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Critical Aquifer Recharge Areas Report

MAPLEWOOD (FORMERLY SHAUGHNESSY HEIGHTS WEST)

Redmond, Washington

Prepared For:

IBBO, LLC AND AMALANI, LLC

Project No. KE120383B
October 9, 2015

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October 9, 2015
Project No. KE120383B

IBBO, LLC and Amalani, LLC
105 South Main Street, Suite 230
Seattle, Washington 98104

Attention: Mr. Barry Margolese

Subject: Critical Aquifer Recharge Areas Report
Maplewood (formerly Shaughnessy Heights West)
167th Avenue NE and NE 85th Street
Redmond, Washington

Dear Mr. Margolese:

We are pleased to present the enclosed copies of the referenced report. This report summarizes the results of our hydrogeologic assessment and "Critical Aquifer Recharge Areas Report."

We have enjoyed working with you on this study and are confident that the recommendations presented in this report will aid in the successful completion of your project. Please contact me if you have any questions or if we can be of additional help to you.

Sincerely,
ASSOCIATED EARTH SCIENCES, INC.
Kirkland, Washington

Bruce L. Blyton, P.E.
Senior Principal Engineer

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105 South Main Street, Suite 230
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GENERAL INFORMATION
FOR CRITICAL AREAS REPORT

Proposal Name: Maplewood (formerly Shaughnessy Heights West).

Applicant Name: IBBO, LLC and Amalani, LLC.

Report Prepared by: Curtis J. Koger of Associated Earth Sciences, Inc. Mr. Koger is a licensed geologist, hydrogeologist, and engineering geologist with over 35 years of professional experience including over 25 years in the state of Washington.

Date Prepared: October 2015.

Site Location: See Figure 1. The site is located east of the intersection of 167th Avenue NE and NE 85th Street. The parcel number is: 0125059114. This report specifically addresses proposed development in the western terminus of the parcel.

Development Proposal: See Section 1.1 and Figure 2.

Description of Existing Site: See Section 1.3, "Project and Site Description."

Aerial Photo Showing Site Boundaries and Critical Areas: See Figures 2 and 3 and Civil Drawings.

Site Map: See Figure 2 and Civil Drawings.

Assumptions and Recommendations: See report.

Bibliography: See Section 7.0, "References."

1.0 INTRODUCTION

This report presents the results of Associated Earth Sciences, Inc.'s (AESI's) Critical Aquifer Recharge Area (CARA) evaluation for the proposed Maplewood (formerly Shaughnessy Heights West) residential short plat. This Hydrogeologic Report was completed with an understanding of the site based on a "Conceptual Short Plat" plan prepared by Core Design, Inc. (Core Design) and dated August 27, 2015, and our previous work on the subject property. We have previously performed geotechnical explorations at or near to the subject site, including for our "Subsurface Exploration, Geologic Hazard, and Preliminary Geotechnical Engineering Report, Shaughnessy Heights," dated February 9, 2004, as well as our "Supplementary Subsurface Explorations and Geotechnical Engineering Study, Shaughnessy Heights," dated October 13, 2006, and are therefore familiar with the underlying soils. We have also previously prepared a "Critical Aquifer Recharge Area" report for the entire parcel (King County Parcel No. 0125059114), dated October 15, 2012.

The site location is shown on the "Vicinity Map," Figure 1. The site topography and approximate locations of the explorations completed during our previous studies are presented on the "Site and Exploration Plan," Figure 2. In the event that any changes in the nature, design, or locations of the proposed improvements are planned, the conclusions and recommendations contained in this report should be reviewed and modified, or verified, as necessary.

1.1 Project and Site Description

The project site is the northwest rectangular terminus of an undeveloped property located at the southeast corner of the intersection of 167th Avenue NE and NE 85th Street in Redmond, Washington (Figure 1). The total site area being developed is 28,196 square feet (0.65 acres).

The ground surface elevation ranges from 70 feet above mean sea level (amsl) in the southwest corner of the site to 125 feet amsl in the east portion of the site. The ground surface generally slopes to the west/southwest across most of the site. There is a faint, remnant stream channel, located in the eastern portion of the site, oriented roughly northeast-southwest, that creates a linear localized depression. Vegetation on the property consists of both large evergreen and deciduous trees with a moderately dense understory of ferns, low brush, vines, blackberries, and small saplings.

We understand that the project would include dividing the site into eight lots for construction of new multistory townhomes with a central north-south trending driveway that exits onto 167th Avenue NE. The townhomes would have partial below grade levels. Based on finished floor elevations of the townhomes shown on the "Conceptual Short Plat" plan we expect cuts from 10 to 15 feet will be required to reach final grades. Temporary slopes or shoring may be

needed along the northern property boundary next to the City of Redmond right-of-way. We understand that low impact development stormwater features such as a green roof or rain garden are being considered for the project. An evaluation of the feasibility of on-site infiltration will be prepared under a separate geotechnical report. The residential development will be provided with water and sewer service from the City of Redmond Public Works Department. As described in the "Short Plat Notice of Decision" letter prepared by the City, dated August 30, 2012, the project lies within the Downtown Redmond Regional Stormwater Facility Basin.

1.2 Purpose and Scope

The purpose of this study was to evaluate hydrogeologic conditions for the site under existing and developed conditions and prepare a CARA report, in accordance with *Redmond Zoning Code* (RZC) Appendix 1, Sections A and F, "Critical Areas Reporting Requirements," 2014.

In accordance with Appendix 1, Sections A and F, a Level 1 CARA is required for this site because it is located within Wellhead Protection Zone 2. The location of the site with respect to the City's Wellhead Protection Zones is shown on Figure 3, "Wellhead Protection Zones Map." In addition, a Level 2 hydrogeologic assessment is required because the proposed development will result in at least 5,000 square feet of impervious surfaces. The Level 1 CARA report shall include the following information:

1. Available information regarding geologic and hydrogeologic characteristics of the site, including the surface location of all critical aquifer recharge areas located on-site or immediately adjacent to the site, and permeability of the unsaturated zone.
2. Ground water depth, flow direction, and gradient based on available information.
3. Currently available data on wells and springs within 1,300 feet of the project area.
4. Locations of other critical areas, including surface waters, within 1,300 feet of the project site.
5. Available historic water quality data for the area to be affected by the proposed activity.
6. Best management practices (BMPs) proposed to be utilized.

The Level 2 hydrogeologic assessment shall include the following site- and proposal-related information:

1. Historic water quality and elevation data for the area to be affected by the proposed activity compiled for at least the previous 5-year period.
2. Ground water monitoring plan provisions.

3. Discussion of the effects of the proposed project on the ground water quality and quantity, including:
    a. Predictive evaluation of ground water withdrawal effects on nearby wells and surface water features.
    b. Predictive evaluation of contaminant transport based on potential releases to ground water.
    c. Predictive evaluation of ground water (recharge, elevation, dewatering feasibility, constructability, discharge permitting, etc.) on the proposed project.
4. Identification of the type and quantities of any deleterious substances or hazardous materials that will be stored, handled, treated, used, produced, recycled, or disposed of on the site, including but not limited to materials, such as elevator lift/hydraulic fluid, hazardous materials used during construction, materials used by the building occupants, proposed storage and manufacturing uses, etc.
5. Proposed methods of storing any of the above substances, including containment methods to be used during construction and/or use of the proposed facility.
6. Proposed plan for implementing Protection Standards During Construction (RZC 21.64.050(D)(3)(f).
7. A spill plan that identifies equipment and/or structures that could fail, resulting in an impact. Spill plans shall include provisions for regular inspection, repair, and replacement of structures and equipment that could fail.
8. A complete discussion of past environmental investigations, sampling, spills, or incidents that may have resulted in or contributed to contaminated soil or ground water at the site. Attach copies of all historical and current reports and sampling results.

Our study included review of available geologic and hydrogeologic literature and assessment of geologic, ground water, and soil conditions, including the type, thickness, distribution, and physical properties of the subsurface sediments and ground water. One exploration pit and one exploration boring were previously completed in the Maplewood project as part of the original Shaughnessy Heights project (Appendix A) (AESI, 2004 and 2006). Two additional exploration pits were completed in the larger Shaughnessy West parcel, but outside of the proposed Maplewood site boundaries.

AESI reviewed several documents related to water levels and water quality of the City of Redmond monitoring and production wells. These documents include reports prepared by GeoEngineers (GeoEngineers, 2008a, 2008b, 2008c, 2010, 2012a through 2012f, and 2013), ground water data tables for wells within the 1,300-foot radius provided by the City, a report on the construction of Production Well No. 4 prepared by CH2MHill (CH2MHill, 1996), and a wellhead protection report prepared by Parametrix et al. (1997). The full references of the

reports cited above are listed in Section 7.0 of this report. AESI reviewed monitoring wells and limited water well reports obtained from the Washington State Department of Ecology (Ecology) (Appendix B). Additionally, AESI reviewed water quality results for wells located within 1,300 feet of the site obtained from the Washington State Department of Health (DOH), Division of Environmental Health, Office of Drinking Water (ODW). These results are summarized in Appendix C.

1.3 Authorization

Authorization to proceed with this study was granted by Mr. Barry Margolese of Amalani, LLC. Our study was accomplished in general accordance with our proposal dated September 14, 2015. This report has been prepared for the exclusive use of IBBO, LLC and Amalani, LLC and their agents for specific application to this project. Within the limitations of scope, schedule, and budget, our services have been performed in accordance with generally accepted hydrogeologic practices in effect in this area at the time our report was prepared. No other warranty, express or implied, is made.

1.4 Summary of Findings

The current proposed Maplewood project would include dividing the 0.65-acre property into eight lots for the proposed construction of new multistory townhomes. Access to the site will be from 167th Avenue NE. The residential development will be provided with water and sewer service from the City. The project site lies within the Downtown Regional Stormwater Facility; therefore, if on-site stormwater infiltration is not implemented, stormwater runoff from the site will be conveyed to the City's regional stormwater facilities for water quantity and quality control.

Site explorations completed for this and previous phases of study and nearby well logs indicate that the subject property is underlain by Vashon recessional outwash, Vashon glacial till, and fine-grained pre-Fraser deposits. The site lies immediately adjacent to the Sammamish River valley which contains an extensive alluvial aquifer within the shallow Quaternary alluvium and Vashon recessional outwash sediments. Although ground water was encountered at depth in one on-site exploration (EB-6), it is our opinion that this ground water is in an older geologic unit and is beyond the limits of the shallow alluvial aquifer of the Sammamish River valley.

The wells identified within the 1,300-foot search radius consist of four City of Redmond ground water monitoring wells and four private monitoring wells. Additional water and monitoring wells and two City drinking water supply wells were identified outside of the 1,300-foot search radius. All the water wells located in the site vicinity are constructed in the alluvial aquifer. City water supply wells No. 1, 2, 3, and 5 are located upgradient from the site. City water supply well No. 4 is located about 3,000 feet downgradient from the site. Based on available data, the

project site does not lie within the 100-foot sanitary control radius of any off-site water supply wells. It is our opinion that none of the wells within the 1,300 feet or in the site vicinity will be adversely impacted by the proposed Maplewood residential development.

2.0 METHODOLOGY

2.1 Data Review

AESI reviewed available soil, ground water, and geologic data to gain an understanding of existing conditions in the study area. Information reviewed included the following:

- Previous reports and maps prepared by AESI for the subject property, including "Subsurface Exploration, Geologic Hazards, and Preliminary Geotechnical Engineering Report, Shaughnessy Heights," dated February 9, 2004 (AESI 2004), "Supplementary Subsurface Explorations and Geotechnical Engineering Study, Shaughnessy Heights," dated October 13, 2006 (AESI 2006), "Phase I Environmental Site Assessment, Shaughnessy Heights," dated June 17, 2011 (AESI 2011), "Geotechnical Findings and Recommendations, Downspout Infiltration Suitability Assessment, Shaughnessy Heights West," dated September 26, 2012 (AESI 2012a), "Critical Aquifer Recharge Areas Report, Shaughnessy Heights West," dated October 15, 2012 (AESI, 2012b);
- Previous reports and maps prepared by AESI for nearby properties;
- Core Design, "Conceptual Short Plat" (Sheet 1 of 1);
- Reports and maps published by the United States Geological Survey (USGS) and the Washington State Department of Natural Resources (WDNR), Division of Geology and Earth Resources, King County, ODW, and Ecology;
- City of Redmond Wellhead Protection Program;
- Well logs obtained from the online Ecology and King County databases;
- King County Groundwater Program;
- DOH and City of Redmond water quality data;
- DOH Source Water Assessment Program (SWAP) online database.

Selected citations for documents used during this study are contained in the "References" section of this report.

2.2 Field Studies

In 2004, AESI conducted a site reconnaissance and observed the excavation of 10 exploration pits completed across the original 17.5-acre "Shaughnessy Heights" project area (AESI, 2004), which includes the 0.65-acre area currently being proposed for development. In 2006, AESI drilled five exploration borings in the vicinity of several steep slopes located within the original "Shaughnessy Heights" project area (AESI, 2006). Exploration EP-10 was located in the area of the currently proposed Maplewood Lot 2, and exploration boring EB-4 was completed near the southeast corner of proposed Lot 8. For our current phase of study, an additional two exploration borings (EB-5 and EB-6) were advanced along the north property line, in proposed Lot 4 and east of proposed Lot 5. The locations of the explorations are shown on Figure 2. The various types of materials and sediments encountered in the explorations, as well as the depths where characteristics of these materials changed, are indicated on the exploration logs presented in Appendix A of this report.

2.3 Hydrogeologic Analysis

A conceptual hydrogeologic model of the site was developed to address depth to water, seasonal fluctuations, aquifer flow direction, recharge and discharge, hydrostratigraphy, and potential interaction between shallow and deeper aquifers. Our analysis also included evaluation of available water quality information from water wells within 1,300 feet of the site, identification of deleterious substances of hazardous materials that will be used, stored, or disposed of on-site, and an evaluation of potential impacts to ground water quality and quantity from the proposed residential development.

2.3.1 Well Log Review

Ecology and King County online databases were reviewed to obtain available water well logs for wells located within 1,300 feet of the subject property. Monitoring well logs and well construction information were also obtained from the City's Wellhead Protection Program reports prepared by GeoEngineers as noted previously. The wells are approximately located on Figure 4, "Well Location Map," and copies of the logs are included in Appendix B. Selected wells located beyond the 1,300-foot radius are also shown on Figure 4. A review of these logs is presented in Section 4.1, which evaluates potential impacts to off-site wells from the proposed residential development.

2.3.2 Water Quality Analysis

The water quality analysis included an evaluation of available water quality information from wells within 1,300 feet of the project site; BMPs to prevent degradation of the area aquifers; identification of deleterious substances or hazardous materials that will be used, stored, or

disposed of on-site due to development of the site; and an evaluation of potential impacts on water quality due to potential releases to ground water. Water quality data was obtained from the DOH online Sentry database, the King County Ground Water Protection Program, and from the City's Wellhead Protection Program

3.0 EXISTING CONDITIONS

3.1 Physical Setting and Topography

As shown on Figure 1, the site is generally located on the southwestern flank of a broad upland area, referred to as Education Hill, which is bounded to the west by the Sammamish River valley and to the south and east by the Bear Creek valley. The site is located immediately upslope and adjacent to the eastern edge of the Sammamish River valley, northeast of downtown Redmond. The Sammamish River is located about 3,500 feet west of the site. Topographic features in the vicinity of the site were formed by glacial and post-glacial processes. The project site is located within the Sammamish River valley basin at approximate ground surface elevations ranging from 70 feet amsl in the southwest to 125 feet amsl in the east.

3.2 Regional and Project Geology

Our interpretation of the geologic/hydrogeologic conditions in the vicinity of the project site is based on a review of selected information in the available literature, water well reports for wells located in the surrounding area, and our experience on numerous hydrogeology projects in the site vicinity. A geologic map of the site vicinity, adapted from Booth et al. (2006), is shown on Figure 5, "Regional Surficial Geologic Map." Figure 4 shows approximate water well locations near the site; approximate ground water surface of the Sammamish River valley alluvial aquifer is presented on Figure 6 "Ground Water Surface Contour Map." The well reports used during this study are presented in Appendix B. A geologic cross-section through the site, based on our explorations, is presented in Figure 7.

Stratigraphic units in the vicinity of the site have been subdivided into Upland Deposits and Valley Deposits. The stratigraphic units were determined with regard to the following parameters: 1) stratigraphic position, 2) composition, and 3) importance of the unit in terms of the presence of ground water. The interpreted subsurface stratigraphy of the site and uplands plateau area are in general agreement with that presented in the City of Redmond "Wellhead Protection Report, Redmond, Washington" (Parametrix et al., 1997) and other published geologic maps for the area, including the *Geologic Map of the Redmond Quadrangle, Washington* (Minard and Booth, 1988), and the *Geologic Map of King County, Washington* (Booth et al., 2006). Similar stratigraphic sequences have been observed in the Sammamish River valley and the adjacent uplands as described in the City of Redmond "Wellhead Protection

Report" (Parametrix et al., 1997), and were identified in previous hydrogeologic evaluations by AESI in the project vicinity.

3.2.1 Upland Deposits

The following sections include a discussion of the geology of the upland plateau on which the site is located. The subject site is located at the southwestern base of the upland plateau. All of the water wells identified within the 1,300-foot search radius are located within the Sammamish Valley. Geology described in the well logs for these wells is described in Section 3.2.2, "Valley Deposits."

According to reports published by the City of Redmond (Parametrix et al., 1997) and other published geologic maps for the area, including *Geologic Map of the Redmond Quadrangle, Washington* (Minard and Booth, 1988), the *Geologic Map of King County, Washington* (Booth et al., 2006), and the *Geologic Map of the Redmond Bear Creek Area* (Booth, Troost, and Wisher, 2007), the Redmond plateau is mantled by Vashon lodgement till (Figure 5). Areas of Vashon recessional outwash are mapped near the base of the slope. Pre Fraser deposits are also mapped on the slopes of the plateau in the vicinity of the site.

Vashon Recessional Outwash

This unit was encountered below the surficial topsoil layer at the locations of exploration pit EP-10 and borings EB-5 and EB-6. These sediments generally consisted of loose to medium dense, tan to brown sand, with variable amounts of silt and gravel. The upper 1½ to 2½ feet of this unit in EP-10 was weathered to a tannish-orange color. The recessional outwash sediments were deposited by meltwater streams emanating from the retreating glacial ice during the latter part of the Vashon Stade of the Fraser Glaciation, approximately 12,500 years ago. This unit generally extended to a depth of 5 feet, but at the location of exploration boring EB-6, it extended to a depth of approximately 9.5 feet. Recessional outwash sediments were not encountered in boring EB-4. No ground water seepage was observed within the recessional outwash at the time of our field studies.

Vashon Lodgement Till

Sediments interpreted as Vashon lodgement till were encountered below the recessional outwash in EP-10, EB-5, and EB-6, and at ground surface in EB-4. The sediments consisted of medium dense to very dense, tan silty sand with variable amounts of gravel, and displayed an unsorted texture. Vashon lodgement till was deposited at the base of an active continental glacier and were subsequently overrun and compacted by about 3,000 feet of glacial ice in the project area during the Vashon Stade of the Fraser Glaciation, approximately 15,000 years ago.

Possession (?) Glaciomarine

These sediments were encountered below the Vashon lodgement till deposits in borings EB-5 and EB-6. These sediments generally consisted of very stiff to hard, unsorted bluish gray silt to sandy silt with scattered dropstones, which exhibited a somewhat fractured texture, were slightly moist to moist, and reacted chemically with hydrochloric acid. These sediments are tentatively interpreted to be representative of Possession-aged deposits, which were possibly deposited in a marine environment. This unit has been glacially consolidated. Ground water was not encountered in these deposits.

Possession (?) Drift

Sediments encountered below the Possession (?) glaciomarine at the location of boring EB-6, and below the Vashon lodgement till in EB-4 consisted of very dense, stratified silty sand and sandy silt with trace gravel. These sediments are tentatively interpreted to be representative of Possession-age drift deposits. These sediments were subsequently overridden by the Possession ice sheet and consolidated.

Ground water was encountered in this unit in boring EB-6 at a depth of 25 feet below ground surface (bgs) (approximately 82 feet amsl). Since our exploration boring was completed at a depth of 26.5 feet bgs, it is unknown whether the water encountered in the 25-foot sample is representative of a ground water table within the drift, or is simply residual water in a slightly sandy interbed within the unit.

3.2.2 Valley Deposits

The subject site is located primarily at the base of an upland plateau that borders downtown Redmond to the northeast. The Valley Deposits described in this section were not encountered in the explorations completed by AESI at the site.

All of the wells within the 1,300-foot search radius are located within the Sammamish Valley. The subject site is located on a slope on the east side of the valley. According to the City of Redmond "Wellhead Protection Report" (Parametrix et al., 1997) and published geologic maps (Minard and Booth, 1988; Booth et al., 2006), Quaternary alluvium and Vashon recessional outwash deposits lie at the ground surface in the floor of the Sammamish Valley. These two geologic units were deposited in valleys that remained after the Vashon glacier retreated at the end of the Vashon Stade of the Fraser Glaciation. These sediments were not compacted by the glacial ice and are generally medium dense. Based on regional information, a thick sequence of fine-grained pre-Fraser sediments appear to be continuous throughout the subsurface near the site. The unit is generally described as firm, gray to blue clay and clayey sand, which ranges from approximately 200 to 275 feet thick (Parametrix et al., 1997; Booth et al., 2006). Beneath

the upland areas surrounding the Sammamish Valley, pre-Fraser deposits underlie a thick sequence of Vashon recessional outwash, Vashon lodgement till, and Vashon advance outwash sediments. In the valley floor, however, it appears the lodgement till and advance outwash units have been eroded away and are no longer present, leaving the alluvium/recessional outwash directly underlain by older pre Fraser sediments.

According to the City of Redmond "Wellhead Protection Report" (Parametrix et al., 1997) and regional geologic mapping (Booth et al., 2006), Quaternary alluvium and Vashon recessional outwash deposits lie at the ground surface on the floor of the Sammamish River valley immediately west/southwest of the site. These two geologic units were deposited in valleys that remained after the Vashon glacier retreated at the end of the Vashon Stade of the Fraser Glaciation. According to these reports, the shallowest Quaternary alluvium consists of relatively fine-grained sand, silt, clay, and organic matter. The Vashon recessional outwash, or a related glacial outwash deposit, appears to underlie the alluvium in the Sammamish River and lower Bear Creek valley floors near downtown Redmond and consists of clean sand and gravel. Ground water was not encountered in the Vashon recessional outwash sediments encountered on-site; however, the alluvium/recessional outwash sediments immediately west/southwest of the project site contain the "alluvial aquifer." The overall thickness of this unit is typically about 70 feet. These sediments were not compacted by the glacial ice.

3.3 Hydrogeology

Water that is present in the pore spaces and sediments is part of the hydrologic cycle. In the natural state, the hydrologic cycle begins with infiltration of precipitation (recharge) and ends with discharge to springs, streams, wetlands, and/or wells. Under natural conditions, ground water recharge and discharge may shift with climatic cycles, but remain in overall balance. Ground water will flow under saturated conditions, preferentially through materials with greater porosity and permeability, such as clean gravels and sands. Where geologic conditions limit discharge, ground water accumulates in such permeable zones, which, if they can support production from wells, are termed aquifers. The sustainability of wells, or the long-term aquifer capacity, depends on the extent of the aquifer, its rate of recharge, and the amount of withdrawal by producing wells. Withdrawal of ground water by wells diverts a part of the ground water cycle, resulting in adjustments to natural recharge, discharge, or both.

Copies of selected well/boring logs are presented in Appendix B. The approximate locations of these logs are shown on Figure 4, "Water Well Location Map". Most of the locations are considered accurate since they are part of the City of Redmond monitoring well and production well systems. However, there is only limited resolution provided by the well reports from Ecology which typically allows water users to be located only within the nearest quarter-quarter section. It should also be noted that the Ecology well reports are prepared by non-geologists and standardized geologic descriptions are not commonly utilized. Locations of the City of

Redmond water supply wells are presented in City of Redmond Wellhead Protection Program reports and in monitoring reports prepared by GeoEngineers (Well Nos. 1 through 5). All of the City of Redmond production wells were determined to be outside the 1,300-foot radius.

Ground water was not encountered in any of the on-site explorations, with the exception of a small amount of water within the Possession (?) Drift unit observed in EB-6. However, based on the information obtained to date (existing literature and on-site explorations), the principal ground water "regime" in the site vicinity is the alluvial aquifer. The alluvial aquifer has a limited hydrologic connection to the pre-Fraser ground water we encountered. The vertical and lateral occurrence of the alluvial aquifer is in general agreement with that presented in the City's "Wellhead Protection Report" (Parametrix et al., 1997).

3.3.1 Alluvial Aquifer

The project site is situated adjacent to a regional aquifer located within the surficial Quaternary alluvium and Vashon recessional outwash deposits within the Sammamish River valley, referred to as the "alluvial aquifer." All of the City monitoring wells within 1,300 feet of the site are interpreted to be completed within the alluvial aquifer. A summary table of water level data obtained from the City of Redmond for monitoring wells within the 1,300-foot search radius is included in Appendix D. The following is a summary of the alluvial aquifer characteristics in the immediate vicinity of the site:

- The alluvial aquifer is unconfined and generally comprised of fine-grained sand, silt, clay, and organic matter, grading to clean sand and gravel (Parametrix et al., 1997). The alluvial aquifer deposit is typically about 70 feet thick, but only an average of 30 feet is highly transmissive.
- The upland areas surrounding the Sammamish River valley form lateral boundaries that constrain ground water flow within the alluvial aquifer.
- The depth to ground water in the alluvial aquifer is variable. Based on the static water levels reported on the well logs, the depth to water in the alluvial aquifer ranges from approximately 8.5 to 18 feet west of the site (Table 1-D included in Appendix D).
- Based on information provided in the City's "Wellhead Protection Report," the transmissivity of the alluvial aquifer is highly variable, ranging from 5,300 to 105,000 square feet per day (feet^2/day) (Parametrix et al., 1997).
- Ground water flow in the alluvial aquifer is parallel to the streams that deposited the outwash and alluvium. The ground water flow direction in the alluvial aquifer adjacent to the site is to the northwest based on water level elevations from the City's monitoring well network and regional information (GeoEngineers, 2012; Parametrix, et al., 1997). A copy of GeoEngineers January 2013 "Ground Water Surface Contour Map" is presented on Figure 6.

- The hydraulic gradient (slope) of the surficial aquifer in the Sammamish Valley in the immediate vicinity of the site is approximately 25 feet per mile based on the GeoEngineers "Ground Water Surface Contour Map" from January 2013, (Figure 6).
- The alluvial aquifer is primarily recharged by the direct infiltration of precipitation and to a lesser degree by ground water through-flow from the upgradient portion of the surficial aquifer.
- The alluvial aquifer is interpreted to be hydraulically connected to area surface water features; however, the degree of connection is unknown and may vary seasonally.
- Based on information presented in the "Wellhead Protection Report," in the immediate vicinity of the site, the total estimated ground water recharge to the alluvial aquifer from precipitation is 26 inches per year (Parametrix, et al., 1997).
- The alluvial aquifer is interpreted to be underlain by over 200 feet of clay, which forms the base of the alluvial aquifer (Parametrix et al., 1997).

4.0 PROJECT IMPACTS AND MITIGATIONS

The following sections provide information regarding the potential impacts the Maplewood residential development project will have on the surrounding properties and local ground water.

4.1 Summary of Nearby Well Systems

As shown on Figure 4, four City monitoring wells (Well No. 006, 007, 331, and 340) and four private monitoring wells have been identified within 1,300 feet of the site (search radius). No Group A water systems were identified within the search radius. An additional two geothermal wells are located within the general site vicinity but beyond the 1,300-foot radius, shown on Figure 4 for reference. All City water supply wells are located greater than 1,800 feet from the site. The City and Ecology monitoring well logs for each of the wells are included in Appendix B. Summaries of the well construction details for the wells located within the 1,300-foot search radius are provided below.

4.1.1 Group A Municipal Wells (City of Redmond Production Wells Nos. 1, 2, 3, 4, and 5)

Based on GeoEngineers 2013 memorandum, these water supply wells are located more than 1,300 feet from the site and, with the exception of Well 4, are upgradient of the site as shown on Figure 7. Due to their upgradient and distant locations, no adverse impacts to these wells would occur due to redevelopment of the site. Well 4 is about 3,000 feet downgradient of the subject site. It is our opinion that no adverse impacts to this well would occur due its distant location from the site.

4.1.2 City of Redmond Monitoring Wells

A total of four City of Redmond monitoring wells were identified within the 1,300-foot radius of the property. These wells are used to monitor water quality and/or water levels. None of these wells are used to supply drinking water. Additionally, all are completed in the alluvial aquifer, which does not appear to be present on the subject property. Copies of well logs are included in Appendix B.

4.1.3 Private Monitoring Wells

Four private monitoring wells were identified within the 1,300-foot radius of the property. These wells were installed on private property by the landowner, typically to monitor water quality and/or water levels. To our knowledge, based on Ecology well log data, none of these wells are used to supply drinking water. Additionally, all are competed in the alluvial aquifer, which is not present on the subject property. Copies of the well logs are included in Appendix B.

4.1.4 Surface Water Features

No springs were identified within 1,300 feet of the site. The nearest surface water body is a small, unnamed Class IV stream located on the eastern portion of the project site. The Sammamish River is located approximately 3,500 feet west of the site and Bear Creek is located approximately 3,750 feet south of the site.

4.1.5 Impacts to Nearby Wells

Based on the available data, the project site does not lie within the 100-foot sanitary control radius of any public or domestic water supply wells.

To our understanding, the drainage plan has not yet been finalized but on-site infiltration is being considered. We anticipate that if infiltration is feasible, only clean roof runoff would be directed to the infiltration facilities. If 100-percent infiltration is not feasible, the excess stormwater would be conveyed to the City of Redmond stormwater system as described previously.

It is our opinion that none of the wells within 1,300 feet of the site will be adversely impacted by the proposed improvements since the proposal is protective of ground water quality by conveying only clean roof runoff directly into the potential infiltration facilities, and conveying all stormwater originating from potential pollution-generating land uses to the City stormwater system for water quality treatment.

4.1.6 Impacts to Surface Water

It is our opinion that none of the surface water features within 1,300 feet of the site will be adversely impacted by the proposed improvements since the proposal is protective of ground water quality by conveying only clean roof runoff directly into the potential infiltration facilities, and conveying all stormwater originating from potential pollution-generating land uses to the City stormwater system for water quality treatment.

4.2 Water Quality Results for Nearby Wells

King County and ODW water quality records were searched to identify any water quality information for wells within 1,300 feet of the project boundary. Water quality data was obtained from City of Redmond for the City monitoring wells. The water quality data are provided in Appendix C and are summarized below.

- **Metals:** Arsenic and manganese were detected in monitoring wells MW006 and MW007 during some monitoring events. For MW007, none of these results are above the published maximum contaminant level (MCL) used by the DOH based on Chapter 246-290 WAC and Ecology criteria based on *Washington Administrative Code* (WAC) Chapter 173-200. Some of the arsenic concentrations ranged above the Ecology MTCA criteria but were below the DOH MCL. Multi-metal concentrations in MW006 and manganese concentrations in MW007 exceeded the DOH MCL, however, the MCL for manganese reflects aesthetic values and is not considered a health concern. The exceedances are summarized in Table 1-C (Appendix C). As described in the report published by GeoEngineers for the City of Redmond (GeoEngineers, 2010), these metals are part of the natural sand and gravel aquifer and are not considered to be anthropogenic sources.

We did not find any evidence of off-site contaminated ground water that could be adversely impacted by the proposed site development. A review of the DOH SWAP online database indicates that there are no known potential contamination sources within the search radius at the time our study was completed. In addition, according to a review of our "Phase I Environmental Site Assessment, Shaughnessy Heights" report dated June 17, 2011, there are no known soil or ground water contamination sources in the site vicinity (AESI, 2011).

5.0 GROUND WATER QUANTITY AND QUALITY IMPACTS AND MITIGATION

The proposed Maplewood project will avoid significant adverse impacts to downgradient water resources by implementing required stormwater management controls. The proposed modern stormwater management controls described in the following sections of this report are

considered BMPs for keeping surface water flows at natural levels, maintaining ground water recharge, and mitigating water quality impacts to surface water and ground water in accordance with WAC Chapter 173.200 and 173.201A (WAC, 2014).

The following sections describe how the stormwater conveyance systems and selected BMPs will protect area ground water resources. The specific stormwater treatment and site construction BMPs that will protect ground water resources are described below.

5.1 Water Quantity Considerations

Water, sanitary sewer, and stormwater service for the project will be provided by the City of Redmond. Although the drainage plan is not finalized, we anticipate minimal, if any, on-site infiltration of clean roof runoff. Excess stormwater will be conveyed to the existing City off-site stormwater service. There is currently no ground water withdrawal related to the existing property. There is no evidence indicating that ground water levels will be adversely impacted by the improvement project. Therefore, there will be no project-related withdrawal effects on nearby wells and surface water features, in our opinion.

5.2 Water Quality Considerations

This section provides an assessment of water quality considerations associated with the proposed project. This assessment includes an evaluation of potential pollutants, fate and transport considerations, and mitigating measures that will be included in the proposed project.

Pollutants generated during construction may include suspended solids and trace petroleum hydrocarbons. These materials will not adversely impact the ground water in AESI's opinion. Following construction, the two primary sources of pollutants include roadways and minimal landscaping chemicals. Roadway runoff may include trace petroleum hydrocarbons and trace metals. Landscaping chemicals may include fertilizers, pesticides, and herbicides.

General fate and transport for each of the pollutants identified above includes the following:

- Suspended solids (including heavy metals in a particulate form) are removed by filtration within several inches of the ground surface.
- Heavy metals in the dissolved form are strongly sorbed to soil particles and do not typically migrate more than several inches through the soil column.
- Dilute concentrations of petroleum hydrocarbons (typical of roadway runoff) are readily degradable in the natural environment. The potential for petroleum hydrocarbons will be highest on the pavement surfaces of the private roadway. Water runoff from the pavement will be directed to the City stormwater system.

- Most modern pesticides and herbicides are strongly sorbed in the soil column and/or readily degraded in the natural environment.
- Fertilizers contain nitrogen that can be present as nitrate (or other forms of nitrogen) and may migrate into the soil column. The nitrogen is utilized by plants and microbes in the soil column and either incorporated into plant material or converted to nitrogen gas.

The proposed project will avoid significant adverse impacts to downgradient water resources by implementing required stormwater management controls. Modern stormwater management controls are considered BMPs for keeping surface water flows at natural levels, maintaining ground water recharge, and mitigating water quality impacts to surface water and ground water.

There are no identified drinking water wells within 1,300 feet of the site. City Water Supply Wells #1 and #2 are located outside of the 1,300-foot radius and they are located upgradient from the site. Therefore, there are no potential water quality impacts to nearby water supply wells from the proposed residential short plat development. In addition, all wells are constructed with well seals to prevent local surface contamination of the sources. Since the proposed development is limited to residential land use, quantities of deleterious substances and hazardous materials are unlikely to exceed standard household quantities. In summary, the available data indicate there is no potential for the proposed project to cause a significant adverse impact to water quality.

Hazardous materials that will be stored on site during construction of the Maplewood development include: gasoline, diesel, hydraulic fluid, machine oil, and paint. A spill prevention and response plan for the proposed development during construction is summarized below, and provided in Appendix E. The spill plan is in accordance with the City of Redmond Protection Standards During Construction RZC 21.64.050 (D)(3)(f).

General Hazardous Material Storage and Spill Prevention

- Ensure all hazardous substances are properly labeled.
- Store, dispense, and/or use hazardous substances in a way that prevents releases.
- Provide secondary containment when storing hazardous substances in bulk quantities (approximately 55 gallons).
- Maintain good housekeeping practices for all chemical materials at the facility.
- Routine/Daily checks in the hazardous substance storage area to be performed by a future person on-site to be named at the commencement of work.

- Monthly inspections of the hazardous substance storage area, secondary containment, and annular space (interior cavity of double wall tank) on any Aboveground Storage Tanks (AST) or Underground Storage Tanks (UST) need to be logged in this plan.
- In general, most substances stored on-site will be minimal in size, such as 5-gallon gasoline cans. Large volume spills are not anticipated involving the work on this site.

Spill Containment

- The general spill response procedure at this facility is to stop the source of the spill, contain any spilled material and clean up the spill in a timely manner to prevent accidental injury or other damage.
- Small spills will be contained by site personnel if they are able to do so without risking injury. Spill kits will be located at the job site safety office

Emergency Procedures

- Immediately call **911** in the event of injury, fire or potential fire, or spill of a hazardous substance that gives rise to an emergency situation.
- Spill cleanup for large spills should be handled by the Spill Cleanup Contractor

5.3 Proposed Stormwater Quality Treatment Best Management Practices

In accordance with the 2012 Ecology *Stormwater Management Manual for Western Washington* (Ecology, 2012), and City of Redmond 2012 *Clearing, Grading, and Stormwater Management Technical Notebook* (SWMTN) (Redmond, 2012), the project will require water quality treatment for pollution-generating surfaces. At the issuance of this report, the design for the drainage and stormwater facility was in preliminary design. We understand stormwater collected from pollution-generating surfaces will be conveyed to the City of Redmond stormwater system for treatment. It is our understanding that the plans will implement BMPs to meet water quality requirements.

5.4 Construction Erosion Hazard Best Management Practices

Construction erosion hazard BMPs are discussed in our concurrent geotechnical report. Care must be taken during construction not to contaminate the stormwater facilities with untreated construction stormwater and silt. Therefore, a properly developed, constructed, and maintained erosion control plan consistent with City of Redmond standards and best management erosion control practices will be required for the project. It is in our opinion that with the proper implementation of the temporary erosion and sediment control (TESC) plans and by field-adjusting appropriate mitigation elements (BMPs) throughout construction, as

recommended by the erosion control inspector, the potential adverse impacts from erosion hazards on the project may be mitigated.

5.5 Description and Management of Deleterious Substances and Hazardous Materials

As specified in Appendix 1, Sections A and F, the Level 2 CARA hydrogeologic assessment shall identify any deleterious substances and hazardous materials that will be stored, handled, treated, used, produced, recycled, or disposed of on the site. If necessary, the assessment shall specify methods of storing and handling these substances and provide a spill plan. Since the proposed development is limited to residential land use, quantities of deleterious substances and hazardous materials are unlikely to exceed standard household quantities. Therefore, specifics regarding storage and handling of these materials is not warranted.

6.0 CLOSURE

We have enjoyed working with you on this study and are confident that these recommendations will aid in the successful completion of your project. If you should have any questions or require further assistance, please do not hesitate to call.

Sincerely,
ASSOCIATED EARTH SCIENCES, INC.
Kirkland, Washington

State of Washington
Hydrogeologist
496
Licensed Geologist
10/9/15
Curtis J. Koger

Danika M. Globokar, E.I.T., G.I.T.
Senior Staff Engineer

Curtis J. Koger, L.G., L.E.G., L.Hg.
Senior Principal Geologist/Hydrogeologist

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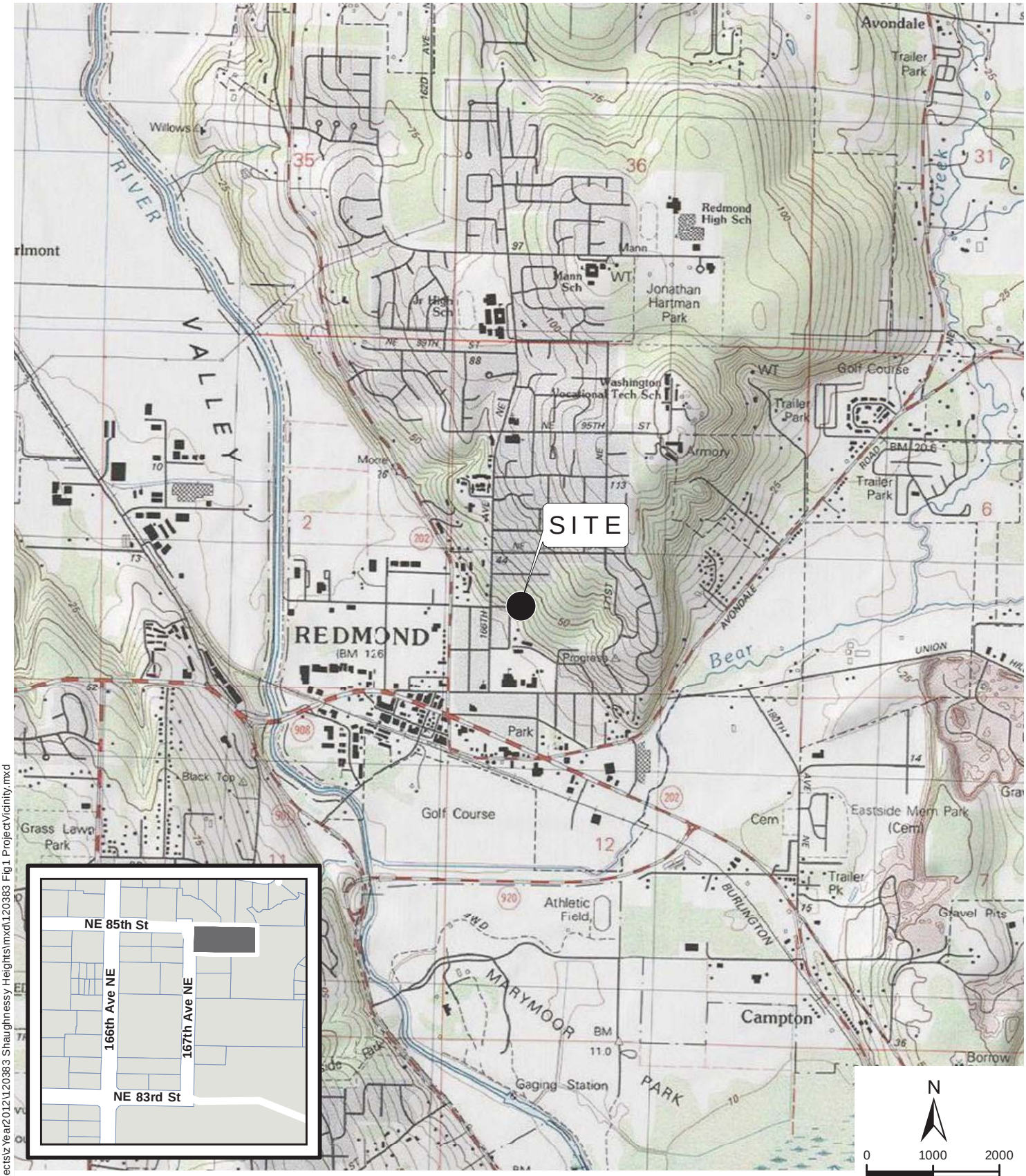

REFERENCE: USGS, KING CO

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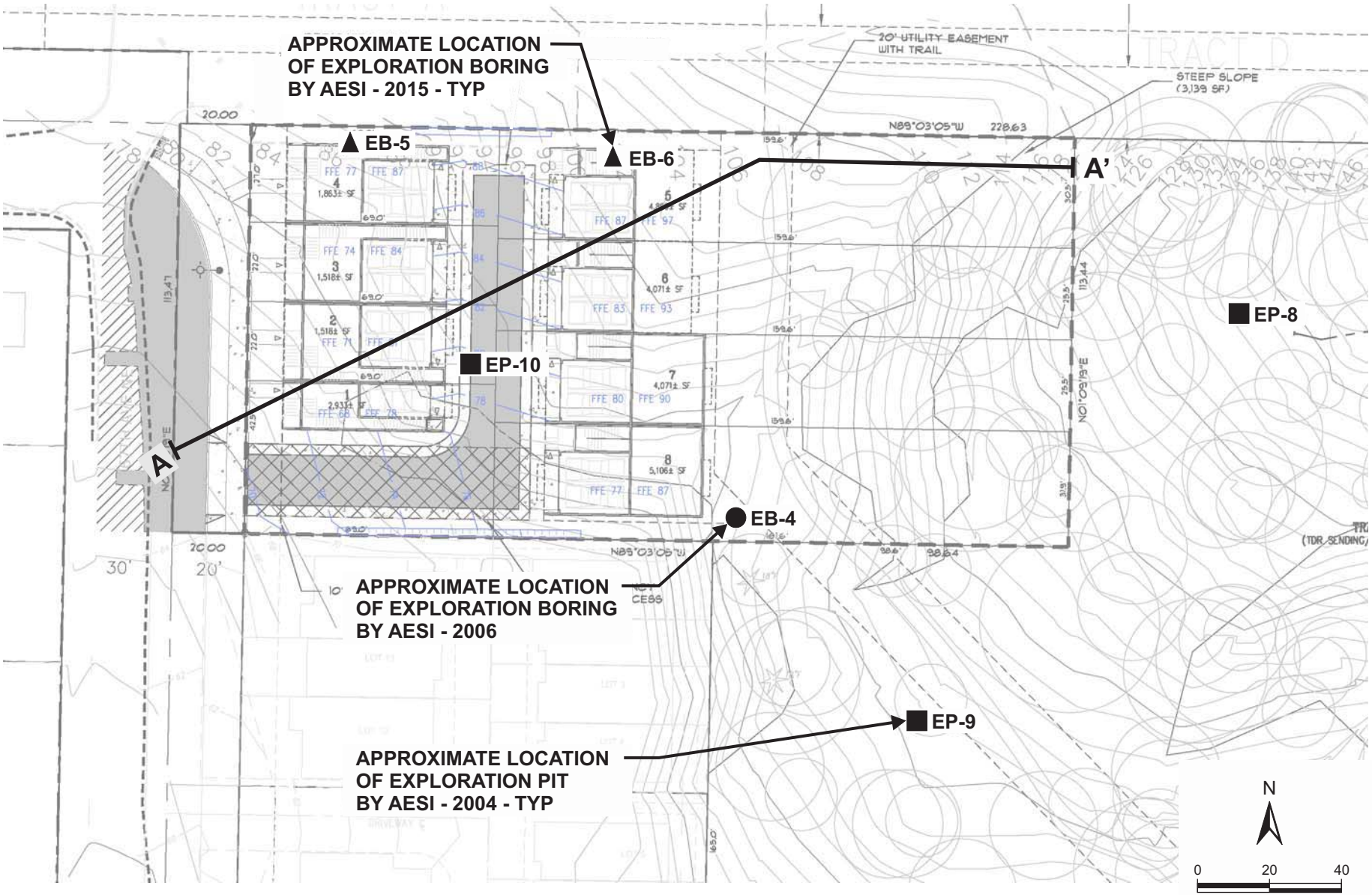
VICINITY MAP

MAPLEWOOD
REDMOND, WASHINGTON

FIGURE 1

DATE 10/15

PROJ. NO. KE120383B



REFERENCE: CORE DESIGN

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SITE AND EXPLORATION PLAN

MAPLEWOOD
REDMOND, WASHINGTON

FIGURE 2
DATE 10/15
PROJ. NO. KE120383B

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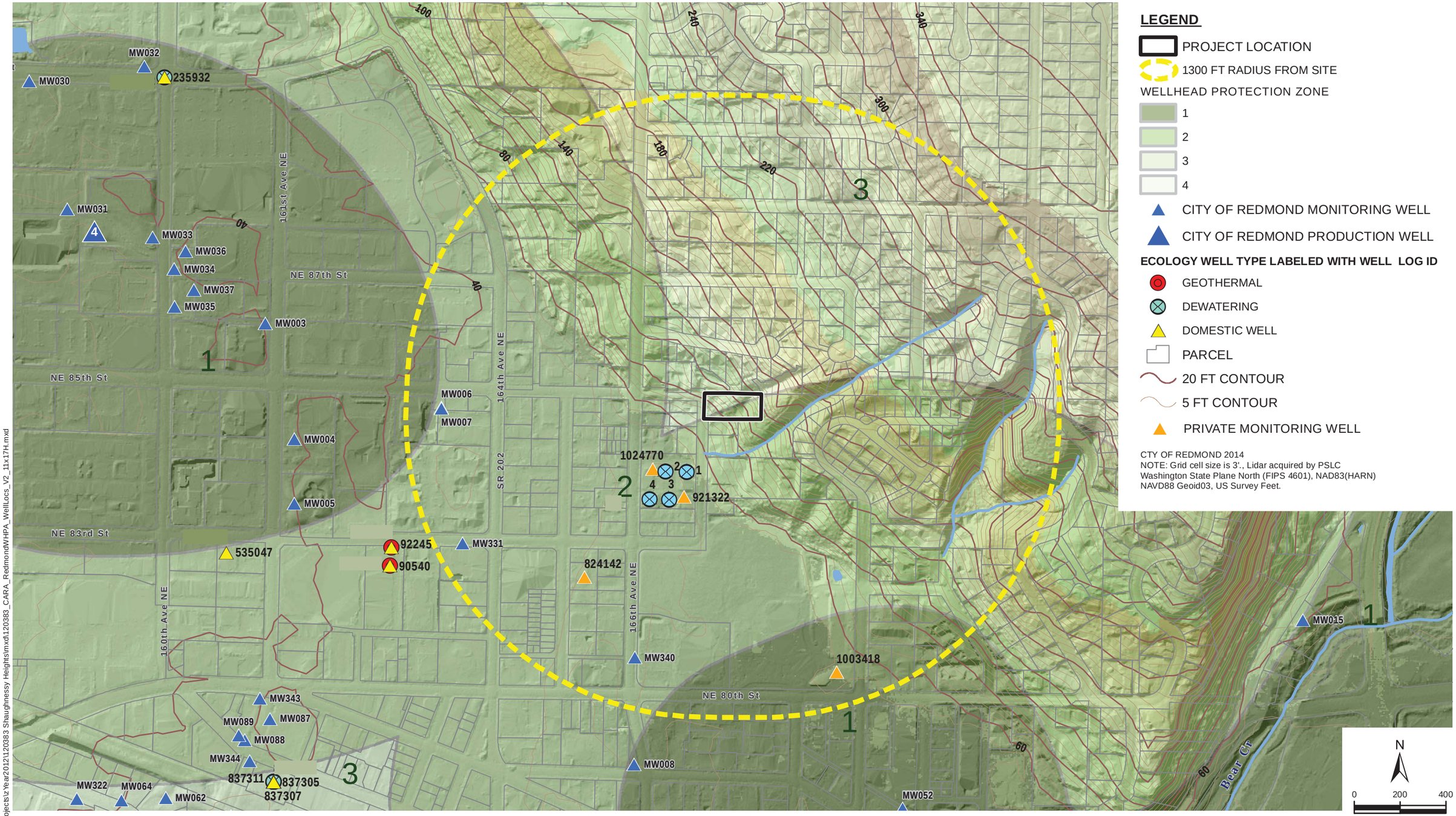

REFERENCE: PSLC, WA DEPT. OF ECOLOGY, KING COUNTY, CITY OF REDMOND

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WELLHEAD PROTECTION AREA MAP

MAPLEWOOD
REDMOND, WASHINGTON

FIGURE 3

DATE 10/15

PROJ. NO. KE120383B

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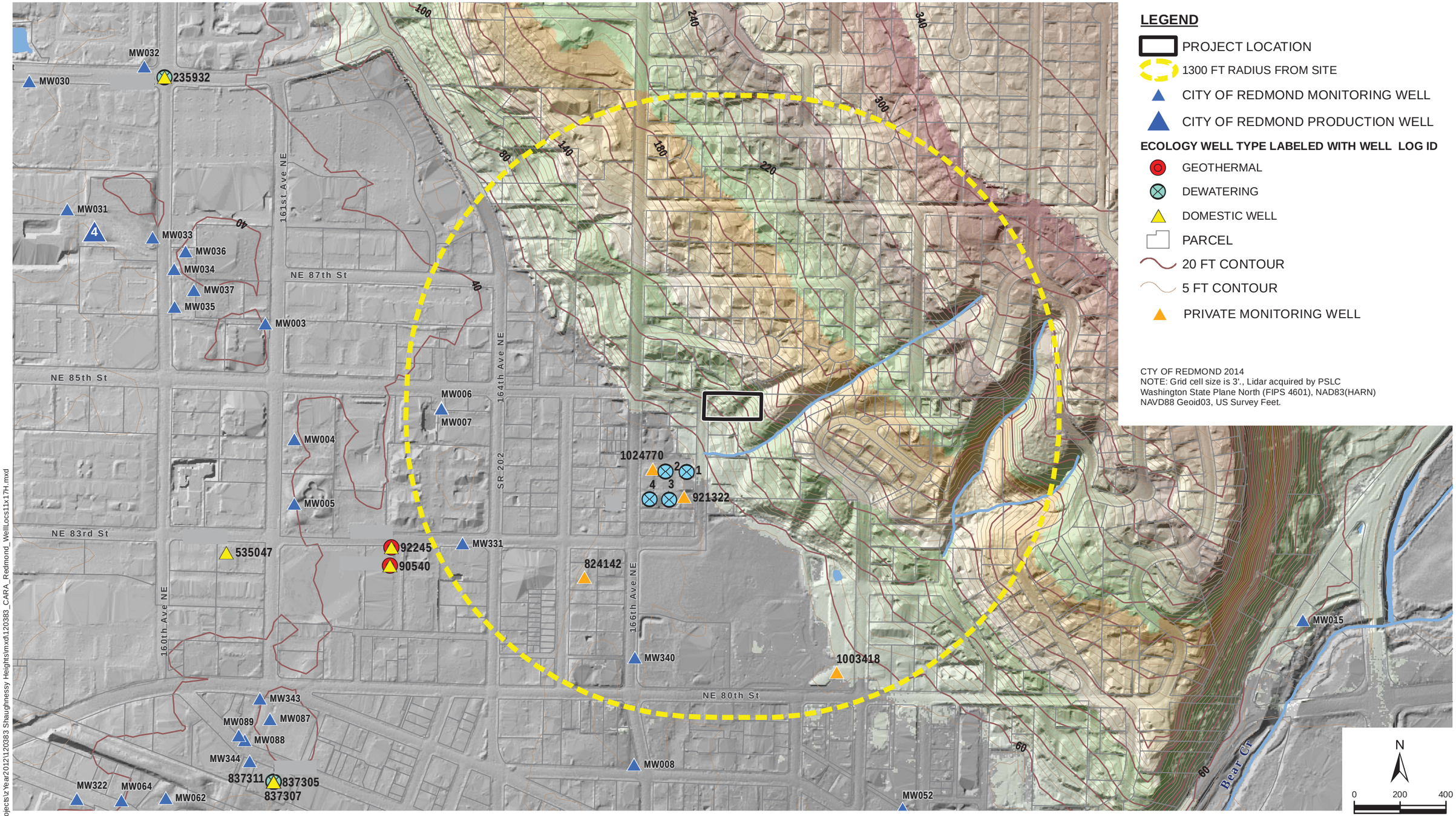

REFERENCE: PSLC, WA DEPT. OF ECOLOGY, KING COUNTY, CITY OF REDMOND

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WATER WELL LOCATION MAP

MAPLEWOOD
REDMOND, WASHINGTON

FIGURE 4

DATE 10/15

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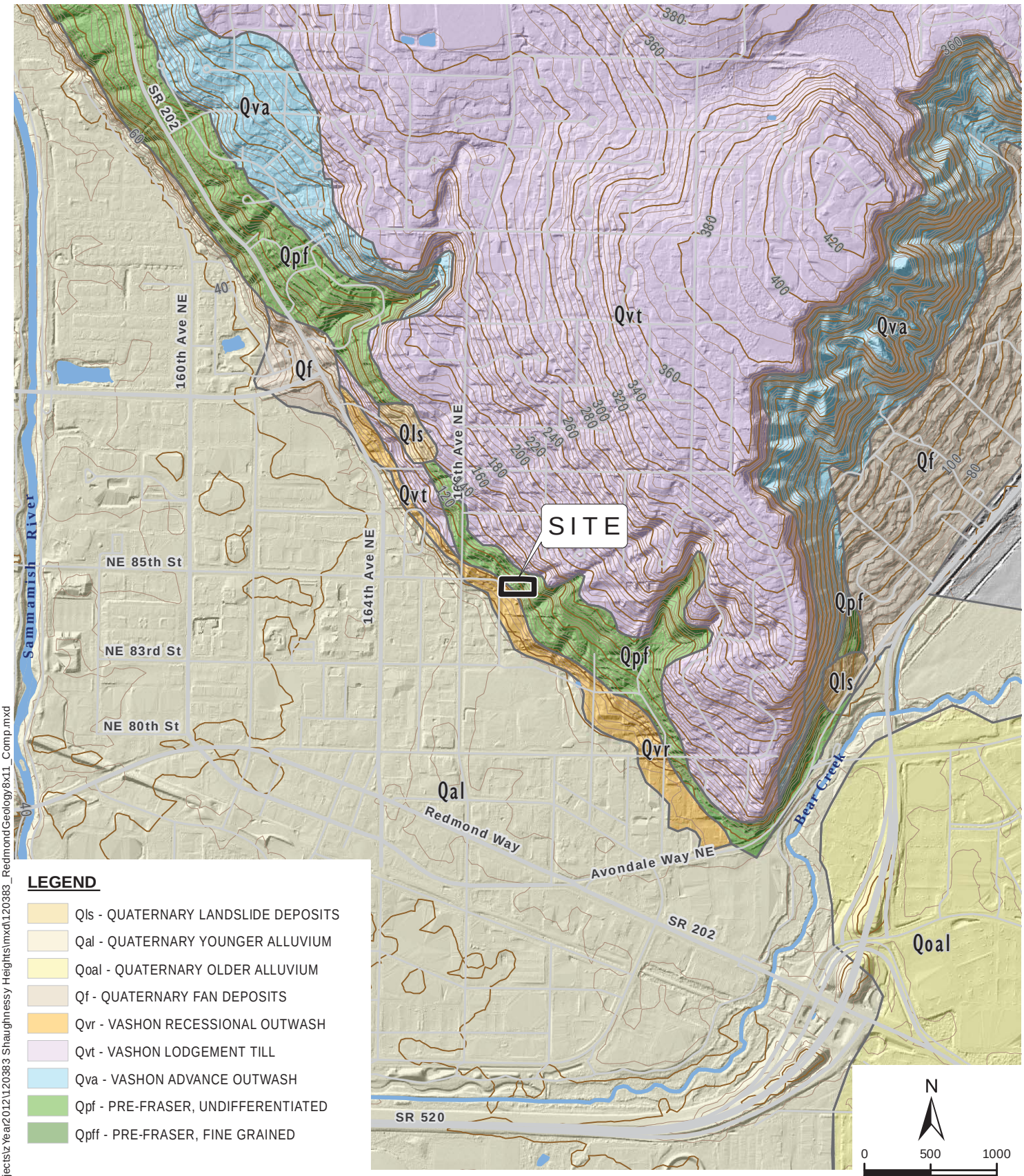

LEGEND

- Qls - QUATERNARY LANDSLIDE DEPOSITS
- Qal - QUATERNARY YOUNGER ALLUVIUM
- Qoal - QUATERNARY OLDER ALLUVIUM
- Qf - QUATERNARY FAN DEPOSITS
- Qvr - VASHON RECESSIONAL OUTWASH
- Qvt - VASHON LODGEMENT TILL
- Qva - VASHON ADVANCE OUTWASH
- Qpf - PRE-FRASER, UNDIFFERENTIATED
- Qpff - PRE-FRASER, FINE GRAINED

REFERENCE: GEOMAPNW, WADNR, KING CO

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REGIONAL SURFICIAL GEOLOGY MAP

MAPLEWOOD
REDMOND, WASHINGTON

FIGURE 5

DATE 10/15

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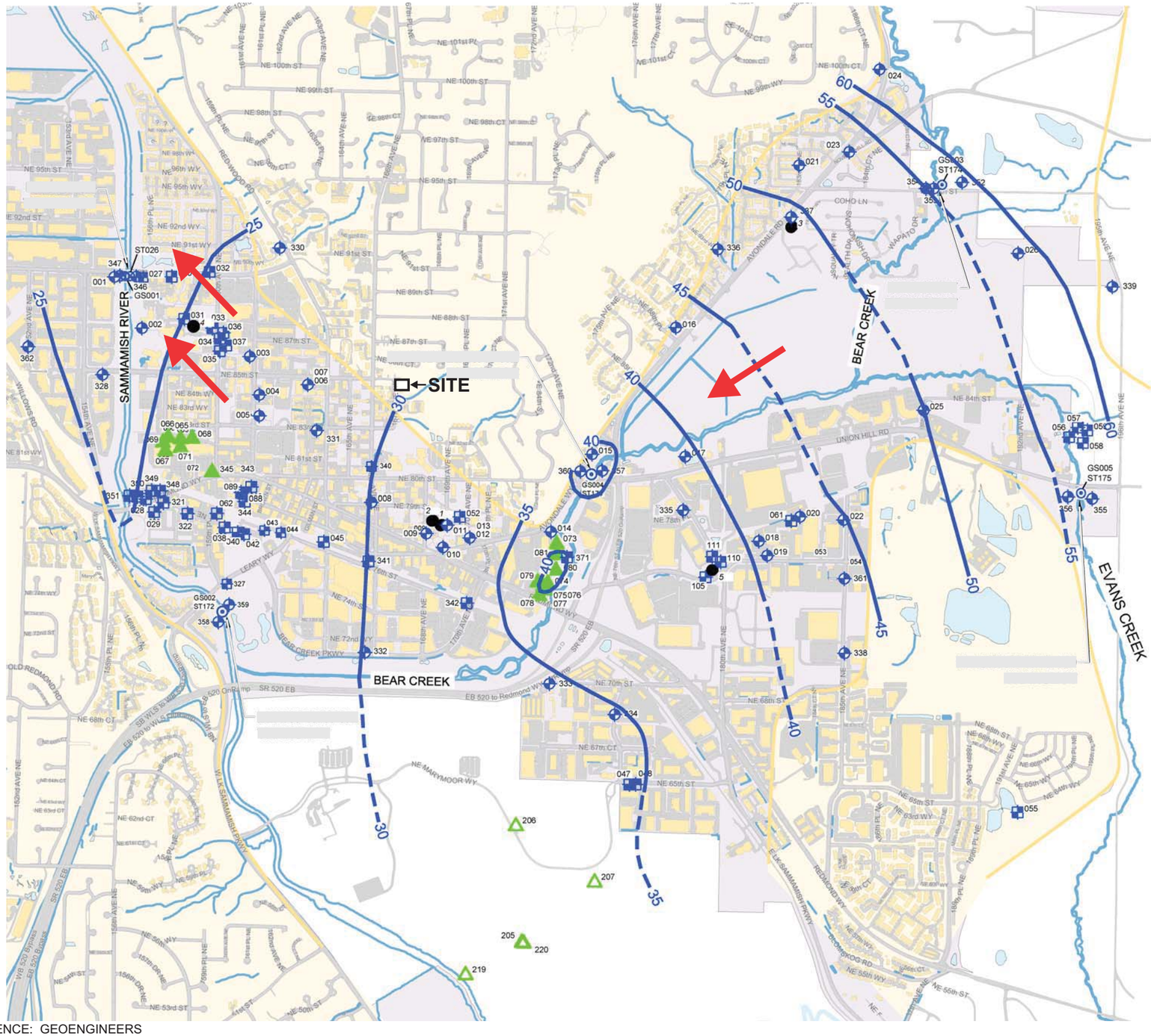

LEGEND

- GROUNDWATER LEVEL CONTOUR, BASED ON JANUARY 23, 2013 MEASUREMENTS, ELEVATION IN FEET (NAVD 88), DASHED WHERE INFERRED.
- GS001 — CITY OF REDMOND GAUGING STATION
- ST026 — CITY OF REDMOND RIVERBED PIEZOMETER
- 001 — CITY OF REDMOND MONITORING WELL (INSTALLED AS PART OF THE GROUNDWATER MONITORING PROGRAM BETWEEN 2007 AND 2011)
- 027 — CITY OF REDMOND MONITORING WELL (INSTALLED DURING OTHER INVESTIGATIONS)
- 065 — PRIVATELY OWNED MONITORING WELL
- 205 — KING COUNTY MONITORING WELL
- 1 — CITY OF REDMOND WATER SUPPLY WELL
- CITY OF REDMOND LIMITS
- UPLAND AREAS
- GROUNDWATER FLOW DIRECTION

NOTES:

1. MONITORING WELL NAMES HAVE BEEN ABBREVIATED TO THE LAST THREE UNIQUE NUMBERS.

2. THE GROUND WATER LEVEL IN MW055 AND MW330 WAS ANOMALOUSLY HIGH, CONSISTENT WITH IT TAPPING A PERCHED UPLAND AQUIFER AND NOT THE ALLUVIAL VALLEY AQUIFER.

N

0 750 1500
FEET

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REFERENCE: GEOENGINEERS

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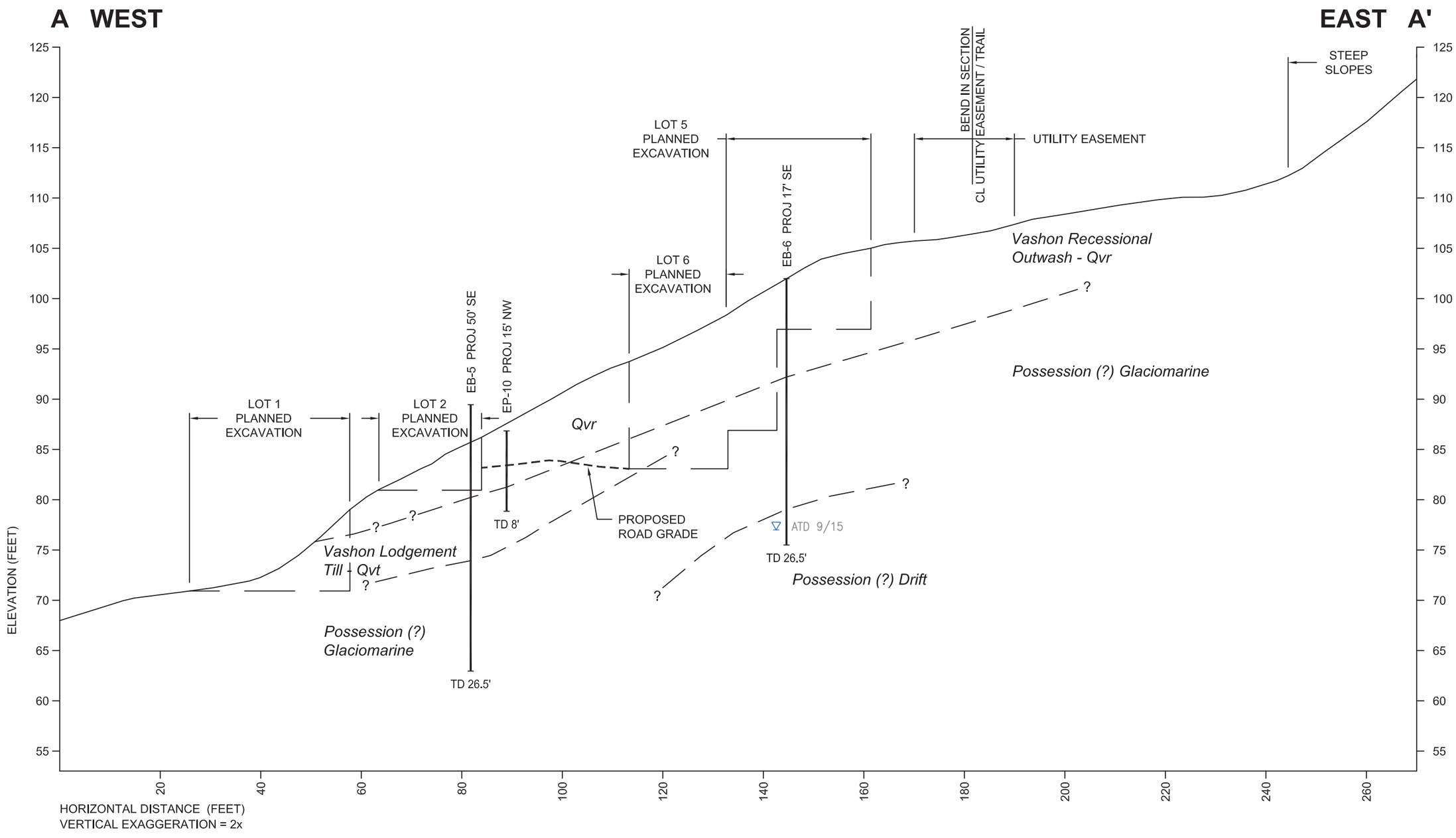
GROUND WATER SURFACE CONTOUR MAP

MAPLEWOOD
REDMOND, WASHINGTON

FIGURE 6
DATE 10/15
PROJ. NO. KE120383B



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GEOLOGIC CROSS-SECTION A - A'
MAPLEWOOD
REDMOND, WASHINGTON

FIGURE 7
DATE 10/15
PROJECT NO. KE120383B

120383 Shaughnessy Heights West \ 120383 Geo Sects.dwg LAYOUT: F7 Section A-A

APPENDIX A

AESI Exploration Logs

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Exploration Log

Project Number	Exploration Number	Sheet
KE03735C	EB-4	1 of 1

Project Name	Shaughnessy Heights	Ground Surface Elevation (ft)	~88
Location	Redmond, WA	Datum	N/A
Driller/Equipment	Holt/CME 850 Mud Rotary	Date Start/Finish	10/4/06,10/4/06
Hammer Weight/Drop	140# / 30"	Hole Diameter (in)	4 inches

Depth (ft)	ST	Samples	Graphic Symbol	DESCRIPTION	Well Completion	Water Level	Blows/6"	Blows/Foot (10 20 30 40)	Other Tests
				Lodgement Till					
		S-1		Moist, brown with iron oxide stains, silty SAND with gravel.			8 13 17	30	
5		S-2					13 17 13	30	
		S-3		No recovery - bad blow counts, sampler tip broken bentonite chips in sampler.			5 6 11	17	
10				**Possession Drift?**					
		S-4		Moist, dark blue-gray, SILT with sand, scattered dropstones.			8 22 34		56
		S-5		Wet (perched water), dark blue-gray, fine SAND with trace silt interbedded with silty very fine sand, scattered silt seams.		▼	22 34 22		56
15									
		S-6		Becomes moist, silty fine SAND to sandy SILT with broken rock piece.			50/5"		50/5"
20									
		S-7					50/5"		50/5"
25									
				Moist, blue-gray, clayey SILT, scattered dropstones.					
		S-8					22 38 38		76
30				Bottom of exploration boring at 29 feet Perched ground water observed at approximately 13 feet at time of drilling.					
35									

Sampler Type (ST):

- 2" OD Split Spoon Sampler (SPT)
- 3" OD Split Spoon Sampler (D & M)
- Grab Sample
- No Recovery
- Ring Sample
- Shelby Tube Sample

M - Moisture

- Water Level ()
- Water Level at time of drilling (ATD)

Logged by: EJL

Approved by:

associated earth sciences incorporated

Exploration Log

Project Number	Exploration Number	Sheet
KE120383B	EB-5	1 of 1

Project Name	Shaughnessy Heights West	Ground Surface Elevation (ft)	88
Location	Redmond, WA	Datum	Core Design
Driller/Equipment	Bortec / Track-Mounted	Date Start/Finish	9/24/15,9/24/15
Hammer Weight/Drop	140# / 30"	Hole Diameter (in)	4 1/4 inches

Depth (ft)	ST	Samples	Graphic Symbol	DESCRIPTION	Well Completion	Water Level	Blows/6"	Blows/Foot (10 20 30 40)	Other Tests
				Grass / Topsoil					
				Recessional Outwash					
		S-1		Very dense, slightly moist, brown, gravelly, fine to coarse SAND, trace silt; blow counts overstated due to rock in drill tip (SP).			23 50/6"	▲	73/12"
5		S-2		Very dense, slightly moist, tan, very gravelly, fine to coarse SAND, some silt; blow counts overstated due to rock in drill tip (SM).			26 32 41	▲	73
		S-3		Very dense, slightly moist, tan, silty, fine to coarse SAND, some gravel; blow counts overstated due to rock in drill tip (SM).			50/4"	▲	50/4"
				Vashon Lodgement Till					
10		S-4		Very dense, slightly moist, gray, very silty, fine SAND, some gravel (SM).			50/2"	▲	50/2"
				Possession (?) Lodgement Till					
15		S-5		Hard, moist, blue gray, sandy SILT, trace gravel; diamict; unsorted; mild reaction with HCl (ML).			11 22 32	▲	54
20		S-6		Hard, moist, blue gray, SILT, trace gravel; diamict; unsorted; mild reaction with HCl (ML).			15 23 34	▲	58
25		S-7		As above.			14 25 37	▲	62

Bottom of exploration boring at 26.5 feet
No ground water encountered.

Sampler Type (ST):

- 2" OD Split Spoon Sampler (SPT)
- 3" OD Split Spoon Sampler (D & M)
- Grab Sample
- No Recovery
- Ring Sample
- Shelby Tube Sample

M - Moisture
Water Level ()
Water Level at time of drilling (ATD)

Logged by: DV
Approved by: JHS

associated earth sciences incorporated

Exploration Log

Project Number	Exploration Number	Sheet
KE120383B	EB-6	1 of 1

Project Name	Shaughnessy Heights West	Ground Surface Elevation (ft)	103
Location	Redmond, WA	Datum	Core Design
Driller/Equipment	Bortec / Track-Mounted	Date Start/Finish	9/24/15,9/24/15
Hammer Weight/Drop	140# / 30"	Hole Diameter (in)	4 1/4 inches

Depth (ft)	ST	Samples	Graphic Symbol	DESCRIPTION	Well Completion	Water Level	Blows/6"	Blows/Foot (10 20 30 40)	Other Tests
				Topsoil					
				Recessional Outwash					
		S-1		Medium dense, slightly moist, tan, gravelly, fine SAND, trace silt (SP).			4 8 7	▲15	
5		S-2		As above.			9 11 18	▲29	
		S-3		Medium dense, slightly moist, tannish brown, gravelly, fine to coarse SAND (SP).			10 11 10	▲21	
				Possession (?) Lodgement Till					
10		S-4		Very stiff, moist, tan, SILT, trace fine to medium sand, trace gravel; diamict; unsorted; mild reaction with HCl (ML).			5 8 11	▲19	
15		S-5		Very stiff, moist, blue gray, SILT, trace sand; diamict; unsorted; mild reaction with HCl (ML).			6 11 14	▲25	
20		S-6		Hard, slightly moist, blue gray, sandy SILT, trace gravel; diamict; unsorted; mild reaction with HCl (ML).			23 50/5"	▲73/11"	
				Possession (?) Drift					
25		S-7		Very dense, wet, blue gray, silty, fine to coarse SAND, trace gravel (SM).		▼	25 34 30	▲64	

Bottom of exploration boring at 26.5 feet
Unable to measure static water level because hole collapsed up to 12 feet.

Sampler Type (ST):

- 2" OD Split Spoon Sampler (SPT)
- 3" OD Split Spoon Sampler (D & M)
- Grab Sample
- No Recovery
- Ring Sample
- Shelby Tube Sample

M - Moisture
Water Level ()
Water Level at time of drilling (ATD)

Logged by: DV
Approved by: JHS

LOG OF EXPLORATION PIT NO. EP-9

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION**
	Duff/Topsoil
1	Loose, moist, tan-orange, fine SAND with few silt and gravel.
2	
3	Medium dense, moist, tan, fine to medium SAND with some gravel.
4	
5	**Till**
6	Becomes dense, moist, tan, fine to medium SAND with some gravel.
7	
8	
9	Dense, moist, slightly oxidized, tan, SILTY very fine SAND with few gravel.
10	
11	Bottom of exploration pit at depth 10 feet No seepage. No caving.
12	
13	
14	
15	
16	
17	
18	
19	
20	

Shaughnessy Heights
Redmond, WA

Logged by: MM

Approved by:

associated earth sciences incorporated

Project No. KE03735A

January 2004

LOG OF EXPLORATION PIT NO. EP-10

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION**
	Duff/Topsoil
1	**Recessional Outwash**
2	Loose, moist, tan-orange, fine to medium SAND.
3	Medium dense, moist, tan, fine to medium SAND with some gravel, scattered cobbles.
4	
5	**Till**
6	Becomes dense, moist, tan, fine to medium SAND with some gravel.
7	Dense, moist, tan, SILTY very fine SAND with few gravel and scattered cobbles.
8	
9	Bottom of exploration pit at depth 8 feet No seepage. No caving.
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	

Shaughnessy Heights
Redmond, WA

Logged by: MM

Approved by:

associated earth sciences incorporated

Project No. KE03735A

January 2004

APPENDIX B

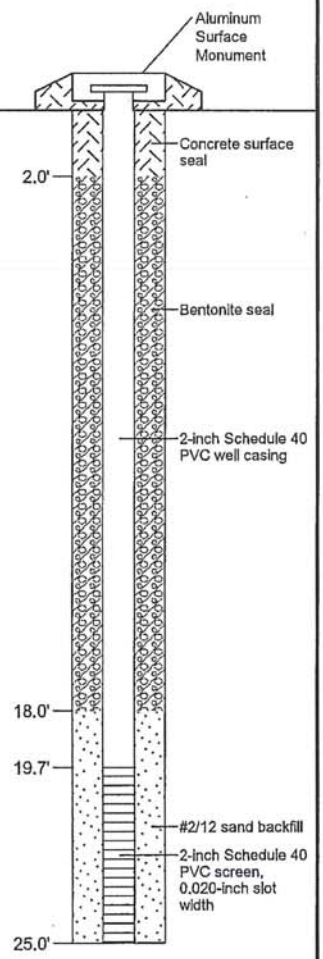
Washington State Department of Ecology
and
City of Redmond Monitoring Well Logs

Drilled Start 12/28/2009 End 12/28/2009	Total Depth (ft) 25.5	Logged By CRW/RNM Checked By RNM	Driller Cascade Drilling	Drilling Method 4-1/4" I.D. Hollow Stem Auger	
Hammer Data 300 lb/ 30 in Drop		Drilling Equipment Truck-Mounted CME 85	Licensing agency well number: **Ecology Well #BBS 973** A 2 (in) well was installed on 12/28/2009 to a depth of 25 (ft).		
Surface Elevation (ft) 40.5 Vertical Datum NAVD88		Top of Casing Elevation (ft) 40.3	Groundwater		
Easting (X) 1322920.5 Northing (Y) 249474.8		Horizontal Datum NAD83	Date Measured 12/31/2009	Depth to Water (ft) 11.7	Elevation (ft) 28.79

Notes: Air-knife to 5.3 feet on 12/21/2009
Heaving sand observed at 25 feet

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor
40	0								AC	8.5 inches asphaltic concrete		
									GP-GM	Dark brown to gray fine to coarse gravel with sand and silt (medium dense, moist) (base course fill)		
									GW-GM	Brown fine to coarse gravel with cobbles, sand and silt, occasional roots (medium dense, moist)		
			3			1						
35	5								GW	Brown fine to coarse gravel with sand, trace silt (medium dense, moist)		
			6	16		2					NS	0.0
30	10								GW-GM	Brown fine to coarse gravel with sand and silt (medium dense, wet)		
			12	28		3					NS	0.0
25	15								GW	Brown to gray fine to coarse gravel with sand, trace silt (medium dense, wet)		
			12	27		4					NS	0.0
20	20								SP	Gray medium to coarse sand with gravel, trace silt (medium dense, wet)		
			16	23		5					NS	0.0
15	25											

WELL LOG



Note: See Figure A-1 for explanation of symbols.

Log of Monitoring Well 560000MW331

GEOENGINEERS

Project: Groundwater Monitoring Network Enhancement
Project Location: Redmond, Washington
Project Number: 0500-147-03

Figure A-5
Sheet 1 of 1

Redmond: Date:4/1/10 Path:W:\REDMOND\PROJECTS\0\0500147\GINT\0500147.GPJ DBTemplate\LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

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

Geologic Drill Exploration, Inc.

MONITOR WELL REPORT

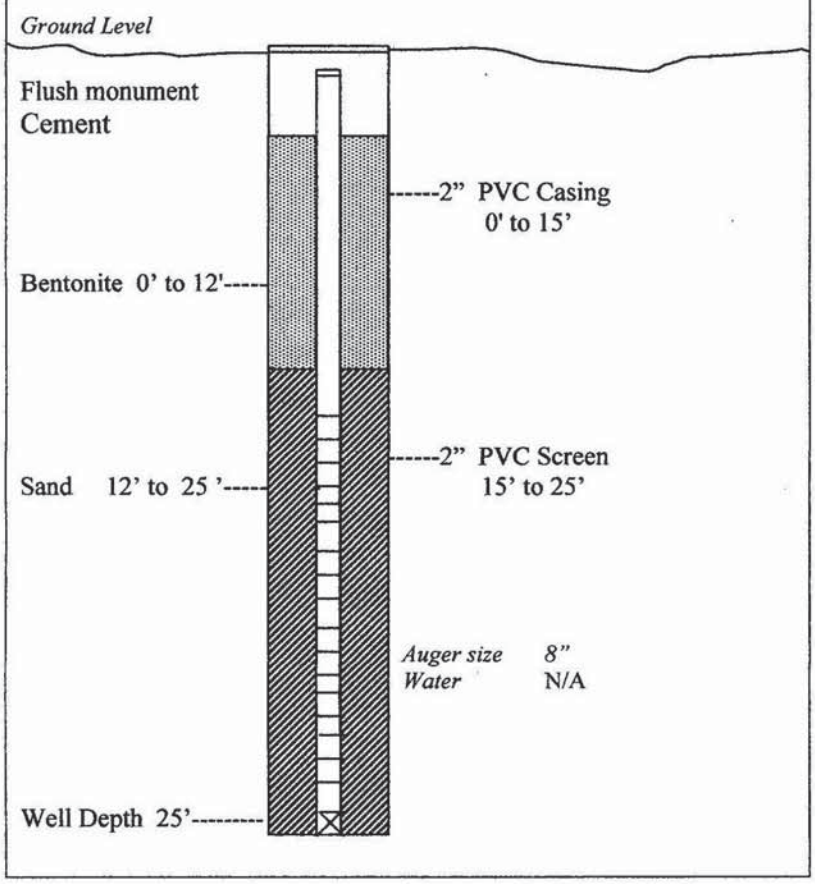
Construction

Notice of Intent # RE 10709

CONSULTING FIRM	AESI	PROPERTY OWNER	Lake Washington School
DRILLING Company	Geologic Drill Explorations	SITE ADDRESS	16800 NE 80th St
DRILLER	Ritch Gibson		Redmond,WA
LICENCE #	1816	LOCATION:	SE,SW,SEC 1,T25N,R5E
SIGNATURE :		COUNTY	King County
		WORK/DECOM DATE	12/23/2014
		DATE COMPLETED	12/23/2014

Unique ID # BIJ-586

Construction



Formation Description

0' to 25 ' Silt & Gravel

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JAN 15 2015
DEPT OF ECOLOGY
NWRO - WR

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

RESOURCE PROTECTION WELL REPORT

Notice of Intent No. KE-07500

(SUBMIT ONE WELL REPORT PER WELL INSTALLED)

Construction/Decommission *("x" in circle)* 465644

☒ Construction

○ Decommission *Original Construction Notice of Intent Number* _____

Type of Well *("x" in circle)*

☒ Resource Protection

○ Geotech Soil Boring

Property Owner: Scott Bergevin

Unique Ecology Well ID Tag No.: BHK-582

Consulting Firm: Kleinfelder

Driller or Trainee Name: Robert A. Sheldon

Driller or Trainee Signature: [signature]

Driller or Trainee License No.: 1815

If trainee, licensed driller's Signature and License no. _____

Site Address: 8178 164th AVE NE

City: Redmond County: King

Location: SW 1/4-1/4 SW 1/4 Sec 1 Twn 25 R 5 (EWM) or WWM *circle one*

Lat/Long (s, t, r still REQUIRED) Lat Deg _____ Lat Min/Sec _____ Long Deg _____ Long Min/Sec _____

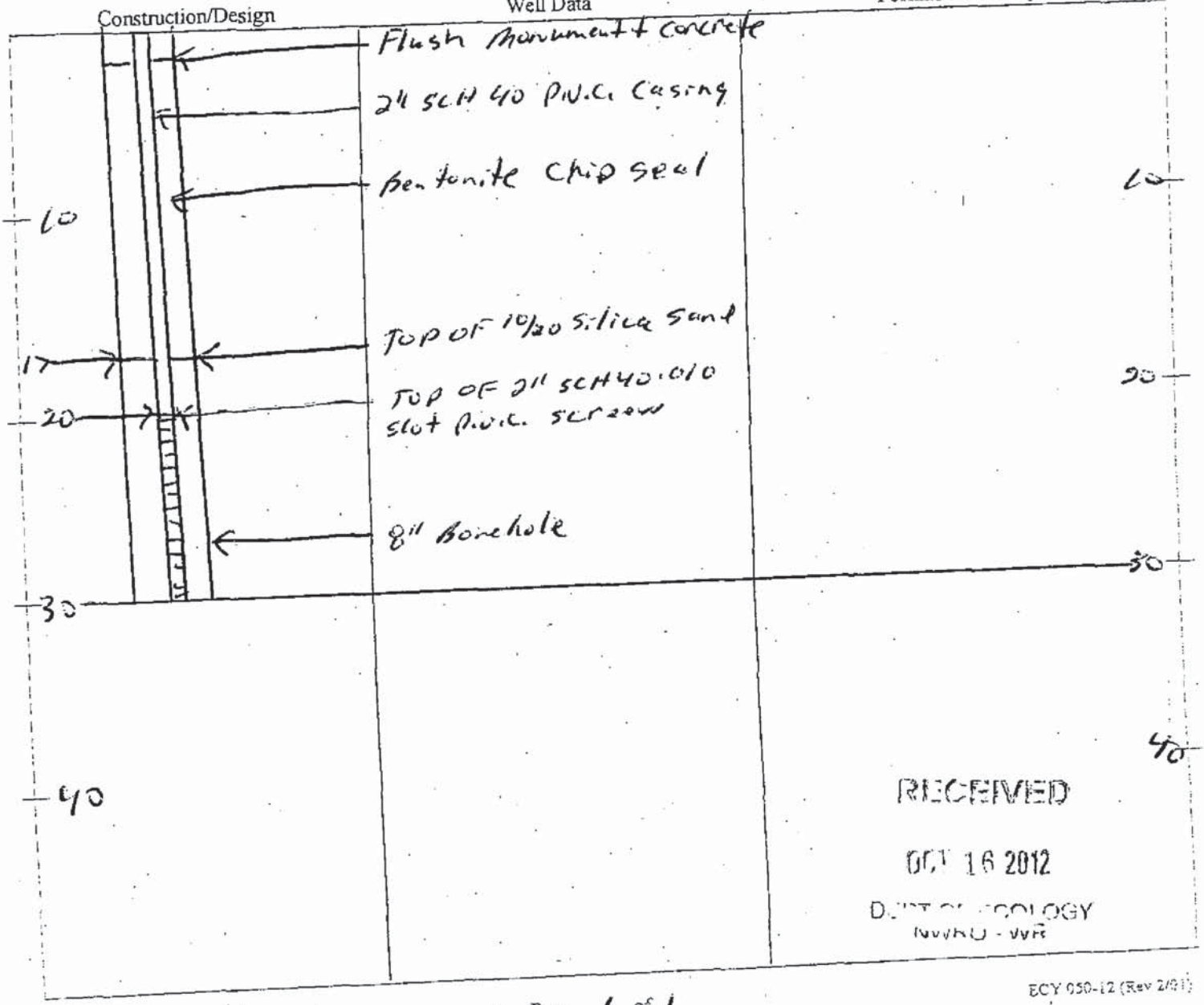
Tax Parcel No. _____

Cased or Uncased Diameter _____ Static Level _____

Work/Decommission Start Date: 9-7-12

Work/Decommission Completed Date: 9-7-12

Construction/Design | Well Data | Formation Description



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OCT 16 2012

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NWRO - WRE

Scale 1" = 10'

Page 1 of 1

ECY 050-12 (Rev 2/01)

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

RESOURCE PROTECTION WELL REPORT

(SUBMIT ONE WELL REPORT PER WELL INSTALLED)

CURRENT

Notice of Intent No. RE09709

Construction/Decommission

[X] Construction

[ ] Decommission *ORIGINAL INSTALLATION Notice of Intent Number* _____

Type of Well

[X] Resource Protection

[ ] Geotechnical Soil Boring

Property Owner: **Redmond Apts LLC**

Site Address: **8345 166th Ave NE**

City: **Redmond** County: **King**

Consulting Firm: **Geotech Consultants**

Unique Ecology Well ID Tag No. BTD-297

Location: 1/4 **SW** 1/4 **SW** Sec **1** TWN **25N** R **5E** EWM or WWM

Lat/Long (s,t,r still Required): Lat Deg x Lat Min/Sec x; Long Deg x Long Min/Sec x

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

Tax Parcel No. **6719700285**

[ ] Driller [X] Trainee Name (Print) **Aaron Ocheltree**

Driller/Trainee Signature

Driller/Trainee License No. **3141T**

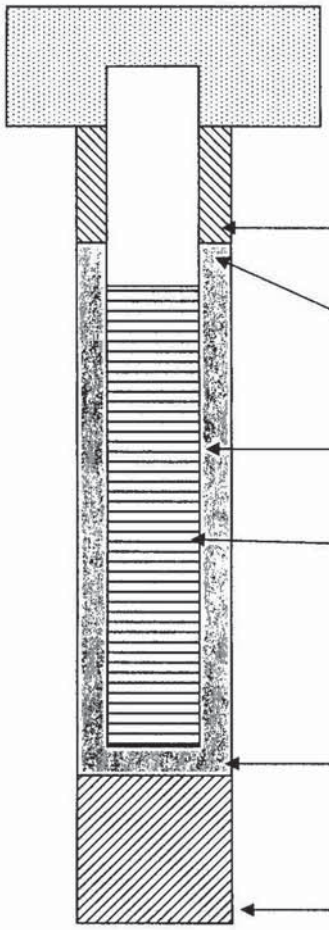
If trainee, licensed driller's Signature and License No. 2330

Cased or Uncased Diameter 8"/4 Static Level 18'

Work/Decommision Start Date 3-20-14

Work/Decommision End Date 3-20-14

Construction/Design



Well Data 103-14-1112

Concrete Surface Seal Depth	3	FT
Blank Casing (dia x dep)	2" x 15'	
Material	PVC	
Backfill	10	FT
Type	—	
Seal	—	
Material	Bent Chip	
Gravel Pack	22	FT
Material	2/12 Sand	
Screen (dia x dep)	2" x 20'	
Slot Size	.010	
Material	PVC	
Well Depth	35	FT
Backfill	—	
Material	—	
Total Hole Depth	35	FT

Formation Description

0 - 5 FT: Brown Fine to Medium Sands & Cobbles

0 5 - 18 FT: Brown fine to Medium Sands

0 18 - 35 FT: Light Brown Course To Medium sands & Gravels

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APR 29 2014

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Scale 1" = _____ Page _____ of _____

ECY 050-12 (Rec=v 2/01)

MONITORING WELL REPORT

1 of 1

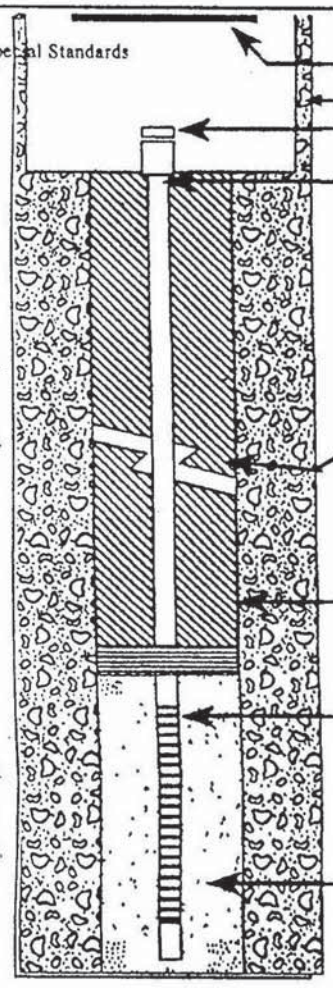
Well ID# BHZ 452
Start Card # RE 10464

(1) OWNER/PROJECT WELL NO. P-1
Name Northwest Pacific Dev. LLC
Address 8360 165th ave
City Redmond State WA Zip 98052

(2) TYPE OF WORK
☒ New construction ☐ Alteration (Repair/Recondition)
☐ Conversion ☐ Deepening ☐ Abandonment

(3) DRILLING METHOD
☐ Rotary Air ☐ Rotary Mud ☐ Cable
☒ Hollow Stein Auger ☐ Other

(4) BORE HOLE CONSTRUCTION:
Special Standards Yes ☐ No ☒ Depth of Completed Well 25' ft.



Water-tight cover ✓
Surface flush vault ✓
Locking cap ✓
Casing diameter 2"
Material PVC
Welded ☐ Threaded ☑ Glued ☐

Well Seal:
Material Bentonite Chip
Amount 5 bgs
Grout weight

Borehole diameter:
8" in. from 0 ft. to 25' ft.
___ in. from ___ ft. to ___ ft.

Bentonite plug at least 3 ft. thick

Screen:
Material PVC
From 15' ft. to 25'
Slot size .010 in.

Filter pack:
Material Sand
Size 10-20

(5) WELL TESTS:
☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian
Permeability ___ Yield ___ GPM
Conductivity ___ PH ___
Temperature of water ___ OF/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 King Latitude ___ Longitude ___
Township 25 (N or S) Range 5 (E or W) Section 1
SW 1/4 of SW 1/4 of above section.
Street address of well location SAME
Tax lot number of well location

(7) STATIC WATER LEVEL:
___ Ft. below land surface. Date ___
Artesian Pressure ___ lb/sq. in. Date

(8) WATER BEARING ZONES:
Depth at which water was first found ~20

From	To	Est. Flow Rate	SWL

(9) WELL LOG:
Ground Elevation

Material	From	To	SWL
Drill	0	25'	
brown Sand & Gravel	0	25'	

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RECEIVED JUN 04 2015 DEPT OF ECOLOGY NWRO-WR

Date started 9-18-14 Completed 9-18-14

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

Type or Print Name THOMAS J. ADAMS License No. 2684
Trainee Name ___ License No. ___
Drilling Company ENVIRONMENTAL DRILLING INC
(Signed) Thomas J Adams License No. 2684
Address 10918 159th AVE SE SNO. WA.
Registration No. ENVIRDI093M6 Date 10-4-14

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

APPENDIX C

Water Quality Results from Wells Within 1,300 Feet

Table 1-C. Metals Exceedances

Table 2-C. pH Exceedances

Table 1-C
Metals Exceedances

Analyte	DOH MCL (µg/L) (1)	Ecology MTCA (µg/L) (2)	Well	Result (µg/L)	Date
Antimony	6	--	MW006	198	7/17/2008
Antimony	6	--	MW006	201	7/17/2008
Arsenic	10	5	MW006	201	7/17/2008
Arsenic	10	5	MW006	201	7/17/2008
Arsenic	10	5	MW006	5.3	12/12/2007
Arsenic	10	5	MW007	5.1	7/11/2008
Arsenic	10	5	MW007	5.4	7/11/2008
Arsenic	10	5	MW007	5.1	12/12/2007
Arsenic	10	5	MW007	5.2	2/5/2009
Arsenic	10	5	MW007	5.4	7/28/2009
Arsenic	10	5	MW007	5.2	7/28/2009
Arsenic	10	5	MW007	5.2	2/7/2012
Beryllium	4	--	MW006	197	7/17/2008
Beryllium	4	--	MW006	201	7/17/2008
Cadmium	5	5	MW006	201	7/17/2008
Cadmium	5	5	MW006	195	7/17/2008
Chromium	100	50	MW006	195	7/17/2008
Chromium	100	50	MW006	195	7/17/2008
Iron	300	--	MW006	23300	7/17/2008
Iron	300	--	MW006	23100	7/17/2008
Iron	300	--	MW006	330	12/12/2007
Iron	300	--	MW331	1300	2/3/2010
Iron	300	--	MW331	410	8/17/2010
Lead	--	15	MW006	202	7/17/2008
Lead	--	15	MW006	200	7/17/2008
Manganese	50	--	MW006	196	7/17/2008
Manganese	50	--	MW006	194	7/17/2008
Manganese	50	--	MW006	200	12/12/2007
Manganese	50	--	MW007	280	7/11/2008
Manganese	50	--	MW007	300	7/11/2008
Manganese	50	--	MW007	200	12/12/2007
Manganese	50	--	MW007	350	2/5/2009
Manganese	50	--	MW007	320	2/5/2009
Manganese	50	--	MW007	340	7/28/2009
Manganese	50	--	MW007	360	7/28/2009
Manganese	50	--	MW007	380	2/7/2012
Manganese	50	--	MW007	380	8/22/2012
Mercury	2	2	MW006	11.9	7/17/2008
Mercury	2	2	MW006	11.7	7/17/2008
Nickel	100	--	MW006	194	7/17/2008
Nickel	100	--	MW006	192	7/17/2008
Selenium	50	--	MW006	201	7/17/2008
Selenium	50	--	MW006	200	7/17/2008
Silver	100	--	MW006	195	7/17/2008
Silver	100	--	MW006	195	7/17/2008
Thallium	2	--	MW006	203	7/17/2008
Thallium	2	--	MW006	201	7/17/2008

Notes:

(1) Published maximum contaminant level (MCL) used by the Washington State

Table 1-C
Metals Exceedances

Analyte	DOH MCL (µg/L) (1)	Ecology MTCA (µg/L) (2)	Well	Result (µg/L)	Date

Department of Health (DOH) based on Chapter 246-290 WAC

(2) Washington State Department of Ecology (Ecology) criteria based on Washington Administrative Code (WAC) Chapter 173-200

Table 2-C
pH Exceedances

Well	Date	Ecology MTCA (µg/L) [1]	Result (µg/L)
MW006	2/3/2010	6.5 to 8.5	6.16
MW006	8/17/2010	6.5 to 8.5	6.01
MW006	8/18/2011	6.5 to 8.5	6.0
MW006	8/14/2012	6.5 to 8.5	5.2
MW006	2/3/2010	6.5 to 8.5	6.25
MW331	2/7/2011	6.5 to 8.5	5.8

Notes:

(1) Washington State Department of Ecology (Ecology) criteria based on Washington Administrative Code (WAC) Chapter 173-200

APPENDIX D

Water Level Data

Appendix D
City of Redmond Monitoring Wells - Water Level Summary

Well		Depth to Water (feet)	Water Elevation (feet above mean sea level)
MW006	minimum	10.23	25.12
	maximum	14.98	29.87
MW007	minimum	10.05	25.16
	maximum	14.74	29.85
MW331	minimum	10.19	25.75
	maximum	14.52	40.27
MW340	minimum	16.31	27.6
	maximum	19.78	47.38

APPENDIX E

Spill Prevention and Response Plan

Spill Prevention and Response Plan

Project: Maplewood

Location: 167th Avenue NE and NE 85th Street, Redmond WA

Types of Hazardous Substances Used:

-Gasoline -Machine Oil

-Diesel -Paint

-Hydraulic Fluid

Spill Prevention

The following are general requirements for any hazardous substances stored or used at this facility.

General Requirements

- Ensure all hazardous substances are properly labeled.
- Store, dispense, and/or use hazardous substances in a way that prevents releases.
- Provide secondary containment when storing hazardous substances in bulk quantities (~55 g).
- Maintain good housekeeping practices for all chemical materials at the facility.
- Routine/Daily checks in the hazardous substance storage area to be performed by a future person on site to be named at the commencement of work
- Monthly inspections of the hazardous substance storage area, secondary containment, and annular space (interior cavity of double wall tank) on any Above-ground Storage Tanks (AST) or Underground Storage Tanks (UST) need to be logged in this plan.
- In general, most substances stored on site will be minimal in size, such as 5 gallon gasoline cans. Large volume spills are not anticipated involving the work on this site.

Spill Containment

- The general spill response procedure at this facility is to stop the source of the spill, contain any spilled material and clean up the spill in a timely manner to prevent accidental injury or other damage.
- Small spills will be contained by site personnel if they are able to do so without risking injury. Spill kits are located at the following location: _____
- Contents of Spill Kit:

  UN approved 20-gallon pack with screw-top lid.
  (15) x 19" Absorbent Pads,
  (3) 3" x 12' Sorbent Socks,
  (2) 18 x 18" Pillows,
  (1) Pair Nitrile Gloves, Emergency Handbook, Goggles and
  (3) Disposal Bags
- Remove all contaminated soil as required at spill location.

Emergency Procedures:

- Immediately call **911** in the event of injury, fire or potential fire, or spill of a hazardous substance that gives rise to an emergency situation.
- If a spill has occurred, contact the following persons immediately:

  _____ (Primary) (___) ____ - _____

  _____ (Secondary) (___) ____ - _____

_____ (After Hours Emergency Contact) (___) ____ - _____

In the event of a large spill, a properly trained employee should:

- Assess the area for any immediate dangers to health or safety (i.e. a wrecked car on fire). If any dangers are present, move away from the area, **call 911**.
- Notify the primary and/or secondary contact from the list above and then continue your spill response. The primary contact should assess additional notification requirements (i.e. notify City of Redmond, Ecology, etc. see Spill Reporting below).
- Retrieve the spill kit from the closest location.
- Assess the size of the leak and any immediate threat of the spill reaching the floor/storm drains or permeable surfaces in the area. If there is an immediate threat and there are no safety concerns, then attempt to block the spill from coming in contact with the floor/storm drain or permeable surface. If no drain covers are available, then try to use absorbent (cat litter) and/or sock booms or rags to stop the spill from getting into the drains or to any permeable surfaces.
- If the spill can be contained with absorbent booms, deploy them around the spill. Use the booms to direct the spill away from any immediate hazards (i.e. a wrecked car).
- If there is no immediate threat to the floor/storm drains or permeable surfaces, or after controlling the spill, try to plug or stop the leak, if possible. If applicable, put on protective gear (gloves, goggles, protective clothing, etc.) and plug the leak.
- Once the spill has been contained and any immediate threat to storm drains or permeable surfaces has been minimized, contact the spill cleanup contractor and dispatch them to clean up the spill or commence spill cleanup procedures.

Spill cleanup for large spills should be handled by the Spill Cleanup Contractor

Company Name: _____ Phone: _____

Spill Reporting

If a hazardous substance spill exceeds 25 gallons or if any amount has been released to soil, surface water, or storm drains, notify the following agencies:

Washington State Department of Ecology	(360) 407-6300
Washington Emergency Management Division	(800) 258-5990
National Response Center (NRC)	(800) 424-8802

Plan Management

The primary contact or designee shall administer this plan and will be responsible for updating and including any required documentation.

Training

All personnel who may respond to any spill, need to be trained on the contents and procedures in this plan. Trained personnel will add their names and dates of training to the Training Log. Only persons trained on this plan shall respond to a spill. If you are not trained and witness a spill, call or notify the primary and secondary contacts listed on Page 2 of this plan.

Spill Tracking

Any spills must be entered into the Spill Log. If a large catastrophic spill occurs, attach additional pages to describe the event. Include known or possible causes, areas affected, and effectiveness of the cleanup. Include a review of the cleanup contractor and their procedures. For small spills, it is sufficient to fill out the Spill Log, and to take measures to prevent a repeat occurrence.

Facility Inspections

Routine inspections will be conducted daily during regular business hours. Daily inspections will include, at a minimum, a visual inspection of the hazardous substances containers and the area immediately adjacent to it for signs of a spill or leak. These inspections do not need to be logged unless a spill or leak is detected. Ideally, these inspections will be conducted by a manager or by regular employees.

Full site inspections will be conducted monthly by the primary contact or designee and, at a minimum, will include those items on the inspection form. If any item on the inspection form is found unacceptable, the inspection form will be attached to this plan. If all items are deemed acceptable; it is sufficient for the inspector to log only the inspection and the results in the Inspection Log.

Maplewood

Spill Prevention Inspection Log

A = Acceptable U = Unacceptable If any items are unacceptable attach Inspection Form with details.

Inspection Month	Year	Inspector Initials	Lids and Labels?	Evidence Of Spills?	Alarms or Sensor?	New Product?	Spill Kit Complete?	Storm Drains?	Items Fixed?
January									
February									
March									
April									
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Inspection Form

Acceptable	Unacceptable	
❒	❒	**Lids and Labels?** Have all lids and caps been returned to their proper place? Do all the containers still have labels?
❒	❒	**Evidence of Spills?** Is there any indication that a spill might have occurred? If so, was the spill properly cleaned up? Was there any spill kit materials used? Was the Spill Log filled out for that incident? Any housekeeping issues?
❒	❒	***For Tanks with alarm systems only* Any Alarms or Sensor issues?** Have there been any alarm conditions in the past month? If alarms have occurred, has the monitoring system been serviced by the manufacturer or an authorized service company? Is the system up and working at this time? Is the sensor working? Did you conduct a test of the alarm and the sensor? When was the last time the sensor was serviced?
❒	❒	**New Hazardous Substances?** Have any new chemical products been purchased? Do you have the MSDS for new products? Have you assessed how to store and handle this new product safely? Have you added the new hazardous substance to the inventory sheet in this plan? Is the container properly labeled?
❒	❒	**Spill Kit Complete?** Have any items been used from the spill kit? If items are missing, is there an associated entry in the Spill Log? Are there any items missing that are currently on order? Is the spill kit stored where it is supposed to be stored? Is there a sufficient supply of daily cleanup materials?
❒	❒	**Storm Drains?** Is there a buildup of sediment in the drain traps? Is there any evidence of drain clogging? Are the drain filters still intact? Any need replacing? Have they been replaced?
❒	❒	**Items Fixed?** Have all deficiencies previously noted been fixed or made acceptable?

List any issues, deficiencies, or failures in detail:

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Hazardous Substance Inventory

Major Groups Only

Hazardous Substance	Manufacturer	Quantity/Unit of Issue