5 RI Screening Levels

This section presents screening levels against which constituent concentrations in soil, groundwater, and soil vapor are compared for the purposes of defining nature and extent of contamination at the Site in the RI. The RI screening levels are intended to be conservative and address the full range of potentially applicable exposure pathways and receptors under current and foreseeable future uses of the Site. For any media, RI screening levels will not be set below background concentrations or below analytical practical quantitation limits (PQLs), in accordance with MTCA. While not listed in the screening level tables, regional background concentrations for common urban contaminants (e.g., cPAHs, heavy metals, dioxins/furans) will be considered in evaluation of the data collected during the RI/FS. An exceedance of a screening level does not indicate that cleanup is required, but may indicate that additional assessment is warranted. Additional information may be collected in subsequent steps of the MTCA cleanup process to support Ecology's determination of cleanup levels and/or remediation levels for the Site, in accordance with MTCA (Chapter 173-340 WAC).

The following subsections identify the range of groundwater, soil, and air (soil vapor) exposure pathways and receptors considered, and then outline the associated RI screening levels and their derivation. For reference, Figure 5-1 schematically depicts the media and exposure pathways considered in development of screening levels for the Site.

The Whatcom Waterway and Bellingham Bay border the GP West Site to the north and west, respectively, but are not part of the Site; they are included within the Whatcom Waterway site. Direct exposure to marine water and sediment in these waterbodies is addressed by cleanup of the Whatcom Waterway site; however, soil and groundwater screening levels for the GP West Site are developed to be protective of these media, as described below.

5.1 Overview of Exposure Pathways and Receptors

An exposure pathway describes the mechanisms by which human or ecological exposure to site contaminants can occur under current (baseline) conditions, assuming no remedial action or protective control is in place. To be considered complete, an exposure pathway must have:

- An identified source of contaminant(s);
- A mechanism for contaminant release and transport from the source;
- An exposure route where contact with the contaminant can occur; and
- A receptor that can be exposed to the contaminant.

An exposure pathway is considered complete if a human or ecological receptor can be exposed to a contaminant via that pathway.

This subsection describes exposure pathways for contaminants in soil, groundwater, and air (soil vapor) at the Site.

5.1.1 Groundwater Exposure Pathways

Assuming the range of potential future land uses, current and future potentially complete exposure pathways for groundwater include:

- Residents, workers, and patrons in buildings inhaling indoor air contaminated – via vapor intrusion – by the volatilization of contaminants from shallow groundwater;
- Workers contacting contaminated groundwater during excavation or other construction-related activities, if no worker protection controls are in place;
- Direct exposure for benthic and aquatic organisms in Bellingham Bay and Whatcom Waterway, if groundwater contaminants migrate and discharge to marine sediment and surface water; and
- Humans consuming organisms contaminated by discharges of contaminated groundwater to marine sediment and surface water.

As discussed in Section 5.2.1, groundwater at the Site is not a practicable source of potable water, under current and foreseeable future conditions. As such, human use of groundwater at the Site for drinking water purposes is not considered a current or future potentially complete pathway.

5.1.2 Soil Exposure Pathways

Assuming the full range of potential future land uses, current and future potentially complete exposure pathways for soil include:

- Workers contacting contaminated soils (skin contact and incidental ingestion) and/or inhaling contaminated dust or vapors from soil during excavation or other construction-related activities, if no worker protection controls are in place; and
- Residents/visitors contacting contaminated soils and/or inhaling contaminated dust or vapors from soil in the future, if no controls are in place to restrict use of the Site.

In addition to these pathways, contaminants in soil can leach to groundwater and be released to air through vapor intrusion of volatile contaminants. Therefore, the soil-to-groundwater and soil-to-groundwater-to-air exposure pathways are also considered in the RI. The soil-to-groundwater pathway considers the most stringent groundwater screening levels protective of the multiple exposure pathways described above.

5.1.2.1 Soil to Terrestrial Species Pathway is Not Complete at Site

Terrestrial wildlife exposure to soil is not considered a complete exposure pathway for the Site. Current conditions limit terrestrial wildlife exposures and plans for future redevelopment of the Site involve raising Site grade to accommodate anticipated future sea level rise through a combination of fill, raised structures, etc. Pending completion of the FS, if contaminated soil is left in place, the Port will put in place legally binding institutional controls (environmental covenant(s)) that require perpetual maintenance of the capping materials as needed to prevent wildlife exposure to underlying potentially contaminated soil after the cleanup action is implemented (refer to Section 4.4.1).

5.1.2.2 Soil to Sediment Pathway is Not Complete at Site

The soil-to-sediment pathway (soil erosion and runoff to Whatcom Waterway) is likewise not a complete exposure pathway at the Site. Under the current land use, Site soils are not available for erosion and runoff because they are nearly entirely paved and Site stormwater is captured and conveyed to the Port's Aerated Stabilization Basin (ASB) which will undergo remediation as part of Phase 2 of the Whatcom Waterway cleanup. As described above, the planned future Site use includes capping the entire Site to raise grade, thus protecting existing soils from erosion, and the Port will execute environmental covenant(s) as described above, which will be legally binding under the future Consent Decree for the Site. The Site-wide capping, with associated environmental covenant(s) to maintain the cap, would prevent existing soils from erosion (soil-to-sediment pathway) in addition to preventing terrestrial exposure to soil.

As part of the adjacent Whatcom Waterway cleanup project, selected shoreline areas of the Site will be sloped back, exposing Site soils on the upper slopes. The completed Whatcom Waterway Cleanup Action Plan (under an existing Consent Decree) requires that exposed Waterway slopes be capped with several feet of clean soil material, including surface armoring to prevent erosion, and a corresponding environmental covenant requiring long-term maintenance of the cap.

Therefore, the current Site soils, whether in the upland or on future sloped banks of the Whatcom Waterway, will be permanently covered so as not to be exposed to erosion, and maintenance of the caps will be required in perpetuity under existing or future Consent Decrees. As such, the soil-to-sediment pathway is incomplete at the Site, and soil screening levels based on that pathway are not developed.

5.1.3 Air (Soil Vapor) Exposure Pathways

Assuming the range of potential future land uses, current and future potentially complete exposure pathways for air (soil vapor) include:

- Residents, workers, and patrons in buildings inhaling indoor air contaminated – via vapor intrusion – by volatile contaminants originating from soil or groundwater; and
- Workers breathing air contaminated by dust or vapors during excavation or other construction-related activities, if no worker protection controls are in place.

5.2 Derivation of Screening Levels by Media

The basis for establishing RI screening levels for groundwater, soil, and air (soil vapor) is described below.

5.2.1 Groundwater Screening Levels

Table 5-1 presents, for constituents analyzed for at the Site (pre-RI and RI data), the range of criteria from which groundwater screening levels are derived, along with the most stringent of those criteria which are applied as the screening levels for this RI. This section presents the derivation of the RI groundwater screening levels.

5.2.1.1 Site Groundwater's Highest Beneficial Use

Ecology has determined that groundwater at this **S**ite is classified as nonpotable in accordance with WAC 173-340-720(2) as follows:

> (2) (a) *The groundwater does not serve as a current source of drinking water.* Drinking water at this site is currently supplied by the City of Bellingham. Drinking water supply wells are not known to exist at this Site.
>
> (2) (c) *The department determines it is unlikely that hazardous substances will be transported from the contaminated groundwater to groundwater that is a current or potential future source of drinking water, as defined in (a) and (b) of this subsection, at concentration which exceed groundwater quality criteria published in chapter 173-200 WAC.* Remedial investigation work at the Site indicates that contaminated groundwater occurs in the uppermost water-bearing zone. This zone occurs in manmade fill placed in Bellingham Bay (Fill Unit) and in the upper part of the underlying native sediments (Lower Sand). The Fill Unit and Lower Sand discharge directly into Bellingham Bay. Contaminated groundwater in these shallow water-bearing zones will not flow laterally inland towards a current or potential future source of drinking water, because the inland aquifer is hydraulically upgradient of the shallow water-bearing zones. Similarly, contaminated groundwater in the Fill Unit will not flow vertically downward into a deeper regional aquifer that is a current or potential future source of drinking water, because groundwater flow at the shoreline is upward from deep regional aquifers into the shallow water-bearing zones, reflecting increasing hydraulic heads with depth.
>
> (2) (d) *Even if ground water is classified as a potential future source of drinking water under (b) of this subsection, the department recognizes that there may be sites where there is an extremely low probability that the ground water will be used for that purpose because of the site's proximity to surface water that is not suitable as a domestic water supply. An example of this situation would be shallow ground waters in close proximity to marine waters such as on Harbor Island in Seattle. At such sites, the department may allow ground water to be classified as nonpotable for the purposes of this section if each of the following conditions can be demonstrated. These determinations must be for reasons other than that the groundwater or surface water has been contaminated by a release of a hazardous substance at the site.*

(i) There are known or projected points of entry of the groundwater into the surface water. Remedial investigation work at the Site indicates that groundwater enters Bellingham Bay;

(ii) The surface water is not classified as a suitable domestic water supply source under chapter 173-201A WAC. Bellingham Bay is a marine surface water body and does not classify as a suitable domestic water supply under Chapter 173-201A WAC; and

(iii) The groundwater is sufficiently hydraulically connected to the surface water that the groundwater is not practicable to use as a drinking water source. Remedial investigation work at the Site indicates that groundwater is hydraulically

connected to Bellingham Bay. It is not practical to utilize Site groundwater for water supply due to the potential for drawing saline water into the water-bearing zone (salt water intrusion). Therefore, it is not practicable to use as a drinking water source.

Because drinking water is not a practicable future use for Site groundwater, groundwater screening levels applied in this RI are the most stringent value based on protection of the adjacent marine environment (water and sediment) or vapor intrusion (VI) to future structures (indoor air) or outdoor ambient air on the Site. The derivation of groundwater screening levels for marine protection and VI protection is described below.

5.2.1.2 Protection of Marine Surface Water and Sediment

Considering the factors presented above, RI groundwater quality data are compared against groundwater screening levels that the most stringent criterion based on protection of marine surface water and sediment, as described below.

Protection of Marine Water Quality (Water Column)

In accordance with MTCA (WAC 173-340-720[1][c]), groundwater screening levels protective of surface water incorporate MTCA surface water cleanup levels including criteria from applicable state and federal laws (WAC 173-340-730).

For protection of marine water quality, screening levels are the most stringent of aquatic life criteria (marine chronic) and human health criteria for consumption of aquatic organisms under state and federal laws:

- Washington State Water Quality Standards (WAC 173-201A-240);
- Federal National Recommended Water Quality Criteria pursuant to Section 304(a) of the Clean Water Act;
- Because Washington State does not fully comply with Section 303(c)(2)(B) of the Clean Water Act, the Federal National Toxics Rule (NTR; 40 CFR 131.36); and
- MTCA standard Method B surface water cleanup levels, which have been adjusted downward assuming a higher fish consumption rate than the 54 gram/day MTCA value, as required by Ecology for this Site to be consistent with assumptions used in developing the sediment bioaccumulation screening levels as part of the Whatcom Waterway cleanup project. Specifically, MTCA assumes a 54 gram/day fish consumption rate and 0.5 fish diet fraction (i.e., half of the fish consumed are from the site). The Whatcom Waterway project assumed a 173 gram/day total fish consumption rate, consisting of 62 gram/day shellfish, 8 gram/day bottom fish, and 103 gram/day pelagic fish (e.g., salmon). The shellfish and bottom fish are assumed to reside solely at the site, whereas the salmon have a broad home range such that their exposure to the site is assumed negligible. As such, a 70 gram/day combined shellfish and bottom fish consumption rate, with a fish diet fraction of 1.0 (all from site), is assumed for calculating Site-specific Method B surface water screening levels for screening level derivation, and those levels are 2.6 times more stringent than MTCA-default values. However, Method B cleanup levels are developed only if sufficiently protective human-health-

based surface water criteria or standards (ARARs[1]) have not been established under applicable state and federal laws, in accordance with WAC 173-340-730(3)(b)(iii). If a sufficiently protective ARAR exists for a compound, "ARAR" is displayed for that compound in the Method B surface water cleanup level column of Table 5-1. If a sufficiently protective[2] ARAR is not available, the Method B surface water cleanup level[3] is applied, adjusted downward for the assumed higher fish consumption rate.

Compound-specific water quality criteria warranting discussion are described below.

Mercury. Within the regulations, the most stringent marine water quality standard for mercury is 0.025 µg/L, the NTR marine chronic criterion, which is adopted into the state's standards (WAC 173-201A-240). However, this value was derived for methylmercury, not inorganic mercury; the equivalent criterion for inorganic mercury is 0.10 µg/L (EPA, 1985). Methylmercury and inorganic mercury are different chemicals with distinct chemical and toxicological properties. Site-specific soil and groundwater data demonstrate that methylmercury comprises less than 1 percent of the total mercury in soil, groundwater, and soil gas media at the Site (Aspect, 2009a), indicating it is inappropriate to apply a standard based on methylmercury at the Site.

In addition, the 0.025 µg/L criterion is based on bioaccumulation of methylmercury in the tissue of aquatic organisms. Specifically, the NTR and WAC 173-201A-240 standards state that exceedance of the 0.025 µg/L criterion once in a 3-year period triggers analysis of edible fish tissue from the waterbody to assess whether the tissue exceeds the federal Food and Drug Administration (FDA) action level of 1.0 mg/kg methylmercury. EPA has also established a more stringent bioaccumulation-based criterion of 0.3 mg/kg methylmercury in fish tissue, which is the sole methylmercury water quality criterion under the Clean Water Act (i.e., there is not a separate criterion for the water column).

Data collected during the Whatcom Waterway site RI demonstrate that mercury concentrations in samples of fish and shellfish tissue collected from the Whatcom Waterway are below the FDA action level and the more stringent EPA bioaccumulation criterion (Anchor Environmental and Hart Crowser, 2000). The lack of mercury bioaccumulation has since been verified through three rounds of analyses for juvenile Dungeness crab tissue within the Whatcom Waterway Log Pond (RETEC, 2006).

Meeting the bioaccumulation-based criteria in site-specific tissue samples empirically demonstrates compliance with the 0.025 µg/L bioaccumulation-based water quality criterion. The most stringent groundwater mercury screening level applied in this RI is based on protection of marine sediment recontamination (0.059 µg/L), as described below.

Formaldehyde. Currently, no state or federal ambient water quality criteria exist for formaldehyde, which has been detected in Site groundwater. Based on a comprehensive

[1] Applicable or relevant and appropriate requirements.
[2] Carcinogenic risk of 1 x 10^{-5} and hazard index of 1 (WAC 173-340-730(5)(b)).
[3] Most restrictive of carcinogenic or non-carcinogenic values from Ecology's CLARC database (May 2012); however, values for trichloroethylene (TCE) and tetrachloroethylene (PCE) have been updated based on updated surface water cleanup levels provided in Ecology (2012a; 2012b).

review of existing literature, a concentration of 1,600 µg/L formaldehyde is protective of aquatic life in marine water, and is thus the basis for the formaldehyde groundwater screening level in the RI (refer to Anchor Environmental, 2008b; included as Appendix A to the RI/FS Work Plan [Aspect, 2009a]).

Groundwater pH. The marine water quality criterion for groundwater pH is the range of 7.0 to 8.5 (WAC 173-201A-210(1)(f)). Groundwater pH measured across much of the Site, including in areas without known contamination, is below pH 7.0. For example, off-Site Fill Unit monitoring well CW-MW01, located just upgradient (south) of the Site adjacent to the Cornwall Warehouse, has a measured groundwater pH of 6.45 (Aspect, 2004).

In addition, statistical analysis of groundwater pH data from across Whatcom County indicates that natural background groundwater pH ranges below 7.0. At our request, the USGS provided their database of groundwater quality data for water wells in Whatcom County. The database included 280 groundwater pH readings. The data were input into Ecology's MTCAstat97 Background Module, which conducts statistical analysis of background concentrations in accordance with MTCA (WAC 173-340-709[3]). The MTCAstat program can only handle 200 data points, so the first 200 of 280 data points (unsorted) were randomly selected for input. Using the MTCAstat program, the background data set was determined to be lognormally distributed. Using the MTCAstat program, percentiles were then calculated for the background data set as follows (MTCAstat output is included in Appendix F):

Calculated Percentiles	Background Groundwater pH
10	6.17
20	6.50
30	6.75
40	6.97
45	7.08
50	7.18
60	7.40
70	7.64
80	7.93
90	8.36

MTCA dictates that, for lognormally distributed data, natural background water quality is defined as the 90th percentile or four times the 50th percentile, whichever is lower (i.e., background encompasses 90 percent of the data) (WAC 173-340-709[3]). Since this analysis is evaluating the lower end of the pH range, not the upper end, it is appropriate to define background as the 10th percentile instead of the 90th percentile (i.e., background still encompasses 90 percent of the data). As tabulated above, the calculated 10th percentile groundwater pH is pH 6.17, rounded to pH 6.2.

Based on the statistical analysis of a robust natural background data set (200 samples), the RI groundwater screening level for groundwater pH is proposed as the range of 6.2 to 8.5 (upper end of range does not change).

Protection of Marine Sediment

The RI groundwater screening levels must protect against recontamination of marine sediment quality, assuming that groundwater contaminants transported from the Site (upland) would partition from groundwater to sediment within the bioactive zone, which is operationally defined for the Whatcom Waterway site as the uppermost 12 centimeters (cm) of sediment below mudline. Sediments within the Whatcom Waterway are already contaminated, but this is not considered in the derivation of RI groundwater screening levels.

For protection of marine sediment quality, the groundwater criterion is calculated as the marine Sediment Quality Standard (SQS; WAC 173-204-320) divided by the partition coefficient for marine sediment. For organics, the calculation uses the organic carbon SQS and sediment organic carbon:water partition coefficient (K_{oc}), such that sediment organic carbon content is normalized. For inorganics, the calculation uses the dry weight SQS and sediment:water distribution coefficient (K_d). Distribution and partition coefficients are taken from Ecology's Cleanup Level and Risk Calculation (CLARC) database (https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx), downloaded May 2012. However, for mercury, a Site-specific sediment:water partition coefficient (K_d) of 6,900 L/kg has been calculated from collocated soil/groundwater and sediment/porewater mercury data, in accordance with WAC 173-340-747(5)(b)(ii); this information was previously presented to Ecology in support of a Site-specific shoreline groundwater modeling analysis (Aspect and Anchor QEA, 2011b).

The SQS in the state Sediment Management Standards (SMS; WAC 173-204-320) are the most stringent promulgated standards protective of benthic organisms. Ecology has subsequently identified three additional sediment exposure pathways to be considered regarding sediment recontamination potential: (1) human consumption of benthic organisms, (2) human direct contact with sediment, and (3) higher trophic level organisms (seals, birds) consuming benthic organisms. Sediment criteria addressing these pathways are not specifically identified in the current SMS, but are included in Ecology's draft SMS rule, which, at the time of this RI, is still in development pending public comment and rule adoption processes. Ecology currently has site-specific flexibility based on best professional judgment regarding these pathways. Presented below are considerations for how each of the three additional sediment exposure pathways are addressed in the screening level development process.

(1) Human consumption of benthic organisms. The downward-adjusted Method B surface water levels, accounting for a higher fish/shellfish consumption rate and already used in the Site groundwater screening level development, are consistent with human health assumptions applied in the Whatcom Waterway sediment cleanup and are adequately protective of this pathway, in our professional opinion.

(2) Human direct contact with sediment. The potential for significant direct contact with sediment adjacent to the Site is low, and it would be inappropriate to apply the MTCA soil direct contact reasonable maximum exposure scenario to sediment adjacent to the Site. Following the Whatcom Waterway cleanup, there will be limited area for "beach play" due to land use and the intertidal cap armoring, limiting human exposure to sediment in the intertidal area. In addition, intertidal sediment is only exposed during limited times each day, and during many months (winter) the exposure occurs primarily

at night. Finally, the area of Fill Unit groundwater discharge within the intertidal beach area is small, further reducing the footprint of sediment falling under this exposure scenario. In short, the SQS based on protection of benthic organisms spending their full lifecycle in the sediment are also protective of humans having very limited direct contact with that sediment, in our professional opinion.

(3) Higher trophic level organism consuming benthic organisms. The potential for food web/ecological exposure is limited because the footprint of Site groundwater discharge to sediment is very small relative the home ranges of higher trophic level organisms that could consume benthic organisms within that sediment. The sediment will also be capped as part of the Whatcom Waterway site cleanup. Therefore, the SQS based on protection of benthic organisms spending their full lifecycle in the sediment are also protective of higher trophic level organisms consuming those organisms, in our professional opinion.

As is presented in Section 7 of this document, the primary Site groundwater contaminants of concern are mercury, oil-range total petroleum hydrocarbons (TPH), and polycyclic aromatic hydrocarbons (PAHs) including carcinogenic PAHs (cPAHs) and naphthalene. Considerations specific to each contaminant are outlined briefly below.

- **Mercury.** Based on rigorous evaluation during the Whatcom Waterway site cleanup process, the 0.41 mg/kg SQS for mercury addresses all sediment exposure pathways.

- **Oil-range TPH.** Sediment bioassay testing conducted in the Whatcom Waterway site offshore of the Bunker C Tank and Million Gallon Tanks subareas met SQS biological criteria. In addition, TPH concentrations were below the analytical practical quantitation limit (PQL) in sediment porewater samples collected downgradient of the Million Gallon Tanks Subarea (area of TPH contamination at Site). The collective empirical data indicate that the groundwater-to-surface water and groundwater-to-sediment pathways are not complete for TPH contamination at the Site, and therefore TPH groundwater criteria based on those pathways need not be established for the RI.

- **cPAHs.** The 0.018 µg/L total cPAH federal Clean Water Act human health criterion is slightly below the 0.02 µg/L PQL, so the PQL will be the screening level for RI data comparison (Table 5-1). Therefore, evaluation of alternative groundwater criteria for cPAH is not warranted.

- **Naphthalene.** An 83 µg/L groundwater screening level for naphthalene is calculated based on recontamination of sediment at the SQS (Table 5-1). In the Bunker C Tank subarea (area of TPH contamination at Site), detected groundwater naphthalene concentrations are below 1 µg/L, including at former monitoring well BC-MW1 located immediately downgradient of oil-saturated soil within the former tank footprint. In the Million Gallon Tanks subarea, groundwater naphthalene concentrations above 83 µg/L are detected at monitoring wells 500 feet or more from the shoreline, but the concentrations drop to below 0.1 µg/L at well CF-MW01 located roughly 200 feet from the shoreline (data described in Section 7). The collective empirical data indicate that a groundwater-to-surface water and groundwater-to-sediment pathway is not

complete for naphthalene at the Site, and additional evaluation of alternative groundwater criteria for naphthalene is not warranted.

In addition, there is a measure of conservatism afforded by the natural attenuation of groundwater contaminant concentrations occurring between Site shoreline monitoring wells (current RI data set) and the sediment bioactive zone (point of exposure), which is not accounted for in RI screening level development.

5.2.1.3 Protection from Vapor Intrusion (VI)

Volatilization of contaminants in shallow groundwater can represent a potential issue for vapor intrusion (VI) to future structures (indoor air) or outdoor ambient air on the Site. For the purposes of this RI, conservative ("Tier 1") groundwater VI screening levels are obtained from Table B-1 of Appendix B to Ecology's guidance for evaluating soil vapor intrusion (Ecology, 2009); however, values for trichloroethylene (TCE) and tetrachloroethylene (PCE) have been updated based on updated air cleanup levels provided in Ecology (2012a; 2012b) . Air concentrations protective of indoor air are more stringent than those for outdoor air, therefore Ecology's guidance includes groundwater screening levels based on indoor air only. Measured soil vapor data can also be used to empirically assess the groundwater-to-air pathway, in accordance with Ecology (2009).

5.2.1.4 Point of Compliance for Groundwater Screening Levels

Under MTCA, the standard point of compliance for groundwater cleanup levels is throughout site groundwater, regardless of whether groundwater is potable or not (WAC 173-340-720(8)(b)). If it is not practicable to meet groundwater cleanup levels throughout the site, Ecology may approve a conditional point of compliance for groundwater, in accordance with WAC 173-340-720(8)(c) and (d).

For volatile groundwater contaminants that can pose of risk via VI, protectiveness is achieved by meeting VI-based groundwater cleanup levels throughout Site groundwater, or wherever structures would be built on grade in the future. Therefore, for VI protection, the point of compliance for Site groundwater is throughout the shallowest aquifer (Fill Unit).

At this Site, where groundwater's highest beneficial use is discharge to marine water, protectiveness of that beneficial use is dependent on meeting marine-protection-based groundwater cleanup levels at the points where groundwater discharges to marine sediment (bioactive zone) and then the marine water column of the Whatcom Waterway or Bellingham Bay. Therefore, a groundwater conditional point of compliance within the sediment bioactive zone would achieve protection of the marine environment (sediment and water column).

The practicability of meeting groundwater cleanup levels throughout the Site will be determined during evaluation of remedial alternatives in the FS, not in this RI. Consequently, for the purposes of this RI, the MTCA standard point of compliance will be assumed, and data from each Site well will be compared against groundwater screening levels protective of both VI and marine protection. However, to inform the evaluation of remedial alternatives in the FS, subarea-specific evaluations of nature and extent will focus on data from shoreline monitoring wells relative to screening levels for protection of the marine environment (Section 7). As part of the FS process, more

detailed evaluation of contaminant natural attenuation occurring in the nearshore portion of the aquifer, prior to discharge to marine environment, may be considered in remedy selection.

5.2.2 Soil Screening Levels

Soil screening levels depend on current and planned use of the Site, which, in accordance with MTCA, can be divided into industrial use and everything else (unrestricted, which includes residential). The current use of the Site is industrial and meets the requirement of a "traditional industrial use" under MTCA (WAC 173-340-745). The Port's future use of the Site could be industrial or another use (e.g., mixed use), and the redevelopment planning is ongoing as described in Section 4.6. In addition to direct contact exposure to soil, the soil screening levels also need to address soil leaching to groundwater discharging to marine water/sediment, soil leaching to groundwater with volatilization to air, and, for petroleum hydrocarbons, generation of mobile non-aqueous phase liquids (residual saturation). Residual saturation is discussed in Section 7, relative to specific subareas of the Site with petroleum occurrences. The soil-to-air pathway is assessed empirically using subarea-specific soil gas data, since numerical soil screening levels are not available for that pathway (Ecology, 2009).

Since the future land use planning process is ongoing, and it is anticipated that land use designations will be variable across the Site, the analytical data for Site soil are compared against soil screening levels for both unrestricted and industrial land uses in this RI. If determined to be applicable, the use of industrial soil cleanup levels will be evaluated on a case-by-case basis in the FS documents, in consultation with Ecology. Derivation of the RI unrestricted and industrial soil screening level purposes is described below.

5.2.2.1 Unrestricted Land Use Soil Screening Levels

Unrestricted soil screening levels are the most stringent concentration based on human-direct-contact and soil-leaching-to-groundwater exposure pathways. The values considered for those exposure pathways are described below. Soil concentrations protective of air are evaluated empirically using soil gas data for applicable subareas of the Site (described in Section 7).

Direct Contact Pathway

Soil concentrations protective of human direct contact under unrestricted land use are the more stringent of MTCA Standard Method B soil cleanup levels[4] and select MTCA Method A unrestricted soil cleanup levels.

Most MTCA Method A unrestricted soil cleanup levels are based on either direct contact using the standard Method B equations (WAC 173-340-740[3][b]) or protection of groundwater for drinking water (potable) use. At this Site, groundwater's highest beneficial use is discharge to marine water/sediment, not drinking water, as described in Section 5.2.1. Therefore, the Method A soil cleanup levels based on groundwater protection are not applicable, and this pathway is addressed separately using the most stringent groundwater screening levels developed in accordance with MTCA (described above). In addition, the Method A direct-contact-based values are covered by including standard Method B cleanup levels in the screening level derivation. The Method A values

[4] Downloaded from Ecology's CLARC database, May 2012.

that are included in the RI unrestricted soil screening level derivation include arsenic (background-based), lead (no Method B value), total PCBs (from the Toxic Substances Control Act [TSCA]), and diesel- and oil-range total petroleum hydrocarbons (TPH) (based on generation of non-aqueous phase liquid petroleum).

Soil pH. Neither Ecology nor EPA have published risk-based criteria for soil pH. Therefore, the Washington State Department of Labor and Industries Division of Occupational Safety and Health (DOSH) pH ranges defining corrosive substances (less than 2.5 or greater than 11.0; DOSH Directive 13.00) are applied as the unrestricted soil pH screening level.

Soil Leaching Pathway

Soil concentrations protective of groundwater's highest beneficial use are calculated using Ecology's variable parameter 3-phase partitioning model (WAC 173-340-747[5]), and using the most stringent groundwater screening level protective of vapor intrusion for unrestricted land use, marine water quality, and marine sediment quality (described in Section 5.2.1). Separate values are developed for unsaturated vs. saturated soil, in accordance with WAC 173-340-747(4)(e). MTCA-default parameters (WAC 173-340-747[4] and [5][5]) are used in the 3-phase model, except for inclusion of two Site-specific parameter values:

- A soil fractional organic carbon content (foc) of 0.016 (1.6 percent)[6] is used for calculation of soil:water partition/distribution coefficients (Kd = Koc x foc) for organics, in accordance with WAC 173-340-747(5)(b)(i); and
- A mercury soil:water partition coefficient (Kd) of 1,700 L/kg is calculated from collocated upland soil and groundwater mercury data, in accordance with WAC 173-340-747(5)(b)(ii). The data were presented to Ecology in support of shoreline groundwater modeling analysis (Aspect and Anchor QEA, 2011b). Since the Kd value is used in this RI to assess upland soil leaching to groundwater, only upland soil and groundwater data are used in its derivation (data in Table A-2 of Aspect and Anchor QEA, 2011b). The Whatcom Waterway sediment and porewater data presented in Table A-1 of that memo are not used here, since they are not representative of upland soil leaching to groundwater. Therefore, the 1,700 L/kg mercury Kd value used in this RI is different, and more conservative for soil-to-groundwater leaching, than the 6,900 L/kg Kd value applied for modeling nearshore groundwater transport to marine sediment (described in Section 5.2.1).

Because the water table is shallow and variable in depth across the Site, the saturated soil screening levels (most stringent) are uniformly applied to all soil data for the purposes of this RI.

It is important to recognize that the RI soil screening levels derived to protect groundwater discharging to the marine environment are extremely conservative in terms of actual soil leaching risk to the marine environment. The derived soil screening levels are back-calculated from a groundwater concentration applicable at the point of marine exposure (sediment bioactive zone). As described in Section 5.2.1.4, this RI applies the

[5] Downloaded from Ecology's CLARC database, May 2012.
[6] Average of measured values from 22 Site soil samples.

MTCA groundwater standard point of compliance, i.e. throughout the aquifer, not a conditional point of compliance where groundwater actually discharges to the marine environment (point of exposure). Substantial attenuation of contaminant concentrations occurs during groundwater transport from upland locations to the sediment bioactive zone[7].

Therefore, beyond the MTCA-default screening levels applied in this RI, empirical evidence is also used to assess soil concentrations protective of groundwater for select subareas of the Site, in accordance with WAC 174-340-747(9) (Section 7 presents subarea-specific information). For example, there is a strong weight of Site-specific empirical evidence indicating that soil mercury concentrations well above the calculated 0.1 mg/kg screening level based on leaching from saturated soil, and above a 24 mg/kg concentration based on unrestricted direct contact (Table 5-2), are protective of groundwater quality for most areas of the Site. The area of possible exception is the highly alkaline core of the Chlor-Alkali plant area, where the data indicate mercury is much more mobile than elsewhere on the Site with more neutral pH conditions. The Site-specific information is detailed in Section 7, which presents a conceptual site model (CSM) identifying contaminant nature, extent, and fate/transport for each of the Site subareas. In Section 7, the soil mercury data for all subareas are screened against the most restrictive screening level (0.1 mg/kg) in the tables and figures presenting the data, and the figures depict sample locations exceeding both 0.1 mg/kg and 24 mg/kg mercury (using different color coding).

Finally, area background contaminant concentrations have not been formally established in accordance with MTCA (WAC 173-340-709) for the area surrounding the Site or elsewhere in Bellingham, Washington, to our knowledge. Therefore, no adjustment of soil screening levels is made based on area background conditions. However, urban background concentrations of widespread urban contaminants (e.g., cPAHs and dioxins/furans) have been measured in soils within Seattle and Bellingham, Washington, and this information is incorporated into Section 7 of this RI as appropriate.

While we are not aware of formalized sampling to determine urban background soil mercury concentrations, there is information to indicate that the 0.1 mg/kg mercury soil screening level applied in this RI is below urban background concentrations. First, the 90th percentile and maximum natural background soil mercury concentration for Washington state is 0.07 mg/kg and 0.185 mg/kg, respectively (Ecology, 1994b). Ecology (1994b) compares the 0.07 mg/kg state natural background value against background soil mercury values measured in other regions, including 0.27 mg/kg from Michigan, 0.16 mg/kg from rural New Jersey, 0.13 mg/kg from rural Ontario, and 0.1 mg/kg nationwide as established by the USGS (Shacklette and Boerngen, 1984). Furthermore, six off-Site soil samples collected adjacent to the Cornwall Warehouse, across Cornwall Avenue from the Site, contained soil mercury concentrations ranging from non-detect to 0.39 mg/kg, with an average of 0.16 mg/kg (Aspect, 2004b).

[7] Groundwater modeling of contaminant attenuation in nearshore groundwater at the Site has been completed (Aspect, 2012a). This information is not applied in the RI but will be incorporated into the FS.

Table 5-2 presents the unrestricted land use screening levels applied in this RI for the list of constituents analyzed for at the Site (pre-RI and RI data). Note that risk-based Method B soil screening levels for TPH, addressing all exposure pathways, are derived for specific Site subareas based on subarea-specific data. These screening levels are not included in Table 5-2, but are presented in Section 7, including in the data tables where subarea-specific data are compared against screening levels.

5.2.2.2 Industrial Land Use Soil Screening Levels

Industrial soil screening levels are the most stringent concentration based on human-direct-contact and soil-leaching-to-groundwater exposure pathways. The values considered for each exposure pathway are described below.

Direct Contact Pathway

Soil concentrations protective of human direct contact under unrestricted land use are the more stringent of MTCA Standard Method C soil cleanup levels[8] and select MTCA Method A industrial soil cleanup levels.

- For the same reasons described for unrestricted soil screening levels above, Method A values included in the industrial soil screening level derivation include arsenic (background-based), lead (no Method C value), total PCBs (from TSCA), and diesel- and oil-range TPH (based on generation of non-aqueous phase liquid petroleum).
- The Washington State DOSH pH ranges defining corrosive substances (less than 2.5 or greater than 11.0) are applied as the industrial soil pH screening level.

Soil Leaching Pathway

The derivation of industrial soil concentrations protective of groundwater is the same as described above for unrestricted soil screening levels, with the one exception that vapor-intrusion-based groundwater screening levels for industrial land use are included in selecting the most stringent groundwater screening level for use in the calculation.

Table 5-3 presents the industrial land use screening levels applied in this RI for the list of constituents analyzed for at the Site (pre-RI and RI data). Note that risk-based Method C soil screening levels for TPH, addressing all exposure pathways, are derived for specific Site subareas based on subarea-specific data. These screening levels are not included in Table 5-3, but are presented in Section 7, including in the data tables where subarea-specific data are compared against screening levels.

5.2.2.3 Point of Compliance for Soil Screening Levels

In accordance with MTCA, the point of compliance for direct contact with soil extends to 15 feet below grade, based on a reasonable maximum depth of excavation and assumed placement of excavated soils at the surface where contact occurs. For the soil-leaching-to-groundwater pathway, the soil point of compliance is all depths, above and below the water table. For the soil-volatilization-to-air pathway, the soil point of compliance is also all depths; however, vapor intrusion risks from soils below the water table are better assessed using empirical groundwater quality data (i.e., saturated soil leaching to groundwater and volatilization from groundwater).

[8] Downloaded from Ecology's CLARC database, May 2012.

5.2.3 Air (Soil Vapor) Screening Levels

Ecology's guidance for evaluating vapor intrusion (Ecology, 2009) provides unrestricted (Method B) and industrial (Method C) soil vapor screening levels against which soil vapor sample analytical results are compared in this RI. Air concentrations protective of indoor air are more stringent than those for outdoor air, therefore Ecology's guidance includes soil vapor screening levels based on indoor air only, for conservatism.

Ecology's soil vapor screening levels are equal to 10 times the corresponding MTCA standard air cleanup levels (for unrestricted or industrial land uses). This is based on EPA's Subsurface Vapor Intrusion Guidance (EPA, 2002), which allows the use of a 10-fold (0.1) slab attenuation factor to conservatively estimate indoor air concentrations using soil vapor sample analytical results. For example, the screening level for mercury in soil vapor for unrestricted land use is therefore 1.4 micrograms per cubed meter of air ($\mu g/m^3$); 10 times the 0.14 $\mu g/m^3$ standard Method B air cleanup level.

The point of compliance for air cleanup levels is ambient air throughout the Site, whether indoors or outdoors. For the purposes of the current RI, concentrations in samples of subsurface soil vapor are compared against the air screening levels.

Table 5-1 - RI Groundwater Screening Levels

GP West Site RI/FS 070188

ANALYTE (BY GROUP)	Marine Surface Water Criteria: Surface Water ARAR - Aquatic Life - Marine - Ch. 173-201A WAC (ma-wac)	Surface Water ARAR - Aquatic Life - Marine - Clean Water Act §304 (ma-cwa)	Surface Water ARAR - Aquatic Life - Marine - National Toxics Rule, 40 CFR 131 (ma-ntr)	Surface Water ARAR - Human Health – Marine – Clean Water Act §304 (hh-cwa)	Surface Water ARAR - Human Health – Marine – National Toxics Rule, 40 CFR 131 (hh-ntr)	Surface Water, Method B, Most Restrictive, Adjusted for Fish Consumption Rate[a] (sw-b)	Protection of Marine Sediment: Partitioning/Distribution Coefficients[b]: Koc (Soil Organic Carbon-Water Partitioning Coefficient) (L/kg)	Kd (Distribution Coefficient for metals) - Sediment to Water Pathway (L/kg)	Marine Sediment Quality Standards: WAC 173-204 Marine SQS (mg/kg organic carbon)	WAC 173-204 Marine SQS (mg/kg dry weight)	Calculated Porewater Concentration Protective of Marine Sediment[c] (sed)	Tier 1 Vapor Intrusion Groundwater Screening Levels[d]: Method B, Unrestricted Land Use (vi-b)	Method C, Indistrial Land Use (vi-c)	Applicable Practical Quantitation Level (PQL) for RI Analyses[e] (pql)	Most Stringent Groundwater Screening Level[f] (This value may vary by land use if most stringent value is based on vapor intrusion.): Unrestricted Land Use		Industrial Land Use	
Total Petroleum Hydrocarbons																		
Gasoline Range Hydrocarbons in ug/L														250				
Diesel Range Hydrocarbons in ug/L														250				
Oil Range Hydrocarbons in ug/L														500				
Bunker C in ug/L														500				
Total TPHs in ug/L																		
Heavy Metals																		
Arsenic in ug/L	36	36	36	0.14	0.14	ARAR		*29*		57	2000			0.5	5	*(footnote i)*	5	*(footnote i)*
Cadmium in ug/L	9.3	8.8	9.3			ARAR		*6.7*		5.1	760			0.02	8.8	*(ma-cwa)*	8.8	*(ma-cwa)*
Chromium (Total) in ug/L								*1000*		260	260			0.2	260	*(sed)*	260	*(sed)*
Chromium (III) in ug/L						93700		*1000*							93700	*(sw-b)*	93700	*(sw-b)*
Chromium (VI) in ug/L	50	50	50			ARAR		*19*		260	14000				50	*(ma-wac)*	50	*(ma-wac)*
Copper in ug/L	3.1	3.1				ARAR		*22*		390	18000			0.1	3.1	*(ma-wac)*	3.1	*(ma-wac)*
Lead in ug/L	8.1	8.1	8.1					*10000*		450	45			0.02	8.1	*(ma-wac)*	8.1	*(ma-wac)*
Mercury in ug/L	*see note g*	0.94	*see note g*		0.15			*6900* [#]		0.41	0.06	0.89	1.9	0.001	0.059	*(sed)*	0.059	*(sed)*
Nickel in ug/L	8.2	8.2	8.2	4600	4600	420		*65*						0.2	8.2	*(ma-wac)*	8.2	*(ma-wac)*
Selenium in ug/L	71	71	71	4200		1040		*5*						1	71	*(ma-wac)*	71	*(ma-wac)*
Silver in mg/L	1.9	1.9	1.9			ARAR		*8.3*		6.1	730			0.02	1.9	*(ma-wac)*	1.9	*(ma-wac)*
Zinc in ug/L	81	81	81	26000		6600		*62*		410	6600			0.5	81	*(ma-wac)*	81	*(ma-wac)*
Mercury Speciation																		
Dimethylmercury in ug/L																		
Mercury (acid-labile) in ug/L																		
Mercury (elemental) in ug/L												0.89	1.9		0.89	*(vi-b)*	1.9	*(vi-c)*
Methylmercury in ug/L	0.025		0.025												0.025	*(ma-wac)*	0.025	*(ma-wac)*
Conventionals and Other Metals																		
Formaldehyde in ug/L															1600	*note h*	1600	*note h*
Nitrate + Nitrite in mg/L																		
Nitrate as Nitrogen in mg/L																		
Nitrite as Nitrogen in mg/L																		
Manganese in mg/L				0.1										0.00005	0.1	*(hh-cwa)*	0.1	*(hh-cwa)*
Volatile Organic Compounds																		
1,1,1,2-Tetrachloroethane in ug/L												7.4	74	0.5	7.4	*(vi-b)*	74	*(vi-c)*
1,1,1-Trichloroethane in ug/L						360000	*140*					11000	25000	0.5	11000	*(vi-b)*	25000	*(vi-c)*
1,1,2 - Trichlorotrifluoroethane in ug/L												1100	2400	0.5	1100	*(vi-b)*	2400	*(vi-c)*
1,1,2,2-Tetrachloroethane in ug/L				4	11	ARAR	*79*					6.2	62	0.5	4	*(hh-cwa)*	4	*(hh-cwa)*
1,1,2-Trichloroethane in ug/L				16	42	ARAR	*75*					7.9	79	0.5	7.9	*(vi-b)*	16	*(hh-cwa)*
1,1-Dichloroethane in ug/L							*53*					2300	5000	0.5	2300	*(vi-b)*	5000	*(vi-c)*
1,1-Dichloroethene in ug/L				7100	3.2	ARAR	*65*					130	280	0.5	3.2	*(hh-ntr)*	3.2	*(hh-ntr)*
1,1-Dichloropropene in ug/L														0.5				
1,2,3-Trichlorobenzene in ug/L														2				
1,2,3-Trichloropropane in ug/L														0.5				
1,2,4-Trichlorobenzene in ug/L				70		0.77	*1700*		0.81		0.48	3900	8400	0.2	0.48	*(sed)*	0.48	*(sed)*
1,2,4-Trimethylbenzene in ug/L												24	52	2	24	*(vi-b)*	52	*(vi-c)*
1,2-Dibromo-3-chloropropane in ug/L														2				
1,2-Dibromoethane (EDB) in ug/L							*66*					0.74	7.4	2	2	*(pql)*	7.4	*(vi-c)*
1,2-Dichlorobenzene in ug/L				1300	17000	ARAR	*380*		2.3		6.1	1800	4000	0.2	6.1	*(sed)*	6.1	*(sed)*
1,2-Dichloroethane (EDC) in ug/L				37	99	ARAR	*38*					4.2	42	0.5	4.2	*(vi-b)*	37	*(hh-cwa)*
1,2-Dichloropropane in ug/L				15			*47*					28	62	0.5	15	*(hh-cwa)*	15	*(hh-cwa)*
1,3,5-Trimethylbenzene in ug/L												25	54	2	25	*(vi-b)*	54	*(vi-c)*
1,3-Dichlorobenzene in ug/L				960	2600									0.2	960	*(hh-cwa)*	960	*(hh-cwa)*
1,3-Dichloropropane in ug/L														0.5				
1,4-Dichloro-2-Butene in ug/L														10				
1,4-Dichlorobenzene in ug/L				190	2600		*620*		3.1		5	7900	17000	0.2	5	*(sed)*	5	*(sed)*
2,2-Dichloropropane in ug/L														0.5				

Table 5-1 - RI Groundwater Screening Levels

GP West Site RI/FS 070188

	APPLICABLE GROUNDWATER CRITERIA																				
	Marine Surface Water Criteria						Protection of Marine Sediment					Tier 1 Vapor Intrusion Groundwater Screening Levels[d]		Applicable Practical Quantitation Level (PQL) for RI Analyses[e]	Most Stringent Groundwater Screening Level[f] (This value may vary by land use if most stringent value is based on vapor intrusion.)			
							Partitioning/Distribution Coefficients[b]		Marine Sediment Quality Standards									
	Surface Water ARAR - Aquatic Life - Marine - Ch. 173-201A WAC	Surface Water ARAR - Aquatic Life - Marine - Clean Water Act §304	Surface Water ARAR - Aquatic Life - Marine - National Toxics Rule, 40 CFR 131	Surface Water ARAR - Human Health – Marine – Clean Water Act §304	Surface Water ARAR - Human Health – Marine – National Toxics Rule, 40 CFR 131	Surface Water, Method B, Most Restrictive, Adjusted for Fish Consumption Rate[a]	Koc (Soil Organic Carbon-Water Partitioning Coefficient) (L/kg)	Kd (Distribution Coefficient for metals) - Sediment to Water Pathway (L/kg)	WAC 173-204 Marine SQS (mg/kg organic carbon)	WAC 173-204 Marine SQS (mg/kg dry weight)	Calculated Porewater Concentration Protective of Marine Sediment[c]	Method B, Unrestricted Land Use	Method C, Indistrial Land Use		Unrestricted Land Use		Industrial Land Use	
2-Butanone in ug/L												350000	760000	20	350000	(vi-b)	760000	(vi-c)
2-Chloroethyl Vinyl Ether in ug/L														5				
2-Chlorotoluene in ug/L														2				
2-Hexanone in ug/L														20				
4-Chlorotoluene in ug/L														2				
4-Methyl-2-pentanone in ug/L												11000	24000	20	11000	(vi-b)	24000	(vi-c)
Acetone in ug/L							0.58							20				
Acrolein in ug/L				9	780							2.9	6.4	20	20	(pql)	20	(pql)
Acrylonitrile in ug/L				0.25	0.66	ARAR						16	160	5	5	(pql)	5	(pql)
Benzene in ug/L				51	71	ARAR	62					2.4	24	0.5	2.4	(vi-b)	24	(vi-c)
Bromobenzene in ug/L														2				
Bromochloromethane in ug/L														0.5				
Bromodichloromethane in ug/L				17	22	ARAR	55					0.09	0.9	0.5	0.5	(pql)	0.9	(vi-c)
Bromoethane in ug/L																		
Bromoform in ug/L				140	360	ARAR	130					200	2000	0.5	140	(hh-cwa)	140	(hh-cwa)
Bromomethane in ug/L				1500	4000	400	9					13	28	0.5	13	(vi-b)	28	(vi-c)
Carbon disulfide in ug/L							46					400	870	0.5	400	(vi-b)	870	(vi-c)
Carbon tetrachloride in ug/L				1.6	4.4	ARAR	150					0.22	2.2	0.5	0.5	(pql)	1.6	(hh-cwa)
Chlorobenzene in ug/L				1600	21000	ARAR	220					100	220	0.5	100	(vi-b)	220	(vi-c)
Chloroethane in ug/L												12	120	0.5	12	(vi-b)	120	(vi-c)
Chloroform in ug/L				470	470	ARAR	53					1.2	12	0.5	1.2	(vi-b)	12	(vi-c)
Chloromethane in ug/L							6					5.2	52	0.5	5.2	(vi-b)	52	(vi-c)
cis-1,2-Dichloroethene (DCE) in ug/L							36					160	350	0.5	160	(vi-b)	350	(vi-c)
cis-1,3-Dichloropropene in ug/L														0.5				
Dibromochloromethane in ug/L				13	34	ARAR	63					0.22	2.2	0.5	0.5	(pql)	2.2	(vi-c)
Dibromomethane in ug/L														0.5				
Dichlorodifluoromethane in ug/L												9.9	22	0.5	9.9	(vi-b)	22	(vi-c)
Ethylbenzene in ug/L				2100	29000	ARAR	200					2800	6100	0.5	2100	(hh-cwa)	2100	(hh-cwa)
Hexachlorobutadiene in ug/L				18	50	ARAR	54000		3.9		0.072	0.81	8.1	0.2	0.2	(pql)	0.2	(pql)
Isopropylbenzene in ug/L												720	1600	2	720	(vi-b)	1600	(vi-c)
m,p-Xylenes in ug/L														0.5				
Methylene chloride in ug/L				590	1600	ARAR	10					94	940	2	94	(vi-b)	590	(hh-cwa)
Methyliodide in ug/L														5				
n-Butylbenzene in ug/L														2				
n-Propylbenzene in ug/L														2				
o-Xylene in ug/L							240					440	960	0.5	440	(vi-b)	960	(vi-c)
p-Isopropyltoluene in ug/L														2				
sec-Butylbenzene in ug/L														2				
Styrene in ug/L							910					78	780	0.5	78	(vi-b)	780	(vi-c)
tert-Butylbenzene in ug/L														2				
Tetrachloroethene (PCE) in ug/L				3.3	8.85	ARAR	270					23	95	0.5	3.3	(hh-cwa)	3.3	(hh-cwa)
Toluene in ug/L				15000	200000	7300	140					15000	33000	0.5	7300	(sw-b)	7300	(sw-b)
trans-1,2-Dichloroethene in ug/L				10000		ARAR	38					130	290	0.5	130	(vi-b)	290	(vi-c)
trans-1,3-Dichloropropene in ug/L														0.5				
Trichloroethene (TCE) in ug/L				30	81	ARAR	94					1.6	8.4	0.5	1.6	(vi-b)	8.4	(vi-c)
Trichlorofluoromethane in ug/L												120	260	0.5	120	(vi-b)	260	(vi-c)
Vinyl acetate in ug/L							5.3					7800	17000	5	7800	(vi-b)	17000	(vi-c)
Vinyl chloride in ug/L				2.4	525	ARAR	19					0.35	3.5	0.5	0.5	(pql)	2.4	(hh-cwa)
Xylenes (total) in ug/L							230											
Naphthalene in ug/L						1900	1200		99		83	170	360	0.2	83	(sed)	83	(sed)

Table 5-1 - RI Groundwater Screening Levels

GP West Site RI/FS 070188

	APPLICABLE GROUNDWATER CRITERIA																
	Marine Surface Water Criteria						Protection of Marine Sediment					Tier 1 Vapor Intrusion Groundwater Screening Levels[d]		Applicable Practical Quantitation Level (PQL) for RI Analyses[e]	Most Stringent Groundwater Screening Level[f] (This value may vary by land use if most stringent value is based on vapor intrusion.)	
							Partitioning/Distribution Coefficients[b]		Marine Sediment Quality Standards							
	Surface Water ARAR - Aquatic Life - Marine - Ch. 173-201A WAC	Surface Water ARAR - Aquatic Life - Marine - Clean Water Act §304	Surface Water ARAR - Aquatic Life - Marine - National Toxics Rule, 40 CFR 131	Surface Water ARAR - Human Health – Marine – Clean Water Act §304	Surface Water ARAR - Human Health – Marine – National Toxics Rule, 40 CFR 131	Surface Water, Method B, Most Restrictive, Adjusted for Fish Consumption Rate[a]	Koc (Soil Organic Carbon-Water Partitioning Coefficient) (L/kg)	Kd (Distribution Coefficient for metals) - Sediment to Water Pathway (L/kg)	WAC 173-204 Marine SQS (mg/kg organic carbon)	WAC 173-204 Marine SQS (mg/kg dry weight)	Calculated Porewater Concentration Protective of Marine Sediment[c]	Method B, Unrestricted Land Use	Method C, Indistrial Land Use		Unrestricted Land Use	Industrial Land Use
Polycyclic Aromatic Hydrocarbons (PAHs)																
Acenaphthene in ug/L				990		247	*4900*		16		3.3			0.02	3.3 *(sed)*	3.3 *(sed)*
Acenaphthylene in ug/L									66					0.02		
Anthracene in ug/L				40000	110000	10000	*23000*		220		9.6			0.02	9.6 *(sed)*	9.6 *(sed)*
Benzo(g,h,i)perylene in ug/L									31					0.02		
Fluoranthene in ug/L				140	370	35	*49000*		160		3.3			0.02	3.3 *(sed)*	3.3 *(sed)*
Fluorene in ug/L				5300	14000	1400	*7700*		23		3			0.02	3 *(sed)*	3 *(sed)*
Phenanthrene in ug/L									100					0.02		
Pyrene in ug/L				4000	11000	1000	*68000*		1000		15			0.02	15 *(sed)*	15 *(sed)*
1-Methylnaphthalene in ug/L														0.02		
2-Methylnaphthalene in ug/L									38					0.02		
Naphthalene in ug/L						1900	*1200*		99		83	170	360	0.02	83 *(sed)*	83 *(sed)*
Total Naphthalenes in ug/L																
Benz(a)anthracene in ug/L				0.018	0.031	ARAR	*360000*		110		0.31			0.02	0.02 *(pql)*	0.02 *(pql)*
Benzo(a)pyrene in ug/L				0.018	0.031	ARAR	*970000*		99		0.1			0.02	0.02 *(pql)*	0.02 *(pql)*
Benzo(b)fluoranthene in ug/L				0.018	0.031	ARAR	*1200000*							0.02	0.02 *(pql)*	0.02 *(pql)*
Benzo(k)fluoranthene in ug/L				0.018	0.031	ARAR	*1200000*							0.02	0.02 *(pql)*	0.02 *(pql)*
Chrysene in ug/L				0.018	0.031	ARAR	*400000*		110		0.28			0.02	0.02 *(pql)*	0.02 *(pql)*
Dibenzo(a,h)anthracene in ug/L				0.018	0.031	ARAR	*1800000*		12		0.007			0.02	0.02 *(pql)*	0.02 *(pql)*
Indeno(1,2,3-cd)pyrene in ug/L				0.018	0.031	ARAR	*3500000*		34		0.010			0.02	0.02 *(pql)*	0.02 *(pql)*
Total cPAHs TEQ in ug/L				0.018	0.031	ARAR	*970000*		99		0.100			0.02	0.02 *(pql)*	0.02 *(pql)*
Other Semi-Volatile Organics																
1,2,4-Trichlorobenzene in ug/L				70		0.77	*1700*		0.81		0.48	3900	8400	0.2	0.48 *(sed)*	0.48 *(sed)*
1,2-Dichlorobenzene in ug/L				1300	17000	ARAR	*380*		2.3		6.1	1800	4000	0.2	6.1 *(sed)*	6.1 *(sed)*
1,3-Dichlorobenzene in ug/L				960	2600									0.2	960 *(hh-cwa)*	960 *(hh-cwa)*
1,4-Dichlorobenzene in ug/L				190	2600		*620*		3.1		5	7900	17000	0.2	5 *(sed)*	5 *(sed)*
2,4,5-Trichlorophenol in ug/L				3600			*1600*							0.5	3600 *(hh-cwa)*	3600 *(hh-cwa)*
2,4,6-Trichlorophenol in ug/L				2.4	6.5	ARAR	*380*							0.5	2.4 *(hh-cwa)*	2.4 *(hh-cwa)*
2,4-Dichlorophenol in ug/L				290	790	73	*150*			0.029				0.5	73 *(sw-b)*	73 *(sw-b)*
2,4-Dimethylphenol in ug/L				850		200	*210*							4	200 *(sw-b)*	200 *(sw-b)*
2,4-Dinitrophenol in ug/L				5300	14000	1400	*0.01*							4	1400 *(sw-b)*	1400 *(sw-b)*
2-Chloronaphthalene in ug/L				1600		390								0.2	390 *(sw-b)*	390 *(sw-b)*
2-Chlorophenol in ug/L						37	*390*							0.5	37.41428571 *(sw-b)*	37.41429 *(sw-b)*
2-Methylphenol in ug/L							*91*			0.063				0.5		
2-Nitroaniline in ug/L														0.2		
2-Nitrophenol in ug/L														0.5		
3,3'-Dichlorobenzidine in ug/L				0.028	0.077	ARAR	*720*							2	2 *(pql)*	2 *(pql)*
3-Nitroaniline in ug/L														1		
4,6-Dinitro-2-methylphenol in ug/L														2		
4-Bromophenyl phenyl ether in ug/L														0.2		
4-Chloro-3-methylphenol in ug/L														0.5		
4-Chloroaniline in ug/L							*66*							0.2		
4-Chlorophenyl phenyl ether in ug/L														0.2		
4-Methylphenol in ug/L										0.67				0.5		
4-Nitroaniline in ug/L														1		
4-Nitrophenol in ug/L														2		
Benzoic acid in ug/L							*0.6*			0.65				5		
Benzyl alcohol in ug/L										0.057				5		
Benzyl butyl phthalate in ug/L				1900		3.2	*14000*		4.9		0.35			0.2	0.35 *(sed)*	0.35 *(sed)*
Bis(2-chloro-1-methylethyl) ether in ug/L						14									14.27142857 *(sw-b)*	14.27143 *(sw-b)*
Bis(2-chloroethoxy)methane in ug/L														0.2		
Bis(2-chloroethyl) ether in ug/L				0.53	1.4	ARAR	*76*					26	260	0.2	0.53 *(hh-cwa)*	0.53 *(hh-cwa)*
Bis(2-ethylhexyl) phthalate in ug/L				2.2	5.9	ARAR	*110000*		47		0.43			1	1 *(pql)*	1 *(pql)*
Carbazole in ug/L							*3400*							0.2		
Dibenzofuran in ug/L									15					0.2		

Table 5-1 - RI Groundwater Screening Levels

GP West Site RI/FS 070188

	APPLICABLE GROUNDWATER CRITERIA													Applicable Practical Quantitation Level (PQL) for RI Analyses[e]	Most Stringent Groundwater Screening Level[f] (This value may vary by land use if most stringent value is based on vapor intrusion.)			
	Marine Surface Water Criteria						Protection of Marine Sediment					Tier 1 Vapor Intrusion Groundwater Screening Levels[d]						
							Partitioning/Distribution Coefficients[b]		Marine Sediment Quality Standards									
	Surface Water ARAR - Aquatic Life - Marine - Ch. 173-201A WAC	Surface Water ARAR - Aquatic Life - Marine - Clean Water Act §304	Surface Water ARAR - Aquatic Life - Marine - National Toxics Rule, 40 CFR 131	Surface Water ARAR - Human Health – Marine – Clean Water Act §304	Surface Water ARAR - Human Health – Marine – National Toxics Rule, 40 CFR 131	Surface Water, Method B, Most Restrictive, Adjusted for Fish Consumption Rate[a]	Koc (Soil Organic Carbon-Water Partitioning Coefficient) (L/kg)	Kd (Distribution Coefficient for metals) - Sediment to Water Pathway (L/kg)	WAC 173-204-320 Marine SQS (mg/kg organic carbon)	WAC 173-204-320 Marine SQS (mg/kg dry weight)	Calculated Porewater Concentration Protective of Marine Sediment[c]	Method B, Unrestricted Land Use	Method C, Indistrial Land Use		Unrestricted Land Use		Industrial Land Use	
Diethyl phthalate in ug/L				44000	120000	10800	*82*		61		740			0.2	740	*(sed)*	740	*(sed)*
Dimethyl phthalate in ug/L				1100000	2900000				53					0.2	1100000	*(hh-cwa)*	1100000	*(hh-cwa)*
Di-n-butyl phthalate in ug/L				4500	12000	1120	*1600*		220		140			0.2	140	*(sed)*	140	*(sed)*
Di-n-octyl phthalate in ug/L							*83000000*		58		0.0007			0.2	0.2	*(pql)*	0.2	*(pql)*
Hexachlorobenzene in ug/L				0.00029	0.00077	ARAR	*80000*		0.38		0.0048			0.2	0.2	*(pql)*	0.2	*(pql)*
Hexachlorobutadiene in ug/L				18	50	ARAR	*54000*		3.9		0.072	0.81	8.1	0.2	0.2	*(pql)*	0.2	*(pql)*
Hexachlorocyclopentadiene in ug/L				1100	17000	ARAR	*200000*							1	1100	*(hh-cwa)*	1100	*(hh-cwa)*
Hexachloroethane in ug/L				3.3	8.9	ARAR	*1800*					8.6	86	0.2	3.3	*(hh-cwa)*	3.3	*(hh-cwa)*
Isophorone in ug/L				960	600	ARAR	*47*							0.2	600	*(hh-ntr)*	600	*(hh-ntr)*
Nitrobenzene in ug/L				690	1900	690	*120*					690	1500	0.2	690	*(hh-cwa)*	690	*(hh-cwa)*
N-Nitroso-di-n-propylamine in ug/L				0.51		0.32	*24*							0.2	0.316285714	*(sw-b)*	0.316286	*(sw-b)*
N-Nitrosodiphenylamine in ug/L				6	16	3.7	*1300*		11		8.5			0.2	3.7	*(sw-b)*	3.7	*(sw-b)*
Pentachlorophenol in ug/L	7.9	7.9	7.9	3	8.2	ARAR	*590*			0.36				1	3	*(hh-cwa)*	3	*(hh-cwa)*
Phenol in ug/L				860000	4600000	216000	*29*			0.42				0.5	216000	*(sw-b)*	216000	*(sw-b)*
2,4-Dinitrotoluene in ug/L				3.4	9.1	ARAR	*96*							0.2	3.4	*(hh-cwa)*	3.4	*(hh-cwa)*
2,6-Dinitrotoluene in ug/L							*69*							0.2				
Polychlorinated Biphenyls (PCBs)																		
Aroclor 1016 in ug/L			0.03			0.00116	*110000*							0.1	0.1	*(pql)*	0.1	*(pql)*
Aroclor 1221 in ug/L														0.1				
Aroclor 1232 in ug/L														0.1				
Aroclor 1242 in ug/L														0.1				
Aroclor 1248 in ug/L														0.1				
Aroclor 1254 in ug/L			0.03			0.00004								0.1	0.1	*(pql)*	0.1	*(pql)*
Aroclor 1260 in ug/L			0.03				*820000*							0.1	0.1	*(pql)*	0.1	*(pql)*
Aroclor 1262 in ug/L														0.1				
Aroclor 1268 in ug/L														0.1				
Total PCBs in ug/L	0.03	0.03	0.03	0.000064	0.00017	ARAR	*310000*		12		0.039			0.1	0.1	*(pql)*	0.1	*(pql)*
Field Parameters																		
pH in pH units	<7.0 or >8.5														<6.2‡ or >8.5	*see note*		

Notes:

a) In accordance with WAC 173-340-730(3)(b)(iii), if sufficiently protective human-health-based criteria or standards (ARARs) have not been established under applicable state and federal laws, Method B surface water values are developed. Method B values are most restrictive of carcinogenic or non-carcinogenic values from CLARC database, but adjusted downward assuming a higher fish consumption rate than the MTCA default, consistent with assumptions applied in the Whatcom Waterway cleanup (refer to Section 5.2.1). If the minimum ARAR value is sufficiently protective (@ risk = 10-5, HQ=1), the ARAR is the Method B value, as displayed.

b) Values from Ecology's CLARC Database downloaded May 2012; except as noted. PCE and TCE values updated September 2012.

c) Calculated assuming equilibrium partitioning: Cw (porewater) = Sediment Quality Standard (SQS; WAC 173-204-320) / Kd.

d) From Table B-1 (Appendix B) of Ecology's Guidance for Evaluation of Soil Vapor Intrusion (Ecology, 2009).

e) From Columbia Analytical Services, Inc. (Kelso, WA) published method reporting limits.

f) Most stringent of values protective of marine surface water, sediment, and vapor intrusion.

g) 0.025 ug/L value was derived for methylmercury (EPA, 1985), and is not applicable for inorganic mercury present at the Site; refer to Section 5.2.1.

h) Formaldehyde value based on protection of aquatic life (Anchor Environmental, 2008b; included as Appendix A to the RI/FS Work Plan [Aspect, 2009a]).

i) Based on background concentrations in Washington state (WAC 173-340-900 Table 720-1).

r

* Site-specific value from Aspect and Anchor QEA (2011b). Refer to Section 5.2.1.

‡ pH 6.2 is the lower-end of natural background groundwater pH range, calculated from Whatcom County background data, in accordance with WAC 173-340-709(3) (refer to Section 5.2.1 text).

Table 5-2 - RI Unrestricted Land Use Soil Screening Levels

GP West Site RI/FS 070188

ANALYTE (BY GROUP)	Most Stringent Unrestricted Land Use Groundwater Screening Level (ug/L) [See Table 5-1]	APPLICABLE SOIL CRITERIA: Groundwater Protection: Constants and Coefficients [a]: Koc (Soil Organic Carbon-Water Partitioning Coefficient) (L/kg)	Kd (Distribution Coefficient for metals) (L/kg)	Henrys Law Constant (unitless) (Hcc)	Groundwater Protection: Calculated Values: **Unsaturated Soil** Concentration Protective of Leachability to Groundwater for **Unrestricted** Land Use (mg/kg)[b] (gwl-u)	**Saturated Soil** Concentration Protective of Leachability to Groundwater for **Unrestricted** Land Use (mg/kg)[c] (gwl-s)	Direct Contact [d]: Soil, Method A, Unrestricted Land Use, Table Value (mg/kg)[e] (mA)	Soil, Method B, Most-Restrictive Standard Formula Value, Direct Contact (ingestion only), unrestricted land use (mg/kg)[f] (mB)	**Natural Background Concentrations (Ecology, 1994b) (mg/kg)** (back)	**Applicable Practical Quantitation Level (PQL) for RI Analyses (mg/kg)[g]** (pql)	*Most Stringent Unrestricted Soil Screening Level (mg/kg)* [h]: **Unsaturated Soil**		**Saturated Soil**	
Total Petroleum Hydrocarbons [i]														
Gasoline Range Hydrocarbons										5				
Diesel Range Hydrocarbons							2000			25	2000	*(mA)*	2000	*(mA)*
Oil Range Hydrocarbons							2000			100	2000	*(mA)*	2000	*(mA)*
Bunker C							2000				2000	*(mA)*	2000	*(mA)*
Total TPHs							2000				2000	*(mA)*	2000	*(mA)*
Heavy Metals														
Arsenic	5		*29*	*0*	2.9	0.15	20	0.67	7	0.5	7	*(back)*	7	*(back)*
Cadmium	8.8		*6.7*	*0*	1.2	0.061		80	1	0.02	1.2	*(gwl-u)*	1	*(back)*
Chromium (Total)	260		*1000*	*0*	5200	260				0.2	5200	*(gwl-u)*	260	*(gwl-s)*
Chromium (VI)	50		*19*	*0*	19	0.96		240	48		48	*(back)*	48	*(back)*
Copper	3.1		*22*	*0*	1.4	0.069		3200	36	0.1	36	*(back)*	36	*(back)*
Lead	8.1		*10000*	*0*	1600	81	250		17	0.05	250	*(mA)*	81	*(gwl-s)*
Mercury	0.06		*1700* *	*0.47*	2	0.1		24	0.07	0.001	2	*(gwl-u)*	0.1	*(gwl-s)*
Nickel	8.2		*65*	*0*	11	0.54		1600	48	0.2	48	*(back)*	48	*(back)*
Selenium	71		*5*	*0*	7.4	0.38		400		1	7.4	*(gwl-u)*	1	*(pql)*
Silver	1.9		*8.3*	*0*	0.32	0.016		400		0.02	0.32	*(gwl-u)*	0.02	*(pql)*
Zinc	81		*62*	*0*	100	5		24000	85	0.5	100	*(gwl-u)*	85	*(back)*
Mercury Speciation														
Mercury (elemental)	0.89													
Methylmercury	0.025							8			8	*(mB)*	8	*(mB)*
Conventionals and Other Metals														
Formaldehyde	1600							16000			16000	*(mB)*	16000	*(mB)*
pH	<6.2 or >8.5										<2.5 or >11.0 ‡	*see note*	<2.5 or >11.0 ‡	*see note*
Manganese	0.1			*0*				11000	1200	0.05	11000	*(mB)*	11000	*(mB)*
Volatile Organic Compounds														
1,1,1,2-Tetrachloroethane	7.4							38		0.005	38	*(mB)*	38	*(mB)*
1,1,1-Trichloroethane	11000	*140*		*0.71*	550	28		160000		0.005	550	*(gwl-u)*	28	*(gwl-s)*
1,1,2 - Trichlorotrifluoroethane	1100							2400000		0.005	2400000	*(mB)*	2400000	*(mB)*
1,1,2,2-Tetrachloroethane	4.0	*79*		*0.014*	0.12	0.0062		5		0.005	0.12	*(gwl-u)*	0.0062	*(gwl-s)*
1,1,2-Trichloroethane	7.9	*75*		*0.037*	0.22	0.012		18		0.005	0.22	*(gwl-u)*	0.012	*(gwl-s)*
1,1-Dichloroethane	2300	*53*		*0.23*	49	2.6		16000		0.005	49	*(gwl-u)*	2.6	*(gwl-s)*
1,1-Dichloroethene	3.2	*65*		*1.1*	0.085	0.0042		4000		0.005	0.085	*(gwl-u)*	0.005	*(pql)*
1,1-Dichloropropene										0.005				
1,2,3-Trichlorobenzene										0.02				
1,2,3-Trichloropropane								0.033		0.005	0.033	*(mB)*	0.033	*(mB)*
1,2,4-Trichlorobenzene	0.48	*1700*		*0.058*	0.26	0.013		35		0.01	0.26	*(gwl-u)*	0.013	*(gwl-s)*
1,2,4-Trimethylbenzene	24									0.02				
1,2-Dibromo-3-chloropropane								1.3		0.02	1.3	*(mB)*	1.3	*(mB)*
1,2-Dibromoethane (EDB)	2	*66*			0.05	0.0027		0.5		0.02	0.05	*(gwl-u)*	0.02	*(pql)*
1,2-Dichlorobenzene	6.1	*380*		*0.078*	0.77	0.039		7200		0.005	0.77	*(gwl-u)*	0.039	*(gwl-s)*
1,2-Dichloroethane (EDC)	4.2	*38*		*0.04*	0.068	0.0038		11		0.005	0.068	*(gwl-u)*	0.005	*(pql)*
1,2-Dichloropropane	15	*47*		*0.12*	0.29	0.016				0.005	0.29	*(gwl-u)*	0.016	*(gwl-s)*
1,3,5-Trimethylbenzene	25							800		0.02	800	*(mB)*	800	*(mB)*
1,3-Dichlorobenzene	960									0.005				
1,3-Dichloropropane										0.005				
1,4-Dichloro-2-Butene										0.02				
1,4-Dichlorobenzene	5	*620*		*0.1*	1	0.051				0.005	1	*(gwl-u)*	0.051	*(gwl-s)*
2,2-Dichloropropane										0.005				
2-Butanone	350000							48000		0.02	48000	*(mB)*	48000	*(mB)*
2-Chloroethyl Vinyl Ether										0.01				
2-Chlorotoluene								1600		0.02	1600	*(mB)*	1600	*(mB)*

Table 5-2 - RI Unrestricted Land Use Soil Screening Levels

GP West Site RI/FS 070188

ANALYTE (BY GROUP)	Most Stringent Unrestricted Land Use Groundwater Screening Level (ug/L) [See Table 5-1]	APPLICABLE SOIL CRITERIA: Groundwater Protection: Constants and Coefficients [a]: Koc (Soil Organic Carbon-Water Partitioning Coefficient) (L/kg)	Kd (Distribution Coefficient for metals) (L/kg)	Henrys Law Constant (unitless) (Hcc)	Groundwater Protection: Calculated Values: **Unsaturated Soil** Concentration Protective of Leachability to Groundwater for **Unrestricted** Land Use (mg/kg)[b] (gwl-u)	**Saturated Soil** Concentration Protective of Leachability to Groundwater for **Unrestricted** Land Use (mg/kg)[c] (gwl-s)	Direct Contact [d]: Soil, Method A, Unrestricted Land Use, Table Value (mg/kg)[e] (mA)	Soil, Method B, Most-Restrictive Standard Formula Value, Direct Contact (ingestion only), unrestricted land use (mg/kg)[f] (mB)	**Natural Background Concentrations (Ecology, 1994b) (mg/kg)** (back)	**Applicable Practical Quantitation Level (PQL) for RI Analyses (mg/kg)[g]** (pql)	*Most Stringent Unrestricted Soil Screening Level (mg/kg)* [h]: **Unsaturated Soil**		**Saturated Soil**	
2-Hexanone										0.02				
4-Chlorotoluene										0.02				
4-Methyl-2-pentanone	11000							6400		0.02	6400	(mB)	6400	(mB)
Acetone		0.58		0.0016				72000		0.02	72000	(mB)	72000	(mB)
Acrolein	20							40		0.1	40	(mB)	40	(mB)
Acrylonitrile	5							1.9		0.02	1.9	(mB)	1.9	(mB)
Benzene	2.4	62		0.23	0.058	0.0031		18		0.005	0.058	(gwl-u)	0.005	(pql)
Bromobenzene										0.005				
Bromochloromethane										0.005				
Bromodichloromethane	0.5	55		0.066	0.011	0.00058		16		0.005	0.011	(gwl-u)	0.005	(pql)
Bromoethane														
Bromoform	140	130		0.022	6.4	0.33		130		0.005	6.4	(gwl-u)	0.33	(gwl-s)
Bromomethane	13	9		0.26	0.095	0.0056		110		0.005	0.095	(gwl-u)	0.0056	(gwl-s)
Carbon disulfide	400	46		1.2	8.3	0.41		8000		0.005	8.3	(gwl-u)	0.41	(gwl-s)
Carbon tetrachloride	0.5	150		1.3	0.027	0.0013		14		0.005	0.027	(gwl-u)	0.005	(pql)
Chlorobenzene	100	220		0.15	7.5	0.38		1600		0.005	7.5	(gwl-u)	0.38	(gwl-s)
Chloroethane	12									0.005				
Chloroform	1.2	53		0.15	0.025	0.0014		800		0.005	0.025	(gwl-u)	0.005	(pql)
Chloromethane	5.2	6			0.031	0.002				0.005	0.031	(gwl-u)	0.005	(pql)
cis-1,2-Dichloroethene (DCE)	160	36		0.17	2.5	0.14		160		0.005	2.5	(gwl-u)	0.14	(gwl-s)
cis-1,3-Dichloropropene										0.005				
Dibromochloromethane	0.5	63		0.032	0.012	0.00065		12		0.005	0.012	(gwl-u)	0.005	(pql)
Dibromomethane								800		0.005	800	(mB)	800	(mB)
Dichlorodifluoromethane	9.9							16000		0.005	16000	(mB)	16000	(mB)
Ethylbenzene	2100	200		0.32	140	7.3		8000		0.005	140	(gwl-u)	7.3	(gwl-s)
Hexachlorobutadiene	0.2	54000		0.33	3.5	0.17		13		0.01	3.5	(gwl-u)	0.17	(gwl-s)
Isopropylbenzene	720							8000		0.02	8000	(mB)	8000	(mB)
m,p-Xylenes										0.005				
Methylene chloride	94	10		0.09	0.69	0.042		130		0.01	0.69	(gwl-u)	0.042	(gwl-s)
Methyliodide										0.5				
n-Butylbenzene										0.02				
n-Propylbenzene								8000		0.02	8000	(mB)	8000	(mB)
o-Xylene	440	240		0.21	36	1.8		16000		0.005	36	(gwl-u)	1.8	(gwl-s)
p-Isopropyltoluene										0.02				
sec-Butylbenzene										0.02				
Styrene	78	910		0.11	23	1.2		16000		0.005	23	(gwl-u)	1.2	(gwl-s)
tert-Butylbenzene										0.02				
Tetrachloroethene (PCE)	3.3	270		0.75	0.3	0.015		480		0.005	0.3	(gwl-u)	0.015	(gwl-s)
Toluene	7300	140		0.27	360	18		6400		0.005	360	(gwl-u)	18	(gwl-s)
trans-1,2-Dichloroethene	130	38		0.39	2.2	0.12		1600		0.005	2.2	(gwl-u)	0.12	(gwl-s)
trans-1,3-Dichloropropene										0.005				
Trichloroethene (TCE)	1.6	94		0.42	0.056	0.0029		120		0.005	0.056	(gwl-u)	0.005	(pql)
Trichlorofluoromethane	120							24000		0.005	24000	(mB)	24000	(mB)
Vinyl acetate	7800	5.3		0.021	45	2.9		80000		0.02	45	(gwl-u)	2.9	(gwl-s)
Vinyl chloride	0.5	19		1.1	0.006	0.0003		0.67		0.005	0.006	(gwl-u)	0.005	(pql)
Xylenes (total)		230		0.28				16000			16000	(mB)	16000	(mB)
Naphthalene	83	1200		0.02	32	1.6		1600		0.001	32	(gwl-u)	1.6	(gwl-s)

Table 5-2 - RI Unrestricted Land Use Soil Screening Levels

GP West Site RI/FS 070188

ANALYTE (BY GROUP)	Most Stringent Unrestricted Land Use Groundwater Screening Level (ug/L) [See Table 5-1]	APPLICABLE SOIL CRITERIA: Groundwater Protection: Constants and Coefficients [a]: Koc (Soil Organic Carbon-Water Partitioning Coefficient) (L/kg)	Kd (Distribution Coefficient for metals) (L/kg)	Henrys Law Constant (unitless) (Hcc)	Groundwater Protection: Calculated Values: **Unsaturated Soil** Concentration Protective of Leachability to Groundwater for **Unrestricted** Land Use (mg/kg)[b] (gwl-u)	**Saturated Soil** Concentration Protective of Leachability to Groundwater for **Unrestricted** Land Use (mg/kg)[c] (gwl-s)	Direct Contact [d]: Soil, Method A, Unrestricted Land Use, Table Value (mg/kg)[e] (mA)	Soil, Method B, Most-Restrictive Standard Formula Value, Direct Contact (ingestion only), unrestricted land use (mg/kg)[f] (mB)	**Natural Background Concentrations (Ecology, 1994b) (mg/kg)** (back)	**Applicable Practical Quantitation Level (PQL) for RI Analyses (mg/kg)[g]** (pql)	*Most Stringent Unrestricted Soil Screening Level (mg/kg)* [h]: **Unsaturated Soil**		**Saturated Soil**	
Polycyclic Aromatic Hydrocarbons (PAHs)														
Acenaphthene	3.3	*4900*		*0.0064*	5.2	0.26		4800		0.0005	5.2	*(gwl-u)*	0.26	*(gwl-s)*
Acenaphthylene										0.0005				
Anthracene	9.6	*23000*		*0.0027*	71	3.5		24000		0.0005	71	*(gwl-u)*	3.5	*(gwl-s)*
Benzo(g,h,i)perylene										0.0005				
Fluoranthene	3.3	*49000*		*0.00066*	52	2.6		3200		0.0005	52	*(gwl-u)*	2.6	*(gwl-s)*
Fluorene	3	*7700*		*0.0026*	7.4	0.37		3200		0.0005	7.4	*(gwl-u)*	0.37	*(gwl-s)*
Phenanthrene										0.0005				
Pyrene	15	*68000*		*0.00045*	330	16		2400		0.0005	330	*(gwl-u)*	16	*(gwl-s)*
1-Methylnaphthalene								35		0.001	35	*(mB)*	35	*(mB)*
2-Methylnaphthalene								320		0.001	320	*(mB)*	320	*(mB)*
Naphthalene	83	*1200*		*0.02*	32	1.6		1600		0.001	32	*(gwl-u)*	1.6	*(gwl-s)*
Total Naphthalenes														
Benz(a)anthracene	0.02	*360000*		*0.00014*	2.3	0.12		1.4		0.0005	1.4	*(mB)*	0.12	*(gwl-s)*
Benzo(a)pyrene	0.02	*970000*		*0.000046*	6.2	0.31		0.14		0.0005	0.14	*(mB)*	0.14	*(mB)*
Benzo(b)fluoranthene	0.02	*1200000*		*0.0046*	7.7	0.38		1.4		0.0005	1.4	*(mB)*	0.38	*(gwl-s)*
Benzo(k)fluoranthene	0.02	*1200000*		*0.000034*	7.7	0.38		14		0.0005	7.7	*(gwl-u)*	0.38	*(gwl-s)*
Chrysene	0.02	*400000*		*0.0039*	2.6	0.13		140		0.0005	2.6	*(gwl-u)*	0.13	*(gwl-s)*
Dibenzo(a,h)anthracene	0.02	*1800000*		*0.0000006*	12	0.58		0.14		0.0005	0.14	*(mB)*	0.14	*(mB)*
Indeno(1,2,3-cd)pyrene	0.02	*3500000*		*0.000066*	22	1.1		1.4		0.0005	1.4	*(mB)*	1.1	*(gwl-s)*
Total cPAHs TEQ	0.02	*970000*		*0.000046*	6.2	0.31		0.14		0.00076	0.14	*(mB)*	0.14	*(mB)*
Other Semi-Volatile Organics														
1,2,4-Trichlorobenzene	0.48	*1700*		*0.058*	0.26	0.013		35		0.01	0.26	*(gwl-u)*	0.013	*(gwl-s)*
1,2-Dichlorobenzene	6.1	*380*		*0.078*	0.77	0.039		7200		0.005	0.77	*(gwl-u)*	0.039	*(gwl-s)*
1,3-Dichlorobenzene	960									0.005				
1,4-Dichlorobenzene	5	*620*		*0.1*	1	0.051				0.005	1	*(gwl-u)*	0.051	*(gwl-s)*
2,4,5-Trichlorophenol	3600	*1600*		*0.00018*	1900	93		8000		0.01	1900	*(gwl-u)*	93	*(gwl-s)*
2,4,6-Trichlorophenol	2.4	*380*		*0.00032*	0.3	0.015		80		0.01	0.3	*(gwl-u)*	0.015	*(gwl-s)*
2,4-Dichlorophenol	73	*150*		*0.00013*	3.8	0.2		240		0.01	3.8	*(gwl-u)*	0.2	*(gwl-s)*
2,4-Dimethylphenol	200	*210*		*0.000082*	14	0.73		1600		0.05	14	*(gwl-u)*	0.73	*(gwl-s)*
2,4-Dinitrophenol	1400	*0.01*		*0.000018*	5.6	0.4		160		0.2	5.6	*(gwl-u)*	0.4	*(gwl-s)*
2-Chloronaphthalene	390							6400		0.01	6400	*(mB)*	6400	*(mB)*
2-Chlorophenol	37	*390*		*0.016*	4.8	0.24		400		0.01	4.8	*(gwl-u)*	0.24	*(gwl-s)*
2-Methylphenol		*91*		*0.000049*				4000		0.01	4000	*(mB)*	4000	*(mB)*
2-Nitroaniline								800		0.02	800	*(mB)*	800	*(mB)*
2-Nitrophenol										0.01				
3,3'-Dichlorobenzidine	2	*720*		*0.00000016*	0.47	0.024		2.2		0.1	0.47	*(gwl-u)*	0.1	*(pql)*
3-Nitroaniline										0.02				
4,6-Dinitro-2-methylphenol										0.1				
4-Bromophenyl phenyl ether										0.01				
4-Chloro-3-methylphenol										0.01				
4-Chloroaniline		*66*		*0.000014*				5		0.01	5	*(mB)*	5	*(mB)*
4-Chlorophenyl phenyl ether										0.01				
4-Methylphenol								400		0.01	400	*(mB)*	400	*(mB)*
4-Nitroaniline										0.02				
4-Nitrophenol										0.1				
Benzoic acid		*0.6*		*0.000063*				320000		0.2	320000	*(mB)*	320000	*(mB)*
Benzyl alcohol								8000		0.02	8000	*(mB)*	8000	*(mB)*
Benzyl butyl phthalate	0.35	*14000*		*0.000052*	1.6	0.079		530		0.01	1.6	*(gwl-u)*	0.079	*(gwl-s)*
Bis(2-chloro-1-methylethyl) ether	14							14			14	*(mB)*	14	*(mB)*
Bis(2-chloroethoxy)methane										0.01				
Bis(2-chloroethyl) ether	0.53	*76*		*0.00074*	0.015	0.0008		0.91		0.01	0.015	*(gwl-u)*	0.01	*(pql)*

Table 5-2 - RI Unrestricted Land Use Soil Screening Levels

GP West Site RI/FS 070188

ANALYTE (BY GROUP)	Most Stringent Unrestricted Land Use Groundwater Screening Level (ug/L) [See Table 5-1]	APPLICABLE SOIL CRITERIA: Groundwater Protection: Constants and Coefficients [a]: Koc (Soil Organic Carbon-Water Partitioning Coefficient) (L/kg)	Kd (Distribution Coefficient for metals) (L/kg)	Henrys Law Constant (unitless) (Hcc)	Groundwater Protection: Calculated Values: Unsaturated Soil Concentration Protective of Leachability to Groundwater for **Unrestricted** Land Use (mg/kg)[b] (gwl-u)	Saturated Soil Concentration Protective of Leachability to Groundwater for **Unrestricted** Land Use (mg/kg)[c] (gwl-s)	Direct Contact [d]: Soil, Method A, Unrestricted Land Use, Table Value (mg/kg)[e] (mA)	Soil, Method B, Most-Restrictive Standard Formula Value, Direct Contact (ingestion only), unrestricted land use (mg/kg)[f] (mB)	Natural Background Concentrations (Ecology, 1994b) (mg/kg) (back)	Applicable Practical Quantitation Level (PQL) for RI Analyses (mg/kg)[g] (pql)	Most Stringent Unrestricted Soil Screening Level (mg/kg)[h]: Unsaturated Soil	Saturated Soil
Bis(2-ethylhexyl) phthalate	1.0	110000		0.0000042	35	1.8		71		0.1	35 (gwl-u)	1.8 (gwl-s)
Carbazole		3400		0.00000063						0.0005		
Dibenzofuran								80		0.0005	80 (mB)	80 (mB)
Diethyl phthalate	740	82		0.000019	22	1.2		64000		0.01	22 (gwl-u)	1.2 (gwl-s)
Dimethyl phthalate	1100000									0.01		
Di-n-butyl phthalate	140	1600		3.9E-08	72	3.6		8000		0.02	72 (gwl-u)	3.6 (gwl-s)
Di-n-octyl phthalate	0.20	83000000		0.0027	5300	270				0.01	5300 (gwl-u)	270 (gwl-s)
Hexachlorobenzene	0.20	80000		0.054	5.1	0.26		0.63		0.01	0.63 (mB)	0.26 (gwl-s)
Hexachlorobutadiene	0.20	54000		0.33	3.5	0.17		13		0.01	3.5 (gwl-u)	0.17 (gwl-s)
Hexachlorocyclopentadiene	1100	200000		1.1	70000	3500		480		0.05	480 (mB)	480 (mB)
Hexachloroethane	3	1800		0.16	1.9	0.096		71		0.01	1.9 (gwl-u)	0.096 (gwl-s)
Isophorone	600	47		0.00027	11	0.62		1100		0.01	11 (gwl-u)	0.62 (gwl-s)
Nitrobenzene	690	120		0.00098	29	1.5		160		0.01	29 (gwl-u)	1.5 (gwl-s)
N-Nitroso-di-n-propylamine	0.32	24		0.000092	0.0037	0.00021		0.14		0.01	0.01 (pql)	0.01 (pql)
N-Nitrosodiphenylamine	3.7	1300		0.00021	1.6	0.079		200		0.01	1.6 (gwl-u)	0.079 (gwl-s)
Pentachlorophenol	3	590		0.000001	0.58	0.029		2.5		0.1	0.58 (gwl-u)	0.1 (pql)
Phenol	216000	29		0.000016	2900	160		24000		0.03	2900 (gwl-u)	160 (gwl-s)
2,4-Dinitrotoluene	3.4	96		0.0000038	0.12	0.0062		160		0.01	0.12 (gwl-u)	0.01 (pql)
2,6-Dinitrotoluene		69		0.000031				80		0.01	80 (mB)	80 (mB)
Polychlorinated Biphenyls (PCBs)												
Aroclor 1016	0.1	110000			3.5	0.18		5.6		0.01		
Aroclor 1221										0.02		
Aroclor 1232										0.01		
Aroclor 1242										0.01		
Aroclor 1248										0.01		
Aroclor 1254	0.1							0.5		0.01		
Aroclor 1260	0.1	820000			26	1.3		0.5		0.01		
Aroclor 1262										0.01		
Aroclor 1268										0.01		
Total PCBs	0.1	31000			0.99	0.05	1	0.5		0.05	1 (mA)	1 (mA)

Table 5-2 - RI Unrestricted Land Use Soil Screening Levels

GP West Site RI/FS 070188

ANALYTE (BY GROUP)	Most Stringent Unrestricted Land Use Groundwater Screening Level (ug/L) [See Table 5-1]	APPLICABLE SOIL CRITERIA: Groundwater Protection: Constants and Coefficients [a]: Koc (Soil Organic Carbon-Water Partitioning Coefficient) (L/kg)	Kd (Distribution Coefficient for metals) (L/kg)	Henrys Law Constant (unitless) (Hcc)	Groundwater Protection: Calculated Values: **Unsaturated Soil** Concentration Protective of Leachability to Groundwater for **Unrestricted** Land Use (mg/kg)[b] (gwl-u)	**Saturated Soil** Concentration Protective of Leachability to Groundwater for **Unrestricted** Land Use (mg/kg)[c] (gwl-s)	Direct Contact [d]: Soil, Method A, Unrestricted Land Use, Table Value (mg/kg)[e] (mA)	Soil, Method B, Most-Restrictive Standard Formula Value, Direct Contact (ingestion only), unrestricted land use (mg/kg)[f] (mB)	**Natural Background Concentrations (Ecology, 1994b) (mg/kg)** (back)	**Applicable Practical Quantitation Level (PQL) for RI Analyses (mg/kg)[g]** (pql)	*Most Stringent Unrestricted Soil Screening Level (mg/kg)* [h]: **Unsaturated Soil**	**Saturated Soil**
Dioxins/Furans												
2,3,7,8-TCDD	1.00E-05	*24500000*		*0.00416*	7.8E-02	3.9E-03		1.1E-05		1.0E-06	1.1E-05 *(mB)*	1.1E-05 *(mB)*
1,2,3,7,8-PeCDD										2.5E-06		
1,2,3,4,7,8-HxCDD										2.5E-06		
1,2,3,6,7,8-HxCDD										2.5E-06		
1,2,3,7,8,9-HxCDD								1.6E-04		2.5E-06	1.6E-04 *(mB)*	1.6E-04 *(mB)*
1,2,3,4,6,7,8-HpCDD										2.5E-06		
OCDD										5.0E-06		
2,3,7,8-TCDF										1.0E-06		
1,2,3,7,8-PeCDF										2.5E-06		
2,3,4,7,8-PeCDF										2.5E-06		
1,2,3,4,7,8-HxCDF										2.5E-06		
1,2,3,6,7,8-HxCDF										2.5E-06		
1,2,3,7,8,9-HxCDF										2.5E-06		
2,3,4,6,7,8-HxCDF										2.5E-06		
1,2,3,4,6,7,8-HpCDF										2.5E-06		
1,2,3,4,7,8,9-HpCDF										2.5E-06		
OCDF										5.0E-06		
Total 2,3,7,8 TCDD (TEQ)	1.00E-05	*24500000*		*0.00416*	7.8E-02	3.9E-03		1.1E-05		6.25E-06	0.000011 *(mB)*	0.000011 *(mB)*

Notes:

a) Values from Ecology's CLARC Database downloaded May 2012; except as noted. PCE and TCE values updated September 2012.

b) Calculated values from 3-phase model, per MTCA Equation 747-1, with groundwater value (Cw) as most stringent unrestricted groundwater screening level (Table 5-1), Dilution Factor = 20, and site-specific foc = 0.016.

c) Calculated values from 3-phase model, per MTCA Equation 747-1, with groundwater value (Cw) as most stringent unrestricted groundwater screening level (Table 5-1), Dilution Factor = 1, and site-specific foc = 0.016.

d) Direct contact criteria applicable for soils to 15-foot depth.

e) Because Site groundwater is not potable, many Method A soil cleanup levels are not applicable. Method A unrestricted cleanup levels used only if they are based on background or ARARs, or there are no corresponding Method B direct contact values, or they are based on generation of separate-phase petroleum. Soil leachability to groundwater is addressed separately.

f) Method B values are most restrictive of carcinogenic or non-carcinogenic values presented in Ecology's CLARC database.

g) From Columbia Analytical Services, Inc. (Kelso, WA) published method reporting limits.

h) Most stringent of unrestricted direct contact values and leachability value for respective soil type (unsaturated or saturated).

i) Risk-based TPH soil screening levels baed on subarea-specific EPH data are not presented here, but are discussed in subarea-specific discussions (Chapter 8).

j) Soil screening levels based on terrestrial ecological risk are not included because the entire Site will be capped and have institutional controls, and is thus excluded from terrestrial ecological risk evaluation (see Sections 4.4.1 and 5.1.2).

k) The soil to sediment pathway (erosion/runoff) is not considered a complete exposure pathway at this Site, thus screening levels specific to that pathway are not developed (see Section 5.1.2).

* Site-specific value from Aspect and Anchor QEA (2011b). Refer to Section 5.2.2.

Koc and Hcc values for 2,3,7,8-TCDD are not provided in CLARC, therefore values are from ATSDR's Toxicological Profile for Chlorinated Dibenzo-p-Dioxins (1998).

‡ pH range defining corrosive substances (State Department of L&I DOSH Directive 13.00; refer to Section 5.2.2).

Table 5-3 - RI Industrial Land Use Soil Screening Levels

GP West Site RI/FS 070188

ANALYTE (BY GROUP)	Most Stringent Industrial Land Use Groundwater Screening Level (ug/L) [See Table 5-1]	APPLICABLE SOIL CRITERIA: Groundwater Protection: Constants and Coefficients [a] — Koc (Soil Organic Carbon-Water Partitioning Coefficient) (L/kg)	Kd (Distribution Coefficient for metals) (L/kg)	Henrys Law Constant (unitless) (Hcc)	Groundwater Protection: Calculated Values — **Unsaturated Soil** Concentration Protective of Leachability to Groundwater for **Industrial** Land Use (mg/kg)[b] (gwl-u)	**Saturated Soil** Concentration Protective of Leachability to Groundwater for **Industrial** Land Use (mg/kg)[c] (gwl-s)	Direct Contact [d] — Soil, Method A, Industrial Land Use, Table Value (mg/kg)[e] (mA)	Soil, Method C, Most-Restrictive Standard Formula Value, Direct Contact (ingestion only), Industrial land use (mg/kg)[f] (mC)	**Natural Background Concentrations (Ecology, 1994b) (mg/kg)** (back)	**Applicable Practical Quantitation Level (PQL) for RI Analyses (mg/kg)[g]** (pql)	*Most Stringent Industrial Soil Screening Level (mg/kg)[h]* — **Unsaturated Soil**	**Saturated Soil**
Total Petroleum Hydrocarbons [i]												
Gasoline Range Hydrocarbons										5		
Diesel Range Hydrocarbons							2000			25	2000 *(mA)*	2000 *(mA)*
Oil Range Hydrocarbons							2000			100	2000 *(mA)*	2000 *(mA)*
Bunker C							2000				2000 *(mA)*	2000 *(mA)*
Total TPHs							2000				2000 *(mA)*	2000 *(mA)*
Heavy Metals												
Arsenic	5		*29*	*0*	2.9	0.15	20	88	7	0.5	7 *(back)*	7 *(back)*
Cadmium	8.8		*6.7*	*0*	1.2	0.061		3500	1	0.02	1.2 *(gwl-u)*	1 *(back)*
Chromium (Total)	260		*1000*	*0*	5200	260		5250000		0.2	5200 *(gwl-u)*	260 *(gwl-s)*
Chromium (VI)	50		*19*	*0*	19	0.96		11000	48		48 *(back)*	48 *(back)*
Copper	3.1		*22*	*0*	1.4	0.069		140000	36	0.1	36 *(back)*	36 *(back)*
Lead	8.1		*10000*	*0*	1600	81	1000		17	0.05	1000 *(mA)*	81 *(gwl-s)*
Mercury	0.06		*1700* *	*0.47*	2	0.1		1050	0.07	0.001	2 *(gwl-u)*	0.1 *(gwl-s)*
Nickel	8.2		*65*	*0*	11	0.54		70000	48	0.2	48 *(back)*	48 *(back)*
Selenium	71		*5*	*0*	7.4	0.38		18000		1	7.4 *(gwl-u)*	1 *(pql)*
Silver	1.9		*8.3*	*0*	0.32	0.016		18000		0.02	0.32 *(gwl-u)*	0.02 *(pql)*
Zinc	81		*62*	*0*	100	5		1100000	85	0.5	100 *(gwl-u)*	85 *(back)*
Mercury Speciation												
Mercury (elemental)	1.9											
Methylmercury	0.025							350			350 *(mC)*	350 *(mC)*
Conventionals and Other Metals												
Formaldehyde	1600							700000			700000 *(mC)*	700000 *(mC)*
pH	<6.2 or >8.5										<2.5 or >11.0‡ *see note*	<2.5 or >11.0‡ *see note*
Manganese	0.1			*0*				490000	1200	0.05	490000 *(mC)*	490000 *(mC)*
Volatile Organic Compounds												
1,1,1,2-Tetrachloroethane	74							5000		0.005	5000 *(mC)*	5000 *(mC)*
1,1,1-Trichloroethane	25000	*140*		*0.71*	1300	63		7000000		0.005	1300 *(gwl-u)*	63 *(gwl-s)*
1,1,2 - Trichlorotrifluoroethane	2400							110000000		0.005	110000000 *(mC)*	110000000 *(mC)*
1,1,2,2-Tetrachloroethane	4.0	*79*		*0.014*	0.12	0.0062		660		0.005	0.12 *(gwl-u)*	0.0062 *(gwl-s)*
1,1,2-Trichloroethane	16.0	*75*		*0.037*	0.45	0.024		2300		0.005	0.45 *(gwl-u)*	0.024 *(gwl-s)*
1,1-Dichloroethane	5000	*53*		*0.23*	110	5.7		700000		0.005	110 *(gwl-u)*	5.7 *(gwl-s)*
1,1-Dichloroethene	3.2	*65*		*1.1*	0.085	0.0042		180000		0.005	0.085 *(gwl-u)*	0.005 *(pql)*
1,1-Dichloropropene										0.005		
1,2,3-Trichlorobenzene										0.02		
1,2,3-Trichloropropane								4.4		0.005	4.4 *(mC)*	4.4 *(mC)*
1,2,4-Trichlorobenzene	0.48	*1700*		*0.058*	0.26	0.013		4500		0.01	0.26 *(gwl-u)*	0.013 *(gwl-s)*
1,2,4-Trimethylbenzene	52									0.02		
1,2-Dibromo-3-chloropropane								160		0.02	160 *(mC)*	160 *(mC)*
1,2-Dibromoethane (EDB)	7.4	*66*			0.19	0.0099		66		0.02	0.19 *(gwl-u)*	0.02 *(pql)*
1,2-Dichlorobenzene	6.1	*380*		*0.078*	0.77	0.039		320000		0.005	0.77 *(gwl-u)*	0.039 *(gwl-s)*
1,2-Dichloroethane (EDC)	37	*38*		*0.04*	0.6	0.033		1400		0.005	0.6 *(gwl-u)*	0.033 *(gwl-s)*
1,2-Dichloropropane	15	*47*		*0.12*	0.29	0.016				0.005	0.29 *(gwl-u)*	0.016 *(gwl-s)*
1,3,5-Trimethylbenzene	54							35000		0.02	35000 *(mC)*	35000 *(mC)*
1,3-Dichlorobenzene	960									0.005		
1,3-Dichloropropane										0.005		
1,4-Dichloro-2-Butene										0.02		
1,4-Dichlorobenzene	5	*620*		*0.1*	1	0.051				0.005	1 *(gwl-u)*	0.051 *(gwl-s)*
2,2-Dichloropropane										0.005		
2-Butanone	760000							2100000		0.02	2100000 *(mC)*	2100000 *(mC)*
2-Chloroethyl Vinyl Ether										0.01		
2-Chlorotoluene								70000		0.02	70000 *(mC)*	70000 *(mC)*
2-Hexanone										0.02		

Table 5-3 - RI Industrial Land Use Soil Screening Levels

GP West Site RI/FS 070188

ANALYTE (BY GROUP)	Most Stringent Industrial Land Use Groundwater Screening Level (ug/L) [See Table 5-1]	APPLICABLE SOIL CRITERIA: Groundwater Protection: Constants and Coefficients [a] — Koc (Soil Organic Carbon-Water Partitioning Coefficient) (L/kg)	Kd (Distribution Coefficient for metals) (L/kg)	Henrys Law Constant (unitless) (Hcc)	Groundwater Protection: Calculated Values — Unsaturated Soil Concentration Protective of Leachability to Groundwater for **Industrial** Land Use (mg/kg)[b] (gwl-u)	Saturated Soil Concentration Protective of Leachability to Groundwater for **Industrial** Land Use (mg/kg)[c] (gwl-s)	Direct Contact [d] — Soil, Method A, Industrial Land Use, Table Value (mg/kg)[e] (mA)	Soil, Method C, Most-Restrictive Standard Formula Value, Direct Contact (ingestion only), Industrial land use (mg/kg)[f] (mC)	Natural Background Concentrations (Ecology, 1994b) (mg/kg) (back)	Applicable Practical Quantitation Level (PQL) for RI Analyses (mg/kg)[g] (pql)	Most Stringent Industrial Soil Screening Level (mg/kg)[h] — Unsaturated Soil		Saturated Soil	
4-Chlorotoluene										0.02				
4-Methyl-2-pentanone	24000							280000		0.02	280000	(mC)	280000	(mC)
Acetone		0.58		0.0016				3200000		0.02	3200000	(mC)	3200000	(mC)
Acrolein	20							1800		0.1	1800	(mC)	1800	(mC)
Acrylonitrile	5							240		0.02	240	(mC)	240	(mC)
Benzene	24.0	62		0.23	0.58	0.031		2400		0.005	0.58	(gwl-u)	0.031	(gwl-s)
Bromobenzene										0.005				
Bromochloromethane										0.005				
Bromodichloromethane	0.9	55		0.066	0.02	0.0011		2100		0.005	0.02	(gwl-u)	0.005	(pql)
Bromoethane														
Bromoform	140	130		0.022	6.4	0.33		17000		0.005	6.4	(gwl-u)	0.33	(gwl-s)
Bromomethane	28	9		0.26	0.21	0.012		4900		0.005	0.21	(gwl-u)	0.012	(gwl-s)
Carbon disulfide	870	46		1.2	18	0.89		350000		0.005	18	(gwl-u)	0.89	(gwl-s)
Carbon tetrachloride	1.6	150		1.3	0.087	0.0043		1900		0.005	0.087	(gwl-u)	0.005	(pql)
Chlorobenzene	220	220		0.15	16	0.84		70000		0.005	16	(gwl-u)	0.84	(gwl-s)
Chloroethane	120									0.005				
Chloroform	12	53		0.15	0.25	0.014		35000		0.005	0.25	(gwl-u)	0.014	(gwl-s)
Chloromethane	52	6			0.31	0.02				0.005	0.31	(gwl-u)	0.02	(gwl-s)
cis-1,2-Dichloroethene (DCE)	350	36		0.17	5.5	0.3		7000		0.005	5.5	(gwl-u)	0.3	(gwl-s)
cis-1,3-Dichloropropene										0.005				
Dibromochloromethane	2.2	63		0.032	0.053	0.0028		1600		0.005	0.053	(gwl-u)	0.005	(pql)
Dibromomethane								35000		0.005	35000	(mC)	35000	(mC)
Dichlorodifluoromethane	22							700000		0.005	700000	(mC)	700000	(mC)
Ethylbenzene	2100	200		0.32	140	7.3		350000		0.005	140	(gwl-u)	7.3	(gwl-s)
Hexachlorobutadiene	0.2	54000		0.33	3.5	0.17		1700		0.01	3.5	(gwl-u)	0.17	(gwl-s)
Isopropylbenzene	1600							350000		0.02	350000	(mC)	350000	(mC)
m,p-Xylenes										0.005				
Methylene chloride	590	10		0.09	4.3	0.26		18000		0.01	4.3	(gwl-u)	0.26	(gwl-s)
Methyliodide										0.5				
n-Butylbenzene										0.02				
n-Propylbenzene								350000		0.02	350000	(mC)	350000	(mC)
o-Xylene	960	240		0.21	78	4		700000		0.005	78	(gwl-u)	4	(gwl-s)
p-Isopropyltoluene										0.02				
sec-Butylbenzene										0.02				
Styrene	780	910		0.11	230	12		700000		0.005	230	(gwl-u)	12	(gwl-s)
tert-Butylbenzene										0.02				
Tetrachloroethene (PCE)	3.3	270		0.75	0.3	0.015		240		0.005	0.3	(gwl-u)	0.015	(gwl-s)
Toluene	7300	140		0.27	360	18		280000		0.005	360	(gwl-u)	18	(gwl-s)
trans-1,2-Dichloroethene	290	38		0.39	4.9	0.26		70000		0.005	4.9	(gwl-u)	0.26	(gwl-s)
trans-1,3-Dichloropropene										0.005				
Trichloroethene (TCE)	8.4	94		0.42	0.29	0.015		1100		0.005	0.29	(gwl-u)	0.015	(gwl-s)
Trichlorofluoromethane	260							1100000		0.005	1100000	(mC)	1100000	(mC)
Vinyl acetate	17000	5.3		0.021	97	6.3		3500000		0.02	97	(gwl-u)	6.3	(gwl-s)
Vinyl chloride	2.4	19		1.1	0.029	0.0014		88		0.005	0.029	(gwl-u)	0.005	(pql)
Xylenes (total)		230		0.28				700000			700000	(mC)	700000	(mC)
Naphthalene	83	1200		0.02	32	1.6		70000		0.001	32	(gwl-u)	1.6	(gwl-s)

Table 5-3 - RI Industrial Land Use Soil Screening Levels

GP West Site RI/FS 070188

ANALYTE (BY GROUP)	Most Stringent Industrial Land Use Groundwater Screening Level (ug/L) [See Table 5-1]	APPLICABLE SOIL CRITERIA: Groundwater Protection: Constants and Coefficients [a]: Koc (Soil Organic Carbon-Water Partitioning Coefficient) (L/kg)	Kd (Distribution Coefficient for metals) (L/kg)	Henrys Law Constant (unitless) (Hcc)	Groundwater Protection: Calculated Values: Unsaturated Soil Concentration Protective of Leachability to Groundwater for **Industrial** Land Use (mg/kg)[b] (gwl-u)	Saturated Soil Concentration Protective of Leachability to Groundwater for **Industrial** Land Use (mg/kg)[c] (gwl-s)	Direct Contact [d]: Soil, Method A, Industrial Land Use, Table Value (mg/kg)[e] (mA)	Soil, Method C, Most-Restrictive Standard Formula Value, Direct Contact (ingestion only), Industrial land use (mg/kg)[f] (mC)	Natural Background Concentrations (Ecology, 1994b) (mg/kg) (back)	Applicable Practical Quantitation Level (PQL) for RI Analyses (mg/kg)[g] (pql)	Most Stringent Industrial Soil Screening Level (mg/kg)[h]: Unsaturated Soil	Saturated Soil
Polycyclic Aromatic Hydrocarbons (PAHs)												
Acenaphthene	3.3	*4900*		*0.0064*	5.2	0.26		210000		0.0005	5.2 *(gwl-u)*	0.26 *(gwl-s)*
Acenaphthylene										0.0005		
Anthracene	9.6	*23000*		*0.0027*	71	3.5		1100000		0.0005	71 *(gwl-u)*	3.5 *(gwl-s)*
Benzo(g,h,i)perylene										0.0005		
Fluoranthene	3.3	*49000*		*0.00066*	52	2.6		140000		0.0005	52 *(gwl-u)*	2.6 *(gwl-s)*
Fluorene	3	*7700*		*0.0026*	7.4	0.37		140000		0.0005	7.4 *(gwl-u)*	0.37 *(gwl-s)*
Phenanthrene										0.0005		
Pyrene	15	*68000*		*0.00045*	330	16		110000		0.0005	330 *(gwl-u)*	16 *(gwl-s)*
1-Methylnaphthalene								4500		0.001	4500 *(mC)*	4500 *(mC)*
2-Methylnaphthalene								14000		0.001	14000 *(mC)*	14000 *(mC)*
Naphthalene	83	*1200*		*0.02*	32	1.6		70000		0.001	32 *(gwl-u)*	1.6 *(gwl-s)*
Total Naphthalenes												
Benz(a)anthracene	0.02	*360000*		*0.00014*	2.3	0.12		180		0.0005	2.3 *(gwl-u)*	0.12 *(gwl-s)*
Benzo(a)pyrene	0.02	*970000*		*0.000046*	6.2	0.31		18		0.0005	6.2 *(gwl-u)*	0.31 *(gwl-s)*
Benzo(b)fluoranthene	0.02	*1200000*		*0.0046*	7.7	0.38		180		0.0005	7.7 *(gwl-u)*	0.38 *(gwl-s)*
Benzo(k)fluoranthene	0.02	*1200000*		*0.000034*	7.7	0.38		1800		0.0005	7.7 *(gwl-u)*	0.38 *(gwl-s)*
Chrysene	0.02	*400000*		*0.0039*	2.6	0.13		18000		0.0005	2.6 *(gwl-u)*	0.13 *(gwl-s)*
Dibenzo(a,h)anthracene	0.02	*1800000*		*0.0000006*	12	0.58		18		0.0005	12 *(gwl-u)*	0.58 *(gwl-s)*
Indeno(1,2,3-cd)pyrene	0.02	*3500000*		*0.000066*	22	1.1		180		0.0005	22 *(gwl-u)*	1.1 *(gwl-s)*
Total cPAHs TEQ	0.02	*970000*		*0.000046*	6.2	0.31		18		0.00076	6.2 *(gwl-u)*	0.31 *(gwl-s)*
Other Semi-Volatile Organics												
1,2,4-Trichlorobenzene	0.48	*1700*		*0.058*	0.26	0.013		4500		0.01	0.26 *(gwl-u)*	0.013 *(gwl-s)*
1,2-Dichlorobenzene	6.1	*380*		*0.078*	0.77	0.039		320000		0.005	0.77 *(gwl-u)*	0.039 *(gwl-s)*
1,3-Dichlorobenzene	960									0.005		
1,4-Dichlorobenzene	5	*620*		*0.1*	1	0.051				0.005	1 *(gwl-u)*	0.051 *(gwl-s)*
2,4,5-Trichlorophenol	3600	*1600*		*0.00018*	1900	93		350000		0.01	1900 *(gwl-u)*	93 *(gwl-s)*
2,4,6-Trichlorophenol	2.4	*380*		*0.00032*	0.3	0.015		3500		0.01	0.3 *(gwl-u)*	0.015 *(gwl-s)*
2,4-Dichlorophenol	73	*150*		*0.00013*	3.8	0.2		11000		0.01	3.8 *(gwl-u)*	0.2 *(gwl-s)*
2,4-Dimethylphenol	200	*210*		*0.000082*	14	0.73		70000		0.05	14 *(gwl-u)*	0.73 *(gwl-s)*
2,4-Dinitrophenol	1400	*0.01*		*0.000018*	5.6	0.4		7000		0.2	5.6 *(gwl-u)*	0.4 *(gwl-s)*
2-Chloronaphthalene	390							280000		0.01	280000 *(mC)*	280000 *(mC)*
2-Chlorophenol	37	*390*		*0.016*	4.8	0.24		18000		0.01	4.8 *(gwl-u)*	0.24 *(gwl-s)*
2-Methylphenol		*91*		*0.000049*				180000		0.01	180000 *(mC)*	180000 *(mC)*
2-Nitroaniline								35000		0.02	35000 *(mC)*	35000 *(mC)*
2-Nitrophenol										0.01		
3,3'-Dichlorobenzidine	2	*720*		*0.00000016*	0.47	0.024		290		0.1	0.47 *(gwl-u)*	0.1 *(pql)*
3-Nitroaniline										0.02		
4,6-Dinitro-2-methylphenol										0.1		
4-Bromophenyl phenyl ether										0.01		
4-Chloro-3-methylphenol										0.01		
4-Chloroaniline		*66*		*0.000014*				660		0.01	660 *(mC)*	660 *(mC)*
4-Chlorophenyl phenyl ether										0.01		
4-Methylphenol								18000		0.01	18000 *(mC)*	18000 *(mC)*
4-Nitroaniline										0.02		
4-Nitrophenol										0.1		
Benzoic acid		*0.6*		*0.000063*				14000000		0.2	14000000 *(mC)*	14000000 *(mC)*
Benzyl alcohol								350000		0.02	350000 *(mC)*	350000 *(mC)*
Benzyl butyl phthalate	0.35	*14000*		*0.000052*	1.6	0.079		69000		0.01	1.6 *(gwl-u)*	0.079 *(gwl-s)*
Bis(2-chloro-1-methylethyl) ether	14							1900			1900 *(mC)*	1900 *(mC)*
Bis(2-chloroethoxy)methane										0.01		
Bis(2-chloroethyl) ether	0.53	*76*		*0.00074*	0.015	0.0008		120		0.01	0.015 *(gwl-u)*	0.01 *(pql)*
Bis(2-ethylhexyl) phthalate	1	*110000*		*0.0000042*	35	1.8		9400		0.1	35 *(gwl-u)*	1.8 *(gwl-s)*

Table 5-3 - RI Industrial Land Use Soil Screening Levels

GP West Site RI/FS 070188

ANALYTE (BY GROUP)	Most Stringent Industrial Land Use Groundwater Screening Level (ug/L) [See Table 5-1]	APPLICABLE SOIL CRITERIA: Groundwater Protection: Constants and Coefficients [a] — Koc (Soil Organic Carbon-Water Partitioning Coefficient) (L/kg)	Kd (Distribution Coefficient for metals) (L/kg)	Henrys Law Constant (unitless) (Hcc)	Groundwater Protection: Calculated Values — Unsaturated Soil Concentration Protective of Leachability to Groundwater for **Industrial** Land Use (mg/kg)[b] (gwl-u)	Saturated Soil Concentration Protective of Leachability to Groundwater for **Industrial** Land Use (mg/kg)[c] (gwl-s)	Direct Contact [d] — Soil, Method A, Industrial Land Use, Table Value (mg/kg)[e] (mA)	Soil, Method C, Most-Restrictive Standard Formula Value, Direct Contact (ingestion only), Industrial land use (mg/kg)[f] (mC)	Natural Background Concentrations (Ecology, 1994b) (mg/kg) (back)	Applicable Practical Quantitation Level (PQL) for RI Analyses (mg/kg)[g] (pql)	Most Stringent Industrial Soil Screening Level (mg/kg)[h] — Unsaturated Soil	Saturated Soil
Carbazole		*3400*		*0.00000063*						0.0005		
Dibenzofuran								3500		0.0005	3500 *(mC)*	3500 *(mC)*
Diethyl phthalate	740	*82*		*0.000019*	22	1.2		2800000		0.01	22 *(gwl-u)*	1.2 *(gwl-s)*
Dimethyl phthalate	1100000									0.01		
Di-n-butyl phthalate	140	*1600*		*3.9E-08*	72	3.6		350000		0.02	72 *(gwl-u)*	3.6 *(gwl-s)*
Di-n-octyl phthalate	0.2	*83000000*		*0.0027*	5300	270				0.01	5300 *(gwl-u)*	270 *(gwl-s)*
Hexachlorobenzene	0.2	*80000*		*0.054*	5.1	0.26		82		0.01	5.1 *(gwl-u)*	0.26 *(gwl-s)*
Hexachlorobutadiene	0.2	*54000*		*0.33*	3.5	0.17		1700		0.01	3.5 *(gwl-u)*	0.17 *(gwl-s)*
Hexachlorocyclopentadiene	1100	*200000*		*1.1*	70000	3500		21000		0.05	21000 *(mC)*	3500 *(gwl-s)*
Hexachloroethane	3.3	*1800*		*0.16*	1.9	0.096		3500		0.01	1.9 *(gwl-u)*	0.096 *(gwl-s)*
Isophorone	600	*47*		*0.00027*	11	0.62		140000		0.01	11 *(gwl-u)*	0.62 *(gwl-s)*
Nitrobenzene	690	*120*		*0.00098*	29	1.5		7000		0.01	29 *(gwl-u)*	1.5 *(gwl-s)*
N-Nitroso-di-n-propylamine	0.32	*24*		*0.000092*	0.0037	0.00021		19		0.01	0.01 *(pql)*	0.01 *(pql)*
N-Nitrosodiphenylamine	3.7	*1300*		*0.00021*	1.6	0.079		27000		0.01	1.6 *(gwl-u)*	0.079 *(gwl-s)*
Pentachlorophenol	3	*590*		*0.000001*	0.58	0.029		330		0.1	0.58 *(gwl-u)*	0.1 *(pql)*
Phenol	216000	*29*		*0.000016*	2900	160		1100000		0.03	2900 *(gwl-u)*	160 *(gwl-s)*
2,4-Dinitrotoluene	3.4	*96*		*0.0000038*	0.12	0.0062		7000		0.01	0.12 *(gwl-u)*	0.01 *(pql)*
2,6-Dinitrotoluene		*69*		*0.000031*				3500		0.01	3500 *(mC)*	3500 *(mC)*
Polychlorinated Biphenyls (PCBs)												
Aroclor 1016	0.1	*110000*			3.5	0.18		250		0.01		
Aroclor 1221										0.02		
Aroclor 1232										0.01		
Aroclor 1242										0.01		
Aroclor 1248										0.01		
Aroclor 1254	0.1							66		0.01		
Aroclor 1260	0.1	*820000*			26	1.3		66		0.01		
Aroclor 1262										0.01		
Aroclor 1268										0.01		
Total PCBs	0.1	*31000*			0.99	0.05	10	66		0.05	10 *(mA)*	10 *(mA)*

Table 5-3 - RI Industrial Land Use Soil Screening Levels

GP West Site RI/FS 070188

ANALYTE (BY GROUP)	Most Stringent Industrial Land Use Groundwater Screening Level (ug/L) [See Table 5-1]	APPLICABLE SOIL CRITERIA: Groundwater Protection: Constants and Coefficients [a] — Koc (Soil Organic Carbon-Water Partitioning Coefficient) (L/kg)	Kd (Distribution Coefficient for metals) (L/kg)	Henrys Law Constant (unitless) (Hcc)	Groundwater Protection: Calculated Values — **Unsaturated Soil** Concentration Protective of Leachability to Groundwater for **Industrial** Land Use (mg/kg)[b] (gwl-u)	**Saturated Soil** Concentration Protective of Leachability to Groundwater for **Industrial** Land Use (mg/kg)[c] (gwl-s)	Direct Contact [d] — Soil, Method A, Industrial Land Use, Table Value (mg/kg)[e] (mA)	Soil, Method C, Most-Restrictive Standard Formula Value, Direct Contact (ingestion only), Industrial land use (mg/kg)[f] (mC)	**Natural Background Concentrations (Ecology, 1994b) (mg/kg)** (back)	**Applicable Practical Quantitation Level (PQL) for RI Analyses (mg/kg)[g]** (pql)	*Most Stringent Industrial Soil Screening Level (mg/kg)[h]* — **Unsaturated Soil**	**Saturated Soil**
Dioxins/Furans												
2,3,7,8-TCDD	1.00E-05	*24500000*		*0.00416*	7.8E-02	3.9E-03		1.5E-03		1.0E-06	1.5E-03 *(mC)*	1.5E-03 *(mC)*
1,2,3,7,8-PeCDD										2.5E-06		
1,2,3,4,7,8-HxCDD										2.5E-06		
1,2,3,6,7,8-HxCDD										2.5E-06		
1,2,3,7,8,9-HxCDD								2.1E-02		2.5E-06	2.1E-02 *(mC)*	2.1E-02 *(mC)*
1,2,3,4,6,7,8-HpCDD										2.5E-06		
OCDD										5.0E-06		
2,3,7,8-TCDF										1.0E-06		
1,2,3,7,8-PeCDF										2.5E-06		
2,3,4,7,8-PeCDF										2.5E-06		
1,2,3,4,7,8-HxCDF										2.5E-06		
1,2,3,6,7,8-HxCDF										2.5E-06		
1,2,3,7,8,9-HxCDF										2.5E-06		
2,3,4,6,7,8-HxCDF										2.5E-06		
1,2,3,4,6,7,8-HpCDF										2.5E-06		
1,2,3,4,7,8,9-HpCDF										2.5E-06		
OCDF										5.0E-06		
Total 2,3,7,8 TCDD (TEQ)	1.00E-05	*24500000*		*0.00416*	7.8E-02	3.9E-03		1.5E-03		6.25E-06	1.5E-03 *(mC)*	1.5E-03 *(mC)*

Notes:

a) Values from Ecology's CLARC Database downloaded May 2012; except as noted. PCE and TCE values updated September 2012.

b) Calculated values from 3-phase model, per MTCA Equation 747-1, with groundwater value (Cw) as most stringent industrial groundwater screening level (Table 5-1), Dilution Factor = 20, and Site-specific foc = 0.016.

c) Calculated values from 3-phase model, per MTCA Equation 747-1, with groundwater value (Cw) as most stringent industrial groundwater screening level (Table 5-1), Dilution Factor = 1, and Site-specific foc = 0.016.

d) Direct contact criteria applicable for soils to 15-foot depth.

e) Because Site groundwater is not potable, many Method A soil cleanup levels are not applicable. Method A industrial soil cleanup levels are used only if they are based on background or ARARs, or there are no corresponding Method C direct contact values, or they are based on generation of separate-phase petroleum. Soil leachability to groundwater is addressed separately.

f) Method C values are most restrictive of carcinogenic or non-carcinogenic values presented in Ecology's CLARC database.

g) From Columbia Analytical Services, Inc. (Kelso, WA) published method reporting limits.

h) Most stringent of industrial direct contact values and leachability value for respective soil type (unsaturated or saturated).

i) Risk-based TPH soil screening levels based on subarea-specific EPH data are not presented here, but are discussed in subarea-specific discussions (Chapter 8).

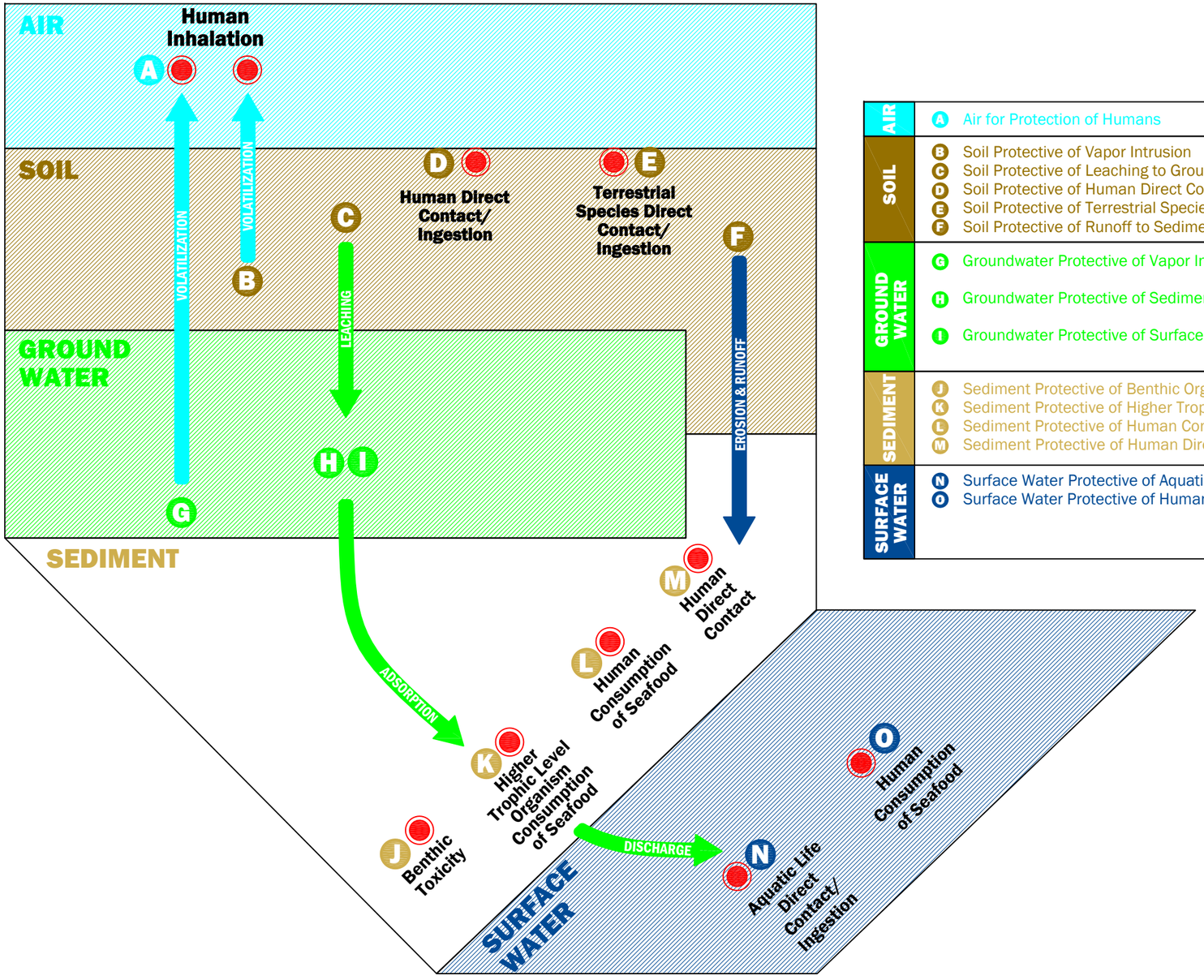
j) Soil screening levels based on terrestrial ecological risk are not included because the entire Site will be capped and have institutional controls, and is thus excluded from terrestrial ecological risk evaluation (see Section 4.4.1).

k) The soil to sediment pathway (erosion/runoff) is not considered a complete exposure pathway at this Site, thus screening levels specific to that pathway are not developed (see Section 5.1.2).

* Site-specific value from Aspect and Anchor QEA (2011b). Refer to Section 5.2.2.

Koc and Hcc values for 2,3,7,8-TCDD are not provided in CLARC, therefore values are from ATSDR's Toxicological Profile for Chlorinated Dibenzo-p-Dioxins (1998).

‡ pH range defining corrosive substances (State Department of L&I DOSH Directive 13.00; refer to Section 5.2.2).



AIR	A Air for Protection of Humans	Groundwater and soil screening levels protective of vapor intrusion
SOIL	B Soil Protective of Vapor Intrusion	Subarea-specific empirical soil vapor data
	C Soil Protective of Leaching to Groundwater	Calculated soil screening levels protective of groundwater (Table 5-2)
	D Soil Protective of Human Direct Contact	Soil screening levels protective of direct contact from CLARC (Table 5-2)
	E Soil Protective of Terrestrial Species	Pathway incomplete at Site (refer to Section 5.1.2.1)
	F Soil Protective of Runoff to Sediments	Pathway incomplete at Site (refer to Section 5.1.2.2)
GROUND WATER	G Groundwater Protective of Vapor Intrusion	Groundwater screening levels protective of vapor intrusion from Ecology (2009) (Table 5-1) & subarea-specific empirical soil vapor data
	H Groundwater Protective of Sediment	Calculated groundwater (porewater) screening levels protective of sediment (Table 5-1)
	I Groundwater Protective of Surface Water	Groundwater screening levels protective of marine water from CLARC (Table 5-1)
SEDIMENT	J Sediment Protective of Benthic Organisms	Site does not include sediment in adjacent Whatcom Waterway site. However, groundwater screening levels applied at Site (Table 5-1) protect against recontamination of Whatcom Waterway sediment (exposure pathway H), as described in Section 5.2.1.
	K Sediment Protective of Higher Trophic Level Organisms	
	L Sediment Protective of Human Consumption of Seafood	
	M Sediment Protective of Human Direct Contact	
SURFACE WATER	N Surface Water Protective of Aquatic Life	Site does not include surface water in adjacent Whatcom Waterway site. However, groundwater screening levels applied at Site (Table 5-1) are protective of Whatcom Waterway surface water (exposure pathway I), as described in Section 5.2.1.
	O Surface Water Protective of Human Consumption of Seafood	

Legend

LEACHING — Contaminant Transport Pathway

Point of Exposure

M — Exposure Pathway/Screening Level

Exposure Pathways Considered for Soil and Groundwater Screening Level Development

GP West Site RI/FS

Bellingham, Washington

Aspect CONSULTING	APR-2013	BY: SJG/SCC	FIGURE NO. 5-1
	PROJECT NO. 070188	REV BY: SCC	