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Agency Review Draft Remedial Investigation Work Plan

3 January 2022

Prepared for

Georgia-Pacific Consumer Operations LLC
401 NE Adams Street
Camas, Washington 98607

KJ Project No. 1865004*21

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Section 1: Introduction and Background

This Work Plan (WP) presents a scope of work to initiate remedial investigation (RI) activities for the Georgia-Pacific Consumer Operations LLC (GP) Site located at 401 NE Adams Street, Camas, Washington ("the Site"). Figure 1 identifies the Site location. Washington State Department of Ecology (Ecology) identifies the Site as Facility Site ID No. 66765272 and Cleanup Site ID No. is 15156 (https://apps.ecology.wa.gov/gsp/Sitepage.aspx?csid=15156). RI activities will occur in accordance with the Model Toxics Control Act (MTCA) regulations (Washington Administrative Code [WAC] 173-340), policies, and guidance[1].

In 2019, GP ceased certain operations at the Site, including wood pulping, the communication paper machine, fine paper converting, and related equipment. Demolition plans[2] are being considered for selected structures and equipment; these activities are in the planning stages and the demolition schedule is unknown at this time. Continuing operations at the Site include production of tissue paper and paper towels from purchased pulp (Brynelson 2017). In response to cessation of certain operations, Ecology engaged GP to initiate RI activities in areas where "release or threatened release of hazardous substance(s), as defined in RCW 70A.305.020(32) and (13), respectively, has occurred" (WDOE 2021). On 12 August 2021, GP and Ecology completed Agreed Order (AO) No. DE 18201 to develop a Remedial Investigation WP and prepare a Remedial Investigation Report per WAC 173-340-350 and WAC 173-204-550. Figure 2 shows areas of the Site included in the RI scope of work: the Main Mill Area (MMA), located north of the Camas Slough; the Camas Business Center[3] (CBC), located north of the MMA; and Lady Island, located between the Camas Slough and the Columbia River.

This Draft RI WP summarizes available historical information about operations at the Site, identifies constituents of potential concern (COPCs) based on historical and continuing operations, and proposes initial data collection efforts in accessible areas. This RI WP also presents a preliminary conceptual site model (CSM) to describe current and historical site operations, the associated chemical use and history of known releases, and the potential for chemical migration and receptor exposure in environmental media. The preliminary CSM informs proposed initial data collection efforts to evaluate environmental conditions (e.g., depth to groundwater) and presence and distribution of COPCs in environmental media on Site (e.g., soil, groundwater).

[1] MTCA (Chapter 173-340 WAC) applies to cleanups in upland areas (on dry land, including groundwater) and sediment cleanups. For in-water work in freshwater and marine environments (i.e., sediment cleanups), the Sediment Management Standards apply (WAC 173-204). This distinction and terminology are presented on the Ecology website and used herein (Ecology 2021a).

[2] As stated in the AO (Section VII.H), planned demolition and construction activities at the Site that do not disturb soil are not considered remedial actions for purposes of this Order.

[3] The former Fort James Specialty Chemicals site is located within the CBC (Ecology assigned Facility Site ID No. 78452582 and Cleanup Site ID No. 2961; https://apps.ecology.wa.gov/gsp/Sitepage.aspx?csid=2961).

Analytical results from RI field activities, as well as other available data (see Section 3.4), will be compared with MTCA cleanup levels[4] for current and planned future land use as well as other applicable, relevant, and appropriate requirements (ARARs) to evaluate potential risks to human health and the environment. Data, analytical results, and evaluations will be presented in a RI report.

1.1 Purpose and Objectives

Per WAC 173-340-350[5], the purpose of a remedial investigation is to collect, develop, and evaluate sufficient information regarding a site to select a cleanup action under WAC 173-340-360 through 173-340-390. To this end, for the implementation of RI activities, the AO recognizes that this Site has operated as a mill for nearly 140 years and continues to operate as a mill in certain areas of the Site. Specifically, Section 1 of the AO states: "due to the ongoing operations at the Site, specific areas may be inaccessible and not allow for complete investigation/characterization/cleanup actions to occur at this time. The cleanup actions described in this Order shall be deferred for such locations until they become accessible. In the event that such identified locations become accessible, Remedial Investigation WP and Remedial Investigation Report addenda shall be submitted to Ecology."

As a result, the RI process at the Site is expected to be iterative and sequential – summarizing known information, identifying data gaps, conducting activities to resolve data gaps, refining the CSM, and working in successive phases until the RI objectives outlined in Section 1.1.1 are met. This RI WP represents the initial phase of RI activities. Additional iterative activities, addressed in RI WP and report addenda, will be performed in currently accessible areas as information from initial phases provides an understanding of site conditions and in currently inaccessible areas (owing to continuing manufacturing operations) as areas become accessible (e.g., after demolition activities are complete in an area) until the RI process is complete at the Site. This approach will allow for the investigation to build on available data in a step-wise manner, make decisions rooted in science and an understanding of Site conditions, and follow adaptive management principles.

Activities proposed in this Draft RI WP are recognized to be an initial, first step. Objectives for the remedial investigation are presented in Section 1.1.1; objectives for this Draft RI WP are presented in Section 1.1.2.

1.1.1 Remedial Investigation

Specific objectives of the RI include:

- Describe current understanding of Site setting based on a review of Site history, operations, and known spills or releases.
- Develop a CSM based on available information and identify data gaps.

[4] See Section 4.1 of this RI WP for discussion of MTCA Cleanup Levels.
[5] Sediment management requirements are defined in WAC 173-204.

- Collect data to describe the geological and hydrogeological setting for the Site, as well as the nature and extent of COPCs present in Site environmental media. Where environmental data are already collected through existing programs (see Section 3.4), this existing data will be used.

- Based on available data, characterize the migration pathways of COPCs and evaluate potential risk to human health and the environment in the context of current and future land use.

1.1.2 Current Work Plan

This RI process is expected to be iterative and follow adaptive management principles. Objectives specific to this RI WP include:

- Introduce a Site organization. This RI WP organizes the Site into six Site Operational Units (SOUs) to facilitate presentation of historical information. The SOUs are further organized into Operational Areas (OAs) based on historical and current operations. Operational Features are identified within each OA. This organizational structure facilitates an adaptive management approach to the RI, allowing evaluation of investigation results and refinement of a CSM to guide identification of data gaps for each OA and SOU. SOUs are presented on Figure 3 and OAs are presented on Figure 4.

- Summarize information regarding operational history, past investigations and/or cleanup activities, existing monitoring programs, and land use.

- Identify continuing manufacturing operations occurring at this time that impede safe and practical access for implementation of RI activities in certain OA. In the AO, these areas are known as inaccessible areas.

- Identify COPCs based on known historical and current operational history as well as documented or known spills or releases.

- Present a preliminary CSM based on information known at this time.

- Identify initial data gaps in accessible upland[6] areas. There is limited information available regarding Site geology and hydrogeology and their effect on fate and transport of COPCs, and limited data regarding potential presence of COPCs. Therefore, this WP focuses on upland media (e.g., soil and groundwater). Other media (e.g., surface water, sediment) will be considered in the RI process as appropriate once upland conditions and associated potential migration pathways to these media are better understood. At this time, groundwater characterization of soluble COPCs is prioritized to understand potential COPC transport from upland areas to the Camas Slough. Soil sampling is proposed during monitoring well installation and in selected locations to target a non-soluble COPC (e.g., PCBs).

[6] In the context of MTCA, "upland" refers to areas on dry land, including groundwater. This is in contrast to in-water areas (e.g., sediment).

- Propose RI activities to address initial data gaps in accessible areas. Activities proposed in this WP are guided by the current understanding of the Site based on historical records and ongoing operations.

At this initial stage of the RI, activities described in this WP focus on potential releases to soil and groundwater in upland OAs of the Site in accessible areas. When the nature and extent of COPCs in upland areas are better understood, informed decisions can be made regarding potential transfer or migration of COPCs to other media, including surface water and sediment. This initial RI phase focuses particularly on soluble COPCs in groundwater to identify potential exposure pathways to receptors and soil in OAs where insoluble COPCs were present. If there are other changes in operations and/or as demolition proceeds, additional areas may become accessible.

1.2 Project Management Strategy

The RI WP has been developed by Kennedy/Jenks Consultants (Kennedy Jenks) on behalf of GP. Ecology provides regulatory oversight of the RI in accordance with the AO (No. DE 18201). As required by the AO, key personnel involved in conducting the RI are listed below.

The project coordinator for Ecology is:

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Each project coordinator shall be responsible for overseeing the implementation of the AO.

1.3 Project Schedule

Exhibit B of the AO defines a schedule for project milestones. The first milestone in Exhibit B of the AO is a Remedial Investigation Planning Meeting; this meeting was held on 17 August 2021. The next milestone in Exhibit B of the AO is submittal of an Agency Review Draft RI WP (this WP), due within 120 calendar days following the effective date of the AO. Subsequent milestones include completing RI field work within 1 year after approval of the Final SAP/QAPP and HASP, an Agency Review Draft RI Report, and a Public Review Draft RI Report. Quarterly

Progress Reports are also required the 10th of the month after the end of each quarter. A Remedial Investigation Pre-Report Check-in Meeting is required prior to submittal of the Draft RI Report for Agency Review.

As described in Section 1.1, the RI process will be iterative. Parts of the Site are currently inaccessible, and there are initial data gaps to be addressed. To accommodate the current state of Site understanding, we propose following adaptive management principles (i.e., following a systematic approach based on defining the current understanding of site conditions, identifying and resolving data gaps, and re-evaluating and re-prioritizing Site activities). There are likely additional RI WP Addenda and associated reports to follow this initial RI WP as we refine our understanding of Site conditions and identify the next priority data gaps. With this in mind, the following timeline is anticipated:

Project Milestone	Completion Time Defined in Agreed Order	Estimated Date
Agency Review Draft *Initial* RI Work Plan	120 calendar days following effective date of the AO	7 January 2022 (e)
Completion of the *Initial* RI Field Work	12 months following completion of the Final SAP/QAPP and HASP	Second Quarter 2023 (a)
Agency Review Draft *Initial* RI Report	90 days following receipt of laboratory data (b)	Third Quarter 2023
Additional RI Work Plan Addendum(s) to follow as needed		
Agency Review Draft RI Report	90 days following receipt of laboratory data (b)	After purpose of RI met
Public Review Draft RI Report	45 calendar days following receipt of Ecology comments on Agency Review Draft RI Report	After purpose of RI met

__Notes:__
(a) This date assumes Ecology approves Final SAP/QAPP and HASP in Second Quarter 2022.
(b) It is assumed that 90 days begins when the last laboratory report associated with RI activities is received.
(c) The Remedial Investigation Pre-Report Check-in Meeting will be held prior to submittal of the Draft RI Report for Agency Review.
(d) The Public Review Draft RI Report will be prepared when the purpose of the RI has been met and after the Agency Review Draft RI Report. A Public Review Draft RI Report will not be prepared after implementation of each RI Work Plan.
(e) Ecology approved a deadline extension from 10 December 2021 to 7 January 2022 to incorporate the CBC into the Draft RI Work Plan (Ecology 2021b).

1.4 Report Organization

The remainder of this RI WP is organized as follows:

- **Section 2** summarizes information regarding the Site location and description and a summary of local geology and hydrogeology.

- **Section 3** summarizes information regarding existing monitoring programs, operational history, past field investigations and cleanup activities, and initial data gaps.

- **Section 4** presents a preliminary CSM.

- **Section 5** identifies details regarding the specific investigative activities that will be performed during this initial RI effort. This section identifies approximate sampling locations, number of samples to be collected, and analytical methods for each sample matrix. Additionally, this section references the Sampling and Analysis Plan/Quality Assurance Project Plan (SAP/QAPP) and Health and Safety Plan (HASP) developed for the site and references Kennedy/Jenks Consultants Standard Operating Guidelines (SOGs) that have been updated for this project (Appendix A).

- Figures, tables, and appendices are referred to in the above sections to support information presented in the text.

Section 2: Site Setting

Per WAC 173-340-250 (7)(c), this section presents available information about Site conditions, including location and size, topography, climate, geology, hydrogeology, and hydrology.

2.1 General Facility Information

The Site is located in southwestern Washington along the banks of the Camas Slough and Columbia River in the City of Camas, Washington (Figure 1). The Site occupies approximately 661 acres, consisting of 476 utilized acres on Lady Island and 159 acres on the upland side north of the Camas Slough. Washington State Route 14 traverses east-west through the Site at Lady Island.

2.1.1 Topography

The Site (excluding Lady Island) topography generally slopes to the south towards the Camas Slough with ground surface elevations ranging from 12 feet to 175 feet, North American Vertical Datum of 1988 (NAVD88). Burlington Northern-Santa Fe (BNSF) railroad tracks and infrastructure split the MMA into northern and southern portions. The southern portion of the MMA has generally flat surface topography. The northern portion of the MMA and the CBC area occur at a higher ground surface elevation with more topographic relief, including exposed bedrock outcroppings in some locations. The highest ground surface elevation at the Site occurs north of NW 6th Avenue at the CBC. Lady Island has generally flat surface topography at an elevation of approximately 30 feet AMSL. Figure 2 presents Site topography.

2.1.2 Climate

Camas receives an average rainfall of 51 inches annually. The majority of precipitation occurs during winter months, with December identified as the wettest month. Summers are drier with July identified as the driest month. Monthly precipitation ranges from 0.5 to 6.5 inches per month (City of Camas 2013).

Based on regional reports, the area experiences mild weather with typical winter temperatures near 40 degrees Fahrenheit and typical summer temperatures from 65 degrees Fahrenheit up into mid-80 degrees Fahrenheit (City of Camas 2013; City of Vancouver 2021).

2.1.3 Geology

Soils in this region are alluvial sediments, deposited by the Washougal and Columbia Rivers during recent and Pleistocene (ice age) periods, underlain by bedrock. Shallower, more recent alluvial deposits consist of fine-grained silt and sand. Deeper, Pleistocene alluvial deposits consist of coarse-grained sands, gravel, and cobbles with areas of abundant silt (PGWG 2003).

Based on available information from areas of the Site where previous investigations have occurred, surface soils (beneath the asphalt or concrete) are generally described as fill material consisting of gravel and sand to depths ranging from approximately 8 feet to 14 feet below ground surface (bgs; Arcadis 2016). Beneath the fill material, soil consists of varying amounts of silt, sand, and gravel. Basalt bedrock was encountered at depths ranging from 15 feet to 18 feet, and also occurs as outcrops at ground surface.

2.1.4 Hydrogeology and Hydrology

A shallow, unconfined aquifer underlies the Site in the Pleistocene alluvial deposits. Native surface soils near the Site belong to hydrologic soil groups C and D which typically have slow to very slow infiltration rates (USDA NRC 2021). Recharge to this unconfined aquifer occurs by precipitation and flow from streams and rivers under influence from tidal fluctuations in the Columbia River (PGWG 2003). Groundwater flow direction is assumed to be southward toward the Camas Slough. Based on previous investigations, groundwater has been encountered at depths ranging from approximately 3 feet to 9 feet bgs (Arcadis 2016).

Blue Creek flows north to south through the Facility. The lower portion is piped through the MMA and conveys stormwater from upstream areas beyond the Site. It also conveys flows from a tributary, Whiskey Creek, which is also piped and merges with Blue Creek just north of the MMA. Blue Creek discharges to the Camas Slough. Both creeks receive urban stormwater runoff (Georgia-Pacific 2019).

Camas Slough and the Columbia River border the Site to the South. The Columbia River is the fourth largest river in North America by volume with a total annual runoff of approximately 198 million acre-feet and year-round average flows of 275,000 cubic feet per second. It flows 1,214 miles from British Columbia to the mouth at the Pacific Ocean near Astoria, Oregon. The tidal influence of the ocean extends 126 miles upriver from the Pacific Ocean to the Bonneville Dam. Substrate in Camas Slough and Columbia River adjacent to the Site consists primarily of sand, gravel, and rock with lesser amounts of silt and clay. Previous sediment sampling investigations have experienced difficulties in collecting enough material for a sediment sample at Outfall 001 and Outfall 002 due to the rocky substrate and absence of significant fine sediment thickness due to strong currents in the Columbia River and Camas Slough (ESA 2018). Flow rates in the Columbia River experience a large seasonal fluctuation. The highest flows occur in the spring and early summer when the moisture stored as snowpack is released from the mountains (BPA 2001).

The Washougal River flows along the eastern edge of the Site to its confluence with the Camas Slough, which separates Lady Island from the MMA. The Site Wastewater Treatment Plant (WWTP) discharges treated storm and process water to the Columbia River on the south side of Lady Island.

Stormwater is discussed in Section 3.4.

Section 3: Site History and Current Operations

This section summarizes information obtained through review of paper and electronic files, documents, reports, plans, images, and correspondence. This compendium of information provides the basis for identification of Operational Areas (OAs) and the operational features (OFs) and COPC involved in processes within OAs. Documents reviewed included incident reports of spills and releases, aerial imagery, historical permits, and engineering drawings. Interviews were also conducted with GP personnel who have worked at the Site for 30 years or more in August 2019.

3.1 Operational History

Mill operations at the Site commenced circa 1883 when Henry Pittock formed the Columbia River Paper Company. Pittock, owner of the Oregonian newspaper, chose the Site owing to ample access to water to power paper-making machines to support his newspaper. In 1885, mill operations at the Site were recognized as the first in the Pacific Northwest to produce wood pulp. Following a fire in 1886, the mill was rebuilt 2 years later with two paper machines. By 1906, the mill produced paper bags in the northern portion of the mill known as the Bag Factory. The mill expanded operations and by 1914 became one of the largest paper producers in the world (City of Camas 2015).

In the 1940s, to support efforts during World War II, machine shops at the mill manufactured parts for Liberty ships assembled at shipyards in nearby Portland and Vancouver. Following the war effort, the Central Research and Technical Department formed in 1946 and two laboratory buildings were constructed in the 1950s at the Camas Business Center (CBC). These facilities became known as the Central Research Division in 1960. Research involved pesticides, energy production, crop yields, and synthetic pulp production. The research laboratory shut down in 1997 (Joner 2010).

Other additions to the Site over time include a wastewater treatment plant (WWTP) located on Lady Island. Operational features and improvements to the WWTP include a primary clarifier[7] constructed in 1968, the South Aerated Stabilization basin[8] (ASB) added between 1956 and 1961 (based on historical aerials; South ASB[9]) initially as a sulfite liquor lagoon and converted to an ASB in 1975, and the North ASB added in 1977 for secondary wastewater treatment. The WWTP captures and treats process water and stormwater[10] that is conveyed from the mill via a pipeline under the Camas Slough. Treated water discharges to the Columbia River under a National Pollutant Discharge Elimination System (NPDES) Waste Discharge Permit (see

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[7] A clarifier is generally used to remove solid particulates or suspended solids from liquid.

[8] An aeration basin (also known as an ASB) is a pond-like structure with aeration to promote treatment (biochemical oxidation) of wastewater.

[9] The South ASB was originally a sulfite liquor lagoon. It was refurbished in 1975 and turned into an aerated lagoon.

[10] Based on available documentation (Georgia-Pacific Consumer Products 2011, 2017c, Ecology 2020a,b), Site stormwater has been generally captured and treated with process wastewater. Improvements have been made over the mill's history to improve capture of stormwater from mill operational areas. At this time, known industrial stormwater associated with the Site is captured and treated by the WWTP.

Section 3.4). Solids from the primary clarifier are either disposed at the Lady Island Landfill (LILF), which operates as a limited purpose landfill under Clark County Public Health Department Permit Number PT 0006096 (LILF permit), or beneficially reused offsite.

From 1981 to 1984, mill operations underwent a modernization project involving demolition of buildings containing outdated production processes and equipment, plus the addition of new machines to manufacture communication papers for copiers and printing. In 2000, GP, now a subsidiary of Koch Industries Inc., acquired the Site and mill operations.

Recently, in November 2017, GP announced plans to cease certain mill operations at the Site, including the communication paper machine, fine paper converting assets, pulping operations, and related equipment. In 2019, GP completed shutdown of these operations. Currently, mill operations continue to produce tissue paper and paper towels, using pulp purchased from off-site sources (Brynelson 2017).

3.2 Paper Making Process

Generally, the paper making process shown on Figure 5 converts pulp fibers (separated from wood) into paper products. Summarily, this section describes processes and operations used in the past or present at the mill to produce paper products.

Historically, paper making at the mill began at the woodmill. Logs delivered to the mill were sent to the Woodyard, where they were processed by a woodmill to remove bark[11] and produce wood chips[12]. These wood chips were conveyed to the pulping area where they underwent a chemical pulping process that separates cellulose fibers from the wood chips to produce "brown stock." Next, the brown stock was sent to the bleaching area where it underwent bleaching and delignification processes to yield a whiter, "bleached pulp." Bleached pulp was then sent to the Paper Mill where it was converted to a continuous roll of paper called a "parent roll." Depending on the final use of the paper, the parent roll may have undergone a finishing step. Finally, the parent roll was cut into the desired final size in the Converting area to produce a final product.

As of 2019, the woodmill/woodyard, pulping, and bleaching operations ceased at the mill. Continuing operations at the mill involve use of purchased pulp (from offsite sources) at the Paper Mill for finishing and converting into paper products such as paper towels. Processes used at the mill are described in more detail below.

Woodmill

The woodmill historically served as the handling area for logs staged in the adjacent Camas Slough. Whole, untreated logs were initially processed into wood chips at the original woodmill (visible in Image 1 below), formerly located in the eastern portion of the Woodyard to the northwest of the dock warehouse. It was replaced in 1947 by a woodmill in the western portion

[11] Removal of bark occurs in machinery known as a debarker. Removed bark provides a fuel to generate steam for other mill operations.

[12] Wood (or wood chips) used to make pulp contain three main components (apart from water): cellulose fibers (primary component for papermaking), lignin (a natural organic polymer that binds cellulose fibers to provide structure in wood) and hemicelluloses (polysaccharide, a carbohydrate composed of monosaccaharides, or simple sugars).

of the Woodyard (seen in Image 2). Both the first woodmill and second woodmill were demolished in 2003. After demolition of the woodmills, log processing ceased on site and wood chips arrived by truck and barge; chips were briefly received via railcar during construction of the truck dumps. The wood chip piles provided feedstock for pulping operations until the cessation of pulping operations in 2018-2019.

Image 1. Aerial Imagery from 1948 showing the first woodmill

Image 2. Aerial Imagery from 1980 showing the second woodmill

Pulping

Pulping operations at the mill used a chemical process to separate (cellulose) fibers from wood chips by dissolving the lignin that holds the fibers together. Chemical pulping produces brown stock (pulp) in pressure vessels called “digesters” in a process commonly called “cooking”. Over its history, prior to cessation of pulping operations in 2018-2019, both the sulfite and Kraft processes produced pulp at the mill. After pulp production in the digesters, a mechanical washing process separates the cooking chemicals from the pulp.

The sulfite pulping process was the first pulping process used at the mill. In the sulfite pulping process, cellulose (wood) fibers are separated from the wood chips by dissolving lignin and hemicellulose. Generally, the sulfite process refers to several methods that involve acidic cooking liquors containing bisulfite (HSO_3). The sulfite process uses sulfur dioxide (SO_2) dissolved in water to yield an acid (sulfurous acid) to extract lignin from wood in digesters using high heat and pressure. From circa 1890 to 1950, the only commercially important sulfite pulping process used a cooking liquor prepared from sulfurous acid and limestone (USEPA 1978). In the 1950s, modifications to the sulfite process involved use of other soluble bases, such as sodium or magnesium (Magnefite) instead of calcium (limestone). In its operational history, sulfite pulping at the mill used calcium, magnesium, and sodium as soluble bases.

Pulping using the Kraft process began at the mill in 1926 (Lacamas Magazine). The Kraft pulping process uses a chemical mixture of water, sodium hydroxide, and sodium sulfide (called “white liquor”) along with heat and pressure to separate (cellulose) fibers from wood chips. Multiple “cooking” steps break down the cellular components of wood. The Kraft process yields pulp (fiber) and black liquor[13]; white liquor converts to black liquor during the cooking process. Before proceeding to the bleaching step, the pulp is washed[14] to separate the pulp from the black liquor.

After washing, the black liquor enters a chemical recovery process. This chemical recovery process is a defining feature of the Kraft process and recovers spent “cooking” chemicals for reuse (i.e., white liquor). The black liquor from pulp washing (called “weak black liquor”) is collected in tanks and pumped through evaporators and concentrators to remove water and increase the black liquor solids content. The collected black liquor, which has a high energy value, is burned in a recovery boiler. The heat in the recovery boiler is used to produce steam for processes throughout the mill. A liquid smelt[15] is removed from the recovery boiler and converted to “green liquor” by addition of a weak caustic solution in a “smelt dissolving tank”. Lime is added to the green liquor to produce white liquor and lime mud, completing the chemical recovery cycle.

The Lime Kiln supports the Kraft process by providing quicklime. Lime mud (calcium carbonate, $CaCO_3$) is converted to quicklime (calcium oxide, CaO) in the lime kiln using heat, mechanical

[13] Black liquor contains inorganic substances from the white liquor used in the cooking process; lignin, hemicellulose, and cellulose degradation products; soaps; and organic acids dissolved from the wood chips during pulping. Inorganic components of black liquor include sodium hydroxide (NaOH), sodium carbonate (Na_2CO_3), sodium sulfide (Na_2S), sodium sulfate (Na_2SO_4) and other sodium salts combined with organic matter.

[14] After the Pulp Mill was constructed during the Mill Modernization Project (1981 to 1984), pulp washing occurred at the Pulp Mill.

[15] Smelt contains mainly sodium sulfide (Na_2S) and sodium carbonate (Na_2CO_3).

movement of materials, and airflow in a process called calcination. Quicklime provides a base to counteract the (sulfurous) acid condition in the sulfite pulping process.

Kraft pulping operations at the mill ceased in April 2018 (Ecology 2020a). Based on historical aerials, sulfite pulping operations at the mill ceased by the 1980s.

Bleaching

In the bleaching process, brown stock completes one or more cycles of low pH bleaching, washing, and high pH extraction, until pulp achieves the desired level of brightness. Unbleached pulp (brown stock) is brown in color due to the presence of residual lignin and residual weak black liquor. Originally, not all pulp at the mill was bleached; pulp at the Pulp Mill reportedly was not bleached and was used to manufacture brown paper products.

The bleaching process was completed in the K4 Bleach Plant, K5 Bleach Plant, Sulfite Pulp Bleaching, and Kraft Pulp Bleaching. There are separate bleaching operations to process pulp from the sulfite pulping process and pulp from the Kraft pulping process.

In the sulfite pulp bleaching process, hydrogen peroxide is used to effectively remove lignin from sulfite pulps (NCASI 2013). In contrast to the Kraft pulp bleaching process, the sulfite pulp bleaching process uses less chemicals, is less reliant on chlorine or chlorine dioxide, and removes less lignin.

Two types of bleaching processes were used in the Kraft process at the mill: chlorine bleaching and elemental free chlorine (ECF) bleaching. In the chlorine bleaching process, elemental chlorine is the bleaching agent. When chlorine reacts with the high organic content of the brown stock, polychlorinated dibenzodioxin and polychlorinated dibenzofuran compounds (PCDD/PCDF) can form as unintended byproducts. To reduce production of PCDD/PCDF, mill bleaching operations transitioned to the ECF process in 2000. In the ECF bleaching process, the bleaching and delignification agent is chlorine dioxide (ClO_2) rather than elemental chlorine and significantly less chlorinated organic matter is generated compared to chlorine bleaching. To supply ECF bleaching agent, chlorine dioxide was manufactured at the R8 plant using sulfuric acid, methanol, and sodium chlorate.

Kraft bleaching operations at the mill ceased in April 2018 (Ecology 2020a). Based on historical aerials, sulfite bleaching operations at the mill ceased by the 1980s.

Paper Mill

At the Paper Mill, bleached pulp moves through presses and dryers to form large rolls of paper (parent rolls). Generally, this mechanical process involves three stages: 1) stock preparation, 2) wet end, and 3) dry end (NCASI 2013). Stock preparation prepares the bleached pulp for the paper machine and may include a repulping system where dry pulp and excess paper from the final, cut product are repulped for reuse. In the wet end stage, pulp is applied to a wire mesh and undergoes multiple pressing and drying steps. In the dry end stage, pulp undergoes additional drying, pressing between rolls to manage sheet thickness and smoothness, and winding into a parent roll. The parent rolls are cut (see “Converting” below) and may be treated with coatings or other chemical additives (see “Finishing” below) depending on the grade of paper and the product being produced. Pulp continues to be used to produce parent rolls at the Mill (using pulp purchased from off-site sources).

Finishing

The finishing step is an optional chemical process dependent on the use of the final product. An example of paper treatment operations in the mill's history is the treatment of paper to be used as food wrapping. Examples of chemicals used for this purpose include diphenyl, which was used primarily as a fungicide for papers used in food wrapping for citrus fruit, and ethoxyquin, which was used in papers specifically to reduce browning (scald) in pears. Other known finishing processes are described in Section 3.5 as applicable.

Converting

The final step in the paper making process is the converting step. At this stage, parent rolls are converted into smaller sizes depending on the type of paper product being produced. This step is primarily a mechanical step; chemical use during this step involves glues to produce cores for products such as paper towels. The mill produced various paper products over its history with different converting and finishing requirements, such as paper towels, tissue paper, coffee filters, envelopes, food wrap, card stock, newspaper, communication paper, and bags. Converting operations continue at the Mill.

Power Boilers

Historically, there have been multiple Power Boilers supplying steam and/or power for mill operations. Power Boilers generate steam by using heat generated by combusting fuel in a furnace chamber. Power Boilers are typically able to burn multiple types of fuel sources, including coal, natural gas, oil, and wood waste (hog fuel).

There was a central Power House at the mill that included a steam plant, turbines and multiple power boilers. These power boilers included:

- No. 1 through No. 4 Hog Fuel Boilers: four power boilers that were primarily fueled by hog fuel, but also had the capability to use fuel oil and natural gas. They were reportedly decommissioned in 1988 and demolished by 1990.

- No. 3 Power Boiler: this power boiler was fueled by natural gas and was decommissioned in 1988 and demolished by 1990.

- No. 3 Combination Boiler: the existing (but inactive) Power Boiler in this area was fueled by hog fuel. It was decommissioned in October 2020.

- No. 4 Power Boiler: the existing (but inactive) Power Boiler in this area was fueled by fuel oil. It was decommissioned in 2020.

Historically, the Power House provided steam and electricity for mill operations. The Power House is no longer operational.

Additional Power Boilers were located in other areas of the mill. The No. 5 Power Boiler is located in the northwestern portion of OA-B1 and is no longer operational as of September 2021. The No. 6 Power Boiler, located in the western portion of OA-C1, is the only active Power Boiler and continues to generate steam and electricity for ongoing mill operations. The No. 6 Power Boiler is powered by natural gas.

Other boilers, called recovery boilers, also produce steam for use in the mill. The recovery boilers use concentrated black liquor as the primary fuel and are a critical piece of the Kraft pulping chemical recovery cycle (see "Pulping" above).

3.3 Past, Present, Future Land Use

As described in Section 3.1, the mill has operated since 1883 under various ownership and is currently owned and operated by GP. The mill property is currently designated by the City of Camas as Industrial land use and zoned for Heavy Industrial land use (City of Camas 2016, 2021a), and GP intends to continue heavy industrial operations at the mill for the foreseeable future.

MTCA (WAC 173-340-200) defines industrial as properties that are "zoned for industrial use by a city or county conducting land use planning under chapter 36.70A RCW (Growth Management Act)." The City of Camas completes their planning under the Growth Management Act (City of Camas 2021b) and as described above, the City of Camas identifies the mill property zoning as heavy industrial and designated for industrial land use. Therefore, per WAC 173-340-200, the mill property is considered an industrial property under MTCA.

3.4 Ongoing Monitoring Programs

There are monitoring programs for compliance with existing permits and programs that pre-date the AO and will continue to occur in parallel with RI activities. Summaries of existing monitoring programs and monitored parameters are described below and presented in Table 3.

<u>National Pollutant Discharge Elimination System (NPDES) Waste Discharge Permit</u>

The mill's wastewater treatment plant (WWTP) operates under NPDES Waste Discharge Permit No. WA0000256. The WWTP treats process wastewater and stormwater[16] flows from the Woodyard, Main Mill Areas, and Ancillary Area (conveyed through the K6 sewer, K7 sewer, process sewer, and acid sewer; see Figure 6)[17]. As summarized in Table 3, monitoring of treated process wastewater effluent and stormwater as well as sediment (in the vicinity of

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[16] As noted in the Storm Water Monitoring Plan (Georgia-Pacific Consumer Operations LLC 2017c), mill runoff and non-mill runoff are commingled and transported together, and ultimately treated by the WWTP.

[17] Until demolition activities in 2021, the WWTP also treated process wastewater and stormwater flows from the CBC.

Outfall 001[18] and Outfall 002[19]; ESA 2018) and sludge occurs through the ongoing NPDES monitoring programs. Sediment samples have been collected to support dredging activities in the Camas Slough and continue to be collected through the existing NPDES permit. The WWTP is active and continues to operate, and RI activities are not proposed for active WWTP areas at this time. However, monitoring data collected through existing programs will be evaluated together with analytical data collected during the RI (see Section 5).

Spill Prevention, Control, and Countermeasure (SPCC) Plan

Spill response follows the SPCC Plan (Georgia-Pacific 2019) prepared in accordance with the requirements of the SPCC regulations (40 CFR 112) and the mill's NPDES Waste Discharge Permit. The SPCC Plan maintains a comprehensive list of bulk oil storage tanks, mobile/portable containers (e.g., drums/totes), and oil-containing equipment and describes preventative measures for routine handling of products, countermeasures for spill response and cleanup, disposal methods, and reporting requirements. Regular inspections occur in accordance with the SPCC Plan. Incident and spill response documentation was reviewed to define the operational features and was one source of information used to define COPCs for an area (see Section 3.5).

LILF Clark County Public Health Department Permit

Dewatered solids from the primary clarifier and No. 3 Power Boiler ash (prior to decommissioning) are either managed at the Lady Island Landfill (LILF) or beneficially reused offsite. The mill operates the LILF as a limited purpose landfill under Clark County Public Health Department Permit Number PT 0006096 (LILF permit). In accordance with the LILF permit, groundwater monitoring is completed quarterly, and seep inspections are completed annually. Seeps have been identified previously but have not been identified for at least 3 years (2019 to 2021). Leachate from this landfill is collected and sent to the WWTP for treatment. The LILF remains regulated by Clark County, continues to receive dewatered wastewater solids, and is considered inaccessible for RI activities at this time.

3.5 Site Operational Units (SOUs) and Operational Areas (OAs)

Based on the information review, for the purpose of developing the RI approach, this WP organizes, presents, and describes historical and recent Site information as follows:

- Six (6) Site Operational Units (SOUs; Figure 3) based on location and historical and continuing mill operations.

[18] Outfall 001 is the primary outfall for the Waste Discharge Permit and discharges treated mill wastewater (Ecology 2020b). There is strong turbulence in the river where Outfall 001 discharges (Ecology 2008).

[19] Discharge at Outfall 002 contains Lacamas Lake water, mill water treatment filter backwash, and stormwater from the City of Camas (Ecology 2008, 2020).

- Sixteen (16) Operational Areas (OAs), distributed across the SOUs based on historical and continuing processes and operational features (see Figure 4, which also highlights locations of currently inaccessible areas related to continuing operations).

- Operational features within each OA based on information about equipment and processes conducted (see Figures 7 and 8) as well as documented spills and releases. These operational features are focused on historical or current activities, as well as spills or releases with the potential to affect human health or the environment, and therefore, may not cover every building at the mill.

This organization approach for the RI facilitates evaluation of prior investigation results, development of a preliminary CSM and identification of initial data gaps for each OA and SOU. COPCs are summarized by Operational Feature in Table 1.

As shown on Figures 3 and 4, SOUs and OAs consist of the following

SOU	OAs
A – Woodyard	A1 – Woodmill
B – Main Mill Area - North	B1 – Pulping B2 – Power House B3 – Bleaching B4 – Finishing/Coatings - North B5 – Specialty Minerals B6 – Warehouse/Product Storage – North
C – Main Mill Area - South	C1 – Finishing/Coatings – South C2 – Warehouse/Product Storage – South C3 – Operational Support C4 – Pump Houses C5 – Wooded Area
D – Lady Island	D1 – Wastewater Treatment Plant D2 – Dredge Spoils Area
E – Ancillary Area	E1 – Ancillary Area
F – Camas Business Center (CBC)	F1 – CBC Area

The following sections provide known information by OA (in each SOU) about:

- Remaining and former structures (where operations occurred)

- Historical and current operations (what was done or continues to occur, and area accessibility for RI activities at this time)

- Chemical usage in operations (what was used)

- Documented incidents or spills (what was released)

- Previous field investigations (were investigation activities conducted in response to a spill; see Figures 9 and 10, Table 2)

- Ongoing monitoring programs (media already monitored through another regulatory program).

Based on this known information, COPCs and initial data gaps are identified for each operational feature. At this time, groundwater characterization of water soluble COPCs is prioritized to understand potential COPC transport from upland areas to the Camas Slough, and therefore initial data gaps focus on water soluble COPCs in groundwater. Where insoluble COPCs are identified for an operational feature, initial data gaps will include presence of insoluble COPCs in soil. Soil sampling may also be proposed opportunistically (i.e., during monitoring well installation).

3.5.1 SOU-A: Woodyard

The woodyard abuts the banks of the Camas Slough south of the railroad tracks. SOU-A contains OA -1 (Woodmill) where log processing occurred to provide wood chips and storage of wood chips for use in the pulping and papermaking operations.

Image 3. Aerial Imagery of SOU-A

3.5.1.1 OA-A1: Woodmill

Operational features in OA-A1 are presented in the following sections. Process wastewater and stormwater from this area is collected by the grit sump and conveyed to the K7 sewer for treatment at the WWTP.

3.5.1.1.1 First Woodmill and Wood Chip Piles

The First Woodmill was located in this area before it was demolished. This area is largely unpaved and contained remnant wood chips up to approximately 16 feet bgs. GP has transported and used the majority of wood chips remaining after cessation of pulping operations at other regional facilities. The hog fuel conveyor and chip screen room structures remain but are included in the demolition plans being considered. There are also two out-of-service aboveground storage tanks (ASTs; 250 gallons and 55 gallons) that formerly contained hydraulic fluid. Operations in this area have ceased. This area is accessible, pending demolition activities.

Chemicals used in this operational feature include petroleum hydrocarbons, which fueled and lubricated machinery used in the discontinued log processing and chip pile management operations. There are documented records[20] of small, discrete diesel fuel and lube oil releases from machinery and vehicle traffic. Site investigation and/or cleanup activities were completed as part of the original spill response.

COPCs associated with operations and/or documented spills/releases include petroleum hydrocarbons. PCBs are also a COPC per Table 830-1 (at WAC 173-340-900) owing to the presence of heavy oil such as lube oil and hydraulic fluid. See Section 3.4 for information regarding ongoing monitoring programs that include this area.

<u>Initial Data Gaps in Accessible Areas:</u>

- Depth to groundwater and groundwater flow direction
- Geologic conditions
- Presence of petroleum hydrocarbons in groundwater
- Presence of petroleum hydrocarbons and PCBs in soil.

3.5.1.1.2 Dock Warehouse

The inactive dock warehouse provided product storage for pulp and paper and shipped product. The dock warehouse is included in the demolition plans being considered. This area is accessible, pending demolition activities.

There are no known chemicals used for operations at the Dock Warehouse. The Dock Warehouse was previously used for chemical storage; there are no known chemical releases of stored chemicals. There is a documented record of a process sewer sump overflow when a pump failed in February 2002[21]. In the notification to Ecology, it was reported that less than half a cup of oil was spilled (Fort James Camas LLC 2002a). Subsequently, a corrective action plan

[20] The following spills documented in Appendix A of the AO occurred in this area: 4 June 2001 and 7 August 2000.

[21] The following spills documented in Appendix A of the AO occurred in this area: 8 February 2002. The AO states the spill occurred at an oil / water separator. Per mill records, the overflow occurred at a process sewer sump (Fort James Camas LLC 2002a).

was completed, including a spill response and cleanup, system repair and redesign, and installation of a high-level alarm (Fort James Camas LLC 2002b).

There are no COPCs associated with operations and/or unresolved documented spills/releases in this area. See Section 3.4 for information regarding ongoing monitoring programs that include this area.

Initial Data Gaps in Accessible Areas:

- None. While there is limited information available regarding geology and hydrogeology specific to this operational feature, COPCs are not identified for this area and geology/hydrogeology information will be obtained in nearby operational features (see Section 5).

3.5.1.1.3 Second Woodmill

The Second Woodmill was located in this area before it was demolished. Existing structures include the rail car chip unloader, chip truck tippers, and an aboveground wood chip conveyor structure. This area is accessible, pending demolition activities.

Chemicals used in this operational feature include petroleum hydrocarbons associated with machinery used in the woodmill. There are documented records of small, discrete oil releases in this area[22]. Site investigation and/or cleanup activities were completed as part of the original spill response.

COPCs associated with operations and/or documented spills/releases include petroleum hydrocarbons. See Section 3.4 for information regarding ongoing monitoring programs that include this area.

Initial Data Gaps in Accessible Areas:

- Depth to groundwater and groundwater flow direction
- Geologic conditions
- Presence of petroleum hydrocarbons in groundwater.

3.5.1.1.4 Former Cat Shop, Electric Shop, and Underground Storage Tanks (USTs)

A former Cat shop, electric shop, and USTs located in this area supported the woodmills. Structures remain in this inactive area, including the Cat shop, an office and parts storage building, and a maintenance shop; these structures are included in the demolition plans being considered. Two USTs in this area were removed in 1985: a 2,000-gallon UST containing gasoline; and a 600-gallon UST containing degreaser solvent. This area is accessible, pending demolition activities.

[22] The following spills documented in Appendix A of the AO occurred in this area: 22 January 2001.

Chemicals used in this operational feature include diesel fuel, gasoline, and degreaser solvents stored in the USTs and/or used in the shops. There are documented records of spills in this area associated with vehicular traffic[23]. For example, in 2015, during sewer line trenching activities, petroleum hydrocarbons were observed between the Cat Shop and the Wood Chip Pile. GP advanced soil borings and collected soil and groundwater samples in the area for analysis of TPH in the gasoline range (TPHg), diesel range (TPHd), and heavy oil range (Figure 9; Arcadis 2016, Georgia-Pacific Consumer Operations LLC 2016). Approximately 20 cubic yards (CY) of soil containing petroleum hydrocarbons were removed and disposed of offsite.

COPCs associated with operations and/or documented spills/releases include petroleum hydrocarbons and volatile organic compounds (VOCs) related to solvent use. See Section 3.4 for information regarding ongoing monitoring programs that include this area.

Initial Data Gaps in Accessible Areas:

- Depth to groundwater and groundwater flow direction
- Geologic conditions
- Presence of petroleum hydrocarbons and VOCs in groundwater
- Presence of petroleum hydrocarbons and VOCs in soil.

3.5.2 SOU-B: Main Mill Area – North

MMA – North (SOU-B) is located south of Northwest 6th Avenue and north of the railroad tracks. MMA-North encompasses six OAs: pulping, Power House, bleaching, finishing/coating, Specialty Minerals, and product storage.

[23] The following spills documented in Appendix A of the AO occurred in this area: 30 June 1999 and 1 July 1999.

Image 4. Aerial Imagery of SOU-B

3.5.2.1 OA-B1: Pulping

Operational features in OA-B1 are presented in the following sections. Process wastewater and stormwater in this OA is collected by the K6, K7, acid, and process sewers (see Figure 6 for approximate coverage areas) and conveyed to the WWTP for treatment.

3.5.2.1.1 Kraft Mill

The Kraft Mill was part of the Kraft pulping process. Structures remain in this area, including the Kraft Mill. However, operation of the Kraft Mill ceased in April 2018 and this area is inactive. The area is inaccessible for RI activities at this time due to the density of structures and below-grade features (e.g., basements).

Chemicals used in this operational feature include white liquor used in the cooking of wood chips during the chemical pulping. There are documented records of black liquor spills (spent cooking chemicals) in this area. In 2014, in response to an observed release of black liquor at the Kraft Mill, GP completed three borings and monitored pH in groundwater encountered (Figure 9; Arcadis 2015). No further action was recommended after the investigation.

COPCs associated with operations and/or documented spills/releases at the Kraft Mill include sulfur, sodium, and petroleum hydrocarbons. See Section 3.4 for information regarding ongoing monitoring programs that include this area.

Initial Data Gaps in Accessible Areas:

- Depth to groundwater and groundwater flow direction

- Geologic conditions
- Presence of petroleum hydrocarbons, sulfur, and sodium in groundwater
- Current pH of groundwater (as an indicator for black liquor).

3.5.2.1.2 Black Liquor Area

ASTs storing black liquor located in this area supported the nearby Kraft Mill. This area is inactive. Black liquor storage ASTs and a green liquor clarifier remain but are included in the demolition plans being considered. The area is currently inaccessible for RI activities due to the density of structures and below-grade features (e.g., basements).

Chemicals in this operational feature include inorganic components of black liquor and green liquor. There are documented records of black liquor releases and K6 sewer spills in this area[24]. An investigation was completed in response to an observed release of black liquor in the No. 4 Swing Tank area in August 2011. Three borings were advanced; soil cores were tested for pH and a groundwater grab sample was collected (where encountered) and a pH and conductivity measurement were collected (Figure 9). Based on the findings of the investigation, no additional actions were recommended (Arcadis 2012). In 2018, there was a black liquor release of 154,000 gallons from an AST. Spilled liquids were diverted to the process sewer for treatment by the WWTP and bulk material that could be collected was disposed of off-site (Georgia-Pacific 2018c, d).

COPCs associated with operations and/or documented spills/releases include petroleum hydrocarbons, sulfur, and sodium. See Section 3.4 for information regarding ongoing monitoring programs that include this area.

Initial Data Gaps in Accessible Areas:

- Depth to groundwater and groundwater flow direction
- Geologic conditions
- Presence of petroleum hydrocarbons, sulfur, and sodium in groundwater
- Current pH of groundwater (as an indicator for black liquor).

3.5.2.1.3 Former Bag Factory

Constructed in 1906, the bag factory produced paper bags until it was demolished, and the Pulp Mill (OA-B1) was constructed during the Mill Modernization Project (1981 to 1984). This area is inactive. Existing structures in this area include the Pulp Mill and multiple ASTs, which are empty and out of service. The area is inaccessible for RI activities at this time due to the density of structures and below-grade features (e.g., basements).

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[24] The following spills documented in Appendix A of the AO occurred in this area: 10 October 2014, 21 April 2014, 18 September 2012, 26 August 2011, 22 September 2002, 2 August 2001, 15 May 2001, 7 July 2000, 8 May 2000, 7 December 1998, and 22 October 1997.

Chemicals used in this operational feature include petroleum hydrocarbons. There are documented records of a black liquor release at the aboveground Filtrate Tank No. 2[25]. Mill staff observed liquid seeping from the base of one of the filtrate ASTs and subsequently observed weak black liquor in the underlying engineered fill material within the tank ringwall. GP excavated soil to approximately 1.5 feet bgs within the ringwall and pumped the encountered liquid to the WWTP for treatment. Weak black liquor leaks were then observed in two additional filtrate ASTs, which were contained by the concrete pad and discharged to the process sewer for treatment at the WWTP. Buildings, structures, and utilities (above and below ground) are dense in this area, and soil borings were advanced where feasible to monitor pH and conductivity (Figure 9). Measurements were also taken in Blue Creek upgradient and downgradient of the filtrate tank area. The investigation concluded that soils in the saturated zone, groundwater, and Blue Creek had not been impacted by the filtrate tank release. (Arcadis 2011).

COPCs associated with operations and/or documented spills/releases include petroleum hydrocarbons, sulfur, and sodium. See Section 3.4 for information regarding ongoing monitoring programs that include this area.

Initial Data Gaps in Accessible Areas:

- Depth to groundwater and groundwater flow direction
- Geologic conditions
- Presence of petroleum hydrocarbons, sulfur, and sodium in groundwater
- Current pH of groundwater (as an indicator for black liquor).

3.5.2.1.4 Former Sulfite Mill

The Former Sulfite Mill was part of the sulfite pulping process. This area is inactive. Existing structures include an electrical and instrumentation shop, compressor building, and ASTs. The Former Sulfite Mill in this area was demolished during the Mill Modernization Project (1981 to 1984). The area is currently inaccessible for RI activities due to the density of structures and below-grade features (e.g., basements).

Chemicals used in this operational feature include sulfurous acid (sulfur dioxide dissolved in water). There is a record of a weak black liquor spill in this area[26]. Site investigation and/or cleanup activities were completed as part of the original spill response. Some soils were excavated during demolition and disposed in the Mill Modernization Debris Area (in OA-C2).

COPCs associated with operations and/or documented spills/releases include petroleum hydrocarbons and sulfur. See Section 3.4 for information regarding ongoing monitoring programs that include this area.

[25] The following spills documented in Appendix A of the AO occurred in this area: 21 April 2011.
[26] The following spills documented in Appendix A of the AO occurred in this area: 21 April 2013.

Initial Data Gaps in Accessible Areas:

- Depth to groundwater and groundwater flow direction
- Geologic conditions
- Presence of petroleum hydrocarbons and sulfur in groundwater.

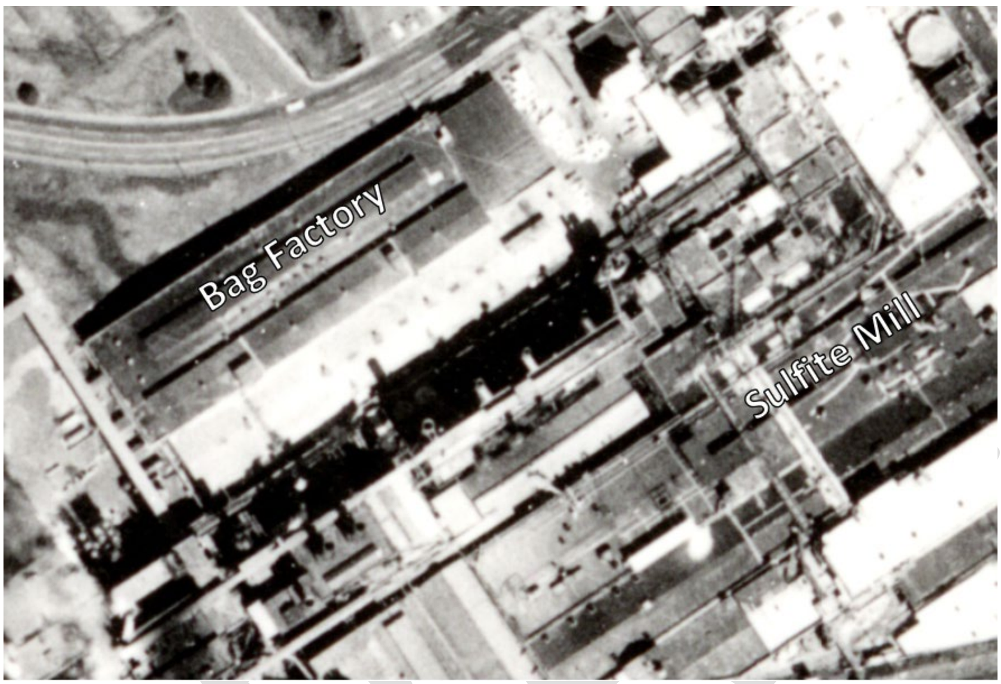

Image 5. Aerial Imagery from 1973 showing the Former Bag Factory and Sulfite Mill

3.5.2.1.5 Lime Kiln

The Lime Kiln was part of the chemical recovery process for the Kraft pulping operations. This area is inactive. The Lime Kiln remains but is included in the demolition plans being considered. The area is anticipated to be accessible, but access to specific locations may be difficult due to the density of structures and demolition activities.

Chemicals used in this operational feature include green liquor and lime mud. There are documented records of lime mud and green liquor spills in this area[27]. Lime mud primarily consists of calcium carbonate with trace amounts of other minerals; residual lime mud (calcium carbonate) from spills to land is not considered to present a threat to human health or the environment. Site investigation and/or cleanup activities were completed as part of the original spill response.

[27] The following spills documented in Appendix A of the AO occurred in this area: 5 May 1999.

There are no COPCs associated with operations and/or documented spills/releases in this area. See Section 3.4 for information regarding ongoing monitoring programs that include this area.

Initial Data Gaps in Accessible Areas:

- None. While there is limited information available regarding geology and hydrogeology specific to this operational feature, COPCs are not identified for this area and geology/hydrogeology information will be obtained in nearby operational features (see Section 5).

3.5.2.1.6 No. 6 Substation

The No. 6 Substation is west of the Lime Kiln. Based on historical aerials, it was constructed between 1966 and 1968. Existing equipment includes three liquid filled non-PCB transformer units (<50 ppm PCB[28]; 1,590 gallons, 1,140 gallons, and 2,429 gallons) and 10 OFEE (oil filled electrical equipment) containing between 200 to 300 gallons of oil each. There are no known spills or previous investigations in this area.

COPCs include petroleum hydrocarbons and PCBs. The equipment in this substation is routinely monitored in accordance with the SPCC Plan (see Section 3.4). This substation is active; only non-invasive activities will be proposed while the substation is active. Geology/hydrogeology information will be obtained in nearby operational features to avoid invasive activities at an active substation (see Section 5).

Initial Data Gaps in Accessible Areas:

- Presence of petroleum hydrocarbons and PCBs in shallow soil.

3.5.2.1.7 No. 8 Substation

The No. 8 Substation is north of the Former Bag Factory. Existing equipment includes four non-PCB transformer units (5,935 gallons, 2,700 gallons, 1,934 gallons, and 3,060 gallons) and three OFEE containing 363 gallons of oil each. There are no known spills or previous investigations in this area.

COPCs include petroleum hydrocarbons and PCBs. The equipment in this substation is routinely monitored in accordance with the SPCC Plan (see Section 3.4). This substation is active; only non-invasive activities will be proposed while the substation is active. Geology/hydrogeology information will be obtained in nearby operational features to avoid invasive activities at an active substation (see Section 5).

Initial Data Gaps in Accessible Areas:

- Presence of petroleum hydrocarbons and PCBs in shallow soil.

[28] In accordance with 40 CFR 761.180, Camas maintains a log of PCB-containing containers, transformers, and/or large capacitors at the mill.

3.5.2.2 OA-B2: Power House

The Power House in SOU-B is the only operational feature in OA-B2. As described in Section 3.2, there were multiple Power Boilers in this area, but they are not operational. There are pipelines (above and below ground) for the K6, acid, and process sewers in this area. Blue Creek flows in an underground pipe through this approximate area.

The Power House is now inactive. There are existing ASTs, including three 3,500-gallon lube oil ASTs, one 80-gallon hydraulic oil AST, and one 55-gallon diesel fuel AST; most tanks are empty and out of service. The area is inaccessible for RI activities at this time due to the density of structures and below-grade features (e.g., basements).

Chemicals used in this operational feature include the Power Boiler fuel (hog fuel, fuel oil, and natural gas), as well as petroleum hydrocarbons associated with operation of the machinery within the steam plant. There are documented records of oil releases in this area[29]. Soils containing petroleum hydrocarbons were observed during the Mill Modernization Project (1981 to 1984) and at least in part, were reportedly removed and disposed in an area near the South Mill office.

COPCs associated with operations and/or documented spills/releases include petroleum hydrocarbons. PCBs are also a COPC per Table 830-1 (at WAC 173-340-900) owing to the presence of heavy oil such as lube oil and hydraulic fluid. This area is inaccessible for RI activities at this time; if the area becomes accessible after potential demolition activities in the future, soil sampling will be considered. See Section 3.4 for information regarding ongoing monitoring programs that include this area.

Initial Data Gaps in Accessible Areas:

- Depth to groundwater and groundwater flow direction
- Geologic conditions
- Presence of residual petroleum hydrocarbons in groundwater.

3.5.2.3 OA-B3: Bleaching

Operational features in OA-B3 are presented in the following sections. Process wastewater and stormwater in this area is collected by the process and acid sewers and conveyed to the WWTP for treatment.

3.5.2.3.1 Kraft Pulp Bleaching

Pulp from the Kraft Mill was bleached in this area. When the Mill transitioned from elemental chlorine to ECF, this building was repurposed to house the R8 Chlorine Dioxide Plant, which produced chlorine dioxide. This area is inactive. The area is inaccessible for RI activities at this time due to the density of structures and below-grade features (e.g., basements).

[29] The following spills documented in Appendix A of the AO occurred near this area: 26 September 2015.

Chemicals used in this operational feature include chlorine, sulfuric acid, methanol, and sodium chlorate. There are documented records of pulp and wastewater spills in this area. Site investigation and/or cleanup activities were completed as part of the original spill response.

COPCs associated with operations and/or documented spills/releases include petroleum hydrocarbons, dioxins (related to wastewater releases), and chromium. This area is inaccessible for RI activities at this time; if the area becomes accessible after potential demolition activities in the future, soil sampling will be considered. See Section 3.4 for information regarding ongoing monitoring programs that include this area.

Initial Data Gaps in Accessible Areas:

- Depth to groundwater and groundwater flow direction
- Geologic conditions
- Presence of petroleum hydrocarbons in groundwater.

3.5.2.3.2 Sulfite Pulp Bleaching

Pulp from the Sulfite Mill was bleached in this area. One out-of-service 150-gallon AST that formerly contained oil remains. The Outside Repulper is now located in this area and is still active. This area is inaccessible due to the density of structures and below-grade features (e.g., basements) and ongoing operations.

Chemicals used in this operational feature include chlorine and hydrogen peroxide. There are no records of notable spills in this area.

COPCs associated with operations include petroleum hydrocarbons. See Section 3.4 for information regarding ongoing monitoring programs that include this area.

Initial Data Gaps in Accessible Areas:

- Depth to groundwater and groundwater flow direction
- Geologic conditions
- Presence of petroleum hydrocarbons in groundwater.

3.5.2.3.3 K5 Bleach Plant

The K5 Bleach Plant bleached pulp using ECF. This area is inactive. One out-of-service 55-gallon AST that formerly contained lube oil remains. The area is inaccessible for RI activities at this time due to the density of structures and below-grade features (e.g., basements).

Chemicals used in this operational feature include chlorine dioxide. There are no records of notable spills in this area.

COPCs associated with operations include petroleum hydrocarbons. PCBs are also a COPC per Table 830-1 (at WAC 173-340-900) owing to the presence of heavy oil such as lube oil. This area is inaccessible for RI activities at this time; if the area becomes accessible after potential demolition activities in the future, soil sampling will be considered. See Section 3.4 for information regarding ongoing monitoring programs that include this area.

Initial Data Gaps in Accessible Areas:

- Depth to groundwater and groundwater flow direction
- Geologic conditions
- Presence of petroleum hydrocarbons in groundwater.

3.5.2.3.4 K4 Bleach Plant

The K4 Bleach Plant bleached pulp for the Mill. This area is inactive. Two 60-gallon oil ASTs have been removed from this area. The area is inaccessible for RI activities at this time due to the density of structures and below-grade features (e.g., basements).

Chemicals used in this operational feature include chlorine, sodium chlorate, sodium dichromate, and hydrochloric acid. There are documented records of sodium chlorate, sodium dichromate, and hydrochloric acid releases in this area[30]. Site investigation and/or cleanup activities were completed as part of the original spill response.

COPCs associated with operations and/or documented spills/releases include petroleum hydrocarbons, PCBs, and chromium. This area is inaccessible for RI activities at this time; if the area becomes accessible after potential demolition activities in the future, soil sampling will be considered. See Section 3.4 for information regarding ongoing monitoring programs that include this area.

Initial Data Gaps in Accessible Areas:

- Depth to groundwater and groundwater flow direction
- Geologic conditions
- Presence of petroleum hydrocarbons and chromium in groundwater
- Current pH of groundwater.

3.5.2.3.5 No. 1 Substation

The No. 1 Substation is on the eastern side of OA-B3. Existing equipment includes two liquid filled non-PCB transformer units (<50 ppm PCB; 1,885 gallons and 2,309 gallons) and four OFEE containing 363 gallons of oil each. There are no known spills or previous investigations in this area.

COPCs include petroleum hydrocarbons and PCBs. The equipment in this substation is routinely monitored in accordance with the SPCC Plan (see Section 3.4). This substation is

[30] The following spills documented in Appendix A of the AO occurred in this area: 7 February 2002.

active; only non-invasive activities will be proposed while the substation is active. Geology/hydrogeology information will be obtained in nearby operational features to avoid invasive activities at an active substation (see Section 5).

Initial Data Gaps in Accessible Areas:

- Presence of petroleum hydrocarbons and PCBs in shallow soil.

3.5.2.4 OA-B4: Finishing/Coatings - North

Operational features in OA-B4 are presented in the following sections. Process wastewater and stormwater in this operational area is collected by the K6, K7, acid, and process sewers (see Figure 6 for approximate coverage areas) and conveyed to the WWTP for treatment.

3.5.2.4.1 Paper Treatment

The area is inactive, but formerly paper treatment operations were completed in this area. The buildings that housed the former paper treatment operation are still existing. The area is inaccessible for RI activities at this time due to the density of structures and below-grade features (e.g., basements).

Chemicals used in this operational feature include diphenyl, ethoxyquin, per- and polyfluoroalkyl substances (PFAS), and copper carbonate. There are no records of spills in this area.

COPCs associated with operations include petroleum hydrocarbons, diphenyl, PFAS, and copper. See Section 3.4 for information regarding ongoing monitoring programs that include this area.

Initial Data Gaps in Accessible Areas:

- Depth to groundwater and groundwater flow direction
- Geologic conditions
- Presence of petroleum hydrocarbons, diphenyl, PFAS, and copper in groundwater.

3.5.2.4.2 Machine Shop

The machine shop was used to produce various parts for machinery used throughout the mill. In order to support the war effort, the machine shop was converted to produce rudders for Liberty Ships during World War II. This area is inactive. The buildings that housed the former machine shop are still existing. The area is inaccessible for RI activities at this time due to the density of structures and below-grade features (e.g., basements). Chemicals used in this operational feature include oils and solvents. There are no records of spills in this area.

COPCs associated with operations include petroleum hydrocarbons and VOCs. PCBs are also a COPC per Table 830-1 (at WAC 173-340-900) owing to the presence of heavy oil such as lube oil and hydraulic fluid. This area is inaccessible for RI activities at this time; if the area becomes accessible after potential demolition activities in the future, soil sampling will be considered. See Section 3.4 for information regarding ongoing monitoring programs that include this area.

Initial Data Gaps in Accessible Areas:

- Depth to groundwater and groundwater flow direction
- Geologic conditions
- Presence of petroleum hydrocarbons and VOCs in groundwater.

3.5.2.4.3 Fuel Oil Day Tank

The Fuel Oil Day Tank is located in the western end of OA-B4, south of the Power House (OA-B2) and the Kraft Mill (OA-B1). The existing 50,400-gallon AST is empty and has been decommissioned and removed from service. This area is inactive. The area is anticipated to be accessible, but access to specific locations may be difficult due to the density of structures.

Fuel oil was stored in the Fuel Oil Day Tank. There are no records of spills in this area; however, fuel oil has been identified in the subsurface in this area. Subsurface impacts were identified during a construction project and subsequently evaluated in 2018 (Figure 9; Kennedy Jenks 2018). Approximately 12 cubic yards of soil containing petroleum hydrocarbons were removed in this area. The excavation extended laterally to surrounding foundations or roads, where further removal was infeasible. Visual indicators of petroleum hydrocarbons were observed at approximately 3 feet bgs around the perimeter of the excavation with the exception of the southwestern corner. Petroleum impacts appeared to extend from 3 feet bgs to bedrock at 4-5 feet bgs (Kennedy Jenks 2018).

Analytical samples were collected from the four excavation sidewalls at a depth of 2 feet bgs to confirm that petroleum hydrocarbon impacts did not extend above the visibly impacted soil at 3 feet bgs. An additional soil sample was collected from the southwest corner of the excavation sidewall at a depth of 3 feet bgs as visible indicators of petroleum hydrocarbons were not observed in this area. Neither diesel-range nor oil-range organics were detected in soil samples at concentrations exceeding the MTCA screening level of 2,000 milligrams per kilogram (mg/kg).

A test pit was dug approximately 25 feet south (presumed downgradient) of the excavation, across the access road, to assess the extent of petroleum hydrocarbon impacts. No visual or olfactory evidence of petroleum hydrocarbons was observed. Groundwater was not encountered. Soil samples were collected at 4.5 feet bgs and 6 feet bgs. Neither diesel- nor oil-range organics were detected in the soil sample at 4.5 feet bgs, and oil-range organics were detected at a concentration below the MTCA screening level in the sample at 6 feet bgs. Therefore, petroleum hydrocarbon impacts were not observed at a distance of 25 feet from the southern extent of the excavation.

COPCs associated with operations include petroleum hydrocarbons. See Section 3.4 for information regarding ongoing monitoring programs that include this area.

Initial Data Gaps in Accessible Areas:

- Depth to groundwater and groundwater flow direction
- Geologic conditions
- Presence of petroleum hydrocarbons in groundwater.

3.5.2.4.4 No. 5 Substation

The No. 5 Substation is south of the Machine Shop. Existing equipment includes six liquid filled non-PCB transformer units (<50 ppm PCB; approximately 1,000 gallons each; one spare being stored, not used), two non-PCB transformer units (2,285 gallons and 2,935 gallons), and six OFEE containing 363 gallons of oil each. There are no known spills or previous investigations in this area.

COPCs include petroleum hydrocarbons and PCBs. The equipment in this substation is routinely monitored in accordance with the SPCC Plan (see Section 3.4). This substation is active; only non-invasive activities will be proposed while the substation is active. Geology/hydrogeology information will be obtained in nearby operational features to avoid invasive activities at an active substation (see Section 5).

Initial Data Gaps in Accessible Areas:

- Presence of petroleum hydrocarbons and PCBs in shallow soil.

3.5.2.5 OA-B5: Specialty Minerals

The mill leased property in the western portion of the Site to Specialty Minerals, Inc. The area is inactive and has been demolished.

The Specialty Minerals operation produced precipitated calcium carbonate ($CaCO_3$) for use as a paper whitener at Paper Machine 20. There are no records of spills in this area.

There are no COPCs associated with operations or documented spills/releases in this area. See Section 3.4 for information regarding ongoing monitoring programs that include this area.

3.5.2.6 OA-B6: Warehouse/Product Storage – North

This operational area is in the northwestern portion of the Site and historically provided warehousing for product storage. There is no known chemical usage, reported spills or releases, or current operations in this OA.

3.5.3 SOU-C: Main Mill Area - South

The Main Mill Area – South (SOU-C) is located between the railroad tracks and the Camas Slough. It encompasses five operational areas which included finishing, coating, product storage, and operational support activities.

Image 6. Aerial Imagery of SOU-C

3.5.3.1 OA-C1: Finishing /Coatings/Additives – South

Operational features in OA-C1 are presented in the following sections. Process wastewater and stormwater in this operational area is collected by the K6 sewer, the acid sewer, and the process sewer (see Figure 6 for approximate coverage areas) and conveyed to the WWTP for treatment.

3.5.3.1.1 Fuel Oil Storage

Historically, this area contained ASTs which stored fuel oil to support mill operations. There is one existing fuel oil AST (No. 5 Storage Tank) located near the Camas Slough between the Dock Warehouse and the No. 20 Paper Machine. The existing No. 5 Storage Tank is empty and has been removed from service. The original capacity of the No. 5 Storage Tank was 1,680,000 gallons; in 2003, the tank was modified, and the capacity reduced to 719,000 gallons. Previously, there were four fuel oil storage tanks in the vicinity of present-day No. 20 Paper Machine (seen in Image 7). One of these tanks was demolished prior to 1950 and the remaining three were demolished during the Mill Modernization Project (1981 to 1984). The eastern portion of this area, near and at the No. 20 Paper Machine, is currently inaccessible.

Chemicals used in this operational feature include the fuel oil stored in tanks. There are no records of spills in this area; however, fuel oil has been discovered in the subsurface in this area. Previous field investigation was completed when suspected petroleum hydrocarbons were observed during excavation activities associated with equipment installation (Kennedy Jenks 2020). No evidence of an active release was observed. Six soil samples were collected from the excavation area and analyzed for Northwest Total Petroleum Hydrocarbons as Diesel and Oil Extended (NWTPH-Dx; without silica gel cleanup); benzene, toluene, ethylbenzene, and total xylenes (BTEX), naphthalene, and PAHs (Figure 9). Eight additional soil samples were collected when excavation was completed and analyzed for NWTPH-Dx (without silica gel cleanup), BTEX, naphthalene, and PAHs. After agreement with Ecology, the excavation was backfilled.

COPCs associated with operations include petroleum hydrocarbons. Additional sampling for PAHs may be completed based on the results of additional TPH sampling.

Initial Data Gaps in Accessible Areas:

- Depth to groundwater and groundwater flow direction
- Geologic conditions
- Presence of petroleum hydrocarbons in groundwater
- Presence of residual petroleum hydrocarbons in soil.

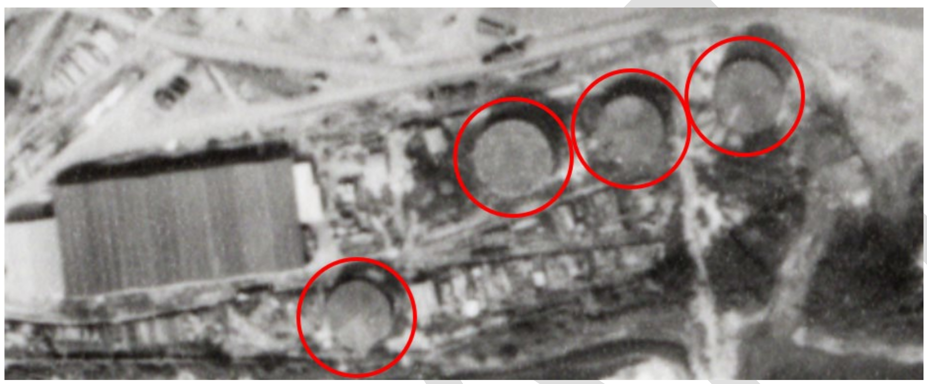

Image 7. Aerial Imagery from 1948 showing four historical fuel oil storage tanks

3.5.3.1.2 Additives/Coatings

This area of the Mill was used to store and apply specialty chemicals used to manufacture specific paper products. This area is still active, including ASTs and Boiler No. 6. Existing structures in this area include buildings that house converting machinery, a storeroom, and finishing operations. There are also reclaim tanks along the northern boundary of these buildings and 20 existing 275-gallon oil ASTs. Based on historical aerials, structures in the northern portion of OA-C1 existed at least as early as 1948. Boiler No. 6 was recently installed in 2020. This area is inaccessible due to ongoing operations.

Chemicals used in this operational feature include petroleum hydrocarbons. There are no records of notable spills in this area.

COPCs associated with operations include petroleum hydrocarbons. PCBs are also a COPC per Table 830-1 (at WAC 173-340-900) owing to the presence of heavy oil such as lube oil and hydraulic fluid. See Section 3.4 for information regarding ongoing monitoring programs that include this area.

Initial Data Gaps in Accessible Areas:

- Depth to groundwater and groundwater flow direction
- Geologic conditions
- Presence of petroleum hydrocarbons in groundwater
- Presence of petroleum hydrocarbons and PCBs in soil.

3.5.3.1.3 Converting

This area of the Mill was used for Converting. This area is still active. Existing structures in this area include buildings that house a converting plant and associated electrical and instrumentation rooms and mechanical shop, two converting annexes, reject paper storage, and baling operations. Based on historical aerials, the converting buildings existed at least as early as 1948. There are no known former structures in this area that do not currently exist. This area is inaccessible due to ongoing operations.

Chemicals used in this operational feature include petroleum hydrocarbons and glues. There are no records of spills in this area.

COPCs associated with operations include petroleum hydrocarbons and VOCs. See Section 3.4 for information regarding ongoing monitoring programs that include this area.

Initial Data Gaps in Accessible Areas:

- Depth to groundwater and groundwater flow direction
- Geologic conditions
- Presence of petroleum hydrocarbons and VOCs in groundwater.

3.5.3.1.4 No. 9 Substation

The No. 9 Substation is on west of the Effluent Pump Station. Existing equipment includes three non-PCB transformer units (two 1,934 gallons each, one 3,060 gallons) and three OFEE containing 363 gallons of oil each. There are no known spills or previous investigations in this area.

COPCs include petroleum hydrocarbons and PCBs. The equipment in this substation is routinely monitored in accordance with the SPCC Plan (see Section 3.4). This substation is active; only non-invasive activities will be proposed while the substation is active. Geology/hydrogeology information will be obtained in nearby operational features to avoid invasive activities at an active substation (see Section 5).

Initial Data Gaps in Accessible Areas:

- Presence of petroleum hydrocarbons and PCBs in shallow soil.

3.5.3.2 OA-C2: Warehouse / Product Storage - South

Operational features in OA-C2 are presented in the following sections. Process wastewater and stormwater in this operational area is collected by the process sewer (see Figure 6 for approximate coverage areas) and conveyed to WWTP for treatment.

3.5.3.2.1 Mill Modernization Debris Area

During the Mill Modernization Project (1981 to 1984), soil and demolition debris from the former Sulfite Mill and Bag Factory underlie the asphalt cover used for vehicle parking. Differential settlement in the parking area has caused the asphalt surface to be uneven. This area is still active. There is an existing structure in this area that is included in the demolition plans being considered. There are no known former structures in this area that do not currently exist. This area is expected to be accessible.

There are no known chemicals used for operations in this operational feature. There are also no records of spills in this area.

COPCs associated with debris underlying the asphalt surface include petroleum hydrocarbons, VOCs, SVOCs, PCBs, dioxins, PFAS, and metals. PCBs and dioxins have low solubility and are typically associated with soil, not groundwater. The nature and extent of buried materials will be evaluated using non-invasive methods prior to proceeding with invasive sampling activities. See Section 3.4 for information regarding ongoing monitoring programs that include this area.

Initial Data Gaps in Accessible Areas:

- Depth to groundwater and groundwater flow direction
- Geologic conditions
- Extent of buried materials
- Presence of petroleum hydrocarbons, VOCs, SVOCs, PFAS, and metals in groundwater.

3.5.3.2.2 No. 2 Substation

The No. 2 Substation is on the western side of the Mill Modernization Debris Area and may extend into the Mill Modernization Debris Area. Existing equipment includes four liquid filled non-PCB transformer units (<50 ppm PCB; three 1,305 gallons and one 1,237 gallons). There are no known spills or previous investigations in this area.

COPCs include petroleum hydrocarbons and PCBs. The equipment in this substation is routinely monitored in accordance with the SPCC Plan (see Section 3.4). This substation is active; only non-invasive activities will be proposed while the substation is active. Geology/hydrogeology information will be obtained in nearby operational features to avoid invasive activities at an active substation (see Section 5).

Initial Data Gaps in Accessible Areas:

- Presence of petroleum hydrocarbons and PCBs in shallow soil.

3.5.3.2.3 Buried Material Area

The Sheeter Building was built on the closed Inert Waste Landfill during the Mill Modernization project (1981 to 1984). Interviews with staff confirmed uncovering trash, debris, and other materials while excavating for construction of the Sheeter Building. Historical aerial imagery identifies locations of other possible buried materials and a waste incinerator (seen in Image 8) near the present-day Sheeter Building. This area is still active. Existing structures in this area include Sheeter Building, which is currently used for storage, a Mobile Maintenance Shop, and a salvage yard. There is one existing 500-gallon AST that formerly contained lube oil but is now empty and has been removed from service. There were three known USTs near the Mobile Maintenance Shop (adjacent to the Sheeter Building): a 12,000-gallon gasoline UST, a 1,000-gallon gasoline UST, and a 150-gallon UST which was part of a spill containment/oil separation system. These three USTs have been removed. There was a waste incinerator in the southeastern corner of this area and waste was stockpiled in the southwestern corner (see Image 8 below). The incinerator was reportedly used to burn paper wastes generated at the Mill. This area is inaccessible due to ongoing operations.

Chemicals used in this operational feature include petroleum hydrocarbons. There are no records of spills in this area. Excavation activities were completed in the Buried Materials Area during construction of the Sheeter Building. During excavation activities, workers uncovered garbage, paint, and other debris. The three USTs in this area near the Mobile Maintenance Shop have been removed. COPCs in this area are related to potential buried materials as well as the former USTs.

COPCs associated with buried materials include petroleum hydrocarbons, VOCs, SVOCs, PCBs, dioxins, PFAS, and metals. PCBs and dioxins have low solubility and are typically associated with soil, not groundwater. The nature and extent of buried materials will be evaluated using non-invasive methods prior to proceeding with invasive sampling activities. See Section 3.4 for information regarding ongoing monitoring programs that include this area.

Initial Data Gaps in Accessible Areas:

- Depth to groundwater and groundwater flow direction
- Geologic conditions
- Extent of buried materials
- Presence of petroleum hydrocarbons, VOCs, SVOCs, PFAS, and metals in groundwater.

Image 8. Aerial Imagery from 1968 showing waste incinerator

3.5.3.3 OA-C3: Operational Support

The Operational Support area serves the Mill, including waste and product storage and fueling. Operational features in OA-C3 are presented in the following sections. Process wastewater and stormwater in this operational area is collected by the K7 sewer and conveyed to the WWTP for treatment (see Figure 6 for approximate coverage areas).

3.5.3.3.1 Waste Handling Area and Fueling Station

This is currently an active Waste Handling Area. Used and clean oil along with miscellaneous wastes, such as waste solvent and paint, are stored in above-ground totes and other containers in this area. There is also a fueling station located in the eastern end of this area with a 5,000-gallon gasoline AST and a 1,000-gallon diesel AST, and three existing structures (two existing covered sheds and a garage). This area is inaccessible due to ongoing operations.

Chemicals used in this operational feature include gasoline and diesel for fueling operations. There are no records of spills in this area. However, petroleum hydrocarbons were identified east of the fueling station during drilling operations for a utility pole installation in 2018 (Figure 9). Diesel-range and heavy oil hydrocarbons were present in water samples collected from the boring installed to receive the utility pole (Kennedy Jenks 2019).

COPCs associated with operations include petroleum hydrocarbons and VOCs. See Section 3.4 for information regarding ongoing monitoring programs that include this area.

Initial Data Gaps in Accessible Areas:

- Depth to groundwater and groundwater flow direction
- Geologic conditions
- Presence of petroleum hydrocarbons and VOCs in groundwater.

3.5.3.3.2 Car Barn, Paint Shop, and UST Area

The Car Barn and Paint Shop were used to store drums and totes of oil and solvents. The Car Barn and Paint Shop buildings are still present. There were three known USTs near the Car Barn: a 10,000-gallon gasoline UST, a 1,000-gallon gasoline UST, and a 300-gallon UST containing thinner solvent. The tanks were removed in the mid-1980s. This area is inaccessible due to ongoing operations.

Chemicals used in this operational feature include petroleum hydrocarbons and solvents. There are no records of spills in this area.

COPCs associated with operations include petroleum hydrocarbons and VOCs. See Section 3.4 for information regarding ongoing monitoring programs that include this area.

Initial Data Gaps in Accessible Areas:

- Depth to groundwater and groundwater flow direction
- Geologic conditions
- Presence of petroleum hydrocarbons and VOCs in groundwater.

3.5.3.3.3 Former Sulfur Pile

When the Mill used the sulfite pulping process, sulfur was stored in an outdoor pile in this location. There are no existing or former structures in this area. This area is accessible.

Chemicals used in this operational feature include the stockpiled sulfur. There are records of hydraulic oil spills in this area[31]. In 1999, less than 1 gallon of hydraulic oil was released, and absorbent media were deployed (Fort James Camas LLC 1999). In 2006, reportedly approximately 60 gallons of hydraulic oil spilled and contacted bare ground. In response, absorbent media was deployed, and the impacted soil was excavated and disposed (Fort James Camas LLC 2006).

COPCs associated with operations and/or documented spills/releases include petroleum hydrocarbons and sulfur. PCBs are also a COPC per Table 830-1 (at WAC 173-340-900) owing to the documented release of hydraulic fluid. See Section 3.4 for information regarding ongoing monitoring programs that include this area.

[31] The following spills documented in Appendix A of the AO occurred in this area: 6 March 2006 and 17 January 1999.

Initial Data Gaps in Accessible Areas:

- Depth to groundwater and groundwater flow direction
- Geologic conditions
- Presence of petroleum hydrocarbons and sulfur in groundwater
- Presence of PCBs in soil.

3.5.3.4 OA-C4: Pump Houses

Operational features in OA-C4 are presented in the following sections.

3.5.3.4.1 River Bank Pump House

The Riverbank Pump House on the banks of the Camas Slough supplies water for the mill's fire suppression system. There was previously an 850-gallon diesel AST to support the former diesel pump; the diesel pump has been replaced with an electric pump, and diesel is no longer stored in this area. This area is still active. This area is inaccessible due to ongoing operations.

Chemicals used in this operational feature include diesel for the pumps. Diesel releases from the AST and equipment have occurred in this location onto the bank and to the slough[32]. In February 2017, oil sheen was observed in Camas Slough (Georgia-Pacific 2017a). The source was found to be a diesel leak at the River Bank Pump House. Oil absorbent equipment (booms, sweeps, and socks) were deployed, the contents of the concrete vault containment for the leaking tank was pumped out, and the pump engine system was disconnected. Approximately 600 cubic feet of diesel contaminated soil was excavated until diesel was not observed visually or by odor (Georgia-Pacific 2017b). Six soil samples were collected from the excavation area in August 2017 and analyzed for diesel range organics (Figure 9); results ranged from 360 mg/kg to 1,800 mg/kg, and were below MTCA cleanup level of 2,000 mg/kg.

Groundwater was not encountered during excavation activities. Additional corrective action and repairs were completed after the required permits and approvals were obtained, including decommissioning the diesel pumps at the River Bank Pump House and replacing with a new electric fire pump (Georgia-Pacific 2018a,b). A new skid-mounted diesel fire pump and a new diesel emergency generator were also installed within the WWTP collection system; there is no longer diesel storage at the River Bank Pump House. A new inspection plan was also established for the Pump House (Georgia-Pacific 2018a, b).

COPCs associated with operations and/or documented spills/releases include petroleum hydrocarbons (i.e., diesel fuel). See Section 3.4 for information regarding ongoing monitoring programs that include this area.

[32] The following spills documented in Appendix A of the AO occurred in this area: 11 December 2006, 7 May 2003, and 26 December 1999.

<u>Initial Data Gaps in Accessible Areas:</u>

- Depth to groundwater and groundwater flow direction
- Geologic conditions
- Presence of residual petroleum hydrocarbons (diesel fuel organics) in groundwater
- Presence of residual petroleum hydrocarbons (diesel fuel) in soil.

3.5.3.4.2 Effluent Pump Station

The Effluent Pump Station located on the banks of the Camas Slough pumps the mill's process wastewater (including the K6 sewer, K7 sewer, and grit sump) to the WWTP on Lady Island. This area is still active. There are no known former structures in this area that do not currently exist. This area is inaccessible due to ongoing operations.

Chemicals used in this operational feature include diesel fuel to feed the backup generator used to run the pump station in case of a power outage. There have been documented releases of wastewater to the bank and to the slough[33].

COPCs associated with operations and/or documented spills/releases include petroleum hydrocarbons, dioxin, and metals. See Section 3.4 for information regarding ongoing monitoring programs that include this area.

<u>Initial Data Gaps in Accessible Areas:</u>

- Depth to groundwater and groundwater flow direction
- Geologic conditions
- Presence of petroleum hydrocarbons (diesel range organics) and metals in groundwater
- Presence of petroleum hydrocarbons (diesel range organics), dioxin, and metals in soil.

3.5.3.5 OA-C5: Wooded Area

There are no historical or current operational activities, no known spills, and no known chemical usage in this area.

3.5.4 SOU-D: Lady Island

Lady Island (SOU-D) is located between the Camas Slough and the Columbia River. Lady Island is only partially developed; the WWTP for the mill is located on Lady Island and consists of a primary clarifier constructed in 1968 and two ASBs added in the 1960s and 1970s. Prior to installation of pipelines connecting the clarifier to the ASBs, wastewater was conveyed through

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[33] The following spills documented in Appendix A of the AO occurred in this area: 7 September 2012 and 3 July 2006.

earthen ditches. A permitted landfill is located west of the primary clarifier and is used for management of dewatered wastewater solids. Highway 14 traverses Lady Island.

The WWTP continues to operate and is regulated by the mill's existing NPDES permit, as well as the Lady Island Landfill (LILF) permit (see Section 3.4).

3.5.4.1 OA-D1: Wastewater Treatment Plant

3.5.4.1.1 Active Landfill

Solids from the primary clarifier[34] are dewatered and managed at the LILF, which operates as a limited purpose landfill under Clark County Public Health Department Permit Number PT 0006096 (LILF permit). In accordance with the LILF permit, quarterly groundwater monitoring occurs at five monitoring wells. In addition, seep inspections occur annually as part of routine monitoring events; although seeps have been identified previously, seeps have not been identified for the last 3 years (2019 – 2021). Leachate from this landfill is collected and sent to the WWTP for treatment[35]. The LILF is active and continues to operate as part of the WWTP.

3.5.4.1.2 Former Wastewater Ditches

Prior to installation of pipelines connecting the clarifier to the ASBs, wastewater was conveyed through earthen ditches. Based on historical aerials, the ditches are apparent between 1968 and 1970, and conveyed effluent from the primary clarifier as well as effluent from the acid sewer to the South ASB and former outfall. The ditches are no longer used. COPCs include petroleum hydrocarbons, dioxin, and metals.

<u>Initial Data Gaps in Accessible Areas:</u>

- Presence of petroleum hydrocarbons, dioxin, and metals in shallow soil.

[34] The primary clarifier receives flows from the K6 sewer, K7 sewer, and process water sewer.
[35] The following spills documented in Appendix A of the AO occurred in this area: 25 June 1999.

Image 9. Aerial Imagery from 1973 showing wastewater ditches on Lady Island

3.5.4.1.3 ASBs

There are two ASBs that are part of the WWTP on Lady Island. The South ASB was constructed in the 1960s, and the North ASB was constructed in 1977 for secondary treatment of wastewater. The ASBs continue to operate as part of the WWTP and are regulated by the mill's existing NPDES permit.

3.5.4.1.4 Primary Clarifier

The primary clarifier was constructed in the 1960s. The primary clarifier receives flows from the K6 sewer, K7 sewer, and process water sewer[36]. Solids from the primary clarifier are dewatered and managed at the LILF (or beneficially reused offsite), and effluent is conveyed from the clarifier to the ASBs. The primary clarifier and supporting buildings and equipment continue to operate as part of the WWTP and are regulated by the mill's existing NPDES permit.

3.5.4.1.5 No. 10 Substation

The No. 10 Substation is south of the Primary Clarifier. Existing equipment includes three non-PCB transformer units (1,160 gallons each) and two OFEE containing 363 gallons of oil each. There are no known spills or previous investigations in this area.

COPCs include petroleum hydrocarbons and PCBs. The equipment in this substation is routinely monitored in accordance with the SPCC Plan (see Section 3.4). This substation is active; only non-invasive activities will be proposed while the substation is active.

[36] The following spills documented in Appendix A of the AO occurred in this area: 31 October 2015.

Geology/hydrogeology information will be obtained in nearby operational features to avoid invasive activities at an active substation (see Section 5).

Initial Data Gaps in Accessible Areas:

- Presence of petroleum hydrocarbons and PCBs in shallow soil.

3.5.4.2 OA-D2: Dredge Spoils Area

Dredge sediments from mill-related dredging activities in Camas Slough are stockpiled in the Dredge Spoils Area on Lady Island. Dredged materials are owned by the Army Corps of Engineers.

3.5.5 SOU-E: Ancillary Area

The Ancillary Area (SOU-E) is located near the intersection of Northeast Adams Street and Northeast 6th Avenue. It contains a single operational area where former private businesses (unrelated to mill) operated.

Image 10. Aerial Imagery of SOU-E

3.5.5.1 OA-E1: Ancillary Area

The Mill acquired multiple properties as it expanded to the north and east including a former fueling station, an auto service station, and a laundromat/dry cleaner. These buildings have been demolished. This area is currently active. Ongoing mill related activities include the repulping operation and mill parking areas. This area is inaccessible due to ongoing operations. There are no COPCs associated with current and ongoing mill-related activities.

3.5.6 SOU-F: CBC

The CBC (SOU-F) is bound by Northwest Benton Street and residential properties to the north, Division Street to the east, Northwest 6th Avenue to the south, and Northwest Drake Street to the west. It contains a single operational area where research and development were conducted.

Image 11. Aerial Imagery of SOU-F

3.5.6.1 OA-F1: CBC Area

This area of the Facility was formerly used for research and development. Former structures in this area include the Camas Business Center, the Non-Wovens Plant, the Environmental Center, and Fort James Specialty Chemicals. Operations in this area ceased by 1999 and many of the former labs and offices were demolished by 2002. Most remaining buildings were demolished in 2021. Building 402 and a water supply tank are the only remaining structures.

Previous investigations have been completed in this area[37]. A preliminary assessment and site investigation was completed in 2000. In 2001, GP submitted a Preliminary Site Assessment Report and Site Investigation Report to Ecology. These activities were followed by a supplemental soil investigation in 2002, a Phase II Environmental Site Assessment (ESA) in 2016, and a groundwater monitoring event in 2021. During the course of investigation, groundwater samples were analyzed for Total Petroleum Hydrocarbon - Hydrocarbon Identification (TPH-HCID), Resource Conservation and Recovery Act (RCRA) metals, PCBs, and VOCs; soil samples were analyzed for TPH-HCID, RCRA metals, PCBs, VOCs (including tentatively identified compounds [TIC]), and SVOCs (including TIC). Groundwater analytical

[37] At one point in time, the Fort James Specialty Chemicals area was in Ecology's Voluntary Cleanup Program (VCP).

results were generally below MTCA cleanup levels; in the most recent event in March 2021, results were below MTCA cleanup levels except TCE, which exceeded the MTCA cleanup level [5 micrograms per liter (µg/L)] at MW-3 (8.2 µg/L). Soil analytical results were generally below MTCA cleanup levels with the exception of one surface soil sample (lead at 345 mg/kg in sample LS-1) and three boring soil samples (PCE at 2.95 mg/kg, PCE at 0.25 mg/kg, and methylene chloride at 0.75 mg/kg). Other soil samples collected in the vicinity were below MTCA cleanup levels for PCE and methylene chloride. A data package summarizing environmental data collected at the CBC was submitted to Ecology via email on 12 July 2021 (GRES 2021). Soil and groundwater analytical results indicate that constituent concentrations have decreased over time.

The COPCs for the CBC Area include PCE, TCE, 1,1,1-trichloroethane, 1,1-dichloroethene, cis-1,2-DCE, and lead. Five monitoring wells exist at CBC. The monitoring wells are not currently in an ongoing monitoring program, but groundwater samples were collected most recently in March 2021. Monitoring wells at CBC are expected to represent groundwater conditions upgradient of the MMA.

Initial Data Gaps in Accessible Areas:

- Concentrations of TCE in groundwater relative to cleanup levels
- Presence of PFAS in groundwater at existing monitoring wells
- Presence of lead in shallow soil in the vicinity of LS-1.

Image 12. Aerial Imagery from 1985 showing the CBC, environmental center, Specialty Chemicals, and Non-Wovens Plant

Section 4: Preliminary Conceptual Site Model

A CSM describes the relationship between COPC sources and receptors through potential or actual migration and exposure pathways. The preliminary CSM described in this section is expected to undergo refinement as information and data are obtained during the RI process.

Regional and local information about the Site setting coupled with historical and current Site-related information (Section 3) provides bases to assemble a preliminary CSM. This information supports development of the preliminary CSM based on:

- Identification of COPC sources and release mechanisms based on review of Site historical and current operations and documentation of spills and releases (Section 3)
- Potential pathways for COPC migration within environmental media (e.g., groundwater flow) or transfer between environmental media (e.g., COPC leaching from soil to groundwater or groundwater discharge to surface water)
- Exposure pathways that may link a COPC and migration pathway to a potential receptor.

Summarily, development of a preliminary CSM facilitates identification of data gaps and/or uncertainties that RI activities will address over time to achieve the objectives listed in Section 1.1.

Previous environmental investigation and monitoring at the Site occurred:

- As part of Site operational permits (e.g., NPDES Waste Discharge Permit)
- In response to spills or discharges related to mill operations (in accordance with the Site-specific SPCC plan)
- Area-specific environmental investigations (e.g., CBC[38]).

These efforts provide operational, incident, and/or area-specific data about COPC sources and releases. Following cessation of certain mill operations and entering into the AO with Ecology, the focus of the RI will build on existing data/information and understanding of Site operations (described in Section 3) to describe the following in accessible portions of the Site:

- Potential sources of COPCs, including spatial and chronological evaluation based on Site operations
- Potentially affected environmental media

[38] As described in Section 3.5.6, previous investigation has been completed in the CBC area under Ecology's Voluntary Cleanup Program.

- Potential migration pathways and fate and transport mechanisms
- Potential receptors and exposure pathways.

The preliminary CSM is described in the following sections and shown on Figure 11. The CSM is preliminary and presented in tabular format using information available at this time. Throughout the RI process, GP will follow an adaptive management process (see Section 1.1) to revisit and refine the CSM. The adaptive management process will incorporate data and information gathered during the RI phases and incorporate existing Site data/information (e.g., permit-required monitoring) to adjust and target subsequent decisions based on observations, prior experience, and actual measurable change.

4.1 Constituents of Potential Concern

COPC sources relate to historical mill operations, as well as construction, renovation, and demolition over the mill's 140-year history. Historical and current chemical usage in each OA as well as known spills were described in Section 3. Isolated subsurface investigations have been performed in response to spills and leaks. Based on the understanding of historical and current chemical usage and known spills/releases at the site, COPCs have been identified for each OA. OAs and COPCs are presented in Table 1.

Review of Site information identifies two groups of COCPs:

- OA-specific COPCs – these COPCs are expected to be localized to mill OAs and operational features where COPCs were used, handled, and stored or where specific documented spills or releases occurred. For example, in the Main Mill Area – North (SOU-B), spills of black liquor occurred during pulping operations in OA-B-1. COPCs related to black liquor include sulfur and sodium from salts used in the pulping operation.
- Site-wide COPCs – these COPCs relate to more general mill operations, typical heavy industrial processes, and support functions. For example, Site-wide mill operations involve use of petroleum hydrocarbons as an energy source to power mill operations and as a lubricant or hydraulic fluid to operate and maintain machinery.

Based on understanding of historical and current chemical usage and known spills/releases at the site, OA-specific COPCs include VOCs, SVOCs, dioxins, metals, sulfur, PCBs, and PFAS. Site-wide COPCs include petroleum hydrocarbons[39].

Cleanup levels for Site COPCs have not been established at this time. MTCA cleanup standards and other ARARs will be evaluated in consultation with Ecology as the CSM is refined through implementation of the RI. Screening levels will be used to evaluate COPC data based on potential receptors and exposure pathways, MTCA requirements, and Ecology's Cleanup Levels and Risk Calculation (CLARC) tool. For most sites and constituents, MTCA Method B provides the screening criteria protective of unrestricted land use; however, as presented in the

[39] Where petroleum hydrocarbons are identified as a COPC, samples will be analyzed by NWTPH-Gx and NWTPH-Dx per Ecology guidance (WAC 173-340-900). Additional analytes may be included based on the type of petroleum hydrocarbons expected to be present in the area based on operations and incident records (see Section 3.5; Table 830-1 of WAC 173-340-900).

Guidance for Remediation of Petroleum Contaminated Sites (Ecology 2016), MTCA Method A provides this information for petroleum hydrocarbons. For the purpose of this RI WP, screening levels consist of the following:

- Soil: MTCA Method B (WAC 173-340-740)[40] provides the bases for developing screening levels for unrestricted or restricted land use. Based on City of Camas zoning, the Site meets the definition of an industrial property. However, at this time, Ecology has not made a determination regarding land use, so analytical results for soil samples analyzed during the RI will consider screening levels based on restricted and unrestricted land use. To this end, MTCA Method B specifies that soil cleanup levels shall be at least as stringent as:
    - Concentrations established under applicable state and federal laws (ARARs);
    - Concentrations that result in no significant adverse effects on the protection and propagation of terrestrial ecological receptors established using the procedures specified in WAC 173-340-7490 through 173-340-7494 unless it is demonstrated under those sections that establishing a soil (COPC) concentration is unnecessary; and
    - For COPCs for which sufficiently protective, health-based criteria or standards have not been established under applicable state and federal laws, those concentrations that protect human health as determined by evaluating the following exposure pathways:
        - Groundwater protection (as a drinking water and transport medium to surface water)
        - Soil direct contact
        - Soil vapors.
- Groundwater: MTCA Method B (WAC 173-340-720) [41] provides the bases for developing screening levels for groundwater. Generally, MTCA Method B requires that groundwater cleanup levels equate to (COPC) concentrations protective of drinking water beneficial uses, unless groundwater qualifies as nonpotable. Groundwater underlying the Site is not used as drinking water. However, for the purpose of the RI, analytical results for groundwater samples will consider screening levels based on MTCA Method B. To this end, MTCA Method B specifies that groundwater cleanup levels shall be at least as stringent as:
    - Concentrations established under applicable state and federal laws (ARARs);

[40] MTCA Method A (WAC 173-340-900) provides screening levels for unrestricted and industrial land use for petroleum hydrocarbons. Method B may be used but requires a site-specific calculation.

[41] MTCA Method A (WAC 173-340-900) provides standard groundwater cleanup levels for petroleum hydrocarbons. Method B may be used but requires a site-specific calculation.

- Concentrations protective of surface water beneficial uses unless COPC are unlikely to reach surface water; and
- For COPCs for which sufficiently protective, health-based criteria or standards have not been established under applicable state and federal laws, those concentrations that protect human health as determined by MTCA Equations 720-1 and 720-2.

- Surface Water: MTCA Method B (WAC 173-340-730) provides the bases for developing screening levels for surface water. For the purpose of the RI, analytical results for surface water samples will consider screening levels based on MTCA Method B. To this end, MTCA Method B specifies that surface water cleanup levels shall be at least as stringent as:
  - Concentrations established under applicable state and federal laws (ARARs);
  - For COPCs for which environmental effects-based concentrations have not been established under applicable state and federal laws, concentrations protective of wildlife, fish, and other aquatic life;
  - For COPCs for which sufficiently protective, health-based criteria or standards have not been established under applicable state and federal laws, those concentrations that protect human health as determined by MTCA Equations 730-1 and 730-2.
  - Concentrations protective of drinking water for surface water classified as suitable for domestic water supply under WAC 173-201A.

4.2 Release Mechanisms and Potential Migration Pathways

Release mechanisms describe the means by which a COPC is released from a source to the environment. Potential migration pathways describe the means for COPC movement within an environmental medium or transfer between environmental media. Potential migration pathways are influenced by COPC physical and chemical properties (e.g., water solubility, vapor pressure) that affect mobility and distribution, characteristics of environmental media (e.g., soil type, depth to water), and Site-specific transport mechanisms (e.g., groundwater flow direction).

Proposed field activities (discussed in Section 5) will improve current understanding of COPC presence and distribution in soil and groundwater related to releases and potential migration to other environmental media (e.g., surface water, vapor). A summary of release mechanisms and migration pathways based on existing data and current operations is presented below:

- Release Mechanisms noted on the AO include:
  - Site Operations – Areas of the Mill where there is potential for COPC release due to historical operations were described in Section 3 and represent a focus of RI activities in accessible areas. It is critical to understand nature and extent of COPCs in soil and groundwater in upland areas with historical and current Site operations; this understanding will allow for an informed evaluation of the potential for COPC migration or transfer to other media.

  - Spills, dumping, leaks, housekeeping, and management practices – GP complies with applicable local, state, and federal requirements, including an SPCC Plan. Spills and materials management have been reviewed and will guide RI activities. As described in Section 3, historical direct discharges have been reported to regulatory agencies, investigated, and mitigated through corrective action.

  - Direct Discharges – Direct discharges relate to wastewater management and monitoring programs (e.g., the NPDES permit). Some historical wastewater discharges may pre-date operation of the WWTP, but discharges are now managed with current monitoring as part of the site's NPDES Waste Discharge Permit No. WA0000256 and in accordance with the site's SPCC Plan (Georgia-Pacific 2019). Further, site stormwater is collected and conveyed to the WWTP on Lady Island; therefore, if spills were to reach the site storm system prior to being controlled, they are connected to the process sewer and managed by the WWTP and are not expected to directly discharge to the environment. Therefore, current and more recent direct discharge of COPCs to surface water or sediment is not anticipated to be a complete migration pathway.

  - Stormwater discharges – As described in Section 3.4 and in the direct discharges summary above, stormwater is currently regulated by NPDES Waste Discharge Permit No. WA0000256. As described in the facility's Storm Water Monitoring Plan for the Camas Mill (Georgia-Pacific Consumer Operations LLC 2017c), stormwater is collected and conveyed to the WWTP. Stormwater samples have previously been collected to comply with the NPDES permit; industrial stormwater is captured and treated by the WWTP, and therefore stormwater samples are not currently collected routinely. However, the mill completes annual surveys to monitor for stormwater discharges not captured by the existing conveyance system. Stormwater discharges are not anticipated to be a complete migration pathway.

- Migration pathways noted in the AO include:

  - Groundwater Discharges and Seeps – Historical spills or releases of COPCs have the potential to reach groundwater. This medium and migration pathway will be evaluated as part of RI activities. In this initial RI WP (Section 5) monitoring wells will be installed for collection and analysis of groundwater samples and evaluation of groundwater flow direction. Characterization of groundwater will also inform and evaluating the groundwater/surface water interaction and potential groundwater seeps (discussed in Section 5).

  - Overland flow – Site operations are conducted under an SPCC Plan and Site stormwater is collected for conveyance and treatment at the WWTP. Overland flow is collected in storm drains and conveyed to the WWTP. Therefore, overland flow is not anticipated to be a complete migration pathway.

  - Soil erosion – The Mill is primarily paved, and the banks of the Columbia River are protected with rip rap to reduce the potential for erosion. Soil erosion is not anticipated to be a complete migration pathway.

4.3 Potential Exposure Pathways

A complete exposure pathway consists of four fundamental components: 1) a source and mechanism of COPC release; 2) an affected environmental medium and probable migration process; 3) an exposure point; and 4) an exposure route by which humans and/or ecological receptors could come into contact with a COPC (ASTM 2003, EPA 2004). If one or more of these components is missing, then the exposure pathway is considered incomplete.

Potential exposure routes include: ingestion, direct contact, and inhalation from potential COPC sources such as surface soil, subsurface soil, and groundwater; and potential uptake by ecological receptors. Potential human receptors include maintenance/utility/trench workers, construction workers, and commercial/industrial workers. Potential ecological receptors include plants, soil invertebrates, birds, and mammals.

The primary exposure pathways for COPCs at the Site include:

- Potential ingestion and direct contact with COPCs by site workers performing subsurface activities where COPCs may be present in soils or groundwater.
- Potential migration (via volatilization) and inhalation of airborne vapors.
- Potential migration and discharge of COPCs to the Camas Slough or Columbia River, uptake by aquatic organisms and consumption of aquatic organisms by humans.

These potential exposure pathways are evaluated by media below, including consideration of current land use, zoning, site operations, and existing permits that regulate discharges from the Mill.

- *Surface and subsurface soil*: The Mill is primarily paved or consists of structures that limit potential exposure to surface or subsurface soils. Intrusive work related to mill operations that may result in worker exposure are controlled through facility health and safety policies and procedures. Due to the heavy industrial land use, minimal ecological receptors are expected to be present. As such, there is limited potential human or ecological exposure to COPCs in surface and subsurface soil.
- *Groundwater*: Groundwater underlying the site is not used as drinking water supply. Areas surrounding the Site are served by municipal water supplies (City of Camas 2019). Therefore, an exposure point for groundwater underlying the site does not exist and the exposure pathway is currently incomplete.
- *Air*: Mill operations are commercial/industrial in nature. The potential for indoor air exposure and/or potential for inhalation of airborne vapors (e.g., during maintenance or construction work) potentially exists.

- *Surface Water and Sediment*: As described in previous sections, overland flow, stormwater, and facility wastewater are collected and conveyed to the WWTP. The WWTP discharges to the Columbia River under NPDES Waste Discharge Permit No. WA0000256. Potential COPC migration to surface water and/or sediment may occur via surface runoff or infiltration (i.e., groundwater/surface water interaction) and will be a focus of RI activities.

4.4 Initial Data Gaps

Initial data gaps were presented for each operational feature in Section 3.5. These initial data gaps should be addressed prior to other data gaps that may exist at the Site to refine the preliminary CSM and improve understanding of potential migration pathways and exposure pathways. As described in Section 1.1.2, initial RI activities (proposed in Section 5) are focused on media in accessible upland areas (e.g., soil and groundwater) and refining an understanding of potential migration pathways from upland areas to other media (e.g., sediment) and receptors (e.g., Camas Slough). This approach will allow for the investigation to build on available data in a step-wise manner, make decisions based on understanding of site conditions, and follow adaptive management principles.

Section 5: Remedial Investigation Activities

COPCs have been identified based on a review of historical documents including historical operations, release reports, and site investigations (Section 3). As presented in Section 3.5 and summarized in Table 4, data gaps exist with respect to presence and migration of COPCs. There is limited information available regarding site geology and hydrogeology, which is important to understand fate and transport mechanisms. As stated in Section 1.1.2 and Section 3.5, groundwater characterization of soluble COPCs is prioritized to understand potential COPC transport from upland areas to the Camas Slough, and therefore initial data gaps focus on soluble COPCs in groundwater. Where insoluble COPCs are identified for an operational feature, initial data gaps will include presence of insoluble COPCs in soil. Soil sampling may also be proposed opportunistically (i.e., during monitoring well installation).

To resolve these data gaps, the following RI field activities are proposed:

- Installation of Monitoring Wells (including soil sampling during installation activities)
- Quarterly groundwater monitoring for four consecutive quarters
- Focused shallow/surface soil sampling to target insoluble COPCs (e.g., PCBs)
- Non-invasive investigation to determine extent of buried materials in OA-C2.

Proposed field activities are described in the following sections. Proposed sampling locations are shown on Figures 12 through 14 and proposed sample analyses are summarized in Tables 6 and 7 and in the SAP/QAPP (Appendix A). SOGs for the field activities that will be performed during this RI are provided in the SAP/QAPP.

As stated in Section 1.1.2 and Section 3.5, the initial data gaps focus on areas currently accessible for RI activities. In some areas of the Site, the density of structures and below-ground features (e.g., basements or utilities) render areas inaccessible for RI activities. In other areas, ongoing operations render areas inaccessible for RI activities. If there are additional changes in operations and/or as potential demolition proceeds, these areas may become accessible.

As described in Section 3, the Facility was organized into SOUs to facilitate discussion, and SOUs are further defined by operational areas and operational features. Groundwater flow direction in upland areas is presumed to be in the direction of the Camas Slough[42], and therefore SOUs may be connected through groundwater. Some field activities, such as groundwater monitoring, are expected to provide useful information for the assessment of more than one SOU.

[42] Groundwater flow direction at Lady Island is presumed to be in the direction of the Columbia River in some areas and in the direction of the Camas Slough in other areas.

5.1 Pre-Field Activities

Invasive activities will be required to complete the scope of work outlined in this Work Plan. Prior to invasive activities, a utility survey will be performed to evaluate the potential for underground utilities at each proposed well location. The utility survey will augment information provided by GP regarding potential underground utilities. The utility location procedures will include:

- Coordination with the Washington Utility Notification Center (as needed; public property only).
- Coordination with GP regarding utilities at proposed sampling locations.
- Coordination with a private utility locator to identify possible underground lines on private property. The private utility locate may be paired with Time Domain Electromagnetic Induction (TDEM) and Ground Penetrating Radar (GPR; see Section 5.2).
- Use of an air-knife or similar tool (where appropriate) to assess possible underground utilities.

When necessary, proposed boring/well locations will be adjusted in the field to accommodate possible underground or overhead utilities. A site HASP that documents the specific procedures to be used to protect the health and safety of Kennedy/Jenks Consultants personnel during the site investigation is presented in the SAP/QAPP.

5.2 Non-Invasive Exploration

There is anticipated to be an extensive network of buried utilities and potentially other buried features at the mill. Non-invasive exploration methods are proposed paired with the private utility locate for enhanced understanding of subsurface features. Two additional non-invasive explorations are proposed beyond the private utility locate:

- Buried materials are suspected to be present in the Mill Modernization Debris Area and Buried Material Area, located in SOU-C. Non-invasive exploration methods are proposed in these areas to better identify the nature and extent of suspect debris buried in the Operational Features prior to developing a plan for subsurface exploration.
- Non-invasive exploration methods are proposed to locate the existing pipeline from the Primary Clarifier to the South ASB on Lady Island to support soil sampling of the former wastewater ditches.

Geophysical surveys will be completed within accessible areas to help identify potential subsurface anomalies. Surveys will be completed in a grid pattern using a combination of TDEM and GPR. Selection of survey method will be based on site specific conditions, such as proximity of metallic objects including buildings, fences, and vehicles, as well as accessibility due to current Mill operations.

5.3 Shallow Monitoring Wells

The purpose of each proposed well location is presented in Table 5. Proposed well locations are shown on Figure 12.

5.3.1 Installation and Soil Sampling

GP proposes installation of thirteen monitoring wells to augment current understanding of site geology and hydrogeology and to evaluate potential presence of COPCs. Proposed monitoring well locations are presented on Figure 12; actual locations may change based on site constraints and field observations.

Monitoring wells will be installed using sonic drilling methods to a target depth of approximately 10 feet below the observed shallow groundwater table[43]. Due to potentially difficult drilling conditions in the Camas area (e.g., cobbles and shallow bedrock) sonic drilling was chosen as the preferred method in order to avoid refusal; however, the total depth of borings may be adjusted based on observed field conditions (including penetration resistance). Since the depth to groundwater at the site has not been fully characterized, field observations will be used to screen wells across the shallow water table. Short core runs may be employed if field screening indicates that the heat from the core barrel could limit easy identification of shallow groundwater levels.

Soil samples will be collected from the borings during monitoring well installations. Sonic drilling allows for retrieval of continuous core samples, which will be field screened and logged. Field screening will include screening for VOCs using a photoionization detector (PID), conducting a field sheen test, and documenting visual characteristics (staining) or olfactory (odor) indicators of impacts.

Soil samples will be collected for laboratory analysis from each boring. Approximately one soil sample per 5 feet will be retained for possible analysis; however, depending on the boring depth and number of soil samples collected, some soil samples retained for analysis may not be analyzed. In general, soil samples prioritized for laboratory analysis will include:

- Soil samples with field indication of impacts
- Soil samples collected near the ground surface (e.g., 0-3 feet) in areas with suspected surface spills
- Soil samples collected at the shallow water table and smear zone, and
- Soil samples collected from the bottom of the boring.

A minimum of two soil samples will be analyzed at each location for the COPCs within the applicable operational area (see Table 7). Soil samples will be collected directly into laboratory-supplied bottles using cleaned equipment or clean disposable gloves.

[43] Anticipated depth to groundwater based on previous work at the Site is presented in Section 2.1.4.

After reaching the target drilling depth, a 2-inch monitoring well will be installed at each boring location. Wells will be constructed with Schedule 40 PVC, with 10 to 15 feet of 0.010-slot screen and a filter pack constructed with 10/20 silica sand. Drilling and well installation will be conducted by a Washington licensed driller and in accordance with the Minimum Standards for Construction and Maintenance of Wells (WAC 173-160).

Following well installation, monitoring wells will be developed by surging and pumping to remove entrained sediments.

5.3.2 Groundwater Monitoring

At least 1 week following development, water levels in the thirteen new monitoring wells will be gauged and groundwater samples will be collected using low-flow sampling methods. Groundwater samples are expected to be collected using either peristaltic or bladder pump, depending on the depth to groundwater. Samples will be analyzed for the COPCs as noted in Table 6. After the initial sampling event, groundwater samples will be collected using the same methods for the following three quarters to complete 1 year (four consecutive quarters) of monitoring.

Groundwater monitoring at existing monitoring wells will continue in accordance with applicable permit requirements (e.g., the LILF monitoring wells). However, additional analyses may be added to existing monitoring wells (Table 6). Groundwater monitoring at the existing CBC monitoring wells will be completed with groundwater monitoring at the proposed new monitoring wells. Groundwater monitoring at the Lady Island monitoring wells will continue on its existing schedule.

Due to the site's proximity to the Columbia River, site groundwater may be influenced by the river. Water level measurements from monitoring wells will be compared to the Columbia River stage to monitor for impacts, if any. The following river stations will be used:

- United States Geological Survey (USGS) Station 14144700 at Vancouver[44], which is approximately 13 miles downstream of the site
- USGS Station 14128870 at Bonneville Dam[45], which is approximately 24 miles upstream of the site.

5.4 Additional Soil Sampling

In addition to soil sample collection during monitoring well installation activities, soil sampling is proposed to target insoluble COPCs. Specifically, additional soil sampling is proposed to address initial data gaps identified related to PCBs and dioxin.

Three types of soil collection methods are proposed: shallow soil samples collected from a depth of 0-1 feet bgs, surface soil samples collected by scraping existing ground surface, and deeper soil samples (within the footprints of the Former Wastewater Ditches). The soil sample depth measurement will start at approximately bare ground for all three cases. If the sample

[44] https://waterdata.usgs.gov/monitoring-location/14144700/#parameterCode=00065&period=P7D
[45] https://waterdata.usgs.gov/monitoring-location/14128870/#parameterCode=00065&period=P7D

location is heavily vegetated, covered by gravel, or otherwise covered, the material will be cleared locally to allow for sample collection.

5.4.1 Shallow Soil Sampling

Proposed shallow soil sampling is presented on Figures 13 and 14 and in Table 7. Generally, two soil samples will be collected from each of the proposed locations for shallow soil sampling (see Table 7). Prior to shallow soil sample collection, the proposed sampling area will be observed for visual characteristics (staining) or olfactory (odor) indicators of impacts. Observations will be photo-documented by Kennedy Jenks staff, subject to Mill photography policy. Final sampling locations will be selected based on field observations to target areas with potential impacts. Sampling locations may also be adjusted based on local low spots or other physical features.

Shallow soil samples will be collected using a push-probe, hand auger, or other hand tools, to excavate to a total depth of 0-1 feet bgs, taking care to avoid loose materials surrounding the excavation from falling into the sample hole. Each soil sample will be collected directly into laboratory-supplied bottles using cleaned equipment or clean disposable gloves. Samples will be analyzed for the COPCs as noted in Table 7.

5.4.2 Surface Soil Sampling

Two surface soil samples are proposed to be collected from each of the Substations No. 1, 2, 5, 6, 8, 9, and 10. See Figures 13 and 14 for approximate sampling locations. Prior to surface soil sample collection, the area surrounding each Substation will be observed for visual characteristics (staining) or olfactory (odor) indicators of impacts. Observations will be photo-documented by Kennedy Jenks staff, subject to Mill photography policy. Final sampling locations will be selected based on field observations to target areas of potential impact.

The Substations are active; only non-intrusive activities are proposed due to ongoing operations at the Site which limit access to these areas. Non-intrusive surface soil samples will be collected by hand using scoops, such as pre-cleaned spoons or trowels. Each soil sample will be collected directly into laboratory-supplied bottles using cleaned equipment or clean disposable gloves. Samples will be analyzed for the COPCs as noted in Table 7.

Soil samples will be collected from areas that are not covered by asphalt, concrete, or other permanent barrier that cannot be removed using hand tools. Soil sampling in areas where pavement disturbance is required will be postponed until Substation is accessible for RI activities.

5.4.3 Soil Sampling in Former Wastewater Ditches

An additional six samples are proposed to be collected from Lady Island, approximately every 500 linear feet (LF) along the Former Wastewater Ditches[46] (see Figure 14 for approximate locations). The Former Wastewater Ditches have been backfilled; aside from a short segment near Outfall 001, there are no visible indicators of the extents of the ditches remaining. Based

[46] Initial sampling efforts will use existing features to guide soil sampling efforts.

on historical aerials and field indicators, the existing pipeline may have been installed in the Former Wastewater Ditch between the Primary Clarifier and the South ASB.

Actual sampling locations will be identified based on field observations and documented in the field. Prior to sampling, the location of the pipeline will be identified (see Section 5.2). Sample locations will be selected within the footprints of the former ditches and offset from the location of the pipeline. To the extent feasible, this work will be completed during dry weather conditions to avoid standing water in the Former Wastewater Ditches.

Soil samples will be collected using either a hand auger or (if needed) a direct-push drill rig. At each sample location, the soil core will be observed, and the fill material used to backfill the ditches will be visually characterized. Changes in soil characteristics potentially indicative of the transition from fill material to material originally present at the base of the ditches will be noted. Based on existing site conditions and historical aerial photographs of the Former Wastewater Ditches, ditch bottom material is expected to be encountered at a depth of approximately 5 feet bgs.

Soil samples will be collected from the depth interval from the transition to ditch bottom material to 6 inches below the transition. Additional samples of the fill material above the transition to ditch bottom material may be collected based on field observations. Each soil sample will be collected directly into laboratory supplied bottles using cleaned equipment or clean disposable gloves. Samples will be analyzed for the COPCs noted in Table 7.

5.5 Seep, Sediment, and Stormwater Sampling

In addition to soil and groundwater, the AO includes sampling and analysis of the following media: seeps, surface and subsurface sediments, and stormwater and catch basin solids. As stated in Section 3.4, routine inspection and/or monitoring of seeps, sediment, and stormwater occurs as part of existing monitoring programs and therefore, no additional sampling of these media is proposed. These media will continue to be monitored and the results will be evaluated together with the results from RI field activities in the RI Report.

Seeps have been identified on Lady Island. However, annual seep inspections occur (Section 3.4) and seeps have not been found in the past 3 years of monitoring activities (2017-2020). As described in Section 5.3, groundwater monitoring is proposed; groundwater is typically the source of a seep, and therefore, characterization of groundwater is expected to be sufficient to characterize seeps, if observed.

Sediment samples are collected through the existing waste discharge monitoring program (Section 3.4). Sediment samples were collected near two active outfalls (Outfall 001 and Outfall 002) in September 2017 in compliance with the facility's Waste Discharge Permit (No. WA0000256) and included comparisons to the Sediment Quality Standards in the Sediment Management Standards (SMS; Chapter 173-204 WAC; ESA 2017, 2018). As reported in the Sediment Data Report (ESA 2018), none of the results from Outfall 001 or Outfall 002 exceeded the SMS chemical criteria. At Outfall 001 (Columbia River), dioxin was not detected above the reportable detection limit. At Outfall 002 (Camas Slough), most dioxin compounds were either not detected or detected between the estimated detection limit and the reportable detection limit. Monitoring through the existing monitoring program for the waste discharge permit is representative of potential impacts from site operations to sediment.

As described in Section 3.4, site stormwater is collected and conveyed to the facility's WWTP and is sampled in accordance with the facility's NPDES Permit (Georgia-Pacific Consumer Products 2011, 2017c). Therefore, stormwater and potential solids in facility stormwater is expected to be captured, managed, and monitored by the facility's Waste Discharge Permit, and stormwater will continue to be monitored in accordance with the facility's NPDES Permit.

5.6 Laboratory Analysis

Laboratory analyses will be conducted in accordance with the SAP/QAPP. Soil and groundwater samples will be submitted under chain-of-custody protocol to the laboratory and will be analyzed on a standard turn-around basis. Sample handling, packing, and shipping procedures are presented in the SAP/QAPP.

Analytical methods to be used during sample analyses are presented in the SAP/QAPP. Additional soil sample analyses may be made based on field screening results or initial analytical results to provide further characterization of site conditions.

References

Arcadis. 2011. Data Summary Report Investigation of Weak Black Liquor Release. Prepared for Georgia-Pacific Consumer Products LLC. October.

Arcadis. 2012. Data Summary Report Investigation of Black Liquor Release from No. 4 Swing Tank. Prepared for Georgia-Pacific Consumer Products LLC. October.

Arcadis. 2015. Data Summary Report Investigation of Black Liquor Basement Release. Prepared for Georgia-Pacific Consumer Products LLC. January.

Arcadis. 2016. Summary Report Investigation of Hydrocarbon Release. Prepared for Georgia-Pacific Consumer Products LLC. January.

Bonneville Power Administration (BPA). April 2001. *The Columbia River System Inside Story*. U.S. Bureau of Reclamation.

Brynelson, Troy and Littman, Adam. November 26, 2017. *As Paper Mill's Presence Fades, Camas Grapples with Identity, Its Future.* The Columbian Newspaper. Accessed online.

City of Camas. 2013. *City of Camas Comprehensive Stormwater Drainage Plan.* Prepared by Otak, Inc. April. City of Camas. 2015. *Brief History of Camas.* http://www.cityofcamas.us/parksfacilities/43-ourcommunity/69-history

City of Camas. 2016. Camas 2035: A Comprehensive Plan to guide future growth and development for the City of Camas. June. https://www.cityofcamas.us/sites/default/files/fileattachments/community_development/page/5971/comprehensive_plan_camas_2035.pdf

City of Camas. 2021a. Camas Zoning, Ordinance 21-010. Map dated 21 July 2021. Accessed 6 October 2021. https://www.cityofcamas.us/sites/default/files/fileattachments/community_development/page/6131/zoning_2021.pdf

City of Camas. 2021b. Long-Range Planning. Accessed 6 October 2021. https://www.cityofcamas.us/com-dev/page/long-range-planning

City of Camas. 2019. City of Camas Water System Plan Update. October.

City of Vancouver. 2021. Climate and Weather. https://www.cityofvancouver.us/ourcity/page/climate-and-weather. Accessed 10 December 2021.

Department of Ecology (Ecology). 2008. Fact Sheet, Permit No. WA 000025-6. National Pollutant Discharge Elimination System Wastewater Discharge Permit, Georgia Pacific Consumer Products (Camas), LLC, Camas, Washington. 15 February.

Ecology. 2016. Guidance for Remediation of Petroleum Contaminated Sites, Toxics Cleanup Program, Publication No. 10-09-057. Revised June 2016.

Ecology. 2020a. Fact Sheet for NPDES Permit WA0000256, Georgia Pacific Consumer Products (Camas), LLC. 29 September.

Ecology. 2020b. National Pollutant Discharge Elimination System, Wastewater Discharge Permit No. WA0000256. Issuance date: 2 November 2015. Second Modification date: 20 November 2020.

Ecology. 2021a. Website: Model Toxics Control Act. Accessed 15 November 2021. https://ecology.wa.gov/Spills-Cleanup/Contamination-cleanup/Rules-directing-our-cleanup-work/Model-Toxics-Control-Act

Ecology. 2021b. Letter from Shingo Yamazaki, Ecology, to Matt Tiller, Georgia-Pacific, RE: Request for Deadline Extension – Draft RI Work Plan. 8 December.

Environmental Science Associates (ESA). 2018. Sediment Data Report. Prepared for Georgia-Pacific Consumer Products LLC. February.

ESA. 2017. Sediment Sampling and Analysis Plan: NPDES Waste Discharge Permit Number WA0000256. Prepared by Environmental Science Associates for Georgia-Pacific Consumer Products (Camas) LLC. Camas, Washington. August 2017.

Fort James Camas LLC. 1999. Letter from R. D. McCollister, Fort James, to Mr. Teddy Le, Department of Ecology. Dated 19 January 1999.

Fort James Camas LLC. 2002a. Letter from James A Cadd, Fort James, to Mr. Teddy Le, Department of Ecology. Dated 8 February 2002.

Fort James Camas LLC. 2002b. Letter from James A Cadd, Fort James, to Mr. Teddy Le, Department of Ecology. Dated 30 May 2002.

Fort James Camas LLC. 2006. Letter from Michael D. Tompkins, Fort James, to Mr. Teddy Le, Department of Ecology. Dated 7 March 2006.

Georgia-Pacific Consumer Products (Camas) LLC. 2011. Camas Mill Storm Water Monitoring: Final Report. July.

Georgia-Pacific Consumer Operations LLC. 2016. Letter from Joe Ertolacci, Georgia-Pacific Consumer Operations LLC, to Ms. Ha Tran, Department of Ecology, RE: Summary Report for Investigation of Hydrocarbon Release. Dated 29 January 2016.

Georgia-Pacific Consumer Operations LLC. 2017a. Letter from Shawn Wood, Georgia-Pacific Consumer Operations LLC, to Ha Tran, Department of Ecology, RE: Incident Report. Dated 20 February 2017.

Georgia-Pacific Consumer Operations LLC. 2017b. Letter from Shawn Wood, Georgia-Pacific Consumer Operations LLC, to Ha Tran, Department of Ecology, RE: Update on the Cleanup of the Diesel Release to the Camas Slough. Dated 15 November 2017.

Georgia-Pacific Consumer Products (Camas) LLC. 2017c. Storm Water Monitoring Plan for the Camas Mill. May.

Georgia-Pacific Consumer Operations LLC (Camas). 2018a. Letter from Shawn Wood, Georgia-Pacific Consumer Operations LLC, to Ha Tran, Department of Ecology, RE: Administrative Order Docket #115397, Completion of Phase 1 Corrective Actions in Response to Administrative Order Docket #15397. Dated 12 January 2018.

Georgia-Pacific Consumer Operations LLC (Camas). 2018b. Letter from Shawn Wood, Georgia-Pacific Consumer Operations LLC, to Ha Tran, Department of Ecology, RE: Administrative Order Docket #115397, Completion of Phase 2 Corrective Actions in Response to Administrative Order Docket #15397. Dated 16 March 2018.

Georgia-Pacific Consumer Operations LLC (Camas). 2018c. Letter from Shawn Wood, Georgia-Pacific Consumer Operations LLC, to Ha Tran, Department of Ecology, RE: 50% Black Liquor Spill. Dated 27 April 2018.

Georgia-Pacific Consumer Operations LLC (Camas). 2018d. Letter from Shawn Wood, Georgia-Pacific Consumer Operations LLC, to Ha Tran, Department of Ecology, RE: Georgia-Pacific Consumer Operations LLC, EPCRA Section 304(c) Written Follow-up Report, NRC Incident Report #1210244, ERTS Incident #680842. Dated 24 May 2018.

Georgia-Pacific. 2001. Letter from Julie B. Raming to Mr. Teddy Le, Department of Ecology, RE: Former Specialty Chemicals Facility, Georgia-Pacific Camas Mill, Camas, Washington. 17 October.

Georgia-Pacific. 2019. Spill Prevention Control and Countermeasure (SPCC) Plan. June.

Global Remediation & Environmental Services LLC (GRES). 2021. Email from Matt Tiller, GRES, to Shingo Yamazaki, Department of Ecology, RE: Camas Business Center (CBC) Soil and Groundwater Summary. 12 July.

Joner, Cami. March 14, 2010. *A Time Line of Georgia-Pacific Corp.'s Central Research Division*. The Columbian Newspaper. Accessed online.

Kennedy/Jenks Consultants (Kennedy Jenks). 2018. Letter from Julia Schwarz, Kennedy Jenks, to Ms. Sunanda Chunder, Georgia-Pacific Consumer Operations LLC, RE: Investigation of Bunker C Release Discovered at Georgia-Pacific Camas Mill. 19 September.

Kennedy Jenks. 2019. Technical Memorandum from Deonne Knill, Kennedy Jenks, to Georgia-Pacific Consumer Operations LLC, RE: Investigation of Suspected Bunker C Release at Georgia-Pacific Camas Mill. 1 February.

Kennedy Jenks. 2020. Letter from Deonne Knill, Kennedy Jenks, to Ms. Ha Tran, Department of Ecology, RE: Investigation of Petroleum Release Discovered at Georgia-Pacific Consumer Operations LLC (Camas, Washington). 13 November.

Lacamas Magazine. Papermaker History, Part 1: Mill Interpretive Center & The Early Years. https://lacamasmagazine.com/2018/02/papermaker-history-part-1-camas-mill-interpretive-center.html

Lacamas Magazine. Papermaker History, Part 2: 1920s-1950s — Corporate Mergers, Newsprint Stops. https://lacamasmagazine.com/2018/04/papemaker-history.html

National Council for Air and Stream Improvement, Inc. (NCASI). 2013. NCASI Handbook of Environmental Regulations and Control. Revised April 2013.

Pacific Groundwater Group (PGWG). June 9, 2003. *Hydrogeologic Evaluation for City of Camas.*

WDOE. 2021. Agreed Order No. DE 18201. August 12.

United Stated Department of Agriculture (USDA) Natural Resources Conservation Service (NRC). 2021. Web Soil Survey. Accessed 24 June 2021.

United States Environmental Protection Agency (USEPA). 1978. Screening Study on Feasibility of Standards of Performance for Two Wood Pulping Processes. EPA-450/3-78-111.

Tables

Table Notes

ASB = aerated stabilization basins
BOD = Biochemical oxygen demand
CBC = Camas Business Center
cis-1,2-DCE = cis-1,2-Dichloroethene
COD = Chemical oxygen demand
COPCs = constituents of potential concern
EPA = U.S. Environmental Protection Agency
LILF = Lady Island Landfill
MTCA = Washington State Model Toxics Control Act
NPDES = National Pollutant Discharge Elimination System
OA = Operational Area
PCBs = polychlorinated biphenyls
PCE = tetrachloroethylene
PFAS = per- and polyfluoroalkyl substances
SOU = Site Operable Unit
SVOCs = semi-volatile organic compounds
TCE = trichloroethylene
TDS = Total dissolved solids
TOC = Total organic carbon
TPH = total petroleum hydrocarbons
VOCs = volatile organic carbons

Table 1: Summary of Operational Areas

Kennedy Jenks **DRAFT**

Operational Area and ID		Operational Feature	Chemicals of Potential Concern (COPCs)
Site Unit A - Woodyard			
Woodmill	OA-A1	Wood Chip Piles and First Woodmill	TPH, PCBs
		Dock Warehouse	None
		Second Woodmill	TPH
		Former Cat Shop, Electric Shop, and USTs	TPH, VOCs
Site Unit B - North Main Mill			
Pulping	OA-B1	Black Liquor Areas	sulfur, sodium, TPH
		Kraft Mill	sulfur, sodium, TPH
		Former Bag Factory	sulfur, sodium, TPH
		Former Sulfite Mill	sulfur, TPH
		Lime Kiln	None
		No. 6 Substation	TPH, PCBs
		No. 8 Substation	TPH, PCBs
Power House	OA-B2	Power House	TPH, PCBs
Bleaching	OA-B3	Kraft Pulp Bleaching	TPH, chromium, dioxins
		Sulfite Pulp Bleaching	TPH
		K5 Bleach plant	TPH, PCBs
		K4 Bleach plant	TPH, chromium, PCBs
		No. 1 Substation	TPH, PCBs
Finishing/Coatings	OA-B4	Paper Treatment	Diphenyl, Copper, TPH, PFAS
		Machine Shop	TPH, VOCs, PCBs
		Fuel Oil Day Tank	TPH
		No. 5 Substation	TPH, PCBs
Specialty Minerals	OA-B5	Specialty Minerals	None
Warehouse/ Product Storage - North	OA-B6	Warehouse/ Product Storage - North	None

Table 1: Summary of Operational Areas

Kennedy Jenks **DRAFT**

Operational Area and ID		Operational Feature	Chemicals of Potential Concern (COPCs)
Site Unit C - South Main Mill			
Finishing/Coatings/ Additives	OA-C1	Fuel Oil Storage	TPH
		Additives / Coatings	TPH, PCBs
		Converting	TPH, VOCs
		No. 9 Substation	TPH, PCBs
Warehouse/ Product Storage	OA-C2	Buried Material Area	TPH, VOCs, SVOCs, PCBs, dioxins, PFAS, and metals
		Mill Modernization Debris Area	TPH, VOCs, SVOCs, PCBs, dioxins, PFAS, and metals
		No. 2 Substation	TPH, PCBs
Operational Support	OA-C3	Waste Handling Area and Fueling Station	TPH, VOCs
		Car Barn / Paint shop	TPH, VOCs
		Former Sulfur Pile	sulfur, TPH, PCBs
	OA-C4	Riverbank Pump House	TPH
		Effluent Pump Station	TPH, dioxin, metals
	OA-C5	Wooded Area	None
Site Unit D - Lady Island			
Lady Island	OA-D1	Active Landfill	*No additional COPCs beyond those defined in existing landfill permit*
		Former Wastewater Ditches	TPH, dioxin, metals
		North ASB	*No additional COPCS beyond those defined in existing NPDES permit*
		South ASB	*No additional COPCS beyond those defined in existing NPDES permit*
		Primary Clarifier	*No additional COPCS beyond those defined in existing NPDES permit*
		No. 10 Substation	TPH, PCBs
	OA-D2	Dredge Spoils Area	None
Site Unit E - Ancillary Area			
Ancillary Area	OA-E1	Ancillary Area	None
Site Unit F - CBC			
CBC/ Specialty Chemical/ R&D	OA-F1	CBC Area	PCE, TCE, 1,1,1-trichloroethane, 1,1-dichloroethene, cis-1,2-DCE, and lead

Notes:

(a) COPCs are summarized as follows:

Site-wide COPCs: TPH

Area-specific COPCs: VOCs, SVOCs, dioxins, PCBs, PFAS, metals (arsenic, copper, chromium), sulfur, sodium, diphenyl

COPCs related to wastewater: TPH, dioxin, metals

Table 2: Previous Sampling and Clean Up Activities

Kennedy Jenks **DRAFT**

Incident/ Discovery Date	Description	Sampling Activities: Soil Boring	Test Pit	Sediment Sampling	Groundwater Sampling	Soil Sampling	Cleanup Activities	Site Unit	Operational Area
11/8/1991	Three underground storage tanks were discovered at the former service station at NE 6th Street and NE Adams Street.	X				X	Soils impacted by petroleum hydrocarbons were excavated and bioremediated onsite.	E - Ancillary Area	OA-E1 - Ancillary Area
4/15/1994	An underground storage tank was discovered near the No. 4 warehouse.					X	No cleanup activities were performed as samples did not indicate presence of hydrocarbons below tank.	C - South Main Mill	OA-C2 - Warehouse/Product Storage
4/21/2011	Weak black liquor was discovered in soil below filtrate tanks.	X			X	X	Released liquid was pumped and discharged to process sewer. Soil was excavated to depth of 1.5 feet below ground surface. No further excavation was completed to maintain integrity of existing structures.	B - North Mill Main	OA-B1 - Pulping
8/25/2011	Cracks in the floor of the No. 4 Swing Tank were observed which released black liquor in underlying fill material beneath tank.	X			X	X	Several feet of fill material were removed during initial investigation of potential extent of black liquor. Further cleanup activities were not completed based on sampling results.	B - North Mill Main	OA-B1 - Pulping
6/23/2014	A release to soil was observed in the basement of the Kraft Mill Building from a damaged U-drain below a 50 percent liquor tank.	X			X	X	Released liquid was pumped and sent for treatment at Mill's wastewater treatment plant. Soils that may have been affected were excavated and were sent off-site for proper disposal.	B - North Mill Main	OA-B1 - Pulping
9/3/2015	Discovery of petroleum hydrocarbons during sewer trenching activities.	X			X	X	15 cubic yards of soil were removed and disposed of offsite.	A - Woodyard	OA-A1 - Woodmill
2/15/2017	Approximately 50 gallons of diesel fuel was released to the Camas Slough from storage tank at River Bank Pump House.					X	Soil was removed for proper disposal. Corrective actions were completed at the pump house.	C - South Main Mill	OA-C4 - Operational Support
9/14/2017	Sediment grab samples collected near Outfall 001 and Outfall 002 as required by NPDES Waste Discharge Permit (No. WA0000256).			X			None.	C - South Main Mill D - Lady Island	OA-C4 - Operational Support OA-D1 - Lady Island

Table 2: Previous Sampling and Clean Up Activities

Kennedy Jenks **DRAFT**

Incident/ Discovery Date	Description	Sampling Activities: Soil Boring	Test Pit	Sediment Sampling	Groundwater Sampling	Soil Sampling	Cleanup Activities	Site Unit	Operational Area
3/7/2018	Petroleum hydrocarbons were discovered during excavation for repairs of a buried valve on the Mill's firewater pipe. Likely source is Fuel Oil Day Tank and was not an active release at the time of discovery.		X		X	X	Accessible petroleum-contaminated soils were removed for proper disposal.	B - North Mill Main	OA-B4 - Finishing / Coatings
4/24/2018	Approximately 154,000 gallons of black liquor were released from the No. 3 Black Liquor Tank.						Released material was contained on the facility and sent to Mill's wastewater treatment plant for treatment. Bulk material that could be collected was disposed of offsite.	B - North Mill Main	OA-B1 - Pulping
9/24/2018	Petroleum hydrocarbons were discovered during a utility pole installation near the fueling station.				X		Localized petroleum impacted soil and water were removed to the maximum extent practicable.	C - South Main Mill	OA-C3 - Operational Support
8/26/2020	Petroleum hydrocarbons were discovered during excavation as part of the Package Boiler #6 installation.				X	X	Accessible soils that did not structurally support buildings and which contained visible petroleum hydrocarbons were removed and segregated for offsite disposal.	C - South Main Mill	OA-C1 - Finishing/Coatings
2000-2021	Site investigations have occurred at the Camas Business Center and Fort James Specialty Chemicals parcel in 2000, 2002, 2016, and 2021. Soil and groundwater samples were collected from installed borings and monitoring wells. Analytes included TPH, VOCs, PCBs, and metals.	X	X		X	X	No cleanup activities have been performed to date.	F - CBC	OA-F1 - CBC Area

Table 3: Existing Monitoring and Inspection Programs

Kennedy Jenks **DRAFT**

Permit / Plan	Monitored Media	Monitoring Locations	Frequency	Monitored Parameters / Activities
NPDES Waste Discharge Permit No. WA0000256	Wastewater Effluent	Outfall 001	Daily (continuous)	Flow, pH, Temperature
			3/week	BOD_5 (concentration and mass), TSS (concentration and mass)
			Annual	2,3,7,8-TCDD, 2,3,7,8-TCDF
		Outfall 002	Daily (continuous)	Flow, pH
		Final effluent	First, Third, and Fifth year of the permit	Cyanide, Total Phenolic Compounds, Primary Pollutants (Total Metals, VOCs, Acid-extractable Compounds, Base-neutral Compounds, Dioxin, Petsticides/PCBs)
			Once in last winter and once in last summer prior to next application for permit renewal	Acute Toxicity Test, Chronic Toxicity Test
	Primary and Secondary Sludge	grab sample from ASB(s)	1/permit cycle	2,3,7,8-TCDD, 2,3,7,8-TCDF
	Paper	at the reel	Daily	Production
	Stormwater	Discharge point east of the River Bank (Fire) Pump House; Discharge point west of the River Bank (Fire) Pump House	Previously, as outlined in Stormwater Monitoring Plan (4/year over two years). Currently, industrial stormwater is captured and treated by the WWTP and stormwater samples are not collected routinely.	When monitored: BOD, COD, color, copper (total), flow, nitrogen, nitrate, nitrite, oil and grease, phosphorus (total), TSS, turbidity, zinc (total). Annual survey to monitor for stormwater discharges not captured by the existing conveyance system.
	Sediment	In vicinity of Outfall 001 and Outfall 002	As outlined in Sediment Sampling and Analysis Plan	
	Inspect Outfall 001		In fourth year of permit term	Visual inspection of integrity and continued function of outfall line and diffuser
SPCC Plan (40 CFR 112)	Aboveground tanks (ASTs), totes, drum storage areas, oil-containing mechanical equipment		Monthly	Visual inspections
	Transformers and oil-filled electrical equipment		Quarterly	Visual inspections
Lady Island Landfill - Clark County Public Health Department Permit Number PT 0006096	Groundwater	Five Monitoring Wells (NE 201, E 202, SE 203, SW 107, NW 102)	Quarterly	Groundwater level; Analytes: Ammonia, barium, bicarbonate (as CaCO3), BOD, boron, calcium, COD, chloride, conductivity, iron, manganese, nitrate, pH, potassium, sodium, sulfate, temperature, TDS, TOC

Note:

(a) For a complete description of monitoring and inspection required by existing programs, refer to the permit and associated plans in question.

Table 4: Summary of Proposed Activities

Kennedy Jenks **DRAFT**

					Initial Data Gaps						
Operational Area and ID		**Operational Feature**	**Chemicals of Potential Concern (COPCs)**	**Accessible for RI Activities**	**Hydrogeology / Geology [(a)]**	**Presence of Soluble COPC(s) in Groundwater**	**pH of Groundwater**	**Presence of Insoluble COPC(s) in Soil**	**Visual Inspection**	**Extent of Buried Materials**	**Proposed Initial Scope**
Site Unit A - Woodyard											
Woodmill	OA-A1	First Woodmill and Wood Chip Piles	TPH, PCBs	Yes [(b)]	X	X		X			MW proposed in area, soil sampling
		Dock Warehouse	None	Yes [(b)]	None						MWs proposed in nearby Operational Features and upgradient
		Second Woodmill	TPH	Yes [(b)]	X	X					MWs proposed in nearby Operational Features, soil sampling
		Former Cat Shop, Electric Shop, and USTs	TPH, VOCs	Yes [(b)]	X	X		X			MW proposed in area, soil sampling
Site Unit B - North Main Mill											
Pulping	OA-B1	Kraft Mill	sulfur, sodium, TPH	No	X	X	X				MWs upgradient and downgradient
		Black Liquor Areas	sulfur, sodium, TPH	No	X	X	X				MWs upgradient and downgradient
		Former Bag Factory	sulfur, sodium, TPH	No	X	X	X				MWs upgradient and downgradient
		Former Sulfite Mill	sulfur, TPH	No	X	X					MWs upgradient and downgradient
		Lime Kiln	None	Yes [(b)]	None						MWs upgradient and downgradient
		No. 6 Substation	TPH, PCBs	Yes [(c)]				X	X		Visual inspection; surface soil sampling if observe potential spill
		No. 8 Substation	TPH, PCBs	Yes [(c)]				X	X		Visual inspection; surface soil sampling if observe potential spill
Power House	OA-B2	Power House	TPH, PCBs	No	X	X					MWs upgradient and downgradient
Bleaching	OA-B3	Kraft Pulp Bleaching	TPH, chromium, dioxins	No	X	X					MWs upgradient and downgradient
		Sulfite Pulp Bleaching	TPH	No	X	X					MWs upgradient and downgradient
		K5 Bleach plant	TPH, PCBs	No	X	X					MWs upgradient and downgradient
		K4 Bleach plant	TPH, chromium, PCBs	No	X	X	X				MWs upgradient and downgradient
		No. 1 Substation	TPH, PCBs	Yes [(c)]				X	X		Visual inspection; surface soil sampling if observe potential spill
Finishing/Coatings	OA-B4	Paper Treatment	Diphenyl, Copper, TPH, PFAS	No	X	X					MWs upgradient and downgradient
		Machine Shop	TPH, VOCs, PCBs	No	X	X					MWs upgradient and downgradient
		Fuel Oil Day Tank	TPH	Yes	X	X					MWs upgradient and downgradient
		No. 5 Substation	TPH, PCBs	Yes [(c)]				X	X		Visual inspection; surface soil sampling if observe potential spill
Specialty Minerals	OA-B5	Specialty Minerals	None	-	None						-
Warehouse/ Product Storage - North	OA-B6	Warehouse/ Product Storage - North	None	-	None						-

Table 4: Summary of Proposed Activities

Kennedy Jenks **DRAFT**

Operational Area and ID		Operational Feature	Chemicals of Potential Concern (COPCs)	Accessible for RI Activities	Initial Data Gaps: Hydrogeology / Geology (a)	Initial Data Gaps: Presence of Soluble COPC(s) in Groundwater	Initial Data Gaps: pH of Groundwater	Initial Data Gaps: Presence of Insoluble COPC(s) in Soil	Initial Data Gaps: Visual Inspection	Initial Data Gaps: Extent of Buried Materials	Proposed Initial Scope
Site Unit C - South Main Mill											
Finishing/Coatings/ Additives	OA-C1	Fuel Oil Storage	TPH	Yes (d)	X	X		X			MWs upgradient, near area, in area, and downgradient; soil sampling
		Additives / Coatings	TPH, PCBs	No	X	X		X			MWs upgradient, downgradient, and in area; soil sampling
		Converting	TPH, VOCs	No	X	X					MWs upgradient and downgradient
		No. 9 Substation	TPH, PCBs	Yes (c)				X	X		Visual inspection; surface soil sampling if observe potential spill
Warehouse/ Product Storage	OA-C2	Buried Material Area	TPH, VOCs, SVOCs, PCBs, dioxins, PFAS, and metals	No	X	X				X	MWs upgradient and downgradient; non-invasive methods within area
		Mill Modernization Debris Area	TPH, VOCs, SVOCs, PCBs, dioxins, PFAS, and metals	Yes	X	X				X	MWs upgradient and downgradient; non-invasive methods within area
		No. 2 Substation	TPH, PCBs	Yes (c)				X	X		Visual inspection; surface soil sampling if observe potential spill
Operational Support	OA-C3	Waste Handling Area and Fueling Station	TPH, VOCs	No	X	X					MWs upgradient and downgradient
		Car Barn / Paint shop	TPH, VOCs	No	X	X					MW upgradient, near area, and downgradient
		Former Sulfur Pile	sulfur, TPH, PCBs	Yes	X	X		X			MWs upgradient and downgradient, soil sampling
	OA-C4	Riverbank Pump House	TPH	No	X	X		X			MW in area, soil sampling
		Effluent Pump Station	TPH, dioxin, metals	No	X	X		X			MW in area, soil sampling
	OA-C5	Wooded Area	None	-	None						-
Site Unit D - Lady Island											
Lady Island	OA-D1	Active Landfill	*No additional COPCs beyond those defined in existing landfill permit*	No	*Monitoring covered by existing landfill permit monitoring*						-
		Former Wastewater Ditches	TPH, dioxin, metals	Yes				X			Shallow soil sampling
		North ASB	*No additional COPCS beyond those defined in existing NPDES permit*	No	*Monitoring covered by existing NPDES permit monitoring*						-
		South ASB	*No additional COPCS beyond those defined in existing NPDES permit*	No	*Monitoring covered by existing NPDES permit monitoring*						-
		Primary Clarifier	*No additional COPCS beyond those defined in existing NPDES permit*	No	*Monitoring covered by existing NPDES permit monitoring*						-
		No. 10 Substation	TPH, PCBs	Yes (c)				X	X		Visual inspection; surface soil sampling if observe potential spill
	OA-D2	Dredge Spoils Area	None	Yes	*Dredged materials owned by Army Corps of Engineers*						-
Site Unit E - Ancillary Area											
Ancillary Area	OA-E1	Ancillary Area	None	No	None						-
Site Unit F - CBC											
CBC Area	OA-F1	CBC Area	PCE, TCE, 1,1,1-trichloroethane, 1,1-dichloroethene, and cis-1,2-DCE, lead	Yes		X		X			Exisiting MWs; New MWs downgradient; soil sampling

Notes:

(a) Hydrogeology / Geology data gaps include depth to groundwater, groundwater flow direction, and geologic conditions.
(b) This area is expected to be accessible, but activities may need to be scheduled around demolition activities being considered.
(c) This substation is active; only non-invasive activities will be proposed while the substation is active.
(d) The eastern portion of this area, near and at the No. 20 Paper Machine, is currently inaccessible.

Table 5: Proposed New Monitoring Well Location Rationale

Monitoring Well	Proposed Location Justification	Site Unit	Operational Area	Potential Upgradient Area(s)	Potential Downgradient Area(s)
MW-A1.1	Proposed location is downgradient of mill property and near the Slough. It is downgradient of the Former Cat Shop and Electric Shop, where TPH has been discovered during trenching activities.	A	OA-A1	OA-B1, OA-B6, OA-B5, OA-F1	Camas Slough
MW-A1.2	Downgradient of western portion of Main Mill Area - North and upgradient of Woodmill (OA-A1)	A	OA-A1	OA-B1, OA-B6, OA-B5, OA-F1	OA-A1
MW-C1.1	Proposed location is downgradient of mill property, including Finishing/Coatings areas, and near the Slough. It is also in the vicinity of the former Fuel Oil tanks. Petroleum and oil have been discovered in this area.	C	OA-C1	OA-B1, OA-B2, OA-B3, OA-B4, OA-C3	Camas Slough
MW-C4.1	Proposed location is downgradient of mill property and near the Slough. It is also in the vicinity of the Riverbank Pump House, where a previous TPH investigation occurred. May be downgradient of the area where Mill Modernization Project debris were buried.	C	OA-C4	OA-B1, OA-B2, OA-B3, OA-B4, OA-C1, OA-C2	Camas Slough
MW-C4.2	Proposed location is downgradient of mill property, including Finishing/Coatings areas, and near the Slough. It is also in the vicinity of the effluent pump station.	C	OA-C4	OA-B1, OA-B2, OA-B3, OA-B4, OA-C1, OA-C2	Camas Slough
MW-C2.1	Proposed location is in the vicinity of the former burner and the buried material discovered during the construction of the Will Sheeter building. Monitoring well is proposed outside of extent of buried materials, and downgradient of buried material areas.	C	OA-C2	OA-B1, OA-B2, OA-B3, OA-B4, OA-C1	Camas Slough
MW-C2.2	Proposed location is downgradient of the area where Mill Modernization Project debris were buried, which contains soils and demolition debris from the old sulfite mill and wooden bag factory. Building materials and paints are from the 1920s and may contain heavy metals. Monitoring well is proposed outside of extent of buried materials.	C	OA-C2	OA-B1, OA-B2, OA-B3, OA-B4, OA-C1	OA-C2, OA-C4
MW-C1.2	Proposed location is near the Finishing/Coatings area. This location may be inaccessible and may need to be moved based on conditions encountered on-site to allow for drill rig access.	C	OA-C1	OA-B1, OA-B2, OA-B3, OA-B4	OA-C1, OA-C4
MW-C3.1	Proposed location is near Dangerous Waste Staging Area and Former Car Barn / Paint Shop. Also downgradient of area with multiple known black liquor releases.	C	OA-C3	OA-B1, OA-B6, OA-B2, OA-B4	OA-C1, OA-C4
MW-C3.2	Proposed location is downgradient of Dangerous Waste Staging Area.	C	OA-C3	OA-B1, OA-B6, OA-B2, OA-B4, OA-C3	Camas Slough
MW-B3.1	Proposed location is upgradient of main mill property and will serve as a background well.	B	OA-B3	OA-E1	OA-B3, OA-B4 OA-C1 OA-C4
MW-B1.1	Proposed location is upgradient of main mill property and will serve as a background well. It is also downgradient of the CBC area and can be used to monitor downgradient conditions from existing CBC monitoring wells.	B	OA-B1	OA-F1	OA-B2, OA-B4, OA-C3, OA-C1, OA-C4
MW-B6.1	Proposed location is upgradient of mill property and will serve as a background well.	B	OA-B6	None (b)	OA-A1, OA-B1, OA-C3, OA-C1

Notes:
(a) Groundwater flow direction is assumed to be towards the Camas Slough. Groundwater flow direction is a data gap to be resolved through proposed RI field activities.
(b) Depending on final field location and groundwater flow direction, CBC may be upgradient of this location.

Table 6: Proposed Groundwater Monitoring [a,b]

Monitoring Well	New or Existing	Site Unit	Operational Area	Potential Upgradient Operational Area	Potential Downgradient Area(s)	Proposed Sampling Matrix: Chromium[c]	PFAS[d]	TPH[e]	BTEX[e]	Metals [f]	VOCs[g]	SVOCs[h]	Diphenyl[i]	Sulfur, Sodium[j]	pH[k]	LILF Permit Parameters [l]
MW-A1.1	New	A	OA-A1	OA-B1, OA-B6, OA-B5, OA-F1	Camas Slough			X	X			X			X	
MW-A1.2	New	A	OA-A1	OA-B1, OA-B6, OA-B5, OA-F1	OA-A1			X	X			X		X	X	
MW-C1.1	New	C	OA-C1	OA-B1, OA-B2, OA-B3, OA-B4, OA-C3	Camas Slough	X	X	X	X	X	X	X	X	X	X	
MW-C4.1	New	C	OA-C4	OA-B1, OA-B2, OA-B3, OA-B4, OA-C1, OA-C2	Camas Slough	X	X	X	X	X	X	X		X	X	
MW-C4.2	New	C	OA-C4	OA-B1, OA-B2, OA-B3, OA-B4, OA-C1, OA-C2	Camas Slough	X	X	X	X	X	X	X	X	X	X	
MW-C2.1	New	C	OA-C2	OA-B1, OA-B2, OA-B3, OA-B4, OA-C1	Camas Slough		X	X	X	X	X	X		X	X	
MW-C2.2	New	C	OA-C2	OA-B1, OA-B2, OA-B3, OA-B4, OA-C1	OA-C2, OA-C4	X	X	X	X	X	X	X		X	X	
MW-C1.2	New	C	OA-C1	OA-B1, OA-B2, OA-B3, OA-B4	OA-C1, OA-C4	X	X	X	X	X	X	X	X	X	X	
MW-C3.1	New	C	OA-C3	OA-B1, OA-B6, OA-B2, OA-B4	OA-C1, OA-C4		X	X	X	X	X	X	X	X	X	
MW-C3.2	New	C	OA-C3	OA-B1, OA-B6, OA-B2, OA-B4, OA-C3	Camas Slough		X	X	X	X	X	X	X	X	X	

Table 6: Proposed Groundwater Monitoring [a,b]

Kennedy Jenks **DRAFT**

Monitoring Well	New or Existing	Site Unit	Operational Area	Potential Upgradient Operational Area	Potential Downgradient Area(s)	Proposed Sampling Matrix										
						Chromium[c]	PFAS[d]	TPH[e]	BTEX[e]	Metals [f]	VOCs[g]	SVOCs[h]	Diphenyl[i]	Sulfur, Sodium[j]	pH[k]	LILF Permit Parameters [l]
MW-B3.1	New	B	OA-B1	OA-E1	OA-B3, OA-B4 OA-C1 OA-C4	X	X	X	X	X	X	X	X	X	X	
MW-B1.1	New	B	OA-B1	OA-F1	OA-B2, OA-B4, OA-C3, OA-C1, OA-C4	X	X	X	X	X	X	X	X	X	X	
MW-B6.1	New	B	OA-B6	None (b)	OA-A1, OA-B1, OA-C3, OA-C1	X	X	X	X	X	X	X	X	X	X	
Lady Island Landfill - Existing Monitoring Wells (SOU-D)																
NE 201	Existing	D	OA-D1	None	Camas Slough					X						X
NW 102	Existing	D	OA-D1	None						X						X
E 202	Existing	D	OA-D1	None			X			X						X
SE 203	Existing	D	OA-D1	None			X			X						X
SW 107	Existing	D	OA-D1	None						X						X
Camas Business Center - Existing Monitoring Wells																
MW-1 (CBC)	Existing	F	OA-F1	None	SOU-A, SOU-B, SOU-C		X				X [m]					
MW-2 (CBC)	Existing	F	OA-F1	None			X				X [m]					
MW-3 (CBC)	Existing	F	OA-F1	None			X				X [m]					
MW-4 (CBC)	Existing	F	OA-F1	None			X				X [m]					
MW-5 (CBC)	Existing	F	OA-F1	None			X				X [m]					

Notes:

X = Groundwater sample collected from this MW will be analyzed for this parameter(s)

(a) Groundwater flow direction is assumed to be towards the Camas Slough. Groundwater flow direction is a data gap to be resolved through proposed RI field activities.

(b) Depending on final field location and groundwater flow direction, CBC may be upgradient of this location.

(c) Groundwater analysis of chromium proposed in areas where dichromate was used in operations. Chromium analysis may also be proposed for upgradient/downgradient wells.

(d) Groundwater analysis for PFAS proposed in areas where PFAS was used in operations (Paper Treatment Operational Feature). PFAS analysis may also be proposed for upgradient/downgradient wells.

(e) Petroleum hydrocarbons were used and stored in many areas of the Site. Therefore, all groundwater samples proposed in this work plan will be analyzed for TPH. TPH analysis may also be proposed for upgradient/downgradient wells. Where TPH analysis is proposed in this work plan, BTEX analysis will also be proposed.

(f) Groundwater analysis of metals proposed in areas where there are suspected buried materials or where process wastewater contacted bare ground (e.g., at the effluent pump station or former wastewater ditches). Metals analysis will include at least arsenic, lead, and copper at a minimum. Metals analysis may also be proposed for upgradient/downgradient wells. The LILF permit includes a specific list of metals for analysis at the existing LILF MWs.

(g) Groundwater analysis of VOCs proposed in areas where fuel oil or solvents were used or stored. VOCs analysis may also be proposed for upgradient/downgradient wells.

(h) Groundwater analysis of SVOCs proposed in areas where there are suspected buried materials. SVOCs analysis may also be proposed for upgradient/downgradient wells.

(i) Groundwater analysis of diphenyl proposed in areas where diphenyl was used in operations (Paper Treatment Operational Feature). Diphenyl analysis may also be proposed for upgradient/downgradient wells.

(j) Groundwater analysis of sulfur and sodium proposed in areas where black liquor spills occurred. Sulfur and sodium analysis may also be proposed for upgradient/downgradient wells.

(k) A pH measurement will be collected for all groundwater samples.

(l) LILF permit parameters also includes alkalinity, ammonia, BOD, bicarbonate, carbonate, COD, chloride, conductivity, nitrate, sulfate, TDS, TOC, and dissolved metals.

(m) Samples will be analyzed for PCE, TCE, 1,1,1-trichloroethane, 1,1-dichloroethene, and cis-1,2-DCE only.

Table 7: Proposed Soil Sampling

Kennedy Jenks **DRAFT**

Site Unit	Operational Area	Operational Feature [a]	Rationale	Type of Sample	Monitoring Well	Number of Proposed Samples [b]	Proposed Sampling Matrix: Dioxins [c]	Chromium [d]	TPH [e]	BTEX [e]	Metals [f]	VOCs [g]	Sulfur, Sodium [h]	pH [i]	SVOCs [j]	PCBs [k]	Total Organic Carbon
A	OA-A1	First Woodmill and Wood Chip Piles	Two out-of-service hydraulic fluid ASTs and documented lube oil releases. Analyze soil samples for TPH, PCBs.	Shallow	NA	2			X	X				X		X	
A	OA-A1	Second Woodmill	Documented diesel spill. Analyze soil samples for TPH.	Shallow	NA	2			X	X				X			
A	OA-A1	Former Cat Shop, Electric Shop, and USTs	Sample during soil boring for MW installation [l]	MW Install	MW-A1.1	2			X	X				X	X		X
A	OA-A1	First Woodmill and Wood Chip Piles	Sample during soil boring for MW installation [l]	MW Install	MW-A1.2	2			X	X				X	X	X	X
B	OA-B1	No. 6 Substation	Substation with transformers and/or other OFEE. Analyze soil samples for TPH, PCBs if visual indications of spills.	Surface	NA	2			X	X				X		X	
B	OA-B1	No. 8 Substation	Substation with transformers and/or other OFEE. Analyze soil samples for TPH, PCBs if visual indications of spills.	Surface	NA	2			X	X				X		X	
B	OA-B3	No. 1 Substation	Substation with transformers and/or other OFEE. Analyze soil samples for TPH, PCBs if visual indications of spills.	Surface	NA	2			X	X				X		X	
B	OA-B4	No. 5 Substation	Substation with transformers and/or other OFEE. Analyze soil samples for TPH, PCBs if visual indications of spills.	Surface	NA	2			X	X				X		X	
B	OA-B3	*Background*	Sample during soil boring for MW installation [l]	MW Install	MW-B3.1	2	X	X	X	X	X	X		X	X		X
B	OA-B1	*Background*	Sample during soil boring for MW installation [l]	MW Install	MW-B1.1	2	X	X	X	X	X	X	X	X	X		X
B	OA-B6	*Background*	Sample during soil boring for MW installation [l]	MW Install	MW-B6.1	2			X	X	X	X	X	X	X		X
C	OA-C1	No. 9 Substation	Substation with transformers and/or other OFEE. Analyze soil samples for TPH, PCBs if visual indications of spills.	Surface	NA	2			X	X				X		X	
C	OA-C2	No. 2 Substation	Substation with transformers and/or other OFEE. Analyze soil samples for TPH, PCBs if visual indications of spills.	Surface	NA	2			X	X				X		X	
C	OA-C4	Riverbank Pump House	Documented diesel release from former diesel AST. Analyze soil samples for TPH.	Shallow	NA	2			X	X				X			
C	OA-C1	Fuel Oil Storage	Sample during soil boring for MW installation [l]	MW Install	MW-C1.1	2			X	X	X	X	X	X	X		X
C	OA-C4	Riverbank Pump House	Sample during soil boring for MW installation [l]	MW Install	MW-C4.1	2			X	X	X	X	X	X	X		X
C	OA-C4	Effluent Pump Station	Sample during soil boring for MW installation [l]	MW Install	MW-C4.2	2	X		X	X	X	X	X	X	X		X
C	OA-C2	Buried Material Area	Sample during soil boring for MW installation [l]	MW Install	MW-C2.1	2	X	X	X	X	X	X	X	X	X		X
C	OA-C2	Mill Modernization Debris Area	Sample during soil boring for MW installation [l]	MW Install	MW-C2.2	2	X	X	X	X	X	X	X	X	X		X
C	OA-C1	Additives/Coatings	Sample during soil boring for MW installation [l]	MW Install	MW-C1.2	2			X	X	X	X	X	X	X		X
C	OA-C3	Waste Handling Area and Fueling Station; Car Barn, Paint Shop, and UST Area	Sample during soil boring for MW installation [l]	MW Install	MW-C3.1	2			X	X	X	X	X	X	X		X
C	OA-C3	Former Sulfur Pile	Sample during soil boring for MW installation [l]	MW Install	MW-C3.2	2			X	X	X	X	X	X	X		X

Table 7: Proposed Soil Sampling

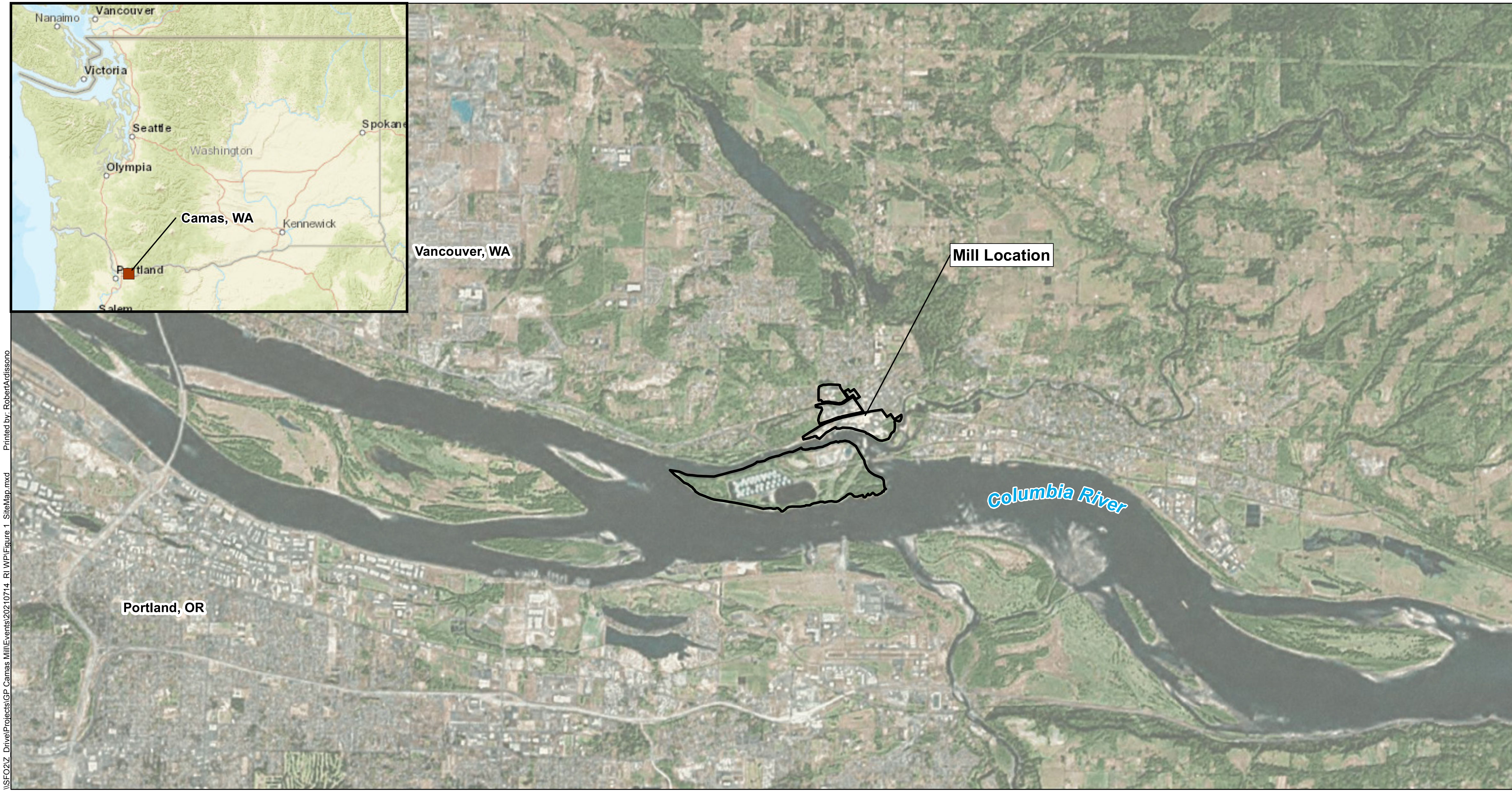
Site Unit	Operational Area	Operational Feature [(a)]	Rationale	Type of Sample	Monitoring Well	Number of Proposed Samples [(b)]	Proposed Sampling Matrix: Dioxins [(c)]	Chromium [(d)]	TPH [(e)]	BTEX [(e)]	Metals [(f)]	VOCs [(g)]	Sulfur, Sodium [(h)]	pH [(i)]	SVOCs [(j)]	PCBs [(k)]	Total Organic Carbon
D	OA-D1	No. 10 Substation	Substation with transformers and/or other OFEE. Analyze soil samples for TPH, PCBs if visual indications of spills.	Surface	NA	2			X	X				X		X	
D	OA-D1	Former Wastewater Ditches	Former ditches used to convey process wastewater. Analyze soil for dioxins, TPH, metals.	Below transition to ditch floor material (identified in the field)	NA	6	X		X	X	X			X			
F	OA-F1	CBC Area	Additional lead soil sampling in vicinity of the previous soil sample that exceeded MTCA lead cleanup level (LS-1, north of Building 402).	Shallow	NA	4					X (lead only)						
					Total	48											

Notes:

X = Soil sample(s) collected within this operational feature will be analyzed for this parameter(s)
NA = not applicable
AST = aboveground storage tank
OFEE = oil-filled electrical equipment
Surface = a soil sample will be collected from surface soils using non-intrusive methods.
Shallow = a shallow soil sample is proposed. Invasive sampling methods will be used to collect a sample from soils within 0-1 feet below ground surface.
MW Install = soil samples will be collected during monitoring well installation activities
Background = located upgradient and intended to represent background conditions
(a) Some monitoring wells may be located outside of the associated operational feature due to site constraints, including concern for invasive activities or density of structures.
(b) A minimum of two soil samples will be analyzed from each monitoring well installation and proposed sample location. Additional samples may be collected and analyzed based on field observations.
(c) Soil samples proposed in areas where there are documented spills of process wastewater from bleaching operations will be analyzed for dioxin.
(d) Soil samples proposed in areas where dichromate was used in operations will be analyzed for chromium.
(e) Petroleum hydrocarbons were used and stored in many areas of the Site. Therefore, all soil samples proposed in this work plan will be analyzed for TPH. Where TPH analysis is proposed in this work plan, BTEX analysis will also be proposed.
(f) Soil samples proposed in areas where there are suspected buried materials or where process wastewater contacted bare ground (e.g., at the effluent pump station or former wastewater ditches) will be analyzed for metals. Metals analysis will include at least arsenic, lead, and copper at a minimum.
(g) Soil samples proposed in areas where fuel oil or solvents were used or stored will be analyzed for VOCs.
(h) Soil samples proposed in areas where black liquor spills occurred will be analyzed for sulfur and sodium.
(i) A pH measurement will be collected for all soil samples.
(j) Soil samples proposed in areas where there are suspected buried materials will be analyzed for SVOCs.
(k) Soil samples proposed at transformer substations and where hydraulic oil or lube oil was stored will be analyzed for PCBs.
(l) Proposed sampling matrix for soil samples collected during MW installations generally align with the proposed sampling matrix for groundwater; however, there may be additional matrices included in groundwater to monitor conditions upgradient and/or downgradient of a chemical use or spill.

Figures

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



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\\SFO2Z_Drive\Projects\GP Camas Mill\Events\20210714_RI WP\Figure 1_SiteMap.mxd

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Scale: Feet

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GP Camas Mill
Camas, Washington

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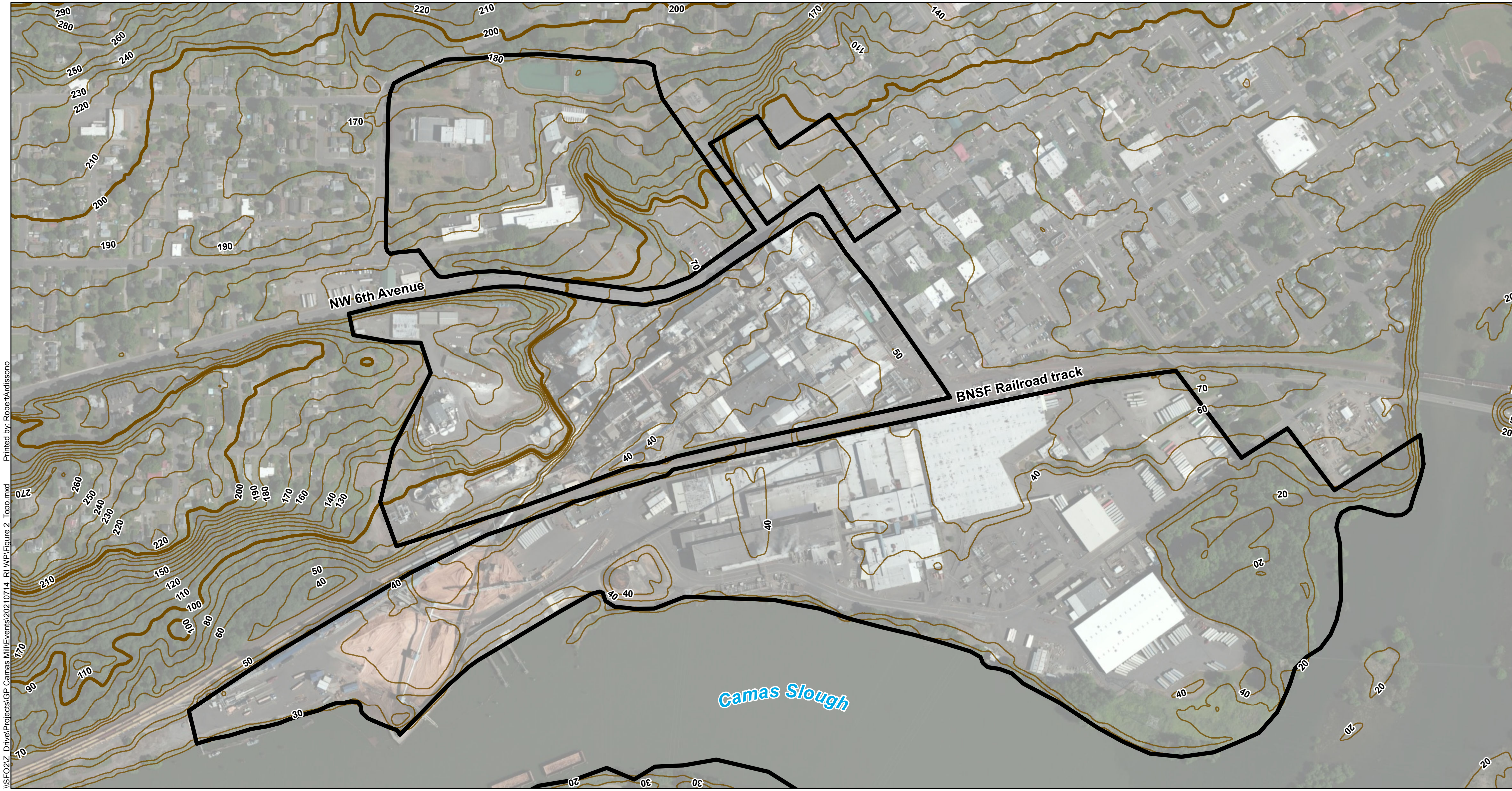
Site Map

November 2021

Figure 1

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



\\SFO2\Z_Drive\Projects\GP Camas Mill\Events\20210714_RI WP\Figure 2_Topo.mxd

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Legend

Site Boundary

Contours (10 ft)

Notes:
1. Contour data is based on NAVD88 Vertical Datum.

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Scale: Feet

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Camas, Washington

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Topography

November 2021

Figure 2

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

\\SFO2\Z_Drive\Projects\GP Camas Mill\Events\20210714_RI WP\Figure 3_GP Camas Mill OpUnits.mxd Printed by: RobertArdissono

Legend

Site Operable Unit

Notes
1. All locations are approximate

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Scale: Feet

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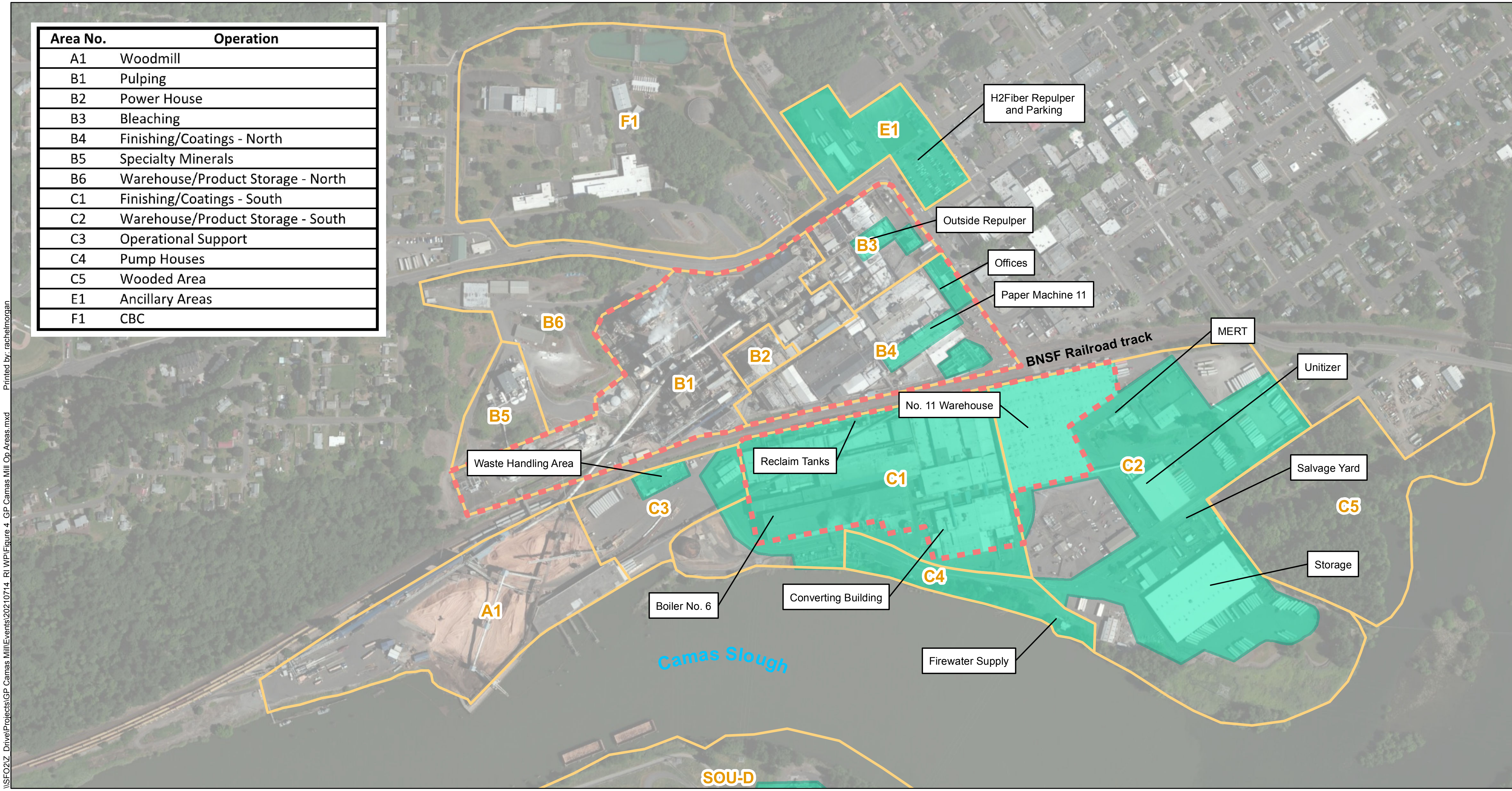
Camas Mill
Site Operable Units

November 2021

Figure 3

Area No.	Operation
A1	Woodmill
B1	Pulping
B2	Power House
B3	Bleaching
B4	Finishing/Coatings - North
B5	Specialty Minerals
B6	Warehouse/Product Storage - North
C1	Finishing/Coatings - South
C2	Warehouse/Product Storage - South
C3	Operational Support
C4	Pump Houses
C5	Wooded Area
E1	Ancillary Areas
F1	CBC



Legend

- Areas inaccessible due to density of structures and below-grade features
- Mill Operational
- Areas inaccessible due to ongoing operations

Notes
1. All locations are approximate

N

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Scale: Feet

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GP Camas Mill
Camas, Washington

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Camas Mill Operational Areas

November 2021

Figure 4

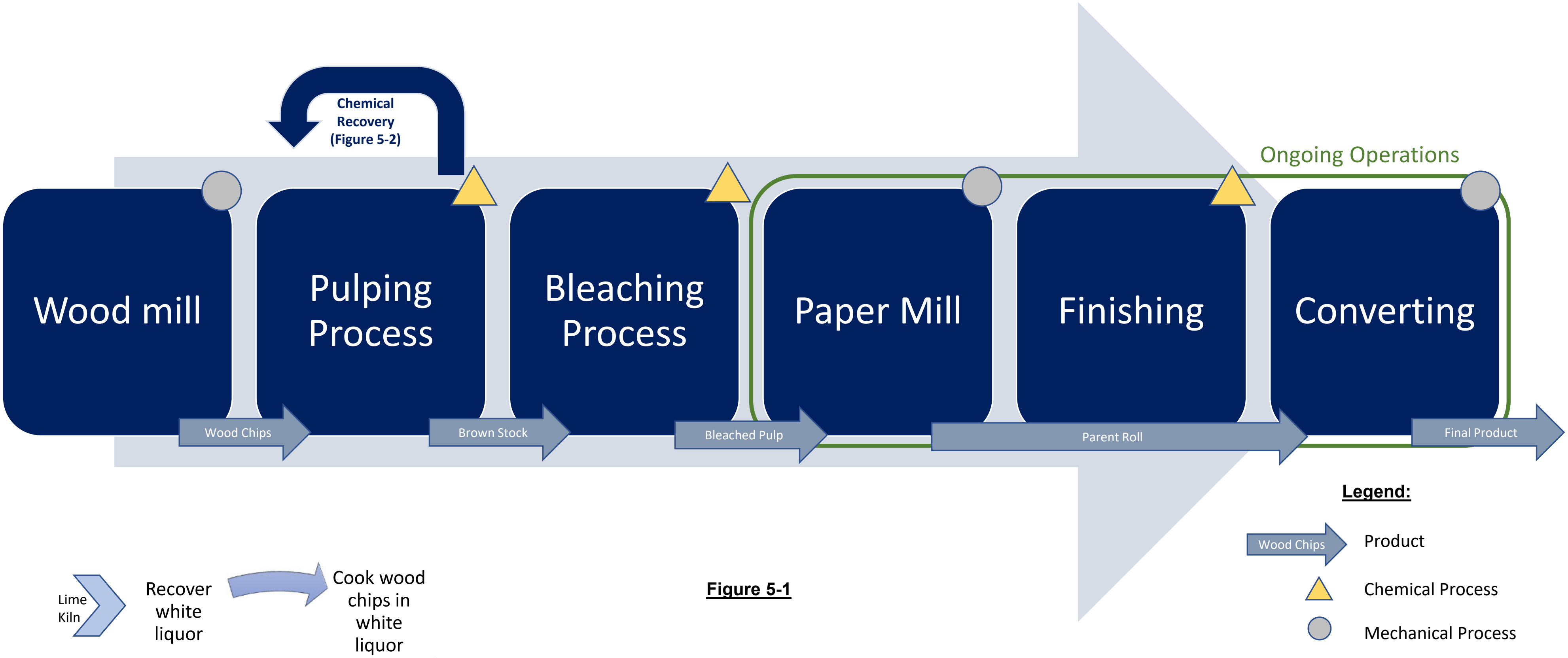
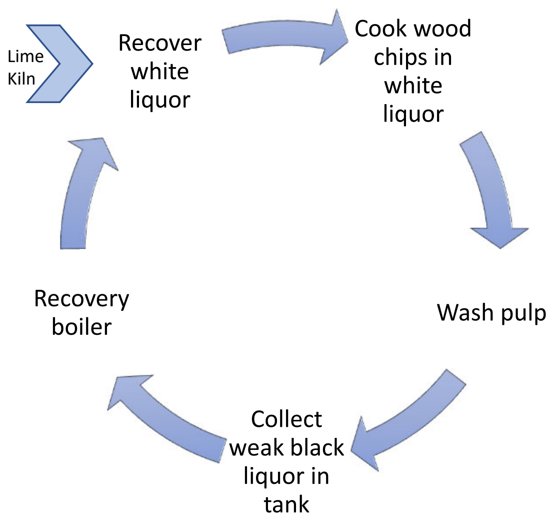


Figure 5-1



Kraft Pulping Chemical Recovery
Figure 5-2

Notes:

1. Other operations that have supported the paper manufacturing processes (some of which continue to support Mill operations) included a powerhouse, machine shops, the wastewater treatment plant, and warehouses.

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GP Camas Mill
Camas, Washington

Paper Mill Process

November 2021
Figure 5

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

\\SFO2\Z_Drive\Projects\GP Camas Mill\Events\20210714_RI WP\Figure 6_GP Camas Mill Flow - Sewer.mxd
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Legend

- Area Served By K7 Sewer
- Area Served By K6 Sewer
- Area Served By Fuel Oil Pipelines
- Area Served By Process Sewer (Directly)
- Area Served By Wood Processing Collections (Grit Sump)
- Acid Sewer Pipeline
- Acid Sewer Pipeline (abandoned)

Notes
1. All locations are approximate.
2. K6 sewer, K7 sewer, and Grit Sump are conveyed to the Process Sewer.
3. Coverage areas represent underground sewer pipelines.
4. Above-ground acid sewer pipelines served the Pulping and Bleaching Operational Areas.
5. Stormwater within the Mill property is captured and conveyed by the sewer systems to the WWTP.

N

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Scale: Feet

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GP Camas Mill
Camas, Washington

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Camas Mill Sewer Flow Areas

November 2021

Figure 6

Legend

Areas inaccessible due to density of structures and below-grade features

Operational Features

Mill Operational Areas

Areas inaccessible due to ongoing operations

Notes
1. All locations are approximate

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Scale: Feet

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Camas, Washington

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Camas Mill Operational Features

November 2021

Figure 7

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

- Operational Features
- Mill Operational Areas
- Areas active and managed under applicable permits
- No historical or current activity associated with the Mill

Notes
1. All locations are approximate.
2. Dredge spoils are owned by the Army Corps. of Engineers.
3. Outfall 001 is the historical clarifier outfall and is the current treated effluent outfall.

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Scale: Feet

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GP Camas Mill
Camas, Washington

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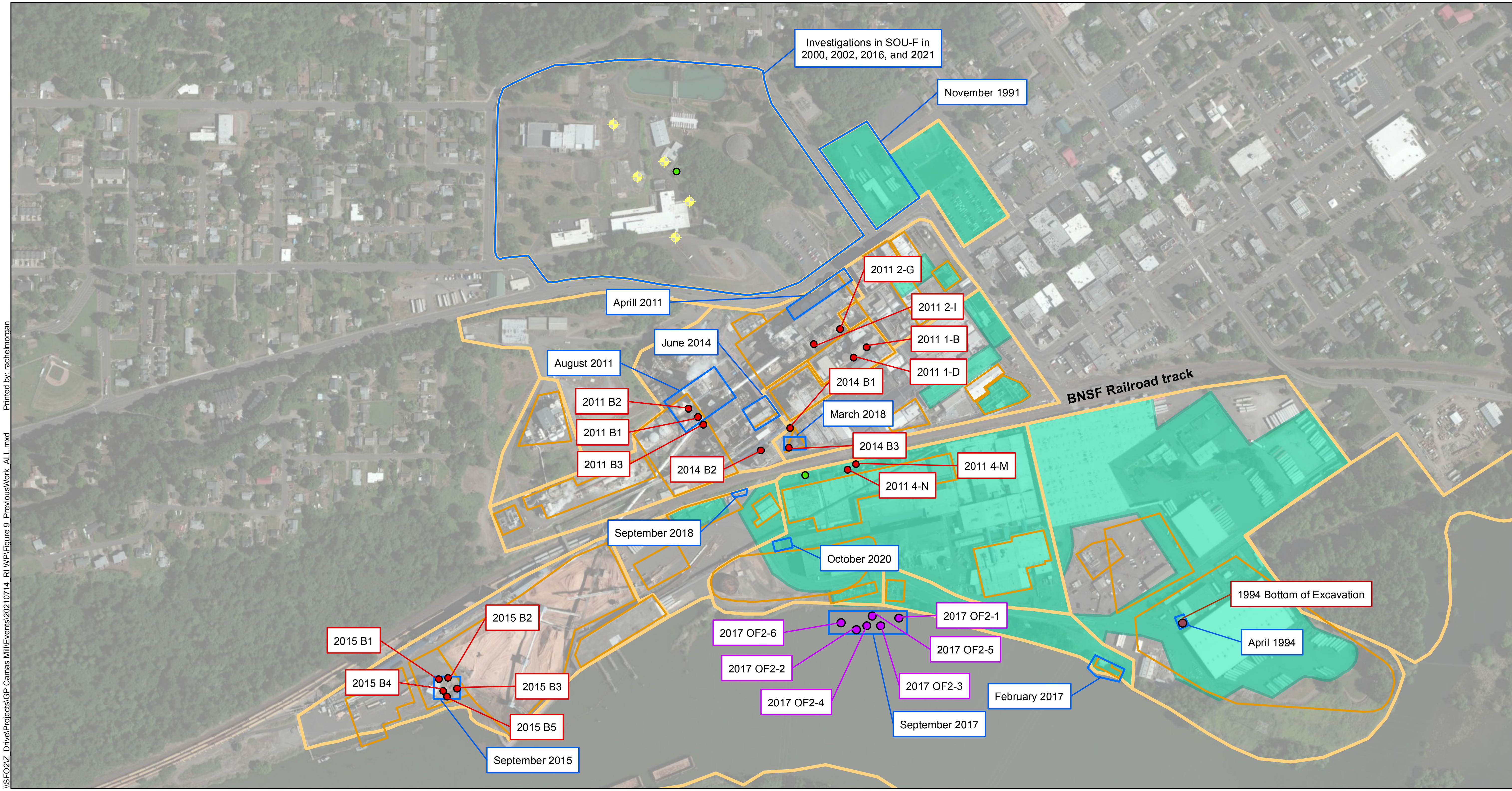
Lady Island
Operational Features

November 2021

Figure 8

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



\\SFO2Z_Drive\Projects\GP Camas Mill\Events\20210714_RI WP\Figure 9_PreviousWork_ALL.mxd Printed by: rachelmorgan

Legend

- Previous Investigation/Cleanup
- Mill Operational Areas
- Areas inaccessible due to ongoing operations
- Previous Boring
- April 2011 Surface Water Monitoring Location
- Previous Sediment Sampling Location
- Soil Sampling Location
- Existing Monitoring Well

Notes
1. All locations are approximate.
2. Additional information about previous investigations and cleanups is summarized in Table 2.
3. There are monitoring programs for compliance with existing permits and programs that pre-date the Agreed Order and continue to occur in parallel with RI activities (see Table 3).

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Scale: Feet

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Camas, Washington

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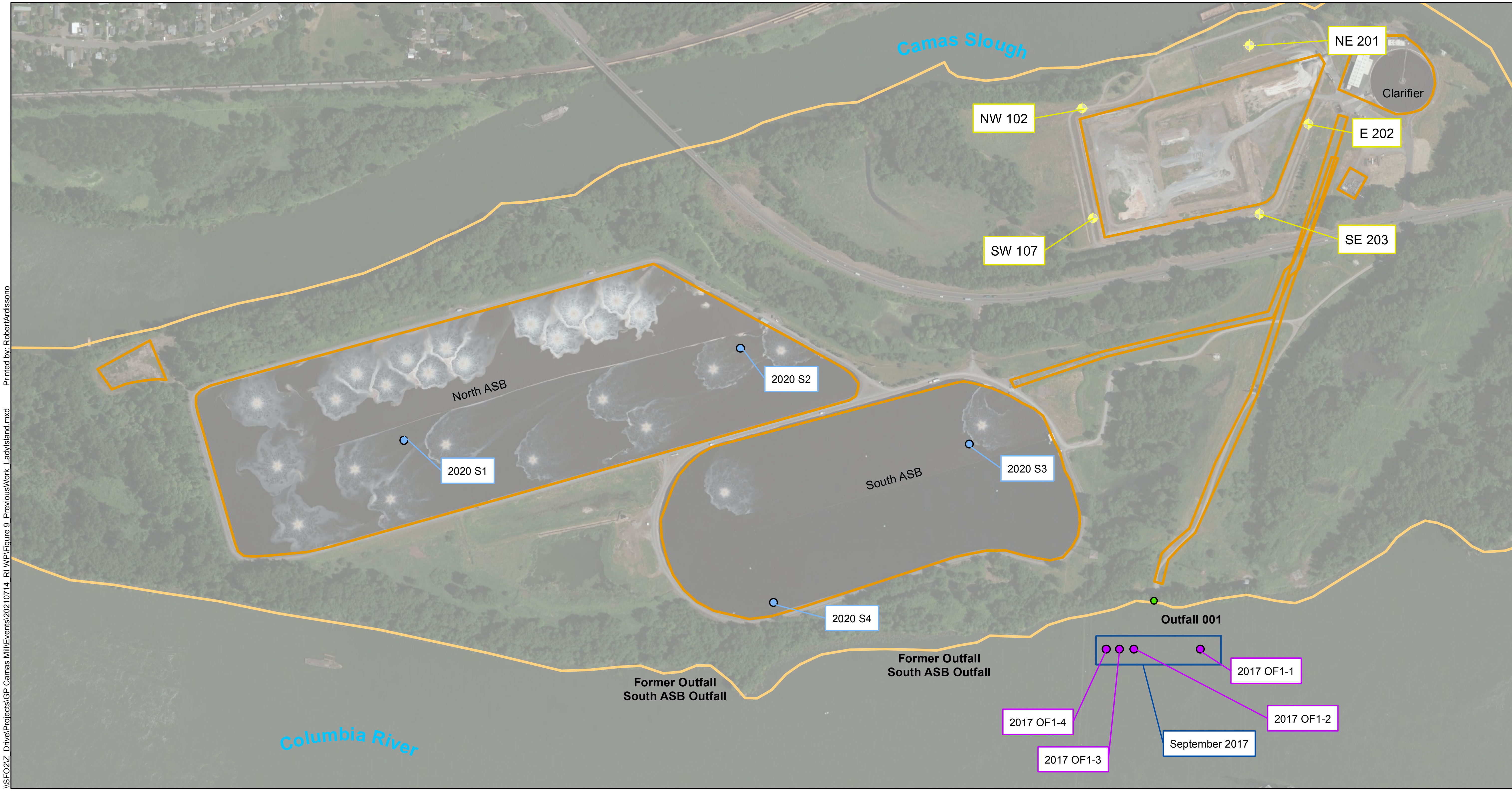
Camas Mill
Previous Investigations

November 2021

Figure 9



Legend

- Monitoring Location
- Previous Sediment Sampling Location
- Sludge Sampling Locations
- Existing Monitoring Well
- Operational Features
- Mill Operational Areas
- Previous Investigation/Cleanup

Notes
1. All locations are approximate

N

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Scale: Feet

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GP Camas Mill
Camas, Washington

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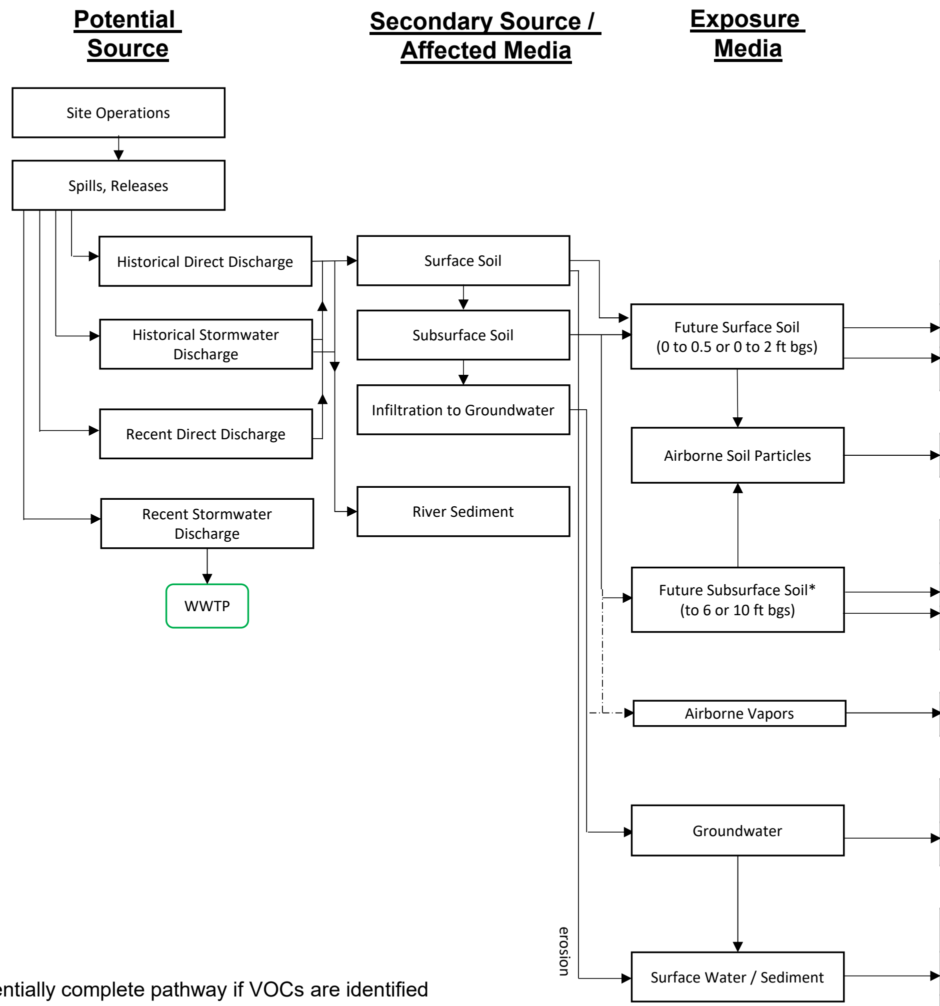
Lady Island
Previous Investigations

November 2021

Figure 10



Exposure Route / Potential Receptors

Exposure Media	Exposure Route	Potential Human Receptors: Maintenance / Utility/ Trench Worker	Potential Human Receptors: Construction worker	Potential Human Receptors: Commercial/ industrial Worker	Potential Ecological Receptors: Plants	Potential Ecological Receptors: Soil Inverts	Potential Ecological Receptors: Aquatic Life	Potential Ecological Receptors: Birds	Potential Ecological Receptors: Mammals
Future Surface Soil (0 to 0.5 or 0 to 2 ft bgs)	Ingestion	✓	✓	✓				✓	✓
	Dermal / Direct Contact	✓	✓	✓	✓	✓		✓*	✓*
	Food / Prey Items							✓	✓
Airborne Soil Particles	Inhalation	✓	✓	✓				✓*	✓*
Future Subsurface Soil* (to 6 or 10 ft bgs)	Ingestion	✓	✓	✓					✓
	Dermal / Direct Contact	✓	✓	✓	✓				✓*
	Food / Prey Items							✓	✓
Airborne Vapors	Inhalation	✓*	✓*	✓*				✓*	✓*
Groundwater	Ingestion				✓	✓			
	Dermal / Direct Contact	✓	✓		✓				
Surface Water / Sediment	Ingestion	✓	✓	✓			✓	✓	✓
	Dermal / Direct Contact	✓	✓	✓	✓	✓*	✓*	✓*	✓*
	Food / Prey Items						✓	✓	✓

Notes:

-·-·-▸ Potentially complete pathway if VOCs are identified
✓ Potentially complete exposure pathway
✓* Potentially complete but likely insignificant pathway

ft bgs = feet below ground surface
VOC = volatile organic compounds

1. Where depth of groundwater is shallow, exposure depths will be limited to 2 feet below the groundwater table.
2. Stormwater includes overland flow.

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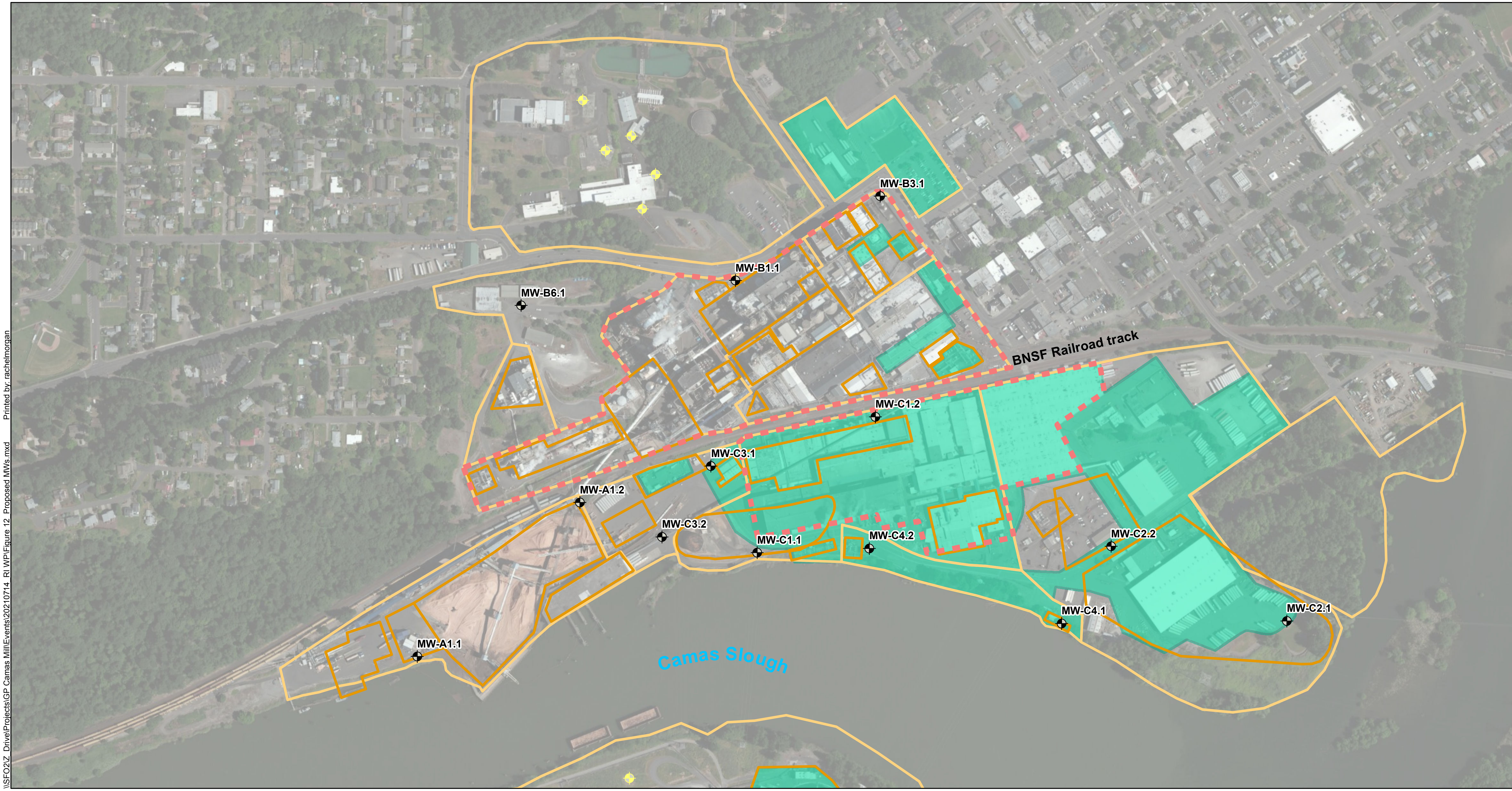
Preliminary Conceptual Site Model

November 2021

Figure 11

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



\\SFO2\Z_Drive\Projects\GP Camas Mill\Events\20210714_RI WP\Figure 12_Proposed MWs.mxd Printed by: rachelmorgan

Legend

- Proposed Monitoring Well Location
- Existing Monitoring Well
- Areas inaccessible due to density of structures and below-grade features
- Areas inaccessible due to ongoing operations
- Operational Features
- Mill Operational Areas

Notes
1. All locations are approximate

N

0 250 500
Scale: Feet

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GP Camas Mill
Camas, Washington

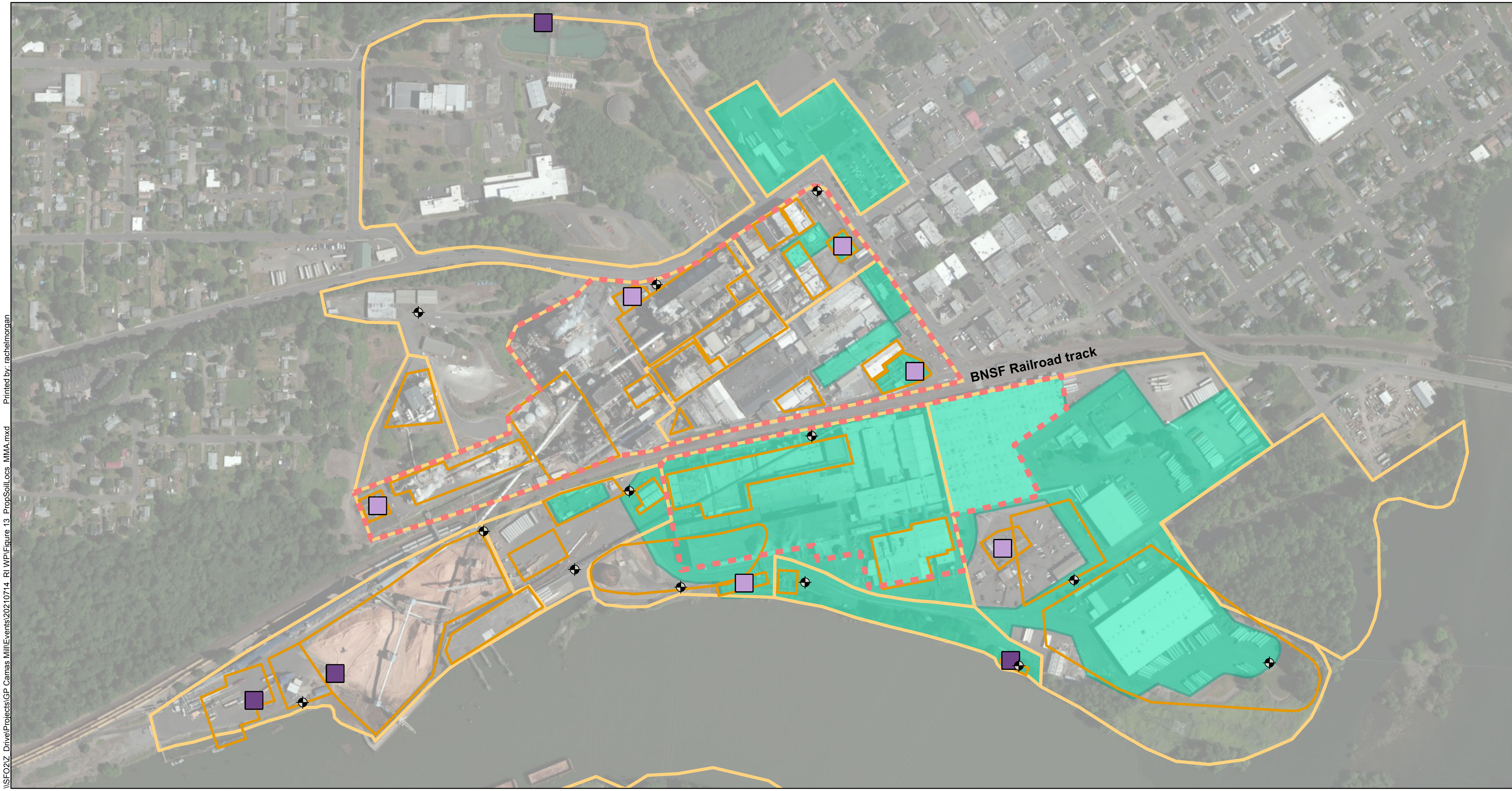
DRAFT

Camas Mill
Proposed Monitoring Well Locations

November 2021

Figure 12

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



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\\SFO2\Z_Drive\Projects\GP Camas Mill\Events\20210714_RI WP\Figure 13_PropSoilLocs_MMA.mxd

Legend

- Proposed Monitoring Wells
- Proposed Shallow Soil Samples (2 samples near this location)
- Proposed Surface Soil Samples (2 samples near this location)
- Areas inaccessible due to density of structures and below-grade features
- Operational Features
- Mill Operational Areas
- Areas inaccessible due to ongoing operations

Notes

1. All locations are approximate and will be confirmed based on field observations.
2. A minimum of 2 soil samples will be collected and analyzed during boring activities associated with each monitoring well installation.
3. "Surface" indicates a soil sample will be collected from exposed surface soils using non-intrusive methods. If soil is not exposed, sample collection will be postponed until the substation is inactive.
4. "Shallow" indicates a shallow soil sample is proposed. Invasive sampling methods will be used to collect a sample from soils within 0-1 feet below ground surface.

N

0 250 500

Scale: Feet

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GP Camas Mill
Camas, Washington

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Camas Mill
Proposed Soil Sampling Locations

November 2021

Figure 13

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

\\SFO2\Z_Drive\Projects\GP Camas Mill\Events\20210714_RI WP\Figure 14_PropSoilLocs_LadyIsland.mxd

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Legend

- Proposed Ditch Bottom Material Soil Samples
- Proposed Surface Soil Samples (2 samples near this location)
- Operational Features
- Mill Operational Areas
- Areas active and managed under applicable permits
- No historical or current activity associated with the Mill

Notes
1. All locations are approximate and will be confirmed based on field observations.
2. Dredge spoils are owned by the Army Corps. of Engineers.
3. "Surface" indicates a soil sample will be collected from exposed surface soils using non-intrusive methods. If soil is not exposed, sample collection will be postponed until the substation is inactive.
4. "Ditch Bottom Material" indicates a soil sample will be collected from the material 0 to 6 inches below the observed transition from material used to backfill ditches to ditch bottom material.
5. Outfall 001 is the historical clarifier outfall and is the current treated effluent outfall.

N

0 250 500

Scale: Feet

Kennedy/Jenks Consultants

GP Camas Mill
Camas, Washington

DRAFT

Lady Island Proposed Soil Sampling Locations

November 2021

Figure 14

Appendix A

Sampling and Analysis Plan/Quality Assurance Project Plan

421 SW 6th Avenue, Suite 1000
Portland, Oregon 97204
503-423-4000

Sampling and Analysis Plan/Quality Assurance Project Plan

29 November 2021

Prepared for

Georgia-Pacific Consumer Operations LLC
401 NE Adams Street
Camas, Washington 98607

KJ Project No. 1865004*21

Quality Assurance Project Plan
Signature Page

Site: Georgia-Pacific Consumer Operations LLC

Address: 401 NE Adams Street Camas, Washington 98607

Document Name: Camas Mill – Sampling and Analysis Plan/Quality Assurance Project Plan/Work Plan (SAP/QAPP)

Document Date: 29 November 2021

Signature below indicates review and approval of the Quality Assurance Project Plan and agreement that the anticipated sampling and analytical methods are sufficient to meet the quality objectives of the Georgia-Pacific Consumer Operations LLC Site.

Washington State
Department of Ecology:

____
Shingo Yamazaki Date
Ecology Project Coordinator

Georgia-Pacific Project Manager:

____
Matt Tiller Date
Project Coordinator

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List of Acronyms

°C	degree Celsius
AO	Agreed Order
ARAR	applicable, relevant, and appropriate requirement
ASTM	ASTM International
BTEX	benzene/toluene/ethylbenzene/xylene
CFR	Code of Federal Regulations
COC	chain-of-custody
COPC	chemical of potential concern
DI	distilled/deionized
DOT	Department of Transportation
DQO	data quality objective
Ecology	Washington State Department of Ecology
EDD	electronic data deliverables
EIM	Environmental Information Management System
EPA	U.S. Environmental Protection Agency
GP	Georgia-Pacific, Consumer Operations LLC
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
IDW	investigation-derived waste
MDL	method detection limit
mL/min	milliliters per minute
MRL	method reporting limit
MS	matrix spike
MSD	matrix spike duplicate
MTCA	Model Toxics Control Act
NWTPH-Dx	Northwest Total Petroleum Hydrocarbons as Diesel and Oil Extended
NWTPH-Gx	Northwest Total Petroleum Hydrocarbons as Gasoline Extended
OSHA	Occupational Safety and Health Administration
PCB	Polychlorinated biphenyl
PDB	Passive Diffusion Bag
PFAS	Per- & Polyfluoroalkyl Substances
PID	photoionization detector
PM	Project Manager
PPE	personal protective equipment
PQL	practical quantitation limit
PVC	polyvinyl chloride
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control

RI	remedial investigation
RPD	relative percent difference
SAP	Sampling and Analysis Plan
SOG	Standard Operating Guideline
SOP	Standard Operating Procedure
SVOC	semi-volatile organic compound
TOC	total organic carbon
TPH	total petroleum hydrocarbon
USGS	United States Geological Survey
VOC	volatile organic compound
WAC	Washington Administrative Code
WISHA	Washington Industrial Safety and Health Act

Section 1: Introduction

This Sampling and Analysis Plan/Quality Assurance Project Plan (SAP/QAPP) documents the sampling procedures and protocols for the remedial investigation (RI) at the Georgia-Pacific Consumer Operations LLC (GP) Site located at 401 NE Adams Street, Camas, Washington ("the Site"). This SAP/QAPP is also intended to satisfy the technical requirements of the Washington Administrative Code (WAC) 173-340-820, Ecology's Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies (Ecology 2004), and other Washington State Department of Ecology (Ecology) policies and/or procedures. This work is being performed pursuant to an Agreed Order (AO, No. DE 18201) between Ecology and GP dated 12 August 2021. This SAP/QAPP is Appendix A of the Draft RI Work Plan.

The purpose of the SAP/QAPP is to describe sample collection, handling, and analysis procedures, including quality assurance and quality control (QA/QC) requirements. This SAP/QAPP is intended to be used in conjunction with other site-specific project documents, including the RI Work Plan, which has been prepared separately and describes detailed background information, sampling locations, and analyses.

Specific information required by WAC 173-340-820 includes:

- Purpose and objectives of the data collection including QA/QC. The purpose and objective for data collection is presented in more detail in the RI Work Plan.

- Organization and responsibilities for sampling and analysis activities. In accordance with the AO, project management details are presented in the RI Work Plan.

- Requirements for sampling activities:

  - Project schedule. This is presented in the RI Work Plan.

  - Rationale for location and frequency of sampling and parameters to be analyzed. This is presented in the RI Work Plan.

  - Procedures for sample collection and handling including cleaning for equipment and personnel.

  - Procedures for management of waste materials generated by sampling activities.

  - Description of QA/QC samples.

  - Sample labeling, packaging, and chain-of-custody (COC) protocols.

- Procedures for sample analyses and reporting including analytical laboratory detection/reporting limits, analytical methods, QA/QC procedures, data reporting, and data validation.

This SAP/QAPP and the attached Health and Safety Plan (HASP) may be amended if additional activities not covered in this SAP/QAPP are necessary in the future.

1.1 Background

The Facility is located in southwestern Washington along the banks of the Camas Slough and Columbia River in the City of Camas, Washington. The Facility occupies approximately 661 total acres, of which 476 acres is on Lady Island and 185 acres is on the upland side of the Slough. Washington State Route 14 travels east-west through the Facility at Lady Island.

Operation of the mill began in 1883 under the Columbia River Paper Company. Site ownership and use has changed over time; currently, the mill property is owned and operated by GP. Additional background information of the Site including operational history and previous investigations is presented in more detail in the RI Work Plan.

In November 2017, GP announced that it planned to shut down multiple mill operations at the Facility, including the communication paper machine, fine paper converting assets, pulping operations, and related equipment. The shutdown of these areas was officially complete in mid-2019. The mill continues to produce paper products, including tissue paper and paper towels, from purchased pulp (Brynelson 2017).

1.2 Purpose and Objective of the Data Collection

The purpose of the RI is to collect and evaluate data of known quality which are sufficient to understand Site conditions and address initial data gaps. The data will be used to select a cleanup under WAC 173-340-360 through 173-340-390. The purpose and objectives of the data collection are described in the RI Work Plan.

As acknowledged in the AO, there are areas of the Site with ongoing operations that may be inaccessible and will not allow complete investigation, characterization, or cleanup actions at this this time. Investigation, characterization, and cleanup of these areas will be deferred until they become accessible. At that time, a separate RI Work Plan will be submitted to Ecology, and the SAP/QAPP will be amended as necessary.

The types of field activities addressed by this SAP/QAPP generally include:

- Utility survey
- Drilling
- Soil sampling
- Monitoring well installation
- Groundwater sampling and water level measurements
- Documentation of field activities

- Analysis of environmental samples.

Field activities are described in more detail in the RI Work Plan. Sampling tasks should follow the QA/QC requirements set forth in this SAP/QAPP, unless otherwise specified.

1.3 Health and Safety Plan

Kennedy Jenks has prepared a HASP (Appendix A) which describes health and safety measures to be followed by Kennedy Jenks' employees for the site investigation. Subcontractors providing support during sampling will be required to maintain their own HASP documenting their health and safety procedures.

Personnel, including subcontractors, must obtain the proper training to recognize and protect themselves from hazardous chemicals known or suspected to be present at the Site. Field personnel are required to have appropriate Occupational Safety and Health Administration (OSHA) health and safety training for hazardous waste sites per 29 Code of Federal Regulations (CFR) 1910.120, supplemented by annual refresher courses. Environmental consultants are responsible for confirming that their personnel are informed about and trained on relevant OSHA and Washington Industrial Safety and Health Act (WISHA) guidelines.

All Site visitors are required to complete Camas Mill Contractor Orientation training prior to commencing work on the Site. Copies of training certificates are to be presented to the Clock Room at the first Site visit and emailed to the GP Project Manager in advance of field work.

1.4 Document Organization

The remainder of this document is organized as follows:

- Section 2: Project Organization
- Section 3: Data Quality Objectives
- Section 4: Field Sampling Activities
- Section 5: Field Documentation
- Section 6: Laboratory Analytical Method Requirements
- Section 7: Quality Control
- Section 8: Data Management Review and Reporting

Section 2: Project Organization

This section identifies the project team members and other key personnel participating in the project and describes their specific roles, responsibilities, and qualifications.

On behalf of GP, Kennedy Jenks will serve as the prime consultant for this RI. The key project personnel and responsibilities are listed in Table 1. Anticipated subcontractors include drillers and laboratory services at a minimum. The analytical laboratory(s) selected to analyze samples for this project will meet the accreditation standards in chapter 173-50 WAC.

The field team is responsible for conducting field activities according to the SAP and for communicating with the Field Team Leader, who will communicate with the Project Manager. The Field Team Leader will coordinate with a Washington-licensed well driller.

The analytical laboratory is responsible for conducting activities according to the accreditation standards established in chapter 173-50 WAC, the SAP, and the RI Work Plan. Laboratories are responsible for maintaining sample custody records throughout processing and analysis, conducting analyses according to specified standard operating guidelines (SOGs), reviewing QC data and implementing corrective action, as appropriate, and contacting the Project Laboratory Manager to communicate issues that could affect sample integrity, data quality, or schedule. The laboratory is responsible for appointing an independent QA Officer who will monitor the study, conduct laboratory inspections and data audits, and report findings to management. Laboratory certifications will be acquired prior to initiating specific scopes of work.

2.1 Special Training/Certification

Most of the activities included in this RI involve routine sampling and analyses with no special training requirements and certifications needed. Staff working on Site will have completed the OSHA's required Hazardous Waste Operations and Emergency Response (HAZWOPER) 40-hour training and will also have currently (within the past year) completed the OSHA/HAZWOPER 8-hour annual refresher health and safety training. All Site visitors are required to complete Camas Mill Contractor Orientation training prior to commencing work on the Site. Health and safety training records for Kennedy Jenks personnel are maintained in the project files. Prior to the start of the investigation, field personnel will be given instruction specific to the project, covering the following areas:

- Organization and lines of communication and authority
- Overview of the SAP (i.e., sample collection, handling, and labeling procedures)
- QA/QC requirements
- Documentation requirements
- Health and safety requirements.

Instructions will be provided by the Kennedy Jenks Project Manager (PM) or Field Team Leader.

2.2 Schedule

The project schedule, including milestones such as field sampling and reporting, is documented in the RI Work Plan.

Section 3: Data Quality Objectives

The data quality objectives (DQOs) for this project are to describe and implement field and laboratory procedures to provide data that are: 1) representative of actual environmental conditions, and 2) of known and acceptable quality. Measurements will be made to yield accurate and precise results representative of the media and conditions measured. Data will be calculated and reported in units consistent with those used by regulatory agencies to allow for comparability of data.

Accuracy, precision, completeness, representativeness, comparability, and sensitivity are terms used to describe the quality of analytical data. Routine procedures for measuring precision and accuracy include use of quality control samples (i.e., replicate analyses, check or laboratory control samples, matrix spikes, and procedural blanks). These indictors of data quality are discussed below.

3.1 Precision

Precision is an appraisal of the reproducibility of a set of measurements. Precision can be better defined as the variability of a group of measurements compared to their average value. Variability for environmental monitoring programs contains both an analytical component and a field component.

Analytical precision will be evaluated by the analyses of matrix spike duplicate and laboratory duplicate samples, which can be mathematically expressed as the relative percent difference (RPD) between duplicate sample analyses. RPD is calculated using the following equation:

$$RPD = \frac{C_1 - C_2}{\overline{C}} \; x\, 100$$

where:

C1 = First concentration value or recovery value measured for a variable

C2 = Second concentration value or recovery value measured for a variable

The frequency of the performance of matrix spike duplicate and laboratory duplicate samples, where applicable, is usually one per batch (which typically consists of up to 20 samples) for each sample matrix received.

Field duplicate samples will be submitted blind to the laboratory as a means to assess field variability. Frequency of field duplicate samples is discussed in Section 7.1.1.

Precision quantities will be calculated for analyses with method reporting limits of the same order of magnitude and with detected concentrations greater than or equal to five times the method reporting limits. In instances where no criteria have been established (e.g., field duplicates), RPD project goals will be 50 percent for well-homogenized soil samples and 30 percent for water samples.

3.2 Bias and Accuracy

Bias is the systematic or persistent distortion of a measurement process that causes error in one direction. Accuracy refers to how close a measurement is to the true value. Bias and accuracy will be evaluated by the analysis of matrix spike samples and laboratory control samples and can be mathematically expressed as the percent recovery of an analyte that has been used to fortify a field sample or clean laboratory matrix sample at a known concentration prior to analysis. The percent recovery (R) for a matrix spike sample is calculated as follows:

$$R = \frac{(\mathrm{SSR} - \mathrm{SR})}{\mathrm{SA}} * 100$$

Where:

SSR = Spiked sample result

SR = Sample result

SA = Spike added.

The following is used to calculate R for a laboratory control sample or reference material:

$$R = \frac{RM}{RC} * 100$$

Where:

RM = Reference material result

RC = Known reference concentration

Results of matrix spike and laboratory control samples will be evaluated to the laboratory's control limits. Control limits will be provided by the laboratory. The laboratory will review the QC samples and surrogate standard recoveries for each analysis to confirm that internal QC data lie within the limits of acceptability. The laboratory will investigate suspect trends and take appropriate corrective actions

Field blank samples and method blank samples will also be used to evaluate bias of the data. Results for field and method blanks can reflect systematic bias that results from contamination of samples during collection or analysis. Analytes detected in field or method blank samples will be evaluated as potential indicators of bias.

3.3 Representativeness

Representativeness is the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. This is a qualitative assessment and is addressed primarily in the sample design, through the selection of sampling sites, and procedures that reflect the project goals and environment being sampled. Sampling locations and methods for selection of those sampling locations are described in the RI Work Plan. Representativeness is accomplished in the laboratory through (1) the proper handling, homogenizing, compositing, and storage of samples and (2) analysis within the specified holding times so that the material analyzed reflects the material collected as accurately as possible.

3.4 Completeness

Completeness is defined as a measure of the amount (percentage) of valid data obtained from a measurement system, field or laboratory, compared to the amount expected from the system. A target of 90 percent completeness for field and laboratory data is the expected minimum for this project. Less than 100 percent may be a result of sample matrix issues, loss of sample, data rejected via validation, or inability to collect all planned sample points.

3.5 Comparability

Comparability is a qualitative QA criterion that expresses the confidence in the ability to compare one data set with another. Comparability among data sets is achieved through the use of similar sampling procedures and analytical methods. Sampling procedures will be performed as specified in the SAP. Analytical procedures will be conducted according to the methods discussed in this QAPP, and comparability will be assessed through analytical performance (QC samples).

3.6 Sensitivity

Sensitivity is the capability of a method or instrument to discriminate between measurement responses representing different levels of the variable of interest. The method detection limit (MDL) is defined as the statistically calculated minimum amount that can be measured with 99 percent confidence that the reported value is greater than zero. MDLs are specified in the individual methods and are developed by the laboratory for each analyte of interest representing the aqueous and solid matrices within the capability of an analytical method.

The method reporting limit (MRL) or practical quantitation limit (PQL) is the lowest value to which the laboratory will report an unqualified quantitative result for an analyte. The PQL is always greater than the statistically calculated MDL. The PQLs required for this project are such that data can be compared to the lowest possible applicable, relevant, and appropriate requirements (ARARs) suitable for the site.

Section 4: Field Sampling Activities

This section of the SAP/QAPP describes anticipated field activities pertaining to the site investigation, including sampling procedures, sample identification, cleaning, and waste disposal. Specific sampling methodologies for various sample types are described in detail in the SOGs provided in Appendix B and referenced below where applicable[1]. The following SOGs will guide sampling activities:

- SOG-1: Environmental Data Collection
- SOG-2: Surface and Shallow Subsurface Soil Sampling (applies for utility clearance)
- SOG-3: Procedures for Using a Photoionization Detector (PID)
- SOG-4: Borehole Logging
- SOG-5: Boring and Subsurface Soil Sampling
- SOG-6: Well Construction and Development
- SOG-7: Measuring Groundwater Levels
- SOG-8: Groundwater Sampling (applies to opportunistic groundwater sampling if performed)
- SOG-9: Measurement of Field Parameters: pH, Dissolved Oxygen, Specific Conductance, Turbidity, Oxidation Reduction Potential, and Temperature
- SOG-10: Collecting Field Duplicates
- SOG-11: Sample Packing and Shipping (Soil and Water)
- SOG-12: Equipment Cleaning
- SOG-13: Personnel Cleaning
- SOG-14: Handling and Disposal of Investigative-Derived Waste
- SOG-PFAS-01: Sampling for Per- & Polyfluoroalkyl Substances (PFAS)

The SOGs identified above are generic and intended to be suitable for a variety of site conditions. There may be additional requirements for specific chemicals (e.g., PFAS). These

[1] As described in the RI Work Plan, sediment sample collection is not proposed at this time. If sediment sampling is proposed, this SAP/QAPP will be amended to include sediment sampling methodologies and follow Ecology's Sediment Sampling and Analysis Plan Appendix (Ecology 2008).

specific additional requirements will be covered in an SOG, in this SAP/QAPP, and/or in the RI Work Plan. It is anticipated the specific procedures in the SOG will be modified in the field as needed to address site-specific conditions, and as described below. Deviations from the SOGs identified above will be documented in the field notes.

4.1 Utility Locating

Prior to subsurface investigation, Kennedy Jenks will coordinate the location of underground utilities adjacent to the Site sampling locations. The appropriate service (Northwest Utility Notification Center) will be contacted to locate publicly owned underground utilities before intrusive activities occur. In addition, underground utilities will be evaluated by reviewing as-built drawings of underground site utilities provided GP and by hiring a private utility location company to locate possible underground utilities and features at subsurface investigation locations. Additional procedures for underground utility location are described in the HASP and in SOG-2: Surface and Shallow Subsurface Soil Sampling.

4.2 Sampling Locations

Soil and groundwater samples will be collected for laboratory analysis from groundwater monitoring wells and/or soil sampling locations. Sampling depths will vary across the Site based on depth to observed impacts and groundwater. Additional information on sample locations and rationale is presented in the RI Work Plan.

4.3 Sampling Frequency

Soil samples will be collected for laboratory analysis at a frequency defined in the RI Work Plan. Some soil samples retained for analysis may not be analyzed and some borings may be sampled at alternate frequency as described in the RI Work Plan.

Groundwater samples will be collected from monitoring wells at least 1 week following development. After the initial sampling event, groundwater samples will be collected using the same methods at a frequency defined in the RI Work Plan or subsequent document describing the purpose of the well and associated data collection.

4.4 Sampling Procedures

Samples will be collected in a manner consistent with the media being sampled and the analytes of interest. Sampling procedures will be carried out following the SOGs listed at the beginning of this Section. Some sources for the appropriate sampling methods include, but are not limited to:

- ASTM International. 1999. Designation: D 6452 - 99. Standard Guide for Purging Methods for Wells Used for Ground-Water Quality Investigations. Copyright ASTM, West Conshocken, PA.

- ASTM International. 2002. Designation D 6771 – 02. Standard Practice for Low-Flow Purging and Sampling for Wells and Devices Used for Ground-Water Quality Investigations. Copyright ASTM International, West Conshocken, PA.
- ASTM International. 2015. Standard Practice for Collection and Handling of Soils Obtained in Core Barrel Samplers for Environmental Investigations, D6640-01.
- ASTM International. 2009. Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), D2488-09a.
- U.S. Environmental Protection Agency (EPA). 2001. *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (EISOPQAM)*. Dated November 2001. U.S. EPA Region 4.
- Vroblesky, Dan A. 2001. U.S. Geological Survey, User's Guide for Polyethylene Based Passive Diffusion Bag Samplers to Obtain Volatile Organic Compound Concentrations in Wells. Part 1: Deployment, Recovery, Data Interpretation, and Quality Control and Assurance. Water-Resources Investigations Report 01-4060. Columbia, South Carolina.

The use of proper sample containers and appropriate preservation techniques when collecting samples is important. Samples will be collected in containers supplied by the analytical laboratory. Laboratory-provided containers will have been properly cleaned and of a suitable size and material to provide the analytical laboratory with sufficient sample material to conduct the requested test. Samples will also be properly preserved, or they may be rejected.

Table 2 summarizes common sample containers, preservation techniques, and holding times for the requested analytes. Sampling containers, analytical methods, preservatives and holding times may be modified as required by the selected analytical laboratory. Specific sampling methods for media of interest are discussed in greater detail in the following sections.

4.4.1 Soil Sampling

Soil sample collection is described in the RI Work Plan. Field screening and logging of soils from boring activities will be conducted by a Kennedy Jenks geologist. Field screening of soil materials will include the following:

- Visual observation of staining and other discoloration.
- Olfactory observation of petroleum hydrocarbons and other odors.
- Water-sheen testing for the presence of hydrocarbon or other sheen/film.
- Headspace analysis for organic vapors using a portable PID and headspace technique.

Field screening methodologies for soil are described in the SOG-3: Procedures for Using a Photoionization Detector in Appendix B. In addition, soils will be logged in general accordance with the United Soil Classification System and as described in SOG-4: Borehole Logging (Appendix B).

Soil samples will be collected from borings at target intervals, as described in the RI Work Plan. Soil samples will be collected as discrete samples by standard grab methods as described in the referenced SOGs and should contain as few cobbles or stones as possible. Samples will be collected according to procedures outlined in SOGs provided in Appendix B; soil samples will be packaged and handled in accordance with SOGs provided in Appendix B.

4.4.2 Water Level Monitoring

At the beginning of groundwater sample collection events, a water level measurement will be collected from each monitoring well. Water levels will be measured in accordance with SOG-7: Measuring Groundwater Levels (Appendix B).

Due to the site's proximity to the Columbia River, site groundwater may be influenced by the river. Water level measurements from monitoring wells will be compared to the Columbia River stage to monitor for impacts, if any. The following river stations will be used:

- United States Geological Survey (USGS) Station 14144700 at Vancouver[2], which is approximately 13 miles downstream of the Site
- USGS Station 14128870 at Bonneville Dam[3], which is approximately 24 miles upstream of the Site (on downstream side of Bonneville Dam).

4.4.3 Groundwater Sampling

Groundwater sample collection is described in the RI Work Plan. Grab groundwater samples will be collected from monitoring wells and may be collected from borings, if encountered. Grab groundwater sampling from borings will consist of collecting a groundwater sample from the uppermost saturated zone without installing a permanent monitoring well and without purging. It is expected that grab groundwater samples may be collected using clean disposable tubing connected to a peristaltic pump. After a grab groundwater sample is collected, it will be transferred to the appropriate sample containers in accordance with groundwater sampling SOG-8 in Appendix B.

Prior to collecting samples, field measurements for specific conductivity, oxidation-reduction potential, temperature, and dissolved oxygen will be obtained using a Yellow Springs Instrument (YSI meter) or equivalent. Additionally, a turbidity meter will be used to collect turbidity measurements and a pH meter will be used to collect pH measurements. Meter readings will be recorded at regular intervals (typically 5- to 10-minute intervals) during the purging process, including a final reading taken at the completion of purging for each well location. Purging will continue until stabilization criteria (listed in SOG-8: Groundwater Sampling and SOG--9: Measurement of Field Parameters: pH, Dissolved Oxygen, Specific Conductance, Turbidity, Oxidation -Reduction Potential, and Temperature) for each parameter have been met.

Following field measurements, groundwater samples will be collected via low-flow purging and sampling procedures and in accordance with SOG 8-Groundwater Sampling. Purge rates during

[2] https://waterdata.usgs.gov/monitoring-location/14144700/#parameterCode=00065&period=P7D
[3] https://waterdata.usgs.gov/monitoring-location/14128870/#parameterCode=00065&period=P7D

groundwater sampling will be kept at or below approximately 200 milliliters per minute (mL/min) (i.e., low-flow) to reduce potential influence of turbidity on samples. Samples will be collected in laboratory-provided sample containers as specified in Table 2.

Samples may also be collected using no-purge methods [e.g., Passive Diffusion Bags (PDBs)] or HydraSleeves). Sampling procedures for no-purge methods are described in SOG-8: Groundwater Sampling.

4.5 Parameters

Parameters to be analyzed for each sample are selected based on chemicals of potential concern (COPCs) identified within the applicable operational feature, as described in the RI Work Plan. Samples at selected locations may be analyzed for one or more of the following compounds: dioxins, metals, PFAS, total petroleum hydrocarbons (TPH), benzene/toluene/ethylbenzene/xylene (BTEX), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), total organic carbon (TOC), and general chemistry parameters outlined in Table 2. Additional information on COPCs in each operational area are found in Section 3 of the RI Work Plan.

The order of sample collection, regardless of the matrix, will generally start with analytes most sensitive to bias (e.g., PFAS) and then from the most volatile to the least volatile, as follows:

- PFAS
- VOCs
- BTEX
- SVOCs
- Northwest Total Petroleum Hydrocarbons as Gasoline Extended (NWTPH-Gx), and as Diesel and Oil Extended (NWTPH-Dx)
- PCBs
- Dioxins
- Metals
- TOC
- pH.

4.6 Sample Identification

To clearly associate a sample with sampling location and date, samples will be identified with a unique sample location identification. Sample names will generally include location code, sample depth (as appropriate), sample date, and matrix. Naming convention for groundwater samples, soil samples, field duplicates, equipment-rinsate blanks, and field blanks is outlined in Table 4.

4.7 Sample Handling and Custody

To verify the integrity of field samples, specific steps will be taken to avoid cross-contamination from containers in which the samples are stored. Sample containers will be compatible with the analyte(s) of interest. Sample containers required for collection of analytical samples for the RI are summarized in Table 2.

The purpose of sample preservation is to avoid or retard the degradation or transformation of target analytes in the field samples during transport and storage. Preservation efforts for sample integrity will be initiated at the time of sampling and will continue until the analyses are performed. Samples for chemical analysis will be packaged and stored in an appropriate manner consistent with preservation requirements for each test method. Samples will be transported directly or shipped to the analytical laboratory within a timeframe appropriate for the sample media and selected analysis under COC protocol in accordance with SOG-11: Sample Packaging and Shipping (Water) provided in Appendix B.

4.8 Equipment Cleaning

To the greatest extent possible, disposable and/or dedicated personal protective and sampling equipment will be used to avoid cross-contamination. All non-disposable sampling equipment will be cleaned between sample locations to avoid cross-contamination in accordance with procedures described in SOG-12: Equipment Cleaning. To the extent possible, sampling using non-disposable sampling equipment will begin at locations suspected to be least affected by target chemicals, progressing to the locations suspected of being most affected.

All fieldwork will be conducted according to the site-specific HASP using Level “D” personal protective equipment (PPE). In accordance with the cleaning procedures described in SOG-13: Personnel Cleaning, disposable PPE and equipment will be placed in appropriate disposal containers.

The following cleaning procedures will be used as the minimum requirements for all non-disposable equipment used to collect routine samples undergoing organic or inorganic constituent analyses:

- Clean with tap water and non-phosphate detergent using a brush if necessary to remove particulate matter and surface films. Equipment may be steam cleaned (using high-pressure hot water) as an alternative to brushing. Polyvinyl chloride (PVC) or plastic items will not be steam cleaned.

- Rinse with tap water. Repeat cleaning and tap water rinse as needed to remove particulate matter and surface films.

  [NOTE: If tap water is suspected to contain target compounds, use containerized drinking water or distilled/deionized (DI) water]

- Final rinse with tap water.

- Additional final rinse with distilled/DI water.

  [NOTE: Each rinse may be performed with distilled/DI water if desired, but only the final rinse needs to be performed with distilled/DI water.]

- Air-dry the equipment completely.

- Store the clean equipment in a clean container.

Cleaning will be conducted in a central location, upwind and away from suspected sources of target compounds.

4.9 Investigation-Derived Waste Management

Investigation-derived waste (IDW) may be generated during the Camas Mill site investigation. Generally, due to the relatively small quantities generated, generated IDW such as disposable sampling equipment and protective clothing (e.g., gloves) can be disposed of at a state-permitted, licensed, or registered municipal or industrial solid waste landfill. Otherwise, IDW may include contaminated soil, water, used PPE, and cleaning water that remains after sampling. IDW will be stored in new or reconditioned, Department of Transportation (DOT)-approved, 55- or 30-gallon drums pending characterization and offsite disposal. They will be stored within a secured location on the Property.

The environmental consultant will be responsible for waste management at the Site, which includes containerizing and securing the IDW, and labeling, staging, and profiling the IDW for ultimate disposal within a timely manner and in accordance with SOG-14: Handling and Disposal of Investigative-Derived Waste. IDW drums will be placed in a configuration that allows room for inspections, operations and maintenance, and handling. Each drum will be labeled with a Non-Hazardous Waste label that includes the following information: contents, name of generator, and date.

IDW will be characterized using the results of the investigation samples. Each IDW container will be referenced to a set of analytical (sample) data that is representative of the IDW. Before receipt of analytical data, IDW will be preliminarily characterized based on site knowledge, field observations, and field analytical data (typically hazardous vs. non-hazardous) or marked "pending analysis". Final IDW classification/characterization will be based on analytical data for investigation and/or waste characterization samples.

IDW will be disposed of promptly after characterization is performed. The IDW characterization process is outlined in EPA's (1991) *Management of Investigation-Derived Wastes During Site Inspections* and EPA's (1992) *Guide to Management of Investigation-Derived Wastes*. Classification of IDW will also follow the regulations as published in Dangerous Waste Regulations (WAC 173-303) and/or Water Quality Regulations on the basis of the laboratory analyses. IDW will also be evaluated as required by WAC 173-303-100 State Only Dangerous Waste. Once the IDW is characterized, the environmental consultant will document the proper management and/or disposal. IDW will be disposed of no more than 60 days from the end of the field work activities.

4.10 Field Equipment Calibration and Maintenance

Non-analytical instruments will be maintained in accordance with manufacturer's specifications and calibration information will be recorded on field calibration sheets on a daily basis.

Examples of field equipment subject to calibration include:

- Air-monitoring equipment – PIDs
- Water quality meter (e.g., YSI or equivalent)
- Turbidity meter
- pH meter
- Water-level monitoring meter
- Field scale.

Calibration of the equipment will be in accordance with the equipment operations manual and as presented in Table 3.

Field instruments and equipment used for sample analysis will be serviced and maintained only by qualified personnel. For rented equipment, repairs, adjustments, routine maintenance, and calibrations will be documented in an appropriate logbook or data sheet that will be kept on file. The instrument maintenance and calibration records will clearly document the date, the description of the maintenance, corrective actions if taken, the result, and who performed the work.

Section 5: Field Documentation

To correctly identify and track samples, careful sample documentation and custody procedures will be used to maintain sample integrity during collection, transport, storage, and analysis.

Field sampling personnel will be responsible for maintaining proper documentation and custody procedures from sample collection until samples are transferred to the analytical laboratory or a commercial freight carrier. The environmental consultant will review and approve field documentation. The analytical laboratory will be responsible for maintaining sample custody and documentation from the time the analytical laboratory receives the samples until final sample disposal. Field documentation and sample COC requirements are discussed below.

5.1 Documentation of Field Activities

A field logbook will be maintained by the sampling team. Field logbooks will be waterproof pages in bound notebooks, unless waterproof materials are inconsistent with the planned analysis (i.e., PFAS), or electronic files created using electronic field data collection tools. Entries to field logbooks, and other field documentation, will be made using indelible ink. Errors will be corrected by drawing a single line through the incorrect entry, entering the correct information, and dating and initialing the change. After project completion, field logbooks will be stored in the final project file.

Daily entries into the logbook or electronic files will generally include the information listed below; information recorded on field forms (i.e., boring logs, purge forms, sample data sheets, etc.) need not be duplicated in the field logbook. Where practical, photographs will be taken to document field activities.

- Date
- Sampler name
- Personnel onsite (including visitors)
- Weather conditions
- Type(s) of field equipment used
- Field equipment calibration methods (if applicable)
- Sample location and depth (locations to be logged using GPS), including description of sample location
- Sample collection method, including any deviations from SAP/QAPP
- Date and time of sample collection
- Field observations and field measurements made

- Sample identification number(s)
- Sample type (e.g., duplicates)
- Sample preservation
- Photographs (including general field activities, soil borings, and sample locations)
- Documentation for IDW (e.g., contents and approximate volume of waste, disposal method)
- Issues encountered and/or corrective actions
- Deviations from the SAP/QAPP
- Other observations that may be relevant to the specific field program or activities that may affect the resulting analytical data.

5.2 Field Forms

Field sampling personnel may complete field sample forms for soil and groundwater. As previously noted, data entered on field forms does not need to be duplicated in the field notebook.

5.3 Field Chain-of-Custody Procedures

Each sample collected will be given a unique sample number that appears on labels that are affixed to the appropriate sample containers. Sample identification numbers will also be included on the COC form to accompany each sample shipment submitted for laboratory analysis. Field sampling personnel will be responsible for uniquely identifying, labeling, and packaging samples to preclude breakage during shipment.

Samples will be placed immediately in appropriate containers with appropriate preservatives per the analytical method requirements (see Table 1). The filled containers will be tightly sealed, the outer surface wiped to remove any loose particulates, and stored in a dedicated cooler with ice (or ice packs) pending transport to the analytical laboratory.

Samples will be labeled with the following information:

- Consultant’s name
- Project name/location
- Sample identification number
- Date and time of sample collection
- Preservative (if applicable)

- Analyses to be performed
- Sample matrix (i.e., water)
- Sampler's name or initials.

COC records provide documentation of the handling of each sample from the time of its collection to its destruction. Environmental consultant will initiate custody of the samples in the field and, in-turn, transfer custody of the samples to the courier (as needed), and lastly to the laboratory. COC forms will be used for recording pertinent information about the types and numbers of samples collected and shipped for analysis.

Each COC form will be completed properly to document sample custody, confirm samples have been collected, and assign intended analyses. Entries will be made using indelible ink. Errors will be corrected by drawing a single line through the incorrect entry, entering the correct information, and then initialing and dating the change. Analytical laboratories typically provide a COC form that they prefer. At a minimum, these forms will contain the following information:

- Sample identification
- Date and time of sample collection
- Sample matrix (i.e., soil, water)
- Number and type of containers per sample
- Preservative (if applicable)
- Analyses to be performed
- Sampler's name and initials
- Release and acceptance information, including date, location, and sampler's signature.

Custody seals will be used when samples are shipped to the analytical laboratory, or when they are delivered to the analytical laboratory after hours. The seals will be signed by the field personnel and be affixed to the sample cooler in a way that would necessitate breaking the seal in order to open the cooler. If the samples are delivered directly to the analytical laboratory by the sampler, sample seals are not necessary.

If the samples are shipped via a commercial carrier, the carrier will relinquish samples to the analytical laboratory upon arrival, and the analytical laboratory personnel will complete the COC form. The COC forms will be sealed in self-sealing plastic bags (or similar) and secured to the top of the lid inside the cooler with tape.

5.4 Analytical Laboratory COC Procedures

A signed COC form will be obtained from the analytical laboratory custodian after the samples have been received and sample condition recorded. Upon receipt by the analytical laboratory, samples will be checked carefully to confirm that sample containers are not broken or leaking, proper preservation methods have been followed [including receipt at less than 4 degrees Celsius (°C) ± 2°C for aqueous samples and less than or equal to 6°C but not frozen for organics when applicable], and labels and custody seals are intact. Each COC form will be verified for accuracy and completeness, and discrepancies will be brought to the attention of the environmental consultant. From the time of receipt, the analytical laboratory will use its standard internal COC procedures to track samples through completion of the analytical process.

Sample custody will be maintained within the analytical laboratory's secure facility until disposal. Following sample analysis and throughout the holding time, the analytical laboratory will archive remaining sample material for all samples (100 percent). The analytical laboratory will be responsible for sample disposal, which will be conducted in accordance with applicable local, state, and federal regulations.

Section 6: Laboratory Requirements

Sampling for this project includes analysis of groundwater and/or soil for dioxins, metals, PFAS, TPH, VOCs, SVOCs, BTEX, PCBs, TOC, and general chemistry parameters. Analytical methods are summarized in Table 2. Laboratory analysis will occur at a laboratory that meets the accreditation standards in WAC 173-50 and in accordance with the laboratory's SOGs. The laboratory will be responsible for necessary equipment calibration procedures and laboratory instrument and equipment maintenance, testing, and inspection.

Prior to field work, Kennedy Jenks will submit a request for supplies and sample containers from vendors and laboratories. These supplies will be free of contaminants and interferences. The laboratories will provide bottles that have been certified clean. Certificates will be maintained in the project files.

Section 7: Quality Control

QC is the implementation, monitoring, and documentation of the quality processes and procedures. Procedural aspects, from project planning, sample collection, laboratory analysis, to data assessment, imparts a significant and often critical bearing on environmental decisions.

QC samples that may be used to evaluate analytical data in terms of the quality criteria parameters include duplicate samples, equipment-rinsate blanks, temperature blanks, method blanks, and matrix spike/matrix spike duplicate (MS/MSD). These include QC samples prepared in the field and by the analytical laboratory. Method-specific QC procedures are detailed in the analytical laboratory's Standard Operating Procedures (SOPs) and will be available upon request. The minimum requirements of the analytical laboratory's QA/QC plan include the frequency of QC sample analysis, acceptance criteria (control limits), and corrective actions and description of the holding time criteria to be used to assess data quality.

7.1 Field QC Requirements Samples

For field sampling, QC samples are used to assess sample collection techniques and environmental conditions during sample collection and transport. For this project, field QC samples include duplicate samples and temperature blanks. Equipment rinsate blanks may be collected if appropriate reusable field equipment is used. QC samples and frequency of collection are discussed in the following sections. A summary of specifications for containers, holding times, preservation, and handling for each matrix and analysis group is shown in Table 1.

7.1.1 Duplicate Samples

Duplicate samples may be used to assess variability in sampling techniques. Duplicate samples will be collected in accordance with SOG-10. A duplicate sample pair is typically a single grab sample that is split into two samples during collection. For each duplicate sample pair, one sample is labeled with the sample identification and the other is labeled with a blind duplicate sample identification. This sample pair is then submitted to the same analytical laboratory as two separate samples. Precision will be evaluated by calculating the RPD between the field duplicate samples. The RPD will be calculated for field duplicate pairs for each analyte whose measured values are greater than twice the MRL.

The frequency for duplicate samples shall typically be one per 20 investigative samples, with a minimum of one duplicate within each media per sampling event. If insufficient groundwater is present in the intended well to collect a duplicate for all analytes, an attempt will be made to collect a duplicate at an alternate well. When recurring sampling provides information about the likely range of results, duplicate samples will be collected from locations where concentrations are likely to be above five times the detection limit for the analyzed compounds to allow RPD calculations.

7.1.2 Equipment-Rinsate Blanks/Field Blanks

Equipment-rinsate blanks consist of analyte- and reagent-free water (preferably provided by the analytical laboratory) that is poured over reusable sampling equipment after standard cleaning has been performed. The runoff (rinsate) is collected in clean sample containers appropriate for the analyses being performed. Typically, equipment-rinsate blanks are analyzed for the same parameters as the associated environmental samples that were collected using the sampling equipment.

Equipment blanks are commonly used to evaluate the effectiveness of cleaning of sampling equipment, and data validation protocols include steps for evaluating equipment-rinsate blank results and application of appropriate data qualifiers when blank results indicate the potential for cross-contamination of field samples. Potential sources of bias or cross-contamination include sampling gloves and sampling equipment that may incidentally come into contact with the sample.

Equipment-rinsate blanks are analyzed as regular field samples for the same suite of analytical parameters as the associated samples. Equipment-rinsate blanks will not be designated for analytical laboratory use in preparation of MS or analytical duplicate samples. Equipment-rinsate blanks may be collected at a minimum frequency of one per every 20 field samples when non-dedicated sampling equipment is used and will only be collected for aqueous samples.

If no reusable sampling equipment is used, a field blank may be collected in lieu of an equipment-rinsate blank. A field blank is collected by pouring analyte- and reagent-free water directly into sample containers at a location that is within the boundaries of the work area at the Site.

7.1.3 Temperature Blanks

A temperature blank is used to monitor temperature preservation of samples transported to the contract analytical laboratory. The temperature blank is distilled water stored in a glass/plastic vial or jar and is typically provided by the analytical laboratory. A temperature blank will be included with each sample cooler submitted for chemical analysis. Upon receipt by the analytical laboratory, the sample custodian will measure and record the temperature of the blank sample.

Temperature blanks are commonly used to evaluate the effectiveness of preservation requirements (e.g., chilling samples on ice during shipment to the analytical laboratory) and application of appropriate data qualifiers when blank results indicate the potential for elevated temperatures to affect field samples during transport to the analytical laboratory. Typically, the temperature blank must be within the criteria of 4±2°C (2°C to 6°C).

Section 8: Data Management, Review, and Reporting

8.1 Laboratory Data Reporting

The analytical laboratory is responsible for providing sufficient laboratory documentation such that the sample results are traceable to the field samples, and the analytical data can be verified and validated by an independent third-party reviewer, if applicable. Analytical laboratory data packages will contain the following information:

- Cover letter
- COC forms
- Summary of sample results
- Summary of QC results.

The minimum information to be presented for each sample for each parameter or parameters group:

- Client sample number and analytical laboratory sample number
- Sample matrix
- Date of extraction/preparation and date/time of analysis
- Dilution factors
- Sample weights/volumes used in sample preparation/analysis
- Identification of analytical instrument
- Analytical method
- Detection/quantitation and reporting limits
- Definitions of any data qualifiers used.

The minimum QC summary information to be presented for each sample for each parameter or parameter group will include:

- Surrogate standard recovery results
- Matrix QC results (MS/MSD, duplicate)

- Method blank results
- Laboratory duplicate results and control limits.

Electronic data deliverables (EDDs) from the laboratory will be provided in an EQuIS EQEDD format. Analytical data collected as part of this program will be incorporated into a database system maintained by the environmental consultant.

8.2 Data Management

Collection and recording of field observations, field measurements, analytical data, and other data management activities will be performed and documented such that project team members can use the information. Field and analytical data typically will be summarized in a tabular or other appropriate format. Information and data will be reported as required by Ecology in the AO. For analytical data, units designated by the analytical method will be reported. Analytical data will be verified with the original sources of laboratory data whenever transcription is required.

Deviation(s) from the SAP and QAPP will be communicated to Ecology when results are reported. As required by the AO, new site data and information will be provided to Ecology in the quarterly Progress Reports as it is available, and laboratory analysis will be provided in electronic format when it has been validated. It is understood that Ecology will be responsible for entering sampling data in the Environmental Information Management System (EIM) in accordance with WAC 173-340-840(5) and Ecology's Toxics Cleanup Program Policy 840: Data Submittal Requirements. Electronic survey data for monitoring locations, electronic lab data, and GIS maps will be provided to Ecology in the RI Report.

8.3 Data Review and Validation

This section discusses data review and verification procedures and requirements.

Field and analytical laboratory data generated from sampling activities will be reviewed and verified. Field data entered into databases will be verified. Errors identified during the verification of data will be corrected prior to release of the final data.

The analytical laboratory is responsible for verifying analytical results prior to the submittal of the final laboratory data report. Initially, all analytical data generated by the analytical laboratory are verified by the laboratory. During the analysis process, the analyst and the laboratory QA Manager verify that the results have met various performance-based control limits (e.g., surrogate recoveries and continuing calibration). Nonconformance of various method QC requirements and control limits warrants the re-analysis and/or re-extraction of a sample.

Data validation will be conducted in general accordance with applicable sections of EPA's National Functional Guidelines for Organic and Inorganic Data Review (EPA 2020a, 2020b). Other versions of the National Functional Guidelines may be used as released in the future by EPA. In addition to the National Functional Guidelines, other EPA guidance, and project specific considerations may be used to conduct validation. For each data package, the environmental consultant's QA Officer will conduct a review of the QC results. Validation will be completed as appropriate for each data set and consistent with the planned use. If data do not meet required criteria, they will be flagged with data qualifiers as specified in the national functional guidelines (EPA 2020a, 2020b). Data validation procedures will entail evaluating the following:

- Preservation and holding times (check to see whether samples were properly preserved and analyzed within the specified holding time)
- Method blank results [check to see whether analytes were present in method blank samples and that a blank was analyzed every 20 samples (or more often) for each matrix]
- Surrogate recovery results for organic analyses (check to see whether surrogate recoveries met control limits)
- Laboratory control sample results (check to see whether laboratory control samples met control limits)
- Field duplicate results
- Field blank results, where appropriate
- Laboratory duplicate results (check to see whether duplicate analyses were conducted every 20 samples for each matrix or at least for each batch of samples, where applicable, and that control limits were met)
- MS/MSD results for all relevant analyses (check to see whether matrix spike and matrix spike duplicates were analyzed every 20 samples for each matrix or at least for each batch of samples, where applicable, and that control limits were met)
- Reported detection limits for analyses (check to see if the detection/reporting limits were adequate for comparison to appropriate regulatory criteria).

The QA Officer will prepare a QA evaluation for each data package describing the decisions and the qualifiers assigned to results as a result of the validation. Limitations to the usability of the data will also be discussed and presented with the report of the data.

8.4 Data Reporting

Data collected during this site investigation will be incorporated into the RI Report, to be submitted to Ecology as described in the RI Work Plan and the AO. The report will include the following:

- A description of the sampling activities and procedures used during sampling.
- A description of the analysis performed on the samples.
- Tabulated analytical results.

- A summary of deviations from the procedures described in this SAP/QAPP, if applicable.
- COC records.
- Laboratory reports.
- Data validation reports.

Deliverables will be provided to Ecology electronically in Adobe (.pdf) format for all documents. Deliverables may be provided in Word (.docx) format as appropriate and required by the AO.

8.5 Data Usability

Laboratory data generated in accordance with this SAP/QAPP will be considered usable for site characterization and to direct future remedial actions unless the data validation process described herein results in rejection of data. Rejected data will not be used to support site characterization or any other project objective.

After environmental data have been reviewed, verified, and validated in accordance with the procedures described in this SAP/QAPP, the data must further be evaluated to assess whether project data quality objectives have been achieved. DQOs may be evaluated by a review of the sampling design and methods to verify that these were implemented as planned and are adequate to support project objectives, a review of issues brought up during data review and validation, and an evaluation of the limitations of the collected data.

Reports or technical memorandum in which data for this project are reported will discuss potential impacts of data usability and will clearly define limitations associated with the data.

References

Brynelson, Troy and Littman, Adam. 2017. As Paper Mill's Presence Fades, Camas Grapples with Identity, Its Future. The Columbian Newspaper. 26 November. Accessed online.

Washington State Department of Ecology (Ecology). 2004. Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies. July. https://apps.ecology.wa.gov/publications/documents/0403030.pdf

Ecology. 2008. Sediment Sampling and Analysis Plan Appendix. February. https://clu-in.org/download/contaminantfocus/sediments/WA-state-characterization-guidance.pdf

U.S. Environmental Protection Agency. 1991. Management of Investigation-Derived Wastes During Site Inspections. Office of Emergency and Remedial Response. EPA/540/G-91/009. May.

U.S. Environmental Protection Agency. 1992. Guide to Management of Investigation-Derived Wastes. Office of Solid Waste and Emergency Response. 9345.3-03F3. January.

U.S. Environmental Protection Agency. 2020a. National Functional Guidelines for Inorganic Superfund Methods Data Review.

U.S. Environmental Protection Agency. 2020b. National Functional Guidelines for Organic Superfund Methods Data Review.

Tables

Kennedy Jenks

Table 1: Key Personnel Roles, Responsibilities, and Qualifications

Name/Role	Organization	Responsibilities	Qualifications / Years of Experience
Matt Tiller Georgia-Pacific Project Coordinator	Georgia-Pacific	Manages RI activities for Georgia-Pacific Consumer Products LLC, with assistance of other Georgia-Pacific personnel and Kennedy Jenks.	NA
Jeremie Maehr Technical Expert	Kennedy Jenks	Assists Georgia-Pacific with managing the RI program, reviews project deliverables for Quality Assurance/Quality Control (QA/QC), and participates in communications by Georgia-Pacific to Ecology.	B.S. Civil Engineering 24 years
Rachel Morgan Project Manager	Kennedy Jenks	Manages RI activities on behalf of Georgia-Pacific. Monitors RI activities for compliance with Agreed Order, Statement of Work, and schedule.	B.S. Environmental Engineering 8 years
John Jindra Corporate Health and Safety Officer	Kennedy Jenks	Oversees company-wide health and safety program for Kennedy Jenks.	NA
Matt Grzegorzewski Project Health and Safety and Field Team Leader	Kennedy Jenks	Serves as Site Health and Safety Officer for on-site activities. Coordinates and oversees sampling events and analytical data assessment activities, verifies adherence to sampling and analytical procedures, implements sample chain-of-custody protocols and performs sample shipments. Prepares or coordinates project report deliverables required by Statement of Work.	M.S., Civil & Environmental Engineering 5 years
Janice Sloan QA Officer and Laboratory Coordinator	Kennedy Jenks	Functions as point of contact for analytical laboratories; oversees analytical, sampling, and data assessment activities; verifies adherence to sampling and analytical procedures; reviews data validation and sampling and analysis plans; verifies data validation completion and deliverables submittal to Ecology; and monitors schedule for field, analytical, and data validation activities. Prepares or coordinates project report deliverables required by Statement of Work.	B.S. Biology M.S. Environmental Science 15 years

Notes:
NA = not applicable
Resumes available upon request.

Table 2: Summary of Analytical Methods, Containers, and Holding Times[(a)]

Kennedy Jenks

Analyte	Method	Soil Samples			Groundwater Samples		
		Containers	Preservatives	Holding Time	Containers	Preservatives	Holding Time
Dioxins	EPA SW8290	1 x 4 oz glass jar	Unpreserved	28 days	2 x 1 liter amber glass bottles	Unpreserved	28 days
Perfluoro Sulfonic Acid (PFOS)/Perfluorooctanoic Acid (PFOA)	EPA SW537M	NA	NA	NA	2 x 250 mL HDPE (Teflon free)	Unpreserved	14 days
Gasoline-range TPH	NWTPH-Gx (gasoline)	1 x 40 mL Terracore	Methanol	14 days	3 x 40 mL glass vials	HCl	14 days
Diesel- and Heavy Oil-range Petroleum Hydrocarbons	NWTPH-Dx (diesel extended)	1 x 4 oz glass jar	Unpreserved	14 days	2 x 40 mL glass vials	HCl	14 days
Benzene, Toluene, Ethylbenzene, Xylene (BTEX)	EPA SW8260	1 x 40 mL Terracore	Methanol	14 days	3 x 40 mL glass vials	HCl	14 days
Metals	EPA SW6010 EPA SW7470 (Hg)	1 x 4 oz glass jar	Unpreserved	6 months; 28 days for Hg; 18 days for Cr	1 x 250 mL HDPE	HNO_3	6 months; 28 days for Hg; 18 days for Cr
Volatile Organic Compounds (VOCs)	EPA SW8260	1 x 40 mL Terracore	Methanol	14 days	3 x 40 mL glass vials	HCl	14 days
Semi-Volatile Organic Compounds (SVOCs)	EPA SW8270	1 x 4 oz glass jar	Unpreserved	14 days	2 x 100 mL amber glass	Unpreserved	7 days
Diphenyl	EPA SW8270E	1 x 4 oz glass jar	Unpreserved	14 days	2 x 100 mL amber glass	Unpreserved	7 days
Total Organic Carbon (TOC)	EPA SW5310B	1 x 4 oz glass jar	Unpreserved	28 days	250 mL glass	H_2SO_4	28 days
Polychlorinated Biphenyls (PCBs)	EPA SW8082	1 x 8 oz jar	Unpreserved	365 days	1 x 1L amber glass	Unpreserved	365 days

Note:
(a) Sampling containers, analytical methods, preservatives, and holding times may be modified as required by the selected analytical laboratory.

Abbreviations:

EPA = United States Environmental Protection Agency
HCl = hydrochloric acid
HDPE = high density polypropylene
HNO_3 = nitric acid
H_2SO_4 = sulfuric acid
Cr = chromium
Hg = mercury
mL = milliliters
NA = Not applicable (no analyses for analyte/media)
oz = ounce
TPH = total petroleum hydrocarbons

Table 3: Field Instruments – Preventative Maintenance Table

Instrument	Activity	Frequency
Multi-Parameter Water Quality Meter	Calibration and Calibration Check – pre-sampling event	Once Prior to Sampling Event
	Battery check Calibration – beginning of day Calibration check – beginning of the day Possible mid-day calibration check Calibration check – end of day	Daily
Turbidity Meter	Calibration and Calibration Check – pre-sampling event	Once Prior to Sampling Event
	Battery check Calibration – beginning of day Calibration check – beginning of the day Possible mid-day calibration check Calibration check – end of day	Daily
Photoionization Detector (PID)	Calibration and Calibration Check – pre-sampling event	Once Prior to Sampling Event
	Battery check Calibration – beginning of day Calibration check – beginning of the day Possible mid-day calibration check Calibration check – end of day	Daily
Electronic Water Level Indicator	Battery check	Daily

Table 4: Sample Identification

Sample Type	Format	Example
Subsurface soil boring sample	BB-ID(LD-UPft)(yyyymmdd)(SO)	MW-B3.1(09.5-10.0ft)(20220810)(SO)
Groundwater grab sample	BB-ID(yyyymmdd)(GW)	MW-B3.1(20220810)(GW)
Groundwater PDB sample	BB-ID(LD-UP)(yyyymmdd)(GW)	MW-B3.1(25-27)(20220810)(GW)
Soil sample	SS-###(LD-UPft)(yyyymmdd)(SO)	SS-024(09.5-10.0ft)(20220810)(SO)
Field duplicate	DUP-##(yyyymmdd)(ME)	DUP-02(20220810)(GW)
Equipment-rinsate blank	EB-##(yyyymmdd)	EB-02(20220810)
Field blank	FB-##(yyyymmdd)	FB-02(20220810)
Trip blank	TB-##(yyyymmdd)	TB-02(20220810)

Abbreviations:

BB = type of boring location (e.g., “SB” for soil boring, “MW” for monitoring well)
ID = location identification (e.g., “BB-ID” for a monitoring well MW-B3.1 would be “MW-B3.1”, “BB-ID” for a soil boring at location 4 would be “SB-04”)
MW = Monitoring Well
SB = soil boring
DUP = duplicate
EB = equipment blank
FB = field blank
TB = trip blank
SO = sample media is soil
GW = sample media is groundwater
ME = media type (e.g., soil or groundwater)
= sample number
LD = lower depth of sample, with two digits and one decimal point (e.g., 05.5 for 5.5 feet)
UD = upper depth of sample, with two digits and one decimal point (e.g., 05.5 for 5.5 feet)
yyyymmdd = four-digit year, two-digit month, two-digit date (e.g., 20220810 for 10 August 2022)

Appendix A

Health and Safety Plan (HASP)

Kennedy Jenks
421 SW 6th Avenue, Suite 1000
Portland, Oregon 97204
503-423-4000

Site-Specific Health and Safety Plan (HASP)

Georgia-Pacific Camas Mill
Camas, Washington

November 2021

Prepared for

Georgia-Pacific LLC
401 NE Adams Street
Camas, Washington 98607

KJ Project No. 1865004*21

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Prepared by	Matthew Grzegorzewski	**Date**	06 October 2021
Project Manager	Rachel Morgan	**Office**	Portland, OR

Field Services Description

Field Services Date(s)	January 2022 to July 2023		
Site Name	Georgia-Pacific Camas Mill		
Location	Camas, Washington		
Client Site Contact	Samantha McDowell	**Client Site Telephone**	360-834-8439

Type of Investigation:

Sampling Investigation:

- ☐ Hand Auger
- ☒ Drilling
- ☐ Trenching
- ☒ Well Installation
- ☒ Soil Sampling
- ☒ Groundwater Sampling
- ☐ Other:

Site Remediation:

- ☐ Excavation
- ☐ Treatment System Installation/O&M
- ☐ Underground Storage Tank (UST) Removal

- ☒ Site Walk-through
- ☐ Other: ___________________

Section 1: Introduction

This Site-Specific Health and Safety Plan (SSHSP), also referred to as a Health and Safety Plan (HASP), developed in accordance with Occupational Safety and Health Administration (OSHA) standards for hazardous waste operations (29 CFR 1910.120), and Washington Industrial Safety and Health Act (WISHA) establishes general health and safety protocols for Kennedy Jenks personnel at the Georgia-Pacific Camas Mill site located at **401 NE Adams Street, Camas, Washington 98607**. As needed, addenda containing activity-specific health and safety protocols will be prepared and attached to this HASP prior to the initiation of each additional field activity. The HASP and activity-specific addenda, as a minimum, contain the following information:

- Names of key personnel and alternates responsible for site health and safety and appointment of a Site Safety Officer (SSO).
- A job hazard analysis (JHA) for each site task and operation (see Appendix A for example).
- Personal protective equipment (PPE) to be used by employees for each site task and operations being conducted.
- Medical surveillance requirements.
- Frequency and types of air monitoring, personal monitoring, and environmental sampling techniques and instrumentation to be used. Methods of maintenance and calibration of monitoring and sampling equipment to be used.
- Site control measures.
- Cleaning procedures.
- An Emergency Response Plan that addresses effective site response to emergencies.
- Procedures to report injuries or illness, property damage, or near miss incidents.

For informational purposes only, this plan may be provided to subcontractors of Kennedy Jenks involved in activities at the site, interested regulatory agencies, or others. However, entities and personnel other than Kennedy Jenks shall be solely responsible for their own health and safety and shall independently assess onsite conditions and develop their own health and safety protocols to meet the minimum health and safety requirements.

Kennedy Jenks has developed a Health & Safety Operations Manual (Kennedy Jenks, Corporate Health and Safety Program, June 2020). Kennedy Jenks' Health & Safety Program, upon which the manual is based, complies with current health and safety regulations, including OSHA 29 CFR 1910.120 and Hazardous Waste Operations and Emergency Response. Many of the protocols of the corporate program are conducted on a routine basis (general training, respirator fit testing, general medical record keeping, etc.) and are not repeated herein. The Health and Safety Operations Manual is available to Kennedy Jenks employees upon request during normal business hours. Questions regarding the program should be referred to the

Kennedy Jenks Health & Safety Manager (H&S Manager) John Jindra, or the Director of Health, Safety, and Environment (Director of HS&E) Bert Drews.

A copy of this HASP, along with any addenda containing activity-specific health and safety information, will be kept in a conspicuous location at all times while work is being conducted at the site.

Section 2: Key Health and Safety Personnel

Kennedy Jenks' SSO will be designated by the Project Manager, as appropriate. The current SSO for the project is Matthew Grzegorzewski. In the absence of the SSO during field activities, a member of the field investigation team will be designated as Kennedy Jenks SSO. The SSO is responsible for the following.

- Conducting daily tailgate safety briefings (TSBs) for Kennedy Jenks personnel at the beginning of each workday and documenting that subcontractors are also conducting TSBs. Kennedy Jenks staff may combine TSBs with the subcontractor in lieu of conducting separate safety meetings. Combined TSB meetings will be led by the subcontractor and must include emphasis provided by the subcontractor relative to the subcontractor's work. Other participants, including Kennedy Jenks and any regulatory personnel in attendance, should also discuss their respective health and safety issues and oversight specific to their activities. The TSB Record is attached to this HASP as Appendix B, and a copy of each day's executed form for Kennedy Jenks' TSB must be obtained for the project files, signed by all Kennedy Jenks employees attending the TSB meeting. Any subcontractors must provide the SSO with a daily copy of the subcontractor's own safety briefing form for the project file.

- Observing field activities for compliance with this HASP, applicable addenda, and Kennedy Jenks Health and Safety Operations Manual.

- Maintaining onsite medical surveillance, if required, and emergency medical treatment programs, and assisting in onsite emergencies.

- Modifying health and safety protocols or terminating field work when unsafe work conditions exist.

- Assuring all project team members participating in field activities have read and signed this HASP and have had the opportunity to ask safety-related questions regarding this project.

- Familiarizing personnel with health and safety protocols.

- Observing field personnel wear appropriate PPE.

- Recording data from direct reading instruments on field logs (as appropriate) and evaluating potential hazards.

- Monitoring cleaning procedures.

- Recording occurrence of any site injury, illness, property damage or near miss incident.

If unsafe conditions are encountered, if illness or injury occurs, or if the level of protection needs to be changed, the SSO will consult, in a timely manner, with the Project Manager, Rachel Morgan; the H&S Manager, John Jindra, or the Director of HS&E, Bert Drews.

Section 3: Site Description and History

The Georgia-Pacific (GP) Camas Mill (site) is located along the Columbia River in the City of Camas (City), at 401 NE Adams Street, Camas, Washington 98607 in Clark County. The site is located south of NW 6th Avenue and is bound by Lewis and Clark Highway to the west, the Camas Slough to the south, and the City to the east. The site occupies approximately 661 acres, consisting of 476 acres on Lady Island and 185 acres on the upland side north of the Camas Slough. In 2019, GP ceased certain operations at the Site, including wood pulping, the communication paper machine, fine paper converting, and related equipment. Continuing operations at the site include production of tissue paper and paper towels from purchased pulp.

Section 4: Planned Site Activities

Type of Investigation:

Sampling Investigation:
- ☐ Hand Auger
- ☒ Drilling
- ☐ Trenching
- ☒ Well Installation
- ☒ Soil Sampling
- ☒ Groundwater Sampling
- ☐ Other:

Site Remediation:
- ☐ Excavation
- ☐ Treatment System Installation/O&M
- ☐ UST Removal

☒ Site Walk-through

☐ Other: ________________

☐ Onsite Inspection or Construction-Related Services

☐ Entry into a Confined Space or Excavation[1]

☐ Work Along a Leading-Edge Requiring Fall Protection

☐ Entry into an Excavation or Trench with a Depth of 5 feet or Greater (4 feet in Oregon and Washington)

☒ Field Investigation Requiring
- ☒ a. Entry into (potentially) hazardous area
- ☐ b. Interruption of vehicular traffic
- ☐ c. Interruption of plant processes
- ☐ d. Operation of pilot plant

☐ Chemical Use[2]

☐ Other - *specify*

[1] Completion of Kennedy Jenks Confined Space Pre-entry Checklist and Entry Authorization is required or review of Client's Confined Space Procedures.

[2] A Field Chemical Use Plan must be completed.

Potential Hazards:

☒ Organics		☒ Solvents	☒ Bases
☒ Inorganics		☒ Pesticides	☐ Fire/Explosion
☒ Metals	☒ Acids	☐ Other: ________________	

Personal Protective Equipment:
- ☐ Level C
- ☒ Level D

In response to cessation of certain operations, Ecology engaged GP to initiate remedial investigation (RI) activities in areas where "release or threatened release of hazardous substance(s), as defined in RCW 70A.305.020(32) and (13), respectively, has occurred." On 12 August 2021, GP and Ecology completed Agreed Order (AO) No. DE 18201 to develop a Remedial Investigation Work Plan and prepare a Remedial Investigation Report per WAC 173-340-350 and WAC 173-204-550. Areas of the site included in the RI scope of work: Main Mill

Area (MMA); Camas Business Center[1] (CBC), located north of the MMA; and Lady Island, located between the Camas Slough and the Columbia River.

The chemical hazards associated with site operations are related to inhalation, ingestion, and skin exposure to site-related chemicals of interest (COI). Risk of exposure can occur during any activity involving sampling of contaminated media. Site COI include Dioxins, Perfluoro Sulfonic Acid (PFOS)/ Perfluorooctanoic Acid (PFOA), Gasoline-Range Total Petroleum Hydrocarbons (TPH), Diesel- and Heavy Oil-Range Petroleum Hydrocarbons (DRO, ORO), Metals, Volatile Organic Compounds (VOCs), Semi-Volatile Organic Compounds (SVOCs), Diphenyl, and Polychlorinated Biphenyls (PCBs).

Nitrile sampling gloves and safety glasses shall be worn during all sampling activities to prevent contact with sample or container preservatives. The flora and fauna of the site may present hazards of poison ivy, poison oak, ticks, fleas, mosquitoes, wasps, spiders, and snakes. The work area presents slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Wet surfaces may be present near the riverbank creating slippery surfaces.

Documented TSBs will be held prior to initiating job duties and a copy of this HASP, including a map and directions to the nearest hospital, will be present at all times at the project site.

Section 5: Hazard Assessment

5.1 Potential Physical & Environmental Hazards

Every job must be scrutinized for potential hazards, which may cause an injury, illness, property damage, or an near miss incident. The preferred method of assessing a job for hazards is to break down each job into smaller tasks. Each task may then be scrutinized by performing a JHA.

Kennedy Jenks JHA form provides examples to assist employees in performing their own JHA. The JHA process is intended to provide a brief, consistent means of identifying and addressing hazards, which may injure employees.

Potential hazards may include, but are not limited to, the following:

- Heavy equipment
- Excavations and Trench work
- Tripping and falling hazards
- Heat stress
- Cold exposure
- Underground/overhead utilities
- Motor vehicle hazards
- Biological exposure
- Equipment hazards
- Working over or near open water
- Chemical exposure

5.1.1 Heavy Equipment

Field personnel should be cognizant of potential physical hazards associated with use of heavy equipment and electrical equipment during field operations. Appropriate precautions include the following:

- American National Standards Institute (ANSI)-approved hardhats, Class II reflective safety vests (when outside), safety glasses or goggles, and safety-toe boots will be worn.
- Loose clothing that may catch in moving parts will not be worn.

- Hearing protection will be worn if a preliminary noise survey or past experience indicates maximum noise levels will exceed 85 decibels at any time during site operations or if sound levels become uncomfortable or prevent conversation at normal levels.

- Maintain visual contact with the equipment operator at all times within or near the equipment operating radius.

Prior to conducting drilling, a survey shall be conducted and discussed in the TSB to identify overhead electrical hazards and potential ground hazards, such as hazardous agents in the soil or underground utilities. Kennedy Jenks' staff will stay at least 25 feet from active drilling rig when possible. Coordinate collection of samples with equipment operator. Wear hearing protection when equipment is operating.

5.1.2 Excavation and Trench Work

Field personnel should enter an excavation or trench only as a last resort. Any excavation or trench exceeding 4 feet in depth must be properly shored, braced, or sloped, and a safety ladder must be provided for ready access or egress.

5.1.3 Tripping and Falling Hazards

Other potential physical hazards include falling and tripping on slippery, uneven, or unpaved surfaces.

Extra care should be taken in the event of frozen ground, sleet, or snow. Modify walking activities accordingly, paying close attention to exposed bare surfaces, such as stairs, platforms, concrete walkways, truck beds, etc.

5.1.4 Heat Stress

Adverse climate conditions, primarily heat, are important considerations in planning and conducting site operations. Maximum daytime temperature may exceed 75 degrees Fahrenheit (°F) at the site, and heat stress is an associated concern. Provisions of Kennedy Jenks Heat Illness Prevention Program, Appendix C, will be applied to all projects when Kennedy Jenks employees are subjected to sustained temperatures of 85 °F or greater.

Preventive measures include the following:

- Water and/or commercial electrolyte solutions will be available, and drinking these fluids will be encouraged. When temperatures exceed 85 °F, sufficient water will be provided to accommodate each employee with 1 quart of water per hour. Water will be kept cool by means of a portable cooler with ice or similar means.

- Suitable acclimation periods will be provided for workers to gradually establish their resistance to heat stress.

Personnel exhibiting symptoms of heat stress (nausea, cramps, dizziness, clammy skin) will be removed from the work area, cooled, and provided with water, and the personnel will be observed (see Appendix C, Heat Stress Card). Personnel exhibiting symptoms of heat stroke (hot dry skin, mental confusion, unconsciousness) will be immediately cooled and taken to the hospital. A map and written directions to the local medical facility are included as Attachment 1.

5.1.5 Cold Exposure

Cold injury (e.g., frostbite and hypothermia) and impaired ability to work are dangers encountered at low temperatures and high wind-chill factors. To guard against these conditions, if cold weather is an important consideration at this site, field personnel should wear appropriate clothing, have access to readily available warm shelter, take carefully scheduled work and rest periods, and monitor physical conditions of other workers. See Appendix D, Cold Stress Fact Sheet.

5.1.6 Underground/Overhead Utilities

The site may contain underground and aboveground utilities, including buried electrical, natural gas, water, sewer and fuel lines, and aboveground utilities, such as high-voltage transmission lines. These utilities present a potential hazard if they are struck or can arc if equipment is located too close to them. Kennedy Jenks will use the following notification, documentation and clearance procedures to clear all boring or excavation locations of utilities prior to subsurface invasive activities. Subsurface invasive work includes excavations, borings, surface grading, and hand augering soil samples when depths penetrate more than 6 inches below ground surface (bgs). Work is not to proceed where there is doubt regarding the location of underground utilities or obstructions. Invasive Activities – Utility Location Standard Operating Procedures are included as Appendix E.

Notification Procedures: Notification is made through the One-Call Center (811) for all subsurface invasive work located on public property. Kennedy Jenks or its designated subcontractor will call for a universal underground notice at least 2 business days before drilling or subsurface invasive activities are to begin.

Document time of the call, names of utilities to be contacted, and obtain a ticket number for the call on Kennedy Jenks Utility Location and Acknowledgement Form included as Appendix E. On private property not covered by the Utilities Underground Location Center, Kennedy Jenks may be required to contact and receive utility clearance approval from a combination of other public and private entities, as well as private landowners, City officials, and State of Washington entities to obtain clearance approval who may have underground utilities in the work area.

Documentation: All proposed subsurface excavations, boring, and well locations are to be marked on the ground surface using **white** paint in accordance with American Public Works as shown on the American Public Works Association (APWA) Uniform Color Code. A Kennedy Jenks Utility Location and Acknowledgement Form must be filled out for each proposed well, boring, or excavation location. Obtain signatures from each private or public utility owner to document clearance on the each form, as required.

At all locations where drilling, probing, or well installation will be performed, an air knife or similar form of suction potholing will be performed to assess possible underground utilities in the upper 6 to 8 feet of soils (depending on local conditions and expected depth of utilities). Potholing is required at **all drilling locations**, except in remote areas where the likelihood of encountering underground utilities is very low and only as approved by a Risk Manager, Resource/Operations Manager or Officer of the company familiar with underground utilities.

(Note: Use of an air knife will be appropriate for most invasive drilling and probing work, but may not be appropriate for certain activities like very shallow borings (less than 1-foot deep), certain hand-auger borings, remedial injections using probe equipment, and test pitting.) Case-by-case exceptions for activities may be provided.

Should an underground line or pipe or other obstruction be encountered unexpectedly or disturbed (broken, damaged, or undermined) immediately discontinue invasive activities and contact the Project Manager. If the Project Manager cannot be reached, contact an officer of Kennedy Jenks. Secure the area to prevent further disturbance/damage.

When clearing the site for utilities, **ALWAYS REMEMBER TO LOOK UP for overhead utilities**. Kennedy Jenks will direct its subcontractors to limit the proximity of equipment to overhead power transmission lines according to the following schedule:

Power Line	Distance from Power Line
50 kilovolts (kV) or below	10 feet
50 KV - 200 kV	15 feet
200 KV - 350 kV	20 feet
350 KV - 500 kV	25 feet
500 kV - 750 kV	35 feet
750 kV – 1,000 kV	45 feet

If the voltage of a power line is unknown, assume it is 1,000 kV

5.1.7 Motor Vehicle Hazards

When working at the site, personnel should be aware of the following situations or activities:

- Vehicle, truck, and equipment traffic on residential streets and nearby service roads. Use barricades, signage, and/or a traffic control plan, where appropriate. Kennedy Jenks personnel are NOT trained in and are NOT authorized to set up traffic control or work as a highway flagger.

- When driving, personnel should be aware of the potential for wildlife to be on the road or run into the road. Driving after dark should be limited as much as possible.

- When driving, personnel should be aware of the potential of falling asleep at the wheel and take rest stops and breaks, at regular intervals or as needed. Do not drive to and from the site if weather conditions make road travel unsafe.

- Unpaved, uneven, or soft roadways. Personnel should only consider driving sport utility vehicles (SUVs) or pickup trucks into the site with 4x4 or all-wheel drive to prevent tires from getting stuck in soft or loose sand/mud.

5.1.8 Biological Hazards

Personnel should be aware of the potential presence of insects such as spiders and wasp/hornets, or snakes in wellheads or other enclosures.

The site may have some vegetative areas that may contain poisonous plants or tress such as sumac and/or poison ivy. Contact with such plants should be avoided. If contact is suspected, wash the area immediately with soap and water.

Ticks are prevalent at the site. To prevent exposure, staff should wear long sleeves, light colors, and consider tucking pant legs into boot cuffs and/or duct taping pant legs to boots. Regular "tick checks" should be conducted throughout the day. Field clothes should be removed immediately after work is complete and washed.

Insect repellent with DEET should also be used to prevent exposure to biting insects such as ticks and mosquitoes.

Mosquitoes may pose a hazard because they are potentially infected with Eastern Equine Encephalitis (EEE) which may be transmitted through their bite. Personnel should have awareness of the severity of EEE warnings currently in the area. Field work should not be conducted during times of day when mosquitoes are known to be most active (i.e., dawn and dusk). Long-sleeve shirts, pants, gloves, and mosquito netting (over head and neck) should be worn to prevent exposure.

5.1.9 Equipment Hazards

Working with hand and small power tools, personnel should be aware of the following:

- Utilize tools only for the purpose for which they were designed.
- Inspect all tools and equipment before they are used.
- Immediately remove from service any tool or piece of equipment that is damaged.
- Be aware of potential of a burning hazard should equipment get hot during use.
- Do not wear any jewelry (including finger rings) or loose-fitting clothes that may get caught in equipment while conducting field activities.
- Use caution when lifting and carrying backpack containing bladder pump. The backpack weighs approximately 25 pounds. If walking long distances between monitoring wells, take intermittent rest breaks as needed to prevent fatigue.

5.1.10 Working Over or Near Water

Employees working over or near water shall consider the following recommended safety procedures:

- Employees must evaluate water conditions such as temperature or water current to select proper PPE. Example: dry suit and/or fall protection equipment. In addition, employees working within 4 feet of the water edge must wear properly sized U.S. Coast Guard personal floatation device (PFD).
- Perform visual inspections of area noting potential overhead and other hazards that are not in the normal field of vision.

- For work to be performed near water and more than 4 feet from the water's edge, erect sufficient barricades 4 feet away from the water's edge using traffic cones, plastic fencing, or caution tape to serve as a warning system when a worker unintentionally approaches the water's edge.

- For work to be performed above water and/or within 4 feet of the water's edge, another worker who can immediately summon emergency rescue must stand guard.

- Employees must know how to use rescue equipment such as "pole & life hook or ring buoy." (Ring buoys with at least 90 feet of line shall be provided and readily available for emergency rescue operations.)

- Proper footwear with adequate traction must be utilized when working or walking on wet faces.

5.1.11 Weather Hazard

There is a potential for snow and/or ice in the area of the proposed investigation. Personnel should layer clothing to lessen impact of the cold stress on the body (see Cold Stress Fact Sheet in Appendix D). Snow and ice can also cause roads and ground to be slick; therefore, extra precaution should be taken while driving, and moving around the work site. If personnel become too cold, they should take a break to warm up or add extra layers that do not impact PPE. If personnel experience symptoms of cold stress, they should stop work, and seek medical attention.

5.1.12 Other Safety Considerations

When working at the site, personnel should be aware of the following situations or activities:

- Vehicle, truck, and equipment traffic on residential streets and nearby service roads. Use barricades, signage, and/or a traffic control plan, where appropriate. Kennedy Jenks personnel are NOT trained in and are NOT authorized to set up traffic control or work as a highway flagger.

- Working with hand and small power tools. Utilize tools only for the purpose for which they were designed. Inspect all tools and equipment before they are used. Immediately remove from service any tool or piece of equipment that is damaged. Be aware of the potential of a burning hazard should equipment get hot during use.

- Do not wear any jewelry (including finger rings) or loose fitting clothes that may get caught in equipment while conducting field activities.

- Personnel should be aware of the potential presence of black widow spiders, wasp/hornets, or snakes in wellhead or other enclosures.

- When driving, personnel should be aware of the potential for wildlife to be on the road, or run into the road. Driving after dark should be limited as much as possible.

- When driving, personnel should be aware of the potential of falling asleep at the wheel and take rest stops and breaks, at regular intervals or as needed. Do not drive to and from the site if weather conditions make road travel unsafe.

5.2 Potential Chemical Hazards

Creosote is suspected to be present in timber piles beneath the PECO crane dock. Petroleum hydrocarbons have been detected in groundwater and soil samples collected at the site. Field personnel could potentially be exposed to petroleum hydrocarbons at the site by direct contact with soil or groundwater, through inhalation of dusts containing organic chemicals or through inhalation of organic chemical vapors. Field personnel will minimize potential chemical hazards by 1) avoiding direct contact with groundwater and soil, 2) performing air monitoring to determine necessary level of personal protective equipment, and 3) avoiding generation of dust. Ingestion of particulate matter containing chemicals is another general exposure route. However, for site personnel, the potential for this type of exposure is minimal. Safe work practices, including restriction of eating, drinking, or smoking to certain times and places, will be enforced at the work site.

5.2.1 Groundwater Samples

Potential chemicals present in groundwater from the site are listed in Table 1.

5.2.2 Soil Samples

Potential chemicals present in soil from the site are listed in Table 2.

Available Threshold Limit Values (TLV) or Permissible Exposure Limits (PEL) published for potential chemicals that may be detected in soil and groundwater are listed in Table 3.

5.2.3 Chemical Use Plan and Safety Data Sheets (SDS)/Hazard Communication

In addition to site-related chemicals, Kennedy Jenks field personnel may work with compressed gasses, cleaning materials, and other materials that present potential health and safety issues. Typical chemicals that may be brought to the site are listed below.

- Marking Spray Paint
- Non-phosphate detergent.

Kennedy Jenks has a "cradle to grave" policy regarding the purchase, storage, use, transportation, and disposal of chemicals used in the field. The Chemical Use Policy and Procedures are attached as Appendix F to provide guidance on the proper protocols for chemical use in the field. The Chemical Use Plan (see Appendix G) must be completed by Kennedy Jenks field staff using the chemicals and approved by the H&S Manager.

Kennedy Jenks has a Hazard Communication Written Program (see Appendix F) and training programs that cover these materials. Personnel conducting field activities must complete a review of the Hazard Communication Written Program and site-related chemical hazards prior to starting field activities.

The Hazard Communication Written Program is part of Kennedy Jenks Health and Safety Operations Manual.

Copies of the SDS for chemicals listed in Table 1 or listed in this section are provided in Appendix G.

Section 6: Community Hazard Analysis

Generally, insignificant particulate and vapor emissions are generated during routine soil and groundwater sampling activities. During construction-related activities, particulate and vapor emissions may increase above concentrations generated during routine soil and groundwater sampling activities. Therefore, activity-specific health and safety addenda will be developed for activities where elevated particulate and vapor emissions may develop. Onsite worker exposure to chemicals at concentrations of concern is not expected. Potential exposures to the surrounding community will likely be much less than potential onsite worker exposure and is, therefore, also not expected to be of concern.

However, a potential for onsite worker exposure to chemicals exists during drilling and sampling activities. If, based on the action levels provided in Section 7, it becomes necessary for site personnel to don Level C PPE, Kennedy Jenks along with its subcontractor (Blaine Tech Services, Inc.), will establish three work zones: Exclusion Zone, Contaminant Reduction Zone, and Support Zone as described in Section 7.2. Exclusion and Contaminant Reduction Zones will control entrance and exit from potential exposure areas. Continuous air monitoring will be performed during activities performed within the Exclusion Zone to ensure that the appropriate level of PPE is selected and within the Support Zone to ensure that support workers are not exposed to chemicals. Potential exposures to the surrounding community are unlikely based on the size of the property. If air monitoring indicates that there is the potential for the surrounding community to be exposed, Kennedy Jenks will stop work and evaluate the need for alternative controls.

Use of barricades, caution tape, or signage to keep the general public away from working areas should be used where and when appropriate. At a minimum, keep public and non-essential personnel at least 50 feet away from an active drilling area. This can be accomplished using barricades, cones, vehicles, and caution tape.

Section 7: Protective Actions

7.1 PPE

Field personnel will wear equipment to protect against potential physical and chemical hazards, which have been identified herein and those that become apparent in the field. Guidelines for Contaminants Commonly Encountered at Kennedy Jenks Sites provide guidance in assessing potential hazards and selecting the appropriate protection. Level D protection will be required at a minimum for field activities at the site. Level D personal protective equipment to be used may include all items on the following list that are denoted by an asterisk (*).

The level of protection employed may be upgraded, as deemed necessary by the SSO. If non-routine field activities are initiated, the level of protection will be specified in the activity-specific health and safety addenda.

Personal Protective Equipment (PPE) and Monitoring Equipment

Eyes: ☒ Safety Glasses ☐ Face Shield
Boots: ☒ Safety-Toe ☐ Work ☐ Rubber ☐ Other
☒ Class II High-Visibility Reflective Safety Vest
☒ Hard hat
☒ Earmuffs/Plugs (as needed)
☒ Work Gloves ☐ *Neoprene* ☐ *Rubber* ☒ *Nitrile*
☐ Suits: ☐ *Cotton* ☐ *Tyvek* ☐ *Nylon* ☐ *Other*

☐ Respirator: (Type/Cartridge: *specify)*
☐ Emergency Eyewash ☐ Emergency Shower
☐ Spill Kit
☐ Fire Extinguisher
☒ First Aid Kit
☐ Life Jackets ☐ Rescue Life Ring
☐ Safety Belt/Harness/Tripod
☐ Lights *(type: Flashlight)*
☒ Camera/Video
☒ Cell Phone

☐ Lockout Tags and Locks
☐ Ventilator/Fan
☐ Volt/Ampere Meter
☐ PID *(calibration date: specify)*
☐ OVA *(calibration date: specify)*
☐ OVM *(calibration date: specify)*
☐ Hydrogen Sulfide Meter *(calibration date: specify)*
☐ Draeger Detection Tubes
☐ Soil Sampling Kit
☐ pH Meter/Paper
☐ Conductivity/Temperature Meter
☐ Metal Detector
☐ Air Sampling Equipment
☐ Peristaltic Pump
☒ US Coastguard approved PFD.
☒ Work clothing as prescribed by weather

7.2 Work Zones

Work zones, including designation of an Exclusion Zone, a Contamination Reduction Zone, and a Support Zone, will be established for any field activity that requires Level C protection or greater. Work zones will be clearly marked in the field. Work zones may vary depending on the proposed field activity and will be established in the activity-specific health and safety addenda.

7.3 Monitoring

7.3.1 Hazardous Substances

As appropriate, field personnel will perform air monitoring at least twice daily with a direct reading organic vapor analyzer (OVA, OVM, or HNU) in the breathing zone at each work location. All readings shall be recorded in field logs. All direct reading instruments shall be calibrated according to the manufacturer's specifications. The following action levels will be used.

- If OVA readings for a particular work area consistently exceed 5 parts per million (ppm) above background, then sampling will cease and personnel will withdraw from the work area.
- If concentrations persist above 5 ppm, then Level C protection will be required if work is to continue.
- If OVA readings exceed 10 ppm in the breathing zone while workers are in Level C protection, then work will cease, and the source of the emission will be determined and eliminated before work continues.
- Periodic measurements of the area will be taken before re-entry to ensure lower exposure limit (LEL) has been reduced to safe working levels.

7.3.2 Explosive Limits

If conditions encountered during drilling or sampling suggest potentially explosive conditions may exist, the SSO will direct explosimeter monitoring be conducted. The following explosimeter monitoring action levels will be used:

- If gas or vapor concentration is less than 10 percent of its LEL, continue investigation.
- If concentrations are between 10 and 25 percent of its LEL, continuously monitor site and continue investigation with extreme caution.
- If concentrations are greater than 25 percent of LEL, withdraw from area immediately.

7.3.3 Noise

Field personnel will initially monitor noise levels associated with equipment and machinery with a direct reading portable noise level monitor unless based on experience, it is known that hearing protection is not necessary. Readings will be taken within the normal worker hearing zone. If maximum noise levels exceed 85 decibels at any time during site operations, hearing protection will be worn.

The OSHA permissible noise exposure limit is 90 decibels as an average exposure over an 8-hour work period. If an employee's 8-hour time-weighted average noise exposure for any day is in excess of 85 decibels, the employee must participate in a hearing conservation program. For most field activities, it is unlikely the employee exposure in excess of 85 decibels for 8 hours will occur. Although a written hearing conservation program is not required, Kennedy Jenks will provide field personnel with appropriate hearing protection (i.e., earmuffs or plugs) whenever noise levels have the potential to exceed 85 decibels.

All contractors are responsible to ensure whether a hearing conservation program is warranted per site conditions and are to ensure compliance with applicable OSHA regulations.

7.4 Site Control

Work zones will not be established for Level D activities. Individuals not directly involved in ongoing work will be requested to stay at least 50 feet away from Level D activities. For work inside a building, access will be controlled using building access control.

7.5 Cleaning

For activities requiring Level D protection and modified Level C protection without established work zones, it is unlikely major cleaning will be necessary. At the conclusion of each day or work period, disposable gloves and coveralls will be removed and disposed of in onsite containers.

If full Level C protection is required, minimum cleaning procedures associated with Level C protection will be followed and established within the Contamination Reduction Zone. These procedures are presented in Table 2.

7.6 Training

Kennedy Jenks personnel participating in field activities will have completed the Hazardous Waste Operations and Emergency Response 40-hour health and safety training course (29 CFR 1910.120), or have equivalent training, and have undergone annual 8-hour refresher training. Training requirements are discussed in Kennedy Jenks Health and Safety Operation Manual. Prior to each work day, a TSB meeting will be held at the site to familiarize personnel with health and safety issues, protective equipment, emergency information, and supplies and to discuss special topics.

7.7 Medical Monitoring

Kennedy Jenks personnel participating in field activities will be included in a medical monitoring program. The program includes a baseline physical examination, pulmonary function test, and blood and urine tests. Periodic (annual) examinations will be provided to employees who are exposed to hazardous substances or health hazards at or above the established PEL, above the published exposure levels for these substances, without regard to the use of respirators, for 30 days or more a year. Annual examinations will also be provided to Kennedy Jenks employees who wear a respirator for 30 days or more a year or as required by 1910.134. Details of the medical program are included in the Kennedy Jenks Health and Safety Operations Manual.

7.8 Sanitation and Illumination

The site may have drinking water, washing water, and restroom facilities available. If drinking water is not available at the site, a sufficient amount of water will be provided to accommodate each employee with 1 quart of water per hour. The water will be kept cool by means of a portable cooler with ice or similar means.

No eating, drinking, smoking, or gum or tobacco chewing is allowed in restricted areas.

Activities will take place during daylight hours. Because natural illumination (approximately 50- to 200-foot candles) will be sufficient to meet the 5-foot candle requirement for general site areas, no additional illumination will be required.

7.9 COVID-19 Procedures and Processes

The following information summarizes hazards, risks, and mitigation/minimization strategies for COVID-19 exposure and transmission in anticipation of field activities in the coming months. The procedures established herein provide a framework, with the expectation that site personnel will work together to optimize and refine these procedures to most effectively achieve the objective of minimizing COVID-19 exposure and transmission risks and safely completing their field assignments.

7.9.1 COVID-19 Background

COVID-19 is a new strain of coronavirus which originated in Wuhan, China, and has since been detected worldwide and now in the United States. COVID-19 is a respiratory virus and symptoms of infection include fever, dry cough, shortness of breath, and breathing difficulties. In severe cases, infection can cause pneumonia, acute respiratory syndrome, organ failure, and death . Treatment of COVID-19 is typically with medication to reduce fever and to support and improve respiratory function.

COVID-19 is thought to spread mainly from person-to-person between people who are in close contact with one another (within about 6 feet), or through respiratory droplets produced when an infected person coughs or sneezes. These droplets can land in the mouths or noses of people who are nearby or possibly be inhaled into the lungs. It may be possible that a person can get COVID-19 by touching a surface or object that has the virus on it and then touching their own mouth, nose, or possibly their eyes, but this is not thought to be the main way the virus spreads.

7.9.2 Prevention and Treatment

The best way to prevent illness is to avoid being exposed to this virus. COVID-19 vaccines are becoming available and being distributed to communities throughout the U.S. when available. Based on the information that is currently available, the vaccine is not expected to have wide-spread distribution until mid to late 2021. Centers for Disease Control and Prevention (CDC) recommends everyday preventive actions to help prevent the spread of respiratory diseases.

CDC Fact Sheets specific to COVID-19 are included in Appendix H.

7.9.3 Site-Specific Procedures and Guidelines

The following presents guidelines to be followed by all personnel onsite in conjunction with those already set in place. Other contractors/consultants working onsite should be provided this document and commit to abiding by these procedures (or more stringent firm-specific procedures). These procedures supplement those established in each firm's site-specific health and safety plan.

7.9.3.1 Transportation and Parking

Visitors to the Mill are required to complete a health self-assessment every day before reporting to work. The health self-assessment can be completed upon check-in at the Clockroom or the entry gate.

Employees are encouraged to drive separately to/from the site, unless their vehicle provides adequate interior space for social distancing. Parking will be situated such that staff traveling between their designated workspace and vehicle should not encounter members of other field teams.

Travel around the site will occur on foot with appropriate social distancing and/or in separate vehicles.

7.9.3.2 Interactions Within Field Teams

All site personnel should limit physical interactions as much as practicable while still allowing for a safe and efficient workspace. Social distancing is the primary means of avoiding physical interactions. The means by which a field team establishes and maintains social distance is task- and location-specific and will be assessed and refined in the field. Those routine elements of the field program are addressed below and associated procedures ensure the CDC suggested 6-foot buffer during physical interactions.

Effective 23 August 2021, Washington Department of Health (DOH) updated the Washington mask requirement. The Mill requires that all employees, vendors, contractors, and visitors wear a mask while indoors, regardless of distance and vaccination status, with limited exceptions for eating/drinking while maintaining social distancing, being alone in an enclosed room with a door, and other medical exceptions.

7.9.3.3 Social Distancing – Non-Work Hours

Procedures established herein effectively limit interactions while onsite. To supplement these onsite procedures, all personnel who will be returning to site the following day should practice social distancing during non-work hours away from the facility. In the event that a questionable encounter occurs during non-working hours, Kennedy Jenks recommends that the employee mention the interaction at the next safety briefing to make others aware and refine onsite procedures if needed.

7.9.3.4 Meals

All personnel should pack and bring their meals (and snacks/drinks) onsite with them. Employees are discouraged from leaving the site during the workday.

7.9.3.5 Daily Safety Tailgate

Field teams conduct daily safety tailgate briefings at the beginning of every workday. These meetings will be conducted outside in the parking area onsite each morning. The meetings include daily scope of work and hazards that are present onsite. Recognizing the everchanging stream of information and decisions related to COVID-19, safety briefings will include an overview of pertinent updates. At the end of each meeting (and anytime during the day), all personnel present will have a chance to voice concerns. All personnel onsite have stop work authority, and COVID-19 comfort concerns are a valid reason to stop work and revisit the procedures outlined herein and/or make a go/no-go decision regarding additional field activities. Field teams will record the meeting attendees in a field book in lieu of passing the tailgate sheet for signatures.

7.9.3.6 Sanitation

All personnel will be required to sanitize their field equipment at the end of the workday before leaving the site to help decrease spread or migration of the virus using sanitation wipes provided by their company. Similarly, once arriving onsite, all personnel should immediately thoroughly wash their hands in the designated restroom.

7.9.4 Communication and Updates

Kennedy Jenks will provide updates as more information on COVID-19 exposure and transmission risks becomes available.

While onsite, all personnel should practice safe prevention techniques as outlined in the Introduction and follow the guidelines hereinto. As the COVID-19 pandemic continues to unfold across the U.S. and in Washington, Kennedy Jenks will maintain constant communication with personnel onsite. Daily updates will be provided to verify that work can continue safely and address emerging situations.

IF YOU FEEL ILL, CONTACT YOUR H&S REPRESENTATIVE - <u>DO NOT COME TO THE SITE</u>.

Section 8: Emergency Response Plan

Hazard recognition is an essential part of the Emergency Response Plan. Initiation of the contingency plan relies on the employee's ability to recognize an emergency or potential for an emergency. The following is a list of events that will immediately initiate emergency procedures:

- Explosion
- Fire
- Release of organic vapors or particulate above the action levels
- Personal injury
- Failure or expected failure of runon/runoff control measures
- Natural occurrences (i.e., lightning, tornado, high winds, etc.)
- Spills.

8.1 Emergency Communications

Emergency communications will consist of two methods.

8.1.1 Verbal Communication

Verbal communication will be the primary method of emergency communication between onsite personnel, distance permitting.

8.1.2 Telephones

Telephones are used for routine communication and to notify offsite agencies of incidents and request assistance. Emergency telephone numbers are given in Section 9.

8.2 Emergency Protocol

When an event recognized as an emergency occurs, the alarm system will be used to notify personnel. As soon as the alarm system is activated, the SSO will be notified.

The SSO will take into account the following information:

- Nature of emergency
- Wind direction
- Location of personnel
- Monitoring results

- Emergency equipment available
- Offsite population.

Based on this information, the SSO will direct appropriate emergency action and agency notification. After the emergency has been controlled and the site is considered safe to re-enter, the SSO, in coordination with the Project Manager, will direct remedial action to restore the site to full operating condition.

The SSO will investigate the nature and cause of the incident so work procedures can be modified to minimize the likelihood of the incident's recurrence.

All incidents must be reported in a timely, appropriate manner to the Director of HS&E or H&S Manager. An incident is any unplanned event resulting in injury, damage, loss of assets, adverse publicity, or which requires notification of a regulatory agency, regardless of severity. All Kennedy Jenks personnel should report an incident to the SSO. The SSO will report to the Project Manager, who is responsible for notifying the Director of HS&E or H&S Manager.

Each incident will be investigated and a Root Cause Analysis Report will be generated and forwarded to the Project Manager and the H&S Manager.

If work zones are established, the Exclusion Zone will have several emergency exits, which will allow safe egress in multiple directions from any point onsite. The exit selection will be based on the emergency location, type of emergency, and wind direction. Upon hearing the evacuation signal or otherwise being notified of an evacuation, employees will immediately travel to the assembly area located at the cleaning station.

Employees will follow a route that avoids locations downwind from the emergency. If emergency exits are used, employees will proceed to the assembly area by the quickest route possible. When the assembly area is reached, employees will immediately check in with the SSO. The site will remain evacuated until the all clear signal has been given.

8.3 Emergency Supplies

The following is a list of emergency equipment available to take to the site:

- Portable emergency eye wash
- First aid supplies
- Cooler for water and ice (when temperatures are predicted to be above 85°F)
- Shade cover to protect from sun exposure.

All personnel will have a thorough understanding of the HASP before starting work. It will be reviewed periodically to keep it current with new or changing site conditions or information.

8.4 Injury Response

In the event of an employee injury in a contaminated area, consideration must be given before moving the injured and contaminated employee to outside the restricted contamination area. The nature of the injury, hazards posing an immediate danger, and other factors must all be weighed before moving an injured employee who is wearing contaminated PPE. Initial responders should follow directions from 9-1-1 personnel or the Director of HS&E or H&S Manager.

Section 9: Reporting (Injury/Illness, Property Damage, or Near Miss)

9.1 Injury/Illness Care and Notification Procedures

9.1.1 Emergency Services (9-1-1)

Call 9-1-1 for critical injuries or illnesses (i.e., head injuries, uncontrolled bleeding, difficulty breathing, chest pain, or altered level of consciousness) or if an employee or his/her supervisor has immediate concerns about an injury or illness.

9.1.2 Injury/Illness Intervention

Kennedy Jenks has retained WorkCare, a team of occupational physicians, to provide our employees with effective treatment of non-critical work-related injuries and illnesses. WorkCare provides on the spot, 24/7 employee consultations at the time an on-the-job incident occurs, as well as post-accident follow-up and consultation.

9.1.3 When to Call WorkCare

In the instance of a non-critical workplace injury or illness, an employee should call WorkCare at (888) 449-7787 to receive instruction on how to contact one of its clinicians and contact their immediate supervisor as soon as possible. Common non-critical workplace injuries/illnesses include:

- Back sprains
- Slips, trips, falls
- Shoulder strains
- Contact with a harmful substance.

9.1.4 Employee Role

The injured employee, if able, must do the following:

- Report any non-critical injuries/illness to WorkCare at (888) 449-7787 and, as soon as possible, to their immediate supervisor. WorkCare will notify the Director of HS&E and the H&S Manager of the injury or illness. The Director of HS&E will immediately notify the appropriate Business Unit President and Director of Operations of the injury or illness.

- If WorkCare determines medical attention is required, transportation must be provided for the injured employee. An injured employee must not transport himself/herself to a facility for medical treatment. If a co-worker is not available to transport the injured employee, an ambulance, a taxi, or other means of transportation must be provided, unless the employee is working in a remote area and no other form of transportation is available. WorkCare will send the employee to an approved local facility and inform the treating physician the injury is work related.

9.1.5 Project Manager Role

The Project Manager must do the following:

- Make sure the injured employee contacts WorkCare and is provided transportation to immediately obtain any required medical care from an approved doctor or hospital, if required.
- Provide emergency ambulance service if needed for critical injuries or illnesses, if required.
- Notify the Director of HS&E and H&S Manager of the injury or illness.

9.1.6 Injured Subcontractor or Other Non-Kennedy Jenks Employee

In the case of injuries or illness to non-employees, the appropriate staff member should ensure they receive proper medical attention, and their supervisor and the Director of HS&E are notified immediately. The Director of HS&E will notify Senior Leadership Team.

9.2 Property Damage and Near Miss Incident Investigation

All work-related property damage and near miss incidents will be investigated by Kennedy Jenks in a timely manner. Minor incidents and “near misses” will also be investigated so the risk of serious occurrences can be reduced in the future. All serious incidents and serious "near misses" will be investigated by the Director of HS&E or the H&S Manager.

- Near Miss. Incidents where no property was damaged and no personal injury sustained, but where, given a slight shift in time or position, damage and/or injury easily could have occurred.
- Rule of Thumb. If you need to ask yourself if the incident was a near miss or not, you have answered the question, and it is a near miss.

Forms

The Injury/Illness, Property Damage Incident, and Near Miss Reporting Forms are included as Appendix I.

Section 10: Emergency/Team Contacts & Approvals

Emergency Telephone Numbers

	Name	Phone
Site Contact	Samantha McDowell	360-834-8439
WorkCare (Non-Critical Injuries)	WorkCare	**888-449-7787**
Fire Department[1]		9-1-1 360-835-2611
Hospital: PeaceHealth Southwest Medical Center		360-514-2000 (non-emergency)
Directions to hospital[2]: See attached map	400 NE Mother Joseph Pl, Emergency Entrance, Vancouver, WA 98664	
Ambulance		9-1-1
Police		9-1-1 360-834-4151 (non-emergency)
Kennedy Jenks:		
Project Manager	Rachel Morgan	415-243-2441 (Office)
Site Safety Officer (SSO)	Matthew Grzegorzewski	503-423-4025 (Office) 847-997-5490 (Cell)
Health and Safety Manager	John Jindra	253-835-6466 (Office) 253-254-1079 (Cell)
Director of Health, Safety and Environment	Bert Drews	415-710-0002 (Cell)

[1] The local fire department prefers the public use 911 to assure the proper assistance in case of accident or injury.
[2] Attach written directions and map showing route to hospital.

Project Team Members Participating in Field Activities

Name	Affiliation	Responsibility	Signature/Date
Matthew Grzegorzewski	KJ	Oversight/SSO	Matt Grzegorzewski

Approvals

	Name	Signature/Date
Project Manager	Rachel Morgan	11/29/2021
Health and Safety Manager	John Jindra	11/29/2021

CC: Project File
PM Portal

Tables

Table 1: Potential Chemicals Present In Groundwater Monitoring Samples

Chemical
Dioxins
Perfluoro Sulfonic Acid (PFOS)/ Perfluorooctanoic Acid (PFOA)
Gasoline-Range Total Petroleum Hydrocarbons (TPH)
Diesel- and Heavy Oil-Range Petroleum Hydrocarbons (DRO, ORO)
Metals
Volatile Organic Compounds (VOCs)
Semi-Volatile Organic Compounds (SVOCs)
Diphenyl
Polychlorinated Biphenyls (PCBs)

Table 2: Potential Chemicals Present In Soil Samples

Chemical
Dioxins
Gasoline-Range Total Petroleum Hydrocarbons (TPH)
Diesel- and Heavy Oil-Range Petroleum Hydrocarbons (DRO, ORO)
Metals
Volatile Organic Compounds (VOCs)
Semi-Volatile Organic Compounds (SVOCs)
Diphenyl
Polychlorinated Biphenyls (PCBs)

Table 3: Chemical Allowable Exposure Values and Exposure Symptoms

Chemical	TLV TWA[(a)]	STEL[(b)]	PEL[(b)]	Acute Exposure Symptoms[(c)]	Target Organs[(c)]
Dioxin	0.10^{-8} mg/m$^{3x`}$	--[(e)]	--[(e)]	Shortness of breath, headaches, fatigue, muscle pains, weakness, digestive disturbance; Nausea, vomiting and possible pancreatitis; Chemical burns, chloracne, skin fragility, hirsutism, photosensitivity, conjunctivitis, and chemical burns to eyes	Eyes, skin[(d)], liver, kidneys, reproductive system
Gasoline	None Developed	--[(e)]	None Developed	Irritant to eyes, skin, mucous membranes, dermatitis, lassitude, blurred vision, dizziness, slurred speech, confusion, convulsions	Eyes, skin, respiratory system, CNS, liver kidneys
Diesel/ Heavy Oil	100 mg/m^3	--[(e)]	--[(e)]	Irritant to eyes, nose, and throat	Eyes, skin, liver, kidneys, respiratory system, CNS
Diphenyl	0.2 ppm	--[(e)]	0.2 ppm	Irritation eyes, throat; headache, nausea, lassitude (weakness, exhaustion), numb limbs; liver damage	Eyes, respiratory system, liver, central nervous system.
Benzo(a)pyrene [65996-93-2]	0.2 mg/m^3	0.2 mg/m^3	0.6 mg/m^3	Dermatitis, bronchitis, [potential occupational carcinogen]	Respiratory system, skin, bladder, kidneys
Benzene	1 ppm	1 ppm	5 ppm	Irritation eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude (weakness, exhaustion); dermatitis; bone marrow depression; [potential occupational carcinogen]	Eyes, skin, respiratory system, blood, central nervous system, bone marrow
Toluene	100 ppm	100 ppm	150 ppm	Irritation eyes, nose; lassitude (weakness, exhaustion), confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, insomnia; paresthesia; dermatitis; liver, kidney damage	Eyes, skin, respiratory system, central nervous system, liver, kidneys
Ethylbenzene	100 ppm	100 ppm	125 ppm	The substance is irritating to the eyes, the skin, and the respiratory tract. Swallowing the liquid may cause aspiration into the lungs with the risk of chemical pneumonitis. The substance may cause effects on the central nervous system. Exposure above the OEL could cause lowering of consciousness	Eyes, skin, respiratory system, central nervous system, liver, kidneys
Xylenes	100 ppm	100 ppm	150 ppm	Irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis	Eyes, skin, respiratory system, central nervous system, gastrointestinal tract, blood, liver, kidneys

Notes:

(a) TLV TWA = threshold limit value – 8-hour time-weighted average.
STEL = short-term exposure limit.
American Conference of Governmental Industrial Hygienists. TLV and Biological Exposure Indices for 1997.

TLV TWA reported in ppm represents parts of vapor per million parts of air by volume at 25 degrees Celsius (°C) and 760 torr. TLV - TWA reported in milligrams per cubic meter (mg/m^3) represents milligrams of substance per cubic meter of air.

(b) PEL = Federal Occupational Safety and Health Administration (OSHA) (29 CFR 1910 Subpart Z) Permissible Exposure Level based on 8-hour time weighted average.

(c) Source: U.S. Department of Health and Human Services. National Institute for Occupational Safety and Health (NIOSH) Pocket Guide to Chemical Hazards. June 1994. Sittig, Marshall. 1985. Handbook of Toxic and Hazardous Chemicals and Carcinogens. Park Ridge, New Jersey. Noyes Publications.

(d) Skin notation indicates route of exposure through cutaneous absorption.

(e) "—" indicates there is no published limit for this chemical at the Oregon State or Federal level.

ppm = parts per million

IDLH = immediately dangerous to life and health

CNS = central nervous system

Table 5: Measures for Level C Cleaning

Station	Description
1	**Equipment Drop** Deposit equipment used onsite (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, a cool down station may be set up within this area.
2	**Outer Garment, Boots, and Gloves Wash and Rinse** Scrub outer boots, outer gloves, and splash suit with decon solution or detergent water. Rinse off using copious amounts of water.
3	**Outer Boot and Glove Removal** Remove outer boots and gloves. Deposit in container with plastic liner.
4	**Canister or Mask Change** If worker leaves Exclusion Zone to change canister (or mask), this is the last step in the cleaning procedure. Worker's canister is exchanged, new outer gloves and boot covers donned, joints taped, and worker returns to duty.
5	**Boot, Gloves and Outer Garment Removal** Boots, chemical-resistant splash suit, inner gloves removed and deposited in separate containers lined with plastic.
6	**Face Piece Removal** Face piece is removed. Avoid touching face with fingers. Face piece is deposited on plastic sheet.
7	**Field Wash** Hands and face are thoroughly washed. Shower as soon as possible.

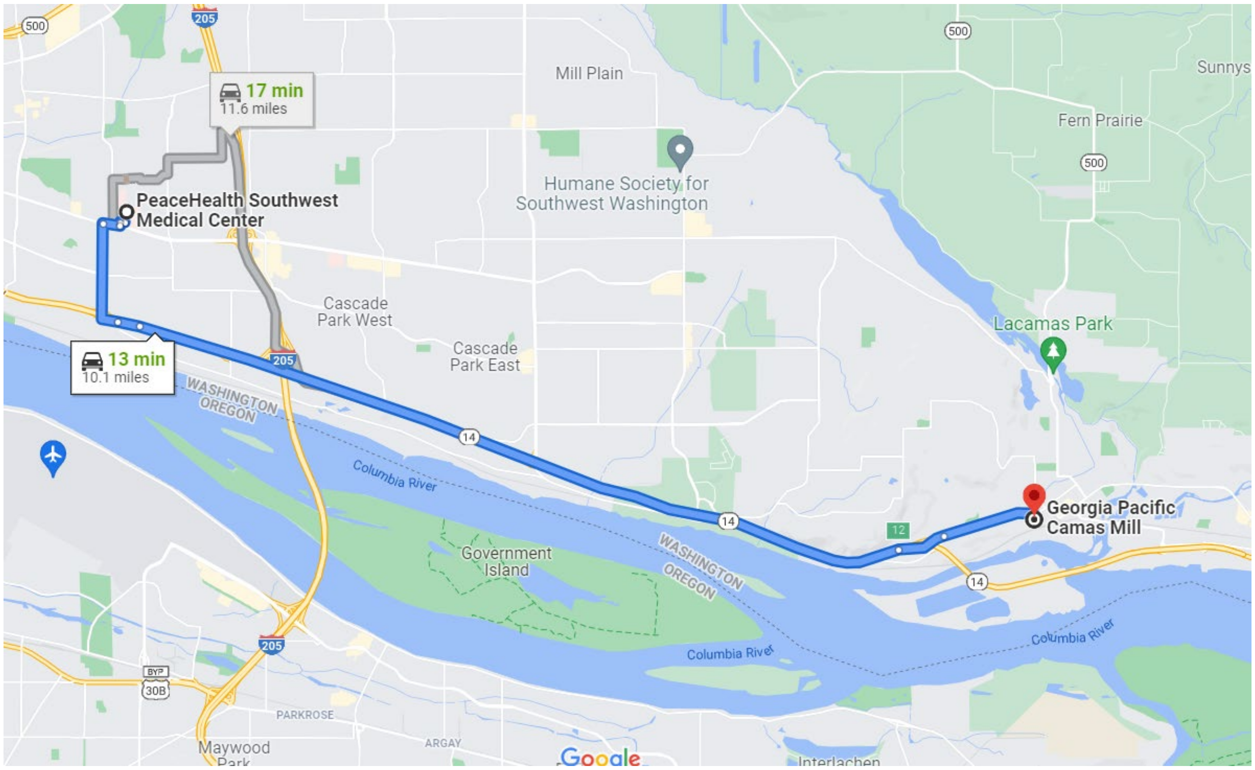
Attachment 1

Site Map

Map and Written Directions to Local Hospital

Directions to Hospital

These directions are to/from the site to PeaceHealth Southwest Medical Center located at 400 NE Mother Joseph Pl, Vancouver, WA 98664. These directions should be confirmed by the Program Manager prior to the start of work at the site. Directions, as provided by Google Maps, are provided below.



Start: 401 NE Adams, Camas, WA 98607 (Georgia-Pacific Camas Mill) --- Drive 10.1 miles, 14 minutes

1. Head west on NW 6th Ave toward NW Fargo St. (0.8 mi)
2. At the traffic circle, continue straight onto the WA-14 W ramp (0.4 mi)
3. Merge onto WA-14 W (7.5 mi)
4. Keep left to stay on WA-14 W (2.1 mi)
5. Take exit 4 for Leiser Road toward Southeast 88th Avenue (0.2 mi)
6. Turn right onto S Lieser Rd (0.8 mi)
7. Turn right onto E Mill Plain Blvd (0.2 mi)
8. Turn left onto NE Mother Joseph Pl (456 ft)
9. Turn right (236 ft)
10. Turn left (20 ft)

Destination will be on the right.

End: PeaceHealth Southwest Medical Center

Appendix A

Job Hazard Analysis

JOB HAZARD ANALYSIS	**Project No.:** 1865004*21
Job/Operation Title: Excavation or Trenching	**Date:** 11/12/2021
Business Unit: Industrial	**JHA Reviewed By:** Rachel Morgan
Project Location: 401 NE Adams St, Camas, WA 98607	**JHA Revised By:** Robert Ardissono
Person(s) Performing This Job/Task: Matthew Grzegorzewski, Robert Ardissono, Shaelyn Thomas	**Project Manager:** Rachel Morgan
Job/Task Start Date: April 2022	**Job/Task Duration:** 12 months

Task/Step	Potential Hazards	Recommended Safe Job Procedures
Mobilize equipment	Risk of injury to automotive or pedestrian traffic.	A Traffic / Pedestrian Control Plan is required when blocking or partially blocking any walkway, roadway, or driveway. Work area should be delineated off from Unauthorized personnel and signs posted. Proper PPE shall be worn by adjacent personnel, as required by their proximity to the work task.
Locate utilities	Risk of damaging underground utilities.	Follow Utility Locate Stand Operating Procedures (SOPs). Ensure all areas to be disturbed have been scanned prior to the start of work.

Task/Step	Potential Hazards	Recommended Safe Job Procedures
Excavate or trench	Risks of injury from cave-in's collapse of unstable or poorly supported soil.	Soil type shall be classified by an Excavation Competent Person (CP). The contractor or subcontractor will provided an Excavation CP. Trenches, spoil piles, and surrounding work areas must be inspected daily or as needed. Kennedy Jenks personnel will not enter any trench greater than 5 feet deep (4 feet in Washington and Oregon) that is not shored or benched. Appropriate shoring or benching is determined by the CP. Excavated soil spoils are properly managed. Any trench greater than 4 feet, located next to underground piping or tanks containing hazardous materials or having soil discoloration or odors shall be evaluated for permit-required confined space controls.
Containment	Risk of accidental release into the storm water drains	Follow Stormwater Pollution Prevention Program as required. If storm drains are below work areas, ensure drain covers are surrounded by waddles, lined with mesh covers (silt screens).

JOB HAZARD ANALYSIS
COVID-19 **Safety Practices**

Similar to any other hazard encountered in the performance of field work, COVID-19 presents hazards we must consider and address as part of our job hazard analysis (JHA).

Supplemental Document References:
COVID-19 General Guidelines
https://kjcnet.sharepoint.com/sites/SafetyZone/SiteAssets/SitePages/Coronavirus/KJ_COVID_01_GeneralGuidelines.pdf?web=1
COVID-19 Projects
https://kjcnet.sharepoint.com/sites/SafetyZone/SiteAssets/SitePages/Coronavirus/KJ_COVID_03_Projects.pdf?web=1
COVID–19 Vehicles
https://kjcnet.sharepoint.com/sites/SafetyZone/SiteAssets/SitePages/Coronavirus/KJ_COVID_04_Vehicles.pdf?web=1
COVID–19 Travel
https://kjcnet.sharepoint.com/sites/SafetyZone/SiteAssets/SitePages/Coronavirus/KJ_COVID_05_Travel.pdf?web=1

Controlling spread of COVID–19 infection

Task/Step	Potential Hazards	Recommended Safe Job Procedures
Pre-Trip Planning	Travel by air, rail or vehicle Access restrictions/closures due to COVID-19 Lack of vital services due to COVID-19 Increased exposure potential to COVID-19	• Check with client regarding potential access restrictions or specific guidance regarding COVID-19. • Determine requirements of any local, state, federal government directives/ordinances applicable to the areas of travel. • Verify flights, hotels, and meal accommodations are available in areas of travel. • Review CDC or local health department guidance with project team members and KJ's COVID-19 Travel Planning Policy (linked above) to prevent or reduce the likelihood of exposure. • Provide adequate supplies for the task and access for all team members (hand washing and sanitation stations, PPE (gloves, safety glasses, face covering, as appropriate). • Follow hygienic practices to reduce the spread of germs: ▪ Wash hands regularly and thoroughly with soap and water, for a minimum of 20 seconds. While in the field keep hand sanitizer[a] (containing at least 60% alcohol) and/or disinfectant wipes[b] easily accessible. ▪ Avoid touching your nose, mouth, and eyes and wash hands before and after eating. ▪ Cover coughs and sneezes with a tissue, or cough and sneeze into upper sleeve if tissues are not available.

Task/Step	Potential Hazards	Recommended Safe Job Procedures
		▪ Properly dispose of tissues immediately after use (do not place used tissues on desk surfaces or in clothing pockets). ▪ Wash hands or use hand sanitizer[(a)] after coughing, sneezing, or blowing your nose. ▪ Wipe down frequently touched work surfaces, tools, and equipment with sanitizing wipes. ▪ Use disposable gloves if handling tools and equipment that may be contaminated. ▪ Avoid using other employees' work tools and equipment. • Avoid close contact with others; maintain social distancing when possible (defined by the CDC as remaining out of congregate settings, avoiding mass gatherings, and maintaining distance (approximately 6 feet from others). • Avoid handshakes. Always wash hands after physical contact with others.
Travel to and from Jobsite	Inadequate social distancing for COVID-19	• Avoid public transportation when possible. • Separate vehicle occupants as far as possible or plan to take individual vehicles/means of transportation to maintain social distancing.
Evaluate Job Sites and Discuss with Client and or Contractor	Contracting COVID-19 virus	Project managers and assigned field staff should evaluate job sites where we will be working for potential exposure. Obtain as much information as you can from the client and/or contractor on current projects and for new projects. • Have there been reported COVID-19 cases or suspected cases at the site? • What precautions has our client and or contractor put in place for disease transmission prevention? • Has the client/contractor provided a COVID-19 revision of their Safety Plan for all site staff to follow and if yes, are you following it? • Ask our client or contractor to immediately notify us of suspected cases at the site. • What requirements or restrictions does our client or contractor have for KJ personnel that will be onsite? ▪ Has anything changed that will impact our services, schedule, staffing, costs? If yes, we will need to discuss with our client immediately.

Task/Step	Potential Hazards	Recommended Safe Job Procedures
Interacting with Co-workers and Client Employees to Deliver Essential Services	Contracting COVID-19 virus	• Provide services remotely if possible, utilizing teleconferencing resources. • Observe social distancing by maintaining a minimum of 6 feet between all persons. • Amend work environment by providing physical barriers or maintaining social distancing. • Limit all physical contact with persons and time spent in close proximity to absolute minimum. • Conduct ongoing cleaning and disinfection of high touch surfaces (e.g., tables, hard-backed chairs, doorknobs, light switches, remotes, handles, desks, toilets, sinks, other’s computers and cell phones) following the Safety Practices for Cleaning[c] and Disinfecting[d]. • Observe proper hand hygiene ▪ Wash your hands often with soap and water for at least 20 seconds especially after you have been in a public place, or after blowing your nose, coughing, or sneezing. ▪ If soap and water are not readily available, use a hand sanitizer that contains at least 60% alcohol. Cover all surfaces of your hands and rub them together until they feel dry. • If social distancing (6 feet minimum) is not possible and employees must work in close proximity wear the following PPE. ▪ Non-sterile or nitrile exam gloves. ▪ Safety glasses. • Hand washing should be done immediately after removing PPE.

Task/Step	Potential Hazards	Recommended Safe Job Procedures

Cleaning and Disinfecting	Contracting COVID-19 virus	• Amend work environment to limit physical contact with high touch surface.
		• Provide individual equipment as possible to limit multiple persons contacting same surfaces.
		• Maintaining social distancing to limit physical contact.
		• Wear disposable gloves when cleaning and disinfecting surfaces.
		  ▪ Gloves should be discarded after each cleaning. If reusable gloves are used, those gloves should be dedicated for cleaning and disinfection of surfaces for COVID-19 and should not be used for other purposes.
		  ▪ Clean hands immediately after gloves are removed.
		• If surfaces are dirty, they should be cleaned using a detergent or soap and water prior to disinfection.
		• For disinfection, diluted household bleach solutions, alcohol solutions with at least 70% alcohol, and most common EPA-registered household disinfectants should be effective.
		• After cleaning:
		  ▪ Launder or dispose of items as appropriate in accordance with the manufacturer’s instructions. If possible, launder items using the warmest appropriate water setting for the items and dry items completely.
		• Staff should wear disposable gloves for all tasks in the cleaning process, including handling trash.
		  ▪ Gloves should be compatible with the disinfectant products being used.
		  ▪ Additional PPE might be required based on the cleaning/disinfectant products being used and whether there is a risk of splash.
		  ▪ Gloves should be removed carefully to avoid contamination of the wearer and the surrounding area. Be sure to clean hands after removing gloves.
		• Gloves should be removed after cleaning. Clean hands immediately after gloves are removed.
		• Staff and others should clean hands often, including immediately after removing gloves, by washing hands with soap and water for 20 seconds. If soap and water are not available and hands are not visibly dirty, an alcohol-based hand sanitizer that contains 60% to 95% alcohol may be used. However, if hands are visibly dirty, always wash hands with soap and water.

Task/Step	Potential Hazards	Recommended Safe Job Procedures
Essential Staff Reporting to Work Location	Contracting COVID-19 virus	• Reduce contact with high touch surfaces. ▪ Disinfect personal spaces with available cleaning solutions. • Amend physical work environment to maximize physical distance between employees. • Provide individual equipment and position workstations to prevent employees from being closer than 6 feet to each other while working. • Limit the number of persons working in the same location contacting same surfaces. • Stay home if you have a fever, cough, or are experiencing shortness of breath. • Follow guidelines for workplace cleaning and disinfection.

Notes:

(a) Hand Sanitizer - Use hand sanitizer as needed and if available. If hand sanitizer is not available, use a combination of nitrile gloves and wash hands with soap and water to prevent the spread of the virus.

(b) Disinfectant Wipes - If disinfecting wipes are not available, mix 1/3 cup of bleach with 1 gallon of water, spray into clean towel or rag and wipe surfaces down.

(c) Cleaning refers to the removal of germs, dirt, and impurities from surfaces. Cleaning does not kill germs, but by removing them, it lowers their numbers and the risk of spreading infection.

(d) Disinfecting refers to using chemicals, found on the Environmental Protection Agency (EPA) “List Nˆ”, to kill germs on surfaces. This process does not necessarily clean dirty surfaces, but by killing germs on a surface after cleaning, it can further lower the risk of spreading infection.
“List N” includes products that meet EPA’s criteria for use against SARS-CoV-2, the novel coronavirus that causes the disease COVID-19. When purchasing a product, check if its EPA registration number is included on “List N”.

JOB HAZARD ANALYSIS
Lone Worker

Control measures to decrease expose of a lone worker to hazards may include instruction, training, supervision, protective equipment and communication devices.

Task/Step	Potential Hazards	Recommended Safe Job Procedures
Working alone	• Remote location • Unidentified hazards • Equipment and material handling • Chemical or hazardous substances exposure • Limiting medical conditions	• Identify hazards of the work and assessing the risks involved • Establish emergency procedures • Regular contact between the lone worker and supervision using cell phone or computer • Lone workers should have access to adequate first-aid facilities or should carry a first-aid kit suitable for treating minor injuries • Verify that a lone worker has returned to their base or home on completion of a task.

JOB HAZARD ANALYSIS
Vehicle Operation

Task/Step	Potential Hazards	Recommended Safe Job Procedures
Entering vehicle	Injury from door	• Be careful when opening vehicle door.
Turn on engine	None foreseen	
Driving motorized vehicle	Injury to self from accidents Injury to others	• Fasten seat belt before driving. • Use defensive driving skills. • Obey all traffic regulations. • Never leave unattended car running. • Refer to the State Department of Motor Vehicles handbook for more information. • Survey surroundings before driving. • Use defensive driving skills.
Parking	Property damage Injury to self from accidents Injury to others	• When or if available, back vehicle into position when parking to enable operator to pull forward when leaving the site.
Turn off engine	None foreseen	

JOB HAZARD ANALYSIS	**Project No.:** 1865004*21
Job/Operation Title: Groundwater Monitoing	**Date:** 11/12/2021
Business Unit: Industrial	**JHA Reviewed By:** Rachel Morgan
Project Location: 401 NE Adams St, Camas, WA 98607	**JHA Revised By:** Robert Ardissono
Person(s) Performing This Job/Task: Matthew Grzegorzewski, Robert Ardissono, Shaelyn Thomas	**Project Manager:** Rachel Morgan
Job/Task Start Date: April 2022	**Job/Task Duration:** 12 months

Task/Step	Potential Hazards	Recommended Safe Job Procedures
Mobilizing / Demobilizing Equipment / Supplies at Each Location	Traffic	• Visually inspect field vehicle before driving (tires, lights, etc.). • Adjust mirrors (views for left, right, and rear). • Fasten seatbelts before engaging vehicle. • Cellphone usage is prohibited while driving a vehicle. • Obey posted speed limits and traffic laws. • Place traffic cones behind vehicles, as needed, to alert vehicular traffic. • When possible, park field vehicle facing into traffic for protection. • Remove keys from ignition and engage parking brake when out of the vehicle.
Perform Site Safety Inspection	Unidentified Site hazards, potential near-misses	• Assess potential hazards. Analyze how to reduce risk. Act to ensure sampling is performed safely. • Site Safety Officer conducts tailgate safety meeting by reviewing Health and Safety Plan (HASP), Vehicle Safety, Job Hazard Analysis (JHA), Evacuation Plan. • Make site-specific changes to JHA, as necessary. • Sign compliance agreement to comply with HASP/JHA. • Identify nearest hospital, location of health and safety equipment (first aid kit/eye/fire extinguisher).

Task/Step	Potential Hazards	Recommended Safe Job Procedures
Personal Health & Safety	Heat stress and heat stroke	• Drink plenty of fluids and have plenty of fluids available (water and sports drinks are recommended; coffee and soda may actually cause further dehydration). • Wear loose, non-restrictive clothing and hat/cap. • Stay in shade as much as possible to keep cool (use vehicle and air-conditioning if necessary). • Use sunscreen to prevent sunburn and lip balm to prevent chapped lips. • Be aware of faintness, dizziness, unconsciousness, paleness, and profuse sweating in Site personnel (contact PM or, if severe, contact emergency personnel). • Redness to the face, high body temperature, and lack of sweating may indicate heat stroke (contact emergency personnel immediately).
Access Monitoring Wells / Well Covers	Strain / sprains from opening well covers / heavy lifting / hand tools / puncture hazards from hidden boards with nails or hidden hails on the ground / biological	• Use proper lifting posture when opening/closing all well or vault covers. • Wear leather gloves and safety glasses when opening and closing well or vault covers and caps, tapping bolts. • Check for poisonous spiders, insects, etc. • Stand upwind of well when removing cover. • Ensure well is securely closed after sampling.
Calibrate and Check Over All Equipment	Equipment malfunction, inaccurate data recovery	• Calibrate water level/water quality meter(s) and check to ensure they are working properly.
Measuring Water Levels	Dermal contact and inhalation of potential constituents	• Perform careful triple-rinse decontamination of sounder or interface meter. • Wear nitrile gloves when handling water. Be careful not to splash or spill large amounts of water on clothing or on the Site.
Well Purge & Sample	Pinch points / cross-contamination of wells / spills, leaks, slips, trips / Chemical exposure	• Keep hands clear of well opening when inserting bailer or pump tubing. • Replace peristaltic pump silicon and polyethylene tubing with new at each well location. • Inspect the integrity of liquid containers prior

Task/Step	Potential Hazards	Recommended Safe Job Procedures
		to and during use. • Carefully pour liquids when transferring between containers. • Avoid spills when filling sample bottles, and handle with care to avoid breakage. • Ensure bottles are labeled accurately. • Maintain good housekeeping. Have trash bag at Site and clean as work is conducted. • Sample preservative may consist of injurious chemicals, such as acids. Maintain adequate rinsing/flushing capabilities and baking soda to neutralize spills.
Place Samples in Cooler with Ice and Padding Materials	Bottle breakage, back strain	• Wear proper PPE and pack bottles carefully (bubble wrap bags are helpful). • Ensure cooler is thoroughly iced to maintain samples at proper temperature (4 degrees Celsius).
Load Equipment and Supplies into Vehicle	Back injury, equipment damage	• Use proper lifting techniques when loading/lifting coolers and equipment into vehicle. • Ensure equipment and supplies are loaded correctly and do not shift during driving.
Site Cleanup	Debris or equipment left onsite or unsecure can cause tripping hazard	• Make careful visual sweep of Site. • Check for tools, debris, or dirt left onsite. • Remove freestanding water by sweeping or with absorbent material.

JOB HAZARD ANALYSIS	**Project No.:** 1865004*21
Job/Operation Title: Hand Auger	**Date:** 11/12/2021
Business Unit: Industrial	**JHA Reviewed By:** Rachel Morgan
Project Location: 401 NE Adams St, Camas, WA 98607	**JHA Revised By:** Robert Ardissono
Person(s) Performing This Job/Task: Matthew Grzegorzewski, Robert Ardissono, Shaelyn Thomas	**Project Manager:** Rachel Morgan
Job/Task Start Date: April 2022	**Job/Task Duration:** 12 months

Task/Step	Potential Hazards	Recommended Safe Job Procedures
Digging Using a Hand Auger	• Striking Underground Utilities • Struck By • Cuts / Laceration • Flying Debris • Strains / Sprains • Blistering	• Hand augering can only occur after a public and private utility locate has cleared the boring location. • Hand augering is not considered a soft digging technique. • Never use a hand auger to locate a utility. • Wear safety-toe boots and safety glasses. • Do not thrust the auger into the ground; the auger is intended to cut through the soil by twisting the handle. • Wear cut resistant gloves when handling the working end of the auger. • Adjust auger so handle is capable of being reached easily. • Wear gloves while auguring.

JOB HAZARD ANALYSIS	**Project No.:** 1865004*21
Job/Operation Title: Hand Tool Use	**Date:** 11/12/2021
Business Unit: Industrial	**JHA Reviewed By:** Rachel Morgan
Project Location: 401 NE Adams St, Camas, WA 98607	**JHA Revised By:** Robert Ardissono
Person(s) Performing This Job/Task: Matthew Grzegorzewski, Robert Ardissono, Shaelyn Thomas	**Project Manager:** Rachel Morgan
Job/Task Start Date: April 2022	**Job/Task Duration:** 12 Months

Task/Step	Potential Hazards	Recommended Safe Job Procedures
Check condition of tool.	Lacerations	Avoid contact with blade or teeth of a tool.
Using hand tool.	Lacerations, pinching or impact and other injuries	Assess surrounding environment and be aware of others. Check to see that replaceable parts such as blades are secured. Be aware of what may happen if the tool slips or is misdirected. Use caution when using a hand tool. When possible, wear gloves.
Transporting hand tool.	Injuries to self and others	Ensure that the blade is not exposed when transporting. Do not throw the tool. Assess surrounding environment and be aware of others.

JOB HAZARD ANALYSIS	**Project No.:** 1865004*21
Job/Operation Title: Hazardous Waste Drum Handling	**Date:** 11/12/2021
Business Unit: Industrial	**JHA Reviewed By:** Rachel Morgan
Project Location: 401 NE Adams St, Camas, WA 98607	**JHA Revised By:** Robert Ardissono
Person(s) Performing This Job/Task: Matthew Grzegorzewski, Robert Ardissono, Shaelyn Thomas	**Project Manager:** Rachel Morgan
Job/Task Start Date: April 2022	**Job/Task Duration:** 12 months

Task/Step	Potential Hazards	Recommended Safe Job Procedures
Examine the drum, for contents (labeling) and structural integrity.	Exposure to unknown substance.	• NEVER open a drum when the contents are unknown. • NEVER open a drum that shows signs of excessive stresses (bulging, damage, rust, etc.).
Examine the rim of the drum, lid, and sealing ring to be sure they will sit properly.	Pinch hand while handling parts. Cuts or abrasions from burrs on metal part.	• Wear leather or similar gloves. • Use care (do not grab) while examining. • Keep your hands open (do not grab) while examining parts.
Place the lid on the drum, sit the ring, and tighten the bold using a wrench.	Pinch hand while handling parts. Cut abrasions from burrs on metal parts. Abrasion or impact from tightening bolt.	• Use care and wear leather or similar gloves. • Position your body so the wrench can be easily turned.
Attach the ring clamp for hard to sit rings, and torque into place by turning the handle.	Impact and pinch while positioning the ring clamp. Muscle strain from tightening clamp.	• Hold clamp so the components do not slip over threaded shaft. • Position your body so the clamp-tightening handle can be easily turned.
Secure and tighten the nut on the ring bold using the pneumatic hammer drill.	Muscle strain from tightening ring bolt	• Seat pneumatic hammer drill properly on nut. Position your body to stabilize position of hammer drill prior to pulling trigger.

JOB HAZARD ANALYSIS	**Project No.:** 1865004*21
Job/Operation Title: Soil Sampling Logging and Screening	**Date:** 11/12/2021
Business Unit: Industrial	**JHA Reviewed By:** Rachel Morgan
Project Location: 401 NE Adams St, Camas, WA 98607	**JHA Revised By:** Robert Ardissono
Person(s) Performing This Job/Task: Matthew Grzegorzewski, Robert Ardissono, Shaelyn Thomas	**Project Manager:** Rachel Morgan
Job/Task Start Date: April 2022	**Job/Task Duration:** 12 months

Task/Step	Potential Hazards	Recommended Safe Job Procedures
Prepare Work Area	Slips Trips and Falls Cuts / Abrasions Struck By Strains / Sprains	• Maintain good housekeeping practices. • Setup work area away from active operations and high traffic areas. • Remove trip hazards in workspace. • Setup work area on a level surface. • Use caution when climbing in and out of truck bed, avoid jumping out of truck bed. • Wear cut resistant gloves while using cutting devices. • Wear cut resistant gloves while unloading work supplies that may have pinch point or sharp edges, such as a sample table or work canopy. • Inspect work area for sharp edges prior to setup. • Wear safety toe boots. • Wear a hardhat. • Use proper lifting techniques. • Use two people to lift objects greater than 50 pounds.
Obtain Sample (Either from loose soil or sample tube)	Contamination with Hazardous Substances Cuts / Abrasions	• Conduct breathing space monitoring with a photoionization detector (PID) and follow site-specific Health and Safety Plan (HASP) requirements. • Wear chemical resistant gloves as defined in the site-specific HASP. • Use caution when collecting sample from sample tube, as there may be rough or

Task/Step	Potential Hazards	Recommended Safe Job Procedures
		sharp edges
Clean work area in preparation for the next sample	Contamination w/ hazardous substances Cuts/abrasions	• Conduct breathing space monitoring with a PID and follow site-specific HASP requirements. • Wear chemical resistant gloves as defined in the site-specific HASP. • Pick up samples and place in appropriate disposal container. • Avoid brushing off work area with your hand, use a brush or broom.
Changing out PPE (Gloves)	Contamination w/ hazardous substances	• Remove gloves by removing one glove and turning the glove inside out as it is being removed. Use the inside out glove to remove the second glove also turning the second glove inside out as it is being removed. • Place the contaminated gloves in appropriate waste container.
Log sample description	Contamination w/ hazardous substances	• Remove contaminated PPE prior to handling the logbook. • Locate logbook away from contaminated areas.
Collect headspace analysis from soil sample	Contamination w/ hazardous substances	• Wear chemical resistant gloves as defined in the site-specific HASP. • Wear safety glasses. • Hold sample bag away from your body when puncturing bag.
Place soil sample in sample jar	Contamination w/ hazardous substances (including sample jar preservative)	• Wear chemical resistant gloves as defined in the site-specific HASP.
Cleanup/Decontaminate work area	Contamination w/ hazardous substances	• Wear chemical resistant gloves as defined in the site-specific HASP. • Wear safety glasses. • Place all waste in appropriate waste containers. • Decontaminate all surfaces and equipment that has contacted the contaminated soil according to the site-specific HASP.
Demobilize work area	Slips, trips, and falls Cuts/abrasions	• Maintain good housekeeping. • Use caution when climbing in and out of

Task/Step	Potential Hazards	Recommended Safe Job Procedures
	Struck by Strains/sprains	truck bed, avoid jumping out of truck bed. • Wear cut resistant gloves while loading work supplies that may have pinch point or sharp edges, such as a sample table or work canopy. • Wear steel toe boots. • Wear a hardhat. • Use proper lifting techniques. • Use two people to lift objects greater than 50 pounds.

JOB HAZARD ANALYSIS	**Project No.:** 1865004*21
Job/Operation Title: Utility Locating	**Date:** 11/12/2021
Business Unit: Industrial	**JHA Reviewed By:** Rachel Morgan
Project Location: 401 NE Adams St, Camas, WA 98607	**JHA Revised By:** Robert Ardissono
Person(s) Performing This Job/Task: Matthew Grzegorzewski, Robert Ardissono, Shaelyn Thomas	**Project Manager:** Rachel Morgan
Job/Task Start Date: April 2022	**Job/Task Duration:** 12 months

Task/Step	Potential Hazards	Recommended Safe Job Procedures
Inspect site for evidence of utilities	Slips, Trips, and Falls	• Inspect walking surfaces for terrain hazards or potholes that could cause a slip, trip, or fall. • Identify and/or communicate fall hazards to project team. • Do not walk through tall grass or vegetation where the walking surface cannot be viewed. The area should be cut down prior to walking through it. • Wear appropriate work shoes or boots. • Avoid working at times when it is dark, or you should use additional lighting when necessary.
	Biological Hazards Animals Insects Poisonous Plants	• Avoid all animals, including domestic animals. • Be aware of insect nests and wear long pants, long sleeve shirts. • Apply insect repellant. • Use insect pesticide to eradicate insects that interfere with work activities. • Review site HASP for understanding of biological hazards, including poisonous plants. • If contacted by a poisonous plant, immediately decontaminate skin with soap and water. • If contact with poisonous plants is necessary, you must don chemical resistant suits and gloves. • Report all incidents involving biological hazards to the site safety officer.

Task/Step	Potential Hazards	Recommended Safe Job Procedures
	Heat/Cold Stress	• Monitor for heat/cold stress. • Dress appropriate for the weather. • Provide fluids to prevent worker dehydration. • Establish work/rest.
	Traffic	• Don a hi-visibility vest. • Do not enter the right-of-way or roads unless free of traffic or a traffic control plan has been developed and implemented.
Perform utility locating using GPR and/or Electromagnetic Induction	Slips, Trips, and Falls	• Inspect walking surfaces for terrain hazards or potholes that could cause a slip, trip, or fall. • Identify and/or communicate fall hazards to project team. • Do not walk through tall grass or vegetation where the walking surface cannot be viewed. The area should be cut down prior to walking through it. • Wear appropriate work shoes or boots. • Avoid working at times when it is dark, or you should use additional lighting when necessary.
	Biological Hazards	• Avoid all animals, including domestic animals. • Be aware of insect nests and wear long pants, long sleeve shirts. • Apply insect repellant. • Use insect pesticide to eradicate insects that interfere with work activities. • Review site HASP for understanding of biological hazards, including poisonous plants. • If contacted by a poisonous plant, immediately decontaminate skin with soap and water. • If contact with poisonous plants is necessary, you must don chemical resistant suits and gloves. • Report all incidents involving biological hazards to the site safety officer.

Task/Step	Potential Hazards	Recommended Safe Job Procedures
	Heat/Cold Stress	• Monitor for heat/cold stress. • Dress appropriate for the weather. • Provide fluids to prevent worker dehydration. • Establish work/rest.
	Traffic	• Don a hi-visibility vest. • Do not enter the right-of-way or roads unless free of traffic.
	Lifting – Strains/Sprains	• Utilize proper lifting techniques when loading and unloading equipment. • Use a team lift if the weight of object is greater than 40 pounds or if the object is an awkward size or shape.
	Electrical	• Avoid opening electrical panels or outlets. • Don insulated gloves and tools if required to be exposed to live electrical wires. • Do not attempt to repair damaged electrical lines. • Maintain a minimum of 10 feet from unprotected electrical lines.
	Gas leaks	• If leaks in gas or fuel lines are identified, immediately contact the public utility company responsible for the utility. • Evacuate area and do not let anyone into area until the leak is resolved. • Remove all sources of ignition from the area if it is safe to do so.
	Hazardous Chemicals	• All chemicals, including spray paints, must have an MSDS onsite. • Portions of the site may be contaminated with hazardous substances. Don nitrile gloves (or similar type of glove if handling soils). • Decontaminate shoes/boots, if necessary.
Soft digging to clear/daylight utilities (air knife, hand dig w/shovel, hydro excavation)	Slips, Trips, and Falls	• Inspect walking surfaces for terrain hazards or potholes that could cause a slip, trip, or fall. • Identify and/or communicate fall hazards to project team. • Do not walk through tall grass or vegetation where the walking surface cannot be

Task/Step	Potential Hazards	Recommended Safe Job Procedures
		viewed. The area should be cut down prior to walking through it. • Wear appropriate work shoes or boots. • Avoid working at times when it is dark, or you should use additional lighting when necessary.
	Biological Hazards	• Avoid all animals, including domestic animals. • Be aware of insect nests and wear long pants, long sleeve shirts. • Apply insect repellant. • Use insect pesticide to eradicate insects that interfere with work activities. • Review site HASP for understanding of biological hazards, including poisonous plants. • If contacted by a poisonous plant, immediately decontaminate skin with soap and water. • If contact with poisonous plants is necessary, you must don chemical resistant suits and gloves. • Report all incidents involving biological hazards to the site safety officer.
	Heat/Cold Stress	• Monitor for heat/cold stress. • Dress appropriate for the weather. • Provide fluids to prevent worker dehydration. • Establish work/rest.
	Traffic	• Don a hi-visibility vest. • Do not enter the right-of-way or roads unless free of traffic.
	Lifting – Strains/Sprains	• Utilize proper lifting techniques when loading and unloading equipment. • Use a team lift if the weight of object is greater than 40 pounds or if the object is an awkward size or shape.
	Noise	• Utilize hearing protection during air knife and hydro excavation.
	Flying Debris	• Wear safety glasses with side shield at a minimum. Upgrade to add a face shield

Task/Step	Potential Hazards	Recommended Safe Job Procedures
		during air knife or at any time debris is flying up towards the operators face.
	Abrasions/Cuts/Contusions	• Wear work gloves to prevent blisters or scratches • Wear steal toe boots or shoes. • Avoid contact with pressure lines/wands for air knife and hydro excavation.

JOB HAZARD ANALYSIS	**Project No.:** 1865004*21
Job/Operation Title: Vehicle Operation	**Date:** 11/12/2021
Business Unit: Industrial	**JHA Reviewed By:** Rachel Morgan
Project Location: 401 NE Adams St, Camas, WA 98607	**JHA Revised By:** Robert Ardissono
Person(s) Performing This Job/Task: Matthew Grzegorzewski, Robert Ardissono, Shaelyn Thomas	**Project Manager:** Rachel Morgan
Job/Task Start Date: April 2022	**Job/Task Duration:** 12 months

Before and after every use, ensure that all items listed in the Vehicle Disinfection Checklist are disinfected and sanitized with an approved cleaner such as disinfectant wipes, 70% isopropyl alcohol (IPA) and disposable paper towels, or similar.

Hard copies of the Vehicle Disinfection Checklist are located within the KJ owned vehicle mileage log. Leave a copy of the completed checklist with the mileage log.

Task/Step	Potential Hazards	Recommended Safe Job Procedures
Entering vehicle	Injury from door	• Be careful when opening vehicle door.
Turn on engine	None foreseen	
Driving motorized vehicle	Injury to self from accidents Injury to others	• Fasten seat belt before driving. • Use defensive driving skills. • Obey all traffic regulations. • Never leave unattended car running. • Refer to the State Department of Motor Vehicles handbook for more information. • Survey surroundings before driving. • Use defensive driving skills.
Parking	Property damage Injury to self from accidents Injury to others	• When or if available, back vehicle into position when parking to enable operator to pull forward when leaving the site.
Turn off engine	None foreseen	
Cleaning and Disinfecting	Infectious disease exposure	At a minimum, vehicle parts to be cleaned Pre- and Post-Use

Task/Step	Potential Hazards	Recommended Safe Job Procedures
		• Steering Wheel • Shift Knob • Emergency Brake • Switch Levers (Windshield Wiper Lever, Signal Lever, Fuel Lever) • Dashboard • Console • Rearview Mirror • Front and Used Side Window Interiors (if sneeze or cough) • Radio and Climate Control Buttons • Cupholders • All Used Door Handles (inside and outside), including Door Locks, Window Controls and Glove Compartment • Seat Adjusters • Seat Belts • Car Keys • Arm Rests • Common Equipment Stored in Vehicle if Used • Mileage Log Binder and Pen

JOB HAZARD ANALYSIS	**Project No.:** 1865004*21
Job/Operation Title: Working in the Vicinity of Heavy Equipment	**Date:** 11/12/2021
Business Unit: Industrial	**JHA Reviewed By:** Rachel Morgan
Project Location: 401 NE Adams St, Camas, WA 98607	**JHA Revised By:** Robert Ardissono
Person(s) Performing This Job/Task: Matthew Grzegorzewski, Robert Ardissono, Shaelyn Thomas	**Project Manager:** Rachel Morgan
Job/Task Start Date: April 2022	**Job/Task Duration:** 12 months

Task/Step	Potential Hazards	Recommended Safe Job Procedures
Preparing Job Site	Trips and Falls. Bodily injury to others.	• Clear area within work zone; remove trip hazards and/or mark clearly hazards with cones, etc. • Identify work zone with cones, barricades, and other means necessary to keep pedestrian and other traffic out of work zone.
Operational Tasks	Bodily Injury to workers.	• Wear reflective safety vest, hardhat, and safety glasses. • A pre-job discussion should occur to ensure both the equipment operator and assisting workers understand the scope of the project. • Operator should keep watch for ground workers near equipment and ensure they are aware of operator's intended direction of movement. Use spotter, as needed, to warn/watch for ground workers. • Ground workers should watch operator and equipment, staying clear of equipment's path. • All workers need to be aware of changing conditions at work site.
After Operations or during periods when area is not occupied by workers	Bodily Injury to workers and others.	• Operator should always leave equipment with bucket/attachments down. • Operator should ensure equipment is secured/locked out so it cannot be used by unauthorized personnel. • Workers should secure job site with barricades, cones, and signs to warn others to keep out of work site. • Supervisor may place employee to watch job site if extreme hazards exist.

JOB HAZARD ANALYSIS	**Project No.:** 1865004*21
Job/Operation Title: Working Over or Near Water	**Date:** 11/12/2021
Business Unit: Industrial	**JHA Reviewed By:** Rachel Morgan
Project Location: 401 NE Adams St, Camas, WA 98607	**JHA Revised By:** Robert Ardissono
Person(s) Performing This Job/Task: Matthew Grzegorzewski, Robert Ardissono, Shaelyn Thomas	**Project Manager:** Rachel Morgan
Job/Task Start Date: April 2022	**Job/Task Duration:** 12 months

Task/Step	Potential Hazards	Recommended Safe Job Procedures
Employee(s) working over or near water	• Drowning • Hypothermia • Slips, trips and falls • Slippery surfaces	• Employees must evaluate water conditions such as temperature or water current to select proper PPE. Example: dry suit and/or fall protection equipment. In addition, employees working within 4 feet of the water edge must wear a certified and properly sized U.S. Coast Guard personal floatation device (PFD). • Perform visual inspections of area noting potential overhead and other hazards that are not in the normal field of vision. • For work to be performed near water and more than four feet from the water's edge, erect sufficient barricades four feet away from the water's edge using traffic cones, plastic fencing, or cation tape to serve as a warning system when a worker unintentionally approaches the water's edge. • For work to be performed above water and/or within four feet of the water's edge, another worker who can immediately summon emergency rescue must stand guard. • At least one lifesaving skiff shall be immediately available at locations where employees are working over or adjacent to water • Prior to each use, the floatation device must be inspected for defects which would alter their strength, buoyancy, or fastening capability. Defective devices must be taken out of service immediately. • Employees must know how to use rescue equipment such as "pole & life hook or ring buoy" (Ring buoys with at least 90 feet of line

Task/Step	Potential Hazards	Recommended Safe Job Procedures
		shall be provided and readily available for emergency rescue operations). • Proper footwear with adequate traction must be utilized when working or walking on wet surfaces.

Appendix B

Tailgate Safety Briefing Record

Kennedy Jenks

Kennedy Jenks
DAILY TAILGATE SAFETY BREIFING

Project Name:____ Date:__________________

Project No.:________________ Conducted By: ______________ Contractor(s):________________________

Check the Topics/Information Reviewed:

O emergency procedures & evacuation route
O site-specific safety plan, review and location
O fire prevention/safety/fire extinguishers
O training/certification
O COVID-19
O sharp objects, rebar, and scrap metals
O slips, trips, and falls
O vehicle safety and driving/road conditions
O overhead utility locations and clearances
O open pits and excavations
O drinking water and restroom locations
O smoking in designated areas only
O eye wash station locations
O Hazard Communication//SDS locations
O site control/security
O heat and cold stress
O confined spaces
O fall protection
O insects/snakes/biological hazards
O daily scope of work
O directions to hospital
O stop work authority
O pinch points
O lifting techniques
O site housekeeping
O parking and lay down areas
O backing-up hazards
O location of utilities
O noise hazards
O equipment movement
O cleaning procedures
O first aid
O no horseplay
O visitors / media / passers-by
O lockout/tagout
O ladders safety
O scaffolding
O cell phone usage / prohibitions
O personal protective equipment
O hard hats, safety vest, steel-toe boots
O strains and sprains
O buddy system
O tool safety
O public safety
O traffic safety
O hearing & eyewear protection
O flying debris hazards
O fire extinguisher locations
O heavy equipment hazards
O dust and/or vapor control
O drug and alcohol policy
O weather hazards
O electrical hazards
O other ___________________

Discussion/Comments/Questions/Near Misses/Follow-up Actions:

List Any Special Site Conditions / H&S Precautions Reviewed

By signing below, I acknowledge that I have participated in this safety briefing. I am aware that a site-specific safety plan exists for this project and that it is available to me upon request.

NAME	SIGNATURE	COMPANY

Appendix C

Heat Stress Fact Sheet

HEAT EXHAUSTION

What happens to the body:

Headaches, dizziness, or light-headedness, weakness, mood changes, irritability or confusion, feeling sick to your stomach, vomiting, fainting, decreased and dark-colored urine, and pale, clammy skin.

What should be done:

- Move the person to a cool, shaded area. Don't leave the person alone. If the person is dizzy or light-headed, lay him on his back and raise his legs about 6-8 inches. If the person is sick to his stomach, lay him on his side.
- Loosen and remove heavy clothing.
- Have the person drink some cool water (a small cup every 15 minutes) if he is not feeling sick to his stomach.
- Try to cool the person by fanning him. Cool the skin with a cool spray mist of water or wet cloth.
- If the person does not feel better in a few minutes call for emergency help (ambulance or 911.)

If heat exhaustion is not treated, the illness may advance to heat stroke.

PUBLICATION F417-218-909 [05-2008]

HEAT STROKE - A Medical Emergency

What happens to the body:

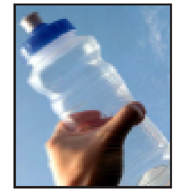
Dry, pale skin, sweating may still be present; hot, red skin (looks like a sunburn); mood changes; irritability, confusion, and not making any sense; seizures or fits, and collapse (will not respond).

What should be done:

- Call for emergency help (ambulance or 911.)
- Move the person to a cool, shaded area. Don't leave the person alone. Lay him on his back and if the person is having seizures; remove objects close to him so he won't hit them. If the person is sick to his stomach, lay him on his side.
- Remove heavy and outer clothing.
- Have the person drink small amounts of cool water if he is alert enough to drink anything and not feeling sick to his stomach.
- Try to cool the person by fanning him or her. Cool the skin with a cool spray mist of water, wet cloth, or wet sheet.
- If ice is available, place ice packs in armpits and groin area.

PREVENTING HEAT-RELATED ILLNESS

- Drink a lot of water, about 1 cup every 15 minutes.
- Know the signs/symptoms of heat-related illness; monitor yourself and co-workers.
- Block out direct sun or other heat sources.
- Use cooling fans/air-conditioning; rest regularly.
- Wear lightweight, light colored, loose-fitting clothes.
- Avoid alcohol, caffeinated drinks, or heavy meals.



Washington State Department of
Labor & Industries
Division of Occupational Safety and Health

HEAT EXHAUSTION

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Headaches, dizziness, or light-headedness, weakness, mood changes, irritability or confusion, feeling sick to your stomach, vomiting, fainting, decreased and dark-colored urine, and pale, clammy skin.

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- Loosen and remove heavy clothing.
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- Try to cool the person by fanning him. Cool the skin with a cool spray mist of water or wet cloth.
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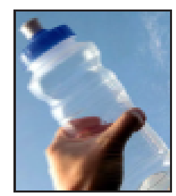
- Move the person to a cool, shaded area. Don't leave the person alone. Lay him on his back and if the person is having seizures; remove objects close to him so he won't hit them. If the person is sick to his stomach, lay him on his side.
- Remove heavy and outer clothing.
- Have the person drink small amounts of cool water if he is alert enough to drink anything and not feeling sick to his stomach.
- Try to cool the person by fanning him or her. Cool the skin with a cool spray mist of water, wet cloth, or wet sheet.
- If ice is available, place ice packs in armpits and groin area.

PREVENTING HEAT-RELATED ILLNESS

- Drink a lot of water, about 1 cup every 15 minutes.
- Know the signs/symptoms of heat-related illness; monitor yourself and co-workers.
- Block out direct sun or other heat sources.
- Use cooling fans/air-conditioning; rest regularly.
- Wear lightweight, light colored, loose-fitting clothes.
- Avoid alcohol, caffeinated drinks, or heavy meals.



Washington State Department of
Labor & Industries
Division of Occupational Safety and Health

Appendix D

Cold Stress Fact Sheet

COLD STRESS PREVENTION

OSHA® QUICK CARD™

Protecting Workers from Cold Stress

Cold temperatures and increased wind speed (wind chill) cause heat to leave the body more quickly, putting workers at risk of cold stress. Anyone working in the cold may be at risk, e.g., workers in freezers, outdoor agriculture and construction.

Common Types of Cold Stress

Hypothermia

- Normal body temperature (98.6°F) drops to 95°F or less.
- **Mild Symptoms**: alert but shivering.
- **Moderate to Severe Symptoms**: shivering stops; confusion; slurred speech; heart rate/breathing slow; loss of consciousness; death.

Frostbite

- Body tissues freeze, e.g., hands and feet. Can occur at temperatures above freezing, due to wind chill. May result in amputation.
- **Symptoms**: numbness, reddened skin develops gray/ white patches, feels firm/hard, and may blister.

Trench Foot (also known as Immersion Foot)

- Non-freezing injury to the foot, caused by lengthy exposure to wet and cold environment. Can occur at air temperature as high as 60°F, if feet are constantly wet.
- **Symptoms**: redness, swelling, numbness, and blisters.

Risk Factors

- Dressing improperly, wet clothing/skin, and exhaustion.

For Prevention, Your Employer Should:

- Train you on cold stress hazards and prevention.
- Provide engineering controls, e.g., radiant heaters.
- Gradually introduce workers to the cold; monitor workers; schedule breaks in warm areas.

How to Protect Yourself and Others

- Know the symptoms; monitor yourself and co-workers.
- Drink warm, sweetened fluids (no alcohol).
- Dress properly:
  - Layers of loose-fitting, insulating clothes
  - Insulated jacket, gloves, and a hat (waterproof, if necessary)
  - Insulated and waterproof boots

What to Do When a Worker Suffers from Cold Stress

For Hypothermia:

- Call 911 immediately in an emergency.
- To prevent further heat loss:
  - Move the worker to a warm place.
  - Change to dry clothes.
  - Cover the body (including the head and neck) with blankets, and with something to block the cold (e.g., tarp, garbage bag). Do **not** cover the face.
- If medical help is more than 30 minutes away:
  - Give warm, sweetened drinks if alert (no alcohol).
  - Apply heat packs to the armpits, sides of chest, neck, and groin. Call 911 for additional rewarming instructions.

For Frostbite:

- Follow the recommendations "**For Hypothermia**".
- Do not rub the frostbitten area.
- Avoid walking on frostbitten feet.
- Do not apply snow/water. Do not break blisters.
- Loosely cover and protect the area from contact.
- Do not try to rewarm the area unless directed by medical personnel.

For Trench (Immersion) Foot:

- Remove wet shoes/socks; air dry (in warm area); keep affected feet elevated and avoid walking. Get medical attention.

Appendix E

Utility Location Standard Operations Procedures

Utility Location and Acknowledgement Form

KENNEDY JENKS

STANDARD OPERATING PROCEDURES

INVASIVE ACTIVITIES - UTILITY LOCATION PROCEDURES

Below is a summary of the minimum requirements for location of potential underground utilities where invasive activities are planned. Invasive activities include, but are not limited to, drilling soil borings, installing wells, hand-auger borings, excavating test pits, remedial injections, and other similar activities which penetrate the ground surface.

Minimum Procedures

1. Contact the client or property owner where invasive activities will be performed to inquire about possible underground utilities and request maps or drawings documenting the location of the utilities. Document your request for information (e.g., written email request for information).

2. Contact the local/regional underground utility location center to document planned activities and request all underground utilities be located. In most (if not all) of the United States, this can be initiated by dialing “811”. Contacting the local underground utility center is also required by state law. Contacting the local utility location center is required for each episode (event) of invasive work. It is preferred to arrange a field meeting with utility representatives to confirm the absence of utilities at each drilling location. Maintain a written record for each boring/invasive location and get signatures from the locators documenting the locations are clear of utilities. This can be performed on a site map or KJ’s *Utility Locate Form & Acknowledgment Form* (provided in the KJ Safety Zone). The goal is to have written acknowledgement that all final drilling locations are free of underground utilities.

3. At all locations where drilling, probing or well installation will be performed, an air-knife or similar form of suction pot-holing will be performed to assess possible underground utilities in the upper 6 to 8 feet of soils (depending on local conditions and expected depth of utilities). Potholing is required at **all drilling locations**, except in remote areas where the likelihood of encountering underground utilities is very low and only as approved by a Risk Manager, Resource Manager or Officer of the company familiar with underground utilities. (Note: Use of an air knife will be appropriate for most invasive drilling and probing work, but may not be appropriate for certain activities like very shallow borings (less than 1 foot deep), certain hand-auger borings, remedial injections using probe equipment and test pitting.) Case by case exceptions for activities may be provided.

Optional Step – While it is recommended under most conditions, an optional additional step includes coordinating (including establishing a written contract) with a private utility locator to perform an independent utility evaluation to locate “all underground utilities” at the proposed locations of invasive work. Maintain written record for each boring/invasive location and get signatures from the locators. *[Note: This step is typically not too expensive and can save costs incurred during suction pot-holing by focusing the areas of the borings (i.e., provides prior knowledge of possible utilities).]*

KENNEDY JENKS
UTILITY LOCATION & ACKNOWLEDGEMENT FORM
Call 811 for Utility Locate at Least 48 Hours Prior to Work

Project Location: ____________________

Project Number: ____________________

Project Name: ____________________

Planned Start Date of Field Activities: ____________________

Kennedy Jenks Personnel: ____________________

Private Utility Locator Name: ____________________

811 Contact Date and Time (48 hours before work begins): ____________________

KJ One-Call Contractor ID# (varies by state) ____________________

Ticket Number: ____________________

Utility Clearance Information

How Were Boring/Excavation Locations Cleared:

Utilities Contacted by 811	Utility Contact Number	Utility Contacted by Telephone	Marked in Field	Other (Describe)

Contact information verified by (KJ Staff):____________________

Scheduled On-Site Meeting Location (if applicable):

Public Utility____________________

Private Utility Locator____________________

Use back of sheet to sketch of identified utilities and proposed boring/excavation locations **OR** attach figure. Include north arrow and structures if applicable.

Notes:

Mark all proposed borings and excavations with WHITE paint per APWA Utility Color Codes.

Request locator to mark utilities as required by their standard operating procedures or at least within 25 feet of boring/excavation, whichever is greater, with paint/flags.

Utility marks are valid for 14 calendar days and must be remarked if work continues beyond 14 days.

Appendix F

Field Chemical Use Policy and Procedures

Field Chemical Use Form

Hazard Communications Written Program

Field Chemical Use Policy & Procedures

Policy: Kennedy Jenks will follow appropriate chemical handling protocol, implement proper health and safety measures, and follow appropriate waste regulations when using chemicals in the field. Examples of field chemical use include, but are not limited to:

- Test kits with chemical reagents
- Chemical preservatives for samples
- Chemicals for field investigations, bench tests, and pilot studies
- Special chemicals for cleaning equipment.

Procedures: Business Unit Health & Safety Managers must review and approve field chemical use before chemicals can be purchased or taken into the field. A site-specific project Health and Safety Plan (HASP) that addresses field chemical use must be prepared by the Project Manager, then reviewed and approved by the Business Unit Health & Safety Manager. The portion of a project HASP that addresses field use of chemicals should include the following information:

- Chemical use justification. Include evaluation of alternatives, such as, less hazardous chemicals, alternative means of measuring (direct measurements without chemical reagents), and testing by a commercial laboratory or mobile laboratory.
- List of chemicals to be used, including quantities on hand.
- Safety Data Sheets (SDS) for the chemicals.
- Names of staff members that will be using the chemicals.
- Personal protective equipment (PPE) required.
- Description of how the materials will be transported, where the materials will be received and how the materials will be stored (note that our office leases prohibit handling or storage of hazardous materials or non-hazardous materials in quantities considered hazardous).
- Description of how the waste residuals will be disposed. Hazardous wastes generated from field testing, pilot studies, or equipment cleaning must be disposed in accordance with state and federal hazardous waste regulations. Project Managers should include provisions and budget for assisting clients with residual waste disposal. As the generator, the client should sign the hazardous waste manifest. Consider:
  - Coordinating with a local analytical laboratory to accept the waste. Some laboratories will accept small quantities of reagent waste along with samples for disposal for a small fee. This typically involves collecting the wastes in an appropriate container, placing wastes into a sealed container inside of a cooler, and including safety data sheets for the materials with the shipment.

- Using client's existing hazardous waste generator process to dispose of waste. Provide client with information on the type of waste generated to assure compatibility with existing waste streams.

- Returning excess chemicals to the vendor for recycling or reuse. Wherever possible, purchase reagents from a vendor that will accept return of unused product. Have the vendor provide appropriate packaging materials for the return shipment.

- Disposing of non-hazardous residuals as solid waste or in a sanitary sewer. Some wastes, with review and approval by the Business Unit Health & Safety Manager, can be disposed of in the local municipal solid waste or wastewater systems.

This information on the field use of chemicals can be provided by incorporating the example form provided at the end of this document into the HASP. An SDS for each chemical or product must be attached to the HASP. The Business Unit Health & Safety Manager will review the HASP and conduct appropriate Hazard Communication update training for the staff that will be using the chemicals.

Project Task: ______________________________

Name of Preparer: ______________________________

Describe Evaluation of Alternatives to Chemical Use:

Chemicals to be Used for Project:

Chemical Name	Quantity (indicate units)

Names of Staff Using Chemicals During Project:

Describe Personal Protection to be Used When Using or Handling Chemicals:

- ☐ Safety Goggles
- ☐ Nitrile Gloves
- ☐ Respirator with _____ cartridges
- ☐ Other: _____
- ☐ Portable Eye Wash
- ☐ Splash Apron/Coveralls
- ☐ Face Shield

Describe how Chemicals will be Transported and Stored at Project Site:

Describe How Used or Leftover Chemicals will be Disposed:

Health and Safety Manager Approval Signature **Date Approved**

Appendix G

Safety Data Sheets (SDSs)

Safety Data Sheet

Effective date: 11 May 2020

Revision : 11 May 2020

Trade Name: Liquinox®

1 Identification of the substance/mixture and of the supplier

1.1 GHS Product identifier

Trade Name: Liquinox®
Product number: 1201, 1201-1, 1205, 1215, 1230, 1232, 1232-1, 1255

1.2 Application of the substance / the mixture: Cleaning material/Detergent

1.2.1 Recommended dilution ratio: 1 - 2% in water

1.3 Details of the supplier of the Safety Data Sheet

Manufacturer:

Alconox Inc.
30 Glenn St
White Plains, NY 10603
(914) 948-4040

Supplier:

Emergency telephone number:
ChemTel Inc
North America: 1-888-255-3924
International: +1 813-248-0573

2 Hazards identification

2.1 Classification of the substance or mixture:

In compliance with EC regulation No. 1272, 29CFR1910/1200 and GHS requirements.

Hazard-determining components of labeling:
Alcohol ethoxylate
Sodium alkylbenzene sulfonate
Sodium xylenesulphonate
Lauramine oxide

2.2 Label elements:

Eye damage, category 1.
Skin irritation, category 2.

Product at recommended dilution:

Eye irritation, category 2B

Hazard pictograms:

Signal word: Danger

Hazard statements:
H315 Causes skin irritation.
H318 Causes serious eye damage.

Precautionary statements:
P264 Wash skin thoroughly after handling.
P280 Wear protective gloves/protective clothing/eye protection/face protection.

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P302+P352 If on skin: Wash with soap and water.
P305+P351+P338 If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.
P332+P313 If skin irritation occurs: Get medical advice/attention.
P501 Dispose of contents and container as instructed in Section 13.

Hazardous Elements at Use Dilution:

Hazard pictograms:

Signal word: Warning

Hazard statements:

H320 Causes eye irritation

Precautionary statements:

P302+P352 If on skin: Wash with soap and water.
P305+P351+P338 If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.
P501 Dispose of contents and container as instructed in Section 13

Additional information: None.

Hazard description
Hazards Not Otherwise Classified (HNOC): May cause surfaces to become slippery. Use caution in areas of foot traffic if on floors.

Information concerning particular hazards for humans and environment:

The product has to be labelled due to the calculation procedure of the "General Classification guideline for preparations of the EU" in the latest valid version.

Classification system:

The classification is according to EC regulation No. 1272, 29CFR1910/1200 and GHS, and extended by company and literature data. The classification is in accordance with the latest editions of international substances lists and is supplemented by information from technical literature and by information provided by the company.

3 Composition/information on ingredients

3.1 Chemical characterization: None

3.2 Description: None

3.3 Hazardous components (percentages by weight)

Identification	Chemical Name	Classification	Wt. %
CAS number: 68081-81-2 or 68411-30-3	Sodium Alkylbenzene Sulfonate	Acute Tox. 4; H303 Skin Irrit. 2 ; H315 Eye Dam. 1; H318	10-25
CAS number: 1300-72-7	Sodium Xylenesulphonate	Eye Irrit. 2; H319	2.5-10
CAS number: 84133-50-6	Alcohol Ethoxylate	Skin Irrit. 2 ; H315 Eye Dam. 1; H318	2.5-10
CAS number: 1643-20-5	Lauramine oxide	Skin Irrit. 2 ; H315 Eye Dam. 1; H318	1-2

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At use dilution:				
	CAS number: 68081-81-2 or 68411-30-3	Sodium Alkylbenzene Sulfonate	Eye Irr. 2B; H319	0.1-0.25

3.4 Additional Information: None.

4 First aid measures

4.1 Description of first aid measures

General information: None.

After inhalation:
Maintain an unobstructed airway.
Loosen clothing as necessary and position individual in a comfortable position.

After skin contact:
Wash affected area with soap and water.
Seek medical attention if symptoms develop or persist.

After eye contact:
Rinse/flush exposed eye(s) gently using water for 15-20 minutes.
Remove contact lens(es) if able to do so during rinsing.
Seek medical attention if irritation persists or if concerned.

After swallowing:
Rinse mouth thoroughly.
Seek medical attention if irritation, discomfort, or vomiting persists.

4.2 Most important symptoms and effects, both acute and delayed

None

4.3 Indication of any immediate medical attention and special treatment needed:

No additional information.

First aid measure at recommended dilution:

General information: None.

After inhalation:
Maintain an unobstructed airway.
Loosen clothing as necessary and position individual in a comfortable position.

After skin contact:
Wash affected area with soap and water.

After eye contact:
Rinse/flush exposed eye(s) gently using water for 15-20 minutes.
Remove contact lens(es) if able to do so during rinsing.

After swallowing:
Rinse mouth thoroughly. Seek medical attention if irritation, discomfort, or vomiting develops.

Safety Data Sheet

Effective date: 11 May 2020 **Revision** : 11 May 2020

Trade Name: Liquinox®

5 Firefighting measures

5.1 Extinguishing media

Suitable extinguishing agents:
Use appropriate fire suppression agents for adjacent combustible materials or sources of ignition.

For safety reasons unsuitable extinguishing agents: None

5.2 Special hazards arising from the substance or mixture:
Thermal decomposition can lead to release of irritating gases and vapors.

5.3 Advice for firefighters

Protective equipment:
Wear protective eye wear, gloves and clothing.
Refer to Section 8.

5.4 Additional information:
Avoid inhaling gases, fumes, dust, mist, vapor and aerosols.
Avoid contact with skin, eyes and clothing.

6 Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures
Ensure adequate ventilation.
Ensure air handling systems are operational.

6.2 Environmental precautions:
Should not be released into the environment.
Prevent from reaching drains, sewer or waterway.

6.3 Methods and material for containment and cleaning up:
Wear protective eye wear, gloves and clothing.

6.4 Reference to other sections: None

7 Handling and storage

7.1 Precautions for safe handling:
Avoid breathing mist or vapor.
Do not eat, drink, smoke or use personal products when handling chemical substances.

7.2 Conditions for safe storage, including any incompatibilities
Store in a cool, well-ventilated area.

7.3 Specific end use(s):

No additional information.

8 Exposure controls/personal protection

8.1 Control parameters :
25322-68-3, Poly(ethylene oxide), AIHA TWA 10 mg/m3 (<0.15% present in concentrate)

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Trade Name: Liquinox®

8.2 Exposure controls

Appropriate engineering controls:
Emergency eye wash fountains and safety showers should be available in the immediate vicinity of use or handling.

Respiratory protection:
Not needed under normal conditions.

Protection of skin:
Select glove material impermeable and resistant to the substance.

Eye protection:
Safety goggles or glasses, or appropriate eye protection.

General hygienic measures:
Wash hands before breaks and at the end of work.
Avoid contact with skin, eyes and clothing.

Exposure Control and Personal Protective Equipment at recommended dilution:

Under normal use and operational conditions, no special personal protective equipment or engineering controls will be necessary. Handle with care.

9 Physical and chemical properties

Appearance (physical state, color):	Pale yellow liquid	**Explosion limit lower**: **Explosion limit upper**:	Not determined or not available. Not determined or not available.
Odor:	Not determined or not available.	**Vapor pressure at 20°C**:	Not determined or not available.
Odor threshold:	Not determined or not available.	**Vapor density**:	Not determined or not available.
pH-value:	8.5 (as is)	**Relative density**:	Not determined or not available.
Melting/Freezing point:	Not determined or not available.	**Solubilities**:	Not determined or not available.
Boiling point/Boiling range:	Not determined or not available.	**Partition coefficient (n-octanol/water)**:	Not determined or not available.
Flash point (closed cup):	Not determined or not available.	**Auto/Self-ignition temperature**:	Not determined or not available.
Evaporation rate:	Not determined or not available.	**Decomposition temperature**:	Not determined or not available.
Flammability (solid, gaseous):	Not flammable	**Viscosity**:	a. Kinematic: Not determined or not available. b. Dynamic: Not determined or not available.
Density at 20°C:	1.08 g/mL		

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Trade Name: Liquinox®

10 Stability and reactivity

10.1 Reactivity: Not determined or not available.
10.2 Chemical stability: Not determined or not available.
10.3 Possibility hazardous reactions: Not determined or not available.
10.4 Conditions to avoid: Not determined or not available.
10.5 Incompatible materials: Not determined or not available.
10.6 Hazardous decomposition products: Not determined or not available.

11 Toxicological information

11.1 Information on toxicological effects:

Acute Toxicity:

Oral:

: LD50 >5000 mg per kg (Rat, Oral) - product.

Chronic Toxicity: No additional information.

Skin corrosion/irritation (raw materials):

Alcohol Ethoxylate: May cause mild to moderate skin irritation.

Sodium Alkylbenzene Sulfonate: Causes skin irritation.

Lauramine oxide: Causes skin irritation.

Serious eye damage/irritation (raw materials):

Sodium Alkylbenzene Sulfonate: Causes serious eye damage.

Alcohol Ethoxylate: Causes moderate to severe eye irritation and conjunctivitis.

Sodium xylenesulphonate: irritating to eyes.

Lauramine oxide: Causes serious eye damage.

Product information at recommended dilution:

Eye irritation may occur upon direct contact with eyes. No specific hazards for skin contact, inhalation, or chronic exposure are expected within normal use parameters.

Respiratory or skin sensitization: No additional information.

Carcinogenicity: No additional information.

IARC (International Agency for Research on Cancer): None of the ingredients are listed.

NTP (National Toxicology Program): None of the ingredients are listed.

Germ cell mutagenicity: No additional information.

Reproductive toxicity: No additional information.

STOT-single and repeated exposure: No additional information.

Additional toxicological information: No additional information.

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12 Ecological information

12.1 Toxicity:

Sodium Alkylbenzene Sulfonate: Fish, LC50 1.67 mg/l, 96 hours.
Sodium Alkylbenzene Sulfonate: Aquatic invertebrates, EC50 Daphnia 2.9 mg/l, 48 hours. Sodium Alkylbenzene Sulfonate: Aquatic Plants, EC50 Algae 29 mg/l, 96 hours.
Lauramine oxide: Fish, LC50 24.3 mg/l, 96h [Killifish (Cyprinodontidae)]
Lauramine oxide: Aquatic invertebrates, (LC50): 3.6 mg/l 96 hours [Daphnia (Daphnia)].
Lauramine oxide: Aquatic plants, EC50 Algae 0.31 mg/l 72 hours [Algae]
Alcohol Ethoxylate: Aquatic invertebrates, (LC50): 4.01 mg/l 48 hours [Daphnia (daphnia)].

12.2 Persistence and degradability: No additional information.

12.3 Bioaccumulative potential: No additional information.

12.4 Mobility in soil: No additional information.

General notes: No additional information.

12.5 Results of PBT and vPvB assessment:

PBT: No additional information.

vPvB: No additional information.

12.6 Other adverse effects: No additional information.

13 Disposal considerations

13.1 Waste treatment methods (consult local, regional and national authorities for proper disposal)

Relevant Information:

It is the responsibility of the waste generator to properly characterize all waste materials according to applicable regulatory entities. (US 40CFR262.11).

14 Transport information

14.1 UN Number: ADR, ADN, DOT, IMDG, IATA	None
14.2 UN Proper shipping name: ADR, ADN, DOT, IMDG, IATA	None
14.3 Transport hazard classes: ADR, ADN, DOT, IMDG, IATA	**Class:** None **Label:** None **LTD. QTY:** None
US DOT **Limited Quantity Exception:**	None

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Trade Name: Liquinox®

Bulk: **RQ (if applicable):** None **Proper shipping Name:** None **Hazard Class:** None **Packing Group:** None **Marine Pollutant (if applicable):** No additional information. **Comments:** None	**Non Bulk:** **RQ (if applicable):** None **Proper shipping Name:** None **Hazard Class:** None **Packing Group:** None **Marine Pollutant (if applicable):** No additional information. **Comments:** None
14.4 Packing group: ADR, ADN, DOT, IMDG, IATA	None
14.5 Environmental hazards:	None
14.6 Special precautions for user: **Danger code (Kemler):** **EMS number:** **Segregation groups:**	None None None None
14.7 Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code: Not applicable.	
14.8 Transport/Additional information: **Transport category:** **Tunnel restriction code:** **UN "Model Regulation":**	 None None None

15 Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture.

North American

SARA

Section 313 (specific toxic chemical listings): None of the ingredients are listed.
Section 302 (extremely hazardous substances): None of the ingredients are listed.

CERCLA (Comprehensive Environmental Response, Clean up and Liability Act)

Reportable Spill Quantity: None of the ingredients are listed.

TSCA (Toxic Substances Control Act):

Inventory: All ingredients are listed as active.
Rules and Orders: Not applicable.

Proposition 65 (California):

Chemicals known to cause cancer: None of the ingredients are listed.

Chemicals known to cause reproductive toxicity for females: None of the ingredients are listed.

Chemicals known to cause reproductive toxicity for males: None of the ingredients are listed.

Chemicals known to cause developmental toxicity: None of the ingredients are listed.

Canadian

Canadian Domestic Substances List (DSL):
All ingredients are listed.

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Asia Pacific

Australia

Australian Inventory of Chemical Substances (AICS): All ingredients are listed.

China

Inventory of Existing Chemical Substances in China (IECSC): All ingredients are listed.

Japan

Inventory of Existing and New Chemical Substances (ENCS): All ingredients are listed.

Korea

Existing Chemicals List (ECL): All ingredients are listed.

New Zealand

New Zealand Inventory of Chemicals (NZOIC): All ingredients are listed.

Philippines

Philippine Inventory of Chemicals and Chemical Substances (PICCS): All ingredients are listed.

Taiwan

Taiwan Chemical Substance Inventory (TSCI): All ingredients are listed.

EU

REACH Article 57 (SVHC): None of the ingredients are listed.
Germany MAK: Not classified.

16 Other information

Abbreviations and Acronyms: None

Summary of Phrases

Hazard statements:

H315 Causes skin irritation.
H318 Causes serious eye damage.

Precautionary statements:

P264 Wash skin thoroughly after handling.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P302+P352 If on skin: Wash with soap and water.
P305+P351+P338 If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.
P332+P313 If skin irritation occurs: Get medical advice/attention.
P501 Dispose of contents and container as instructed in Section 13.

Manufacturer Statement:

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

NFPA: 1-0-0
HMIS: 1-0-0

At recommended dilution:

NFPA: 1-0-0
HMIS: 1-0-0

Safety Data Sheet: **Simple Green® All-Purpose Cleaner** ★

Version No. 13000-21A Issue Date: February 1, 2021 Supersedes Date: August 8, 2018 *OSHA HCS-2012 / GHS*

Section 1: IDENTIFICATION

Product Name: Simple Green® All-Purpose Cleaner
Additional Names:

Manufacturer's Part Number: **Please refer to Section 16*

Recommended Use: Cleaner & Degreaser for water tolerant surfaces.
Restrictions on Use: Do not use on non-rinseable surfaces.

Company: Sunshine Makers, Inc.
15922 Pacific Coast Highway
Huntington Beach, CA 92649 USA

Telephone: 800-228-0709 ● 562-795-6000 *Mon – Fri, 8am – 5pm PST*
Fax: 562-592-3830
Email: info@simplegreen.com

Emergency Phone: Chem-Tel 24-Hour Emergency Service: 800-255-3924

Section 2: HAZARDS IDENTIFICATION

This product is not considered hazardous under 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA HCS 2012
Label Elements
Signal Word: None
Hazard Symbol(s)/Pictogram(s): None required
Hazard Statements: None
Precautionary Statements: None
Hazards Not Otherwise Classified (HNOC): None
Other Information: None Known

Section 3: COMPOSITION/INFORMATION ON INGREDIENTS

Ingredient	CAS Number	Percent Range
Water	7732-18-5	> 80.698%*
C9-11 Alcohols Ethoxylated	68439-46-3	< 5.000%*
Surfactant	Proprietary	< 5.000%*
Sodium Citrate	68-04-2	< 5.000%*
Sodium Carbonate	497-19-8	< 1.000%*
Tetrasodium Glutamate Diacetate	51981-21-6	< 1.000%*
Citric Acid	77-92-9	< 1.000%*
Blend of Polyoxyalkylene Substituted Chromophores (Cyan and Yellow)	Proprietary Mixture	< 0.100%*
Fragrances	Proprietary Mixture	< 1.000%*
Anethole	104-46-1	< 0.100%*
Eucalyptol	470-82-6	< 0.100%*
Methylchloroisothiazolinone	26172-55-4	< 0.001%*
Methylisothiazolinone	2682-20-4	< 0.0001%*

**specific percentages of composition are being withheld as a trade secret*

Section 4: FIRST-AID MEASURES

Inhalation: Not expected to cause respiratory irritation. If adverse effect occurs, move to fresh air.
Skin Contact: Not expected to cause skin irritation. If adverse effect occurs, rinse skin with water.
Eye Contact: Not expected to cause eye irritation. If adverse effect occurs, flush eyes with water.
Ingestion: May cause upset stomach. Drink plenty of water to dilute. See section 11.
Most Important Symptoms/Effects, Acute and Delayed: None known.

Section 4: FIRST-AID MEASURES - continued

Indication of Immediate Medical Attention and Special Treatment Needed, if necessary: Treat symptomatically

Section 5: FIRE-FIGHTING MEASURES

Suitable & Unsuitable Extinguishing Media: Use Dry chemical, CO_2, water spray or "alcohol" foam. Avoid high volume jet water.
Specific Hazards Arising from Chemical: In event of fire, fire created carbon oxides may be formed.
Special Protective Actions for Fire-Fighters: Wear positive pressure self-contained breathing apparatus; Wear full protective clothing.

This product is non-flammable. See Section 9 for Physical Properties.

Section 6: ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures: *For non-emergency and emergency personnel:* See section 8 – personal protection. Avoid eye contact. Safety goggles suggested.

Environmental Precautions: Do not allow into open waterways and ground water systems.

Methods and Materials for Containment and Clean Up: Dike or soak up with inert absorbent material. See section 13 for disposal considerations.

Section 7: HANDLING AND STORAGE

Precautions for Safe Handling: Ensure adequate ventilation. Keep out of reach of children. Keep away from heat, sparks, open flame and direct sunlight. Do not pierce any part of the container. Do not mix or contaminate with any other chemical. Do not eat, drink or smoke while using this product.

Conditions for Safe Storage including Incompatibilities: Keep container tightly closed. Keep in cool dry area. Avoid prolonged exposure to sunlight. Do not store at temperatures above 109°F (42.7°C). If separation occurs, mix the product for reconstitution.

Section 8: EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Limit Values: No components listed with TWA or STEL values under OSHA or ACGIH.

Appropriate Engineering Controls: Showers, eyewash stations, ventilation systems

Individual Protection Measures / Personal Protective Equipment (PPE)
Eye Contact: Use protective glasses or safety goggles if splashing or spray-back is likely.
Respiratory: Use in well ventilated areas or local exhaust ventilations when cleaning small spaces.
Skin Contact: Use protective gloves (any material) when used for prolonged periods or dermally sensitive.
General Hygiene Considerations: Wash thoroughly after handling and before eating or drinking.

Section 9: PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Green Liquid	**Partition Coefficient: n-octanol/water:**	Not determined
Odor:	Added sassafras odor	**Autoignition Temperature:**	Non-flammable
Odor Threshold:	Not determined	**Decomposition Temperature:**	42.7°C (109°F)
pH:	8.5 – 9.2	**Viscosity:**	Like water
Freezing Point:	0-3.33°C (32-38°F)	**Specific Gravity:**	1.01 – 1.03
Boiling Point & Range:	101°C (213.8°F)	**VOCs:** ***Water & fragrance exemption in calculation*	

Section 9: PHYSICAL AND CHEMICAL PROPERTIES - continued

Flash Point:	> 212°F	SCAQMD 304-91 / EPA 24:	0 g/L	0 lb/gal	0%
Evaporation Rate:	Not determined	CARB Method 310**:	< 5 g/L	<0.0417lb/gal	<0.5%
Flammability (solid, gas):	Not applicable	SCAQMD Method 313:	Not tested		
Upper/Lower Flammability or Explosive Limits:	Not applicable	**VOC Composite Partial Pressure:**	Not determined		
Vapor Pressure:	0.60 PSI @77°F, 2.05 PSI @100°F	**Relative Density:**	8.42 – 8.59 lb/gal		
Vapor Density:	Not determined	**Solubility:**	100% in water		

Section 10: STABILITY AND REACTIVITY

Reactivity: Non-reactive.
Chemical Stability: Stable under normal conditions 70°F (21°C) and 14.7 psig (760 mmHg).
Possibility of Hazardous Reactions: None known.
Conditions to Avoid: Excessive heat or cold.
Incompatible Materials: Do not mix with oxidizers, acids, bathroom cleaners, or disinfecting agents.
Hazardous Decomposition Products: Normal products of combustion - CO, CO2.

Section 11: TOXICOLOGICAL INFORMATION

Likely Routes of Exposure:
Inhalation - Overexposure may cause headache.
Skin Contact - Not expected to cause irritation, repeated contact may cause dry skin.
Eye Contact - Not expected to cause irritation.
Ingestion - May cause upset stomach.

Symptoms related to the physical, chemical and toxicological characteristics: no symptoms expected under typical use conditions.
Delayed and immediate effects and or chronic effects from short term exposure: no symptoms expected under typical use conditions.
Delayed and immediate effects and or chronic effects from long term exposure: headache, dry skin, or skin irritation may occur.
Interactive effects: Not known.

Numerical Measures of Toxicity
Acute Toxicity: Oral LD_{50} (rat) > 5 g/kg body weight
Dermal LD_{50} (rabbit) > 5 g/kg body weight
Calculated via OSHA HCS 2012 / Globally Harmonized System of Classification and Labelling of Chemicals

Skin Corrosion/Irritation: Non-irritant per Dermal Irritection® assay modeling. No animal testing performed.
Eye Damage/Irritation: Non-irritant per Ocular Irritection® assay modeling. No animal testing performed.
Germ Cell Mutagenicity: Mixture does not classify under this category.
Carcinogenicity: Mixture does not classify under this category.
Reproductive Toxicity: Mixture does not classify under this category.
STOT-Single Exposure: Mixture does not classify under this category.
STOT-Repeated Exposure: Mixture does not classify under this category.
Aspiration Hazard: Mixture does not classify under this category.

Section 12: ECOLOGICAL INFORMATION

Ecotoxicity: Volume of ingredients used does not trigger toxicity classifications under the Globally Harmonized System of Classification and Labelling of Chemicals.
Aquatic: Aquatic Toxicity - Low, based on OECD 201, 202, 203 + Microtox: EC_{50} & IC_{50} ≥100 mg/L. Volume of ingredients used does not trigger toxicity classifications under the Globally Harmonized System of Classification and Labelling of Chemicals.
Terrestrial: Not tested on finished formulation.

Section 12: ECOLOGICAL INFORMATION - continued

Persistence and Degradability: Readily Biodegradable per OCED 301D, Closed Bottle Test. Reaches 100% biodegradation within 60 days.
Bioaccumulative Potential: No data available.
Mobility in Soil: No data available.
Other Adverse Effects: No data available.

Section 13: DISPOSAL CONSIDERATIONS

Unused or Used Liquid: May be considered hazardous in your area depending on usage and tonnage of disposal – check with local, regional, and or national regulations for appropriate methods of disposal.

Empty Containers: May be offered for recycling.

Never dispose of used degreasing rinsates into lakes, streams, and open bodies of water or storm drains.

Section 14: TRANSPORT INFORMATION

U.N. Number: Not applicable
U.N. Proper Shipping Name: Cleaning Compound, Liquid NOI
Transport Hazard Class(es): Not applicable
Packing Group: Not applicable
Environmental Hazards: Marine Pollutant - NO
Transport in Bulk (according to Annex II of MARPOL 73/78 and IBC Code): Unknown.
Special precautions which user needs to be aware of/comply with, in connection with transport or conveyance either within or outside their premises: None known.

U.S. (DOT) / Canadian TDG:	Not Regulated for shipping.	**ICAO/ IATA:**	Not classified as Hazardous
IMO / IDMG:	Not classified as Hazardous	**ADR/RID:**	Not classified as Hazardous

Section 15: REGULATORY INFORMATION

All components are listed on: TSCA and DSL Inventory.

SARA Title III: Sections 311/312 Hazard Categories – Not applicable.
Sections 313 Superfunds Amendments and Reauthorizations Act of 1986 – Not applicable.
Sections 302 – Not applicable.

Clean Air Act (CAA): Not applicable
Clean Water Act (CWA): Not applicable

State Right To Know Lists: No ingredients listed
California Proposition 65: No ingredients listed

This product has been classified as “not classifiable as hazardous” in accordance with Consumer Product Safety Commission (16 CFR Chapter 2) and labelled and packaged accordingly.

US Consumer Product Safety Commission Regulations
This product is labeled in accordance with regulations administered by the Consumer Product Safety Commission (CPSC). However, the use pattern and exposure in the workplace are generally not consistent with those experienced by consumers. Therefore, the requirements of the Occupational Safety and Health Administration applicable to this SDS differ from the labeling requirements of the CPSC, and this SDS may contain additional health hazard information not pertinent to consumer use and not found on the product label.

Section 16: OTHER INFORMATION

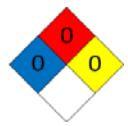
Size	UPC	Size	UPC
2 fl. oz.	043318131035	67.6 fl. oz.	043318000393
4 fl. oz.	043318130014	67.6 fl. oz.w/ dilution bottle	043318005442
16 fl. oz.	043318130021	140 fl. oz.	043318001390
22 fl. oz.	043318130229	140 fl. oz. w/ dilution bottle	043318001468
24 fl. oz.	043318006241	1 gallon	043318000799
24 fl. oz.	043318130137	1 gallon	043318004957
32 fl. oz.	043318000652	1 gallon	043318130052
32 fl. oz.	043318002557	1 gallon w/ dilution bottle	043318480416
32 fl. oz.	043318130335	1 gallon w/ dilution bottle	043318480492
67.6 fl. oz.	043318130144	2.5 gallon	043318004889

USA items listed only. Not all items listed. USA items may not be valid for international sale.

NFPA:

Health – None
Flammability – Non-flammable

Stability – Stable
Special - None



Acronyms

NTP	National Toxicology Program	IARC	International Agency for Research on Cancer
OSHA	Occupational Safety and Health Administration	CPSC	Consumer Product Safety Commission
TSCA	Toxic Substances Control Act	DSL	Domestic Substances List

Prepared / Revised By: Sunshine Makers, Inc., Regulatory Department.
This SDS has been revised in the following sections: Aligned Section 3 with California Ingredient Disclosure and minor fixes.

DISCLAIMER: The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Appendix H

CDC Fact Sheet

SHARE FACTS ABOUT COVID-19

Know the facts about coronavirus disease 2019 (COVID-19) and help stop the spread of rumors.

FACT 1

Diseases can make anyone sick regardless of their race or ethnicity.

Fear and anxiety about COVID-19 can cause people to avoid or reject others even though they are not at risk for spreading the virus.

FACT 2

For most people, the immediate risk of becoming seriously ill from the virus that causes COVID-19 is thought to be low.

Older adults and people of any age who have serious underlying medical conditions may be at higher risk for more serious complications from COVID-19.

FACT 3

Someone who has completed quarantine or has been released from isolation does not pose a risk of infection to other people.

For up-to-date information, visit CDC's coronavirus disease 2019 web page.

FACT 4

There are simple things you can do to help keep yourself and others healthy.

- Wash your hands often with soap and water for at least 20 seconds, especially after blowing your nose, coughing, or sneezing; going to the bathroom; and before eating or preparing food.
- Avoid touching your eyes, nose, and mouth with unwashed hands.
- Stay home when you are sick.
- Cover your cough or sneeze with a tissue, then throw the tissue in the trash.

FACT 5

You can help stop COVID-19 by knowing the signs and symptoms:

- Fever
- Cough
- Shortness of breath

Seek medical advice if you

- Develop symptoms

AND

- Have been in close contact with a person known to have COVID-19 or if you live in or have recently been in an area with ongoing spready of COVIID-19.

cdc.gov/COVID-19

Appendix I

Injury/Illness, Property Damage Incident,
Near Miss Reporting Forms, and
Motor Vehicle Accident Report

Kennedy Jenks

Injury/Illness Report Form

This form should only be used for reporting an incident resulting in employee injury/illness. Prior to completing this form, verify that the appropriate notifications have been made as identified below. Use the Property Damage/Incident Report Form to document property damage or other incident. Use the Near-Miss Report Form to document Near-Misses.

Name and job title of injured/illness employee:

Employee's address and telephone number:

Time, Date, and Location where the injury/illness occurred:

Address of KJ site contact:

Check the appropriate nature of injury/illness(s):

___ Sprain ___ Laceration ___ Impact/Compression Injury ___ Nausea

___ Fracture ___ Puncture ___ Allergic Reaction ___ Chemical/Substance Exposure

___ Abrasion ___ Avulsion (amputation) ___ Eye Injury ___ Heat/Cold Exposure

___ Bruise ___ Burn ___ Hearing-Related Injury

___ Altered Level of Consciousness ___ Respiratory/Cardiac-Related Event

Identify the body part affected:

What was the employee doing when the injury/illness occurred?

What action, mechanism, or piece of equipment directly contributed to the injury/illness?

What other processes or items may have indirectly contributed to the employee injury/illness?

Description of accident, accident scene and if accident scene has been instrumentally altered by employees, bystanders and/or emergency personnel and equipment:

How might have this injury/illness been avoided?

Was the injury/illness immediate or did it gradually evolve over time?

If this event occurred at a job site, was a site-specific safety plan prepared and approved? If so, please attach to this form.

If this event occurred at a job site, was a job hazard analysis completed for the task which the employee was performing at the time of injury/illness? If so, please attach.

What were weather conditions at the time of the injury/illness?

Was the employee's supervisor notified? When?

Did the employee contact WorkCare for medical direction? When?

List emergency medical services, fire, or law enforcement agencies summoned for the injured employee:

Provide names and phone numbers of witnesses:

Injured employee was transported to:

Name of person preparing this report: ___________________________________

Title: _______________________________ Date: ________________________

Property Damage Incident Report Form

This form should be used only for an incident resulting in property damage without injury to employees involved. Use the Injury/Illness Report Form to document employee injuries. Use the Near-Miss Report Form to document Near-Misses.

Name(s) of employee(s) involved:

Time, Date, and Location where the incident occurred:

Description of the incident:

What was the employee doing when the incident occurred?

What action, mechanism, or piece of equipment may have directly contributed to the incident?

What other processes or items may have indirectly contributed to this incident?

If this incident occurred at a job site, was a site-specific safety plan prepared and approved? If so, please attach to this form.

Detail any corrective actions taken.

Provide names and phone numbers of witnesses:

Name of person preparing this report: ____________________________________

Title: ________________________________ Date: _________________________

Signature of H&S Manager: __________________________________ Date:____________________

Signature of Project Manager: _______________________________ Date:____________________

Near-Miss Report Form

This form should only be used for Near-Miss events which did NOT result in injury or property damage. Use the Injury/Illness Report Form to record injuries or illness. Use the Property Damage Incident Report Form to record property damage.

Date: ___________________ Location: ____

Time:________________ ☐a.m. ☐p.m.

Weather Conditions: ____

Please check all that apply:

☐Unsafe Act ☐Unsafe Condition ☐Unsafe Equipment ☐Unsafe Use of Equipment

Description of Near-Miss in detail:

Employee Name ____ Date: ___________________

This section to be completed by Health & Safety Manager or Representative.

Cause of Near-Miss:

Corrective action(s) taken:

H&S Manager ______________________________ Date: ___________________

Kennedy Jenks
Motor Vehicle Accident Report

Directions: Employee, Project Manager or Supervisor must gather the detailed information below and submit to the Health and Safety Manager (John Jindra) and the Chief Risk Officer (Jerry Cavaluzzi) for review as soon as possible or safe to do so.
After review and approval by the Health and Safety Manager and the Chief Risk Officer, Employee, Project Manager or Supervisor must contact Zurich noting Policy Number BAP9326879 and E-mail Accident Report to: USZ_CareCenter@Zurichna.com Phone: 1-800-987-3373
Copy Katie Haun at Khaun@lockton.com and Jerry Cavaluzzi at JerryCavaluzzi@KennedyJenks.com on initial report.

Employee Information

Employee Name: ____

Address: ____ City: ___________________ State: __________ Zip: ______________

Home Phone (_____) _____-_____ Employee's preferred language: ____

Driver's License: _______________________________ State Issued __________________ Injured? ☐ Yes ☐ No

Company Vehicle

Was the vehicle Company/Personal/Rental? _________________________ Rental Agency: ____

Year: _________ Make: _____________________ Model: ___________________ License Plate Number: ______________________________

VIN: _______________________________ Area of Damage to Vehicle: ____

Vehicle Drivable? ☐ Yes ☐ No Phone number of garage taken to: ____

Accident Information

Date of Accident: _____/_____/_____ Time of Accident: _____:_____ A.M./P.M.
Location of Accident: ___________________________________ City: ____________________ State: _________ Zip: ____________

Were Police Called? ☐ Yes ☐ No Department: ______________

Officer Name/Badge # ____ Phone (_____)_____-_____

Police Report Number: _____________________ Was a citation/ticket issued to any driver? ☐ Yes ☐ No

Reason: ____

How did accident occur? (please be specific) ____

Other Vehicle (use additional sheet if necessary, for additional vehicles)

Was another person/vehicle involved in accident? ☐ Yes ☐ No Were they issued a citation? ☐ Yes ☐ No

Year: _____ Make: ____________ Model: _______________ License Plate Number: _________________ Driver's License #: ________

Owner's Name: __________________ Address: ____________ City: ________________________ State: ______ Zip: ______________

Driver's Name: _________________ Address: ____________ City: ________________________ State: ______ Zip: ______________

Home Phone (_____)_____-_____ Work Phone (_____))_________-________ Damage to Vehicle: ________

Insurance Carrier: ________________ Policy #: ____________ Agent's Name: _______________ Phone (____)_____-_____

Were there passengers in the other vehicle? ☐ Yes ☐ No Injured

Name: ____ Phone (____)_____-_____ ☐ Yes ☐ No

Name: ____ Phone (______)_____-_____ ☐ Yes ☐ No No

Name: ____ Phone (______)_____-_____ ☐ Yes ☐

Witness Information

Were there any witnesses to this accident? Yes No

Name: ____ Phone (______)_____-_____

Name: ____ Phone (______)_____-_____

Appendix B

Kennedy Jenks Standard Operating Guidelines (SOGs)

SAMPLING FOR PER- & POLYFLUOROALKYL SUBSTANCES

PURPOSE

The purpose of this Standard Operating Guideline (SOG) is to provide guidance for collecting samples for per- and polyfluoroalkyl substances (PFAS) analysis. *Please note that PFAS are emerging contaminants; therefore, this SOG will be modified as new information becomes available.*

Because of the potential presence of PFAS in common consumer products and in equipment typically used to collect groundwater samples and the low detection limits associated with laboratory PFAS analysis, special handling and care must be taken when collecting samples for PFAS analysis.

This SOG outlines general practices for collecting PFAS samples and provides a summary of non-acceptable field and sampling materials (likely to contain PFAS) and acceptable alternatives.

BACKGROUND

Based on U.S. Environmental Protection Agency (EPA) guidance, "per- and polyfluoroalkyl substances (PFAS)" is the preferred term to refer to this class of chemicals, although the general public and others may also refer to them as "perfluorinated chemicals (PFCs)" or "perfluorinated compounds (PFCs)."

PFAS are a family of man-made compounds that do not naturally occur in the environment. They have a large number of industrial uses and are found in many commercial products because of their properties to resist heat, oil, grease and water.

RESOURCES

Frequently asked questions, fact sheets and additional information concerning PFAS can be found on the EPA website[1], applicable state regulatory websites, and the Interstate Technology & Regulatory Council (ITRC) website[2]. ITRC and state environmental agencies often release and/or update PFAS guidance related to regulatory action levels, sample collection guidance, analytical methodology, permitting, remediation, and reporting/compliance. Ensure that project work plans and/or site-specific sampling and analysis plans (SAPs) reflect current guidance prior to PFAS sample collection.

[1] https://www.epa.gov/pfas
[2] https://pfas-1.itrcweb.org/

GENERAL GUIDANCE

Personal Protective Equipment

Disposable nitrile gloves must be worn at all times. Further, a new pair of nitrile gloves shall be donned prior to the following activities at each sample location:

1. Cleaning of re-usable sampling equipment.
2. Contact with sample bottles or water containers.
3. Insertion of anything into the well (e.g., tubing, pump, bailer, war level meter).
4. Insertion of silicon tubing into the peristaltic pump.
5. Sample collection upon completion of monitoring well purging.
6. Handling of any quality assurance/quality control samples including field blanks and equipment blanks.

New gloves shall also be donned after the handling of any non-dedicated sampling equipment, contact with non-decontaminated surfaces, or when judged necessary by field personnel.

The use of a different colored glove (e.g., bright orange) for the collection of PFAS samples can help provide a visual reminder to prevent cross-contamination.

Sample Collection Method/Sequence

1. After donning a new pair of nitrile gloves, collect the sample for PFAS ***first***, prior to collecting samples for any other parameters into any other containers; this avoids contact with any other type of sample container, bottles or packaging materials that may have PFAS-related content.
2. Do not place the sample bottle cap on any surface when collecting the sample and avoid all contact with the inside of the sample bottle or its cap.
3. Once the sample is collected, capped and labeled, place the sample bottle(s) in an individual re-sealable plastic bag (e.g., Ziploc®) and place in an appropriate cooler packed only with loose ice (preferably from a verifiable PFAS-free source).

Samples Collected From Drinking Water Supply Wells

1. Contact the owner to get permission to sample their drinking water supply well, if necessary.

2. Collect as much data about the well as possible, such as: the well depth, type of well (e.g., deep bedrock or shallow dug well) and type of treatment system, if any (e.g., a cartridge filter, a water softener, pH adjuster, point of entry, radon, carbon or an ultra violet system).

3. The sample must be collected from a point in the plumbing system that is prior to any type of water treatment system, preferably from the closest spigot to the holding tank in the plumbing system, or the treatment system must be bypassed. For convenience and to prevent unnecessary loading of the septic system, an outside spigot is preferable to an inside faucet.

4. The water (cold water) is typically purged at a high rate of flow for 10-15 minutes (a minimum of 10 minutes).

5. Once the well has been purged, reduce the rate of flow to a very slow rate.

6. As described above in the **Sample Collection Method/Sequence** section, don a new pair of nitrile gloves and collect PFAS samples ***first***, prior to collecting samples for any other parameters. The PFAS sample must be collected directly from the spigot or sampling port.

7. Do not place the sample bottle cap on any surface when collecting the sample and avoid all contact with the inside of the sample bottle or its cap.

8. Once the sample is collected, capped, and labeled place the sample in an individual re-sealable plastic bag and then into loose ice (preferably from a verifiable PFAS-free source) within the cooler.

9. Once the PFAS samples have been collected, shut the water off. Attach a decontaminated brass tap apparatus to the tap, if appropriate. Turn water back on at a very slow flow rate. Purge a small amount of water through the apparatus to rinse it with the water being sampled.

10. Collect remaining samples as required.

Samples Collected From Monitoring Wells

1. If collecting field parameters using a multiparameter meter, samples for laboratory analyses must be collected before the flow-through cell and the three-way stopcock (if utilized). This will be done by disconnecting the three-way stopcock from the pump discharge tubing so that the samples are collected directly from the pump tubing.

2. When feasible, use dedicated single-use or disposable polyethylene or silicone materials (tubing, bailers, etc.) for monitoring well purging and sampling equipment.

3. When reuse of materials or sampling equipment across multiple sampling locations is necessary, follow project cleaning protocols with allowed materials identified in the table below and incorporate collection of equipment blanks into the sampling program, as appropriate.

4. When using positive displacement/submersible pump or bladder pump sampling equipment, familiarize yourself with the sampling pump/accessory equipment specifications to confirm that device components are not made of nor contain polytetrafluoroethylene (PTFE, a.k.a. Teflon®) or other PFAS-containing components.

Samples Collected During Production Well Pumping Tests

1. If feasible, do not use tape or pipe thread sealant containing Teflon on pipe fittings or sampling tap threads on the pump discharge pipe.

2. As with all other sample parameters, the sample for PFAS will be collected at the last hour (or hours) of the pumping portion of the testing program, but before the collection of other sample parameters.

3. Discharge water will be purged through the sampling tap on the discharge pipe for a minimum of 20 minutes prior to collection of samples.

Samples Collected From Active Production Wells

1. If feasible, avoid contact with any tape or pipe thread paste containing Teflon on pipe fittings or sampling tap threads that may be present on the water supply discharge pipe.

2. The sample for PFAS will be collected while the production well pump is operating, and, preferably, has been operating for at least one hour.

3. Discharge water will be purged through the sampling tap on the discharge pipe for a minimum of 20 minutes prior to collection of samples.

Cleaning

Cleaning fluids have been viewed as a possible source of equipment cross contamination. Therefore, more frequent changes of cleaning liquids may be warranted. Refer to the Equipment and Materials Table below for prohibited and acceptable cleaning liquids.

A final rinse with “PFAS-free” deionized (DI) water, typically provided by the analytical laboratory or other verifiable source, is required.

SITE-SPECIFIC SOGs AND SAMPLING AND ANALYSIS PLANS

The details within this SOG should be used in conjunction with approved site-specific SOGs or an approved site-specific SAP. The site-specific SAP will provide the following information:

- Sample collection objectives;
- Locations to be sampled;
- Number and volume of samples to be collected at each location;
- Types of chemical analyses to be conducted for the samples;
- Specific quality control procedures and sampling required;
- Personnel responsibilities;
- Site-specific Health and Safety Plan; and
- Any additional sampling requirements or procedures beyond those covered in this SOG, as necessary.

All field personnel must confer with their Project Manager or Field Lead before deviating from approved procedures. All deviations must be documented in the field log book and presented in the final sampling report.

Sample Collection Objectives, Locations, and Number of Samples

When developing site-specific SAPs, the scope of the investigation shall consider whether the site history includes, or has the potential to include, activities such as industrial processes that manufactured or used PFAS, solid waste management (e.g., landfilling), fire training and/or response with storage or use of Class B Foam [e.g., aqueous film forming foam (AFFF)], wastewater management (e.g., onsite septic or disposal, treatment facilities, sludge and/or biosolids management). It is appropriate to consider the wide-ranging use of PFAS in commercial and industrial applications, as summarized, but not limited to, the uses shown in the table below.

Commercial Products	Industrial Uses
Cookware (Teflon®, Nonstick) Fast Food Containers Candy Wrappers Microwave Popcorn Bags Personal Care Products (Shampoo, Dental Floss) Cosmetics (Nail Polish, Eye Makeup) Paints and Varnishes Stain Resistant Carpet Stain Resistant Chemicals (Scotchgard®) Water Resistant Apparel (Gore-Tex®) Cleaning Products Electronics Ski Wax	Photo Imaging Metal Plating Semiconductor Coatings Aviation Hydraulic Fluids Medical Devices Firefighting Aqueous Film-Forming Foam Insect Baits Printer and Copy Machine Parts Chemically Driven Oil Production Textiles, Upholstery, Apparel and Carpets Paper and Packaging Rubber and Plastics

Sample locations, media (e.g., soil, groundwater, drinking water, surface water), and number of samples shall be selected based on the professional judgement of the Professional Engineer, Geologist, and/or Scientist directing the sampling effort in consideration of previous and current uses of the site, site hydrogeology, proximity to sensitive receptors, and other known releases. The sampling approach shall be described in the site-specific SAP and/or work plan. Note that samples collected from water supply wells must be collected from a point in the plumbing system that is prior to treatment.

Chemical Analyses

Currently, PFAS are not federally regulated in drinking water, and there is no requirement for PFAS testing under the federal Safe Drinking Water Act. Therefore, review applicable state laws, regulations, and/or guidance for required analytical laboratory qualifications, analytical methods, parameters, and reporting limits. If state(s) do not have applicable laws, regulations, and/or guidance regarding PFAS analysis, the site-specific SAP should detail analytical laboratory qualifications, analytical methods, parameters, and reporting limits. Analytical laboratories with Department of Defense (DOD) and/or National Environmental Laboratory Accreditation Program (NELAP) certification should be used for PFAS analysis.

Analysis should be conducted by a method that uses isotope dilution techniques, unless otherwise specified in the site-specific SAP. As of the date of this document, EPA has developed and validated three analytical methods for PFAS analysis: Method 537.1 for analysis of 18 PFAS congeners in drinking (potable) water; Method 533 for analysis of 25 PFAS congeners in drinking (potable) water; and SW846 Method 8327 for analysis of 24 analytes in non-potable water and other environmental media (e.g., groundwater, surface water, wastewater). Certain laboratories may adapt these methods for media other than those specified (e.g., groundwater, surface water, wastewater, biosolids, soil). Other analytical methods are also currently under development by EPA, DoD, and ASTM International (ASTM).

Samples for PFAS analysis shall be analyzed for PFAS congeners in accordance with:

- State-specific analytical requirements (if applicable)
- Standard EPA method analyte list [see applicable Method(s)]; or
- Site-specific analyte list (detail in the site-specific SAP).

The site-specific SAP should include the selected analytical method and the analyte list. Modifications may be requested on a site-by-site basis. The analyte list should be evaluated and changed, if necessary, based on site history and environmental data.

Quality Assurance Quality Control

Many clothing items and types of field equipment may contain PFAS, which increases the potential for inadvertent contamination of the samples. In order to evaluate the potential impact these, as well as laboratory-provided materials, might have on PFAS samples, various Quality Assurance Quality Control (QA/QC) samples are to be considered in the PFAS sampling and analysis plan.

Refer to the site-specific SAP for specific information on QA/QC samples to be collected. QA/QC requirements may vary for initial screening and assessment, and site investigations.

To support the validity of the data, the following QA/QC is suggested:

- Trip Blanks
  - Trip blanks for PFAS samples shall be prepared by the laboratory prior to the sampling event using PFAS-free DI water.
  - Only one PFAS trip blank per chain-of-custody, per cooler is acceptable.
- Field Duplicates
  - Duplicate samples shall be collected by filling a separate container for each analysis immediately following the collection of the primary sample (e.g., PFAS sample, PFAS duplicate sample; VOC sample, VOC duplicate sample).
  - Duplicate samples are typically collected at a frequency of one duplicate sample per twenty field samples (1:20), with a minimum of one field duplicate per sampling event.
  - The duplicates may be Blind Duplicates.
- Equipment Blanks - for all non-dedicated equipment used to collect samples
  - Equipment blanks shall be prepared using PFAS-free laboratory grade DI water provided by the laboratory.
  - Equipment blanks consist of a sample of PFAS-free laboratory grade DI water which has been poured around and through sample collection equipment to evaluate the equipment cleaning procedures and the potential for cross- contamination between sample locations.
  - One equipment blank per type of non-dedicated equipment is typically collected per sampling event (e.g., water level meter, bailer, submersible pump, bladder pump) to evaluate the cleaning procedure.
  - A second equipment blank on certain types of equipment (e.g., bladder pump) may be useful in order to evaluate the potential influence of components within the piece of equipment.

- Field Blanks
  - Collect a field blank from each batch of PFAS-free DI water while in the field by pouring an aliquot of the water into the appropriate PFAS sample container.
  - Refer to the site-specific SAP for the quantity of field blanks to be collected. At a minimum, field blanks should be collected by each person collecting PFAS samples. Consideration should also be given to when the field blank should be collected so that it is representative of the conditions most likely to influence the sample.

QA/QC shall also include management to ensure that field crews are adhering to procedures provided herein and procedures described in the site-specific SAP, including sampling techniques, field documentation, cleaning, sample packaging, chain-of-custody sample handling and shipping documentation procedures, and equipment calibration.

EQUIPMENT AND MATERIALS

The following table provides a summary of items that are likely to contain PFAS (i.e., prohibited items) and that should not be used by the sampling team at the site during sampling for PFAS, along with acceptable alternatives. This list may change as new information becomes available.

Category	Prohibited Items	Allowable Items
Field Equipment Including: • Pumps • Tubing • Bailers	Teflon and other fluoropolymer-containing materials (e.g., Teflon tubing, bailers, tape; T e f l on -containing plumbing paste, or other Teflon materials) **Note**: The Grundfos Redi-Flow Submersible Pump is a submersible pump which, as of this revision, has a Teflon impeller and is not recommended for collecting PFAS samples.	High-density polyethylene (HDPE) - *preferred,* low density polyethylene (LDPE), or silicone tubing. HDPE/LDPE or stainless steel bailers. Peristaltic pumps. Stainless steel submersible pumps (e.g., ProActive stainless steel pumps with PVC [polyvinyl chloride]) leads and Geotech Stainless Steel Geosub pumps). Bladder pumps with polyethylene bladders and tubing need to be evaluated on a case-by-case basis because the gaskets and O-rings may contain PFAS. Equipment with Viton components needs to be evaluated on a case-by-case basis. Viton contains PTFE, but may be acceptable if used in gaskets or O-rings that are sealed away and will not come into contact with sample or sampling equipment.).
Cleaning	Decon 90	Alconox® or Liquinox®[3], potable water followed by laboratory “PFAS-free” DI water rinse.

[3] While Alconox and Liquinox soap is acceptable for use for PFAS decontamination, they may contain 1,4-dioxane. If Alconox and Liquinox soap is used at sites where 1,4-dioxane is a contaminant of concern/interest, then equipment blanks analyzed for 1,4-dioxane should be collected. Refer to the site-specific Equipment Decontamination SOG for required decontamination procedures.

Category	Prohibited Items	Allowable Items
Sample Storage and Preservation	LDPE or glass bottles, PTFE- or Teflon-lined caps, chemical ice packs[4]	Laboratory-provided sample container - *preferred*; or, HDPE or polypropylene bottles with an unlined plastic screw cap, as specified by the laboratory doing the analysis, regular loose ice (preferably from a known PFAS-free source).
Field Documentation	Waterproof/treated paper or field books, plastic clipboards, non-Sharpie® markers, Post-It® and other adhesive paper products.	Plain Paper, metal clipboard, Sharpies, ballpoint pens.
Clothing/ laundering	Clothing or boots made of or with Gore-Tex™ or other synthetic water proof/ resistant and/or stain resistant materials, coated Tyvek® material that may contain PFAS; fabric softener	Synthetic or cotton material, previously laundered clothing (preferably previously washed greater than six times) without the use of fabric softeners. Polyurethane and wax coated materials. Boots made with polyurethane and PVC, well-worn or untreated leather boots. Tyvek material that is PFAS free (e.g., uncoated).
Personal Care Products (for day of sample collection)	Cosmetics, moisturizers, hand cream, and other related products	**Sunscreens:** Alba Organics Natural Yes to Cucumbers Aubrey Organics Jason Natural Sun Block Kiss My Face Baby-safe sunscreens ('free' or 'natural') **Insect Repellents**: Jason Natural Quit Bugging Me Repel Lemon Eucalyptus Herbal Armor California Baby Natural Bug Spray BabyGanics **Sunscreen and Insect Repellents:** Avon Skin So Soft Bug Guard-SPF 30
Food and Beverage	Pre-packaged food, fast food wrappers or containers	Bottled water or hydration drinks (i.e., Gatorade® and Powerade®).

[4] All samples requiring cooling must be placed in loose ice within a cooler; the use of bagged ice (unless the bag is verified PFAS-free material), block ice, dry ice, and ice packs is not acceptable.

Appendix B: Data Quality Standard Operating Guidelines
SOG-1: Environmental Data Collection

B.1 Introduction

This guideline describes recommended procedures to be followed by Kennedy Jenks personnel when collecting environmental data. The guideline is divided into Pre-field Procedures and Field Procedures for ease of use.

B.2 Pre-Field Procedures

The following procedures represent the minimal effort appropriate for most environmental data collection projects. Refer to project-specific plans for additional data collection procedures.

1. Review the work plan or sampling plan prior to initiating fieldwork, and discuss any questions with project manager or field leader.

2. Review the Health and Safety Plan.

3. Set up subcontract[1] with analytical laboratory for type and quantity of analyses, documentation and delivery format, both hard copy and electronic data deliverables (EDDs) and turnaround time requirements. Establish contacts at the laboratory, field and home office (Project Manager or person responsible) for all communications.

4. Notify the analytical laboratory of the upcoming fieldwork and advise about the following:

    a. Number of samples per medium

    b. Analyses needed

    c. Dates of sample delivery, coordinate for Saturday pick-up if necessary

    d. Means of delivery (e.g., courier, FedEx)

    e. Turnaround time required

    f. Level of quality control (QC) reporting required

    g. Delivery format, for both hard copy and EDDs.

5. Order the sample containers from the laboratory. Determine whether field personnel will preserve the samples in the field or if pre-preserved sample containers will be provided. It is preferable to order containers with appropriate preservatives.

6. Arrange for delivery or pickup of sample containers.

[1] The analytical laboratory may be contracted with another entity, with Kennedy Jenks facilitating the order.

7. Request the laboratory fax or email you chain-of-custody forms and laboratory receipt documents immediately after receiving the samples.

8. Check the chain-of-custody form to verify the correct samples were collected and correct analyses were requested. Double check the laboratory receipt documents to verify there are no typographical errors for samples.

   If changes are required, request change in writing, via email, do not request over the phone. Request the laboratory to include all change request documentation in the laboratory summary report.

B.3 Field Procedures

1. At the beginning of each field day, identify planned work and document field conditions in the field notes.

2. Hold Tailgate Safety Meeting and have all present sign the form.

3. Complete sample identification labels for each sampling container using an indelible pen. Use the sample identification protocol described in the work plan or sampling plan. It is recommended that pre-printed labels be created at the office prior to going to the field site, if possible.

4. Complete the chain-of-custody form, accounting for each sample. Verify that sample identifications, sampling times, and requested analyses on the chain-of-custody form match the sample identifications, sampling times, and requested analyses on the sample labels.

5. Verify that the appropriate QC samples (field duplicate samples, trip blanks samples, etc.) required in the work plan or sampling plan were collected. If applicable, document blind duplicate parents in field notes, and if using a database, supply a summary table of your parent and duplicate samples to your database coordinator.

6. Verify, where applicable, that the appropriate sample volume was collected to enable the analytical laboratory to perform QC analyses (e.g., matrix spike and matrix spike duplicate analysis). (For example, if a water sample is being analyzed for polynuclear aromatic hydrocarbons, 1 liter of sample is required for the analysis, and another 2 liters are required for the matrix spike and matrix spike duplicate analyses.)

7. Collect, preserve, and transport samples to the analytical laboratory in accordance with the work plan or sampling plan.

8. Provide adequate ice in coolers so that the coolers arrive at the laboratory at a temperature of 4 degrees C ± 2 degrees C.

9. Keep in contact with the project manager or other team member to report any problems, unusual observations, etc.

10. Verify that samples were received by the analytical laboratory and that the laboratory understands the chain-of-custody and requested analyses prior to beginning analyses.

11. If samples are sent by overnight delivery, include the tracking number and time released to the delivery service on the chain-of-custody form.

Appendix B: Standard Operating Guideline
SOG-2: Surface and Shallow Soil Sampling

B.1 Introduction

This guideline describes the equipment and procedures that are used by Kennedy Jenks personnel for collecting surface and shallow soil samples.

B.2 Equipment

- Stainless steel or plastic scoops
- Hand auger
- Split-spoon drive sampler (2.5-inch or 2.0-inch I.D.) and associated drill rods, wrench and other tools needed to break down equipment
- Slide hammer
- 2.5-inch or 2.0-inch brass liners and sealing materials (plastic end caps, Teflon seals, silicon tape, zip-lock plastic bags)
- Shovel
- Post hole digger
- Pick
- Breaker bar
- Foxboro FID-Organic Vapor Analyzer (OVA)
- HNU PID-Organic Vapor Analyzer
- OVM
- Measuring tape or measuring wheel
- Stakes or spray paint for sampling grid
- Sampler cleaning equipment
  - Steamcleaner (if available)
  - Generator (if available)
  - Stiff-bristle brushes
  - Buckets
  - High priority phosphate-free liquid soap, such as Liquinox
  - Trisodium phosphate (TSD) for use if samples are oily
  - Methanol (if necessary)
  - 0.1N nitric acid (if necessary)
  - Deionized water
  - Potable water

- Insulated sample storage and shipping containers
- Personal protective equipment (as specified in site safety plan)

B.3 Typical Procedure

1. Obtain applicable drilling and well construction permits, prior to mobilization, if necessary.

2. Clear locations for underground utilities and structures by Underground Service Alert (USA) and subcontractors, if necessary.

3. Measure and mark sampling locations prior to initiation of the sampling program, as specified in the sampling and analysis plan. If sampling locations are based on a grid pattern, stakes can be used to define the grid layout.

4. Collect soil samples for chemical analysis by using precleaned scoops or a hand auger, or by driving a split-spoon drive sampler.

5. If overlying soil is to be removed (as specified in the sampling and analysis plan), use shovels, picks, or post-hole diggers, as needed.

6. Collect soil samples for lithologic logging purposes.

7. If applicable, as described in the site safety plan, use an OVA to analyze *in situ* air samples from the breathing zone and other locations as necessary.

8. Have the soils classified in the field in approximate accordance with the visual-manual procedure of the Unified Soil Classification System (ASTM D 2488-90) and the Munsell Color Classification (refer to SOG-4).

9. Prior to each sampling event, wash sampling equipment (scoops, hand auger, split-spoon drive sampler, and brass liners) with high purity phosphate-free soap. Double-rinse it with deionized water and methanol, and/or 0.1N nitric acid, as appropriate.

10. At each sampling interval, collect soil and place it in the appropriate sampling container. Fill the sample container and compact the soil to minimize air space. Minimize handling of the soil, especially if it is being collected for analysis of volatile compounds.

11. If a split-spoon drive sampler is being used, select one brass liner for potential laboratory analysis. Cover the ends of this sample in Teflon sheets, seal it with plastic caps, and wrap it with silicon or Teflon tape. Place a completed sample label on the brass liner.

12. Place the selected samples in appropriate containers and store them at approximately 4 °C.

13. As a field screening procedure (if applicable), for each sampling interval, place soil not selected for chemical analysis in an airtight container (e.g., plastic bag or jar) and allow it to equilibrate. After this, monitor the headspace in the container using either an HNU, OVM or OVA. Record the headspace concentration in the field notes (refer to SOGs 4 and 5).

14. Complete chain-of-custody forms in the field and transport the selected samples in insulated containers, at an internal temperature of approximately 4°C, to the analytical laboratory (refer to SOG-3).

B.4 Equipment Cleaning

Prior to collection of each soil sample, the sampling equipment should be either steamcleaned or hand washed. If the sampling equipment is hand washed, wash excavation equipment with a brush, in a solution of high purity phosphate-free soap and potable water. Rinse the equipment with potable water and methanol, and/or 0.1N nitric acid, as appropriate. Follow this with double-rinsing using distilled water (refer to SOG-12).

B.5 Investigation-Derived Residuals

If sufficient volumes of soil cuttings and other residuals are generated, contain the material in appropriately labeled containers for disposition by the client. All soil samples transported to the laboratory must be returned to the client for disposition if required by the laboratory. Kennedy Jenks is available to assist the client with options for disposition of residuals.

Appendix B: Standard Operating Guideline
SOG-3: Procedures for Using a PID Vapor Analyzer

B.1 Introduction

This guideline identifies the procedures that will be used by Kennedy Jenks personnel during operation of a photo ionizing detector (PID) vapor analyzer or Organic Vapor Monitor (OVM).

B.2 Equipment

- H-Nu model P-10 or Thermo Analytical Model 580A PID Organic Vapor Analyzer
- Calibration gas with regulator, tubing
- Pint plastic jars
- Aluminum foil
- Small screw driver

B.3 Procedures

1. Check battery charge level. If in doubt, charge battery as described in manual. Battery should typically be recharged daily after use.

2. Turn unit on. DO NOT look into sensor (ultraviolet radiation hazard).

3. The probe or pump should make an audible sound (whine or click) confirming operation.

4. Perform zero and calibration procedures as described in operating manual. Calibration for specific compounds can be performed so instrument response is proportional to the calibration gas concentration. Isobutylene calibrant is available and response factors for other compounds are provided in the instrument manual.

5. The PID does not detect methone and many compounds with an ionization potential greater than the lamp energy (typically about 10 eV). Consult the operation manual reference for ionization potentials and response factors for common compounds.

6. If so equipped, set alarm at desired level.

7. Once calibrated, unit is ready for use.

8. Position intake assembly should be in close proximity to area in question as sampling rate only allows for localized readings.

9. A slow, sweeping motion of the intake assembly will help prevent the bypassing of problem areas.

10. For screening soil samples in the field refer to the headspace method described in SOG-5.

11. Be prepared to evacuate the area if preset alarm sounds.

12. Static voltage sources; such as power lines, radio transmissions, or transformers; may interfere with measurements. See operating manual for discussion of necessary considerations.

13. Regular cleaning and maintenance of instrument and accessories will ensure representative readings.

14. As with any field instrument, accurate results depend on the operator being completely familiar with the operator's manual for unit use.

15. Moisture may affect readings.

16. The PID is capable of recording readings at a determined rate which are logged and downloaded to a computer. Refer to manual for instructions on how to use this feature.

B.4 References

HNU Systems, Inc. 1975. *Instruction Manual for Model PI 101 Photoionization Analyzer*.

OVM - SM 580 Instruction Manual, Thermo-Analytical.

Appendix B: Standard Operating Guideline
SOG-4: Borehole Logging

Introduction

This Standard Operating Guideline (SOG) provides the procedures typically followed by Kennedy Jenks personnel for classifying soils and preparing boring logs and other types of soil reports. The purpose of this SOG is to facilitate the acquisition of uniform descriptions of soils encountered during borehole programs and to promote consistency in the logging practices used by Kennedy Jenks personnel. This SOG provides guidance on procedures that are generally consistent with standard practices used to classify soils. Deviations from, and additions to, the procedures described herein may be appropriate based on project-specific objectives, site-specific conditions, and/or regulatory requirements. The user of this SOG should modify the sampling procedures used, as appropriate, to conform to the project-specific requirements and then document such deviations from this SOG in the project-specific documentation of subsurface exploration activities.

Borehole logging is the systematic observation and recording of geologic and hydrogeologic information from subsurface borings and excavations. The Unified Soil Classification System (USCS) (ASTM D2487-00) is used to identify, classify, and describe soils principally for engineering purposes, and is based on laboratory tests.

For field applications, ASTM D2488-06 (Visual-Manual Procedure) is used as the general guide adopted under this SOG.

Both ASTM D2487 and ASTM D2488 utilize the same group names and symbols. However, soil reports should state that boring logs are not formal USCS laboratory determinations but are based on the visual-manual procedures described in ASTM D2488.

This SOG contains the following sections:

- Field Equipment/Materials
- Typical Procedures
  - Soil Classification
  - Classification of Coarse-Grained Soil
  - Classification of Fine-Grained Soil including Organic Soils
- Other Logging Parameters
- Logging Refuse
- References.

Field Equipment/Materials

Material/equipment typically required for classifying soils and preparing boring logs may include:

- Pens, pencils, waterproof pens, and field logbook or other appropriate field forms (e.g., boring log forms), water-tight field case.

- Daily inspection report forms

- USCS (ASTM D 2488-06) table and classification chart
- Soil color chart (i.e., Munsell) If used, the edition of the Munsell chart should be specified on each borehole log as the color descriptions and hue, color values and chromas have changed between editions. Also, whenever possible, the newest version of Munsell's color charts should be used due to fading of color chips over time.
- American Geological Institute (AGI) Data Sheets
- Graph paper
- Engineer's scale
- Previous project reports and boring logs (if available)
- Pocket knife or putty knife
- Hand lens
- Supply of clean water
- Dilute hydrochloric acid (HCl) (make sure and MSDS for HCl is included in the project HASP)
- Aluminum foil, Teflon® sheets, and paper towels
- Sample containers (brass, stainless steel or aluminum liners, plastic or glass jars)
- Clean rags or paper towels
- Sample shipping and packaging supplies
- Personnel and equipment decontamination supplies
- Personal protective equipment as described in the Health and Safety Plan (HASP).

Typical Procedures

Soil classification and borehole logging should be conducted by a qualified geologist, engineer; or other personnel trained and experienced in the classification of soils.

Soils are typically logged in conjunction with advancing boreholes and sampling subsurface soils. Although the guideline focuses on classifying soil samples obtained from boreholes, this particular procedure also applies to soils and sediments collected using other techniques (e.g., post hole digger, scoop, Ekman, Ponar, or Van Veen grab samplers, and backhoe).

The USCS as described in ASTM D2488-06 categorizes soils into 15 basic group names, each with distinct geologic and engineering properties. The following steps are required to classify a soil sample:

1. Observe basic properties and characteristics of the soil. These include grain-size grading and distribution and influence of moisture on fine-grained soil.

2. Assign the soil a USCS classification and denote it by the standard group name and symbol.

3. Provide a written description to differentiate between soils in the same group, if necessary.

Many soils have characteristics that are not clearly associated with a specific soil group. These soils might be near the borderline between groups, based on either grain-size grading and distribution, or plasticity characteristics. In this case, assigning dual group names and symbols might be appropriate (e.g., GW-GC or ML-CL).

The two basic soil groups are:

1. **Coarse-Grained Soils –** For soils in this group, more than half of the material is larger than No. 200 sieve (0.074 mm).

2. **Fine-Grained Soils (including Organic Soils) –** For soils in this group, one half or more of the material is smaller than No. 200 sieve (0.074 mm).

Note: No. 200 sieve is the smallest size that can be seen with the naked eye.

Classification of Coarse-Grained Soils

Coarse-grained soils are classified on the basis of:

1. Grain size and distribution

2. Quantity of fine-grained material (i.e., silt and clay)

3. Character of fine-grained material

Classification uses the following symbols:

Basic Symbols	**Modifying Symbols**
G - gravel	W - well graded
S - sand	P - poorly graded
	M - with silt fines
	C - with clay fines

The following are basic facts about coarse-grained soil classification:

- The basic symbol G is used if the estimated volume percentage of gravel is greater than that for sand. In contrast, the symbol S is used when the estimated volume percentage of sand is greater than the percentage of gravel.

- Gravels include material in the size range from 3 inches to 0.2 inch (i.e., retained on No. 4 sieve). Sand includes material in the size range from 0.2 inches to 0.003 inches. Use the grain size scale used by engineers (ASTM Standards D422-63 and D643-78) to further classify grain size as specified by the USCS.

- Although not specifically treated in ASTM D2488-06, cobbles range in size from 3 inches to 10 inches and boulders refer to particles with a single dimension greater than 10 inches. They are included here for the purpose of completeness and for their hydrogeologic significance.

  Note: The ASTM grain size scale differs from the Modified Wentworth Scale used in teaching most geologists. Also, it introduces a distinction between sorting and grading (i.e., well graded equals poorly sorted and poorly graded equals well sorted.)

- The modifying symbol W indicates good representation of a range of particle sizes in a soil.
- The modifying symbol P indicates that there is a predominant excess or absence of particle sizes.
- The symbol W or P is only used when a sample contains less than 15 percent fines.
- Modifying symbol M is used if fines have little or no plasticity.
- Modifying symbol C is used if fines have low to high plasticity (clayey)

The following rules apply for the written description of the soil group name:

Types of Soil	**Rule**
Sands and gravels (clean)	Less than 5 percent fines
Sands (or gravels) with fines	5 to 15 percent fines
Silty (or clayey) sands or gravels	Greater than 15 percent fines

- Other descriptive information may include:
  - Color (e.g., Munsell Soil Color chart, specify edition). Soil color is named and coded using the Munsell Soil Color chart if required for the project. The code should be in parentheses immediately following the written description. Presence of mottling and banding is also recorded. For example, “dk brn (7.5 YR, 3/4).”
  - Relative Density/Penetration Resistance. For cohesionless materials use very loose, loose, medium, dense, or very dense estimated from drive sample hammer blows or other field tests. Blow counts may be used, if reliable.
  - Maximum grain size (fine, medium, coarse, as described in AGI data sheets or USCS). Note the largest cross-sectional dimension measured in tenths of an inch for grains larger than sand size.
  - Composition of grains (mineralogy)
  - Approximate percentage of gravel, sand, and fines (use a percentage estimation chart as provided in the AGI data sheets)

Modifiers	**Description**
Trace	Less than 5 percent
Few	5 to 10 percent
Little	15 to 25 percent
Some	30 to 45 percent
Mostly	50 to 100 percent

- Angularity (round, subround, angular, subangular)
- Shape (flat or elongated)
- Moisture Condition (dry, moist, wet)
  - Dry - Absence of moisture to the touch.
  - Damp - Contains enough water to keep the sample from being brittle, dusty or cohesionless; is darker in color than the same material in the dry state.
  - Moist - Leaves moisture on your hand, but displays no visible free water.
  - Wet - Displays visible free water.
- HCI Reaction (none, weak, strong)
- Cementation (Crumbles under finger pressure: weak, moderate, or strong)
- Range of Particle Sizes (sand, gravel, cobble, boulder)
- Maximum Particle Size (fine, medium, coarse)
- Cementation (weak, moderate, or strong)
- Hardness (breaks with hammer blow)
- Structure (stratified, laminated, fissured, slickensided, blocky, lensed, homogeneous)
- Organic material
- Odor
- Iridescent sheen (based on sheen test)
- Debris (e.g., paper, wood, plastic, cloth, concrete, construction materials, etc.).
- Additional Comments (e.g., roots or rootholes, difficult drilling, borehole caving, presence of mica, contact and/or bedding dip, bedding features, sorting, structures, fossils, cementation, geologic origin, formation name, minerals, oxidation, etc.

Classification of Fine-Grained Soils

Fine-grained soils are classified on the basis of:

1. Liquid limit
2. Plasticity

Classification uses the following symbols:

Basic Symbols	**Modifying Symbols**
M - silt	L - low liquid limit
C - clay	H - high liquid limit
O - organic	
Pt - peat	

The following rules apply for the written description of the soil group name:

Types of Soil	Rule
Silts and clays with sand and/or gravel	5 to 15 percent sand and/or gravel
Sandy or gravelly silts or clays	Greater than 15 percent sand and/or gravel

The following are basic facts about fine-grained soil classification:

- The basic symbol M is used if the soil is mostly silt, while symbol C applies if it consists mostly of clay. Use of symbol O indicates that organic matter is present in an amount sufficient to influence soil properties. The symbol Pt indicates soil that consists mostly of organic material.

- Modifying symbols are based on the following hand tests conducted on a soil sample:

  - Dry strength (crushing resistance : none, low, medium, high, very high)
  - Dilatancy (molded ball reaction to shaking: none, slow, rapid)
  - Toughness (resistance to rolling or kneading near plastic limit : low, medium, high)
  - Plasticity (nonplastic, low, medium, high).

- Soil designated ML has little or no plasticity and can be recognized by none to low dry strength, slow to rapid dilatency, and low toughness.

- CL (lean clay) indicates soil with medium plasticity, which can be recognized by medium to high dry strength, no or slow dilatency, and medium toughness.

- OL is used to describe an organic, fine-grained soil that is less plastic than CL soil and can be recognized by low to medium dry strength, medium to slow dilatency, and low toughness. In some cases, it may be possible to differentiate organic silts (OL) from organic clays (OH), based on correlations between dilatancy, dry strength, toughness, or laboratory tests.

- MH soil has low to medium plasticity and can be recognized by low to medium dry strength, no to slow dilatency, and low to medium toughness.

- Soil designated CH (fat clay) has high plasticity and is recognizable by its high to very high dry strength, no dilatency, and high toughness.

- OH is used to describe an organic fine-grained soil that is less plastic than CH soil and can be recognized by medium to high dry strength, slow dilatency, and low to medium toughness. In some cases, it may be possible to differentiate organic silts (OL) from organic clays (OH), based on correlations between dilatancy, dry strength, toughness, or laboratory tests.

Note: PT (peat) is used to describe a highly organic soil composed primarily of vegetable tissue with a fibrous to amorphous texture, usually a dark brown to black color, and an organic odor.

- Other descriptive information includes:
  - Color (e.g., Munsell) Soil color is named and coded using the Munsell Soil Color chart if required for the project. The code should be in parentheses immediately following the written description. Presence of mottling and banding is also recorded. For example, "reddish brn (5YR, 4/4)."
    - Moisture condition,
  - Omit moisture terms below the regional water table and when drilling with mud or air-mist rotary systems.
  - Consistency (thumb penetration test: very soft, soft, firm, hard, very hard . For fine sediments use very soft, soft, medium, stiff, very stiff, and hard.) These are estimated from drive sample hammer blows or other field tests. Blow counts may also be used, if reliable.
    - Structure (same descriptors as coarse grain)
    - Compactness (loose, dense) for silts
    - Odor
    - Iridescent sheen (based on sheen test)
    - Debris (e.g., paper, wood, plastic, cloth, concrete, construction materials, etc.).
    - HCl Reaction (none, weak, strong).
  - Additional Comments (e.g. roots or rootholes, difficult drilling, borehole caving, presence of mica, , contact and/or bedding dip, bedding features, cementation, structures, fractures, fracture fillings, fossils, formation name, minerals, oxidation).

Fine-Grained Rock Description

- Textural Classification
- Color. Rock color is named and coded using the Geological Society of America rock color chart. The code should be in parentheses immediately following the written description. Presence of mottling and banding is also recorded. For example, "gry grn (5G, 5/2)."
- Hardness. Very hard, hard, medium, soft, very soft..
- Moisture Content. Dry, damp, moist, wet (saturated).
- Size Distribution. Approximate percentage of gravel, sand, and fines (silt and clay).
- Estimated Permeability. Very low, low, moderate, or high. This is based primarily on grain size, sorting, and cementation. Estimate secondary permeability due to natural rock fractures when applicable.
- Miscellaneous. Odor, contact and/or bedding dip, cementation, bedding, inclusions, secondary mineralization, fossils, structures, formation name, and fractures.

- Fractures are identified by depth, angle, width, and associated mineralization if applicable. The interpretation of the fracture type (i.e., as natural [N], coring induced [CI], or handling induced [HI]) should be stated. For example, “NF @90.8', 25 deg to axis, 0.1” wide, minor calcite.”

- Coarse-Grained Rock Description

- Textural Classification.

- Color. Rock color is named and coded using the Geological Society of America rock color chart. The code should be in parentheses immediately following the written description. Presence of mottling and banding also is recorded. For example, “gry olive grn (5GY, 3/2).”Hardness. Very hard, hard, medium, soft, very soft.

- Moisture Content. Dry, damp, moist, and wet (saturated).

- Size Distribution. Approximate percentage of gravel, sand, and fines (silt and clay).

- Grain Shape. Angular, subangular, subrounded, rounded, or well-rounded, for grains larger than sand size.

- Grain Size. The largest cross-sectional dimension measured in tenths of an inch for grains larger than sand size.

- Miscellaneous. Odor, contact and/or bedding dip, cementation, bedding, inclusions, secondary mineralization, fossils, structures, formation name, and fractures.

- Fractures are identified by depth, angle, width, and associated mineralization, if applicable. The interpretation of the fracture type (i.e., as natural [N], coring induced [CI], or handling induced [HI]), should be stated. For example, “NF @126.1', 35 deg to axis, 0.1” wide, minor calcite.”

Other Logging Parameters

Rock Quality Designation

This designation generally follows ASTM D6032-08 Standard Test Method for Determining Rock (RQD) of Rock Core.

The RQD denotes the percentage of intact and sound rock retrieved from a borehole of any orientation. All pieces of intact and sound rock core equal to or greater than 100 mm (4 in.) long are summed and divided by the total length of the core run. This method is generally applied to core barrel samples.

Standard Penetration Tests

This method generally follows ASTM D1586-08A Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils. This method provides a means of assigning a relative density to the soil by counting the number of hammer blows (blow counts) required to advance a split-barrel sampler a specified distance into the undisturbed soil ahead of the lead auger. This method is not applicable to boreholes advanced with direct-push sampling equipment. It is used primarily in conjunction with hollow stem auger drilling apparatus as the test can be performed through the auger string without removal of the augers thereby allowing the borehole to remain open to the bottom of the drill string without risk of caving. As the sampler is advanced by the repeated drop of a hammer of known weight, the blow counts are recorded on the log and used to provide a relative density descriptor to the soil penetrated during the test.

The number of blows required to drive the sampler 6 inches by a 140-lb hammer falling 30 inches. Fifty blow counts per 6-inch drive is considered “refusal,” and sampling at this depth is usually terminated. In addition, a total of 100 blow counts per 18-in. drive, or no observed advance of the sampler during ten successive hammer blows, is also considered “refusal.” During coring, leave this section blank. Normally, the second and third 6-inch intervals are recorded and added as the number of blows per feet.

Sampler Type/Depth. Give sampler type by the letter code listed below and identify the depth at the top of the sampling interval in feet below ground surface (bgs).

Sampler type	Inside diameter(in.)	Code
Standard penetrometer	1.38	SP
Split-barrel (small)	2.0	SBS
Split-barrel (large)	2.5	SBL
HQ wireline core	2.3	PC

Those descriptors are as follows for coarse grained soils:

Very Loose	0 to 3 SPT Sampler	0 to 4 Mod CA Sampler
Loose	4 to 7 SPT Sampler	5 to 10 Mod CA Sampler
Medium Dense	8 to 23 SPT Sampler	11 to 30 Mod CA Sampler
Dense	24 to 38 SPT Sampler	31 to 50 Mod CA Sampler
Very Dense	> 38 SPT Sampler	>50 Mod CA Sampler

Relative Density Descriptors for fine grained soils are as follows:

Very Soft	<1 SPT Sampler	0 to 1 Mod CA Sampler
Soft	1 to 3 SPT Sampler	2 to 4 Mod CA Sampler
Firm	4 to 6 SPT Sampler	4 to 8 Mod CA Sampler
Stiff	7 to 12 SPT Sampler	8 to 15 Mod CA Sampler
Very Stiff	13 to 23 SPT Sampler	15 to 30 Mod CA Sampler
Hard	> 23 SPT Sampler	>30 Mod CA Sampler

Regardless of the degree of adherence to the ASTM Standard Method, split barrel samplers are used as the preferred method of undisturbed sample acquisition in a hollow stem auger drilling. Upon retrieval of the sampler from the borehole, the sampler should be opened without making contact with its interior contents and the logging personnel should record the percent recovery or length of the sample recovered. Sample containers should be removed with a clean gloved (gloves may not be needed, depending upon requirements of HASP) hand and placed in a clean, dry area for examination and logging. The sample will be described per the above. Any lithologic changes that may be observable in the exposed ends of the intact core over the sampled interval should be recorded on the log before any disturbance thereof. The depth of the lithologic changes should be estimated and recorded on the boring log. The least disturbed sample container of the two deeper six-inch sample increments should be secured with Teflon® or aluminum end sheets and snug fitting plastic end caps, sealed with silicon tape, depending upon testing, sampler may be filled with one inch rings instead of 6 inch. Sealing material should also be compatible with subsequent testing requirements.

Ambient Temperature Head-Space:

Organic vapor analyzers such as photoionization detectors (PIDs) or flame ionization detectors (FIDs) are generally used to assess the relative concentration of volatile hydrocarbons in the soil as the borehole is advanced and recorded as a value in parts per million on the boring log. This can be done by placing a uniform amount of soil in a Ziploc® bag, glass jar or other clean container, allowing the soil in the container to equilibrate to the ambient temperature, then inserting the probe of the PID or FID into the sealed container and recording the maximum PID or FID reading.

Non-Aqueous Phase Liquid (NAPL) Containing Soil

Appropriate observations of NAPL containing soil should include the following:

Appearance: If a separate phase liquid appears to be present, it might be described as “dark brown viscous fluid or liquid observed in the soil matrix.” This remark should follow the lithologic description in the borehole log. Observations of color should be made such as “black streaks” or “mottled gray to “olive brown”, however, it should not be inferred or remarked that the color is a necessary consequence of petroleum staining.

Odor: If the soil smells like petroleum it might be remarked that it has a “petroleum like” or “solvent like” odor. The use of terms like “strong” or “slight” should be avoided because there is no way to ensure that these terms can be applied uniformly in the field between various persons performing the logging (i.e., each person’s olfactory sense is different). The use of terms like “chemical odor” should also be avoided as there is no common reference point. Notations regarding the type of petroleum distillate present (e.g., “diesel-like odor” or “gasoline odor”) are inappropriate as these are determination s that can only be accurately made by laboratory analysis.

Logging Refuse

This procedure applies to the logging of subsurface samples collected from a landfill or other waste disposal sites:

1. Observe refuse as it is brought up by the hollow stem auger, bucket auger, or backhoe.

2. If necessary, place the refuse in a plastic bag to examine the sample.

3. Record observations according to the following:

   a. Composition (by relative volume), e.g., paper, wood, plastic, cloth, cement, construction debris. Use such terms as "mostly" or "at least half." Do not use percentages.

   b. Moisture content: dry, damp, moist, wet.

   c. State of decomposition: highly decomposed, moderately decomposed, slightly decomposed, etc.

   d. Color: obvious mottling included.

   e. Texture: spongy, plastic (cohesive), friable.

   f. Odor.

   g. Combustible gas indicator readings (measure downhole).

   h. Miscellaneous: dates of periodicals and newspapers, degree of drilling effort (easy, difficult, very difficult).

References

Grain Size Scale Used by Engineers. ASTM D422-63 and ASTM D643-78.

Compton, R. R. 1962. *Manual of Field Geology*. New York: John Wiley & Sons, Inc.

International Society for Rock Mechanics. Commission on Classification of Rocks and Rock Masses. Int. J. Rock Mech. Min. Sci. & Geomech. Abstr. 1981, Vol. 18, pp. 85-110, Great Britain.

Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils. ASTM D1586-08A

Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). ASTM D2488-06.

Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System. ASTM D2487-00

Standard Test Method for Determining Rock Quality Designation (RQD) of Rock Core. ASTM D6032-08.

U.S. Department of the Interior. 1989. *Earth Manual*. Washington, D.C.: Water and Power Resources Service.

Appendix B: Standard Operating Guideline
SOG-5: Boring and Subsurface Soil Sampling

B.1 Introduction

This guideline describes the equipment and procedures that are used by Kennedy Jenks personnel for drilling and collecting soil samples.

B.2 Equipment

- Drill rigs and associated drilling and sampling equipment as specified in work plan:
  - Hollow stem auger
  - Air-rotary casing hammer
  - Dual tube percussion hammer
  - Cable tool
  - Mud rotary
  - Reverse rotary
- CME, 5 ft x 94 mm continuous-core barrels (hollow-stem auger)
- 2.5-inch or 2.0-inch I.D. split-spoon drive sampler
- 2.5-inch or 2.0-inch brass liners and sealing materials (plastic end caps, Teflon seals, silicon tape, zip-lock plastic bags)
- Large capacity stainless steel borehole bailer
- Foxboro FID-Organic Vapor Analyzer (OVA)
- HNU PID-Organic Vapor Analyzer
- OVM
- Sampler cleaning equipment
  - Steamcleaner
  - Generator
  - Stiff-bristle brushes
  - Buckets
  - High purity phosphate-free liquid soap, such as Liquinox
  - Methanol (if necessary)
  - 0.1N nitric acid (if necessary)
  - Deionized water
  - Potable water
- Insulated sample storage and shipping containers
- Personal protective equipment (refer to project site safety plan)

B.3 Typical Procedure

1. Obtain applicable drilling and well construction permits prior to mobilization.

2. Clear drilling locations for underground utilities and structures by Underground Service Alert (USA) and subcontractors.

3. Have all downhole equipment steam-cleaned prior to drilling each boring.

4. Ensure that soil borings not to be completed as monitoring wells are drilled with an auger drill rig, using hollow stem augers of appropriate size.
5. Make sure that borings not completed as monitoring wells are grouted to the surface, using a neat cement-bentonite grout (containing approximately 5 percent bentonite).
6. Ensure that borings made to construct shallow monitoring wells are drilled with an auger drill rig that uses hollow stem augers of appropriate size to provide an annular space of a minimum of 2 inches between borehole wall and well casing.
7. Verify that drill borings used to construct deeper monitoring wells are drilled with a dual tube percussion hammer or air-rotary casing hammer, using a steel drive casing of appropriate size, or with hollow stem augers through a steel conductor casing.
8. Collect soil samples for lithologic logging purposes with a CME continuous coring system in 5-foot increments.
9. Collect soil samples for lithologic logging and chemical and physical analyses by driving a split-spoon drive sampler, in 2.5- to 5-foot increments, below the depth of the auger bit with a rig-mounted hammer. Record the standard penetration resistance. If the sample is pushed rather than driven, be sure to record the push force.
10. When drilling with air-driven drill rigs, collect soil samples for lithologic logging purposes from the cyclone separator discharge on the dual tube percussion hammer, which separates air from formation cuttings as the drive casing is advanced.
11. Have the soils classified in the field in approximate accordance with the visual-manual procedure of the Unified Soil Classification System (ASTM D-2488-90) and the Munsell Color Classification.
12. Prior to each sampling event, wash the split-spoon drive sampler and brass liners with high purity phosphate-free soap, and double-rinse them with deionized water and methanol and/or 0.1N nitric acid, as appropriate.
13. At each sampling interval, collect soil in one brass liner for potential laboratory analysis. Cover this sample in Teflon sheets, seal it with plastic caps, and wrap it with silicon tape. Place a completed sample label on the brass liner. Then see that the samples are placed in appropriate containers and stored at approximately 4°C.
14. As a field screening procedure (if applicable), at each sampling interval put the soil from one of the brass liners into an airtight container and allow it to equilibrate. After this, use an OVA to monitor the headspace in the container. If significant organic vapors are detected with the OVA, save the appropriate brass sample liners for potential laboratory analysis.
15. Complete chain-of-custody forms in the field and transport the samples in insulated containers, at an internal temperature of approximately 4 °C, to the selected laboratory.
16. If applicable, as described in the site safety plan, use an OVA to analyze in situ air samples from the breathing zone, the inside of the augers or casing, and other locations as necessary.

B.4 Installation and Testing of Isolation Casing

1. Upon completion of the initial small-diameter boring, use a rotary drill bit of appropriate diameter to ream the boring to a depth (to be determined). Use a bentonite mud mixture, in accordance with standard drilling practice, to maintain hole stability and to minimize infiltration and development of a mud cake on the borehole wall.

2. When reaming is completed, install isolation casing in the boring. Use conductor casing of an appropriate grade of 14-inch diameter steel with a wall thickness of 0.25 inch, per the following specifications:

   a. Sections are 20, 10, or 5 feet in length.

   b. Casing sections are beveled or butt-jointed.

   c. Field joints are arc-welded with 70 percent weld penetration, having a minimum of two passes per circumference.

   d. Welding rod is compatible with casing material.

   e. Joints are watertight.

   f. Casing centralizers are set on the bottom, middle, and top of the total casing length. Centralizers are installed in sets of four, spaced at 90°, and attached at the bottom by a tack weld. They are flanged 2 inches at the top and bottom to contact the borehole wall.

3. Make volumetric calculations prior to grouting, to estimate the total volume of grout required to fill the annular space. The amount of grout actually used must be compared with this estimate. Ensure that the grout meets the following specifications:

   a. Volumes of grout used must be within 10 percent of estimated value.

   b. The grout consists of ASTM C150 Type II cement and water at a ratio of 5 gallons of water per 94 lb sack of cement, weighing approximately 118 lbs per foot. Approximately 5 lb of powdered bentonite for each sack of cement is mixed into the grout.

4. Note that leakage tests or a bond log might be required to validate the grout seal.

5. Grout conductor casing into place by one of the following methods:

   a. Pressure-grout from the bottom of the casing, using a packer or Braden-head to force the grout into the annular space between the conductor casing and the borehole wall.

   b. Fill the casing with grout and use a spacer plug apparatus to force the grout into the annular space between the conductor casing and the borehole wall. The spacer plug must be composed of a material that can be left in the boring and later drilled through to complete it.

6. After allowing the grout to set, continue drilling with an appropriate diameter hollow stem auger. A rotary bit can be used initially to drill through any grout that might have hardened in, or directly below, the casing.

B. 5 Equipment Cleaning

1. Prior to drilling each boring, steamclean downhole equipment (augers, well casing, sampler).

2. Before collection of each drilling sample, steamclean or wash sampling equipment (sampler and brass liners) with a brush, in a solution of high purity phosphate-free soap and potable water. Rinse the equipment with potable water and methanol and/or 0.1N nitric acid, as appropriate. Follow this with double-rinsing using distilled water.

3. Before leaving the site at completion of drilling, steamclean downhole equipment and vehicles that require cleaning.

B.6 Investigation-Derived Residuals

Place soil cuttings and other residuals in appropriately labeled containers for disposition by the client. All soil samples transported to the laboratory must be returned to the client for disposition. Kennedy Jenks is available to assist the client with options for disposition of residuals.

Appendix B: Standard Operating Guideline
SOG-6: Well Construction and Development

B.1 Introduction

This guideline describes procedures used by Kennedy Jenks personnel for well construction and development following completion of boring and soil sampling procedures (described in Standard Operating Guideline, Boring and Subsurface Soil Sampling).

B.2 Well Construction Materials

- 2-inch or 4-inch Schedule 40 PVC blank casing
- 2-inch or 4-inch Schedule 40 PVC slotted casing, of appropriate slot size
- 2-inch or 4-inch Schedule 40 PVC threaded and slip caps
- 2-inch or 4-inch Schedule 40 stainless steel blank casing
- 2-inch or 4-inch Schedule 40 stainless steel wire wrapped casing, of appropriate slot size
- 2-inch or 4-inch stainless steel threaded and slip caps
- Stainless steel well centralizers
- 12-inch x 0.25-inch mild steel isolation casing with welded centralizers
- Hasp-locking standpipes
- Ground-level traffic-rated watertight well housing enclosure
- Locking expansion plugs
- Combination or key lock
- Filter pack sand (refer to Standard Operating Guideline, Design of Filter Packs and Selection of Well Screens for Monitoring Wells)
- Type I or II Portland cement
- Concrete
- Bentonite powder
- 0.25-inch bentonite pellets or chips.

A.1 Well Development Equipment

- 2-inch or 4-inch-diameter vented surge block
- 1-inch dedicated PVC hose for monitoring well development and purging
- Centrifugal surface pump
- Submersible pump (4-inch-diameter wells or larger)
- 55-gallon DOT-approved drums
- Teflon, stainless steel or PVC bailer
- Teflon-coated bailer retrieval wire
- Airlift pump with foot valve and compressor
- Bladder pump (2-inch diameter wells only).

B.3 Typical Procedure

1. Following completion of selected borings, install the monitoring well casing through the center of the hollow stem auger, drive casing, or open boring. The monitoring well consists of a PVC Schedule 40 slotted well casing of appropriate diameter and a blank casing with a threaded

bottom cap and a slip or threaded top cap or watertight expansion plug. The casing string must be held in tension during initial installation.

2. Place clean, well graded sand around the slotted section of the monitoring well to serve as the filter pack. The grade of sand is chosen on the basis of aquifer units encountered (refer to Standard Operating Guideline, Design of Filter Packs and Selection of Well Screens for Monitoring Wells). The filter pack is emplaced as the auger or temporary casing is removed from the boring.

3. Ensure that filter pack sand for the well extends to approximately 3 feet above the top of the screened interval.

4. If required in the well construction permit, notify the appropriate inspector prior to placing the well seal.

5. Place a 2- to 3-foot thick bentonite pellet seal above the sand pack, as the auger and/or casing is removed from the boring. If the seal is placed above the water table, the bentonite pellets must be hydrated with potable water prior to placement of the annular seal.

6. Fill the remainder of the annulus between the well casing and the borehole wall with cement/bentonite grout (with approximately 5 percent bentonite), or a high-solids bentonite slurry (11 to 13 pounds per gallon), to a depth of approximately 1 foot below ground surface. If the water level is higher than the seal, use a tremie pipe to place the grout.

7. Install either a threaded cap or a locking watertight expansion plug on the monitoring well. Place a steel hasp-locking well housing over the top of the well and cement it into the annulus of the boring.

8. Place a traffic-rated precast concrete or steel well enclosure approximately 1 to 2 inches above grade, and cement it into place with concrete. Have a concrete apron constructed around the well housing enclosure to facilitate runoff.

9. For aboveground completion, ensure that the well casing extends approximately 3 feet above ground surface. An 8-inch diameter hasp-locking steel well housing surrounds the well casing. Traffic bollards can be installed around the well housing as necessary.

10. Repeat Steps 1 through 9 for all monitoring wells at site.

11. Following the curing of the grout (approximately 24 hours), each monitoring well is developed. Prior to development activities, measure the depth in each well to static water level and total casing depth.

12. Also prior to well development, if applicable, check the water interface of each monitoring well for the presence of floating product (NAPL). Use a clear bailer or color indicator paste for the inspection.

13. If a monitoring well has a water level of less than 25 feet, it may be developed by using a centrifugal surface pump with dedicated 1-inch I.D. clear flex suction hose, placed with the hose intake placed temporarily at all levels of the screened interval. If the well is greater than 25 feet deep, a submersible pump or airlift pump with air filter is used for development. In either case, a

surge block of appropriate size can be moved up and down inside the screened section of the well casing to create a surging action that hydraulically stresses the filter pack.

14. During development of each well, ensure that field parameters and observations are recorded on a Kennedy Jenks purge and sample form (attached). Information to be recorded includes, but is not limited to, the following items:

    a. Depth to water

    b. Development time and volume

    c. Development (flow) rate

    d. pH, temperature, specific conductivity, and turbidity

    e. Other observations, as appropriate (e.g., color, presence of odors, or sheen)

15. Develop each monitoring well until water of relatively low turbidity is removed from the casing.

16. When development of each well is discontinued, record the following field parameters/observations:

    a. Depth to water

    b. Temperature

    c. pH

    d. Specific conductance

    e. Turbidity

    f. Color.

B.4 Investigation-Derived Wastes

Place groundwater produced by well development in appropriately labeled containers for disposition by the client. Kennedy Jenks is available to assist the client with options for disposition of groundwater.

Appendix B: Standard Operating Guideline
SOG-7: Measuring Groundwater Levels

B.1 Introduction

This guideline describes the field procedure typically followed by Kennedy Jenks when measuring groundwater levels. Groundwater levels in wells will be measured prior to commencing developing, purging, sampling, and pumping tests.

B.2 Equipment

- Electronic water level monitoring probe or other measuring device
- Decontamination supplies (e.g., buckets, Alconox, distilled water, squirt bottle)
- Field notebook
- Groundwater purge-and-sample form(s) if in conjunction with groundwater sampling
- Keys for locks (if necessary)
- Tools to open well covers (e.g., socket wrench, spanner wrench)
- Disposable gloves (as a minimum), and other protective clothing (as necessary).

B.3 Typical Procedure

1. If more than one well will be measured, begin depth measurement in the order in terms of lowest to highest chemical concentrations in the monitoring wells.

2. Remove well caps from all wells prior to initiation of water level measurement activities. This will allow wells to equilibrate, if necessary.

3. If the potential exists for floating product (LNAPL) to be present, use an electric oil-water interface probe or oil-sensitive paper to measure depth of the floating product and the electronic depth probe to measure the depth-to-water. Record both depths in field notebook and note the water depth as the "depth with oil layer present." Unless otherwise instructed, always measure depths to floating product layer and groundwater from the top of the north side of the well casing.

4. When floating product is not present, measure depth-to-water using a pre-cleaned water level probe from the top of the northern side of the well casing, unless otherwise instructed.

5. Repeat measurements a minimum of three times or have field partner confirm measurement.

6. Record time of day the measurement was taken using military time (e.g., 16:00).

7. Decontaminate water level and/or oil-water interface probe and line prior to reuse (refer to SOG-12, Equipment Cleaning).

Appendix B: Standard Operating Guideline
SOG-8: Groundwater Sampling

Introduction

This Standard Operating Guideline (SOG) provides the procedures typically followed by Kennedy Jenks personnel during the collection of groundwater samples from monitoring wells. Groundwater sampling from temporary boreholes (e.g., grab groundwater samples collected from direct push borings) is not addressed by this SOG. This SOG provides guidance on procedures that are generally consistent with standard practices used in environmental sampling. Federal, state, and/or local regulatory agencies may require groundwater sampling procedures that differ from those described in this SOG and/or may require additional procedures. As guidance, this SOG does not constitute a specification of requirements for groundwater sampling. Deviations from, and additions to, the procedures described herein may be appropriate based on project-specific sampling objectives, site-specific conditions, and/or regulatory requirements. The user of this SOG should modify the sampling procedures used, as appropriate, to conform to the project-specific requirements and then document such deviations from this SOG in the project-specific documentation of groundwater sampling activities.

This SOG does not address Quality Assurance/Quality Control (QA/QC) procedures for groundwater sampling in detail. While some general QA/QC procedures are addressed, project-specific QA/QC procedures should be developed and presented in a Quality Assurance Project Plan (QAPP), field sampling and analysis work plan, or other project- or activity-specific document.

This SOG contains the following sections:

- Field Equipment/Material
- Typical Procedures for Monitoring Well purging and Groundwater Sampling
- Stabilization Criteria for Adequacy of Monitoring Well Purging
- Typical Procedures for Groundwater Sampling using Passive Diffusion Bags (PDBs)
- Quality Control Guidance
- Investigation-Derived Waste (IDW) Management
- References

Field Equipment/Materials

Material/equipment typically required for the collection of groundwater samples from monitoring wells may include:

- Electric water-level monitoring probe
- Multi-phase interface monitoring probe

- Bladder pump, peristaltic pump, pre-cleaned, disposable, 2- or 4-inch bailers with disposable cord, inertial pump, submersible pump, passive diffusion bags or other suitable apparatus for purging the well and sampling
- Flexible discharge tubing [polyethylene (PE), Teflon™, or similar]
- Purge water collection container
- Multi-parameter water quality meter (temperature, pH, specific conductance, redox potential)
- Turbidity meter
- Flow-through cell
- Nitrocellulose filters (if conducting field filtering)
- Sample containers (laboratory-supplied) with appropriate preservatives
- Additional chemical preservatives (if necessary)
- Watch or stopwatch
- Sample labels, pens, field logbook, or other appropriate field forms (e.g., groundwater purge and sample forms, chain-of-custody forms), and access agreements and third-party sample receipts (if warranted)
- Previous purging and sampling data for monitoring wells to be sampled, including water levels, purging parameters, and laboratory analysis results.
- Monitoring well boring and construction log (including wellhead elevation survey and reference point information)
- Personnel and equipment cleaning supplies
- Sample shipping and packaging supplies
- Personal protective equipment as specified in the Health and Safety Plan (HASP).

Typical Procedures for Monitoring Well Purging and Groundwater Sampling

1. **Pre-Purging Data Collection and Purging Equipment Placement.** Record the data and information collected during this procedure on a groundwater purge and sample form. Perform the following prior to groundwater sampling:
   a. Calibrate the multi-parameter water quality meter, prior to beginning sampling and as necessary based on field conditions, in accordance with the instructions in the manufacturer's operation manual. Note that it may be appropriate to keep a written log of the calibration procedures and an instrument maintenance with the instrument.
   b. Examine the monitoring well to be sampled and associated protective surface enclosure for any structural damage, poorly fitting caps, and leaks into the inner casing. If notable conditions exist, they should be recorded on the sampling log

for the well so that any necessary follow-up corrective actions can be planned and implemented.

c. Record an initial measurement of the depth to water. Calculate the volume of water in the well casing if wetted-casing-volume-based purging is to be used to remove the so-called “stagnant water” from the well prior to sampling. The volume of water in the wetted well casing should be calculated using the formula: $V = (\pi r^2) \times L$ where r is one half of the inner diameter of the well casing/screen and L is the length of wetted casing/screen (calculated by subtracting the depth to water from the total well depth). Total well depth should not be measured at the start of a sampling event (due to the potential to cause turbidity). Measure the total well depth after sample collection. Note that some regulatory agencies require that the calculated “stagnant water” volume include the water contained in the pores space of the wetted portion of the monitoring well filter pack in addition to the casing/screen. If this is a requirement, it should be defined in the project-specific sampling requirements.

d. If light non-aqueous phase liquid (LNAPL) is potentially present, measure the depth and thickness of the LNAPL and the static water level using a multiphase interface monitoring probe. Use one of the following devices for purging:

a. Bladder pump: adjust the pump intake at a depth approximately equal to the middle or just slightly below the middle of the well screen interval or water column unless another position is justified based on site-specific conditions.

b. Peristaltic pump: place the pump intake at a depth equal to the approximate middle or just slightly above the middle of the well screen interval or water column unless another position is justified based on site-specific conditions. Note: If degassing of water is occurring when sampling with a peristaltic pump, alternative types of sampling equipment should be used for volatile organic compound (VOC) or volatile petroleum hydrocarbon (VPH) sample collection.

c. Inertial pump: place the pump intake at a depth approximate to the middle or just slightly below the middle of the well screen interval or water column unless another position is justified based on site-specific conditions. Note: Some studies suggest that the use of inertial pumps for purging and/or sampling may produce a low bias when collecting samples for VOC and VPH analyses. This should be considered along with regulatory requirements when selecting an inertial pump for purging and/or sampling.

d. Submersible pump: place the pump intake at a depth approximate to the middle or just slightly below the middle of the well screen interval unless another position is justified based on site-specific conditions.

e. Pre-cleaned or disposable bailers. Note: The use of bailers for low-flow purging/sampling is not appropriate.

f. Another suitable purging/sampling device may be selected for use depending upon project requirements.

2. **Monitoring Well Purging and Sampling.** When purging of a monitoring well prior to sampling is appropriate and/or required, purge the well using either (a) wetted-casing-volume-based purging or (b) low-flow purging as described in the following sections. If a well exhibits evidence of slow recharge, or produces excessively silty water, etc., the well may need to be redeveloped.

   a. Wetted-casing-volume-based purging.

      (1) Establish a purging rate to pump or bail approximately three wetted-casing volumes of groundwater without dewatering the well.

      (2) If using a pump, set-up the discharge tubing, flow-through cell, water quality meter, and purge water collection container. If turbidity is measured, collect the sample for turbidity measurement after groundwater passes through the flow-through cell in the vial provided with the turbidity meter. If using a bailer, maintain a clean plastic container next to the well for collecting observation samples. Begin purging the well.

      (3) At the beginning of purging and periodically thereafter, record the following information and water quality parameters/observations on the groundwater purge and sample form: As guidance, field parameters may be measured after one purge volume is removed and every ½ purge volume thereafter.

         - Date and time
         - Purge volume and/or flow rate
         - Water depth
         - Temperature
         - pH
         - Specific conductance
         - Dissolved oxygen
         - Oxidation-reduction potential (ORP)
         - Other observations as appropriate (turbidity, color, presence of odors, sheen, etc.).

      (4) Continue purging until water quality parameters have stabilized (refer to “Stabilization Criteria for Adequacy of Monitoring Well Purging” below) and/or a minimum of three wetted-casing volumes of water have been removed from the well. If a well purges dry, let it recover to 80 percent of original water column, then sample. If the well takes a very long time to recover (i.e., longer than 2 hours), try to sample the well at the end of day or first thing the next day.

      (5) Collect the sample in pre-cleaned sample containers suitable for the laboratory analyses to be performed.

      (6) If sampling using a bailer, use a bottom-emptying device or other technique to avoid sample agitation. If the collected water is very turbid, or a bottom-emptying bailer is not used, properly transfer the water from the bailer into the appropriate sample containers. Be careful to avoid agitating the sample.

When sampling for VOCs, turn the bottle upside down after filling the container to identify possible headspace. If bubbles are present, top off the sample container or resample.

b. Low-flow purging and sampling.

(1) Place the pump intake at a depth equal to the approximate middle or just slightly above the middle of the well screen interval or water column or otherwise as dictated by well-specific soil stratigraphy and project-specific requirements**.** For example, it may be appropriate that the pump intake be set opposite to any preferential flow pathways (i.e., zones of higher permeability).

(2) Place an electronic water-level indicator probe in the well, approximately 0.5 to 3 inches below the piezometric surface. If available, a transducer of sufficient accuracy can also be used to measure depth to water when purging.

(3) Connect the pump discharge tube to a flow-through cell housing a water quality parameter probe.

(4) Activate the pump for purging at a flow rate ranging from approximately 0.1 to 0.5 liters per minute (L/min) or other flow rate as dictated by project-specific and/or site-specific requirements. (Note: Some regulatory agencies may require specific flow rates). Determine the flow rate by timing the rate at which the flow-through cell is filled.

(5) During purging, monitor the water level in the well to evaluate potential drawdown. The goal is to minimize drawdown to less than approximately 4 inches. If drawdown is observed (especially rapid drawdown at the beginning of purging), decrease the pumping rate.

(6) Measure water quality parameters at approximately 3- to 5-minute intervals during purging. Continue purging until water quality parameters have stabilized (refer to “Stabilization Criteria for Adequacy of Monitoring Well Purging” below).

(7) Immediately after purging, collect the sample in pre-cleaned sampled containers suitable for the laboratory analyses to be performed using the same flow rate that was used during purging unless it is necessary to decrease the rate to minimize aeration or turbulent filling of sample containers. If sampling for VOCs or VPH reduce the flow rate to 0.1 L/min or less.

3. **<u>Sampling with LNAPL Present in a Monitoring Well.</u>** Wells containing LNAPL are typically not sampled for dissolved phase constituents in groundwater due to the potential for entrainment of LNAPL in the aqueous sample matrix. If such sampling is required, and purging is not required, make sure the pump intake is placed in the upper 2 feet of water column and collect the samples without purging in a manner that reduces the potential for mixing of the groundwater sample with air or LNAPL. If groundwater sampling is required from wells containing LNAPL for the purposes of characterizing VOCs, and purging is required, purge the well prior to sampling unless or until LNAPL becomes entrained in the sampling apparatus. If LNAPL will likely become entrained in the groundwater, the sample should be collected without

purging. If LNAPL becomes entrained in the sampling apparatus then the sampling effort for VOCs should be aborted.

4. **<u>Field Filtering Groundwater Samples.</u>** Groundwater sample filtering and/or preservation should be performed in accordance with the requirements of the analytical method being specified and any other project-specific requirements. For example, samples collected for dissolved metals are typically filtered using a 0.45 μm filter.

5. **<u>Sample Collection Considerations.</u>** When multiple analyses will be performed, collect the samples in order of decreasing sensitivity to volatilization (i.e., VOC samples first and metals last). When sampling for VOCs, turn the sample container upside down after filling to identify possible headspace. If bubbles are present, top off the sample bottle or resample (do not reuse bottles, especially if they have been pre-preserved by the vendor or laboratory). If possible, the pump should not be moved or turned off between purging and sampling; however, the pump may need to be turned off for a very brief period (as a practical matter) so field personnel can handle samples and minimize the potential for water to splash on the ground surface. The ground surface should be protected from incidental splashing, especially if water from the well would be considered a hazardous waste for disposal purposes.

6. **<u>Monitoring Wells with Slow Recharge.</u>** If a well purges dry, let it recover to 80 percent of original water column, then sample. If the well takes a very long time to recover (i.e., longer than 2 hours), try to sample the well at the end of day or first thing the next day.

7. **<u>Sample Container Filling and Shipping.</u>** Fill the appropriate containers for the analyses to be requested and ensure that the required label information is completely and accurately filled in. Follow sampling packaging, shipping, and chain-of-custody procedures (see applicable SOG).

8. **<u>Cleaning.</u>** Follow personnel and equipment cleaning procedures (see applicable SOG).

Stabilization Criteria for Adequacy of Monitoring Well Purging

Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (EPA 2001) states that “with respect to groundwater chemistry, an adequate purge is achieved when pH, specific conductance, and temperature of groundwater have stabilized, and the turbidity has either stabilized or is below 10 Nephelometric Turbidity Units (NTUs). Wells should be considered stable when the criteria listed in the following table have been met for pH, specific conductance, temperature, and turbidity. Attempts should also be made to stabilize ORP and dissolved oxygen.

Field Parameters	Stabilization Criteria for Three or More Consecutive Readings	Notes
pH	Difference between three or more consecutive readings is within ±0.2 units	–
Temperature	Difference between three or more consecutive readings is constant	–

Field Parameters	Stabilization Criteria for Three or More Consecutive Readings	Notes
Specific Conductance	Difference between three or more consecutive readings is within ±3%	–
Turbidity	Difference between three or more consecutive readings is within ±10% or three consecutive readings below 10 NTUs	Generally, turbidity is the last parameter to stabilize. Attempts should be made to achieve stabilization; however, this may not be possible. It should be noted that natural turbidity in groundwater may exceed 10 NTUs. If turbidity is greater than 50 NTU, redevelopment of the well may be warranted.
ORP	Difference between three or more consecutive readings is within ±20mV	Very sensitive. Attempts should be made to achieve stabilization; however, due to parameter sensitivity this may not be possible.
Dissolved Oxygen	Difference between three or more consecutive readings is within ±10% or ±0.2 milligrams per liter (mg/L), whichever is greater	Very sensitive. Attempts should be made to achieve stabilization, especially when collecting samples of VOC analysis; however, due to parameter sensitivity this may not be possible.

Attempts should be made to achieve the stabilization criteria. Because of geochemical heterogeneities in the subsurface environment, stabilization of field parameters during purging may not always be achievable. If field parameter measurements do not indicate stabilization, continued conventional purging may be required until a minimum of three wetted-casing volumes have been removed. During low-flow purging of a well containing a large volume of casing water, it may be practical to discontinue low-flow purging and proceed with sampling if field parameters have not stabilized within a reasonable period. This judgment must be made on a site-specific/project-specific basis.

Typical Procedures for Groundwater Sampling Using Passive Diffusion Bags (PDBs)

Groundwater sampling using water-filled passive diffusion bag (PDB) samplers may be suitable for obtaining samples for VOC analysis. The suggested application of the method is for long-term monitoring of VOCs in groundwater wells at well characterized sites. (Note: The use of PDBs may not be suitable for the assessment of Tertiary Amyl Methyl Ether, methyl tert-butyl ether, methyl-isobutyl ketone, styrene, and acetone). The effectiveness of the use of a single PDB sampler in a well is dependent on the assumption that there is horizontal flow through the well screen and that the quality of the water in the well screen is representative of the groundwater in the aquifer directly adjacent to the screen. If there are vertical components of intrabore-hole flow, multiple intervals of the formation contributing to flow, or varying concentrations of VOCs vertically within the screened or open interval, then a multiple deployment of PDB samplers within a well may be more appropriate for sampling the well.

Typically, PDB samplers should not be used in wells having screened or open intervals longer than10 feet. If PDB samplers are to be used in wells with screened intervals of greater than 10 feet, then they are generally used in conjunction with borehole flow meters or other techniques to characterize vertical variability in hydraulic conductivity and contaminant distribution or used strictly for qualitative reconnaissance purposes. In larger well screens or in wells that may have vertical flow, the use of baffles should be considered.

Following are the procedures for deploying a PDB sampler.

1. **Acquire PDBs.** Obtain the pre-filled PDB samplers from the analytical laboratory. (The PDB samplers are prefilled at the laboratory with laboratory-grade deionized water. Unfilled PDB samplers can be obtained and filled in the field but this is not recommended.)
2. **Deploy PDBs in Monitoring Wells.** To deploy the PDB sampler in the well:
   a. Measure the well depth and compare the measured depth with the reported depth to the bottom of the well screen from well-construction records. This is to check whether sediment has accumulated in the bottom of the well, whether there is a non-screened section of pipe (sediment sump) below the well screen, and the accuracy of well-construction records.
   b. Attach the PDB sampler to a weighted line. (Sufficient weight should be added to counterbalance the buoyancy of the PDB sampler.) (Note: Stainless-steel or Teflon-coated stainless-steel wire is preferable, but rope can be used if it is of sufficient strength, non-buoyant, and subject to minimal stretching. However, the rope should not be reused due to the potential for cross contamination.) Additionally, to prevent cross-contamination, the weighted lines should not be reused in different wells.
   c. To prevent cross-contamination, he PDB samplers should not contact non-aqueous phase liquid (NAPL) during deployment or retrieval.
   d. Calculate the distance from the bottom of the well, or top of the sediment in the well, up to the point where the PDB sampler is to be placed.
   e. Attach the PDB sampler to the weight or weighted line at the target depth.
      1) For the field-fillable type of PDB sampler, the sampler is equipped with a hanger assembly and weight that can be slid over the sampler body until it rests securely near the bottom of the sampler.
      2) If using a coated stainless-steel wire as a weighted line, make loops at appropriate points to attach the upper and lower ends of PDB sampler.
      3) Where the PDB sampler position varies between sampling events, movable clamps with rings can be used.
      4) When using rope as a weighted line, tie knots or attach clasps at the appropriate depths. Nylon cable ties or stainless-steel clips inserted through the knots can be used to attach the PDB samplers.
   f. Lower the weight and weighted line down the well until the weight rests on the bottom of the well and the line above the weight is taut. The PDB samplers should now be positioned at the expected depth. (The depth can be checked by placing a knot or mark on the line at the correct distance from the top knot/loop of the PDB sampler to the top of the well casing and checking to make sure that the mark aligns with the lip of the casing after deployment.)

g. Secure the assembly. (A suggested method is to attach the weighted line to a hook on the inside of the well cap.)

h. Reattach the well cap. The well should be sealed in such a way as to prevent surface-water in-flow into the well.

i. Allow the system to remain undisturbed until the PDB sampler equilibrates. Laboratory and field data suggest that a 2-week equilibration time is probably adequate for most applications. Note: In less-permeable formations, longer equilibration times may be required.

3. **Recovering the PDBs.** Following the equilibration time, recover the PDB sampler from the monitoring well.

   a. Remove the PDB samplers from the well by using the attached line. The PDB samplers should not be exposed to heat or agitated.

   b. Examine the surface of the PDB sampler for evidence of algae, iron or other coatings, and for tears in the membrane. Note the observations in a sampling field book. If there are tears in the membrane, the sample should be rejected. If there is evidence that the PDB sampler exhibits a coating, then this should be noted in the report.

   c. Detach and remove the PDB sampler from the weighted line. Remove the excess liquid from the exterior of the bag to minimize the potential for cross contamination.

4. **Sample Container Filling and Shipping.** Transfer the water from the PDB sampler to sample container. This is typically accomplished by carefully cutting a small hole in the bag and directing the flow into the sample container. Some commercially available PDB samplers provide a discharge device that can be inserted into the sampler. When transferring the sample to the sample container, minimize agitation. Ensure that the required label information is completely and accurately filled in. Follow sampling packaging, shipping, and chain-of-custody procedures (see applicable SOG).

5. **Cleaning.** Follow personnel and equipment cleaning procedures (see applicable SOG).

Quality Control Guidance

Follow the quality control requirements specified in the Quality Assurance Project Plan (QAPP), project-specific field sampling and analysis work plan, and/or project-specific regulatory requirements, as applicable. The following may be used as guidelines.

1. Approximately one duplicate sample should be obtained for each sampling event or for each batch of samples (a batch is typically defined as 20 samples). Collect duplicate samples immediately after the original samples are collected. Purging is not performed between original sample collection and collection of duplicate samples. Original and duplicate samples are collected sequentially, without appreciable delay between collection cycles. Duplicate samples are to be submitted to the laboratory blind (i.e., not identified as a duplicate sample).

2. Typically, at least one type of field blank sample (rinsate or transfer) should be collected per day of water sampling. All field blank samples are to be collected, preserved, labeled, and treated like any other sample. Field blank samples are to be sent blind to the laboratory (i.e., not identified as a field blank). Record in the field notebook the collection of any blank sample (rinsate, transfer, trip). The types of field blank samples are discussed below.

   a. Rinsate blank samples. If rinsate field blank samples are required, prepare the sample by pouring deionized water over, around, and through the various reusable sampling implements contacting a natural sample. Rinsate blanks need not be collected when dedicated sampling equipment is used for purging and sampling the well. Rinsate blank samples are to be analyzed for the same parameters as the environmental samples.

   b. Transfer blank samples. Transfer blank samples are routinely prepared when no rinsate blank samples are collected. (The purpose of a transfer blank sample is to monitor for entrainment of contaminants into the sample from existing atmospheric conditions at the sampling location during the sample collection process.) A transfer blank sample is prepared by filling a sample container(s) with distilled or deionized water at a given sampling location. Transfer blank samples are to be analyzed for the same parameters as the environmental samples.

   c. Trip blank samples. Trip blank samples are submitted for VOC analysis to monitor for possible sampling contamination during shipment as volatile organic samples are susceptible to contamination by diffusion of organic contaminants through the Teflon-faced silicone rubber septum of the sample vial. Trip blank samples are prepared by the laboratory by filling VOA vials from organic-free water and shipped with field sample containers. Trip blank samples accompany the sample bottles through collection and shipment to the laboratory and are stored with the samples. It is suggested that a trip blank sample be included in each cooler of samples submitted for VOC analysis.

Investigation-Derived Waste (IDW) Management

Purge water is to be contained onsite in an appropriate labeled container for disposition by the client unless other project-specific procedures are defined. Other investigation-derived wastes, such as personal protective equipment, are to be properly handled and disposed. Preferably, PPE IDW should also be containerized and left onsite for disposal by the client. As a matter of practice, any waste, or potential waste, generated onsite, should remain onsite. Refer to the IDW SOG.

REFERENCES

ASTM. 1999. Designation: D 6452 - 99. Standard Guide for Purging Methods for Wells Used for Ground-Water Quality Investigations. Copyright ASTM, West Conshocken, PA.

ASTM International. 2002. Designation D 6771 – 02. Standard Practice for Low-Flow Purging and Sampling for Wells and Devices Used for Ground-Water Quality Investigations. Copyright ASTM International, West Conshocken, PA.

U.S. Environmental Protection Agency. 2001. *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (EISOPQAM)*. Dated November 2001. U.S. EPA Region 4.

Vroblesky, Dan A. 2001. U.S. Geological Survey, User's Guide for Polyethylene Based Passive Diffusion Bag Samplers to Obtain Volatile Organic Compound Concentrations in Wells. Part 1: Deployment, Recovery, Data Interpretation, and Quality Control and Assurance. Water-Resources Investigations Report 01-4060. Columbia, South Carolina.

Appendix B: Standard Operating Guideline
SOG-9: Field Measurement of Dissolved Oxygen

B.1 Introduction

This guideline describes the procedures that will typically be followed by Kennedy Jenks personnel during field measurement of dissolved oxygen.

B.2 Equipment

- Yellow Springs Instruments' dissolved oxygen meter
- Spare membranes
- Electrolyte solution
- Deionized water
- Sodium sulfite solution (zero O_2 solution)
- D.O. bottle (BOD bottle).

B.3 Procedure

1. Inspect dissolved oxygen meter for damage. Inspect probe for sufficient electrolyte and to determine if oxygen sensor membrane is in good condition. Field Services will replace the membrane if torn or wrinkled. Inspect for air bubbles beneath the membrane. If bubbles are present, remove membrane and add electrolyte solution. Replace membrane so no air bubbles are entrapped.

2. Rinse probe with deionized water.

3. Calibrate probe and meter according to manufacturer's instruction.

4. Take a grab sample, using a D.O. bottle so it is filled without headspace, flush water by inserting tube into bottle or fill bottle while submerged. Insert probe into bottle, allow time for stabilization.

5. Read and record dissolved oxygen concentration.

Appendix B: Standard Operating Guideline
SOG-9: Field Measurement of pH

B.1 Introduction

This guideline describes the procedure that will be used by Kennedy Jenks personnel during performance of field pH measurements.

B.2 Equipment

- Portable pH meter with potassium chloride (KCl) probe and temperature probe
- Extra KCl filling solution
- 50 ml plastic jar or other suitable container
- Squirt bottle and supply of deionized (DI) water
- pH 7, 10, and 4 buffer solutions.

B.3 Typical Procedures

1. Calibrate meter according to manufacturer's instructions. Prior to first measurement, check calibration against pH 7 buffer and again periodically over the course of the day, and recalibrate if the reading is more than 0.1 units from 7.
2. Use 50 ml plastic jar or other suitable containers for measurement readings. Rinse sample test container with sample water three times prior to measurement.
3. Immerse pH probe and temperature electrode in sample water. Gently stir sample for thorough mixing. Read and record pH to nearest 0.1 unit once pH reading has stabilized. Many pH meters possess an automatic feature which indicates final stabilized measurement.
4. Rinse or bathe pH and temperature probes with DI water or soak in DI water between measurements. Changing DI water bath between measurement stations increases accuracy of measurements.

B.4 Instrument Calibration - General Procedure

1. Calibrate pH meter in the field at the beginning of each day of field work and when the standard check is out of calibration.
2. Rinse pH and temperature probes in DI water.
3. Turn on meter and immerse pH and temperature probe in a pH 7 buffer solution. Calibrate meter to pH 7, allowing enough time for meter to stabilize.
4. Rinse pH and temperature probe with DI water.

5. Immerse pH and temperature probe in either a pH 4 or a pH 10 buffer solution, depending on whether expected pH of samples is above or below pH 7. If expected sample pH is above pH 7, use pH 10 solution for the second calibration. If expected sample pH is below pH 7, use pH 4 for the second calibration. Calibrate meter to second pH solution, allowing enough time for meter to stabilize.

6. Rinse pH and temperature probe with DI water.

7. Perform occasional rechecking of meter calibration to pH 7 calibration solution during usage. Repeat the calibration process (Steps 2-4) if value for final pH check is more than 0.1 unit from pH 7.0.

B.5 Maintenance

1. Store meter in case with pH electrode immersed in a pH 7 buffer solution.
2. Inspect pH and temperature probes for cracks and scratches.
3. Inspect pH probe for containing adequate amount of KCl solution. If amount is low, refill as needed.
4. Carry spare batteries and screwdriver in the meter case.
5. Carry a copy of the instruction manual with meter.

Appendix B: Standard Operating Guideline
SOG-9: Field Measurement of Redox Potential (EH)

B.1 Introduction

This guideline describes the procedures that will typically be used by Kennedy Jenks personnel during field measurement of redox potential (eH).

B.2 Equipment

- Portable pH meter capable of output in millivolts
- eH and KCl reference probe
- Quinhydrone
- pH 4, 7, and 10 buffers
- 125 ml plastic jars
- Deionized water

B.3 Procedure

1. Calibrate instrument in accordance with manufacturer's recommendations immediately prior to making measurements.

2. Rinse decontaminated glass beaker with approximately 50 ml of sample water three times.

3. Rinse eH electrode with deionized water.

4. Fill beaker with sample water, minimize aeration.

5. Turn on meter. Immerse electrode in sample and allow several minutes for the probe to equilibrate with the water. Obtain reading to nearest 10 mv. Use a consistent amount of time for reading to stabilize.

6. Record reading on standardized field forms or in the field book. Note any problems (e.g., erratic readings).

7. Rinse probe with deionized water and store according to manufacturer's directions.

B.4 References

Standard Method 2580*, Standard Methods for the Examination of Water and Wastewater*, 18th ed., APHA/AWWA/WEF 1992.

Appendix B: Standard Operating Guideline SOG-9: Field Measurement of Temperature and Specific Conductance

B.1 Introduction

This guideline provides procedures for measuring specific conductance and temperature using a Yellow Springs Instruments (YSI) conductivity meter.

B.2 Equipment

- YSI conductivity meter
- Standard conductivity solutions (1,000; 10,000 and 100,000 μmho/cm)
- Deionized water in squirt bottle
- Pint plastic jar
- Small brush

B.3 Field Procedures

This guideline describes the procedures that will typically be used by Kennedy Jenks personnel during performance of field temperature and specific conductance measurements.

1. Check red line and zero point on meter. Adjust meter needle to read zero in the off position using adjustment screw below needle. Adjust meter to red line in the red line position using the red-line knob. Replace batteries if meter will not adjust to the red line.

2. Rinse sample cup (500 ml plastic) beaker with sample water three times.

3. Fill sample cup with water sample.

4. Rinse conductivity probe with deionized water then with sample water and place probe in sample cup.

5. Submerge conductivity probe in sample so that flow cell holes are immersed. Pump probe up and down a few times to dislodge bubbles. Do not submerge to bottom, for this causes false high readings. Turn instrument on to highest scale multiplier and downscale to appropriate scale for sample reading. Multiply reading on scale by the correct multiplier from the dial and record to the nearest half-increment between marks. Turn function knob to the Temp position. Read sample temperature to the nearest 0.5 degrees C after temperature has equilibrated (about one minute).

6. Remove probe from sample and rinse with deionized water (soak).

7. Report conductivity and temperature so temperature correction can be applied if necessary.

B.4 Calibration of Conductivity Meter

The probe correction factor should be determined at the beginning and end of each sampling day as follows:

1. Check red line and zero point on meter and adjust if necessary.

2. Rinse probe with deionized water.

3. Calculate probe correction factor for each standard and average the two values. The probe correction factor is the ratio of the computed conductivity to the measured conductivity of the standard solution.

B.5 Monthly Calibration Procedure

1. Measure and graph the conductivity meter probe response to known standards throughout the range of response.

2. If a linear response is observed, two calibration standards can be used in the field.

3. If a nonlinear response is observed, more than two field calibration standards will be necessary in the field.

B.6 Maintenance

1. Store meter in case during transport. Immerse probe in deionized water for storage.

2. Check batteries before taking meter into the field. Carry spare batteries and deionized water for rinsing probe.

3. If meter readings are erratic, use a bottle brush and mild acid to clean holes in probe, otherwise, return meter and probe to factory for repair.

Appendix B: Standard Operating Guideline
SOG-10: Collecting Field Duplicates

B.1 Introduction

Duplicate analysis is a measure of precision for all sources of variability in the field and the laboratory. Laboratory replicates attempt to eliminate all sources external of imprecision, so that the difference between field duplicates and laboratory replicates is the error introduced by field techniques.

B.2 Equipment

Any equipment needed to collect samples is required. Additional containers for duplicates are needed. A system for generating and tracking blind field duplicates (a permanent notebook).

B.2.1 Sources of Imprecision in the Field

- Sampling techniques.
- Actual inhomogeneity of samples.

B.2.2 Sources of Imprecision in the Laboratory

- Sample preparation - how well mixed and measured out.
- Analysis - inherent noise of analytical procedure.

B.2.3 Separating Precision Errors

Field duplicates vs. laboratory replicates:

- Try to segregate sources of variation from field and laboratory.
- Laboratory replicates are known by the analyst to be similar (possible unconscious bias).
- Field duplicates should be "blind" to the laboratory.
- Laboratory replicates are deliberately homogenized.
- Field duplicates may be spatially or temporally separated, but logically connected - supposed to be same for some reason. For example:
    - o Collecting a waste stream at different times of day
    - o Collecting solids from different areas of a drum

B.3 Typical Procedures

Field duplicates and laboratory replicates should be collected as follows.

B.3.1 Collecting Duplicates and Replicates for Solids:

1. Laboratory replicates should be collected:

    a. From same area - avoid obvious inhomogeneity.

b. Fill one large container with enough sample for triplicate analysis (the lab does replicate and spike analysis).

c. The analyst will remove large rocks, nuts and bolts, etc., and grind or screen the sample.

2. When collecting field duplicates:

   a. You must be clear on what constitutes your definition of "all the same stuff."

   b. If it is inhomogeneous, consider compositing in duplicate.

   c. Make the sample truly "blind" to the laboratory by using:

      1) Field identification numbers that are similar to other samples.

      2) Do not mark both samples with exactly the same time.

      3) Keep track of what sample the duplicate is for; keep careful notes in a permanent notebook.

B.3.2 Collecting Duplicates and Replicates for Liquids

1. Laboratory replicates are actually collected in triplicates for spiking.

   a. Liquid samples are often collected in separate containers and the analysts do not mix the contents before analysis since liquids are typically homogenous, and because the volume is difficult to work with.

   b. Try to fill like containers from the same bailer pull, or the sample tap at the same time (e.g., line up and fill all VOC vials first, then all liters, etc.).

   c. List all samples with same identification and time (or time period) to avoid confusion at sample log in. Mark chain-of-custody and analysis request to indicate these samples are for "Lab QC".

2. Field duplicates have the same considerations as for solids above.

   a. You may want to use separate sampling equipment to prove there is no bias from contaminated device.

   b. You may also want to collect the sample at a different time (re-purging wells is an option, or you may want to determine if time of sampling after purging has an effect).

   c. Fill whole sets of containers for one sample, then fill duplicate set.

3. Spikes are rarely done in the field since there are too many potential sources of error to identify the reason for poor recoveries. But, consider using "travel spikes" for volatiles.

B.4 Interpretation of Results

- For laboratory replicates, there are two ways inhomogeneity can invalidate analysis: precision and accuracy can be affected.
    - There are statistically derived limits for laboratory replicates

      industrial statistic =

      $$[(A - B / A + B) * 100]$$

    - This value describes inherent variability of analytical method.

- For field duplicates there are no control limits established, but if the industrial statistic is within laboratory limits, it is safe to assume the samples are essentially the same.

  Significant variation does not necessarily invalidate a field effort, just the assumption that the particular samples are representing the same source. Control checks could be established for a large field sampling project.

- Finally, quality assurance data should be considered as a whole.
    1. Field blanks and laboratory blanks.
    2. Field duplicates and laboratory replicates.
    3. Laboratory replicates and laboratory spikes.

  They are often helpful in pinpointing a problem. For example, if duplicates do not make sense and a travel blank is contaminated, the source of imprecision may be outside contamination.

Appendix B: Standard Operating Guideline
SOG-11: Sample Packaging and Shipping

B.1 Introduction

This guideline presents methods for shipping non-hazardous materials, including most environmental samples via United Parcel Service (UPS), Federal Express, and Greyhound. Many local laboratories offer courier service as well.

B.2 Equipment

- Coolers or ice chests
- Sorbent material
- Bubble-wrap
- Strapping tape
- Labels and pens
- Chain-of-Custody forms
- Chain-of-Custody seals
- UPS, Federal Express, or Greyhound manifests

Samples shipped to each analytical laboratory can be sent by UPS or Federal Express on a next-day basis unless other arrangements are made. Greyhound bus service should only be used if there is direct service (e.g., Sacramento or Bakersfield to San Francisco). Ice chests, used to refrigerate perishable items, can be used to convey non-hazardous samples to the analytical laboratory.

Absorbent pads should be placed in the bottom of the shipping container to absorb liquids in the event of sample container breakage. Transportation regulations require absorbent capacity of the material to equal the amount of liquid being shipped; each pad absorbs approximately 1 quart of liquid. Liquid samples in glass jars or bottles should also be wrapped in plastic bubble wrap. A small amount of air space is desirable in filled plastic containers. This often prevents the cap of the container from coming off should the container undergo compression. Volatile organics analysis (VOA) vials should be packed in sponge holders. Additionally, exposure of filled VOA vials to other types of sample containers, by placement in the same shipping container, is not recommended. Various non-VOA sample containers are solvent-rinsed which may contaminate the VOA vials before or after sample collection. Therefore, a separate shipping container for VOA vials is recommended. An equal weight of ice substitute should be used to keep the samples below 4 degrees Centigrade for the duration of the shipment (up to 48 hours). Care in choosing a method of sample chilling should be observed so that the collected samples are not physically or chemically damaged. Re-usable blue ice blocks, block ice, ice cubes, or dry-ice are suitable for keeping samples chilled. Labels of samples may get wet. Use of waterproof pens and labels is desirable for identification of sample containers. Use of clear tape to cover each affixed sample label is helpful in ensuring sample identification. Strong adhesive tape should be used to band the coolers closed. Additionally, it is recommended that the drain plug be covered with adhesive tape to prevent any liquid from escaping.

Specific requirements for packaging materials may apply if the samples being shipped are known to be hazardous materials as defined in 49 CFR 171.8 (samples are not considered hazardous waste and therefore manifest requirements do not apply). UPS holds shippers responsible for damage occurring in the event of accidents when a hazardous material is shipped as a non-hazardous material. Samples which obviously are hazardous materials should therefore be shipped as such, and samples which most likely are not hazardous materials should be shipped in coolers. Guidelines for shipping hazardous materials by UPS are provided in the *Guide for Shipping Hazardous Materials* available from UPS. Specific labels for shipping of hazardous materials are available.

Chain-of-custody documentation should accompany shipments of samples to the analytical laboratory. Often, the chain-of-custody document contains an analytical request section which may be completed following sample collection. Chronological listing of collected samples is desirable. A copy of the completed chain-of-custody form should be retained in the event that the original form is lost or destroyed.

It should be noted that samples retained by the analytical laboratory which are not chosen for analysis may be assessed a fee for disposal. Often a disposal fee is assigned to a sample, typically soil, that has been retained beyond standard analytical holding periods. Therefore, consultation with project management is recommended to determine which samples may be of interest. Contacting the selected analytical laboratory regarding disposal policies is also recommended. Arrangements may be made with the analytical laboratory for return of the unanalyzed samples for later disposal to the area of origin.

Appendix B: Standard Operating Guideline
SOG-12: Equipment Cleaning

Introduction

This guideline describes field procedures typically followed by Kennedy Jenks personnel during the cleaning of sampling and monitoring equipment. Proper cleaning procedures minimize the potential for cross-contamination among sampling points on a single site or between separate sites.

Equipment

- Two or three containers (e.g., 5-gallon buckets, or 5- or 10-gallon plastic tubs) for dip rinsing, washing, and collection of rinse water.
- Two or three utility brushes or test tube brushes for removal of visible contamination. A test tube brush (or similar) can be stapled to the end of a dowel and used to clean the inside of a bailer.
- Non-phosphate Alconox, Liquinox, or trisodiumphosphate (TSP) to be mixed with potable or distilled water.
- Rinse solutions, such as methyl alcohol (methanol), dilute nitric acid (0.1 molar), deionized or distilled water, and/or tap water. Deionized water is preferable to distilled water because the deionization process typically results in greater removal of organic compounds as discussed below:
    1. Acid rinse (inorganic desorption) 10% nitric or hydrochloric acid solution reagent grade nitric or hydrochloric acid and deionized water (1% to be used for low carbon steel equipment).
    2. Solvent rinse (organic desorption isopropanol, acetone, or methanol; pesticide grade).
    3. Deionized water is preferable to distilled water because the deionization process typically results in greater removal of organic compounds.
- Multi-gallon storage containers filled with potable water to be used for rinsing or washing.
- Spray bottles, squirt bottles, or garden sprayers to apply rinse liquid. A separate bottle should be used for each liquid.
- Solvex or neoprene gloves that extend, as a minimum, halfway up the forearm. In cooler weather, it is advisable to use different resistant chemicals neoprene gloves that provide better insulation against cold temperatures.
- Paper towels to wipe off gross contamination.
- Garbage bags, or other plastic bags, and aluminum foil to wrap clean sampling equipment after cleaning, to store sampling equipment or and to dispose of cleaning debris.

- Sample bottles for rinsate blanks. For these blanks, Laboratory Type II (millipore) water should be used. Purified water from the selected analytical laboratory is recommended. This water is often filtered and boiled to remove impurities.

- DOT-approved container (e.g., 55-gallon drum) to store contaminated wash and rinse water. Contained cleaning should be labeled appropriately.

- Steamcleaner with power source and water supply.

Procedures

In most cases, the following procedures are adequate to remove contamination.

1. Preclean sampling equipment. If there is gross contamination on equipment, wipe it off with paper towels and/or rinse it off with water. Additional internal cleaning may be possible by circulation of water or cleaning solutions.

2. Wash all parts of equipment with detergent water and scrub with brushes. Take equipment apart when appropriate to remove visible contamination.

3. Steamclean sampling equipment. The steamcleaner is effective in removing contamination, especially volatile hydrocarbons. Steamcleaning is highly recommended in most cases and sometimes is the only method for cleaning equipment that is grossly contaminated with hydrocarbons.

4. Rinse equipment by dipping in rinse solution, spraying, or pouring solution over it. Dip rinsing can introduce contaminants into solution. Spraying might not allow a thorough rinsing of the equipment, but it is a more efficient rinsing method because less rinse solution is used. Appropriate rinsing solutions are specified in the project sampling and analysis plan. Some typical solutions are indicated in the equipment section of this SOG.

    1. Methanol (used to remove organic compounds)

    2. Dilute acids (used to remove metals and other cations)

    3. Tap water

    4. Deionized/distilled water.

5. Rinse the sampler with generous amounts of deionized water. Pouring water over the sampler is best, although spraying or using a squirt bottle to apply rinse water might be adequate if you are trying to minimize waste.

6. Prepare rinsate blanks. To ensure proper cleaning, submit a rinsate blank for analysis. It is best to do this just before sampling. The blank should be analyzed for the same chemicals the samples are being checked for and for the chemical used to clean equipment, if appropriate.

    [Note: The heading for this section indicates procedures to remove contamination.]

    To prepare a rinsate blank, pour millipore analyte-free water through or over the into the sampler. Collect the rinsate water in a clean bottle. Pour the collected rinsate water into the appropriate sample container(s). It is advisable to prepare one rinsate blank every day in the field. Use water specifically for blank preparation.

7. Wipe sampling equipment with a paper towel or allow it to air dry.

8. Place samplers in clean plastic bags or sealed containers, or wrap them in aluminum foil for storage in an undisturbed location that is free of contamination.

Investigation-Derived Residuals

For details of handling investigation-derived residuals, refer to the project sampling and analysis plan.

Special Notes

- To reduce the potential for cross-contamination, samples should be collected so that the least contaminated stations areas are sampled first. Subsequent sampling should be completed in the order of increasing contamination. Areas that typically have lower levels of contamination include those upgradient of source, background areas, and the periphery of the contaminated area.

- Prepare rinsate blanks. To ensure proper cleaning, submit a rinsate blank for analysis. It is best to do this just before sampling. The blank should be analyzed for the same chemicals the samples are being checked for and for the chemical used to clean equipment, if appropriate.

- To prepare a rinsate blank, pour analyte-free water through or into the sampler. Pour the collected rinsate water into the appropriate sample container(s). It is advisable to prepare one rinsate blank every day in the field. Use water specifically for blank preparation.

- Monitoring instruments that come into contact with sampled materials must be cleaned, along with sampling devices. They should be washed, or at least rinsed before monitoring other sampling sites.

- As determined from analysis of rinsate blanks, cleaning using soap and water is adequate in removing detectable quantities of contaminants. This type of cleaning has been compared to laboratory procedures for cleaning sampling bottles. Using methanol as a rinse does help in cases of contamination with organic compounds.

References

U.S. Environmental Protection Agency. 1987. *Handbook: Groundwater*. U.S. Environmental Protection Agency, Office of Research and Development, Cincinnati, Ohio.

Washington Department of Ecology. 1982. *Methods for Obtaining Waste Samples*. Ch. 173-303 WAC. Washington State Department of Ecology, Olympia, Washington.

Appendix B: Standard Operating Guideline
SOG-13: Personnel Cleaning

B.1 Introduction

This guideline describes field procedures typically followed by Kennedy Jenks for personnel cleaning. Cleaning of personnel is critical to health and safety during and after environmental fieldwork. It protects personnel from hazardous substances that can contaminate and eventually permeate protective clothing, respiratory equipment, tools, vehicles, and other equipment used onsite. Cleaning reduces exposure of site personnel to such substances by minimizing the transfer of harmful materials into clean areas and preventing the mixing of incompatible chemicals. It also protects the community by preventing uncontrolled transportation of contaminants from the site.

B.2 Equipment

The materials, equipment, and facilities described in the following list are not required in every case of personnel cleaning. However, they represent all that might be required for sites where maximum cleaning procedures are necessary.

- Drop cloths (plastic or other suitable material) on which heavily contaminated equipment and outer protective clothing can be deposited.
- Collection containers, such as drums or suitably lined trash cans, for storing disposable clothing, heavily contaminated personal protective clothing, or equipment that must be discarded.
- Lined box with absorbent for wiping or rinsing off gross contaminants and liquid contaminants.
- Large tubs to hold wash and rinse solutions; tubs should be at least large enough to hold a worker's booted foot and allow full access for washing.
- Non-phosphate wash solutions (e.g., Alconox, Liquinox) to wash off debris and chemicals and reduce hazards associated with any contaminants.
- Rinse solutions (e.g., potable or distilled water) to remove contaminants and contaminated wash solutions.
- Long-handled soft-bristled brushes to wash and rinse off contaminants.
- Paper or cloth towels for drying protective clothing and equipment.
- Lockers or containers for storage of cleaned non-disposable clothing (e.g., hard hat, boots) and equipment.
- Department of Transportation (DOT)-approved containers for contaminated wash and rinse solutions.
- Plastic sheeting, sealed pads with drains, or other appropriate means of secondary containment of contaminated wash and rinse solutions that might be spilled during cleaning.

- Shower facilities for full body wash or, at a minimum, wash sinks available to personnel.
- Soap or wash solution, wash cloths, and towels for personnel.
- Lockers or containers for clean clothing and personal item storage.

B.3 Cleaning Procedures

B.3.1 Level C

At a minimum, the following procedures apply when operating in a Level C exclusion zone:

1. Deposit items used onsite on plastic drop cloth. Segregation at the drop site reduces the probability of cross-contamination.
2. Scrub outer boots, gloves, and splash suit with cleaning solution or detergent water. Rinse items with generous amounts of water. Follow this step scrupulously for protective clothing that is not disposable.
3. Remove outer boots and gloves; deposit or discard them in container with plastic liner.
4. To continue cleaning outside the exclusion zone, change canister or mask when leaving the zone. Upon re-entering, remember to gear up again.
5. Remove boots, chemical-resistant splash suit, and inner gloves and deposit them in separate containers lined with plastic.
6. Remove respirator by taking off facepiece. Avoid touching the face with the fingers. Deposit the facepiece on a plastic sheet.
7. As a field wash, clean hands and face thoroughly and shower as soon as possible. Wash respirator facepiece with respirator cleaning solution.
8. Ensure that all cleaning procedures are in accordance with the project sampling and analysis plan and Kennedy Jenks Standard Operating Guideline, Investigation-Derived Residuals (Unit 9.0).

B.3.2 Level D

If operating in a Level D area, perform the following procedures before leaving the site:

1. Wash and rinse all reusable equipment and garments. If gear is to be used elsewhere, wash it with detergent and then rinse with generous amounts of water.
2. If grossly contaminated, discard disposable protective clothing in appropriate container.
3. Wash hands and face thoroughly, and shower as soon as possible.

B.4 Special Notes

When working in an exclusion zone, be sure that the cleaning area is placed in an upwind direction (plus or minus 20 degrees) from the site.

B.5 Investigation-Derived Wastes

Refer to the specific project sampling and analysis plan for details of disposition of investigation-derived wastes.

B.6 Emergency Cleaning Procedures

1. If the cleaning procedure is essential to the lifesaving process, cleaning must be performed immediately.

2. If a heat-related illness develops, protective clothing should be removed as soon as possible. Protective clothing and equipment should be washed, rinsed, and/or cut off.

3. If medical treatment is required to save a life, cleaning should be delayed until the victim is stabilized or until cleaning will not interfere with medical treatment.

4. Dispose of contaminated clothing and equipment properly.

5. Alert medical personnel to the emergency.

6. Instruct medical personnel about potential contamination.

7. Instruct medical personnel about specific cleaning procedures.

B.7 References

NIOSH/OSHA/USCG/EPA. 1985. *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*. Washington, DC. Federal Way.

U.S. Environmental Protection Agency. 1988. *Standard Operating Safety Guidelines*. United States Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC.

Appendix B. Standard Operating Guideline
SOG-14: Handling and Disposal of Investigation-Derived Waste

B.1 Introduction

Environmental site investigations usually result in generation of some regulated waste, particularly if the project involves drilling and construction of monitoring wells. Any potentially hazardous or dangerous material that is generated during a site investigation must be handled and disposed of in accordance with applicable regulations (22 CCR, Chapter 30). This guideline provides a procedure to be used for dealing with investigation-derived wastes that have the potential of being classified as hazardous or dangerous, including soil cuttings, well development water, and decontamination water.

B.2 Equipment

- DOT-approved packaging (typically DOT 17E or 17H drums)
- Funnel
- Bushing wrench
- 15/16-inch socket wrench
- Shovel
- Appropriate markers (spray paint, paint pen)
- Plastic sheeting
- Drip pans
- Pallets

B.3 Typical Procedures

B.3.1 Preparing Containers

1. Place each container on a pallet if it is to be moved with a fork lift after it is full.

2. Place plastic sheeting under containers for soil and drip pans under containers used to hold water.

3. Ensure that packaging materials are compatible with the wastes to be stored in them. Bung-type drums should be used to contain liquids. If a liquid is corrosive, a plastic or polymer drum should be used.

4. Solids should be placed in open-top drums. Liners are placed in the drums if the solid material is corrosive or contains free liquids. Gaskets are also used on open-top drums.

B.3.2 Storing Wastes

1. As waste materials are generated, place them directly into storage containers.

2. Do not fill storage drums completely. Provide sufficient outage so that the containers will not be overfull if their contents expand.

3. After filling a storage drum, seal it securely, using a bung wrench or socket wrench, for a bung-type or open-top drum, respectively.

4. Label drums or other packages containing hazardous or dangerous materials and mark them for storage or shipment. To comply with marking and labeling requirements, affix a properly filled out yellow hazardous waste marker and a DOT hazard class label to each waste container. Do not mark drums with Kennedy Jenks' name. All waste belongs to the client. Mark accumulation start date.

5. During an ongoing investigation, use a paint marker to mark the contents, station number, date, and quantity of material on each drum or other container. Do not mix investigation-derived wastes with one another or with other materials. Do not place items such as Tyvek, gloves, equipment, or trash into drums containing soils or liquids, and do not mix water and soil. Disposable protective clothing, trash, soil, and water materials should be disposed of in separate containers.

6. Upon completion of field work, or the portion of the project that generates wastes, notify the client as to the location, number, contents, and waste type of waste containers. Remind the client of the obligation to dispose of wastes in a timely manner and in accordance with applicable regulations.

B.4 Regulations

22 CCR, Chapter 30 *California Hazardous Waste Regulations*.

49 CFR 100-177, *Federal Transportation of Hazardous Materials Regulations*.

EPA Region X, Technical Assistance Team. 1984. *Manual for Sampling, Packaging, and Shipping Hazardous Materials*. Seattle, WA: EPA.