DEPARTMENT OF
ECOLOGY
State of Washington

CLEANUP ACTION PLAN
LIGNIN OPERABLE UNIT

Chlor-Alkali Remedial Action Unit of
Georgia-Pacific West Site
Bellingham, Washington

Facility Site ID: 14
Site Cleanup ID: 2279

August 2022

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1 Introduction and Background

This Cleanup Action Plan (CAP) defines the cleanup action selected by the Washington State Department of Ecology (Ecology) for the portion of the Georgia-Pacific (G-P) West Site (Site) referred to as the Lignin Operable Unit (OU) of the Chlor-Alkali Remedial Action Unit (RAU). The Site is being cleaned up under the authority of the Washington State Model Toxics Control Act (MTCA), Chapter 70A.305 of the Revised Code of Washington (RCW), and the Model Toxics Control Act Cleanup Regulation, Chapter 173-340 of the Washington Administrative Code (WAC).

The Port of Bellingham (Port) acquired the former G-P Mill property located at 300 West Laurel Street in Bellingham, Washington, in January 2005. In August 2009, Ecology and the Port entered into Agreed Order No. DE 6834 (Order), which required the Port to perform a Remedial Investigation (RI) and a Feasibility Study (FS) for the Site. The Site is defined by the extent of contamination caused by the release of hazardous substances from the former mill facility, which included a Chlorine Plant[1] and a Pulp and Tissue Mill, and associated facilities.

In August 2013, a Site-wide RI was completed (Aspect, 2013) and an amendment to the Order separated the Site into the Pulp/Tissue Mill and Chlor-Alkali RAUs, which are shown on Figure 1. The amended Order established independent timelines for cleanup of the two RAUs, which allowed for expedited cleanup and redevelopment at the Pulp/Tissue Mill RAU.

For the Pulp/Tissue Mill RAU, Ecology issued the final Cleanup Action Plan (CAP) in October 2014 (Ecology, 2014). In December 2014, the Port and Ecology executed Consent Decree No. 142027008 requiring cleanup of the Site, which included the Pulp/Tissue Mill RAU CAP as Exhibit C. Cleanup construction for the Pulp/Tissue Mill RAU was completed in 2016. Since then, monitoring of groundwater natural attenuation and inspection and maintenance of the environmental cap have been ongoing.

For the Chlor-Alkali RAU, Ecology issued the final CAP in September 2021 (Ecology, 2021). Since then, the Port has been conducting remedial design for cleanup of the Chlor-Alkali RAU under the Order.

The Lignin OU is an approximately 4-acre property located within the Chlor-Alkali RAU and at the corner of Cornwall and Laurel Streets (Figure 1). During G-P's operation of the pulp and paper mill, lignin, a byproduct of pulping, was converted into commercial lignin-containing products.[2] No historical pulp/paper production processes occurred on the Lignin OU, although lignin waste liquors were stored in several aboveground storage tanks near the north[3] edge of the property. G-P used the Lignin Warehouse B, which

[1] The terms "Chlor-Alkali Plant" and "Chlorine Plant" are used interchangeably.

[2] Including artificial vanilla flavoring, animal feeds, adhesives, pharmaceuticals, dust retardants, fuel pellets, solvents, ferromagnetic liquids, oil well drilling mud thinners, and other products.

[3] For consistency with previous environmental reports for the GP West Site, this document uses the former Georgia-Pacific mill's "Mill north" as its directional reference, with "Mill-north" approximately 45 degrees west of true north (see north arrows on figures).

occupied much of the Lignin OU (Figure 2), for storage of the finished lignin-containing commercial products until 2007. The Port demolished the Lignin Warehouse B in 2020.

The Chlor-Alkali RAU CAP-selected cleanup action for the Lignin OU included hard capping to contain soils contaminated with carcinogenic polycyclic aromatic hydrocarbons (cPAHs) that pose a direct contact risk for an unrestricted land use,[4] plus monitored natural attenuation (MNA) for dissolved chromium concentrations in groundwater.

Since 2019, the Port has been working with local development partners Mercy Housing Northwest and Millworks LLC to evaluate the feasibility of developing affordable/workforce housing and other mixed uses at the Lignin OU. In early 2019, Ecology selected the Port as a recipient of a Toxics Cleanup Healthy Housing Integrated Planning Grant (IPG) to fund early planning efforts for the integrated cleanup and redevelopment of the Lignin OU. In November 2021, Ecology issued a grant to the Port to support remedial design and construction for the Lignin OU Affordable Housing Project. The preliminary plans for the Mercy Housing Northwest Affordable Housing Project will redevelop a portion of the Lignin OU with a total of 83 affordable housing units and childcare facility.

In March 2022, Ecology issued a minor modification to the Order, amending the Schedule of Deliverables to include preparation of a draft CAP and completion of a pre-remedial design investigation (PRDI) for the Lignin OU, in addition to conducting remedial design for the Chlor-Alkali RAU outside of the Lignin OU.

2 Summary of Contaminant Nature and Extent

The Site-wide RI and Chlor-Alkali RAU FS identified the following contaminants of concern and impacted media within the Lignin OU:

- cPAHs in soil exceeding a cleanup level based on unrestricted human direct contact
- Chromium in groundwater exceeding cleanup levels that are protective of discharge to marine surface water and sediment[5]

Subsequent sampling and analysis conducted in 2022 confirmed those contaminants of concern and impacted media, and also identified the following:

- Zinc in soil exceeding a cleanup level based on unrestricted human direct contact
- Copper in groundwater exceeding a cleanup level that is protective of discharge to marine surface water and sediment

[4] Assuming a child's incidental ingestion of soil for a lifetime.

[5] Groundwater throughout the GP West Site, including the Lignin OU, is deemed non-potable in accordance with MTCA.

The following sections further describe soil and groundwater contamination present within the Lignin OU.

2.1 Soil Contamination

Figure 2 depicts the estimated extents of soil contamination at the Lignin OU posing an unacceptable risk for soil direct contact under an unrestricted (residential) land use. This collective area encompasses predominantly shallow soils (upper 2 feet) contaminated by cPAHs, but it also includes one small area containing high zinc concentrations to an estimated depth of 6 feet. While all portions of the historical railroad spur alignments were not sampled, they included treated railroad ties and, where shallow soil samples were collected from them, the soils contained cPAH concentrations greater than the cleanup level; it is therefore inferred that shallow soils along the entire railroad spur alignments contain cPAH exceedances.

The data also confirm that fill soils throughout most of the Lignin OU (at 30 of 37 soil sampling locations) contain concentrations of one or more metals (predominantly copper and zinc) exceeding concentrations predicted by the MTCA three-phase partitioning model (WAC 173-340-747(3)(a)) to contaminate groundwater by leaching. Figure 3 depicts the distribution of sampling locations where detected soil metals concentrations exceed and do not exceed the leaching-based cleanup levels (purple and green symbols, respectively).

2.1.1 Exclusion for Terrestrial Ecological Evaluation

The Lignin OU qualifies for an exclusion from conducting a terrestrial ecological evaluation (TEE) under MTCA based on the types of contamination present on the OU and its proximity to ecological receptors. Specifically, the Lignin OU is not contaminated by chlorinated chemicals and there is less than 1.5 acres of contiguous undeveloped land located anywhere within 500 feet of the OU. Therefore, in accordance with MTCA (WAC 173-340-7491(1)(c)), no further terrestrial ecological evaluation is required for the Lignin OU.

2.2 Groundwater Contamination

Despite the widespread distribution of soil metals exceeding leaching criteria, the empirical groundwater data collected within the Lignin OU indicate that metals contamination in groundwater has declined over time and is currently not extensive in space or of high magnitude concentration. Figure 4 illustrates the generalized groundwater flow direction, and locations of monitoring wells with and without metals exceedances during the 2022 groundwater sampling within the Lignin OU.

The gradual improvement in groundwater metals concentrations is indicated by sampling data from well LW-MW01 located along the property's northern boundary (Figure 4), in which dissolved chromium concentrations declined from an average of about 700 µg/L when measured in 2009-2010 to an average of about 30 µg/L when measured in 2022. Despite the gradual improvement over time, low-level metals exceedances persist in

groundwater at the Lignin OU. During one of the two 2022 sampling events,[6] dissolved chromium was detected at a concentration exceeding its cleanup level in newly installed monitoring well LW-MW02 located upgradient[7] of LW-MW01 (Figure 4). In addition, dissolved copper was detected at concentrations exceeding its cleanup level in wells LW-MW02 and LW-MW03 during one of the two 2022 sampling events. No dissolved metals exceedances were detected in wells LW-MW01 and LW-MW04 located generally downgradient of wells LW-MW02 and LW-MW03.

None of the groundwater metals exceedances were reproducible in the two rounds of 2022 sampling and none were greater than two times the cleanup level. The dissolved metals exceedances are largely attributable to natural geochemically reducing conditions that enhance the mobility of metals in the shallow water-bearing unit, as is observed throughout the entire Site.

3 Remedial Action Objectives

Remedial action objectives (RAOs) are specific goals for protecting human health and the environment assuming an unrestricted (non-industrial) land use within the Lignin OU. RAOs for the Lignin OU are as follows:

- Permanently remove cPAH- and zinc-contaminated soils to achieve cleanup levels for unrestricted soil direct contact. This will eliminate the need for engineering and institutional controls with respect to soil direct contact exposure for the planned residential redevelopment.
- Remove additional metals-impacted soil to accelerate the restoration timeframe for natural attenuation of metals contamination in groundwater.
- Prevent discharge of metals-contaminated groundwater from the Lignin OU to the Whatcom Waterway.

4 The Selected Cleanup Action

4.1 Description of Selected Cleanup Action

The selected cleanup action for the Lignin OU consists of the following elements as illustrated on Figure 5:

Remove Contaminated Soils Posing a Direct Contact Risk. The cleanup will include the Port's excavation and disposal at a permitted off-Site landfill of an estimated 5,600 tons of soils containing concentrations of cPAHs and/or zinc greater than soil cleanup levels for unrestricted direct contact. This includes soils in the following areas:

- cPAH-contaminated soils extending to an estimated depth of 2 feet in areas north of the historical warehouse including the rail spur there, at the west end of the

[6] Conducted in January and February 2022.

[7] The groundwater flow direction is to the northwest, toward Laurel Street, as depicted on Figure 4.

warehouse, beneath a portion of the warehouse, and along the rail spur extending northeastward from the warehouse (purple crosshatched areas on Figure 5).

- A localized occurrence of zinc-contaminated soils in the southwest portion of the OU extending to the fill-native soil contact at an estimated depth of approximately 6 feet (dark blue crosshatched area on Figure 5).

Once the post-excavation, performance-monitoring sampling demonstrates that direct contact cleanup levels have been achieved for the OU, the excavation areas will be backfilled with suitable clean fill to the design grades within the subsequent affordable housing redevelopment and to existing grades outside of that redevelopment area.

Remove Structural Obstructions and Metals-Impacted Soils. The cleanup will also include the Port's removal and off-Site disposition of: (a) an estimated 8,400 tons of remnant structures (e.g., concrete foundation elements including the large floor slab of the former Lignin Warehouse B, asphalt pavement, and railroad spurs) located on top of and adjacent to contaminated soils being removed, and (b) an estimated 10,400 tons of metals-impacted soils requiring excavation to accelerate the restoration timeframe for natural attenuation of metals contamination in groundwater. The excavation depth for most of those soils is 4 feet or less, with a localized excavation as deep as 7 feet (green-shaded areas on Figure 5). Because the metals concentrations in those soils exceed leaching-based soil cleanup levels, removing them will permanently reduce the mass of metals contamination remaining within the Lignin OU soils and thereby accelerate the restoration timeframe for metals concentrations in the OU's groundwater.

The excavation areas will be backfilled as needed with suitable clean fill to meet the design grades for the subsequent redevelopment. All recyclable structural materials (e.g., concrete, asphalt, metal) removed during the cleanup will be transported to permitted facilities for recycling.

Monitored Natural Attenuation (MNA) of Groundwater. The cleanup will include MNA to address residual dissolved chromium and copper concentrations that exceed groundwater cleanup levels based on protection of discharge to the Whatcom Waterway. The dissolved metals concentrations are expected to continue to attenuate through a combination of sorption/complexation and dispersion.

The Port will prepare a Compliance Monitoring Plan for Groundwater MNA as a deliverable for cleanup of the Lignin OU. The MNA Compliance Monitoring Plan will identify monitoring locations, analytes, and frequency. The Port will decommission all existing monitoring wells at the start of the Lignin OU soil removal action and will install new monitoring wells for the MNA monitoring program after completion of the soil removal project. The MNA monitoring wells will be positioned along the downgradient edge of the Lignin OU which, based on a groundwater flow direction toward the northwest, would be along the north and northwestern boundaries of the OU as indicated on Figure 4. Specific locations for the new wells will be identified in the MNA Compliance Monitoring Plan and will consider location of utilities or other access considerations following completion of the soil removal action.

The Port will implement a contingent groundwater cleanup action if it is determined that groundwater MNA within the Lignin OU is not sufficient to prevent migration of groundwater exceeding cleanup levels to the Whatcom Waterway (e.g., if a statistically significant increasing trend for concentrations is measured at the downgradient edge of the OU).

Institutional Controls. The Port and Ecology will develop environmental covenants for the Lignin OU that restrict certain activities and uses of the property to protect the integrity of the selected cleanup action and thereby protect human health and the environment. It is anticipated that institutional controls for the Lignin OU will:

- Prohibit interference with the completed cleanup action
- Prohibit use of groundwater
- Provide for long-term monitoring and stewardship of the cleanup action

The Port intends to sell Mercy Housing Northwest a parcel of land encompassing the southern portion of the Lignin OU within which the affordable housing redevelopment will occur. The Port will retain ownership of the remaining northern parcel within the Lignin OU. The Port and Mercy Housing Northwest will seek separate environmental covenants for their respective parcels within the Lignin OU. The two parties will work with Ecology and the Attorney General's Office to define each covenant's specific restrictions and requirements applicable to each parcel prior to the covenants being legally recorded with Whatcom County.

4.2 Contamination Remaining in the Lignin OU

The selected cleanup action requires the removal of all contaminated soils posing a potential risk for unrestricted soil direct contact. Therefore, no soil posing a direct contact risk under any future land use will remain following the completion of the cleanup action. Fill soils throughout most of the Lignin OU contain concentrations of one or more metals greater than cleanup levels based on leaching to groundwater. Following the removal of roughly 16,000 tons of soil during the cleanup, an estimated 48,000 tons of fill soil containing metals exceedances of leaching-based soil cleanup levels will remain in the OU.

Groundwater containing residual metals concentrations exceeding cleanup levels based on protection of discharge to the Whatcom Waterway is generally located within the eastern half of the Lignin OU. Groundwater monitoring data indicate that the groundwater cleanup levels are currently achieved at the downgradient edge of the OU, which is approximately 1,000 feet from the point of groundwater discharge to the Whatcom Waterway.

The Groundwater MNA Compliance Monitoring Plan discussed in Section 4.1 will also define requirements for data evaluation and reporting, including a decision process for adjusting the monitoring program over time and ultimately ceasing it. It will also include provisions for implementation of a contingent action if it is determined that groundwater MNA within the Lignin OU is not sufficient to prevent migration of groundwater exceeding cleanup levels to the Whatcom Waterway (e.g., statistically significant increasing trend for concentrations at the downgradient edge of the OU). Contingent

actions the Port may need to perform could include groundwater treatment and/or control. Selection and design of a contingent action would be conducted if potential failure of MNA is indicated based on groundwater compliance monitoring results. At that time, substantial information would be available to determine the causes of failure and, therefore, the most effective and practicable means to remedy it.

4.3 Other Remedial Alternatives Evaluated

The FS for Chlor-Alkali RAU evaluated eight remedial alternatives (Alternatives 1 through 8). Specific to the Lignin OU portion of the RAU, each of the eight alternatives included groundwater MNA for metals and institutional controls. Alternatives 1 through 6 included capping to contain the cPAH-contaminated soils and Alternatives 7 and 8 included excavation and landfilling of the cPAH-contaminated soils. Refer to Section 7 of the Chlor-Alkali FS (Aspect, 2018) for more detailed descriptions of the eight remedial alternatives evaluated.

4.4 Rationale for Selecting Cleanup Action

The Chlor-Alkali RAU FS determined that each of the eight remedial alternatives considered would meet the following MTCA threshold requirements and other requirements in accordance with WAC 173-340-360(2):

Threshold Requirements

- Protection of human health and the environment
- Compliance with cleanup standards and applicable state and federal laws
- Provision for compliance monitoring

Other Requirements

- Use of permanent solutions to the maximum extent practicable
- Provision for a reasonable restoration time frame
- Consideration of public concerns

The FS included a disproportionate cost analysis (DCA) to assess the extent to which the remedial alternatives would use permanent solutions to the maximum extent practicable. The DCA quantified the environmental benefits of each alternative, and then compared incremental benefits versus costs between alternatives. Under MTCA, costs are disproportionate to benefits if the incremental cost of a more permanent alternative over that of a lower-cost alternative exceeds the incremental benefits achieved by the more permanent alternative. Based on the results of the DCA, Alternative 4 was identified as the alternative that is permanent to the maximum extent practicable for the Chlor-Alkali RAU. Refer to Section 8.3 of the Chlor-Alkali RAU FS for more a detailed description of the DCA for the eight remedial alternatives. Ecology's CAP for the Chlor-Alkali RAU selected Alternative 4 as the cleanup action (Ecology, 2021).

For the Lignin OU portion of the Chlor-Alkali RAU, Alternative 4 included capping (containment) of cPAH-contaminated soils, MNA for metals in groundwater, and institutional controls.

Since completion of the Chlor-Alkali CAP, the redevelopment planning for the Lignin OU has advanced to include residential use and a child-care facility. Consistent with that future use, Ecology is increasing the permanence, protectiveness, and long-term effectiveness of the Lignin OU cleanup action to include full removal (instead of capping) of contaminated soils that pose a risk due to direct contact with soil under the future land use. The Chlor-Alkali RAU CAP anticipated completing a more permanent cleanup action for capped areas when justified to support redevelopment, by including the following language:

> *"As redevelopment of the RAU occurs, the redevelopment project proponent may choose to permanently remove (excavate/properly dispose), instead of cap, residual contaminated soils if such an action is completed in consultation with, and with approval from, Ecology. Excavation of soils undertaken as part of future redevelopment at the Site may require a formal amendment to this Cleanup Action Plan and any associated future Consent Decree, depending on the contaminant levels of the soil to be excavated and the depth or location of the excavation."*

MNA for metals in groundwater and institutional controls remain in the selected cleanup action for the Lignin OU.

4.5 Compliance with WAC 173-340-360

The cleanup action selected for the Lignin OU complies with the provisions of WAC 173-340-360. It will be protective of human health and the environment, comply with cleanup standards and applicable state and federal laws, and provide for compliance monitoring.

Contaminated soils that pose a direct-contact risk will be excavated and properly disposed of at a landfill permitted to receive and manage the soils. Additional metals-impacted soils will also be excavated and disposed of, and thereby reduce the restoration timeframe for metals in groundwater. MNA will address residual metals contamination in groundwater that exceeds applicable groundwater cleanup levels, and a groundwater MNA Compliance Monitoring Plan will specify identification and implementation of a contingency action if groundwater contaminant migration to the Whatcom Waterway is indicated based on the monitoring information. Institutional controls in the form of an environmental covenant for the Lignin OU will prohibit activities that would interfere with the completed cleanup action, prohibit use of groundwater, and provide for long-term monitoring and stewardship of the cleanup action.

Ecology determines that the selected cleanup action uses permanent solutions to the maximum extent practicable and provides for a reasonable restoration time frame.

5 Cleanup Standards

A cleanup standard consists of a cleanup level for a hazardous substance present at a site, combined with the location where the cleanup level must be met (point of compliance), and other regulatory requirements that apply to the site ("applicable state and federal laws"). The soil and groundwater cleanup standards for the Lignin OU are described below.

5.1 Soil

Table 1 lists soil cleanup levels for the contaminants of concern within the Lignin OU. Soil cleanup levels are provided for the soil direct contact (soil ingestion) and soil-leaching-to-groundwater pathways. In accordance with MTCA, soil cleanup levels based on groundwater protection are different for soils located above the water table (unsaturated soil) versus soils below the water table (saturated soil), as presented in Table 1. The exception is total cPAHs (TEQ), for which the values are the same and are based on an empirical demonstration using groundwater quality data in accordance with MTCA (WAC 173-340-747(9)). Soil cleanup levels based on unrestricted direct contact are the same value for unsaturated and saturated soils.

The point of compliance for soil cleanup levels based on groundwater protection is all depths within the corresponding unsaturated or saturated soil zone. The point of compliance for the direct-contact exposure pathway is from the ground surface to 15 feet below ground surface (bgs).

5.2 Groundwater

Table 2 lists groundwater cleanup levels for the contaminants of concern within the Lignin OU. As described in the Chlor-Alkali CAP (Ecology, 2021), the highest beneficial use of groundwater throughout the Site, including the Lignin OU, is discharge to marine sediment and water—not potable use.

In the Chlor-Alkali RAU CAP, Ecology established conditional points of compliance for achieving groundwater cleanup levels in the sediment bioactive zones of the Log Pond within the Whatcom Waterway and Bellingham Bay based on an evaluation of reasonable restoration timeframes for the mercury plumes in those areas, as presented in Section 9 of the Chlor-Alkali RAU FS (Aspect, 2018). The FS evaluation did not consider metals in Lignin OU groundwater. Therefore, groundwater cleanup levels apply to groundwater throughout the Lignin OU (i.e., a standard point of compliance) in accordance with WAC 173-340-720(8)(b). The fact that Lignin OU groundwater cleanup levels are established to be protective at the point of groundwater discharge to the Whatcom Waterway may be considered in any future assessment for implementation of a contingency action for groundwater MNA as described in Section 4.1.

6 Applicable State and Federal Laws

Cleanup standards established for the Lignin OU of the Chlor-Alkali RAU incorporate applicable state and federal laws and regulations in the form of chemical-specific regulatory criteria for soil and groundwater. In addition, there may be location- and action-specific requirements for completing a cleanup action.

In accordance with MTCA, the Lignin OU cleanup action would be exempt from the procedural requirements of RCW Chapters 70A.15, 70A.205, 70A.300, 77.55, 90.48, and 90.58, and of any laws requiring or authorizing state or local government permits or approvals. However, the Port must still comply with the substantive requirements of such

permits or approvals (WAC 173-340-520). The cleanup action must also comply with any applicable federal regulations and obtain any required federal permits.

7 Cleanup Implementation Schedule

The March 2022 amended Schedule of Deliverables for the Order identifies milestones for completing this CAP and preparing a Project Plan for and then implementing the PRDI. The subsequent components of the Lignin OU cleanup process are as follows:

- Cleanup design (Engineering Design Report, Construction Plans and Specifications, and Compliance Monitoring Plan for Soil Removal)
- Cleanup construction
- As-Built Report for the cleanup construction
- Environmental covenant
- Groundwater MNA (MNA Compliance Monitoring Plan preparation, initiation of MNA monitoring, and Annual Reports for the MNA monitoring program).

Design and construction of the Lignin OU cleanup are planned to be completed in 2022. Thereafter, groundwater MNA compliance monitoring will continue until the requirements for terminating the monitoring program, as defined in the MNA Compliance Monitoring Plan, have been met.

Any schedule changes agreed to by Ecology and the Port will be formally documented in writing, pursuant to the terms of the Consent Decree's Extension of Schedule section.

8 References

Aspect Consulting, LLC (Aspect), 2013, Remedial Investigation, Georgia-Pacific West Site, Bellingham, August 5, 2013, Volume 1 of RI/FS.

Aspect Consulting, LLC (Aspect), 2018, Feasibility Study, Chlor-Alkali Remedial Action Unit, Vol. 2b of RI/FS, Georgia-Pacific West Site, Bellingham, Washington, June 2018.

Washington State Department of Ecology (Ecology), 2014, Cleanup Action Plan, Pulp /Tissue Mill Remedial Action Unit, Georgia-Pacific West Site, Bellingham, Washington, October 30, 2014.

Washington State Department of Ecology (Ecology), 2021, Cleanup Action Plan, Chlor-Alkali Remedial Action Unit, Georgia-Pacific West Site, Bellingham, Washington, September 7, 2021.

TABLES

Table 1. Soil Cleanup Levels for Contaminants of Concern

Lignin Operable Unit, Chlor-Alkali RAU Cleanup Action Plan, GP West Site

Constituent of Concern	Soil Cleanup Level (mg/kg)		
	Based on Unrestricted Direct Contact	Based on Leaching to Groundwater	
		Unsaturated Soil	Saturated Soil
Heavy Metals			
Cadmium	80	1	1
Chromium (Total)	120,000	5,200	260
Copper	3,200	36	36
Zinc	24,000	100	85
Polycyclic Aromatic Hydrocarbons (PAHs)			
Total cPAHs (TEQ)	0.19	0.19*	0.19*

Abbreviations: cPAH: carcinogenic PAH. mg/kg: milligrams per kilogram. TEQ: toxic equivalent concentration of benzo(a)pyrene.

Notes:

Cleanup levels are from the Chlor-Alkali Remedial Action Unit Cleanup Action Plan (Ecology, 2021), with distinction made here for levels based on soil direct contact versus those based on leaching to groundwater.

*: Determined based on empirical demonstration of soil concentrations protective of groundwater in accordance with WAC 173-340-747(9).

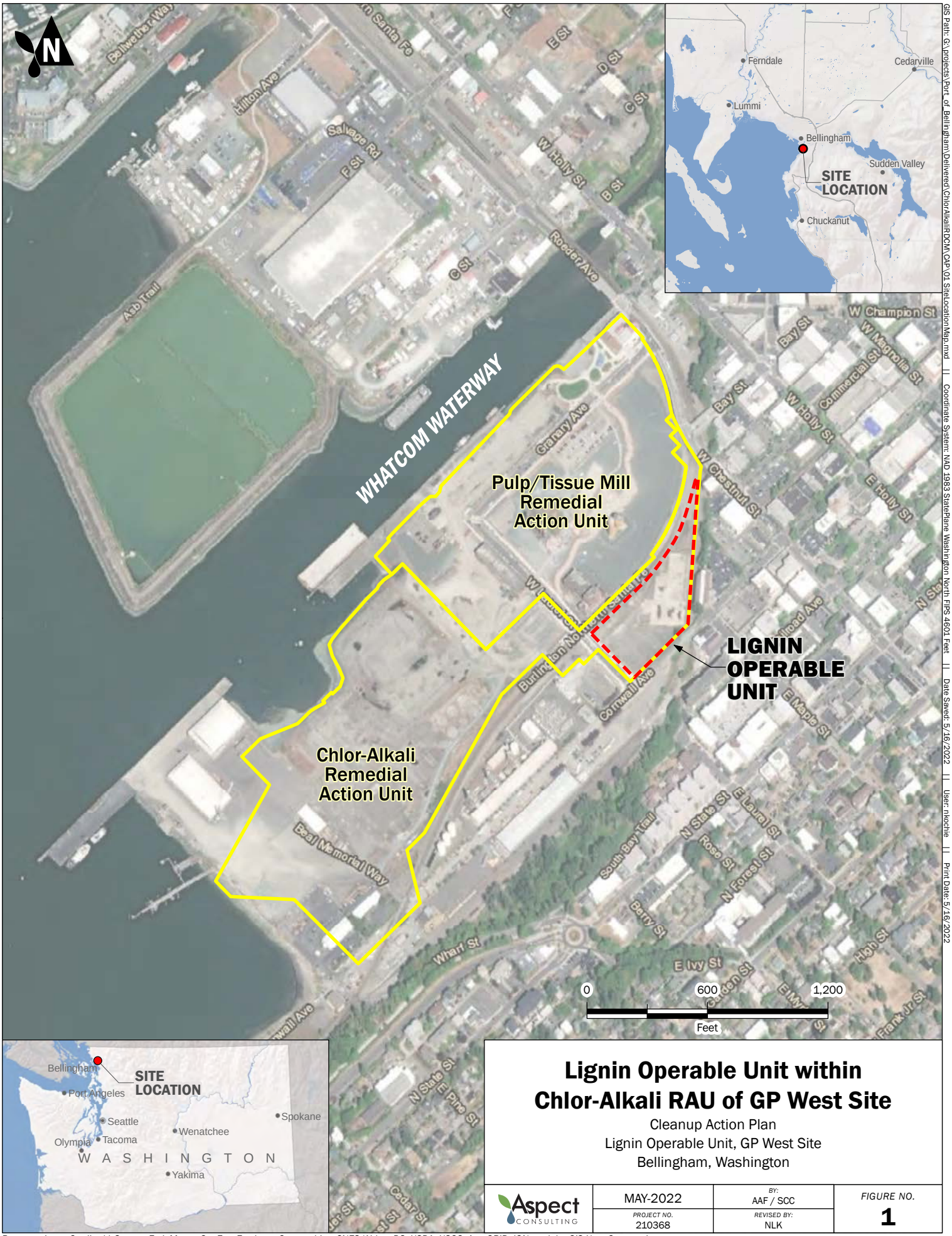
Table 2. Groundwater Cleanup Levels for Contaminants of Concern

Lignin Operable Unit, Chlor-Alkali RAU Cleanup Action Plan, GP West Site

Constituent of Concern	Groundwater Cleanup Level (µg/L)
Heavy Metals	
Chromium (Total)	260
Copper	3.1
Zinc	81

Note: Cleanup levels are from the Chlor-Alkali Remedial Action Unit Cleanup Action Plan (Ecology, 2021).

FIGURES



Lignin Operable Unit within Chlor-Alkali RAU of GP West Site

Cleanup Action Plan
Lignin Operable Unit, GP West Site
Bellingham, Washington

Aspect CONSULTING	MAY-2022	BY: AAF / SCC	FIGURE NO. 1
	PROJECT NO. 210368	REVISED BY: NLK	

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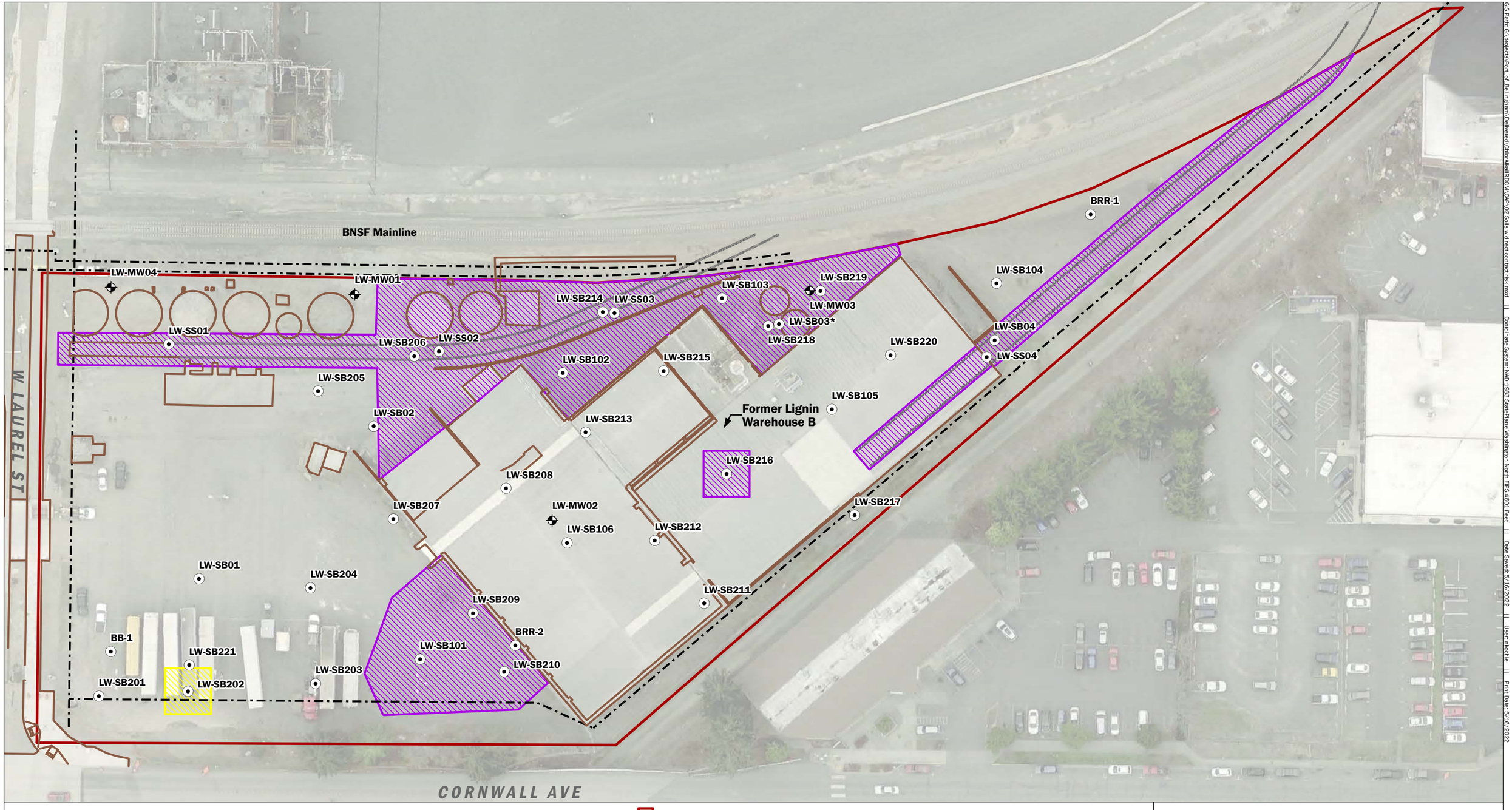

Explorations

- Soil Boring
- Monitoring Well

Soil Contamination Posing Direct Contact Risk

- Zinc
- Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)

- Remnant Concrete Structure to be Removed
- Railroad Spur
- Lignin Operable Unit
- Existing Easement

MILL NORTH

TRUE NORTH

45°

0 30 60

Feet

Note:
1. Existing features and Lignin operable unit from Millworks survey NOV-2021.

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Areas of Soil Contamination Posing Direct Contact Risk

Cleanup Action Plan
Lignin Operable Unit, GP West Site
Bellingham, Washington

Aspect Consulting	MAY-2022	BY: SJG / AAF	FIGURE NO. 2
	PROJECT NO. 210368	REVISED BY: NLK	

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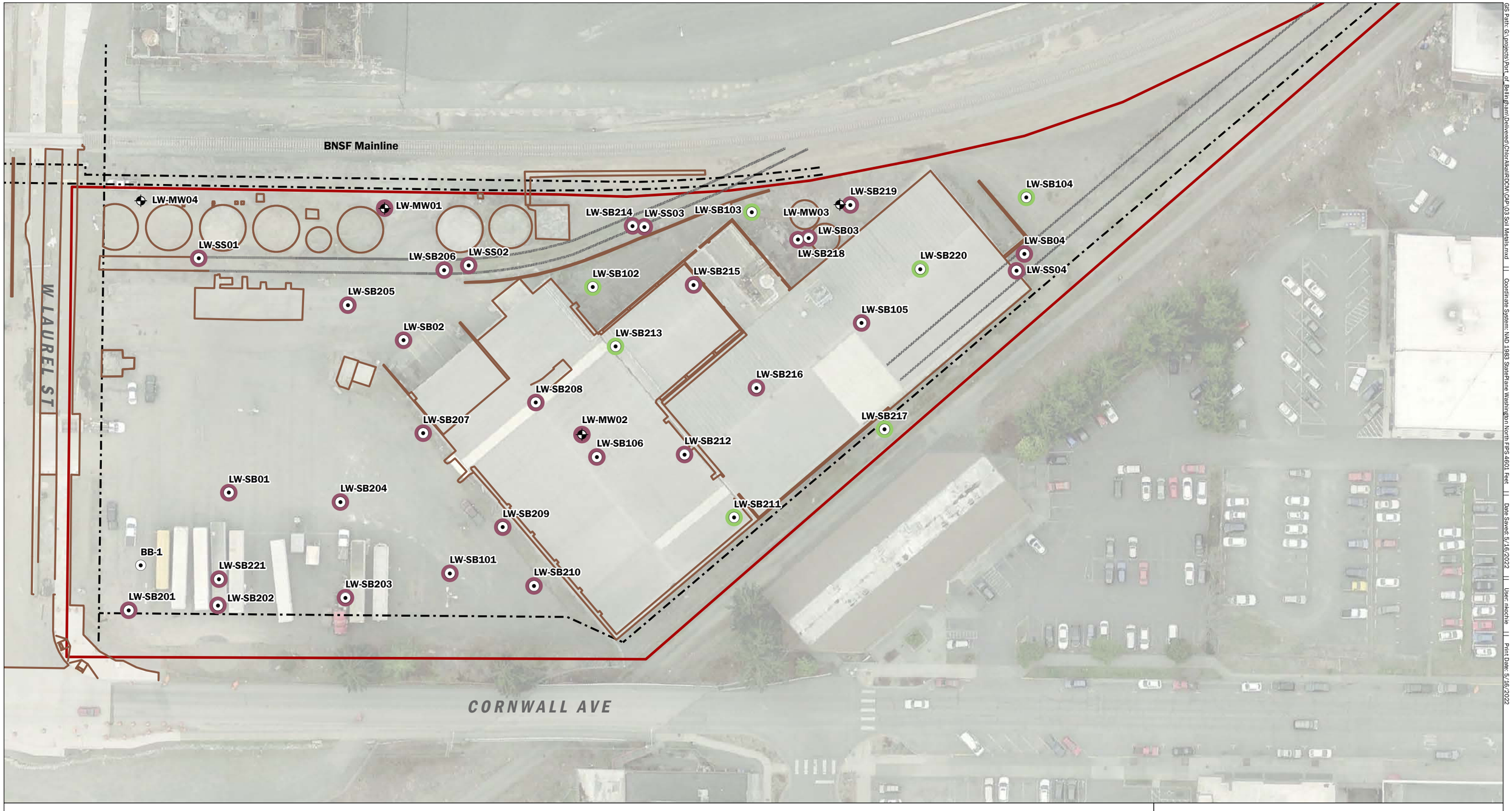

Explorations

- Soil Boring
- Monitoring Well

Soil Metals Concentrations

- Exceeds concentration modeled to be protective of leaching
- Less than concentration modeled to be protective of leaching

- Remnant Concrete Structure to be Removed
- Railroad Spur
- Lignin Operable Unit
- Existing Easement

MILL NORTH
TRUE NORTH
45°

0 30 60
Feet

Note:
1. CUL = soil cleanup level,
2. Existing features and Lignin operable unit from Millworks survey NOV-2021.

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Distribution of Soil Metals Concentrations Relative to Leaching-Based Cleanup Levels

Cleanup Action Plan
Lignin Operable Unit, GP West Site
Bellingham, Washington

Aspect Consulting	MAY-2022	BY: SJG / AAF	FIGURE NO. 3
	PROJECT NO. 210368	REVISED BY: NLK	

GIS Path: G:\projects\Port_of_Bellingham\Delivered\Chlor-Alkali\RDM\CAP\03 Soil Metals.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 5/16/2022 || User: nkochie || Print Date: 5/16/2022

Explorations

- Monitoring Well
- CUL exceedance in January and/or February 2022 groundwater samples. Exceeding constituent is listed.
- No CUL exceedances in January or February 2022 groundwater samples
- Anticipated General Area for Future Groundwater MNA Monitoring Wells
- Water table elevation, NAVD88 1/24/2022
- Generalized Groundwater Flow Direction
- Remnant Concrete Structure to be Removed
- Existing Easement
- Railroad Spur
- Lignin Operable Unit

Note:
1. Existing features, Lignin operable unit, and utility lines from Millworks survey NOV-2021.
2. City raw water lines from Georgia-Pacific CAD file.

MILL NORTH
TRUE NORTH
45°

0 30 60
Feet

Groundwater Flow Direction and Metals Exceedances

Cleanup Action Plan
Lignin Operable Unit, GP West Site
Bellingham, Washington

Aspect Consulting	JUN-2022	BY: SJG / AAF	FIGURE NO. 4
	PROJECT NO. 210368	REVISED BY: NLK	

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Soils to be Removed
Soil Exceeding Direct Contact CULs
- Metals > direct contact CUL (6-ft excavation)
- cPAH > direct contact CUL (2-ft excavation)

Soils to be Removed
Additional Metals-Impacted Soils*
- 0.5- to 4-foot deep excavation
- 7-foot deep excavation

- Remnant Concrete Structure to be Removed
- Railroad Spur to be Removed
- Pavement to be Removed
- Lignin Operable Unit

Notes:
1. CUL = cleanup level
2. Existing features and Lignin operable unit from Millworks survey NOV-2021.
*: Because the affordable housing redevelopment subgrade design is in process, the excavation depths may change somewhat by the time that the cleanup construction plans and specifications are finalized. All excavation depths are approximate.

MILL NORTH
TRUE NORTH
45°

0 30 60
Feet

Selected Cleanup Action

Cleanup Action Plan
Lignin Operable Unit, GP West Site
Bellingham, Washington

Aspect Consulting	MAY-2022	BY: SJG / AAF	FIGURE NO. 5
	PROJECT NO. 210368	REVISED BY: NLK	

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