FINAL

Remedial Investigation Work Plan for the Former Eatonville Landfill

Ecology Facility Site ID No. 85933

September 2021

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Abbreviations and Acronyms

ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
CLARC	Cleanup Levels and Risk Calculation (under MTCA)
CSM	conceptual site model
CUL	Cleanup Level
Eatonville	Town of Eatonville
Ecology	State of Washington Department of Ecology
EIM	Environmental Information Management
EPA	U.S. Environmental Protection Agency
FS	Feasibility Study
gpm	gallons per minute
GSI	GSI Water Solutions, Inc.
HASP	Health and Safety Plan
mg/L	milligrams per liter
MRL	Method Reporting Limit
MTCA	State of Washington Model Toxics Control Act
Order	2021 Agreed Order No. 20072
PAH	polycyclic aromatic hydrocarbon
PBDE	polybrominated diethyl ether
PCB	polychlorinated biphenyl
PID	photo-ionization detector
PSL	preliminary screening levels
QAPP	Quality Assurance Project Plan
RCW	Revised Code of Washington
RI	Remedial Investigation
RIWP	Remedial Investigation Work Plan
SAP	Sampling and Analysis Plan
SHPO	State Historic Preservation Office
Site	Former Eatonville Landfill
TEE	Terrestrial Ecological Evaluation
TOC	total organic carbon
TPH	total petroleum hydrocarbons
Tribe	Nisqually Indian Tribe
µg/L	micrograms per liter
µg/g	micrograms per gram
VCP	Voluntary Cleanup Program
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife

Weyerhaeuser	Weyerhaeuser Company

SECTION 1: **Introduction**

This Draft Remedial Investigation Work Plan (RIWP) for the Former Eatonville Landfill (Site[1]) was prepared by GSI Water Solutions, Inc. (GSI), on behalf of Weyerhaeuser Company (Weyerhaeuser) and the Town of Eatonville. This Work Plan is in accordance with the requirements of the 2021 Agreed Order No. 20072 (Order) between the State of Washington Department of Ecology (Ecology), the Town of Eatonville, and Weyerhaeuser, pursuant to the Washington State Model Toxics Control Act (MTCA; Revised Code of Washington [RCW] 70A.305) and MTCA regulations (Washington Administrative Code [WAC] Chapter 173-340).

1.1 Background

The Site consists of an approximately rectangular parcel of about 2.25 acres of land owned by Weyerhaeuser and located in the Nisqually State Park, west of Eatonville, Pierce County, Washington (see Figures 1 and 2). The Site has been identified by Ecology as a State Cleanup Site with Facility Site ID #85933.

Historical activities conducted on the Site include use of the area as a municipal landfill for the Town of Eatonville (Eatonville). Eatonville operated the landfill under a lease agreement with Weyerhaeuser. Landfilling activity commenced November 1, 1950, and ended March 1, 1980 (Parametrix, 1996).

Between 1996 and 2013, several investigations and closure evaluations were completed for the Site by Parametrix, Schwyn Environmental, and PES Environmental, Inc. These prior environmental investigations have been performed in support of Weyerhaeuser and Eatonville. A 1996 analysis of surface water runoff indicated that zinc was present downstream of the Site at concentrations that would exceed current MTCA soil cleanup levels (Parametrix, 1996). A 2017 investigation conducted by Washington Department of Fish and Wildlife (WDFW) of the surrounding watershed identified the former landfill as a potential source of polybrominated diethyl ethers (PBDEs) adversely affecting steelhead trout (*Oncorhynchus mykiss*) in the Mashel and Nisqually Rivers (O'Neill et al., 2020). Following the release of the WDFW study, in September 2020 the Nisqually Indian Tribe notified Ecology of concerns about releases of PBDEs (Bellon and Gavin, 2020). Additional investigation activities are needed to comply with MTCA requirements.

On September 22, 2020, Weyerhaeuser received an Early Notice letter from Ecology regarding a potential release of hazardous substances from the Eatonville Landfill. Weyerhaeuser's October 13, 2020, letter responded to Ecology's Early Notice Letter and indicated a desire to cooperate with Ecology to further investigate options for closure of the landfill.

1.2 Purpose and Objectives

The RIWP was developed to comply with a requirement of the Order between Ecology, Eatonville, and Weyerhaeuser. The Order requires preparation of a remedial investigation/feasibility study (RI/FS) that will determine what remedial actions are required to comply with current MTCA regulations and a draft Cleanup Action Plan for public review.

[1] For the purposes of this Remedial Investigation Work Plan (RIWP), the Site encompasses the real property currently owned by Weyerhaeuser. The final site definition will be developed after completion of the remedial investigation/feasibility study (RI/FS).

The purpose of this RIWP is to describe the RI investigation activities that will be completed to address the site data gaps and support preparation of the Draft RI. Specifically, the primary objectives of this RIWP are the following:

- Develop and describe RI activities to collect, develop, and evaluate sufficient information regarding the Site to allow completion of the RI/FS and to support the selection of a cleanup action under WAC 173-340-360 through 173-340-390.
- Develop and describe sufficient RI activities to characterize the distribution of hazardous substances present at the Site and the potential threat(s) to human health and the environment. These investigations will address the following requirements of WAC 173-340-350 - *Remedial Investigation and Feasibility Study*:
    - Surface water
    - Soil and sediment
    - Geology and groundwater system characteristics
    - Current and future site land use
    - Natural resources and ecological receptors
    - Hazardous substance sources

The first phase of the RI consists of a comprehensive sampling plan and focuses on addressing the objectives listed above.

Because additional data may be generated during the RI that impact the current understanding of the Site, the investigation approach or methods presented in this RIWP may be refined or modified to incorporate new information (e.g., drilling methods, sampling methodologies). Changes to the approach presented in this RIWP will be discussed with Ecology before implementation and subsequently submitted in writing to Ecology for approval, per Section VIII K of the Order.

1.3 Document Organization

This RIWP summarizes the operational, investigative, and regulatory history at the Site from a review of existing documents. It also presents a preliminary conceptual site model (CSM) and identifies data needs and data gaps that will be addressed through the RI sampling efforts described in this RIWP.

The RIWP is organized into the following sections:

- **Section 1** – Introduces the project and its objectives.
- **Section 2** – Summarizes the pre-industrial development and the operational and regulatory history of the landfill.
- **Section 3** –Summarizes the geologic and hydrogeologic site setting and physical features.
- **Section 4** – Provides a description of the preliminary CSM.
- **Section 5** – Discusses identified data gaps and summarizes the proposed RI sampling approach to address the data gaps.
- **Section 6** – Discusses the schedule and reporting for the investigation.
- **Section 7** – Includes a list of references cited in this RIWP.

Detailed descriptions of planned sampling events, analysis, quality assurance, and health and safety guidelines are presented as appendices to this RIWP, which include the following:

- **Appendix A** - Sampling and Analysis Plan (SAP)

- **Appendix B** - Quality Assurance Project Plan (QAPP)
- **Appendix C** - Health and Safety Plan (HASP).

SECTION 2: **Site History**

This section describes the pre-industrial development of the Site and vicinity (Section 2.1) and the operational and regulatory history of the landfill (Section 2.2). Additional information about the hydrogeologic site setting and physical features is provided in Section 3.

2.1 Pre-Industrial Development and Land Use

2.1.1 The Nisqually Indian Tribe

The Site is centrally situated within the Nisqually River watershed, in the area where the Nisqually Indian Tribe (Tribe)—and its ancestors, the Squalli-absch—resided for 10,000 years. The tribe had established several villages in the basin, including a major village near the Mashel River (Nisqually Indian Tribe, 2021).

The first white settlement in the area was established in 1833 and the Nisqually Reservation was established under the 1854 Medicine Creek Treaty, which secured land and hunting, fishing, and gathering rights for the Tribe. In reaffirming these rights, the federal courts have recognized the Tribe's sovereign management responsibility to these critical natural resources.

The salmon and steelhead species that use the Mashel River as spawning and rearing habitat continue be culturally significant to the Nisqually people. Two of these species, fall Chinook salmon and steelhead trout, are now listed as threatened under the Endangered Species Act and are vulnerable. Water quality degradation is a significant factor in the decline of these species and resolving potential water quality impacts to the Mashel River is crucial to supporting population recovery.

2.1.2 Industrial Development

The Northern Pacific Railway extended service to the region in 1883 and brought many settlers to the area for commercial agriculture and logging (Nisqually Indian Tribe, 2021). The majority of the previously established Nisqually Reservation land was transferred to the Fort Lewis Army Base in 1917. Increased energy demands during the world wars led to construction Alder Dam on the Nisqually River south of the Site by Tacoma City Light (Norberg, 2018).

A review of historical aerial photographs from Google Earth and the University of Washington Libraries indicates that the Site and surrounding areas have not changed considerably since the 1950s. Prior to operating the landfill, the area was undisturbed. Throughout the landfill period and until today, the surrounding forest has remained mostly intact. Figure 3 provides historical aerial representations of the Site over time. As shown on the 1957 and 1980 aerial photos included in Figure 3, the access road to the landfill is highly eroded and leads to the landfill area. The wastes were dumped down a steep slope on the northeastern side of the former landfill area. The toe of the landfill is located at the southwestern side of the landfill outline.

Following development of a 2005–2007 master plan by the Washington State Legislature, 1,230 acres of the land was officially designated as Nisqually State Park in 2010 (Fields, 2010). The park continues to be developed, with critical phase construction (including addition of trails, trailhead parking, and camping facilities) planned for as early as spring and summer of 2022 (Town of Eatonville, 2021).

2.2 Operational and Regulatory History

Eatonville leased the Site from Weyerhaeuser during the period of landfill operation. A previous record review did not locate a solid waste handling permit for the landfill but determined that the "Town of

Eatonville was listed as the permit holder." The landfill essentially operated as an open dump and burn site. Accepted wastes included municipal solid waste, tires, car parts, appliances, stumps, empty barrels, and various additional items. During the active landfilling years, gravel (borrowed from the other side of the access road to the landfill) was intermittently used as landfill cover material (PES Environmental, Inc., 2013a). The nature of landfilling and potential burn activities was not closely monitored, and operational details are therefore limited.

Previous evaluations assumed that the final years of the landfill lifetime and its closure were conducted per Ecology's *Regulation Relating to Minimum Functional Standards for Solid Waste Handling*, Chapter 173-301 WAC, which became effective in 1972 (PES Environmental, Inc., 2013a). However, current site conditions, such as soil cover and face slope, are not compliant with this regulation. It is unknown whether the other requirements under this regulation—including creation of maps, a statement of fact following the landfill closure, and inspection of the landfill for 5 years after stabilization of fill—were ever completed.

During closure of the former landfill, a barrier of tree stumps was placed at the upslope landfill ridge to prevent illegal dumping. The effectiveness of this measure at preventing additional wastes from being deposited in the area is unclear. Over time, the decomposable landfill material settled, giving way to protruding bulky wastes such as metal debris, automobiles parts, tires, and household appliances.

A wetland is present at the toe of the landfill on the southwestern side of the landfill outline (Figure 2). This wetland has been classified as a Class II jurisdictional wetland, per *Washington State Wetland Rating System for Western Washington* (Schwyn Environmental Services, 2014). The original report outlining this delineation (by Shaw in 2002) cannot be located. Any future movement or additional placement of waste—including rehabilitation of the soil cover that may be required—will need to be evaluated against potential impacts to the downgradient wetland area.

SECTION 3: **Physical Site Setting**

3.1 Site Location

The Site is located in Nisqually State Park. Nisqually State Park is approximately 3.5 miles west of the Town (Township 16N, Range 4E, Section 20). The Site is accessed via an unpaved road located off Mashel Prairie/Medical Springs Road (a turnoff from State Highway 7). The Site is a part of the 460,172-acre Nisqually River watershed, whose headwaters begin 26.5 miles east of the Site at the summit of Mount Rainier. The Nisqually River discharges into the southern end of the Puget Sound located 25 miles to the Northwest. The Mashel River is located to the south of the Site and discharges into the Nisqually River 1.25 miles downstream of the Site.

3.2 Site Conditions

The landfill was intermittently covered during its operational period using adjacent borrowed fill from across the access road. Due to the steep grade of the landfill and surrounding areas (generally between 1H:1V and 2H:1V), as well as the bulky nature of the refuse and stormwater infiltration across the Site, the original cover material has gradually settled and/or eroded over time, leaving existing refuse (tires, automobile parts, appliances, etc.) exposed. The upslope portion of the landfill, due to a shallower grade and limited surface water drainage, has maintained limited cover and contains some shallow-rooted vegetation (mostly blackberry bushes and brush). Access to the Site is difficult, due to the need for bush whacking through dense brush to reach the top of the landfill and navigating down steep, unimproved grades to reach the base of the landfill. However, there is a historic access road, which once cleared, can provide easier access to at the upper portions of the landfill.

3.3 Geology and Hydrogeology

The Site is underlain by unconsolidated clay, sand, and lignite deposits of the upper Mashel Formation (Tertiary-age). Outcrops of the Mashel Formation are visible on the slopes of the Mashel River. The landfill is located on a bluff north of the river, surrounded by unconsolidated Vashon glacial drift deposits of sands and gravels (Quaternary age). The steep slope is an erosional feature of the historical Mashel River channel. The bluff gives way to a wetland at the slope and landfill toe, then drops into a creek bed that carries surface water from springs and seeps at or near the landfill face and the surrounding bluff to the Mashel River. The presence of springs on the northwest corner and north side of the landfill indicates that low-permeability materials (part of the Mashel Formation) may underlie the landfill and may result in a discharge of perched groundwater at the top of the bluff (Schasse, 1987; Walters and Kimmel, 1968).

A series of 27 test pits were excavated to a depth of 5 to 9 feet below ground surface (bgs) in 2013 to determine subsurface site conditions to the extent possible. Due to safety concerns, these pits were excavated only in the flatter upslope portion of the Site before the grade becomes steep and difficult to navigate. The east corner of the Site contained up to 18 inches of topsoil above gravels, cobbles, and large boulders with very little sand and silt. Test pits from the upper reaches of the landfill contained little debris. It was not evident that the pits were in the waste area until moving further west (residual municipal solid waste was revealed in the pits along the western boundary of the waste area). Large boulders, gravel, cobbles, and soil were also mixed with the waste on the western portion of the landfill (PES Environmental, Inc., 2013b).

3.4 Hydrology

The average annual precipitation in the area is 44.5 inches, based on a weather station near Centralia, Washington (NOAA, 2021). Most of this precipitation occurs during the fall and winter months (October to March).

Surface water from the springs and seeps support the wetland and unnamed creek that flows from the wetland to the south/southwest approximately a quarter of a mile before entering the Mashel River. The creek takes an extended southerly track, rather than the most direct path to the Mashel River, at approximately 400 to 500 feet southeast of the wetland. Reportedly in 1996, runoff from the springs infiltrated into the refuse at the midpoint of the landfill slope. The springs currently continue to persist with discharge periods and volume varying dependent upon the time of year. Several seeps were identified at the slope terminus that may coincide with the refuse extent. Stormwater and industrial inputs from Eatonville enter the Mashel River upstream of the Site.

SECTION 4: **Preliminary Conceptual Site Model**

This section describes the preliminary CSM, which describes the potential sources, release mechanisms, and transport pathways of contaminants present at the Site, and identify how potential human or ecological receptors may be exposed to site contaminants via exposure media (e.g., soil, groundwater, surface water, wetland and stream sediments) and exposure routes (e.g., direct contact, ingestion). The CSM will be refined throughout the RI/FS process as additional information and data are collected and evaluated. The CSM helps identify and prioritize potential data needs, as well as potential site cleanup needs.

Figures 4 and 5 show historical results onsite and in the surrounding watershed. Figure 6 is a graphical representation of the preliminary CSM reflecting current conditions and illustrating the relationship among potential sources, release mechanisms, and transport media and mechanisms. Each of these categories is discussed in the following sections.

4.1 Sources

The potential source of contamination at the Site is solid wastes that were dumped during the landfilling period, which occurred between 1950 and 1980. There is little documentation of the types of wastes dumped at this time, but observations of exposed waste indicate that, in addition to general municipal solid waste, the landfill received tires, automobile parts, household appliances, and barrels. Oxidized metal scrap and tires are the predominant residual contents of the landfill visible during a January 2021 reconnaissance and investigation.

4.2 Historical Data

4.2.1 Parametrix Investigation (1996)

4.2.1.1 Approach

Parametrix sampled surface and seep water upstream and downstream of the landfill, including at the north spring before it entered the landfill and the creek exiting the wetland prior to its confluence with the Mashel River. Sampling occurred during the dry season (July), when flows through the landfill were low (5–10 gallons per minute [gpm] and wetland; 30–50 gpm entering the landfill). The analytical suite included field parameters (pH, specific conductivity, and temperature), biological oxygen demand, N-ammonia, chloride, sulfate, iron, manganese, and zinc.

4.2.1.2 Results

The laboratory result for pH in the spring water sample entering the landfill was 6.4, which is slightly below standard screening levels of 6.5 (however, field-collected pH was within the normal range). The two seep samples (collected at the toe of the landfill) contained iron and zinc concentrations of 0.69 milligrams per liter (mg/L) (iron in SEEP-1), 0.49 mg/L (zinc in SEEP-1), and 0.09 mg/L (zinc in SEEP-2), which were above the applicable surface water quality standards (WAC 173-201A). The results from this investigation are displayed on Figures 4 and 5.

4.2.2 PES Environmental, Inc., Investigation (2013)

4.2.2.1 Approach

In this investigation, PES Environmental, Inc., excavated a total of 27 test pits using a small excavator. These pits were located on the upper portion of the landfill where the grade was shallower, because the machinery could not access the areas with steeper slope and thick vegetation. Investigators determined the geologic conditions underlying the landfill and characterized the waste present. This investigation was conducted in order to estimate the cost for various rehabilitation options (waste removal and cover modification).

4.2.2.2 Results

Large boulders, gravels, and cobbles overlain with topsoil were predominant in test pits located on the northeast corner of the Site. Few silts and sands and minimal waste were uncovered in this area. As excavation moved to the southwest corner of the investigation area, less topsoil was encountered but the same size of rock was revealed. Increasing amounts of waste were uncovered, including plastics, rubber, paper, cans, cables, tires, and metals intermixed with soil and rock.

4.2.3 WDFW Investigation (2017)

4.2.3.1 Approach

The 2017 dry season (August through September) study evaluated PBDE concentrations in eleven sampling locations by collecting collocated water and biofilm samples within the Nisqually River watershed. Water was collected as both grab and passive samples (via semipermeable membrane devices) deployed for 27 to 29 days. Biofilms were scraped from rocks using stainless steel blades. Samples were extracted using dichloromethane and analyzed via mass spectrometry according to EPA Method 1614, AXYS method MLA-033.

4.2.3.2 Results

Four of eleven sample locations were near (upstream and downstream) of the Site. The highest total PBDE concentration was found upstream of the Site on the Mashel River (just downstream of Eatonville) at station 9b. The total PBDE concentration in water at this location was 63.3 picograms per liter (pg/L). Downstream of the Site on the Mashel River (station 9a), the concentrations in water were 8.5 and 7.9 pg/L. On the Nisqually River just upstream of its confluence with the Mashel River (background, station 10), the total PBDE concentration was 3.7 pg/L. At station 8, Ohop Creek just before its confluence with the Nisqually River, the total PBDE concentration was 4.5g/L. Results are displayed on Figure 5.

Biofilm samples displayed a similar pattern. Station 10 (background) contained 35 picograms per gram (pg/g) of total PBDEs, station 9b (upper Mashel River) contained 290 pg/g, station 9a (lower Mashel River) contained 40 and 51.5 pg/g, and station 8 (Ohop Creek) contained 97 pg/g. There is currently no regulatory screening and/or cleanup levels for PBDEs.

4.2.4 GSI Water Solutions, Inc. Investigation (2021)

4.2.4.1 Approach

The GSI investigation occurred during the wet season (January) of 2021. The study aimed to collect surface water moving through the Site, seeps into the wetland from the landfill, and shallow groundwater at the toe of the landfill. The investigation also evaluated the riverbank to the Mashel River for the presence of seeps (none were found). Three surface water samples were collected and included the spring entering the Site from the northwest edge of the landfill footprint, the toe of the landfill, and the creek flowing from the wetland to the Mashel River. Two seep samples were collected from the toe of the landfill. One shallow (approximately 1 foot bgs) presumptive groundwater sample (GW-01) was collected from a push-probe boring after 24 hours of rest time. However, despite trying to avoid surface runoff from impacting the sample, it is unclear whether this sample is actually representative of perched or unconfined aquifer groundwater conditions due to the extremely heavy rains during the sampling event and the saturated soil conditions at the base of the landfill. The shallow screened depth (1-foot screen length set at approximately 1-2 feet bgs) may be more representative of soil/wetland sediment porewater conditions of the saturated soil than perched groundwater. Field parameters were collected during each sampling event (pH, temperature, oxygen-reduction potential, conductivity, dissolved oxygen, and turbidity).

4.2.4.2 Results

Seep, groundwater and surface water analytical and field parameter results are presented in Table 1 and on Figures 4 and 5. No volatile organic compounds, semivolatile organic compounds, or PBDEs were detected above method reporting levels (MRLs). Dissolved and total barium, copper, lead, and zinc were detected in most samples, while antimony, arsenic, cadmium, nickel, and vanadium were detected in up to two samples. No dissolved copper or nickel was detected. Laboratory analytical reports for the field event are presented in Appendix D.

4.3 Site-Associated Contaminants

Site-associated contaminants were identified during previous investigations, based on analytical testing and comparison against MTCA screening levels. These include iron, lead, and zinc. Based upon the age of the waste, other contaminants, including polycyclic aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPH), polychlorinated biphenyls (PCBs), and additional metals (including chromium, selenium, silver, and mercury) (Lee and Jones, 1991) are possible. Other wastes, such as corrosive wastes, wood debris, asbestos, and organic matter, have a potential to be present in the landfill (Ecology, 2020). Some metals, including antimony, arsenic, barium, cadmium, copper, nickel, and vanadium have been detected at the Site. Elevated biological oxygen demand and methane have also been identified (Parametrix, 1996). Updated landfill gas methane concentrations will be collected as part of the RI, but it is anticipated that methane generation rates are likely to be limited, as the landfill has been closed for more than 40 years (Reinhart et al., 2005) and lacks an effective low-permeability landfill cover.

Given that some of the available data for the Site may no longer be representative of current conditions, and screening levels used in past investigations may no longer be applicable to the Site, a re-screening of useable analytical data may be conducted as part of the RI. Proposed preliminary screening levels (PSLs) are discussed in Section 4.5. Final cleanup levels will be determine after initial RI sample collection and human health and ecological risk evaluations have been performed for appropriate risk scenarios.

Data collected during the RI will be publicly available and uploaded to the State of Washington Environmental Information Management (EIM) database after final validation and submittal of associated reporting.

4.4 Contaminant Migration Pathways

The results of the previous site investigations identify soil and groundwater, which may exhibit as surface water at the base of the landfill, as the primary media of concern, although impacts to wetland soil/sediments, surface water from leachate, and ambient air may exist. Historical and current contaminant migration pathways are discussed by media in the following sections. Contaminant fate and transport is discussed in Section 4.4.

4.4.1 Soil and Wetland Sediments

Potential migration pathways for contaminants in soil include the following:

- Clean cover or offsite soil being impacted by landfill leachate or contaminated groundwater seeps
- Stormwater and seepage eroding impacted site soil and transporting soil off-site
- Landfill cover soil impacted by landfill waste due to lack of top liner and mixing in areas of eroding cover
- Wind erosion of contaminated surface soil to offsite soil and wetland sediments

Attempts to cover the landfill with borrowed gravels/sands have not prevented erosion over time, causing waste and potentially impacted soil to be re-exposed at the ground surface.

Eroded soil that may accumulate at the toe of the landfill is not anticipated to (1) impact benthic invertebrates that may become food sources for migrating or resident fish species or (2) result in river sediments that are in direct contact with the river or riverbank receptors. As such, sediment human health and ecological screening considerations (which are more appropriate to river sediment sampling conditions) are not currently being used. However, the RI will confirm this assumption through the risk evaluation process and sampling of soil and wetland sediments along and beyond the toe of the landfill. For the purposes of the RIWP and associated appendices, this material will be screened in a manner similar to that used for other soil sampling and defined throughout as soil and/or wetland sediments to distinguish them from river sediments and the associated risks associated with sediments in river systems.

4.4.2 Surface Water

Potential migration pathways for contaminants in surface water include the following:

- Leaching of landfill-generated liquids out of the landfill surface through seeps
- Clean perched groundwater coming in contact with buried waste, becoming impacted, and discharging through surface seeps
- Stormwater coming into contact with impacted soil or seeps

Surface water testing was performed in January 2021 upstream of, within, and downstream of the Site. Although limited, the data showed that elevated metals concentrations are present near the toe of the landfill. Additional testing of surface water will be conducted near the landfilled area and areas outside the believed refuse boundaries as part of the RI to determine whether site-associated discharges are adversely affecting water quality, including in the Mashel River.

4.4.3 Groundwater

Potential migration pathways for contaminants in groundwater include the following:

- Clean perched groundwater coming in contact with buried waste and re-entering the groundwater aquifer below the landfill
- Impacted surface water percolating downward into groundwater
- Landfill leachate migrating into surface water and groundwater

The release of contaminants in the subsurface to groundwater is controlled by the contaminant chemical properties (e.g., solubility, partitioning coefficients, and pH) and by processes such as infiltration, leaching, dissolution, and adsorption.

Additional information is needed to evaluate whether discharge of pollutants from groundwater to the Mashel River is a significant transport mechanism. Current groundwater quality and the hydrogeologic characteristics governing flow (e.g., gradient, seasonal effects, and potential preferential flow paths) will be evaluated during the RI.

4.4.4 Air

Potential migration pathways for contaminants in air include the following:

- Methanogenesis (creation of methane gas by methane-generating microorganisms) due to reductive landfill conditions within the waste prism with residual waste providing continued microbial food source.
- Release of landfill gases from wastes and volatile or semi-volatile contaminants or microbial and/or chemical conversion of landfill waste to volatile or semi-volatile contaminants that migrate to the cover soil and bind with clean cover soil.

It is not anticipated that volatile or semi-volatile contaminant concentrations are present above the landfill surface at levels of inhalation risk but a photo-ionization detector (PID) will be used during the RI investigation to confirm this assumption.

Although methane was detected in a previous investigation (Parametrix, 1996), the concentration have likely diminished over time. The RI to evaluate whether methane gas generation continue to occur at levels sufficient to result in an adverse risk to human receptors due to potential flammability.

4.5 Preliminary Screening Levels

PSLs are selected for the Site for the purposes of screening for indicator hazardous substances. In accordance with MTCA, PSLs for site-associated contaminants are selected by media and site uses. MTCA's Cleanup Levels (CULs) are risk-based concentrations that are protective of generic exposure scenarios for a given site use. An explanation of PSL selection is provided below for each medium that may be impacted by site-associated contaminants.

4.5.1 Soil and Wetland Sediment

Human Health. The Site is within a state park that is currently open for public use, but access to the former landfill area is difficult due to the steep slope and thick vegetation. The only human receptors who might come into contact with contaminants in soil at the Site are excavation workers (while remediating the Site), researchers or park workers performing forest studies or surveys who encounter the landfill, and hikers who go off the trail at the location of the landfill. It is currently assumed that MTCA Method A (WAC 173-340) soil screening levels will be used for screening site contaminants.

Ecological. The Site consists of a public plot of land adjacent to and near the Mashel River and within Nisqually State Park. PSLs for potential ecological exposures to contaminants that may be in the adjacent wetlands or creek connecting to the Mashel River are discussed in Section 4.5.3. Terrestrial habitat on the upland portion of the Site is anticipated to be present and therefore presents a high potential for ecological receptors to be exposed to contaminants in site soil. Therefore, a Terrestrial Ecological Evaluation (TEE) under MTCA (WAC 173-340) is anticipated to be required.

Background. In addition to the above PSLs, MTCA states that CULs should not be lower than natural background concentrations.

4.5.2 Groundwater

Groundwater at the Site currently is not used as a potable supply, but residential wells are present in the nearby area (Ecology, 2021). Figure 7 shows all registered water wells within a half mile of the Site. While impacts to groundwater are not anticipated, four residential wells are present within 2,000 feet of the Site (Ecology, 2021). It is assumed shallow groundwater moves towards the Mashel River and discharges to surface water below the Site or recharges the river. It is not anticipated that contaminants are migrating to potable drinking water supplies. However, a beneficial use survey should be conducted to verify any potential groundwater is not impacting residential well supplies.

Human Health. Groundwater near the Site has potable uses and MTCA CULs related to drinking water are currently assumed for the Site.

Ecological. Contaminants in groundwater at the Site may migrate to surface water in the adjacent Mashel River, impacting ecological receptors in the adjacent creek. Washington State Water Quality Criteria (acute and chronic) for the protection of marine aquatic life (WAC 173-201A) will be used as PSLs for the screening of groundwater. Surface water PSLs are discussed in Section 4.5.3.

Background. As mentioned in Section 4.5.1, MTCA states that CULs should not be lower than natural background concentrations.

4.5.3 Surface Water

Contaminants may migrate from groundwater to surface water or landfill seeps that are present that can impact surface water.

Human Health. Surface water discharges may reach the Mashel River leading to the Nisqually River, which is especially significant to the Tribe for cultural fishing practices. MTCA Method A Values for Surface Water (cancer and non-cancer endpoints) (WAC 173-340) will be used as PSLs for surface water. PSLs also will include the National Toxics Rule (40 Code of Federal Regulations 131) criteria for protection of human health from freshwater fish consumption.

Ecological. Aquatic ecological receptors may be impacted by contaminants in surface water that have migrated from the Site. PSLs for ecological receptors in surface water are applicable or relevant and appropriate requirements (ARARs) for the protection of marine aquatic life, including Washington State Surface Water Regulations (acute and chronic).

SECTION 5: **Remedial Investigation Data Needs and Proposed Remedial Investigation Approach**

The purpose of the RI is to investigate the nature and extent of contamination caused by the release of hazardous substances at the Site in all media (i.e., site-associated contaminants) and collect data to support the selection of an appropriate cleanup actions. Some of the RI data needs have been satisfied during previous investigations completed on the Site. However, there remain potential site-associated contaminants and migration pathways for which additional data are needed to assess the presence and significance of these contaminants. Specifically, additional data are needed in the following categories to provide sufficient information to enable Ecology to select a cleanup action for the Site in accordance with RCW 70.105D.050(1) and MTCA (WAC Chapter 173-340-350):

- Environmental setting
- Geology and hydrogeology
- Nature and extent of contamination
- Contaminant fate and transport

This section presents the preliminary approach for completing the RI to address the identified data gaps and complete the RI/FS process. The RI approach addresses the major components of WAC 173-340-350. The data and information derived from previous investigations will be supplemented by data collected during the RI.

The RI approach focuses on developing a comprehensive understanding of current site environmental conditions and potential impacts associated with site contaminants. At least two sampling events will be conducted (during the wet and dry seasons of one calendar year) to evaluate concentrations of site-associated contaminants in multiple media (groundwater, surface water, soil, wetland sediments, and landfill gas). Samples collected during each sampling event will provide comprehensive groundwater, surface water, soil, wetland sediment, and landfill gas chemistry data across the Site and adjacent to the toe of the landfill. These data will be used to supplement existing site information and evaluate contaminant fate and transport mechanisms. Groundwater and surface water sampling will be required to be conducted more than once to determine the difference in contaminant trends during the wet and dry seasons.

A summary of specific sampling locations by media and sub-area is provided in the SAP, Appendix A. The SAP will discuss sampling and analytical techniques and quality assurance procedures.

A summary of the general RI sampling approach by data gap category is provided below. These data gaps will be addressed to the extent possible, given the accessibility and safety challenges presented by the Site's configuration. Information developed during implementation of the RIWP will be used to update and refine the CSM.

5.1 Environmental Setting

Data gaps related to characterization of the site environmental setting include the following:

- Information to confirm topography, existing drainage features, unknown aspects of the landfill cover, and material in the landfill and contamination extent in all media.
- Potential groundwater use and human and ecological uses of the Site and surrounding or downstream area, including the Mashel River watershed. It is anticipated that the Site will eventually be part of Nisqually State Park and the RI will consider future uses with that expectation.

Work conducted for the RI will include the following activities to address these data gaps:

- **Pre-RI Work Topographic Survey.** Targeted elevation surveys will be conducted to fill gaps and increase the resolution of existing survey data and to document the locations and elevations of anticipated sampling and monitoring locations. This will include surveying to confirm the following:
  - Methods to access investigation areas
  - Locations of proposed monitoring wells
  - Temporary borings and/or test pit locations
  - Stormwater drainage pathways
  - Seeps, springs and wetland locations on the landfill face and landfill area
  - Access areas of sediment deposition within the wetlands near the landfill toe
  - Extents and locations of buried and exposed debris to help establish the landfill footprint

  The survey information will be used during the RI to prepare site maps; revise the CSM; document sample locations; and perform seep, surface water, and stormwater analyses.
- **Future Land-Use Evaluation.** Ecology, the State of Washington Parks and Recreation Commission, and the Tribe will be consulted to discuss current and anticipated long-term plans for Nisqually State Park. An updated description of the potential land use for the Site will be provided in the RI report.
- **Cultural Resources Evaluation.** Proper considerations will be given to the potential for encountering protected historical cultural resources. As part of due diligence during the RI, notifications, research, and mitigation actions, as necessary and requested by the State Historic Preservation Office (SHPO) will be performed.
- **Current Human and Fish/Wildlife Use Evaluation.** Further evaluation of existing and newly collected data will be conducted following implementation of the RIWP. The RI Report will contain a description of human and ecological uses of the Site and nearby areas.

5.2 Geology and Hydrogeology

Identified data gaps related to the Site's geologic and hydrogeologic setting include the following:

- The depth and type of fill placed in the former landfill
- Data to refine the influences of groundwater flow (directions, gradients, and migration pathways) and presence

The following data-collection efforts will be conducted during implementation of the RIWP to address these data gaps:

- **Landfill Evaluation.** Vertical borings will be collected on gradual slope faces and flat areas of the landfill with safe access for tracked equipment to attempt to delineate remaining data gaps in the understanding of waste thickness and characteristics. Any borings or test pits will be logged to document depth and type of fill in the landfill and type, depth, and permeability of cover over the landfill. Soil samples will be collected from the cover, municipal fill, the underlying soil, and toe and wetland area of the landfill, as needed and accessible to complete site characterization. Any evaluations conducted at the toe of the landfill will be performed with hand equipment due to access limitations. In addition to site-associated contaminants, analysis of these samples will include grain size, total organic carbon (TOC), and total solids.
- **Groundwater Levels and Flow Direction Assessment.** Manual water level measurements will be collected from temporary wells/piezometers placed via hand augering at the toe of the landfill and with hand augers or drilling equipment at the north of the landfill during RI sampling. At least one temporary

piezometer or well will be placed upgradient of the Site at a location that can be safely accessed to evaluate depth to groundwater. Sitewide groundwater contour maps will be developed from these data to better evaluate groundwater elevations and flow directions.

Updated descriptions of groundwater flow directions, gradients, and migration pathways within the Site and adjacent to the Site will be included in the RI Report. Details on the sampling approaches and analytical procedures to fill the data gaps mentioned above are provided in the SAP (Appendix A) and QAPP (Appendix B).

5.3 Nature and Extent of Contamination

Data gaps in understanding of the nature and extent of contamination at the Site relate to characterization of the current surface water, wetland and stream sediments, and groundwater quality, as well as onsite and near-site impacts to surface soil. Specific data gaps identified include the following:

- The current nature and extent of contamination in groundwater beneath the Site
- The extent of contamination in surface water and groundwater along the southern portion of the Site (see Figure 2)
- Soil properties and potential contamination in the capping materials and landfill waste
- The potential impacts to the wetland sediments and surface water runoff adjacent to the Site

To address these data gaps, the RIWP includes the following data-collection efforts, outlined in detail in the SAP (Appendix A):

- **Source Characterization.** Surface water, groundwater, soil, and landfill gas samples from waste areas will be sampled and analyzed to determine the current concentrations of site-associated contaminants present. To address the identified data gaps, a comprehensive set of samples will be collected and analyzed to define the extent of site-associated contaminants present above applicable PSLs.
- **Groundwater Contamination Characterization.** The RI groundwater investigation approach focuses on a data collection program to develop a thorough understanding of groundwater contamination and contaminant mobility. Groundwater data are needed to define the nature and extent of contamination on the Site and along the southern portion of the Site. The RI will characterize current contaminant concentrations using groundwater grab samples from temporary soil borings to obtain a "snapshot" of contaminant concentrations at a single point in time. Temporary borings are anticipated to be more attainable in most locations than permanent well borings, given the difficulty of access at the Site. Samples will be analyzed for site-associated contaminants and support development of the FS.

  The results of the groundwater investigation will be used to do the following:

  - Refine the physical (i.e., geologic and hydrogeologic) CSM
  - Delineate groundwater concentrations and assess against appropriate PSLs
  - Determine areas of potential impact from the landfill
  - Understand the fate and transport of site-associated contaminants in groundwater
  - Support development of the FS

  The spatial distribution of groundwater sample locations has been selected to meet the defined objectives for the RI and are based on preliminary assumptions of groundwater flow directions.

- **Soil and Wetland Sediment Contamination Characterization.** As discussed in Section 3, soil and wetland sediment contamination at the Site is expected to be limited in vertical and horizontal extent. Soil and wetland sediment samples will be collected from surface locations and inside and outside the waste perimeter to better understand potential contaminant concentrations and fate and transport mechanisms. Additional samples will be collected and analyzed from site source areas, as mentioned above.

The spatial distribution of soil sample locations has been selected to meet the defined objectives for the RI and identified contaminant migration and risk exposure pathways (i.e., the preliminary CSM). The results of the RI sampling will be used to do the following:

- Verify the CSM and historical findings
- Refine the physical (i.e., geologic and hydrogeologic) CSM
- Delineate contaminant concentrations
- Support development of the FS

- **Surface Water Characterization.** Surface water samples will be collected from seep locations, surface water runoff, and downgradient areas to supplement previous data collection efforts, and the results will be used to evaluate potential human health impacts of surface water. Surface water presence and surface water quality monitoring will be performed during the RI. The results of the surface water sampling program will be used to do the following:
  - Verify and refine the CSM
  - Identify whether site-associated contaminants are present in surface water
  - Assess whether surface water concentrations are greater than applicable PSLs
  - Support the FS

Analytical suites for soil and water samples are provided in Table 1 Updated descriptions of contaminant nature and extent and the potential significance of migration pathways will be evaluated further and described in the RI Report.

5.4 Contaminant Fate and Transport

Data gaps related to fate and transport of contaminants at the Site include the following:

- The extent and concentrations of contaminants in groundwater, soil, wetland sediments and surface water
- Additional information to document the geochemical properties (multi-meter field parameters and TOC) in sampled media, as necessary

Groundwater data has been limited to collection of groundwater from near surface expressions during the January 2021 sampling event and may better characterize porewater or downward percolating surface water than groundwater. Groundwater and surface water data will be collected to (1) quantify the concentrations of site-associated contaminants in the wetland and landfill area, (2) document concentrations of site-associated contaminants within and below the bioactive zone in the wetlands adjacent to the landfill, (3) determine whether water coming from the landfill could adversely impact the Mashel River from discharges of site-associated contaminants, and (4) obtain geochemical data to better understand the processes that may affect the attenuation or transport of contaminants along the groundwater-to-surface-water pathway.

Fate and transport processes will be evaluated further using new and existing data, and will be described in the RI Report.

SECTION 6: **Schedule and Reporting**

The preliminary schedule for investigations and reporting is shown below. This schedule is subject to change and is based on a number of factors including, but not limited to, results of approval of this and future documents, initial sampling results, coordination with Nisqually State Park, and grant funding.

Fall 2021: Initial RI Sampling Event (Dry Season)

Winter/Early Spring 2022: Initial RI Sampling Event (Wet Season)

Early Spring 2022: Draft RI/FS Report, including human health and ecological risk evaluations. Draft RI/FS may not include wet season sampling results but assumes sampling results are consistent with draft RI/FS assumptions and considerations

Late Spring/Early Summer 2022: Final RI/FS Report or Supplemental RI Work Plan, if necessary

Summer/Early Fall 2022: Supplemental RI Sampling, if necessary

To Be Determined 2022 (likely summer or early fall): Interim Action, if approved

SECTION 7: **References**

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TABLES

Table 1. Analytical and Field Parameter Results
January 2021 Sampling Event, Eatonville Landfill Site

Analytical Results

Sample ID	Matrix	Sample Date	VOCs (ug/L) by EPA 8260D	SVOCs (ug/L) by EPA 8270E	PBDEs (ng/L) by GC/MS SIM	Total Metals (ug/L) by EPA 6020B									Dissolved Metals (ug/L) by EPA 6020B									Total Hardness (mg CaCO3/L) by Calculation	Nitrate + Nitrite (mg/L) by EPA 353.2
						Sb	As	Ba	Cd	Cu	Pb	Ni	Vn	Zn	Sb	As	Ba	Cd	Cu	Pb	Ni	Vn	Zn		
SE01	SW (Seep)	1/11/2021	<20.0	<10.0	<10.0	<1.0	<1.0	**6.61**	<0.2	**3.79**	**1.55**	<2.0	<2.0	**50.4**	<1.0	<1.0	**5.73**	<0.2	<2.0	<0.2	<2.0	<2.0	**41.1**	42	0.459
SE101 (SE01 dup)	SW (Seep)	1/11/2021	<20.0	<10.0	<10.0	<1.0	<1.0	**6.77**	<0.2	**5.24**	**3.27**	<2.0	<2.0	**59.6**	<1.0	<1.0	**5.64**	<0.2	<2.0	<0.2	<2.0	<2.0	**43.8**	41	0.454
SE02	SW (Seep)	1/11/2021	<20.0	<25.0	<25.0	<1.0	**1.66**	**382**	<0.2	**10.5**	**7.32**	<2.0	**5.95**	**205**	<1.0	**1.01**	**36.6**	<0.2	<2.0	<0.2	<2.0	**2.46**	**134**	380	3.76
SW01	SW (Surface)	1/12/2021	<20.0	<10.0	<10.0	<1.0	<1.0	**7.32**	<0.2	**2.19**	**1.08**	<2.0	**2.21**	**42.0**	<1.0	<1.0	**6.33**	<0.2	<2.0	**0.493**	<2.0	<2.0	**35.2**	35.4	0.812
SW02	SW (Surface)	1/12/2021	<20.0	<25.0	<25.0	<1.0	<1.0	**5.22**	<0.2	**2.9**	**2.59**	<2.0	<2.0	**62.4**	<1.0	<1.0	**3.78**	<0.2	<2.0	<0.2	<2.0	<2.0	**36.8**	32.7	0.303
SW03	SW (Surface)	1/12/2021	<20.0	<5.0	<5.0	<1.0	<1.0	**2.18**	<0.2	<2.0	<0.2	<2.0	<2.0	**4.0**	<1.0	<1.0	**1.83**	<0.2	<2.0	<0.2	<2.0	<2.0	<4.0	31.1	0.346
GW01	GW (Shallow)	1/12/2021	<20.0	<10.0	<10.0	**1.49**	<1.0	**55.1**	**0.285**	**2.07**	**0.564**	**2.39**	**2.35**	**580**	**1.47**	<1.0	**51.7**	**0.283**	<2.0	<0.2	<2.0	<2.0	**547**	456	5.99

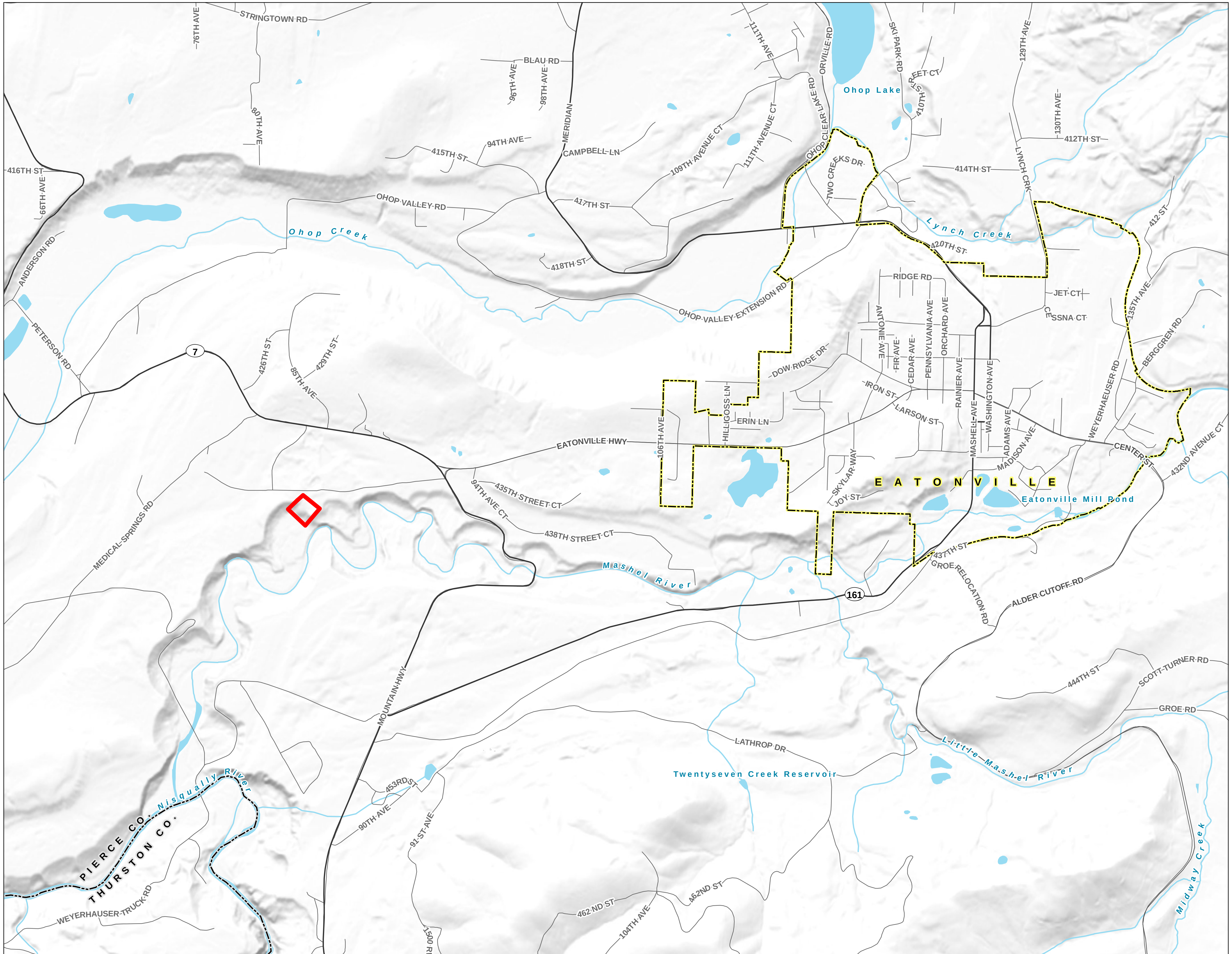
Reporting limit shown for non-detect results.

Field Parameters

Sample ID	Matrix	Sample Date	pH	Temperature (°C)	Oxygen Reduction Potential (mV)	Conductivity (uS/cm^2)	Dissolved Oxygen (%)	Turbidity (NTU)
SE01 and SE101	SW (Seep)	1/11/2021	6.79	8.99	201.9	104	11.33	1.94
SE02	SW (Seep)	1/11/2021	6.8	7.7	178.4	630	3.14	0.64
SW01	SW (Surface)	1/12/2021	7.95	8.43	215.4	87	12.2	4.31
SW02	SW (Surface)	1/12/2021	8.07	9.08	172.9	81	11.46	2.64
SW03	SW (Surface)	1/12/2021	6.92	9.12	188.4	52	10.45	1.47
GW01	GW (Shallow)	1/12/2021	7.63	7.71	213.7	825	7.38	16.7

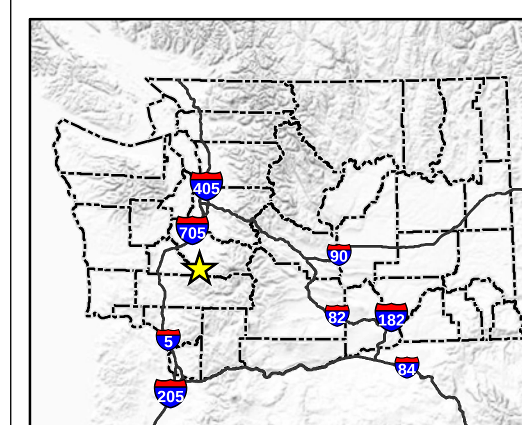
FIGURES

FIGURE 1
Eatonville Landfill Vicinity Map
Eatonville, Washington



LEGEND

- Approximate boundary of Weyerhaeuser property within the Nisqually State Park
- Major Road
- City Boundary
- Watercourse
- Waterbody



N

0 1,000 2,000
Feet

Date: April 20, 2021
Data Sources: ESRI

GSI Water Solutions, Inc.

Document Path: Y:\0171_Weyerhaeuser\Source_Figures\064_Eatonville_Landfill\Figure1_Eatonville_Landfill_Vicinity_Map.mxd, wkimmon

FIGURE 2
Eatonville Landfill Site Map
Eatonville, Washington

LEGEND

- Approximate boundary of Weyerhaeuser property within the Nisqually State Park
- Approximate location of former landfill
- Watercourse

N

0 200 400
Feet

GSI Water Solutions, Inc.

Date: April 20, 2021
Data Sources: ESRI

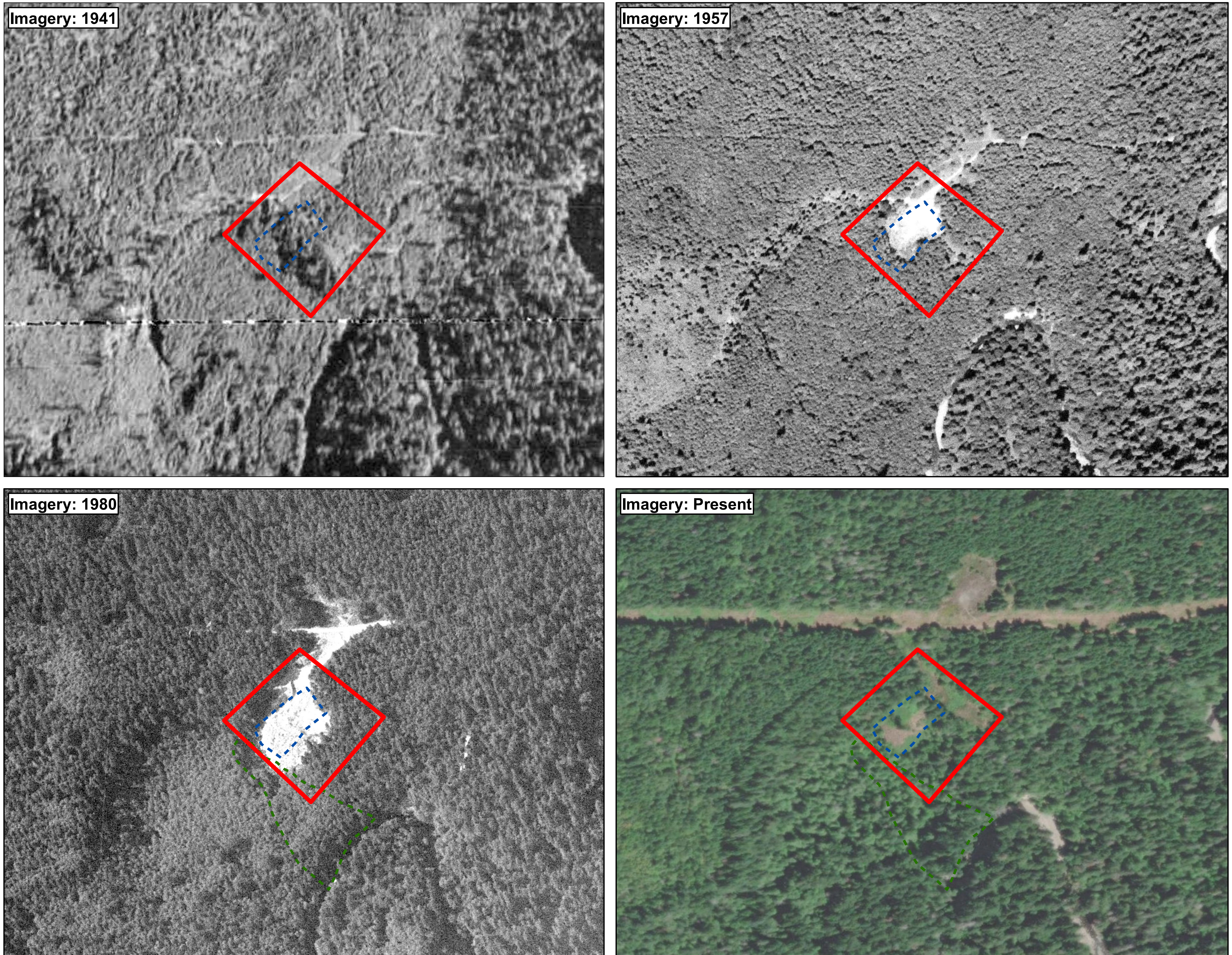


FIGURE 3
Former Eatonville Landfill Aerial Imagery Showing Former Landfill Footprint

Eatonville, Washington

LEGEND

- Approximate boundary of Weyerhaeuser property within the Nisqually State Park
- Approximate location of former landfill

N

0 200 400
Feet

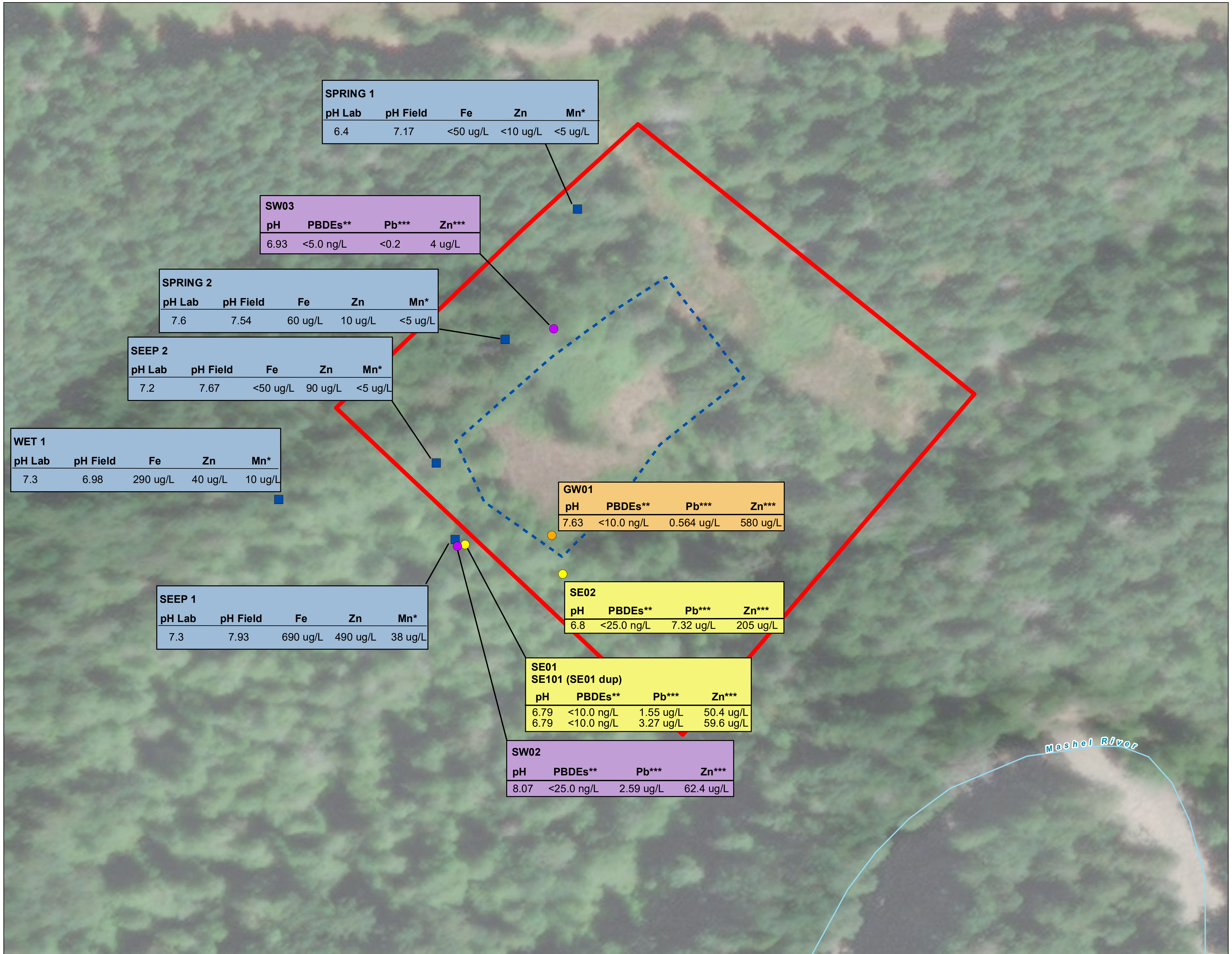
Date: April 14, 2021
Data Sources: ESRI, EDR

GSI Water Solutions, Inc.

FIGURE 4

Eatonville Municipal Landfill Previous Sampling Locations and Results: Onsite

Eatonville, Washington



LEGEND

Sample Location

- Groundwater (January 2021)
- Seep (January 2021)
- Surface Water (January 2021)
- Sampling Location (July 1996)
- Approximate boundary of Weyerhaeuser property within the Nisqually State Park
- Approximate location of former landfill
- Watercourse

NOTE

* No screening level for Mn provided.
** All PBDEs are non-detects, detection limits shown.
*** Sb, As, Ba, Cd, Cu, Ni, Vn all detected below screening levels.

N

0 50 100
Feet

Date: April 13, 2021
Data Sources: ESRI, DigitalGlobe

GSI Water Solutions, Inc.

Document Path: Y:\0171_Weyerhaeuser\Source_Figures\064_Eatonville_Landfill\Figure1_Eatonville_Landfill_Analytical_Results_Jan_2021_And_July_1996.mxd, wkimmon

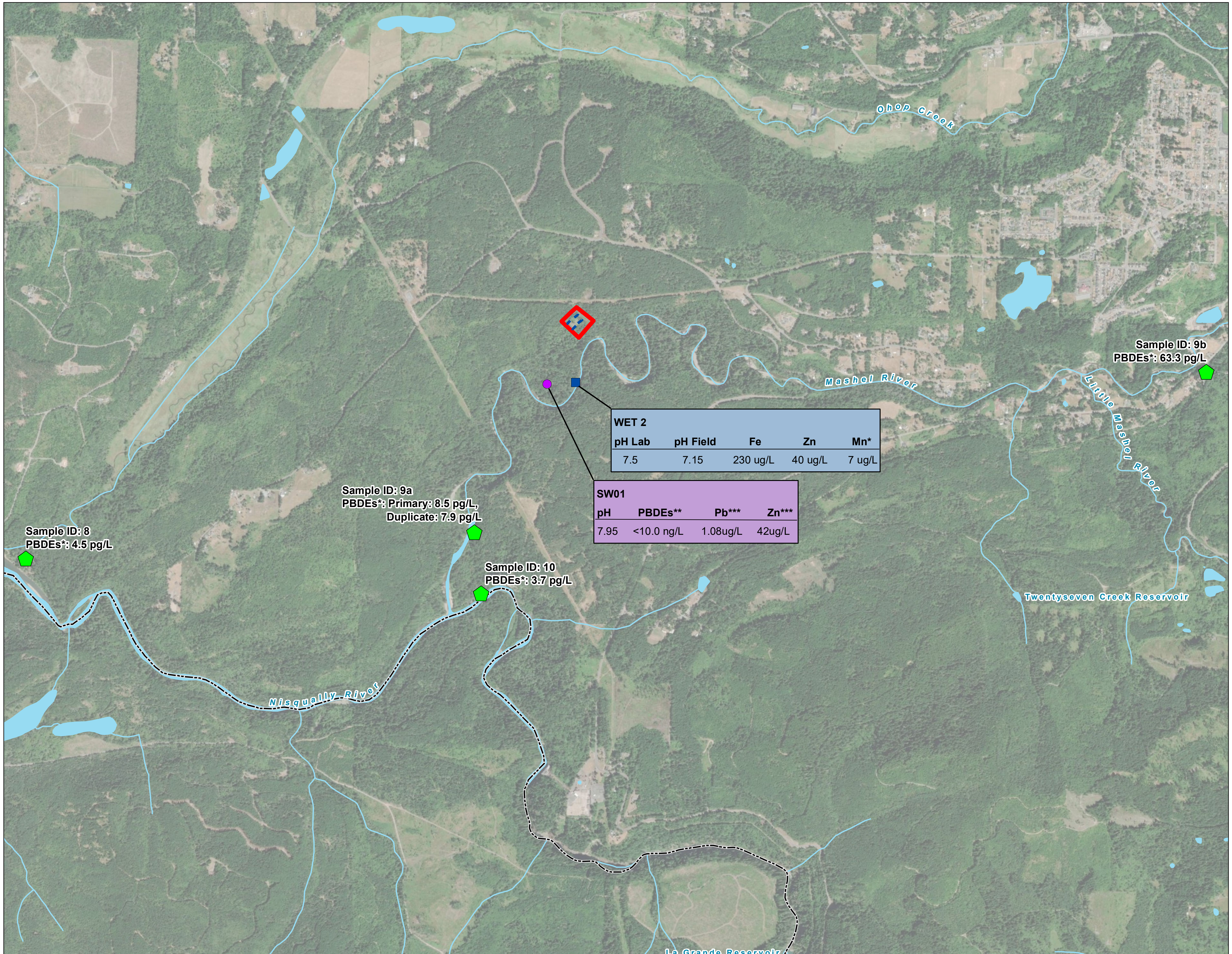


FIGURE 5

Eatonville Municipal Landfill Previous Sampling Locations and Results: Mashel River

Eatonville, Washington

LEGEND

- Surface Water Sample Location (January 2021)
- Sample Location (September 2017)
- Sampling Location (July 1996)
- Approximate boundary of Weyerhaeuser property within the Nisqually State Park
- Approximate location of former landfill
- Watercourse

NOTE

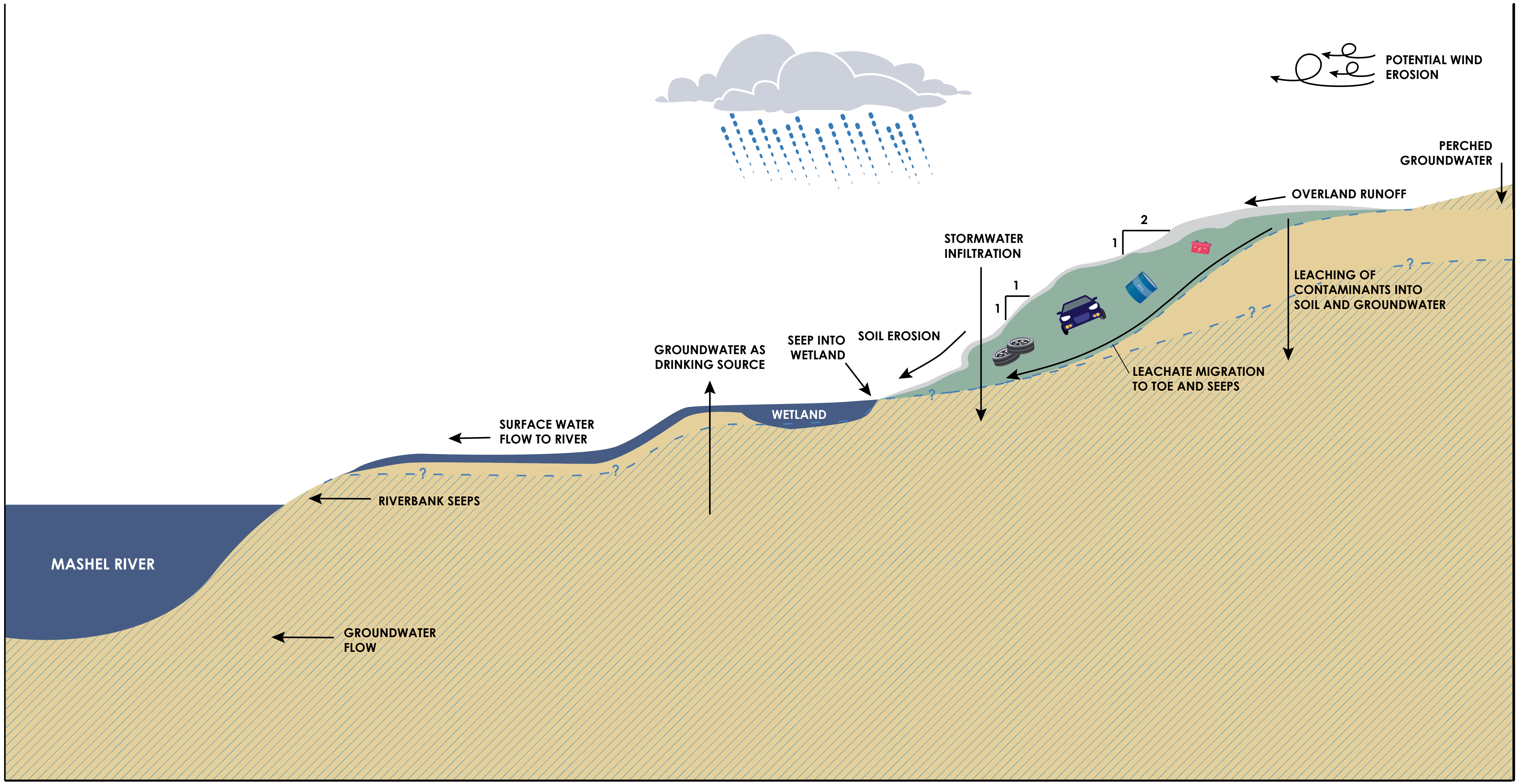
ug/L = Micrograms per liter
ng/L = Nanograms per liter
pg/L = Picograms per liter
* No screening level for Mn provided.
** All PBDEs are non-detects, detection limits shown.
*** Sb, As, Ba, Cd, Cu, Ni, Vn all detected below screening levels.

N

0 1,000 2,000
Feet

Date: September 7, 2021
Data Sources: ESRI, DigitalGlobe

GSI Water Solutions, Inc.



LEGEND

Groundwater

Existing Partial Cover

Existing Liquid and Solid Waste

Vashon Drift (coarse gravels) overlying Mashel Formation (unconsolidated layers of clays, sands, and lignite)[1,2]

[1]Schasse, 1987
[2]Walter and Kimmel, 1968

NOTES

1 ⌐ 1 Represents horizontal to vertical slope

FIGURE 6

Conceptual Site Model and Geological Cross-Section
Current and Historical Conditions
Remedial Investigation and Feasibility Study Work Plan
Eatonville Municipal Landfill

GSI Water Solutions, Inc.

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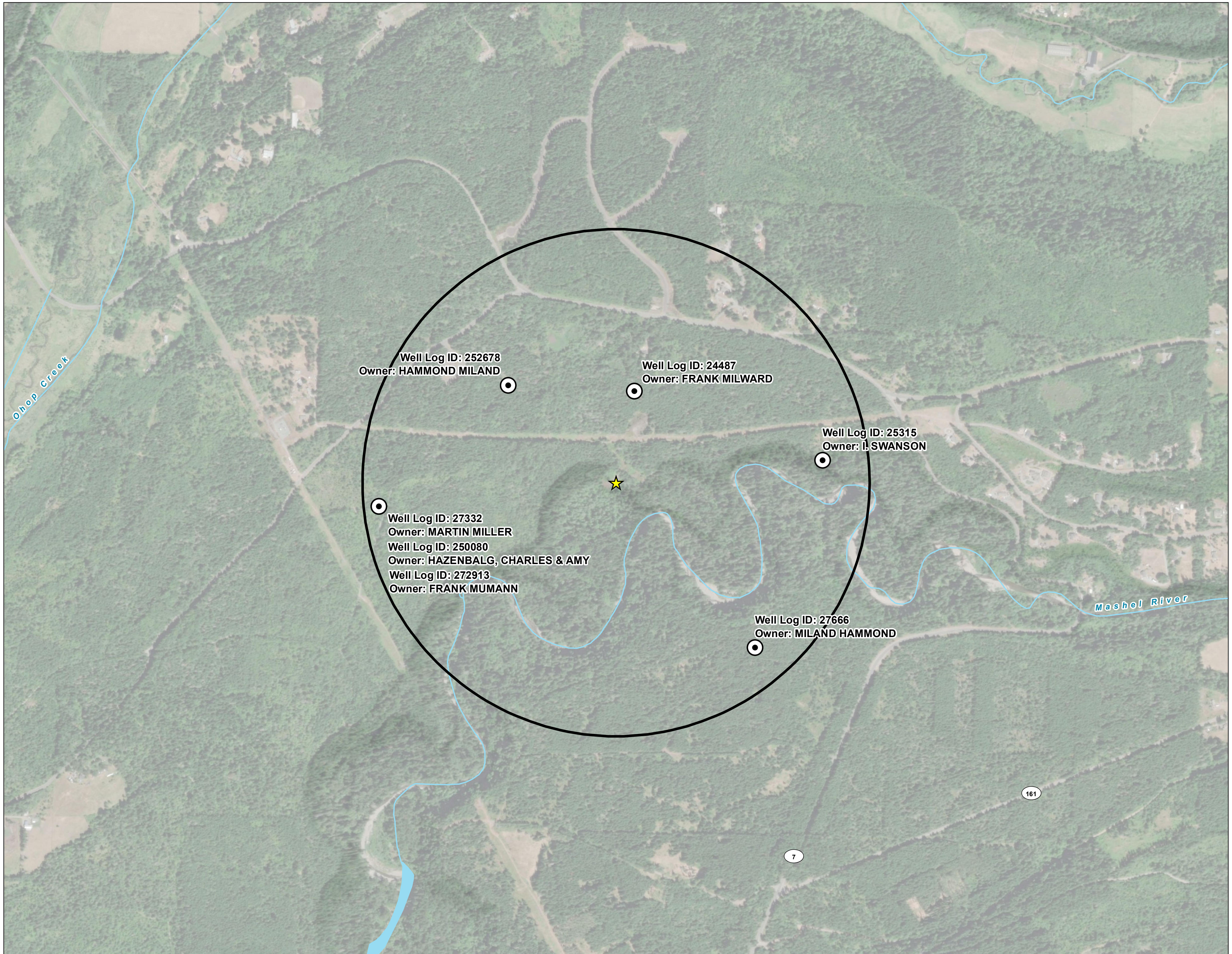

Document Path: Y:\0171_Weyerhaeuser\Source_Figures\065_Eatonville_Landfill_Investigation\Figure7_Wells_Within_Half_Mile_of_Landfill.mxd, wkimmon

FIGURE 7
Drinking Water Wells Identified Within a Half Mile of Site
Eatonville, WA

LEGEND
- Eatonville Landfill
- Well Location
- Half Mile Buffer
- Watercourse
- Waterbody

N

0 500 1,000
Feet

Date: May 5, 2021
Data Sources: BLM, ESRI, ODOT, USGS, Department of Ecology, Aerial Photo 2019

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APPENDICES