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KINDER MORGAN LIQUIDS TERMINAL – LINNTON PETROLEUM TERMINAL
CSM Site Summary – [Appendix #]

KINDER MORGAN LIQUIDS TERMINAL – LINNTON PETROLEUM TERMINAL

Oregon DEQ ECSI #: 1096

11400 NW St. Helens Road
DEQ Site Mgr: Don Pettit
Latitude: 45.6033° (DEQ)
Longitude: -122.787° (DEQ)
Township/Range/Section: 1N/1W/3

River Mile: 4.4

LWG Member ☒ Yes ☐ No

Upland Analytical Data Status: ☒ Electronic Data Available ☐ Hardcopies only

1. SUMMARY OF POTENTIAL CONTAMINANT TRANSPORT PATHWAYS TO THE RIVER

The general potential migration pathways include movement of released contaminants through air, soil and groundwater. The potential air pathway results from a potential release where a portion of the material volatilizes into the ambient air and would be dispersed by prevailing winds. The potential soil and groundwater migration pathways would typically result from a potential release where a portion of the released material penetrates into the predominately sandy silt and gravel surface soils and downward through the soil column to the subsurface soil to the groundwater, which has been observed at depths ranging from approximately 9 to 24 feet below grade. If released contaminants reach groundwater, the insoluble components of the released material, such as the separate phase hydrocarbons (SPHs) will generally form a lens on the groundwater surface, whereas the more soluble components will tend to dissolve into the groundwater. Both the SPH and dissolved components have the potential to migrate downgradient (in the direction of groundwater flow) with or on the surface of the groundwater. Based on the *Draft Remedial Investigation* report (KHM Environmental Management, Inc., October 2002) and groundwater monitoring reports, the groundwater flow direction at the Kinder Morgan Linnton Terminal (Site) generally appears to be northeasterly, toward the Willamette River.

1.1 Overland Transport

The ASTs are all located within containment walls and the surface covering within the containment wall is primarily imported sand and gravel that helps reduce potential for erosion. Additionally, access to the area within the AST containment walls is limited and activities that might cause or exacerbate erosion are limited to foot traffic. A majority of areas outside of the AST containment areas are paved with concrete or asphalt. Stormwater that collects within the AST containment area and into site catch basins is directed to one of two large API oil-water separators. Under normal conditions the discharge from the two API oil-water separators is pumped into AST 3034 where it is sampled prior to batch discharge. During larger precipitation events, once AST 3034 is full, storm water is visually inspected at the effluent end of the API oil-water separator and discharged to the Willamette River. Stormwater is discharged from the Site under a 1300 general NPDES stormwater discharge permit. Limited site operations and site controls limit potential pathways for contaminants to reach the Willamette River.

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1.2 Direct Discharge (Overwater Activities and Stormwater/Wastewater Systems)

Overwater activities at the Site are limited to the dock on the Willamette River. The dock is infrequently used for loading and unloading of petroleum fuels through above-grade conveyance pipelines connecting the Site dock to the ASTs. No petroleum storage occurs at or near the riverfront outside of the AST containment area.

Stormwater, under normal conditions, discharges from the two API oil-water separators and is pumped into AST 3034 where it is sampled prior to batch discharge. During larger precipitation events, once AST 3034 is full, storm water is visually inspected at the effluent end of the API oil-water separator and discharged to the Willamette River. Storm water is discharge from the Site under a 1300 general NPDES storm water discharge permit. Limited site operations and site controls limit potential pathways for contaminants to reach the Willamette River via stormwater.

Wastewater systems at the Site are limited to the IRAM Area Containment System where the treated groundwater is discharged to the Willamette River under a 1500A General NPDES discharge permit (DEQ permit files number 32300). Process water volumes from Site operations are limited and are typically generated from the separation of water from product in the ASTs. Typically, this water is conveyed with the product to the owners of the product. Prior to the mid-1980s, the process water was treated through the oil-water separator.

1.3 Groundwater

Groundwater is first encountered at the Site at depths ranging from approximately 9 to 24 feet below grade within the sand, silty-sand, and gravelly-silt fill material and alluvium soil encountered below the fill material. The alluvium consists primarily of silty, sandy silt soil with inter-laying of silty-sand soils. Based on the *Draft Remedial Investigation* report (KHM Environmental Management, Inc., October 2002) and the known history of Site activities, the contaminants of potential concern (COPCs) identified in soil and groundwater at the Site are associated with refined petroleum products and can be arranged into three broad groups of chemicals: volatile organic compounds (VOCs), polynuclear aromatic hydrocarbons (PAHs) and metals. The Draft RI report identified 1,2-dichloroethane, benzene, naphthalene, and n-propylbenzene as groundwater COPCs for the Site.

During January 2002, an apparent hydrocarbon sheen was noticed on the Willamette River along the seawall of the Site. During the completion of the Remedial Investigation (RI), KMLT extensively investigated the upland area near this apparent hydrocarbon seep. SPH has been found in the upland monitoring wells immediately adjacent to the seawall. Two separate pilot test events have been performed using recovery wells to evaluate the appropriate Interim Remedial Action Measures (IRAM), and in July 2004, KMLT completed the installation and start-up of the IRAM Area Containment System that consist of five four-inch diameter groundwater recovery wells RW-1 through RW-5 along the seawall. This IRAM Area Containment System (system) is designed to control groundwater flow in the area of the SPH seep and the recovery of SPH from the five recovery wells and from MW-2 and MW-19.

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Groundwater control is accomplished by the simultaneous extraction of groundwater from the five recovery wells RW-1 through RW-5. Extracted groundwater is treated with a sand filter followed by activated carbon. Treated groundwater is discharged to the Willamette River under a 1500A General NPDES discharge permit (DEQ permit files number 32300). SPH is recovered from each of the five RW wells and in wells MW-2 and MW-19 using free-product pumps installed in the wells mentioned above.

1.1. Riverbank Erosion

With the one exception of above-grade pipeline connecting the Site dock to the ASTs, no petroleum storage or handling occurs at or near the riverfront outside of the AST containment area. Contaminant transport via river bank erosion is not considered relevant at this site since Site contaminants are limited to petroleum fuels and are not associated with the river bank or river bank area. The entire shoreline of the KMLT Linnton Terminal is lined with a three-tiered timber seawall and associated rip rap covering for protection of the seawall. Thus eliminating riverbank erosion of the terminal's shoreline.

1.2. Relationship of Upland Sources to River Sediments

See Final CSM Update.

1.3. Sediment Transport

The Site is located on the west bank of the river just upstream of RM 4. This portion of the river was characterized in the Portland Harbor Work Plan (Integral et al. 2004) as transitional between the upstream transport zone (RM 5-7) and the downstream depositional zone (RM 1-3). The Sediment Trend Analysis® results suggest that the nearshore environment off of Site episodically experiences both net accretion and net erosion and that the mid-channel and eastern side of the river is in dynamic equilibrium. Time-series bathymetric change data over the 25-month period from January 2002 through February 2004 (Integral and DEA in prep) show notable sediment accumulation up to greater than 2ft in extent along the outside of the Site dock structure and out to the –30 ft NAVD88 contour. No time-series bathymetry data were collected inside of the dock structure due to limited boat access. The riverbed in the main channel offshore of the Site shows no measurable riverbed elevation change over measurement period.

Integral and DEA. 2004. In preparation. Lower Willamette River February 2004 Multibeam Bathymetric Survey Report. Draft. Prepared for Lower Willamette Group, Portland, OR. Prepared by Integral Consulting, Inc. (Olympia, WA) and David Evans and Associates, Inc. (Portland, OR).

2. CSM SITE SUMMARY REVISIONS

Date of Last Revision: 9-08-04

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3. PROJECT STATUS

[Primary Source: ECSI file and DEQ Staff Report]

Activity		Date(s)/Comments
PA/XPA	☒	DEQ prepared PA during October 1991
RI	☒	Draft RI submitted October 2002
FS	☐	
Interim Action/Source Control	☒	Interim Remedial Action Measures initiated in July 2004
ROD	☐	
RD/RA	☐	
NFA	☐	

DEQ Portland Harbor Site Ranking (Tier 1, 2, or 3): ____1_

4. SITE OWNER HISTORY

Owner/Occupant	Type of Operation	Years
Kinder Morgan Liquid Terminals LLC	Refined petroleum products storage	2001 - present
GATX Terminals Corporation	Refined petroleum products storage	1974 - 2001
Phillips Petroleum and other operating names	Refined petroleum products storage	1918 - 1974

5. PROPERTY DESCRIPTION

Placeholder: whether the riparian area and /or river bed are leased from DSL.

The Site is approximately 15 acres located at 11400 NW St. Helens Road at the northeast corner of the community of Linnton, on a narrow strip of land between the Willamette River and the Portland Hills. The site has 34 tanks with a total storage capacity of about 20 million gallons. Currently, many of the tanks are unused. The tanks are connected via a piping system to the Olympic Pipeline, the SFPP LP Pipeline (formerly Santa Fe Pacific Pipeline), the truck loading rack (unused), the rail-car loading rack (unused) and to the Site dock facilities. The Site dock facilities are used for the transfer of refined petroleum products to and from barges and ships. The Site dock facilities use is limited with nearly all products entering and leaving the Site by pipeline. Buildings on the Site consist of four warehouses (designated as "A" through "D"), the boiler and pump house, an electrical house, a maintenance shop and an office which is connected to warehouse "A". Currently, only the office, maintenance shop and part of Warehouse "C" are used regularly, the remaining warehouse space appears to be rarely used. The northern one-third of the facility is almost entirely surfaced with concrete pavement and building floor slabs, while the AST containment area (tank yards) and remaining portions of the property are surfaced with imported gravel and sandy soil. Access to the Site is restricted with fences on all sides and security personnel 24 hours per day.

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The Site is bound on the northeast by the Willamette River and on the northwest by a Portland & Western Railroad right-of-way with an active rail line. The former Linnton Planing Mill and Owens-Corning Fiberglass/Trumbull Asphalt facility is located to the north-northwest of the Site and a steel yard (formerly West Coast Adhesives) is located to the south-southeast. Site zoning by the City of Portland is Heavy Industrial. The adjacent properties of the north (former Linnton Planing Mill and Owens-Corning Fiberglass/Trumbull Asphalt facility) and to the south (steel yard) are also zoned Heavy Industrial. Properties to the northwest (across the Portland & Western Railroad right-of-way and along NW St. Helens Road) are zoned employment general (EG1).

The rail car loading rack was taken out of service in 1997 and the truck loading rack was taken out of service in March 2000. The Site dock facilities, on the Willamette River, are used for loading and unloading of petroleum fuels, however, use of the dock is limited, and nearly all products enter and leave the Site by pipeline. The aboveground storage tanks (ASTs) are all located within containment walls. Storm water that collects within the AST containment area collects into a series of storm water collection sumps. These sumps are plumbed to an American Petroleum Institute (API) oil-water separator, then pumped to a storage tank, and sampled prior to discharge under a general NPDES storm water discharge permit. Limited site operations and site controls limit potential pathways for contaminants to reach the Willamette River.

6. CURRENT SITE USE

The Site currently is operated as a bulk petroleum facility. Currently, many of the ASTs are unused. The tanks are connected via a piping system to the Olympic Pipeline, the SFPP LP Pipeline (formerly Santa Fe Pacific Pipeline), the truck loading rack (unused), the rail-car loading rack (unused) and to the Site dock facilities. The truck loading rack and rail-car loading rack are no longer is use. The Site dock facilities use is limited with nearly all products entering and leaving the Site by pipeline.

7. SITE USE HISTORY

The Site has operated as a bulk petroleum facility since the installation of ASTs as early as 1918.

8. CURRENT AND HISTORIC SOURCES AND COPCS

The understanding of historic and current potential upland and overwater sources at the site is summarized in Table 1. The following sections provide a brief overview of the potential sources and COPCs at the site requiring additional discussion.

Releases of petroleum products from the storage and distribution system appear to be the primary release mechanism for petroleum hydrocarbons and the other associated chemicals to enter the Site in soil and groundwater.

8.1. UPLANDS

Table 1 of the *Draft Remedial Investigation* report (KHM Environmental Management, Inc, October 2002) provides a summary of the documented releases history of the Site. A majority of those documented releases were reported to occur at the dock facilities and are listed with the overwater activities (below). Based on the results of the RI sampling and analytical program, a list of COPCs was

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developed for the Site to include only those contaminants that were positively identified in soil and groundwater somewhere on the Site. The Draft RI report identified 1,2-dichloroethane, benzene, naphthalene, and n-propylbenzene as groundwater COPCs for the Site. Benzo(a)anthrancene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, n-propylbenzene, lead, benzene, naphthalene, chromium, and arsenic are identified as soil COPCs for the Site.

8.2. Overwater Activities ☐ *Yes* ☒ *No*

Historically the KMLT dock was used for regular scheduled offloading of petroleum products from barges and ships as well as the refueling of tugboats. Currently, the dock is used occasionally for the offloading of petroleum products from barges and ships. The dock is no longer used for the refueling of tugboats. The following summary of documented overwater releases (activities at the Site dock facilities) is taken from Table 1 of the *Draft Remedial Investigation* report (KHM Environmental Management, Inc., October 2002).

Date Reported	Reported Estimated Volume (gallons)	Product Reported	Comments
07/06/72	5 - 20	Gasoline	Dock Area – Drained from hose after product transfer.
02/27/73	Unspecified	Fuel Oil	Dock Area – Details not available.
07/26/82	Seepage	Oil	Bypassed subsurface seepage control system.
05/10/89	50 – 100	Diesel Fuel	Dock Area – lost during product transfer.
11/26/92	4 – 5	Unleaded Gasoline	Dock Area – drained from hose after product transfer; 4 – 5 gallons.
08/10/94	10	Oil	Dock Area – release during product transfer.
11/11/95	Sheen	Diesel Fuel	Sheen observed on river – area near 1994 diesel fuel release from transfer line.
10/16/97	20	Unleaded Gasoline	Dock Area - Ten-inch valve cracked into two. Most gasoline contained in dock containment.
10/03/98	200	Unleaded Gasoline	Dock Area - Check valve in 6-inch dock transfer line broke.

8.3. Spills

As stated in the *Draft Remedial Investigation* report (KHM Environmental Management, Inc., October 2002), a December 1994 diesel release from a diesel line near the northern approach of the Site dock facilities is the only historical documented upland release at the Site not included in the table above.. In response to the December 1994 release , four monitoring wells (MW-1 through MW-4) were installed in 1995 in the vicinity of release. All other documented releases were reported to occur at the dock facilities and are listed above. This information was gathered by review of the DEQ SPINS database and the Coast Guard and National Response Center's database.

9. PHYSICAL SITE SETTING

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9.1. Geology

The Site's soil profile is typified by a layer of fill covering alluvium. The source of the fill (silt and sand) is likely from dredging activities on the Willamette and Columbia Rivers. Based on borings, the fill material has been identified to an approximate depth of 35 feet below ground surface (the maximum depth explored on-site) near the river and only 1 foot below grade in the borings furthest from the river near the western property boundary. Holocene alluvial deposits underlie the fill material. It is estimated that the thickness of alluvium is approximately 60 feet in the area of the Site. In general, the alluvium beneath the Site consists of alternating layers of sandy silt, silt, silty sand, sand with occasional layers of sandy gravel, gravelly sand, or clayey silt containing organics to the total depth explored. Figure 2 presents a cross section prepared by the Lower Willamette Group of the Site's shallow subsurface stratigraphy. Investigation activities conducted at the Site have not assessed the depth at which the basalt formation exists beneath the Site. It is estimated, based upon the findings of other drilling activities in the region along the Willamette River, that the basalt unit is present at approximately 50 to 100 feet below grade.

9.2. Hydrogeology

Currently the 32 monitoring wells/piezometers/recovery wells are used as part of the groundwater-monitoring network for the Site (Figure 3). All wells present at the Site are screened in a single, shallow aquifer, with most of the monitoring wells screened to a depth of approximately 25 feet below grade. Based on the most recent groundwater monitoring and sampling event, completed on April 28th and 29th, 2004 the depth to groundwater measurements ranged from 11.12 feet (in MW-16) to 23.21 feet (in MW-5). Based on the groundwater level measurements taken from twenty-nine wells during this monitoring event, the groundwater flow direction appears to be generally to the northeast, toward the Willamette River.

A pump test was started in the morning on May 13, 2003 at 10:06 AM and was shut down after a 24-hour period. During the test, the groundwater extraction rate from Well RW-2 ranged from 2.25 to 3.25 gallons per minute (gpm) with an average extraction rate of approximately 2.5 gpm. The draw down in the pumping well was approximately 13 feet during the pump test. This resulted in a draw down of approximately 1.5 feet in the adjacent recovery well (RW-3) which is located approximately 35 feet south of the pumping well. The pumping well and observation wells used in the pump test are partially penetrating wells in an unconfined aquifer. The Moench Method analysis calculated a hydraulic conductivity (K) of 19.4 feet per day (ft/d). This calculated hydraulic conductivity is within the range of hydraulic conductivities typical of silty sand, which is the soil type of the aquifer as identified in the installation of the recovery wells.

During January 2002, an apparent petroleum hydrocarbon sheen was noticed on the Willamette River along the seawall of the Site. During the completion of the Remedial Investigation (RI), KMLT extensively investigated the upland area near this apparent hydrocarbon seep. In July 2004, KMLT completed the installation and start-up of the IRAM Area Containment System that consist of five four-inch diameter groundwater recovery wells RW-1 through RW-5) along the seawall near the southern half of the riverfront. This IRAM Area Containment System (system) is designed to control groundwater flow in the area of the SPH seep and the recovery of SPH from the five recovery wells and from MW-2 and MW-19. A seep and iron (ferric hydroxide) staining on beach is occasionally observed at the northern end of the riverfront.

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10. NATURE AND EXTENT *(Current Understanding)*

In a March 13, 2003 letter to the DEQ (*Comments to the Draft RI Report*, KHM Environmental Management, Inc.), in regards to a comment about the Locality of Facility, it is stated that the COPCs near the site's down gradient property boundaries are below the appropriate human health and ecological screening levels, indicating that additional assessment is not warranted at this time to further define the lateral extent of petroleum hydrocarbons constituents in groundwater with the exception of further definition of dissolved petroleum hydrocarbons down gradient of MW-13. The western (up-gradient) extent of petroleum hydrocarbons is currently being assessed. Recent Geoprobe borings and two additional monitoring wells have been installed near the former rail-car loading rack on the western side of the Site to further defined SPH occasionally observed in MW-16 associated with past rail car loadong/unloading operations. The eastern extent of the petroleum hydrocarbons in groundwater is addressed by on-going monitoring of the groundwater monitoring well network and the operation of the IRAM Area Containment System. Potential changes and trends in the concentrations of petroleum hydrocarbon constituents in the groundwater at the Site continue to be evaluated as part of the on-going groundwater monitoring and sampling program.

10.1. Soil

10.1.1. Upland Soil Investigations ☒ Yes ☐ No

A total of 27 subsurface soil samples representing a range of geographic coverage were submitted for laboratory analysis. These samples were collected during the RI field work in January, February, and April of 2002. Select soil samples were submitted for analysis by TPH-G (NW TPH-Gx), TPH-D (NW TPH-Dx), BTEX and naphthalene (EPA 8021B), VOCs (EPA 8260B), SVOCs (EPA 8270C), PAHs (8270M-SIM), and total metals (EPA 6000/7000 series). The Draft RI report identified benzo(a)anthrancene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, n-propylbenzene, lead, benzene, naphthalene, chromium, and arsenic as soil COPCs for the Site. The following table presents the minimum and maximum concentration detected (detected above the MRL) for each of the COPCs for soil:

Analyte	Minimum Detected Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)	Location of Maximum Detected Concentration
Benzo(a)anthrancene	0.03	15.3	SS-26 (surface soil)
Benzo(a)pyrene	0.03	14.8	SS-26 (surface soil)
Benzo(b)fluoranthene	0.023	16	SS-01(surface soil)
Dibenzo(a,h)anthracene	0.01	4.56	SS-26 (surface soil)
Indeno(1,2,3-cd)pyrene	0.011	11.5	SS-01, SS-26
N-propylbenzene	0.0421	14.9	MW-12
lead	4.15	3,570	SS-16 (surface soil)
benzene	0.00759	26.9	P-4
Naphthalene	0.012	164	HO-2
Chromium	6.93	2,360	SS-27 (surface soil)
Arsenic	1.14	80.7	SS-08 (surface soil)

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10.1.2. Riverbank Samples ☐ Yes ☒ No

10.1.3. Summary

As presented in the Draft RI report, the Site-related risks and hazards are calculated for the reasonable maximum exposure and the central tendency exposure for each pathway, a calculation that overestimates risks for the majority of the population in order to ensure that public health is protected. Risks and hazards for construction workers were below target health goals for all chemicals and pathways evaluated. Risks for on-site workers were 2×10^{-5}, due to soil ingestion and dermal contact primarily of benzo(a)pyrene, and secondarily due to arsenic and dibenz(a,h)anthracene. The risks for these three compounds are driven by three soil concentrations within the tank farms. The tank farm soils are covered by gravel, limiting soil contact, and workers do not spend the majority of their time in that area. Thus, the estimated risks calculated in this document likely overestimate the actual risks for workers.

10.2. Groundwater

10.2.1. Groundwater Investigations ☒ Yes ☐ No

Groundwater assessment activities at the Site consist of sampling from the existing site monitoring well network and groundwater samples for Geoprobe boring locations. Currently the 32 monitoring wells/piezometers/recovery wells are used as part of the groundwater monitoring network for the Site. During normal groundwater monitoring (depth-to-product/depth-to-water measurements) and sampling events, approximately 25 to 29 wells are monitored and approximately 10 to 15 wells are sampled. All Site wells are screened in a single, shallow aquifer.

10.2.2. NAPL (Historic & Current) ☒ Yes ☐ No

During the October 2003 groundwater monitoring and sampling event, 14 of the 32 wells gauged during this event contained measurable amounts for Non-aqueous Phase Liquid (NAPL) or SPH, with the greatest apparent SPH thicknesses measured in recovery well RW-3. The SPH is composed of a mixture of mostly diesel with a small amount of gasoline with the exception of the SPH consistently observed in Well MW-11. The SPH observed in Well MW-11 is of a high viscosity mostly composed of Bunker C type oil. All 14 wells with measurable SPH are located in the same proximity, with five wells used as groundwater and SPH recovery wells (RW-1 through RW-5) and two wells used for SPH recovery (MW-2 and MW-19). This IRAM Area Containment System (system) is designed to control groundwater flow in this area and to recover of SPH.

10.2.3. Dissolved Contaminant Plumes ☒ Yes ☐ No

Plume characterization status – complete/incomplete

Characterization of the COPC associated with the Site is documented in the *Draft Remedial Investigation* report (KHM Environmental Management, Inc., October 2002)

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and on-going groundwater monitoring reports. The extent of the COPCs in groundwater (plume) is discussed below.

Plume Extent [*Assess nature and extent here*]

In response to DEQ comments regarding the Locality of Facility for the Site, a March 13, 2003 letter to the DEQ (*Comments to the Draft RI Report*, KHM Environmental Management, Inc.) stated that the COPCs near the down gradient property boundaries are below the appropriate human health and ecological screening levels, indicating that additional assessment is not warranted at this time to further define the downgradient extent of petroleum hydrocarbons constituents in groundwater at the Site. The western (up-gradient) extent of petroleum hydrocarbons is currently being assessed. Recent Geoprobe borings and two additional monitoring wells have been completed near the former rail-car loading rack on the western side of the Site to further define SPH associated with the former operations of the railcar loading rack. The eastern extent of the petroleum hydrocarbons in groundwater is addressed by on-going monitoring of the groundwater monitoring well network and the operation of the IRAM Area Containment System. Potential changes and trends in the concentrations of petroleum hydrocarbon constituents in the groundwater at the Site continue to be evaluated as part of the on-going groundwater monitoring and sampling program.

Min/Max Detections (Current situation)

The Human Health and Ecological Risk Assessments presented in the Draft RI report identified 1,2-dichloroethane, benzene, naphthalene, and n-Propylbenzene as groundwater COPCs for the Site. The following table is taken from the Draft RI report and presents the minimum and maximum concentration detected (detected above the MRL) for each of the COPCs in groundwater.

Analyte	Minimum Detected Concentration (µg/l)	Maximum Detected Concentration (µg/l)	Location of Maximum Detected Concentration
1,2-Dichloroethane	0.25	0.61	MW-6
Benzene	2.85	420	MW-9
Naphthalene	0.0968	2,340	HO-2
N-Propylbenzene	0.21	308	MW-13

Current Plume Data (using December 2003 data set)

The following table presents the analysis from October 2003 groundwater sampling. Groundwater sampling in October 2003 was limited to BTEX and TPH analysis, accordingly, no values are available for Naphthalene, 1,2-dichloroethane, nor n-Propylbenzene. The plume map presented as Figure 3 shows the location and the highest concentration detected of each COPC at the site. In addition, the plume map presents the extent of measureable SPH at the site.

Analyte	Minimum Detected Concentration (µg/l)	Maximum Detected Concentration (µg/l)	Location of Maximum Detected Concentration
Benzene	0.927	77.9	MW-16

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Preferential Pathways

No preferential pathways for groundwater or SPH have been identified at this Site.

Downgradient Plume Monitoring Points (min/max detections)

Groundwater monitoring wells MW-1, MW-3, MW-7, MW-8, MW-13, and MW-22 are down-gradient monitoring points for the existing groundwater monitoring network. The following table presents the minimum and maximum groundwater concentrations and ecological screening level values used for the COPCs for these down-gradient monitoring wells. Groundwater sampling in 2003 was limited to BTEX + Naphthalene and TPH analysis, accordingly, values for 1,2-dichloroethane, and n-propylbenzene are from the analytical samples completed for the Draft RI report (2002).

Well	Benzene	Naphthalene	1,2-Dichloroethane	N-Propylbenzene
MW-1	Not Detected in both samples from 2003	Not Detected in both samples from 2003	Not detected in the 2002 RI sampling	11.3 µg/l detected in the 2002 RI Sampling
MW-3	Not Detected in the one 2003 sample	2.31 µg/l detected in one 2003 sample	Not detected in the 2002 RI sampling	No Sampled
MW-7	Not Detected all four of the samples from 2003	Not Detected in both samples from 2003	Not detected in the 2002 RI sampling	Not detected in the 2002 RI sampling
MW-8	Concentrations range from 0.927 to 15.8 µg/l in the four 2003 Samples	Concentrations range from 5.89 to 23.1 µg/l in the two 2003 Samples	Not detected in the 2002 RI sampling	47.5 µg/l detected in the 2002 RI Sampling
MW-13	Concentrations range from 2.18 to 107 µg/l in the four 2003 Samples	Not Detected in both samples from 2003	Not detected in the 2002 RI sampling	308 µg/l detected in the 2002 RI Sampling
MW-22	Concentrations range from ND to 11.7 µg/l in the three 2003 Samples	Not Detected in the one sample collected in 2003	Not Sampled for this COPC (Installed in 2003 after RI sampling)	Not Sampled for this COPC (Installed in 2003 after RI sampling)
Screening Level Values	**130 µg/l** – DEQ Level II SLV for surface water (fresh) aquatic receptor	**620 µg/l** – DEQ Level II SLV for surface water (fresh) aquatic receptor	**280 µg/l** – DEQ RBC for GW in an excavation – excavation worker scenario. There is not an established Level II screening level for this compound.	**1,600 µg/l** – DEQ RBC for GW in an excavation – excavation worker scenario. There is not an established Level II screening level for this compound.

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Visual Seep Sample Data ☐ **Yes** ☐ **No**

[Information Source: Seep Reconnaissance Survey Report. Kinder Morgan requests the ability to review this section before any submittal to EPA.]

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Nearshore Porewater Data

None

GW Plume Temporal Trend

No analysis of the potential trends regarding the groundwater plume has been completed for the Site.

10.2.4. Summary

Based on the *Draft Remedial Investigation* report and groundwater monitoring reports, the groundwater flow direction at the Site generally appears to be northeasterly, toward the Willamette River. The eastern extent (seep area) of the petroleum hydrocarbons in groundwater is addressed by on-going monitoring of the groundwater monitoring well network and the operation of the IRAM Area Containment System. This system is designed to control groundwater flow in the area of the SPH seep and the recovery of SPH from the five recovery wells and from MW-2 and MW-19. Groundwater control is accomplished by the simultaneous extraction of groundwater from the five recovery wells RW-1 through RW-5. Extracted groundwater is treated with a sand-filter followed by activated carbon. Treated groundwater is discharged to the Willamette River under a 1500A General NPDES discharge permit. Outside the IRAM Area, groundwater-monitoring wells MW-1, MW-3, MW-7, MW-8, MW-13, and MW-22 are down-gradient monitoring points for the existing groundwater monitoring network for the Site. Concentrations of the Site groundwater COPCs measured in these wells are non-detect or below the screening level values. Only two of the COPCs (naphthalene and benzene) have DEQ Level II ecological screening levels established. These levels are 620 µg/l for naphthalene and 130 µg/l for benzene. Potential changes and trends in the concentrations of petroleum hydrocarbon constituents in the groundwater at the Site continue to be evaluated as part of the on-going groundwater monitoring and sampling program.

10.3. Surface Water

10.3.1. Surface Water Investigation ☐ Yes ☒ No

10.3.2. General or Individual Stormwater Permit (Current or Past) ☒ Yes ☐ No

As presented in the direct discharge section (above), the stormwater from the AST containment area, under normal conditions, discharges from the two API oil-water separators and is pumped into AST 3034 where it is sampled prior to batch discharge. During larger precipitation events, once AST 3034 is full, storm water is visually

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inspected at the effluent end of the API oil-water separator and discharged to the Willamette River. Storm water is discharged from the Site under a 1300 general NPDES storm water discharge permit. The limited site operations and site controls limit potential pathways for contaminants to reach the Willamette River via stormwater.

Permit Type	Permit Number	Start Date	Outfalls	Volumes	Parameters/Frequency
GEN 1300J (NPDES general permit)	10287	07/31/2001	Willamette River	N/A	Storm water run-off (Standard requirements)

Do other non-stormwater wastes discharge to the system? ☐ Yes ☒ No

10.3.3. Stormwater Data ☒ Yes ☐ No

Storm water sampling has been completed per the permit requirements and sampling results have been in compliance with the permit limitations. In addition to the general storm water permit sampling requirements, Kinder Morgan has voluntarily collected two rounds of samples from the storm water discharge for total metals analysis. Samples were collected on November 14, 2002 and December 16, 2002 and analyzed for arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver by EPA 6000/7000 series methods. Only barium and lead were detected above the MRLs; barium at a concentration of 0.019 and 0.022 mg/l and lead at 0.010 mg/l and non-detect in the December 16 sample.

10.3.4. Catch Basin Solids Data ☐ Yes ☒ No

10.3.5. Wastewater Permit ☐ Yes ☒ No

Permit Type	Permit Number	Start Date	Outfalls	Volumes	Parameters/Frequency
GEN 1500A (NPDES general permit)	17609	02/12/2003	Willamette River	N/A	Petroleum hydrocarbons cleanup (Standard Requirements)

10.3.6. Wastewater Data ☒ Yes ☐ No

Sampling of the discharge from the IRAM Area Containment System (1500A general permit) has been completed per the permit requirements and sampling results have been in compliance with permit limitations.

10.3.7. Summary

Storm water and waste water sampling has shown that the Site is in compliance with sampling requirements and the associated permit discharge limitations. Voluntarily sampling of the storm

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water discharge for total metals analysis has shown that only barium and lead were detected above the MRLs.

10.4. Sediment

This information is to be provided by the LWG. [Kinder Morgan requests the ability to review this section before any submittal to EPA.]

10.4.1. River Sediment Data ☐ Yes ☒ No

10.4.2. Summary

11. CLEANUP HISTORY AND SOURCE CONTROL MEASURES

11.1. Soil Cleanup/Source Control

The October 2002 Draft RI completed for the Site includes a preliminary hot spot analysis for soil, based on the DEQ guidance for highly concentrated and highly mobile hot spots in soil. Based on this analysis for highly concentrated or highly mobile hot spots in soil, no preliminary hot spots in soil were identified at the Site.

11.2. Groundwater Cleanup/Source Control

As presented above, in July 2004, KMLT completed the installation and start-up of the IRAM Area Containment System that consists of five four-inch diameter groundwater recovery wells RW-1 through RW-5) along the seawall near the southern half of the riverfront to address the observation of a hydrocarbon sheen. This system is designed to control groundwater flow in the area of the SPH seep and the recovery of SPH from the five recovery wells and from MW-2 and MW-19.

11.3. Other

11.4. Potential for Recontamination from Upland Sources

LWG Placeholder *[Kinder Morgan requests the ability to review this section before any submittal to EPA.]*

12. BIBLIOGRAPHY / INFORMATION SOURCES

Figure 1 – (Provided by LWG) Site Features (aerial photo base with outfalls, beaches, Round 1, existing Category 1 & 2 data, planned Round 2 sediment sample locations). Label adjacent properties to the subject site.

Figure 2 – Cross Section (as available)

Figure 3 – Extent of Impacted Groundwater (as available)

- **Include basis for plume definition (detection limit, etc)**

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- **Show max. concentration and date location**
- **Provide arrows or similar graphic that demonstrate understanding of groundwater pathway to the river (e.g., deflections around slurry wall, subsurface/buried channels, known discharge points)**

Tables:

Table 1: Potential Sources
Table 2: (Provided by LWG) Queried Sediment Chemistry Data (summary statistics only, Category 1 & 2 surface and subsurface data separated). Query boundaries are from site boundaries out to the toe of the channel slope.

KHM Environmental Management, Inc. Draft Remedial Investigation, October 2002. Prepared for Kinder Morgan Liquid Terminals by KHM Environmental Management, Inc.

KHM Environmental Management, Inc. letter to DEQ, Comments to the Draft RI Report, March 12, 2003. Prepared for Kinder Morgan Liquid Terminals by KHM Environmental Management, Inc.

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Willbridge Terminals (WMCSR-NWR-94-06)
Table 1. Potential Sources and Transport Pathways Assessment

Last Updated: July 19, 2004

Potential Sources		Media Impacted					COIs																	Potential Complete Pathway				
							TPH			VOCs																		
Map Location	Description of Potential Source	Surface Soil	Subsurface Soil	Groundwater	Catch Basin Solids	River Sediment	Gasoline-Range	Diesel - Range	Heavier - Range	Petroleum-Related (e.g. BTEX)	VOCs	Chlorinated VOCs	SVOCs	PAHs	Phthalates	Phenolics	Metals	PCBs	Herbicides and Pesticides	Dioxins/Furans	Butyltins	[Others -List]	[Others -List]	[Others -List]	Overland Transport	Groundwater	Direct Discharge - Overwater	Direct Discharge - Storm/Wastewater	River Bank Erosion
Upland Areas																													
A	ConocoPhillips	√	√	√			√			√				√			√									√	√	√	
B	Chervon Products	√	√	√			√	√		√				√			√									√	√	√	
C	Kinder Morgan Liquid Terminals	√	√	√			√	√		√				√			√									√	√	√	
Overwater Areas																													
A	ConocoPhillips - Dock Operations						√	√		√				√															
B	Chervon Products - Dock Operations						√	√		√				√															
C	Kinder Morgan Liquid Teminals - Dock Operations						√	√		√				√															
Other Areas/Other Issues																													

Notes:

UST	Underground storage Tank
AST	Above-ground Storage Tank
TPH	Total Petroleum Hydrocarbons
VOCs	Volatile Organic Compounds
SVOCs	Semi-volatile Organic Compounds
PAHs	Polycyclic aromatic hydrocarbons
BTEX	Benzene, toluene, ethylbenzene, and xylenes
PCBs	Polychorinated biphenols

√ Source, COI are present or currnet or historic pathway is determined to be complete or pootentially complete
? There is not enough information to determine if source of COI is present or if pathway is complete.
Blank Source, COI and Histroic and Current pathways have been investigated and shown to be not present or incomplete.

LEGEND

MW-1 ◉ Groundwater Monitoring Well Location and Designation and (Gauging date: April 28, 2004)

P-1 ▲ Piezometer Location and Designation

RW-2 ◎ Wells Containing Separate Phase Hydrocarbon (SPH) - April 28, 2004

MW-9 ● Wells with the highest concentrations of the COPCs and Sampling Event Date

COPCs are based on the *Draft Remedial Investigation Report*, dated October 2002, for the Site

DEQ Guidance for Ecological Risk Assessment Level II for COPCs:

Benzene:	130 µg/L
Naphthalene:	620 µg/L
1,2-Dichloroethane:	None Established (Human Health values used in the RI)
n-Propylbenzene:	None Established (Human Health values used in the RI)

Estimated Extent of SPH on Groundwater

Approximate Groundwater Flow Direction - April 28, 2004

0 75 FT

APPROX. SCALE

Basemap taken from 1980 aerial photograph. Well locations taken from *Groundwater Monitoring Report*, April 28, 2004, Delta Environmental Consultants, Inc.

FIGURE 3

EXTENT OF IMPACTED GROUNDWATER

KINDER MORGAN LIQUID TERMINALS LLC
LINNTON TERMINAL
11400 NW ST. HELENS ROAD
PORTLAND, OREGON

PROJECT NO. PTKM-001-8	DRAWN BY CRF
FILE NO.	PREPARED BY CRF 6/2/04
REVISION NO.	REVIEWED BY

Delta Environmental Consultants, Inc.