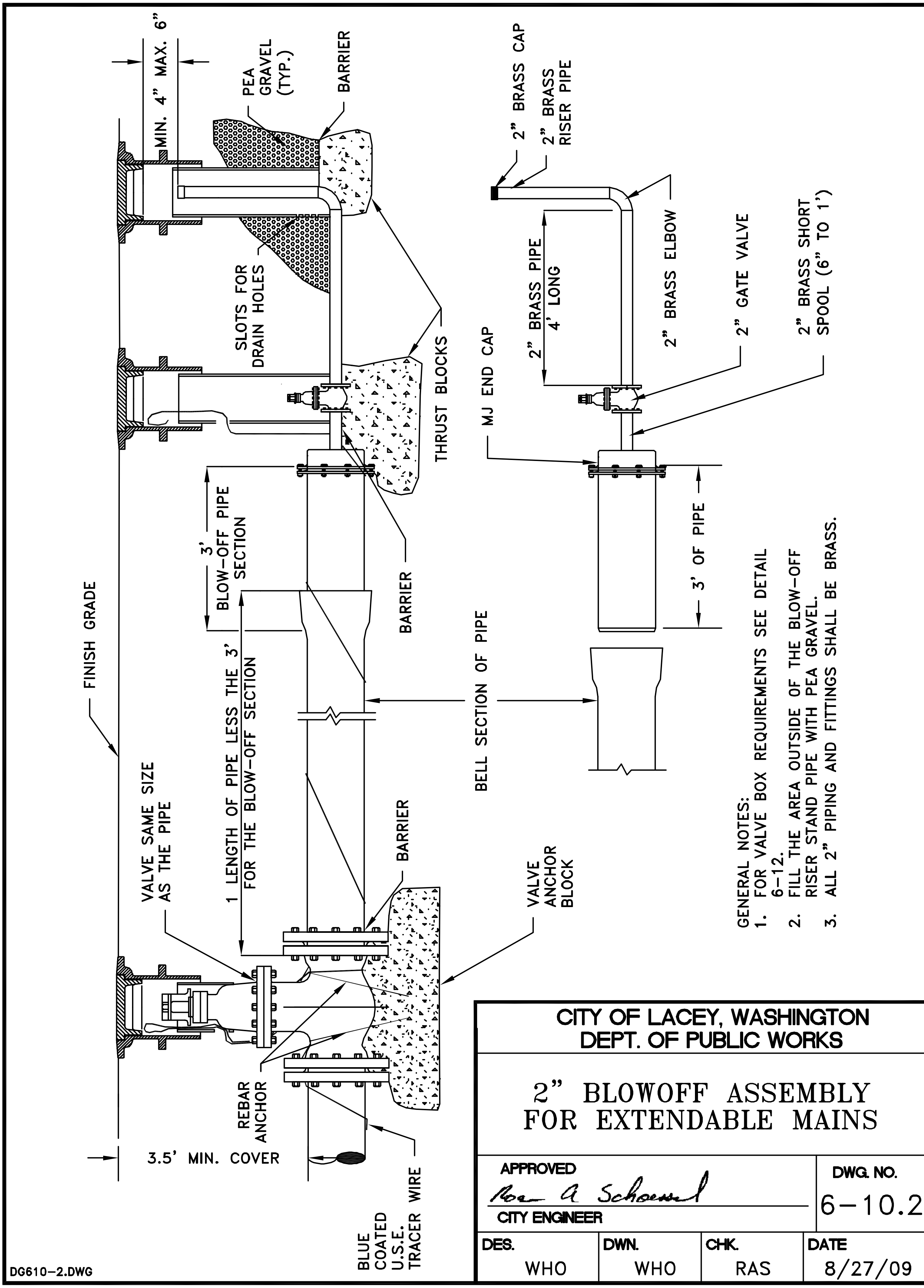


CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

BLOW-OFF HYDRANT ASSEMBLY IN THE PLANTER STRIP

APPROVED			DWG. NO.
CITY ENGINEER			6-10.1
DES.	DWN.	CKD.	DATE
EP	BP	RAS	8/27/09

DG6-10.1.DWG

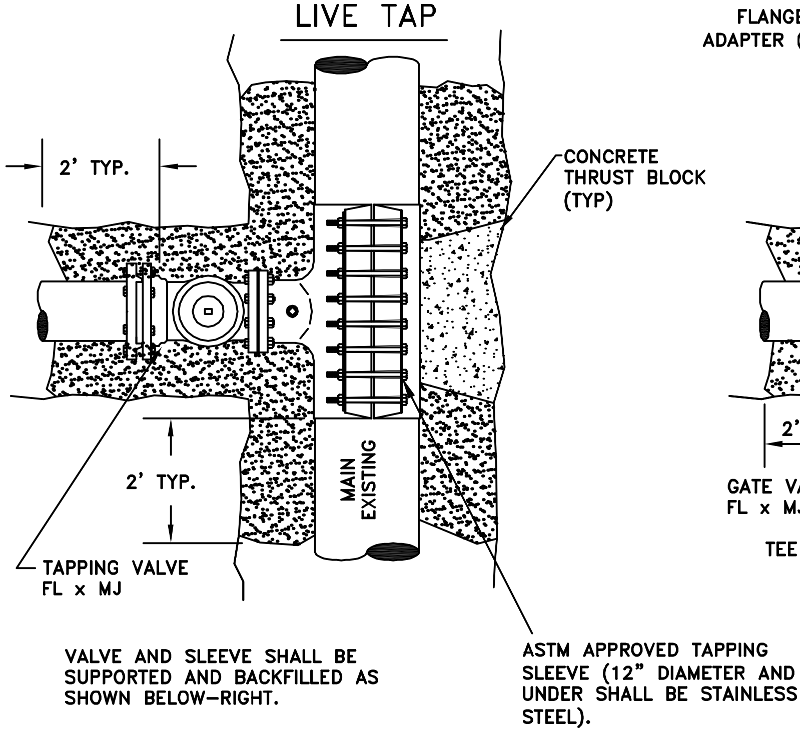


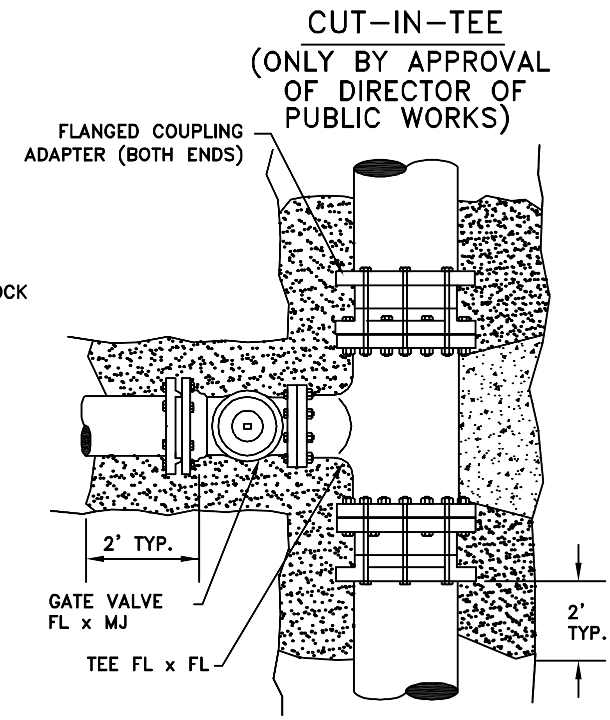
GENERAL NOTES:

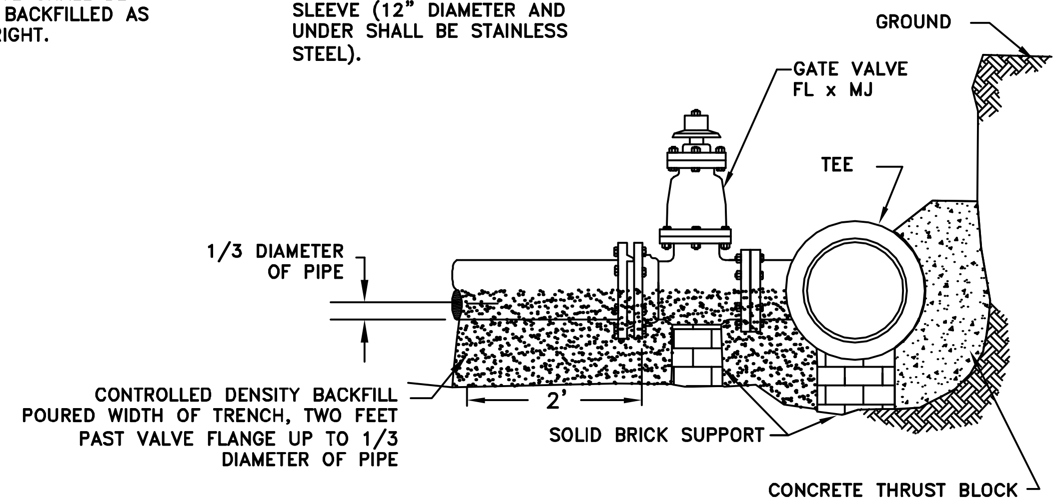
1. FOR VALVE BOX REQUIREMENTS SEE DETAIL 6-12.
2. FILL THE AREA OUTSIDE OF THE BLOW-OFF RISER STAND PIPE WITH PEA GRAVEL.
3. ALL 2" PIPING AND FITTINGS SHALL BE BRASS.

CITY OF LACEY, WASHINGTON DEPT. OF PUBLIC WORKS			
2" BLOWOFF ASSEMBLY FOR EXTENDABLE MAINS			
APPROVED Ron A Schoessel CITY ENGINEER			DWG. NO. 6-10.2
DES. WHO	DWN. WHO	CHK. RAS	DATE 8/27/09

DG610-2.DWG







GENERAL NOTES:

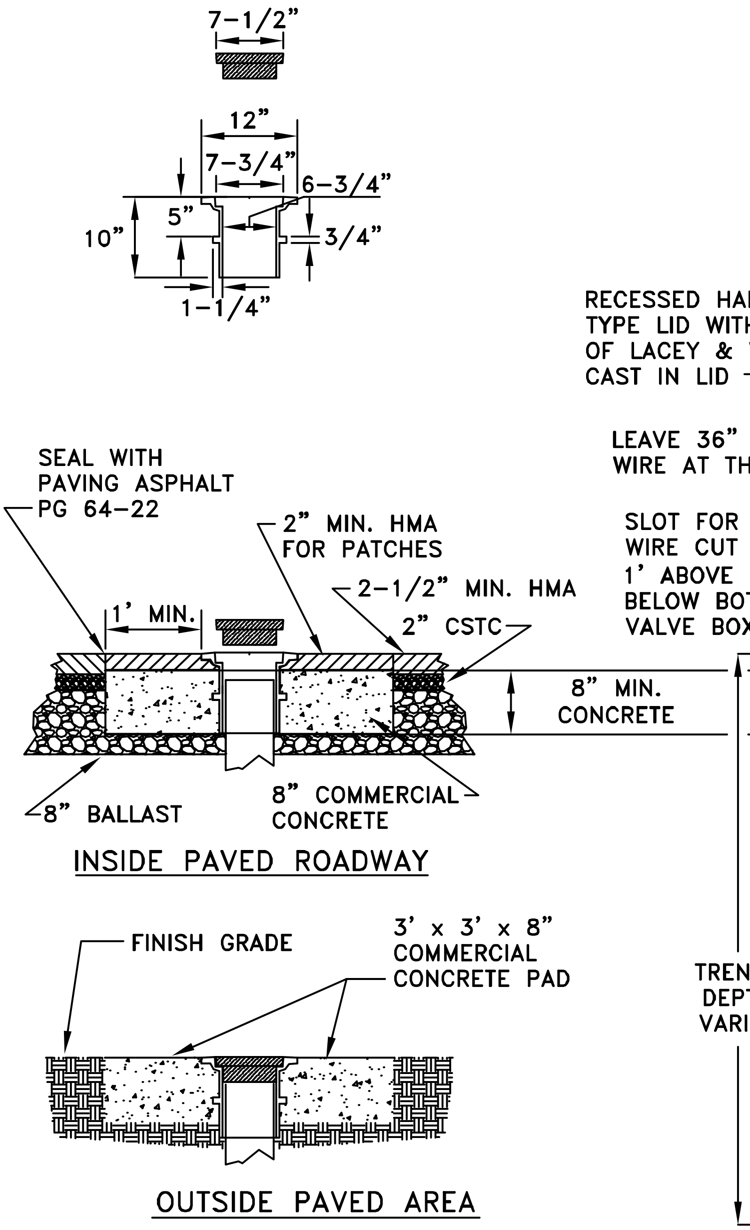
1. 11 MIL. PLASTIC OR CONSTRUCTION FABRIC SHALL BE WRAPPED AROUND PIPE AND FITTINGS BEFORE THRUST BLOCK OR CDF BACKFILL ARE POURED.
2. CONTROLLED DENSITY FILL SHALL CONSIST OF 1750# SAND, 1750# PEA GRAVEL, 230# WATER, 141# CEMENT, 6 OUNCES WATER REDUCING AGENT PER 100# CEMENT.
3. MJ CUT IN TEES SHALL NOT BE PERMITTED.
4. THE EXISTING MAIN, TAPPING SLEEVE AND VALVE SHALL BE SUPPORTED THROUGHOUT THE ENTIRE PROCESS WHEN TAPPING THE EXISTING WATER MAIN.

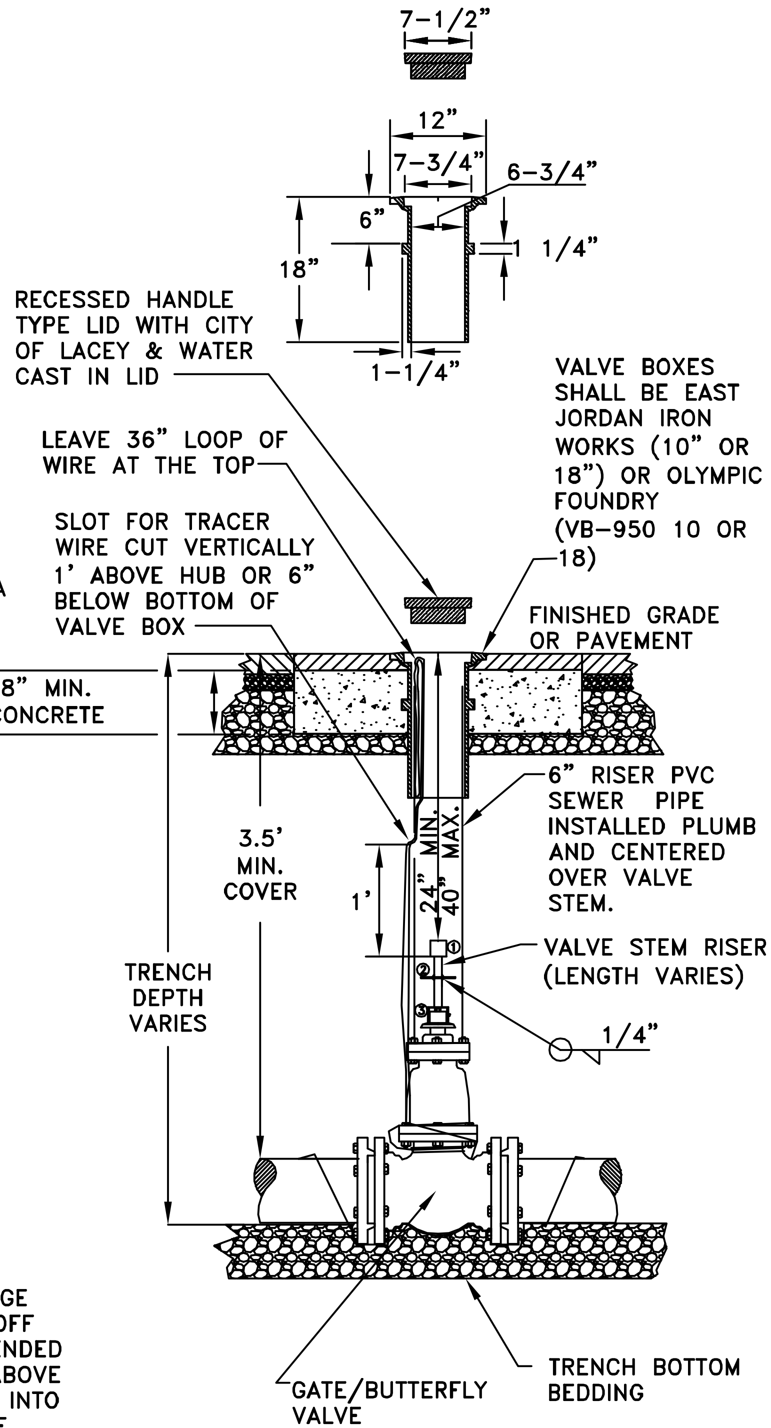
DG6-11.DWG

CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

CONNECTION TO EXISTING MAIN

APPROVED			DWG. NO.
CITY ENGINEER			6-11
DES.	DWN.	CKD.	DATE
LRW	WHO	RAS	8/27/09





GENERAL NOTES:

1. ALL VALVES SHALL HAVE A U.S.E. 14 GAUGE BLUE COATED COPPER TRACER WIRE TIED OFF AT VALVE BODY. THE WIRE SHALL BE EXTENDED UP ON THE OUTSIDE RISER PIPE A FOOT ABOVE THE VALVE HUB BEFORE THE WIRE IS PUT INTO THE RISER THROUGH A SLOT CUT INTO THE RISER. LEAVE 36" OF WIRE ABOVE THE TOP OF VALVE BOX.
2. ALL WELDS TO THE SHAFT SHALL BE FILLET WELD, AROUND THE ENTIRE PLATE PER #2 BELOW,

VALVE STEM EXTENSION LEGEND

① VALVE OPERATING NUT OR 1-7/8" X 1-7/8" X 2" HIGH GRADE STEEL WELDED TO GUIDE PLATE.

② 3/16" THICK X 5 1/5" DIA STEEL GUIDE PLATE WELDED TO RISER SHAFT.

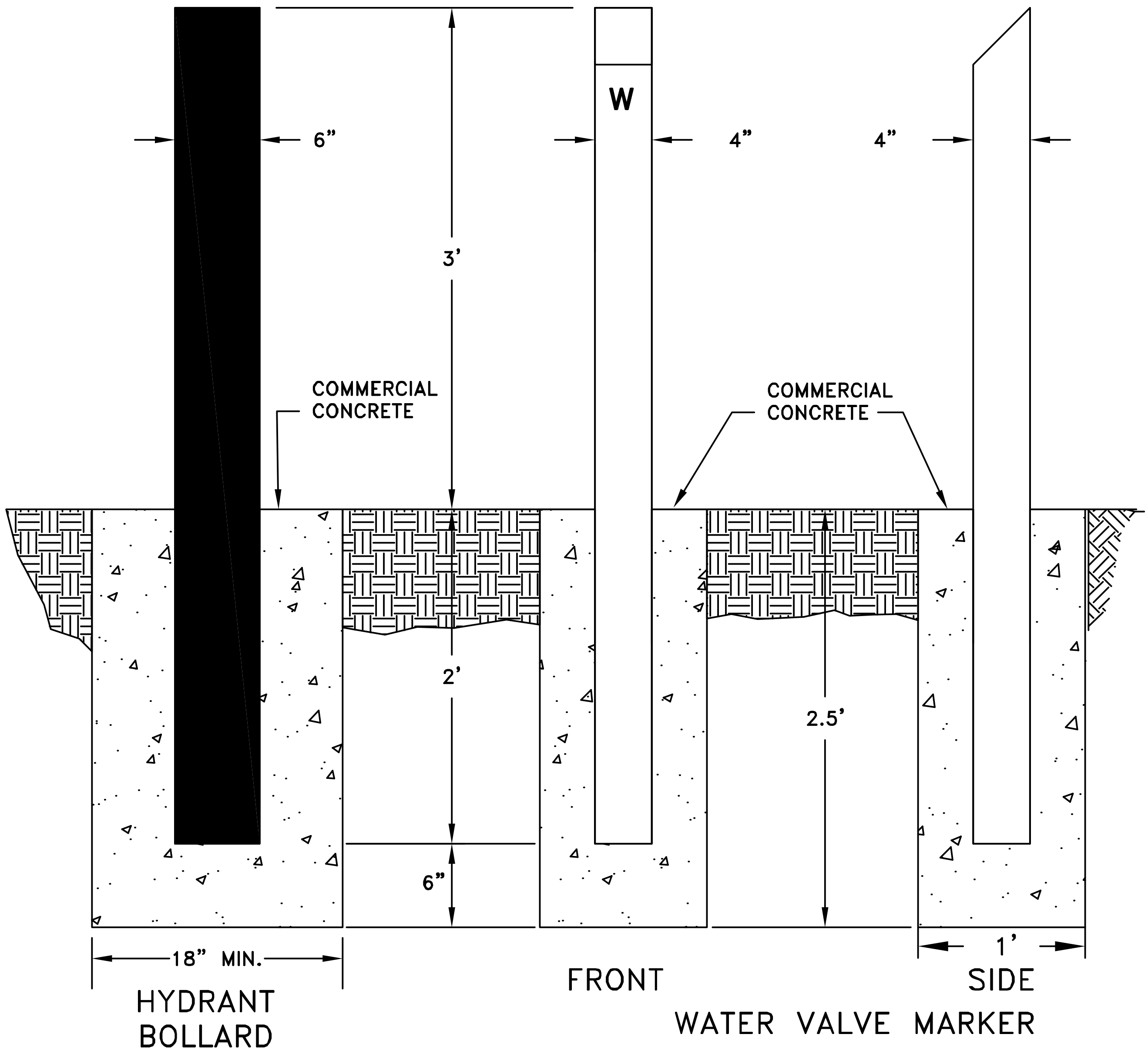
③ 2"X2"X 3/16" SQUARE STRUCTURAL STEEL TUBING TO FIT OPERATING NUT. LENGTH AS REQUIRED.

DG6-12.DWG

CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

STANDARD VALVE BOX INSTALLATION

APPROVED			DWG. NO.
Ron A Schoessel CITY ENGINEER			6-12
DES	DWN	CKD	DATE
WHO	WHO	RAS	8/27/09



GENERAL NOTES:
1. 4" SCHEDULE 40 STEEL OR REINFORCED CONCRETE MARKER POST STAMPED WITH "W" AND DISTANCE TO VALVE.
2. THE POST TO BE COATED WITH ONE PRIME COAT AND TWO COATS OF OUTDOOR OIL BASE ENAMEL (WHITE).

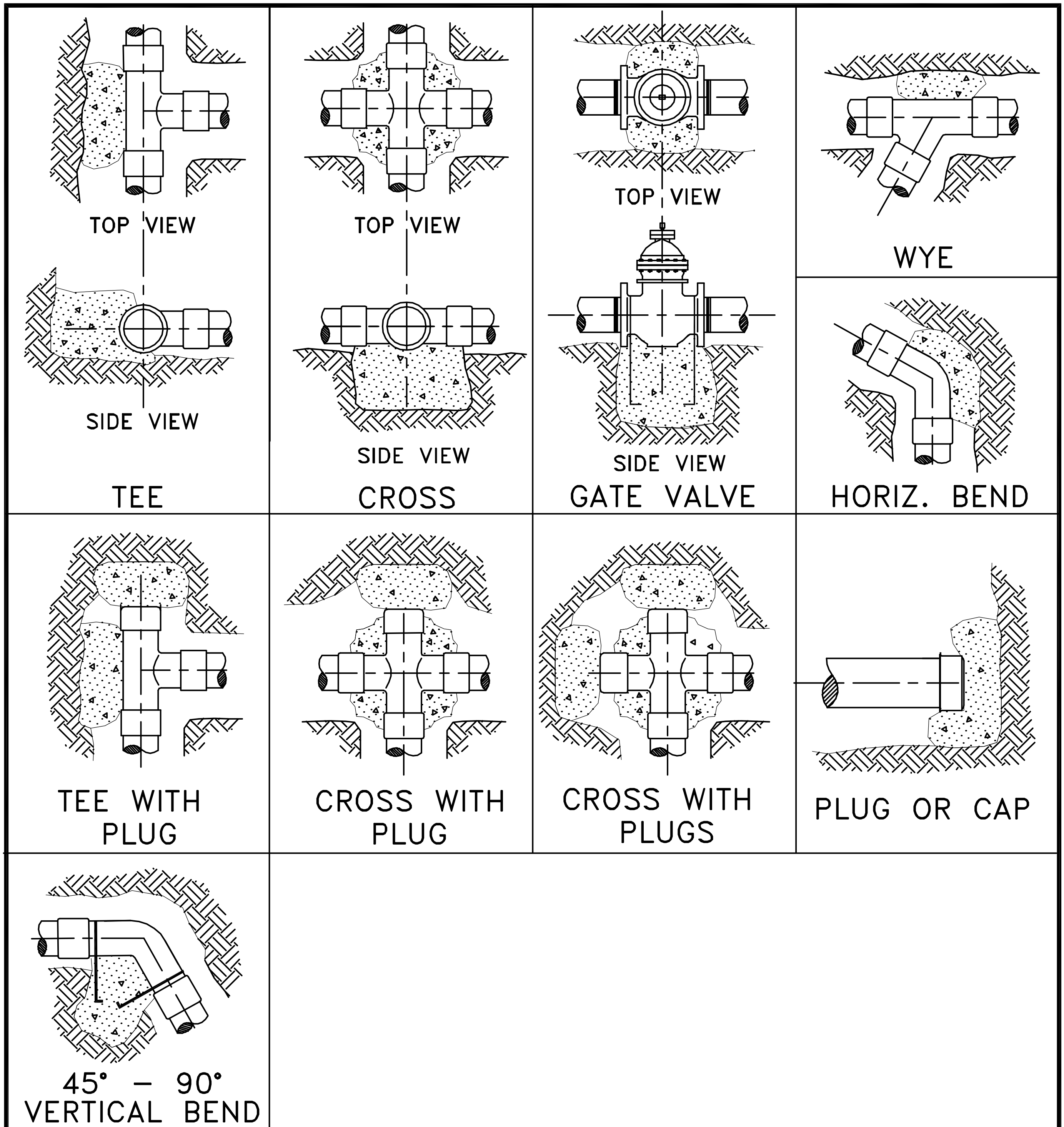
GENERAL NOTES:
1. HYDRANT BOLLARDS SHALL BE INSTALLED AT A MINIMUM OF 5' FROM THE HYDRANT SITUATED SO AS NOT TO BLOCK ANY OF THE HYDRANT PORTS.
2. THE HYDRANT BOLLARDS SHALL BE 6" IN DIAMETER SCHEDULE 20 STEEL POST AND FILLED WITH CONCRETE.
3. THE HYDRANT BOLLARDS SHALL BE COATED WITH 1 PRIME COAT AND TWO COATS OUTDOOR OIL BASE EMANEL THE SAME COLOR AS THE HYDRANT SEE DETAIL 6-8.
4. WHEN HYDRANT BOLLARDS ARE REQUIRED IN HIGH TRAFFIC AREAS GLASS BEADS SHALL BE SPRAYED OR PLACE ON TO THE WET PAINT TO PROVIDE BETTER VISABILITY AT NIGHT.

DG6-13.DWG

CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

HYDRANT BOLLARD & WATER VALVE MARKER POST DETAIL

APPROVED			DWG. NO.
CITY ENGINEER			6-13
DES	DWN	CKD	DATE
WHO	WHO	RAS	8/27/09



GENERAL NOTES:

1. CONCRETE THRUST BLOCKING TO BE POURED AGAINST UNDISTURBED EARTH.
2. PLASTIC BARRIER SHALL BE PLACED BETWEEN ALL THRUST BLOCKS AND FITTIINGS.
3. ANCHOR REBAR SHALL BE 5/8" MINIMUM DIAMETER

DG6–14.DWG

CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

STANDARD
BLOCKING DETAIL

APPROVED			DWG. NO.
Ron A Schoessel CITY ENGINEER			6–14
DES. LRW	DWN. RLM	CKD. RAS	DATE 8/27/09

THRUST LOADS

THRUST AT FITTINGS IN POUNDS AT 200 POUNDS PER SQUARE INCH OF WATER PRESSURE

PIPE DIAMETER	90° BEND	45° BEND	22-1/2° BEND	11-1/4° BEND	DEAD END OR TEE
4"	3,600	2,000	1,000	500	2,600
6"	8,000	4,400	2,300	1,200	5,700
8"	14,300	7,700	4,000	2,000	10,100
10"	22,300	12,100	6,200	3,100	15,800
12"	32,000	17,400	8,900	4,500	22,700
14"	43,600	23,600	12,100	6,100	30,800
16"	57,000	30,800	15,700	7,900	40,300

NOTES:

1. BLOCKING SHALL BE COMMERCIAL CONCRETE POURED IN PLACE AGAINST UNDISTURBED EARTH. FITTING SHALL BE ISOLATED FROM CONCRETE THRUST BLOCK WITH PLASTIC OR SIMILAR MATERIAL.

2. TO DETERMINE THE BEARING AREA OF THE THRUST BLOCK IN SQUARE FEET (S.F.):

   EXAMPLE : 12" – 90° BEND IN SAND AND GRAVEL
   32,000 LBS ÷ 3000 LB/S.F. = 10.7 S.F. OF AREA

3. AREAS MUST BE ADJUSTED FOR OTHER PIPE SIZE, PRESSURES AND SOIL CONDITIONS.

4. BLOCKING SHALL BE ADEQUATE TO WITHSTAND FULL TEST PRESSURE AS WELL AS TO CONTINUOUSLY WITHSTAND OPERATING PRESSURE UNDER ALL CONDITIONS OF SERVICE.

SAFE SOIL BEARING LOADS

FOR HORIZONTAL THRUSTS WHEN THE DEPTH OF COVER OVER THE PIPE EXCEEDS 2 FEET

SOIL	POUNDS PER SQUARE FOOT
MUCK, PEAT	0
SOFT CLAY	1,000
SAND	2,000
SAND & GRAVEL	3,000
SAND & GRAVEL CEMENTED WITH CLAY	4,000
HARD SHALE	10,000

CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

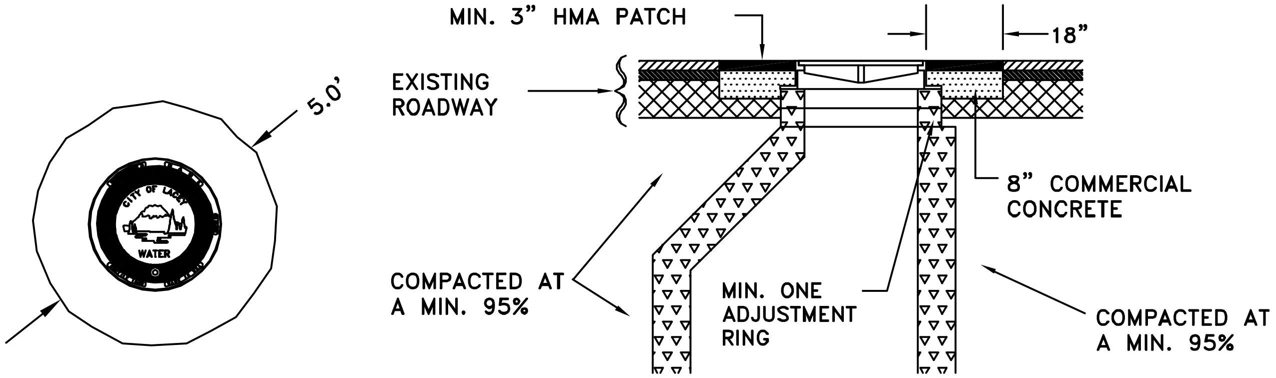
THRUST LOADS

APPROVED	DWG. NO.
Ross A. Schoessel CITY ENGINEER	6-15

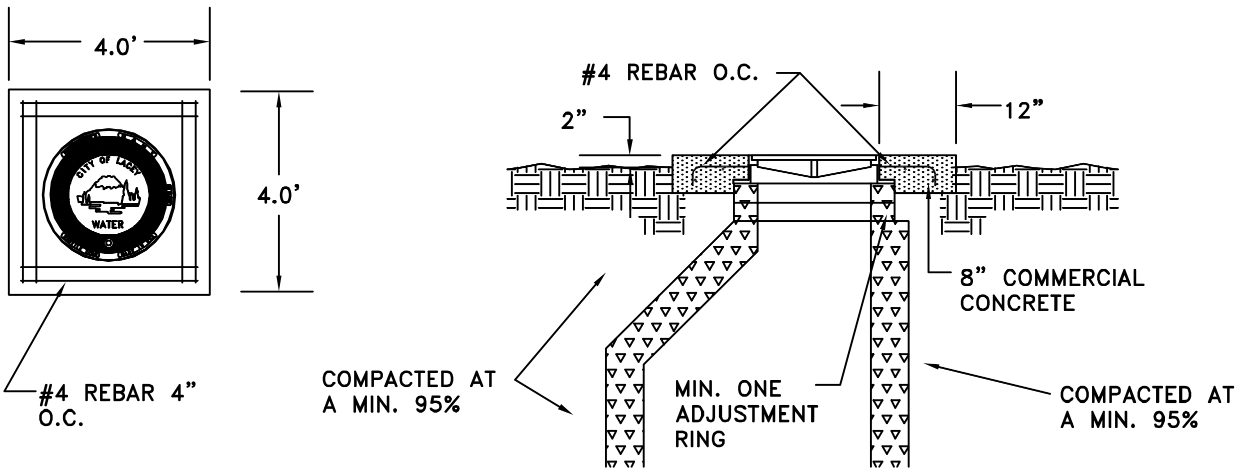
DES.	DWN.	CKD.	DATE
LRW	RLM	RAS	8/27/09

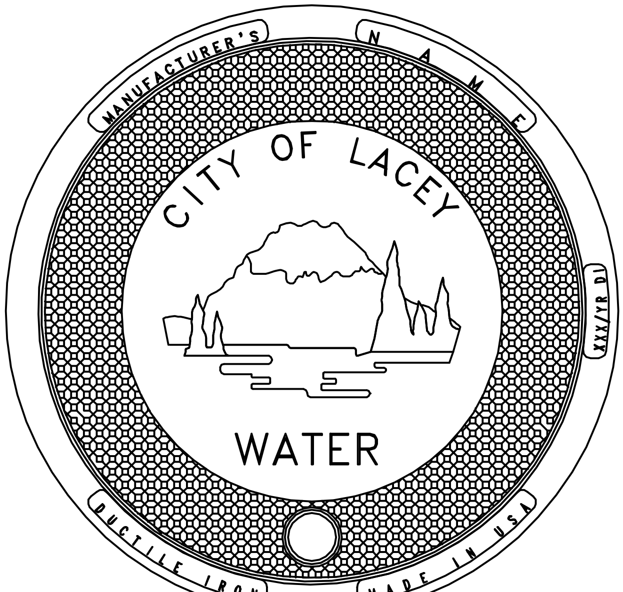
DG6-15.DWG

MANHOLE IN ASPHALT



MANHOLE OUTSIDE ASPHALT





GENERAL NOTES:

1. ON MANHOLES OUTSIDE OF THE ASPHALT ADD REINFORCING STEEL AS SHOWN ABOVE, DEFORMED BAR TO MEET ASTM A615 GRADE 60 FY=60,000 P.S.I.
2. ALL WATER MANHOLE LIDS SHALL BE EAST JORDAN IRON WORKS OR OLYMPIC FOUNDARY WSDOT STYLE #MH-41 CITY OF LACEY LOGO LIDS.
3. ALL LIDS SHALL BE DUCTILE IRON AND MANUFACTURED IN THE USA.

CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

WATER MANHOLE LOGO
LID & FRAME
INSTALLATION

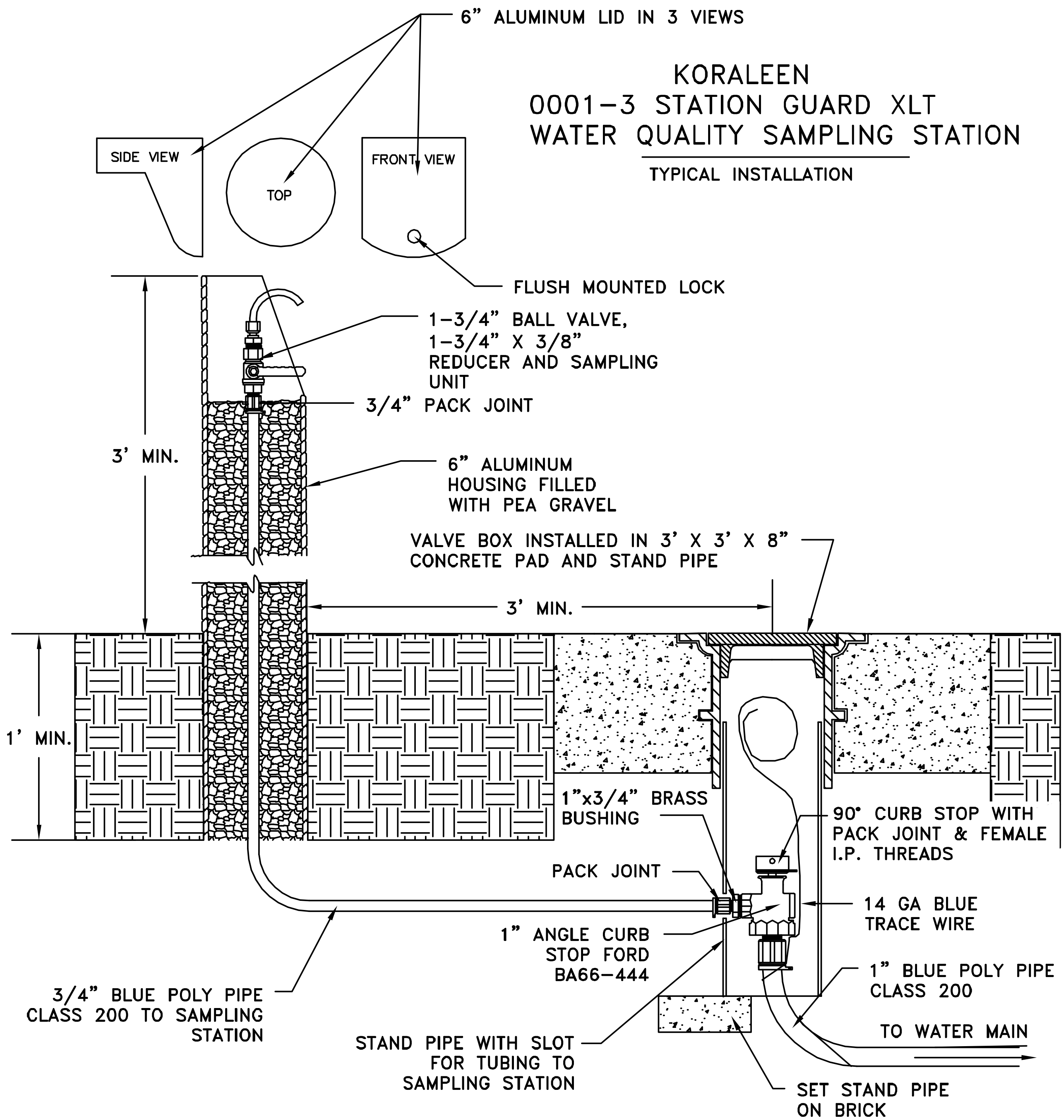
APPROVED

CITY ENGINEER

DWG. NO. 6-16

DES.	DWN.	CKD.	DATE
WHO	WHO	RAS	8/27/09

DG6-16.DWG



GENERAL NOTES:
1. THE KORALEEN SAMPLING STATION SHALL BE INSTALLED BEHIND THE SIDEWALK WITHIN 1 FOOT OF THE PROPERTY LINE AND WHEN POSSIBLE IN A OPEN SPACE. THE VALVE BOX SHALL BE INSTALLED IN THE PLANTER STRIP IN A CONCRETE PAD.
2. THE STAND PIPE SHALL REST ON A BRICK TO PROTECT THE WATER LINE FROM BEING CRUSHED.
3. A TRACER WIRE SHALL BE INSTALLED WITH THE WATER LINE.

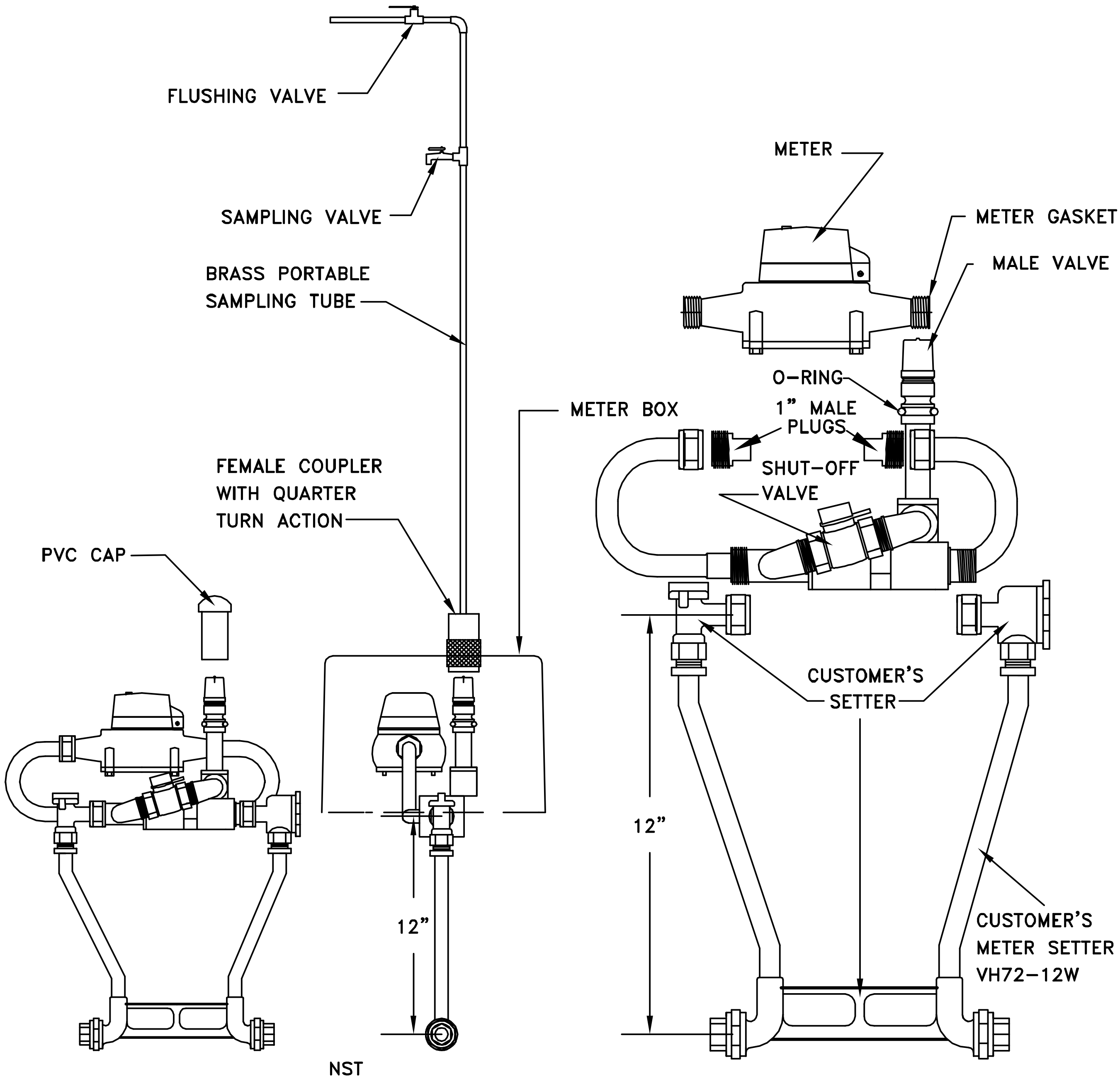
DG6-17.DWG

CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

KORALEEN SAMPLING STATION

APPROVED	DWG. NO.
Ron A Schoessel CITY ENGINEER	6-17

DES.	DWN.	CKD.	DATE
WHO	WHO	RAS	8/27/09



GENERAL NOTES:
1. PROVIDE THE CITY WITH A BRASS PORTABLE SAMPLING TUBE.
2. PROVIDE 2 EACH 1" MALE PLUGS TO CAP AND PROTECT THE SAMPLING UNIT.
3. THE SAMPLING STATION SHALL BE INSTALLED IN THE CUSTOMER'S METER SETTER. A SEPARATE METER SETTER IS NOT REQUIRED.

CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

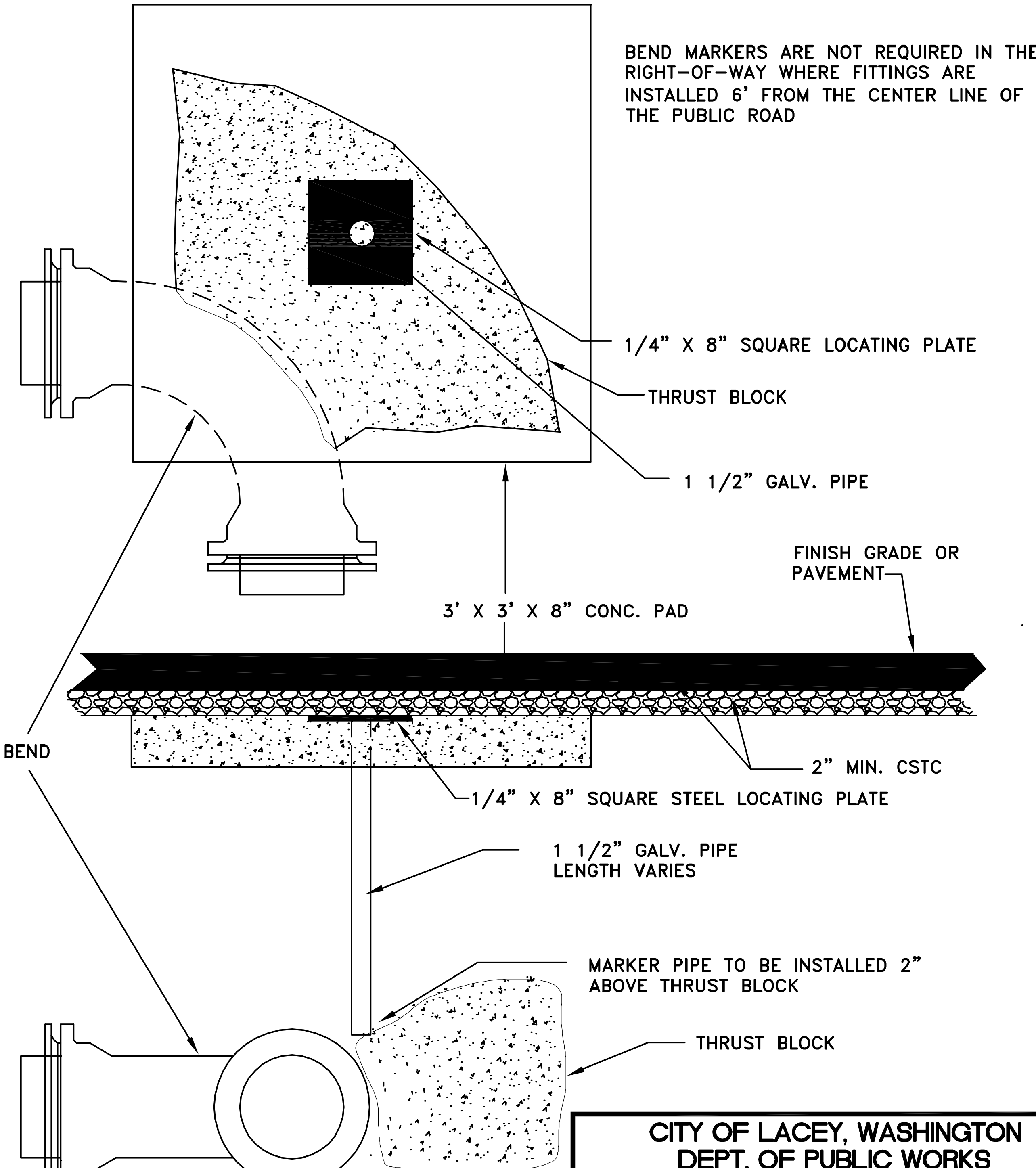
#93-WM SAMPLING STATION

APPROVED
[signature]
CITY ENGINEER

DWG. NO. 6-18

DES.	DWN.	CKD.	DATE
WHO	WHO	RAS	8/27/09

DG6-18.DWG



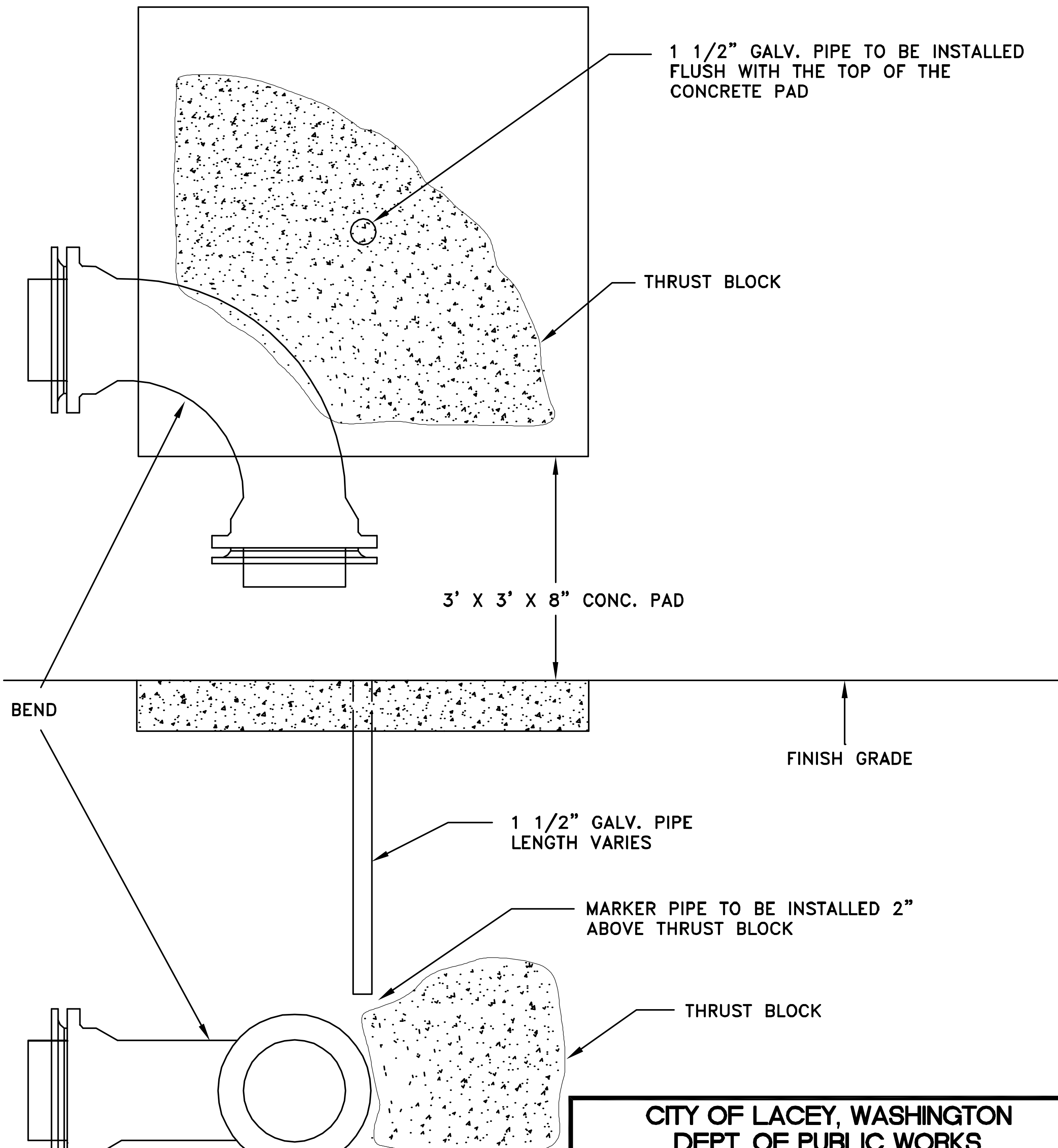
GENERAL NOTE:
1. TO BE INSTALLED IN EASEMENTS SUCH AS GRAVEL ACCESS ROADS, PAVED PRIVATE ROADS, PARKING LOTS AND PLAY GROUNDS.

CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

BEND MARKER TYPE I FOR GRAVEL ACCESS AND PAVED AREAS

APPROVED			DWG. NO.
Ron A. Schoessel CITY ENGINEER			6–19
DES. WHO	DWN. WHO	CKD. RAS	DATE 8/27/09

DG6–19.DWG



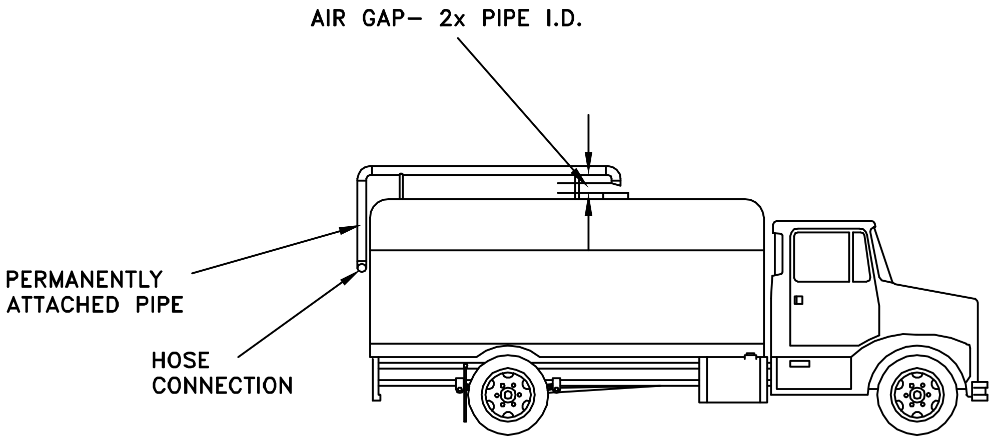
GENERAL NOTES:
1. TO BE INSTALLED IN EASEMENTS OTHER THAN PLAY GROUNDS, PARKING LOTS, GRAVEL ACCESS OR PRIVATE ROADS.

CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

BEND MARKER TYPE II

APPROVED			DWG. NO.
Ron A Schoessel CITY ENGINEER			6-20
DES.	DWN.	CKD.	DATE
WHO	WHO	RAS	8/27/09

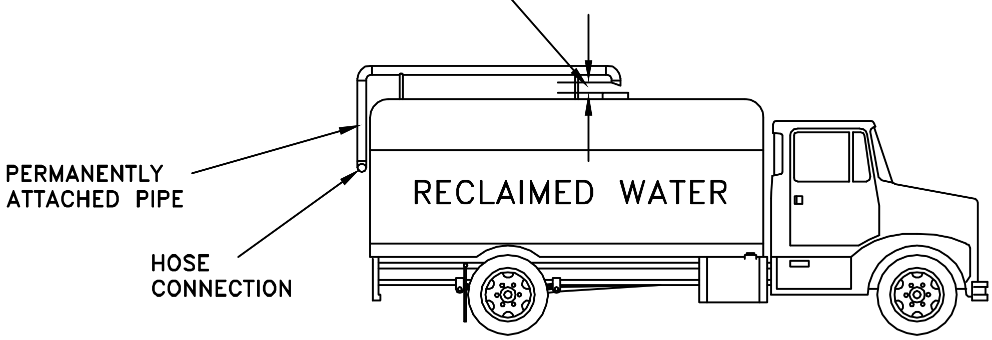
DG6-20.DWG



APPROVED AIR GAP

CITY OF LACEY, WASHINGTON DEPT. OF PUBLIC WORKS			
BACKFLOW PREVENTION FOR VEHICLE FILLING			
APPROVED Ron A Schoessel CITY ENGINEER			DWG. NO. 6–21
DES EA	DWN WHO	CKD RAS	DATE 8/27/09

DG6–21.DWG



APPROVED AIR GAP

GENERAL NOTES:

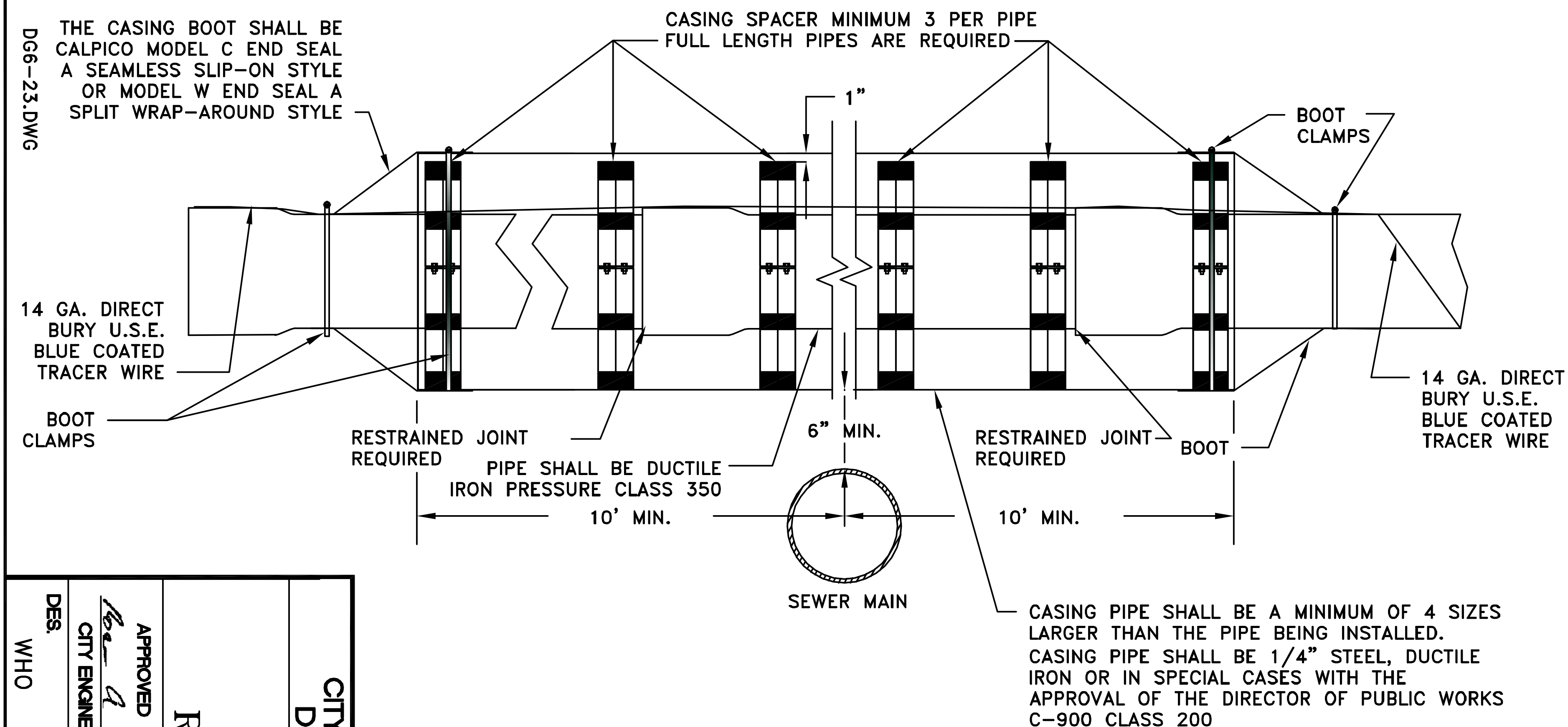
1. WHEN USING RECLAIMED WATER IN VEHICLES TO DISTRIBUTE WATER THE TRUCK SHALL BE STENCILED ON THE SIDES AND BACK "RECLAIMED WATER".

CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

FILLING TRUCKS WITH RECLAIMED WATER

APPROVED			DWG. NO.
CITY ENGINEER			6–22
DES	DWN	CKD	DATE
EA	WHO	RAS	8/27/09

DG6–22.DWG



GENERAL NOTES:

1. MANUFACTURED CASING SPACERS ARE REQUIRED AND SHALL BE UNI-FLANGE OR CALPICO INC. PRODUCTS OR AS APPROVED BY THE CITY OF LACEY.
2. THE PIPE LENGTHS SHALL BE 20' WITH A MINIMUM OF 3 CASING SPACERS PER PIPE.
3. THERE SHALL BE NO MORE THAN 1" OF CLEARANCE BETWEEN THE TOP OF THE SPACER TO THE TOP OF THE CASING.
4. ALL JOINTS FOR THE PIPE BEING INSTALLED SHALL BE RESTRAINED.
5. IF PLASTIC PIPE IS ALLOWED BY THE CITY THE RESTRAINTS SHALL BE APPROVED BEFORE IT CAN BE ORDERED.
6. SINCE MOST CASING SPACERS ARE MANUFACTURED WHEN ORDERED ALL OF THE ABOVE INFORMATION SHOULD BE OBTAINED AS EARLY AS POSSIBLE SO THERE IS NO DELAY IN THE PROJECT.

CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

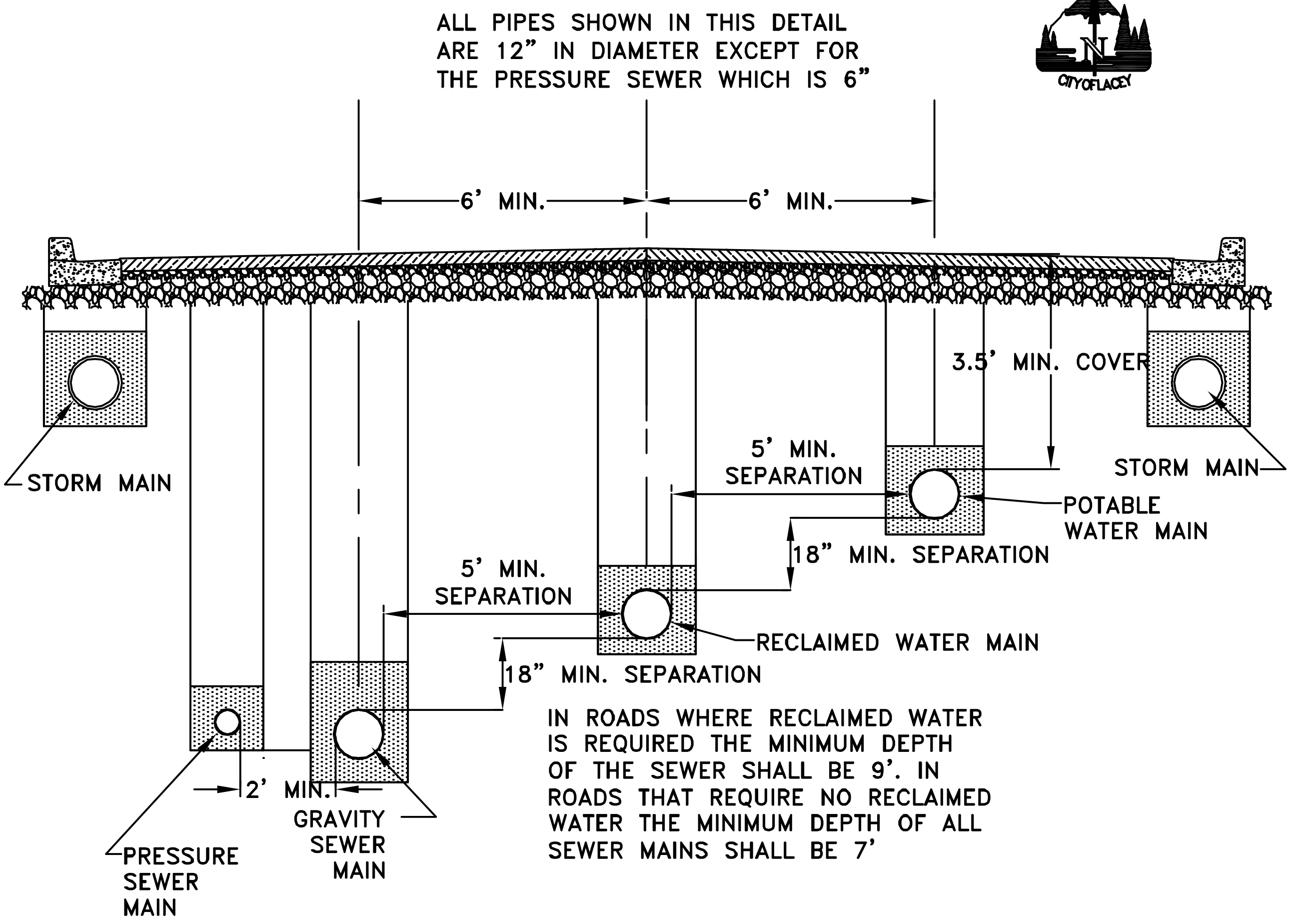
WATER PIPE ENCASEMENT REQUIREMENTS

APPROVED: Ross A. Schoessel (signature)
CITY ENGINEER

DWG. NO. 6-23

DES.	DWN.	CKD	DATE
WHO	WHO	RAS	8/27/09

DG6-23.DWG



GENERAL NOTES:

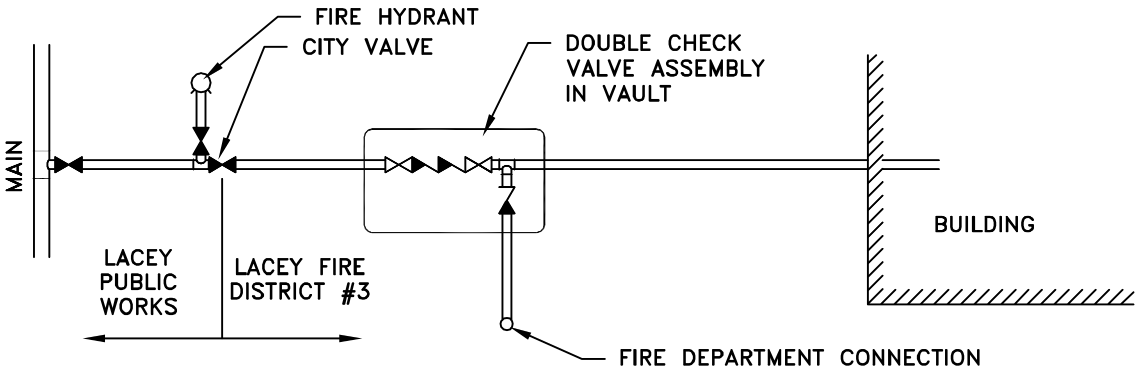
1. THE POTABLE WATER MAIN SHALL BE INSTALLED ON THE NORTH AND EAST SIDE OF THE ROADWAY (6' OFF CENTERLINE).
2. THE SEWER MAIN SHALL BE INSTALLED ON THE SOUTH AND WEST SIDES OF THE ROADWAY (6' OFF CENTERLINE). WHEN THE INSTALLATION REQUIRES BOTH GRAVITY AND PRESSURE SEWER MAINS THE PRESSURE MAIN SHALL BE INSTALLED FURTHER SOUTH OR WEST OF THE GRAVITY SEWER MAIN.
3. THE RECLAIMED WATER MAIN SHALL BE INSTALLED IN THE CENTER OR TO THE SOUTH OR WEST THE CENTER LINE OF THE ROADWAY OR AS DIRECTED BY THE CITY.
4. ALL OF THE ABOVE PIPING SHALL BE INSTALLED IN ORDER OF DESCENDING QUALITY WITH A MINIMUM OF 18" SEPARATION FROM THE BOTTOM OF THE HIGHER PIPE TO THE CROWN OF THE LOWER PIPE. NO DEVIATIONS FROM THIS REQUIREMENT SHALL BE ALLOWED.
5. THE HORIZONTAL SEPARATION WHEN ATTAINABLE SHALL BE 10' FROM THE SPRING LINE OF ONE PIPE TO THE SPRING LINE OF THE NEXT PIPE. WHEN THE 10' SEPARATION IS NOT ATTAINABLE, APPROVAL FROM THE CITY IS REQUIRED TO REDUCE THE SEPARATION REQUIREMENTS TO 5' HORIZONTAL AND 18" VERTICAL.
6. THE DESIGN REQUIREMENT ON THIS SHEET SHALL APPLY TO ALL SITUATIONS WITHIN THE RIGHT-OF-WAY OR EASEMENTS, EXISTING OR PROPOSED.

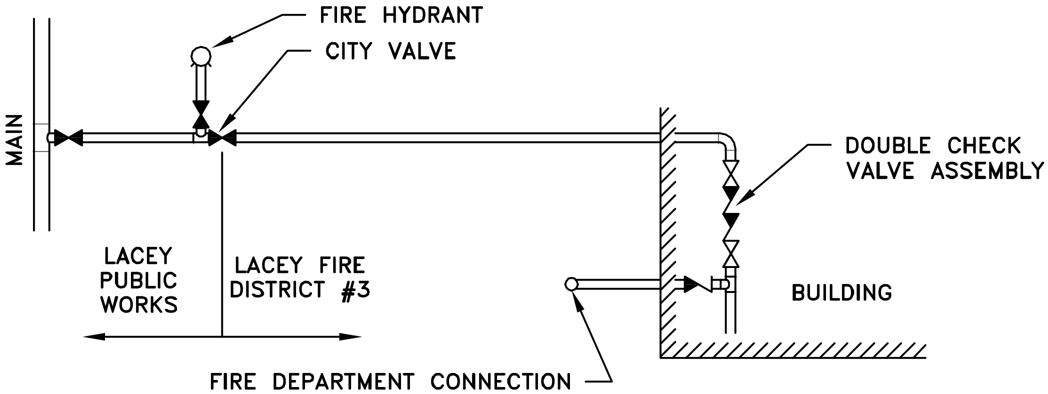
DG6-24.DWG

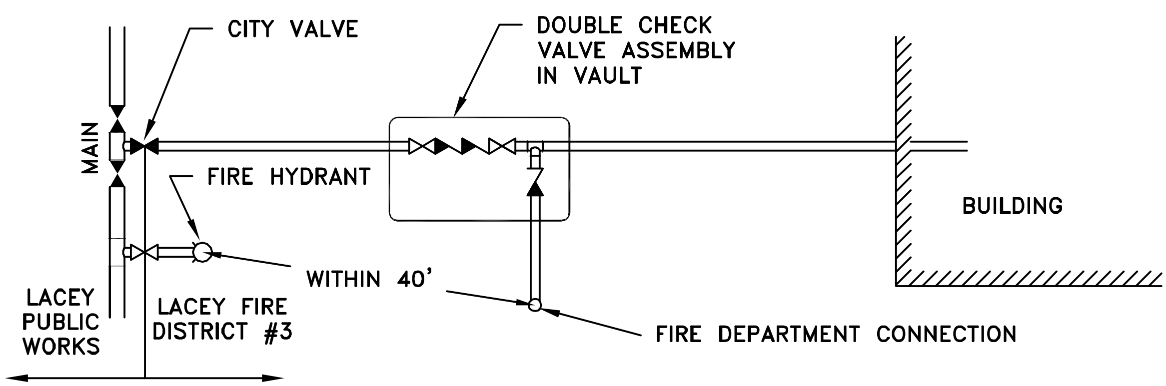
CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

WATER, RECLAIMED WATER, GRAVITY & PRESSURE SEWER PIPE ZONES IN ORDER OF DESCENDING QUALITY

APPROVED			DWG. NO.
Ron A Schoessel CITY ENGINEER			6-24
DES	DWN	CKD	DATE
WHO	WHO	RAS	8/27/09







GENERAL NOTES:

1. THE CITY OF LACEY INSPECTOR SHALL WITNESS THE TESTING OF THE WATER MAINS AND HYDRANTS TO THE CITY'S VALVE. THE REQUIREMENT FOR DISINFECTING AND PURITY SHALL BE PER SECTION 6.200. NOTIFY THE CITY INSPECTOR FOR ALL TESTING THAT IS REQUIRED.
2. ALL FIRE SPRINKLER MAINS SHALL BE DUCTILE IRON CLASS 52.
3. SEE CHAPTER 6.110 FOR MORE INFORMATION ON BACKFLOW PREVENTION.
4. ALL HYDRANTS SHALL BE INSTALLED ON THE UP STREAM SIDE OF THE FIRE LINE CONNECTION.
5. THERE SHALL BE 3 VALVES ON A TEE AND 4 VALVES ON A CROSS WHEN THE CITY'S WATER MAIN SERVICES A FIRE LINE OR AS DEEMED NECESSARY BY THE FIRE MARSHAL.
6. THE FDC SHALL BE LOCATED WITHIN 40' OF A HYDRANT.
7. ALL FIRE SPRINKLER MAINS SHALL BE TESTED AND PURIFIED TO THE 1ST VALVE AT THE DCDA.

CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

FIRE SPRINKLER UNDERGROUND TESTING LIMITS

APPROVED: Ron A Schoessel
CITY ENGINEER

DWG. NO. 6-25.1

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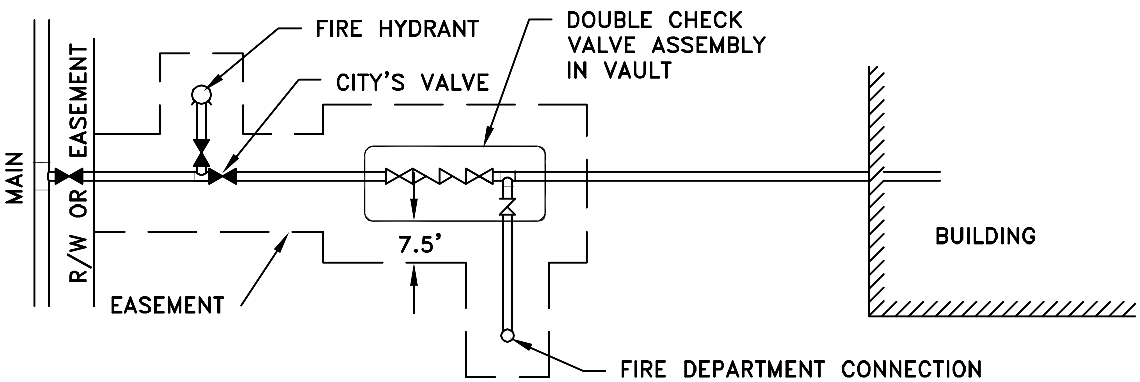
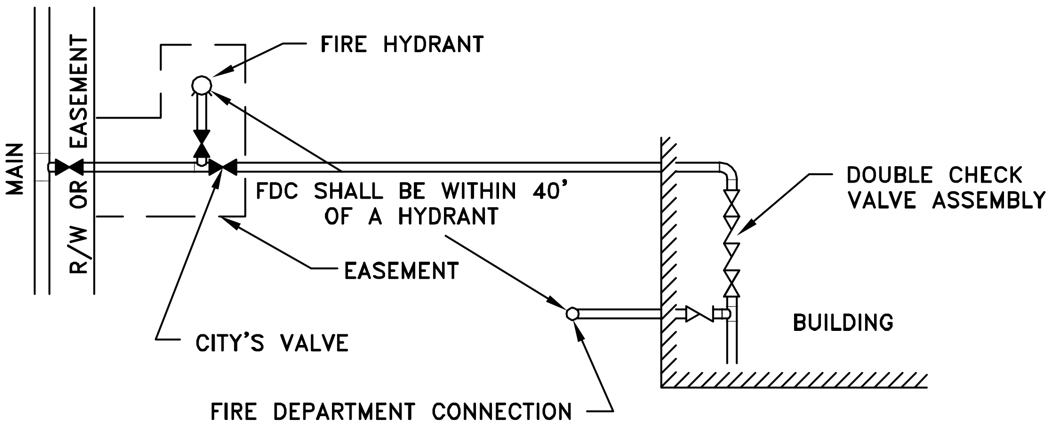
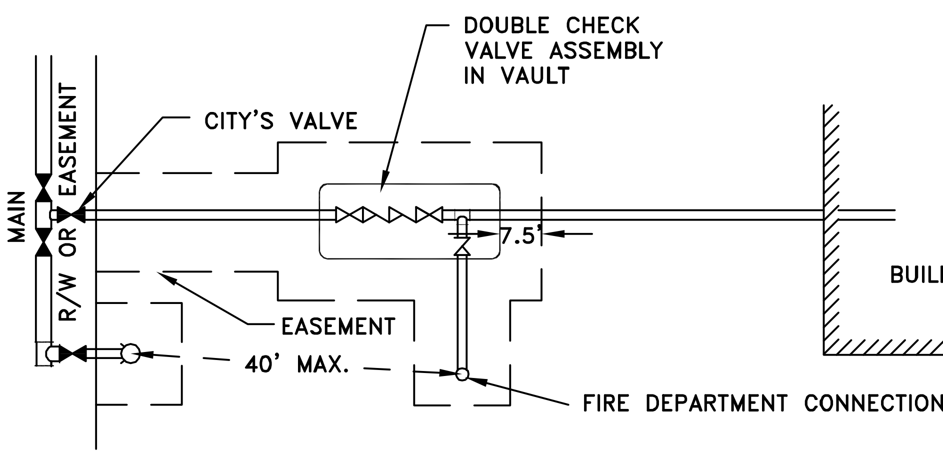
LRW	WHO	RAS	8/27/09

DG6-25.1.DWG







GENERAL NOTES:

1. ALL PIPE EASEMENTS SHALL BE A MINIMUM 15 FEET WIDE WITH THE PIPE CENTERED IN THE EASEMENT.
2. WHEN THE DCVA IS IN A VAULT OUTSIDE THE BUILDING, THE CITY EASEMENT SHALL ENCOMPASS THE VAULT 7.5 FEET OUTSIDE THE PERIMETER OF THE VAULT.
3. WHEN THE DCVA IS LOCATED WITHIN THE BUILDING, THE CITY EASEMENT SHALL END AT THE CITY VALVE.
4. THE FDC SHALL BE LOCATED WITHIN 40' OF A HYDRANT.
5. HYDRANTS SHALL BE PLACED ON THE UP STREAM SIDE OF THE FIRE CONNECTION.

CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

FIRE SPRINKLER UNDERGROUND EASEMENT LIMITS

APPROVED

Roger A Schoessel

CITY ENGINEER

DWG. NO. 6–25.2

DES	DWN	CKD	DATE
LRW	WHO	RAS	8/27/09

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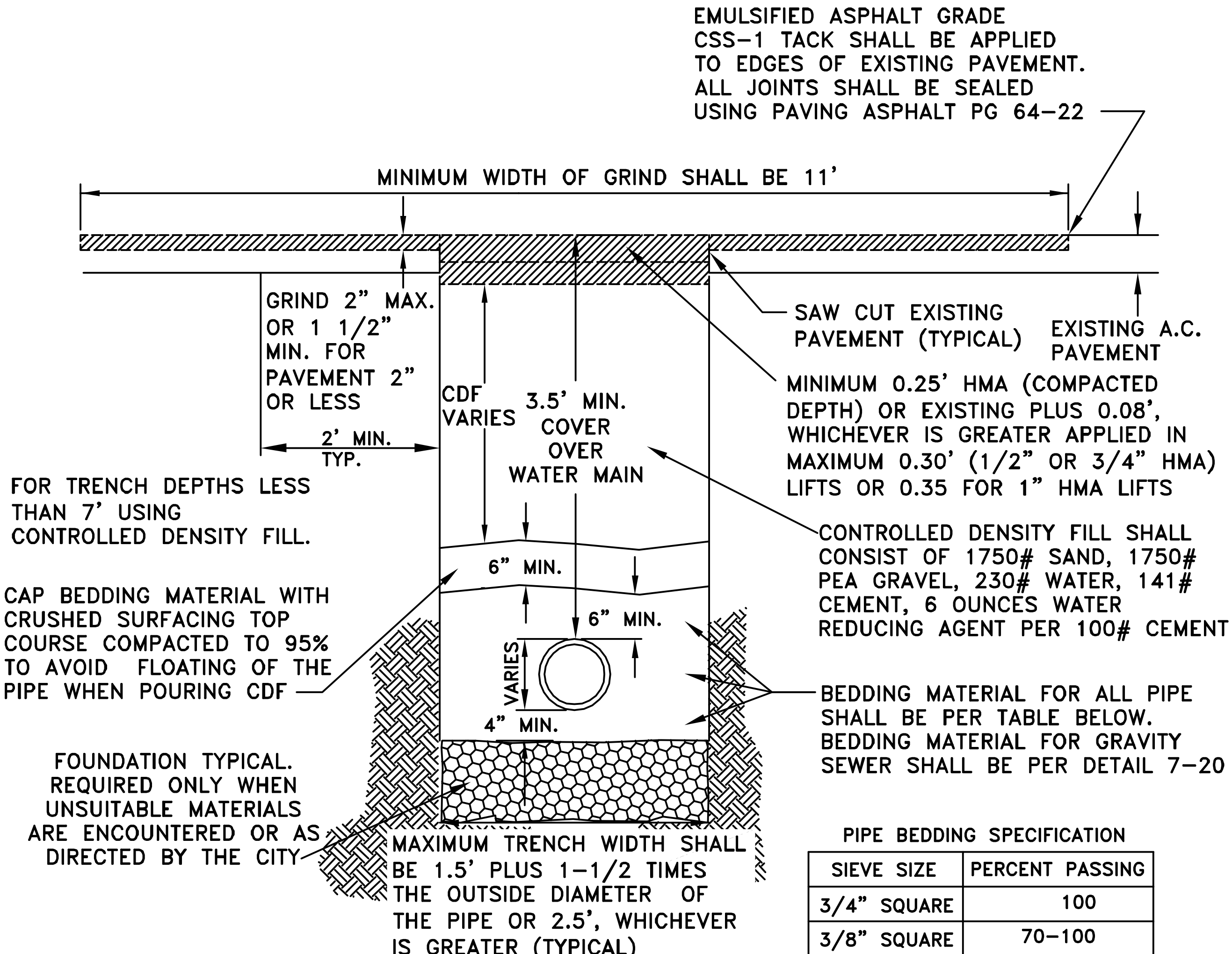


PIPE BEDDING SPECIFICATION

SIEVE SIZE	PERCENT PASSING
3/4" SQUARE	100
3/8" SQUARE	70–100
U.S. NO.4	55–100
U.S. NO. 10	35–95
U.S. NO. 20	20–80
U.S. NO. 40	10–55
U.S. NO. 100	0–10
U.S. NO. 200	0–03

GENERAL NOTES:

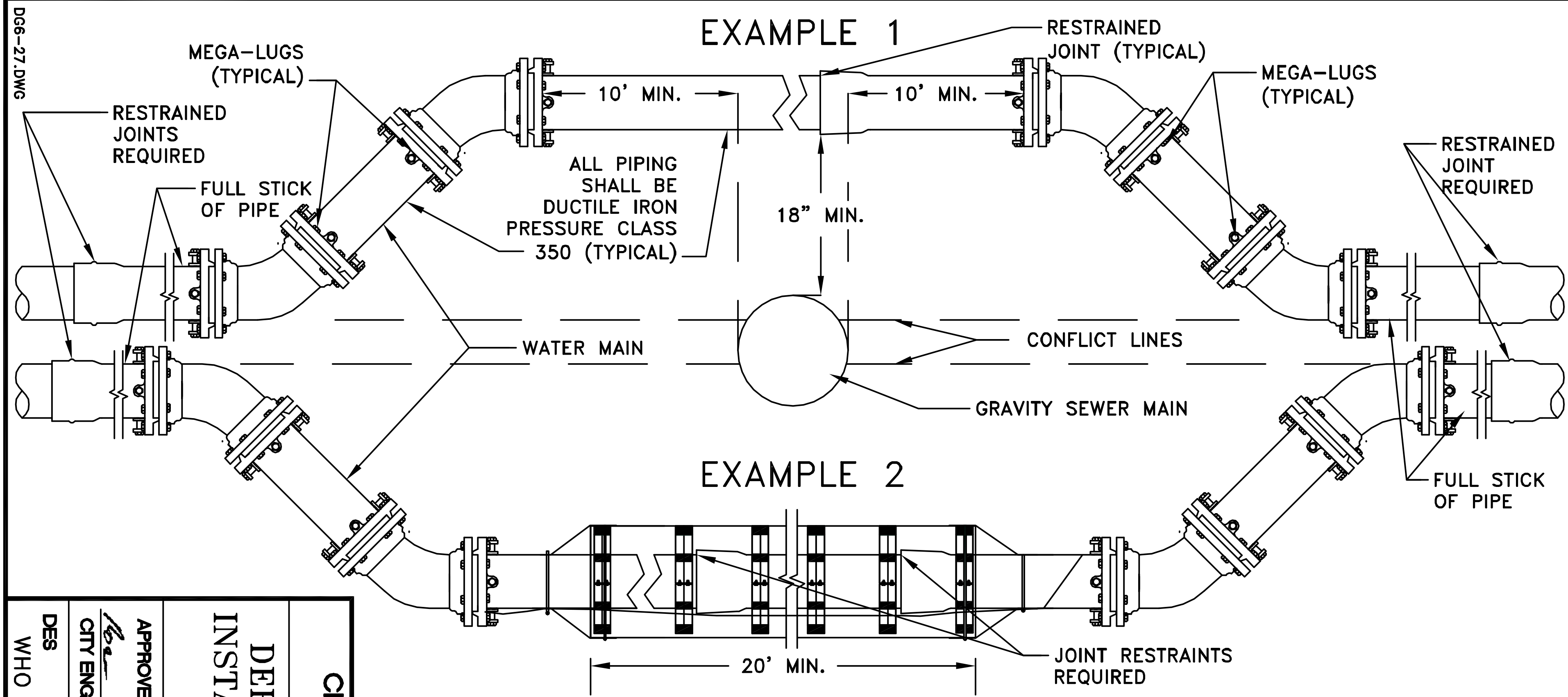
1. ALL MATERIALS EXCEPT H.M.A. SHALL BE COMPACTED IN 6-INCH MAXIMUM LIFTS TO 95% DENSITY AS DETERMINED BY ASTM D1557.
2. ALL MATERIALS, WORKMANSHIP, AND INSTALLATION SHALL BE IN CONFORMANCE WITH THE WSDOT STANDARD SPECIFICATIONS FOR ROAD, BRIDGE AND MUNICIPAL CONSTRUCTION AS AMENDED BY CITY OF LACEY STANDARDS.
3. KEEP TRENCH BOTTOM COMPACTED WITH UNIFORM GRADE. NO TEMPORARY SUPPORTS, I.E. BLOCKS, WILL BE ALLOWED TO SUPPORT PIPE. TRENCH BOTTOM SHALL BE TO GRADE PRIOR TO PIPE INSTALLATION.
4. SAW CUT PAVEMENT TO MAX. TRENCH WIDTH. BACKFILL AND PAVE TO TOP OF EXISTING PAVEMENT FOR TRENCH WIDTH. ALLOW 24 HOURS MINIMUM FOR TRENCH PATCH TO CURE. GRIND AND PAVE FINAL PATCH AS SHOWN.

DG6-26.DWG

CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

PIPE ZONE BEDDING FOR WATER MAINS & SERVICES

APPROVED			DWG. NO.
Ross A Schoessel — CITY ENGINEER			6–26
DES	DWN	CKD	DATE
WHO	WHO	RAS	8/27/09



GENERAL NOTES:

1. THE ENTIRE RUN SHALL BE DUCTILE IRON AND RESTRAINED.
2. FOR CASING REQUIREMENTS SEE DETAIL 6-23.
3. A FULL LENGTH OF PIPE SHALL BE INSTALLED AT BOTH BEGINNING AND END OF THE DEFLECTED RUNS. SEE ABOVE DETAIL.
4. THE FIRST BELL END JOINT AFTER THE DEFLECTED RUNS SHALL BE RESTRAINED.
5. WHEN THE WATER MAIN IS REQUIRED BE INSTALLED OVER THE SEWER MAIN (DEFLECTED) AND DOES NOT MEET THE 18" SEPARATION A CASING SHALL BE INSTALLED USING EXAMPLE 2 AS A GUIDE.
6. THE MINIMUM DEPTH OF THE WATERMAIN SHALL BE 3.5' BUT WHEN DEFLECTING THE WATER MAIN OVER THE SEWER MAIN USING A CASING THE SEPARATION BETWEEN THE BOTTOM OF THE CASING AND THE TOP OF THE SEWER MAIN MAY BE 6".
7. WHEN DEFLECTING THE WATER MAIN OVER THE SEWER MAIN WITHOUT A CASING THE MINIMUM DEPTH OF THE DEFLECTED WATER MAIN MAY BE 3'. THE MINIMUM SEPARATION BETWEEN THE BOTTOM OF THE WATER MAIN AND TOP OF THE SEWER MAIN SHALL BE 18".
8. AT NO TIME SHALL A PRESSURE SEWER MAIN BE INSTALLED OVER THE WATER MAIN OR SERVICE.

CITY OF LACEY, WASHINGTON
DEPT. OF PUBLIC WORKS

DEFLECTED WATER MAIN INSTALLATION FOR GRAVITY SEWER ONLY

APPROVED			DWG. NO.
[signature] CITY ENGINEER			6-27
DES	DWN	CKD	DATE
WHO	WHO	RAS	8/27/09

DG6-27.DWG

Appendix Z
WATER RATE AND CHARGE STUDY

City of Lacey,
Washington

Final Report for

WATER RATE AND GENERAL FACILITIES CHARGES STUDY

Consulting Services Provided by:

FCS GROUP
Solutions-Oriented Consulting

7525 166th Avenue NE, Suite D-215
Redmond, WA 98052
T: 425.867.1802 | F: 425-867-1937

January 2013

www.fcsgroup.com

FCS GROUP
Solutions-Oriented Consulting

January 7, 2013

Mr. Brandon McAllister
City of Lacey
420 College Street SE
Lacey, WA 98509

Transmittal of Study Report:
Water Rate and General Facilities Charges Study

Dear Brandon:

FCS GROUP is pleased to submit our report describing our assumptions, findings and recommendations of the Water Rate and General Facilities Charges Study prepared for the City of Lacey.

Please distribute copies of this document to other City staff and management, as you deem appropriate. A CD-ROM accompanies this document containing electronic versions of the spreadsheet model and a pdf version of the study report.

We greatly appreciate the efforts and support of City staff throughout this study process. It has been a pleasure working with you and other City staff, as well as with the Utilities Committee and Council members. We look forward to assisting you with your future financial / management needs. Any questions or commentary regarding this report can be directed to me at 425-867-1802, ext. 241, or karynj@fcsgroup.com.

Sincerely,

Karyn Johnson
Principal

TABLE OF CONTENTS

SECTION 1
STUDY FRAMEWORK

A. INTRODUCTION

The City of Lacey (City) retained FCS GROUP to complete a Water Rate and General Facilities Charge (GFC) study for its water system. The scope of this study included the following major elements:

- Financial policies development
- General facilities charges (GFC) update
- Revenue requirement forecast
- Removal of fire protection costs from rates
- Cost of service analysis
- Rate structure evaluation

These scope elements are addressed throughout each section described in this report.

B. METHODOLOGY

The methods used to complete our work are based on analytical principals that are generally accepted and widely followed throughout the industry – rates and charges must generate enough revenue to maintain a self-supporting and financially viable utility without undue discrimination toward or against any customer.

We worked closely with the City to develop a six-year rate strategy (2012-2017) that recovers the forecasted costs of utility operations, complies with legal requirements and industry practices, supports City pricing goals, and remains affordable to customers. This report summarizes our assumptions, findings and recommendations for the study and documents City implementation.

This study process involved several iterations of data analyses and the development of scenarios for rate and charge increase strategies and customer class rate structures. Meetings were held with City staff to validate input parameters, review interim findings, and receive policy direction. Draft results were presented to the Utilities Committee for comment with final results presented to City Council for consideration.

C. REPORT ORGANIZATION

The remainder of this report provides separate sections for Policy Development (Section 2), General Facilities Charges (Section 3); Revenue Requirements (Section 4); Removal of Fire Protection Costs; and Proposed Rates (Section 5). The technical appendix contains the analytical detail supporting study conclusions and study presentation materials.

SECTION 2
POLICY DEVELOPMENT

The purpose of establishing financial policies for the water utility is to promote the financial integrity and stability of the utility and to provide for the sustainability of essential utility services. These policies form the foundation of utility management and, with routine application, can act as overarching guidelines for consistent decision making.

Some financial policies are imposed by outside sources (minimum debt service coverage, bond reserves, and regulatory compliance) while other policies are specific to the agency and its utility (discretionary reserve levels, reinvestment protocols, use of debt). We have presented policies in this section that should help the City achieve financial and rate stability from year-to-year. In developing the revenue requirement forecast presented in Section 4, we have incorporated the fiscal policies discussed below.

A. FUND ACCOUNTING

From an industry and financial management perspective, cash balances are a necessary and appropriate part of prudent utility management practices. Within each utility enterprise, appropriate segregation of monies should be established and maintained to provide adequate controls as to the sources and uses of funds. This practice helps to ensure that funds raised through the utility are applied to the appropriate purposes, and that equity attained through rate and charge structures is maintained in application. Above all, the City should establish and maintain a financial structure that provides for adequate and predictable revenues to meet the forecasted needs and operational, legal, and policy objectives of its utility system.

The City maintains a separate fund for the water utility and segregates account balances for cash, investments, capital and restricted debt reserves. The rate management strategy presented in this study presumes that the water utility will continue to operate as a self-supporting enterprise fund. This means water utility-specific rates and charges have been designed to recover the forecasted costs and financial obligations of the water system– without subsidy from other City utilities or City general fund revenue sources, such as property taxes.

1. Operating Reserves

The operating reserve is designed to provide a liquidity cushion to provide for financial viability of the water utility despite short-term variability in revenues and expenses, primarily caused by seasonal fluctuations in billings and receipts, unanticipated cash operating expenses, or lower than expected revenue collections. Target funding levels are generally expressed in number of days' operating and maintenance (O&M) expenses, with the minimum requirement varying with the expected risk of unanticipated needs or revenue volatility. Consistent with general industry guidelines, this study established water utility reserves of 60 to 90 days.

The operating reserve target should be as of December 31st of each calendar year, with the balance expected to vary during the course of the year. Generally, in any year where operating reserves exceed the maximum target, we recommend using the excess cash to help pay for capital projects. This can be accomplished by calculating the target balance at year end (e.g. 90/365 x actual O&M expense for the year) and comparing it against the actual ending cash balance. If the actual balance is greater than the target, the difference is transferred to the water utility capital account. The rate strategy presented herein complies with the proposed target balance threshold.

2. Capital Contingency Reserves

A capital contingency reserve is an amount of cash set aside in case of an emergency, should a major piece of equipment or a portion of the utility's infrastructure fail unexpectedly. Additionally, the reserve could be used for other unanticipated capital needs or capital cost overruns. These reserves are not intended to cover the cost of system-wide failures resulting from catastrophic events; a more common practice is to carry property and casualty insurance for such purposes. The capital account holds debt proceeds, GFC revenues, system reinvestment funding from rates, and any transfers of cash reserves from the operating account.

Common industry practice is to maintain a minimum balance in the capital account equal to 1% to 2% of system fixed assets. For this study, we assume that cash from rates for system reinvestment funding and surplus cash from the operating account will be transferred to the capital account and become available for capital use in that year. The rate management strategy presented herein complies with the above established target balance threshold. The capital reserve does not have a direct impact on rates. It is essentially "nested" with the policy to fund annual system reinvestment from rates.

3. Restricted Debt Reserves

When issuing revenue bonds, underwriters require the municipality to establish and maintain a restricted cash reserve for the utility through the term of debt repayment. The purpose of a debt reserve is to provide one safeguard for bondholders, in the event the utility has insufficient funds to meet annual debt service payments. This reserve is generally equal to one year's debt service payment for each bond issue. The reserve can be used to fund the last year's debt service payment for each issue.

The City has no outstanding revenue bonds for the water utility. The rate management strategy presented in this study conservatively presumes that the City will use revenue bonds for future debt-financing needs. Reserves have been incorporated for each future bond issue (assumed to be funded with debt proceeds equal to one year's principal and interest payment). The City will pursue low-cost loans to reduce future bond financing requirements.

B. System Reinvestment Funding

The purpose of system replacement funding is to provide for the replacement of aging system facilities to ensure sustainability of the system for ongoing operations. A common approach of municipal utilities is to incorporate a replacement funding (or equity accumulation) mechanism based on annual depreciation expense as a reasonable level of reinvestment in the system.

Annual depreciation is a non-cash expense intended to recognize the consumption of utility assets over their useful lives. Collecting the amount of annual depreciation expense through rates provides a funding source for capital expenditures, especially those related to repair and replacement of existing utility plant. Further, funding depreciation through rates helps to ensure that existing ratepayers pay for the use of the assets serving them, with the cash flow funding at least a portion of the eventual replacement of those assets. As an alternative to full depreciation funding, depreciation funding net of outstanding debt principal is sometimes used as a relatively moderate replacement funding strategy. This approach recognizes that the utility improves its financial condition through reducing liabilities, such as debt, and augments this through the incremental difference to full depreciation funding. This method most directly relates to a financial "break-even" in terms of profit or loss, mitigates the rate impacts of replacement funding, and avoids overly burdening existing ratepayers with the payment of debt and funding for future asset replacement at the same time.

The City's current practice is to set aside 15% of annual rate revenues for replacement funding. The rate management strategy developed for this study incorporates system reinvestment funding from rates using the depreciation "net debt" funding approach, phased in over the study period. This approach equates closer to 20%-25% of rate revenue.

C. Debt Service Coverage Requirements

When a municipality issues revenue bonds (and other types of debt instruments), it agrees to certain terms and conditions related to the repayment of those bonds. One of those terms is referred to as bond coverage. Simply put, the agency agrees to collect enough in annual system revenues to meet all operating expenses and not only pay debt service, but actually collect an additional multiple of that debt service. Bond coverage ratios typically range from 1.10 to 1.50, meaning that the agency would collect expenses plus 1.10 to 1.50 times revenue bond debt service as a minimum legal level of revenues. The stated coverage factor is a minimum requirement – meaning anything less than this level would be a technical default of the bond covenant.

The rate management strategy presented for this rate study applies a coverage test of 1.25 times annual revenue bond debt service, excluding GFC revenues. Revenue generated above cash needs to comply with coverage requirements may be used for capital purposes, and thus reduce future borrowing needs. Note that the cash needs of the water utility drive the indicated rate increases. No incremental funding for debt coverage is required for the study period.

D. Use of General Facilities Charge (GFC) Revenues

GFCs are charges assessed on new development rather than from the existing customer base. Because of the variability in customer growth from year to year, the annual revenue stream can be unreliable and subject to wide fluctuations. The City should estimate and budget GFC revenues based on long-term growth estimates, recent growth experience, and the scale of known development planned or underway. The purpose is to establish a reasonable and conservative estimate of potential GFC revenue collections.

GFC revenue should be deposited in the capital account and made available for capital purposes only. GFCs can legally be used in two ways – they can be applied to capital project costs directly (reducing the amount of debt issued), or they can be applied toward annual debt service payments. FCS GROUP recommends that, as a general policy, GFC revenues be used to directly fund capital expenditures. This practice serves to mitigate the risk of relying on this volatile revenue source to pay debt obligations. Per City policy direction, the sewer utility interfund loan will be repaid with GFCs.

E. Capital Program Funding / Debt Management

In conjunction with establishing or planning its capital program, the City should develop a corresponding capital-financing plan that supports execution of that program. This program should incorporate system replacement and rehabilitation, system upgrade and improvement, and system expansion. The policy intent is to establish an integrated capital funding strategy that considers best management practices for debt management.

1. Capital Funding

Utilities can typically draw funds for capital projects from a variety of sources:

- Grants
- Developer contributions
- General facilities charges
- System reinvestment funding
- Direct funding from rates
- Other capital revenues
- Debt

Given these potential funding sources, utilities often find themselves choosing between funding sources when establishing a capital financing plan. While available grants and developer contributions would logically be applied to project costs first, the next choice in the funding "hierarchy" is not necessarily apparent.

The specific decision regarding whether to fund projects by cash or debt is an important policy decision that will likely be driven by a number of considerations. Cash funding might be cheaper in the long-run because there is no interest, but debt funding could be the more practical option since it allows for the payment of project costs over an extended period of time. In addition, using debt to spread the cost over time will help ensure that future customers pay for their fair share of system costs.

Finding the appropriate balance of cash / debt financing requires an evaluation of debt management policies discussed below.

2. Debt Management

Historically, the City has funded capital projects through a combination of "pay-as-you-go" cash funding (cash reserves, GFCs, rates) and debt issuance. Excessive use of debt is unfavorable for a utility, and can damage the utility's credit rating, reducing its ability to acquire low-cost debt in the future. On the other hand, "pay-as-you-go" funding might create excessive burdens for existing customers, raising questions of practicality and equity between current and future customers.

Industry best practices (and bond underwriter's preference) suggest that municipalities should maintain a debt-to-equity ratio (total debt divided by the sum of total debt and equity) of no greater than 50% debt and 50% equity (cash). The only debt for the water utility is a $10 million interfund loan from the sewer utility – affording capacity to fund near-term capital projects through debt instruments.

The rate management strategy presented for this study presumes the City will fund its capital programs first, with available capital cash resources (generated from GFCs, system reinvestment funding, and transfers from the operating account in excess of the targeted balance threshold) and next with the use of debt. As a point of reference, the current capital program (2012 – 2017) is forecasted to be funded 43% from debt and 57% from cash resources; thus, expected to remain well within industry guidelines over the study period.

F. Cumulative Impact of Fiscal Policies

Satisfying all of these policy objectives might seem daunting at first, but the outcome is that multiple benchmarks overlap, resulting in the simultaneous achievement of multiple objectives within the same level of rates. For example, the policy for system reinvestment funding through rates serves several beneficial purposes: it provides a cash resource to the capital account that helps maintain the recommended capital contingency reserve; it contributes to the cash funding of capital, helping to maintain a healthy debt-to-equity ratio; and it may help to provide the additional level of rate revenues necessary to meet the incremental debt service coverage requirement.

Each criterion provides a different perspective on how much revenue is appropriate, and satisfying them all generally results in a higher rate than if only a single standard is considered. However, this approach reduces financial risk and increases financial stability – any near term increases that result will help to promote more stable, and lower, long-term rates.

SECTION 3
GENERAL FACILITIES CHARGES

A connection charge, provided for by RCW 35.92.025, is a charge imposed on new development as a condition of connection to the water system or when increasing the capacity of an existing connection. In general, the purpose of a connection charge is to mitigate the impact of growth on the water system, or to compensate for investments already made to provide available capacity to serve future growth. The City's connection charges are referred to as general facilities charges (GFCs).

Revenues generated from connection charges can be used to directly fund capital projects or to pay debt service incurred to finance capital projects - but *cannot* be used to pay operating and maintenance costs. As noted previously, per City policy direction, debt service payment for the sewer utility interfund loan will paid with GFCs.

A. METHODOLOGY

There are several documented approaches to establish a connection charge that are legally defensible if designed properly. Within the range of legally defensible approaches, the choice of the costs the City targets is a matter of policy. It is important that the City follow a methodical and rational approach to consistently determine and implement cost-based connection charges. The most common approaches used in calculating connection charges are: (1) System Buy-In Approach, (2) Average Cost Approach, and (3) Integrated Cost Approach. While all three methods adhere to acceptable industry standards, each focuses on different capital and capacity components of the system as a means of defining an "equitable" capital contribution. Based on City direction, this study used the integrated cost approach for calculating the charges.

In short, this approach recognizes that systems sometimes commit existing capacity but must add incremental elements of capacity to augment or extend the existing system. This approach effectively discounts the buy-in to the existing system by allocating existing system costs to all customers, but adds an increment for future expansion projects. The increment for future costs is computed by dividing the costs related to capacity expansion projects by the growth to be served by that incremental capacity. The components included in the calculation of the charge are described below.

1. Existing Cost Basis

Legal interpretations of state statutes have provided guidelines for connection charges, which suggest that such charges should reflect the actual original cost of the utility system, and can include interest on that cost at the rate of interest applicable at the time of facility construction for up to a 10-year period, not to exceed 100 percent of the construction costs. This cost should be net of donated facilities and non-utility cash payments, whether from grants, developers or through Local Improvement District assessments. Although not required by state law, outstanding debt principal (net of existing cash balances) is often subtracted from this cost basis to avoid double-charging in recognition that debt service is repaid through rates.

2. Future Cost Basis

The future cost basis component of the charge is intended to recover the costs of planned capacity increasing projects that will serve new customers. Projects directly funded by grants, developer contributions or assessments are not included in the calculation.

In the absence of specific regulation for cities, the planning horizon for the capital program to be used in the calculation is debatable. The key consideration in determining an appropriate planning horizon is to maintain consistency between the capital construction (and related costs) that will be incurred and the system capacity that will be available to serve growth commensurate with that construction. The 20-year capital improvement program (2011 – 2029) was used in the calculation of the updated GFC.

3. Customer Base / System Capacity

The customer base used in the calculation of the charge is typically expressed in terms of equivalent residential units that can be supported by the system capacity. This concept charges customers based on the potential demand that they will place on the system. Based on current customer records and growth projections from the Comprehensive Water System Plan (CWSP), existing, incremental and total customer equivalents were calculated.

4. Calculation of Charges

The connection charge is calculated as follows: Existing cost basis divided by the total customer base plus the future cost basis divided by the incremental customer base. The calculated charge represents the maximum allowable charge - the City may choose to implement a charge at any level up to the calculated charge.

It is important to note that the calculated connection charges are expressed in terms of current dollars. In other words, the calculated charges will only recover an equitable share of costs from new customers connecting to the system in the first year of implementation. A customer connecting in the following year should pay a charge that reflects the cumulative system investment at the time they connect. This would include:

- Assets added to the system during the current year
- An extra year of interest accrued
- Updated costs for construction-work-in-progress and capacity increasing capital projects

Given these considerations, the calculated charges would not recover a fair share of costs from customers connecting in subsequent years.

The City could potentially address this concern in several ways:

- Recalculate the charges annually,
- Build a provision for inflation into the connection charges, or
- Compute the charges in current dollars and adjust annually for inflation (recommended).

Calculating the connection charges annually is the most accurate method, but might not be practical given the amount of effort required. FCS GROUP recommends that the City update it charges commensurate with updates to its comprehensive water system plan. In between updates, we suggest adopting a policy for annual inflationary adjustments to the charges, based on established sources, such as the *Engineering News Record's* "Construction Cost Index". This practice facilitates both appropriate cost recovery and increased equity.

B. RESULTS

Results of the connection charge analysis are summarized in this section. Additional detail identifying specific assets and eligible capital projects is provided in the technical appendix.

The current (2012) water GFC is $4,850 per meter capacity equivalent (5/8 or 3/4-inch meter) and increases with meter size.

The water system currently serves 25,942 customer equivalents. Based on estimates provided by the City's consulting engineer, incremental growth over the study period is assumed at 11,271, for a total customer base of 37,212 by year 2029.

Based on financial records, water system assets equal $76.4 million (including construction-work-in-progress and net of contributed assets). Adding interest accumulation of $26.9 million yields an existing cost basis of $103.3 million. No debt deduction was required. Dividing by the total estimated customer base of 37,212 results in an existing cost component of $2,776.

The City and its consulting engineer identified projects or portions of projects that will increase system capacity - totaling $41 million over the 20-year period. Diving by the incremental customer base of 11,271, results in a future cost component of $3,636.

The sum of the two components yields a maximum allowable GFC of $6,412.

A comparison of existing and proposed GFCs is shown in Exhibit 3-1.

Exhibit 3-1: Schedule of Existing and Proposed GFCs

Meter Size	2012 GFC [a]	Meter Capacity Ratio [b]	Proposed GFC
5/8-inch	4,850	1.00	$ 6,412
1-inch	9,719	2.00	12,847
1 1/2-inch	19,353	3.99	25,581
2-inch	31,606	6.52	41,779
3-inch	59,629	12.29	78,822
4-inch	99,382	20.49	131,370
6-inch	198,560	40.94	262,469

[a] Source: Ord. 1308, 2008. 2008 schedule of charges increased by ENR or 6% per ordinance.

As authorized under LMC 13.32.005.

[b] Based on City's current meter capacity ratio

C. City Implementation

City Council direction was to continue the current policy of 6.0% annual increases, to be applied to the existing charge until such time as it reaches the calculated maximum allowable charge of $6,412.

SECTION 4
REVENUE REQUIREMENTS

The revenue requirement analysis forms the basis for a long-range financial plan and multi-year rate management strategy. It also forms the basis for the City to set utility rate structures that are rooted in the "costs-of-service" and which fully recover the total costs of operating the utility: capital improvement and replacement, operations, maintenance, general administration, and fiscal policy attainment. Linking utility rate levels to a financial plan such as this helps to enable not only sound financial performance for the water utility, but also, a clear and reasonable relationship between the costs imposed on water system customers and the costs incurred to provide them the service.

A. METHODOLOGY

The financial plan includes the following core elements, which together, form a complete portrayal of the water system's financial obligations:

- *Capital Funding Analysis* – Defines a strategy for funding the water system capital improvement program including an analysis of available resources from rate revenues, general facilities charges, debt financing, and any special resources (e.g., grants, developer participation, etc.).
- *Operating Forecast* – Identifies future annual non-capital costs associated with the operation, maintenance, and administration of the water system.
- *Sufficiency Testing* – Evaluates the sufficiency of utility revenues in meeting all obligations, including cash uses such as operating expenses, debt service, capital outlays, and reserve contributions, as well as any coverage requirements associated with long-term debt.
- *Rate Strategy Development* – Designs a forward-looking strategy for adjusting utility resources to fully fund all utility obligations on an annual or periodic basis over the forecast period.
- *Reserve Analysis* – Forecasts cash flow and fund balance activity in utility reserves. Tests for satisfaction of recommended minimum fund balance policies (as discussed in Section 2 – Policy Development).

From this foundation, utility rate structures can be adjusted to meet the defined annual and long-term funding targets, as well as the City's pricing objectives.

The financial plan was developed for the planning period 2012 through 2016. The approach used for each core element of the financial plan is described below.

1. Capital Projects and Funding

The capital funding analysis identifies the costs of capital projects and summarizes funding sources available to help meet those costs. In other words, total sources of funds must at least equal capital expenditures and provide for the targeted level of capital reserve funding.

The first step is to estimate current day costs of capital improvements and replacement needs over the study period. The City's recently completed comprehensive water system plan (CWSP) provided the basis for the annual capital improvements and replacement needs over the study period. Adjustments were made by City staff to capital projects and timing to mitigate near term rate impacts. These capital projects were provided in current day dollars and escalated to year of construction using an annual inflation factor of 4.0% (based on the construction cost index as published by Engineering News Record).

With the system's capital needs defined, the next step is to identify the sources of funding available to help the City meet those needs. Potential sources include grants, developer contributions, and capital reserves (including GFC revenues and system reinvestment funding). Debt can be issued to cover any costs not met by these other funding sources.

The capital financing strategy developed for this study utilizes the following hierarchy of funding sources:

- Capital projects are first funded with available grants, developer contributions and/or other outside sources.
- Capital needs are next funded with available capital cash resources generated from GFCs, system reinvestment funding from rates, transfers from the operating account, and interest earnings on capital account balances.
- Capital needs not met from the above cash resources will be funded with debt. The City will regularly pursue low-cost state loans, but unless loan approval is reasonably expected, the financing strategy assumes the issuance of revenue bonds.

Debt service payments are assumed to begin in the year debt is issued. Current financing terms for revenue bonds assume a 20-year repayment period; 5.0% rate of interest (based on prevailing rates from the Bond Buyer Index at the time of the study); 1.0% issuance cost; and debt service coverage of 1.25.

2. Operating Forecast

The operating forecast focuses on annual expenses incurred to operate, maintain, and manage the water utility and annual revenue collections to meet those expenses. The baseline for this forecast is the 2012 operating budget, adjusted for future years to incorporate cost escalation, growth, and known or anticipated future expenditures. Operating and maintenance (O&M) costs generally go up over time due to inflation. For this study, a general inflation rate of 3.0% was used. Employee benefits are escalated at a higher rate of 6.0% to recognize historical cost increases above the rate of general inflation.

Operating revenues are forecasted based on a combination of customer growth, interest earnings rates and general inflation. Customer growth is estimated at 1.25% per year for the study period, slightly lower than the CWSP growth projections in order to remain conservative in our rate forecast. Interest earnings on cash balances are ramped up from 0.15% to 1.0% over the study period.

3. Revenue Needs Assessment

After forecasting the complete array of obligations facing the utility, those costs are compared to forecasted revenues – comprised primarily by rate revenues – at their current levels. Rate revenues are increased over the forecast period by the incremental revenues presumed to be generated from estimated customer growth.

When comparing utility obligations with available resources, we have examined sufficiency from two perspectives: cash sufficiency and debt coverage sufficiency.

- The *"Cash Test"* focuses on cash resources compared to cash obligations. Cash resources in this test include rate revenue, miscellaneous operating revenue, and interest earnings in the operating account. Cash obligations include operating expenses, debt service, system reinvestment funding from rates, and any contributions to the operating account to achieve minimum balance thresholds. If these cash obligations exceed resources available, a rate increase is required to fully fund the needs of the utility.
- The *"Coverage Test"* refers to the ability of the utility to meet debt covenants (or established internal policies) which require utility revenue streams to satisfy a specific margin. The coverage test evaluates revenues and expenses somewhat differently than under the cash test. For the coverage test, obligations include operating expenses (net of internal utility taxes), revenue bond debt service, and incremental debt service coverage (25% of annual revenue bond debt service). In addition to the revenues included in the cash test, the coverage test allows for the inclusion of interest earnings from all utility accounts (operating account, capital account, and any restricted reserve accounts), and often allows for annual general facilities charge revenues (excluded for this study to remain conservative). This test does not allow for the use of cash reserves in meeting annual coverage obligations.

In determining the revenue requirements, both the cash and coverage sufficiency tests must be met. If a rate revenue deficiency exists under both tests, the analysis adds the greatest deficiency to the forecasted rate revenue. This yields the total rate revenue requirement for any given year. The analysis uses the revenue requirement to indicate system-wide annual rate revenue adjustments for the water utility and to drive the cost of service analysis.

B. Results

Results of the revenue requirement analysis are summarized in this section. Additional detail can be viewed in the technical appendix (e.g., detailed listings of capital projects, budgeted revenue and expense line items, inflows and outflows of fund balances, etc.).

1. Capital Funding Strategy

Over the six-year forecast, the water system faces a total of $44.0 million (escalated) in capital program costs. Of this total, 37% is for replacement projects, 12% for system improvements /upgrades, and 51% for system expansion.

The capital funding plan presumes that the capital program will be funded through a combination of cash resources and debt issuance. Based on our analysis, 30% ($13.2 million) of the total capital program can be funded with system reinvestment funding from rates; 16% ($6.9 million) from GFCs, net of monies used to pay debt service; 11% ($5.0 million) from cash reserves; and 43% ($18.9 million) from revenue bonds. Exhibit 4-1 summarizes annual planned capital expenditures, along with assumed funding sources.

Exhibit 4-1: Capital Projects and Funding Sources

Capital Funding		2012	2013	2014	2015	2016	2017	6-Year Total (2012-2017)
Total Capital Projects	**2011 Dollars:**	**6,398,312**	**9,431,000**	**5,717,000**	**9,190,000**	**2,740,000**	**5,255,000**	**38,731,312**
	Escalated:	**6,654,244**	**10,200,570**	**6,430,847**	**10,751,000**	**3,333,629**	**6,649,251**	**44,019,542**
System Reinvestment Funding		1,558,802	1,763,058	2,166,917	2,356,339	2,818,358	2,543,342	13,206,817
Net General Facilities Charge Revenues		1,087,848	1,174,475	1,265,623	1,244,661	515,271	1,568,655	6,856,533
Cash Reserves		4,007,595	-	1,011,344	-	-	-	5,018,939
Revenue Bonds		-	7,263,036	1,986,964	7,150,000	(0)	2,537,254	18,937,254
Total Funding Sources		**$ 6,654,244**	**$ 10,200,570**	**$ 6,430,847**	**$ 10,751,000**	**$ 3,333,629**	**$ 6,649,251**	**$ 44,019,542**

It should be emphasized that this capital funding strategy presumes implementation of the system reinvestment funding policy at the level described in Section 2 – Policy Development. Forecasted revenues from GFCs were based on assumed customer growth. Therefore, any changes from these sources or changes in the amount of planned annual capital expenditures could impact this capital funding strategy.

2. Operating Forecast

Expenses

The water utility's total operating expenditures are forecasted to increase from $10.0 million in 2012 to $14.8 million per year (inclusive of inflation effects) by the end of the study period. The annual forecast is provided in Exhibit 4-2. In addition to O&M expenditures, existing and new annual debt service payments are forecasted over the planning horizon. Existing debt service payment schedules were provided by City staff and include repayment of the interfund loan from the sewer utility. Future years' debt service incorporates impacts of the capital funding strategy. Incremental debt service incurred to finance the capital program will begin in 2013 at about $816,000 and reach $2.2 million by the end of the study period.

Revenues

Water operating revenues are categorized as rate revenues and non-rate revenues. The revenue forecast relied on a combination of historical revenue collection, budgeted line items, customer growth, and cost escalation. The annual forecast is provided in Exhibit 4-2. In summary:

RATE REVENUES UNDER EXISTING RATES:

Year 2012 rate revenue is calculated from 2010 customer statistics and includes customer growth and the adopted 4% rate increase. Future years' incorporate estimated annual customer growth.

NON-RATE REVENUES:

Non-rate revenues include City utility tax revenues, currently at 6.0% of rate revenues; miscellaneous utility charges; use of GFCs to pay debt service; and transfers from the General Fund to pay fire protection costs, adjusted for future years (discussed further in the next section).

3. Revenue Needs Assessment

The water utility faces $75.8 million in total cash obligations over the study period, including operating expenses, existing and new debt service, and system reinvestment funding. Revenues (prior to rate increases) are forecasted at $68.0 million over the same time period - yielding a deficit of $7.8 million over the study period. In addition to the 4.0% adopted 2012 increase, the utility will need 6.5% increases for each year 2013-2017 to make up the shortfall and provide for the recommended cash balance target. The annual forecast is provided in Exhibit 4-2.

Major cost drivers include capital program funding (debt service payments and system reinvestment funding) and annual cost escalation.

Exhibit 4-2: Revenue Requirements and Reserves Analysis

Revenue Requirements	2012	2013	2014	2015	2016	2017
Revenues						
Rate Revenues Under Existing Rates	$ 9,352,519	$ 8,958,741	$ 9,070,725	$ 9,184,109	$ 9,298,910	$ 9,415,147
Transfer In from Gen. Fund for Fire	-	510,685	517,068	523,532	530,076	536,702
Non-Rate Revenues	1,207,800	1,121,948	1,135,886	1,151,209	1,161,157	1,169,707
Use of GFCs for Debt Service	521,681	520,359	519,037	517,715	516,393	515,071
Total Revenues	**$ 11,082,000**	**$ 11,111,733**	**$ 11,242,716**	**$ 11,376,565**	**$ 11,506,536**	**$ 11,636,626**
Expenses						
Cash Operating Expenses	$7,925,976	$8,385,904	$8,662,895	$8,934,938	$9,250,183	$ 9,541,073
Existing Debt Service	521,681	520,359	519,037	517,715	516,393	515,071
Debt Service - New Revenue Bonds	-	815,870	815,870	1,446,516	1,446,516	2,231,515
Rate Funded System Reinvestment	1,558,802	1,763,058	2,166,917	2,356,339	2,818,358	2,543,342
Total Expenses	**$ 10,006,459**	**$ 11,485,191**	**$ 12,164,718**	**$ 13,255,507**	**$ 14,031,449**	**$ 14,831,001**
Annual Surplus / (Deficiency)	**$ 1,075,541**	**$ (373,459)**	**$ (922,002)**	**$ (1,878,942)**	**$ (2,524,913)**	**$ (3,194,375)**
Net Revenue from Rate Increases	-	545,535	1,140,611	1,789,194	2,495,560	3,264,321
Net Surplus / (Deficiency)	**$ 1,075,541**	**$ 172,076**	**$ 218,609**	**$ (89,748)**	**$ (29,354)**	**$ 69,946**
Debt Service Coverage (target: at least 1.25)	**n/a**	**2.72**	**2.56**	**1.34**	**1.22**	**0.72**
Annual Rate Adjustment	**0.00%**	**6.50%**	**6.50%**	**6.50%**	**6.50%**	**6.50%**
Cumulative Annual Rate Adjustment	**0.00%**	**6.50%**	**13.42%**	**20.79%**	**28.65%**	**37.01%**
Rate Revenues After Rate Increase	$ 9,352,519	$ 9,541,059	$ 10,288,243	$ 11,093,941	$ 11,962,735	$ 12,899,567
Xfer in from Gen. Fund for Fire After Rate Inc.	-	543,879	586,472	632,400	681,925	735,328
Net Cash Flow After Rate Increase	1,075,541	172,076	218,609	(89,748)	(29,354)	69,946
Days of O&M (target: 60 to 90)	79	82	89	83	79	79
Debt Service Coverage (target: at least 1.25)	**n/a**	**2.80**	**3.42**	**2.30**	**2.69**	**2.04**

Ending Fund Balances	2012	2013	2014	2015	2016	2017
Operating Fund	$ 1,719,578	$ 1,891,654	$ 2,110,264	$ 2,020,516	$ 1,991,162	$ 2,061,108
Capital Fund	2,611,741	4,609,151	1,640,803	1,772,441	2,737,349	9,127,468
Debt Reserves	32,139	848,009	848,009	1,478,655	1,478,655	2,263,654
Total	**$ 4,363,457**	**$ 7,348,815**	**$ 4,599,076**	**$ 5,271,611**	**$ 6,207,165**	**$ 13,452,231**

4. Rate Forecast

The updated schedule of water rates (under the existing water rate structure) is presented in the next section, following discussion of the removal of fire protection costs from water rates in compliance with the recent Supreme Court ruling.

SECTION 5
REMOVAL OF FIRE PROTECTION COSTS

The Washington State Supreme Court decision in *Lane vs. Seattle* defines fire protection as a general government service that cannot be funded through water rates. This analysis aims to facilitate compliance with the *Lane* verdict by identifying fire protection costs embedded in the City's water rates and removing those costs from the rate structure.

To finance this shift in funding responsibility, the court upheld "a solution" that an increase to the utility tax on the water utility to recover identified fire protection costs is valid and within statutory authority. This analysis presumes the City will follow this approach. Alternatively, the City could directly bill the General Fund for payment. The City should consult with its own legal counsel regarding the mechanism for recovery.

The City's current practice is to apply the utility tax on top of each customer's calculated water rate bill, with that portion of the revenue collections deposited directly in the General Fund.

It is important to note that compliance with this ruling under the proposed approach will not impact resulting customer water bills. The water rates will be reduced to reflect the removal of fire protection costs and the utility tax applied to water rate bills will be increased to generate an equal amount to that removed from rates – resulting in no change to the overall water bill. The water utility is made whole by receiving payment from the General Fund to recover the fire protection costs, and the General Fund is made whole by receiving the incremental revenue generated from the increased water utility tax. Should the City choose the alternative approach of a direct payment from the General Fund without a corresponding increase to the water utility tax, the General Fund would not be made whole.

A. METHODOLOGY

While the decision in *Lane vs. Seattle* requires the removal of "the cost of providing hydrants" from water rates, it does not provide a specific methodology for identifying such costs. Consequently, local governments have considerable discretion in determining the best way to address this decision. There is ambiguity in the definition of the "cost of providing fire hydrants." The most literal interpretations would suggest that it only includes costs specifically related to fire hydrants (such as the operation and maintenance of fire hydrants) that are embedded in water rates; other interpretations may be more aggressive in allocating water system facilities and revenue requirement components to fire protection. There is flexibility in assigning the water system to fire protection, depending on how the water system is viewed:

- *Most Common* – Allocating primary cost to general water service, with incremental costs allocated to fire protection service. This would result in relatively lower fire protection costs.

- *Rare* – Allocating primary cost to fire protection service, with additional costs allocated to general water service. This would result in relatively higher fire protection costs.
- *Seattle* Method – Allocating costs to general water service and fire protection on a proportional basis.

The methodology used in this study is based on cost allocations that are driven by an analysis of the City's entire water system to identify costs related to fire protection. We believe that this methodology is most consistent with the intent of the decision in *Lane vs. Seattle*.

B. RESULTS

Results of the fire removal analysis for the water utility are summarized in this section. Additional detail can be viewed in the technical appendix.

1. Allocation of Assets to "Fire Protection"

The first step is to allocate water system assets to functional categories, including:

- Customer: related to providing customer service.
- Meters & Services: related to servicing meters and customer connections.
- Base Capacity: related to providing capacity to meet average demands.
- Peak Capacity: related to providing capacity to meet peak demands.
- Fire Capacity: related to providing capacity for fire flow, including portions of certain assets (mains, pumping facilities and storage facilities) dedicated to fire protection.
- Direct Fire: related directly to fire protection including costs related to fire hydrants, hydrant stub lines, and private fire sprinkler systems.

The water system fixed asset schedule and system design criteria form the basis for allocating the water costs between functions of service, as discussed in further detail below.

Supply/treatment assets are assigned to base and peak capacity using the ratio of peak day to average day demand. As cited in the CWSP, this ratio is 2.2, resulting in a split of 45.5% and 54.5%, respectively, to base and peak capacity.

Pumping assets are allocated to the functions based on a detailed analysis of individual pump stations. Exhibit 5-1 summarizes the pumping allocation.

Exhibit 5-1: Allocation of Pumping

PUMPING STATION [a]	PUMPING CAPACITY (GPM)	FUNCTIONS OF WATER SERVICE					AS ALL OTHERS	TOTAL	ALLOCATION BASIS
		CUSTOMER	METERS & SERVICES	BASE	PEAK	FIRE PROTECTION			
Westside	6,400	0.00%	0.00%	31.96%	38.35%	29.69%	0.00%	100.00%	*1-1900 gpm for fire-flow, remainder peaking factor 2.2*
Judd Hill	1,200	0.00%	0.00%	45.45%	54.55%	0.00%	0.00%	100.00%	*Based on peaking factor of 2.2*
Mt. Aire	750	0.00%	0.00%	45.45%	54.55%	0.00%	0.00%	100.00%	*Based on peaking factor of 2.2*
McAllister	500	0.00%	0.00%	45.45%	54.55%	0.00%	0.00%	100.00%	*Based on peaking factor of 2.2*
Skyridge	110	0.00%	0.00%	45.45%	54.55%	0.00%	0.00%	100.00%	*Based on peaking factor of 2.2*
400 Zone	5,700	0.00%	0.00%	29.51%	35.41%	35.09%	0.00%	100.00%	*1-2000 gpm for fire-flow, remainder peaking factor 2.2*
Total Supply Stations	14,660								
Allocation of Pumping Capacity		-	-	4,891	5,869	3,900	-	14,660	
Reallocation of "As All Other" Pumping Capacity		-	-	-	-	-	-	-	
Reallocated Pumping Capacity		**-**	**-**	**4,891**	**5,869**	**3,900**	**-**	**14,660**	
Percent of Total		**0.00%**	**0.00%**	**33.36%**	**40.03%**	**26.60%**	**0.00%**		

[a] Source of pumping information: Carollo Engineering. City of Lacey Comprehensive Plan Update, Table 1.12. Fireflow proportion estimates provided by Brandon McAllister, City of Lacey.

Storage assets are allocated to the functions based on the CWSP analysis of operational, equalizing, standby, and fire suppression. Exhibit 5–2 summarizes the storage allocation.

Exhibit 5-2: Allocation of Storage Facilities

Function	MILLION GALLONS OF STORAGE [a]	FUNCTIONS OF WATER SERVICE					AS ALL OTHERS	TOTAL	ALLOCATION BASIS
		CUSTOMER	METERS & SERVICES	BASE	PEAK	FIRE PROTECTION			
Operational Storage	0.31	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	100.00%	*All to Base*
Equalizing Storage	1.01	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	*All to Peak*
Emergency (Standby) Storage	5.11	0.00%	0.00%	45.45%	54.55%	0.00%	0.00%	100.00%	*Peak/Average Day Ratio*
Fire Suppression	1.79	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	100.00%	*All to Fire*
TOTAL STORAGE	8.22	0.00%	0.00%	32.05%	46.21%	21.74%	0.00%	100.00%	

[a] Source of Data: Source of data: Carollo Engineering. Comprehensive Plan Update Table 8.8, Table 8.9

Mains are allocated to the functions based on the estimated replacement cost, type, and size of pipe. Pipes are allocated to fire capacity based on the estimated cost of over-sizing pipes. Exhibit 5-3 shows the functional allocation of mains:

- Pipe sizes up through 4-inches are assumed to provide domestic capacity only, and thus, are allocated to base and peak capacity using the peak day to average day demand ratio.
- Pipe sizes between 6 and 12-inches are assumed to be oversized one increment from 4-inch pipes to provide fire capacity.
- Pipes greater than 12-inches are assumed to be transmission mains, allocated to base and peak capacity.

Exhibit 5-3: Allocation of Mains

Pipe Size	Length (lf) [a]	Replacement Cost perl lf. [b]	Estimated Cost	Incremental Cost for Fire Oversizing	FUNCTIONS OF WATER SERVICE				TOTAL	ALLOCATION BASIS
					BASE	PEAK	FIRE PROTECTION	AS ALL OTHERS		
1	3,338		$ -							
2	113,647		$ -		45.45%	54.55%	0.00%	0.00%	100.00%	Domestic: Base/Peak
3	20,771		$ -		45.45%	54.55%	0.00%	0.00%	100.00%	Domestic: Base/Peak
4	65,356	130	$ 8,496,280		45.45%	54.55%	0.00%	0.00%	100.00%	Domestic: Base/Peak
6	443,522	160	$ 70,963,520	$ 13,305,660	36.9%	44.3%	18.8%	0.00%	100.00%	Fire Flow Oversizing: Base/Peak
8	701,832	185	$ 129,838,920	$ 17,545,800	39.3%	47.2%	13.5%	0.00%	100.00%	Fire Flow Oversizing: Base/Peak
10	94,212	215	$ 20,255,580	$ 2,826,360	39.1%	46.9%	14.0%	0.00%	100.00%	Fire Flow Oversizing: Base/Peak
12	354,617	230	$ 81,561,910	$ 5,319,255	42.5%	51.0%	6.5%	0.00%	100.00%	Fire Flow Oversizing: Base/Peak
14	30,631	268	$ 8,219,318		45.45%	54.55%	0.00%	0.00%	100.00%	Transmission Main: Base/Peak
16	51,396	280	$ 14,390,880		45.45%	54.55%	0.00%	0.00%	100.00%	Transmission Main: Base/Peak
18	8,045	315	$ 2,534,175		45.45%	54.55%	0.00%	0.00%	100.00%	Transmission Main: Base/Peak
20	-	320	$ -		45.45%	54.55%	0.00%	0.00%	100.00%	Transmission Main: Base/Peak
24	-	360	$ -		45.45%	54.55%	0.00%	0.00%	100.00%	Transmission Main: Base/Peak
Total	**1,887,367**		**$ 336,260,583**	**$ 38,997,075**	**40.18%**	**48.22%**	**11.60%**	**0.00%**	**100.00%**	

[a] Source of data: Carollo Engineering. Comprehensive Plan Update Table 1.9
[b] Source: General planning estimates, Murray Smith and Associates

Hydrant assets are assigned directly to fire protection.

Meter and services assets are directly assigned to meters and services, and **general plant** assets are allocated in proportion to all other assets.

Exhibit 5-4 shows the resulting functional allocation of total water system assets. The percentage allocations by function serve as the basis for allocating certain elements of the rate revenue requirement amongst the functions of service, as later discussed.

Exhibit 5-4: Functional Allocation of Assets

PLANT-IN-SERVICE	TOTAL COSTS	FUNCTIONS OF WATER SERVICE					AS ALL OTHERS	TOTAL	ALLOCATION BASIS
		CUSTOMER	METERS & SERVICES	BASE	PEAK	FIRE PROTECTION			
Supply/Treatment	28,651,973	0.00%	0.00%	45.45%	54.55%	0.00%	0.00%	100.00%	*Based on peaking factor of 2.2 [a]*
Pumping	740,506	0.00%	0.00%	33.36%	40.03%	26.60%	0.00%	100.00%	*See Pumping Station Allocation Table*
Storage	5,150,231	0.00%	0.00%	32.05%	46.21%	21.74%	0.00%	100.00%	*See Storage Capacity Allocation Table*
Transmission & Distribution	88,197,301	0.00%	0.00%	40.18%	48.22%	11.60%	0.00%	100.00%	*See Pipe Capacity Allocation Table*
Meters & Services	5,866,344	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	100.00%	*All to Meters and Services*
Hydrants	354,953	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	100.00%	*All to Fire Protection*
General Plant	6,796,162	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%	*All to As All Other*
Total Utility Plant	$ 135,757,471	$ -	$ 5,866,344	$ 50,361,557	$ 60,833,120	$ 11,900,287	$ 6,796,162	$ 135,757,471	
Water Service Functions		0.00%	4.55%	39.05%	47.17%	9.23%		100.00%	
General Water Service Functions		0.00%	5.01%	43.02%	51.97%				
Allocation of "As All Others"		$ -	$ 340,580	$ 2,923,820	$ 3,531,763		$ (6,796,162)	$ -	
TOTAL	**$ 135,757,471**	**$ -**	**$ 6,206,924**	**$ 53,285,377**	**$ 64,364,883**	**$ 11,900,287**	**$ -**	**$ 135,757,471**	
Total Allocation %		**0.00%**	**4.57%**	**39.25%**	**47.41%**	**8.77%**	**0.00%**	**100.00%**	
General Water Service Allocation %		**0.00%**	**5.01%**	**43.02%**	**51.97%**				

[a] Source of data: City of Lacey Comprehensive Water Plan Update: Chapter 3 Water Demand Forecast, Table 3.6, ratio: (Maximum Day Demand/Average Daily Demand)

2. Functional Allocation of Revenue Requirement

The allocation principles developed in this analysis will extend to the determination of water rates for 2013 and subsequent years. This step involved a detailed review of line item expenditures and revenues to determine an appropriate allocation of revenue requirements to functions, as summarized below:

- Operating and maintenance costs are allocated based on a detailed review of line items, such as salaries, office and operating supplies, professional services, repairs and maintenance, indirect/overhead cost and so on, and assigned to functions based on assumed cost causation.

- State excise tax expenses are not allocated to fire protection. Since the *Lane* verdict removed fire protection from the purview of water utility activities, this cost is now allocated among all other components (excluding fire protection), as overhead.
- Debt service payments and rate funded system reinvestment are allocated in proportion to total plant in service.
- Miscellaneous operating revenues (non-rate revenues and interest earnings) are allocated in proportion to total operating and maintenance expenses.
- GFCs revenues used to pay debt service are allocated in proportion to total plant in service.
- Other adjustments are allocated as all other general water service costs.
- The analysis incorporates a transfer from the General Fund to the water utility for the identified fire protection costs. This revenue stream effectively "reimburses" the water utility for fire protection costs that are incurred by the water system. This new cost to the General Fund is assumed to be funded through an incremental increase to the current water utility tax. (Note: the utility tax is applied to the total water bill and deposited directly in the General Fund).

Exhibit 5-5 shows the 2012 revenue requirement allocation.

Exhibit 5-5: Functional Allocation of Revenue Requirement

REVENUE REQUIREMENT	TOTAL COSTS	FUNCTIONS OF WATER SERVICE					AS ALL OTHERS	TOTAL	ALLOCATION BASIS
		CUSTOMER	METER SERVICES	BASE	PEAK	FIRE PROTECTION			
OPERATING AND CAPITAL EXPENSES									
Cash Operating Expenses	$ 7,925,976	15.49%	2.76%	34.20%	41.23%	6.31%	0.00%	100.00%	As O&M Expense
Existing Debt Service	521,681	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
New Debt Service	-	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Rate-Funded CIP	-	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Rate Funded System Reinvestment	1,558,802	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Total Expenses	**$ 10,006,459**	**12.27%**	**3.14%**	**35.25%**	**42.52%**	**6.82%**	**0.00%**	**100.00%**	
OTHER REVENUES AND ADJUSTMENTS									
Less: Other Revenues	$ (1,206,834)	15.49%	2.76%	34.20%	41.23%	6.31%	0.00%	100.00%	As O&M Expense
Less: Use of Connection Charges for Debt Service	(521,681)	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Less: Operating Fund Interest Earnings	(966)	15.49%	2.76%	34.20%	41.23%	6.31%	0.00%	100.00%	As O&M Expense
Plus: Additional taxes Due to Rate Increase	-	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%	*As All Other*
Plus: Net Cash Flow after Rate Increase	1,075,541	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%	*As All Other*
Plus: Adjustment for Partial Year Increase	-	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%	*As All Other*
Rate Revenue Requirement	$ 9,352,519	$ 1,040,966	$ 256,728	$ 2,909,786	$ 3,509,076	$ 560,422	$ 1,075,541	$ 9,352,519	
Water Service Functions		12.58%	3.10%	35.16%	42.40%	6.77%		100.00%	
Water Service Functions (Excluding Fire)		13.49%	3.33%	37.71%	45.47%			100.00%	
Allocation of "As All Others (Excluding Fire)"		$ 145,091	$ 35,783	$ 405,569	$ 489,098		$(1,075,541)	$ -	
Rate Revenue Requirement	**$ 9,352,519**	**$ 1,186,057**	**$ 292,511**	**$ 3,315,355**	**$ 3,998,174**	**$ 560,422**	**$ -**	**$ 9,352,519**	
Allocation Percentages		**12.68%**	**3.13%**	**35.45%**	**42.75%**	**5.99%**	**0.00%**	**100.00%**	
Provision for Operational Use of Fire Assets (10%)	**-**	**7,560**	**1,865**	**21,133**	**25,485**	**$ (56,042)**			
General Fund Transfer (Reimbursement of Fire Costs)	**(504,380)**					**(504,380)**		**(504,380)**	
Rate Revenue Requirement	**$ 8,848,139**	**$ 1,193,617**	**$ 294,376**	**$ 3,336,487**	**$ 4,023,659**			**$ 8,848,139**	
Allocation Percentages		**13.49%**	**3.33%**	**37.71%**	**45.47%**			**100.00%**	

As shown in the table above, 10% of the costs allocated to fire protection are separated out from that category and are reallocated proportionally amongst the other functions. This adjustment attempts to account for the fact that fire-related assets are periodically used for operational purposes such as the flushing of water mains.

The resulting allocation of costs to fire protection of $504,380 (adjusted for 2013) is removed from water rates.

3. Water Utility Tax Rate Increase

The identified fire protection costs of $504,380 form the basis for the General Fund payment to the water utility for fire protection costs incurred by the water utility, as well as the calculation of the necessary utility tax increment. The payment from the General Fund to the water utility is offset by an increase to the water utility tax rate.

The existing water utility tax rate is 6.0%. This tax rate would need to increase to 12.04 % to offset the General Fund payment. The incremental portion related to fire protection costs, and the basis for the annual General Fund payment is 6.04%. This percentage would be applied to the annual budgeted water rate revenues in subsequent years to determine the annual payment from the General Fund to the water utility for fire protection costs.

4. Removal of Fire Protection Costs from Customer Class Rates

The City currently applies essentially the same schedule of rates to the two customer groups, thus, the fire protection costs were removed from each customer group in proportion to existing rate revenues. The equivalent dollar amount to be generated from the incremental utility tax (6.04%) was then added back to the customer groups in the same proportion, resulting in no net impact to the customer bill. In short, the reduction in water rates for the removal of fire protection costs is offset by the increase in the utility tax. Exhibit 5-6 shows the progression of customer bill impacts.

Exhibit 5-6: Total Customer Bill Impacts

Customer Classes	2012 Revenue with ATB Increase	Fire Removal [a]	2012 Revenue with ATB Increase Net of Fire	Total % Rate Change with ATB Net of Fire	Reallocation of Additional Utility Tax	2012 Revenue with ATB Increase Net of Fire w/Tax	Total % Bill Impact with ATB Net of Fire (w/Tax Increment)
Group 1	$ 7,301,851	$ (393,788)	$ 6,908,063	-5.39%	$ 393,788	$ 7,301,851	0.00%
Group 2	2,050,668	$ (110,592)	1,940,076	-5.39%	110,592	2,050,668	0.00%
TOTAL	**$ 9,352,519**	**$ (504,380)**	**$ 8,848,139**	-5.39%	**$ 504,380**	**$ 9,352,519**	0.00%

[a] Fire removal costs are allocated proportional to revenues.

SECTION 6
PROPOSED RATES

A cost of service analysis and alternative water rate structure design was also completed for the water utility, with draft results presented to City staff for consideration. Based on indicated impacts to certain customer class rates, City staff provided direction to finalize water rates under the existing water rate structure (net of fire cost removal) for presentation to the Utilities Committee and City Council. [For informational purposes only, draft results of the cost of service analysis and alternative water rate structure design are documented in presentation materials provided in Appendix B].

A. RESULTS

Exhibit 6-1 presents a comparison of the existing (2012) water rates and proposed future water rates reflecting the removal of fire protection costs, increased utility tax, and incorporation of the 6.5% annual rate increases (2013-2017) applied across-the-board to the existing rate structure.

Exhibit 6-1: Comparison of Existing and Proposed Rates

Rate Structure	2012 In-City	2013 In-City	2014 In-City	2015 In-City	2016 In-City
Group 1 [a]					
Fixed Chg/Mo	$ 11.74	$ 11.83	$ 12.60	$ 13.42	$ 14.29
Volume					
Blk 1 (0-6ccf)	$ 0.9767	$ 0.9841	$ 1.0481	$ 1.1162	$ 1.1887
Blk 2 (6-12ccf)	2.2926	2.3099	2.4601	2.6200	2.7903
Blk 3 (12-24ccf)	2.9301	2.9523	3.1442	3.3485	3.5662
Blk 4 (24+ccf)	3.9126	3.9422	4.1984	4.4713	4.7620
Group 2 [b]					
Fixed Chg/Mo	$ 11.74	$ 11.83	$ 12.60	$ 13.42	$ 14.29
Volume					
Blk 1 (0-6ccf)	$ 0.9767	$ 0.9841	$ 1.0481	$ 1.1162	$ 1.1887
Blk 2 (6+ccf)	2.2926	2.3099	2.4601	2.6200	2.7903
Sample Residential Bill					
Water Rate Bill (9 ccf)	$ 24.48	$ 24.66	$ 26.27	$ 27.97	$ 29.79
Plus: Utility Tax	1.47	$ 2.97	$ 3.16	$ 3.37	$ 3.59
Total Customer Bill	$ 25.95	$ 27.63	$ 29.43	$ 31.34	$ 33.38

[a] Group 1 rates apply to SFR, Duplex, and Irrigation customers.
[b] Group 2 rates apply to all remaining customers (MF, Mobile Home, Commercial and Exempt)
Notes:
50% Senior Discount in effect
Outside City rates will reflect 1.2 multiplier

B. CITY IMPLEMENTATION

City Council adopted the proposed rates of rates shown in Exhibit 6-1 (with slight rounding differences) to become effective January 1 of each year (2013-2107).

City of Lacey
Water Utility Rate Study
Summary

Capital Funding		2011	2012	2013	2014	2015	2016	2017	6-Year Total (2012-2017)
Total Capital Projects	**2011 Dollars:**	**3,198,375**	**6,398,312**	**9,431,000**	**5,717,000**	**9,190,000**	**2,740,000**	**5,255,000**	**38,731,312**
	Escalated:	**3,198,375**	**6,654,244**	**10,200,570**	**6,430,847**	**10,751,000**	**3,333,629**	**6,649,251**	**44,019,542**
Grant Proceeds		-	-	-	-	-	-	-	-
Revenue Bond Proceeds		-	-	9,250,000	-	7,150,000	-	1,602,286	18,002,286
Use of / (Addition to) Capital Fund Balance		3,198,375	6,654,244	950,570	6,430,847	3,601,000	3,333,629	5,046,966	26,017,256
Total Funding Sources		**3,198,375**	**$ 6,654,244**	**$ 10,200,570**	**$ 6,430,847**	**$ 10,751,000**	**$ 3,333,629**	**$ 6,649,251**	**$ 44,019,542**
	check:	-	-	-	-	-	-	-	-

Revenue Requirements	2011	2012	2013	2014	2015	2016	2017
Revenues							
Rate Revenues Under Existing Rates	$ 8,880,296	$ 9,352,519	$ 8,958,741	$ 9,070,725	$ 9,184,109	$ 9,298,910	$ 9,415,147
Transfer In from Gen. Fund for Fire	-	-	510,685	517,068	523,532	530,076	536,702
Non-Rate Revenues	1,179,958	1,207,800	1,121,948	1,135,886	1,151,209	1,161,157	1,169,707
Use of Connection Charges for Debt Service	623,267	521,681	520,359	519,037	517,715	516,393	515,071
Total Revenues	**$ 10,683,521**	**$ 11,082,000**	**$ 11,111,733**	**$ 11,242,716**	**$ 11,376,565**	**$ 11,506,536**	**$ 11,636,626**
Expenses							
Cash Operating Expenses	$7,896,147	$7,925,976	$8,385,904	$8,662,895	$8,934,938	$9,250,183	$ 9,541,073
Existing Debt Service	623,267	521,681	520,359	519,037	517,715	516,393	515,071
Debt Service - New Revenue Bonds	-	-	815,870	815,870	1,446,516	1,446,516	2,231,515
Rate Funded System Reinvestment	1,332,044	1,558,802	1,763,058	2,166,917	2,356,339	2,818,358	2,543,342
Total Expenses	**$ 9,851,458**	**$ 10,006,459**	**$ 11,485,191**	**$ 12,164,718**	**$ 13,255,507**	**$ 14,031,449**	**$ 14,831,001**
Annual Surplus / (Deficiency)	**$ 832,062**	**$ 1,075,541**	**$ (373,459)**	**$ (922,002)**	**$ (1,878,942)**	**$ (2,524,913)**	**$ (3,194,375)**
Net Revenue from Rate Increases	-	-	545,535	1,140,611	1,789,194	2,495,560	3,264,321
Net Surplus / (Deficiency)	**$ 832,062**	**$ 1,075,541**	**$ 172,076**	**$ 218,609**	**$ (89,748)**	**$ (29,354)**	**$ 69,946**
Debt Service Coverage (target: at least 1.25)	**n/a**	**n/a**	**2.72**	**2.56**	**1.34**	**1.22**	**0.72**
Annual Rate Adjustment	**0.00%**	**0.00%**	**6.50%**	**6.50%**	**6.50%**	**6.50%**	**6.50%**
Cumulative Annual Rate Adjustment	**0.00%**	**0.00%**	**6.50%**	**13.42%**	**20.79%**	**28.65%**	**37.01%**
Rate Revenues After Rate Increase	$ 8,880,296	$ 9,352,519	$ 9,541,059	$ 10,288,243	$ 11,093,941	$ 11,962,735	$ 12,899,567
Xfer in from Gen. Fund for Fire After Rate Inc.	-	-	543,879	586,472	632,400	681,925	735,328
Net Cash Flow After Rate Increase	832,062	1,075,541	172,076	218,609	(89,748)	(29,354)	69,946
Days of O&M (target: 60 to 90)	30	79	82	89	83	79	79
Debt Service Coverage (target: at least 1.25)	**n/a**	**n/a**	**2.80**	**3.42**	**2.30**	**2.69**	**2.04**

Ending Fund Balances	2011	2012	2013	2014	2015	2016	2017
Operating Fund	$ 644,037	$ 1,719,578	$ 1,891,654	$ 2,110,264	$ 2,020,516	$ 1,991,162	$ 2,061,108
Capital Fund	6,609,421	2,611,741	4,609,151	1,640,803	1,772,441	2,737,349	9,127,468
Debt Reserves	32,139	32,139	848,009	848,009	1,478,655	1,478,655	2,263,654
Total	**$ 7,285,597**	**$ 4,363,457**	**$ 7,348,815**	**$ 4,599,076**	**$ 5,271,611**	**$ 6,207,165**	**$ 13,452,231**

City of Lacey
Water Utility Rate Study
Assumptions

Reader's note: Refer to footnotes on last page of this section

Economic & Financial Factors

			2011	2012	2013	2014	2015	2016	2017
1	General Cost Inflation	(Based on 10 year CPI average)	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
2	Construction Cost Inflation	(Based 10 year CCI average)		4.00%	4.00%	4.00%	4.00%	4.00%	4.00%
3	Labor Cost Inflation	(Per Chun Saul)	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
4	Benefit Cost Inflation	(Per Chun Saul)	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%
5	General Inflation plus Growth		7.43%	4.29%	4.29%	4.29%	4.29%	4.29%	4.29%
6	[Other]								
7	[Other]								
8	No Escalation		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Fund Earnings	[a]	0.15%	0.15%	0.40%	0.65%	0.90%	1.00%	1.00%
9	Customer Growth	(Per Chun Saul for 2011)	4.30%	1.25%	1.25%	1.25%	1.25%	1.25%	1.25%
	Cumulative Growth		4.30%	5.60%	6.92%	8.26%	9.61%	10.98%	12.37%
	State Excise tax - public utility rate		5.029%	5.029%	5.029%	5.029%	5.029%	5.029%	5.029%
	State B&O tax - service rate (amended to 1.8% by 2010 Legislature)	[b]	1.800%	1.800%	1.650%	1.500%	1.500%	1.500%	1.500%
	City Utility tax - public water utility rate	[c]	6.000%	6.000%	6.340%	6.340%	6.340%	6.340%	6.340%

Accounting Assumptions

	2011	2012	2013	2014	2015	2016	2017
FISCAL POLICY RESTRICTIONS							
Min. Op. Fund Balance Target (days of O&M expense)	60	60	60	60	60	60	60
Max. Op. Fund Balance (days of O&M expense)	90	90	90	90	90	90	90
Minimum Capital Fund Balance Target							
Select Minimum Capital Fund Balance Target: 1 — **Defined as % of Plant**							
1 - Defined as % of Plant							
Plant-in-Service in 2010: $ 135,757,471	*$ 1,389,558*	*$ 1,456,101*	*$ 1,558,107*	*$ 1,622,415*	*$ 1,729,925*	*$ 1,763,261*	*$ 1,829,754*
Minimum Capital Fund Balance - % of plant assets	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
2 - Amount at Right ==>							

City of Lacey
Water Utility Rate Study
Assumptions

Reader's note: Refer to footnotes on last page of this section

RATE FUNDED SYSTEM REINVESTMENT

Select Reinvestment Funding Strategy	2	**Equal to Annual Depreciation Expense less Annual Debt Principal Payments**

Amount of Annual Cash Funding from Rates:

		2010	2011	2012	2013	2014	2015	2016	2017
1 - Equal to Annual Depreciation Expense	[d]								
2 - Equal to Annual Depreciation Expense less Annual Debt Principal Payments			50%	60%	70%	80%	90%	100%	100%
3 - Equal to Amount at Right (15% of Rate Revenues) ==>			$ 1,332,044	$ 1,332,044	$ 1,402,878	$ 1,431,159	$ 1,543,236	$ 1,664,091	$ 1,794,410
4 - Do Not Fund System Reinvestment									
	Phased in Funding		*$ 1,221,879*	*$ 1,558,802*	*$ 1,763,058*	*$ 2,166,917*	*$ 2,356,339*	*$ 2,818,358*	*$ 2,543,342*
	Full Funding		*$ 2,443,757*	*$ 2,598,003*	*$ 2,518,655*	*$ 2,708,646*	*$ 2,618,154*	*$ 2,818,358*	*$ 2,543,342*
	.		28%	28%	26%	26%	24%	24%	20%

Capital Financing Assumptions

GENERAL FACILITIES CHARGE REVENUES

Select GFC Alternative	1	**Current GFC in use**
1 - User Input (Current Charge)	$ 4,576	[d]
2 - Calculated Charge	$ 4,155	

		2010	2011	2012	2013	2014	2015	2016	2017
Total Equivalent Residential Units (ERUs)	[e]	25,942	27,057	27,395	27,738	28,084	28,435	28,791	29,151
Annual Growth in ERU's:			*4.30%*	*1.25%*	*1.25%*	*1.25%*	*1.25%*	*1.25%*	*1.25%*
Current Charge (per Ord. 1308)			$ 4,576	$ 4,759	$ 4,949	$ 5,147	$ 5,353	$ 5,567	$ 5,790
Total General Facilities Charge Revenues		$ 1,875,989	$ 1,700,000	$ 1,609,529	$ 1,694,834	$ 1,784,660	$ 1,879,247	$ 1,978,847	$ 2,083,726
Percent available for debt service		[f]	37%	32%	31%	29%	28%	26%	25%
GFC revenues available to pay debt service			$ 623,267	$ 521,681	$ 520,359	$ 519,037	$ 517,715	$ 516,393	$ 515,071

REVENUE BONDS

			2011	2012	2013	2014	2015	2016	2017
Term (years)			20	20	20	20	20	20	20
Interest Cost			5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
Issuance Cost			1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
Bond Coverage Requirement	1.25	[g]							

OTHER LOANS

Term (years)

Interest Cost

Issuance Cost

Footnotes:

Note: Analysis utilizes City budgeted O&M in 2011 and 2012, unless otherwise noted. Escalation assumptions therefore not included during these periods.

[a] Per Chun Saul. Used current rate (State Investment Pool) and escalated by 0.25% per year until we reached 1%.

[b] RCW: 82.04.29002; Additional tax on certain business and service activities.

[c] City utility tax applicable to public water utilities is 6.0%, per LMC 3.01.040.

[d] Ord. 1357 §1, 2010 provides for funding a depreciation reserve in 2011 at 15% of rate revenues, up from 12.6% in 2010.

[d] City terminology: General Facilities Charge LMC 13.32.005.

[e] Calculated ERU's by Meter Equivalents based on 2010 customer statistics

[f] $10.0M transfer was made in two installments, $4.0M in 2007 and $6.0M in 2008. No further transfers are anticipated. Source: City of Lacey Revenue Report, Fund 410 Capital fund. Repayments from water capital fund to sewer capital fund.
Source: 2009 CAFR p.4-32. City intends to continue $500,000 annual repayment installments until debt is fully repaid-- except in 2010, where a $700,000 payment was made-- per T. McGuire.

[g] Although City has adopted a minimum coverage of 1.2 for water sewer under ordinance (2010 CAFR p.3-13), a minimum of 1.25 is assumed for this analysis

City of Lacey
Water Utility Rate Study
Operating Revenue and Expenditure Forecast

			Annual Estimate	2012 Proposed Budget					
			Budget	**Budget**	**Projection**	**Projection**	**Projection**	**Projection**	**Projection**
		FORECAST BASIS	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Revenues									
WATER UTILITY OPERATIONS									
RATE REVENUES [a]			Base Year	Test Year					
Water Sales	9	Customer Growth	$ 8,880,296	$ 9,352,519	$ 8,958,741	$ 9,070,725	$ 9,184,109	$ 9,298,910	$ 9,415,147
[Other]	9	Customer Growth	-	-	-	-	-	-	-
[Other]	8	No Escalation	-	-	-	-	-	-	-
TOTAL RATE REVENUES			**8,880,296**	**9,352,519**	**8,958,741**	**9,070,725**	**9,184,109**	**9,298,910**	**9,415,147**
Note: 2011 and 2012 Revenues are calculated from 2010 customer statistics plus growth and rate increases.			*0.00%*	*5.32%*	*-4.21%*	*1.25%*	*1.25%*	*1.25%*	*1.25%*
5.70% **TRANSFER IN FROM GENERAL FUND FOR FIRE [c]**			$ -	$ -	$ 510,685	$ 517,068	$ 523,532	$ 530,076	$ 536,702
OTHER OPERATING REVENUES [b]									
City Utility Tax Revenues (6%)		*Calculated value*	$ 532,818	$ 561,151	$ 567,984	$ 575,084	$ 582,273	$ 589,551	$ 596,920
Shutoffs	8	No Escalation	124,320	124,320	124,320	124,320	124,320	124,320	124,320
Penalties	9	Customer Growth	105,900	105,900	107,224	108,564	109,921	111,295	112,686
Plan check fees	9	Customer Growth	6,151	6,330	6,409	6,489	6,570	6,652	6,736
Inspection service - streets	8	No Escalation	14,690	14,367	14,367	14,367	14,367	14,367	14,367
Water/fire flow analysis	8	No Escalation	1,030	-	-	-	-	-	-
Cell tower lease	8	No Escalation	85,495	110,717	110,717	110,717	110,717	110,717	110,717
Hydrant meter rental	8	No Escalation	29,500	13,500	13,500	13,500	13,500	13,500	13,500
Sale of scrap and surplus	8	No Escalation	-	-	-	-	-	-	-
Sale of Meters	8	No Escalation	160,000	160,000	160,000	160,000	160,000	160,000	160,000
Construction water	8	No Escalation	8,838	299	299	299	299	299	299
Other misc revenues	8	No Escalation	750	750	750	750	750	750	750
Escrow search fees	8	No Escalation	9,500	9,500	9,500	9,500	9,500	9,500	9,500
Transfer In - Current Exp [c] (Hydrant)	8	No Escalation	100,000	100,000	-	-	-	-	-
	8	No Escalation	-	-	-	-	-	-	-
	8	No Escalation	-	-	-	-	-	-	-
TOTAL OTHER OPERATING REVENUES			**1,178,992**	**1,206,834**	**1,115,070**	**1,123,590**	**1,132,217**	**1,140,952**	**1,149,795**
			0.00%	*2.36%*	*-7.60%*	*0.76%*	*0.77%*	*0.77%*	*0.78%*
TOTAL REVENUES			**$ 10,059,287**	**$ 10,559,353**	**$ 10,584,496**	**$ 10,711,384**	**$ 10,839,858**	**$ 10,969,938**	**$ 11,101,644**
				4.97%	*0.24%*	*1.20%*	*1.20%*	*1.20%*	*1.20%*
		City of Lacey Figure	*8,250,817*	*8,556,420*					
		Difference	*$ 1,808,470*	*$ 2,002,933*					
		Adjustments	*$ (1,452,425)*	*$ (1,454,065)*	Less: Water Sales from Capital Fund added to Revenue				
			$ 176,772	*$ 10,375*	Difference between calculated revenue and budgeted revenue				
			$ (532,818)	*$ (561,151)*	City Utility Tax Revenues (6%)				
			$ -	*$ 1,908*	Investment Interest Included in Funds Tab				
			$ (1,808,470)	*$ (2,002,933)*					
		Check difference: Budget v O&M	*$ -*	*$ -*					

City of Lacey
Water Utility Rate Study
Operating Revenue and Expenditure Forecast

			Annual Estimate	2012 Proposed Budget					
			Budget	**Budget**	**Projection**	**Projection**	**Projection**	**Projection**	**Projection**
		FORECAST BASIS	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Expenditures [d]		FORECAST BASIS	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
WATER UTILITY									
GENERAL SERVICES DIVISION									
Salaries - Regular	3	Labor Cost Inflation	$ 482,974	$ 455,856	$ 469,532	$ 483,618	$ 498,126	$ 513,070	$ 528,462
Salaries - Overtime	3	Labor Cost Inflation	35,000	35,000	36,050	37,132	38,245	39,393	40,575
Salaries - Part-time	3	Labor Cost Inflation	-	-	-	-	-	-	-
Employer paid benefits	4	Benefit Cost Inflation	206,005	193,031	204,613	216,890	229,903	243,697	258,319
Unemployment compensation	4	Benefit Cost Inflation	-	-	-	-	-	-	-
Office and operating supply	1	General Cost Inflation	4,000	4,000	4,120	4,244	4,371	4,502	4,637
Small tools and equipment	1	General Cost Inflation	500	500	515	530	546	563	580
Supplies - uniform purchase	1	General Cost Inflation	5,412	5,412	5,574	5,742	5,914	6,091	6,274
Software upgrade	1	General Cost Inflation	6,630	6,630	6,829	7,034	7,245	7,462	7,686
Professional services - Other	3	Labor Cost Inflation	47,300	47,300	48,719	50,181	51,686	53,237	54,834
Professional services - Engineering	3	Labor Cost Inflation	532,044	547,921	564,359	581,289	598,728	616,690	635,191
Professional services - Audit	3	Labor Cost Inflation	9,425	9,425	9,708	9,999	10,299	10,608	10,926
Professional services - Legal	3	Labor Cost Inflation	20,000	20,000	20,600	21,218	21,855	22,510	23,185
Professional services - Water Resources	3	Labor Cost Inflation	394,098	423,173	435,868	448,944	462,413	476,285	490,573
Professional services - Utility locates	3	Labor Cost Inflation	2,000	2,000	2,060	2,122	2,185	2,251	2,319
Transportation - per diem	1	General Cost Inflation	11,872	11,872	12,228	12,595	12,973	13,362	13,763
Dues & subscriptions	1	General Cost Inflation	5,000	5,000	5,150	5,305	5,464	5,628	5,796
Registrations	1	General Cost Inflation	22,280	22,280	22,948	23,637	24,346	25,076	25,829
Equipment rental	1	General Cost Inflation	2,566	2,997	3,087	3,180	3,275	3,373	3,474
IMS rental	1	General Cost Inflation	140,071	149,269	153,747	158,359	163,110	168,004	173,044
Lease miscellaneous	1	General Cost Inflation	4,400	6,900	7,107	7,320	7,540	7,766	7,999
Insurance	1	General Cost Inflation	53,563	53,563	55,170	56,825	58,530	60,286	62,094
Repairs and maintenance - facilities	1	General Cost Inflation	2,000	2,000	2,060	2,122	2,185	2,251	2,319
Printing and Binding	1	General Cost Inflation	500	500	515	530	546	563	580
Recording Fees	1	General Cost Inflation	3,000	3,000	3,090	3,183	3,278	3,377	3,478
Maintenance contracts	1	General Cost Inflation	1,000	1,000	1,030	1,061	1,093	1,126	1,159
Uniform contracts	1	General Cost Inflation	5,147	5,147	5,301	5,460	5,624	5,793	5,967
Assessments / taxes	1	General Cost Inflation	-	-	-	-	-	-	-
CDL - physicals / licenses	1	General Cost Inflation	210	210	216	223	229	236	243
Conservation program	1	General Cost Inflation	-	-	-	-	-	-	-
Common facilities	1	General Cost Inflation	102,864	115,294	118,753	122,315	125,985	129,764	133,657
Intragovernmental	1	General Cost Inflation	112,550	112,550	115,927	119,404	122,986	126,676	130,476
	8	No Escalation		-	-	-	-	-	-
	8	No Escalation		-	-	-	-	-	-
	8	No Escalation		-	-	-	-	-	-
B&O Taxes - calculated		*Calculated value*	*$ 50,022*	*$ 48,895*	*$ 46,363*	*$ 43,624*	*$ 45,172*	*$ 46,797*	*$ 48,503*
State Excise Taxes - calculated		*Calculated value*	*$ 446,590*	*$ 470,338*	*$ 450,535*	*$ 456,167*	*$ 461,869*	*$ 467,642*	*$ 473,488*
City Utility Taxes - calculated		*Calculated value*	*$ 532,818*	*$ 561,151*	*$ 567,984*	*$ 575,084*	*$ 582,273*	*$ 589,551*	*$ 596,920*
	8	No Escalation		-	-	-	-	-	-
TOTAL			**3,241,841**	**3,322,214**	**3,379,758**	**3,465,335**	**3,557,994**	**3,653,629**	**3,752,349**
			0.00%	*2.48%*	*1.73%*	*2.53%*	*2.67%*	*2.69%*	*2.70%*

City of Lacey
Water Utility Rate Study
Operating Revenue and Expenditure Forecast

			Annual Estimate	2012 Proposed Budget					
			Budget	Budget	Projection	Projection	Projection	Projection	Projection
		FORECAST BASIS	2011	2012	2013	2014	2015	2016	2017
CUSTOMER SERVICES DIVISION									
Salaries - Regular	3	Labor Cost Inflation	394,646	373,306	384,505	396,040	407,922	420,159	432,764
Salaries - Overtime	3	Labor Cost Inflation	100	100	103	106	109	113	116
Salaries - Part-time	3	Labor Cost Inflation	-	-	-	-	-	-	-
Employer paid benefits	4	Benefit Cost Inflation	164,274	175,238	185,752	196,897	208,711	221,234	234,508
Unemployment compensation	3	Labor Cost Inflation	-	-	-	-	-	-	-
Office and operating supply	1	General Cost Inflation	21,950	4,000	4,120	4,244	4,371	4,502	4,637
Small tools and equipment	1	General Cost Inflation	500	500	515	530	546	563	580
Supplies - uniform purchase	1	General Cost Inflation	650	650	670	690	710	732	754
Professional services - computer	1	General Cost Inflation	750	750	773	796	820	844	869
Communications - telephone	1	General Cost Inflation	11,500	11,500	11,845	12,200	12,566	12,943	13,332
Communications - postage	1	General Cost Inflation	78,015	78,015	80,355	82,766	85,249	87,807	90,441
Transportation - per diem	1	General Cost Inflation	2,140	2,140	2,204	2,270	2,338	2,409	2,481
Registrations	1	General Cost Inflation	990	990	1,020	1,050	1,082	1,114	1,148
Equipment rental	1	General Cost Inflation	10,003	12,018	12,379	12,750	13,132	13,526	13,932
IMS rental	1	General Cost Inflation	32,964	33,260	34,258	35,286	36,344	37,434	38,557
Insurance - AWC L&I pool	1	General Cost Inflation	2,340	2,340	2,410	2,483	2,557	2,634	2,713
Repairs & maintenance - equipment	1	General Cost Inflation	150	150	155	159	164	169	174
Excise taxes **(Calculated separately)**	1		-	-	-	-	-	-	-
Printing and binding	1	General Cost Inflation	23,900	23,900	24,617	25,356	26,116	26,900	27,707
Maintenance contracts	1	General Cost Inflation	21,750	21,750	22,403	23,075	23,767	24,480	25,214
Uniform cleaning	1	General Cost Inflation	500	500	515	530	546	563	580
Bad debt expense	1	General Cost Inflation	12,600	12,600	12,978	13,367	13,768	14,181	14,607
Software maintenance	1	General Cost Inflation	7,900	7,900	8,137	8,381	8,633	8,892	9,158
Contractual services	1	General Cost Inflation	45,700	45,700	47,071	48,483	49,938	51,436	52,979
Transfers out - Construction **(Calculated separately)**	8		-	-	-	-	-	-	-
Meters	1	General Cost Inflation	-	160,000	164,800	169,744	174,836	180,081	185,484
Capital Outlays - Equipment	1	General Cost Inflation	-	46,500	47,895	49,332	50,812	52,336	53,906
TOTAL			**833,322**	**1,013,807**	**1,049,478**	**1,086,535**	**1,125,038**	**1,165,051**	**1,206,639**
			0.00%	*21.66%*	*3.52%*	*3.53%*	*3.54%*	*3.56%*	*3.57%*
PRODUCTION AND STORAGE DIVISION									
Salaries - Regular	3	Labor Cost Inflation	488,998	402,042	414,103	426,526	439,322	452,502	466,077
Salaries - Overtime	3	Labor Cost Inflation	19,000	19,000	19,570	20,157	20,762	21,385	22,026
Salaries - Part-time	3	Labor Cost Inflation	-	-	-	-	-	-	-
Employer paid benefits	4	Benefit Cost Inflation	163,649	173,468	183,876	194,909	206,603	218,999	232,139
Unemployment compensation	3	Labor Cost Inflation	-	-	-	-	-	-	-
Office and operating supply	1	General Cost Inflation	9,145	9,145	9,419	9,702	9,993	10,293	10,602
Small tools and equipment	1	General Cost Inflation	6,495	6,495	6,690	6,891	7,097	7,310	7,529
Water treatment supplies	1	General Cost Inflation	95,300	95,300	98,159	101,104	104,137	107,261	110,479
Conference space - safety equipment	1	General Cost Inflation	3,200	3,200	3,296	3,395	3,497	3,602	3,710
Electrical supplies	1	General Cost Inflation	5,000	5,000	5,150	5,305	5,464	5,628	5,796
Small tools - electrical	1	General Cost Inflation	700	700	721	743	765	788	811
Fuel	1	General Cost Inflation	-	-	-	-	-	-	-
Professional services - Other	1	General Cost Inflation	23,589	24,297	25,026	25,776	26,550	27,346	28,166
Professional services - Parks	1	General Cost Inflation	43,042	43,042	44,333	45,663	47,033	48,444	49,897
Professional services - DSHS water samples	1	General Cost Inflation	1,500	1,500	1,545	1,591	1,639	1,688	1,739

City of Lacey
Water Utility Rate Study
Operating Revenue and Expenditure Forecast

		FORECAST BASIS	Annual Estimate Budget 2011	2012 Proposed Budget Budget 2012	Projection 2013	Projection 2014	Projection 2015	Projection 2016	Projection 2017
Communications - Telephone	1	General Cost Inflation	4,600	4,600	4,738	4,880	5,027	5,177	5,333
Equipment rental	1	General Cost Inflation	43,618	50,936	52,464	54,038	55,659	57,329	59,049
Rentals - Other	1	General Cost Inflation	3,100	3,100	3,193	3,289	3,387	3,489	3,594
Insurance - Fire / Property	1	General Cost Inflation	34,108	34,108	35,131	36,185	37,271	38,389	39,541
Utility - Electric	1	General Cost Inflation	615,000	615,000	633,450	652,454	672,027	692,188	712,954
Utility - City of Lacey	1	General Cost Inflation	7,000	7,000	7,210	7,426	7,649	7,879	8,115
Olympia Water Agreement	1	General Cost Inflation	350,000	350,000	360,500	371,315	382,454	393,928	405,746
Repair and Maintenance - Equipment	1	General Cost Inflation	2,500	2,500	2,575	2,652	2,732	2,814	2,898
Repair and Maintenance - Equipment Non Power	1	General Cost Inflation	300	300	309	318	328	338	348
Repair and Maintenance - Facilities	1	General Cost Inflation	75,000	75,000	77,250	79,568	81,955	84,413	86,946
Repair and Maintenance - Telemetry	1	General Cost Inflation	23,000	23,000	23,690	24,401	25,133	25,887	26,663
Maintenance Contracts	1	General Cost Inflation	31,790	31,790	32,744	33,726	34,738	35,780	36,853
Capital outlays - equipment	1	General Cost Inflation	-	-	-	-	-	-	-
[Blank]	8	No Escalation		-	-	-	-	-	-
[Blank]	8	No Escalation		-	-	-	-	-	-
TOTAL			**2,049,634**	**1,980,523**	**2,045,142**	**2,112,013**	**2,181,221**	**2,252,855**	**2,327,011**
			0.00%	*-3.37%*	*3.26%*	*3.27%*	*3.28%*	*3.28%*	*3.29%*
SYSTEM MAINTENANCE DIVISION									
Salaries - Regular	3	Labor Cost Inflation	$ 427,328	$ 595,187	$ 613,043	$ 631,434	$ 650,377	$ 669,888	$ 689,985
Salaries - Overtime	3	Labor Cost Inflation	10,000	10,800	11,124	11,458	11,801	12,155	12,520
Salaries - Part-time	3	Labor Cost Inflation	-	-	-	-	-	-	-
Employer paid benefits	4	Benefit Cost Inflation	211,527	292,162	309,692	328,273	347,970	368,848	390,979
Unemployment compensation	3	Labor Cost Inflation	-	-	-	-	-	-	-
Office and operating supply	1	General Cost Inflation	10,700	12,150	12,515	12,890	13,277	13,675	14,085
Small tools and equipment	1	General Cost Inflation	9,518	11,668	12,018	12,379	12,750	13,132	13,526
Inventory	1	General Cost Inflation	55,000	70,000	72,100	74,263	76,491	78,786	81,149
Street restoration	1	General Cost Inflation	20,000	20,000	20,600	21,218	21,855	22,510	23,185
Non-inventory under $60	1	General Cost Inflation	13,700	17,400	17,922	18,460	19,013	19,584	20,171
Manhole lid replacement	1	General Cost Inflation	250	250	258	265	273	281	290
Valves	1	General Cost Inflation	50,000	41,000	42,230	43,497	44,802	46,146	47,530
Hydrants	1	General Cost Inflation	50,000	50,000	51,500	53,045	54,636	56,275	57,964
Professional services - other	1	General Cost Inflation	-	-	-	-	-	-	-
Professional services - leak survey	1	General Cost Inflation	6,500	6,500	6,695	6,896	7,103	7,316	7,535
Communications - telephone	1	General Cost Inflation	5,500	5,500	5,665	5,835	6,010	6,190	6,376
Equipment rental	1	General Cost Inflation	202,534	254,492	262,127	269,991	278,090	286,433	295,026
Rentals - other	1	General Cost Inflation	1,800	2,300	2,369	2,440	2,513	2,589	2,666
Repair and Maintenance - Equipment	1	General Cost Inflation	5,200	6,550	6,747	6,949	7,157	7,372	7,593
Repair and Maintenance - Equipment Non Power	1	General Cost Inflation	1,350	2,550	2,627	2,705	2,786	2,870	2,956
Capital outlays - equipment	1	General Cost Inflation	143,122	-	-	-	-	-	-
Hydrant Meters	1	General Cost Inflation	-	9,000	9,270	9,548	9,835	10,130	10,433
	8	No Escalation		-	-	-	-	-	-
TOTAL			**1,224,029**	**1,407,509**	**1,458,499**	**1,511,545**	**1,566,739**	**1,624,181**	**1,683,972**
			0.00%	*14.99%*	*3.62%*	*3.64%*	*3.65%*	*3.67%*	*3.68%*

City of Lacey
Water Utility Rate Study
Operating Revenue and Expenditure Forecast

		FORECAST BASIS	Annual Estimate Budget 2011	2012 Proposed Budget Budget 2012	Projection 2013	Projection 2014	Projection 2015	Projection 2016	Projection 2017
CONSTRUCTION - UTILITY CREWS DIVISION									
Salaries - Regular	3	Labor Cost Inflation	$ 95,888	$ -	$ -	$ -	$ -	$ -	$ -
Salaries - Overtime	3	Labor Cost Inflation	800	-	-	-	-	-	-
Salaries - Part-time	3	Labor Cost Inflation	-	-	-	-	-	-	-
Employer paid benefits	4	Benefit Cost Inflation	47,964	-	-	-	-	-	-
Unemployment compensation	4	Benefit Cost Inflation	-	-	-	-	-	-	-
Office and operating supply	1	General Cost Inflation	1,450	-	-	-	-	-	-
Small tools and equipment	1	General Cost Inflation	2,150	-	-	-	-	-	-
Inventory	1	General Cost Inflation	15,000	-	-	-	-	-	-
Non-inventory - under $60	1	General Cost Inflation	3,700	-	-	-	-	-	-
Meters	1	General Cost Inflation	160,000	-	-	-	-	-	-
Equipment - rental	1	General Cost Inflation	15,395	-	-	-	-	-	-
Rentals - other	1	General Cost Inflation	500	-	-	-	-	-	-
Repairs & maintenance - equipment	1	General Cost Inflation	1,350	-	-	-	-	-	-
Repairs & maintenance - equipment non-power	1	General Cost Inflation	1,200	-	-	-	-	-	-
	8	No Escalation	-	-	-	-	-	-	-
	8	No Escalation	-	-	-	-	-	-	-
TOTAL			**345,397**	**-**	**-**	**-**	**-**	**-**	**-**
			0.00%	*-100.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*
CROSS CONNECTION CONTROL DIVISION									
Salaries - Regular	3	Labor Cost Inflation	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Salaries - Overtime	3	Labor Cost Inflation	-	-	-	-	-	-	-
Salaries - Part-time	3	Labor Cost Inflation	-	-	-	-	-	-	-
Employer paid benefits	4	Benefit Cost Inflation	-	-	-	-	-	-	-
Unemployment compensation	4	Benefit Cost Inflation	-	-	-	-	-	-	-
Office and operating supply	1	General Cost Inflation	1,600	1,600	1,648	1,697	1,748	1,801	1,855
Small tools and equipment	1	General Cost Inflation	1,200	1,200	1,236	1,273	1,311	1,351	1,391
Professional services - other	1	General Cost Inflation	500	500	515	530	546	563	580
Repairs & maintenance - equipment non-power	1	General Cost Inflation	750	750	773	796	820	844	869
CDL - Physicals / Licenses	1	General Cost Inflation	120	120	124	127	131	135	139
	8	No Escalation		-	-	-	-	-	-
	8	No Escalation		-	-	-	-	-	-
TOTAL			**4,170**	**4,170**	**4,295**	**4,424**	**4,557**	**4,693**	**4,834**
			0.00%	*0.00%*	*3.00%*	*3.00%*	*3.00%*	*3.00%*	*3.00%*

City of Lacey
Water Utility Rate Study
Operating Revenue and Expenditure Forecast

		FORECAST BASIS	Annual Estimate Budget 2011	2012 Proposed Budget Budget 2012	Projection 2013	Projection 2014	Projection 2015	Projection 2016	Projection 2017
WATER QUALITY DIVISION									
Office and operating supply	1	General Cost Inflation	$ 750	$ 750	$ 773	$ 796	$ 820	$ 844	$ 869
Small tools and equipment	1	General Cost Inflation	1,150	1,150	1,185	1,220	1,257	1,294	1,333
Supplies - uniform purchase	1	General Cost Inflation	500	500	515	530	546	563	580
Professional service - other	1	General Cost Inflation	14,225	14,225	14,652	15,091	15,544	16,010	16,491
Professional service - ground water mgmt	1	General Cost Inflation	25,000	25,000	25,750	26,523	27,318	28,138	28,982
Professional service - DSHS water samples	1	General Cost Inflation	51,279	51,279	52,817	54,402	56,034	57,715	59,446
Communications - telephone	1	General Cost Inflation	500	500	515	530	546	563	580
Communications - postage	1	General Cost Inflation	9,500	9,500	9,785	10,079	10,381	10,692	11,013
Dues & subscriptions	1	General Cost Inflation	500	500	515	530	546	563	580
Repairs and maintenance - equipment	1	General Cost Inflation	250	250	258	265	273	281	290
Printing and binding	1	General Cost Inflation	18,600	18,600	19,158	19,733	20,325	20,934	21,562
Operating permit - DSHS	1	General Cost Inflation	8,500	8,500	8,755	9,018	9,288	9,567	9,854
Project green	1	General Cost Inflation	2,500	2,500	2,575	2,652	2,732	2,814	2,898
Conservation program	1	General Cost Inflation	64,500	64,500	66,435	68,428	70,481	72,595	74,773
Capital outlays - equipment	1	General Cost Inflation	-	-	-	-	-	-	-
	8	No Escalation	-	-	-	-	-	-	-
	8	No Escalation	-	-	-	-	-	-	-
TOTAL			**197,754**	**197,754**	**203,687**	**209,797**	**216,091**	**222,574**	**229,251**
			0.00%	*0.00%*	*3.00%*	*3.00%*	*3.00%*	*3.00%*	*3.00%*
TOTAL - WATER UTILITY (BEFORE CIP O&M)			**7,896,147**	**7,925,976**	**8,140,860**	**8,389,649**	**8,651,640**	**8,922,982**	**9,204,056**
				0.38%	*2.71%*	*3.06%*	*3.12%*	*3.14%*	*3.15%*
ADDITIONAL O&M FROM CIP									
Additional annual O&M from CIP			$0	$0	$245,044	$273,245	$283,298	$327,200	$337,016
GRAND TOTAL CASH O&M EXPENDITURES			**$7,896,147**	**$7,925,976**	**$8,385,904**	**$8,662,895**	**$8,934,938**	**$9,250,183**	**$9,541,073**
				0.38%	*5.80%*	*3.30%*	*3.14%*	*3.53%*	*3.14%*

	2011	2012
City of Lacey 2011 Budget	*$ 8,250,817*	*$ 8,556,420*
Difference	*(354,670)*	*(630,444)*
Adjustments:		
Difference in excise taxes	*(59,817)*	*(52,019)*
Additional annual O&M from CIP	*-*	*-*
Budgeted P&S Employee Benefits (Used average in model)	*76,840*	*17,000*
Budgeted P&S Prof-Svcs - Other (Used average in model)	*60,511*	*59,803*
City of Lacey 6% utility tax	*(532,818)*	*(561,151)*
Transfers to construction fund	*809,954*	*1,166,810*
Total Adjustments	*354,670*	*630,444*
Check difference: Budget v O&M	*-*	*-*

City of Lacey
Water Utility Rate Study
Operating Revenue and Expenditure Forecast

	FORECAST BASIS		Annual Estimate Budget 2011	2012 Proposed Budget Budget 2012	Projection 2013	Projection 2014	Projection 2015	Projection 2016	Projection 2017
Depreciation Expense in: 2010	[e]	$ 3,041,157							
Depreciation Expense	*Last year's plus annual additions from CIP*		$ 3,043,757	$ 3,098,003	$ 3,326,148	$ 3,531,514	$ 3,694,849	$ 3,923,887	$ 3,975,006
	debt principal payments		(600,000)	(500,000)	(807,493)	(822,868)	(1,076,695)	(1,105,529)	(1,431,664)
	System Reinvestment Funding		$ 2,443,757	$ 2,598,003	$ 2,518,655	$ 2,708,646	$ 2,618,154	$ 2,818,358	$ 2,543,342

Footnotes

[a] 2011 rate revenue is calculated from 2010 customer statistics with updated rates.

2012 rate revenue is calculated from 2010 customer statistics and includes adopted 4% rate increase in 2012 Ord. 1376, 2011.

[b] Source: City of Lacey 2011 Adopted Budget and 2012 Proposed Budget

[c] Transfer for hydrant rental charges to the general fund (per email from Tim McGuire, City of Lacey). These transfers to be replaced in 2013 by FCS method.

[d] Source: City of Lacey 2011 Adopted Budget and 2012 Proposed Budget

[e] Source: City of Lacey 2010 CAFR

City of Lacey
Water Utility Rate Study
Existing Debt Input

Existing Debt Service - Revenue Bonds	2011	2012	2013	2014	2015	2016	2017
Bond 1							
Annual Interest Payment	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Principal Payment	-	-	-	-	-	-	-
Total Annual Payment	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Bond 2							
Annual Interest Payment	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Principal Payment	-	-	-	-	-	-	-
Total Annual Payment	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Bond 3							
Annual Interest Payment	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Principal Payment	-	-	-	-	-	-	-
Total Annual Payment	$ -	$ -	$ -	$ -	$ -	$ -	$ -
TOTAL REVENUE BONDS							
Annual Interest Payment	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Principal Payment	-	-	-	-	-	-	-
Total Annual Payment	$ -	$ -	$ -	$ -	$ -	$ -	$ -

Per data request notes from the City of Lacey - City does not have any outstanding revenue bonds.

City of Lacey
Water Utility Rate Study
Existing Debt Input

Existing Debt Service - Other Loans	2011	2012	2013	2014	2015	2016	2017
Interfund Loan: $10.0M from Sewer Capital Fund to Water Capital Fund							
Annual Interest Payment	$ 23,267	$ 21,681	$ 20,359	$ 19,037	$ 17,715	$ 16,393	$ 15,071
Annual Principal Payment	600,000	500,000	500,000	500,000	500,000	500,000	500,000
Total Annual Payment	$ 623,267	$ 521,681	$ 520,359	$ 519,037	$ 517,715	$ 516,393	$ 515,071
Note: Interest rate is assumed to be 0.2644% per Tim McGuire.	NOTE: Principal and Interest Repaid Through General Facility Charges						
Loan 2							
Annual Interest Payment	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Principal Payment	-	-	-	-	-	-	-
Total Annual Payment		$ -	$ -	$ -	$ -	$ -	$ -
Loan 3							
Annual Interest Payment	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Principal Payment	-	-	-	-	-	-	-
Total Annual Payment	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Loan 4							
Annual Interest Payment	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Principal Payment	-	-	-	-	-	-	-
Total Annual Payment	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Loan 5							
Annual Interest Payment	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Principal Payment	-	-	-	-	-	-	-
Total Annual Payment	$ -	$ -	$ -	$ -	$ -	$ -	$ -
TOTAL OTHER LOANS							
Annual Interest Payment	$ 23,267	$ 21,681	$ 20,359	$ 19,037	$ 17,715	$ 16,393	$ 15,071
Annual Principal Payment	600,000	500,000	500,000	500,000	500,000	500,000	500,000
Total Annual Payment	$ 623,267	$ 521,681	$ 520,359	$ 519,037	$ 517,715	$ 516,393	$ 515,071

City of Lacey
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Capital Improvement Program

Capital Improvement Program in Current Year Dollars

Project Costs and O&M Impacts are in	2011	dollars.

	Annual O&M Impact	Life in Years	Project Completion Year	Expansion %	Upgrade %	Replacement %	Total Project Cost (2011 forward)	2011	2012	2013	2014	2015	2016	2017
WATER SUPPLY														
General Water Supply														
WS-1 Hawks Prairie Well S31 Construction	$ 149,250	37	2012	100%	0%	0%	$ 1,264,133	$ 64,133	$ 1,200,000	$ -	$ -	$ -	$ -	$ -
WS-2 Brewery Wellfield Development/Reactivation	188,200	25	2018	100%	0%	0%	3,100,000	-	150,000	300,000	-	-	500,000	1,000,000
WS-3 Well S04 Improvements	99,250	37	2024	100%	0%	0%	1,800,000	-	-	-	-	-	-	-
WS-4 Marvin Road Well Development	-	37	2011	100%	0%	0%	250,000	250,000	-	-	-	-	-	-
WS-4 Marvin Road Well Development (PHASE II; 2019-2021)	149,250	37	2021	100%	0%	0%	2,200,000	-	-	-	-	-	-	-
WS-5 Reclaimed Water Facilities and Distribution System	59,800	50	2020	100%	0%	0%	8,300,000	-	-	-	-	-	150,000	350,000
Water Supply Sub-total:							***$ 16,914,133***	***$ 314,133***	***$ 1,350,000***	***$ 300,000***	***$ -***	***$ -***	***$ 650,000***	***$ 1,350,000***
Water Rights														
WS-6 Water Rights Annual Allocation	$ -		Ongoing	0%	0%	100%	$ 1,576,055	$ 46,055	$ 85,000	$ 85,000	$ 85,000	$ 85,000	$ 85,000	$ 85,000
WS-7 Water Rights Mitigation	-		2015	100%	0%	0%	2,310,000	-	1,185,000	125,000	125,000	875,000	-	-
WS-8 Woodland Creek Regional Reclaimed Water InfiltrationF	17,275	50	2013	100%	0%	0%	5,074,985	623,673	451,312	4,000,000	-	-	-	-
Water Rights Sub-total:							***$ 8,961,040***	***$ 669,728***	***$ 1,721,312***	***$ 4,210,000***	***$ 210,000***	***$ 960,000***	***$ 85,000***	***$ 85,000***
Well Rehabilitation/Replacement														
WS-9 Biennial Well Rehabilitation/Replacement	$ -	10	Ongoing	0%	0%	100%	$ 460,000	$ -	$ 60,000	$ -	$ 50,000	$ -	$ 50,000	$ -
WS-10 Well S06 Replacement	-	37	2011	0%	0%	100%	312,000	312,000	-	-	-	-	-	-
WS-10 Well S06 Replacement (PHASE II; 2013-2014)	1,600	37	2014	0%	0%	100%	1,678,000	-	-	300,000	1,378,000	-	-	-
WS-11 Well S15 and S16 Replacement	2,200	37	2015	0%	0%	100%	2,080,000	-	-	400,000	500,000	1,180,000	-	-
WS-12 Well S01 Replacement	1,600	37	2018	0%	0%	100%	1,750,000	-	-	-	-	-	250,000	300,000
HPWTF Skylight Replacement			2013	0%	0%	100%	60,000	-	-	60,000	-	-	-	-
Well Rehabilitation/Replacement Sub-total:							***$ 6,340,000***	***$ 312,000***	***$ 60,000***	***$ 760,000***	***$ 1,928,000***	***$ 1,180,000***	***$ 300,000***	***$ 300,000***
TOTAL WATER SUPPLY PROJECTS							**$ 32,215,173**	**$ 1,295,861**	**$ 3,131,312**	**$ 5,270,000**	**$ 2,138,000**	**$ 2,140,000**	**$ 1,035,000**	**$ 1,735,000**
WATER QUALITY AND TREATMENT														
WQ-1 ATEC Treatment Facility Particulates Removal & Dispos	$ -	30	2013	0%	50%	50%	$ 1,743,764	$ 93,764	$ 400,000	$ 1,250,000	$ -	$ -	$ -	$ -
WQ-2 Well S04 Corrosion Control	70,000	22	2012	0%	60%	40%	2,123,893	243,893	1,880,000	-	-	-	-	-
WQ-3 Groundwater Protection Monitoring Wells	-	50	2013	0%	0%	100%	168,000	-	-	168,000	-	-	-	-
HPWTF H2O Evaluation			2011	0%	100%	0%	26,682	26,682	-	-	-	-	-	-
TOTAL WATER QUALITY PROJECTS							**$ 4,062,339**	**$ 364,339**	**$ 2,280,000**	**$ 1,418,000**	**$ -**	**$ -**	**$ -**	**$ -**
STORAGE														
ST-1 Union Mills Res. Altitude Valve Vault & Upgrades	$ -	30	2012	0%	0%	100%	$ 450,000	$ 43,000	$ 407,000	$ -	$ -	$ -	$ -	$ -
ST-2 New 3.2-MG Res in 337 Zone (or Equivalent)	27,450	50	2015	100%	0%	0%	5,600,000	-	-	150,000	800,000	4,650,000	-	-
ST-3 Overflow for Union Mills Reservoir	-	50	2014	0%	0%	100%	152,000	-	-	-	152,000	-	-	-
ST-4 Overflow for Judd Hill Reservoir	-	50	2014	0%	0%	100%	350,000	-	-	-	350,000	-	-	-
ST-5 Overflow for Nisqually Reservoir	-	50	2014	0%	0%	100%	82,000	-	-	-	82,000	-	-	-
TOTAL STORAGE PROJECTS							**$ 6,634,000**	**$ 43,000**	**$ 407,000**	**$ 150,000**	**$ 1,384,000**	**$ 4,650,000**	**$ -**	**$ -**
PUMP STATIONS														
PS-1 Install VFDs at Westside Booster Pump Station	$ -	20	2014	0%	0%	100%	$ 253,000	$ -	$ -	$ 23,000	$ 230,000	$ -	$ -	$ -
PS-2 Portable Generator to serve Westside Booster Pump Sta	1,250	20	2013	0%	0%	100%	150,000	-	-	150,000	-	-	-	-
PS-3 New 3.2-mgd Brewery Pump Station & Intertie	27,725	31	2018	100%	0%	0%	1,625,000	-	-	-	-	-	125,000	500,000
TOTAL PUMP STATION PROJECTS							**$ 2,028,000**	**$ -**	**$ -**	**$ 173,000**	**$ 230,000**	**$ -**	**$ 125,000**	**$ 500,000**

City of Lacey
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PRV STATIONS														
PRV-1 Telemetry Controls at PRV Stations	$ -	20	Ongoing	0%	0%	100%	$ 700,000	$ 20,000	$ 200,000	$ 200,000	$ 200,000	$ 80,000	$ -	$ -
TOTAL PRV STATION PROJECTS							**$ 700,000**	**$ 20,000**	**$ 200,000**	**$ 200,000**	**$ 200,000**	**$ 80,000**	**$ -**	**$ -**
PIPELINES														
Capacity Improvement Projects														
P-1 Capitol City Golf Course Fireflow Improvements	$ -	50	2018	0%	75%	25%	$ 2,229,000	$ -	$ -	$ -	$ -	$ -	$ 200,000	$ 1,000,000
P-2 48th/50th NE Ave Fireflow Improvements	-	50	2019	0%	64%	36%	564,000	-	-	-	-	-	-	-
P-3 Willamette Drive Velocity Improvement	-	50	2021	0%	0%	100%	134,000	-	-	-	-	-	-	-
P-4 20th Ave SE Fireflow Improvements	-	50	2014	0%	44%	56%	245,000	-	-	-	245,000	-	-	-
P-5 College Street Service Pressure Improvement	800	50	2022	100%	0%	0%	350,000	-	-	-	-	-	-	-
Capacity Improvement Projects Sub-total:							***$ 3,522,000***	***$ -***	***$ -***	***$ -***	***$ 245,000***	***$ -***	***$ 200,000***	***$ 1,000,000***
Watermain Replacement Program														
P-6 35th Avenue SE Watermain Replacement - Construction	$ -	50	2011	0%	44%	56%	$ 375,060	$ 375,060	$ -	$ -	$ -	$ -	$ -	$ -
P-7 Skokomish Way Watermain Replacement	-	50	2014	0%	0%	100%	1,140,000	-	-	100,000	1,040,000	-	-	-
P-8 Annual Pipeline Replacement Allocation	-	50	Ongoing	0%	30%	70%	17,670,000	70,000	-	1,000,000	100,000	1,100,000	1,100,000	1,100,000
Watermain Replacement Program Sub-total:							***$ 19,185,060***	***$ 445,060***	***$ -***	***$ 1,100,000***	***$ 1,140,000***	***$ 1,100,000***	***$ 1,100,000***	***$ 1,100,000***
Pipeline Improvement Program														
P-9 Annual Pipeline Improvement Program	$ -	50	Ongoing	100%	0%	0%	$ 9,000,000	$ -	$ 80,000	$ 920,000	$ 80,000	$ 920,000	$ 80,000	$ 920,000
P-10 Martin Way Waterline	-	50	2011	100%	0%	0%	569,001	569,001	-	-	-	-	-	-
Pipeline Improvement Program Sub-total:							***$ 9,569,001***	***$ 569,001***	***$ 80,000***	***$ 920,000***	***$ 80,000***	***$ 920,000***	***$ 80,000***	***$ 920,000***
Other Projects														
P-11 Carpenter Road Waterline Relocation	$ -	50	2012	0%	0%	100%	$ 261,892	$ 260,892	$ 1,000	$ -	$ -	$ -	$ -	$ -
P-12 Critical Valves Program	-	50	Ongoing	0%	100%	0%	400,000	10,000	90,000	100,000	100,000	100,000	-	-
Transportation/Development Driven Projects			Ongoing	0%	50%	50%	350,000	10,000	140,000	-	200,000	-	-	-
Other Projects Sub-total:							***$ 1,011,892***	***$ 280,892***	***$ 231,000***	***$ 100,000***	***$ 300,000***	***$ 100,000***	***$ -***	***$ -***
TOTAL PIPELINE PROJECTS							**$ 33,287,953**	**$ 1,294,953**	**$ 311,000**	**$ 2,120,000**	**$ 1,765,000**	**$ 2,120,000**	**$ 1,380,000**	**$ 3,020,000**
GENERAL														
G-1 SCADA System Upgrade	$ 5,000	7	2012	0%	0%	100%	$ 120,000	$ 70,000	$ 50,000	$ -	$ -	$ -	$ -	$ -
G-2 Water Use Efficiency Program	-		Ongoing	0%	0%	100%	-	-						
G-3 Emergency Response Plan Update	-		2013	0%	0%	100%	50,000	-	-	50,000	-	-	-	-
G-4 Cross-Connection Control Plan	-		2013	0%	0%	100%	50,000	-	-	50,000	-	-	-	-
G-5 Comprehensive Water System Plan Update	-		Ongoing	0%	0%	100%	1,284,222	80,222	4,000	-	-	200,000	200,000	-
Rate Study	-		2012	50%		50%	45,000	30,000	15,000	-	-	-	-	-
TOTAL GENERAL PROJECTS							**$ 1,549,222**	**$ 180,222**	**$ 69,000**	**$ 100,000**	**$ -**	**$ 200,000**	**$ 200,000**	**$ -**
TOTAL COSTS in CURRENT COSTS				**51.53%**	**12.87%**	**35.61%**	**$ 80,476,687**	**$ 3,198,375**	**$ 6,398,312**	**$ 9,431,000**	**$ 5,717,000**	**$ 9,190,000**	**$ 2,740,000**	**$ 5,255,000**
Total Expansion Projects							$ 41,465,619	$ 1,521,807	$ 3,073,812	$ 5,495,000	$ 1,005,000	$ 6,445,000	$ 855,000	$ 2,770,000
Total Upgrade Projects							$ 10,354,436	$ 420,926	$ 1,488,000	$ 1,025,000	$ 337,800	$ 430,000	$ 480,000	$ 1,080,000
Total R&R Projects							$ 28,656,632	$ 1,255,642	$ 1,836,500	$ 2,911,000	$ 4,374,200	$ 2,315,000	$ 1,405,000	$ 1,405,000

City of Lacey
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Capital Improvement Program in Inflated Dollars

Construction Cost Inflation							
Annual	0.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%
Cumulative	0.00%	4.00%	8.16%	12.49%	16.99%	21.67%	26.53%

	Annual O&M Impact [a]	Life in Years	Project Completion Year	Expansion %	Upgrade %	Replacement %	Total Project Cost (2011 forward)	2011	2012	2013	2014	2015	2016	2017
WATER SUPPLY														
General Water Supply														
WS-1 Hawks Prairie Well S31 Construction	$ 149,250	37	2012	100.0%	0.0%	0.0%	$ 1,312,133	$ 64,133	$ 1,248,000	$ -	$ -	$ -	$ -	$ -
WS-2 Brewery Wellfield Development/Reactivation	188,200	25	2018	100.0%	0.0%	0.0%	3,867,447	-	156,000	324,480	-	-	608,326	1,265,319
WS-3 Well S04 Improvements	99,250	37	2024	100.0%	0.0%	0.0%	2,958,708	-	-	-	-	-	-	-
WS-4 Marvin Road Well Development	-	37	2011	100.0%	0.0%	0.0%	250,000	250,000	-	-	-	-	-	-
WS-4 Marvin Road Well Development (PHASE II; 2019-2021)	149,250	37	2021	100.0%	0.0%	0.0%	3,143,986	-	-	-	-	-	-	-
WS-5 Reclaimed Water Facilities and Distribution System	59,800	50	2020	100.0%	0.0%	0.0%	11,218,926	-	-	-	-	-	182,498	442,862
Water Supply Sub-total:							***$ 22,751,200***	***$ 314,133***	***$ 1,404,000***	***$ 324,480***	***$ -***	***$ -***	***$ 790,824***	***$ 1,708,181***
Water Rights														
WS-6 Water Rights Annual Allocation	$ -	0	Ongoing	0.0%	0.0%	100.0%	$ 2,313,109	$ 46,055	$ 88,400	$ 91,936	$ 95,613	$ 99,438	$ 103,415	$ 107,552
WS-7 Water Rights Mitigation	-	0	2015	100.0%	0.0%	0.0%	2,531,834	-	1,232,400	135,200	140,608	1,023,626	-	-
WS-8 Woodland Creek Regional Reclaimed Water InfiltrationF	17,275	50	2013	100.0%	0.0%	0.0%	5,419,437	623,673	469,364	4,326,400	-	-	-	-
Water Rights Sub-total:							***$ 10,264,381***	***$ 669,728***	***$ 1,790,164***	***$ 4,553,536***	***$ 236,221***	***$ 1,123,064***	***$ 103,415***	***$ 107,552***
Well Rehabilitation/Replacement														
WS-9 Biennial Well Rehabilitation/Replacement	$ -	10	Ongoing	0.0%	0.0%	100.0%	$ 664,107	$ -	$ 62,400	$ -	$ 56,243	$ -	$ 60,833	$ -
WS-10 Well S06 Replacement	-	37	2011	0.0%	0.0%	100.0%	312,000	312,000	-	-	-	-	-	-
WS-10 Well S06 Replacement (PHASE II; 2013-2014)	1,600	37	2014	0.0%	0.0%	100.0%	1,874,543	-	-	324,480	1,550,063	-	-	-
WS-11 Well S15 and S16 Replacement	2,200	37	2015	0.0%	0.0%	100.0%	2,375,505	-	-	432,640	562,432	1,380,433	-	-
WS-12 Well S01 Replacement	1,600	37	2018	0.0%	0.0%	100.0%	2,262,877	-	-	-	-	-	304,163	379,596
HPWTF Skylight Replacement	-	0	2013	0.0%	0.0%	100.0%	64,896	-	-	64,896	-	-	-	-
Well Rehabilitation/Replacement Sub-total:							***$ 7,553,927***	***$ 312,000***	***$ 62,400***	***$ 822,016***	***$ 2,168,738***	***$ 1,380,433***	***$ 364,996***	***$ 379,596***
TOTAL WATER SUPPLY PROJECTS							**$ 40,569,509**	**$ 1,295,861**	**$ 3,256,564**	**$ 5,700,032**	**$ 2,404,959**	**$ 2,503,497**	**$ 1,259,236**	**$ 2,195,328**
WATER QUALITY AND TREATMENT														
WQ-1 ATEC Treatment Facility Particulates Removal & Dispos	$ -	30	2013	0.0%	50.0%	50.0%	$ 1,861,764	$ 93,764	$ 416,000	$ 1,352,000	$ -	$ -	$ -	$ -
WQ-2 Well S04 Corrosion Control	70,000	22	2012	0.0%	60.0%	40.0%	2,199,093	243,893	1,955,200	-	-	-	-	-
WQ-3 Groundwater Protection Monitoring Wells	-	50	2013	0.0%	0.0%	100.0%	181,709	-	-	181,709	-	-	-	-
HPWTF H2O Evaluation	-	0	2011	0.0%	100.0%	0.0%	26,682	26,682	-	-	-	-	-	-
TOTAL WATER QUALITY PROJECTS							**$ 4,269,248**	**$ 364,339**	**$ 2,371,200**	**$ 1,533,709**	**$ -**	**$ -**	**$ -**	**$ -**
STORAGE														
ST-1 Union Mills Res. Altitude Valve Vault & Upgrades	$ -	30	2012	0.0%	0.0%	100.0%	$ 466,280	$ 43,000	$ 423,280	$ -	$ -	$ -	$ -	$ -
ST-2 New 3.2-MG Res in 337 Zone (or Equivalent)	27,450	50	2015	100.0%	0.0%	0.0%	6,501,974	-	-	162,240	899,891	5,439,842	-	-
ST-3 Overflow for Union Mills Reservoir	-	50	2014	0.0%	0.0%	100.0%	170,979	-	-	-	170,979	-	-	-
ST-4 Overflow for Judd Hill Reservoir	-	50	2014	0.0%	0.0%	100.0%	393,702	-	-	-	393,702	-	-	-
ST-5 Overflow for Nisqually Reservoir	-	50	2014	0.0%	0.0%	100.0%	92,239	-	-	-	92,239	-	-	-
TOTAL STORAGE PROJECTS							**$ 7,625,174**	**$ 43,000**	**$ 423,280**	**$ 162,240**	**$ 1,556,812**	**$ 5,439,842**	**$ -**	**$ -**

City of Lacey
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PUMP STATIONS														
PS-1 Install VFDs at Westside Booster Pump Station	$ -	20	2014	0.0%	0.0%	100.0%	$ 283,596	$ -	$ -	$ 24,877	$ 258,719	$ -	$ -	$ -
PS-2 Portable Generator to serve Westside Booster Pump Sta	1,250	20	2013	0.0%	0.0%	100.0%	162,240	-	-	162,240	-	-	-	-
PS-3 New 3.2-mgd Brewery Pump Station & Intertie	27,725	31	2018	100.0%	0.0%	0.0%	2,100,673	-	-	-	-	-	152,082	632,660
TOTAL PUMP STATION PROJECTS							**$ 2,546,508**	**$ -**	**$ -**	**$ 187,117**	**$ 258,719**	**$ -**	**$ 152,082**	**$ 632,660**
PRV STATIONS														
PRV-1 Telemetry Controls at PRV Stations	$ -	20	Ongoing	0.0%	0.0%	100.0%	$ 762,881	$ 20,000	$ 208,000	$ 216,320	$ 224,973	$ 93,589	$ -	$ -
TOTAL PRV STATION PROJECTS							**$ 762,881**	**$ 20,000**	**$ 208,000**	**$ 216,320**	**$ 224,973**	**$ 93,589**	**$ -**	**$ -**
PIPELINES														
Capacity Improvement Projects														
P-1 Capitol City Golf Course Fireflow Improvements	$ -	50	2018	0.0%	75.0%	25.0%	$ 2,862,743	$ -	$ -	$ -	$ -	$ -	$ 243,331	$ 1,265,319
P-2 48th/50th NE Ave Fireflow Improvements	-	50	2019	0.0%	64.0%	36.0%	771,873	-	-	-	-	-	-	-
P-3 Willamette Drive Velocity Improvement	-	50	2021	0.0%	0.0%	100.0%	198,353	-	-	-	-	-	-	-
P-4 20th Ave SE Fireflow Improvements	-	50	2014	0.0%	44.0%	56.0%	275,592	-	-	-	275,592	-	-	-
P-5 College Street Service Pressure Improvement	800	50	2022	100.0%	0.0%	0.0%	538,809	-	-	-	-	-	-	-
Capacity Improvement Projects Sub-total:							***$ 4,647,370***	***$ -***	***$ -***	***$ -***	***$ 275,592***	***$ -***	***$ 243,331***	***$ 1,265,319***
Watermain Replacement Program														
P-6 35th Avenue SE Watermain Replacement - Construction	$ -	50	2011	0.0%	44.0%	56.0%	$ 375,060	$ 375,060	$ -	$ -	$ -	$ -	$ -	$ -
P-7 Skokomish Way Watermain Replacement	-	50	2014	0.0%	0.0%	100.0%	1,278,019	-	-	108,160	1,169,859	-	-	-
P-8 Annual Pipeline Replacement Allocation	-	50	Ongoing	0.0%	30.0%	70.0%	27,031,328	70,000	-	1,081,600	112,486	1,286,844	1,338,318	1,391,851
Watermain Replacement Program Sub-total:							***$ 28,684,407***	***$ 445,060***	***$ -***	***$ 1,189,760***	***$ 1,282,345***	***$ 1,286,844***	***$ 1,338,318***	***$ 1,391,851***
Pipeline Improvement Program														
P-9 Annual Pipeline Improvement Program	$ -	50	Ongoing	100.0%	0.0%	0.0%	$ 13,555,260	$ -	$ 83,200	$ 995,072	$ 89,989	$ 1,076,270	$ 97,332	$ 1,164,093
P-10 Martin Way Waterline	-	50	2011	100.0%	0.0%	0.0%	569,001	569,001	-	-	-	-	-	-
Pipeline Improvement Program Sub-total:							***$ 14,124,261***	***$ 569,001***	***$ 83,200***	***$ 995,072***	***$ 89,989***	***$ 1,076,270***	***$ 97,332***	***$ 1,164,093***
Other Projects														
P-11 Carpenter Road Waterline Relocation	$ -	50	2012	0.0%	0.0%	100.0%	$ 261,932	$ 260,892	$ 1,040	$ -	$ -	$ -	$ -	$ -
P-12 Critical Valves Program	-	50	Ongoing	0.0%	100.0%	0.0%	441,232	10,000	93,600	108,160	112,486	116,986	-	-
Transportation/Development Driven Projects	-	0	Ongoing	0.0%	50.0%	50.0%	380,573	10,000	145,600	-	224,973	-	-	-
Other Projects Sub-total:							***$ 1,083,737***	***$ 280,892***	***$ 240,240***	***$ 108,160***	***$ 337,459***	***$ 116,986***	***$ -***	***$ -***
TOTAL PIPELINE PROJECTS							**$ 48,539,775**	**$ 1,294,953**	**$ 323,440**	**$ 2,292,992**	**$ 1,985,385**	**$ 2,480,100**	**$ 1,678,981**	**$ 3,821,263**
GENERAL														
G-1 SCADA System Upgrade	$ 5,000	7	2012	0.0%	0.0%	100.0%	$ 122,000	$ 70,000	$ 52,000	$ -	$ -	$ -	$ -	$ -
G-2 Water Use Efficiency Program	-	0	Ongoing	0.0%	0.0%	100.0%	-	-	-	-	-	-	-	-
G-3 Emergency Response Plan Update	-	0	2013	0.0%	0.0%	100.0%	54,080	-	-	54,080	-	-	-	-
G-4 Cross-Connection Control Plan	-	0	2013	0.0%	0.0%	100.0%	54,080	-	-	54,080	-	-	-	-
G-5 Comprehensive Water System Plan Update	-	0	Ongoing	0.0%	0.0%	100.0%	1,929,800	80,222	4,160	-	-	233,972	243,331	-
Rate Study	-	0	2012	50.0%	0.0%	50.0%	45,600	30,000	15,600	-	-	-	-	-
TOTAL GENERAL PROJECTS							**$ 2,205,560**	**$ 180,222**	**$ 71,760**	**$ 108,160**	**$ -**	**$ 233,972**	**$ 243,331**	**$ -**
TOTAL COSTS in CURRENT COSTS				**50.69%**	**13.09%**	**36.22%**	**$ 106,518,656**	**$ 3,198,375**	**$ 6,654,244**	**$ 10,200,570**	**$ 6,430,847**	**$ 10,751,000**	**$ 3,333,629**	**$ 6,649,251**
Total Expansion Projects							$ 53,990,988	$ 1,521,807	$ 3,196,764	$ 5,943,392	$ 1,130,488	$ 7,539,738	$ 1,040,238	$ 3,504,934
Total Upgrade Projects							$ 13,945,280	$ 420,926	$ 1,547,520	$ 1,108,640	$ 379,979	$ 503,039	$ 583,993	$ 1,366,545
Total R&R Projects							$ 38,582,387	$ 1,255,642	$ 1,909,960	$ 3,148,538	$ 4,920,380	$ 2,708,223	$ 1,709,397	$ 1,777,773

[a] Annual O&M impacts are in 2011 dollars.

TRUE

City of Lacey
Water Utility Rate Study
Capital Funding Analysis

Summary of Expenditures		2011	2012	2013	2014	2015	2016	2017
CAPITAL PROJECTS								
Expansion Projects		$ 1,521,807	$ 3,196,764	$ 5,943,392	$ 1,130,488	$ 7,539,738	$ 1,040,238	$ 3,504,934
Upgrade Projects		$ 420,926	$ 1,547,520	$ 1,108,640	$ 379,979	$ 503,039	$ 583,993	$ 1,366,545
Repairs and Replacements		1,255,642	1,909,960	3,148,538	4,920,380	2,708,223	1,709,397	1,777,773
TOTAL CAPITAL EXPENDITURES		**$ 3,198,375**	**$ 6,654,244**	**$ 10,200,570**	**$ 6,430,847**	**$ 10,751,000**	**$ 3,333,629**	**$ 6,649,251**

Capital Financing Plan		2011	2012	2013	2014	2015	2016	2017
Grants / Developer Donations / Other Outside Sources	[a]	$ 485,000						
Other Loans								
System Reinvestment Funding Proceeds		1,332,044	1,558,802	1,763,058	2,166,917	2,356,339	2,818,358	2,543,342
GFC Revenues		1,076,733	1,087,848	1,174,475	1,265,623	1,361,532	515,271	1,568,655
Capital Fund Balance (from balance available at year beginning)		304,598	4,007,595	2,611,741	2,998,308	1,640,803	-	2,537,254
Revenue Bond Proceeds		-	-	4,651,296	-	5,392,326	-	-
Rates	[c]	-	-	-	-	-	-	-
Total		$ 3,198,375	$ 6,654,244	$ 10,200,570	$ 6,430,847	$ 10,751,000	$ 3,333,629	$ 6,649,251
TOTAL CAPITAL RESOURCES		**$ 3,198,375**	**$ 6,654,244**	**$ 10,200,570**	**$ 6,430,847**	**$ 10,751,000**	**$ 3,333,629**	**$ 6,649,251**
Info: Capital Contingency Deficit		-	-	-	-	-	-	-

Footnotes:

[a] EPA Grant to help fund the Woodland Creek regional water infiltration facility & mains. (Source: Carollo Draft CIP).

NOTE A: SELECTION OF FUNDING SOURCE FOR REMAINING CAPITAL FUNDING NEEDS

Select the Residual Funding Source	1	**Bond Proceeds**

1 - Revenue Bond Proceeds

2 - Rates

NOTE C: USER INPUT FOR REVENUE BOND PROCEEDS

Select Amount of Bond Proceeds	1	**User Defined**

	2011	2012	2013	2014	2015	2016	2017
1 - Amounts at Right ==>	$ -	$ -	$ 9,250,000	$ -	$ 7,150,000	$ -	$ 8,900,000

2 - Calculated by the Model

City of Lacey
Water Utility Rate Study
Capital Funding Analysis

New Debt Computations	2011	2012	2013	2014	2015	2016	2017
REVENUE BONDS							
Amount to Fund	$ -	$ -	$ 9,250,000	$ -	$ 7,150,000	$ -	$ 8,900,000
Issuance Costs	-	-	101,675	-	78,592	-	97,828
Reserve Required	-	-	815,870	-	630,646	-	784,999
Amount of Debt Issue	$ -	$ -	$ 10,167,546	$ -	$ 7,859,238	$ -	$ 9,782,828
OTHER LOANS							
Amount to Fund	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Issuance Costs	-	-	-	-	-	-	-
Amount of Debt Issue	$ -	$ -	$ -	$ -	$ -	$ -	$ -

Debt Service Summary	2011	2012	2013	2014	2015	2016	2017
EXISTING DEBT SERVICE							
Annual Interest Payments	$ 23,267	$ 21,681	$ 20,359	$ 19,037	$ 17,715	$ 16,393	$ 15,071
Annual Principal Payments	600,000	500,000	500,000	500,000	500,000	500,000	500,000
Total Debt Service Payments	$ 623,267	$ 521,681	$ 520,359	$ 519,037	$ 517,715	$ 516,393	$ 515,071
Revenue Bond Payments Only	-	-	-	-	-	-	-
NEW DEBT SERVICE							
Annual Interest Payments	$ -	$ -	$ 508,377	$ 493,003	$ 869,821	$ 840,986	$ 1,299,851
Annual Principal Payments	-	-	307,493	322,868	576,695	605,529	931,664
Total Debt Service Payments	$ -	$ -	$ 815,870	$ 815,870	$ 1,446,516	$ 1,446,516	$ 2,231,515
Revenue Bond Payments Only	-	-	815,870	815,870	1,446,516	1,446,516	2,231,515
TOTAL DEBT SERVICE PAYMENTS	**$ 623,267**	**$ 521,681**	**$ 1,336,229**	**$ 1,334,907**	**$ 1,964,231**	**$ 1,962,909**	**$ 2,746,586**
Total Interest Payments	23,267	21,681	528,736	512,039	887,536	857,379	1,314,922
Total Principal Payments	600,000	500,000	807,493	822,868	1,076,695	1,105,529	1,431,664
Total Revenue Bond Payments Only	-	-	815,870	815,870	1,446,516	1,446,516	2,231,515

City of Lacey
Water Utility Rate Study
Revenue Requirements Analysis

Cash Flow Sufficiency Test	2011	2012	2013	2014	2015	2016	2017
EXPENSES							
Cash Operating Expenses	$7,896,147	$ 7,925,976	$ 8,385,904	$ 8,662,895	$ 8,934,938	$ 9,250,183	$ 9,541,073
Existing Debt Service	623,267	521,681	520,359	519,037	517,715	516,393	515,071
New Debt Service	-	-	815,870	815,870	1,446,516	1,446,516	2,231,515
Rate-Funded CIP	-	-	-	-	-	-	-
Rate-Funded System Reinvestment at Current Rates	1,332,044	1,558,802	1,763,058	2,166,917	2,356,339	2,818,358	2,543,342
Additions Required to Meet Minimum Op. Fund Balance	-	-	-	-	-	-	-
Total Expenses	$ 9,851,458	$ 10,006,459	$ 11,485,191	$ 12,164,718	$ 13,255,507	$ 14,031,449	$ 14,831,001
REVENUES							
Rate Revenue	$ 8,880,296	$ 9,352,519	$ 8,958,741	$ 9,070,725	$ 9,184,109	$ 9,298,910	$ 9,415,147
Transfer In from General Fund for Fire	-	-	510,685	517,068	523,532	530,076	536,702
Other Revenue	1,178,992	1,206,834	1,115,070	1,123,590	1,132,217	1,140,952	1,149,795
Use of Connection Charges for Debt Service	623,267	521,681	520,359	519,037	517,715	516,393	515,071
Operating Fund Interest Earnings	966	966	6,878	12,296	18,992	20,205	19,912
Total Revenue	$ 10,683,521	$ 11,082,000	$ 11,111,733	$ 11,242,716	$ 11,376,565	$ 11,506,536	$ 11,636,626
USE OF OPERATING RESERVES	$ -	$ -	$ -	$ -	$ -	$ -	$ -
NET CASH FLOW (DEFICIENCY)	**$ 832,062**	**$ 1,075,541**	**$ (373,459)**	**$ (922,002)**	**$ (1,878,942)**	**$ (2,524,913)**	**$ (3,194,375)**

Coverage Sufficiency Test	2011	2012	2013	2014	2015	2016	2017
Coverage Test - Include GFC Revenues (1=Y; 0=N)? 0							
EXPENSES							
Cash Operating Expenses	$ 7,896,147	$ 7,925,976	$ 8,385,904	$ 8,662,895	$ 8,934,938	$ 9,250,183	$ 9,541,073
Revenue Bond Debt Service	-	-	815,870	815,870	1,446,516	1,446,516	2,231,515
Revenue Bond Coverage Requirement	-	-	203,968	203,968	361,629	361,629	557,879
Total Expenses	$ 7,896,147	$ 7,925,976	$ 9,405,742	$ 9,682,732	$ 10,743,083	$ 11,058,327	$ 12,330,466
ALLOWABLE REVENUES							
Rate Revenue	$ 8,880,296	$ 9,352,519	$ 8,958,741	$ 9,070,725	$ 9,184,109	$ 9,298,910	$ 9,415,147
Transfer In from General Fund for Fire	-	-	510,685	517,068	523,532	530,076	536,702
GFC Revenue	-	-	-	-	-	-	-
Other Revenue	1,178,992	1,206,834	1,115,070	1,123,590	1,132,217	1,140,952	1,149,795
Interest Earnings - All Funds	8,019	10,880	17,325	42,255	33,760	37,930	47,285
Total Revenue	$ 10,067,307	$ 10,570,233	$ 10,601,821	$ 10,753,639	$ 10,873,617	$ 11,007,867	$ 11,148,929
Coverage Realized	n/a	n/a	2.72	2.56	1.34	1.22	0.72
COVERAGE SURPLUS (DEFICIENCY)	$ 2,171,160	$ 2,644,257	$ 1,196,079	$ 1,070,907	$ 130,535	$ (50,460)	$ (1,181,537)

City of Lacey
Water Utility Rate Study
Revenue Requirements Analysis

Maximum Revenue Deficiency	2011	2012	2013	2014	2015	2016	2017
Sufficiency Test Driving the Deficiency	*None*	*None*	*Cash*	*Cash*	*Cash*	*Cash*	*Cash*
Maximum Deficiency From Tests	$ -	$ -	$ 373,459	$ 922,002	$ 1,878,942	$ 2,524,913	$ 3,194,375
less: Net Revenue From Prior Rate Increases	-		-	(552,354)	(1,154,869)	(1,811,559)	(2,526,754)
Total Revenue Deficiency (before taxes)	$ -	$ -	$ 373,459	$ 369,648	$ 724,073	$ 713,354	$ 667,620
Additional Taxes from Revenue Deficiency	-	-	47,905	47,416	92,879	91,504	85,638
Total Revenue Deficiency (after taxes)	**$ -**	**$ -**	**$ 421,363**	**$ 417,064**	**$ 816,952**	**$ 804,859**	**$ 753,258**

Rate Increases	2011	2012	2013	2014	2015	2016	2017
Rate Revenue with no Increase & Gen. Fund Pmt. For Fire	$ 8,880,296	$ 9,352,519	$ 9,469,426	$ 9,587,793	$ 9,707,641	$ 9,828,986	$ 9,951,849
Revenues from Prior Rate Increases	-	-	-	623,207	1,303,008	2,043,934	2,850,870
Rate Revenue Before Rate Increase (Incl. previous increases)	8,880,296	9,352,519	9,469,426	10,211,000	11,010,649	11,872,920	12,802,719
Required Annual Rate Increase	0.00%	0.00%	4.45%	4.08%	7.42%	6.78%	5.88%
Number of Months New Rates Will Be In Effect	12	12	12	12	12	12	12
Info: Percentage Increase to Generate Required Revenue	0.00%	0.00%	4.45%	4.08%	7.42%	6.78%	5.88%
Policy Induced Rate Increases	0.00%	0.00%	6.50%	6.50%	6.50%	6.50%	6.50%
ANNUAL RATE INCREASE	**0.00%**	**0.00%**	**6.50%**	**6.50%**	**6.50%**	**6.50%**	**6.50%**
CUMULATIVE RATE INCREASE	**0.00%**	**0.00%**	**6.50%**	**13.42%**	**20.79%**	**28.65%**	**37.01%**
memo only: No of days of reserves	30	79	82	89	83	79	79
memo only: min number of days of reserves	60	60	60	60	60	60	60
memo only: max number of days of reserves	90	90	90	90	90	90	90
memo only: system reinvestment funding	50%	60%	70%	80%	90%	100%	100%
memo only: Annual CIP	*$ 3,198,375*	*$ 6,654,244*	*$ 10,200,570*	*$ 6,430,847*	*$ 10,751,000*	*$ 3,333,629*	*$ 6,649,251*

Impacts of Rate Increases	2011	2012	2013	2014	2015	2016	2017
Rate Revenues After Rate Increase	$ 8,880,296	$ 9,352,519	$ 9,541,059	$ 10,288,243	$ 11,093,941	$ 11,962,735	$ 12,899,567
Full Year Rate Revenues After Rate Increase	8,880,296	9,352,519	9,541,059	10,288,243	11,093,941	11,962,735	12,899,567
General Fund Transfer After Rate Increase	-	-	543,879	586,472	632,400	681,925	735,328
Additional Taxes Due to Rate Increases	-	-	69,978	146,310	229,506	320,114	418,726
Net Cash Flow After Rate Increase	832,062	1,075,541	172,076	218,609	(89,748)	(29,354)	69,946
Coverage After Rate Increase	n/a	n/a	2.80	3.42	2.30	2.69	2.04

City of Lacey
Water Utility Rate Study
Fund Activity

Funds		2011	2012	2013	2014	2015	2016	2017
OPERATING FUND								
Beginning Balance	[a]	$ 644,037	$ 644,037	$ 1,719,578	$ 1,891,654	$ 2,110,264	$ 2,020,516	$ 1,991,162
plus: Net Cash Flow after Rate Increase		832,062	1,075,541	172,076	218,609	(89,748)	(29,354)	69,946
Less: Use of Operating Reserves		-	-	-	-	-	-	-
less: Transfer of Surplus to Capital Fund		-	-	-	-	-	-	-
Ending Balance		$ 644,037	$ 1,719,578	$ 1,891,654	$ 2,110,264	$ 2,020,516	$ 1,991,162	$ 2,061,108
Minimum Target Balance		*1,297,997*	*1,299,340*	*1,378,505*	*1,424,037*	*1,468,757*	*1,516,423*	*1,568,395*
Maximum Funds to be Kept as Operating Reserves		*1,946,995*	*1,949,011*	*2,067,757*	*2,136,056*	*2,203,135*	*2,274,635*	*2,352,593*
Info: No of Days of Cash Operating Expenses		*30*	*79*	*82*	*89*	*83*	*79*	*79*
CAPITAL FUND								
Beginning Balance	[a]	$ 4,702,162	$ 6,609,421	$ 2,611,741	$ 4,609,151	$ 1,640,803	$ 1,772,441	$ 2,737,349
plus: Rate-Funded System Reinvestment		1,332,044	1,558,802	1,763,058	2,166,917	2,356,339	2,818,358	2,543,342
plus: Grants / Developer Donations / Other Outside Sources		485,000	-	-	-	-	-	-
plus: GFC Revenues		1,700,000	1,609,529	1,694,834	1,784,660	1,879,247	1,978,847	2,083,726
plus: Net Debt Proceeds Available for Projects		-	-	9,250,000	-	7,150,000	-	8,900,000
plus: Direct Rate Funding		-	-	-	-	-	-	-
plus: Interest Earnings		7,053	9,914	10,447	29,959	14,767	17,724	27,373
plus: Transfer of Surplus from Operating Fund		-	-	-	-	-	-	-
plus: Transfer from Fund 414				-	-	-	-	-
less: Use of Connection Charge Revenue for Debt Service		(623,267)	(521,681)	(520,359)	(519,037)	(517,715)	(516,393)	(515,071)
less: Capital Expenditures		(3,198,375)	(6,654,244)	(10,200,570)	(6,430,847)	(10,751,000)	(3,333,629)	(6,649,251)
Ending Balance		$ 6,609,421	$ 2,611,741	$ 4,609,151	$ 1,640,803	$ 1,772,441	$ 2,737,349	$ 9,127,468
Minimum Target Balance		$ 1,389,558	$ 1,456,101	$ 1,558,107	$ 1,622,415	$ 1,729,925	$ 1,763,261	$ 1,829,754
memo only: principal remaining for wastewater loan (end of year)		$ 8,200,000	$ 7,700,000	$ 7,200,000	$ 6,700,000	$ 6,200,000	$ 5,700,000	$ 5,200,000
DEBT RESERVE								
Beginning Balance	[a]	$ 24,597	$ 32,139	$ 32,139	$ 848,009	$ 848,009	$ 1,478,655	$ 1,478,655
plus: Reserve Funding from Rates		-	-	-	-	-	-	-
plus: Reserve Funding from New Debt		-	-	815,870	-	630,646	-	784,999
less: Use of Reserves for Debt Service		-	-	-	-	-	-	-
Ending Balance		$ 32,139	$ 32,139	$ 848,009	$ 848,009	$ 1,478,655	$ 1,478,655	$ 2,263,654
Minimum Target Balance		-	-	*815,870*	*815,870*	*1,446,516*	*1,446,516*	*2,231,515*

[a] Water Utility ending fund balances per Chun Saul (9-30-2011 and 11-30-2011)

City of Lacey
Water Utility Rate Study
Plant-in-Service

Assets as of:	2010

Fx	Description [a]	Year Purchased	Total Cost	Allocation to Utility	Allocated Original Cost	Total CIAC	Applicable Asset Age	Applicable Interest Rate	Allocable Interest Cost
7	2010 DONATED EASEMENT - UTILITIES	2010	$ 471,940	100%	$ 471,940	$ (471,940)	0.00	4.29%	$ -
7	2010 DONATED EASEMENT - WATER	2010	$ 83,551	100%	$ 83,551	$ (83,551)	0.00	4.29%	$ -
4	05 DEVELOPER CONTRIB WA LINES	2005	$ 12,393,683	100%	$ 12,393,683	$ (12,393,683)	5.00	4.96%	$ -
4	DEVELOPER CONTRIB WA LINES	1995	$ 1,631,005	100%	$ 1,631,005	$ (1,631,005)	10.00	6.20%	$ -
4	DEVELOPER CONTRIB WA LINES	1996	$ 2,157,787	100%	$ 2,157,787	$ (2,157,787)	10.00	6.00%	$ -
4	DEVELOPER CONTRIB WA LINES	1997	$ 2,211,515	100%	$ 2,211,515	$ (2,211,515)	10.00	5.80%	$ -
4	DEVELOPER CONTRIB WA LINES	1998	$ 1,803,227	100%	$ 1,803,227	$ (1,803,227)	10.00	5.30%	$ -
4	DEVELOPER CONTRIB WA LINES	1999	$ 2,231,382	100%	$ 2,231,382	$ (2,231,382)			
4	DEVELOPER CONTRIB WA LINES	2000	$ 2,199,857	100%	$ 2,199,857	$ (2,199,857)			
4	DEVELOPER CONTRIB WA LINES	2001	$ 3,797,759	100%	$ 3,797,759	$ (3,797,759)	9.00	5.44%	$ -
4	DEVELOPER CONTRIB WA LINES	2002	$ 2,856,577	100%	$ 2,856,577	$ (2,856,577)	8.00	5.37%	$ -
4	DEVELOPER CONTRIB WA LINES	2003	$ 1,531,409	100%	$ 1,531,409	$ (1,531,409)	7.00	5.15%	$ -
4	2004 WATER LINES CONTRIBUTED	2004	$ 4,575,686	100%	$ 4,575,686	$ (4,575,686)	6.00	5.09%	$ -
4	2006 DEVELOPER CONTRIB LINE	2006	$ 5,898,103	100%	$ 5,898,103	$ (5,898,103)	4.00	4.99%	$ -
4	2007 DEVELOPER CONTRIB WA LINE	2007	$ 3,330,511	100%	$ 3,330,511	$ (3,330,511)	3.00	4.44%	$ -
4	2008 DEVELOPER CONTRIB WA LINE	2008	$ 10,178,081	100%	$ 10,178,081	$ (10,178,081)	2.00	5.46%	$ -
4	2009 DEVELOPER CONTRIB LINES	2009	$ 1,574,219	100%	$ 1,574,219	$ (1,574,219)	1.00	4.21%	$ -
4	2009 DEVELOPER CONTRIB WA LINE	2009	$ 1,078,701	100%	$ 1,078,701	$ (1,078,701)	1.00	4.21%	$ -
1	EASEMENT @ WELL SITE MADRONA	1996	$ 105,000	100%	$ 105,000		10.00	6.00%	$ 63,000
1	EASEMENT @ WELL SITE MEADOWS	1996	$ 375,000	100%	$ 375,000		10.00	6.00%	$ 225,000
1	BETTI WATER RIGHTS	2003	$ 7,500	100%	$ 7,500		7.00	5.15%	$ 2,704
1	BETTI WATER RIGHTS	2004	$ 636,538	100%	$ 636,538				
1	WATER RIGHTS - CAPITAL COLF CO	2006	$ 508,200	100%	$ 508,200		4.00	4.99%	$ 101,433
7	LAND @ LONG LAKE C. C. LOT 15	1964	$ 14,000	100%	$ 14,000		10.00	3.25%	$ 4,554
7	LAND @ LONG LAKE C.C. LOT 16	1964	$ 2,000	100%	$ 2,000		10.00	3.25%	$ 651
7	LAND @ FOREST GLADE EST L15	1968	$ 7,000	100%	$ 7,000		10.00	4.58%	$ 3,209
7	LAND @ PORTION L16, FOREST GL	1968	$ 1,500	100%	$ 1,500		10.00	4.58%	$ 688
7	LAND @ WELL @ FIRE STATION	1978	$ 900	100%	$ 900		10.00	6.35%	$ 572

7	LAND @ POSSIBLE RESERVOIR	1978	$	7,500	100%	$	7,500	10.00	6.35%	$	4,766
7	LAND @ WELL SITE (ABANDONED)	1981	$	29,300	100%	$	29,300	10.00	12.20%	$	35,746
7	LAND @ WELL SITE CAPITAL CITY	1983	$	-	100%	$	-	10.00	10.00%	$	-
7	LAND @ STEILACOOM RD SESERVOIR	1986	$	17,200	100%	$	17,200	10.00	7.80%	$	13,416
7	LAND @ BEACHCREST WELL SITE	1986	$	11,900	100%	$	11,900	10.00	7.80%	$	9,282
7	LAND @ JUDD ST WELL	1987	$	200	100%	$	200	10.00	8.00%	$	160
7	LAND @ JUDD ST WELL	1987	$	200	100%	$	200				
7	LAND @ WELL 1,2,3	1991	$	7,500	100%	$	7,500	10.00	7.10%	$	5,325
7	LAND @ WELLS 1,2,3	1991	$	78,700	100%	$	78,700	10.00	7.10%	$	55,877
7	LAND @ NISQALLY WELLS	1991	$	300	100%	$	300	10.00	7.10%	$	213
7	LAND @ MT AIRE PARK RESERVOIR	1992	$	19,000	100%	$	19,000	10.00	6.60%	$	12,540
7	LAND @ STANFIELDS RD SE WELL	1992	$	27,800	100%	$	27,800	10.00	6.60%	$	18,348
7	LAND @ SHOP	1994	$	198,500	100%	$	198,500	10.00	6.50%	$	129,025
7	LAND @ SO OF NPRR & E OF MARVI	1994	$	170,782	100%	$	170,782	10.00	6.50%	$	111,008
7	LAND @ MARVIN RD PARK	1994	$	317,166	100%	$	317,166	10.00	6.50%	$	206,158
7	LAND @ SHOP	1994	$	122,900	100%	$	122,900	10.00	6.50%	$	79,885
7	LAND @ LACEY VILLAS L62	1994	$	4,000	100%	$	4,000				
7	LAND @ NISQUALLY WELLS	1995	$	1,300	100%	$	1,300				
7	LAND @ EVERGREEN EST L15	1997	$	2,400	100%	$	2,400	10.00	5.80%	$	1,392
7	LAND @ EVERGREEN ESTATES	2000	$	17,400	100%	$	17,400	10.00	6.00%	$	10,440
7	LAND @ SHOP	2001	$	189,047	100%	$	189,047	9.00	5.44%	$	92,558
7	LAND @ BETTI WELL PROPERTY	2004	$	-	100%	$	-	6.00	5.09%	$	-
7	LAND @ FUTURE WATER TOWER LOT6	2007	$	337,682	100%	$	337,682	3.00	4.44%	$	44,979
7	LAND @ MARVIN & WILM (HP WELL)	2008	$	436,489	100%	$	436,489	2.00	5.46%	$	47,665
7	LAND @ WOODLAND & EAGLE CREEK	2009	$	306,687	100%	$	306,687				
7	WATER RIGHTS-OLD BREWERY IN TW	2008	$	2,076,735	100%	$	2,076,735	2.00	5.46%	$	226,779
5	TELEMETARY RADIO SYS (WATER %)	1996	$	75,372	100%	$	75,372	10.00	6.00%	$	45,223
5	EDP/BILLING/RADIX	1992	$	101,824	100%	$	101,824	10.00	6.60%	$	67,204
5	LID/ULID SYSTEM (CITY OF OLY)	1998	$	7,500	100%	$	7,500	10.00	5.30%	$	3,975
5	TELEMETRY SYS SOFTWARE (WA %)	2010	$	33,574	100%	$	33,574	0.00	4.29%	$	-
7	H2O NET ANALYZER VISION 5.2(2)	2002	$	9,736	100%	$	9,736	8.00	5.37%	$	4,183
7	*OFFICE FURNITURE & EQUIPMENT*	1996	$	51,871	100%	$	51,871	10.00	6.00%	$	31,122
2	*ELECTRIC PUMP EQUIPMENT*	1996	$	715,923	100%	$	715,923	10.00	6.00%	$	429,554
7	*TRANSPORTATION EQUIPMENT*	1996	$	11,274	100%	$	11,274	10.00	6.00%	$	6,764
7	*TOOLS*	1996	$	27,232	100%	$	27,232	10.00	6.00%	$	16,339

7	*POWER OPERATING EQUIPMENT*	1996	$	322,144	100%	$	322,144		10.00	6.00%	$	193,287
7	*EQUIPMENT/COMMUNICATIONS*	1996	$	42,978	100%	$	42,978		10.00	6.00%	$	25,787
7	*MISCELLANEOUS*	1996	$	264,764	100%	$	264,764		10.00	6.00%	$	158,858
2	PUMPHOUSE #4 REHAB OF ELEC EQ	2010	$	5,800	100%	$	5,800		0.00	4.29%	$	-
5	RADIX METER READERS (4) PORTAB	1998	$	15,223	100%	$	15,223		10.00	5.30%	$	8,068
2	MCALLISTER EMERGENCY PUMP	2010	$	6,226	100%	$	6,226		0.00	4.29%	$	-
5	METERING KIT-PACIFIC CLA-VALVE	2010	$	8,325	100%	$	8,325		0.00	4.29%	$	-
5	LEAK DETECTOR, ZCORR 8	2007	$	23,239	100%	$	23,239		3.00	4.44%	$	3,095
5	HMI TELEMETRY SOFTWARE (WA 50%	2007	$	30,406	100%	$	30,406		3.00	4.44%	$	4,050
7	*GENERAL STRUCTURES*	1996	$	60,099	100%	$	60,099		10.00	6.00%	$	36,059
7	SHOP BUILDING (WATER PORTION)	2002	$	553,955	100%	$	553,955		8.00	5.37%	$	237,979
4	PRITTON PARKWAY WATER LINES	2000	$	221,726	100%	$	221,726		10.00	6.00%	$	133,036
7	SYSTEM PLAN UPDATE	1995	$	27,889	100%	$	27,889		10.00	6.20%	$	17,291
1	SURVEY MAPPING	2010	$	41,508	100%	$	41,508		0.00	4.29%	$	-
4	MEADOWS SERVICE AREA	1995	$	8,569	100%	$	8,569		10.00	6.20%	$	5,313
1	WATER TREATMENT/MAPS/COMP PLAN	1996	$	1,011,736	100%	$	1,011,736		10.00	6.00%	$	607,042
7	CYBERNET(WA SYS0 MODELING PROG	1999	$	41,665	100%	$	41,665		10.00	5.70%	$	23,749
1	SURVEY MAPPING - 1997	1997	$	60,163	100%	$	60,163		10.00	5.80%	$	34,894
1	SERVEY MAPPING	1998	$	60,000	100%	$	60,000		10.00	5.30%	$	31,800
1	REGIONAL SOURCE	2003	$	143,592	100%	$	143,592		7.00	5.15%	$	51,765
1	400 ZONE EXPANSION	2003	$	213,930	100%	$	213,930		7.00	5.15%	$	77,122
7	SHOP FENCING	2001	$	6,313	100%	$	6,313		9.00	5.44%	$	3,091
1	WATER COMPREHENSIVE PLAN	2002	$	144,735	100%	$	144,735		8.00	5.37%	$	62,178
1	HAWKS PRAIRIE TRMT STUDY & IMP	2003	$	67,739	100%	$	67,739		7.00	5.15%	$	24,420
7	SHOP PAVING (WA %)	2003	$	11,778	100%	$	11,778		7.00	5.15%	$	4,246
6	HYDRANTS	1982	$	312,216	100%	$	312,216		10.00	12.40%	$	387,148
4	TRANSMISSION & DISBRIB WA LINE	1989	$	10,490,444	100%	$	10,490,444		10.00	7.50%	$	7,867,833
4	TRANSMISSION & DISTRIB WA LINE	1989	$	652,762	100%	$	652,762		10.00	7.50%	$	489,572
4	RAPHAEL WATER LINE	1994	$	11,474	100%	$	11,474		10.00	6.50%	$	7,458
4	ULID #17 NISQUALLY HGTS	1994	$	63,832	100%	$	63,832		10.00	6.50%	$	41,491
4	RUDDELL RD - 39TH TO YELM	1997	$	72,368	100%	$	72,368		10.00	5.80%	$	41,974
1	LONG LAKE	1994	$	76,807	100%	$	76,807		10.00	6.50%	$	49,925
4	LID #13 WATER LINES	1994	$	104,417	100%	$	104,417		10.00	6.50%	$	67,871

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4	LILAC & SCHOOL TO 25TH	1994	$	151,156	100%	$	151,156		10.00	6.50%	$	98,251
4	PACIFIC AVE WATERLINE	1994	$	11,354	100%	$	11,354		10.00	6.50%	$	7,380
4	BEACHCREST PRV	1998	$	22,605	100%	$	22,605		10.00	5.30%	$	11,981
4	ULID #18	1995	$	241,808	100%	$	241,808		10.00	6.20%	$	149,921
4	BEACHCREST INTERTIE	1994	$	40,222	100%	$	40,222		10.00	6.50%	$	26,145
4	LACEY STREET LINES	1994	$	146,934	100%	$	146,934		10.00	6.50%	$	95,507
4	HOLMES ISLAND	1994	$	161,604	100%	$	161,604		10.00	6.50%	$	105,043
4	QUINAULT DR-MANITO-YAKIMA	1994	$	59,882	100%	$	59,882		10.00	6.50%	$	38,923
5	METER-MOVE OUT	1996	$	6,128	100%	$	6,128		10.00	6.00%	$	3,677
6	HYDRANT EXTENSIONS/REPLACEMENT	1996	$	42,737	100%	$	42,737		10.00	6.00%	$	25,642
4	BEACHCREST SYSTEM IMPROVEMENT	1995	$	58,873	100%	$	58,873		10.00	6.20%	$	36,501
4	SHOREWOOD	1997	$	77,971	100%	$	77,971		10.00	5.80%	$	45,223
4	LONG LAKE LOOP	1997	$	64,125	100%	$	64,125		10.00	5.80%	$	37,193
4	GWINN LANE	1997	$	97,825	100%	$	97,825		10.00	5.80%	$	56,739
4	LONG LAKE CT	1997	$	21,089	100%	$	21,089		10.00	5.80%	$	12,232
4	TIMBER CT	1997	$	35,666	100%	$	35,666		10.00	5.80%	$	20,686
4	FRANKFORD	1997	$	49,241	100%	$	49,241		10.00	5.80%	$	28,560
4	EVERGREEN ESTATES	1999	$	80,901	100%	$	80,901		10.00	5.70%	$	46,114
4	WATERLINES 1997	1997	$	299,343	100%	$	299,343		10.00	5.80%	$	173,619
4	WATERLINES REPLACEMENT 97/98	1998	$	417,899	100%	$	417,899		10.00	5.30%	$	221,487
4	MULLEN RD REPLACEMENT	2000	$	60,147	100%	$	60,147		10.00	6.00%	$	36,088
4	MERIDIAN/DUTTERROW WATER LINE	1998	$	38,330	100%	$	38,330		10.00	5.30%	$	20,315
4	WATERLINE REPLACEMENTS 98-99	1999	$	221,080	100%	$	221,080		10.00	5.70%	$	126,016
4	NOTH WOODLANDS ULID#20	1999	$	720,795	100%	$	720,795		10.00	5.70%	$	410,853
4	NUSQUALLY CONNECTION	1999	$	339,666	100%	$	339,666		10.00	5.70%	$	193,610
4	WATERLINE REPLACEMENTS 2000	2000	$	671,657	100%	$	671,657		10.00	6.00%	$	402,994
4	MARVIN RD (TIA GRANT) WATER	2000	$	647,596	100%	$	647,596		10.00	6.00%	$	388,558
4	WATERLINE REPLACEMENT 2001	2002	$	727,086	100%	$	727,086		8.00	5.37%	$	312,356
4	MARVIN RD WATER LINE	2003	$	540,283	100%	$	540,283		7.00	5.15%	$	194,772
4	WATERLINE OVERSIZING 2001	2001	$	44,092	100%	$	44,092					
4	WATERLINE LOOPING 2001	2002	$	40,011	100%	$	40,011		8.00	5.37%	$	17,189
4	ONE WAY COUPLET	2003	$	187,904	100%	$	187,904		7.00	5.15%	$	67,739
4	WATERLINE REPLACEMENT 2003	2003	$	663,577	100%	$	663,577		7.00	5.15%	$	239,220
4	YELM HIGHWAY	2003	$	18,159	100%	$	18,159					
4	WATERLINE OVERSIZING 2002	2002	$	57,738	100%	$	57,738		8.00	5.37%	$	24,804
4	45TH AVE WATERMAIN	2003	$	38,488	100%	$	38,488					
4	WOODGROVE CT WRT EXT	2003	$	25,123	100%	$	25,123		7.00	5.15%	$	9,057

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3	HAWKS PRAIRIE/MARVIN TANK SITE	1994	$	6,341	100%	$	6,341	10.00	6.50%	$	4,122
3	JUDD HILL RESERVOIRS REPAIR	1998	$	255,857	100%	$	255,857	10.00	5.30%	$	135,604
3	NEW TANKS HAWKS PRAIRIE	1998	$	859,715	100%	$	859,715	10.00	5.30%	$	455,649
3	NEW TANK - S.W. LACEY 9621 PAC	2002	$	1,807,135	100%	$	1,807,135	8.00	5.37%	$	776,345
3	RESERVOIR PAINTING	2003	$	89,192	100%	$	89,192	7.00	5.15%	$	32,154
3	HAWKS PRAIRIE TANK PAINTING	2003	$	61,332	100%	$	61,332	7.00	5.15%	$	22,110
1	*WELLS*	1996	$	1,557,246	100%	$	1,557,246	10.00	6.00%	$	934,348
1	BEACHCREST	1996	$	1,049,695	100%	$	1,049,695	10.00	6.00%	$	629,817
1	*STRUCTURES AROUND WELLS*	1996	$	242,649	100%	$	242,649				
1	WELL HEAD PROTECTION	1994	$	72,823	100%	$	72,823	10.00	6.50%	$	47,335
1	HAWKS PRAIRIE WELL #1		$	295,633	100%	$	295,633	N/A	N/A		N/A
1	MADRONA PARK WELL "A"	1997	$	1,135,722	100%	$	1,135,722	10.00	5.80%	$	658,719
1	MCALLISTER PARK WELL "B"	1997	$	588,520	100%	$	588,520	10.00	5.80%	$	341,342
1	MADRONA 2 WELL "C"	1998	$	584,738	100%	$	584,738	10.00	5.30%	$	309,911
1	MCCALLISTER SPRING STUDY	1994	$	10,607	100%	$	10,607	10.00	6.50%	$	6,895
7	FENCING WELLS 1,2,3	1997	$	17,942	100%	$	17,942	10.00	5.80%	$	10,406
2	PUMPHOUSE #4 REHAB ELEC. EQUIP	1997	$	12,557	100%	$	12,557	10.00	5.80%	$	7,283
1	MADRONA WELL #3	2000	$	121,761	100%	$	121,761	10.00	6.00%	$	73,057
1	WELL #7 WATER QUALITY	2001	$	684,690	100%	$	684,690	9.00	5.44%	$	335,224
1	SKYRIDGE BOOSTER STATION	2001	$	29,145	100%	$	29,145	9.00	5.44%	$	14,269
1	ATEC BUILDING @ WELL # 7	2002	$	169,437	100%	$	169,437	8.00	5.37%	$	72,790
1	MCALLISTER PARK PRESSURE	2002	$	154,385	100%	$	154,385	8.00	5.37%	$	66,324
1	SPRING AIR PRESSURE		$	149,332	100%	$	149,332	N/A	N/A		N/A
1	EVERGREEN ESTATES WELL & BLDG	2003	$	1,043,549	100%	$	1,043,549	7.00	5.15%	$	376,199
1	WELL IMPROVEMENT	2003	$	120,877	100%	$	120,877	7.00	5.15%	$	43,576
3	HAWKS PRAIRIE RESERVIOR PIPING	1997	$	1,495,741	100%	$	1,495,741	10.00	5.80%	$	867,530
4	WATERLINE REPLACEMENT 2004	2004	$	22,093	100%	$	22,093	6.00	5.09%	$	6,747
1	MADRONA 3 WELL	2003	$	46,524	100%	$	46,524	7.00	5.15%	$	16,772
1	MADRONA 3 WELL	2004	$	424,766	100%	$	424,766	6.00	5.09%	$	129,724
4	MARTIN WAY LINE CROSSING	2004	$	100,574	100%	$	100,574	6.00	5.09%	$	30,715
1	400 ZONE EXPANSION	2004	$	133,001	100%	$	133,001	6.00	5.09%	$	40,619
7	FA #794 - 2004 DISPOSED PORTION	2004	$	43,625	100%	$	43,625	6.00	5.09%	$	13,323
7	FA #792 - 2004 REPLACED PORTION	2004	$	4,542	100%	$	4,542	6.00	5.09%	$	1,387
4	WATERLINE REPLACEMENT 2004	2004	$	507,637	100%	$	507,637				
1	WELL#7 CHLORINE GEN MODFICATIO	2005	$	20,596	100%	$	20,596	5.00	4.96%	$	5,108
1	WELL#7 EXTERIOR WALL ADDITION	2005	$	15,992	100%	$	15,992	5.00	4.96%	$	3,966
7	SHOP PAVING - SHARED	2003	$	4,203	100%	$	4,203	7.00	5.15%	$	1,515

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4	YELM HWY CONSTRUCTION	2005	$	20,216	100%	$	20,216	5.00	4.96%	$	5,014
4	WATERLINE LOOPING STEILACOOM	2005	$	704,168	100%	$	704,168	5.00	4.96%	$	174,634
5	METERS - PRE 1997 (6,731 EA)	1996	$	584,002	100%	$	584,002				
5	METERS ADDED IN 1998 (454 EA)	1998	$	106,630	100%	$	106,630	10.00	5.30%	$	56,514
5	METERS ADDED IN 1997 (561 EA)	1997	$	104,128	100%	$	104,128	10.00	5.80%	$	60,394
5	METERS ADDED IN 2000 (303 EA)	2000	$	78,479	100%	$	78,479	10.00	6.00%	$	47,087
5	METERS ADDED IN 2003 (451 EA)	2003	$	137,319	100%	$	137,319	7.00	5.15%	$	49,504
5	METERS ADDED IN 1999 (300 EA)	1999	$	19,203	100%	$	19,203	10.00	5.70%	$	10,946
5	METERS ADDED IN 2001 (356 EA)	2001	$	76,974	100%	$	76,974	9.00	5.44%	$	37,687
5	METERS ADDED IN 2002 (402 EA)	2002	$	85,154	100%	$	85,154	8.00	5.37%	$	36,582
5	METERS ADDED IN 2003 (41 EA)	2003	$	7,499	100%	$	7,499	7.00	5.15%	$	2,703
5	AMR WATER METER -NEW 788 UNITS	2005	$	205,175	100%	$	205,175	5.00	4.96%	$	50,883
5	AMR WATER METER -REPLACE 1612	2005	$	350,510	100%	$	350,510	5.00	4.96%	$	86,926
5	AMR - DATA COLLECTION UNITS	2005	$	114,948	100%	$	114,948	5.00	4.96%	$	28,507
1	BETTI WELL IMPRV (PRODUCTION)	2005	$	863,453	100%	$	863,453	5.00	4.96%	$	214,136
4	WATERLINES LOOOING- STEILACOOM	2006	$	130,751	100%	$	130,751	4.00	4.99%	$	26,097
4	DUTTEROW WATRLINE	2006	$	326,265	100%	$	326,265	4.00	4.99%	$	65,120
3	2005 VALVES & BLOWOFFS	2006	$	507,480	100%	$	507,480				
5	AMR - WATER METERS (1,393 EA)	2006	$	220,985	100%	$	220,985				
5	AMR - WATER METERS 5,111 REPLD	2006	$	810,818	100%	$	810,818	4.00	4.99%	$	161,833
5	AMR - DCU & INSTALL	2006	$	81,571	100%	$	81,571	4.00	4.99%	$	16,281
4	2006 FLOW METERS	2007	$	211,912	100%	$	211,912	3.00	4.44%	$	28,227
5	AMR - 2007 WA METERS NEW 1,062	2007	$	164,806	100%	$	164,806	3.00	4.44%	$	21,952
5	AMR - 2007 REPLACE (8,598)	2007	$	1,334,276	100%	$	1,334,276	3.00	4.44%	$	177,726
5	AMR 2008 AMR - NEW 596	2008	$	132,722	100%	$	132,722	2.00	5.46%	$	14,493
5	AMR 2008 REPLACED 2,359 UNITS	2008	$	525,319	100%	$	525,319	2.00	5.46%	$	57,365
1	ZONE 380 CONVERSION - FAC %	2008	$	809,866	100%	$	809,866	2.00	5.46%	$	88,437
4	ZONE 380 CONVERSION -MACHANICA	2008	$	1,007,978	100%	$	1,007,978	2.00	5.46%	$	110,071
4	ZONE 380 CONVERSION - LINES%	2008	$	359,215	100%	$	359,215	2.00	5.46%	$	39,226
4	WATERLINE REPLACEMENT	2008	$	691,128	100%	$	691,128	2.00	5.46%	$	75,471
4	2006 VALVES & BLOWOFFS	2008	$	64,201	100%	$	64,201	2.00	5.46%	$	7,011
1	2005 CHLORINIZATION - FAC%	2008	$	1,982,394	100%	$	1,982,394	2.00	5.46%	$	216,477
4	2005 CHLORINIZATION - LINES%	2008	$	699,668	100%	$	699,668	2.00	5.46%	$	76,404
1	2005 CHLORINIZATION-MACHNICAL%	2008	$	1,982,394	100%	$	1,982,394	2.00	5.46%	$	216,477
1	HAWKS PRAIRIE WATER EVAL-FAC%	2008	$	5,781,836	100%	$	5,781,836	2.00	5.46%	$	631,376
1	HAWKS PRAIRIE WATER EVAL-MACH%	2008	$	5,127,894	100%	$	5,127,894	2.00	5.46%	$	559,966
4	HAWKS PRAIRIE WATER EVAL-LINE%	2008	$	354,223	100%	$	354,223	2.00	5.46%	$	38,681

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4	POTABLE WATER	2008	$ 1,775,765	100%	$ 1,775,765		2.00	5.46%	$ 193,914
4	GATEWAY PROJECTS	2008	$ 452,034	100%	$ 452,034		2.00	5.46%	$ 49,362
4	MULLEN ROAD-EASH OF RUDDELL	2008	$ 427,291	100%	$ 427,291		2.00	5.46%	$ 46,660
5	METERS ADDED IN 2004 (547 EA)	2004	$ 100,050	100%	$ 100,050		6.00	5.09%	$ 30,555
4	TRANSMISSION & DISTRIBUTION WA LINE		$ 167,070	100%	$ 167,070		N/A	N/A	N/A
5	AMR - 2009 WA METERS (515 EA)	2009	$ 163,554	100%	$ 163,554		1.00	4.21%	$ 6,886
5	AMR - 2009 WA METERS RPLC 37EA	2009	$ 11,750	100%	$ 11,750		1.00	4.21%	$ 495
5	AMR - 2009 METERS DUC'S (11EA)	2009	$ 52,141	100%	$ 52,141		1.00	4.21%	$ 2,195
4	2009 WATERLINE REPLACEMENT	2009	$ 362,488	100%	$ 362,488		1.00	4.21%	$ 15,261
4	18TH AVE LINES UPGRADE	2009	$ 368,399	100%	$ 368,399		1.00	4.21%	$ 15,510
3	SOUTH END RESERVOIR	2008	$ 67,437	100%	$ 67,437		2.00	5.46%	$ 7,364
4	400 ZONE TRANSMISSION	2009	$ 204,581	100%	$ 204,581		1.00	4.21%	$ 8,613
7	GENERATOR, KATOLIGHT D500KW	2008	$ 162,600	100%	$ 162,600		2.00	5.46%	$ 17,756
7	2010 MULLEN RD EXTENSION	2010	$ 169,973	100%	$ 169,973		0.00	4.29%	$ -
5	AMR - 2010 WA METERS (471 EA)	2010	$ 96,740	100%	$ 96,740		0.00	4.29%	$ -
4	2007 WA LOOPING	2007	$ 454,117	100%	$ 454,117		3.00	4.44%	$ 60,488
4	WATERLINE REPLACEMENT 2010	2010	$ 630,205	100%	$ 630,205		0.00	4.29%	$ -
	Total Plant-in-Service		**$ 135,757,471**	**100%**	**$ 135,757,471**	**$ (60,004,991)**	**5.38**	**5.19%**	**$ 26,908,681**

City of Lacey
Water Utility Rate Study
Plant-in-Service

Fx	PLANT-IN-SERVICE	TOTAL COSTS
1	Supply/Treatment	$ 28,651,973
2	Pumping	740,506
3	Storage	5,150,231
4	Transmission & Distribution	88,197,301
5	Meters & Services	5,866,344
6	Hydrants	354,953
7	General Plant	6,796,162
	Total Utility Plant	**$ 135,757,471**

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City of Lacey
Water Utility Rate Study
General Facility Charge Customer Base

Projected Number of Account and Annualized Growth Rates (per Page 3-15 of Water System Plan)

	Base	Projected	Projected	Projected	Projected	
Year	2008	2009	2015	2019	2029	
Number of Accounts	21,559	22,105	25,462	27,703	32,465	**2008 - 2029**
Number of Years		1	6	4	10	21
Average Annual Growth Rate		2.53%	2.38%	2.13%	1.60%	1.97%

Meter Size	# of Meters	Meter EQ	Total ERUs
75	20,536	1	20,536
100	713	1.67	1,191
150	474	3.33	1,578
200	339	5.33	1,807
300	59	10.67	630
400	10	16.67	167
600	1	33.33	33
	22,132		**25,942**

Year	Annual Growth Rate	No of MEs
2010		25,942
2011	2.38%	26,560
2012	2.38%	27,193
2013	2.38%	27,842
2014	2.38%	28,506
2015	2.38%	29,185
2016	2.13%	29,807
2017	2.13%	30,443
2018	2.13%	31,091
2019	2.13%	31,754
2020	1.60%	32,262
2021	1.60%	32,778
2022	1.60%	33,302
2023	1.60%	33,834
2024	1.60%	34,375
2025	1.60%	34,925
2026	1.60%	35,483
2027	1.60%	36,050
2028	1.60%	36,627
2029	1.60%	37,212

City of Lacey
Water Utility Rate Study
General Facility Charge

Existing Cost Basis

				Notes
PLANT-IN-SERVICE				
Utility Capital Assets		$ 135,757,471		Original cost of plant-in-service as of 2010
plus: Construction Work-In-Progress		626,076	[a]	2010 Year-End Construction Work-In-Progress
less: Contributed Capital		(60,004,991)		CIAC, Grants, and other contributed capital
plus: Interest on Non-Contributed Plant		26,908,681	[b]	Interest on assets up to a maximum 10-year period
Existing Cash Balances	$ 5,370,796			Ending cash balances for 2010
less: Debt Principal Outstanding	-			Total principal outstanding for the existing debt ending 2010.
less: Net Debt Principal Outstanding		$ -		Debt principal outstanding, net of cash reserves ending 2010
TOTAL EXISTING COST BASIS		**$ 103,287,236**		

Future Cost Basis

		Notes
20 YEAR CAPITAL IMPROVEMENT PLAN		
Total Future Projects	$ 80,476,687	Total 20-year CIP 2011-2029
less: Identified Upgrade Projects	(10,354,436)	Upgrade Projects are not eligible for General Facility
less: Identified Repair & Replacement Projects	(28,656,632)	R&R projects are not eligible for General Facility
less: Contributed Future Upgrade & Expansion Assets	(485,000)	Not eligible for recovery through General Facility Charge
TOTAL FUTURE COST BASIS	**$ 40,980,619**	

City of Lacey
Water Utility Rate Study
General Facility Charge

Customer Base	ERUs	Notes
Existing Equivalent Residential Units	25,942	Existing ERU Service Capacity, ending 2010
Future Equivalent Residential Units (Incremental)	11,271	Projected Incremental ERUs
TOTAL CUSTOMER BASE	**37,212**	**Projected ERU Service Capacity, completion of CIP**

Resulting Charge	Total	Notes
Existing Cost Basis	$ 103,287,236	
Total Customer Base	37,212	
	$ 2,776	
Future Cost Basis	$ 40,980,619	
Future Equivalent Residential Units (Incremental)	11,271	
	$ 3,636	
Total Customer Base		
TOTAL CHARGE PER ERU	**$ 6,412**	**Maximum Allowable Charge per ERU**

[a] Source: City of Lacey, 2010 Asset Depreciation Detail

[b] Existing debt principle is paid through General Facilities Charge revenue.

City of Lacey
Water Utility Rate Study
General Facility Charge

Schedule of Charges

Meter Size	2012 GFC [a]	Meter Capacity Ratio [b]	Revised GFC
5/8-inch	4,850	1.00	$ 6,412
1-inch	9,719	2.00	12,847
1 1/2-inch	19,353	3.99	25,581
2-inch	31,606	6.52	41,779
3-inch	59,629	12.29	78,822
4-inch	99,382	20.49	131,370
6-inch	198,560	40.94	262,469

[a] Source: Ord. 1308, 2008. 2008 schedule of charges increased by ENR or 6% per ordinance.
As authorized under LMC 13.32.005.
[b] Based on City's current meter capacity ratio

City of Lacey
Water Utility Rate Study
Functional Allocations

Allocation of Plant-in-Service

PLANT-IN-SERVICE	TOTAL COSTS	FUNCTIONS OF WATER SERVICE: CUSTOMER	METERS & SERVICES	BASE	PEAK	FIRE PROTECTION	AS ALL OTHERS	TOTAL	ALLOCATION BASIS
Supply/Treatment	28,651,973	0.00%	0.00%	45.45%	54.55%	0.00%	0.00%	100.00%	*Based on peaking factor of 2.2 [a]*
Pumping	740,506	0.00%	0.00%	33.36%	40.03%	26.60%	0.00%	100.00%	*See Pumping Station Allocation Table*
Storage	5,150,231	0.00%	0.00%	32.05%	46.21%	21.74%	0.00%	100.00%	*See Storage Capacity Allocation Table*
Transmission & Distribution	88,197,301	0.00%	0.00%	40.18%	48.22%	11.60%	0.00%	100.00%	*See Pipe Capacity Allocation Table*
Meters & Services	5,866,344	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	100.00%	*All to Meters and Services*
Hydrants	354,953	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	100.00%	*All to Fire Protection*
General Plant	6,796,162	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%	*All to As All Other*
Total Utility Plant	$ 135,757,471	$ -	$ 5,866,344	$ 50,361,557	$ 60,833,120	$ 11,900,287	$ 6,796,162	$ 135,757,471	
Water Service Functions		0.00%	4.55%	39.05%	47.17%	9.23%		100.00%	
General Water Service Functions		0.00%	5.01%	43.02%	51.97%				
Allocation of "As All Others"		$ -	$ 340,580	$ 2,923,820	$ 3,531,763		$ (6,796,162)	$ -	
TOTAL	**$ 135,757,471**	**$ -**	**$ 6,206,924**	**$ 53,285,377**	**$ 64,364,883**	**$ 11,900,287**	**$ -**	**$ 135,757,471**	
Total Allocation %		**0.00%**	**4.57%**	**39.25%**	**47.41%**	**8.77%**	**0.00%**	**100.00%**	
General Water Service Allocation %		**0.00%**	**5.01%**	**43.02%**	**51.97%**				

[a] Source of data: City of Lacey Comprehensive Water Plan Update: Chapter 3 Water Demand Forecast, Table 3.6, ratio: (Maximum Day Demand/Average Daily Demand)

Storage Capacity Allocation Table

Function	MILLION GALLONS OF STORAGE [a]	FUNCTIONS OF WATER SERVICE: CUSTOMER	METERS & SERVICES	BASE	PEAK	FIRE PROTECTION	AS ALL OTHERS	TOTAL	ALLOCATION BASIS
Operational Storage	0.31	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	100.00%	*All to Base*
Equalizing Storage	1.01	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%	*All to Peak*
Emergency (Standby) Storage	5.11	0.00%	0.00%	45.45%	54.55%	0.00%	0.00%	100.00%	*Peak/Average Day Ratio*
Fire Suppression	1.79	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	100.00%	*All to Fire*
TOTAL STORAGE	8.22	0.00%	0.00%	32.05%	46.21%	21.74%	0.00%	100.00%	

[a] Source of Data: Source of data: Carollo Engineering. Comprehensive Plan Update Table 8.8, Table 8.9

City of Lacey
Water Utility Rate Study
Functional Allocations

Pumping Station Allocation Table

PUMPING STATION [a]	PUMPING CAPACITY (GPM)	FUNCTIONS OF WATER SERVICE					AS ALL OTHERS	TOTAL	ALLOCATION BASIS
		CUSTOMER	METERS & SERVICES	BASE	PEAK	FIRE PROTECTION			
Westside	6,400	0.00%	0.00%	31.96%	38.35%	29.69%	0.00%	100.00%	*1-1900 gpm for fire-flow, remainder peaking factor 2.2*
Judd Hill	1,200	0.00%	0.00%	45.45%	54.55%	0.00%	0.00%	100.00%	*Based on peaking factor of 2.2*
Mt. Aire	750	0.00%	0.00%	45.45%	54.55%	0.00%	0.00%	100.00%	*Based on peaking factor of 2.2*
McAllister	500	0.00%	0.00%	45.45%	54.55%	0.00%	0.00%	100.00%	*Based on peaking factor of 2.2*
Skyridge	110	0.00%	0.00%	45.45%	54.55%	0.00%	0.00%	100.00%	*Based on peaking factor of 2.2*
400 Zone	5,700	0.00%	0.00%	29.51%	35.41%	35.09%	0.00%	100.00%	*1-2000 gpm for fire-flow, remainder peaking factor 2.2*
Total Supply Stations	14,660								
Allocation of Pumping Capacity		-	-	4,891	5,869	3,900	-	14,660	
Reallocation of "As All Other" Pumping Capacity		-	-	-	-	-	-	-	
Reallocated Pumping Capacity		**-**	**-**	**4,891**	**5,869**	**3,900**	**-**	**14,660**	
Percent of Total		**0.00%**	**0.00%**	**33.36%**	**40.03%**	**26.60%**	**0.00%**		

[a] Source of pumping information: Carollo Engineering. City of Lacey Comprehensive Plan Update, Table 1.12. Fireflow proportion estimates provided by Brandon McAllister, City of Lacey.

Pipe Capacity Allocation Table

Pipe Size	Length (lf) [a]	Replacement Cost perl lf. [b]	Estimated Cost	Incremental Cost for Fire Oversizing	FUNCTIONS OF WATER SERVICE			AS ALL OTHERS	TOTAL	ALLOCATION BASIS
					BASE	PEAK	FIRE PROTECTION			
1	3,338		$ -							
2	113,647		$ -		45.45%	54.55%	0.00%	0.00%	100.00%	Domestic: Base/Peak
3	20,771		$ -		45.45%	54.55%	0.00%	0.00%	100.00%	Domestic: Base/Peak
4	65,356	130	$ 8,496,280		45.45%	54.55%	0.00%	0.00%	100.00%	Domestic: Base/Peak
6	443,522	160	$ 70,963,520	$ 13,305,660	36.9%	44.3%	18.8%	0.00%	100.00%	Fire Flow Oversizing: Base/Peak
8	701,832	185	$ 129,838,920	$ 17,545,800	39.3%	47.2%	13.5%	0.00%	100.00%	Fire Flow Oversizing: Base/Peak
10	94,212	215	$ 20,255,580	$ 2,826,360	39.1%	46.9%	14.0%	0.00%	100.00%	Fire Flow Oversizing: Base/Peak
12	354,617	230	$ 81,561,910	$ 5,319,255	42.5%	51.0%	6.5%	0.00%	100.00%	Fire Flow Oversizing: Base/Peak
14	30,631	268	$ 8,219,318		45.45%	54.55%	0.00%	0.00%	100.00%	Transmission Main: Base/Peak
16	51,396	280	$ 14,390,880		45.45%	54.55%	0.00%	0.00%	100.00%	Transmission Main: Base/Peak
18	8,045	315	$ 2,534,175		45.45%	54.55%	0.00%	0.00%	100.00%	Transmission Main: Base/Peak
20	-	320	$ -		45.45%	54.55%	0.00%	0.00%	100.00%	Transmission Main: Base/Peak
24	-	360	$ -		45.45%	54.55%	0.00%	0.00%	100.00%	Transmission Main: Base/Peak
Total	**1,887,367**		**$ 336,260,583**	**$ 38,997,075**	**40.18%**	**48.22%**	**11.60%**	**0.00%**	**100.00%**	

[a] Source of data: Carollo Engineering. Comprehensive Plan Update Table 1.9
[b] Source: General planning estimates, Murray Smith and Associates

City of Lacey
Water Utility Rate Study
Functional Allocations

Allocation of Operating Expenses

OPERATING EXPENSE	TOTAL COSTS		FUNCTIONS OF WATER SERVICE				AS ALL OTHERS	TOTAL	ALLOCATION BASIS
Test Year =>	2012								
		CUSTOMER	METERS & SERVICES	BASE	PEAK	FIRE PROTECTION			
WATER UTILITY									
GENERAL SERVICES DIVISION									
Salaries - Regular	$ 455,856	0.00%	5.01%	43.02%	51.97%	0.00%	0.00%	100.00%	*General Service Plant*
Salaries - Overtime	$ 35,000	0.00%	5.01%	43.02%	51.97%	0.00%	0.00%	100.00%	*General Service Plant*
Salaries - Part-time	$ -	0.00%	5.01%	43.02%	51.97%	0.00%	0.00%	100.00%	*General Service Plant*
Employer paid benefits	$ 193,031	0.00%	5.01%	43.02%	51.97%	0.00%	0.00%	100.00%	*General Service Plant*
Unemployment compensation	$ -	0.00%	5.01%	43.02%	51.97%	0.00%	0.00%	100.00%	*General Service Plant*
Office and operating supply	$ 4,000	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%	*As All Other*
Small tools and equipment	$ 500	0.00%	5.01%	43.02%	51.97%	0.00%	0.00%	100.00%	*General Service Plant*
Supplies - uniform purchase	$ 5,412	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%	*As All Other*
Software upgrade	$ 6,630	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%	*As All Other*
Professional services - Other	$ 47,300	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Professional services - Engineering	$ 547,921	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Professional services - Audit	$ 9,425	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%	*As All Other*
Professional services - Legal	$ 20,000	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%	*As All Other*
Professional services - Water Resources	$ 423,173	0.00%	0.00%	45.45%	54.55%	0.00%	0.00%	100.00%	*Supply/Treatment*
Professional services - Utility locates	$ 2,000	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	100.00%	*Meters and Services*
Transportation - per diem	$ 11,872	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%	*As All Other*
Dues & subscriptions	$ 5,000	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%	*As All Other*
Registrations	$ 22,280	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%	*As All Other*
Equipment rental	$ 2,997	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
IMS rental	$ 149,269	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Lease miscellaneous	$ 6,900	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%	*As All Other*
Insurance	$ 53,563	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Repairs and maintenance - facilities	$ 2,000	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Printing and Binding	$ 500	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	*Customer*
Recording Fees	$ 3,000	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%	*As All Other*
Maintenance contracts	$ 1,000	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Uniform contracts	$ 5,147	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%	*As All Other*
Assessments / taxes	$ -	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%	*As All Other*
CDL - physicals / licenses	$ 210	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%	*As All Other*
Conservation program	$ -	0.00%	0.00%	45.45%	54.55%	0.00%	0.00%	100.00%	*Supply/Treatment*
Common facilities	$ 115,294	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Intragovernmental	$ 112,550	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%	*Customer*
B&O Taxes - calculated	$ 48,895	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%	*As All Other*
State Excise Taxes - calculated	$ 470,338	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%	*As All Other*
City Utility Taxes - calculated	$ 561,151	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%	*As All Other*
CUSTOMER SERVICES DIVISION									
Salaries - Regular	$ 373,306	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	*Customer*
Salaries - Overtime	$ 100	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	*Customer*
Salaries - Part-time	$ -	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	*Customer*
Employer paid benefits	$ 175,238	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	*Customer*
Unemployment compensation	$ -	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	*Customer*

City of Lacey
Water Utility Rate Study
Functional Allocations

Office and operating supply	$	4,000	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	*Customer*
Small tools and equipment	$	500	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	*Customer*
Supplies - uniform purchase	$	650	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	*Customer*
Professional services - computer	$	750	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	*Customer*
Communications - telephone	$	11,500	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	*Customer*
Communications - postage	$	78,015	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	*Customer*
Transportation - per diem	$	2,140	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	*Customer*
Registrations	$	990	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	*Customer*
Equipment rental	$	12,018	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	*Customer*
IMS rental	$	33,260	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	*Customer*
Insurance - AWC L&I pool	$	2,340	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	*Customer*
Repairs & maintenance - equipment	$	150	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	*Customer*
Excise taxes (Calculated separately)	$	-	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	*Customer*
Printing and binding	$	23,900	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	*Customer*
Maintenance contracts	$	21,750	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	*Customer*
Uniform cleaning	$	500	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	*Customer*
Bad debt expense	$	12,600	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	*Customer*
Software maintenance	$	7,900	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	*Customer*
Contractual services	$	45,700	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	*Customer*
Transfers out - Construction (Calculated separately)	$	-	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	*Customer*
Meters	$	160,000	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	*Customer*
Capital Outlays - Equipment	$	46,500	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	*Customer*
PRODUCTION AND STORAGE DIVISION										
Salaries - Regular	$	402,042	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Salaries - Overtime	$	19,000	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Salaries - Part-time	$	-	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Employer paid benefits	$	173,468	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Unemployment compensation	$	-	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Office and operating supply	$	9,145	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Small tools and equipment	$	6,495	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Water treatment supplies	$	95,300	0.00%	0.00%	45.45%	54.55%	0.00%	0.00%	100.00%	*Supply/Treatment*
Conference space - safety equipment	$	3,200	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Electrical supplies	$	5,000	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Small tools - electrical	$	700	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Fuel	$	-	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Professional services - Other	$	24,297	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Professional services - Parks	$	43,042	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Professional services - DSHS water samples	$	1,500	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Communications - Telephone	$	4,600	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Equipment rental	$	50,936	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Rentals - Other	$	3,100	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Insurance - Fire / Property	$	34,108	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Utility - Electric	$	615,000	0.00%	0.00%	33.36%	40.03%	26.60%	0.00%	100.00%	*Pumping*
Utility - City of Lacey	$	7,000	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Olympia Water Agreement	$	350,000	0.00%	0.00%	45.45%	54.55%	0.00%	0.00%	100.00%	*Supply/Treatment*
Repair and Maintenance - Equipment	$	2,500	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Repair and Maintenance - Equipment Non Power	$	300	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Repair and Maintenance - Facilities	$	75,000	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Repair and Maintenance - Telemetry	$	23,000	0.00%	0.00%	45.45%	54.55%	0.00%	0.00%	100.00%	*Supply/Treatment*
Maintenance Contracts	$	31,790	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Capital outlays - equipment	$	-	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*

SYSTEM MAINTENANCE DIVISION										
Salaries - Regular	$	595,187	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Salaries - Overtime	$	10,800	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Salaries - Part-time	$	-	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Employer paid benefits	$	292,162	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Unemployment compensation	$	-	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Office and operating supply	$	12,150	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Small tools and equipment	$	11,668	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Inventory	$	70,000	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Street restoration	$	20,000	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Non-inventory under $60	$	17,400	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Manhole lid replacement	$	250	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Valves	$	41,000	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Hydrants	$	50,000	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	100.00%	*All to Fire*
Professional services - other	$	-	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Professional services - leak survey	$	6,500	0.00%	0.00%	45.45%	54.55%	0.00%	0.00%	100.00%	*Supply/Treatment Plant*
Communications - telephone	$	5,500	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Equipment rental	$	254,492	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Rentals - other	$	2,300	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Repair and Maintenance - Equipment	$	6,550	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Repair and Maintenance - Equipment Non Power	$	2,550	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Capital outlays - equipment	$	-	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Hydrant Meters	$	9,000	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	100.00%	*All to Fire*
CONSTRUCTION - UTILITY CREWS DIVISION										
Salaries - Regular	$	-	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Salaries - Overtime	$	-	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Salaries - Part-time	$	-	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Employer paid benefits	$	-	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Unemployment compensation	$	-	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Office and operating supply	$	-	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Small tools and equipment	$	-	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Inventory	$	-	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Non-inventory - under $60	$	-	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Meters	$	-	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Equipment - rental	$	-	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Rentals - other	$	-	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Repairs & maintenance - equipment	$	-	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Repairs & maintenance - equipment non-power	$	-	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
CROSS CONNECTION CONTROL DIVISION										
Salaries - Regular	$	-	0.00%	0.00%	40.18%	48.22%	11.60%	0.00%	100.00%	*Transmission/Distribution*
Salaries - Overtime	$	-	0.00%	0.00%	40.18%	48.22%	11.60%	0.00%	100.00%	*Transmission/Distribution*
Salaries - Part-time	$	-	0.00%	0.00%	40.18%	48.22%	11.60%	0.00%	100.00%	*Transmission/Distribution*
Employer paid benefits	$	-	0.00%	0.00%	40.18%	48.22%	11.60%	0.00%	100.00%	*Transmission/Distribution*
Unemployment compensation	$	-	0.00%	0.00%	40.18%	48.22%	11.60%	0.00%	100.00%	*Transmission/Distribution*
Office and operating supply	$	1,600	0.00%	0.00%	40.18%	48.22%	11.60%	0.00%	100.00%	*Transmission/Distribution*
Small tools and equipment	$	1,200	0.00%	0.00%	40.18%	48.22%	11.60%	0.00%	100.00%	*Transmission/Distribution*
Professional services - other	$	500	0.00%	0.00%	40.18%	48.22%	11.60%	0.00%	100.00%	*Transmission/Distribution*
Repairs & maintenance - equipment non-power	$	750	0.00%	0.00%	40.18%	48.22%	11.60%	0.00%	100.00%	*Transmission/Distribution*
CDL - Physicals / Licenses	$	120	0.00%	0.00%	40.18%	48.22%	11.60%	0.00%	100.00%	*Transmission/Distribution*

City of Lacey
Water Utility Rate Study
Functional Allocations

WATER QUALITY DIVISION									
Office and operating supply	$ 750	0.00%	0.00%	45.45%	54.55%	0.00%	0.00%	100.00%	*Supply/Treatment*
Small tools and equipment	$ 1,150	0.00%	0.00%	45.45%	54.55%	0.00%	0.00%	100.00%	*Supply/Treatment*
Supplies - uniform purchase	$ 500	0.00%	0.00%	45.45%	54.55%	0.00%	0.00%	100.00%	*Supply/Treatment*
Professional service - other	$ 14,225	0.00%	0.00%	45.45%	54.55%	0.00%	0.00%	100.00%	*Supply/Treatment*
Professional service - ground water mgmt	$ 25,000	0.00%	0.00%	45.45%	54.55%	0.00%	0.00%	100.00%	*Supply/Treatment*
Professional service - DSHS water samples	$ 51,279	0.00%	0.00%	45.45%	54.55%	0.00%	0.00%	100.00%	*Supply/Treatment*
Communications - telephone	$ 500	0.00%	0.00%	45.45%	54.55%	0.00%	0.00%	100.00%	*Supply/Treatment*
Communications - postage	$ 9,500	0.00%	0.00%	45.45%	54.55%	0.00%	0.00%	100.00%	*Supply/Treatment*
Dues & subscriptions	$ 500	0.00%	0.00%	45.45%	54.55%	0.00%	0.00%	100.00%	*Supply/Treatment*
Repairs and maintenance - equipment	$ 250	0.00%	0.00%	45.45%	54.55%	0.00%	0.00%	100.00%	*Supply/Treatment*
Printing and binding	$ 18,600	0.00%	0.00%	45.45%	54.55%	0.00%	0.00%	100.00%	*Supply/Treatment*
Operating permit - DSHS	$ 8,500	0.00%	0.00%	45.45%	54.55%	0.00%	0.00%	100.00%	*Supply/Treatment*
Project green	$ 2,500	0.00%	0.00%	45.45%	54.55%	0.00%	0.00%	100.00%	*Supply/Treatment*
Conservation program	$ 64,500	0.00%	0.00%	45.45%	54.55%	0.00%	0.00%	100.00%	*Supply/Treatment*
Capital outlays - equipment	$ -	0.00%	0.00%	45.45%	54.55%	0.00%	0.00%	100.00%	*Supply/Treatment*
Additional annual O&M from CIP	$ -	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%	*As All Other*
ADDITIONAL O&M FROM CIP	$ -	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%	*As All Other*
Total Operating Expenses	$ 7,925,976	$ 1,014,307	$ 180,709	$ 2,239,100	$ 2,699,083	$ 499,968	$ 1,292,810	$ 7,925,976	
Water Service Functions		15.29%	2.72%	33.76%	40.69%	7.54%		100.00%	
Water Service Functions (Excluding Fire)		16.54%	2.95%	36.51%	44.01%			100.00%	
Allocation of "As All Others (Excluding Fire)"		$ 213,805	$ 38,092	$ 471,977	$ 568,936	$ -	$ (1,292,810)	$ -	
TOTAL	**$ 7,925,976**	**$ 1,228,112**	**$ 218,801**	**$ 2,711,077**	**$ 3,268,019**	**$ 499,968**	**$ -**	**$ 7,925,976**	
Allocation Percentages		**15.49%**	**2.76%**	**34.20%**	**41.23%**	**6.31%**	**0.00%**	**100.00%**	
check operating expense	7,925,976								
difference	-								

City of Lacey
Water Utility Rate Study
Functional Allocations

Allocation of Revenue Requirement

Design Rates For =>	2012								
REVENUE REQUIREMENT	TOTAL COSTS	FUNCTIONS OF WATER SERVICE					AS ALL OTHERS	TOTAL	ALLOCATION BASIS
		CUSTOMER	METER SERVICES	BASE	PEAK	FIRE PROTECTION			
OPERATING AND CAPITAL EXPENSES									
Cash Operating Expenses	$ 7,925,976	15.49%	2.76%	34.20%	41.23%	6.31%	0.00%	100.00%	As O&M Expense
Existing Debt Service	521,681	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
New Debt Service	-	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Rate-Funded CIP	-	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Rate Funded System Reinvestment	1,558,802	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Total Expenses	**$ 10,006,459**	**12.27%**	**3.14%**	**35.25%**	**42.52%**	**6.82%**	**0.00%**	**100.00%**	
OTHER REVENUES AND ADJUSTMENTS									
Less: Other Revenues	$ (1,206,834)	15.49%	2.76%	34.20%	41.23%	6.31%	0.00%	100.00%	As O&M Expense
Less: Use of Connection Charges for Debt Service	(521,681)	0.00%	4.57%	39.25%	47.41%	8.77%	0.00%	100.00%	*Total Plant-In-Service*
Less: Operating Fund Interest Earnings	(966)	15.49%	2.76%	34.20%	41.23%	6.31%	0.00%	100.00%	As O&M Expense
Plus: Additional taxes Due to Rate Increase	-	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%	*As All Other*
Plus: Net Cash Flow after Rate Increase	1,075,541	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%	*As All Other*
Plus: Adjustment for Partial Year Increase	-	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%	*As All Other*
Rate Revenue Requirement	$ 9,352,519	$ 1,040,966	$ 256,728	$ 2,909,786	$ 3,509,076	$ 560,422	$ 1,075,541	$ 9,352,519	
Water Service Functions		12.58%	3.10%	35.16%	42.40%	6.77%		100.00%	
Water Service Functions (Excluding Fire)		13.49%	3.33%	37.71%	45.47%			100.00%	
Allocation of "As All Others (Excluding Fire)"		$ 145,091	$ 35,783	$ 405,569	$ 489,098		$ (1,075,541)	$ -	
Rate Revenue Requirement	**$ 9,352,519**	**$ 1,186,057**	**$ 292,511**	**$ 3,315,355**	**$ 3,998,174**	**$ 560,422**	**$ -**	**$ 9,352,519**	
Allocation Percentages		**12.68%**	**3.13%**	**35.45%**	**42.75%**	**5.99%**	**0.00%**	**100.00%**	
Provision for Operational Use of Fire Assets	**-**	**7,560**	**1,865**	**21,133**	**25,485**	**$ (56,042)**			
General Fund Transfer (Reimbursement of Fire Costs)	**(504,380)**					**(504,380)**		**(504,380)**	
Rate Revenue Requirement	**$ 8,848,139**	**$ 1,193,617**	**$ 294,376**	**$ 3,336,487**	**$ 4,023,659**			**$ 8,848,139**	
Allocation Percentages		**13.49%**	**3.33%**	**37.71%**	**45.47%**			**100.00%**	
Check to revenue req't on tests page	9,352,519		Note: incremental utility tax percent based upon rate revenues after rate increase			5.70%			

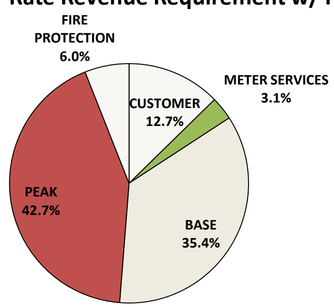
[a] Percent of fire assets used for operations:	10%

FUNCTIONAL ALLOCATION OF REVREQ W/ 6.11% INCREMENTAL UTILITY TAX FOR FIRE

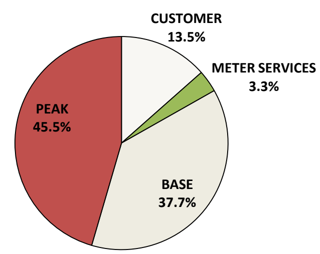
$	1,261,658	CUSTOMER
$	311,157	METER SERVICES
$	3,526,681	BASE
$	4,253,024	PEAK
$	**9,352,519**	**TOTAL**

Existing Utility Tax Rate	6.00%
Fire Protection Rate	5.70%
New Total Utility Tax Rate	12.04%
Incremental Tax Rate	**6.04%**

Rate Revenue Requirement w/ Fire



Rate Revenue Requirement w/o Fire



City of Lacey
Water Utility Rate Study
Summary & Reconciliation of Fire Protection Adjustment

Existing Utility Tax Rate	6.00%
Share of Fire Protection Costs (*i.e. General Fund Fire Protection Payment Rate*)	5.70%
New Utility Tax Rate	12.04%
Incremental Utility Tax Rate Increase	6.04%

	Before the Adjustment	After the Adjustment
Rate Revenues in 2012	$ 9,352,519	$ 8,848,139
Fire Protection Transfer from General Fund (*5.70% of rate revenues collected*)	$ -	$ 504,380
Total Rate Revenues for the Utility	**$ 9,352,519**	**$ 9,352,519**
Utility Tax Revenue @ 6.00%	$ 561,151	$ 530,888
Incremental Tax Revenue @ 6.04%	$ -	$ 534,643
Total Revenue (Utility Rates + Taxes) Collected From Ratepayers	**$ 9,913,670**	**$ 9,913,670**
Incremental Tax Revenue @ 6.04%	$ -	$ 534,643
Fire Protection Transfer from General Fund @ 5.70%	$ -	$ (504,380)
Revenue Left in the General Fund from the Incremental Tax Increase	$ -	$ 30,263
Utility Tax Revenue @ the Existing Tax Rate of 6.00%	$ 561,151	$ 530,888
Total Net Revenue for the General Fund	**$ 561,151**	**$ 561,151**

City of Lacey
Water Utility Rate Study
Fire Deduction Allocation

Total Fire Allocation	$ 504,380

Fire Flow Requirements (Current Rate Structure)	2012 Revenue at Current Rates	Percentage share	Fire Allocation
Group 1 [a]	$ 7,301,851	78.1%	393,788
Group 2 [b]	2,050,668	21.9%	110,592
Total	**$ 9,352,519**	**100.0%**	**504,380**

[a] Group 1 rates apply to SFR, Duplex, and Irrigation customers.
[b] Group 2 rates apply to all remaining customers (Multifamily, Mobile Home, Commercial and Govt Exempt).

City of Lacey
Water Utility Rate Study
Fire Deduction Allocation

Test Year **2012**

Comparison of Current Rates to Rates Net of Fire and COS Adjustments

			0.00%					5.70%		
	Customer Classes	**2012 Revenue at Current Rates**	**2012 Revenue with ATB Increase**	**% Change with ATB Increase**	**Fire Removal [a]**	**2012 Revenue with ATB Increase Net of Fire**	**Total % Rate Change with ATB Net of Fire**	**Reallocation of Additional Utility Tax**	**2012 Revenue with ATB Increase Net of Fire w/Tax**	**Total % Bill Impact with ATB Net of Fire (w/Tax Increment) [b]**
11	Group 1	$ 7,301,851	$ 7,301,851	0.00%	$ (393,788)	$ 6,908,063	-5.39%	$ 393,788	$ 7,301,851	0.00%
12	Group 2	2,050,668	2,050,668	0.00%	$ (110,592)	1,940,076	-5.39%	110,592	2,050,668	0.00%
	TOTAL	**$ 9,352,519**	**$ 9,352,519**	0.00%	**$ (504,380)**	**$ 8,848,139**	-5.39%	**$ 504,380**	**$ 9,352,519**	0.00%

[a] Fire removal costs are allocated proportional to revenues.
[b] To be applied across-the-board (ATB) to existing rate structure and rates to meet revenue requirements and comply with *Lane vs. Seattle* .

								5.70%		
	Customer Classes	**Revenue at 2011 Rates**	**Revenue with 2012 Adopted Rates**	**% Change**	**Fire Removal from 2012 Rates [a]**	**Revenue with 2012 Rates Net of Fire**	**Total % Rate Change Net of Fire**	**Reallocation of Additional Utility Tax**	**Revenue with 2012 Rates Net of Fire w/Tax Increment**	**Total % Bill Impact [b]**
11	Group 1	$ 7,019,651	$ 7,301,851	4.0%	$ (393,788)	$ 6,908,063	-1.6%	$ 393,788	$ 7,301,851	4.0%
12	Group 2	1,971,648	2,050,668	4.0%	$ (110,592)	1,940,076	-1.6%	110,592	2,050,668	4.0%
	TOTAL	**$ 8,991,299**	**$ 9,352,519**	4.0%	**$ (504,380)**	**$ 8,848,139**	-1.6%	**$ 504,380**	**$ 9,352,519**	4.0%

[a] Fire removal costs are allocated proportional to revenues.
[b] To be applied across-the-board (ATB) to existing rate structure and rates to meet revenue requirements and comply with *Lane vs. Seattle* .

City of Lacey
Water Utility Rate Study
Rate Schedule with Across the Board Rate Adjustments

Test Year 2012

6.50%
-5.39%

Current and Proposed Water Rates with Across the Board Adjustments Net of Fire

Rate Structure	2012 In-City	2013 In-City	2014 In-City	2015 In-City	2016 In-City	2017 In-City
Group 1 [a]						
Fixed Chg/Mo	$ 11.74	$ 11.83	$ 12.60	$ 13.42	$ 14.29	$ 15.22
Volume						
Blk 1 (0-6ccf)	$ 0.9767	$ 0.9841	$ 1.0481	$ 1.1162	$ 1.1887	$ 1.2660
Blk 2 (6-12ccf)	2.2926	2.3099	2.4601	2.6200	2.7903	2.9717
Blk 3 (12-24ccf)	2.9301	2.9523	3.1442	3.3485	3.5662	3.7980
Blk 4 (24+ccf)	3.9126	3.9422	4.1984	4.4713	4.7620	5.0715
Group 2 [b]						
Fixed Chg/Mo	$ 11.74	$ 11.83	$ 12.60	$ 13.42	$ 14.29	$ 15.22
Volume						
Blk 1 (0-6ccf)	$ 0.9767	$ 0.9841	$ 1.0481	$ 1.1162	$ 1.1887	$ 1.2660
Blk 2 (6+ccf)	2.2926	2.3099	2.4601	2.6200	2.7903	2.9717
Rate Charge (9 ccf)	$ 24.48	$ 24.66	$ 26.27	$ 27.97	$ 29.79	$ 31.73

[a] Group 1 rates apply to SFR, Duplex, and Irrigation customers.
[b] Group 2 rates apply to all remaining customers (MF, Mobile Home, Commercial and Exempt)

Notes:

50% Senior Discount in effect
Outside City rates will reflect 1.2 multiplier

CITY OF LACEY

Results

Water Rate Study

Presented by :
Karyn Johnson, Principal

February 23,2012
City Council

FCS GROUP
Solutions-Oriented Consulting

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Major Scope Elements

- Update Revenue Requirement Analysis **(system-wide revenue needs assessment)**
- Update General Facility Charge **(equity between existing & future customers)**
- Cost of Service Analysis **(equity between customer classes)**
- Rate Structure Evaluation **(equity within customer classes)**

Presentation Agenda

- Financial policies & impacts
- Capital program funding & impacts
- Annual rate adjustment strategy & assumptions
- General facilities charges
- Recap of policy choices & major assumptions

3

Financial Policies

Overview of Financial Policies

- Considered best management practices to promote the financial integrity and stability of the utility and help ensure the sustainability of essential utility services
- Commonly reviewed by bond / loan underwriters to determine creditworthiness
- Policies evaluated:
  - Operating reserves
  - Capital reserves
  - System reinvestment funding
  - Debt coverage
  - Debt management

Documented policy framework to guide future financial decisions; incorporates phase-in strategies to smooth near-term rate impacts

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Financial Policies: Operating Reserve

Purpose

✓ Adequate working capital to accommodate fluctuations in the timing of revenues and expenditures

Recommend

✓ Maintain target balance in the operating accounts equal to 60 (16%) to 90 days (25%) of total operating & maintenance expenses

Impact

✓ Current cash reserves sufficient to maintain target balance thresholds with no incremental impact on rates

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Financial Policies: Capital Reserve

Purpose
- ✓ Source of funding to mitigate the impact of unanticipated capital costs on rates; not intended to cover catastrophic loss

Recommend
- ✓ Maintain target balance in each utility's capital account equal to 1% of original cost of system's total fixed assets

Impact
- ✓ "Nested" with system reinvestment funding and other capital resources - no incremental impact on rates

Financial Policies: System Reinvestment Funding

Purpose
- ✓ Ensure ongoing system integrity through reinvestment in the system; charge customers commensurate with the consumption of facility useful lives; and maintain rate stability

Recommend
- ✓ Fund from rates an amount equal to annual depreciation expense net of annual debt principal payments; phase in over 5 years

Impact
- ✓ Revised current practice of 15% of rate revenue to annual depreciation expense less annual debt principal payments
  - ✓ Equates to 20% - 25% of rate revenue
- ✓ Incremental rate impacts

Financial Policies: Debt Service Coverage

Purpose
- ✓ To comply with existing debt covenants and/or maintain creditworthiness for future debt issuance

Recommend
- ✓ Set rates to maintain a coverage ratio of at least 1.25 times annual bond debt service payments, excluding general facilities charge (GFC) revenues

Impact
- ✓ Cash needs drive necessary rate increases - no incremental impact to rates

Financial Policies: Debt Management

Purpose
- ✓ Prudent balance between use of debt and cash funding of capital programs

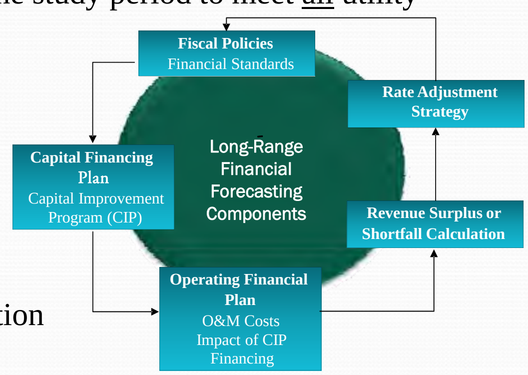
Recommend
- ✓ Maintain a ratio of no greater than 50% debt to 50% equity
- ✓ "Rule of thumb" – debt finance no more than 75% of current 6-year capital programs
- ✓ Issue debt for major capital projects with longer useful lives (especially when interest rates are low)

Impact
- ✓ Currently about 6.0% debt ($10 million interfund loan from Sewer Capital Fund)
- ✓ Expected to remain well within industry guidelines over study period

Revenue Requirements

Overview of Revenue Requirements

- Multi-year financial plan that determines the amount of revenue necessary each year over the study period to meet all utility financial obligations
  - Financial policy impacts
  - Capital program impacts
  - Operating / maintenance costs
- Evaluates sufficiency of current rates
- Develops rate implementation strategy
- Determines amount of revenue to be recovered from rates



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Revenue Requirements: Economic / Forecast Assumptions

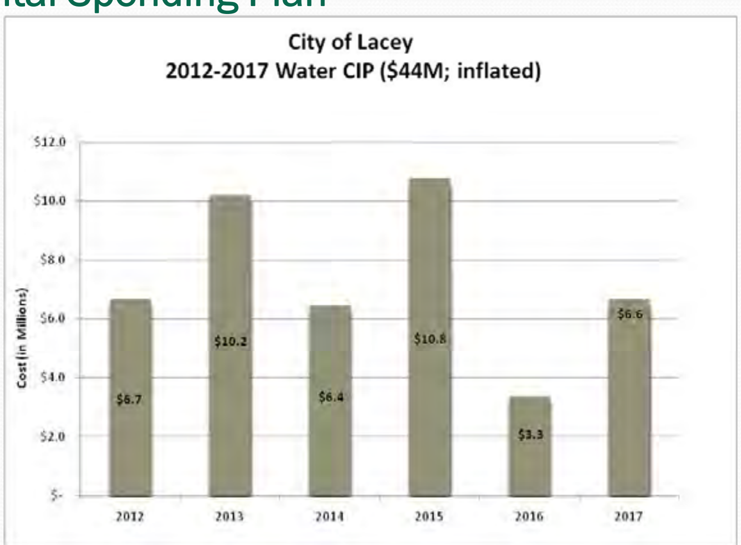
- Customer growth forecast of 1.25% per year
- Cost escalation:
  - Labor costs: 3.0% per year
  - Benefits costs: 6.0% per year
  - General inflation (Non-labor operating costs): 3.0% per year
  - Construction costs: 4.0% per year
- Interest earnings ramping up from 0.15% to 1.0% over study period

Revenue Requirements: Capital Financing Assumptions

- Revenue bonds
  - 20-year term
  - 5.0% interest rate
  - 1.0% issue cost
  - Coverage requirement = 1.25
  - Restricted reserve equal to one-year of debt service

Revenue Requirements Results

Capital Spending Plan



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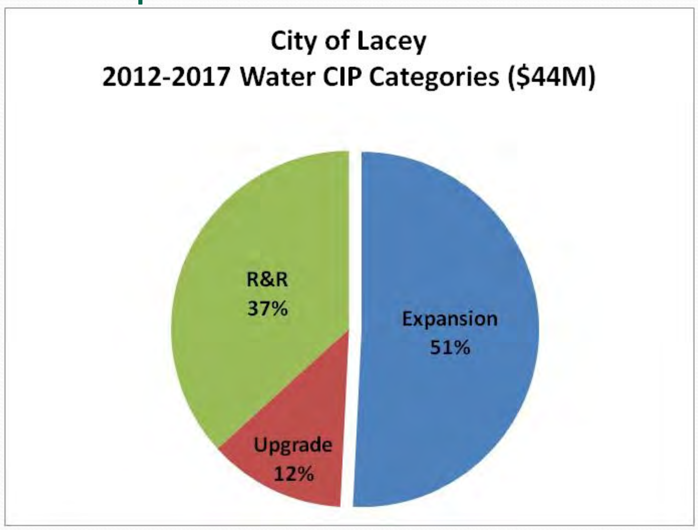
Capital Components



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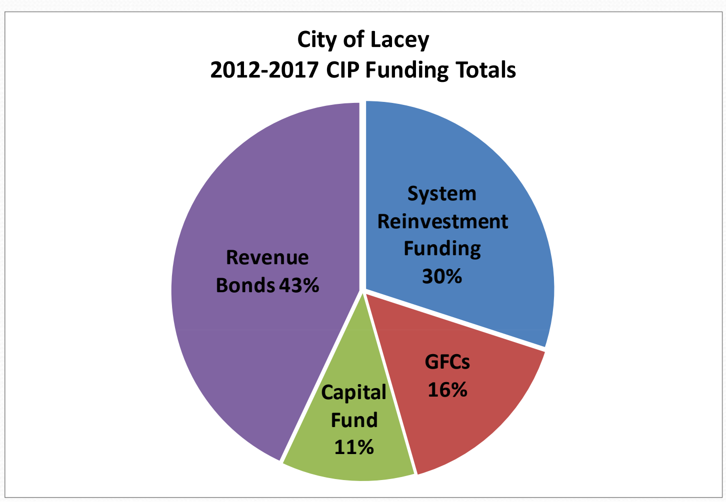
Capital Funding Plan



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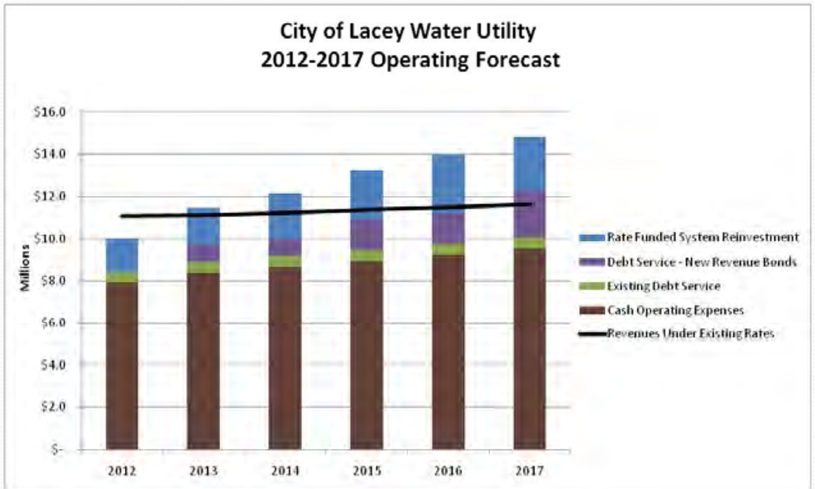
Operating Forecast



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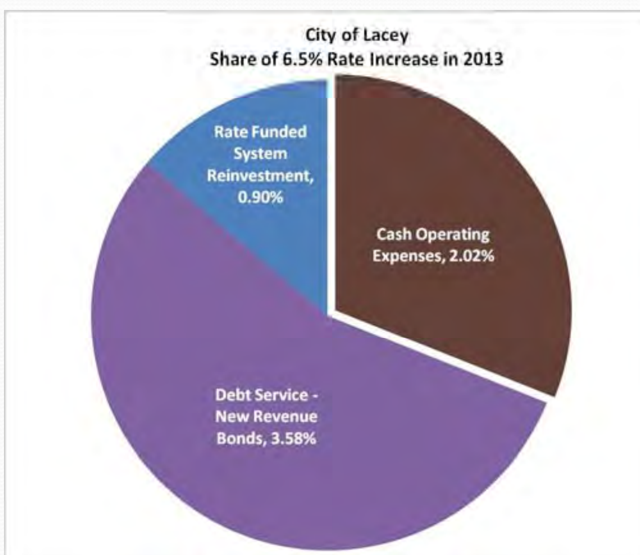
Rate Increase Drivers



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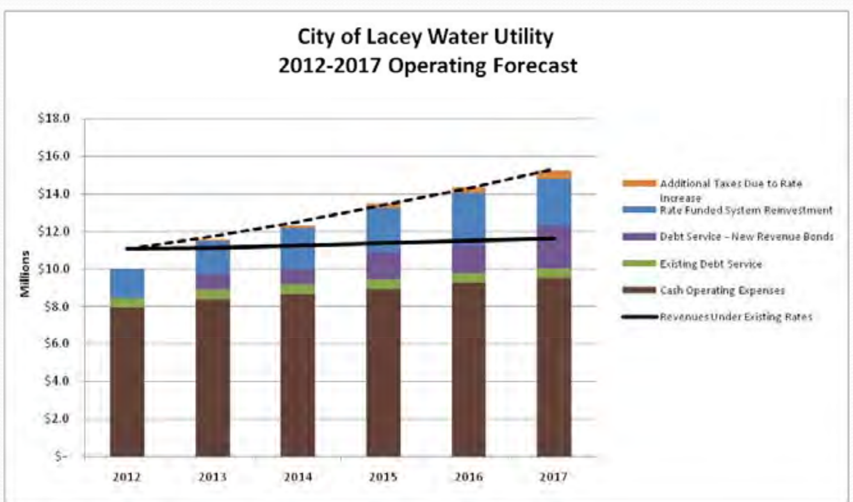
Water Rate Adjustment Strategy

- Major cost drivers of rate increases:
  - Capital program funding
    - Debt service
    - System reinvestment funding
  - Annual cost inflation

Annual Rate Adjustments	Existing	2012	2013	2014	2015	2016	2017
Annual Rate Adjustment		4.00%	6.50%	6.50%	6.50%	6.50%	6.50%
Cumulative Rate Adjustment		4.00%	10.76%	17.96%	25.63%	33.79%	42.49%
Monthly Rate Charge (9 ccf) [a]	$ 23.53	$ 24.48	$ 24.66	$ 26.27	$ 27.97	$ 29.79	$ 31.73

[a] Does not include Utility Tax

Water Rate Revenue Requirement



Implications of *Lane v. Seattle* - Fire Protection Cost Recovery

- Municipal water utilities can no longer include the cost of fire protection in their water rates – it is a general fund obligation
- Fire protection cost recovery options
  - Direct payment from General Fund
  - Increase to water utility tax - Proposed approach 2013 forward

Impact of Fire Cost Removal in 2013

- Total fire protection related costs = 5.70%
- Current utility tax = 6.0%
- New utility tax = 12.04%
- No net impact to the customer's bill
  - Reduction in water rates for fire cost removal offset by increase to utility tax

Legal requirement of removing fire protection costs from rates met; approach to recover costs from utility tax increase results in no impact to General Fund and no impact to customer bills for fire cost removal

Comparison of Water Rates – Existing Rate Structure; Removal of Fire Costs

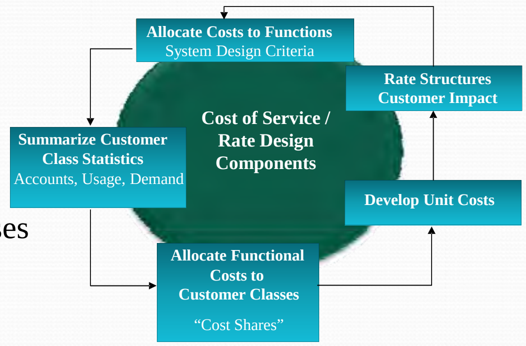
Average SFR Bill	Existing (2012) Rates	Existing Rates Net of Fire Protection [a]
Monthly Base Charge	$ 11.74	$ 11.11
Volume Charge (9 ccf water usage)	$ 12.74	$ 12.05
Total Utility Charge	**$ 24.48**	**$ 23.16**
plus: Existing City Utility Tax (6.00%)	$ 1.47	$ 1.39
plus: Incremental Increase to City Utility Tax (6.04%)	$ -	$ 1.40
GRAND TOTAL	**$ 25.95**	**$ 25.95**

[a] Before the proposed 6.50% rate increase for 2013.

Cost of Service / Rate Design

Overview of Cost of Service & Rate Design

- Provides a defensible basis for assigning “cost shares” and establishing “equity” for system customers
  - Number of customers
  - Patterns of use
  - Level of service
  - Other
- Determines appropriate grouping of customer classes
- Serves as the foundation for rate structure designs



Key Considerations in Rate Design

- Financial stability & predictability
- Consistency with underlying costs by class
- Consistency with policy objectives
  - Conservation & efficiency
  - Economic development
- Complexity of rates
  - Understandable
  - Implementable
- Transitional impacts
  - Customer rate impacts
  - Utility impacts

Rate Design Results

City Staff Recommendation

- Maintain existing rate structure
- Adjust rates for Lane v. Seattle
- Increase utility tax from 6.0% to 12.04%

Rate Structure	2012 In-City	2013 In-City	2014 In-City	2015 In-City	2016 In-City	2017 In-City
Group 1 [a]						
Fixed Chg/Mo	$ 11.74	$ 11.83	$ 12.60	$ 13.42	$ 14.29	$ 15.22
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[a] Group 1 rates apply to SFR, Duplex, and Irrigation customers.
[b] Group 2 rates apply to all remaining customers (MF, Mobile Home, Commercial and Exempt)

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2012 Water Rate Survey Comparison

Jurisdiction	Monthly SFR Bill [a][b]
Steilacoom	$ 34.31
Tacoma (Summer)	30.45
Tacoma (Winter)	29.07
DuPont	27.60
Olympia	24.72
Lacey 2012 Adopted	**24.48**
Tumwater	23.65
Puyallup	22.92

[a] Based on 5/8"x 3/4" or 3/4", and 9 ccf of water consumption
[b] Lacey Monthly Bill does not include Utility Tax

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Other Related Rates

- Low income senior/disabled rate discounts of 50% – no change
- Outside city rate multiplier of 1.2 times inside city rates – no change

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General Facility Charges

Meter Size	2012 GFC [a]	Meter Capacity Ratio [b]	Revised GFC
5/8-inch	4,850	1.00	$ 6,412
1-inch	9,719	2.00	12,847
1 1/2-inch	19,353	3.99	25,581
2-inch	31,606	6.52	41,779
3-inch	59,629	12.29	78,822
4-inch	99,382	20.49	131,370
6-inch	198,560	40.94	262,469

[a] Source: Ord. 1308, 2008. 2008 schedule of charges increased by ENR or 6% per ordinance.
As authorized under LMC 13.32.005.
[b] Based on City's current meter capacity ratio

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2012 General Facility Charge Survey Comparison

Jurisdiction	GFC [a]
Lacey	**$ 4,850**
Tumwater	3,565
Puyallup	3,130
Olympia	3,089
Tacoma	2,229
Steilacoom	1,155
DuPont	400

[a] Based on 3/4" meter or smaller
Note: Calculated charge is $6,412. City Staff recommends maintaining current charge & policy of an annual 6% increase or ENR CCI (higher of two)

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Financial Policies

- Operating reserve: 60-90 days
- Capital reserve: 1% of existing plant assets
- System reinvestment funding
  - Existing policy: 15% of water sales
  - Proposed: equal to annual depreciation expense less annual debt principal payments; phased-in over 5 years (equates to 20% - 25% of water sales)
- Debt management
  - Maintain a ratio of no greater than 50% debt to 50% equity (currently 6% debt)
  - Rate study forecasts debt financing of about 40% of the five-year capital project (increases debt ratio to about 18%; well within standards)

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Key Assumptions

- Growth rate: 1.25%
  - Not consistent with Water System Plan but gives conservative revenue estimates
- Cost escalators:
  - Labor costs: 3.0% per year
  - Benefits costs: 6.0% per year
  - General inflation: 3.0% per year
  - Construction costs: 4.0% per year
- Capital Improvement Plan
  - Rate study includes essential projects only
  - Other capital deferred

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Rates and Charges

- Fire protection cost recovery (Lane v. Seattle)
  - Effectively an accounting change
  - Cost burden remains with the utility customer
- Rates
  - 6.5% across-the-board increases starting in 2013
  - Maintain current rate structure, low-income discount, and outside city multiplier
- GFCs
  - Continue with 6% annual increases to existing charge until reaches calculated charge