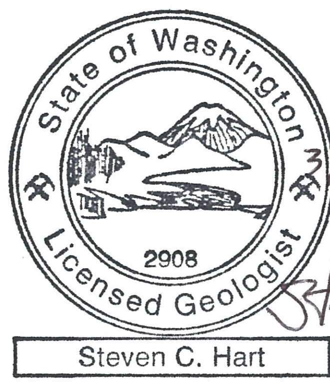
Updated Conceptual Site Model
Chemtrade Performance Chemicals US LLC Site
(aka Former Clariant Corporation Facility)

Kalama, Washington
Facility No. 24634187
VCP Project No. SW0492

H&H Job No. CLR-045
March 19, 2018



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Kalama, Washington
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1.0 Introduction

On behalf of Clariant Corporation (Clariant), Hart & Hickman, PC (H&H) has prepared this updated Conceptual Site Model (CSM) for the Chemtrade Performance Chemicals US LLC site (Cleanup Site No. 1784, Facility/Site No. 24634187) located at 404 N. Hendrickson Drive in Kalama, Cowlitz County, WA. A site location map is included as Figure 1 and a site vicinity map is included as Figure 2. Note that we have previously referred to the site as the former Clariant Corporation facility. The site is currently enrolled in the Washington State Department of Ecology (Ecology) Voluntary Cleanup Program (VCP Project No. SW0492). In an opinion letter dated February 9, 2017, Ecology recommended preparation and submittal of an updated CSM.

Environmental investigations indicate that there are soil and groundwater impacts at the site, and that the compounds of concern (COCs) associated with the site are cadmium and zinc. There are two main areas of impact at the site: the Former Settling Basins (FSB) area and the Manufacturing Plant Area (MPA). Impacts in the FSB area are associated with former settling basin #1 (FSB1) and former settling basin #2 (FSB2), and impacts in the MPA are associated with previous manufacturing activities. A site map is provided as Figure 3.

This CSM has been prepared to provide a description of:

- site setting and background information;
- site geology and hydrogeology;
- current and potentially applicable COC cleanup levels (CULs) and points of compliance (POCs);
- COC sources and remediation activities; and,

- current COC conditions, fate and transport, and potential exposure pathways and risks.

The CSM is also intended to assist with COC data interpretation and project communications.

2.0 Site Setting and Background

2.1 Site Location and Description

Based on information obtained from Cowlitz County Assessor's Office, the site is an approximately 8-acre parcel (Cowlitz County PIN 6005401) which is zoned industrial. Previous reports indicate the areal extent of the site property to be approximately 6.7 acres. The site is located in the Port of Kalama industrial area. The site is currently owned by Chemtrade Performance Chemicals, Inc. (Chemtrade). Chemtrade purchased the site from Clariant in January 2003. The site is bordered to the west by the Columbia River, and to the north, south, and the east by parcels which are zoned commercial and owned by the Port of Kalama. The parcels to the north and east of the site are developed with Hendrickson Drive, and the parcel to the north of the site includes a paved driveway and walking path which provide access to riverfront. The parcel to the south of the site is developed with rail spur lines which run along the eastern portion of the parcel, but is otherwise largely undeveloped and primarily used to stockpile river dredge spoils. The parcel to the east of Hendrickson Drive (east of the Port of Kalama-owned parcel) adjacent to the site is owned by Burlington Northern, Inc. and is developed with railroad lines.

Note that manufacturing operations ceased at the site during 2016 and future plans for the site are not known to Clariant. Process equipment and tanks located at the site were decommissioned and cleaned during 2016 and 2017. As of the date of this CSM, an approximately 17,000-square foot (sf) manufacturing building that contains offices, storage space, a break room, loading docks, a mechanic shop, a lab, a utility room, and product manufacturing areas is located on the southeastern portion of the site. The manufacturing building is generally constructed with steel column and beam framing with sheet metal siding and a concrete slab-on-grade foundation. A concrete-lined subgrade tank vault which contains two former process tanks is located inside the northern portion of the manufacturing building in the area identified as the Make Tank Room. A concrete secondary containment area which contains chillers and tanks formerly used to store wastewater, glycol, and dissolver are located adjacent to the northwestern portion of the manufacturing building. To the north-northwest of the manufacturing building are an approximately 1,000-sf building which was used for zinc oxide drying, two concrete secondary containment areas that contain former process tanks and equipment, a truck loading area, and two silos.

A railroad spur runs along the east side of the site structures and crosses Hendrickson Drive to the northeast of the manufacturing structures. A sulfur dioxide above ground storage tank (AST) is located to the east of the railroad spur near the northeastern portion of the manufacturing building, and a pump house is located west of the manufacturing building near the western edge of the site. The areas surrounding the northern portion of the manufacturing building and secondary containment structures are paved with asphalt. An asphalt parking lot is located to the south of the building, and an asphalt driveway runs along the western side of the site from the parking lot to the paved area around the northern portion of building. Asphalt and concrete pavement are also present along the eastern side of the manufacturing building. These portions of the site are collectively referred to as the MPA.

North of the manufacturing facility structures where four settling basins were formerly located, the site property is largely undeveloped except for an asphalt driveway which extends from the paved area in the northern portion of the MPA to an access gate. In undeveloped areas, the ground is primarily sandy and portions of the undeveloped land are sparsely vegetated with grasses. The site is almost entirely fenced except for the perimeter area along Hendrickson Drive in the southeastern portion of the site. Site features are shown in Figure 3.

2.2 Land Use Classification for Exposure Scenarios

The Model Toxics Control Act (MTCA), Washington Administration Code (WAC) 173-340-7490 (3)(c) indicates that "industrial property" means properties that are or have been characterized by, or are to be committed to, traditional industrial uses such as processing or manufacturing of materials, marine terminal and transportation areas and facilities, fabrication, assembly, treatment, or distribution of manufactured products, or storage of bulk materials, that are either:

- zoned for industrial use by a city or county conducting land use planning under chapter 36.70A RCW (Growth Management Act); or

- for counties not planning under chapter 36.70A RCW (Growth Management Act) and the cities within them, zoned for industrial use and adjacent to properties currently used or designated for industrial purposes.

"Commercial property" means properties that are currently zoned for commercial or industrial property use and that are characterized by or are committed to traditional commercial uses such as offices, retail and wholesale sales, professional services, consumer services, and, warehousing.

The site is located in a county not planning under chapter 36.70A RCW (Growth Management Act), and the property is zoned industrial. The site is bordered to the west by the Columbia River, and to the north, south, and the east by parcels which are zoned commercial and owned by the Port of Kalama. As discussed in Section 2.1, these three parcels include paved roads/pathways or railroad spurs, but are otherwise largely undeveloped. In addition, the parcel to the east of the Hendrickson Drive adjacent to the site is owned by Burlington Northern, Inc. and is developed with a railroad.

Based on the information presented above, we believe the site qualifies as industrial/commercial land use under MTCA for the purposes of exposure scenarios.

2.3 Historical Site Use and Manufacturing Processes

According to the Camp Dresser & McKee (CDM) report entitled *Phase I Environmental Assessment* (CDM 2002), which is hereafter referred to as the CDM EA, and the CDM Feasibility Study (CDM 2008), which is hereafter referred to as the CDM FS, the site was first developed in 1969 by Virginia Chemicals. At that time, the manufacturing facility contained the structures discussed above, except the structures to the north-northwest of the building were constructed at a later date. Prior to 1969, the site was undeveloped and was physically built up with approximately 20 ft of dredge spoils from the Columbia River shortly before the start of manufacturing operations. Hoechst Celanese purchased the site in 1989 and operated the facility until 1997 when Clariant and Hoechst Celanese merged. Clariant sold the property and manufacturing facility to Chemtrade in 2003; however, Clariant maintained environmental liability for the site.

The CDM EA indicates the site has always been used for manufacturing sodium hydrosulfite; however, the CDM FS indicates that zinc hydrosulfite was manufactured from 1969 through 1973 before manufacturing sodium hydrosulfite from 1974 through the time of the report (2002). The plant continued to manufacture sodium hydrosulfite until 2016 when the plant was shut down. According to the CDM EA, sodium hydrosulfite was manufactured at the site utilizing a batch process that generally included mixing zinc dust and water in a reactor tank, then reacting the mixture with sulfur dioxide to formulate zinc hydrosulfite. The zinc hydrosulfite was then reacted with sodium hydroxide (aqueous) to form sodium hydrosulfite (aqueous) and zinc oxide (non-aqueous). This formulation process was primarily completed in two process tanks located in the Make Tank Room concrete-lined subgrade tank vault. Prior to 2004, cadmium sulfate solution was utilized as needed to remove lead impurities from the zinc hydrosulfite. The sodium hydrosulfite was diluted to final product specification prior to placement into tankers for off-site shipment. After being dried, zinc oxide solids were paced into rail cars for off-site shipment. The sodium hydrosulfite was sold for use in newspaper production, and zinc oxide byproduct was sold for use in tire manufacturing.

According to the CDM FS, from approximately 1974 until the late 1970s or early 1980s, the manufacturing process generated zinc carbonate sludge as a byproduct, and the sludge was discharged to FSB2. The CDM FS indicates that sludge was apparently not discharged to FSB2 after 1984. FSB1 received minor spillage of zinc carbonate sludge from conveyance of the sludge to FSB2. Former settling basins #3 and #4 (FSB3 and FSB4) were never used. The settling basins were closed in 1989 by removing the marketable zinc carbonate sludge from FSB2 and filling in the basins. As discussed in Section 5.2.1, in 2003 and 2010, residual sludge and impacted soil were removed from the area of FSB1 (to an average depth of 7 ft below ground surface – bgs) and FSB2 (to a depth of 15 ft bgs).

Approximately 20 ASTs were used for storage and processing of liquid materials at the site. No underground storage tanks are known to have been present or previously used at the site. Dry materials used in the manufacturing processes were stored in drums, totes, and bag/sacks inside the warehouse portion of the manufacturing building. Refer to the CDM EA for additional manufacturing process details and summaries of tanks and chemicals previously used at the site. Wastewater generated during the manufacturing processes and potentially contaminated storm water collected from areas such as the secondary containment and rail car/tanker loading areas was collected and used as make-up water in the production processes.

3.0 Geology and Hydrogeology

The site is located along the eastern bank of the Columbia River and is underlain by dredge spoils, alluvial deposits, and bedrock. As previously mentioned, the site was built up with approximately 20 ft of river dredge spoils shortly before the start of manufacturing operations, and the riverbank adjacent to the site is armored with rip rap. The dredge spoils consist primarily of fine to coarse-grained loose brown, gray, and black sand. The alluvium consists of fine to coarse-grained loose brown, gray, and black sand with silts and gravels. The bedrock geology in the area of the site is complex and primarily consists of basalt flows and marine and non-marine sandstone. Based on borings installed at the site, bedrock is present at approximately 25 to 30 ft bgs beneath the northern and eastern portions of the site and slopes downwards to greater than 60 ft bgs in southern and western portions of the site.

The Columbia River is subject to tidal fluctuations at the location of the site. Based on verified Columbia River elevation data obtained from the National Oceanic and Atmospheric Association (NOAA), the elevation of the Columbia River can fluctuate by as much as approximately 7 ft between low and high tides in the vicinity of the site. Historical groundwater elevation data collected from site monitor wells indicate that shallow groundwater flow at the site is influenced by the tidal elevation variations of the Columbia River. In the eastern portion of the site, there is a hydraulic gradient from east to west toward the river. In the western portion of the site, hydraulic communication between the river and shallow groundwater results in a temporal mound in the groundwater table near the river that creates a relatively weak hydraulic gradient from west to east in that area. The groundwater mound near the river is temporal and its presence depends upon the timing and magnitude of the tides. The converging hydraulic gradients appear to cause groundwater in the central portion of the site (where maximum cadmium and zinc concentrations are located) to be temporally stagnant. The groundwater mound and gradient appear to vary in magnitude with the tidal fluctuations of the river (being largest at high tide and smallest at low tide), but do not appear to vary significantly with seasonal changes in the elevation of the river.

In addition, groundwater elevation data indicate that groundwater elevations at the site fluctuate in concert with seasonal changes in average river levels. In the period between 2010 and 2017, average high and average low groundwater elevations have differed by approximately eight feet at the site as a result of seasonal changes in average river levels. Depth-to-groundwater ranged from approximately 16 to 26 ft bgs during monitoring events completed during this period.

A summary of site monitor well construction details is included as Table 1, and 2010 through 2017 groundwater elevation data is summarized along with river elevation data in Table 2. A groundwater elevation contour map for August 2017 is included as Figure 4.

4.0 Cleanup Levels (CULs) and Points of Compliance (POCs)

Under MTCA, a cleanup level (CUL) is the concentration of a hazardous substance in soil, water, air, or sediment that is determined to be protective of human health and the environment under specified exposure conditions. CULs, in combination with points of compliance (POCs), typically define the area or volume of environmental media (e.g., soil, water, air, or sediment) at a site that is addressed by the cleanup action. CULs and POCs which are currently applicable to the site and those which we interpret to be potentially applicable to the site are presented below for the COCs associated with the site (cadmium and zinc).

4.1 Soil CULs and POCs

4.1.1 Soil – Direct Contact

Per WAC 173-340-740 (6)(d), for soil CULs based on human exposure via direct contact or other exposure pathways where contact with the soil is required to complete the pathway, the POC shall be established in the soils throughout a site from the ground surface to 15 ft bgs. Per Ecology, this represents a reasonable estimate of the depth of soil that may be excavated and distributed at the soil surface as a result of hypothetical development activities.

Per WAC 173-340-705, Method B is applicable to all sites and shall be used to develop CULs unless one or more of the conditions for using Method A or Method C are demonstrated to exist and the person conducting the cleanup action elects to use that method. Per WAC 173-340-740 (3)(b)(iii)(B)(1), the unrestricted land use soil – direct contact Method B soil CULs for substances with noncarcinogenic effects (such as cadmium and zinc) shall be determined using Equation 740-1. The soil – direct contact CULs calculated using this equation are 80 mg/kg for cadmium and 24,000 mg/kg for zinc. As discussed in Section 2.2, we believe the site qualifies as industrial/commercial under MTCA for the purposes of exposure scenarios. Therefore, we believe the site qualifies for use of industrial soil CULs under WAC 173-340-745.

The industrial soil – direct contact Method C soil CULs (calculated using Equation 745-1) potentially applicable to the site are 3,500 mg/kg for cadmium and 1,050,000 mg/kg for zinc. In addition, implementation of institutional and/or engineered controls to limit or prohibit activities which may result in exposure to hazardous substances via the direct contact pathway may be appropriate for the site in lieu of achieving soil – direct contact CULs.

4.1.2 Soil – Protection of Terrestrial Environment

WAC 173-340-7490 defines the goals and procedures Ecology will use for determining whether a release of hazardous substances to soil may pose a threat to the terrestrial environment, characterizing existing or potential threats to terrestrial plants or animals exposed to hazardous substances in soil, and establishing site-specific cleanup standards for the protection of terrestrial plants and animals. Per WAC 173-340-7490 (2), in the event of a release of a hazardous substance to the soil at a site, one of the following actions shall be taken:

(a) Document an exclusion from any further terrestrial ecological evaluation using the criteria in WAC 173-340-7491;
(b) Conduct a simplified terrestrial ecological evaluation as set forth in WAC 173-340-7492; or,
(c) Conduct a site-specific terrestrial ecological evaluation as set forth in WAC 173-340-7493.

<u>Exclusions</u>
An exclusion from further terrestrial ecological evaluation may be applicable at a site if Ecology determines that soil contaminated with hazardous substances is located below applicable POCs established under WAC 173-340-7490 (4). For sites with institutional controls to prevent excavation of deeper soil, a conditional POC may be set at the biologically active soil zone. This zone is assumed to extend from the surface to 6 ft bgs. An institutional control is not required for soil contamination that is more than 15 ft bgs (the standard POC). An exclusion may also be applicable if it is determined that all soil contaminated with hazardous substances is, or will be,

covered by buildings, paved roads, pavement, or other physical barriers that will prevent plants or wildlife from being exposed to the soil contamination. To qualify for this exclusion, an institutional control shall be required by the department under WAC 173-340-440. Based upon our review, the site does not appear to currently qualify for an exclusion from terrestrial ecological evaluation using these criteria because not all of the residual impacted soil at the site is covered with physical barriers which will prevent plant/wildlife exposure to the impacted soil.

When a site does not qualify for an exclusion, a site-specific terrestrial ecological evaluation should be performed if any of the criteria of WAC 173-340-7491 (2)(a) summarized below apply:

i. The site is located on or adjacent to an area where management or land use plans will maintain or restore native or semi-native vegetation.
ii. The site is used by threatened or endangered species, wildlife species classified by the Washington state department of fish and wildlife as a "priority species" or "species of concern" under Title 77 RCW; or a plant species classified by the Washington state department of natural resources natural heritage program as "endangered," "threatened," or "sensitive" under Title 79 RCW. For plants, "used" means that a plant species grows at the site or has been found growing at the site. For animals, "used" means that individuals of a species have been observed to live, feed, or breed at the site.
iii. The site is located on a property that contains at least ten acres of native vegetation within 500 feet of the site, not including vegetation beyond the property boundaries.
iv. Ecology determines that the site may present a risk to significant wildlife populations.

If the criteria of WAC 173-340-7491 (2)(a) do not apply to a site, either a simplified or a site-specific terrestrial ecological evaluation shall be conducted. It does not appear that any of the criteria of WAC 173-340-7491 (2)(a) likely apply to the site. Therefore, we believe that either a simplified or a site-specific terrestrial ecological evaluation are appropriate for the site, each of which are described in the following sections.

Simplified Terrestrial Ecological Evaluation

WAC 173-340-7492 sets forth the procedures for conducting a simplified terrestrial ecological evaluation. The simplified terrestrial ecological evaluation process is intended to identify those sites which do not have a substantial potential for posing a threat of significant adverse effects to terrestrial ecological receptors, and thus may be removed from further ecological consideration during the remedial investigation and cleanup process. The process is structured with an intent to protect terrestrial wildlife at industrial or commercial sites, and terrestrial plants, soil biota and terrestrial wildlife at other sites, as provided under WAC 173-340-7490 (3)(b).

WAC 173-340-7490 (3)(b) indicates that for industrial or commercial properties, current or future potential for exposure to soil contamination need only be evaluated for terrestrial wildlife protection. Plants and soil biota need not be considered at industrial or commercial properties unless the species is protected under the federal Endangered Species Act or the soil contamination is located on an area of an industrial or commercial property where vegetation must be maintained to comply with local government land use regulations. There are no known species of plants or soil biota protected under the federal Endangered Species Act and there is no requirement for maintenance of vegetation at the site. As discussed in Section 2.2, we believe the site qualifies as industrial/commercial under MTCA for the purposes of exposure scenarios. Therefore, we believe that exposure to soil contamination need only be evaluated for terrestrial wildlife protection.

The simplified terrestrial ecological evaluation process focuses on exposure, pathways, and contaminants as key screening steps in evaluating ecological risk. These screening steps need not be followed in order, and the results of analysis of any one of these screening steps may be used to determine that no further evaluation is necessary to conclude that a site does not pose a substantial threat of significant adverse effects to terrestrial ecological receptors. If none of the simplified terrestrial ecological evaluation screening step conditions are met, chemical concentrations listed in Table 749-2 (presented for cadmium and zinc below) may be used as ecological CULs, or a site-specific terrestrial ecological evaluation must be conducted.

	Unrestricted Land Use	Industrial/Commercial
Cadmium	25 mg/kg	36 mg/kg
Zinc	270 mg/kg	570 mg/kg

The exposure, pathways, and contaminants screening steps of the simplified terrestrial ecological evaluation process are discussed briefly below for the site.

The exposure screening step is used to determine the likelihood of substantial wildlife exposure based on land use at the site and surrounding areas. It does not appear that the site meets criteria of the exposure screening step which would allow for the simplified terrestrial ecological evaluation process to be ended. The pathways screening step is used to evaluate potential exposure pathways for ecological receptors. Per WAC 173-340-7492 (2)(b), only exposure pathways for the chemicals of ecological concern listed in Table 749-2 above the concentrations provided in the table (presented for cadmium and zinc above) must be considered. Incomplete pathways may be due to the presence of man-made physical barriers in combination with a restrictive covenant to ensure maintenance of the barrier. The contaminants screening step is used to determine if chemicals of ecological concern listed in Table 749-2 are, or will be, present in soil at a depth not exceeding POCs, above the concentrations provided in the table, as determined using the statistical compliance methods described in WAC 173-340-740 (7). Use of statistical compliance methods to evaluate COC concentrations in site soil will be discussed with Ecology as part of Feasibility Study (FS) development.

For the site to qualify for a simplified terrestrial ecological evaluation, it is possible that physical barriers could be used to eliminate potential ecological exposure to COC concentrations in site soil above those presented in Table 749-2 and to end the exposure screening step. In addition, it is possible that soil removal could be performed to reduce COC concentrations in site soil to below those presented in Table 749-2 to end the contaminants screening step. If any of the screening steps discussed above are used to end the simplified terrestrial ecological evaluation, institutional controls may be required to ensure that the condition will continue to be met in the future. Cleanup remedies that rely on chemical concentrations for industrial or commercial sites in Table 749-2 shall include appropriate institutional controls to prevent future exposure to plants or soil biota in the event of a change in land use.

<u>Site-Specific Terrestrial Ecological Evaluation</u>

The site-specific terrestrial ecological evaluation process is intended to be highly likely to be protective at any site. WAC 173-340-7493 sets forth the procedures for conducting a site-specific terrestrial ecological evaluation. In addition to the purposes specified in WAC 173-340-7490 (1)(a), the site-specific terrestrial ecological evaluation is intended to facilitate selection of a cleanup action by developing information necessary to conduct evaluations of cleanup action alternatives in the FS. There are two elements in planning a site-specific terrestrial ecological evaluation. Both elements shall be done in consultation with Ecology and must be approved by Ecology. The two elements are: 1) completing the problem formulation step as required under WAC 173-340-7493 (2), and 2) selecting one or more methods under WAC 173-340-7493 (3) for addressing issues identified in the problem formulation step. After reviewing the problem formulation step, Ecology, at its discretion, may determine that selection of one or more methods for addressing issues identified in the problem formulation step is not necessary by making either of the following decisions:

1. No further site-specific terrestrial ecological evaluation is necessary because the cleanup action plans developed for the protection of human health will eliminate exposure pathways of concern to all of the soil contamination.

2. A simplified terrestrial ecological evaluation may be conducted under WAC 173-340-7492 because this evaluation will adequately identify and address any existing or potential threats to ecological receptors.

The problem formulation step is intended to define the focus of the site-specific terrestrial ecological evaluation and identify issues to be addressed in the evaluation, specifying: chemicals of ecological concern, exposure pathways, terrestrial ecological receptors of concern, and potential adverse toxicological effects. Hazardous substances may be eliminated from further consideration where the maximum or the ninety-five percent upper confidence limit (95% UCL) soil concentration found at the site does not exceed ecological indicator concentrations presented in Table 749-3 (summarized for the site COCs below).

	Plants	Soil Biota	Wildlife
Cadmium	4 mg/kg	20 mg/kg	14 mg/kg
Zinc	86 mg/kg	200 mg/kg	360 mg/kg

Please note that WAC 173-340-7493 (2)(i) indicates the ecological indicator concentrations presented above are not cleanup levels, and concentrations that exceed the values do not necessarily require remediation. These values represent soil concentrations that are expected to be protective at any MTCA site.

As previously discussed, WAC 173-340-7490 (3)(b) indicates that for industrial or commercial properties, current or future potential for exposure to soil contamination need only be evaluated for terrestrial wildlife protection, and we believe the site qualifies as industrial/commercial under MTCA for the purposes of exposure scenarios. Therefore, we believe that only the ecological indicator concentrations for wildlife should be considered applicable to site soil for terrestrial ecological evaluation purposes if a site-specific terrestrial ecological evaluation is performed to develop soil – protection of terrestrial environment CULs.

If it is determined during the problem formulation step that further evaluation is necessary, the ecological indicator concentrations listed in Table 749-3 may be used as soil – protection of terrestrial environment CULs. Alternatively, one or more of the methods listed in WAC 173-340-7493 (3)(a-g) may be utilized for addressing issues identified in the problem formulation step. These methods include use of literature surveys, soil bioassays, wildlife exposure modeling, biomarkers, field studies, a weight of evidence approach, and other methods approved by Ecology.

Based on the information presented above, and with Ecology concurrence, it appears that use of a simplified terrestrial ecological evaluation process is most appropriate for the site and that the site should qualify as industrial/commercial for the purposes of exposure scenarios. Therefore, we believe that the COC concentrations listed in Table 749-2 for industrial/commercial sites (36 mg/kg for cadmium and 570 mg/kg for zinc) are most appropriate for use in evaluating ecological risk, and these values are hereafter referred to as Ecological CULs.

4.1.3 Soil – Protection of Groundwater

Since 2010, depth-to-groundwater measured in flush construction site wells has ranged from approximately 16 to 24 ft bgs, and the average depth-to-groundwater during these monitoring events is approximately 20 ft bgs. As previously discussed, groundwater elevation data indicate that groundwater elevations at the site fluctuate in correspondence with seasonal changes in average Columbia River levels. As such, the unsaturated soil – protection of groundwater POC is throughout the site from the ground surface to a proposed depth of 20 ft bgs, and the saturated soil – protection of groundwater POC is throughout the site at a proposed depth of greater than 20 ft bgs.

Per WAC 173-340-740 (3)(b)(iii)(A), the unrestricted land use Method B groundwater protection soil CULs are concentrations that will not cause impact to groundwater at levels which exceed groundwater CULs established under WAC 173-340-720 as determined using the methods described in WAC 173-340-747. Saturated and unsaturated soil – protection of groundwater CULs for cadmium and zinc were calculated using the three-phase partitioning model described by Equation 747-1 per WAC 173-340-747 (4)(b) through (e).

The calculated unrestricted land use Method B unsaturated soil – protection of groundwater CULs for cadmium and zinc are 0.69 mg/kg and 5,970 mg/kg, respectively. The calculated unrestricted land use Method B saturated soil – protection of groundwater CULs for cadmium and zinc are 0.035 mg/kg and 299 mg/kg, respectively.

The soil – protection of groundwater CULs discussed above are concentrations that are unlikely to cause impacts to groundwater at levels which exceed groundwater CULs established under WAC 173-340-720. Method B potable groundwater CULs consist of standard and modified CULs, either of which may be used at any site. Per WAC 173-340-720 (4)(c), modified Method B groundwater CULs for drinking water beneficial uses are standard Method B groundwater CULs modified with chemical-specific or site-specific data. Changes to exposure assumptions used to calculate modified Method B groundwater CULs must comply with WAC 173-340-708 (10).

Because drinking water ingestion rate can be controlled through an institutional control implemented to prohibit use of site groundwater for potable purposes, the drinking water ingestion rate parameter in the Method B formula used to calculate potable groundwater CULs established for human health protection could be adjusted to zero, resulting in unlimited CULs for cadmium and zinc. Therefore, we believe that implementation of an institutional control to prohibit use of site groundwater for potable purposes is appropriate under the MTCA rules in lieu of the potable groundwater CULs established for human health protection and the groundwater soil – protection of groundwater CULs calculated to prevent impacts to groundwater at levels which exceed these groundwater CULs.

Potable groundwater CULs established for protection of surface water beneficial uses are also applicable to a site unless it can be demonstrated that the hazardous substances are not likely to reach surface water. Where the groundwater CUL is based on protection of surface water beneficial uses and the property containing the source of contamination directly abuts the surface water, Ecology may approve a conditional POC that is located within the surface water as close as technically possible to the point or points where groundwater flows into the surface water under certain conditions (see discussion in Section 4.2 below). The applicability of soil – protection of groundwater CULs and practicability of achieving soil – protection of groundwater CULs to prevent impacts to groundwater at levels which exceed potable groundwater CULs for protection of surface water beneficial uses will be evaluated as part of the FS.

4.1.4 Summary of Soil CULs

Below is a summary of soil CULs discussed above.

	Cadmium CUL (mg/kg)	Zinc CUL (mg/kg)	Notes
Direct Contact (Human Health)			
Unrestricted Use	80	24,000	Site is Industrial
Industrial Use	3,500	1,050,000	
Terrestrial Environment			
Unrestricted Use	25	270	Site is Industrial
Industrial Use	36	570	
Protection of GW			
Unsaturated (0-20 ft bgs)	0.69	5,970	Can be Addressed through Groundwater Use Restriction
Saturated (20+ ft bgs)	0.035	299	

4.2 Groundwater CULs and POCs

Per WAC 173-340-720, groundwater CULs shall be based on estimates of the highest beneficial use and the reasonable maximum exposure expected to occur under both current and potential future site use conditions. Ecology has determined that at most sites, use of groundwater as a source of drinking water is the beneficial use warranting the highest quality of groundwater and that exposure to hazardous substances through ingestion of drinking water and other domestic uses represents the reasonable maximum exposure. Groundwater at the site is classified as potable to protect drinking water beneficial uses. Based upon our review of WAC 173-340-720 (2) "Potable groundwater defined", it does not appear that site groundwater is likely to be classified as nonpotable.

Potable groundwater CULs established for human health protection (hereafter referred to as HH CULs) applicable to the site are 5 micrograms per liter (µg/l) for cadmium and 4,800 µg/l for zinc. These CULs are based on the Method A cadmium concentration presented in WAC 173-

340-790, Table 720-1 and the Method B zinc concentration determined using Equation 720-1. The standard POC for the HH CULs is throughout the site from the uppermost level of the saturated zone extending vertically to the lowermost depth which could potentially be affected by the site.

Method B is applicable to all sites. It shall be used to develop CULs unless one or more of the conditions for using Method A or Method C are demonstrated to exist and the person conducting the cleanup action elects to use that method. Method B potable groundwater CULs consist of standard and modified CULs, either of which may be used at any site. Per WAC 173-340-720 (4)(c), modified Method B groundwater CULs for drinking water beneficial uses are standard Method B groundwater CULs modified with chemical-specific or site-specific data. Changes to exposure assumptions used to calculate modified Method B groundwater CULs must comply with WAC 173-340-708 (10). Because drinking water ingestion rate can be controlled through an institutional control implemented at the site to prohibit use of site groundwater for potable purposes, the drinking water ingestion rate parameter in the Method B formula used to calculate HH CULs could be adjusted to zero, resulting in unlimited high CULs for cadmium and zinc. Therefore, we believe that implementation of an institutional control to prohibit use of site groundwater for potable purposes should be allowed under the MTCA rules in lieu of the HH CULs.

Potable groundwater CULs established for protection of surface water beneficial uses (hereafter referred to as SW CULs) are also applicable to the site unless it can be demonstrated that the hazardous substances are not likely to reach surface water. The SW CULs established in accordance with the methods specified in WAC 173-340-730 which are potentially applicable to the site are 0.7 µg/l for cadmium and 66 µg/l for zinc. These are the chronic freshwater aquatic life protection values calculated per Table 240 of WAC 173-201A-240 using a Columbia River average hardness value of 58 milligrams per liter (mg/l).

Per WAC 173-340-720 (8)(i), where the groundwater CUL is based on protection of surface water beneficial uses and the property containing the source of contamination directly abuts surface water, Ecology may approve an off-property conditional POC that is located within the surface water as close as technically possible to the point or points where groundwater flows into the surface water subject to the following conditions:

> (A) It has been demonstrated that the contaminated groundwater is entering the surface water and will continue to enter the surface water even after implementation of the selected cleanup action;
> (B) It has been demonstrated under WAC 173-340-350 through 173-340-390 that it is not practicable to meet the CUL at a point within the groundwater before entering the surface water, within a reasonable restoration time frame;
> (C) Use of a mixing zone under WAC 173-201A-100 to demonstrate compliance with SW CULs shall not be allowed;
> (D) Groundwater discharges shall be provided with all known available and reasonable methods of treatment before being released into surface waters;
> (E) Groundwater discharges shall not result in violations of sediment quality values published in chapter 173-204 WAC;
> (F) Groundwater and surface water monitoring shall be conducted to assess the long-term performance of the selected cleanup action including potential bioaccumulation problems resulting from surface water concentrations below method detection limits; and
> (G) Before approving the conditional POC, a notice of the proposal shall be mailed to the natural resource trustees, the Washington state department of natural resources and the United States Army Corps of Engineers. The notice shall be in addition to any notice provided under WAC 173-340-600 and invite comments on the proposal.

We believe that Ecology approval of a conditional POC for the groundwater CUL based on protection of surface water beneficial uses may be appropriate for the site, subject to the above conditions being met.

Below is a summary of groundwater CULs discussed above.

	Cadmium CUL (µg/l)	Zinc CUL (µg/l)	Notes
Potable GW Protection of Human Health	5	4,800	Can be addressed through groundwater use restriction
Potable GW Protection of Surface Water	0.7	66	Can be addressed through use of conditional POC in Columbia River

4.3 Sediment CULs

Sediment CULs applicable to the site are 2.1 mg/kg for cadmium and 3,200 mg/kg for zinc. These are the Freshwater Sediment Cleanup Objectives presented in Table IV of WAC 173-204-563 which are established for protection of the benthic community in freshwater sediments.

5.0 COC Sources and Remedial Activities

5.1 COC Sources

Soil and groundwater impacts were first identified at the site during environmental assessment activities completed by CDM in November 2002. As previously mentioned, environmental investigations indicate the COCs associated with the site are cadmium and zinc. There are two main areas of impact at the site: the FSB area and the MPA. Impacts in the FSB area are associated with FSB1 and FSB2. FSB2 was an unlined basin which received zinc carbonate sludge and FSB1 was an unlined basin which received minor spillage of zinc carbonate sludge from conveyance of the sludge to FSB2.

Based on our review of historical site operations and the results of environmental assessment activities which have been completed at the site, sources of cadmium impacts in the MPA appear to be releases from process tank systems (particularly in the area of the subgrade tank vault in the Make Tank Room) and wastewater collection system infrastructure (as evidenced by elevated cadmium concentrations detected in soil samples collected adjacent to a floor drain located near a former cadmium AST in the Formulation Room). Sources of zinc impacts in the MPA appear to be releases along the rail spur adjacent to the manufacturing building (where zinc oxide loading operations were conducted) and from wastewater collection system infrastructure. In addition, due to the relatively widespread distribution of zinc impacts in MPA soil, it appears that zinc dust may have been distributed by storm water to areas west of the manufacturing building.

Note that lead was detected above soil – direct contact and Ecological CULs in three samples of/containing zinc carbonate sludge which were collected from FSB1 and FSB2 during 2002. However, the residual sludge was removed during excavation activities completed at the site during 2003 and 2010 (see Section 5.3) and lead was not detected above soil – direct contact and Ecological CULs in any other soil samples collected from the site. Lead has only been detected above laboratory reporting limits in one groundwater sample collected from the site, but the detected concentration was below the HH CULs. Therefore, lead is not considered a COC at the site and is not discussed further.

5.2 Remedial Activities

5.2.1 Soil Removal

In September and October 2003, Clariant excavated and disposed of approximately 16,000 tons of soil from the MPA and the FSB1 and FSB2 areas. Surface soils located in the eastern and western portions of the MPA were excavated to an average depth of 1.5 ft bgs. Soil located under the railroad spur was not excavated in the MPA; however, this area was later paved over. Soil was removed to an average depth of approximately 7 ft bgs in the FSB1 area and to an average depth of approximately 15 ft bgs in the FSB2 area.

Soils located beneath a truck access road that crosses the southern portion of the FSB2 area were not excavated during the 2003 soil removal. The soil left in place below the access road was sloped away from either side of the road to prevent the excavation sidewalls from collapsing under the road. Sidewall confirmation samples collected from the walls of the excavation located along this portion of the access road contained concentrations of zinc and cadmium exceeding CULs. In addition to the soil left in place because of the access road, an approximately 4,500 sf area of soil to the southeast of the access road was excavated to a depth ranging from approximately 5.5 to 8 ft bgs, which is shallower than the standard POC for soil. Refer to the CDM *Soil Excavation Summary Report* (CDM 2004a) for additional information on the 2003 excavation activities.

Soil removal activities targeting soil beneath the access road that crossed the southern portion of FSB2 and soil beneath the previous depth of excavation within the FSB2 area southeast of the access road were conducted at the site in August and September 2010. The excavation activities consisted of access road removal, excavation and off-site disposal of impacted soils located beneath the access road to a depth of 15 ft bgs (including soil that sloped outward from both sides of the access road during the 2003 excavation), excavation of soil beneath the previous depth of excavation within the FSB2 area southeast of the access road to a depth of 15 ft bgs, and replacement of the access road. In total, approximately 11,500 tons of soil were excavated and disposed off-site during the 2010 excavation activities. The 2003 and 2010 excavation areas are identified in Figure 5.

Soil removed from the top four feet of the FSB2 area during the 2003 excavation activities was used to backfill the bottom five feet of the 2003 FSB2 excavation (i.e., from 10 to 15 ft bgs). Approximately one-half of this soil is estimated to have subsequently been removed and disposed off-site during excavation activities complete in 2010. The remainder of the 2003 and 2010 excavations were backfilled with Columbia River dredge spoils obtained from the Port of Kalama-owned property located to the south of the site. Refer to the H&H *Remedial Action Report* (H&H 2011a) for additional information on the 2010 excavation activities.

5.2.2 Groundwater

In addition to the soil removal activities discussed above, the following remedial activities have been completed at the site to address groundwater impacts:

- In September 2010, 23 vertical injection wells and six horizontal injection wells were installed at the site and calcium polysulfide (CaSx) was injected into the wells to address dissolved cadmium and/or zinc in groundwater. CaSx is a lime-sulfur solution designed to be used in various treatment systems as a metal precipitating agent and has been used for in-situ treatment of groundwater impacted with metals. Post-injection monitoring indicated initial reduction of zinc concentrations in groundwater followed by a rebound in concentrations. Injection well locations are depicted in Figure 3. Refer to the H&H *Remedial Action Report* (H&H 2011a) and *Post-Injection Monitoring Report & RAWP Addendum* (H&H 2011b) for additional information on the 2010 injection and monitoring activities.

- In September 2011, a pilot test was performed using three existing injection wells and one newly installed extraction well to inject CaSx and recirculate groundwater in an effort to assist with CaSx distribution in the aquifer. Post-injection monitoring indicated reduction of zinc concentrations in the pilot test area. Refer to the H&H *Pilot Test Report* (H&H 2011c) for additional information on the 2011 pilot test activities.

- In December 2011, six additional recovery wells were installed at the site and full-scale injection of CaSx and groundwater recirculation was performed. Recovery well locations are depicted in Figure 3. Post-injection monitoring indicated initial reduction of zinc concentrations in groundwater followed by a rebound in concentrations. A geochemical evaluation completed in early 2013 concluded that the CaSx applications resulted in temporary reducing conditions needed to immobilize cadmium and zinc, but influence from the Columbia River subsequently oxidized solid zinc compounds resulting in increased dissolved zinc concentrations in the aquifer. Decreased pH may have also dissolved residual zinc carbonate present in the subsurface below 15 ft bgs. Refer to the H&H *Additional Remedial Action & Performance Monitoring Report* (H&H 2012) and *Geochemical Evaluation Summary & 2013 Remedial Action Work Plan* (H&H 2013) for additional information on the 2011 injection and monitoring activities.

- Based on the results of the geochemical evaluation, a pilot test injection of magnesium hydroxide and ferrous sulfate was performed using four existing injection wells during June 2013 to increase aquifer pH and augment the aquifer with iron adsorbent. Field observations and post-injection groundwater monitoring indicate that the injection was likely successful in distributing iron within the aquifer, but distribution of the insoluble magnesium hydroxide was likely limited and therefore had limited effectiveness in increasing aquifer pH. H&H concluded that significant amounts of additional magnesium hydroxide would be needed to substantially raise pH and lower dissolved zinc concentrations, but that long-term reduction of dissolved zinc concentrations using such pH adjustment is not likely to be effective due to interactions between the Columbia River and the site aquifer. Refer to the H&H *Pilot-Scale Injection Report* (H&H 2014) for additional information on the pilot-scale injection activities.

6.0 Current COC Conditions, Fate and Transport, Exposure Pathways and Receptor Risk

This section presents a summary of current COC conditions, receptor risk and mechanisms for risk control, and COC fate and transport associated with site COCs. Soil, groundwater, surface water, and sediment sample locations and COC concentrations are depicted together in Figure 6 and cross-section maps are included as Figures 7A and 7B.

6.1 Current COC Conditions

6.1.1 Soil

Cadmium and zinc data for soil samples which remain in-place at the site (i.e., locations not removed during the 2003 and 2010 excavation activities) are summarized in Table 3 and the "remaining soil" sample locations are depicted in Figure 5. Refer to the CDM EA and the CDM report entitled *Contaminant Delineation* (CDM 2004b) for a summary of the methods and results of sampling completed during October 2002 and March/April 2003, respectively. Refer to the CDM *Soil Excavation Summary Report* (CDM 2004a) and the H&H *Remedial Action Report* (H&H 2011a) for a summary of the methods and results of post-excavation sampling completed during September/October 2003 and August through October 2010, respectively. Refer to the H&H *Soil Sampling Report* (H&H 2017a) for a summary of the methods and results of sampling completed during August 2017. Remaining soil impacts are discussed in the sections below.

<u>Cadmium</u>

Cadmium was detected above the unrestricted land use soil – direct contact CUL currently applicable to the site (80 mg/kg) and the Ecological CUL (36 mg/kg) in remaining soil samples collected from two borings installed in the MPA (SB-10 located near a floor drain in the Formulation Room of the manufacturing building and SB-21 located adjacent to the subgrade tank vault in the Make Tank Room). Cadmium concentrations ranging from 76.2 to 305 mg/kg were detected in the four samples collected from the borings. There were no other cadmium detections above the unrestricted land use soil – direct contact or Ecological CULs in remaining soil samples at the site. Please note that none of the cadmium detections are above the industrial soil – direct contact Method C soil CUL which is potentially applicable to the site (3,500 mg/kg). In the area of SB-10 and SB-21, the manufacturing building's concrete slab prevents ecological receptors from being exposed to soil and prevents human exposure to soil via the direct contact pathway. Cadmium concentrations above the unrestricted land use soil – direct contact and Ecological CULs are identified in Table 3 and depicted in Figure 5.

Cadmium was detected slightly above the unsaturated soil – protection of groundwater CUL (0.69 mg/kg) in one remaining unsaturated zone (i.e., from the proposed POC of 0 to 20 ft bgs) soil sample in the FSB area. No remaining samples were collected from the saturated zone (i.e., from the proposed POC of greater than 20 ft bgs) in the FSB area. Cadmium was detected above the unsaturated soil – protection of groundwater CUL in one or more remaining unsaturated zone soil samples collected from 16 soil borings in the MPA. Cadmium was detected above the saturated soil – protection of groundwater CUL (0.035 mg/kg) in three of the eight remaining saturated zone soil samples collected in the MPA. The cadmium concentrations in these three samples range from 0.75 to 13 mg/kg.

<u>Zinc</u>

Zinc was not detected above the unrestricted land use soil – direct contact CUL currently applicable to the site (24,000 mg/kg) or the industrial soil – direct contact Method C soil CUL potentially applicable to the site (1,050,000 mg/kg) in remaining soil samples collected from the site.

Zinc was detected above the Ecological CUL (570 mg/kg) within the POC of 0 to 15 ft bgs in one of 120 remaining FSB area soil samples (OB4 at 930 mg/kg). OB4 is one of four samples collected from overburden soil removed from the surface of FSB2 and used as backfill in the bottom 5 ft of FSB2 during the 2003 excavation activities. Concentrations of zinc were detected below the Ecological CUL in the remaining three overburden samples (OB1 through OB3). (Note that approximately one-half of the overburden soil used to backfill the 2003 FSB2 excavation is estimated to have been removed during the 2010 excavation activities.) Zinc was detected above the Ecological CUL within the POC of 0 to 15 ft bgs in 23 of 104 remaining MPA soil samples collected from sample locations which are generally widespread across the MPA. Zinc concentrations above the Ecological CUL are identified in Table 3 and depicted in Figure 5. As shown in Figure 5, the majority of the sample locations where zinc was detected above the Ecological CUL are below the manufacturing building or pavement. However, five of the samples were collected from locations along the western edge of the site in an unpaved area, and two samples were collected from an unpaved area between the manufacturing building and the paved driveway to the west of the building.

Zinc was detected above the unsaturated soil – protection of groundwater CUL (5,970 mg/kg) in only three remaining unsaturated zone (i.e., from the proposed POC of 0 to 20 ft bgs) soil samples at the site. Zinc was detected in a 2003 FSB2 excavation base sample (B8) at a concentration of 6,200 mg/kg. The other two samples were collected from two borings (SS7 and SB-7) located in close proximity to each other in the former zinc oxide loading (rail spur) area adjacent to the eastern side of the manufacturing building and the sample locations are currently covered with asphalt pavement. Zinc was detected at 19,100 mg/kg in the 0 to 0.5 ft bgs depth interval of SS7 and at 9,360 mg/kg in the 1 to 3 ft bgs depth interval of SB-7. Note that zinc was detected below the unsaturated soil – protection of groundwater CUL in the 3 to 6 ft bgs depth interval of SB-7 (2,590 mg/kg). Therefore, zinc impacts in shallow soil in the zinc loading area may not be a significant contributor to groundwater impacts in the MPA.

Zinc was not detected above the saturated soil – protection of groundwater CUL (299 mg/kg) in any remaining saturated zone (i.e., from the proposed POC of greater than 20 ft bgs) soil samples. Note that a total of only eight soil samples were collected from below 20 ft at the site, and that each of these samples was collected from the MPA. Therefore, it is possible that zinc concentrations above the saturated soil – protection of groundwater CUL are present in soil greater than 20 ft bgs, particularly in the FSB2 area where relatively high zinc concentrations were detected in excavation base samples collected from 15 ft bgs.

6.1.2 Groundwater

A summary of groundwater cadmium and zinc analytical data is included in Table 4. Zinc and cadmium isoconcentration maps for the most recent monitoring event (completed in August 2017) are included as Figures 8A and 8B, respectively.

During August 2017, H&H performed seep study activities along the portion of the Columbia River bank adjacent to the site property between the locations of onsite piezometers PZ14 and PZ15. The seep study was performed to evaluate for the potential presence and location of areas of relatively higher hyporheic exchange (i.e., the process of water and solute exchange in both directions across a streambed) which may act as preferential pathways (or, seeps) for contaminants in groundwater associated with the site to enter sediments and surface water in the Columbia River. The seep study activities included visual observations, thermal imaging, a sediment survey, and PushPoint groundwater, surface water, and sediment sampling. The study was performed during low river stage and low daily tidal elevation when groundwater to surface water flux rates at the site (and, the potential for contaminant transport from site groundwater to surface water) were expected to be relatively high.

There were no groundwater seeps identified along the river bank by visual observations or sediment survey activities completed as part of the seep study. Because there were no seeps identified, 22 PushPoint groundwater samplers (identified as PP-1 through PP-22) were installed at a spacing of approximately 40 ft along the river shore line adjacent to the site, and PushPoint groundwater samplers were installed at an upstream (PP-US) and a downstream (PP-DS) location. The screened intervals of the PushPoint samplers were installed within the transitional zone beneath the depth of the biologically active zone in the Columbia River sediments (15 cm). Based on our review of Ecology's July 25, 2017 Implementation Memorandum No. 16 and the EPA ERASC *Determination of the Biologically Relevant Sampling Depth for Terrestrial and Aquatic Ecological Risk Assessments*, water in the transitional zone beneath 15 cm is considered to be groundwater. A summary of PushPoint groundwater and surface water zinc and cadmium analytical data is included in Table 5 and PushPoint and surface water sample locations are depicted in Figures 8A and 8B.

Refer to the H&H *Groundwater Monitoring and Seep Study Report* (H&H 2017b) for a summary of the methods and results of the groundwater monitoring event and seep study completed during August 2017. The methods and results of the majority of groundwater sampling completed prior to August 2017 are summarized in the reports referenced in Section 6.1.1.

6.1.2.1 MPA

Zinc

As shown in Figure 8A, concentrations of zinc detected in MPA groundwater above the SW CUL (66 µg/l) during August 2017 extend from east of the northern portion of the manufacturing building to west of the site toward the Columbia River. Zinc was detected above the SW CUL in seven MPA wells at concentrations ranging from 250 µg/l to 6,760 µg/l, and the zinc concentrations detected in PZ3 (6,760 µg/l) and PZ9 (5,940 µg/l) were the only detections above the HH CUL (4,800 µg/l) in the MPA wells. PZ3 and PZ9 are located along the western edge of the site. The August 2017 zinc concentrations detected in the MPA wells were generally similar to historical concentrations and fluctuations.

In the period between January 2015 and August 2017, zinc concentrations decreased in PZ4 (from 2,450 to 1,180 µg/l), PZ5 (from 4,100 to 2,260 µg/l), and PZ6 (from 10,700 to 1,150 µg/l). These three wells are located to the west (downgradient) of the manufacturing building and within the area of groundwater injections completed during 2010 and 2011. In the period between January 2015 and August 2017, zinc concentrations increased in PZ3 (from 3,780 to 6,760 µg/l) and AB1 (from 447 to 854 µg/l). These two wells are located along the western edge of the site (and, AB1 is installed at an angle beneath the bank of the Columbia River). Note that prior to August 2017, PZ7, PZ8, and PZ10 were last sampled in 2005, PZ15 was last sampled in 2007, and PZ9 was last sampled in 2010. These five wells are located outside the anticipated influence of groundwater injections completed during 2010 and 2011 and, therefore were not included in injection performance monitoring events completed after the injections. Zinc was detected in PZ7 (250 µg/l) and PZ9 (5,940 µg/l) during August 2017, but was not detected in PZ8, PZ10, or PZ15.

Results of analyses of the August 2017 PushPoint groundwater samples indicate zinc was detected above laboratory detection limits in three samples (PP-8 at 362 µg/l, PP-9 at 22.4 µg/l, PP-10 at 53.4 µg/l) to the west of the MPA. As previously mentioned, the zinc SW CUL is 66 µg/l. Therefore, only the zinc concentration detected in PP-8 is above the SW CUL. As shown in Figure 8A, the PP-8 sample location is approximately 15 ft downstream of on-site angle bore well AB1, and PP-9 and PP-10 are located approximately 40 ft and 80 ft downstream of PP-8, respectively. The zinc concentrations detected in these PushPoint groundwater samples appear to be associated with the MPA zinc plume.

Cadmium

As shown in Figure 8B, concentrations of cadmium detected in MPA groundwater above the SW CUL (0.7 µg/l) during August 2017 are inferred to extend from the north-central portion of the manufacturing plant to approximately 100 ft west of the building. Cadmium concentrations were detected above the SW CUL and the HH CUL (5 µg/l) in two MPA wells (PZ4 at 9.76 µg/l and PZ5 at 64.6 µg/l). These detections are lower than the January 2015 cadmium concentrations detected in PZ4 (16.4 µg/l) and PZ5 (111 µg/l). Cadmium was not detected in any of the other MPA well samples during August 2017 and was not detected in any PushPoint groundwater samples. Based on the data, it does not appear that the cadmium plume associated with the MPA extends to the Columbia River.

6.1.2.2 FSB Area

Zinc

As shown in Figure 8A, concentrations of zinc detected in FSB2 area groundwater above the SW CUL (66 µg/l) during August 2017 are inferred to extend from the eastern portion of FSB2 to the west toward the Columbia River. Zinc was detected above the SW CUL and HH CUL (4,800 µg/l) in each of seven FSB2 area wells at concentrations ranging from 6,460 µg/l to

141,000 μg/l. Consistent with previous sampling events, zinc concentrations detected in the FSB2 area plume during August 2017 were generally higher than those detected in the MPA plume.

In the period between January 2015 and August 2017, zinc concentrations decreased significantly in OW1 (from 146,000 μg/l to 41,800 μg/l), OW3 (from 73,100 μg/l to 52,100 μg/l), PZ1 (from 76,800 μg/l to 45,400 μg/l), PZ12 (from 90,900 μg/l to 6,460 μg/l), and PZ13 (from 65,900 μg/l to 28,200 μg/l). PZ12 and PZ13 are located within the extents of FSB2 and the 2010 and 2011 injections areas, OW1 and OW3 are located adjacent to the western edge of FSB2, and PZ1 is located approximately 20 ft west of FSB2. During the August 2017 event, zinc was detected at a maximum concentration of 141,000 μg/l in OW2 which is located along the western edge of the site in the FSB2 area near angle bore well AB2. The detection is similar to the zinc concentration (145,000 μg/l) detected in OW2 during January 2015. Finally, in the period between January 2015 and August 2017, zinc concentrations increased in angle bore well AB2 (from 17,300 μg/l to 59,800 μg/l). AB2 is located at the western edge of the site and is installed at an angle beneath the bank of the Columbia River. Zinc was not detected in PZ14 which is located northwest of FSB2 near the western edge of the site.

Zinc was also detected at a relatively low concentration above the SW CUL and below the HH CUL in the August 2017 sample collected from PZ11 (415 μg/l). PZ11 is located in FSB1. Zinc was not detected in PZ2 which is located to the west of PZ11 near the western edge of the site. Therefore, it does not appear that zinc concentrations above the SW CUL likely extend to the western edge of the site from the area of PZ11.

Results of analyses of the August 2017 PushPoint groundwater samples indicate zinc was detected above laboratory detection limits in one sample (PP-20 at 58.8 μg/l) to the west of the FSB area. As previously mentioned, the zinc SW CUL is 66 μg/l. As shown in Figure 8A, PP-20 is located approximately 115 ft downstream of angle bore well AB2, and the zinc concentration detected in this PushPoint groundwater sample appears to be associated with the FSB2 zinc plume.

Cadmium

As shown in Figure 8B, concentrations of cadmium were detected above the SW CUL (0.7 µg/l) and the HH CUL (5 µg/l) in two wells (OW2 at 8.13 µg/l and PZ1 at 6.31 µg/l) located to the west of FSB2 during August 2017. In addition, concentrations of cadmium were detected above the SW CUL (0.7 µg/l), but below the HH CUL (5 µg/l), in two wells (AB2 at 4.69 µg/l and OW3 at 4.19 µg/l). These two wells are also located to the west of FSB2. During January 2015, cadmium was detected in AB2 (1.06 µg/l), OW2 (2.61 µg/l), and PZ1 (1.32 µg/l), but was not detected in OW3. Cadmium was not detected in any of the other FSB area wells during August 2017 and was not detected in any PushPoint groundwater samples. Based on the data, it does not appear that the cadmium plume associated with FSB2 extends off-site to the Columbia River.

6.1.3 Surface Water

As mentioned in Section 6.1.2, surface water samples were collected from the Columbia River adjacent to the site as part of the August 2017 seep study activities. Analytical results of three surface water samples collected during August 2017 are summarized along with the PushPoint groundwater data in Table 5, and the surface water sample locations and analytical results are depicted in Figures 8A and 8B. Results of analyses of the surface water samples indicate cadmium and zinc were not detected above laboratory detection limits (1.0 and 52.0 µg/l, respectively) in any of the surface water samples. The SW CULs for cadmium and zinc are 0.7 and 66 µg/l, respectively. Surface water sample SW-1 was collected in the area of PushPoint sample PP-8 (which contained the highest concentration of zinc detected in the PushPoint groundwater samples), indicating that the low concentrations of zinc in transitional groundwater in this area are not affecting surface water quality.

6.1.4 Sediment

As mentioned in Section 6.1.2, sediment samples were collected from the Columbia River adjacent to the site as part of the August 2017 seep study activities. Sediment samples were collected at every even-numbered PushPoint sampling location starting with PP-2 and proceeding through PP-20 (total of 10 sediment samples). In addition, upstream (SD-US) and downstream (SD-DS) sediment samples were collected near the upstream and downstream boundaries of the site. Analytical results of sediment samples collected during August 2017 are summarized along with July 2015 sediment sample data in Table 6, and the sediment sample locations and zinc results are depicted in Figure 6. Results of analyses of the sediment samples indicate zinc was detected in each sample collected within the extents of the seep study (i.e., between wells PZ14 and PZ15) at concentrations ranging from 16.2 to 42.4 mg/kg. Zinc was detected in the upstream and downstream sample locations at concentrations of 250 mg/kg and 17.8 mg/kg, respectively. The zinc concentrations detected in each sediment sample are consistent with background and significantly lower than the sediment CUL of 3,200 mg/kg. Results of analyses of the sediment samples indicate cadmium was not detected in any of the samples.

6.2 COC Fate and Transport

The COCs associated with the site (i.e., cadmium and zinc) are non-biodegradable metals that do not break down to less harmful compounds or components in the environment. The primary transport mechanism for the COCs at the site is dissolution into and migration with water. These processes can occur as water infiltrates from the ground surface downward through impacted unsaturated soil and as groundwater moves through impacted saturated aquifer sediments. Within the subsurface, the fate and transport of dissolved COCs is generally controlled by processes of metals immobilization and remobilization, which are largely dependent on geochemical conditions in saturated and unsaturated zone sediments.

Generally, under oxidizing conditions, a significant amount of dissolved COC mass will be immobilized by adsorption to negatively charged particles (e.g., to iron and manganese hydroxides which are typically abundant in aquifers) and co-precipitation. Under reducing conditions, COC mass which was immobilized by adsorption and co-precipitation can be remobilized. However, note that immobile metal sulfides can also be formed under reducing conditions where sulfur is present (such as in the site aquifer). Reducing conditions typically exist within the biologically active zone of river beds due to relatively higher metabolic activities and biological and chemical oxygen demand, and these conditions are expected to reduce the potential for accumulation of COCs in riverbed sediments. Aquifer pH also effects solubility of metals. As pH decreases from neutral levels, the solubility of the COCs associated with the site increases.

Interaction of surface water and groundwater at the site, and generally widespread relatively low pH conditions in site groundwater (average of approximately 5.4 standard units during August 2017) result in complex geochemical conditions and COC transport in the site aquifer. Based on soil, groundwater, surface water, and sediment data from the site, it appears that migration of relatively high COC concentrations in site groundwater toward the river is retarded by immobilization of COCs in the aquifer. In addition, the temporal mound in the groundwater table near the river (discussed in Section 3.0) appears to cause groundwater in the central portion of the site (where maximum COC concentrations are located) to be temporally stagnant, further reducing the rate of COC mass migration toward the river. As discussed in Section 3.1, relatively low zinc concentrations appear to extend to transitional groundwater at the edge of the Columbia River, but the low concentrations are not affecting surface water or sediment quality.

COCs in surface soil can also be dispersed on the surface by storm water and through the air as airborne particulates. In addition, plants, soil biota, and wildlife can uptake COCs from shallow soil (which can result in bioaccumulation of COCs in an organism and biomagnification of COCs at successively higher levels of food chains). However, the majority of zinc impacts in surface soil at the site are covered with the manufacturing building or asphalt and are therefore not subject to significant dispersion and uptake by ecological receptors.

6.3 Exposure Pathways and Receptor Risks

Current or future potential exposure pathways to COCs at the site include the following:

- human exposure via direct contact with COCs in soil;
- terrestrial plant and animal exposure to COCs in soil;
- human exposure via ingestion of COCs in groundwater used as a source of drinking water;
- benthic community exposure to COCs in sediments; and,
- aquatic life exposure to COCs in surface water.

These potential exposure pathways and receptor risks are discussed below.

Human Exposure via the Direct Contact Pathway

As discussed in Section 6.1.1, zinc has not been detected in remaining site soil above the unrestricted land use soil – direct contact CUL. Cadmium was detected above the unrestricted land use soil – direct contact CUL in remaining soil samples collected from two borings (SB-10 and SB-21) installed in the MPA beneath portions of the manufacturing building. Please note that none of the cadmium detections are above the industrial soil – direct contact Method C soil CUL which is potentially applicable to the site.

In the area of SB-10 and SB-21, the manufacturing building's concrete slab prevents human exposure to soil via the direct contact pathway. Potential future exposure to cadmium concentrations above soil – direct contact CULs may be controlled by implementation of an institutional control to maintain a cover over impacted soil in order to prevent human exposure via the direct contact pathway. Alternatively, because the site appears to qualify as industrial, a land use restriction (LUR) to restrict future property use to industrial purposes may be implemented so that industrial soil – direct contact soil CULs are applicable to the site (in which case COC concentrations in remaining soil would not exceed direct contact CULs).

Terrestrial Plant and Animal Exposure

As discussed in Section 4.1.2, we believe that use of a simplified terrestrial ecological evaluation process is most appropriate for the site and that the site should qualify as industrial/commercial for the purposes of exposure scenarios. As such, we believe that the COC concentrations listed in Table 749-2 for industrial/commercial sites (36 mg/kg for cadmium and 570 mg/kg for zinc) are most appropriate for use in evaluating ecological risk at the site, and should be considered to be the Ecological CULs applicable to the site. As discussed in Section 6.1.1, all soil sample locations where cadmium was detected above the Ecological CUL, and the majority of soil sample locations where zinc was detected above the Ecological CUL are located beneath the manufacturing building or pavement. There are two relatively small areas of exposed soil (not covered by the manufacturing building or pavement) with zinc concentrations above the Ecological CUL located to the west of the manufacturing building in the areas of PZ3 and PZ5 (see Figure 5). In addition, zinc was detected above the Ecological CUL in one of four samples collected from overburden soils which were used to backfill the bottom five feet (from 10 to 15 ft bgs) of the 2003 FSB2 excavation.

Based on the limited amount of remaining exposed soil with zinc concentrations above the Ecological CUL, and the fact that these areas are unvegetated or sparsely vegetated with grasses, it is unlikely that the zinc concentrations pose a significant risk to ecological receptors. Potential future risks posed to ecological receptors at the site may be controlled by removal of soil impacted with COCs above Ecological CULs and/or implementation of an institutional control to maintain a cover over soil impacted with COCs above Ecological CULs. In addition, because the site appears to qualify as industrial, a LUR to restrict future property use to industrial purposes may be implemented so that the Ecological CULs discussed above are applicable to the site. Finally, please note that statistical compliance methods may be utilized (with Ecology approval) to evaluate COC concentrations, and use of such statistical methods may adequately demonstrate that existing conditions are protective of terrestrial ecological receptors.

<u>Ingestion of Groundwater</u>

As discussed in Section 6.1.2, concentrations of cadmium and zinc above HH CULs are present in the FSB2 area and MPA groundwater. Concentrations of zinc above the HH CUL appear to extend to the Columbia River. Concentrations of COCs do not appear to extend off-site to the north, east, or south of the site. There are no potable wells located within 1,000 ft of the site, municipal water is available to properties located within the Kalama city limits, and the City of

Kalama's municipal water source is groundwater obtained from horizontal collection pipes installed in the Kalama River streambed (located 2 miles east of the confluence of the Kalama and Columbia Rivers).

Groundwater from the site has never been used as a source of potable water. Future exposure to ingestion of site groundwater may be controlled by implementation of an institutional control to prohibit use of site groundwater for potable purposes. Based on the extents of the groundwater plumes associated with the site and transport mechanisms which limit migration of the site COCs in the aquifer, it does not appear that COCs in site groundwater pose a potential risk to off-site properties where potable wells could be installed in the future.

Benthic Community Exposure

As discussed in Section 6.1.4, concentrations of zinc detected in sediment samples collected from the Columbia River adjacent to the site are consistent with background levels and significantly lower than the sediment CUL established for protection of the benthic community in freshwater sediments. Cadmium was not detected in sediment samples collected from the Columbia River adjacent to the site. As discussed in Section 6.2, there is a low potential for accumulation of COCs in riverbed sediments due to the geochemical conditions typically found in the biologically active zone of riverbed sediments. Therefore, the site COCs do not pose a current or future exposure concern to the benthic community.

Surface Water Exposure

As discussed in Section 6.1.2, concentrations of zinc above the SW CUL are generally widespread in the MPA and FSB2 area of the site and extend toward the Columbia River from both areas. Zinc was detected above the SW CUL in one PushPoint groundwater sample collected from the edge of the river during August 2017. It does not appear that the cadmium plumes associated with the MPA and FSB2 extend to the Columbia River. Cadmium and zinc were not detected in surface water samples collected from the Columbia River adjacent to the site. Based on the data, the low concentrations of zinc in transitional groundwater along the Columbia River adjacent are not affecting surface water quality, and it is unlikely that discharge of impacted groundwater to the Columbia River has the potential to measurably affect surface water quality due to the effects of dilution and dispersion in the river.

7.0 Conceptual Site Model Summary

In summary, the conceptual site model is:

- The site is located in the Port of Kalama industrial area adjacent to the eastern bank of the Columbia River and is developed with a 17,000 sf manufacturing building, an ancillary 1,000 sf building, two secondary containment areas that contain former process tanks, a railroad spur, and paved areas. Unlined settling basins (one of which was used for placement of zinc carbonate sludge) were formerly located in the northern portion of the site. The site was operated from 1969 through 2016 to produce zinc hydrosulfite and sodium hydrosulfite for use in newspaper production. Zinc oxide and zinc carbonate were produced as byproducts of the manufacturing processes. Approximately 20 ASTs were used for storage and processing of liquid materials at the site. Dry materials used in the manufacturing processes were stored inside the warehouse portion of the manufacturing building.

- The site is underlain by dredge spoils, alluvial deposits, and bedrock. The site was built up with approximately 20 ft of river dredge spoils shortly before the start of manufacturing operations and the riverbank adjacent to the site is armored with rip rap. The dredge spoils consist primarily of fine to coarse-grained loose brown, gray, and black sand. The alluvium consists of fine to coarse-grained loose brown, gray, and black sand with silts and gravels. The bedrock geology in the area of the site is complex and primarily consists of basalt flows and marine and non-marine sandstone. Based on borings installed at the site, bedrock is present at approximately 25 to 30 ft bgs beneath northern and eastern portions of the site and slopes downwards to greater than 60 ft bgs in southern and western portions of the site.

- The Columbia River is subject to tidal fluctuations at the location of the site, and can fluctuate by as much as approximately 7 ft between low and high tides in the vicinity of the site. Historical groundwater elevation data collected from site monitor wells indicate that shallow groundwater flow at the site is influenced by the tidal elevation variations of the Columbia River. In the eastern portion of the site, there is a hydraulic gradient from east to west toward the river. In the western portion of the site, hydraulic communication between the river and shallow groundwater results in a temporal mound in the groundwater table near the river that creates a relatively weak hydraulic gradient from west to east in that area. The groundwater mound near the river is temporal and its presence depends upon the timing and magnitude of the tides. The converging hydraulic gradients appear to cause groundwater in the central portion of the site (where maximum cadmium and zinc concentrations are located) to be temporally stagnant. The groundwater mound and gradient appear to vary in magnitude with the tidal fluctuations of the river (being largest at high tide and smallest at low tide), but do not appear to vary significantly with seasonal changes in the elevation of the river.

Groundwater elevations at the site fluctuate in correspondence with seasonal changes in average river levels. In the period between 2010 and 2017, average high and average low groundwater elevations have differed by approximately eight feet at the site as a result of seasonal changes in average river levels. Depth-to-groundwater ranged from approximately 16 to 26 ft bgs during monitoring events completed during this period.

- Site soil and groundwater are impacted with cadmium and zinc. There are two main areas of impact at the site: the FSB area and the MPA. Impacts in the FSB area are associated with FSB1 and FSB2. FSB2 was an unlined basin which received zinc carbonate sludge, and FSB1 was an unlined basin which received minor spillage of zinc carbonate sludge from conveyance of the sludge to FSB2. Significant soil impacts were removed in the area of FSB1 and FSB2 in 2003 and 2010; however, some deeper unsaturated and saturated zone soil impacts below a depth of 15 ft are present and may be a source of groundwater impacts.

  Sources of cadmium impacts in the MPA appear to be releases from process tank systems (particularly in the area of the subgrade tank vault in the Make Tank Room) and wastewater collection system infrastructure. Sources of zinc impacts in the MPA appear to be releases along the rail spur adjacent to the manufacturing building (where zinc oxide loading operations were conducted) and from wastewater collection system infrastructure. In addition, due to the relatively widespread distribution of zinc impacts in MPA soil, it appears that zinc dust may have been distributed by storm water to areas west of the manufacturing building.

- Cadmium and zinc are non-biodegradable metals that do not break down to less harmful compounds or components in the environment. The primary transport mechanism for the COCs at the site is dissolution into and migration with water. These processes can occur as water infiltrates from the ground surface downward through impacted unsaturated soil and as groundwater moves through impacted saturated aquifer sediments. Within the subsurface, the fate and transport of dissolved COCs is generally controlled by complex metals immobilization and remobilization processes, which are largely dependent on geochemical conditions in the aquifer. The geochemical conditions in the aquifer are affected by the tidal fluctuations of the Columbia River.

- Approximately 27,500 tons of impacted soil were removed from FSB1 (to an average depth of approximately 7 ft bgs) and FSB2 (to approximately 15 ft bgs) during 2003 and 2010. Impacted surface soils were excavated to an average depth of 1.5 ft bgs in the eastern and western portions of the MPA during 2003.

- Zinc has not been detected in site soil above the unrestricted land use soil – direct contact CUL. Cadmium was detected above the unrestricted land use soil – direct contact CUL (but, below the industrial soil – direct contact Method C soil CUL) in remaining soil samples collected from two borings installed in the MPA beneath portions of the manufacturing building. The manufacturing building's concrete slab prevents human exposure to this area of soil. The zinc and cadmium impacts in soil do not pose a significant human health risk.

- All soil sample locations where cadmium was detected above the Ecological CUL, and the majority of soil sample locations where zinc was detected above the Ecological CUL are located beneath the manufacturing building or pavement. There are two relatively small areas of exposed soil (not covered by the manufacturing building or pavement) with zinc concentrations above the Ecological CUL located to the west of the manufacturing building, and zinc was detected above the Ecological CUL in one of four samples collected from overburden soils which were used to backfill the bottom five feet (from 10 to 15 ft bgs) of the 2003 FSB2 excavation.

  Based on the limited amount of remaining exposed soil with zinc concentrations above the Ecological CUL, and the fact that these areas are unvegetated or sparsely vegetated with grasses, it is unlikely that the zinc concentrations pose a significant risk to ecological receptors. Potential future risks posed to ecological receptors at the site may be controlled by removal of soil impacted with COCs above Ecological CULs and/or implementation of an institutional control to maintain a cover over soil impacted with COCs above Ecological CULs. Alternatively, statistical data evaluation may indicate that existing conditions are protective of ecological receptors.

- During 2010 and 2011, groundwater remediation activities which included injection of calcium polysulfide were completed at the site on multiple occasions to reduce dissolved cadmium and zinc concentrations. A geochemical evaluation completed in early 2013 concluded that the injections resulted in temporary reducing conditions needed to immobilize cadmium and zinc, but influence from the Columbia River subsequently oxidized solid zinc compounds resulting in reversal of the reducing conditions.

  Based on the results of the geochemical evaluation, a pilot test injection of magnesium hydroxide and ferrous sulfate was performed at the site during 2013 to increase aquifer pH and augment the aquifer with iron adsorbent. Field observations and post-injection groundwater monitoring indicated that the injection was likely successful in distributing iron within the aquifer, but distribution of the insoluble magnesium hydroxide was likely limited and therefore had limited effectiveness in increasing aquifer pH. H&H concluded that significant amounts of additional magnesium hydroxide would be needed to substantially raise pH and lower dissolved zinc concentrations, but that long-term reduction of dissolved zinc concentrations using such pH adjustment is not likely to be effective due to interactions between the Columbia River and the site aquifer.

- Based upon the extensive groundwater remedial efforts performed, H&H concludes that immobilization of metals in groundwater is likely not reasonably technically or economically feasible due to the significant influence of the Columbia River on groundwater at the site.

- Concentrations of cadmium and zinc above HH CULs are present in the FSB2 area and MPA groundwater. Concentrations of zinc above the HH CUL appear to extend to the Columbia River west of the site. Concentrations of COCs do not appear to extend off-site to the north, east, or south of the site. There are no potable wells located within 1,000 ft of the site, municipal water is available to properties located within the Kalama city limits, and the City of Kalama's municipal water source is groundwater obtained from horizontal collection pipes installed in the Kalama River streambed (located 2 miles east of the confluence of the Kalama and Columbia rivers). Groundwater from the site has never been used as a source of potable water. Future exposure to ingestion of site groundwater may be controlled by implementation of an institutional control to prohibit use of site groundwater for potable purposes. Based on the extents of the groundwater plumes associated with the site and transport mechanisms which limit migration of the site COCs in the aquifer, it does not appear that COCs in site groundwater pose a potential significant risk to off-site properties where potable wells could be installed in the future.

- Concentrations of zinc above the SW CUL are generally widespread in the MPA and FSB2 area of the site and extend toward the Columbia River from both areas. Zinc was detected above the SW CUL in one PushPoint groundwater sample collected from the edge of the river during August 2017. It does not appear that the cadmium plumes associated with the MPA and FSB2 extend to the Columbia River. Cadmium and zinc were not detected in surface water samples collected from the Columbia River adjacent to the site. Based on the data, the low concentrations of zinc in transitional groundwater along the Columbia River adjacent are not affecting surface water quality, and it is unlikely that discharge of impacted groundwater to the Columbia River has the potential to measurably affect surface water quality due to the effects of dilution and dispersion in the river.

- Concentrations of zinc detected in sediment samples collected from the Columbia River adjacent to the site are consistent with background levels and significantly lower than the sediment CUL established for protection of the benthic community in freshwater sediments. Cadmium was not detected in sediment samples collected from the Columbia River adjacent to the site. There is a low potential for accumulation of COCs in riverbed sediments due to the geochemical conditions typically found in the biologically active zone of riverbed sediments. Therefore, the site COCs do not pose a current or future exposure concern to the benthic community.

- Consistent with previous sampling events, zinc concentrations detected in the FSB2 area plume during August 2017 were generally higher than those detected in the MPA plume. Cadmium and zinc concentrations detected during August 2017 in site wells were generally consistent with historical concentrations and fluctuations in the wells. However, in the period between January 2015 and August 2017, COC concentrations decreased significantly in the majority of wells located within previous injection areas.

8.0 References

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Table 1
Summary of Site Monitor Well Construction Details
Chemtrade Performance Chemicals US LLC Site
Kalama, WA
H&H Project No. CLR-045

Well ID	Installation Date	Well Diameter (inches)	Total Depth (ft bgs)	Sceen Interval (ft bgs)	TOC Elevation (ft CRD)
PZ1	04/15/03	1	32	17-32	28.99
PZ2	04/15/03	1	32	17-32	30.16
PZ3	04/15/03	1	32	17-32	28.47
PZ4	04/15/03	1	32	17-32	26.78
PZ5	04/16/03	1	32	17-32	26.86
PZ6	04/16/03	1	32	17-32	27.58
PZ7	04/16/03	1	31	16-31	28.06
PZ8	04/16/03	1	31	15.5-30.5	28.17
PZ9	05/06/03	1	32	17-32	27.54
PZ10	07/26/05	0.75	32	17-32	26.94
PZ11	07/27/05	0.75	32	17-32	30.39
PZ12	07/27/05	0.75	32	17-32	30.53
PZ13	07/27/05	0.75	30	15-30	30.40
PZ14	02/06/07	0.75	32	17-32	29.09
PZ15	02/06/07	0.75	32	17-32	27.79
AB1	07/01/03	2	28	14.1-28.2	27.53
AB2	07/01/03	2	30	14.4-30.0	28.41
OW1	09/20/10	2	35	20-35	26.51
OW2	09/20/10	2	35	20-35	25.99
OW3	09/20/10	2	35	20-35	26.13

Notes:
ft bgs = feet below ground surface
ft CRD = elevation in ft relative to Columbia River Datum
TOC = Top of Casing
Survey of well elevations based on NAVD88 and adjusted to CRD by subtracting 3.8 ft
OW1 through OW3 TOC elevations have not been surveyed
Depth and screen interval of AB1 and AB2 account for 45^o and 35^o angles of installation relative to vertical, respectively.

Table 2
Summary of Groundwater Elevation Data
Chemtrade Performance Chemicals US LLC Site
Kalama, WA
H&H Project No. CLR-045

Well ID	Date Measured	TOC Elevation[1] (ft CRD)	Depth to Water (ft below TOC)	Water Elevation[1] (ft CRD)	Time Measured	High (CRD)[2]		Low (CRD)[2]	
						Time	Elevation (ft)	Time	Elevation (ft)
PZ1	02/04/10	28.99	23.65	5.34	8:29 a.m.	7:39 a.m.	5.47	2.45 p.m.	1.34
PZ1	09/01/10		26.84	2.15	9:54 a.m.	9:42 p.m.	2.62	5.33 a.m.	-0.93
PZ1	11/02/10		25.50	3.49	11:19 a.m.	1:15 p.m.	4.42	8:42 a.m.	0.75
PZ1	12/20/10		22.68	6.31	11:13 a.m.	--	--	10:09 a.m.	4.25
PZ1	12/20/10		21.74	7.25	2:25 p.m.	2:27 p.m.	7.11	--	--
PZ1	03/21/11		21.64	7.35	3:52 p.m.	--	--	2:15 p.m.	4.77
PZ1	03/23/11		21.34	7.65	8:32 a.m.	7:18 a.m.	7.27	--	--
PZ1	06/21/11		18.43	10.56	3:17 p.m	8:48 a.m.	9.36	5:06 p.m.	8.39
PZ1	06/22/11		18.49	10.50	8:20 a.m.	9:48 a.m.	9.13	6:54 a.m.	8.71
PZ1	09/23/11		26.97	2.02	8:45 a.m.	--	--	9:06 a.m.	-0.73
PZ1	09/28/11		25.31	3.68	3.25 p.m.	5:27 p.m.	4.72	--	--
PZ1	01/12/12		24.59	4.40	8:26 a.m.	5:57 a.m.	4.01	1:48 p.m.	1.02
PZ1	03/20/12		20.72	8.27	9:30 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
PZ1	06/26/12		19.87	9.12	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
PZ1	10/31/12		24.11	4.88	1:20 p.m.	5:42 a.m.	5.17	12:45 p.m.	2.67
PZ1	05/31/13		21.99	7.00	1:00 p.m.	5:42 a.m.	10.15	5:00 p.m.	3.80
PZ1	08/27/13		25.68	3.31	10:30 a.m.	4:00 p.m.	6.91	8:21 a.m.	2.01
PZ1	12/19/13		25.31	3.68	10:00 a.m.	2:39 p.m.	8.48	4:15 a.m.	1.69
PZ1	01/07/15		23.32	5.67	2:30 p.m.	4:53 p.m.	5.85	1:33 a.m.	3.19
PZ1	08/07/17		25.06	3.93	9:45 a.m.	4:03 a.m.	4.13	12:54 p.m.	-0.03
PZ2	02/04/10	30.16	24.74	5.42	9:05 a.m.	7:39 a.m.	5.47	2.45 p.m.	1.34
PZ2	09/01/10		28.04	2.12	9:51 a.m	9:42 p.m.	2.62	5.33 a.m.	-0.93
PZ2	12/20/10		23.86	6.30	11:28 a.m	--	--	10:09 a.m.	4.25
PZ2	12/20/10		22.80	7.36	2:34 p.m	2:27 p.m.	7.11	--	--
PZ2	03/21/11		22.86	7.30	4:06 p.m.	--	--	2:15 p.m.	4.77
PZ2	03/23/11		22.44	7.72	8:41 a.m.	7:18 a.m.	7.27	--	--
PZ2	06/21/11		19.67	10.49	3:33 p.m	8:48 a.m.	9.36	5:06 p.m.	8.39
PZ2	06/22/11		19.72	10.44	8:06 a.m	9:48 a.m.	9.13	6:54 a.m.	8.71
PZ2	09/23/11		28.24	1.92	8:45 a.m.	--	--	9:06 a.m.	-0.73
PZ2	09/28/11		26.52	3.64	3.25 p.m.	5:27 p.m.	4.72	--	--
PZ2	01/12/12		25.78	4.38	8:42 a.m.	5:57 a.m.	4.01	1:48 p.m.	1.02
PZ2	03/20/12		21.92	8.24	9:28 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
PZ2	06/26/12		21.02	9.14	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
PZ2	10/31/12		23.61	6.55	2:18 p.m.	5:42 a.m.	5.17	12:45 p.m.	2.67
PZ2	05/31/13		23.21	6.95	1:00 p.m.	5:42 a.m.	10.15	5:00 p.m.	3.80
PZ2	08/27/13		26.82	3.34	10:30 a.m.	4:00 p.m.	6.91	8:21 a.m.	2.01
PZ2	12/19/13		26.45	3.71	10:00 a.m.	2:39 p.m.	8.48	4:15 a.m.	1.69
PZ2	01/07/15		24.62	5.54	2:30 p.m.	4:53 p.m.	5.85	1:33 a.m.	3.19
PZ2	08/07/17		26.85	3.31	9:23 a.m.	4:03 a.m.	4.13	12:54 p.m.	-0.03
PZ3	02/04/10	28.47	22.99	5.48	9:19 a.m.	7:39 a.m.	5.47	2.45 p.m.	1.34
PZ3	09/01/10		26.30	2.17	09:45 a.m.	9:42 p.m.	2.62	5.33 a.m.	-0.93
PZ3	11/02/10		24.55	3.92	11:59 a.m.	1:15 p.m.	4.42	8:42 a.m.	0.75
PZ3	12/20/10		22.08	6.39	11:32 a.m.	--	--	10:09 a.m.	4.25
PZ3	12/20/10		20.96	7.51	2:38 p.m.	2:27 p.m.	7.11	--	--
PZ3	03/21/11		20.98	7.49	4:34 p.m	--	--	2:15 p.m.	4.77
PZ3	03/23/11		20.70	7.77	9:07 a.m.	7:18 a.m.	7.27	--	--
PZ3	06/21/11		17.96	10.51	3:38 p.m	8:48 a.m.	9.36	5:06 p.m.	8.39
PZ3	06/22/11		18.01	10.46	7:45 a.m.	9:48 a.m.	9.13	6:54 a.m.	8.71
PZ3	09/23/11		26.66	1.81	8:45 a.m.	--	--	9:06 a.m.	-0.73
PZ3	09/28/11		24.66	3.81	3.25 p.m.	5:27 p.m.	4.72	--	--
PZ3	01/12/12		24.07	4.40	8:45 a.m.	5:57 a.m.	4.01	1:48 p.m.	1.02
PZ3	03/20/12		20.23	8.24	9:24 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
PZ3	06/26/12		19.29	9.18	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
PZ3	10/31/12		23.61	4.86	1:47 p.m.	5:42 a.m.	5.17	12:45 p.m.	2.67
PZ3	05/31/13		21.31	7.16	1:00 p.m.	5:42 a.m.	10.15	5:00 p.m.	3.80
PZ3	08/27/13		25.04	3.43	10:30 a.m.	4:00 p.m.	6.91	8:21 a.m.	2.01
PZ3	12/19/13		24.70	3.77	10:00 a.m.	2:39 p.m.	8.48	4:15 a.m.	1.69
PZ3	01/07/15		22.92	5.55	2:30 p.m.	4:53 p.m.	5.85	1:33 a.m.	3.19
PZ3	08/07/17		24.72	3.75	9:15 a.m.	4:03 a.m.	4.13	12:54 p.m.	-0.03
PZ4	02/04/10	26.78	NM	NM	NM	7:39 a.m.	5.47	2.45 p.m.	1.34
PZ4	09/01/10		24.61	2.17	10:18 a.m.	9:42 p.m.	2.62	5.33 a.m.	-0.93
PZ4	11/02/10		23.16	3.62	11:52 a.m.	13:15 p.m.	4.42	8:42 a.m.	0.75
PZ4	12/20/10		20.41	6.37	10:30 a.m	--	--	10:09 a.m.	4.25
PZ4	12/20/10		19.60	7.18	2:44 p.m.	2:27 p.m.	7.11	--	--
PZ4	03/21/11		19.17	7.61	4:11 p.m	--	--	2:15 p.m.	4.77
PZ4	03/23/11		19.14	7.64	9:12 a.m	7:18 a.m.	7.27	--	--
PZ4	06/21/11		16.07	10.71	2:55 p.m.	8:48 a.m.	9.36	5:06 p.m.	8.39
PZ4	06/22/11		16.26	10.52	7:42 a.m.	9:48 a.m.	9.13	6:54 a.m.	8.71
PZ4	09/23/11		24.60	2.18	8:45 a.m.	--	--	9:06 a.m.	-0.73
PZ4	09/28/11		23.13	3.65	3.25 p.m.	5:27 p.m.	4.72	--	--
PZ4	01/12/12		22.39	4.39	8:48 a.m.	5:57 a.m.	4.01	1:48 p.m.	1.02
PZ4	03/20/12		18.49	8.29	9:55 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
PZ4	06/26/12		17.69	9.09	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
PZ4	10/31/12		21.87	4.91	1:54 p.m.	5:42 a.m.	5.17	12:45 p.m.	2.67
PZ4	05/31/13		19.74	7.04	1:00 p.m.	5:42 a.m.	10.15	5:00 p.m.	3.80
PZ4	08/27/13		23.44	3.34	10:30 a.m.	4:00 p.m.	6.91	8:21 a.m.	2.01
PZ4	12/19/13		23.30	3.48	10:00 a.m.	2:39 p.m.	8.48	4:15 a.m.	1.69
PZ4	01/07/15		21.08	5.70	2:30 p.m.	4:53 p.m.	5.85	1:33 a.m.	3.19
PZ4	08/07/17		23.20	3.58	9:05 a.m.	4:03 a.m.	4.13	12:54 p.m.	-0.03
PZ5	02/04/10	26.86	21.70	5.16	9:27 a.m.	7:39 a.m.	5.47	2.45 p.m.	1.34
PZ5	09/01/10		24.73	2.13	10:22 a.m.	9:42 p.m.	2.62	5.33 a.m.	-0.93
PZ5	11/02/10		23.34	3.52	11:56 a.m.	1:15 p.m.	4.42	8:42 a.m.	0.75
PZ5	12/20/10		20.41	6.45	11:36 a.m.	--	--	10:09 a.m.	4.25
PZ5	12/20/10		19.83	7.03	2:42 p.m.	2:27 p.m.	7.11	--	--
PZ5	03/21/11		19.19	7.67	4:56 p.m	--	--	2:15 p.m.	4.77
PZ5	03/23/11		19.30	7.56	9:17 a.m.	7:18 a.m.	7.27	--	--
PZ5	06/21/11		16.06	10.80	2:53 p.m.	8:48 a.m.	9.36	5:06 p.m.	8.39
PZ5	06/22/11		16.29	10.57	7:39 a.m.	9:48 a.m.	9.13	6:54 a.m.	8.71
PZ5	09/23/11		24.47	2.39	8:45 a.m.	--	--	9:06 a.m.	-0.73
PZ5	09/28/11		23.22	3.64	3.25 p.m.	5:27 p.m.	4.72	--	--
PZ5	01/12/12		22.51	4.35	8:50 a.m.	5:57 a.m.	4.01	1:48 p.m.	1.02
PZ5	03/20/12		18.51	8.35	10:00 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
PZ5	06/26/12		17.85	9.01	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
PZ5	10/31/12		21.91	4.95	1:50 p.m.	5:42 a.m.	5.17	12:45 p.m.	2.67
PZ5	05/31/13		19.78	7.08	1:00 p.m.	5:42 a.m.	10.15	5:00 p.m.	3.80
PZ5	08/27/13		23.57	3.29	10:30 a.m.	4:00 p.m.	6.91	8:21 a.m.	2.01
PZ5	12/19/13		23.24	3.62	10:00 a.m.	2:39 p.m.	8.48	4:15 a.m.	1.69
PZ5	01/07/15		21.06	5.80	2:30 p.m.	4:53 p.m.	5.85	1:33 a.m.	3.19
PZ5	08/07/17		22.69	4.17	9:02 a.m.	4:03 a.m.	4.13	12:54 p.m.	-0.03

Table 2
Summary of Groundwater Elevation Data
Chemtrade Performance Chemicals US LLC Site
Kalama, WA
H&H Project No. CLR-045

Well ID	Date Measured	TOC Elevation[1] (ft CRD)	Depth to Water (ft below TOC)	Water Elevation[1] (ft CRD)	Time Measured	High (CRD)[2] Time	High (CRD)[2] Elevation (ft)	Low (CRD)[2] Time	Low (CRD)[2] Elevation (ft)
PZ6	02/04/10	27.58	22.54	5.04	9:23 a.m.	7:39 a.m.	5.47	2.45 p.m.	1.34
PZ6	09/01/10		25.46	2.12	10:10 a.m.				
PZ6	09/01/10		24.80	2.78	10:15 a.m.	9:42 p.m.	2.62	5.33 a.m.	-0.93
PZ6	11/02/10		24.10	3.48	11:48 a.m.	1:15 p.m.	4.42	8:42 a.m.	0.75
PZ6	12/20/10		21.15	6.43	10:21 a.m.	--	--	10:09 a.m.	4.25
PZ6	12/20/10		20.65	6.93	2:52 p.m.	2:27 p.m.	7.11	--	--
PZ6	03/21/11		19.92	7.66	4:47 p.m.	--	--	2:15 p.m.	4.77
PZ6	03/23/11		20.16	7.42	8:50 a.m.	7:18 a.m.	7.27	--	--
PZ6	06/21/11		16.70	10.88	2:30 p.m.	8:48 a.m.	9.36	5:06 p.m.	8.39
PZ6	06/22/11		16.99	10.59	7:50 a.m.	9:48 a.m.	9.13	6:54 a.m.	8.71
PZ6	09/23/11		25.11	2.47	8:45 a.m.	--	--	9:06 a.m.	-0.73
PZ6	09/28/11		23.96	3.62	3.25 p.m.	5:27 p.m.	4.72	--	--
PZ6	01/12/12		NM	NM	NM	5:57 a.m.	4.01	1:48 p.m.	1.02
PZ6	03/20/12		19.33	8.25	10:10 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
PZ6	06/26/12		18.61	8.97	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
PZ6	10/31/12		22.57	5.01	1:52 p.m.	5:42 a.m.	5.17	12:45 p.m.	2.67
PZ6	05/31/13		20.58	7.00	1:00 p.m.	5:42 a.m.	10.15	5:00 p.m.	3.80
PZ6	08/27/13		24.35	3.23	10:30 a.m.	4:00 p.m.	6.91	8:21 a.m.	2.01
PZ6	12/19/13		24.15	3.43	10:00 a.m.	2:39 p.m.	8.48	4:15 a.m.	1.69
PZ6	01/07/15		21.68	5.90	2:30 p.m.	4:53 p.m.	5.85	1:33 a.m.	3.19
PZ6	08/07/17		24.16	3.42	9:10 a.m.	4:03 a.m.	4.13	12:54 p.m.	-0.03
PZ7	02/04/10	28.06	24.80	3.26	10:40 a.m.	7:39 a.m.	5.47	2.45 p.m.	1.34
PZ7	12/20/10		20.89	7.17	10:55 a.m.	--	--	10:09 a.m.	4.25
PZ7	12/20/10		20.84	7.22	3:03 p.m.	2:27 p.m.	7.11	--	--
PZ7	03/21/11		19.52	8.54	4:25 p.m.	--	--	2:15 p.m.	4.77
PZ7	03/23/11		19.17	8.89	9:00 a.m.	7:18 a.m.	7.27	--	--
PZ7	06/21/11		16.61	11.45	2:42 p.m.	8:48 a.m.	9.36	5:06 p.m.	8.39
PZ7	06/22/11		16.91	11.15	7:55 p.m.	9:48 a.m.	9.13	6:54 a.m.	8.71
PZ7	09/23/11		24.61	3.45	8:45 a.m.	--	--	9:06 a.m.	-0.73
PZ7	09/28/11		23.77	4.29	3.25 p.m.	5:27 p.m.	4.72	--	--
PZ7	01/12/12		NM	NM	NM	5:57 a.m.	4.01	1:48 p.m.	1.02
PZ7	03/20/12		19.40	8.66	9:15 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
PZ7	06/26/12		18.20	9.86	2:30 p.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
PZ7	10/31/12		NM	NM	NM	5:42 a.m.	5.17	12:45 p.m.	2.67
PZ7	05/31/13		NM	NM	NM	5:42 a.m.	10.15	5:00 p.m.	3.80
PZ7	08/27/13		NM	NM	NM	4:00 p.m.	6.91	8:21 a.m.	2.01
PZ7	12/19/13		NM	NM	NM	2:39 p.m.	8.48	4:15 a.m.	1.69
PZ7	01/07/15		21.20	6.86	2:30 p.m.	4:53 p.m.	5.85	1:33 a.m.	3.19
PZ7	08/07/17		23.00	5.06	8:45 a.m	4:03 a.m.	4.13	12:54 p.m.	-0.03
PZ8	02/04/10	28.17	21.02	7.15	9:35 a.m.	7:39 a.m.	5.47	2.45 p.m.	1.34
PZ8	09/01/10		21.54	6.63	10:10 a.m.	9:42 p.m.	2.62	5.33 a.m.	-0.93
PZ8	12/20/10		20.39	7.78	11:05 a.m.	--	--	10:09 a.m.	4.25
PZ8	12/20/10		20.35	7.82	2:55 p.m.	2:27 p.m.	7.11	--	--
PZ8	03/21/11		19.35	8.82	4:15 p.m.	--	--	2:15 p.m.	4.77
PZ8	03/23/11		19.84	8.33	8:54 a.m.	7:18 a.m.	7.27	--	--
PZ8	06/21/11		16.59	11.58	2:38 p.m.	8:48 a.m.	9.36	5:06 p.m.	8.39
PZ8	06/22/11		16.89	11.28	7:58 a.m.	9:48 a.m.	9.13	6:54 a.m.	8.71
PZ8	09/23/11		21.83	6.34	8:45 a.m.	--	--	9:06 a.m.	-0.73
PZ8	09/28/11		21.68	6.49	3.25 p.m.	5:27 p.m.	4.72	--	--
PZ8	01/12/12		21.09	7.08	9:04 a.m.	5:57 a.m.	4.01	1:48 p.m.	1.02
PZ8	03/20/12		19.31	8.86	9:10 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
PZ8	06/26/12		17.52	10.65	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
PZ8	10/31/12		20.31	7.86	2:30 p.m.	5:42 a.m.	5.17	12:45 p.m.	2.67
PZ8	05/31/13		20.02	8.15	1:00 p.m.	5:42 a.m.	10.15	5:00 p.m.	3.80
PZ8	08/27/13		21.58	6.59	10:30 a.m.	4:00 p.m.	6.91	8:21 a.m.	2.01
PZ8	12/19/13		21.26	6.91	10:00 a.m.	2:39 p.m.	8.48	4:15 a.m.	1.69
PZ8	01/07/15		20.19	7.98	2:30 p.m.	4:53 p.m.	5.85	1:33 a.m.	3.19
PZ8	08/07/17		21.50	6.67	8:40 a.m	4:03 a.m.	4.13	12:54 p.m.	-0.03
PZ9	02/04/10	27.54	22.04	5.50	9:42 a.m.	7:39 a.m.	5.47	2.45 p.m.	1.34
PZ9	09/01/10		25.34	2.20	9:47 a.m	9:42 p.m.	2.62	5.33 a.m.	-0.93
PZ9	12/20/10		21.06	6.48	11:40 a.m.	--	--	10:09 a.m.	4.25
PZ9	12/20/10		19.97	7.57	2:40 p.m.	2:27 p.m.	7.11	--	--
PZ9	03/21/11		19.98	7.56	4:39 p.m.	--	--	2:15 p.m.	4.77
PZ9	03/23/11		19.73	7.81	9:23 a.m.	7:18 a.m.	7.27	--	--
PZ9	06/21/11		16.98	10.56	3:40 p.m.	8:48 a.m.	9.36	5:06 p.m.	8.39
PZ9	06/22/11		17.06	10.48	7:36 a.m.	9:48 a.m.	9.13	6:54 a.m.	8.71
PZ9	09/23/11		25.67	1.87	8:45 a.m.	--	--	9:06 a.m.	-0.73
PZ9	09/28/11		23.68	3.86	3.25 p.m.	5:27 p.m.	4.72	--	--
PZ9	01/12/12		23.07	4.47	8:53 a.m.	5:57 a.m.	4.01	1:48 p.m.	1.02
PZ9	03/20/12		19.23	8.31	9:20 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
PZ9	06/26/12		18.32	9.22	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
PZ9	10/31/12		23.61	3.93	2:21 p.m.	5:42 a.m.	5.17	12:45 p.m.	2.67
PZ9	05/31/13		20.50	7.04	1:00 p.m.	5:42 a.m.	10.15	5:00 p.m.	3.80
PZ9	08/27/13		24.01	3.53	10:30 a.m.	4:00 p.m.	6.91	8:21 a.m.	2.01
PZ9	12/19/13		23.82	3.72	10:00 a.m.	2:39 p.m.	8.48	4:15 a.m.	1.69
PZ9	01/07/15		22.00	5.54	2:30 p.m.	4:53 p.m.	5.85	1:33 a.m.	3.19
PZ9	08/07/17		23.82	3.72	8:58 a.m	4:03 a.m.	4.13	12:54 p.m.	-0.03
PZ10	02/04/10	26.94	NM	NM	NM	7:39 a.m.	5.47	2.45 p.m.	1.34
PZ10	09/01/10		24.62	2.32	10:05 a.m.	9:42 p.m.	2.62	5.33 a.m.	-0.93
PZ10	12/20/10		20.26	6.68	11:51 p.m.	2:27 p.m.	7.11	10:09 a.m.	4.25
PZ10	12/20/10		19.73	7.21	3:10 p.m.	2:27 p.m.	7.11	10:09 a.m.	4.25
PZ10	03/21/11		19.02	7.92	4:57 p.m.	--	--	2:15 p.m.	4.77
PZ10	03/23/11		19.26	7.68	9:27 a.m.	7:18 a.m.	7.27	--	--
PZ10	06/21/11		15.79	11.15	3:04 p.m.	8:48 a.m.	9.36	5:06 p.m.	8.39
PZ10	06/22/11		16.06	10.88	7:33 a.m.	9:48 a.m.	9.13	6:54 a.m.	8.71
PZ10	09/23/11		24.00	2.94	8:45 a.m.	--	--	9:06 a.m.	-0.73
PZ10	09/28/11		23.08	3.86	3.25 p.m.	5:27 p.m.	4.72	--	--
PZ10	01/12/12		22.45	4.49	8:59 a.m.	5:57 a.m.	4.01	1:48 p.m.	1.02
PZ10	03/20/12		18.26	8.68	9:05 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
PZ10	06/26/12		17.82	9.12	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
PZ10	05/31/13		19.66	7.28	1:00 p.m.	5:42 a.m.	10.15	5:00 p.m.	3.80
PZ10	08/27/13		23.51	3.43	10:30 a.m.	4:00 p.m.	6.91	8:21 a.m.	2.01
PZ10	12/19/13		23.28	3.66	10:00 a.m.	2:39 p.m.	8.48	4:15 a.m.	1.69
PZ10	01/07/15		20.87	6.07	2:30 p.m.	4:53 p.m.	5.85	1:33 a.m.	3.19
PZ10	08/07/17		22.64	4.30	8:50 a.m	4:03 a.m.	4.13	12:54 p.m.	-0.03

Table 2
Summary of Groundwater Elevation Data
Chemtrade Performance Chemicals US LLC Site
Kalama, WA
H&H Project No. CLR-045

Well ID	Date Measured	TOC Elevation[1] (ft CRD)	Depth to Water (ft below TOC)	Water Elevation[1] (ft CRD)	Time Measured	High (CRD)[2]		Low (CRD)[2]	
						Time	Elevation (ft)	Time	Elevation (ft)
PZ11	02/04/10	30.39	25.26	5.13	9:10 a.m.	7:39 a.m.	5.47	2.45 p.m.	1.34
PZ11	09/01/10		28.39	2.00	10:02 a.m.	9:42 p.m.	2.62	5.33 a.m.	-0.93
PZ11	12/20/10		24.11	6.28	11:26 a.m	--	--	10:09 a.m.	4.25
PZ11	12/20/10		23.50	6.89	2:31 p.m.	2:27 p.m.	7.11	--	--
PZ11	03/21/11		22.92	7.47	4:03 p.m	--	--	2:15 p.m.	4.77
PZ11	03/23/11		22.98	7.41	8:38 a.m.	7:18 a.m.	7.27	--	--
PZ11	06/21/11		19.73	10.66	3:10 p.m.	8:48 a.m.	9.36	5:06 p.m.	8.39
PZ11	06/22/11		19.92	10.47	8:08 a.m.	9:48 a.m.	9.13	6:54 a.m.	8.71
PZ11	09/23/11		28.17	2.22	8:45 a.m.	--	--	9:06 a.m.	-0.73
PZ11	09/28/11		26.86	3.53	3.25 p.m.	5:27 p.m.	4.72	--	--
PZ11	01/12/12		26.17	4.22	8:40 a.m.	5:57 a.m.	4.01	1:48 p.m.	1.02
PZ11	03/20/12		22.14	8.25	9:50 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
PZ11	06/26/12		21.42	8.97	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
PZ11	10/31/12		23.70	6.69	2:24 p.m.	5:42 a.m.	5.17	12:45 p.m.	2.67
PZ11	05/31/13		23.40	6.99	1:00 p.m.	5:42 a.m.	10.15	5:00 p.m.	3.80
PZ11	08/27/13		27.25	3.14	10:30 a.m.	4:00 p.m.	6.91	8:21 a.m.	2.01
PZ11	12/19/13		26.90	3.49	10:00 a.m.	2:39 p.m.	8.48	4:15 a.m.	1.69
PZ11	01/07/15		24.72	5.67	2:30 p.m.	4:53 p.m.	5.85	1:33 a.m.	3.19
PZ11	08/07/17		27.18	3.21	9:20 a.m.	4:03 a.m.	4.13	12:54 p.m.	-0.03
PZ12	02/04/10	30.53	25.42	5.11	8:34 a.m.	7:39 a.m.	5.47	2.45 p.m.	1.34
PZ12	09/01/10		NM	NM	NM	9:42 p.m.	2.62	5.33 a.m.	-0.93
PZ12	11/02/10		27.18	3.35	11:37 a.m.	1:15 p.m.	4.42	8:42 a.m.	0.75
PZ12	12/20/10		24.25	6.28	11:20 a.m.	--	--	10:09 a.m.	4.25
PZ12	12/20/10		23.50	7.03	3:12 p.m.	2:27 p.m.	7.11	--	--
PZ12	03/21/11		23.06	7.47	3:33 p.m.	--	--	2:15 p.m.	4.77
PZ12	03/23/11		23.21	7.32	8:08 a.m	7:18 a.m.	7.27	--	--
PZ12	06/21/11		19.91	10.62	3:12 p.m.	8:48 a.m.	9.36	5:06 p.m.	8.39
PZ12	06/22/11		20.11	10.42	8:11 a.m.	9:48 a.m.	9.13	6:54 a.m.	8.71
PZ12	09/23/11		28.27	2.26	8:45 a.m.	--	--	9:06 a.m.	-0.73
PZ12	09/28/11		NM	NM	3.25 p.m.	5:27 p.m.	4.72	--	--
PZ12	01/12/12		26.32	4.21	8:38 a.m.	5:57 a.m.	4.01	1:48 p.m.	1.02
PZ12	03/20/12		22.27	8.26	9:45 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
PZ12	06/26/12		21.60	8.93	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
PZ12	10/31/12		25.61	4.92	5:42 a.m.	5:42 a.m.	5.17	12:45 p.m.	2.67
PZ12	05/31/13		23.58	6.95	1:00 p.m.	5:42 a.m.	10.15	5:00 p.m.	3.80
PZ12	08/27/13		27.44	3.09	10:30 a.m.	4:00 p.m.	6.91	8:21 a.m.	2.01
PZ12	12/19/13		27.31	3.22	10:00 a.m.	2:39 p.m.	8.48	4:15 a.m.	1.69
PZ12	01/07/15		24.83	5.70	2:30 p.m.	4:53 p.m.	5.85	1:33 a.m.	3.19
PZ12	08/07/17		26.89	3.64	9:30 a.m.	4:03 a.m.	4.13	12:54 p.m.	-0.03
PZ13	02/04/10	30.40	25.50	4.90	8:32 a.m.	7:39 a.m.	5.47	2.45 p.m.	1.34
PZ13	09/01/10		28.21	2.19	9:59 a.m.	9:42 p.m.	2.62	5.33 a.m.	-0.93
PZ13	11/02/10		26.93	3.47	11:30 a.m.	1:15 p.m.	4.42	8:42 a.m.	0.75
PZ13	12/20/10		23.89	6.51	11:18 a.m.	--	--	10:09 a.m.	4.25
PZ13	12/20/10		23.56	6.84	2:22 p.m.	2:27 p.m.	7.11	--	--
PZ13	03/21/11		23.57	6.83	3:36 p.m.	--	--	2:15 p.m.	4.77
PZ13	03/23/11		23.11	7.29	8:05 a.m.	7:18 a.m.	7.27	--	--
PZ13	06/21/11		19.50	10.90	3:14 p.m	8:48 a.m.	9.36	5:06 p.m.	8.39
PZ13	06/22/11		19.75	10.65	8:14 a.m.	9:48 a.m.	9.13	6:54 a.m.	8.71
PZ13	09/23/11		27.82	2.58	8:45 a.m.	--	--	9:06 a.m.	-0.73
PZ13	09/28/11		26.63	3.77	3.25 p.m.	5:27 p.m.	4.72	--	--
PZ13	01/12/12		26.12	4.28	8:30 a.m	5:57 a.m.	4.01	1:48 p.m.	1.02
PZ13	03/20/12		21.81	8.59	9:40 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
PZ13	06/26/12		21.36	9.04	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
PZ13	10/31/12		25.31	5.09	5:42 a.m.	5:42 a.m.	5.17	12:45 p.m.	2.67
PZ13	05/31/13		23.19	7.21	1:00 p.m.	5:42 a.m.	10.15	5:00 p.m.	3.80
PZ13	08/27/13		27.17	3.23	10:30 a.m.	4:00 p.m.	6.91	8:21 a.m.	2.01
PZ13	12/19/13		26.95	3.45	10:00 a.m.	2:39 p.m.	8.48	4:15 a.m.	1.69
PZ13	01/07/15		24.35	6.05	2:30 p.m.	4:53 p.m.	5.85	1:33 a.m.	3.19
PZ13	08/07/17		26.50	3.90	9:30 a.m.	4:03 a.m.	4.13	12:54 p.m.	-0.03
PZ14	02/04/10	29.09	23.74	5.35	8:20 a.m.	7:39 a.m.	5.47	2.45 p.m.	1.34
PZ14	09/01/10		26.94	2.15	9:57 a.m.	9:42 p.m.	2.62	5.33 a.m.	-0.93
PZ14	06/21/11		18.55	10.54	3:17 p.m	8:48 a.m.	9.36	5:06 p.m.	8.39
PZ14	06/22/11		18.62	10.47	8:16 a.m.	9:48 a.m.	9.13	6:54 a.m.	8.71
PZ14	09/23/11		27.15	1.94	8:45 a.m.	--	--	9:06 a.m.	-0.73
PZ14	09/28/11		25.44	3.65	3.25 p.m.	5:27 p.m.	4.72	--	--
PZ14	01/12/12		24.72	4.37	8:35 a.m.	5:57 a.m.	4.01	1:48 p.m.	1.02
PZ14	03/20/12		21.02	8.07	9:35 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
PZ14	06/26/12		19.57	9.52	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
PZ14	05/31/13		22.10	6.99	1:00 p.m.	5:42 a.m.	10.15	5:00 p.m.	3.80
PZ14	08/27/13		25.85	3.24	10:30 a.m.	4:00 p.m.	6.91	8:21 a.m.	2.01
PZ14	12/19/13		25.52	3.57	10:00 a.m.	2:39 p.m.	8.48	4:15 a.m.	1.69
PZ14	01/07/15		23.56	5.53	2:30 p.m.	4:53 p.m.	5.85	1:33 a.m.	3.19
PZ14	08/07/17		25.96	3.13	9:27 a.m.	4:03 a.m.	4.13	12:54 p.m.	-0.03
PZ15	02/04/10	27.79	22.22	5.57	9:45 a.m.	7:39 a.m.	5.47	2.45 p.m.	1.34
PZ15	09/01/10		25.58	2.21	9:50 a.m.	9:42 p.m.	2.62	5.33 a.m.	-0.93
PZ15	06/21/11		NM	NM	NM	8:48 a.m.	9.36	5:06 p.m.	8.39
PZ15	06/22/11		NM	NM	NM	9:48 a.m.	9.13	6:54 a.m.	8.71
PZ15	09/23/11		26.04	1.75	8:45 a.m.	--	--	9:06 a.m.	-0.73
PZ15	09/28/11		23.91	3.88	3.25 p.m.	5:27 p.m.	4.72	--	--
PZ15	01/12/12		23.31	4.48	8:56 a.m.	5:57 a.m.	4.01	1:48 p.m.	1.02
PZ15	03/20/12		19.51	8.28	9:18 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
PZ15	06/26/12		18.30	9.49	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
PZ15	05/31/13		20.81	6.98	1:00 p.m.	5:42 a.m.	10.15	5:00 p.m.	3.80
PZ15	08/27/13		24.23	3.56	10:30 a.m.	4:00 p.m.	6.91	8:21 a.m.	2.01
PZ15	12/19/13		23.95	3.84	10:00 a.m.	2:39 p.m.	8.48	4:15 a.m.	1.69
PZ15	01/07/15		22.05	5.74	2:30 p.m.	4:53 p.m.	5.85	1:33 a.m.	3.19
PZ15	08/07/17		24.26	3.53	8:55 a.m	4:03 a.m.	4.13	12:54 p.m.	-0.03

Table 2
Summary of Groundwater Elevation Data
Chemtrade Performance Chemicals US LLC Site
Kalama, WA
H&H Project No. CLR-045

Well ID	Date Measured	TOC Elevation[1] (ft CRD)	Depth to Water (ft below TOC)	Water Elevation[1] (ft CRD)	Time Measured	High (CRD)[2]		Low (CRD)[2]	
						Time	Elevation (ft)	Time	Elevation (ft)
AB1[3]	02/04/10	27.53	30.08	6.26	9:17 a.m.	7:39 a.m.	5.47	2.45 p.m.	1.34
AB1[3]	09/01/10		34.71	2.99	10:27 a.m.	9:42 p.m.	2.62	5.33 a.m.	-0.93
AB1[3]	11/02/10		32.19	4.77	12:03 p.m.	13:15 p.m.	4.42	8:42 a.m.	0.75
AB1[3]	12/20/10		29.08	6.97	11:30 a.m.	--	--	10:09 a.m.	4.25
AB1[3]	12/20/10		28.32	7.50	2:36 p.m.	2:27 p.m.	7.11	--	--
AB1[3]	03/21/11		27.65	7.98	4:32 p.m.	--	--	2:15 p.m.	4.77
AB1[3]	03/23/11		27.07	8.39	8:30 a.m.	7:18 a.m.	7.27	--	--
AB1[3]	06/21/11		23.48	10.93	3:36 p.m.	8:48 a.m.	9.36	5:06 p.m.	8.39
AB1[3]	06/22/11		23.49	10.92	7:46 a.m.	9:48 a.m.	9.13	6:54 a.m.	8.71
AB1[3]	09/23/11		35.19	2.65	8:45 a.m.	--	--	9:06 a.m.	-0.73
AB1[3]	09/28/11		32.64	4.45	3.25 p.m.	5:27 p.m.	4.72	--	--
AB1[3]	01/12/12		31.76	5.07	8:46 a.m.	5:57 a.m.	4.01	1:48 p.m.	1.02
AB1[3]	03/20/12		26.52	8.78	9:23 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
AB1[3]	06/26/12		25.13	9.76	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
AB1[3]	10/31/12		31.11	5.53	1:45 p.m.	5:42 a.m.	5.17	12:45 p.m.	2.67
AB1[3]	05/31/13		28.32	7.50	1:00 p.m.	5:42 a.m.	10.15	5:00 p.m.	3.80
AB1[3]	08/27/13		32.97	4.22	10:30 a.m.	4:00 p.m.	6.91	8:21 a.m.	2.01
AB1[3]	12/19/13		32.59	4.49	10:00 a.m.	2:39 p.m.	8.48	4:15 a.m.	1.69
AB1[3]	01/07/15		30.29	6.11	2:30 p.m.	4:53 p.m.	5.85	1:33 a.m.	3.19
AB1[3]	08/07/17		32.80	4.34	9:17 a.m.	4:03 a.m.	4.13	12:54 p.m.	-0.03
AB2[3]	02/04/10	28.41	27.23	6.10	8:27 a.m.	7:39 a.m.	5.47	2.45 p.m.	1.34
AB2[3]	09/01/10		31.21	2.84	10:30 a.m	9:42 p.m.	2.62	5.33 a.m.	-0.93
AB2[3]	11/02/10		29.56	4.19	11:21 a.m.	13:15 p.m.	4.42	8:42 a.m.	0.75
AB2[3]	12/20/10		26.36	6.82	11:16 a.m.	--	--	10:09 a.m.	4.25
AB2[3]	12/20/10		24.97	7.95	2:26 p.m.	2:27 p.m.	7.11	--	--
AB2[3]	03/21/11		25.20	7.77	3:54 p.m.	--	--	2:15 p.m.	4.77
AB2[3]	03/23/11		24.63	8.23	8:30 a.m.	7:18 a.m.	7.27	--	--
AB2[3]	06/21/11		21.36	10.91	3:21 p.m.	8:48 a.m.	9.36	5:06 p.m.	8.39
AB2[3]	06/22/11		21.35	10.92	8:19 a.m.	9:48 a.m.	9.13	6:54 a.m.	8.71
AB2[3]	09/23/11		31.66	2.47	8:45 a.m.	--	--	9:06 a.m.	-0.73
AB2[3]	09/28/11		29.45	4.28	3.25 p.m.	5:27 p.m.	4.72	--	--
AB2[3]	01/12/12		28.60	4.98	8:25 a.m.	5:57 a.m.	4.01	1:48 p.m.	1.02
AB2[3]	03/20/12		24.03	8.72	9:32 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
AB2[3]	06/26/12		22.93	9.63	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
AB2[3]	10/31/12		28.01	5.46	1:23 p.m.	5:42 a.m.	5.17	12:45 p.m.	2.67
AB2[3]	05/31/13		25.56	7.47	1:00 p.m.	5:42 a.m.	10.15	5:00 p.m.	3.80
AB2[3]	08/27/13		29.80	4.00	10:30 a.m.	4:00 p.m.	6.91	8:21 a.m.	2.01
AB2[3]	12/19/13		29.47	4.27	10:00 a.m.	2:39 p.m.	8.48	4:15 a.m.	1.69
AB2[3]	01/07/15		27.17	6.15	2:30 p.m.	4:53 p.m.	5.85	1:33 a.m.	3.19
AB2[3]	08/07/17		29.29	4.42	9:40 a.m.	4:03 a.m.	4.13	12:54 p.m.	-0.03
OW1	11/02/10	26.51	23.00	3.51	11:26 a.m.	13:15 p.m.	4.42	8:42 a.m.	0.75
OW1	12/20/10		20.22	6.29	11:10 a.m.	--	--	10:09 a.m.	4.25
OW1	12/20/10		19.38	7.13	2:20 p.m.	2:27 p.m.	7.11	--	--
OW1	03/21/11		19.15	7.36	3:40 p.m.	--	--	2:15 p.m.	4.77
OW1	03/23/11		18.97	7.54	8:20 a.m.	7:18 a.m.	7.27	--	--
OW1	06/21/11		15.93	10.58	3:26 p.m.	8:48 a.m.	9.36	5:06 p.m.	8.39
OW1	06/22/11		16.05	10.46	8:21 a.m.	9:48 a.m.	9.13	6:54 a.m.	8.71
OW1	09/23/11		24.43	2.08	8:45 a.m.	--	--	9:06 a.m.	-0.73
OW1	09/28/11		22.79	3.72	3.25 p.m.	5:27 p.m.	4.72	--	--
OW1	01/12/12		22.16	4.35	8:26 a.m.	5:57 a.m.	4.01	1:48 p.m.	1.02
OW1	03/20/12		18.25	8.26	10:20 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
OW1	06/26/12		17.41	9.10	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
OW1	10/31/12		21.62	4.89	1:26 p.m.	5:42 a.m.	5.17	12:45 p.m.	2.67
OW1	05/31/13		19.49	7.02	1:00 p.m.	5:42 a.m.	10.15	5:00 p.m.	3.80
OW1	08/27/13		23.25	3.26	10:30 a.m.	4:00 p.m.	6.91	8:21 a.m.	2.01
OW1	12/19/13		23.00	3.51	10:00 a.m.	2:39 p.m.	8.48	4:15 a.m.	1.69
OW1	01/07/15		20.85	5.66	2:30 p.m.	4:53 p.m.	5.85	1:33 a.m.	3.19
OW1	08/07/17		22.66	3.85	9:35 a.m.	4:03 a.m.	4.13	12:54 p.m.	-0.03
OW2	11/02/10	25.99	22.45	3.54	11:24 p.m.	13:15 p.m.	4.42	8:42 a.m.	0.75
OW2	12/20/10		19.71	6.28	11:08 a.m.	--	--	10:09 a.m.	4.25
OW2	12/20/10		18.56	7.43	3:14 p.m.	2:27 p.m.	7.11	--	--
OW2	03/21/11		18.64	7.35	3:58 p.m.	--	--	2:15 p.m.	4.77
OW2	03/23/11		18.37	7.62	8:27 a.m.	7:18 a.m.	7.27	--	--
OW2	06/21/11		15.48	10.51	3:24 a.m.	8:48 a.m.	9.36	5:06 p.m.	8.39
OW2	06/22/11		15.51	10.48	8:23 a.m.	9:48 a.m.	9.13	6:54 a.m.	8.71
OW2	09/23/11		23.99	2.00	8:45 a.m.	--	--	9:06 a.m.	-0.73
OW2	09/28/11		22.85	3.14	3.25 p.m.	5:27 p.m.	4.72	--	--
OW2	01/12/12		21.62	4.37	8:28 a.m	5:57 a.m.	4.01	1:48 p.m.	1.02
OW2	03/20/12		17.81	8.18	10:25 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
OW2	06/26/12		16.87	9.12	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
OW2	10/31/12		21.14	4.85	1:30 p.m.	5:42 a.m.	5.17	12:45 p.m.	2.67
OW2	05/31/13		19.01	6.98	1:00 p.m.	5:42 a.m.	10.15	5:00 p.m.	3.80
OW2	08/27/13		22.67	3.32	10:30 a.m.	4:00 p.m.	6.91	8:21 a.m.	2.01
OW2	12/19/13		22.35	3.64	10:00 a.m.	2:39 p.m.	8.48	4:15 a.m.	1.69
OW2	01/07/15		20.34	5.65	2:30 p.m.	4:53 p.m.	5.85	1:33 a.m.	3.19
OW2	08/07/17		22.21	3.78	9:35 a.m.	4:03 a.m.	4.13	12:54 p.m.	-0.03

Table 2
Summary of Groundwater Elevation Data
Chemtrade Performance Chemicals US LLC Site
Kalama, WA
H&H Project No. CLR-045

Well ID	Date Measured	TOC Elevation[1] (ft CRD)	Depth to Water (ft below TOC)	Water Elevation[1] (ft CRD)	Time Measured	High (CRD)[2]		Low (CRD)[2]	
						Time	Elevation (ft)	Time	Elevation (ft)
OW3	11/02/10	26.13	22.62	3.51	11:28 a.m.	13:15 p.m.	4.42	8:42 a.m.	0.75
OW3	12/20/10		19.83	6.30	11:13 a.m.	--	--	10:09 a.m.	4.25
OW3	12/20/10		19.98	6.15	2:28 p.m.	2:27 p.m.	7.11	--	--
OW3	03/21/11		18.76	7.37	3:42 p.m.	--	--	2:15 p.m.	4.77
OW3	03/23/11		18.60	7.53	8:14 a.m.	7:18 a.m.	7.27	--	--
OW3	06/21/11		15.55	10.58	3:30 p.m.	8:48 a.m.	9.36	5:06 p.m.	8.39
OW3	06/22/11		15.65	10.48	8:24 a.m.	9:48 a.m.	9.13	6:54 a.m.	8.71
OW3	09/23/11		24.05	2.08	8:45 a.m.	--	--	9:06 a.m.	-0.73
OW3	09/28/11		22.52	3.61	3.25 p.m.	5:27 p.m.	4.72	--	--
OW3	01/12/12		21.76	4.37	8:07 a.m.	5:57 a.m.	4.01	1:48 p.m.	1.02
OW3	03/20/12		17.90	8.23	10:30 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
OW3	06/26/12		17.03	9.10	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
OW3	10/31/12		21.22	4.91	1:33 p.m.	5:42 a.m.	5.17	12:45 p.m.	2.67
OW3	05/31/13		19.15	6.98	1:00 p.m.	5:42 a.m.	10.15	5:00 p.m.	3.80
OW3	08/27/13		22.87	3.26	10:30 a.m.	4:00 p.m.	6.91	8:21 a.m.	2.01
OW3	12/19/13		22.70	3.43	10:00 a.m.	2:39 p.m.	8.48	4:15 a.m.	1.69
OW3	01/07/15		20.46	5.67	2:30 p.m.	4:53 p.m.	5.85	1:33 a.m.	3.19
OW3	08/07/17		22.51	3.62	9:40 a.m.	4:03 a.m.	4.13	12:54 p.m.	-0.03

Notes:
Pre-2010 data not shown in table
1) Survey based on NAVD88 and adjusted to CRD by subtracting 3.8 feet. Control point was taken from the I-5 intersection at the Todd Road overpass located at the northeast corner of the interchange.
2) Tidal data are from NOAA Co-ops web site http://co-ops.nos.noaa.gov. Verified times and high/low water level data from the Longview and St. Helens stations were used. Tides for Kalama were estimated by using the difference between the times and water level data at these two stations (assuming Kalama is located approximately at the midpoint). These elevations are based on MLLW.
3) Water elevations in the angle monitoring wells are approximated by the following calculations (where WL = depth to water):
AB1 (27.53 - WL COS 45°)
AB2 (28.41 - WL COS 35°)
ft TOC = feet below top of casing; CRD = Columbia River Datum; NM = n

Table 3
Summary of Remaining Soil Analytical Data
Former Clariant Facility
Kalama, WA
H&H Project No. CLR-045

Sample ID	Sample Date	Sample Depth (ft bgs)	Cadmium (mg/kg)	Zinc (mg/kg)
Former Settling Basin Areas				
1	09/05/2003	5	<0.53	33
3	09/05/2003	3	<0.52	33
4	09/05/2003	5	<0.51	26
5	09/05/2003	1	<0.51	33
6	09/05/2003	3	<0.51	32
8	09/05/2003	1	0.56	280
9	09/09/2003	3	<0.53	31
10	09/09/2003	5	<0.54	33
11	09/09/2003	1	0.88	270
12	09/09/2003	3	<0.54	28
13	09/09/2003	3	<0.54	27
14	09/09/2003	5	<0.54	31
15	09/09/2003	1	<0.54	31
16	09/09/2003	3	<0.54	31
17	09/09/2003	1	<0.54	32
32	10/02/2003	1	<0.52	34
34	10/02/2003	5	<0.52	47
35	10/02/2003	7	<0.52	40
45	10/08/2003	7	<0.53	24
46	09/25/2003	5	<0.53	27
47	09/16/2003	9	<0.53	22
48	09/25/2003	3	<0.53	29
49	09/16/2003	7	<0.53	29
50	09/25/2003	1	<0.53	35
51	09/16/2003	5	<0.53	32
52	09/25/2003	3	<0.53	29
53	09/16/2003	9	<0.53	29
54	09/25/2003	1	<0.53	33
55	09/16/2003	7	<0.53	23
56	09/16/2003	5	<0.53	24
57	09/16/2003	5	<0.53	24
58	09/25/2003	1	<0.53	34
59	09/16/2003	7	<0.53	32
60	09/25/2003	3	<0.53	32
61	09/16/2003	9	<0.53	36
62	09/25/2003	5	<0.53	33
2R	09/12/2003	1	--	210
33R	10/02/2003	3	<0.52	36
63R	10/06/2003	7	<0.53	34
7R	09/12/2003	5	--	100
ARSW-1	09/16/2010	7-8	<2.16	91.5
ARSW-2	09/16/2010	7-8	<2.16	283
ARSW-3	09/16/2010	7-8	<2.07	141
ARSW-4	09/16/2010	7-8	<2.08	146
B1	09/16/2003	7-8	<5.3	32
B2	09/05/2003	9	<0.53	410
B3	09/12/2003	5.5	<0.52	27
B8	10/02/2003	15	<0.53	6,200
B9	10/02/2003	15	<0.53	1,300
B10	09/25/2003	15	<0.53	2,400
B11	09/25/2003	15	<0.53	4,500
B12	09/19/2003	15	<0.53	2,700
B13	09/19/2003	15	<0.53	2,100
EB-1	08/20/2010	15	0.34	780
EB-2	08/20/2010	15	0.35	480
EB-3	08/20/2010	15	0.34	560
EB-4	09/02/2010	15	<0.534	462
EB-5	09/02/2010	15	<2.68	793
EB-6	09/02/2010	15	<2.63	738
EB-7	09/16/2010	15	<2.12	2,110
EB-8	09/16/2010	15	<2.16	1,380
EB-9	09/16/2010	15	<2.14	1,800
EB-10	09/16/2010	15	<2.12	950
EB-11	09/16/2010	15	<2.12	1,160
EB-12	09/16/2010	15	<2.14	1,220
EB-13	09/16/2010	15	<2.16	729
ESW-1	08/17/2010	7-8	<2.1	55.1
ESW-2B	08/23/2010	7-8	0.15	44
ESW-3A	08/20/2010	7-8	0.32	<46.7
ESW-4A	08/20/2010	7-8	0.30	<48.0
ESW-5A	08/27/2010	7-8	<0.532	37
ESW-6A	08/27/2010	7-8	<0.521	40.1
ESW-7	08/17/2010	7-8	<2.1	43.3
ESW-8	08/27/2010	7-8	<0.532	52.1
LG5	10/23/2002	5	<0.2	376
LG6	10/23/2002	5	<0.2	47.2
NSW-0A	08/31/2010	7-8	<0.531	169
NSW-1	08/17/2010	7-8	<2.11	48.8
NSW-2	08/17/2010	7-8	<2.00	62.7
NSW-3	08/17/2010	7-8	<2.04	126
NSW-4	08/17/2010	7-8	<2.08	79
NSW-5	08/17/2010	7-8	<2.15	48.7
NSW-6	08/17/2010	7-8	<2.15	47.8
OB1*	09/16/2003	10-15	<0.52	390
OB2*	09/16/2003	10-15	0.56	510
OB3*	09/16/2003	10-15	<0.52	120
OB4*	09/16/2003	10-15	<0.52	**930**
SB1-Surf-1	10/16/2003	0-0.5	<0.55	35
SB1-Surf-2	10/16/2003	0-0.5	<0.54	71
SB1-Surf-3	10/16/2003	0-0.5	<0.56	98
SB1-Surf-4	10/16/2003	0-0.5	<0.55	40
SB2-Surf-1	10/16/2003	0-0.5	<0.56	99
SB2-Surf-2	10/16/2003	0-0.5	<0.56	49
SB2-Surf-3	10/16/2003	0-0.5	<0.56	38
SB2-Surf-4	10/16/2003	0-0.5	<0.56	52
SS11A	03/11/2003	0-3	<0.50	76
SS12	04/16/2003	0.5-1	<0.50	27
SS13	04/16/2003	0.5-1	<0.50	220
SSW-1	08/17/2010	7-8	<2.12	84.9
SSW-2	08/17/2010	7-8	<2.13	47.9
SSW-3	08/17/2010	7-8	<2.1	53.5
SSW-4	08/17/2010	7-8	<2.16	48.7
SSW-5	08/17/2010	7-8	<2.14	50.4
SSW-6	08/30/2010	7-8	<0.52	80.3
SSW-7	08/30/2010	7-8	<0.516	44.2
TP1	03/11/2003	7	<0.50	30
TP1	03/11/2003	5	<0.50	49
TP1	03/11/2003	3	<0.50	34
TP1	03/11/2003	1	<0.50	34
TP10	03/11/2003	3	<0.50	46
TP11	03/11/2003	7	<0.50	38
TP11	03/11/2003	5	<0.50	48
TP11	03/11/2003	3	<0.50	62
TP11	03/11/2003	1	<0.50	38
TP12	03/11/2003	3	<0.50	65
TP2	03/11/2003	7	<0.50	22
TP2	03/11/2003	5	<0.50	28
TP2	03/11/2003	3	<0.50	23
TP2	03/11/2003	1	<0.50	49
TP3	03/11/2003	0-3	<0.50	34
TP4	03/11/2003	3	<0.50	26
TP5	03/11/2003	7	<0.50	27
TP5	03/11/2003	5	<0.50	31
TP5	03/11/2003	3	<0.50	37
TP5	03/11/2003	1	<0.50	37
TP7	03/11/2003	3	<0.50	31
TP8	03/11/2003	7	<0.50	28
TP8	03/11/2003	5	<0.50	42
TP8	03/11/2003	3	<0.50	31
TP8	03/11/2003	1	<0.50	38
W1	10/15/2003	0-0.2	<0.54	160
W2	10/15/2003	0-0.2	<0.56	140
W3	10/15/2003	0-0.2	<0.67	26
W4	10/15/2003	0-0.2	<0.51	71
WSW-1	08/17/2010	7-8	<2.15	45.6
WSW-2	08/17/2010	7-8	<2.14	41.7
WSW-3	08/17/2010	7-8	<2.12	44.4
WSW-4	08/17/2010	7-8	<2.12	48.3
WSW-5	08/17/2010	7-8	<2.12	61.0
Manufacturing Plant Area				
E-1	10/08/2003	1.4	<0.56	120
E-2	10/08/2003	1.5	<0.56	250
E-3	10/08/2003	1.5	<0.56	140
E-4	10/08/2003	1	<0.56	340
E-5	10/08/2003	0-0.25	<0.56	63
E-6	10/08/2003	0-0.25	<0.56	100
E-7	10/08/2003	0-0.25	0.65	120
E-8	10/08/2003	0-0.25	<0.56	480
E-9	10/08/2003	0-0.25	<0.56	390
PZ3A	04/15/2003	1	1.5	**1,300**
PZ3A	04/15/2003	20	<0.50	700
PZ3A	04/15/2003	15	<0.50	370
PZ3A	04/15/2003	10	<0.50	220
PZ3A	04/15/2003	8	<0.50	230
PZ4	04/15/2003	1	0.78	270
PZ4	04/15/2003	20	1.0	280
PZ4	04/15/2003	25	5.2	250
PZ4	04/15/2003	15	<0.50	410

Table 3
Summary of Remaining Soil Analytical Data
Former Clariant Facility
Kalama, WA
H&H Project No. CLR-045

Sample ID	Sample Date	Sample Depth (ft bgs)	Cadmium (mg/kg)	Zinc (mg/kg)
PZ4	04/15/2003	10	<0.50	80
PZ4	04/15/2003	5	<0.50	45
PZ5	04/15/2003	5	0.88	530
PZ5	04/15/2003	10	1.5	**1,300**
PZ5	04/15/2003	20	4.2	200
PZ5	04/15/2003	25	13	240
PZ5	04/15/2003	15	<0.50	180
PZ5	04/15/2003	1	<0.50	100
PZ6	04/15/2003	25	<0.50	110
PZ6	04/15/2003	20	<0.50	180
PZ6	04/15/2003	15	<0.50	190
PZ6	04/15/2003	10	<0.50	180
PZ6	04/15/2003	5	<0.50	360
PZ6	04/15/2003	1	<0.50	150
PZ7	04/15/2003	5	0.61	470
PZ7	04/15/2003	25	0.75	180
PZ7	04/15/2003	1	3.4	**2,100**
PZ7	04/15/2003	20	<0.50	86
PZ7	04/15/2003	15	<0.50	130
PZ7	04/15/2003	10	<0.50	530
PZ8	04/15/2003	25	<0.50	66
PZ8	04/15/2003	20	<0.50	29
PZ8	04/15/2003	15	<0.50	36
PZ8	04/15/2003	10	<0.50	61
PZ8	04/15/2003	5	<0.50	34
PZ8	04/15/2003	1	<0.50	84
PZ9	05/06/2003	20	<0.50	33
PZ9	05/06/2003	15	<0.50	32
PZ9	05/06/2003	10	<0.50	28
PZ9	05/06/2003	5	<0.50	26
PZ9	05/06/2003	1	<0.50	37
SS1	10/23/2002	0-0.5	0.60	400
SS2	10/23/2002	0.5-1	1.8	**1,290**
SS3	10/23/2002	0-0.5	1.7	**868**
SS4	10/24/2002	0-0.5	1.1	**2,330**
SS5	10/24/2002	0-0.5	<0.2	116
SS7	10/24/2002	0-0.5	8.5	**19,100**
SS10	04/16/2003	0.5-1	<0.50	170
SS11B	04/16/2003	0.5-1	0.78	**1,200**
W-1	10/02/2003	1.5	<0.53	210
W-2	10/02/2003	1.5	<0.53	26
W-3	10/02/2003	1.5	<0.53	420
W-4	10/02/2003	1	<0.53	60
W6	04/16/2003	25	<0.50	150
W6	04/16/2003	20	<0.50	88
W6	04/16/2003	15	<0.50	89
W6	04/16/2003	10	<0.50	74
W6	04/16/2003	5	<0.50	160
W6	04/16/2003	1	<0.50	490
W7	04/16/2003	1	0.82	**900**
W7	04/16/2003	25	<0.50	160
W7	04/16/2003	20	<0.50	110
W7	04/16/2003	15	<0.50	91
W7	04/16/2003	10	<0.50	500
W7	04/16/2003	5	<0.50	170
W8	04/16/2003	10	2.3	61
W8	04/16/2003	25	<0.50	75
W8	04/16/2003	20	<0.50	180
W8	04/16/2003	15	<0.50	140
W8	04/16/2003	5	<0.50	350
W8	04/16/2003	1	<0.50	230
W9	04/16/2003	20	<0.50	110
W9	04/16/2003	15	<0.50	330
W9	04/16/2003	10	<0.50	45
W9	04/16/2003	5	<0.50	36
W9	04/16/2003	1	<0.50	37
W10	04/16/2003	1	0.65	280
W10	04/16/2003	20	<0.50	56
W10	04/16/2003	15	<0.50	510
W10	04/16/2003	10	<0.50	180
W10	04/16/2003	5	<0.50	88
W11	04/16/2003	20	<0.50	38
W11	04/16/2003	15	<0.50	30
W11	04/16/2003	10	<0.50	35
W11	04/16/2003	5	<0.50	22
W11	04/16/2003	1	<0.50	31
W12	04/16/2003	1	5.5	**620**
W12	04/16/2003	20	<0.50	360
W12	04/16/2003	15	<0.50	260
W12	04/16/2003	10	<0.50	330
W12	04/16/2003	5	<0.50	330
SB-1	08/10/2017	0-3	<1.29	15.4
SB-1	08/10/2017	3-6	<1.32	<13.2
SB-2	08/09/2017	0-3	<1.26	94.5
SB-2	08/09/2017	3-6	<1.30	209
SB-3	08/10/2017	0-3	<1.29	299
SB-3	08/10/2017	3-6	<1.33	17.9
SB-4	08/10/2017	0-3	<1.29	36.3
SB-4	08/10/2017	3-6	<1.31	<13.1
SB-5	08/10/2017	0-3	<5.12	238
SB-5	08/10/2017	3-6	<5.13	119
SB-6	08/09/2017	1-3	5.92	**5,250**
SB-6	08/09/2017	3-6	5.30	**3,200**
SB-7	08/09/2017	1-3	7.37	**9,360**
SB-7	08/09/2017	3-6	<5.29	**2,590**
SB-8	08/10/2017	1-3	<5.33	**652**
SB-8	08/10/2017	3-6	<5.21	441
SB-9	08/10/2017	0-3	<5.00	97.4
SB-9	08/10/2017	3-6	<4.92	91.9
SB-10	08/10/2017	0-3	**107**	367
SB-10	08/10/2017	3-6	**76.2**	**627**
SB-11	08/10/2017	1-3	<5.03	**592**
SB-11	08/10/2017	3-6	<5.01	166
SB-12	08/10/2017	0-3	<4.99	**754**
SB-12	08/10/2017	3-6	<5.18	91.9
SB-13	08/10/2017	0-3	<5.19	**1,300**
SB-13	08/10/2017	3-6	<5.13	113
SB-14	08/10/2017	0-3	<2.54	488
SB-14	08/10/2017	3-6	<2.60	109
SB-15	08/10/2017	0-3	<2.51	372
SB-15	08/10/2017	3-6	<2.62	513
SB-16	08/10/2017	0-3	<2.52	387
SB-16	08/10/2017	3-6	<2.59	32.7
SB-17	08/10/2017	0-3	<2.55	303
SB-17	08/10/2017	3-6	<2.66	166
SB-18	08/10/2017	0-3	<2.59	46.8
SB-18	08/10/2017	3-6	<2.69	38.4
SB-19	08/11/2017	0-3	<2.58	<25.8
SB-19	08/11/2017	3-6	<2.60	<26.0
SB-20	08/11/2017	0-3	<2.67	**594**
SB-20	08/11/2017	3-4	<2.56	**813**
SB-21	08/11/2017	10-13	**91.6**	150
SB-21	08/11/2017	13-16	**305**	255
SB-22	08/11/2017	0-3	<2.56	160
SB-23	08/10/2017	1-3	<5.04	**728**
SB-23	08/10/2017	3-6	<5.26	**4,260**
Backfill and Background Samples				
Backfill	08/18/2010	0-15	<2.05	39.4
SP1	09/19/2003	0-15	<0.53	37
SP2	09/19/2003	0-15	<0.53	32
SP3	09/19/2003	0-15	<0.53	38
SP4	09/19/2003	0-15	<0.53	31
SP5	09/19/2003	0-15	<0.53	27
BG1	10/23/2002	0-0.5	<0.6	83
BG2	10/23/2002	0-0.5	<0.2	49.1
BG3	10/23/2002	0-0.5	0.30	43.3
Soil Cleanup Levels (CULs)[1]				
Unrestricted Land Use Direct Contact			**80**	**24,000**
Ecological Value			**36**	**570**
Unsaturated Soil - Protection of Groundwater[2]			**0.69**	**5,970**
Saturated Soil - Protection of Groundwater[2]			**0.035**	**299**

Notes:
bgs = below ground surface; mg/kg = milligrams per kilogram; -- indicates not analyzed
[1] Refer to the Section 4.1 of the CSM for discussion of soil CULs
[2] Concentrations above protection of groundwater CULs are not identified in table
Bold concentration exceeds WAC 173-340-900 Table 749-2 value (Ecological CUL) for industrial/commercial site (witihin the standard point of compliance of 0-15 ft bgs)
Higlighted Bold concentration exceeds unrestricted land use soil-direct contact CUL (within the standard point of compliance of 0-15 ft bgs)
*Samples OB1 through OB4 were collected from overburden soil removed from the top of former settling basin #2 (FSB2) and used as backfill in the bottom 5 ft of FSB2 during 2003 excavation activities. Approximately 1/2 of the soil was removed during 2010 excavation activities.

Table 4
Summary of Groundwater Zinc and Cadmium Analytical Data
Chemtrade Performance Chemicals US LLC Site
Kalama, WA
H&H Project No. CLR-045

			Zinc		Cadmium	
			Total	Dissolved	Total	Dissolved
Sample ID	Sample Date	Sample Time	µg/L			
PZ1	04/15/03	1255	--	2,100	--	<4.4
PZ1	07/18/03	1430	--	3,500	--	--
PZ1	08/13/03	1035	7,300	--	<4.4	--
PZ1	01/28/04	1530	10,000	--	--	--
PZ1	04/29/04	1214	--	13,000	--	--
PZ1	07/29/04	1532	--	16,000	--	--
PZ1	10/27/04	0915	--	13,000	--	--
PZ1	01/27/05	1015	--	16,100	--	--
PZ1	05/03/05	1532	--	16,800	--	--
PZ1	07/26/05	0900	--	20,500	--	<2.0
PZ1	10/26/05	1535	--	12,600	--	--
PZ1	07/12/06	1836	--	11,500	--	0.7
PZ1	02/04/10	1415	--	8,440	--	0.5
PZ1	09/02/10	1400	5,630	--	<1.0	--
PZ1	11/02/10	1650	--	7,290	--	<1.0
PZ1	12/20/10	1640	--	6,720	--	<1.0
PZ1	03/22/11	1030	--	12,300	--	<10.0
PZ1	06/21/11	1140	--	14,700	--	<10.0
PZ1	09/22/11	1125	--	17,800	--	<1.0
PZ1	01/12/11	1010	--	40,000	--	<10.0
PZ1	03/21/12	1235	--	70,000	--	5.1 J
PZ1	06/26/12	1255	--	84,500	--	<100
PZ1	10/31/12	1340	--	29,900	--	3
PZ1	05/30/13	920	--	85,400	--	2.1
PZ1	08/28/13	855	--	51,000	--	1.5
PZ1	12/20/13	830	--	44,200	--	<10.0
PZ1	01/06/15	1640	76,800	--	1.32	--
PZ1	08/07/17	1015	45,400	--	6.31	--
PZ2	04/15/03	1430	--	<28	--	<4.4
PZ2	08/13/03	1120	<28	--	<4.4	--
PZ2	01/28/04	1450	<28	--	--	--
PZ2	04/28/04	1919	--	<50	--	--
PZ2	07/29/04	1434	--	<50	--	--
PZ2	10/27/04	1030	--	<50	--	--
PZ2	01/27/05	1315	--	27	--	--
PZ2	05/03/05	1450	--	14	--	--
PZ2	07/26/05	1025	--	15	--	<2.0
PZ2	10/26/05	1630	--	15	--	--
PZ2	07/12/06	1634	--	11	11	<0.2
PZ2	02/05/10	0945	--	8	--	<0.2
PZ2	08/07/17	1625	<25.0	--	<1.0	--
PZ3	04/15/03	1645	--	7,200	--	<4.4
PZ3	05/06/03	1550	--	11,000	--	<4.4
PZ3	05/21/03	1215	--	12,000	--	<4.0
PZ3	07/18/03	1615	--	12,000	--	--
PZ3	08/13/03	1202	7,400	--	<4.4	--
PZ3	01/28/04	1330	8,300	--	<4.4	--
PZ3	04/28/04	1747	--	11,000	--	<4.0
PZ3	07/29/04	1239	--	6,600	--	<4.0
PZ3	10/27/04	1100	--	4,300	--	<4.0
PZ3	01/27/05	1440	--	8,920	--	<2
PZ3	05/03/05	1335	--	7,160	--	<2
PZ3	07/25/05	1256	--	6,850	--	<2.0
PZ3	10/27/05	0915	--	4,140	--	<2.0
PZ3	07/13/06	0718	--	7,510	--	1.0
PZ3	07/13/06	1600	--	850	--	0.3
PZ3	02/05/10	1170	--	3,690	--	0.5
PZ3	09/01/10	1436	2,670	--	<1.0	--
PZ3	11/03/10	1310	--	1,940	--	<1.0
PZ3	12/21/10	1445	--	2,280	--	<1.0
PZ3	03/22/11	1620	--	4,370	--	<10.0
PZ3	09/22/11	1625	--	2,930		<10.0
PZ3	06/21/11	0945	--	4,420	--	<1.0
PZ3	01/12/12	1420	--	4,530	--	<10.0
PZ3	03/21/12	1020	--	11,000	--	1.7 J
PZ3	06/27/12	900	--	6,480	--	1.0
PZ3	10/31/12	1030	--	3,530	--	<1.0
PZ3	05/30/13	1505	--	6,240	--	<1.0
PZ3	08/27/13	1140	--	4,480	--	0.7 J
PZ3	12/19/13	1120	--	4,570	--	<1.0
PZ3	01/07/15	1345	--	3,780	--	<1.0
PZ3	08/08/17	845	6,760	--	<1.0	--
PZ4	04/15/03	1845	--	3,300	--	46
PZ4	05/21/03	1246	--	650	--	9.2
PZ4	08/13/03	1346	720	--	9.6	--
PZ4	01/28/04	1110	6,600	--	64	--
PZ4	04/28/04	2122	--	2,300	--	27
PZ4	07/29/04	1825	--	3,500	--	37
PZ4	10/27/04	1335	--	1,700	--	16
PZ4	01/27/05	1645	--	8,060	--	82
PZ4	05/03/05	1152	--	2,090	--	19
PZ4	07/25/05	1530	--	1,190	--	10
PZ4	10/26/05	1310	--	1,450	--	13
PZ4	07/13/06	0746	--	620	--	7.7
PZ4	07/13/06	1640	--	420	--	5.3
PZ4	09/01/10	1244	2,210	--	16.6	--
PZ4	11/03/10	1120	--	1,890	--	15.6
PZ4	12/21/10	1515	--	896	--	6.61

Table 4
Summary of Groundwater Zinc and Cadmium Analytical Data
Chemtrade Performance Chemicals US LLC Site
Kalama, WA
H&H Project No. CLR-045

			Zinc		Cadmium	
			Total	Dissolved	Total	Dissolved
Sample ID	Sample Date	Sample Time	µg/L			
PZ4	03/22/11	1445	--	3,980	--	36.9
PZ4	06/21/11	1515	--	5,310	--	38.3
PZ4	09/22/11	1620	--	2,810	--	26.1
PZ4	01/12/12	1510	--	437	--	<10.0
PZ4	03/21/12	1135	--	1,700	--	10.0
PZ4	06/26/12	1520	--	4,880	--	31.2
PZ4	10/31/12	945	--	2,770	--	21.5
PZ4	05/30/13	1545	--	1,720	--	11.6
PZ4	08/27/13	1340	--	1,710	--	13.4
PZ4	12/19/13	1240	--	1,930	--	12.6
PZ4	01/07/15	1255	--	2,450	--	16.4
PZ4	08/07/17	1715	1,180	--	9.76	--
PZ5	04/16/03	1115	--	3,600	--	180
PZ5	05/21/03	1320	--	3,000	--	120
PZ5	08/13/03	1729	4,300	--	160	--
PZ5	01/28/04	1150	3,700	--	110	--
PZ5	04/28/04	1958	--	6,700	--	200
PZ5	07/29/04	1902	--	8,800	--	320
PZ5	10/27/04	1415	--	34,000	--	1,100
PZ5	01/27/05	1605	--	7,930	--	326
PZ5	05/03/05	1100	--	5,850	--	244
PZ5	07/25/05	1737	--	7,550	--	302
PZ5	10/26/05	1224	--	14,100	--	628
PZ5	07/13/06	0800	--	3,390	--	152
PZ5	07/13/06	1658	--	3,250	--	146
PZ5	02/05/10	1450	--	3,060	--	107
PZ5	09/01/10	1521	4,350	--	118	--
PZ5	11/03/10	1035	--	2,080	--	69.7
PZ5	12/21/10	1545	--	2,880	--	91.8
PZ5	03/22/11	1520	--	2,980	--	84.7
PZ5	06/21/11	1555	--	35,800	--	1,150
PZ5	09/22/11	1650	--	2,390	--	102
PZ5	01/12/12	1550	--	394	--	<10.0
PZ5	03/21/12	1200	--	2,100	--	43
PZ5	06/26/12	1600	--	1,680	--	4.3
PZ5	10/31/12	905	--	141	--	1.8
PZ5	05/30/13	1605	--	2,110	--	47
PZ5	08/27/13	1405	--	2,410	--	94.6
PZ5	12/19/13	1200	--	3,480	--	151
PZ5	01/07/15	1240	--	4,100	--	111
PZ5	08/08/17	935	2,260	--	64.6	--
PZ6	04/16/03	1310	--	1,500	--	<4.4
PZ6	05/21/03	1415	--	1,400	--	<4.0
PZ6	08/13/03	1642	2,100	--	<4.4	--
PZ6	01/28/04	1020	2,600	--	--	--
PZ6	04/28/04	1412	--	1,400	--	--
PZ6	07/29/04	1738	--	4,600	--	--
PZ6	10/27/04	1500	--	2,600	--	--
PZ6	01/27/05	1730	--	5,370	--	--
PZ6	05/03/05	1233	--	12,500	--	--
PZ6	07/25/05	1549	--	26,200	--	6
PZ6	10/27/05	0721	--	16,800	--	6
PZ6	07/13/06	0906	3,800	--	1.7	--
PZ6	09/01/10	1133	1,310	--	<1.0	--
PZ6	11/03/10	1155	--	1,190	--	<1.0
PZ6	12/20/10	1715	--	553	--	<1.0
PZ6	03/22/11	1415	--	740	--	<10.0
PZ6	06/21/11	1550	--	1,660	--	<10.0
PZ6	09/22/11	1555	--	500	--	<1.0
PZ6	01/12/12	1450	--	26.3	--	<10.0
PZ6	03/21/12	1105	--	980	--	<10.0
PZ6	06/26/12	805	--	3,570	--	<1.0
PZ6	11/01/12	920	--	6,360	--	2.2
PZ6	05/30/13	1525	--	1,650	--	<1.0
PZ6	08/27/13	1215	--	565	--	<1.0
PZ6	12/19/13	1325	--	4,080	--	<1.0
PZ6	01/07/15	1045	--	10,700	--	3.60
PZ6	08/07/17	1715	1,150	--	<1.0	--
PZ7	04/16/03	1425	--	570	--	<4.4
PZ7	08/13/03	1603	--	<25	--	<4.0
PZ7	07/26/05	1641	--	22	--	<2
PZ7	08/08/17	1545	250	--	<1.0	--
PZ8	04/16/03	1645	--	390	--	<4.4
PZ8	08/13/03	1435	--	<25	--	<4.0
PZ8	07/25/05	1235	--	15	--	<2.0
PZ8	08/09/17	945	<25.0	--	<1.0	--
PZ9	05/06/03	1210	--	1,300	--	<4.4
PZ9	08/13/03	1313	<28	--	<4.4	--
PZ9	01/28/04	1225	2,900	--	--	--
PZ9	04/28/04	1713	--	4,100	--	--
PZ9	07/29/04	1121	--	3,400	--	--
PZ9	10/27/04	1300	--	2,700	--	--
PZ9	01/27/05	1515	--	2,230	--	--
PZ9	05/03/05	1008	--	2,580	--	--
PZ9	07/25/05	1139	--	4,050	--	<2.0
PZ9	10/26/05	1115	--	4,240	--	--
PZ9	07/13/06	0944	--	5,530	--	0.8
PZ9	02/05/10	1345	--	2,910	--	1.2
PZ9	08/08/17	925	5,940	--	<1.0	--
PZ10	07/26/05	1505	--	46	--	<2.0
PZ10	08/08/17	1010	<25.0	--	<1.0	--

Table 4
Summary of Groundwater Zinc and Cadmium Analytical Data
Chemtrade Performance Chemicals US LLC Site
Kalama, WA
H&H Project No. CLR-045

			Zinc		Cadmium	
			Total	Dissolved	Total	Dissolved
Sample ID	Sample Date	Sample Time	µg/L			
PZ11	07/27/05	1615	--	592	--	<2.0
PZ11	10/26/05	1355	--	900	--	--
PZ11	07/12/06	1721	--	600	--	0.4
PZ11	02/04/10	1430	--	330	--	0.2
PZ11	08/07/17	1630	415	--	<1.0	--
PZ12	07/27/05	1452	--	57,300	--	<2.0
PZ12	10/26/05	1430	--	44,600	--	--
PZ12	07/12/06	1802	--	37,400	--	0.4
PZ12	02/04/10	1230	--	34,200	--	0.6
PZ12	09/02/10	1124	37,800	--	<1.0	--
PZ12	11/03/10	945	--	1,940	--	<1.0
PZ12	12/21/10	1230	--	87,100	--	<1.0
PZ12	03/22/11	945	--	112,000	--	<10.0
PZ12	06/21/11	1405	--	74,100	--	<10.0
PZ12	09/22/11	1520	--	88,100	--	<1.0
PZ12	01/12/12	1255	--	83,600	--	<200
PZ12	03/21/12	1505	--	300,000	--	6.7 J
PZ12	06/27/12	1025	--	352,000	--	<100
PZ12	11/01/12	1015	--	68,500	--	1.0
PZ12	05/30/13	1255	--	118,000	--	2.9
PZ12	08/28/13	1150	--	135,000	--	10.9
PZ12	12/19/13	1415	--	175,000	--	27
PZ12	01/07/15	925	--	90,900	--	2.40
PZ12	08/07/17	1535	6,460	--	<1.0	--
PZ13	07/27/05	1032	--	17,300	--	<2.0
PZ13	09/02/10	1029	18,400	--	<1.0	--
PZ13	11/02/10	1420	--	151	--	<1.0
PZ13	12/21/10	1020	--	79,000	--	<1.0
PZ13	03/22/11	900	--	68,200	--	<10.0
PZ13	06/21/11	1340	--	21,100	--	<10.0
PZ13	09/22/11	1430	--	<10.0	--	<1.0
PZ13	01/12/12	1325	--	2,140	--	<10.0
PZ13	03/21/12	1555	--	89,000	--	2.4 J
PZ13	06/27/12	940	--	210	--	<1.0
PZ13	11/01/12	1145	--	<50	--	<1.0
PZ13	05/30/13	1330	--	749,000	--	<1.0
PZ13	08/28/13	1235	--	70,400	--	<1.0
PZ13	12/19/13	1515	--	208,000	--	<10.0
PZ13	01/07/15	1010	--	65,900	--	<1.0
PZ13	08/07/17	1155	28,200	--	<1.0	--
PZ14	02/07/07	--	--	15	--	<0.2
PZ14	08/07/17	1545	<25.0	--	<1.0	--
PZ15	02/07/07	--	--	19	--	<0.2
PZ15	08/08/17	1635	<25.0	--	<1.0	--
AB1	07/07/03	1531	1,200	1,100	<4.4	<4.0
AB1	07/18/03	1525	--	610	--	--
AB1	08/13/03	1218	--	810	--	<4.0
AB1	01/28/04	1410	680	--	--	--
AB1	04/28/04	1843	--	1,200	--	--
AB1	07/29/04	1356	--	1,100	--	--
AB1	10/27/04	1210	--	660	--	--
AB1	01/27/05	1355	--	1,050	--	--
AB1	05/03/05	1408	--	1,330	--	--
AB1	07/25/05	1425	--	1,280	--	<2.0
AB1	10/27/05	1030	--	697	--	--
AB1	07/13/06	0730	--	630	--	0.3
AB1	07/13/06	1612	--	9,000	--	1.2
AB1	02/05/10	1045	--	980	--	0.3
AB1	09/01/10	1339	996	--	<1.0	--
AB1	11/03/10	1245	--	613	--	<1.0
AB1	12/21/10	1410	--	463	--	<1.0
AB1	03/22/11	1600	--	439	--	<10.0
AB1	06/21/11	1640	--	304	--	<10.0
AB1	09/22/11	1020	--	1090	--	<1.0
AB1	01/12/12	1350	--	923	--	<10.0
AB1	03/21/12	1035	--	950	--	<10.0
AB1	06/27/12	835	--	736	--	<1.0
AB1	10/31/12	1105	--	877	--	<1.0
AB1	05/30/13	1435	--	1,130	--	<1.0
AB1	08/27/13	1100	--	772	--	0.4 J
AB1	12/19/13	1045	--	1,380	--	<1.0
AB1	01/07/15	1410	--	447	--	<1.0
AB1	08/08/17	850	854	--	<1.0	--
AB2	07/07/03	1247	3,700	3,600	<4.0	<4.0
AB2	07/18/03	1325	--	3,200	--	--
AB2	08/12/03	1700	--	2,700	--	<4.0
AB2	01/28/04	1860	3,500	--	--	--
AB2	04/28/04	1030	--	1,200	--	--
AB2	07/29/04	1628	--	6,200	--	--
AB2	10/27/04	0955	--	4,800	--	--
AB2	01/27/05	1135	--	8,490	--	--
AB2	05/03/05	1732	--	10,600	--	--
AB2	07/26/05	0811	--	7,960	--	<2.0
AB2	10/26/05	1510	--	7,540	--	--
AB2	07/13/06	0702 (HT)	--	8,010	--	0.8
AB2	07/13/06	1542 (LT)	--	4,840	--	0.5
AB2	02/04/10	1330	--	5,840	--	0.4
AB2	09/02/10	1319	9,290	--	<1.0	--
AB2	11/02/10	1545	--	7,310	--	<1.0
AB2	12/20/10	1610	--	6,310	--	<1.0
AB2	03/22/11	1125	--	5,630	--	<10.0
AB2	06/21/11	935	--	4,210	--	<10.0
AB2	09/22/11	1155	--	14,300	--	<1.0
AB2	01/12/12	940	--	19,500	--	<10.0

Table 4
Summary of Groundwater Zinc and Cadmium Analytical Data
Chemtrade Performance Chemicals US LLC Site
Kalama, WA
H&H Project No. CLR-045

			Zinc		Cadmium	
			Total	Dissolved	Total	Dissolved
Sample ID	Sample Date	Sample Time	µg/L			
AB2	03/21/12	1255	--	20,000	--	1.5 J
AB2	06/26/12	1230	--	33,300	--	<1.0
AB2	10/31/12	1255	--	9,600	--	<1.0
AB2	05/30/13	1005	--	15,300	--	1.1
AB2	08/28/13	815	--	13,700	--	1.3
AB2	12/20/13	930	--	16,900	--	<10.0
AB2	01/06/15	1545	17,300	--	1.06	--
AB2	08/07/17	1000	59,800	--	4.69	--
OW1	09/23/10	1000	--	15,200	--	<1.0
OW1	11/02/10	1845	--	14,800	--	<1.0
OW1	12/20/10	1545	--	14,600	--	<1.0
OW1	03/22/10	1340	--	12,500	--	<10.0
OW1	06/21/11	1040	--	21,100	--	<10.0
OW1	09/22/11	1305	--	28,600	--	1.18
OW1	01/12/12	1100	--	44,500	--	<100
OW1	03/21/12	1420	--	46,000	--	2.8 J
OW1	06/26/12	1435	--	23,900	--	<100
OW1	10/31/12	1455	--	22,200	--	<1.0
OW1	05/30/13	1040	--	26,300	--	1.4
OW1	08/28/13	1020	--	68,100	--	<1.0
OW1	12/20/13	1130	--	106,000	--	<10.0
OW1	01/06/15	1610	146,000	--	<2.0	--
OW1	08/07/17	1105	41,800	--	<1.0	--
OW2	09/23/10	0920	--	11,700	--	<1.0
OW2	11/02/10	1645	--	9,790	--	<1.0
OW2	12/20/10	1355	--	7,750	--	<1.0
OW2	03/22/11	1055	--	19,900	--	<10.0
OW2	06/21/11	1015	--	28,600	--	<10.0
OW2	09/22/11	1235	--	31,100	--	1.62
OW2	01/12/12	1035	--	52,500	--	<100
OW2	03/21/12	1320	--	91,000	--	8.4 J
OW2	06/26/12	1400	--	91,400	--	<100
OW2	10/31/12	1540	--	71,800	--	<1.0
OW2	05/30/13	1055	--	76,200	--	2.4
OW2	08/28/13	935	--	77,100	--	0.2 J
OW2	12/20/13	1030	--	38,100	--	<10.0
OW2	01/06/15	1500	145,000	--	2.61	--
OW2	08/07/17	1105	141,000	--	8.13	--
OW3	09/23/10	0830	--	13,200	--	<1.0
OW3	11/02/10	1845	--	16,700	--	<1.0
OW3	12/21/10	1110	--	22,400	--	<1.0
OW3	03/22/11	1150	--	35,100	--	<10.0
OW3	06/21/11	1120	--	22,400	--	<10.0
OW3	09/22/11	1330	--	41,600	--	1.72
OW3	01/12/12	1140	--	8,100	--	<10
OW3	03/21/12	1400	--	11,000	--	<10.0
OW3	06/26/12	1335	--	47,700	--	<100
OW3	10/31/12	1415	--	10,800	--	3.5
OW3	05/30/13	1115	--	52,500	--	<1.0
OW3	08/28/13	1105	--	28,800	--	0.6 J
OW3	12/20/13	1230	--	23,600	--	<10.0
OW3	01/07/15	845	--	73,100	--	<1.0
OW3	08/07/17	1140	52,100	--	4.19	--
Groundwater Cleanup Levels (CULs)[1]						
		Human Health Protection	**4,800**		**5**	
		Surface Water Protection	**66**		**0.7**	

Notes:
µg/L = micrograms per liter; -- indicates not analyzed
[1] Refer to the Section 4.2 of the CSM for discussion of groundwater CULs
"J" indicates result is less than laboratory reporting limit, but greater than or equal to the minimum detection limit and the concentration is approximate

Table 5
Summary of PushPoint Groundwater and Surface Water Zinc and Cadmium Analytical Data
Chemtrade Performance Chemicals US LLC Site
Kalama, WA
H&H Project No. CLR-045

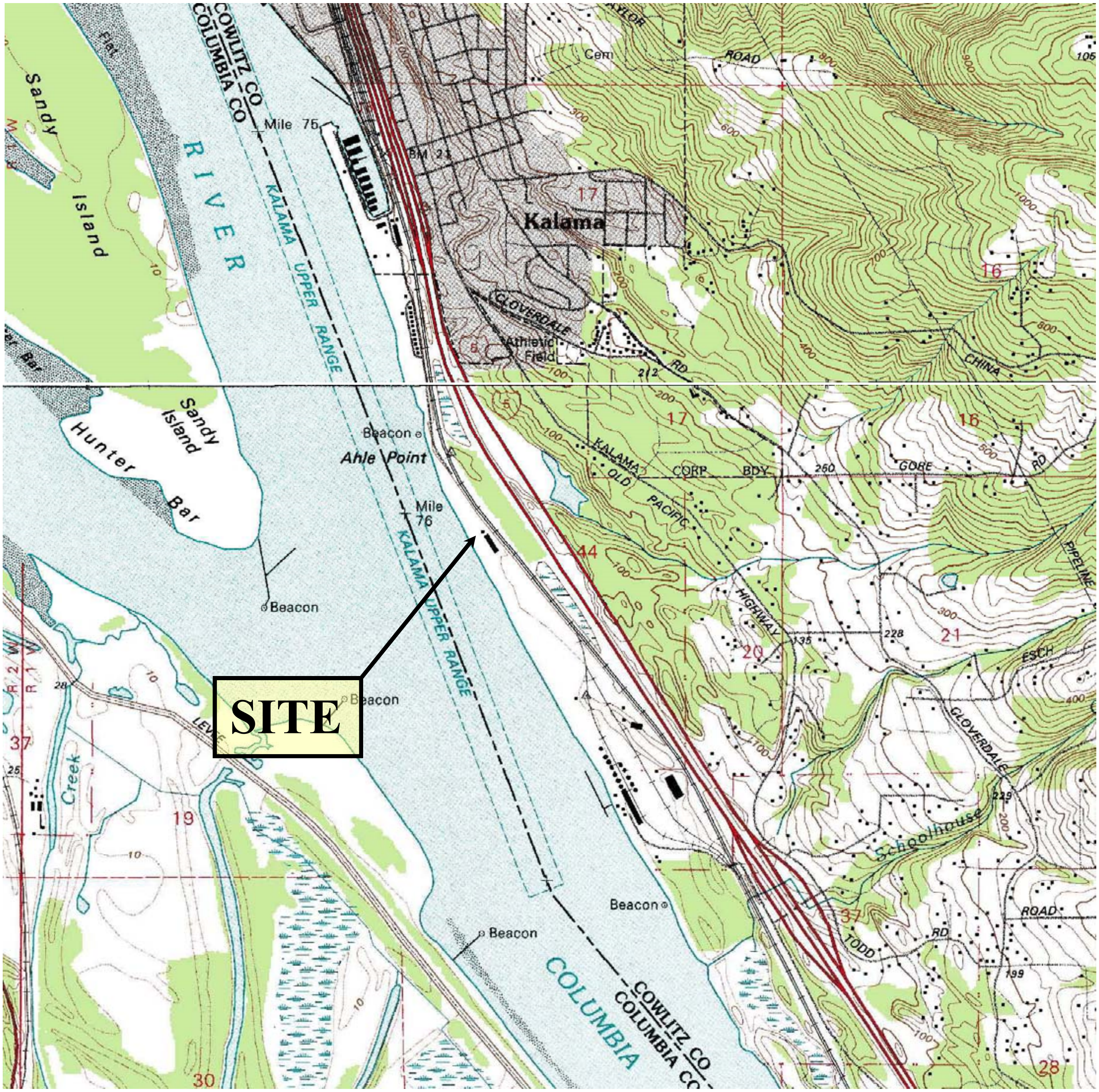
Sample ID	Sample Date	Sample Time (PDT/LST)	Dissolved Zinc (µg/L)	Dissolved Cadmium (µg/L)
PW AB1-A	07/21/15	10:25	<50.0	<1.0
PW AB1-B	07/21/15	11:15	<50.0	<1.0
PW AB1-C	07/21/15	12:00	<50.0	<1.0
PW AB2-A	07/21/15	14:25	<50.0	<1.0
PW AB2-B	07/21/15	15:05	<50.0	<1.0
PW AB2-C	07/21/15	15:35	<50.0	<1.0
PW-US (Background)	07/22/15	10:45	<50.0	<1.0
PW-DS	07/22/15	10:00	<50.0	<1.0
PP-1	08/09/17	13:10	<52.0	<1.0
PP-2	08/09/17	13:15	<52.0	<1.0
PP-3	08/09/17	13:30	<52.0	<1.0
PP-4	08/09/17	13:40	<52.0	<1.0
PP-5	08/09/17	13:55	<52.0	<1.0
PP-6	08/09/17	14:10	<52.0	<1.0
PP-7	08/09/17	14:20	<52.0	<1.0
PP-8	08/09/17	14:40	**362**	<1.0
PP-9	08/09/17	15:00	22.4 J	<0.1
PP-10	08/09/17	15:10	53.4 J	<1.0
PP-11	08/10/17	13:15	<52.0	<1.0
PP-12	08/10/17	13:30	<52.0	<1.0
PP-13	08/10/17	13:45	<52.0	<1.0
PP-14	08/10/17	14:00	<52.0	<1.0
PP-15	08/11/17	13:30	<52.0	<1.0
PP-16	08/10/17	14:20	<52.0	<1.0
PP-17	08/10/17	14:30	<52.0	<1.0
PP-18	08/10/17	14:45	<52.0	<1.0
PP-19	08/10/17	15:15	<52.0	<1.0
PP-20	08/11/17	13:40	58.8 J	<1.0
PP-21	08/11/17	13:50	<52.0	<1.0
PP-22	08/11/17	14:00	<52.0	<1.0
PP-US (Background)	08/10/17	16:00	<52.0	<1.0
PP-DS	08/11/17	14:45	<52.0	<1.0
SW-1	08/11/17	14:35	<52.0	<1.0
SW-2	08/11/17	14:40	<52.0	<1.0
SW-3	08/11/17	14:45	<52.0	<1.0
Groundwater CUL - Surface Water Protection[1]			**66**	**0.7**

Notes:
µg/L = micrograms per liter
PDT = Pacific Daylight Time; LST = local standard time
Samples were field-filtered and analyzed by EPA Method 6010/6020 for dissolved cadmium and zinc only
[1]Potable groundwater cleanup level (CUL) established for protection of surface water beneficial uses (Chronic freshwater aquatic life protection value established in accordance with WAC 173-201A-240)
Bold concentration exceeds the groundwater cleanup level
"J" indicates result is less than laboratory reporting limit, but greater than or equal to the minimum detection limit and the concentration is approximate

Table 6
Summary of Sediment Analytical Data
Chemtrade Performance Chemicals US LLC Site
Kalama, WA
H&H Project No. CLR-045

Sample ID	Sample Date	Cadmium (mg/kg)	Zinc (mg/kg)
SED AB1-A	07/21/15	<1.24	47.9
SED AB1-B	07/21/15	<1.29	44.5
SED AB1-C	07/21/15	<1.25	61.9
SED AB2-A	07/21/15	<1.27	55.1
SED AB2-B	07/21/15	<1.22	35.1
SED AB2-C	07/21/15	<1.08	51.7
SED-US (Background)	07/22/15	<1.20	31.1
SED-DS	07/22/15	<1.28	27.4
SD-1	08/11/17	<0.545	16.9
SD-2	08/11/17	<0.773	34.1
SD-3	08/11/17	<0.766	32.8
SD-4	08/11/17	<0.745	26.8
SD-5	08/11/17	<0.669	26.8
SD-6	08/11/17	<0.759	42.4
SD-7	08/11/17	<0.651	17.6
SD-8	08/11/17	<0.624	18.0
SD-9	08/11/17	<0.608	16.2
SD-10	08/11/17	<0.751	26.9
SD-US (Background)	08/11/17	<1.26	250
SD-DS	08/11/17	<0.529	17.8
	Sediment CUL[1]	**2.1**	**3,200**

Notes:
mg/kg = milligrams per kilogram
Samples were analyzed by EPA Method 6010/6020 for cadmium and zinc only
[1]Sediment cleanup levels (CULs) are the Freshwater Sediment Cleanup Objectives from Table VI of Washington Administrative Code (WAC) 173-204-563 Sediment Management Standards.



N

APPROXIMATE

0 2,000 4,000

SCALE IN FEET

U.S.G.S. QUADRANGLE MAP

DEER ISLAND & KALAMA, WA 7.5 MIN. TOPOGRAPHIC QUADRANGLES

QUADRANGLE
7.5 MINUTE SERIES (TOPOGRAPHIC)

TITLE
SITE LOCATION MAP

PROJECT
CHEMTRADE PERFORMANCE CHEMICALS SITE
FACILITY/SITE ID No. 24634187
KALAMA, WASHINGTON

hart hickman
SMARTER ENVIRONMENTAL SOLUTIONS

2923 South Tryon Street – Suite 100
Charlotte, North Carolina 28203
704-586-0007 (p) 704-586-0373 (f)

DATE: 12/19/17	REVISION NO. 0
JOB NO: CLR-045	FIGURE NO. 1

N

APPROXIMATE

0 400 800

SCALE IN FEET

LEGEND

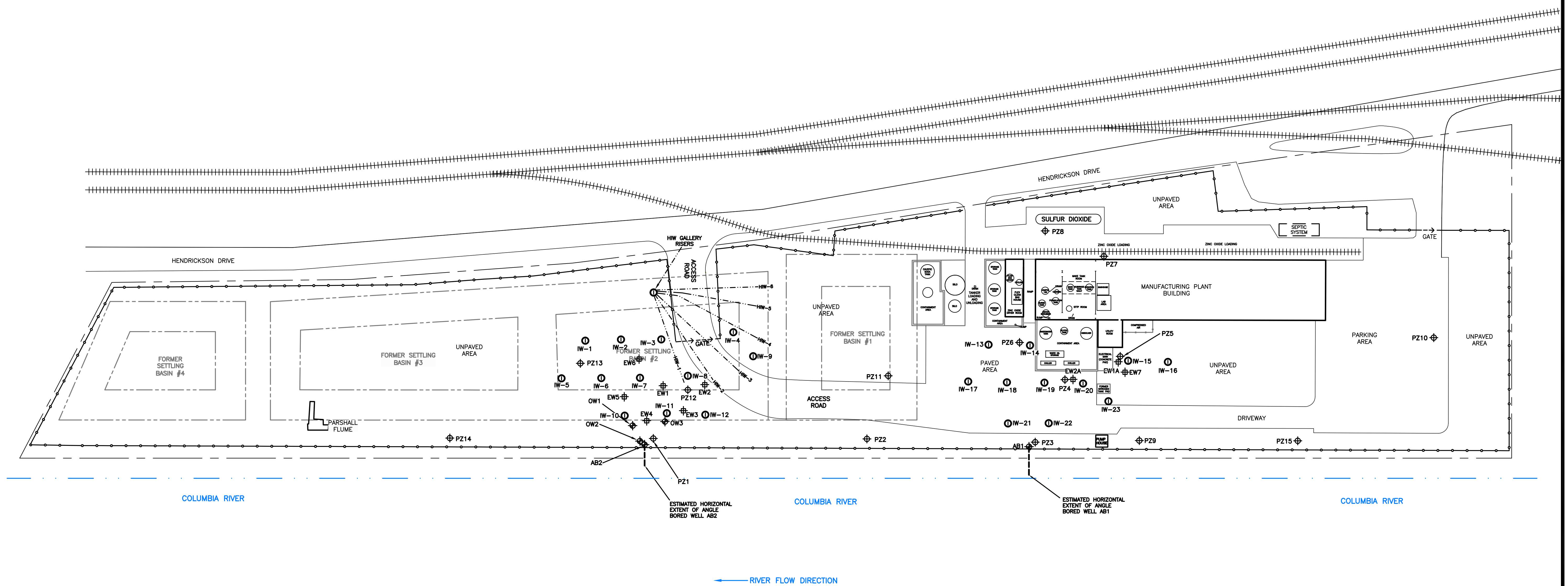
Site Property Boundary

Off-Site Property Boundary

600540200 Property Identification Number

Map Source: Cowlitz County NetMaps

TITLE SITE VICINITY MAP	
PROJECT CHEMTRADE PERFORMANCE CHEMICALS SITE FACILITY/SITE ID No. 24634187 KALAMA, WASHINGTON	
hart hickman SMARTER ENVIRONMENTAL SOLUTIONS	2923 South Tryon Street – Suite 100 Charlotte, North Carolina 28203 704-586-0007 (p) 704-586-0373 (f)
DATE: 12/19/17	REVISION NO. 0
JOB NO: CLR-045	FIGURE NO. 2



LEGEND:

- PROPERTY LINE
- FENCE LINE
- RAILROAD TRACK
- APPROXIMATE EAST EDGE OF COLUMBIA RIVER
- EXTENT OF FORMER SETTLING BASIN
- MONITORING/OBSERVATION WELL
- PIEZOMETER
- INJECTION WELL
- RECOVERY WELL
- EXTENT OF HORIZONTAL INJECTION WELL

APPROXIMATE

0 100 200

SCALE IN FEET

TITLE

SITE MAP

PROJECT

CHEMTRADE PERFORMANCE CHEMICALS SITE
FACILITY/SITE No. 24634187
KALAMA, WA

hart hickman
SMARTER ENVIRONMENTAL SOLUTIONS
2923 South Tryon Street-Suite 100
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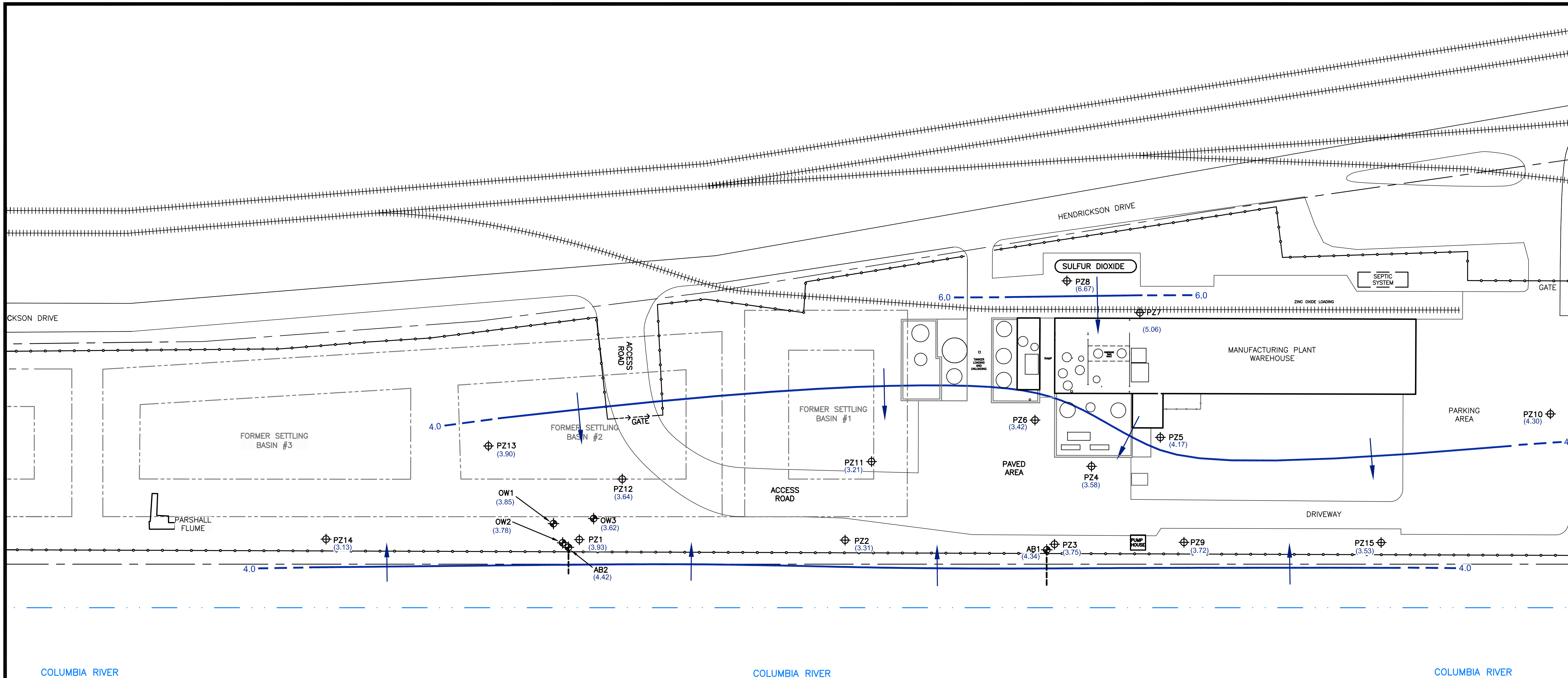
704-586-0007(p) 704-586-0373(f)
License # C-1269 / #C-245 Geology

DATE: 12-19-17	REVISION NO. 0
JOB NO. CLR-045	FIGURE NO. 3



LEGEND:

PROPERTY LINE
FENCE LINE
RAILROAD TRACK
EAST EDGE OF COLUMBIA RIVER
EXTENT OF FORMER SETTLING BASIN
MONITORING/OBSERVATION WELL
PIEZOMETER
(3.93) GROUNDWATER ELEVATION (FT CRD)
4.0 GROUNDWATER ELEVATION CONTOUR IN FT CRD (DASHING INDICATES EXTRAPOLATED CONTOUR)
INFERRED GROUNDWATER FLOW DIRECTION

RIVER FLOW DIRECTION

APPROXIMATE
0 80 160
SCALE IN FEET

NOTES
THE BOTTOM OF ANGLE WELLS AB1 AND AB2 ARE LOCATED APPROXIMATELY 30 AND 20 FEET (RESPECTIVELY) SOUTHWEST OF THE WELL LOCATION DEPICTED ON THE MAP. THE DASHED LINES EXTENDING TOWARD THE COLUMBIA RIVER FROM THOSE WELLS INDICATES THE ESTIMATED LATERAL EXTENT OF EACH WELL IN THAT DIRECTION.

TITLE
GROUNDWATER ELEVATION CONTOUR MAP (AUGUST 2017)

PROJECT
CHEMTRADE PERFORMANCE CHEMICALS SITE
FACILITY/SITE No. 24634187
KALAMA, WA

hart hickman
SMARTER ENVIRONMENTAL SOLUTIONS
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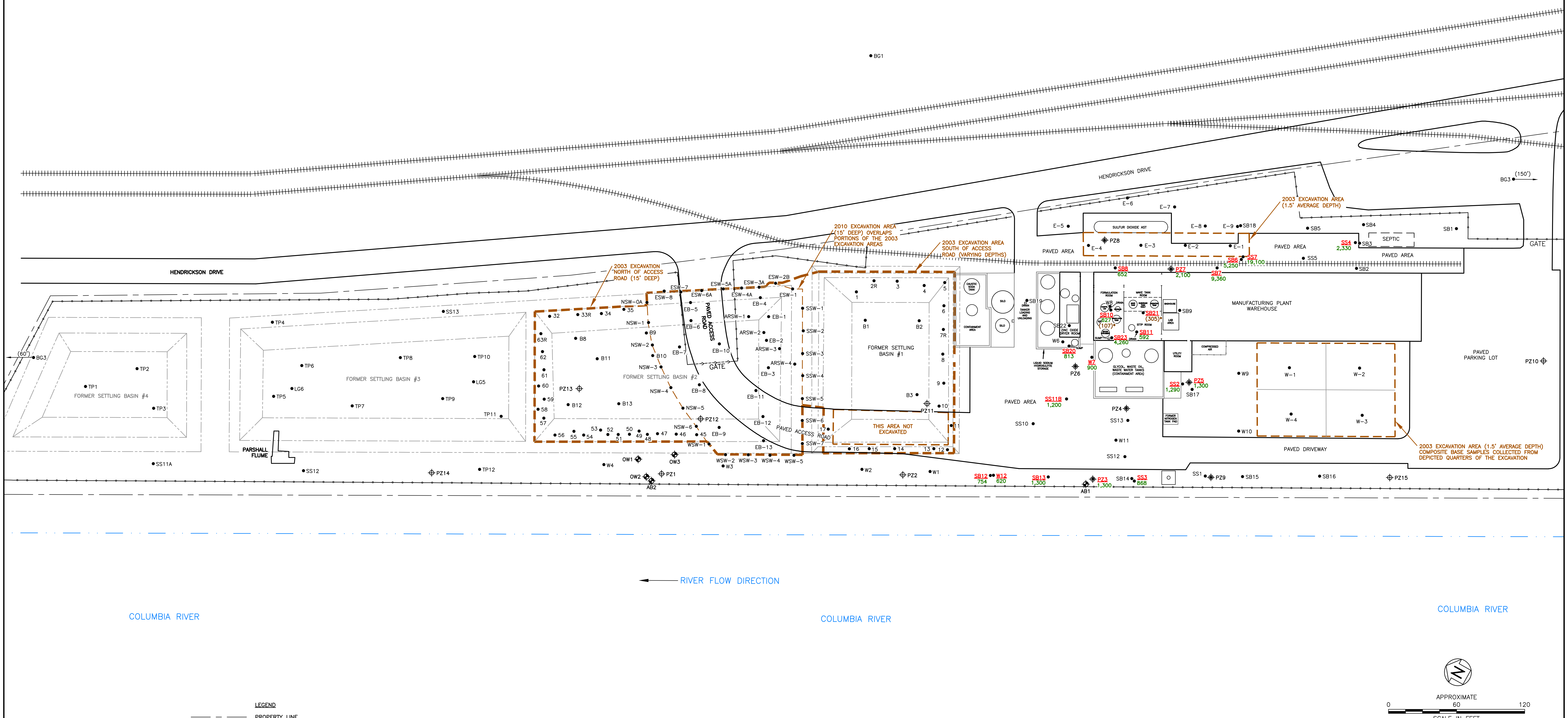
DATE: 12-20-17	REVISION NO. 0
JOB NO. CLR-045	FIGURE NO. 4



LEGEND

- PROPERTY LINE
- FENCE LINE
- APPROXIMATE EAST EDGE OF COLUMBIA RIVER
- RAILROAD TRACK
- EXTENT OF FORMER SETTLING BASIN (FSB)
- PERIMETER OF FORMER SOIL EXCAVATION
- MONITORING/OBSERVATION WELL
- PIEZOMETER
- SOIL SAMPLE LOCATION
- PZ5 SAMPLE LOCATION WITH ZINC/CADMIUM ABOVE ECOLOGICAL CUL (SEE NOTE 4)
- 627 ZINC CONCENTRATION (mg/kg)
- (107) CADMIUM CONCENTRATION (mg/kg)

NOTES

1. SOIL SAMPLE LOCATIONS ARE FROM SOIL WHICH REMAINS IN PLACE AT THE SITE AFTER COMPLETION OF EXCAVATION ACTIVITIES. SOIL SAMPLE LOCATIONS WHICH WERE REMOVED BY EXCAVATION ACTIVITIES ARE NOT DEPICTED.
2. IMPORTED COLUMBIA RIVER DREDGE SPOILS OBTAINED FROM ADJACENT PROPERTY SOUTH OF THE SITE WERE USED TO BACKFILL EXCAVATIONS.
3. SAMPLES OB1 THROUGH OB4, SB1–SURF–1/2/3/4, AND SB2–SURF–1/2/3/4 REPRESENT SOIL WITHIN THE EXTENTS OF FSB1 AND FSB2, BUT EXACT LOCATIONS ARE NOT KNOWN AND THE SAMPLES ARE NOT DEPICTED.
4. ONLY ZINC AND CADMIUM CONCENTRATIONS ABOVE ECOLOGICAL CLEANUP LEVELS (CULs) OF 36 AND 570 mg/kg, RESPECTIVELY (WAC 173–340–900 TABLE 749–2 VALUES FOR INDUSTRIAL/COMMERCIAL SITES) ARE DEPICTED, AND ONLY THE MAXIMUM CONCENTRATION DETECTED WITHIN THE STANDARD POINT OF COMPLIANCE IN A BORING (0–15 FT) IS DEPICTED.
5. *CADMIUM WAS DETECTED ABOVE THE UNRESTRICTED LAND USE SOIL–DIRECT CONTACT CLEANUP LEVEL (80 mg/kg) CURRENTLY APPLICABLE TO THE SITE IN SB10 AND SB21 ONLY. ZINC WAS NOT DETECTED IN ANY REMAINING SOIL SAMPLES ABOVE THE UNRESTRICTED LAND USE SOIL–DIRECT CONTACT CLEANUP LEVEL (24,000 mg/kg) CURRENTLY APPLICABLE TO THE SITE.

TITLE

REMAINING SOIL SAMPLE LOCATIONS

PROJECT

CHEMTRADE PERFORMANCE CHEMICALS SITE
FACILITY/SITE No. 24634187
KALAMA, WA

hart hickman
SMARTER ENVIRONMENTAL SOLUTIONS

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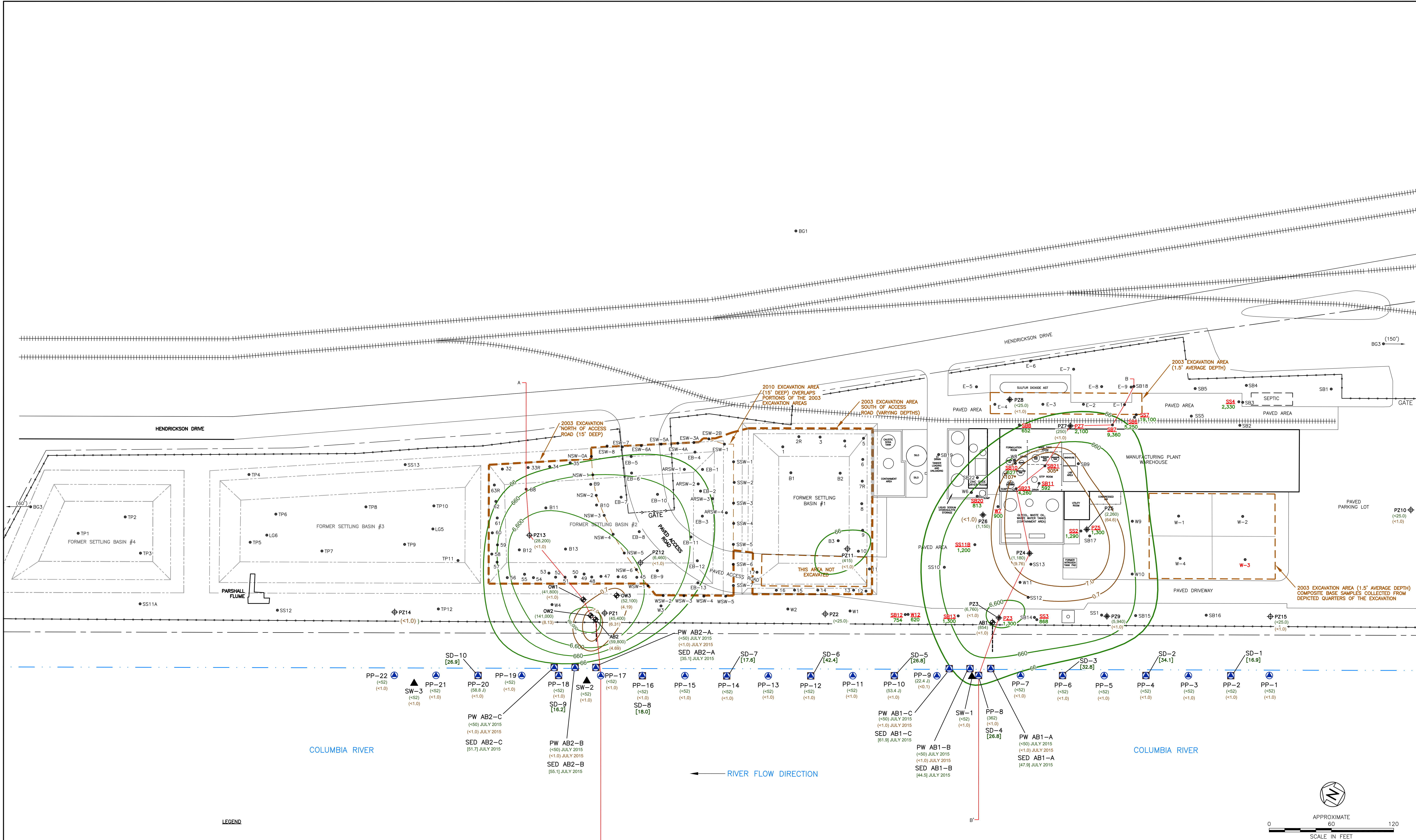
DATE: 01-16-18	REVISION NO. 0
JOB NO. CLR-045	FIGURE NO. 5



LEGEND

	PROPERTY LINE
	FENCE LINE
	APPROXIMATE EAST EDGE OF COLUMBIA RIVER
	RAILROAD TRACK
	EXTENT OF FORMER SETTLING BASIN (FSB)
	PERIMETER OF FORMER SOIL EXCAVATION
	MONITORING/OBSERVATION WELL
	PIEZOMETER
	PUSHPOINT GROUNDWATER SAMPLE LOCATION
	SURFACE WATER SAMPLE LOCATION
	SOIL SAMPLE LOCATION
PZ5	SOIL SAMPLE LOCATION WITH ZINC/CADMIUM ABOVE ECOLOGICAL CUL (SEE NOTE 4)
	SEDIMENT SAMPLE LOCATION (AT PUSHPOINT SAMPLE LOCATION)
627	ZINC CONCENTRATION IN SOIL (mg/kg)
107*	CADMIUM CONCENTRATION IN SOIL (mg/kg)
(6,460)	ZINC CONCENTRATION IN GROUNDWATER μg/L
660	INFERRED ZINC ISOCONCENTRATION CONTOUR IN μg/L
(4.19)	CADMIUM CONCENTRATION IN GROUNDWATER IN μg/L
0.7	INFERRED CADMIUM ISOCONCENTRATION CONTOUR IN μg/L
[26.9]	ZINC CONCENTRATION IN SEDIMENT (mg/kg)
A	CROSS-SECTION TRANSECT LINE (GEOLOGIC CROSS-SECTIONS PRESENTED IN FIGURES 8A AND 8B)

NOTES

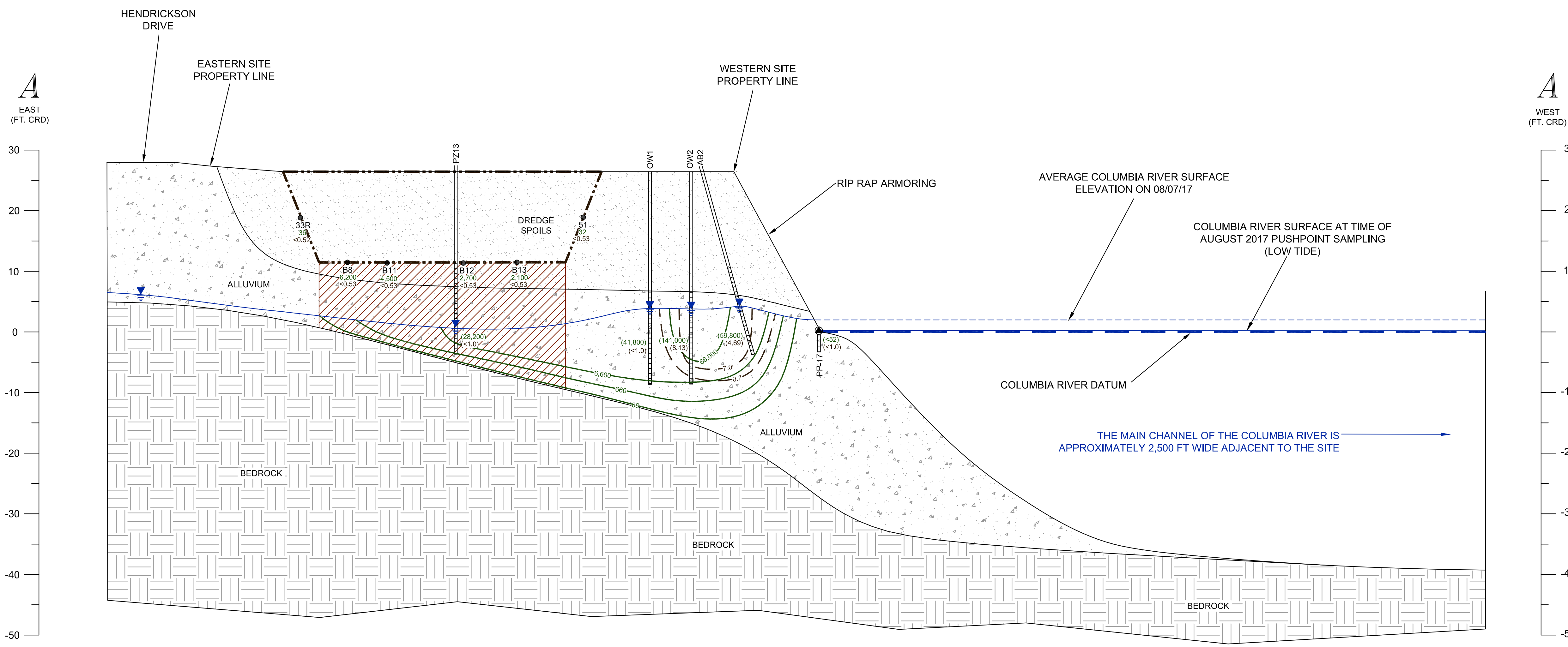
1. SOIL SAMPLE LOCATIONS ARE FROM SOIL WHICH REMAINS IN PLACE AT THE SITE AFTER COMPLETION OF EXCAVATION ACTIVITIES. SOIL SAMPLE LOCATIONS WHICH WERE REMOVED BY EXCAVATION ACTIVITIES ARE NOT DEPICTED.
2. IMPORTED COLUMBIA RIVER DREDGE SPOILS OBTAINED FROM ADJACENT PROPERTY SOUTH OF THE SITE WERE USED TO BACKFILL EXCAVATIONS.
3. SAMPLES OB1 THROUGH OB4, SB1-SURF-1/2/3/4, AND SB2-SURF-1/2/3/4 REPRESENT SOIL WITHIN THE EXTENTS OF FSB1 AND FSB2, BUT EXACT LOCATIONS ARE NOT KNOWN AND THE SAMPLES ARE NOT DEPICTED.
4. ONLY ZINC AND CADMIUM CONCENTRATIONS DETECTED IN SOIL SAMPLES ABOVE ECOLOGICAL CLEANUP LEVELS (CULs) OF 36 AND 570 MILLIGRAMS PER KILOGRAM (mg/kg), RESPECTIVELY (WAC 173-340-900 TABLE 749-2 VALUES FOR INDUSTRIAL/COMMERCIAL SITES) ARE DEPICTED, AND ONLY THE MAXIMUM CONCENTRATION DETECTED WITHIN THE STANDARD POINT OF COMPLIANCE IN A BORING (0-15 FT) IS DEPICTED.
5. *CADMIUM WAS DETECTED ABOVE THE UNRESTRICTED LAND USE SOIL-DIRECT CONTACT CLEANUP LEVEL (80 mg/kg) CURRENTLY APPLICABLE TO THE SITE IN SB10 AND SB21 ONLY. ZINC WAS NOT DETECTED IN ANY REMAINING SOIL SAMPLES ABOVE THE UNRESTRICTED LAND USE SOIL-DIRECT CONTACT CLEANUP LEVEL (24,000 mg/kg) CURRENTLY APPLICABLE TO THE SITE.
6. ALL SAMPLE DATA ARE FROM AUGUST 2017 UNLESS INDICATED OTHERWISE.
7. μg/L = MICROGRAMS PER LITER
8. THE BOTTOM OF ANGLE WELLS AB1 AND AB2 ARE LOCATED APPROXIMATELY 30 AND 20 FEET (RESPECTIVELY) SOUTHWEST OF THE WELL LOCATION DEPICTED ON THE MAP. THE DASHED LINES EXTENDING TOWARD THE COLUMBIA RIVER FROM THOSE WELLS INDICATES THE ESTIMATED LATERAL EXTENT OF EACH WELL IN THAT DIRECTION.
9. CADMIUM WAS NOT DETECTED IN ANY SEDIMENT SAMPLES.

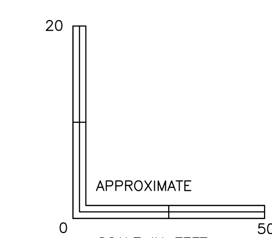
TITLE
COMBINED MEDIA SAMPLE LOCATIONS AND IMPACTS OVERLAY MAP

PROJECT
CHEMTRADE PERFORMANCE CHEMICALS SITE
FACILITY/SITE No. 24634187
KALAMA, WA

hart hickman
SMARTER ENVIRONMENTAL SOLUTIONS
2923 South Tryon Street-Suite 100
Charlotte, North Carolina 28203
704-586-0007(p) 704-586-0373(f)
License # C-1269 / #C-245 Geology

DATE: 01-16-18	REVISION NO. 0
JOB NO. CLR-045	FIGURE NO. 6





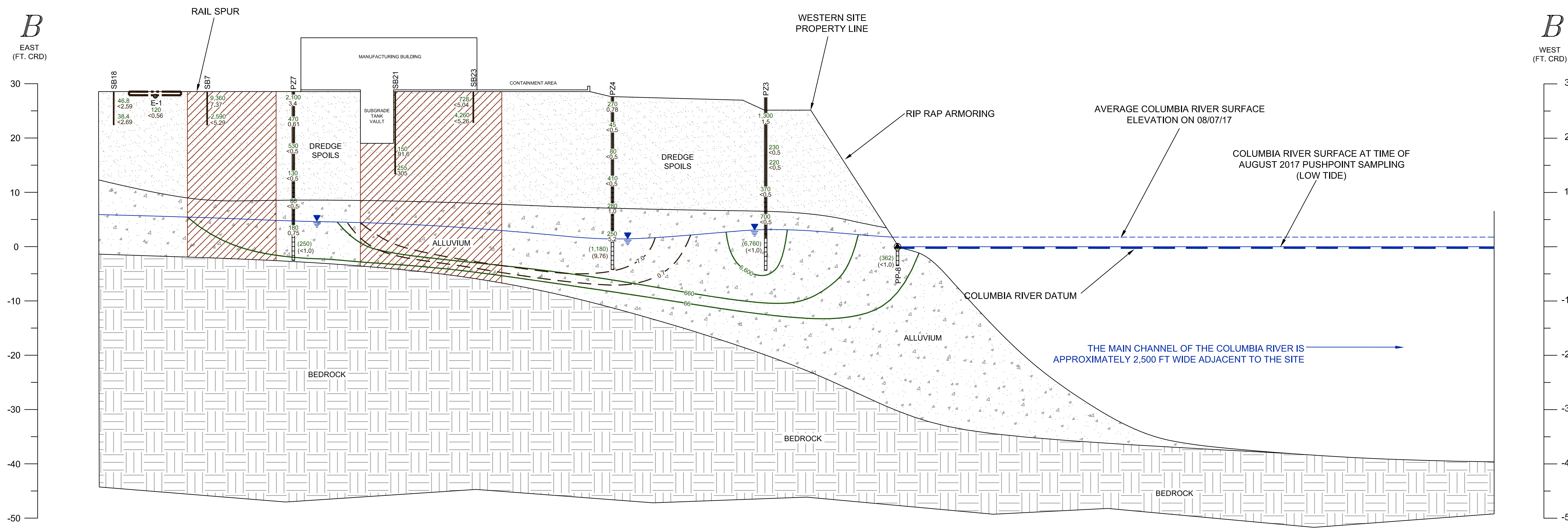
LEGEND

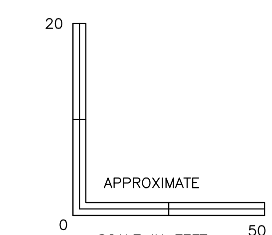
- AUGUST 2017 GROUNDWATER TABLE
- APPROXIMATE EXTENT OF SOIL EXCAVATION
- SOIL SAMPLE LOCATION (B11, B12, AND B13 OFF-SET FROM CROSS-SECTION TRANSECT LINE)
- PUSHPOINT GROUNDWATER SAMPLE LOCATION
- 6,200 — ZINC CONCENTRATION IN SOIL (mg/kg)
- <0.53 — CADMIUM CONCENTRATION IN SOIL (mg/kg)
- (41,800) — AUGUST 2017 ZINC CONCENTRATION IN GROUNDWATER (µg/L)
- (8.13) — AUGUST 2017 CADMIUM CONCENTRATION IN GROUNDWATER (µg/L)
- 6,600 — ZINC ISOCONCENTRATION CONTOUR IN µg/L
- 7.0 — CADMIUM ISOCONCENTRATION CONTOUR IN µg/L
- AREA OF SATURATED AND UNSATURATED ZONE SOIL POTENTIALLY IMPACTED WITH ZINC CONCENTRATIONS WHICH MAY BE A SOURCE OF GROUNDWATER IMPACTS
- RIVER DREDGE SPOILS (FINE TO COARSE-GRAIN SANDS)
- ALLUVIUM (FINE TO COARSE-GRAIN SANDS WITH SILTS AND GRAVELS)
- BEDROCK (BASALT/SANDSTONE)
- OW-1 — MONITOR WELL
- SCREENED INTERVAL

NOTES

1. COLUMBIA RIVER IS TIDAL AT SITE LOCATION.
2. GROUND WATER ELEVATIONS ARE FROM AUGUST 7, 2017.
3. EASTERN LIMIT OF 43 FT FEDERALLY MAINTAINED DEEP DRAFT NAVIGATION CHANNEL IS LOCATED APPROXIMATELY 900 FT FROM WESTERN SITE PROPERTY BOUNDARY.
4. µg/L = MICROGRAMS PER LITER; mg/kg = MILLIGRAMS PER KILOGRAM; CRD = COLUMBIA RIVER DATUM
5. CROSS-SECTION TRANSECT LINE SHOWN IN FIGURE 7.

TITLE: CROSS-SECTION A-A'	
PROJECT: CHEMTRADE PERFORMANCE CHEMICALS SITE FACILITY/SITE No. 24634187 KALAMA, WA	
hart hickman SMARTER ENVIRONMENTAL SOLUTIONS	2923 South Tryon Street-Suite 100 Charlotte, North Carolina 28203 704-586-0007(p) 704-586-0373(f) License # C-1269 / #C-245 Geology
DATE: 01/25/18	REVISION NO. 0
JOB NO. CLR-045	FIGURE NO. 7A



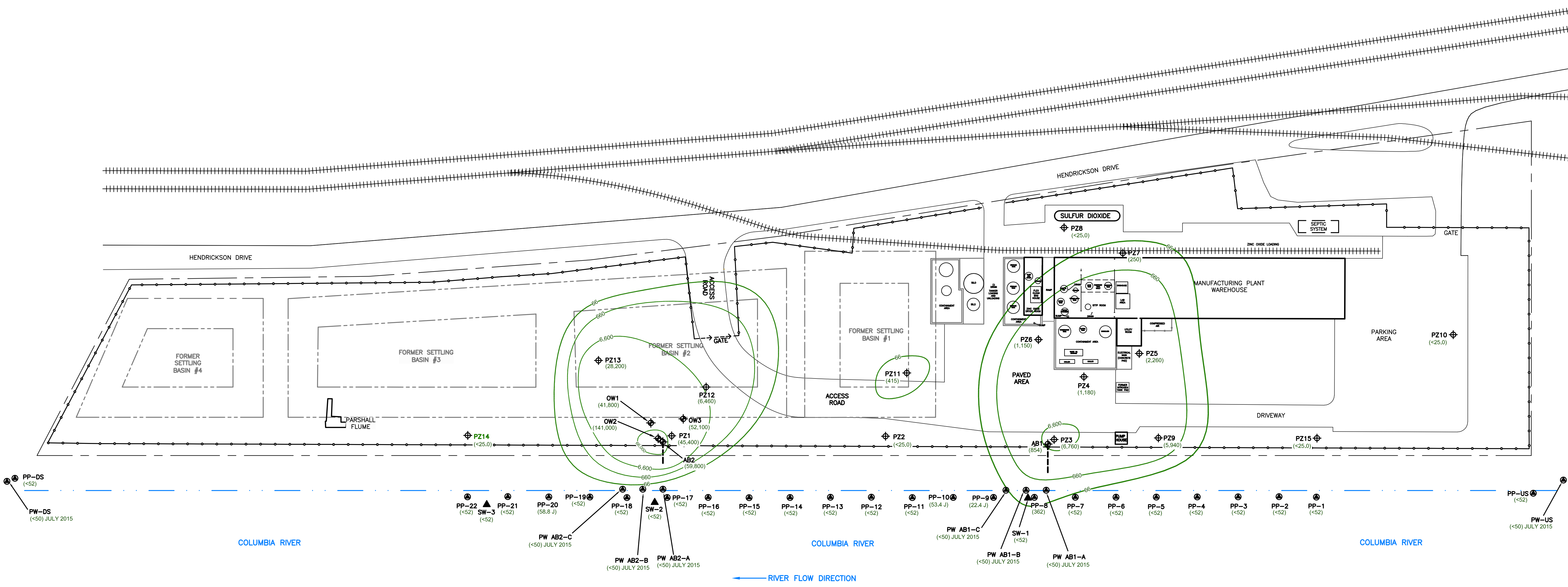


LEGEND

- AUGUST 2017 GROUNDWATER TABLE
- APPROXIMATE EXTENT OF SOIL EXCAVATION
- SOIL SAMPLE LOCATION (B11, B12, AND B13 OFF-SET FROM CROSS-SECTION TRANSECT LINE)
- PUSHPOINT GROUNDWATER SAMPLE LOCATION
- 255 ZINC CONCENTRATION IN SOIL (mg/kg)
- 305 CADMIUM CONCENTRATION IN SOIL (mg/kg)
- (1,180) AUGUST 2017 ZINC CONCENTRATION IN GROUNDWATER (µg/L)
- (9.76) AUGUST 2017 CADMIUM CONCENTRATION IN GROUNDWATER (µg/L)
- 6,600 ZINC ISOCONCENTRATION CONTOUR IN µg/L
- 7.0 CADMIUM ISOCONCENTRATION CONTOUR IN µg/L
- AREA OF SATURATED AND UNSATURATED ZONE SOIL POTENTIALLY IMPACTED WITH ZINC AND/OR CADMIUM CONCENTRATIONS WHICH MAY BE A SOURCE OF GROUNDWATER IMPACTS
- RIVER DREDGE SPOILS (FINE TO COARSE-GRAIN SANDS)
- ALLUVIUM (FINE TO COARSE-GRAIN SANDS WITH SILTS AND GRAVELS)
- BEDROCK (BASALT/SANDSTONE)
- OW-1 MONITOR WELL; SCREENED INTERVAL
- SB21 SOIL BORING

NOTES
1. COLUMBIA RIVER IS TIDAL AT SITE LOCATION.
2. GROUND WATER ELEVATIONS ARE FROM AUGUST 7, 2017.
3. EASTERN LIMIT OF 43 FT IS FEDERALLY MAINTAINED DEEP DRAFT NAVIGATION CHANNEL LOCATED APPROXIMATELY 900 FT FROM WESTERN SITE PROPERTY BOUNDARY.
4. µg/L = MICROGRAMS PER LITER; mg/kg = MILLIGRAMS PER KILOGRAM; CRD = COLUMBIA RIVER DATUM
5. CROSS-SECTION TRANSECT LINE SHOWN IN FIGURE 7.

TITLE	CROSS-SECTION B-B'
PROJECT	CHEMTRADE PERFORMANCE CHEMICALS SITE FACILITY/SITE No. 24634187 KALAMA, WA
hart hickman SMARTER ENVIRONMENTAL SOLUTIONS	2923 South Tryon Street-Suite 100 Charlotte, North Carolina 28203 704-586-0007(p) 704-586-0373(f) License # C-1269 / #C-245 Geology
DATE: 01/25/18	REVISION NO. 0
JOB NO. CLR-045	FIGURE NO. 7B



LEGEND:

PROPERTY LINE

FENCE LINE

RAILROAD TRACK

APPROXIMATE EAST EDGE OF COLUMBIA RIVER

EXTENT OF FORMER SETTLING BASIN

MONITORING/OBSERVATION WELL

PIEZOMETER

PUSHPOINT SAMPLE LOCATION

SURFACE WATER SAMPLE LOCATION

(6,460) ZINC CONCENTRATION IN µg/L

660 INFERRED ZINC ISOCONCENTRATION CONTOUR IN µg/L

NOTES

1. µg/L = MICROGRAMS PER LITER
2. THE BOTTOM OF ANGLE WELLS AB1 AND AB2 ARE LOCATED APPROXIMATELY 30 AND 20 FEET (RESPECTIVELY) SOUTHWEST OF THE WELL LOCATION DEPICTED ON THE MAP. THE DASHED LINES EXTENDING TOWARD THE COLUMBIA RIVER FROM THOSE WELLS INDICATES THE ESTIMATED LATERAL EXTENT OF EACH WELL IN THAT DIRECTION.
3. DATA IS FROM AUGUST 2017 UNLESS INDICATED OTHERWISE.

APPROXIMATE

0 100 200

SCALE IN FEET

TITLE

ZINC ISOCONCENTRATION MAP
(AUGUST 2017)

PROJECT

CHEMTRADE PERFORMANCE CHEMICALS SITE
FACILITY/SITE No. 24634187
KALAMA, WA

hart hickman
SMARTER ENVIRONMENTAL SOLUTIONS

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Charlotte, North Carolina 28203
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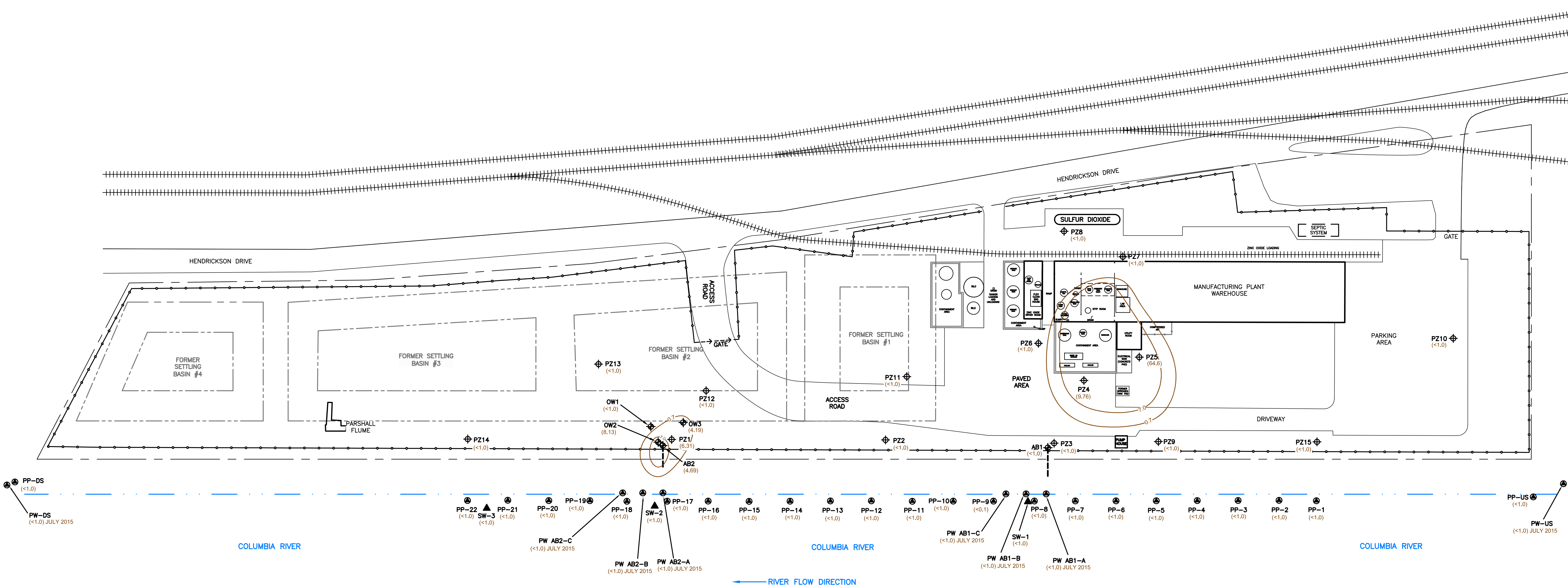
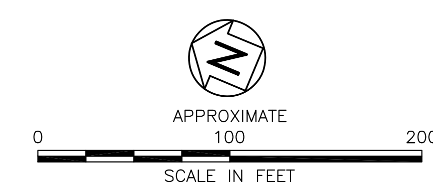
DATE: 01-17-18	REVISION NO. 0
JOB NO. CLR-045	FIGURE NO. 8A





LEGEND:

PROPERTY LINE

FENCE LINE

RAILROAD TRACK

APPROXIMATE EAST EDGE OF COLUMBIA RIVER

EXTENT OF FORMER SETTLING BASIN

MONITORING/OBSERVATION WELL

PIEZOMETER

PUSHPOINT SAMPLE LOCATION

SURFACE WATER SAMPLE LOCATION

(4.19) CADMIUM CONCENTRATION IN µg/L

0.7 INFERRED CADMIUM ISOCONCENTRATION CONTOUR IN µg/L

NOTES

1. µg/L = MICROGRAMS PER LITER
2. THE BOTTOM OF ANGLE WELLS AB1 AND AB2 ARE LOCATED APPROXIMATELY 30 AND 20 FEET (RESPECTIVELY) SOUTHWEST OF THE WELL LOCATION DEPICTED ON THE MAP. THE DASHED LINES EXTENDING TOWARD THE COLUMBIA RIVER FROM THOSE WELLS INDICATES THE ESTIMATED LATERAL EXTENT OF EACH WELL IN THAT DIRECTION.
3. DATA IS FROM AUGUST 2017 UNLESS INDICATED OTHERWISE.

TITLE

CADMIUM ISOCONCENTRATION MAP (AUGUST 2017)

PROJECT

CHEMTRADE PERFORMANCE CHEMICALS SITE
FACILITY/SITE No. 24634187
KALAMA, WA

hart hickman
SMARTER ENVIRONMENTAL SOLUTIONS

2923 South Tryon Street-Suite 100
Charlotte, North Carolina 28203
704-586-0007(p) 704-586-0373(f)
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DATE: 01-17-18	REVISION NO. 0
JOB NO. CLR-045	FIGURE NO. 8B