

Sampling Plan Vanier Expansion Woodward Mine

Crook County, Oregon



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1.0 INTRODUCTION

As outlined here, Knife River intends to collect samples from both groundwater and surface water sites located on or adjacent to the mining and proposed expansion area for at least one year. With regard to groundwater, our plan is to sample 17 shallow and deep aquifer wells quarterly to assess manganese (Mn), aluminum (Al), and iron (Fe) concentrations. In a similar fashion, Knife River will sample surface water sites quarterly, including at least five sites similarly identified on **Figure 1**.

The mining facility at Woodward and Vanier is underlain by two aquifers: a shallow aquifer and a deep aquifer. The shallow aquifer exists within the unconsolidated sands, silty sands and gravels that extend from the land surface to depths of approximately 50 to 70 feet. This aquifer is unconfined and was encountered as mining progressed toward the east end of the Woodward property. The majority of the mining at Woodward was “dry mining” and the groundwater table was not encountered. Below the shallow aquifer is a thick impermeable bed of clay or silt that ranges in thickness from approximately 110 to 160 feet. This clay layer serves as a confining bed and based on local pumping and potentiometric surface information, isolates the shallow aquifer from the deep aquifer. The stratigraphic top of this lower aquifer ranges from 200 to 230 feet below ground surface, and the permeable beds range in thickness from 30 to 50 feet. The geologic relationships of the shallow and deep aquifers below the mining facility are illustrated by the geologic cross sections presented on **Figures 2, 3, and 4**. These geologic cross sections were prepared from well completion reports on file with the Oregon Water Resources Department.

Knife River has identified the groundwater flow direction in the shallow aquifer based on monitoring wells they completed at the mining facility. As shown in **Figure 5** and based on the most recent water level measurements collected on October 17, 2024, groundwater in the shallow aquifer flows west and southwest across the mine site. These water level measurements were obtained from the monitoring wells installed at the mine since 2021, as well as one neighboring shallow aquifer well. Completion details for all the wells that Knife River plans to monitor are provided in **Tables 1 and 2**. Borehole logs and well completion data for the Knife River monitoring wells are included in **Appendix A**. While October 17, 2024 data are valuable for assessing groundwater flow paths, Knife River recognizes that the static water level within an unconfined aquifer may fluctuate seasonally and over time. To assess these potential variations, monthly water level measurements will be taken for wells completed in the unconfined aquifer for one year to better capture seasonal changes in hydraulic gradients and flow directions. Based on these data, Knife River will likely petition to reduce the monthly water level data collection to quarterly after one year. The data from October 2024 and **Figure 5** serve as an illustrative planning tool for this sampling plan. A detailed overview of the sampling locations and proposed frequencies for groundwater, surface water, and sediment/soil monitoring is provided in **Table 3**.

In addition to the wells referenced herein, Knife River is willing to add two additional wells to the sampling plan based on direction from the Oregon Department of Environmental Quality (DEQ) and Department of Geology and Mineral Industries (DOGAMI). One of the monitoring wells may be completed into the backfill (or reclaimed mine pit) near the east end of the Woodward site. The other monitoring well may be completed west of Knife River’s processing ponds. Knife River is waiting for written guidance from DEQ and DOGAMI on the selected location and proposed construction details for these two wells prior to scheduling the well construction effort.

2.0 SAMPLING PLAN

2.1 Sampling Locations

Knife River is planning to sample shallow aquifer wells across the mining facility and based on the shallow aquifer water table map in **Figure 5**, has identified their hydrogeologic position relative to the Woodward Mine. For clarity, "upgradient" refers to wells located hydrologically upstream of mining activities at Woodward, while "downgradient" refers to wells positioned downstream of mining activities at Woodward. Within this area, some references to gradient position are noted with reference to the local area. **Table 3** summarizes the proposed groundwater and surface water sampling plan, detailing the sampling locations and the recommended sampling frequency based on feedback from DOGAMI and Oregon DEQ.

The upgradient shallow aquifer wells, relative to the Woodward mine-related disturbance, are located east of the site, as shown on **Figure 1**. These upgradient wells include MW-1, MW-2, MW-3, MW-4, WW-2A, and the Vanier House Well. Although MW-7 is upgradient of the processing ponds, it is not upgradient relative to the mining activities that have already taken place at Woodward. Once the Vanier application is approved and mining begins in the Vanier Expansion Area, the designated upgradient wells will continue to include MW-1, MW-2, and the Vanier House Well. Knife River also proposes to continue monitoring select cross-gradient shallow aquifer residential wells, including MW-3, MW-4, the Mikulski well (3992) and the Johnson well (3320), to further assess groundwater conditions in the area.

With respect to the three wells downgradient of Vanier and upgradient of Woodward (identified as WW-1A, WW-2A and WW-3A), Knife River proposes to sample only one (WW-2A) until site conditions dictate a change in sampling protocol. Such site conditions may include, but are not limited to, a significant change in water level, water chemistry, temperature or field parameters. The three wells drilled in 2021—WW-1A, WW-2A, and WW-3A—are within 100 feet of each, all completed in the shallow aquifer, with minor elevation differences (ranging from 2928 to 2930 feet), and similar lithologic and well construction characteristics. WW-1A extends to 30 feet below ground surface (bgs) (screened 10 to 30 feet), WW-2A extends to 25 feet bgs (screened 10 to 25 feet), and WW-3A extends to 28 feet bgs (screened 13 to 28 feet). The well completion reports for these wells are included in **Appendix A**. Given these similarities and the minimal drawdown observed at WW-2A during aquifer testing, only WW-2A will be sampled to represent groundwater conditions in this area.

West of the disturbance area at the mine, the downgradient shallow aquifer wells consist of MW-5 and MW-6. Both wells are situated downgradient from the Process Water Ponds and the Woodward mining operation. Both wells were completed in September 2024 to depths between 62 and 71 feet. Although these two wells (MW-5 and MW-6) represent downgradient site conditions, no baseline data was collected on the shallow aquifer in this area before the mining and processing at Woodward commenced. The samples collected from these wells only reflect current site conditions and do not reflect compliance points where one can compare the current results to an undisturbed baseline. These two wells, MW-5 and MW-6, will continue to be sampled in accordance with permit conditions. In addition to these two wells MW-7, which is a shallow well downgradient from the majority of mining at Woodward will be sampled. This well is also located upgradient of the Process Water Ponds and adjacent to the deep aquifer well identified as the Production Well.

In addition, Knife River is planning to sample several deep aquifer wells, shown on **Figure 1**, at or immediately adjacent to the property, including the Production Well, the Woodward Shop Well, the Mikulski Deep Well (3992-Deep), and the Kriege Deep Well (4144). Knife River has been sampling the Mikulski and Kriege wells since 2016, prior to the beginning of Woodward Mine operations.

As requested by DOGAMI and shown in **Figure 1**, Knife River proposes to sample several surface water bodies, including: Knife River's Process Water Ponds; Knife River's Water Intake near the ditch/slough; and Standing Water within the last unreclaimed mine cell (if applicable) on the Woodward property. Surface water will be sampled from the water's surface to a depth of 30 centimeters (or shallower depending upon the water depth) to the extent that water is available at the time of sampling, following Environmental Protection Agency (EPA) standard procedures (EPA, 1983). At the time of sampling, the sampler will document site conditions with photographs, including water clarity, weather, flow rate, pH, temperature, turbidity, and electrical conductivity. Sample integrity will be preserved by using clean, dedicated equipment, and samples will be properly documented on a Chain of Custody form. With regard to the process water ponds, Knife River will sample these ponds at two locations: Pond 1 (WWSP-1), which generally receives "first" water from the processing plant, and Pond 3 (WWSP-3). All surface water sources, including the process water ponds, will be sampled to the extent that there is water available to sample (at least 12 inches of water must be present in the respective pond). At the time of sampling, the sampler will document site conditions, including whether makeup water was being added at the time of sampling, makeup water source, how long it has been since makeup water was added and last source of water, whether gravel processing was ongoing during sample collection or if not how long it has been since gravel processing occurred, flow rate, pH, temperature, and other relevant parameters.

With regard to the source of process/makeup water, it is important to note that during the irrigation season, makeup water generally comes from the Water Intake (**Figure 1**), and during the remainder of the year, makeup water is produced from the Production Well (**Figure 1**). The Woodward Processing Plant is not currently operational, and Knife River does not have a target date when they anticipate operating again. When in operation, make up water is typically added to the largest pond (Pond 4). Water may also be added to any of the other ponds when needed to get them to the proper water level for circulation between the ponds but generally the ponds tend to equilibrate during normal plant operations. During plant operation make up water is added, generally at a rate of 150 gallons per minute (gpm). After weekends, holidays, prolonged shutdowns or at the start of the season ponds are filled at a higher rate, which is dependent on a rate agreed to by the Ochoco Irrigation District and their agreement is based on availability. When Knife River sources "make up" water from their deep aquifer well (Production Well), they can fill the ponds at a higher rate, but again this is generally on a one-time basis when they are filling the ponds. The Production Well water right allows pumping up to 500 gpm.

In relation to the sediment sampling program, Knife River will sample within the Process Water Ponds depending on the availability of water versus sediment or slimes. Knife River plans to collect sediment samples from Pond 1 (coarsest sediment) and Pond 4 (finest sediment).

The WW-Standing Water (**Figure 1**) sampling point can be the most difficult from which to obtain a valid water sample and may have questionable technical value. It has only been added to this sampling plan based on DOGAMI's request of October 25, 2024. This sampling point varies in available water and is greatly influenced by direct precipitation and stormwater. Generally, Knife

River protocol does not endorse sampling standing or stagnant water, but based on DOGAMI's request, Knife River is willing to collect a sample from this location.

2.2 Sample Parameters and Frequency

Knife River has surveyed all its completed monitoring wells, including “ground” and “top of casing” measurements, to assess changes in groundwater levels and flow directions during the monitoring period. “Top of casing” will serve as the reference point for all static water level measurements. Knife River proposes to install pressure transducers and measure water levels continuously (data recorded at a minimum of 12-hour intervals) in MW-1, MW-2, MW-3, MW4, and WW-2A, with data downloaded quarterly. For wells with continuous water level monitors, measurements will be manually checked and calibrated monthly for the first three months, then quarterly thereafter. Shallow aquifer monitoring wells without transducers will be manually measured and monitored monthly for a minimum of one year. Changes in the water level measuring schedule will require approval from DOGAMI and DEQ. Additionally, monthly water level measurements will be collected for all offsite shallow aquifer wells including offsite wells 4144, 3992, 3320, and the Vanier House Well for a similar one-year period. Water levels for the deep aquifer wells will be collected on a quarterly basis. **Table 3** presents Sampling Schedule and Frequency.

Static water level measurements will be taken from all monitoring wells (including those with transducers) identified on **Figure 1** at the time of sample collection. Synoptic gauging events (gathering depth to water level measurements at all wells) will be performed before purging and sampling, and wells will be allowed to equilibrate as needed before gauging. Following EPA protocols (EPA, 1991), equilibration is confirmed when water level fluctuations are less than 0.05 feet in three successive measurements after removing any well cap. Knife River will attempt to gather water levels on domestic or industrial water supply wells at opportune times, but it may not always be practical to obtain static water levels on these wells. Water elevation data will be collected quarterly at the “ditch/slough Water Intake” site and ponds.

Knife River will collect quarterly water quality samples from the wells and quarterly surface water samples to assess seasonal impacts, if any, on water quality from the sources identified in **Figure 1**. The groundwater and surface water data collection will consider hydrologic conditions such as: end of summer (i.e., low water condition); springtime (i.e., high water condition); during irrigation season; and after ditches are shut off. After one year, Knife River will petition DOGAMI and DEQ to either continue the current strategy or may petition to adjust monitoring frequency or parameters.

Knife River will collect field parameters during well purging and sampling for all field parameters, including pH, conductivity (EC), temperature, turbidity, dissolved oxygen (DO), and oxidation-reduction potential (ORP). Field parameters will also be measured prior to sampling from surface water sources (**Figure 1**) and will include pH, EC, temperature (°C), DO, ORP, and turbidity (NTU). All EPA sample handling and Chain of Custody protocols will be followed.

Knife River also commits that during one sampling round, they will assess whether the use of different well purging methods has any material effect on water quality results. Four monitor wells (MW-2, MW-5, MW-6, and MW-7) will be purged and sampled using both purge methods to compare analytical results and thereby determine if there is any significant difference in analytical results based on the purge method. The purging and sampling of these wells using the two different methods will be completed on two different days within the same quarterly sampling event. Should a significant difference be determined, Knife River will discuss the difference with

DEQ and DOGAMI and identify the most applicable and representative protocol for sampling all wells without dedicated pumping equipment during future sampling rounds.

Samples from the groundwater wells and surface water sources will be submitted to an EPA-certified laboratory for analysis. All metals will be analyzed for both total and dissolved species. Knife River intends to submit all water and soil samples to Neilson Research Corporation of Medford, Oregon, for testing. Table B1 in **Appendix B** presents a list of laboratories in Oregon that are certified by both the EPA and the Oregon DEQ. Lab certifications can also be found in **Appendix B**. The general analyte (**GA**) list that will be performed on all groundwater and surface water samples will include the following:

- Laboratory pH, EC, and Total Dissolved Solids (TDS)
- Total Organic Carbon (TOC)
- Dissolved and total manganese (Mn)
- Dissolved and total iron (Fe)
- Dissolved and total aluminum (Al)
- Dissolved and total Arsenic (As)
- Nitrates (NO₃+NO₂) as N
- Major Cations: calcium, magnesium, sodium, potassium
- Major Anions: sulfate (SO₄), chloride (Cl), carbonate (CO₃), and bicarbonate (HCO₃)
- Coliform
- Turbidity (NTU)

Knife River will sample monitoring wells completed in the shallow aquifer for the following petroleum hydrocarbons (PH):

- Gasoline Range Organics (GRO)
- Diesel Range Organics (DRO)

Knife River plans to complete the analysis for these petroleum hydrocarbon (**PH**) constituents one time for all the shallow aquifer wells. After that sampling event, Knife River plans to sample MW-1, MW-2, MW-3, MW-4, and WW-2A quarterly for DRO and GRO to establish a Vanier Baseline for at least one year. If GRO or DRO is detected in any well during any sampling event, Knife River will conduct follow-up sampling for the appropriate parameter, within a month of receiving sample results. No sampling of the deep aquifer wells for these additional analytes is planned.

Finally, Knife River will collect a minimum of two soil samples from the sediment within the wash pond complex, one sediment sample at the Water Intake site and two soil samples upgradient from mining operations twice during the one-year sampling period as shown on **Figure 1**. These samples will be collected using a California Tube pushed into the sludge until refusal is encountered. Each sample will be capped and sealed and delivered to the laboratory. The two remaining samples will be collected from Woodward reclaim and Vanier native soils. These latter two samples (Sed 4 and Sed 5) will be collected at a depth of 12 to 15 inches and/or below the organic horizon. All samples will be placed in a Ziploc bag, labelled, and delivered to the laboratory. The soil samples will be analyzed for manganese, aluminum and iron using the following three methods:

- Total Metals (Mn, Al, Fe). Total Metals indicates as the name states total metals or whole element analysis. It is accomplished after “acidification” (use of a strong acid) of all of the sediment and an analysis of all metals present- whether mobile or immobile.

- **Extractable Metals (AB-DPTA).** Extractable metals indicates those metals which can be extracted by an organic solvent (AB-DPTA) and reflect the metal concentration that is likely to go into solution and are available for plant uptake or movement through the unsaturated or vadose zone.
- **RCRA-based TCLP extraction.** As the name suggests, this is the standard method used in the determination of hazardous waste-recognizing that neither Mn, Al, nor Fe are determined to be a hazardous waste or a hazardous chemical. In fact, there is no maximum contaminant level for Mn and EPA has only established an aesthetic standard and a Health Advisory Level. The TCLP extraction method uses acetic acid and sodium hydroxide as an extraction solvent.

In addition, all soil analyses will be analyzed for nitrate-nitrogen. This analysis will address the impacts of fertilizers on the soils and water courses that may influence shallow aquifer water chemistry.

2.3 Sample QA/QC

Knife River plans to collect one duplicate sample and one blank per sampling event. In addition, one rinseate or equipment blank sample will be collected during the monitoring period. As such, the duplicate may be obtained from either a surface water or groundwater source but will be collected to check on the laboratory results. The blank and rinseate samples will provide data regarding the field sampling methods.

2.4 Sample Collection Protocol

Knife River will continue to collect and document sample collection in accordance with EPA protocols and will deliver all samples to the respective laboratory within the required sample holding times. A list of approved Oregon laboratories is included in **Appendix B**. Knife River sampling protocol includes:

- **Equipment and Preparation:** Arrive on-site with laboratory-approved sample bottles, Chain of Custody forms, laboratory-provided preservatives, field filters (as applicable), ice, pumping equipment, and shipping coolers.
- **Site and Well Condition Documentation:** The sampler will document the condition of the well or sampling site (for surface water and soil), including any observations of vandalism, access issues, water use, or whether the well is pumping. Field notes will also record weather conditions, recent heavy rainfall, adjacent land irrigation, standing water on-site, and any recent site activities.
- **Water Level and Well Pumping Observation:** Measure the water level (depth to water for wells using a water level meter) and note if the domestic well is pumping. Wells will be allowed to equilibrate as needed before gauging. Equilibration is confirmed when water level fluctuations are less than 0.05 feet over three successive measurements.
- **Flow and Depth Estimates:** Estimate water flow (for surface water) or the depth for soil sampling. Collect photographs on site of all surface water and sediment locations.
- **Dedicated Tubing:** the sampler may use tubing that is dedicated to each respective well, assuming the tubing was new prior to sampling. This tubing will only be used to purge and sample the same well during each sampling event.

- **Well Purging Procedure (See Section 2.2) for the Assessment of Procedures:** The sampler will calculate the required purge volume using the measured depth to water and total well depth, ensuring the sample represents groundwater from the aquifer rather than the well casing. Based on **Table 3**, either a minimum of three casing volumes will be purged using a dedicated submersible pump already installed in a production or domestic water supply well, or low-flow purging principles will be used for wells that do not have dedicated pumping equipment installed. Both methodologies (three casing volume and low flow purge methods) are acceptable EPA protocols for collecting representative groundwater samples for metals (Mn, Fe, Al). In an effort to address EPA/DEQ review comments, Knife River will incorporate both the three casing volumes purging method with parameter stabilization and low flow purging techniques based on the well type and presence of existing pumping equipment.

The purging method to be used for each respective well is identified on **Table 3**. For any well not equipped with dedicated pumping equipment, at least one casing volume will be purged with the pump set in the middle of the screen before sampling under the low flow purging method. Any production or domestic water supply well with dedicated pumping equipment will be purged and sampled using the existing pumping equipment with the pump intake set at its current depth. Under both purging approaches, water quality parameters will be monitored throughout the purging process to identify when water quality parameters have stabilized, and representative aquifer water is being discharged. The revised procedure acknowledges the importance of minimizing drawdown in monitoring wells (<0.3 feet, ideally) regardless of the pumping rate used for purging.

- **Field Parameters Measurement:** Using a handheld water quality meter, the sampler will measure field parameters, including pH, conductivity (EC), temperature (°C), and turbidity (NTU), dissolved oxygen (DO), and oxidation-reduction potential (ORP) at roughly 2-to-5-minute intervals throughout the purging period prior to sampling.
- **Field Parameter Stabilization:** If field parameters stabilize after three casing volumes or at least one volume depending upon the purging method used, the sampler will collect the sample, filter in the field as necessary, and/or preserve samples as required. If field parameters do not stabilize or if additional purging is deemed necessary, the sampler will continue purging the well until all field parameters stabilize and the well is yielding groundwater representative of the aquifer as determined by the sampler's professional judgment. According to EPA guidelines (EPA, 2015), parameters are considered stable when they show minimal variation (typically within $\pm 10\%$) over 15 to 30 minutes, indicating the water is representative of the aquifer. Stabilization thresholds are:
 - Water level: 0.3 feet
 - pH: ± 0.5 units
 - Conductivity: $\pm 3\%$ of previous reading
 - Temperature: $\pm 0.2^\circ\text{C}$
- **Final Field Parameter Measurement:** Prior to completing sampling at each well, the sampler will measure a final depth to water while pumping and record the following final parameters: pH, conductivity (EC), temperature (°C), dissolved oxygen (DO), oxidation-reduction potential (ORP), and turbidity (NTU). All metals samples will be field filtered (0.45 μm) and preserved so dissolved analysis can be completed.

- Metals samples (both Total and Dissolved) will be preserved in the field, and the pH will be verified to ensure it is at or below 2.
- **Surface Water Sampling:** Surface water samples and in particular “pond water” samples (WWSP1 and WWSP3) will contain significant volumes of suspended solids. As such field filtration may be difficult. In an effort to meet the analytical requirements for both dissolved and total metals, the sample will either be field filtered (0.45µm) or the sampler will cool to 4°C and send to the laboratory in an unpreserved bottle. This will allow the accurate completion of a dissolved analysis in addition to total metals. For pond water samples, the sampler will analyze EC and pH in the field prior to filtration.
- **Soil Sampling Considerations:** For soil samples, the sampler will employ the following methods to ensure accurate and representative soil composition:
 - The sampler will target collecting soil from the mineral layer, avoiding surface layers that may contain excess organic matter. In areas where organic material is prevalent, sampling will focus on the deeper mineral horizon to ensure that the sample reflects the true soil composition. It is anticipated that soil samples will be collected at a depth of 12 to 15 inches.
- **Sample Labeling and Shipping:** All water samples will be labeled and placed in a shipping container or cooler with ice to maintain a temperature of 4°C.
- **Chain of Custody:** The sampler will fill out the Chain of Custody form, coordinate with the laboratory for sample receipt, and ensure the sample is shipped promptly to the laboratory to meet holding times.
- **Holding Times and Preservation:** Holding times are critical and vary depending on the parameter (e.g., coliform has a very short holding time). Based on EPA protocol, the holding time for most unpreserved metals is 48 hours.
- **Soil Sample Shipping:** Soil samples can be placed in plastic Ziploc bags, labeled and shipped to the laboratory for analysis. Chain of Custody forms will accompany soil samples.
- **Decontamination Procedures:** As necessary, decontamination of all multi-use equipment between wells will be performed using an Alconox and distilled water mixture to clean equipment and be rinsed with distilled water.

2.5 Data Analysis Procedure

In compliance with OAR 340-040-0030(2), this sampling plan includes a comprehensive Data Analysis Procedure to evaluate analytical data from groundwater, surface water, and soil/sediment samples. The analysis will use statistical methods such as comparative and trend analysis, data normalization, and spatial variability assessments to evaluate water quality against regulatory standards. Data will be analyzed quarterly to assess trends, detect potential impacts from site operations, and identify exceedances of water quality criteria. Special focus will be placed on seasonal variations, spatial patterns, and the migration of contaminants, particularly manganese.

Potential impacts on groundwater quality will be quantified by comparing manganese concentrations collected at upgradient background wells with those from wells downgradient of

facility operations. This interwell analysis will be conducted using a one-way analysis of variance (ANOVA) to determine if there are statistically significant differences in manganese concentrations (mg/L) between samples from background and potentially impacted wells ($\alpha = 0.05$). The one-way ANOVA approach was chosen for efficiency in retaining degrees of freedom compared to more complex methods, thereby providing greater statistical power to accurately quantify variance and ensure reliable results. Analyses and data visualizations will be conducted using the statistical program R (R Core Team 2024). The frequency of analysis will repeat quarterly to align with ongoing sample collection intervals.

Because a confining layer separates the shallow and deep aquifers, this analysis will focus on monitoring wells that draw groundwater from the uppermost (shallow) aquifer, which is more likely to be affected by site activities. For this analysis, shallow wells are defined as those less than 75 feet deep. The background wells include MW-1 and MW-2, as well as the Vanier House Well, which is located upgradient (Wenck 2021; water table map 2024). These wells are located approximately 1,500 feet northwest of the Woodward property line and about 3,000 feet upgradient from formerly active mining operations. The immediately downgradient shallow wells (MW-5, MW-6, and MW-7) are also situated on the Woodward Site. Another cluster of shallow wells exist outside the permit area and include CRO 953 (Elbek), CRO 939 (Porfily) and CRO 948 (McCormick). These three wells shall be analyzed in a third group. These wells were sampled by MFA one time and Knife River recommends that DEQ sample them quarterly in conjunction with Knife River's sampling program. If landowner consent could be obtained, Knife River could add these three wells into their sampling program.

Following data collection, Knife River will develop a Conceptual Site Model (CSM) to assess the spatial distribution and migration of contaminants, considering interactions between shallow and deep aquifers, and the influence of subsurface features like improperly abandoned wells or buried channels as appropriate. Findings from the data analysis will guide corrective actions or adjustments to the sampling program to maintain regulatory compliance, with reports reviewed by qualified personnel to determine necessary changes to monitoring protocols or remedial actions.

3.0 DATA EVALUATION AND REPORTING

Knife River will collect, validate, and manage groundwater, surface water, and soil data in a centralized database, ensuring quality control through EPA-compliant validation procedures. Statistical analyses, including trend and spatial variability assessments, will be used to evaluate changes in water chemistry over time. If concentrations exceed regulatory thresholds, further statistical evaluations will be conducted to identify sources and potential impacts, with findings informing updates to the CSM to refine the understanding of contaminant behavior and migration pathways. Knife River has made efforts and will continue to evaluate the high groundwater inflow rates that were observed in the shallow aquifer in 2021 at the east end of Woodward (Stantec, 2021). That information will be considered along with information about potential sources, such as an improperly abandoned deep aquifer well or a buried channel in the shallow aquifer.

Groundwater flow and contaminant transport will be assessed through monitoring well data, potentiometric surface maps, and flow modeling, considering factors such as hydraulic conductivity, groundwater flux, and redox conditions. Results will be compiled into annual reports (spring), including analytical results, statistical trends, appropriate statistical analysis, regulatory comparisons, and CSM updates. Any CSM will be complicated by the fact that no site-specific baseline water quality data were collected prior to mining and historic data suggests manganese "hot spots" are present in the general area of the mine and that these "hot spots" existed prior to

mining. Reports will be shared with DEQ, DOGAMI, and stakeholders, with recommendations for monitoring adjustments based on observed trends and regulatory feedback. The annual reporting will also identify data gaps and suggest means to address such data gaps.

4.0 SUMMARY

Knife River has developed a comprehensive sampling and monitoring plan for the Woodward and Vanier properties, which will involve groundwater and surface water sampling over a minimum one-year period. Groundwater monitoring will include shallow and deep aquifer wells, as well as offsite wells where neighbors have granted access for sampling. A total of 17 wells, both shallow and deep, will be sampled quarterly, and the water levels in these wells will be monitored manually monthly and at the time of sampling. Additionally, Knife River will install pressure transducers in five upgradient monitoring wells to continuously measure water levels. Surface water sampling will be conducted quarterly at key locations, including Knife River's processing ponds, Water Intake, and standing water areas, as identified by DOGAMI. A sediment sampling plan will also be included as part of this effort. The water and sediment samples will be analyzed for a variety of chemical constituents of public concern, including manganese, aluminum, and iron, as well as major anions, cations, nitrates, and coliforms. In compliance with Crook County land use conditions, groundwater samples from Vanier wells (MW-1, MW-2, MW-3, MW-4 and WW-2A) will also include testing for GRO and DRO. At EPA's request, Knife River will complete a one-time sampling of all shallow wells for GRO and DRO.

All sample data collection, handling, and delivery to an EPA-certified laboratory will follow strict EPA Sample Handling and Chain of Custody protocols. Quarterly groundwater sampling and quarterly surface water sampling will continue for at least one year, with all data being reported to regulatory agencies such as DOGAMI, DEQ, and Crook County. The data collected will be analyzed for trends and compared to regulatory standards. An annual report (spring) will summarize analytical results, trend analysis, and regulatory comparisons, and will include updates to the CSM. After one year, based on data analysis and regulatory feedback, Knife River may petition the regulatory agencies for adjustments to sampling frequency, analytical constituents, or sample locations. The full set of field and laboratory certifications will accompany the data reports, ensuring compliance with all relevant regulations.

5.0 REFERENCES

R Core Team. 2024. R: A language and environment for statistical computing. R foundation for statistical computing. Vienna, Austria.

Stantec, 2021, Woodward/Vanier Aggregate Mine Hydrogeologic Characterization. Consultant's report prepared for Knife River Corporation.

United States Environmental Protection Agency. *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*. June 1996, updated 2015, <https://www.epa.gov/sites/default/files/2015-06/documents/lwflw2a.pdf>.

United States Environmental Protection Agency. *Methods for Collecting and Analyzing Groundwater Samples*. EPA/600/4-91/002, 1991.

United States Environmental Protection Agency. *Manual of Methods for Chemical Analysis of Water and Wastes*. Environmental Protection Agency, 1983.

Tables

Table 1. KRC Shallow Aquifer Monitoring Wells

Table 2. KRC Deep Aquifer Monitoring Wells

Table 3. Proposed Sampling Plan Schedule

Table 1. KRC Shallow Aquifer Monitoring Wells

CROO Number	Current Homeowner/ Well Name	Well Owner Name	Tax Lot	Address	Completed Depth	Completed Perf or Screen	Depth to First Water ¹ (ft bgs)	Yield (gpm)	Completed Date	Aquifer Lithology	Interval (ft bgs)	Temperature (deg F)	Measuring Point Elevation NGVD 1929	Static Water Level October 2024
55482	MW1	Knife River	1415140000103	4755 NW Stahancyk Ln. Prineville, OR 97754	36	16	13	5	3/4/2024	WB brown silty sand	17-36	53	2910.9	2906.4
55480	MW2	Knife River	1415140000103	4755 NW Stahancyk Ln. Prineville, OR 97754	36	16	16	10	3/5/2024	WB light brown silty gravel	16-36	53	2923.0	2912.2
55481	MW3	Knife River	1415140000103	4755 NW Stahancyk Ln. Prineville, OR 97754	35.5	16	17	10	3/8/2024	WB silty gravel; WB clayey silt	17-25; 25-35.5	53	2925.6	2910.1
55483	MW4	Knife River	1415140000103	4755 NW Stahancyk Ln. Prineville, OR 97754	36	16	26	10	3/11/2024	Brown silt and clay; clay gravels	20-26; 26-36	53	2927.9	2907.4
55570	MW5	Knife River	1415140000703	4755 Stahancyk Ln. Prineville, OR 97754	71	51	25	20	9/13/2024	Grey sand with silt	51-71	53	2901.9	2880.1
55571	MW6	Knife River	1415140000702	4755 Stahancyk Ln. Prineville, OR 97754	62	42	46	15	9/17/2024	Gravel; silt and sand	24-34; 46-62	53	2904.1	2869.9
55572	MW7	Knife River	1415140000703	4755 Stahancyk Ln. Prineville, OR 97754	54.5	34.5	30	10	9/17/2024	Fine sand	29-45	53	2908.1	2886.4
55017	WW-1A	Woodward Land & Timber LLC	1415140000703	4755 NW Stahancyk Ln. Prineville, OR 97754	30	10	21	NR	1/18/2021	Sand, gravel, and cobbles	0-30	56	2928.0	2907.4
55018	WW-2A	Woodward Land & Timber LLC	1415140000703	4755 NW Stahancyk Ln. Prineville, OR 97754	25	10	20	NR	1/18/2021	Sand, gravel, and cobbles	0-25	56	2927.4	2907.5
55019	WW-3A	Woodward Land & Timber LLC	1415140000703	4755 NW Stahancyk Ln. Prineville, OR 97754	28	13	20	NR	1/20/2021	Sand, gravel, and cobbles	10-28	56	2924.8	2908.3
977	3992/Mikulski	Elmer Self	1415230000111	3992 NW Stahancyk Ln. Prineville, OR 97754	50	30	NR	30	3/29/1969	Sand and gravel	28-50	56	2928.0	2902.1
NR	Vanier	NR	1415140000103	6487 NW Lamonta Rd. Prineville, OR 97754	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
970	3320/Johnson	Ray Fox	1415230000102	3320 NW Stahancyk Ln. Prineville, OR 97754	40	20	23	15	8/16/1982	Fine Sand	22-40	56	NR	NR
<div>Notes:</div> <div>1 – first occurrence of observable water during drilling and/or installation of the well.</div> <div>ft bgs = feet below ground surface</div> <div>gpm = gallons per minute</div> <div>deg F = degrees Fahrenheit</div> <div>WB = water bearing</div> <div>NR = not reported</div>														

Table 2. KRC Deep Aquifer Monitoring Wells

CROO Number	Current Homeowner/Well Name	Well Owner Name	Tax Lot	Address	Completed Depth	Completed Perf or Screen	Depth to First Water	Yield (gpm)	Completed Date	Aquifer Lithology	Interval (ft bgs)	Temperature (deg F)	Measuring Point Elevation NGVD 1929	Static Water Level October 2024
55536/55470	Knife River	Knife River Production	1415140000703	4755 Stahancyk Ln. Prineville, OR 97754	291	257	7	291	6/24/2024	Fractured claystone	248-291	52	2906.6	2893.5
50140	Woodward	Prineville Sawmill Co.	1415140000702	4755 Stahancyk Ln. Prineville, OR 97754	255	250	60	300	7/15/1996	Gravel and sand	236-255	54	2913.4	2879.6
54339	3992-Deep/Mikulski	Adam Mikulski	1415230000114	3992 NW Stahancyk Ln. Prineville, OR 97754	281	266	30	40	3/11/2016	Fine sand, gravel, and broken claystone	266-281	57	2928.0	2885.5
329	4144/Kriege	Ron Wilkinson	1415230000116	4144 NW Stahancyk Ln. Prineville, OR 97754	260	255	250	14	11/18/1991	Broken claystone	250-260	62	2919.6	2885.1

Table 3. Proposed Sampling Plan Schedule

Sampling Type	Location Name/Identifier	Purging and Sampling Method for Wells ⁴	Sampling Frequency ¹	Sample Parameters ²	Notes ³
Shallow Aquifer Wells (Upgradient)	MW-1, MW-2, MW-3, MW-4	Low flow	Quarterly, for a minimum of one year	GA & PH	Upgradient (east of Woodward mine-related disturbance)
	MW-7	Low flow	Quarterly, for a minimum of one year	GA & PH	Upgradient of processing ponds
	WW-2A	Low flow	Quarterly, for a minimum of one year	GA & PH	Will be sampled instead of WW-1A and WW-3A; Upgradient of Woodward Mine
	Vanier House Well	3 Well volumes	Quarterly, for a minimum of one year	GA & PH	Included before and after Vanier expansion
Shallow Aquifer Wells (Cross Gradient - Residential)	Mikulski (3992)	3 Well volumes	Quarterly, for a minimum of one year	GA & PH	Residential well
	Johnson (3320)	3 Well volumes	Quarterly, for a minimum of one year	GA & PH	Residential well
Shallow Aquifer Wells (Downgradient)	MW-5, MW-6	Low flow	Quarterly, for a minimum of one year	GA & PH	Downgradient of Process Water Ponds and mining operation
Deep Aquifer Wells	Knife River Production Well	3 Well volumes	Quarterly, for a minimum of one year	GA	
	Woodward Shop Well	3 Well volumes	Quarterly, for a minimum of one year	GA	
	Mikulski Deep Well (3992-Deep))	3 Well volumes	Quarterly, for a minimum of one year	GA	
	Kriege Deep Well (4144)	3 Well volumes	Quarterly, for a minimum of one year	GA	
Surface Water Sampling Sites	Knife River Processing Ponds	NA	Quarterly, for a minimum of one year	GA	Two locations: Pond 1 (initial processing) and Pond 3
	Knife River Water Intake (ditch/slough)	NA	Quarterly, for a minimum of one year	GA	Source of process/makeup water
	Standing Water (WW-Standing Water)	NA	Quarterly, for a minimum of one year	GA	Unreclaimed mine cell, sampling per DOGAMI request
Additional Sampling (Soil & Sediment)	Pond 1 & 4 Sediment Water Intake (SED1-SED3)	NA	Biannually	manganese, aluminum, nitrate as N, and iron	Collected per ODEQ request
	Upgradient Soil Samples (SED 4 and SED5)	NA	Biannually	manganese, aluminum, nitrate as N, and iron	Two locations, sampled twice per year

1 – Sampling frequency may be reduced with DOGAMI approval and DEQ consensus if the data demonstrate no operational or seasonal variation. Sampling will continue until DEQ and DOGAMI provide written notice to Knife River.

2 – Sample parameters listed in Section 2.2. GA refers to the general analytes listed in Section 2.2. These will be analyzed quarterly at all groundwater and surface water sites. PH refers to the GRO and DRO analytes that will be analyzed once at all shallow aquifer wells, and then quarterly at only MW-1, MW-2, MW-3, MW-4, and WW-2A for one year.

3- Sample locations generally shown on **Figure 1**.

4. Purging and sampling method will be established site specifically following evaluation as discussed. Knife River commits that during one sampling round, they will test the applicability of each procedure. Four monitor wells (MW-2, MW-5, MW-6, and MW-7) will be purged and sampled using both purge methods to compare analytical results and thereby determine if there is any significant difference in analytical results based on each respective method.

Figures

Figure 1 Knife River Monitoring Locations

Figure 2 Geologic Cross Section and Well Locations

Figure 3 Geologic Cross Section A-A'

Figure 4 Geologic Cross Section B-B'

Figure 5 Shallow Aquifer Water Table Map



NOTE: SEE TABLE 3 FOR FURTHER DETAILS REGARDING MONITORING LOCATIONS AND SAMPLING FREQUENCY

MONITORING LOCATIONS

SCALE: 1" = 300'

LEGEND

- - SHALLOW AQUIFER
- - DEEP AQUIFER
- - SURFACE WATER
- - ADDITIONAL MONITORING WELLS (NOT MONITORED OR SAMPLED AS PART OF THIS SAMPLING PLAN)
- - SEDIMENT SAMPLE LOCATIONS (SED)

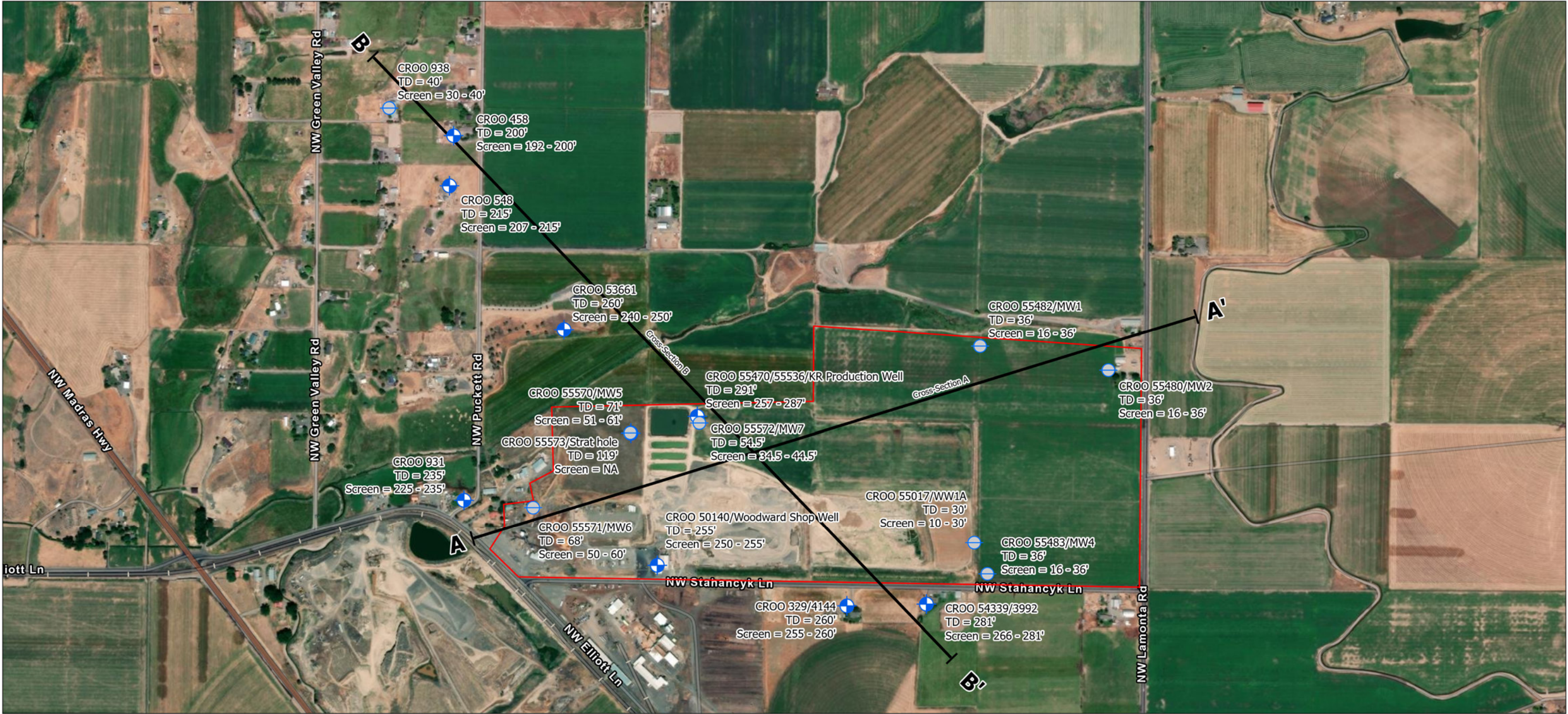
VANIER EXPANSION
WOODWARD MINE
CROOK COUNTY
PRINEVILLE, OREGON 97754

**KNIFE RIVER
MONITORING LOCATIONS**



FIGURE

01



- Legend
- Shallow Water Wells
 - Deep Water Wells
 - Cross-Sections
 - Permit Boundary

0 800 1,600 Feet
(At original document size of 11x17)
9,600



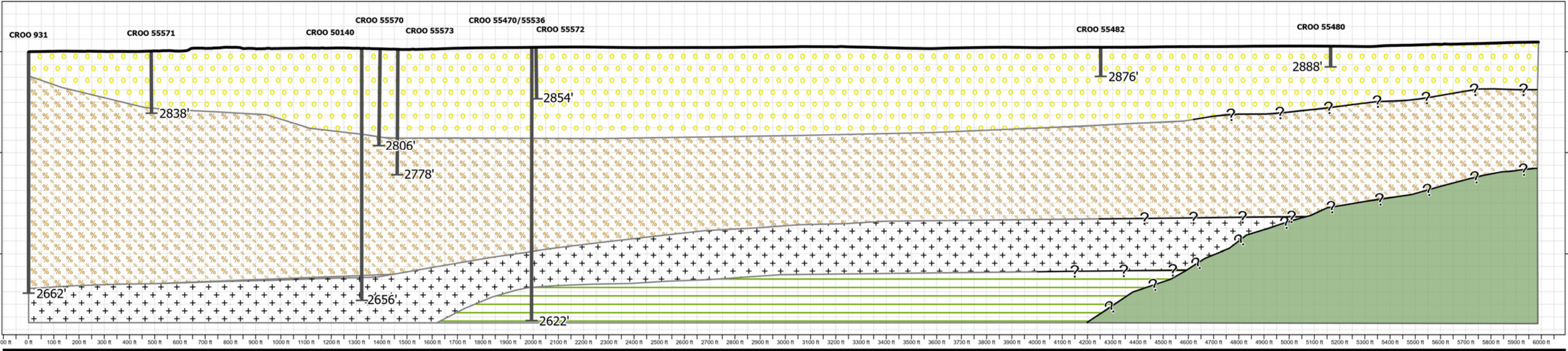
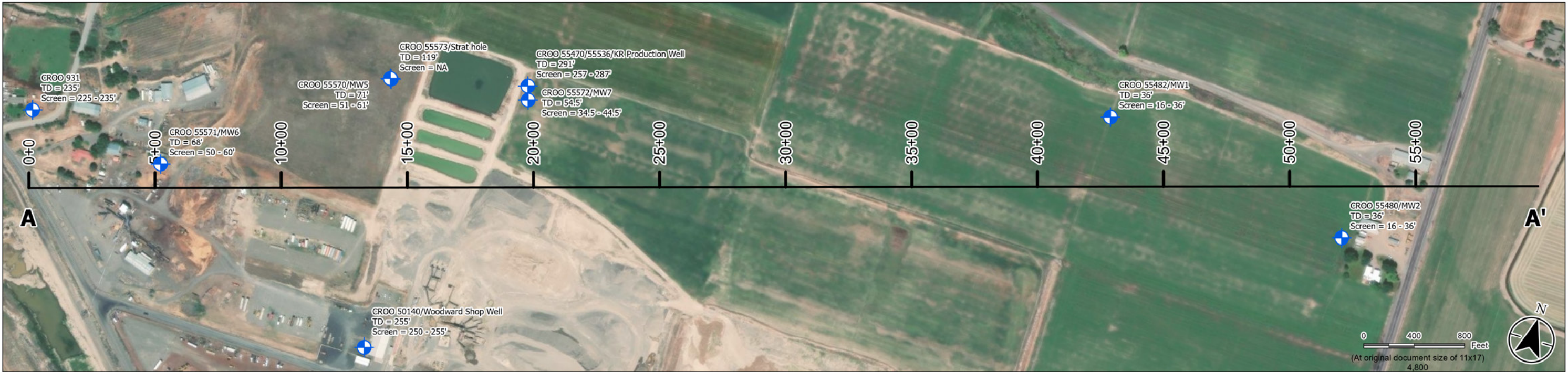
Project Location
T14S, R15E
Prineville, Crook Co., OR
Client/Project
Client: CDLidstone
Project: Woodward/Vanier Gravel Mine
Prepared by KB on 12/2/2024
TR by EZ on 12/2/2024
IR by MS on 12/2/2024
227704752

Figure No.
2
Title
Geologic Cross Section and Well Locations

- Notes
- Coordinate System: NAD 1983 StatePlane Oregon South FIPS 3602 Feet
 - Data Sources: Stantec
 - Background: ESRI World Imagery 2023
 - Wells labeled by Oregon Water Resources Department well report number. TD (total depth in feet) and Screen (depth interval in feet) from well report

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- Legend**
- Water Wells
 - Cross-Section
 - Drillhole
 - Unknown Geological Contact
 - John Day Formation
 - Clay
 - Claystone
 - Gravel/Sand
 - Sand

Notes

- Coordinate System: NAD 1983 StatePlane Oregon South FIPS 3602 Feet
- Data Sources: Stantec
- Background: ESRI World Imagery 2023
- Wells labeled by Oregon Water Resources Department well report number. TD (total depth in feet) and Screen (depth interval in feet) from well report.
- Cross-Section Profile is for viewing purposes only. Features are not set to an engineering scale
- Lithology queried where uncertain



Project Location
T14S, R15E
Prineville, Crook Co., OR

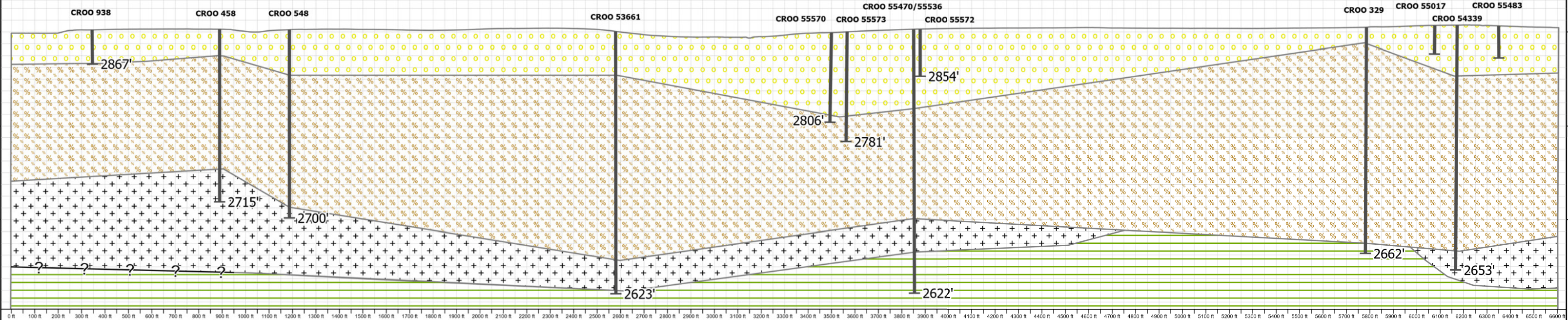
Client/Project
Client: CDLidstone
Project: Woodward/Vanier Gravel Mine

Prepared by KB on 12/2/2024
TR by EZ on 12/2/2024
IR by MS on 12/2/2024

227704752

Figure No.
3

Title
Geologic Cross-Section A-A'



- Legend**
- Water Wells
 - Cross-Section
 - Drillhole
 - Unknown Geological Contact
 - Clay
 - Claystone
 - Gravel/Sand
 - Sand

- Notes**
1. Coordinate System: NAD 1983 StatePlane Oregon South FIPS 3602 Feet
 2. Data Sources: Stantec
 3. Background: ESRI World Imagery 2023
 4. Wells labeled by Oregon Water Resources Department well report number, TD (total depth in feet) and Screen (depth interval in feet) from well report.
 5. Cross-Section Profile is for viewing purposes only. Features are not set to an engineering scale



Project Location
T14S, R15E
Prineville, Crook Co., OR

Client/Project
Client: CDLidstone
Project: Woodward/Vanier Gravel Mine

Prepared by KB on 12/2/2024
TR by EZ on 12/2/2024
IR by MS on 12/2/2024

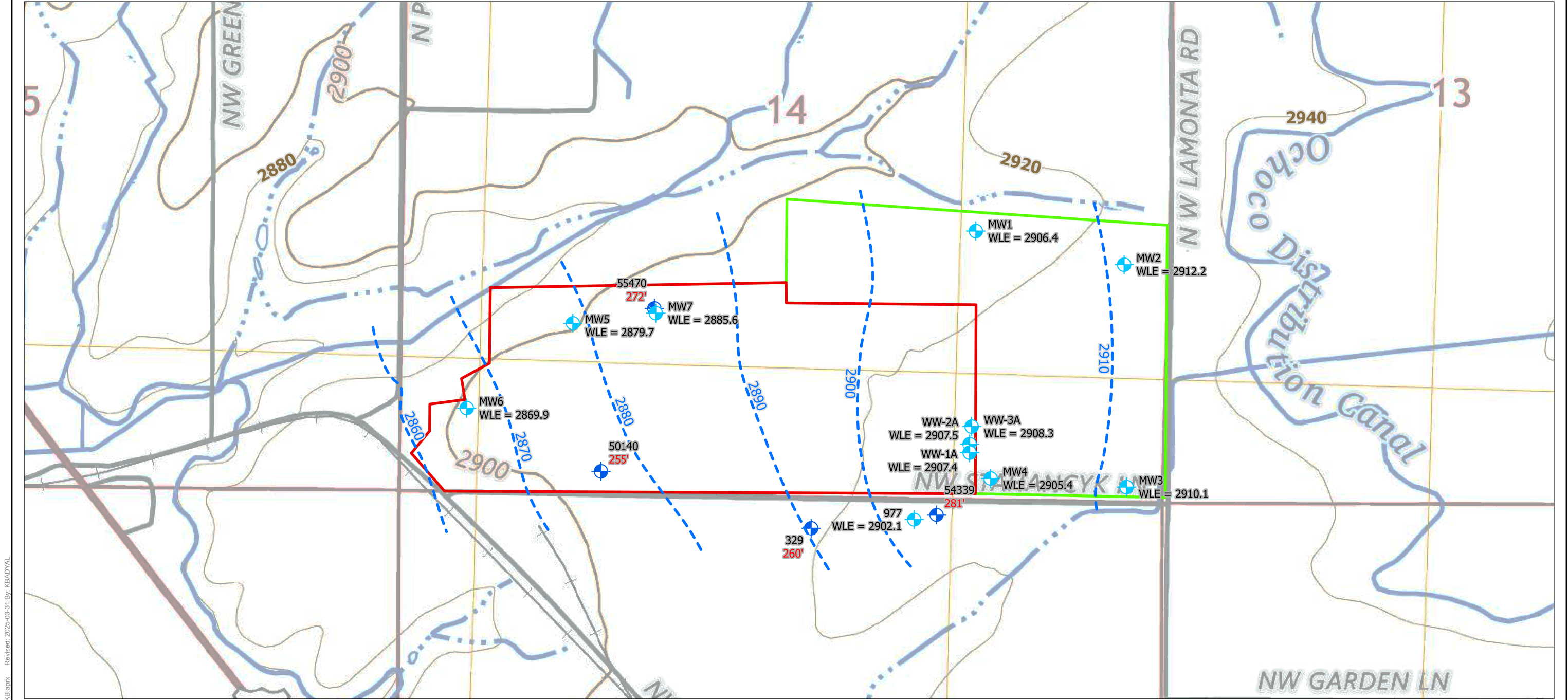
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Figure No.
4

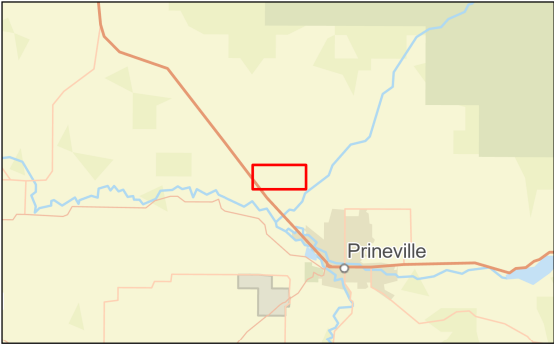
Title
Geologic Cross-Section B-B'

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- Legend
- Shallow Aquifer Water Wells
 - Deep Aquifer Water Wells with Well Depth (Red)
 - Groundwater Elevation Contours (Oct. 2024)
 - Permit Boundary Woodward MLRR ID 07-0159
 - Property Boundary Vanier

0 340 680 Feet
(At original document size of 11x17)
8,160



Project Location
T14S, R15E
Prineville, Crook Co., OR

Prepared by KB on 3/31/2025
TR by CB on 3/31/2025
IR by MS on 3/31/2025

Client/Project
Client: CDLidstone
Project: Woodward/Vanier Gravel Mine

Figure No.
5

Title
Shallow Aquifer Water Table Map

- Notes
- Coordinate System: NAD 1983 StatePlane Oregon South FIPS 3602 Feet
 - Data Sources: Stantec and USGS
 - Background: USGS 24k Topo Imagery 2023
 - Wells labeled by Knife River well name. WLE (water level elevation) based on depths to water measured on 10/17/24 and surveyed wellhead elevations.
 - Contour interval of the topographic map is 20 feet

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Appendix A

Well Completion Reports

ORIGINAL LOG

4/25/2024

(4) CONSTRUCTION

[illegible][illegible]

CASING/LINER

Casing Liner	Dia	+	From	To	Gauge	Stl	Plstc	Wld	Thrd
<div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></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SCREENS

[illegible]

(5) WELL TESTS

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)

Water Quality Concerns

From	To	Description	Amount	Units

(7) STATIC WATER LEVEL

Water Bearing Zones

[illegible]

(8) WELL LOG

[illegible]

Name of person(s) who assisted with construction and Trainee License # / Helper #

Assistant Name

Type

#

ZACHARY MIHEVC

| TRAINEE WATER

8888935

Comments/Remarks

DRILLED TO 51'. BACKFILL TO 39' WITH PEA GRAVEL. BENTONITE
FROM 39'-36'

MONITORING WELL REPORT - Map with location identified must be attached and shall include an approximate scale and north arrow

CROO 55482

4/25/2024

Map of Hole

STATE OF OREGON WELL LOCATION MAP

This map is supplemental to the WATER SUPPLY WELL REPORT

Oregon Water Resources Department

725 Summer St NE, Salem OR 97301
(503)986-0900



LOCATION OF WELL

Latitude: 44.35368000 Datum: WGS84

Longitude: -120.89156000

Township/Range/Section/Quarter-Quarter Section:

WM14.00S15.00E14NESE

Address of Well:

4755 NW STAHANCYK LN PRINEVILLE, OR 97754

Well Label: 152274

Printed: April 9, 2024

DISCLAIMER: This map is intended to represent the approximate location the well. It is not intended to be construed as survey accurate in any manner.

Provided by well constructor



WELL I.D. LABEL#	L149468	
START CARD #	1072892	
ORIGINAL LOG #		

4/25/2024

(4) CONSTRUCTION

[illegible][illegible]

CASING/LINER

Casing Liner	Dia	+	From	To	Gauge	Stl	Plstc	Wld	Thrd
	4		1.5	16	SCH 40				

SCREENS

[illegible]

(5) WELL TESTS

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)

Water Quality Concerns

From	To	Description	Amount	Units

(7) STATIC WATER LEVEL

Water Bearing Zones

[illegible]

(8) WELL LOG

[illegible]

Name of person(s) who assisted with construction and Trainee License # / Helper #

Assistant Name	Type	#
ZACHARY MIHEVC	TRAINEE WATER	8888935

Comments/Remarks

[illegible]

MONITORING WELL REPORT - Map with location identified must be attached and shall include an approximate scale and north arrow

CROO 55480

4/25/2024

Map of Hole

STATE OF OREGON WELL LOCATION MAP

This map is supplemental to the WATER SUPPLY WELL REPORT

Oregon Water Resources Department

725 Summer St NE, Salem OR 97301
(503)986-0900



LOCATION OF WELL

Latitude: 44.35316830 Datum: WGS84

Longitude: -120.88766833

Township/Range/Section/Quarter-Quarter Section:

WM14.00S15.00E14NESE

Address of Well:

4755 NW STAHANCYK LN PRINEVILLE, OR 97754

Well Label: 149468

Printed: April 9, 2024

DISCLAIMER: This map is intended to represent the approximate location the well. It is not intended to be construed as survey accurate in any manner.

Provided by well constructor



[illegible]

STATE OF OREGON WELL LOCATION MAP

This map is supplemental to the WATER SUPPLY WELL REPORT

Oregon Water Resources Department

725 Summer St NE, Salem OR 97301
(503)986-0900



LOCATION OF WELL

Latitude: 44.34863300 Datum: WGS84

Longitude: -120.887842

Township/Range/Section/Quarter-Quarter Section:

WM 14S 15E 14 SESE

Address of Well:

4755 NW STAHANCYK LN PRINEVILLE, OR 97754

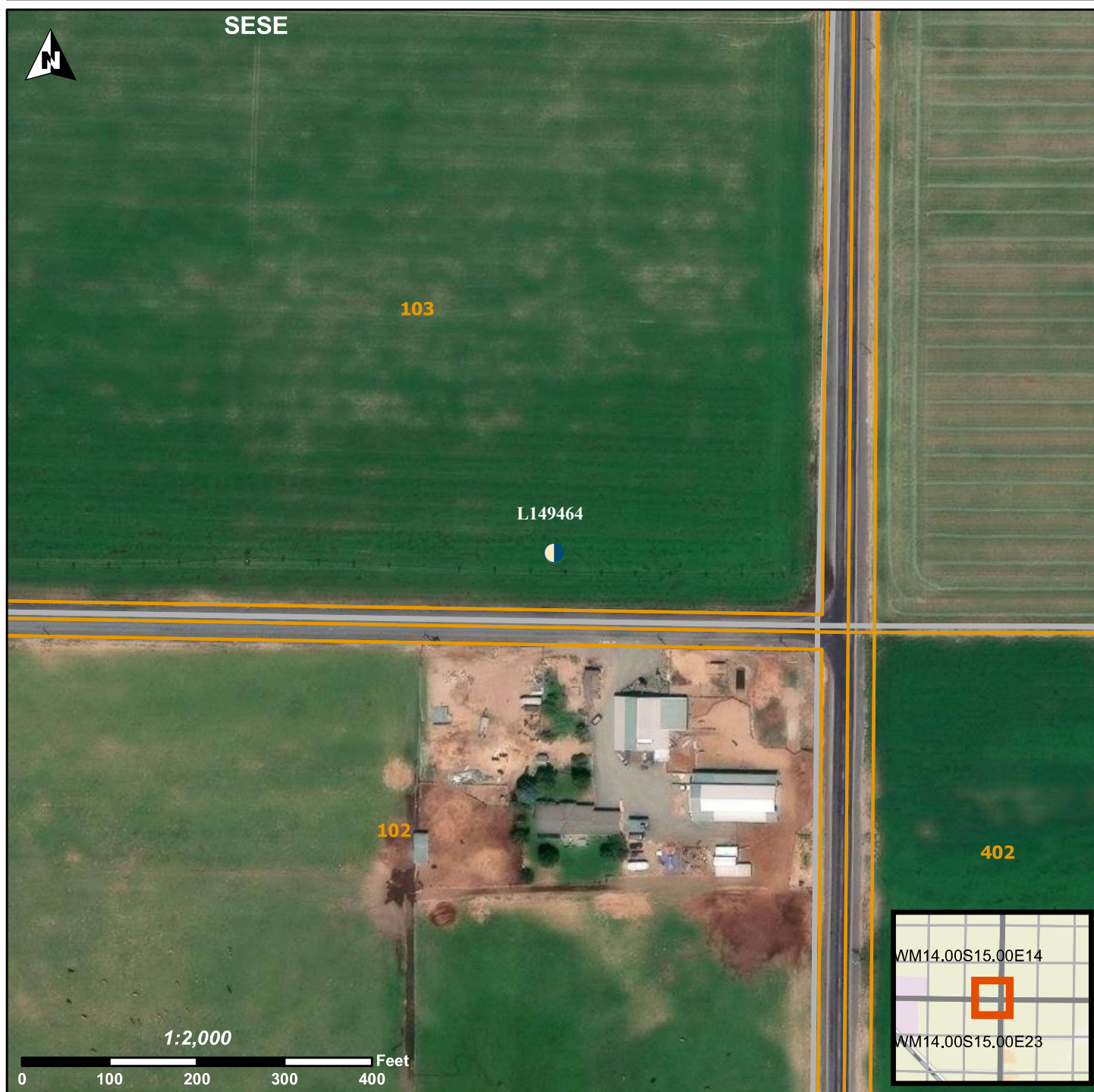
Well Label: L149464

Well Log: CROO 55481

Printed: May 28, 2024

DISCLAIMER: This map is intended to represent the approximate location of the exempt use well provided by the land owner. It is not intended to be construed as survey accurate in any manner.

Generated by OWRD



STATE OF OREGON
MONITORING WELL REPORT(as required by ORS 537.545 & ORS 537.765 &
OAR 690-240-0395)

4/25/2024

WELL I.D. LABEL# L

149463

START CARD #

1072894

ORIGINAL LOG #

(1) LAND OWNER

Owner Well I.D. _____

First Name BILLLast Name GIBSONCompany KNIFE RIVERAddress 32260 OLD HWY 34City TANGENTState ORZip 97389-9770

(2) TYPE OF WORK

☒ New☐ Deepening☐ Conversion☐ Alteration (repair/recondition)☐ Abandonment

(3) DRILL METHOD

☒ Rotary Air☐ Rotary Mud☐ Cable☐ Hollow Stem Auger☐ Cable Mud☐ Reverse Rotary☐ Other _____

(4) CONSTRUCTION

Piezometer Well ☐Depth of Completed Well 36.00 ft.Special Standard ☐

MONUMENT/VAULT

Above Ground

From 2To 3

BORE HOLE

Diameter 12From 0To 3

CASING

Dia. 8From ☒ 2To 3Gauge .250

Wld Thrd

Material ☒ Steel☐ Plastic☒ ☐

LINER

Dia. _____

From ☐

To _____

Gauge _____

Wld Thrd

Material ☐ Steel☐ Plastic☐ ☐

SEAL

From 0To 13Material Bentonite ChipsAmount 4

Sacks

Grout weight _____

SCREEN

Casing/Liner CasingMaterial PVCDiameter 4From 16To 36Slot Size 0.200

FILTER

From 13To 36Material SANDSize of pack 10/20Seal Placement Begin Date 3/11/2024Begin Time 11 40

(5) WELL TESTS

☐ Pump☐ Bailer☒ Air☐ Flowing Artesian

Yield gal/min

Drawdown

Drill stem/Pump depth

Duration (hr)

10361Temperature 53 °FLab analysis ☐ Yes

By _____

Supervising Geologist/Engineer _____

Water quality concerns? ☐ Yes (describe below)TDS amount 172 ppm

From _____

To _____

Description

Amount

Units

(6) LOCATION OF WELL (legal description)

County CROOKTwp 14.00S N/SRange 15.00E E/W WMSec 14SE 1/4 of theSE 1/4Tax Lot 103

Tax Map Number _____

Lot _____

Lat _____

" or 44.34871830

DMS or DD

Long _____

" or -120.89129000

DMS or DD

☒ Street address of well☐ Nearest address4755 NW STAHANCYK LN PRINEVILLE, OR 97754

(7) STATIC WATER LEVEL

Date

SWL(psi)

+ SWL(ft)

Existing Well / Predeepening

Completed Well

3/11/2024☐25Flowing Artesian? ☐Dry Hole? ☐

WATER BEARING ZONES

Depth water was first found 26.00

SWL Date

From

To

Est Flow

SWL(psi)

+ SWL(ft)

3/11/2024263610☐25

(8) WELL LOG

Ground Elevation 2930.06 FT

Material

From

To

SILT CLAY BROWN

020

CLAY GRAVELS

2026

WB CLAY SAND

2636

Construction

Begin Date 3/11/2024Begin Time 9 0End Date 3/11/2024

(unbonded) Monitor Well Constructor Certification

I certify that the work I performed on the construction, deepening, alteration, or abandonment of this well is in compliance with Oregon monitoring well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

License Number 1720Date 4/25/2024

Password : (if filing electronically) _____

Signed JACK ABBAS (E-filed)

(bonded) Monitor Well Constructor Certification

I accept responsibility for the construction, deepening, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon monitoring well construction standards. This report is true to the best of my knowledge and belief.

License Number 758Date 4/9/2024

Password : (if filing electronically) _____

Signed THOMAS PECK (E-filed)

Contact Info (optional) _____

ORIGINAL - WATER RESOURCES DEPARTMENT

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

Form Version:

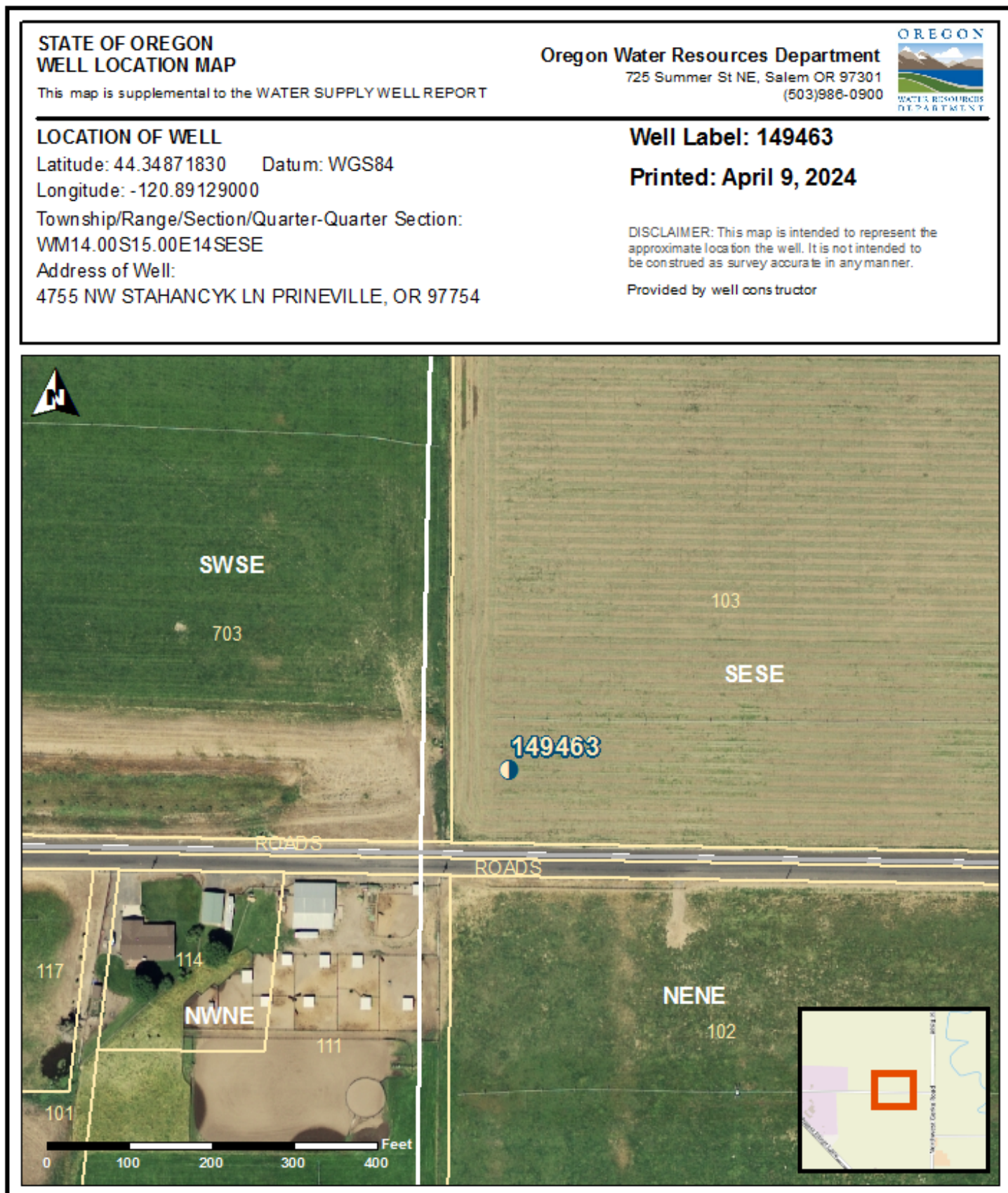
BACK FILLED PEA GRAVEL 46' - 39'. BENTONITE CHIPS 39'-36'

MONITORING WELL REPORT - Map with location identified must be attached and shall include an approximate scale and north arrow

CROO 55483

4/25/2024

Map of Hole





PROJECT NAME: Woodward

DATE STARTED: 09/10/2024

DRILLING CONTRACTOR: Abbas Well Drilling

FIRST WATER:

Hole Number: MW-5

COMPLETED: 09/10/2024

STATIC LEVEL:

LOGGED BY: B. Houston

GROUND ELEVATION: ~2,893-ft msl

METHOD: Air Rotary

Flow RATE (gpm):

Page:1:2

Depth (ft)	Elevation (ft)	GRAPHIC LOG	DESCRIPTION	Completion as report on CROO 55571		
			Topsoil: Very fine sand and organic matter, brown			Cement from 3-ft to 0-ft.
			Sand with gravel (s: 60-70%; gr: 30-40%)	Water Well Log: CROO 55570		
10						8" steel casing gauge 0.250 from 4.5 to 3-ft
			Very fine sand, brown			
20						
			Cemented sand layer (1-2 cm) at 24-ft bgs			
			Reddish to black cement possible FeO and MnO			
30						Bentonite chips from 51-ft to 4-ft
			Very fine sand, brown			
40						
			Silt, light tan			
50						Material between 51-ft to 45.5-ft not reported on well log report
			Very fine sand, brown, minor woody debris in returns			Sand from 61-ft to 51-ft
						4" Sched 40 PCV Screen Screen slot size 0.200
60						
						Material between 71-ft to 61-ft not reported on well log report
70						
			Blackish-tan, silt, contains sparse freshwater bivalves and minor woody debris in returns			Sand from 72-ft to 71-ft
						Backfill from 91-ft to 72-ft with bentonite chips



PROJECT NAME: Woodward

Hole Number: MW-5

LOGGED BY: B. Houston

Page: 2:2

DATE STARTED: 09/10/2024

COMPLETED: 09/10/2024

GROUND ELEVATION:

DRILLING CONTRACTOR: Abbas Well Drilling

METHOD: Air Rotary

FIRST WATER: 25-ft bgs

STATIC LEVEL: 23-ft bgs

Flow RATE (gpm):

Depth (ft)	Elevation (ft)	GRAPHIC LOG	DESCRIPTION	Completion as report on CROO 55570		
90			Blackish-tan, silt, contains sparse freshwater bivalves and minor woody debris in returns			Backfill from 91-ft to 72-ft with bentonite chips
			Clay, sticky dark gray, easily forms balls and rods TD: 92 - ft bgs			
						Annulus fill material not reported on the water well report from 61-ft to 71-ft



PROJECT NAME: Woodward

Hole Number: MW-6

LOGGED BY: B. Houston

Page: 1:1

DATE STARTED: 09/10/2024

COMPLETED: 09/10/2024

GROUND ELEVATION: ~2,902-ft msl

DRILLING CONTRACTOR: Abbas Well Drilling

METHOD: Air Rotary

FIRST WATER: 46-ft bgs

STATIC LEVEL: 34-ft bgs

Flow RATE (gpm):

Depth (ft)	Elevation (ft)	GRAPHIC LOG	DESCRIPTION	Completion as report on CROO 55571		
			Topsoil: Very fine sand and organic matter, brown			Cement from 3-ft to 0-ft.
10			Sand with gravel (s: 60-70%; gr: 30-40%)			8" steel casing gauge 0.250 from 4.5 to 3-ft
20						
30			Gravel with minor sand (gr: 070-90%; s: 10-30%)			Bentonite chips from 39-ft to 3-ft
40			Clayey silt			
			H ₂ O at 46-ft bgs; Significant volume est. >25 gal./min.			
50			Silty very fine sand, tan to brown			Sand from 52-ft to 39-ft
			Very fine sand, brown			4" Sched 40 PCV Screen Screen slot size 0.200
60						Material between 62-ft to 52-ft not reported on well log report
			Clay, sticky dark gray, easily forms balls and rods			Sand from 62-ft to 63-ft
70			TD: 68-ft bgs			Backfill from 68-ft to 63-ft with bentonite chips



PROJECT NAME: Woodward

Hole Number: MW-7

LOGGED BY: B. Houston

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DATE STARTED: 09/18/2024

COMPLETED:

GROUND ELEVATION: ~2,911-ft msl

DRILLING CONTRACTOR: Abbas Well Drilling

METHOD: Air Rotary

FIRST WATER: 30-ft bgs

STATIC LEVEL: 20-ft bgs

Flow RATE (gpm):

Depth (ft)	Elevation (ft)	GRAPHIC LOG	DESCRIPTION	Completion as report on CROO 55572		
			Topsoil: Very fine sand and organic matter, brown			
10			Silty very fine sand, tan to brown	Bentonite Chips	4" Sched 40 PCV Blank	Cement from 3-ft to 0-ft.
20						8" steel casing gauge 0.250 from 4.5 to 3-ft
30			Very fine sand, brown	Sand	4" Sched 40 PCV Screen	Bentonite chips from 31.5-ft to 3-ft
40						4" Sched 40 PCV Screen Screen slot size 0.200
50			Clayey silt	?	?	As reported on the well log report Sand from 55-ft to 31.5-ft
			Clay			As reported on the well log report there is either sand or bentonite chips from 55-ft to 45-ft
60			Very fine sand, brown	Bentonite Chips		As reported on the well log report bentonite chips from 60-ft to 45-ft
			TD: 60-ft bgs			
70						

Depth (ft)	Elevation (ft)	GRAPHIC LOG	DESCRIPTION	SAMPLE INTERVAL	RECOVERY %	NOTES/REMARKS
			Topsoil: Very fine sand and organic matter, brown			
10			Very fine sand, brown			
			Sand with gravel (s: 60-70%; gr: 30-40%)			
20						H ₂ O at 18-ft bgs; Minor volume est. <5 gal./min.
30			Very fine sand, brown			
40						
50						
60			Very fine sand, black (high % of magnetite)	2 to 66-ft		
70			Gray, clayey silt, contains minor woody debris in returns	69 to 105-ft		
			Gravel with minor silt & clay			

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GROUND ELEVATION: ~2,893-ft msl

METHOD: DR-24HD - Dual Air Rotary

Flow RATE (gpm):

Depth (ft)	Elevation (ft)	GRAPHIC LOG	DESCRIPTION	SAMPLE INTERVAL	RECOVERY %	NOTES/REMARKS
			Gravel with minor silt & clay			
90			Clay, gray, easily forms balls and rods			
100						
110						
120						
130						

<div><div></div><div>now part of</div><div></div></div>	Project:	Woodward	Well Name:	WW-1A
	Location:	44.34941°, -120.89169°	Drilling Method:	Sonic
	Drilled by:	Yellow Jacket Drilling Services	Logged by:	F. Tremblay
	Date started:	1/18/2021	Total depth:	35 Ft.
	Date completed:	1/18/2021	Elevation:	2928 Ft.

Depth (feet)	Well Construction	Lithology	Remarks
0		0-3 Ft.: SILT W/ SAND (ML) : dark brown, rooted and moist with some organic content to 1.5', dries out below, fine sand well graded sand, low plasticity, somewhat cohesive, carbonate concretions at 3', silt is very carbonaceous, trace amounts of gravel at 4'	Water level measured at 20.73 feet bgs on 1/19/2021.
1		3-7 Ft.: SILTY SAND (SM) : brown, medium to low plasticity, dry, fine sand in a carbonaceous silt, massive, carbonaceous concretions, sand is well sorted, poorly graded, platy structure and consolidated at 5', slightly to very carbonaceous, 0.25-0.5" bedding	
2	0-2 Ft.: Neat cement to surface	7-10 Ft.: FAT CLAY (CH) : brown, high plasticity, little to no coarse sediments, platy, medium to dense, cohesive, thinly bedded, non to slightly carbonaceous, 12" layer of medium grained poorly sorted sand at 8.5', some trace gravel, subrounded, back to clay at 9.5'	
3	4" Sched 40 PVC Blank	10-12 Ft.: SILTY SAND (SM) : loose, moist, fine to medium grained sand, non plastic, noncohesive, blocky and semiconsolidated to 11', granular and unconsolidated below that, trace gravel ~1 cm in diameter	
4		12-13 Ft.: SILT W/ SAND (ML) : brown, fine sand in a calcareous silt, loose, low to medium plasticity, cohesive, granular, brittle carbonaceous concretions, very carbonaceous	
5		13-15 Ft.: SILTY SAND (SM) : noncalcareous, similar to 10-12' interval, moist, silt content decreases below 14', medium sorted, medium grained, sub rounded, noncalcareous, trace amounts of gravel ~1cm diameter	
6	2-8 Ft.: 3/8" bentonite chips	15-21 Ft.: WELL GRADED SAND W/ SAND (SW) : brown, loose to medium dense, moist, nonplastic, noncohesive, granular, gravel between 0.5-1.5" in diameter, subrounded, 20-30%, gravel content decreases below 18', silty sand dominates below 19', noncalcareous	
7	4" Sched 40 PVC Screen	21-23 Ft.: WELL GRADED SAND W/ SILT & GRAVEL (SW-SM) : loose, dry, fine sand in a calcareous silt, low plasticity, granular, gravel conetent 15-20%, 0.5-2" diameter	
8		23-24 Ft.: WELL GRADED SAND W/ GRAVEL (SW) : loose, moist, medium grained sand, nonplastic, noncohesive, granular	
9		24-29 Ft.: WELL GRADED GRAVEL W/ SAND (GW) : some silt and medium grained sand, gravel between 0.5-3" in diameter, well rounded, wet, sand and silt below 27', mostly gravel, sharp contact with clay layer below	
10	0-10 Ft.: 4" Schedule 40 PVC blank well casing	29-32 Ft.: SILTY SAND (SM) : wet, fine sand in a noncalcareous silt, gravel is gone, low to medium plasticity, massive, silt sontent increases significantly below 30', blocky, sand gone below 32'	
11	4" Sched 40 PVC Screen	32-35 Ft.: LEAN CLAY (CL) : wet, medium plasticity, little to no coarse sediments	
12			
13			
14	10-30 Ft.: 4" Schedule 40 PVC 0.020" slot screen		
15	4" Sched 40 PVC Screen		
16			
17			
18	8-30 Ft.: 12X20 silica sand pack		
19	4" Sched 40 PVC Screen		
20			
21			
22	0-35 Ft.: 8.25" diameter borehole		
23	4" Sched 40 PVC Screen		
24			
25			
26	30-35 Ft.: Backfilled hole		
27			
28			
29			
30			
31			
32			
33			
34			
35			

Notes: This figure presents the as-built details for WW-1A located near Knife River's ISR Woodward Property in the SESW of Section 14 of T14S, R15E. This well was drilled and completed by Yellow Jacket Drilling Services of Sandy, OR using sonic drilling methods to assess shallow subsurface alluvial groundwater. Upon completion, the well was developed for three hours via surge block and pumping techniques. Water quality parameters at the end of development were as follows: pH=7.63; EC=571 uS; and T= 11.7 degrees Celsius.

<div><div></div><div>now part of</div><div></div></div>	Project:	Woodward	Well Name:	WW-2A
	Location:	44.349494°, -120.891692°	Drilling Method:	Sonic
	Drilled by:	Yellow Jacket Drilling Services	Logged by:	F. Tremblay
	Date started:	1/18/2021	Total depth:	30 Ft.
	Date completed:	1/18/2021	Elevation:	2930 Ft.

Depth (feet)	Well Construction	Lithology	Remarks
0		0-6 Ft.: SILTY SAND (SM) : rooted from 0-1', moist form surface moisture, fine well sorted sand, medium plasticity, carbonate concretions at 2', silt is calcareous from 2-5', clay content increases below 2-5'	Water level measured at 21.35 feet bgs on 1/21/2021.
1	0-2 Ft.: Neat cement to surface		
2			
3			
4	4" Sched 40 PVC Blank		
5			
6	2-8 Ft.: 3/8" bentonite chips	6-11 Ft.: LEAN CLAY W/ SAND (CL) : moist at 6', platy, medium plasticity, carbonate leaching, trace fine sand, calcite content decreases below 5', coincides with fine sand increase between 5-7', increases again between 10-11', platy carbonate concretions	
7			
8			
9			
10	0-10 Ft.: 4" Schedule 40 PVC blank well casing	11-14 Ft.: SILTY SAND (SM) : low plasticity, non calcareous, granular, moist, fine to medium grained sand, silt between 12-13', decreases below 13'	
11			
12			
13			
14		14-17 Ft.: POORLY GRADED SAND W/ GRAVEL (SP) moist, granular, nonplastic, noncohesive, medium grained sand, gravel content 10-15% between 14-15', 0.5-1" diameter, gravel decreases from 15-16'	
15	10-25 Ft.: 4" Schedule 40 PVC 0.020" slot screen		
16		17-19 Ft.: SANDY SILT (ML) : moist, calcareous, medium plasticity, cohesive, some trace gravel, trace roots, massive	
17	4" Sched 40 PVC Screen		
18		19-24 Ft.: POORLY GRADE SAND W/ GRAVEL (SP) :D.O. as 14-17', gravel content low from 20-21.5', noncalcareous	
19			
20	8-25 Ft.: 12X20 silica sand pack	24-26 Ft.: WELL GRADED GRAVEL W/ SAND (GW) : medium to coarse sand, trace silts, gravel betwene 0.5-3" in diameter, well rounded, wet, sharp contact with unit below	
21			
22		26-30 Ft.: SILTY SAND (SM) : wet, medium to low plasticity, cohesive, noncalcareous, clay content increases with depth, prismatic, sand is fine grained and well sorted	
23			
24			
25	0-30 Ft.: 8.25" diameter borehole		
26			
27			
28	25-30 Ft.: Backfilled hole		
29			
30			

Notes: This figure presents the as-built details for WW-2A located near Knife River's Woodward Property in the SESE of Section 14 of T14S, R15E. This well was drilled and completed by Yellow Jacket Drilling Services of Sandy, OR using sonic drilling methods to assess shallow subsurface alluvial groundwater. Upon completion, the well was developed for two hours via surge block and pumping techniques. Water quality parameters at the end of development were as follows: pH=7.58; EC=598 uS; and T= 13.1 degrees Celsius.

<div><div><div><div></div><div>WENCK</div></div><div>now part of</div><div><div></div><div>Stantec</div></div></div></div>	Project:	Woodward	Well Name:	WW-3A
	Location:	44.349629°, -120.891684°	Drilling Method:	Sonic
	Drilled by:	Yellow Jacket Drilling Services	Logged by:	F. Tremblay
	Date started:	1/20/2021	Total depth:	30 Ft.
	Date completed:	1/20/2021	Elevation:	2929 Ft.

Depth (feet)	Well Construction	Lithology	Remarks
0			
1			
2	0-2 Ft.: Neat cement to surface		
3			
4			
5			
6	4" Sched 40 PVC Blank		
7			
8	2-11 Ft.: 3/8" bentonite chips		
9			
10			
11	0-13 Ft.: 4" Schedule 40 PVC blank well casing	0-11 Ft.: SILT W/ SAND (ML) : overburden, rooted and moist with some organic content to 1.5', fine well sorted sand, clay content increases below 6', moist at contact	
12			
13		11-14 Ft.: SILTY SAND (SM) : fine to medium grained sand with occasionally calcareous silt, semiconsolidate, trace amounts of gravel <1cm in diameter, some carbonate concretions	
14			
15	11-28 Ft.: 12X20 silica sand pack	14-24 Ft.: POORLY GRADED SAND W/ GRAVEL (SP) : moist, granular, coarsens with depth, nonplastic and noncohesive, medium grained well sorted sand, gravel is 0.5-1" in diameter, some medium plasticity sandy silt zones from 19-20'	
16			
17			
18			
19			
20	13-28 Ft.: 4" Schedule 40 PVC 0.020" slot screen		
21	4" Sched 40 PVC Screen		
22			
23	0-30 Ft.: 8.25" diameter borehole		
24		24-28 Ft.: WELL GRADED GRAVEL W/ SAND (GW) : medium to coarse grained sand, trace silt, well rounded poorly sorted gravel, 0.5-3.5" in diameter	
25			
26			
27			
28		28-30 Ft.: SILY SAND (SM) : fine grained well sorted sand in silt, wet, blocky, well consolidated, noncalcareous, clay content increases with depth	
29	28-30 Ft.: Backfilled hole		
30			

Notes: This figure presents the as-built details for WW-3A located near Knife River's Woodward Property in the SESE of Section 14 of T14S, R15E. This well was drilled and completed by Yellow Jacket Drilling Services of Sandy, OR using sonic drilling methods to assess shallow subsurface alluvial groundwater. Upon completion, the well was developed for 3 hours via surge block and pumping techniques. Water quality parameters at the end of development were as follows: pH=7.62; EC=338 uS; and T= 12.1 degrees Celsius.

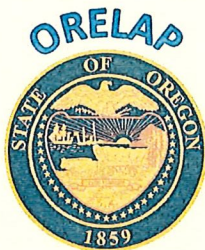
Appendix B

Oregon EPA/DEQ Certified Laboratories Lab Certifications

Table B1. List of EPA and DEQ Certified Laboratories

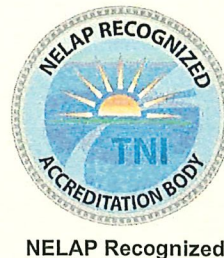
Lab Name	ORELAP ID	Address	City	State	Zip	Phone	Email
2 River Labs Oregon	4112	2535 N. Ross Ave	Portland	OR	97227	503-493-2535	info@lightscale.com
Camp Rilea Laboratory	OR100059	33168 Patriot Way, Bld. 7239	Warrenton	OR	97146	9713554657	daniel.oldham@omd.oregon.gov
City of Bend Water Quality Laboratory	OR100038	22395 McGrath Rd	Bend	OR	97701	541-317-3017	cwhitman@bendoregon.gov
City of Corvallis Water Quality Laboratory	OR100027	1304 NE 2nd St	Corvallis	OR	97330	541-766-6720	john.hoppner@corvallisoregon.gov
Neilson Research Corporation	OR100016	245 South Grape St	Medford	OR	97501	541-770-5678	https://nrclabs.com/contact/
City of Portland Water Pollution Control Laboratory	4023	6543 North Burlington Avenue	Portland	OR	97203	503-823-5614	Jennifer.Shackelford@portlandoregon.gov
Clackamas Water Environment Services-Water Quality Laboratory	OR100053	15941 S. Agnes Ave., Bldg. B	Oregon City	OR	97045	503-557-2868	ebecker@clackamas.us
Portland Water Bureau Laboratory	OR100014	2010 N Interstate Ave	Portland	OR	97227	503-823-1829	marsha.farooqui@PortlandOregon.gov
SC Laboratories Oregon LLC	4133	15865 SW 74th Avenue, Suite 110	Tigard	OR	97224	503-272-8830	max.duimstra@sclabs.com

Source: Oregon Environmental Laboratory Accreditation Program



Oregon

Environmental Laboratory Accreditation Program



Neilson Research Corporation

OR100016

245 South Grape St

Medford, OR 97501

IS GRANTED APPROVAL BY ORELAP UNDER THE 2016 TNI STANDARDS, TO PERFORM
ANALYSES ON ENVIRONMENTAL SAMPLES IN MATRICES AS LISTED BELOW :

Air	Drinking Water	Non-Potable Water	Solids & Chem. Waste	Tissue
	Chemistry	Chemistry	Chemistry	
	Microbiology	Microbiology		

AND AS RECORDED IN THE LIST OF APPROVED ANALYTES, METHODS, ANALYTICAL TECHNIQUES, AND
FIELDS OF TESTING ISSUED CONCURRENTLY WITH THIS CERTIFICATE AND REVISED AS NECESSARY.

ACCREDITED STATUS DEPENDS ON SUCCESSFUL ONGOING PARTICIPATION IN THE PROGRAM AND
CONTINUED COMPLIANCE WITH THE STANDARDS.

CUSTOMERS ARE URGED TO VERIFY THE LABORATORY'S CURRENT ACCREDITATION STATUS IN
OREGON.

Oregon State Public Health Laboratory
ORELAP Program Manager
7202 NE Evergreen Parkway, Suite 100
Hillsboro, OR 97124

EFFECTIVE DATE : 12/24/2024

EXPIRATION DATE : 12/23/2025

Certificate No : OR100016 - 032

