Basalt Aquifer Storage and Recovery Assessment Near Reecer Creek

Kittitas County, Washington

Photo: Kittitas Reclamation District

March 2023
Version: FINAL

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Publication Information

Data for this project will be available on Ecology's Environmental Information Management (EIM) website: https://fortress.wa.gov/ecy/eimreporting/default.aspx; at www.data.wa.gov; and from Project Proponent Kittitas Reclamation District at 509-925-6158.

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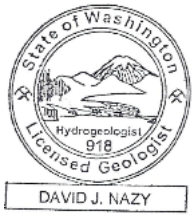

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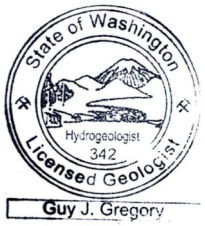

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LIST OF ACRONYMS AND ABBREVIATIONS

ASR	Aquifer Storage and Recovery
Ecology	Washington State Department of Ecology
EA	EA Engineering, Science, and Technology, Inc., PBC
ICP	Inductively coupled plasma
KRD	Kittitas Reclamation District
MAR	Managed Aquifer Recharge
ML	Machine learning
Project	Basalt Aquifer Storage and Recovery Project
WDNR	Washington State Department of Natural Resources
WSU	Washington State University
XRF	X-Ray Fluorescence
YBIP	Yakima Basin Integrated Plan

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1. Introduction

The Basalt Aquifer Storage and Recovery (ASR) Project (Project) was conceived by the Kittitas Reclamation District (KRD) to supplement the assessment of Yakima Basin Managed Aquifer Recharge (MAR) projects. MAR projects were identified through previous funding provided by the Yakima Basin Integrated Plan (YBIP) in support of the plan's water storage objective. This Project is funded through Grant Agreement No. WRYBIP-2123-KittRD-00031 between KRD and the Washington State Department of Ecology (Ecology). The project provides the findings of an initial investigation of a basalt occurrence located near Reecer Creek, which is approximately 9 miles north of Ellensburg in Kittitas County, Washington. The Project site is in Sections 22 and 27, Township 19 North, Range 18 East Willamette Meridian (Figure 1). The western portion of Section 22 is located on Washington State Department of Natural Resources (WDNR) managed land (Figure 2). The remainder of the proposed Project area is located on private land.

The purpose of this investigation is to determine, through examination and evaluation of basalt stratigraphy and geologic structures, whether additional investigation is warranted to evaluate ASR at this location.

This assessment provides detailed information of the following:

- Geologic mapping.
- Visual and physical assessment.
- Field description of structural fabrics in outcrop.
- Sample collection for geochemical identification of specific Columbia River Basalt units.
- Determination of location and stratigraphic position of particular outcrops.
- Identification and investigation of springs, wells, or other points of hydrogeologic significance for this site.

This report includes 1) a geologic map showing the location of outcrops, sample locations, and observed physical elements; 2) tabulated and compiled geochemical and physical data gathered at the site; and 3) a conceptual model of the project area.

This assessment provides Project-specific recommendations for implementation of specific ASR project at this site. Information within this report will inform KRD as they coordinate proposed work with YBIP partners including the Yakama Nation, National Marine Fisheries Service, Ecology, Washington Department of Fish and Wildlife, the United States Bureau of Reclamation, Trout Unlimited, local conservation districts, and other partners to make use of regional understanding to realize the benefits of groundwater storage.

2. Project Objectives

The objectives of this Basalt ASR assessment are as follows:

- Characterize a potential ASR/MAR opportunity, which was recently identified by WDNR-published geologic mapping at the project location (Figure 1).
- Acquire surface and groundwater information to inform artificial recharge potential at this site.
- Evaluate the desirability of proceeding with additional hydrogeologic assessment of this project area to establish basalt-hosted ASR/MAR in shallow rocks.
- Present the initial investigation activities and results, along with an assessment of pursuing additional work, to evaluate ASR/MAR potential.

This work supports YBIP goals and objectives for water storage needs within the Upper Yakima Basin, with the goals of supplementing the Total Water Supply Available and providing aquatic habitat improvement(s).

The primary purpose of all local MAR/ASR projects is to implement the goals and objectives of the YBIP by capturing water when it is available and storing or re-timing discharge for later use. An integrated approach to using surface water and groundwater storage to increase Total Water Supply Available providing water for streamflow is central to improving salmonid populations and fish passage in the basin.

3. Background

Recent mapping supported by WDNR and conducted by Sadowski et al. (2020) identified a potential structural zone in the vicinity of Reecer Creek on the north slope of the Kittitas Valley that may be suitable for a shallow basalt-hosted ASR project (Figure 1). The source of water for ASR at the site is assumed to be water that has been conserved by KRD and delivered to the site from KRD's North Branch Canal. The area is mapped as an anticlinal structure in the basalt, which is illustrated in the geologic map (Figure 3) and cross section (Figure 4) modified from Sadowski et al. 2020. This structure, if associated with reverse faults and jointing, may provide the open space connectivity and containment necessary to store significant water within the basalt.

Initial Conceptual Geologic Model

The initial review of the recent WDNR map (Figure 4) suggests the basalt exposure might be desirable for a basalt hosted ASR opportunity. This is predicated on several factors:

- Space for recharge water likely exists within the target location: exposures of Grande Ronde basalt to the north and west of this area are few. It is likely that this location is

near the margin of flows of Grande Ronde age, thus may have textural components that increase the primary porosity of relatively thick portions of the basalt flows. These textures are those most common in flow base and tops: 1) brecciated and fragmented rubbly textures; 2) significant areas of gas vesicles and glassy units; and 3) palagonite and hyaloclastite occurrences. Palagonite and hyaloclastite are volcanic rocks that represent interactions with hot melt or rock with water. They are characterized by broken glassy fragments of the basalt flow in a generally soft, glassy matrix of altered volcanic material. All the textures described above are textures common near the edge of a volcanic flow overriding existing landforms. Increased percentages of platy fractured basalt relative to dense entablature may also indicate relatively rapid cooling near the flow margin.

- It is probable that the aquifer maintains the ability to accept recharge water: the modified WDNR map indicates a set of northwest-trending reverse faults elevating an anticlinal wedge of basalt; likely due to some subsurface structure resulting from stress from the southwest. In these cases, fracturing and faulting associated with brittle deformation of solid basalt may connect and create secondary permeability.

- The aquifer likely maintains the storage capability to hold recharge water: connecting basalt flow textures of relatively high porosity with a likelihood of increased secondary fracturing may form unusual reservoir conditions, perhaps suitable for water storage. In addition, structural bounds on the potential reservoir rock may assist in reducing potential lateral migration of water from any reservoir and minimize leakage and loss of injected water.

This work evaluates the conceptual site model by the following means:

- Assessing Sadowski et al. (2020) including surface mapping and to supplement existing geochemical determinations with additional sampling to expand stratigraphic knowledge and evaluate or refine structural interpretations.

- Examining geologic features at the site to assess likely primary and secondary porosity and permeability of rock units.

- Compiling information and, where desirable, suggesting subsequent steps toward field evaluation of ASR potential of the Project area.

4. Work Performed

4.1 PROPERTY ACCESS

Property access was sought for private and publicly owned parcels (Figure 2). Letters (Appendix A) were sent by KRD to select private landholders in the area requesting walk-in access to their property for the purpose of geologic mapping and limited geochemical sampling in the Project area.

The WDNR parcel located in the west half of Section 22, Township 19 North, Range 18 East-Willamette Meridian was the central focus of the field effort. Several adjacent private-property owners also allowed access to their properties. Ultimately, no private land access was necessary in this field effort. Private land in the project area is generally covered by younger unconsolidated sediments, and there are very few basalt outcroppings.

Follow up letters were sent to those property owners who granted access, thanking them for their permission, and notifying them of the conclusion of the field evaluation and that no further access was necessary.

Property access letters and specifics are on file at KRD and not included in this report for privacy reasons. Example text is in Appendix A.

4.2 GEOLOGIC EVALUATION

The initial conceptual model was derived from the map (Sadowski et. Al 2020) published by the WDNR Washington Geologic Survey, which is discussed in Section 3. Mr. Sadowski was contacted to evaluate the initial conceptual model, and to assess other opportunities in areas in which he and his team are currently conducting geologic mapping.

Mr. Sadowski was most helpful discussing the geology in the area. In addition to basalt flow margin ASR opportunities at the site, he suggested that the Coleman member, an informally named member of the Ellensburg Formation occurring beneath the surface exposures of Sentinel Bluffs basalt, may be a good target for storing groundwater. The Coleman member is not exposed in the project area, and not known from wells in the immediate area.

The excerpts of the map and cross section of Sadowski et al. (2020) are included in this report (Figures 3 and 4). Geologic age and stratigraphic relationships for geologic units in this report are illustrated on Figure 5.

4.3 FIELD GEOLOGIC MAPPING

Guy Gregory of Gregory Geologic LLC conducted geologic mapping and geochemical sampling of exposures on WDNR property from June 20-24, 2022. Sampling was infrequent because very little actual “outcrop” that was thought to represent bedrock is present. The outcrop map indicates exposures that are most likely actual bedrock (Figure 6).

Actual bedrock outcrop density did not permit traditional evaluation of contact relationships between either stratigraphic or textural units. As the rock units are rubbly and broken everywhere, which is typical of flow margin textures, no reliable planar features associated with volcanic flows or fault/fold axis elements were observed or measured. (Appendix B).

4.4 GEOCHEMICAL SAMPLING

Outcrop rock samples were collected to permit stratigraphic discrimination. Nine samples were taken in total including two "Target of Opportunity" samples from prospective areas (Figure 6, Table 1, Section 4.5) and seven samples from exposures in the main Section 22 project area (Figure 7, Table 1). Brief rock descriptions of all basalt samples are provided in Appendix C. All samples were submitted to the Peter Hooper GeoAnalytical Laboratory at Washington State University (WSU). The GeoAnalytical Laboratory performed X-Ray Fluorescence (XRF) determination of 29 major and trace elements and inductively coupled plasma (ICP) mass spectrometer determination of 27 trace elements on each sample permit formation assignment. All sampling was conducted per methodology outlined in Hooper 2000. Geochemical sampling results are provided in Appendix D.

Chemical results were also input into the machine learning (ML) model developed by researchers at the Peter Hooper GeoAnalytical laboratory at WSU. Researchers compiled and gathered a regional compilation of Columbia River Group rocks with whole rock geochemical analyses to construct this model. The ML model compared our Project sample chemical results to those in their regional compilation as described in Section 5.2.

4.5 TARGETS OF OPPORTUNITY

Discussions with Mr. Sadowski indicated two additional areas of potential interest; areas where basalt flows of the Grande Ronde Formation are near or at the surface and initial textural information exhibits potential for basalt hosted ASR. Additionally, stratigraphic information may indicate a potential for ASR hosted in the Coleman member of the Ellensburg formation.

Both sites are within areas identified and assessed for MAR priority in the Ecology-funded Yakima Basin Managed Aquifer Recharge Assessment (KRD 2020). Given results of the assessment, samples were gathered and analyzed to determine stratigraphic position and an initial evaluation of ASR potential in these areas. Locations where samples were gathered are shown on Figure 6and complete chemical analysis is available in Appendix D.

Neither site revealed significant interest in basalt hosted ASR based on textural elements or evidence of structural deformation consistent with increased permeability.

5. Assessment

5.1 GEOLOGIC EVALUATION

Most of the mapped area is covered by unconsolidated Quaternary alluvium or colluvium. Thickness of this material is unknown, but wells and geotechnical borings in Sections 22 and 27 indicate 5 to 200 feet of cemented gravel covers most of the area. The boring logs on file with Ecology are included as Appendix F. This study assumes the thickness of Quaternary sediments on the hill are generally thinner than those lower on the alluvial fan surface, meaning few actual in-place exposures were available to supplement the observations of Sadowski, et al., 2020.

Actual outcrop exposures, and exposures of basalt in the proposed Project area are typically vesicular and glassy, often brecciated. Generally, they look like an aggregate of vesicular subangular clasts in a matrix of glassy, vesicular lava. Some float appears to have multiple generations of clast/matrix relationships, suggesting these flows were emplaced at or near their margins, where emplacement of the cooling flow over irregular substrates leads to textural fragmentation. Local hyaloclastites suggest rapid lava emplacement in places over standing water, leading to cryptoexplosive textures. Photos in Appendix B and brief rock descriptions in Appendix C provide more information.

No contact relationships were observable between flows or bounding outcrops; thus faults, folds, and other geologic boundaries can only be inferred between relationships of chemically determined basalt flow stratigraphy. Most textural characteristics are only traceable over a distance of a few feet (i.e., flow banding or lineated vesicles).

5.2 GEOCHEMICAL RESULTS AND FORMATION ASSIGNMENT

Discrimination between basalt flows of the Columbia River Basalts is only reliable through chemical assessment. That discrimination is necessary to understand relationships between individual basalt flows, in this case to determine whether and what kind of structural deformation affects the set of rocks. As described in section 4.4, chemical analysis was performed by the laboratory at Washington State University.

Sampling results revealed a very similar stratigraphy to that noted in Sadowski et.al. (2020), though the increased sample density revealed some previously unidentified relationships. These are discussed in Section 6.

Full geochemical results are provided in Appendix D. Appendix E gives a detailed technical discussion of these results. Sample locations are shown on Figure 7 and summarized in Table 1. Table 3 summarizes the formation assignments of each individual sample based on geochemical results in comparison to ML assignment.

5.3 HYDROGEOLOGY

There were no wells, seeps, or springs observed in accessible areas of basalt exposure in Section 22.

There are two well casings containing geotechnical instruments located on the property, which are shown on Table 2. Inquiries made to WDNR staff revealed no permits issued for this construction and there are no identification markings on the casings. Additionally, no logs are available for the project on the Ecology website. Geotechnical serial numbers from the manufacturer are on the instruments inside the casings.

A review of the well logs for the broader area (Appendix F) reveals Kittitas County Public Works drilled several geotechnical borings. Most of these were only advanced to 5 feet deep and seem typical of borings related to assessing the road material reserve. These borings were

reported to be in section 22, however boring logs are sometimes mislocated. If the borings were actually located in Section 22, they were likely constructed inside the fence near the center of the west section line in the borrow pit area. Table 2 contains global positioning system locations of the fence corners and a survey monument used by Kittitas County, as well as other points of interest.
Otherwise, static water levels reported as of the date of well construction to the north and east of the area are approximately 180-240 feet below ground surface. Most production comes from sandstone, which may be Coleman member material. South of the section, static water levels are generally less than 100 feet; however, these levels come from water-bearing zones well below this elevation, thus the water table is at least semi-confined below the area. Two wells are included on the cross section (Figure 9), which indicate static water levels at the time of construction at least 200 feet below ground surface.

Based on the above review of available subsurface information, we believe there is approximately 200 feet between ground surface and the area water table. Thus, there is approximately 200 feet of unsaturated zone available for water storage.

6. ASR Assessment and Conceptual Geologic Model Comparison

The stratigraphic assignments of these samples favor a somewhat different conceptual geologic model than that described in Sadowski et al., 2020. That paper suggested an anticline was present in the area, with older rocks flanking a center of younger rocks, as discussed in the initial conceptual geologic model. This model requires dominantly ductile deformation of this section in this area.

This study suggests a brittle, rather than ductile deformation model. The geologic map (Figure 8) and the cross section (Figure 9) shows a series of reverse faults, lifting the stratigraphic package of rocks from the southwest over the northeast. These faults are postulated to be oriented sub parallel to the Dead Coyote Fault of Sadowski, et al., 2020. Central to this interpretation is the assignment of samples G-622-001, G-622-006, and G-622-007 to the Museum member, which essentially repeats the stratigraphic section from the west side of the hill to the east in a manner more akin to fault displacement than folding.

This conceptual model is consistent with brittle deformation effects mapped near important structural features for basalt units found elsewhere in the Columbia Basin. Widely spaced outcroppings with little continuity between them make this model fairly uncertain. However, this interpretation is consistent with the observed chemical data and observations elsewhere in the Columbia Basin.

6.1 CONCLUSIONS AND RECOMMENDATIONS: ASR POTENTIAL

Brittle fracture systems can create areas of enhanced open space and connected fracturing, which are desirable targets for ASR. Brittle fracture systems can also generate no-flow boundary conditions where fractures are poorly connected or otherwise sealed. Those kinds of boundaries are good because they limit reservoir leakage, but they can be undesirable because they may limit the volume of reservoir material. Together with the primary textures observed in outcrop, as

well as the relatively thick unsaturated zone, we conclude here is potential for at least small volume ASR hosted by basalts at the project area.

We recommend, as next steps:

- Identify the best locations to characterize the hydraulic properties of shallow basalts in WDNR property. The major considerations for establishing these locations include practical access constraints like overhead powerlines, cost considerations of access road permitting, construction, reclamation, and any permitting considerations by WDNR.

- Obtain access from WDNR to construct test wells.

- Construct test borings and conduct tests injecting water into dry wells in the shallow basalts, while monitoring hydraulic response in nearby observation wells.

This work is required to determine if the site could be used to store and recover water in the basalt structure present.

6.1.1 Conceptual Testing Plan

If KRD proceeds with further testing to determine the feasibility of Basal ASR at this location, test wells are recommended to be located east of the Dead Coyote Fault and north of the Bonneville Power Administration power transmission lines. The objective will be to establish a test boring "nest" consisting of a boring constructed as a water production well and two borings constructed as monitoring wells. Monitoring wells should be situated approximately 120 degrees azimuth from the test well at variable radial distances of up to 75 feet. The production well is anticipated to be 200-feet deep or less, intersecting a zone of fractures and favorable textural characteristics. The monitoring wells will be constructed to monitor the zone identified in the production well.

Based on local ground water conditions, encountering groundwater in these wells is not anticipated. Consequently, once constructed, water will need to be delivered to the well site and injected at a constant rate into the production well. Monitoring wells will be measured to assess the time and volume of water that arrives in the wells. Once a sufficient volume is introduced, injection will cease and monitoring will continue until hydraulic heads stabilize or water dissipates. Conceptually, this will resemble a large-scale constant-head and falling head permeameter test, with the objective of determining hydraulic conductivity of the aquifer material. If repeated along a same structure, a storage volume can be assessed and later tested for injection and recovery of water using pumped water, and boundary conditions evaluated.

As an initial estimate, water sourced from the North Branch Canal at the Reecer Creek Road Bridge delivered to the center of the northwest quarter of Section 22, would need to be piped approximately 9,000 feet and lifted roughly 320 feet.

Disclaimer

This report is prepared describing the geology of a specific location. Standard field methods were used in gathering information presented herein, within the precision and accuracy of instruments and equipment used. Field observations were made by a professional geologist with experience in this terrain and conclusions have been drawn based on that experience and the information gathered. Rock outcroppings on the project area are few, and the ability to establish contacts between or within rocks of similar type is hampered by unconsolidated sediments. Further investigation may reveal rock relationships not considered or in evidence with the current density of information.

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Sadowski, A. J., J.B. McCosby, M.L. Anderson, T.R. Lau, A. Steiner, S.A. DuFrane, T. Rittenour, and B. Housen. 2020. *Geologic map of the Ellensburg North and southern half of the Reecer Canyon 7.5-minute quadrangles, Kittitas County, Washington*: Washington Geological Survey Map Series 2020-01, 1 sheet, scale 1:24,000, 25 p. text. http://www.dnr.wa.gov/publications/ger_ms2020-01_geol_map_ellensburg_north_reecer_canyon_24k.zip

TABLES

Table 1. Sample Numbers and Locations (WGS84)

Sample Numbers	Latitude	Longitude
G-622-001	47.12725	-120.577
G-622-002	47.12704	-120.581
G-622-003	47.1278	-120.581
G-622-004	47.05957	-120.426
G-622-005	47.12066	-120.574
G-622-006	47.12033	-120.572
G-622-007	47.12216	-120.573
G-622-008	47.12075	-120.575
KEks002	47.00739	-120.302

Note:
WGS84 - Coordinate System

Table 2. Points of Interest and Location

Latitude	Longitude	Description	Details
47.12843	-120.579	Fence Corner	NE Fence Corner-Borrow Pit
47.12752	-120.58	Survey monument	Kittitas County Control Point (Rebar)
47.12482	-120.579	Fence Corner	SE Fence Corner, Borrow Pit
47.12482	-120.58	Fence Corner	SE-mid Fence Corner, Borrow Pit
47.12427	120.5799	Fence Corner	S Fence Corner, Borrow Pit
47.12428	-120.582	Fence Corner	SW Fence Corner, Borrow Pit
47.12845	-120.582	Fence Corner	NW Fence Corner, Borrow Pit
47.13058	-120.577	Outcrop	Subcrop, rock 20-A
47.13199	-120.577	Fence Corner	Fence Crib at North end of gully on North fence line
47.13196	-120.571	Fence Corner	NE Corner Fence corner
47.13012	-120.574	Casing	4-inch PVC stickup casing with 1-inch PVC casing inside, contains GeoKon tool
47.12725	-120.577	Outcrop	Slight outcrop 20-B..NE/SW trending no measurable fractures
47.12704	-120.581	Outcrop	20-A outcrop,
47.1278	-120.581	Outcrop	20-B outcrop
47.05957	-120.426	Outcrop	Rader Rd. west of Fairview Rd.-Vesicular float
47.12075	-120.575	Outcrop	Hyaloclasite outcrop 22-A
47.12066	-120.574	Outcrop	22-B outcrop
47.11998	-120.571	Survey monument	Center southernmost power line on N-S section line
47.12033	-120.572	Outcrop	22-C outcrop
47.1209	-120.571	Fence Corner	Powerline road gate in N-S fence
47.12207	-120.573	Outcrop	22-B outcrop
47.12216	-120.573	Outcrop	22-C subcrop
47.12294	-120.574	Casing	4-inch PVC stickup casing with 1-inch PVC casing inside, contains GeoKon tool serial number 1005934
47.12075	-120.575	Outcrop	Hyaloclasite 22-A Sample
47.12115	-120.582	Road junction	BPA Gate on Pheasant Ln
47.1261	-120.582	Road junction	Borrow Pit Gate on Pheasant Ln
47.11715	-120.582	Road junction	Pheasant Lane at Reecer Ck. Rd.
47.10868	-120.582	Road junction	c/l KRD Canal at Reecer Ck. Rd.

Notes:

Table 3. Machine Learning and This Study Formation Assignment

Sample Name	Formation-Machine Learning	Member-Machine Learning	Flow-Machine Learning	Flow-This Study
G-622-001	Grande Ronde	Meyer Ridge	---	Museum
G-622-002	Grande Ronde	Sentinel Bluffs	Spokane Falls	Spokane Falls
G-622-003	Grande Ronde	Sentinel Bluffs	Museum	Museum
G-622-004	Grande Ronde	Sentinel Bluffs	Spokane Falls	Spokane Falls
G-622-005	Grande Ronde	Sentinel Bluffs	Museum	Stember Creek
G-622-006	Grande Ronde	Meyer Ridge	---	Museum
G-622-007	Grande Ronde	Sentinel Bluffs	Museum	Museum
G-622-008	Not a basalt	---	---	Hyaloclastite
KEks002	Grande Ronde	Sentinel Bluffs	Museum	Museum

Notes:
Dashes (---) N/A

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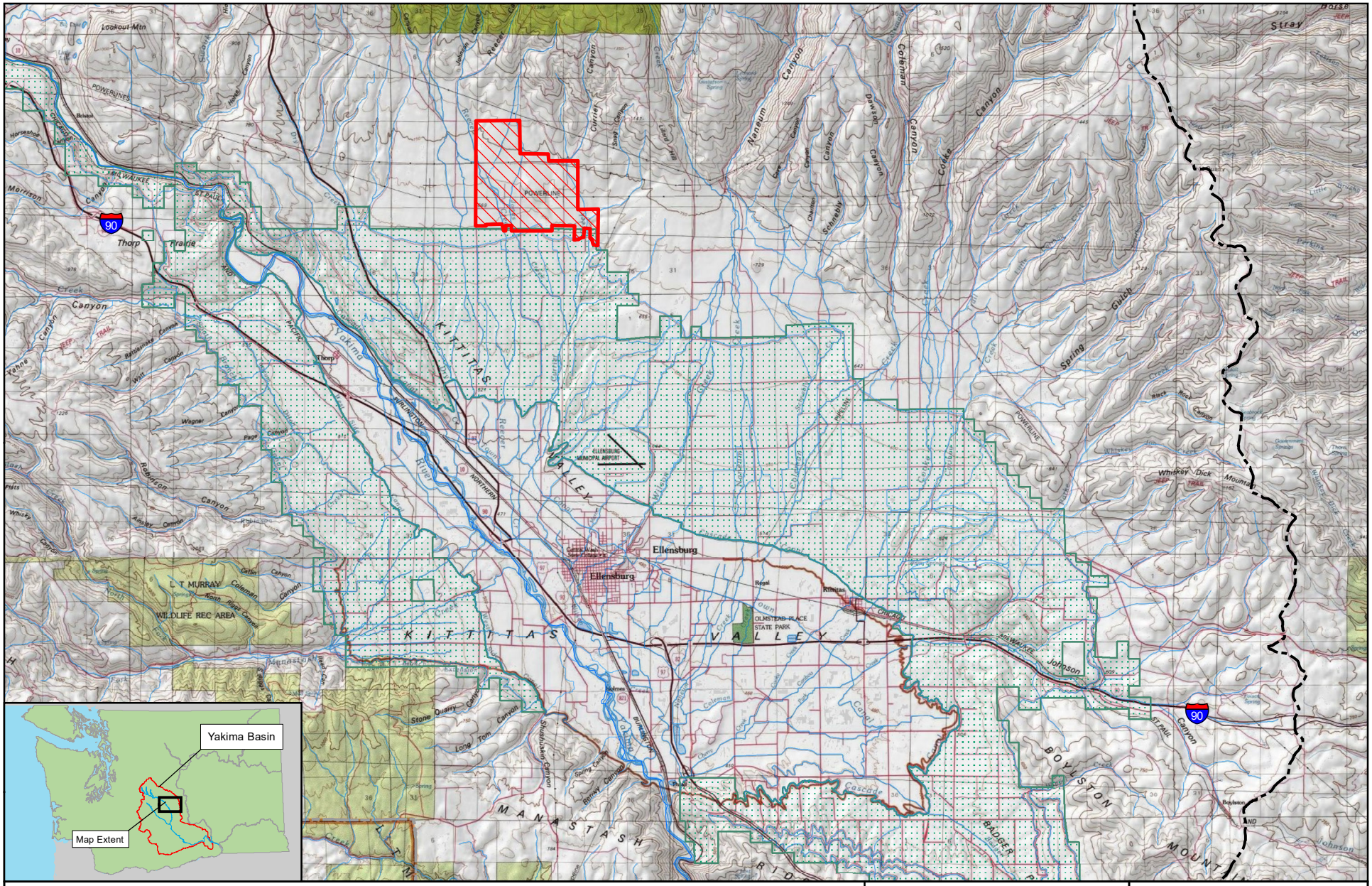
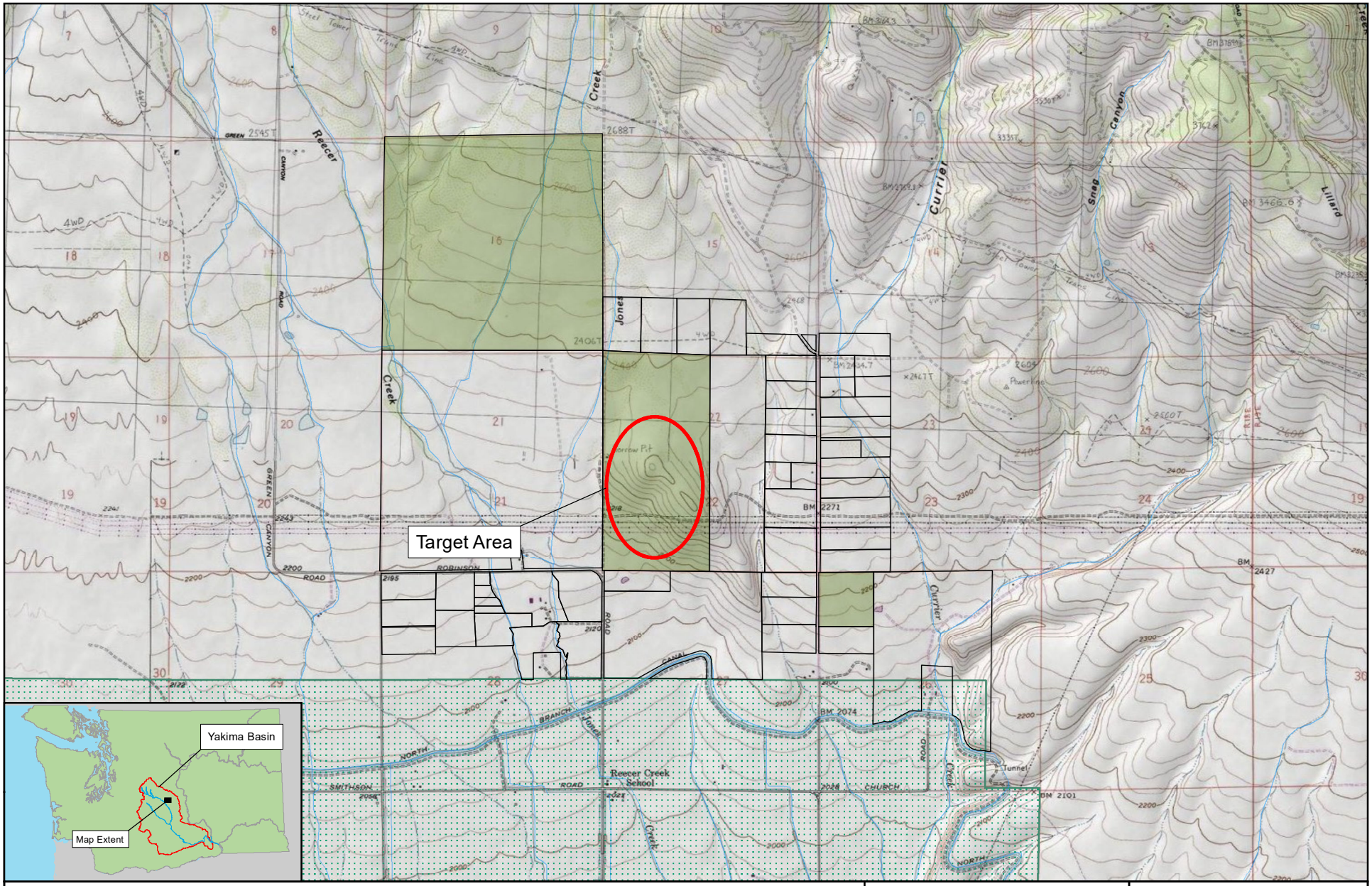
FIGURES



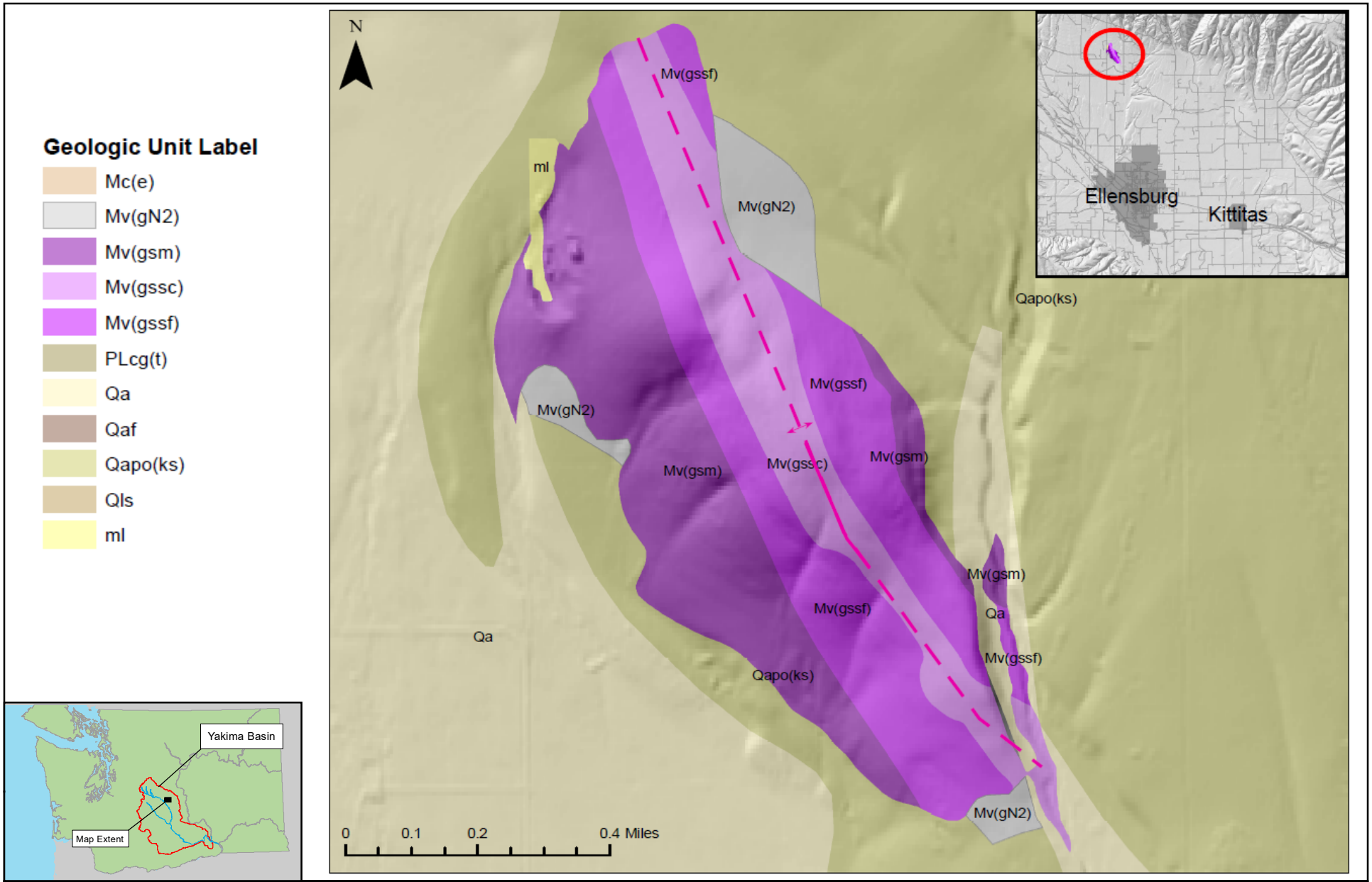
BASALT ASR
INITIAL ASSESSMENT

FIGURE 1
SITE LOCATION



BASALT ASR
INITIAL ASSESSMENT

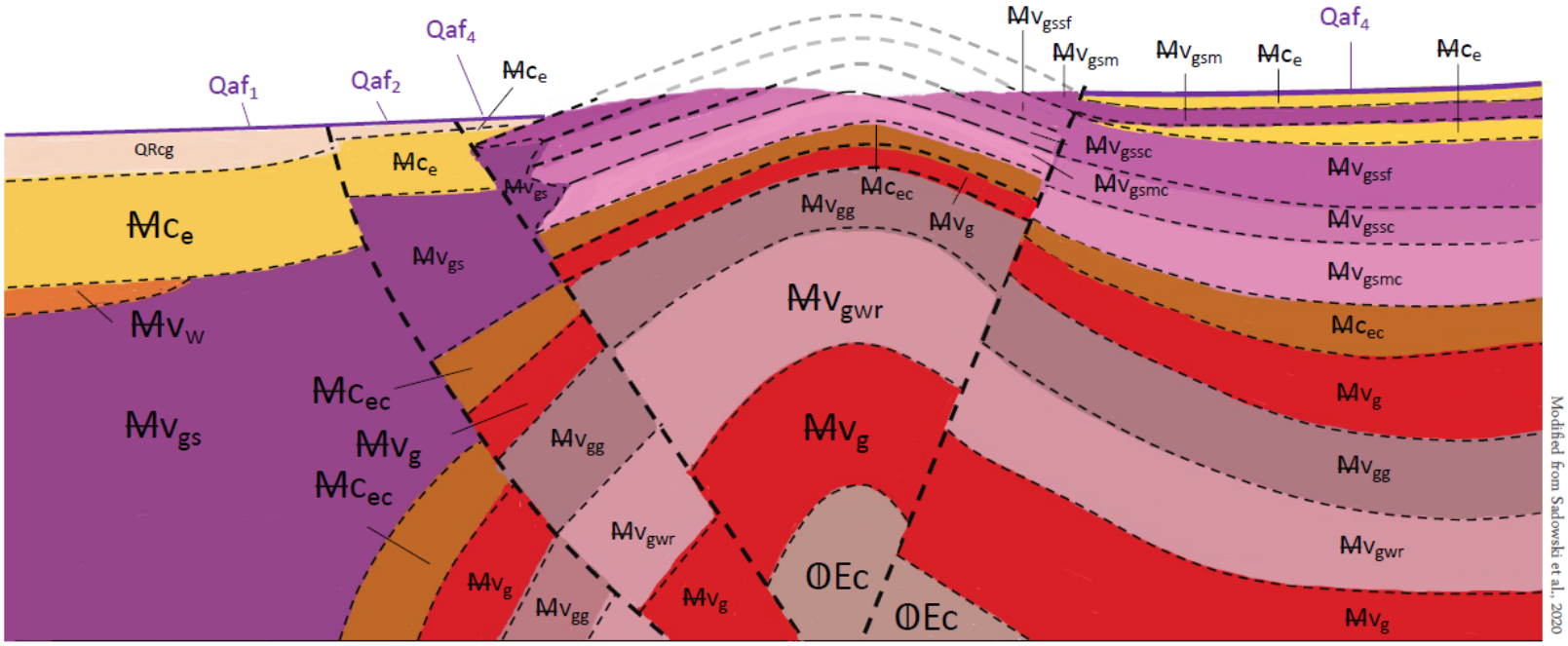
FIGURE 2
PROPERTY OWNERSHIP



Modified from Sadowski et al., 2020

BASALT ASR INITIAL ASSESSMENT

FIGURE 3 EXCERPT of DNR GEOLOGY MAP



HOLOCENE TO PLIOCENE NONGLACIAL DEPOSITS

QRcg **Oldest alluvium, gravelly unit (Pleistocene to Pliocene)**—Monomict, clast-supported, semi-consolidated, basalt-derived cobbles and pebbles with weathering rinds 1-mm to 2-cm-thick sourced from Naneum Canyon and possibly Wilson Canyon to the north. Possibly glaciofluvial. Imbrications of clasts suggest southward and westward paleocurrent directions. Loess is extremely pervasive on this unit and silicic caliche is common.

TERTIARY SEDIMENTARY AND VOLCANIC BEDROCK

Mce **Ellensburg Formation, undivided (Miocene)**—Volcaniclastic to lacustrine or fluvial sedimentary bedrock underlying, interfingering, and overlying rocks of the Columbia River Basalt Group.

Mcec **Coleman member of the Ellensburg Formation, undivided**—Sedimentary rock divided into subunits by grain size, and can contain basaltic boulder(?)-sized exposures of Winter Water and Wapshilla Ridge members (geochemistry sites G25 and G29, respectively). Less than 200 ft thick of well-exposed sedimentary outcrop. Overlies the Grouse Creek member and underlies the Sentinel Bluffs member.

Columbia River Basalt Group (CRBG)—Very dark gray to medium gray, aphanitic, fine- to medium-grained basaltic andesite, divided into:

Mvg **Grande Ronde Basalt (GRB), undivided (Miocene)**—Basaltic andesite. GRB is subdivided based on geochemical composition into:

Mvgs **Sentinel Bluffs Member, undivided**—Subdivided into:

Mvgsm **Basalt of Museum**

Mvgssf **Basalt of Spokane Falls**—Contains hyaloclastite horizons.

Mvgssc **Basalt of Stember Creek**

Mvgsmc **Basalt of McCoy Canyon**

Mvgw **Winter Water Member (cross section only)**—Basaltic andesite.

Mvgg **Grouse Creek member**—Basaltic andesite commonly features hyaloclastite (and (or) peperite?), especially where directly underlying the Coleman member of the Ellensburg Formation. Unit consists of 2–6 flows of fanning entablatures with a basal colonnade. Colonnades and vesicular tops are poorly developed to absent in the unit's interior. Previously mapped as the Howard Creek invasive flow.

Mvgwr **Wapshilla Ridge member**—Basaltic andesite contains well-developed basal colonnades and vesicular tops. Well exposed in Wilson Creek. Base is not exposed.

PRE-MIOCENE BEDROCK

ΦEc **Continental sedimentary rocks, undivided (Oligocene to Eocene)(cross section only)**—Unit may include tuffaceous siltstone and sandstone of the Oligocene to Eocene Ohanapecosh Formation, coal-bearing sandstone and tuffaceous(?) siltstone of the Eocene Roslyn formation, and (or) sandstone and conglomerate of the Eocene Swauk Formation. Unit is interpreted as entirely Eocene in age beneath unit Ev_t.

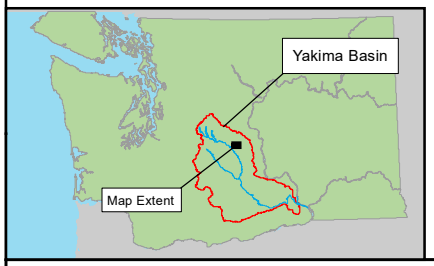
Modified from Sadowski et al., 2020

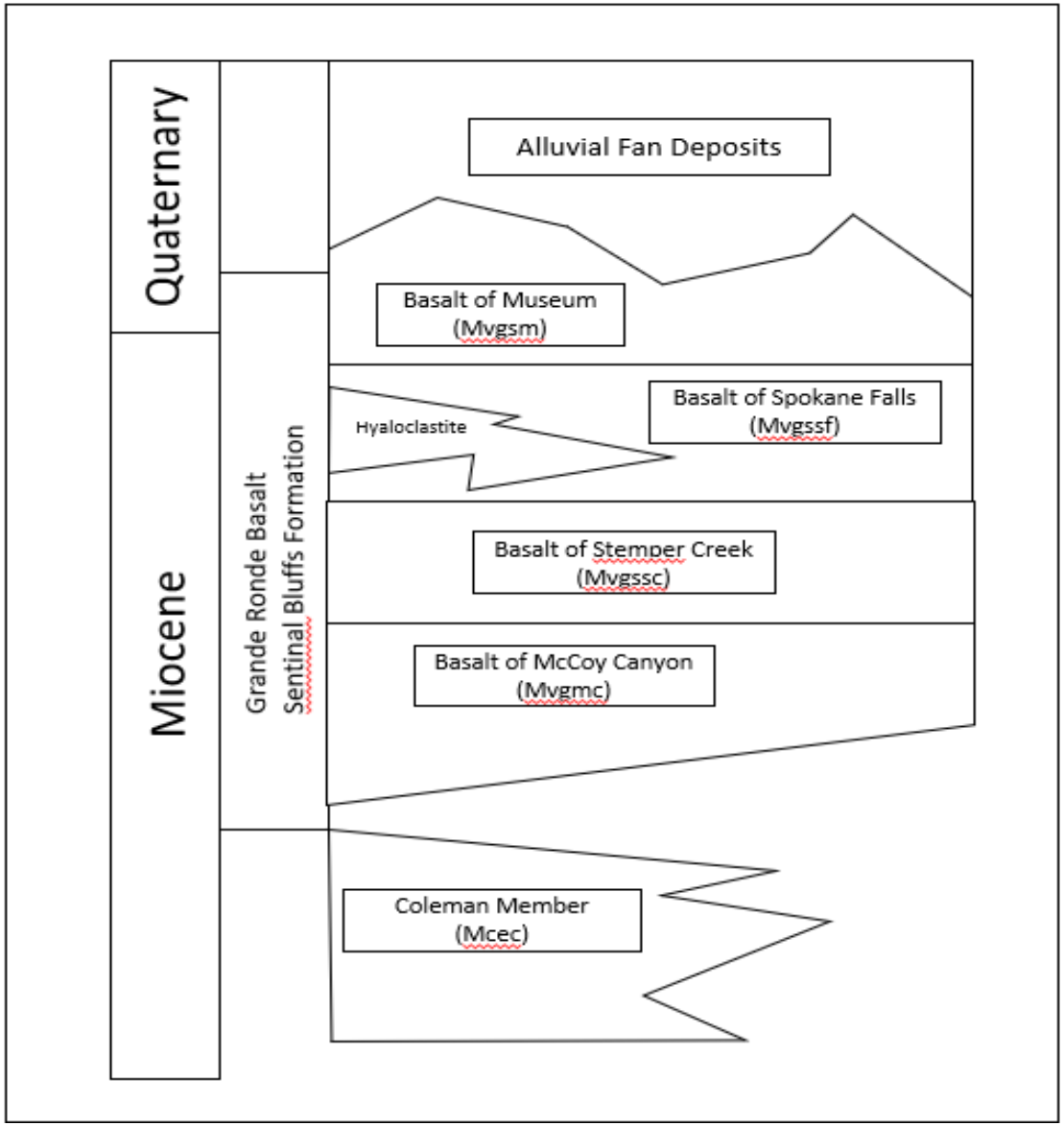
BASALT ASR INITIAL ASSESSMENT

FIGURE 4
EXCERPT of DNR GEOLOGY CROSS SECTION

Geologic Map Label

- Mc(e)
- Mv(gN2)
- Mv(gsm)
- Mv(gssc)
- Mv(gssf)
- PLcg(t)
- Qa
- Qaf
- Qapo(ks)
- Qls
- ml

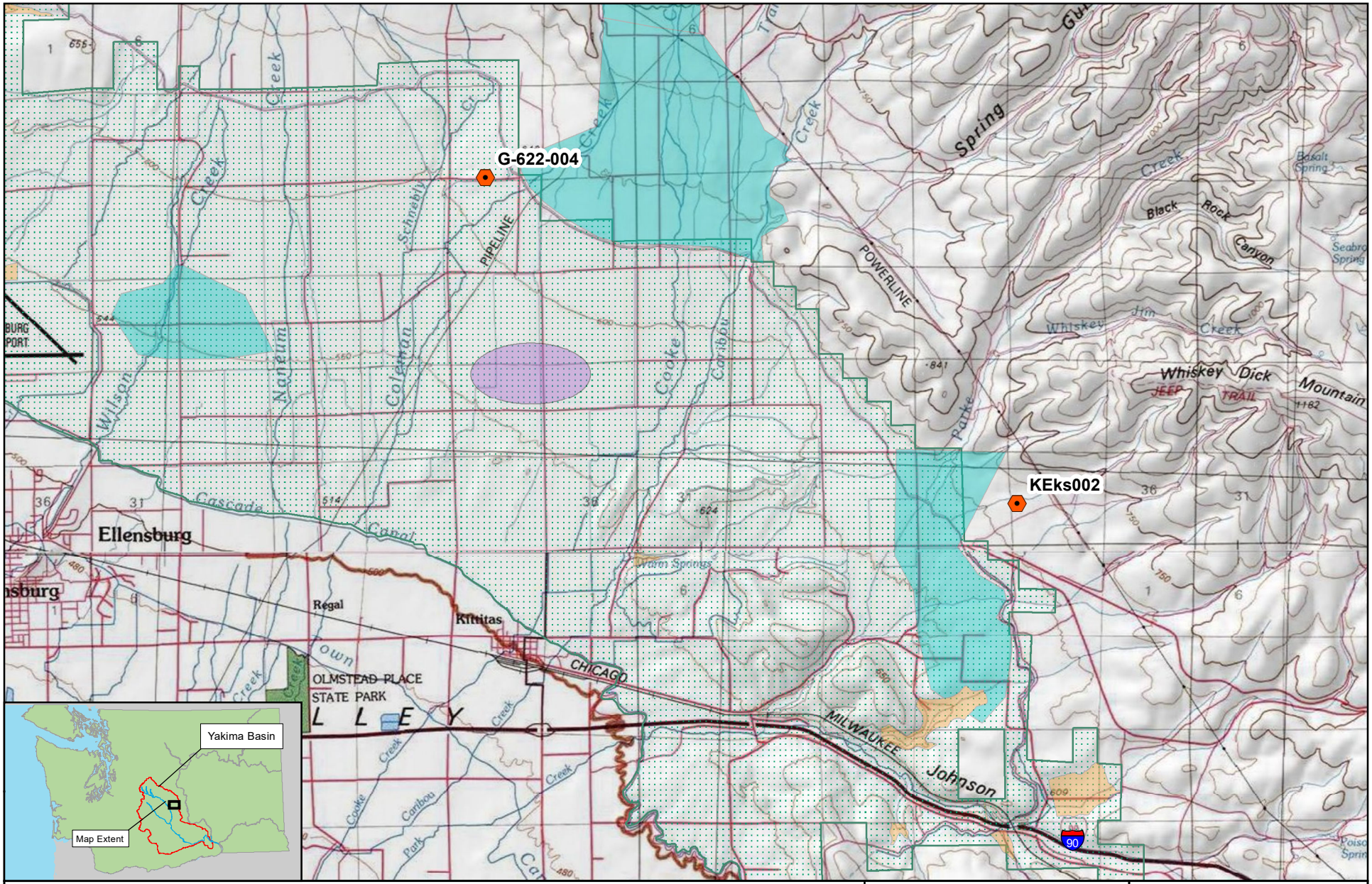


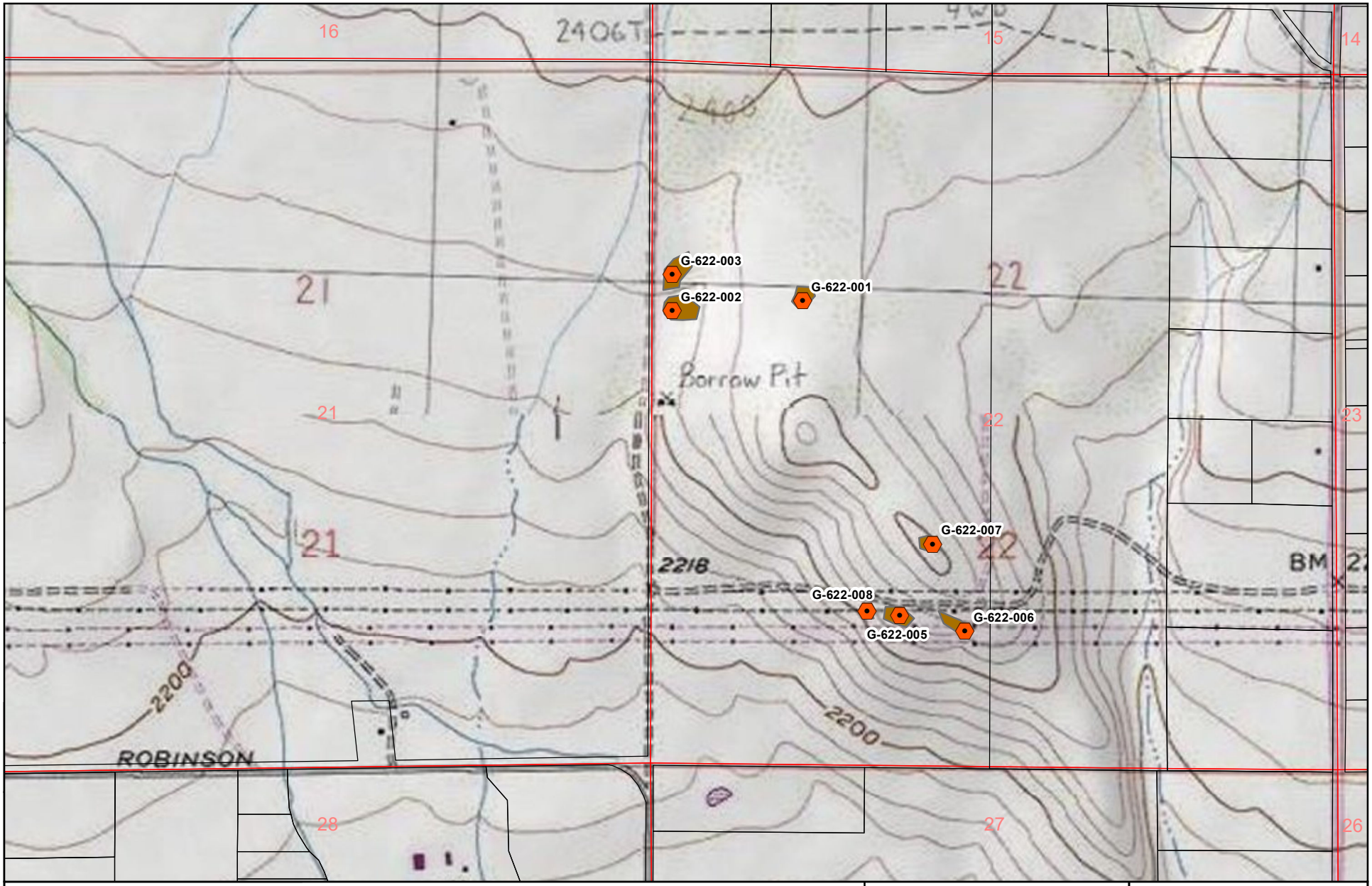


Mapped by Gregory Geologic, LLC 2022

BASALT ASR
INITIAL ASSESSMENT

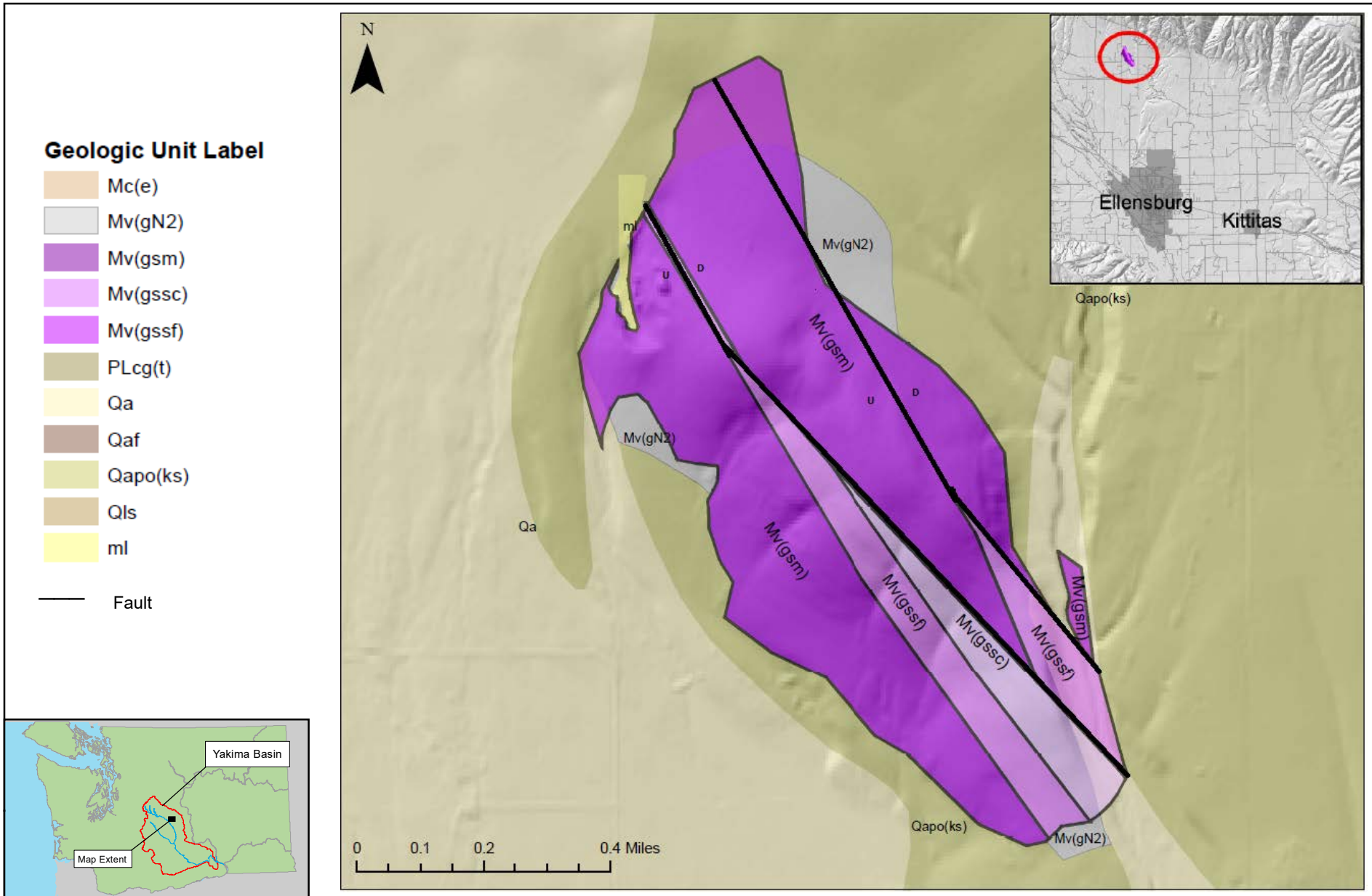
FIGURE 5 STRATIGRAPHY in SECTION 22, T19N, R18E W.M.


G-622-004
KEks002
Ellensburg
Regal
Kittitas
OLMSTEAD PLACE
STATE PARK
Yakima Basin
Map Extent
MAR Assessment Sites
Aquifer Storage and Recovery
Return Flow Recovery
Surface Infiltration
Surface Storage Assessment Site
XRF Sample Location
KRD District
0 0.5 1 2
Miles
N
BASALT ASR
INITIAL ASSESSMENT
FIGURE 6
X-RAY FLORESENCE (XRF)
TARGETS OF OPPORTUNITY
KRD



BASALT ASR INITIAL ASSESSMENT

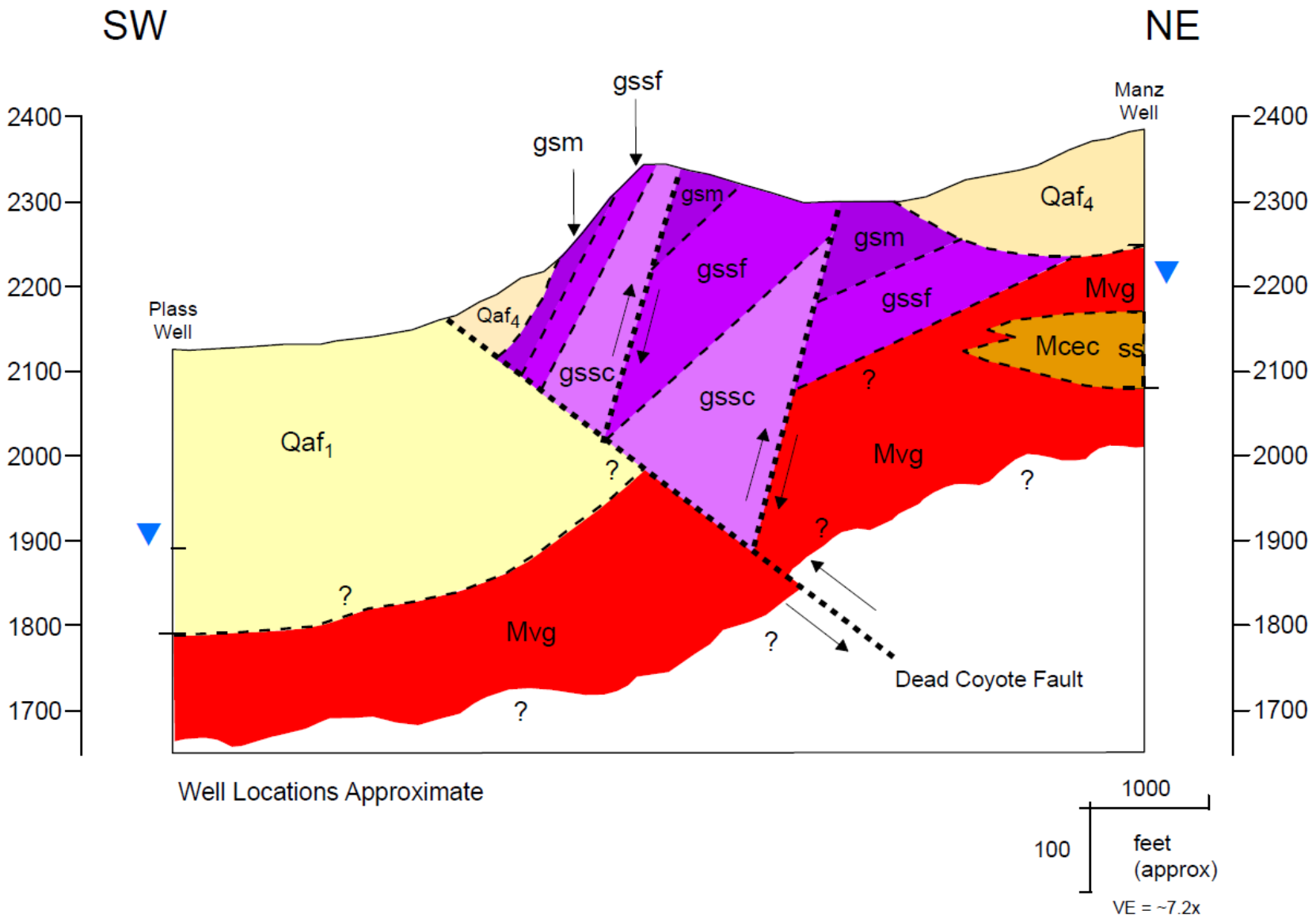
FIGURE 7
BASALT OUTCROPS AND XRF SAMPLE LOCATION



Mapped by Gregory Geologic, LLC 2022

BASALT ASR
INITIAL ASSESSMENT

FIGURE 8
GEOLOGY MAP



After Gregory Geologic, LLC 2022

BASALT ASR INITIAL ASSESSMENT

FIGURE 9 GEOLOGY CROSS SECTION

APPENDICES

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Appendix A. Access Solicitations

Kittitas Reclamation District
P.O. Box 276
Ellensburg, WA 98926
Phone: (509) 925-6158 Fax: (509) 925-7425

To: Property owner

RE: KRD surface geology survey

Dear Sir:

The Kittitas Reclamation District is conducting a surface geology survey in your area and has contracted the work out to Guy Gregory of Gregory Geologic LLC. Mr. Gregory works well with us, and we appreciate his knowledge and integrity.

Please see his attached letter.

Thank you,

Urban Eberhart
Secretary Manager
Kittitas Reclamation District (KRD)

Gregory Geologic LLC
6205 E. Clements Ln
Spokane, WA 99217
509.939.1052
gregorygeologic@gmail.com

To: Property Owner

Greetings:

During the last half of June, Kittitas Reclamation District (KRD) will be sending me, as a contractor to KRD, to your property located in Section 27, Township 19N, Range 18E to conduct geologic mapping. I will have KRD photo ID.

During the course of the mapping project, I'll be likely parking during the day on Reecer Ck. Road or Pheasant Lane. I'll be walking in the area, observing the bedrock in the area and, if possible, taking a small (1 lb) sample of the rock for analysis. I will not be digging holes or otherwise disturbing the ground. In addition, I am not going to disturb livestock or otherwise damage crops beyond footprints.

I intend to have the project completed and be out of the area by July 1.

I request your permission to access your property during this time to view the geology of the area and, if available, take a sample for analysis. Of course, following completion of the project and final report, I'll forward you a copy of the report and the location and results of any sampling done on your property.

If you could, please phone me at (509) 939-1052 at your convenience or email me at gregorygeologic@gmail.com and we'll find a convenient time for you to connect with me either by phone or in person to discuss. You may also contact the KRD office by phone at (509)925-6158 or by email at krdoffice@fairpoint.net. I appreciate your consideration.

I look forward to hearing from you.

Regards,

Guy J. Gregory, L.G., L. Hg., R.G.
Principal
Gregory Geologic LLC

Appendix B: Field Photos

Figure B1 Exposure north of quarry, east side of gully

Figure B2 Rubbly outcrop with variable, discontinuous texture

Figure B3 Rubbly subcrop -Black, glassy material with 1 cm weathering rind

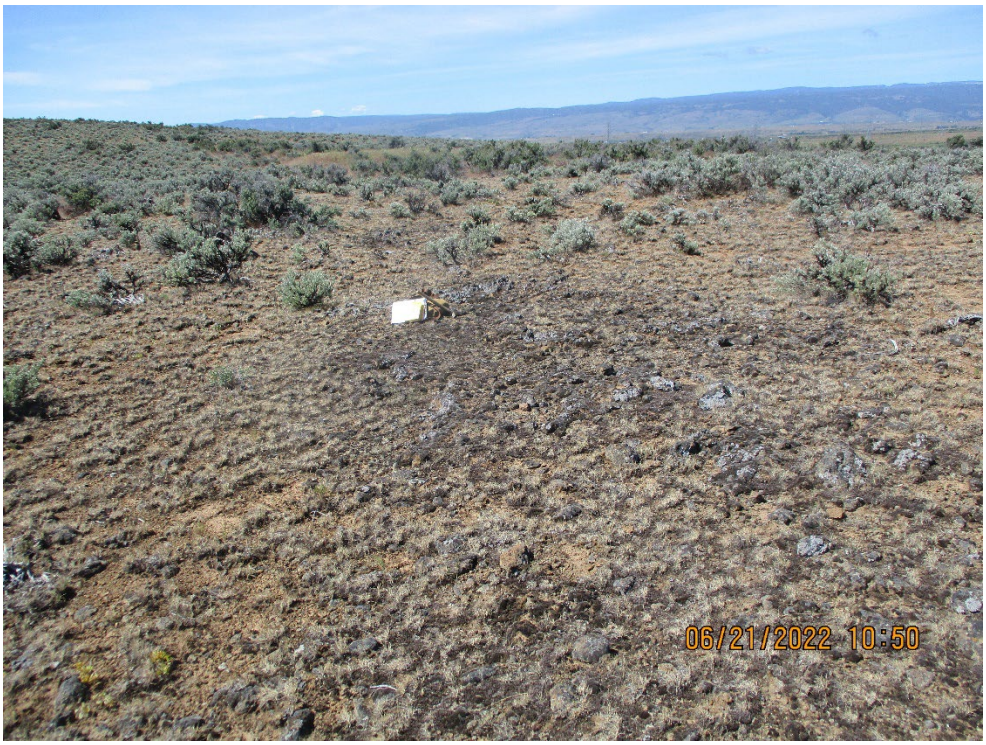


Figure B4 Typical low exposure outcrop-location Sample G-622-001

Figure B5 Outcrop of multiple brecciated basalt Sample G-622-005

Figure B6 Hyaloclastite at location G-622-008

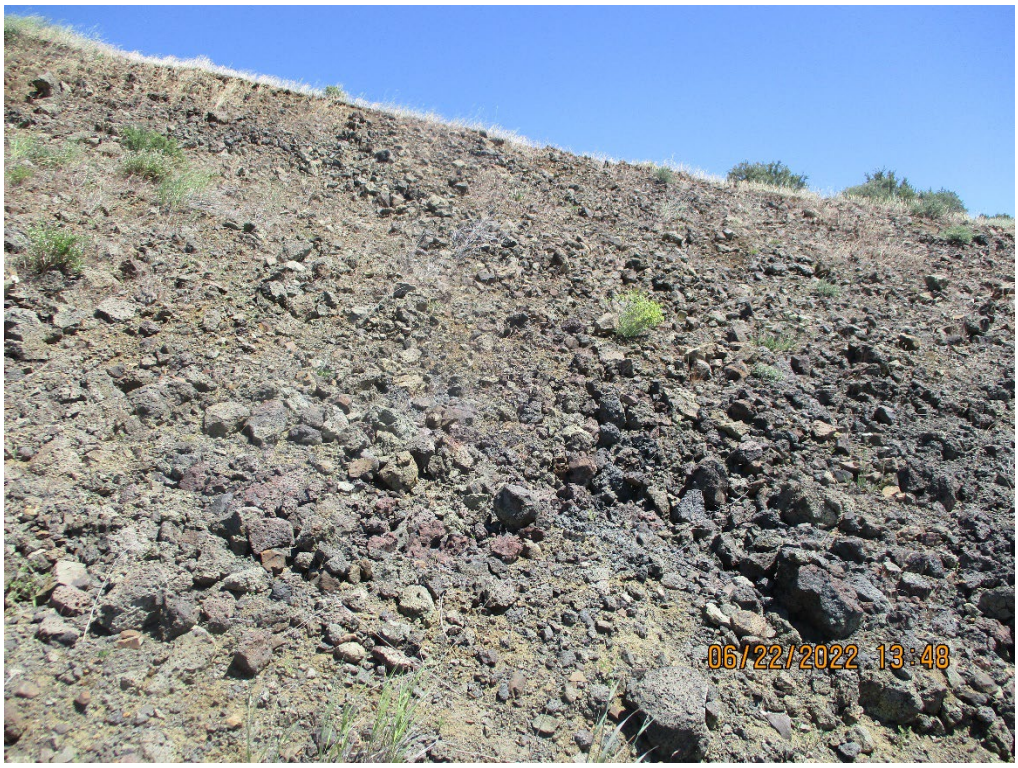


Figure B7 Gravel Pit exposure

Figure B8 Rubble in gravel pit, see streched vesicles in glassy matrix

Appendix C: Rock sample Descriptions

Rock Descriptions

Rock Type 20A Sample G-622-002
Glassy basalt +/- magnetite and 1 mm glassy nodules. Vesicular, vesicles lined with quartz, hummocky outcrop pattern. Flow toppy-appearing, vesicles of variable size, fracture set 1/meter, E-W trending, not pervasive

Rock Type 20-C Sample G-622-003 Waypoint 89
Very vesicular overlying interbed or intercalated brecciated horizon. Generally granular/tuffy appearing, some sub horizontal lineation

Rock type 21-A float, Waypoint 83
Blocky, 6" angular framents of tan/brown weathering basalt with ½" weiathering rind-interior material black and glassy

Waypoint 87
Rocktype looks like 20A, call 21-A, slight outcrop of hard, glassy vesicular dark grey basalt, vesicles lined with quartz and zeolites, low rubbly exposure

Sample G-622-004: Target of Opportunity
Subcrop vesicular basalt and palagonite in float. Basalt with large vesicles, silica in vug lining, very hard and glassy

Hyaloclastite-Waypoint 91, Sample G-622-008
Outcrop of tuff/ingnimbrite containing angular fragments of glass in a matrix supported breccia. Frags often altered to clay. Glassy bits variable in size.

Waypoint 94, Rock type 22-C Sample G-622-006
Low outcrop under powerline. Very vesicular basalt, vugs lined with silica and occasional olivine, smpall phenocrysts of plagioclase in glassy matrix.

Waypoint 96: Subcrop rock type 22-C
Looks like outcrop, or close subcrop. Similar rock to Waypoint 94.

Appendix D: Geochemical Results

Trace Element Results

Sample ID	La ppm	Ce ppm	Pr ppm	Nd ppm	Sm ppm	Eu ppm	Gd ppm	Tb ppm
GGL G-622-001	19.83	41.87	5.50	23.54	5.70	1.80	6.10	1.04
GGL G-622-002	21.05	43.97	5.84	24.98	6.08	1.85	6.36	1.07
GGL G-622-003	18.39	37.49	5.18	21.85	5.33	1.67	5.49	0.94
GGL G-622-004	19.31	37.05	5.30	22.89	5.52	1.71	5.83	0.96
GGL G-622-005	23.65	46.46	6.59	27.99	6.89	2.12	7.12	1.21
GGL G-622-006	23.83	41.52	6.48	27.63	6.59	1.99	7.04	1.18
GGL G-622-007	21.69	42.86	5.91	24.91	6.05	1.92	6.38	1.06
GGL G-622-008	20.69	37.91	4.93	19.71	4.14	1.18	4.10	0.68
AGV-2	39.28	70.77	8.29	31.12	5.57	1.52	4.60	0.65
BHVO-2	15.49	37.65	5.37	24.67	5.97	2.10	6.27	0.99
BCR-2	25.72	53.30	6.87	28.81	6.66	1.97	6.71	1.10

Sample ID	La ppm	Ce ppm	Pr ppm	Nd ppm	Sm ppm	Eu ppm	Gd ppm	Tb ppm
GGL KEks002	21.09	43.93	5.79	24.35	5.80	1.83	6.12	1.01
BCR-2	25.77	53.52	6.87	28.79	6.68	2.04	6.88	1.12
BHVO-2	15.48	37.74	5.35	24.63	6.21	2.10	6.37	0.95

Trace Element Results

Dy ppm	Ho ppm	Er ppm	Tm ppm	Yb ppm	Lu ppm	Ba ppm	Th ppm	Nb ppm	Y ppm
6.07	1.24	3.48	0.51	3.11	0.50	853	3.44	10.88	35.64
6.22	1.32	3.59	0.54	3.22	0.51	823	3.79	11.56	35.73
5.43	1.14	3.08	0.46	2.85	0.44	787	3.64	11.10	31.83
5.70	1.17	3.20	0.48	2.92	0.46	487	3.48	10.86	32.27
7.10	1.46	4.02	0.60	3.63	0.55	668	4.09	12.40	39.24
6.77	1.38	3.77	0.55	3.35	0.52	963	3.76	11.47	38.50
6.30	1.31	3.52	0.52	3.15	0.49	518	3.69	11.35	35.66
3.85	0.81	2.18	0.34	2.03	0.33	641	4.87	8.97	22.69
3.56	0.69	1.75	0.26	1.64	0.26	1125	6.43	13.95	19.96
5.33	0.98	2.47	0.34	1.93	0.28	128	1.24	18.07	26.04
6.47	1.32	3.51	0.54	3.29	0.51	668	6.03	12.21	35.64

Dy ppm	Ho ppm	Er ppm	Tm ppm	Yb ppm	Lu ppm	Ba ppm	Th ppm	Nb ppm	Y ppm
6.04	1.28	3.46	0.53	3.15	0.51	589	4.06	11.13	34.20
6.36	1.32	3.62	0.55	3.34	0.52	679	5.94	12.40	35.87
5.33	0.99	2.49	0.34	2.01	0.29	130	1.25	18.25	26.10

Trace Element Results

Hf ppm	Ta ppm	U ppm	Pb ppm	Rb ppm	Cs ppm	Sr ppm	Sc ppm	Zr ppm
4.03	0.66	1.14	10.51	24.1	0.67	349	38.0	155
4.25	0.71	1.15	5.96	25.2	0.72	358	37.8	162
4.19	0.68	0.94	5.51	25.4	0.64	349	38.2	158
4.08	0.68	0.82	5.03	16.9	0.64	326	37.5	156
4.66	0.76	1.19	6.39	29.0	0.78	361	40.5	176
4.31	0.70	1.03	5.68	26.3	0.73	344	37.2	164
4.27	0.70	0.96	6.06	24.8	0.65	334	36.7	160
3.50	0.64	1.12	8.96	54.0	1.59	267	18.3	131
5.29	0.87	1.89	13.47	66.5	1.10	653	12.5	229
4.40	1.15	0.41	1.73	9.2	0.12	390	31.8	167
4.96	0.77	1.64	10.32	46.1	1.20	336	33.6	183

Hf ppm	Ta ppm	U ppm	Pb ppm	Rb ppm	Cs ppm	Sr ppm	Sc ppm	Zr ppm
4.30	0.69	1.05	6.49	26.4	0.74	327	36.4	162
4.89	0.78	1.61	10.46	46.1	1.22	334	33.5	182
4.43	1.19	0.40	1.61	9.2	0.12	392	31.7	168

Perform'X Run 0221, Guy Gregory, Gregory Geologic LLC

	G-622-001	G-622-002	G-622-003	G-622-004	G-622-005	G-622-006	G-622-007	G-622-008
	GGL 2516-1	GGL 2516-2	GGL 2516-3	GGL 2516-4	GGL 2516-5	GGL 2516-6	GGL 2516-7	GGL 2516-8
Date	13-Jul-22	13-Jul-22	13-Jul-22	13-Jul-22	13-Jul-22	13-Jul-22	13-Jul-22	13-Jul-22
SO3 >/=	0.03	0.25	0.02	0.01	0.02	0.04	0.02	0.02
	Unnormalized Major Elements (Weight %):							
SiO2	53.03	53.31	53.36	51.31	54.88	53.50	52.94	67.10
TiO2	1.773	1.859	1.831	1.800	1.997	1.866	1.833	0.940
Al2O3	14.43	14.56	14.80	14.36	15.50	14.52	14.56	10.81
FeO*	10.96	9.52	9.93	11.99	7.97	10.98	10.50	6.73
MnO	0.176	0.174	0.149	0.152	0.142	0.155	0.145	0.088
MgO	4.38	3.85	3.79	3.52	3.93	3.42	3.37	1.82
CaO	8.68	9.16	8.13	7.85	8.66	7.94	7.93	3.47
Na2O	2.71	2.76	2.70	2.56	2.98	2.68	2.76	1.70
K2O	1.04	1.10	1.10	0.72	1.33	1.08	1.02	1.73
P2O5	0.286	0.335	0.313	0.257	0.360	0.327	0.310	0.131
Sum	97.46	96.63	96.09	94.53	97.75	96.46	95.37	94.53
LOI %	2.39	2.85	3.64	5.17	2.00	3.45	4.48	5.24
	Normalized Major Elements (Weight %):							
SiO2	54.41	55.17	55.53	54.28	56.15	55.47	55.51	70.98
TiO2	1.82	1.92	1.91	1.90	2.04	1.93	1.92	0.99
Al2O3	14.80	15.06	15.40	15.19	15.85	15.05	15.27	11.43
FeO*	11.25	9.85	10.33	12.69	8.15	11.38	11.01	7.12
MnO	0.18	0.18	0.16	0.16	0.15	0.16	0.15	0.09
MgO	4.50	3.98	3.94	3.72	4.02	3.55	3.53	1.93
CaO	8.90	9.48	8.46	8.31	8.86	8.23	8.32	3.67
Na2O	2.78	2.86	2.81	2.71	3.05	2.77	2.90	1.80
K2O	1.06	1.14	1.14	0.76	1.36	1.11	1.07	1.83
P2O5	0.29	0.35	0.33	0.27	0.37	0.34	0.33	0.14
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	Unnormalized Trace Elements (ppm):							
Ni	18	15	17	19	14	15	14	11
Cr	51	44	50	50	47	45	48	25
Sc	39	39	38	38	42	39	37	18
V	322	312	298	289	318	292	289	147
Ba	874	840	809	502	690	987	530	650
Rb	23	25	24	16	28	26	24	56
Sr	343	358	348	322	361	342	329	265
Zr	152	160	156	154	175	163	160	133
Y	35	36	32	32	39	39	35	22
Nb	11.0	11.4	10.5	11.3	12.0	10.8	10.6	8.4
Ga	20	22	22	20	23	22	21	14
Cu	38	35	30	38	27	33	34	15
Zn	113	122	115	108	135	117	109	64
Pb	10	7	6	5	7	6	5	9
La	19	23	19	20	28	23	21	23
Ce	40	42	37	38	45	41	44	39
Th	2	3	3	2	3	2	3	4
Nd	24	25	23	24	29	30	27	21
U	1	2	1	2	1	1	1	1
sum tr.	2136	2121	2040	1693	2023	2235	1743	1524
in %	0.21	0.21	0.20	0.17	0.20	0.22	0.17	0.15
sum m+tr	97.67	96.84	96.30	94.69	97.96	96.68	95.54	94.68
l+Toxides	97.72	96.89	96.34	94.74	98.00	96.73	95.59	94.72
w/LOI	100.11	99.74	99.99	99.90	100.00	100.18	100.06	99.96
if Fe3+	101.33	100.79	101.09	101.23	100.89	101.40	101.23	100.71
	Major elements are normalized on a volatile-free basis, with total Fe expressed as FeO.							
	® denotes a duplicate bead made from the same rock powder.							
NiO	23.5	19.7	21.7	24.6	18.0	19.0	17.2	14.4
Cr2O3	75.0	64.8	73.2	73.0	68.5	66.3	69.9	37.1
Sc2O3	59.4	59.5	59.0	57.9	63.9	59.6	57.0	27.0
V2O3	473.6	458.7	439.1	425.3	467.8	429.4	425.6	216.2
BaO	975.5	938.2	903.0	561.0	769.8	1101.9	591.7	725.2
Rb2O	24.7	27.3	26.2	17.9	31.1	28.4	26.4	60.8
SrO	405.7	423.4	411.0	380.3	426.5	404.3	389.1	313.3
ZrO2	205.1	216.6	210.7	208.3	236.6	220.2	216.0	179.4
Y2O3	44.9	45.2	40.3	41.3	49.3	49.7	44.5	27.9
Nb2O5	15.8	16.4	15.0	16.2	17.2	15.5	15.1	12.0
Ga2O3	27.4	29.3	29.2	27.4	31.0	29.2	28.5	19.2

CuO	47.2	44.1	37.6	47.5	34.0	41.0	41.9	19.2
ZnO	140.6	151.7	143.5	135.0	167.4	145.8	136.0	79.5
PbO	10.9	7.2	6.5	5.7	7.0	7.0	5.8	9.7
La2O3	22.7	26.6	22.8	23.5	32.5	27.5	25.2	26.4
CeO2	49.5	51.6	45.8	46.6	55.7	51.0	53.8	48.0
ThO2	2.8	3.0	3.6	2.1	3.4	2.4	3.5	4.3
Nd2O3	28.2	29.5	27.1	28.3	33.7	34.8	32.0	24.2
U2O3	0.6	1.8	1.1	2.3	1.3	1.1	1.4	1.5
sum tr.	**2633**	**2615**	**2516**	**2124**	**2515**	**2734**	**2181**	**1845**
in %	**0.26**	**0.26**	**0.25**	**0.21**	**0.25**	**0.27**	**0.22**	**0.18**

	USGS AGV-2	AGV-2 USGS CRM-1	USGS BCR-2	BCR-2 USGS CRM-2	USGS GSP-2	GSP-2 USGS CRM-3
Date	PV	14-Jul-22	PV	14-Jul-22	GeoRem	14-Jul-22
SO3 >/=	0.01	0.00	0.08	0.03		0.04
Unnormalized Major Elements (Weight %):						
SiO2	59.14	59.36	54.00	53.85	66.60	66.54
TiO2	1.051	1.047	2.265	2.265	0.660	0.676
Al2O3	17.03	16.99	13.48	13.48	14.90	14.96
FeO*	6.10	6.11	12.39	12.54	4.41	4.45
MnO	0.100	0.100	0.197	0.196	0.041	0.041
MgO	1.80	1.78	3.60	3.60	0.96	0.94
CaO	5.15	5.26	7.11	7.16	2.10	2.13
Na2O	4.20	4.17	3.12	3.11	2.78	2.79
K2O	2.90	2.90	1.77	1.77	5.38	5.43
P2O5	0.483	0.484	0.359	0.358	0.290	0.294
Sum	97.96	98.19	98.30	98.32	98.12	98.26
LOI %						
Normalized Major Elements (Weight %):						
SiO2	60.37	60.45	54.93	54.76	67.88	67.73
TiO2	1.07	1.07	2.30	2.30	0.67	0.69
Al2O3	17.39	17.30	13.71	13.71	15.19	15.22
FeO*	6.23	6.22	12.60	12.75	4.49	4.53
MnO	0.10	0.10	0.20	0.20	0.04	0.04
MgO	1.84	1.81	3.66	3.66	0.98	0.96
CaO	5.26	5.35	7.24	7.28	2.14	2.17
Na2O	4.29	4.25	3.17	3.16	2.83	2.84
K2O	2.96	2.95	1.80	1.80	5.48	5.53
P2O5	0.49	0.49	0.37	0.36	0.30	0.30
Total	100.00	100.00	100.00	100.00	100.00	100.00
Unnormalized Trace Elements (ppm):						
Ni	19	20	13	12	17	16
Cr	16	16	16	13	20	19
Sc	13	13	34	35	6	6
V	119	123	418	410	52	54
Ba	1134	1136	684	686	1340	1337
Rb	68	67	46	45	245	247
Sr	660	662	337	330	240	238
Zr	232	233	187	180	550	569
Y	19	20	36	35	28	28
Nb	14.1	14.2	12.4	13.2	27.0	26.5
Ga	20	21	22	22	22	23
Cu	52	51	20	20	43	45
Zn	87	90	130	131	120	114
Pb	13	14	11	11	42	42
La	38	41	25	24	180	201
Ce	69	72	53	53	410	439
Th	6	6	6	4	105	106
Nd	30	32	28	31	200	201
U	2	2	2	1	2	2
sum tr.	2611	2631	2078	2055	3650	3714
in %	0.26	0.26	0.21	0.21	0.36	0.37
sum m+tr	98.22	98.45	98.51	98.53	98.49	98.63
M+Toxides	98.27	98.50	98.56	98.58	98.56	98.70
w/LOI	98.27	98.50	98.56	98.58	98.56	98.70
if Fe3+	98.95	99.18	99.93	99.97	99.04	99.19
Major elements are normalized on a volatile-free basis, with total Fe expressed as FeO						
® denotes a duplicate bead made from the same rock powder.						
NiO	24.0	25.1	16.0	15.2	21.6	20.8
Cr2O3	23.7	22.8	23.2	19.7	29.2	28.1
Sc2O3	20.1	20.2	51.4	53.0	9.7	8.7
V2O3	174.3	180.2	614.3	603.3	76.5	78.9
BaO	1266.1	1268.3	763.6	765.9	1496.1	1492.5
Rb2O	74.1	73.3	50.3	49.3	267.9	269.7
SrO	779.9	782.8	399.0	390.2	283.8	281.3
ZrO2	313.4	314.1	251.9	242.5	742.9	768.4
Y2O3	24.3	25.1	45.8	44.5	35.6	35.4
Nb2O5	20.2	20.3	17.8	18.9	38.6	37.9
Ga2O3	27.4	27.8	29.7	29.9	29.6	30.0

CuO	**64.5**	64.4	**24.6**	25.2	**53.8**	56.0
ZnO	**107.9**	111.9	**161.2**	162.8	**149.4**	142.4
PbO	**14.2**	15.0	**11.4**	11.4	**45.2**	45.5
La2O3	**44.8**	48.0	**29.4**	28.6	**211.1**	236.0
CeO2	**85.3**	88.4	**65.3**	64.9	**504.0**	539.2
ThO2	**7.0**	6.3	**6.6**	4.3	**119.5**	121.2
Nd2O3	**35.6**	37.9	**33.0**	36.0	**233.3**	235.0
U2O3	**2.1**	1.8	**1.9**	0.7	**2.6**	2.4
sum tr.	**3109**	**3134**	**2596**	**2566**	**4351**	**4430**
in %	**0.31**	**0.31**	**0.26**	**0.26**	**0.44**	**0.44**

		KEks002	USGS	AGV-2	USGS	BCR-2	USGS
		GGL 2526-1	AGV-2	USGS CRM-1	BCR-2	USGS CRM-2	GSP-2
Date	Date	5-Aug-22	PV	4-Aug-22	PV	5-Aug-22	GeoRem
SO3 >/=							
		Unnormalized Major Elements (Weight %):					
SiO2	SiO2	53.67	59.14	59.46	54.00	53.90	66.60
TiO2	TiO2	1.744	1.051	1.049	2.265	2.267	0.660
Al2O3	Al2O3	14.42	17.03	17.00	13.48	13.47	14.90
FeO*	FeO*	10.58	6.10	6.12	12.39	12.56	4.41
MnO	MnO	0.174	0.100	0.099	0.197	0.196	0.041
MgO	MgO	4.11	1.80	1.78	3.60	3.61	0.96
CaO	CaO	8.85	5.15	5.26	7.11	7.17	2.10
Na2O	Na2O	2.83	4.20	4.20	3.12	3.13	2.78
K2O	K2O	1.11	2.90	2.90	1.77	1.78	5.38
P2O5	P2O5	0.314	0.483	0.479	0.359	0.353	0.290
Sum	Sum	97.81	97.96	98.34	98.30	98.43	98.12
LOI %	LOI %	1.86					
		Normalized Major Elements (Weight %):					
SiO2	SiO2	54.87	60.37	60.46	54.93	54.76	67.88
TiO2	TiO2	1.78	1.07	1.07	2.30	2.30	0.67
Al2O3	Al2O3	14.75	17.39	17.28	13.71	13.69	15.19
FeO*	FeO*	10.81	6.23	6.22	12.60	12.76	4.49
MnO	MnO	0.18	0.10	0.10	0.20	0.20	0.04
MgO	MgO	4.20	1.84	1.81	3.66	3.67	0.98
CaO	CaO	9.05	5.26	5.35	7.24	7.28	2.14
Na2O	Na2O	2.90	4.29	4.27	3.17	3.18	2.83
K2O	K2O	1.13	2.96	2.95	1.80	1.80	5.48
P2O5	P2O5	0.32	0.49	0.49	0.37	0.36	0.30
Total	Total	100.00	100.00	100.00	100.00	100.00	100.00
		Unnormalized Trace Elements (ppm):					
Ni	Ni	14	19	20	13	12	17
Cr	Cr	42	16	16	16	14	20
Sc	Sc	36	13	13	34	34	6
V	V	315	119	124	418	412	52
Ba	Ba	591	1134	1130	684	688	1340
Rb	Rb	25	68	67	46	46	245
Sr	Sr	324	660	663	337	331	240
Zr	Zr	160	232	234	187	180	550
Y	Y	34	19	20	36	35	28
Nb	Nb	11.7	14.1	14.6	12.4	12.9	27.0
Ga	Ga	22	20	21	22	21	22
Cu	Cu	28	52	51	20	19	43
Zn	Zn	115	87	90	130	132	120
Pb	Pb	6	13	14	11	11	42
La	La	21	38	41	25	27	180
Ce	Ce	40	69	69	53	51	410
Th	Th	4	6	5	6	4	105
Nd	Nd	25	30	30	28	30	200
U	U	1	2	1	2	2	2
sum tr.	sum tr.	1813	2611	2621	2078	2061	3650
in %	in %	0.18	0.26	0.26	0.21	0.21	0.36
sum m+tr	sum m+tr	97.99	98.22	98.61	98.51	98.64	98.49
M+Toxides	Toxides	98.04	98.27	98.66	98.56	98.69	98.56
w/LOI	w/LOI	99.89	98.27	98.66	98.56	98.69	98.56
if Fe3+	if Fe3+	101.07	98.95	99.34	99.93	100.08	99.04
		Major elements are normalized on a volatile-free basis, with total Fe expressed as FeO.					
		® denotes a duplicate bead made from the same rock powder.					
NiO	NiO	17.5	24.0	25.2	16.0	15.6	21.6
Cr2O3	Cr2O3	61.0	23.7	22.8	23.2	20.0	29.2
Sc2O3	Sc2O3	55.9	20.1	20.0	51.4	51.7	9.7
V2O3	V2O3	464.1	174.3	181.9	614.3	606.0	76.5
BaO	BaO	659.8	1266.1	1261.8	763.6	768.1	1496.1
Rb2O	Rb2O	27.0	74.1	73.4	50.3	50.4	267.9
SrO	SrO	382.6	779.9	783.8	399.0	391.6	283.8
ZrO2	ZrO2	216.1	313.4	316.4	251.9	243.1	742.9
Y2O3	Y2O3	42.9	24.3	25.1	45.8	44.7	35.6
Nb2O5	Nb2O5	16.7	20.2	20.9	17.8	18.4	38.6
Ga2O3	Ga2O3	29.3	27.4	28.6	29.7	28.2	29.6

	GSP-2 USGS CRM-3
Date	5-Aug-22
SO3 >/=	
SiO2	66.63
TiO2	0.676
Al2O3	14.94
FeO*	4.45
MnO	0.041
MgO	0.95
CaO	2.13
Na2O	2.79
K2O	5.45
P2O5	0.290
Sum	98.35
LOI %	
SiO2	67.75
TiO2	0.69
Al2O3	15.19
FeO*	4.53
MnO	0.04
MgO	0.96
CaO	2.16
Na2O	2.84
K2O	5.54
P2O5	0.29
Total	100.00
Ni	16
Cr	21
Sc	6
V	54
Ba	1340
Rb	247
Sr	239
Zr	569
Y	27
Nb	26.2
Ga	23
Cu	43
Zn	113
Pb	42
La	203
Ce	440
Th	106
Nd	203
U	2
sum tr.	3720
in %	0.37
sum m+tr	98.72
M+Toxides	98.79
w/LOI	98.79
if Fe3+	99.29
NiO	20.1
Cr2O3	30.3
Sc2O3	9.2
V2O3	80.0
BaO	1496.6
Rb2O	269.8
SrO	282.5
ZrO2	769.1
Y2O3	34.6
Nb2O5	37.4
Ga2O3	30.8

CuO	CuO	34.6	64.5	63.6	24.6	23.3	53.8
ZnO	ZnO	143.4	107.9	111.7	161.2	164.2	149.4
PbO	PbO	6.4	14.2	14.8	11.4	11.8	45.2
La2O3	La2O3	24.4	44.8	47.7	29.4	31.1	211.1
CeO2	CeO2	49.6	85.3	84.6	65.3	63.2	504.0
ThO2	ThO2	4.5	7.0	5.2	6.6	4.9	119.5
Nd2O3	Nd2O3	28.8	35.6	34.7	33.0	34.9	233.3
U2O3	U2O3	1.0	2.1	1.1	1.9	1.7	2.6
sum tr.	**sum tr.**	**2266**	**3109**	**3123**	**2596**	**2573**	**4351**
in %	**in %**	**0.23**	**0.31**	**0.31**	**0.26**	**0.26**	**0.44**

CuO	53.7
ZnO	140.6
PbO	45.2
La2O3	237.6
CeO2	540.7
ThO2	120.6
Nd2O3	236.7
U2O3	2.7
sum tr.	**4438**
in %	**0.44**

Appendix E: Detailed Discussion of Geochemical Results

Appendix E: Detailed discussion of geochemical results

WSU provided formation picks for individual samples from their Machine Learning Algorithm. See Sadowski, et al., 2022 for a detailed discussion of the strengths and limitations of this analysis. Table 3 summarizes formation picks from the machine learning algorithm, and my alternative picks discussed below.

Figure E-1 plots major oxides typically used to discriminate between formations for the 6 site samples. Samples G-622-001 and -005 seem outliers relative to the others. Sample -001 has a generally lower TiO2 content, while -005 is relatively higher in TiO2 than the others.

Figure E-2 compares major oxide values in samples G-622-001, -005, and -006 to typical formation values compiled for Grande Ronde Basalt flows from Reidel and Tolan, 2013, Hammond, 2013, and those for samples taken in Sadowski et al., 2022. Hammond's values are generally accepted as the type values for the formations in this portion of the Columbia Basin region. Samples G-622-001 and -006 were identified by the Machine Learning algorithm as Meyer Ridge; Sample -005 is included as it seems an outlier on Figure 8 plots.

Overall, samples show a general pattern typical of weathering: depletion of iron, magnesium, and phosphorus relative to standards. Significant effort was applied in the field and in the laboratory to select unweathered material, but the range of values suggest weathered material from surface exposures.

Interpreting these results in this light:

1. The Machine Learning algorithm at the WSU Laboratory assigns samples G-622-001 and -006 to the Meyer Ridge Member. The Meyer Ridge Member is older than the Sentinel Bluffs, and generally restricted to southeast Washington (Reidel and Tolan, 2013). It is a small volume flow and sometimes interbedded with the Grouse Creek Member flows. The Meyer Ridge Member is generally understood to have TiO2 analyses <1.8 and MgO analyses >5.1 on a normalized weight percent basis. Neither G-622-001 or -005 meet those criteria. We conclude these samples are not from the Meyer Ridge member.

2. The map shows samples G-622-001 and -006 were taken within an area mapped by Sadowski, et al.,2000 as Stember Creek member of the Sentinel Bluffs Formation. Sample G-622-005 is also within the area mapped as Stember Creek. Plots of normalized major oxides (Figure 6) seem to associate G-622-001 with the Museum member , while -005 and -006 have a signature more closely approximated by the Ortley member, as defined in Reidel and Tolan (2013) and Hammond (2013). As discussed in Sadowski, et al.,, 2000, when discussing lower confidence samples:

"It is unlikely that these lower confidence samples could be classified as the older members, as this would require complicated eruptive histories or complex structural relationships that were not observed. Additionally, the low confidence samples do not reside in the Ortley compositional type-field (Fig. 1). For all of these reasons, the low confidence samples are inferred to be Grouse Creek-type compositions. As of August 2020, geochemical data from Hammond (2013) is not incorporated into the training dataset for WSU's ML model so ML classifications do not well characterize the middle portion of our stratigraphy. In general, samples with Sentinel Bluffs-type compositions have lower SiO_2 content (~53.7–55.7 wt. %), lower TiO_2 content (<2.0 wt. %) and higher MgO content (~3.8–5.1 wt .%), whereas older GRB units have higher SiO_2 (~54.7–57.7 wt. %), higher TiO (~2.0–2.3 wt. %), and lower MgO (<4.2 wt. % MgO). "

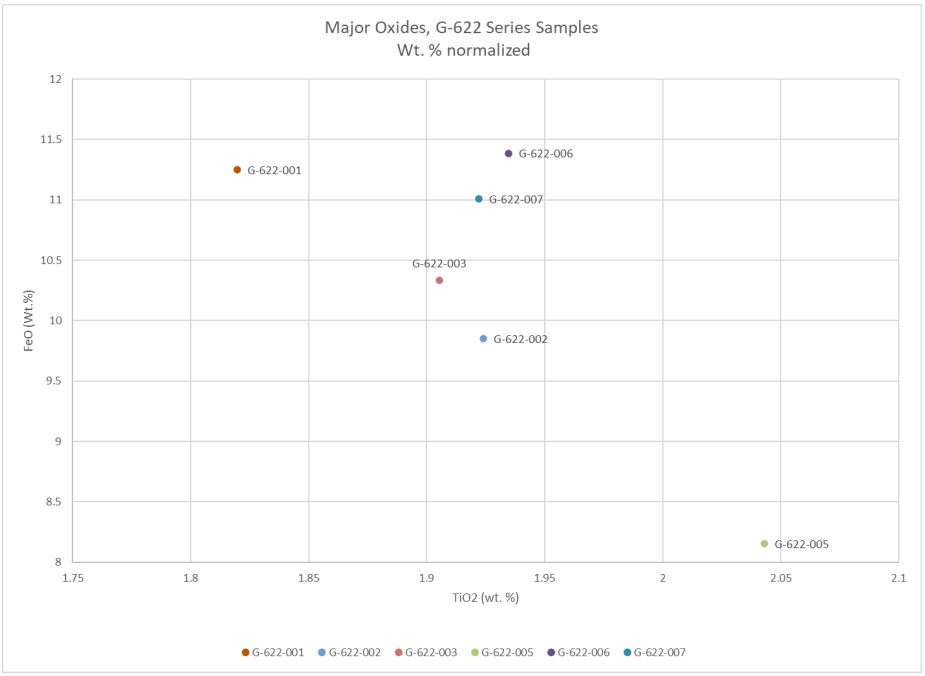
Sample G-622-001 has a significantly greater chemical similarity to the Museum member than Stember Creek material. Limited outcrop density does not permit assessment of a complex geologic model, however little complexity is required to offset along a speculative fault south of G-622-001 subparallel to Reecer Canyon.

Certainly, assigning G-622-005 and -006 to the Ortley member would similarly require significant eruptive and/or structural complexity not otherwise in evidence. For this reason, we concur with the assignment of G-622-005 to the Stember Creek member. (Table 3). The degree of weathering makes this assignment uncertain.

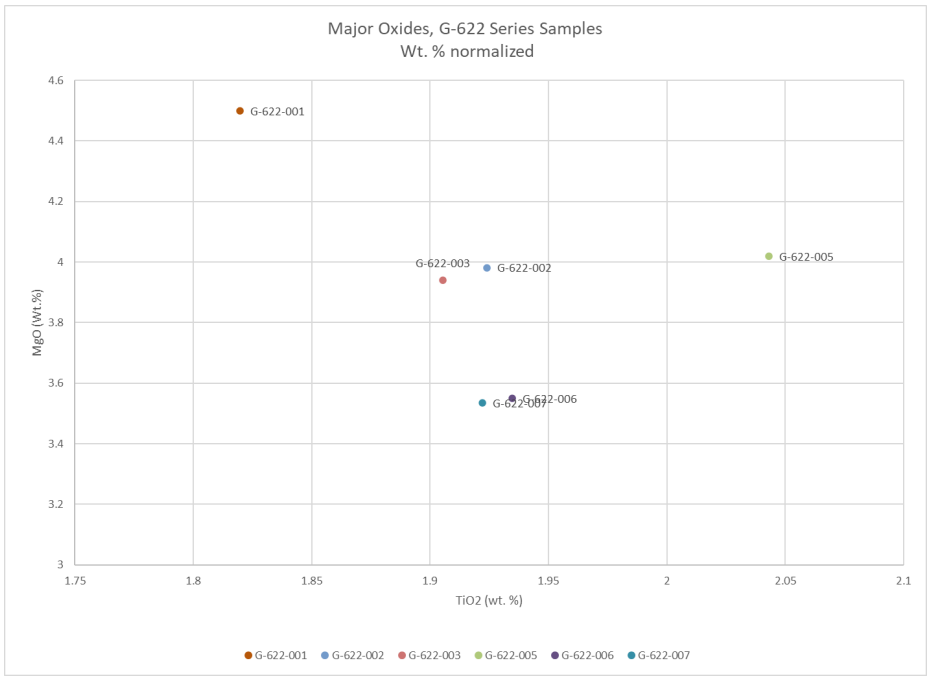
Sample G-622-006 is similar in major oxide chemistry to -007. This report assigns it similarly to the Museum member and is assigned as such in this study.

Figure E-1: Major Oxide Plots of Rock Chemistry

FeO v. TiO2



MgO v. TiO2



P2O5 v. TiO2

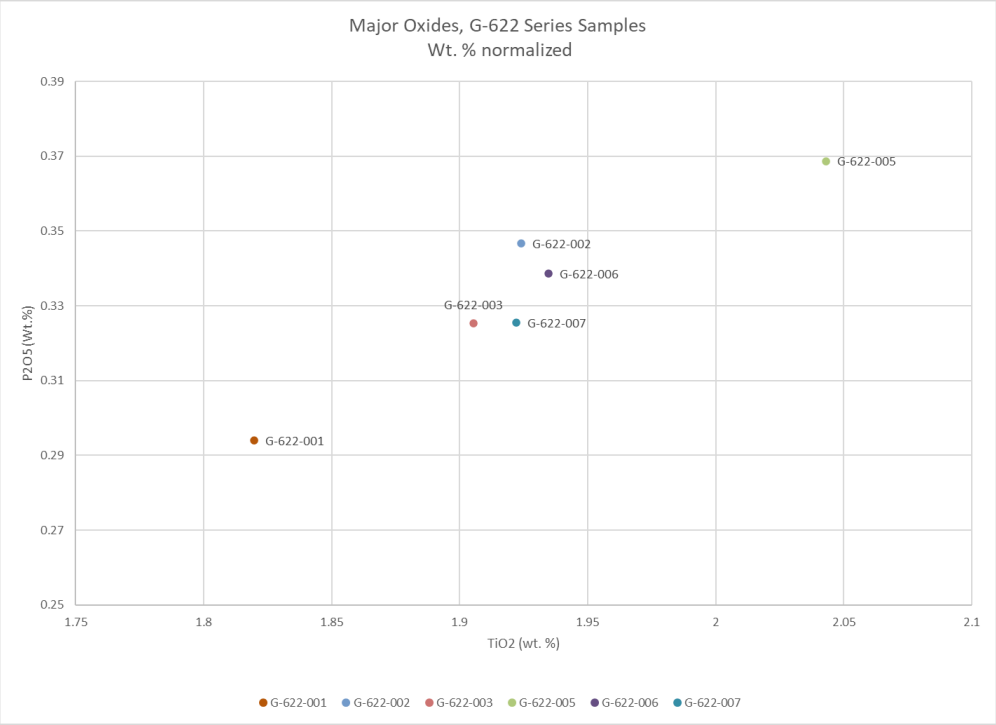
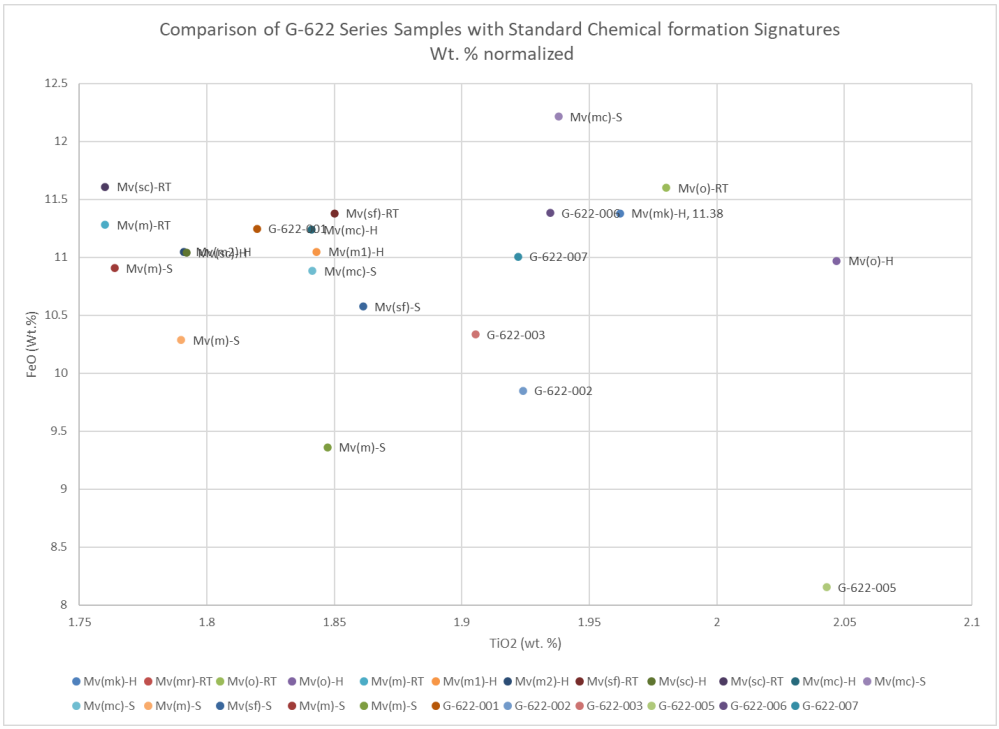
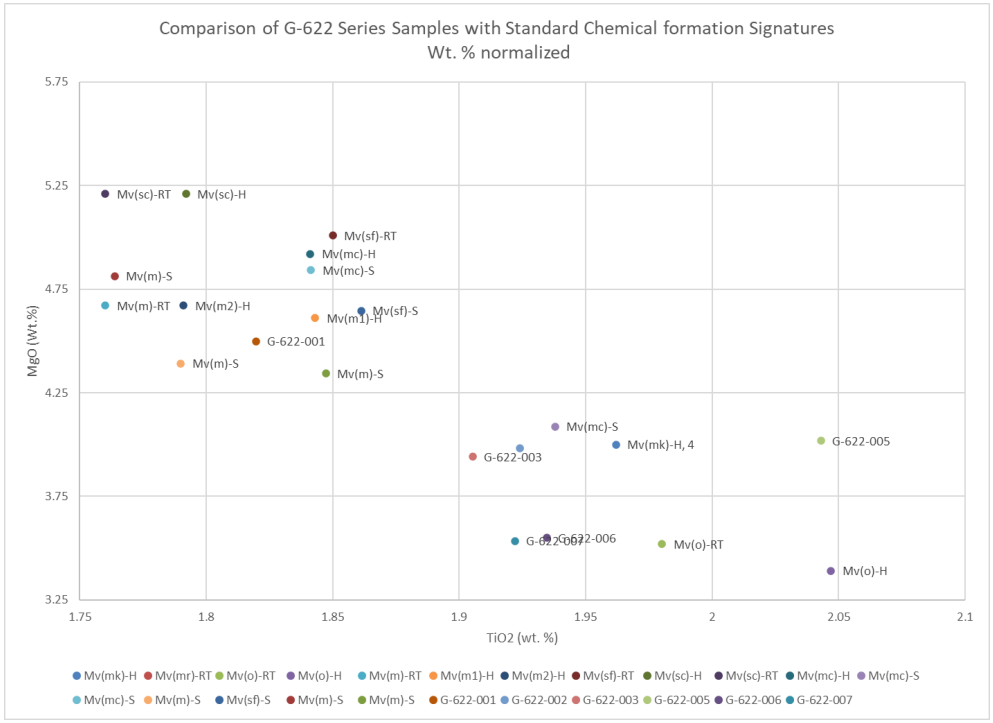

Major Oxides, G-622 Series Samples
Wt. % normalized
P2O5 (Wt.%)
TiO2 (wt. %)
0.39
0.37
0.35
0.33
0.31
0.29
0.27
0.25
1.75
1.8
1.85
1.9
1.95
2
2.05
2.1
G-622-001
G-622-002
G-622-003
G-622-005
G-622-006
G-622-007

Figure E-2: Formation Discrimination of G-622 Series Samples

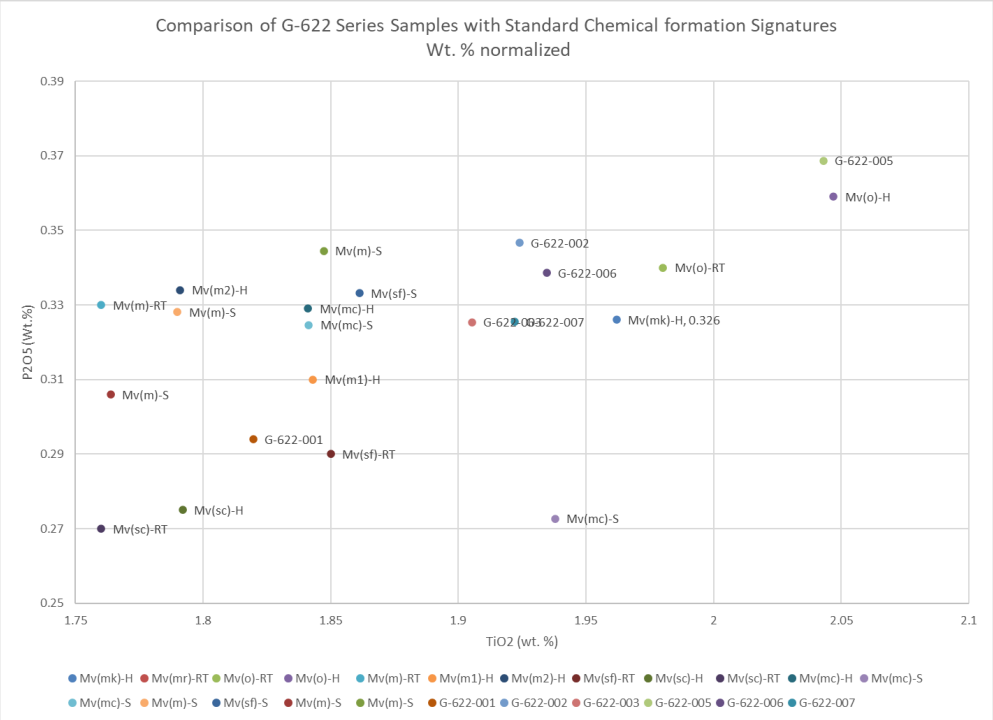
FeO v. TiO2



MgO v. TiO2



P2O5 v. TiO2



Key to Formation Designations for Figure E-2

Source	Graph name
Meeks (Hammond, 2013)	Mv(mk)-H
Meyer Ridge (Reidel and Tolan, 2013)	Mv(mr)-RT
Ortley (Reidel and Tolan, 2013)	Mv(o)-RT
Ortley (Hammond, 2013)	Mv(o)-H
Sentinel Bluffs Museum (Reidel and Tolan, 2013)	Mv(m)-RT
Sentinel Bluffs Museum 1 (Hammond, 2013)	Mv(m1)-H
Sentinel Bluffs Museum 2 (Hammond, 2013)	Mv(m2)-H
Sentinel Bluffs Spokane Falls (Reidel and Tolan, 2014	Mv(sf)-RT
Sentinel Bluffs Stember Creek (Hammond, 2013)	Mv(sc)-H
Sentinel Bluffs Stember Creek (Reidel and Tolan, 2013)	Mv(sc)-RT
Upper McCoy Canyon (Hammond, 2013)	Mv(mc)-H
McCoy Canyon (Sadowski, et. Al 2022)	Mv(mc)-S
McCoy Canyon (Sadowski, et. Al 2022)	Mv(mc)-S
Museum (Sadowski, et. Al 2022)	Mv(m)-S
Spokane Falls (Sadowski, et. Al 2022)	Mv(sf)-S
Museum (Sadowski, et. Al 2022)	Mv(m)-S
Museum (Sadowski, et. Al 2022)	Mv(m)-S
	G-622-001

	G-622-002
	G-622-003
	G-622-005
	G-622-006
	G-622-007

Appendix F: Well Logs in the Vicinity

MONITORING WELL REPORT

378155

Well ID# Geotech Soil Boring

Start Card # AE09663

(1) OWNER/PROJECT WELL NO.

Name Kittitas County Public Works

Address 411 North Ruby St

City Ellensburg State WA Zip 98926

(2) TYPE OF WORK

☐ New construction ☐ Alteration (Repair/Recondition)

☐ Conversion ☐ Deepening ☒ Abandonment

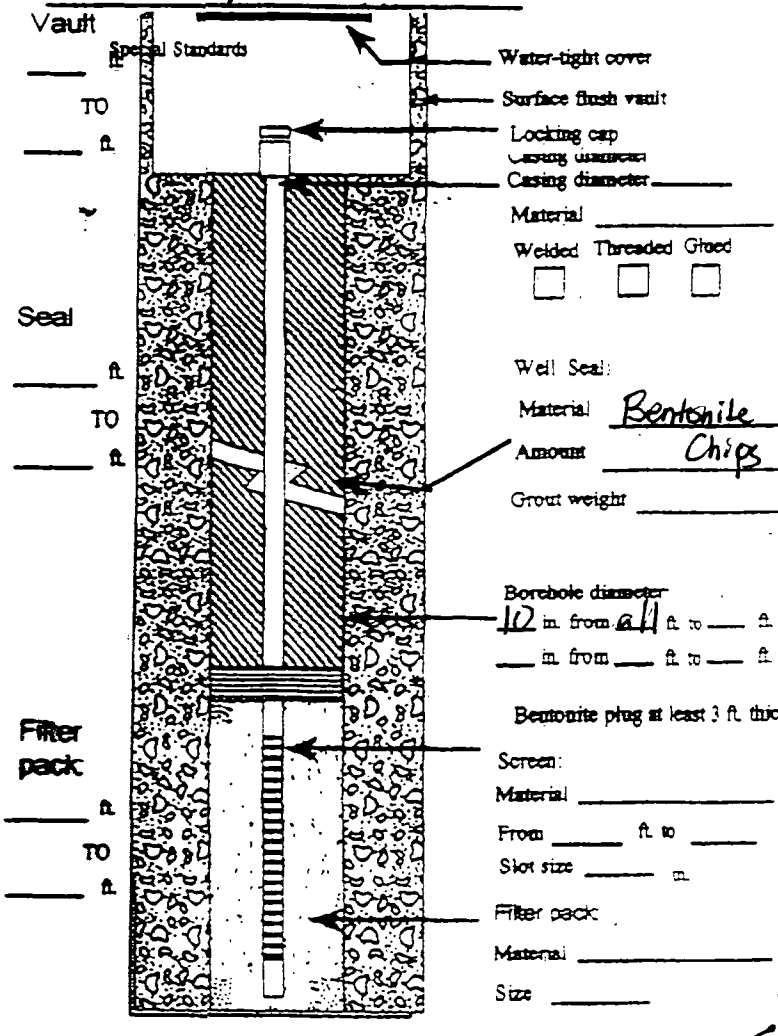
(3) DRILLING METHOD

☐ Rotary Air ☐ Rotary Mud ☐ Cable

☒ Hollow Stem Auger ☐ Other

(4) BORE HOLE CONSTRUCTION:

Special Standards ☐ Yes ☒ No Depth of Completed Well 3 ft.



(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 GN Northern, Inc.

(6) LOCATION OF WELL By legal description:

County Kittitas Latitude Longitude

Township 19 (N or S) Range 18E (E or W) Section 27

NW 1/4 of NW 1/4 of above section.

Street address of well location Pheasant Lane Ellensburg, WA 98926

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

From	To	Est. Flow Rate	SWL

(9) WELL LOG:

Ground Elevation

Material	From	To	SWL
Back filled from bottom to top with Bentonite Chips	0	3	

RECEIVED

JUN 28 2010

DEPARTMENT OF ECOLOGY - CENTRAL REGIONAL OFFICE

Date started 6/15/10 Completed 6/15/10

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 Todd Knipschield License No 3021

Trainee Name License No.

Drilling Company Holocene Drilling Inc

(Signed) License No. 3021

Address 10621 Todd Road E Edgewood WA 98372

Registration No. HOLOCDI044KH Date 6/22/10

MONITORING WELL REPORT
378154

Well ID# Geotech Soil Boring
Start Card # AE09663

(1) OWNER/PROJECT
Name Kittitas County Public Works WELL NO.
Address 411 North Ruby St
City Ellensburg State WA Zip 98926

(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 5 ft.

Vault
Special Standards
ft. TO ft.
Water-tight cover
Surface flush vault
Locking cap
Casing diameter
Material
Welded ☐ Threaded ☐ Glued ☐

Seal
ft. TO ft.
Well Seal:
Material Bentonite Chips
Amount
Grout weight
Borehole diameter
10 in. from all ft. to ft.
in. from ft. to ft.
Bentonite plug at least 3 ft. thick

Filter pack
ft. TO ft.
Screen:
Material
From ft. to
Slot size in.
Filter pack:
Material
Size

(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 GN Northern, Inc.

(6) LOCATION OF WELL By legal description:
County Kittitas Latitude Longitude
Township 19 (N or S) Range 18E (E or W) Section 27
NW 1/4 of NW 1/4 of above section.
Street address of well location Pheasant Lane Ellensburg, WA 98926
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

From	To	Est. Flow Rate	SWL

(9) WELL LOG:
Ground Elevation

Material	From	To	SWL
Back filled from bottom to top with Bentonite Chips	0	5	

RECEIVED
JUN 28 2010
DEPARTMENT OF ECOLOGY - CENTRAL REGIONAL OFFICE

Date started 6/15/10 Completed 6/15/10

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 Todd Knipschield License No. 3021
Trainee Name License No.
Drilling Company Holocene Drilling Inc
(Signed) License No 3021
Address 10621 Todd Road E Edgewood WA 98372
Registration No. HOLOCDI044KH Date 6/22/10

MONITORING WELL REPORT

318153

Well ID# Geotech Soil Boring

Start Card # AE09663

(1) OWNER/PROJECT

WELL NO.

Name Kittitas County Public Works

Address 411 North Ruby St

City Ellensburg State WA Zip 98926

(2) TYPE OF WORK

☐ New construction ☐ Alteration (Repair/Recondition)

☐ Conversion ☐ Deepening ☒ Abandonment

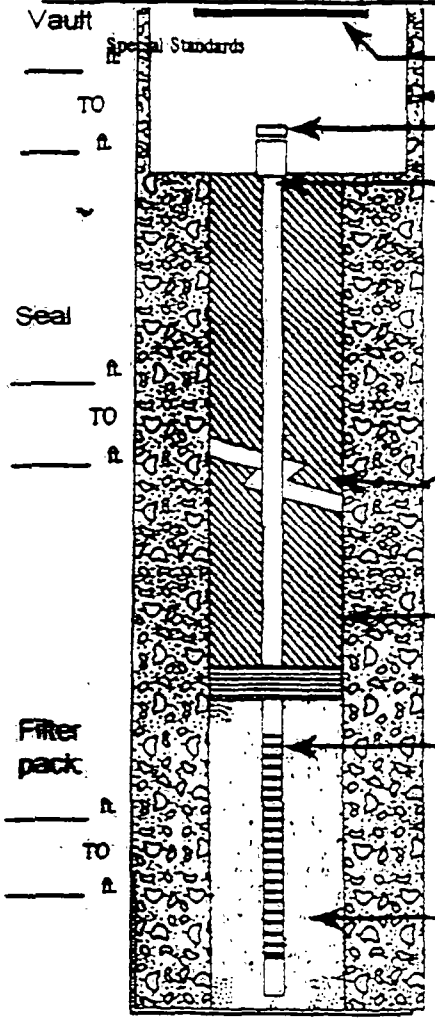
(3) DRILLING METHOD

☐ Rotary Air ☐ Rotary Mud ☐ Cable

☒ Hollow Stem Auger ☐ Other

(4) BORE HOLE CONSTRUCTION:

Special Standards Yes ☐ No ☒ Depth of Completed Well 5 ft.



(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 GN Northern, Inc.

(6) LOCATION OF WELL By legal description:

County Kittitas Latitude Longitude

Township 19 (N or S) Range 18E (E or W) Section 27

NW 1/4 of NW 1/4 of above section.

Street address of well location Pheasant Lane Ellensburg, WA 98926

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

From	To	Est. Flow Rate	SWL

(9) WELL LOG:

Ground Elevation

Material	From	To	SWL
Back filled from bottom to top with Bentonite Chips	0	5	

RECEIVED

JUN 28 2010

DEPARTMENT OF ECOLOGY - CENTRAL REGIONAL OFFICE

Date started 6/15/10 Completed 6/15/10

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 Todd Knipschield License No 3021

Trainee Name License No.

Drilling Company Holocene Drilling Inc

(Signed) License No. 3021

Address 10621 Todd Road E Edgewood WA 98372

Registration No HOLOCDI044KH Date 6/22/10

MONITORING WELL REPORT

378152

Well ID# Geotech Soil Boring

Start Card # AE09663

(1) OWNER/PROJECT

WELL NO.

Name Kittitas County Public Works

Address 411 North Ruby St

City Ellensburg State WA Zip 98926

(2) TYPE OF WORK

☐ New construction ☐ Alteration (Repair/Recondition)

☐ Conversion ☐ Deepening ☒ Abandonment

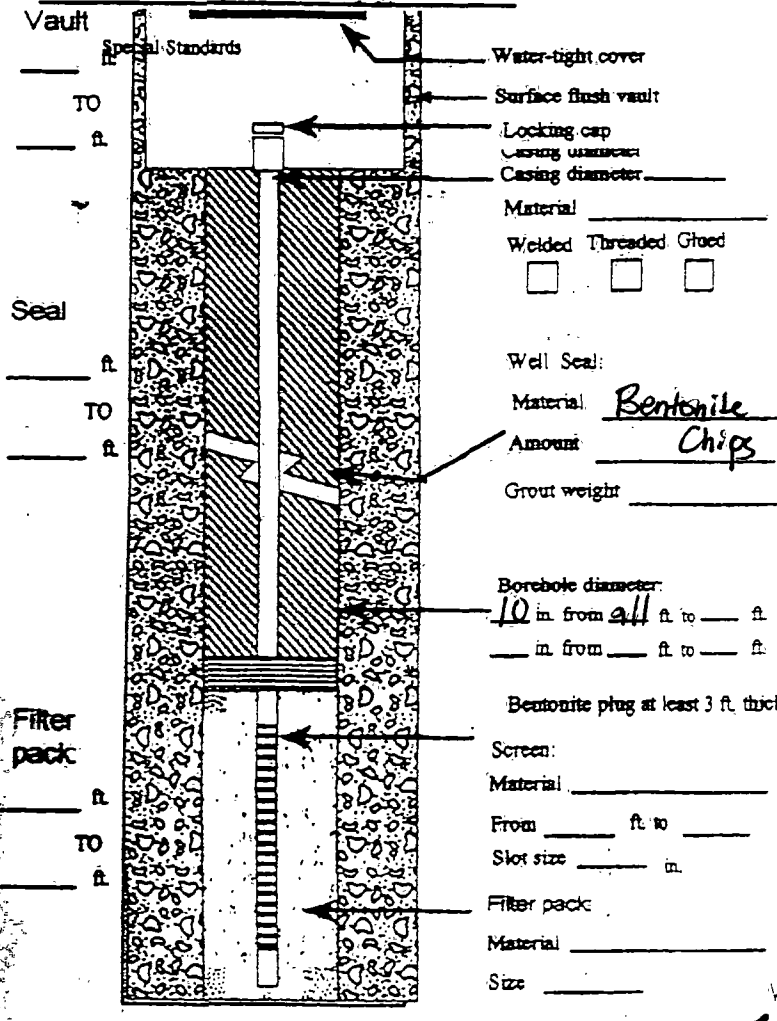
(3) DRILLING METHOD

☐ Rotary Air ☐ Rotary Mud ☐ Cable

☒ Hollow Stem Auger ☐ Other

(4) BORE HOLE CONSTRUCTION:

Special Standards Yes ☐ No ☒ Depth of Completed Well 5 ft.



(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 GN Northern, Inc.

(6) LOCATION OF WELL By *legal description:*

County Kittitas Latitude Longitude

Township 19 (N or S) Range 18E (E or W) Section 27

NW 1/4 of NW 1/4 of above section.

Street address of well location Pheasant Lane Ellensburg, WA 98926

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

From	To	Est. Flow Rate	SWL

(9) WELL LOG:

Ground Elevation

Material	From	To	SWL
Back filled from bottom to top with Bentonite Chips	0	5	

RECEIVED

JUN 28 2010

DEPARTMENT OF ECOLOGY - CENTRAL REGIONAL OFFICE

Date started 6/15/10 Completed 6/15/10

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 Todd Knipschield License No. 3021

Trainee Name License No.

Drilling Company Holocene Drilling Inc

(Signed) License No. 3021

Address 10621 Todd Road E Edgewood WA 98372

Registration No. HOLOCDI044KH Date 6/22/10

MONITORING WELL REPORT

318151

Well ID# Geotech Soil Boring

Start Card # SEO74 25

1) OWNER/PROJECT WELL NO.

Name Kittitas County Public Works

Address 411 North Ruby St

City Ellensburg State WA Zip 98926

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 3 ft.

Vault

Special Standards ft

TO ft

Seal

ft

TO ft

Filter pack

ft

TO ft

Water-tight cover

Surface flush vault

Locking cap

Casing diameter

Material

Welded ☐ Threaded ☐ Glued ☐

Well Seal:

Material

Amount

Grout weight

Borehole diameter:

10 in. from all ft. to ft.

in. from ft. to ft.

Bentonite plug at least 3 ft. thick

Screen:

Material

From ft. to

Slot size in.

Filter pack

Material

Size

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 GN Northern, Inc.

(6) LOCATION OF WELL By *legal description:*

County Kittitas Latitude Longitude

Township 19 (N or S) Range 18E (E or W) Section 27

NW 1/4 of NW 1/4 of above section.

Street address of well location Pheasant Lane Ellensburg, WA 98926

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

From	To	Est. Flow Rate	SWL

(9) WELL LOG:

Ground Elevation

Material	From	To	SWL
Cobbles	0	3	

RECEIVED

JUN 28 2010

DEPARTMENT OF ECOLOGY - CENTRAL REGIONAL OFFICE

Date started 6/15/10 Completed 6/15/10

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 Todd Knipschield License No. 3021

Trainee Name License No.

Drilling Company Holocene Drilling Inc

(Signed) License No. 3021

Address 10621 Todd Road E Edgewood WA 98372

Registration No HOLOCDI044KH Date 6/22/10

MONITORING WELL REPORT

378150

Well ID# Geotech Soil Boring

Start Card # SE07425

1) OWNER/PROJECT — WELL NO.

Name Kittitas County Public Works

Address 411 North Ruby St

City Ellensburg State WA Zip 98926

2) TYPE OF WORK

☒ New construction ☐ Alteration (Repair/Recondition)

☐ Conversion ☐ Deepening ☐ Abandonment

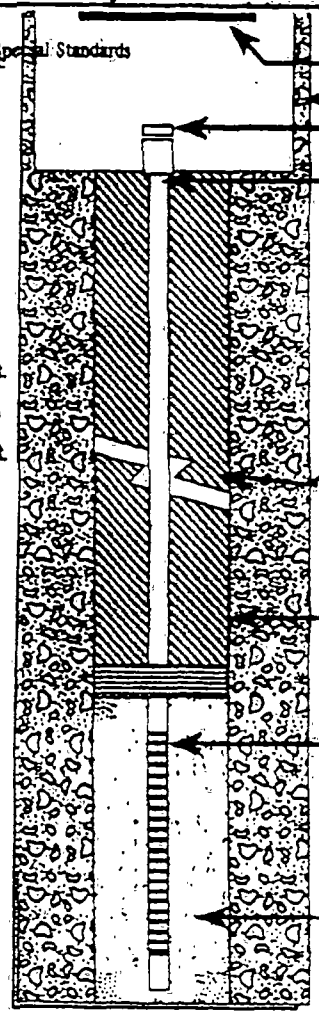
3) DRILLING METHOD

☐ Rotary Air ☐ Rotary Mud ☐ Cable

☒ Hollow Stem Auger ☐ Other

4) BORE HOLE CONSTRUCTION:

Special Standards Yes No ☐ ☒ Depth of Completed Well 5 ft.



Water-tight cover

Surface flush vault

Locking cap

Casing diameter

Material

Welded ☐ Threaded ☐ Glued ☐

Well Seal:

Material

Amount

Grout weight

Borehole diameter:

10 in. from 411 ft. to ___ ft.

___ in. from ___ ft. to ___ ft.

Bentonite plug at least 3 ft. thick

Screen:

Material

From ___ ft. to ___

Slot size ___ in.

Filter pack:

Material

Size

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 GN Northern, Inc.

(6) LOCATION OF WELL By *legal description:*

County Kittitas Latitude ___ Longitude ___

Township 19 (N or S) Range 18E (E or W) Section 27

NW 1/4 of NW 1/4 of above section.

Street address of well location Pheasant Lane Ellensburg, WA 98926

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 ___

From	To	Est. Flow Rate	SWL

(9) WELL LOG:

Ground Elevation ___

Material	From	To	SWL
Cobbles	0	3	
Silt	3	5	

RECEIVED

JUN 28 2010

DEPARTMENT OF ECOLOGY - CENTRAL REGIONAL OFFICE

Date started 6/15/10 Completed 6/15/10

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 Todd Knipschield License No. 3021

Trainee Name ___ License No. ___

Drilling Company Holocene Drilling Inc

(Signed) ___ License No. 3021

Address 10621 Todd Road E Edgewood WA 98372

Registration No. HOLOCDI044KH Date 6/22/10

MONITORING WELL REPORT

378149

Well ID# Geotech Soil Boring

Start Card # SEO74 25

(1) OWNER/PROJECT WELL NO.

Name Kittitas County Public Works

Address 411 North Ruby St

City Ellensburg State WA Zip 98926

(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 5 ft.

Vault

Special Standards

ft. TO ft.

Water-tight cover

Surface flush vault

Locking cap

Casing diameter

Material

Welded ☐ Threaded ☐ Glued ☐

Seal

ft. TO ft.

Well Seal:

Material

Amount

Grout weight

Borehole diameter:

10 in. from all ft. to ft.

in. from ft. to ft.

Bentonite plug at least 3 ft. thick

Filter pack

ft. TO ft.

Screen:

Material

From ft. to

Slot size in.

Filter pack:

Material

Size

(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 GN Northern, Inc.

(6) LOCATION OF WELL By legal description:

County Kittitas Latitude Longitude

Township 19 (N or S) Range 18E (E or W) Section 27

NW 1/4 of NW 1/4 of above section.

Street address of well location Pheasant Lane Ellensburg, WA 98926

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

From	To	Est. Flow Rate	SWL

(9) WELL LOG:

Ground Elevation

Material	From	To	SWL
Cobbles	0	3	
Silt	3	5	

RECEIVED

JUN 28 2010

DEPARTMENT OF ECOLOGY - CENTRAL REGIONAL OFFICE

Date started 6/15/10 Completed 6/15/10

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 Todd Knipschield License No. 3021

Trainee Name License No.

Drilling Company Holocene Drilling Inc

(Signed) License No. 3021

Address 10621 Todd Road E Edgewood WA 98372

Registration No. HOLOCDI044KH Date 6/22/10

MONITORING WELL REPORT

378148

Well ID# Geotech Soil Boring

Start Card # SEO74 25

(1) OWNER/PROJECT

WELL NO.

Name Kittitas County Public Works

Address 411 North Ruby St

City Ellensburg State WA Zip 98926

(2) TYPE OF WORK

☒ New construction ☐ Alteration (Repair/Recondition)

☐ Conversion ☐ Deepening ☐ Abandonment

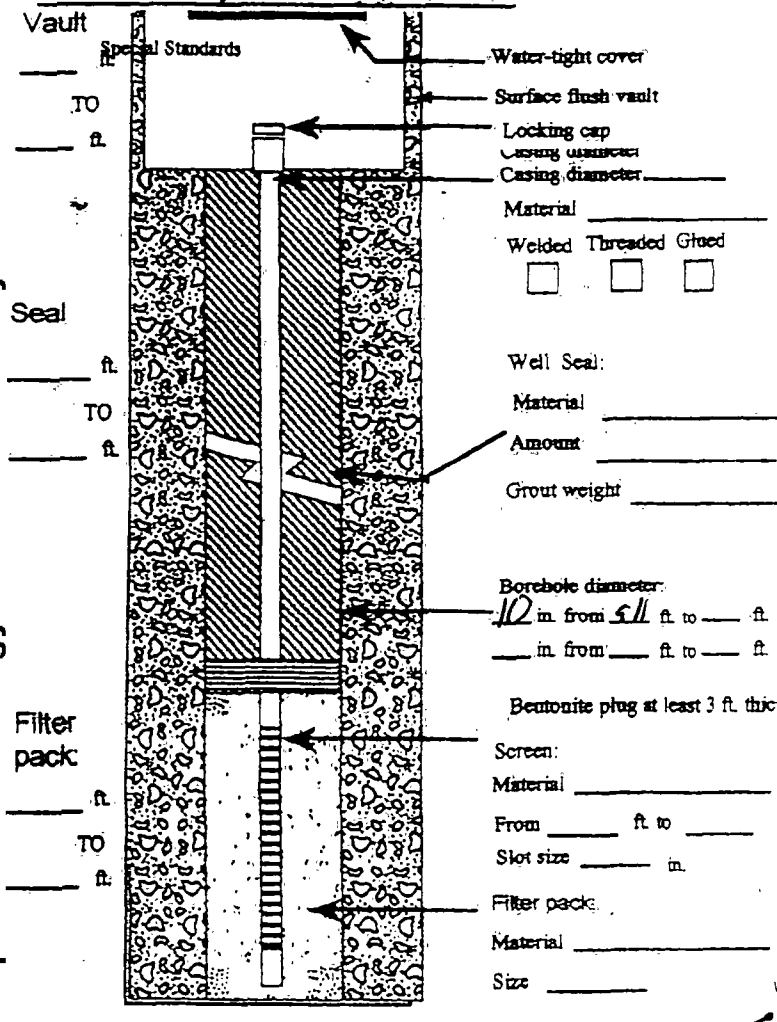
(3) DRILLING METHOD

☐ Rotary Air ☐ Rotary Mud ☐ Cable

☒ Hollow Stem Auger ☐ Other

(4) BORE HOLE CONSTRUCTION:

Special Standards Yes ☐ No ☒ Depth of Completed Well 5 ft.



(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 GN Northern, Inc.

(6) LOCATION OF WELL By *legal description:*

County Kittitas Latitude Longitude

Township 19 (N or S) Range 18E (E or W) Section 27

NW 1/4 of NW 1/4 of above section.

Street address of well location Pheasant Lane Ellensburg, WA 98926

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

From	To	Est. Flow Rate	SWL

(9) WELL LOG:

Ground Elevation

Material	From	To	SWL
Cobbles	0	3	
Silt	3	5	

RECEIVED

JUN 28 2010

DEPARTMENT OF ECOLOGY - CENTRAL REGIONAL OFFICE

Date started 6/15/10 Completed 6/15/10

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 Todd Knipschield License No. 3021

Trainee Name License No.

Drilling Company Holocene Drilling Inc

(Signed) License No. 3021

Address 10621 Todd Road E Edgewood WA 98372

Registration No. HOLOCDI044KH Date 6/22/10

Please print, sign and return to the Department of Ecology

Water Well Report

Original – Ecology, 1st copy – owner, 2nd copy – driller

Construction/Decommission

☐ Construction 203097

☐ Decommission *ORIGINAL INSTALLATION Notice of Intent Number* _____

Current Notice of Intent No. WI-212009

Unique Ecology Well ID Tag No. ALC-811

Water Right Permit No. _____

Property Owner Name Rich Whittaker

Well Street Address 4671 Robbins Rd

City Ellensburg County Kittitas

Location NE 1/4-1/4 NE 1/4 Sec 27 Twn 19 R 18 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. 19-18-27000-0018 A

PROPOSED USE: ☒ Domestic ☐ Industrial ☐ Municipal ☐ DeWater ☐ Irrigation ☐ Test Well ☐ Other _____

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

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

DIMENSIONS: Diameter of well 6 inches, drilled 170 ft. Depth of completed well 170 ft.

CONSTRUCTION DETAILS

Casing Installed: ☒ Welded 6" Diam. from +2 ft. to 890 ft.

☐ Liner installed 5" Diam. from +2 ft. to 160 ft.

☐ Threaded _____" Diam. from _____ ft. to _____ ft.

Perforations: ☒ Yes ☐ No

Type of perforator used TORCH

SIZE of perfs 1/4 in. by 6 in. and no. of perfs 40 from 50 ft. to 160 ft.

Screens: ☐ Yes ☒ No ☐ K-Pac Location _____

Manufacturer's Name _____

Type _____ Model No. _____

Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Gravel/Filter packed: ☐ Yes ☒ No ☐ Size of gravel/sand _____

Materials placed from _____ ft. to _____ ft.

Surface Seal: ☒ Yes ☐ No To what depth? 20 ft.

Material used in seal Bentonite

Did any strata contain unusable water? ☐ Yes ☒ No

Type of water? _____ Depth of strata _____

Method of sealing strata off _____

PUMP: Manufacturer's Name _____

Type: _____ H.P. _____

WATER LEVELS: Land-surface elevation above mean sea level _____ ft.

Static level 54 ft. below top of well Date 8/12/05

Artesian pressure _____ lbs. per square inch Date _____

Artesian water is controlled by _____ (cap, valve, etc.)

WELL TESTS: Drawdown is amount water level is lowered below static level

Was a pump test made? ☐ Yes ☐ No If yes, by whom? _____

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

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

Time	Water Level	Time	Water Level	Time	Water Level

Date of test _____

Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.

Airtest 10 gal./min. with stem set at 160 ft. for 2 hrs.

Artesian flow _____ g.p.m. Date _____

Temperature of water _____ Was a chemical analysis made? ☐ Yes ☒ No

CONSTRUCTION OR DECOMMISSION PROCEDURE

Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information indicate all water encountered. (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL	FROM	TO
Dirt	0	2
Cemented gravel + boulders	2	12
Cemented gravel - broKen basalt	12	88
Broken basalt clay + gravel	88	126
Black Basalt - Hard	126	141
Broken black basalt - water	141	170

DEPT OF ECOLOGY Received AUG 04 2006 CENTRAL REGION OFFICE

Start Date 8/11/05 Completed Date 8/12/05

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

Driller/Engineer/Trainee Name (Print) Craig M Ramsey

Driller/Engineer/Trainee Signature _____

Driller or trainee License No. 2428

Drilling Company Hidden Rivers Drilling

Address P.O. Box 993

City, State, Zip Selah, WA 98942

Contractor's Registration No. HIDDERO1DB Date _____

If TRAINEE,

Driller's Licensed No. _____

Driller's Signature _____

Ecology is an Equal Opportunity Employer. ECY 050-1-20 (Rev 2/03)

89958

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No W 129963
Unique Well I D # AFQ721
Water Right Permit No

(1) OWNER Name MILLER, R / WEICHT, U Address P.O.BOX 322 CLE ELUM, WA 98943-

(2) LOCATION OF WELL County KITTITAS - NE 1/4 NE 1/4 Sec 27- T 19- N , R 18E WM
(2a) STREET ADDRESS OF WELL (or nearest address) ROBBINS RD , ELLENSBURG

A

(3) PROPOSED USE DOMESTIC

(4) TYPE OF WORK Owner's Number of well (If more than one)
NEW WELL Method. ROTARY

(5) DIMENSIONS. Diameter of well 6 inches
Drilled 133 ft Depth of completed well 130 ft

(6) CONSTRUCTION DETAILS
Casing installed. 6 " Dia from +1.5 ft to 127 ft
WELDED W/TUBEX " Dia from ft to ft
5 1/2" DRIVESHOE " Dia from ft. to ft.

Perforations NO
Type of perforator used
SIZE of perforations in by in
perforations from ft to ft.
perforations from ft. to ft
perforations from ft to ft.

Screens. NO
Manufacturer's Name
Type Model No
Diam slot size from ft to ft
Diam slot size from ft. to ft

Gravel packed: NO Size of gravel
Gravel placed from ft to ft

Surface seal. YES To what depth? 85 ft
Material used in seal BENTONITE
Did any strata contain unusable water? NO
Type of water? Depth of strata ft
Method of sealing strata off SEAL METHOD 1

(7) PUMP Manufacturer's Name
Type SUBMERSIBLE H P

(8) WATER LEVELS Land-surface elevation above mean sea level ft
Static level 64 ft below top of well Date 01/05/01
Artesian Pressure lbs per square inch Date
Artesian water controlled by CAP

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

Recovery data

Time	Water Level	Time	Water Level	Time	Water Level

Date of test / /
Bailer test gal/min ft drawdown after hrs
Air test 9 gal/min w/ stem set at 126 ft for 2 25 hrs
Artesian flow g p m Date
Temperature of water Was a chemical analysis made? NO

(10) WELL LOG

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

MATERIAL	FROM	TO
BROKEN BASALT	0	51
BROWN CLAY	51	58
BROKEN BASALT WITH	58	93
BROWN CLAY WATER BEARING	58	93
BASALT	93	118
FRACTURED BASALT WATER BEARING	118	127
HARD BLACK BASALT	127	133

DEPT OF ECOLOGY Received FEB - 2 2001 CENTRAL REGION OFFICE

Work started 01/04/01 Completed 01/05/01

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

NAME TUMWATER DRILLING, INC
(Person, firm, or corporation) (Type or print)

ADDRESS P O BOX 787

[SIGNED] License No 1249

Contractor's Registration No TUMWADP 011 LZ Date 01/08/01

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

WATER WELL REPORT
STATE OF WASHINGTON

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

(1) OWNER: Name ART MANZ Address RT4 Box 216K Ellensburg WA

(2) LOCATION OF WELL: County Kittitas SE¼ NW¼ Sec 22 T. 19 N. R 18 W.M.
Bearing and distance from section or subdivision corner Sun. East-unrecorded - Dw XT - Tact 3 F

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

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

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 300 ft. Depth of completed well 300 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6 " Diam. from 0 ft. to 160 ft.
Threaded ☐ ..... " Diam. from ..... ft. to ..... ft.
Welded ☐ ..... " Diam. from ..... ft. to ..... ft.

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

Screens: Yes ☐ No ☑
Manufacturer's Name .....
Type ..... Model No. .....
Diam. ..... Slot size ..... from ..... ft. to ..... ft.
Diam. ..... Slot size ..... from ..... ft. to ..... ft.

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

Surface seal: Yes ☑ No ☐ To what depth? 25 ft.
Material used in seal BENTONITE
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? ..... Depth of strata .....
Method of sealing strata off .....

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

(8) WATER LEVELS: Land-surface elevation above mean sea level .... ft.
Static level 180 ft. below top of well Date .....
Artesian pressure ..... lbs. per square inch Date .....
Artesian water is controlled by ..... (Cap, valve, etc.)

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

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

Time	Water Level	Time	Water Level	Time	Water Level

Date of test .....
Bailer test 25 gal./min. with ..... ft. drawdown after ..... hrs.
Artesian flow ..... g.p.m. Date .....
Temperature of water ..... Was a chemical analysis made? Yes ☐ No ☐

(10) WELL LOG:

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

MATERIAL	FROM	TO
Dirt	0	5
CEMENT gravel	5	155
Medium Basalt	155	175
Soft Basalt	175	240
SANDSTONE (WATER BEARING)	240	300

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DEC 31 1985
DEPARTMENT OF ECOLOGY
CENTRAL REGION OFFICE

Work started 8-20 19 85 Completed 8-21 19 85

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 Bach Drilling Co
(Person, firm, or corporation) (Type or print)

Address Rt. 5, Box 1010, Ellensburg

[Signed] Mike Bach
(Well Driller)

License No. 22 Date 8-28 1985

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

Please print, sign and return to the Department of Ecology

RESOURCE PROTECTION WELL REPORT

CURRENT Notice of Intent No. SE068445

(SUBMIT ONE WELL REPORT PER WELL INSTALLED)

Construction/Decommission *("x" in box)*

☒ Construction

☐ Decommission

ORIGINAL INSTALLATION Notice of Intent Number: 375980

Type of Well *("x in box)*

☐ Resource Protection

☒ Geotech Soil Boring

Property Owner _____

Site Address _____

Consulting Firm Barr Engineering

City Ellensburg County Kittitas

Unique Ecology Well IDTag No. _____

Location NE 1/4-1/4 1/4 Sec 22 Twn 19 R 18

EWM ☒ or WWM ☐

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.

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

Long Deg _____ Min _____ Sec _____

☒ Driller ☐ Engineer ☐ Trainee

Name (Print Last, First Name) Rodney, Gilseth

Driller/Engineer /Trainee Signature _____

Driller or Trainee License No. 1473

Tax Parcel No. _____

Cased or Uncased Diameter 6" Static Level None

Work/Decommission Start Date 4-2-10

Work/Decommission Completed Date 4-2-10

If trainee, licensed driller's Signature and License Number:

Construction Design	Well Data	Formation Description
		Silt 0 2 Sandy Silty Gravels cobble 45 Silty sandy cobbles 60

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MAY 19 2010

DEPARTMENT OF ECOLOGY - CENTRAL REGIONAL OFFICE

SCALE: 1"= _____ PAGE _____ OF _____

Please print, sign and return to the Department of Ecology

RESOURCE PROTECTION WELL REPORT

CURRENT Notice of Intent No. AE08895

(SUBMIT ONE WELL REPORT PER WELL INSTALLED)

Construction/Decommission *("x" in box)*

☐ Construction 375981

☒ Decommission

ORIGINAL INSTALLATION Notice of Intent Number: SE06845

Type of Well *("x in box)*

☐ Resource Protection

☒ Geotech Soil Boring

Consulting Firm Barr Engineering

Unique Ecology Well IDTag No. _____

Property Owner _____

Site Address _____

City Ellensburg County Kittitas

Location NE 1/4-1/4 NW 1/4 Sec 22 Twn 19 R 18

EWM ☒ or WWM ☐

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

Long Deg _____ Min _____ Sec _____

Tax Parcel No. _____

Cased or Uncased Diameter 6 Static Level None

Work/Decommission Start Date 4-2-10

Work/Decommission Completed Date 4-2-10

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.

☒ Driller ☐ Engineer ☐ Trainee

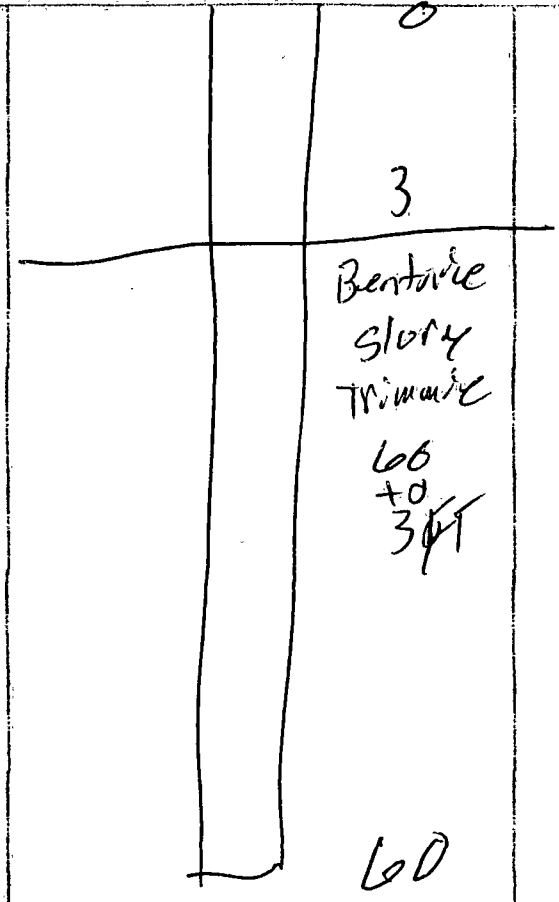
Name (Print Last, First Name) Rodney, Gilsetth

Driller/Engineer /Trainee Signature Rodney A Gilsetth

Driller or Trainee License No. 1473

If trainee, licensed driller's Signature and License Number:

Construction Design	Well Data	Formation Description



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MAY 19 2010

DEPARTMENT OF ECOLOGY - CENTRAL REGIONAL OFFICE

SCALE: 1"= _____ PAGE _____ OF _____

Please print, sign and return to the Department of Ecology

RESOURCE PROTECTION WELL REPORT

CURRENT Notice of Intent No. SE06836

(SUBMIT ONE WELL REPORT PER WELL INSTALLED)

Construction/Decommission *("x" in box)*

☒ Construction
☐ Decommission 375982

ORIGINAL INSTALLATION Notice of Intent Number:

Type of Well *("x in box)*

☐ Resource Protection
☒ Geotech Soil Boring

Property Owner _____

Site Address _____

Consulting Firm Barr Engineering

City Ellensburg County Kittitas

Unique Ecology Well IDTag No. _____

Location NW 1/4-1/4 SW 1/4 Sec 22 Twn 19 R 18

EWM ☒ or WWM ☐

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.

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

Long Deg _____ Min _____ Sec _____

☒ Driller ☐ Engineer ☐ Trainee

Name (Print Last, First Name) Rodney Gilseth

Driller/Engineer/Trainee Signature Rodney Gilseth

Driller or Trainee License No. 1473

Tax Parcel No. _____

Cased or Uncased Diameter 6" Static Level None

Work/Decommission Start Date 4-1-10

Work/Decommission Completed Date 4-1-10

If trainee, licensed driller's Signature and License Number:

Construction Design	Well Data	Formation Description
		0 Sandy Silty Wthered Rock 6

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MAY 19 2010

DEPARTMENT OF ECOLOGY - CENTRAL REGIONAL OFFICE

SCALE: 1"= _____ PAGE _____ OF _____

Please print, sign and return to the Department of Ecology

RESOURCE PROTECTION WELL REPORT

CURRENT Notice of Intent No. AE08886

(SUBMIT ONE WELL REPORT PER WELL INSTALLED)

Construction/Decommission *("x" in box)*

☐ Construction

☒ Decommission 375983

ORIGINAL INSTALLATION Notice of Intent Number: SE06836

Consulting Firm Barr Engineering

Unique Ecology Well IDTag No. _____

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

☒ Driller ☐ Engineer ☐ Trainee

Name (Print Last, First Name) Rodney, Gilseth

Driller/Engineer /Trainee Signature [signature]

Driller or Trainee License No. 1473

If trainee, licensed driller's Signature and License Number:

Type of Well *("x in box)*

☐ Resource Protection

☒ Geotech Soil Boring

Property Owner _____

Site Address _____

City Ellensburg County Kittitas

Location NW 1/4-1/4 SW 1/4 Sec 22 Twn 19 R 18

EWM ☒ or WWM ☐

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

Long Deg _____ Min _____ Sec _____

Tax Parcel No: _____

Cased or Uncased Diameter 6" Static Level Now

Work/Decommission Start Date 4-1-10

Work/Decommission Completed Date 4-1-10

Construction Design	Well Data	Formation Description
	0 3/8 Hole plug 3 Bentonite slurry Trimmie 60 to 3 60	

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MAY 19 2010

DEPARTMENT OF ECOLOGY - CENTRAL REGIONAL OFFICE

SCALE: 1"= _____ PAGE _____ OF _____

File Original with Department of Ecology
Second Copy - Owner's Copy
Third Copy - Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Notice of Intent W113427
UNIQUE WELL I.D. # AFE 217
Water Right Permit No.

(1) OWNER: Name David lee Address 9600 20th Ave East Tacoma Wa

(2) LOCATION OF WELL: County Kittitas NE 1/4 SE 1/4 Sec 22 T 19 N.R. 18 WM 9844
(2a) STREET ADDRESS OF WELL: (or nearest address) Suneast
TAX PARCEL NO.: J

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

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

(5) DIMENSIONS: Diameter of well 10" 8" 6" inches
Drilled 285 feet. Depth of completed well 285 ft.

(6) CONSTRUCTION DETAILS
Casing Installed:
☒ Welded 6" Diam. from +2 ft. to 257 ft.
☐ Liner installed " Diam. from ft. to ft.
☐ Threaded " Diam. from ft. to ft.

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

Screens: ☐ Yes ☒ No ☐ K-Pac Location
Manufacturer's Name
Type Model No.
Diam. Slot Size from ft. to ft.
Diam. Slot Size from ft. to ft.

Gravel/Filter packed: ☐ Yes ☐ No ☐ Size of gravel/sand
Material placed from ft. to ft.

Surface seal: ☒ Yes ☐ No To what depth? 100+ ft.
Material used in seal Bentonite
Did any strata contain unusable water? ☐ Yes ☐ No
Type of water? Depth of strata
Method of sealing strata off

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

(8) WATER LEVELS: Land-surface elevation above mean sea level ft.
Static level 163 ft. below top of well Date
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☐ No If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
Yield: gal./min. with ft. drawdown after hrs.
Yield: gal./min. with ft. drawdown after hrs.
Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
	Approx		Air Lift		
	40 to 45 gpm				

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

(10) WELL LOG or DECOMMISSIONING PROCEDURE DESCRIPTION
Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. Indicate all water encountered.

MATERIAL	FROM	TO
topsoil Br. M	0	2
Clay + gr. Cobbels Bl Br MH	2	17
cemented gr. Cob Bl. Br MH	17	28
Cem. gravel Cob Bl. Br MH sandstone	28	57
Cem. gr. Cobb Bl. Br H	73	103
Cem. gr. Cob Clay Bl Br H	103	197
Sandstone w clay len Br H S	197	248
sandstone malty color M S	248	285

SEP 20 2000

Work Started 9/6/00 Completed 9/8/00

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 Steve Mills License No. 1335
(Licensed Driller/Engineer)

Trainee Name License No.
Drilling Company WATERMAN WELL Drilling Inc
(Signed) License No. 1335
(Licensed Driller/Engineer)
Address 106 Berryman ln Selah Wa 98942
Contractor's Registration No WATERMW022DB 9/8/00

(USE ADDITIONAL SHEETS IF NECESSARY)

Ecology is an Equal Opportunity and Affirmative Action employer. For special accommodation needs, contact the Water Resources Program at (360) 407-6600. The TDD number is (360) 407-6006.

ECY 050-1-20 (11/98)

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

WATER WELL REPORT

STATE OF WASHINGTON

Application No. .....

Permit No. .....

(1) OWNER: Name Gordon Pederson Address RT 4 Box 216 B Ellensburg

(2) LOCATION OF WELL: County Kittitas NW ¼ NW ¼ Sec. 22 T. 18 N. R. 17 E.W.M.

Bearing and distance from section or subdivision corner

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

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

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 370 ft. Depth of completed well 370 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6 " Diam. from 0 ft. to 200 ft.
Threaded ☐ 5 " Diam. from 200 ft. to 370 ft.
Welded ☒ " Diam. from ft. to ft.

Perforations: Yes ☒ No ☐
Type of perforator used cutting torch
SIZE of perforations 1/8 in. by 5 in.
40 perforations from 330 ft. to 370 ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☐ No ☒
Manufacturer's Name .....
Type ..... Model No. .....
Diam. ..... Slot size ..... from ..... ft. to ..... ft.
Diam. ..... Slot size ..... from ..... ft. to ..... ft.

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

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

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

(8) WATER LEVELS: Land-surface elevation above mean sea level ..... ft.
Static level 230 ft. below top of well Date .....
Artesian pressure ..... lbs. per square inch Date .....
Artesian water is controlled by ..... (Cap, valve, etc.)

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

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

Time	Water Level	Time	Water Level	Time	Water Level

Date of test .....
Bailer test 30 gal./min. with 140 ft. drawdown after 1 hrs.
Artesian flow ..... g.p.m. Date .....
Temperature of water ..... Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG:

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

MATERIAL	FROM	TO
Soil, Brown		5
Sand. Gravel. Boulders. Cemented	5	203
Clay. Brown	203	330
Sandstone. Brown. WB	330	370

Work started 4-30-71 19.. Completed 5-3-71 19..

WELL DRILLER'S STATEMENT:

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

NAME Bill's Well Drilling
(Person, firm, or corporation) (Type or Print)

Address Rt. 7 Box 600 Yakima, Wash.

[Signed] [illegible] (Well Driller)

License No. 1057 Date 5-3-71 19..

(USE ADDITIONAL SHEETS IF NECESSARY)

S. F. No. 7356—OS—(Rev. 4-71)
ECY-070-28

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy 123264

WATER WELL REPORT
STATE OF WASHINGTON

Start Card No. W-49051
UNIQUE WELL I.D. # ABL810
Water Right Permit No. _____

(1) OWNER: Name JERRY SALISBURY Address RT 4 BOX 215C ELLENSBURG WA 98926

(2) LOCATION OF WELL: County Kittitas E½ 1/4 E½ 1/4 Sec 22 T 19 N, R 18 W.M.

(2a) STREET ADDRESS OF WELL (or nearest address) _____ A

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

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

(5) DIMENSIONS: Diameter of well 6 inches. Drilled 380 feet. Depth of completed well 380 ft.

(6) CONSTRUCTION DETAILS:
Casing Installed: 6" Diam. from +3 ft. to 277 ft. Welded ☐
5" Diam. from 280 ft. to 380 ft. Liner installed ☒
_____" Diam. from _____ ft. to _____ ft. Threaded ☐

Perforations: Yes ☒ No ☐
Type of perforator used SAW
SIZE of perforations ⅛ in. by 6 in.
240 perforations from 340 ft. to 380 ft.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.

Screens: Yes ☐ No ☐
Manufacturer's Name _____
Type _____ Model No. _____
Diam. ____ Slot size _____ from _____ ft. to _____ ft.
Diam ____ Slot size _____ from _____ ft. to _____ ft.

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

Surface seal: Yes ☒ No ☐ To what depth? 290+ ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? _____ Depth of strata _____
Method of sealing strata off _____

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

(8) WATER LEVELS: Land-surface elevation above mean sea level _____ ft.
Static level 253 ft. below top of well Date 6-1-94
Artesian pressure _____ lbs. per square inch Date _____
Artesian water is controlled by _____ (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☐ If yes, by whom? _____
Yield _____ gal./min. with _____ ft. drawdown after _____ hrs.
" " " "
" " " "
Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test _____
Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.
Airtest 40 gal./min. with stem set at _____ ft. for _____ hrs.
Artesian flow _____ g.p.m. Date _____
Temperature of water _____ Was a chemical analysis made? Yes ☐ No ☐

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION
Formation. Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL		FROM	TO
SOIL COBBLES	H	0	5
COBBLES BOULDERS CLAY	H	5	100
COBBLES BOULDERS SANDSTONE	H	100	188
CLAY COBBLES BOULDERS	M	188	194
" " "	MH	194	218
SANDSTONE COBBLES	H	218	235
CLAY	M	235	245
SANDSTONE GRAVEL	M	245	271
CLAY GRAVEL	M	271	279
SANDSTONE	M	279	313
CLAY	M	313	317
SANDSTONE	M	317	325
CLAY - TRACE WATER	M	325	329
SANDSTONE - WATER	M	329	376
CLAY	M	376	380

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JUN 9 1994
DEPARTMENT OF ECOLOGY

Work Started 5-17-94 19 Completed 6-1-94 19

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

NAME RIEBE WELL DRILLING (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address PO BOX 10866 YAKIMA
(Signed) WELL DRILLER License No. 1828
Contractor's Registration No. 132K1 Date 7-20-94 19

(USE ADDITIONAL SHEETS IF NECESSARY)

Ecology is an Equal Opportunity and Affirmative Action employer. For special accommodation needs, contact the Water Resources Program at (206) 407-6600. The TDD number is (206) 407-6006.

ECY 050-1-20 (9/93)

WELL LOG CHANGE FORM

Instructions: Record any change made to the well log record on this form. Append this form to the well log image. File with the original.

WCL Log ID (Required) _____ Well Log ID _____

Regional Office: ☑ CRO ☐ ERO ☐ NWRO ☐ SWRO

Type of Well: ☐ Water ☐ Resource

Notice of Intent: _____ Ecology Well ID Tag No. _____

Property (Well) Owner's Name _____
Well Street Address _____
City _____ County _____ Zip Code _____

Location: ____1/4-1/4 ____1/4 Sec ____ Twn ____ R ____ E or W (Circle One)

Lat./Long: (Required) Lat. Deg. _____ Lat. Min/Sec _____
Long. Deg. _____ Long. Min/Sec _____
Horizontal Collection Method Code _____

Tax Parcel No _____

Type of Work: ☐ New Well ☐ Reconditioned ☐ Deepened
Well Log Received Date __/__/__
Well Diameter ___ (in inches) Well Depth _____ (in feet) Well Completed Date __/__/__

Driller's Ecology License No. _____
Trainee's Ecology License No. _____

Reason/Source of Change (Required)
INTERNAL CORRECTION - IMAGE UNCHANGED

Signature of Well Log Tracker (Required) EG Date 3/05

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

WATER WELL REPOR
STATE OF WASHINGTON

Application No. ....
Permit No. 64-24803P

(1) OWNER: Name Jim Roan Address Rt. 4 Box 80 Ellensburg Wn.

(2) LOCATION OF WELL: County Kittitas ... Sec 21, 19 18 ... N., R. ... W.M.
ing and distance from section or subdivision corner NENE Sec. 21 T19N R18 EWM

A

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

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

(5) DIMENSIONS: Diameter of well 12 inches.
Drilled 700 ft. Depth of completed well 700 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 12 " Diam. from 0 ft. to 125 ft.
Threaded ☒ 10 " Diam. from 0 ft. to 325 ft.
Welded ☒ ... " Diam. from ... ft. to ... ft.

Perforations: Yes ☒ No ☐
Type of perforator used Torch
SIZE of perforations 1/4 in. by 2 in.
50 perforations from 300 ft. to 325 ft.
... perforations from ... ft. to ... ft.
... perforations from ... ft. to ... ft.

Screens: Yes ☐ No ☒
Manufacturer's Name ....
Type .... Model No. ....
Diam. .... Slot size .... from .... ft. to .... ft.
Diam. .... Slot size .... from .... ft. to .... ft.

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

Surface seal: Yes ☒ No ☐ To what depth? 25 ft.
Material used in seal CEMENT
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? .... Depth of strata ....
Method of sealing strata off ....

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

(8) WATER LEVELS: Land-surface elevation above mean sea level .... ft.
Static level 180 ft. below top of well Date ....
Artesian pressure .... lbs. per square inch Date ....
Artesian water is controlled by .... (Cap, valve, etc.)

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

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

Time	Water Level	Time	Water Level	Time	Water Level

Date of test ....
Bailer test 400 gal./min. with .... ft. drawdown after .... hrs.
Artesian flow .... g.p.m. Date ....
Temperature of water .... Was a chemical analysis made? Yes ☐ No ☐

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

MATERIAL	FROM	TO
Cement gravel - cobbles	0	120
soft Broken Basalt water bearing	120	320
Medium Basalt	320	440
Sandrock	440	445
Hard Basalt	445	535
Blue shale	535	600
Hard Basalt	600	650
Soft Basalt water	650	660
Hard Basalt	660	700

RECEIVED
20 ..
DEPARTMENT ...
CENTRAL ...

Work started August, 1978. Completed May, 1979

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 Bach Drilling Co.
(Person, firm, or corporation) (Type or print)
Address Box 1010, Rte 5

[Signed] Mike Bach
(Well Driller)

License No. 22 Date Nov. 18, 1980

(USE ADDITIONAL SHEETS IF NECESSARY)

✓DK 1.02.81

ECY 050-1-20

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

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. W090348
UNIQUE WELL I.D. # ACK843
Water Right Permit No. 9803A

OWNER: Name Mikail Tarasenko Address 13115 SE 258th St. Kent, Wa

(2) LOCATION OF WELL: County Kittitas SE 1/4 NE 1/4 Sec 22 T. 19 N., R 18 E W.M.

(2a) STREET ADDRESS OF WELL (or nearest address) Robbin's Rd H

(3) PROPOSED USE: [X] Domestic [ ] Industrial [ ] Municipal [ ] Irrigation [ ] Test Well [ ] Other [ ] DeWater

(4) TYPE OF WORK: Owner's number of well (If more than one) _____

Abandoned [ ] New well [X] Method: Dug [ ] Bored [ ] Deepened [ ] Cable [ ] Driven [ ] Reconditioned [ ] Rotary [X] Jetted [ ]

(5) DIMENSIONS: Diameter of well 6 inches. Drilled 305 feet. Depth of completed well 300 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6" Diam. from +2 ft. to 178 ft.
Welded [X] 4" Diam. from -10 ft. to 300 ft.
Liner installed [X]
Threaded [ ] _____" Diam. from _____ ft. to _____ ft.

Perforations: Yes [ ] No [X]
Type of perforator used _____
SIZE of perforations _____ in. by _____ in.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.

Screens: Yes [ ] No [X]
Manufacturer's Name _____
Type _____ Model No. _____
Diam. ____ Slot size _____ from _____ ft. to _____ ft.
Diam. ____ Slot size _____ from _____ ft. to _____ ft.

Gravel packed: Yes [ ] No [X] Size of gravel _____
Gravel placed from _____ ft. to _____ ft.

Surface seal: Yes [X] No [ ] To what depth? 47 ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes [ ] No [X]
Type of water? _____ Depth of strata _____
Method of sealing strata off _____

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

(8) WATER LEVELS: Land-surface elevation above mean sea level _____ ft.
Static level 205 ft. below top of well Date 9-12
Artesian pressure _____ lbs. per square inch Date _____
Artesian water is controlled by _____ (Cap, valve, etc.)

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

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

Time	Water Level	Time	Water Level	Time	Water Level

Date of test _____
Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.
Airtest 25 gal./min. with stem set at 29 ft. for 2 hrs.
Artesian flow _____ g.p.m. Date _____
Temperature of water _____ Was a chemical analysis made? Yes [ ] No [X]

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

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

MATERIAL	FROM	TO
Top Soil	0	4
Brown Clay & gravel	4	81
Sticky Brown Clay	81	136
Brown Clay & gravel	136	157
Basalt Black with fractured areas	157	198
Sticky Brown Clay	198	260
Crumbly Brown Sand Stone 9.5 GPM	260	271
Brown Clay	271	292
Brown Sand Stone (Soft) & Water	292	305

RECEIVED
OCT - 6 1998
DEPARTMENT OF ECOLOGY
CENTRAL REGIONAL OFFICE

Work Started 9-11 19. Completed 9-12 19 98

WELL CONSTRUCTOR CERTIFICATION:

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

NAME Mathews Drilling (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address 9455 Stonecrest Rd ML
(Signed) Mikail Mathews (WELL DRILLER) License No. 1267
Contractor's Registration No. MATHEDC167BC Date 9.13 19 98

(USE ADDITIONAL SHEETS IF NECESSARY)

Ecology is an Equal Opportunity and Affirmative Action employer. For special accommodation needs, contact the Water Resources Program at (206) 407-6600. The TDD number is (206) 407-6006.

ECY 050-1-20 (9/93) * * f

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

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

WATER WELL REPORT
STATE OF WASHINGTON

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

(1) OWNER: Name Mr. & Mrs. Donald McLaughlin Address Rt 4, Box 216 Ellensburg

(2) LOCATION OF WELL: County Yakima — E 1/4 E 1/2 - 1/4 Sec. 22 T. 19 N., R. 18 W.M.

Bearing and distance from section or subdivision corner Sun East Development

(3) PROPOSED USE: Domestic [X] Industrial [ ] Municipal [ ]
Irrigation [ ] Test Well [ ] Other [ ]

(4) TYPE OF WORK: Owner's number of well (if more than one) 1
New well [X] Method: Dug [ ] Bored [ ]
Deepened [ ] Cable [ ] Driven [ ]
Reconditioned [ ] Rotary [X] Jetted [ ]

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 160 ft. Depth of completed well 160 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6 " Diam. from 0+ ft. to 154 ft.
Threaded [ ] " Diam. from ft. to ft.
Welded [X] " Diam. from ft. to ft.

Perforations: Yes [X] No [ ]
Type of perforator used Torch cut
SIZE of perforations 1/8 in. by 6 in.
50 perforations from 114 ft. to 154 ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes [ ] No [X]
Manufacturer's Name
Type Model No
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes [ ] No [X] Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes [X] No [ ] To what depth? 18+ ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes [ ] No [X]
Type of water? Depth of strata
Method of sealing strata off

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

(8) WATER LEVELS: Land-surface elevation above mean sea level .... ft.
Static level 96.6 ft. below top of well Date
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes [ ] No [ ] If yes, by whom?
Yield: 15 gal./min. with ft. drawdown after hrs.
" by airlift " " "
" " " "

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

Time	Water Level	Time	Water Level	Time	Water Level

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

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OCT 10 1985
DEPARTMENT OF ECOLOGY
CENTRAL REGION OFFICE

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

MATERIAL			FROM	TO
Top Soil	brn	S	0	1
Hard pan boulders	brn	H	1	11
Yellow clay		S	11	14
Brown clay		S	14	42
Sandstone	white	M	42	60
Tan clay Streaks of Sandstone			60	97
Broken rock and clay	brn	H	97	144
Broken rock	brn	VH	144	154
Hole is caving, had to run casing				
perforated from 114 to 154 ft.				
Torch perforated 6" casing with				
50 1/8" x 6" slots				
6x8 packer set at 94 ft.				
Broken rock & shale	brn	H	154	160
15 gpm at 160 ft.				
SWL 96.6 ft.				
Cased 154 ft. with 6 inch steel casing.				
Total depth of well is 160 ft.				

Work started 8/21/85 19 Completed 8/23/85 19

WELL DRILLER'S STATEMENT:

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

NAME RIEBE WELL DRILLING
(Person, firm, or corporation) (Type or print)
Address 1503 E. Nob Hill Blvd.

[Signed] John Riebe
(Well Driller)

License No. 0422 Date 8/26/85 19

Drilled by Bob Brittain

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

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

WATER WELL REPORT
STATE OF WASHINGTON

Application No. /
Permit No. /

(1) **OWNER:** Name Mr. & Mrs. Donald McLaughlin Address Rt 4, Box 216 Ellensburg

(2) **LOCATION OF WELL:** County Yakima — E½ E½ ¼ Sec. 22 T. 19 N., R. 18 W.M.

Bearing and distance from section or subdivision corner Sun East Development

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

(4) **TYPE OF WORK:** Owner's number of well (if more than one) 1
New well X Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary X Jetted ☐

(5) **DIMENSIONS:** Diameter of well 6 inches.
Drilled 160 ft. Depth of completed well 160 ft.

(6) **CONSTRUCTION DETAILS:**
Casing installed: 6 " Diam. from 0+ ft. to 154 ft.
Threaded ☐ " Diam. from ft. to ft.
Welded X " Diam. from ft. to ft.

Perforations: Yes X No ☐
Type of perforator used Torch cut
SIZE of perforations 1/8 in. by 6 in.
50 perforations from 114 ft. to 154 ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☐ No X
Manufacturer's Name
Type Model No
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to ft.

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

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

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

(8) **WATER LEVELS:** Land-surface elevation above mean sea level ft.
Static level 96.6 ft. below top of well Date
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) **WELL TESTS:** Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☐ If yes, by whom?
Yield: 15 gal./min. with ft. drawdown after hrs.
" by airlift " "
" " " "

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

Time	Water Level	Time	Water Level	Time	Water Level

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

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OCT 10 1985
DEPARTMENT OF ECOLOGY
CENTRAL REGION OFFICE

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

MATERIAL			FROM	TO
Top Soil	brn	S	0	1
Hard pan boulders	brn	H	1	11
Yellow clay		S	11	14
Brown clay		S	14	42
Sandstone	white	M	42	60
Tan clay Streaks of Sandstone			60	97
Broken rock and clay	brn	H	97	144
Broken rock	brn	VH	144	154
Hole is caving, had to run casing.				
perforated from 114 to 154 ft.				
Torch perforated 6" casing with				
50 1/8" x 6" slots				
6x8 packer set at 94 ft.				
Broken rock & shale	brn	H	154	160
15 gpm at 160 ft.				
SWL 96.6 ft.				
Cased 154 ft. with 6 inch steel casing.				
Total depth of well is 160 ft.				

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DEC 13 1985
DEPARTMENT OF ECOLOGY
CENTRAL REGION

Work started 8/21/85 19 Completed 8/23/85 19

WELL DRILLER'S STATEMENT:

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

NAME RIEBE WELL DRILLING
(Person, firm, or corporation) (Type or print)
Address 1503 E. Nob Hill Blvd.

[Signed] John Riebe (Well Driller)

License No. 0422 Date 8/26/85 19

Drilled by Bob Britton

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

E 1/2 - SE 1/4 - SW 1/4 - NE 1/4 - W 1/2 - SW 1/4 - SE 1/4 - NE 1/4 of Sec. 28 - 19N R-18EWM

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

WATER WELL REPORT
STATE OF WASHINGTON

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

(1) **OWNER:** Name George V. Plaas Address RT-BX 123A - Ellensburg

(2) **LOCATION OF WELL:** County Kittitas SW¼ NE¼ - SW¼ SE¼ NE¼ Sec. 28 T. 19 N., R. 18 E.W.M.

Bearing and distance from section or subdivision corner

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

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

(5) **DIMENSIONS:** Drilled 363 ft. Diameter of well 6 inches. Depth of completed well 347 ft.

(6) **CONSTRUCTION DETAILS:**
Casing installed: 6 " Diam. from 0 ft. to 344 ft.
Threaded ☐ " Diam. from ..... ft. to ..... ft.
Welded ☑ " Diam. from ..... ft. to ..... ft.

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

Screens: Yes ☐ No ☑
Manufacturer's Name .....
Type ..... Model No. .....
Diam. ..... Slot size ..... from ..... ft. to ..... ft.
Diam. ..... Slot size ..... from ..... ft. to ..... ft.

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

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

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

(8) **WATER LEVELS:** Land-surface elevation above mean sea level ..... ft.
Static level 230 ft. below top of well Date 11/16/77
Artesian pressure ..... lbs. per square inch Date .....
Artesian water is controlled by ..... (Cap, valve, etc.)

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

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

Time	Water Level	Time	Water Level	Time	Water Level

Date of test .....
Bailer test 50 gal./min. with 185 ft. drawdown after ½ hrs.
Artesian flow ..... g.p.m. Date .....
Temperature of water ..... Was a chemical analysis made? Yes ☐ No ☑

(10) **WELL LOG:**

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

MATERIAL	FROM	TO
Top Soil	0	1
GRAVEL MED / CLAY BRN	1	70
CLAY BRN / SOFT MED	70	270
GRAVEL MED / SAND BRN WB	270	290
CLAY BRN SOFT TO MED	290	343
GRAVEL MED SAND BRN	343	
WB 50 GPM		

RECEIVED
NOV 18 1977
DEPARTMENT OF ECOLOGY
CENTRAL REGIONAL OFFICE

Work started 11/11 19 77 Completed 11/16 19 77

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 B+B WELL DRILLING (Person, firm, or corporation) (Type or print)

Address RT 2 Box 600-A YAKIMA WA

[Signed] Kenneth Blackman (Well Driller)

License No. 790 Date 11/17/77

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20