7- WATER QUALITY

This section presents the water quality standards and guidelines that will be used on the Terminal 4 Removal Action, results of contaminant mobility testing, and predicted water quality around the different Removal Action activities. These factors will be used to in-form the basis of design for the CDF, contractor required BMPs to protect water quality during construction, the short term and long term water quality monitoring programs for all aspects of the Removal Action activities, and the sediment acceptance criteria for the CDF.

Provide overview of WQ approach including references to various Plans/Appendices (WQMP, QAPP, CQAP, WQMCCP, specifications, etc.)

Table XX provides a summary of proposed RA activities, associated water quality monitoring, compliance criteria, points of compliance, etc.

7.1 Water Quality Criteria

Water quality criteria are applied depending on the duration of the impact. Short-term, intermediate-term, and long -term water quality effects associated with the Terminal 4 Removal Action are evaluated in this chapter. Short-term effects are temporary and transient effects associated with construction activities. These effects could occur, both at the point of construction (i.e., at the site of dredging, capping, demolition, etc.), and from filling the CDF with contaminated sediments. During filling of the CDF, water quality impacts could occur either at the point of effluent discharge (i.e., discharge of return water over the weir at the CDF or at the point of, discharge of groundwater through the CDF berm during filling). For the CDF, short-term water quality impacts are assumed to continue until the water level in the CDF equalizes within 1 foot of the water level in the river.

Intermediate-term effects are associated with movement of groundwater through the CDF berm during the dormant periods between times when contaminated sediments are filled into the CDF. During these dormant times, no discharge over the CDF weir will occur. The CDF state will be very similar to its long-term condition (discussed below), except that the interior of the CDF will contain groundwater and surface water rather than groundwater only.

Long-term effects are associated with more continuous movement of groundwater through the contaminanted sediment fill and the CDF berm and into the river, or groundwater migrating through the sediment cap surfaces. Water quality criteria used to regulate these various activities will be consistent with the scale and duration of exposure, and consistent with the regulatory conditions imposed at other recent Region 10 Superfund projects, including projects in Commencement Bay (Thea Foss/St. Paul Waterways, Blair Slip 1 CDF, Middle Waterway), and Portland Harbor.

Proposed water quality criteria for the Terminal 4 Removal Action project are discussed below and summarized in Table 6.

7.1.1 Short-Term Water Quality Criteria (During Construction)

Short-term water quality criteria will be used to regulate in-water construction activities (dredging, capping, demolition, etc.) and overflow discharges from the CDF weir. Water quality monitoring associated with these construction activities will be specified in the USEPA-issued WQCCMP. It is anticipated that a single comprehensive certificationWQCCMP will be issued for

the Slip 1 CDF ~~and this certification will be used~~ to regulate all filling activities, including initial placement of Terminal 4 material, subsequent placement of external material from other Portland Harbor locations, and final placement of imported fill material to close the CDF. Because future candidate sites that are proposed for placement in the CDF may contain COCs other than those being evaluated at Terminal 4, additional site-specific monitoring parameters may be required and will be specified in an addendum to the USEPA-issued WQCCMP at such time as the materials are identified and accepted for placement. Although the USEPA-issued WQCCMP for Terminal 4 will cover water quality monitoring activities associated with placement in the CDF, the responsible parties will also need to obtain a separate USEPA-issued WQCCMP for their dredging and transport activities related to other cleanup actions.

Short-term water quality criteria include acute and chronic ambient water quality criteria, with exposure times of one hour and four days, respectively, as well as narrative standards for conventional parameters, generally measured in terms of acceptably small deviations from ambient ~~background~~ conditions in the river. ~~Chronic criteria will be used to regulate effluent discharges from the CDF outfall if these discharges occur continuously for four days or longer.~~ Acute criteria will be used to regulate ~~all other~~ construction activity water quality impacts ~~ies~~ (USEPA and USACE 1994). Chronic criteria will be used to guide the use of additional BMPs to protect water quality. Narrative standards will apply to all activities.

For the CDF, short-term water quality monitoring will occur while in-water construction activities are performed, and will continue until the water level in the CDF equalizes within 1 foot of the water level in the river.

7.1.1.1 Conventional Parameters

Turbidity. State water quality standards allow for limited turbidity exceedances for "dredging, construction, or other legitimate activities" [OAR 340-041-036(b)]. Exceedances of the turbidity standard (or an alternative TSS guideline), would be limited to the vicinity of the construction site, as described in Section 7.2 below. Consistent with state regulations, the following turbidity criteria will apply at the compliance boundary:

- ~~Turbidity should not exceed 5 NTUs above background if background is less than 50 NTUs~~
- Turbidity should not exceed 10% above ~~background~~ambient ~~if~~ ambient ~~background~~ is greater than 50 NTUs.

TSS. As an alternative to the turbidity criteria, the following TSS criteria may be applied at the compliance boundary (although both TSS and turbidity will be measured during monitoring activities):

- TSS should not exceed 10 percent above ~~background~~ambient

TSS is an acceptable surrogate for turbidity for the following reasons:

- TSS is measured in concentration and is therefore relevant for contaminant transport and mass balance calculations, whereas turbidity is a measure of light transmission but not a direct measure of concentration (DISCUSS PER EPA COMMENTS #111 and #149)

- TSS has greater ecological relevance, and literature studies have investigated the biological effects of high TSS concentrations on fish and other organisms (DISCUSS PER EPA COMMENT #110)
- In remedial dredging projects, migration of contaminated sediments outside the project area is a key concern. TSS is a more direct measure of construction-induced sediment resuspension and transport processes.
- When subjected to a column settling test (CST), Terminal 4 sediments showed high levels of residual turbidity even after much of the suspended solids had settled out (see Figure 28). Terminal 4 sediments appear to color the water, even though elutriate test results indicate the turbidity generated by these sediments is not associated with elevated levels of dissolved contaminants (see Section 7.3.3).

If elevated turbidity measurements are observed during monitoring activities, the Port will monitor TSS in addition to turbidity and ~~may monitor TSS~~ to provide ~~as~~ a more reliable indicator of construction-related water quality effects. An initial estimate of TSS may be determined based on a best-fit power function of the Terminal 4 column settling test data (CST data; see Section 7.3.3), as shown on Figure 28 (EXPLAIN RELATIVE TO AMBIENT TURBIDITY & TSS IN RIVER). The TSS-turbidity correlation will be periodically updated with results of the ~~background~~ambient water quality survey and ongoing monitoring conducted during the project. To provide useful data in the field, ~~verify initial regression based estimates follow up~~ TSS measurements will be performed at a ~~fast turnaround~~ on-site field laboratory capable of providing results within X hours of sample collection.

Dissolved oxygen (DO). At the compliance boundary, DO will not be less than 6.5 mg/L.

pH

Temperature

Oil/Sheens

7.1.1.2 Ambient Baseline ~~Background~~ Concentrations

Ambient baseline ~~background~~ water quality in the Willamette River will be determined solely for the purposes of the T4 removal action and evaluating water quality impacts from the T4 cleanup project. The ambient water quality will be determined using a pre-construction survey of ambient ~~background~~ conditions in the RAA, ongoing ~~background~~ measurements during the RAA, and current and ongoing monitoring efforts conducted by the USGS and others in the Portland Harbor. The ~~background~~ambient values for both conventional and toxic constituents will be calculated as the 9~~5~~0th percentile value of ambient ~~background~~ baseline data.

The USGS maintains a comprehensive monitoring program for conventional and trace metal parameters in the Willamette River at Portland (Station #14211720); water quality statistics for USGS measurements of turbidity, TSS, and dissolved metals are presented in Table 7. Based on Table 7 and the 303(d) list, the following chemicals have ambient concentrations affecting Terminal 4 construction activities:

- (LIST AND INDICATE LIKELY SIGNIFICANCE OR ISSUE)

A pre-construction baseline ~~background~~ water quality survey will be conducted in the vicinity of Terminal 4, including multiple sampling events over a range of flow, tide, and weather conditions. Baseline ~~Background~~ stations will continue to be monitored during the RAA for flow events that may cause short-term excursions in water quality parameters, and ambient ~~background~~ baseline statistics will be updated on a regular basis. Other ongoing studies in the Portland Harbor (e.g. Lower Willamette Group) will be evaluated and incorporated, as appropriate, as they become available. The pre-construction baseline water quality survey will include the following components:

- Sample collection at the XX stations shown on Figure XX.
- Sample collection during XX sampling events during (MONTHS), 2007. River flows and water elevations during these times are listed below:
  - (LIST)
- Sample collection at XX and XX depths during each sampling event.
- Analysis of samples for turbidity, TSS, DO, pH, oil/sheens, and the following list of analytes:
  - (LIST)

Two ~~background~~ reference stations will be established upstream and across the river from the RAA. Both stations will be monitored during the pre-construction ~~background~~ baseline survey~~,~~ and ~~one or both of these stations will continue to be monitored~~ during construction to detect any excursions of ambient river conditions (e.g., turbidity caused by high flow events, etc.) that are not caused by the Removal Action, but which may nevertheless affect water quality in the vicinity of construction activities. Figure XX shows the location of the proposed monitoring stations. Monitoring will consist of the following components:

- Sample collection at a frequency of XX
- Sample collection at XX and XX depths during each sampling event.
- Analysis of samples for turbidity, TSS, DO, pH, oil/sheens, and the following list of analytes:
  - (LIST)

Monitoring data will be used as follows: (EXPLAIN).

7.1.1.3 Chemical Parameters

The specific chemical parameters to be monitored for will be based on contaminants found above PEC criteria in that area of the Terminal 4 site (see Table XX).

Metals Criteria. Water quality criteria for metals (arsenic, cadmium, copper, lead, and zinc) are derived from current USEPA National Recommended Water Quality Criteria (USEPA 2006b; http://www.epa.gov/waterscience/criteria/wqcriteria.html), the same criteria that have been adopted by the state of Oregon. Hardness-based metals criteria (all except arsenic) have been adjusted to a hardness value of 25 mg/L based on ambient measurements in the Lower Willamette River (USGS 2006).

PAH Guidance Values. Aquatic life criteria for PAHs are not available in ~~either~~ federal ~~or state standards~~criteria, but are listed in Table 20 of OAR 340-041. ~~However,~~ Aacute and chronic guidance values for PAHs have been developed by USEPA for use in deriving sediment quality

benchmarks (USEPA 2003a). These State and federal PAH values, listed in Table 8, will ~~may~~ be used as compliance values ~~as guidance values~~ during the monitoring program to assess the effectiveness of construction BMPs for controlling releases of PAHs. ~~However, these guidance values will not be used as compliance criteria.~~

Other Criteria. Acute and chronic water quality criteria for 4,4'-DDT and Total PCBs are derived from current USEPA National Recommended Water Quality Criteria (USEPA 2006b; http://www.epa.gov/waterscience/criteria/wqcriteria.html), These are limited-area COCs, applying to construction activities in the vicinity of T4-VC29 in the southeast corner of Slip 3, the only portion of the construction areas where PEC exceedances of these chemicals were found.

~~7.1.1.4 Parameters Likely to Drive Compliance~~
~~Based on the results of contaminant mobility testing on Terminal 4 sediments (see Section 7.3 below), turbidity and TSS will serve as reliable sentinels for water quality conditions during dredging, capping, CDF filling, and other construction activities. Based on those test results, it is expected that higher dilution factors will be required for turbidity and TSS than for any of the toxic constituents. By controlling releases of suspended sediments during construction, releases of sediment-associated contaminants will also be controlled. Although turbidity and TSS are the parameters likely to drive compliance, chemical testing will also be initiated for all of the construction activities. The intensity of the chemical monitoring will vary based on construction activity as well as location within the project site.~~

7.1.2 Intermediate-Term Water Quality (Dormant Periods Between Filling CDF with Contaminated Sediments)

(EXPLAIN. Please make Sections 7.1.2 and 7.1.3 consistent with EPA comments on the 60% Design Submittal, include Table 1 provided by EPA. Note that additional analytes may be added to monitoring list due to acceptance of sediments from other sites that have other contaminants that are present at the T4 site.)

7.1.~~3~~2 ***Long-Term Water Quality Criteria***
The movement of groundwater through the CDF berm after filling of the CDF with contaminated sediments is described ~~and into the river following completion of the CDF will be evaluated~~ in this section. Unlike the short-term water quality effects described in Section 7.1.1, which are regulated by the project WQCCMP, the monitoring of long-term water quality will be described in the LTMRP to be submitted as part of the Final (100 percent) Design. The LTMRP will address all contaminants of concern present in sediments accepted into the CDF.

7.1.~~3~~2.1 Water Quality Criteria Applicable to the CDF~~s~~ Groundwater Discharge
~~Consistent with the monitoring requirements of other recently built CDFs in the USEPA Region 10, the evaluation of long-term water quality will include a comparison of groundwater release concentrations to~~
Final cleanup standards will not be established for the Portland Harbor Superfund Site until the ROD is issued. Applicable or Relevant and Appropriate Requirements (ARARs) have been identified for this removal action given current information. To ensure that the CDF meets ARARs and to increase the probability that it will meet the future ROD standards, if lower,, the

evaluation of long-term water quality compares predicted contaminant concentrations in groundwater released from the CDF to the following criteria:

- EPA's national recommended chronic water quality criteria for both aquatic organisms and fish consumption by humans (17.5 g/day).
  Applicable chronic criteria include National Recommended Water Quality Criteria for m etals (USEPA 2006b) and PAH guidance values (USEPA 2003a) as presented in Section 7. 1.1.3 and Table 8.
- Oregon chronic water quality standards [OAR 340-041],
- EPA Region 9 Tap Water Preliminary Remediation Goals (PRGs)
- Relevant, promulgated drinking water criteria (otherwise known as Maximum Contaminant Levels).- Drinking water MCLs are ARARs for discharges to the Willamette River from the T4 early action because drinking water supply is a designated beneficial use of water the in the Lower Willamette River.

~~or ambient background water quality in the Willamette River adjacent to the CDF berm.~~
~~The derivation of background water quality values is presented in Section 7.1.1.2. Applicable chronic criteria include National Recommended Water Quality Criteria for metals (USEPA 2006b) and PAH guidance values (USEPA 2003a) as presented in Section 7.1.1.3 and Table 8.~~

~~7.1.2.2 Fish Consumption Criteria~~
~~A key pathway of interest for the Portland Harbor risk assessment is the potential bioaccumulation of contaminants in fish and shellfish and subsequent risks posed to humans that eat fish from the harbor. The pathway of concern for bioaccumulation at Terminal 4 is groundwater release to the river. Bioaccumulation-based fish consumption criteria have been developed as a screening tool for evaluating this pathway (DEQ and USEPA 2005).~~

~~Consistent with USEPA guidance developed under Clean Water Act, Section 401, bioaccumulation exposures are averaged temporally over the lifetime of the fish being exposed to contaminants in the river, as well as the lifetimes of the humans that are consuming fish from the river (i.e., assumed human lifetime of 70 years; USEPA 1991). In addition, USEPA draft guidance on estimating sediment-associated bioaccumulation risks is based on the fact that bioaccumulation exposures are averaged spatially over the home range of the fish and the harvesting area of the receptor (USEPA 2006c). Whereas chronic water quality criteria are applicable to a "point in space" (any location on the face of the berm) and a "point in time" (a 4-day duration is essentially instantaneous in the lifetime of the CDF), fish consumption criteria should be applied to conditions in the receiving water in consideration of the spatial and temporal scales of interest.~~

~~Table 8 provides an estimate of receiving water concentrations in the vicinity of the berm, and calculated bioaccumulation-based discharge criteria at the point of groundwater release necessary to meet fish consumption criteria in the receiving water. Because the groundwater flux (as determined from MODFLOW results; see~~

Appendix I) is quite small compared to ambient currents in the river, groundwater releases are rapidly mixed to concentrations below fish consumption criteria in the receiving water. At the discharge criteria indicated, fish consumption criteria (DEQ and USEPA 2005) would be achieved a mere 10 cm above the face of the berm. As specified in USEPA (1991), these bioaccumulation□based discharge criteria would also be temporally averaged over a 70□year human lifetime. Based on these calculations, achieving chronic water quality criteria at the point of groundwater release from the CDF would be implicitly protective of bioaccumulative exposures in the receiving water.

7.1.2.3 Drinking Water Guidelines and Criteria

USEPA directed the Port to consider drinking water guidelines and criteria in its evaluation of groundwater releases from the CDF, specifically drinking water maximum contaminant levels (MCLs) and USEPA Region 9 "tap water" preliminary remediation goals (PRGs). Similar to the evaluation of fish consumption criteria, any potential drinking water exposure will be based on a receiving water concentration rather than a groundwater release concentration at the face of the berm.

Several points are relevant to the evaluation of drinking water exposures:

- **Drinking Water Not Yet an ARAR**. The Safe Drinking Water Act has been determined by USEPA to be potentially relevant and appropriate to the Terminal 4 Removal Action CDF. The exact application of drinking water criteria as an ARAR will not be determined until the Harbor□wide ROD. At this point, USEPA has directed the Port to evaluate drinking water exposures to be conservative and to prepare for any and all possibilities that may result from the issuance of the Harbor□wide ROD.
- **Drinking Water Criteria/Guidelines Are Applied at the Tap.** Drinking water guidelines and criteria are applied "at the tap" and not at the point of intake. Recent experience upstream in Wilsonville Oregon has shown that the background characteristics of Willamette River water are unsuitable for direct consumption without first subjecting the water to a multi□stage treatment process, including, in this case, sedimentation, ozonation, carbon filtration, sand filtration, and chlorination. Thus drinking water criteria/guidelines should account for water treatment requirements that apply prior to consumption.
- **Institutional Controls will Preclude Water In take on Port Property.** The Port is in the process of acquiring the land beneath the CDF from the State of Oregon. The Port's ownership will extend out to the Harbor Line, and the Port will ensure through institutional controls that no drinking water intakes are placed on submerged Portland. Therefore, the closest possible point for a drinking water intake would be at the Harbor Line, between 10 and 50 meters from the face of the berm.

With these considerations in mind, Table 8 provides an estimate of receiving water concentrations at the Harbor Line, 10 meters from the berm, and calculated drinking water□based discharge criteria at the point of ground water release necessary to meet "tap water" criteria in the receiving water. Because the ground water flux (as determined from MODFLOW results; see Appendix I) is quite small compared to ambient currents in

~~the river, groundwater releases are rapidly mixed to concentrations below drinking water criteria in the receiving water. Based on these calculations, achieving chronic water quality criteria at the point of groundwater release from the CDF will be implicitly protective of possible drinking water exposures at the Harbor Line. This evaluation is considered conservative because it does not take in to account water treatment that is permitted to occur prior to application of drinking water criteria under state and federal law.~~