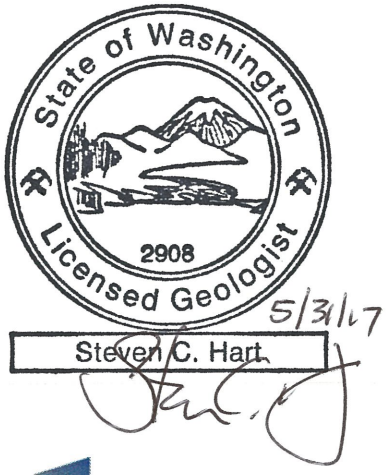
Seep Study Work Plan
Chemtrade Performance Chemicals US LLC Site
(aka Former Clariant Corporation Facility)

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

H&H Job No. CLR-045
May 31, 2017



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Seep Study Work Plan
Chemtrade Performance Chemicals US LLC Site
404 N Hendrickson Drive
Kalama, Washington
H&H Job No. CLR-045

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1.0 Introduction and Background

On behalf of Clariant Corporation (Clariant), Hart & Hickman, PC (H&H) is submitting this seep study work plan 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. Note that we have previously referred to the site as the former Clariant Corporation facility site. The site is currently enrolled in the Washington State Department of Ecology (Ecology) Voluntary Cleanup Program (VCP Project No. SW0492). A site location map is included as Figure 1.

Previous investigations indicate that there are soil and groundwater impacts at the site, and that the primary compounds of concern 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). A site plan is provided as Figure 2.

In an opinion letter dated February 9, 2017, Ecology recommended preparation and submittal of a work plan for Ecology review and approval for a seep study at the site. The purpose of the recommended seep study is to evaluate the potential presence and location of preferential pathways for contaminants associated with the site to enter sediments and surface water, and to evaluate compliance with surface water and sediment standards at locations of preferential pathways. The results of the seep study will be used to update the conceptual site model (CSM).

Site background information is presented in Section 2.0. A brief description of site hydrogeology and groundwater impacts, and a discussion of groundwater cleanup levels (CULs)

and points of compliance (POCs) which are currently and potentially applicable at the site are presented in Section 3.0. Our proposed scope of work for the seep study is presented in Section 4.0.

We are requesting that Ecology provide comment/technical assistance regarding the applicability of groundwater CULs and POCs we have presented in Section 3.2 and comment/technical assistance on the proposed seep study scope of work.

2.0 Site Background

2.1 Site Description

The site is an approximately 6.7-acre parcel which is zoned industrial and located in the Port of Kalama industrial area. The site is currently owned by Chemtrade Logistics, 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 south of the site are undeveloped. The parcel to the east of the site is developed with Hendrickson Drive and the parcel to the east of Hendrickson Drive is owned by Burlington Northern, Inc. and is developed with railroad lines.

An approximately 17,000-square foot (sf) manufacturing building that contains offices, storage, loading docks, a mechanic shop, a lab, and product manufacturing areas is located on the southeastern portion of the site. To the north and northwest of the manufacturing building are two concrete secondary containment areas that contain process tanks and equipment, an approximately 1,000-sf building that contains a zinc oxide dryer, a truck loading area, a tank, and two silos. The area to the south of the manufacturing building and large portions of the areas to the east and west of the building are paved. A railroad spur runs along the east side of the site structures and crosses Hendrickson Drive to the northeast of the manufacturing structures. These portions of the site are collectively referred to as the MPA.

North of the manufacturing facility structures, the property is undeveloped where four settling basins were formerly located. 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 perimeter areas along Hendrickson Drive, the railroad spur, and the Columbia River.

2.2 Site History

Prior to 1969, the site was undeveloped and was built up with approximately 20 ft of dredge spoils from the Columbia River shortly before the start of manufacturing operations. The site was developed in 1969 with a manufacturing plant. The plant manufactured zinc hydrosulfite from 1969 to 1973 and sodium hydrosulfite from 1974 through mid-2016 when the plant was shut down. The latter process generated zinc oxide as a byproduct. From approximately 1974 until the late 1970s or early 1980s, the manufacturing process also generated zinc carbonate sludge as a byproduct. This sludge was discharged to FSB2. Zinc carbonate sludge was apparently not discharged to FSB2 after 1984. Former settling basins #3 and #4 (FSB3 and FSB4) were never used. FSB1 received minor spillage of zinc carbonate sludge from conveyance of the sludge to FSB2. The settling basins were closed in 1989 by removing the marketable zinc carbonate sludge from FSB2 and filling in the basins. 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). Prior to January 2004, cadmium sulfate was used as a catalyst in manufacturing processes.

3.0 Groundwater Summary

3.1 Site 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 up to approximately 20 ft of river dredge spoils shortly before the start of manufacturing operations. The dredge spoils consist primarily of fine to coarse-grained loose brown 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 eastern portions of the site and slopes downwards to greater than 60 ft bgs along 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 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. A groundwater elevation contour map for January 2015 is included as Figure 3.

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.

3.2 CULs and POCs

Under the Model Toxics Control Act (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 soil, water, air or sediment at a site that must be addressed by the cleanup action.

Groundwater

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 may be classified as nonpotable.

Potable groundwater CULs established for human health protection 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 potable groundwater CULs established for human health protection 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 potable groundwater CULs established for human health protection can 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 potable groundwater CULs established for human health protection.

Potable groundwater CULs established for protection of surface water beneficial uses (hereafter referred to as surface water CULs) are also applicable to the site unless it can be demonstrated that the hazardous substances are not likely to reach surface water. The surface water 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).

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 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 surface water 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 the groundwater CUL should be based upon a conditional POC in the surface water, subject to the above conditions being met.

Sediment

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.

In the February 9, 2017 opinion letter, Ecology indicates that a sediment bioaccumulation target concentration CUL of 2,783 µg/kg for zinc is applicable to the site. This value is from Table 10-1 (List 1 Bioaccumulative Chemicals of Concern) of the U.S. Army Corps of Engineers Dredged

Material Evaluation and Disposal Procedures Manual dated November 2015. However, based on Table 8-2 (Dredged Material Management Program COCs and regulatory guidelines) of the November 2015 manual, the Table 10-1 zinc value should be 2,783 mg/kg, not 2,783 µg/kg. In addition, Table 8-2 indicates this value is applicable to Marine Projects, whereas the Sediment Management Standards (SMS) Freshwater Screening Level 1 (SL1) value listed in the table for zinc is 3,200 mg/kg. Furthermore, the U.S. Army Corps of Engineers Dredged Material Evaluation and Disposal Procedures Manual dated August 2016 (USCOE Procedures Manual) indicates that zinc was removed from List 1 Bioaccumulative Chemicals of Concern because it does not have methylated or organic forms, making it unlikely to biomagnify. In the August 2016 USCOE Procedures Manual, the SMS Freshwater SL1 values listed in Table 8-3 (Dredged Material Management Program COCs and regulatory guidelines) for cadmium and zinc are 2.1 mg/kg and 3,200 mg/kg, respectively. These are the same values as presented in the Freshwater Sediment Cleanup Objectives presented in Table IV of WAC 173-204-563. Therefore, we believe that the sediment CULs for cadmium and zinc should be 2.1 mg/kg and 3,200 mg/kg, respectively.

3.3 Groundwater Impacts

Results of previous groundwater sampling at the site indicate the presence of cadmium and zinc concentrations above CULs in the MPA and in the area of the FSBs (primarily in the area of FSB2). Zinc and cadmium isoconcentration maps which depict the most recent groundwater sample data from site wells and sediment pore water are included as Figures 4A and 4B, respectively.

As shown in Figure 4A, concentrations of zinc detected above the surface water CUL (66 µg/l) in the MPA during January 2015 extended from the manufacturing building to the western edge of the site adjacent to the Columbia River. Concentrations of zinc detected above the surface water CUL during January 2015 in the FSB2 area also extended to the western edge of the site adjacent to the Columbia River. Concentrations of zinc above the surface water CUL have consistently been detected in historical groundwater samples collected from angle bore wells

AB1 and AB2. These two wells are located at the western edge of the site and are installed at an angle beneath the bank of the Columbia River.

As shown in Figure 4A, zinc concentrations detected in the FSB2 area plume are generally significantly higher than those detected in the MPA plume. Zinc was also detected at a relatively low concentration above the surface water CUL in a February 2010 sample collected from piezometer PZ11 which is located in FSB1; however, it does not appear that zinc concentrations above the surface water CUL likely extend to the western edge of the site from this area.

As shown in Figure 4B, concentrations of cadmium above the surface water CUL (0.7 µg/l) were detected in three wells located to the west of the manufacturing building during January 2015, and cadmium was detected slightly above the surface water CUL in a February 2010 sample collected from piezometer PZ9 (1.2 µg/l) which is located near the western edge of the MPA. Note that cadmium was not detected in AB1 or PZ3 (also located along the western edge of the MPA portion of the site) during January 2015. Relatively low concentrations of cadmium (ranging from 1.06 µg/l to 2.61 µg/l) were detected above the surface water CUL in four wells located in the FSB2 area during January 2015. Three of these wells (including angle well AB2) are located near the western edge of the site. As shown in Figure 4B, cadmium concentrations detected in the MPA plume are generally significantly higher than those detected in the FSB2 area plume.

During July 2015, H&H personnel collected sediment and sediment pore water samples at the eastern edge of the Columbia River adjacent to the site at the locations depicted in Figures 4A and 4B. Sediment and sediment pore water samples were collected from three locations to the west of the MPA and three locations to the west of the FSB2 area zinc plumes to assess sediment and pore water in the areas where the zinc groundwater plumes were believed to most likely discharge from the site aquifer into the surface water. In addition, upstream and downstream sediment and sediment pore water samples were collected from locations near the southern and northern boundaries of the site to evaluate potential background levels of zinc and cadmium. There were no detections of cadmium or zinc in the sediment pore water samples.

Zinc was detected in each of the sediment samples at concentrations ranging from 27.4 mg/kg to 61.9 mg/kg. These detections are significantly lower than the sediment CUL of 3,200 mg/kg. The detections are also less than the natural background zinc concentration in Washington State soils (86.0 mg/kg) published in Ecology's Toxic Cleanup Program Publication No. 94-115. Cadmium was not detected in any of the sediment samples.

4.0 Seep Study Plan

H&H proposes to conduct a seep study to evaluate the potential presence and locations of preferential pathways for cadmium and zinc associated with the site to enter sediments and surface water, and to evaluate compliance with surface water and sediment standards at locations of preferential pathways (if identified).

As Ecology noted in the February 9, 2017 opinion letter, the Columbia River bank adjacent to the site is armored with riprap. The bank is also steep and difficult to access with large equipment. This setting presents challenges for performing a seep study in addition to complications posed by daily tidal and seasonal elevation variations in the river level at the site. Furthermore, because there is typically substantial variability in the location and rates of hyporheic exchange (i.e., the process of water and solute exchange in both directions across a streambed), it should be recognized that there are significant inherent challenges to identifying preferential pathways for contaminant transport from groundwater to surface water.

According to NOAA, low river stages in the Columbia River generally occur during August through October each year. A review of confirmed river elevations at the measuring stations located nearest to the site (Longview, WA and St. Helens, OR) indicates the lowest average monthly river elevations during 2016 occurred during July, August, and September (with the lowest being August). Groundwater to surface water flux rates at the site (and, therefore the potential for contaminant transport from site groundwater to surface water) are expected to be relatively higher during low river stages and as the river level decreases leading up to the low river stage. In addition, groundwater to surface water flux rates are expected to be relatively higher during periods of the day when the river level is at or approaching low tide.

4.1 Seep Study Methods

H&H proposes to utilize several methods as part of the seep study to attempt to identify areas of relatively higher hyporheic exchange adjacent to the site. These methods are presented below.

We propose to conduct the seep study in late July/early August 2017 when river levels are expected to be approaching low river stage and groundwater to surface water flux rates are expected to be relatively higher.

Visual Observations

H&H personnel will initially conduct a field reconnaissance from the river bank and/or from the river in a boat to observe for:

- Pools and riffles which may be indicative of downwelling/upwelling, subaqueous seeps and springs, and seeps in the river bank above the surface water level.

- Discoloration of riprap and sediments potentially attributable to mineral precipitates (which may be indicative of relatively high hyporheic exchange areas where dissolved metals in groundwater precipitate as insoluble complexes when introduced to the surface water).

- Areas with a relatively high density of aquatic plant biomass (which may be indicative of relatively high hyporheic exchange areas). Nutrients in groundwater and other groundwater conditions have the potential to enhance aquatic plant growth.

- Thermal variations using a thermal imaging camera. Thermal variation is potentially indicative of relatively high hyporheic exchange areas. A thermal imaging camera will be utilized to observe for thermal variation in surface water near the river bank in the morning (to minimize the potential interference from diurnal heating of riprap). Note that groundwater is expected to be cooler than surface water during the summer.

The field reconnaissance will be performed at low tide (or, as river levels are nearing low tide), and the reconnaissance will be conducted along the portion of the river bank adjacent to the site property between the locations of onsite piezometers PZ14 and PZ15 (see Figure 5). Based on groundwater sample data from these piezometers, we believe it is reasonable to assume that the

potential for discharge of impacted groundwater to surface water is limited to these extents. A GPS unit will be utilized to record the coordinates of notable observations.

Sediment Survey

H&H personnel will conduct a survey of sediments located in the river channel adjacent to the site between the locations of onsite piezometers PZ14 and PZ15 (see Figure 5). The survey will be conducted to assess for areas of groundwater upwelling and will be performed using a probe to measure and log temperature, conductivity, dissolved oxygen (DO), oxidation-reduction potential (ORP), pH, and total dissolved solids (TDS). The probe will be towed behind a small boat while remaining in contact with riverbed sediments and a GPS unit will be utilized to record the coordinates of data points. We anticipate that the survey will include assessment of sediments along two lines oriented parallel to the shore line. The survey activities will be conducted beyond the edge of subaqueous riprap which extends an unknown distance to the west of the shoreline.

Areas of thermal variation, higher conductivity, lower DO, lower ORP, lower pH, and/or higher TDS relative to surrounding areas may be indicative of relatively high hyporheic exchange areas.

Pore Water and Sediment Testing

If areas of potentially high hyporheic exchange are identified by the visual observations and/or sediment survey, samples of pore water, sediment, and surface water will be collected in these locations. At these locations, piezometers will be installed to evaluate the hydraulic gradients between the sediment pore water and surface water, to measure sediment pore water quality parameters (e.g., temperature, conductivity, DO, ORP, pH, and TDS), and to collect sediment pore water samples for laboratory analysis of dissolved cadmium and zinc by EPA Method 6010. Surface water in the area of the pore water sample locations will also be measured for the water quality parameters listed above and samples of the surface water will be collected for laboratory analysis of dissolved cadmium and zinc. Sediment samples will also be collected from the pore water sample locations for laboratory analysis of cadmium and zinc. Samples will be collected at low tide (or, as river levels are nearing low tide).

The piezometers used in the testing described above will be 24” to 36” long, 1/4" diameter PushPoint sediment pore water samplers obtained from MHE Products. The PushPoint sampler is a machined sampling tool consisting of a tubular stainless steel body constructed with an approximately 2-inch long screened zone at the bottom end and a sampling port at the top end. The Pushpoint samplers will be inserted to a depth of approximately 24” below the top of the sediment, or to refusal depth at each sample location. Samples will be collected from the PushPoint sampler using a peristaltic pump or syringe connected to the sampler by tubing.

If potentially high hyporheic exchange areas are not identified by the visual observations and/or sediment survey discussed above, H&H proposes to collect pore water and sediment samples from a line of 22 Pushpoint samplers installed at a spacing of approximately 40 ft along the portion of the shore line adjacent to the site property between the locations of onsite piezometers PZ14 and PZ15. Pore water and sediment samples will also be collected from previously sampled upstream and downstream locations (identified as PW-US and PW-DS). The proposed sample locations for this approach are depicted in Figure 5. The samplers will be installed and sampled using the same methods and for the same parameters and analyses presented above. In addition, sediment samples will be collected from each location for analysis of cadmium and zinc. Sampling of pore water along the line will be completed at low tide (or, as river levels are nearing low tide); however, the samples will likely be collected during multiple tide cycles. If results of one or more samples indicate evidence of contaminants associated with the site entering sediments and/or surface water, the area of the sample(s) will be further evaluated.

4.2 Groundwater Monitoring

During the seep study mobilization, a groundwater monitoring event will be completed in order to obtain current site-wide groundwater data. Groundwater samples will be collected from piezometers PZ1 through PZ15, angle bore wells AB1 and AB2, and observation wells OW1, OW2, and OW3 during the event. Prior to sampling, groundwater elevations will be measured in the site wells. Samples will then be collected using standard low-flow/low-stress techniques. Groundwater parameters that include temperature, conductivity, DO, ORP, pH, and TDS will be

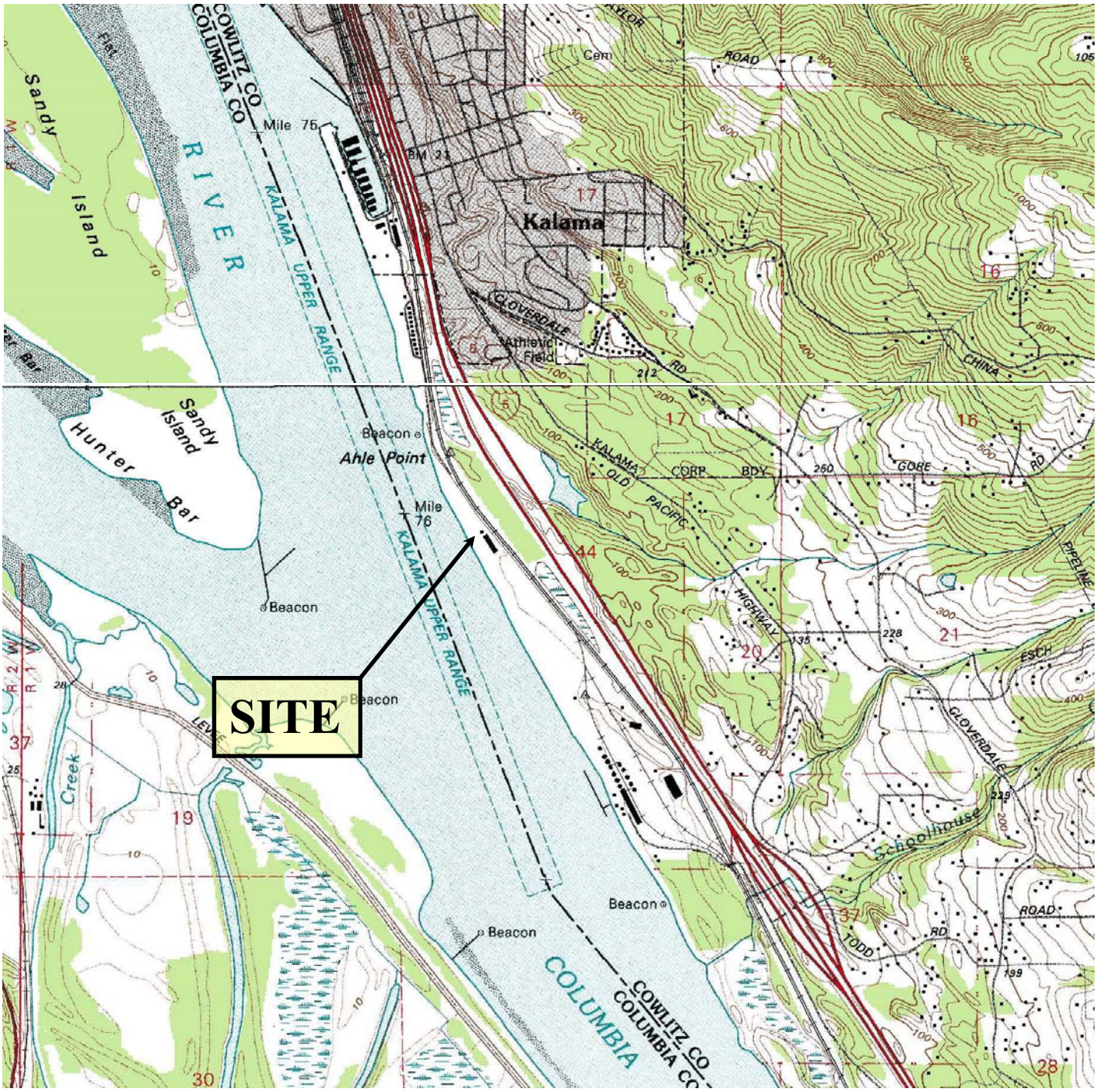
measured during the low-flow purging. After groundwater parameters stabilize during purging, samples will be collected for laboratory analysis of dissolved cadmium and zinc by EPA Method 6010. The samples will be field-filtered using a 0.45-micron ground water filter prior to collection into sample containers.

4.3 Data Evaluation

Following completion of the seep study, an updated CSM which includes preferential pathways for contaminants to enter sediments and surface water identified by the seep study will be prepared and submitted to Ecology. In the case that preferential pathways are not identified by the study and/or contaminants are not identified in pore water, surface water, and sediment samples collected as part of the seep study, we believe that reasonable due diligence will have been made by Clariant to demonstrate that hazardous substances associated with the site are not likely to reach surface water, and that a conditional POC in surface water is appropriate.

We understand that performance of a geophysical survey is an option for identifying preferential pathways between groundwater and surface water which we have not included in this work plan. However, undertaking and interpreting these surveys can be complex (requiring specific technical expertise and extensive calibration with other datasets, such as borehole logs and chemical analyses). Based on our discussions with a potential geophysical survey contractor (Aestus LLC), performance of a geophysical survey will be expensive at the site (on the order of $150,000) and there is no guarantee that the survey will successfully identify preferential flow pathways. Furthermore, we believe that the pore water sampling which will be completed in 22 locations (if high hyporheic exchange areas are not identified by the visual observations and/or sediment survey) provides a sample coverage and a degree of randomness which is reasonable for identifying evidence of contaminants entering sediments and/or surface water.

As mentioned in Section 1.0, we are requesting that Ecology provide comment/technical assistance regarding the applicability of groundwater CULs and POCs we have presented in Section 3.2 and comment/technical assistance on the proposed seep study scope of work.



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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

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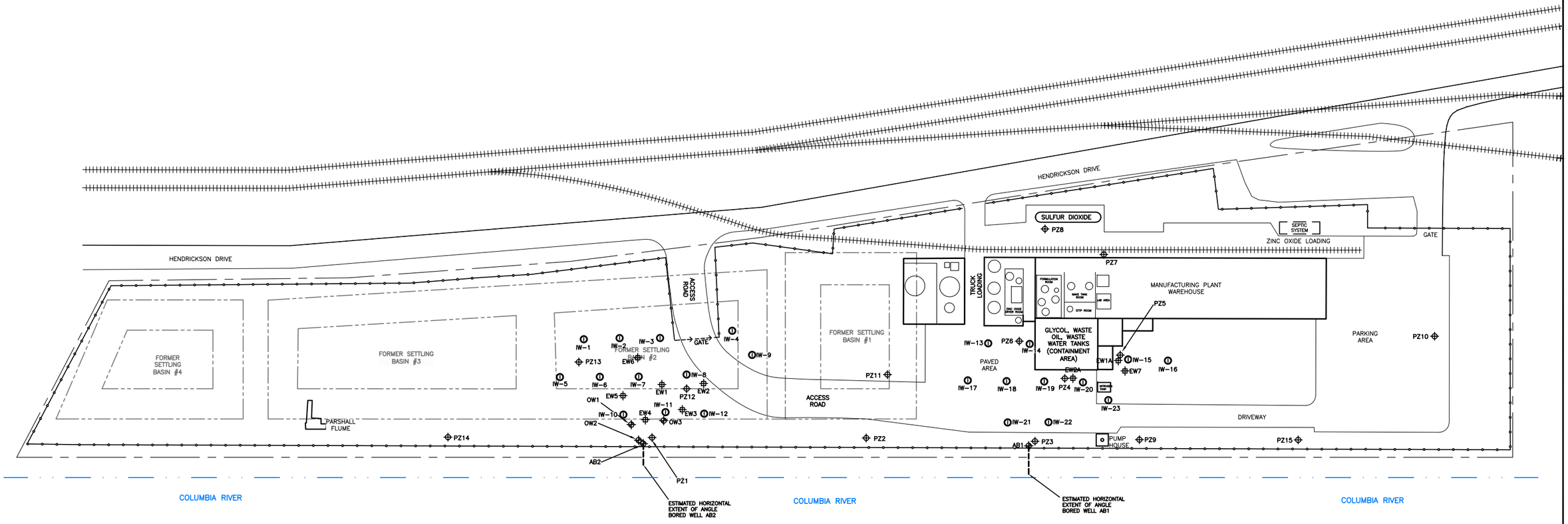
DATE: 05/12/17	REVISION NO. 0
JOB NO: CLR-045	FIGURE NO. 1



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

APPROXIMATE
0 100 200
SCALE IN FEET

TITLE

SITE MAP

PROJECT

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

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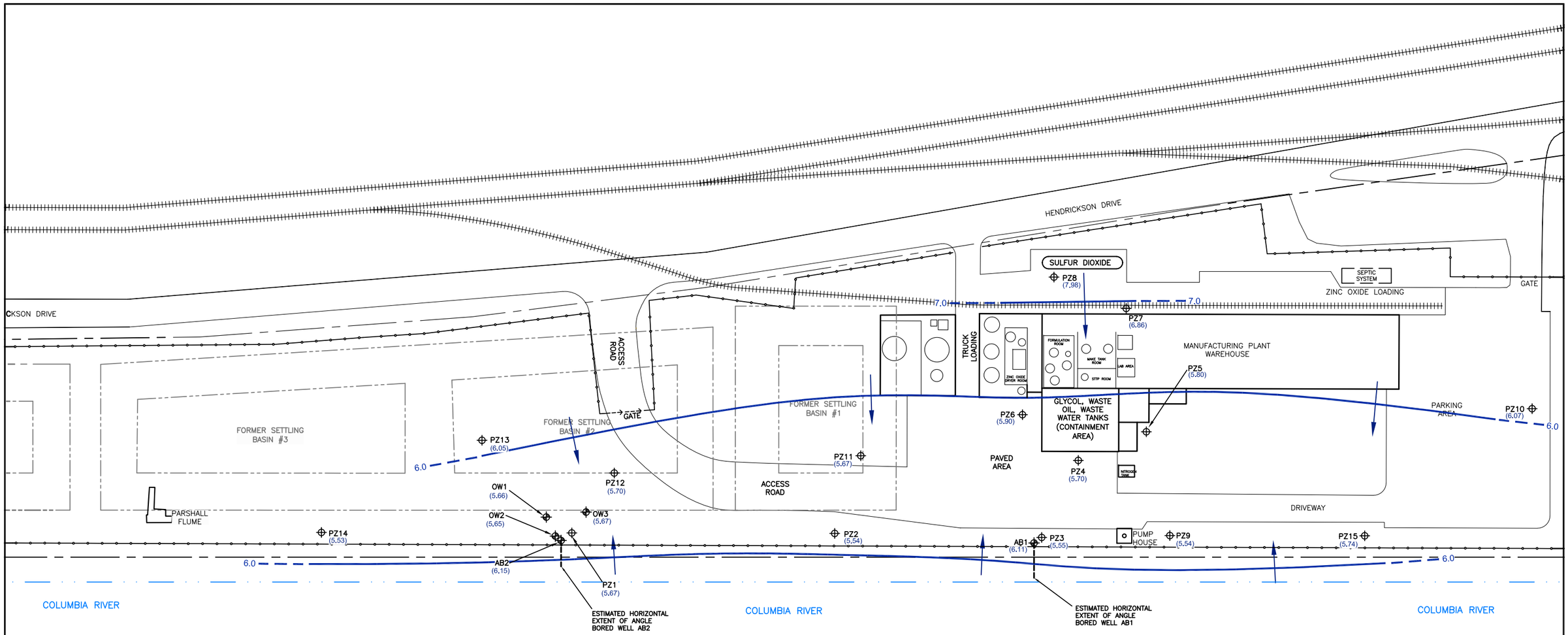
License # C-1269 / #C-245 Geology

DATE: 05-12-17	REVISION NO. 0
JOB NO. CLR-045	FIGURE NO. 2



LEGEND:

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

NOTES

1. 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.

N

APPROXIMATE

0 80 160

SCALE IN FEET

TITLE: GROUNDWATER ELEVATION CONTOUR MAP (JANUARY 2015)

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

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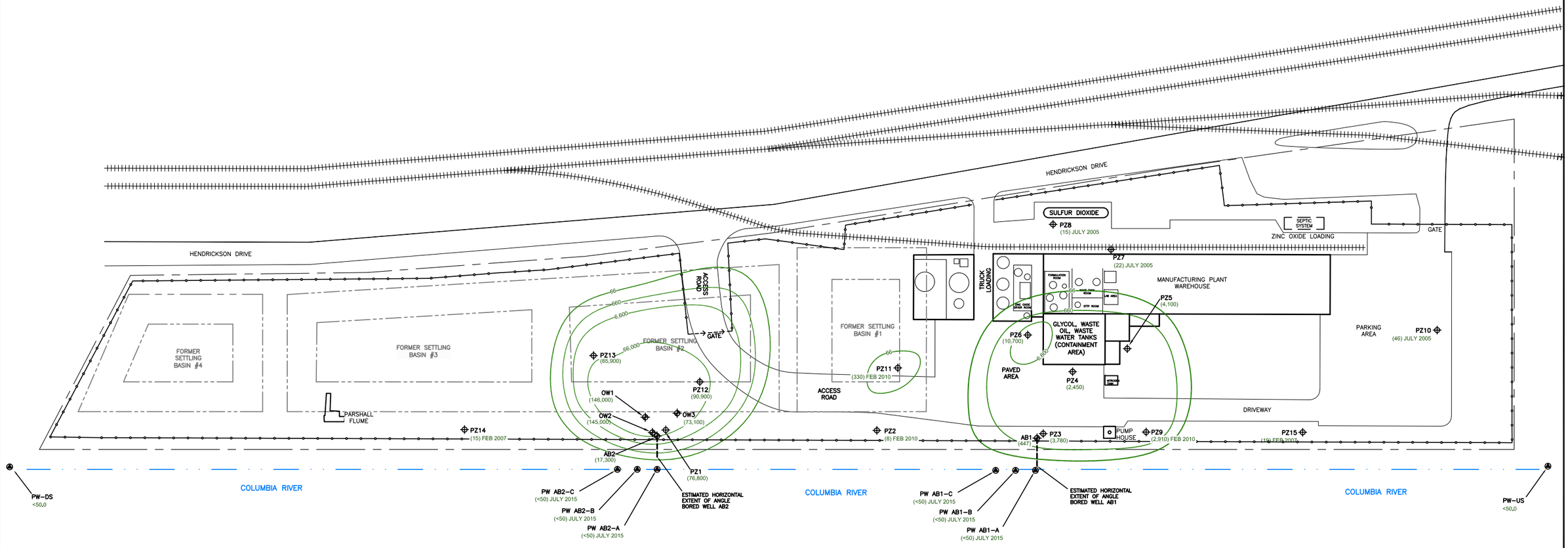
DATE: 05-12-17	REVISION NO. 0
JOB NO. CLR-045	FIGURE NO. 3



LEGEND:

- PROPERTY LINE
- FENCE LINE
- RAILROAD TRACK
- APPROXIMATE EAST EDGE OF COLUMBIA RIVER
- EXTENT OF FORMER SETTLING BASIN
- MONITORING/OBSERVATION WELL
- PIEZOMETER
- (447) ZINC CONCENTRATION (µg/L), SEE NOTES
- 660 ZINC ISOCONCENTRATION CONTOUR IN µg/L
- SEDIMENT PORE WATER SAMPLE LOCATION

NOTES
1. GROUNDWATER ZINC DATA FROM JANUARY 2015 UNLESS OTHERWISE INDICATED BY DATE.
2. SEDIMENT PORE WATER SAMPLES COLLECTED JULY 2015.
3. µg/L = MICROGRAMS PER LITER

APPROXIMATE
0 100 200
SCALE IN FEET

TITLE
ZINC ISOCONCENTRATION 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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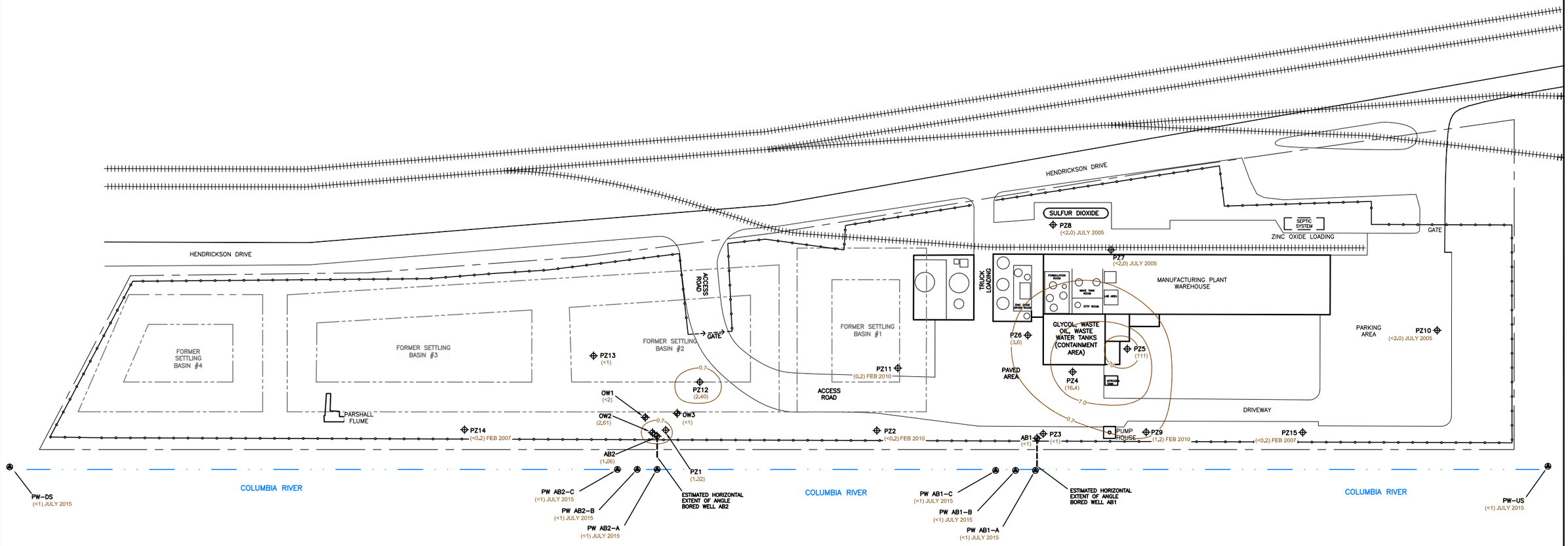
704-586-0007(p) 704-586-0373(f)
License # C-1269 / #C-245 Geology

DATE: 05-12-17 | REVISION NO. 0
JOB NO. CLR-045 | FIGURE NO. 4A



LEGEND:

- PROPERTY LINE
- FENCE LINE
- RAILROAD TRACK
- APPROXIMATE EAST EDGE OF COLUMBIA RIVER
- EXTENT OF FORMER SETTLING BASIN
- MONITORING/OBSERVATION WELL
- PIEZOMETER
- (3.6) CADMIUM CONCENTRATION (µg/L), SEE NOTES
- 0.7 CADMIUM ISOCONCENTRATION CONTOUR IN µg/L
- SEDIMENT PORE WATER SAMPLE LOCATION

NOTES
1. GROUNDWATER CADMIUM DATA FROM JANUARY 2015 UNLESS OTHERWISE INDICATED BY DATE.
2. SEDIMENT PORE WATER SAMPLES COLLECTED JULY 2015.
3. µg/L = MICROGRAMS PER LITER

APPROXIMATE
0 100 200
SCALE IN FEET

TITLE
CADMIUM ISOCONCENTRATION MAP

PROJECT
CHEMTRADE PERFORMANCE CHEMICALS SITE
FACILITY/SITE No. 24634187
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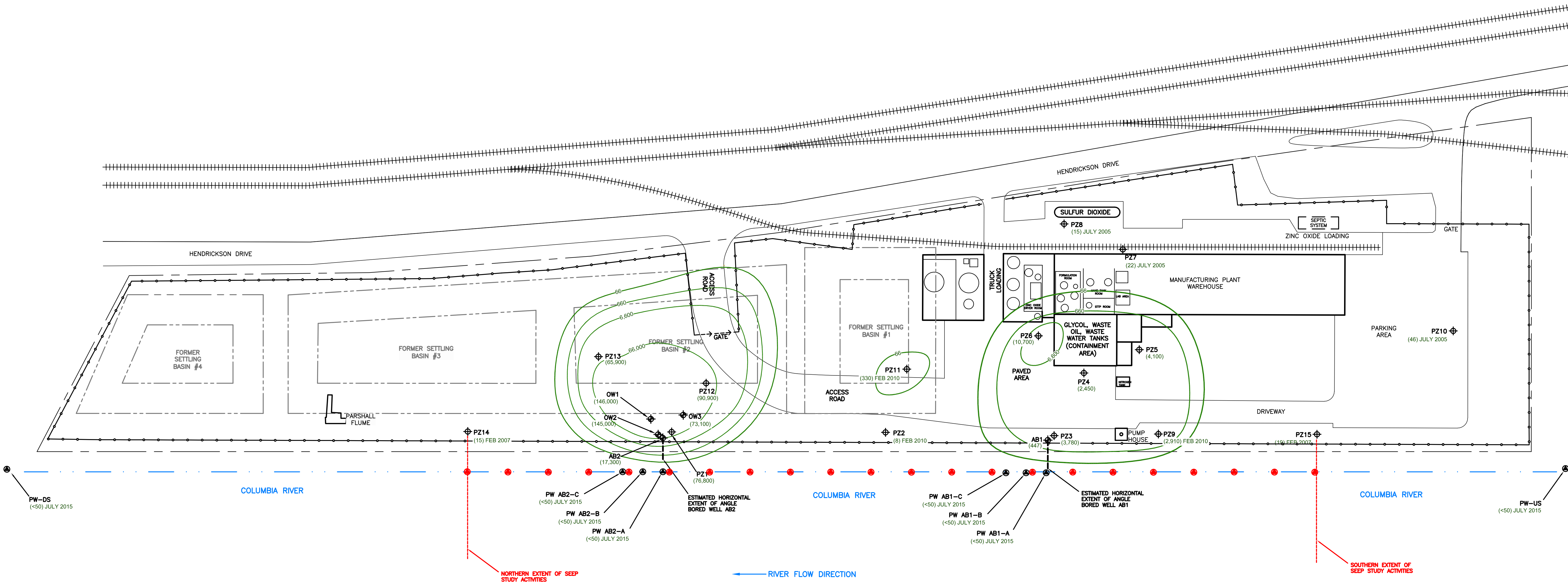
DATE: 05-12-17	REVISION NO. 0
JOB NO. CLR-045	FIGURE NO. 4B



LEGEND:

- PROPERTY LINE
- FENCE LINE
- RAILROAD TRACK
- APPROXIMATE EAST EDGE OF COLUMBIA RIVER
- EXTENT OF FORMER SETTLING BASIN
- MONITORING/OBSERVATION WELL
- PIEZOMETER
- (447) ZINC CONCENTRATION (μg/L), SEE NOTES
- 660 ZINC ISOCONCENTRATION CONTOUR IN μg/L
- SEDIMENT PORE WATER SAMPLE LOCATION
- POTENTIAL SEDIMENT PORE WATER SAMPLE LOCATION

NOTES

1. GROUNDWATER ZINC DATA FROM JANUARY 2015 UNLESS OTHERWISE INDICATED BY DATE.
2. SEDIMENT PORE WATER SAMPLES COLLECTED JULY 2015.
3. μg/L = MICROGRAMS PER LITER

TITLE

POTENTIAL PORE WATER SAMPLE LOCATIONS

PROJECT

CHEMTRADE PERFORMANCE CHEMICALS SITE
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DATE: 05-12-17	REVISION NO. 0
JOB NO. CLR-045	FIGURE NO. 5