ASR License No. _____
(ASSIGNED AFTER FILING)

STATE OF OREGON
WATER RESOURCES DEPARTMENT
APPLICATION FOR LIMITED WATER USE LICENSE
FOR
AQUIFER STORAGE AND RECOVERY (ASR)

Applicant(s): The Joint Water Commission (JWC)
Contact Person: Kevin Hanway
Mailing Address: 150 E. Main Street, Third Floor

Hillsboro	Oregon	97123	503-615-6702
City	State	Zip	Phone #

1. DATE(S) OF PRE-APPLICATION CONFERENCE(S): October 19, 2010

INFORMATION REGARDING ASR TESTING UNDER A LIMITED LICENSE

2. SOURCE OF INJECTION WATER for ASR: Sain Creek, the Tualatin River, Scoggins Creek, and Bull Run River,
a tributary of Scoggins Creek, The Willamette River, the Tualatin River, and the Sandy River, respectively

3. MAXIMUM DIVERSION RATE: Up to 8,100 gpm (18.051 cfs), subject to change based on pilot testing

4. MAXIMUM INJECTION RATE AT EACH WELL(S): Up to 1,500 gpm (3.342 cfs), subject to change based on pilot testing

5. MAXIMUM STORAGE VOLUME: 2.1 billion gallons

6. MAXIMUM STORAGE DURATION: 5 years

7. MAXIMUM WITHDRAWAL RATE AT EACH WELL(S): 2,000 gpm (4.456 cfs), subject to change based on pilot testing

8. LICENSE TERM OR DURATION SOUGHT (5 year maximum): 5 years

9. PROPOSED USE OR DISPOSAL OF RECOVERED WATER: Municipal use, recovery of stored water will be distributed into the JWC water supply system

10. IF CONTINGENCIES PRECLUDE THE USE IN ITEM 9, SPECIFY AN ALTERNATE USE OR DISPOSAL OF THE RECOVERED WATER: Contingency plan for disposal of injected water is to discharge to a pump-to-waste system or a nearby storm sewer

INFORMATION REGARDING THE ULTIMATE ASR PROJECT AS CURRENTLY ANTICIPATED

11. SOURCE OF INJECTION WATER for ASR: Sain Creek, the Tualatin River, Scoggins Creek, and Bull Run River,

    a tributary of Scoggins Creek, The Willamette River, the Tualatin River, and the Sandy River, respectively

12. MAXIMUM DIVERSION RATE: Up to 8,100 gpm (18.051 cfs), subject to change based on pilot testing

13. MAXIMUM INJECTION RATE AT EACH WELL(S): Up to 1,500 gpm (3.342 cfs), subject to change based on pilot testing

14. MAXIMUM STORAGE VOLUME: 2.1 billion gallons

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16. MAXIMUM WITHDRAWAL RATE AT EACH WELL(S): 2,000 gpm (4.456 cfs), subject to change based on pilot testing

NOTE: The materials required by rule for an ASR limited license are extensive. The items on this sheet consist of those outlined in OAR 690-350-020(2) and (3)(a)(A-E). Please consult the rule and provide as attachments to this form the other requirements in OAR 690-350-020(3)(a).

Signature of Applicant [signature] Date 1/18/11

Title JWC General Manager

Joint Water Commission
Aquifer Storage and Recovery

Limited License Application and
Pilot Test Work Plan

Prepared For
Oregon Department of Water Resources

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Appendices

1. Introduction

The Joint Water Commission (JWC) is a collective water supply agency formed under an Oregon Revised Statute (ORS) 190 agreement between the Cities of Hillsboro, Forest Grove, and Beaverton, and the Tualatin Valley Water District (TVWD)[1]. Through its member agencies, the JWC provides the primary potable water supply to more than 400,000 residents. The next 10 years in the JWC's infrastructure planning will be critical because of the major financial investments needed to meet the growing demands for reliable water supply and transmission to its customers. Comparing projected JWC peak season demand with the existing infrastructure capacity during the next 20 years indicates that the JWC may not be able to meet peak season demands between 2015 and 2021 (Figure 1). Specifically, JWC is currently limited on water treatment plant (WTP) and transmission line capacity (Figure 1). In 2008, JWC had a peak day demand of 66 million gallons, which is 88% of the WTP's 75 million gallons per day (mgd) capacity. In addition, the JWC anticipates needing access to additional water supply to meet its future peak day demands. Moreover, the anticipated date of the new supply project (e.g., Tualatin Basin Water Supply Project) may be further delayed due to federal studies of new seismic standards. Because of delays in future water supply development projects, the JWC is seeking opportunities to "bridge" its infrastructure limits and augment its future water supply. The Cities of Hillsboro and Beaverton and the TVWD are the only participating JWC members in the initial exploration and development phase of the JWC ASR project.

The JWC will use ASR in the Tualatin Basin, Washington County, Oregon, to meet peak water demands in the summer by storing surplus water during the winter months. ASR will provide economic benefit to the JWC because it would act as a bridge to help meet future supply shortfalls, specifically between 2015 and 2021, and delay the need for additional JWC WTP expansions and a new costly transmission line. ASR also would benefit the JWC because it will provide an emergency storage and reserve capacity.

The JWC would like to develop a phased ASR program that ultimately consists of 14 operational ASR wells in the Cooper Mountain area. Full-scale development of the JWC ASR program would sustainably provide about 14 to 15 mgd of recovered water during 140 to 180 days in the summer months (peak season) based on storing roughly an equivalent of 2 billion gallons (BG) of water. A numeric groundwater model was developed in support of this limited license application, to evaluate the feasibility of developing the proposed ASR program at full build-out. It is important to note that the JWC intends to expand the ASR program in stages so that (1) potential impacts from the ASR program can be assessed and potentially modified at each stage and (2) the conceptual and numeric groundwater models can be refined as the program develops.

This document, prepared by GSI Water Solutions, Inc. (GSI), is an ASR limited license application and includes a work plan for the proposed ASR program. The ASR limited license application and work plan are in compliance with Oregon Administrative Rules (OAR) 690-350-020 (OAR, 2010). The following index identifies where information

[1] The City of Tigard was previously a member of the JWC, but is no longer. However, data from the City of Tigard ASR wells, with their permission, are included in this application as a reference.

required under OAR 690-350-020 can be found in this application. The index was prepared to assist in preparing and reviewing the JWC's ASR limited license application.

OAR	Information Location
690-350-020 (2) **Pre-Application Conference**	October 19, 2010
690-350-020 (3) (a) **Applicant Information**	Application Form (Appendix A)
690-350-020 (3)(a)(B) **Operations Information**	Section 5 – Pilot Testing Program (Pages 23-27), ASR Limited License Application (Appendix A)
690-350-020 (3)(a)(C) **License Duration**	Section 5 – Pilot Test Program (Page 23-27)
690-350-020 (3)(a)(D) **Proposed Use**	Section 5 – Pilot Test Program (Page 23-27)
690-350-020 (3)(a)(E) **Ultimate Project Size**	ASR Limited License Application (Appendix A)
690-350-020 (3)(a)(F) **Water Right Statement**	Section 3 – Permits and Approvals (Page 20) and Appendix G
690-350-020 (3)(a)(G) **Water Right Holder Agreement**	Appendix G
690-350-020 (3)(a)(H) **Legal Land Use**	Appendix I
690-350-020 (3)(a)(I) **Map**	Figure 2
690-350-020 (3)(a)(J) **DHS Compliance**	Section 5 – Pilot Testing Program (Page 23-27)
690-350-020 (3)(a)(K) **Supplemental Information**	Appendix B
690-350-020 (3)(b)(A) **Proposed ASR Test Program**	Section 5 – Pilot Testing Program (Page 23-27), Section 6 – Water Quality Monitoring Program (Page 28), Section 7 – Quality Assurance and Quality Control Plan (Pages 29 – 31), Figure 2, Tables 4 and 5, Appendix L
690-350-020 (3)(b)(B) **Proposed System Design**	Section 4 – System Operation and Wellhead Facility Design (Page 22) and Appendix J
690-350-020 (3)(b)(C) **Groundwater Information**	Section 2 – Hydrogeologic Setting, Water Quality, and ASR Well Construction (Page 9 - 19, Figures 5 through 9, Table 1, and Appendix B
690-350-020 (3)(b)(D) **Source Water Quality**	Section 2 – Hydrogeologic Setting, Water Quality, and ASR Well Construction (Pages 9 – 19), Table 1, Figure 11, and Appendix D and Appendix E
690-350-020 (3)(b)(E) **Comments on Source Water/Standards**	Section 2 – Hydrogeologic Setting, Water Quality, and ASR Well Construction (Pages 9 – 19), Table 1, Figure 11, and Appendix D and Appendix E
690-350-020 (3)(b)(F) **Receiving Water Quality**	Section 2 – Hydrogeologic Setting, Water Quality, and ASR Well Construction (Pages 9 – 19), Table 1, Figure 11, and Appendix D and Appendix E
690-350-020 (3)(b)(G) **Comments on Compatibility**	Section 2 – Hydrogeologic Setting, Water Quality, and ASR Well Construction (Pages 9 – 19), Table 1, Figure 11, and Appendix D
690-350-020 (3)(c) **Other Information**	UIC Registration located in Appendix H JWC Model Development and Application located in Appendix B

Appendix A presents a completed Oregon Water Resources Department (OWRD) ASR limited license application for pilot testing at the proposed JWC ASR wells. The form was completed in a manner that allows operational flexibility during the testing period.

1.1 ASR Pilot Testing Objectives

The purpose of ASR pilot testing is to evaluate ASR feasibility and capacity in the basalt aquifer in the Cooper Mountain area, and to develop design criteria for a full-scale operational ASR program. The pilot testing will be conducted in stages and in a controlled manner designed to provide the data necessary to develop an initial ASR operational plan. The objective of the pilot testing is to evaluate the following at each ASR well:

- Wellhead facility operation and response to ASR
- Aquifer hydraulic response to ASR
- Long-term performance of the ASR well
- Optimal rate of injection and target storage volume
- Recovery rate and sustainability of pumping
- Chemical compatibility of the native groundwater and source water (including an assessment of mixing, potential clogging, and potential water quality changes)
- Quality of recovered water over time
- Frequency of redevelopment necessary to maintain an acceptable and sustainable degree of well efficiency during full-scale operations
- Potential impacts of ASR including loss of stored water to springs, other aquifers, or surface water; slope instability; water quality degradation; and interference with surrounding wells as a result of injection and recovery.

The goal of pilot testing is to complete a testing program that will meet the objectives above and can be used to apply for a permanent ASR permit.

1.2 Pilot Testing Study Area

The pilot testing study area (Figure 2) is located in the Tualatin Valley, which is a broad synclinal basin with extensive valley plains and a few anticlinal hills. Cooper Mountain is the most notable of the anticlinal hills in the study area and is the area of interest for the pilot testing program. The proposed ASR well locations are shown in Figure 2. Before pilot testing, the proposed ASR wells will be identified as JWC ASR A, JWC ASR B, JWC ASR C, etc. After pilot testing begins, ASR wells will be identified by number in the order that they are constructed (i.e., JWC ASR 1, JWC ASR 2, JWC ASR 3, etc.). The pilot test work plan included in the JWC ASR limited license application addresses the initial three sites planned for test well drilling and subsequent pilot testing, but is intended to be used as a template for pilot testing at the other proposed ASR well locations.

Several existing operational ASR wells are hosted in the basalt aquifer within the study area. The preliminary hydrogeologic assessment used for this pilot testing program is largely based on data from these wells and on a numerical groundwater model developed specifically for this ASR program. Results from this preliminary assessment indicate that the aquifer has the following characteristics:

- Relatively productive
- Potentially large storage capacity
- Sustainable injection rates greater than 700 gallons per minute (gpm)
- Good groundwater quality within the study area

Following the issuance of an ASR limited license by OWRD, the pilot testing program will be conducted in phases. As additional wells are drilled and pilot tested as part of this ASR program, the conceptual hydrogeologic model of the study area will be updated to incorporate the new data. Detailed geologic and hydrogeologic information and results from the numeric groundwater model are presented in Section 2.

1.3 Pilot Testing Approach and Schedule

The JWC intends to drill three test wells on Cooper Mountain during years 2011 through 2012 before pilot testing begins in 2013 (Figure 3). Data from the three test wells will be used to develop a site-specific pilot testing work plan for the first ASR well brought online. Subsequent work plans would be developed for the remaining test wells, and future test wells, prior to pilot testing. As shown in Figure 3 and Figure 4, the JWC expects to bring the first ASR well online in December 2013 and to develop up to 13 additional ASR wells by the year 2025. The goal for the JWC ASR program under this ASR limited license is to develop up to 14.4 million gallons per day (mgd) by the year 2025. Details of the anticipated schedule for the JWC ASR pilot testing program and the pilot testing procedures are presented in Section 5.

During pilot testing, recharge will be conducted in a controlled manner, and each ASR well and aquifer response to initial ASR operations will be evaluated. The first year of the pilot testing at each ASR well will consist of a shakedown test followed by a full recharge-storage-recovery cycle. The shakedown test will assess the performance of the piping, pumps, valves, and controls, and will last about 1 day. During this test, a relatively small volume of water will be injected and recovered to evaluate initial system operations. The full recharge-storage-recovery tests (i.e., Cycle 1 test) will more closely approximate operational-scale ASR at each well. The full recharge-storage-recovery test will be used to evaluate the aquifer response to ASR. It is anticipated that during this test, approximately 150 million gallons (MG) of water will be injected during a 150-day period (an average of approximately 700 gpm). The water will be stored under observation for about 60 days before an approximately 100-day withdrawal period (an average of approximately 1,000 gpm). The anticipated rates, storage volume, and schedule are subject to change based on the JWC's needs, construction schedules, or actual performance of the completed ASR wells. During the first year of pilot testing at each ASR well, up to 100 percent of water originally injected may be recovered, if approved by OWRD, to provide data for assessment of mixing zone size and geochemical interactions. During subsequent years of operation, injection, storage, and recovery rates and durations will be determined on the basis of the volume of water recovered the previous year and requirements established in the limited license.

During pilot testing at each ASR well, it is anticipated that JWC will inject water from late fall to early summer (approximately November through May) of each year so that the maximum amount of water can be stored. Water may be injected up to a rate of 1,500 gpm, and water may be recovered at a pumping rate up to 2,000 gpm. The maximum storage volume requested under this ASR limited license is 2.1 BG, which is equal to the target ASR storage volume after full build-out. Specifically the 2.1 BG storage volume request assumes roughly 150 MG of storage per ASR well and 14 completed ASR wells at full build-out. If pilot testing suggests that an increase in storage volume and rates is appropriate, the JWC would like the option to petition OWRD for an increase in total storage volume and rates. The ASR limited license request is for 5 years (rule limited); however, because full build-out will not be achieved until 2025, at a minimum two additional 5-year extensions to the ASR limited license will be requested at the conclusion of this limited license period.

Source water used for recharge for this ASR program will be supplied from two different sources that have excess treated drinking water supply during the winter: the JWC and the City of Portland Bull Run (Portland Bull Run) water supply. When feasible, source water used for recharge primarily will be supplied by the JWC. However, because of distribution system constraints, some proposed ASR well locations may require recharge from the Portland Bull Run water supply or a blend of the two sources. During the ASR recharge season, which typically runs from November through April or May, the JWC will utilize live flow water rights of the participating JWC member agencies on the Tualatin River. In addition to these live flow water rights, the JWC has one permitted water right in its name, which allows water to be diverted from Scoggins Creek for municipal purposes. The JWC currently is preparing a permit amendment to move this point of diversion to the Spring Hill Pump Plant for the use of the JWC WTP. Details of the source water rights for the JWC ASR pilot testing program are presented in Section 3.

The 14 proposed ASR well locations are shown in Figure 2; however, GSI anticipates the possibility for these site locations to change and/or be dropped as more hydrogeologic data are obtained and land use acquisitions move forward. Information from the three test wells will improve the JWC’s understanding of the storage capacity of the basalt aquifer in the Cooper Mountain area and will help guide future ASR well siting. In the event that a proposed ASR well is relocated by a distance greater than an adjacent ¼ ¼ section, the relocation request will be accompanied by a technical memorandum justifying the movement of the well and describing any potential impacts of the move on other users. Information from pilot testing the three test wells also will help refine further planning and economic analysis of future ASR wells and infrastructure improvements that may be needed to integrate the ASR wells into the existing water distribution system.

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2. Hydrogeologic Setting, Water Quality, and ASR Well Construction

This section summarizes the results of a detailed hydrogeologic and water quality evaluation that was conducted as part of the *Feasibility of Aquifer Storage and Recovery in the Tualatin Basin within the Context of the Tualatin Basin Water Supply Project* (GSI, 2009) prepared for Black and Veatch by GSI. Figure 5 presents the general geology of the area based on work done by Schlicker and Deacon (1967), and Figure 6 presents a geologic legend to the base map shown in Figure 5. Two cross sections were prepared through the study area as shown in Figure 5. Cross section A-A' (Figure 7) bisects the entire study area from the northwest section through Cooper Mountain and Bull Mountain and cross section B-B' (Figure 8) is oriented from the northeast through Cooper Mountain and perpendicular to cross section A-A' to provide a complementary perspective of the subsurface conditions beneath Cooper Mountain. The predominant geologic units of the area from youngest to oldest include fine-grained unconsolidated sediments, Columbia River Basalt Group (CRBG), and older marine sediments. The older marine sediments and younger basalts generally dip toward the center of the valley (e.g., Hillsboro area) and bow upward toward the Coast Range and toward the Cooper Mountain-Bull Mountain anticline (see Figures 7 and 8). The CRBG is the target aquifer for ASR in the Tualatin Basin. This section presents preliminary hydrogeologic information about the target aquifer for ASR (i.e., the CRBG) required under OAR 690-350-020(3)(b)(C) and OAR 690-350-020(3)(b)(D).

2.1 Geology

The CRBG consists of Miocene-age (23 to 5.3 million years ago), areally extensive basalt lava flows originating from linear fissures in eastern Washington and Oregon and western Idaho. The CRBG outcrops west and east of the Tualatin Valley in the Coast Range and Tualatin Mountains, respectively (see Figure 5), and dips toward the center of the Tualatin Basin. The CRBG also outcrops along the flanks of Cooper Mountain and Bull Mountain. A deep oil test well drilled by the Texas Oil Company in 1947 on Cooper Mountain (WASH 10236) indicates that the CRBG is approximately 1,000 feet thick in the Cooper Mountain area.

2.2 Aquifer Description

The CRBG basalts contain some of the most productive aquifers in Oregon and comprise the target aquifers for this ASR program. Vertical exposures through CRBG flows reveal that they exhibit the same basic three-part internal arrangement of features shown in Figure 9. These structures originated during emplacement and cooling of the lava flow and are referred to as flow top, dense flow interior, and flow bottom. The combination of the flow top and flow bottom is commonly referred to as the interflow zone.

It is widely agreed that within CRBG aquifers, given the typical distribution and physical characteristics of CRBG intraflow structures, groundwater primarily resides within interflow zones (Newcomb, 1969; Tolan et al., 2008). CRBG interflows are tabular, stratiform, laterally extensive bodies. The permeability of interflow zones varies because not all interflow zones are vesicular and brecciated. The presence of a large pillow complex (Figure 9) can considerably increase the permeability of an interflow zone, whereas the presence of interbedded sediments can either enhance or inhibit groundwater flow. Another critical aspect of interflow zones is their potential lateral variability, which also can enhance or inhibit the flow of water in these zones. Both of these factors (sedimentary interbeds and lateral interflow variability) have significant impacts on the ability of the aquifer to transmit groundwater and/or store water. The dense interior portions of the CRBG flows (see Figure 9) make this portion of the flow essentially impermeable and thus result in confined aquifer conditions for most CRBG aquifers (Tolan et al., 2008). Additionally, because groundwater levels in water wells completed in the CRBG rise above the top of the CRBG aquifer, the aquifer is considered semi-confined to confined.

Several processes can modify the hydraulic behavior of CRBG aquifers, including faults, folds, and secondary mineralization. Faults can form barriers to the lateral and vertical movement of groundwater, but also can (1) provide vertical pathways, (2) cause secondary fracturing to enhance the interconnection between interflow zones, and (3) expose interflow zones to local opportunities for aquifer recharge and/or discharge. Folding of the CRBG can fracture the flows enhancing secondary permeability, possibly providing a vertical pathway to enhance interconnection between interflow zones. However, if these secondary fractures heal or are “filled” with secondary mineralization, which is often the case, the overall effect results in significant reductions in permeability of the aquifer system (Tolan et al., 2008).

Because the factors described above (sedimentary interbeds, lateral interflow variability, faults, folds, and secondary mineralization) can have significant impacts on the ability of the aquifer to transmit groundwater and/or store water, it is important to evaluate the hydraulic properties of the basalt aquifers at each ASR well or wellfield (i.e., multiple ASR wells located near each other) and to assess the formation’s suitability for ASR operation. Given that aquifer test data and groundwater quality data are not yet available for the particular ASR well locations proposed in this ASR limited license application, historical data from existing nearby wells (e.g., TVWD’s Grabhorn ASR well, the City of Beaverton’s Sorrento ASR wells, and the City of Tigard’s ASR wells) and a numerical groundwater model developed specifically for this ASR program were used to evaluate the aquifer’s storage and recovery capacities and the potential impacts of the ASR system to the regional aquifer.

Porosity and storativity of CRBG interflow zones have not been measured at the proposed ASR well locations. Based on Tolan et al. (2000), the effective porosity of CRBG interflow zones is expected to range from 6 percent to more than 25 percent (flow top breccias) and 3 percent to 6 percent (vesicular flow top). Based on storage measurements at the City of Beaverton’s ASR Well No. 3, which is within the study area, the storativity of CRBG interflow zones is expected to be on the order of 10^{-4}.

The horizontal hydraulic conductivity of the CRBG aquifer in the study area was estimated on the basis of previously conducted aquifer pumping tests and published literature. The horizontal hydraulic conductivity values then were calibrated using the numeric groundwater model. The model results suggest an estimated horizontal hydraulic conductivity of 50 feet per day (ft/d) in the simple interflow zones and 120 ft/d in the pillow complex zones.

The volume of water contained in the Cooper Mountain aquifer under static conditions was estimated to be approximately 44 BG. The Cooper Mountain block, as delineated by mapped faults, was used as the aquifer area; an area of approximately 13 square miles. The volume estimate was based on an effective porosity of 4 percent in the simple interflow zones and 15 percent in the pillow complex zones. The aquifer thickness was based on detailed well log evaluations and previous work in the area. The total aquifer thickness assumed for the storage capacity estimate was 79 feet of simple interflow zones and 84 feet of pillow complex (Figure B-2 in Appendix B). The aquifer thickness used for the volume estimate accounted for the saturated zones only.

2.3 Conceptual Hydrogeologic Model

Generally in the Tualatin Basin, groundwater recharges the CRBG where it outcrops in the Tualatin Mountains and Coast Range on the east and west edges of the Tualatin Basin, respectively. Based on the many years of hydraulic data at the City of Beaverton's Sorrento wellfield, it appears that faults situated between the Tualatin Mountains and this wellfield do not allow groundwater to migrate to the Sorrento area from the east. Instead, the aquifer at Cooper Mountain is thought to have groundwater elevations that are controlled primarily by recharge from the Coast Range on the west edge of the Tualatin Basin. Groundwater likely flows down-dip along basalt interflow zones. Because the dense flow interiors of the CRBG have extremely low permeabilities, it is unlikely that the overlying unconsolidated sediments are in hydraulic communication with the CRBG interflows.

In the Cooper Mountain area, the depth to the static water level in the CRBG is relatively deep (e.g., often more than 500 feet below ground surface [bgs]). The basalts along the flanks of the Cooper Mountain area are down-dropped by normal faults (see Figures 7 and 8). The depth to the top of the CRBG in the valley (see Figures 5 and 6) is much deeper (e.g., up to 1,000 feet bgs). Because of the change in the topography from the highlands to the valley floor, the static water levels in the CRBG wells completed in the valley typically are less than 50 feet bgs (see Figures 7 and 8).

Folding and faulting have compartmentalized the basalts in the study area (truncate interflow zones), which can limit the amount of water that can be stored in a given location. In areas where the basalts crop out (e.g., Cooper Mountain-Bull Mountain area), faults have been mapped in some detail (still difficult because of urbanization and limited outcrops) by the U. S. Geological Survey (USGS); however, where the basalts are deep beneath overlying sediments, there is little to no knowledge of the faulting in the basalts or how compartmentalized the basalts might be in those areas. To date, the ASR wells completed by local municipalities in the study area, at a minimum, have been able to store 150 MG per well.

2.4 Flow Direction and Rate of Movement

Regional groundwater flow within the Tualatin Basin is thought to originate primarily as recharge on the eastern flanks of the Coast Range, where the CRBG has been heavily faulted and thrust upward along the Mount Angel–Chehalem Structural Zone. The regional groundwater flow pattern across much of the Tualatin Basin is from the north and northwest to the south and southeast, toward the City of Wilsonville and the Willamette River. However, ambient groundwater flow velocities and horizontal gradients are thought to be very low across this region; specifically, the horizontal gradient has been estimated to be no more than 0.2 meter per kilometer, or 0.0002, in the Wilsonville area where data are available (Burt et al., 2009; Conlon et al., 2005).

2.5 Area Affected by the ASR Wells

The area affected by the proposed JWC ASR program at full build-out was estimated using the numerical groundwater model. Details of the model development and calibration are included in Appendix B. The numerical groundwater model was built to aid in selecting an appropriate observation well network and to aid in decision making in the future as the JWC ASR program develops. Because hydrogeologic data are not yet available for the JWC ASR wells, the model is considered to be in a preliminary stage and is not intended to describe with certainty the potential future full build-out effects from the proposed JWC ASR program. The model will be refined as hydrogeologic data become available from the initial JWC ASR test wells and subsequent ASR wells as they are brought online.

The model was calibrated to responses at 15 observation wells during the 2008 through 2009 ASR cycle at the City of Beaverton's Sorrento ASR wellfield and TVWD's Grabhorn ASR well. The model layering was stratified to represent the permeable interflow zones and the relatively impermeable dense interior zones of the CRBG aquifer. This was accomplished by constructing a geologic type section based on detailed well log evaluations and previous work in the area (Appendix B). The type section was used throughout the model extent and was offset at major faults based on mapped displacements. Actual contrasts in hydraulic conductivity values between the interflow zones and the dense flow interiors were tested extensively during model calibration, including tests that considered the possibility of only modest contrast. Additionally, extensive testing of the horizontal and vertical hydraulic conductivities of (1) fault planes inside the Cooper Mountain area and (2) fault planes bounding Cooper Mountain (particularly the Beaverton Fault Zone) was conducted during the process of calibrating the model to the hydraulic responses observed in wells located on each side of the fault planes. As discussed in Appendix B, these tests indicated that (1) the dense flow interiors have much lower hydraulic conductivity than the interflow zones; (2) at least some of the interflow zones must have lateral continuity across the Beaverton Fault Zone to cause the observed responses north of the Grabhorn ASR well; (3) the fault zones, while providing for outward propagation of hydraulic responses, do not provide hydraulic propagation of these responses through the full thickness of the basalt section; and (4) some faults inside the Cooper Mountain area act hydraulically as low-permeability features (e.g., barriers) that limit the outward propagation of responses in some areas.

Following the calibration process, the model was used to simulate 5 consecutive years of ASR operation under full build-out conditions (14 wells located on Cooper Mountain, 2.1 BG of total annual storage, and 95 percent recovery of stored water each year). Preliminary model results indicate that under full build-out conditions, the mound created during injection cycles could extend 3.1 to 4.7 miles from the top of Cooper Mountain, and about 0.8 to 2.6 miles beyond the perimeter of Cooper Mountain (Figure 10). The areal extent of mounding (i.e., the area affected by the ASR wells) was defined as the portion of the CRBG that experiences more than 2 feet of water level rise during ASR cycle testing.

2.6 Allocation of Surface Water, Springs, or Wells in the Affected Area

In general, surface water and groundwater use in the area affected by the proposed JWC ASR wells at full build-out primarily consists of domestic use and various forms of irrigation use. To determine water use in the area, the OWRD well log and water right databases were queried and the results were evaluated on the basis of specified water use. The query was conducted in 54 sections surrounding the Cooper Mountain study area (townships included: T1S-R1W, T1S-R2W, T2S-R1W, and R2S-R2W). The area selected for the water well inventory extends beyond the 5-foot pressure response contour estimated from the groundwater model (Figure 10).

A water well inventory of the OWRD well log database was conducted to identify wells completed in the target aquifer (CRBG) in the estimated area affected by the proposed JWC ASR wells (Appendix C). Excluding abandonment well logs, the query produced approximately 811 water well logs. All well logs in the estimated affected area were evaluated on the basis of the material encountered during drilling, as described on the OWRD well log, to determine whether each well was completed in the CRBG or the unconsolidated sediments. As noted in the second column of Appendix C (Well Log Inventory in Area Affected by ASR Wells), the query included logs for deepening or alteration work or for abandonment of a preexisting water well, and in many cases a log showing the well's original installation was unavailable. When possible the log showing the well's original installation was matched to the log showing later work (i.e., deepening, alteration, or abandonment). The type of water use specified on the water well logs, excluding abandonment well logs, included: 81 percent domestic use; 5 percent irrigation use; 3 percent domestic and livestock use; 2 percent domestic and irrigation use; 1 percent community use; and less than 1 percent industrial use, livestock use, and domestic and industrial use. Approximately 7 percent of water well logs did not specify a use. Although a thorough review of existing water wells in the estimated affected area was completed by inventorying the OWRD well log database, there is the possibility that undocumented wells are present in the estimated affected area.

The water well inventory was completed, in part, to identify wells in areas that may have a higher potential for surface discharge during ASR operation. Data from existing ASR wells and the associated observation well networks in the study area suggest that the wells with a higher potential for surface discharge tend to be located in the valley floor surrounding Cooper Mountain where static water levels are near ground surface. For example, TVWD has identified several wells located in the immediate vicinity of the Grabhorn ASR well and in the valley floor that have required wellhead modifications as a proactive means to mitigate surface discharge during recharge operations. The proposed JWC ASR program has been designed to reduce the risk of surface discharge by locating the JWC ASR wells relatively far from the valley floor. Additionally, the observation well network for the proposed JWC ASR program is designed such that potential surface discharge should be anticipated before it occurs. However, if conditions arise that require wellhead modifications to prevent surface discharge, the JWC will address the needs of the particular well in a proactive manner.

Non-exempt, non-canceled surface, groundwater, and storage water rights in the estimated affected area also are listed in Appendix C (Water Rights in Area Affected by ASR Wells).

Within the 54 sections described above, the OWRD water rights information query produced 736 water rights; groundwater rights constituted 19 percent, surface water rights constituted 63 percent, and storage water rights constituted 18 percent. Water use specified on the water rights included more than 62 percent irrigation or nursery use; less than 10 percent each storage, wildlife, and municipal use; and less than 4 percent each aesthetics, livestock, recreation, and other various uses.

It is important to note that these water rights are not expected to be affected by this ASR program. Natural discharge of groundwater from the basalt aquifer may occur as groundwater migrates via natural conduits such as faults and vertical fractures. In much of the area surrounding Cooper Mountain the basalt aquifer is buried by at least 100 feet of sediments. Therefore, unless there is a preferential pathway to surface water in the area surrounding Cooper Mountain, such as a fault, it is not expected that impact to surface water or springs will be a concern. However, one known natural discharge point from the basalt aquifer (i.e., seep near Johnson Creek at SW 150th Court, Beaverton) has been identified in the pilot test study area. Work already has been completed to mitigate impacts resulting from ASR operations at this location. Additionally, the 150th Court site will be monitored throughout the JWC ASR pilot testing program to ensure that adverse impacts resulting from increased seepage are not a problem.

2.7 Anticipated Changes to the Groundwater System

Potential impacts from ASR operations may result from piezometric head changes in the basalt aquifer or reaction in the aquifer because of the mixing of injection water, native groundwater, and the aquifer matrix. In addition, other nearby wells could capture stored ASR water or be affected by ASR activities. The process used for ASR site selection incorporated these factors as well as potential productivity of the interflow zones. As a result, the targeted interflow zones for ASR storage are deeper than most of the basalt wells in the area.

Because of the relatively high transmissivity and low storativity values of the target aquifer, it is anticipated that piezometric head increases resulting from injection will be transmitted over relatively great distances (estimated from the groundwater model to be 3.1 to 4.7 miles from the top of Cooper Mountain). The potential for these head increases to affect wells, create seeps, or cause an increase in spring discharge in low-lying locations where the basalt interflow zones intersect the ground surface was evaluated using the numeric groundwater model. It is anticipated that most of the injection at the ASR wells on Cooper Mountain will occur within the pillow complex that is below approximately 900 feet in elevation. The potential for groundwater to discharge at the surface because of increased heads will depend on the degree of vertical continuity between the interflow zones, as well as the geometry of the injection mound surrounding the particular ASR well. Based on previous experience with similar local conditions, injection at the proposed ASR well locations is not likely to create surface discharge of groundwater at most locations because of the sufficient injection head space and predicted rapid decrease in injection head with distance from the site as indicated by the model. As previously mentioned, a natural discharge point from the basalt aquifer at SW 150th Court has been identified in the pilot test study area and will continue to be monitored throughout the JWC ASR program. The potential for surface discharges will be of more concern as additional ASR sites are developed and the potential for interference increases. Potential impacts to the wells identified in Section 2.6 will be monitored closely using an observation well network and periodic visual surveys of potential seep areas, which are described in detail in Section 5.1.

2.8 Potential Natural Resources Problems of Testing

The JWC does not anticipate natural resources problems as a result of ASR testing in the Cooper Mountain area.

2.9 Other Information

The City of Beaverton and TVWD have been conducting ASR pilot testing on or near Cooper Mountain for a number of years. Some degree of interference is expected between the proposed JWC ASR wells on Cooper Mountain and the City of Beaverton Sorrento wellfield and the TVWD Grabhorn well, although it is not anticipated to inhibit normal operations at any of the ASR wells. Because the City of Beaverton and TVWD are members of the JWC, coordination on any impacts to their existing ASR wells will be handled internally within the JWC.

In addition, the City of Tigard's ASR wells located on Bull Mountain have been in operation for a number of years and are within the estimated affected area at full project build-out. Observation wells between the City of Tigard's ASR wells and the proposed JWC ASR wells will be monitored closely to assess the extent and magnitude of interference as the project progresses.

2.10 Water Chemistry

A thorough understanding of recharge (source) water quality, native groundwater quality, and the geochemical interaction between the recharge water and the native aquifer being recharged is necessary for an ASR project. This section discusses the water quality of the JWC water supply, Portland Bull Run water supply, and native basalt groundwater, and evaluates the individual compatibility of the JWC water supply and the Portland Bull Run water supply with the basalt aquifer groundwater. As discussed later in this section, adverse reactions or impacts are not expected from mixing between the JWC source water or Portland Bull Run water supply and native basalt groundwater. This assessment is supported by the success of the City of Beaverton, TVWD, and the City of Tigard ASR programs, which use the JWC source water, a mix of the JWC and the Portland Bull Run source water, or the Portland Bull Run source water, respectively, and inject into the CRBG aquifer.

The water quality was evaluated using available water quality data collected from ASR wells or source water used for recharge during operational ASR programs in or near the study area. A map showing the water quality sample locations used in this assessment is included in Appendix D. Native groundwater and source water analytical results are presented in Table 1. The geochemical compatibility was assessed using previous evaluations conducted for the City of Tigard and TVWD. The geochemical compatibility evaluations referenced in this ASR limited license application also are presented in Appendix D.

Native basalt groundwater quality results for Safe Drinking Water Act constituents are presented in Table 1. Native basalt groundwater samples were collected from the City of Tigard's ASR 1 on November 29 and 30, 2001; January 23, 2008; and May 6, 2008.

Laboratory reports for the samples collected in 2001 are unavailable. Samples collected in 2008 were submitted to Alexin Analytical for analysis. For reference, the groundwater quality discussion based on the 2001 samples is provided in Appendix E (Golder Associates, 2003). Native basalt groundwater quality data from TVWD's Grabhorn well collected on May 15, 2003, and from the City of Beaverton ASR 1 well collected on July 14, 1994, are provided for comparison. Available laboratory reports are provided in Appendix E.

Source water quality data presented in Table 1 are from the JWC water supply and Portland Bull Run water supply. The JWC source water samples were collected on December 16, 2008; April 13, 2009; and December 28, 2009, during injection at the City of Beaverton's ASR 4 site, and were submitted to Alexin Analytical for analysis. The Portland Bull Run water supply sample was collected on November 26, 2007, during injection at the City of Tigard's ASR 2 site, and was submitted to Alexin Analytical for analysis. Bacteriological data for the Portland Bull Run water supply were obtained from the 2009 City of Portland, Water Bureau, Water Quality Report. Laboratory reports and the 2009 City of Portland, Water Bureau, Water Quality Report bacteriological results are provided in Appendix E.

The JWC source water and Portland Bull Run source water meet the regulatory criteria for all Safe Drinking Water Act constituents and thus are suitable for ASR purposes. This statement is supported by the following: (1) JWC water currently is being used to recharge the City of Beaverton's ASR wells under ASR Limited License #002 and has complied with all state ASR regulatory criteria since the City of Beaverton began recharging its ASR wells in 1999, (2) Portland Bull Run source water currently is being used to recharge the City of Tigard's ASR 2 well under ASR Limited License #005 and has complied with all state ASR regulatory criteria since the City of Tigard began recharging ASR 2 in 2006, and (3) a mix of Portland Bull Run source water and the JWC source water has been used to recharge the TVWD Grabhorn ASR well under ASR Limited License #002 and has complied with all state ASR regulatory criteria since TVWD began recharging its ASR well in 2008.

Water Quality of the Native Basalt Groundwater

Available native basalt groundwater quality data indicate that the basalt groundwater quality is generally good. The concentrations of bicarbonate (HCO_3^-), calcium (Ca), silica (Si), and total dissolved solids were higher in the native groundwater samples than in both source water samples. The measured native basalt groundwater pH was near neutral. Concentrations of most metals were below detectable limits and all monitored organic compounds were undetected. Stiff diagrams (Figure 11) show the chemical components of native basalt groundwater samples from three operational ASR wells in or near the study area before pilot testing: City of Beaverton ASR 1 well, TVWD Grabhorn well, and City of Tigard ASR 1 well. As shown in Figure 11, the results from these samples indicate that there is little spatial variability in groundwater quality near the study area suggesting that data from these wells suitably represent regional native basalt groundwater quality. In addition, land use practices near the wells used for the native basalt groundwater quality evaluation are similar to land use practices near the proposed JWC ASR well locations. Land use designation for the Cooper Mountain area, including the vicinity of the three wells used for this evaluation, has been developed by Metro for Washington County. Single-family residence is the primary land use classification in the Cooper Mountain area and immediately surrounding the three wells used for basalt groundwater quality data. The majority of the remaining land is classified as a mix of public facilitates, vacant, agriculture, multi-family residential, and rural, with isolated areas of commercial use. Less than 1 percent of the Cooper Mountain area and the area immediately surrounding the three wells used to evaluate basalt groundwater quality are classified for industrial use.

While the land use practices near the City of Beaverton ASR 1 well, TVWD Grabhorn well, and City of Tigard ASR 1 well are similar to land use practices near the proposed JWC ASR well locations, it is important to note that the well construction of each of these wells suggests that the likelihood of connectivity between the aquifer and ground surface activities is very low. The City of Beaverton ASR 1 well is cased and sealed to a depth of 63 feet bgs (9 feet into the CRBG) and the static water level is approximately 160 feet bgs. The TVWD Grabhorn well is cased and sealed to a depth of 403 feet bgs and the static water level is approximately 200 feet bgs. The City of Tigard ASR 1 well is sealed to a depth of 300 feet bgs and the static water level is approximately 256 feet bgs.

Water Quality of the JWC Source Water Supply

In the non-peak season, the JWC source water supply is from the Tualatin River. Because the JWC source water is treated surface water, it varies chemically from year to year and likely throughout an injection cycle time period. However, the chemical variations are relatively minor and are not expected to affect ASR operations. The JWC source water quality is very good and concentrations of regulated parameters in samples were below all state and federal limits for water quality criteria. Metal concentrations were very low or undetected. Organic compounds were not detected, with the exception of low-level concentrations of disinfection by-products (DBP). Fluoride was detected at 0.9 milligrams/liter (mg/L) in the sample collected in the City of Beaverton's system. The JWC does not fluoridate its treated water supply; however, the City of Beaverton and TVWD fluoridate the water they receive from the JWC. Water quality results indicate that the treated water is fairly soft; hardness as $CaCO_3$ ranged from 30 mg/L to 40 mg/L. Concentrations of total dissolved solids (72 mg/L to 97 mg/L) indicate that mineral content is fairly low. A stiff diagram (Figure 11) shows the chemical components of the JWC source water sample collected on December 16, 2008. All detected concentrations of constituents with maximum contaminant levels (MCL) or maximum measurable levels (MML) in the samples were less than 50 percent of the standards and all detected concentrations of constituents with secondary maximum contaminant levels (SMCL) were less than the standards. Therefore, the water is acceptable for use as source water for an ASR project.

Water Quality of the Portland Bull Run Source Water Supply

The Portland Bull Run source water is unfiltered, but is chlorinated before delivery into the distribution system. Because the City of Portland source water is treated surface water, it varies chemically from year to year and likely throughout an injection cycle time period. However, the chemical variations are relatively minor and are not expected to affect ASR operations. The Portland Bull Run source water quality is very good and concentrations of regulated parameters in the sample were less than all state and federal limits for water quality criteria. Metal concentrations were undetected. Organic compounds were not detected, with the exception of low-level concentrations of DBPs. Water quality results indicate that the treated water is fairly soft (hardness as $CaCO_3$ was 10 mg/L). The concentration of total dissolved solids (30 mg/L) indicates that mineral content is low. A stiff diagram (Figure 11) shows the chemical components of the Portland Bull Run source water sample collected on November 26, 2007. With the exception of DBPs, which were less than the regulatory screening criteria of 100 percent of the standards, all detected concentrations of constituents with MCL or MML in the sample were less than 50 percent of the standards and all detected concentrations of constituents with SMCL were less than the standards. Therefore, the Portland Bull Run water supply is acceptable for use as source water for an ASR project.

Groundwater Quality Degradation Potential

As shown in Figure 11, the treated JWC and City of Portland source water are different than the basalt groundwater in quality. The total dissolved solids, which are a general indicator of water quality, are significantly lower in the treated source waters than in the basalt groundwater. This indicates that recharge will result in an improvement of the existing water quality. DBPs (trihalomethane and haloacetic acids), formed during the chlorination of treated water, typically are present in drinking water and are not naturally occurring in the aquifer. Studies investigating the impact of ASR on DPBs have concluded that residual chlorine and DBPs break down rapidly and do not degrade the existing groundwater quality (Singer et al., 1993). Additionally, concentrations of DBPs detected in recovered water at existing ASR wells near the study area are less than 50 percent of the MCL. Testing for DBPs will be conducted during the pilot testing phase to evaluate the fate of DBPs in the aquifer.

Potential for Clogging Because of Suspended Solids or Biofouling

Clogging because of suspended solids is the most common problem with ASR projects. The JWC and Portland Bull Run source waters have suspended solids concentrations below 2 mg/L; therefore, clogging by suspended solids is not expected to be a concern (Pyne and David, 1995). However, the JWC water is the preferred source water for injection because it is filtered. Where infrastructure precludes using the JWC water for injection, the Portland Bull Run water may be used. Removal of suspended solids that may accumulate in the well will be accomplished by periodic backflushing of the ASR wells on a routine basis. The backflushing schedule will be determined during pilot testing based on changes in specific capacity. Biofouling is not expected to be an issue because of the low level of nutrients and high chlorine residual in the JWC and Portland Bull Run source water. However, because clogging is the most common problem with ASR projects, the proposed JWC ASR wells will be monitored closely for signs clogging.

Geochemical Compatibility Evaluation

The goal of evaluating the geochemical compatibility of the source waters and native basalt groundwater is to assess whether mixing within the aquifer will create chemical conditions that result in precipitating solids that potentially could clog the aquifer or dissolution of minerals naturally present in the aquifer. For the purpose of this application, two previously conducted geochemical compatibility evaluations are referenced. *ASR Hydrogeological Feasibility Study of Cooper Mountain Basalt Aquifer* (CH2M HILL, 1997) was prepared by CH2M HILL for TVWD, and was presented to OWRD in the joint TVWD and City of Beaverton ASR limited license application (ASR Limited License #002). The second referenced geochemical compatibility evaluation was included in the *Phase 1 – ASR Feasibility Report* (Montgomery Watson and Golder Associates, 2001) prepared by Golder Associates for the City of Tigard, which was presented to OWRD in the City of Tigard's ASR limited license application (ASR Limited License #005).

The referenced geochemical evaluations for this study used the USGS water chemistry software package PHREEQC to model the chemical reactions that may result from mixing source water and native basalt groundwater (Parkhurst et al., 1980). PHREEQC simulates mixing of two waters and calculates mineral solubility in the mixed water. This software is applicable to evaluating ASR feasibility because it assesses whether mixing between source water and native groundwater will cause precipitation of minerals within the aquifer and/or well screen. Both evaluations modeled mixing of the two source waters (JWC source water and Portland Bull Run source water) with native basalt groundwater in varying proportions. For the TVWD/ City of Beaverton model, source water was mixed with groundwater in 25 percent increments, and for the City of Tigard model, source water was mixed with groundwater in 10 percent increments.

PHREEQC determines the effect of mineral solubility and water chemistry by calculating the saturation index (SI) for a mineral. The likelihood of mineral precipitation depends on mineral solubility in water and water chemistry. The SI is the log of the ratio of actual concentration of the mineral components divided by the theoretical concentrations of the mineral at saturation (i.e., the solubility) for the chemical state being considered. If the SI is negative, then the solution is undersaturated in a mineral, and a mineral will dissolve in the solution. If the SI is positive, then the solution is oversaturated in a mineral, and the mineral may have a tendency to precipitate from the solution. The precipitation and growth of a mineral are complicated by the fact that before the mineral can grow, a mineral nucleus is needed to form spontaneously in the solution, which generally requires the SI to be a value greater than one.

Results of the modeling from both evaluations concluded that mixing of the native basalt groundwater with the JWC source water or Portland Bull Run source water is not likely to result in any geochemical reactions that would adversely affect the aquifer or ASR operation. Results from the geochemical evaluation conducted for TVWD and the City of Beaverton suggested that some iron precipitate may form in the aquifer; however, the amount of iron in the aquifer is not sufficient to create significant clogging. The concentrations of other minerals that potentially pose a clogging threat were not sufficient for precipitation to occur. Results from the geochemical evaluation conducted for the City of Tigard suggested that oxidizing conditions are expected to persist in the aquifer throughout injection and that dissolution of amorphous silica may result in an increase in silica concentrations; however, maximum concentrations are not expected to exceed 40 mg/L. Detailed results for each evaluation referenced in this application are presented in Appendix D.

Model results indicating that clogging is unlikely to occur because of geochemical reactions between the JWC or the Portland Bull Run source water and native basalt groundwater are supported by the fact that basalt ASR wells in or near the study area (the City of Beaverton’s ASR wells, which use JWC source water; TVWD’s Grabhorn ASR well, which uses primarily JWC source water or a mix of Portland Bull Run source water and the JWC source water; and the City of Tigard’s ASR 2 well, which uses Portland Bull Run source water) have been in operation for a number of years and have experienced no adverse impacts because of geochemical reactions.

2.11 ASR Well Construction Details

Before pilot testing begins, the JWC plans to drill and test three exploratory wells on Cooper Mountain. If the aquifer tests indicate that the aquifer can store and recover at capacities necessary to meet the JWC's goal, the diameter of the exploratory wells will be reamed to production size. An as-built schematic for the JWC exploratory wells is provided in Appendix F. The JWC exploratory wells are intended to test the capacity of the deeper interflow zones in the basalt aquifer; therefore, they will be drilled through the CRBG section and contact with the marine sediments is made. In the Cooper Mountain area, the contact between the CRBG and the marine sediments is at an estimated depth of 1,000 feet bgs. According to information on well logs, static water levels near the potential exploratory well locations range from approximately 385 to 580 feet bgs. The exploratory wells will have a 12-inch-diameter open borehole from approximately 50 feet bgs to 1,000 feet bgs. The exploratory wells will be cased through the upper sediments and have a surface seal to an approximate depth of 50 feet bgs. The exploratory wells will be constructed in accordance with State of Oregon standards.

Two as-built schematics (Scenario 1 and Scenario 2) for the completed initial JWC ASR wells also are provided in Appendix F. Scenario1 represents a completed ASR well that is open to unsaturated and saturated interflow zones. The typical open interval length of the Scenario 1 well is 900 feet. Scenario 2 represents a completed ASR well that is cased and sealed below the static water level and has a typical open interval length of 430 feet.

Testing to determine whether there is water loss to the unsaturated zones will be conducted during the exploration phase to determine, with OWRD's concurrence, whether the ASR wells could be open to unsaturated interflow zones. The testing of loss to the unsaturated zones also would need input and approval from OWRD. In addition, static water levels will be measured regularly during borehole advancement to determine whether significant head changes occur as deeper interflow zones are encountered. If no significant head changes are observed during borehole advancement, it may be assumed that the encountered interflow zones constitute a single aquifer. Based on observations during exploratory drilling and test results, a final well design that minimizes potential water loss will be developed and submitted to OWRD and the Oregon Department of Human Services (DHS) for approval before well completion. The completed ASR wells will be constructed in accordance with State of Oregon standards.

Based on previous drilling experience in the Cooper-Bull Mountain area, it is anticipated that significant head changes will not be observed in the saturated interflow zones. For example, during drilling at the City of Tigard ASR 2 well, static water levels fluctuated no more than a couple of feet between 580 feet bgs and 1,012 feet bgs. Changes in static water level with depth of borehole from City of Tigard ASR 2 are shown in Appendix F.

3. Permits and Approvals

This section identifies permits and approvals necessary to conduct ASR pilot testing and provides documentation that the permits and approvals have either been obtained, requested, or will be obtained before ASR pilot testing.

3.1 Source Water Rights

The JWC intends to use water from the JWC and the City of Portland for ASR source water during late fall to early summer (November through April or May). The JWC and the City of Portland are regional water providers that provide treated drinking water to more than 400,000 and 884,000 residents, respectively.

The JWC source water intended for recharge is appropriated under surface water rights owned by the City of Hillsboro, City of Beaverton, and JWC. Specifically, the City of Hillsboro will provide water under water rights Certificates 81026, 81027, 67891, and 85913; the City of Beaverton will provide water under water rights Certificate 85914; and the JWC will provide water under water right Permit S-50879 (Table 2). Water rights certificates for the JWC source water are provided in Appendix G. As required by OAR 690-350-0020(3)(G), a statement from the water right holders (i.e., the City of Hillsboro and City of Beaverton) indicating permission for use of source water for ASR under water rights Certificates 81026, 81027, 67891, 85913, and 85914 is provided in Appendix G. The JWC holds the water right Permit S-50879 and also has provided a statement indicating permission for use of source water under Permit S-50879.

The City of Portland source water intended for recharge is appropriated under surface water rights owned by the City of Portland for supply from the Bull Run River as established by the Oregon Legislature (ORS 538.420). Because the JWC does not hold the above mentioned water right, a statement from the water right holder (i.e., the City of Portland) indicating permission for use of the City of Portland source water for ASR is provided in Appendix G, as required by OAR 690-350-0020(3)(G).

3.2 Groundwater Rights

The City of Beaverton and TVWD hold groundwater rights for use of water at existing wells in the study area (GR-343 and Certificates 44119 and 36441). In the future, the City of Beaverton or TVWD may choose to add the proposed JWC ASR wells as additional points of appropriation to their groundwater rights to increase operational flexibility for utilization of water and management of the basalt aquifer near Cooper Mountain.

3.3 Wastewater Discharge Approval

During the ASR pilot testing, some well water, distribution system water, and stored water will be pumped to waste to minimize and control particulates in the well or the distribution system. Discharges to waste will include backflushing episodes when injection will be stopped and the pump will be turned on for approximately 15 to 30 minutes to remove particulates that may have entered the well during recharge. The distribution system also will be flushed just before starting injection cycles to remove any particulates from the lines before injection of water into the aquifer. Depending on infrastructure and the property dimensions at each ASR well location, the pump-to-waste discharge will be conveyed to an onsite detention system adjacent to the ASR well or a nearby storm manhole for delayed discharge to a nearby stormwater system. The discharge water will consist of ASR source water (treated drinking water), native groundwater, or a mixture of the two. All proposed components of the pump-to-waste system will obtain the appropriate local and state permits before installation and operation.

3.4 Underground Injection Control (UIC) Registration

All ASR operation and testing require registration under the Oregon Department of Environmental Quality (DEQ) UIC program. Initial pilot testing is expected to occur at JWC ASR C shown in Figure 2 (the Cooper Mountain Reservoir site owned by the City of Beaverton). Appendix H contains a completed UIC registration form for the proposed ASR test well at this first site. This form was submitted to DEQ for review and approval. UIC registration forms will be submitted to DEQ for all subsequent ASR test wells as the ASR test well sites are confirmed and/or acquired.

3.5 Land Use Approval

All ASR operation and testing require evidence that land use and development approval from a local government is sought, obtained, or unnecessary. Appendix I contains a completed Land Use Information Form for the first ASR test well site (JWC ASR C shown in Figure 2). As the site is within Washington County limits and outside of city limits, the approval is issued by Washington County. Completed Land Use Information Forms will be submitted to OWRD for all subsequent ASR test well sites as the sites are confirmed and/or acquired.

4. System Operation and Wellhead Facility Design

Before pilot testing, each JWC ASR wellhead will be designed for ASR operation. The design will allow the well to supply water to the distribution system during the peak demand season and to inject potable water into the aquifer during the non-peak demand season. The well will be equipped with system controls that allow automatic and manual operation. The ASR wellhead will be situated within a pump house and wellhead facility. A schematic diagram showing the proposed wellhead assembly and piping are provided in Appendix J. The ASR wellhead will be constructed in accordance with DHS standards, and will include the following:

- Piping valves that allow for flushing distribution system water lines that provide injection source water to remove particulates before injection.
- ASR injection line valves that allow for pump-to-waste during periodic back flushing events.
- Controls to monitor turbidity and shutdown ASR injection at adjustable nephelometric turbidity unit (NTU) settings. The turbidity meter will be located far enough upstream from the wellhead to provide sufficient time for the well to be shutdown if a turbidity event occurs.
- A bi-directional totalizing flow meter that can provide real-time data during injection and recovery.
- A dedicated downhole water level transducer so that the performance of the well can be monitored.
- An access port and sounding pipe for manual water level measurements.
- Access ports for sampling during injection, storage, and recovery.
- A downhole control valve or orifice plate, if needed, to maintain enough back pressure to ensure the injection pipe remains full during injection.
- Real-time monitoring.
- An onsite disinfection system to maintain disinfection residual in the distribution system.

Design plans of the proposed wellhead will be submitted to DHS for plan review before initiating construction, and following DHS approval, the final documentation will be sent to OWRD.

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5. Pilot Testing Program

The goal for the JWC ASR program under the requested ASR limited license is to develop an ASR well program that can provide storage for 2.1 BG of water by the year 2025. The JWC plans to develop the ASR program in a phased manner such that no more than two ASR wells are brought online within a given year (Figure 4). Initially, three test wells will be drilled and tested during years 2011 and 2012 (Figure 3). Based on data from the first three test wells, the numerical groundwater model will be refined. The results from the updated numerical groundwater model will be used to develop a site-specific pilot testing work plan for the first ASR well brought online. Additional site-specific pilot testing work plans for each additional ASR well brought online will be submitted to OWRD for review and approval, but are expected to generally follow the approach outlined below.

The purpose of pilot testing is to confirm ASR feasibility in the basalt aquifer near Cooper Mountain, and to develop design criteria for full-scale ASR operation within the basalt aquifer. The pilot testing program at the first three ASR wells will be used as a blueprint for pilot testing at the other proposed ASR wells. If the pilot test program indicates that ASR is feasible, a modified version of this program will be used to bring the additional ASR wells online as the program is expanded. The pilot testing program described below is the framework that will be implemented initially at the first three ASR wells.

The pilot testing program under an ASR limited license consists of two components:

- **Baseline Testing and Monitoring –** Includes water level monitoring, evaluations of aquifer water quality, and well testing initiated before the start of ASR testing to document pre-ASR aquifer conditions and well performance.

- **ASR Testing –** ASR testing is divided into yearly cycle tests for each ASR test well. Each ASR pilot testing cycle includes an injection period, a storage period, and a recovery period.

    - **Year 1 –** Includes a shakedown test, a longer-duration, operational-scale pilot testing cycle, and water quality sampling.

    - **Years 2 through 5 –** Injection, storage, and recovery rates and duration for subsequent pilot testing cycles will be determined on the basis of previous years' operations. Because all of the stored water may not be fully recovered each year, the subsequent year's injection volume may be reduced. Water quality sampling also is included.

Each of the testing components is presented in the following subsections.

5.1 Baseline Testing and Monitoring

The purpose of the baseline testing and monitoring is to obtain background water level data near each ASR well and to assess pre-ASR well performance and aquifer characteristics. These data are compared to data collected during ASR testing to evaluate the effects of ASR on the aquifer and well. Baseline testing at each ASR well will consist of: water level monitoring and well testing.

Water Level Monitoring

A minimum of 2 weeks before ASR testing, the JWC will begin frequent monitoring at a subset of the observation wells discussed below to obtain background water levels. At observation wells without dedicated pressure transducer, water level measurements will be collected manually twice per week using an electronic water level sounder or a pressure gauge. In addition, water levels at six of the wells listed below will be monitored with electronic data loggers and pressure transducers (specific wells equipped with transducers are noted below). Where transducers are installed, water levels will be collected on an hourly basis at a minimum.

Water level monitoring will include the ASR wells and the following network of observation wells currently monitored as part of the City of Beaverton and TVWD's ASR programs:

- Schuepbach well (WASH 8862) – Manual measurements.
- Sage Place well (WASH 8976) – Equipped with transducer.
- Davies Road well (OWRD well log unavailable; well video was conducted) – Manual measurements.
- Dernbach well (WASH 8961) – Equipped with transducer.
- ASR No. 4 Obs. well (WASH 58005) – Equipped with transducer connected to City of Beaverton telemetry system.
- Rubber Reservoir well (WASH 58076) – Equipped with transducer.
- Maverick well (WASH 57796) – Manual measurements.
- 150th Court well (WASH 67488) – Equipped with transducer.
- ASR No. 3 well (WASH 55816) – Manual measurements.
- WASH 9205 – OWRD manual measurements and equipped with transducer.
- Pierson well (WASH10218) – Manual measurements.
- Baker Rock well (WASH 50723) – Manual measurements.
- Schulz well (WASH 10143) – Manual measurements.
- Ames well (WASH 59603) – Manual measurements. Wellhead sealed and instrumented with pressure gauge.
- Fischer well (OWRD well log unavailable) – Manual measurements. Wellhead sealed and instrumented with pressure gauge.
- Oglesby well (OWRD well log unavailable) – Manual measurements. Wellhead sealed and instrumented with pressure gauge.
- Hylton well (WASH 13787) – Manual measurements. Wellhead sealed and instrumented with pressure gauge.

Water well records from OWRD were reviewed to identify additional existing wells in the pilot test study area that could be used to evaluate background water levels and aquifer conditions in the deep basalt aquifer during future ASR testing or full-scale operations. The potential observation wells identified are listed in Table 3 and shown in Figure 2.

Initial pilot testing is expected to occur at JWC ASR C (the Cooper Mountain Reservoir site owned by the City of Beaverton). Not all the potential observation wells listed in Table 3 will be used for initial pilot testing or at each subsequent pilot test. Only wells nearest the pilot test that may be affected by the testing will be used for that respective test. The JWC will attempt to obtain approval for access to the potential observation wells listed in Table 3. However, if efforts are unsuccessful and data supports the addition of an observation well or wells, the JWC will install observation wells in the affected areas, as needed. If subsequent pilot testing at the proposed ASR wells requires specific observation wells other than the wells identified in Table 3, a work plan addendum outlining the additional observation wells will be presented to OWRD before the pilot testing program begins.

The observation well locations (including potential observation wells) are shown in Figure 2. Available well construction information is presented in Table 3 and well logs are provided in Appendix K.

Well Testing

Before pilot testing at each new ASR well, a step-rate test and a constant-rate aquifer test will be conducted after test well installation. Injection testing will be conducted under an approved UIC permit. Baseline water level monitoring and aquifer testing conducted before pilot testing will be used to assess static water level trends in the well, the specific capacity of the well, projected drawup/ drawdown during longer-term injection and recovery, recovery rates, and local hydrogeologic boundary conditions that could adversely affect the long-term performance of the ASR well. These baseline conditions are used to assess the performance of the well during subsequent pilot testing events.

5.2 ASR Testing: Year 1

This section describes the first year of pilot testing at each JWC ASR well. The testing will consist of an initial shake-down test followed by a longer-duration, operational-scale pilot testing cycle. Each of the testing cycles and the planned monitoring are described in the following sections.

During pilot testing, water levels will be measured in the same wells used for baseline groundwater monitoring. The purpose of monitoring water levels is to assess aquifer response to injection and recovery, benefits to other production wells, and adverse impacts from ASR (e.g., flowing wells or reactivation of seeps). It is important to note that the water level monitoring component of the JWC ASR Pilot Testing Program is designed to be proactive with regard to water level response in the aquifer because of impacts from this project. Monitoring wells will be concentrated in areas where data indicate that impacts may be greatest (i.e., antecedent water levels are relatively high) and at least one monitoring well will be located beyond the extent of the affected area. Each ASR well will be instrumented with a pressure transducer and data logger that will record water levels approximately every 30 minutes. Other well locations will be monitored weekly or bi-monthly using a water level sounder; however the frequency could be increased and/or reduced if the data support changes.

The initial recommended operational rates for pilot testing of each ASR well will be based on testing conducted during the exploratory phase (i.e., test wells drilling) before pilot testing begins. It is anticipated that source water may be injected at recharge rates up to 1,500 gpm and recovered at pumping rates up to 2,000 gpm during pilot testing. These rates are based on maximum available drawup, maximum available drawdown, and the specific capacity observed at existing nearby ASR wells.

The combined maximum recharge rate assuming full build-out on Cooper Mountain (14 ASR wells) is 21,000 gpm (46.79 cubic feet per second [cfs]), which is less than the maximum rate allowed under the JWC live flow water rights. The combined maximum pumping rate assuming full build-out on Cooper Mountain is 28,000 gpm (62.38 cfs). Actual recharge and recovery rates during the ASR pilot testing program at each ASR well will be based on transient aquifer and well conditions, and are anticipated to average 700 to 800 gpm (recharge) and 800 to 1,200 gpm (recovery).

Water quality samples will be collected during pilot testing. The planned water quality monitoring program is presented in Sections 6 and 7.

Shakedown Test

Before initiating the first pilot testing cycle, a shakedown test will be performed that will consist of injecting source water into the ASR well to check the operation of the injection system. The function of the automatic flow control system and the downhole valve also will be checked. Adjustments to the system will be made as necessary. After the short injection period, the well pump will be operated to recover all of the injected water and check well pump operation. The injection and pumping rate will be adjusted to optimize system operation for the longer cycle test. The shakedown test is anticipated to last 8 hours. Recovered water from the testing will be directed into the pump-to-waste system or a nearby storm drain.

Cycle 1

The objective of Cycle 1 is to evaluate the long-term aquifer response, well performance, and water quality conditions under operational-scale ASR in the basalt aquifer.

Cycle 1 will consist of injection, storage, and recovery phases. The injection phase of Cycle 1 will be used to assess head buildup in the aquifer, increased production performance resulting from recharge, potential for loss of stored water, area affected, and injection well efficiency changes over time. The storage phase will be used to determine if the quality of the stored water changes substantially during storage and the degree to which the head buildup is maintained. A step-rate pumping test will be performed at the start of the recovery phase, and will consist of pumping the ASR well at three pumping rates for approximately 2 hours each. Results of the step-rate test will be compared to the baseline step-rate test to assess changes in well efficiency following ASR. The recovery portion of Cycle 1 will be used to estimate the amount of mixing between source water and native groundwater, and to identify changes in well performance and aquifer characteristics relative to the initial baseline pumping tests.

Cycle 1 of pilot testing will consist of injecting, storing, and recovering source water at the ASR well. The Cycle 1 schedule will depend on construction schedules, JWC demands, and well performance. For the first ASR well (JWC ASR C – Cooper Mountain Reservoir site), Cycle 1 schedule is anticipated to consist of:

- An approximately 150-day injection period from December 1, 2013, through April 30, 2014, with a storage target of 150 MG at an estimated average injection rate of 1 mgd at approximately 700 gpm.

- A 60-day storage period (May through June 2014).

- A 100-day recovery period from July 1 through mid-October 2014, potentially recovering 100 percent of injected volume at an average recovery rate of 1,050 gpm.

The schedules, rates, and volumes described above are estimates only and may vary significantly. Consequently, the total amount of water stored may be variable and carryover of stored water to hedge against future drought periods may occur in any given year. As previously stated, a work plan outlining a detailed sampling and monitoring plan, along with injection, recovery, and storage estimates will be submitted to OWRD before cycle testing for each ASR well that is brought online.

As shown in Table 4, water quality samples will be collected during ASR testing to characterize the mixing zone during the end of the target recovery volume (using criteria developed during baseline monitoring). The recovered water will be put into the JWC's distribution system. Water quality sampling and analysis procedures and frequency are described in Section 6 and 7, and the water quality sampling schedule also is presented in Section 8.

Contingency Plan

The JWC intends to use recovered water in its distribution system. In the unlikely event that the quality of the injected water becomes impaired or the recovered water is unacceptable, all of the water injected into the aquifer will need to be recovered and pumped to waste. The current wellhead system will be modified to allow for discharge of water to a pump-to-waste system or the storm system. However, on the basis of the water quality analysis conducted to date and our experience with ASR in basalt aquifers throughout the region, the likelihood of this situation occurring appears highly improbable.

5.3 ASR Testing: Years 2 through 5

The results of the Year 1 pilot testing at each ASR well will be evaluated and used to optimize ASR operation in future years. Target ASR volumes, rates, durations, and schedules will be developed on the basis of Year 1 results. The ASR operations plan for the following year will be submitted with each annual report. Any modifications to the sampling and monitoring plan provided in Table 4 will be submitted to OWRD for review and approval.

Limited License Duration

The JWC is seeking approval of a limited license for a 5-year period with the option to extend the limited license period for an additional length.

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6. Water Quality Monitoring Program

ASR regulations require that source water and native groundwater be analyzed for DHS regulated and unregulated constituents, DEQ water quality MML constituents, and federal SMCL constituents before pilot testing begins and periodically during the testing period. In addition to the above-mentioned constituents, the native groundwater also must be tested for selected general water quality parameters and common ions. These analyses are listed in Table 5 of this application.

The objectives of water quality monitoring for the ASR pilot testing program include the following:

- Confirm that the injected and recovered water meets Safe Drinking Water Act drinking water criteria:
  - Drinking water parameters
  - Aesthetics of the recovered water (taste and odor)

- Assess water quality compatibility with respect to:
  - Injection well clogging caused by particulates (turbidity), air, biological activity, and chemical reactions
  - Mineral dissolution reactions in the aquifer that could affect recovered water quality
  - ASR well redevelopment criteria
  - Recovery efficiencies

The components of water quality monitoring for the pilot testing program are described in the following subsections. A discussion of the background native groundwater quality, source water quality, and predicted geochemistry resulting from mixing is presented in Section 2 of this application.

6.1 Water Quality Monitoring: Year 1 Pilot Testing

Water quality samples will be collected during the injection, storage, and recovery periods of Cycle 1 testing. Water quality analyses and a tentative ASR operations schedule for the first year of pilot testing at each ASR well are presented in Table 4. The program has been designed to meet the objectives stated previously. It is anticipated that the water quality analyses and operations schedule framework summarized in Table 4 will be implemented at each ASR well. However, if a wellfield is developed such that ASR wells are located in close proximity to each other, and with OWRD's approval, water quality sampling will occur at one ASR well within the ASR wellfield.

6.2 Water Quality Monitoring: Pilot Testing, Years 2 through 5

Table 4 presents the anticipated water quality monitoring program for Years 2 through 5. If this anticipated program changes based on Year 1 pilot testing results, an updated water quality monitoring program for Years 2 through 5 will be developed and submitted to OWRD.

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7. Quality Assurance and Quality Control Plan

This quality assurance and quality control (QA/QC) plan describes water sampling QA/QC procedures that will be performed during the JWC ASR pilot testing program at each ASR well. The purpose of the QA/QC plan is to obtain water quality data that are valid representations of the water quality at each sampling location. GSI and/or the JWC will collect the water quality samples and submit them to a laboratory for analysis. GSI will review field and laboratory data for completeness and compliance with this plan.

7.1 Field QA/QC

QA/QC procedures that will be used in the field during the ASR pilot testing program include field equipment calibration, field record keeping, and chain-of custody documentation. No duplicate samples will be collected in the field. If lab testing results indicate that a parameter has an unexpectedly high concentration approaching the MCL or MML, injection or pumping will be stopped and the location will be resampled as soon as possible. Each element of the field QA/QC is described below.

7.2 Field Equipment Calibration

Field meters require calibration to ensure accurate and precise measurement of field parameters. The field meters will be calibrated before each sampling event and subsequently operated in a manner consistent with the manufacture's recommendations.

7.3 Field Record Keeping

The sampling technician will document field observations and measurements on a water sampling field form during sampling. The following information will be recorded on the form for each sampling point:

- Time of day and date
- Name of person performing the sampling
- Location of sampling point
- Field parameter values (pH, temperature, specific conductivity, dissolved oxygen, and oxygen reduction potential) collected during sampling
- Appearance of sample
- Thermal and chemical preservation (if any)

If groundwater samples are collected from wells, the following additional information will be recorded on the form:

- Depth to groundwater
- Field parameter values collected during purging intervals
- Purging time and volume of water purged

7.4 Sample Labels

A sample label will be secured to each water sample container. The following information will be included on the sample labels:

- Project location
- Sample number (e.g., well ID# and date)
- Name of person collecting the sample
- Date and time of sample collection
- Type of preservative (if any)
- Other pertinent information requested by the analytical laboratory that will be analyzing the water samples

7.5 Sample Names

Each sample will be named according to the following format: JWC ASR #- AAA-BB-C, where:

- "JWC ASR #" indicates the sample was collected at the JWC ASR No. # well,
- "*AAA*" indicates whether the water represents native basalt groundwater (GW), source water (SW), stored water (ST), or recovered water (RW),
- "*BB*" indicates the cycle (C1 for Cycle 1, C2 for Cycle 2, etc.), and
- "*C*" indicates the sample number within a given cycle (1 indicates the first sample of "*AAA*" collected during a cycle, and 2 indicates the second sample of "*AAA*" collected during a cycle).

For example, JWC ASR 3-SW-C1-2 would be the second source water sample collected during Cycle 1 at JWC ASR 3 well.

7.6 Chain-of-Custody

A chain-of-custody form will be used to track possession of each sample and document the requested analyses. The following procedure will be used regarding chain-of-custody records.

1. After collecting the samples, the sampling technician will complete the chain-of-custody form.

2. The chain-of-custody record will accompany the samples from the field to the laboratory.

3. Each individual having samples in his/her custody must ensure that the samples are not tampered with and that the chain-of-custody record is completed upon sample transfer.

4. A copy of the completed forms will be retained in the project files.

7.7 Laboratory Quality Assurance Program

Samples collected during the pilot testing program will be analyzed by an analytical laboratory certified by the Oregon Environmental Laboratory Accreditation Program (ORELAP).

The analytical laboratory will use trip blanks, method blanks, spikes, duplicates, surrogates, and control samples in each analytical batch containing the JWC samples being analyzed, or at a frequency of at least one in every 20 samples, depending on the analysis being performed. The results from these procedures will accompany the sample test results. A copy of the analytical laboratory's quality assurance manual is available upon request.

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8. Schedule for Year 1 Pilot Testing

Table 4 presents the anticipated pilot testing schedule for the first year of JWC ASR cycle testing. Table 4 outlines the injection, storage, recovery, and water quality sampling schedule at the first JWC ASR well (JWC ASR C). The schedule may vary depending on when the ASR limited license is approved, and could change in response to construction schedules, JWC demands, and well performance. As noted previously, it is anticipated that the water quality analyses and operations schedule framework summarized in Table 4 will be implemented at each ASR well. However, if a wellfield is developed, water quality sampling will occur at one ASR well within the ASR wellfield rather than each individual well.

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9. Pilot Test Report Outline

The following is an outline of the pilot test report that will be submitted at the conclusion of Year 1 pilot testing:

Executive Summary

Project Description
Introduction
Existing Site Conditions

Pilot Test Results
ASR Injection and Pumping Rates and Volumes (stored water and native groundwater)
Injection and Pumping Efficiency

Water Quality Monitoring
Injected water quality
Recovered water quality
Chemical Reactions

Water Level Monitoring and Aquifer Response
Data Collection
Results

Conclusions

Proposed ASR Operations Plan for Year 2

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Tables

Table 1
Summary of Native Groundwater and ASR Source Water Quality Testing
Joint Water Commission Limited License Application

	Analyte	Lowest Regulatory Standard	Units	JWC Source Water City of Beaverton HNSN-C12SW-1 ASR 4 12/16/2008		JWC Source Water City of Beaverton HNSN-C12SW-3 ASR 4 4/13/2009		JWC Source Water City of Beaverton HNSN-C13SW-1 ASR 4 12/28/2009		PWB Bull Run Source Water City of Tigard ASR2-C3SW-1 11/26/2007		PWB Bull Run Source Water 2009	
Bacteriological	Fecal Coliforms/E.Coli							Absent				Absent [3]	
	Total Coliform	<1/100 ML	CFU/100 ml					Absent				Absent [4]	
Disinfection By-Products	Chloroform (Trichloromethane)	None	mg/L	0.022						0.0326			
	Bromodichloromethane	None	mg/L	0.0037						0.0016			
	Dibromochloromethane	None	mg/L	0.001	U					0.005	U		
	Bromoform (Tribromomethane)	None	mg/L	0.001	U					0.005	U		
	Total Trihalomethanes	0.08	mg/L	0.0257						0.0342			
	Monochloroacetic Acid	None	mg/L	0.002	U					0.002	U		
	Dichloroacetic Acid	None	mg/L	0.0133						0.0176			
	Trichloroacetic Acid	None	mg/L	0.0136						0.026			
	Monobromoacetic Acid	None	mg/L	0.001	U					0.001	U		
	Dibromoacetic Acid	None	mg/L	0.001	U					0.001	U		
	Total Haloacetic Acids	0.06	mg/L	0.0269						0.0436			
Field Parameters	Temperature	None	Celsius	7.82		9.4				10.36			
	Conductivity	None	mS/cm	132		114				39			
	Dissolved Oxygen	None	mg/L	12.37		10.88				10.24			
	pH	6 - 8.5	Units	8.3		8				8.03			
	ORP	None	mV	676		658				437			
Geochemical	Bicarbonate	None	mg/L	39		28				12			
	Calcium	None	mg/L	10		7.7				2.1			
	Carbonate	None	mg/L	2	U	2	U			2	U		
	Chloride	250	mg/L	7		4				3			
	Hardness (as CaCO3)	250	mg/L	40		30				10			
	Magnesium	None	mg/L	2.93		2.26				0.81			
	Nitrate as N	10	mg/L	0.7		0.8				0.5	U		
	Nitrite as N	1	mg/L	0.01	U	0.01	U			0.01	U		
	Total Nitrate-Nitrite	10	mg/L	0.7		0.8				0.01	U		
	Potassium	None	mg/L	0.6		0.5				0.2			
	Silica	None	mg/L	15		15				11			
	Sodium	20	mg/L	12.3		10.1				3.6			
	Sulfate	250	mg/L	13		9				1	U		
	Total Alkalinity	250	mg/L	39		28				12			
	Total Dissolved Solid	500	mg/L	97		72				30			
	Total Organic Carbon	None	mg/L	1.75		2.55				1.84			
	Total Suspended Solids	None	mg/L	2	U	2	U			2	U		
Metals	Aluminum	0.05 - 0.2	mg/L	0.05	U	0.18				0.05	U		
	Antimony	0.006	mg/L	0.001	U	0.001	U			0.001	U		
	Arsenic	0.01	mg/L	0.003	U	0.003	U			0.003	U		
	Barium	1	mg/L	0.05	U	0.05	U			0.02	U		
	Beryllium	0.004	mg/L	0.001	U	0.001	U			0.001	U		
	Cadmium	0.005	mg/L	0.0005	U	0.0005	U			0.0005	U		
	Chromium	0.05	mg/L	0.01	U	0.01	U			0.01	U		
	Copper	1.3	mg/L	0.05	U	0.05	U			0.05	U		
	Iron (Total)	None	mg/L	0.05	U	0.05	U			0.05	U		
	Iron (Dissolved)	0.3	mg/L	0.05	U	0.05	U			0.05	U		
	Lead	0.015	mg/L	0.002	U	0.002	U			0.002	U		
	Manganese (Total)	None	mg/L	0.02	U	0.02	U			0.02	U		
	Manganese (Dissolved)	0.05	mg/L	0.02	U	0.02	U			0.01	U		
	Mercury	0.002	mg/L	0.0003	U	0.0003	U			0.0003	U		
	Nickel	0.1	mg/L	0.02	U	0.02	U			0.02	U		
	Selenium	0.01	mg/L	0.005	U	0.005	U			0.005	U		
	Silver	0.05	mg/L	0.02	U	0.02	U			0.02	U		
	Thallium	0.002	mg/L	0.001	U	0.001	U			0.001	U		
	Zinc	5	mg/L	0.01	U	0.05	U			0.01	U		
Miscellaneous	Odor	3	TON	1		2				1			
	Color	15	ACU	5		5	U			9			
	Methylene Blue Active Substance	0.5	mg/L	0.05	U	0.05	U			0.05	U		
	Corrosivity (Langelier Saturation Index)	Non-Corrosive	mg/L	-0.59		-2.05				-1.91			
	Cyanide (as free cyanide)	0.2	mg/l	0.02	U	0.02	U			0.02	U		
	Fluoride	2	mg/L	0.9		0.9				0.5	U		
Radionuclides	Combined Radium 226/228	5	pCi/L	0.9	U					1	U		
	Uranium [1]	0.03	mg.L	0.001	U					0.001	U		
	Gross Alpha	15	pCi/L	0.9	±0.8					1	U		
	Gross Beta	50	pCi/L	1.5	U					2	U		
	Radon [2]	None	pCi/L										
Regulated Synthetic Organic Compounds (SOCs)	2,4,5-TP (Silvex)	0.01	mg/L	0.0004	U					0.0004	U		
	2,4-D	0.07	mg/L	0.0002	U					0.0002	U		
	Alachlor (Lasso)	0.002	mg/L	0.004	U					0.0004	U		
	Atrazine	0.003	mg/L	0.002	U					0.0002	U		
	Benzo(a)Pyrene	0.0002	mg/L	0.00004	U					0.00004	U		
	BHC-gamma (Lindane)	0.0002	mg/L	0.0002	U					0.00002	U		
	Carbofuran	0.04	mg/L	0.001	U					0.001	U		
	Chlordane	0.002	mg/L	0.00004	U					0.00004	U		
	Dalapon	0.2	mg/L	0.002	U					0.002	U		
	Di(2-ethylhexyl)adipate *(adipates)*	0.4	mg/L	0.001	U					0.001	U		
	Di(2-ethylhexyl)phthalate *(phthalates)*	0.006	mg/L	0.001	U					0.001	U		
	Dibromochloropropane (DBCP)	0.0002	mg/L	0.00002	U					0.00002	U		
	Dinoseb	0.007	mg/L	0.0004	U					0.0004	U		
	Diquat	0.02	mg/L	0.0004	U					0.0004	U		
	Ethylene Dibromide (EDB)	0.00005	mg/L	0.00001	U					0.00001	U		
	Endothall	0.1	mg/L	0.01	U					0.01	U		
	Endrin	0.0002	mg/L	0.00002	U					0.00002	U		
	Glyphosate	0.7	mg/L	0.01	U					0.01	U		
	Heptachlor	0.0004	mg/L	0.00004	U					0.00004	U		
	Heptachlor Epoxide	0.0002	mg/L	0.00002	U					0.00002	U		
	Hexachlorobenzene (HCB)	0.001	mg/L	0.0001	U					0.0001	U		
	Hexachlorocyclopentadiene	0.05	mg/L	0.0002	U					0.0002	U		
	Methoxychlor	0.04	mg/L	0.0002	U					0.0002	U		
	Polychlorinated Biphenyls (PCBs)	0.0005	mg/L	0.00002	U					0.00002	U		
	Pentachlorophenol	0.001	mg/L	0.00008	U					0.00008	U		
	Picloram	0.5	mg/L	0.0002	U					0.0002	U		
	Simazine	0.004	mg/L	0.0001	U					0.0001	U		
	Toxaphene	0.003	mg/L	0.0001	U					0.0001	U		
	Vydate (Oxamyl)	0.2	mg/L	0.002	U					0.002	U		
Regulated Volatile Organic Compounds (VOCs)	1,1,1-Trichloroethane	0.2	mg/L	0.0005	U					0.0005	U		
	1,1,2-Trichloroethane	0.005	mg/L	0.0005	U					0.0005	U		
	1,1-Dichloroethylene	0.007	mg/L	0.0005	U					0.0005	U		
	1,2,4-Trichlorobenzene	0.07	mg/L	0.0005	U					0.0005	U		
	1,2-Dichlorobenzene (o)	0.6	mg/L	0.0005	U					0.0005	U		
	1,2-Dichloroethane (EDC)	0.005	mg/L	0.0005	U					0.0005	U		
	1,2-Dichloropropane	0.005	mg/L	0.0005	U					0.0005	U		
	1,4-Dichlorobenzene (p)	0.075	mg/L	0.0005	U					0.0005	U		
	Benzene	0.005	mg/L	0.0005	U					0.0005	U		
	Carbon Tetrachloride	0.005	mg/L	0.0005	U					0.0005	U		
	Chlorobenzene (monochlorobenzene)	0.1	mg/L	0.0005	U					0.0005	U		
	cis-1,2-Dichloroethylene	0.07	mg/L	0.0005	U					0.0005	U		
	Ethylbenzene	0.7	mg/L	0.0005	U					0.0005	U		
	Dichloromethane (methylene chloride)	0.005	mg/L	0.0005	U					0.0005	U		
	Styrene	0.1	mg/L	0.0005	U					0.0005	U		
	Tetrachloroethylene	0.005	mg/L	0.0005	U					0.0005	U		
	Toluene	1	mg/L	0.0005	U					0.0005	U		
	trans-1,2-Dichloroethylene	0.1	mg/L	0.0005	U					0.0005	U		
	Trichloroethylene	0.005	mg/L	0.0005	U					0.0005	U		
	Vinyl chloride	0.002	mg/L	0.0005	U					0.0005	U		
	Total Xylenes	10	mg/L	0.0015	U					0.0015	U		

NOTE

ND = Not detected at concentrations greater than the MDL

U = Undetected at concentrations greater than the MDL

Samples are unfiltered unless noted (i.e., dissolved)

1 = Combined Radium 226/228 and Uranium required after December 2003

2 = Analyte not required.

3 = E.Coli data from Portland Water Bureau Water Quality Report. One routine sample and repeat sample in November, 2009 had detectable E.coli bacteria.

4 = Total Coliform data from Portland Water Bureau Water Quality Report. In October, 2009, 8 samples out of 319 (2.5%) had detectable coliform bacteria.

5 = The laboratory report refers to the sample as ASR1-C7R-1. However, the sample was collected following an ASR cycle with 98 MG of native groundwater pumping and no ASR storage and later was refered to as ASR1-C7GW-2.

GSI Water Solutions, Inc.

Table 1
Summary of Native Groundwater and ASR Source Water Quality Testing
Joint Water Commission Limited License Application

	Analyte	Lowest Regulatory Standard	Units	Native Basalt Groundwater City of Tigard ASR1-C1GW 11/29/2001	Native Basalt Groundwater City of Tigard ASR1-C1GW 11/30/2001	Native Basalt Groundwater City of Tigard ASR1-C7GW 1/23/2008	Native Basalt Groundwater City of Tigard ASR1-C7GW-2[5] 5/6/2008	Native Basalt Groundwater TVWD Grabhorn Pre-injection 5/15/2003	Native Basalt Groundwater City of Beaverton ASR1 Pre-injection 7/14/1994
Bacteriological	Fecal Coliforms/E.Coli				Absent			Absent	
	Total Coliform	<1/100 ML	CFU/100 ml		6.4			Absent	1.1 U
Disinfection By-Products	Chloroform (Trichloromethane)	None	mg/L			0.0126			
	Bromodichloromethane	None	mg/L			0.0011			
	Dibromochloromethane	None	mg/L			0.001 U			
	Bromoform (Tribromomethane)	None	mg/L			0.001 U			
	Total Trihalomethanes	0.08	mg/L		0.0005 U	0.0137			
	Monochloroacetic Acid	None	mg/L			0.002 U			
	Dichloroacetic Acid	None	mg/L			0.001 U			
	Trichloroacetic Acid	None	mg/L			0.001 U			
	Monobromoacetic Acid	None	mg/L			0.001 U			
	Dibromoacetic Acid	None	mg/L			0.001 U			
	Total Haloacetic Acids	0.06	mg/L		0.001 U	ND		0.001 U	
Field Parameters	Temperature	None	Celsius			10.65	10.66	14.4	
	Conductivity	None	mS/cm			200	192	252	
	Dissolved Oxygen	None	mg/L			10.2	5.43	6.3	
	pH	6 - 8.5	Units		7.4	7.56	7.2	7.2	6.88
	ORP	None	mV			375.8	164.7	72.9	
Geochemical	Bicarbonate	None	mg/L	133		80	76	138	110
	Calcium	None	mg/L	25		16.9	14	23.4	36
	Carbonate	None	mg/L	0.217		2 U	2 U	3 U	
	Chloride	250	mg/L	3.7		3	4	3.86	47.5
	Hardness (as CaCO3)	250	mg/L	108		78	82	107	140
	Magnesium	None	mg/L	11		7.57	7.77	11.9	19
	Nitrate as N	10	mg/L	1.7	1.7	1.5	2.5	0.09	0.56
	Nitrite as N	1	mg/L	<0.10		0.01 U	0.01 U	0.1 U	0.01 U
	Total Nitrate-Nitrite	10	mg/L			1.5	2.5	0.09	0.56
	Potassium	None	mg/L	3		2.1	0.5	2.8	2.6
	Silica	None	mg/L			41.9	41.8	66.5	
	Sodium	20	mg/L	8.2		7.3	6.9	13.3	12.1
	Sulfate	250	mg/L	4.3		2.94	3.46	2.33	7 U
	Total Alkalinity	250	mg/L	109		80	76	135	110
	Total Dissolved Solid	500	mg/L	200		136	148	210	245
	Total Organic Carbon	None	mg/L			3.08	1.83	0.5 U	0.7
	Total Suspended Solids	None	mg/L			2 U	2 U		
Metals	Aluminum	0.05 - 0.2	mg/L		0.025 U			0.1	0.1 U
	Antimony	0.006	mg/L		0.001 U		0.001 U	0.002	
	Arsenic	0.01	mg/L		0.001 U		0.003 U	0.002 U	0.002 U
	Barium	1	mg/L		0.0026		0.02 U	0.025 U	0.1 U
	Beryllium	0.004	mg/L		0.001 U		0.001 U	0.0005 U	
	Cadmium	0.005	mg/L		0.0005 U		0.0005 U	0.001 U	0.0002 U
	Chromium	0.05	mg/L		0.00001 U		0.01 U	0.01 U	0.002 U
	Copper	1.3	mg/L		0.002 U			0.01 U	0.005 U
	Iron (Total)	None	mg/L		0.0001 U	0.05 U	0.05 U	0.02 U	0.03 U
	Iron (Dissolved)	0.3	mg/L			0.05 U	0.05 U		
	Lead	0.015	mg/L		0.0023		0.002 U	0.003 U	0.001 U
	Manganese (Total)	None	mg/L		0.0024	0.02 U	0.02 U	0.01 U	0.019
	Manganese (Dissolved)	0.05	mg/L			0.02 U	0.02 U	0.01 U	
	Mercury	0.002	mg/L		0.0002 U		0.0003 U	0.0001 U	0.0003 U
	Nickel	0.1	mg/L				0.02 U	0.02 U	
	Selenium	0.01	mg/L		0.005 U		0.005 U	0.01 U	0.002 U
	Silver	0.05	mg/L		0.0005 U			0.01 U	
	Thallium	0.002	mg/L		0.001 U		0.001 U	0.0005 U	
	Zinc	5	mg/L		0.0054			0.02 U	
Miscellaneous	Odor	3	TON	3	3	1 U		1 U	
	Color	15	ACU	3				5 U	
	Methylene Blue Active Substance	0.5	mg/L		0.05 U				
	Corrosivity (Langelier Saturation Index)	Non-Corrosive	mg/L		-0.5	-0.74	-1.21	-2.09	
	Cyanide (as free cyanide)	0.2	mg/l		0.025 U	0.02 U	0.02 U	0.005 U	
	Fluoride	2	mg/L		0.09	0.5 U	0.5 U	0.11	0.25 U
Radionuclides	Combined Radium 226/228	5	pCi/L				0.7 U		
	Uranium[1]	0.03	mg.L				0.001 U		
	Gross Alpha	15	pCi/L		<1		1 U	1	0.211
	Gross Beta	50	pCi/L		2.3		1.5 U	3	2.7
	Radon[2]	None	pCi/L		290	358			
Regulated Synthetic Organic Compounds (SOCs)	2,4,5-TP (Silvex)	0.01	mg/L		0.0002 U		0.0004 U	0.0004 U	0.005 U
	2,4-D	0.07	mg/L		0.0001 U		0.0002 U	0.0002 U	0.007 U
	Alachlor (Lasso)	0.002	mg/L		0.0002 U		0.0004 U	0.0004 U	0.0004 U
	Atrazine	0.003	mg/L		0.0001 U		0.0002 U	0.0002 U	0.0003 U
	Benzo(a)Pyrene	0.0002	mg/L		0.00004 U		0.00004 U	0.00004 U	
	BHC-gamma (Lindane)	0.0002	mg/L		0.00004 U		0.00002 U		0.00002 U
	Carbofuran	0.04	mg/L		0.0009 U		0.001 U	0.001 U	0.004 U
	Chlordane	0.002	mg/L		0.0001 U		0.00004 U	0.0004 U	0.0004 U
	Dalapon	0.2	mg/L		0.001 U		0.002 U	0.002 U	
	Di(2-ethylhexyl)adipate *(adipates)*	0.4	mg/L		0.0012 U		0.001 U		
	Di(2-ethylhexyl)phthalate *(phthalates)*	0.006	mg/L		0.0012 U		0.001 U		
	Dibromochloropropane (DBCP)	0.0002	mg/L		0.00001 U		0.00002 U	0.00002 U	0.00002 U
	Dinoseb	0.007	mg/L		0.0002 U		0.0004 U	0.0004 U	
	Diquat	0.02	mg/L		0.0004 U		0.0004 U	0.0004 U	
	Ethylene Dibromide (EDB)	0.00005	mg/L		0.00001 U		0.00001 U	0.00001 U	0.00001 U
	Endothall	0.1	mg/L		0.005 U		0.01 U	0.01 U	
	Endrin	0.0002	mg/L		0.0002 U		0.00002 U	0.00002 U	0.00002 U
	Glyphosate	0.7	mg/L		0.006 U		0.01 U	0.01 U	
	Heptachlor	0.0004	mg/L		0.00008 U		0.00004 U	0.00004 U	0.00004 U
	Heptachlor Epoxide	0.0002	mg/L		0.00001 U		0.00002 U	0.00002 U	0.00002 U
	Hexachlorobenzene (HCB)	0.001	mg/L		0.0001 U		0.0001 U	0.0001 U	
	Hexachlorocyclopentadiene	0.05	mg/L		0.0001 U		0.0002 U	0.0002 U	
	Methoxychlor	0.04	mg/L		0.0001 U		0.0002 U	0.0002 U	0.004 U
	Polychlorinated Biphenyls (PCBs)	0.0005	mg/L		0.0001 U		0.00002 U		0.00025 U
	Pentachlorophenol	0.001	mg/L		0.0004 U		0.00008 U	0.00008 U	0.0001 U
	Picloram	0.5	mg/L		0.0001 U		0.0002 U		
	Simazine	0.004	mg/L		0.00007 U		0.0001 U	0.0001 U	
	Toxaphene	0.003	mg/L		0.0005 U		0.0001 U	0.001 U	0.001 U
	Vydate (Oxamyl)	0.2	mg/L		0.002 U		0.002 U	0.002 U	
Regulated Volatile Organic Compounds (VOCs)	1,1,1-Trichloroethane	0.2	mg/L		0.0005 U		0.0005 U	0.0005 U	0.0005 U
	1,1,2-Trichloroethane	0.005	mg/L		0.0005 U		0.0005 U	0.0005 U	
	1,1-Dichloroethylene	0.007	mg/L		0.0005 U		0.0005 U	0.0005 U	0.0005 U
	1,2,4-Trichlorobenzene	0.07	mg/L		0.0005 U		0.0005 U	0.0005 U	
	1,2-Dichlorobenzene (o)	0.6	mg/L		0.0005 U		0.0005 U	0.0005 U	0.0005 U
	1,2-Dichloroethane (EDC)	0.005	mg/L		0.0005 U		0.0005 U	0.0005 U	0.0005 U
	1,2-Dichloropropane	0.005	mg/L		0.0005 U		0.0005 U	0.0005 U	0.0005 U
	1,4-Dichlorobenzene (p)	0.075	mg/L		0.0005 U		0.0005 U	0.0005 U	0.0005 U
	Benzene	0.005	mg/L		0.0005 U		0.0005 U	0.0005 U	0.0005 U
	Carbon Tetrachloride	0.005	mg/L		0.0005 U		0.0005 U	0.0005 U	0.0005 U
	Chlorobenzene (monochlorobenzene)	0.1	mg/L		0.0005 U		0.0005 U	0.0005 U	0.0005 U
	cis-1,2-Dichloroethylene	0.07	mg/L		0.0005 U		0.0005 U	0.0005 U	0.0005 U
	Ethylbenzene	0.7	mg/L		0.0005 U		0.0005 U	0.0005 U	0.0005 U
	Dichloromethane (methylene chloride)	0.005	mg/L		0.0005 U		0.0005 U	0.0005 U	
	Styrene	0.1	mg/L		0.0005 U		0.0005 U	0.0005 U	0.0005 U
	Tetrachloroethylene	0.005	mg/L		0.0005 U		0.0005 U	0.0005 U	0.0005 U
	Toluene	1	mg/L		0.0005 U		0.0005 U	0.0005 U	0.0005 U
	trans-1,2-Dichloroethylene	0.1	mg/L		0.0005 U		0.0005 U	0.0005 U	0.0005 U
	Trichloroethylene	0.005	mg/L		0.0005 U		0.0005 U	0.0005 U	0.0005 U
	Vinyl chloride	0.002	mg/L		0.0003 U		0.0005 U	0.0005 U	0.0005 U
	Total Xylenes	10	mg/L		0.0005 U		0.0005 U	0.0015 U	0.0005 U

NOTE

ND = Not detected at concentrations greater than the MDL

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1 = Combined Radium 226/228 and Uranium required after December 2003

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GSI Water Solutions, Inc.

TABLE 2

Summary of JWC and Member Agency Live Flow Water Rights

Joint Water Commission Limited License Application

Source	Priority Date	Application and Permit	Certificate, Claim or Transfer, or Registration	Entity Name on Water Right	Type of Beneficial Use	Authorized Rate (cfs)	Authorized Rate (mgd)	Authorized Volume	Maximum Rate of Withdrawal to Date	Authorized Date for Completion
									Instantaneous (cfs)	
JWC Water Rights										
Sain Creek	1/22/1912	A: S-2016 P: S-1136	c. 81026	City of Hillsboro	MU	3.00	1.94	n/a	3.00	Certificated - no action pending
Sain Creek	5/1/1915	A: S-4250 P: S-2443	c. 81027	City of Hillsboro	MU	2.00	1.29	n/a	2.00	Certificated - no action pending
Tualatin River	8/15/1930	A: S-13681 P: S-10408	c. 67891	City of Hillsboro	MU	9.00	5.81	n/a	9.00	Certificated - no action pending
Tualatin River	2/6/1974	A: S-51643 P: S-46423	c. 85913	City of Hillsboro	MU	43.00	27.8	n/a	43	Certificated - no action pending
Tualatin River	7/15/1980	A: S-60357 P: S-45455	c. 85914	City of Beaverton	MU	25.00	16.2	n/a	25.00	Certificated - no action pending
Scoggins Creek	6/9/1988	A: S-69637 P: S-50879		Joint Water Commission	MU	75.00	48.5	n/a	0	10-1-2071

n/a = not applicable

MU = municipalities

cfs = cubic feet per second

A = application

P = permit

mgd = million gallons per day

GSI Water Solutions, Inc.

Table 3
Observation Wells and Potential Observation Wells - Construction Information
Joint Water Commission Limited License Application

Name	OWRD Well Log ID	Monitoring Method	Well Status and Usage	Notes	Well Tag	Approximate Ground Surface Elevation (ft MSL)	Approximate Bottom of Casing Elevation (ft MSL)	Approximate Top of Basalt Elevation (ft MSL)	Well Depth (ft)	Approximate Bottom Elevation of Well (ft MSL)	Casing Diameter (in)	Latitude (WGS84)	Longitude (WGS84)
ASR 3	WASH 57952	Manual	Exisiting, Municipal		L51450	318.5	171.5	303.5	1000	-681.5	8	45.428719	-122.846262
ASR 4 Obs	WASH 58005	Transducer	Exisiting, Municipal (monitoring)		L54408	348.1	254.1	269.1	477	-128.9	6	45.463450	-122.814631
Davies/Speer	n/a	Manual	Exisiting, Private (irrigation)	Well construction information based on well video		298.7	234.7	234.7	300	-1.3	6	45.460602	-122.814291
Dernbach	WASH 8961/ 8845/ 8957	Transducer	Exisiting, Private (domestic)	Casing information based on well video		467.0	452.5	452.5	410	57	6	45.472696	-122.842852
Maverick	WASH 57796	Manual	Exisiting, Municipal (monitoring)		L51452	348.5	160.5	313.5	225	123.5	2	45.455720	-122.825736
Rubber Reservoir	WASH 58076	Transducer	Exisiting, Municipal (monitoring)		L54323	411.5	157.5	354.5	280	131.5	2	45.457746	-122.825764
Sage Place	WASH 8976	Transducer	Exisiting, Private (irrigation)			290.8	70.8	85.8	395	-104.2	6	45.465523	-122.806823
WASH 9205	WASH 9205	Manual and Transducer	Exisiting, Private (domestic)			211.0	-74	Does not contact basalt	325	-114	6	45.438842	-122.821785
150th Court	WASH 67488	Transducer	Exisiting, Municipal (monitoring)		L96899	173.7	148.7	Does not contact basalt	25	148.7	2	45.478593	-122.831180
Pierson Well	WASH 10218/ 10226/ 10235	Manual	Exisiting, Private (domestic)			543.8	525.8	543.8	487	56.8	6	45.461740	-122.879160
Baker Rock Well	WASH 50723	Manual	Exisiting, Private (industrial)			210.8	145.8	208.8	65	145.8	6	45.455990	-122.894710
Schulz Well	WASH 10143	Manual	Exisiting, Private (domestic)			211.3	-381.7	-428.7	805	-593.7	12 and 10	45.471010	-122.896180
Ames Well	WASH 59603	Manual	Exisiting, Private (domestic)	Wellhead sealed, pressure gauge	L64128	205.2	-70.8	5.2	445	-239.8	6	45.461360	-122.903060
Schuepbach Well	WASH 8862	Manual	Exisiting, Municipal		L101486	273.9	233.9	262.9	414	-140.1	14	45.479230	-122.841070
Fischer Well	n/a	Manual	Exisiting, Private (domestic)	Wellhead sealed, pressure gauge		198.6	n/a	n/a	n/a	n/a	n/a	45.471850	-122.898080
Oglesby Well	n/a	Manual	Exisiting, Private (domestic)	Wellhead sealed, pressure gauge		194.9	n/a	n/a	n/a	n/a	n/a	45.459060	-122.904930
Hylton Well	WASH 13787	Manual	Exisiting, Private (domestic)	Wellhead sealed, pressure gauge		197.2	-241.8	-230.8	448	-250.8	6	45.459450	-122.906190
Potential Observation Well	WASH 56299/ WASH 42	TBD	Existing, Private (domestic)		L41145	262.0	234.0	241.0	360	-98.0	10	45.438331	-122.880150
Potential Observation Well	WASH 56058	TBD	Existing, Private (domestic)		L39466	251.0	-49.0	231.0	400	-149.0	6 and 5	45.437138	-122.880128
Potential Observation Well	WASH 64258	TBD	Existing, Private (domestic)		L85856	181.0	103.0	111.0	290	-109.0	8	45.426099	-122.927844
Potential Observation Well	WASH 58886	TBD	Existing, Private (domestic)		L61012	265.0	146.0	253.0	308	-43.0	6	45.425046	-122.880982
Potential Observation Well	WASH 3841	TBD	Existing, Private (domestic)			180.0	89.0	96.0	385	-205.0	6	45.420164	-122.897816
Potential Observation Well	WASH 4308	TBD	Existing, Private (irrigation)			175.0	97.0	140.0	300	-125.0	8	45.434744	-122.909293
Potential Observation Well	WASH 64738	TBD	Existing, Private (domestic)		L87451	174.0	122.0	161.0	370	-196.0	6	45.437074	-122.917724
Potential Observation Well	WASH 60911	TBD	Existing, Private (domestic)		L64517	155.0	-78.0	-59.0	310	-155.0	6	45.437845	-122.921078
Potential Observation Well	WASH 51133	TBD	Existing, Private (domestic)		L01422	244.0	205.0	227.0	318	-74.0	6	45.421473	-122.881965
Potential Observation Well	WASH 52941	TBD	Existing, Private (domestic)		L18358	578.0	538.0	563.0	500	78.0	8	45.443234	-122.863926
Potential Observation Well	WASH 58107	TBD	Existing, Private (domestic)	Deepening - unable to identify original lot	L553321	291.0	n/a	n/a	305	-14.0	6	45.430158	-122.877438
Potential Observation Well	WASH 51246	TBD	Existing, Private (domestic)		L08783	311.0	144.0	221.0	245.0	66.0	6.0	45.422036	-122.801854
Potential Observation Well	WASH 9828	TBD	Existing, Private (irrigation)	Application No. GR-2846		224.0	-534.0	n/a	930.0	-706.0	6.0	45.477437	-122.874024
Potential Observation Well	WASH 60092	TBD	Existing, Private (domestic)		L66008	165.0	-255.0	-224.0	480	-315.0	8	45.448649	-122.944547
Potential Observation Well	WASH 60862	TBD	Existing, Private (domestic)		L69268	230.0	n/a	n/a	n/a	n/a	n/a	45.438694	-122.796358
Potential Observation Well	WASH 8816	TBD	Existing, Private (domestic)			199.0	19.0	-38.0	245	-46.0	6	45.481975	-122.787485
Potential Observation Well	WASH 50709	TBD	Existing, Private (domestic)			251.0	53.0	211.0	360	-109.0	6	45.391069	-122.887252
Potential Observation Well	WASH 1126	TBD	Existing, Private (domestic)			277.0	252.0	257.0	265	12.0	6	45.404205	-122.840621
Potential Observation Well	WASH 69250	TBD	Existing, Private (domestic)		L102674	422.0	159.0	415.0	400	22.0	6	45.407103	-122.831986
Potential Observation Well	WASH 62430	TBD	Existing, Private (domestic)		L72766	419.0	255.0	416.0	362	57.0	6	45.408520	-122.837902
Potential Observation Well	WASH 58498	TBD	Existing, Private (domestic)		L55309	253.0	-46.0	234.0	459	-206.0	6	45.437138	-122.880128
Potential Observation Well	WASH 56470	TBD	Existing, Private (domestic)		L42477	152.0	-364.0	-5.0	583	-431.0	6	45.406706	-122.879082
Potential Observation Well	WASH 51495	TBD	Existing, Private (domestic)		L10538	199.0	-416.0	-361.0	705	-506.0	8	45.484186	-122.914953
Potential Observation Well	WASH 56918	TBD	Existing, Private (domestic)		L41138	185.0	-612.0	-552.0	798	-613.0	6	45.483817	-122.912264

Notes:
n/a = Not available
TBD = To be determined

GSI Water Solutions, Inc.

Table 4
Anticipated Water Quality Analyses and ASR Operations Schedule -- Year 1 Pilot Testing
Joint Water Commission Limited License Application

Estimated -- QA needed

Previous Year Carrryover
0

AVERAGE Injection Rate:	694	(gpm)	
AVERAGE Recovery Rate:	1000	(gpm)	
Target Storage Volume	150,000,000	(gallons)	
Injection Start Date (Cycle 1)	12/1/2013		
Injection End Date (Cycle 1)	4/30/2014		
Elapsed Injection Days (Cycle 1)		150.0	(days)
Elapsed Injection Hours (Cycle 1)		3600	(hours)
	Target	150,000,000	gallons injected at injection rate
Total Planned Injection Volume		150,000,000	gallons Total with Carryover
Storage Start Date (Cycle 1)	4/30/2014		
Storage End Date (Cycle 1)	7/1/2014		
Elapsed Storage Days (Cycle 1)		62.0	(days)
Elapsed Storage Hours (Cycle 1)		1488	(hours)
Total Planned Recovery Volume		150,000,000	(gallons)
Recovery Start Date	7/1/2014		100% Recovered
Days Required to Recover 100% of Injection Volume	10/13/2014		
Days Required to Recover Planned Volume	104	(days)	

Water Quality Monitoring Program (Cycle 1)

Water Type	Progress Point	Estimated Date	Elapsed Days	Analyte Group	Sample ID	Date Collected	Bottles Verified?	Bottle Order Code
Baseline								
GW	-	12/1/2013	-	FP, GC, DBP, SDWA, and Radon	JWC ASR 1-GW-C1-1			
Injection Period								
Source	0%	12/1/2013	0	FP, GC, DBP, SDWA, and Radon	JWC ASR 1-SW-C1-1			
Source	50%	2/14/2014	75	FP and GC	JWC ASR 1-SW-C1-2			
Source	100%	4/30/2014	150	FP, GC, and DBP	JWC ASR 1-SW-C1-3			
Storage Period								
Stored	100%	7/1/2014	62	FP, GC, DBP, SDWA, and Radon	JWC ASR 1-ST-C1-1			
Recovery Period								
Recovered	50%	8/22/2014	52	FP and GC	JWC ASR 1-RW-C1-1			
Recovered	75%	9/17/2014	78	FP and GC	JWC ASR 1-RW-C1-2			
Recovered	100%	10/13/2014	104	FP, GC, DBP, SDWA, and Radon	JWC ASR 1-RW-C1-3			

Water Quality Monitoring Program (Subsequent Cycles)

Water Type	Progress Point	Estimated Date	Elapsed Days	Analyte Group	Sample ID	Date Collected	Bottles Verified?	Bottle Order Code
Baseline Groundwater								
GW	-	12/1/2014	-	FP, GC, DBP, SDWA, and Radon	JWC ASR 1-GW-C2-1			
Injection Period								
Source	0%	12/1/2014	0	FP, GC, DBP, and SDWA	JWC ASR 1-SW-C2-1			
Source	50%	2/14/2015	75	FP and GC	JWC ASR 1-SW-C2-2			
Source	100%	4/30/2015	150	FP, GC, and DBP	JWC ASR 1-SW-C2-3			
Storage Period								
Stored	50%	7/1/2015	62	FP, GC, DBP, SDWA, and Radon	JWC ASR 1-ST-C2-1			
Recovery Period								
Recovered	0%	7/1/2015	0	FP and GC	JWC ASR 1-RW-C2-1			
Recovered	50%	8/22/2015	52	FP and GC	JWC ASR 1-RW-C2-2			
Recovered	95%	10/7/2015	99	FP, GC, and DBP	JWC ASR 1-RW-C2-3			

Notes: If storage period is less than 30 days, then collect storage sample immediately prior to recovery
Spreadsheet is based on average injection rates, recovery rates, and storage volumes.
FP = Field Parameters
GC = Geochemical Parameters
DBP = Disinfection By-Products
SDWA = Safe Drinking Water Act Parameters (Oregon Dept. of Health, EPA and DEQ recent water quality prameter list)
Radon = Radon in drinking water analysis, SM 7500 or EPA 913.0
* Includes carryover from previous year

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Table 5

Analyses for Native Groundwater and Source Water

Joint Water Commission Limited License Application

Group	Analyte	Unit	Criteria	ASR Standards*	Note
Bacteriological	Coliform Bacteria	/100ml	MML	0.5	
	Total Coliforms (including fecal coliform and E. Coli)	%	MCL	2.5	1
Disinfection By-Products	Chloroform (Trichloromethane)	mg/L	None	--	
	Bromodichloromethane	mg/L	None	--	
	Dibromochloromethane	mg/L	None	--	
	Bromoform (Tribromomethane)	mg/L	None	--	
	Total Trihalomethanes	mg/L	0.08	0.08	
	Monochloroacetic Acid	mg/L	None	--	
	Dichloroacetic Acid	mg/L	None	--	
	Trichloroacetic Acid	mg/L	None	--	
	Monobromoacetic Acid	mg/L	None	--	
	Dibromoacetic Acid	mg/L	None	--	
	Total Haloacetic Acids	mg/L	0.06	0.06	
Field Parameters	Dissolved Oxygen	mg/L	None	--	
	ORP	mv	None	--	
	pH	--	SMCL	6.5-8.5	
	Specific Conductance	us/cm	None	--	
	Temperature	Celcius	None	--	
	Turbidity	NTU	MML	0.5	
Geochemical	Bicarbonate	mg/L	None	--	
	Calcium	mg/L	None	--	
	Carbonate	mg/L	None	--	
	Chloride	mg/L	SMCL	250	
	Hardness as CaCO3	mg/L	None	--	
	Magnesium	mg/L	None	--	
	Nitrate (measured as Nitrogen)	mg/L	MCL	5	
	Nitrite (measured as Nitrogen)	mg/L	MCL	0.5	
	Total Nitrate+Nitrite	mg/L	MCL	5	
	Potassium	mg/L	None	--	
	Silica	mg/L	None	--	
	Sodium	mg/L	None	--	
	Sulfate	mg/L	SMCL	250	
	Total Alkalinity as CaCO3	mg/L	None	--	
	Total Dissolved Solids	mg/L	SMCL	500	
	Total Suspended Solids	mg/L	None	--	
	Total Organic Carbon	mg/L	None	--	
Metals	Aluminum	mg/L	SMCL	0.05 - 0.2	
	Antimony	mg/L	MCL	0.003	
	Arsenic	mg/L	MCL	0.005	
	Barium	mg/L	MCL	1	
	Beryllium	mg/L	MCL	0.002	
	Cadmium	mg/L	MCL	0.0025	
	Chromium (total)	mg/L	MCL	0.05	
	Copper	mg/L	SMCL	1	
	Iron (Total)	mg/L	None	--	
	Iron (Dissolved)	mg/L	SMCL	0.3	
	Lead	mg/L	MML	0.05	
	Manganese (Total)	mg/L	None	--	
	Manganese (Dissolved)	mg/L	SMCL	0.05	
	Mercury (inorganic)	mg/L	MCL	0.001	
	Nickel	mg/L	None	--	
	Selenium	mg/L	MCL	0.025	
	Silver	mg/L	SMCL	0.1	
	Thallium	mg/L	MCL	0.001	
	Zinc	mg/L	SMCL	5	
Miscellaneous	Color	Color units	SMCL	15	
	Corrosivity	--	SMCL	noncorrosive	
	Cyanide (as free cyanide)	mg/L	MCL	0.1	
	Fluoride	mg/L	MCL, SMCL	2	
	Foaming Agents (Surfacants)	mg/L	SMCL	0.5	
	Odor	Threshold odor number	SMCL	3	
Radionuclides	Gross Alpha	pCi/L	MCL, MML	15	2
	Gross Beta	pCi/L	MML	50	
	Combined Radium 226/228	pCi/L	MCL, MML	5	3
	Radon	pCi/L	None	--	4
	Uranium	ug/L	MCL	30	5
Synthetic Organic Compounds	1,2-Dibromo-3-chloropropane (DBCP)	mg/L	MCL	0.0001	
	2,4,5-TP (Silvex)	mg/L	MML	0.005	
	2,4-D	mg/L	MCL	0.035	
	Alachlor	mg/L	MCL	0.001	
	Atrazine	mg/L	MCL	0.0015	
	Benzo(a)pyrene (PAHs)	mg/L	MCL	0.0001	
	Carbofuran	mg/L	MCL	0.02	
	Chlordane	mg/L	MCL	0.001	
	Dalapon	mg/L	MCL	0.1	
	Di(2-ethylhexyl) adipate	mg/L	MCL	0.2	
	Di(2-ethylhexyl) phthalate	mg/L	MCL	0.003	
	Dinoseb	mg/L	MCL	0.0035	
	Dioxin (2,3,7,8-TCDD)	mg/L	MCL	0.000000015	
	Diquat	mg/L	MCL	0.01	
	Endothall	mg/L	MCL	0.05	
	Endrin	mg/L	MML	0.0001	
	Ethylene dibromide (EDB)	mg/L	MCL	0.000025	
	Glyphosate	mg/L	MCL	0.35	
	Heptachlor	mg/L	MCL	0.0002	
	Heptachlor epoxide	mg/L	MCL	0.0001	
	Hexachlorobenzene	mg/L	MCL	0.0005	
	Hexachlorocyclopentadiene	mg/L	MCL	0.025	
	Lindane (BHC-gamma)	mg/L	MCL	0.0001	
	Methoxychlor	mg/L	MCL	0.02	
	Oxamyl (Vydate)	mg/L	MCL	0.1	
	Pentachlorophenol	mg/L	MCL	0.0005	
	Picloram	mg/L	MCL	0.25	
	Polychlorinatedbiphenyls (PCBs)	mg/L	MCL	0.00025	
	Simazine	mg/L	MCL	0.002	
	Toxaphene	mg/L	MCL	0.0015	
Volatile Organic Compounds	1,1,1-Trichloroethane	mg/L	MCL, MML	0.1	
	1,1,2-Trichloroethane	mg/L	MCL	0.0025	
	1,1-Dichloroethylene	mg/L	MCL, MML	0.0035	
	1,2,4-Trichlorobenzene	mg/L	MCL	0.035	
	1,2-Dichloroethane (ethylene chloride)	mg/L	MCL, MML	0.0025	
	1,2-Dichloropropane	mg/L	MCL	0.0025	
	Benzene	mg/L	MCL, MML	0.0025	
	Carbon tetrachloride	mg/L	MCL, MML	0.0025	
	Chlorobenzene	mg/L	MCL	0.05	
	cis-1,2-Dichloroethylene	mg/L	MCL	0.035	
	Ethylbenzene	mg/L	MCL	0.35	
	Methylene chloride (dichloromethane)	mg/L	MCL	0.0025	
	o-Dichlorobenzene	mg/L	MCL	0.3	
	p-Dichlorobenzene	mg/L	MCL, MML	0.0375	
	Styrene	mg/L	MCL	0.05	
	Tetrachloroethylene (perchloroethylene)	mg/L	MCL	0.0025	
	Toluene	mg/L	MCL	0.5	
	trans-1,2-Dichloroethylene	mg/L	MCL	0.05	
	Trichloroethylene	mg/L	MCL, MML	0.0025	
	Vinyl chloride	mg/L	MCL, MML	0.001	
	Xylenes (total)	mg/L	MCL	5	

NOTE

* - ASR Standards = Lowest value within MCL/2, MML/2 and SMCL except Disinfection Byproducts and Radionuclides. ASR Standards for Disinfection Byproducts and Radionuclides = Lowest value within MCL, MML and SMCL.

Definitions:
- Maximum Contaminant Level (MCL) - The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to MCLGs as feasible using the best available treatment technology and taking cost into consideration. MCLs are enforceable standards.
- Maximum Residual Disinfectant Level (MRDL) - 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.
- Treatment Technique (TT) - A required process intended to reduce the level of a contaminant in drinking water.

1. More than 5.0% samples total coliform-positive in a month. (For water systems that collect fewer than 40 routine samples per month, no more than one sample can be total coliform-positive per month.) Every sample that has total coliform must be analyzed for either fecal coliforms or E. coli if two consecutive TC-positive samples, and one is also positive for E.coli fecal coliforms, system has an acute MCL violation.

2. Including Radium 225 but excluding Radon and Uranium.

3. If the gross alpha is less than or equal to 5 pCi/L, then that numerical value can be substituted for the radium 226 analysis, so combined radium 226 and 228 is equal to gross alpha plus radium 228.
If gross alpha plus radium 228 over 5 pCi/L, and don't have radium 226, we will have to resample or reanalyze and resubmit complete results for gross alpha, radium 226 and radium 228.

4. Analyte not required.

4. If the gross alpha is less than or equal to 15 pCi/L then that numerical value can be substituted for the uranium analysis. But If gross alpha over 15 pCi/L and uraniums are not reported, we will have to resample or reanalyze and resubmit complete results for gross alpha, radium 226, radium 228 and uranium.

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Figures

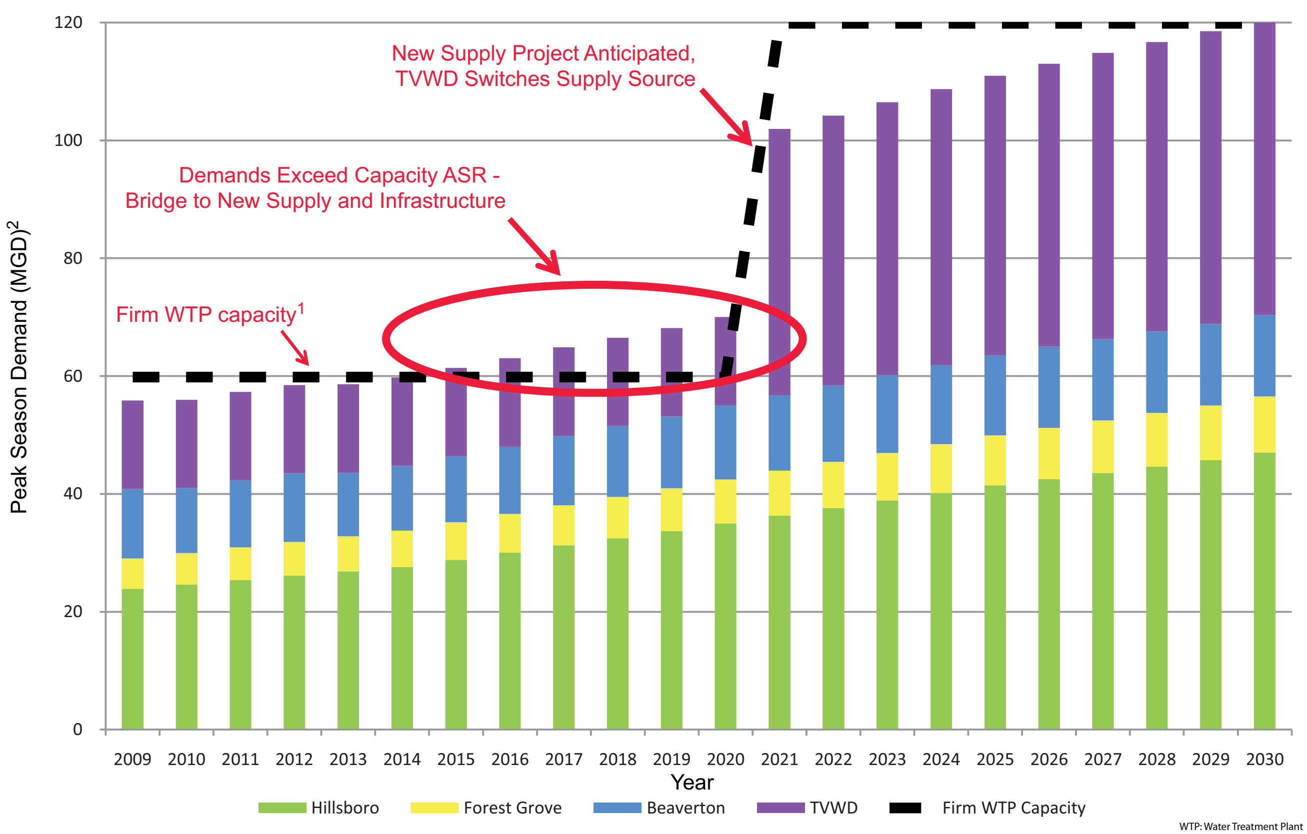

FIGURE 1

JWC Peak Season Demand Projections

Joint Water Commission
Limited License Application

NOTE:

1. Firm WTP capacity is defined as the plant capacity with the largest unit of production capacity out of service.

2. Peak season demand is utilized by the JWC to determine stored water supply needs, and is based on daily demand from May through October.

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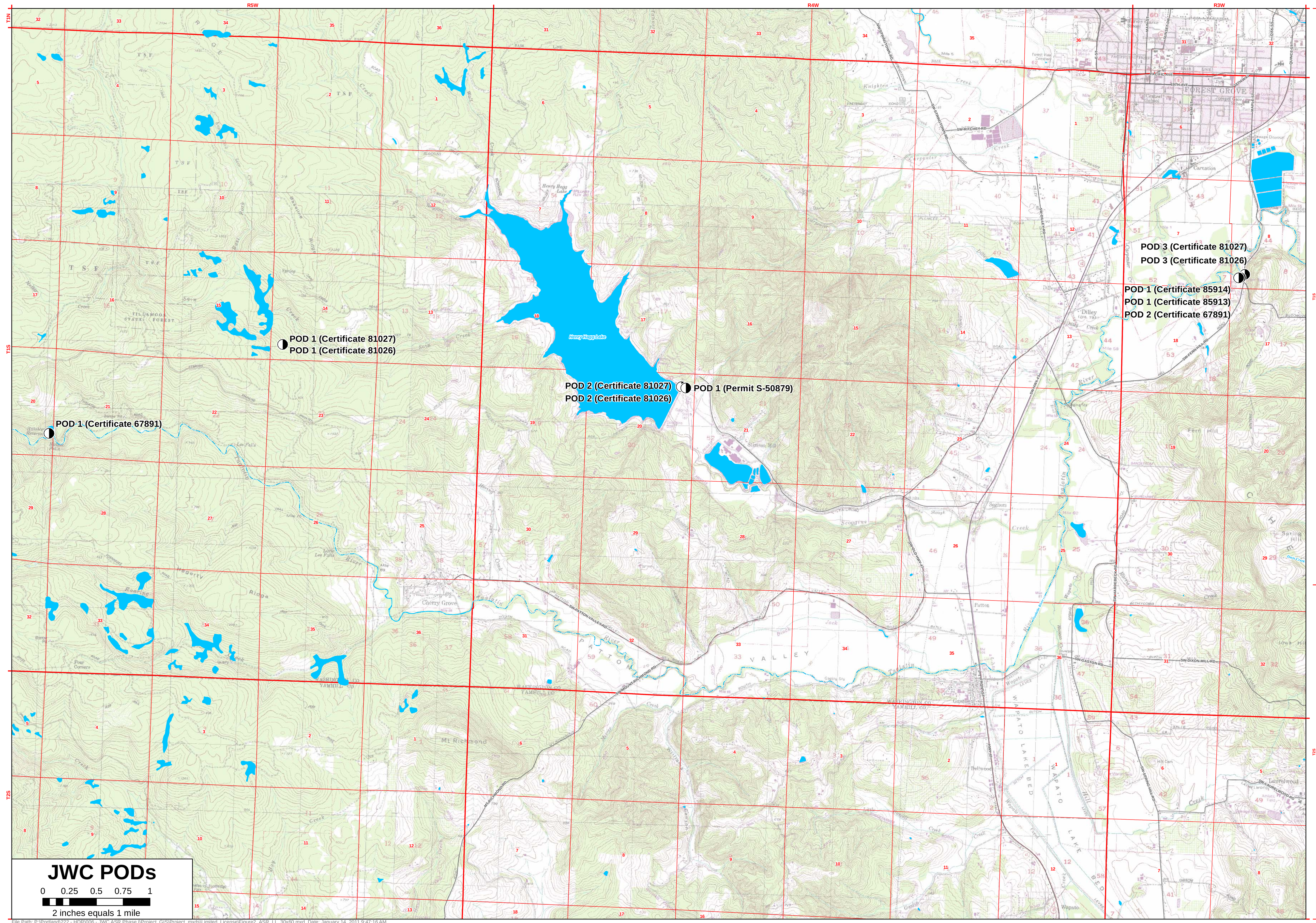

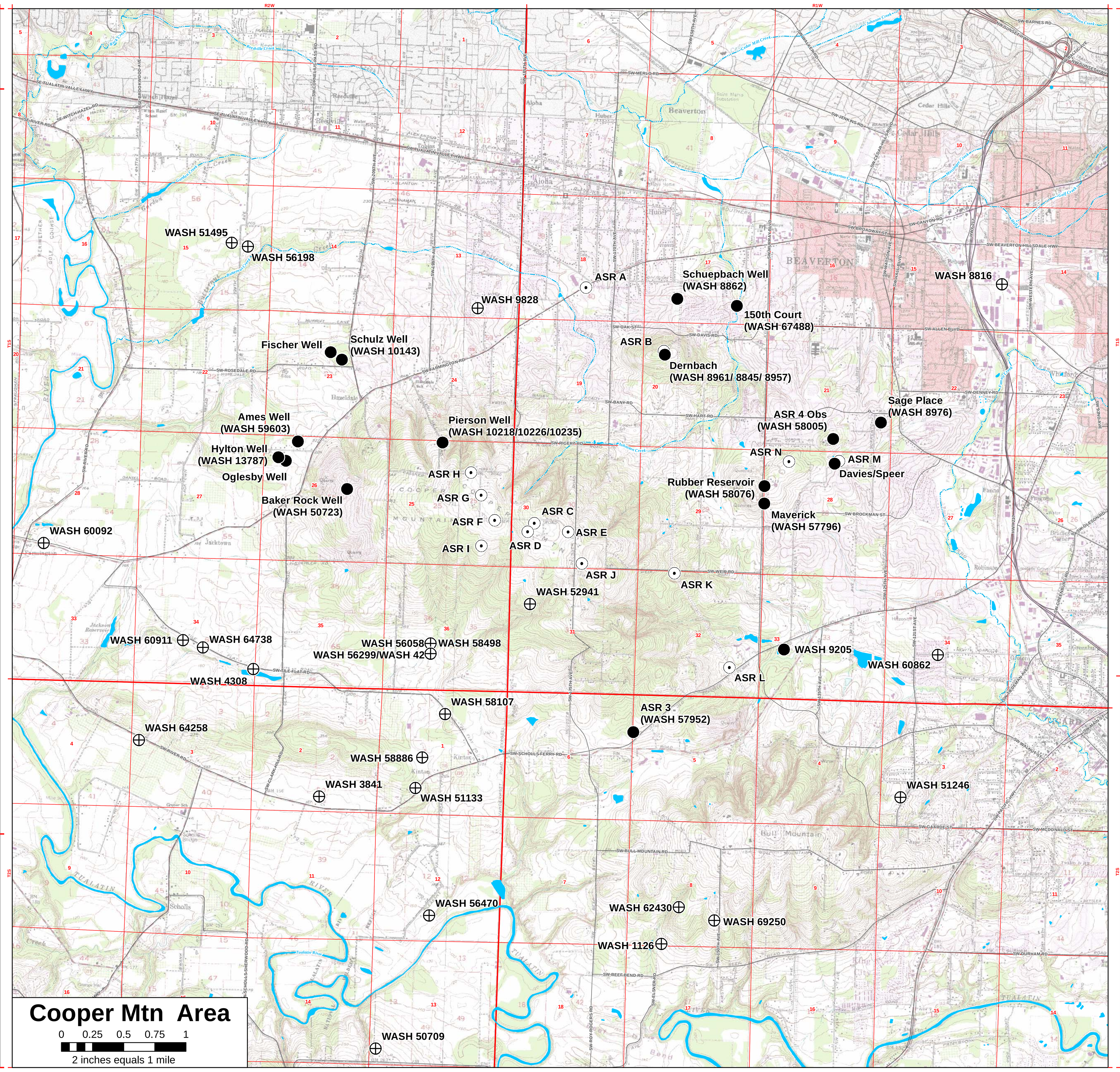

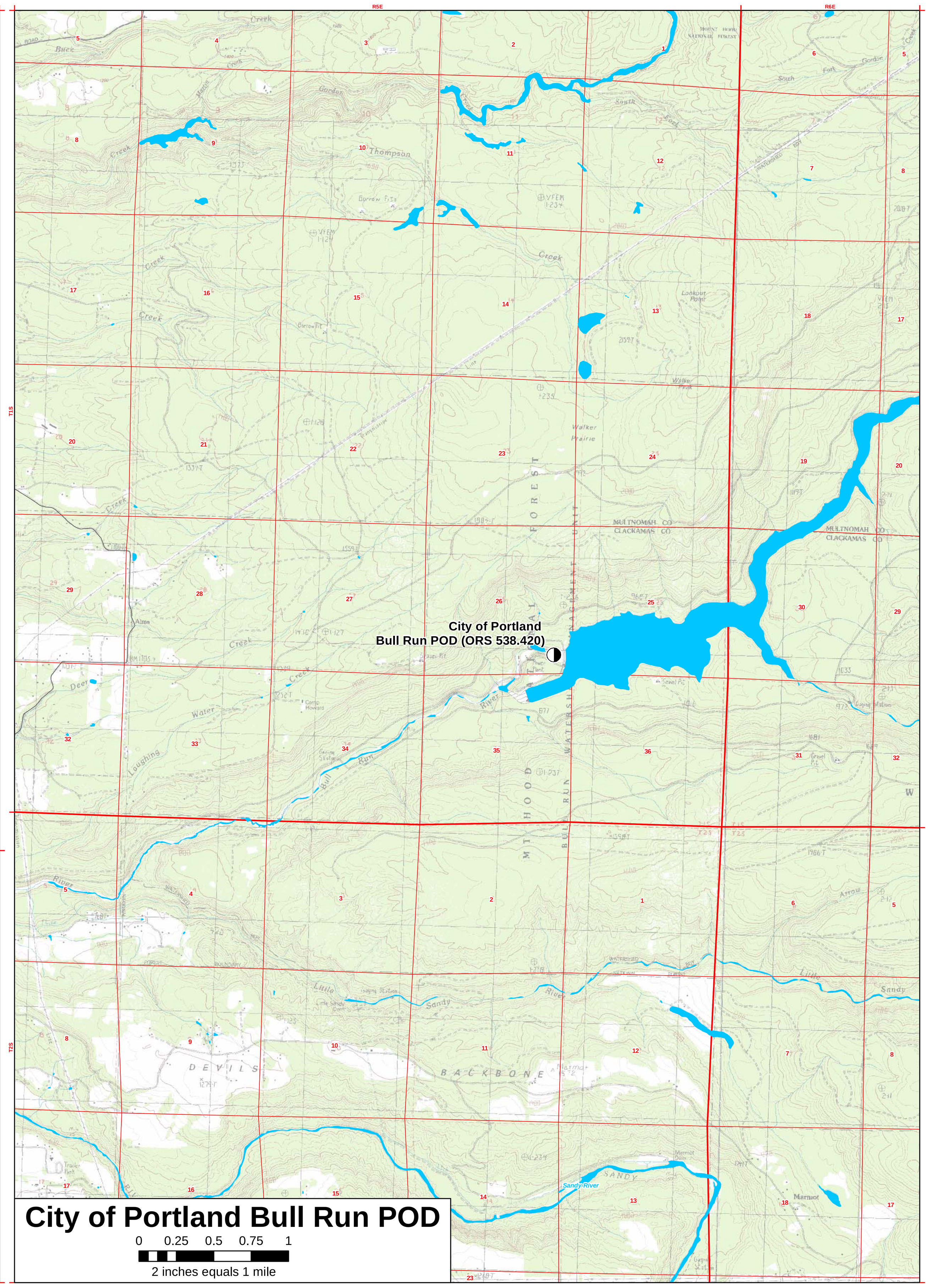

FIGURE 2

Limited License Map

Joint Water Commission

Limited License Application

LEGEND

- Points of Diversion (PODs)
- Observation Wells
- Potential Observation Wells
- Proposed ASR Wells
- Focus Areas
- Major Roads
- Watercourses
- Waterbodies

POINTS OF DIVERSIONS

POD 1 (Certificate 81026) Located 750 feet North, 590 feet East from the SW corner of Section 14, Township 1 South, Range 5 West (W.M.)
Latitude: 45.4792393742, Longitude: -123.275999539

POD 1 (Certificate 67891) Located 1,080 feet North, 210 feet West from the SE corner of Section 20, Township 1 South, Range 5 West (W.M.)
Latitude: 45.4661442477, Longitude: -123.320222573

POD 1 (Certificate 81027) Located 750 feet North, 590 feet East from the SW corner of Section 14, Township 1 South, Range 5 West (W.M.)
Latitude: 45.4792393742, Longitude: -123.275999539

POD 2 (Certificate 81026) Located 650 feet South, 650 feet West from the NE corner of Section 20, Township 1 South, Range 4 West (W.M.)
Latitude: 45.4753551108, Longitude: -123.199166307

POD 2 (Certificate 81027) Located 650 feet South, 650 feet West from the NE corner of Section 20, Township 1 South, Range 4 West (W.M.)
Latitude: 45.4753551108, Longitude: -123.199166307

POD 2 (Certificate 67891) Located 500 feet North, 415 feet East from the SW corner of Section 8, Township 1 South, Range 3 West (W.M.)
Latitude: 45.4924844114, Longitude: -123.09276219

POD 1 (Certificate 85913) Located 515 feet North, 475 feet East from the SW corner of Section 8, Township 1 South, Range 3 West (W.M.)
Latitude: 45.4925557747, Longitude: -123.092534702

POD 3 (Certificate 81026) Located 695 feet North, 685 feet East from the SW corner of Section 8, Township 1 South, Range 3 West (W.M.)
Latitude: 45.4930223607, Longitude: -123.091717438

POD 3 (Certificate 81027) Located 695 feet North, 685 feet East from the SW corner of Section 8, Township 1 South, Range 3 West (W.M.)
Latitude: 45.4930223607, Longitude: -123.091717438

POD 1 (Certificate 81914) Located 500 feet North, 410 feet East from the SW corner of Section 8, Township 1 South, Range 3 West (W.M.)
Latitude: 45.4925246796, Longitude: -123.0928645

POD 1 (Permit S-50879) Located 707 feet South, 441 feet West from the NE corner of Section 20, Township 1 South, Range 4 West (W.M.)
Latitude: 45.47521258, Longitude: -123.198321186

City of Portland POD Bull Run (ORS 538.420) Located 660 feet North, 670 feet West from the SE corner of Section 26, Township 1 South, Range 5 East (W.M.)
Latitude: 45.4486716721, Longitude: -122.150243168

OBSERVATION WELLS

150th Court (WASH 67488) Located 775 feet North, 1,375 feet West from the SE corner of Section 17, Township 1 South, Range 1 West (W.M.)
Latitude: 45.478593, Longitude: -122.831180

Ames Well (WASH 59603) Located 220 feet South, 1,440 feet East from the NW corner of Section 26, Township 1 South, Range 2 West (W.M.)
Latitude: 45.46136, Longitude: -122.90306

ASR 3 (WASH 57952) Located 1,180 feet North, 185 feet East from the W quarter corner of Section 5, Township 2 South, Range 1 West (W.M.)
Latitude: 45.428719, Longitude: -122.846262

ASR 4 Obs (WASH 58005) Located 540 feet North, 2,440 feet West from the SE corner of Section 21, Township 1 South, Range 1 West (W.M.)
Latitude: 45.46345, Longitude: -122.814631

Baker Rock Well (WASH 50723) Located 2,150 feet South, 1,750 feet West from the NE corner of Section 26, Township 1 South, Range 2 West (W.M.)
Latitude: 45.45599, Longitude: -122.89471

Davies/Speer Located 500 feet South, 2,355 feet West from the NE corner of Section 28, Township 1 South, Range 1 West (W.M.)
Latitude: 45.460602, Longitude: -122.814291

Dernbach (WASH 8961/8845/8957) Located 1,360 feet South, 925 feet East from the NW corner of Section 20, Township 1 South, Range 1 West (W.M.)
Latitude: 45.472696, Longitude: -122.842852

Fischer Well Located 1,635 feet South, 2,600 feet West from the NE corner of Section 23, Township 1 South, Range 2 West (W.M.)
Latitude: 45.47185, Longitude: -122.89808

Hylton (WASH 13787) Located 920 feet South, 625 feet East from the NW corner of Section 26, Township 1 South, Range 2 West (W.M.)
Latitude: 45.45945, Longitude: -122.90619

Maverick (WASH 57796) Located 2,265 feet South, 20 feet East from the NW corner of Section 28, Township 1 South, Range 1 West (W.M.)
Latitude: 45.45572, Longitude: -122.825736

Oglesby Well Located 1,060 feet South, 950 feet East from the NW corner of Section 26, Township 1 South, Range 2 West (W.M.)
Latitude: 45.45906, Longitude: -122.90493

Pierson Well (WASH 10218/10226/10235) Located 70 feet South, 2,230 feet East from the NW corner of Section 25, Township 1 South, Range 2 West (W.M.)
Latitude: 45.46174, Longitude: -122.87916

Rubber Reservoir (WASH 58076) Located 1,520 feet South, 10 feet East from the NW corner of Section 28, Township 1 South, Range 1 West (W.M.)
Latitude: 45.457746, Longitude: -122.825764

Sage Place (WASH 8976) Located 1,285 feet North, 425 feet West from the SE corner of Section 21, Township 1 South, Range 1 West (W.M.)
Latitude: 45.465523, Longitude: -122.806823

Schuepbach Well (WASH 8862) Located 65 feet South, 2,290 feet West from the NE corner of Williams DLC, Township 1 South, Range 1 West (W.M.)
Latitude: 45.47923, Longitude: -122.84107

Shulz Well (WASH 10143) Located 1,930 feet South, 2,130 feet West from the NE corner of Section 23, Township 1 South, Range 2 West (W.M.)
Latitude: 45.47101, Longitude: -122.89618

WASH 9205 Located 2,100 feet North, 1,030 feet East from the SW corner of Section 33, Township 1 South, Range 1 West (W.M.)
Latitude: 45.438842, Longitude: -122.821785

POTENTIAL OBSERVATION WELLS

WASH 1126 Located 85 feet North, 1,480 feet East from the SW corner of Section 8, Township 2 South, Range 1 West (W.M.)
Latitude: 45.4042045136, Longitude: -122.840620815

WASH 3841 Located 635 feet North, 2,440 feet West from the SE corner of Section 2, Township 2 South, Range 2 West (W.M.)
Latitude: 45.4201636758, Longitude: -122.897816101

WASH 4308 Located 695 feet North, 60 feet West from the SE corner of Section 34, Township 1 South, Range 2 West (W.M.)
Latitude: 45.434743866, Longitude: -122.909293062

WASH 8816 Located 2,030 feet North, 705 feet West from the SE corner of Section 15, Township 1 South, Range 1 West (W.M.)
Latitude: 45.481974837, Longitude: -122.787484815

WASH 9828 Located 405 feet North, 1,805 feet West from the SE corner of Section 13, Township 1 South, Range 2 West (W.M.)
Latitude: 45.4774366734, Longitude: -122.874023954

WASH 50709 Located 680 feet North, 265 feet East from the SW corner of Section 13, Township 2 South, Range 2 West (W.M.)
Latitude: 45.3910690796, Longitude: -122.887252414

WASH 51133 Located 1,100 feet North, 1,630 feet East from the SW corner of Section 1, Township 2 South, Range 2 West (W.M.)
Latitude: 45.421472714, Longitude: -122.881964864

WASH 51246 Located 1,285 feet North, 860 feet East from the SW corner of Section 3, Township 2 South, Range 1 West (W.M.)
Latitude: 45.4220361857, Longitude: -122.801853848

WASH 51495 Located 2,450 feet South, 1,680 feet West from the NE corner of Section 15, Township 1 South, Range 2 West (W.M.)
Latitude: 45.484185639, Longitude: -122.914952872

WASH 52941 Located 1,560 feet South, 870 feet East from the NW corner of Section 31, Township 1 South, Range 1 West (W.M.)
Latitude: 45.4432337085, Longitude: -122.863925707

WASH 56058 Located 1,970 feet North, 1,980 feet East from the SW corner of Section 36, Township 1 South, Range 2 West (W.M.)
Latitude: 45.43713768, Longitude: -122.880128043

WASH 56198 Located 2,605 feet South, 1,000 feet West from the NE corner of Section 15, Township 1 South, Range 2 West (W.M.)
Latitude: 45.483816843, Longitude: -122.912264419

WASH 56299/WASH 42 Located 1,540 feet North, 2,000 feet East from the SW corner of Section 36, Township 1 South, Range 2 West (W.M.)
Latitude: 45.4383311729, Longitude: -122.880150192

WASH 56470 Located 1,080 feet North, 2,350 feet East from the SW corner of Section 12, Township 2 South, Range 2 West (W.M.)
Latitude: 45.4067059127, Longitude: -122.879082308

WASH 58107 Located 1,000 feet South, 2,600 feet West from the NE corner of Section 1, Township 2 South, Range 2 West (W.M.)
Latitude: 45.4301580729, Longitude: -122.877437547

WASH 58498 Located 1,970 feet North, 1,980 feet East from the SW corner of Section 36, Township 1 South, Range 2 West (W.M.)
Latitude: 45.43713768, Longitude: -122.880128043

WASH 58886 Located 2,400 feet North, 1,875 feet East from the SW corner of Section 1, Township 2 South, Range 2 West (W.M.)
Latitude: 45.425045705, Longitude: -122.880981921

WASH 60092 Located 470 feet North, 1,260 feet East from the SW corner of Section 28, Township 1 South, Range 2 West (W.M.)
Latitude: 45.448649048, Longitude: -122.944547474

WASH 60862 Located 2,070 feet North, 2,200 feet East from the SW corner of Section 34, Township 1 South, Range 1 West (W.M.)
Latitude: 45.4386941073, Longitude: -122.796357543

WASH 60911 Located 1,840 feet North, 2,000 feet East from the SW corner of Section 34, Township 1 South, Range 2 West (W.M.)
Latitude: 45.4378451154, Longitude: -122.921078414

WASH 62430 Located 1,650 feet North, 2,200 feet East from the SW corner of Section 8, Township 2 South, Range 1 West (W.M.)
Latitude: 45.4085197764, Longitude: -122.837901929

WASH 64258 Located 2,440 feet South, 340 feet East from the NW corner of Section 3, Township 2 South, Range 2 West (W.M.)
Latitude: 45.4260994035, Longitude: -122.927844095

WASH 64738 Located 1,550 feet North, 2,240 feet West from the SE corner of Section 34, Township 1 South, Range 2 West (W.M.)
Latitude: 45.4370744928, Longitude: -122.917723916

WASH 69250 Located 1,225 feet North, 1,570 feet West from the SE corner of Section 8, Township 2 South, Range 1 West (W.M.)
Latitude: 45.4071030795, Longitude: -122.831986153

PROPOSED ASR WELLS

ASR A Located 1,390 feet North, 2,500 feet West from the SE corner of Section 18, Township 1 South, Range 1 West (W.M.)
Latitude: 45.4802011535, Longitude: -122.856197551

ASR B Located 1,220 feet South, 885 feet East from the NW corner of Section 20, Township 1 South, Range 1 West (W.M.)
Latitude: 45.4730714689, Longitude: -122.843051154

ASR C Located 1,870 feet North, 990 feet East from the SW corner of Section 30, Township 1 South, Range 1 West (W.M.)
Latitude: 45.452651656, Longitude: -122.863620909

ASR D Located 1,500 feet North, 705 feet East from the SW corner of Section 30, Township 1 South, Range 1 West (W.M.)
Latitude: 45.4516299905, Longitude: -122.864676572

ASR E Located 1,530 feet North, 2,415 feet East from the SW corner of Section 30, Township 1 South, Range 1 West (W.M.)
Latitude: 45.4517420515, Longitude: -122.857970076

ASR F Located 1,950 feet North, 790 feet West from the SE corner of Section 25, Township 1 South, Range 2 West (W.M.)
Latitude: 45.4528571054, Longitude: -122.870161472

ASR G Located 2,265 feet South, 1,310 feet West from the NE corner of Section 25, Township 1 South, Range 2 West (W.M.)
Latitude: 45.4557296951, Longitude: -122.872512784

ASR H Located 1,320 feet South, 1,770 feet West from the NE corner of Section 25, Township 1 South, Range 2 West (W.M.)
Latitude: 45.4583156259, Longitude: -122.87429445

ASR I Located 850 feet North, 1,260 feet West from the SE corner of Section 25, Township 1 South, Range 2 West (W.M.)
Latitude: 45.4498358507, Longitude: -122.872237195

ASR J Located 210 feet North, 2,380 feet West from the SE corner of Section 30, Township 1 South, Range 1 West (W.M.)
Latitude: 45.4481199001, Longitude: -122.855567445

ASR K Located 80 feet South, 1,550 feet East from the NW corner of Section 32, Township 1 South, Range 1 West (W.M.)
Latitude: 45.4473027049, Longitude: -122.840242522

ASR L Located 1,250 feet North, 1,295 feet West from the SE corner of Section 32, Township 1 South, Range 1 West (W.M.)
Latitude: 45.436524371, Longitude: -122.830697458

ASR M Located 400 feet South, 2,150 feet West from the NE corner of Section 28, Township 1 South, Range 1 West (W.M.)
Latitude: 45.4608853613, Longitude: -122.813586712

ASR N Located 470 feet South, 1,060 feet East from the NW corner of Section 28, Township 1 South, Range 1 West (W.M.)
Latitude: 45.4606624335, Longitude: -122.821833045

MAP NOTES:
Projection: Oregon State Plane North
Date: January 14, 2011
Data Sources: OWRD, METRO

N

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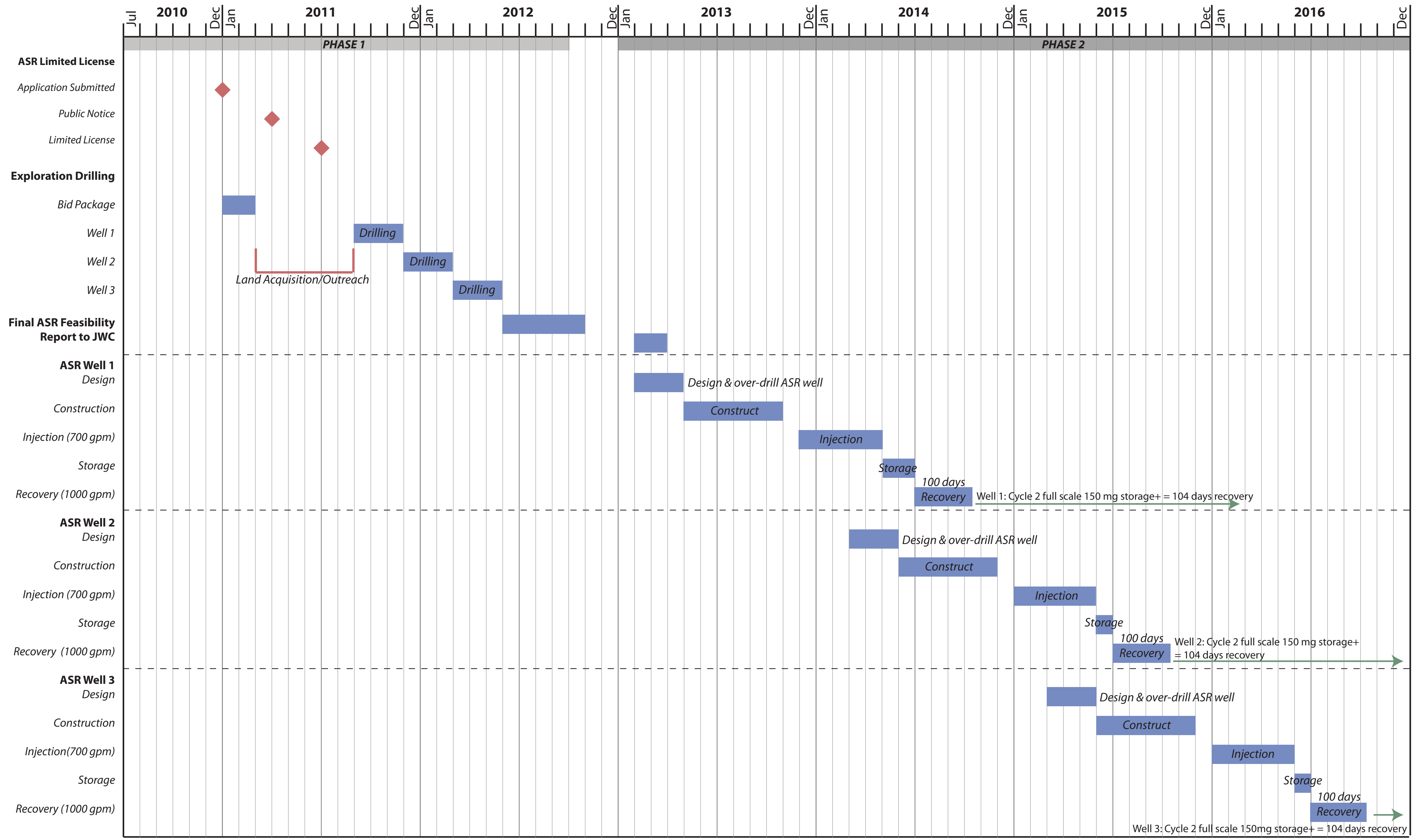
FIGURE 3

Joint Water Commission Potential Schedule for First Three ASR Wells

Joint Water Commission
Limited License Application



Assumptions:

- 3 months for test well drilling
- 3 months for pump station design
- 6 months for pump station construction
- Injection starts in Dec/Jan
- Recovery starts in June/July

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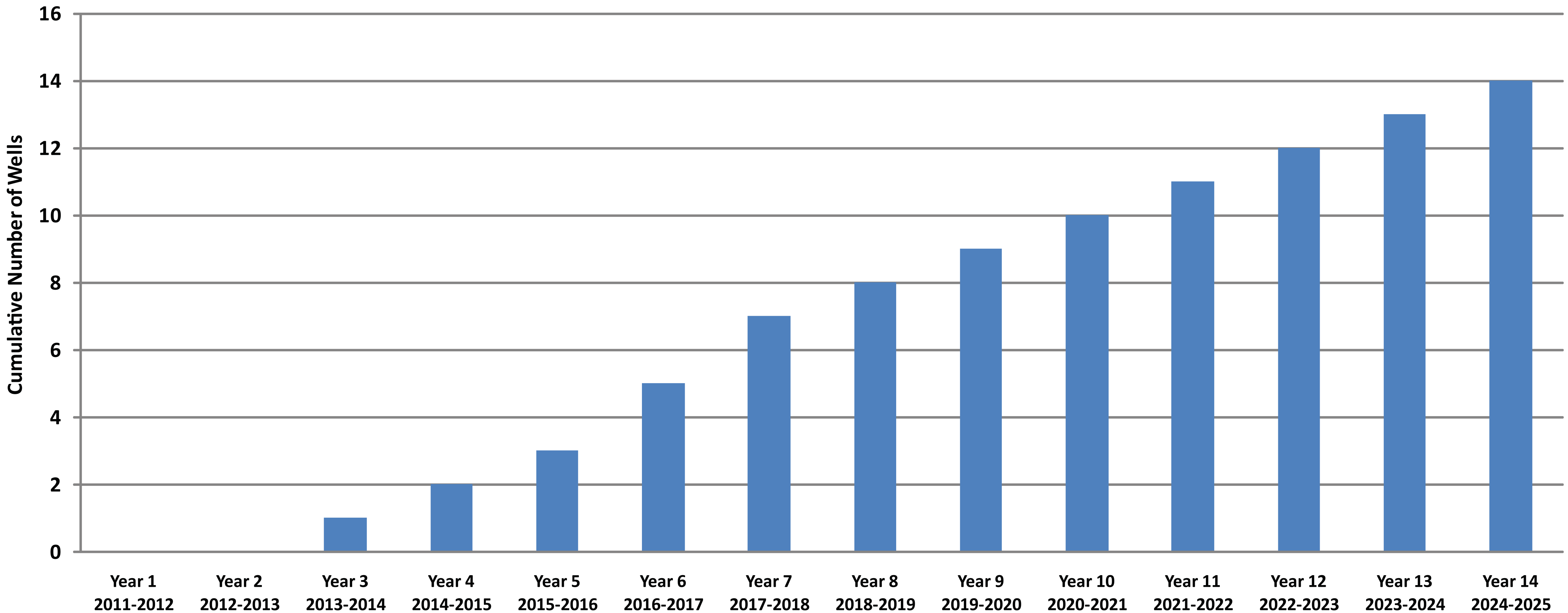
FIGURE 4

Joint Water Commission Potential Schedule for Full Build-Out

Joint Water Commission
Limited License Application

JWC ASR Schedule for Full Build-Out



■ Number of Cumulative Operational ASR Wells

Well Development Schedule	Year 1 2011-2012	Year 2 2012-2013	Year 3 2013-2014	Year 4 2014-2015	Year 5 2015-2016	Year 6 2016-2017	Year 7 2017-2018	Year 8 2018-2019	Year 9 2019-2020	Year 10 2020-2021	Year 11 2021-2022	Year 12 2022-2023	Year 13 2023-2024	Year 14 2024-2025	Total
Number of Test Wells in the Cooper Mt. Area	3														3
Number of ASR Wells On-line			1	1	1	2	2	1	1	1	1	1	1	1	14
Total Wells	3	0	1	1	1	2	2	1	1	1	1	1	1	1	17

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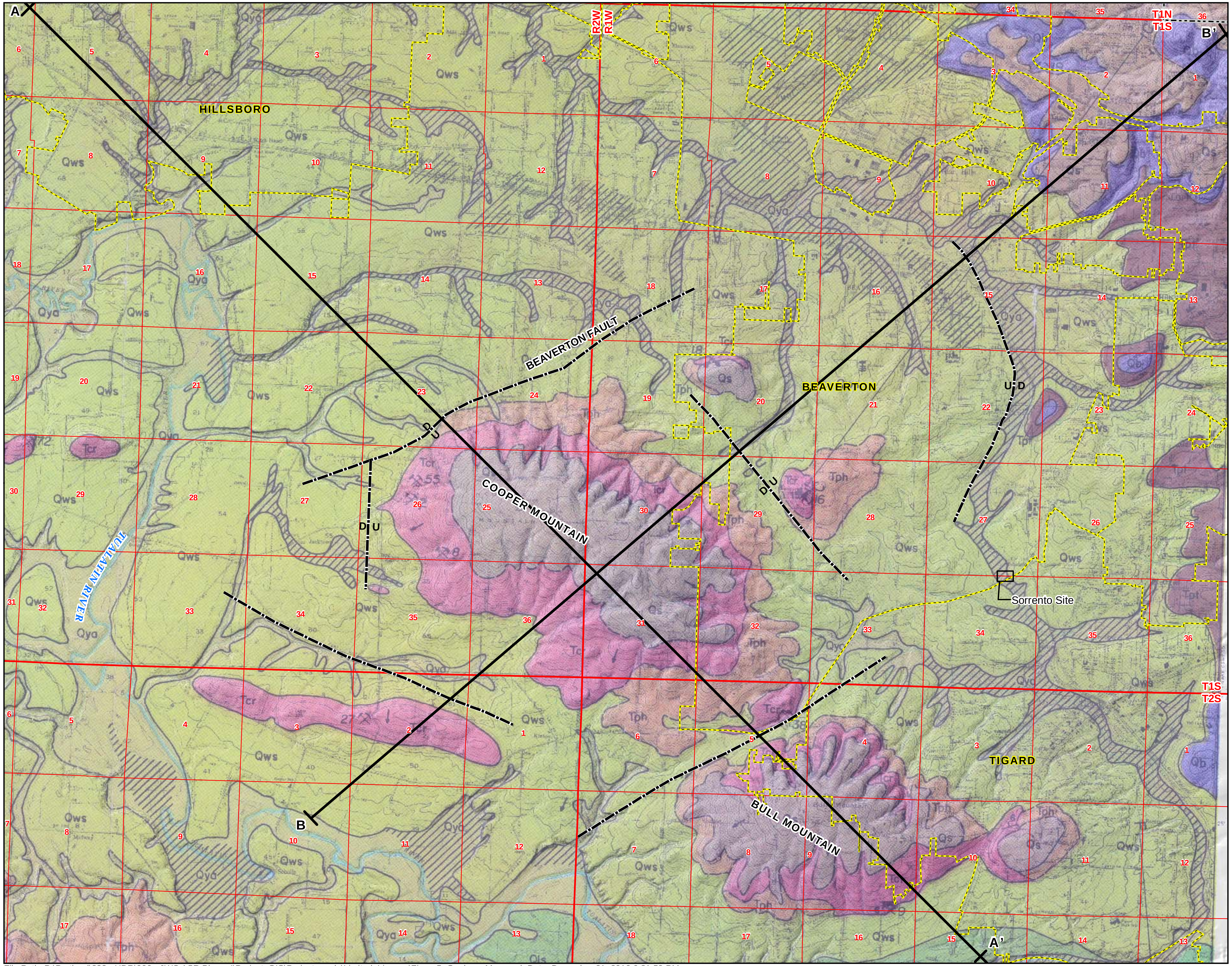

FIGURE 5

Geology Map

Joint Water Commission
Limited License Application

LEGEND

- Cross Section Lines
- Major Faults
- Cities
- Counties

NOTES:

1) Original Geology map from Schlicker and Deacon 1967, "Geology and Surficial Deposits of the Tualatin Valley Region, Oregon".
2) See Figure 4 for Geologic Legend.

N

Scale
1:54,000

0 0.5 1 1.5 2
Miles

MAP NOTES:
Projection: Oregon State Plane North Zone
Datum: North American Datum of 1983
Date: December 21, 2010
Data Sources: Oregon Geospatial Data Clearinghouse, METRO RLIS, USGS, ESRI

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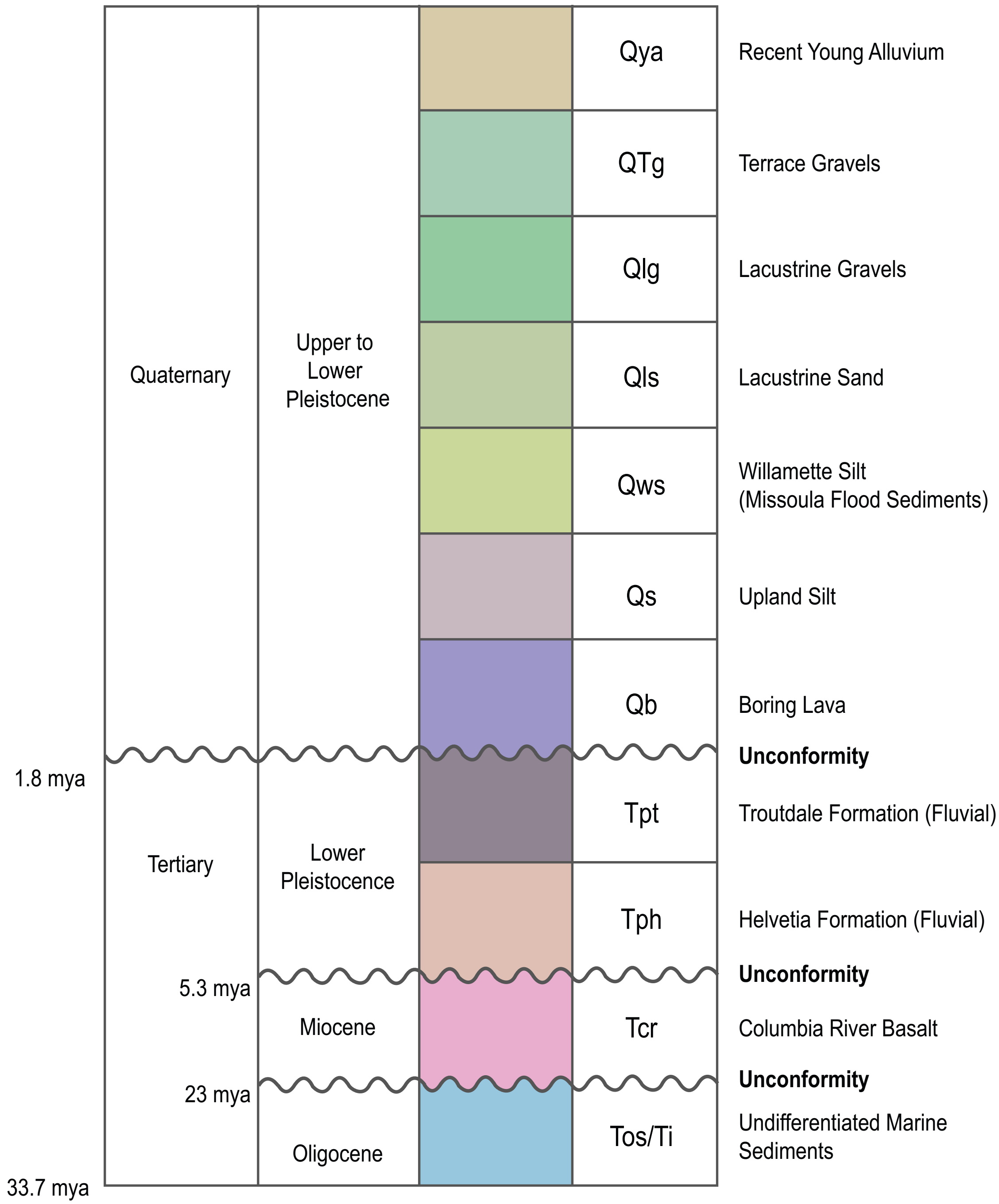
File Path: P:\Portland\222 - HDR\006 - JWC ASR Phase I\Project_GIS\Project_mxds\Limited_License\Figure5_Geology_Map.mxd, Date: December 21, 2010 6:31:59 PM



mya = Million Years Ago

FIGURE 6

Geologic Legend

Joint Water Commission
Limited License Application

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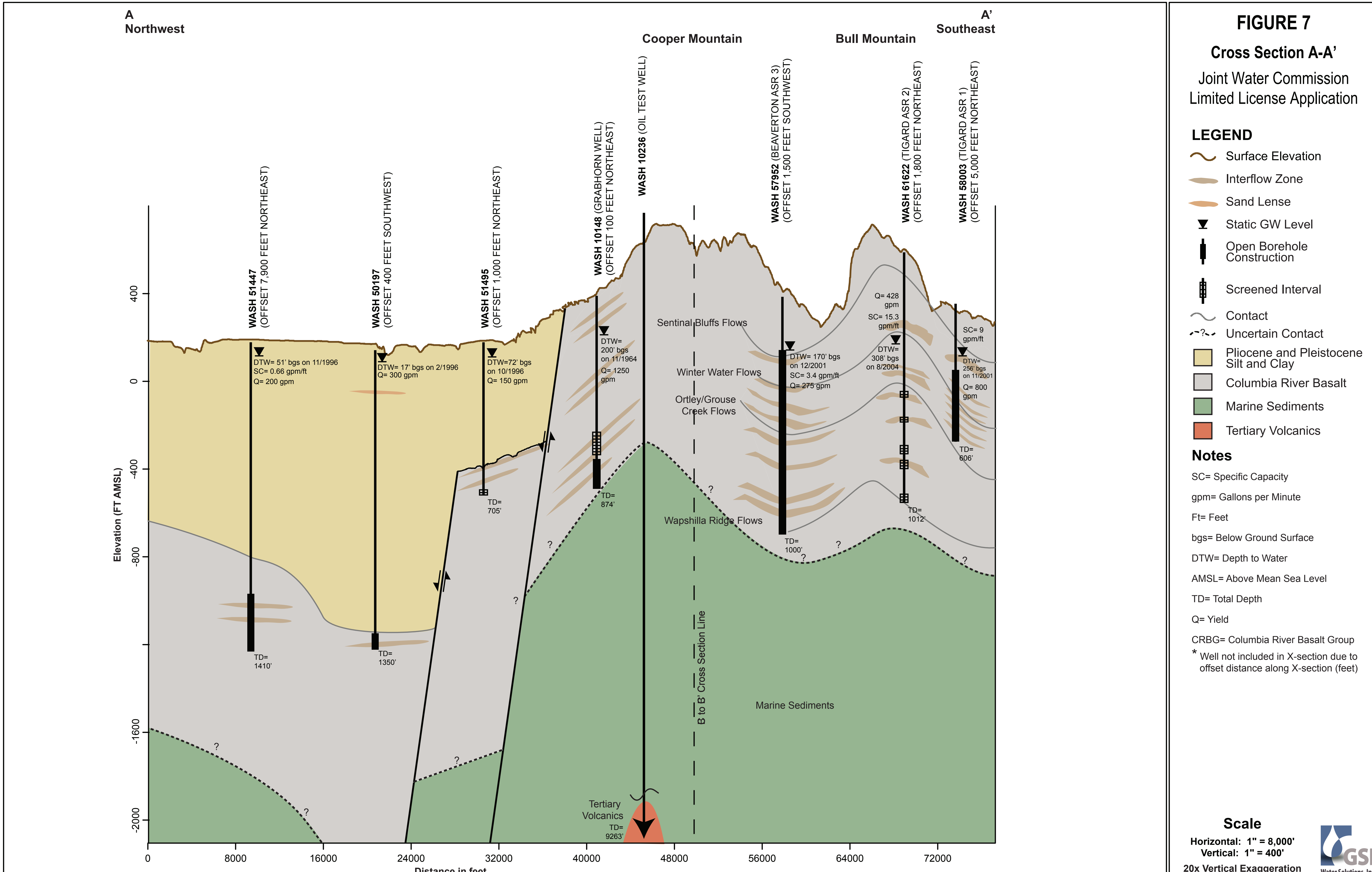

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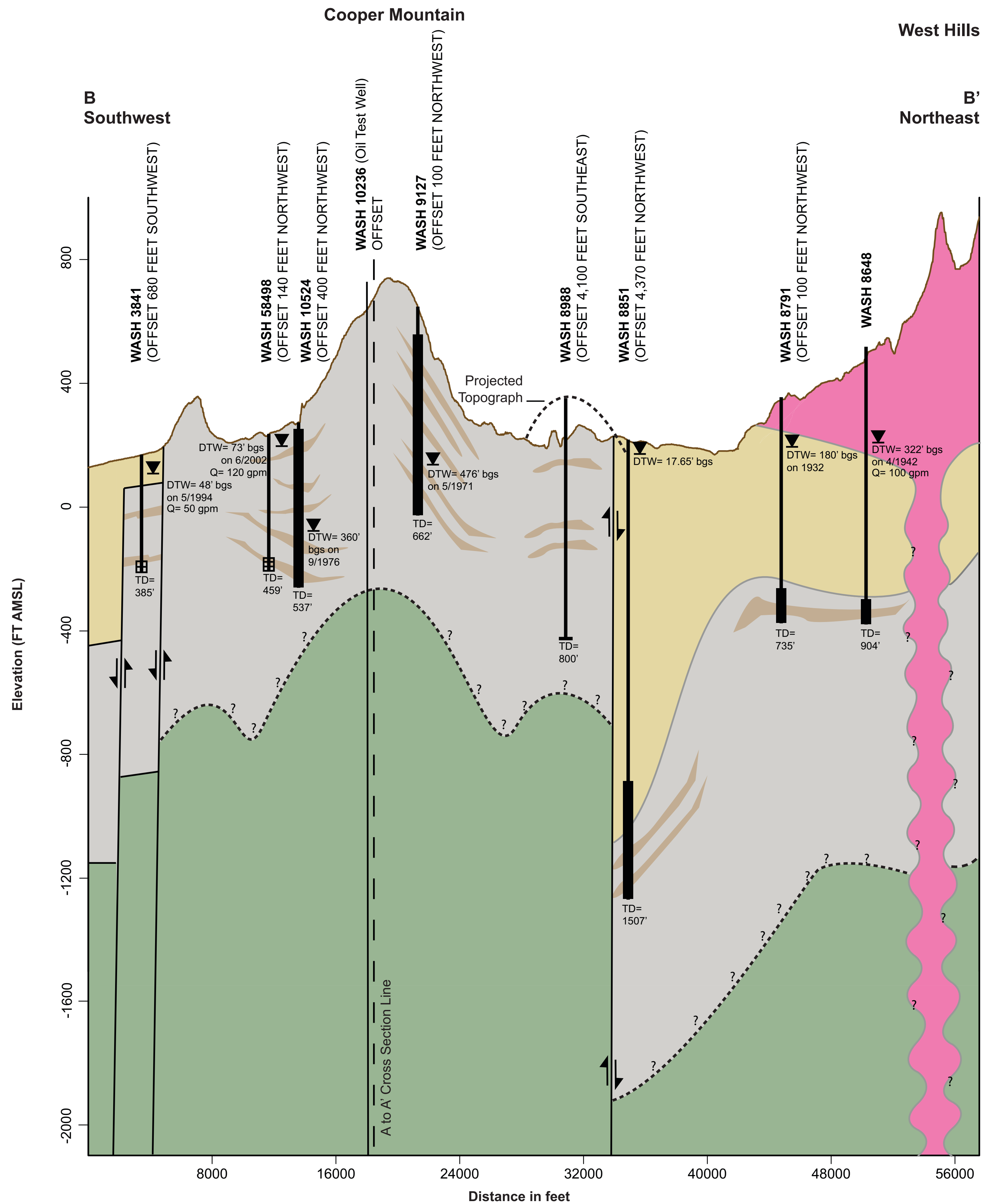
FIGURE 8

Cross Section B-B'

Joint Water Commission
Limited License Application



LEGEND

- Surface Elevation
- Interflow Zone
- Sand Lense
- Static GW Level
- Open Borehole Construction
- Screened Interval
- Contact
- Uncertain Contact
- Pliocene and Pleistocene Silt and Clay
- Columbia River Basalt
- Marine Sediments
- Boring Lava

Notes

SC= Specific Capacity

gpm= Gallons per Minute

Ft= Feet

bgs= Below Ground Surface

DTW= Depth to Water

AMSL= Above Mean Sea Level

TD= Total Depth

Q= Yield

CRBG= Columbia River Basalt Group

* Well not included in X-section due to offset distance along X-section (feet)

Scale

Horizontal: 1" = 8,000'
Vertical: 1" = 400'

20x Vertical Exaggeration

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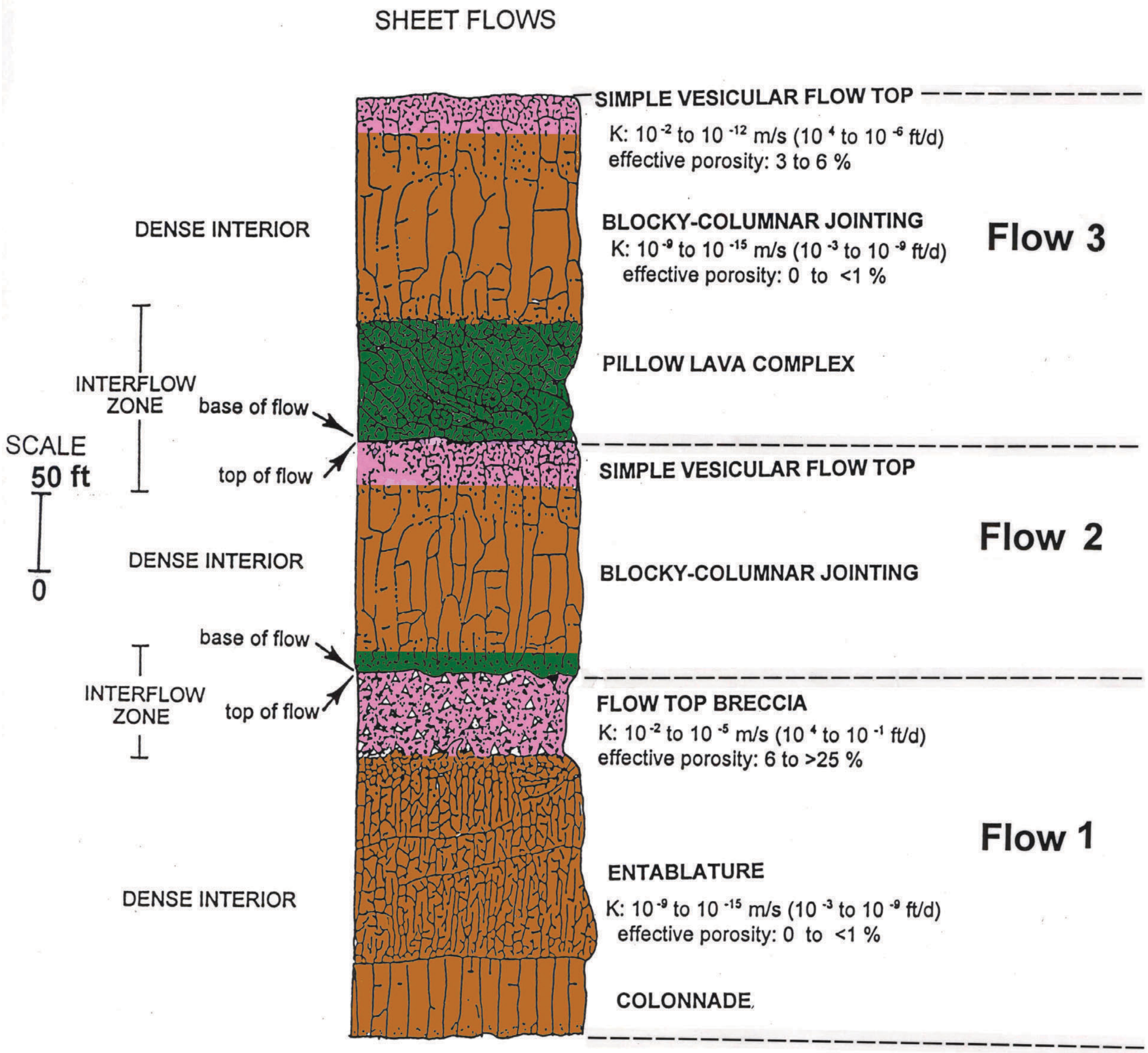

Diagrammatic representation of common Columbia River Basalt Group (CRBG) intraflow structure and terminology. Flow tops are highlighted in pink, dense interiors in orange, and flow bottoms in green. From Tolan et al. (2000)

K= represents a bulk hydraulic conductivity value

FIGURE 9
CRBG Geomorphology and Hydraulic Properties
Joint Water Commission
Limited License Application

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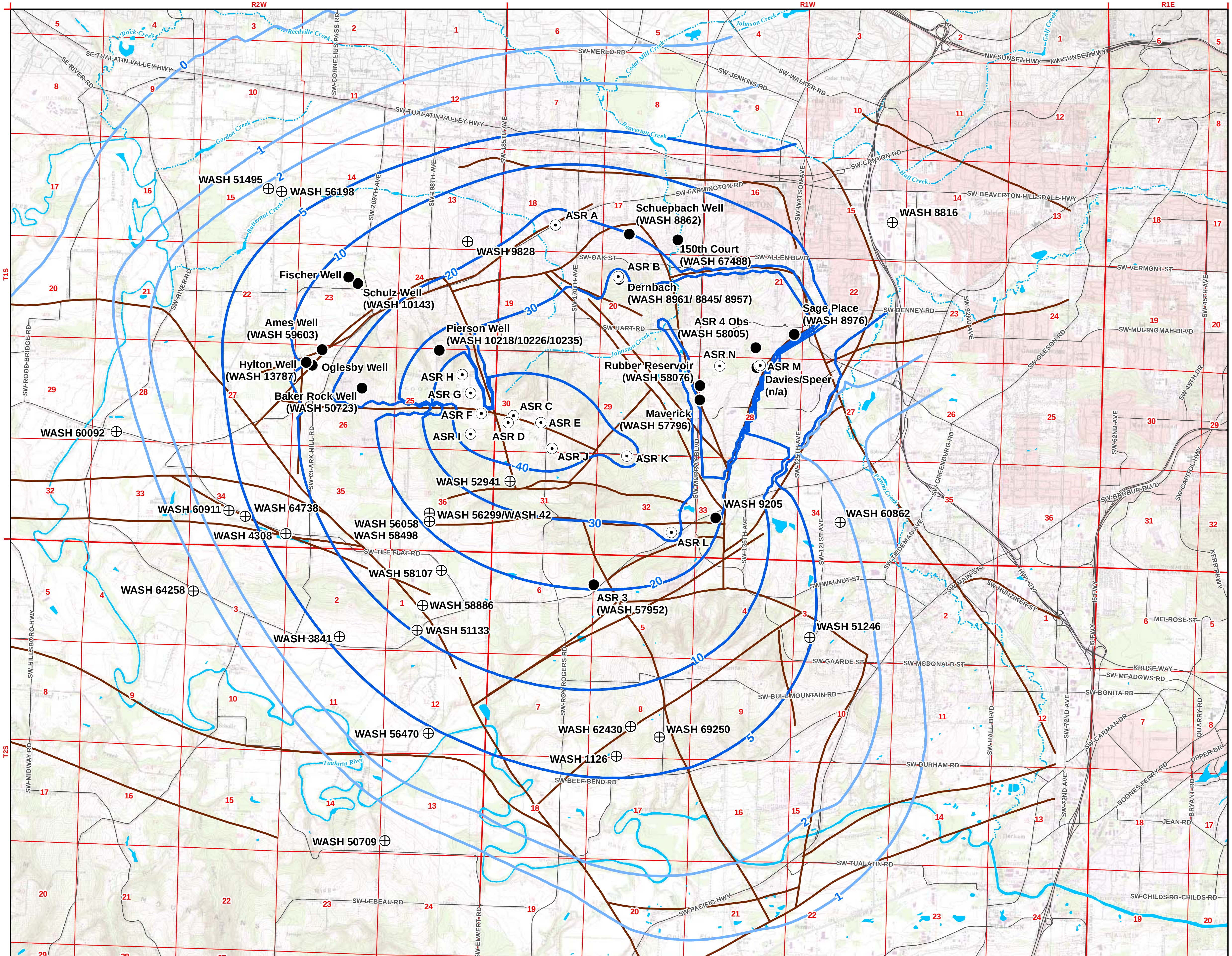


FIGURE 10

Estimated Area Affected by Proposed JWC ASR Wells

Joint Water Commission
Limited License Application

LEGEND

- Proposed ASR Wells
- Observation Wells (With OWRD Well ID)
- Potential Observation Wells (With OWRD Well ID)
- Estimated Mounding Contour (Feet of Change)
- Faults Used for Groundwater Model
- Major Roads
- Watercourses
- Waterbodies

N

Scale
1:60,000

0 0.5 1 1.5 2
Miles

NOTES

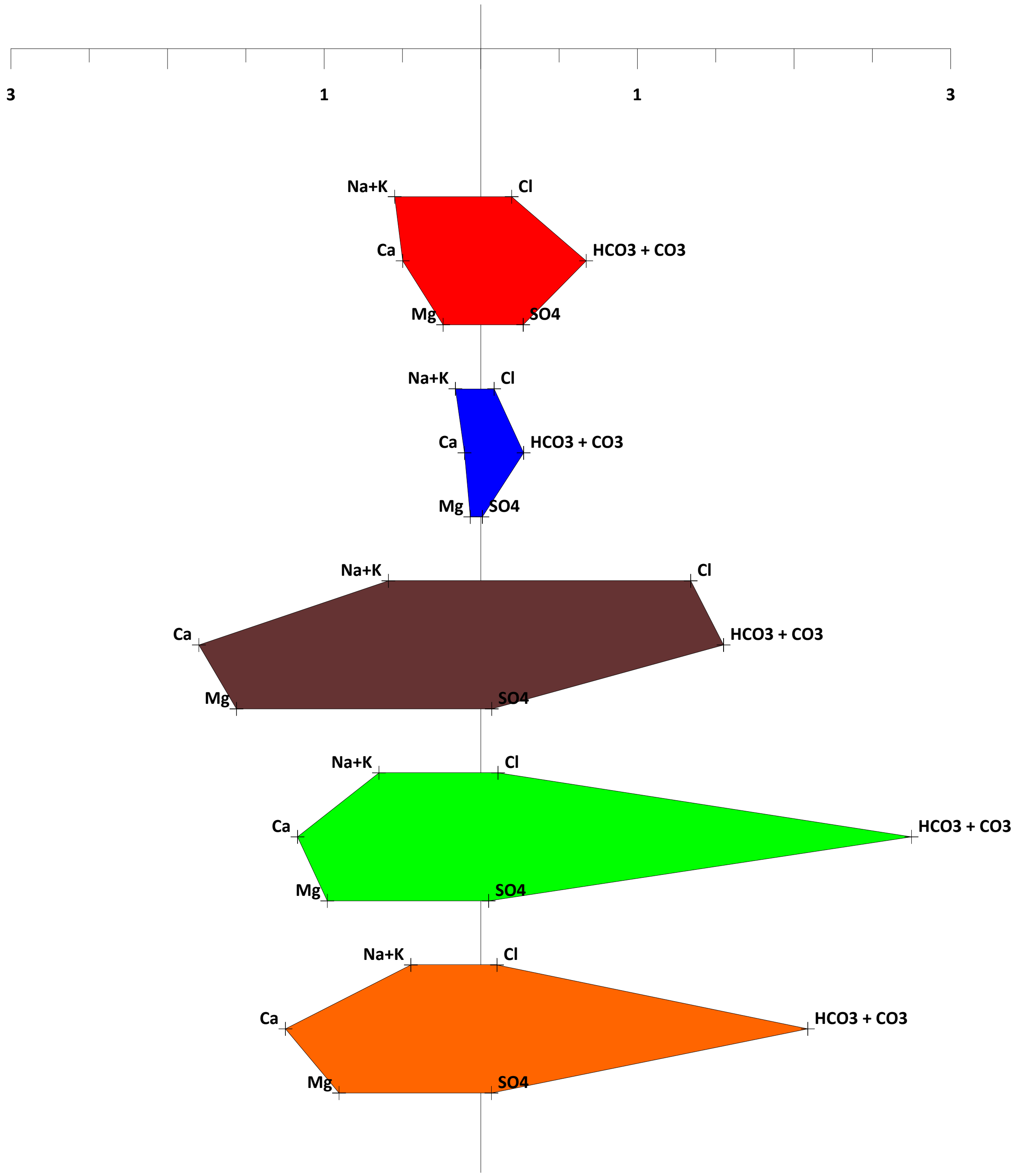
Mounding contour is based on simulation of injection of 2.1 billion gallons of water over 150 days at rates equally distributed over the 14 proposed ASR wells. This magnitude of response, if actually observed, will not be expected until full project buildout.

A well search in the northern extent of the area affected indicates no existing basalt wells in this vicinity, and as such, no potential observation wells are identified in this area.

MAP NOTES:
Projection: Oregon State Plane North Zone
Datum: North American Datum of 1983
Date: January 14, 2011
Data Sources: Oregon Geospatial Data Clearinghouse, METRO RLIS, ESRI

GSI Water Solutions, Inc.

File Path: P:\Portland\222 - HDR\006 - JWC ASR Phase I\Project_GIS\Project_mxds\Limited_License\Figure10_Area_Affected_ASR_Wells.mxd, Date: January 14, 2011 9:54:40 AM



Source Water and Native Groundwater

- JWC Source Water, City of Beaverton HNSN-C12SW-1
- City of Portland Source Water, City of Tigard ASR2-C3SW1
- Native Basalt Groundwater, City of Beaverton Sorrento Site-Pre-injection, 7/14/1994
- Native Basalt Groundwater, TVWD Grabhorn-Pre-injection, 5/15/2003
- Native Basalt Groundwater, City of Tigard ASR1-Pre-injection, 2/7/2001

FIGURE 11

Stiff Diagram

Joint Water Commission
Limited License Application

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Appendices

Appendix A

ASR License No. _____
(ASSIGNED AFTER FILING)

STATE OF OREGON
WATER RESOURCES DEPARTMENT
APPLICATION FOR LIMITED WATER USE LICENSE
FOR
AQUIFER STORAGE AND RECOVERY (ASR)

Applicant(s): The Joint Water Commission (JWC)
Contact Person: Kevin Hanway
Mailing Address: 150 E. Main Street, Third Floor

Hillsboro	Oregon	97123	503-615-6702
City	State	Zip	Phone #

1. DATE(S) OF PRE-APPLICATION CONFERENCE(S): October 19, 2010

INFORMATION REGARDING ASR TESTING UNDER A LIMITED LICENSE

2. SOURCE OF INJECTION WATER for ASR: Sain Creek, the Tualatin River, Scoggins Creek, and Bull Run River,
a tributary of Scoggins Creek, The Willamette River, the Tualatin River, and the Sandy River, respectively

3. MAXIMUM DIVERSION RATE: Up to 8,100 gpm (18.051 cfs), subject to change based on pilot testing

4. MAXIMUM INJECTION RATE AT EACH WELL(S): Up to 1,500 gpm (3.342 cfs), subject to change based on pilot testing

5. MAXIMUM STORAGE VOLUME: 2.1 billion gallons

6. MAXIMUM STORAGE DURATION: 5 years

7. MAXIMUM WITHDRAWAL RATE AT EACH WELL(S): 2,000 gpm (4.456 cfs), subject to change based on pilot testing

8. LICENSE TERM OR DURATION SOUGHT (5 year maximum): 5 years

9. PROPOSED USE OR DISPOSAL OF RECOVERED WATER: Municipal use, recovery of stored water will be distributed into the JWC water supply system

10. IF CONTINGENCIES PRECLUDE THE USE IN ITEM 9, SPECIFY AN ALTERNATE USE OR DISPOSAL OF THE RECOVERED WATER: Contingency plan for disposal of injected water is to discharge to a pump-to-waste system or a nearby storm sewer

-over-

INFORMATION REGARDING THE ULTIMATE ASR PROJECT AS CURRENTLY ANTICIPATED

11. SOURCE OF INJECTION WATER for ASR: Sain Creek, the Tualatin River, Scoggins Creek, and Bull Run River,
a tributary of Scoggins Creek, The Willamette River, the Tualatin River, and the Sandy River, respectively

12. MAXIMUM DIVERSION RATE: Up to 8,100 gpm (18.051 cfs), subject to change based on pilot testing

13. MAXIMUM INJECTION RATE AT EACH WELL(S): Up to 1,500 gpm (3.342 cfs), subject to change based on pilot testing

14. MAXIMUM STORAGE VOLUME: 2.1 billion gallons

15. MAXIMUM STORAGE DURATION: 5 years

16. MAXIMUM WITHDRAWAL RATE AT EACH WELL(S): 2,000 gpm (4.456 cfs), subject to change based on pilot testing

NOTE: The materials required by rule for an ASR limited license are extensive. The items on this sheet consist of those outlined in OAR 690-350-020(2) and (3)(a)(A-E). Please consult the rule and provide as attachments to this form the other requirements in OAR 690-350-020(3)(a).

Signature of Applicant Kevin Hanway Date 1/18/11

Title JWC General Manager

Appendix B

Appendix B
JWC Model Development and Application

This report discusses the development and application of a three-dimensional numerical groundwater flow model to support the limited license application for the Joint Water Commission (JWC) aquifer storage and recovery (ASR) program. This report presents the following:

- Background information about the modeling work, including its objectives
- A description of the design of the model grid and its relationship to the hydrogeologic setting
- A discussion of the model's calibration, including key findings from the calibration process
- An initial assessment of the proposed ASR program's potential influence on the local aquifer
- A list of references cited in this report

Background and Modeling Objectives

The JWC is in the planning phase of an ASR pilot testing program in the Cooper Mountain area of Beaverton, Oregon. The ASR program is targeting water-bearing interflow zones that lie at various depths in basalt rock beneath Cooper Mountain. The basalt rock, which consists of the flood basalts of the Grande Ronde Basalt of the Columbia River Basalt Group (CRBG), consists of a series of stacked, dense, low-permeability basalt lava flows, with groundwater present in interflow zones that lie between successive flows. Some interflow zones are referred to as flowtops, which are the crust that formed on the top of a molten lava flow, and which in some cases can form moderate- to high-permeability brecciated zones that can transmit water. Another type of interflow zone is a pillow lava complex, which forms at the base of a lava flow where lava was deposited in a standing water body; these complexes also can host productive aquifers.

Two ASR projects currently operate on Cooper Mountain. The City of Beaverton has operated a successful ASR project in the basalt aquifers at its Sorrento wellfield (three operational ASR wells) since 1999, targeting flowtops situated at intermediate depths in the basalt sequence. During 2009, the City injected nearly 350 million gallons (MG) using three ASR wells. A second project is owned and operated by the Tualatin Valley Water District (TVWD), which began pilot testing a single-well ASR system in 2008; its third cycle (in 2008-2009) injected nearly 260 MG. This water is injected via a single well (the Grabhorn ASR well) into a pillow breccia zone that is situated at the base of the basalt section, on top of underlying marine sedimentary rocks; some injection also occurs in a flowtop situated above the breccia.

The project being planned by JWC currently is designed to inject an additional 2 billion gallons (BG) of water each year upon full build-out. Recovery also would occur each year; on a long-term basis, the recovery volume would be 95 percent of the injection volume. The project will be constructed in phases, with the first phase of exploratory drilling occurring in 2011 and the first ASR well planned to be online by 2013.

JWC currently is funding the development of a three-dimensional numerical groundwater flow model of Cooper Mountain and adjoining areas. An initial phase of the model has been developed in support of the limited license application to provide technical evaluations of the project's feasibility and its potential influence on groundwater levels upon full build-out. The model uses the U.S. Geological Survey (USGS) MODFLOW-2000 finite-difference groundwater modeling software (Harbaugh et al., 2000), and the Groundwater Vistas graphical user interface (ESI, 2007) is used to manage the modeling process. The model currently is calibrated to historical data from the two existing ASR programs; future work will be conducted to expand the model's calibration to data that will be collected by the JWC during pilot testing. Specific near-term and long-term objectives for the model are:

1. Develop a three-dimensional numerical model that can simulate the compartmentalized nature of the basalt aquifers at specific well locations, while also simulating the historically observed water level responses to ASR cycles at observation wells in and beyond Cooper Mountain.

2. Evaluate the feasibility of JWC's target injection volume at full project build-out, specifically:

    - Will the amount of water level mounding during injection cause water levels to rise to (or above) ground surface at any of the ASR wells?

    - On a long-term basis, will multiple cycles of annual injection and recovery create a continual head build-up that eventually will cause groundwater levels to rise to the ground surface? Or will water levels likely stabilize and remain below ground surface?

3. Evaluate whether groundwater levels beyond the Cooper Mountain complex might rise above ground surface, which could cause artesian conditions in privately owned wells in these areas.

Model Grid Design and Relationship to Hydrogeology

Following are discussions of the grid extent, the model layering, and the boundary conditions.

Grid Extent

The finite-difference grid for the MODFLOW-2000 model encompasses an area extending from the Tualatin Mountains on the north and northwest to the Tualatin River on the south, and from the east slope of the Coast Range on the west to approximately the foot of the Tualatin Mountains on the east. As shown in Figure B-1, the grid is oriented such that its principal axes are rotated 45 degrees from true north. This alignment is parallel with the approximate trends of (1) the Tualatin Mountains east and northeast of Cooper Mountain and (2) the Mount Angel–Chehalem Structural Zone that forms the eastern slopes of the Coast Range.

The model grid is constructed using Oregon State Plane coordinates. The grid cells are variably spaced, with the largest cells on the outermost perimeter of the grid being 1,000 feet long on a side, and the smallest cells being situated inside Cooper Mountain with dimensions of 125 feet on a side. The grid contains 235 rows, 186 columns, and 42 layers; more than 1.1 million cells are active, with the model calculating groundwater elevations, responses, and fluxes in each of these cells.

Model Layering

Significant effort was devoted to the design of the layering scheme that is programmed into the model grid. Several factors were considered during this process. First, as presented by GSI (2009), geologic cross sections in the Tualatin Basin, both within and beyond Cooper Mountain area, show the presence of a series of stepped-down basalt blocks when moving northward and westward from the perimeter of Cooper Mountain. Secondly, data from the Grabhorn observation well network indicate that injection inside the Cooper Mountain block generates increases in water levels not only inside the block, but also just beyond the Beaverton fault zone. Additionally, wells south of Cooper Mountain have been found to respond to ASR cycles at the Sorrento wellfield and at the City of Tigard's ASR wellfield on Bull Mountain.

To simulate the outward propagation of hydraulic pressure changes to areas beyond the perimeter of Cooper Mountain, considerable care was necessary to design a model layering scheme that would allow for such outward propagation to occur during model calibration and subsequent application. The layering scheme also needed to consider the compartmentalized nature of the CRBG basalt flows, both in terms of the hydraulic conductivity contrasts vertically, as well as the need to model the elevations of each of the compartmentalized aquifers that existing and future proposed ASR wells are open to. Additionally, the offsetting of interflow zones by faults along and beyond the perimeter of Cooper Mountain needed to be modeled in a way that would provide for outward propagation of hydraulic pressure laterally across fault zones, as indicated by the observation well data north of the Grabhorn ASR well.

The process of developing the model layering scheme consisted of studying the lithologic logs of wells in the Tualatin Basin to identify a typical sequence and thickness of basalt section through the full profile of the Grande Ronde Basalt. Figure B-2 shows the composite geologic section that was developed from this evaluation. As shown in Figure B-2, the composite section is nearly 1,100 feet thick and consists of alternating sequences of water-bearing flowtops; dense flow interiors and flow bottoms that are not productive aquifers; and, at the bottom of the Grande Ronde Basalt, a pillow lava complex that is water-bearing and productive. This composite section then was translated into a model layering scheme by identifying the typical amount of water-bearing materials versus non-water-bearing materials in 100-foot-thick sequences through the composite section, and then translating this into a model layering scheme. For the most part, each 100-foot-thick sequence showed approximately 30 feet of water-bearing materials and 70 feet of dense basalt. Above the pillow complex, the primary exceptions to this 30/70 rule were for the 300-foot to 400-foot depth interval, where only 10 feet of flowtop were present; and for the 700-foot to 800-foot depth interval, which was entirely dense basalt. In both of these zones, the model nonetheless used a 30-foot thickness for water-bearing materials to provide a pathway for outward propagation of water level changes in the event that water-bearing zones are encountered in the future at these depths in the JWC's future ASR wells.

As shown in Figure B-2, each 1,100-foot-thick section of basalt is represented with 22 model layers, with each layer alternating in thickness between 30 feet and 70 feet to represent the alternating sequence of aquifers and dense basalt in zones above the pillow complex. Because faults are present that offset this typical basalt block when moving outward from Cooper Mountain, it was necessary to use more model layers to simulate potential propagation of water level changes across fault planes and multiple block structures simultaneously. Figure B-3 shows the groups of block structures that are simulated in the modeled area, including their relative vertical offsets of each block from adjoining blocks. The Bull Mountain block is the highest block in the modeled area, followed by the Cooper Mountain block. Given the 6 blocks that were identified in the model area, 42 model layers were used to simulate the connection between the blocks. From the top of Bull Mountain to the bottom of the deepest block, the 42 layers together span a vertical distance of 2,100 feet.

Boundary Conditions

The following types of boundary conditions are used in the model:

- Constant head and no-flow boundaries on the model perimeter
- Fault zones of variable permeability within the model domain
- ASR wells (specified fluxes within the model domain)

These boundaries are discussed below.

Model Perimeter

A constant-head boundary was placed along the entire western and southern boundaries of the model, to simulate a northwest to southeast groundwater flow pattern. Head values were chosen along these boundaries so as to create an ambient horizontal hydraulic gradient on the order of 1 x 10^{-4} foot/foot, which is about one-half of the maximum hydraulic gradient for the basalt aquifer in the southern Tualatin Basin that has been estimated by the USGS (Conlon et al., 2005). The northern and eastern boundaries of the model were set as no-flow boundaries. Figure B-4 shows regional groundwater elevation contours under ambient conditions across the model domain, with no operation of either the existing ASR systems or the proposed JWC ASR system.

Internal Faults

State geologic maps show mapped faults along the perimeter of Cooper Mountain and at certain locations within the Cooper Mountain block. Recently, the USGS released unpublished preliminary identifications of other faults within and around the horst block (Wells, personnel communication, 2009). In the model, each fault plane is assumed to penetrate the full thickness of basalt at any given location where the fault has been mapped. These internal faults are simulated through the choice of hydraulic conductivity that is assigned to the cells where the faults lie. During model calibration, the hydraulic conductivities of these faults were tested extensively for their effects on simulated water level responses at the ASR observation wells.

ASR Wells (Specified Fluxes)

An internal boundary condition is injection and recovery from ASR wells, as the wells themselves represent points where fluxes are specified in the model. The Multi-Node Well (MNW) package of MODFLOW (Halford and Hanson, 2002) was used to represent the ASR wells, so that the model could, as part of its solution process, determine how to allocate injection and pumping rates between the multiple aquifer layers, given their hydraulic conductivities and the hydraulic gradients in the formation (adjacent to the open borehole). Additionally, the model varies this distribution over time, according to changes in hydraulic gradients around the well.

The existing ASR wells were simulated as being open to the following model layers:

- Sorrento ASR-1: Layers 3 through 15 (flowtops and dense flow interiors)
- Sorrento ASR-2: Layers 3 through 11 (flowtops and dense flow interiors)
- Sorrento ASR-4: Layers 3 through 11 (flowtops and dense flow interiors)
- Grabhorn ASR well: Layers 21 through 24 (one flowtop, one dense flow interior, pillow complex)

For each model simulation, the wells were assumed to be 50 percent efficient during injection and pumping cycles alike, for the purpose of deriving the SKIN coefficient required by the MNW package. Existing ASR wells have 16-inch diameters, while the wells for the proposed JWC ASR program were simulated as having 20-inch diameters.

Model Calibration Process and Key Findings

The model calibration process focused on simulating the injection phase of the 2008-2009 ASR cycles at the City of Beaverton's Sorrento wellfield and TVWD's Grabhorn ASR well. Injection cycles were as follows:

- Sorrento: December 22, 2008, through April 13, 2009
- Grabhorn: December 16, 2008, through June 26, 2009

Table B-1 shows how the calibration simulations represent the distribution of injection rates at each well over time throughout this period. The calibration model used daily time steps to calculate aquifer system responses to these injection cycles.

Calibration results are discussed separately for the Sorrento and Grabhorn ASR systems.

Calibration at the Sorrento ASR Wellfield

For the final calibrated version of the groundwater flow model, Figure B-5 shows contours of the amount of mounding simulated by the model on March 12, 2009. This was the 82nd day of injection at the Sorrento wellfield, and the last day before daily ASR injection rates began to be scaled back at these wells for the end of the injection cycle. Figure B-5 shows that the water level mound was centered around the wellfield and radiated outward, but over a limited area that is bounded by mapped faults that were indicated (during model calibration) to be partial or complete barriers limiting lateral transmission of the hydraulic response. The resulting response field radiates to a localized area south of the wellfield, based on calibrating the model to the recorded responses at the Maverick, Rubber Reservoir, ASR-3, and WASH-9205 wells. Responses are generated over a broader area north of the Sorrento wellfield, based on calibrating the model to the measured responses at the Dernbach, Schuepach, and 150th Court observation wells.

Figures B-6 through B-8 show time-series hydrographs of the observed and simulated water level responses inside each of the three operating Sorrento ASR wells. The figures show the following:

- The injection cycles at ASR-1 and ASR-4 are closely matched through early March. During March and the first half of April, when these wells injected at lower rates, the model predicts too much subsequent reduction in the mound that was created before March.

- The match between measured and simulated responses is not as close at ASR-2 as at ASR-1 and ASR-4. The model slightly under-predicts water level responses during the injection cycle at ASR-2 and does not have quite the same timing as suggested by the observed data. The discrepancies in the magnitude of water level response are a likely indication that the well's actual efficiency is less than the assumed values of 50 percent. The timing discrepancies at ASR-2 suggest either a data-recording or processing error for the injection rates and timing, or an influence from ASR-1 and ASR-4 that is not completely captured by the model.

Figure B-9 shows time-series hydrographs that compare the observed responses for each of the 10 Sorrento observation wells with those simulated (computed) by the final calibrated model. The responses are plotted as negative drawdown values, which are equivalent to positive mounding of the water table that occurs in response to injection cycles. The plots show that the model reasonably replicates the timing and rates of change in the water table, and that the maximum amount of mounding is simulated reasonably closely at some wells (ASR-4, Davies-Speer, Sage Place, Dernbach, 150th Court, and ASR-3), but is somewhat underestimated at four wells (Rubber Reservoir, Maverick, Schuepach, and WASH-9205). Considerable testing of the model did not identify any improvements that could be correlated with currently mapped features. It is more likely that the discrepancy is in some way related to the ongoing historical rate of increase in groundwater levels at some observation wells which may be related to the current ASR programs and less native groundwater pumping. Burt et al. (2009) reported that groundwater levels rose more than 12 meters (39.4 feet) during the 7-year period from early 2001 (when the City of Tigard began operating its ASR system to the south) to early 2008 – an average rate of increase of nearly 6 feet per year. The target water level data shown in the Figure B-9 calibration plots do not account for this influence; hence, the finding that the model predicts slightly less water level response to ASR injection than shown by the "observed" data on each plot is to be expected. This same situation also was observed with the model's calibration to the Grabhorn ASR data, as discussed below.

Calibration at the Grabhorn ASR Wellfield

Figure B-10 shows contours of the amount of mounding simulated by the model on March 12, 2009. Figure B-10 shows that the response field must radiate outward more strongly than at the Sorrento wellfield to allow for calibration of the model to the two observation wells situated along the Beaverton Fault Zone (the Ames and Schulz wells). Considerable model testing during the calibration effort indicated that this outward propagation of the response field was possible only if (1) the Beaverton Fault Zone had a low vertical hydraulic conductivity and (2) certain faults mapped inside the Cooper Mountain block were treated as low-permeability barriers that prevent the response field from propagating to the south, southwest, and southeast.

Figure B-11 shows the time-series hydrographs of the observed and simulated (computed) responses at the five Grabhorn observation wells (Ames, Baker Rock, Jenkins Estate, Pierson, and Schulz) and at the Schuepach well, which is located in the northeast corner of the Cooper Mountain block, roughly equidistant from the Grabhorn and Sorrento wellfields. Responses are well-matched or slightly over-predicted near the Grabhorn ASR well, as indicated by the plots for the Jenkins, Pierson, and Baker Rock wells, while the responses are somewhat under-predicted at the more distant wells (Ames, Schulz, and Schuepach). However, the "observed" data shown on the plots are calculated without considering background trends; Golder (2010) noted that an antecedent trend of rising water levels before the beginning of the 2008-2009 injection cycle may have been responsible for 7 to 10 feet of the rise in observed water levels at the Ames and Schulz wells during the injection cycle. Figure B-12 shows how the simulated responses at the end of the peak-injection period (on March 12, 2009) compare with a range of responses reflecting zero to 10 feet of background influence at the Ames well, and zero to 7 feet of background influence at the Schulz well. Golder (2010) also estimated that the wells closer to the injection well exhibited 6 to 7 feet of background influence; this is also shown in Figure B-12. As indicated in Figure B-12, the simulated responses fall within the range of the estimated response, or over-predict the estimated response, at every observation well except the Schulz well.

Golder (2010) reported a water level increase of 95 feet in the Grabhorn ASR well between the beginning of the injection cycle and the end of the peak-injection period on March 12, 2009. Using an assumed well efficiency of 50 percent, the model simulated approximately 70 feet of increase inside the casing of the Grabhorn ASR well, suggesting that the well's efficiency may be lower.

Estimated Hydraulic Properties

The model calibration process produced the following estimates of hydraulic properties:

- Horizontal hydraulic conductivity:
    - Flow tops: ~ 50 feet/day (ft/d)
    - Pillow complexes: ~ 120 ft/d
    - Dense flow interiors: 10^{-4} to 10^{-5} ft/d or less
    - Faults: Highly variable

- Vertical hydraulic conductivity:
  - Dense flow interiors: 10^{-4} to 10^{-5} ft/d or less within and outside of fault zones
- Storage coefficient: ~ 10^{-3} in all locations

These values are initial estimates that are focused on the areas where data are currently available – i.e., near the Sorrento and Grabhorn networks of ASR wells and observation wells. These estimates also are used where these units exist elsewhere in the model, farther from these areas. <u>These estimates will be refined in the future as the model undergoes further development during the course of JWC's initial well drilling and ASR pilot testing program</u>.

Key Findings from the Calibration Process

Three key findings about the aquifer system in and around Cooper Mountain have arisen from the process of calibrating the model to the 2008-2009 injection cycle at the Sorrento and Grabhorn ASR wellfields:

1. Some, though not all, faults inside the Cooper Mountain horst must be acting as internal barriers that limit, in certain areas, how far outward a pressure change can be transmitted in the aquifer. This is indicated by calibration to both the Grabhorn and Sorrento data sets. Without these barriers, water level changes are too small – often many feet (or tens of feet) less than observed at the various observation wells.

2. The dense flow interiors have very low hydraulic conductivity and effectively compartmentalize the aquifer system vertically; without such compartmentalization, simulated responses are far too muted compared with those measured in the field.

3. The propagation of responses beyond the faults along the perimeter of Cooper Mountain requires the fault planes to connect interflow zones, but this connection is likely predominantly lateral rather than vertical. Extensive model testing specifically indicates the following:

   a. Where a fault zone causes vertical displacement of an individual interflow zone on each side of the fault plane, there must be relatively close vertical juxtaposition of different interflow zones on each side of the fault plane for a change in head pressure inside Cooper Mountain to be transmitted beyond the fault plane. If an interflow zone inside Cooper Mountain fully abuts a dense flow interior on the opposite side of the fault plane, then pressure will not be readily transmitted across the fault plane. This may explain why some faults inside Cooper Mountain act as barriers, while other faults inside and bounding Cooper Mountain have only a minor or moderate effect on limiting the outward transmission of pressure responses.

   b. Movement along fault planes likely has not fully destroyed the low vertical permeability that existed in the dense flow interiors before the onset of faulting. This finding is based on extensive testing throughout the model calibration process. Figures B-13 and B-14, for the Grabhorn and Sorrento wellfields, respectively, compare the simulated drawdown responses for the calibrated model (which uses a vertical hydraulic conductivity of 10^{-5} ft/d for the dense flow interiors) with the responses for a simulation in which the vertical hydraulic conductivity is set to 5 ft/d within all fault planes located at and beyond the perimeter of Cooper Mountain (while all other model attributes remain the same as in the calibration model). Figure B-13 shows that the hydraulic responses at the Grabhorn well network are 10 to 15 feet less under the "High-Kz Faults" model than for the calibrated model, though the Schuepach well shows somewhat less difference because of its much greater distance from the Grabhorn ASR well. Figure B-14 shows that some of the Sorrento observation wells have responses on the order of 5 feet or less, indicating that the local permeability and nature of nearby faults is more important than the permeability of the faults bounding Cooper Mountain.

c. These observations together indicate that the permeability of faults within and around Cooper Mountain have a significant influence on the amount of outward propagation of aquifer responses.

Model Simulations of JWC Operations Under Full Build-Out Conditions

Following the calibration process, the model was used to simulate 5 consecutive years of ASR operation under full build-out conditions. The model simulated injection, storage, and recovery from 14 wells located on Cooper Mountain. The location of each well is listed in Table B-2, along with the operating details for each well throughout an annual cycle. As shown in Table B-2, each ASR well was assumed to have an efficiency of 50 percent and to operate in the same manner as the other ASR wells, with the 14 wells together injecting 2.1 BG of water annually and recovering 95 percent of that water each year (2.0 BG). Within the limited license application, the 14 ASR wells used in the model were relabeled as ASR A through ASR N; these alpha designations will be converted to numbers as the ASR wells come online.

Each ASR well was modeled as injecting into the pillow basalt complex at the base of the Grande Ronde Basalt, plus multiple flowtops at shallower depths. Two scenarios for the well depths were modeled:

- Scenario 1: Open to unsaturated zones and saturated zones alike, with a typical open interval length of 900 feet (which extends from the pillow basalt in Layer 23 upward 900 feet to model Layer 5)

- Scenario 2: Cased and sealed down to the static water level, with a typical open interval length of 430 feet (which extends from the pillow basalt in Layer 23 upward 430 feet to model Layer 15)

The simulations for both scenarios did not include operation of the Sorrento and Grabhorn ASR wellfields. Although these wellfields will operate, this modeling approach allowed for evaluation of the JWC ASR system by itself, without interference effects from the existing systems. Initial groundwater elevations for the modeling evaluation were the long-term steady-state conditions simulated by the calibration model without ASR wellfield operations; these groundwater elevations range between about 184 and 187 feet, as shown in Figure B-4.

The results of the two simulations are as follows:

1. For Scenario 1, simulated groundwater elevations in the ASR wells peak at elevations of no more than 230 feet, which is about 45 feet above the pre-development water level (see Figure B-15). For pumping cycles, the groundwater elevations at the end of the recovery period range between about elevations 140 and 160 feet, which is between 25 and 45 feet lower than pre-development water levels.

2. For Scenario 2, which has ASR wells with less than half the open interval length of Scenario 1, Figure B-16 shows that the simulated groundwater elevations are much higher during injection cycles and much lower during pumping cycles than was the case for Scenario 1. Peak elevations at the end of injection are as high as elevation 260 feet, which is 75 feet above the pre-development water level; and pumping results in water levels as low as elevation 100 feet, which is about 85 feet below the pre-development water level. This much greater response in Scenario 2 than in Scenario 1 arises because the same volume of water is being injected and recovered in the two scenarios, but from a much thinner section of aquifer in Scenario 2 than in Scenario 1.

3. Although the two scenarios cause notable changes in groundwater elevations at and near the ASR wells, the amounts by which these groundwater elevations change for each component of the ASR cycle are similar to the amounts of change observed in the existing ASR wells at the Sorrento and Grabhorn wellfields. Moreover, the resulting groundwater elevations are substantially below the ground surface at each proposed ASR well location based on the proposed operation and target volumes for the JWC program.

4. The model indicates that groundwater level changes can be expected at the Grabhorn and Sorrento observation wells in response to JWC operations. Additionally, like the ASR wells, the observation wells show similar distinctions between Scenarios 1 and 2, as shown in Figures B-17 and B-18 for the Sorrento observation wells and Figures B-19 and B-20 for the Grabhorn observation wells. Well-by-well comparisons of responses for Scenarios 1 and 2 are contained in Figures B-21 through B-29 for the Sorrento observation wells and Figures B-30 through B-35 for the Grabhorn observation wells.

5. Increases in groundwater elevations can be expected during injection cycles within and beyond the Cooper Mountain structural block. Figure B-36 shows the increases in groundwater levels at the end of injection cycles that are estimated by the model for Scenario 1, and Figure B-37 shows the increases for Scenario 2. Both figures show water levels in model Layer 15, which is about 400 feet above the pillow complex in model Layer 23 and is the highest injection zone to which ASR wells are open in Scenario 2. Figures B-36 and B-37 show the following:

a. Along the Beaverton Fault Zone, which bounds the north side of the Cooper Mountain structural block, the maximum increase in groundwater elevations is about 10 feet under Scenario 1 and about 20 feet under Scenario 2.

b. Along the fault zone on the southern perimeter of Cooper Mountain, the maximum increase in groundwater elevations is between about 5 and 10 feet for Scenario 1 and between about 7 and 20 feet for Scenario 2.

c. Inspection of the -1 and zero contours indicates that the northern and eastern limits of the zone of water level increase are in about the same location for Scenarios 1 and 2, while the southern and western limits are about ¼ to ½ mile farther out from the perimeter of Cooper Mountain for Scenario 2 than for Scenario 1.

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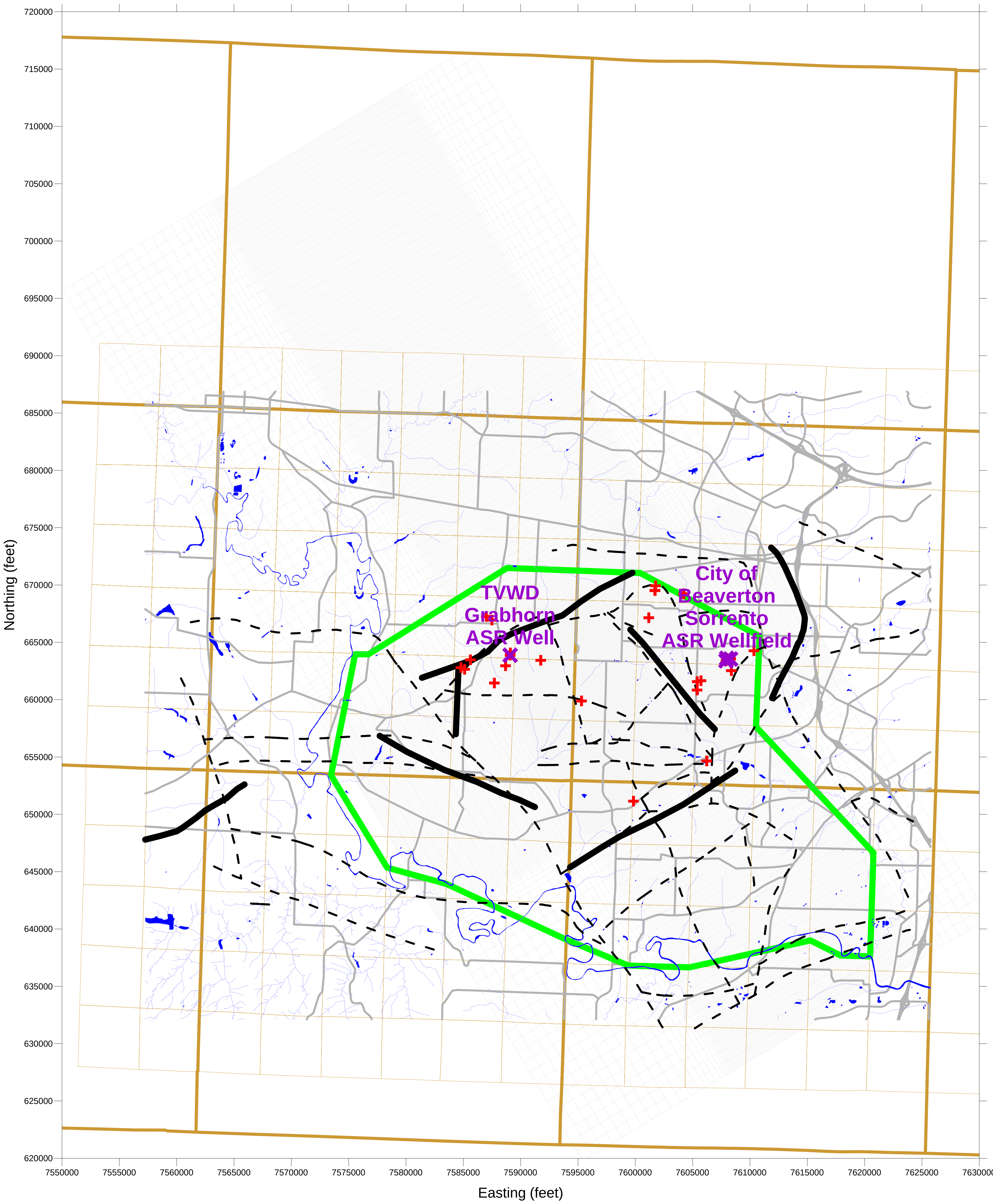


LEGEND

- Model Grid Cell
- Mapped Faults
- Inferred Faults
- Existing ASR Well
- Existing Observation Well
- Cooper Mtn / Bull Mtn Critical Ground Water Area
- Townships and Sections

0 9000 18000 27000

N

Figure B-1

Map Showing Model Grid, Mapped Faults, and Locations of Existing ASR Wells and Observation Wells

Joint Water Commission, Washington County, Oregon

Figure B-2

Relationship of Composite Geologic Section to Model Layer

Joint Water Commission Groundwater Flow Model

Composite Geologic Section		
Thickness (ft)	Depth (ft)	Material
10	10	FT
25	35	DI+NFB
8	43	FT
23	66	DI+NFB
9	75	FT
27	102	DI+NFB
17	119	FT
40	159	DI+NFB
13	172	FT
60	232	DI+NFB
18	250	FT
35	285	DI+NFB
21	306	FT
52	358	DI+NFB
10	368	FT
34	402	DI+NFB
12	414	FT
32	446	DI+NFB
23	469	FT
46	515	DI+NFB
28	543	FT
107	650	DI+NFB
18	668	FT
187	855	DI+NFB
33	888	FT
116	1004	DI+NFB
84	1088	PC

Thickness Simplification		
Thickness (ft)	Depth (ft)	Material
10	10	FT
25	35	DI+NFB
10	45	FT
25	70	DI+NFB
10	80	FT
20	100	DI+NFB
15	115	FT
40	155	DI+NFB
15	170	FT
30	200	DI+NFB
30	230	DI+NFB
20	250	FT
35	285	DI+NFB
15	300	FT
50	350	DI+NFB
10	360	FT
40	400	DI+NFB
10	410	FT
40	450	DI+NFB
20	470	FT
30	500	DI+NFB
10	510	DI+NFB
30	540	FT
60	600	DI+NFB
50	650	DI+NFB
20	670	FT
30	700	DI+NFB
100	800	DI+NFB
55	855	DI+NFB
35	890	FT
10	900	DI+NFB
100	1000	DI+NFB
100	1100	PC

Thickness of 100-ft Intervals	
FT or PC	DI+NB
30	70
30	70
35	65
10	90
30	70
30	70
20	80
0	100
35	65
0	100
100	0

Representative Section and Model Layering			
Thickness (ft)	Depth (ft)	Material	Layer No.
30	30	FT	1
70	100	DI+NFB	2
30	130	FT	3
70	200	DI+NFB	4
30	230	FT	5
70	300	DI+NFB	6
30	330	FT	7
70	400	DI+NFB	8
30	430	FT	9
70	500	DI+NFB	10
30	530	FT	11
70	600	DI+NFB	12
30	630	FT	13
70	700	DI+NFB	14
30	730	FT	15
70	800	DI+NFB	16
30	830	FT	17
70	900	DI+NFB	18
30	930	FT	19
70	1000	DI+NFB	20
30	1030	PC	21
70	1100	PC	22

FT = Flow Top

DI = Dense Interior

FB = Flow Bottom

PC = Pillow Complex

Figure B-3
Relationship of Composite Geologic Section to Faulting and Model Layering
Joint Water Commission Groundwater Flow Model

Model Layer No.	Bull Mtn Block			Cooper Mtn Block			First Block Down			Second Block Down			Third Block Down			Fourth Block Down		
	Thickness	Depth	Material	Thickness	Depth	Material	Thickness	Depth	Material	Thickness	Depth	Material	Thickness	Depth	Material	Thickness	Depth	Material
1	30	30	FT	Above Ground			Above Ground			Above Ground			Above Ground			Above Ground		
2	70	100	DI+NFB															
3	30	130	FT	30	30	FT												
4	70	200	DI+NFB	70	100	DI+NFB												
5	30	230	FT	30	130	FT	30	---	Sed	30	---	Sed	30	---	Sed	30	---	Sed
6	70	300	DI+NFB	70	200	DI+NFB	70	---	Sed	70	---	Sed	70	---	Sed	70	---	Sed
7	30	330	FT	30	230	FT	30	30	FT	30	---	Sed	30	---	Sed	30	---	Sed
8	70	400	DI+NFB	70	300	DI+NFB	70	100	DI+NFB	70	---	Sed	70	---	Sed	70	---	Sed
9	30	430	FT	30	330	FT	30	130	FT	30	---	Sed	30	---	Sed	30	---	Sed
10	70	500	DI+NFB	70	400	DI+NFB	70	200	DI+NFB	70	---	Sed	70	---	Sed	70	---	Sed
11	30	530	FT	30	430	FT	30	230	FT	30	30	FT	30	---	Sed	30	---	Sed
12	70	600	DI+NFB	70	500	DI+NFB	70	300	DI+NFB	70	100	DI+NFB	70	---	Sed	70	---	Sed
13	30	630	FT	30	530	FT	30	330	FT	30	130	FT	30	---	Sed	30	---	Sed
14	70	700	DI+NFB	70	600	DI+NFB	70	400	DI+NFB	70	200	DI+NFB	70	---	Sed	70	---	Sed
15	30	730	FT	30	630	FT	30	430	FT	30	230	FT	30	30	FT	30	---	Sed
16	70	800	DI+NFB	70	700	DI+NFB	70	500	DI+NFB	70	300	DI+NFB	70	100	DI+NFB	70	---	Sed
17	30	830	FT	30	730	FT	30	530	FT	30	330	FT	30	130	FT	30	---	Sed
18	70	900	DI+NFB	70	800	DI+NFB	70	600	DI+NFB	70	400	DI+NFB	70	200	DI+NFB	70	---	Sed
19	30	930	FT	30	830	FT	30	630	FT	30	430	FT	30	230	FT	30	---	Sed
20	70	1000	DI+NFB	70	900	DI+NFB	70	700	DI+NFB	70	500	DI+NFB	70	300	DI+NFB	70	---	Sed
21	30	1030	PC	30	930	FT	30	730	FT	30	530	FT	30	330	FT	30	30	FT
22	70	1100	PC	70	1000	DI+NFB	70	800	DI+NFB	70	600	DI+NFB	70	400	DI+NFB	70	100	DI+NFB
23				30	1030	PC	30	830	FT	30	630	FT	30	430	FT	30	130	FT
24				70	1100	PC	70	900	DI+NFB	70	700	DI+NFB	70	500	DI+NFB	70	200	DI+NFB
25							30	930	FT	30	730	FT	30	530	FT	30	230	FT
26							70	1000	DI+NFB	70	800	DI+NFB	70	600	DI+NFB	70	300	DI+NFB
27							30	1030	PC	30	830	FT	30	630	FT	30	330	FT
28							70	1100	PC	70	900	DI+NFB	70	700	DI+NFB	70	400	DI+NFB
29										30	930	FT	30	730	FT	30	430	FT
30										70	1000	DI+NFB	70	800	DI+NFB	70	500	DI+NFB
31										30	1030	PC	30	830	FT	30	530	FT
32										70	1100	PC	70	900	DI+NFB	70	600	DI+NFB
33													30	930	FT	30	630	FT
34													70	1000	DI+NFB	70	700	DI+NFB
35													30	1030	PC	30	730	FT
36													70	1100	PC	70	800	DI+NFB
37																30	830	FT
38																70	900	DI+NFB
39																30	930	FT
40																70	1000	DI+NFB
41																30	1030	PC
42																70	1100	PC

FT = Flow Top
DI = Dense Interior
FB = Flow Bottom
PC = Pillow Complex
Sed = Sedimentary Overburden on Top of Basalt

Figure B-3a

Relationship of Composite Geologic Section to Faulting and Model Layering

Joint Water Commission Groundwater Flow Model

Model Layer No.	Layer Top Elevation (feet MSL)	Layer Bottom Elevation (feet MSL)	Bull Mtn Block			Cooper Mtn Block			First Block Down (Depth Interval #1)		
			Thickness	Depth	Material	Thickness	Depth	Material	Thickness	Depth	Material
1	400	370	30	30	FT		Above Ground			Above Ground	
2	370	300	70	100	DI+NFB						
3	300	270	30	130	FT	30	30	FT			
4	270	200	70	200	DI+NFB	70	100	DI+NFB			
5	200	170	30	230	FT	30	130	FT	30	---	Sed
6	170	100	70	300	DI+NFB	70	200	DI+NFB	70	---	Sed
7	100	70	30	330	FT	30	230	FT	30	30	FT
8	70	0	70	400	DI+NFB	70	300	DI+NFB	70	100	DI+NFB
9	0	-30	30	430	FT	30	330	FT	30	130	FT
10	-30	-100	70	500	DI+NFB	70	400	DI+NFB	70	200	DI+NFB
11	-100	-130	30	530	FT	30	430	FT	30	230	FT
12	-130	-200	70	600	DI+NFB	70	500	DI+NFB	70	300	DI+NFB
13	-200	-230	30	630	FT	30	530	FT	30	330	FT
14	-230	-300	70	700	DI+NFB	70	600	DI+NFB	70	400	DI+NFB
15	-300	-330	30	730	FT	30	630	FT	30	430	FT
16	-330	-400	70	800	DI+NFB	70	700	DI+NFB	70	500	DI+NFB
17	-400	-430	30	830	FT	30	730	FT	30	530	FT
18	-430	-500	70	900	DI+NFB	70	800	DI+NFB	70	600	DI+NFB
19	-500	-530	30	930	FT	30	830	FT	30	630	FT
20	-530	-600	70	1000	DI+NFB	70	900	DI+NFB	70	700	DI+NFB
21	-600	-630	30	1030	PC	30	930	FT	30	730	FT
22	-630	-700	70	1100	PC	70	1000	DI+NFB	70	800	DI+NFB
23	-700	-730				30	1030	PC	30	830	FT
24	-730	-800				70	1100	PC	70	900	DI+NFB
25	-800	-830							30	930	FT
26	-830	-900							70	1000	DI+NFB
27	-900	-930							30	1030	PC
28	-930	-1000							70	1100	PC
29	-1000	-1030									
30	-1030	-1100									
31	-1100	-1130									
32	-1130	-1200									
33	-1200	-1230									
34	-1230	-1300									
35	-1300	-1330									
36	-1330	-1400									
37	-1400	-1430									
38	-1430	-1500									
39	-1500	-1530									
40	-1530	-1600									
41	-1600	-1630									
42	-1630	-1700									

Model Layer No.	Second Block Down (Depth Interval #2)			Third Block Down (Depth Interval #3)			Fourth Block Down (Depth Interval #4)		
	Thickness	Depth	Material	Thickness	Depth	Material	Thickness	Depth	Material
1		Above Ground			Above Ground			Above Ground	
2									
3									
4									
5	30	---	Sed	30	---	Sed	30	---	Sed
6	70	---	Sed	70	---	Sed	70	---	Sed
7	30	---	Sed	30	---	Sed	30	---	Sed
8	70	---	Sed	70	---	Sed	70	---	Sed
9	30	---	Sed	30	---	Sed	30	---	Sed
10	70	---	Sed	70	---	Sed	70	---	Sed
11	30	30	FT	30	---	Sed	30	---	Sed
12	70	100	DI+NFB	70	---	Sed	70	---	Sed
13	30	130	FT	30	---	Sed	30	---	Sed
14	70	200	DI+NFB	70	---	Sed	70	---	Sed
15	30	230	FT	30	30	FT	30	---	Sed
16	70	300	DI+NFB	70	100	DI+NFB	70	---	Sed
17	30	330	FT	30	130	FT	30	---	Sed
18	70	400	DI+NFB	70	200	DI+NFB	70	---	Sed
19	30	430	FT	30	230	FT	30	---	Sed
20	70	500	DI+NFB	70	300	DI+NFB	70	---	Sed
21	30	530	FT	30	330	FT	30	30	FT
22	70	600	DI+NFB	70	400	DI+NFB	70	100	DI+NFB
23	30	630	FT	30	430	FT	30	130	FT
24	70	700	DI+NFB	70	500	DI+NFB	70	200	DI+NFB
25	30	730	FT	30	530	FT	30	230	FT
26	70	800	DI+NFB	70	600	DI+NFB	70	300	DI+NFB
27	30	830	FT	30	630	FT	30	330	FT
28	70	900	DI+NFB	70	700	DI+NFB	70	400	DI+NFB
29	30	930	FT	30	730	FT	30	430	FT
30	70	1000	DI+NFB	70	800	DI+NFB	70	500	DI+NFB
31	30	1030	PC	30	830	FT	30	530	FT
32	70	1100	PC	70	900	DI+NFB	70	600	DI+NFB
33				30	930	FT	30	630	FT
34				70	1000	DI+NFB	70	700	DI+NFB
35				30	1030	PC	30	730	FT
36				70	1100	PC	70	800	DI+NFB
37							30	830	FT
38							70	900	DI+NFB
39							30	930	FT
40							70	1000	DI+NFB
41							30	1030	PC
42							70	1100	PC

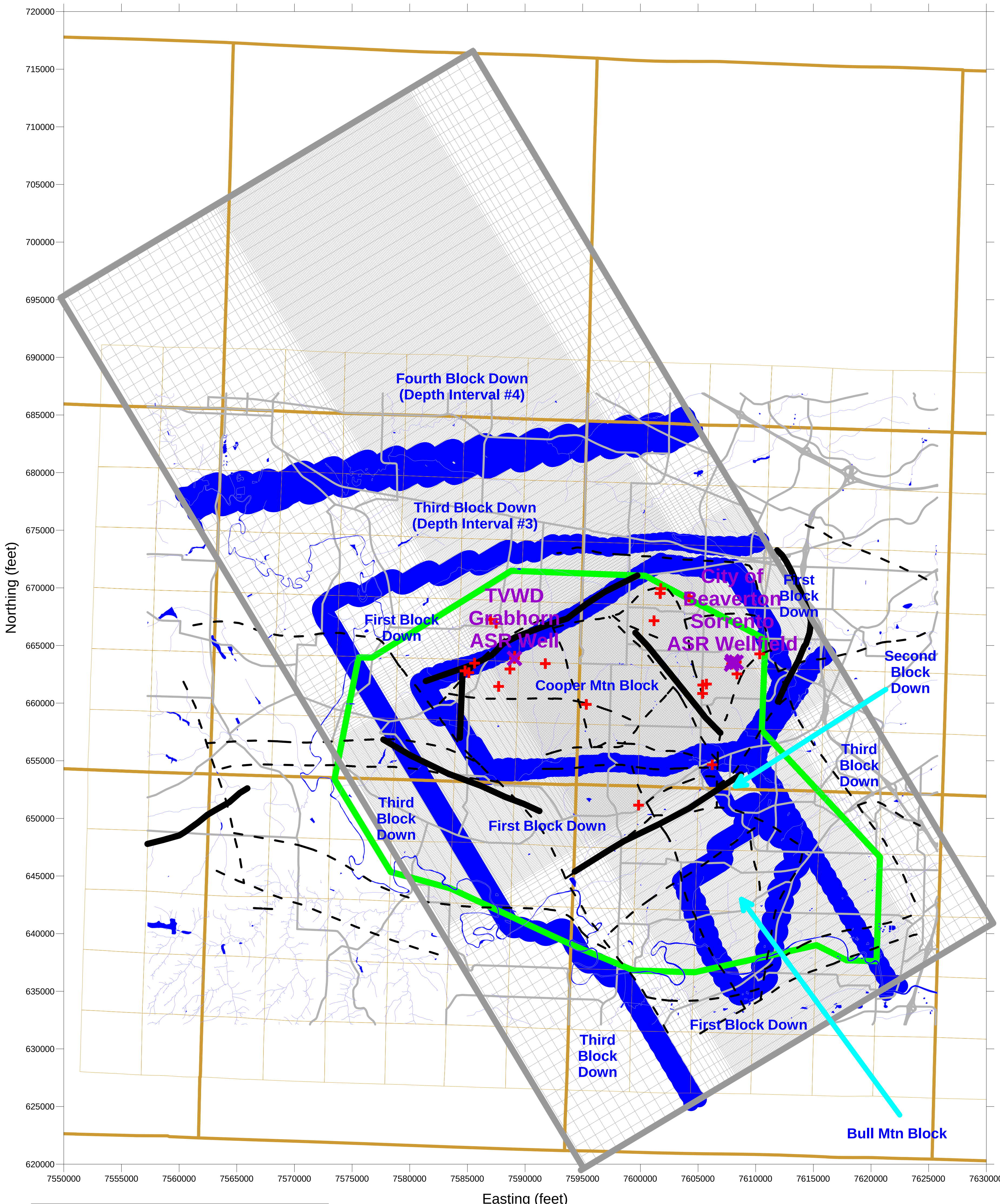
FT = Flow Top

DI = Dense Interior

FB = Flow Bottom

PC = Pillow Complex

Sed = Sedimentary Overburden on Top of Basalt



LEGEND

- Model Grid Cell
- Mapped Faults
- Inferred Faults
- Existing ASR Well
- Existing Observation Well
- Cooper Mtn / Bull Mtn Critical Ground Water Area
- Townships and Sections
- Fault Zone

0 9000 18000 27000

N

Figure B-3b
Map Showing Locations of Model-Simulated Stratigraphic Blocks and Fault Zones
Joint Water Commission, Washington County, Oregon

GSI Water Solutions, Inc.

See Figure B-3a for the Layering and Depth Intervals of Each Stratigraphic Block

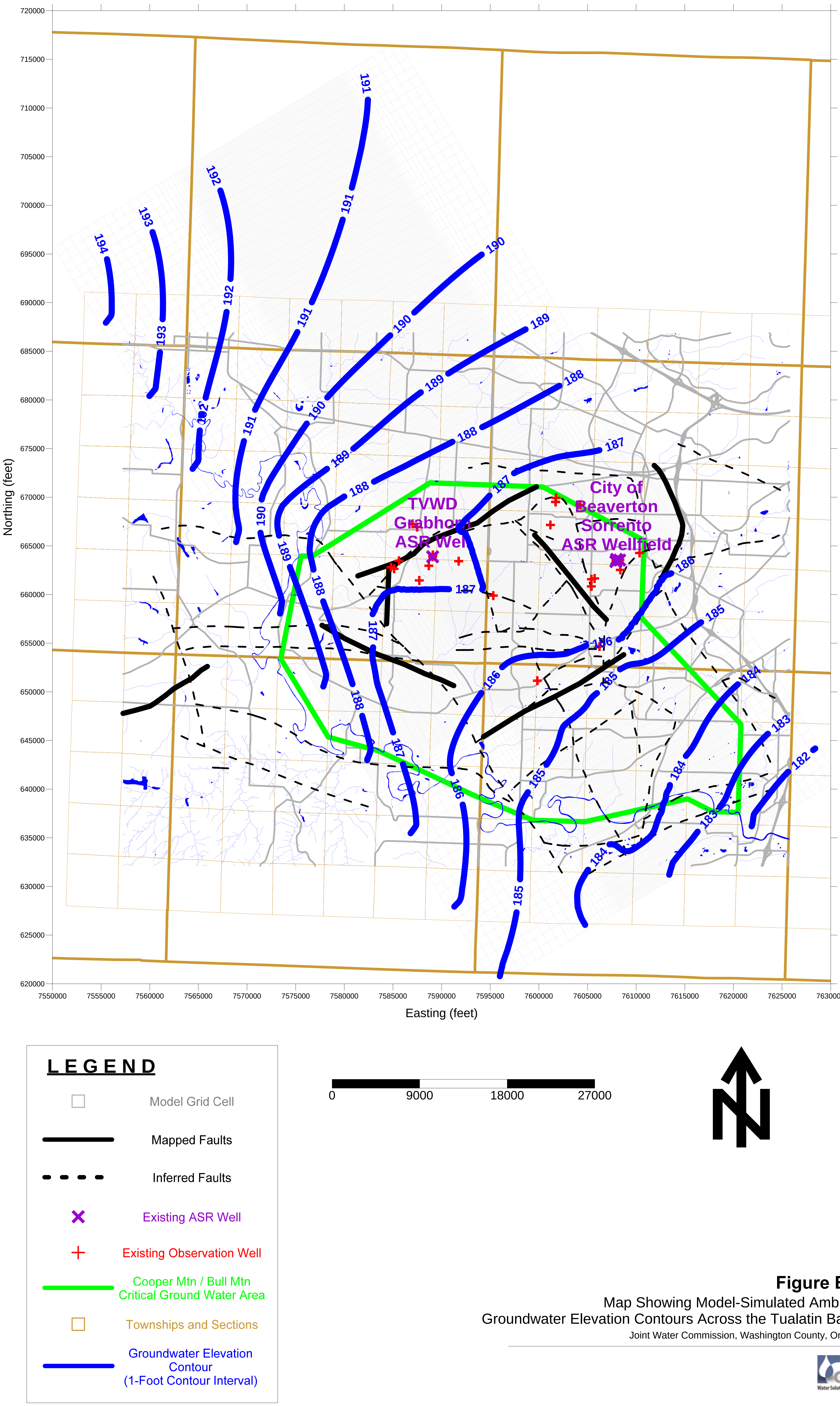


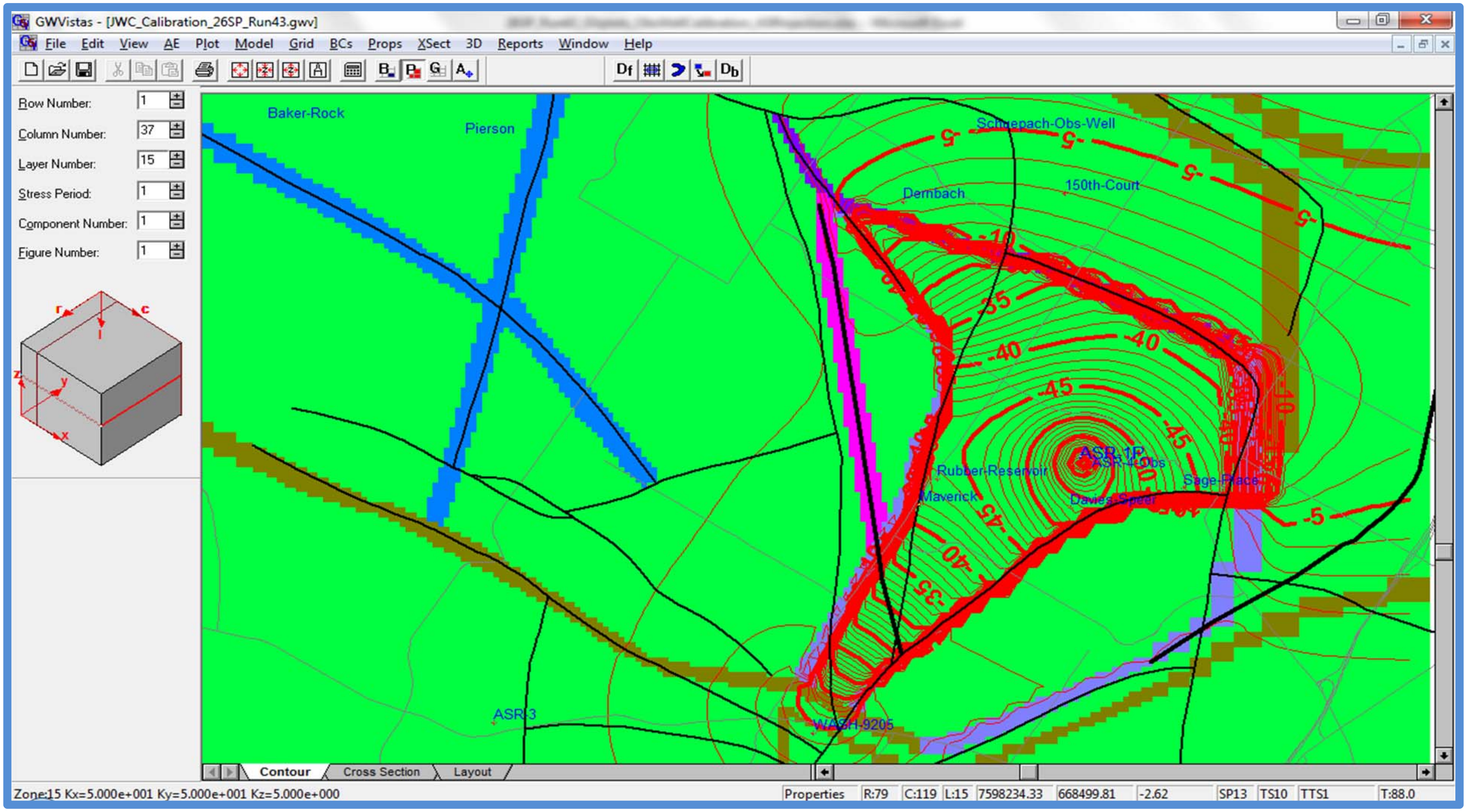
Figure B-4

Map Showing Model-Simulated Ambient Groundwater Elevation Contours Across the Tualatin Basin

Joint Water Commission, Washington County, Oregon

GSI Water Solutions, Inc.

Figure B-5
Sorrento Observation Wells
Simulated Mounding (1-Foot Contours)



Note: Negative values are for negative drawdowns of the water level (i.e., a rise / mounding induced by ASR injection).

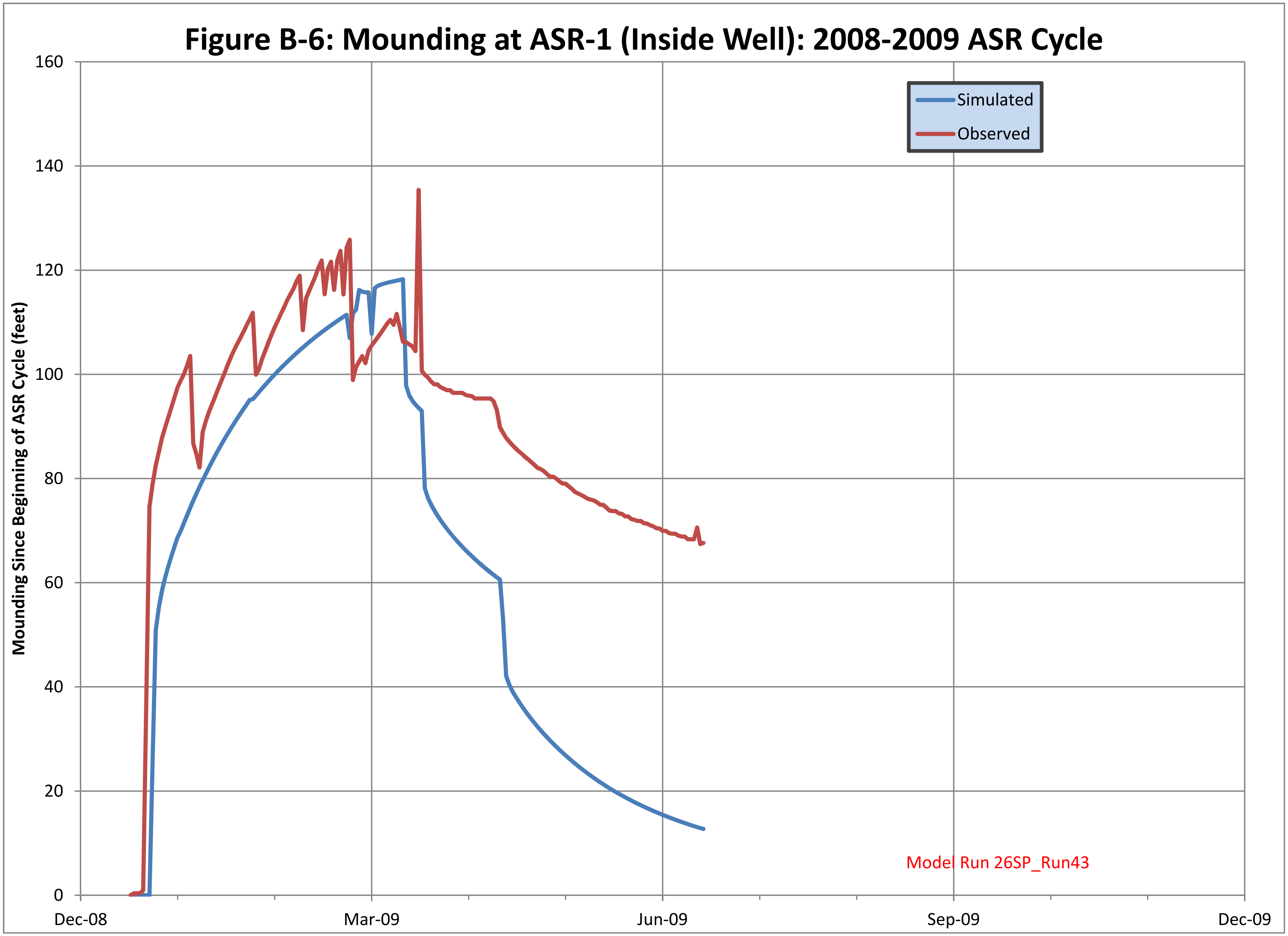


Figure B-6: Mounding at ASR-1 (Inside Well): 2008-2009 ASR Cycle
Mounding Since Beginning of ASR Cycle (feet)
160
140
120
100
80
60
40
20
0
Dec-08
Mar-09
Jun-09
Sep-09
Dec-09
Simulated
Observed
Model Run 26SP_Run43

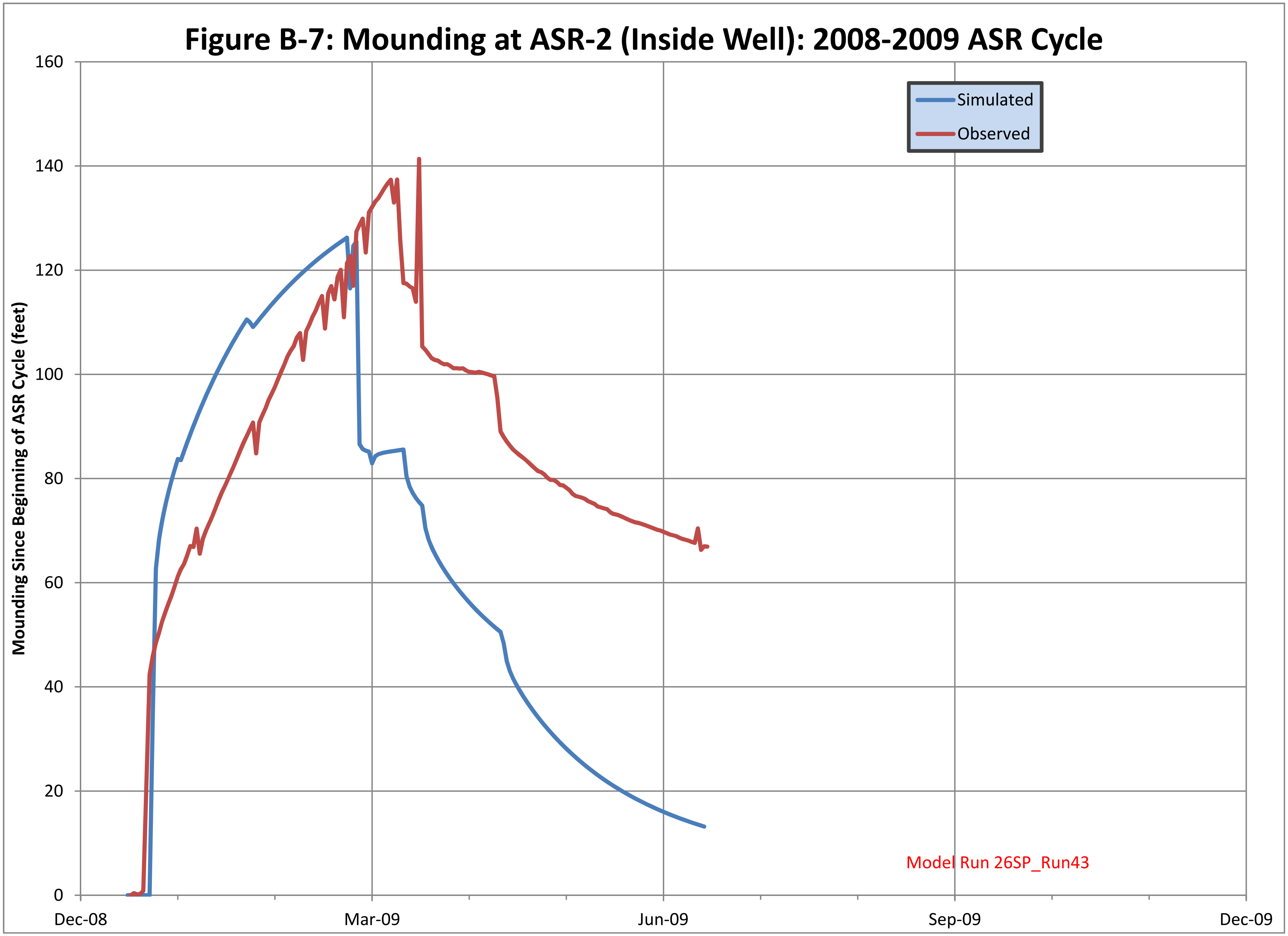


Figure B-7: Mounding at ASR-2 (Inside Well): 2008-2009 ASR Cycle
Simulated
Observed
Mounding Since Beginning of ASR Cycle (feet)
160
140
120
100
80
60
40
20
0
Dec-08
Mar-09
Jun-09
Sep-09
Dec-09
Model Run 26SP_Run43

Figure B-8: Mounding at ASR-4 (Inside Well): 2008-2009 ASR Cycle

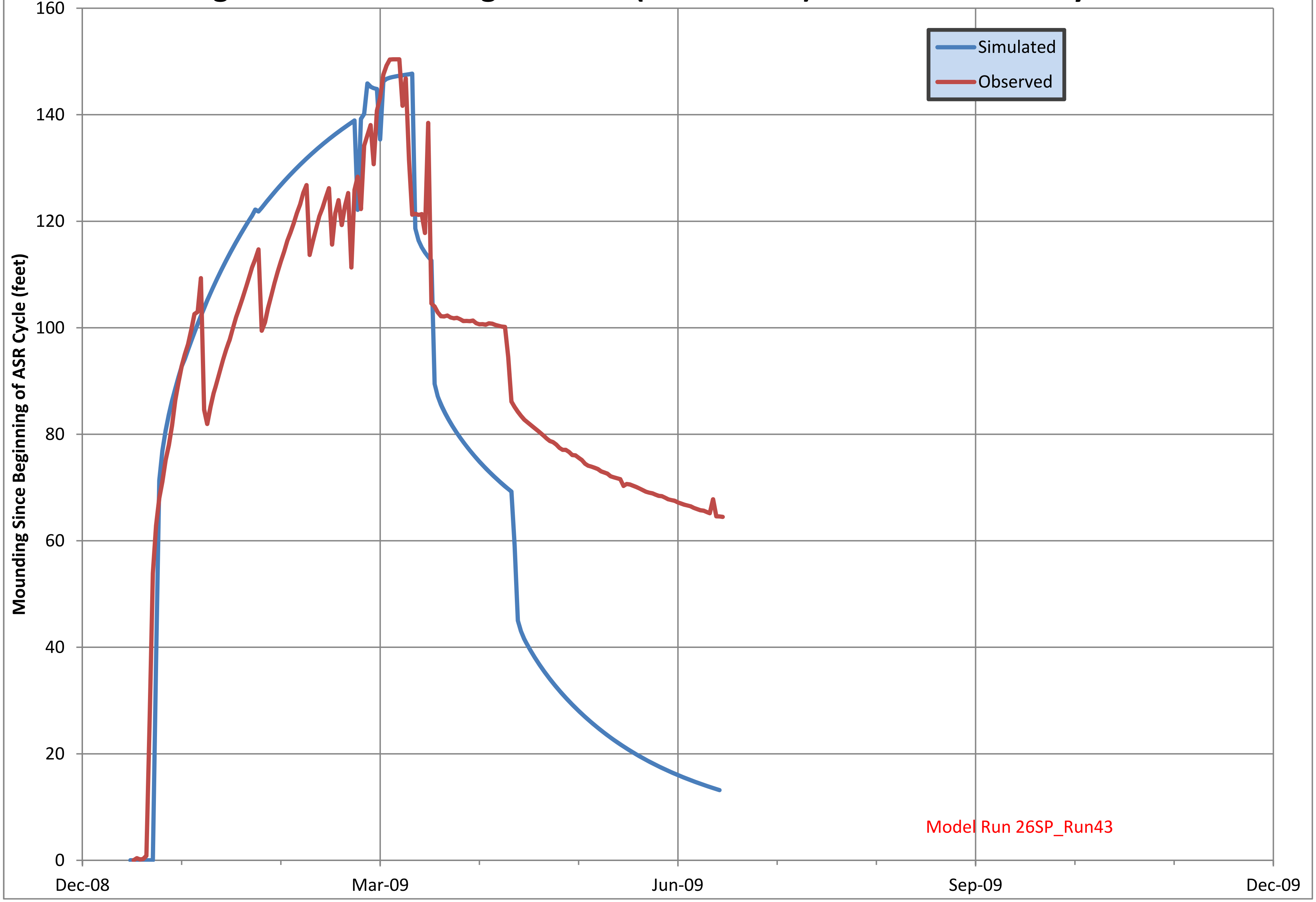
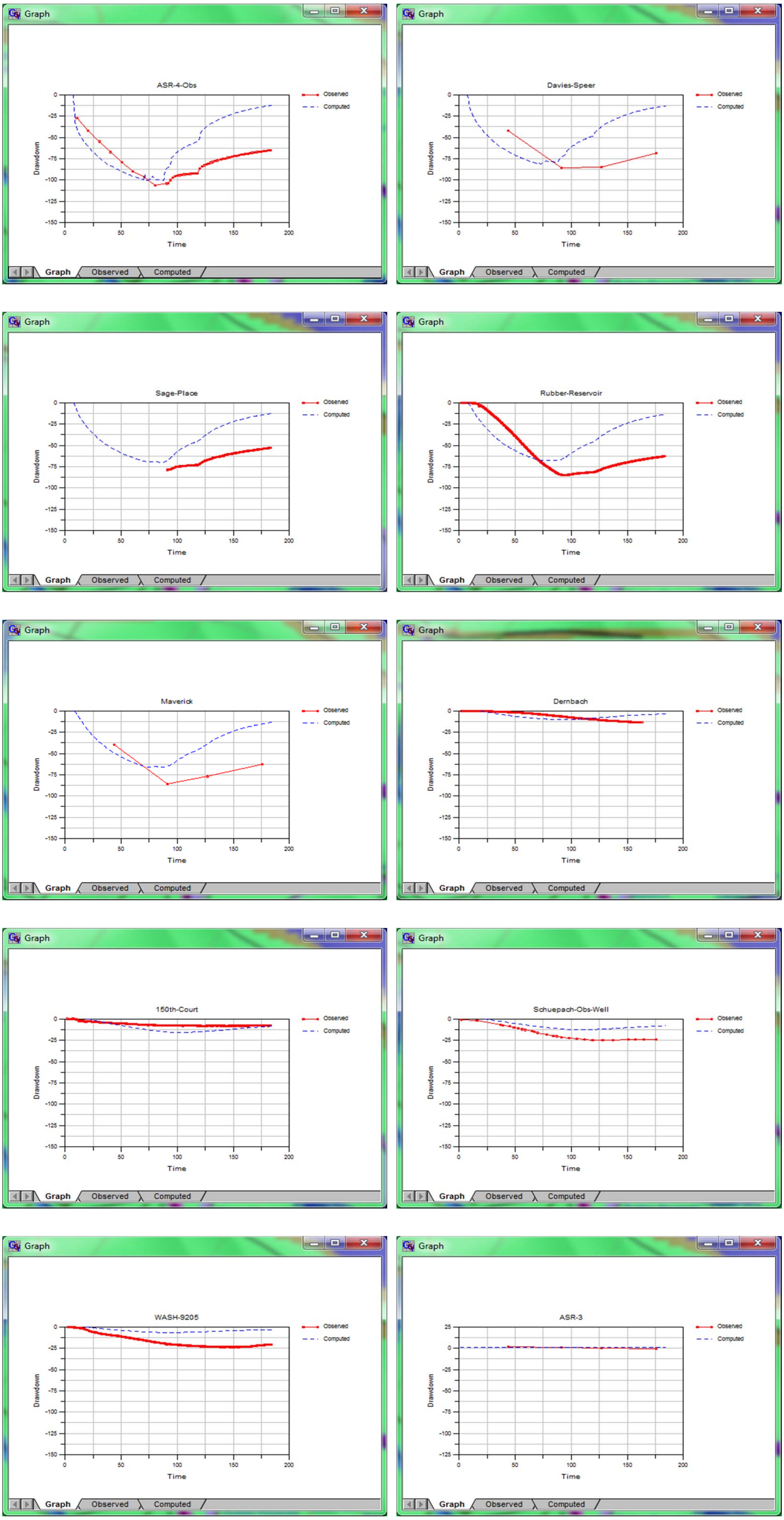


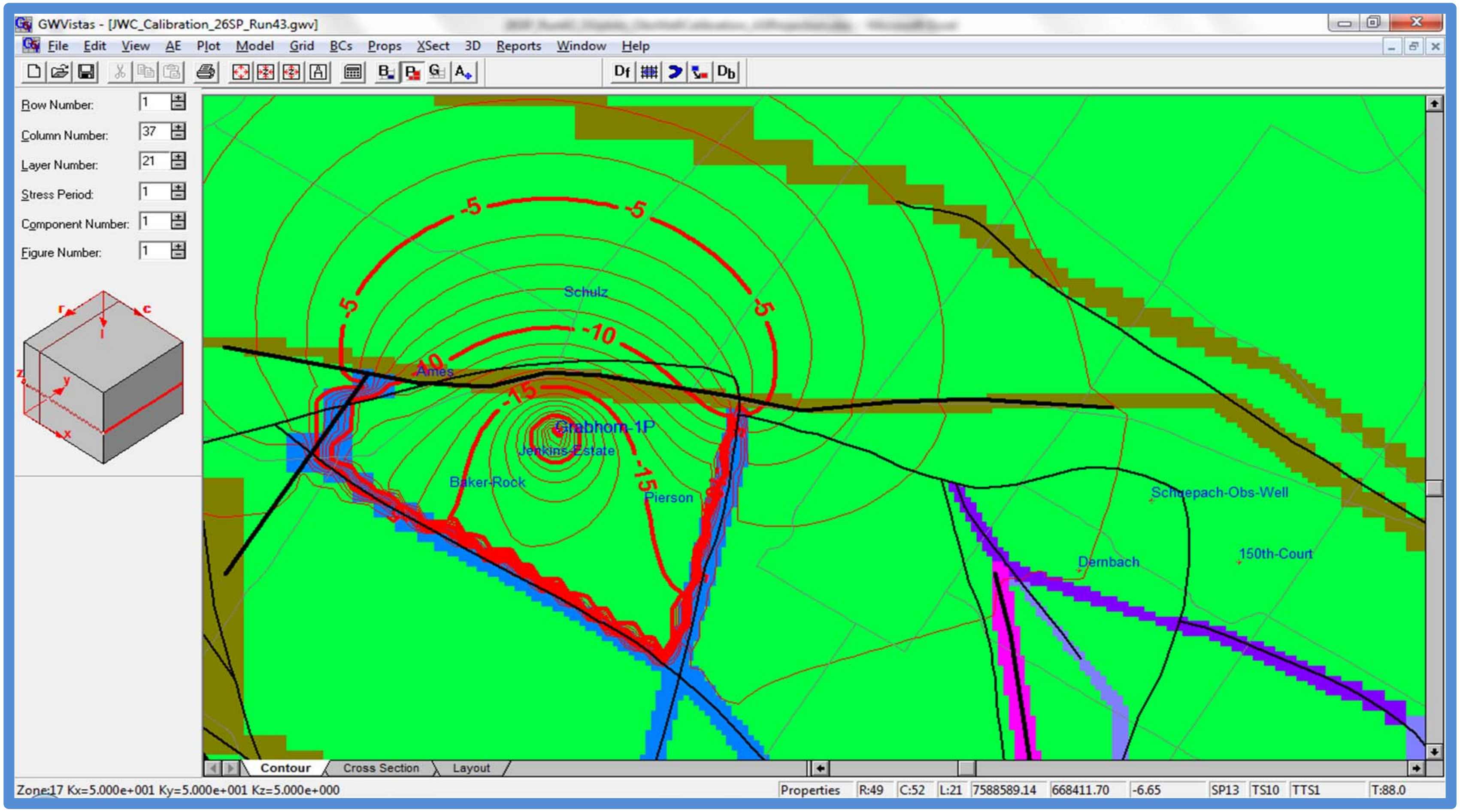
Figure B-9
Sorrento Observation Wells
Simulated Mounding versus Estimates of Observed Mounding
Note: Negative values are for negative drawdowns of the water level (i.e., a rise / mounding induced by ASR injection).



Figures_26SP_Run43_GV_CalibrationMapsAndPlots_ObsWells.xlsx, Sheet "Sorrento-AllInjection"

Created by GSI Water Solutions
November 2010

Figure B-10
Grabhorn Observation Wells
Simulated Mounding (1-Foot Contours)



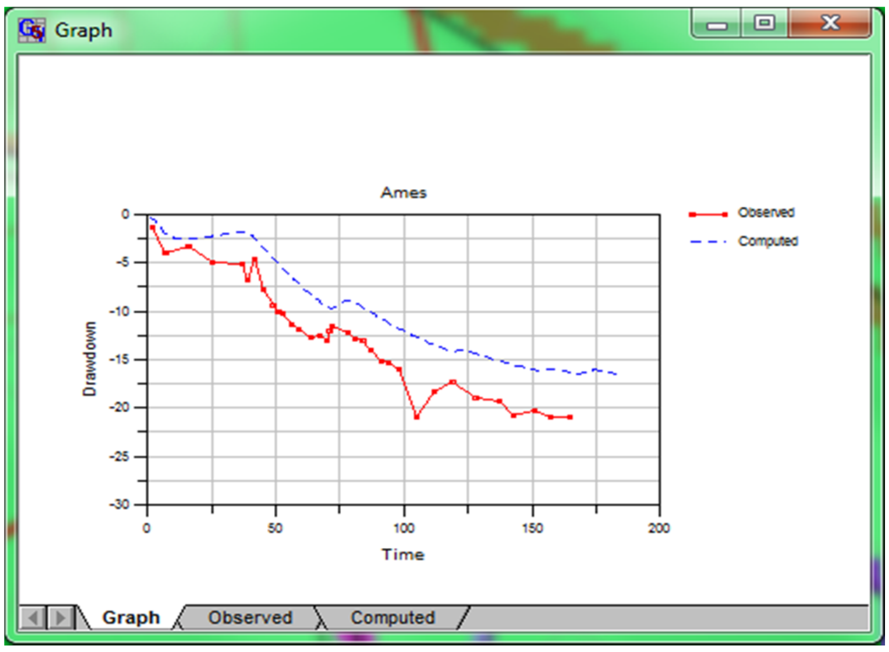
Note: Negative values are for negative drawdowns of the water level (i.e., a rise / mounding induced by ASR injection).

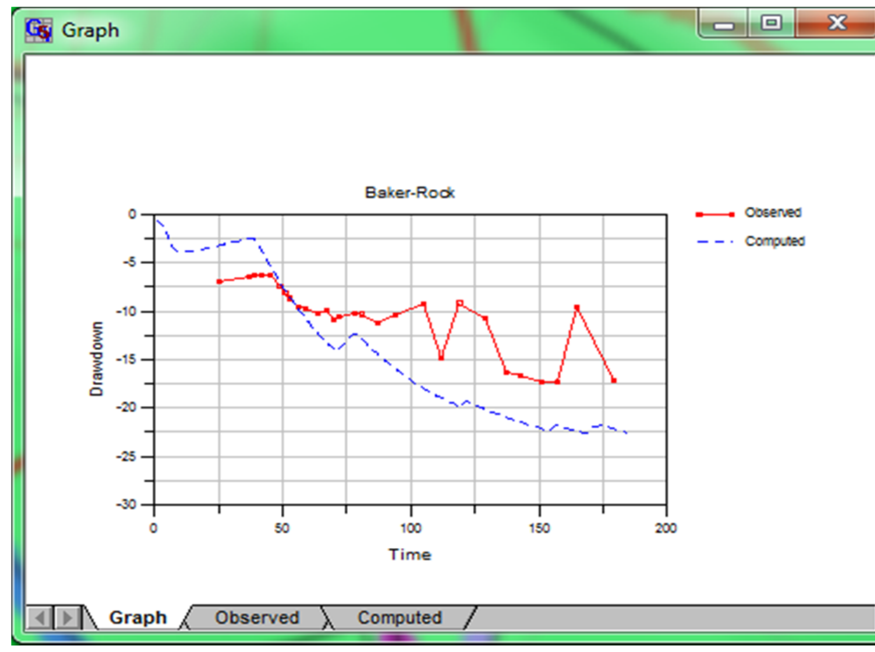
Figure B-11

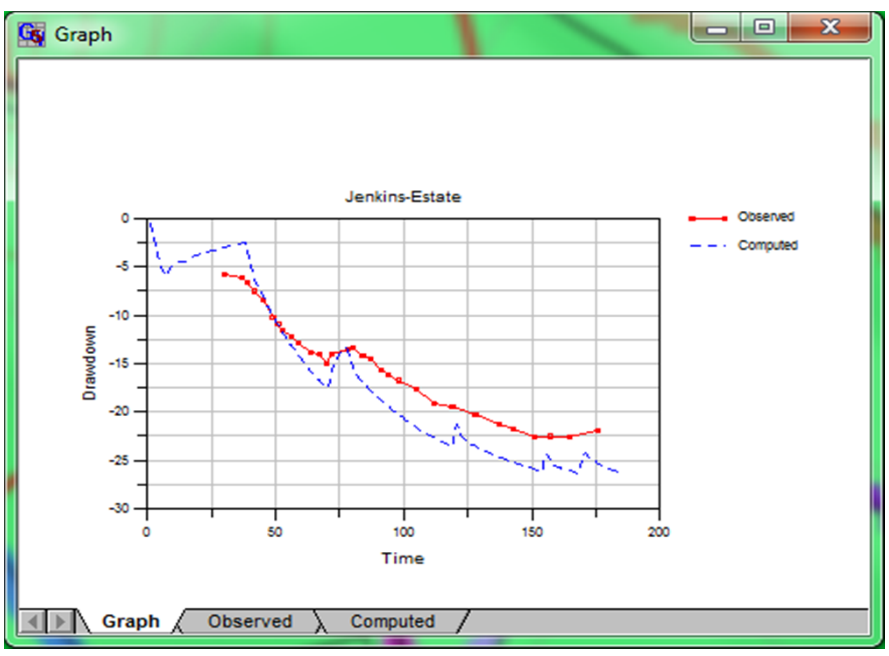
Grabhorn Observation Wells

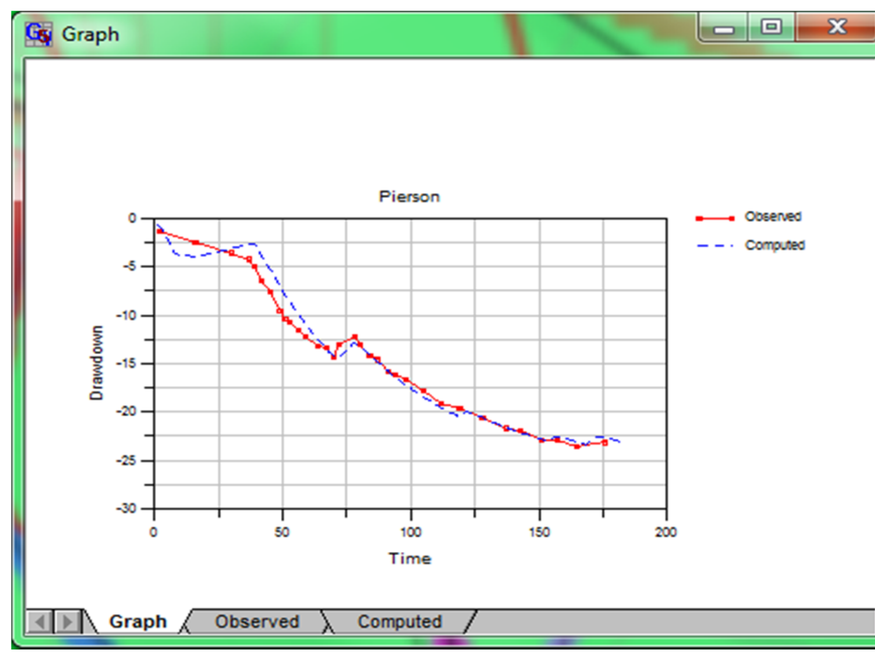
Simulated Mounding versus Estimates of Observed Mounding

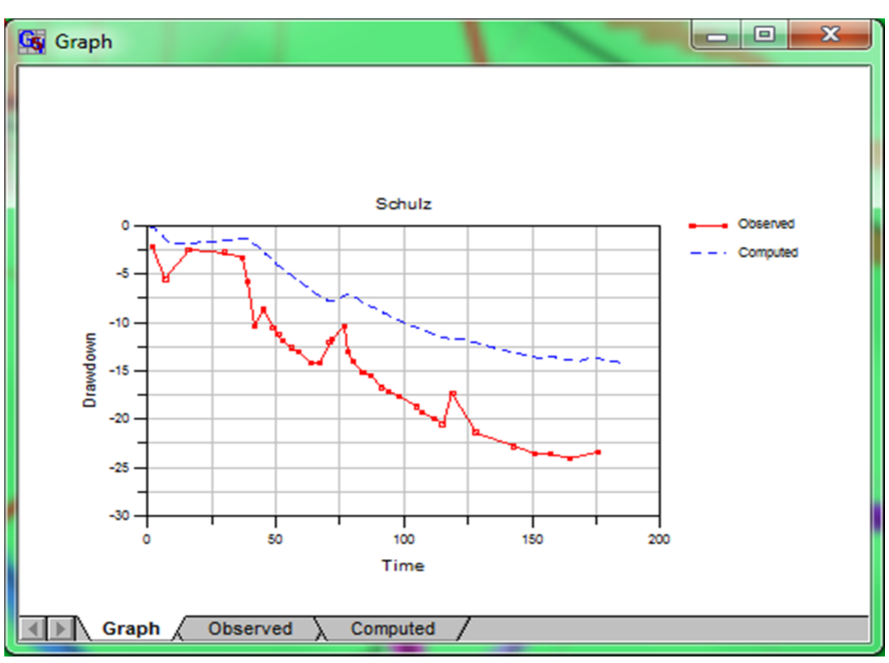
Note: Negative values are for negative drawdowns of the water level (i.e., a rise / mounding induced by ASR injection).











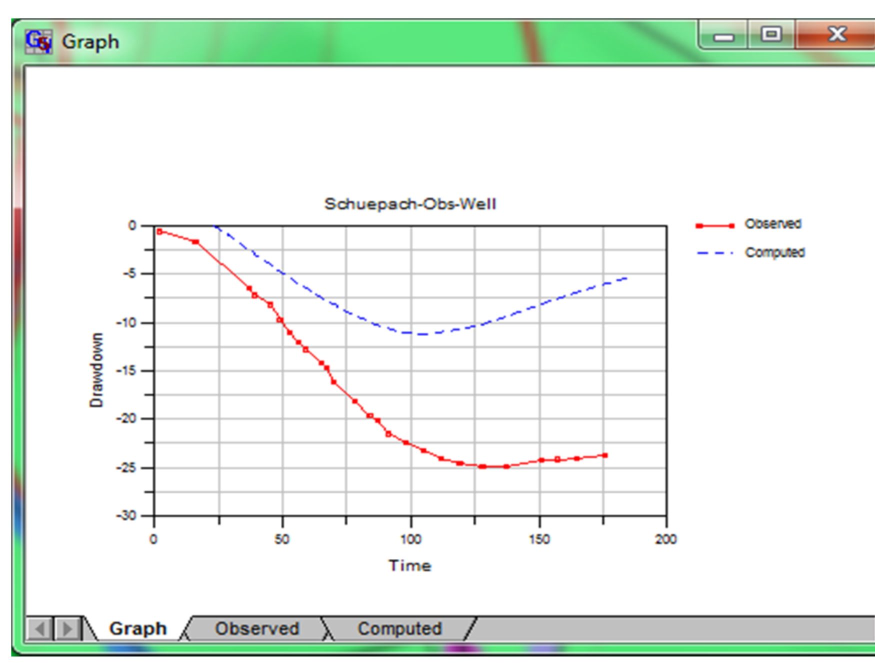
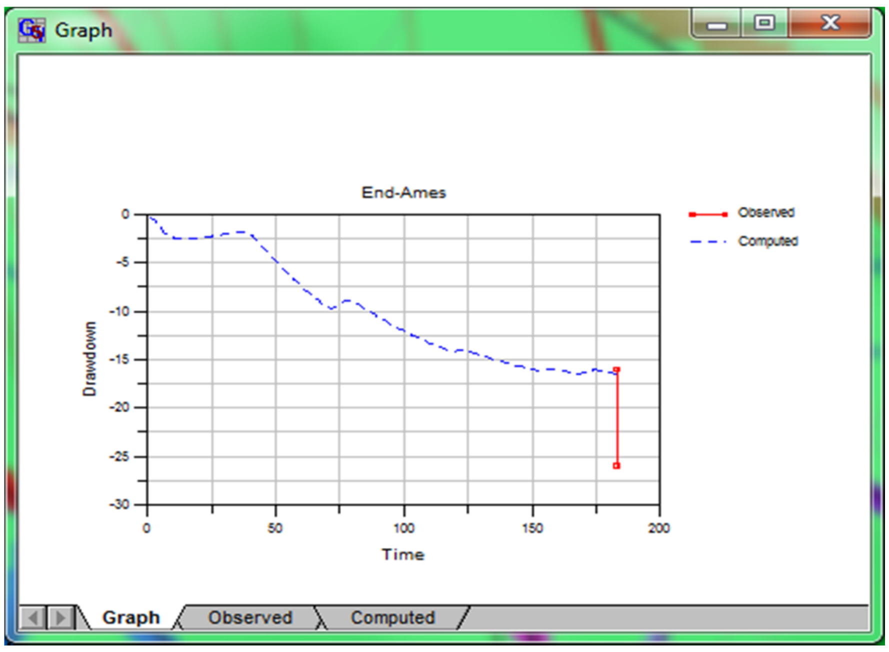


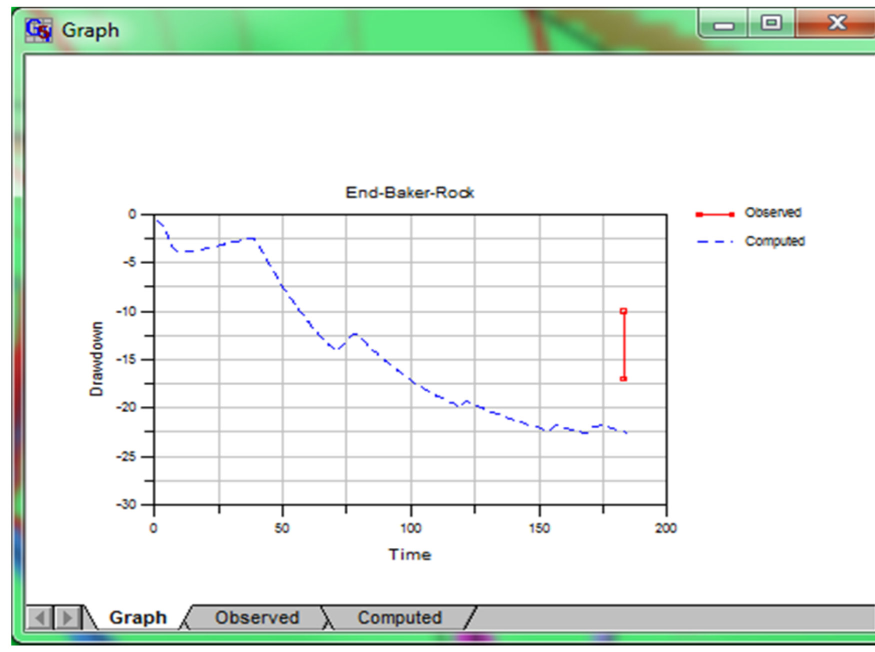
Figure B-12

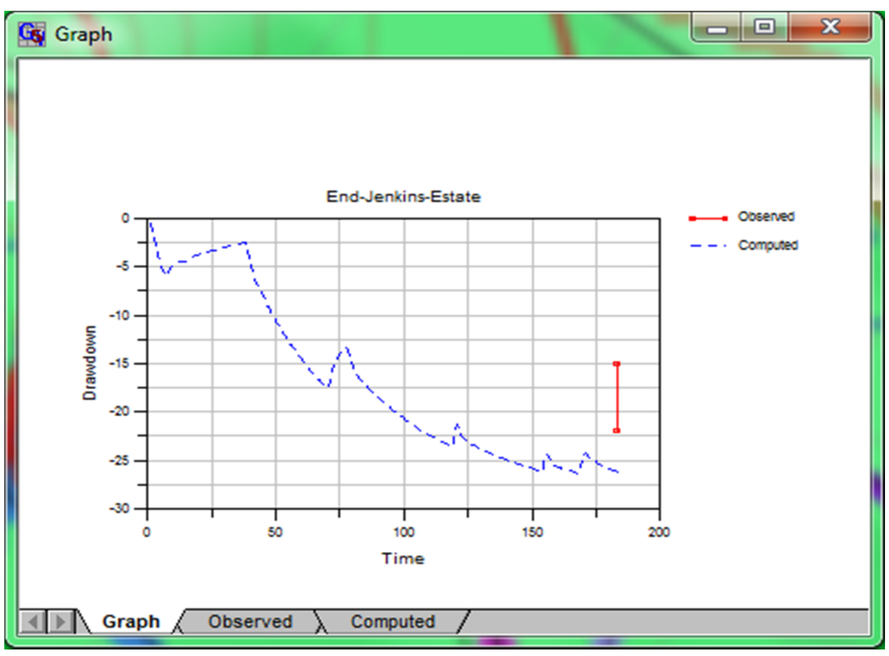
Grabhorn Observation Wells

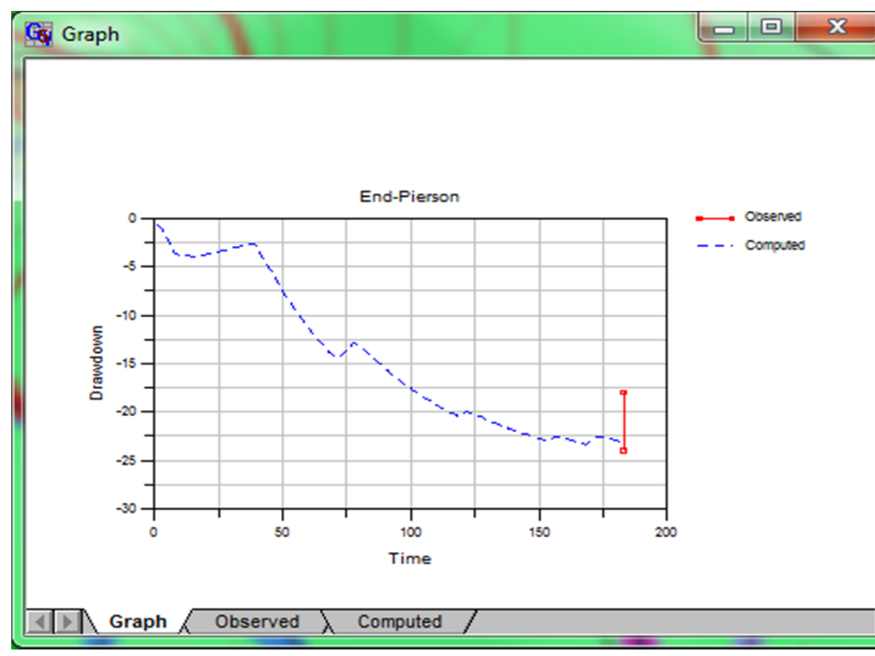
Simulated Mounding versus Reported Range of Observed Mounding

Note: Negative values are for negative drawdowns of the water level (i.e., a rise / mounding induced by ASR injection).









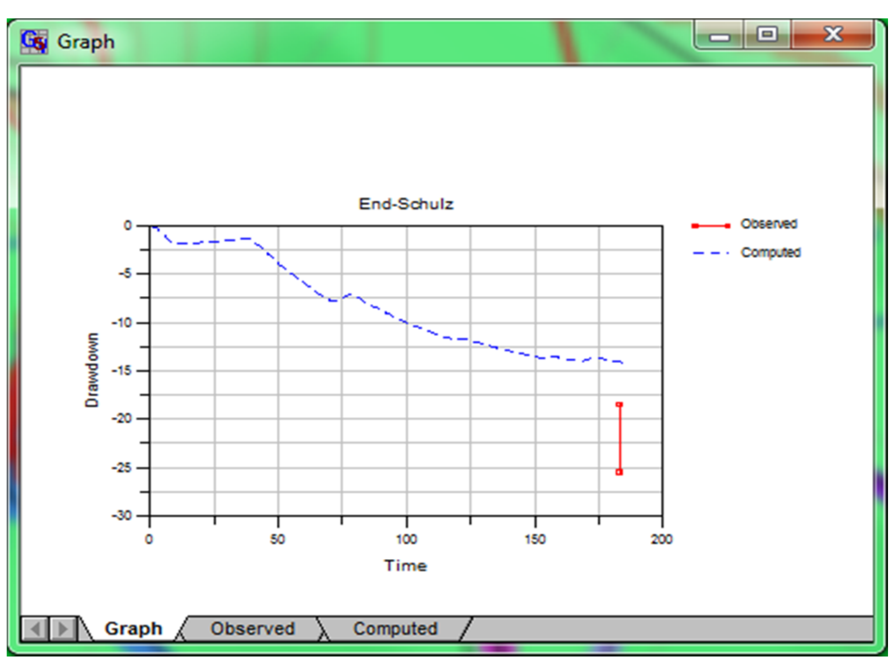
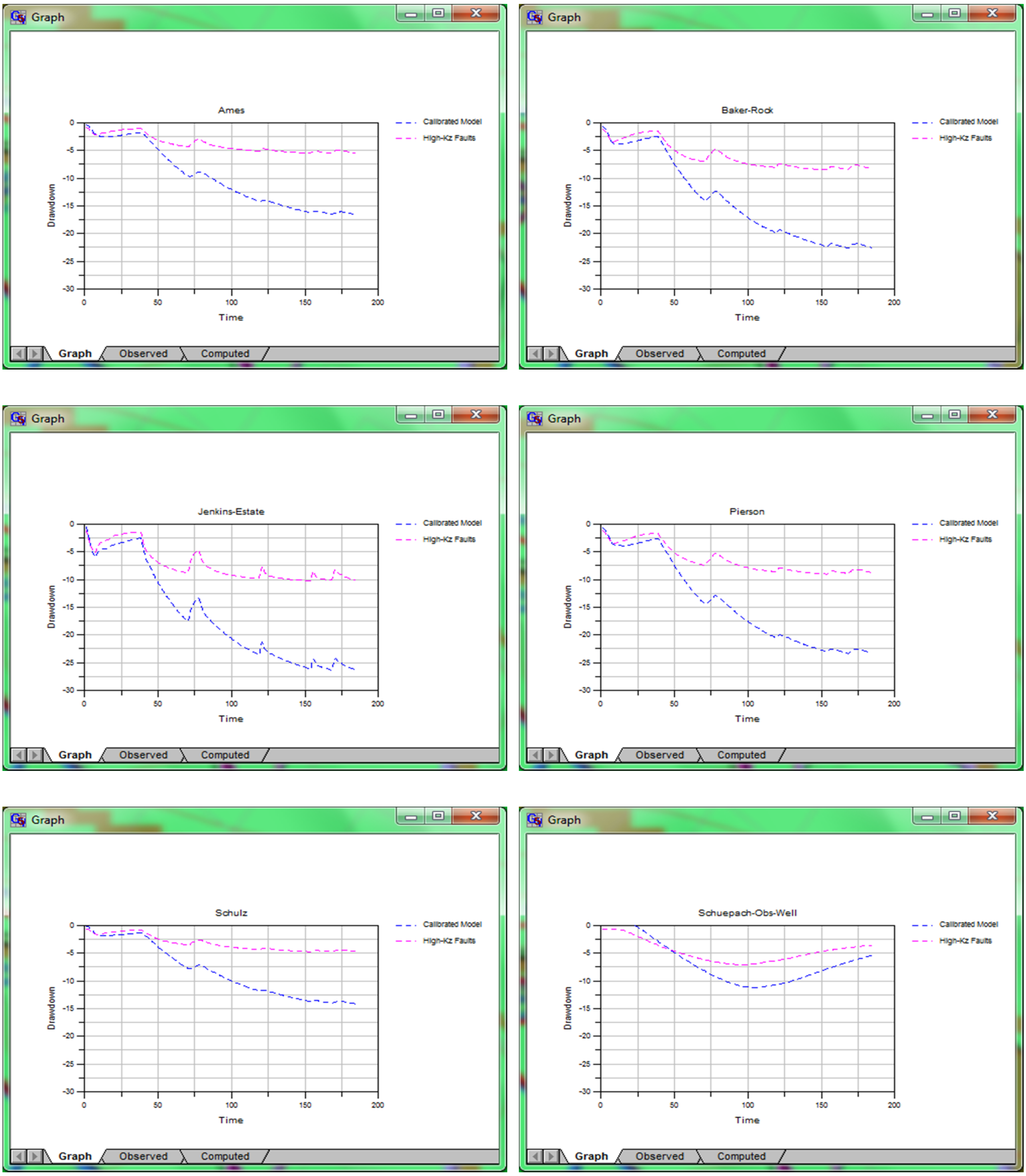


Figure B-13

Grabhorn Observation Wells

Simulated Mounding for Calibrated Model versus Model of High Vertical Hydraulic Conductivity in Perimeter Fault Planes

Note: Negative values are for negative drawdowns of the water level (i.e., a rise / mounding induced by ASR injection).



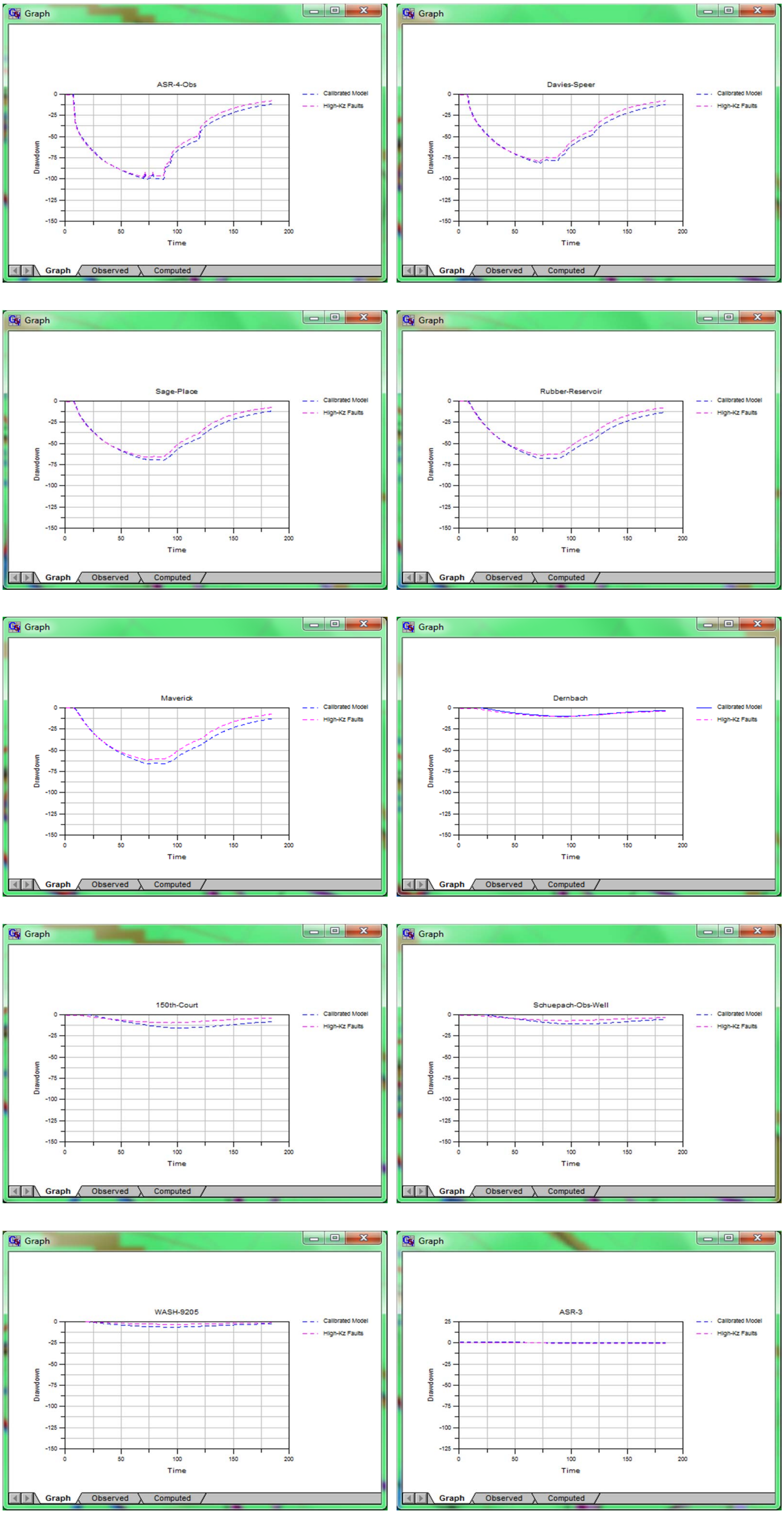
Vertical hydraulic conductivity = 0.00001 ft/day for the calibrated model and 5 ft/day for the "High-Kz Faults" model.
The "High-Kz Faults" model simulates the value of 5 ft/day for the faults along and beyond the perimeter of Cooper Mountain, but faults inside Cooper Mountain remain at 0.00001 ft/day.

Figure B-14

Sorrento Observation Wells

Simulated Mounding for Calibrated Model versus Model of High Vertical Hydraulic Conductivity in Perimeter Fault Planes

Note: Negative values are for negative drawdowns of the water level (i.e., a rise / mounding induced by ASR injection).



Vertical hydraulic conductivity = 0.00001 ft/day for the calibrated model and 5 ft/day for the "High-Kz Faults" model.

The "High-Kz Faults" model simulates the value of 5 ft/day for the faults along and beyond the perimeter of Cooper Mountain, but faults inside Cooper Mountain remain at 0.00001 ft/day.

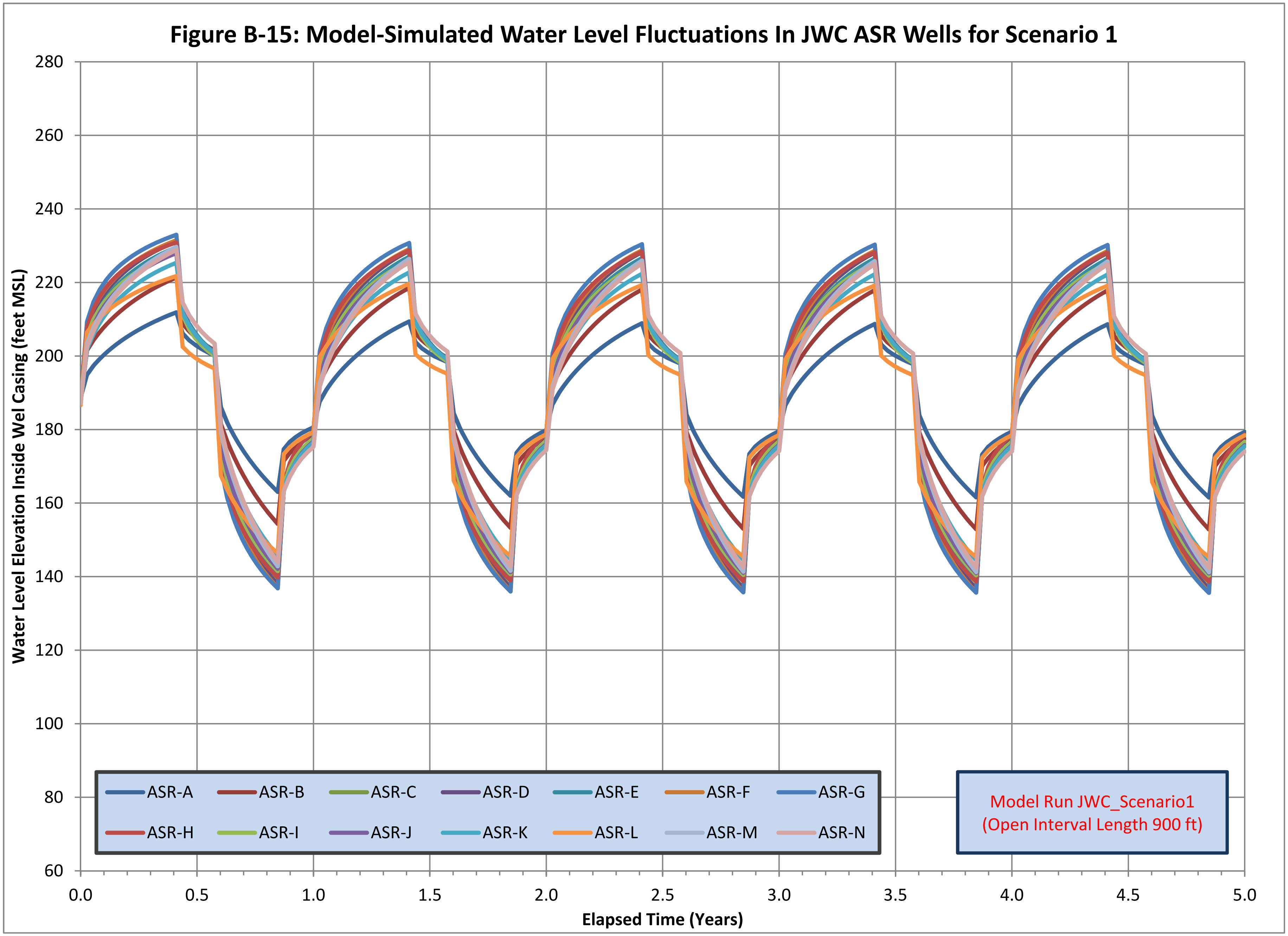
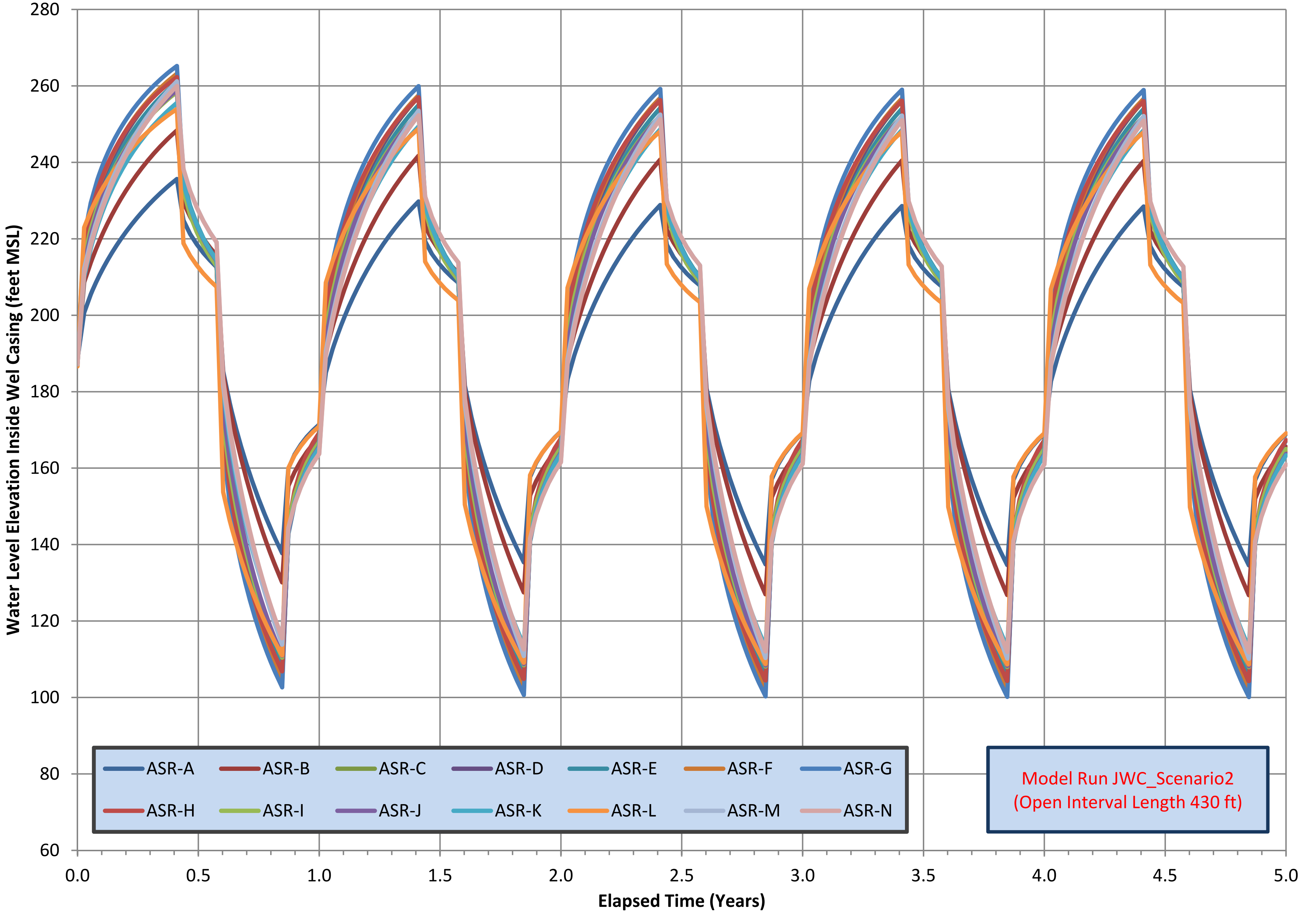


Figure B-15: Model-Simulated Water Level Fluctuations In JWC ASR Wells for Scenario 1
280
260
240
220
200
180
160
140
120
100
80
60
Water Level Elevation Inside Wel Casing (feet MSL)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Elapsed Time (Years)
ASR-A
ASR-B
ASR-C
ASR-D
ASR-E
ASR-F
ASR-G
ASR-H
ASR-I
ASR-J
ASR-K
ASR-L
ASR-M
ASR-N
Model Run JWC_Scenario1
(Open Interval Length 900 ft)

Figure B-16: Model-Simulated Water Level Fluctuations In JWC ASR Wells for Scenario 2



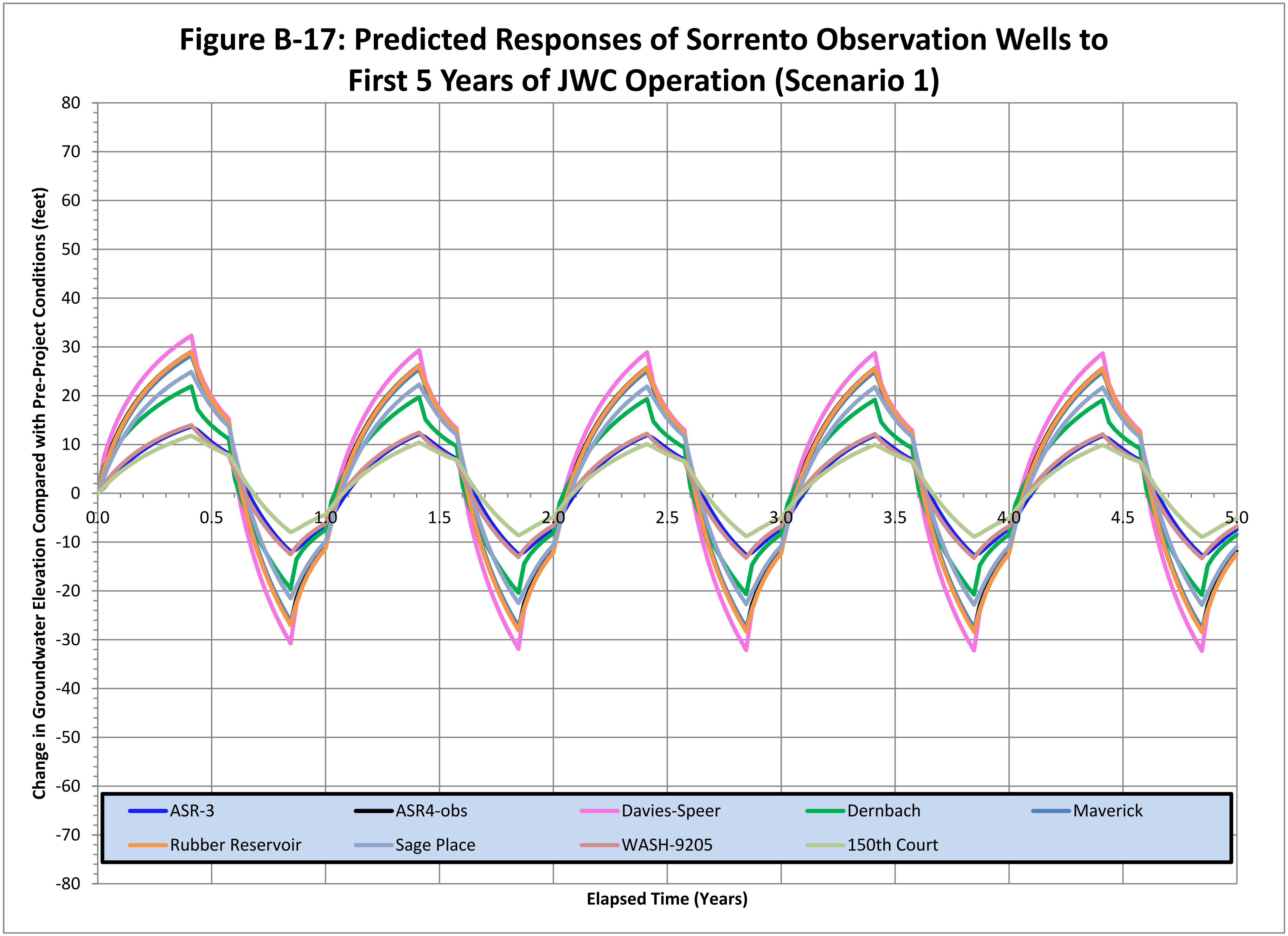
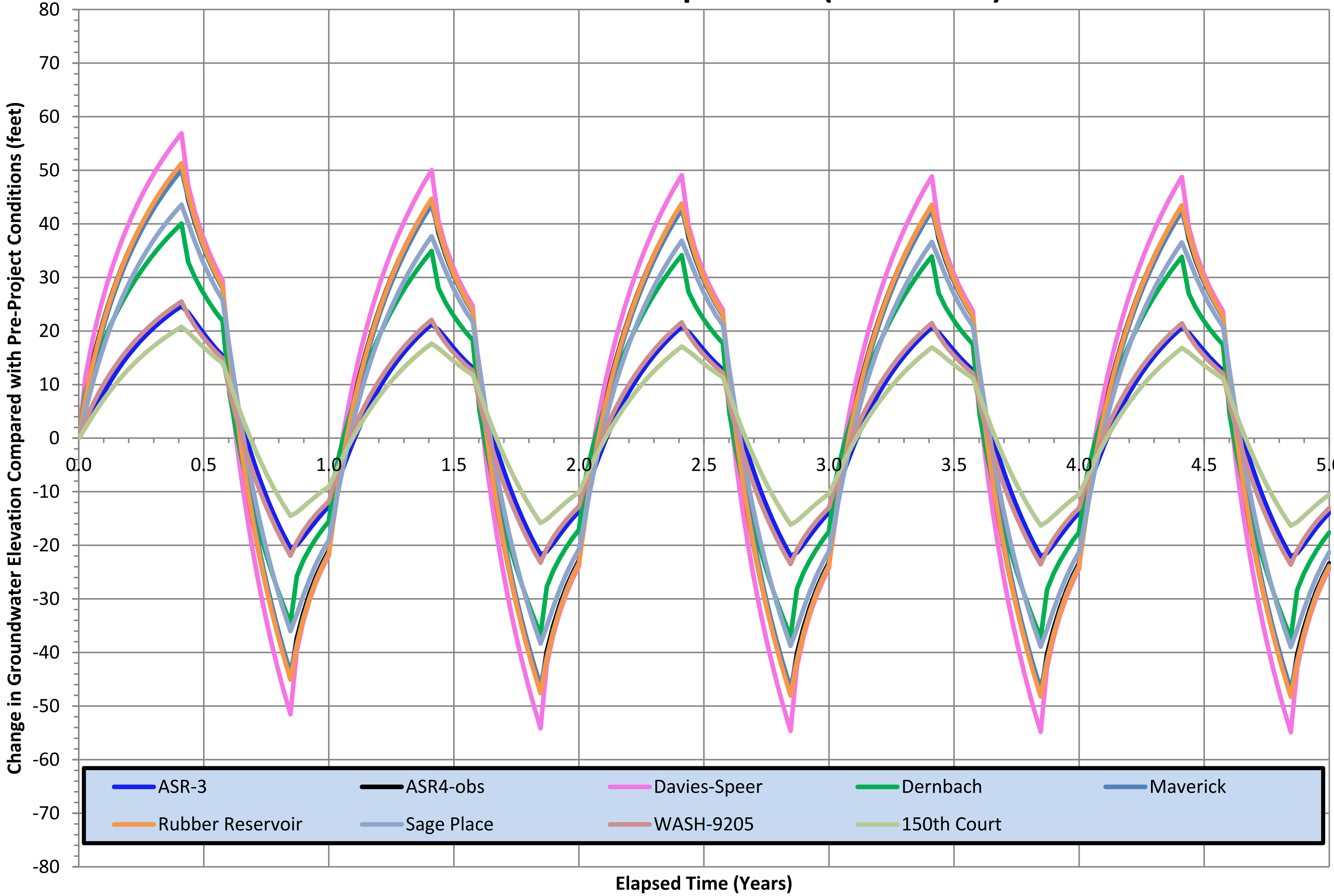


Figure B-17: Predicted Responses of Sorrento Observation Wells to
First 5 Years of JWC Operation (Scenario 1)
Change in Groundwater Elevation Compared with Pre-Project Conditions (feet)
Elapsed Time (Years)
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
ASR-3
ASR4-obs
Davies-Speer
Dernbach
Maverick
Rubber Reservoir
Sage Place
WASH-9205
150th Court

Figure B-18: Predicted Responses of Sorrento Observation Wells to First 5 Years of JWC Operation (Scenario 2)



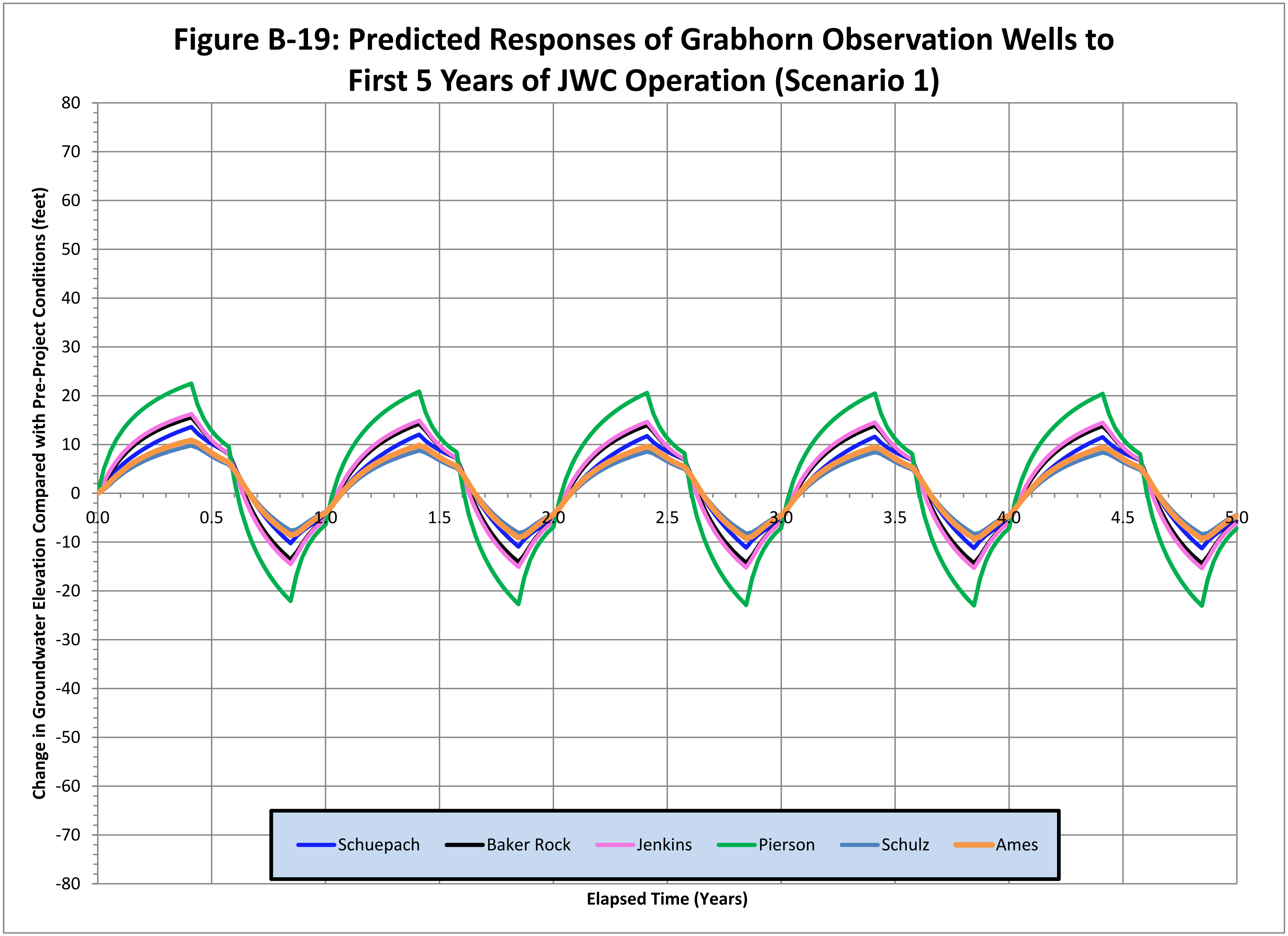


Figure B-19: Predicted Responses of Grabhorn Observation Wells to First 5 Years of JWC Operation (Scenario 1)
Change in Groundwater Elevation Compared with Pre-Project Conditions (feet)
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Elapsed Time (Years)
Schuepach
Baker Rock
Jenkins
Pierson
Schulz
Ames

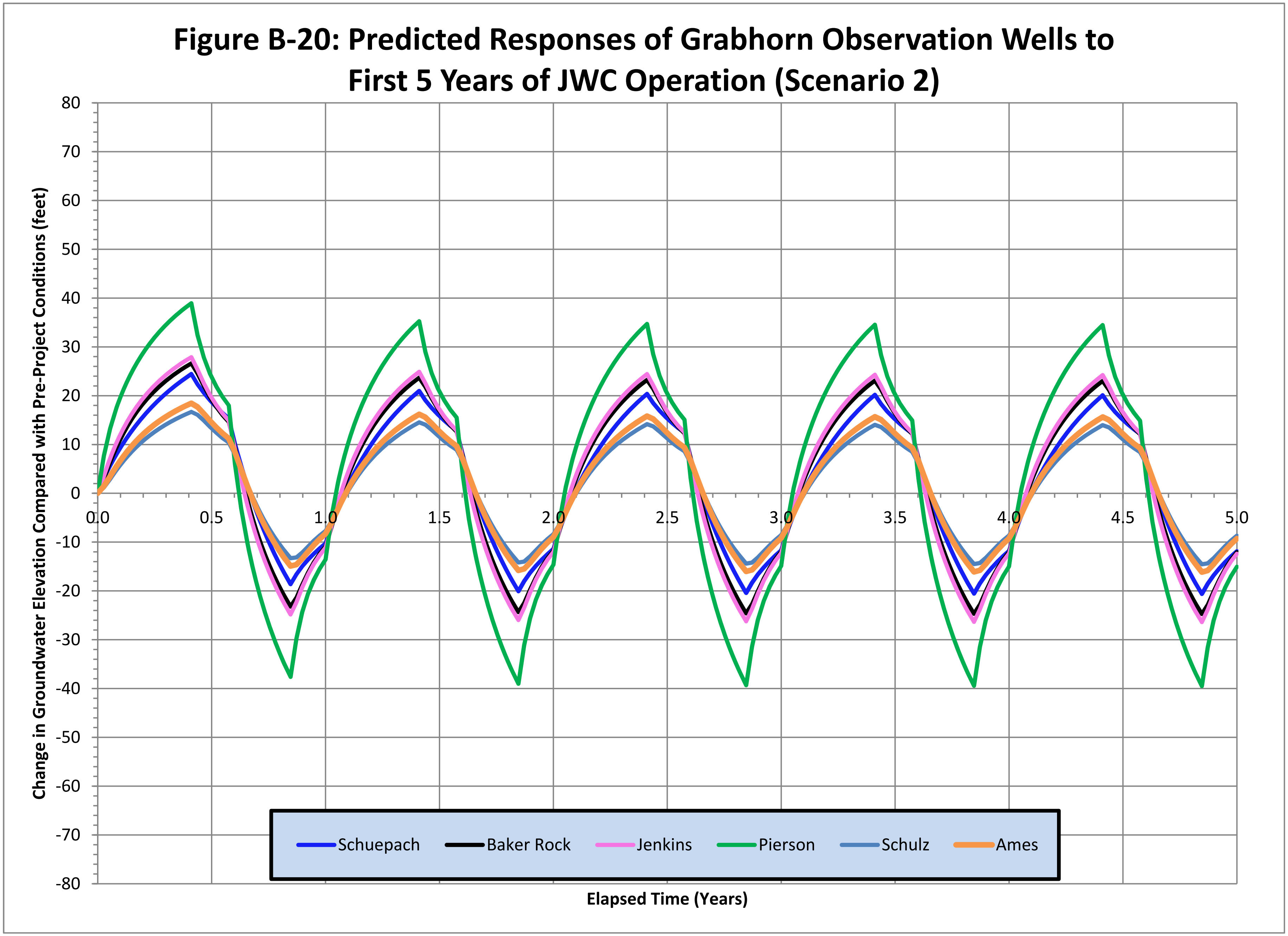


Figure B-20: Predicted Responses of Grabhorn Observation Wells to First 5 Years of JWC Operation (Scenario 2)
Change in Groundwater Elevation Compared with Pre-Project Conditions (feet)
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Elapsed Time (Years)
Schuepach
Baker Rock
Jenkins
Pierson
Schulz
Ames

Figure B-21: Predicted Responses of ASR-3 Observation Well to First 5 Years of JWC Operation (Scenarios 1 and 2)

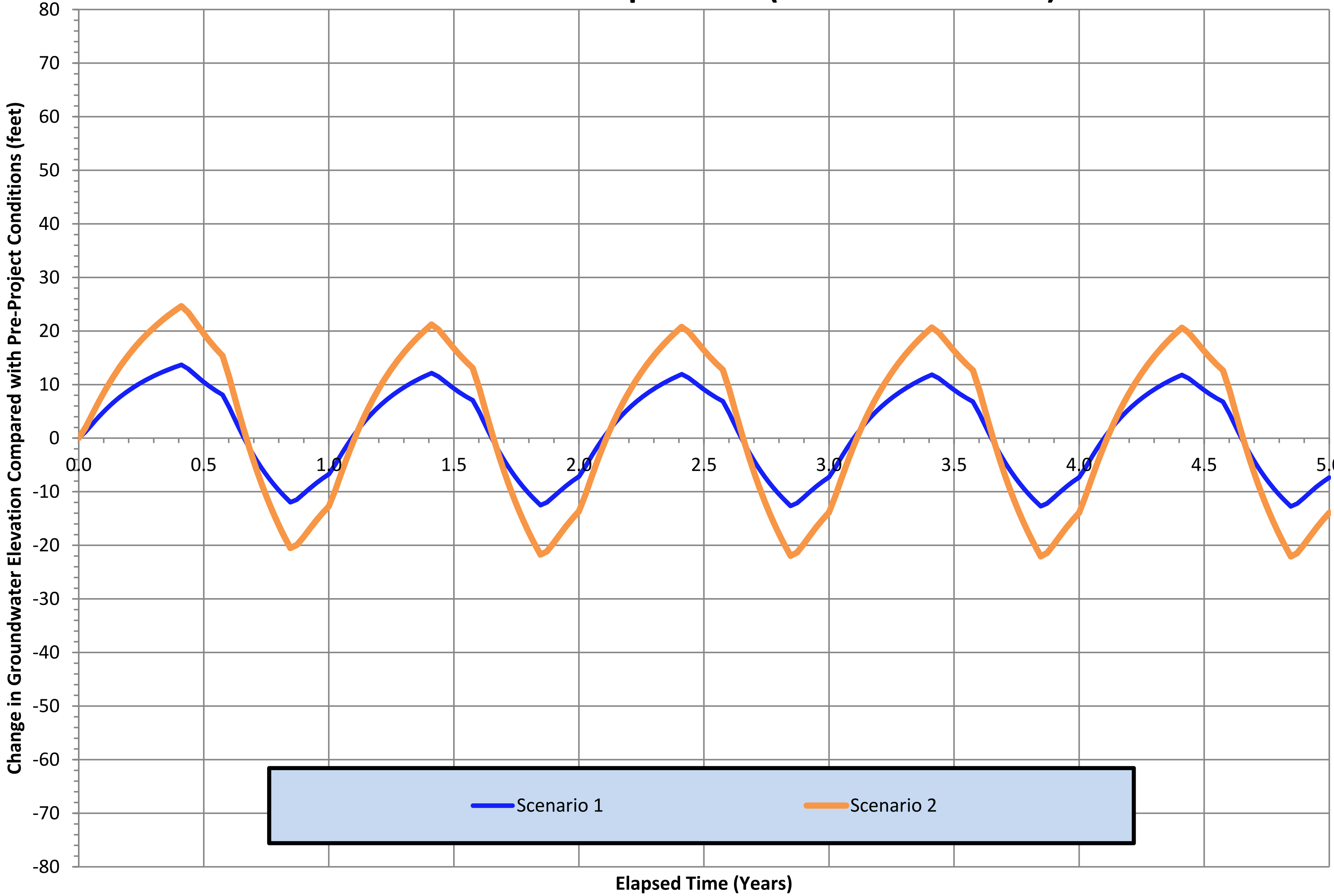


Figure B-22: Predicted Responses of ASR-4 Observation Well to First 5 Years of JWC Operation (Scenarios 1 and 2)

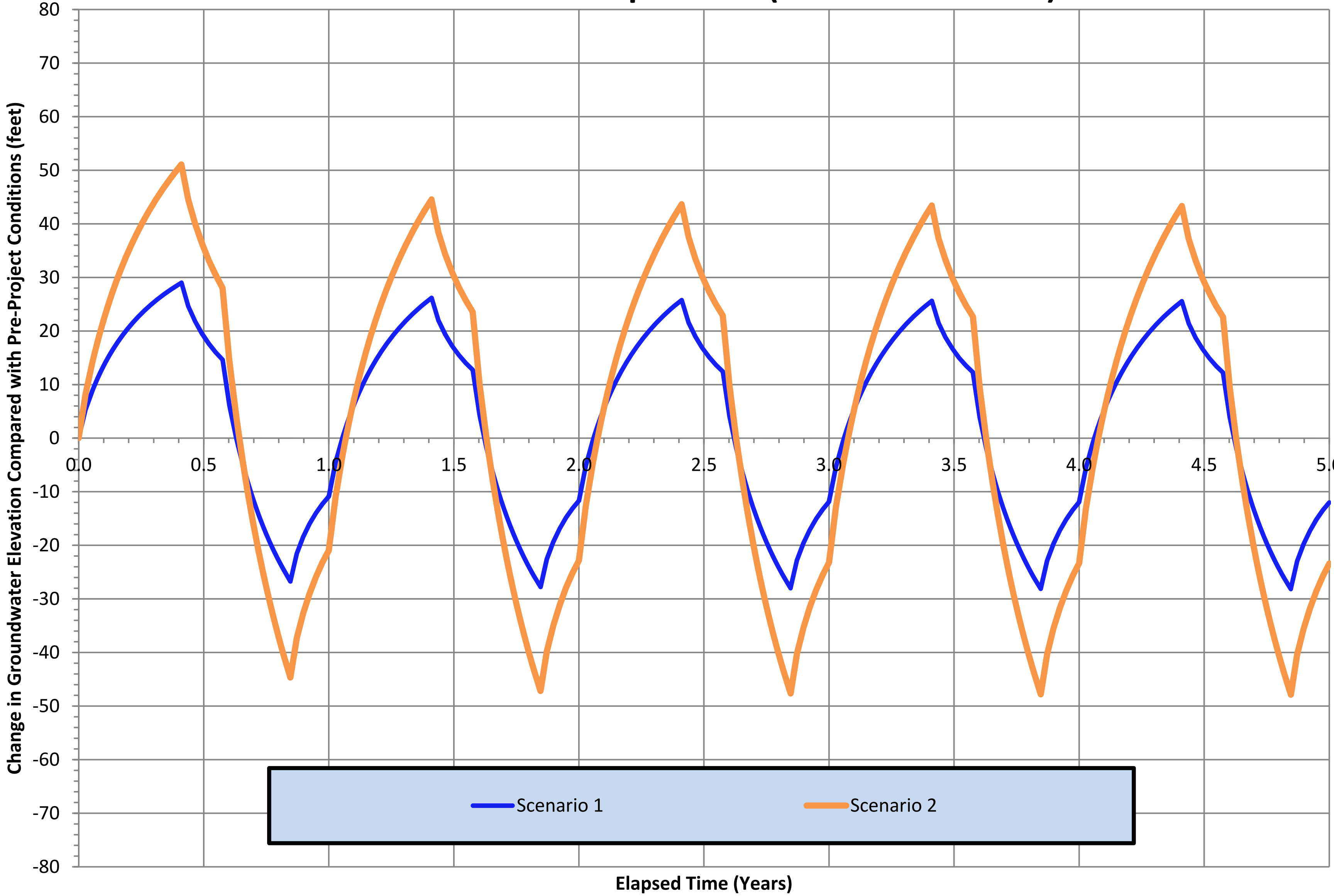
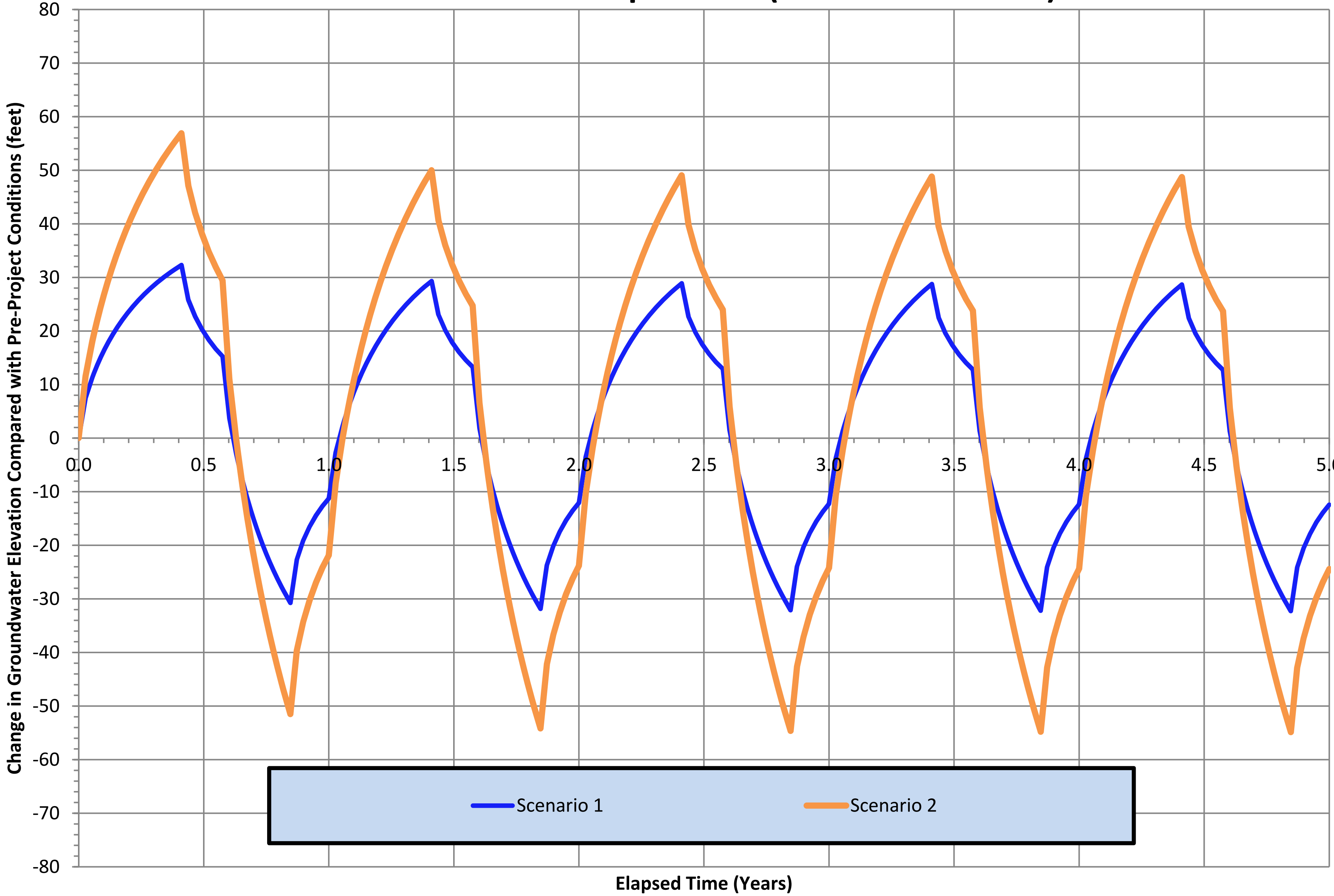


Figure B-23: Predicted Responses of Davies-Speer Observation Well to First 5 Years of JWC Operation (Scenarios 1 and 2)



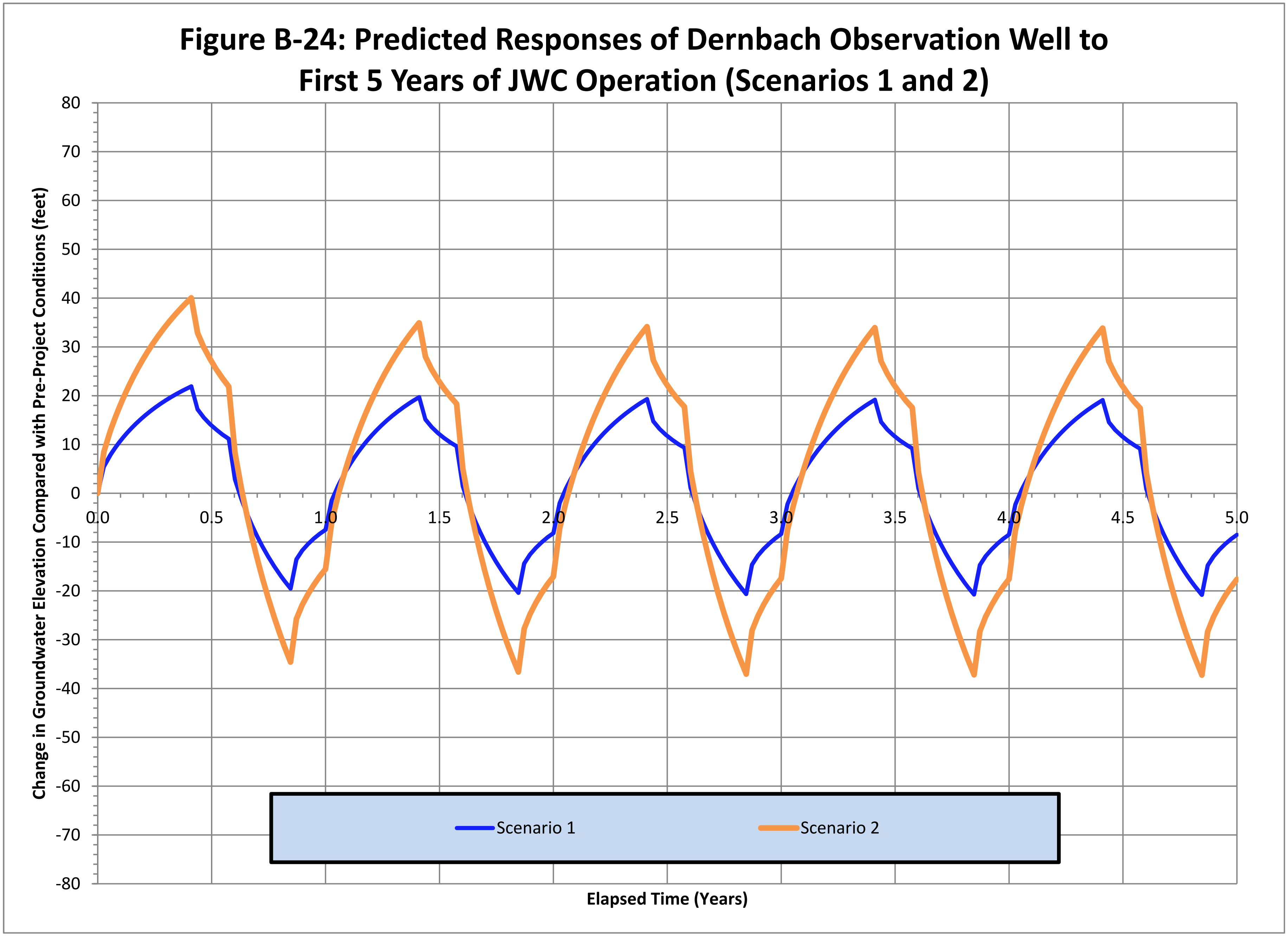
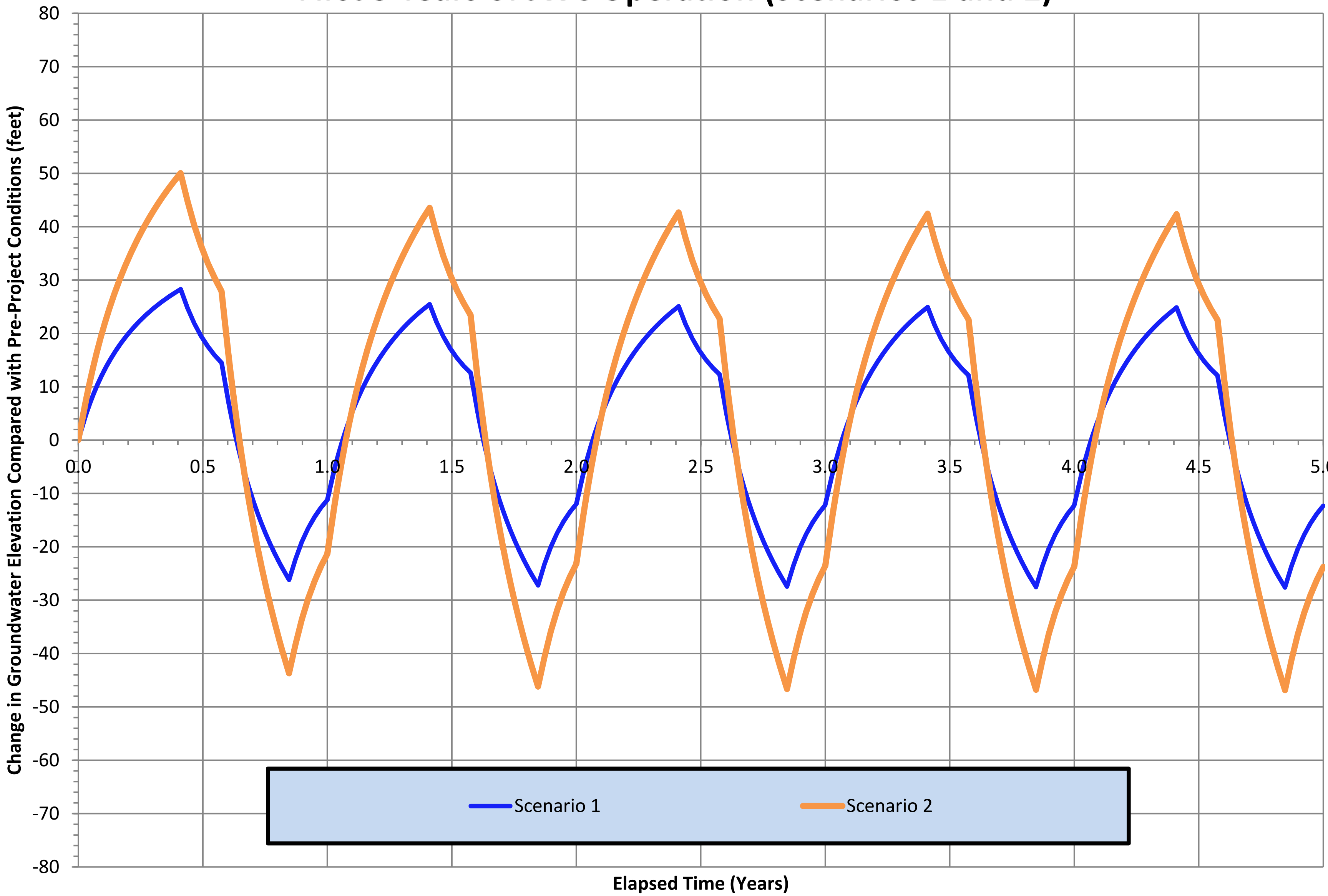


Figure B-24: Predicted Responses of Dernbach Observation Well to
First 5 Years of JWC Operation (Scenarios 1 and 2)
Change in Groundwater Elevation Compared with Pre-Project Conditions (feet)
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Elapsed Time (Years)
Scenario 1
Scenario 2

Figure B-25: Predicted Responses of Maverick Observation Well to First 5 Years of JWC Operation (Scenarios 1 and 2)



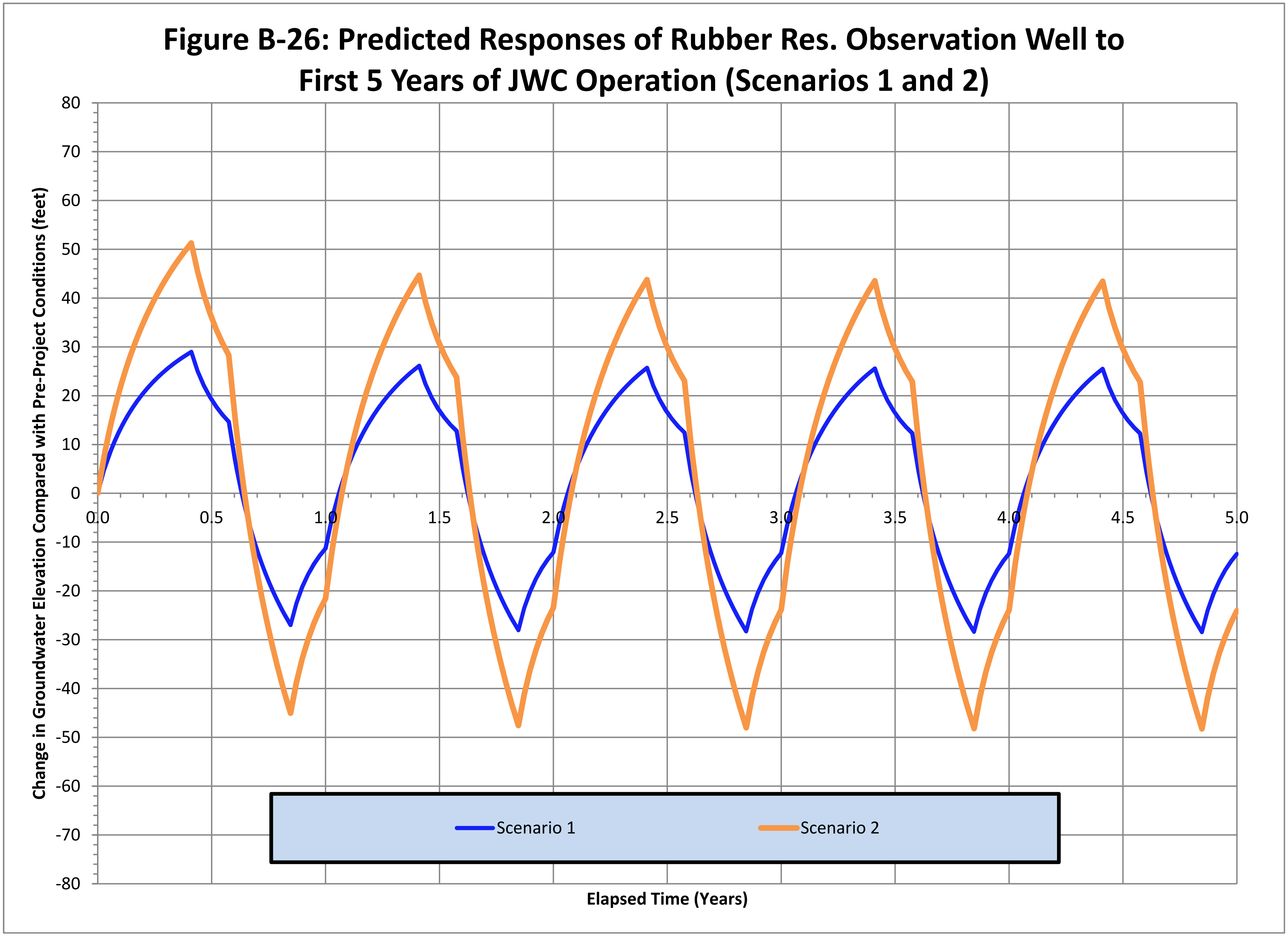
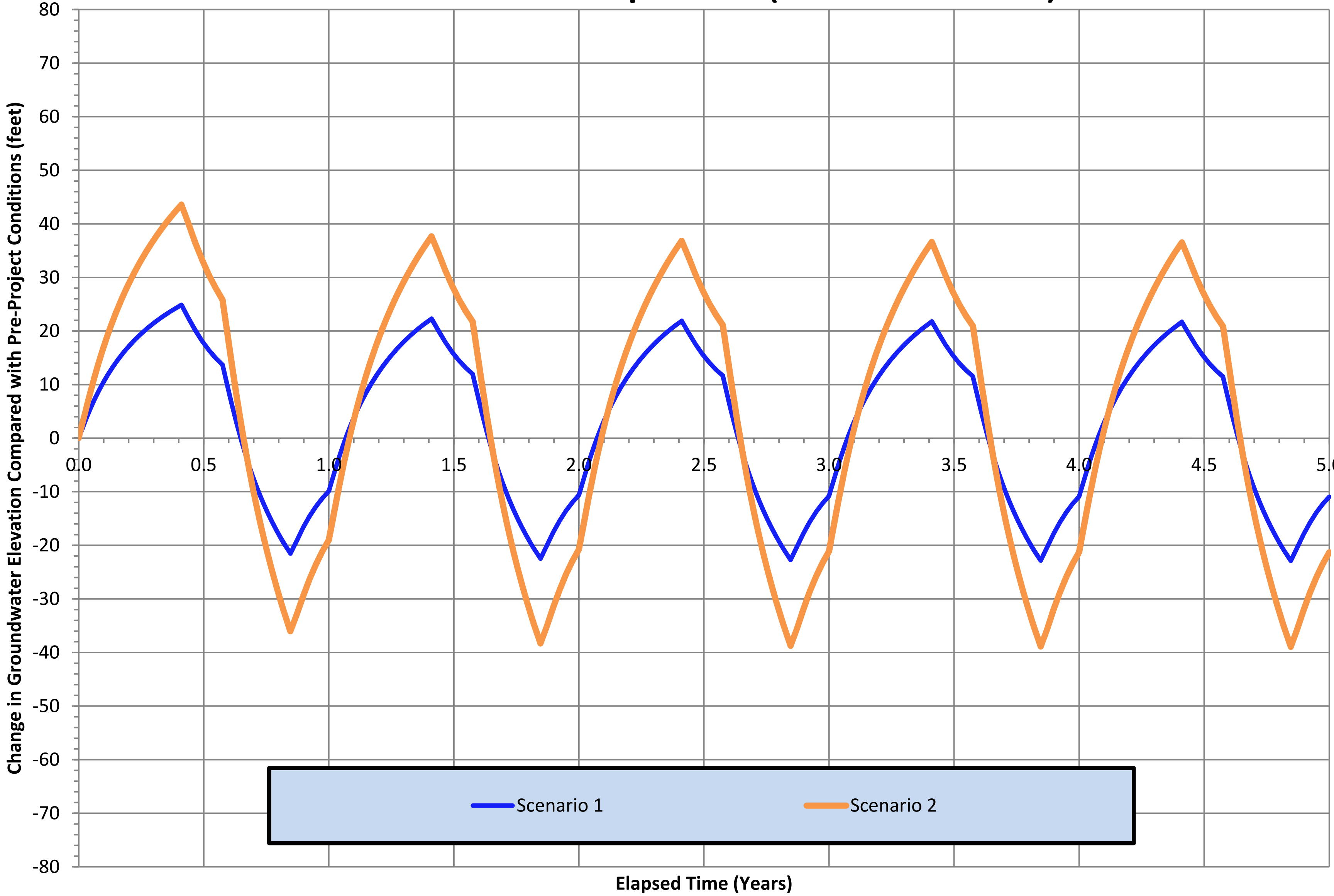


Figure B-26: Predicted Responses of Rubber Res. Observation Well to First 5 Years of JWC Operation (Scenarios 1 and 2)
Change in Groundwater Elevation Compared with Pre-Project Conditions (feet)
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Elapsed Time (Years)
Scenario 1
Scenario 2

Figure B-27: Predicted Responses of Sage Place Observation Well to First 5 Years of JWC Operation (Scenarios 1 and 2)



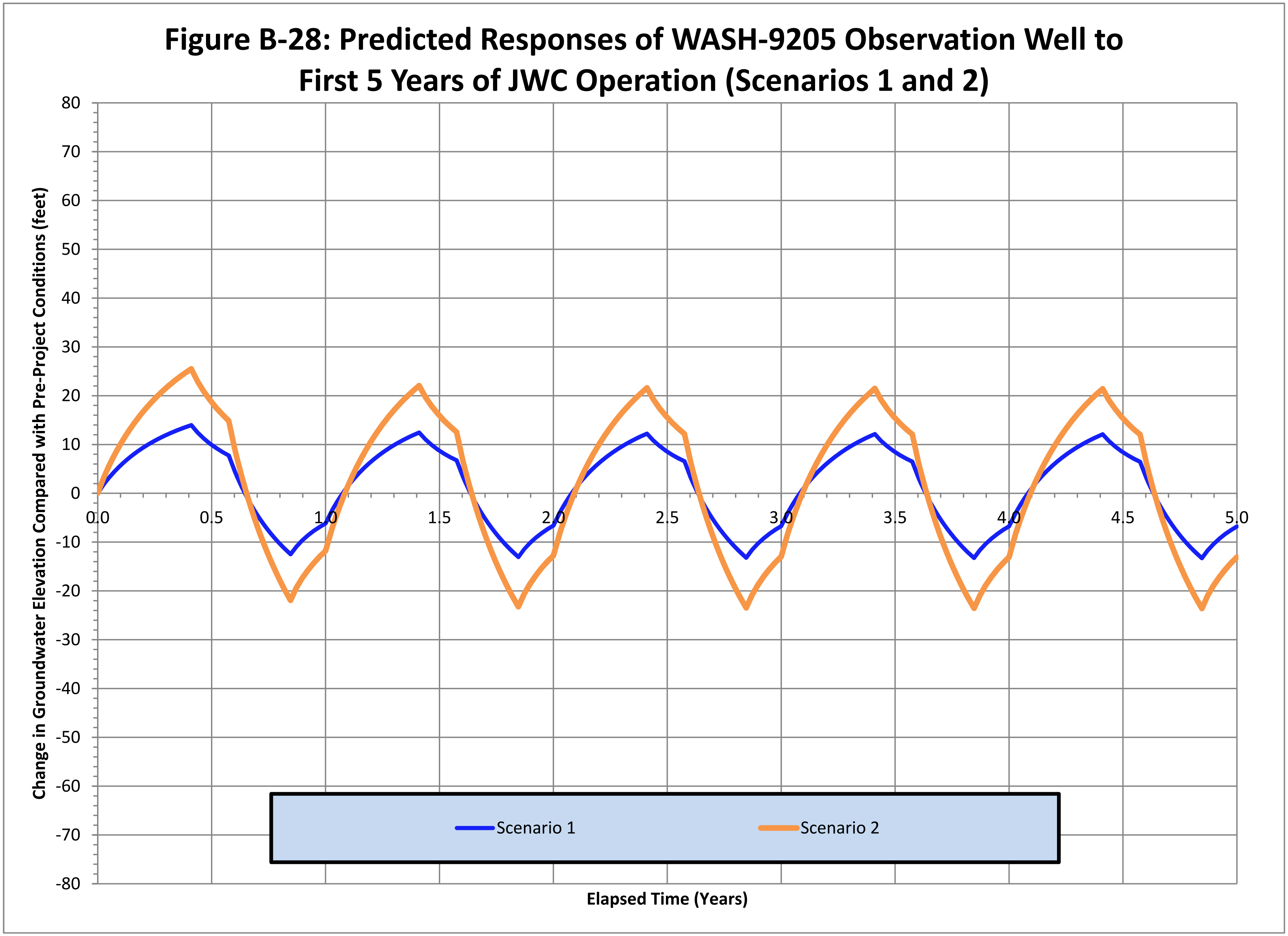


Figure B-28: Predicted Responses of WASH-9205 Observation Well to First 5 Years of JWC Operation (Scenarios 1 and 2)
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Change in Groundwater Elevation Compared with Pre-Project Conditions (feet)
Elapsed Time (Years)
Scenario 1
Scenario 2

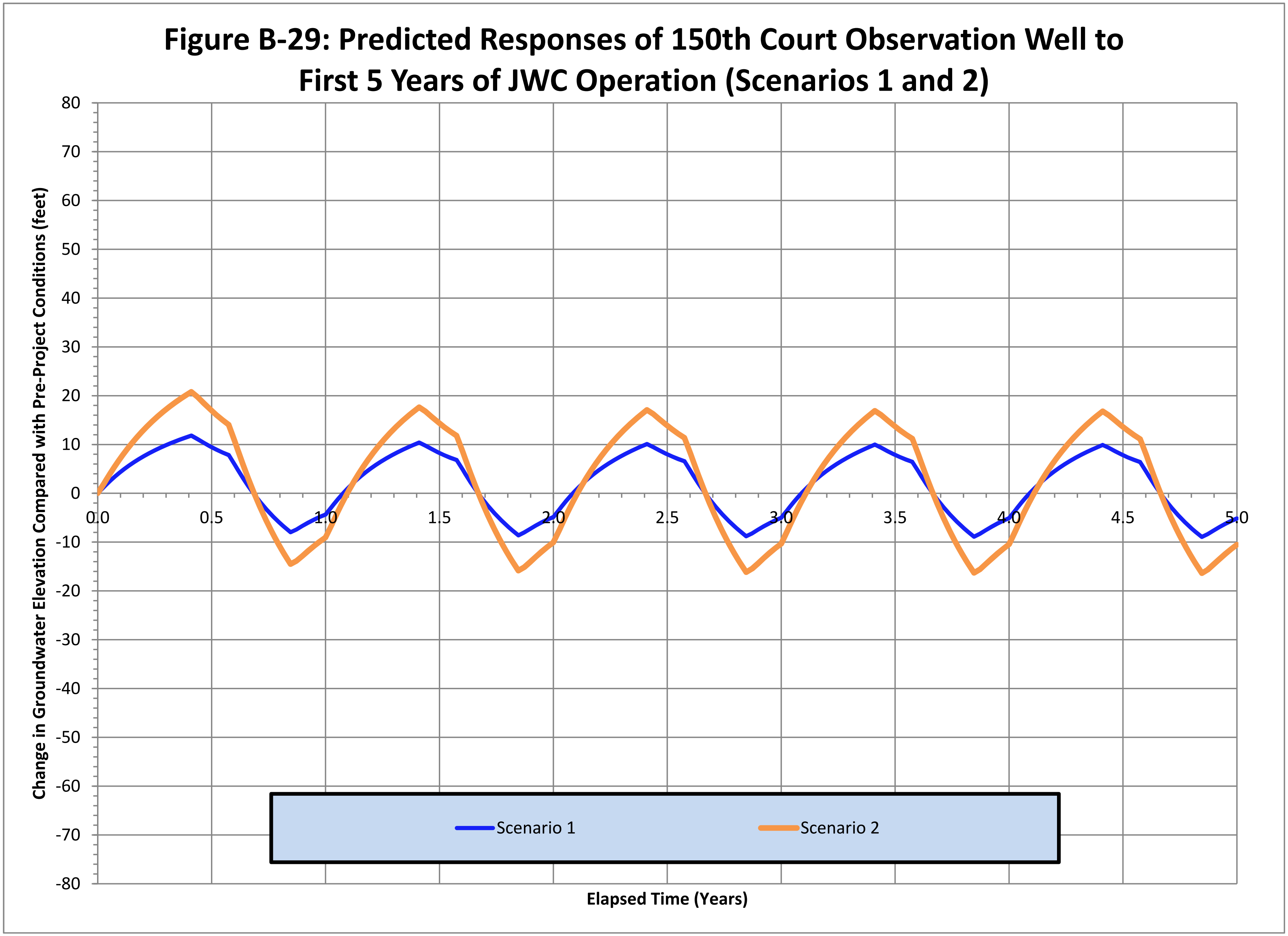
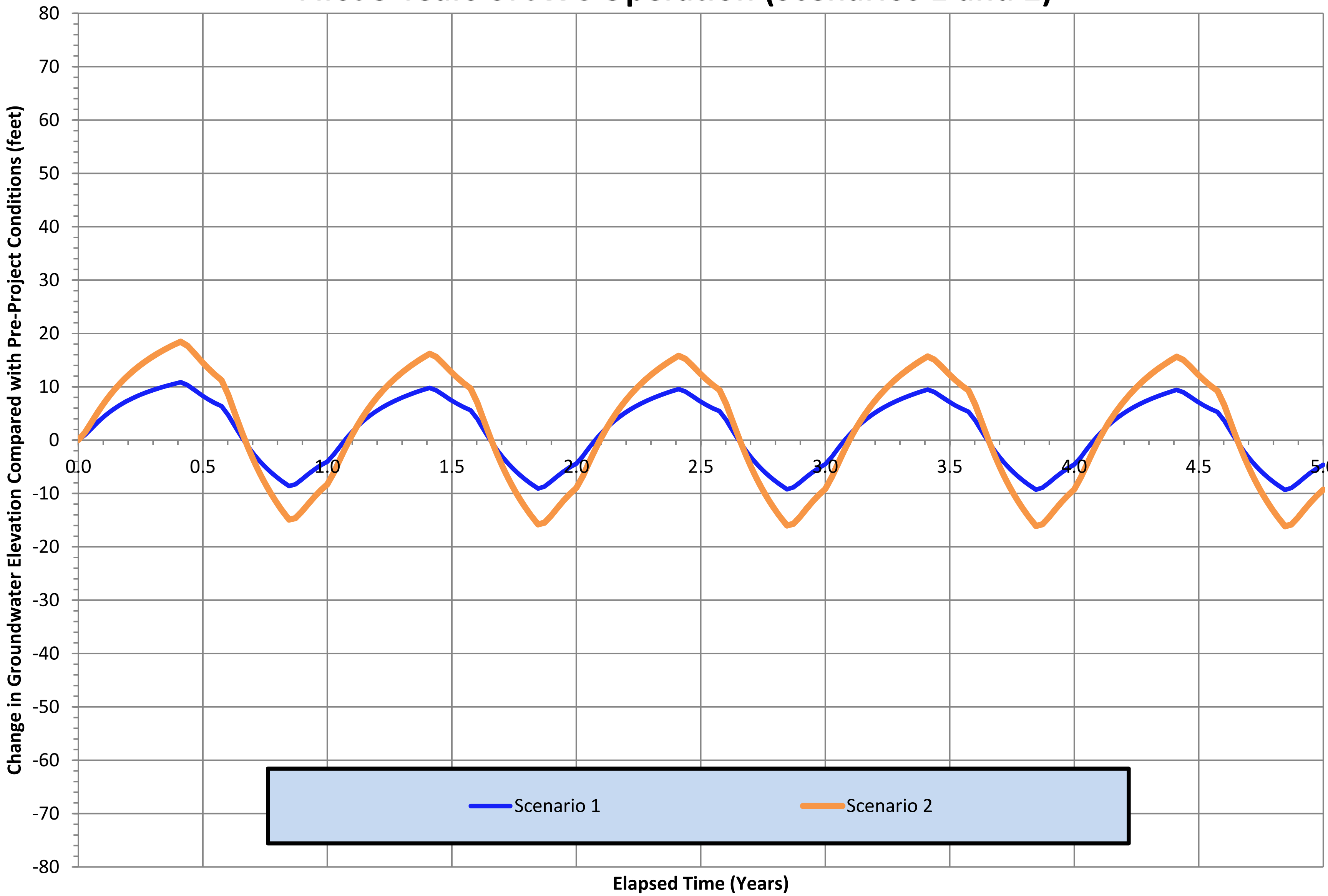


Figure B-29: Predicted Responses of 150th Court Observation Well to
First 5 Years of JWC Operation (Scenarios 1 and 2)
Change in Groundwater Elevation Compared with Pre-Project Conditions (feet)
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Elapsed Time (Years)
Scenario 1
Scenario 2

Figure B-30: Predicted Responses of Ames Observation Well to First 5 Years of JWC Operation (Scenarios 1 and 2)



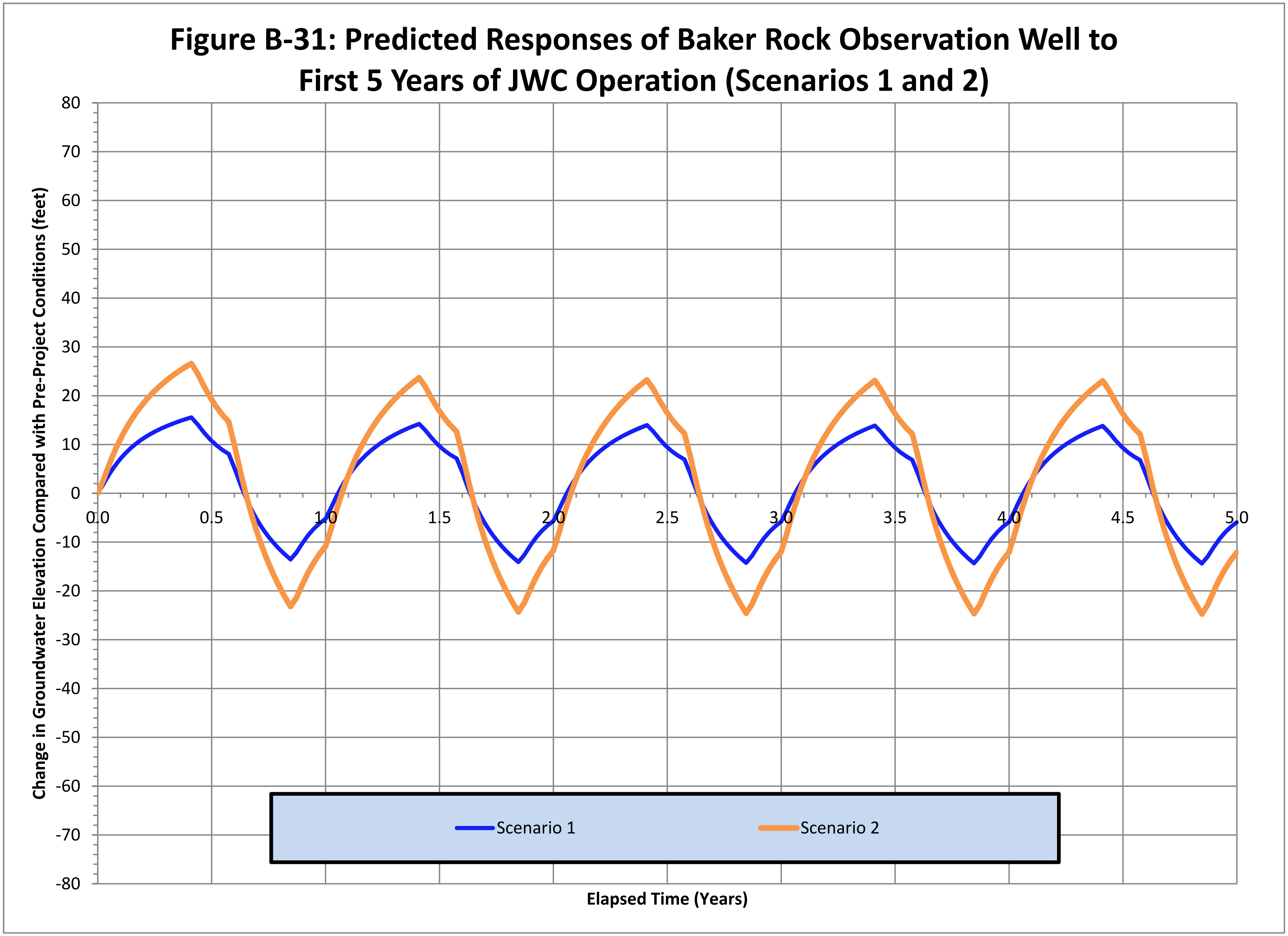


Figure B-31: Predicted Responses of Baker Rock Observation Well to First 5 Years of JWC Operation (Scenarios 1 and 2)
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Change in Groundwater Elevation Compared with Pre-Project Conditions (feet)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Elapsed Time (Years)
Scenario 1
Scenario 2

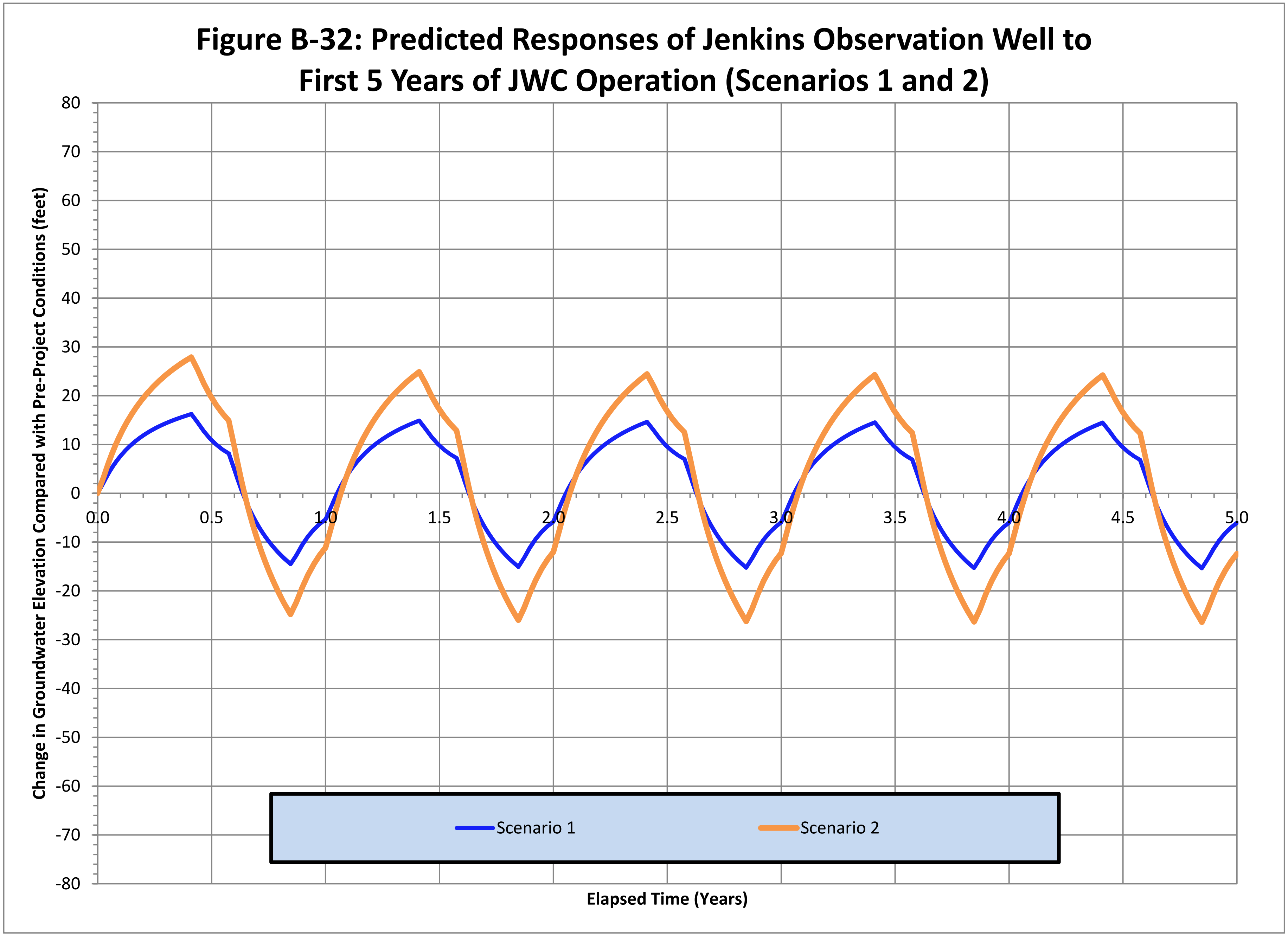
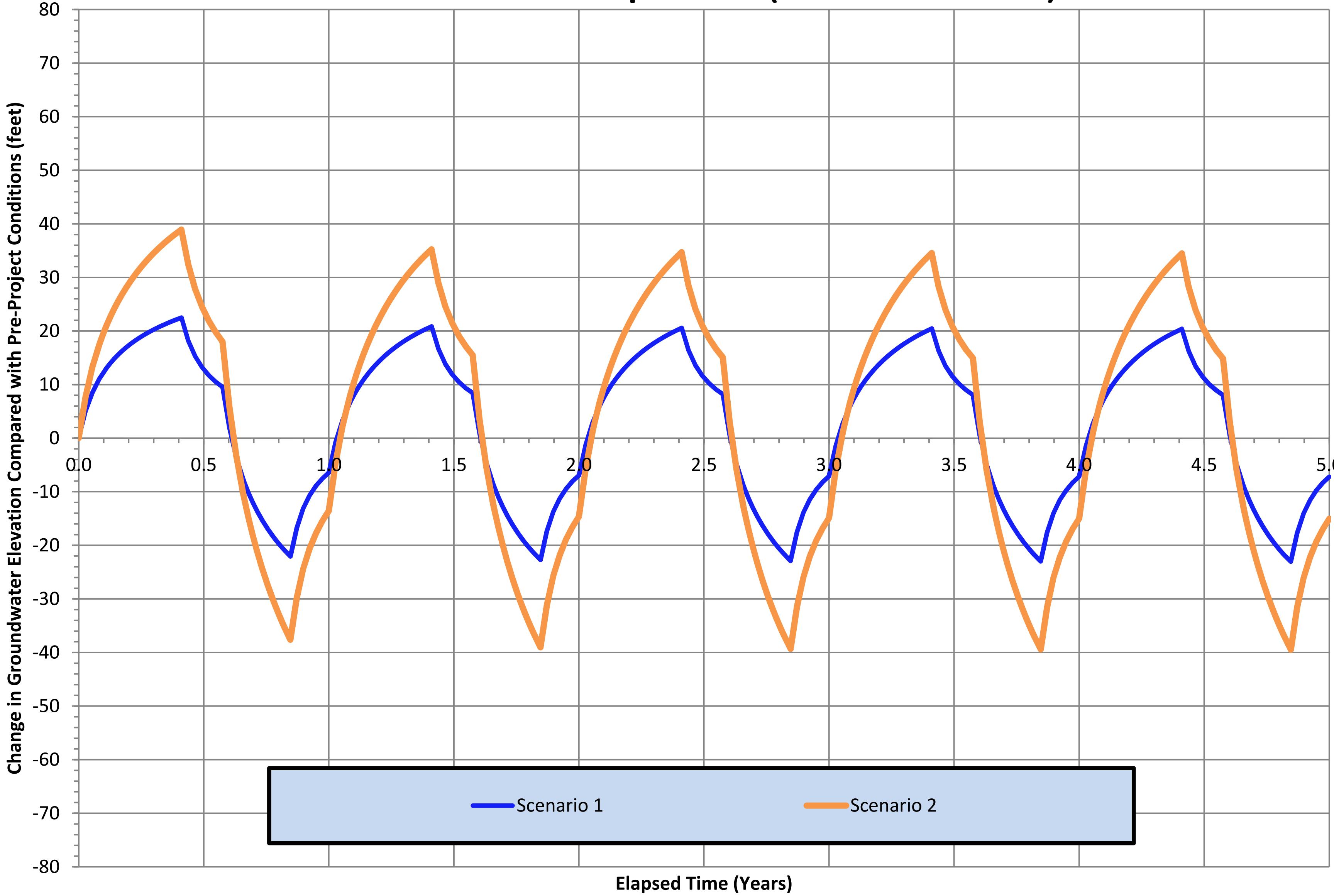


Figure B-32: Predicted Responses of Jenkins Observation Well to
First 5 Years of JWC Operation (Scenarios 1 and 2)
Change in Groundwater Elevation Compared with Pre-Project Conditions (feet)
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Elapsed Time (Years)
Scenario 1
Scenario 2

Figure B-33: Predicted Responses of Pierson Observation Well to First 5 Years of JWC Operation (Scenarios 1 and 2)



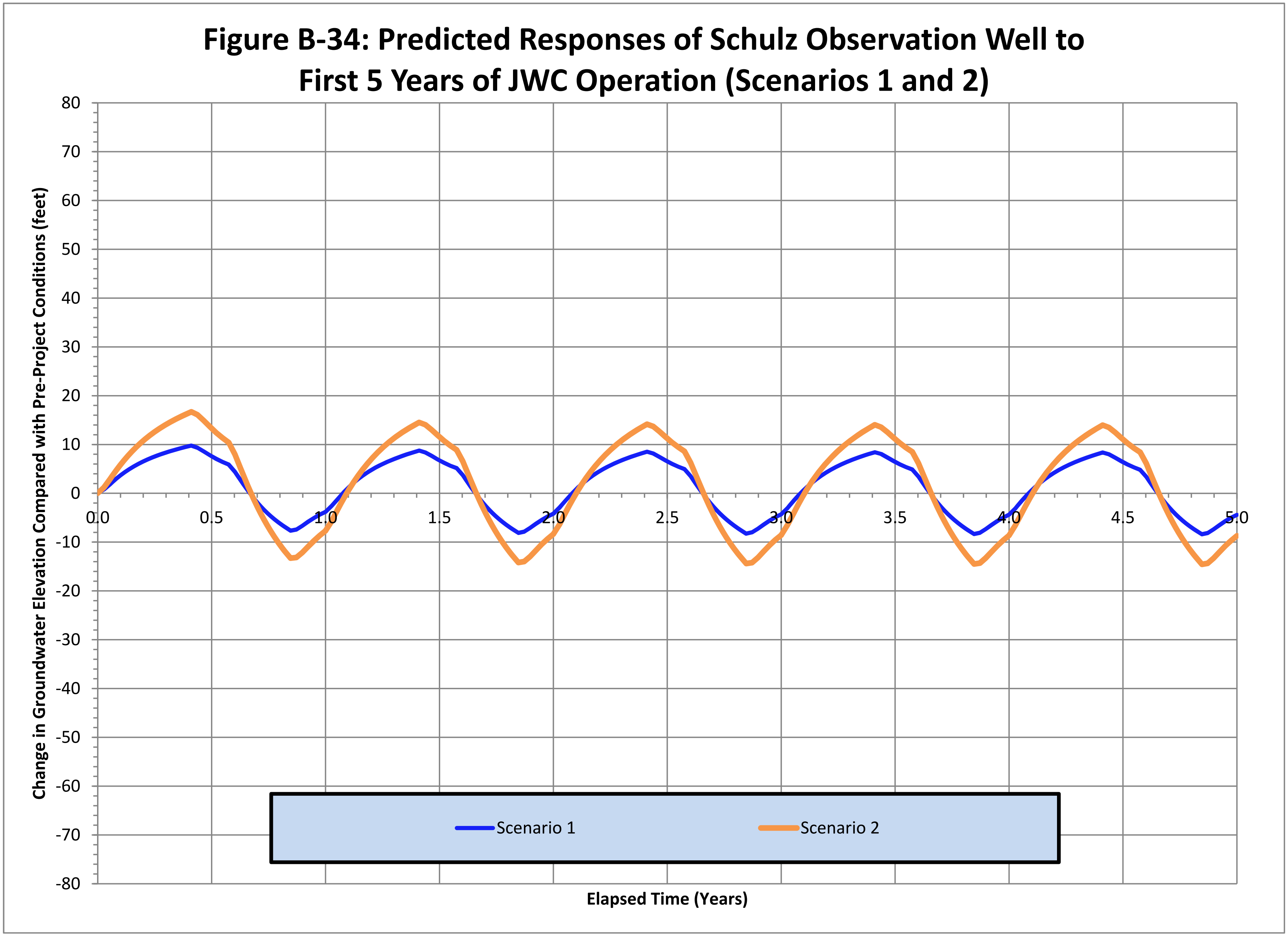


Figure B-34: Predicted Responses of Schulz Observation Well to First 5 Years of JWC Operation (Scenarios 1 and 2)
Change in Groundwater Elevation Compared with Pre-Project Conditions (feet)
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Elapsed Time (Years)
Scenario 1
Scenario 2

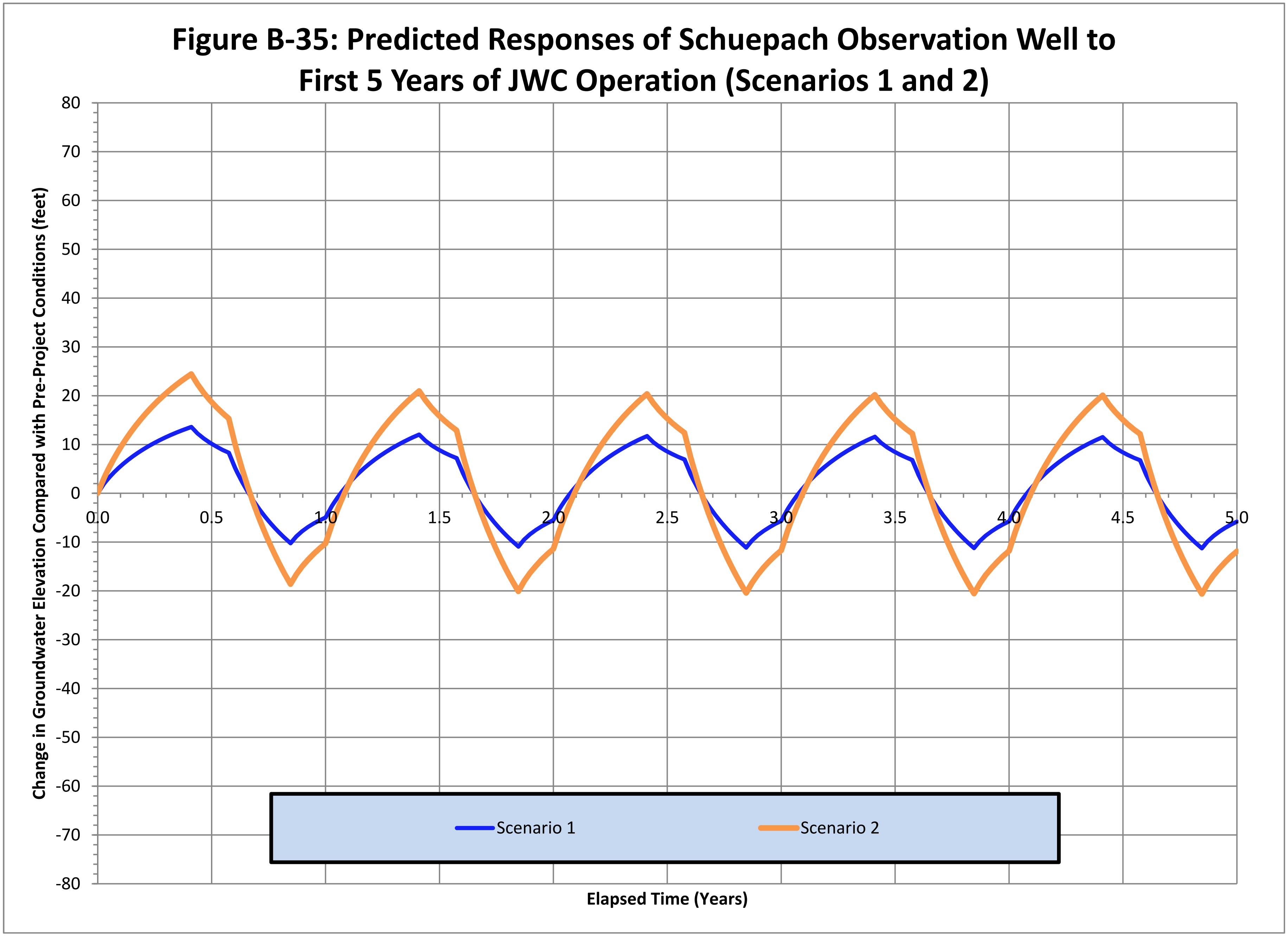
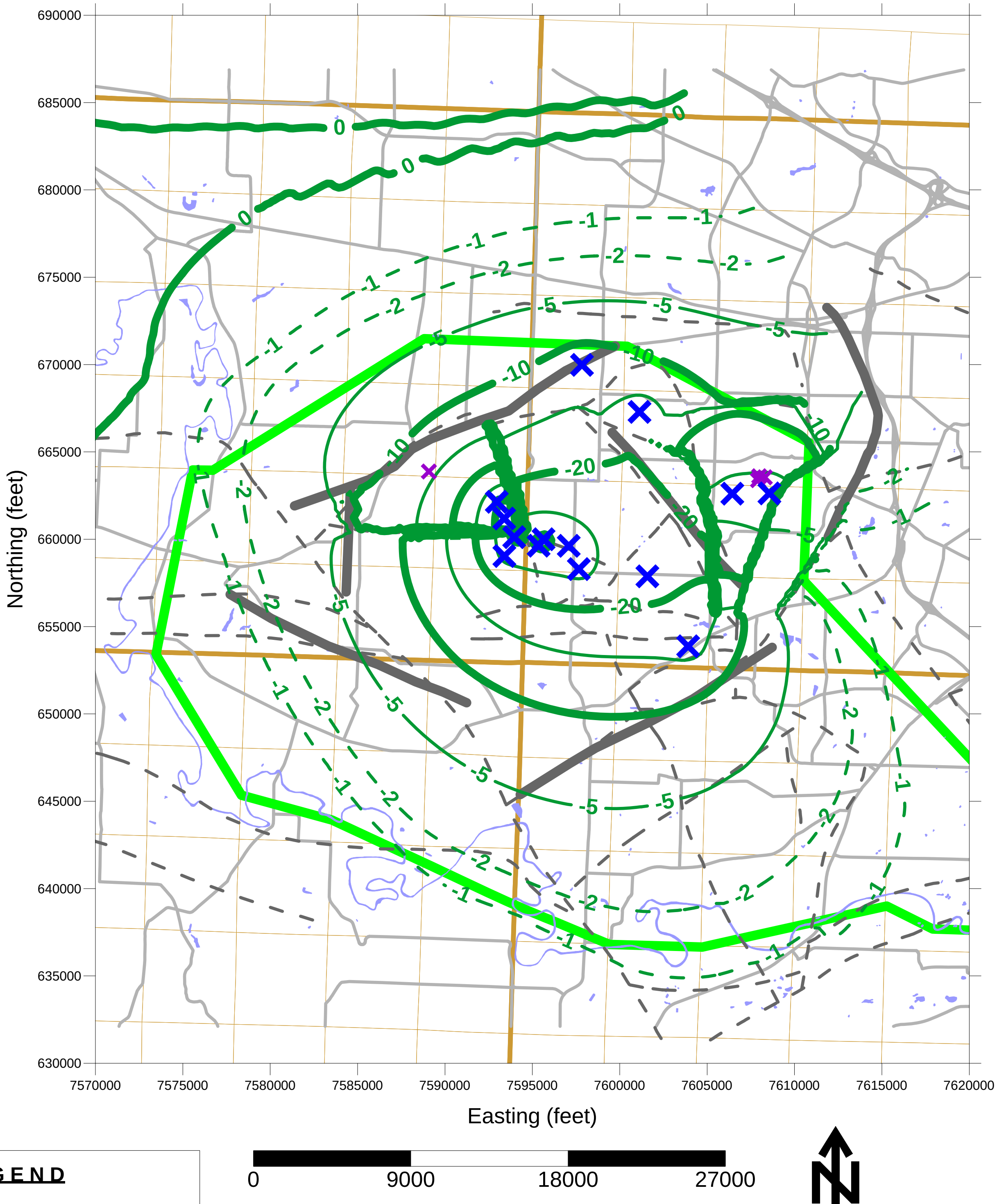
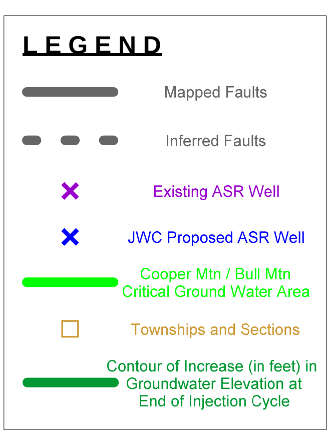


Figure B-35: Predicted Responses of Schuepach Observation Well to First 5 Years of JWC Operation (Scenarios 1 and 2)
Change in Groundwater Elevation Compared with Pre-Project Conditions (feet)
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Elapsed Time (Years)
Scenario 1
Scenario 2





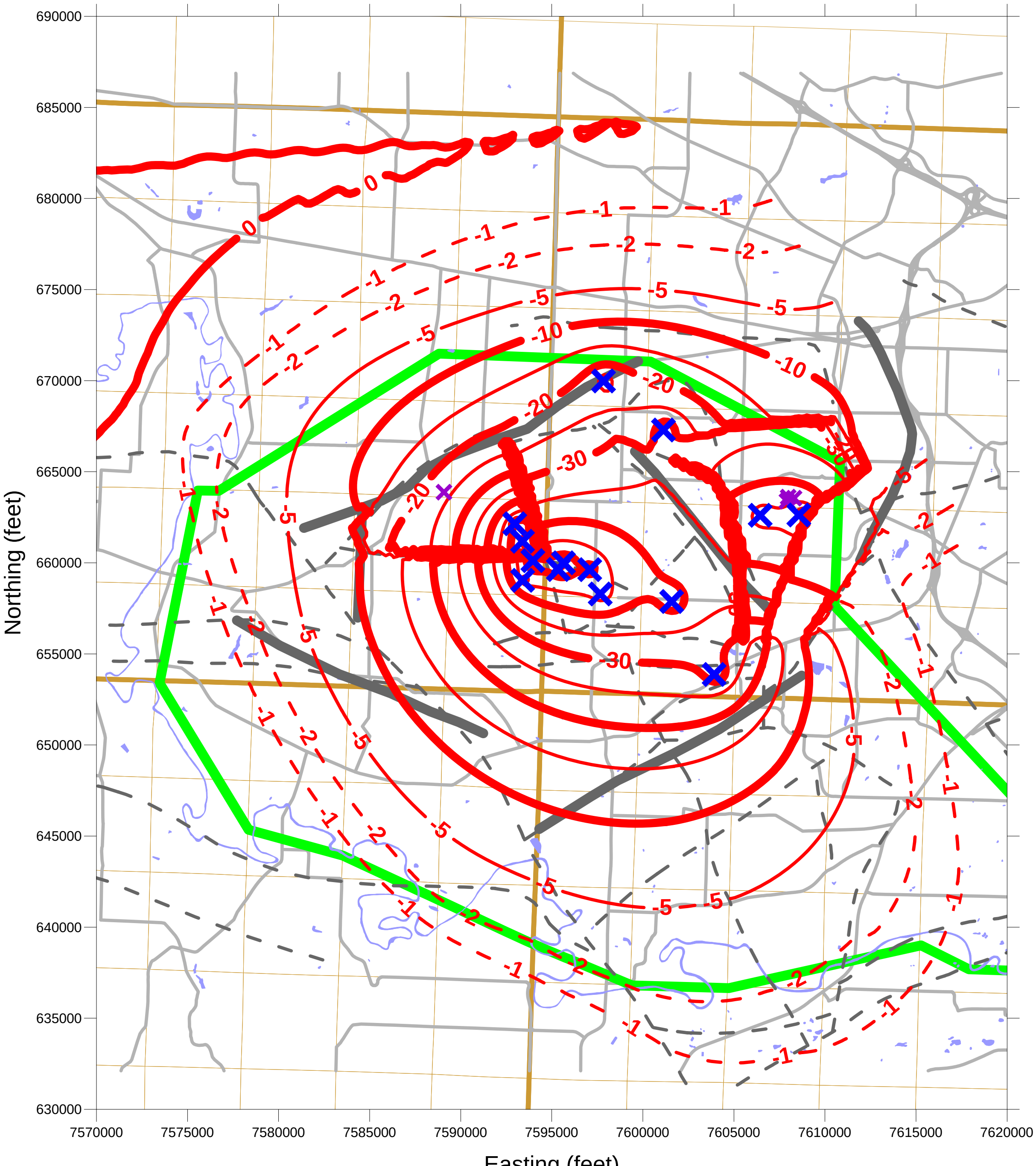
Note:
Contours Show Model-Computed Drawdown in Layer 15 of the Model.
Hence, Negative Values Indicate an Increase in the Groundwater Elevation.

Figure B-36

JWC Well Design Scenario 1
Model-Simulated Mounding During Peak Injection
at Full Build-Out of the JWC ASR Program

Joint Water Commission, Washington County, Oregon

GSI Water Solutions, Inc.



LEGEND

- Mapped Faults
- Inferred Faults
- Existing ASR Well
- JWC Proposed ASR Well
- Cooper Mtn / Bull Mtn Critical Ground Water Area
- Townships and Sections
- Contour of Increase (in feet) in Groundwater Elevation at End of Injection Cycle

Note:
Contours Show Model-Computed Drawdown in Layer 15 of the Model.
Hence, Negative Values Indicate an Increase in the Groundwater Elevation.

Figure B-37

JWC Well Design Scenario 2
Model-Simulated Mounding During Peak Injection
at Full Build-Out of the JWC ASR Program
Joint Water Commission, Washington County, Oregon

GSI Water Solutions, Inc.

Appendix C

Well Log ID	Notes	Well Tag No.	Well Owner Last Name	Well Owner First Name	Company Name	Depth to First Water	Depth Drilled	Completed Depth	Post Static Water Level	Completed Date	Work New	Work Abandon-ment	Work Deepening	Work Alteration	Use Domestic	Use Irrigation	Use Community	Use Live-stock	Use Industrial	Township	Range	Sctn	Qtr160	Qtr40	Tax Lot	Street of Well	Max Yield
WASH 8816			HAMAR	EDE		0	245	245	40	10/22/1986	X				X					1 S	1 W	15	SE	NE			11
WASH 58247		57589	MUESSIG	WAYNE	MUESSIG, BETTY															1 S	1 W	16	NW	SW		5470 SW MURRAY BLVD	
WASH 1030	Abandonment - unable to identify original log				HALIFAX CORPORATION	0	0	0	0			X			X					1 S	1 W	16	SW	SW		5600 SW MURRAY RD, BEAVERTON	
WASH 56072		42999			MR & MRS LOPEZ															1 S	1 W	16					
WASH 8827			BURRIS	BOBBY D		0	335	335	32	8/6/1966	X				X					1 S	1 W	16					7
WASH 8851					ST MARY'S OF THE VALLEY ACADEMY	0	1507	1100	18											1 S	1 W	17	NE				
WASH 8844/WASH 50267	Abandonment - original log likely identified		SHUTTO	ROSS D	K R WEST CONSTRUCTION	0	120	120	73/	12/29/1995	X	X			X					1 S	1 W	17	NW	NE	293	BLANTON AND 160TH	15
WASH 53221	Abandonment - unable to identify original log				D AND L EXCAVATING			0	36	1/28/1998		X			X					1 S	1 W	17	NW	SW	2701	16165 FARMINGTON RD, BEAVERTON	
WASH 55636	Abandonment - unable to identify original log				COUNTY OF WASHINGTON; FOWLER, JAMES W (C/O)			0		1/6/2000		X								1 S	1 W	17	NW	SW			
WASH 8861			PIKE	L F		0	90	90	0		X				X					1 S	1 W	17	SE	NE			
WASH 51685	Abandonment - unable to identify original log				THRIFTY PAYLESS CORP.			0	100	1/7/1997		X			X					1 S	1 W	17	SE	SE	900	14625 SW ALLEN BLVD, BEAVERTON	
WASH 54507		16382			TUALATIN VALLEY WATER DISTRICT	260	410	410	91.3	11/24/1998	X									1 S	1 W	17	SW	NE	2400	SCHUEPAC PARK	500
WASH 8862		100486			SCHUEPBACH BROTHERS	0	414	414	109	5/17/1959	X					X				1 S	1 W	17	SW	SE			1089
WASH 8846					WEST OREGON NURSERY	0	620	620	150	4/18/1960	X									1 S	1 W	17		SW			25
WASH 8845	Deepening - unable to identify original log		DERNBACH	C J		0	320	320	280	8/6/1960			X							1 S	1 W	17					9
WASH 62771	Abandonment - unable to identify original log				K AND G CONSTRUCTION		310	0	109	8/23/2005		X			X					1 S	1 W	18	NW	NW	300	18230 SW WHEELER COURT	
WASH 56816		47315	MAINELLA	JOHN	MAINELLA, SUSAN															1 S	1 W	18			2200	4725 SW 180TH AVE - ALOHA	
WASH 8897/WASH 55222	Abandonment - original log likely identified		SUNSERI	S V	MALNERICH CONSTRUCTION INC.	0	170/170	170/0	0/61	9/3/1999	X	X			X					1 S	1 W	19	NE	NE	1500	16830 SW OAK ST, BEAVERTON	
WASH 57966	Abandonment - unable to identify original log				RCI CONSTRUCTION GROUP			0	60	11/28/2001		X			X					1 S	1 W	19	NE	SW	14703	6815 SW 170TH AVE, BEAVERTON	
WASH 8904	Deepening - unable to identify original log		WISTRAND	MRS ARNOLD		0	196	196	81	7/28/1970			X		X					1 S	1 W	19	NE	SW			12
WASH 8908			NIELSON	HENRY		0	200	0	0		X					X				1 S	1 W	19	NE				
WASH 53250	Abandonment - unable to identify original log		FLAKER	STEVE	FLAKER, ROXANNE			0	31	2/12/1998		X			X					1 S	1 W	19	NW	SE	6600	7274 SW 171ST DR	
WASH 8910			AMSTAD	K		0	145	14	0		X				X			X		1 S	1 W	19	NW	SE			
WASH 8911			JOHNSON	SUSAN		0	125	120	65	8/4/1962	X				X					1 S	1 W	19	NW	SE			15
WASH 8898/WASH 8913	Deepening - original log likely identified		SCHURMAN/ MARTIN	W A/LEWIS C		0	71/253	325/73	60/116	4/1/1963	X		X		X	X				1 S	1 W	19	SE	NE			10
WASH 8912			CVOZIER	EDGAR F		0	308	308	85	7/9/1965	X				X					1 S	1 W	19	SE	NE			20
WASH 8915			BARRON	EDNA E		0	301	223	79	12/31/1944	X					X				1 S	1 W	19	SE	NE			100
WASH 8916			BARRON			0	312	0	100		X									1 S	1 W	19	SE	NE			
WASH 8890	Abandonment - unable to identify original log				L A DEVELOPMENT	0	220	0	0	9/28/1988		X								1 S	1 W	19	SE	NW			
WASH 8917			BURNETT	ARVIN A		0	283	75	150	12/31/1954	X					X				1 S	1 W	19	SE	NW			
WASH 3475	Abandonment - unable to identify original log				NOYES DEVELOPMENT; EQUITY GROUP (C/O)	0	0	0	0			X			X					1 S	1 W	19	SE	SE		COOPER MTN. PARK OFF 170TH	
WASH 8922			HIGGINS	J S		0	242	224	21	5/20/1947	X					X				1 S	1 W	19	SE	SE			10
WASH 8923					SCH DIST NO 94 OF WASHINGTON COUNTY	0	459	293	130	8/2/1954	X				X	X				1 S	1 W	19	SE	SE			55
WASH 8924					COOPER MOUNTAIN SCHOOL DISTRICT 3	0	150	0	0		X						X			1 S	1 W	19	SE	SE			
WASH 8925			BYRKIT	G PALMER		0	380	0	120	12/31/1953	X					X				1 S	1 W	19	SE	SE			12
WASH 8926/WASH 8894	Deepening - original log likely identified		BYRKIT/ BARTLAND	G PALMER/ WAYNE		380	380/20	380/400	178	4/8/1971			X	X	X					1 S	1 W	19	SE	SE			90
WASH 8927/WASH 8928/ WASH 3193	Deepening, likely abandoned		MILLER/ JACOBSEN	EARLE L/ CARL	GVS CONTRACTING INC.	0	220/320	176/320	15/135	7/23/1960	X	X	X		X					1 S	1 W	19	SE	SE	400	7750 SW 170TH, BEAVERTON	12
WASH 51753	Alteration - unable to identify original log	12338	YAMALOVA	LANA				165	60	1/17/1997				X	X					1 S	1 W	19	SW	NE	23	17600 SW BANEY RD, BEAVERTON	15
WASH 8901	Abandonment - unable to identify original log				PACESETTER HOMES INC.	0	0	0	0	2/27/1979		X								1 S	1 W	19	SW	NE			
WASH 8906/WASH 8907	Deepening		MAIXNEY	BENJAMIN R		0	165/114	165/114	119/55	8/29/1970	X		X		X					1 S	1 W	19	SW	NE			25
WASH 8918			SCHURMAN	WM A		0	253	253	0	12/31/1924	X					X				1 S	1 W	19	SW	NE			15
WASH 8921			BURNS	HENRY L		0	292	90	210	10/31/1953	X					X				1 S	1 W	19	SW	SE			
WASH 8919			MILLER	MORT		0	193	193	153	12/31/1952	X				X					1 S	1 W	19	SW	SW			
WASH 8905			KENNEDY	JAMES		195	308	308	208	3/7/1973	X				X					1 S	1 W	19	SW				20
WASH 8920/WASH 1661	Abandonment - original log likely identified		ERICKSON/ LANG	AXEL/ CHRIS D		0	215	215	185	6/10/1957	X	X			X					1 S	1 W	19	SW/SE	SW/NW	6900	17260 SW BANY RD, ALOHA	
WASH 8891/WASH 553	Deepening		OLSEN	LEE R		455	231/239	231/470	135/188	4/6/1973	X		X		X					1 S	1 W	19					30
WASH 8892			SCHINDLER	TED		120	245	245	110	6/19/1972	X				X					1 S	1 W	19					12
WASH 8893			ZUVER	WILBER		125	245	245	105	5/3/1972	X				X					1 S	1 W	19					15
WASH 8895	Deepening - unable to identify original log		JOHNSTON	JOHN J		0	132	132	100	5/15/1970			X		X					1 S	1 W	19					10
WASH 8896			JOHNSON	ERVEN		0	152	152	68	6/15/1967	X				X					1 S	1 W	19					10
WASH 8899			YOUNG	MANFORD		0	151	151	40	6/11/1960	X				X					1 S	1 W	19					8
WASH 8903			REAVIS	REGINALD W		0	264	0	57	12/31/1954	X				X					1 S	1 W	19					
WASH 8914			COOK	DONALD		0	211	211	43	9/3/1958	X				X					1 S	1 W	19					12
WASH 8956/WASH 555	Deepening		ELMER	PETER		240	152/243	152/243	85/136	8/21/1971	X		X		X					1 S	1 W	20	/SW	SE			12
WASH 8959	Deepening - unable to identify original log		UNIS	WALTER		0	90	90	0	8/8/1956			X		X					1 S	1 W	20	NE	NW			8
WASH 1793	Abandonment - unable to identify original log				RCR HOMES	0	0	0	0			X			X					1 S	1 W	20	NE	SE	5300	6835 SW TERRA DELMAR, BEAVERTON	
WASH 178			JARAMILLO	FRANCISCO		140	264	264	114	11/13/1990	X				X					1 S	1 W	20	NW	SE			17
WASH 8935/WASH 181	Deepening and Abandonment - deepening log likely identified		KOEHLER/ JARAMILLO	C C/ FRANCISCO		200	204	204	150	4/11/1972		X	X		X					1 S	1 W	20	NW	SE			5
WASH 8962			MATTSON	A R		0	210	0	0		X				X					1 S	1 W	20	NW	SE			
WASH 8963	Deepening - unable to identify original log		KOFFEL	C E		0	170	170	105	5/5/1958			X		X					1 S	1 W	20	NW	SE			15
WASH 8957	Deepening - unable to identify original log		DERNBACH	C J		0	410	410	312	10/20/1970			X		X					1 S	1 W	20	NW	SW			11
WASH 8961			DERNBACH	C J		0	279	0	268	12/31/1953	X				X					1 S	1 W	20	NW	SW			
WASH 61348	Abandonment - unable to identify original log				CRESTVIEW CONSTRUCTION		200	0	110	7/13/2004		X			X					1 S	1 W	20	SE	NW	1400	7075 SW 155TH AVE, BEAVERTON	
WASH 61350	Abandonment - unable to identify original log				CRESTVIEW CONSTRUCTION		200	0	180	7/7/2004		X			X					1 S	1 W	20	SE	NW	1300	7115 SW 155TH AVE, BEAVERTON	
WASH 8948/WASH 54570/ WASH 57938	Alteration and Abandonment	30217	BERRY	HARRY L	BERRY, RENATA/RUTAN CONSTRUCTION	145	157	157	60/112	11/19/2001	X	X		X	X					1 S	1 W	20	SE	NW	3700	7200 SW 155TH AVE, BEAVERTON	15
WASH 8967			ROPER	W E		0	167	167	54	9/20/1962	X				X					1 S	1 W	20	SE	NW			10
WASH 8969	Deepening - unable to identify original log		ALTIG	ELMER		0	110	0	34	5/17/1959			X		X					1 S	1 W	20	SE	NW			25
WASH 8970			EVANS	WALTER		0	180	180	83	6/20/1970	X				X					1 S	1 W	20	SE	NW			12
WASH 51341	Abandonment - unable to identify original log				HART RD DEVELOPMENT CORP.					10/3/1995		X								1 S	1 W	20	SE	SE	100	14570 SW HART RD	
WASH 8971			NONWELL	O C		0	138	0	0						X					1 S	1 W	20	SE	SE			
WASH 52068	Abandonment - unable to identify original log				BETON CONSTRUCTION		165	0		4/21/1997		X			X					1 S	1 W	20	SW	NE	800	NW CORNER 115TH AND HART, BEAVERTON	
WASH 8930	Deepening - unable to identify original log		ROPER	W E		0	155	155	53	7/11/1960			X		X					1 S	1 W	20	SW	NE			10

GSI Water Solutions, Inc.

Appendix C
Well Log Inventory in Area Affected by ASR Wells
Joint Water Commission Limited License Application

Well Log ID	Notes	Well Tag No.	Well Owner Last Name	Well Owner First Name	Company Name	Depth to First Water	Depth Drilled	Completed Depth	Post Static Water Level	Completed Date	Work New	Work Abandon-ment	Work Deepening	Work Alteration	Use Domestic	Use Irrigation	Use Community	Use Live-stock	Use Industrial	Township	Range	Sctn	Qtr160	Qtr40	Tax Lot	Street of Well	Max Yield
WASH 8966			BARRON	JACK L		0	276	233	78							X				1 S	1 W	20	SW	NW			
WASH 4162	Abandonment - unable to identify original log				KEMP CONSTRUCTION	0	0	0	0			X			X					1 S	1 W	20	SW	SE		7275 SW 155TH, BEAVERTON	
WASH 8968/WASH 61349	Abandonment - original log likely identified		MACARAEG	M B	CRESTVIEW CONSTRUCTION	0	160	160	54/140	7/12/2004	X	X			X					1 S	1 W	20	SW/SE	SE/NW	100	7015 SW 155TH AVE, BEAVERTON	20
WASH 8964/WASH 8965	Deepening		TERRY	G M		252	165	252/165	165/110	7/16/1972	X		X		X					1 S	1 W	20	SW/SW	NE			12
WASH 52815		7690	NIGHTINGALE	WILLIAM B																1 S	1 W	20			600	14965 SW DAVIS RD, BEAVERTON	
WASH 554	Deepening - unable to identify original log		DIGIORGIO	DON		263	138	335	165	5/8/1973			X		X					1 S	1 W	20					30
WASH 8931			HILLIARD	ELSIE C		0	110	260	130	1/15/1974				X	X					1 S	1 W	20					10
WASH 8932			KEEVER	H G		236	340	340	210	10/16/1973	X				X					1 S	1 W	20					18
WASH 8933	Deepening - unable to identify original log		BANKS	KENNETH W		138	64	185	123	10/30/1972			X		X					1 S	1 W	20					15
WASH 8936	Deepening - unable to identify original log		MATTSON	A R		0	310	310	186	12/1/1965			X		X					1 S	1 W	20					20
WASH 8937			MCCALLEN	CECIL W		204	400	400	196	6/9/1971	X				X					1 S	1 W	20					24
WASH 8939	Deepening - unable to identify original log		CRINKLAW	WAYNE E		178	125	260	111	6/21/1971			X		X					1 S	1 W	20					24
WASH 8940	Deepening - unable to identify original log				CAMP FIRE GIRLS	196	206	206	105	4/10/1971			X		X					1 S	1 W	20					10
WASH 8941					CODY AND CODY	96	320	320	80	7/9/1970	X				X					1 S	1 W	20					40
WASH 8942	Abandonment - unable to identify original log		SMITH	SCOTT		0	320	320	0	12/22/1988		X								1 S	1 W	20			460000000		
WASH 8944	Deepening - unable to identify original log		MERX	R H		0	110	210	90	3/9/1968			X		X					1 S	1 W	20					20
WASH 8945			TAYLOR	WM C		0	95	95	35	5/4/1967	X				X					1 S	1 W	20					10
WASH 8946			TAYLOR	WM C		0	95	95	55	6/2/1966	X				X					1 S	1 W	20					15
WASH 8947			TURNER	DONALD K		0	95	95	30	9/13/1965	X				X					1 S	1 W	20					15
WASH 8949/WASH 8943	Deepening - original log likely identified		PATRICK/ SEWARD	DEAN L/G A		0	150/60	150/210	39/150	11/26/1969	X		X		X					1 S	1 W	20					15
WASH 8951	Deepening - unable to identify original log		MITCHELL	BENSON C		0	275	275	80	6/23/1958			X		X					1 S	1 W	20					30
WASH 8952			SANDSTORM	HUGO		0	211	211	42	9/15/1958	X				X					1 S	1 W	20					12
WASH 8953			ROHRBACH	JOHN		0	190	190	40	6/11/1965	X				X					1 S	1 W	20					40
WASH 8955/WASH 8934	Deepening - original log likely identified	48315	COX/MCCOY	JAMES F/ LAWRENCE R		0	170/140	170/310	40/200	9/30/1972	X		X		X					1 S	1 W	20			4300	15575 SW BRIGHTON CT-BEAVERTON	25
WASH 8978						0	0	0	0	10/18/1958	X				X					1 S	1 W	21	NE	SW			
WASH 8977			CHARNESLEA	GEO		0	118	118	0	10/21/1956	X				X					1 S	1 W	21	SE	NE			15
WASH 8979			KELLY	J A		0	11	0	66.5						X					1 S	1 W	21	SE	NE			
WASH 8980			STEWART	ROBERT M		0	140	0	85							X				1 S	1 W	21	SE	NW			
WASH 8981			STEWARD	R M		0	96	45	73						X					1 S	1 W	21	SE	NW			
WASH 8982			BARLOW	MRS JAMES		0	0	0	59						X					1 S	1 W	21	SE	NW			
WASH 8976			KLOTZ	JOHN		0	395	395	80	2/9/1968	X					X				1 S	1 W	21	SE	SE			45
WASH 8985			WALTHER	H C		0	24	0	2											1 S	1 W	21	SE	SE			
WASH 8986			SHIRELY	ELINOR		0	141	21	0						X					1 S	1 W	21	SE	SE			
WASH 58005		54408			CITY OF BEAVERTON	270	480	477	216.4	12/3/2001	X									1 S	1 W	21	SE	SW	1800	13450 SW HANSON RD	100
WASH 61319		58870			CITY OF BEAVERTON	185	482	482	120	6/2/2004	X									1 S	1 W	21	SE	SW	1800	13450 SW HANSON RD	225
WASH 64529		54408			CITY OF BEAVERTON			477		8/24/2006				X			X			1 S	1 W	21	SE	SW	1800	13450 SW HANSON RD	
WASH 8983			HANSEN	A E		0	124	4	99.5						X					1 S	1 W	21	SE	SW			
WASH 8987/WASH 58898	Abandonment - original log likely identified		WOODWORTH	GUY	WAYNE JESKY CONSTRUCTION CO.	0	164	162	153	10/25/2002		X								1 S	1 W	21	SE	SW	1300	13450 SW HANSON RD, BEAVERTON	
WASH 55918		33784			CITY OF BEAVERTON	200		484	200	4/13/2000	X						X			1 S	1 W	21	SW	SE	200	7770 SW 136TH AVE	1730
WASH 57507		33784			CITY OF BEAVERTON		10	0		7/13/2001				X			X			1 S	1 W	21	SW	SE	200	7770 SW 136TH AVE	
WASH 8988					CITY OF BEAVERTON	0	800	800	170								X			1 S	1 W	21	SW	SE			
WASH 11894					MIESEN BROS. PARTNETSHIP	316	340	340	10	11/30/1979	X				X					1 S	1 W	21					50
WASH 8972					BEAVERTON CHRISTIAN CHURCH	145	355	355	80	9/11/1971	X									1 S	1 W	21					25
WASH 8973			HOLTZ	JOHN		0	207	207	90	6/24/1965	X				X					1 S	1 W	21					14
WASH 9054/ WASH 62474	Abandonment				SAWYERS INC./ HARSCH INVESTMENT PROPERTIES	0	160	160	32	12/31/1950		X							X	1 S	1 W	27	NE	SE	100	8585 SW CASCADE AVE, BEAVERTON	20
WASH 9051			FAUNCO	FRANK		0	110	110	15	8/30/1965	X				X					1 S	1 W	27	NE				45
WASH 9055			THOMAS	R J		0	124	120	0		X				X			X		1 S	1 W	27	SE	SE			
WASH 9053			MURPHY	ROBERT		0	314	280	0		X									1 S	1 W	27	SW				
WASH 9050			LEE	PHILLIP MR & MR		0	81	81	34	5/21/1969	X				X					1 S	1 W	27					50
WASH 9052	Deepening - unable to identify original log		GRACE	S G		0	93	93	20	12/7/1959			X		X					1 S	1 W	27					7
WASH 9068			BRANDT	FRED		0	126	35	46						X					1 S	1 W	28	NE	SW			
WASH 9069	Deepening - unable to identify original log		BRANDT	FRED		0	186	186	141	8/27/1958			X		X					1 S	1 W	28	NE	SW			7
WASH 9064			BRIMLEY	G G		0	310	234	2						X					1 S	1 W	28	NE				
WASH 9067	Deepening - unable to identify original log		JENKINS	O C		0	183	183	137	8/23/1958			X		X					1 S	1 W	28	NW	SE			5
WASH 9065			BLETHEN	B F		0	105	64	84						X			X		1 S	1 W	28	NW				
WASH 9056	Abandonment - unable to identify original log				L E C PARTNERSHIP	0	0	0	0	10/5/1989		X								1 S	1 W	28	SE	NE			
WASH 61405	Abandonment - unable to identify original log				G V S MADISON PARK PORJECT			0	17	8/9/2004		X			X					1 S	1 W	28	SE	NW	1900	9205 SW 130TH, BEAVERTON	
WASH 9060			BROWN	CLARENCE B		0	175	175	51	8/17/1963	X				X					1 S	1 W	28	SE	SW			19
WASH 9076			DEROSSETT JR	ARMAND JOHN		0	360	360	88	12/31/1948	X					X				1 S	1 W	28	SE	SW			
WASH 9072	Deepening - unable to identify original log		DOBAJ	HENRY S		0	57	237	135	1/5/1963			X		X					1 S	1 W	28	SW	NW			15
WASH 9073			DAVIS	GEORGE		0	0	0	11											1 S	1 W	28	SW	NW			
WASH 9074			DAVIES	GEORGE		0	60	20	39		X				X			X		1 S	1 W	28	SW	NW			
WASH 9057/WASH 9075	Abandonment - original log likely identified		ANNIS	CHARLES T	BEACON HOMES INC.	0	80	80	40	9/21/1989	X	X			X			X		1 S	1 W	28	SW	SW	600000000		
WASH 9066			CARR	G C		0	158	20	140						X			X		1 S	1 W	28	SW				
WASH 65596	Abandonment - unable to identify original log				CITY OF BEAVERTON			0		7/23/2007		X			X					1 S	1 W	28				12660 SW STILLWELL LANE	
WASH 9061			MCGRAW	JAMES L		0	222	222	32	6/29/1961	X				X					1 S	1 W	28					9
WASH 9063	Deepening - unable to identify original log				ER-SUE KENNELS	0	173	195	125	10/7/1959			X		X					1 S	1 W	28					4
WASH 1666/WASH 1698	Abandonment		COBB	LYLE H	NORTHWEST EARTHMOVERS INC.	0	900	900	230	1/26/1962	X	X			X	X			X	1 S	1 W	29	NE	SE	100	MURRY RD & COBB HILL, BEAVERTON	235
WASH 9109/WASH 9087	Deepening		HERDINA/SORB ETS	GUS/PAUL		362	243/137	243/380	150/265	9/21/1972	X		X		X					1 S	1 W	29	NE	SW			15
WASH 9108			ACZYSKINSKI	VALERIA		0	214	214	84	6/3/1965	X				X					1 S	1 W	29	NW	SE			15
WASH 9107			LOGAN	F F		0	227	227	128	10/7/1963	X				X					1 S	1 W	29	NW	SW			10
WASH 3551	Abandonment - unable to identify original log				RUTAN CONSTRUCTION	0	0	0	0			X			X					1 S	1 W	29	NW		1		
WASH 3552	Abandonment - unable to identify original log				RUTAN CONSTRUCTION	0	0	0	0			X			X					1 S	1 W	29	NW		1		
WASH 9106/WASH 50921	Abandonment - original log likely identified	1701	BRANDON	ANNE M	CLEARWATER CONSTRUCTION	0	165	165	32/105	6/27/1996	X	X			X					1 S	1 W	29	NW/SW	NW/NE	600		10
WASH 9103/WASH 63795	Abandonment - original log likely identified		VRANDER	V	JLS HOMES	0	230	230	136/140	3/28/2006	X	X			X					1 S	1 W	29	NW/SW	SW/SE	200	9565 SW 155TH AVE	45
WASH 9110/WASH 3804	Abandonment - original log likely identified		FOWLER	ROBERT	FERNWOOD DEVELOPMENT	0	230	230	90	6/20/1967	X	X			X					1 S	1 W	29	SE	NE	300	14975 SW BEARD RD	14
WASH 9111/WASH 558	Abandonment - original log likely identified		COLLINS/COLLIN S	RONALD/MARI ANNE		275	185/275	185/275	37/68	9/27/1976	X		X		X					1 S	1 W	29	SE	NE/SE			8

GSI Water Solutions, Inc.

Well Log ID	Notes	Well Tag No.	Well Owner Last Name	Well Owner First Name	Company Name	Depth to First Water	Depth Drilled	Completed Depth	Post Static Water Level	Completed Date	Work New	Work Abandon-ment	Work Deepening	Work Alteration	Use Domestic	Use Irrigation	Use Community	Use Live-stock	Use Industrial	Township	Range	Sctn	Qtr160	Qtr40	Tax Lot	Street of Well	Max Yield
WASH 52211	Abandonment - unable to identify original log				W A JONES CO.			0	81	5/22/1997		X			X					1 S	1 W	29	SE	NW	701	15350 SW BEARD, BEAVERTON	
WASH 56049	Abandonment - unable to identify original log		HENRIKSEN	L S				0	160	5/31/2000		X			X					1 S	1 W	29	SE	NW	801	15330 BEARD RD	
WASH 57394	Abandonment - unable to identify original log				BONES CONSTRUCTION		160	0	140	6/28/2001		X			X					1 S	1 W	29	SE	NW		155TH AVE AND SW BEARD, BEAVERTON	
WASH 9113/WASH 9100/WASH 233	Deepening and Abandonment		HARDLE/BUTLER	CYRENE/JOHN	CENTURY 21 PROPERTIES INC.	0	160/308	160/307	80/15	4/1/1961		X	X		X					1 S	1 W	29	SE	NW			35
WASH 9105/WASH 52403	Abandonment		KUNKLE	JACK D	W A JONES CO	0	160	160	65/81	7/16/1997	X	X			X					1 S	1 W	29	SE	NW	600	15350 SW BEARD, BEAVERTON	20
WASH 161	Abandonment - unable to identify original log				RUTAN CONSTRUCTION	0	0	0	0			X			X					1 S	1 W	29	SE	SE			
WASH 9077	Abandonment - unable to identify original log				HUGH WOMACK CONSTRUCTION	0	280	0	90	9/23/1987		X								1 S	1 W	29	SE	SE			
WASH 9123			MILLER	ADAM		0	294	279	30						X					1 S	1 W	29	SE	SE			
WASH 53065/WASH 53166	Abandonment	12908			EMERALD CONSTRUCTION			162	60	1/8/1998		X		X	X					1 S	1 W	29	SE	SW	500	153RD WEIR RD, BEAVERTON OR	
WASH 59831	Abandonment - unable to identify original log				DOPHIN DEVELOPMENT; DOW BROS INC. (C/O)		130	0	72	7/10/2003		X			X					1 S	1 W	29	SE	SW	800	9710 SW 155TH AVE, BEAVERTON	
WASH 9086/WASH 59830	Abandonment - original log likely identified		HEDGES	KIRK	DOLPHIN DEVELOPMENT; DOW BROS INC. (C/O)	0	215/210	215	152/131	7/10/2003	X	X			X					1 S	1 W	29	SE	SW	700	9800 SW 155TH AVE, BEAVERTON	10
WASH 9102/WASH 59433	Abandonment - original log likely identified		SHANK	WILBER	DOPHIN DEVELOPMENT; DOW BROTHERS INC. (C/O)	0	164	164	60/89	4/18/2003	X	X			X					1 S	1 W	29	SE	SW	3600	9530 SW 155TH AVE, BEAVERTON	20
WASH 9121			PEABODY	ETHEN A		0	245	245	55	6/25/1966	X				X					1 S	1 W	29	SE	SW			10
WASH 9089	Abandonment		EDWARDS	JACK		135	160	160	100	4/26/1978		X			X					1 S	1 W	29	SE				12
WASH 9116/WASH 3614	Abandonment		BOHNA/CLAUSEN	JAMES E/BJORN C		0	203	203	0	7/27/1950	X	X			X					1 S	1 W	29	SE/NE	NW			10
WASH 9122/WASH 57505	Abandonment - original log likely identified		HALLOWELL	GEO	BONES CONSTRUCTION INC.	0	135	135	70/76	7/11/1958	X	X			X					1 S	1 W	29	SE/SW	SW	300	NE CORNER OF SW BEARD AND 155TH, BEAVERTON	10
WASH 9080/WASH 64536	Abandonment - original log likely identified				TEADAMEN REALTY INC./DERRICK BROWN AND ASSOCIATES	86	260/258	260	145/65	9/5/2006	X	X			X					1 S	1 W	29	SW	NE	100	9075 SW 155TH AVE, BEAVERTON	11
WASH 9088/WASH 57141	Abandonment - original log likely identified				TIEDMANN REAL ESTATE INC./CRESTVIEW CONSTRUCTION	110	290	290	210/166	4/3/2001	X	X			X					1 S	1 W	29	SW	NE	200	15785 SW NORA RD, BEAVERTON	12
WASH 9099/WASH 56472	Abandonment - original log likely identified		FIELD	ROBERT	CRESTVIEW CONSTRUCTION	0	180	180	74/90	9/12/2000	X	X			X					1 S	1 W	29	SW	NE	400	15655 SW NORA RD, BEAVERTON	14
WASH 9115	Deepening - unable to identify original log		GRAHAM	TED		0	270	270	150	10/4/1967			X		X					1 S	1 W	29	SW	NE			10
WASH 9117	Deepening - unable to identify original log		ARNOLD	A A		0	326	326	0	5/25/1967			X							1 S	1 W	29	SW	NE			14
WASH 62431	Abandonment - unable to identify original log				KERR CONTRACTORS INC.		237	0	165	6/6/2005		X			X					1 S	1 W	29	SW	NW	100	16005 SW NORA RD, BEAVERTON	
WASH 9118			BURDICK	B F		230	244	244	150	10/6/1956	X				X					1 S	1 W	29	SW	NW			15
WASH 56466	Abandonment - unable to identify original log				DOW BROTHERS INC.; DOW, BUD		200	0		8/21/2000		X								1 S	1 W	29	SW	SE	200	9565 SW 155TH AVE	
WASH 9104/WASH 63794	Abandonment		LANEY	HOWARD	JLS HOMES	340	345	345	243/200	3/27/2006	X	X			X					1 S	1 W	29	SW	SE	100	9525 SW 155TH AVE	12
WASH 9119			KELLER	W M		0	181	181	79	8/31/1960	X				X					1 S	1 W	29	SW	SE			18
WASH 9120			KELLER	W		0	182	182	0						X					1 S	1 W	29	SW	SE			
WASH 13847	Abandonment - unable to identify original log				K & G CONSTRUCTION	0	0	0	0			X			X					1 S	1 W	29	SW		1000	15740 SW NORA RD, BEAVERTON	
WASH 1409	Abandonment - unable to identify original log				MAY WOOD CO.	0	0	0	0			X			X					1 S	1 W	29					
WASH 50755	Abandonment - unable to identify original log				AVALON PARK LLC					6/11/1996		X								1 S	1 W	29			600	SW CORNER 155TH AND NORA	
WASH 557			WRIDGE JR	WILBUR S		70	245	245	110	8/4/1972	X				X					1 S	1 W	29					15
WASH 9081					TEADAMEN REALTY INC.	126	330	330	168	5/13/1974	X				X					1 S	1 W	29					17
WASH 9082					TEADAMEN REALTY INC.	94	245	245	55	5/12/1974	X				X					1 S	1 W	29					12
WASH 9083			STAUSELL	MICHAEL		100	190	190	85	11/1/1972	X				X					1 S	1 W	29					12
WASH 9085	Deepening - unable to identify original log		HOLLOWELL	GEORGE W		0	130	260	125	11/1/1972			X		X					1 S	1 W	29					15
WASH 9091	Abandonment		WALDREP	MR ERWIN		0	200	0	0	6/25/1975	X	X			X					1 S	1 W	29					
WASH 9092			WALDROP	ERWIN		228	234	234	199	7/7/1975	X				X					1 S	1 W	29					20
WASH 9093			RUDE	HARVEY		192	215	215	128	6/6/1971	X				X					1 S	1 W	29					12
WASH 9094			TRUMBO	MR LOREN		0	182	182	115	11/20/1968	X				X					1 S	1 W	29					20
WASH 9095/WASH 9084	Deepening - original log likely identified		SEGEL	DAN/ DANIEL R		225	200/120	200/320	165/184	7/5/1973	X		X		X					1 S	1 W	29					25
WASH 9096			CLARK	BRUCE		0	233	233	145	7/8/1968	X									1 S	1 W	29					15
WASH 9098/WASH 9090	Deepening - original log likely identified		JACKSON/BURCH	EMERY R/GENE		180	133	133/260	70/155	8/17/1976	X		X		X					1 S	1 W	29					24
WASH 9101	Deepening - unable to identify original log		SORBETS	PAUL		0	485	485	370	12/1/1960			X		X					1 S	1 W	29					60
WASH 9124					GTE NORTHWEST INC.	0	60	60	0	5/16/1989	X									1 S	1 W	30	NE	NE			
WASH 9125/WASH 65242	Abandonment - original log likely identified		RESER	AL	J S R DEVELOPMENT LLC; TAURUS HOMES	0	338/337	338	221/225	4/11/2007	X	X			X					1 S	1 W	30	NE	NW	1100	8200 SW 175TH AVE, BEAVERTON	35
WASH 9146/WASH 9137	Deepening - original log likely identified		BRISBINE	GLEN		0	371/270	371/70	253/160	11/25/1970			X		X	X				1 S	1 W	30	NE	NW			11
WASH 9154/WASH 9147	Deepening		MORRISON	C V		325	305/80	41/385	230/286	1/18/1974	X		X		X	X				1 S	1 W	30	NE	SE/SW			20
WASH 9138/WASH 9131/ WASH 9133	Deepening - original log likely identified		HOEREN/ MODRELL/ ERICKSON	TED/ EUGEGE L/HAROLD M	HOEREN, RITA	0	75/65/110	275/340/385	120/420/260	9/8/1969	X		X		X					1 S	1 W	30	NE				20
WASH 9151			TRAPPE	JAMES M		0	368	368	260	12/3/1960	X				X					1 S	1 W	30	NW	NE			10
WASH 52591	Abandonment - unable to identify original log				WESTWAY INVESTMENT		400	0		9/12/1997		X			X					1 S	1 W	30	NW	NW	200	8350 SW 175TH AVE, BEAVERTON	
WASH 9152			RIGERT			0	369	369	339	12/31/1924					X					1 S	1 W	30	NW	NW			
WASH 9153/WASH 9135	Deepening - original log likely identified		REED/ CHAPMAN	/JACK		0	450/110	450/560	390/445	8/15/1967			X		X					1 S	1 W	30	NW	SE			10
WASH 1323	Deepening - unable to identify original log		KING	W	PECK, W		63	333	263	8/6/1971			X		X					1 S	1 W	30	NW				15
WASH 9130/WASH 58155	Abandonment - original log likely identified		NEWBERRY	ROBERT	RUTAN CONSTRUCTION	363	122/430	440	299	3/5/2002		X	X		X					1 S	1 W	30	SE	NW	3200	SW 175TH AVE, BEAVERTON; S OF ARBUTUS DR	20
WASH 9148			SCHUEPBACH	FRED		0	600	600	450	5/5/1969	X				X					1 S	1 W	30	SE	NW			7
WASH 9150	Deepening - unable to identify original log		PEYTON	JOHN		0	241	241	0	8/18/1956			X		X					1 S	1 W	30	SE	NW			18
WASH 1736			KINZER	DONALD		490	608	608	355	11/3/1992	X				X					1 S	1 W	30	SE	SE	500	9355 SW 166TH, BEAVERTON	40
WASH 9140/WASH 65241	Abandonment - original log likely identified		MCALLISTER	JOHN H	J S R DEVELOPMENT LLC; TAURUS HOMES	0	283/284	283	200/185	4/12/2007	X	X			X	X				1 S	1 W	30	SE/NE	NW	300	17200 SW RIGERT RD, BEAVERTON	60
WASH 9155/WASH 9143	Deepening		KEMMEN/ ROWSER JR	J D/T R		0	592/720	592/720	575/598	1/21/1961			X		X			X		1 S	1 W	30	SW	NE			5
WASH 9156			KEMMER	ALBERT		0	535	535	455	5/20/1957	X				X					1 S	1 W	30	SW	NE			10
WASH 9139			MUESSIG	JOHN A	MUESSIG, EDNA J	0	760	760	580	12/1/1963	X				X					1 S	1 W	30	SW				7
WASH 4148			SAYRE	CASEY		460	600	600	415	9/23/1994	X				X					1 S	1 W	30				SW HOURSETALE RD	24
WASH 9127			TOPICH	C		481	662	662	476	5/27/1971	X				X					1 S	1 W	30					12
WASH 9129			NOURIGAT	GARY H		300	331	331	275	10/5/1970	X				X					1 S	1 W	30					
WASH 9132			ELDRIDGE	W E		0	347	347	161	6/10/1969	X				X					1 S	1 W	30					25
WASH 9134			ONODY	FRANK		0	375	375	192	9/25/1967	X				X					1 S	1 W	30					10
WASH 9136	Deepening - unable to identify original log		PEYTON	JOHN		0	320	320	176	5/8/1967			X		X					1 S	1 W	30					75

Well Log ID	Notes	Well Tag No.	Well Owner Last Name	Well Owner First Name	Company Name	Depth to First Water	Depth Drilled	Completed Depth	Post Static Water Level	Completed Date	Work New	Work Abandon-ment	Work Deepening	Work Alteration	Use Domestic	Use Irrigation	Use Community	Use Live-stock	Use Industrial	Township	Range	Sctn	Qtr160	Qtr40	Tax Lot	Street of Well	Max Yield
WASH 9142			PEYTON	JOHN B		0	241	130	170	12/31/1940	X					X				1 S	1 W	30					20
WASH 9144			SCHULD JR	FRED		0	600	600	510	12/15/1960	X									1 S	1 W	30					45
WASH 9145			MICHOS	TOM		0	592	592	0		X									1 S	1 W	30					
WASH 54549	Abandonment - unable to identify original log				ALTERNATIVE LIVING SERVICES	50	150	0	50	3/19/1999		X								1 S	1 W	31	NE	NE	200	16575 NW WALKER RD, BEAVERTON	
WASH 52941 Version 2		18358	OHLSEN	DAVE		390	500	500	390	10/17/1997	X				X					1 S	1 W	31	NE	NW	1800	18485 SW HORSE TALE DR	36
WASH 62757	Alteration - unable to identify original log	78361	MCDANIEL	TED	PRECISION PUMP SERVICE (C/O)				438	8/18/2005				X	X					1 S	1 W	31	NW	SE	900	10911 SW 175TH, BEAVERTON	
WASH 9158/WASH 57808	Abandonment		FLEURY/ ROBERTS	JERRY/ EDWARD E		0	490	490	360/384.5	10/5/2001	X	X			X					1 S	1 W	31	NW	SE	1500	11431 SW 175TH	20
WASH 9164			MORTON	L C		0	177	177	139	9/25/1964	X				X					1 S	1 W	31	NW	SE			6
WASH 66109		90619	GARCIA	TORY	MAKENA CUSTOM HOMES	475	585	585	354	10/17/2007	X				X					1 S	1 W	31	NW	SW	1603	18450 SW HORSE TALE DR, BEAVERTON	50
WASH 875			DEGN	DOUG	DEGN, DEB; LEARY CONSTRUCTION (C/O)	162	190	190	118	3/7/1991	X				X					1 S	1 W	31	SW	NE		11401 SW REUSSER RD	15
WASH 9160			MONTGOMERY	LESTER ARNOLD		0	433	9	0	3/1/1950						X				1 S	1 W	31	SW	NW			
WASH 559					MEADOWLARK INVESTMENT CORP.	117	205	205	85	1/7/1981	X				X					1 S	1 W	31	SW	SW			36
WASH 3819			COOPER	JOHN			600	600	405	4/28/1994	X				X					1 S	1 W	31				SW HOURSTALE RD	15
WASH 4148 Version 2			SAYRE	CASEY		460	600	600	415	9/23/1994	X				X					1 S	1 W	31			1700	SW HOURSETALE DRIVE	24
WASH 4379					COOPER MT VINEYARDS	60	385	385	275	12/22/1994	X				X					1 S	1 W	31			1600	17520 HORSETAIL RD	30
WASH 9157		52875	COFFIN	WILBUR		175	620	620	520	4/6/1971	X				X					1 S	1 W	31					15
WASH 9159	Deepening - unable to identify original log		WALKER	RICHARD		0	532	532	443	3/20/1968			X		X					1 S	1 W	31					6
WASH 9161			KING	WAYNE		0	200	200	140	12/11/1962	X				X					1 S	1 W	31					9
WASH 9162					COOPER MOUNTAIN WATER DISTRICT	0	892	892	520	3/29/1969	X						X			1 S	1 W	31					30
WASH 9166			BROWN	FRANCIS		0	278	278	40	10/11/1965	X				X					1 S	1 W	32	NE	NE			12
WASH 9165	Abandonment - unable to identify original log				FAMILY HOMES OF AMERICA	0	0	0	0	10/31/1989		X								1 S	1 W	32	NE	NW			
WASH 9172/WASH 62582	Abandonment - original log likely identified		MERICKA	FRANK	ROUNDSTONE DEVELOPMENT	0	213/215	213	88/75	7/15/2005	X	X			X					1 S	1 W	32	NE	NW	700	15105 SW HEDLUND LANE	20
WASH 65587	Abandonment - unable to identify original log				WASHINGTON MUTUAL AT MURRAY HILL		120	0	4.6	7/17/2007		X								1 S	1 W	32	NE	SE	400	14700 SW TEAL BLVD	
WASH 9183	Abandonment - unable to identify original log				BONES CONSTRUCTION	0	0	0	0	10/18/1988		X								1 S	1 W	32	NE	SW			
WASH 9185	Abandonment - unable to identify original log				BONES CONSTRUCTION	0	0	0	0	10/18/1988		X								1 S	1 W	32	NE	SW			
WASH 9177	Deepening - unable to identify original log		NAUMAN	MR DANIAL		314	365	365	252	10/12/1971			X		X					1 S	1 W	32	NW	NE			30
WASH 9170/WASH 9184	Abandonment - original log likely identified		CUNNINGHAM	CHESTER V	BONES CONSTRUCTION	0	210	210	65	10/18/1988	X	X			X					1 S	1 W	32	NW/NE	SW			20
WASH 55776	Abandonment - unable to identify original log		DEACON	S D				0	75	3/15/2000		X			X					1 S	1 W	32	SE	NE	400		
WASH 9182	Abandonment				COLUMBIA-WILLAMETTE DEVELOPMENT CO	0	245	0	0	8/11/1986	X	X				X				1 S	1 W	32	SE	NW			8
WASH 9186	Abandonment				COLUMBIA-WILLAMETTE DEVELOPMENT	0	155	155	3	7/24/1986	X	X				X				1 S	1 W	32	SE	NW			15
WASH 9187	Alteration - unable to identify original log				COLUMBIA-WILLAMETTE DEVELOPMENT	0	0	148	6	8/7/1986				X		X				1 S	1 W	32	SE	NW			15
WASH 66000	Abandonment - unable to identify original log				MOORE EXCAVATION INC.		300	0	200	9/4/2007		X			X					1 S	1 W	32	SW	SE	200	11035 SW 135 AVE, TIGARD	
WASH 66001	Abandonment - unable to identify original log				MOORE EXCAVATION INC.		500	0	200	9/3/2007		X			X					1 S	1 W	32	SW	SE	100	11035 SW 135 AVE, TIGARD	
WASH 9178/WASH 65999	Deepening - unable to identify original log, likely abandoned		WILHOIT	DARREL	MOORE EXCAVATION INC.	197	100/250	250	162/200	9/6/2007		X	X		X					1 S	1 W	32	SW	SE	300	11035 SW 135 AVE, TIGARD	60
WASH 25	Abandonment - unable to identify original log				BONES CONSTRUCTION	0	0	0	0	4/16/1990		X								1 S	1 W	32			147000000		
WASH 9173			CALNON JR	DONALD C		0	275	275	150	4/17/1968	X				X					1 S	1 W	32					20
WASH 9174	Deepening - unable to identify original log				PORTLAND HUNT CLUB	0	385	385	275	6/6/1968			X		X					1 S	1 W	32					40
WASH 9175	Deepening - unable to identify original log		SKEI	ALFRED		0	384	384	220	8/10/1968			X		X					1 S	1 W	32					22
WASH 9176			WELTER	BOB		0	241	240	67	8/22/1968	X				X					1 S	1 W	32					10
WASH 9179			CAMPBELL	DR N J		369	400	400	385	12/21/1971	X				X					1 S	1 W	32					18
WASH 9180/WASH 9181	Deepening - original log likely identified		SCHREINER/ ANDERSON	G L/O W	RIELY, MRS W	309/365	325/194	325/470	180/250	5/15/1973	X		X		X					1 S	1 W	32					60
WASH 55143		33829	SWANSON	KARL		128	149	149	37	8/24/1999	X				X					1 S	1 W	34	NE	NW	1200	11410 SW IRONWOOD LOOP	
WASH 9230			SAVAGE	R H		0	90	90	0		X				X			X		1 S	1 W	34	NE	SW			
WASH 60862		69268	FEHREN-BACHER	HELEN							X									1 S	1 W	34	NE	SW	300	11685 SW NORTH DAKOTA; TIGARD	
WASH 3476	Abandonment - unable to identify original log				KEMP CONSTRUCTION INC.	0	0	0	0			X			X					1 S	1 W	34	NE	SW	2500	10995 SW NORTH DAKOTA, TIGARD	
WASH 13936	Abandonment - unable to identify original log		N/A	N/A	TIMCO INVESTMENT			0	140	9/14/1995		X			X					1 S	1 W	34	NE	SW	7700	10995 SW 111TH	
WASH 13936	Abandonment - unable to identify original log		N/A	N/A	TIMCO INVESTMENT			0	140	9/14/1995		X			X					1 S	1 W	34	NE	SW	7700	10995 SW 111TH	
WASH 1461	Abandonment - unable to identify original log				MILLER AND SONS	0	0	0	0			X			X					1 S	1 W	34	SE	NE	3200	10570 SW N DAKOTA AVE, TIGARD	
WASH 53031	Abandonment - unable to identify original log				GVS CONTRACTING			0		11/13/1997		X			X					1 S	1 W	34	SE	NE	3300	10520 SW N DAKOTA, TIGARD	
WASH 64147	Abandonment - unable to identify original log				N E I; VENTURE PROPERTIES; DAKOTA PROJECT			0	27	6/22/2006		X			X					1 S	1 W	34	SE	NW	3500	10970 SW NORTH DAKOTA ST, TIGARD	
WASH 62199	Abandonment - unable to identify original log				PAYS CUSTOM HOMES INC.; REVCON (C/O)		90	0	26	4/4/2005		X			X					1 S	1 W	34	SW	NE	400	11685 SW NORTH DAKOTA ST, TIGARD	
WASH 64132	Abandonment - unable to identify original log				REVCON INC.		75	0	12	6/23/2006		X			X					1 S	1 W	34	SW	NE	400	11705 SW DAKOTA, TIGARD	
WASH 9213	Abandonment - unable to identify original log				MOCON CORP.	0	84	0	28	7/6/1987		X								1 S	1 W	34					
WASH 9828			WRIGHT	LESLIE T		0	930	758	50	8/9/1938	X					X				1 S	2 W	13	SE	SW			55
WASH 10260	Deepening - unable to identify original log		ANDRANEI	EDWARD		0	134	134	99	9/9/1960			X		X					1 S	2 W	13					12
WASH 9800			COLLINS	WARREN		300	500	500	395	3/21/1971	X				X					1 S	2 W	13					10
WASH 68824		103741	MILBERGER	MARK	MILBERGER, JANELL															1 S	2 W	13			121	19460 SW KINNAMAN RD	
WASH 56198		41138			KOZAK INTERPRISES INC.	797	798	798	53	7/7/2000	X				X					1 S	2 W	15	NE	SE	904	22830 SW NOBLE ST	125
WASH 54455/WASH 1353	Deepening	30220	ROPER	CLIFFORD		245/160	267/204	267/204	124/132	2/12/1999	X		X		X					1 S	2 W	21	NE	NW	605	7499 SW HEUGERT RD	60
WASH 10070			LEMMA	STEVEN		370	410	410	35	5/5/1980	X				X					1 S	2 W	22	SE	NE			100
WASH 13886			ELLERBROOK	PAUL		435	510	510	18	8/24/1995	X				X					1 S	2 W	22	SE	SE			240
WASH 60013		64167	FRANK	JOHN		350	355	355	78	8/13/2003	X				X					1 S	2 W	22	SE	SE	2600	22750 SW ROSEDALE RD	60
WASH 67846	Alteration - unable to identify original log	100227	SHULZ	PETER	TUALATIN VALLEY WATER DISTRICT					4/16/2009				X		X				1 S	2 W	23	NE	SW	3700	6565 SW 211TH AVE	
WASH 10118	Alteration - unable to identify original log		KUHNS	DAVID		0	0	0	0	3/13/1982				X	X					1 S	2 W	23	NW	NE			
WASH 590	Deepening - unable to identify original log		NACHEMAN	ALLEN		700	730	730	55	11/9/1973			X		X					1 S	2 W	23	NW	SE			150
WASH 10140			KINCHELOE	R H		0	300	300	47						X			X		1 S	2 W	23	NW	SE			
WASH 4578	Abandonment - unable to identify original log				NORTHWEST EARTHMOVERS INC.	0	0	0	0			X			X					1 S	2 W	23	SE	NE	700	20630 SW FARMINGTON RD, BEAVERTON	
WASH 10144			SMURTHWAITE JR	RICHARD J		0	138	138	32	12/31/1938						X				1 S	2 W	23	SE	NW			
WASH 10146					ALOHA HUBER WATER DISTRICT	0	892	892	195	12/14/1962	X									1 S	2 W	23	SE	SE			269
WASH 10148/ WASH 60890	Alteration	100484			ALOHA-HUBER WATER DISTRICT/ TVWD	0	874	874	200	11/17/1964	X			X			X			1 S	2 W	23	SE	SE	1000	7975 SW GRABHORN RD	1250

Appendix C

Well Log Inventory in Area Affected by ASR Wells

Joint Water Commission Limited License Application

Well Log ID	Notes	Well Tag No.	Well Owner Last Name	Well Owner First Name	Company Name	Depth to First Water	Depth Drilled	Completed Depth	Post Static Water Level	Completed Date	Work New	Work Abandon-ment	Work Deepening	Work Alteration	Use Domestic	Use Irrigation	Use Community	Use Live-stock	Use Industrial	Township	Range	Sctn	Qtr160	Qtr40	Tax Lot	Street of Well	Max Yield
WASH 13954			HAYS	M A		0	155	155	55	7/8/1967	X				X					1 S	2 W	23	SE	SE			36
WASH 65112	Alteration - unable to identify original log	88231			TUALATIN VALLEY WATER DISTRICT		120		199	2/28/2007				X						1 S	2 W	23	SE	SE	4100	7975 SW GRABHORN RD	
WASH 10116					SANTORO BROTHERS	0	139	42	0							X				1 S	2 W	23	SE	SW			
WASH 10145			TAUTE	L	W	0	115	65	60						X					1 S	2 W	23	SE	SW			
WASH 10114			SANTORO	JOHN	SANTORO, JOE	0	127	32	0	10/14/1952						X				1 S	2 W	23	SW	SE			
WASH 10115	Deepening - unable to identify original log				SANTORO BROTHERS	0	100	227	50	3/27/1970			X			X				1 S	2 W	23	SW	SE			650
WASH 10109			SANTORO	JOHN		0	125	125	15	11/4/1986	X				X					1 S	2 W	23			270000000		75
WASH 10124	Deepening - unable to identify original log		NUSSBAUMER	BENEDICT J		35	102	350	35	3/30/1973			X		X					1 S	2 W	23					42
WASH 10120			NEWMAN	R J		795	860	850	65	7/30/1974	X				X					1 S	2 W	23					25
WASH 10129	Deepening - unable to identify original log		GENHEIMER	JAOH W		149	123	215	110	8/31/1970			X		X					1 S	2 W	23					30
WASH 10130	Deepening - unable to identify original log		SMURTHWAITE	J R		157	81	215	115	8/30/1971			X		X					1 S	2 W	23					30
WASH 10132			CHURCH	HAJELDALE		0	125	125	20	6/16/1964	X				X					1 S	2 W	23					10
WASH 10196			KOCH	C W		0	214	210	0		X					X				1 S	2 W	24	NE	SE			
WASH 10197			HAYES	W A		0	49	49	39						X					1 S	2 W	24	NE	SE			
WASH 10151	Abandonment - unable to identify original log				MONARCH CONSTRUCTION	0	0	0	0	1/23/1990		X								1 S	2 W	24	NE	SE			
WASH 52446	Abandonment - unable to identify original log				PARSONS DEVELOPMENT CO.			0		6/26/1997		X								1 S	2 W	24	NE	SE	601	6695 SW 185TH AVE	
WASH 10191			RACINE	BILL		0	130	130	27						X					1 S	2 W	24	NW	SW			
WASH 55739	Abandonment - unable to identify original log				CLACKAMAS CONSTRUCTION			0	48	12/7/1999		X								1 S	2 W	24	NW	SW	900	19800 SW MARLIN DR, BEAVERTON	
WASH 10186					NORTHWEST NATURAL GAS CO.	0	400	400	0	11/29/1979	X									1 S	2 W	24	NW				
WASH 10198			KELLER	A D		0	140	140	40	12/31/1937	X				X					1 S	2 W	24	SE	NE			
WASH 10199			FALB	M		0	220	220	0						X					1 S	2 W	24	SE	NE			
WASH 10201					ALOHA HUBER WATER DISTRICT	98	416	416	130	4/18/1957	X									1 S	2 W	24	SE	NE			350
WASH 10203			SHIELDS			0	0	0	0		X				X					1 S	2 W	24	SE	NE			
WASH 10200		100485			ALOHA-HUBER WATER DISTRICT	0	720	720	138	7/15/1958	X						X			1 S	2 W	24	SE	NE			470
WASH 10202			REMINGTON	CHARLES		0	0	0	0		X				X					1 S	2 W	24	SE	NE			
WASH 10204			GUSTUFSON			0	164	164	70		X				X					1 S	2 W	24	SE	NE			
WASH 53958	Abandonment - unable to identify original log				NORTHWEST EARTHMOVERS			0	289.5	8/31/1998		X			X					1 S	2 W	24	SE	SE	300	7885 SW 185TH, ALOHA	
WASH 10214			MILLER	JANE		0	242	0	232		X				X					1 S	2 W	24	SE	SW			
WASH 10213			MILLER	LYLE R	MILLER, MRS JAMES AND	0	241	241	230	5/4/1951	X					X				1 S	2 W	24	SE	SW			
WASH 10208/WASH 10183	Deepening		KERSTON	L		68	73/175	73/175	67	10/23/1964	X		X		X					1 S	2 W	24	SW	NE			15
WASH 10150	Abandonment - unable to identify original log		BUNCH	G W		0	0	0	0	12/21/1989		X								1 S	2 W	24	SW	NE	140000000		
WASH 56499	Abandonment - unable to identify original log		GODWIN	BILL	FERNWOOD DEVELOPMENT			0	51	9/20/2000		X			X					1 S	2 W	24	SW	NE	400	7035 SW 195TH AVE	
WASH 65142	Abandonment - unable to identify original log		HILGERICK	STEVE			210	0	81	3/8/2007		X			X					1 S	2 W	24	SW	NE	4400	7228 SW CRISP DR	
WASH 10205			ALTISHIN	GEORGE		0	180	0	101	12/31/1951	X				X					1 S	2 W	24	SW	NW			
WASH 10207			WIREN	R C		60	110	110	0	3/25/1957	X				X					1 S	2 W	24	SW	NW			10
WASH 54812	Abandonment - unable to identify original log		BERNHARDT	LEONARD	BERNHARDT, GEORGENE		340	0	116	6/15/1999		X			X					1 S	2 W	24	SW	NW	100	SW 195TH AVE, ALOHA	
WASH 10211			WATTS	R N		370	0	382	0	5/11/1956	X				X					1 S	2 W	24	SW	SE			10
WASH 10212			GAUNT	A J		0	296	296	236	4/21/1958	X				X					1 S	2 W	24	SW	SE			10
WASH 10210/WASH 10184	Deepening		JORDAN	JAMES I		305	312/327	312/327	277/297	6/10/1963	X		X		X					1 S	2 W	24	SW	SE			8
WASH 10209			MILLS	VIOLET V	MILLS, VIOLET V, HEIRS OF	0	186	180	0	12/31/1911	X				X	X				1 S	2 W	24	SW	SW			
WASH 10175			BECHTEL	CLARENCE		0	155	155	18.5	6/17/1964	X				X					1 S	2 W	24					10
WASH 10152	Deepening - unable to identify original log		STARR	L L		0	100	213	104	2/27/1962			X		X					1 S	2 W	24					15
WASH 10158	Deepening - unable to identify original log				BERNHARDT, ORCHARD & HOWE	0	128	340	178	3/30/1973			X		X					1 S	2 W	24					24
WASH 10160	Deepening - unable to identify original log		MONBECK	WAYNE		348	107	410	330	8/27/1970			X		X					1 S	2 W	24					30
WASH 10164	Deepening - unable to identify original log		RINI	VICTOR		0	398	398	325	9/15/1967			X		X					1 S	2 W	24					10
WASH 10166	Deepening - unable to identify original log		FORDHAM	ROY		417	112	485	385	7/15/1971			X		X					1 S	2 W	24					20
WASH 10171	Deepening - unable to identify original log		STARR	L L		0	55	130	63	10/23/1965			X		X					1 S	2 W	24					18
WASH 10172			SINK	MRS PATRICIA		0	219	219	150	8/25/1965	X				X					1 S	2 W	24					20
WASH 10195			GIBSON	ARTHUR C			104	104		10/27/1956	X				X					1 S	2 W	24					15
WASH 10174/WASH 10168	Deepening	12137	HURLBUTT	L C		0	325/387	325/387	280/250	7/12/1967	X		X		X					1 S	2 W	24					10
WASH 10185/WASH 10161	Deepening		SHERRICH	W A		0	125/130	125/250	65/80	8/30/1968	X		X		X					1 S	2 W	24					20
WASH 10167	Deepening - unable to identify original log		FORDHAM	ROY		0	387	385	347	7/24/1967			X		X					1 S	2 W	24					22
WASH 10177			MOORE	GEORGE E		0	105	60	25	12/31/1953	X				X	X				1 S	2 W	24					
WASH 10176/WASH 10165	Deepening - original log likely identified		MILLER/ TIMMONS JR	TOM/ HOWARD		0	217/68	215/285	140/203	3/29/1971	X		X		X					1 S	2 W	24					20
WASH 10153/WASH 10154	Deepening		GAUNT	A J		0	350/337	347/337	320/312	8/21/1964	X		X		X					1 S	2 W	24					5
WASH 66640	Abandonment - unable to identify original log				D V G LLC			0	505	2/27/2008		X			X					1 S	2 W	25	NE	NE	200	8285 SW 185TH AVE	
WASH 10232/WASH 10227	Deepening		TAUSCHER	ARTHUR A	TAUSCHER, MILDRED E	0	492/506	80/505	456/0	12/19/1963			X		X					1 S	2 W	25	NE	NW			12
WASH 65892	Abandonment - unable to identify original log				BEACON HOMES NW INC.		475	0	422	9/17/2007		X			X					1 S	2 W	25	NW	NW	200	20011 SW GASSNER RD	
WASH 10235			PIERSON	O		0	459	18	494						X					1 S	2 W	25	NW	SE			
WASH 10233	Deepening - unable to identify original log		BUBLER	P P, CAPTAIN		0	550	550	457	8/1/1958			X		X					1 S	2 W	25	NW				5
WASH 10236			HACKMAN	JANE S		0	9263	9263	0	12/31/1947										1 S	2 W	25	SE	NE			
WASH 67385	Abandonment - unable to identify original log				METRO REGIONAL PARKS AND GREENSPACES		727	0	575	10/9/2008		X			X					1 S	2 W	25	SE	NE	3700	18892 SW KEMMER RD, BEAVERTON; ALSO TAX LOT 3702	
WASH 10238			FERRIER	RALPH		0	662	662	542	7/1/1958	X				X					1 S	2 W	25	SE	NW			9
WASH 10234					RENTER	0	415	0	0											1 S	2 W	25	SE				
WASH 10237			GRONLUND	A		0	600	1515	0						X					1 S	2 W	25	SW	NW			
WASH 62850/WASH 10224	Abandonment - original log likely identified		SPOONER	ROY	MILLER HILL LLC	0	500	550	505	8/22/2005	X	X			X					1 S	2 W	25	SW	NW	1500	MILLER HILL RD, ALOHA	8
WASH 10239			KELLEY	FRED		0	345	0							X			X		1 S	2 W	25	SW	SE	100	9939 SW STONECREEK DR	
WASH 55680	Deepening - unable to identify original log	32579	MORTON	STEVE			390	390	352	1/4/2000			X		X					1 S	2 W	25	SW	SE	100	9939 SW STONE CREEK DR	12
WASH 10216	Deepening - unable to identify original log		BURNS	HENRY L		318	109	405	284	6/15/1971			X		X					1 S	2 W	25					45
WASH 10217	Deepening - unable to identify original log		SHANNON	JERRY		0	117	508	385	6/30/1970			X		X					1 S	2 W	25					30
WASH 10218	Deepening - unable to identify original log		PIERSON	OSCAR		0	97	487	412	8/22/1969			X		X					1 S	2 W	25					15
WASH 10219	Deepening - unable to identify original log		FURBER	ART		0	518	518	396	8/22/1968			X		X					1 S	2 W	25					25
WASH 10220	Deepening - unable to identify original log		COX	WM B		0	663	663	480	10/26/1968			X		X					1 S	2 W	25					28
WASH 10221	Deepening - unable to identify original log		TAUSCHER	A A		0	566	565	495	10/16/1978			X		X					1 S	2 W	25					10
WASH 10222			KNOLES	DON	BASTASCH, FRANK AND	0	625	625	545	2/4/1967	X				X					1 S	2 W	25					12
WASH 10225	Deepening - unable to identify original log		SHANNON	JERRY		0	391	391	360	7/5/1966			X		X					1 S	2 W	25					10
WASH 10226	Deepening - unable to identify original log		PIERSON	OSCAR		0	392	392	360	6/15/1966			X		X					1 S	2 W	25					5
WASH 10230/WASH 10231	Deepening		MUESSIG	JOHN A		0	756/640	640	585/530	12/30/1964	X		X		X					1 S	2 W	25					7
WASH 10367	Alteration - unable to identify original log					0	0	0	0	6/22/1966				X	X					1 S	2 W	25					
WASH 4145	Abandonment - unable to identify original log		HOPPER	TOM		0	0	0	0			X			X					1 S	2 W	25					
WASH 54086					THE TEXAS CO.		9263			5/14/1946										1 S	2 W	25					
WASH 10279					U.S. NATIONAL BANK	0	400	0	0							X				1 S	2 W	26	NE	NE			
WASH 10241	Abandonment - unable to identify original log		HOAK	RICH		0	190	190	0	11/14/1989		X								1 S	2 W	26	NE	NE			
WASH 10242	Abandonment - unable to identify original log		HOAK	RICH		0	114	0	0	10/21/1989		X								1 S	2 W	26	NE	NE			
WASH 10273/WASH 10261	Deepening - original log likely identified		PIERCE/ LANGLAND	ROBERT/ MARIA A		0	60/85	145/85	60	7/11/1968	X		X		X					1 S	2 W	26	NE	NW			20

Well Log ID	Notes	Well Tag No.	Well Owner Last Name	Well Owner First Name	Company Name	Depth to First Water	Depth Drilled	Completed Depth	Post Static Water Level	Completed Date	Work New	Work Abandon-ment	Work Deepening	Work Alteration	Use Domestic	Use Irrigation	Use Community	Use Live-stock	Use Industrial	Township	Range	Sctn	Qtr160	Qtr40	Tax Lot	Street of Well	Max Yield
WASH 10304					B & D CRUSHING CO.	0	472	472	125	3/25/1961	X								X	1 S	2 W	26	NE	SW			232
WASH 61232		69648	LEE	PETER		270	305	305	38	5/25/2004	X				X					1 S	2 W	26	NE	SW	3100	21770 SW RIGGS RD, BEAVERTON	180
WASH 10286			SCRIVENER	M E		110	113	113	37	10/17/1956	X				X					1 S	2 W	26	NW	NE			9
WASH 53372	Deepening and Alteration - unable to identify original log	18236	ANDERSON	BOB		255	300	300	32	4/3/1998			X	X	X					1 S	2 W	26	NW	NE	1200	21905 SW RIGGS RD	40
WASH 59603		64128	AMES	HOMER		440	445	445	19	6/4/2003	X				X					1 S	2 W	26	NW	NE	900	22065 SW RIGGS RD	90
WASH 556/WASH 52948	Deepening and Alteration	18236	LANGLAND/ANDERSON	O A/BOB		70/245	150/255	150/255	52/39	11/4/1997	X		X	X	X					1 S	2 W	26	NW	NE	1200	21905 SW RIGGS RD	70
WASH 59604	Abandonment - unable to identify original log		AMES	HOMER			185	0	20	6/4/2003		X			X					1 S	2 W	26	NW	NE	900	22065 SW RIGGS RD	
WASH 65141/WASH 593	Abandonment		SAHNOW/ MOHR	DARYL/ MERIE	SAHNOW, SHANNON/	283	290	290	26/125	3/6/2007	X	X			X					1 S	2 W	26	NW	NW	1600	22135 SW RIGGS RD, BEAVERTON	1
WASH 64922		87457	SAHNOW	DARYL	SAHNOW, SHANNON	459	470	470	22	12/27/2006	X				X					1 S	2 W	26	NW	NW	1600	22135 SW RIGGS RD, BEAVERTON	50
WASH 10289			GUTHRIE	THOMAS		0	301	301	115	11/1/1966	X				X					1 S	2 W	26	NW	SE			10
WASH 10306			SCHAEFER	KARL		0	403	403	4	7/18/1957	X					X				1 S	2 W	26	NW	SE			425
WASH 10245			ANDERSON	DON		104	145	145	48	9/15/1987	X				X					1 S	2 W	26	NW	SW			30
WASH 10246			ANDERSON	DON		0	70	70	0	5/19/1987	X				X					1 S	2 W	26	NW	SW			
WASH 10269		33813	TOMPKINS	HARRY		0	205	205	58	7/29/1968	X				X					1 S	2 W	26	NW	SW	3300	22105 SW FARMINGTON RD	100
WASH 10288			DOERN	JOHN		0	155	155	75	8/22/1969	X				X					1 S	2 W	26	NW	SW			25
WASH 55685		32580	SHUEY	BILL		19	155	155	40	1/17/2000	X				X					1 S	2 W	26	NW	SW	3601	22385 SW FARMINGTON RD	26
WASH 55220/WASH 10268	Alteration	33813	TOMPKINS	HARRY	TOMPKINS, CHERYL	64	205	205	64/58	9/9/1999	X			X	X					1 S	2 W	26	NW	SW	3300	22105 SW FARMINGTON RD	100
WASH 10277	Alteration - unable to identify original log	33813	TOMPKINS	HARRY		0	0	0	0	6/30/1978				X	X					1 S	2 W	26	NW	SW	3300	22105 SW FARMINGTON RD	
WASH 58973	Alteration - unable to identify original log	32580	DURBIN	MICHAEL			155	155	44	12/5/2002				X	X					1 S	2 W	26	NW	SW	3601	22385 SW FARMINGTON	
WASH 50723					BAKER ROCK PRODUCTS	57	65	65	27	5/30/1996	X								X	1 S	2 W	26	SE	NW	200	21880 SW FARMINGTON RD	20
WASH 50757	Alteration - unable to identify original log				BAKER ROCK PRODUCTS					6/5/1996				X	X				X	1 S	2 W	26	SE	NW	200	21880 SW FARMINGTON RD	
WASH 10308					METROPOLITAN MTLS. CO.	0	432	432	270	7/21/1961	X				X	X				1 S	2 W	26	SE	SE			
WASH 10247					L H COBB CRUSHED ROCK	170	460	460	167	5/23/1984	X								X	1 S	2 W	26	SE	SW			150
WASH 10307					WARREN NORTHWEST INC.	0	299	299	165	9/19/1958	X				X	X				1 S	2 W	26	SE	SW			20
WASH 10280			BURRIS	JOE		302	350	350	247	4/10/1971	X				X					1 S	2 W	26	SW	NE			30
WASH 10283			JACOBS	R C DOCTOR		298	335	335	195	9/23/1971	X				X					1 S	2 W	26	SW	NE			10
WASH 10291			FRAZER	J K		0	145	0	0		X				X			X		1 S	2 W	26	SW	NE			
WASH 10292			BRACKE	JOHN		0	350	350	268	8/22/1969	X				X					1 S	2 W	26	SW	NE			40
WASH 10294			RAWLINS	DON		0	350	350	232	7/28/1969	X				X					1 S	2 W	26	SW	NE			15
WASH 10295			BAISLEY	WAYNE J		0	220	220	147	7/29/1969	X				X					1 S	2 W	26	SW	NE			15
WASH 51801		9616	ENSINGER	AMELIA		19	144	144	105	2/6/1997	X				X					1 S	2 W	26	SW	NE	1400	9720 SW CLARK HILL RD	37
WASH 10293/WASH 10290	Deepening - original log likely identified		COTTRELL	ROBERT	LYLE COBB CRUSHED ROCK	401	330/142	330/472	234/293	1/22/1973	X		X		X					1 S	2 W	26	SW	NE			30
WASH 10296			TRUMP	WILLIAM E		0	111	111	25	6/27/1957	X				X					1 S	2 W	26	SW	NW			30
WASH 10297			BRISBINE	W P		0	90	29	20.6		X				X					1 S	2 W	26	SW	NW			
WASH 67399		97493	PESSNER	RONALD		280	320	320	149	10/15/2008	X				X					1 S	2 W	26	SW	SE	1100	SW GREEN SLOPE RD, BEAVERTON	40
WASH 10299					THE P R L COMPANY	0	220	220	60	4/18/1963	X				X					1 S	2 W	26	SW	SW			20
WASH 50814		6122	OEKERMAN	AL		90	205	205	74	6/6/1996	X				X					1 S	2 W	26	SW	SW	500	9915 CLARK HILL RD	20
WASH 10300					THE P R L COMPANY	0	200	200	70	3/20/1963	X				X					1 S	2 W	26	SW	SW			20
WASH 10302					P R L CO.	0	132	132	90	8/1/1962	X				X					1 S	2 W	26	SW	SW			10
WASH 10303					P R L COMPANY	0	150	150	75	8/24/1962	X				X					1 S	2 W	26	SW	SW			10
WASH 10298/WASH 10301	Deepening - original log likely identified		CLINK	CHARLES	P R L COMPANY	0	56/168	223/168	70/93	6/8/1963	X		X		X					1 S	2 W	26	SW	SW			18
WASH 4146			WAHLSTROM	LARS		165	220	220	93	9/23/1994	X				X					1 S	2 W	26	SW		2400		25
WASH 10248			SNEED	PHILLIP		95	225	225	57	7/6/1972	X				X					1 S	2 W	26					21
WASH 10259			KELLEY	JIM		0	245	245	11	6/19/1970	X				X					1 S	2 W	26					17
WASH 10263	Deepening - unable to identify original log		HUFFMAN	HOWARD		0	110	110	70	9/6/1960			X		X					1 S	2 W	26					30
WASH 10269		33813	TOMPKINS	HARRY		0	205	205	58	7/29/1968	X				X					1 S	2 W	26					100
WASH 10271	Deepening - unable to identify original log		HUFFMAN	HOWARD			245	245	102	7/16/1968			X							1 S	2 W	26					60
WASH 10249			BOSTON	ALFRED H		30	215	215	0	5/18/1972	X				X					1 S	2 W	26					15
WASH 10258			WICKENKAMP	JOHN A		0	196	196	105	9/2/1969	X				X					1 S	2 W	26					30
WASH 10262			HOENZE	D R		0	335	335	245	5/18/1961	X				X					1 S	2 W	26					10
WASH 10264			HEUSSER	DONALD		0	215	215	125	3/22/1969	X				X					1 S	2 W	26					20
WASH 10265	Deepening - unable to identify original log		WITLER	MRS		0	149	147	86	8/30/1969			X		X					1 S	2 W	26					9
WASH 10267	Deepening - unable to identify original log		SWAN	KEITH		0	203	203	112	9/18/1968			X		X					1 S	2 W	26					27
WASH 10272			LENTZER	FRANK		0	164	164	85	4/27/1967	X				X					1 S	2 W	26					39
WASH 10275			CLARK	JOS T		0	170	170	40	9/12/1966	X				X					1 S	2 W	26					10
WASH 10278	Deepening		LARSON/	L/ GARY		225	5/220/127	105/220/232	10/96/54	7/26/1978	X		X		X					1 S	2 W	26					30
WASH 10277	Alteration - unable to identify original log	33813	TOMPKINS	HARRY		0	0	0	0	6/30/1978				X	X					1 S	2 W	26				22105 SW FARMINGTON RD	
WASH 10281	Alteration - unable to identify original log		MOHR	MERIE		0	0	0	31	5/17/1976				X	X					1 S	2 W	26					2
WASH 10305	Alteration - unable to identify original log				BAKER ROCK CRUSHING CO INC	170	470	470	170	2/26/1982				X					X	1 S	2 W	26					
WASH 61345		70602	BERGEY	MATT		97	145	133	63	6/28/2004	X				X					1 S	2 W	27	NE	NW	1500	8160 SW JACKTOWN, BEAVERTON	30
WASH 994			LINDOW	KEN		268	370	370	16	6/26/1991	X				X					1 S	2 W	27	NW	NW			75
WASH 10319			SCHLESSER	RUTH E		73	124	124	29	12/17/1979	X				X					1 S	2 W	27	NW	SE			7
WASH 53689		25347	DAVIS	EVA		25	295	295	33	6/24/1998	X				X					1 S	2 W	27	NW	SE	3100	23839 SW DANIEL RD, HILLSBORO	60
WASH 10341			PAUCKE	VAN A		0	95	0	0		X							X		1 S	2 W	27	SE	NE			
WASH 10312			TABB	DOCTOR		156	170	170	22	2/23/1989	X				X					1 S	2 W	27	SE	NW			36
WASH 10342			LUX	EDWIN C		0	90	50	12						X					1 S	2 W	27	SE	NW			
WASH 10347/WASH 10324	Deepening - original log likely identified		ESTBERG	E/STEVE		120	105/60	165	20/49	10/20/1970	X		X		X					1 S	2 W	27	SE	SE			75
WASH 2119			KIM	DAVID		167	230	230	65	10/5/1993	X				X					1 S	2 W	27	SE	SE	4000	22640 SW FARMINGTON RD	85
WASH 594			EHLER	JOHN		187	250	250	12	5/6/1987	X				X					1 S	2 W	27	SE	SW			15
WASH 10310			LANE	CYR		355	408	408	25	5/4/1989	X				X					1 S	2 W	27	SW	NW			72
WASH 10318			VASQUEZ	MANUEL		425	497	497	13	5/6/1982	X				X					1 S	2 W	27	SW	SE			60
WASH 10338			SHAW	O BRYAN		218	255	255	15	10/17/1978	X				X					1 S	2 W	27	SW	SE			50
WASH 68112		100301	PRENTICE	CHARLES	PRENTICE, JUDY	290	345	345	41	7/23/2009	X				X					1 S	2 W	27	SW	SE	2000	9688 SW JACKTOWN RD	90
WASH 1050			LUX	EDWARD	COLUMBIA EMPIRE MEAT CO.	201	224	224	27	3/16/1993	X				X					1 S	2 W	27	SW	SW		9339 SW JACKTOWN RD, BEAVERTON	100
WASH 59048	Alteration - unable to identify original log	55261	WARNER	CHRIS				400		12/28/2002				X	X					1 S	2 W	27	SW	SW	1300	22600 SW RIGGS RD	
WASH 64480		85982	FOUSTE	WILLIAM		410	416	416	45	8/23/2006	X				X					1 S	2 W	27	SW	SW	3400	24425 SW FARMINGTON RD	150
WASH 10321			LUX	EDWIN		90	380	380	48	7/12/1972	X				X					1 S	2 W	27					150
WASH 10323			LUX	MR EDWIN		315	245	245	36	11/4/1970	X				X					1 S	2 W	27					150
WASH 10328			PITMAN MD	W G		0	212	212	15	11/11/1967	X				X	X				1 S	2 W	27					250
WASH 10343			BUTCHER	E H		0	365	350	20						X					1 S	2 W	27					
WASH 595			SCHURMAN	JOHN H	SCHURMAN, MARY M	278	355	355	50	9/5/1972	X				X					1 S	2 W	27					25
WASH 3120/WASH 10349	Deepening		WANDELL	JOHN		155	175/140	175/140	6/30	5/20/1993	X			X	X					1 S	2 W	28	NE	NW		8105 RIVER RD, HILLSBORO	40
WASH 10312 Version 2			TABB	ROGER DOCTOR		156	170	170	22	2/23/1989	X				X					1 S	2 W	28	NE	SE	200	24658 SW DANIEL RD	
WASH 10382			PAULSEN	JERRY		95	130	130	23	5/15/1973	X				X					1 S	2 W	28	NE	SE			10
WASH 10350			EVANS	RUSS		80	134	134	14	12/23/1982	X				X					1 S	2 W	28	NE	SW			7
WASH 930/WASH 10380	Deepening		STARR	CHARLES		135	163/120	163/120	17/0	5/16/1991	X		X		X	X				1 S	2 W	28	NE	SW/NW			63
WASH 10379			WATTS	JOHN		0	150	150	20	12/16/1965	X					X				1 S	2 W	28	NE				150

Appendix C
Well Log Inventory in Area Affected by ASR Wells
Joint Water Commission Limited License Application

Well Log ID	Notes	Well Tag No.	Well Owner Last Name	Well Owner First Name	Company Name	Depth to First Water	Depth Drilled	Completed Depth	Post Static Water Level	Completed Date	Work New	Work Abandon-ment	Work Deepening	Work Alteration	Use Domestic	Use Irrigation	Use Community	Use Live-stock	Use Industrial	Township	Range	Sctn	Qtr160	Qtr40	Tax Lot	Street of Well	Max Yield
WASH 5602 Version 2			DONALDSON	GLENN			185	185	17.5	11/16/1964	X				X					1 S	2 W	28	NW	SW			24
WASH 10351			KAUFMAN	ROBERT	KAUFMAN, ELEANOR	38	220	220	22	8/17/1981	X				X					1 S	2 W	28	SW	NW			20
WASH 11245					TWIN OAKS BAR AND GRILL	360	400	400	10	9/13/1995	X				X					1 S	2 W	28	SW	SW		9785 RIVER RD	40
WASH 60092		66008	DECKER	MARVIN		20	480	480	42	9/9/2003	X				X					1 S	2 W	28	SW	SW	400	25960 SW FARMINGTON RD	75
WASH 10355			GILBERT	HOWARD C		60	130	130	40	8/5/1971	X				X					1 S	2 W	28					20
WASH 10356/WASH 10352	Deepening		HANSON	ROBERT D		100/130	120/50	120/170	75/30	7/3/1979	X		X		X					1 S	2 W	28					20
WASH 10358			YACCNETTI	ERNEST D		115	330	330	60	5/18/1979	X				X					1 S	2 W	28					15
WASH 10359			MENDER	LOWELL D		20	285	285	12	6/29/1971	X				X					1 S	2 W	28					50
WASH 10360			MILLER	THOMAS M		50	155	155	90	6/29/1971	X				X					1 S	2 W	28					25
WASH 10361	Flow test of WASH 10377		MAY	EDWARD M		0	0	0	15	11/16/1970				X	X					1 S	2 W	28					15
WASH 10363			SPEER	WARREN		0	133	133	17	8/25/1969	X				X					1 S	2 W	28					10
WASH 10365			HAWKINSON	C E		0	175	175	17	9/18/1967	X				X					1 S	2 W	28					30
WASH 10366			O'MERA	JOE		0	200	200	30	7/24/1966	X				X					1 S	2 W	28					30
WASH 10370			VANDEHEY	VINCENT H		0	126	126	12	3/23/1962	X				X					1 S	2 W	28					12
WASH 10381						17	0	0	0	6/9/1975	X				X					1 S	2 W	28					7
WASH 62569		78351	EVENSON	FRANK		370	392	392	20	7/14/2005	X				X					1 S	2 W	33	NE	SE	1401	24380 SW TILE FLAT RD	24
WASH 895			GOLD	LES	GOLD, FLORIS	635	655	650	24	4/5/1991	X				X					1 S	2 W	33	NE	SW			75
WASH 10495			BELLAMY	LLOYD		0	375	355	23						X			X		1 S	2 W	33	NW	SW			
WASH 1524/WASH 10487	Deepening		LOPEZ/ BELLAMY	JUAN/LLOYD		365	375/245	375/245	20/25	6/12/1992	X		X		X					1 S	2 W	33	NW	SW	700		10
WASH 65855		90611	ROSHAK	DONALD		630	700	700	78	9/12/2007	X				X					1 S	2 W	33	NW	SW	700	11300 SW RIVER RD, HILLSBORO	40
WASH 10480			HESSE	BILL		260	305	305	9	2/28/1990	X				X					1 S	2 W	33	SE	SW			100
WASH 10490			ASBAHR	C E		0	715	266	3		X				X	X				1 S	2 W	33	SW	SE			
WASH 10482	Abandonment - unable to identify original log		SWANSON	BILL		0	0	0	0	10/11/1985		X			X					1 S	2 W	33	SW	SW			
WASH 887			DECKER	MARVIN				244	0	3/14/1991				X	X					1 S	2 W	33	SW	SW			102
WASH 10485			HIRSCH- BERGER	DONALD W		0	245	245	129	9/12/1969	X				X					1 S	2 W	33					30
WASH 64738		87451	REDYK	JAN	EUROPEAN NURSERIES	186	370	370	56	10/19/2006	X				X					1 S	2 W	34	NE	SW	1700	23400 SW TILE FLAT RD, BEAVERTON	75
WASH 10497			THOMAS	F M		0	640	610	3											1 S	2 W	34	NW	NE			
WASH 5803/WASH 10502	Deepening		STEELE/PETER	H M/JOE		178/450	178/530	178/530	33/15	4/25/1979	X		X		X					1 S	2 W	34	NW	NW			15
WASH 10496			HEATON	ERWIN		214	245	245	4	5/19/1977	X				X					1 S	2 W	34	SE	SE			30
WASH 10500			TANKERSLEY	RON		120	135	135	30	1/12/1981	X				X					1 S	2 W	34	SE	SE			7
WASH 4308					COLUMBIA EMPIRE FARM INC.	180	300	300	27	11/14/1994	X					X				1 S	2 W	34	SE	SE		22525 TILE FLAT RD	250
WASH 53715	Deepening - unable to identify original log	25342			COLUMBIA EMPIRE FARM INC.	127	207	207	9	6/30/1998			X		X					1 S	2 W	34	SE	SE	1800	22525 TILE FLAT RD	60
WASH 10501			GRON	CLIFF		129	232	232	20	8/3/1979	X				X					1 S	2 W	34	SE	SW			45
WASH 67973		98566	WOOLLETT	THOM		165	225	225	14	6/8/2009	X				X					1 S	2 W	34	SE	SW	1902	12700 SW 231ST PLACE	60
WASH 10515 Version 2			BENNETT	HAROLD		152	155	155	7	7/3/1974	X				X					1 S	2 W	34	SW	NE	1601	23415 SW TILE FLAT RD	40
WASH 55527		37862	BASHAR	ANWAR		179	360	360	15	11/1/1999	X				X					1 S	2 W	34	SW	NE	1500		60
WASH 60911		64517	STALNAKER	JIM	STALNAKER, TAMI	250	310	310	15	9/29/2003	X				X					1 S	2 W	34	SW	NE	1503	23660 SW TILE FLAT RD	24
WASH 10504			SAMPSON	KELLY		22	245	245	135	6/14/1976	X				X					1 S	2 W	34					15
WASH 10513			WENZEL	JOE		162	185	185	92	4/23/1973	X				X					1 S	2 W	35	NW	NE			30
WASH 10514			HEIMECK	BEN		0	408	403	48	3/26/1962	X				X	X				1 S	2 W	35	NW	NW			183
WASH 10518			WOLLERTZ	C J		0	55	20	33						X			X		1 S	2 W	35	NW	NW			
WASH 10520			COX	E L		0	86	27	0						X					1 S	2 W	35	NW	SE			
WASH 10508			BERARDI	GERAD	BERARDI, LESLIE	140	305	305	95	6/1/1988	X									1 S	2 W	35	SE	NE	12020000		25
WASH 10507			BROCK	ROBERT	MR & MRS	61	175	175	28	9/21/1988	X				X					1 S	2 W	35	SE	SW			18
WASH 10516			SAUTER	JIM		88	100	100	6	3/22/1978	X				X					1 S	2 W	35	SE	SW			20
WASH 10515			BENNETT	HAROLD		152	155	155	7	7/3/1974	X				X					1 S	2 W	35	SW	SW			40
WASH 10517			ALGESEHIMER	ANN		0	200	0	3						X			X		1 S	2 W	35	SW	SW			
WASH 10509			TANKERSLEY	RON		100	260	260	20	7/13/1979	X				X					1 S	2 W	35					20
WASH 10511	Deepening - unable to identify original log		HURLEY	PAT		0	153	153	78	10/30/1969			X		X					1 S	2 W	35					10
WASH 10512			ROYER	CRAIG		0	186	186	54	6/22/1970	X				X					1 S	2 W	35					15
WASH 609			MCCARTY	MR JAMES	MCCARTY, MRS JAMES	225	328	325	220	1/11/1977	X				X					1 S	2 W	35					30
WASH 52941		18358	OHLSEN	DAVE		390	500	500	390	10/17/1997	X				X					1 S	2 W	36	NE	NW	1800	HORSETAIL DR	36
WASH 10521			EBERT	RALPH		112	305	305	215	8/9/1982	X				X					1 S	2 W	36	NW	SW			24
WASH 10529	Deepening - unable to identify original log		WENZEL	WILLIAM		0	350	350	228	10/3/1967			X		X					1 S	2 W	36	SE	NE			40
WASH 10525			WENZEL	WILLIAM		0	222	20	170						X			X		1 S	2 W	36	SE				
WASH 56299/WASH 42	Deepening	41145	FOGLIO	DAVID	FOGLIO, CHARLENE	350/124	360/210	360/210	80	8/3/2000	X		X		X					1 S	2 W	36	SW	NE	801		100
WASH 610			TYGART	STEPHEN C		165	195	190	90	10/2/1981	X				X					1 S	2 W	36	SW	NE			25
WASH 56058		39466	BIERLY	ROSCO		75	400	400	67	6/2/2000	X				X					1 S	2 W	36	SW	NW	2	11480 SW GRABHORN	30
WASH 58498		55309	BIERLY	ROSCOE		78	459	459	73	6/10/2002	X				X					1 S	2 W	36	SW	NW	2	11480 SW GRABHORN RD	120
WASH 3166			BERGEY	BRUCE		140	157	157	51	6/7/1993	X				X					1 S	2 W	36	SW	SW			30
WASH 10522			REMPEL	DANIEL		140	280	280	120	4/16/1984	X				X					1 S	2 W	36					9
WASH 10523			OLSON	DAVE		430	465	465	300	4/7/1973	X				X					1 S	2 W	36					20
WASH 10524			LOW	DENNIS		410	537	535	360	10/4/1976	X				X					1 S	2 W	36					45
WASH 10527	Deepening - unable to identify original log		KLODZ	JOHN		0	110	230	30	4/9/1969			X		X					1 S	2 W	36					75
WASH 10528	Deepening - unable to identify original log		KLODZ	JOHN		0	60	290	56	6/14/1973			X		X					1 S	2 W	36					130
WASH 10530	Deepening - unable to identify original log		REMPEL	DANIEL		196	105	245	133	1/20/1972			X		X					1 S	2 W	36					18
WASH 10531	Deepening - unable to identify original log		KOBBE	JOHN R		0	205	365	240	7/4/1973			X		X					1 S	2 W	36					30
WASH 10532	Deepening - unable to identify original log		DACHTLER, SR	ED		0	453	453	307	10/24/1967			X		X					1 S	2 W	36					22
WASH 11429			DUFFIELD	S D		112	125	125	32	4/2/1976	X				X					2 S	1 W	3	NE	NE			30
WASH 57562		33799	ULRICH	KATHY		84	294	294	163	8/3/2001	X				X					2 S	1 W	3	NE	NW	500	11225 SW CLAY	25
WASH 56897	Abandonment - unable to identify original log				CRESTVIEW CONSTRUCTION INC.		80	0	65	1/4/2001		X			X					2 S	1 W	3	NW	SE	4401	11565 SW FONNER, TIGARD	
WASH 11432			PATCHEN	C H		0	80	80	44	10/30/1958	X				X					2 S	1 W	3	SE	NW			20
WASH 11434			DAVIS	LEONARD S		0	218	164	185		X					X				2 S	1 W	3	SE	SW			
WASH 1138	Abandonment - unable to identify original log		OLSEN	LLOYD		0	0	0	0			X								2 S	1 W	3	SW	NE		11985 SW 113TH PLACE, TIGARD	
WASH 51246		8783	MOORE	GORDON		90	245	232	158	9/16/1996	X				X					2 S	1 W	3	SW	NW		13535 SW 121ST AVE	45
WASH 54878	Abandonment - unable to identify original log				BRUNDIDGE CONSTRUCTION INC.		402	0		6/3/1999		X			X					2 S	1 W	3	SW	NW		QUAIL HOLLOW SUB EAST OF 121ST	
WASH 11430	Deepening - unable to identify original log		BECHTOLD	GLEN		0	290	290	207	7/18/1969			X		X					2 S	1 W	3	SW	SW			25
WASH 11433			LOOMIS			0	190	0	0		X				X			X		2 S	1 W	3	SW	SW			
WASH 51246/WASH 54390/ WASH 54391		8783	MOORE	GORDON	CHEROKEE GENERAL CORP./CHEROKEE GENERAL CORP.	90	245	232	158/25	12/30/1998	X				X					2 S	1 W	4	NE	SE	100	13535 SW 121ST AVE	45
WASH 54878/WASH 11438	Abandonment - original log likely identified		BARTL.ETT	ALLEN	BRUNDIDGE CONSTRUCTION INC.	0	402/261	261	133	6/3/1999		X	X		X					2 S	1 W	4	NE	SE	100	QUAIL HOLLOW EAST OFF OF 121ST IN TIGARD	30
WASH 11449					TIGARD WATER DISTRICT	0	494	494	215	2/17/1958	X						X			2 S	1 W	4	NE	SW			380
WASH 11445/WASH 11437	Deepening - original log likely identified	922	WILLENBERG/ BOWNMAN	JESS L/ EARL R		0	198/152	198/345	155	6/29/1969	X		X		X					2 S	1 W	4	NW	SE			15
WASH 4428/WASH 11436	Abandonment		HANSEN	HARRIS H	MATRIX DEVELOPMENT	0	600	600	114	4/25/1960	X	X			X	X				2 S	1 W	4	NW	SE/NE	3200	CASTLE HILL DEVELOPMENT OFF 135TH	25
WASH 11442/WASH 11435	Abandonment		SUNAMOTO	R	CITY OF TIGARD	0	385	385	0	1/5/1990		X				X				2 S	1 W	4	NW/NE	SW			
WASH 8610	Abandonment - unable to identify original log				SIERRA PACIFIC DEVELOPMENT	0	0	0	0			X			X					2 S	1 W	4	SW	SW			
WASH 11444			MILES			0	190	190	150						X			X		2 S	1 W	4	SW				
WASH 11446			SANDNESS			0	170	42	142						X			X		2 S	1 W	4	SW				

Well Log ID	Notes	Well Tag No.	Well Owner Last Name	Well Owner First Name	Company Name	Depth to First Water	Depth Drilled	Completed Depth	Post Static Water Level	Completed Date	Work New	Work Abandon-ment	Work Deepening	Work Alteration	Use Domestic	Use Irrigation	Use Community	Use Live-stock	Use Industrial	Township	Range	Sctn	Qtr160	Qtr40	Tax Lot	Street of Well	Max Yield
WASH 11448			HANSELL	HARRIS H		0	600	600	114	4/25/1960	X									2 S	1 W	4	SW				25
WASH 11450/WASH 11447	Deepening - original log likely identified		NASH/ SANDNESS	V L/ REUBEN C	SANDNESS, JOYCE V	0	247/178	247/63	85/145	5/25/1957			X		X	X				2 S	1 W	4	SW/NW	NW/SE			16
WASH 11439			LANE	KARL E	LANE BROTHERS	0	200	200	160	5/10/1960	X									2 S	1 W	4					4
WASH 11440			BOWMAN	E R		0	200	200	125	5/18/1960	X				X					2 S	1 W	4					2
WASH 682			HAMPHILL	RAY		382	395	395	238	3/15/1973	X				X					2 S	1 W	5	NE	NE			25
WASH 11476			BRINGAS	MARINO		0	258	258	107	10/10/1967	X				X					2 S	1 W	5	NE	SE			41
WASH 50028	Abandonment - unable to identify original log				SIERRA PACIFIC		0	0		1/3/1996		X			X					2 S	1 W	5	NE	SE	1300	14664 SW SCHOLLS FERRY RD	
WASH 11452			DEFREES	DUANE		0	223	223	118	6/4/1986				X	X					2 S	1 W	5	NE	SW			24
WASH 11472	Deepening - unable to identify original log		MAY	DANE		0	310	310	120	12/6/1985			X		X					2 S	1 W	5	NE	SW			50
WASH 11474	Deepening - unable to identify original log		FERRIS	R		307	125	350	208	8/30/1974			X		X					2 S	1 W	5	NE	SW			8
WASH 11480/WASH 11475	Deepening		NEHER/NEHER	DR IRA/IRA J		230/316	262/73	262/335	200/237	9/3/1974	X		X		X					2 S	1 W	5	NE	SW			25
WASH 12164/WASH12169	Deepening - likely abandoned		CARLETON	C E		0	206	206	95	7/20/1965	X		X		X					2 S	1 W	5	NE	SW	1900	15310 SW SCHOLLS FERRY RD	18
WASH 13860/WASH 11473	Abandonment - original log likely identified		ANDEREGG	ARNOLD	STANDRING INC.	190	300	291	182	7/21/1978		X		X	X					2 S	1 W	5	NE	SW	1800	WAS RT 1 BX 416	20
WASH 50889	Abandonment - unable to identify original log				VENTURE PROPERTIES					7/8/1996		X			X					2 S	1 W	5	NE	SW	1900	15310 SW SCHOLLS FERRY RD	
WASH 50890	Abandonment - unable to identify original log				VENTURE PROPERTIES					7/9/1996		X			X					2 S	1 W	5	NE	SW	1900	15370 SW SCHOLLS FERRY RD	
WASH 60710	Abandonment - unable to identify original log				BONES CONSTRUCTION; PROGRESS QUARRY PROJECT			0	133	11/7/2003		X			X					2 S	1 W	5	NE	SW	100	NEAREST 15301 SW BARROW RD, BEAVERTON	
WASH 11461			CAMPBELL	ROBERT F		0	268	268	200	6/21/1965	X				X					2 S	1 W	5	NE				14
WASH 11482	Deepening - unable to identify original log		NAUMAN	DAN		0	34	267	215	10/11/1958			X		X					2 S	1 W	5	NW	NE			5
WASH 51199	Abandonment - unable to identify original log				MATRIX DEVELOPMENT CORP.				299	9/16/1996		X			X					2 S	1 W	5	NW	NE	400	15651 SW OLD SCHOLLS FERRY, BEAVERT	0
WASH 53893	Abandonment - unable to identify original log				ROBINSON CONSTRUCTION		14	0		8/18/1998		X			X					2 S	1 W	5	NW	NE	400	15605 SW OLD SCHOOLS FERRY RD	
WASH 9168	Deepening - unable to identify original log		CAMPBELL	R F		0	324	324	118	7/16/1960			X		X					2 S	1 W	5	NW	NE	400	15651 SW OLD SCHOLLS FERRY RD	6
WASH 9177	Deepening - unable to identify original log		NAUMAN	MR DANIAL		314	365	365	252	10/12/1971			X		X					2 S	1 W	5	NW	NE			30
WASH 52069/WASH 11459	Abandonment - original log likely identified		SHERK	ROBERT H	W A JONES CO.	0	265	265	200	4/23/1997	X	X			X					2 S	1 W	5	NW	NW	4	158TH & OLD SCHOLLS FRY, BEAVERTON	10
WASH 62070/WASH 11481	Abandonment		VIEHOUSER	DARYL	OLSON BROTHERS EXCAVATING INC.	0	315	315	202/203	2/19/2005	X	X			X					2 S	1 W	5	NW	NW	300	16079 SW OLD SCHOLLS FERRY RD, BEAVERTON	15
WASH 59939	Abandonment - unable to identify original log				G V S CONTRACTING			0	131	8/4/2003		X			X					2 S	1 W	5	NW	SE	200	12615 SW 157TH, BEAVERTON	
WASH 59940	Abandonment - unable to identify original log				G V S CONTRACTION INC.			0	142	8/5/2003		X			X					2 S	1 W	5	NW	SE	200	12615 SW 157TH, BEAVERTON	
WASH 11456			CAMPBELL	ROBERT		320	445	445	210	7/29/1971	X				X					2 S	1 W	5	NW	SW	500	16405 SW OLD SCHOLLS FERRY RD	16
WASH 51194	Abandonment - unable to identify original log				MATRIX DEVELOPMENT CORP.				176	9/16/1996		X			X					2 S	1 W	5	NW	SW	500	16405 SW OLD SCHOLLS FERRY, BEAVERT	
WASH 51200	Abandonment - unable to identify original log				MATRIX DEVELOPMENT CORP.				299	9/16/1996		X			X					2 S	1 W	5	NW	SW	500	16405 SW OLD SCHOLLS FERRY, BEAVERT	
WASH 53714/WASH 11478	Abandonment - original log likely identified		WERNER	HARRY	EXCEL EXCAVATION INC.	0	230/229	229	146/150	7/2/1998	X	X			X	X				2 S	1 W	5	NW	SW	700	12655 SW CANVAS ROCK WAY, BEAVERTON	30
WASH 9179			CAMPBELL	DR N J		369	400	400	385	12/21/1971	X				X					2 S	1 W	5	NW	SW	500	16405 SW OLD SCHOLLS FERRY RD	18
WASH 681/WASH 55158	Abandonment - original log likely identified		STYLES	TOM	COFFMAN EXCAVATING	240	285	280	195	8/9/1977	X	X			X					2 S	1 W	5	SE	SW	300	HILLSHIRE CREEK ESTATES, TIGARD	30
WASH 11485/WASH 11479	Deepening - original log likely identified		BARR/CACH	J H/G C		368	374/165	374/530	368	6/24/1968	X		X		X					2 S	1 W	5	SE	SW/N W			10
WASH 11477/WASH 11465	Deepening		BRINGUS/MANG US	MARINO A/FREEMAN		140	20/175	188/170	160/127	11/20/1974	X		X		X					2 S	1 W	5	SE/NE	NW/NE			24
WASH 11469			ROSHAK	DON		192	220	220	116	8/21/1979	X				X					2 S	1 W	5	SW	NW			50
WASH 3073	Abandonment - unable to identify original log				NORTHWEST EARTHMOVERS INC.	0	0	0	0			X			X					2 S	1 W	5	SW	NW	2301	SCHOLLS FERRY RD	
WASH 3533	Abandonment - unable to identify original log				C M CONSTRUCTION	0	0	0	0			X			X					2 S	1 W	5	SW	NW	175	160TH SCHOOLS FRY RD	
WASH 53011			DOWDLE	RYAN		150	410	410	100	11/8/1997	X				X					2 S	1 W	5	SW	NW	16100	16399 SW HOOPS COURT	5
WASH 11486			FERRIS	CARL D		0	215	215	0	9/25/1955	X				X					2 S	1 W	5	SW	SW			5
WASH 52445/WASH 11484	Abandonment		ROSHAK	FRANK	POLYGON NORTHWEST CO.	0	230	20	222/195	7/23/1997	X	X			X			X		2 S	1 W	5	SW	SW	3801	16035 SW ROSHAK RD, TIGARD	
WASH 58932/WASH 11451	Abandonment - original log likely identified		ROSHAK	GARY	C AND M CONSTRUCTION	271	312/310	310	280/250	11/11/2002	X	X			X					2 S	1 W	5	SW	SW		13985 SW 164TH, TIGARD	20
WASH 11453			KERRON	HARRY		250	365	365	172	7/26/1973	X				X					2 S	1 W	5					20
WASH 11454			BOWMAN	WALTER		360	485	485	245	11/15/1973	X				X					2 S	1 W	5					25
WASH 11455	Deepening - unable to identify original log		DUNHAM	DUANE		0	100	258	103	9/29/1972			X		X					2 S	1 W	5					10
WASH 11456			CAMPBELL	ROBERT		320	445	445	210	7/29/1971	X				X					2 S	1 W	5					16
WASH 11457	Deepening - unable to identify original log		CHRISTIAN	GLADYS		208	100	290	172	7/21/1971			X		X					2 S	1 W	5					28
WASH 11458	Deepening - unable to identify original log		WALTER	M E		0	79	0	169	10/7/1969			X		X					2 S	1 W	5					15
WASH 11460			FITZSIMMONS	BOB		0	265	265	200	4/3/1968	X				X					2 S	1 W	5					20
WASH 11462	Abandonment - unable to identify original log		HVAM	HJALMER		0	277	0	0	12/24/1970		X			X					2 S	1 W	5					
WASH 11463			HVAM	HJAMLER		304	470	470	289	12/24/1970	X				X					2 S	1 W	5					30
WASH 11466					SUNWOOD FARMS OF OREGON LTD.	0	350	350	130	6/14/1969	X									2 S	1 W	5					20
WASH 11467	Deepening				DALES SAND AND GRAVEL	0	240	240	80	4/15/1968	X		X		X					2 S	1 W	5					30
WASH 4163/WASH 11483	Abandonment - original log likely identified		WHITE	HENRY L	TOM MILLER BUILDER INC.	163	169	169	0	2/4/1958	X	X			X					2 S	1 W	5			2000	15440 SW SCHOLLS FERRY	10
WASH 57952		51450			CITY OF BEAVERTON	200	1000	1000	169	11/1/2001	X									2 S	1 W	6	NE	SE	175	DR AND SW SCHOLLS FERRY RD	275
WASH 50853/WASH 50854	Abandonment	3227			TRANSPORTATION	259	301	301	177	6/3/1996	X	X			X					2 S	1 W	6	NE	SW	106	SCHOLLS FERRY AT BEEF BEND RD	35
WASH 54366		18952	LIN	DAVID		15	267	267	132	12/8/1998	X				X					2 S	1 W	6	NW	SE	500	18185 SW SCHOLLS FERRY RD	32
WASH 11510			LINDQUIST	E J	LINDQUIST, R E	0	544	29	88	12/31/1953	X					X				2 S	1 W	6	NW	SW			300
WASH 3859			LOLICH	FRANK			548	548	110	5/21/1994				X		X				2 S	1 W	6	NW	SW			250
WASH 54366		18952	LIN	DAVID		15	267	267	132	12/8/1998	X				X					2 S	1 W	6	NW	SW	500	18185 SW SCHOLLS FERRY RD	32
WASH 11493	Deepening - unable to identify original log		NELSON	JAMES J		218	62	235	162	6/4/1973			X		X					2 S	1 W	6	NW				12
WASH 3456	Abandonment - unable to identify original log		ERICKSON	KARL	VILLAGE SQUARE HOMES INC.	0	0	0	0			X			X					2 S	1 W	6	NW			SW FOSBERG RD	
WASH 11511			WALSTROM	C R		0	198	32	143						X					2 S	1 W	6	SE	NE			
WASH 58861		54611	RALSTON	MRS SHARI	DEAN SEEBURGER CONSTRUCTION	210	235	235	171	9/23/2002	X				X					2 S	1 W	6	SE	NE	2106	16765 SW FRIENDLY LANE, BEAVERTON	12
WASH 11490			BARSTAD	MARTIN		175	275	275	115	9/30/1981	X				X					2 S	1 W	6	SE	NW			45
WASH 11491			LANCASTER	DAVID	LANCASTER, MARSH	167	210	210	110	12/12/1979	X				X					2 S	1 W	6	SE	NW			30
WASH 11513			ROSHAK	EDWARD		0	232	92	90	11/30/1952						X				2 S	1 W	6	SE	SE			
WASH 11512/WASH 11495	Deepening - original log likely identified		CLAYTON	KEN		200	190/147	190/345	105/180	11/21/1970	X		X		X					2 S	1 W	6	SE	SW			40
WASH 11492	Deepening - unable to identify original log		TAYLOR	CHERRYL		220	100	260	95	7/17/1979			X		X					2 S	1 W	6	SW	NE			60
WASH 11489			TAYLOR	CHERYL		120	170	170	99	5/17/1982	X				X					2 S	1 W	6	SW	NW			8
WASH 11509	Deepening - unable to identify original log		SINGER	DONALD		184	100	200	93	9/4/1970			X		X					2 S	1 W	6	SW	NW			30

Appendix C
Well Log Inventory in Area Affected by ASR Wells
Joint Water Commission Limited License Application

Well Log ID	Notes	Well Tag No.	Well Owner Last Name	Well Owner First Name	Company Name	Depth to First Water	Depth Drilled	Completed Depth	Post Static Water Level	Completed Date	Work New	Work Abandon-ment	Work Deepening	Work Alteration	Use Domestic	Use Irrigation	Use Community	Use Live-stock	Use Industrial	Township		Range		Sctn	Qtr160	Qtr40	Tax Lot	Street of Well	Max Yield
WASH 683			FARRIS	GARY		160	227	227	105	7/13/1984	X				X					2	S	1	W	6	SW	NW			40
WASH 51515		3340			COLUMBIA NORTHWEST INC.	510	520	520	405	11/26/1996	X				X					2	S	1	W	6	SW	SW	805	BROOKMAN RD, SHERWOOD	6
WASH 11487			BARTHOLEMY	ED		270	320	320	175	6/19/1989	X				X					2	S	1	W	6			301000000		30
WASH 11488			ARNELL	MICHAEL J		0	305	305	200	8/29/1983	X				X					2	S	1	W	6			402000000		27
WASH 11494			CARSON	JIM		125	200	200	105	8/22/1972	X				X					2	S	1	W	6					30
WASH 11496	Deepening - unable to identify original log		WARD	HAROLD		198	142	310	161	9/9/1970			X		X					2	S	1	W	6					30
WASH 11498			ERICKSON	MRS HENRY		0	290	290	192	7/3/1970	X				X					2	S	1	W	6					24
WASH 11501	Deepening - unable to identify original log		SIMONSEN	IRVING		0	60	192	90	8/11/1967			X		X					2	S	1	W	6					20
WASH 11502	Deepening - unable to identify original log		GRANT	RALPH E		0	50	180	105	7/11/1967			X		X					2	S	1	W	6					10
WASH 11503			IRWIN	LEE		0	230	230	155	3/4/1967	X				X					2	S	1	W	6					15
WASH 11504/WASH 11505	Deepening		HIATT	ERMAN B		182	134/97	134/227	110/155	9/19/1972	X		X		X					2	S	1	W	6					20
WASH 11506	Deepening - unable to identify original log		STYLES JR	T V		0	223	208	171	8/29/1964			X		X					2	S	1	W	6					10
WASH 11507/WASH 11499	Deepening		S	MR M/JESS		0	128/60	128/188	42/59	2/20/1970	X		X		X					2	S	1	W	6					10
WASH 11508/WASH 11500	Deepening		PAGE JR	ROBERT N		120	210/111	210/321	0/187	7/1/1969	X		X		X					2	S	1	W	6					25
WASH 684			ODONNELL	MARK I		140	220	220	148	4/26/1972	X				X					2	S	1	W	6					20
WASH 11519/ WASH 256	Alteration		JETTE	DAVE	JETTE, SUSAN	246	130	260	116	6/30/1981			X	X	X					2	S	1	W	7	NE	NE			35
WASH 53776		18412	ROSHAK	HENRY		140	380	380	170	7/6/1998	X				X					2	S	1	W	7	NE	NE	3110	BULL MOUNTAIN RD	69
WASH 51759		9499	MATTHIAS	FRED		35	270	270	109.5	1/23/1997	X				X					2	S	1	W	7	NE	NE	1000	16748 SW BEEF BEND RD	21
WASH 11523			NUCIGORO	LARRY		154	154	154	105	7/16/1974	X				X					2	S	1	W	7	NE	NW			10
WASH 11514			YOUNG	JACK E		278	292	292	162	5/3/1990	X				X					2	S	1	W	7	NE	SE	130000000		14
WASH 11525/ WASH 11517	Deepening		ARENDS	LESLIE L	ARENDS, MRS CAROL	0	158/ 240	158/ 398	92/ 97	10/11/1963	X		X		X					2	S	1	W	7	NE	SW			75
WASH 52530		16254	MATTHIAS	FRED		238	282	282	117	9/1/1997	X				X					2	S	1	W	7	NE		1000	16748 BEEF BEND RD	50
WASH 11516			MATHIAS	FRED		0	206	200	85	5/31/1964	X				X					2	S	1	W	7	NE				30
WASH 55647		38443			PONZI VINEYARDS	100	203	203	85	1/11/2000	X				X					2	S	1	W	7	NW	NW	800	14665 SW WINERY LANE	40
WASH 53773		25344	THOMPSON	JUNE		190	221	221	60	7/10/1998	X				X					2	S	1	W	7	NW	SE	901	14900 SW WINERY LANE	18
WASH 11524			LUDWIG	HARRY	LUDWIG, HELEN	0	80	80	0	11/16/1955	X				X					2	S	1	W	7	NW	SW			5
WASH 11518			GRAY	KYLE	GRAY, DOROTHY	115	205	205	80	10/28/1984	X				X					2	S	1	W	7	NW		600000000		33
WASH 11515	Deepening - unable to identify original log		BURNELL	ROBERT		100	168	168	88	4/28/1989			X		X					2	S	1	W	7	SE	SE			9
WASH 50813		3226	AMSTAD	WAYNE		221	300	300	118	6/25/1996	X				X					2	S	1	W	7	SE	SE	1800	16465 SW BEEF BEND RD	27
WASH 685			GRABHORN	HOWARD		143	204	203	5	7/6/1978	X				X					2	S	1	W	7	SW	NW			20
WASH 11521			SCHULZ	CHARLES		145	205	200	116	4/29/1976	X				X					2	S	1	W	7		NE			15
WASH 11520			UPCHURCH	GEORGE		176	300	300	160	7/27/1970	X				X					2	S	1	W	7					35
WASH 11522			WEBSTER	MELANIE		0	300	300	190	7/21/1967	X				X					2	S	1	W	7					10
WASH 11527	Abandonment - unable to identify original log		SWOBODA	CHUCK		0	0	0	0	6/7/1989		X								2	S	1	W	8	NE	NW			
WASH 3383/ WASH 3382	Deepening		GROCE	WALTER R			58	408	339	10/4/1969	X		X		X					2	S	1	W	8	NE	SE			20
WASH 11542			BUSHNELL	JOHN J		0	500	13	397		X				X					2	S	1	W	8	NE	SW			
WASH 55875	Abandonment - unable to identify original log				NORTHWEST EARTHMOVERS			0	248	4/21/2000		X			X					2	S	1	W	8	NW	SW	2300	16010 SW BULL MOUNTAIN RD, TIGARD	
WASH 56870	Abandonment - unable to identify original log		CHIMENTO	CHUCK	PICULELL GROUP (C/O)		585	0		12/22/2000	X	X			X					2	S	1	W	8	SE	NE	500	15100 SW 150TH AVE, TIGARD	
WASH 11538	Deepening - unable to identify original log		CHADWICH	C C		0	160	545	374	2/17/1968			X		X					2	S	1	W	8	SE	NE			30
WASH 11541			WIESE	WALT		182	195	195	110	12/18/1973	X				X					2	S	1	W	8	SE	NE			18
WASH 11543			BISHOP	M H		0	339	18	200		X				X			X		2	S	1	W	8	SE	NW			
WASH 61561	Abandonment - unable to identify original log				BONES CONSTRUCTION			0	246	9/5/2004		X								2	S	1	W	8	SE	SE	101	15740 SW 150TH, TIGARD	
WASH 61621		67858			CITY OF TIGARD	340	1022	1022	251	6/15/2004	X									2	S	1	W	8	SE	SE	101	100 FT S OF WOODHUE ST	
WASH 69250		102674	NIEDERS	REGINE		164	400	400	250	10/22/2010	X				X					2	S	1	W	8	SE	SW	1401	15515 SW 150TH AVE, TIGARD	20
WASH 55736		18951	KNOX	DAN	KNOX, PAT	252	366	366	198	11/20/1998	X				X					2	S	1	W	8	SE	SW	1405	15955 SW 150TH	21
WASH 11530			LYNCH	GREG		260	300	300	200	8/23/1983	X				X					2	S	1	W	8	SE	SW	140300000		45
WASH 11545			HASUIKE	Y		0	240	40	220		X				X					2	S	1	W	8	SE	SW			
WASH 11528			HASULKE	WENDY		0	380	380	244	7/1/1986	X				X					2	S	1	W	8	SE				15
WASH 51235		3194	RASMUSSEN	ROGER		380	465	465	287	9/28/1996	X				X					2	S	1	W	8	SW	NE	300	FINIS MEADOWS LANE	25
WASH 62430		72766	NOFFZ	JOHN O	BRENTWOOD HOMES INC.	330	362	362	297	5/13/2005	X				X					2	S	1	W	8	SW	NE	200	15170 SW FINIS LANE	29
WASH 4511			KERSHNER	DALE		278	344	344	261	3/3/1995	X				X					2	S	1	W	8	SW	NE	400		35
WASH 11535			MILAN	DAVE		284	336	336	290	6/22/1979	X				X					2	S	1	W	8	SW	NW			20
WASH 11544			VOLPE	JOE		0	189	189	164	9/28/1964	X				X					2	S	1	W	8	SW	NW			13
WASH 11526			PETERSON	DR DONALD	WILLIAM LLOYD CORPORATION	343	424	424	292	7/14/1989	X				X					2	S	1	W	8	SW	SE	330000000		26
WASH 190			MCCLUSKEY	DR MICHAEL	WILLIAM LLOYD CORPORATION	289	360	360	256	11/14/1990	X				X					2	S	1	W	8	SW	SE			27
WASH 59110		62701	SUNDERMEIER	BILL	SUNDERMEIER, RONDA	275	310	310	232	1/6/2003	X				X					2	S	1	W	8	SW	SE	100	SW FINISH LANE	20
WASH 1126			PISCITELLI	VINCE		216	265	265	176	4/24/1992	X				X					2	S	1	W	8	SW	SE	3700	15540 SW APRIL LANE, TIGARD	45
WASH 11540			NANA	A R		212	230	230	173	9/28/1971	X				X					2	S	1	W	8	SW	SW			25
WASH 11529			DURAZO	ARNOLD		162	240	240	140	10/8/1985	X				X					2	S	1	W	8	SW				25
WASH 1112	Abandonment - unable to identify original log				MOLAR CONSTRUCTION	0	0	0	0			X			X					2	S	1	W	8				15780 SW BULL MT RD	
WASH 686	Deepening - unable to identify original log		JOHNSON	JAMES C		370	178	485	354	1/29/1971			X		X					2	S	1	W	8					12
WASH 11534	Deepening - unable to identify original log		MEYERS	NORMAN		0	133	385	233	10/3/1969			X		X					2	S	1	W	8					12
WASH 11536			BISHOP			0	415	415	310	8/31/1967	X				X					2	S	1	W	8					26
WASH 11539		15517	RONNE	L R		0	355	355	250	9/2/1967	X				X					2	S	1	W	8					20
WASH 11533			HASUIKE	YOSHIO	HASUIKE, SACHIKO	0	335	335	248	6/10/1966	X				X					2	S	1	W	8					22
WASH 11531			TINTO	J F		0	308	308	238	7/22/1964	X				X					2	S	1	W	8					15
WASH 11532			YOUNG	JACK E		0	264	264	98	4/22/1967	X				X					2	S	1	W	8					14
WASH 11537			PRICE	H C		0	165	165	133	6/21/1961	X				X					2	S	1	W	8					15
WASH 69177	Abandonment - unable to identify original log				INC / HIGHLAND HILLS PROJECT			0	378	10/8/2010		X			X					2	S	1	W	9	NE	NW	300	13273 SW BULL MOUNTAIN RD, TIGARD	
WASH 52306	Abandonment - unable to identify original log				NW EARTHMOVERS			0	127	6/26/1997		X			X					2	S	1	W	9	NE	SE	1600	12700 SW BULL MTN, BEAVERTON	
WASH 11546	Abandonment - unable to identify original log				RUTAN CONSTRUCTION, INC.	0	500	0	0	8/16/1989		X								2	S	1	W	9	NE	SW			
WASH 64871	Abandonment - unable to identify original log				N E I / WILSON RIDGE II PROJECT			0	376	11/20/2006		X			X					2	S	1	W	9	NE	SW	2000	13210 SW BULL MOUNTAIN RD, TIGARD	
WASH 11554			HABERFELD	PAUL		0	500	500	0		X				X					2	S	1	W	9	NE	SW			
WASH 66115		89515			CITY OF TIGARD	370	1100	1100	348.7	9/17/2007	X						X			2	S	1	W	9	NW	SW	2500	13001 SW BULL MOUNTAIN RD	1500
WASH 11553	Deepening - unable to identify original log		HODLER	HENRY		190	25	200	155	7/21/1974			X		X					2	S	1	W	9	SE	SE			20
WASH 11547	Abandonment - unable to identify original log		CAHILL	JEFF		0	200	0	0	8/15/1989		X								2	S	1	W	9	SE	SW			
WASH 11555			FOSKETT	H H		0	265	10	130		X				X					2	S	1	W	9	SE	SW			

Appendix C
Water Rights in Area Affected by ASR Wells
Joint Water Commission Limited License Application

Water Right ID	Application Character	Application Number	Permit Character	Permit Number	Certificate	Decree	Claim Character	Claim Nbr	Transfer	POD ID	Township	Range	Sctn	Qtr40	Qtr160	DLC	Lot	Source	TributaryTo	StreamCode	POD Max Rate	POD Max Acre Feet	Use	PriorityDate	Legal
4940	P	80975								26240	1 S	1 W	30	NE	NW			JOHNSON CREEK/POND	BEAVERTON CREEK	2114003000420060000		0.1	WI	2/21/1996	
5800	P	82417								27941	1 S	1 W	20	SE	SE			JOHNSON CREEK/POND	BEAVERTON CREEK	2114003000420060000		1	MU	1/31/1997	
25264							GR	343	T 10990	13376	1 S	1 W	11	NE	SW			WELL 1	SYLVAN CREEK	2114003000180190	0.8912		MU	12/31/1932	220 FEET SOUTH AND 2550 FEET EAST FROM W1/4 CORNER, SECTION 11
25264							GR	343	T 10990	13377	1 S	1 W	21	SE	SW			WELL 2	UNNAMED STREAM	2114003000420060000	2.1166		MU	12/31/1945	460 FEET NORTH AND 2500 FEET EAST FROM SW CORNER, SECTION 21
25462							GR	553		13650	1 S	1 W	27	NE	SE			A WELL	UNNAMED STREAM	2114003000180100	0.1108		IM	12/31/1950	599 FEET ON LINE BEARING NO 28 DEG 30 MIN WEST 1/4 SECTION POST ON EAST LINE
25505							GR	600		13693	1 S	1 W	19	SE	SW			A WELL	BUTTERNUT CREEK	2114003000380	0.0267		ID	9/30/1953	1800 FEET FROM SW CORNER, SECTION 19
25805							GR	894		13977	1 S	1 W	28	SW	SE			A WELL	UNNAMED STREAM	2114003000180090	0.0178		ID	12/31/1948	1250 FEET NORTH & 1200 FEET EAST OF 1/4 CORNER, ON SOUTH LINE, SECTION 28
26192							GR	1299		14351	1 S	1 W	17	NE	NE			WELL 1	UNNAMED STREAM	2114003000420060000	0.0668		ID	12/31/1935	1280 FEET SOUTH 37 DEGREES 30 SECONDS WEST FROM NE CORNER, SECTION 17
26193							GR	1300		14352	1 S	1 W	17	NE	NE			WELL 2	UNNAMED STREAM	2114003000420060000	0.0668		ID	5/31/1954	970 FEET SOUTH 7 DEGREES 0 MINUTES WEST OF NE CORNER, SECTION 17
26194							GR	1301		14353	1 S	1 W	17	SE	NE			WELL 4	UNNAMED STREAM	2114003000420060000	0.1114		ID	12/31/1935	1400 FEET SOUTH 12 DEGREES 0 MINUTES WEST OF NE CORNER, SECTION 17
26684							GR	1807		14802	1 S	1 W	18	NW	NW			A WELL	BEAVERTON CREEK	2114003000420060000	0.0557		IR	12/31/1930	660 FEET SOUTH & 300 FEET EAST FROM NW CORNER, SECTION 18
26740							GR	1864		14854	1 S	1 W	18	SE	NE			A WELL	BEAVERTON CREEK	2114003000420060000	0.0223		IR	12/31/1949	SOUTH 3 DEGREES 50 MINUTES WEST 1800 FEET FROM NE CORNER, SECTION 18
27194							GR	2376		15286	1 S	1 W	19	NE	SE			A WELL	BUTTERNUT CREEK	2114003000380	0.1782		IR	2/28/1944	NORTH 7 DEGREES 30 MINUTES WEST, 1750 FEET FROM SE CORNER, SECTION 19
27271							GR	2465		15360	1 S	1 W	20	NW	SW			A WELL	JOHNSON CREEK	2114003000420060000	0.0312		IR	4/30/1949	NORTH 8 DEGREES 31 MINUTES EAST 1580 FEET FROM SW CORNER, SECTION 20
27476							GR	2681		15560	1 S	1 W	7	NW	NW			A WELL	BEAVERTON CREEK	2114003000420060	0.1114		IR	12/31/1945	SOUTH 20 DEGREES 5 MINUTES EAST 640 FEET FROM NW CORNER, SECTION 7
27572							GR	2789		15652	1 S	1 W	19	NW	SE			A WELL	BUTTERNUT CREEK	2114003000380	0.0267		IR	9/15/1954	2700 FEET NWSE CORNER, SECTION 19
27606							GR	2834		15686	1 S	1 W	30	NW	NE			A WELL	JOHNSON CREEK	2114003000420060000	0.0267		IR	12/31/1940	1800 FEET SWNE CORNER, SECTION 30
27750							GR	3005		15827	1 S	1 W	19	SE	SE			A WELL	BUTTERNUT CREEK	2114003000380	0.0267		IR	11/6/1952	1320 FEET SOUTH & 660 FEET EAST FROM SE CORNER, SECTION 19
27962							GR	3252		16020	1 S	1 W	7	SE	SW			A WELL	UNNAMED STREAM	2114003000420060000	0.0223		IR	5/31/1946	30 FEET NORTH & 380 FEET WEST FROM S1/4 CORNER, SECTION 7
28262							GR	3632		16304	1 S	1 W	19	NE	SW			A WELL	BUTTERNUT CREEK	2114003000380	0.01		IR	12/31/1924	1400 FEET NORTH & 1550 FEET EAST FROM SW CORNER, SECTION 19
28410							GR	3812		16446	1 S	1 W	30	NW	NE			A WELL	JOHNSON CREEK	2114003000420060000	0.0111		IR	8/31/1949	570 FEET SOUTH AND 2360 FEET WEST FROM NW CORNER, SECTION 30
28433							GR	3837		16467	1 S	1 W	21	NW	SE			A WELL	UNNAMED STREAM	2114003000420060000	0.0936		IR	10/31/1951	2460 FEET NORTH AND 1950 FEET WEST FROM SE CORNER, SECTION 21
28587							GR	4050		16620	1 S	1 W	19	SE	SE			A WELL	BUTTERNUT CREEK	2114003000380	0.1114		SC	8/2/1954	1500 FEET NORTHWEST FROM SE CORNER, SECTION 19
28587							GR	4050		16620	1 S	1 W	19	SE	SE			A WELL	BUTTERNUT CREEK	2114003000380	0.1114		FP	8/2/1954	1500 FEET NORTHWEST FROM SE CORNER, SECTION 19
28589							GR	4053		16622	1 S	1 W	31	NW	SW			A WELL	TUALATIN RIVER	211400300	0.0134		IR	3/1/1950	1200 FEET SOUTH & 950 FEET WEST FROM CENTER, NWSW, SECTION 31
28811							GR	2427		16832	1 S	1 W	7	SE	NW			A WELL	BEAVERTON CREEK	2114003000420060	0.0401		IR	7/5/1949	50 FEET NORTH & 490 FEET WEST FROM CENTER, SECTION 7
28855							GR	3371		16876	1 S	1 W	30	SE	NE			A WELL	UNNAMED STREAM	2114003000420060000000	0.0223		IR	8/31/1950	200 FEET SE OF NW CORNER, SENE, SECTION 30
28895							GR	3534		16916	1 S	1 W	34	NE	NE			A WELL	FANNO CREEK	2114003000180	0.4991		IR	4/4/1953	510 FEET SOUTH & 950 FEET WEST FROM NE CORNER, SECTION 34
28988							GR	3533		17009	1 S	1 W	18	NW	SE			A WELL	UNNAMED STREAM	2114003000420060000	0.0223		IR	12/31/1942	770 FEET SOUTH AND 550 FEET EAST FROM CENTER, SECTION 18
28998							GR	3364		17019	1 S	1 W	19	SE	SE			A WELL	BUTTERNUT CREEK	2114003000380	0.0178		IR	5/20/1947	PROPERTY LINE ON WEST IS 170TH AVE, ON SOUTH, COUNTY ROAD 223
29032							GR	3194		17053	1 S	1 W	18	SW	SE			A WELL	UNNAMED STREAM	2114003000420060000	0.0223		IR	7/12/1946	1740 FEET NORTH AND 1000 FEET WEST FR0M SE CORNER, SECTION 19
32838	R	81474	R	12137						33187	1 S	1 W	31	NW	SW			RUNOFF/RES	TUALATIN RIVER	211400300		5	WI	8/29/1996	
32923	R	81961	R	12228						33300	1 S	1 W	8	SW	SE			BEAVERTON CREEK/RESERVOIR	ROCK CREEK	2114003000420060000		36.2	FW	2/12/1997	
32923	R	81961	R	12228						33300	1 S	1 W	8	SW	SE			BEAVERTON CREEK/RESERVOIR	ROCK CREEK	2114003000420060000		36.2	RC	2/12/1997	
32923	R	81961	R	12228						33301	1 S	1 W	8	SW	SE			JOHNSON CREEK/RESERVOIR	ROCK CREEK	2114003000420060000		36.2	FW	2/12/1997	
32923	R	81961	R	12228						33301	1 S	1 W	8	SW	SE			JOHNSON CREEK/RESERVOIR	ROCK CREEK	2114003000420060000		36.2	RC	2/12/1997	
33242	R	83829	R	12553						33685	1 S	1 W	20	NE	NE			UNNAMED STREAM/RESERVOIR	JOHNSON CREEK	2114003000420060000		0.3	WI	5/11/1998	ALSO NWNE, SWNE, SENE
33243	R	83831	R	12554						33686	1 S	1 W	31	NW	SW			RUNOFF/RES	TUALATIN RIVER	2114003000320		0.25	WI	5/15/1998	
33261	R	83898	R	12572						33706	1 S	1 W	31	NW	SW			RUNOFF/RES	TUALATIN RIVER	2114003000320		0.125	WI	7/29/1998	
54010	S	2714	S	1429	1657					50371	1 S	1 W	17	NE	SE			JOHNSON CREEK	BEAVERTON CREEK	2114003000420060000	0.02		IR	12/26/1912	
60590	S	10581	S	7154	8208					59040	1 S	1 W	27	NW	NE			FANNO CREEK	TUALATIN RIVER	2114003000180	0.08		IR	2/4/1926	
61667	S	13965	S	10063	9284					60433	1 S	1 W	15	NE	NE			HALL CREEK	WESSENGER CREEK	2114003000420060000000	0.03		IR	2/21/1931	
63210	S	15061	S	10968	10821					62566	1 S	1 W	15	NE	NE			HALL CREEK	WESSENGER CREEK	2114003000420060000000	0.02		IR	8/3/1933	
63797	S	16029	S	11851	11408					63314	1 S	1 E	18	NW	NE			FANNO CREEK	TUALATIN RIVER	2114003000180	0.23		IR	9/5/1935	
63797	S	16029	S	11851	11408					63315	1 S	1 E	1	NE	NW			FANNO CREEK	TUALATIN RIVER	2114003000180	0.23		IR	9/5/1935	
63797	S	16029	S	11851	11408					63316	1 S	1 W	1	SE	SE			FANNO CREEK	TUALATIN RIVER	2114003000180	0.23		IR	9/5/1935	
63797	S	16029	S	11851	11408					63317	1 S	1 W	27	NW	SE			FANNO CREEK	TUALATIN RIVER	2114003000180	0.23		IR	9/5/1935	
65719	S	16097	S	11947	13330					65612	1 S	1 W	15	NE	NE			HALL CREEK	WESSENGER CREEK	2114003000420060000000	0.1		DI	10/14/1935	NW1/4
65719	S	16097	S	11947	13330					65612	1 S	1 W	15	NE	NE			HALL CREEK	WESSENGER CREEK	2114003000420060000000	0.1		AS	10/14/1935	NW1/4
66924	S	14369	S	15011	14535					67261	1 S	1 W	9	SE	SE			WESSENGER CREEK	BEAVERTON CREEK	2114003000420060000	0.1		IR	10/13/1931	
66924	S	14369	S	15011	14535					67262	1 S	1 W	15	NW	NW			WESSENGER CREEK	BEAVERTON CREEK	2114003000420060000	0.1		IR	10/13/1931	
66924	S	14369	S	15011	14535					67263	1 S	1 W	16	NE	NE			WESSENGER CREEK	BEAVERTON CREEK	2114003000420060000	0.1		IR	10/13/1931	
67102	S	14366	S	15020	14713					67515	1 S	1 W	15	NW	NW			WESSENGER CREEK	BEAVERTON CREEK	2114003000420060000	0.11		IR	10/13/1931	
72141	S	14364	S	15019	19751					71399	1 S	1 W	10	SE	SW			BEAVERTON CREEK	ROCK CREEK	2114003000420060	0.17		IR	10/13/1931	
72141	S	14364	S	15019	19751					71400	1 S	1 W	15	NE	NW			BEAVERTON CREEK	ROCK CREEK	2114003000420060	0.17		IR	10/13/1931	
72147	S	14368	S	15021	19757					71410	1 S	1 W	9	SE	SE			BEAVERTON CREEK	ROCK CREEK	2114003000420060	0.12		IR	10/13/1931	
72511	S	24523	S	19355	20121					71891	1 S	1 W	8	NE	SE			BEAVERTON CREEK	ROCK CREEK	2114003000420060	0.173		IR	3/20/1950	
73051	S	23882	S	18829	20661					72550	1 S	1 W	34	SE	NE			SUMMER CREEK	FANNO CREEK	2114003000180070	0.25		FI	6/28/1949	
75422	S	25906	S	20539	23032					75436	1 S	1 W	27	SE	NW			FANNO CREEK	TUALATIN RIVER	2114003000180	0.18		IR	5/4/1951	
75506	S	29078	S	22866	23116					75533	1 S	1 W	15	NW	NW			BEAVERTON CREEK	ROCK CREEK	2114003000420060	0.076		IR	3/22/1954	
75995	S	27431	S	21599	23605					76177	1 S	1 W	8	NE	SE			BEAVERTON CREEK	ROCK CREEK	2114003000420060	0.06		IR	7/9/1952	
76006	S	27500	S	21937	23616					76189	1 S	1 W	7	NW	NE			BEAVERTON CREEK	ROCK CREEK	2114003000420060	0.05		IR	7/28/1952	
79467	S	29261	S	23804	27076					80684	1 S	1 W	17	SW	NE			JOHNSON CREEK	BEAVERTON CREEK	2114003000420060000	0.15		IR	12/8/1955	
80669	G	1189	G	1058	28278					82145	1 S	1 W	34	NE	SE			A WELL	FANNO CREEK	2114003000180040	0.04		IR	8/11/1958	350 FEET NORTH & 1420 FEET EAST FROM NW CORNER, DLC 54
81599					29207	TUALATIN RIVER				83287	1 S	1 W	27	SW	NE			FANNO CREEK	TUALATIN RIVER	2114003000180	0.306		ID	12/31/1890	UNN DITCHES & PIPELINE
81599					29207	TUALATIN RIVER				83287	1 S	1 W	27	SW	NE			FANNO CREEK	TUALATIN RIVER	2114003000180	0.306		LV	12/31/1890	UNN DITCHES & PIPELINE
82182	S	31404	S	24755	29788					83983	1 S	1 W	8	NE	SE			BEAVERTON CREEK	ROCK CREEK	2114003000420060	0.31		IR	3/5/1957	
82930	S	32057	S	25317	30536					84959	1 S	1 W	9	SE	SE			BEAVERTON CREEK	ROCK CREEK	2114003000420060	0.07		IR	1/13/1958	
83239	S	30862	S	24280	30845					85295	1 S	1 W	8	SW	SW			BEAVERTON CREEK	ROCK CREEK	2114003000420060	0.5		IR	6/15/1956	
83691	R	32428	R	2154	31297					85852	1 S	1 W	33	SW	SE			SUMMER CREEK	FANNO CREEK	2114003000180070		4	ST	6/27/1958	
83692	S	32427	S	25599	31298					85853	1 S	1 W	33	SW	SE			UNNAMED STREAM/RESERVOIR	FANNO CREEK	2114003000180	0.22		IR	6/27/1958	
87224	R	41119	R	4688	34829					90122	1 S	1 W	31	NW	NE			SUMMER CREEK	FANNO CREEK	2114003000180070		1	LV	7/20/1965	
87225	S	42192	S	31114	34830					90123	1 S	1 W	31	SW	NE			RESERVOIR	SUMMER CREEK	2114003000180070		1	LV	5/9/1966	60 FT S & 680 FT E FM NW COR, SWNE, S31
87338	G	3665	G	3441	34943					90266	1 S	1 W	29	NW	SE			A WELL	TUALATIN RIVER	2114003000420060000000000	0.12		IR	9/12/1966	1870 FT N & 1710 FT W FM SE COR, S29
88968	S	40655	S	30287	36571					92378	1 S	1 W	8	SW	SE			BEAVERTON CREEK	ROCK CREEK	2114003000420060	0.34		IR	3/3/1965	1280 FT W & 790 FT S FM SW COR, DLC 42
92885	R	43554	R	5070	40488					97463	1 S	1 W	33	NE	SE			SUMMER CREEK	FANNO CREEK	2114003000180070		23	ST	5/4/1967	
92885	R	43554	R	5070	40488					97463	1 S	1 W	33	NE	SE			SUMMER CREEK	FANNO CREEK	2114003000180070		23	RC	5/4/1967	
92885	R	43554	R	5070	40488					97463	1 S	1 W	33	NE	SE			SUMMER CREEK	FANNO CREEK	2114003000180070		23	RC	3/7/1968	
92886	S	43555	S	32879	40489					97464	1 S	1 W	33	NE	SE			UNNSTR/RS	FANNO CREEK	2114003000180070	0.06		IR	5/4/1967	1140 FT S & 20 FT W FM E1/4 COR, S33
92886	S	43555	S	32879	40489					97464	1 S	1 W	33	NE	SE			UNNSTR/RS	FANNO CREEK	2114003000180070	0.06		RC	5/4/1967	1140 FT S & 20 FT W FM E1/4 COR, S33
92886	S	43555	S	32879	40489					97464	1 S	1 W	33	NE	SE			UNNSTR/RS	FANNO CREEK	2114003000180070	0.06		RC	3/7/1968	1140 FT S & 20 FT W FM E1/4 COR, S33
92887	R	44336	R	5100	40490					97465	1 S	1 W	33	NW	SW			SUMMER CREEK	FANNO CREEK	2114003000180070		1	ST	12/15/1967	2010 FT N & 870 FT E FM SW COR, S33
92888	S	44085	S	32995	40491					97466	1 S	1 W	33	NW	SW			SUMMER CREEK	FANNO CREEK	2114003000180070	0.04		AH	9/20/1967	2090 FT N & 920 FT E FM SW COR, S33
92888	S	44085	S	32995	40491					97466	1 S	1 W	33	NW	SW			SUMMER CREEK	FANNO CREEK	2114003000180070	0.04		IR	9/20/1967	2090 FT N & 920 FT E FM SW COR, S33
92888	S	44085	S	32995	40491					97467	1 S	1 W	33	NW	SW			RESERVOIR	SUMMER CREEK	2114003000180070	0.04		IR	9/20/1967	2010 FT N & 870 FT E FM SW COR, S33
93097	G	4379	G	4131	40700					97714	1 S	1 W	21	SE	SE			A WELL	FANNO CREEK	2114003000180	0.06		IR	9/3/1968	1280 FT N & 330 FT W FM SE COR, S21
96334	G	4248	G	4008	43937					101992	1 S	1 W	31	NE	SE			A WELL	FANNO CREEK	2114003000180040	0.07		MU	2/23/1968	2280 FT N & 1290 FT W FM SE COR, S31
96517	G	1351	G	1229	44119				T 2490	102228	1 S	1 W	17	SE	SW			A WELL	BEAVERDAM CREEK	2114003000420060000	0.61		IR	1/21/1959	80 FT S & 2140 FT W FM NE COR, DLC 50
99948	S	52072	S	37504	47548					106716	1 S	1 W	34	SE	SW			SUMMER CREEK	FANNO CREEK	2114003000180070	0.01		IR	6/17/1974	450 FT N & 690 FT W FM S1/4 COR, S34
103044	R	53606	R	6401	50643					110766	1 S	1 W	34	SW	NE			SUMMER CREEK	FANNO CREEK	2114003000180070		5	FI	9/3/1975	
120034	R	68976	R	11251	67697					131906	1 S	1 W	33	NW	SW			UNNAMED STREAM	FANNO CREEK	2114003000180070		1.24	AS	3/26/1990	NONE GIVEN
120034	R	68976	R	11251	67697					131906	1 S	1 W	33	NW	SW			UNNAMED STREAM	FANNO CREEK	2114003000180070		1.24	WI	3/26/1990	NONE GIVEN
120034	R	68976	R	11251	67697					131907	1 S	1 W	33	NW	SW			UNNAMED STREAM	FANNO CREEK	2114003000180070		3.68	AS	3/26/1990	NONE GIVEN

GSI Water Solutions, Inc.

Appendix C

Water Rights in Area Affected by ASR Wells

Joint Water Commission Limited License Application

Water Right ID	Application Character	Application Number	Permit Character	Permit Number	Certificate	Decree	Claim Character	Claim Nbr	Transfer	POD ID	Township		Range		Sctn	Qtr40	Qtr160	DLC	Lot	Source	TributaryTo	StreamCode	POD Max Rate	POD Max Acre Feet	Use	PriorityDate	Legal
120034	R	68976	R	11251	67697					131907	1	S	1	W	33	NW	SW			UNNAMED STREAM	FANNO CREEK	2114003000180070		3.68	WI	3/26/1990	NONE GIVEN
120034	R	68976	R	11251	67697					131908	1	S	1	W	33	NW	SW			UNNAMED STREAM	FANNO CREEK	2114003000180070		5.66	AS	3/26/1990	NONE GIVEN
120034	R	68976	R	11251	67697					131908	1	S	1	W	33	NW	SW			UNNAMED STREAM	FANNO CREEK	2114003000180070		5.66	WI	3/26/1990	NONE GIVEN
120034	R	68976	R	11251	67697					131909	1	S	1	W	33	NW	SW			UNNAMED STREAM	FANNO CREEK	2114003000180070		0.16	AS	3/26/1990	NONE GIVEN
120034	R	68976	R	11251	67697					131909	1	S	1	W	33	NW	SW			UNNAMED STREAM	FANNO CREEK	2114003000180070		0.16	WI	3/26/1990	NONE GIVEN
120035	R	68977	R	11252	67698					131910	1	S	1	W	32	NE	SE			UNNAMED STREAM	SUMMER CREEK	2114003000180070000		17.4	AS	3/21/1990	ALSO SENE
120038	S	70245	S	51089	67701					131914	1	S	1	W	32	NE	SE			UNNAMED STREAM	SUMMER CREEK	2114003000180070000	0.3		AS	3/21/1990	200 FEET SOUTH & 65 FEET WEST FROM E1/4 CORNER, SECTION 32
120039	S	70259	S	51090	67702					131915	1	S	1	W	33	NW	SW			UNNAMED STREAM/RESERVOIR A	FANNO CREEK	2114003000180070	0.11		AS	3/26/1990	297 FEET SOUTH & 608 FEET EAST FROM W1/4 CORNER, SECTION 33
120039	S	70259	S	51090	67702					131915	1	S	1	W	33	NW	SW			UNNAMED STREAM/RESERVOIR A	FANNO CREEK	2114003000180070	0.11		WI	3/26/1990	297 FEET SOUTH & 608 FEET EAST FROM W1/4 CORNER, SECTION 33
120039	S	70259	S	51090	67702					131916	1	S	1	W	33	NW	SW			UNNAMED STREAM/RESERVOIR B	FANNO CREEK	2114003000180070	0.11		AS	3/26/1990	225 FEET SOUTH & 512 FEET EAST FROM W1/4 CORNER, SECTION 33
120039	S	70259	S	51090	67702					131916	1	S	1	W	33	NW	SW			UNNAMED STREAM/RESERVOIR B	FANNO CREEK	2114003000180070	0.11		WI	3/26/1990	225 FEET SOUTH & 512 FEET EAST FROM W1/4 CORNER, SECTION 33
120039	S	70259	S	51090	67702					131917	1	S	1	W	33	NW	SW			UNNAMED STREAM/RESERVOIR C	FANNO CREEK	2114003000180070	0.11		AS	3/26/1990	267 FEET SOUTH & 340 FEET EAST FROM W1/4 CORNER, SECTION 33
120039	S	70259	S	51090	67702					131917	1	S	1	W	33	NW	SW			UNNAMED STREAM/RESERVOIR C	FANNO CREEK	2114003000180070	0.11		WI	3/26/1990	267 FEET SOUTH & 340 FEET EAST FROM W1/4 CORNER, SECTION 33
120039	S	70259	S	51090	67702					131918	1	S	1	W	33	NW	SW			UNNAMED STREAM/WETLAND AREA	FANNO CREEK	2114003000180070	0.11		AS	3/26/1990	380 FEET SOUTH & 720 FEET EAST FROM W1/4 CORNER, SECTION 33
120039	S	70259	S	51090	67702					131918	1	S	1	W	33	NW	SW			UNNAMED STREAM/WETLAND AREA	FANNO CREEK	2114003000180070	0.11		WI	3/26/1990	380 FEET SOUTH & 720 FEET EAST FROM W1/4 CORNER, SECTION 33
121377	R	73814			69054					134107	1	S	1	W	29	NW	NE			JOHNSON CREEK	BEAVERTON CREEK	2114003000420060000		0.3	WI	1/1/1993	
121525	R	74438			69204					134392	1	S	1	W	33	SW	NW			UNNAMED STREAM	FANNO CREEK	2114003000180090		6	WI	1/1/1993	
121525	R	74438			69204					134392	1	S	1	W	33	SW	NW			UNNAMED STREAM	FANNO CREEK	2114003000180090		6	AS	1/1/1993	
121525	R	74438			69204					134392	1	S	1	W	33	SW	NW			UNNAMED STREAM	FANNO CREEK	2114003000180090		6	PA	1/1/1993	
122408	R	76112			70098					137017	1	S	1	W	29	NW	SW			UNNAMED STREAM/RESERVOIR	JOHNSON CREEK	2114003000420060000		0.57	WI	1/1/1993	
122456	R	76169			70146					137165	1	S	1	W	20	SW	SE			JOHNSON CR/VALE PK	BEAVERTON CREEK	2114003000420060000		1.2	WI	1/1/1993	
126059	R	74834			73683					145123	1	S	1	W	20	SW	SE			JOHNSON CR/RESERVOIR	BEAVERTON CREEK	2114003000420060000		0.15	WI	1/1/1993	
126089	R	75499			73713					145166	1	S	1	W	29	NE	SW			UNNAMED STREAM/RESERVOIR	JOHNSON CREEK	2114003000420060000		0.3	WI	1/1/1993	
126872	S	24593	S	19376	74511					146529	1	S	1	W	34	SE	NE			FANNO CREEK	TUALATIN RIVER	2114003000180	0.32		IR	4/12/1950	
126872	S	24593	S	19376	74511					146530	1	S	1	W	34	NW	NE			FANNO CREEK	TUALATIN RIVER	2114003000180	0.32		IR	4/12/1950	
168220	G	1351	G	1229	86081				T 2490	268020	1	S	1	W	17	SE	SW	50		A WELL	JOHNSON CREEK	2114003000420060000	0.58		MU	1/21/1959	65 FEET SOUTH AND 2290 FEET WEST FROM NE CORNER, WILLIAMS DLC 50
5799	P	82416								27940	1	S	2	W	35	NW	NE			RUNOFF/POND	TUALATIN RIVER	2114003000320030		2.5	LV	1/31/1997	
6661	P	83325								30447	1	S	2	W	28	SW	SW			SPRINGS/POND	TUALATIN RIVER	2114003000320030		20	WI	1/2/1997	
6661	P	83325								30447	1	S	2	W	28	SW	SW			SPRINGS/POND	TUALATIN RIVER	2114003000320030		20	LV	1/2/1997	
23796	G	14435	G	13163						10225	1	S	2	W	15	SW	NE			A WELL	BUTTERNUT CREEK	2114003000400	0.334		CM	1/10/1997	312 FEET SOUTH & 1527 FEET WEST FROM SW CORNER, ROBERTSON DLC
24357	G	14687	G	13729						11109	1	S	2	W	23	NW	NW			A WELL	TUALATIN RIVER	2114003000360	0.063		NU	2/20/1998	565 FEET SOUTH & 210 FEET EAST FROM NW CORNER, SECTION 23
25254							GR	333		13366	1	S	2	W	23	SE	SW			A WELL	UNNAMED STREAM	2114003000360	0.4902		IR	10/14/1952	NO 0 DEGREES 15 MIN WEST 733.17 FEET FROM 1/4 CORNER ON SO LINE, SECTION 23
26279							GR	1386		14430	1	S	2	W	14	NW	SE			A WELL	BUTTERNUT CREEK	2114003000380	0.0334		IR	12/31/1930	780 FEET SOUTH 33 DEG EAST FROM NW CORNER, SECTION 14
26345							GR	1460		14486	1	S	2	W	23	NW	NE			WELL 1	UNNAMED STREAM	2114003000360	0.078		IR	10/5/1951	SOUTH 63 DEG EAST 1330 FEET FROM N1/4 CORNER, SECTION 33
26431							GR	1551		14564	1	S	2	W	22	SE	NE			A WELL	UNNAMED STREAM	2114003000360	0.1114		IR	5/31/1952	SOUTH 27 DEG WEST 2000 FEET FROM NE CORNER, SECTION 22
26846							GR	1979		14959	1	S	2	W	16	SE	NE			A WELL	GORDAN CREEK	2114003000400	0.0713		IR	3/31/1954	1860 FEET SOUTH 27 DEG WEST FROM NE CORNER, SECTION 16
27210							GR	2393		15302	1	S	2	W	24	SE	SE			A WELL	UNNAMED STREAM	2114003000320	0.0201		IR	7/1/1955	18 DEGREES NORTHWEST, 700 FEET FROM SE CORNER, SECTION 24
27336							GR	2540		15424	1	S	2	W	23	NW	SE			A WELL	UNNAMED STREAM	2114003000360	0.0401		IR	12/31/1937	1500 FEET NORTH AND 1400 FEET WEST FROM SE CORNER, SECTION 23
27475							GR	1353		15559	1	S	2	W	21	NW	NE			A WELL	TUALATIN RIVER	211400300	0.0334		IR	2/28/1952	SOUTH 85 DEGREES 50 MINUTES WEST 1451 FEET FROM NE CORNER, SECTION 31
27584							GR	2806		15664	1	S	2	W	24	NE	NE			A WELL	UNNAMED STREAM	2114003000380040	0.0334		IR	11/1/1952	1580 FEET SW FROM NE CORNER, SECTION 24
27798							GR	3056		15870	1	S	2	W	12	SE	SE			A WELL	BEAVERTON CREEK	2114003000420060	0.0223		IR	7/31/1947	25.5 FEET NORTH & 103 FEET EAST OF WEST PROPERTY LINE
28311							GR	3681		16353	1	S	2	W	23	SE	NW			A WELL	UNNAMED STREAM	2114003000360	0.1782		IR	12/31/1932	SOUTH 42 DEGREES 0 MINUTES EAST 2970 FEET FROM NW CORNER, SECTION 23
28535							GR	3990		16569	1	S	2	W	26	NE	NE			A WELL	UNNAMED STREAM	2114003000360	0.0557		IR	12/31/1918	720 FEET SOUTH & 950 FEET WEST FROM COMMON CORNER, SECTIONS 23, 24, 25 & 26
28544							GR	4001		16578	1	S	2	W	13	SW	NE			A WELL	BUTTERNUT CREEK	2114003000380	0.0178		IR	5/14/1952	1450 FEET SOUTH & 1750 FEET WEST FROM NE CORNER, SECTION 13
28563							GR	4028		16597	1	S	2	W	24	SW	SE			A WELL	UNNAMED STREAM	2114003000380040	0.0267		IR	5/4/1951	800 FEET NORTH & 150 FEET EAST FROM S1/4 CORNER, SECTION 24
28845							GR	3130		16866	1	S	2	W	12	SE	SE			A WELL	BEAVERTON CREEK	2114003000420060	0.0401		IM	12/31/1946	1180 FEET NORTH & 840 FEET WEST FROM SE CORNER, SECTION 12
28898							GR	4149		16919	1	S	2	W	13	NE	NE			A WELL	BUTTERNUT CREEK	2114003000380	0.0446		IR	2/28/1954	510 FEET SOUTH & 260 FEET WEST FROM NE CORNER, SECTION 13
28974							GR	2846		16995	1	S	2	W	13	SW	SE			A WELL	UNNAMED STREAM	2114003000380040	0.1114		IR	8/9/1938	400 FEET NORTH & 950 FEET EAST FROM S1/4 CORNER, SECTION 13
32439	R	76874	R	11703						32464	1	S	2	W	21	NW	NW			TUALATIN RIVER/RESERVOIR A	WILLAMETTE RIVER	2114003000420	0.01	8.46	ST	1/25/1995	310 FEET SOUTH & 360 FEET WEST FROM C1/16 CORNER, SECTION 16
32439	R	76874	R	11703						32464	1	S	2	W	21	NW	NW			TUALATIN RIVER/RESERVOIR A	WILLAMETTE RIVER	2114003000420	0.01	8.46	AS	1/25/1995	310 FEET SOUTH & 360 FEET WEST FROM C1/16 CORNER, SECTION 16
32439	R	76874	R	11703						32464	1	S	2	W	21	NW	NW			TUALATIN RIVER/RESERVOIR A	WILLAMETTE RIVER	2114003000420	0.01	8.46	RC	1/25/1995	310 FEET SOUTH & 360 FEET WEST FROM C1/16 CORNER, SECTION 16
32439	R	76874	R	11703						32465	1	S	2	W	21	NW	NW			TUALATIN RIVER/RESERVOIR B	WILLAMETTE RIVER	2114003000420	0.01	6.91	RC	1/25/1995	560 FEET SOUTH & 280 FEET WEST FROM C1/16 CORNER, SECTION 16
32439	R	76874	R	11703						32465	1	S	2	W	21	NW	NW			TUALATIN RIVER/RESERVOIR B	WILLAMETTE RIVER	2114003000420	0.01	6.91	AS	1/25/1995	560 FEET SOUTH & 280 FEET WEST FROM C1/16 CORNER, SECTION 16
32439	R	76874	R	11703						32466	1	S	2	W	16	SW	SW			TUALATIN RIVER/RESERVOIR C	WILLAMETTE RIVER	2114003000420	0.01	8.15	RC	1/25/1995	270 FEET NORTH & 140 FEET WEST FROM NW CORNER, SECTION 21
32439	R	76874	R	11703						32466	1	S	2	W	16	SW	SW			TUALATIN RIVER/RESERVOIR C	WILLAMETTE RIVER	2114003000420	0.01	8.15	AS	1/25/1995	270 FEET NORTH & 140 FEET WEST FROM NW CORNER, SECTION 21
33223	R	81905	R	12532						33659	1	S	2	W	15	SW	NW			SCOGGINS RES/RES 1	TUALATIN RIVER	2114003000640		33.74	RC	1/30/1997	DAM LOC 1400 FEET SOUTH & 350 FEET EAST FROM NW1/4 CORNER, SECTION 15
33223	R	81905	R	12532						33659	1	S	2	W	15	SW	NW			SCOGGINS RES/RES 1	TUALATIN RIVER	2114003000640		33.74	AS	1/30/1997	DAM LOC 1400 FEET SOUTH & 350 FEET EAST FROM NW1/4 CORNER, SECTION 15
33223	R	81905	R	12532						33660	1	S	2	W	15	SW	NW			RUNOFF/RES 1	TUALATIN RIVER	2114003000640		33.74	AS	11/2/1998	DAM LOC 1400 FEET SOUTH & 350 FEET EAST FROM NW1/4 CORNER, SECTION 15
33223	R	81905	R	12532						33660	1	S	2	W	15	SW	NW			RUNOFF/RES 1	TUALATIN RIVER	2114003000640		33.74	RC	11/2/1998	DAM LOC 1400 FEET SOUTH & 350 FEET EAST FROM NW1/4 CORNER, SECTION 15
33224	R	83786	R	12533						33661	1	S	2	W	15	SE	NW			SCOGGINS RES/RES 2	TUALATIN RIVER	2114003000640		17.18	RC	3/16/1998	DAM LOC 2400 FEET SOUTH & 2300 FEET EAST FROM NW CORNER, SECTION 15
33224	R	83786	R	12533						33661	1	S	2	W	15	SE	NW			SCOGGINS RES/RES 2	TUALATIN RIVER	2114003000640		17.18	AS	3/16/1998	DAM LOC 2400 FEET SOUTH & 2300 FEET EAST FROM NW CORNER, SECTION 15
33224	R	83786	R	12533						33662	1	S	2	W	15	SE	NW			RUNOFF/RES 2	TUALATIN RIVER	2114003000640		17.18	AS	11/2/1998	DAM LOC 2400 FEET SOUTH & 2300 FEET EAST FROM NW CORNER, SECTION 15
33224	R	83786	R	12533						33662	1	S	2	W	15	SE	NW			RUNOFF/RES 2	TUALATIN RIVER	2114003000640		17.18	RC	11/2/1998	DAM LOC 2400 FEET SOUTH & 2300 FEET EAST FROM NW CORNER, SECTION 15
33226	R	83787	R	12535						33665	1	S	2	W	15	SW	NW			SCOGGINS RES/RES 5	TUALATIN RIVER	2114003000640		3	RC	3/16/1998	DAM LOC 1600 FEET SOUTH & 900 FEET EAST FROM NW CORNER, SECTION 15
33226	R	83787	R	12535						33665	1	S	2	W	15	SW	NW			SCOGGINS RES/RES 5	TUALATIN RIVER	2114003000640		3	AS	3/16/1998	DAM LOC 1600 FEET SOUTH & 900 FEET EAST FROM NW CORNER, SECTION 15
33226	R	83787	R	12535						33666	1	S	2	W	15	SW	NW			RUNOFF/RES 5	TUALATIN RIVER	2114003000640		3	AS	11/2/1998	DAM LOC 1600 FEET SOUTH & 900 FEET EAST FROM NW CORNER, SECTION 15
33226	R	83787	R	12535						33666	1	S	2	W	15	SW	NW			RUNOFF/RES 5	TUALATIN RIVER	2114003000640		3	RC	11/2/1998	DAM LOC 1600 FEET SOUTH & 900 FEET EAST FROM NW CORNER, SECTION 15
33227	R	83788	R	12536						33668	1	S	2	W	15	NE	SW			RUNOFF/RES 4	TUALATIN RIVER	2114003000640		3	AS	11/2/1998	3800 FEET SOUTH & 1800 FEET EAST FROM NW CORNER, SECTION 15
33227	R	83788	R	12536						33668	1	S	2	W	15	NE	SW			RUNOFF/RES 4	TUALATIN RIVER	2114003000640		3	RC	11/2/1998	3800 FEET SOUTH & 1800 FEET EAST FROM NW CORNER, SECTION 15
33227	R	83788	R	12536						33667	1	S	2	W	15	NE	SW			SCOGGINS RES/RES 4	TUALATIN RIVER	2114003000640		3	RC	3/16/1998	3800 FEET SOUTH & 1800 FEET EAST FROM NW CORNER, SECTION 15
33227	R	83788	R	12536						33667	1	S	2	W	15	NE	SW			SCOGGINS RES/RES 4	TUALATIN RIVER	2114003000640		3	AS	3/16/1998	3800 FEET SOUTH & 1800 FEET EAST FROM NW CORNER, SECTION 15
33228	R	83789	R	12537						33669	1	S	2	W	15	SW	NW			SCOGGINS RES/RES 3	TUALATIN RIVER	2114003000640		4	RC	3/16/1998	DAM LOC 2200 FEET SOUTH & 1100 FEET EAST FROM NW CORNER, SECTION 15
33228	R	83789	R	12537						33669	1	S	2	W	15	SW	NW			SCOGGINS RES/RES 3	TUALATIN RIVER	2114003000640		4	AS	3/16/1998	DAM LOC 2200 FEET SOUTH & 1100 FEET EAST FROM NW CORNER, SECTION 15
33228	R	83789	R	12537						33670	1	S	2	W	15	SW	NW			RUNOFF/RES 3	TUALATIN RIVER	2114003000640		4	AS	11/2/1998	DAM LOC 2200 FEET SOUTH & 1100 FEET EAST FROM NW CORNER, SECTION 15
33228	R	83789	R	12537						33670	1	S	2	W	15	SW	NW			RUNOFF/RES 3	TUALATIN RIVER	2114003000640		4	RC	11/2/1998	DAM LOC 2200 FEET SOUTH & 1100 FEET EAST FROM NW CORNER, SECTION 15
33637	R	84336	R	12955						34185	1	S	2	W	15	SE	SW			SCOGGINS RES/RESERVOIR A	SCOGGINS CREEK	2114003000400		0.16	ST	2/28/2000	
33638	R	84337	R	12956						34186	1	S	2	W	15	SE	SW			SCOGGINS RES/RESERVOIR B	SCOGGINS CREEK	2114003000400		0.26	ST	2/28/2000	
33639	R	84338	R	12957						34187	1	S	2	W	15	NE	SW			SCOGGINS RES/RESERVOIR C	SCOGGINS CREEK	2114003000400		0.17	ST	2/28/2000	
49248	S	54580	S	49958						42669	2	S	1	W	18	NW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	410 FEET SOUTH & 360 FEET WEST OF THE SW CORNER,SECTION 7
49248	S	54580	S	49958						42669	2	S	1	W	18	NW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	12/18/1986	410 FEET SOUTH & 360 FEET WEST OF THE SW CORNER,SECTION 7
49248	S	54580	S	49958						42670	2	S	1	W	7	SW	SW			UNNAMED STREAM	TUALATIN RIVER	2114003000279	25		IC	1/4/1984	1100 FEET NORTH & 640 FEET EAST OF THE SW CORNER,SECTION 7
49248	S	54580	S	49958						42671	2	S	2	W	11	NW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	1850 FEET NORTH & 2440 FEET WEST FROM THE SE CORNER,SECTION 11
49248	S	54580	S	49958						42672	2	S	1	W	18	SE	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	2130 FEET SOUTH & 1510 FEET EAST FROM THE NW CORNER,SECTION 18
49248	S	54580	S	49958						42673	2	S	2	W	11	NW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	1850 FEET NORTH & 2440 FEET WEST FROM THE SE CORNER,SECTON 11
49248	S	54580	S	49958						42674	2	S	2	W	11	SW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	1850 FEET NORTH & 2440 FEET WEST FROM THE SE CORNER,SECTION 11
49248	S	54580	S	49958						42675	1	S	2	W	29	SE	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	140 FEET NORTH & 530 FEET WEST FROM THE SW CORNER,SECTON 28
49248	S	54580	S	49958						42676	1	S	2	W	21	NE	SW			UNNAMED STREAM	TUALATIN RIVER	2114003000370	25		IC	1/4/1984	1160 FEET SOUTH & 1460 FEET EAST FROM THE W1/4 CORNER,SECTION 21
49248	S	54580	S	49958						42677	2	S	2	W	9	NE	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	1600 FEET NORTH & 1080 FEET WEST FROM THE SE CORNER,SECTION 9
49248	S	54580	S	49958						42678	2	S	2	W	16	NE	NE			MCFEE CREEK	TUALATIN RIVER	2114003000310	25		IC	1/4/1984	940 FEET SOUTH & 120 FEET WEST FROM THE NE CORNER,SECTION 16
49248	S	54580	S	49958						42679	2	S	1	W	20	NE	NW			CHICKEN CREEK	TUALATIN RIVER	2114003000270	25		IC	1/4/1984	250 FEET SOUTH & 2850 FEET WEST FROM THE NE CORNER,SECTION 20
49248	S	54580	S	49958						42680	2	S	2	W	10	SE	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	900 FEET NORTH & 1820 FEET EAST FROM THE SW CORNER,SECTION 10
49248	S	54580	S	49958						42681	2	S	2	W	14	SW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	2112 FEET SOUTH & 1056 FEET EAST FROM THE NE CORNER,SECTION 15
49248	S	54580	S	49958						42682	2	S	2	W	19	NW	NW			UNNAMED STREAM	MCFEE CREEK	2114003000310150	25		IC	1/4/1984	10 FEET SOUTH & 400 FET EAST FROM THE SE CORNER,SECTION 18

Appendix C
Water Rights in Area Affected by ASR Wells
Joint Water Commission Limited License Application

Water Right ID	Application Character	Application Number	Permit Character	Permit Number	Certificate	Decree	Claim Character	Claim Nbr	Transfer	POD ID	Township		Range		Sctn	Qtr40	Qtr160	DLC	Lot	Source	TributaryTo	StreamCode	POD Max Rate	POD Max Acre Feet	Use	PriorityDate	Legal
49248	S	54580	S	49958						42683	2	S	1	W	18	NW	SW			UNNAMED STREAM	CEDAR CREEK	2114003000270010000	25		IC	1/4/1984	2260 FEET NORTH & 174 FEET WEST FROM THE SE CORNER,SECTION 13
49248	S	54580	S	49958						42684	2	S	2	W	11	NW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	1850 FEET NORTH & 2440 FEET WEST FROM THE SE CORNER,SECTION 11
49248	S	54580	S	49958						42685	1	S	2	W	34	SE	SE			UNNAMED STREAM	TUALATIN RIVER	2114003000320	25		IC	1/4/1984	620 FEET NORTH & 720 FEET WEST FROM THE SE CORNER,SECTION 34
49248	S	54580	S	49958						42686	1	S	2	W	19	NE	SE			DAVIS CREEK	TUALATIN RIVER	2114003000430	25		IC	1/4/1984	1500 FEET NORTH & 500 FEET WEST FROM THE SE CORNER,SECTION 19
49248	S	54580	S	49958						42687	1	S	2	W	17	NW	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	1130 FEET SOUTH & 950 FEET EAST FROM THE W1/4 CORNER,SECTION 17
49248	S	54580	S	49958						42688	2	S	2	W	11	SW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	340 FEET NORTH & 1630 FEET WEST FROM THE SE CORNER,SECTION 11
49248	S	54580	S	49958						42689	2	S	2	W	11	SW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	340 FEET NORTH & 1630 FEET WEST FROM THE SE CORNER,SECTION 11
49248	S	54580	S	49958						42690	2	S	2	W	9	SW	NE			MCFEE CREEK	TUALATIN RIVER	2114003000310	25		IC	1/4/1984	750 FEET NORTH & 250 FEET EAST FROM THE CENTER,SECTION 9
49248	S	54580	S	49958						42691	1	S	2	W	21	SW	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	470 FEET NORTH & 730 FEET EAST FROM THE NE CORNER,SECTION 29
49248	S	54580	S	49958						42692	1	S	2	W	34	SE	SE			UNNAMED STREAM	TUALATIN RIVER	2114003000320	25		IC	1/4/1984	1000 FEET NORTH & 700 FEET WEST FROM THE SE CORNER,SECTON 34
49248	S	54580	S	49958						42693	2	S	2	W	19	NW	NW			GULF CANYON	MCFEE CREEK	2114003000310130	25		IC	1/4/1984	10 FEET SOUTH & 400 FEET EAST FROM THE SE CORNER,SECTION 18
49248	S	54580	S	49958						42694	2	S	2	W	11	SW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	340 FEET NORTH & 1630 FEET WEST FROM THE SE CORNER,SECTION 11
49248	S	54580	S	49958						42695	2	S	2	W	11	SW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	340 FEET NORTH & 1630 FEET WEST FROM THE SE CORNER,SECTION 11
49248	S	54580	S	49958						42696	2	S	2	W	11	SW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	4170 FEET SOUTH & 1790 FEET WEST FROM THE NE CORNER,SECTION 11
49248	S	54580	S	49958						42697	2	S	1	W	18	NE	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	870 FEET SOUTH & 660 FEET WEST FROM THE CENTER,SECTION 18
49248	S	54580	S	49958						42698	2	S	2	W	10	SW	NE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	2390 FEET SOUTH & 1870 FEET WEST FROM THE NE CORNER,SECTION 10
50407	S	71157	S	51996						44748	1	S	2	W	28	SW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.0074		TC	1/30/1991	1075 FEET NORTH & 900 FEET EAST FROM W1/4 CORNER, SECTION 28
50407	S	71157	S	51996						44749	2	S	2	W	4	SW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.0074		TC	1/30/1991	440 FEET NORTH & 740 FEET EAST FROM W1/4 CORNER, SECTION 4
50407	S	71157	S	51996						44750	2	S	2	W	4	SE	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.0074		TC	1/30/1991	340 FEET SOUTH & 150 FEET WEST FROM MOST WESTERLY CORNER, DLC 41
50407	S	71157	S	51996						44751	2	S	2	W	21	SW	NE			HEATON CREEK	MCFEE CREEK	2114003000310010	0.003		TC	1/30/1991	1400 FEET SOUTH & 385 FEET EAST FROM N1/4 CORNER, SECTION 21
50407	S	71157	S	51996						44752	2	S	2	W	16	NE	NW			MCFEE CREEK	WILLAMETTE RIVER	2114003000310	0.0024		TC	1/30/1991	915 FEET SOUTH & 1650 FEET EAST FROM NW CORNER, SECTION 16
50437	S	76875	S	52026						44793	1	S	2	W	16	SW	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	2.09		IR	1/25/1995	280 FEET SOUTH & 240 FEET WEST FROM C1/16 CORNER, SECTION 16
50437	S	76875	S	52026						44794	1	S	2	W	16	SW	SW			TUALATIN R/POND A	WILLAMETTE RIVER	211400300		8.46	IR	1/25/1995	
51439	S	81904	S	53162						46633	1	S	2	W	16	SW	NE			SCOGGINS RESERVOIR	SCOGGINS CREEK	211400300		552.5	IR	1/30/1997	2170 FEET SOUTH & 2400 FEET WEST FROM NE CORNER, SECTION 16
51439	S	81904	S	53162						46634	1	S	2	W	16	SW	NE			SCOGGINS RES/POND 1	WILLAMETTE RIVER	211400300		16.87	ST	1/30/1997	2170 FEET SOUTH & 2400 FEET WEST FROM NE CORNER, SECTION 16
51439	S	81904	S	53162						46635	1	S	2	W	16	SW	NE			SCOGGINS RES/POND 2	WILLAMETTE RIVER	211400300		8.59	ST	1/30/1997	2170 FEET SOUTH & 2400 FEET WEST FROM NE CORNER, SECTION 16
51439	S	81904	S	53162						46636	1	S	2	W	16	SW	NE			SCOGGINS RES/POND 3	WILLAMETTE RIVER	211400300		2	ST	1/30/1997	2170 FEET SOUTH & 2400 FEET WEST FROM NE CORNER, SECTION 16
51439	S	81904	S	53162						46637	1	S	2	W	16	SW	NE			SCOGGINS RES/POND 4	WILLAMETTE RIVER	211400300		1.5	ST	1/30/1997	2170 FEET SOUTH & 2400 FEET WEST FROM NE CORNER, SECTION 16
51439	S	81904	S	53162						46638	1	S	2	W	16	SW	NE			SCOGGINS RES/POND 5	WILLAMETTE RIVER	211400300		1.5	ST	1/30/1997	2170 FEET SOUTH & 2400 FEET WEST FROM NE CORNER, SECTION 16
53058	S	211	S	68	713					49202	1	S	2	W	21	NE	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.48		IR	8/4/1909	
64239	S	15939	S	11780	11850					63882	1	S	2	W	21	SE	NE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.19		IR	8/20/1935	
66105	S	16777	S	12558	13716					66134	1	S	2	W	21	NW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.19		IR	2/22/1937	
67785	S	17752	S	13445	15395					68465	1	S	2	W	28	NW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.15		IR	1/17/1939	
67967	S	17930	S	13613	15577					68711	1	S	2	W	21	NW	NE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.125		IR	4/25/1939	
69061	S	19181	S	14778	16671					70049	1	S	2	W	16	NW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	2.01		IR	3/3/1941	ALSO DLC 67
69061	S	19181	S	14778	16671					70050	1	S	2	W	1	SW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	2.01		IR	3/3/1941	ALSO DLC 67
69061	S	19181	S	14778	16671					70051	1	S	2	W	1	NE	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	2.01		IR	3/3/1941	ALSO DLC 67
69061	S	19181	S	14778	16671					70052	1	S	2	W	16	SE	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	2.01		IR	3/3/1941	ALSO DLC 67
69180	S	21284	S	16677	16790					70192	1	S	2	W	28	SW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.188		IR	11/16/1945	
72182	S	22221	S	17495	19792					71455	1	S	2	W	28	NW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.15		IR	2/6/1947	
72299	S	23176	S	18252	19909					71612	1	S	2	W	28	SW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.375		IR	5/13/1948	
72299	S	23176	S	18252	19909					71613	1	S	2	W	28	NW	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.375		IR	5/13/1948	
72362	S	21485	S	16852	19972					71694	1	S	2	W	22	SE	SW			BUTTERNUT CREEK	TUALATIN RIVER	2114003000380	0.335		IR	3/16/1946	
72397	S	20795	S	18290	20007					71744	1	S	2	W	15	NW	NW			BUTTERNUT CREEK	TUALATIN RIVER	2114003000380	0.375		IR	4/16/1945	
72979	S	17750	S	13443	20589					72461	1	S	2	W	21	NE	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.5		IR	1/17/1939	
75312	S	25060	S	19734	22922					75301	1	S	2	W	15	NE	SE			BUTTERNUT CREEK	TUALATIN RIVER	2114003000380	0.21		IR	7/31/1950	
75453	S	26941	S	21166	23063					75475	1	S	2	W	16	NE	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	1.05		IR	3/10/1952	
75464	S	27123	S	21336	23074					75489	1	S	2	W	16	NE	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.16		IR	4/30/1952	
75605	S	25291	S	19855	23215					75652	1	S	2	W	21	NW	NE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.21		IR	9/21/1950	
75676	S	16647	S	12420	23286					75739	1	S	2	W	21	NW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.18		IR	10/28/1936	
75677	S	17039	S	12786	23287					75740	1	S	2	W	21	NW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.08		IR	8/16/1937	
75678	S	24380	S	19234	23288					75741	1	S	2	W	21	NE	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.2		IR	1/3/1950	
75704	R	23694	R	1030	23314					75777	1	S	2	W	33	NE	SE		7	UNNAMED STREAM	TUALATIN RIVER	2114003000320		30	ST	4/5/1949	
75704	R	23694	R	1030	23314					75778	1	S	2	W	33	NW	SE		2	UNNAMED STREAM	TUALATIN RIVER	2114003000020		30	ST	4/5/1949	
75725	R	25883	R	1212	23335					75804	1	S	2	W	34	NW	SW			UNNAMED STREAM	TUALATIN RIVER	2114003000320		4.6	ST	4/30/1951	
75726	S	25884	S	20534	23336					75805	1	S	2	W	33	NE	SE			LINDOW RESERVOIR	UNNAMED STREAM	2114003000320		4.6	IS	4/30/1951	
75726	S	25884	S	20534	23336					75806	1	S	2	W	33	SE	NE			LINDOW RESERVOIR	UNNAMED STREAM	2114003000320		4.6	IR	4/30/1951	
75821	S	23690	S	18713	23431				T 7833, T 8810	75921	1	S	2	W	33	SE	NE			UNNAMED STREAM	TUALATIN RIVER	2114003000320	0.17		IR	4/4/1949	
75821	S	23690	S	18713	23431				T 7833, T 8810	75922	1	S	2	W	33	NE	SE			UNNAMED STREAM	TUALATIN RIVER	2114003000320	0.19		IR	4/4/1949	
75839	S	24427	S	19261	23449					75940	1	S	2	W	21	SE	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.55		IR	2/7/1950	
75864	S	24602	S	19465	23474					75970	1	S	2	W	28	NW	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.53		IR	4/13/1950	
75864	S	24602	S	19465	23474					75970	1	S	2	W	28	NW	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.53		IR	6/5/1950	
75865	S	24627	S	19390	23475					75971	1	S	2	W	28	SW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	1.51		IR	4/19/1950	
75975	S	26936	S	21163	23585					76155	1	S	2	W	16	SE	NE			BUTTERNUT CREEK	TUALATIN RIVER	2114003000380	0.18		IR	3/6/1952	
75981	S	27071	S	21301	23591					76162	1	S	2	W	28	SW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.32		IR	4/14/1952	
78823	S	26077	S	21918	26432					79849	1	S	2	W	14	SE	NW			BUTTERNUT CREEK	TUALATIN RIVER	2114003000380	0.01		IR	6/22/1951	
79113	R	26808	R	1322	26722					80214	1	S	2	W	34	SW	SE			UNNAMED STREAM	TUALATIN RIVER	2114003000320		1	ST	1/24/1952	
79114	S	26809	S	21055	26723					80215	1	S	2	W	34	SW	SE			RESERVOIR	UNNAMED STREAM	2114003000320		1	IR	1/24/1952	
79141	R	28717	R	1570	26750					80249	1	S	2	W	15	NW	NW			BUTTERNUT CREEK	TUALATIN RIVER	2114003000380		56	ST	8/18/1953	ALSO NENE SECTION 16
79142	S	28718	S	22647	26751					80250	1	S	2	W	16	NE	NE			BUTTERNUT CREEK	TUALATIN RIVER	2114003000380	0.33		IR	8/18/1953	
79142	S	28718	S	22647	26751					80251	1	S	2	W	16	NE	NE			RESERVOIR	GORDON CREEK	2114003000400		56	IR	8/18/1953	
79300	S	24566	S	19321	26909					80454	1	S	2	W	22	SW	SW			UNNAMED STREAM	TUALATIN RIVER	2114003000360	0.21		IR	4/3/1950	
79348	S	30798	S	24248	26957					80527	1	S	2	W	27	NE	NW			UNNAMED STREAM	TUALATIN RIVER	2114003000360	0.01		LV	5/28/1956	
80882	G	1135	G	965	28491					82406	1	S	2	W	26	SW	SE			A WELL	TUALATIN RIVER	2114003000250070	0.11		IM	7/31/1958	3 CHAINS NORTH & 25 CHAINS WEST FROM SE CORNER, SECTION 26
81593					29201	TUALATIN RIVER				83275	1	S	2	W	21					SPRINGS	UNNAMED STREAM	2114003000360	0.1875		IR	12/31/1896	TRACT 1
81593					29201	TUALATIN RIVER				83276	1	S	2	W	22					SPRINGS	UNNAMED STREAM	2114003000360	0.1875		LV	12/31/1896	TRACT 2
81593					29201	TUALATIN RIVER				83277	1	S	2	W	21					UNNAMED STREAM	TUALATIN RIVER	2114003000360	0.1875		LV	12/31/1896	IR TRACT 1; LV TRACT 2
81593					29201	TUALATIN RIVER				83277	1	S	2	W	21					UNNAMED STREAM	TUALATIN RIVER	2114003000360	0.1875		IR	12/31/1896	IR TRACT 1; LV TRACT 2
82178	S	31250	S	24622	29784					83979	1	S	2	W	16	NE	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.26		IR	12/11/1956	
82181	S	31402	S	24753	29787					83982	1	S	2	W	28	NW	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.12		IR	3/4/1957	
82188	S	33128	S	26199	29794					83991	1	S	2	W	22	SW	SW			UNNAMED STREAM	TUALATIN RIVER	2114003000360	0.12		IR	5/27/1959	
82191	S	33768	S	26661	29797					83994	1	S	2	W	28	SW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.05		IR	3/23/1960	
82836	S	23602	S	18614	30442				P 53	84841	2	S	2	W	4	NW	NE			UNNAMED STREAM	TUALATIN RIVER	2114003000320	0.37		IR	1/28/1949	
82836	S	23602	S	18614	30442				P 53	84842	1	S	2	W	33	SW	SE			UNNAMED STREAM	TUALATIN RIVER	2114003000320	0.37		IR	1/28/1949	
85519	R	37919	R	3203	33124					88074	1	S	2	W	28	SW	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300		2	ST	3/11/1963	
85520	S	37894	S	28552	33125					88075	1	S	2	W	28	SW	SW			UNNAMED STREAM/RS	TUALATIN RIVER	211400300	0.07		IR	3/11/1963	1550 FEET NORTH & 3580 FEET WEST FROM NE CORNER, DLC 53
87124	G	2530	G	2345	34729					90008	1	S	2	W	35	NW	NW			A WELL	TUALATIN RIVER	2114003000290	0.03		IR	1/17/1963	3150 FT S & 200 FT W FM MOST EASTERLY NE COR, DLC 55
88837	G	637	G	588	36440					92201	1	S	2	W	24	NE	SE			ALOHA HUBER WELL #1	BEAVERTON CREEK	2114003000380040	1.1		MU	5/2/1957	750 FT W & 1500 FT N FM SE COR, S24
88838	G	2242	G	2064	36441					92202	1	S	2	W	23	SE	SE			WELL #2	BUTTERNUT CREEK	2114003000250070	2.2		MU	2/23/1962	200 FT N & 780 FT W FM SE COR, S23

GSI Water Solutions, Inc.

Appendix C
Water Rights in Area Affected by ASR Wells
Joint Water Commission Limited License Application

Water Right ID	Application Character	Application Number	Permit Character	Permit Number	Certificate	Decree	Claim Character	Claim Nbr	Transfer	POD ID	Township	Range	Sctn	Qtr40	Qtr160	DLC	Lot	Source	TributaryTo	StreamCode	POD Max Rate	POD Max Acre Feet	Use	PriorityDate	Legal
88843	S	39025	S	29070	36446					92207	1 S	2 W	21	NW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.41		IR	8/26/1963	820 FT S & 1400 FT W FM E1/4 COR, S21
91300	R	43019	R	4898	38903					95488	1 S	2 W	14	SE	NE			BUTTERNUT CREEK	TUALATIN RIVER	2114003000380		2.2	ST	11/10/1966	
91301	S	43020	S	32162	38904					95489	1 S	2 W	1	SE	NE			BUTTERNUT CREEK	TUALATIN RIVER	2114003000380	0.03		IR	11/10/1966	2780 FT N & 80 FT W FM SE COR, S14
91301	S	43020	S	32162	38904					95490	1 S	2 W	14	SE	NE			RESERVOIR	BUTTERNUT CREEK	2114003000380	0.03		IR	11/10/1966	2810 FT N & 430 FT W FM SE COR, S14
93095	G	4100	G	3848	40698					97712	1 S	2 W	28	SE	NE	54		A WELL	TUALATIN RIVER	2114003000420	0.08		IR	10/4/1967	1360 FT S & 1180 FT W FM NE COR, S28
93363	G	3373	G	3177	40966					98025	1 S	2 W	28	NE	NE			A WELL	TUALATIN RIVER	2114003000250070	0.35		IR	2/8/1966	350 FT S & 750 FT W FM NE COR, S28
96088	G	3315	G	3087	43691					101664	1 S	2 W	26	NW	NW			A WELL	TUALATIN RIVER	2114003000250070	0.03		IR	12/8/1965	870 FT S & 190 FT E FM NW COR, S26
97184	G	5203	G	5024	44786					103092	1 S	2 W	28	NW	NE			A WELL	TUALATIN RIVER	2114003000250070	0.11		IR	5/29/1970	1060 FT S & 2000 FT W FM NE COR, S28
97518	S	26648	S	20873	45119					103526	1 S	2 W	16	NE	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.355		IR	11/19/1951	
100601	G	7010	G	6510	48201					107543	1 S	2 W	16	NW	NE			A WELL	TUALATIN RIVER	211400300	0.025		IR	6/23/1975	620 FT S & 2000 FT W FM NE COR, DLC 61
100603	R	53344	R	6336	48203					107545	1 S	2 W	14	SW	NE			BUTTERNUT CREEK	TUALATIN RIVER	2114003000380		1.15	ST	6/30/1975	
100604	S	53345	S	39578	48204					107546	1 S	2 W	14	SW	NE			BUTTERNUT CREEK	TUALATIN RIVER	2114003000380	0.05		IR	6/30/1975	440 FT N & 1560 FT W FM E1/4 COR, S14
100604	S	53345	S	39578	48204					107547	1 S	2 W	14	SW	NE			WITZIG RS	BUTTERNUT CREEK	2114003000380	0.05		IR	6/30/1975	460 FT N & 1500 FT W FM E1/4 COR, S14
100719	G	6658	G	5266	48319					107705	1 S	2 W	27	SE	SW			A WELL	TUALATIN RIVER	2114003000250070	0.1		IR	9/12/1974	450 FT E & 2100 FT N FM SW COR, DLC 55
107950	S	23695	S	19431	55548				T 3658	117086	1 S	2 W	33	NW	SE		2	UNNAMED STREAM/RESERVOIR	TUALATIN RIVER	2114003000320	0.45		IR	4/5/1949	1300 FEET SOUTH & 1375 FEET WEST FROM E1/4 CORNER, SECTION 33
107951	S	23695	S	19431	55549				T 4845, T 3658	117087	1 S	2 W	33	NW	SE		2	UNNAMED STREAM/RESERVOIR	TUALATIN RIVER	2114003000320	0.18		IR	4/5/1949	1300 FEET SOUTH & 1375 FEET WEST FROM E1/4 CORNER, SECTION 33
108249	S	58676	S	44860	55847					117465	1 S	2 W	33	NE	SE		7	A RESERVOIR	UNNAMED STREAM	2114003000320		30	IR	5/18/1979	1300 FEET SOUTH & 1275 FEET WEST FROM EAST 1/4 CORNER, SECTION 33
108579	S	59810	S	44717	56177					117908	1 S	2 W	33	NE	SE		7	A RESERVOIR	UNNAMED STREAM	2114003000320		30	IR	2/21/1980	1300 FEET SOUTH & 1275 FEET WEST FROM EAST 1/4 CORNER, SECTION 33
116201	S	26214	S	20441	63837				T 6258	126908	1 S	2 W	21	SW	NE	67		TUALATIN RIVER	WILLAMETTE RIVER	211400300	1.2		IR	7/19/1951	
117006	S	59346	S	44801	64661					127928	1 S	2 W	14	SW	NE		1	BUTTERNUT CREEK	TUALATIN RIVER	2114003000380	0.045		IR	9/20/1979	330 FEET NORTH & 250 FEET EAST FROM C1/4 CORNER, SECTION 14
117006	S	59346	S	44801	64661					127928	1 S	2 W	14	SW	NE		1	BUTTERNUT CREEK	TUALATIN RIVER	2114003000380	0.045		LV	9/20/1979	330 FEET NORTH & 250 FEET EAST FROM C1/4 CORNER, SECTION 14
118632	S	27985	S	22028	66294				T 6230	130036	1 S	2 W	16	NW	SE	61		TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.33		IR	2/11/1953	650 FEET SOUTH & 2350 FEET WEST FROM E1/4 CORNER, SECTION 16
119685	R	53375	R	6459	67348					131482	1 S	2 W	34	SE	SE	60		UNNAMED STREAM	TUALATIN RIVER	2114003000320		28	ST	2/26/1975	
119685	R	53375	R	6459	67348					131483	1 S	2 W	35	SW	SW	60		UNNAMED STREAM	TUALATIN RIVER	2114003000320		28	ST	2/26/1975	
119686	S	53951	S	40466	67349					131484	1 S	2 W	34	SE	SE	60		A RESERVOIR	UNNAMED STREAM	2114003000320		28	IR	2/26/1976	490 FEET NORTH & 800 FEET WEST FROM SE CORNER, SECTION 34
119687	S	57378	S	43958	67350					131485	1 S	2 W	34	SE	SE	60		RESERVOIR	UNNAMED STREAM	2114003000320		4.12	IS	5/5/1978	490 FEET NORTH & 800 FEET WEST FROM SE CORNER, SECTION 34
119688	R	57674	R	7803	67351					131486	1 S	2 W	34	SE	SE	60		UNNAMED STREAM	TUALATIN RIVER	2114003000320		4.21	ST	7/20/1978	
119688	R	57674	R	7803	67351					131487	1 S	2 W	35	SW	SW	60		UNNAMED STREAM	TUALATIN RIVER	2114003000320		4.21	ST	7/20/1978	
120507	S	26214	S	20441	68172				T 6258	132514	1 S	2 W	21					TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.3		IR	7/19/1951	NO AUTHORIZED POINT OF DIVERSION
122507	R	76243			70199					137348	1 S	2 W	22	SE	SE			UNNAMED STREAM/RESERVOIR	RANNOW CREEK	2114003000380		0.65	WI	1/1/1993	
125775	G	2641	G	2485	73414				T 7365	144248	1 S	2 W	33	SW	NE		1	WELL 2	TUALATIN RIVER	2114003000420060	0.1		IM	6/25/1963	850 FEET SOUTH & 700 FEET WEST FROM SW CORNER, DLC 54
126050	R	74321			73674					145112	1 S	2 W	35	SE	NW			UNNAMED STREAM	TUALATIN RIVER	2114003000320030		1.5	LV	1/1/1993	
126050	R	74321			73674					145112	1 S	2 W	35	SE	NW			UNNAMED STREAM	TUALATIN RIVER	2114003000320030		1.5	WI	1/1/1993	
126318	R	80172			73943					145670	1 S	2 W	25	SW	SW			RUNOFF/RESERVOIR	TUALATIN RIVER	2114003000380040		5	WI	1/1/1993	
129168	S	17268	S	12979	76835				T 7838	150465	1 S	2 W	28	NW	SW	54		TUALATIN RIVER	WILLAMETTE RIVER	211400140	0.43		IR	3/17/1938	3685 FEET SOUTH & 350 FEET EAST FROM NW CORNER, SECTION 28
129168	S	17268	S	12979	76835				T 7838	150466	1 S	2 W	28	SW	SW	54		TUALATIN RIVER	WILLAMETTE RIVER	211400140	0.43		IR	3/17/1938	4070 FEET SOUTH & 180 FEET EAST FROM NW CORNER, SECTION 28
133083	G	15629	G	15330						162858	1 S	2 W	33	NW	SW			A WELL	TUALATIN RIVER	2114003000320030	0.189		NU	10/9/2001	2600 FEET NORTH & 10 FEET EAST FROM SW CORNER, SECTION 33
133083	G	15629	G	15330						162858	1 S	2 W	33	NW	SW			A WELL	TUALATIN RIVER	2114003000320030	0.189		NU	10/9/2001	2600 FEET NORTH & 10 FEET EAST FROM SW CORNER, SECTION 33
133083	G	15629	G	15330						162858	1 S	2 W	33	NW	SW			A WELL	TUALATIN RIVER	2114003000320030	0.189		NU	10/9/2001	2600 FEET NORTH & 10 FEET EAST FROM SW CORNER, SECTION 33
133174	G	3794	G	3576	79625					162987	1 S	2 W	34	SE	SE	60		A WELL	TUALITY CREEK	2114003000420060	0.21		IR	1/31/1967	800 FEET NORTH & 130 FEET WEST FROM SE CORNER, SECTION 34
133674	G	2641	G	2485	79626				T 7365	163901	1 S	2 W	34	SE	SE	60		A WELL	BEAVERTON CREEK	2114003000420060	0.44		IR	6/25/1963	800 FEET NORTH & 130 FEET WEST FROM SE CORNER, SECTION 34
133674	G	2641	G	2485	79626				T 7365	163902	1 S	2 W	35	SW	SW	60		A WELL	BEAVERTON CREEK	2114003000420060	0.44		IR	6/25/1963	828 FEET NORTH & 51 FEET EAST FROM SW CORNER, SECTION 35
134220	IS	73538			80000					164931	1 S	2 W	16	NW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	100		PO	8/5/1993	TUALATIN RIVER FROM RIVER MILE 38.5 (NW1/4, SECTION 16, T1S, R2W WM); TO THE MOUTH AT RIVER MILE 0.0 (SW1/4, SECTION 2, T3S, R2E WM)
134220	IS	73538			80000					164931	1 S	2 W	16	NW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	100		PO	8/5/1993	TUALATIN RIVER FROM RIVER MILE 38.5 (NW1/4, SECTION 16, T1S, R2W WM); TO THE MOUTH AT RIVER MILE 0.0 (SW1/4, SECTION 2, T3S, R2E WM)
134220	IS	73538			80000					164931	1 S	2 W	16	NW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	100		PO	8/5/1993	TUALATIN RIVER FROM RIVER MILE 38.5 (NW1/4, SECTION 16, T1S, R2W WM); TO THE MOUTH AT RIVER MILE 0.0 (SW1/4, SECTION 2, T3S, R2E WM)
134220	IS	73538			80000					164931	1 S	2 W	16	NW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	100		PO	8/5/1993	TUALATIN RIVER FROM RIVER MILE 38.5 (NW1/4, SECTION 16, T1S, R2W WM); TO THE MOUTH AT RIVER MILE 0.0 (SW1/4, SECTION 2, T3S, R2E WM)
134220	IS	73538			80000					164931	1 S	2 W	16	NW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	100		PO	8/5/1993	TUALATIN RIVER FROM RIVER MILE 38.5 (NW1/4, SECTION 16, T1S, R2W WM); TO THE MOUTH AT RIVER MILE 0.0 (SW1/4, SECTION 2, T3S, R2E WM)
134220	IS	73538			80000					164931	1 S	2 W	16	NW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	100		PO	8/5/1993	TUALATIN RIVER FROM RIVER MILE 38.5 (NW1/4, SECTION 16, T1S, R2W WM); TO THE MOUTH AT RIVER MILE 0.0 (SW1/4, SECTION 2, T3S, R2E WM)
134220	IS	73538			80000					164931	1 S	2 W	16	NW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	100		PO	8/5/1993	TUALATIN RIVER FROM RIVER MILE 38.5 (NW1/4, SECTION 16, T1S, R2W WM); TO THE MOUTH AT RIVER MILE 0.0 (SW1/4, SECTION 2, T3S, R2E WM)
134220	IS	73538			80000					164931	1 S	2 W	16	NW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	100		PO	8/5/1993	TUALATIN RIVER FROM RIVER MILE 38.5 (NW1/4, SECTION 16, T1S, R2W WM); TO THE MOUTH AT RIVER MILE 0.0 (SW1/4, SECTION 2, T3S, R2E WM)
134220	IS	73538			80000					164931	1 S	2 W	16	NW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	100		PO	8/5/1993	TUALATIN RIVER FROM RIVER MILE 38.5 (NW1/4, SECTION 16, T1S, R2W WM); TO THE MOUTH AT RIVER MILE 0.0 (SW1/4, SECTION 2, T3S, R2E WM)
134220	IS	73538			80000					164931	1 S	2 W	16	NW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	100		PO	8/5/1993	TUALATIN RIVER FROM RIVER MILE 38.5 (NW1/4, SECTION 16, T1S, R2W WM); TO THE MOUTH AT RIVER MILE 0.0 (SW1/4, SECTION 2, T3S, R2E WM)
134220	IS	73538			80000					164931	1 S	2 W	16	NW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	100		PO	8/5/1993	TUALATIN RIVER FROM RIVER MILE 38.5 (NW1/4, SECTION 16, T1S, R2W WM); TO THE MOUTH AT RIVER MILE 0.0 (SW1/4, SECTION 2, T3S, R2E WM)
134220	IS	73538			80000					164931	1 S	2 W	16	NW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	100		PO	8/5/1993	TUALATIN RIVER FROM RIVER MILE 38.5 (NW1/4, SECTION 16, T1S, R2W WM); TO THE MOUTH AT RIVER MILE 0.0 (SW1/4, SECTION 2, T3S, R2E WM)
134220	IS	73538			80000					164931	1 S	2 W	16	NW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	100		PO	8/5/1993	TUALATIN RIVER FROM RIVER MILE 38.5 (NW1/4, SECTION 16, T1S, R2W WM); TO THE MOUTH AT RIVER MILE 0.0 (SW1/4, SECTION 2, T3S, R2E WM)
134220	IS	73538			80000					164931	1 S	2 W	16	NW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	100		PO	8/5/1993	TUALATIN RIVER FROM RIVER MILE 38.5 (NW1/4, SECTION 16, T1S, R2W WM); TO THE MOUTH AT RIVER MILE 0.0 (SW1/4, SECTION 2, T3S, R2E WM)
134220	IS	73538			80000					164931	1 S	2 W	16	NW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	100		PO	8/5/1993	TUALATIN RIVER FROM RIVER MILE 38.5 (NW1/4, SECTION 16, T1S, R2W WM); TO THE MOUTH AT RIVER MILE 0.0 (SW1/4, SECTION 2, T3S, R2E WM)
134220	IS	73538			80000					164931	1 S	2 W	16	NW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	100		PO	8/5/1993	TUALATIN RIVER FROM RIVER MILE 38.5 (NW1/4, SECTION 16, T1S, R2W WM); TO THE MOUTH AT RIVER MILE 0.0 (SW1/4, SECTION 2, T3S, R2E WM)
134220	IS	73538			80000					164931	1 S	2 W	16	NW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	100		PO	8/5/1993	TUALATIN RIVER FROM RIVER MILE 38.5 (NW1/4, SECTION 16, T1S, R2W WM); TO THE MOUTH AT RIVER MILE 0.0 (SW1/4, SECTION 2, T3S, R2E WM)
134220	IS	73538			80000					164931	1 S	2 W	16	NW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	100		PO	8/5/1993	TUALATIN RIVER FROM RIVER MILE 38.5 (NW1/4, SECTION 16, T1S, R2W WM); TO THE MOUTH AT RIVER MILE 0.0 (SW1/4, SECTION 2, T3S, R2E WM)
134220	IS	73538			80000					164931	1 S	2 W	16	NW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	100		PO	8/5/1993	TUALATIN RIVER FROM RIVER MILE 38.5 (NW1/4, SECTION 16, T1S, R2W WM); TO THE MOUTH AT RIVER MILE 0.0 (SW1/4, SECTION 2, T3S, R2E WM)
134220	IS	73538			80000					164931	1 S	2 W	16	NW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	100		PO	8/5/1993	TUALATIN RIVER FROM RIVER MILE 38.5 (NW1/4, SECTION 16, T1S, R2W WM); TO THE MOUTH AT RIVER MILE 0.0 (SW1/4, SECTION 2, T3S, R2E WM)
134220	IS	73538			80000					164931	1 S	2 W	16	NW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	100		PO	8/5/1993	TUALATIN RIVER FROM RIVER MILE 38.5 (NW1/4, SECTION 16, T1S, R2W WM); TO THE MOUTH AT RIVER MILE 0.0 (SW1/4, SECTION 2, T3S, R2E WM)
134220	IS	73538			80000					164931	1 S	2 W	16	NW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	100		PO	8/5/1993	TUALATIN RIVER FROM RIVER MILE 38.5 (NW1/4, SECTION 16, T1S, R2W WM); TO THE MOUTH AT RIVER MILE 0.0 (SW1/4, SECTION 2, T3S, R2E WM)
134220	IS	73538			80000					164931	1 S	2 W	16	NW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	100		PO	8/5/1993	TUALATIN RIVER FROM RIVER MILE 38.5 (NW1/4, SECTION 16, T1S, R2W WM); TO THE MOUTH AT RIVER MILE 0.0 (SW1/4, SECTION 2, T3S, R2E WM)
134220	IS	73538			80000					164931	1 S	2 W	16	NW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	100		PO	8/5/1993	TUALATIN RIVER FROM RIVER MILE 38.5 (NW1/4, SECTION 16, T1S, R2W WM); TO THE MOUTH AT RIVER MILE 0.0 (SW1/4, SECTION 2, T3S, R2E WM)
139903	G	904	G	798					T 7346	177955	1 S	2 W	26	SE	NW			A WELL	ROCK CREEK	2114003000250070	0.07		NU	3/26/1958	600 FEET EAST FROM NE CORNER, JOHNSON DLC 55
139903	G	904	G	798					T 7346	177955	1 S	2 W	26	SE	NW			A WELL	ROCK CREEK	2114003000250070	0.07		NU	3/26/1958	600 FEET EAST FROM NE CORNER, JOHNSON DLC 55
139903	G	904	G	798					T 7346	177955	1 S	2 W	26	SE	NW			A WELL	ROCK CREEK	2114003000250070	0.07		NU	3/26/1958	600 FEET EAST FROM NE CORNER, JOHNSON DLC 55
141397	G	2157	G	1985					T 8853	182067	1 S	2 W	26	NW	SW			A WELL	TUALATIN RIVER	2114003000360	0.19		NU	11/9/1961	600 FEET EAST FROM NE CORNER, H JOHNSON DLC 55

GSI Water Solutions, Inc.

Appendix C
Water Rights in Area Affected by ASR Wells
Joint Water Commission Limited License Application

Water Right ID	Application Character	Application Number	Permit Character	Permit Number	Certificate	Decree	Claim Character	Claim Nbr	Transfer	POD ID	Township	Range	Sctn	Qtr40	Qtr160	DLC	Lot	Source	TributaryTo	StreamCode	POD Max Rate	POD Max Acre Feet	Use	PriorityDate	Legal
141397	G	2157	G	1985					T 8853	182067	1 S	2 W	26	NW	SW			A WELL	TUALATIN RIVER	2114003000360	0.19		NU	11/9/1961	600 FEET EAST FROM NE CORNER, H JOHNSON DLC 55
141397	G	2157	G	1985					T 8853	182067	1 S	2 W	26	NW	SW			A WELL	TUALATIN RIVER	2114003000360	0.19		NU	11/9/1961	600 FEET EAST FROM NE CORNER, H JOHNSON DLC 55
141398	G	591	G	499					T 8853	182068	1 S	2 W	26	SE	NW			A WELL	TUALATIN RIVER	2114003000360	0.004		NU	3/29/1957	9.5 CHAINS EAST FROM NE CORNER, JOHNSON DLC 55
141398	G	591	G	499					T 8853	182068	1 S	2 W	26	SE	NW			A WELL	TUALATIN RIVER	2114003000360	0.004		NU	3/29/1957	9.5 CHAINS EAST FROM NE CORNER, JOHNSON DLC 55
141497	S	85857	S	54134						182339	1 S	2 W	23	SE	NW			A RESERVOIR	TUALATIN RIVER	2114003000360		1	NU	10/23/2003	1425 FEET SOUTH & 2300 FEET EAST FROM NW CORNER, SECTION 23
141497	S	85857	S	54134						182339	1 S	2 W	23	SE	NW			A RESERVOIR	TUALATIN RIVER	2114003000360		1	NU	10/23/2003	1425 FEET SOUTH & 2300 FEET EAST FROM NW CORNER, SECTION 23
141497	S	85857	S	54134						182339	1 S	2 W	23	SE	NW			A RESERVOIR	TUALATIN RIVER	2114003000360		1	NU	10/23/2003	1425 FEET SOUTH & 2300 FEET EAST FROM NW CORNER, SECTION 23
141788	G	904	G	798					T 7346	182975	1 S	2 W	26	SE	NW			A WELL	TUALATIN RIVER	211400300	0.04		NU	3/26/1958	9.5 CHAINS EAST FROM NE CORNER, JOHNSON DLC 55
141788	G	904	G	798					T 7346	182975	1 S	2 W	26	SE	NW			A WELL	TUALATIN RIVER	211400300	0.04		NU	3/26/1958	9.5 CHAINS EAST FROM NE CORNER, JOHNSON DLC 55
141788	G	904	G	798					T 7346	182975	1 S	2 W	26	SE	NW			A WELL	TUALATIN RIVER	211400300	0.04		NU	3/26/1958	9.5 CHAINS EAST FROM NE CORNER, JOHNSON DLC 55
141790	G	904	G	798	80650				T 7346	182977	1 S	2 W	26	SE	NW			A WELL	TUALATIN RIVER	211400300	0.19		IR	3/26/1958	9.5 CHAINS EAST FROM NE CORNER, JOHNSON DLC 55
142116	G	591	G	499	80733				T 8853	183739	1 S	2 W	26	SE	NW			A WELL	TUALATIN RIVER	2114003000360	0.346		IR	3/29/1957	9.5 CHAINS EAST FROM NE CORNER, JOHNSON DLC 55
142124	R	86113	R	14104						183755	1 S	2 W	34	SW	SE			UNNAMED STREAM	TUALATIN RIVER	2114003000320		4.5	MP	10/7/2004	1100 FEET NORTH & 2050 FEET WEST FROM SE CORNER, SECTION 34
142124	R	86113	R	14104						183755	1 S	2 W	34	SW	SE			UNNAMED STREAM	TUALATIN RIVER	2114003000320		4.5	MP	10/7/2004	1100 FEET NORTH & 2050 FEET WEST FROM SE CORNER, SECTION 34
142342	G	2157	G	1985	81133					184235	1 S	2 W	26	SW	NE			A WELL	TUALATIN RIVER	2114003000360	0.2593		IM	11/9/1961	275 FEET NORTH & 1000 FEET WEST FROM SE CORNER, SWNE, SECTION 26
144125	G	904	G	798					T 9958	188298	1 S	2 W	26	SE	NW			A WELL	ROCK CREEK	2114003000250070	0.009		NU	3/26/1958	600 FEET EAST FROM NE CORNER, JOHNSON DLC 55
144125	G	904	G	798					T 9958	188298	1 S	2 W	26	SE	NW			A WELL	ROCK CREEK	2114003000250070	0.009		NU	3/26/1958	600 FEET EAST FROM NE CORNER, JOHNSON DLC 55
144125	G	904	G	798					T 9958	188298	1 S	2 W	26	SE	NW			A WELL	ROCK CREEK	2114003000250070	0.009		NU	3/26/1958	600 FEET EAST FROM NE CORNER, JOHNSON DLC 55
144839	R	85912	R	13944						190370	1 S	2 W	26	SW	NW			RUNOFF	TUALATIN RIVER	2114003000360		1	ST	1/20/2004	2280 FEET SOUTH & 1050 FEET EAST FROM NW CORNER, SECTION 26
144839	R	85912	R	13944						190370	1 S	2 W	26	SW	NW			RUNOFF	TUALATIN RIVER	2114003000360		1	ST	1/20/2004	2280 FEET SOUTH & 1050 FEET EAST FROM NW CORNER, SECTION 26
144840	R	85913	R	13945						190371	1 S	2 W	27	SE	NE			RUNOFF	TUALATIN RIVER	2114003000360		5	ST	1/20/2004	1820 FEET SOUTH & 540 FEET WEST FROM NE CORNER, SECTION 27
144840	R	85913	R	13945						190371	1 S	2 W	27	SE	NE			RUNOFF	TUALATIN RIVER	2114003000360		5	ST	1/20/2004	1820 FEET SOUTH & 540 FEET WEST FROM NE CORNER, SECTION 27
144847	S	85914	S	54204						190391	1 S	2 W	26	SW	NW			A RESERVOIR	TUALATIN RIVER	2114003000360		1	NU	1/20/2004	2280 FEET SOUTH & 1050 FEET EAST FROM NW CORNER, SECTION 26
144847	S	85914	S	54204						190391	1 S	2 W	26	SW	NW			A RESERVOIR	TUALATIN RIVER	2114003000360		1	NU	1/20/2004	2280 FEET SOUTH & 1050 FEET EAST FROM NW CORNER, SECTION 26
144847	S	85914	S	54204						190391	1 S	2 W	26	SW	NW			A RESERVOIR	TUALATIN RIVER	2114003000360		1	NU	1/20/2004	2280 FEET SOUTH & 1050 FEET EAST FROM NW CORNER, SECTION 26
144847	S	85914	S	54204						190392	1 S	2 W	27	SE	NE			A RESERVOIR	TUALATIN RIVER	2114003000360		5	NU	1/20/2004	1820 FEET SOUTH & 540 FEET WEST FROM NE CORNER, SECTION 27
144847	S	85914	S	54204						190392	1 S	2 W	27	SE	NE			A RESERVOIR	TUALATIN RIVER	2114003000360		5	NU	1/20/2004	1820 FEET SOUTH & 540 FEET WEST FROM NE CORNER, SECTION 27
144847	S	85914	S	54204						190392	1 S	2 W	27	SE	NE			A RESERVOIR	TUALATIN RIVER	2114003000360		5	NU	1/20/2004	1820 FEET SOUTH & 540 FEET WEST FROM NE CORNER, SECTION 27
144847	S	85914	S	54204						190393	1 S	2 W	26	SW	NW			RUNOFF	TUALATIN RIVER	2114003000360	1.56		NU	1/20/2004	2280 FEET SOUTH & 1050 FEET EAST FROM NW CORNER, SECTION 26
144847	S	85914	S	54204						190393	1 S	2 W	26	SW	NW			RUNOFF	TUALATIN RIVER	2114003000360	1.56		NU	1/20/2004	2280 FEET SOUTH & 1050 FEET EAST FROM NW CORNER, SECTION 26
144847	S	85914	S	54204						190393	1 S	2 W	26	SW	NW			RUNOFF	TUALATIN RIVER	2114003000360	1.56		NU	1/20/2004	2280 FEET SOUTH & 1050 FEET EAST FROM NW CORNER, SECTION 26
144847	S	85914	S	54204						190393	1 S	2 W	26	SW	NW			RUNOFF	TUALATIN RIVER	2114003000360	1.56		NU	1/20/2004	2280 FEET SOUTH & 1050 FEET EAST FROM NW CORNER, SECTION 26
144847	S	85914	S	54204						190393	1 S	2 W	26	SW	NW			RUNOFF	TUALATIN RIVER	2114003000360	1.56		NU	1/20/2004	2280 FEET SOUTH & 1050 FEET EAST FROM NW CORNER, SECTION 26
144847	S	85914	S	54204						190393	1 S	2 W	26	SW	NW			RUNOFF	TUALATIN RIVER	2114003000360	1.56		NU	1/20/2004	2280 FEET SOUTH & 1050 FEET EAST FROM NW CORNER, SECTION 26
144847	S	85914	S	54204						190394	1 S	2 W	27	SE	NE			RUNOFF	TUALATIN RIVER	2114003000360	1.56		NU	1/20/2004	1820 FEET SOUTH & 540 FEET WEST FROM NE CORNER, SECTION 27
144847	S	85914	S	54204						190394	1 S	2 W	27	SE	NE			RUNOFF	TUALATIN RIVER	2114003000360	1.56		NU	1/20/2004	1820 FEET SOUTH & 540 FEET WEST FROM NE CORNER, SECTION 27
144847	S	85914	S	54204						190394	1 S	2 W	27	SE	NE			RUNOFF	TUALATIN RIVER	2114003000360	1.56		NU	1/20/2004	1820 FEET SOUTH & 540 FEET WEST FROM NE CORNER, SECTION 27
144847	S	85914	S	54204						190394	1 S	2 W	27	SE	NE			RUNOFF	TUALATIN RIVER	2114003000360	1.56		NU	1/20/2004	1820 FEET SOUTH & 540 FEET WEST FROM NE CORNER, SECTION 27
144847	S	85914	S	54204						190394	1 S	2 W	27	SE	NE			RUNOFF	TUALATIN RIVER	2114003000360	1.56		NU	1/20/2004	1820 FEET SOUTH & 540 FEET WEST FROM NE CORNER, SECTION 27
144847	S	85914	S	54204						190394	1 S	2 W	27	SE	NE			RUNOFF	TUALATIN RIVER	2114003000360	1.56		NU	1/20/2004	1820 FEET SOUTH & 540 FEET WEST FROM NE CORNER, SECTION 27
147410	S	38447	S	35792					T 10293, T 10683, T 10688, T 10729, T 8590, T 11071	197461	1 S	4 W	20	NE	NE			SCOGGINS CREEK/RESERVOIR	WILLAMETTE RIVER	2114003000640	245.8		MU	2/20/1963	700 FEET SOUTH & 1030 FEET WEST FROM NE CORNER, SECTION 20
147410	S	38447	S	35792					T 10293, T 10683, T 10688, T 10729, T 8590, T 11071	197461	1 S	4 W	20	NE	NE			SCOGGINS CREEK/RESERVOIR	WILLAMETTE RIVER	2114003000640	245.8		IC	2/20/1963	700 FEET SOUTH & 1030 FEET WEST FROM NE CORNER, SECTION 20
147410	S	38447	S	35792					T 10293, T 10683, T 10688, T 10729, T 8590, T 11071	197462	1 S	4 W	0					CARPENTER CREEK	TUALATIN RIVER	2114003000580	6		MU	2/20/1963	PORTABLE PUMPING BETWEEN SECTIONS 1 & 2
147410	S	38447	S	35792					T 10293, T 10683, T 10688, T 10729, T 8590, T 11071	197463	1 S	4 W	0					GALES CREEK	TUALATIN RIVER	2114003000560	13		MU	2/20/1963	PORTABLE PUMPING IN SECTION 35 TOWNSHIP 1 N RANGE 4W & BETWEEN SECTIONS 1 & 2
147410	S	38447	S	35792					T 10293, T 10683, T 10688, T 10729, T 8590, T 11071	197464	1 N	3 W	0					DAIRY CREEK	TUALATIN RIVER	2114003000480	8		MU	2/20/1963	PORTABLE PUMPING BETWEEN SECTIONS 21, 26 & 27
147410	S	38447	S	35792					T 10293, T 10683, T 10688, T 10729, T 8590, T 11071	197465	1 N	3 W	0					MCKAY CREEK	DAIRY CREEK	2114003000480020	4		MU	2/20/1963	PORTABLE PUMPING BETWEEN SECTIONS 24 & 25
147410	S	38447	S	35792					T 10293, T 10683, T 10688, T 10729, T 8590, T 11071	197466	1 S	2 W	21	NE	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	90		FI	2/20/1963	700 FEET SOUTH & 1100 FEET WEST FROM NE CORNER, SECTION 21
147410	S	38447	S	35792					T 10293, T 10683, T 10688, T 10729, T 8590, T 11071	197466	1 S	2 W	21	NE	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	90		MU	2/20/1963	700 FEET SOUTH & 1100 FEET WEST FROM NE CORNER, SECTION 21
147955	S	86114	S	54322						200091	1 S	2 W	34	SW	SE			UNNAMED STREAM	TUALATIN RIVER	2114003000320	3.68		NU	10/7/2004	1100 FEET NORTH AND 2050 FEET WEST FROM SE CORNER, SECTION 34
147955	S	86114	S	54322						200091	1 S	2 W	34	SW	SE			UNNAMED STREAM	TUALATIN RIVER	2114003000320	3.68		NU	10/7/2004	1100 FEET NORTH AND 2050 FEET WEST FROM SE CORNER, SECTION 34
147955	S	86114	S	54322						200091	1 S	2 W	34	SW	SE			UNNAMED STREAM	TUALATIN RIVER	2114003000320	3.68		NU	10/7/2004	1100 FEET NORTH AND 2050 FEET WEST FROM SE CORNER, SECTION 34
147955	S	86114	S	54322						200091	1 S	2 W	34	SW	SE			UNNAMED STREAM	TUALATIN RIVER	2114003000320	3.68		NU	10/7/2004	1100 FEET NORTH AND 2050 FEET WEST FROM SE CORNER, SECTION 34
147955	S	86114	S	54322						200091	1 S	2 W	34	SW	SE			UNNAMED STREAM	TUALATIN RIVER	2114003000320	3.68		NU	10/7/2004	1100 FEET NORTH AND 2050 FEET WEST FROM SE CORNER, SECTION 34
147955	S	86114	S	54322						200091	1 S	2 W	34	SW	SE			UNNAMED STREAM	TUALATIN RIVER	2114003000320	3.68		NU	10/7/2004	1100 FEET NORTH AND 2050 FEET WEST FROM SE CORNER, SECTION 34
149439	R	69168	R	11224	83212					208320	1 S	2 W	22	SW	SW			UNNAMED STREAM	TUALATIN RIVER	2114003000360		38	ST	10/27/1989	250 FEET NORTH AND 650 FEET EAST FROM SW CORNER, SECTION 22

Appendix C

Water Rights in Area Affected by ASR Wells

Joint Water Commission Limited License Application

Water Right ID	Application Character	Application Number	Permit Character	Permit Number	Certificate	Decree	Claim Character	Claim Nbr	Transfer	POD ID	Township	Range	Sctn	Qtr40	Qtr160	DLC	Lot	Source	TributaryTo	StreamCode	POD Max Rate	POD Max Acre Feet	Use	PriorityDate	Legal
149440	S	69169	S	50969	83211					208321	1 S	2 W	22	SW	SW			UNNAMED STREAM	TUALATIN RIVER	2114003000360	0.6		IR	6/29/1987	250 FEET NORTH AND 650 FEET EAST FROM SW CORNER, SECTION 22
149440	S	69169	S	50969	83211					208321	1 S	2 W	22	SW	SW			UNNAMED STREAM	TUALATIN RIVER	2114003000360	0.6		IR	6/29/1987	250 FEET NORTH AND 650 FEET EAST FROM SW CORNER, SECTION 22
149440	S	69169	S	50969	83211					208322	1 S	2 W	22	SW	SW			A RESERVOIR	TUALATIN RIVER	2114003000360		38	IS	6/29/1987	250 FEET NORTH AND 650 FEET EAST FROM SW CORNER, SECTION 22
149440	S	69169	S	50969	83211					208322	1 S	2 W	22	SW	SW			A RESERVOIR	TUALATIN RIVER	2114003000360		38	IR	6/29/1987	250 FEET NORTH AND 650 FEET EAST FROM SW CORNER, SECTION 22
155513	G	16726	G	16261						227855	1 S	2 W	27	SW	NW			A WELL	TUALATIN RIVER	2114003000360	0.03		IR	9/19/2006	1640 FEET SOUTH AND 50 FEET EAST FROM NE CORNER, SECTION 28
156888	R	69748	R	11201	83966					231722	1 S	2 W	23	SE	NW			UNNAMED STREAM	TUALATIN RIVER	2114003000360		2	ST	11/7/1988	NONE GIVEN
156896	S	69749	S	50943	83967					231744	1 S	2 W	23	SE	NW			UNNAMED STREAM	TUALATIN RIVER	2114003000360	0.01		NU	11/7/1988	1390 FEET SOUTH AND 2320 FEET EAST FROM NW CORNER, SECTION 23
156896	S	69749	S	50943	83967					231744	1 S	2 W	23	SE	NW			UNNAMED STREAM	TUALATIN RIVER	2114003000360	0.01		NU	11/7/1988	1390 FEET SOUTH AND 2320 FEET EAST FROM NW CORNER, SECTION 23
156896	S	69749	S	50943	83967					231744	1 S	2 W	23	SE	NW			UNNAMED STREAM	TUALATIN RIVER	2114003000360	0.01		NU	11/7/1988	1390 FEET SOUTH AND 2320 FEET EAST FROM NW CORNER, SECTION 23
156896	S	69749	S	50943	83967					231753	1 S	2 W	23	SE	NW			A RESERVOIR	TUALATIN RIVER	2114003000360	0.01		NU	11/7/1988	1390 FEET SOUTH AND 2320 FEET EAST FROM NW CORNER, SECTION 23
156896	S	69749	S	50943	83967					231753	1 S	2 W	23	SE	NW			A RESERVOIR	TUALATIN RIVER	2114003000360	0.01		NU	11/7/1988	1390 FEET SOUTH AND 2320 FEET EAST FROM NW CORNER, SECTION 23
156896	S	69749	S	50943	83967					231753	1 S	2 W	23	SE	NW			A RESERVOIR	TUALATIN RIVER	2114003000360	0.01		NU	11/7/1988	1390 FEET SOUTH AND 2320 FEET EAST FROM NW CORNER, SECTION 23
156896	S	69749	S	50943	83967					231753	1 S	2 W	23	SE	NW			A RESERVOIR	TUALATIN RIVER	2114003000360	0.01		NU	11/7/1988	1390 FEET SOUTH AND 2320 FEET EAST FROM NW CORNER, SECTION 23
156896	S	69749	S	50943	83967					231753	1 S	2 W	23	SE	NW			A RESERVOIR	TUALATIN RIVER	2114003000360	0.01		NU	11/7/1988	1390 FEET SOUTH AND 2320 FEET EAST FROM NW CORNER, SECTION 23
156896	S	69749	S	50943	83967					231753	1 S	2 W	23	SE	NW			A RESERVOIR	TUALATIN RIVER	2114003000360	0.01		NU	11/7/1988	1390 FEET SOUTH AND 2320 FEET EAST FROM NW CORNER, SECTION 23
161429	S	86704	S	54476						245495	1 S	2 W	16	NW	NW			TREATED EFFLUENT	TUALATIN RIVER	211400300	10.4		F4	10/18/2006	45 FEET SOUTH AND 1057 FEET EAST FROM NW CORNER, SECTION 16
161429	S	86704	S	54476						245496	1 S	2 W	16	NW	NW			TREATED EFFLUENT	TUALATIN RIVER	211400300	10.4		F4	10/18/2006	41 FEET SOUTH AND 1094 FEET EAST FROM NW CORNER, SECTION 16
164123	G	904	G	798	82829				T 9958	256894	1 S	2 W	26	SE	NW			A WELL	ROCK CREEK	2114003000250070	0.041		NU	3/26/1958	600 FEET EAST FROM NE CORNER, JOHNSON DLC 55
164123	G	904	G	798	82829				T 9958	256894	1 S	2 W	26	SE	NW			A WELL	ROCK CREEK	2114003000250070	0.041		NU	3/26/1958	600 FEET EAST FROM NE CORNER, JOHNSON DLC 55
164123	G	904	G	798	82829				T 9958	256894	1 S	2 W	26	SE	NW			A WELL	ROCK CREEK	2114003000250070	0.041		NU	3/26/1958	600 FEET EAST FROM NE CORNER, JOHNSON DLC 55
166934	S	74474	S	52031	85758					264664	1 S	2 W	23	NE	NW			A RESERVOIR	TUALATIN RIVER	2114003000360		2	IR	9/6/1994	1500 FEET SOUTH AND 2200 FEET EAST FROM NW CORNER, SECTION 23
170248	S	27985	S	22028	86603				T 6230	273331	1 S	2 W	16	SW	NE	61		TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.05		IR	2/11/1953	240 FEET NORTH AND 2250 FEET WEST FROM E1/4 CORNER, SECTION 16
4206	P	79083								23767	2 S	1 W	7	SE	SE			RUNOFF/POND		2114003000290		0.298	LV	11/28/1994	
5231	P	81687								26784	2 S	1 W	16	SW	NW			UNNAMED STREAM/POND	TUALATIN RIVER	211400300		2	WI	10/28/1996	
5231	P	81687								26784	2 S	1 W	16	SW	NW			UNNAMED STREAM/POND	TUALATIN RIVER	211400300		2	LV	10/28/1996	
5492	P	82109								27264	2 S	1 W	8	NW	SE			RUNOFF/POND 1	TUALATIN RIVER	2114003000246		1.12	LV	1/31/1997	
5492	P	82109								27265	2 S	1 W	8	NW	SE			RUNOFF/POND 2	TUALATIN RIVER	2114003000246		1.51	LV	1/31/1997	
25288							GR	366		13403	2 S	1 W	6	SE	SE			A WELL	UNNAMED STREAM	2114003000290	0.156		IR	10/31/1952	NO 63 DEG 54 MIN WEST 1200.81 FEET FROM SE CORNER, SECTION 6
25484							GR	575		13672	2 S	1 W	4	NW	NE			A WELL	UNNAMED STREAM	2114003000180070	0.557		IR	12/31/1953	1070 FEET SOUTH & 2200 FEET WEST FROM NE CORNER, SECTION 4
25503							GR	597		13691	2 S	1 W	3	SW	SE			A WELL	UNNAMED STREAM	2114003000180050	0.1337		IR	3/3/1953	522 FEET NORTH & 245 FEET EAST OF 1/4 SECTION CORNER, SOUTH LINE SECTION 3
26417							GR	1538		14551	2 S	1 W	6	SW	SW			A WELL	UNNAMED STREAM	2114003000290	0.3008		IR	10/15/1953	NORTH 38 DEG 27 MIN EAST 347 FEET FROM W1/4 CORNER, SECTION 6
26481							GR	667		14611	2 S	1 W	10	NW	SE			A WELL	UNNAMED STREAM	2114003000220	0.0624		IR	8/27/1951	1950 FEET NORTH & 1560 FEET WEST FROM SE CORNER, SECTION 10
26754							GR	1879		14868	2 S	1 W	18	NE	SE			A WELL	UNNAMED STREAM	2114003000246	0.3342		IR	12/31/1951	350 FEET SOUTH & 430 FEET WEST FROM NE CORNER, SECTION 19
26755							GR	1880		14869	2 S	1 W	17	NW	NE			A WELL	UNNAMED STREAM	2114003000246	0.4456		IR	8/8/1953	100 FEET SOUTH & 1800 FEET WEST FROM NE CORNER, SECTION 17
27040							GR	2199		15142	2 S	1 W	10	SW	NE			A WELL	UNNAMED STREAM	2114003000220	0.078		IR	3/1/1948	1700 FEET SOUTH & 2050 FEET EAST FROM NE CORNER, SECTION 10
27040							GR	2199		15142	2 S	1 W	10	SW	NE			A WELL	UNNAMED STREAM	2114003000220	0.078		IM	3/1/1948	1700 FEET SOUTH & 2050 FEET EAST FROM NE CORNER, SECTION 10
28933							GR	2636		16954	2 S	1 W	4	SE	NW			A WELL	UNNAMED STREAM	2114003000180070	0.0356		DI	12/31/1949	980 FEET NORTH & 1930 FEET EAST FROM W1/4 CORNER, SECTION 4
32820	R	79610	R	12116						33155	2 S	1 W	5	NW	NE			SUMMERS CREEK/REES 1	FANNO CREEK	2114003000180070		399	AS	3/3/1995	ALSO SWNE; S 89 DEG 35 MIN W 440 FT, N 474.2 FT FROM NW CORNER, SWNE, SEC 5
33717	R	84503	R	13037						34274	2 S	1 W	18	SW	NE			RUNOFF/DENNIS RESERVOIR	WILLAMETTE RIVER	211400300		200	FW	8/8/2000	ALSO SENW, NESW AND NWSE
33717	R	84503	R	13037						34274	2 S	1 W	18	SW	NE			RUNOFF/DENNIS RESERVOIR	WILLAMETTE RIVER	211400300		200	FW	8/8/2000	ALSO SENW, NESW AND NWSE
33997	R	84813	R	13319						34615	2 S	1 W	16	NW	SW			RUNOFF	TUALATIN RIVER	2114003000232		20	FI	7/25/2001	1735 FEET NORTH & 1085 FEET EAST FROM SW CORNER, SECTION 16
33997	R	84813	R	13319						34615	2 S	1 W	16	NW	SW			RUNOFF	TUALATIN RIVER	2114003000232		20	WI	7/25/2001	1735 FEET NORTH & 1085 FEET EAST FROM SW CORNER, SECTION 16
49248	S	54580	S	49958						42669	2 S	1 W	18	NW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	410 FEET SOUTH & 360 FEET WEST OF THE SW CORNER,SECTION 7
49248	S	54580	S	49958						42669	2 S	1 W	18	NW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	12/18/1986	410 FEET SOUTH & 360 FEET WEST OF THE SW CORNER,SECTION 7
49248	S	54580	S	49958						42670	2 S	1 W	7	SW	SW			UNNAMED STREAM	TUALATIN RIVER	2114003000279	25		IC	1/4/1984	1100 FEET NORTH & 640 FEET EAST OF THE SW CORNER,SECTION 7
49248	S	54580	S	49958						42671	2 S	2 W	11	NW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	1850 FEET NORTH & 2440 FEET WEST FROM THE SE CORNER,SECTION 11
49248	S	54580	S	49958						42672	2 S	1 W	18	SE	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	2130 FEET SOUTH & 1510 FEET EAST FROM THE NW CORNER,SECTION 18
49248	S	54580	S	49958						42673	2 S	2 W	11	NW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	1850 FEET NORTH & 2440 FEET WEST FROM THE SE CORNER,SECTON 11
49248	S	54580	S	49958						42674	2 S	2 W	11	SW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	1850 FEET NORTH & 2440 FEET WEST FROM THE SE CORNER,SECTION 11
49248	S	54580	S	49958						42675	1 S	2 W	29	SE	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	140 FEET NORTH & 530 FEET WEST FROM THE SW CORNER,SECTON 28
49248	S	54580	S	49958						42676	1 S	2 W	21	NE	SW			UNNAMED STREAM	TUALATIN RIVER	2114003000370	25		IC	1/4/1984	1160 FEET SOUTH & 1460 FEET EAST FROM THE W1/4 CORNER,SECTION 21
49248	S	54580	S	49958						42677	2 S	2 W	9	NE	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	1600 FEET NORTH & 1080 FEET WEST FROM THE SE CORNER,SECTION 9
49248	S	54580	S	49958						42678	2 S	2 W	16	NE	NE			MCFEE CREEK	TUALATIN RIVER	2114003000310	25		IC	1/4/1984	940 FEET SOUTH & 120 FEET WEST FROM THE NE CORNER,SECTION 16
49248	S	54580	S	49958						42679	2 S	1 W	20	NE	NW			CHICKEN CREEK	TUALATIN RIVER	2114003000270	25		IC	1/4/1984	250 FEET SOUTH & 2850 FEET WEST FROM THE NE CORNER,SECTION 20
49248	S	54580	S	49958						42680	2 S	2 W	10	SE	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	900 FEET NORTH & 1820 FEET EAST FROM THE SW CORNER,SECTION 10
49248	S	54580	S	49958						42681	2 S	2 W	14	SW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	2112 FEET SOUTH & 1056 FEET EAST FROM THE NE CORNER,SECTION 15
49248	S	54580	S	49958						42682	2 S	2 W	19	NW	NW			UNNAMED STREAM	MCFEE CREEK	2114003000310150	25		IC	1/4/1984	10 FEET SOUTH & 400 FET EAST FROM THE SE CORNER,SECTION 18
49248	S	54580	S	49958						42683	2 S	1 W	18	NW	SW			UNNAMED STREAM	CEDAR CREEK	2114003000270010000	25		IC	1/4/1984	2260 FEET NORTH & 174 FEET WEST FROM THE SE CORNER,SECTION 13
49248	S	54580	S	49958						42684	2 S	2 W	11	NW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	1850 FEET NORTH & 2440 FEET WEST FROM THE SE CORNER,SECTION 11
49248	S	54580	S	49958						42685	1 S	2 W	34	SE	SE			UNNAMED STREAM	TUALATIN RIVER	2114003000320	25		IC	1/4/1984	620 FEET NORTH & 720 FEET WEST FROM THE SE CORNER,SECTION 34
49248	S	54580	S	49958						42686	1 S	2 W	19	NE	SE			DAVIS CREEK	TUALATIN RIVER	2114003000430	25		IC	1/4/1984	1500 FEET NORTH & 500 FEET WEST FROM THE SE CORNER,SECTION 19
49248	S	54580	S	49958						42687	1 S	2 W	17	NW	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	1130 FEET SOUTH & 950 FEET EAST FROM THE W1/4 CORNER,SECTION 17
49248	S	54580	S	49958						42688	2 S	2 W	11	SW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	340 FEET NORTH & 1630 FEET WEST FROM THE SE CORNER,SECTION 11
49248	S	54580	S	49958						42689	2 S	2 W	11	SW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	340 FEET NORTH & 1630 FEET WEST FROM THE SE CORNER,SECTION 11
49248	S	54580	S	49958						42690	2 S	2 W	9	SW	NE			MCFEE CREEK	TUALATIN RIVER	2114003000310	25		IC	1/4/1984	750 FEET NORTH & 250 FEET EAST FROM THE CENTER,SECTION 9
49248	S	54580	S	49958						42691	1 S	2 W	21	SW	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	470 FEET NORTH & 730 FEET EAST FROM THE NE CORNER,SECTION 29
49248	S	54580	S	49958						42692	1 S	2 W	34	SE	SE			UNNAMED STREAM	TUALATIN RIVER	2114003000320	25		IC	1/4/1984	1000 FEET NORTH & 700 FEET WEST FROM THE SE CORNER,SECTON 34
49248	S	54580	S	49958						42693	2 S	2 W	19	NW	NW			GULF CANYON	MCFEE CREEK	2114003000310130	25		IC	1/4/1984	10 FEET SOUTH & 400 FEET EAST FROM THE SE CORNER,SECTION 18
49248	S	54580	S	49958						42694	2 S	2 W	11	SW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	340 FEET NORTH & 1630 FEET WEST FROM THE SE CORNER,SECTION 11
49248	S	54580	S	49958						42695	2 S	2 W	11	SW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	340 FEET NORTH & 1630 FEET WEST FROM THE SE CORNER,SECTION 11
49248	S	54580	S	49958						42696	2 S	2 W	11	SW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	4170 FEET SOUTH & 1790 FEET WEST FROM THE NE CORNER,SECTION 11
49248	S	54580	S	49958						42697	2 S	1 W	18	NE	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	870 FEET SOUTH & 660 FEET WEST FROM THE CENTER,SECTION 18
49248	S	54580	S	49958						42698	2 S	2 W	10	SW	NE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	2390 FEET SOUTH & 1870 FEET WEST FROM THE NE CORNER,SECTION 10
50393	S	73365	S	51982						44719	2 S	1 W	18	NE	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	1		IR	4/30/1993	900 FEET SOUTH & 650 FEET WEST FROM C1/4 CORNER, SECTION 18
50393	S	73365	S	51982						44719	2 S	1 W	18	NE	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	1		AG	4/30/1993	900 FEET SOUTH & 650 FEET WEST FROM C1/4 CORNER, SECTION 18
64753	S	16012	S	11843	12364					64557	2 S	1 W	3	NW	NW			UNNAMED STREAM	FANNO CREEK	2114003000180050	0.05		IR	8/27/1935	
72151	S	18312	S	14691	19761					71414	2 S	1 W	16	SE	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	1.08		IR	8/1/1939	
72151	S	18312	S	14691	19761					71415	2 S	1 W	16	NW	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	1.08		IR	8/1/1939	
72533	S	25409	S	19895	20143					71916	2 S	1 W	7	NW	SW			UNNAMED STREAM	TUALATIN RIVER	2114003000300	0.348		IR	11/1/1950	
75395	R	27858	R	1465	23005					75400	2 S	1 W	3	SE	NW			UNNAMED STREAM	FANNO CREEK	2114003000180050			ST	11/26/1952	
75396	S	28114	S	21986	23006					75401	2 S	1 W	3	SE	NW			UNNAMED CR/HUNTS RS		2114003000180	0.06		IR	2/16/1953	
75451	S	26859	S	21093	23061					75472	2 S	1 W	7	SW	NW			UNNAMED STREAM	TUALATIN RIVER	2114003000290	0.22		IR	2/14/1952	
75479	S	27890	S	21968	23089					75504	2 S	1 W	7	SW	NW			UNNAMED STREAM	TUALATIN RIVER	2114003000290	0.36		IR	12/4/1952	
79672	S	30561	S	24078	27281					80921	2 S	1 W	16	SE	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.36		IR	2/21/1956	
79994	S	30966	S	24355	27603					81309	2 S	1 W	16	NW	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.01		IR	7/25/1956	
80895	S	30646	S	24142	28504					82421	2 S	1 W	16	NW	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.01		IR	4/4/1956	
81136	R	30294	R	1771	28745					82718	2 S	1 W	3	SW	NW			SUMMER CREEK	FANNO CREEK	2114003000180070		2	ST	9/13/1955	
81137	S	30295	S	23729	28746					82719	2 S	1 W	3	SW	NW			UNNAMED CR/2 RESERVOIR	FANNO CREEK	2114003000180	0.05		IR	9/13/1955	
81588					29196	TUALATIN RIVER				83268	2 S	1 W	5					BURRIS CREEK	TUALATIN RIVER	2114003000330	0.31		IR	12/31/1908	TRACT 2; PIPELINE
81588					29196	TUALATIN RIVER				83268	2 S	1 W	5					BURRIS CREEK	TUALATIN RIVER	2114003000330	0.31		LV	12/31/1900	TRACT 2; PIPELINE
81850	R	32350	R	2146	29458					83577	2 S	1 W	3	NW	NW			UNNAMED STREAM	FANNO CREEK	2114003000180050		4.5	ST	5/26/1958	
81851	S	32351	S	25531	29459					83578	2 S	1 W	3	NW	NW			UNNAMED STREAM/RESERVOIR	MCKAY CREEK	2114003000180	0.17		IR	5/26/1958	
82055	G	690	G	612	29661					83825	2 S	1 W	10	SE	SE			A WELL	TUALATIN RIVER	2114003000220	0.03		IR	6/24/1957	NORTH 27 DEGREES 55 MINUTES WEST 796.4 FEET FROM SE CORNER, SECTION 10

Appendix C
Water Rights in Area Affected by ASR Wells
Joint Water Commission Limited License Application

Water Right ID	Application Character	Application Number	Permit Character	Permit Number	Certificate	Decree	Claim Character	Claim Nbr	Transfer	POD ID	Township	Range	Sctn	Qtr40	Qtr160	DLC	Lot	Source	TributaryTo	StreamCode	POD Max Rate	POD Max Acre Feet	Use	PriorityDate	Legal
82312	S	31792	S	25054	29918					84166	2 S	1 W	3	SW	SE			A SPRING	FANNO CREEK	2114003000180	0.01		DO	8/13/1957	
84415	G	2309	G	2170	32020					86765	2 S	1 W	10	NW	SE			A WELL	TUALATIN RIVER	2114003000220	0.03		IR	4/30/1962	30 CH N & 24 CH W FM SE COR, S10
88841	G	3752	G	3542	36444					92205	2 S	1 W	7	SW	NE			A WELL	UNNAMED CREEK	2114003000040	0.13		IR	12/9/1966	1280 FT E & 280 FT N FM CEN, S7
93098	G	4422	G	4167	40701					97715	2 S	1 W	5	SW	NW			A WELL	TUALATIN RIVER	211400300	0.2		IR	5/29/1968	1540 FT S & 1150 FT E FM NW COR, S5
93123	S	40957	S	30545	40726					97742	2 S	1 W	18	SE	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.6		IR	6/2/1965	1060 FT S & 2030 FT W FM SOUTHERLY SE COR DLC 42
93257	S	25704	S	20250	40860				T 2506	97909	2 S	1 W	18	SE	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.38		IR	3/12/1951	860 FT S & 340 FT W FM NE COR, DLC 42
93775	G	3240	G	3116	41378					98577	2 S	1 W	16	NW	SE			A WELL	TUALATIN RIVER	211400300	0.01		IR	9/23/1965	2040 FT N & 1480 FT W FM SE COR, S16
94307	R	49470	R	6019	41910					99314	2 S	1 W	7	SW	NW			UNNAMED STREAM	TUALATIN RIVER	2114003000290		10.5	IS	7/19/1972	2580 FT S & 150 FT E FM NW COR, S7
94308	S	49471	S	37057	41911					99315	2 S	1 W	7	NW	SW			RESERVOIR	TUALATIN RIVER	211400300		10.5	IS	7/19/1972	3210 FT S & 280 FT E FM NW COR, S12
96087	G	3777	G	3463	43690					101663	2 S	1 W	10	SW	SW			A WELL	TUALATIN RIVER	2114003000220	0.53		IR	1/17/1967	610 FT N & 570 FT E FM SW COR, S10
96343	S	48082	S	36063	43946					102003	2 S	1 W	18	SE	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.96		IR	3/31/1971	810 FT S & 2060 FT W FM NE COR, SWNE, S18
98935	R	53647	R	6325	46535					105438	2 S	1 W	17	NW	SW			UNNAMED STREAM	TUALATIN RIVER	2114003000246		1.5	ST	9/18/1975	
98936	S	53227	S	39499	46536					105439	2 S	1 W	17	NW	SW			UNNAMED STREAM	TUALATIN RIVER	2114003000246	0.006		IR	6/9/1975	1520 FT N & 4320 FT W FM SE COR, S17
98936	S	53227	S	39499	46536					105440	2 S	1 W	17	NW	SW			RESERVOIR	UNNAMED STREAM	2114003000246	0.006		IR	6/9/1975	1520 FT N & 4320 FT W FM SE COR, S17
103573	G	5501	G	5476	51171					111484	2 S	1 W	18	SE	NE			A WELL	TUALATIN RIVER	211400300	0.34		IR	5/5/1971	1020 FT N & 480 FT W FM E1/4 COR, S18
107952	G	2157	G	1985	55550				T 5405	117088	2 S	1 W	6	NW	SE			A WELL	TUALATIN RIVER	211400300	0.0007		DO	11/9/1961	158 FEET SOUTH & 1302 FEET EAST FROM CENTER 1/4 CORNER, SECTION 6
108370	R	54627	R	6528	55968					117610	2 S	1 W	7	SE	SW			UNNAMED STREAM	TUALATIN RIVER	2114003000290		1.6	IS	8/9/1976	RESERVOIR
108371	S	54628	S	40915	55969					117611	2 S	1 W	7	SW	SW		4	TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.25		IS	8/9/1976	1300 FEET NORTH & 650 FEET EAST FROM SW CORNER, SECTION 7
108371	S	54628	S	40915	55969					117612	2 S	1 W	7	SE	SW			RESERVOIR	WILLAMETTE RIVER	21140		1.6	IS	8/9/1976	230 FEET NORTH & 2250 FEET EAST FROM SW CORNER, SECTION 7
109570	S	48082	S	36063	57168					119134	2 S	1 W	18	NE	SW	42		TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.75		IR	3/31/1971	2530 FEET SOUTH & 1840 FEET WEST FROM NE CORNER OF SWNE SEC 18.
110849	R	60443	R	8179	58447					120736	2 S	1 W	6					UNNAMED STREAM	TUALATIN RIVER	2114003000290		12	ST	7/31/1980	W1/2 NW1/4
110849	R	60443	R	8179	58447					120736	2 S	1 W	6					UNNAMED STREAM	TUALATIN RIVER	2114003000290		12	ST	8/8/1980	W1/2 NW1/4
110850	S	60444	S	45100	58448					120737	2 S	1 W	6	SW	NW			UNNAMED STREAM/MCFARLAND RS	TUALATIN RIVER	2114003000290	0.2		IR	7/31/1980	1270 FEET NORTH & 1020 FEET EAST FROM W1/4 CORNER, SECTION 6
110859	R	59927	R	8279	58457					120752	2 S	1 W	18	NE	SE			UNNAMED STREAM	TUALATIN RIVER	2114003000246		4.8	IS	4/1/1980	
110901	S	59928	S	45854	58499					120804	2 S	1 W	18	NE	SE			UNNAMED STREAM/RESERVOIR	TUALATIN RIVER	211400300	0.55		IS	4/1/1980	2270 FEET NORTH & 200 FEET WEST FROM SE CORNER, SECTION 18
112431	R	57732	R	7675	60067					122493	2 S	1 W	17	NW	SE			UNNAMED STREAM	TUALATIN RIVER	2114003000240		1.2	ST	8/3/1978	150 FEET SOUTH & 650 FEET EAST FROM C 1/4 CORNER SECTION 17.
112431	R	57732	R	7675	60067					122493	2 S	1 W	17	NW	SE			UNNAMED STREAM	TUALATIN RIVER	2114003000240		1.2	FP	8/3/1978	150 FEET SOUTH & 650 FEET EAST FROM C 1/4 CORNER SECTION 17.
112432	S	57733	S	43310	60068					122494	2 S	1 W	17	NW	SE			UNNAMED STREAM	TUALATIN RIVER	2114003000240	0.04		FP	8/3/1978	20 FEET SOUTH & 810 FEET EAST FROM C1/4 CORNER, SECTION 17
112432	S	57733	S	43310	60068					122494	2 S	1 W	17	NW	SE			UNNAMED STREAM	TUALATIN RIVER	2114003000240	0.04		IR	8/3/1978	20 FEET SOUTH & 810 FEET EAST FROM C1/4 CORNER, SECTION 17
112432	S	57733	S	43310	60068					122495	2 S	1 W	17	NW	SE			RESERVOIR	UNNAMED STREAM	2114003000240	0.04		FP	8/3/1978	150 FEET SOUTH & 650 FEET EAST FROM C1/4 CORNER, SECTION 17
112432	S	57733	S	43310	60068					122495	2 S	1 W	17	NW	SE			RESERVOIR	UNNAMED STREAM	2114003000240	0.04		IR	8/3/1978	150 FEET SOUTH & 650 FEET EAST FROM C1/4 CORNER, SECTION 17
113047	R	68582	R	10588	60683					123201	2 S	1 W	8	SW	SW			UNNAMED STREAM	TUALATIN RIVER	2114003000246		1.7	ST	10/1/1985	
113048	S	68583	S	49558	60684					123202	2 S	1 W	8	SW	SW			UNNAMED DR/ARNOLDS RESERVOIR	TUALATIN RIVER	211400300	0.014		IR	10/1/1985	60 FEET NORTH & 200 FEET WEST FROM SE CORNER, SWSW, SECTION 8
118390	S	64838	S	47550	66052					129728	2 S	1 W	18	NW	NE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.2228		GH	4/28/1983	RE DIVERSION 5050 FEET NORTH & 1460 FEET WEST FROM SW CORNER, NENE, SECTION 18
118390	S	64838	S	47550	66052					129729	1 S	4 W	20	NE	NE			HENRY HAGG L	SCOGGINS CREEK	2114003000640		15	GH	6/16/1983	
123090	R	76868			70783					138848	2 S	1 W	8	NW	SE			RUNOFF/RESERVOIR 1		2114003000246		1.51	LV	1/1/1993	
123090	R	76868			70783					138849	2 S	1 W	8	NW	SE			RUNOFF/RESERVOIR 1		2114003000246		1.12	LV	1/1/1993	
123346	R	77453			71044					139795	2 S	1 W	4	NE	NE			UNNAMED STREAM/RESERVOIR	SUMMER CREEK	2114003000180070000		0.912	WI	1/1/1993	
123346	R	77453			71044					139795	2 S	1 W	4	NE	NE			UNNAMED STREAM/RESERVOIR	SUMMER CREEK	2114003000180070000		0.912	RC	1/1/1993	
124264	R	80468			71999					142388	2 S	1 W	17	NW	NW			RUNOFF/MINERS RESERVOIR	TUALATIN RIVER	2114003000246		2.4	WI	1/1/1993	
124264	R	80468			71999					142388	2 S	1 W	17	NW	NW			RUNOFF/MINERS RESERVOIR	TUALATIN RIVER	2114003000246		2.4	LV	1/1/1993	
124264	R	80468			71999					142388	2 S	1 W	17	NW	NW			RUNOFF/MINERS RESERVOIR	TUALATIN RIVER	2114003000246		2.4	FP	1/1/1993	
124651	G	2556	G	2367	72399					143087	2 S	1 W	4	NW	NE			A WELL	FANNO CREEK	2114003000180	0.106		IR	2/28/1963	1080 FEET SOUTH & 330 FEET EAST FROM N1/4 CORNER, SECTION 4
125419	G	563	G	488	73179				T 7502, T 8768, T 5626, T 5689	143950	2 S	1 W	6	SE	SE			A WELL	TUALATIN RIVER	2114003000040	0.467		IR	2/7/1957	NORTH 63 DEGREES 54 MINUTES WEST, 1200.8 FEET FROM SE CORNER, SECTION 6
126073	R	75064			73697					145141	2 S	1 W	6	SE	SE			UNNAMED STREAM/BLUEBERY RESERVOIR	TUALATIN RIVER	2114003000290		20	ST	1/1/1993	
127854	S	26361	S	20681	75498					148452	2 S	1 W	3	NW	SE			UNNAMED STREAM	FANNO CREEK	2114003000180070000	0.05		IR	8/27/1951	
127855	S	27597	S	21649	75499					148453	2 S	1 W	3	SE	SW			UNNAMED STREAM	FANNO CREEK	2114003000180070000	0.05		IR	8/29/1952	
128795	R	59747	R	8181	76473					149891	2 S	1 W	6	SE	SE			UNNAMED STREAM/RESERVOIR	TUALATIN RIVER	2114003000290		0.092	ST	1/31/1980	
128795	R	59747	R	8181	76473					149892	2 S	1 W	6	SE	SE			TILE LINE/RESERVOIR	TUALATIN RIVER	2114003000290		0.092	ST	1/31/1980	
139645	S	26266	S	20617					T 9656	177487	2 S	1 W	16	SE	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.218		IR	8/6/1951	NONE GIVEN
140591	G	563	G	488	80708				T 7502	179661	2 S	1 W	7	NE	NE			A WELL	TUALATIN RIVER	2114003000040	0.013		DN	2/7/1957	940 FEET SOUTH & 103 FEET WEST FROM NE CORNER, SECTION 7
140608	S	75063	S	52603	80706				T 8768	179710	2 S	1 W	6	SE	SE			UNNAMED STREAM	TUALATIN RIVER	2114003000290	0.78		IS	11/30/1994	800 FEET NORTH & 625 FEET WEST FROM SE CORNER, SECTION 6
140608	S	75063	S	52603	80706				T 8768	179710	2 S	1 W	6	SE	SE			UNNAMED STREAM	TUALATIN RIVER	2114003000290	0.78		AG	11/30/1994	800 FEET NORTH & 625 FEET WEST FROM SE CORNER, SECTION 6
140608	S	75063	S	52603	80706				T 8768	179710	2 S	1 W	6	SE	SE			UNNAMED STREAM	TUALATIN RIVER	2114003000290	0.78		IR	11/30/1994	800 FEET NORTH & 625 FEET WEST FROM SE CORNER, SECTION 6
140608	S	75063	S	52603	80706				T 8768	179710	2 S	1 W	6	SE	SE			UNNAMED STREAM	TUALATIN RIVER	2114003000290	0.78		IS	11/30/1994	800 FEET NORTH & 625 FEET WEST FROM SE CORNER, SECTION 6
140608	S	75063	S	52603	80706				T 8768	179710	2 S	1 W	6	SE	SE			UNNAMED STREAM	TUALATIN RIVER	2114003000290	0.78		IS	11/30/1994	800 FEET NORTH & 625 FEET WEST FROM SE CORNER, SECTION 6
140608	S	75063	S	52603	80706				T 8768	179710	2 S	1 W	6	SE	SE			UNNAMED STREAM	TUALATIN RIVER	2114003000290	0.78		IR	11/30/1994	800 FEET NORTH & 625 FEET WEST FROM SE CORNER, SECTION 6
140608	S	75063	S	52603	80706				T 8768	179710	2 S	1 W	6	SE	SE			UNNAMED STREAM	TUALATIN RIVER	2114003000290	0.78		AG	11/30/1994	800 FEET NORTH & 625 FEET WEST FROM SE CORNER, SECTION 6
140608	S	75063	S	52603	80706				T 8768	179710	2 S	1 W	6	SE	SE			UNNAMED STREAM	TUALATIN RIVER	2114003000290	0.78		IR	11/30/1994	800 FEET NORTH & 625 FEET WEST FROM SE CORNER, SECTION 6
140608	S	75063	S	52603	80706				T 8768	179711	2 S	1 W	6	SE	SE			A RESERVOIR	TUALATIN RIVER	2114003000290		20	IS	11/30/1994	800 FEET NORTH & 625 FEET WEST FROM SE CORNER, SECTION 6
140608	S	75063	S	52603	80706				T 8768	179711	2 S	1 W	6	SE	SE			A RESERVOIR	TUALATIN RIVER	2114003000290		20	AG	11/30/1994	800 FEET NORTH & 625 FEET WEST FROM SE CORNER, SECTION 6
140608	S	75063	S	52603	80706				T 8768	179711	2 S	1 W	6	SE	SE			A RESERVOIR	TUALATIN RIVER	2114003000290		20	IR	11/30/1994	800 FEET NORTH & 625 FEET WEST FROM SE CORNER, SECTION 6
140608	S	75063	S	52603	80706				T 8768	179711	2 S	1 W	6	SE	SE			A RESERVOIR	TUALATIN RIVER	2114003000290		20	AG	11/30/1994	800 FEET NORTH & 625 FEET WEST FROM SE CORNER, SECTION 6
140608	S	75063	S	52603	80706				T 8768	179711	2 S	1 W	6	SE	SE			A RESERVOIR	TUALATIN RIVER	2114003000290		20	IR	11/30/1994	800 FEET NORTH & 625 FEET WEST FROM SE CORNER, SECTION 6
140608	S	75063	S	52603	80706				T 8768	179711	2 S	1 W	6	SE	SE			A RESERVOIR	TUALATIN RIVER	2114003000290		20	IR	11/30/1994	800 FEET NORTH & 625 FEET WEST FROM SE CORNER, SECTION 6
140608	S	75063	S	52603	80706				T 8768	179711	2 S	1 W	6	SE	SE			A RESERVOIR	TUALATIN RIVER	2114003000290		20	IS	11/30/1994	800 FEET NORTH & 625 FEET WEST FROM SE CORNER, SECTION 6
140608	S	75063	S	52603	80706				T 8768	179711	2 S	1 W	6	SE	SE			A RESERVOIR	TUALATIN RIVER	2114003000290		20	IS	11/30/1994	800 FEET NORTH & 625 FEET WEST FROM SE CORNER, SECTION 6
141209	S	59746	S	45190	80876					180991	2 S	1 W	6	SE	SE			A RESERVOIR	TUALATIN RIVER	2114003000290	0.04		IR	1/31/1980	1070 FEET NORTH & 1100 FEET WEST FROM SE CORNER, SECTION 6
141209	S	59746	S	45190	80876					180991	2 S	1 W	6	SE	SE			A RESERVOIR	TUALATIN RIVER	2114003000290	0.04		IR	1/31/1980	1070 FEET NORTH & 1100 FEET WEST FROM SE CORNER, SECTION 6
141209	S	59746	S	45190	80876					180991	2 S	1 W	6	SE	SE			A RESERVOIR	TUALATIN RIVER	2114003000290	0.04		IS	1/31/1980	1070 FEET NORTH & 1100 FEET WEST FROM SE CORNER, SECTION 6
141209	S	59746	S	45190	80876					180991	2 S	1 W	6	SE	SE			A RESERVOIR	TUALATIN RIVER	2114003000290	0.04		IS	1/31/1980	1070 FEET NORTH & 1100 FEET WEST FROM SE CORNER, SECTION 6
141209	S	59746	S	45190	80876					180991	2 S	1 W	6	SE	SE			A RESERVOIR	TUALATIN RIVER	2114003000290	0.04		IR	1/31/1980	1070 FEET NORTH & 1100 FEET WEST FROM SE CORNER, SECTION 6
141209	S	59746	S	45190	80876					180991	2 S	1 W	6	SE	SE			A RESERVOIR	TUALATIN RIVER	2114003000290	0.04		IS	1/31/1980	1070 FEET NORTH & 1100 FEET WEST FROM SE CORNER, SECTION 6
141209	S	59746	S	45190	80876					180990	2 S	1 W	6	SE	SE			TILE LINE	TUALATIN RIVER	2114003000290	0.04		IR	1/31/1980	1070 FEET NORTH & 1100 FEET WEST FROM SE CORNER, SECTION 6
141209	S	59746	S	45190	80876					180990	2 S	1 W	6	SE	SE			TILE LINE	TUALATIN RIVER	2114003000290	0.04		IS	1/31/1980	1070 FEET NORTH & 1100 FEET WEST FROM SE CORNER, SECTION 6
141209	S	59746	S	45190	80876					180990	2 S	1 W	6	SE	SE			TILE LINE	TUALATIN RIVER	2114003000290	0.04		IR	1/31/1980	1070 FEET NORTH & 1100 FEET WEST FROM SE CORNER, SECTION 6
141209	S	59746	S	45190	80876					180990	2 S	1 W	6	SE	SE			TILE LINE	TUALATIN RIVER	2114003000290	0.04		IS	1/31/1980	1070 FEET NORTH & 1100 FEET WEST FROM SE CORNER, SECTION 6
141209	S	59746	S	45190	80876					180989	2 S	1 W	6	SE	SE			UNNAMED STREAM	TUALATIN RIVER	2114003000290	0.04		IR	1/31/1980	1070 FEET NORTH & 1100 FEET WEST FROM SE CORNER, SECTION 6
141209	S	59746	S	45190	80876					180989	2 S	1 W	6	SE	SE			UNNAMED STREAM	TUALATIN RIVER	2114003000290	0.04		IS	1/31/1980	1070 FEET NORTH & 1100 FEET WEST FROM SE CORNER, SECTION 6
141209	S	59746	S	45190	80876					180989	2 S	1 W	6	SE	SE			UNNAMED STREAM	TUALATIN RIVER	2114003000290	0.04		IR	1/31/1980	1070 FEET NORTH & 1100 FEET WEST FROM SE CORNER, SECTION 6
141209	S	59746	S	45190	80876					180989	2 S	1 W	6	SE	SE			UNNAMED STREAM	TUALATIN RIVER	2114003000290	0.04		IS	1/31/1980	1070 FEET NORTH & 1100 FEET WEST FROM SE CORNER, SECTION 6
141603	S	26823	S	21065					T 9819	182536	2 S	1 W	7	SW	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	1.26		IR	1/30/1952	NONE GIVEN
141603	S	26823	S	21065					T 9819	182537	2 S	1 W	7	SE	SW			UNNAMED STREAM	TUALATIN RIVER	2114003000279	0.25		IR	1/30/1952	NONE GIVEN
141603	S	26823	S	21065					T 9819	187063	2 S	2 W	13	SW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.65		IR	1/30/1952	NONE GIVEN
158292	R	85572	R	13743	84054					235335	2 S	1 W	18	NW	SE			RUNOFF	TUALATIN RIVER	211400300		2	WI	4/24/2003	2978 FEET SOUTH AND 1755 FEET WEST FROM NE CORNER, SECTION 18
158541	R	85570	R	13741	84056					235970	2 S	1 W	18	SW	NE			RUNOFF	TUALATIN RIVER	211400300		1.6	WI	4/24/2003	1809 FEET SOUTH AND 1745 FEET WEST FROM NE CORNER, SECTION 18
158544	R	85571	R	13742	84055					235972	2 S	1 W	18	SW	NE			RUNOFF	TUALATIN RIVER	211400300		2.9	WI	4/24/2003	2228 FEET SOUTH AND 1824 FEET WEST FROM NE CORNER, SECTION 18
164233	R	75603			85081					257227	2 S	1 W	4	NW	NW			UNNAMED STREAM	SUMMER CREEK	2114003000180070		3	WI	1/1/1993	NONE GIVEN

GSI Water Solutions, Inc.

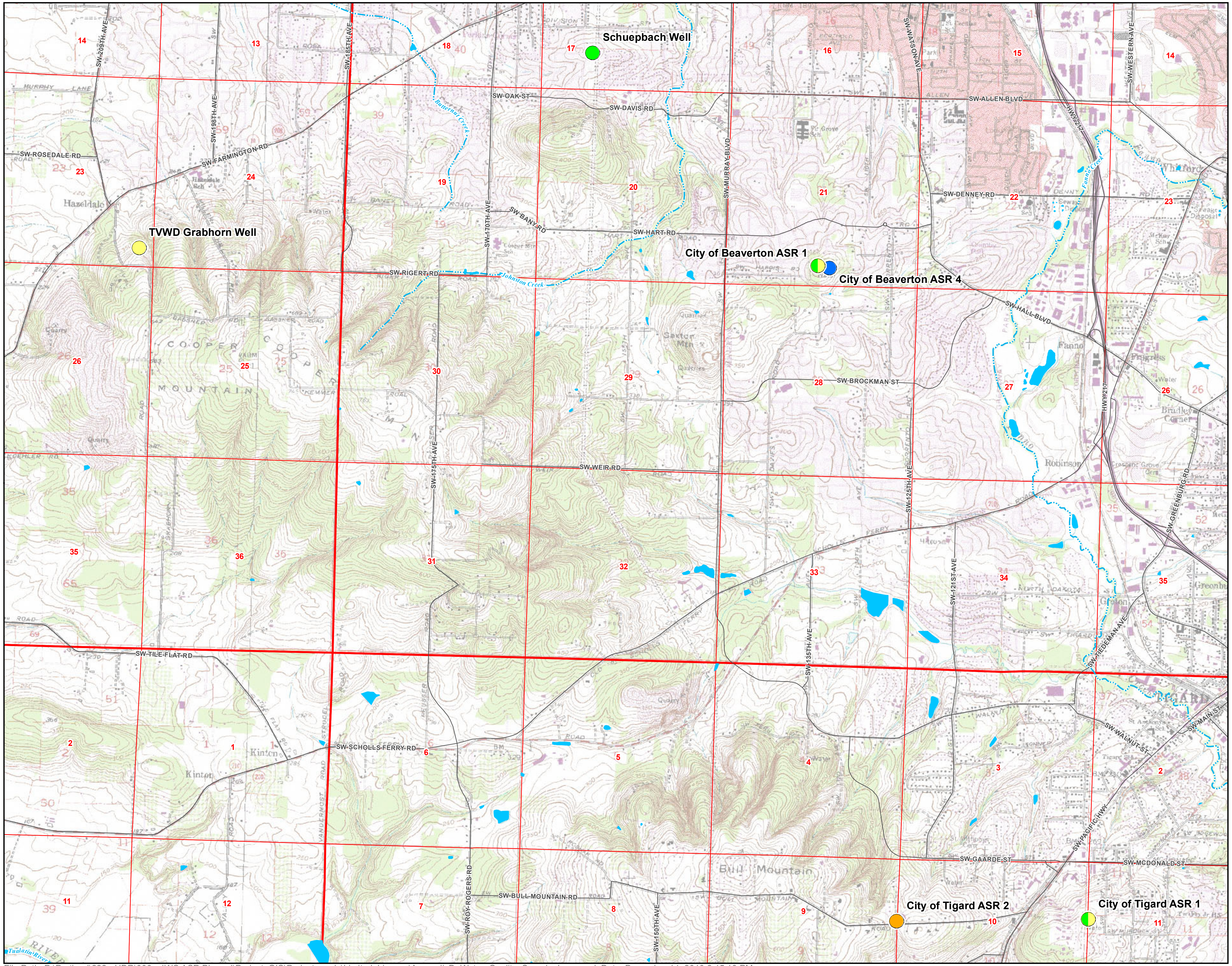
Appendix C
Water Rights in Area Affected by ASR Wells
Joint Water Commission Limited License Application

Water Right ID	Application Character	Application Number	Permit Character	Permit Number	Certificate	Decree	Claim Character	Claim Nbr	Transfer	POD ID	Township	Range	Sctn	Qtr40	Qtr160	DLC	Lot	Source	TributaryTo	StreamCode	POD Max Rate	POD Max Acre Feet	Use	PriorityDate	Legal
166078	S	26266	S	20617	83833				T 9656	262250	2 S	1 W	16	SE	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.216		IR	8/6/1951	NONE GIVEN
167487	G	3466	G	3270	85870				T 9864	266313	2 S	1 W	10	NW	NW			A WELL	FANNO CREEK	2114003000180050	0.67		MU	4/25/1966	610 FEET SOUTH AND 1270 FEET EAST FROM NW CORNER, SECTION 10
167487	G	3466	G	3270	85870				T 9864	266314	2 S	1 W	10	SW	NW			A WELL	FANNO CREEK	2114003000180050	0.67		MU	4/25/1966	1750 FEET SOUTH AND 30 FEET EAST FROM NW CORNER, SECTION 10
167487	G	3466	G	3270	85870				T 9864	266315	2 S	1 W	11	SW	NW			A WELL	FANNO CREEK	2114003000180040	0.67		MU	4/25/1966	SOUTH 3 DEGREES 13 MINUTES 22 SECONDS EAST, 1561 FEET FROM NW CORNER, SECTION 11
167488	G	3301	G	2999	85871				T 9865	266316	2 S	1 W	10	NW	NW			A WELL	FANNO CREEK	2114003000180050	0.63		MU	11/19/1965	610 FEET SOUTH AND 1270 FEET EAST FROM NW CORNER, SECTION 10
167488	G	3301	G	2999	85871				T 9865	266317	2 S	1 W	10	SW	NW			A WELL	FANNO CREEK	2114003000180050	0.63		MU	11/19/1965	1750 FEET SOUTH AND 30 FEET EAST FROM NW CORNER, SECTION 10
167488	G	3301	G	2999	85871				T 9865	266318	2 S	1 W	11	SW	NW			A WELL	FANNO CREEK	2114003000180040	0.63		MU	11/19/1965	SOUTH 3 DEGREES 13 MINUTES 22 SECONDS EAST, 1561 FEET FROM NW CORNER, SECTION 11
167491	G	760	G	655	85872				T 9866	266330	2 S	1 W	10	NW	NW			A WELL	FANNO CREEK	2114003000180050	0.78		MU	9/16/1957	610 FEET SOUTH AND 1270 FEET EAST FROM NW CORNER, SECTION 10
167491	G	760	G	655	85872				T 9866	266331	2 S	1 W	10	SW	NW			A WELL	FANNO CREEK	2114003000180050	0.78		MU	9/16/1957	1750 FEET SOUTH AND 30 FEET EAST FROM NW CORNER, SECTION 10
167491	G	760	G	655	85872				T 9866	266332	2 S	1 W	11	SW	NW		2	A WELL	FANNO CREEK	2114003000180	0.78		MU	9/16/1957	SOUTH 3 DEGREES 13 MINUTES 22 SECONDS EAST, 1561 FEET FROM NW CORNER, SECTION 11
169629	R	87185	R	14865						271686	2 S	1 W	3	NW	NW			UNNAMED STREAM	SUMMER CREEK	2114003000180070000		4.6	MP	5/27/2008	800 FEET SOUTH AND 747 FEET EAST FROM NW CORNER, SECTON 3
170556							GR	616	T 10802	274103	2 S	1 W	10	NW	NW			A WELL	FANNO CREEK	2114003000180050	0.4456		MU	4/25/1947	610 FEET SOUTH AND 1270 FEET EAST FROM NW CORNER, SECTION 10
170556							GR	616	T 10802	274101	2 S	1 W	10	SW	NW			A WELL	FANNO CREEK	2114003000180050	0.4456		MU	4/25/1947	1750 FEET SOUTH AND 100 FEET EAST FROM NW CORNER , SECTION 10
170556							GR	616	T 10802	274102	2 S	1 W	9	SW	NE			A WELL	FANNO CREEK	2114003000180050	0.4456		MU	4/25/1947	1600 FEET SOUTH AND 1130 FEET WEST FROM NE CORNER, SECTION 9
170556							GR	616	T 10802	274100	2 S	1 W	11	SW	NW			A WELL	FANNO CREEK	2114003000180040	0.4456		MU	4/25/1947	SOUTH 3 DEGREES 13 MINUTES 22 SECONDS EAST, 1561 FEET FROM NW CORNER, SECTION 11
170556							GR	616	T 10802	274104	2 S	1 W	11	SW	NW			A WELL	FANNO CREEK	2114003000180040	0.4456		MU	4/25/1947	1625 FEET SOUTH AND 30 FEET EAST FROM NW CORNER, SECTION 11
170564							GR	615	T 10803	274116	2 S	1 W	11	SW	NW			A WELL	FANNO CREEK	2114003000180040	1.114		MU	7/30/1949	SOUTH 3 DEGREES 13 MINUTES 22 SECONDS EAST, 1561 FEET FROM NW CORNER, SECTION 11
170564							GR	615	T 10803	274117	2 S	1 W	10	SW	NW			A WELL	FANNO CREEK	2114003000180050	1.114		MU	7/30/1949	1750 FEET SOUTH AND 100 FEET EAST FROM NW CORNER, SECTION 10
170564							GR	615	T 10803	274118	2 S	1 W	9	SW	NE			A WELL	FANNO CREEK	2114003000180050	1.114		MU	7/30/1949	1600 FEET SOUTH AND 1130 FEET WEST FROM NE CORNER, SECTION 9
170564							GR	615	T 10803	274119	2 S	1 W	10	NW	NW			A WELL	FANNO CREEK	2114003000180050	1.114		MU	7/30/1949	610 FEET SOUTH AND 1270 FEET EAST FROM NW CORNER, SECTION 10
5786	P	82403								27922	2 S	2 W	11	NE	SE			RUNOFF/POND	TUALATIN RIVER	211400300		0.2	ST	1/30/1997	
5786	P	82403								27922	2 S	2 W	11	NE	SE			RUNOFF/POND	TUALATIN RIVER	211400300		0.2	LV	1/30/1997	
5786	P	82403								27922	2 S	2 W	11	NE	SE			RUNOFF/POND	TUALATIN RIVER	211400300		0.2	WI	1/30/1997	
5787	P	82404								27923	2 S	2 W	11	NE	SE			RUNOFF/POND 1	TUALATIN RIVER	211400300		0.2	ST	1/30/1997	
5787	P	82404								27923	2 S	2 W	11	NE	SE			RUNOFF/POND 1	TUALATIN RIVER	211400300		0.2	LV	1/30/1997	
5787	P	82404								27923	2 S	2 W	11	NE	SE			RUNOFF/POND 1	TUALATIN RIVER	211400300		0.2	WI	1/30/1997	
5787	P	82404								27924	2 S	2 W	11	NE	SE			RUNOFF/POND 2	TUALATIN RIVER	211400300		0.2	ST	1/30/1997	
5787	P	82404								27924	2 S	2 W	11	NE	SE			RUNOFF/POND 2	TUALATIN RIVER	211400300		0.2	WI	1/30/1997	
5787	P	82404								27925	2 S	2 W	11	SE	SE			RUNOFF/POND 3	TUALATIN RIVER	211400300		0.3	LV	1/30/1997	
5787	P	82404								27925	2 S	2 W	11	SE	SE			RUNOFF/POND 3	TUALATIN RIVER	211400300		0.3	WI	1/30/1997	
5787	P	82404								27926	2 S	2 W	12	NW	SW			A SPRING/POND 4	TUALATIN RIVER	211400300		9	ST	1/30/1997	
5787	P	82404								27926	2 S	2 W	12	NW	SW			A SPRING/POND 4	TUALATIN RIVER	211400300		9	FI	1/30/1997	
5787	P	82404								27927	2 S	2 W	12	NW	NW			UNNAMED STREAM/POND 5	TUALATIN RIVER	211400300		0.12	ST	1/30/1997	
5787	P	82404								27927	2 S	2 W	12	NW	NW			UNNAMED STREAM/POND 5	TUALATIN RIVER	211400300		0.12	WI	1/30/1997	
5842	P	82459								28045	2 S	2 W	12	NE	NW			RUNOFF/POND	CRABAPPLE CREEK	211400300		1.5	WI	1/28/1997	
6663	P	83327								30449	2 S	2 W	3	NW	SE			RUNOFF/POND 1	TUALATIN RIVER	2114003000320		1.65	LV	1/27/1997	
6663	P	83327								30450	2 S	2 W	3	NE	SE			RUNOFF/POND 2	TUALATIN RIVER	2114003000320		0.41	LV	1/27/1997	
18312	S	27101	S	21325					T 3350	2541	2 S	2 W	13	SW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.39		IR	4/21/1952	2280 FEET SOUTH AND 79 FEET EAST FROM NW CORNER SECTION 13
23844	G	12227	G	13211						10295	2 S	2 W	4	SE	SW			A WELL	TUALATIN RIVER	2114003000320	0.118		DO	9/10/1990	1175 FEET NORTH & 50 FEET WEST FROM S1/4 CORNER, SECTION 4
23844	G	12227	G	13211						10295	2 S	2 W	4	SE	SW			A WELL	TUALATIN RIVER	2114003000320	0.118		IM	9/10/1990	1175 FEET NORTH & 50 FEET WEST FROM S1/4 CORNER, SECTION 4
25301							GR	379		13420	2 S	2 W	12	NE	NW			A WELL	TUALATIN RIVER	211400300	0.1782		IR	4/30/1955	150 FEET SOUTH AND 410 FEET EAST OF NE CORNER, THOMAS HUMPHREY DLC
27708							GR	2954	T 10991	15785	2 S	2 W	1	NE	SE			A WELL	UNNAMED STREAM	2114003000290	0.9803		IR	4/30/1950	2840 FEET SOUTH & 1000 FEET WEST FROM NE CORNER, SECTION 1
27866							GR	3123		15931	2 S	2 W	1	SW	SW			A WELL	UNNAMED STREAM	2114003000290	0.0223		IR	12/31/1948	400 FEET NORTH & 890 FEET EAST FROM SW CORNER, SECTION 1
28458							GR	3872		16492	2 S	2 W	3	NW	SE			A WELL	TUALATIN RIVER	211400300	0.0735		IR	12/31/1922	1830 FEET NORTH & 60 FEET EAST FROM S1/4 CORNER, SECTION 3
49248	S	54580	S	49958						42669	2 S	1 W	18	NW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	410 FEET SOUTH & 360 FEET WEST OF THE SW CORNER,SECTION 7
49248	S	54580	S	49958						42669	2 S	1 W	18	NW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	12/18/1986	410 FEET SOUTH & 360 FEET WEST OF THE SW CORNER,SECTION 7
49248	S	54580	S	49958						42670	2 S	1 W	7	SW	SW			UNNAMED STREAM	TUALATIN RIVER	2114003000279	25		IC	1/4/1984	1100 FEET NORTH & 640 FEET EAST OF THE SW CORNER,SECTION 7
49248	S	54580	S	49958						42671	2 S	2 W	11	NW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	1850 FEET NORTH & 2440 FEET WEST FROM THE SE CORNER,SECTION 11
49248	S	54580	S	49958						42672	2 S	1 W	18	SE	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	2130 FEET SOUTH & 1510 FEET EAST FROM THE NW CORNER,SECTION 18
49248	S	54580	S	49958						42673	2 S	2 W	11	NW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	1850 FEET NORTH & 2440 FEET WEST FROM THE SE CORNER,SECTON 11
49248	S	54580	S	49958						42674	2 S	2 W	11	SW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	1850 FEET NORTH & 2440 FEET WEST FROM THE SE CORNER,SECTION 11
49248	S	54580	S	49958						42675	1 S	2 W	29	SE	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	140 FEET NORTH & 530 FEET WEST FROM THE SW CORNER,SECTON 28
49248	S	54580	S	49958						42676	1 S	2 W	21	NE	SW			UNNAMED STREAM	TUALATIN RIVER	2114003000370	25		IC	1/4/1984	1160 FEET SOUTH & 1460 FEET EAST FROM THE W1/4 CORNER,SECTION 21
49248	S	54580	S	49958						42677	2 S	2 W	9	NE	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	1600 FEET NORTH & 1080 FEET WEST FROM THE SE CORNER,SECTION 9
49248	S	54580	S	49958						42678	2 S	2 W	16	NE	NE			MCFEE CREEK	TUALATIN RIVER	2114003000310	25		IC	1/4/1984	940 FEET SOUTH & 120 FEET WEST FROM THE NE CORNER,SECTION 16
49248	S	54580	S	49958						42679	2 S	1 W	20	NE	NW			CHICKEN CREEK	TUALATIN RIVER	2114003000270	25		IC	1/4/1984	250 FEET SOUTH & 2850 FEET WEST FROM THE NE CORNER,SECTION 20
49248	S	54580	S	49958						42680	2 S	2 W	10	SE	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	900 FEET NORTH & 1820 FEET EAST FROM THE SW CORNER,SECTION 10
49248	S	54580	S	49958						42681	2 S	2 W	14	SW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	2112 FEET SOUTH & 1056 FEET EAST FROM THE NE CORNER,SECTION 15
49248	S	54580	S	49958						42682	2 S	2 W	19	NW	NW			UNNAMED STREAM	MCFEE CREEK	2114003000310150	25		IC	1/4/1984	10 FEET SOUTH & 400 FET EAST FROM THE SE CORNER,SECTION 18
49248	S	54580	S	49958						42683	2 S	1 W	18	NW	SW			UNNAMED STREAM	CEDAR CREEK	2114003000270010000	25		IC	1/4/1984	2260 FEET NORTH & 174 FEET WEST FROM THE SE CORNER,SECTION 13
49248	S	54580	S	49958						42684	2 S	2 W	11	NW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	1850 FEET NORTH & 2440 FEET WEST FROM THE SE CORNER,SECTION 11
49248	S	54580	S	49958						42685	1 S	2 W	34	SE	SE			UNNAMED STREAM	TUALATIN RIVER	2114003000320	25		IC	1/4/1984	620 FEET NORTH & 720 FEET WEST FROM THE SE CORNER,SECTION 34
49248	S	54580	S	49958						42686	1 S	2 W	19	NE	SE			DAVIS CREEK	TUALATIN RIVER	2114003000430	25		IC	1/4/1984	1500 FEET NORTH & 500 FEET WEST FROM THE SE CORNER,SECTION 19
49248	S	54580	S	49958						42687	1 S	2 W	17	NW	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	1130 FEET SOUTH & 950 FEET EAST FROM THE W1/4 CORNER,SECTION 17
49248	S	54580	S	49958						42688	2 S	2 W	11	SW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	340 FEET NORTH & 1630 FEET WEST FROM THE SE CORNER,SECTION 11
49248	S	54580	S	49958						42689	2 S	2 W	11	SW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	340 FEET NORTH & 1630 FEET WEST FROM THE SE CORNER,SECTION 11
49248	S	54580	S	49958						42690	2 S	2 W	9	SW	NE			MCFEE CREEK	TUALATIN RIVER	2114003000310	25		IC	1/4/1984	750 FEET NORTH & 250 FEET EAST FROM THE CENTER,SECTION 9
49248	S	54580	S	49958						42691	1 S	2 W	21	SW	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	470 FEET NORTH & 730 FEET EAST FROM THE NE CORNER,SECTION 29
49248	S	54580	S	49958						42692	1 S	2 W	34	SE	SE			UNNAMED STREAM	TUALATIN RIVER	2114003000320	25		IC	1/4/1984	1000 FEET NORTH & 700 FEET WEST FROM THE SE CORNER,SECTON 34
49248	S	54580	S	49958						42693	2 S	2 W	19	NW	NW			GULF CANYON	MCFEE CREEK	2114003000310130	25		IC	1/4/1984	10 FEET SOUTH & 400 FEET EAST FROM THE SE CORNER,SECTION 18
49248	S	54580	S	49958						42694	2 S	2 W	11	SW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	340 FEET NORTH & 1630 FEET WEST FROM THE SE CORNER,SECTION 11
49248	S	54580	S	49958						42695	2 S	2 W	11	SW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	340 FEET NORTH & 1630 FEET WEST FROM THE SE CORNER,SECTION 11
49248	S	54580	S	49958						42696	2 S	2 W	11	SW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	4170 FEET SOUTH & 1790 FEET WEST FROM THE NE CORNER,SECTION 11
49248	S	54580	S	49958						42697	2 S	1 W	18	NE	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	870 FEET SOUTH & 660 FEET WEST FROM THE CENTER,SECTION 18
49248	S	54580	S	49958						42698	2 S	2 W	10	SW	NE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	25		IC	1/4/1984	2390 FEET SOUTH & 1870 FEET WEST FROM THE NE CORNER,SECTION 10
50407	S	71157	S	51996						44748	1 S	2 W	28	SW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.0074		TC	1/30/1991	1075 FEET NORTH & 900 FEET EAST FROM W1/4 CORNER, SECTION 28
50407	S	71157	S	51996						44749	2 S	2 W	4	SW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.0074		TC	1/30/1991	440 FEET NORTH & 740 FEET EAST FROM W1/4 CORNER, SECTION 4
50407	S	71157	S	51996						44750	2 S	2 W	4	SE	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.0074		TC	1/30/1991	340 FEET SOUTH & 150 FEET WEST FROM MOST WESTERLY CORNER, DLC 41
50407	S	71157	S	51996						44751	2 S	2 W	21	SW	NE			HEATON CREEK	MCFEE CREEK	2114003000310010	0.003		TC	1/30/1991	1400 FEET SOUTH & 385 FEET EAST FROM N1/4 CORNER, SECTION 21
50407	S	71157	S	51996						44752	2 S	2 W	16	NE	NW			MCFEE CREEK	WILLAMETTE RIVER	2114003000310	0.0024		TC	1/30/1991	915 FEET SOUTH & 1650 FEET EAST FROM NW CORNER, SECTION 16
65753	S	17548	S	13251	13364					65651	2 S	2 W	11	NW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.22		IR	8/29/1938	
66132	S	17483	S	13192	13743					66167	2 S	2 W	4	SE	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.85		IR	8/5/1938	
67481	S	18318	S	13954	15092					68024	2 S	2 W	13	SW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.16		IR	8/4/1939	
72152	S	19147	S	14744	19762					71416	2 S	2 W	9	NW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.5		IR	2/3/1941	
72152	S	19147	S	14744	19762					71417	2 S	2 W	9	NE	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.5		IR	2/3/1941	
72152	S	19147	S	14744	19762					71418	2 S	2 W	1	SW	SW			BAKER CREEK	HEATON CREEK	2114003000310010000	0.5		IR	2/3/1941	
72366	S	21606	S	16975	19976					71700	2 S	2 W	11	NW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.45		IR	5/3/1946	
72522	S	25035	S	19722	20132					71903	2 S	2 W	12	SW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.213		IR	7/25/1950	
73018	S	18174	S	13808	20628					72510	2 S	2 W	4	NE	NW			UNNAMED STREAM	TUALATIN RIVER	2114003000320	0.21		IR	6/8/1939	
73068	S	22486	S	17726	20678					72567	2 S	2 W	4	SW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.1		IR	4/29/1947	

Appendix C
Water Rights in Area Affected by ASR Wells
Joint Water Commission Limited License Application

Water Right ID	Application Character	Application Number	Permit Character	Permit Number	Certificate	Decree	Claim Character	Claim Nbr	Transfer	POD ID	Township	Range	Sctn	Qtr40	Qtr160	DLC	Lot	Source	TributaryTo	StreamCode	POD Max Rate	POD Max Acre Feet	Use	PriorityDate	Legal
74778	S	26880	S	21926	22388					74656	2 S	2 W	4	SE	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.04		IR	2/19/1952	
75018	S	19483	S	15097	22628				T 8270, T 8163	74960	2 S	2 W	12	NE	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.52		IR	9/27/1941	
75308	S	24881	S	19576	22918				IL 868	75294	2 S	2 W	14	SW	NE	46		TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.35		IR	6/16/1950	NONE GIVEN
75308	S	24881	S	19576	22918				IL 868	75295	2 S	2 W	1	NE	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.35		IR	6/16/1950	NONE GIVEN
75308	S	24881	S	19576	22918				IL 868	75296	2 S	2 W	14	SE	NE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.35		IR	6/16/1950	NONE GIVEN
75538	S	25034	S	20492	23148					75572	2 S	2 W	12	NW	SW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.1		IR	7/25/1950	
75538	S	25034	S	20492	23148					75573	2 S	2 W	12	NW	SW			UNNAMED STREAM/RESERVOIR	TUALATIN RIVER	211400300	0.06		IR	7/25/1950	
75539	R	25033	R	1190	23149					75574	2 S	2 W	12	SW	NW			UNNAMED STREAM	TUALATIN RIVER	2114003000290	0.34		ST	7/25/1950	
75729	R	26660	R	1284	23339					75811	2 S	2 W	4	NE	NW			UNNAMED STREAM	TUALATIN RIVER	2114003000320		0.5	IS	11/26/1951	
75730	S	26661	S	20879	23340					75812	2 S	2 W	4	NE	NW			RESERVOIR	TUALATIN RIVER	211400300		0.5	IS	11/26/1951	
75730	S	26661	S	20879	23340					75813	2 S	2 W	4	SW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.1		IS	11/26/1951	
75778	S	17741	S	13436	23388					75865	2 S	2 W	4	SW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.26		IS	1/10/1939	
75778	S	17741	S	13436	23388					75865	2 S	2 W	4	SW	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.26		IR	1/10/1939	
75789	S	20028	S	15599	23399					75879	2 S	2 W	32	NE	NE			HEATON CREEK	MCFEE CREEK	2114003000310010	0.01		IR	9/3/1943	
75789	S	20028	S	15599	23399					75880	2 S	2 W	3	NW	NE			EAST SPRING	UNNAMED STREAM	2114003000320	0.01		DO	9/3/1943	
75789	S	20028	S	15599	23399					75880	2 S	2 W	3	NW	NE			EAST SPRING	UNNAMED STREAM	2114003000320	0.01		IR	9/3/1943	
75789	S	20028	S	15599	23399					75880	2 S	2 W	3	NW	NE			EAST SPRING	UNNAMED STREAM	2114003000320	0.01		LV	9/3/1943	
76084	S	28883	S	22711	23694					76278	2 S	2 W	12	SE	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.18		IR	11/4/1953	
79654	S	28994	S	22795	27263					80900	2 S	2 W	11	NW	SE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.81		IR	2/3/1954	
79673	S	30587	S	24089	27282					80922	2 S	2 W	14	NW	NE			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.41		IR	3/13/1956	
79673	S	30587	S	24089	27282					80923	2 S	2 W	1	NE	NW			TUALATIN RIVER	WILLAMETTE RIVER	211400300	0.41		IR	3/13/1956	

Appendix D



APPENDIX D

Water Quality Sample Locations

Joint Water Commission
Limited License Application

LEGEND

- Native basalt water quality sample location
- JWC source water quality sample location
- City of Portland Bull Run water quality sample location
- Water quality sample locations used in referenced geochemical compatibility evaluations
- Major Roads
- Watercourses
- Waterbodies

N

Scale
1:32,000

0 0.25 0.5 0.75 1
Miles

MAP NOTES:
Projection: Oregon State Plane North Zone
Datum: North American Datum of 1983
Date: December 14, 2010
Data Sources: Oregon Geospatial Data Clearinghouse, METRO RLIS, ESRI

GSI Water Solutions, Inc.

File Path: P:\Portland\222 - HDR\006 - JWC ASR Phase I\Project_GIS\Project_mxds\Limited_License\AppendixD_Water_Quality_Sample_Locs.mxd, Date: December 14, 2010 2:45:19 PM

TVWD and the City of Beaverton

ASR Geochemical Evaluation

Excerpts from text and Appendix D of *Aquifer Storage and Recovery Hydrogeological Feasibility Study of Cooper Mountain Basalt Aquifer* prepared for TVWD by CH2M HILL (1997)

well. This could be accomplished by using a trickle feed of chlorinated water during the storage period.

Chemical Reactions

A geochemical model was used to conduct a preliminary analysis of clogging potential and other chemical reactions that may result from mixing recharge water with native groundwater. The modeling was performed using a model written and distributed by USGS, titled PHREEQE (Parkhurst, Thorstenson, and Plummer, 1980). A geochemical model is a computer model that calculates the detailed chemical composition of a water sample and estimates the potential for precipitation or dissolution of mineral solids based on a general description of water quality. A more detailed description of the modeling process is provided in Appendix D.

The model was used to simulate mixing of two types of recharge water (JWC-treated water and Portland-treated water) with groundwater from two potential recharge wells (Beaverton's Hanson Road well and TVWD's Schuepbach well). Each mixing simulation evaluated mixing in three different proportions: 25 percent recharge water with 75 percent groundwater, 50 percent of each water type, and 75 percent recharge water with 25 percent groundwater. Each mixing proportion is indicative of a different zone within the envelope of recharge water that will surround the well during subsurface storage.

The primary goal of this geochemical modeling effort was to evaluate whether mixing within the aquifer would create chemical conditions conducive to precipitating solids that could lead to aquifer clogging or to dissolving minerals naturally present in the rock and bringing them into solution. These results are summarized in the form of a saturation index, which is the ratio between an equilibrium constant for the precipitation reaction of interest and the product of the activities (the activity roughly translates into concentration for this situation) of the compounds or ions participating in the reaction. Because the results can vary over many orders of magnitude, the logarithm of each value is used to simplify reporting. The mixed waters are considered to be oversaturated with respect to any mineral whose saturation index is greater than 1 (making the log saturation index greater than 0), and there will be a tendency for that mineral to precipitate from solution, assuming that equilibrium conditions apply.

It is apparent that a number of assumptions must be made for these modeling results to be directly applicable to the recharge scenarios simulated (for example, that equilibrium conditions exist between waters). Therefore, the primary utility of these results is to define the potential for chemical precipitation or mineral dissolution to occur and to evaluate whether the potential is great enough to be of concern in the ASR planning. For the geochemical model, CH2M HILL assumed that more reducing conditions exist in the basalt groundwater than the dissolved oxygen data may suggest, to provide a conservative analysis of possible mixing scenarios.

Iron hydroxide is commonly formed when oxygenated recharge water comes in contact with groundwater containing high iron concentrations in a reduced state. High iron and manganese concentrations have been noted in various locations within the basalt aquifer.

Assuming that the source water is oxidizing (pE = 5 to 6) and that the groundwater is reducing (pE = 0 to -2), the modeling results indicate that some iron precipitate is likely to form in the aquifer as result of mixing recharge and groundwater in the subsurface. The majority of these precipitation reactions will occur within the mixing zone of the ASR bubble, (which will be controlled during operation of the system). However, the amount of iron in the water is not sufficient to create significant clogging. It is anticipated that even if iron precipitation does occur, the relatively large pore spaces in the basalt will not plug easily. Other minerals that can precipitate quickly and potentially pose a clogging threat, such as calcium carbonate, calcium sulfate, and sodium chloride, are not likely to precipitate as a result of ASR activities. The concentrations of the ions that participate in these reactions are not sufficient for precipitation to occur.

Because the recharge water will be relatively oxidized, it may promote some dissolution of iron-bearing minerals, such as pyrite. Pyrite, a common iron sulfide mineral found associated with basalt rocks, may dissolve and produce iron and sulfate ions in solution when in contact with the recharge water. This reaction may also lower the pH slightly. Again, these reactions are not expected to substantially alter groundwater quality.

Air Entrainment

Air entrainment can cause clogging or a reduction in aquifer permeability. Air entrainment can occur when air bubbles are injected into the well with the recharge water or when air bubbles come out of solution after cool recharge water comes into contact with warmer groundwater. It is anticipated that the injection water will be colder than the native groundwater because the injection phase of the project will occur during the winter. Using measured temperature values for the groundwater and expected recharge water temperatures, the computed saturation indices for carbon dioxide and oxygen are less than one, suggesting that mixing in the subsurface should not create conditions conducive to the degassing and bubble formation that would cause clogging. Air entrainment caused by direct injection can be prevented or minimized by injecting the recharge water through a drop pipe or pump column (under full pipe flow) beneath the water level in the well, or by cascading recharge water down the well annulus or pump column under vacuum. These techniques for controlling air entrainment have been used at other ASR sites (Pyne, 1995).

5.2.4 Surface Water Quality Degradation Potential

Surface water quality could be affected by ASR operations if stored water leaks out of the aquifer and discharges into a stream or spring. If this were to occur to a large extent, the loss of stored water could make ASR impractical because OWRD would probably not allow full recovery of the stored water volume. Discharge of stored water containing elevated levels of metals (particularly copper) or chlorine could adversely affect aquatic life in a stream. The potential for loss of stored water to springs or surface water is not considered significant in the study area except possibly near Johnson Creek, where one of the basalt interflow zones may discharge groundwater naturally to the stream (refer to Section 4.3 of this report). The potential for loss of stored water to the creek will be evaluated during the pilot project. Even if some loss of stored water to the stream does occur, the stream would not be adversely

Appendix D
Geochemical Modeling

The Aquifer Storage and Recovery (ASR) process involves mixing recharge water and groundwater in the subsurface. The resulting change in the geochemical composition of the subsurface water within the recharge bubble may produce chemical reactions between the surrounding aquifer material and the recharge water. The geochemical model PHREEQE (Parkhurst, Thorstenson, and Plummer, 1980) was used to evaluate the compatibility of the injection water with the natural water present in the aquifer system. The geochemical computer model calculates the detailed chemical composition of water mixtures based on the general chemical composition of each water source. The model also estimates the potential for the precipitation-dissolution of solids in the mixed water zone.

Modeling Objectives

The geochemical model PHREEQE was used to simulate chemical processes initiated in the subsurface as a result of artificial recharge of the basalt aquifer. The model was used to make a preliminary assessment of the potential for clogging to occur as a result of introducing either Joint Water Commission (JWC) or City of Portland-treated water into the aquifer. Particular attention was paid to the precipitation of minerals and the release of gas from solution as a result of recharge and groundwater being mixed in the subsurface. Both mineral precipitation and degassing could reduce the effectiveness of recharging and withdrawing water from the wells in the basalt aquifer and could make the project infeasible. This effort is intended to provide an initial evaluation of whether the geochemical processes initiated by artificial recharge will have an adverse impact on the project.

The PHREEQE model was chosen for this application for three reasons. It is an established geochemical tool that has been successfully applied to a number of hydrogeologic situations. It contains a mixing option that simulates the physical processes of introducing recharge water through a well. Finally, it can be run using a personal computer with a minimum of set-up and input data. These features made PHREEQE the appropriate model because only existing water quality data were available as input. A more sophisticated model (such as EQ3) would not be appropriate for an initial assessment such as this because a more complete data set would be needed to justify the higher cost of operating the model.

Model Description

The PHREEQE model contains a library of thermodynamic equilibrium constants, atomic weights, and atomic numbers for many minerals and ions commonly found in natural waters. It uses these data in conjunction with concentrations in water that are input by the user to simulate three main types of reactions:

- The addition of reactants to a solution

- The mixing of two waters
- The titration of one solution with another

Each reaction type is described below to better illustrate the types of situations to which the model can be applied. An example is included in each description to illustrate a particular application.

The first reaction involves the addition of reactant to a solution. A simple example of this type of reaction is adding table salt to water. The concentrations of various dissolved ions of interest are input for the water and a specified amount of salt is added. The model calculates the changes in the concentrations of the dissolved chemical parameters that are the result of adding the salt. This includes a number of ion pairs that contain at least one of the components of the salt.

The second reaction simulates the mixing of two waters. As in the first option, the concentrations of various dissolved ions of interest are input for each of the two waters. The model mixes the two waters in specified ratios and calculates the beginning and final concentrations of various dissolved chemical species.

The third reaction simulated by the model involves titrating one solution with another. A titration is a procedure in which a solution of known concentration (called a standard solution) is slowly added to a second solution until a reaction between two solutes is complete (an example of a solute is table salt that has been dissolved in water). This procedure is useful in determining the concentration of a particular dissolved species in the second solution. The most commonly applied example is the procedure to determine alkalinity in a water sample.

The PHREEQE model's primary utility as a geochemical tool lies in its ability to relate the results of the simulated reaction to a number of minerals. It will calculate a parameter called the saturation index for all the applicable minerals in its library using the input data and reaction results. The saturation index is a ratio of the dissolved activities (concentrations) to the equilibrium constant. Therefore, the mixed waters are considered to be oversaturated with respect to any mineral whose saturation index is greater than 1 (making the log saturation index greater than 0) and there will be a tendency for that mineral to precipitate from solution. It provides a convenient means of evaluating whether, at equilibrium, a mineral will have a tendency to dissolve into the solution or precipitate from solution.

The model can calculate saturation indices for each reacting solution prior to simulating the reaction and then repeat the calculation for the final solution. This makes it possible to make "before" and "after" comparisons. Comparing the tendency of different minerals to precipitate as a result of artificially recharging an aquifer is the primary reason for using a geochemical model.

Model Application

The model was used to simulate mixing of two types of recharge water (JWC-treated water and City of Portland-treated water) with groundwater from two potential recharge wells (Beaverton's Hanson Road well and TVWD's Schuepbach well). Water quality data were obtained for each recharge source and the injection wells and used as input for the model. Model input files and results are attached to this appendix.

The mixing option was used to simulate artificial recharge through a well because it best approximates the actual system. Each mixing simulation evaluated mixing in three different proportions: 25 percent recharge water with 75 percent groundwater, 50 percent of each type of water, and 75 percent recharge water with 25 percent groundwater. Each mixing proportion is indicative of a different zone within the envelope of recharge water that will surround the well during subsurface storage. The rationale for choosing this approach to the mixing simulation can best be explained by considering the way in which the recharge water enters and is stored in the aquifer.

When recharge water is introduced into an aquifer through a well, it enters the aquifer at a much greater rate than the normal rate of groundwater flow. Therefore, it moves out into the formation as a slug of roughly cylindrical shape. The degree of mixing varies from very little near the well to a maximum at the outer edge of the slug. Therefore, a higher percentage of recharge water will be found in the zone near the well with an increasing proportion of native groundwater as the distance from the well increases.

Each of the three steps is intended to represent a different zone within this slug of recharge water. The first step simulated a mixture that was 75 percent groundwater and 25 percent recharge water. This represents the area on the outer edge of the expanding slug of recharge water where the two waters initially come into contact in the subsurface. The mixture in the second step was 50 percent groundwater and 50 percent recharge water, and the final simulation mixed 75 percent recharge water with 25 percent groundwater, representing the zone nearer the well where a small percentage of resident groundwater remains.

The results of the modeling effort are a list of saturation indices for all the minerals in the models library to which the input data apply. The saturation index relates the activity (concentration) of the dissolved constituents to the mineral's thermodynamic equilibrium constant. It is a convenient way of stating whether a mineral can precipitate from solution given the current measured concentrations. The results for the simulations performed for this study have been discussed in detail in the body of this report.

Attachment

Model Input Files and Results

Sample Input File

```
Portland Treated Water (August 1993) Mixed with Beaverton Hanson Road Well Water
(7/14/95)
001010000  3 0        .00000
ELEMENTS
C        10     50.04460

SOLUTION 1
Portland Treated Water (August 1993)
12 10 2       6.7000    8.0000   15.0000    1.0000
 11 .18000E+01  21 .74000E+00  19 .30000E+00  24 .16000E+01  17 .89000E-01
 22 .11000E-01  16 .25000E-01  13 .20000E+01  10 .75000E+01  23 .10000E-01
 29 .25000E+00
SOLUTION 2
Beaverton Hanson Road Well Water (7/14/95)
12 10 2       7.3200    -2.000   13.3000    1.0000
 11 .36000E+02  21 .19000E+02  19 .26000E+01  24 .12100E+02  17 .15000E-01
 22 .19000E-01  16 .12000E+00  13 .47500E+02  10 .11000E+03  23 .12000E+00
 29 .35000E+01
STEPS
 .250000  .500000  .750000
END
```

Geochemical Modeling Results

Several assumptions were made for geochemical modeling. These assumptions are as follows:

- assumed equilibrium conditions exist
- assumed that the temperature of the recharge water was 15 degrees C
- The pH for JWC recharge water is the same as the pH for Portland water (there were no data for the JWC recharge water.
- The value of 19 ppm Mn reported for both Schuepbach and Beaverton is actually 19 ppb
- artificially set the pE for recharge water at 5-6 (well oxygenated) and pE for groundwater at 0 for JWC and -2 for Beaverton. This placed the water within the Fe2+ stability field for the pH reported for Beaverton and undersaturated with respect to amorphous Fe(OH) so we could look at the effects of mixing oxygenated water with low DO groundwater. The DO data for the groundwater suggest that the pE condition for the groundwater is actually higher than the value used for the simulation, making these results conservative or tending to overestimate the potential for ppt Fe

JWC Treated Water Mixed with Beaverton Hanson Road Well Water

	Phase	Log IAP	Log KT	Log IAP/KT
JWC Recharge Water				
	Fe3(OH)8	42.9151	46.7987	-3.8836
	FeOH)2.7	16.0418	10.2444	5.7975
	Hematite	38.4101	23.3535	15.0566
	Goethite	19.2050	14.1527	5.0524
	Calcite	-10.8052	-8.4231	-2.3821
	Dolomite	-21.8651	-16.7891	-5.0760
	Gypsum	-7.7353	-4.8566	-2.8787
	Halite	-7.1753	1.5566	-8.7319
	Fe(OH)3S	19.2050	15.9544	3.2507
Beaverton Groundwater				
	Fe3(OH)8	34.4539	46.8888	-12.4349
	Fe(OH)2.7	10.1898	10.2894	-0.0996
	Hematite	26.5160	23.5823	2.9337
	Phase	**Log IAP**	**Log KT**	**Log IAP/KT**
Beaverton Groundwater				
	Goethite	13.2580	14.2629	-1.0049

Calcite	-9.0084	-8.4167	-0.5916
Dolomite	-18.0779	-16.7518	-1.3261
Gypsum	-7.8191	-4.8578	-2.9613
Halite	-6.2196	1.5525	-7.7720
Fe(OH)3S	13.2579	15.9994	-2.7414

25% Recharge Water and

75% Beaverton Groundwater

Fe3(OH)8	33.7746	46.8661	-13.0915
FeOH)2.7	9.9699	10.2781	-0.3082
Hematite	26.0800	23.5249	2.5551
Goethite	13.0400	14.2352	-1.1952
Calcite	-9.2710	-8.4182	-0.8528
Dolomite	-18.6120	-16.7612	-1.8508
Gypsum	-7.6094	-4.8575	-2.7519
Halite	-6.3310	1.5535	-7.8845
Fe(OH)3S	13.0399	15.9881	-2.9481

50% Recharge Water and

50% Beaverton Groundwater

Fe3(OH)8	33.0248	46.8436	-13.8188
FeOH)2.7	9.7319	10.2668	-0.5349
Hematite	25.6183	23.4676	2.1507
Goethite	12.8091	14.2076	-1.3985
Calcite	-9.6005	-8.4198	-1.1807
Dolomite	-19.2866	-16.7705	-2.5161
Gypsum	-7.5343	-4.8572	-2.6771
Halite	-6.4786	1.5545	-8.0332
Fe(OH)3S	12.8091	15.9768	-3.1677

75% Recharge Water and

25% Beaverton Groundwater

Fe3(OH)8	32.2507	46.8211	-14.5704
Fe(OH)2.7	9.5040	10.2556	-0.7516
Hematite	25.2027	23.4104	1.7923
Goethite	12.6014	14.1801	-1.5788
Calcite	-10.0461	-8.4214	-1.6246
Dolomite	-20.2118	-16.7798	-3.4319
Gypsum	-7.5556	-4.8569	-2.6987
Halite	-6.7008	1.5556	-8.2564
Fe(OH)3S	12.6013	15.9656	-3.3642

JWC Treated Water Mixed with TVWD Schuepbach Well Water

	Phase	Log IAP	Log KT	Log IAP/KT
JWC Recharge Water				
	Fe3(OH)8	42.9151	46.7987	-3.8836
	FeOH)2.7	16.0418	10.2444	5.7975
	Hematite	38.4101	23.3535	15.0566
	Goethite	19.2050	14.1527	5.0524
	Calcite	-10.8052	-8.4231	-2.3821
	Dolomite	-21.8651	-16.7891	-5.0760
	Gypsum	-7.7353	-4.8566	-2.8787
	Halite	-7.1753	1.5566	-8.7319
	Fe(OH)3S	19.2050	15.9544	3.2507
TVWD Schuepback Well Water				
	Fe3(OH)8	31.9569	46.9906	-15.0337
	Fe(OH)2.7	10.1259	10.3403	-0.2144
	Hematite	25.8713	23.8414	2.0300
	Goethite	12.9342	14.3876	-1.4533
	Calcite	-10.1229	-8.4104	-1.7125
	Dolomite	-20.3658	-16.7096	-3.6562
	Gypsum	-5.2510	-4.8591	-0.3919
	Halite	-6.0148	1.5478	-7.5626
	Fe(OH)3S	12.9313	16.0503	-3.1190
25% Recharge Water and 75% Beaverton Groundwater				
	Fe3(OH)8	32.0144	46.9422	-14.9278
	Fe(OH)2.7	10.1544	10.3161	-0.1617
	Hematite	25.9799	23.7182	2.2617
	Goethite	12.9889	14.3283	-1.3394
	Calcite	-10.3176	-8.4133	-1.9043
	Dolomite	-20.7609	-16.7297	-4.0313
	Gypsum	-5.3890	-4.8585	-0.5306
	Halite	-6.2244	1.5500	-7.7744
	Fe(OH)3S	12.9867	16.0261	-3.0394
50% Recharge Water and 50% Beaverton Groundwater				
	Fe3(OH)8	32.1889	46.8941	-14.7052
	Fe(OH)2.7	10.2268	10.2920	-0.0653
	Hematite	26.1981	23.5959	2.6022
	Goethite	13.0983	14.2694	-1.1711
	Calcite	-10.5513	-8.4164	-2.1350
	Dolomite	-21.2377	-16.7496	-4.4881

	Phase	Log IAP	Log KT	Log IAP/KT
50% Recharge Water and 50% Beaverton Groundwater				
	Gypsum	-5.5665	-4.8579	-0.7086
	Halite	-6.5046	1.5522	-8.0568
	Fe(OH)3S	13.0969	16.0020	-2.9051
75% Recharge Water and 25% Beaverton Groundwater				
	Fe3(OH)8	32.6674	46.8463	-14.1788
	Fe(OH)2.7	10.4134	10.2681	0.1453
	Hematite	26.6952	23.4743	3.2209
	Goethite	13.3472	14.2109	-0.8636
	Calcite	-10.8494	-8.4196	-2.4298
	Dolomite	-21.8525	-16.7694	-5.0831
	Gypsum	-5.8271	-4.8572	-0.9699
	Halite	-6.9433	1.5544	-8.4977
	Fe(OH)3S	13.3465	15.9781	-2.6316

Portland Treated Water (August 1993) Mixed with Beaverton Hanson Road Well Water

	Phase	Log IAP	Log KT	Log IAP/KT
Portland Treated Water				
	Fe3(OH)8	46.0839	46.7987	-0.7149
	Fe(OH)2.7	16.9741	10.2444	6.7298
	Hematite	40.5226	23.3535	17.1691
	Goethite	20.2613	14.1527	6.1086
	Calcite	-11.9449	-8.4231	-3.5218
	Dolomite	-24.0587	-16.7891	-7.2696
	Gypsum	-10.0056	-4.8566	-5.1490
	Halite	-8.4231	1.5566	-9.9797
	Fe(OH)3S	20.2613	15.9544	4.3069
Beaverton Groundwater				
	Fe3(OH)8	34.4539	46.8888	-12.4349
	Fe(OH)2.7	10.1898	10.2894	-0.0996
	Hematite	26.5160	23.5823	2.9337
	Goethite	13.2580	14.2629	-1.0049
	Calcite	-9.0084	-8.4167	-0.5916
	Dolomite	-18.0779	-16.7518	-1.3261
	Gypsum	-7.8191	-4.8578	-2.9613
	Halite	-6.2196	1.5525	-7.7720
	Fe(OH)3S	13.2579	15.9994	-2.7414
25% Recharge Water and 75% Beaverton Groundwater				
	Fe3(OH)8	35.5718	46.8661	-11.2944
	Fe(OH)2.7	10.5687	10.2781	0.2906
	Hemaitie	27.3261	23.5249	3.8012
	Goethite	13.6630	14.2352	-0.5722
	Calcite	-9.2436	-8.4182	-0.8254
	Dolomite	-18.5499	-16.7612	-1.7887
	Gypsum	-8.0099	-4.8575	-3.1524
	Halite	-6.4368	1.5535	-7.9903
	Fe(OH)3S	13.6630	15.9881	-2.3251
50% Recharge Water and 50% Beaverton Groundwater				
	Fe3(OH)8	36.1658	46.8436	-10.6778
	Fe(OH)2.7	10.7760	10.2668	0.5092
	Hematite	27.8075	23.4676	4.3399

	Phase	Log IAP	Log KT	Log IAP/KT
50% Recharge Water and 50% Beaverton Groundwater				
	Goethite	13.9037	14.2076	-0.3039
	Calcite	-9.5813	-8.4198	-1.1614
	Dolomite	-19.2280	-16.7705	-2.4574
	Gypsum	-8.2784	-4.8572	-3.4212
	Halite	-6.7325	1.5545	-8.2870
	Fe(OH)3S	13.9037	15.9768	-2.0731
75% Recharge Water and 25% Beaverton Groundwater				
	Fe3(OH)8	36.4061	46.8211	-10.4150
	Fe(OH)2.7	10.8746	10.2556	0.6191
	Hematite	28.0993	23.4104	4.6888
	Goethite	14.0496	14.1801	-0.1305
	Calcite	-10.1578	-8.4214	-1.7364
	Dolomite	-20.3890	-16.7798	-3.6092
	Gypsum	-8.7224	-4.8569	-3.8655
	Halite	-7.1973	1.5556	-8.7528
	Fe(OH)3S	14.0496	15.9656	-1.9160

Portland Treated Water (August 1993) Mixed with TVWD Schuepbach Well Water

	Phase	Log IAP	Log KT	Log IAP/KT
Portland Treated Water				
	Fe3(OH)8	46.0839	46.7987	-0.7149
	Fe(OH)2.7	16.9741	10.2444	6.7298
	Hematite	40.5226	23.3535	17.1691
	Goethite	20.2613	14.1527	6.1086
	Calcite	-11.9449	-8.4231	-3.5218
	Dolomite	-24.0587	-16.7891	-7.2696
	Gypsum	-10.0056	-4.8566	-5.1490
	Halite	-8.4231	1.5566	-9.9797
	Fe(OH)3S	20.2613	15.9544	4.3069
TVWD Schuepback Well Water				
	Fe3(OH)8	31.9569	46.9906	-15.0337
	Fe(OH)2.7	10.1259	10.3403	-0.2144
	Hematite	25.8713	23.8414	2.0300
	Goethite	12.9342	14.3876	-1.4533
	Calcite	-10.1229	-8.4104	-1.7125
	Dolomite	-20.3658	-16.7096	-3.6562
	Gypsum	-5.2510	-4.8591	-0.3919
	Halite	-6.0148	1.5478	-7.5626
	Fe(OH)3S	12.9313	16.0503	-3.1190
25% Recharge Water and 75% Beaverton Groundwater				
	Fe3(OH)8	33.2961	46.9422	-13.6462
	Fe(OH)2.7	10.5812	10.3161	0.2651
	Hematite	26.8425	23.7182	3.1242
	Goethite	13.4202	14.3283	-0.9081
	Calcite	-10.3372	-8.4133	-1.9239
	Dolomite	-20.7970	-16.7297	-4.0673
	Gypsum	-5.4027	-4.8585	-0.5443
	Halite	-6.2216	1.5500	-7.7716
	Fe(OH)3S	13.4180	16.0261	-2.6081
50% Recharge Water and 50% Beaverton Groundwater				
	Fe3(OH)8	34.3762	46.8941	-12.5179
	Fe(OH)2.7	10.9546	10.2920	0.6625
	Hematite	27.6768	23.5959	4.0809

	Phase	Log IAP	Log KT	Log IAP/KT
50% Recharge Water and 50% Beaverton Groundwater				
	Goethite	13.8377	14.2694	-0.4317
	Calvite	-10.6106	-8.4164	-2.1942
	Dolomite	-21.3472	-16.7496	-4.5976
	Gypsum	-5.6054	-4.8579	-0.7476
	Halite	-6.4972	1.5522	-8.0495
	Fe(OH)3S	13.8362	16.0020	-2.1658
75% Recharge Water and 25% Beaverton Groundwater				
	Fe3(OH)8	35.7088	46.8463	-11.1375
	Fe(OH)2.7	11.4225	10.2681	1.1544
	Hematite	28.7627	23.4743	5.2884
	Goethite	14.3810	14.2109	0.1701
	Calcite	-11.0204	-8.4196	-2.6008
	Dolomite	-22.1724	-16.7694	-5.4030
	Gypsum	-5.9285	-4.8572	-1.0712
	Halite	-6.9278	1.5544	-8.4822
	Fe(OH)3S	14.3802	15.9781	-1.5979

City of Tigard

ASR Geochemical Evaluation

Memorandum included in *Phase I – ASR Feasibility Report* prepared for the City of Tigard by Golder Associates (2001)

MEMORANDUM

TO: Joe Glicker And Jennifer Renninger - Montgomery Watson — April 13, 2001

FR: Cheryl Ross, Steve Moncaster And David Banton - Golder Associates

RE: FINAL MEMORANDUM — 013-1419.004

TIGARD ASR GEOCHEMICAL EVALUATION

INTRODUCTION

The Tigard Aquifer Storage and Recovery (ASR) program proposes to store treated surface water in the ground during periods of low demand. Currently, the proposed recharge well is the City Well No. 1 (COT-1). The three potential suppliers of recharge water are: Lake Oswego (LO), the City of Portland (COP) and the Joint Water Commission (JWC).

This memorandum presents the results of geochemical modeling conducted to evaluate geochemical reactions that may occur during recharge of surface water to the COT-1 Well. Mixing of recharge water and groundwater may result in mineral precipitation reactions. Minerals that typically precipitate during mixing of well oxygenated surface water with less oxidized groundwater include carbonates and iron, aluminum and manganese oxides and hydroxides. Mineral precipitation is generally regarded as a problem during ASR projects due to the potential for clogging of the well screen and formation. Because the COT-1 Well is an open hole well completed in fractured basalt, the potential for clogging due to mineral precipitation is expected to be low. Mineral precipitation reactions are however still of interest due to their effects on water quality. Changes in water quality may also result from mineral dissolution following interaction of the injected water and the basalt.

Historical recharge and groundwater quality was previously presented by Montgomery Watson (2001). This document provides a brief characterization of both recharge water and groundwater and presents the results of geochemical modeling.

GROUNDWATER WATER QUALITY

The COT-1 Well is a 610-foot basalt well cased to a depth of 71 feet. Historical water quality data are presented in Table 1. The most recent sampling of COT-1 was conducted by Montgomery Watson on February 7, 2001 during a pumping test.

The February 7, 2001 sampling indicates that COT-1 water is near neutral in pH and has a total dissolved solids concentration (TDS) of 180 mg/L. The redox potential (Eh) of COT-1 groundwater was 183 mV, indicating mildly oxidizing conditions. Mildly oxidizing conditions are supported by the absence of iron and manganese (both Fe and Mn were below detectable limits) and the presence of dissolved oxygen (7 mg/L).

Although nitrate analysis was not conducted on the February 7, 2001 sample, historical nitrate concentrations are typically on the order of 1 mg/L. The presence of nitrate is consistent with oxidizing conditions.

Over the period of record, iron concentrations in COT-1 have declined. Iron concentrations for the three sampling events between 1949 and 1983 ranged from 0.03 mg/L (4/5/66) to 0.22 mg/L (6/1/83). During the two sampling events in 2000 and 2001, iron was below detectable limits. On the last sampling event, the detection limit for iron was 0.1 mg/L. A possible decline in iron concentrations may be the result of a decline in water levels. Between 1947 and 2001, the static water level in the COT-1 Well declined 65 feet (from 188 feet to 253 feet). It is possible that the source of iron in groundwater samples collected prior to 1983 was the shallow sediments, which are now part of the unsaturated zone. Because recharge to the COT-1 well may result in a rise in groundwater levels in the area immediately surrounding the well, a potential shallow source of iron is relevant. Geophysical logging of the COT-1 Well by a Golder Hydrogeologist in 2001 identified regions of high groundwater flow in both the shallow (280 feet) and deep (>500 feet) sections of the well.

INJECTION WATER QUALITY

Three water suppliers are being considered as source water for the Tigard ASR Project: Lake Oswego (LO), the City of Portland (COP) and the Joint Water Commission (JWC). Lake Oswego and the Joint Water Commission have river water sources, the Clackamas River (LO) and the Trask and Tualatin Rivers (JWC), respectively. Both LO and the COP filter their river water prior to distribution. The City of Portland's primary source of water is the Bull Run Watershed.

Historical water quality data (1996 to 2001) for the three potential recharge waters are presented in Table 2. Complete inorganic analyses are available for both the JWC and COP waters. Complete major ion chemistry is not available for Lake Oswego. Both calcium and magnesium are missing from historical analysis. Lake Oswego water was therefore not included in geochemical mixing modeling.

All three source waters exhibit near neutral pH. Major ion concentrations in JWC water are generally higher than those in COP. This difference is illustrated by comparison of the most recent total dissolved solids concentrations (TDS) for JWC and COP, 54 mg/L (8/8/00) and 20 mg/L (3/27/00), respectively. Stiff Diagrams for the two source waters (Figure 1) also clearly illustrate this difference. A Stiff Diagram for COT-1 groundwater is included for comparison. The relative concentrations of major ions in COP, COT-1 and JWC are illustrated in Figure 2. This diagram shows that groundwater is more calcium and bicarbonate rich than the surface water. Relative cation concentrations for the two surface waters are similar. It is notable that for both the Piper and Stiff diagram, a sulfate concentration of 10 mg/L for COP was assumed. The reason for this assumption is explained in the geochemical modeling section of this document.

Dissolved oxygen data is not available for the three recharge waters. However, because these waters are in contact with atmospheric oxygen they should contain oxygen. Both manganese and iron are presently below detectable limits in JWC. The most recent sampling of COP water indicated manganese below detectable limits and iron at a concentration of 0.066 mg/L. Nitrate is typically present in both waters. Average nitrate concentrations for COP and JWC waters are 0.02 mg/L and 0.5 mg/L, respectively.

GEOCHEMICAL MODELING

During recharge, treated drinking water injected into the basalt aquifer will displace native groundwater in the area surrounding the COT-1 well. Advection and dispersion will result in some mixing of recharge water and groundwater as the recharge water flows through the aquifer. To evaluate the geochemical effects of this interaction between surface water and groundwater, mixing modeling was conducted using PHREEQC Version 2.3.1 (Parkhurst and Appelo, 1999) and the Minteqa2 database. The potential for both secondary mineral precipitation and mineral dissolution were evaluated.

PHREEQC is an equilibrium mass transfer code developed by the United States Geological Survey (USGS). It is widely accepted by the regulatory and scientific community. PHREEQC was used to calculate the aqueous speciation and stability of minerals with respect to dissolved constituents following mixing. The potential for mineral precipitation was assessed using the saturation index (SI) calculated according to Equation 1.

$$SI = \log \frac{IAP}{K_{sp}} \qquad (1)$$

The saturation index is the ratio of the ion activity product (IAP) of a mineral and the solubility product (K_{sp}). An SI greater than zero indicates that the water is supersaturated with respect to a particular mineral phase and therefore mineral precipitation may occur. An evaluation of precipitation kinetics is then required to evaluate the likelihood that a supersaturated mineral will indeed form. An SI less than zero denotes undersaturation, and that the mineral in question will have a general propensity to dissolve. Mineral stability was evaluated for a limited number of geochemically-credible phases that are known to precipitate/dissolve relatively easily under surficial conditions.

Model simulations were conducted in which recharge water was mixed with native groundwater (COT-1) in 10% increments. Simulations were conducted using both COP and JWC recharge water. Mixing simulation conditions ranged from a groundwater dominated system (90% groundwater : 10% recharge water) to a recharge water dominated system (10% groundwater : 90% recharge water). The simulation of a range of mixing ratios was intended to bracket conditions that may occur throughout the aquifer. The greatest mixing of recharge water and groundwater is expected to occur during the early stages of injection when recharge water displaces groundwater. As injected water occupies a greater aquifer volume around the well, interaction of recharge and groundwater will likely be limited to the periphery of the recharge water under quasi steady state conditions.

Speciation Modeling

The first step in geochemical modeling was to speciate and charge balance each water chemistry. For each water type (COT-1, COP and JWC) the most recent complete chemical analysis was used in model simulations. A summary of the chemistry data used in model simulations is provided in Table 3. As shown in Table 3, only constituents with detectable concentrations were included.

Charge balance errors for the three water chemistries were 46% (COP), 13% (JWC) and 7% (COT-1). A charge balance error less than 5% is generally accepted as indicative of a good analysis (Hounslow, 1995). The charge balance error for COP is particularly poor. Although organic constituents may account for some of this error (total organic carbon = 1.1 mg/L), they likely cannot account for such a large discrepancy. Consideration was given to using the results from the August 2, 1999 sampling date in model simulations; however, incomplete major ion data for this date (Na and K) prevented its use. Both the COP and JWC waters were anion deficient. Sulfate was therefore added to these waters to achieve electroneutrality. For the COP water, 10 mg/L of sulfate was added. Sulfate was below detectable limits in COP water at a detection limit of 0.5 mg/L. Addition of 10-mg/L sulfate therefore represents a significant input; however, sulfate addition did not effect the model results with respect to predictions regarding mineral precipitation and dissolution. Potassium was added to JWC to achieve electroneutrality.

<u>Injection Water (COP and JWC)</u>

For recharge water (COP and JWC), an initial Eh of 900 mV was assumed. This Eh is representative of near neutral pH waters in contact with the atmosphere (Appelo and Postma, 1994). COP and JWC were equilibrated with atmospheric oxygen at a partial pressure of 0.2 atmospheres resulting in dissolved oxygen concentrations of approximately 6 mg/L.

Saturation indices for select minerals are presented in Table 4. For carbon dioxide, the partial pressure of the gas is provided. The COP water is at equilibrium with respect to gibbsite (amorphous) and supersaturated with respect to ferrihydrite. Both waters are near equilibrium with carbon dioxide at atmospheric pressure ($10^{-3.5}$ atm), as would be expected.

<u>Groundwater (COT-1)</u>

The redox condition of the groundwater was initially assumed to be equal to the measured value (183 mV). Based on the oxygen concentration in the groundwater, an Eh of 850 mV was calculated by PHREEQC. This Eh is considered high for a groundwater system (Appelo and Postma, 1994). Because inclusion of dissolved oxygen resulted in Eh adjustments by PHREEQC to values above what typical groundwaters exhibit, dissolved oxygen was omitted from the initial groundwater chemistry. It is possible that field measured dissolved oxygen values may overestimate groundwater dissolved oxygen concentrations due to atmospheric contact during sampling. It is likely that the groundwater does contain dissolved oxygen, although perhaps at lower concentrations. Omission of oxygen from the groundwater chemistry did not result in any significant changes to the final mixture chemistry with respect to potential mineral precipitation and dissolution reactions.

Saturation indices for COT-1 are provided in Table 4. Groundwater is at equilibrium with respect to amorphous silica (SI = -0.12). Silica [SiO2] accounts for greater than 50% of the total oxide composition of the basalt. Although quartz has extremely sluggish reaction kinetics, amorphous silica is less stable and may control groundwater silicon concentrations (Appelo and Postma, 1994). Amorphous silica was therefore included as an equilibrium phase during mixing modeling scenarios. As such, amorphous silica was present and allowed to dissolve to maintain equilibrium (SI=0).

Both iron (<0.1 mg/L) and manganese (<2 μg/L) were below detectable limits in COT-1 on February 7, 2001. The iron detection limit is considered high with respect to evaluation of mineral precipitation reactions. Because oxidation of iron and manganese resulting in mineral precipitation is common during recharge of oxygenated surface water into less oxygenated groundwater, a simulation was conducted in which both iron and manganese were present at a concentration equal to the detection limit. At an Eh of 183 mV, ferrihydrite [$Fe(OH)_3$] and manganite [MnOOH] were both undersaturated with SIs of −0.7 and −9.5, respectively.

Mixing Modeling

As outlined earlier, to simulate the range of geochemical conditions expected to occur throughout the aquifer, recharge water was mixed with groundwater in 10% increments. Due to the similarities in pH and redox conditions of the groundwater and recharge (both COP and JWC) waters, mixing of these waters did not result in significant mineral precipitation. The minerals listed in Table 4 that were initially undersaturated, remained undersaturated following mixing. Ferrihydrite, which was initially supersaturated in the COP water, remained supersaturated following mixing. Ferrihydrite precipitation may therefore occur in the aquifer if it does not occur prior to injection.

Mixing of COP and JWC with COT-1 water containing iron and manganese at the their respective detection limits was conducted to evaluate the potential for ferrihydrite and manganite precipitation. These simulations predicted supersaturation with respect to both minerals. Due to the low manganese concentrations (<0.0002 mg/L), if manganese precipitation should occur, it not be significant. To better evaluate the potential for iron mineral precipitation, groundwater sampling at a lower detection limit is required. Because mineral precipitation is not anticipated to be a problem in the fractured aquifer, this sampling is not warranted at this time.

For all mixing simulations, oxidizing conditions persisted. Because the groundwater does not contain significant concentrations of any reduced species (e.g. Fe^{2+}, HS^-, and $Mn2^+$), oxygen introduced into the aquifer in recharge water is not consumed by redox reactions. Without detailed mineralogic information for the aquifer, consumption of oxygen by mineral oxidation cannot be fully addressed. Iron carbonate (siderite) and iron sulfides (pyrite, marcasite) are typically the most susceptible minerals to oxidation by recharge water (Pyne, 1995). On the basis of groundwater quality for COT-1, it can be speculated that if these minerals were present in significant concentrations in the basalt and their oxidation rate was not limited by kinetic impediments, these minerals would consume the oxygen present in the groundwater.

Equilibrium with respect to amorphous silica resulted in silica dissolution during mixing. Figure 3 plots predicted silica concentrations for mixing of COP and COT-1 water. Both the concentration following pure mixing (open circles) and equilibration with amorphous silica (closed circles) are shown. Dissolution of silica results in a final silicon concentration of between 34 mg/L and 40 mg/L over the range of mixing ratios. This silicon concentration is representative of an upper limit due to the fact that the kinetics of silica dissolution may prevent complete attainment of equilibrium during the period of storage in the aquifer. Silicon is not a regulated drinking water parameter and therefore the observed range in predicted concentrations is not a concern. Mixing of JWC and COT-1 water yielded similar results.

SUMMARY

Due to the similarities in pH and redox conditions of the groundwater and recharge waters (both COP and JWC), mixing of these waters is not predicted to result in significant mineral precipitation. Throughout injection, oxidizing conditions are expected to persist in the aquifer. Dissolution of amorphous silica [SiO2] may result in an increase in silicon concentrations. Maximum silicon concentrations are not expected to exceed 40 mg/L.

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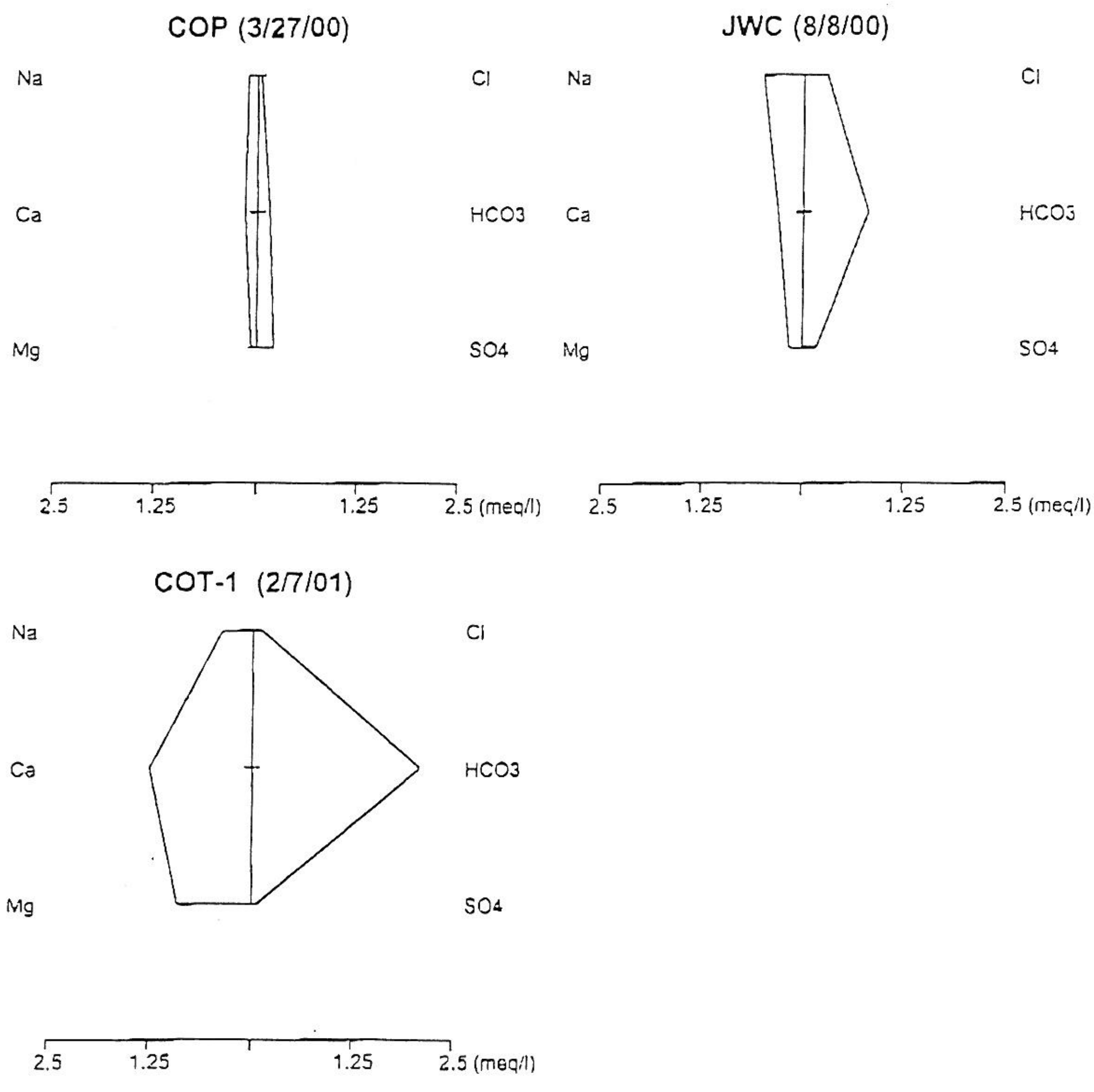
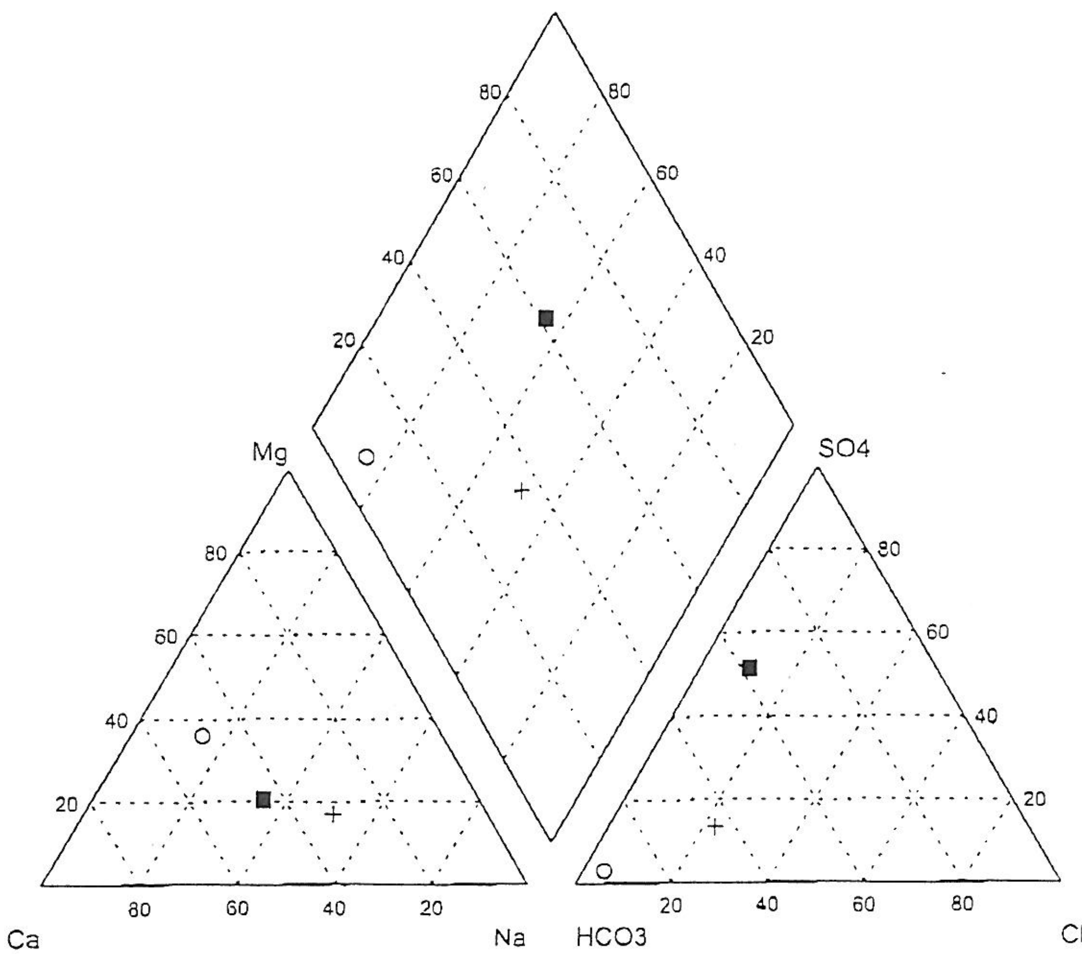
Pyne, R.D.G., 1995. Groundwater Recharge and Wells – A Guide to Aquifer Storage and Recovery, Lewis Publishers, Boca Raton, FL.

v:\enviros\2001_projects\013 1419 – Tigard ASR\Task 4\Geochemical Modeling Memo\Tigard modeling memo - FINAL



Sulfate concentration of 10 mg/L assumed for COP.

Golder Associates	FIGURE 1 Groundwater and Injection Water Stiff Diagams	
	PROJECT NO.: 013-1409.004	DATE: April 6, 2001



Sulfate concentration of 10 mg/L assumed for COP.

Golder Associates

FIGURE 2 Groundwater and Injection Water Piper Diagram

PROJECT NO.: 013-1409.004	DATE: April 6, 2001

FIGURE 3

Silicon Concentrations

COP - COT-1 Mixing

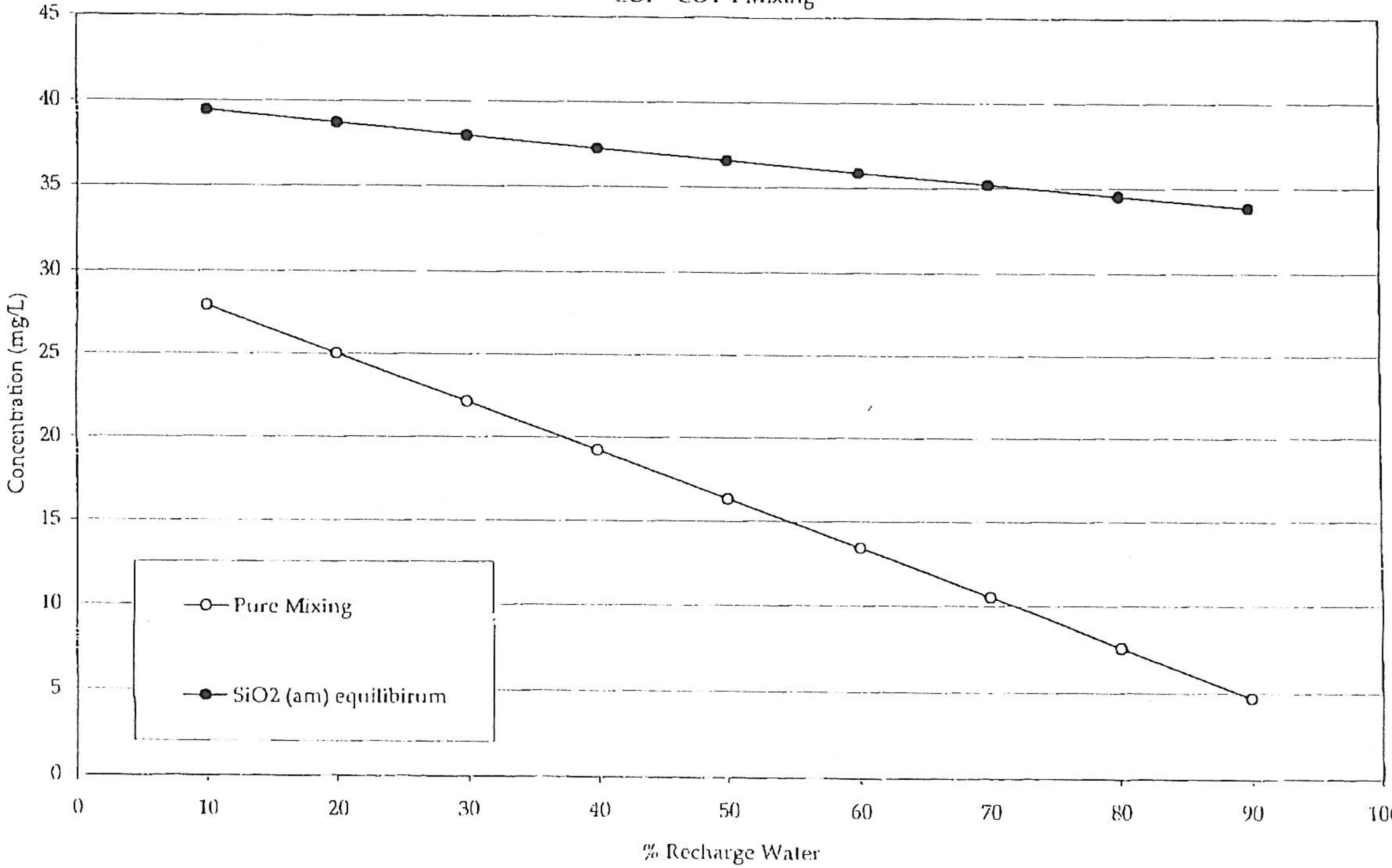


TABLE 1

Well No. 1 (COT-1) Historical Water Quality Data

Parameter	MCL	Unit	2/7/01	6/29/00	2/18/00	9/8/99	6/28/99	7/8/98	2/12/96	7/14/94	7/14/93	8/26/92	6/1/83	6/12/79	4/5/66	4/30/49
Alkalinity		mg/L	104	-	120	-	-	-	-	-	-	-	-	-	-	-
Antimony	0.006	mg/L	-	-	-	ND	-	-	ND	ND	ND	-	-	-	-	-
Arsenic	0.05	mg/L	-	-	-	ND	-	-	ND	ND	ND	<0.002	0.036	ND	-	-
Barium	2	mg/L	-	-	-	ND	-	-	ND	ND	ND	<0.025	0.01	ND	-	-
Beryllium	0.004	mg/L	-	-	-	ND	-	-	ND	ND	ND	-	-	-	-	-
Bicarbonate		mg/L	127	-	-	-	-	-	-	-	-	-	-	-	122	162
Cadmium	0.005	mg/L	-	-	-	ND	-	-	ND	ND	ND	<0.005	ND	ND	-	-
Calcium		mg/L	25	-	26.9	-	-	-	-	-	-	-	-	-	-	-
Carbonate as CO3		mg/L	0.261	-	-	-	-	-	-	-	-	-	-	-	0	-
Chloride		mg/L	3.67	-	-	-	-	-	-	-	-	-	-	-	6.6	3.6
Chromium	0.1	mg/L	-	-	-	ND	-	-	ND	ND	ND	<0.005	ND	ND	-	-
Conductivity		µS/cm	145	-	200	-	-	-	-	-	-	-	-	-	-	-
Copper	1.3	mg/L	-	-	-	0.005	-	-	ND	ND	ND	-	-	-	-	-
Cyanide	0.2	mg/L	-	-	-	ND	-	-	ND	ND	ND	-	-	-	-	-
Dissolved Oxygen		mg/L	6.98	-	-	-	-	-	-	-	-	-	-	-	-	-
Eh		mV	183	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoride	4	mg/L	-	-	-	ND	-	-	ND	ND	0.17	0.16	0.24	ND	-	-
Free CO2		mg/L	8.03	-	-	-	-	-	-	-	-	-	-	-	-	-
Hardness	250	mg/L	108	-	110	-	-	-	-	-	-	-	-	-	118	50
Hydroxide as OH		mg/L	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	0.3	mg/L	ND	-	ND	-	-	-	-	-	-	-	0.22	-	0.03	0.1
Lead	0.015	mg/L	-	-	-	ND	-	-	ND	0.002	ND	<0.002	0.005	ND	-	-
Magnesium		mg/L	11	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese		mg/L	ND	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	0.002	mg/L	-	-	-	ND	-	-	ND	ND	ND	<0.0002	ND	ND	-	-
Nickel	0.1	mg/L	-	-	-	ND	-	-	ND	ND	ND	-	-	-	-	-
Nitrate	10	mg/L	-	1.3	-	1.5	ND	0.5	1	1.6	1	1.2	1.01	ND	-	-
Nitrite	1	mg/L	-	-	-	ND	-	-	ND	ND	ND	-	-	-	-	-
pH (field)			6.78	-	-	-	-	-	-	-	-	-	-	-	-	-
pH			7.5	-	6.85	-	-	-	-	-	-	-	-	-	7.2	6.8
Potassium		mg/L	3	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	0.05	mg/L	-	-	-	ND	-	-	ND	ND	ND	0.003	ND	ND	-	-
Silica		mg/L	66	-	-	-	-	-	-	-	-	-	-	-	-	-
Silver	0.05	mg/L	-	-	-	-	-	-	-	-	-	-	ND	ND	-	-
Sodium		mg/L	8.5	-	-	9.13	-	-	8.7	8.6	8.7	10.3	-	-	-	-
Sulfate	250	mg/L	3.24	-	-	ND	-	-	ND	ND	13.5	-	-	-	3	-
Temperature		°C	11.7	-	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	0.002	mg/L	-	-	-	ND	-	-	ND	ND	ND	-	-	-	-	-
Total Dissolved Solids		mg/L	180	-	-	-	-	-	-	-	-	-	-	-	-	206

ND = non-detect

'-' indicates constituent not measured

TABLE 2

Injection Water Historical Water Quality Data

		Lake Oswego (continued)							Joint Water Commission (JWC)						
Parameter	Units	1/11/00	2/2/99	4/22/97	8/14/96	5/14/96	1/9/96	12/1/95	8/8/00	2/22/00	12/21/99	1/13/99	7/15/98	7/24/97	1/15/97
Aluminum	mg/L	-	-	-	-	-	-	-	0.08	ND	ND	-	0.013	0.007	0.007
Antimony	mg/L	ND	ND	ND	ND	ND	ND	-	ND	ND	ND	ND	ND	ND	ND
Arsenic	mg/L	ND	ND	ND	ND	ND	ND	-	ND	ND	ND	ND	ND	ND	ND
Barium	mg/L	0.006	ND	ND	ND	ND	ND	-	ND	0.02	ND	0.004	0.004	0.0037	0.005
Beryllium	mg/L	ND	ND	ND	ND	ND	ND	-	ND	ND	ND	ND	ND	ND	ND
Cadmium	mg/L	ND	ND	ND	ND	ND	ND	-	ND	ND	ND	ND	ND	ND	ND
Calcium	mg/L	-	-	-	-	-	-	-	6.2	8.66	6.25	-	8.1	7.7	6.8
Chloride	mg/L	-	-	8	-	-	-	-	10	8	8	-	4.7	4.6	4.7
Chromium	mg/L	ND	ND	ND	ND	ND	ND	-	ND	ND	ND	ND	ND	ND	ND
Conductivity	µmhos/cm	-	-	-	-	-	-	-	77	100	88	-	120	120	110
Copper	mg/L	ND	ND	ND	-	-	-	-	ND	0.011	ND	-	0.0011	ND	0.001
Cyanide	mg/L	ND	ND	ND	ND	ND	ND	-	ND	ND	ND	ND	ND	ND	ND
Fluoride (free)	mg/L	ND	ND	ND	ND	ND	ND	-	ND	ND	ND	ND	ND	ND	ND
Iron	mg/L	-	-	ND	-	-	-	-	ND	ND	ND	-	ND	ND	ND
Lead	mg/L	ND	ND	ND	ND	ND	0.002	-	ND	ND	ND	-	ND	ND	ND
Magnesium	mg/L	-	-	-	-	-	-	-	2	2.5	2.13	-	2.9	2.7	2.3
Manganese	mg/L	-	-	ND	-	-	-	-	ND	ND	ND	-	0.0006	ND	ND
Mercury	mg/L	ND	ND	ND	ND	ND	ND	-	ND	ND	ND	ND	ND	ND	ND
Nickel	mg/L	ND	ND	ND	ND	ND	ND	-	ND	ND	ND	ND	ND	ND	ND
Nitrate	mgN/L	ND	0.6	ND	ND	ND	ND	0.6	ND	0.8	0.7	0.42	0.21	0.22	0.4
Nitrite	mgN/L	ND	ND	ND	ND	ND	0.42	-	ND	ND	ND	ND	ND	ND	ND
Orthophosphate		-	-	-	-	-	-	-	ND	ND	ND	-	ND	-	ND
pH		-	-	6.44	-	-	-	-	7.6	7.7	7.8	-	7.33	7.6	7.6
Potassium	mg/L	-	-	-	-	-	-	-	0.4	0.5	0.6	-	0.6	0.6	-
Selenium	mg/L	ND	ND	ND	ND	ND	ND	-	ND	ND	ND	ND	ND	ND	ND
Silica (SiO2)	mg/L	-	-	-	-	-	-	-	16	20	19	-	14	15	15
Silver	mg/L	-	-	-	-	-	-	-	ND	ND	ND	-	ND	ND	ND
Sodium	mg/L	3.8	3.6	1.9	17.5	3	2.2	-	11.41	13.5	13.9	14	13	13	14
Sulfate	mg/L	ND	ND	11	ND	ND	ND	-	8	12	10	10	9.4	10	10
Thallium	mg/L	ND	ND	ND	ND	ND	ND	-	ND	ND	ND	ND	ND	ND	ND
Total Alkalinity	mg/L	-	-	-	-	-	-	-	41	42	39	-	39	38	41
Total Hardness	mg/L-CaCO2	-	-	16	-	-	-	-	27	40	28	-	32	30	26
Total Kjeldahl Nitrogen		-	-	-	-	-	-	-	ND	ND	ND	-	ND	-	ND
Total nitrate and nitrite	mgN/L	-	-	-	ND	ND	0.42	-	-	-	-	-	-	-	-
Total Phosphorus		-	-	-	-	-	-	-	ND	ND	ND	-	ND	ND	ND
Total Volatile Solids		-	-	-	-	-	-	-	20	27	57	-	ND	33	25
(TDS) Total Dissolved Solids	mg/L	-	-	-	-	-	-	-	54	83	91	-	64	96	72
(TOC) Total Organic Carbon	mg/L	-	-	-	-	-	-	-	ND	1.5	0.7	-	0.6	0.5	0.9
(TS) Total Solids	mg/L	-	-	43	-	-	-	-	80	82	98	-	67	92	120
(TSS) Total Suspended Solids		-	-	-	-	-	-	-	ND	ND	ND	-	ND	ND	ND
Turbidity	NTU	-	-	-	-	-	-	-	0.04	0.04	0.04	-	0.1	0.04	-
Zinc	mg/L	-	-	ND	-	-	-	-	ND	ND	ND	-	ND	ND	0.008

ND = non-detect
'-' indicates constituent not measured

Model Simulation Input Data

Parameter	Units	COT-1	COP	JWC
Alkalinity	mg/L	104	7.9	41
Aluminum	mg/L	-	0.67	0.08
Barium	mg/L	-	0.002	-
Calcium	mg/L	25	2.9	6.2
Chloride	mg/L	3.67	1.5	10
Copper	mg/L	-	0.19	-
Eh	mV	183	885	885
Iron	mg/L	-	0.066	-
Lead	mg/L	-	0.009	-
Magnesium	mg/L	11	0.8	2
Manganese	mg/L	-	-	-
Nickel	mg/L	-	0.002	-
Nitrate	mg/L N	-	0.02	-
pH	s.u.	6.78	7.5	7.6
Phosphorus	mg/L	-	0.007	-
Potassium	mg/L	3	0.2	0.4
Silicon	mg/L	30.9	1.82	7.5
Sodium	mg/L	8.5	2.6	11.41
Sulfate	mg/L	3.24	-	8
Temperature	°C	11.7	4	4

TABLE 4

Saturation Indices

Mineral		Saturation Index		
		COP	**JWC**	**COT-1**
Gibbsite - amorphous	$Al(OH)_3$	-0.50	-1.43	NA
Calcite	$CaCO_3$	-2.99	-1.57	-1.31
Gypsum	$CaSO_4$-$2H_2O$	-3.36	-3.19	-3.09
Dolomite	$CaMg(CO_3)_2$	-6.57	-3.67	-2.86
Silica - amorphous	SiO_2	-1.26	-0.65	-0.12
Ferrihydrite	$Fe(OH)_3$	2.17	NA	NA
Carbon dioxide	CO2(g)	$10^{-4.0}$	$10^{-3.1}$	$10^{-1.8}$

[1] Partial pressure shown.

Appendix E

HNSN-C12SW-1

12/16/2008

CHAIN OF CUSTODY RECORD

Alexin Analytical Laboratories, Inc.
13035 SW Pacific Hwy.
Tigard, OR 97223

Tel. 503-639-9311
Fax 503-684-1588

Date Received:
Project Manager:
Company Name: **City of Beaverton** / Public Works
Address: **P. O. Box 4755**
City, State, ZIP: **Beaverton, OR 97076**
Phone: **(503) 526-2208**
FAX: **(503) 526-2535**

Lab Project Number: 08351/01

P.O. # or Project #:
Project Name: ASR #4
Sampling Location: Beaverton, OR 97076
Sampling Date/Time: 12/16/08 9:15 Sampled By: Beth Dolbow
Sample Composition: Raw or Treated / Source or Distribution / Single or Combin

Sample Integrity Check: Pass Fail

Send to OR St. Health Div* (Please Circle) Yes No

RUSH? YES NO
Prior notification is required

PWSID #: 4100081

LAB USE ONLY	SAMPLE IDENTIFICATION	SAMPLE TYPE	ANALYSIS REQUIRED
	1 HMSN - C12SW-1		See bottle order
	2		
	3		
	4 pH: 8.29		
	5		
	6		
	7		
	8		
	9		
	10		
	11		
	12		
	13 The part of the sample was filtered through 0.45 um filter for dissolved Fe, Mn test 12/17/08 LD		

Note: FAILURE TO FILL OUT ENTIRE CHAIN OF CUSTODY MAY RESULT IN REJECTION OF SAMPLES.

LAB USE ONLY

Additional Analyses: **# of Bottles:**
Requested By:
Date:

Relinquished By	Date/Time	Received By	Date/Time
Beth Dolbow	12/16/08 10:20	MS	12/16/8 10²²a
Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

Field Parameters

Injection Period
HNSN-C12SW-1
Sample location: ASR #4
Date: 12/16/08

Time	Temp	Spc	Do	pH	ORP	Cl2	Fluoride
9:10 AM	7.64	132	12.34	8.29	671	0.85	0.88
9:15 AM	7.82	132	12.37	8.30	676	0.85	0.88

Chain of Custody

Public Drinking Water

Alexin Analytical Laboratories, Inc.
Professional Laboratory Services

To be COMPLETELY filled out by the Person submitting the sample

Analysis Requested: (Circle all that apply)

IOC **SOC*** **VOC** **Secondaries** **Other** ______

PWS ID #: 4100051 **Source (Well, Spring, etc.):** Surface water

Water System City of Beaverton

Attn: Rick Weaver

Address PO Box 4755

City, State, Zip Beaverton OR 97076

Phone: 503 781-6704 **Fax:**

SAMPLE INFORMATION

Sampled at: Acc #4 **Sampled by:** Beth DuBow

Date Collected: 12/16/08 **Time Collected:** 9:15

Sample Composition: (circle one of each)

Raw or Treated | Source or Distribution | Single or Combined

Send to Oregon State Health Division Yes No (Please Circle)

To be completed by Laboratory

Lab Sample ID #: 08351/01

Sample Integrity Check: Pass Fail

Relinquished By: Beth DuBow **Date:** 12/16/08 **Received By:** [signature] **Date:** 12/16/08 1020

Relinquished By: ______ **Date:** ______ **Received By:** ______ **Date:** ______

* Subcontracted

NOTE: FAILURE TO FILL OUT CHAIN OF CUSTODY COMPLETELY MAY RESULT IN REJECTION OF SAMPLES

ANALYSIS REPORT

Alexin Analytical LABORATORIES, INC.

Professional Laboratory Services

CLIENT

City of Beaverton/Public Works
P.O. Box 4755
Beaverton, Oregon 97076

Date Reported: 1/26/09
Date Sampled: 12/16/08 9:15am
Date Received: 12/16/08
Job Number: **08351/01**

Project Name: ASR #4
Sampling Location: Beaverton, OR 97076
Sample Composition: Treated, Distribution, Single
Sampled By: Beth Dolbow

PWSID: 4100081

Geochemical

Lab Number:		08351/01	Laboratory Reporting Limit	Date Analyzed
Sample ID:		**HNSN-C12SW-1**		
Analysis	Method	mg/L;ppm	mg/L;ppm	
Bicarbonate	SM4500-CO2D	**39**	2	12/30/08
Calcium	SM 3111D	**10.0**	2	1/9/09
Carbonate	SM4500-CO2D	**ND**	2	12/30/08
Chloride	SM4500-Cl E	**7**	1	12/18/08
Hardness	EPA 130.2	**40**	4	12/17/08
Magnesium	EPA 200.7	**2.93**	0.01	1/5/09
Nitrate	SM4500-NO3 D	**0.7**	0.5	12/16/08 4:50pm
Nitrate&Nitrite	-	**0.7**	0.01	-
Nitrite	SM4500-NO2 B	**ND**	0.01	12/17/08 2:30pm
Potassium	SM 3111B	**0.6**	0.5	12/31/08
Silica	EPA 370.1	**15**	1	12/30/08
Sodium	SM 3111B	**12.3**	0.1	1/7/09
Sulfate	EPA 375.4	**13**	5	12/18/08
Total Alkalinity	EPA 310.1	**39**	2	12/30/08
Total Dissolved Solids	EPA 160.1	**97**	1	12/17/08
Total Suspended Solids	EPA 160.2	**ND**	2	12/19/08
Total Organic Carbon	SM 5310 C	**1.75**	0.50	12/30/08

This report reflects the results for this sample only ND=None Detected

This sample shall not be reproduced, except in full, without the written approval of the laboratory.

ANALYSIS REPORT

Analysis by: ORELAP ID# OR100013

Alexin Analytical LABORATORIES, INC.
Professional Laboratory Services

C L I E N T

City of Beaverton
P.O. Box 4755
Beaverton, Oregon 97076

Date Reported: 1/26/09
Date Sampled: 12/16/08 9:15am
Date Received: 12/16/08
Job Number: **08351/01**

Project Name: ASR #4
Sampling Location: Beaverton, OR 97076
Sample Composition: Treated, Distribution, Single
Sampled By: Beth Dolbow

Metals

Sample ID: Client ID: Analysis	Method	08351/01 **HNSN-C12SW-1** Total Metals		Laboratory Reporting Limit	Date Analyzed
		mg/L;ppm		mg/L;ppm	
Aluminum	EPA 200.7	**ND**		0.05	1/5/09
Antimony	EPA 200.9	**ND**		0.001	1/7/09
Arsenic	EPA 200.9	**ND**		0.003	12/26/08
Barium	EPA 200.7	**ND**		0.05	1/5/09
Beryllium	EPA 200.7	**ND**		0.001	1/5/09
Cadmium	SM 3113B	**ND**		0.0005	1/8/09
Chromium	EPA 200.7	**ND**		0.01	1/5/09
Copper	EPA 200.7	**ND**		0.05	1/5/09
		total	dissolved		
Iron	SM3111B	**ND**	**ND**	0.05	12/29/08
Lead	EPA 200.9	**ND**		0.002	12/23/08
		total	dissolved		
Manganese	EPA200.7	**ND**	**ND**	0.02	12/30/08
Mercury	EPA 245.1	**ND**		0.0003	1/12/09
Nickel	EPA 200.7	**ND**		0.02	1/5/09
Selenium	EPA 200.9	**ND**		0.005	12/30/08
Silver	EPA 200.7	**ND**		0.02	1/5/09
Thallium	EPA 200.9	**ND**		0.001	1/8/09
Zinc	EPA 200.7	**ND**		0.01	1/5/09

ND=None Detected

This report reflects the results for this sample only and shall not be reproduced, except in full, without the written approval of the laboratory.

ANALYSIS REPORT

Analysis by: ORELAP ID#OR100013

Alexin Analytical LABORATORIES, INC. **Professional Laboratory Services**

C L I E N T
City of Beaverton/Public Works
P.O. Box 4755
Beaverton, Oregon 97076

Date Reported: 1/27/09
Date Sampled: 12/16/08 9:15am
Date Received: 12/16/08
Job Number: **08351/01**
Page: 3 of 5

Project Name: ASR #4
Sampling Location: Beaverton, OR 97076
Sample Composition: Treated, Distribution, Single
Sampled By: Beth Dolbow

PWSID: 4100081

Misc.

Sample ID: / Client ID:		08351/01 **HNSN-C12SW-1**	Laboratory Reporting Limit	Date Analyzed
Analysis	Method	mg/L;ppm	mg/L;ppm	
Color	SM2120B	**ND**	5 cu	12/17/09
Corrosivity	SM2330B	**-0.59** **Moderately Aggressive**		12/30/08
Fluoride	SM4500-F C	**0.9**	0.5	1/5/09
MBAS	EPA 425.1	**ND**	0.05	12/17/08
Odor	SM2150-B	**1 TON**	1 TON	12/17/08
Cyanide	SM4500 CN-C/E	**ND**	0.02	12/27/08

ND=None Detected
cu=color units
TON=threshhold odor number

This report reflects the results for this sample only and shall not be reproduced,

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Approved By:

Scott Dickman
Inorganic Technical Director

ANALYSIS REPORT

Professional Laboratory Services

Analysis by: ORELAP #WY200001

C
L
I City of Beaverton/Public Works
E P.O. Box 4755
N Beaverton, Oregon 97076
T

Date Reported: 1/27/09
Date Sampled: 12/16/08 9:15am
Date Received: 12/16/08
Job Number: **08351/01**

Project Name: ASR #4 **PWSID #: 4100081**
Sampling Location: Beaverton, OR 97076
Sample Composition: Treated, Distribution, Single
Sampled By: Beth Dolbow
Sample Identification: HNSN-C12SW-1

Analysis	EPA Code	Method	**Results** pCi/L	Laboratory Reporting Limit pCi/L	EPA Limit pCi/L
Gross Alpha	4000	E900.0	**pending**	1.4	15
Radium226/228	4010	E903.0 & RA-05	**pending**	0.7	5
Gross Beta	4100	E900.0	**pending**	1.6	50

Analysis	EPA Code	Method	**Results** mg/L	Laboratory Reporting Limit mg/L	EPA Limit mg/L
Uranium	4006	E200.8	**pending**	0.001	0.03

ND = None Detected

Analysis by Energy Laboratories, Inc. 2393 Salt Creek Hwy. Casper, WY 82601
Contact: Roger Garling 888-235-0515

This report reflects the results for this sample only.

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ANALYSIS REPORT

C L I E N T
City of Beaverton
P.O. Box 4755
Beaverton, Oregon 97076

phone: 503-526-2208
fax: 503-526-2535

Alexin Analytical Laboratories, Inc. Professional Laboratory Services

Analysis by: ORELAP ID #OR100031

Date Reported: 1/27/09
Date Sampled: 12/16/08 9:15am
Date Received: 12/16/08
Job Number: **08351/01**

Project Name: ASR #4
Sampling Location: Beaverton, OR 97076
Sample Composition: Treated, Distribution, Single
Sampled By: Beth Dolbow
Sample identification: HNSN-C12SW-1

PWSID #: 4100081

Regulated Synthetic Organic Compounds

FRDS#	COMPOUND	RESULT mg/L	MCL mg/L	MRL mg/L	EPA Method
2946	EDB	ND	0.00005	0.00001	504.1
2931	DBCP	ND	0.0002	0.00002	504.1
2051	Alachlor (Lasso)	ND	0.002	0.0004	525.2
2050	Atrazine	ND	0.003	0.0002	525.2
2037	Simazine	ND	0.004	0.0001	525.2
2959	Chlordane	ND	0.002	0.00004	508.1
2005	Endrin	ND	0.002	0.00002	525.2
2065	Heptachlor	ND	0.0004	0.00004	525.2
2067	Heptachlor Epoxide	ND	0.0002	0.00002	525.2
2274	Hexachlorobenzene	ND	0.001	0.0001	525.2
2042	Hexachlorocyclopentad	ND	0.05	0.0002	525.2
2010	BHC-gamma (Lindan	ND	0.0002	0.00002	525.2
2015	Methoxychlor	ND	0.04	0.0002	525.2
2020	Toxaphene	ND	0.003	0.0001	508.1

FRDS#	COMPOUND	RESULT mg/L	MCL mg/L	MRL mg/L	EPA Method
2383	Polychlorinatedbiphenyls-PC	ND	0.0005	0.00002	508.1
2031	Dalapon	ND	0.2	0.002	515.3
2041	Dinoseb	ND	0.007	0.00040	515.2
2326	Pentachlorophenol	ND	0.001	0.00008	515.2
2040	Picloram	ND	0.5	0.00020	515.2
2105	2,4-D	ND	0.07	0.00020	515.2
2110	2,4,5-TP (Silvex)	ND	0.05	0.00040	515.2
2306	Benzo(a)pyrene	ND	0.0002	0.00004	525.2
2035	Bis(2-ethylhexyl)adipate	ND	0.4	0.001	525.2
2039	Bis(2-ethylhexyl)phthalate	ND	0.006	0.001	525.2
2046	Carbofuran	ND	0.04	0.001	531.1
2036	Vydate (Oxamyl)	ND	0.2	0.002	531.1
2034	Glyphosate	ND	0.7	0.010	547
2033	Endothall	ND	0.1	0.010	548.1
2032	Diquat	ND	0.02	0.0004	549.2

Unregulated Synthetic Organic Compounds

FRDS#	COMPOUND	RESULT mg/L		MRL mg/L	EPA Method
2076	Butachlor	ND		0.0001	525.2
2045	Metolachlor	ND		0.0002	525.2
2595	Metribuzin	ND		0.0001	525.2
2356	Aldrin	ND		0.0001	525.2
2070	Dieldrin	ND		0.0001	525.2
2077	Propachlor	ND		0.0001	525.2
2440	Dicamba	ND		0.00050	515.2

FRDS#	COMPOUND	RESULT mg/L		MRL mg/L	EPA Method
2047	Aldicarb	ND		0.002	531.1
2044	Aldicarb Sulfone	ND		0.001	531.1
2043	Aldicarb Sulfoxide	ND		0.003	531.1
2021	Carbaryl	ND		0.004	531.1
2066	3-Hydroxycarbofuran	ND		0.004	531.1
2022	Methomyl	ND		0.004	531.1

EPA Method	Analysis Date
504.1	12/18/08
508.1	1/7/09
515.2	1/5/09
515.3	12/21/08
525.2	1/5/09

EPA Method	Analysis Date
531.1	1/12/09
547	12/17/08
548.1	1/5/09
549.2	1/9/09

ND=None Detected
MCL=Maximum Contaminant Level
MRL=Method Reporting Limit

UMPQUA RESEARCH COMPANY*
Reported By

* 626 Division St., Myrtle Creek, OR 97457 Contact: Lisa Leming (541) 863-5201

Reviewed By:
Scott Dickman
Inorganic Technical Director

ANALYSIS REPORT

Alexin Analytical Laboratories, Inc.
Professional Laboratory Services

Analysis by: ORELAP #WY200001

C
L
I City of Beaverton/Public Works
E P.O. Box 4755
N Beaverton, Oregon 97076
T

Date Reported: 3/2/10
Date Sampled: 12/16/08 9:15am
Date Received: 12/16/08
Job Number: **08351/01**

Project Name: ASR #4 **PWSID #: 4100081**
Sampling Location: Beaverton, OR 97076
Sample Composition: Treated, Distribution, Single
Sampled By: Beth Dolbow
Sample Identification: HNSN-C12SW-1

Analysis	EPA Code	Method	**Results** pCi/L	Laboratory Reporting Limit pCi/L	EPA Limit pCi/L
Gross Alpha	4000	E900.0	**0.9 +/- 0.8**	0.7	15
Radium226/228	4010	E903.0 & RA-05	**ND**	0.9	5
Gross Beta	4100	E900.0	**ND**	1.5	50

Analysis	EPA Code	Method	**Results** mg/L	Laboratory Reporting Limit mg/L	EPA Limit mg/L
Uranium	4006	E200.8	**ND**	0.001	0.03

ND = None Detected

Analysis by Energy Laboratories, Inc. 2393 Salt Creek Hwy. Casper, WY 82601
Contact: Roger Garling 888-235-0515

This report reflects the results for this sample only.

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Reviewed By:

Scott Dickman
Inorganic Technical Director

ORELAP # OR100013

Alexin Analytical LABORATORIES, INC.

Professional Laboratory Services

Volatile Organic Compounds

Date Reported:	12/19/2008	**Job Number:**	08351/01	Page 1 of 2
System ID #:	4100081	**Source ID:**		
Water System	City of Beaverton/ Public Works	Attn:		
Address	P.O. Box 4755	Project Name:	Ase #4	
City, State, Zip	Beaverton, OR 97076	Sample Composition:	Treated/Distribution/Single	
SAMPLE IDENTIFICATION:	HNSN – C12SW-1			
Sampled by:	Beth Dolbow	Date/Time Collected:	12/16/08	
Date Received in Lab:	12/16/2008	Date Analyzed:	12/17/2008	
Lab sample ID#:	**08351/01**	Analyst: AGG	**Method: 524.2**	

Regulated VOC

Contaminant	Code	MRL (mg/L)	Sample Results (mg/L)	MCL (mg/L)
Benzene	2990	0.0005	**ND**	0.0050
Carbon Tetrachloride	2982	0.0005	**ND**	0.0050
Chlorobenzene	2989	0.0005	**ND**	0.1000
1,2-Dichlorobenzene	2968	0.0005	**ND**	0.6000
1,4-Dichlorobenzene	2969	0.0005	**ND**	0.0750
1,2-Dichloroethane	2980	0.0005	**ND**	0.0050
1,1-Dichloroethylene	2977	0.0005	**ND**	0.0070
cis-1,2-Dichloroethylene	2380	0.0005	**ND**	0.0700
trans-1,2-Dichloroethylene	2979	0.0005	**ND**	0.1000
Dichloromethane	2964	0.0005	**ND**	0.0050
1,2-Dichloropropane	2983	0.0005	**ND**	0.0050
Ethylbenzene	2992	0.0005	**ND**	0.7000
Styrene	2996	0.0005	**ND**	0.1000
Tetrachloroethylene	2987	0.0005	**ND**	0.0050
Toluene	2991	0.0005	**ND**	1.0000
1,2,4-Trichlorobenzene	2378	0.0005	**ND**	0.0700
1,1,1-Trichloroethane	2981	0.0005	**ND**	0.2000
1,1,2-Trichloroethane	2985	0.0005	**ND**	0.0050
Trichloroethylene	2984	0.0005	**ND**	0.0050
Vinyl Chloride	2976	0.0005	**ND**	0.0020
Xylenes, total	2955	0.0015	**ND**	10.0000

ND = None Detected **MRL** = Minimum Reporting Level

Analyst Notes:

Approved by: Adriana Gonzalez-Gray, Organic Technical Director

Reviewed by: Scott Dickman, Lab Director

All procedures for this report conform to NELAC standards

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ORELAP # OR100013

Alexin Analytical LABORATORIES, INC.

Professional Laboratory Services

Volatile Organic Compounds

Date Reported:	12/19/2008	**Job Number:** 08351/01	
System ID #:	4100081	**Source ID:**	
Water System	City of Beaverton/ Public Works	Attn:	
Address	P.O. Box 4755	Project Name: Ase #4	
City, State, Zip	Beaverton, OR 97076	Sample Composition: Treated/Distribution/Single	

SAMPLE IDENTIFICATION:	HNSN – C12SW-1		
Sampled by:	Beth Dolbow	Date/Time Collected:	12/16/08
Date Received in Lab:	12/16/2008	Date Analyzed:	12/17/2008
Lab sample ID#:	**08351/01**	Analyst: AGG	**Method: 524.2**

Unregulated VOC

Contaminant	MRL (mg/L)	Sample Results (mg/L)	Contaminant	MRL (mg/L)	Sample Results (mg/L)
Bromobenzene	0.0005	**ND**	1,1-Dichloroethane	0.0005	**ND**
Bromochloromethane	0.0005	**ND**	1,3-Dichloropropane	0.0005	**ND**
Bromodichloromethane	0.0005	**0.0036**	2,2-Dichloropropane	0.0005	**ND**
Bromoform	0.0005	**ND**	*cis*-1,3-Dichloropropene	0.0005	**ND**
Bromomethane	0.0005	**ND**	*trans*-1,3-Dichloropropene	0.0005	**ND**
n-Butylbenzene	0.0005	**ND**	Fluorotrichloromethane	0.0005	**ND**
sec-Butylbenzene	0.0005	**ND**	Hexachlorobutadiene	0.0005	**ND**
tert-Butylbenzene	0.0005	**ND**	Isopropylbenzene	0.0005	**ND**
tert-Butyl methyl ether (MTBE)	0.0005	**ND**	4-Isopropyltoluene	0.0005	**ND**
Chloroethane	0.0005	**ND**	Naphthalene	0.0005	**ND**
Chloroform	0.0005	**0.0178**	*n*-Propylbenzene	0.0005	**ND**
Chloromethane	0.0005	**ND**	1,1,1,2-Tetrachloroethane	0.0005	**ND**
2-Chlorotoluene	0.0005	**ND**	1,1,2,2-Tetrachloroethane	0.0005	**ND**
4-Chlorotoluene	0.0005	**ND**	1,2,3-Trichlorobenzene	0.0005	**ND**
Dibromochloromethane	0.0005	**ND**	1,2,3-Trichloropropane	0.0005	**ND**
Dibromomethane	0.0005	**ND**	1,2,4-Trimethylbenzene	0.0005	**ND**
1,3-Dichlorobenzene	0.0005	**ND**	1,3,5-Trimethylbenzene	0.0005	**ND**
Dichlorodifluoromethane	0.0005	**ND**			

ND = None Detected **MRL** = Minimum Reporting Level

Analyst Notes:

Approved by: Adriana Gonzalez-Gray, Organic Technical Director

Reviewed by: Scott Dickman, Lab Director

All procedures for this report conform to NELAC standards

This report shall not be reproduced, except in full, without the written approval of the laboratory

ORELAP # OR100013

Alexin Analytical LABORATORIES, INC. Professional Laboratory Services

Total Trihalomethanes and Haloacetic Acids

Date Reported:	**12/29/2008**	**Job Number:**	**08351/01 – 02**		**Page 1 of 1**
System ID #:	**4100081**				
Water System	City of Beaverton/ Public Works	Attn:			
Address	P.O. Box 4755	Project Name:	ASR #4		
City, State, Zip	Beaverton, OR 97076	Sample Composition:			
SAMPLE IDENTIFICATION:	(Listed below sample results)				
Sampled by:	Beth Bolbow	Date Collected:	12/16/2008		
Date Received in Lab:	12/16/2008	Date Analyzed:	THM: 12/17/08	HAA: 12/19/08	
Lab sample ID#:	**(Listed below)**	Analyst:	THM: AGG	HAA: AGG	

TRIHALOMETHANES	Method: EPA 524.2	Sample Results (mg/L)			
	MRL (mg/L)	**#1 – 08351/01**	**#2 – 08351/02**		
$CHCl_3$ (Chloroform)	0.0010	**0.0220**	**0.0170**		
$CHBrCl_2$ (Bromodichloromethane)	0.0010	**0.0037**	**0.0012**		
$CHBr_2Cl$ (Dibromochloromethane)	0.0010	**ND**	**ND**		
$CHBr_3$ (Bromoform)	0.0010	**ND**	**ND**		
Total THM (2950)		**0.0257**	**0.0182**		
Max. Contaminant Level	0.0800 mg/L				

HALOACETIC ACIDS	Method: SM 6251B	Sample Results (mg/L)			
	MRL (mg/L)	**#1 – 08351/01**	**#2 – 08351/02**		
MCAA (Monochloroacetic acid)	0.0020	**ND**	**ND**		
DCAA (Dichloroacetic acid)	0.0010	**0.0133**	**ND**		
MBAA (Monobromoacetic Acid)	0.0010	**ND**	**ND**		
TCAA (Trichloroacetic acid)	0.0010	**0.0136**	**ND**		
DBAA (Dibromoacetic acid)	0.0010	**ND**	**ND**		
Total HAA5 (2456)		**0.0269**	**0.0000**		
Max. Contaminant Level	0.0600 mg/L				

Client ID:

#1: HNSN – C12SW – 1 (Treated/Distribution/Single)
#2: HNSN – C12GW (Raw/Source/Single)

ND = None Detected
MRL = Minimum Reporting Level

Analyst Notes:

Approved by: Adriana Gonzalez-Gray, Organic Technical Director

Reviewed by: Scott Dickman, Lab Director

All procedures for this report conform to NELAC standards

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HNSN-C12SW-3

4/13/2009

CHAIN OF CUSTODY RECORD

Alexin Analytical Laboratories, Inc.
13035 SW Pacific Hwy.
Tigard, OR 97223

Tel. 503-639-9311
Fax 503-684-1588

Date Received:
Project Manager:
Company Name: City of Beaverton / Public Works
Address: P. O. Box 4755
City, State, ZIP: Beaverton, OR 97076
Phone: (503) 526-2208
FAX: (503) 526-2535

Lab Project Number: 09103/03

P.O. # or Project #:
Project Name: HNSN-C12SW-3
Sampling Location: Beaverton, OR 97076
Sampling Date/Time: 4/13/09 8:30 Sampled By: Beth Dolbow
Sample Composition: Raw or Treated / Source or Distribution / Single or Combin

Sample Integrity Check: Pass Fail

Send to OR St. Health Div* (Please Circle) Yes No

RUSH? YES NO
Prior notification is required

PWSID #: 4100081

LAB USE ONLY	SAMPLE IDENTIFICATION	SAMPLE TYPE	ANALYSIS REQUIRED
	1 HNSN-C12SW-3		see bottle order
	2 8°C		
	3		
	4		
	5		
	6		
	7		
	8		
	9		
	10		
	11		
	12 The portion of the sample is filtered through 0.45um filter		
	13 for dissolved Fe, Mn test	4/13/09	

Note: FAILURE TO FILL OUT ENTIRE CHAIN OF CUSTODY MAY RESULT IN REJECTION OF SAMPLES.

LAB USE ONLY

Additional Analyses: **# of Bottles:**
Requested By:
Date:

Relinquished By	Date/Time	Received By	Date/Time
Beth Dolbow	4/13/09 9:10	L. Wheeler	4/13/09 9:35

* Exceptions DBP's and TOC's

Field Parameters

Injection Period
HNSN-C12SW-3
Sample location: ASR #4
Date: 04/13/09

Time	Temp	Spc	Do	pH	ORP	Cl2	Fluoride
8:20 AM	10.00	112	11.10	8.01	637	0.60	0.87
8:25 AM	9.70	113	10.95	8.01	649	0.60	0.87
8:30 AM	9.40	114	10.88	8.00	658	0.60	0.87

ANALYSIS REPORT

Alexin Analytical Laboratories, Inc.
Professional Laboratory Services

C
L
I City of Beaverton/Public Works
E P.O. Box 4755
N Beaverton, Oregon 97076
T

Date Reported: 5/26/09
Date Sampled: 4/13/09 8:30
Date Received: 4/13/09
Job Number: **09103/03**

Project Name: HNSN-C12SW-3
Sampling Location: Beaverton, OR 97076
Sample Composition: Treated, Distribution, Single
Sampled By: Beth Dolbow

PWSID: 4100081

Geochemical

Lab Number:		09103/03	Laboratory	
Sample ID:		**HNSN-C12SW-3**	Reporting Limit	Date Analyzed
Analysis	Method	mg/L;ppm	mg/L;ppm	
Bicarbonate	SM4500-CO2D	**28**	2	4/21/09
Calcium	SM 3111D	**7.7**	0.2	5/6/09
Carbonate	SM4500-CO2D	**ND**	2	4/21/09
Chloride	SM4500-Cl E	**4**	1	4/17/09
Hardness	EPA 130.2	**30**	4	4/15/09
Magnesium	EPA 200.7	**2.26**	0.01	4/28/09
Nitrate	SM4500-NO3 D	**0.8**	0.5	4/14/09 4:20pm
Nitrate&Nitrite	-	**0.8**	0.01	-
Nitrite	SM4500-NO2 B	**ND**	0.01	4/14/09 3:20pm
Potassium	SM 3111B	**0.5**	0.5	4/30/09
Silica	EPA 370.1	**15**	1	4/14/09
Sodium	SM 3111B	**10.1**	0.1	4/14/09
Sulfate	EPA 375.4	**9**	5	4/30/09
Total Alkalinity	EPA 310.1	**28**	2	4/21/09
Total Dissolved Solids	EPA 160.1	**72**	1	4/13-14/09
Total Suspended Solids	EPA 160.2	**ND**	2	4/17/09
Total Organic Carbon	SM 5310 C	**2.55**	0.50	4/23/09

This report reflects the results for this sample only ND=None Detected

This sample shall not be reproduced, except in full, without the written approval of the laboratory.

ANALYSIS REPORT

Analysis by: ORELAP ID# OR100013

Alexin Analytical LABORATORIES, INC.

Professional Laboratory Services

C
L
I City of Beaverton/Public Works
E P.O. Box 4755
N Beaverton, Oregon 97076
T

Date Reported: 5/26/09
Date Sampled: 4/13/09 8:30
Date Received: 4/13/09
Job Number: **09103/03**

Project Name: HNSN-C12SW-3
Sampling Location: Beaverton, OR 97076
Sample Composition:Treated, Distribution, Single
Sampled By: Beth Dolbow

Metals

Sample ID: / Client ID: / Analysis	Method	09103/03 **HNSN-C12SW-3** Total Metals mg/L;ppm	Laboratory Reporting Limit mg/L;ppm	Date Analyzed
Aluminum	EPA 200.7	**0.18**	0.05	5/21/09
Antimony*	EPA 200.9	**ND**	0.001	4/21/09
Arsenic	EPA 200.9	**ND**	0.003	4/14/09
Barium	EPA 200.7	**ND**	0.05	4/28/09
Beryllium	EPA 200.7	**ND**	0.001	4/28/09
Cadmium	SM 3113B	**ND**	0.0005	5/5/09
Chromium	EPA 200.7	**ND**	0.01	4/28/09
Copper	EPA 200.7	**ND**	0.05	4/28/09
Iron	EPA 200.7	total **ND** dissolved **ND**	0.05	4/28/09
Lead	EPA 200.9	**ND**	0.002	4/20/09
Manganese	EPA200.7	total **ND** dissolved **ND**	0.02	4/28/09
Mercury	EPA 245.1	**ND**	0.0003	4/22/09
Nickel	EPA 200.7	**ND**	0.02	4/28/09
Selenium	EPA 200.9	**ND**	0.005	5/3/09
Silver	EPA 200.7	**ND**	0.02	4/28/09
Thallium	EPA 200.9	**ND**	0.001	4/21/09
Zinc	EPA 200.7	**ND**	0.05	4/28/09

ND=None Detected

This report reflects the results for this sample only and shall not be reproduced, except in full, without the written approval of the laboratory.

* Matrix spike failure for this analyte.

ANALYSIS REPORT

Analysis by: ORELAP ID#OR100013

Alexin Analytical LABORATORIES, INC. Professional Laboratory Services

C L I E N T

City of Beaverton/Public Works
P.O. Box 4755
Beaverton, Oregon 97076

Date Reported: 5/26/09
Date Sampled: 4/13/09 8:30
Date Received: 4/13/09
Job Number: **09103/03**

Project Name: HNSN-C12SW-3
Sampling Location: Beaverton, OR 97076
Sample Composition:Treated, Distribution, Single
Sampled By: Beth Dolbow

PWSID: 4100081

Misc.

Sample ID:		09103/03	Laboratory Reporting Limit	Date Analyzed
Client ID:		**HNSN-C12SW-3**		
Analysis	Method	mg/L;ppm	mg/L;ppm	
Color	SM2120B	**ND**	5 cu	4/13/09
Corrosivity	SM2330B	**-2.05** Highly Aggressive		4/21/09
Fluoride	SM4500-F C	**0.9**	0.5	4/21/09
MBAS	EPA 425.1	**ND**	0.05	4/13/09
Odor	SM2150-B	**2 TON**	1 TON	4/13/09
Cyanide	SM4500 CN-E	**ND**	0.02	4/23/09

ND=None Detected
cu=color units
TON=threshhold odor number

ND=None Detected

This report reflects the results for this sample only and shall not be reproduced,

This report shall not be reproduced, except in full, without the written approval of the laboratory.

Approved By:

Scott Dickman
Inorganic Technical Director

HNSN-C13SW-1

12/28/2009

ID # 4 1 0 0 0 8 1 of Water System: : ction date/time: / / a.m. / p.m. ted by: e type: x special ___ other e point: nated?: ___no ___yes Free Chlorine ______mg/L	**MICROBIOLOGICAL ANALYSIS** **Alexin Analytical Laboratories** 13035 SW Pacific Hwy, Tigard, OR 97223 503-639-9311 OR 100013 **LABORATORY RESULTS** **Total Coliform:** Absent X Present___ **E. coli / fecal** Absent X Present___ **SPC :** ________ **CFU/ mL**	Sample #: 0936621-3 Date/Time Received: 12/28/9 1109a Date/Time Analysis Start: 12/28/09 2^{14}p Date/Time Analysis Complete: 12/29/09 912a **Comments:** sample temperature 1 °C	Paid: Received by: Analyzed by: RC Completed by: RC
Return address for report:	**Test Methods:** (check all that apply) X SM 9223 ___Colilert X Colilert-18 ___Colisure ___Quanti-tray SM ed 19 ___SM 9215B (SPC) ___SM 9221E	Reported by: date : 12/29/09 Reviewed by: RC date: 12/29/09	

Test results as reported on this document represent this sample only, as submitted, and may not be indicative of the results of previous or subsequent testing of this water supply. The laboratory certifies that the test results meet all the requirements of NELAC.

ASR2-C3SW-1

11/26/2007

Alexin Analytical LABORATORIES, INC. Professional Laboratory Services

January 21, 2008

Attention: Sally Mills
City of Tigard
13125 SW Hall Blvd.
Tigard, Oregon 97223

ASR2-C3SW1

To Whom It May Concern::

On November 26, 2007, Alexin Analytical Laboratories received one sample identified by you as ASR2. It was inspected and met general laboratory QA/QC acceptance criteria and was assigned the Alexin job number 07330/08.

There were no problems encountered in the analysis of said sample, and all analytical data met NELAC or laboratory standards.

Approved By:

Scott Dickman
Inorganic Technical Director

ANALYSIS REPORT

C L I E N T
City of Tigard
Attn: Sally Mills
13125 SW Hall Blvd.
Tigard, Oregon 97223

Alexin Analytical LABORATORIES, INC. Professional Laboratory Services

Date Reported: 1/15/08
Date Sampled: 11/26/07 11:35
Date Received: 11/26/07
Job Number: **07330/08**
Page: 1 of 8

Project #: ASR2-C3SW1
Project Name: ASR2-Cycle 3
Sampling Location: ASR2
Sampled By: J. Joc/A. Beattie
Sample Composition: Treated, Distribution, Single

PWSID: 4100878

Geochemical

Lab Number: / Sample ID: / Analysis	Method	07330/08 **ASR2-C3SW1** mg/L;ppm		Laboratory Reporting Limit mg/L;ppm	Date Analyzed
Bicarbonate	SM4500-CO2D	**12**		2	11/28/07
Calcium	SM 3111D	**2.1**		0.1	11/27/07
Carbonate	SM4500-CO2D	**ND**		2	11/28/07
Chloride	SM4500-Cl E	**3**		1	12/4/07
Hardness	EPA 130.2	**10**		4	11/27/07
Magnesium	EPA 200.7	**0.81**		0.05	12/12/07
Nitrate	SM4500-NO3 D	**ND**		0.5	11/27/07 2:30pm
Nitrate&Nitrite	-	**ND**		0.01	-
Nitrite	SM4500-NO2 B	**ND**		0.01	11/27/07 3:10pm
Potassium	SM 3111B	**0.2**		0.1	11/30/07
Silica	EPA 370.1	**11.0**		0.2	11/28/07
Sodium	SM 3111B	**3.6**		0.1	12/4/07
Sulfate*	EPA 300.0	**ND**		1.00	11/27/07
		total	**dissolved**		
Iron	SM3111B	**0.05**	**ND**	0.05	12/3/07
		total	**dissolved**		
Manganese	SM3111B	**0.02**	**0.01**	0.01	12/7/07
Total Alkalinity	EPA 310.1	**12**		2	11/28/07
Total Dissolved Solids	EPA 160.1	**30**		1	11/27/07
Total Suspended Solids	EPA 160.2	**ND**		2	11/26/07
Total Organic Carbon	SM 5310 C	**1.84**		0.50	11/27/07

This report reflects the results for this sample only

ND=None Detected

This sample shall not be reproduced, except in full, without the written approval of the laboratory.

Approved By:

Scott Dickman
Inorganic Technical Director

* Analyzed at Umpqua Research
626 Division St., Myrtle Creek, OR 97457
ORELAP ID#OR100031, contact: Lisa Leming

ANALYSIS REPORT

Analysis by: ORELAP ID# OR100013

Alexin Analytical LABORATORIES, INC. Professional Laboratory Services

C L I E N T
City of Tigard
Attn: Sally Mills
13125 SW Hall Blvd.
Tigard, Oregon 97223

Date Reported: 1/15/08
Date Sampled: 11/26/07 11:35
Date Received: 11/26/07
Job Number: **07330/08**

Project #: ASR2-C3SW1
Project Name: ASR2-Cycle 3
PWSID: 4100878
Sampling Location: ASR2
Sampled By: J. Joc/A. Beattie
Sample Composition: Treated, Distribution, Single

Metals

Sample ID: Client ID: Analysis	Method	07330/08 **ASR2-C3SW1** Total	Laboratory Reporting Limit	Date Analyzed
		mg/L;ppm	mg/L;ppm	
Aluminum	EPA 200.7	**ND**	0.05	12/12/07
Antimony	EPA 200.9	**ND**	0.001	12/20/07
Arsenic	EPA 200.9	**ND**	0.003	11/30/07
Barium	EPA 200.7	**ND**	0.02	12/12/07
Beryllium	EPA 200.7	**ND**	0.001	12/12/07
Cadmium	SM 3113B	**ND**	0.0005	12/19/07
Chromium	EPA 200.7	**ND**	0.01	12/12/07
Copper	SM3111B	**ND**	0.05	12/10/07
Lead	EPA 200.9	**ND**	0.002	11/30/07
Mercury	EPA 245.1	**ND**	0.0003	11/28/07
Nickel	EPA 200.7	**ND**	0.02	12/12/07
Selenium	EPA 200.9	**ND**	0.005	11/29/07
Silver	EPA 200.7	**ND**	0.02	12/12/07
Sodium	SM3111B	**3.6**	0.1	12/4/07
Thallium	EPA 200.9	**ND**	0.001	12/20/07
Zinc	EPA 200.7	**ND**	0.01	12/12/07

ND=None Detected

This report reflects the results for this sample only and shall not be reproduced, except in full, without the written approval of the laboratory.

ORELAP # OR100031

Alexin Analytical LABORATORIES, INC.

Professional Laboratory Services

Total Trihalomethanes and Haloacetic Acids

Date Reported:	**1/15/08**	**Job Number:**	**07330/08**	**Page 3 of 8**
System ID #:				
Water System	City of Tigard	Attn:	Sally Mills	
Address	13125 SW Hall Blvd.	Project Name:	ASR2-Cycle 3	
City, State, Zip	Tigard, Oregon 97223	Sample Composition:	Treated, Distribution, Single	

SAMPLE IDENTIFICATION:	(Listed below sample results)		
Sampled by:	JJ/AB	Date Collected:	11/26/07 11:35
Date Received in Lab:	11/26/07	Date Analyzed:	THM: 12/3/07 HAA: 12/3/07
Lab sample ID#:	**(Listed below)**	Analyst:	THM: JCN HAA: JCN

TRIHALOMETHANES	Method: EPA 524.2				
		Sample Results (mg/L)			
	MRL (mg/L)	**#1 - 07330/08**	**#2 -**	**#3 -**	**#4 -**
$CHCl_3$ (Chloroform)	0.0005	**0.0326**			
$CHBrCl_2$ (Bromodichloromethane)	0.0005	**0.0016**			
$CHBr_2Cl$ (Dibromochloromethane)	0.0005	**ND**			
$CHBr_3$ (Bromoform)	0.0005	**ND**			
Total THM (2950)		**0.0342**			
Max. Contaminant Level	0.0800 mg/L				

HALOACETIC ACIDS	Method: SM 6251B				
		Sample Results (mg/L)			
	MRL (mg/L)	**#1 - 07330/08**	**#2 -**	**#3 -**	**#4 -**
MCAA (Monochloroacetic acid)	0.0020	**ND**			
MBAA (Monobromoacetic Acid)	0.0010	**ND**			
DCAA (Dichloroacetic acid)	0.0010	**0.0176**			
TCAA (Trichloroacetic acid)	0.0010	**0.0260**			
DBAA (Dibromoacetic acid)	0.0010	**ND**			
Total HAA5 (2456)		**0.0436**			
Max. Contaminant Level	0.0600 mg/L				

Client ID:

#1: ASR2-C3SW

#2:

#3:

#4:

* = DBPMAX

ND = None Detected

MRL = Minimum Reporting Level

Analyst Notes:

Reported by: Umpqua Research Company
626 Division St. Myrtle Creek, OR 97457
Contact: Lisa Leming 541.863.5201

All procedures for this report conform to NELAC standards *This report reflects the results for this sample only.*

This report shall not be reproduced, except in full, without the written approval of the laboratory.

ANALYSIS REPORT

Alexin Analytical Laboratories, Inc. Professional Laboratory Services

Analysis by: ORELAP ID#OR100013

CLIENT
City of Tigard
Attn: Sally Mills
13125 SW Hall Blvd.
Tigard, Oregon 97223

Date Reported: 1/15/08
Date Sampled: 11/26/07 11:35
Date Received: 11/26/07
Job Number: **07330/08**
Page: 4 of 8

Project #: ASR2-C3SW1
Project Name: ASR2-Cycle 3
Sampling Location: ASR2
Sampled By: J. Joc/A. Beattie
Sample Composition: Treated, Distribution, Single
Matrix: DW

PWSID: 4100878

Misc.

Sample ID: Client ID:		07330/08 **ASR2-C3SW1**	Laboratory Reporting Limit	Date Analyzed
Analysis	Method	mg/L;ppm	mg/L;ppm	
Color	SM2120B	**9**	5 cu	11/26/07
Corrosivity	SM2330B	**-1.91** **Moderately Aggressive**		11/28/07
Fluoride	SM4500-F C	**ND**	0.5	11/27/07
MBAS	EPA 425.1	**ND**	0.05	11/27/07
Odor	SM2150-B	**1 TON**	1 TON	11/26/07
Cyanide(free)	SM4500 CN-E	**ND**	0.02	11/27/07
Chlorine	EPA330.5	**0.8**	0.1	11/26/07

ND=None Detected
cu=color units
TON=threshhold odor number

ND=None Detected

ANALYSIS REPORT

Alexin Analytical Laboratories, Inc. — Professional Laboratory Services

Analysis by: Energy Laboratories, Inc. ORELAP #WY200001

CLIENT

City of Tigard
Attn: Sally Mills
13125 SW Hall Blvd.
Tigard, Oregon 97223

Date Reported: 1/15/08
Date Sampled: 11/26/07 11:35
Date Received: 11/26/07
Lab ID#: **07330/08**

Project #: ASR2-C3SW1
Project Name: ASR2-Cycle 3
PWSID: 4100878
Sampling Location: ASR2
Sampled By: J. Joc/A. Beattie
Sample Composition: Treated, Distribution, Single

Lab # / Analysis	EPA Code	Method	**Results** pCi/L	Laboratory Reporting Limit pCi/L	EPA Limit pCi/L	Date Analyzed
Gross Alpha	4000	E900.0	**ND**	1.0	15	12/14/07
Radium226/228	4010	E903.0 & RA-05	**ND**	1.0	5	12/17/07
Gross Beta	4100	E900.0	**ND**	2.0	50	12/14/07

Lab # / Analysis	EPA Code	Method	**Results** mg/L	Laboratory Reporting Limit mg/L	EPA Limit mg/L	EPA Limit mg/L
Uranium	4006	E200.8	**ND**	0.001	0.030	12/5/07

ND = None Detected

Analysis by Energy Laboratories, Inc. 2393 Salt Creek Hwy. Casper, WY 82601
Contact: Roger Garling 888-235-0515

This report reflects the results for this sample only.

This report shall not be reproduced, except in full, without the written approval of the laboratory.

ANALYSIS REPORT

CLIENT
City of Tigard
Attn: Sally Mills
13125 SW Hall Blvd.
Tigard, Oregon 97223

Alexin Analytical LABORATORIES, INC. Professional Laboratory Services

Analysis by: ORELAP ID #OR100031

Project #: ASR2-C3SW1
Project Name: ASR2-Cycle 3
Sampling Location: ASR2
Sampled By: J. Joc/A. Beattie
Sample Composition: Treated, Dist., Single

Date Reported: 1/15/08
Date Sampled: 11/26/07 11:35
Date Received: 11/26/07
Job Number: **07330/08**

Regulated Synthetic Organic Compounds

FRDS#	COMPOUND	RESULT mg/L	MCL mg/L	MDL mg/L	EPA Method	FRDS#	COMPOUND	RESULT mg/L	MCL mg/L	MDL mg/L	EPA Method
2946	EDB	ND	0.00005	0.00001	504.1	2383	Polychlorinatedbiphenyls-PCB	ND	0.0005	0.0002	508.1
2931	DBCP	ND	0.0002	0.00002	504.1	2031	Dalapon	ND	0.2	0.002	515.3
2051	Alachlor (Lasso)	ND	0.002	0.0004	525.2	2041	Dinoseb	ND	0.007	0.00040	515.2
2050	Atrazine	ND	0.003	0.0002	525.2	2326	Pentachlorophenol	ND	0.001	0.00008	515.2
2037	Simazine	ND	0.004	0.0001	525.2	2040	Picloram	ND	0.5	0.00020	515.2
2959	Chlordane	ND	0.002	0.00004	508.1	2105	2,4-D	ND	0.07	0.00020	515.2
2005	Endrin	ND	0.002	0.00002	525.2	2110	2,4,5-TP (Silvex)	ND	0.05	0.00040	515.2
2065	Heptachlor	ND	0.0004	0.00004	525.2	2306	Benzo(a)pyrene	ND	0.0002	0.00004	525.2
2067	Heptachlor Epoxide	ND	0.0002	0.00002	525.2	2035	Bis(2-ethylhexyl)adipate	ND	0.4	0.001	525.2
2274	Hexachlorobenzene	ND	0.001	0.0001	525.2	2039	Bis(2-ethylhexyl)phthalate	ND	0.006	0.001	525.2
2042	Hexachlorocyclopentadien	ND	0.05	0.0002	525.2	2046	Carbofuran	ND	0.04	0.001	531.1
2010	BHC-gamma (Lindane)	ND	0.0002	0.00002	525.2	2036	Vydate (Oxamyl)	ND	0.2	0.002	531.1
2015	Methoxychlor	ND	0.04	0.0002	525.2	2034	Glyphosate	ND	0.7	0.010	547
2020	Toxaphene	ND	0.003	0.0001	508.1	2033	Endothall	ND	0.1	0.010	548.1
						2032	Diquat	ND	0.02	0.0004	549.2

Unregulated Synthetic Organic Compounds

FRDS#	COMPOUND	RESULT mg/L		MDL mg/L	EPA Method	FRDS#	COMPOUND	RESULT mg/L		MDL mg/L	EPA Method
2076	Butachlor	ND		0.0001	525.2	2047	Aldicarb	ND		0.002	531.1
2045	Metolachlor	ND		0.0002	525.2	2044	Aldicarb Sulfone	ND		0.001	531.1
2595	Metribuzin	ND		0.0001	525.2	2043	Aldicarb Sulfoxide	ND		0.003	531.1
2356	Aldrin	ND		0.0001	525.2	2021	Carbaryl	ND		0.004	531.1
2070	Dieldrin	ND		0.0001	525.2	2066	3-Hydroxycarbofuran	ND		0.004	531.1
2077	Propachlor	ND		0.0001	525.2	2022	Methomyl	ND		0.004	531.1
2440	Dicamba	ND		0.00050	515.2						

EPA Method	Analysis Date
504.1	12/10/07
508.1	12/6/07
515.2	12/5/07
525.2	12/4/07
515.3	12/4/07

EPA Method	Analysis Date
531.1	11/30/07
547	12/18/07
548.1	12/12/07
549.2	12/5/07

ND=None Detected
MCL=Maximum Contaminant Level
MDL=Method Detection Limit

UMPQUA RESEARCH COMPANY
Reported By
626 Division St., Myrtle Creek, OR 97457 Contact: Lisa Leming (541) 863-5201

ORELAPID #: OR100031

Report Date: 1/15/08

Alexin Analytical Laboratories, Inc. — Professional Laboratory Services

Project #: ASR2-C3SW1 | **Project Name: ASR2-Cycle 3** |

Water System: City of Tigard	Attn: Sally Mills
Address: 13125 SW Hall Blvd	Phone: 503-718-2604
City, Sate, Zip: Tigard, Oregon 97223	Fax: 503-684-8840

Sample Identification

Sampled at: ASR2	Sampled by: JJ/AB
Date collected: 11/26/07	Time collected: 11:35
Date received: 11/26/07	Date analyzed: 12/3/07
Sample Composition: Treated, Distribution, Single	
Lab Sample ID #: 07330/08	Client Sample ID: ASR2-C3SW

Volatile Organic Chemicals

Regulated VOCs

Contaminant	Code	MCL (mg/L)	Results (mg/L)	LRL (mg/L)	Method	Analyst
1,1-Dichloroethylene	2977	0.007	**ND**	.0005	524.2	JCN
1,1,1-Trichloroethane	2981	0.2	**ND**	.0005	524.2	JCN
1,1,2-Trichloroethane	2985	0.005	**ND**	.0005	524.2	JCN
1,2 Dichloroethane	2980	0.005	**ND**	.0005	524.2	JCN
1,2 Dichloropropane	2983	0.005	**ND**	.0005	524.2	JCN
1,2,4-Trichlorobenzene	2378	0.07	**ND**	.0005	524.2	JCN
Benzene	2990	0.005	**ND**	.0005	524.2	JCN
Carbon Tetrachloride	2982	0.005	**ND**	.0005	524.2	JCN
Cis-1,2-Dichloroethylene	2380	0.07	**ND**	.0005	524.2	JCN
Dichloromethane	2964	0.005	**ND**	.0005	524.2	JCN
Ethylbenzene	2992	0.7	**ND**	.0005	524.2	JCN
Monochlorobenzene	2989	0.1	**ND**	.0005	524.2	JCN
1,2-Dichlorobenzene	2968	0.6	**ND**	.0005	524.2	JCN
1,4-Dichlorobenzene	2969	0.075	**ND**	.0005	524.2	JCN
Styrene	2996	0.1	**ND**	.0005	524.2	JCN
Tetrachloroethylene	2987	0.005	**ND**	.0005	524.2	JCN
Toluene	2991	1	**ND**	.0005	524.2	JCN
Total Xylenes	2955	10	**ND**	.0015	524.2	JCN
Trans-1,2-Dichloroethylene	2979	0.1	**ND**	.0005	524.2	JCN
Trichloroethylene	2984	0.005	**ND**	.0005	524.2	JCN
Vinyl Chloride	2976	0.002	**ND**	.0005	524.2	JCN

ND = None Detected

Reported by: Umpqua Research Company
626 Division St. Myrtle Creek, OR 97457
Contact: Lisa Leming 541-863-5201

Reviewed by: Scott Dickman
Inorganic Technical Director

ANALYSIS REPORT

Alexin Analytical Laboratories, Inc.
Professional Laboratory Services

CLIENT
City of Tigard
Attn: Sally Mills
13125 SW Hall Blvd.
Tigard, Oregon 97223

Date Reported: 1/21/08
Date Sampled: 11/26/07 11:35
Date Received: 11/26/07
Job Number: **07330/08**

Project #: ASR2-C3SW1
Project Name: ASR2-Cycle 3
Sampling Location: ASR2
Sampled By: J Joc/A. Beattie
Matrix: Drinking Water
Sample Composition: Treated, Distribution, Single

Charge Balance

Sample ID:		**ASR-2**
Analysis	**Cations**	meq/L
Calcium		0.1048
Magnesium		0.0666
Potassium		0.0051
Sodium		0.1566
Total		0.3331
	Anions	
Chloride		0.0846
Nitrate		<0.0081
Nitrite		<0.0002
Carbonate		<0.0666
Bicarbonate		0.1967
Sulfate		<0.0268
Total		0.2813

Approved By:

Scott Dickman
Inorganic Technical Director

Alexin Analytical LABORATORIES, INC.
Professional Laboratory Services

Metals - Quality Control

Laboratory Control Sample or Continuing Calibration Verification

Analyte	Method	% Recovery	% Recovery Limits
Aluminum	EPA200.7	115	90-110
Antimony	EPA200.9	102	90-110
Arsenic	EPA200.9	103	90-110
Barium	EPA200.7	98	90-110
Beryllium	EPA200.7	100	90-110
Cadmium	SM3113B	95	90-110
Calcium	SM3111D	95	90-110
Chromium	EPA200.7	97	90-110
Copper	SM3111B	104	90-110
Iron	SM3111B	93	90-110
Lead	EPA200.9	105	90-110
Magnesium	EPA200.7	90	90-110
Manganese	SM3111B	97	90-110
Mercury	EPA245.1	102	90-110
Nickel	EPA200.7	95	90-110
Potassium	SM3111B	100	90-110
Selenium	EPA200.9	103	90-110
Silver	EPA200.7	98	90-110
Sodium	SM3111B	100	90-110
Thallium	EPA200.9	104	90-110
Zinc	EPA200.7	95	90-110

Metals - Quality Control

Matrix Spike

Analyte	Method	% Recovery	% Recovery Limits
Aluminum	EPA200.7	103	70-130
Antimony	EPA200.9	104	70-130
Arsenic	EPA200.9	110	70-130
Barium	EPA200.7	97	70-130
Beryllium	EPA200.7	97	70-130
Cadmium	SM3113B	90	70-130
Calcium	SM3111D	108	70-130
Chromium	EPA200.7	98	70-130
Copper	SM3111B	100	70-130
Iron	SM3111B	85	70-130
Lead	EPA200.9	100	70-130
Magnesium	EPA200.7	76	70-130
Manganese	SM3111B	95	70-130
Mercury	EPA245.1	84	70-130

*Spike recovery exempt from acceptance criteria when spike is <10% of sample concentration.

13035 SW Pacific Hwy. • Tigard, OR 97223 • Tel: (503) 639-9311 • Fax: (503) 684-1588

Metals - Quality Control, continued

Matrix Spike, continued

Analyte		% Recovery	% Recovery Limits
Nickel	EPA200.7	99	70-130
Potassium	SM3111B	100	70-130
Selenium	EPA200.9	87	70-130
Silver	EPA200.7	96	70-130
Sodium	SM3111B	93	70-130
Thallium	EPA200.9	107	70-130
Zinc	EPA200.7	99	70-130

Inorganic Analyses - Quality Control

Relative Percent Difference

Analyte	Method	RPD	RPD Limits
Alkalinity	EPA310.1	3%	20%
Chloride	SM4500Cl-E	4%	20%
Fluoride	SM4500-F C	<1%	20%
Nitrate	SM4500-NO3 D	<1%	20%
Nitrite	SM4500-NO2 B	<1%	20%
Silica	EPA370.1	<1%	20%
Total Organic Carbon	SM5310-C	<1%	20%

Inorganic Analyses - Quality Control

Laboratory Control Sample

Analyte	Method	LCS % Recovery	LCS % Recovery Limits
Alkalinity	EPA310.1	103%	90-110
Chloride	SM4500Cl-E	91%	90-110
Color	SM2120B	100%	90-110
Fluoride	SM4500-F C	107%	90-110
Free Cyanide	SM4500-CN E	102%	90-110
Hardness	EPA130.2	101%	90-110
Nitrate	SM4500-NO3 D	99%	90-110
Nitrite	SM4500-NO2 B	102%	90-110
Silica	EPA370.1	102%	90-110
Total Diss. Solids	EPA160.1	100%	90-110
Total Organic Carbon	SM5310-C	118%	80-120
Total Susp. Solids	EPA160.2	100%	90-110

*Spike recovery exempt from acceptance criteria when spike is <10% of sample concentration.

Inorganic Analyses - Quality Control, continued

Continuing Calibration Verification

Analyte	Method	CCV % Recovery	CCV % Recovery Limits
Free Cyanide	SM4500-CN E	100%	90-110

Inorganic Analyses - Quality Control

Matrix Spike

Analyte	Method	Spike % Recovery	Spike % Recovery Limits
Fluoride	SM4500-F C	95%	70-130
Nitrate	SM4500-NO3 D	96%	70-130
Nitrite	SM4500-NO2 B	98%	70-130
TOC	SM5310-C	118%	70-130

*Spike recovery exempt from acceptance criteria when spike is <10% of sample concentration.

CHAIN OF CUSTODY RECORD

Alexin Analytical Laboratories, Inc.
13035 SW Pacific Hwy.
Tigard, OR 97223

Tel. 503-639-9311
Fax 503-684-1588

Date Received:
Project Manager: Sally Mills
Company Name: City of Tigard, OR
Address: 13125 SW Hall Blvd.
City, State, ZIP: Tigard, OR 97223
Phone: 503-718-2604
FAX: 503-684-8840

Lab Project Number: 07330/08

P.O. # or Project #: ASR2-C3SW1
Project Name: ASR2- Cycle 3
Sampling Location: ASR 2
Sampling Date/Time: 11.26.7 1135 Sampled By: J. Joe/A. Beattie
Sample Composition: Raw or Treated / Source or Distribution / Single or Combined
Send to OR St. Health Div* (Please Circle) Yes No
PWSID #: 4100878

Sample Integrity Check
Pass Fail

RUSH? YES NO
Prior authorization is required

LAB USE ONLY		SAMPLE IDENTIFICATION	SAMPLE TYPE	ANALYSIS REQUIRED
	1	ASR2- C3SW	DW	General Chemistry
	2	pH 8.03 D.O. 10.24 mg/L		Metals
	3	Temp 10.36°C ORP 437 mV		DBPs
	4	S.C 39 µS/cm		MISC
	5			Radio-nuclides
	6	* Please send report to		VOCs
	7	Tigard: Attention Sally Mills		SOCs
	8	& a copy to		(See bottle
	9	GSI - Attention Ted		form request
	10	Reesler		for details)
	11			
	12			
	13			

Note: FAILURE TO FILL OUT ENTIRE CHAIN OF CUSTODY MAY RESULT IN REJECTION OF SAMPLES.

LAB USE ONLY
The sample was filtered through 0.45um for dissolved Fe, Mn 11/26/07 LD
Additional Analyses:
# of Bottles:
Requested By:
Date:

Relinquished By	Date/Time	Received By	Date/Time
[signature]	11-26-07 1217	K. Wheeler	11/26/07 12:17
Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

* Exceptions-DBP's and TOC 's

2009 Portland Water Bureau Water Quality Report

Regulated Contaminants Detected in 2009

Regulated Contaminant	Minimum Detected	Maximum Detected	Maximum Contaminant Level (MCL) or Treatment Technique	Maximum Contaminant Level Goal (MCLG)	Sources of Contaminant
SOURCE WATER FROM BULL RUN WATERSHED					
Turbidity	0.20 NTU	3.8 NTU	Cannot exceed 5 NTU more than two times in twelve months	Not Applicable	Erosion of natural deposits
Giardia	Not Detected	One sample of 50 liters had 3 *Giardia* cysts	Treatment technique required: Disinfection to kill 99.9% of cysts	Not Applicable	Animal wastes
Fecal Coliform Bacteria	Not Detected	1 sample had 6 bacterial colonies (100% of samples had fewer than 20 bacterial colonies per 100 milliliters of water)	At least 90% of samples measured during the previous six months must have 20 or fewer bacterial colonies per 100 milliliters of water	Not Applicable	Animal wastes
ENTRY POINTS TO DISTRIBUTION SYSTEM — from Bull Run Watershed and Columbia South Shore Well Field					
NUTRIENTS					
Nitrate Nitrogen	< 0.01 parts per million	0.18 parts per million	10 parts per million	10 parts per million	Found in natural aquifer deposits; animal wastes
METALS AND MINERALS					
Arsenic	< 0.5 parts per billion	3 parts per billion	10 parts per billion	0 parts per billion	Found in natural aquifer deposits
Barium	< 0.005 parts per million	0.013 parts per million	2 parts per million	2 parts per million	Found in natural aquifer deposits
Fluoride	< 0.05 parts per million	0.14 parts per million	4 parts per million	4 parts per million	Found in natural aquifer deposits
Lead	< 1 part per billion	5 parts per billion	Not Applicable	0 parts per billion	Found in natural aquifer deposits
INORGANIC CONTAMINANTS					
Cyanide	<10 parts per billion	46 parts per billion	200 parts per billion	200 parts per billion	Produced by algae and plants naturally found in the Bull Run watershed
RADIONUCLIDES					
Gross Beta	3.4 picocuries per liter	3.4 picocuries per liter	Not applicable; Screening level of 50 picocuries per liter	0 picocuries per liter	Decay of natural deposits
DISTRIBUTION SYSTEM OF RESERVOIRS, TANKS AND MAINS					
MICROBIOLOGICAL CONTAMINANTS					
***E. Coli* Bacteria**	Not Detected	A routine sample and a repeat sample in November had detectable *E. coli* bacteria	A routine sample and a repeat sample are total coliform positive, and one is also *E. coli* positive	0% of samples with detectable *E. coli* bacteria	Human and animal fecal waste
Total Coliform Bacteria	Not Detected	8 samples out of 319 in October (2.5%) had detectable coliform bacteria	Must not detect coliform bacteria in more than 5.0% of samples in any month	0% of samples with detectable coliform bacteria	Found throughout the environment
DISINFECTION BYPRODUCTS					
TOTAL TRIHALOMETHANES					
Running Annual Average of All Sites	15 parts per billion	21 parts per billion	80 parts per billion	Not Applicable	Byproduct of drinking water disinfection
Single Result at Any One Site	11 parts per billion	33 parts per billion	Not Applicable		
HALOACETIC ACIDS					
Running Annual Average of All Sites	21 parts per billion	25 parts per billion	60 parts per billion	Not Applicable	Byproduct of drinking water disinfection
Single Result at Any One Site	11 parts per billion	42 parts per billion	Not Applicable		

City of Tigard ASR 1

Native Groundwater Quality

Golder Associates, 2003

quality reference levels, also obtained from the SDWA. Maximum contaminant levels (MCL) have been established under the SDWA for Primary parameters. Secondary parameters are non-enforceable standards by the EPA and adopted by the DHS. Constituents specified under OAR 690-350-020 (3)(b)(F)(iv) include common ion constituents and general water quality parameters. As specified in Section 8 Water Quality Conditions and Limits (E) of the Limited License, if a constituent which is regulated under OAR 331-061-0030 or OAR 340-040 is detected above 50% of the MCL, the licensee shall employ technically feasible, practical and cost-effective methods to minimize concentrations of such constituents in the injection source water.

Table 2-5 lists the constituents tested and the corresponding package number. In order to present the water quality data in a meaningful way, data are presented according to injection, storage and recovered waters. Results are further divided into primary and secondary standards, and additional parameters not regulated. With the exception of package 1, 1(a) and field measurements presented in Table 4-4, results for all water quality sampling are presented in Table 4-5.

4.5.2.1 Receiving Aquifer Water Quality

In-situ groundwater from the COT_1 well was collected on November 30, 2001 and sampled for all regulated constituents as listed above. All inorganic parameters were either non detect or 50% below the MCL. Total trihalomethanes and haleoacetic acids were not detected. Total coliform was detected, but no E.coli were detected. SDWA regulations state that no more than 5% of monthly samples are to be detected. Radon was detected at 290 pCi/l, however this parameter is not regulated at this time.

4.5.2.2 Injection Water Quality

All regulated inorganic contaminants analyzed as part of the pilot testing were either non-detectable or were well below treated water standards. These constituents are noted by an asterisk in Table 4-5. Water quality results for the remaining regulated constituents as reported by DHS indicate that no regulated organic constituents were detected. Total

ASR1-C7GW

1/23/2008

ANALYSIS REPORT

C L I E N T
City of Tigard
Attn: Sally Mills
13125 SW Hall Blvd.
Tigard, Oregon 97223

Alexin Analytical Laboratories, Inc. — Professional Laboratory Services

Date Reported: 3/3/08
Date Sampled: 1/23/08
Date Received: 1/23/08
Job Number: **08023/08**

Project Name: ASR1-C7GW
Sampling Location: EP-C = ASR Well 1
Sample Composition: Raw, Source, Single

PWSID: 4100878

Geochemical

Lab Number: / Sample ID: / Analysis	Method	08023/08 EP-C = ASR Well 1 mg/L;ppm		Laboratory Reporting Limit mg/L;ppm	Date Analyzed
Bicarbonate	SM4500-CO2D	**80**		2	1/29/08
Calcium	SM 3111D	**16.9**		0.1	2/4/08
Carbonate	SM4500-CO2D	**ND**		2	1/29/08
Chloride	SM4500-Cl E	**3**		1	1/24/08
Hardness	EPA 130.2	**78**		4	1/24/08
Magnesium	EPA 200.7	**7.57**		0.05	1/29/08
Nitrate	SM4500-NO3 D	**1.5**		0.5	1/23/08 4:16pm
Nitrate&Nitrite	-	**1.5**		0.01	-
Nitrite	SM4500-NO2 B	**ND**		0.01	1/24/08 5:00pm
Potassium	SM 3111B	**2.1**		0.1	2/6/08
Silica	EPA 370.1	**41.9**		0.2	1/25/08
Sodium	SM 3111B	**7.3**		0.1	2/12/08
Sulfate*	EPA 300.0	**2.94**		1.00	1/24/08
		total	**dissolved**		
Iron	SM3111B	**ND**	**ND**	0.05	2/4/08
		total	**dissolved**		
Manganese	SM3111B	**ND**	**ND**	0.02	2/8/08
Total Alkalinity	EPA 310.1	**80**		2	1/29/08
Total Dissolved Solids	EPA 160.1	**136**		1	1/24/08
Total Suspended Solids	EPA 160.2	**ND**		2	1/25/08
Total Organic Carbon	SM 5310 C	**3.08**		0.50	1/23/08

This report reflects the results for this sample only

ND=None Detected

This sample shall not be reproduced, except in full, without the written approval of the laboratory.

* Analyzed at Umpqua Research
626 Division St., Myrtle Creek, OR 97457
ORELAP ID#OR100031, contact: Lisa Leming

ANALYSIS REPORT

Analysis by: ORELAP ID#OR100013

Alexin Analytical LABORATORIES, INC.

Professional Laboratory Services

C L I E N T

City of Tigard
Attn: Sally Mills
13125 SW Hall Blvd.
Tigard, Oregon 97223

Date Reported: 3/3/08
Date Sampled: 1/23/08
Date Received: 1/23/08
Job Number: **08023/08**
Page: 2 of 4

PWSID: 4100878

Project Name: ASR1-C7GW
Sampling Location: EP-C = ASR Well 1
Sample Composition: Raw, Source, Single

Misc.

Sample ID: / Client ID:		08023/08 **EP-C = ASR Well 1**	Laboratory Reporting Limit	Date Analyzed
Analysis	Method	mg/L;ppm	mg/L;ppm	
Corrosivity	SM2330B	**-0.74** ✓ **Moderately Aggressive**		1/29/08
Fluoride	SM4500-F C	**ND** ✓	0.5	1/24/08
Odor	SM2150-B	**ND** ✓	1 TON	1/23/08
Cyanide(free)	SM4500 CN-E	**ND** ✓	0.02	1/30/08
Chlorine	EPA330.5	**ND** ✓	0.1	1/23/08

ND=None Detected
TON=threshhold odor number

ND=None Detected

ANALYSIS REPORT

Analysis by: Truesdail Laboratories CA#062

Alexin Analytical LABORATORIES, INC. Professional Laboratory Services

C
L City of Tigard
I Attn: Sally Mills
E 13125 SW Hall Blvd.
N Tigard, Oregon 97223
T

Date Reported: 3/3/08
Date Sampled: 1/23/08
Date Received: 1/23/08
Date Analyzed: 1/24/08
Job Number: **08023/08**
Page: 3 of 4

Project Name: ASR1-C7GW
Sampling Location: EP-C = ASR Well 1
Sample Composition: Raw, Source, Single

Radon Analysis per SM7500-Rn

Lab #	EPA Code	Client ID	**Results**	Two Sigma Error
			pCi/L	pCi/L
08023/08	4004	EP-C = ASR Well 1	**358**	+/- 24

EPA proposed radon standard is 300 pCi/L for community water systems that use ground water.

Analysis by Truesdail Laboratories, Inc. 14201 Franklin Ave. Tustin, CA 714-730-6239
Contact: Rossina Tomova

This report reflects the results for this sample only.

This report shall not be reproduced, except in full, without the written approval of the laboratory.

ANALYSIS REPORT

Alexin Analytical Laboratories, Inc.
Professional Laboratory Services

CLIENT

City of Tigard
Attn: Sally Mills
13125 SW Hall Blvd.
Tigard, Oregon 97223

Date Reported: 3/12/08
Date Sampled: 1/23/08
Date Received: 1/23/08
Job Number: **08023/08**

Project Name: ASR1-C7GW
Sampling Location: EP-C = ASR Well 1
Sample Composition:Raw, Source, Single

Charge Balance

Sample ID:		ASR1-C7GW
Analysis	**Cations**	meq/L
Calcium		0.8433
Magnesium		0.6229
Potassium		0.0537
Sodium		0.3176
Total		1.8375
	Anions	
Chloride		0.0846
Nitrate		0.0242
Nitrite		<0.0002
Carbonate		<0.0666
Bicarbonate		1.3112
Sulfate		0.0612
Total		1.4812

Approved By:

Scott Dickman
Inorganic Technical Director

ORELAP # OR100013

Alexin Analytical LABORATORIES, INC.

Professional Laboratory Services

Total Trihalomethanes and Haloacetic Acids

Date Reported:	2/6/2008	**Job Number:**	08023/08	**Page 1 of 1**
System ID #:	4100878			
Water System	City of Tigard	Attn:	Sally Mills	
Address	13125 SW Hall Blvd	Project Name:	ASR1-C7GW	
City, State, Zip	Tigard, OR 97223	Sample Composition:	Raw/Source/Single	

SAMPLE IDENTIFICATION:	(Listed below sample results)		
Sampled by:		Date Collected:	1/23/2008
Date Received in Lab:	1/23/2008	Date Analyzed: THM: 1/23/08 HAA: 2/5/08	
Lab sample ID#:	**(Listed below)**	Analyst: THM: bc HAA: bc	

TRIHALOMETHANES	Method: EPA 524.2	Sample Results (mg/L)			
	MRL (mg/L)	**#1 - 08023/08**			
$CHCl_3$ (Chloroform)	0.0010	**0.0126**			
$CHBrCl_2$ (Bromodichloromethane)	0.0010	**0.0011**			
$CHBr_2Cl$ (Dibromochloromethane)	0.0010	**ND**			
$CHBr_3$ (Bromoform)	0.0010	**ND**			
Total THM (2950)		**0.0137** ✓			
Max. Contaminant Level	0.0800 mg/L				

HALOACETIC ACIDS	Method: SM 6251B	Sample Results (mg/L)			
	MRL (mg/L)	**#1 - 08023/08**			
MCAA (Monochloroacetic acid)	0.0020	**ND**			
DCAA (Dichloroacetic acid)	0.0010	**ND**			
MBAA (Monobromoacetic Acid)	0.0010	**ND**			
TCAA (Trichloroacetic acid)	0.0010	**ND**			
DBAA (Dibromoacetic acid)	0.0010	**ND**			
Total HAA5 (2456)		**ND** ✓			
Max. Contaminant Level	0.0600 mg/L				

Client ID: **#1:** EP-C: ASR Well 1

ND = None Detected
MRL = Minimum Reporting Level

Analyst Notes:

Reported by: [signature]
Brandon Canfield, Ph.D.
Organic Technical Director

Reviewed by: [signature]
Scott Dickman
Lab Director

All procedures for this report conform to NELAC standards

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CHAIN OF CUSTODY RECORD

Alexin Analytical Laboratories, Inc.
13035 SW Pacific Hwy.
Tigard, OR 97223

Tel. 503-639-9311
Fax 503-684-1588

Date Received:
Project Manager: Sally U. Mills
Company Name: City of Tigard OR
Address: 13125 SW Hall Blvd
City, State, ZIP: Tigard, OR 97223
Phone: (503)718-2604
FAX: (503)684-8840

Lab Project Number: 08023/08

P.O. # or Project #:
Project Name: ASR1-C7GW
Sampling Location: EP-C: ASR Well 1
Sampling Date/Time: ✱ 1 Sampled By:
Sample Composition: Raw or Treated Source or Distribution / Single or Combined
Send to OR St. Health Div* (Please Circle) Yes No

Sample Integrity Check: Pass Fail

RUSH? YES NO
Prior authorization is required

PWSID #: 4100878

LAB USE ONLY	SAMPLE IDENTIFICATION	SAMPLE TYPE	ANALYSIS REQUIRED
08023/08	1 EP-C: ASR Well 1	DW	General Chemistry
	2		DBPs
	3		Misc.
	4 Temp = 10.65°C		(See attached bottle
	5 S.C. = 200		order for specifics)
	6 D.O. = 10.2		
	7 pH = 7.56		
	8 ORP = 375.8		
	9 ✱Please send original to		
	10 Tigard: Attention Sally Mills		
	11 and another copy to		
	12 GSI: Attention Ted Ressler		
	13 ✱ sample date is 1/23/08 as per	Sally Mills	-US 3/3/08

Note: FAILURE TO FILL OUT ENTIRE CHAIN OF CUSTODY MAY RESULT IN REJECTION OF SAMPLES.

LAB USE ONLY
Additional Analyses: The portion of the sample was filtered through 0.45um filter for Fe & Mn dissol. **# of Bottles:**
Requested By: 01/23/08 LD
Date:

Relinquished By	Date/Time	Received By	Date/Time
S. Mills	01/23/08 11:06	[signature]	1/23/08 1106
		V. Angert	1/23/08 12:30pm

* Exceptions-DBP's and TOC 's

CHAIN OF CUSTODY RECORD

Alexin Analytical Laboratories, Inc.
13035 SW Pacific Hwy.
Tigard, OR 97223

Tel. 503-639-9311
Fax 503-684-1588

Date Received:
Project Manager: Sally W. Mills
Company Name: City of Tigard OR
Address: 13125 SW Hall Blvd
City, State, ZIP: Tigard, OR 97223
Phone: (503)718-2604
FAX: (503)684-8840

Lab Project Number

P.O. # or Project #:
Project Name: ASR1-C7GW
Sampling Location: EP-C: ASR Well 1
Sampling Date/Time: 01/23/08 Sampled By: S. Mills
Sample Composition: Raw or Treated / Source or Distribution / Single or Combined
Send to OR St. Health Div* (Please Circle) Yes No
PWSID #: 4100878

Sample Integrity Check
Pass Fail

RUSH? YES NO
Prior authorization is required

LAB USE ONLY	SAMPLE IDENTIFICATION	SAMPLE TYPE	ANALYSIS REQUIRED
	1 EP-C: ASR Well 1	DW	General Chemistry
	2		DBPs
	3		Misc.
	4 Temp = 10.65°C		(See attached bottle
	5 S.C. = 200		order for specifics)
	6 D.O. = 10.2 mg/L		
	7 pH = 7.56		
	8 ORP = 375.8 mV		
	9 *Please send original to		
	10 Tigard: Attention Sally Mills		
	11 and another copy to		
	12 GSI: Attention Ted Ressler		
	13		

Note: FAILURE TO FILL OUT ENTIRE CHAIN OF CUSTODY MAY RESULT IN REJECTION OF SAMPLES.

LAB USE ONLY
Additional Analyses: **# of Bottles:**
Requested By:
Date:

Relinquished By	Date/Time	Received By	Date/Time
S. Mills	01/23/08 11:06	[signature]	1/23/08 1106
Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

* Exceptions-DBP's and TOC 's

Bottle Order

Client contact:
Ted Ressler (503) 239-8799 x106
tressler@gsiwatersolutions.com

GSI Water Solutions, Inc.
55 SW Yamhill Street, Suite 400 Portland, OR 97204
P: 503.239.8799 F: 503.239.8940
info@gsiwatersolutions.com www.gsiwatersolutions.com

Analytical laboratory: Alexin Analytical (503) 639-9311

Date submitted to laboratory: November 15, 2007

Date bottle set needed: November 19, 2007

ASR 1 ***Baseline Groundwater***
FP, GC, DBP, Radon

Sample ID:	**ASR1-C7GW**

Analyte List

	Analyte	Requested Detection Limit	
General Chemistry	Bicarbonate		
	Calcium		
	Carbonate		
	Chloride	≤ 250	mg/L
	Hardness (as CaCO3)	≤ 250	mg/L
	Magnesium		
	Nitrate as N	≤ 10	mg/L
	Nitrite as N	≤ 1	mg/L
	Total Nitrate-Nitrite	≤ 10	mg/L
	Potassium		
	Silica		
	Sodium	≤ 20	mg/L
	Sulfate	≤ 1**	mg/L
	Iron (Total)		
	Iron (Dissolved)	≤ 0.3	mg/L
	Manganese (Total)		
	Manganese (Dissolved)	≤ 0.05	mg/L
	Total Alkalinity	≤ 250	mg/L
	Total Dissolved Solid	≤ 500	mg/L
	Total Organic Carbon		
	Total Suspended Solids		
Disinfection By-Products	Chloroform (Trichloromethane)		
	Bromodichloromethane		
	Dibromochloromethane		
	Bromoform (Tribromomethane)		
	Total Trihalomethanes	≤ 0.08	mg/L
	Monochloroacetic Acid		
	Dichloroacetic Acid		
	Trichloroacetic Acid		
	Monobromoacetic Acid		
	Dibromoacetic Acid		
	Total Haloacetic Acids	≤ 0.06	mg/L
Misc.	Odor		
	Chlorine (as Cl_2)	≤ 4	mg/L
	Corrosivity (Langelier Saturation Index)		
	Charge balance of analysis using major ions		
	Cyanide (as free cyanide)	≤ 0.2	mg/l
	Fluoride	≤ 2	mg/L
	Radon		

**** Send out for analysis per phone conversation with S. Dickman**

ASR1-C7GW-2

5/6/2008

ANALYSIS REPORT

CLIENT
City of Tigard
Attn: Sally Mills
13125 SW Hall Blvd.
Tigard, Oregon 97223

phone: 503-718-2604

Alexin Analytical LABORATORIES, INC. Professional Laboratory Services

Analysis by: ORELAP ID #OR100031

P.O. #: ASR1-C7R1
Sampling Location: EP-C: ASR Well #1
Sample Composition: Raw, Source, Single
Sampled By: Sally Mills

Date Reported: 6/18/08
Date Sampled: 5/6/08 2:15pm
Date Received: 5/6/08
Job Number: **08127/24**

PWSID #: 4100878

Regulated Synthetic Organic Compounds

FRDS#	COMPOUND	RESULT mg/L	MCL mg/L	MRL mg/L	EPA Method	FRDS#	COMPOUND	RESULT mg/L	MCL mg/L	MRL mg/L	EPA Method
2946	EDB	ND	0.00005	0.00001	504.1	2383	Polychlorinatedbiphenyls-PC	ND	0.0005	0.00002	508.1
2931	DBCP	ND	0.0002	0.00002	504.1	2031	Dalapon	ND	0.2	0.002	515.3
2051	Alachlor (Lasso)	ND	0.002	0.0004	525.2	2041	Dinoseb	ND	0.007	0.00040	515.2
2050	Atrazine	ND	0.003	0.0002	525.2	2326	Pentachlorophenol	ND	0.001	0.00008	515.2
2037	Simazine	ND	0.004	0.0001	525.2	2040	Picloram	ND	0.5	0.00020	515.2
2959	Chlordane	ND	0.002	0.00004	508.1	2105	2,4-D	ND	0.07	0.00020	515.2
2005	Endrin	ND	0.002	0.00002	525.2	2110	2,4,5-TP (Silvex)	ND	0.05	0.00040	515.2
2065	Heptachlor	ND	0.0004	0.00004	525.2	2306	Benzo(a)pyrene	ND	0.0002	0.00004	525.2
2067	Heptachlor Epoxide	ND	0.0002	0.00002	525.2	2035	Bis(2-ethylhexyl)adipate	ND	0.4	0.001	525.2
2274	Hexachlorobenzene	ND	0.001	0.0001	525.2	2039	Bis(2-ethylhexyl)phthalate	ND	0.006	0.001	525.2
2042	Hexachlorocyclopentadi	ND	0.05	0.0002	525.2	2046	Carbofuran	ND	0.04	0.001	531.1
2010	BHC-gamma (Lindan	ND	0.0002	0.00002	525.2	2036	Vydate (Oxamyl)	ND	0.2	0.002	531.1
2015	Methoxychlor	ND	0.04	0.0002	525.2	2034	Glyphosate	ND	0.7	0.010	547
2020	Toxaphene	ND	0.003	0.0001	508.1	2033	Endothall	ND	0.1	0.010	548.1
						2032	Diquat	ND	0.02	0.0004	549.2

Unregulated Synthetic Organic Compounds

FRDS#	COMPOUND	RESULT mg/L		MRL mg/L	EPA Method	FRDS#	COMPOUND	RESULT mg/L		MRL mg/L	EPA Method
2076	Butachlor	ND		0.0001	525.2	2047	Aldicarb	ND		0.002	531.1
2045	Metolachlor	ND		0.0002	525.2	2044	Aldicarb Sulfone	ND		0.001	531.1
2595	Metribuzin	ND		0.0001	525.2	2043	Aldicarb Sulfoxide	ND		0.003	531.1
2356	Aldrin	ND		0.0001	525.2	2021	Carbaryl	ND		0.004	531.1
2070	Dieldrin	ND		0.0001	525.2	2066	3-Hydroxycarbofuran	ND		0.004	531.1
2077	Propachlor	ND		0.0001	525.2	2022	Methomyl	ND		0.004	531.1
2440	Dicamba	ND		0.00050	515.2						

EPA Method	Analysis Date
504.1	5/8/08
508.1	5/28/08
515.2	5/14/08
515.3	5/21/08
525.2	5/23/08

EPA Method	Analysis Date
531.1	5/16/08
547	5/21/08
548.1	5/24/08
549.2	5/27/08

ND=None Detected
MCL=Maximum Contaminant Level
MRL=Method Reporting Limit

UMPQUA RESEARCH COMPANY**
Reported By

** 626 Division St., Myrtle Creek, OR 97457 Contact: Lisa Leming (541) 863-5201

* Written on bottles only, not on Chain of Custody.

ANALYSIS REPORT

Alexin Analytical Laboratories, Inc. — Professional Laboratory Services

C L I E N T
City of Tigard
Attn: Sally Mills
13125 SW Hall Blvd.
Tigard, Oregon 97223

phone: 503-718-2604

Analysis by: ORELAP ID#: OR100013

Date Reported: 6/18/08
Date Sampled: 5/6/08 2:15pm
Date Received: 5/6/08
Job Number: **08127/24**

PWSID: 4100878

P.O. #: ASR1-C7R1
Sampling Location: EP-C: ASR Well #1
Sample Composition: Raw, Source, Single
Sampled By: Sally Mills

Inorganic Compounds

Laboratory Sample #			**Results** 08127/24	Maximum Contaminant Level	Method Reporting Limit	Date
Contaminant	Code	Method	mg/L (ppm)	mg/L (ppm)	mg/L (ppm)	Analyzed
Total Antimony	1074	EPA 200.9	**ND**	0.006	0.001	5/12/08
Total Arsenic	1005	EPA 200.9	**ND**	0.01	0.003	5/9/08
Total Barium	1010	EPA 200.7	**ND**	2	0.02	5/14/08
Total Beryllium	1075	EPA 200.7	**ND**	0.004	0.001	5/14/08
Total Cadmium	1015	SM 3113B	**ND**	0.005	0.0005	5/13/08
Total Chromium	1020	EPA 200.7	**ND**	0.1	0.01	5/14/08
Total Lead	1022	EPA 200.9	**ND**	0.015	0.002	5/7/08
Total Mercury	1030	EPA 245.1	**ND**	0.002	0.0003	5/23/08
Total Nickel	1035	EPA 200.7	**ND**	0.1	0.02	5/14/08
Total Selenium	1036	EPA 200.9	**ND**	0.05	0.005	5/12/08
Total Thallium	1045	EPA 200.9	**ND**	0.002	0.001	5/8/08
Total Sodium**	1052	SM 3111B	**7.0**	20.0*	0.1	5/13/08
Fluoride	1025	SM4500-F C	**ND**	4	0.5	5/12/08
Nitrate	1040	SM4500-NO3 D	**2.5**	10	0.5	5/6/08 4:24pm
Nitrite	1041	SM4500-NO2 B	**ND**	1	0.01	5/7/08 10:20am
Cyanide	1024	SM4500-CN C/E	**ND**	0.2	0.02	5/14-15/08

*recommended

** Analyte not accredited by NELAC
ND=None Detected

This report reflects the results for this sample only.
All procedures utilized for this report conform to NELAC standards.
This report shall not be reproduced, except in full, without the written approval of the laboratory.

ANALYSIS REPORT

Alexin Analytical Laboratories, Inc.
Professional Laboratory Services

CLIENT
City of Tigard
Attn: Sally Mills
13125 SW Hall Blvd.
Tigard, Oregon 97223

PWSID: 4100878

Date Reported: 6/18/08
Date Sampled: 5/6/08 2:15pm
Date Received: 5/6/08
Job Number: **08127/24**

P.O. #: ASR1-C7R1
Sampling Location: EP-C: ASR Well #1
Sample Composition: Raw, Source, Single
Sampled By: Sally Mills

phone: 503-718-2604
fax: 503-684-8840

Laboratory Sample # / Client Identification / Contaminant	Code	Method	Results 08127/24 EP-C: ASR Well #1 mg/L (ppm)	SMCL mg/L (ppm)	Method Reporting Limit mg/L (ppm)
Alkalinity	1067	EPA 310.1	**76**	-	2
Bicarbonate	-	SM4500-CO2 D	**76**	-	2
Carbonate	-	SM4500-CO2 D	**ND**	-	2
Chloride	1017	SM4500-Cl E	**4**	250	1
Corrosivity	1910	Calc.	**-1.21** Moderately Aggressive	Non Aggressive	
Hardness	1916	EPA 130.2	**82**	250	4
Nitrate	1040	SM4500-NO3 D	**2.5**	10	0.5
Nitrate & Nitrite	-	calc.	**2.5**	10	0.01
Nitrite	1041	SM4500-NO2 B	**ND**	1	0.01
Silica	1049	EPA 370.1	**41.8**	-	0.2
Sulfate*	1055	EPA 300.0	**3.46**	250	1.00
Total Dissolved Solids	1930	EPA 160.1	**148**	500	1
Total Organic Carbon	2920	SM5310-C	**1.83**	-	0.50
Total Suspended Solids	1063	EPA 160.2	**ND**	2	2
Calcium	1919	SM3111D	**14.0**	-	0.2
Iron (total)	1028	SM 3111B	**ND**	0.3	0.05
Iron (dissolved)	1028	SM 3111B	**ND**	-	0.05
Magnesium	1031	EPA 200.7	**7.77**	-	0.05
Manganese (total)	1032	SM 3111B	**ND**	0.05	0.02
Manganese (dissolved)	1032	SM 3111B	**ND**	-	0.02
Potassium	1042	SM 3111B	**0.5**	-	0.1
Sodium	1052	SM 3111B	**6.9**	20	0.1

ND = None Detected

SMCL= Secondary Maximum Contaminant Level

This report reflects the results for this sample only.

This report shall not be reproduced, except in full, without the written approval of the laboratory.

Approved by:

Melanie Sanderson
Quality Assurance Director

*Analyzed at Umpqua Research Co.
626 Division St. Myrtle Creek, OR 97457
Contact Lisa Leming: (541) 863-5201

ANALYSIS REPORT

Alexin Analytical Laboratories, Inc. Professional Laboratory Services

Analysis by: ORELAP ID #: OR100013

C L I E N T

City of Tigard
Attn: Sally Mills
13125 SW Hall Blvd.
Tigard, Oregon 97223

phone: 503-718-2604

Date Reported: 5/23/08
Date Sampled: 5/6/08 14:15
Date Received: 5/6/08
Date Analyzed: 5/6/08 4:24pm
Lab Number: **08127/24**
Page: 1 of 1

PWSID#: 4100878

Project: ASR1-C7R1
Sample Location: EP-C: ASR Well #1
Sample Composition: Raw, Source, Single
Sampled By: Sally Mills
Sample Identification: EP-C: ASR Well #1

Sample ID Lab# / Analysis	EPA Code	Method	**Results** mg/L (ppm)	EPA Limit mg/L (ppm)	Laboratory Reporting Limit mg/L (ppm)
Nitrate	1040	SM4500-NO3 D	**2.5** **Passes**	10	0.5

All procedures utilized for this report conform to NELAC standards.

This report shall not be reproduced, except in full, without the written approval of the laboratory.

This report reflects the result for this sample only.

Approved By:

Scott Dickman
Inorganic Technical Director

ORELAP # OR100013

Alexin Analytical LABORATORIES, INC. Professional Laboratory Services

Volatile Organic Compounds

Date Reported:	5/7/2008	**Job Number:**	08127/24	Page 1 of 2
System ID #:	4100878	**Source ID:**	**ASR Well**	
Water System	City of Tigard	Attn:	Sally Mills	
Address	13125 SW Hall Blvd	Project Name:		
City, State, Zip	Tigard, OR 97223	Sample Composition:	Raw/Source/Single	
SAMPLE IDENTIFICATION:	Entry Point			
Sampled by:	Sally Mills	Date/Time Collected:	05/06/08	
Date Received in Lab:	5/6/2008	Date Analyzed:	5/6/2008	
Lab sample ID#	**08127/24**	Analyst: bc	**Method: 524.2**	

Regulated VOC

Contaminant	Code	MRL (mg/L)	Sample Results (mg/L)	MCL (mg/L)
Benzene	2990	0.0005	ND	0.0050
Carbon Tetrachloride	2982	0.0005	ND	0.0050
Chlorobenzene	2989	0.0005	ND	0.1000
1,2-Dichlorobenzene	2968	0.0005	ND	0.6000
1,4-Dichlorobenzene	2969	0.0005	ND	0.0750
1,2-Dichloroethane	2980	0.0005	ND	0.0050
1,1-Dichloroethylene	2977	0.0005	ND	0.0070
cis-1,2-Dichloroethylene	2380	0.0005	ND	0.0700
trans-1,2-Dichloroethylene	2979	0.0005	ND	0.1000
Dichloromethane	2964	0.0005	ND	0.0050
1,2-Dichloropropane	2983	0.0005	ND	0.0050
Ethylbenzene	2992	0.0005	ND	0.7000
Styrene	2996	0.0005	ND	0.1000
Tetrachloroethylene	2987	0.0005	ND	0.0050
Toluene	2991	0.0005	ND	1.0000
1,2,4-Trichlorobenzene	2378	0.0005	ND	0.0700
1,1,1-Trichloroethane	2981	0.0005	ND	0.2000
1,1,2-Trichloroethane	2985	0.0005	ND	0.0050
Trichloroethylene	2984	0.0005	ND	0.0050
Vinyl Chloride	2976	0.0005	ND	0.0020
Xylenes, total	2955	0.0005	ND	10.0000

ND = None Detected

MRL = Minimum Reporting Level

Analyst Notes:

Reported by: Brandon Canfield, Ph.D. Organic Technical Director

Reviewed by: Scott Dickman Lab Director

All procedures for this report conform to NELAC standards

This report shall not be reproduced, except in full, without the written approval of the laboratory

ORELAP # OR100013

Alexin Analytical Laboratories, Inc.

Professional Laboratory Services

Volatile Organic Compounds

Date Reported:	5/7/2008	Job Number: 08127/24	
System ID #:	4100878	Source ID: ASR Well	
Water System	City of Tigard	Attn: Sally Mills	
Address	13125 SW Hall Blvd	Project Name:	
City, State, Zip	Tigard, OR 97223	Sample Composition: Raw/Source/Single	
SAMPLE IDENTIFICATION:	Entry Point		
Sampled by:	Sally Mills	Date/Time Collected:	05/06/08
Date Received in Lab:	5/6/2008	Date Analyzed:	5/6/2008
Lab sample ID#:	08127/24	Analyst: bc	Method: 524.2

Unregulated VOC

Contaminant	MRL (mg/L)	Sample Results (mg/L)
Bromobenzene	0.0005	ND
Bromochloromethane	0.0005	ND
Bromodichloromethane	0.0005	**0.0009**
Bromoform	0.0005	ND
Bromomethane	0.0005	ND
n-Butylbenzene	0.0005	ND
sec-Butylbenzene	0.0005	ND
tert-Butylbenzene	0.0005	ND
tert-Butyl methyl ether (MTBE)	0.0005	ND
Chloroethane	0.0005	ND
Chloroform	0.0005	**0.0078**
Chloromethane	0.0005	ND
2-Chlorotoluene	0.0005	ND
4-Chlorotoluene	0.0005	ND
Dibromochloromethane	0.0005	ND
Dibromomethane	0.0005	ND
1,3-Dichlorobenzene	0.0005	ND
Dichlorodifluoromethane	0.0005	ND
1,1-Dichloroethane	0.0005	ND
1,3-Dichloropropane	0.0005	ND
2,2-Dichloropropane	0.0005	ND
cis-1,3-Dichloropropene	0.0005	ND
trans-1,3-Dichloropropene	0.0005	ND
Fluorotrichloromethane	0.0005	ND
Hexachlorobutadiene	0.0005	ND
Isopropylbenzene	0.0005	ND
4-Isopropyltoluene	0.0005	ND
Naphthalene	0.0005	ND
n-Propylbenzene	0.0005	ND
1,1,1,2-Tetrachloroethane	0.0005	ND
1,1,2,2-Tetrachloroethane	0.0005	ND
1,2,3-Trichlorobenzene	0.0005	ND
1,2,3-Trichloropropane	0.0005	ND
1,2,4-Trimethylbenzene	0.0005	ND
1,3,5-Trimethylbenzene	0.0005	ND

ND = None Detected MRL = Minimum Reporting Level

Analyst Notes:

Reported by: Brandon Canfield, Ph D, Organic Technical Director

Reviewed by: Scott Dickman, Lab Director

All procedures for this report conform to NELAC standards

This report shall not be reproduced, except in full, without the written approval of the laboratory

ANALYSIS REPORT

Alexin Analytical LABORATORIES, INC.
Professional Laboratory Services

Analysis by: ORELAP #WY200001

CLIENT
City of Tigard
Attn: Sally Mills
13125 SW Hall Blvd.
Tigard, Oregon 97223

phone: 503-718-2604

Date Reported: 6/18/08
Date Sampled: 5/6/08 2:15pm
Date Received: 5/6/08
Job Number: **08127/24**
Page: 1 of 1

JUN 25 2008

PWSID: 4100878

Source: ASR Well #1
Sampled At: EP to EP-C
Sample Composition: Raw, Source, Single
Sampled By: Sally Mills

Analysis	EPA Code	Method	**Results** pCi/L	Laboratory Reporting Limit pCi/L	EPA Limit pCi/L
Gross Alpha	4000	E900.0	**ND**	1.0	15
Radium226/228	4010	E903.0 & RA-05	**ND**	0.7	5
Gross Beta	4100	E900.0	**ND**	1.5	50

Analysis	EPA Code	Method	**Results** mg/L	Laboratory Reporting Limit mg/L	EPA Limit mg/L
Uranium	4006	E200.8	**ND**	0.001	0.03

ND = None Detected

Analysis by Energy Laboratories, Inc. 2393 Salt Creek Hwy. Casper, WY 82601
Contact: Roger Garling 888-235-0515

This report reflects the results for this sample only.

This report shall not be reproduced, except in full, without the written approval of the laboratory.

Reviewed By:

Melanie Sanderson
Quality Assurance Director

CHAIN OF CUSTODY RECORD

Alexin Analytical Laboratories, Inc.
13035 SW Pacific Hwy.
Tigard, OR 97223

Tel. 503-639-9311
Fax 503-684-1588

Date Received:

MAILING ADDRESS

Project Manager: Sally Mills
Company Name: City of Tigard
Address: 13125 SW Hall Blvd.
City, State, ZIP: Tigard, OR 97223
Phone: (503) 718.2604
FAX: (503) 684.8840

P.O. # or Project #: ASR1-C7R1
Project Name:
Sampling Location: EP-C: ASR Well #1
Sampling Date/Time: 05.06.08 14:15
Sampled By: Sally Mills
Sample Composition: (Raw) or Treated (Source) or Distribution (Single) or Combined
Send to OR St. Health Div*
(Please Circle) Yes (No)
PWSID #: 4100878

Alexin Project Number: 08127/24

Sample Integrity Check: (Pass) Fail

LAB USE ONLY	SAMPLE IDENTIFICATION	SAMPLE TYPE	ANALYSIS REQUIRED
	1 EP-C: ASR Well #1	DW	Phase II & V
	2		Radiologicals
	3		General Chemistry (see
	4		attached bottle order)
	5 Temp = 10.66°C		
	6 Cond: 192		
	7 DO: 5.43		
	8 pH: 7.20		
	9 ORP: 164.7		
	10		
	11		
	12 The portion of the sample is filtered through 0.45um filter		
	13 for dissolved Fe, Mn test.	05/06/08	LD

Note: FAILURE TO FILL OUT ENTIRE CHAIN OF CUSTODY MAY RESULT IN REJECTION OF SAMPLES.

Relinquished By	Date/Time	Received By	Date/Time
S. Mills	05.06.08 14:40	K. Wheeler	5/6/08 2[42]
Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

I understand that if the analyses I have requested the laboratory to perform are not NELAC accredited, or if the sample and/or it's container do not meet NELAC standards, no claim to NELAC certification will be acknowledged on the written report.

Client's Initials

* Exceptions - DBP's and TOC's

Alexin Analytical LABORATORIES, INC.

Professional Laboratory Services

Chain of Custody
Public Drinking Water

To be COMPLETELY filled out by the Person submitting the sample

Analysis Requested: (Circle all that apply) **IOC** (circled) **SOC*** (circled) **VOC*** (circled) **Secondaries** **Other** ____________

PWS ID #: 41 00878 **Source (Well, Spring, etc.):** ASR Well

Water System City of Tigard

Attn: Sally Mills

Address 13125 SW Hall Blvd.

City, State, Zip Tigard, OR 97223

Phone: 503.718.2604 **Fax:** 503.684.8840

SAMPLE INFORMATION

Sampled at: Entry Point **Sampled by:** Sally Mills

Date Collected: 05.06.08 **Time Collected:** 14:15

Sample Composition: (circle one of each)

Raw (circled) **or Treated** | **Source** (circled) **or Distribution** | **Single** (circled) **or Combined**

Send to Oregon State Health Division **Yes** **No** (circled) **(Please Circle)**

To be completed by Laboratory

Lab Sample ID #: 08127/24

Sample Integrity Check: **Pass** **Fail**

Relinquished By: S. Mills **Date:** 05.06.08 **Received By:** K. Wheeler **Date:** 5/6/08

Relinquished By: ____________ **Date:** ______ **Received By:** ____________ **Date:** ______

*** Subcontracted**

NOTE: FAILURE TO FILL OUT CHAIN OF CUSTODY COMPLETELY MAY RESULT IN REJECTION OF SAMPLES

13035 SW Pacific Hwy. • Tigard, OR 97223 • Tel: (503) 639-9311 • Fax: (503) 684-1588

CHAIN OF CUSTODY RECORD

Alexin Analytical Laboratories, Inc.
13035 SW Pacific Hwy.
Tigard, OR 97223

Tel. 503-639-9311
Fax 503-684-1588

Date Received:

MAILINGS / ADDRESS

Project Manager: Sally Mills
Company Name: City of Tigard
Address: 13125 SW Hall Blvd.
City, State, ZIP: Tigard, OR 97223
Phone: (503) 718.2604
FAX: (503) 684.8840

P.O. # or Project #: ASR1-C7R1
Project Name:
Sampling Location: EP-C: ASR Well #1
Sampling Date/Time: 05.06.08 14:15
Sampled By: Sally Mills
Sample Composition: (Raw) or Treated (Source) or Distribution (Single) or Combined
Send to OR St. Health Div* (Please Circle) Yes (No)
PWSID #: 4100878

Alexin Project Number

Sample Integrity Check

Pass Fail

LAB USE ONLY	SAMPLE IDENTIFICATION	SAMPLE TYPE	ANALYSIS REQUIRED
	1 EP-C: ASR Well #1	DW	Phase II & V
	2		Radiologicals
	3		General Chemistry (see
	4		attached bottle order)
	5 Temp = 10.66°C		
	6 Cond: 192		
	7 DO: 5.43		
	8 pH: 7.20		
	9 ORP: 164.7		
	10		
	11		
	12		
	13		

Note: **FAILURE TO FILL OUT ENTIRE CHAIN OF CUSTODY MAY RESULT IN REJECTION OF SAMPLES.**

Relinquished By	Date/Time	Received By	Date/Time
S. Mills	05.06.08 14:40	K. Wheeler	5/6/08 2:42
Relinquished By	Date/Time	Received By	Date/Time
Relinquished By	Date/Time	Received By	Date/Time

I understand that if the analyses I have requested the laboratory to perform are not NELAC accredited, or if the sample and/or it's container do not meet NELAC standards, no claim to NELAC certification will be acknowledged on the written report.

Client's Initials

* Exceptions - DBP's and TOC's

Bottle Order

Client contact:
Ted Ressler (503) 239-8799 x106
tressler@gsiwatersolutions.com

GSI Water Solutions, Inc.

Analytical laboratory: Alexin Analytical (503) 639-9311
Date submitted to laboratory: April 25, 2008
Date bottle set needed: April 28, 2008

ASR 1

Native Groundwater Production
FP, GC

Sample ID: ASR1-C7R1

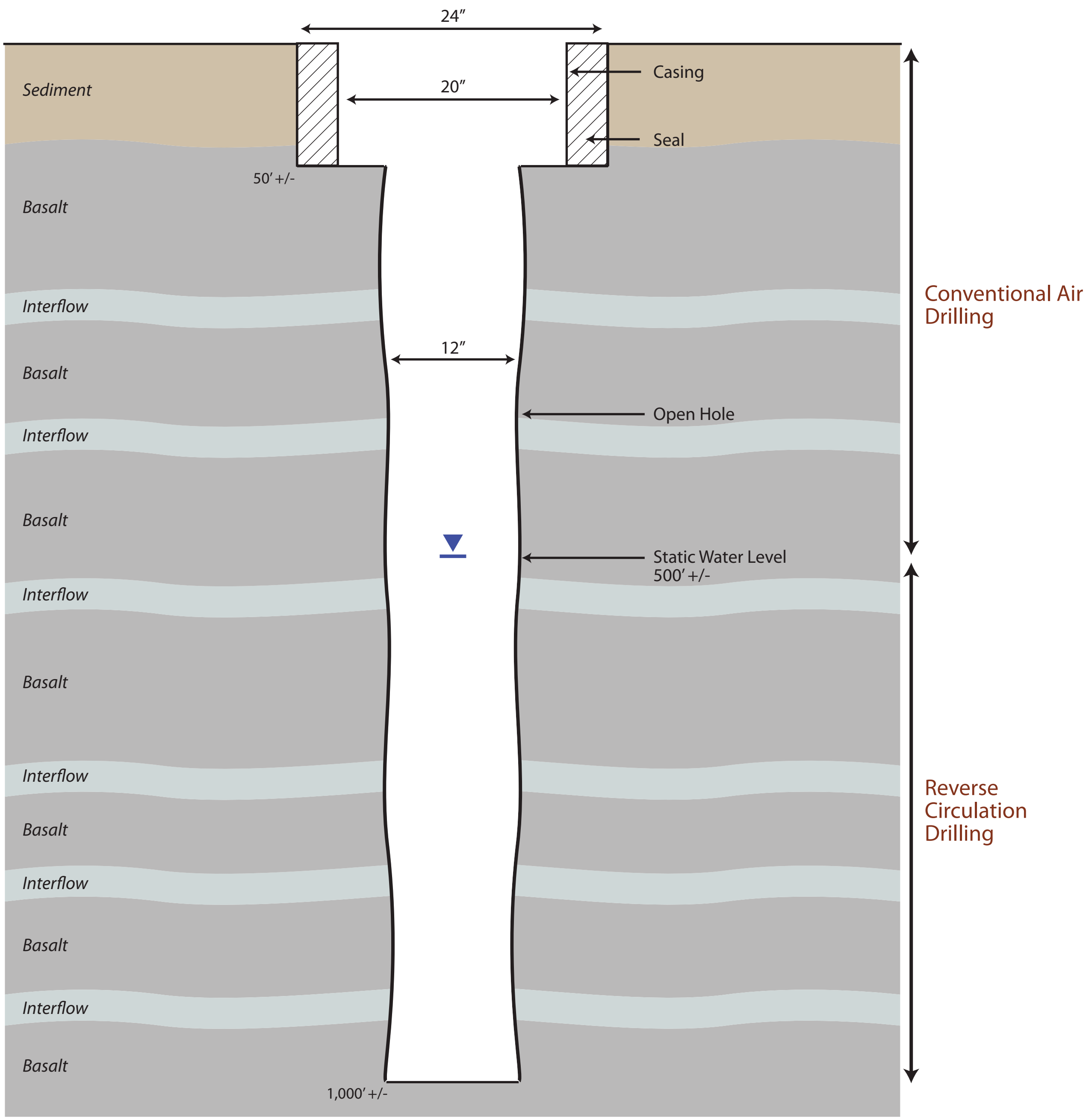
Analyte List

	Analyte	Requested Detection Limit	
General Chemistry	Bicarbonate Alkalinity		
	Calcium		
	Carbonate Alkalinity		
	Chloride	≤ 250	mg/L
	Hardness (as CaCO3)	≤ 250	mg/L
	Magnesium		
	Nitrate as N	≤ 10	mg/L
	Nitrite as N	≤ 1	mg/L
	Total Nitrate-Nitrite	≤ 10	mg/L
	Potassium		
	Silica		
	Sodium	≤ 20	mg/L
	Sulfate	**≤ 1****	mg/L
	Iron (Total)		
	Iron (Dissolved)	≤ 0.3	mg/L
	Manganese (Total)		
	Manganese (Dissolved)	≤ 0.05	mg/L
	Total Alkalinity	≤ 250	mg/L
	Total Dissolved Solid	≤ 500	mg/L
	Total Organic Carbon		
	Total Suspended Solids		
Misc	Corrosivity (Langelier Saturation Index)		
	Charge balance of analysis using major ions		

**** Send out for analysis per phone conversation with S. Dickman**

Appendix F

JWC Proposed ASR
Exploratory Well Approach



NOTES

1. Borehole large enough to support submersible pump at 1,000 gpm
2. Borehole can be reamed to production size 20 inch with 16 inch liner
3. Approach: reduces drilling costs based on discussions with Boart Longyear

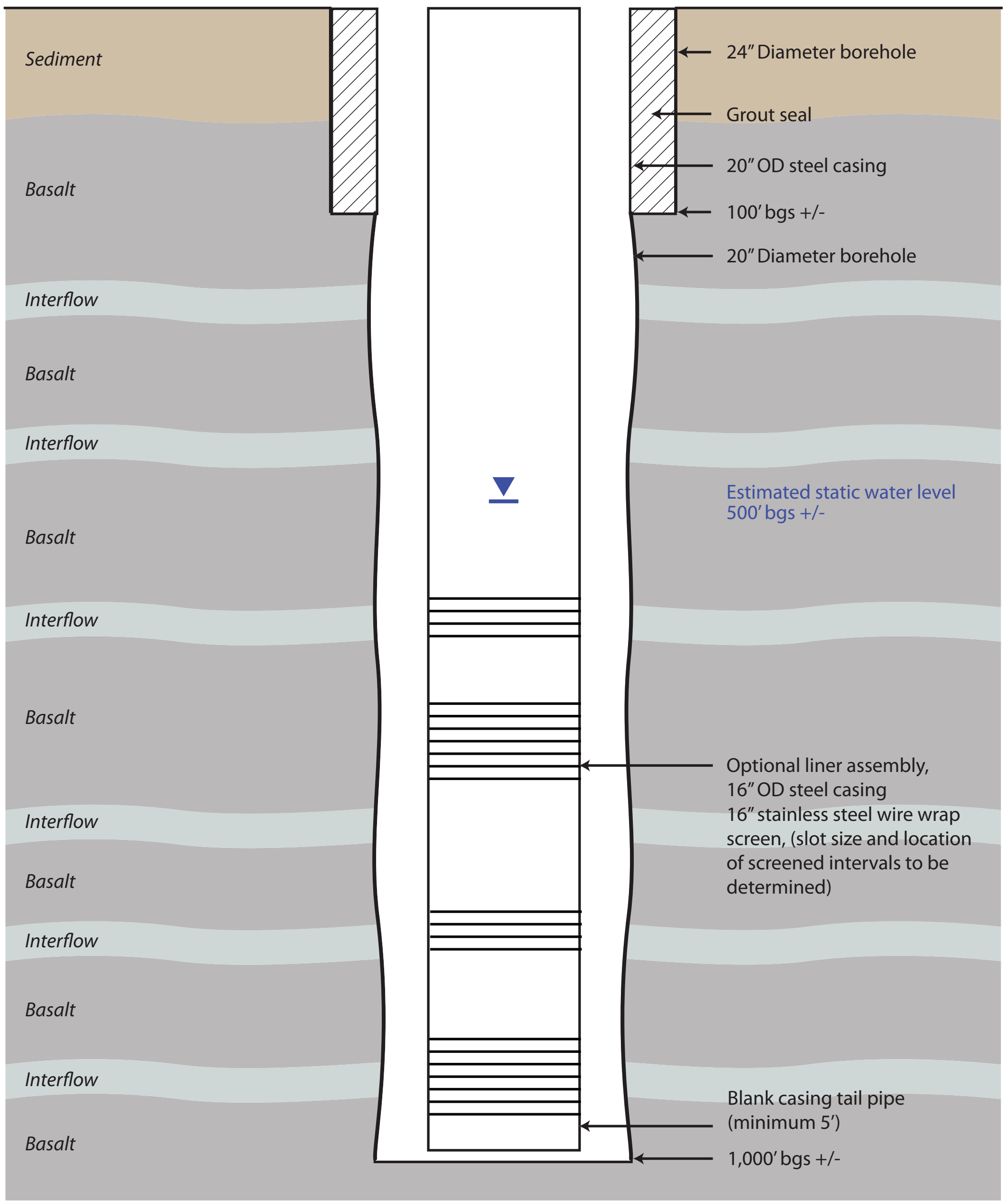
APPENDIX F

Exploratory Well Schematic

Joint Water Commission Limited License Application

GSI Water Solutions, Inc.

JWC Proposed ASR Well



NOTES

1. All depths are estimates and will be determined after drilling.
2. Depth and thickness of interflows are estimated.
3. Optional liner assembly based on Basalt coherency.

BGS - Below Ground surface
SWL - Static Water Level

APPENDIX F

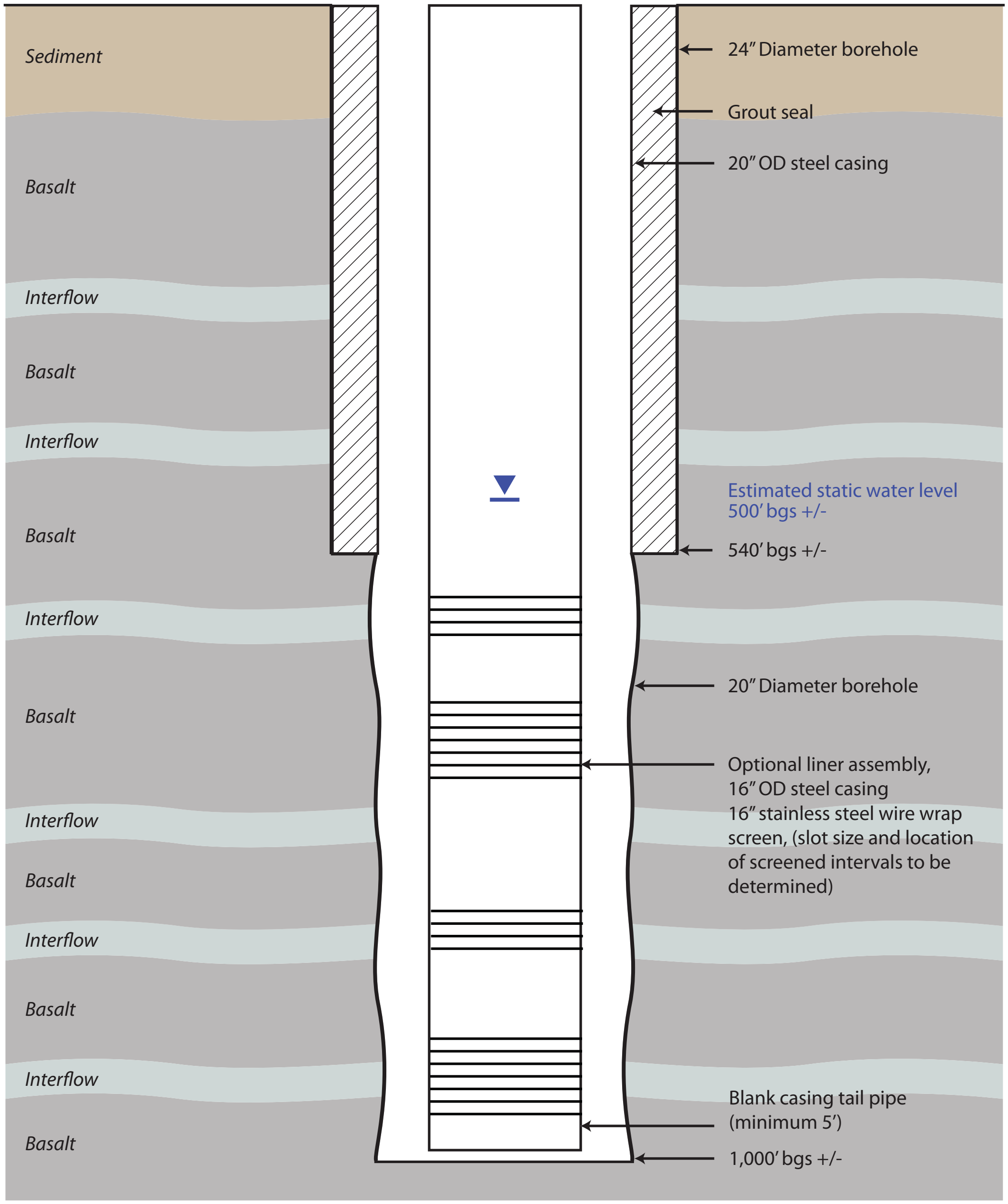
Proposed ASR Well Schematic
Scenario 1: Open to Unsaturated and Saturated Zones

Joint Water Commission Limited License Application

GSI Water Solutions, Inc.

P:\Portland\222 - HDR\006 - JWC ASR Phase I\Figures\LL

JWC Proposed ASR Well



NOTES

1. All depths are estimates and will be determined after drilling.
2. Depth and thickness of interflows are estimated.
3. Optional liner assembly based on Basalt coherency.

BGS - Below Ground surface
SWL - Static Water Level

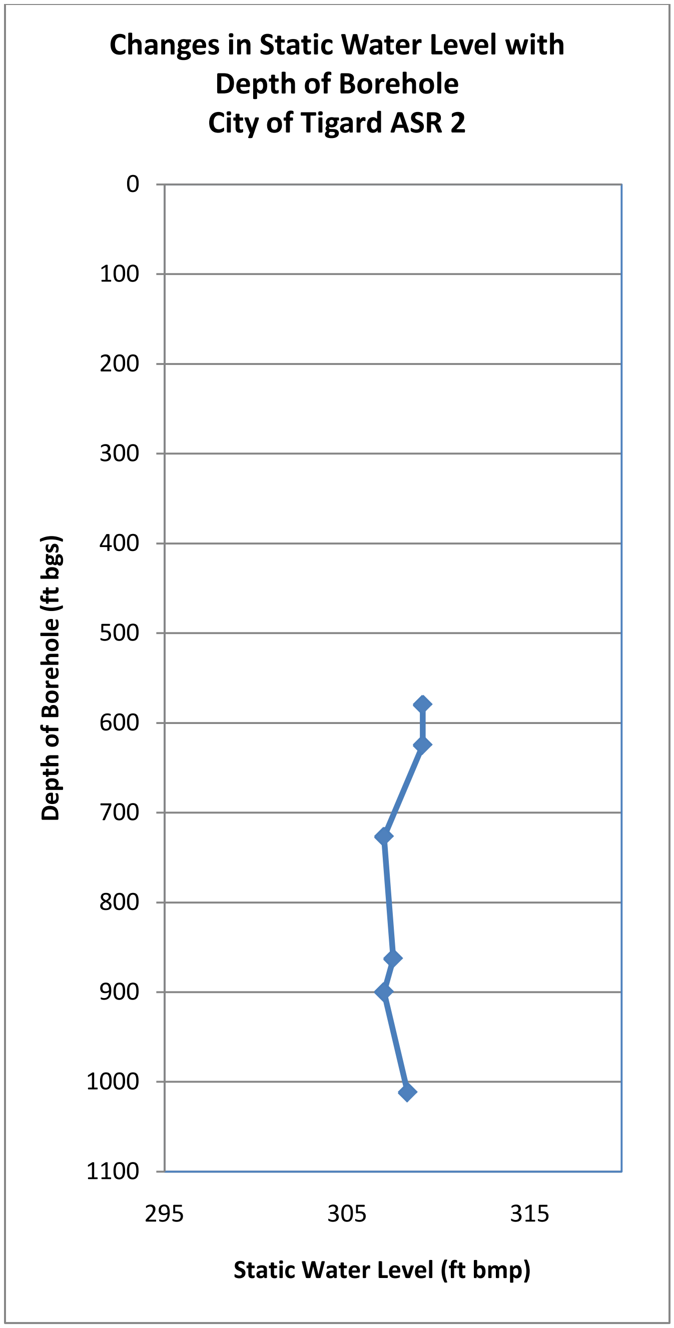
APPENDIX F

Proposed ASR Well Schematic
Scenario 2: Cased and Sealed Below SWL

Joint Water Commission Limited License Application

GSI Water Solutions, Inc.

P:\Portland\222 - HDR\006 - JWC ASR Phase I\Figures\LL



Appendix F

Changes in Static Water Level with Depth of Borehole

City of Tigard ASR 2

GSI Water Solutions, Inc.

Appendix G

STATE OF OREGON

COUNTY OF WASHINGTON

CERTIFICATE OF WATER RIGHT

THIS CERTIFICATE ISSUED TO

CITY OF HILLSBORO
123 WEST MAIN
HILLSBORO, OREGON 97123

confirms the right to use the waters of SAIN CREEK, a tributary of SCOGGINS CREEK, for MUNICIPAL SUPPLY.

This right was perfected under Permit 1136. The date of priority is JANUARY 22, 1912. The amount of water to which this right is entitled is limited to an amount actually beneficially used and shall not exceed 3.0 CUBIC FEET PER SECOND, or its equivalent in case of rotation, measured at the point of diversion from the source. The quantity of water diverted at the new point of diversion, shall not exceed the quantity of water available at the original point of diversion.

The points of diversion is located as follows:

SAIN CREEK (ORIGINAL POINT OF DIVERSION) - SW 1/4 SW 1/4, SECTION 14, TOWNSHIP 1 SOUTH, RANGE 5 WEST, W.M.; 1130 FEET NORTH FROM THE SW CORNER OF SECTION 14;

SCOGGINS CREEK (NEW POINT OF DIVERSION) - NE 1/4 NE 1/4, AS PROJECTED WITHIN MARTIN DLC 52, SECTION 20, TOWNSHIP 1 SOUTH, RANGE 4 WEST, W.M.; 707 FEET SOUTH AND 441 FEET WEST FROM THE NE CORNER OF SECTION 20;

TUALATIN RIVER REDIVERSION - SW 1/4 SW 1/4, SECTION 8, TOWNSHIP 1 SOUTH, RANGE 3 WEST, W.M.; 500 FEET NORTH AND 450 FEET EAST FROM THE SW CORNER OF SECTION 8.

The use shall conform to such reasonable rotation system as may be ordered by the proper state officer.

A description of the place of use to which this right is appurtenant is as follows:

THE CITY OF HILLSBORO
WASHINGTON COUNTY
OREGON

This is a final order in other than contested case. This order is subject to judicial review under ORS 183.484. Any petition for judicial review of the order must be filed within the 60 days of the date of service.

T-6308A.SB

Certificate Number 81026

Water may be applied to lands which are not specifically described above, provided the holder of this right complies with ORS 540.510(3).

If loss of water is determined by the Watermaster, for example seepage or evaporation, the rate of diversion at the new point of diversion shall be reduced by an amount equal to the losses between the old and new points of diversion, or appropriated under another water right.

The City of Hillsboro shall install and maintain a staff gage, an in-line flow meter, weir, or other suitable device for measuring and/or recording the quantity of water diverted at both the old and new points of diversion. The type and plans of the staff gage, headgate, and /or measuring devices must be approved by the Department prior to beginning construction and shall be installed under the general supervision of the Department.

This certificate is issued to confirm a change in POINT OF DIVERSION approved by an order of the Water Resources Director entered MARCH 28, 1991, and supersedes Certificate 1882, State Record of Water Right Certificates.

The issuance of this superseding certificate does not confirm the status of the water right in regard to the provisions of ORS 540.610 pertaining to forfeiture or abandonment.

The use confirmed herein may be made only at times when sufficient water is available to satisfy all prior rights, including rights for maintaining instream flows.

Issued December 16, 2004.

Phillip C. Ward, Director
Water Resources Department

Recorded in State Record of Water Right Certificates Number 81026.

T-6308A.SB

STATE OF OREGON

COUNTY OF WASHINGTON

CERTIFICATE OF WATER RIGHT

THIS CERTIFICATE ISSUED TO

CITY OF HILLSBORO
123 WEST MAIN
HILLSBORO, OREGON 97123

confirms the right to use the waters of SAIN CREEK, a tributary of SCOGGINS CREEK, for MUNICIPAL SUPPLY.

This right was perfected under Permit 2443. The date of priority is May 1, 1915. The amount of water to which this right is entitled is limited to an amount actually beneficially used and shall not exceed 2.0 CUBIC FEET PER SECOND, or its equivalent in case of rotation, measured at the point of diversion from the source. The quantity of water diverted at the new point of diversion, shall not exceed the quantity of water available at the original point of diversion.

The points of diversion is located as follows:

SAIN CREEK (ORIGINAL POINT OF DIVERSION) - SW 1/4 SW 1/4, SECTION 14, TOWNSHIP 1 SOUTH, RANGE 5 WEST, W.M.; 1130 FEET NORTH FROM THE SW CORNER OF SECTION 14;

SCOGGINS CREEK (NEW POINT OF DIVERSION) - NE 1/4 NE 1/4, AS PROJECTED WITHIN MARTIN DLC 52, SECTION 20, TOWNSHIP 1 SOUTH, RANGE 4 WEST, W.M.; 707 FEET SOUTH AND 441 FEET WEST FROM THE NE CORNER OF SECTION 20; AND

TUALATIN RIVER REDIVERSION - SW 1/4 SW 1/4, SECTION 8, TOWNSHIP 1 SOUTH, RANGE 3 WEST, W.M.; 500 FEET NORTH AND 450 FEET EAST FROM THE SW CORNER OF SECTION 8.

The use shall conform to such reasonable rotation system as may be ordered by the proper state officer.

A description of the place of use to which this right is appurtenant is as follows:

THE TOWNS OF GASTON, DILLEY, SOUTH FOREST GROVE, CORNELIUS, HILLSBORO, BEAVERTON, AS WELL AS THE TERRITORY BETWEEN SAID TOWNS AND VILLAGES, IN WASHINGTON COUNTY, OREGON

This is a final order in other than contested case. This order is subject to judicial review under ORS 183.484. Any petition for judicial review of the order must be filed within the 60 days of the date of service.

T-6308B.SB

Certificate Number 81027

Water may be applied to lands which are not specifically described above, provided the holder of this right complies with ORS 540.510(3).

If loss of water is determined by the Watermaster, for example seepage or evaporation, the rate of diversion at the new point of diversion shall be reduced by an amount equal to the losses between the old and new points of diversion, or appropriated under another water right.

The City of Hillsboro shall install and maintain a staff gage, an in-line flow meter, weir, or other suitable device for measuring and/or recording the quantity of water diverted at both the old and new point of diversion. The type and plans of the staff gage, headgate, and/or measuring devices must be approved by the Department prior to beginning construction and shall be installed under the general supervision of the Department.

This certificate is issued to confirm a change in POINT OF DIVERSION approved by an order of the Water Resources Director entered MARCH 28, 1991, and supersedes Certificate 3930, State Record of Water Right Certificates.

The issuance of this superseding certificate does not confirm the status of the water right in regard to the provisions of ORS 540.610 pertaining to forfeiture or abandonment.

The use confirmed herein may be made only at times when sufficient water is available to satisfy all prior rights, including rights for maintaining instream flows.

Issued December 16, 2004.

Phillip C. Ward, Director
Water Resources Department

Recorded in State Record of Water Right Certificates Number 81027.

T-6308B.SB

STATE OF OREGON

COUNTY OF WASHINGTON

CERTIFICATE OF WATER RIGHT

THIS CERTIFICATE ISSUED TO

CITY OF HILLSBORO
205 SE 2ND AVENUE
HILLSBORO, OREGON 97123

confirms the right to use the waters of THE TUALATIN RIVER, a tributary of THE WILLAMETTE RIVER, for MUNICIPAL USE.

This right was perfected under PERMIT 10408. The date of priority is AUGUST 15, 1930. This right is limited to 9.0 CUBIC FEET PER SECOND or its equivalent in case of rotation, measured at the point of diversion from the source. The quantity of water diverted at the new point of diversion shall not exceed the quantity of water available at the old point of diversion, and shall not exceed 9.0 cubic feet per second.

The points of diversion are located as follows:

HAINES FALLS INTAKE - SE 1/4 SE 1/4, SECTION 20, T 1 S, R 5 W, W.M.; 1100 FEET NORTH AND 200 FEET WEST FROM THE SOUTHEAST CORNER OF SECTION 20. SPRING HILL INTAKE - SW 1/4 SW 1/4, SECTION 8, T 1 S, R 3 W, W.M.; 500 FEET NORTH AND 410 FEET EAST FROM THE SOUTHWEST CORNER OF SECTION 8.

The use shall conform to such reasonable rotation system as may be ordered by the proper state officer.

A description of the place of use to which this right is appurtenant is as follows:

S 1/2
NW 1/4
SECTION 32
TOWNSHIP 1 NORTH, RANGE 2 WEST, W.M.

S 1/2
SECTION 33

S 1/2
SECTION 34

S 1/2
SECTION 35
TOWNSHIP 1 NORTH, RANGE 3 WEST, W.M.

ALL
SECTION 7

NE 1/4
SECTION 16

ALL
SECTION 17

ALL
SECTION 18

N 1/2
SECTION 19
TOWNSHIP 1 SOUTH, RANGE 1 WEST, W.M.

SEE NEXT PAGE

SE 1/4
SECTION 1

E 1/2
SECTION 4

ALL
SECTION 5

N 1/2
SE 1/4
SECTION 6

ALL
SECTION 9

N 1/2
SECTION 10

N 1/2
SECTION 11

ALL
SECTION 12

ALL
SECTION 13

W 1/2
SECTION 24
TOWNSHIP 1 SOUTH, RANGE 2 WEST, W.M.

N 1/2
SECTION 1

N 1/2
SECTION 2

N 1/2
SECTION 3

N 1/2
SECTION 4

N 1/2
SECTION 5

S 1/2
SECTION 6

NW 1/4
SECTION 7
TOWNSHIP 1 SOUTH, RANGE 3 WEST, W.M.

E 1/2
SECTION 12

N 1/2
SW 1/4
SECTION 13

SE 1/4
SECTION 14
TOWNSHIP 1 SOUTH, RANGE 4 WEST, W.M.

SEE NEXT PAGE

NE 1/4
SW 1/4
SECTION 23

W 1/2
SECTION 26

E 1/2
SECTION 27

N 1/2
SECTION 31

NW 1/4
SE 1/4
SECTION 32

NE 1/4
SW 1/4
SECTION 33

N 1/2
SECTION 34

ALL
SECTION 35
TOWNSHIP 1 SOUTH, RANGE 4 WEST, W.M.

S 1/2
SECTION 25

N 1/2
SECTION 36
TOWNSHIP 1 SOUTH, RANGE 5 WEST, W.M.

This certificate is issued to confirm an ADDITIONAL POINT OF DIVERSION approved by an order of the Water Resources Director entered MARCH 7, 1977, and supersedes Certificate 23540, State Record of Water Right Certificates.

The issuance of this superseding certificate does not confirm the status of the water right in regard to the provisions of ORS 540.610 pertaining to forfeiture or abandonment.

The right to the use of the water for the above purpose is restricted to beneficial use on the lands or place of use described. The use confirmed herein may be made only at times when sufficient water is available to satisfy all prior rights, including rights for maintaining instream flows.

WITNESS the signature of the Water Resources Director, affixed OCTOBER 12, 1992.

/s/ MARTHA O. PAGEL

Martha O. Pagel

Recorded in State Record of Water Right Certificates numbered 67891.

T-3130.JSR

STATE OF OREGON

COUNTIES OF WASHINGTON AND YAMHILL

CERTIFICATE OF WATER RIGHT

THIS CERTIFICATE ISSUED TO

CITY OF HILLSBORO
150 MAIN STREET, THIRD FLOOR
HILLSBORO OR 97123

confirms the right to use the waters of TUALATIN RIVER, a tributary of the Willamette River, for MUNICIPAL USE.

This right was perfected under Permit 46423. The date of priority is FEBRUARY 6, 1974. The amount of water to which this right is entitled is limited to an amount actually used beneficially, and shall not exceed 43.0 CUBIC FEET PER SECOND or its equivalent in case of rotation, measured at the point of diversion.

The point of diversion is located as follows:

Twp	Rng	Mer	Sec	Q-Q	Measured Distances
1 S	3 W	WM	8	SW SW	500 FEET NORTH & 410 FEET EAST FROM SW CORNER, SECTION 8

The right to the use of the water for the above purpose is restricted to beneficial use on the lands or place of use described.

A description of the place of use to which this right is appurtenant is as follows:

Twp	Rng	Mer	Sec	Q-Q
1 N	2 W	WM	19	S 1/2 S 1/2
1 N	2 W	WM	20	S 1/2 S 1/2
1 N	2 W	WM	21	S 1/2 S 1/2
1 N	2 W	WM	22	S 1/2 S 1/2
1 N	2 W	WM	23	S 1/2 SW 1/4
1 N	2 W	WM	26	W 1/2
1 N	2 W	WM	27	ALL
1 N	2 W	WM	28	ALL
1 N	2 W	WM	29	ALL
1 N	2 W	WM	30	ALL
1 N	2 W	WM	31	ALL
1 N	2 W	WM	32	ALL

NOTICE OF RIGHT TO PETITION FOR RECONSIDERATION OR JUDICIAL REVIEW

This is an order in other than a contested case. This order is subject to judicial review under ORS 183.484. Any petition for judicial review must be filed within the 60-day time period specified by ORS 183.484(2). Pursuant to ORS 536.075 and OAR 137-004-0080, you may either petition for judicial review or petition the Director for reconsideration of this order. A petition for reconsideration may be granted or denied by the Director, and if no action is taken within 60 days following the date the petition was filed, the petition shall be deemed denied. In addition, under ORS 537.260 any person with an application, permit or water right certificate subsequent in priority may jointly or severally contest the issuance of the certificate at any time before it has issued, and after the time has expired for the completion of the appropriation under the permit, or within three months after issuance of the certificate.

Twp	Rng	Mer	Sec	Q-Q
1 N	2 W	WM	33	ALL
1 N	2 W	WM	34	ALL
1 N	2 W	WM	35	W 1/2
1 N	3 W	WM	24	S 1/2 SE 1/4
1 N	3 W	WM	25	E 1/2
1 N	3 W	WM	25	N 1/2 NW 1/4
1 N	3 W	WM	25	SE 1/4 NW 1/4
1 N	3 W	WM	25	E 1/2 SW 1/4
1 N	3 W	WM	30	SW 1/4
1 N	3 W	WM	31	ALL
1 N	3 W	WM	32	S 1/2 NE 1/4
1 N	3 W	WM	32	S 1/2 NW 1/4
1 N	3 W	WM	32	S 1/2
1 N	3 W	WM	33	S 1/2 N 1/2
1 N	3 W	WM	33	S 1/2
1 N	3 W	WM	34	S 1/2 N 1/2
1 N	3 W	WM	34	S 1/2
1 N	3 W	WM	35	SW 1/4 NW 1/4
1 N	3 W	WM	35	S 1/2
1 N	3 W	WM	36	E 1/2
1 N	3 W	WM	36	E 1/2 NW 1/4
1 N	3 W	WM	36	SW 1/4
1 N	4 W	WM	25	NW 1/4 NW 1/4
1 N	4 W	WM	25	S 1/2 NW 1/4
1 N	4 W	WM	25	S 1/2
1 N	4 W	WM	26	NE 1/4 NE 1/4
1 N	4 W	WM	26	S 1/2 NE 1/4
1 N	4 W	WM	26	SE 1/4 NW 1/4
1 N	4 W	WM	26	S 1/2
1 N	4 W	WM	35	NE 1/4
1 N	4 W	WM	35	N 1/2 NW 1/4
1 N	4 W	WM	35	SE 1/4 NW 1/4
1 N	4 W	WM	35	N 1/2 SE 1/4
1 N	4 W	WM	35	SE 1/4 SE 1/4
1 N	4 W	WM	36	ALL
1 S	1 W	WM	5	S 1/2 S 1/2
1 S	1 W	WM	7	E 1/2 SW 1/4
1 S	1 W	WM	7	SW 1/4 SW1/4
1 S	1 W	WM	8	ALL
1 S	1 W	WM	9	E 1/2 NE 1/4
1 S	1W	WM	9	SW 1/4 NE 1/4
1 S	1 W	WM	9	W 1/2 SW 1/4
1 S	1 W	WM	9	SE 1/4 SW 1/4
1 S	1W	WM	9	SE 1/4
1 S	1 W	WM	10	N 1/2
1 S	1 W	WM	10	SW 1/4
1 S	1 W	WM	10	N 1/2 SE 1/4
1 S	1 W	WM	14	SW 1/4 NE 1/4
1 S	1 W	WM	14	NE 1/4 NW 1/4

Twp	Rng	Mer	Sec	Q-Q
1 S	1 W	WM	14	S 1/2 NW 1/4
1 S	1 W	WM	14	SW 1/4
1 S	1 W	WM	14	W 1/2 SE 1/4
1 S	1 W	WM	15	W 1/2 NE 1/4
1 S	1 W	WM	15	SE 1/4 NE 1/4
1 S	1 W	WM	15	W 1/2
1 S	1 W	WM	15	SE 1/4
1 S	1 W	WM	16	ALL
1 S	1 W	WM	17	ALL
1 S	1 W	WM	20	ALL
1 S	1 W	WM	21	ALL
1 S	1 W	WM	22	ALL
1 S	1 W	WM	23	W 1/2
1 S	1 W	WM	23	W 1/2 NE 1/4
1 S	1 W	WM	23	SE 1/4 NE 1/4
1 S	1 W	WM	26	W 1/2 NW 1/4
1 S	1 W	WM	26	W 1/2 SW 1/4
1 S	1 W	WM	27	ALL
1 S	1 W	WM	28	ALL
1 S	1 W	WM	29	ALL
1 S	1 W	WM	32	ALL
1 S	1 W	WM	33	NE 1/4
1 S	1 W	WM	33	NW 1/4
1 S	1 W	WM	33	N 1/2 SW 1/4
1 S	1 W	WM	33	SW 1/4 SW 1/4
1 S	2 W	WM	2	W 1/2
1 S	2 W	WM	3	ALL
1 S	2 W	WM	4	ALL
1 S	2 W	WM	5	ALL
1 S	2 W	WM	6	ALL
1 S	2 W	WM	7	E 1/2 NE 1/4
1 S	2 W	WM	7	NW 1/4
1 S	2 W	WM	7	N 1/2 SW 1/4
1 S	2 W	WM	7	NE 1/4 SE 1/4
1 S	2 W	WM	8	ALL
1 S	2 W	WM	9	N 1/2
1 S	2 W	WM	9	N 1/2 SW 1/4
1 S	2 W	WM	9	S 1/2 SW 1/4
1 S	2 W	WM	9	SE 1/4
1 S	2 W	WM	10	ALL
1 S	2 W	WM	11	NW 1/4
1 S	2 W	WM	11	N 1/2 SW 1/4
1 S	2 W	WM	11	N 1/2 SE 1/4
1 S	2 W	WM	11	SE 1/4 SE 1/4
1 S	2 W	WM	12	S 1/2
1 S	2 W	WM	14	E 1/2 NE 1/4
1 S	2 W	WM	14	SW 1/4 NE 1/4
1 S	2 W	WM	16	NW 1/4 NW 1/4
1 S	2 W	WM	17	N 1/2 NE 1/4

Twp	Rng	Mer	Sec	Q-Q
1 S	2 W	WM	17	NE 1/4 NW 1/4
1 S	3 W	WM	1	N 1/2
1 S	3 W	WM	1	NE 1/4 SW 1/4
1 S	3 W	WM	1	N 1/2 SE 1/4
1 S	3 W	WM	2	N 1/2 N 1/2
1 S	3 W	WM	3	NE 1/4 NE 1/4
1 S	3 W	WM	3	W 1/2 NE 1/4
1 S	3 W	WM	3	NW 1/4
1 S	3 W	WM	4	N 1/2
1 S	3 W	WM	4	N 1/2 SW 1/4
1 S	3 W	WM	4	SE 1/4 SW 1/4
1 S	3 W	WM	4	N 1/2 SE 1/4
1 S	3 W	WM	4	SW 1/4 SE 1/4
1 S	3 W	WM	5	N 1/2
1 S	3 W	WM	5	SW 1/4
1 S	3 W	WM	5	N 1/2 SE 1/4
1 S	3 W	WM	5	SW 1/4 SE 1/4
1 S	3 W	WM	6	N 1/2
1 S	3 W	WM	6	N 1/2 SW 1/4
1 S	3 W	WM	6	SE 1/4 SW 1/4
1 S	3 W	WM	6	SE 1/4
1 S	3 W	WM	7	NW 1/4 NE 1/4
1 S	3 W	WM	7	NE 1/4 NW 1/4
1 S	3 W	WM	8	N 1/2 NW 1/4
1 S	3 W	WM	31	NW 1/4
1 S	3 W	WM	31	S 1/2
1 S	3 W	WM	32	SW 1/4
1 S	4 W	WM	1	NE 1/4
1 S	4 W	WM	1	E 1/2 NW 1/4
1 S	4 W	WM	1	S 1/2 SW 1/4
1 S	4 W	WM	1	NE 1/4 SE 1/4
1 S	4 W	WM	1	S 1/2 SE 1/4
1 S	4 W	WM	2	SE 1/4 SE 1/4
1 S	4 W	WM	11	NE 1/4 NE 1/4
1 S	4 W	WM	12	ALL
1 S	4 W	WM	13	N 1/2 NE 1/4
1 S	4 W	WM	13	SW 1/4 NE 1/4
1 S	4 W	WM	13	NW 1/4
1 S	4 W	WM	13	N 1/2 SW
1 S	4 W	WM	13	S 1/2 SW 1/4
1 S	4 W	WM	13	NW 1/4 SE 1/4
1 S	4 W	WM	14	S 1/2 NE 1/4
1 S	4 W	WM	14	SE 1/4 NW 1/4
1 S	4 W	WM	14	E 1/2 SW 1/4
1 S	4 W	WM	14	SE 1/4
1 S	4 W	WM	20	E 1/2 NE 1/4
1 S	4 W	WM	20	NE 1/4 SE 1/4
1 S	4 W	WM	21	S 1/2 NE 1/4
1 S	4 W	WM	21	W 1/2 NW 1/4

Twp	Rng	Mer	Sec	Q-Q
1 S	4 W	WM	21	SE 1/4 SW 1/4
1 S	4 W	WM	21	N 1/2 SW 1/4
1 S	4 W	WM	21	SE 1/4 SW 1/4
1 S	4 W	WM	21	SE 1/4
1 S	4 W	WM	22	S 1/2 SE 1/4
1 S	4 W	WM	23	N 1/2
1 S	4 W	WM	23	SW 1/4
1 S	4 W	WM	23	W 1/2 SE 1/4
1 S	4 W	WM	23	SE 1/4 SE 1/4
1 S	4 W	WM	25	NW 1/4 NW 1/4
1 S	4 W	WM	26	N 1/2 NE 1/4
1 S	4 W	WM	26	W 1/2
1 S	4 W	WM	27	N 1/2
1 S	4 W	WM	27	S 1/2 SW 1/4
1 S	4 W	WM	27	NE 1/4 SE 1/4
1 S	4 W	WM	27	S 1/2 SE 1/4
1 S	4 W	WM	28	N 1/2 NE 1/4
1 S	4 W	WM	28	SE 1/4 NE 1/4
1 S	4 W	WM	28	S 1/2 SE 1/4
1 S	4 W	WM	30	S 1/2 SW 1/4
1 S	4 W	WM	30	S 1/2 SE 1/4
1 S	4 W	WM	31	NE 1/4
1 S	4 W	WM	31	N 1/2 NW 1/4
1 S	4 W	WM	32	S 1/2 NE 1/4
1 S	4 W	WM	32	NW 1/4
1 S	4 W	WM	32	N 1/2 SW 1/4
1 S	4 W	WM	32	SE 1/4
1 S	4 W	WM	33	NE 1/4
1 S	4 W	WM	33	NE 1/4 NW 1/4
1 S	4 W	WM	33	S 1/2 NW 1/4
1 S	4 W	WM	33	N 1/2 SW 1/4
1 S	4 W	WM	33	SW 1/4 SW 1/4
1 S	4 W	WM	34	NE 1/4
1 S	4 W	WM	34	N 1/2 NW 1/4
1 S	4 W	WM	34	SW 1/4 NW 1/4
1 S	4 W	WM	35	N 1/2 NW 1/4
1 S	4 W	WM	35	SW 1/4 NW 1/4
1 S	4 W	WM	35	NE 1/4 SW 1/4
1 S	4 W	WM	35	S 1/2 SW 1/4
1 S	4 W	WM	35	SE 1/4
1 S	4 W	WM	36	E 1/2 NE 1/4
1 S	4 W	WM	36	SE 1/4 NW 1/4
1 S	4 W	WM	36	E 1/2 SW 1/4
1 S	4 W	WM	36	SE 1/4
1 S	5 W	WM	25	NW 1/4 SW 1/4
1 S	5 W	WM	25	S 1/2 S 1/2
1 S	5 W	WM	36	N 1/2 N 1/2
2 S	1 W	WM	5	N 1/2
2 S	3 W	WM	2	E 1/2 SW 1/4

Twp	Rng	Mer	Sec	Q-Q
2 S	3 W	WM	2	SE 1/4
2 S	3 W	WM	3	S 1/2
2 S	3 W	WM	4	ALL
2 S	3 W	WM	5	ALL
2 S	3 W	WM	6	ALL
2 S	3 W	WM	7	E 1/2
2 S	3 W	WM	8	ALL
2 S	3 W	WM	9	ALL
2 S	3 W	WM	10	N 1/2 NE 1/4
2 S	3 W	WM	10	SE 1/4 NE 1/4
2 S	3 W	WM	10	NW 1/4
2 S	3 W	WM	10	SW 1/4
2 S	3 W	WM	11	NE 1/4
2 S	3 W	WM	11	E 1/2 NW 1/4
2 S	3 W	WM	15	S 1/2 NE 1/4
2 S	3 W	WM	15	NW 1/4
2 S	3 W	WM	15	S 1/2
2 S	3 W	WM	16	ALL
2 S	3 W	WM	17	ALL
2 S	3 W	WM	18	ALL
2 S	3 W	WM	19	ALL
2 S	3 W	WM	20	N 1/2
2 S	3 W	WM	20	SW 1/4
2 S	3 W	WM	20	N 1/2 SE 1/4
2 S	3 W	WM	20	SW 1/4 SE 1/4
2 S	3 W	WM	21	ALL
2 S	3 W	WM	22	N 1/2 NE 1/4
2 S	3 W	WM	22	SW 1/4 NE 1/4
2 S	3 W	WM	22	W 1/2
2 S	3 W	WM	22	W 1/2 SE 1/4
2 S	4 W	WM	1	E 1/2
2 S	4 W	WM	1	NE 1/4 NW 1/4
2 S	4 W	WM	2	NE 1/4 NE 1/4
2 S	4 W	WM	2	S 1/2 NE 1/4
2 S	4 W	WM	2	NW 1/4
2 S	4 W	WM	2	S 1/2
2 S	4 W	WM	3	ALL
2 S	4 W	WM	4	E 1/2
2 S	4 W	WM	9	NE 1/4
2 S	4 W	WM	9	E 1/2 SE 1/4
2 S	4 W	WM	10	N 1/2
2 S	4 W	WM	10	SW 1/4
2 S	4 W	WM	10	N 1/2 SE 1/4
2 S	4 W	WM	11	N 1/2
2 S	4 W	WM	11	N 1/2 SW 1/4
2 S	4 W	WM	11	SE 1/4 SW 1/4
2 S	4 W	WM	11	SE 1/4
2 S	4 W	WM	12	ALL
2 S	4 W	WM	13	ALL

Twp	Rng	Mer	Sec	Q-Q
2 S	4 W	WM	14	NE 1/4
2 S	4 W	WM	14	E 1/2 NW 1/4
2 S	4 W	WM	14	E 1/2 SE 1/4
2 S	4 W	WM	24	S 1/2 SE 1/4

Water may be applied to lands which are not specifically described above, provided the holder of this right complies with ORS 540.510(3).

The use of water allowed herein may be made only at times when sufficient water is available to satisfy all prior rights, including prior rights for maintaining instream flows.

Issued NOV 1 7 2009.

Dwight French for

Phillip C. Ward, Director
Water Resources Department

STATE OF OREGON 1859

STATE OF OREGON

COUNTY OF WASHINGTON

CERTIFICATE OF WATER RIGHT

THIS CERTIFICATE ISSUED TO

CITY OF BEAVERTON
4755 SW GRIFFITH DR
PO BOX 4755
BEAVERTON OR 97076

confirms the right to use the waters of TUALATIN RIVER, a tributary of the Willamette River, for MUNICIPAL USE.

This right was perfected under Permit 45455. The date of priority is JULY 15, 1980. The amount of water to which this right is entitled is limited to an amount actually used beneficially, and shall not exceed 25.0 CUBIC FEET PER SECOND or its equivalent in case of rotation, measured at the point of diversion.

The diversion of water shall be made only during the period September 15 to July 31 of each year.

The point of diversion is located as follows:

Twp	Rng	Mer	Sec	Q-Q	Measured Distances
1 S	3 W	WM	8	SW SW	500 FEET NORTH & 410 FEET EAST FROM SW CORNER, SECTION 8

The right to the use of the water for the above purpose is restricted to beneficial use on the lands or place of use described.

A description of the place of use to which this right is appurtenant is as follows:

Twp	Rng	Mer	Sec	Q-Q
1 S	1 W	WM	5	SW SE
1 S	1 W	WM	5	SE SE
1 S	1 W	WM	8	NE NE
1 S	1 W	WM	8	NW NE
1 S	1 W	WM	8	SW NE
1 S	1 W	WM	8	SE NE
1 S	1 W	WM	8	NE NW
1 S	1 W	WM	8	SE NW
1 S	1 W	WM	8	NE SW
1 S	1 W	WM	8	SE SW
1 S	1 W	WM	8	NE SE

NOTICE OF RIGHT TO PETITION FOR RECONSIDERATION OR JUDICIAL REVIEW

This is an order in other than a contested case. This order is subject to judicial review under ORS 183.484. Any petition for judicial review must be filed within the 60-day time period specified by ORS 183.484(2). Pursuant to ORS 536.075 and OAR 137-004-0080, you may either petition for judicial review or petition the Director for reconsideration of this order. A petition for reconsideration may be granted or denied by the Director, and if no action is taken within 60 days following the date the petition was filed, the petition shall be deemed denied. In addition, under ORS 537.260 any person with an application, permit or water right certificate subsequent in priority may jointly or severally contest the issuance of the certificate at any time before it has issued, and after the time has expired for the completion of the appropriation under the permit, or within three months after issuance of the certificate.

Twp	Rng	Mer	Sec	Q-Q
1 S	1 W	WM	8	NW SE
1 S	1 W	WM	8	SW SE
1 S	1 W	WM	8	SE SE
1 S	1 W	WM	9	NE NE
1 S	1 W	WM	9	SW NE
1 S	1 W	WM	9	SE NE
1 S	1 W	WM	9	SW SW
1 S	1 W	WM	9	SE SW
1 S	1 W	WM	9	NE SE
1 S	1 W	WM	9	NW SE
1 S	1 W	WM	9	SW SE
1 S	1 W	WM	9	SE SE
1 S	1 W	WM	10	NW NW
1 S	1 W	WM	10	SW NW
1 S	1 W	WM	10	NE SW
1 S	1 W	WM	10	NW SW
1 S	1 W	WM	10	SW SW
1 S	1 W	WM	10	SE SW
1 S	1 W	WM	10	NW SE
1 S	1 W	WM	14	SW NE
1 S	1 W	WM	14	NE NW
1 S	1 W	WM	14	SW NW
1 S	1 W	WM	14	SE NW
1 S	1 W	WM	14	NE SW
1 S	1 W	WM	14	NW SW
1 S	1 W	WM	14	SW SW
1 S	1 W	WM	14	SE SW
1 S	1 W	WM	14	NW SE
1 S	1 W	WM	14	SW SE
1 S	1 W	WM	15	NW NE
1 S	1 W	WM	15	SW NE
1 S	1 W	WM	15	SE NE
1 S	1 W	WM	15	NE NW
1 S	1 W	WM	15	NW NW
1 S	1 W	WM	15	SW NW
1 S	1 W	WM	15	SE NW
1 S	1 W	WM	15	NE SW
1 S	1 W	WM	15	NW SW
1 S	1 W	WM	15	SW SW

Twp	Rng	Mer	Sec	Q-Q
1 S	1 W	WM	15	SE SW
1 S	1 W	WM	15	NE SE
1 S	1 W	WM	15	NW SE
1 S	1 W	WM	15	SW SE
1 S	1 W	WM	15	SE SE
1 S	1 W	WM	16	NE NE
1 S	1 W	WM	16	NW NE
1 S	1 W	WM	16	SW NE
1 S	1 W	WM	16	SE NE
1 S	1 W	WM	16	NE NW
1 S	1 W	WM	16	NW NW
1 S	1 W	WM	16	SW NW
1 S	1 W	WM	16	SE NW
1 S	1 W	WM	16	NE SW
1 S	1 W	WM	16	NW SW
1 S	1 W	WM	16	SW SW
1 S	1 W	WM	16	SE SW
1 S	1 W	WM	16	NE SE
1 S	1 W	WM	16	NW SE
1 S	1 W	WM	16	SW SE
1 S	1 W	WM	16	SE SE
1 S	1W	WM	17	NE NE
1 S	1W	WM	17	NW NE
1 S	1W	WM	17	SE NE
1 S	1W	WM	17	NE NW
1 S	1W	WM	17	NE SE
1 S	1W	WM	17	SW SE
1 S	1W	WM	17	SE SE
1 S	1W	WM	20	NE NE
1 S	1W	WM	20	SW NE
1 S	1W	WM	20	SE NE
1 S	1W	WM	20	NE SE
1 S	1W	WM	20	SW SE
1 S	1W	WM	20	SE SE
1 S	1 W	WM	21	NE NE
1 S	1 W	WM	21	NW NE
1 S	1 W	WM	21	SW NE
1 S	1 W	WM	21	SE NE
1 S	1 W	WM	21	NE NW
1 S	1 W	WM	21	NW NW
1 S	1 W	WM	21	SW NW
1 S	1 W	WM	21	SE NW
1 S	1 W	WM	21	NE SW
1 S	1 W	WM	21	NW SW
1 S	1 W	WM	21	SW SW
1 S	1 W	WM	21	SE SW
1 S	1 W	WM	21	NE SE

Twp	Rng	Mer	Sec	Q-Q
1 S	1 W	WM	21	NW SE
1 S	1 W	WM	21	SW SE
1 S	1 W	WM	21	SE SE
1 S	1 W	WM	22	NE NE
1 S	1 W	WM	22	NW NE
1 S	1 W	WM	22	SW NE
1 S	1 W	WM	22	SE NE
1 S	1 W	WM	22	NE NW
1 S	1 W	WM	22	NW NW
1 S	1 W	WM	22	SW NW
1 S	1 W	WM	22	SE NW
1 S	1 W	WM	22	NE SW
1 S	1 W	WM	22	NW SW
1 S	1 W	WM	22	SW SW
1 S	1 W	WM	22	SE SW
1 S	1 W	WM	22	NE SE
1 S	1 W	WM	22	NW SE
1 S	1 W	WM	22	SW SE
1 S	1 W	WM	22	SE SE
1 S	1 W	WM	23	NW NE
1 S	1 W	WM	23	SW NE
1 S	1 W	WM	23	NE NW
1 S	1 W	WM	23	NW NW
1 S	1 W	WM	23	SW NW
1 S	1 W	WM	23	SE NW
1 S	1 W	WM	23	NW SW
1 S	1 W	WM	27	NE NE
1 S	1 W	WM	27	NW NE
1 S	1 W	WM	27	SW NE
1 S	1 W	WM	27	SE NE
1 S	1 W	WM	27	NE NW
1 S	1 W	WM	27	NW NW
1 S	1 W	WM	27	SW NW
1 S	1 W	WM	27	SE NW
1 S	1 W	WM	27	NE SW
1 S	1 W	WM	27	NW SW
1 S	1 W	WM	27	SW SW
1 S	1 W	WM	27	SE SW
1 S	1 W	WM	27	NE SE
1 S	1 W	WM	27	NW SE
1 S	1 W	WM	27	SW SE
1 S	1 W	WM	27	SE SE
1 S	1 W	WM	28	NE NE
1 S	1 W	WM	28	NW NE
1 S	1 W	WM	28	SW NE
1 S	1 W	WM	28	SE NE
1 S	1 W	WM	28	NE NW
1 S	1 W	WM	28	NW NW
1 S	1 W	WM	28	SW NW

Twp	Rng	Mer	Sec	Q-Q
1 S	1 W	WM	28	SE NW
1 S	1 W	WM	28	NE SW
1 S	1 W	WM	28	NW SW
1 S	1 W	WM	28	SW SW
1 S	1 W	WM	28	SE SW
1 S	1 W	WM	28	NE SE
1 S	1 W	WM	28	NW SE
1 S	1 W	WM	28	SW SE
1 S	1 W	WM	28	SE SE
1 S	1 W	WM	29	NE NE
1 S	1 W	WM	29	NW NE
1 S	1 W	WM	29	SW NE
1 S	1 W	WM	29	SE NE
1 S	1 W	WM	29	NE SE
1 S	1 W	WM	29	NW SE
1 S	1 W	WM	29	SE SE
1 S	1 W	WM	32	NE NE
1 S	1 W	WM	32	NW NE
1 S	1 W	WM	32	SW NE
1 S	1 W	WM	32	SE NE
1 S	1 W	WM	32	NE NW
1 S	1 W	WM	32	NW NW
1 S	1 W	WM	32	SW NW
1 S	1 W	WM	32	SE NW
1 S	1 W	WM	32	NE SW
1 S	1 W	WM	32	NW SW
1 S	1 W	WM	32	NE SE
1 S	1 W	WM	32	NW SE
1 S	1 W	WM	32	SW SE
1 S	1 W	WM	32	SE SE
1 S	1 W	WM	33	NE NE
1 S	1 W	WM	33	NW NE
1 S	1 W	WM	33	SW NE
1 S	1 W	WM	33	SE NE
1 S	1 W	WM	33	NE NW
1 S	1 W	WM	33	NW NW
1 S	1 W	WM	33	SW NW
1 S	1 W	WM	33	SE NW
1 S	1 W	WM	33	NE SW
1 S	1 W	WM	33	NW SW
1 S	1 W	WM	34	NE NE
1 S	1 W	WM	34	NW NE
1 S	1 W	WM	34	NE NW
1 S	1 W	WM	34	NW NW
1 S	1 W	WM	34	SW NW

Water may be applied to lands which are not specifically described above, provided the holder of this right complies with ORS 540.510(3).

The use of water allowed herein may be made only at times when sufficient water is available to satisfy all prior rights, including prior rights for maintaining instream flows.

Issued NOV 17 2009

Dwight French for
Phillip C. Ward, Director
Water Resources Department

STATE OF OREGON

COUNTY OF WASHINGTON

PERMIT TO APPROPRIATE THE PUBLIC WATERS

THIS PERMIT IS HEREBY ISSUED TO

HILLSBORO, FOREST GROVE AND
BEAVERTON JOINT WATER COMMISSION
205 SE SECOND AVENUE
HILLSBORO, OREGON 97123

503-681-6158

to use the waters of SCOGGINS CREEK, a tributary of TUALATIN RIVER, for MUNICPAL USE.

This Permit is issued approving Application 69637. The date of priority is JUNE 9, 1988. The use is limited to not more than 75.0 CUBIC FEET PER SECOND, or its equivalent in case of rotation, measured at the point of diversion from the source.

The point of diversion is located as follows:

NE 1/4 NE 1/4, SECTION 20, T 1 S, R 4 W, W.M.; 707 FEET SOUTH AND 441 FEET WEST FROM NE CORNER, SECTION 20.

THE USE OF WATER UNDER THE TERMS OF THIS PERMIT WILL BE FURTHER RESTRICTED AS FOLLOWS:

The diversion will be limited to the period from October 1 through May 31; and

A bypass flow of 20 cfs will be maintained in Scoggins Creek from Scoggins Dam to the mouth from October 1 through November 30 and 15 cfs will be maintained from December 1 through May 31; and

The use of water for municipal use will be subordinate to the fill schedule of Scoggins Reservoir; and

The Joint Commission will report to the Water Resources Commission by February 1994 on the use of water under the terms of this permit and determine if other water rights from the Tualatin River are surplus and should be cancelled.

This project was considered and approved by the Water Resources Commission on February 12, 1990.

The use shall conform to such reasonable rotation system as may be ordered by the proper state officer.

A description of the proposed place of use under the Permit is as follows:

TOWNSHIP 1 NORTH, RANGE 1 WEST, W.M.
TOWNSHIP 1 NORTH, RANGE 2 WEST, W.M.
TOWNSHIP 1 NORTH, RANGE 3 WEST, W.M.
TOWNSHIP 1 NORTH, RANGE 4 WEST, W.M.
TOWNSHIP 1 SOUTH, RANGE 1 WEST, W.M.
TOWNSHIP 1 SOUTH, RANGE 2 WEST, W.M.
TOWNSHIP 1 SOUTH, RANGE 3 WEST, W.M.
TOWNSHIP 1 SOUTH, RANGE 4 WEST, W.M.
TOWNSHIP 2 SOUTH, RANGE 3 WEST, W.M.
TOWNSHIP 2 SOUTH, RANGE 4 WEST, W.M.

Actual construction work shall begin on or before FEBRUARY 16, 1991, and shall be completed on or before October 1, 1991. Complete application of the water to the use shall be made on or before October 1, 1992. BC extended to 10-1-95
B+C ext to 10-1-2000

Failure to comply with any of the provisions of this permit may result in action including, but not limited to restrictions on the use, civil penalties, or cancellation of the permit.

This permit is for the beneficial use of water without waste. The water user is advised that new regulations may require the use of best practical technologies or conservation practices to achieve this end.

By law, the land use associated with this water use must be in compliance with statewide land-use goals and any local acknowledged land-use plan.

The use of water shall be limited when it interferes with any prior surface or ground water rights.

Issued this date, FEBRUARY 16, 1990.

/s/ WILLIAM H. YOUNG
Water Resources Department
William H. Young
Director

CITY OF HILLSBORO

Water Department

November 24, 2010

Jen Woody
Groundwater Section
Oregon Water Resources Department
725 Summer Street NE, Suite A
Salem, OR 97301

Subject: Joint Water Commission's Limited License Application for ASR testing

Dear Ms. Woody:

The Joint Water Commission (JWC) is proposing to develop an aquifer storage and recovery (ASR) project in the vicinity of Cooper Mountain. JWC is applying to the Oregon Water Resources Department for a limited license to conduct ASR testing. The JWC plans to recharge the ASR wells predominantly with water that is provided by the Joint Water Commission (JWC). Some of the JWC ASR wells may be recharged with water purchased from the Portland Water Bureau by Tualatin Valley Water District, and authorization to do so will be provided separately. Injection would occur between November and June, provided that live flow is available. The water will be recovered during the peak demand season for municipal use by the JWC member agencies.

The City of Hillsboro (City) is one of the JWC's member agencies and is participating in the JWC ASR project. The City also serves as the managing agency and manages the water rights and sources for the JWC. The City is the holder of Certificates 67891, 81026, 81027 and 85913, which are used to provide water to JWC during the recharge period from November to June. As the holder of these water rights, the City gives the JWC permission to use water under its water rights for JWC ASR testing.

Sincerely,

Kevin Hanway
Hillsboro Water Department Director

cc: Larry Eaton, GSI Water Solutions, Inc.
Adam Sussman, GSI Water Solutions, Inc.

150 E. Main Street, Hillsboro Oregon 97123
Office: 503-615-6702
Fax: 503-615-6595

CITY of BEAVERTON
4755 S.W. Griffith Drive, P.O. Box 4755, Beaverton, OR 97076 General Information (503) 526-2222 V/TDD

November 30, 2010

Ms. Jen Woody
Groundwater Section
Oregon Water Resources Department
725 Summer Street NE, Suite A
Salem, OR 97301

Subject: Joint Water Commission's Limited License Application for ASR testing

Dear Ms. Woody:

The Joint Water Commission (JWC) is proposing to develop an aquifer storage and recovery (ASR) project in the vicinity of Cooper Mountain, in southeastern Washington County. JWC is applying to the Oregon Water Resources Department for a limited license to conduct ASR testing. The JWC plans to recharge the ASR wells predominantly with water that is provided by the Joint Water Commission (JWC). Some of the JWC ASR wells may be recharged with water purchased from the Portland Water Bureau by Tualatin Valley Water District, and authorization to do so will be provided separately. Injection would occur between November and June, provided that live flow is available. The water will be recovered during the peak demand season for municipal use by the JWC member agencies.

The City of Beaverton (City) is one of the JWC's member agencies and is participating in the JWC ASR project. The City is the holder of Certificate 85914, which is used to provide water to JWC during the recharge period from November to June. As the holder of this water right, the City gives the JWC permission to use water under its water right for JWC ASR testing.

Sincerely,

David A. Winship

David A. Winship, PE, PLS, WRE
Principal Engineer
Economic and Capital Development Department
City of Beaverton
4755 SW Griffith Drive
Beaverton, Oregon 97076

Joint Water Commission

General Manager
Kevin Hanway
150 E. Main Street
Hillsboro, OR 97123
503-615-6585

Board of Commissioners

City of Hillsboro
Will Crandall
John Godsey
John Rosenberger

City of Forest Grove
Rod Fuiten
Carl Heisler
Victoria Lowe

City of Beaverton
Forrest Soth
Marc San Soucie
Denny Doyle

Tualatin Valley Water District
Greg DiLoreto
Jim Doane
Dick Schmidt

November 24, 2010

Jen Woody
Groundwater Section
Oregon Water Resources Department
725 Summer Street NE, Suite A
Salem, OR 97301

Subject: Joint Water Commission's Limited License Application for ASR testing

Dear Ms. Woody:

The Joint Water Commission (JWC) is a collective water supply agency between the Cities of Hillsboro, Beaverton, Forest Grove, and the Tualatin Valley Water District. The Joint Water Commission (JWC) is proposing to develop an aquifer storage and recovery (ASR) project in the vicinity of Cooper Mountain. JWC is applying to the Oregon Water Resources Department for a limited license to conduct ASR testing. The JWC plans to recharge the ASR wells predominantly with water that is provided by the Joint Water Commission (JWC). Some of the JWC ASR wells may be recharged with water purchased from the Portland Water Bureau by Tualatin Valley Water District, and authorization to do so will be provided separately. Injection would occur between November and June, provided that live flow is available. The water will be recovered during the peak demand season for municipal use by the JWC member agencies.

The City of Hillsboro serves as the managing agency and manages the water rights and sources for the JWC. The JWC is the holder of Permit S-50879, which is used to provide water to JWC during the recharge period from November to May. As the holder of this water right, the JWC gives permission to use water under its water right for JWC ASR testing.

Sincerely,

Kevin Hanway
JWC General Manager
Hillsboro Water Department Director

cc: Larry Eaton, GSI Water Solutions, Inc.
Adam Sussman, GSI Water Solutions, Inc.

PORTLAND WATER BUREAU
FROM FOREST TO FAUCET

Randy Leonard, Commissioner
David G. Shaff, Administrator
1120 SW 5th Avenue, Room 600
Portland, Oregon 97204-1926
Information: 503-823-7404
www.portlandonline.com/water
An Equal Opportunity Employer

RECEIVED
DEC 03 2010
TUALATIN VALLEY WATER DISTRICT

November 30, 2010

Ms. Jen Woody
Groundwater Section
Oregon Water Resources Department
725 Summer Street NE, Suite A
Salem, Oregon 97301

Subject: Joint Water Commission Limited License Application for ASR Testing

Dear Ms. Woody:

The Portland Water Bureau understands the Tualatin Valley Water District (TVWD), as a partner in the Joint Water Commission (JWC), is proposing to develop an aquifer storage and recovery (ASR) project in the vicinity of Cooper Mountain. We further understand that the JWC is applying to the Oregon Water Resources Department for a limited license to conduct ASR testing.

The City of Portland Water Bureau holds statutory rights to waters of the Bull Run River under ORS 538.420. It also holds ground water permits for its Columbia South Shore Well Field. TVWD buys water from the City of Portland pursuant to a wholesale contract executed in 2006. TVWD proposes to use Bull Run surface waters purchased from Portland for its ASR project.

Subject to the terms and conditions of the water sales agreement between the City and TVWD, the City hereby grants TVWD permission to use of water provided under that agreement for its ASR testing.

Sincerely,

David G. Shaff

David G. Shaff
Administrator

cc: Mark Knudson, Tualatin Valley Water District
Randy Leonard, Commissioner, City of Portland

The City of Portland will make reasonable accommodation for people with disabilities. Please notify us no later than five (5) business days prior to the event by phone 503-823-7404, by the City's TTY at 503-823-6868, or by the Oregon Relay Service at 1-800-735-2900.

Appendix H

DEQ USE ONLY
Received:______________
Amount Received: $ ______________

UNDERGROUND INJECTION CONTROL REGISTRATION
Aquifer Storage & Recover (ASR)
(Submit two copies. See pages 3-4 for detailed instructions.)

Return form with your payment to:
Oregon Department of Environmental Quality
Attn: Business Office
811 SW Sixth Avenue
Portland OR 97204

DEQ DATE STAMP
Registration #:______________

A. AUTHORIZATION FEE

1. **Number of injection systems 1 x $125.00 = $125.00 (Amount enclosed)**

B. FACILITY NAME, LOCATION & CONTACT

1. Facility's Legal Name: Cooper Mountain Reservoir	2. Common Name: Cooper Mountain Reservoir
3. Facility Physical Address: 18250 SW Kemmer Rd. City, State, Zip Code: Beaverton, OR 97007	4. Facility Mailing Address: The JWC, 150 E. Main Street, 3rd Floor City, State, Zip Code: Hillsboro, OR 97123
5. Consultant Contact Name: GSI Water Solutions, Inc., Larry Eaton Contact Telephone #: (503) 239-8799 ext. 103 Fax #: (503) 239-8940	6. Responsible Official/Owner Name: City of Beaverton, Public Works – Engineering, David Winship Address: P.O. Box 4755, 4755 SW Griffith Drive City, State, Zip Code: Beaverton, OR 97076-4755

7. Latitude (decimal): **45.452111°** Longitude (decimal): **-122.864873°**

C. FACILITY DESCRIPTION (ATTACH DOCUMENTS AS NEEDED)

1. Oregon Water Resources Dept. Water Site Permit #: NA Discharge rate: NA Discharge volume: NA SIC Code: 4941

   Note: Using City of Beaverton of the JWC potable water for injection

2. Briefly describe the nature of business at this site and list the SIC/NAICS codes: Reservoir for public potable water supply, 4941

3. Briefly describe the types of materials, products, and wastes handled at the facility, if any. Attach a copy of the Fire Marshall's survey. If available, note if your site qualifies as a small- or large-quantity generator. Attach & sign the UIC no-exposure certification form: ☒ Attached

   No materials, products, and wastes handled at this facility.

4. Name of nearest cleanup site within one-half mile, if any (ESCI, LUST, Superfund, CERCLA): MC KIE, N HOT - LUST
   Distance to site: 0.38 ☒ Attach map from DEQ Profiler, http://deq12.deq.state.or.us/fp20/.

   Heating oil release. Soil effected. Tank was decommissioned. Cleanup was started on 8/28/1998.

5. Land use zoning of facility: ☐ Industrial ☐ Commercial ☐ Residential ☒ Other: Public (Land use), Agriculture and forestry (Zoning class)

6. Drinking water source: Surface Water: City of Beaverton or the JWC water source (Tualatin River, Sain Creek, or Scoggins Creek) (River name) or Aquifer: _____

7. Is the site located in a groundwater management area (GWMA), steep slope, known hazard area, or flood plain (circle)? ☐ Yes ☒ No

8. Attach nearest drinking water well log (with soil profile) and site maps: ☒ Attached

9. Is this aquifer confined? ☒ Yes ☐ No ☐ Do Not Know Has Department of Human Services (DHS) delineated this area? ☒ Yes ☐ No

   If "YES," attach relevant documentation, such as a vulnerability report and maps from the Oregon Health Division.

10. List any other DEQ or public agency permits applied for or issued to this facility: NA

11. DEQ Reviewer/Contact at regional office: ______________

D. SIGNATURE OF LEGALLY AUTHORIZED REPRESENTATIVE

I hereby certify that the information contained in this registration is true and correct to the best of my knowledge and belief.

Kevin Hanway	JWC General Manager
Name of Legally Authorized Representative (Type or Print)	**Title**
[signature]	12/1/10
Signature of Legally Authorized Representative	**Date**
David Winship, PE	Utilities Engineer
Name of Legally Authorized Representative (Type or Print)	**Title**
[signature]	12/1/10
Signature of Legally Authorized Representative	**Date**

UIC REGISTRATION FOR AQUIFER STORAGE & RECOVERY (ASR) SYSTEMS

Oregon Department of Environmental Quality

(See pages 3 & 4 for detailed instructions)

E. UNDERGROUND INJECTION CONTROL INFORMATION

EPA Well Types

5A19 - Cooling Water Return	5R21 -Aquifer Recharge	5W12 Water Treatment Plant Effluent	5X26 Aquifer Remediation
5D2 - Stormwater	5W9 -Untreated Sewage	5W20 Industrial Process Water	5X27 Other Wells
5D4 - Industrial Storm Runoff	5W10 Cesspool	5W31 Septic System (well disposal)	5X28 Motor Vehicle Waste
5G30 Special Drainage Water	5W11 Septic System (gen)	5W32 Septic System (drainfield)	5X29 Abandoned Drinking Well
5A5 - Electric Power Generator	5A6 --Geothermal Heat	5A7 ---Closed Loop Heat Pump Return	5D3--Drill Hole

Complete the information requested below for each UIC system that is at the facility. Attach additional copies of this sheet if necessary. Also attach a facility map that clearly identifies the location of each UIC by name or number.

UIC SYSTEM # or NAME: JWC ASR Well No. 1 **INSTALLATION YEAR:** **Not yet installed**

1. Latitude (decimal): **45.452111°**

   Longitude (decimal): **-122.864873°**

2. Distance to nearest: Domestic/public water well: about 1,000 feet

   Wetland: 14,000 feet Other surface water(s): 1,500 feet

3. Type: ☒ 5R21 ☐ Other: _____

4. Status: (see instructions for status definition)

   ☒ Planning stage ☐ Under construction ☐ Active

   ☐ Not in use ☐ Temporarily Abandoned

   ☒ Note any monitoring:

   The response of the aquifer will be monitored using a network of observation wells. Water level changes will be measured using dedicated pressure transducers and data loggers or water level sounders.

5. Characteristics:

   Depth: 1000 ft Diameter: 1.67 ft

   Design injection rate: 1500 gpm

   Location of nearest cleanup site (miles): 0.38

   Impervious Area Drained by UIC: NA

   Pretreatment: Injection water is treated to drinking water standards

UIC SYSTEM # or NAME: ____________________ **INSTALLATION YEAR:** ________________

1. Latitude (decimal): ____________________

   Longitude (decimal): ____________________

2. Distance to nearest: Domestic/public water well: ____________

   Wetland: _____ Other surface water(s): ______________

3. Type: ☐ 5R21 ☐ Other: _____

4. Status: (see instructions for status definition)

   ☐ Planning stage ☐ Under construction ☐ Active

   ☐ Not in use ☐ Temporarily Abandoned

   ☐ Note any monitoring:

   ____

   ____

5. Characteristics:

   Depth: _____ ft Diameter: _____ ft

   Design injection rate: ______________________________

   Location of nearest cleanup site (miles): ________________

UIC SYSTEM # or NAME: ____________________ **INSTALLATION YEAR:** ________________

1. Latitude (decimal): ____________________

   Longitude (decimal): ____________________

2. Distance to nearest: Domestic/public water well: ____________

   Wetland: _____ Other surface water(s): ______________

3. Type: ☐ 5R21 ☐ Other: _____

4. Status: (see instructions for status definition)

   ☐ Planning stage ☐ Under construction ☐ Active

   ☐ Not in use ☐ Temporarily Abandoned

   ☐ Note any monitoring:

   ____

5. Characteristics:

   Depth: _____ ft Diameter: _____ ft

   Design injection rate: ______________________________

   Location of nearest cleanup site (miles): ________________

To expedite the registration of your facility, please fill out this form in its entirety.

Use this form to register underground injection control (UIC) systems
Common UIC systems include dry wells, sumps, drain holes, infiltration trenches, or infiltration basins.

A. AUTHORIZATION FEE

1. **This form will be returned to sender if the fee is not attached or if the form is incomplete.**

B. FACILITY NAME, LOCATION & CONTACT

1. Enter the **legal** Oregon corporate name (i.e., Acme Products, Inc.) or the name of the **legal** representative of the company if the company operates under an assumed business name (i.e., John Smith, dba Acme Products). The name must be a legal, active name registered with the Oregon Department of Commerce, Corporation Division (503) 378-4752, unless otherwise exempted by the Department of Commerce regulations.
2. Enter the common name of this facility if different than the legal name.
3. Enter the physical location of the facility (not mailing address), including city, state, and zip code.
4. Enter the mailing address of the facility if different from the physical location.
5. Enter the name, telephone and fax number of the consultant contact; this would be the person to call in case there are any questions about this registration
6. Enter the name and mailing address of the responsible official/owner or organization for this facility.
7. Enter the latitude and longitude of the approximate center of the ASR site in decimal degrees if possible. Latitude and longitude can be obtained by accessing DEQ's web site at http://deq12.deq.state.or.us/fp20/. If a GPS unit is used to determine lat/long, set the datum to the state standard, NAD83; otherwise, location data will not be accurate.

C. FACILITY DESCRIPTION

1. Note the Water Resources Dept. (WRD) reference file number, application number, and license number.
2. Enter the Standard Industrial Classification (SIC) four-digit code **or** North American Industry Classification System five or six-digit code (NAICS) for the facility. These codes are used to describe the primary activity at the facility that generates the most money and may be found on fire marshal reports, insurance papers, or tax forms. The NAICS codes replaced the SIC system in 1997, however, it is usually easy to convert between the two systems so either code is acceptable. SIC or NAICS information is also available from the U.S. Census Bureau at 1-888-756-2427 or at http://www.naics.com/search.htm. Include a secondary code if applicable.
   Briefly describe the nature of business at the facility. For example, "retail clothing store," "gasoline service station with repair shop," "retail and wholesale cabinet store with cabinet manufacturing," or "rental service store for home, yard, and contractor equipment with in-house maintenance shop."
3. Briefly describe the types of materials, products, and wastes handled at the facility. For example, from a service station one might expect "new and used gasoline, diesel, transmission oil, brake fluid, antifreeze, solvents and tires; general cleaners (409, Simple Green, etc.); office wastes; and general garbage." Submit a list of the water-soluble compounds from the MSDS sheets or a copy of the Oregon State Fire Marshal survey and note if hazardous waste generator. The non-exposure form can be found at http://www.deq.state.or.us/wq/uic/forms.htm.
4. Note if the site has had past contamination problems or if a cleanup site exists within one-half mile. See the DEQ Profiler utility at http://deq12.deq.state.or.us/fp20/.
5. Indicate if the facility is located on property that is zoned for industrial, commercial, residential, or some other use.
6. Indicate the source of drinking water for the site.
7. Indicate whether the site is located in a DEQ groundwater management area, is located on steep slopes, in a floodplain (e.g., flooded in 1996), a groundwater management area, or in a known hazard area (mapped by Oregon Department of Geology, USGS and others). The hazard data should be available at your local planning agency or the Oregon Department of Geology, (503) 731-4100.
8. If you do not have your well log, you may be able to access it through the Oregon Water Resources Department (WRD) web site at http://www.wrd.state.or.us/groundwater/index.shtml, or by calling (503) 986-0900. The Natural Resource Conservation Service in your area may also have this information.
9. Indicate if your local aquifer is confined locally. You may wish to contact a registered geologist, cite US Geological Service report, Water Resources Department study, or the Department of Human Services (DHS) Vulnerability Studies, (541) 726-2587. Note if DHS has delineated the two-year time-of-travel zone through their source water program.
10. In order for DEQ to coordinate with other DEQ offices and public agencies, list all permits applied for or issued to this facility.
11. Please note the regional DEQ office contact (hydrogeologist).

D. SIGNATURE OF LEGALLY AUTHORIZED REPRESENTATIVE

The signature of a legally authorized representative must be provided in order to process this registration.

Definition of Legally Authorized Representative:
Please also provide the information requested in brackets *[ ]*

- ♦ **Corporation** — president, secretary, treasurer, vice-president, or any person who performs principal business functions; or a manager of one or more facilities that is authorized in accordance to corporate procedure to sign such documents
- ♦ **Partnership** — General partner *[list of general partners, their addresses and telephone numbers]*
- ♦ **Sole Proprietorship** — Owner(s) *[each owner must sign the application]*
- ♦ **City, County, State, Federal, or other Public Facility** — Principal executive officer or ranking elected official

♦ **Limited Liability Company** — Member *[articles of organization]*
♦ **Trusts** — Acting trustee *[list of trustees, their addresses and telephone numbers]*

E.. UNDERGROUND INJECTION CONTROL (UIC) INFORMATION

Please submit a facility map that clearly identifies the location of each UIC system (specific point of discharge or injection, e.g. dry well, sump, drain hole, infiltration trench, etc.) by number or name.

For each UIC system, provide the number or name and its installation date. The installation date will be on your well log or permit. Your city or county building department may also have this information for your site. If the installation date is not known, provide the Oregon Resources Department (WRD) card number and/or the well identification number, or estimate when the UIC system was installed. Also, for **each** UIC system provide the following:

1. Enter the latitude and longitude of the approximate center of each ASR in decimal degrees if possible. Latitude and longitude can be obtained by accessing DEQ's web site at http://deq12.deq.state.or.us/fp20/. If a GPS unit is used to determine lat/long, set the datum to the state standard, NAD83; otherwise, location data will not be accurate..

2. Type of UIC system (listed on top of page 2).

3. Estimated distance in feet of the ASR system to the nearest domestic or public water supply well, wetland, and other surface water.

4. Indicate whether the UIC system is being planned, under construction, active, inactive, temporarily abandoned, or permanently abandoned (closed or decommissioned). A UIC system is considered "temporarily abandoned" when it is taken out of service but still exists. Owners of temporarily abandoned UICs intend to bring them back into service at a future date. A watertight cap or seal that prevents any materials from entering the UIC must cover temporarily abandoned UICs. A UIC is considered "permanently abandoned" when it is completely filled so that movement of water within the UIC is permanently stopped. With the exception of hand-dug UIC systems, a licensed water well constructor, or the landowner under a Landowner's Water Well Permit, must perform a permanent abandonment. Please see Oregon Administrative Rule (OAR) 690-220-0005 or visit WRD's web page for the rule at http://arcweb.sos.state.or.us/rules/OARS_600/OAR_690/690_220.html. WRD has also developed a well guide that may be of use: *A Consumer's Guide to Water Well Construction, Maintenance and Abandonment* available at http://www.wrd.state.or.us/publication/wellcon99/index.shtml#abandoning. You may also contact WRD at (503) 986-0900. If the UIC system has been permanently abandoned/decommissioned, provide the date and method of closure. If you are planning to decommission the system, submit a *DEQ Pre-Closure Notification Form* 30 days before proposed closure.

5. The following design characteristics:

   - Depth and diameter in feet
   - Design injection rate
   - Nearest cleanup site. To find the nearest cleanup site, use DEQ's Profiler utility at http://deq12.deq.state.or.us/fp20/.
   - Size of the impervious area in square feet drained by the UIC system. An impervious area is an area that does not allow rain to soak into the ground. It includes paved areas, concrete pads, buildings, and compacted areas such as graveled or dirt roads. For example, if the UIC system is used for roof drainage, estimate the square footage of the building the roof drain serves.
   - Type of treatment prior to subsurface discharge or BMPs to protect groundwater. For storm drainage systems, this could be a grassy swale, "stormceptor"-type pretreatment devices, catch basin inserts, or other pre-treatment design. It does not include the rocks inside a dry well. If there is no treatment prior to the UIC system, write "no treatment." Please visit DEQ's UIC webpage for more information about pretreatment systems under Storm Water Guidelines.

REGISTRATION SUBMITTAL AND QUESTIONS

Please return this form with your payment to:	For more information, contact:
Department of Environmental Quality Attn: Business Office 811 SW 6th Avenue Portland OR 97204	Barbara Priest, DEQ WQ Division 811 SW 6th Avenue, Portland, OR 97204 Phone (503) 229-5945 Fax: (503) 229-6037

DEQ's UIC web page: http://www.deq.state.or.us/wq/uic/uic.htm

Oregon Department of Environmental Quality
811 SW 6th Avenue
Portland, Oregon 97204

NO-EXPOSURE CERTIFICATION
For Underground Injection Control

State of Oregon Department of Environmental Quality

Submission of this No-Exposure Certification constitutes notice that the facility or municipality owning or operating storm water injection systems certifies that the areas with hazardous substances use are not in contact with storm water which is being injected. This certification is required as part of inventory registration to qualify as rule authorized for storm water disposal to an injection system.

A condition of no exposure exists at a site, facility or municipality when all industrial materials and activities are protected by a storm-resistant shelter to prevent exposure to rain, snow, snowmelt, and/or runoff. Industrial materials or activities include, but are not limited to, stored or generated toxic or hazardous materials, petroleum products, material handling equipment or activities, industrial machinery, raw materials, intermediate products, by-products, final products, or waste products. Material handling activities include the storage, loading and unloading, transportation, or conveyance of any raw material, intermediate product, final product or waste product. A storm resistant shelter is not required for the following industrial materials and activities:

- drums, barrels, tanks, and similar containers that are tightly sealed, provided those containers are not deteriorated and do not leak. "Sealed" means banded or otherwise secured and without operational taps or valves;
- adequately maintained vehicles used in material handling; and
- final products, other than products that would be mobilized in storm water discharges (e.g., rock salt).

A No-Exposure Certification must be provided for each site or facility as part of the qualifications for rule authorization. If any industrial activities or materials are or will be exposed to precipitation, the facility or site is not eligible for the no-exposure exclusion.

By signing and submitting this No-Exposure Certification form, the entity is certifying that a condition of no exposure exists at its facility or site, and is obligated to comply with the terms and conditions of 40 CFR 122.26(g) and OAR 340-44.

ALL INFORMATION MUST BE PROVIDED ON THIS FORM.

Detailed instructions for completing this form and obtaining the No-Exposure exclusion are provided on page 3 and 4.

A. Facility Operator Information

1. Name: **David Winship - City of Beaverton** 2. Phone: **503-526-2434**
3. Mailing Address: a. Street/P.O. Box: **P.O. Box 4755, 4755 SW Griffith Drive**
   b. City: **Beaverton** c. State: **OR** d. Zip Code: **97076**

B. Facility/Site Location Information

1. Facility Name: **Cooper Mountain Reservoir - City of Beaverton**
2. a. Street Address: **18250 SW Kemmer Rd.**
   b. City: **Beaverton** c. County: **Washington**
   d. State: OR e. Zip Code: **97007**
3. Is the facility located on Indian Lands? Yes ☐ No ☒
4. Is this a Federal facility? Yes ☐ No ☒
5. a. Latitude (decimal): **45.452111°** b. Longitude (decimal): **-122.864873°**
6. a. Was or is the facility or site previously covered under a WPCF permit? Yes ☐ No ☒
   b. If yes, enter WPCF permit number: ______ c. If under an NPDES permit, enter permit number: ______
7. SIC/Activity Codes: **4941** Primary: ______ Secondary (if applicable): ______
8. Total size of site associated with industrial activity: **NA** acres
9. a. Have you paved or roofed over a formerly exposed, pervious area in order to qualify for the No-Exposure exclusion? Yes ☐ No ☒
   b. If yes, please indicate approximately how much area was paved or roofed over. Completing this question does not disqualify you for the No-Exposure exclusion. However, DEQ may use this information in considering whether storm water discharges from your site are likely to have an adverse impact on water quality, in which case you could be required to obtain permit coverage.
   Less than one acre ☐ One to five acres ☐ More than five acres ☐

C. Exposure Checklist

Are any of the following materials or activities exposed to precipitation in the area served by your injection systems, now or in the foreseeable future? (Please check either "Yes" or "No" in the appropriate box.) **If you answer "Yes" to any of these questions, you do not qualify for the No-Exposure certification or rule authorization.**

	Yes	No
1. Using, storing or cleaning industrial machinery or equipment, and areas where residuals from using, storing or cleaning Industrial machinery or equipment remain and are exposed to storm water..........	☐	☒
2. Materials or residuals on the ground, in trenches, running into injection systems or in storm water inlets resulting from spills/leaks (e.g. petroleum products)	☐	☒
3. Materials or products from past industrial activity	☐	☒
4. Material handling equipment (except adequately maintained vehicles)	☐	☒
5. Materials or products handling during loading/unloading or transporting activities [e.g. drywell at loading dock]	☐	☒
6. Materials or products stored outdoors (except final products intended for outside use [e.g., new cars] where exposure to storm water does not result in the discharge of pollutants)	☐	☒
7. Materials contained in open, deteriorated or leaking storage drums, barrels, tanks, and similar containers	☐	☒
8. Materials or products handled/stored on roads or railways owned or maintained by the discharger ...	☐	☒
9. Waste material (except waste in covered, non-leaking containers [e.g., dumpsters])	☐	☒
10. Application or disposal of process wastewater (unless otherwise permitted, such as vehicle washing)	☐	☒
11. Particulate matter or visible deposits of residuals from roof stacks and/or vents not otherwise regulated (i.e., under an air quality control permit) and evident in the storm water outflow	☐	☒

D. Certification Statement

I certify under penalty of law that I have read and understand the eligibility requirements for claiming a condition of "no exposure" to be considered as qualifying for Rule Authorization for storm water injection. I certify under penalty of law that there are no discharges of storm water contaminated by exposure to industrial activities or materials from the industrial facility or site identified in this document (except as allowed under 40 CFR 122.26(g)(2)) and/or OAR 340-44 UIC rules.

I understand that I am obligated to submit a No-Exposure certification form once every five years to DEQ. I understand that I must allow the DEQ permitting authority, where the discharge is to perform inspections to confirm the condition of no exposure and to make such inspection reports publicly available upon request.

Additionally, I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Print Name: Kevin Hanway
Print Title: General Manager, Joint Water Commission
Signature: [signature]
Date: 11/23/10

C. Exposure Checklist

Are any of the following materials or activities exposed to precipitation in the area served by your injection systems, now or in the foreseeable future? (Please check either "Yes" or "No" in the appropriate box.) **If you answer "Yes" to any of these questions, you do not qualify for the No-Exposure certification or rule authorization.**

		Yes	No
1.	Using, storing or cleaning industrial machinery or equipment, and areas where residuals from using, storing or cleaning Industrial machinery or equipment remain and are exposed to storm water..........	☐	☒
2.	Materials or residuals on the ground, in trenches, running into injection systems or in storm water inlets resulting from spills/leaks (e.g. petroleum products)	☐	☒
3.	Materials or products from past industrial activity	☐	☒
4.	Material handling equipment (except adequately maintained vehicles)	☐	☒
5.	Materials or products handling during loading/unloading or transporting activities [e.g. drywell at loading dock]	☐	☒
6.	Materials or products stored outdoors (except final products intended for outside use [e.g., new cars] where exposure to storm water does not result in the discharge of pollutants)	☐	☒
7.	Materials contained in open, deteriorated or leaking storage drums, barrels, tanks, and similar containers	☐	☒
8.	Materials or products handled/stored on roads or railways owned or maintained by the discharger ...	☐	☒
9.	Waste material (except waste in covered, non-leaking containers [e.g., dumpsters])	☐	☒
10.	Application or disposal of process wastewater (unless otherwise permitted, such as vehicle washing)	☐	☒
11.	Particulate matter or visible deposits of residuals from roof stacks and/or vents not otherwise regulated (i.e., under an air quality control permit) and evident in the storm water outflow	☐	☒

D. Certification Statement

I certify under penalty of law that I have read and understand the eligibility requirements for claiming a condition of "no exposure" to be considered as qualifying for Rule Authorization for storm water injection. I certify under penalty of law that there are no discharges of storm water contaminated by exposure to industrial activities or materials from the industrial facility or site identified in this document (except as allowed under 40 CFR 122.26(g)(2)) and/or OAR 340-44 UIC rules.

I understand that I am obligated to submit a No-Exposure certification form once every five years to DEQ. I understand that I must allow the DEQ permitting authority, where the discharge is to perform inspections to confirm the condition of no exposure and to make such inspection reports publicly available upon request.

Additionally, I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Print Name: David A. Winship

Print Title: Pricipal Engineer, City of Beaverton

Signature: David A. Winship

Date: 11/30/10

Who May File a No-Exposure Certification

State law prohibits discharges of storm water associated with industrial activity into waters of the U.S., including groundwater, without qualifying as Rule Authorized or under a permit. However, WPCF permit coverage is not required for discharges of storm water associated with industrial activities if the discharger can certify that a condition of "no exposure" exists at the facility or site.

Obtaining and Maintaining the No-Exposure Exclusion

This form is used to certify that a condition of no exposure exists at the facility or site described herein. This certification is only applicable where DEQ is the UIC permitting authority and must be re-submitted at least once every five years.

The facility operator must maintain a condition of no exposure at its facility or site in order for the No-Exposure exclusion to remain applicable. If conditions change resulting in the exposure of materials and activities to storm water, the facility operator must obtain coverage under a WPCF storm water permit immediately.

Where to File the No-Exposure Certification Form

Mail the completed No-Exposure Certification Form to:
DEQ UIC Coordinator
811 SW 6th Avenue, WQ Division
Portland, Oregon 97204

Completing the Form

You must type or print, using uppercase letters, in appropriate areas only. One form must be completed for each facility or site for which you are seeking to certify a condition of no exposure. Please make sure you have addressed all applicable questions and have made a photocopy for your records before sending the completed form to the above address.

Section A. Facility Operator Information

1. Provide the legal name of the person, firm, public organization, or any other entity that operates the facility or site described in this certification. The name of the operator may or may not be the same as the name of the facility. The operator is the legal entity that controls the facility's operation, rather than the plant or site manager.

2. Provide the telephone number of the facility operator.

3. Provide the mailing address of the operator (P.O. Box numbers may be used). Include the city, state, and zip code. All correspondence will be sent to this address.

Section B. Facility/Site Location Information

1. Enter the official or legal name of the facility or site.

2. Enter the complete street address (if no street address exists, provide a geographic description [e.g., Intersection of Routes 9 and 55]), city, county; state, and zip code.

3. Indicate whether the facility is located on Indian Lands.

4. Indicate whether the facility is operated by a municipality, state agency, or a department of the Federal Government.

5. Enter the latitude and longitude* of the approximate center of the facility or site in decimal degrees if possible. Latitude and longitude can be obtained by accessing DEQ's web site at http://deq12.deq.state.or.us/fp20/. If a GPS unit is used to determine lat/long, set the datum to the state standard, NAD83; otherwise, location data will not be accurate.

   *Latitude and longitude for a facility is preferred in decimal form rather than degrees (°), minutes ('), and seconds (") for proper entry on the certification form. To convert decimal latitude or longitude degrees/ minutes/seconds, access the mapping web site listed above.

6. Indicate whether the facility was previously covered under an NPDES or WPCF storm water permit. If so, include the permit number.

7. Enter the 4-digit SIC code which identifies the facility's primary activity, and second 4-digit SIC code identifying the facility's secondary activity, if applicable. SIC codes can be obtained from the Standard Industrial Classification Manual, 1987 or from Federal OSHA's web site at http://www.osha.gov/oshstats/sicer.hmtl.

8. Enter the total size of the site associated with industrial activity in acres. Acreage may be determined by dividing square footage by 43,560, as demonstrated in the following example.

   Example: Convert 54,450 ft^2 to acres

   Divide 54,450 ft^2 by 43,560 square feet per acre:

   $$54{,}450\ ft^2 \div 43{,}560\ ft^2/acre = 1.25\ acres.$$

9. Check "Yes" or "No" as appropriate to indicate whether you have paved or roofed over a formerly exposed, pervious area (i.e., lawn, meadow, dirt or gravel parking lot) in order to qualify for no exposure. If yes, also indicate approximately how much area was paved or roofed over and is now impervious area.

Section C. Exposure Checklist

Check “Yes” or “No” as appropriate to describe the exposure conditions at your facility. If you answer “Yes” to **ANY** of the questions (1) through (11) in this section, a potential for exposure exists at your site and you cannot certify to a condition of no exposure. You must obtain (or already have) coverage under a WPCF storm water permit. After obtaining permit coverage, you can institute modifications to eliminate the potential for a discharge of storm water exposed to industrial activity, and then certify to a condition of no exposure.

Section D. Certification Statement

State statutes provide for penalties for submitting false information on this application form. State regulations require this application to be signed as follows:

For a corporation: by a responsible corporate officer, which means:

(i) president, secretary treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision making functions for the corporation, or

(ii) the manager of one or more manufacturing, production, or operating facilities, provided the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures;

For a partnership or sole proprietorship: by a general partner or the proprietor; or

For a municipal, State, Federal, or other public facility: by either a principal executive or ranking elected official.

Where to File This Form

Send Signed Original Document to:
Oregon Department of Environmental Quality (DEQ)
Water Quality Division - LAL
UIC Coordinator
811 SW 6th Avenue
Portland, OR 97204-1390

Or Fax to: (503) 229-6037

For office use only – UIC Verification of No-Exposure Certification	
Agency: DEQ Water Quality –UIC Coordinator	UIC #:
Inspection Date: / /	Date Approved: / /
Inspector (Signature):	Inspector (print):

Oregon DEQ Facility Profiler 2.0

[Help] [Close Window]

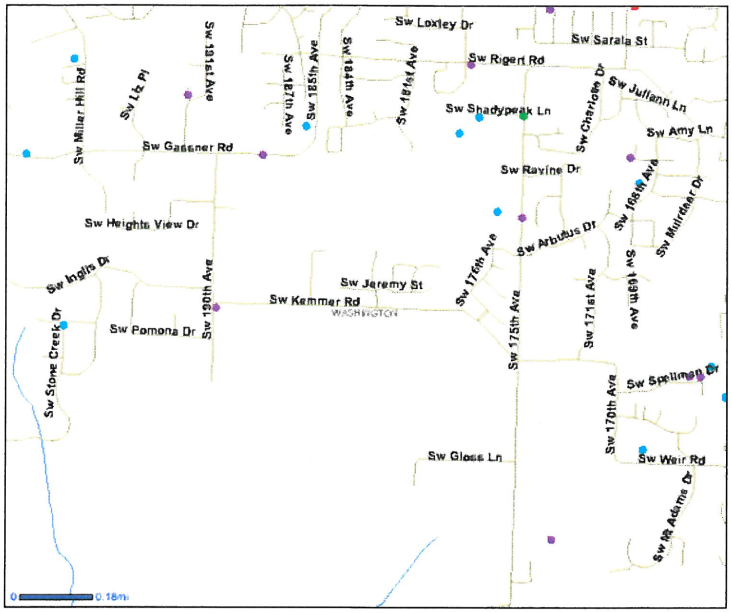
Image Dimensions (in Pixels): width 600 height 500 Update

DEQ Sites

- Multiple Programs
- Water Quality Permit
- Solid Waste Site
- Hazardous Waste
- Cleanup Site
- Air Quality Permit
- Underground Storage Tank
- Leaking Underground Storage Tank

ROADS

- Interstate/US Hwy
- State/Local Hwy
- Arterial
- Collector
- Liteduty
- Alley/Trail
- Water
- DW Source-Ground
- DW Source- Surface



[DEQ's Privacy Notice] [Contact DEQ] [Application Feedback]

Disclaimer: *This product is for informational purposes, and may not be suitable for legal, engineering or surveying purposes. This information or data is provided with the understanding that conclusions drawn from such information are the responsibility of the user.*

Oregon DEQ Facility Profiler 2.0

[Help] [Close Window]

Facility Summary Report

Return to Site Listing   Print Report

Maps

Facility / Site Information for Location 30339

Facility/Site Name:	MC KIE, N HOT	**Latitude:**	45° 27' 10.02"
Address:	18992 SW KEMMER	**Longitude:**	-122° 52' 21.12"
City State Zip:	ALOHA OR 97007	**Location Accuracy:**	HIGH
		Last Updated:	12/22/1998 12:00:00 AM

Aliases

MC KIE, N HOT   LUST

Geographic Features

Township:	T1S-R2W-S25	**Congress Dist:**	1	**Forest Type:**	
County:	WASHINGTON	**OR Senate Dist:**	13	**Vegetation:**	Douglas fir-Oregon white oak forest and woodland
Watershed:	TUALATIN	**OR House Dist:**	26	**Agricultural Land:**	PREDOM IRR
Drinking Water Source:		N/A			

Oregon DEQ Program Information

Leaking Underground Storage Tanks (LUST)

Log Number	Received	Cleanup Initiated	Cleanup Complete	Type	Heating Oil Tank	UST Facility ID	Status	Detail Information[1]
34-98-0712		08/28/1998		NON_REGULATED	HEATING_OIL_TANK		CLEANUP_STARTED	LUST Site Report

[1] Linked reports may be unavailable from 9:00pm to 7:00am PST due to system maintenance.

[2] DEQ does not maintain air discharge permit information for Lane County.

More Information on this location

Oregon DEQ Neighborhood Info (by region/county)
See wells in the same Township Range Section from the Oregon Water Resources Department Well logs Application
See county's scanned assessor maps through ORMAP

[DEQ's Privacy Notice] [Contact DEQ] [Application Feedback]

Disclaimer: *This product is for informational purposes, and may not be suitable for legal, engineering or surveying purposes. This information or data is provided with the understanding that conclusions drawn from such information are the responsibility of the user.*

Leaking Underground Storage Tanks (LUST) Site Information

(Use "Back" button on browser to return to previous search results)

Leaking Underground Storage Tank (LUST) Site Information

Basic Incident Information

Log Nbr: **34-98-0712**
Site Name: HEATING OIL TANK
Address: 18992 SW KEMMER
City: ALOHA
Zip Code: 97007
County: WASHINGTON
Status: **ACTIVE**
Received Date: 8/28/1998
Site Type:
File Status:
Heating Oil Tank (HOT): YES
Regulated Tank:

Assessment Information 34-98-0712

Cause: UNKNOWN
Source: Not Reported
Discovery: SITE ASSESSMENT

Media Effected
>Soil

Contaminants Released
>HeatingOil

Free Product Removed:
Free Vapor Removed:
CAP Requested:
Delineate Groundwater:
Groundwater Delineated:
CAP Submitted:
Delineate Soil:
Soil Delineated:
CAP Approved:
Compliance Monitoring:

Management Information 34-98-0712

Release Stopped Date: 8/28/1998
Cleanup Start Date: 8/28/1998
Cleanup End Date:

Work Reported Information 34-98-0712

Work Reported	Reported By	Reported Date
Tank Decommissioning	DeMinimis Inc.	9/15/1998
Tank Decommissioning	Data Conversion 2006	9/11/1998

This information may not reflect current status of site.
For further detail, refer to the DEQ Regional Office file.

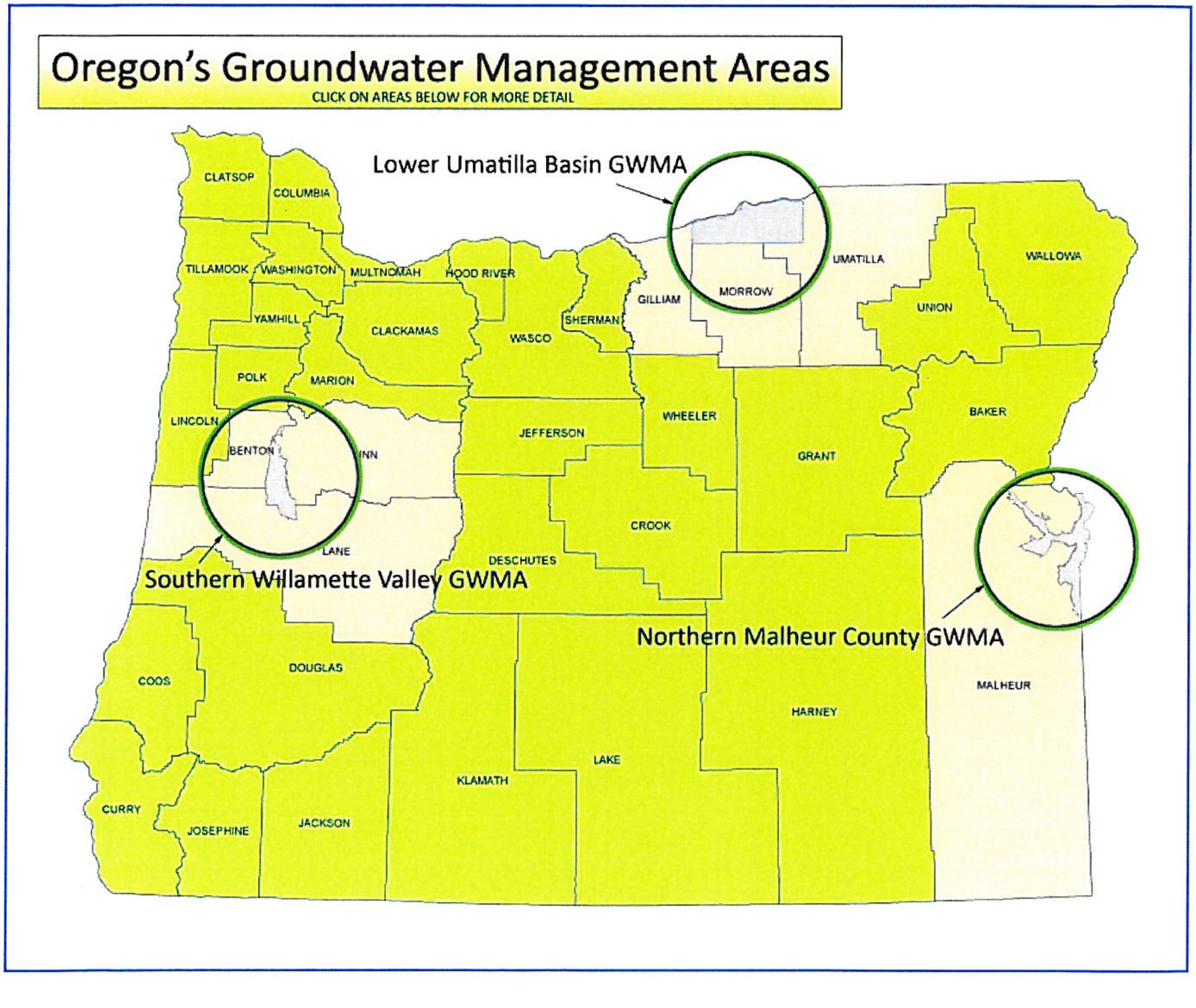
This page last updated: January 9, 2006
DEQ Online is the official web site for the Oregon Department of Environmental Quality.

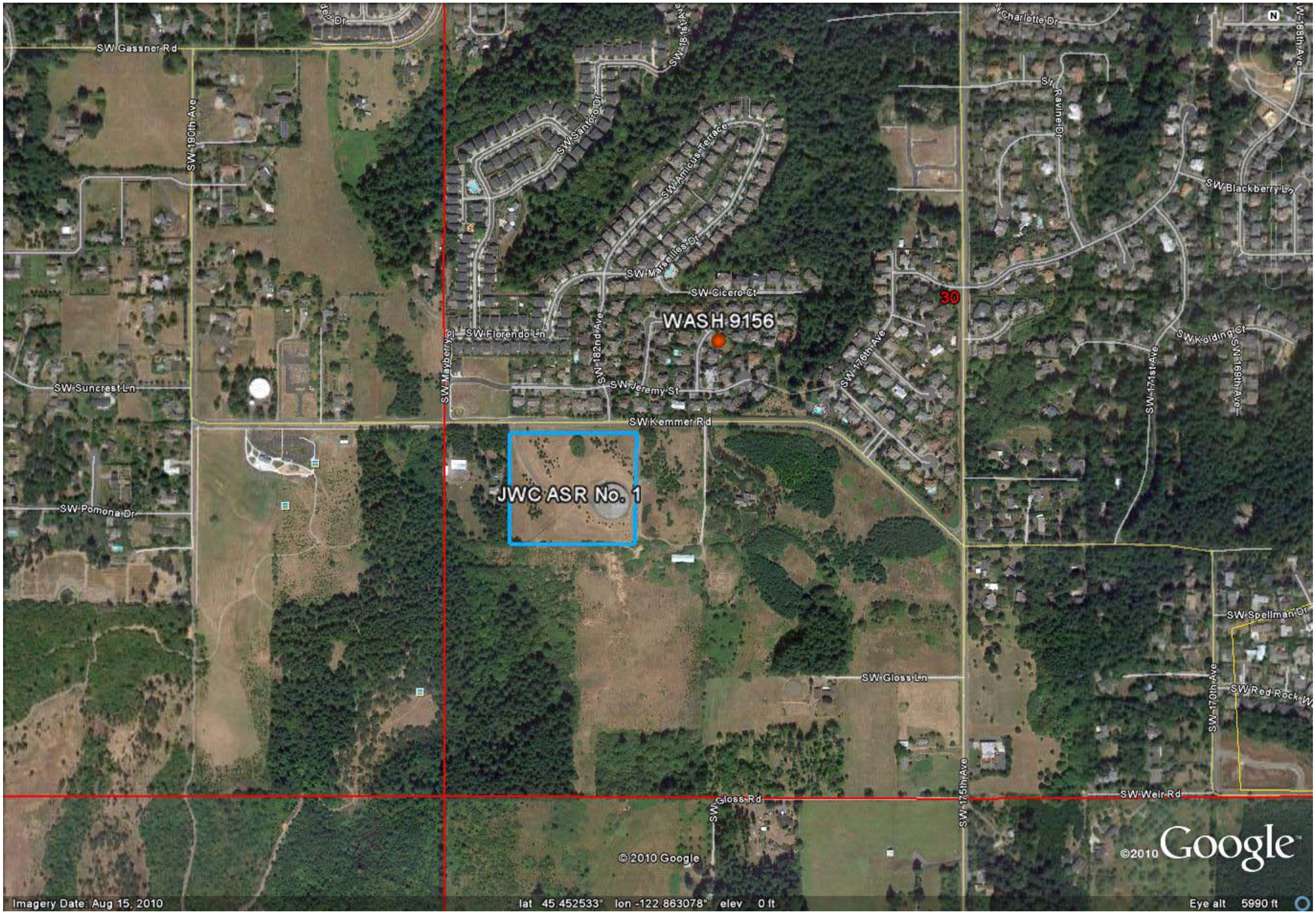
Oregon Department of Environmental Quality

Groundwater Management Areas (GWMAs)

GWMAs are designated by DEQ when groundwater in an area has elevated contaminant concentrations resulting, at least in part, from non-point sources. Once the GWMA is declared, a local Groundwater Management Committee comprised of affected and interested parties is formed. The Committee then works with and advises the state agencies that are required to develop an action plan that will reduce groundwater contamination in the area.

Oregon has designated three GWMAs because of elevated nitrate concentrations in groundwater. These include the Lower Umatilla Basin GWMA, the Northern Malheur County GWMA, and the Southern Willamette Valley GWMA. Each one has developed a voluntary action plan to reduce nitrate concentrations in groundwater.

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SW 190th Ave
SW Suncrest Ln
SW Pomona Dr
SW Mayberry
SW Florendo Ln
SW Santoro Dr
SW Amicus Terrace
SW Marsellios Dr
SW Cicero Ct
SW 182nd Ave
SW Jeremy St
SW Kemmer Rd
WASH 9156
JWC ASR No. 1
SW 176th Ave
SW 175th Ave
SW Charlotte Dr
SW Ravine Dr
SW Blackberry Ln
SW Kolding Ct
SW 171st Ave
SW 169th Ave
SW 168th Ave
30
SW Spellman Dr
SW Gloss Ln
SW 170th Ave
SW Red Rock W
SW Weir Rd
Gloss Rd
SW Gloss
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Imagery Date: Aug 15, 2010
lat 45.452533° lon -122.863078° elev 0 ft
Eye alt 5990 ft

ORIGINAL
File Original and Duplicate with the STATE ENGINEER, SALEM, OREGON

RECEIVED JUN 14 1957 STATE ENGINEER SALEM, OREGON

WATER WELL REPORT — WASH
STATE OF OREGON

009156

State Well No. 1/1W-30L(2)
State Permit No.

(1) OWNER:
Name Albert Kemmerer
Address 119 - S.E. 2nd Street
Beaverton, Oregon

(2) LOCATION OF WELL:
County — Owner's number, if any—
¼ ¼ Section T. R. W.M.
Bearing and distance from section or subdivision corner
30 Acres In Sec. 30 Township 1 south Range 1 West of WM Well located on slope just North of Kenner Road. Washington County Oregon

) TYPE OF WORK (check):
ew Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 11.

(4) PROPOSED USE (check):
omestic ☒ Industrial ☐ Municipal ☐
igation ☐ Test Well ☐ Other ☐

(5) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

(6) CASING INSTALLED:
Threaded ☐ Welded ☐
8" Diam. from 0 ft. to 81 ft. Gage std
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

(7) PERFORATIONS:
Perforated? ☐ 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.
perforations from ft. to ft.
perforations from ft. to ft.

(8) SCREENS:
Well screen installed ☐ Yes ☐ No
nufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

CONSTRUCTION:
as well gravel packed? ☐ Yes ☒ No Size of gravel:
Gravel placed from ft. to ft.
Was a surface seal provided? ☐ 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

(10) WATER LEVELS:
Static level 455 ft. below land surface Date 5-20-57
Artesian pressure lbs. per square inch Date

Log Accepted by:
[Signed] Albert Kemmerer Date June 10, 1957
(Owner)

(11) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☐ No If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " " "
" " " "
Bailer test 10 gal./min. with ft. drawdown after 2 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? ☐ Yes ☐ No

(12) WELL LOG:
Diameter of well 8" inches.
Depth drilled 535 ft. Depth of completed well 535 ft.

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
mud & Clay	0	25
red clay	25	50
clay to loose rock	50	65
loose to hard rock	65	80
drove pipe into hard rock at 81 ft		
brown to black rock	81	100
crivese basalt rock	100	535
good quality all the way		

Work started 4-18-57 19 . Completed May 20 1957

(13) PUMP:
Manufacturer's Name Pacific Pump Co.
Type Pacific Sub. H.P. 3.

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 Barron & Strayer
(Person, firm, or corporation) (Type or print)
Address Beaverton Ore.

Driller's well number

[Signed] Lance Strayer
(Well Driller)

License No. 36 Date 6-10-57, 19

(USE ADDITIONAL SHEETS IF NECESSARY)

SOURCE WATER ASSESSMENT SUMMARY BROCHURE

JOINT WATER COMMISSION
PWS # 4100379
AND
HILLSBORO-CHERRY GROVE
PWS # 4100985

WHAT IS A SOURCE WATER ASSESSMENT?

The Source Water Assessment was recently completed by the Department of Environmental Quality (DEQ) and the Oregon Department of Human Services (DHS) to identify the surface areas (and/or subsurface areas) that supply water to the Hillsboro Utilities Commission, Beaverton, Forest Grove, and Tualatin Valley Water District Joint Water Commission (JWC) and Hillsboro-Cherry Grove's public water system intakes and to inventory the potential contaminant sources that may impact the water supply.

WHY WAS IT COMPLETED?

The Source Water Assessment was completed to provide information so that the JWC and Hillsboro-Cherry Grove public water system's staff/operator, consumers, and community citizens can begin developing strategies to protect the source of their drinking water, and to minimize future public expenditures for drinking water treatment. The assessment was prepared under the requirements and guidelines of the Federal Safe Drinking Water Act (SDWA).

WHAT AREAS ARE INCLUDED IN JWC AND HILLSBORO-CHERRY GROVE 'S DRINKING WATER PROTECTION AREA?

The drinking water for the JWC and Hillsboro-Cherry Grove public water systems is supplied by three intakes located on the Tualatin River, the Upper Tualatin River at Hillsboro Reservoir, and the North Fork Trask River at Barney Reservoir. The drinking water intakes for the City of Forest Grove public water system are located on tributaries to the Tualatin River upstream of the JWC Tualatin River intake. This assessment includes Information for the portion of JWC's protection area upstream of the Forest Grove intakes.

Combined, the JWC and Hillsboro-Cherry Grove public water systems serve approximately 65,350 citizens (65,100 for JWC and 250 for Hillsboro Cherry Grove). The Tualatin River intakes are located in the Gales Creek/Scroggins Creek Watersheds in the Tualatin Subbasin of the Willamette Basin. The North Fork Trask River intake is located in the Trask River Watershed in the Wilson-Trask-Nestucca Subbasin of the Northern Oregon Coastal Basin. The boundaries of the Drinking Water Protection Area are illustrated on the figure attached to this summary.

The geographic area (drinking water protection area) providing water to JWC and Hillsboro-Cherry Grove's intakes includes a cumulative total of 467 stream miles (448 stream miles upstream of the Tualatin River intakes and 19 stream miles upstream of the North Fork Trask intake) and encompasses a total of 220 square miles (212 square miles in the Tualatin Subbasin and 8.2 square miles in the Wilson-Trask-Nestucca Subbasin). Included in this area are a number of tributaries to the Tualatin River main stem including Carpenter Creek, Dilley Creek, Scroggins Creek and Hagg Lake, Ayers Creek, Roaring Creek, Lee Creek, and Sunday Creek.

For surface water systems that encompass an area greater than 100 square miles, such as the area upstream of JWC's Tualatin River intake, DEQ has also estimated the area within an 8-hour time of travel from the intake. The protection area within an 8-hour travel time from the JWC Tualatin River intake extends approximately 7.6 miles upstream. It is recommended that the water systems and community consider increased protection within an 8-hour travel time from the intake since eight hours should provide adequate response time to protect the integrity of the public water system intake should a spill or release occur at any crossing or discharge point to the stream.

WHAT ARE THE POTENTIAL SOURCES OF CONTAMINATION TO JWC AND HILLSBORO-CHERRY GROVE 'S PUBLIC DRINKING WATER SUPPLY?

The primary intent of this inventory was to identify and locate significant potential sources of contaminants of concern. The delineated drinking water protection area is primarily dominated by a mix of agricultural, forestry, and residential land uses.

♦ The potential contaminant sources identified in the watershed that relate to *agricultural/forest management* include managed forest lands, road improvement, a pond, an arboretum, boat ramps, land slide areas, crop areas, stables, nurseries, orchards, grazing animals, areas with pesticide storage/handling/mixing, dairies, a land application site, a holding pond, a fish hatchery and farm machinery repair operations.

♦ Potential contaminant sources related to *commercial land uses* include a lumber company, machine shops, gas stations, auto repair shops, an auto body shop, a furniture store, a lumber store, quarries, wood products shops, a fabricator, an office building, food processing operations, construction waste, junkyards, a wrecking yard, a well drilling operation, a mini-storage, and a saw mill.

♦ Potential contaminant sources related to *residential/municipal land uses* include reservoirs, rural homes, areas with high density housing, schools, a home machine shop, an aboveground tank, underground storage tanks, a campground, RV parks, utility stations, water treatment plants, sewage pump stations, a transfer station, parks, cemeteries, sewer lines, stream crossings, a home machine shop, a slow sand filter plant, a storm water retention basin, areas with new construction, apartments, fire stations, a parking lot, airstrips, a railroad yard, a church, a motor pool, large capacity septic systems, highways, power lines, and a railroad.

♦ Two additional potential sources of contamination (landslides and clear-cut forest areas) were identified upstream of the Forest Grove intakes.

This provides a quick look at the existing potential sources of contamination that could, if improperly managed or released, impact the water quality in the watershed.

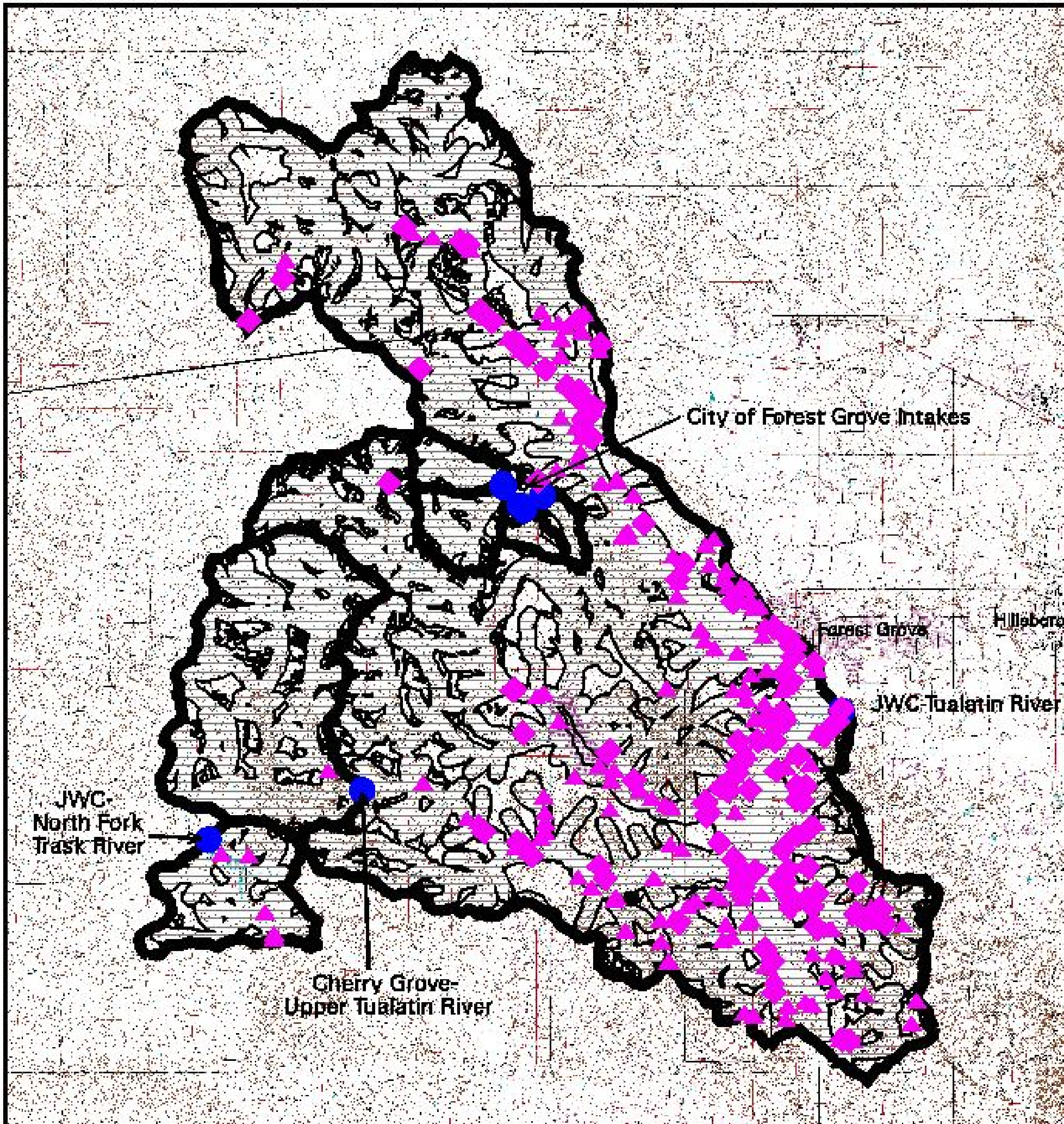
WHAT ARE THE RISKS FOR OUR SYSTEM?

A total of 306 potential contaminant sources were identified in the JWC and Hillsboro-Cherry Grove's drinking water protection area. Of these, 295 are located in the sensitive areas and 272 are high- to moderate-risk sources within "sensitive areas". The sensitive areas within the JWC and Hillsboro-Cherry Grove drinking water protection area include areas with high soil permeability, high soil erosion potential, high runoff potential and areas within 1000' from the river/streams. The sensitive areas are those where the potential contamination sources, if present, have a greater potential to impact the water supply. The information in this assessment provides a basis for prioritizing areas in and around our community that are most vulnerable to potential impacts and can be used by the JWC and Hillsboro-Cherry Grove community to develop a voluntary Drinking Water Protection Plan.

NEED MORE INFORMATION?

The Hillsboro Utilities Commission, Beaverton, Forest Grove, and Tualatin Valley Water District Joint Water Commission and Hillsboro-Cherry Grove's Source Water Assessment Report provides additional details on the methodology and results of this assessment. The full report is available for review at:

Contact your water provider if you would like additional information on these Source Water Assessment results.



Source Water Assessment Results

Joint Water Commission and Hillsboro-Cherry Groves's Drinking Water Protection Area with Sensitive Areas and Potential Contamination Sources

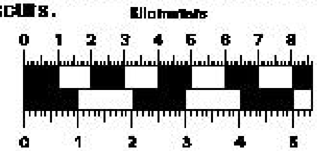
PWS 4100379/4100985

Drinking Water Protection Area
Drinking Water Intake - Surface Water
Sensitive Areas
Area Feature (see Note 2)
Point Feature (see Note 2)

Notes on Potential Contaminant Sources

Note 1: Sites and areas noted in this Figure are potential sources of contamination to the drinking water identified by Oregon drinking water protection staff. Environmental contamination is not likely to occur when contaminants are used and managed properly.

Note 2: Feature identification markers correspond to the potential contaminant source numbers in the SWA Report. The area features represent the approximate area where the land use or activity occurs and is marked at the point closest to the intake. The point features represent the approximate point where the land use or activity occurs.



Printed July, 2003

Oregon Department of Environmental Quality GIS

TABLE 1. SUMMARY OF POTENTIAL CONTAMINANT SOURCES BY LAND USE

PWS # 4100379 - JWC and PWS# 4100985 - HILLSBORO-CHERRY GROVE

Residential/Municipal Land Uses

Potential Contamination Source	Note	Relative Risk Level	Total in DWPA
Airport - Maintenance/Fueling Area		Moderate	1
Apartments and Condominiums		Lower	2
Campgrounds/RV Parks	(1)	Moderate	5
Cemeteries - Pre-1945		Lower	7
Drinking Water Treatment Plants		Moderate	3
Fire Station		Lower	2
Fire Training Facilities		Moderate	1
Golf Courses		Moderate	0
Housing - High Density (> 1 House/0.5 acres)		Moderate	8
Landfill/Dumps	(1)	Higher	0
Lawn Care - Highly Maintained Areas		Moderate	2
Motor Pools		Moderate	1
Parks		Moderate	12
Railroad Yards/Maintenance/Fueling Areas		Higher	1
Schools		Moderate	12
Septic Systems - High Density (> 1 system/acre)	(1)	Higher	0
Sewer Lines - Close Proximity to PWS	(1)	Moderate	1
Utility Stations - Maintenance Transformer Storage		Higher	10
Waste Transfer/Recycling Stations	(1)	Higher	1
Wastewater Treatment Plants/Collection Stations	(1)	Higher	1
Other			0

NOTES:
Sites and areas identified in this Table are only potential sources of contamination to the drinking water. Environmental contamination is not likely to occur when contaminants are used and managed properly.
(1) - Potential source of microbial contamination
(2) - Drip irrigated crops, such as vineyards and some vegetables, are considered lower risk than spray irrigation
(3) - For groundwater public water systems, septic systems located within the 2-year time-of-travel (TOT) are considered moderate risks.

TABLE 1. SUMMARY OF POTENTIAL CONTAMINANT SOURCES BY LAND USE

PWS # 4100379 - JWC and PWS# 4100985 - HILLSBORO-CHERRY GROVE

Commercial/Industrial Land Uses

Potential Contamination Source	Note	Relative Risk Level	Total in DWPA
Automobiles - Body Shops		Moderate	1
Automobiles - Car Washes		Moderate	0
Automobiles - Gas Stations		Moderate	2
Automobiles - Repair Shops		Moderate	2
Boat Services/Repair/Refinishing		Higher	0
Cement/Concrete Plants		Moderate	0
Chemical/Petroleum Processing/Storage		Higher	4
Dry Cleaners		Higher	0
Electrical/Electronic Manufacturing		Higher	0
Fleet/Trucking/Bus Terminals		Moderate	3
Food Processing		Moderate	8
Furniture/Lumber/Parts Stores		Moderate	1
Home Manufacturing		Higher	0
Junk/Scrap/Salvage Yards		Higher	3
Machine Shops		Higher	4
Medical/Vet Offices	(1)	Moderate	0
Metal Plating/Finishing/Fabrication		Higher	2
Mines/Gravel Pits		Higher	8
Office Buildings/Complexes		Lower	3
Parking Lots/Malls (> 50 Spaces)		Higher	1
Photo Processing/Printing		Higher	0
Plastics/Synthetics Producer		Higher	0
Research Laboratories		Higher	0
RV/Mini Storage		Lower	1
Wood Preserving/Treating		Higher	0
Wood/Pulp/Paper Processing and Mills		Higher	4
Other: - Equipment Storage		Moderate	1

NOTES:
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(3) - For groundwater public water systems, septic systems located within the 2-year time-of-travel (TOT) are considered moderate risks.

TABLE 1. SUMMARY OF POTENTIAL CONTAMINANT SOURCES BY LAND USE

PWS # 4100379 - JWC and PWS# 4100985 - HILLSBORO-CHERRY GROVE

Agricultural/Forest Land Uses

Potential Contamination Source	Note	Relative Risk Level	Total in DWPA
Auction Lots	(1)	Higher	0
Boarding Stables	(1)	Higher	12
Confined Animal Feeding Operations (CAFOs)	(1)	Higher	5
Crops - Irrigated (inc. orchards, vineyards, nurseries,	(2)	Higher	67
Crops - Nonirrigated (inc. Christmas trees, grains, grass seed,		Lower	12
Farm Machinery Repair		Moderate	6
Grazing Animals (> 5 large animals or equivalent/acre)	(1)	Higher	41
Lagoons/Liquid Wastes	(1)	Higher	2
Land Application Sites	(1)	Higher	2
Managed Forest Land - Broadcast Fertilized Areas		Lower	0
Managed Forest Land - Clearcut Harvest (< 35 yrs.)		Higher	4
Managed Forest Land - Partial Harvest (< 10 yrs.)		Higher	2
Managed Forest Land - Road Density (> 2 mi./sq. mi.)		Moderate	0
Pesticide/Fertilizer/Petroleum Storage, Handling, Mixing, &		Higher	6
Recent Burn Areas (< 10 yrs.)		Lower	0
Managed Forest Lands - Status Unknown		Higher	1
Other: - Arboretum		Moderate	1
Other: - Fish Hatchery		Moderate	1
Other: - Irrigation		Moderate	1
Other: - Managed Forest - Development Status Unknown		Higher	1

NOTES:
Sites and areas identified in this Table are only potential sources of contamination to the drinking water. Environmental contamination is not likely to occur when contaminants are used and managed properly.
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TABLE 1. SUMMARY OF POTENTIAL CONTAMINANT SOURCES BY LAND USE

PWS # 4100379 - JWC and PWS# 4100985 - HILLSBORO-CHERRY GROVE

Miscellaneous Land Uses

Potential Contamination Source	Note	Relative Risk Level	Total in DWPA
Above Ground Storage Tanks - Excluding Water		Moderate	7
Channel Alterations - Heavy		Lower	0
Combined Sewer Outfalls	(1)	Lower	0
Stormwater Outfalls	(1)	Lower	0
Composting Facilities	(1)	Moderate	0
Historic Gas Stations		Higher	7
Historic Waste Dumps/Landfills	(1)	Higher	1
Homesteads - Rural - Machine Shops/Equipment Maintenance		Higher	10
Homesteads - Rural - Septic Systems (< 1/acre)	(1)(3)	Lower	2
Injection/Dry Wells, Sumps - Class V UICs	(1)	Higher	0
Kennels (> 20 Pens)	(1)	Lower	0
Military Installations		Higher	0
Random Dump Sites		Moderate	0
River Recreation - Heavy Use (inc. campgrounds)	(1)	Moderate	1
Sludge Disposal Areas	(1)	Higher	1
Stormwater Retention Basins	(1)	Higher	1
Transmission Lines - Right-of-Ways		Higher	1
Transportation - Freeways/State Highways/Other Heavy Use		Higher	2
Transportation - Railroads		Higher	1
Transportation - Right-Of-Ways - Herbicide Use Areas		Moderate	0
Transportation - River Traffic - Heavy		Lower	0
Transportation - Stream Crossing - Perennial		Higher	17
UST - Confirmed Leaking Tanks - DEQ List		Moderate	7
UST - Decommissioned/Inactive		Lower	12
UST - Nonregulated Tanks (< 1,100 gals or Large Heating Oil		Higher	0
UST - Not Upgraded and/or Registered Tanks		Higher	0
UST - Upgraded/Registered - Active		Lower	1
UST - Status Unknown		Moderate	4
Upstream Reservoirs/Dams		Moderate	2
Wells/Abandoned Wells		Higher	0
Large Capacity Septic Systems (serves > 20 people) - Class V	(1)	Moderate	9
Construction/Demolition Areas		Higher	3
Other: - DEQ Cleanup Program Site		Higher	3
Other: - Equipment		Moderate	2

NOTES:
Sites and areas identified in this Table are only potential sources of contamination to the drinking water. Environmental contamination is not likely to occur when contaminants are used and managed properly.
(1) - Potential source of microbial contamination
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(3) - For groundwater public water systems, septic systems located within the 2-year time-of-travel (TOT) are considered moderate risks.

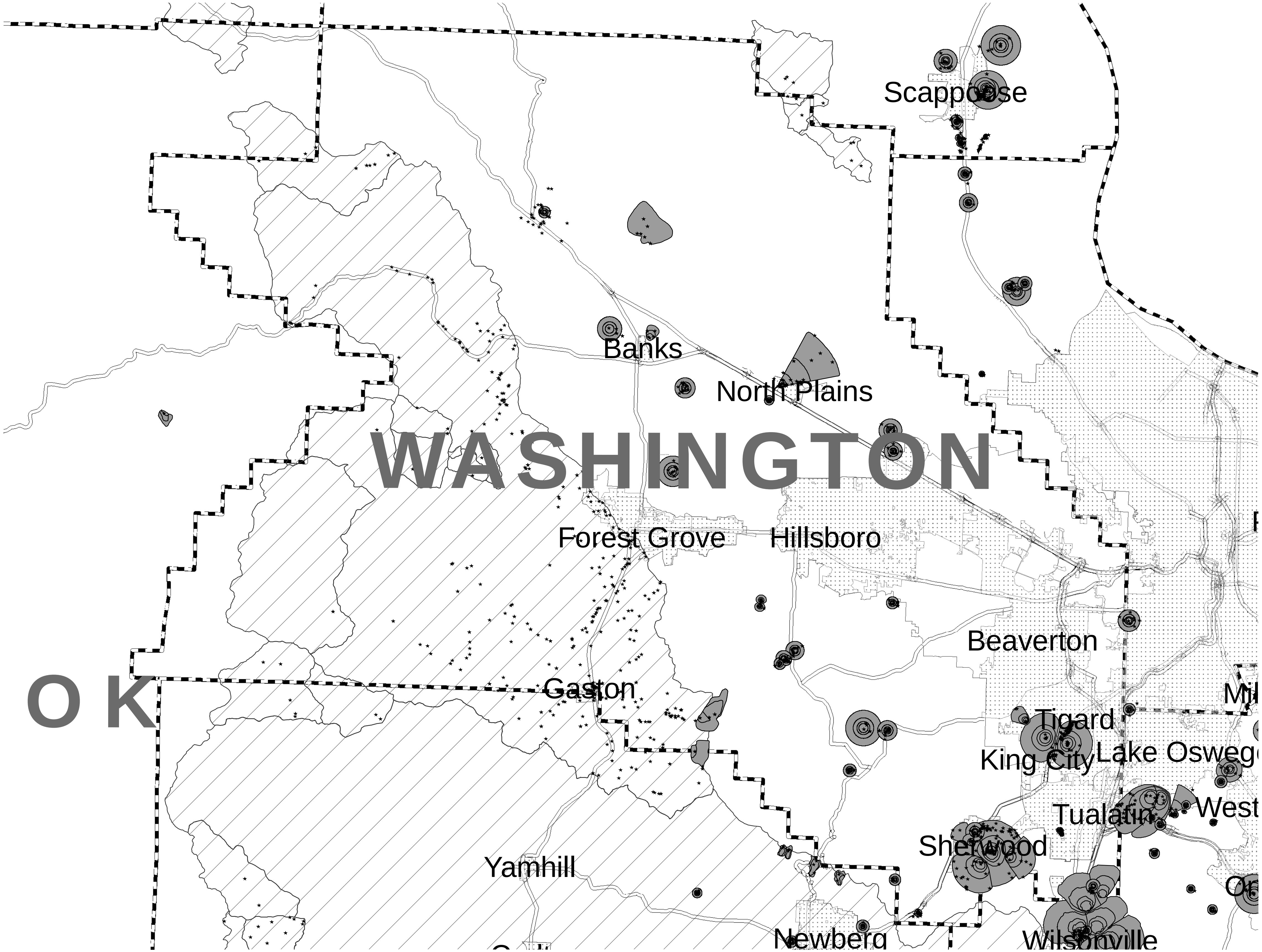
TABLE 1. SUMMARY OF POTENTIAL CONTAMINANT SOURCES BY LAND USE

PWS # 4100379 - JWC and PWS# 4100985 - HILLSBORO-CHERRY GROVE

Other: - Landslide	Moderate	1
Other: - Landslide Area	Moderate	1
Other: - Road Improvement	Moderate	1

NOTES:
Sites and areas identified in this Table are only potential sources of contamination to the drinking water. Environmental contamination is not likely to occur when contaminants are used and managed properly.
(1) - Potential source of microbial contamination
(2) - Drip irrigated crops, such as vineyards and some vegetables, are considered lower risk than spray irrigation
(3) - For groundwater public water systems, septic systems located within the 2-year time-of-travel (TOT) are considered moderate risks.

Washington County Drinking Water Source Areas for Public Water Systems



See map notes for source areas and potential contaminant sources at:
http://www.deq.state.or.us/wq/dwp/docs/swcountymapnotes.pdf

Legend

- Potential Contaminant Sources
- Groundwater Drinking Water Source Areas
- Surface Water Drinking Water Source Areas
- City Limits (2007)
- Urban Growth Boundary (1996 & 1998)
- County Boundary
- Highways

1:245,000

0 1.5 3 6 9 12 Miles

Oregon Lambert Projection

This product is for informational purposes and may not have been prepared for, or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information. This information or data is provided with the understanding that conclusions drawn from such information are the responsibility of the user.

DHS Oregon Department of Human Services

DEQ State of Oregon Department of Environmental Quality

Oregon Department of Environmental Quality/Water Quality Division
Drinking Water Protection Program/GIS
Oregon Surface Water and Groundwater Drinking Water Source Areas
File:\\deqhq1\DWP\Updated_county_maps\Washington_County_GW&SW_B-size_map(21FEB2006).mxd
Prepared by: S. Aalbers (Revised: 15APR2008 (sda)), Printed: 15APR2008

Appendix I

Land Use Information Form

Oregon Water Resources Department
725 Summer Street NE, Suite A
Salem, Oregon 97301-1266
(503) 986-0900
www.wrd.state.or.us

NOTE TO APPLICANTS

In order for your application to be processed by the Water Resources Department (WRD), this Land Use Information Form must be completed by a local government planning official in the jurisdiction(s) where your water right will be used and developed. The planning official may choose to complete the form while you wait, or return the receipt stub to you. Applications received by WRD without the Land Use Form or the receipt stub will be returned to you. Please be aware that your application will not be approved without land use approval.

This form is NOT required if:

1) Water is to be diverted, conveyed, and/or used only on federal lands; **OR**
2) The application is for a water right transfer, allocation of conserved water, exchange, permit amendment, or ground water registration modification, and **all** of the following apply:
   a) The existing and proposed water use is located entirely within lands zoned for exclusive farm-use or within an irrigation district;
   b) The application involves a change in place of use only;
   c) The change does not involve the placement or modification of structures, including but not limited to water diversion, impoundment, distribution facilities, water wells and well houses; and
   d) The application involves irrigation water uses only.

NOTE TO LOCAL GOVERNMENTS

The person presenting the attached Land Use Information Form is applying for or modifying a water right. The Water Resources Department (WRD) requires its applicants to obtain land-use information to be sure the water rights do not result in land uses that are incompatible with your comprehensive plan. Please complete the form or detach the receipt stub and return it to the applicant for inclusion in their water right application. You will receive notice once the applicant formally submits his or her request to the WRD. The notice will give more information about WRD's water rights process and provide additional comment opportunities. You will have 30 days from the date of the notice to complete the land-use form and return it to the WRD. If no land-use information is received from you within that 30-day period, the WRD may presume the land use associated with the proposed water right is compatible with your comprehensive plan. Your attention to this request for information is greatly appreciated by the Water Resources Department. If you have any questions concerning this form, please contact the WRD's Customer Service Group at 503-986-0801.

Land Use Information Form

Oregon Water Resources Department
725 Summer Street NE, Suite A
Salem, Oregon 97301-1266
(503) 986-0900
www.wrd.state.or.us

Applicant: ____The Joint Water Commission_-_Kevin _____ (First) _______________Hanway_________________ (Last)

Mailing Address: ______150 E. Main Street, Third Floor____

___Hillsboro___________________ (City) ___OR___ (State) __97123_______ (Zip) Daytime Phone: _(503) 615-6702___

A. Land and Location

Please include the following information for all tax lots where water will be diverted (taken from its source), conveyed (transported), and/or used or developed. Applicants for municipal use, or irrigation uses within irrigation districts may substitute existing and proposed service-area boundaries for the tax-lot information requested below.

Township	Range	Section	¼ ¼	Tax Lot #	Plan Designation (e.g., Rural Residential/RR-5)	Water to be:	Proposed Land Use:
1 S	1 W	30	NW SW	1S130CB0 2400	Agriculture and forestry/AF-20	☒ Diverted ☐ Conveyed ☐ Used	ASR – water storage
The Joint Water Commission Service Area Boundary (please see attached map)						☐ Diverted ☒ Conveyed ☒ Used	
						☐ Diverted ☐ Conveyed ☐ Used	

List all counties and cities where water is proposed to be diverted, conveyed, and/or used or developed:

Washington County

B. Description of Proposed Use

Type of application to be filed with the Water Resources Department:

☐ Permit to Use or Store Water ☐ Water Right Transfer ☐ Permit Amendment or Ground Water Registration Modification
☒ Limited Water Use License ☐ Allocation of Conserved Water ☐ Exchange of Water

Source of water: ☐ Reservoir/Pond ☐ Ground Water ☒ Surface Water (name) Sain Creek, Tualatin River, and Scoggins Creek

Estimated quantity of water needed: 700 inject, 1000 recover ☐ cubic feet per second ☒ gallons per minute ☐ acre-feet

Intended use of water: ☐ Irrigation ☐ Commercial ☐ Industrial ☐ Domestic for _______ household(s)
☒ Municipal ☐ Quasi-Municipal ☐ Instream ☐ Other ___________________________

Briefly describe:

Storage of treated drinking water for municipal use. Treated drinking water from the JWC or the City of Portland surface water source will be injected into an ASR well for storage. Water will then be recovered from ASR well and delivered to the JWC distribution system for consumption.

Note to applicant: If the Land Use Information Form cannot be completed while you wait, please have a local government representative sign the receipt at the bottom of the next page and include it with the application filed with the Water Resources Department.

See bottom of Page 3. →

For Local Government Use Only

The following section must be completed by a planning official from each county and city listed unless the project will be located entirely within the city limits. In that case, only the city planning agency must complete this form. This deals only with the local land-use plan. Do not include approval for activities such as building or grading permits.

Please check the appropriate box below and provide the requested information

☐ Land uses to be served by the proposed water uses (including proposed construction) are allowed outright or are not regulated by your comprehensive plan. Cite applicable ordinance section(s): ______________________.

☒ Land uses to be served by the proposed water uses (including proposed construction) involve discretionary land-use approvals as listed in the table below. (Please attach documentation of applicable land-use approvals which have already been obtained. Record of Action/land-use decision and accompanying findings are sufficient.) **If approvals have been obtained but all appeal periods have not ended, check "Being pursued."**

Type of Land-Use Approval Needed (e.g., plan amendments, rezones, conditional-use permits, etc.)	Cite Most Significant, Applicable Plan Policies & Ordinance Section References	Land-Use Approval:	
Utility Facility Necessary for Public Service	ORS 215.275, ORS 215.213(1)(c), CDC 430-105	☒ Obtained ☐ Denied	☐ Being Pursued ☐ Not Being Pursued
Case file 92-356-SU/D(INS) approved a		☐ Obtained ☐ Denied	☐ Being Pursued ☐ Not Being Pursued
water tank at this site		☐ Obtained ☐ Denied	☐ Being Pursued ☐ Not Being Pursued
		☐ Obtained ☐ Denied	☐ Being Pursued ☐ Not Being Pursued
		☐ Obtained ☐ Denied	☐ Being Pursued ☐ Not Being Pursued

Local governments are invited to express special land-use concerns or make recommendations to the Water Resources Department regarding this proposed use of water below, or on a separate sheet.

Casefile 92-356-SU contains a condition of this approved utility facility which limits extension of water service hook-ups to lands located outside the UGB.

Name: Terry Lawler Title: Senior Planner

Signature: TERRY LAWLER Phone: 503-846-3846 Date: 11-24-10

Government Entity: Washington County Dept of Land Use & Transportation

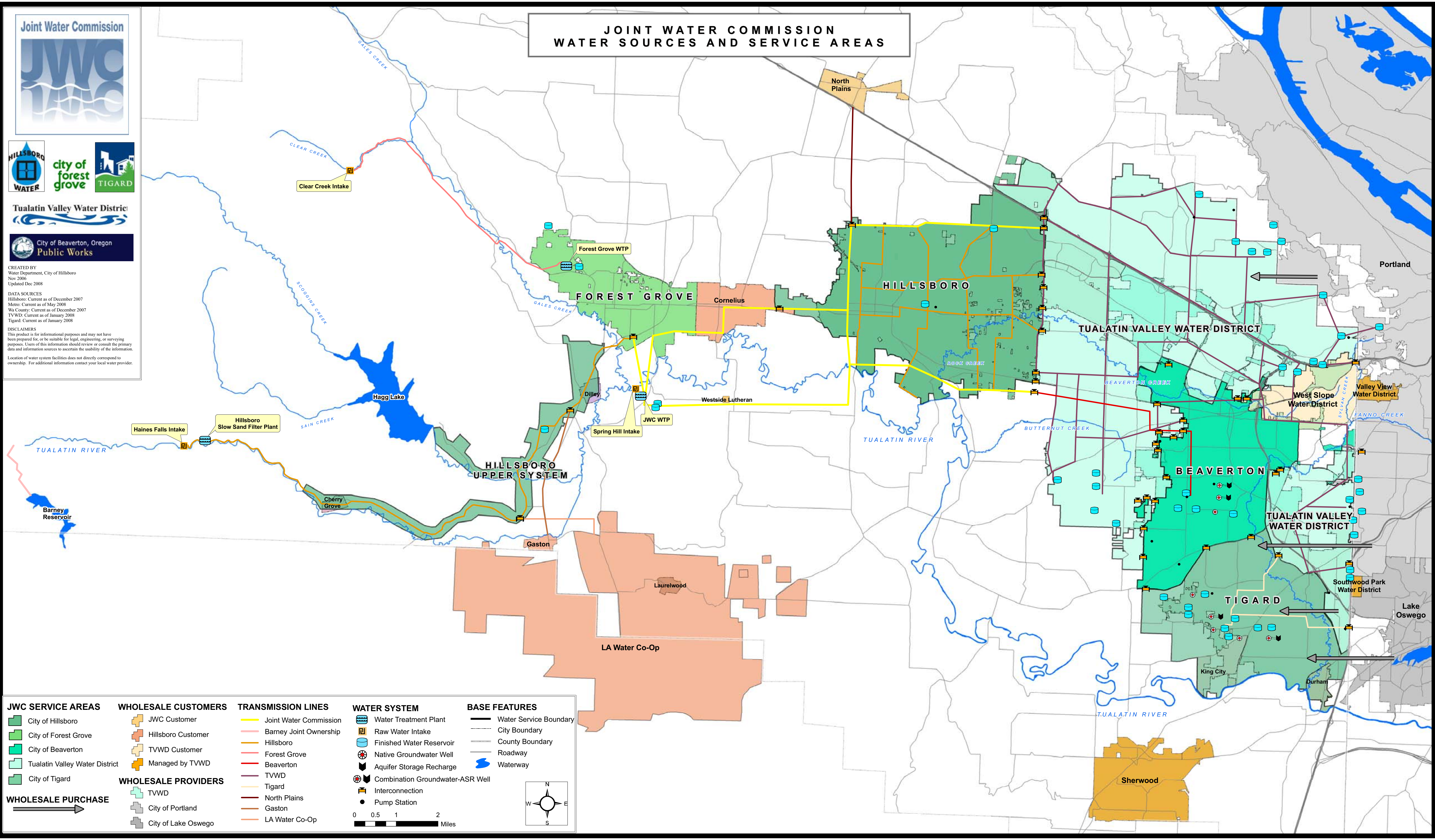
Note to local government representative: Please complete this form or sign the receipt below and return it to the applicant. If you sign the receipt, you will have 30 days from the Water Resources Department's notice date to return the completed Land Use Information Form or WRD may presume the land use associated with the proposed use of water is compatible with local comprehensive plans.

Receipt for Request for Land Use Information

Applicant name: ______________________

City or County: ______________________ Staff contact: ______________________

Signature: ______________________ Phone: ______________________ Date: ______________________


JOINT WATER COMMISSION
WATER SOURCES AND SERVICE AREAS
Joint Water Commission
Tualatin Valley Water District
City of Beaverton, Oregon
Public Works
CREATED BY
Water Department, City of Hillsboro
Nov 2006
Updated Dec 2008
DATA SOURCES
Hillsboro: Current as of December 2007
Metro: Current as of May 2008
Wa County: Current as of December 2007
TVWD: Current as of January 2008
Tigard: Current as of January 2008
DISCLAIMERS
This product is for informational purposes and may not have been prepared for, or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information.
Location of water system facilities does not directly correspond to ownership. For additional information contact your local water provider.
North Plains
Clear Creek Intake
Forest Grove WTP
FOREST GROVE
Cornelius
HILLSBORO
TUALATIN VALLEY WATER DISTRICT
Portland
Hagg Lake
Dilley
Westside Lutheran
JWC WTP
Spring Hill Intake
Haines Falls Intake
Hillsboro Slow Sand Filter Plant
TUALATIN RIVER
HILLSBORO UPPER SYSTEM
Cherry Grove
Barney Reservoir
Gaston
Laurelwood
LA Water Co-Op
West Slope Water District
Valley View Water District
BEAVERTON
TUALATIN VALLEY WATER DISTRICT
TIGARD
Southwood Park Water District
Lake Oswego
King City
Durham
Sherwood
JWC SERVICE AREAS
City of Hillsboro
City of Forest Grove
City of Beaverton
Tualatin Valley Water District
City of Tigard
WHOLESALE PURCHASE
WHOLESALE CUSTOMERS
JWC Customer
Hillsboro Customer
TVWD Customer
Managed by TVWD
WHOLESALE PROVIDERS
TVWD
City of Portland
City of Lake Oswego
TRANSMISSION LINES
Joint Water Commission
Barney Joint Ownership
Hillsboro
Forest Grove
Beaverton
TVWD
Tigard
North Plains
Gaston
LA Water Co-Op
WATER SYSTEM
Water Treatment Plant
Raw Water Intake
Finished Water Reservoir
Native Groundwater Well
Aquifer Storage Recharge
Combination Groundwater-ASR Well
Interconnection
Pump Station
0 0.5 1 2 Miles
BASE FEATURES
Water Service Boundary
City Boundary
County Boundary
Roadway
Waterway

WASHINGTON COUNTY
DEPARTMENT OF LAND USE AND TRANSPORTATION
LAND DEVELOPMENT SERVICES DIVISION
155 NORTH FIRST AVENUE
HILLSBORO, OREGON 97124 648-8761

NOTICE OF DECISION OF BOARD APPEAL

CASEFILE: 92-356-SU/D(INS)

APPLICANT:
W & H Pacific
P.O. Box 80040
Portland, OR 97280

OWNER:
City of Beaverton, Engineering
4755 SW Griffith Dr.
Beaverton, OR 97005

PROCEDURE TYPE: III

CPO: 6 COMMUNITY PLAN: Rural/Natural Resources

LAND USE DISTRICT:
AF-20 (Agriculture and Forest)

PROPERTY DESCRIPTION:
ASSESSOR MAP#: 1S1 30 CB
LOT#: 2400
SITE SIZE: 9.82 acres
ADDRESS:
LOCATION: On the south side of SW Kemmer Road, approx. 350' east of Mayberry Place

PROPOSED DEVELOPMENT ACTION: Special Use and Development Review Approval for a 5.5 Million Gallon Water Reservoir

Date of Mailing: December 22, 1992

A summary of the decision of the Board of County Commissioners and conditions of approval, if any, are attached.

This decision may be appealed to the Land Use Board of Appeals (LUBA) by filing a Notice of Intent to Appeal with LUBA within 21 days of the date this decision is final. Contact your attorney if you have any questions in this regard.

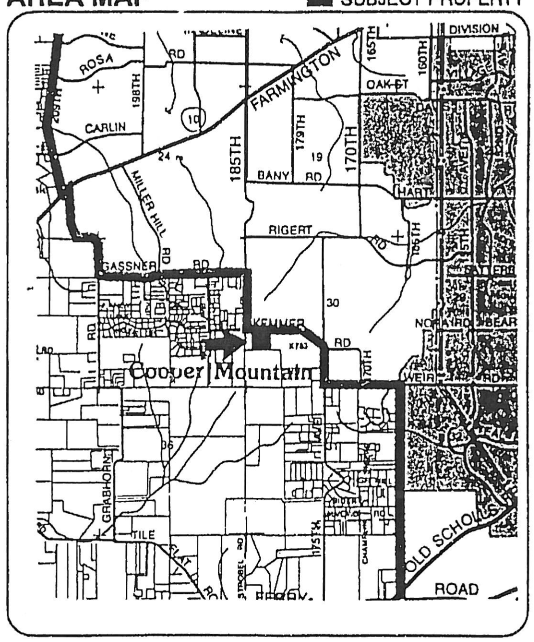
A petition for reconsideration of the Board of Commissioners' decision may be filed by a party within seven calendar days after this notice was provided (see Section 210).

The Washington County Community Development Code holds that this decision is final on the date of mailing unless a motion or petition for reconsideration is granted by the Board of County Commissioners.

For further information about a petition for reconsideration, contact Appeal Secretary, DLUT, at 648-8761.

The complete case, including Notice of Decision, Application, Staff Report, Findings and Conclusions, and Conditions of Approval, if any, are available for review at no cost at the Department of Land Use and Transportation. Copies of this material will be provided at reasonable cost.

AREA MAP ■ SUBJECT PROPERTY



Notice to Mortgagee, Lien Holder, Vendor or Seller:
ORS Chapter 215 requires that if you receive this notice it must promptly be forwarded to the purchaser.

11/91

CASE FILE NUMBER <u>92-356-SU/D(INS)</u>

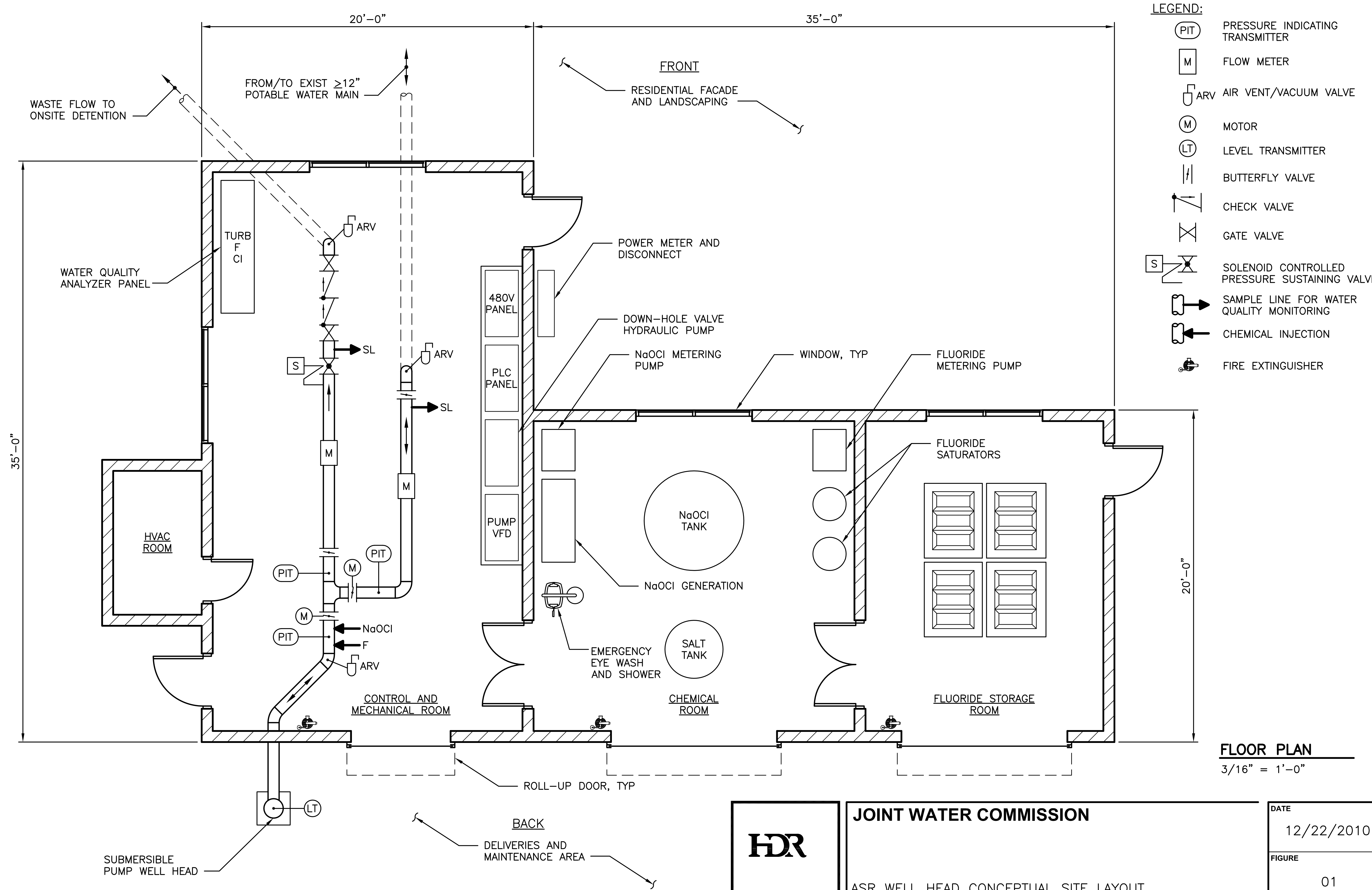
<u>SUMMARY OF DECISION</u>

On December 15, 1992, the Washington County Board of Commissioners issued a written decision (see copy of Resolution and Order No. 92-174 attached as Attachment "A") which denied the appeal and affirmed the Hearings Officer's approval of the request for Special Use and Development Review Approval for a 5.5 Million Gallon Water Reservoir on property described as tax lot 2400 on Assessor's Map 1S1 30 CB, W.M., Washington County, Oregon.

Attachment "A": Resolution and Order No. 92-174

92356bcc

Appendix J



FLOOR PLAN
3/16" = 1'–0"

HDR

JOINT WATER COMMISSION

ASR WELL HEAD CONCEPTUAL SITE LAYOUT

DATE
12/22/2010

FIGURE
01

Appendix K

WASH 57952

RECEIVED
NOV 29 2001
WATER RESOURCES DEPT
SALEM, OREGON

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)

Instructions for completing this report are on the last page of this form.

WELL I.D. # L 51450
START CARD # 135195

(1) LAND OWNER Well Number 7-23A-01
Name City Of Beaverton
Address 4755 SW Griffith DR
City Beaverton State OR Zip 97076

(2) TYPE OF WORK
☒ New Well ☐ Deepening ☐ Alteration (repair/recondition) ☐ Abandonment

(3) DRILL METHOD:
☒ Rotary Air ☐ Rotary Mud ☐ Cable ☐ Auger
☐ Other

(4) PROPOSED USE:
☐ Domestic ☐ Community ☐ Industrial ☐ Irrigation
☐ Thermal ☐ Injection ☐ Livestock ☒ Other Test hole

(5) BORE HOLE CONSTRUCTION:
Special Construction approval ☐ Yes ☒ No Depth of Completed Well 1000 ft.
Explosives used ☐ Yes ☒ No Type ____ Amount ____

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
12	0	147	cement	0	147	60 sacks
8	147	450				
6	450	1,000				

How was seal placed: Method ☐ A ☐ B ☒ C ☐ D ☐ E
☐ Other
Backfill placed from ____ ft. to ____ ft. Material ____
Gravel placed from ____ ft. to ____ ft. Size of gravel ____

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	8"	+2	147		☒	☐	☒	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:					☐	☐	☐	☐
					☐	☐	☐	☐

Drive Shoe used ☐ Inside ☐ Outside ☒ None
Final location of shoe(s)

(7) PERFORATIONS/SCREENS:
☐ Perforations Method
☐ Screens Type ____ Material ____

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
						☐	☐
						☐	☐
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour
☒ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
275	80		120 hr.

Temperature of water 57° Depth Artesian Flow Found
Was a water analysis done? ☐ Yes By whom
Did any strata contain water not suitable for intended use? ☐ Too little
☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other
Depth of strata:

(9) LOCATION OF WELL by legal description:
County Washington Latitude ____ Longitude ____
Township 2S N or S Range 1W E or W. WM.
Section 6 SE 1/4 NE 1/4
Tax Lot 00175 Lot ____ Block ____ Subdivision ____
Street Address of Well (or nearest address) NE Side of intersection of SW 100th Dr and SW Scholls Ferry Rd

(10) STATIC WATER LEVEL:
169 ft. below land surface. Date 8-28-01
Artesian pressure ____ lb. per square inch Date ____

(11) WATER BEARING ZONES:
Depth at which water was first found 200

From	To	Estimated Flow Rate	SWL
200	220	5	169
300	340	75	169
340	350	100	169
880			

(12) WELL LOG:
Ground Elevation

Material	From	To	SWL
Very fine Red/brown Silt	0	15	-
Weathered/Broken Basalt	15	16	-
Weathered Basalt grey	16	138	-
Basalt grey med	138	240	169
Basalt grey-Black med	240	300	169
Weathered Basalt Red	300	340	169
Weathered Basalt Grey/Red	340	350	169
Basalt Grey med	350	660	169
Weathered grey Basalt	660	662	169
with light Green clay			169
Black/Grey Basalt med	662	815	171
Basalt Grey med fractured	815	830	169
Basalt Grey Black med	830	880	169
Weathered Basalt	880	940	169
Basalt med fractured	940	960	169
with blue/Green clays			
Basalt grey med	960	1000	169

Date started 8-6-01 Completed 11-1-01

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.
WWC Number 1751
Signed [signature] Date 11/27/01

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.
WWC Number 1764
Signed [signature] Date 11/27/01

ORIGINAL – WATER RESOURCES DEPARTMENT FIRST COPY – CONSTRUCTOR SECOND COPY – CUSTOMER

WASH 58005

RECEIVED WASH 58005

DEC 14 2001

WATER RESOURCES DEPT. SALEM, OREGON

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)
Instructions for completing this report are on the last page of this form.

WELL I.D. # L 54408
START CARD # 146260

(1) OWNER: Well Number ______
Name City of Beaverton
Address PO Box 4755
City Beaverton State OR Zip 97076

(2) TYPE OF WORK
[X] New Well [ ] Deepening [ ] Alteration (repair/recondition) [ ] Abandonment

(3) DRILL METHOD:
[X] Rotary Air [ ] Rotary Mud [ ] Cable [ ] Auger
[ ] Other

(4) PROPOSED USE:
[ ] Domestic [ ] Community [ ] Industrial [ ] Irrigation
[ ] Thermal [ ] Injection [ ] Livestock [X] Other Observation

(5) BORE HOLE CONSTRUCTION:
Special Construction approval [X] Yes [ ] No Depth of Completed Well 477 ft.
Explosives used [ ] Yes [X] No Type ______ Amount ______

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
10"	0	94	Cement	0	94	48 Sacks
6"	94	477				

How was seal placed: Method [ ] A [ ] B [X] C [ ] D [ ] E
[ ] Other
Backfill placed from ____ ft. to ____ ft. Material ____
Gravel placed from ____ ft. to ____ ft. Size of gravel ____

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	6	0	94	.250	X		X	
Liner:	4 1/2	0	477	200		X		

Final location of shoe(s) ______

(7) PERFORATIONS/SCREENS:
[ ] Perforations Method ______
[X] Screens Type Machine Slot Material PVC

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
255	475	.020		4 1/2"			X
185	205	.020		4 1/2"			X

(8) WELL TESTS: Minimum testing time is 1 hour
[ ] Pump [ ] Bailer [X] Air [ ] Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
100		477	1 hr.

Temperature of water 58° Depth Artesian Flow Found ______
Was a water analysis done? [ ] Yes By whom ______
Did any strata contain water not suitable for intended use? [ ] Too little
[ ] Salty [ ] Muddy [ ] Odor [ ] Colored [ ] Other ______
Depth of strata: ______

(9) LOCATION OF WELL by legal description:
County Washington Latitude ______ Longitude ______
Township 1 N or (S) Range 1 E or (W) WM.
Section 21 SW 1/4 SE 1/4
Tax Lot 1800 Lot ____ Block ____ Subdivision ____
Street Address of Well (or nearest address) 13450 SW Hanson Rd

(10) STATIC WATER LEVEL:
216.4 ft. below land surface. Date 12/04/01
Artesian pressure ______ lb. per square inch. Date ______

(11) WATER BEARING ZONES:
Depth at which water was first found ______

From	To	Estimated Flow Rate	SWL
270	310	5	216
370	460	100	216

RECEIVED APR 14 2003 WATER RESOURCES DEPT. SALEM, OREGON

(12) WELL LOG:
Ground Elevation ______

Material	From	To	SWL
Brown Silt	0	4	
Tight Silt	4	26	
Silt & Sand Gravels Small	26	60	
Silty Sand Gravels Brown	60	79	
Basalt med. - Gray	79	96	
Weathered Basalt Gray/Red	96	112	
Red Vesicular Basalt	112	122	
Basalt Gray Med. Fractures	122	138	
Frac. Gray Basalt w/ Tan	138	-	
Clay Deposits	-	190	
Basalt Gray Red Very Fractured	190	200	
Basalt Med. gray frac.	200	225	216
Basalt med. gray	225	270	
Basalt med gray frac. (H2O)	270	310	
Basalt med-gray frac. (dry)	310	370	
Basalt Red Brown V. Frac.	370	390	
Basalt Gray - Red frac.	390	410	
Basalt Med. Gray frac	410	460	
Basalt Gray Med.	460	480	477

Date started 11-20-01 Completed 12-3-01

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.
WWC Number 1751
Signed [signature] Date 12-11-01

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.
WWC Number 1464
Signed [signature] Date 12/12/01

ORIGINAL & FIRST COPY-WATER RESOURCES DEPARTMENT SECOND COPY-CONSTRUCTOR THIRD COPY-CUSTOMER

STATE ENGINEER
Salem, Oregon

WASH

008961

Well Record

STATE WELL NO. 1/1W - 20E(1)
COUNTY WASH
APPLICATION NO.

OWNER: C. J. Dernbach
MAILING ADDRESS: 15820 S.W. Davis
LOCATION OF WELL: Owner's No.
CITY AND STATE: Beaverton Oregon

SW ¼ NW ¼ Sec. 20 T. 1 S., R. 1 W., W.M.

Bearing and distance from section or subdivision corner

Altitude at well

E1

Section 20

TYPE OF WELL: Drilled Date Constructed

Depth drilled 279 Depth cased

CASING RECORD:

FINISH:

AQUIFERS:

Basalt

WATER LEVEL:

268 feet in 1953

PUMPING EQUIPMENT: Type Deep well Piston H.P.
Capacity G.P.M.

WELL TESTS:
Drawdown ft. after hours G.P.M.
Drawdown ft. after hours G.P.M.

USE OF WATER Domestic Temp. °F. , 19
SOURCE OF INFORMATION Obs. & Owner
DRILLER or DIGGER A.M. Janssen
ADDITIONAL DATA:
Log Water Level Measurements Chemical Analysis Aquifer Test

REMARKS:

RECEIVED SEP 13 1960 (stamp)

WASH

File Original and First Copy with the STATE ENGINEER, SALEM, OREGON

WATER WELL REPORT 008845

STATE OF OREGON

State Well No. 1/1W-17

State Permit No.

(1) OWNER:

Name C. J. Dernbach

Address 15820 S.W. Davis Beaverton, Ore

(2) LOCATION OF WELL:

County Wash Owner's number, if any—

¼ ¼ Section 17 T. 1 S. R. 1 West W.M.

Bearing and distance from section or subdivision corner Well is located on DLC No 50 in sec. 17 T 1S R 1 W Washington County = 600 ft south of north line at entrance of Davis RD and 700 West of east line 2½ mi southwest of Beaverton, Ore Washington Co. 15820 SW Davis

(3) TYPE OF WORK (check):

New Well ☐ Deepening ☒ Reconditioning ☐ Abandon ☐

If abandonment, describe material and procedure in Item 11.

(4) PROPOSED USE (check):

Domestic ☐ Industrial ☐ Municipal ☐

Irrigation ☐ Test Well ☐ Other ☐

(5) TYPE OF WELL:

Rotary ☐ Driven ☐

Cable ☐ Jetted ☐

Dug ☐ Bored ☐

(6) CASING INSTALLED:

Threaded ☐ Welded ☐

" Diam. from ft. to ft. Gage

" Diam. from ft. to ft. Gage

" Diam. from ft. to ft. Gage

(7) PERFORATIONS:

Perforated? ☐ 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.

perforations from ft. to ft.

perforations from ft. to ft.

(8) SCREENS:

Well screen installed ☐ Yes ☐ No

Manufacturer's Name

Type Model No.

Diam. Slot size Set from ft. to ft.

Diam. Slot size Set from ft. to ft.

(9) CONSTRUCTION:

Was well gravel packed? ☐ Yes ☐ No Size of gravel:

Gravel placed from ft. to ft.

Was a surface seal provided? ☐ 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

(10) WATER LEVELS:

Static level 280 ft. below land surface Date 8/6/60

Artesian pressure lbs. per square inch Date

Log Accepted by:

[Signed] C J Dernbach (Owner) Date Sept 10, 1960

(11) WELL TESTS:

Drawdown is amount water level is lowered below static level

Was a pump test made? ☐ Yes ☐ No If yes, by whom? -

Yield: gal./min. with ft. drawdown after hrs.

" " " "

" " " "

Bailer test 9 gal./min. with 0 ft. drawdown after 2 hrs.

Artesian flow g.p.m. Date

Temperature of water Was a chemical analysis made? ☐ Yes ☒ No

(12) WELL LOG:

Diameter of well six inches.

Depth drilled 320 ft. Depth of completed well 320 ft.

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
Original depth - 273		
rock formation		
Rock - medium hard	273	285
Rock - medium heavy	285	296
Sandstone - brown	296	298
Rock - Hard	298	310
Rock - Varying hardness containing water flow	310	320

Work started 7/30 1960 Completed 8/6 1960

(13) PUMP:

Manufacturer's Name Fairbanks Morse

Type: Lift - Cylinder H.P. 1

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 Jack Barron (Person, firm, or corporation) (Type or print)

Address 16435 S.W. Hart

Driller's well number 57

[Signed] Jack Barron (Well Driller)

License No 59 Date 8/6, 1960

(USE ADDITIONAL SHEETS IF NECESSARY)

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the
STATE ENGINEER, SALEM, OREGON 97310
within 30 days from the date of well completion.

RECEIVED NOV 20 1970 STATE ENGINEER SALEM, OREGON

WATER WELL REPORT WASH
STATE OF OREGON
(Please type or print)
(Do not write above this line) 008957

State Well No. 1/1W-20 6c
State Permit No.

(1) OWNER:
Name C. J. Dernbach
Address 15820 SW. Davis Rd. Beaverton, Oregon 97005

(2) TYPE OF WORK (check):
New Well ☐ Deepening ☒ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

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

CASING INSTALLED: Threaded ☐ Welded ☐
None " Diam. from .... ft. to .... ft. Gage ....
........" Diam. from .... ft. to .... ft. Gage ....
........" Diam. from .... ft. to .... ft. Gage ....

PERFORATIONS: Perforated? ☐ Yes ☒ No.
...e of perforator used
Size of perforations .... in. by .... in.
.... perforations from .... ft. to .... ft.
.... perforations from .... ft. to .... ft.
.... perforations from .... ft. to .... ft.
.... perforations from .... ft. to .... ft.
.... perforations from .... ft. to .... ft.

(7) SCREENS: Well screen installed? ☐ Yes ☒ No
Manufacturer's Name ....
Type .... Model No. ....
Diam. .... Slot size .... Set from .... ft. to .... ft.
Diam. .... Slot size .... Set from .... ft. to .... ft.

(8) WATER LEVEL: Completed well.
Static level 312 ft. below land surface Date 10/18/70
...sian pressure .... lbs. per square inch Date ....

(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: .... gal./min. with .... ft. drawdown after .... hrs.
" " "
" " "
Bailer test 11 gal./min. with 0 ft. drawdown after 1 hrs.
Artesian flow .... g.p.m. Date ....
Temperature of water 53° Was a chemical analysis made? ☐ Yes ☒ No

(10) CONSTRUCTION:
Well seal—Material used ....
Depth of seal .... ft.
Diameter of well bore to bottom of seal .... in.
Were any loose strata cemented off? ☐ Yes ☐ No Depth ....
Was a drive shoe used? ☐ Yes ☐ No
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? .... depth of strata ....
Method of sealing strata off ....
Was well gravel packed? ☐ Yes ☒ No Size of gravel: ....
Gravel placed from .... ft. to .... ft.

(11) LOCATION OF WELL:
County Washington Driller's well number 161
SW ¼ NW ¼ Section 20 T. 1 S. R. 1 W. W.M.
Bearing and distance from section or subdivision corner
1820' south and 480' East of North West Corner of Sec. 20

(12) WELL LOG: Diameter of well below casing 6"
Depth drilled 410 ft. Depth of completed well 410 ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level as drilling proceeds. Note drilling rates.

MATERIAL	From	To	SWL
Deepening - of original Well in Rock from 320' to 410' original Static level 312'			
Rock - brown	320	340	312'
Rock - gray -	340	385	
Rock - soft	385	410	312'

Work started 10/6 1970 Completed 10/20 1970
Date well drilling machine moved off of well 10/21 1970

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] Jack Barron (Drilling Machine Operator) Date 11/9, 1970
Drilling Machine Operator's License No. 165

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
NAME Jack Barron
(Person, firm or corporation) (Type or print)
Address 16425 SW. Hart, Beaverton, Oregon
[Signed] Jack Barron (Water Well Contractor)
Contractor's License No. 59 Date 11/9, 1970

(USE ADDITIONAL SHEETS IF NECESSARY)

WASH 57796

STATE OF OREGON
MONITORING WELL REPORT

Wash 57796 — Amended Well Report

(as required by ORS 537.765 & OAR 690-240-095)

Instructions for completing this report are on the last page of this form.

Well ID# L51452

Start Card # 135197

(1) OWNER/PROJECT

WELL NO. 2

Name City of Beaverton

Address 4755 S.W. Griffith Dr.

City Beaverton State OR Zip 97076

(2) TYPE OF WORK

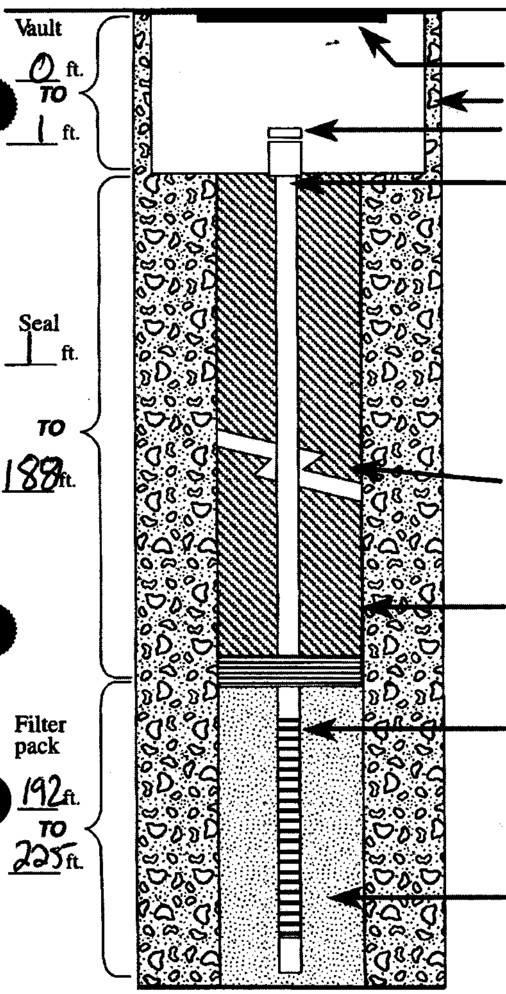
☒ New construction ☐ Alteration (Repair/Recondition)
☐ Conversion ☐ Deepening ☐ Abandonment

(3) DRILLING METHOD

☒ Rotary Air ☐ Rotary Mud ☐ Cable
☐ Hollow Stem Auger ☐ Other ______

(4) BORE HOLE CONSTRUCTION:

Special Standards Yes ☐ No ☒ Depth of Completed Well 225 ft.



Vault 0 ft. TO 1 ft.

Seal 1 ft. TO 188 ft.

Filter pack 192 ft. TO 225 ft.

Casing diameter 2 in. material PVC
Welded ☐ Threaded ☒ Glued ☐

Liner diameter ______ in. material ______
Welded ☐ Threaded ☐ Glued ☐

Well seal: Material Bent. Grout Amount 400 gallons Grout weight 9.7

Borehole diameter 6 in.

Bentonite plug at least 3 ft. thick

Screen material PVC interval(s): From 195 To 225 From ______ To ______ Slot size .020 in.

Filter pack: Material CSSI Size 10-20 in.

(5) WELL TESTS:

☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Permeability ______ Yield ______ GPM

Conductivity ______ PH ______

Temperature of water 51 °F/C Depth artesian flow found ______ ft.

Was water analysis done? ☐ Yes ☒ No

By whom? ______

Depth of strata to be analyzed. From ______ ft. to ______ ft.

Remarks: ______

Name of supervising Geologist/Engineer ______

(6) LOCATION OF WELL By legal description:

County Washington Latitude ______ Longitude ______

Township 2 (N or S) Range 1 (E or W) Section 6

SE 1/4 of NE 1/4 of above section.

Street address of well location 40' East North East of intersection of SW Maverick & Murray

Tax lot number of well location ______

ATTACH MAP WITH LOCATION IDENTIFIED. Map shall include approximate scale and north arrow.

(7) STATIC WATER LEVEL:

104 Ft. below land surface. Date 10/10/01

Artesian Pressure ______ lb/sq. in. Date ______

(8) WATER BEARING ZONES:

Depth at which water was first found 180

From	To	Est. Flow Rate	SWL
180	225	10-15	104

(9) WELL LOG:

Ground Elevation ______

Material	From	To	SWL
Brown tight Clay	0	35	
Weath. Basalt	35	65	
Sandy Silt	65	75	
Weathered Basalt	75	105	
Basalt Med Gray	105	147	104
Weathered Basalt	147	205	
Basalt med gray	205	212	
Red Silty Weathered Basalt	212	225	

RECEIVED JAN 10 2002 WATER RESOURCES DEPT. SALEM, OREGON

RECEIVED JAN 24 2002 WATER RESOURCES DEPT SALEM, OREGON

Date started 10-8-01 Completed 10-10-01

(unbonded) Monitor Well Constructor Certification:

I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

MWC Number 10453

Signed [signature] Date 01-09-02

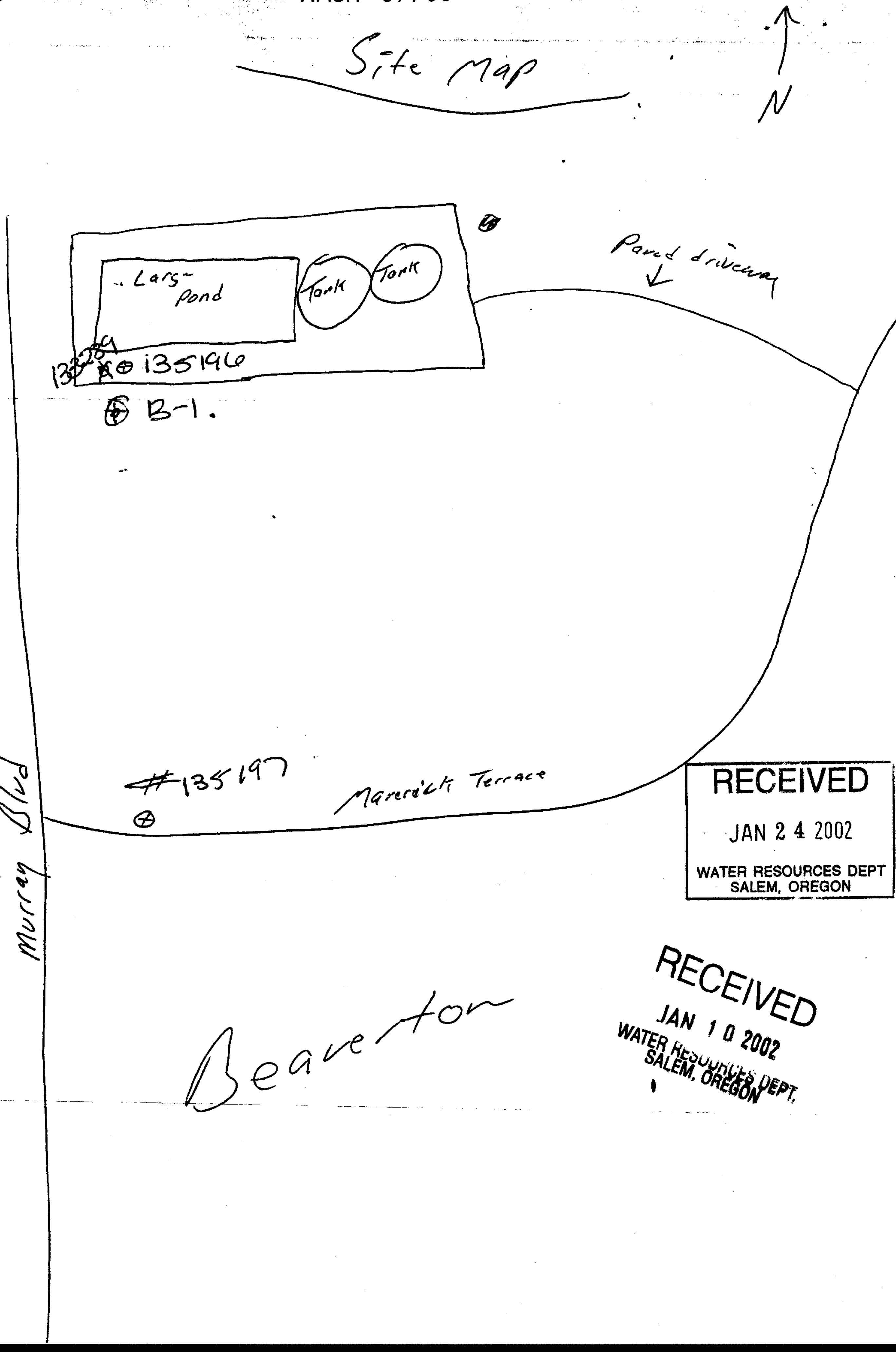
(bonded) Monitor Well Constructor Certification:

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.

MWC Number 10011

Signed [signature] Date 1/9/02

ORIGINAL COPY – WATER RESOURCES DEPARTMENT FIRST COPY – CONSTRUCTOR SECOND COPY – CUSTOMER



RECEIVED
JAN 24 2002
WATER RESOURCES DEPT
SALEM, OREGON

RECEIVED
JAN 10 2002
WATER RESOURCES DEPT,
SALEM, OREGON

WASH 58076 Amended Well Report

STATE OF OREGON
MONITORING WELL REPORT
(as required by ORS 537.765 & OAR 690-240-095)

Instructions for completing this report are on the last page of this form.

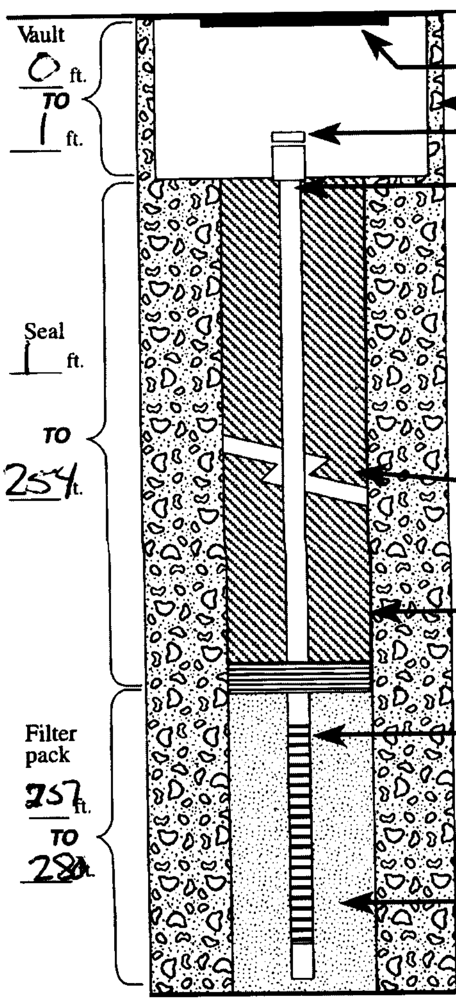
Well ID# L54323
Start Card # 133289

(1) OWNER/PROJECT
WELL NO. ______
Name City of Beaverton
Address 4755 SW Griffith Dr.
City Beaverton State OR Zip 97070

(2) TYPE OF WORK
☒ New construction ☐ Alteration (Repair/Recondition)
☐ Conversion ☐ Deepening ☐ Abandonment

(3) DRILLING METHOD
☒ Rotary Air ☐ Rotary Mud ☐ Cable
☐ Hollow Stem Auger ☐ Other ______

(4) BORE HOLE CONSTRUCTION:
Special Standards Yes ☐ No ☒ Depth of Completed Well 280 ft.



Vault 0 ft. TO 1 ft.

Seal 1 ft. TO 254 ft.

Filter pack 257 ft. TO 280 ft.

Casing diameter 2 in.
material PVC
Welded ☐ Threaded ☒ Glued ☐

Liner diameter ______ in.
material ______
Welded ☐ Threaded ☐ Glued ☐

Well seal:
Material Bent. Grout
Amount 410 Gallons
Grout weight 9.7

Borehole diameter 6 in.

Screen material PVC
interval(s):
From 260 To 280
From ______ To ______
Slot size .020 in.

Filter pack:
Material CSSI
Size 10-20 in.

(5) WELL TESTS:
☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Permeability ______ Yield ______ GPM
Conductivity ______ PH ______
Temperature of water ______ °F/C Depth artesian flow found ______ ft.
Was water analysis done? ☐ Yes ☐ No
By whom? ______
Depth of strata to be analyzed. From ______ ft. to ______ ft.
Remarks: ______

Name of supervising Geologist/Engineer ______

(6) LOCATION OF WELL By legal description:
County Washington Latitude ______ Longitude ______
Township 2 (N or S) Range 1 (E or W) Section 6
SE 1/4 of NE 1/4 of above section.
Street address of well location 200' North of SW Maverick 80' East of SW Murray
Tax lot number of well location ROW

ATTACH MAP WITH LOCATION IDENTIFIED. Map shall include approximate scale and north arrow.

(7) STATIC WATER LEVEL:
263 Ft. below land surface. Date 11/13/01
Artesian Pressure ______ lb/sq. in. Date ______

(8) WATER BEARING ZONES:
Depth at which water was first found 263

From	To	Est. Flow Rate	SWL
263	280	2-3	263

(9) WELL LOG:
Ground Elevation ______

Material	From	To	SWL
Reddish Brown Clay	0	10	
Very Light Brown Clay	10	27	
Light Brown Silt	27	30	
Dark Brown Silt	30	45	
Sandy Silt Brown Gray	45	55	
Grey Sandstone	55	57	
Basalt grey med	57	77	
Weath. Basalt grey med	77	110	
Basalt Grey Med	110	178	
Grey Weth. Basalt	178	280	

RECEIVED
JAN 10 2002
WATER RESOURCES DEPT.
SALEM, OREGON

Date started 11/9/01 Completed 11/13/01

(unbonded) Monitor Well Constructor Certification:

I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

MWC Number 10453
Signed [signature] Date 01-09-02

(bonded) Monitor Well Constructor Certification:

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.

MWC Number 10011
Signed [signature] Date 1/9/02

ORIGINAL COPY – WATER RESOURCES DEPARTMENT FIRST COPY – CONSTRUCTOR SECOND COPY – CUSTOMER

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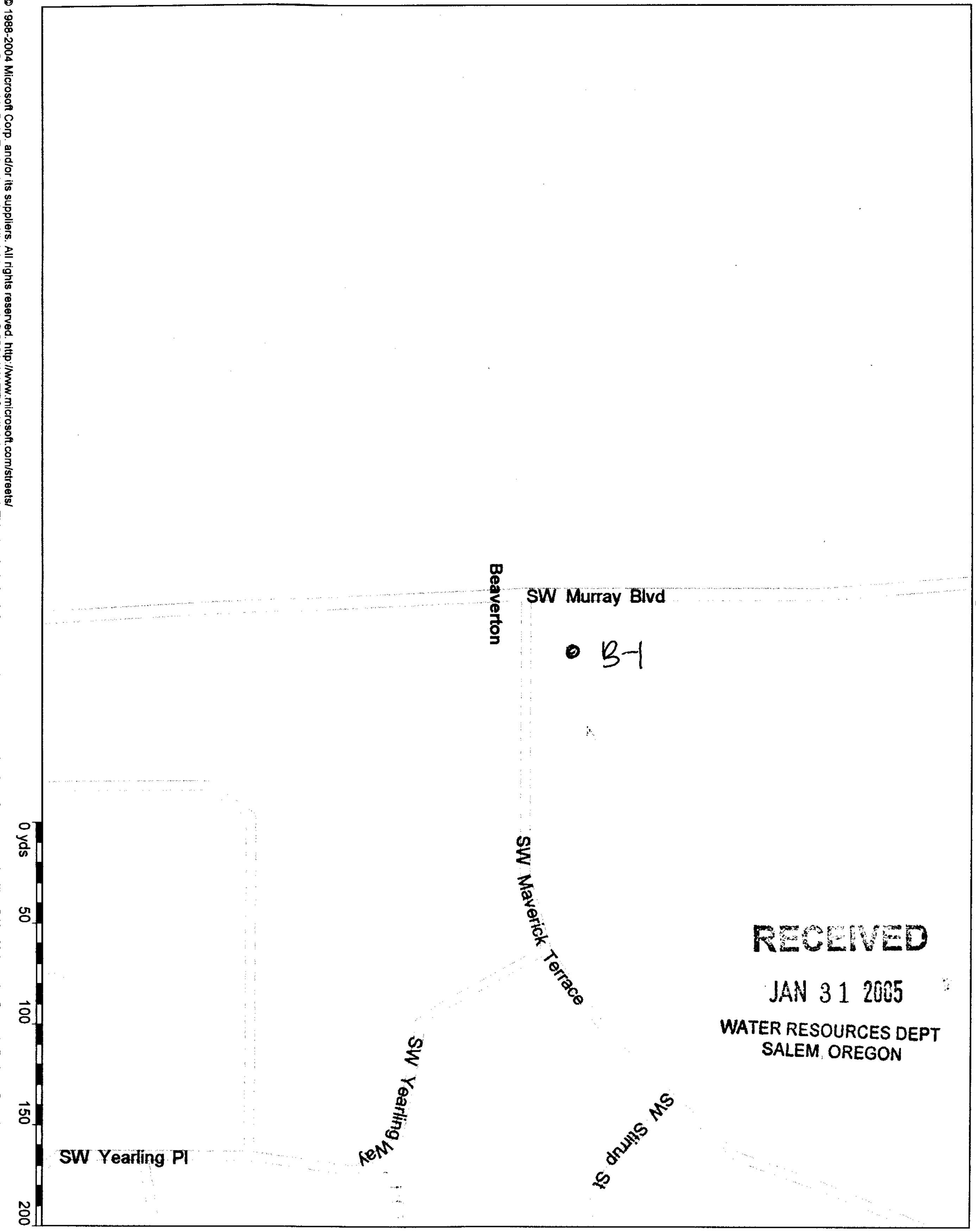
© Copyright 2003 by Geographic Data Technology, Inc. All rights reserved. © 2004 NAVTEQ. All rights reserved. This data includes information taken with permission from Canadian authorities © Her Majesty the Queen in Right of Canada.

Beaverton, Oregon, United States



RECEIVED
JAN 31 2005
WATER RESOURCES DEPT
SALEM, OREGON

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the
STATE ENGINEER, SALEM, OREGON 97310
within 30 days from the date of well completion.

OBSERVATION WELL

WATER WELL REPORT WASH
STATE OF OREGON
(Please type or print)
(Do not write above this line)

RECEIVED FEB 13 1968 STATE ENGINEER SALEM, OREGON

008976
G-4379

State Well No. 1/1W-21J dda
State Permit No.

(1) OWNER: Klotz
Name John ~~Klodz~~
Address Rte. 1 Box 212 Beaverton, Ore.

(2) TYPE OF WORK (check):
New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary ☒ Driven ☐
Cable ☐ Jetted ☐
Dug ☐ Bored ☐

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

(5) CASING INSTALLED:
Threaded ☐ Welded ☒
6" Diam. from 0 ft. to 220 ft. Gage 17#
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

(6) PERFORATIONS:
Perforated? ☐ 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.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS:
Well screen installed? ☐ Yes ☒ No
Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(8) WATER LEVEL: Completed well.
Static level 80 ft. ft. below land surface Date 2-9-68
Artesian pressure lbs. per square inch Date

(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: gal./min. with ft. drawdown after hrs.
" " " "
" " " "
Bailer test 45 gal./min. with 180 ft. drawdown after 1 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? ☐ Yes ☒ No

(10) CONSTRUCTION:
Well seal—Material used sand and cement
Depth of seal 220 feet ft.
Diameter of well bore to bottom of seal 9 in.
Were any loose strata cemented off? ☐ Yes ☒ No Depth
Was a drive shoe used? ☐ Yes ☒ No
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? ☐ Yes ☒ No Size of gravel:
Gravel placed from ft. to ft.

(11) LOCATION OF WELL:
County Washington Driller's well number
¼ S. E¼ Section 21 T. 1 S R. 1 W W.M.
Bearing and distance from section or subdivision corner

(12) WELL LOG:
Diameter of well below casing 6 inch
Depth drilled 395 ft. Depth of completed well 395 ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level as drilling proceeds. Note drilling rates.

MATERIAL	From	To	SWL
Top soil	0	2	
Yellow clay	2	110	
Blue clay	110	165	
Brown clay	165	205	
Brown rock	205	210	
Brown soft rock	210	300	
Black med. rock	300	350	
Brown soft	350	380	
Brown med.	380	385	
Brown lava	385	395	

Work started Feb. 7 1968 Completed Feb. 9, 1968
Date well drilling machine moved off of well Feb. 9, 1968

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] Ralph Turner (Drilling Machine Operator) Date 2/10, 1968
Drilling Machine Operator's License No. 254

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
NAME Ralph Turner Drilling Co. (Person, firm or corporation) (Type or print)
Address Rte. 1 Box 141, Hillsboro, Ore.
[Signed] Ralph Turner (Water Well Contractor)
Contractor's License No. 247 Date Feb. 9, 1968

(USE ADDITIONAL SHEETS IF NECESSARY)

WATER WELL REPORT
STATE OF OREGON

WASH
009205

RECEIVED
OCT 28 1982
WATER RESOURCES DEPT.
SALEM, OREGON

State Well No. 1S/1W-33 cb

State Permit No. ....

(1) OWNER:
Name Douglas Thomas
Address Route 1, Box 363
City Beaverton, Oregon 97007 State

(2) TYPE OF WORK (check):
New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary Air ☒ Driven ☐
Rotary Mud ☐ Dug ☐
☐ Bored ☐

(4) PROPOSED USE (check):
Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐
Thermal: Withdrawal ☐ Reinjection ☐

(5) CASING INSTALLED:
Steel ☒ Plastic ☐
Threaded ☐ Welded ☒
6" Diam. from +1 ft. to 285 ft. Gauge .250
......" Diam. from ...... ft. to ...... ft. Gauge ......

LINER INSTALLED:
5" Diam. from 275 ft. to 325 ft. Gauge .188

(6) PERFORATIONS:
Perforated? ☒ Yes ☐ No
Type of perforator used Torch
Size of perforations 1/4 in. by 12 in.
140 perforations from 290 ft. to 325 ft.
...... perforations from ...... ft. to ...... ft.
...... perforations from ...... ft. to ...... ft.

(7) SCREENS:
Well screen installed? ☐ Yes ☒ No
Manufacturer's Name ....
Type .... Model No. ....
Diam. ...... Slot Size ...... Set from ...... ft. to ...... ft.
Diam. ...... Slot Size ...... Set from ...... ft. to ...... ft.

(8) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☒ No If yes, by whom?
d: Airlift 25 gal./min. with 65 ft. drawdown after 2 hrs.
" 20 " 60 " " "
Air test gal./min. with drill stem at ft. hrs.
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m.
perature of water 50° F. Depth artesian flow encountered ...... ft.

(9) CONSTRUCTION:
Special standards: Yes ☐ No ☒
Well seal—Material used Cement grout + 5% gel
Well sealed from land surface to 100 ft.
Diameter of well bore to bottom of seal 10 in.
Diameter of well bore below seal 6 in.
Number of sacks of cement used in well seal 32 sacks
How was cement grout placed? Pumped in place through tremme line on outside of casing @ 100' to ground level.
Was pump installed? no Type HP Depth ft.
Was a drive shoe used? ☒ Yes ☐ No Plugs Size: location ft.
Did any strata contain unusable water? ☐ Yes ☒ No
Type of Water? depth of strata
Method of sealing strata off
Was well gravel packed? ☐ Yes ☒ No Size of gravel: ......
Gravel placed from ...... ft. to ...... ft.

(10) LOCATION OF WELL:
County Washington Driller's well number
NW ¼ SW ¼ Section 33 T. 1S R. 1W W.M.
Tax Lot # Lot Blk Subdivision
Address at well location:

(11) WATER LEVEL: Completed well.
Depth at which water was first found 290 ft.
Static level 63 ft. below land surface. Date 10/22/82
Artesian pressure lbs. per square inch. Date

(12) WELL LOG:
Diameter of well below casing 6" 6"
Depth drilled 325 ft. Depth of completed well 325 ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level and indicate principal water-bearing strata.

MATERIAL	From	To	SWL
Brown clay - occ. silt	0	25	
Blue gray silty clay - occ. fine sand	25	40	
Brown clay - occ. silty	40	50	
Blue-gray & gray-brown silty clay	50	70	
Sticky brown & red-brown clay occ. cemented pea-gravel streaks	70	180	
Brown claystone-occ. silty	180	290	
Brown conglomerate w/claystone streaks - waterbearing	290	325	63'

Work started 10/18/82 19 Completed 10/22/82 19
Date well drilling machine moved off of well 10/22/82 19

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] [signature] (Drilling Machine Operator) Date 10/25 19 82
Drilling Machine Operator's License No. 523

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Name A. M. Jannsen Well Drilling Co/ Inc. (Person, firm or corporation) (Type or print)
Address 21075 SW Tualatin Valley Hwy. Aloha, Or.
[Signed] [signature] (Water Well Contractor)
Contractor's License No. 79 Date 10/25/82, 19

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the

WATER RESOURCES DEPARTMENT,
SALEM, OREGON 97310
within 30 days from the date of well completion.

SP*12658-690

WASH 67488

STATE OF OREGON
MONITORING WELL REPORT
(as required by ORS 537.765 & OAR 690-240-0395)

11-18-2008
AMENDED
12/30/08

WELL LABEL # L 96899
START CARD # 1005667

(1) LAND OWNER

Owner Well I.D. 150th Court Piezo
First Name P08410 Last Name
Company CITY OF BEAVERTON
Address 4755 SW GRIFFITH DRIVE
City BEAVERTON State OR Zip 97007

(2) TYPE OF WORK

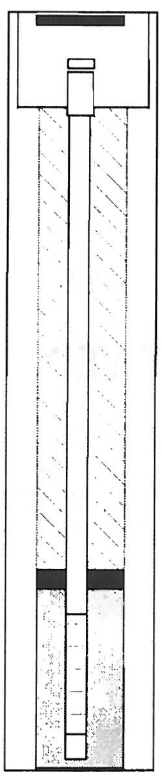
☒ New ☐ Deepening ☐ Conversion
☐ Alteration (repair/recondition) ☐ Abandonment

(3) DRILL METHOD

☐ Rotary Air ☐ Rotary Mud ☐ Cable ☐ Hollow Stem Auger ☐ Cable Mud
☐ Reverse Rotary ☒ Other Push Probe

(4) CONSTRUCTION

Piezometer Well ☒
Depth of Completed Well 25 ft. Special Standard ☐



MONUMENT/VAULT Below Ground
From 0 To 1

BORE HOLE
Diameter 8 From 0 To 25

CASING
Dia. 2 From ☒ 0 To 25
Gauge sch 40 Wld Thrd
Material ◯ Steel ◉ Plastic ☐ ☒

LINER
Dia. From ☐ To
Gauge Wld Thrd
Material ◯ Steel ◯ Plastic ☐ ☐

SEAL
From 1 To 8
Material Bentonite Chips
Amount 175.00 P Grout weight

SCREEN
Casing/Liner Casing Material PVC
Diameter 2 From 10 To 25
Slot Size .010

FILTER
From 8 To 25 Material Silica Sand Size of pack 10/20

(5) WELL TESTS

◯ Pump ◯ Bailer ◯ Air ◯ Flowing Artesian

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)

Temperature 56 °F Lab analysis ☐ Yes By
Supervising Geologist/Engineer
Water quality concerns? ☐ Yes (describe below)

From	To	Description	Amount	Units

(6) LOCATION OF WELL (legal description)

County Washington Twp 1.00 S N/S Range 1.00 W E/W WM
Sec 17 SE 1/4 of the SE 1/4 Tax Lot 8600
Tax Map Number Lot
Lat ° 0 ' " or 45.47924400 DMS or DD
Long ° 0 ' " or -122.83198400 DMS or DD
◉ Street address of well ◯ Nearest address

15015 SW 150TH CT BEAVERTON, OR

(7) STATIC WATER LEVEL

	Date	SWL(psi)	+	SWL(ft)
Existing Well / Predeepening			☐	
Completed Well	11-14-08		☐	15

Flowing Artesian? ☐ Dry Hole? ☐

WATER BEARING ZONES Depth water was first found

SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)
11-14-08	15	25			☐	25
					☐	
					☐	
					☐	

(8) WELL LOG

Ground Elevation

Material	From	To
Silt sand, dark brown sand	0	13
Silty sand and gravels	13	25

RECEIVED
DEC 31 2008
WATER RESOURCES DEPT
SALEM, OREGON

Date Started 11-14-2008 Completed 11-14-2008

(unbonded) Monitor Well Constructor Certification
I certify that the work I performed on the construction, deepening, alteration, or abandonment of this well is in compliance with Oregon monitoring well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

License Number 10548 Date 11-18-2008
Electronically Submitted
Signed MARC CHALONA (E-filed)

(bonded) Monitor Well Constructor Certification
I accept responsibility for the construction, deepening, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon monitoring well construction standards. This report is true to the best of my knowledge and belief.

License Number 10357 Date 11-18-2008
Electronically Submitted
Signed TERRENCE JACQUES (E-filed)
Contact Info (optional)

ORIGINAL - WATER RESOURCES DEPARTMENT
THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the STATE ENGINEER, SALEM, OREGON 97310 within 30 days from the date of well completion.

RECEIVED AUG 29 1969 STATE ENGINEER SALEM, OREGON

WASH

WATER WELL REPORT
STATE OF OREGON
(Please type or print)
(Do not write above this line)

010218

State Well No. 1/2W1-25

State Permit No.

(1) OWNER:
Name Oscar Pierson
Address 7920 S. W. Miller Hill Road, Beaverton Oregon

(2) TYPE OF WORK (check):
New Well ☐ Deepening ☒ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary ☒ Driven ☐
Cable ☐ Jetted ☐
Dug ☐ Bored ☐

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

(5) CASING INSTALLED: Threaded ☐ Welded ☐
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

(6) PERFORATIONS: Perforated? ☐ 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.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS: Well screen installed? ☐ Yes ☐ No
Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(8) WATER LEVEL: Completed well.
Static level 412 ft. below land surface Date 8/22/69
Artesian pressure lbs. per square inch Date

(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: gal./min. with ft. drawdown after hrs.
" " " "
" " " "
~~Bailer~~ AIR LIFT test 15 gal./min. with 55 ft. drawdown after 2 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? ☐ Yes ☐ No

(10) CONSTRUCTION:
Well seal—Material used
Depth of seal ft.
Diameter of well bore to bottom of seal in.
Were any loose strata cemented off? ☐ Yes ☐ No Depth
Was a drive shoe used? ☐ Yes ☐ No
Did any strata contain unusable water? ☐ Yes ☐ No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? ☐ Yes ☐ No Size of gravel:
Gravel placed from ft. to ft.

(11) LOCATION OF WELL:
County Washington Driller's well number
¼ ¼ Section 25 T. 1 S. R2 W. W.M.
Bearing and distance from section or subdivision corner

(12) WELL LOG:
Diameter of well below casing 6"
Depth drilled 97 ft. Depth of completed well 487 ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level as drilling proceeds. Note drilling rates.

MATERIAL	From	To	SWL
Breviously drilled	0	390	
Broken gray rock	390	428	
~~Soft~~ brown & gray rock hard	428	461	
Soft brown & gray r ock	461	479	
Soft brown rock	479	482	
Hard Rock	482	487	

Work started 8/19/69 19 Completed 8/22/69 19
Date well drilling machine moved off of well 8/22/69 19

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] Hollis C Kunnenkamp (Drilling Machine Operator) Date 8/25/69 19
Drilling Machine Operator's License No. 235

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
NAME A. M. Jannsen Drilling Co.
(Person, firm or corporation) (Type or print)
Address 21075 S. W. Tualatin Valley Hwy, Aloha, Oregon
[Signed] Edward M Jannsen
(Water Well Contractor)
Contractor's License No. 79 Date 8/25/69 19

(USE ADDITIONAL SHEETS IF NECESSARY)

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the
STATE ENGINEER, SALEM, OREGON 97310
within 30 days from the date of well completion.

RECEIVED
JUN 21 1966
STATE ENGINEER
SALEM, OREGON

WATER WELL REPORT
STATE OF OREGON
(Please type or print)

010226

WASH

State Well No. 1/2W-25
State Permit No.

(1) OWNER:
Name Oscar Pierson
Address 7920 SW Miller Hill Rd.
Beaverton, Ore

(2) LOCATION OF WELL:
County Wash Driller's well number
¼ ¼ Section 25 T. 1S R. 2 W W.M.
Bearing and distance from section or subdivision corner

(3) TYPE OF WORK (check):
New Well ☐ Deepening ☒ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

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

(5) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

(6) CASING INSTALLED: Threaded ☐ Welded ☐
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

(7) PERFORATIONS: Perforated? ☐ 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.
perforations from ft. to ft.
perforations from ft. to ft.

(8) SCREENS: Well screen installed? ☐ Yes ☐ No
Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(9) CONSTRUCTION:
Well seal—Material used in seal
Depth of seal ft. Was a packer used?
Diameter of well bore to bottom of seal in.
Were any loose strata cemented off? ☐ Yes ☐ No Depth
Was a drive shoe used? ☐ Yes ☐ No
Was well gravel packed? ☐ Yes ☐ No Size of gravel:
Gravel placed from ft. to ft.
Did any strata contain unusable water? ☐ Yes ☐ No
Type of water? depth of strata
Method of sealing strata off

(10) WATER LEVELS:
Static level 360 ft. below land surface Date June 15-66
Artesian pressure lbs. per square inch Date

(11) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☒ No If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " " "
" " " "
Bailer test 5 gal./min. with 10 ft. drawdown after 1/2 hrs.
Artesian flow g.p.m. Date
Temperature of water Norm Was a chemical analysis made? ☐ Yes ☒ No

(12) WELL LOG: Diameter of well below casing 6
Depth drilled 392 ft. Depth of completed well 392 ft.
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
Black rock (med.)	362	375-380
Black sand	380	392

Work started June 7 1966 Completed June 15 1966
Date well drilling machine moved off of well June 15 1966

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

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
NAME A. J. Gaunt
(Person, firm or corporation) (Type or print)
Address Aloha Ore
Drilling Machine Operator's License No. 4
[Signed] A J Gaunt
(Water Well Contractor)
Contractor's License No. 4 Date June 19, 1966

(USE ADDITIONAL SHEETS IF NECESSARY)

STATE ENGINEER
Salem, Oregon

WASH

010235

Well Record

STATE WELL NO. 1S/2W 25E(1)
COUNTY Washington
APPLICATION NO. ....

OWNER: O. Pierson
MAILING ADDRESS: ....

LOCATION OF WELL: Owner's No. ....
CITY AND STATE: ....

..........¼ ....¼ Sec. .... T. .... N. S., R. .... E. W., W.M.

Bearing and distance from section or subdivision corner ....

Altitude at well 635 ft.

Section ....

TYPE OF WELL: drilled Date Constructed ....

Depth drilled 459 ft. Depth cased 18 ft.

CASING RECORD: 6 inch

FINISH:

AQUIFERS: Basalt from 444 ft. to 459 ft.

WATER LEVEL: 444 ft. below land surface.

PUMPING EQUIPMENT: Type piston H.P. ....
Capacity .... G.P.M.

WELL TESTS:
Drawdown .... ft. after .... hours .... G.P.M.
Drawdown .... ft. after .... hours .... G.P.M.

USE OF WATER domestic Temp. .... °F. ...., 19..........
SOURCE OF INFORMATION U.S.G.S.
DRILLER or DIGGER ....
ADDITIONAL DATA:
Log .... Water Level Measurements .... Chemical Analysis .... Aquifer Test ....

REMARKS: Supplies two families.

WASH 50723

RECEIVED

JUN 12 1996

WATER RESOURCES DEPT.

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)

(START CARD) # 86723

Instructions for completing this report are on the last page of this form.

(1) OWNER: Well Number

Name BAKER ROCK PRODUCTS
Address 21880 SW FARMINGTON RD
City BEAVERTON State OR Zip 97007

(2) TYPE OF WORK
[X] New Well [ ] Deepening [ ] Alteration (repair/recondition) [ ] Abandonment

(3) DRILL METHOD:
[X] Rotary Air [ ] Rotary Mud [ ] Cable [ ] Auger
[ ] Other

(4) PROPOSED USE:
[ ] Domestic [ ] Community [X] Industrial [ ] Irrigation
[ ] Thermal [ ] Injection [ ] Livestock [ ] Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval [ ] Yes [X] No Depth of Completed Well 65 ft.
Explosives used [ ] Yes [X] No Type Amount

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
10	0	65	Bentonite	0	30	15 SKS

How was seal placed: Method [ ] A [ ] B [ ] C [ ] D [ ] E
[X] Other POURED INTO ANNULAR
Backfill placed from ft. to ft. Material
Gravel placed from ft. to ft. Size of gravel

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	6"	+1	65	250	[X]	[ ]	[X]	[ ]
Liner:								

Final location of shoe(s) TRAP @ 30'

(7) PERFORATIONS/SCREENS:
[X] Perforations Method TORCH
[ ] Screens Type Material STEEL

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
47	64	1/4 x 8	7			[X]	[ ]

(8) WELL TESTS: Minimum testing time is 1 hour
[ ] Pump [ ] Bailer [X] Air [ ] Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
20		45	1 hr.

Temperature of water 53°F Depth Artesian Flow Found
Was a water analysis done? [ ] Yes By whom
Did any strata contain water not suitable for intended use? [ ] Too little
[ ] Salty [ ] Muddy [ ] Odor [ ] Colored [ ] Other
Depth of strata:

(9) LOCATION OF WELL by legal description:
County WASHINGTON Latitude Longitude
Township 1S N or S Range 2W E or W. WM.
Section 26 NW 1/4 se 1/4
Tax Lot #200 Lot Block Subdivision
Street Address of Well (or nearest address) 21880 SW FARMINGTON R[D]
BEAVERTON, OR

(10) STATIC WATER LEVEL:
27 ft. below land surface. Date 05/30/96
Artesian pressure lb. per square inch. Date

(11) WATER BEARING ZONES:
Depth at which water was first found 57

From	To	Estimated Flow Rate	SWL
57	65	20 GPM	27

(12) WELL LOG:
Ground Elevation

Material	From	To	SWL
Rock fill	0	2	
Gray basalt	2	22	
Brown basalt	22	57	
Gray-brown basalt	57	65	27

Date started 05/29/96 Completed 05/30/96

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.
WWC Number 1610
Signed [signature] Date 06/06/96

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.
WWC Number 1266
Signed [signature] Date 06/06/96

ORIGINAL & FIRST COPY-WATER RESOURCES DEPARTMENT SECOND COPY-CONSTRUCTOR THIRD COPY-CUSTOMER

OBSERVATION WELL

NOTICE TO WATER WELL CONTRACTOR: The original and first copy of this report are to be filed with the STATE ENGINEER, SALEM, OREGON 97310 within 30 days from the date of well completion.

RECEIVED OCT 28 1965 STATE ENGINEER SALEM, OREGON

WASH

WATER WELL REPORT
STATE OF OREGON
(Please type or print)

State Well No. 1/2w-23G(1)

State Permit No.

010143

(1) OWNER:

Name A.M. Jannsen Drilling Co.

Address 21075 S.W. Tualatin Valley Highway
Aloha, Oregon

(2) LOCATION OF WELL:

County Wash. Driller's well number

¼ ¼ Section 23 T. 1S R. 2W W.M.

Bearing and distance from section or subdivision corner

Well originally drilled for
Country Living, Inc.

(3) TYPE OF WORK (check):

New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐

If abandonment, describe material and procedure in Item 12.

(4) PROPOSED USE (check):

Domestic ☒ Industrial ☐ Municipal ☒
Irrigation ☐ Test Well ☐ Other ☐

(5) TYPE OF WELL:

Rotary ☒ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

(6) CASING INSTALLED: Threaded ☐ Welded ☐

12" Diam. from 0 ft. to 569 ft. Gage .250
10" Diam. from 553 ft. to 593 ft. Gage .331
" Diam. from ft. to ft. Gage

(7) PERFORATIONS: Perforated? ☐ 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.
perforations from ft. to ft.
perforations from ft. to ft.

(8) SCREENS: Well screen installed? ☐ Yes ☒ No

Manufacturer's Name

Type Model No.

Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(9) CONSTRUCTION:

Well seal—Material used in seal Cement

Depth of seal 569 ft. Was a packer used? No

Diameter of well bore to bottom of seal 15 in.

Were any loose strata cemented off? ☐ Yes ☒ No Depth

Was a drive shoe used? ☐ Yes ☒ No

Was well gravel packed? ☐ Yes ☒ No Size of gravel:

Gravel placed from ft. to ft.

Did any strata contain unusable water? ☐ Yes ☒ No

Type of water? depth of strata

Method of sealing strata off

(10) WATER LEVELS:

Static level 8 (31) ft. below land surface Date 4-13-62

Artesian pressure lbs. per square inch Date

(11) WELL TESTS: Drawdown is amount water level is lowered below static level

Was a pump test made? ☒ Yes ☐ No If yes, by whom?

Yield: 400 gal./min. with 167 ft. drawdown after hrs.
" " " "
" " " "

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

(12) WELL LOG: Diameter of well below casing 10

Depth drilled 805 ft. Depth of completed well 805 ft.

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	0	25
Soft sandy blue clay	25	35
Firm blue clay	35	57
Blue clay	72	115
Brown clay	115	124
Sand-fine to med. with clay, water bearing	124	135
Brown clay	135	146
Blue clay w/decomp. clay streaks	146	152
Blue clay w/small sandy streaks	152	158
Blue clay	158	170
Firm brown clay	170	207
Soft brown clay	207	215
Brown clay	215	294
Blue sand with clay	294	309
Soft blue clay	309	347
Blue clay	347	375
Firm blue clay	375	392
Soft blue clay	392	396
Firm blue clay	396	440
Sandy blue clay	440	467
Soft gray sand rock	467	469
Brown clay	469	490
Blue clay w/streaks of brown	490	540

Work started Feb. 1961 Completed Apr. 1962

Date well drilling machine moved off of well 4 1962

(13) PUMP:

Manufacturer's Name

Type: H.P.

Water Well Contractor's Certification:

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

NAME A.M. Jannsen Drilling Co.
(Person, firm or corporation) (Type or print)

Address 21075 S.W. Tualatin Valley Highway
Aloha, Ore.

Drilling Machine Operator's License No. 243 & 274

[Signed] Edward M. Jannsen
(Water Well Contractor)

Contractor's License No. 79 Date 10-26, 1965

(USE ADDITIONAL SHEETS IF NECESSARY)

WASH

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the STATE ENGINEER, SALEM, OREGON 97310 within 30 days from the date of well completion.

RECEIVED
OCT 28 1965
STATE ENGINEER
SALEM, OREGON

WATER WELL REPORT
STATE OF OREGON
(Please type or print)

010142

State Well No. 1/2w-23 G (1)
State Permit No. (continued)

(1) OWNER:
Name A.M. Jannsen Drilling Co.
Address 21075 S.W. Tualatin Valley Highway
Aloha, Oregon

(2) LOCATION OF WELL:
County ______ Driller's well number ______
¼ ______ ¼ Section ______ T. ______ R. ______ W.M.
Bearing and distance from section or subdivision corner ______

(3) TYPE OF WORK (check):
New Well ☐ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(4) PROPOSED USE (check):
Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☐ Jetted ☐
Dug ☐ Bored ☐

(6) CASING INSTALLED:
Threaded ☐ Welded ☐
......" Diam. from ...... ft. to ...... ft. Gage ......
......" Diam. from ...... ft. to ...... ft. Gage ......
......" Diam. from ...... ft. to ...... ft. Gage ......

(7) PERFORATIONS:
Perforated? ☐ 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.
...... perforations from ...... ft. to ...... ft.
...... perforations from ...... ft. to ...... ft.

(8) SCREENS:
Well screen installed? ☐ Yes ☐ No
Manufacturer's Name ......
Type ...... Model No. ......
Diam. ...... Slot size ...... Set from ...... ft. to ...... ft.
Diam. ...... Slot size ...... Set from ...... ft. to ...... ft.

(9) CONSTRUCTION:
Well seal—Material used in seal ......
Depth of seal ...... ft. Was a packer used? ......
Diameter of well bore to bottom of seal ...... in.
Were any loose strata cemented off? ☐ Yes ☐ No Depth ......
Was a drive shoe used? ☐ Yes ☐ No
Was well gravel packed? ☐ Yes ☐ No Size of gravel: ......
Gravel placed from ...... ft. to ...... ft.
Did any strata contain unusable water? ☐ Yes ☐ No
Type of water? ______ depth of strata ______
Method of sealing strata off ______

(10) WATER LEVELS:
Static level ______ ft. below land surface Date ______
Artesian pressure ______ lbs. per square inch Date ______

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

(12) WELL LOG:
Diameter of well below casing ......
Depth drilled ______ ft. Depth of completed well ______ ft.

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	540	560
Blue clay w/streaks of brown	560	596
Soft multi-colored rock, mostly green	596	640
Gray hard rock	640	670
Soft brown rock, some water loss	670	685
Gray hard rock, small streaks, green	685	710
Mostly green streaks of gray	710	725
Gray basalt	725	730
Broken gray basalt & clay	730	747
Hard gray basalt	747	799
Broken gray basalt	794	801
Hard gray basalt	801	805

Work started ______ 19 ______ Completed ______ 19 ______
Date well drilling machine moved off of well ______ 19 ______

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

Water Well Contractor's Certification:

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 ......
Drilling Machine Operator's License No. ......
[Signed] ...... (Water Well Contractor)
Contractor's License No. ...... Date ......, 19......

(USE ADDITIONAL SHEETS IF NECESSARY)

RECEIVED JUN 1 2 2003 WATER RESOURCES DEPT. SALEM, OREGON

WASH 59603

Wash. 59603

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)
Instructions for completing this report are on the last page of this form.

WELL I.D. # L L64128
START CARD # 156193

(1) LAND OWNER Well Number
Name Homer Ames
Address 22065 S.W. Riggs Rd.
City Beaverton State OR Zip 97007

(2) TYPE OF WORK
☒ New Well ☐ Deepening ☐ Alteration (repair/recondition) ☐ Abandonment

(3) DRILL METHOD:
☒ Rotary Air ☐ Rotary Mud ☐ Cable ☐ Auger
☐ Other

(4) PROPOSED USE:
☒ Domestic ☐ Community ☐ Industrial ☐ Irrigation
☐ Thermal ☐ Injection ☐ Livestock ☐ Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval ☐ Yes ☒ No Depth of Completed Well 445 ft.
Explosives used ☐ Yes ☒ No Type Amount

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
10"	0	60	cement	0	60	20 sacks
8"	60	276	cement	60	276	102 sacks
6"	276	445	SEE 12			

How was seal placed: Method ☐ A ☒ B ☒ C ☐ D ☐ E
☐ Other
Backfill placed from ft. to ft. Material
Gravel placed from ft. to ft. Size of gravel

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					☐	☐	☐	☐
	6"	+2	276	.250	☒	☐	☒	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:	4-1/2"	205	445		☐	☒	☒	☐
			200 psi		☐	☐	☐	☐

Drive Shoe used ☐ Inside ☐ Outside ☒ None
Final location of shoe(s) 4½X7 shale traps at 360'-205'

(7) PERFORATIONS/SCREENS:
☒ Perforations Method drilled
☐ Screens Type Material pvc-200

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
						☐	☐
425	445	½"	64	4½"	pipe	☐	☒
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour
☐ Pump ☐ Bailer ☒ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
90		445	1 hr.
60		300	" "
50		145	" "

Temperature of water 54° Depth Artesian Flow Found
Was a water analysis done? ☒ Yes By whom AMJ
Did any strata contain water not suitable for intended use? ☐ Too little
☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☒ Other high iron
Depth of strata: 300'-400' (sealed-off)

(9) LOCATION OF WELL by legal description:
County Washington Latitude Longitude
Township 1-S N or S Range 2W E or W. WM.
Section 26 NE 1/4 NW 1/4
Tax Lot 900 Lot Block Subdivision
Street Address of Well (or nearest address) 22065 S.W. Riggs Rd. Beaverton, OR 97007

(10) STATIC WATER LEVEL:
19 ft. below land surface. Date 6-4-03
Artesian pressure lb. per square inch Date

(11) WATER BEARING ZONES:
Depth at which water was first found 440

From	To	Estimated Flow Rate	SWL
440	445	90	19'

RECEIVED JUN 2 3 2003 WATER RESOURCES DEPT SALEM, OREGON

(12) WELL LOG:
Ground Elevation

Material	From	To	SWL
Bro cly & boulders	0	4	
Gry cly w/ br. seams	4	12	
Gry. silty clay	12	39	
Gray clay	39	47	
Bro./oranage clay	47	110	
Br. cly & dec. rock	110	123	
Bro. clay w/ sand	123	128	
Br. cly & dec. rock	128	229	
Gr. & bro. brok. bas.	229	267	
Gray basalt	267	283	
Gr./br. brok. bas.	283	304	
Soft br. weath. bas.	304	321	
Gr./brown & brown			
broken, basalt	321	445	19'
Note: Hole was cemented and			
redrilled from 440 to 276' to			
stabilize caving formations.			

Date started 5-21-03 Completed 6-4-03

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.
Signed [signature] WWC Number 1492 Date 6/9/03

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.
WWC Number 573
Signed [signature] Date 6/9/03

ORIGINAL – WATER RESOURCES DEPARTMENT FIRST COPY – CONSTRUCTOR SECOND COPY – CUSTOMER

RECEIVED
JUN 8 1959
STATE ENGINEER
SALEM, OREGON

File Original and First Copy with the STATE ENGINEER, SALEM, OREGON

This well purchased by Aloha-Huber water District #3

~~OBSERVATION~~ WASH 8862 WELL

G-1351

WATER WELL REPORT

STATE OF OREGON → G5265

State Well No. 1/1W-17(D) cd

State Permit No. WASH 008862

(1) OWNER:

Name Schuepbach Brothers

Address Beaverton, Oregon

(2) LOCATION OF WELL:

County Wash. Owner's number, if any—

¼ ¼ Section T. R. W.M.

Bearing and distance from section or subdivision corner

(3) TYPE OF WORK (check):

New Well ☑ Deepening ☐ Reconditioning ☐ Abandon ☐

If abandonment, describe material and procedure in Item 11.

(4) PROPOSED USE (check):

Domestic ☐ Industrial ☐ Municipal ☐

Irrigation ☑ Test Well ☐ Other ☐

(5) TYPE OF WELL:

Rotary ☐ Driven ☐

Cable ☑ Jetted ☐

Dug ☐ Bored ☐

(6) CASING INSTALLED: Threaded ☐ Welded ☑

14" Diam. from 0 ft. to 40 ft. Gage 3/8"

" Diam. from ft. to ft. Gage

" Diam. from ft. to ft. Gage

(7) PERFORATIONS: Perforated? ☐ 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.

perforations from ft. to ft.

perforations from ft. to ft.

(8) SCREENS: Well screen installed ☐ Yes ☐ No

Manufacturer's Name

Type Model No.

Slot size Set from ft. to ft.

Slot size Set from ft. to ft.

(9) CONSTRUCTION:

Was well gravel packed? ☐ Yes ☑ No Size of gravel:

Gravel placed from ft. to ft.

Was a surface seal provided? ☑ Yes ☐ No To what depth? 40 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

(10) WATER LEVELS:

Static level 109 ft. below land surface Date 5/17/59

Artesian pressure lbs. per square inch Date

Log Accepted by:

[Signed] Rudolph Schuepbach Jr. (Owner) June 8, 1959

(11) WELL TESTS: Drawdown is amount water level is lowered below static level

Was a pump test made? ☑ Yes ☐ No If yes, by whom? Harty Bros

Yield: 744 gal./min. with 49 ft. drawdown after hrs.

" 925 " 68 "

" 1089 " 83 " 15 hrs all together

Bailer test — gal./min. with — ft. drawdown after — hrs.

Artesian flow g.p.m. Date

Temperature of water 54° Was a chemical analysis made? ☐ Yes ☑ No

(12) WELL LOG: Diameter of well 14 inches.

Depth drilled 414 ft. Depth of completed well 414 ft.

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
Clay	0	11
Weathered Basalt	11	167
Black Basalt	167	268
Red Inner Flow	268	271
Black Basalt	271	309
Porous Honeycombed Rock Showing Rose Quartz	309	326
Black Basalt	326	393
Porous Basalt	393	397
Black Basalt	397	405
Porous Basalt	405	414

Work started 19 . Completed 19

(13) PUMP:

Manufacturer's Name Johnston

Type: Turbine H.P. 100

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 Harty Bros. (Person, firm, or corporation) (Type or print)

Address 3340 S.W. Seymour

Driller's well number

[Signed] Glenn Harty (Well Driller)

License No. 168 Date 5/8/59, 19

(USE ADDITIONAL SHEETS IF NECESSARY)

WASH 8862

Oregon Water Resources Department
725 Summer Street NE, Suite A
Salem Oregon 97301
(503) 986-0900
www.wrd.state.or.us

Application for Well ID Number

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JUL 16 2009
WATER RESOURCES DEPT
SALEM, OREGON

Do not complete if the well already has a Well I.D Number.

I. OWNER INFORMATION

Current Owner Name *(please print)*: Tualatin Valley Water District; Attn: Joel A. Cary
Mailing Address: 1850 SW 170th Avenue
City: Beaverton State: OR Zip: 97006
Mailing Address *(to send Well I.D.)*: Same as above
City: State: Zip:

II. WELL INFORMATION *(Do not complete this section if the well report is attached.)*

Township: 1S (North/South) Range: 1W (East/West) Section: 17
Tax Lot: County: 1/4 1/4
Street Address of Well: BETWEEN SW DIVISION & VILLAGE, IN BPA RIGHT OF WAY City:
Owner at time the well was constructed, (if known):
If the property had a different street address in the past:

III. GENERAL WELL INFORMATION *(Do not complete this section if the well report is attached)*

Use of Well (domestic, irrigation, commercial, industrial, monitoring):
Date Well Constructed: Total Well Depth: Casing Diameter:
Other Information:

SUBMITTED BY *(please print)*: Joel A. Cary
PHONE: D; 503.848.3019 FAX: 503.356.3119

Send application to Oregon Water Resoureces Department; 725 Summer St NE, Suite A; Salem, Oregon 97301-1266; fax (503) 986-0902. Applications are processed and Well I.D. Numbers are mailed every Wednesday.

For Official Use Only by the Oregon Water Resources Department:

Received Date:	Well Log Number:	Well Identification #:
	WASH 8862	100486

Wash 13787

RECEIVED JUL 27 1995 WATER ... SALEM

15/2W/26 bb

18

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)

(START CARD) # 80730

Instructions for completing this report are on the last page of this form.

(1) OWNER: Well Number ______

Name MRS. MARY HYLTON
Address 22250 SW RIGGS RD.
City ALOHA State OR Zip 97007

(2) TYPE OF WORK
[X] New Well [ ] Deepening [ ] Alteration (repair/recondition) [ ] Abandonment

(3) DRILL METHOD:
[ ] Rotary Air [X] Rotary Mud [ ] Cable [ ] Auger
[ ] Other

(4) PROPOSED USE:
[X] Domestic [ ] Community [ ] Industrial [ ] Irrigation
[ ] Thermal [ ] Injection [ ] Livestock [ ] Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval [ ] Yes [X] No Depth of Completed Well 448 ft.
Explosives used [ ] Yes [X] No Type ______ Amount ______

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
10"	0	439	cement	0	75	17 sks.
			cement	375	439	19 sks.
6"	439	448				

How was seal placed: Method [ ] A [X] B [X] C [ ] D [ ] E
[ ] Other
Backfill placed from 75 ft. to 375 ft. Material bent.+ gel
Gravel placed from ______ ft. to ______ ft. Size of gravel ______

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	6"	+1	439	250	[X]	[ ]	[X]	[ ]
					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
Liner:					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]

Final location of shoe(s) ______

(7) PERFORATIONS/SCREENS:
[ ] Perforations Method ______
[ ] Screens Type ______ Material ______

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
						[ ]	[ ]
						[ ]	[ ]
						[ ]	[ ]
						[ ]	[ ]
						[ ]	[ ]

(8) WELL TESTS: Minimum testing time is 1 hour
[ ] Pump [ ] Bailer [X] Air [ ] Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
45		448	1 hr.

Temperature of water 54°F Depth Artesian Flow Found ______
Was a water analysis done? [X] Yes By whom AMJ
Did any strata contain water not suitable for intended use? [ ] Too little
[ ] Salty [ ] Muddy [ ] Odor [ ] Colored [ ] Other ______
Depth of strata: ______

(9) LOCATION OF WELL by legal description:
County WASH. Latitude ______ Longitude ______
Township 1S N or S Range 2W E or W. WM.
Section 26 NW 1/4 NW 1/4
Tax Lot 2600 Lot ______ Block ______ Subdivision ______
Street Address of Well (or nearest address) Mary Hylton
22250 SW RIGGS RD., ALOHA, OR 97006

(10) STATIC WATER LEVEL:
27' ft. below land surface. Date 7-20-95
Artesian pressure ______ lb. per square inch. Date ______

(11) WATER BEARING ZONES:

Depth at which water was first found 439

From	To	Estimated Flow Rate	SWL
439	448	45 gpm	27

(12) WELL LOG:
Ground Elevation ______

Material	From	To	SWL
Brown silty clay	0	13	
Gray-brown clay w/sandy streaks	13	22	
Soft gray clay w/sticky streaks	22	56	
Brown & gray-brn. silty clay	56	104	
Brown & red-brn. clay w/occ. rock frag.	104	195	
Sticky gray clay	195	224	
Sticky dark gray clay w/ blue-gray streaks	224	245	
Brown clay w/rock frag.	245	270	
Red-brown clay	270	336	
Sticky gray-brn. clay	336	391	
Firm gray-brn. clay	391	428	
Gray-brn. comglomerate	428	448	27'

Date started 7-14-95 Completed 7-20-95

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

WWC Number 1492
Signed [signature] Date 7-24-95

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.

WWC Number 1266
Signed [signature] Date 7-24-95

ORIGINAL & FIRST COPY-WATER RESOURCES DEPARTMENT SECOND COPY-CONSTRUCTOR THIRD COPY-CUSTOMER

WASH
56299

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)
Instructions for completing this report are on the last page of this form.

WELL I.D. # L 41145
START CARD # 134060

(1) OWNER: Well Number
Name DAVID FOGLIO
Address 11500 S.W. GRABHORN RD.
City BEAVERTON, State OR Zip 97007

(2) TYPE OF WORK
☐ New Well ☒ Deepening ☐ Alteration (repair/recondition) ☐ Abandonment

(3) DRILL METHOD:
☒ Rotary Air ☐ Rotary Mud ☐ Cable ☐ Auger
☐ Other

(4) PROPOSED USE:
☒ Domestic ☐ Community ☐ Industrial ☐ Irrigation
☐ Thermal ☐ Injection ☐ Livestock ☐ Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval ☐ Yes ☒ No Depth of Completed Well 360 ft.
Explosives used ☐ Yes ☒ No Type Amount

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
6	210	360	Seal not Disturbed			

How was seal placed: Method ☐ A ☐ B ☐ C ☐ D ☐ E
☐ Other
Backfill placed from ft. to ft. Material
Gravel placed from ft. to ft. Size of gravel

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					☐	☐	☐	☐
Liner:	4"	20	360	160#	☐	☒	☒	☐

Final location of shoe(s)

(7) PERFORATIONS/SCREENS:
☒ Perforations Method DRILLED
☐ Screens Type Material PVC

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
340	360		30	½		☐	☒

(8) WELL TESTS: Minimum testing time is 1 hour
☐ Pump ☐ Bailer ☒ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
100		360	1 hr.
100		300	"
90		200	"

Temperature of water 55°F Depth Artesian Flow Found
Was a water analysis done? ☐ Yes By whom
Did any strata contain water not suitable for intended use? ☐ Too little
☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other
Depth of strata:

(9) LOCATION OF WELL by legal description:
County Washington Latitude Longitude
Township 1S N or S Range 2W E or W. WM.
Section 36 NE 1/4 SW 1/4
Tax Lot 801 Lot Block Subdivision
Street Address of Well (or nearest address) SAME

(10) STATIC WATER LEVEL:
80 ft. below land surface. Date 8/3/2000
Artesian pressure lb. per square inch. Date

(11) WATER BEARING ZONES:
Depth at which water was first found 350

From	To	Estimated Flow Rate	SWL
350	360	100	80

(12) WELL LOG:
Ground Elevation

Material	From	To	SWL
Previous Depths		210	
Gray Brn basalt	210	240	
Gray basalt hard	240	350	
Gray brn basalt partially decomposed.	350	360	80'

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RECEIVED DEC 2 8 2000 WATER RESOURCES DEPT. SALEM, OREGON

Date started 8/2/2000 Completed 8/3/2000

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.
WWC Number 1749
Signed [signature] Date 8-3-2000

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.
WWC Number 1266
Signed [signature] Date 8/3/2000

ORIGINAL WATER RESOURCES DEPARTMENT FIRST COPY CONSTRUCTOR SECOND COPY CUSTOMER

STATE OF OREGON
WATER WELL REPORT
(as required by ORS 537.765)

WASH 042 MAY 22 1990

15/2W/36Ca

(START CARD) # 17983

(1) OWNER:
Well Number:
Name David & Charlene Foglio
Address 10255 SW Murry Rd. Blvd
City Beaverton State OR Zip 97005

(2) TYPE OF WORK:
☒ New Well ☐ Deepen ☐ Recondition ☐ Abandon

(3) DRILL METHOD
☒ Rotary Air ☐ Rotary Mud ☐ Cable
☐ Other

(4) PROPOSED USE:
☒ Domestic ☐ Community ☐ Industrial ☐ Irrigation
☐ Thermal ☐ Injection ☐ Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval Yes ☐ No ☒ Depth of Completed Well 210 ft.
Explosives used Yes ☐ No ☒ Type Amount

HOLE Diameter	From	To	SEAL Material	From	To	Amount sacks or pounds
10	0	28	Cement	0	28	6 sks + gel
6	28	210				

How was seal placed: Method ☐ A ☐ B ☒ C ☐ D ☐ E
☐ Other
Backfill placed from ft. to ft. Material
Gravel placed from ft. to ft. Size of gravel

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	6	+1	28	.250	☒	☐	☒	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:	4	10	200	PVC160	☐	☒	☒	☐
					☐	☐	☐	☐

Final location of shoe(s)

(7) PERFORATIONS/SCREENS:
☒ Perforations Method Drilled
☐ Screens Type Material PVC 160

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
190	210		80	1/2		☐	☒
						☐	☐
						☐	☐
						☐	☐
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour
☐ Pump ☐ Bailer ☒ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
20		190	1 hr.
12		130	"

Temperature of water 56° F Depth Artesian Flow Found
Was a water analysis done? ☐ Yes By whom
Did any strata contain water not suitable for intended use? ☐ Too little
☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other
Depth of strata:

(9) LOCATION OF WELL by legal description:
County Washington Latitude ' " Longitude ' "
Township 1S N or S, Range 2W E or W, WM.
Section 36 NE ¼ SW ¼
Tax Lot 801 Lot Block Subdivision
Street Address of Well (or nearest address)

(10) STATIC WATER LEVEL:
80 ft. below land surface. Date 05/15/90
Artesian pressure lb. per square inch. Date

(11) WATER BEARING ZONES:
Depth at which water was first found 124

From	To	Estimated Flow Rate	SWL
124	150	6 gpm	80
150	202	6 "	80
202	210	8 "	80

(12) WELL LOG:
Ground elevation

Material	From	To	SWL
Brown clay,gritty occ rock frag.	0	21	
Gray-brown basalt	21	25	
Gray-black basalt, occ gray brown	25	93	
Gray basalt hard	93	124	
Black basalt & lava, broken	124	150	80
Gray&black basalt, broken occ lava	150	202	80
Brown basalt, broken	202	210	80

Date started 05/15/90 Completed 05/15/90

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon well construction standards. Materials used and information reported above are true to my best knowledge and belief.
WWC Number
Signed Date

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. all work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief.
WWC Number 573
Signed [signature] Date 05/18/90

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)
Instructions for completing this report are on the last page of this form

WASH 56058

WELL ID # 39466
(START CARD) # 131407

(1) OWNER: Well Number: 662
Name Rosco Bierly
Address 11480 SW Grabhorn
City Beaverton State OR Zip 97075

(2) TYPE OF WORK:
[X] New Well [ ] Deepening [ ] Alteration (repair/recondition) [ ] Abandonment

(3) DRILL METHOD:
[X] Rotary Air [ ] Rotary Mud [ ] Cable [ ] Auger
[ ] Other

(4) PROPOSED USE:
[X] Domestic [ ] Community [ ] Industrial [ ] Irrigation
[ ] Thermal [ ] Injection [ ] Livestock [ ] Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval [ ] Yes [X] No Depth of Completed Well 400 ft.
Explosives used [ ] Yes [X] No Type Amount

HOLE Diameter	From	To	SEAL Material	From	To	Amount sacks or pounds
10"	0	25	Bentonite	0	25	18 Sacks
8"	25	200	Cement	150	200	20 Sacks
6"	200	340				
5"	340	400				

How was seal placed: Method [ ] A [X] B [ ] C [ ] D [ ] E
[ ] Other
Backfill placed from ft. to ft. Material
Gravel placed from ft. to ft. Size of gravel

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	6"	+1	200	1/4	[X]	[ ]	[X]	[ ]
Liner:	5"	150	300	1/4	[X]	[ ]	[X]	[ ]

Final location of shoe(s)

(7) PERFORATIONS/SCREENS:
[X] Perforations Method Torch
[X] Screens Type Material

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
279	299	1"hls	30	5"		[ ]	[X]

(8) WELL TESTS: Minimum testing time is 1 hour
[X] Pump [ ] Bailer [X] Air [ ] Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
12		400	1 hr.
30	10		2hrs.

Temperature of Water 54 Depth Artesian Flow found
Was a water analysis done? [ ] Yes By whom
Did any strata contain water not suitable for intended use? [ ] Too little
[ ] Salty [ ] Muddy [ ] Odor [ ] Colored [ ] Other
Depth of strata:

(9) LOCATION OF WELL by legal description:
County Washington Latitude Longitude
Township 1S N or S. Range 2W E or W. of WM.
Section 36 NW ¼ SW ¼
Tax Lot 0002 Lot Block Subdivision
Street Address of Well (or nearest address)
Same as above

(10) STATIC WATER LEVEL:
67 ft. below land surface. Date 6/2/00
Artesian pressure lb. per square inch. Date

(11) WATER BEARING ZONES:
Depth at which water was first found 75

From	To	Estimated Flow Rate	SWL
78	120	30	50
360	400	30	67

(12) WELL LOG:
Ground elevation

Material	From	To	SWL
Clay, Brown	0	20	
Basalt, Brown & Soft	20	60	
Basalt, Bray & Brown	60	78	
Basalt, Brown	78	120	50
Basalt, Gray	120	240	
Basalt, Brown & Broken	240	260	
Basalt, Gray	260	360	
Basalt, Brown & Gray	360	400	67

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JUN 16 2000
WATER RESOURCES DEPT.
SALEM, OREGON

Date started 5/24/00 Completed 6/2/00

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to my best knowledge and belief.
Signed [signature] WWC Number 1651
Date 6-10-00

(bonded) Water Well Constructor Certification:
AMERICAN WELL DRILLING
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.
Signed [signature] WWC Number 663
Date 6/10/00

ORIGINAL & FIRST COPY - WATER RESOURCES DEPARTMENT SECOND COPY - CONSTRUCTOR THIRD COPY - CUSTOMER

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765 & OAR 690-205-0210)

WASH 64258
07-27-2006

WELL LABEL # L 85856
START CARD # 188752

(1) LAND OWNER

Owner Well I.D.
First Name MARVIN Last Name DECKER
Company DECKER ENTERPRISES
Address 12635 SW RIVER RD
City HILLSBORO State OR Zip 97123

(2) TYPE OF WORK

[X] New Well [ ] Deepening [ ] Conversion [ ] Alteration (repair/recondition) [ ] Abandonment

(3) DRILL METHOD

[X] Rotary Air [ ] Rotary Mud [ ] Cable [ ] Auger [ ] Cable Mud [ ] Reverse Rotary [ ] Other

(4) PROPOSED USE

[X] Domestic [ ] Irrigation [ ] Community [ ] Industrial/ Commericial [ ] Livestock [ ] Dewatering [ ] Thermal [ ] Injection [ ] Other

(5) BORE HOLE CONSTRUCTION

Special Standard [ ] (Attach copy)
Depth of Completed Well 290.00 ft.

BORE HOLE Dia	From	To	SEAL Material	From	To	Amt	sacks/ lbs
12	0	78	Cement	0	78	65	S
8	78	290					

How was seal placed: Method [ ] A [ ] B [X] C [ ] D [ ] E
[ ] Other
Backfill placed from ___ ft. to ___ ft. Material ___
Filter pack from ___ ft. to ___ ft. Material ___ Size ___
Explosives used: [ ] Yes Type ___ Amount ___

(6) CASING/LINER

Casing	Liner	Dia	+	From	To	Gauge	Stl	Plstc	Wld	Thrd
(•)	( )	8	[X]	2	78	.25	(•)	( )	[X]	[ ]

Shoe [ ] Inside [X] Outside [ ] Other Location of shoe(s) 78
Temp casing [ ] Yes Dia ___ From ___ To ___

(7) PERFORATIONS/SCREENS

Perforations Method ___
Screens Type ___ Material ___

Perf/ Screen	Casing/ Liner	Screen Dia	From	To	Scrn/slot width	Slot length	# of slots	Tele/ pipe size

(8) WELL TESTS: Minimum testing time is 1 hour

( ) Pump ( ) Bailer (•) Air ( ) Flowing Artesian

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)
190		290	

Temperature 57 °F Lab analysis [ ] Yes By ___
Water quality concerns? [ ] Yes (describe below)

From	To	Description	Amount	Units

(9) LOCATION OF WELL (legal description)

County Washington Twp 2.00 S N/S Range 2.00 W E/W WM
Sec 3 NW 1/4 of the SW 1/4 Tax Lot 700
Tax Map Number ___ Lot ___
Lat ___ ° ___ ' ___ " or ___ DMS or DD
Long ___ ° ___ ' ___ " or ___ DMS or DD
(•) Street address of well ( ) Nearest address

12945 SW RIVER RD

(10) STATIC WATER LEVEL

	Date	SWL(psi)	+	SWL(ft)
Existing Well / Predeepening			[ ]	
Completed Well	07-26-2006		[ ]	40

Flowing Artesian? [ ] Dry Hole? [ ]

WATER BEARING ZONES Depth water was first found 45

SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)
07-25-2006	21	70	4		[ ]	21
07-26-2006	105	108	8		[ ]	40
07-26-2006	175	180	52		[ ]	40
07-26-2006	240	265	130		[ ]	40

(11) WELL LOG

Ground Elevation ___

Material	From	To
BROWN SANDY CLAY	0	22
GRAY CLAY	22	40
GRAY SANDSTONE	40	70
GRAY BASALT	70	170
BROWN AND GRAY BASALT	170	290

Date Started 07-24-2006 Completed 07-26-2006

(unbonded) Water Well Constructor Certification
I certify that the work I performed on the construction, deepening, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

License Number 1776 Date 07-27-2006
Electronically Filed
Signed DOUGLAS D TUCKER (E-filed)

(bonded) Water Well Constructor Certification
I accept responsibility for the construction, deepening, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.

License Number 1541 Date 07-27-2006
Electronically Filed
Signed CASEY JONES JR (E-filed)
Contact Info (optional) Casey Jones Well Drilling Co. Inc. 541-747-2806

RECEIVED OCT 07 2002 WATER RESOURCES DEPT. SALEM, OREGON

WASH 58886

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)
Instructions for completing this report are on the last page of this form.

WELL I.D. # L ~~61012~~
START CARD # ~~149022~~

(1) LAND OWNER Well Number
Name DONALD HARVEY
Address PO BOX 1072
City BEAVERTON State OR Zip 97005

(2) TYPE OF WORK
☒ New Well ☐ Deepening ☐ Alteration (repair/recondition) ☐ Abandonment

(3) DRILL METHOD:
☒ Rotary Air ☐ Rotary Mud ☐ Cable ☐ Auger
☐ Other

(4) PROPOSED USE:
☒ Domestic ☐ Community ☐ Industrial ☐ Irrigation
☐ Thermal ☐ Injection ☐ Livestock ☐ Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval ☐ Yes ☒ No Depth of Completed Well 308 ft.
Explosives used ☐ Yes ☒ No Type Amount

HOLE			SEAL			
Diameter	From	To	Material	From	To	Sacks or pounds
10	0	20	Cem/Bent	0	20	8 sks w/gel
8	20	119	Cem/Bent	20	119	10 sks w/gel
6	119	308				

How was seal placed: Method ☐ A ☒ B ☒ C ☐ D ☐ E
☐ Other
Backfill placed from ft. to ft. Material
Gravel placed from ft. to ft. Size of gravel

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	6"	+1	119	250	☒	☐	☒	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:	4½"	108	308	160#	☐	☒	☒	☐
					☐	☐	☐	☐

Drive Shoe used ☐ Inside ☐ Outside ☒ None
Final location of shoe(s) 4" FPT @ 108'

(7) PERFORATIONS/SCREENS:
☒ Perforations Method DRILLED
☐ Screens Type Material PVC160

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
288	308		60	3/8		☐	☒
						☐	☐
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour
☐ Pump ☐ Bailer ☒ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
60+		308	1 hr.
50		220	"
25-30		160	"

Temperature of water 53°F Depth Artesian Flow Found
Was a water analysis done? ☒ Yes By whom amj
Did any strata contain water not suitable for intended use? ☐ Too little
☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other
Depth of strata:

(9) LOCATION OF WELL by legal description:
County WASHINGTON Latitude Longitude
Township 2S N or S Range 2W E or W. WM.
Section 01 NE 1/4 SW 1/4
Tax Lot 1407 Lot Block Subdivision
Street Address of Well (or nearest address) 13191 SW GLEN OAK PL. BEAVERTON, OR

(10) STATIC WATER LEVEL:
116 ft. below land surface. Date 10/01/02
Artesian pressure lb. per square inch Date

(11) WATER BEARING ZONES:
Depth at which water was first found 140

From	To	Estimated Flow Rate	SWL
140	160	5 gpm	116
190	235	15 "	"
235	290	20 "	"
290	308	20 gpm	116

(12) WELL LOG:
Ground Elevation

Material	From	To	SWL
Brn.clay occ.silty/gritty	0	12	
Brn.basalt weath.firm	12	18	
Gray-brn.basalt,frac.	18	44	
Red-brn.basalt&lava,inter.	44	52	
Brn. basalt,soft strks	52	70	
Gray-brn.basalt,mineral strks	70	100	
Gray basalt, hard	100	127	
Brn.basalt brkn.inter.	127	148	116
Gray-brn.basalt,frac.	148	160	"
Gray-black basalt,hard	160	190	"
Brn.basalt&lava,brkn.inter	190	235	"
Gray-blk&gray-brn.basalt	235	290	"
Basalt gray-black,occ. lava streaks	290	308	116

Date started 9/25/02 Completed 10/01/02

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.
WWC Number
Signed Date

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.
WWC Number 573
Signed [signature] Date 10/02/02

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SALEM, OREGON

WASH 3841

2s/2w/2cd

14

STATE OF OREGON
WATER WELL REPORT
(as required by ORS 537.765)
Instructions for completing this report are on the last page of this form.

PAGE (START CARD) # 48191

(1) OWNER: Well Number 1436
Name OREGON HERITAGE DEVELOPMENT, INC.
Address 20285 NW CORNELL RD
City HILLSBORO State OR Zip 97124

(2) TYPE OF WORK
[X] New Well [ ] Deepening [ ] Alteration (repair/recondition) [ ] Abandonment

(3) DRILL METHOD:
[X] Rotary Air [ ] Rotary Mud [ ] Cable [ ] Auger
[ ] Other

(4) PROPOSED USE:
[X] Domestic [ ] Community [ ] Industrial [ ] Irrigation
[ ] Thermal [ ] Injection [ ] Livestock [ ] Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval [ ] Yes [X] No Depth of Completed Well 385 ft.
Explosives used [ ] Yes [X] No Type ____ Amount ____

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
9	0	91	CEMENT	5	91	23 SAX
6	91	385	BENTNITE	0	5	2 SAX

How was seal placed: Method [X] A [ ] B [ ] C [ ] D [ ] E
[ ] Other
Backfill placed from ____ ft. to ____ ft. Material ____
Gravel placed from ____ ft. to ____ ft. Size of gravel ____

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
	6	+1	91	.25	[X]	[ ]	[X]	[ ]
					[ ]	[ ]	[ ]	[ ]
Liner:					[ ]	[ ]	[ ]	[ ]
	4	0	385	160#	[ ]	[X]	[X]	[ ]

Final location of shoe(s) ____

(7) PERFORATIONS/SCREENS:
[X] Perforations Method SAW
[ ] Screens Type ____ Material ____

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
345	385	6"	72			[ ]	[X]
						[ ]	[ ]
						[ ]	[ ]
						[ ]	[ ]
						[ ]	[ ]

(8) WELL TESTS: Minimum testing time is 1 hour
[ ] Pump [ ] Bailer [X] Air [ ] Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
50.00		385	1 hr.

Temperature of water 53 Depth Artesian Flow Found ____
Was a water analysis done? [ ] Yes By whom ____
Did any strata contain water not suitable for intended use? [ ] Too little
[ ] Salty [ ] Muddy [ ] Odor [ ] Colored [ ] Other ____
Depth of strata: ____

(9) LOCATION OF WELL by legal description:
County WASH. Latitude 45 25 12 Longitude 122 5350
Township 2 S N or S Range 2 W E or W. WM.
Section 2 SE 1/4 SW 1/4
Tax Lot ____ Lot ____ Block ____ Subdivision ____
Street Address of Well (or nearest address)
21435 SW SCHOLLS FERRY RD ,

(10) STATIC WATER LEVEL:
48 ft. below land surface. Date 05/19/94
Artesian pressure ____ lb. per square inch. Date ____

(11) WATER BEARING ZONES:
Depth at which water was first found 151

From	To	Estimated Flow Rate	SWL
151	191	20	48
340	372	30	48

(12) WELL LOG:
Ground Elevation ____

Material	From	To	SWL
TOP SOIL	0	3	
BROWN CLAY	3	9	
YELLOW CLAY	9	18	
BLUE CLAY W/SAND/GRAVEL	18	84	
MEDIUM GRAY BASALT	84	151	
RED DECAYED BASALT	151	191	48
MEDIUM GRAY BASALT	191	340	
DECAYED BASALT	340	372	48
MEDIUM GRAY BASALT	372	385	
DAVE PAYSINGER			
BLUE WATER DRILLING CO.			
DAYTON, OR. 97114			

Date started 05/16/94 Completed 05/19/94

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.
WWC Number ____
Signed ____ Date ____

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.
WWC Number 1438
Signed David G. Paysinger Date 05/19/94

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18

WASH 4308

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WATER RESOURCES DEPT
SALEM, OREGON

1S/2W/34dd

STATE OF OREGON
WATER WELL REPORT
(as required by ORS 537.765)

Instructions for completing this report are on the last page of this form.

(START CARD) # 68073

(1) OWNER: Well Number 233

Name Columbia Empire Farm Inc.
Address 31461 NE Bell Rd.
City Sherwood State OR. Zip 97140

(2) TYPE OF WORK

[X] New Well [ ] Deepening [ ] Alteration (repair/recondition) [ ] Abandonment

(3) DRILL METHOD:

[X] Rotary Air [ ] Rotary Mud [ ] Cable [ ] Auger
[ ] Other

(4) PROPOSED USE:

[ ] Domestic [ ] Community [ ] Industrial [X] Irrigation
[ ] Thermal [ ] Injection [ ] Livestock [ ] Other

(5) BORE HOLE CONSTRUCTION:

Special Construction approval [ ] Yes [X] No Depth of Completed Well 300 ft.
Explosives used [ ] Yes [X] No Type Amount

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
12	0	55	cement	0	55	25
10	55	78	cement	55	78	10
8	78	300				

How was seal placed: Method [ ] A [X] B [ ] C [ ] D [ ] E
[ ] Other
Backfill placed from ft. to ft. Material
Gravel placed from ft. to ft. Size of gravel

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	8	+2	78	1/4	[X]	[ ]	[X]	[ ]
					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
Liner:	6	-71	300	1/4	[X]	[ ]	[X]	[ ]
					[ ]	[ ]	[ ]	[ ]

Final location of shoe(s)

(7) PERFORATIONS/SCREENS:

[X] Perforations Method cutting tourch
[ ] Screens Type Material

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
180	300	1"/10"	104	6		[ ]	[X]
						[ ]	[ ]
						[ ]	[ ]
						[ ]	[ ]
						[ ]	[ ]

(8) WELL TESTS: Minimum testing time is 1 hour

[ ] Pump [ ] Bailer [X] Air [ ] Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
250	220	300	1 hr.

Temperature of water 59 Depth Artesian Flow Found
Was a water analysis done? [ ] Yes By whom
Did any strata contain water not suitable for intended use? [ ] Too little
[ ] Salty [ ] Muddy [ ] Odor [ ] Colored [ ] Other
Depth of strata:

(9) LOCATION OF WELL by legal description:

County Wash. Latitude Longitude
Township 1 N or S Range 2 E or W. WM.
Section 34 SE 1/4 SE 1/4
Tax Lot Lot Block Subdivision
Street Address of Well (or nearest address) 22525 Tile Flat Rd.

(10) STATIC WATER LEVEL:

27 ft. below land surface. Date 11/14/94
Artesian pressure lb. per square inch. Date

(11) WATER BEARING ZONES:

Depth at which water was first found 180

From	To	Estimated Flow Rate	SWL
180	300	250	27

(12) WELL LOG:

Ground Elevation

Material	From	To	SWL
top soil	0	1	
clay brown	1	20	
claystone brown	20	35	
rock brown/gray	35	65	
rock gray	65	135	
rock brown broken	135	170	
rock gray/brown	170	180	
rock brown/gray	180	300	27

Date started 11/10/94 Completed 11/14/94

(unbonded) Water Well Constructor Certification:

I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

WWC Number
Signed Date

(bonded) Water Well Constructor Certification:

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.

WWC Number 663
Signed Rody C. Erl Date 11/15/94

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WASH 64738

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765 & OAR 690-205-0210)

WELL LABEL # L 87451

START CARD # 189389

(1) LAND OWNER

Owner Well I.D. ______

First Name JAN Last Name REDYK
Company EUROPEAN NURSERIES
Address 5490 SW MINTER BRIDGE RD
City HILLSBORO State OR Zip 97123

(2) TYPE OF WORK

[X] New Well [ ] Deepening [ ] Conversion
[ ] Alteration (repair/recondition) [ ] Abandonment

(3) DRILL METHOD

[X] Rotary Air [ ] Rotary Mud [ ] Cable [ ] Auger [ ] Cable Mud
[ ] Reverse Rotary [ ] Other ______

(4) PROPOSED USE

[X] Domestic [ ] Irrigation [ ] Community
[ ] Industrial/ Commercial [ ] Livestock [ ] Dewatering
[ ] Thermal [ ] Injection [ ] Other ______

(5) BORE HOLE CONSTRUCTION

Special Standard [ ] (Attach copy)

Depth of Completed Well 370 ft.

BORE HOLE Dia	From	To	SEAL Material	From	To	Amt	sacks/ lbs
10	0	52	Cement	0	52	16	S
6	52	370					

How was seal placed: Method [ ] A [ ] B [X] C [ ] D [ ] E
[ ] Other ______
Backfill placed from ______ ft. to ______ ft. Material ______
Filter pack from ______ ft. to ______ ft. Material ______ Size ______
Explosives used: [ ] Yes Type ______ Amount ______

(6) CASING/LINER

Casing	Liner	Dia	+	From	To	Gauge	Stl	Plstc	Wld	Thrd
(•)	( )	6	[X]	1	52	.250	(•)	( )	[X]	[ ]
( )	(•)	4.5	[ ]	3	350	160	( )	(•)	[X]	[ ]
( )	( )		[ ]				( )	( )	[ ]	[ ]
( )	( )		[ ]				( )	( )	[ ]	[ ]
( )	( )		[ ]				( )	( )	[ ]	[ ]

Shoe [ ] Inside [ ] Outside [ ] Other Location of shoe(s) ______
Temp casing [ ] Yes Dia ______ From ______ To ______

(7) PERFORATIONS/SCREENS

Perforations Method ______
Screens Type SLOTTED Material PVC

Perf/ Screen	Casing/ Screen Liner	Dia	From	To	Scrn/slot width	Slot length	# of slots	Tele/ pipe size
Screen	Liner	4.5	350	370	.125			

(8) WELL TESTS: Minimum testing time is 1 hour

( ) Pump ( ) Bailer (•) Air ( ) Flowing Artesian

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)
75		150	1

Temperature 56 °F Lab analysis [ ] Yes By ______
Water quality concerns? [ ] Yes (describe below)

From	To	Description	Amount	Units

(9) LOCATION OF WELL (legal description)

County WASHINGTON Twp 1 S N/S Range 2 W E/W WM
Sec 34 SW 1/4 of the NE 1/4 Tax Lot 1700
Tax Map Number ______ Lot ______
Lat ______ ° 0 ' ______ " or ______ DMS or DD
Long ______ ° 0 ' ______ " or ______ DMS or DD
(•) Street address of well ( ) Nearest address

23400 SW TILE FLAT RD, BEAVERTON

(10) STATIC WATER LEVEL

	Date	SWL(psi)	+	SWL(ft)
Existing Well / Predeepening			[ ]	
Completed Well	10-19-2006		[ ]	56

Flowing Artesian? [ ] Dry Hole? [ ]

WATER BEARING ZONES Depth water was first found 186

SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)
10-17-2006	186	202	24		[ ]	56
10-19-2006	365	370	51		[ ]	56
					[ ]	
					[ ]	
					[ ]	

(11) WELL LOG

Ground Elevation ______

Material	From	To
TOPSOIL	0	1
BROWN CLAY	1	13
DECOMP BROWN BASALT	13	33
FIRM GRAY-BROWN BASALT	33	52
HARD GRAY BASALT	52	171
FIRM GRAY-BLACK BASALT	171	186
SOFT BROWN BASALT	186	192
FIRM GRAY-BLACK BASALT	192	202
SOFT BROWN BASALT	202	219
FIRM GRAY BASALT	219	365
SOFT GRAY BASALT	365	370

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WATER RESOURCES DEPT
SALEM, OREGON

Date Started 10-13-2006 Completed 10-19-2006

(unbonded) Water Well Constructor Certification

I certify that the work I performed on the construction, deepening, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

License Number ______ Date ______
Password : (if filing electronically) ______
Signed ______

(bonded) Water Well Constructor Certification

I accept responsibility for the construction, deepening, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.

License Number 1266 Date 10/23/06
Password : (if filing electronically)
Signed [signature]
Contact Info (optional)

ORIGINAL - WATER RESOURCES DEPARTMENT
THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

Form Version: 0.88

WASH 60911

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)
Instructions for completing this report are on the last page of this form.

WELL I.D. # L 64517
START CARD # 159680

(1) LAND OWNER Well Number
Name JIM & TAMI STALNAKER
Address 23660 SW TILE FLAT RD.
City HILLSBORO State OR Zip 97123

(2) TYPE OF WORK
☒ New Well ☐ Deepening ☐ Alteration (repair/recondition) ☐ Abandonment

(3) DRILL METHOD:
☒ Rotary Air ☒ Rotary Mud ☐ Cable ☐ Auger
☐ Other

(4) PROPOSED USE:
☒ Domestic ☐ Community ☐ Industrial ☐ Irrigation
☐ Thermal ☐ Injection ☐ Livestock ☐ Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval ☐ Yes ☒ No Depth of Completed Well 310 ft.
Explosives used ☐ Yes ☒ No Type Amount

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
10"	0	233	Cement	0	40	13 sks
			Cement	185	233	15 sks
6"	233	310				

How was seal placed: Method ☐ A ☒ B ☒ C ☐ D ☐ E
☐ Other
Backfill placed from 40 ft. to 185 ft. Material Drill gel
Gravel placed from ft. to ft. Size of gravel

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	6"	+1	233	.250	☒	☐	☒	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:					☐	☐	☐	☐
					☐	☐	☐	☐

Drive Shoe used ☐ Inside ☐ Outside ☒ None
Final location of shoe(s)

(7) PERFORATIONS/SCREENS:
☐ Perforations Method
☐ Screens Type Material

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
						☐	☐
						☐	☐
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour
☐ Pump ☐ Bailer ☒ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
15		100	1 hr.
24		200	"
24		300	"

Temperature of water 56°F Depth Artesian Flow Found
Was a water analysis done? ☒ Yes By whom AMJ
Did any strata contain water not suitable for intended use? ☐ Too little
☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other
Depth of strata:

(9) LOCATION OF WELL by legal description:
County WASHINGTON Latitude Longitude
Township 1S N or S Range 2W E or W WM
Section 34 NE 1/4 SW 1/4
Tax Lot 1503 Lot Block Subdivision
Street Address of Well (or nearest address) 23660 SW TILE FLAT

(10) STATIC WATER LEVEL:
15 ft. below land surface. Date 09/29/0
Artesian pressure lb. per square inch Date

(11) WATER BEARING ZONES:
Depth at which water was first found 250

From	To	Estimated Flow Rate	SWL
250	300	24 gpm	15'

(12) WELL LOG:
Ground Elevation

Material	From	To	SWL
Topsoil	0	1	
Brown clay	1	19	
Gray clay	19	80	
Sticky gray clay, occ. sandy zone	80	138	
Sticky brown clay	138	187	
Interbedded gray & brown clays w/decomp basalt seams	187	206	
Soft gray-brown clay	206	214	
Decomp red-brown basalt	214	220	
Firm gray-brown basalt	220	231	
Hard gray basalt	231	244	
Soft brown basalt	244	260	15'
Firm gray-brown basalt	260	267	"
Firm gray-black basalt	267	310	15'

Date started 09/24/03 Completed 09/29/03

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.
WWC Number
Signed Date

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.
WWC Number 1266
Signed [signature] Date 09/29/03

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WATER RESOURCES DEPT
SALEM, OREGON

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WASH 51133

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)

WELL I.D. # L01422

(START CARD) # 86767

Instructions for completing this report are on the last page of this form.

(1) OWNER: Well Number
Name EDWIN A. VILHAUER
Address 9730 SW NEW FOREST DRIVE
City BEAVERTON State OR Zip 97008

(2) TYPE OF WORK
[X] New Well [ ] Deepening [ ] Alteration (repair/recondition) [ ] Abandonment

(3) DRILL METHOD:
[X] Rotary Air [ ] Rotary Mud [ ] Cable [ ] Auger
[ ] Other

(4) PROPOSED USE:
[X] Domestic [ ] Community [ ] Industrial [ ] Irrigation
[ ] Thermal [ ] Injection [ ] Livestock [ ] Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval [ ] Yes [X] No Depth of Completed Well 318 ft.
Explosives used [ ] Yes [X] No Type Amount

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
10"	0	39	Cement/Bent	0	39	13 SKS
6"	39	318				

How was seal placed: Method [ ] A [ ] B [X] C [ ] D [ ] E
[X] Other poured into dry annular
Backfill placed from ft. to ft. Material
Gravel placed from ft. to ft. Size of gravel

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	6"	+1	39	.250	[X]	[ ]	[X]	[ ]
Liner:	4"	5	308	PVC 200#	[ ]	[X]	[XX]	[ ]

Final location of shoe(s) TRAP @ 168'

(7) PERFORATIONS/SCREENS:
[X] Perforations Method DRILLED
[ ] Screens Type Material PVC 200

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
288	308		80	1/2"		[ ]	[XX]

(8) WELL TESTS: Minimum testing time is 1 hour
[ ] Pump [ ] Bailer [X] Air [ ] Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
24		318	1 hr.

Temperature of water 53°F Depth Artesian Flow Found
Was a water analysis done? [XX] Yes By whom AMJ
Did any strata contain water not suitable for intended use? [ ] Too little
[ ] Salty [ ] Muddy [ ] Odor [ ] Colored [ ] Other
Depth of strata:

(9) LOCATION OF WELL by legal description:
County WASHINGTON Latitude Longitude
Township 2S N or S Range 2W E or W. WM.
Section 1 NE 1/4 SW 1/4
Tax Lot 2602 Lot Block Subdivision
Street Address of Well (or nearest address) GROVE LANE & SCHOLLS FERRY RD.

(10) STATIC WATER LEVEL:
95 ft. below land surface. Date 08/30/96
Artesian pressure lb. per square inch. Date

(11) WATER BEARING ZONES:
Depth at which water was first found 283

From	To	Estimated Flow Rate	SWL
283	313	24 GPM	95

(12) WELL LOG:
Ground Elevation

Material	From	To	SWL
Brown clay	0	10	
Gray-brown broken rock & clay	10	17	
Firm gray-brown basalt	17	69	
Firm gray & gray-brown basalt	69	156	
Hard gray basalt	156	283	
Firm brown & gray-brown basalt w/soft streaks	283	313	95
Hard gray-black basalt	313	318	

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WATER RESOURCES DEPT.
SALEM, OREGON

Date started 08/29/96 Completed 08/30/96

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.
WWC Number 1492
Signed Mel Bigsby Date 08/30/96

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.
WWC Number 573
Signed Date 08/30/96

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Wash
52941

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)
Instructions for completing this report are on the last page of this form

WELL ID # L18358
(START CARD) # 095377

(1) OWNER: Well Number: 475
Name Dave Ohlsen
Address 8751 SW 194th Place
City Beaverton State OR Zip 97007

(2) TYPE OF WORK:
[X] New Well [ ] Deepening [ ] Alteration (repair/recondition) [ ] Abandonment

(3) DRILL METHOD:
[X] Rotary Air [ ] Rotary Mud [ ] Cable [ ] Auger
[ ] Other

(4) PROPOSED USE:
[X] Domestic [ ] Community [ ] Industrial [ ] Irrigation
[ ] Thermal [ ] Injection [ ] Livestock [ ] Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval [ ] Yes [X] No Depth of Completed Well 500 ft.
Explosives used [ ] Yes [X] No Type Amount

HOLE Diameter	From	To	SEAL Material	From	To	Amount sacks or pounds
12"	0	38	Cement	0	38	15 Sacks
8"	38	500				

How was seal placed: Method [ ] A [ ] B [X] C [ ] D [ ] E
[ ] Other
Backfill placed from ft. to ft. Material
Gravel placed from ft. to ft. Size of gravel

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	8"	0	40	1/4	[X]	[ ]	[X]	[ ]
Liner:	4-1/2	0	500	1/4	[ ]	[X]	[ ]	[ ]

Final location of shoe(s) Shale Trap at 360'

(7) PERFORATIONS/SCREENS:
[X] Perforations Method Saw
[ ] Screens Type Material

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
460	500	1/8x10	40	4-1/2		[ ]	[X]

(8) WELL TESTS: Minimum testing time is 1 hour
[ ] Pump [ ] Bailer [X] Air [ ] Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
36		500	1 hr.

Temperature of Water 54 Depth Artesian Flow found
Was a water analysis done? [ ] Yes By whom
Did any strata contain water not suitable for intended use? [ ] Too little
[ ] Salty [ ] Muddy [ ] Odor [ ] Colored [ ] Other
Depth of strata:

(9) LOCATION OF WELL by legal description:
County Washington Latitude Longitude
Township 1S N or S. Range 2W E or W. of WM.
Section 36 NW ¼ NE ¼
Tax Lot 1800 Lot Block Subdivision
Street Address of Well (or nearest address)
Horsetail Dr., Beaverton, OR

(10) STATIC WATER LEVEL:
390 ft. below land surface. Date 10/17/97
Artesian pressure lb. per square inch. Date

(11) WATER BEARING ZONES:
Depth at which water was first found 390

From	To	Estimated Flow Rate	SWL
390	500	36	390

(12) WELL LOG:
Ground elevation

Material	From	To	SWL
Clay Brown	0	10	
Clay Brown Basalt Decomp.	10	15	
Basalt Brown & Gray	15	25	
Basalt Gray	25	390	
Basalt Brown	390	410	390
Basalt Gray & Yellow	410	430	
Basalt Gray & Pink & Yellow	430	445	
Basalt Gray & Green	445	500	

RECEIVED
NOV - 6 1997
WATER RESOURCES DEPT.
SALEM, OREGON

Date started 10/15/97 Completed 10/17/97

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to my best knowledge and belief.

WWC Number 1622
Signed [signature] Date 11/3/97

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.

WWC Number 663
Signed [signature] Date 11/3/97
AMERICAN WELL DRILLING

ORIGINAL & FIRST COPY - WATER RESOURCES DEPARTMENT SECOND COPY - CONSTRUCTOR THIRD COPY - CUSTOMER

WASH 58107

RECEIVED FEB 11 2002 WATER RESOURCES DEPT SALEM, OREGON

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)
Instructions for completing this report are on the last page of this form.

WELL I.D. # L 55321
START CARD # 147039

(1) LAND OWNER Well Number
Name ROLAND J. ITALIANO
Address 11060 SW GOLDFINCH TER.
City BEAVERTON, State OR Zip 97007

(2) TYPE OF WORK
☐ New Well ☒ Deepening ☐ Alteration (repair/recondition) ☐ Abandonment

(3) DRILL METHOD:
☒ Rotary Air ☐ Rotary Mud ☐ Cable ☐ Auger
☐ Other

(4) PROPOSED USE:
☒ Domestic ☐ Community ☐ Industrial ☐ Irrigation
☐ Thermal ☐ Injection ☐ Livestock ☐ Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval ☐ Yes ☒ No Depth of Completed Well 305 ft.
Explosives used ☐ Yes ☒ No Type ____ Amount ____

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
			ORIGINAL SEAL NOT DISTURBED			
6"	250	305				

How was seal placed: Method ☐ A ☐ B ☐ C ☐ D ☐ E
☐ Other
Backfill placed from ____ ft. to ____ ft. Material ____
Gravel placed from ____ ft. to ____ ft. Size of gravel ____

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					☐	☐	☐	☐
	6"	+2	?	250	☒	☐	☒	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:					☐	☐	☐	☐
	4"	-10	305	160psi	☐	☒	☒	☐

Drive Shoe used ☐ Inside ☐ Outside ☐ None
Final location of shoe(s)

(7) PERFORATIONS/SCREENS:
☒ Perforations Method DRILLED
☐ Screens Type ____ Material PVC 160

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
						☐	☐
265	305	1/2"	115	4"	Pipe	☐	☒
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour
☐ Pump ☐ Bailer ☒ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
40		305	1 hr.
36		285	"
18		205	"

Temperature of water 54°F Depth Artesian Flow Found ____
Was a water analysis done? ☒ Yes By whom A.M.J.
Did any strata contain water not suitable for intended use? ☐ Too little
☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other
Depth of strata:

(9) LOCATION OF WELL by legal description:
County Washington Latitude ____ Longitude ____
Township 2S N or S Range 2W E or W. WM.
Section 1 NW 1/4 NE 1/4
Tax Lot 302 Lot ____ Block ____ Subdivision ____
Street Address of Well (or nearest address) TILE FLAT RD. BEAVERTON, or 97007

(10) STATIC WATER LEVEL:
139' ft. below land surface. Date 2/5/02
Artesian pressure ____ lb. per square inch Date ____

(11) WATER BEARING ZONES:
Depth at which water was first found 265

From	To	Estimated Flow Rate	SWL
265	300	40	139'

(12) WELL LOG:
Ground Elevation ____

Material	From	To	SWL
DEEPENED EXISTING 6"WELL			
Existing seal undisturbed,			
pump pulled 6" casing			
added from -3' to +2'.			
A sealed with bentonite.			
Previous depth of 6"	0	250'	
Gry basalt	250	261	
Red brn basalt	261	265	
Brn frac basalt	265	276	139'
Gry brn & brn frac			
basalt,w/broken strks.	276	300	139'
Gry & gry blk basalt	300	305	

Date started 2/4/02 Completed 2/5/02

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.
Signed [signature] WWC Number 1492 Date 2/6/02

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.
Signed [signature] WWC Number 1266 Date 2/4/02

RECEIVED

OCT - 9 1996

WATER RESOURCES DEPT.
SALEM, OREGON

WASH 51246

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)
Instructions for completing this report are on the last page of this form.

WELL I.D. # ~~L08783~~

(START CARD) # 88883

(1) OWNER: Well Number 96-019

Name Gordon Moore
Address 13535 SW 121st Avenue
City Tigard State OR Zip 97223

(2) TYPE OF WORK
[x] New Well [ ] Deepening [ ] Alteration (repair/recondition) [ ] Abandonment

(3) DRILL METHOD:
[x] Rotary Air [ ] Rotary Mud [ ] Cable [ ] Auger
[ ] Other

(4) PROPOSED USE:
[x] Domestic [ ] Community [ ] Industrial [ ] Irrigation
[ ] Thermal [ ] Injection [ ] Livestock [ ] Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval [ ] Yes [x] No Depth of Completed Well 232 ft.
Explosives used [ ] Yes [x] No Type ______ Amount ______

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
10"	0	167	cement	10	167	24 sacks
			5% bent			
			bent chp	0	10	6 sacks
6"	167	245				

How was seal placed: Method [ ] A [ ] B [x] C [ ] D [ ] E
[x] Other bent poured dry and hydrated
Backfill placed from ______ ft. to ______ ft. Material ______
Gravel placed from ______ ft. to ______ ft. Size of gravel ______

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	6"	+2	167	.250	[x]	[ ]	[x]	[ ]
					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
Liner:	4"	-3	232	160#	[ ]	[x]	[x]	[ ]
					[ ]	[ ]	[ ]	[ ]

Final location of shoe(s) 167'

(7) PERFORATIONS/SCREENS:
[x] Perforations Method saw cut
[ ] Screens Type ______ Material ______

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
182	212	1/8x8	62			[ ]	[x]
222	232	1/8x8	16			[ ]	[x]
						[ ]	[ ]
						[ ]	[ ]
						[ ]	[ ]

(8) WELL TESTS: Minimum testing time is 1 hour

[ ] Pump [ ] Bailer [x] Air [ ] Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
45	n/a	244	1 hr.
40	n/a	230	1 hr

Temperature of water 53° Depth Artesian Flow Found ______
Was a water analysis done? [ ] Yes By whom ______
Did any strata contain water not suitable for intended use? [ ] Too little
[ ] Salty [ ] Muddy [ ] Odor [ ] Colored [ ] Other ______
Depth of strata: ______

(9) LOCATION OF WELL by legal description:
County Washington Latitude ______ Longitude ______
Township 2S N or S Range 1W E or W. WM.
Section 4 SE 1/4 NE 1/4
Tax Lot 100 Lot ______ Block ______ Subdivision ______
Street Address of Well (or nearest address) Same

(10) STATIC WATER LEVEL:
158 ft. below land surface. Date 9-16-96
Artesian pressure ______ lb. per square inch. Date ______

(11) WATER BEARING ZONES:
Depth at which water was first found 90'

From	To	Estimated Flow Rate	SWL
90	152	< 5	?
210	230	45	158

(12) WELL LOG:
Ground Elevation ______

Material	From	To	SWL
topsoil	0	1	
clay brown silty	1	17	
clay brown sticky	17	90	
basalt very decomposed			
brn/green/grey/red	90	152	
basalt grey medium	152	190	
basalt grey visa with			
clay lenses white	190	195	
basalt wthd brown	195	200	
basalt brn/grey broken	200	210	
basalt brn/grey vesic			
very broken (caving)	210	230	158
basalt brn/grey medium	230	245	
ARROW DRILLING 538-4422			

Date started 9-11-96 Completed 9-16-96

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.
WWC Number ______
Signed ______ Date ______

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.
WWC Number 1483
Signed [signature] Date 10-7-96

ORIGINAL & FIRST COPY-WATER RESOURCES DEPARTMENT SECOND COPY-CONSTRUCTOR THIRD COPY-CUSTOMER

STATE ENGINEER
Salem, Oregon

WASH

OBSERVATION WELL
Well Record

STATE WELL NO. 1/2W-13Q
COUNTY Washington
APPLICATION NO. GR-2846

009828

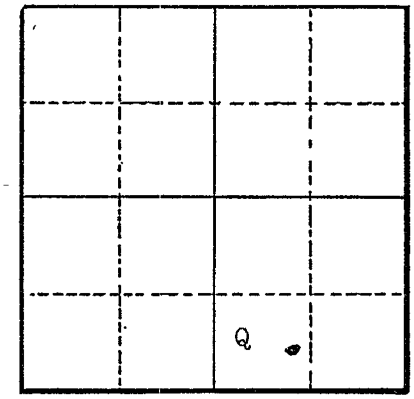
OWNER: Leslie T. Wright
MAILING ADDRESS: 19140 SW Rosa Road

LOCATION OF WELL: Owner's No. ....
CITY AND STATE: Aloha, Oregon

SW ¼ SE ¼ Sec. 13 T. 1 ~~N.~~ S., R. 2 ~~E.~~ W., W.M.

Bearing and distance from section or subdivision corner 950 feet East and 400 feet North of the S¼ Corner, Section 13

Altitude at well ....



Section 13

TYPE OF WELL: Drilled Date Constructed Aug. 9, 1938

Depth drilled 930 feet Depth cased 758 feet

CASING RECORD:

6-inch casing set from surface to 600 feet
lost casing size 600 to 758 feet
no casing 758 to 930 feet

FINISH:

AQUIFERS:

WATER LEVEL:

50 feet

PUMPING EQUIPMENT: Type Pamona Turbine 6-6MCB-4"x3/4" column H.P. 5
Capacity 55@ 20 lbs G.P.M.

WELL TESTS: in dry weather test August 1956

Drawdown 50/ ft. after .... hours 55 G.P.M.

Drawdown 25 ft. after .... hours 50 G.P.M.

USE OF WATER Irrigation Temp. .... °F. ...., 19....
SOURCE OF INFORMATION GR-4038
DRILLER or DIGGER ....
ADDITIONAL DATA:
Log x Water Level Measurements .... Chemical Analysis .... Aquifer Test ....

REMARKS:

STATE ENGINEER
Salem, Oregon

State Well No. 1/2W-13Q
County Washington
Application No. GR-2846

Well Log

Owner: Leslie T. Wright   Owner's No.

Driller: Date Drilled Aug. 1938

CHARACTER OF MATERIAL		(Feet below land surface) From	To	Thickness (feet)
Top soil	Surface water 24 feet	0	2	2
Yellow clay	Blue sand old lake bed	2	38	36
Blue sand	Leaves sticks of wood	38	78	40
Blue sand		78	98	20
Blue sand & green		98	136	38
Hard green sand	Water between layer of sand	136	152	16
Hard sand rock		152	157	5
Gray clay or shale	Very sticky	157	211	54
Blue clay or shale	Very little water	211	250	39
Blue clay	"	250	284	34
Blue sand	"	284	289	5
Blue clay		289	314	25
Brown clay sand	Old lake bed	314	344	30
Blue clay sand	Thick leaves and wood	344	388	44
Gray clay		388	420	32
Yellow clay		420	465	45
Blue clay and broken rock mur		465	496	31
Red clay		496	518	22
Yellow clay		518	534	16
Blue clay small rock		534	563	19
Rock gray color		563	586	23
Yellow clay and blue		586	608	22
Sand rock ledge		608	611	3
Yellow clay		611	638	27

STATE ENGINEER
Salem, Oregon

State Well No. 1/2W-13Q
County Washington
Application No. GR-2846

Well Log

Owner: Leslie T. Wright Owner's No.

Driller: Date Drilled Aug. 1938

CHARACTER OF MATERIAL	(Feet below land surface) From	To	Thickness (feet)
(Continued)			
Clay in different colors	638	648	10
Gray clay, rock	648	686	38
Yellow clay and shale	686	702	16
Sand water bearing 5 gal. per. raised to 60 ft. of top	702	704	2
Gray shale	7104	714	10
Sandy shale gray	714	728	14
Sand rock some more water 13 gal.	728	729	1
Gray and yellow clay rotten rock	729	760	31
Hard sandstone 8 gal. res.	760	762	2
Volcanic rock water big flow raised 40 feet	762	776	14
Gray hard rock	776	789	13
Gray very hard rock	789	805	16
Lava rock bed lash 172 ft. no casing to hard to drive pipe	805	830	25
Sand rock gray	830	846	16
Gray rock	846	853	7
Lava rock gray	853	880	27
Cemented rock	880	904	24
Rock gray more water in lower courses do not know how much	904	916	12
Yellow shale well will make 100 gal. per. hour, 100 ft. from top.	916	930	14

STATE ENGINEER
Salem, Oregon

State Well No. 1/2W-13Q(1)

County Washington

Application No.

Water Level Record

OWNER: L.T. Wright OWNER'S NO.

Description of measuring point: Lip of hole on NE corner of Pump which is 2.3 feet below LSD in pit at pumphouse floor. + 2.3 ft.

Date	Water Level Feet (~~above~~) (below) Land Surface	Remarks	Date	Water Level Feet (above) (below) Land Surface	Remarks
1-10-61	27.50	WSB			
4-4-61	26.60	WSB			
5-23-61	Wet tapes	WSB			
7-27-61	44.85	WSB			
10-13-61	28.91	WSB			
1-17-62	23.50	WSB & RD			

REMARKS:

State Printing 89314

WASH 60092

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)

Instructions for completing this report are on the last page of this form.

(WELL I.D.)# L 66008

(START CARD) # 158868

(1) OWNER:
Well Number #1

Name Marvin Decker

Address 12635 SW River Road

City Hillsboro State or Zip 97123

(2) TYPE OF WORK
☑ New Well ☐ Deepening ☐ Alteration (repair/recondition) ☐ Abandonment

(3) DRILL METHOD:
☑ Rotary Air ☐ Rotary Mud ☐ Cable ☐ Auger

☐ Other

(4) PROPOSED USE:
☑ Domestic ☐ Community ☐ Industrial ☐ Irrigation

☐ Thermal ☐ Injection ☐ Livestock ☐ Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval ☐ Yes ☑ No Depth of Completed Well 480 ft.

Explosives used ☐ Yes ☑ No Type Amount

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
12"	0	50	Bentonite	0	50	110 sacks
12"	50	80	Backfill	50	80	34 sacks
12"	80	420	Cement	50	420	864 sacks
7 1/2"	420	480				

How was seal placed: Method ☐ A ☑ B ☐ C ☐ D ☐ E

☑ Other Poured and Tamped

Backfill placed from 50 ft. to 80 ft. Material Bentonite

Gravel placed from ft. to ft. Size of gravel

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	8"	+2	420	.250	☑	☐	☑	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:					☐	☐	☐	☐
					☐	☐	☐	☐

Final location of shoe(s) 420' Inside

(7) PERFORATIONS/SCREENS:
☐ Perforations Method N/A

☐ Screens Type Material

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
						☐	☐
						☐	☐
						☐	☐
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour
☐ Pump ☐ Bailer ☑ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
75+	438	480	1 hr.

Temperature of water 56 Depth Artesian Flow Found

Was a water analysis done? ☐ Yes By whom

Did any strata contain water not suitable for intended use? ☐ Too little

☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other

Depth of strata:

(9) LOCATION OF WELL by legal description:
County Washington Latitude Longitude

Township 1 S Range 2 W WM.

Section 28 SW 1/4 SW 1/4

Tax Lot 0400 Lot Block Subdivision

Street Address of Well (or nearest address) 25960 SW Farmington Road Hillsboro

(10) STATIC WATER LEVEL:
42 ft. below land surface. Date 09/09/03

Artesian pressure lb. per square inch. Date

(11) WATER BEARING ZONES:
Depth at which water was first found 20

From	To	Estimated Flow Rate	SWL
20	40	5	20
~~310~~	~~400~~	~~30~~	~~42~~
440	480	75+	42

(12) WELL LOG:
Ground Elevation

Material	From	To	SWL
Topsoil	0	3	
Brown clay	3	8	
Sandy Brown clay	8	17	
Gray clay	17	23	
Gray Brown Sandy Clay	23	67	27
Gray Brown cemented clay and sand	67	185	
Blue Clay Stone Medium	185	306	
Gray Sand Stone Medium	306	389	
Gray Basalt Hard	389	480	42

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SEP 1 8 2003
WATER RESOURCES DEPT
SALEM, OREGON

Date started 08/26/03 Completed 09/09/03

(unbonded) Water Well Constructor Certification:

I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

WWC Number 1722

Signed [signature] Date 09/10/03

(bonded) Water Well Constructor Certification:

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.

WWC Number 1541

Signed [signature] Date 09/10/03

ORIGINAL & FIRST COPY-WATER RESOURCES DEPARTMENT SECOND COPY-CONSTRUCTOR THIRD COPY-CUSTOMER

WASH 60862

1-69268

For Official Use Only by **The Oregon Water Resources Department:**

Received Date:	County Well Log ID #:	Well Identification Tag #
1-27-04	"Wash 60862"	L-69268

WELL IDENTIFICATION APPLICATION FORM

INSTRUCTIONS ARE IN THE ACCOMPANYING "DEAR LANDOWNER" LETTER. FOR SHARED WELLS PLEASE SEE THE 3RD PARAGRAPH FROM THE TOP IN THE LETTER.

(Your ID Tag will be mailed out in approximately 10 days from the date we receive your application.)

****LANDOWNER** (For the property that the well is located on. The Well ID tag will be sent to this address unless otherwise specified here.) C/O BUNNY WRIGHT

Landowner: HELEN FEHRENBACHER *Other party to mail tag to(realtor,etc.)* WRIGHT PROP INC

Mailing Address: 15685 SW 116th AVE B-159 *Address:* [struck out] MAIL

Wright Properties, Inc
15685 SW 116th Ave
PMB 159
Tigard, OR 97224

City: TIGARD State: OR Zip: 97224 *City, State, Zip:*

****WELL LOCATION:**

County: WASHINGTON Well # ______ *(if multiple wells exist on same property-ie: well #1,#2, etc.)*

Township: 1 North or (South) *(circle one)* Range: 1 East or (West) *(circle one)* Section: 34, SW 1/4 NE 1/4 *(If known)*

Tax Lot #: 300 *(Not the same as the tax acct.#)* Type of Well: water supply? domestic *(Ex: domestic or irrigation use)* monitoring? N *(Ex: monitoring water for contaminants)*

Address of Well: 11685 *(Number)* SW NORTH DAKOTA *(Street)* TIGARD *(City)* 97224 *(Zip)*

(Optional): Does this well have a formal water right associated with it? Yes: ______ No: X

(If unknown you may want to contact the Water Rights Group at 503-986-0945 for research)

If Yes: Application #: ______ Permit #: ______ Certificate #: ______

(Optional): Latitude ______ Longitude ______ *(May sometimes be obtained from Well Log Report)*

****WELL INFORMATION:** **(Important note: If attaching a well log you obtained from our web-site please be certain that you have the correct log. Simply matching the tax lot number isn't enough. See attached instructions for assistance. If a well report is not available please complete as much of the following as possible, at a minimum the prior landowner names going back until around the time the well would have been drilled. Prior landowner names can be obtained from the County Assessor - see instructions.)**

Start Card # from well log report if known: NONE Approx. Well Construction Date: 1945

Well Constructor if known: UNKNOWN

Name of Land Owner at Time of Construction (or prior landowners, going back in time to when well was constructed, contact your county assessor for list)

UNKNOWN

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JAN 27 2004
WATER RESOURCES DEPT
SALEM OREGON

Well Depth (in feet): ______ Static Water Level *(in feet)*: ______ Diameter of Exposed Well Casing *(in inches)*: ______

Please Return Completed Form to: Well ID Program, Oregon Water Resources Department
725 Summer St. NE, Suite A, Salem, OR 97301-1271, *or fax to 503-986-0902*

(App12-03)

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OCT 27 1986

WATER RESOURCES DEPT.
SALEM, OREGON

WASH
008816

1S/1W-15 da

STATE OF OREGON
WATER WELL REPORT
(as required by ORS 537.765)

(1) OWNER:
Owner's Well Number:

Name: Ede Hamar
Address: Rt 4 Box 312
City: Sherwood State: OR Zip: 97140

(2) TYPE OF WORK:
☒ New Well ☐ Deepen ☐ Recondition ☐ Abandon

(3) DRILL METHOD:
☐ Rotary Air ☐ Rotary Mud ☒ Cable ☐ Other

(4) PROPOSED USE:
☒ Domestic ☐ Community ☐ Industrial ☐ Irrigation
☐ Thermal ☐ Injection ☐ Other

(5) BORE HOLE CONSTRUCTION:
Depth of Completed Well 245 ft.
Special Standards date of approval

HOLE			SEAL			Amount
Diameter	From	To	Material	From	To	sacks or pounds
10	0	30	Cement	0	30	47
6	30	245				

How was seal placed? Method ☐ A ☐ B ☒ C ☐ D ☐ E
☐ Other

Backfill placed from ___ ft. to ___ ft. Material
Gravel placed from 180 ft. to 245 ft. Size of gravel 3/8"–

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	6"	+1½	180	.250	☒	☐	☒	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:	4"	+1½	245	160PSI	☐	☒	☐	☐
					☐	☐	☐	☐

Final location of shoe(s)

(7) PERFORATIONS/SCREENS:
☒ Perforations Method SKill SAW
☐ Screens Type ___ Material

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
						☐	☐
225	242	1/8x2	40			☐	☒
						☐	☐
						☐	☐
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour
☐ Pump ☒ Bailer ☐ Air ☐ Flowing Artesian

Yield gal/min	Pumping level	Drill stem at	Time
			½ hr
			1 hr
11	210		1½

Temperature of water 52 Depth Artesian Flow Found
Was a water analysis done? ☐ Yes By whom
Did any strata contain water not suitable for intended use? ☐ Too little
☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other
Depth of strata:

(9) LOCATION OF WELL by legal description:
County Washington Latitude ' " Longitude ' "
Township 1 N or S Range 1 E or W WM.
Section 15 NE ¼ SE ¼
Tax Lot ___ Lot ___ Block ___ Subdivision
Street Address of Well (or nearest address)

(10) STATIC WATER LEVEL:
40 ft. below land surface. Date 10/20/86
Artesian pressure ___ lb. per square inch. Date

(11) WELL LOG:
Ground elevation

Material	From	To	WB?	SWL
Topsoil, Brw	0	3		
Clay, Red Brw	3	14		
Silty Clay w Fine Sand	14	39		
Sand Fine Heaving	39	102	1gpm	
Sand Med Black	102	109	"	
Clay, Red Brw	109	120		
Clay, Red Brw w Small weathered Rock	120	237		
Rock, Fractured Brw	237	245		40

Date started 10/7/86 Completed 10/22/86

(unbonded) Water Well Constructor Certification:

I constructed this well in compliance with Oregon well construction standards. Materials used and information reported above are true to my best knowledge and belief.

Signed ___ Date

(bonded) Water Well Constructor Certification:

I accept responsibility for construction of this well and its compliance with all Oregon water well standards. This report is true to the best of my knowledge and belief.

Signed Thomas E Bryant Date 10/24/86

Company Bryant Well Drilling Co. Job No.

9809C 10/85

STATE ENGINEER
Salem, Oregon

State Well No. 1/1W-15K1

County Washington

Application No.

Chemical Analysis

OWNER Southern Pacific Company OWNER'S NO.

ANALYST Charlton Laboratories, Inc. Address Portland, Oregon

Date of Collection 11/18/41

Point of Collection

	P.P.M.	E.P.M.
Silica (SiO_2)	25	
Iron (Fe) Total	.16	
Manganese (Mn)		
Calcium (Ca)	13	
Magnesium (Mg)	6.6	
Sodium (Na)	98	
Potassium (K)	.9	
Bicarbonate (HCO_3)	285	
Carbonate (CO_3)		
Sulfate (SO_4)	.6	
Chloride (Cl)	29	
Fluoride (F)	.1	
Nitrate (NO_3)		
Boron (B)		
Dissolved Solids	348	
Hardness as $CaCO_3$	60	
Specific Conductance (Micromhos at 25°C)		
pH		
Percent Sodium	78	
Sodium Absorption Ratio (S.A.R.)		
CLASS		

State Printing 89313

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WATER RESOURCES DEPT.
SALEM, OREGON

Wash 50709

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)

(START CARD) # 85636

Instructions for completing this report are on the last page of this form.

(1) OWNER: Well Number 360

Name J. Chay
Address PO Box 1210
City Sherwood State OR Zip 97140

(2) TYPE OF WORK
[X] New Well [ ] Deepening [ ] Alteration (repair/recondition) [ ] Abandonment

(3) DRILL METHOD:
[X] Rotary Air [ ] Rotary Mud [ ] Cable [ ] Auger
[ ] Other

(4) PROPOSED USE:
[X] Domestic [ ] Community [ ] Industrial [ ] Irrigation
[ ] Thermal [ ] Injection [ ] Livestock [ ] Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval [ ] Yes [X] No Depth of Completed Well 360 ft.
Explosives used [ ] Yes [X] No Type ______ Amount ______

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
10	0	50	Bentonite	0	50	50
8	50	198	cement	50	198	30
6	198	360				

How was seal placed: Method [ ] A [X] B [ ] C [ ] D [ ] E
[ ] Other
Backfill placed from ____ ft. to ____ ft. Material ____
Gravel placed from ____ ft. to ____ ft. Size of gravel ____

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	6	+2	198	¼	[X]	[ ]	[X]	[ ]
Liner:					[ ]	[ ]	[ ]	[ ]

Final location of shoe(s) 198 under

(7) PERFORATIONS/SCREENS:
[ ] Perforations Method ______
[ ] Screens Type ______ Material ______

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
						[ ]	[ ]

(8) WELL TESTS: Minimum testing time is 1 hour

[ ] Pump [ ] Bailer [X] Air [ ] Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
90		200	1 hr.

Temperature of water 56 Depth Artesian Flow Found ______
Was a water analysis done? [ ] Yes By whom ______
Did any strata contain water not suitable for intended use? [ ] Too little
[ ] Salty [ ] Muddy [ ] Odor [ ] Colored [ ] Other ______
Depth of strata: ______

(9) LOCATION OF WELL by legal description:
County Wash. Latitude ______ Longitude ______
Township 2 N or S Range 2 E or W. WM.
Section 13 SW 1/4 SW 1/4
Tax Lot 200 Lot ______ Block ______ Subdivision ______
Street Address of Well (or nearest address) 20419 SW Schools-Sherwood Rd.

(10) STATIC WATER LEVEL:
65 ft. below land surface. Date 5/20/96
Artesian pressure ______ lb. per square inch. Date ______

(11) WATER BEARING ZONES:
Depth at which water was first found 265

From	To	Estimated Flow Rate	SWL
265	275	4	65
350	355	90	65

(12) WELL LOG:
Ground Elevation ______

Material	From	To	SWL
Clay Brown Sandy	0	30	
Clay Gray Sandy	30	40	
Basalt Gray & Brown Broken	40	80	
Basalt Gray Hard	80	160	
Basalt Gray & Red Soft	160	170	
Basalt Gray Hard	170	180	
Basalt Gray Soft	180	185	
Basalt Gray Hard	185	220	
Basalt Red & Brown	220	225	
Basalt Gray Hard	225	265	
Basalt Gray&Yellow & Brown Soft	265	275	65
Basalt Gray	275	330	
Basalt Red&Brown&Gray	330	350	
Basalt Gray&Green&Red	350	355	65
Basalt Gray	355	360	

Date started 5/15/96 Completed 5/20/96

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

WWC Number 1622
Signed [signature] Date 5/22/96

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.

AMERICAN WELL DRILLING

WWC Number 663
Signed [signature] Date 5/22/96

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WASH 1126

2S/1W/8cd

STATE OF OREGON
WATER WELL REPORT
(as required by ORS 537.765)

(START CARD) # 38493

(1) OWNER: Well Number 01
Name Vince Piscitelli
Address 6715 S. W. Lilly
City Beaverton State Or. Zip 97005

(2) TYPE OF WORK:
[x] New Well [ ] Deepen [ ] Recondition [ ] Abandon

(3) DRILL METHOD:
[x] Rotary Air [ ] Rotary Mud [ ] Cable
[ ] Other

(4) PROPOSED USE:
[x] Domestic [ ] Community [ ] Industrial [ ] Irrigation
[ ] Thermal [ ] Injection [ ] Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval [ ] Yes [x] No Depth of Completed Well 255 ft.
Explosives used [ ] Yes [x] No Type Amount

HOLE Diameter	From	To	SEAL Material	From	To	Amount sacks or pounds
10"	0	25	Gran/Bent	0	25	10 sacks
6"	25	265				

How was seal placed: Method [ ] A [ ] B [ ] C [ ] D [ ] E
[x] Other Granular Bentonite Placed Dry
Backfill placed from ft. to ft. Material
Gravel placed from ft. to ft. Size of gravel

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	6"	+1	25	.250	[x]	[ ]	[x]	[ ]
Liner:	4"	12	265	160	[ ]	[x]	[x]	[ ]

Final location of shoe(s) None Used

(7) PERFORATIONS/SCREENS:
[x] Perforations Method Saw
[ ] Screens Type Material

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
246	264	1/8x2	160			[ ]	[x]

(8) WELL TESTS: Minimum testing time is 1 hour
[ ] Pump [ ] Bailer [x] Air [ ] Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
45		262	1 hr.

Temperature of Water 53° Depth Artesian Flow Found
Was a water analysis done? [ ] Yes By whom
Did any strata contain water not suitable for intended use? [ ] Too little
[ ] Salty [ ] Muddy [ ] Odor [ ] Colored [ ] Other
Depth of strata:

(9) LOCATION OF WELL by legal description:
County Washington Latitude Longitude
Township 2 South N or S. Range 1 West E or W. WM.
Section 8 SE ¼ SW ¼
Tax Lot 03700 Lot Block Subdivision
Street Address of Well (or nearest address) 15540 SW April Lane Tigard, Or. 97223

(10) STATIC WATER LEVEL:
176 ft. below land surface. Date 4-24-92
Artesian pressure lb. per square inch. Date

(11) WATER BEARING ZONES:
Depth at which water was first found 216

From	To	Estimated Flow Rate	SWL
216	262	45	176

(12) WELL LOG:
Ground elevation

Material	From	To	SWL
Sandy clay brown	0	20	
Basalt weathered gray	20	27	
Basalt Porous brown	27	42	
Basalt Gray/w/brown seams	42	65	
Basalt brown w/yellow seams	65	69	
Basalt Gray w/brown seams	69	74	
Basalt brown porous	74	89	
Basalt Gray w/yellow seams	89	108	
Basalt Gray	108	118	
Basalt brown porous	118	154	
Basalt Gray fractured	154	161	
Basalt gray w/brown seams	161	199	
Basalt Gray	199	216	
Yellow cinders loose	216	262	176
Basalt Gray	262	265	

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Date started 4-23-92 Completed 4-24-92

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon well construction standards. Materials used and information reported above are true to my best knowledge and belief.
Signed [signature] WWC Number 1547 Date

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief.
Signed [signature] WWC Number 553 Date 4-29-92

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)
Instructions for completing this report are on the last page of this form

WASH 69250
SKYLES DRILLING, INC.
503-656-2683

WELL ID # L 102674
START CARD # W204823

(1) OWNER:
Well Number: 1
Name Regine Neiders
Address 14517 SE 178th Place
City Renton State WA Zip 98058

(2) TYPE OF WORK:
[X] New Well [ ] Deepening [ ] Alteration (repair/recondition) [ ] Abandonment

(3) DRILL METHOD:
[X] Rotary Air [ ] Rotary Mud [ ] Cable [ ] Auger
[ ] Other

(4) PROPOSED USE:
[X] Domestic [ ] Community [ ] Industrial [ ] Irrigation
[ ] Thermal [ ] Injection [ ] Livestock [ ] Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval [ ] Yes [X] No Depth of Completed Well 400 ft.
Explosives used [ ] Yes [X] No Type ____ Amount ____

HOLE Diameter	From	To	SEAL Material	From	To	Amount sacks or pounds
10	0	263	Cement w/ 5%	263		
6	263	400	Bentonite		7	66 Sacks
			Bentonite	7	0	5 Sacks

How was seal placed: Method [ ] A [ ] B [X] C [ ] D [ ] E
[X] Other Poured Bentonite
Backfill placed from ____ ft. to ____ ft. Material ____
Gravel placed from ____ ft. to ____ ft. Size of gravel ____

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	6	+2	263	.250	[X]	[ ]	[X]	[ ]
Liner:	4	240	400	sch40	[ ]	[X]	[ ]	[X]

Drive Shoe used [ ] Inside [ ] Outside [X] None
Final location of shoe(s)

(7) PERFORATIONS/SCREENS:
[X] Perforations Method Saw
[ ] Screens Type ____ Material ____

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
379	399	1/8x3	76			[ ]	[X]

(8) WELL TESTS: Minimum testing time is 1 hour
[ ] Pump [ ] Bailer [X] Air [ ] Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
20		398	1 hr.

Temperature of Water 60 Depth Artesian Flow found
Was a water analysis done? [ ] Yes By whom
Did any strata contain water not suitable for intended use? [ ] Too little
[ ] Salty [ ] Muddy [ ] Odor [ ] Colored [ ] Other
Depth of strata:

(9) LOCATION OF WELL by legal description:
County Washington Latitude ____ Longitude ____
Township 2SOUTH N or S. Range 1WEST E or W. of WM.
Section 08 SW 1/4 SE 1/4
Tax lot 01401 Lot ____ Block ____ Subdivision ____
Street Address of Well (or nearest address) 15515 SW 150th Avenue, Tigard, OR

(10) STATIC WATER LEVEL:
250 ft. below land surface. Date 10/22/2010
Artesian pressure ____ lb. per square inch. Date ____

(11) WATER BEARING ZONES:
Depth at which water was first found 164

From	To	Estimated Flow Rate	SWL
164	180	2	NA
213	258	3	NA
364	400	20	250

(12) WELL LOG:
Ground elevation ____

Material	From	To	SWL
Clay, Brown	0	7	
Basalt, Gray & Brown Broken	7	13	
Basalt, Weathered	13	22	
Basalt, Gray & Brown Fractured	22	51	
Basalt, Multicolored Fract &	51		
Porous		56	
Basalt, Gray & Brown, Fractured	56	69	
Basalt, MC Fract & Porous	69	86	
Basalt, Brown Fract & Porous	86	92	
Basalt, Gray & Brown Fract	92	105	
Basalt, Gray	105	112	
Basalt, Gray & Brown Fract	112	131	
Basalt, MC Fract & Porous	131	138	
Basalt, Gray & Brown	138	164	
Basalt, MC Fract & Porous	164	180	
Basalt, Gray & Brown Fract	180	187	
Basalt, MC Porous	187	192	
Basalt, Gray & Brown	192	204	
Basalt, Gray	204	207	
Basalt, Gray & Brown Fract	207	213	
Basalt, Gray & Brown Fract &	213		
Porous		227	
Basalt, MC Fract & Porous	227	242	

Continued on next page

Date started 10/18/2010 Completed 10/22/2010

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

Signed [signature] WWC Number 1884
Date 10/25/2010
Skyles Drilling, Inc.

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.

Signed [signature] WWC Number 1592
Date 10/25/2010
Skyles Drilling, Inc.

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NOV 1 2 2010

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)
Instructions for completing this report are on the last page of this form

SKYLES DRILLING, INC.
WASH 69250
503-656-2683

WELL ID # L 102674
START CARD # W204823
Page 2

(1) OWNER: Well Number: 1
Name Regine Neiders
Address 14517 SE 178th Place
City Renton State WA Zip 98058

(2) TYPE OF WORK:
☐ New Well ☐ Deepening ☐ Alteration (repair/recondition) ☐ Abandonment

(3) DRILL METHOD:
☐ Rotary Air ☐ Rotary Mud ☐ Cable ☐ Auger
☐ Other

(4) PROPOSED USE:
☐ Domestic ☐ Community ☐ Industrial ☐ Irrigation
☐ Thermal ☐ Injection ☐ Livestock ☐ Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval ☐ Yes ☐ No Depth of Completed Well ft.
Explosives used ☐ Yes ☐ No Type Amount

HOLE Diameter	From	To	SEAL Material	From	To	Amount sacks or pounds

How was seal placed: Method ☐ A ☐ B ☐ C ☐ D ☐ E
☐ Other
Backfill placed from ft. to ft. Material
Gravel placed from ft. to ft. Size of gravel

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:					☐	☐	☐	☐
					☐	☐	☐	☐

Drive Shoe used ☐ Inside ☐ Outside ☐ None
Final location of shoe(s)

(7) PERFORATIONS/SCREENS:
☐ Perforations Method
☐ Screens Type Material

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
						☐	☐
						☐	☐
						☐	☐
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour
☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time

Temperature of Water Depth Artesian Flow found NOV 17 2010
Was a water analysis done? ☐ Yes By whom
Did any strata contain water not suitable for intended use? ☐ Too little
☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other
Depth of strata:

(9) LOCATION OF WELL by legal description:
County Washington Latitude Longitude
Township 2SOUTH N or S. Range 1WEST E or W. of WM.
Section 08 SW 1/4 SE 1/4
Tax lot 01401 Lot Block Subdivision
Street Address of Well (or nearest address) 15515 SW 150th Avenue, Tigard, OR

(10) STATIC WATER LEVEL:
ft. below land surface. Date
Artesian pressure lb. per square inch. Date

(11) WATER BEARING ZONES:
Depth at which water was first found

From	To	Estimated Flow Rate	SWL

(12) WELL LOG:
Ground elevation

Material	From	To	SWL
Basalt, Gray & Brown Fract &	242		
Porous		258	
Basalt, Gray	258	270	
Basalt, Gray & Brown Fract @times	270	344	
Basalt, Gray & Brown Porous	344	358	
Basalt, Gray & Brown	358	364	
Basalt, MC Fract & Porous	364	381	250
Basalt, Gray & Brown Fract &	381		
Porous		384	250
Basalt, Black Fractured	384	388	250
Basalt, Gray & Brown Fract &	388		
Porous		397	250
Basalt, Black Fractured	397	400	250

Date started 10/18/2010 Completed 10/22/2010

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.
WWC Number 1884
Signed [signature] Date 10/25/2010
Skyles Drilling, Inc.

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.
WWC Number 1592
Signed Steven C. Bland Date 10/25/2010
Skyles Drilling, Inc.

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)
Instructions for completing this report are on the last page of this form

WASH 62430
SKYLES DRILLING, INC.
503-656-2683

WELL ID # L 72766
START CARD # W173070

(1) OWNER:
Well Number: 01
Name: John O. Noffz, Jr. / Brentwood Homes, Inc.
Address: 14912 SW Summerview Dr.
City: Tigard State: OR Zip: 97224

(2) TYPE OF WORK:
[X] New Well [ ] Deepening [ ] Alteration (repair/recondition) [ ] Abandonment

(3) DRILL METHOD:
[X] Rotary Air [ ] Rotary Mud [ ] Cable [ ] Auger
[ ] Other

(4) PROPOSED USE:
[X] Domestic [ ] Community [ ] Industrial [ ] Irrigation
[ ] Thermal [ ] Injection [ ] Livestock [ ] Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval [ ] Yes [X] No Depth of Completed Well 362 ft.
Explosives used [ ] Yes [X] No Type Amount

HOLE Diameter	From	To	SEAL Material	From	To	Amount sacks or pounds
10	0	164	Bentonite	21	0	8 Sacks
6	164	362	Cement & Bentonite	164	21	30 Sacks

How was seal placed: Method [ ] A [ ] B [X] C [ ] D [ ] E
[X] Other Poured Bentonite
Backfill placed from ft. to ft. Material
Gravel placed from ft. to ft. Size of gravel

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	6	+2	164	.250	[X]	[ ]	[X]	[ ]
Liner:	4	5	362	160#	[ ]	[X]	[X]	[ ]

Drive Shoe used [ ] Inside [ ] Outside [X] None
Final location of shoe(s)

(7) PERFORATIONS/SCREENS:
[X] Perforations Method Saw
[ ] Screens Type Material

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
343	361	1/8x3	80				[X]

(8) WELL TESTS: Minimum testing time is 1 hour
[ ] Pump [ ] Bailer [X] Air [ ] Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
29		360	1 hr

Temperature of Water 55.7 Depth Artesian Flow found
Was a water analysis done? [ ] Yes By whom
Did any strata contain water not suitable for intended use? [ ] Too little
[ ] Salty [ ] Muddy [ ] Odor [ ] Colored [ ] Other
Depth of strata:

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WATER RESOURCES DEPT
SALEM, OREGON

(9) LOCATION OF WELL by legal description:
County Washington Latitude Longitude
Township 2SOUTH N or S. Range 1WEST E or W. of WM.
Section 08CA NE 1/4 SW 1/4
Tax lot 00200 Lot Block Subdivision
Street Address of Well (or nearest address) 15170 SW Finis Ln., Tigard, OR

(10) STATIC WATER LEVEL:
297 ft. below land surface. Date 05/13/2005
Artesian pressure lb. per square inch. Date

(11) WATER BEARING ZONES:
Depth at which water was first found 330'

From	To	Estimated Flow Rate	SWL
330	359	29	297

(12) WELL LOG:
Ground elevation

Material	From	To	SWL
Top Soil, Brown	0	3	
Basalt, Brown & Gray, Soft	3	61	
Claystone, Brown	61	64	
Clay, Gray	64	66	
Claystone, Multicolored	66	68	
Basalt, Multicolored	68	139	
Basalt, Gray & Brown, Fractured	139	158	
Basalt, Gray	158	193	
Basalt, Multicolored	193	199	
Basalt, Gray & Brown	199	207	
Basalt, Gray	207	223	
Basalt, Brown & Red, Porous	223	240	
Basalt, Gray & Brown, Some Fractures	240	262	
Basalt, Brown & Gray, Fractured & Porous	262	268	
Basalt, Gray	268	277	
Basalt, Brown & Gray, Fractured	277	306	
Basalt, Gray, Fractured at times	306	330	
Basalt, Brown & Gray, Porous & Fractured	330	359	297
Basalt, Gray, Semi-Fractured	359	362	

Date started 05/09/2005 Completed 05/13/2005

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.
WWC Number 1715
Signed [signature] Date 5-18-05
Skyles Drilling, Inc.

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.
WWC Number 1592
Signed Steven C. Blood Date 5/18/05
Skyles Drilling, Inc.

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RECEIVED WASH 58498

JUN 13 2002

WATER RESOURCES DEPT.
SALEM, OREGON

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)

Instructions for completing this report are on the last page of this form.

WELL I.D. # L 55309
START CARD #147084

(1) LAND OWNER Well Number
Name ROSCOE BIERLY
Address P.O. BOX 1094
City BEAVERTON State OR Zip 97075

(2) TYPE OF WORK
☒ New Well ☐ Deepening ☐ Alteration (repair/recondition) ☐ Abandonment

(3) DRILL METHOD:
☒ Rotary Air ☐ Rotary Mud ☐ Cable ☐ Auger
☐ Other

(4) PROPOSED USE:
☒ Domestic ☐ Community ☐ Industrial ☐ Irrigation
☐ Thermal ☐ Injection ☐ Livestock ☐ Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval ☐ Yes ☒ No Depth of Completed Well 459 ft.
Explosives used ☐ Yes ☒ No Type ____ Amount ____

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
10	0	40	Bentonite	0	40	112 sks
8	40	299	Cement	250	299	20 sks.
6	299	459				

How was seal placed: Method ☐ A ☒ B ☐ C ☐ D ☐ E
☒ Other ~~poured into annular~~
Backfill placed from 40 ft. to 250 ft. Material Bentonite Chips
Gravel placed from ____ ft. to ____ ft. Size of gravel ____

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	6"	+1	299	.250	☒	☐	☒	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:	4½"	-259	459	160#	☐	☒	☒	☐
					☐	☐	☐	☐

Drive Shoe used ☒ Inside ☐ Outside ☐ None
Final location of shoe(s) ~~Shoe milled out@ 299'~~

(7) PERFORATIONS/SCREENS:
☒ Perforations Method Drilled
☐ Screens Type ____ Material PVC 160

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
419	459	½"	120	4½"	pipe	☐	☒
						☐	☐
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour
☐ Pump ☐ Bailer ☒ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
120		459	1 hr.
60		200	"
15		100	"

Temperature of water 54°F Depth Artesian Flow Found ____
Was a water analysis done? ☒ Yes By whom AMJ
Did any strata contain water not suitable for intended use? ☐ Too little
☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☒ Other Hi-Iron
Depth of strata: 78-150' (sealed off)

(9) LOCATION OF WELL by legal description:
County WASHINGTON Latitude ____ Longitude ____
Township 1S N or S Range 2W E or W. WM.
Section 36 NW 1/4 SW 1/4
Tax Lot 0002 Lot ____ Block ____ Subdivision ____
Street Address of Well (or nearest address) 11480 SW GRABHORN RD.

(10) STATIC WATER LEVEL:
73 ft. below land surface. Date 06/10/02
Artesian pressure ____ lb. per square inch Date ____

(11) WATER BEARING ZONES:
Depth at which water was first found 78/423

From	To	Estimated Flow Rate	SWL
423	459	120 gpm	73'

(12) WELL LOG:
Ground Elevation ____

Material	From	To	SWL
Brown clay	0	19	
Brown decomp rock	19	22	
Gray-brown&brown basalt broken	22	78	
Brown-gray,brown basalt broken	78	105	wb
Gray-brown basalt,frac. w/broken strks.	105	174	wb
Gray&gray-brn.basalt,brkn	174	268	
Hard gray basalt	268	272	
Gray-brown&brown rotten rock	272	277	
Gray basalt w/gry-brn seam	277	316	
Gray & gry-brn basalt	316	331	
Gray-gry-blk.basalt,frac.	331	459	73

Date started 06/10/02 Completed 06/10/02

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.
WWC Number 1492
Signed [signature] Date 06/11/02

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.
WWC Number 573
Signed [signature] Date 06/11/02

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WASH 56470

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)

Arrow 00-019

PAGE 1 of 2

WELL ID # L 42477
START CARD # 127489

(1) OWNER:
Name: Neil and Artis Schroeder
Address: 19407 SW Elert Road
City: Sherwood State: OR Zip: 97140

(2) TYPE OF WORK:
☒New Well ☐Deepening ☐Alteration (repair/recondition) ☐Abandonment

(3) DRILL METHOD:
☒Rotary Air ☒Rotary Mud ☐Cable ☐Auger
☐Other:

(4) PROPOSED USE:
☒Domestic ☐Community ☐Industrial ☐Irrigation
☐Thermal ☐Injection ☐Livestock ☐Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval ☐Yes ☒No
Depth of Completed Well 583
Explosives Used ☐Yes ☒No Type _____ Amount

HOLE Diameter	From	To	SEAL Material	From	To	sacks or pounds
12 1/4	0	19	bent chps	0	18	11 bags
10"	19	416	cement	18		
9 7/8	416	516	cement		516	108 bags
6"	516	583				

How was seal placed: Method ☐A ☐B ☒C ☐D ☐E
☒ Other bent chips poured - probed
Backfill placed from _____ to _____ Material _____
from _____ to _____ Material _____
Gravel placed from _____ to _____ Size of gravel

(6) CASING/LINER:
CASING:

Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
6"	+20"	516'	.250	☒	☐	☒	☐
				☐	☐	☐	☐
				☐	☐	☐	☐
				☐	☐	☐	☐

LINER:

				Steel	Plastic	Welded	Threaded
N/A				☐	☐	☐	☐
				☐	☐	☐	☐

Final location of Shoe(s):

(7) PERFORATIONS/SCREENS: N/A
☐ Perforations Method:
☐ Screen Type: _____ Material: _____

From	To	Slot Size	No.	Diameter	Tele/pipe size	Casing	Liner
						☐	☐
						☐	☐
						☐	☐
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour
☐ Pump ☐ Bailer ☒ Air ☐ Flowing Artesian

Yield gpm	Drawdown	Drill Stem at	Time
160+	N/A	580	1 hr.
75	N/A	120	15 min.
45	N/A	80	15 min.

Temperature of water 54 Depth Artesian Flow Found
Was a water analysis done? _____ By whom:
Did any strata contain water not suitable for intended use? (explain)

Depth of Strata:_________

ARROW DRILLING (503) 538-4422

(9) LOCATION OF WELL by legal description:
County: Wash Latitude: _____ Longitude: _____
Township: 2S Range: 2W
Section: 13 NW ¼ NW ¼
Tax Lot: 2202 Lot: _____ Block: _____ Subdivision: _____
Street Address of Well (or nearest address) 15522 Pleasant Valley Road, Beaverton, Oregon 97007

(10) STATIC WATER LEVEL:
26 Ft. below land surface Date 8/30/00
Artesian pressure _____ lb. per sq. in. Date _____

(11) WATER BEARING ZONES:
Depth at which water was first found suspect 20' to 30'

From	To	Est. Flow Rate	SWL
520	583	160 + gpm	26'

(12) WELL LOG: Ground Elevation:

Material	From	To	SWL
top soil	0	1	
silt/sand brwn	1	36	
sand gray	36	45	
sand brwn	45	53	
sand gray	53	64	
sand gray slight cementation	64	88	
sand gray w/wood	88	92	
sand gray/brwn w/wood	92	97	
clay brwn sandy	97	110	
clay brwn hrd w/gravel	110	121	
clay brwn soft	121	130	
clay brwn hrd	130	133	
clay brwn sandy	133	148	
sand w/small gravel cemented	148	157	
basalt gray firm	157	158	
clay gray/brwn sandy	158	192	
clay gray/brwn sandy w/occ basalt fragments	192	228	
clay gray/brwn sandy softer	228	249	
clay gray sandy occ small gravel	249	271	
basalt gray firm	271	272	
clay brwn/gray	272	292	
basalt decomp brwn/gray bkn	292	297	
basalt decomp brwn soft	297	314	
basalt decomp brwn very soft	314	325	
(continued)			

Date Started: 8/22/00 Completed: 8/30/00

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration,, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.
WWC Number _____
Signed _____ Date _____

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.
WWC Number 1483
Signed [signature] Date 9/12/00

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WATER RESOURCES DEPT.
SALEM, OREGON

[STATE] OF OREGON Arrow 00-019
[WAT]ER SUPPLY WELL REPORT
[as] required by ORS 537.765)

(1) OWNER: Well Number: ______
Name: Neil and Artis S[...]
Address: 19407 SW Elwert Road
City: Sherwood State: OR Zip: 97140

(2) TYPE OF WORK:
☒New Well ☐Deepening ☐Alteration (repair/recondition) ☐Abandonment

(3) DRILL METHOD:
☒Rotary Air ☐Rotary Mud ☐Cable ☐Auger
☐Other:

(4) PROPOSED USE:
☒Domestic ☐Community ☐Industrial ☐Irrigation
☐Thermal ☐Injection ☐Livestock ☐Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval ☐Yes ☐No
Depth of Completed Well ______
Explosives Used ☐Yes ☐No Type _____ Amount

HOLE Diameter	From	To	SEAL Material	From	To	sacks or pounds

How was seal placed: Method ☐A ☐B ☐C ☐D ☐E
☐ Other ______
Backfill placed from _____ to _____ Material _____
from _____ to _____ Material _____
Gravel placed from _____ to _____ Size of gravel

(6) CASING/LINER:
CASING:

Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
				☐	☐	☐	☐
				☐	☐	☐	☐
				☐	☐	☐	☐
				☐	☐	☐	☐

LINER:

Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
				☐	☐	☐	☐
				☐	☐	☐	☐

Final location of Shoe(s):

(7) PERFORATIONS/SCREENS:
☐ Perforations Method:
☐ Screen Type: _____ Material: ______

From	To	Slot Size	No.	Diameter	Tele/pipe size	Casing	Liner
						☐	☐
						☐	☐
						☐	☐
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour
☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Yield gpm	Drawdown	Drill Stem at	Time
			1 hr.

Temperature of water _____ Depth Artesian Flow Found
Was a water analysis done? _____ By whom:
Did any strata contain water not suitable for intended use? (explain)
______
Depth of Strata: ______

ARROW DRILLING (503) 538-4422

PAGE 2 of 2 **WELL ID # L 42477**
START CARD # 127489

(9) LOCATION OF WELL by legal description:
County: Wash Latitude: _____ Longitude: _____
Township: 2S Range: 2W
Section: 13 NW ¼ NW ¼
Tax Lot: 2202 Lot: _____ Block: _____ Subdivision: _____
Street Address of Well (or nearest address) 15522 Pleasant Valley Road, Beaverton, Oregon 97007

(10) STATIC WATER LEVEL:
____ Ft. below land surface Date
Artesian pressure _____ lb. per sq. in. Date ______

(11) WATER BEARING ZONES:
Depth at which water was first found

From	To	Est. Flow Rate	SWL

(12) WELL LOG: Ground Elevation:

Material	From	To	SWL
clay reddish brwn firm sandy	325	361	
basalt decomp red/brwn very soft	361	402	
basalt decomp gray/brwn firm	402	413	
basalt decomp grayish green firm	413	441	
basalt gray/brwn decomp vesic	441	453	
basalt gray med	453	457	
basalt gray decomp occ green prog hrder	457	478	
basalt brwn/gray med	478	520	
basalt green decomp	520	529	
basalt gray med	529	533	
basalt gray hrd fract	533	583	

Date Started: 8/22/00 Completed: 8/30/00

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration,, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

WWC Number ______
Signed ______ Date ______

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.

WWC Number 1483
Signed [signature] Date 9/12/00

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WATER RESOURCES DEPT.
SALEM, OREGON

WASH 51495

WELL I.D. # L10538

(START CARD) # 89018

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)
Instructions for completing this report are on the last page of this form.

(1) OWNER: Well Number
Name Reserve Vineyards Golf Club
Address 4805 SW 229th Ave
City Aloha State OR Zip 97007

(2) TYPE OF WORK
[X] New Well [ ] Deepening [ ] Alteration (repair/recondition) [ ] Abandonment

(3) DRILL METHOD:
[X] Rotary Air [X] Rotary Mud [ ] Cable [ ] Auger
[ ] Other

(4) PROPOSED USE:
[X] Domestic [ ] Community [ ] Industrial [ ] Irrigation
[ ] Thermal [ ] Injection [ ] Livestock [ ] Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval [ ] Yes [X] No Depth of Completed Well 705 ft.
Explosives used [ ] Yes [X] No Type Amount

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
12 1/4	0	615	Cement	0	150	73 Sacks
				595	615	15 Sacks
8	615	705				

How was seal placed: Method [ ] A [ ] B [X] C [ ] D [ ] E
[X] Other Braiden Head for bottom seal
Backfill placed from 595 ft. to 150 ft. Material Bent Slurry
Gravel placed from ft. to ft. Size of gravel

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	8	+1	615	.322	✓	[ ]	✓	[ ]
					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
Liner:	6"	605	705	.250	[X]	[ ]	[X]	[ ]
					[ ]	[ ]	[ ]	[ ]

Final location of shoe(s)

(7) PERFORATIONS/SCREENS:
[X] Perforations Method FACTORY
[X] Screens Type Johnson Material Stainless Steel

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
						[ ]	[ ]
685	705	30		6"	6"	[ ]	[X]
665	685		1/8x3	6"		[ ]	[X]
						[ ]	[ ]
						[ ]	[ ]

(8) WELL TESTS: Minimum testing time is 1 hour

[ ] Pump [ ] Bailer [X] Air [ ] Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
150		704	1 hr.

Temperature of water 62 Depth Artesian Flow Found
Was a water analysis done? [X] Yes By whom AGRA
Did any strata contain water not suitable for intended use? [ ] Too little
[ ] Salty [ ] Muddy [ ] Odor [ ] Colored [ ] Other
Depth of strata:

(9) LOCATION OF WELL by legal description:
County Washington Latitude Longitude
Township 1S N or S Range 2W E or W. WM.
Section 15 SW 1/4 NE 1/4
Tax Lot 600 Lot Block Subdivision
Street Address of Well (or nearest address) Same

(10) STATIC WATER LEVEL:
72 ft. below land surface. Date 11/13/96
Artesian pressure — lb. per square inch. Date

(11) WATER BEARING ZONES:

Depth at which water was first found 625

From	To	Estimated Flow Rate	SWL
625	650	80	72
665	705	150+	72

(12) WELL LOG:
Ground Elevation

Material	From	To	SWL
Reddish brn clay	0	20	
Silty sand gray brn	20	130	
Clay grayish grn soft sticky	130	250	
Green clay	250	260	
Silty clay w/sand olive grn	260	280	
Silty clay grn & gray	280	560	
W/hrd grayish blk basalt soft	560	590	
W/hrd basalt w/red silt stone seams	590	600	
Med to hrd blk basalt	600	626	
Basalt brn blk frac pounds	626	649	
Med to hrd basalt no frac	649	664	
Basalt soft med slight frac	664	683	
Basalt med-hrd slight frac black & brn	683	705	

Date started 10/30/96 Completed 11-27-96

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.
WWC Number 1358
Signed [signature] Date 12-4-96

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.
WWC Number 1358
Signed [signature] Date 12-4-96

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WASH 56198

WASH

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)
Instructions for completing this report are on the last page of this form.

WELL I.D. # L 41138
START CARD # 131746

(1) OWNER: Well Number
Name KOZAK INTERPRISES INC.
Address 22830 S.W. NOBLE ST.
City BEAVERTON State OR Zip 97007

(2) TYPE OF WORK
[X] New Well [ ] Deepening [ ] Alteration (repair/recondition) [ ] Abandonment

(3) DRILL METHOD:
[X] Rotary Air [X] Rotary Mud [ ] Cable [ ] Auger
[ ] Other

(4) PROPOSED USE:
[X] Domestic [ ] Community [ ] Industrial [ ] Irrigation
[ ] Thermal [ ] Injection [ ] Livestock [ ] Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval [ ] Yes [X] No Depth of Completed Well 798 ft.
Explosives used [ ] Yes [X] No Type Amount

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
10	0	797	BENTONITE	0	25	17 SACKS
			DRILLGEL	25	697	
			CEMENT	697	797	36 SACKS
6	792	798				

How was seal placed: Method [ ] A [ ] B [ ] C [X] D [ ] E
[X] Other POURED INTO DRY ANNULAR
Backfill placed from ft. to ft. Material
Gravel placed from ft. to ft. Size of gravel

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	6	+2	797	.250	[X]	[ ]	[X]	[ ]
					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
Liner:					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]

Final location of shoe(s)

(7) PERFORATIONS/SCREENS:
[ ] Perforations Method
[ ] Screens Type Material

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
						[ ]	[ ]
						[ ]	[ ]
						[ ]	[ ]
						[ ]	[ ]
						[ ]	[ ]

(8) WELL TESTS: Minimum testing time is 1 hour
[ ] Pump [ ] Bailer [X] Air [ ] Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
33		125	1 hr.
60		200	"
125		400	"

Temperature of water 56°F Depth Artesian Flow Found
Was a water analysis done? [ ] Yes By whom
Did any strata contain water not suitable for intended use?
[ ] Salty [ ] Muddy [ ] Odor [ ] Colored [ ] Other
Depth of strata:

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SALEM, OREGON

(9) LOCATION OF WELL by legal description:
County WASHINGTON Latitude Longitude
Township 1S N or S Range 2W E or W. WM.
Section 15 SE 1/4 NE 1/4
Tax Lot 904 Lot Block Subdivision
Street Address of Well (or nearest address)
22830 S.W. NOBLE ST., BEAVERTON, OR

(10) STATIC WATER LEVEL:
53 ft. below land surface. Date 7/7/2000
Artesian pressure lb. per square inch. Date

(11) WATER BEARING ZONES:
Depth at which water was first found 797

From	To	Estimated Flow Rate	SWL
797	798	125 GPM	53

(12) WELL LOG:
Ground Elevation

Material	From	To	SWL
Topsoil	0	1	
Brn clay	1	5	
Brn silty clay	5	39	
Gray silty clay	39	53	
Coarse red-brn sand	53	57	
Sticky gray-brn clay	57	97	
Sticky blue-gray clay	97	148	
Sticky gray-brn clay	148	228	
Sticky brn clay	228	252	
Medium blk sand	252	256	
Sticky gray clay	256	468	
Sticky brn clay	468	494	
Sticky gray clay	494	654	
Med.blk sand(flat)w/wood& gray clay	654	704	
Sticky dk.brn clay	704	737	
Soft decomp.brn basalt	737	748	
Soft decomp blk basalt	748	784	
Firm blk basalt	784	798	53

Date started 6/20/2000 Completed 7/7/2000

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

WWC Number
Signed Date

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.

WWC Number 1266
Signed Date 7/7/2000

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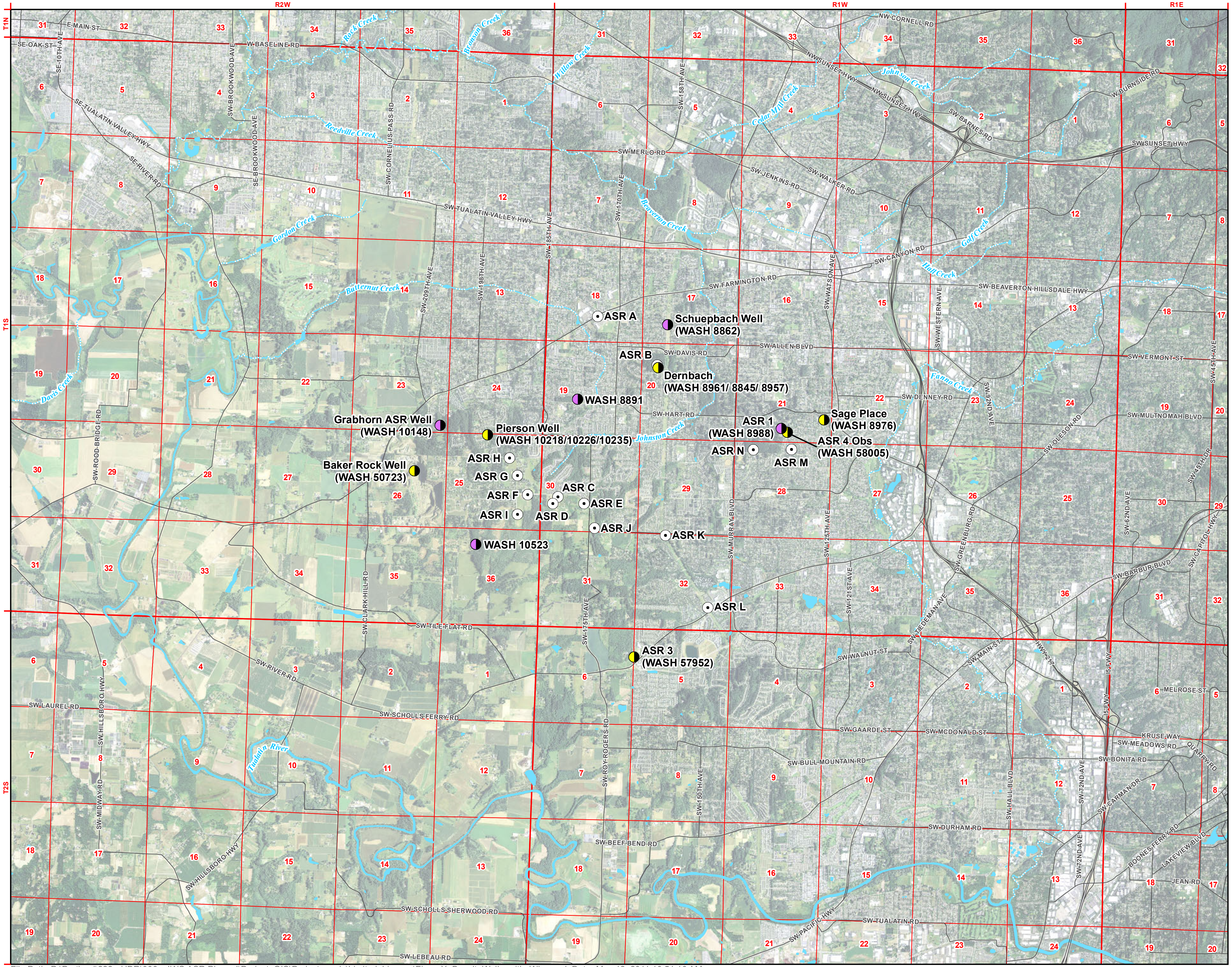

File Path: P:\Portland\222 - HDR\006 - JWC ASR Phase I\Project_GIS\Project_mxds\Limited_License\FigureX_Basalt_Wells_with_WLs.mxd, Date: May 12, 2011 10:51:16 AM

FIGURE X

Locations of Basalt Wells with Water Levels Antecedent to New ASR

Joint Water Commission
Limited License Application

LEGEND

Basalt Wells

- Post ASR Water Level Data (1998 - 2010)
- Long Term Water Level Data

All Other Data

- Proposed ASR Wells
- Major Roads
- Watercourses
- Waterbodies

N

0 0.5 1 1.5
Miles

MAP NOTES:
Date: May 12, 2011
Data Sources: Oregon Geospatial Data Clearinghouse, METRO RLIS, Aerial Photo Taken on June 23, 2009 by the USDA

GSI Water Solutions, Inc.

GSI
Water Solutions, Inc.

REGISTERED PROFESSIONAL
OREGON
LARRY G EATON
G1388
GEOLOGIST
Exp. 31-Dec-2011

April 4, 2011

Jen Woody, Hydrogeologist
Water Resources Department
725 Summer Street NE, Suite A
Salem, Oregon 97301

RE: Response to OWRD Application Comments and Completeness Needs for the Joint Water Commission ASR LL #019

Dear Jen,

The Joint Water Commission (JWC) is interested in developing a phased Aquifer Storage and Recovery (ASR) program in the Tualatin Basin to augment its future water supply. Full-scale development of the JWC ASR program would ultimately consist of 14 operational ASR wells in the Cooper Mountain area by the year 2025. The JWC submitted a Limited License Application to the Oregon Water Resources Department (OWRD) in January 2011. OWRD conducted a review of the application and in a March 2011 letter, provided application comments and identified several data necessary to complete the application. This letter provides the additional information requested by OWRD.

ITEM 1:
690-350-0020 (3)(a)(D) Proposed Use or Disposal of Recovered Water
Proposed use or disposal of recovered water, including contingencies: Intended use of water is well documented but contingency plan is not very descriptive. Is there a volume of recovered water that would exceed the capacity of the pump to waste system or the storm water system? Are there downstream surface water users that might be impacted by large volume releases through the storm water system (i.e. other public water systems…. turbidity, etc?). What are the high probability problems and associated contingencies? What are the low probability – high impact problems and their associated contingencies?

GSI RESPONSE:
Based on the potential storage volume of each well, there is a possibility that the volume of recovered water could exceed the capacity of the pump to waste system or the storm water system; however, the volume of water discharged will be adjusted according to each particular system and will not exceed its individual capacity. At this time the exact volume of water that would exceed the capacity of the pump to waste system or the storm water system is not known because it will depend on each particular site layout and the nearest storm water system. Water released to the storm water system will meet the water quality requirements of the discharge permit; therefore, there should not be adverse impacts to other downstream users. Additionally,

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since the volume of water will not exceed the local storm system capacity, downstream users will not be impacted. Specifics are further described below.

The high probability situations in which recovered water will be disposed of (discharged to pump to waste and/or the storm water system) are minor clogging events due to particulates in the source water and routine backflushing episodes related to periodic well maintenance. During these high probability situations, the volume of water discharged will not exceed the capacity of the pump to waste system or the storm water system.

There is a very low probability that unacceptable water could be injected into the aquifer if the treatment plant or the distribution system were to be impacted. In the unlikely event that the treatment plant was impacted, system operators would be notified promptly thereby minimizing the volume of impacted water injected into the aquifer. In the unlikely event that the distribution system was impacted, the volume of impacted water injected into the aquifer would be dependent on the timing and frequency of ASR water quality sample collection that includes onsite monitoring, compared to the timing of the distribution system impact. During either of these unlikely situations, discharge to the pump to waste and/or storm water systems would be limited in volume to the design capacity of the system. To accomplish this, injection would be stopped, a water quality sample would be taken on first recovery, and the stored water would be pumped and discharged to the storm system in batches. Additionally, water would not be discharged to the storm water systems during significant storm events.

Water discharged to the pump to waste and/or storm water systems will meet all water quality criteria described in the discharge permit. If the water is unacceptable for discharge to the storm system, it will be treated onsite and then discharged in batches to the storm water systems. If onsite treatment is not possible, stored water will be pumped to a holding tank and transported offsite for treatment. Stored water would be pumped and treated until recovered water meets Safe Drinking Water Act (SDWA) water quality requirements.

ITEM 2:
690-350-0020 (3)(a)(D) Proposed Use or Disposal of Recovered Water
Notification of permits: page 20 notes the licensee will obtain appropriate local and state permits for all components of their pump-to-waste system. OWRD will need to be notified when they get approval from CWS or DEQ to discharge to waters of the state, and UIC registration at each new ASR well.

GSI RESPONSE:
GSI will notify OWRD when approval from CWS or DEQ to discharge to waters of the state is obtained, and when each new ASR well UIC registration is approved.

ITEM 3:
690-350-0020(3)(b)(A) Proposed ASR Test Program
Monitoring and Test Plan: It appears that site-specific monitoring and test plans will be submitted for approval at a later time. The information provided is a reasonable outline of general protocols, but does not satisfy the need for detailed monitoring and test plans. This is in alignment with what was discussed at the JWC pre-application meetings. Prior to beginning each new phase of testing, the licensee must submit and obtain Department approval of a monitoring and test plan. An acceptable plan for the first stage of the project will identify where the first 3 test wells are located, and when and where monitoring will take place.

GSI RESPONSE:
Detailed site-specific monitoring and test plans will be submitted to the Department for review and approval before each new phase of testing begins. During the first stage of the project and before cycle testing begins, a detailed site-specific monitoring and test plan for the first test well completed as an ASR well will be submitted to the Department. Subsequent site-specific monitoring and test plans will be submitted before cycle testing as additional test wells are converted into ASR wells.

ITEM 4:
690-350-0020(3)(b)(A) Proposed ASR Test Program
<u>Proposed Observation wells</u>: The monitoring wells associated with other ASR projects are a good start. OWRD needs something closer to ASR C (or the first ASR well) for the first stage. The list of proposed observation wells does not provide a nearby monitoring point. Based on the proposed magnitude of this project, dedicated monitoring wells are probably necessary. Without knowing the ASR well(s) depth, construction and actual location, the list of potential observation wells cannot be evaluated. These issues can be addressed in the site-specific monitoring plan.

GSI RESPONSE:
Once test well drilling of the first proposed ASR well (ASR C) is complete and before cycle testing begins, an observation well that is closer than the observation wells listed in the application will be identified. Specifically, a detailed monitoring and test plan for the first test well will be submitted to the Department before cycle testing begins. If an existing well cannot serve as a suitable observation well, a dedicated monitoring well will be drilled. Moreover, once construction and location information are available for each new ASR well, a list of observation wells and dedicated monitoring wells will be presented to OWRD for review and approval in the site-specific ASR monitoring plan.

ITEM 5:
690-350-0020(3)(b)(A) Proposed ASR Test Program
<u>Potential Natural Resource Problems of testing and contingency plans</u>: We know existing ASR projects in the Cooper-Bull Mountain area have activated new seeps and flowing wells. Page 12, Section 2.7, references a seep at SW 150th Court that will likely be affected by the ASR injections, but they did not go into contingency plans if seepage increases at this site or is discovered at other sites in the future. Therefore, the assertion on page 13 that no impact is anticipated needs to be justified. OWRD data show water levels this winter at WASH 9205 are within 2 feet of land surface. Depending on well construction, the model created for JWC predicts 15 to 30 feet of water level increase at WASH 9205 at full build-out. Please clarify.

GSI RESPONSE:
As noted above, potential impacts from ASR operation as a result of piezometric head changes in the basalt aquifer were discussed in Section 2.7, and also in Section 2.6, but a contingency plan to mitigate seepage increases was not outlined. The assertion in Section 2.8 that no natural resources problems are anticipated as a result of ASR testing in the Cooper Mountain area assumed that seeps and flowing wells were not natural resources problems, rather that they were issues covered under Section 2.6, Allocation of Surface Water, Springs, or Wells in the Affected Area and Section 2.7, Anticipated Changes to the Groundwater System.

As discussed in Section 2.7, injection at the proposed JWC ASR wells is not likely to create surface discharge of groundwater at most locations, particularly in the early phases of development, because of the sufficient injection head space and predicted rapid decrease in injection head with distance from the site. However, the potential for surface discharges will be of more concern as additional ASR sites are developed. Potential impacts will be monitored closely using a network of dedicated monitoring wells. If seepage increases at SW 150th Court or if new seeps and flowing wells are activated as a result of the JWC ASR program, the JWC will assess the impacts and will take the associated steps necessary to mitigate the impacts on a case-by-case basis. Depending on the impact, potential contingency plans include: mitigate seeps with engineered drainage systems (much like what was done at the 150th Court seep); shut in flowing wells and equip the wells with pressure gages [much like what Tualatin Valley Water District (TVWD) did northwest of the Grabhorn ASR site]; and evaluate reducing injection rates and/or volumes at the ASR wells near the impacted site if needed.

ITEM 6:
690-350-0020(3)(b)(A) Proposed ASR Test Program
Recovery percentage: On page 4, the application proposes to recover 100% for geochemical analysis in the first ASR cycle. OWRD may be able to accommodate this request for a first-year only test, given adequate supporting information. Please provide more information about what exactly would be analyzed and how that extra 5% recovery will enable project development.

GSI RESPONSE:
Recovery of 100% during the first year of testing was proposed to ensure that geochemical results of source water and aquifer water mixing at the boundary of the ASR bubble are captured. However, recovery of 95% of the ASR account during the first year of ASR testing likely will be sufficient for the geochemical analysis. Therefore, the request to recovery 100% during the first year of testing is withdrawn.

ITEM 7:
690-350-0020(3)(b)(A) Proposed ASR Test Program
QA/QC issues: As part of the QA/QC, include the sampling and analysis plan. The application glosses over taking field parameters and purging (stating they will do so), but there were no details as to how they will determine when conditions are appropriate for sample collection. It's important that they provide copies of the actual, hand written field reports and not something that's transcribed later in the office. ODEQ staff are happy to provide examples of good field data sheets, if so asked. Section 7. 1, Field QA/QC. This paragraph states that "No duplicate samples will be collected in the field". As a matter of standard field sampling protocol, the DEQ Lab requires field personnel to collect field duplicate samples at a frequency of 10% or 1 per sampling event, whichever is more frequent. This ASR Pilot Test Work Plan should also collect field duplicate samples at the same frequency. In the overall scheme of the project, the addition of field duplicate samples should not result in an unaffordable level of cost, and would go a long way toward assuring that the field samples were providing reliable data. Field duplicate samples could also be useful in terms of helping to explain an unexpectedly high parameter concentration, and reduce the likelihood that injection or pumping would have to be stopped and incur additional re-sampling efforts.

In addition to these concerns about the need for duplicate samples, in section 7.7, they do discuss the need for duplicates, blanks, surrogates, spikes, etc, but they say they will do one for every 20 samples. ODEQ's standard practice for duplicates is at least one a day and/or one per every ten samples collected.

There is a lot of the QC frequency built into the analytical methods. But not for all of them. The 200 series and 500 series methods should have specific frequencies that need to be followed.

The one per 20 scenario referenced in the plan is for Method Blanks and Control Samples that are generally one per batch or 5% frequency, whichever is more frequent (one per batch unless your batch is more than 20 samples). Laboratory Matrix spikes are usually one per batch or one per 20 samples for Organics and one per 10 for metals for DW methods (1/20 for non-drinking waters). Trip Blanks are typically one per sample shipment (or cooler) for VOCs. Surrogates are for Organics and are part of every sample and QC sample.

Please revise QA/QC to address these issues.

GSI RESPONSE:
The ASR water quality analysis and QA/QC protocol has been designed to meet DHS SDWA standards for municipal drinking water projects rather than protocol for environmental contaminant site evaluations. Additionally, as previously mentioned, samples will be analyzed by an analytical laboratory certified by the Oregon Environmental Laboratory Accreditation Program (ORELAP). Consequently, testing by the laboratory will meet the U.S. Environmental Protection Agency's National Environmental Laboratory Accreditation Program (NELAP) standards as adopted by the National Environmental Laboratory Accreditation Conference (NELAC) (EPA/600/R-04/003). This standard of practice has historically been used for the past 12 years on ASR projects that GSI and/or GSI staff have been involved with.

The following bullets are in response to specific comments in Item 7:

- All wells that will be sampled during ASR activities are considered water supply wells. Therefore, sampling procedures will be in accordance with accepted America Water Works Association (AWWA) standards that are typically applied to public water systems. Field parameters will be collected in a manner that assures accurate readings. Specifically, when collecting field parameters, which include temperature, pH, specific conductance, dissolved oxygen, turbidity, and oxidation reduction (redox) potential (ORP), an open-top overflow cell or a flow-through cell will be used to prevent atmospheric oxygen from mixing with the sample. Field parameter measurements will be made at least once per well casing volume as the well is being purged. The field instruments will be calibrated before each sampling event and in accordance with manufacturer's recommendations.

- When collecting groundwater, stored water, or recovered water samples from an ASR well, the well will be purged of up to three well volumes prior to sampling. Stabilized field parameter measurements will determine the final purge volume, not a predetermined number of well volumes; this ensures the collected samples are representative of water in the aquifer rather than borehole water. Source water samples are collected directly from the source water line at the wellhead using standard sampling protocols (e.g., wearing gloves and decontaminating the supply spigot before collecting the sample.)

- Copies of hand written field sampling reports can be submitted to OWRD if requested.

- Collecting duplicate groundwater samples is very useful in environmental monitoring programs, where monitoring wells are used to assess temporal changes in a contaminant source. For example, concentrations at a well are expected to change between sampling events because of contaminant plume migration, seasonal water table changes, and/or sampling methods. Potential discrepancies can often be resolved by collecting duplicate samples. However, in drinking water applications, duplicate water sampling is typically not performed because groundwater constituent concentrations are relatively constant with time. The same is true of source water supplies from the treatment plant. If an unexpected analytical result is encountered in drinking water applications (e.g., a VOC or some other contaminant is detected), then the typical approach is to immediately re-sample the well to assess the potential for sampling error. This is a standard practice in water well and DHS compliance monitoring and will be used in the JWC ASR project for QA/QC purposes.

- It is assumed that analytical laboratories certified by the ORELAP are conducting the appropriate QC frequency for the 200 series and 500 series methods, method blanks, control samples, laboratory matrix spikes, trip blanks, and surrogates.

ITEM 8:
690-350-0020(3)(b)(A) Proposed ASR Test Program
Proposed ASR Test Program: DHS Drinking Water Program (DHS DWP) requirements for monitoring of Water Quality frequency is less than what is proposed in the LL Application. DHS DWP has long-term SDWA monitoring results for the injection water and would entertain a reduced SDWA injection water monitoring frequency or suspension of SDWA injection water monitoring if WRD and DEQ also concur (provided SDWA water quality standards are met at the injection water source). In addition DHS DWP would also entertain a reduction in SDWA recovery water monitoring after the third year of operation of any stand alone ASR Well.

GSI RESPONSE:
Because DHS DWP has long-term SDWA monitoring results for the injection water and SDWA water quality standards are tested and met at the injection water source, a reduced SDWA injection water monitoring frequency would be an effective way to decrease the already high analytical costs of operating an ASR system. GSI and the JWC appreciate the cooperation of DHS in considering a reduction in SDWA injection and recovery water monitoring frequency.

ITEM 9:
690-350-0020(3)(b)(B) Proposed System Design
Proposed System Design: per DHS DWP: Note that if proposed ASR Well schematic Scenario 1: Open to Unsaturated and Saturated Zones is used and there is a surface water body present within 500 feet of the ASR Wellhead, the well may be subject to Monthly Assessment Monitoring and subsequent GWUDI testing. Likewise, if a fecal contaminant source is present within the delineated 2-yr Time-of-Travel zone and the recovery water is chlorinated, Monthly Assessment Monitoring would also be required to determine if the recovery water is virally contaminated.

GSI RESPONSE:
The JWC and GSI understand that if an ASR well is constructed as shown in the Scenario 1 schematic, and there is a surface water body present within 500 feet of the ASR wellhead, the well may be subject to Monthly Assessment Monitoring and subsequent GWUDI testing. If an ASR well is constructed as shown in the Scenario 1 schematic, and a fecal contaminant source is present within the delineated 2-yr Time-of-Travel zone and the recovery water is chlorinated, the JWC and GSI understand that Monthly Assessment Monitoring will be conducted to determine if the recovery water is virally contaminated. However, given the lack of surface

water bodies on Cooper Mountain, the deep static water levels, and the anticipated seal depth of the ASR wells, we do not anticipate this issue to be of concern for this project.

ITEM 10:

690-350-0020(3)(b)(B) Proposed System Design

Well construction: The licensee will need to demonstrate open hole well construction in the ASR well(s) is not commingling. WRD will also need some demonstration that open hole construction is not leading to loss. The application argues that the target zone is deeper than other wells in the area, which should minimize interference. The proposed open hole construction contradicts that idea.

GSI RESPONSE:

After test well drilling, GSI will work with OWRD to develop testing and monitoring criteria that demonstrates whether commingling or loss is occurring in the ASR well(s) with proposed open hole construction. Additionally, GSI will work with OWRD to develop an approved final completion design. GSI agrees that the argument that the target zone is deeper than other wells in the area, thereby minimizing interference, is not applicable to the proposed open hole construction. However, GSI anticipates working with OWRD to develop a final design for the ASR wells that is reasonable and protective of other wells and the aquifer system.

ITEM 11:

690-350-0020(3)(b)(C) Groundwater Information

Appendix B: Model: The model addresses the ASR LL application requirement to describe the potential impact of proposed ASR. It appears to use aquifer parameters that make sense. However, documentation is lacking some features that are necessary for the reader to accurately interpret the results. Please provide some information in the following areas:

Premodeling data: What independently derived data was fed into the model? Items of interest are groundwater levels, recharge and discharge sources, surface water fluxes, climatic signals, Tigard ASR wells. Is it possible to provide hydraulic head data spatially before predictive modeling results?

GSI RESPONSE:

The primary independently derived data that form the basis on which the model was developed were:

- Geologic structure data, as interpreted from drillers logs on Cooper Mountain and in adjoining areas
- Regional static water level data identified on drillers logs at the time the wells were constructed.
- An interpretation by the USGS (Conlon et al., 2005) of very gentle ambient hydraulic gradients in the Columbia River Basalt Group (CRBG) within the Tualatin Basin (see Page 4 of Appendix B)
- Injection, pumping, and water level data at the Sorrento wellfield and the Grabhorn ASR well

These data indicate that static water levels were very similar within and around Cooper Mountain at multiple wells that were drilled during the historical period of record. Recorded static water levels were below ground surface at these wells, which means that groundwater discharge from the basalt to streams and creeks in and around Cooper Mountain is not occurring under ambient conditions. Additionally because the surficial soils in the region are silty in nature, and also because the CRBG basalt flow interiors are regionally known to have low permeability, little if any rainfall or water from streams and creeks can directly infiltrate into the basalt interflow zones from the ground surface. Groundwater levels are thought to be controlled by the outcropping of basalt flows along the Mount Angel – Chehalem Structural Zone that bounds the Tualatin Valley to the west.

To our knowledge, no recent published groundwater contour maps exist for the basalt aquifers in the Tualatin Valley. This is not surprising, given the similarity of static water levels in drillers logs. Figure B-4 in Appendix B provides a modeled interpretation of a possible regional static water level contour map, based on (1) an interpretation of regional gradients published by Conlon et al. (2005) and (2) the boundary conditions for the model that represent the Mount Angel – Chehalem Structural Zone as a regional zone of recharge (given the infiltration that can occur into the outcropping basalt in this area).

ITEM 12:

690-350-0020(3)(b)(C) Groundwater Information

Model development: What is the relationship between the conceptual and numerical model spatially? In other words, how does Fig. B-3 relate to the map view of the model? Define and justify targets for head and flow, sources and magnitude of error, identify stresses. Pages 6-7 discusses the calibration process and the fact that there is a background water level trend (on the order of 6 feet increase per year) that the model does not capture. What is the cause of this trend?

GSI RESPONSE:

The spatial relationship between the conceptual model of basalt layering and basalt blocks is shown in the attached Figures B-3a and B-3b.

- Figure B-3a is a new version of the original Figure B-3 that appeared in Appendix B. Figure B-3a (1) adds some minor clarifications on the headings, and (2) adds two new columns that show the elevations for the top and bottom of each model layer. (These elevations apply throughout the entire model domain.)
- Figure B-3b is a new map showing where each fault block system lies within the model grid.

The primary calibration target data are the changes in water levels during the year 2008-2009 operations at the Sorrento ASR wellfield and the Grabhorn ASR well. The data are presented graphically on the following plots in Appendix B: Figures B-6 through B-8, Figure B-9, and Figures B-11 through B-14. The primary calibration target data that were used during model calibration were the measured changes in water levels during operation of these two wellfields. The changes in water levels were used because the calibration process showed that the choice of modeled aquifer parameters (horizontal and vertical hydraulic conductivity and aquifer storativity) was highly sensitive to the changes in water levels over time and comparatively insensitive to the choice of the absolute value of head. This observation is likely attributable to the fact that the ASR operations cause large changes in water levels (several tens of feet) that are far greater in magnitude than the smaller difference in static water level elevations between the upgradient and downgradient ends of the model (only about 12 feet across the entire model grid, and only about 1 foot across Cooper Mountain; see Figure B-4). In other words, ASR operations superimpose large seasonally-varying changes in water levels on an otherwise stable ambient system that experiences only minor fluctuations in local or regional water levels in and around Cooper Mountain.

The background water level trend (on the order of 6 feet increase per year) that the model does not capture has been observed at all wells monitored by the City of Beaverton since the start of ASR at the Sorrento site. A similar trend has been observed at the wells monitored by the City or Tigard. The increasing water level trend at these monitoring wells has been documented in the ASR annual reports submitted to OWRD. The rising trend is believed in large part to reflect the recovery from decreased net pumping from the CRBG aquifer system by the Cities of Tigard and Beaverton after ca. 1999 (Burt et al., 2009).

ITEM 13:
690-350-0020(3)(b)(C) Groundwater Information
<u>Sensitivity analysis is lacking</u>: Was there anything interesting in the sensitivity analysis?

GSI RESPONSE:
A classic sensitivity analysis of the calibrated model was not conducted, in part because such analyses commonly perturb the model in a manner that reduces the calibration quality (i.e., increases its calibration error). Hence, these types of analyses are only minimally informative by themselves. However, during calibration itself, repeated testing (akin to a sensitivity analysis) indicated some particularly striking characteristics about the kind of aquifer conditions that would be generating the water level response fields that have been measured in the past under the TVWD and Sorrento ASR operations. Specifically, (1) some faults inside Cooper Mountain itself must be acting as internal no-flow boundaries (barriers); (2) the dense flow interiors are compartmentalizing the system vertically; and (3) the faults along the perimeter of Cooper Mountain also compartmentalize the system vertically but not horizontally. Further discussions and details about these findings are presented in the section titled "Key Findings from the Calibration Process" starting on page 8 of Appendix B.

ITEM 14:
690-350-0020(3)(b)(C) Groundwater Information
<u>Predictions</u>: What are the assumptions, uncertainties and limitations? Page 9 states the model was run for JWC at full build-out for five years, without Beaverton, TVWD or Tigard ASR. It makes sense to do this as a starting point. However, doesn't this by definition underestimate the impact of new ASR? The JWC project, at full build-out will almost double the authorized storage in the area (Beaverton, TVWD, Tigard combined have a total storage of 1.6 BG). In recent years, Beaverton, TVWD and Tigard have at most stored just over half their authorized maximum volume. So the existing projects have not yet tested at full build-out. What do water levels look like when all these projects are at full build-out? When discussing ASR-induced water level increases, it would help to provide starting elevations for reference. Where, if any, do these changes put the water level above ground surface? How do the predictions inform project development?

GSI RESPONSE:
The principal assumption built into the model is the inherent simplification of basalt layering that is necessary in order to build a numerical groundwater flow model. The simplification occurs in the form of imposing a layered structure within each subarea of the model, based on comparing well logs that show varying degrees in the depths at which particular interflow zones and flow interiors lie at any given location. While some simplification in the layering stratigraphy was necessary in this model (as is the case with any model), a detailed stratigraphy

is nevertheless built into the model in the form of (1) the large number of model layers, (2) the spatial delineation of blocks of basalt lying at various depths, and (3) the direct simulation of different aquifer parameters along fault zones. These details ultimately allowed us to replicate the observed water level responses; this might not have been as successful if we had used a simpler, and more "lumped", stratigraphy.

The primary uncertainties and limitations lie with the fact that the calibration is well-constrained in the places where a full season's worth of ASR operations have taken place and been closely monitored, but is less well constrained elsewhere. The current model is a preliminary model that will be refined greatly after test drilling data and one years' worth of operational data for the JWC system become available.

The Limited License application process requires that the project-specific zone of impact be defined. Consequently, we interpreted this to require an evaluation of the effect of this project, exclusive of other independently operating projects.

Comparison Figure B-3a with the simulated water level hydrographs in Figures B-15 through B-27 shows the following water level changes attributable to the JWC ASR operations (exclusive of ASR operations at the TVWD and Sorrento wellfields):

- **Inside the Cooper Mountain Block.** The typical (and modeled) ground surface elevation inside the Cooper Mountain Block is 300 feet, though it is higher in some locations. Typical static water level elevations that have been measured regionally in and around Cooper Mountain are on the order of 185 to 195 feet MSL, which indicates that the static water level lies 100 feet or more below ground surface throughout Cooper Mountain. Given the initial 100-foot or greater depth to static water, the model simulations presented in Appendix B suggest that it is unlikely that JWC ASR program (by itself) will cause water levels to rise above ground surface. Specifically:
  - During JWC ASR operations, the highest amounts of water level rises will occur at the injection wells themselves. The model simulates the highest water level elevations inside each ASR well as being about 230 feet for ASR Scenario 1 (see Figure B-15) and about 260 feet for ASR Scenario 2 (see Figure B-16). These peak elevations are below the typical ground surface elevation by 70 feet and 40 feet for ASR Scenarios 1 and 2, respectively.
  - At more distant locations inside Cooper Mountain, the hydrographs for the sites of the various TVWD and Sorrento observation wells provide an indication of the potential water level changes that could occur as a result of JWC ASR operations; see Figures B-17 through B-20. Water level rises attributable to JWC ASR operations are predicted to be 50 feet or less in the Sorrento wellfield (see Figure B-18) and 35 feet or less in the Grabhorn wellfield (see Figure B-20). These increases are substantially less than the 100-foot or greater depth to water under static (non-operating) conditions.
- **Surrounding Cooper Mountain (First Block Down).** The typical (and modeled) ground surface elevation inside the Cooper Mountain Block is 200 feet, though it varies with location, and the static water level in the basalt aquifer system lies 10 to 20 feet below ground surface in this area. Model-simulated hydrographs show that water level rises of

as much as 10 feet for ASR Scenario 1 and 20 feet for ASR Scenario 2 could occur immediately south of Copper Mountain (at ASR-3 and WASH-9205; see Figure B-18) and immediately north of Cooper Mountain (at the Ames and Schulz wells; see Figure B-20). Consequently, close to Cooper Mountain, the project could induce water level rises in the basalt aquifer system that create potentiometric heads that lie close to, or even above, ground surface. However, the modeling results indicate that these heads would not likely propagate to the ground surface; hence, surface flooding from ASR operations is unlikely to occur in this area. Additionally, as shown in Figures B-36 and B-37, areas that are more distant areas from Cooper Mountain are predicted to show notably less water level change than might occur close to the foot of Cooper Mountain.

ITEM 15:
690-350-0020(3)(b)(C) Groundwater Information
Groundwater data antecedent to new ASR are missing: The application needs to summarize groundwater levels. This is a proposed regional project, and the historical and current groundwater situation in the region is an important piece of the puzzle. For example, page 9 states that water levels on Cooper Mountain are generally > 500 ft bgs. Where are the data behind this?

GSI RESPONSE:
Regional groundwater levels were described previously in the feasibility study provided to OWRD, in various sections of the application, and in the above responses (Items 12 and 14). Data sources include static water levels recorded on OWRD well logs and water levels measured at current monitoring wells.

ITEM 16:
690-350-0020(3)(b)(C) Groundwater Information
Conceptual Hydrogeologic Model: The application failed to follow current nomenclature for lithologies presented in maps and cross sections. In addition, on the base map, Boring Lavas are indicated as a blue color and Tertiary Volcanics as red, but on the cross section, Tertiary Volcanics are red on Figure 7 and Boring Lavas are red on figure 8. As a matter of academic concern, Figure 6 Geologic Legend, doesn't include Tertiary Volcanics and "Lower Pleistocene" is placed in the Tertiary.

GSI RESPONSE:
GSI has taken note of the error regarding the "Lower Pleistocene" label in the Tertiary Volcanics segment of the geologic legend; it should have been labeled "Miocene to Pliocene".

ITEM 17:
690-350-0020(3)(b)(C) Groundwater Information
Other Groundwater Info: The potential for natural resource problems is not very well developed. At a minimum would like those problems that have the highest probability of occurrence identified and discounted. Section 2.9, Other Information was very good in addressing potential impacts with City of Tigard ASR Wells. However, other Public Water Supply wells are also present within the identified area of impact that is associated with the project at full build out. A rough map of other Public Water Supply wells and their Drinking Water Source Areas is attached to this file. Potential impacts to these wells should also be addressed. Due to their distance from the project location, it would be acceptable to address any potential issues in a general sense. Even if not in the same aquifer as the ASR wells, adding some of these wells to the monitoring well network (as needed) may yield some useful information (i.e., does the overlying sedimentary aquifer react/respond to injection into the basalt?).

GSI RESPONSE:
The potential for natural resource problems was addressed in response to Item 5. The problems that have the highest probability of occurrence likely involve flowing wells near the boundary of Cooper Mountain. The majority of the wells shown on the Potentially Impacted Public Water Supplies map are a substantial distance away from the project location; therefore, impacts to these wells are expected to be minimal if at all. However, if static water levels are near the ground surface, ASR operation potentially could cause flowing wells at some of these locations. Possible mitigation measures include: (1) shut in flowing wells and equip the shut in wells with pressure gages (as what was done by TVWD northwest of the Grabhorn ASR site), and/or (2) evaluate reducing injection rates and/or volumes at the ASR wells near the flowing well. As the JWC ASR program develops, wells will be added to the monitoring network as needed. At least one of the wells on the map has already been identified as a potential observation well; however, in the future it may be necessary to add additional wells. A monitoring well completed in the overlying sediments may be identified in the site-specific monitoring and test plan for the first ASR well to evaluate whether the sedimentary aquifer shows a response to injection into the basalt aquifer if needed.

ITEM 18:
690-350-0020(3)(b)(E)(ii) Quality of Source Water
Quality of Source Water: Source Water SDWA results reviewed and all looks good.

GSI RESPONSE:
Thank you for the review.

ITEM 19:
690-350-0020(3)(b)(E)(ii) Quality of Source Water
*DBP levels: Is it correct that the Portland Bull Run source water exceeded 50% of the SDWA MCL for DBPs in the November 26, 2007 sample? If so, it is not immediately acceptable as ASR source water as the paragraph asserts. There is a provision in **690-350-0020(3)(b)(E)(ii) through (iv)** to negotiate constituent levels that are between 50 and 100% of the SDWA MCL. Page 16 states that the regulatory criteria for DBPs in ASR source water is 100% of standards. This is not true, criteria is 50% of standards. Please clarify. Page 16 also refers to a 1993 study that states DBPs breakdown rapidly and do not degrade groundwater quality. Are we more confident now than in the past? DBP breakdown can be dependent upon site specifics.*

GSI RESPONSE:
ASR General Provisions, OAR 690-350-0010(6)(e), states that constituents that have a secondary contaminant level or constituents that are associated with disinfection of the water may be injected into the aquifer up to the standards established under OAR 333-061-0030 (ORS 448.131 and 448.273). As noted, DBP breakdown can be dependent on site specific conditions. However, ASR water quality data near Cooper Mountain (TVWD Grabhorn ASR well, City of Tigard's ASR wells, and City of Beaverton's ASR wells) indicate that DBP concentrations tend to be lower in recovered water than in injected source water, and they have historically never exceeded the regulatory standards established under OARA 333-061-0030 (ORS 448.131 and 448.273).

OWRD ITEM 20:
690-350-0020(3)(b)(E)(ii) Quality of Source Water

*Turbidity: Since the source water is surface water (and sometimes unfiltered Bull Run surface water) the list of water quality analyses should include **turbidity**.*

GSI RESPONSE:

Turbidity will be included in the water quality analyses.

ITEM 21:

690-350-0020(3)(b)(F) Quality of Receiving Aquifer Water

Quality of Receiving Water: DHS DWP is comfortable with the use of receiving water quality SDWA results from other nearby ASR projects for the LL Application with the condition that at least one full SDWA testing suite will be conducted at each ASR Well site prior to injection unless otherwise approved.

GSI RESPONSE:

A full SDWA testing suite will be conducted at each ASR well site prior to injection unless otherwise approved.

ITEM 22:

690-350-0020(3)(b)(G) Comments on Compatibility

Matrix degradation: The bottom of Page 17, states that based on previous modeling, well screen clogging is unlikely to occur due to mixing of surface water and groundwater, however, I didn't see where they modeled for potential clogging from matrix degradation due to increased D.O. concentrations.

GSI RESPONSE:

Matrix degradation because of increased dissolved oxygen concentrations was not modeled. Since we do not have whole rock chemistry for the CRBG in the deep target zone we cannot model the reaction between the host matrix and the source water. However, based on more than 10 years of recovered ASR water quality data in the Tualatin Basin, the likelihood of aquifer or screen clogging because of matrix degradation appears to be very low to non-existent. To date, data have not suggested elevated levels of common precipitates such as manganese oxide or iron oxide.

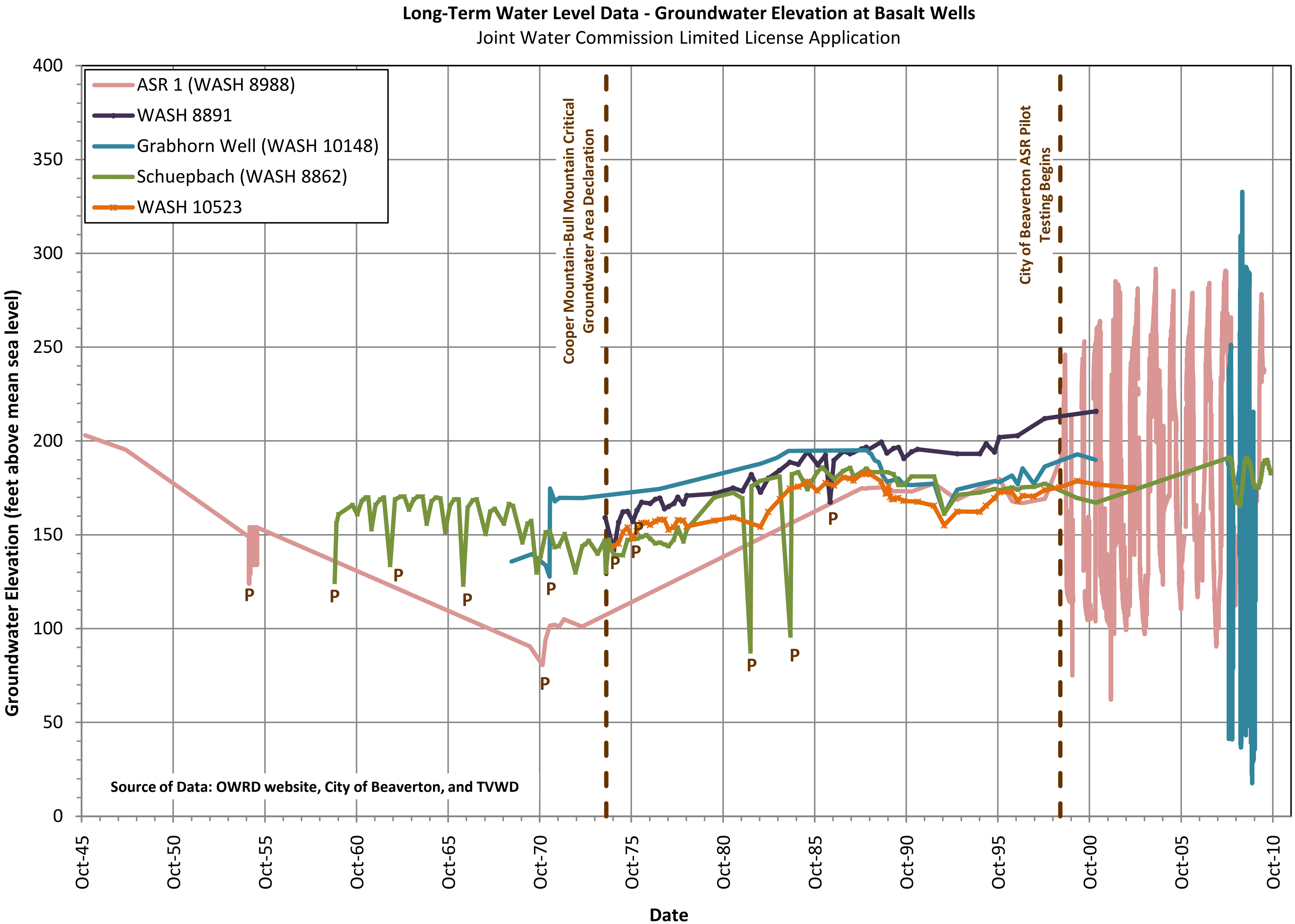
Thank you for your comments,

Larry Eaton, RG	Jason Melady, RG	Rachael Peavler
Principal Hydrogeologist	Project Hydrogeologist	Staff Hydrogeologist

cc: Kevin Hanway, JWC
Niki Iverson, JWC
Jack Arendt, DEQ
Tom Pattee, DHS
David Cole, DEQ
Josh Hackett, OWRD
Karl Wozniak, OWRD
Darrell Hedin, OWRD

REFERENCE:

Burt, W.D., Conlon, T., Tolan, T., Wells, R., and Melady, J., 2009, Hydrogeology of the Columbia River Basalt Group in the northern Willamette Valley, Oregon, *in* O'Connor, J.E., Dorsey, R.J., and Madin, I.P., eds., Volcanoes to Vineyards: Geologic Field Trips through the Dynamic Landscape of the Pacific Northwest: Geological Society of America Field Guide 15, p. 1-40, doi: 10.1130/2009.fld015(31).



Notes:

P = Well was being pumped: OWRD data or inferred due to a large decrease in water level during a short time period.

Large changes in water level observed in ASR 1 after 1998 and Grabhorn after 2007 are due to ASR cycle testing.

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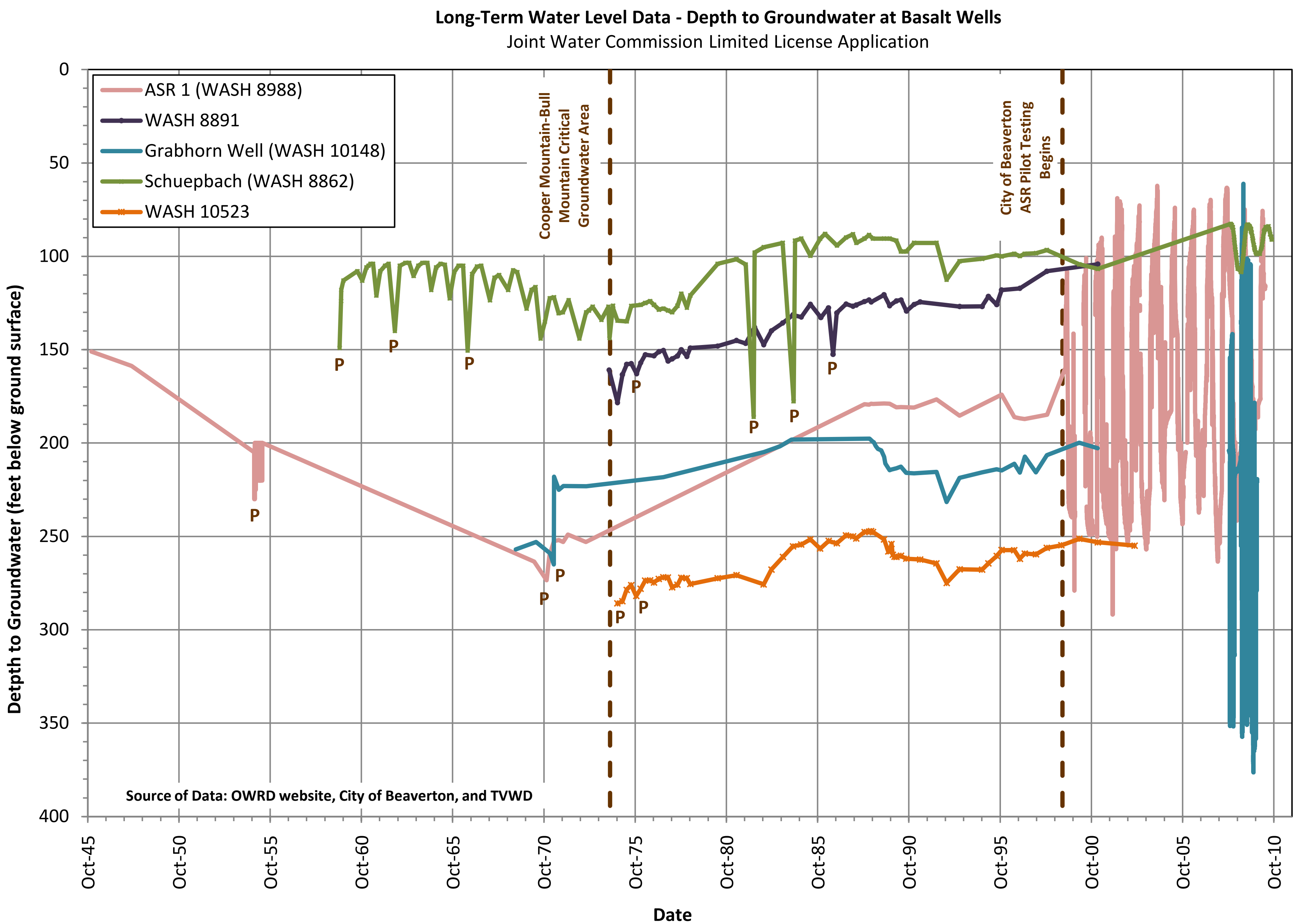

Notes:
P = Well was being pumped: OWRD data or inferred due to a large decrease in water level during a short time period.
Large changes in water level observed in ASR 1 after 1998 and Grabhorn after 2007 are due to ASR cycle testing.

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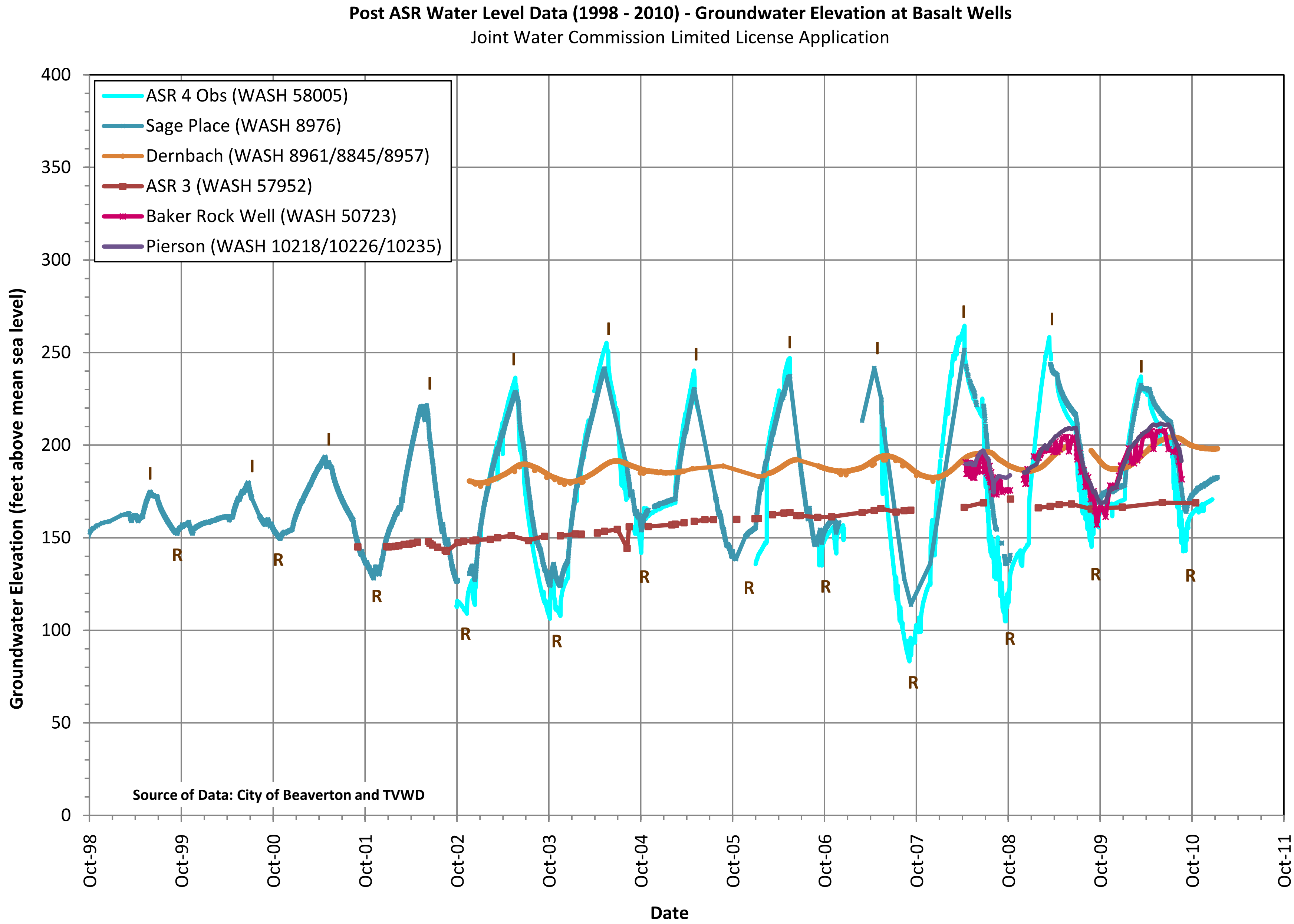
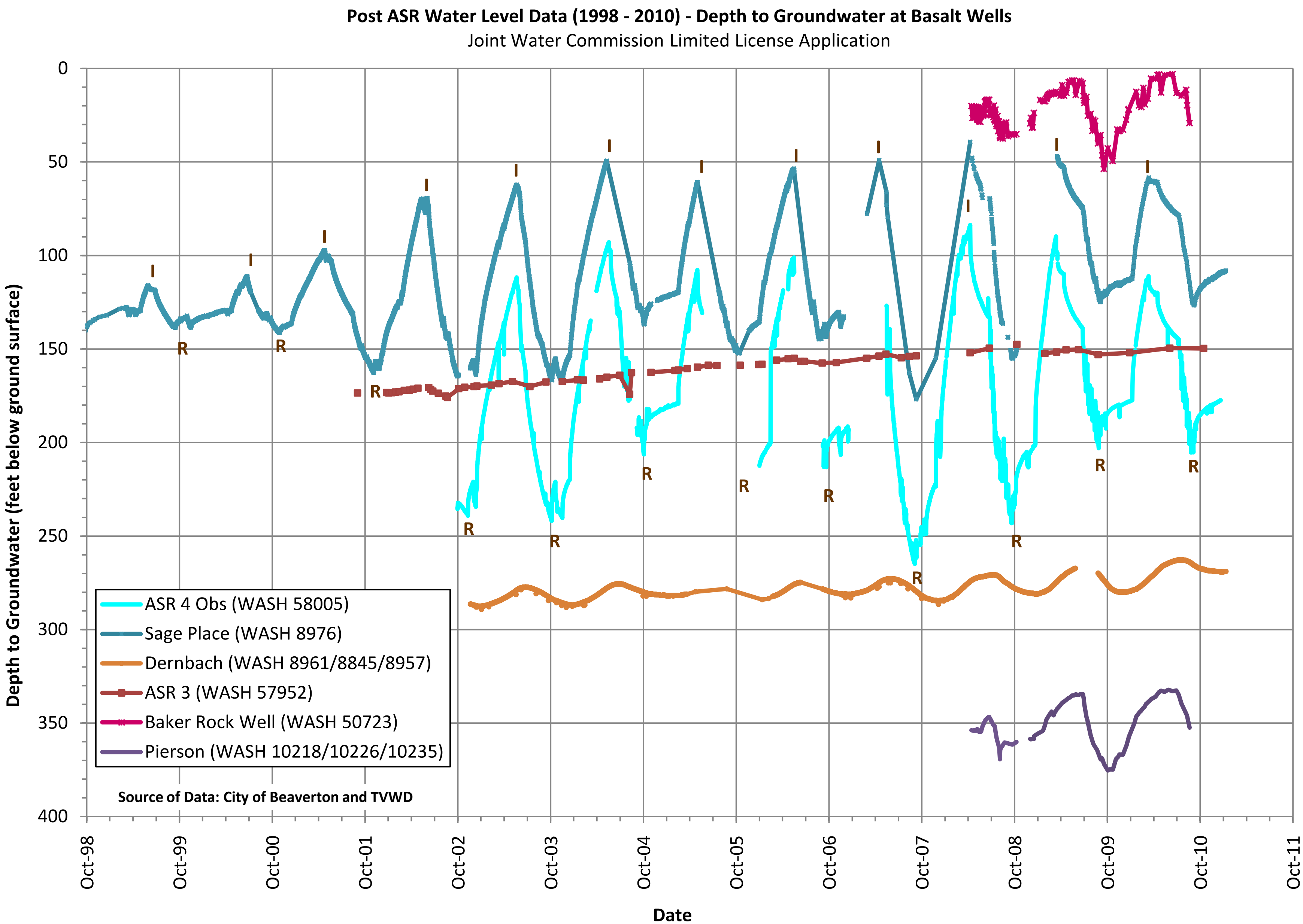


Notes:

Peak and low water levels assoicated with maximum injection (I) and recovery (R) volumes during City of Beaverton, Tigard, and/or TVWD ASR cycle testing.

GSI Water Solutions, Inc.



Notes:
Peak and low water levels assoicated with maximum injection (I) and recovery (R) volumes during City of Beaverton, Tigard, and/or TVWD ASR cycle testing.

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