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Subject: Response to DEQ's Comments on the Draft Interim Feasibility Study for the Gasco OU

Dana –

On behalf of NW Natural, I am pleased to provide the attached responses to DEQ's August 15, 2019 comments on the Draft Interim Feasibility Study (IFS) for the Former Gasco Manufactured Gas Plant Operable Unit (Gasco OU). The IFS was submitted to DEQ on November 18, 2018, with submittal of final content on January 11, 2019. Following receipt of DEQ's comments on August 15, 2019, DEQ and NW Natural technical teams met on October 2, 2019, October 15, 2019, November 18, 2019 and January 28, 2020 to discuss, clarify and resolve comments. In addition, comments were discussed further during numerous one-on-one phone calls between the two of us.

As we have discussed, it is NW Natural's preference to address DEQ's comments and include the necessary updated IFS content in the Draft FS Report rather than revising the IFS. To meet this objective, the attached response to comments (RTC) matrix is intended to document how DEQ's comments will be addressed and to identify those comments that will require additional discussion as we begin development of PRGs and remedial alternatives. As we have demonstrated through comparative schedules, incorporating the updated information requested in DEQ's August 15, 2019 comments in the Draft FS Report will save at least 9 months in the project schedule, providing better alignment between the upland and in-water schedules.

We appreciate the time DEQ and its technical team have spent discussing and clarifying your comments with us, and we look forward to developing PRGs and beginning work on the Draft FS Report. Please let me know if you have any questions or need additional information regarding any of the responses. Thanks.

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Interim Feasibility Study, Gasco OU, November 21, 2018
DEQ Comment and Response Matrix

ID No.	Section Name/Topic	Section/ Table/Figure No.	Page No.	DEQ Comment	Discussed with DEQ	Response/Path Forward
1	List of Relevant Preceding Documents	Section 1.2	3	Section 1.2 provides NW Natural's list of documents for work completed on the Gasco Site and the Siltronic Site. DEQ did not review the section and is not providing comments. As DEQ has indicated previously, the current RI/FS process began with DEQ's issuance of our March 10, 2010 letter reviewing the Gasco Site RI Report and the "Revised Baseline Level III Ecological and Human Health Risk Assessment Report" (Anchor, 2004).	NR	Comment noted.
2	Background	Section 2	7	This section of the Draft Interim FS provides an overview of the historic and current uses of the Gasco OU GSAs, including sources of contamination; and brief descriptions of stormwater and groundwater source control measures (SCMs). The information relies in large part on previous submittals. Certain sections include updated and new information (e.g., Section 2.3.4.1). DEQ's comments are intended to clarify information for consistency with previous documents, and/or to request additional information or revisions as indicated. Lack of comments on new and/or updated information does not imply DEQ acceptance of, or agreement with the information.	NR	Comment noted.
3	Historical Use/Site-Wide Filling Activities (non-PG&C)	Section 2.3.5.1	16	The section states that, "Depending on origin, dredged sediments may have included various constituents from different operations, including wood treating, shipyard, pesticide, or petroleum terminal-related materials." This statement is speculative in terms of contaminant types present and appears to be based on general information regarding historic industries along the Willamette River. The Draft Interim FS should acknowledge that assessing the nature of potential uplands contamination in the Siltronic GSA associated with dredged material is an objective of Gasco OU investigations.	NR	The text will be edited in the FS Report as requested.
4	Historical Uses/Former Office Area	Section 2.3.1.1	10	According to the section, during demolition of the former Administration Building no longer in-service left-in-place subsurface utilities were "cut and capped." The potential for these utilities to contain MGP residuals or to act as conduits for migration of contamination should be further discussed. To the extent known, the locations and alignments of left-in-place utilities should be shown on a figure. Based on available information, further investigatory work and/or removal of these utilities may be warranted. This comment applies to similar situations across the Gasco Site.	11/13/19	As part of stormwater source control evaluations, the potential for utilities to serve as preferential conduits for groundwater or stormwater transport are being monitored and evaluated, and no preferential paths have been identified. As discussed during our November 13, 2019 meeting, the text will be updated in the FS Report to identify the need for protocol development related to the discovery of previously unknown utilities during future site work by NW Natural, tenants, or contractors. Items such as documentation and assessment needs, as well as DEQ notification, will be elements of this protocol.
5	Current Uses/Siltronic GSA	Section 2.3.5.2	17	DEQ notes that Fabrication Building 1 (Fab 1) is vacant and no longer in use for wafer manufacturing.	NR	The text will be updated in the FS Report to include this information.
6	Stormwater Discharges	Section 2.4.1.2	19	The section indicates that NW Natural is implementing SCMs to control runoff from the Gasco Site geographic sub-areas (GSAs) to the Willamette River and Doane Creek. DEQ requests that additional descriptions of the SCMs, including status, approach, type(s), and locations be added to the section for informational purposes.	NR	The text will be updated in the FS Report to include this information.

ID No.	Section Name/Topic	Section/ Table/Figure No.	Page No.	DEQ Comment	Discussed with DEQ	Response/Path Forward
7	NW Natural Hydraulic Control and Containment System	Section 2.4.2	19	DEQ's comments on the section include the following: • The Draft Interim FS states that, "A groundwater and DNAPL HC&C system is currently in operation to prevent discharge of upland groundwater from the Upper and Lower Alluvium water-bearing zones (WBZs) to the Willamette River." The description of the hydraulic control and containment (HC&C) system as a "groundwater and DNAPL HC&C system" is inaccurate as the design objective of the system is to hydraulically control and contain groundwater. The system is not designed to control dense non-aqueous phase liquid (DNAPL). DEQ directs NW Natural to replace the statement with: "A groundwater HC&C system is currently in operation to control and contain discharges of upland groundwater from the Upper and Lower Alluvium water-bearing zones (WBZs) to the Willamette River. Incidental to operating the system, DNAPL accumulation in, and removal from many extraction wells and monitoring wells does occur and is currently reported semi-annually (e.g., see Appendix D)."	NR	This edit will be made in the text of the FS Report.
8	NW Natural Hydraulic Control and Containment System	Section 2.4.2	19	• DEQ acknowledges the testing phase of the HC&C system was completed in May 2016. DEQ notes that system commissioning occurred from May 2015 through May 2016. DEQ confirmed completion of HC&C system commissioning and acknowledged the system was operational by letter dated December 30, 2016.	NR	This edit will be made in the text of the FS Report.
9	NW Natural Hydraulic Control and Containment System	Section 2.4.2	19–20	• The section incorrectly states that, "The Gasco groundwater model is used to demonstrate that the HC&C system prevents groundwater in the upper, Lower, and Deep Lower Alluvium WBZs from discharging to the river." For clarification, DEQ has only approved use of the model to evaluate the influence of the HC&C system on the Deep Lower Alluvium WBZ. Hydraulic control and containment of groundwater in the Upper Alluvium WBZ and Lower Alluvium WBZ is evaluated by comparing groundwater elevations in these WBZs to river elevations. The HC&C system operates to maintain groundwater elevations in these two WBZs more than 0.1-feet below the elevation of the river (i.e., maintain the hydraulic gradient towards the uplands).	NR	The cited sentence will be revised in the FS Report to the following: "The Gasco groundwater model is used to demonstrate that the HC&C system prevents groundwater in the Deep Lower Alluvium WBZ from discharging to the river. HC&C of groundwater in the Upper Alluvium WBZ and Lower Alluvium WBZ is evaluated by comparing groundwater elevations in these WBZs to river elevations."
10	NW Natural Hydraulic Control and Containment System	Section 2.4.2	20	• The last paragraph indicates that DNAPL removed from installations "…is pumped to a satellite accumulation area and removed for off-site recycling. NW Natural should review and confirm that all DNAPL is managed offsite by recycling, and revise the text if appropriate.	NR	The text will be revised in the FS Report to clarify that DNAPL removed from installations is pumped to a satellite accumulation area and sent off site for fuel blending/energy recovery.
11	Surface Water Features and Stormwater Management	Figure 2-4	--	DEQ comments on the figure include the following: • The alignments of the piping and drains to the Gasco outfalls are difficult to distinguish using the current selection of colors and symbols (e.g., the stormwater force main and gravity lines). DEQ requests that figure be revised to clearly distinguish the different types of piping.	NR	The figure will be updated in the FS Report as requested.
12	Surface Water Features and Stormwater Management	Figure 2-4	--	• Many labels reference stormwater sub-basins that are not shown on the figure. Sub-basin boundaries should be added to the figure for reference.	NR	The figure will be updated in the FS Report as requested.

ID No.	Section Name/Topic	Section/ Table/Figure No.	Page No.	DEQ Comment	Discussed with DEQ	Response/Path Forward
13	Surface Water Features and Stormwater Management	Figure 2-4	--	• Many features on the figure are not shown clearly due to topographic contours. DEQ suggests that Figure 2-2 include topographic contours. DEQ requests that the figure be revised to address each comment.	NR	The figure will be updated as requested in the FS Report, or topographic contours will be shown in a separate or different figure per DEQ's suggestion.
14	Environmental Setting	Section 3	21	This section of the Draft Interim FS summarizes available information regarding the geologic setting (Section 3.1) and hydrogeologic setting (Section 3.2) of the Gasco OU. In general, the section should summarize information from previous submittals to provide a framework for understanding the geology and hydrogeology of the Gasco OU. DEQ notes the section revises certain previous presentations of site information. Some of these revisions alter jointly held understandings regarding the types and distribution of material types, and/or do not reflect prior DEQ comments. Consequently, DEQ does not approve Section 3 as written.	NR	No edit is required—specific comments are addressed further in this matrix.
15	Environmental Setting	Section 3	21	DEQ's comments focus on correcting and clarifying information in the context of previous documents, including our comments. The comments also identify information or revisions that provide necessary context regarding Gasco OU geology and hydrogeology to support the FS. Note, that many of our comments on Section 3.1 apply to Section 3.2 as geologic units are also interpreted to be hydrogeologic units. Examples include the "upper silt unit" (Section 3.1 and Section 3.2), and the "lower silt unit" (Section 3.1) referred in Section 3.2 as the "Deep Aquitard." DEQ will accept the section subject to NW Natural revising the content to include the information indicated in our comments, and providing the information as requested below.	NR	No edit is required—specific comments are addressed further in this matrix.
16	Bedrock	Section 3.1.1	21	This section describes the basalt under the Gasco OU from a broad area-wide perspective. Descriptions of the basalt under the Gasco OU are not provided. The section should summarize information available for the basalt under the Gasco OU. Information is available from drilling and video logs available from the drilling of a test well (and nearby monitoring well) on the Siltronic GSA, and during the decommissioning of cathodic protection wells on the Gasco Site. Descriptions should include changes in the nature, character, and water-bearing properties of the rock with depth (e.g., dense, broken, vesicular).	NR	The text will be edited in the FS Report as requested.
17	Bedrock	Section 3.1.1	21	The configuration of the top of the basalt beneath the Gasco OU is an important element of the geology and hydrogeology. The top of the basalt forms a basin-like feature under the Gasco OU. Overall, the depth to the top of basalt increases away from the northwest (NW Natural/U.S. Moorings property line) and southwest (along Highway 30) margins of the Gasco OU. The basin extends southeast with the upper basalt surface rising (depth decreasing) just south of the line between the Gasco OU and Siltronic OU. The basalt basin opens to the northeast (towards the river) and is greater than 220-feet deep near the shoreline. At the margins of the Gasco OU, the depth to the top of basalt is less than 100-feet bgs near the NW Natural/U.S. Moorings property line, less than approximately 50-feet bgs along Highway 30, and approximately 200-feet bgs to the southeast at the southern boundary. The depth to the basalt is interpreted to range between 20 and 60-feet bgs along the southwest margin of the Gasco OU. The basin controls the geometry and thickness of alluvial deposits under the Gasco OU. DEQ requests that the Draft Interim FS be revised to include this information and a structural contour map of the top of the basalt under the Gasco OU.	NR	The text will be revised in the FS Report to discuss the configuration of the top of the basalt beneath the Gasco OU.

ID No.	Section Name/Topic	Section/ Table/Figure No.	Page No.	DEQ Comment	Discussed with DEQ	Response/Path Forward
18	Alluvial Deposits	Section 3.1.2	22	DEQ has numerous clarifying comments on the section that are provided below: • Consistent with previous submittals, the upper-most unit of the alluvium under the Gasco OU is predominantly comprised of silt or fine-grained mixtures of silt and sand. The unit is not a clayey silt as indicated here. DEQ directs the Draft Interim FS to be revised accordingly. Future documents should refer to the "upper silt unit."	11/13/19	As we discussed in the meeting, we will remove the sentence including the references to the 1987 and 1991 reports. Future documents will refer to the "upper silt unit."
19	Alluvial Deposits	Section 3.1.2	22	• Although the silt-portion of the unit varies in thickness, the overall nature of the upper-most alluvium is very fine-grained and the hydraulic connection between the fill and alluvium is limited.	NR	This text will be updated in the FS Report to include this information.
20	Alluvial Deposits	Section 3.1.2	22	• Historic MGP operations modified the upper surface of the silt unit in places (e.g., clean-out of former effluent ponds on the Siltronic GSA to maintain capacity).	NR	The text will be edited in the FS Report to state that historical MGP operations may have modified the upper surface of the silt unit in places. However, the available information does not indicate that the effluent overflow area on the Siltronic GSA were cleaned out as part of historical MGP operations.
21	Alluvial Deposits	Section 3.1.2	22	• The configuration of the top of the upper-silt unit surface influences the thickness and distribution of DNAPL in the fill, such as occurrence and movement of DNAPL along a northwest-southeast oriented depression in the top of the silt-unit under the Former Koppers/LNG Area GSA. DEQ requests that the Draft Interim FS include a structural contour map of the top of the upper-silt unit under the Gasco OU.	NR	A structural contour map of the top of the upper silt unit will be added in the FS Report
22	Alluvial Deposits	Section 3.1.2	22	• The alluvium beneath the upper-silt unit is a coarsening downward sedimentary sequence, transitioning from predominantly fine-sand with layers and lenses of silt/sand mixtures in the upper alluvium, through primarily medium-grained sand, into mixtures of gravel and sand at the base of the deposits.	NR	The text will be revised in the FS Report to include this description.
23	Alluvial Deposits	Section 3.1.2	22	• A lower-silt unit separates the lower alluvium from the deep lower alluvium. The depth of occurrence (not the thickness) of the unit ranges between approximately 100 and 125-feet bgs. The nature and continuity of the lower-silt unit changes from northwest to southeast under the Gasco OU. Near the shoreline (see Figure 3-3b, sheets 1 through 4), the aquitard is thicker, more continuous, and more uniform in nature from under the northern half of the Former Tar Ponds GSA, northwest to where the layer projects into the side of the basalt basin; and more variable (e.g., thinner, less continuous) to the southeast under the Siltronic GSA. Drilling observations do not indicate the lower-silt unit projects out and under the Willamette River (see Figure 3-3e, Sheet 2; Figure 3-3f, Sheet 2; Figure 3-3g, Sheet 3; Figure 3-3h, Sheet 3; Figure 3-3i, Sheet 3).	NR	A discussion of the lower silt unit will be added to the discussion of the alluvial deposits in the FS Report.
24	Surface Fill Deposits	Section 3.1.3	22	Section 2.3.5 indicates that grading and filling of the Siltronic Site began in 1966 and was completed in 1973. DEQ understands that in general, the filling sequence of involved: 1) importing and placing material from off-site sources, including the basalt quarry across Highway 30 from the Gasco OU; and spreading MGP residuals away from the former effluent pond overflow area and spent oxide/purifier pile; followed by 2) hydraulically dredging sediment from the Willamette River onto the uplands. DEQ requests that the section be revised to include additional information regarding the general distribution of material types resulting from historic filling, or that NW Natural clarify or correct our understanding.	NR	The text will be edited in the FS Report to include this information.

ID No.	Section Name/Topic	Section/ Table/Figure No.	Page No.	DEQ Comment	Discussed with DEQ	Response/Path Forward
33	Fill WBZ	Section 3.2.2	24	• In addition to the LNG Basin, the potential influence on the Fill WBZ resulting from cessation of pumping from the former Koppers Tank Farm should be discussed here, including the current program to monitor Fill WBZ groundwater levels within, below, and around the tank farm.	NR	Discussion of the potential influence on the Fill WBZ resulting from cessation of pumping from the former Koppers Tank Farm will be added to the text of the FS Report, including the current program to monitor Fill WBZ groundwater levels within, below, and around the tank farm and status of implementation of interim measure to address increases in downgradient chemical concentrations.
34	Alluvium WBZ	Section 3.2.3	24	Many of DEQ's comments on Section 3.2.1 apply here. DEQ's additional clarifying comments include the following: • Overall the material descriptions for the Alluvium WBZs are not consistent with previous submittals. The descriptions of the material comprising WBZs in sections 3.2.3.2 through 3.2.3.5, and shown on the legend of the cross-sections better describe the material types. The section should be revised accordingly.	NR	The text will be revised in the FS Report to include the descriptions of the material comprising WBZs in Sections 3.2.3.2 through 3.2.3.5 and shown on the legend of the cross sections.
35	Alluvium WBZ	Section 3.2.3	24	• Hydrogeologically, there is not a reason for designating the "Alluvial gravels" as a separate WBZ. The basal gravels have previously been incorporated into, and should remain within the Deep Lower Alluvium WBZ. DEQ recommends that Section 3.1.2 discuss the occurrence of the basal gravels. .	NR	The discussion of the Deep Lower Alluvium WBZ will be revised in the FS Report to incorporate the "alluvial gravels" rather than include a separate bullet.
36	Alluvium WBZ	Section 3.2.3	24	• The basalt basin described in DEQ's comment to Section 3.1.1, controls many aspects of the Gasco OU hydrogeology. The Lower Alluvium WBZ is thickest within the basin, and the lower-silt unit (Deep Aquitard) and Deep Lower Alluvium WBZ occur within the basin. The cross-sections in the Draft Interim FS graphically illustrate this information.	NR	Comment noted.
37	Upper Silt	Section 3.2.3.1	25	The last paragraph indicates that, "…in a few nearshore areas where the silt unit is locally thin or absent, the Fill WBZ is in direct hydraulic communication with the Alluvium WBZ." As DEQ has previously communicated to NW Natural and as reiterated above, although the silt-portion of the unit varies in thickness, the overall nature of upper-most alluvium is very fine-grained and the hydraulic connection between the fill and alluvium is limited. In support of this interpretation, evidence is lacking that the HC&C system influences the Fill WBZ. In addition, the vertical gradients between the Fill WBZ and Upper Alluvium WBZ are large (i.e., groundwater levels in the Fill WBZ are feet above those in the Upper Alluvial WBZ). DEQ considers the matter to be resolved pending new information that indicates otherwise, and directs this sentence to be deleted and not mentioned in subsequent correspondence.	NR	This sentence will be deleted in the FS Report.
38	Lower Alluvium WBZ	Section 3.2.3.3	26	The Draft Interim FS incorrectly states that, "The HC&C system maintains an upward vertical hydraulic gradient from the Lower Alluvium WBZ to the Upper Alluvium WBZ to prevent downward migration of DNAPL from the Upper Alluvium WBZ." DEQ directs NW Natural to replace the sentence with, "Along the portion of the shoreline where DNAPL occurs, the HC&C system includes extraction wells in the Upper Alluvium WBZ and Lower Alluvium WBZ. The design objective is to induce horizontal gradients from the river towards the wells and upward vertical gradients from the Lower Alluvium WBZ to the Upper Alluvium WBZ. Gradients toward the uplands and upwards are intended to hydraulically control and contain groundwater while not exacerbating mobilization of DNAPL due to system operations." DEQ's comment to Section 2.4.2 regarding the design objective of the HC&C system (hydraulic control and containment of groundwater) and Section 3.2.3.1 (nature of upper-silt unit and lack of evidence for connection with Upper Alluvium WBZ) apply here.	NR	The text will be replaced in the FS Report as directed.

ID No.	Section Name/Topic	Section/ Table/Figure No.	Page No.	DEQ Comment	Discussed with DEQ	Response/Path Forward
39	Lower Alluvium WBZ	Section 3.2.3.3	26	According to the section, the thickness of the Lower Alluvium WBZ ranges from 30 to 75-feet along the shoreline. The text should acknowledge that the hydraulic connection between the Upper Alluvium WBZ and Deep Lower Alluvium WBZ increases where the lower-silt unit is discontinuous, and the WBZs merge where the unit is absent (i.e., offshore of the Gasco OU).	11/13/19	As discussed in the November 13, 2019, meeting with DEQ, there is a typo in this comment. The comment should read, "the hydraulic connection between the **Lower** Alluvium WBZ and Deep Lower Alluvium WBZ." The text will be updated in the FS Report as requested.
40	Deep Aquitard	Section 3.2.3.4	26	DEQ comments on Section 3.1.2 apply here. DEQ requests the continued use of the term "lower-silt unit" given information that indicates the unit is discontinuous and does not project offshore.	11/13/19	The document will be updated in the FS Report to use the term lower silt unit in the text, tables, and figures. Descriptive text will be added to explain that this unit serves as an aquitard in some areas (i.e., Gasco site) and refer to the definitions presented in Freeze and Cherry (1979).
41	Deep Lower Alluvium WBZ	Section 3.2.3.5	27	The section should acknowledge that unlike the Lower Alluvium WBZ, a basal gravel up to 30-feet thick occurs at the base of the Deep Lower Alluvium WBZ.	NR	Text will be added in the FS Report to acknowledge the basal gravel.
42	Basalt WBZ	Section 3.2.4	27	Work done on the Siltronic GSA identified three WBZs in the basalt (i.e., WBZs A, B, and C) within 400-feet of ground surface. The section should acknowledge that "Basalt WBZ A" projects into and recharges the alluvium as indicated in the Groundwater Model Report. The water-bearing properties of Basalt WBZ A should be described by depth based on observations and measurements made during drilling of the test well on the Siltronic GSA. DEQ considers geologic cross-sections and conceptual site models in the Draft Interim FS to be incomplete without Basalt WBZ A, and requests the figures be revised accordingly.	11/13/19	As discussed with DEQ during the November 13, 2019, meeting, information about the basalt unit will be added to the narrative, generalized CSM cross section, and specific hydrogeological cross sections where the data exist (e.g., test well, y, z) in the FS Report.
43	Uncertainty in Groundwater Recharge Rate	Section 3.2.5	28, 2nd para-graph	The Draft Interim FS indicates that, "The recharge rate assumed in the site-wide groundwater flow model may be overestimated…" DEQ disagrees with NW Natural's interpretation that the recharge rate to, and the simulated groundwater flow from the Fill WBZ are overestimates. Since a geometric mean calculation is always less than the arithmetic mean, it underestimates the "average" conductivity value. This, coupled with basing aquifer properties on slug tests that have a known low-bias, may explain the discrepancy between estimates of precipitation inputs and volumetric flow in the Fill WBZ. The use of 50% precipitation recharge is a reasonable estimate given the surfacing of the site and the absence of a storm water collection system. The estimate is not DEQ-specified, but reflects the outcome of discussions with NW Natural to provide a representative conservative estimate of recharge to the Fill WBZ. Until information becomes available to indicate otherwise, DEQ expects the current recharge rate of 50% and associated simulated groundwater flux be carried forward into Fill WBZ remedy planning (e.g., evaluating remedial technologies) and the source control measure evaluation.	10/2/19	The hydraulic conductivity values measured using single well pumping tests in the Fill WBZ span four orders of magnitude and are log-normally distributed. Therefore, the geometric mean provides a better representation of the bulk hydraulic conductivity than the arithmetic mean. Fill WBZ hydraulic conductivity values are not based on slug tests, as suggested by this comment. They are based on single-well pumping tests. Additional data will be collected during the FS data gaps investigation and used to inform model parameters for the FS.

ID No.	Section Name/Topic	Section/ Table/Figure No.	Page No.	DEQ Comment	Discussed with DEQ	Response/Path Forward
44	WBZ Potentiometric Maps	Figures 3-2a through 3-2h	--	This sequence of figures is intended to provide seasonally representative equipotential maps for the Fill WBZ, Upper Alluvium WBZ, Lower Alluvium WBZ, and Deep Lower Alluvium WBZ prior to start-up of the HC&C system. DEQ comments on the figures follow: • To varying degrees, equipotential surfaces for the fill and alluvium WBZs are distorted by the contouring algorithm and lack of data in the alluvium in the southwestern third of the Gasco OU. The representativeness of the figures declines with depth. DEQ does not consider the equipotential contour maps for the Deep Lower Alluvium WBZ (figures 3-22g and 3-22h) to be representative for these reasons. DEQ also notes that the figures appear to use groundwater level measurements taken on a single day. DEQ requests that: – Figures for the alluvium WBZs use the Serfes 3-day averages of groundwater and river stage elevations representative of seasonal high and low groundwater conditions; – Figures for the Deep Lower Alluvium WBZ should not rely on computer contouring alone; and – Recharge from Basalt WBZ A should factor into the figures for Deep Lower Alluvium WBZ. • Monitoring wells MW-23-73 and MW-23-106 appear to be missing from figures 3-2c and 3- 2d, and figure 3-2e and 3-2f, respectively. The figures should be reviewed and revised accordingly.	11/13/19	As discussed during the November 13, 2019, meeting with DEQ, the figures reflect baseline conditions before the HC&C system was installed. We do not have transducer data before HC&C system operation, and therefore, we cannot calculate a Serfes 3-day average. Transducer data and data from wells installed after 2013 were not used to create the map. These wells were installed in April 2014 and did not exist for the period of the noted figures (March and August 2013). In the FS Report, edits will be made to the Deep Lower Alluvium WBZ potentiometric surface maps (Figures 3-2g and 3-2h) to include a conceptual recharge from Basalt WBZ A. We understand there are typos in this comment and that DEQ meant to refer to NWN-13-73 and NWN-13-106 (not MW-23-73 and MW-23-106). Those wells are not included in the figures DEQ cites because they were installed in April 2014 and did not exist for the period of the noted figures (March and August 2013).
45	Cross Sections	Figures 3-3b through 3-3i,	--	Cross-sections graphically depict interpretations of subsurface geology, the occurrence of WBZs, and distributions of MGP residuals. DEQ comments follow: • Note 1 on each of the sections states that, "Inferred WBZ and Basalt unit contacts interpolated from geologic unit structural maps created for the site hydrogeologic model." NW Natural should confirm that the basis for the information shown on the figures are boring logs that document and summarize observations made during drilling. Otherwise, the meaning of the note should be fully explained.	NR	The note will be edited in the FS Report to say, "Inferred WBZ and basalt unit contacts in areas where borings do not extend to bedrock were interpolated from geologic unit structural maps created for the site hydrogeologic model."
46	Cross Sections	Figures 3-3b through 3-3i,	--	• The cross-sections include a note stating, "Zones containing MGP residuals depicted on this figure are highly generalized. Within the depicted zones, the distribution of MGP materials is highly heterogenous and discontinuous in three dimensions within the stratigraphy and soil matrix." The note does not appear to apply to cross-sections and should be removed. The cross-sections depict interpretations of the occurrence of MGP residuals based on location specific observations made during drilling.	11/13/19	As discussed during the November 13, 2019, meeting with DEQ, the note will be revised in the FS Report to the following: "Zones containing MGP residuals depicted in this figure are generalized. Within the depicted zones, the distribution of MGP materials may be discontinuous within the stratigraphy and soil matrix. Observations of MGP materials are detailed on individual boring logs located in Appendix F."

ID No.	Section Name/Topic	Section/ Table/Figure No.	Page No.	DEQ Comment	Discussed with DEQ	Response/Path Forward
47	Cross Sections	Figures 3-3b through 3-3i,	--	• The cross-sections modify descriptions of, and symbols for MGP residuals. The modified descriptions do not provide useful information regarding the nature and vertical distribution of MGP residuals below the Gasco OU, particularly DNAPL (or "oil") in the alluvium. The note, "Oil or Mixed oil and Tar within a soil matrix," incorrectly associates tar with DNAPL for all occurrences in the alluvium. Furthermore, the MGP residual descriptions do not align with those shown on figure 4-1a through 4-1j. DEQ does not approve the figures. Earlier versions of the cross-sections extended the occurrence of "Tar" below the bottom of the fill. DEQ directs NW Natural to replace tar shown below the fill with a symbol for "Weathered DNAPL" and revising the legend accordingly.	11/13/19	As discussed during the November 13, 2019, meeting, all observations of tar beneath the Fill WBZ will be reviewed for accuracy in how it is classified on the cross sections. During our meeting, it was concluded that boring B-33 is the primary boring requiring this review. On the cross sections in the FS, depictions of "Tar" below the Fill WBZ will be changed to "Weathered DNAPL," which will be called out separately in the legend. Language will be added to the text and Table 4.1 to clarify that when observed, "weathered DNAPL" has properties that are similar to tar (e.g., semisolid, highly viscous). The following definition will be added in the FS Report at the first use of the term "weathered DNAPL": "Tar-like materials observed below the Fill WBZ are referred to as 'weathered DNAPL.' These materials are interpreted to represent DNAPL that historically migrated as a fluid phase downward from the Fill WBZ into the Upper Alluvium WBZ and subsequently weather so extensively that the material became similar to tar observed in the Fill WBZ (e.g., semisolid, highly viscous). Consequently, weathered DNAPL observed below the Fill WBZ was described as 'tar' during field investigation. For practical purposes, tar in the Fill WBZ and weathered DNAPL below the Fill WBZ are similar—semisolid, highly viscous, and considered immobile and non-recoverable."
48	Cross Sections	Figures 3-3b through 3-3i,	--	• Monitoring wells MW-23-73 and MW-23-106 are shown as SB-21 and P-21 on Figure 3-3a. The figure should be revised accordingly.	11/13/19	As discussed in the meeting with DEQ on November 13, 2019, there was a typo in this comment. NWN-13-73 and NWN-13-106 are the wells that should be shown at the P-21/SB-21 location. The cross section will be updated in the FS Report to include these wells.
49	Cross Sections	Figures 3-3b through 3-3i,	--	• DEQ requests that the Draft Interim FS include an additional cross-section, aligned roughly along the center-line of the Gasco OU roughly parallel to Cross-section FSA-FSA' (shoreline section) and located approximately half-way between the river the Highway 30. The cross- section is needed to illustrate the change in thickness of the alluvium and basalt across the general direction groundwater migration and towards the river.	NR	A new cross section will be prepared as requested.
50	Cross Sections	Figures 3-3b through 3-3i,	--	• The cross-sections in the Draft Interim FS use the term "undifferentiated" for the first time. The Notes on each cross-section should include a definition of the term.	NR	The term "undifferentiated" will be defined in the FS Report.

ID No.	Section Name/Topic	Section/ Table/Figure No.	Page No.	DEQ Comment	Discussed with DEQ	Response/Path Forward
51	Nature and Extent of Contamination	Section 4	29	This intent of this section of the Draft Interim FS is to summarize information regarding remedial investigation (RI) work (i.e., site investigatory work) completed at the Gasco Site (Section 4.1.1 and Siltronic Site (Section 4.2), with an emphasis on the nature and extent of MGP residuals (Section 4.2). In general, the section does not adequately summarize information available in previous submittals and/or DEQ comments regarding the findings of RI work. DEQ's comments focus on correcting, clarifying, and/or supplementing information in the context of previous documents, including our comments on those documents. The comments also identify and/or to request additional information or revisions that DEQ considers necessary for presenting a complete summary of the information. DEQ requests that NW Natural incorporate our comments into a revised version of the section and providing the information as indicated.	NR	Comment noted.
52a	Nature and Extent of Contamination	Section 4	29	DEQ requests that NW Natural supplement the section with information summarizing the overall findings and conclusions of site characterization investigations regarding the nature and extent of contamination and MGP residuals associated with the Gasco OU. The section should acknowledge, but not necessarily be limited to the following general conclusions: • Except for the Former Office Area GSA, surface and subsurface soils under the Gasco GSAs, and subsurface soil beneath the Siltronic GSA, associated with former Gasco MGP production and waste management areas are contaminated by MGP residuals and associated contamination.	NR	The section will be supplemented as requested in the FS Report.
52b	Nature and Extent of Contamination	Section 4	29	• MGP residuals occur in the Fill WBZ over much of Gasco OU.	NR	The section will be supplemented as requested in the FS Report.
52c	Nature and Extent of Contamination	Section 4	29	• MGP DNAPL and potential solvent DNAPL from historic Siltronic operations commingle in the Fill WBZ on the Siltronic GSA (i.e., Central Facilities Building vicinity).	NR	The section will be supplemented as requested in the FS Report.
52d	Nature and Extent of Contamination	Section 4	29	• Mobile DNAPL occurs in the Fill WBZ, primarily under the Former Koppers/LNG Area.	NR	The section will be supplemented as requested in the FS Report.
52e	Nature and Extent of Contamination	Section 4	29	• MGP DNAPL in the fill unit has penetrated through the upper-silt unit of the alluvium with components of movement horizontally towards the river and vertically downward to depths of approximately 90 feet bgs under the Former Tar Pond GSA and nearly 150-feet bgs beneath former MGP effluent overflow pond area in the northern corner of the Siltronic GSA.	NR	The section will be supplemented as requested in the FS Report.
52f	Nature and Extent of Contamination	Section 4	29	• MGP residuals and contamination have resulted in widespread groundwater impacts in the Fill WBZ; and contaminated the underlying Upper Alluvium WBZ and Lower Alluvium WBZ at concentrations that exceed relevant human health and ecological screening criteria.	NR	The section will be supplemented as requested in the FS Report.
52g	Nature and Extent of Contamination	Section 4	29	• Commingling of dissolved MGP constituents and chemicals associated with historic releases from former Siltronic operations commingle in the Upper Alluvium WBZ in the northeastern portion of the Siltronic GSA.	NR	The section will be supplemented as requested in the FS Report.

ID No.	Section Name/Topic	Section/ Table/Figure No.	Page No.	DEQ Comment	Discussed with DEQ	Response/Path Forward
52h	Nature and Extent of Contamination	Section 4	29	• Dissolved MGP constituents in the Fill WBZ discharge into the Willamette River.	NR	The section will be supplemented as requested in the FS Report.
52i	Nature and Extent of Contamination	Section 4	29	• Prior to operation of the HC&C system, dissolved MGP constituents in the ~~Fill WBZ,~~ Upper Alluvium WBZ, and Lower Alluvium WBZ, and solvent groundwater contamination in the Upper Alluvium WBZ migrated under and into the Willamette River.	NR	The section will be supplemented as requested except for the following. As discussed during the November 13, 2019, meeting, the term "Fill WBZ" should be deleted from the second to last bullet.
52j	Nature and Extent of Contamination	Section 4	29	• MGP residuals have impacted surface water and sediments (or soil when dry) in the seasonal pond areas and Doane Creek.	11/13/19	The section will be supplemented in the FS Report as requested regarding the seasonal pond areas. As discussed during the November 13, 2019, meeting with DEQ, MGP residuals have not been observed within Doane Creek. Therefore, no edit is needed regarding Doane Creek.
53a	Nature and Extent of Contamination	Section 4	29	Based on site characterization work completed on the Gasco OU: • The locality of the facility (LOF) currently: – Encompasses the Gasco OU and extends offsite to the north onto the adjoining U.S. Moorings Site; – Extends vertically downward to include the Fill WBZ, Upper Alluvium WBZ, Lower Alluvium WBZ; and Deep Lower Alluvium WBZ. – Includes impacted sediments and surface water in the Willamette River offshore of the Gasco OU, and Doane Creek.	NR	The text in Section 4.1.1 will be updated in the FS Report to include a description of the LOF established by DEQ in comments on the 2007 RI. Please note that contaminants associated with sources other than Portland Gas & Coke (e.g., Siltronic and Koppers) are present within and beyond the Gasco OU, and impacts within the LOF may be attributable to these other sources.
53b	Nature and Extent of Contamination	Section 4	29	• Groundwater in the Fill WBZ, Upper Alluvium WBZ, and Lower Alluvium WBZ are complete contaminant transport pathways from the Gasco OU uplands to the Willamette River, and groundwater in the Fill WBZ is a complete contaminant transport pathway to Doane Creek;	NR	No edit is required. Section 4 already addresses this comment and presents nature and extent of contamination, not the CSM or risk assessment.
53c	Nature and Extent of Contamination	Section 4	29	• Soil and groundwater impacted by MGP residuals and/or its associated contamination, represent a significant potential risk of exposure to human health and ecological receptors in the uplands of the Gasco OU, including the riverbank	NR	No edit is required. Section 4 already addresses this comment and presents nature and extent of contamination, not the CSM or risk assessment.
53d	Nature and Extent of Contamination	Section 4	29	• Groundwater in the Fill WBZ, Upper Alluvium WBZ, and Lower Alluvium WBZ is contaminated by MGP constituents that significantly and adversely affect the current beneficial uses of groundwater (river recharge), and the reasonably likely future use of groundwater under an industrial use scenario.	NR	NW Natural does not agree that the industrial use scenario is reasonably likely, but the scenario will be evaluated in the FS Report as required by DEQ. No edit is required. Section 4 already presents nature and extent of contamination, not the CSM or risk assessment.
54	Nature and Extent of Contamination	Section 4	29	DEQ notes that historic direct discharge and deposition of MGP residuals have also resulted in extensive impacts to river sediments offshore of the Gasco OU. The contamination represents significant potential risk of exposure to benthic and aquatic organisms in the Willamette River and its sediments. The contamination to the Willamette River, including the riverbank along the Gasco OU shoreline, is being addressed under EPA oversight consistent with the Portland Harbor Record of Decision (January 2017) and under the 2009 Administrative Order on Consent executed by EPA with NW Natural and the Siltronic Corporation.	NR	Comment noted. No edit is required. Section 4 presents nature and extent of contamination, not the CSM or risk assessment. Please note that Siltronic is no longer a party to the 2009 EPA Order.

ID No.	Section Name/Topic	Section/ Table/Figure No.	Page No.	DEQ Comment	Discussed with DEQ	Response/Path Forward
55	Nature and Extent of Contamination	Section 4	29	The term "MGP residuals" is defined in the footnote at the bottom of the page. Residuals from historic MGP operations include "spent-oxide material."	NR	"Spent-oxide material" will be added to the "MGP residuals" footnote in the FS Report.
56	Remedial Investigation Activities on the Gasco GSAs	Section 4.1.1	30–31	DEQ understands the chemicals of interest identified in the section are taken from the 2007 Gasco Site RI Report. It is unclear why this report and these constituents are referenced, as the list is incomplete in the context of work completed subsequent to submittal of the document. For clarification, the list of Gasco OU "contaminants of concern" identified in Section 5 is the basis for FS planning.	11/13/19	The text will be amended in the FS Report to clarify that these COIs were identified only in the context of guiding previous investigations.
57	Remedial Investigation Activities on the Siltronic GSA	Section 4.1.2	31	DEQ's comments on this section of the Draft Interim FS follow: • The section acknowledges that investigations are being conducted of "pesticides and other impacts" associated with the Rhone Poulenc Site occur under the Siltronic Site, including the Siltronic GSA. The section also indicates that "these off-site sourced impacts are not part of the Gasco OU." For clarification, the investigations referenced here are ongoing and focus on groundwater contamination in the deepest portions of the alluvium.	11/13/19	Comment noted.
58	Remedial Investigation Activities on the Siltronic GSA	Section 4.1.2	31	• DEQ notes that the "Former lowland/effluent pond overflow area" is essentially an extension of the "Former tar settling ponds" that comprise the Former Tar Ponds GSA, onto the Siltronic GSA. In other words, historically the areas were continuous and many of the characteristics and properties of the MGP residuals and contamination associated with Former Tar Ponds GSA apply to this ponds area on the Siltronic GSA. In particular, the two areas are sources of DNAPL to the alluvium, and the deepest occurrence of DNAPL under the Gasco OU is documented under these areas.	NR	Comment noted.
59	Remedial Investigation Activities on the Siltronic GSA	Section 4.1.2	31	• The text indicates that analysis of TPH collected from the Gasco GSAs differed from the Siltronic GSA, and that data are not comparable. This information is not entirely incorrect as all of the samples collected during the Gasco Site FS data gaps investigation utilized the same laboratory analytical methods as those on Siltronic GSA (i.e., NWTPH-Dx and NWTPH Gx).	NR	The FS data gap samples used the same laboratory analytical methods as the Siltronic GSA but most of the historical TPH data from the Gasco GSAs are not comparable. The text will be updated in the FS Report to clarify this.
60	Nature and Extent of MGP Residuals	Section 4.2	33	DEQ's comments on the section are included below: • DEQ concurs with the general categories of MGP residuals listed here. DEQ does not agree with or approve applying the term "Tar" to MGP residuals that are observed below the bottom of the fill. Consistent with previous documents, the Draft Interim FS describes tar as being "solid and semi-solid" material. DEQ maintains the site-specific definition of the term limits the tar residual type to the fill. Observations of residuals below the fill in native alluvial deposits indicates mobility, and provides evidence of residuals migration through the depth interval of occurrence. Table 4-1 attempts to impart mobility to tar residuals by indicating that, "Semisolid tar has characteristics that place it as an intermediary between solid tar and liquid oil." DEQ directs NW Natural to use the term "Weathered DNAPL" to indicate the occurrence of tar-like material observed below the fill. DEQ believes the terms weathered, ~~immobile,~~ residual, potentially mobile, and mobile DNAPL are more informative and useful for identifying and distinguishing residual types in the fill and below the fill, including their occurrence and chemical and physical properties.	11/13/19	As discussed during the November 13, 2019, meeting, DEQ requested that the term "immobile" be removed from this DEQ comment. The text will be edited in the FS Report as requested.

ID No.	Section Name/Topic	Section/ Table/Figure No.	Page No.	DEQ Comment	Discussed with DEQ	Response/Path Forward
67	MGP Residuals by GSA/Former Koppers/LNG Area	Section 4.2.2	36	The section references the presence of "potential mobile DNAPL" in the GSA. There is evidence of mobile DNAPL. For example, Fill WBZ monitoring wells MW-6-32 and MW-13-30 are piped together for purposes of DNAPL removal. Removal of DNAPL from the two wells is being sustained with recovery totaling more than 3,000 gallons since August 2000.	11/13/19	The draft IFS used the ITRC (2015) DNAPL mobility definitions, whereby recovery of DNAPL does not demonstrate the presence of mobile DNAPL. "Mobile DNAPL," according to ITRC, is migrating, meaning moving into soil not yet occupied by DNAPL. DNAPL recovery does not demonstrate that type of movement. It only demonstrates that the DNAPL can move within its current footprint. Anchor QEA has reviewed the EPRI residual saturation document cited by DEQ, and the document states in several places that if NAPL is above residual saturation, it is *potentially mobile*, which is consistent with the ITRC DNAPL mobility definitions presented in the IFS. The text will be clarified in the FS Report regarding classification of DNAPL mobility at MW-13-30 and MW-6-32. MW-13-30 was not logged (which is typical when you are putting in a well cluster since it was not the deepest well). For MW-13-61, which was logged, a potential hydrocarbon odor was noted from 21 to 28 feet bgs, but no sheen or NAPL was visible. On the log for MW-16-61 (MW-6-32 was not logged), DNAPL was documented at 28 to 30.5 feet. Since these two wells are plumbed together, the interpretation of DNAPL mobility is complex.
68	MGP Residuals by GSA/Former Tar Pond Area	Section 4.2.2	36	DEQ's general comments to Section 4 (see 5th bullet), regarding MGP DNAPL penetration of the upper-silt unit and migration in the alluvium applies here.	NR	The text will be revised in the FS Report as requested.
69	MGP Residuals by GSA/Siltronic GSA	Section 4.2.2	37	DEQ's general comments to Section 4 (see 5th bullet) about MGP DNAPL penetrating the upper-silt unit and migration in the alluvium applies here.	NR	The text will be revised in the FS Report as requested.
70	Continuity of MGP Residuals	Section 4.2.3	37	The section includes that statement that, "Anchor QEA does not attempt to interpolate the presence of DNAPL and other MGP residuals between well and boring locations due to the complexity and inherent uncertainty. Nonetheless, collectively the MGP residual maps, geologic cross sections, and generalized cross section help to form the basis for the Gasco OU CSM." DEQ's comments to Section 4.2 (see 3rd bullet) applies here.	NR	The text will be revised in the FS Report as requested.
71	Continuity of MGP Residuals	Section 4.2.3	37	DEQ requests that Section 4 include an updated summary table for the MGP residuals picks from boring logs as back up for cross-sections and figures illustrating the occurrence of MGP residuals. Previous submittals include such summary tables, including Table 2-11 of the Gasco Site HERA. In addition, DEQ requests the details of how the MGP picks were translated into volume calculations for the various media for depth intervals of interest.	NR	A summary table of MGP residuals picks will be included in the FS Report. A discussion of how MGP observations were translated into volume calculations will be provided.

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76	DNAPL Characteristics	Section 4.2.4	39	• The section indicates DNAPL that is at or below residual saturation is immobile. For clarification, DNAPL at or near residual saturation is stable within a range of prevailing conditions (e.g., seasonal variations in groundwater gradient and/or or temperature). The same DNAPL may be mobilized in response to changes in one or more of those conditions, such as an increase in groundwater gradient due to a nearby extraction well or fluid injection; or the injection of heated fluid.	NR	No change is requested; however, note that the interpretation of residual DNAPL is based on laboratory DNAPL mobility tests that were conducted with gradients orders of magnitude stronger than those that exist in the field at the site. Seasonal changes in gradient and temperature would be very unlikely to mobilize the DNAPL that we have classified as residual.
77	Types of MGP Residuals	Table 4-1	--	The table categorizes and summarizes information for MGP residual types that occur in the Gasco OU, including descriptions from field observations; methods to determine presence; and occurrence in WBZs.	NR	Comment noted.
78a	Types of MGP Residuals	Table 4-1	--	DEQ requests that "mobile DNAPL" be added as a category to Table 4-1. Section 3.1.1 of Appendix H discusses DNAPL mobility categories in general and in the context of the Gasco OU. The categories include "mobile DNAPL." Consistent with Section 3.1.1 evidence of mobility in the fill and alluvium are sufficient to add the category. As indicated in Section 3.1.1, mobile DNAPL is present in the alluvium in the vicinity of HC&C system extraction wells. Mobile DNAPL is also present in areas not influenced by the HC&C system, including: • In the vicinity of MW-13-30/61 where DNAPL migrated into an area where it had not been previously observed; and	11/13/19	Table 4-1 will be updated in the FS Report to include mobile DNAPL as a category, and observations of its occurrence on site will be added. The text in the last row of the table for potentially mobile DNAPL was inadvertently cut off in the table. This will be corrected; MW-13-30 was not logged. At MW-13-61, which was logged, a potential hydrocarbon odor was noted from 21 to 28 feet bgs, but no sheen or NAPL was visible. We cannot confirm that DNAPL was not present at MW-13-30 when it was installed, but based on groundwater chemistry and observations during groundwater sampling, there is evidence that DNAPL migrated into an area where it had not previously been observed, and DNAPL at MW-13-30 will be classified as mobile.
78b	Types of MGP Residuals	Table 4-1	--	• At installations where DNAPL occurs in sufficient volumes to sustain accumulation/removal over time in the fill (e.g., MW-6/MW13 recovery system, WS-43-36) and the alluvium (e.g., WS-33-81).	11/13/19	See response to Comment No. 67.
79a	Types of MGP Residuals	Table 4-1	--	Many of the entries in Table 4-1 focus on specific aspects of a residual type. The entries do not mention other information relevant to interpreting the nature, extent, and presence of the various materials. DEQ requests the NW Natural revise the table to incorporate the following information. • Potentially Mobile DNAPL, Determination of Presence – 2nd bullet - The entry indicates that core samples have been collected for laboratory DNAPL mobility testing "throughout the Former Gasco OU." DEQ requests that the table include a note clarifying the majority of core samples are from the fill and represent depths of 35-feet bgs or less (one sample from more than 40-feet bgs). To date, the Upper Alluvium WBZ and Upper Alluvium has not been subject to similar laboratory testing.	NR	A clarifying note will be added in the FS Report if appropriate. (Following the completion of the data gaps work, this note may no longer be needed.)
79b	Types of MGP Residuals	Table 4-1	--	– 4th bullet – The bullet references "residual saturation" and DEQ's comment to Section 4.2.4 applies.	NR	See response to Comment No. 76.

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79c	Types of MGP Residuals	Table 4-1	--	• Potentially Mobile NAPL, Additional Considerations – 2nd- bullet - DEQ does not approve the third item. Although there is the potential for TarGOST® to detect other fluorescent materials, DEQ concludes the uncertainty associated with false positive responses is small relative to the scale and magnitude of DNAPL occurrence below the Gasco OU.	NR	The cited item will be footnoted in the FS Report, and the note will state that false positives could lead to interpreting DNAPL presence at locations and depths where DNAPL is absent. However, to be conservative, %RE responses are interpreted as indicating DNAPL presence.
79d	Types of MGP Residuals	Table 4-1	--	• Residual DNAPL, Determination of Presence – 2nd bullet - DEQ again notes that laboratory testing is limited to cores taken from the fill.	NR	This will be modified if appropriate following completion of the FS data gaps work.
79e	Types of MGP Residuals	Table 4-1	--	– 3rd bullet - The bullet indicates that DNAPL occurring outside a well screen without entry is "residual DNAPL." DEQ requests the bullet to be revised to indicate that under prevailing subsurface conditions, residual DNAPL is unlikely to enter a well screen. For clarification, drilling and installation of a monitoring well an area of mobile DNAPL can disrupt saturated flowpaths and time is necessary to re-establish flow to and into a monitoring well.	NR	See response to Comment No. 76.
79f	Types of MGP Residuals	Table 4-1	--	• Solid and Semisolid Tar, Description – DEQ's comments to Section 4.2 (see first bullet) apply to the description of semisolid tar (also to "Additional Considerations" for this residual type).	NR	The subject bullet in Table 4-1 will be modified in the FS Report to the following: "Tar has been observed in the Fill WBZ. Tar is not mobile in a soil matrix; however, it can form from weathered DNAPL. Weathered DNAPL has been observed in the upper silt layer immediately below the Fill WBZ, and in some cases this material has been described in the field as 'tar.'"
79g	Types of MGP Residuals	Table 4-1	--	• Spent Oxide Materials, Additional Considerations – DEQ agrees that isolated occurrence of wood chips in the fill does not confirm the presence of spent oxide material. That said, the presence of isolated or scattered wood chips, or soils exhibiting "Prussian Blue" provide evidence that spent oxide material may have been reworked into fill.	NR	Text will be added in the FS Report to say, "Isolated or scattered wood chips or soils exhibiting Prussian blue provide evidence that spent oxide material may have been reworked into fill."
80a	Interpreted Generalized Areas of MGP Residuals	Figures 4-1a through 4-1j	--	This series of figures graphically illustrates the lateral extent of MGP residual types for depth intervals of interest. DEQ's comments on the figures for Section 4 are provided below. • As requested in our comment to Section 4.2.3.2, backup documentation is needed to support the data presented on these figures. Please provide a summary table noting the location, depth, and MGP type characterized, consistent with prior submittals.	NR	A summary table will be provided in the FS Report.
80b	Interpreted Generalized Areas of MGP Residuals	Figures 4-1a through 4-1j	--	• Based well entry before decommissioning, the location of former monitoring well WS-14-125 shown on Figure 4-1g should be included within the area containing DNAPL.	11/13/19	As discussed during the November 13, 2019, meeting, DEQ retracted this bullet.
80c	Interpreted Generalized Areas of MGP Residuals	Figures 4-1a through 4-1j	--	• Clarification is needed regarding volume calculations and the interpolation of areas of MGP residuals depicted in figures/cross-sections (differences in grouping in cross section versus residuals depicted in these figures). The summary table providing documentation for mapped MGP residuals should be easily referenced for use in volume calculations in later sections of the Draft Interim FS.	NR	A note will be added to this series of figures in the FS Report to reference the summary table providing documentation for mapped MGP residuals.

ID No.	Section Name/Topic	Section/ Table/Figure No.	Page No.	DEQ Comment	Discussed with DEQ	Response/Path Forward
80d	Interpreted Generalized Areas of MGP Residuals	Figures 4-1a through 4-1j	--	• Figures 4-1i and 4-1j indicate no DNAPL occurs between 125-feet and deeper than 150-feet below the base of the Fill WBZ. Figure 3-3b indicates that DNAPL ("oil") and evidence of DNAPL (sheen) occur at depths greater than 125-feet bgs at several locations (e.g., WS-14- 161, WS-47-183, MW-PW2L, PW-2L). The figures should be reviewed and revised accordingly.	11/13/19	As discussed during the November 13, 2019, meeting, we double checked NAPL occurrence at WS-47-183 for Figures 4-1i and 4-1j, and no revision is necessary. Observations of DNAPL at these locations are greater than 125 feet bgs, but less than 125 feet below the base of the fill.
81a	Generalized Cross Section	Figure 4-2	--	This figure presents one cross-sectional conceptual view of the Gasco OU illustrating the principal geologic and hydrogeologic elements;, occurrence and migration of MGP residuals, and groundwater occurrence. DEQ requests that the figure be revised as indicated below: • The figure illustrates DNAPL occurrence and migration using an interpretation that predates much of the work at the site, including the TarGOST® borings. Current information indicates that vertical occurrence of residual and potentially mobile DNAPL is not limited to migration via secondary porosity features (e.g., root voids), but is more laterally extensive and generally present to depths of between 55 to 65-feet bgs under the Former Tar Ponds GSA.	NR	The figure will be revised in the FS Report to make it clear that vertical occurrence of residual and potentially mobile DNAPL is not limited to migration via secondary porosity features.
81b	Generalized Cross Section	Figure 4-2	--	• The figure incorrectly indicates that recharge to the Fill WBZ and the alluvium WBZs is restricted by the presence of Highway 30 and shallow bedrock. The influence of Highway 30 on recharge has not been mentioned previously and is likely negligible. Basalt WBZ A does recharge the alluvium. DEQ requests removal of the note about Highway 30, and the addition Basalt WBZ A to the figure.	NR	The note about recharge limited by Highway 30 will be removed, and Basalt WBZ A will be added to the figure in the FS Report.
81c	Generalized Cross Section	Figure 4-2	--	• The figure is intended to represent conceptually represent any GSA bordering the river. The note for the installation on the left-side of the figure indicates that DNAPL and dissolved contamination do not occur in the Lower Alluvium WBZ. For clarification, groundwater contamination does occur in the Lower Alluvium WBZ in the northern portion of the Siltronic GSA (e.g., NWN-13-106).	NR	The referenced note will be modified for accuracy in the FS Report. DNAPL is not present at NWN-13-106, but there are elevated dissolved concentrations at this well.
82	Generalized Cross Section	Figure 4-2	--	• DEQ requests the following revisions to the figure: – Adding arrows illustrating groundwater flow from the Fill WBZ to the river; – Revising the label indicating "Limited DNAPL and/or tar in TarGOST boring…" to "Limite DNAPL in TarGOST boring…;" – Revising the label indicating "Tar and DNAPL in Upper Native Silt" to "DNAPL weathering to tar-like material, Residual DNAPL, and DNAPL and in upper-silt unit;" – Revising the label "DNAPL in Upper Alluvium WBZ and perched on SILT lenses" to "DNAPL accumulation and movement on silt lenses in Upper Alluvium WBZ;" and – Adding labels indicating "DNAPL entry and dissolved phase COCs in Lower Alluvium WBZ wells" and "DNAPL accumulation and movement on silt lenses in Upper Alluvium WBZ."	NR	Edits will be made as requested.

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83	Summary of DNAPL Data Collection and Evaluations	Appendix H	--	The appendix represents the most complete compilation and assessment of DNAPL information and properties completed to date. DEQ believes the appendix provides a framework for presenting, assessing, and comparing DNAPL properties for purposes of the Gasco OU FS. That said, the information and data are primarily available from the Fill WBZ under the Former Koppers/LNG Area GSA and HC&C system installations constructed in the Upper Alluvium WBZ along the shoreline. Consequently, additional investigations of the properties and occurrence of DNAPL under other areas of the Gasco OU are warranted. The scope of these investigations will be included in the Gasco OU data gaps investigation work plan for the alluvium. DEQ is not requesting Appendix H to be revised at this time. DEQ's comments are provided for NW Natural's information going forward and for consideration during preparation of the data gaps work plan. DEQ anticipates that the tables and attachments will be updated as appropriate as additional information becomes available.	NR	Comment noted.
84	Summary of DNAPL Data Collection and Evaluations	Appendix H	--	The variability of the DNAPL both horizontally within each GSA and vertically between the depth zones is not well defined in the document. The Draft Interim FS discusses the approximate, or average DNAPL properties on a site-wide basis, but does not discuss how such simplifications may result in uncertainties, or bias conclusions about DNAPL recovery compared to a compartmentalized evaluation of the DNAPL mobility on a smaller spatial scale. The DNAPL weathering depends upon several factors such as volatilization, solubilization, fractionation, selective adsorption, etc. and thus DNAPL present at different locations at the Gasco OU, both laterally and vertically, would likely have gone through different levels of weathering over the long period of time since it was first deposited on the ground. This weathering process would have influenced DNAPL's properties and hence would influence DNAPL's recovery, depending upon where that specific DNAPL has been located. This, of course, does not take into the account the MGP operational changes/variations over time that would also have changed DNAPL characteristics over time. Therefore, to improve the evaluation of where DNAPL removal is plausible, and where a remedial approach can be tailored for successful DNAPL recovery, a more detailed conceptual site model (CSM) for the DNAPL should be developed for the Gasco OU FS that discusses/highlights these differences in the DNAPL and subsurface properties on a smaller scale within each of the GSAs. Also, the CSM should be supported with 3-dimensional depiction of MGP residual and DNAPL as such.	NR	A more detailed CSM for the DNAPL will be developed for the FS Report, including GSA-specific assessment of DNAPL properties and recoverability.
85	Summary of DNAPL Data Collection and Evaluations/Depth of occurrence	Appendix H	--	The areas of DNAPL impact were estimated within discrete depth intervals such as 0 to 12-feet bgs. However, depth intervals were later combined and averaged over areas for volume estimates. The rationale for the averaging is unclear. Averaging of intervals that were more discretely characterized is an unnecessary step because that reduces the resolution and detail description of the DNAPL distribution in the subsurface.	NR	Appendix H does not include a discussion of DNAPL volume estimates. DNAPL thickness averaging was required to develop DNAPL volume estimates for larger areas than logged in a specific borehole.
86	Summary of DNAPL Data Collection and Evaluations/DNAPL Thickness	Appendix H	--	The volume estimates in a GSA were estimated based on the thickness of DNAPL observed in individual borings. Please add a table to the appendix summarizing the thickness of DNAPL (and other MGP residual types) estimated for each boring in each GSA. Examples for how DNAPL impacted intervals were identified within borings and TarGOST logs, and how multiple intervals with DNAPL impacts were summed up would be illustrative and useful.	NR	A table will be added to the appendix in the FS Report summarizing the thickness of DNAPL-containing soil layers (and other MGP residual types) estimated for each boring in each GSA.

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87	Summary of DNAPL Data Collection and Evaluations/Physical properties	Appendix H	--	Almost all the laboratory core testing was conducted on DNAPL samples collected from shallow depths of less than approximately 32-feet bgs. Many of these locations have very low residual NAPL levels, and simply confirmed an absence of mobility without providing information to identify the threshold(s) for mobility. It was anticipated that DNAPLs found at different depth intervals would have different properties and different thresholds for mobility. However, the scope of the testing completed to date did not produce this information. Further, the testing appeared to be conducted at the fringes of source areas, and excluded the center of the source areas, such as within and below the Former Tar Pond Area GSA, where thicker accumulations of mobile DNAPL may be encountered in the subsurface. DEQ understands that additional information will be obtained in future data gaps work in the Upper Alluvium WBZ and Lower Alluvium WBZ, and anticipates the discussion of physical properties will likely be expanded, refined, and made more comprehensive with these additional data. Evaluation of DNAPL mobility based on well accumulation/recovery rates did not include testing of the DNAPL itself. Several of the wells (e.g. PW-1-80, PW-2L) draw from intervals significantly deeper than the shallow borings where the majority of DNAPL samples were collected to evaluate DNAPL properties. DEQ believes DNAPLs from these wells, as well as from deeper monitoring wells, should be tested for the standard DNAPL properties. This testing would enable a comparison of DNAPL properties as a function of depth and provide a second method for estimating DNAPL transmissivity and potential recovery rates.	NR	The Data Gaps Work Plan will consider this comment. Twenty-eight laboratory NAPL mobility test samples collected demonstrated a range in NAPL saturation and mobility test results. Those data indicated a transition from immobile DNAPL to potentially mobile DNAPL at approximately 20% NAPL saturation. These results provided useful information regarding NAPL mobility in the fill. DNAPL physical properties were tested for all wells where DNAPL was present, including Upper and Lower Alluvium WBZ wells. Table H-1 identifies all wells where DNAPL samples were submitted for physical testing. Therefore, evaluation of DNAPL mobility based on well accumulation/recovery rates **did** include testing of the DNAPL itself.
88	Summary of DNAPL Data Collection and Evaluations/Use of Geometric Means	Appendix H	--	Geometric means can be misleading way of defining "average" properties that affects estimates of recoverability. Approaches and nomenclature for describing DNAPL properties will be further discussed and agreed upon during development of the scope of work for the data gaps investigation of the Lower Alluvium WBZ and Upper Alluvium WBZ.	NR	Future estimates of recoverability will evaluate the use of geometric means.
89	Analyses	Appendix H, Section 3	H-11	References for calculations of transmissivity and determination criteria for recoverability are based on LNAPL calculations. Section 3.2 of Appendix H states that, "Although DNAPL transmissivity has not received as much attention in the literature as LNAPL transmissivity, the same principles are applicable to DNAPL." The section does not explain why the LNAPL principals are applicable to petroleum DNAPL under the Gasco OU which are very viscous, and why DNAPL transmissivity calculations directly co-related/proportional to LNAPL transmissivity, considering significant differences in physical properties such as density and viscosity. The section should be revised to discuss the potential limitations and/or uncertainties associated with applying LNAPL principles to the range of DNAPL under the Gasco OU.	10/2/19	The section will be revised in the FS Report to discuss the potential limitations and/or uncertainties associated with applying LNAPL principles to the range of DNAPL under the Gasco OU.
90	Analyses	Appendix H, Section 3	H-11	Transmissivity in the Fill WBZ seems poorly defined, and only one non-pumping well (MW-18-30) was discussed (e.g. Section 2.2, third bullet, Page H-6). The hydraulic conductivity range determined from aquifer tests was quite broad at 0.03-120 feet/day (Page H-9). See additional notes below in DNAPL estimated volumes and Fill. DEQ notes that the combined MW-6-32/MW-13-30 pumping system may provide additional information for consideration.	NR	Comment noted.

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91	Analyses	Appendix H, Section 3	H-11	Most of the transmissivity estimates provided in the section are for the Upper Alluvium WBZ (where most of the HC&C wells are screened). The range of hydraulic conductivity was determined from aquifer tests to be 2 to 200 feet/day (Page H-9). While the relationship between accumulation rates and the calculated transmissivity generally correspond (e.g., MW-38U, DW- 14U, MW-26U); other low transmissivity values correlate to wells with higher accumulation rates (e.g., PW-14U, PW-13U). The hydraulic conductivity appears to be highest in the Lower Alluvium WBZ (100 to 1,250 feet/day). Based on the accumulation rates, it appears PW-2L should have much higher transmissivity than shown. Refining the relationships between hydraulic conductivity, transmissivity, and accumulation rates is a data need for the Gasco OU FS. These relationships should be further developed based on information generated during the data gaps investigations of the Lower Alluvium WBZ and Upper Alluvium WBZ.	NR	The PW-2L DNAPL accumulation rate is relatively high because it has by far the highest estimated drawdown value; the result is a relatively low DNAPL transmissivity estimate. The relationships between hydraulic conductivity, transmissivity, and accumulation rates will be discussed in the FS Report.
92	DNAPL Transmissivity Results	Table H-6	--	The table indicates that the pool thickness at each installation is based on observations made during drilling. Section 3.1.2 indicates the drilling observations or logs for nearby TarGOST® borings will be used to estimate DNAPL thickness. The apparent reliance on drilling observations warrants further discussion. Future evaluations should calculate transmissivities using both sources of information. DEQ concludes that the recoverability criteria shown in Table H-6 for the Fill WBZ and Lower Alluvium WBZ are limited by the number of available data points. Overall DEQ considers the information in the table to be preliminary and subject to change, improvements and updates based on data gaps work to be completed in the Upper Alluvium WBZ Lower Alluvium WBZ.	NR	Table H-6 will be updated in the FS Report based on the results of data gap work in the Upper and Lower Alluvium WBZs.
93	Summary of Risk Assessments	Section 5	40–41	Except for the information presented in Appendix I regarding outdoor air, soil vapor, and subslab sampling and analytical data, DEQ did not review Section 5 in detail as it is intended to summarize content from previously approved submittals including the Gasco Site HERA and the HERA Addendum Package (Anchor, 2018a). These documents and DEQ's comments on the "Human Health and Ecological Risk Assessment Report–NW Natural Gasco Site" (Anchor, 2013 [Draft Gasco Site HERA]), the Gasco Site HERA, and the HERA Addendum Package should be referred to for additional information. DEQ's review comments focus on identifying issues that require clarification and/or revision for uplands FS planning. DEQ's conclusions regarding the information in Appendix I are also provided.	NR	Comment noted.
94	Summary of Risk Assessments	Section 5	40–41	DEQ has numerous general comments regarding this section that apply throughout as appropriate, including the following: • The section should discuss how and when the 2017 Data Gaps Investigation data were incorporated into the Draft Interim FS, including describing how the work supplemented previous data for the Gasco GSAs. To avoid misunderstandings, the section should clarify that Section 6 of the Draft Interim FS integrated the 2017 Gasco Site data gaps investigation data into data analyses and presentations.	NR	Section 5 presents a summary of the risk assessments; however, the integration of the FS data gaps results can be clarified in the FS Report.
95	Summary of Risk Assessments	Section 5	40–41	• The third paragraph indicates that COCs were not carried forward into the FS if they are "…associated with uncertain or inappropriate screening criteria." DEQ does not approve excluding COCs for these reasons. NW Natural did not inform DEQ of, or involve DEQ in this decision. For clarification, the COCs identified in the Gasco Site HERA and the HERA Addendum Package should be carried forward into the data analyses that are the basis for evaluating the magnitude and distribution of COCs, assessing potential hot spots, and identifying "principal indicator compounds" (PICs) for the Gasco OU.	NR	This comment will be discussed with DEQ and addressed in the PRG memorandum.

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96	Summary of Risk Assessments	Section 5	40–41	• NW Natural indicates in the fourth paragraph that for the Draft Interim FS, "…the risk pathways that were evaluated in the Gasco Site HERA and HERA Addendum Package were prioritized to develop a site-wide approach to risk management and to help focus the FS evaluation of remedial alternatives." This sentence suggests that by addressing risk pathways site-wide NW Natural envisions reducing the number of remedial alternatives for consideration. DEQ does not approve this approach and expects FS planning to be structured around the GSAs. Remedial technology selection and development of RAAs may identify factors for remedial action planning along the river, that are less (or not) applicable further in the uplands.	NR	The text will be revised in the FS Report to clarify that the FS planning will be structured around the GSAs.
97	Summary of Risk Assessments	Section 5	40–41	• The Draft Interim FS summarizes NW Natural's opinions on the uncertainty associated with the human health and ecological risk assessments completed for the Gasco Site and the Siltronic GSA. DEQ finds these discussions to be incomplete and not reflective of our understandings. The results of the risk assessments will be considerations for developing preliminary remediation goals (PRGs) for the Gasco OU. The uncertainty associated with screening criteria will be a consideration in PRG identification. DEQ is not commenting on each of the sources of uncertainty discussed in the Draft Interim FS. Our general comments, and those for sections 5.3.7 and 5.4.8 focus on comments requiring clarification for purposes of moving forward into the FS.	NR	Comment noted.
98	Summary of Risk Assessments	Section 5	40–41	• NW Natural indicates in the fourth bullet that with regard to ecological risk from contamination in the Fill WBZ, "This pathway represents groundwater discharges to aquatic receptors, including threatened salmonid species, in the adjacent Willamette River." The statement omits wildlife (birds and mammals) exposure to groundwater in the Fill WBZ (via seeps) that the Gasco Site HERA identifies as a complete pathway. Also, DEQ does not approve NW Natural's assertion that "risk characterization results are biased high." DEQ's comments on Section 5.4.8 provide additional information.	NR	We agree to add aquatic-dependent wildlife as an ecological receptor for Fill WBZ groundwater in the FS Report. The remedial action to address this pathway was selected by EPA in the Portland Harbor ROD and is being designed under the EPA Consent Order.
99	Summary of Risk Assessments	Section 5	40–41	• As DEQ indicates in other comments on the Draft Interim FS, any conclusions regarding the status of the Upper Alluvium WBZ and Lower Alluvium WBZ as complete risk pathways to the Willamette River are premature given the HC&C system remains subject to evaluation in the FS. In addition, DEQ does not approve NW Natural's assertion that "risk characterization results are biased high." DEQ's comments on Section 5.4.8 provide additional information.	NR	This comment will be included in the discussion of existing source control measures in the FS Report.
100	Summary of Risk Assessments	Section 5	40–41	• DEQ does not consider the Seasonal Ponds (also referred to as the "Wetland Ponds) to be a high priority pathway for FS planning as NW Natural agreed to implement a removal action to eliminate the ponds and associated ecological risk independent of the FS. DEQ notes that the agreement to eliminate the ponds dates back to NW Natural's July 9, 2015 response to DEQ comments on the Gasco Site HERA Report.	NR	This pathway will be discussed separately as part of interim removal actions that may be undertaken prior to the implementation of the site-wide FS.

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101	Summary of Risk Assessments	Section 5/ Appendix I	40–41	• For the Gasco Site, soil gas, subslab, and outdoor ambient air data collected in 2017 were used to characterize contaminant levels and conduct risk screening on a point-by-point basis. Indoor and outdoor air data collected in 2005 and 2006 were not included in the evaluation; however, exclusion of the older data is acceptable to DEQ. For the Siltronic GSA, soil gas, subslab, indoor, and outdoor air data collected between 2004 and December 2015 were screened on a point-by-point basis. Results from Draft Interim FS data gaps sampling are provided in Appendix I. Based on our review of the 2017 outdoor air and sub-slab data, DEQ concludes that: – Sampling and analysis of outdoor air successfully characterized air quality at the site and the overall needs of the project are met. Concentrations of naphthalene and benzene exceeded occupational screening levels at ambient air sampling station AA-3, located within the former Tar Pond Area, however, all other samples met occupational RBCs. Exceedance factors for benzene and naphthalene at AA-3 were 1.6 for both contaminants. The pathway does not represent a risk of exposure that warrants further investigation and marginal exceedances of ambient air RBCs are anticipated to be mitigated through the site-wide remedy. – Subslab sampling and analytical is complete, data is favorable with no screening levels exceeded, and the vapor intrusion (VI) does not represent a risk of exposure to people working in existing structures. The results of soil vapor sampling warrant consideration for the FS and future development plans for the Gasco Site. DEQ's comments regarding the results of soil vapor sampling are provided under Section 5.3.3 below.	NR	Comment noted.
102	Summary of Risk Assessments	Section 5	40–41	• DEQ does not approve characterizing the Upper Alluvium WBZ/Lower Alluvium WBZ as a low-priority human health pathway. Although there is not a current use, the groundwater is suitable for industrial purposes and evaluations to replace municipal water with groundwater have been completed within the Gasco OU indicating potential reasonably likely future use. Furthermore, DEQ does not share NW Natural's expectation that these WBZs will be addressed through use of institutional controls (i.e., groundwater use restrictions) on the Gasco OU. The pathway should be carried forward into the uplands FS planning process, including the identification of remedial technologies and development of RAAs. DEQ's selection of institutional controls as an element of the final remedy will be based on the remedial alternatives analysis in the Gasco OU FS report.	NR	This pathway will be carried forward into the FS, including the identification of remedial technologies and development of RAAs to address it.
103	Summary of Risk Assessments	Section 5	40–41	The Draft Interim FS risk assessment summaries rely on information in the Gasco Site HERA and the HERA Addendum Package. The HERA Addendum Package assessed human health risks for the GSA, and ecological risks in three exposure areas: one located between the Siltronic developed area and the Willamette River (Area 1), one in the seasonally ponded area south of the Siltronic developed area (Area 2), and another in a small portion of Doane Creek (Area 3). The HERA Addendum Package ecological COCs for the three Siltronic GSA exposure areas are presented in Table 5-6, which summarizes COCs for combined areas 1 and 2 for soils or groundwater. Given the disparities in contaminant fate and transport mechanisms, habitats, and land uses between these two exposure areas, COC summaries for soil and each groundwater zone should be specific to each exposure area. DEQ requests that Table 5-6 be revised so that COC soil and groundwater summaries for Areas 1 and 2 are separate since they could be individually important for FS planning.	NR	Table 5-6 will be revised in the FS Report to include both the soil COCs for the combined Exposure Areas 1 and 2 and for each exposure area separately. There are no nearshore groundwater wells in Exposure Area 2, so ecological groundwater COCs for transport to the Willamette River are limited to Exposure Area 1.

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104	Risk Assessment Process	Section 5.1	43	DEQ understands that the nested table maps human health risk exposure areas to GSAs. DEQ requests that NW Natural include ecological exposure areas in the table for completeness.	NR	This change will be made in the FS Report.
105	Overview of Risk Assessment Process	Section 5.3.1	44	This section of the Draft Interim FS summarizes the human health and ecological exposure pathways evaluated in the Gasco Site HERA and the HERA Addendum Package. Two pathways are listed for occupational worker exposure to groundwater in the Alluvium WBZs: 1) ingestion and inhalation (Gasco Site HERA); and 2) dermal contact and inhalation (HERA Addendum Package). Evaluating risk to occupational workers through ingestion and inhalation is inconsistent with DEQ's May 8, 2014 comments to the Draft Gasco Site HERA. DEQ's comments recommends "…the EPA regional screening level (RSL) calculator to develop screening values to calculate an alternate estimate of the risk to human health associated with exposure to groundwater in the Alluvium WBZ through vapors and dermal contact." DEQ's comment further recommends that "…this analysis be included in the Gasco Site HERA for use in the FS." In other words, evaluations of occupational exposure to groundwater in the alluvium should be through inhalation and dermal contact for the Gasco OU. The Draft Interim FS should clarify whether this objective is met, and whether the Draft Interim FS data analyses are consistent with DEQ's comments.	NR	The text will be updated in the FS Report to clarify that the FS objective was met for the HH Alluvium WBZ scenario/pathway.
106a	Upland Soil Risk Characterization/Occupational Worker Soil Vapor Intrusion to Indoor Air COCs and Occupational Worker Soil Volatilization to Outdoor Air COCS	Appendix I	46	Appendix I presents the results of the outdoor air and soil gas evaluations completed at the site during 2017. Outdoor air sampling was conducted in September and October 2017 and involved evaluating the Gasco Site and Siltronic Site. Soil vapor sampling occurred April through June 2017 with additional follow-up sampling work done in September 2017. DEQ's comments are provided below and are intended to correct or clarify information in the appendix regarding the results of soil vapor sampling. Based on DEQ's review Appendix I contains the following errors: • The text indicates naphthalene has the same distribution as benzene, however this does not acknowledge the impacts in the Former Office Area GSA and the Famm/Former Spent Oxide GSA.	NR	The soil gas results for naphthalene and associated risk screenings will be corrected (see Comment No. 106b), and naphthalene impacts in the Former Office Area and the FAMM/Former Spent Oxide Area will be identified in the FS Report.
106b	Upland Soil Risk Characterization/Occupational Worker Soil Vapor Intrusion to Indoor Air COCs and Occupational Worker Soil Volatilization to Outdoor Air COCS	Appendix I	46	• Naphthalene concentrations at several soil gas sampling locations are under-reported in the text of Appendix I. The text indicates SG-4, SG-6 and SG-7 were 45, 730 and 200 ug/m3, respectively. Instead, the correct values are 450, 7,300, and 2,000 ug/m3. These values exceed the soil gas RBC of 360 ug/m3, altering the risk screening conclusion regarding VI risks around the Main Treatment Building.	NR	The soil gas results for naphthalene and associated risk screenings will be corrected in the FS Report.
106c	Upland Soil Risk Characterization/Occupational Worker Soil Vapor Intrusion to Indoor Air COCs and Occupational Worker Soil Volatilization to Outdoor Air COCS	Appendix I	46	• The text correctly indicates the highest naphthalene detection in the investigation was located at SG-6. However, the text erroneously indicates SG-6 is located "in the Former Tar Pond Area GSA". Based on Figure G-2, SG-6 is located adjacent to the Main Treatment Building. Based on the distribution and composition of petroleum contamination across the site, DEQ believes the highest concentrations of naphthalene in soil gas likely occur in the Tar Pond Area, even though conditions prevented soil gas sampling at several points in this area.	NR	Comment noted.

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107a	Upland Soil Risk Characterization/Occupational Worker Soil Vapor Intrusion to Indoor Air COCs and Occupational Worker Soil Volatilization to Outdoor Air COCS	Appendix I	46	DEQ has the following additional comments that highlight notable soil vapor sampling data for particular sampling locations, and provide our general observations regarding the results of the sampling. • Detections of benzene and TPH are extremely high at SG-27 and SG-12 and are summarized below: – Benzene concentrations exceed IDLH levels[1] at both sampling points; – Soil vapor concentrations for benzene and TPH exceed the LEL at SG-27; – Benzene represents roughly 50% and 30% of vapor levels at SG-27 and SG-12, respectively; and – The sampling points represent soil gas hot spots for benzene (SG-12) and TPH (SG-12 and SG-27). [1] Information on LELs and IDLH can be found at http://www.afcintl.com/pdfs/applications/combustibles.pdf	NR	Comment noted.
107b	Upland Soil Risk Characterization/Occupational Worker Soil Vapor Intrusion to Indoor Air COCs and Occupational Worker Soil Volatilization to Outdoor Air COCS	Appendix I	46	• Soil gas levels indicates there is potential VI risk over 50% of the site roughly encompassing the Former Tar Ponds Area GSA, the southeastern half of the Former Koppers/LNG Area GSA, and portions of the Former Office Area and FAMM/Former Spent Oxide Area.	NR	Comment noted.
107c	Upland Soil Risk Characterization/Occupational Worker Soil Vapor Intrusion to Indoor Air COCs and Occupational Worker Soil Volatilization to Outdoor Air COCS	Appendix I	46	• Trichloroethene (TCE) was detected in two samples as follows: – Between the LNG Basin and the Wetland Ponds at SG-21 at a concentration of 440 ug/m3; and – At indoor air location SS-4 at a concentration of 4.6 ug/m3 (DEQ notes the detection is from February 2017 and outside the period of FS data gaps sampling).	NR	Comment noted.
107d	Upland Soil Risk Characterization/Occupational Worker Soil Vapor Intrusion to Indoor Air COCs and Occupational Worker Soil Volatilization to Outdoor Air COCS	Appendix I	46	• Due to a lack of detections of TCE in soil and/or groundwater in the vicinity of SG-21, additional investigation is not warranted.	NR	Comment noted.

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108	Upland Soil Risk Characterization/Occupational Worker Soil Vapor Intrusion to Indoor Air COCs and Occupational Worker Soil Volatilization to Outdoor Air COCS	Section 5.3.3	46	Based on the results of soil gas sampling and analysis, potential soil vapor data gaps remain for the Gasco OU, including: • Data coverage is poor for the Former Tar Ponds Area GSA due to sampling conditions. Consequently, NW Natural should presume an unacceptable risk for this area. • The potential for soil gas exceedances to extend onto US Moorings Property has not been assessed.	NR	Comment noted.
109	Upland Soil Risk Characterization/Occupational Worker Soil Vapor Intrusion to Indoor Air COCs and Occupational Worker Soil Volatilization to Outdoor Air COCS	Section 5.3.3	46	Data indicates that soil vapor in portions of the Gasco Site represents potentially significant risk of exposure to occupational, construction, and excavation workers. Future site development and construction plans should include evaluations of soil vapor during project planning. Evaluations should include developing sufficient information so mitigate risk to workers during construction. Future building construction may require the use of construction methods and engineering controls to minimize potential vapor intrusion.	NR	Comment noted.
110	Summary of Uncertainties Associated with the Human Health Risk Assessment	Section 5.3.7	49, 2nd bullet	DEQ's general comments on Section 5 apply to this section.	NR	Comment noted.
111	Summary of Uncertainties Associated with the Human Health Risk Assessment/Summary of Uncertainties Associated with the Ecological Risk Assessment/Uncertain screening levels	Sections 5.3.7 and 5.4.8	48/54	DEQ's general comment on Section 5 not approving removal of COCs with uncertain screening levels, along with comments to Section 5.4.8 apply here.	NR	This comment will be discussed with DEQ and addressed in the PRG memorandum.
112	Summary of Uncertainties Associated with the Human Health Risk Assessment	Section 5.3.7	49, last bullet	The statement in the section that "risk evaluations for these metals were adjusted to natural background concentrations" is not clear. The text should reiterate the approach DEQ-approved for the Gasco Site HERA and HERA Addendum Package.	NR	Text will be added to clarify the soil background adjustments made in the human health risk assessments and reiterate the approach DEQ approved for the Gasco site HERA and HERA Addendum Package.
113	Fill WBZ Groundwater Risk Characterization	Section 5.4.4	52	DEQ's general comment for Section 5 applies here. Although these receptors are identified in Table 5-1, Section 5.4.4 should be revised to acknowledge and discuss this pathway.	NR	This change will be made in the FS Report. See response to Comment No. 98.

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114	Summary of Uncertainties Associated with the Ecological Risk Assessment	Section 5.4.8	54	This section of the Draft Interim FS provides NW Natural's summary of uncertainties associated with the Gasco OU ecological risk assessment. DEQ general comments on Section 5 and comments to Section 7.4.1 apply here. Additional comments are provided below. • The second bullet discusses uncertainties associated with the methods used to screen data for Fill WBZ, Upper Alluvium WBZ, Lower Alluvium WBZ, and Deep Lower Alluvium WBZ against ecological criteria. DEQ does not approve the characterization of uncertainty as representing, "…potentially significant overestimation of site risk that may affect the evaluation of potential remedial alternatives." In the case of the Fill WBZ, groundwater discharges directly into the river within a relatively short distance of monitoring wells located along the shoreline. Consequently, attenuation during transport to the river is likely not a factor for data screening. The rate of discharge varies daily with the tides and seasonally.	NR	This comment, and the approach for dealing with uncertain ecological SLs, including uncertainties identified in prior risk assessment reports, will be further discussed with DEQ and addressed in the PRG memorandum.
115	Summary of Uncertainties Associated with the Ecological Risk Assessment	Section 5.4.8	54	• Groundwater contamination in the alluvium primarily occurs in the Upper Alluvium WBZ and Lower Alluvium WBZ, both of which project out and under the river. The fate and transport processes NW Natural mentions are considerations for estimating groundwater contaminant concentrations at the point(s) of exposure. To date, the scope for evaluating the point of exposure has not been discussed, however DEQ questions whether the evaluation would alter FS planning given the contaminant concentrations and occurrence of DNAPL in both WBZs near the shoreline. In addition, the sediment remedy will likely be an element of the evaluation and may determine point of exposure. Going forward, it is technically valid and reasonable to use available groundwater data collected along the shoreline and in the nearshore area for uplands FS planning.	NR	The groundwater to surface water exposure pathway is presented in the IFS for information only. Exposure pathways in the Willamette River will be appropriately addressed with EPA. .
116	Summary of Uncertainties Associated with the Ecological Risk Assessment	Section 5.4.8	54	• The third bullet discusses use of baseline data for the Lower Alluvium WBZ, Upper Alluvium WBZ, and Deep Lower Alluvium WBZ in the risk assessment. DEQ does not approve NW Natural's conclusion that the baseline condition overestimates risk in comparison to current conditions. The basis for the conclusion is the presence of the HC&C system and enhance in-situ bioremediation (EIB) system. The HC&C system is a gradient control system aligned along the shoreline that is designed to interrupt the contaminant transport pathway. The system is not intended or designed to reduce source contaminant mass in the uplands (i.e., operation of the system does not reduce risk).	NR	Comment noted. The HC&C system reduces risk to the river by eliminating the alluvium groundwater to the surface water/sediment pathway while it is operating. ORS 465.315(c) provides that a "remedial action may achieve protection of human health and the environment through […] containment or other engineering controls." RAAs that incorporate the HC&C system will be evaluated in the FS Report against at least one alternative that does not include long-term operation of the HC&C for comparison using DEQ's balancing factors.
117	Summary of Uncertainties Associated with the Ecological Risk Assessment	Section 5.4.8	54	• Performance and effectiveness monitoring of the EIB system on the Siltronic property is ongoing. The EIB system has reduced dissolved concentrations of chlorinated volatile organic compounds (cVOCs) in groundwater (notably TCE). Consequently, the risk associated with current conditions is less than baseline conditions. That said, the presence of fine-grained sediments and the commingling MGP and solvent DNAPL in the source area represent potential long-term sources of groundwater contamination (i.e., there is the potential for contaminant rebound to occur). Based on this information DEQ considers evaluation using baseline conditions to be reasonable. Furthermore, the baseline conditions evaluations provide the basis for the "no-action alternative" against which RAAs will be compared and measured.	NR	Comment noted.

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118	Summary of Uncertainties Associated with the Ecological Risk Assessment	Section 5.4.8	54	• NW Natural indicates that uncertain ecological screening levels may overestimate potential risks. DEQ acknowledges that uncertain screening levels may result in overestimations, or underestimations, of potential risk. Given the chemical complexity of MGP residuals and associated contamination, and the limitations of currently accepted conventional analytical methods in fully characterizing the chemistry of MGP residuals, DEQ concludes that the overall uncertainty underestimates potential risk. That said, it is not up to NW Natural to decide, without informing or involving DEQ, that COCs with uncertain screening levels will not be evaluated according to a data analysis process agreed upon for the Draft Interim FS. Consequently, DEQ does not approve, in whole, NW Natural's discussion of uncertainty here. DEQ's review of Section 6 provides additional information regarding including parameters with uncertain screening levels, as well as the results of our review of the data analysis NW Natural completed for the Draft Interim FS. The results of DEQ's review revise the Draft Interim FS.	NR	This comment and the approach for dealing with uncertain ecological SLs, including uncertainties identified in prior risk assessment reports, will be further discussed with DEQ and addressed in the PRG memorandum.
119	Risk Pathway Prioritization Summary	Table 5-1	--	The table states that for the Ecological Fill WBZ (4th line), "Receptors" are defined as 'Aquatic Community; Birds and Mammals on Riverbank; T&E Salmonids in Willamette River." In addition, under "Site Conditions Affecting Exposure," the table indicates that, "Risk characterization results are biased high because groundwater is not the point of exposure. Attenuation during groundwater transport and initial dilution in receiving water were not considered."	NR	No change is needed.
120	Risk Pathway Prioritization Summary	Table 5-1	--	DEQ considers the "Site Conditions" statement above to be incorrect as it does not reflect the Gasco Site HERA. The point of exposure to contaminated groundwater in the Fill WBZ is the point of contact for Birds and Mammals on the Riverbank (seeps). The Draft Interim FS mentions but does not acknowledge and/or evaluate this pathway in discussions and analyses presented in later sections of document. NW Natural should include this complete pathway in all relevant evaluations and discussion throughout the Draft Interim FS. DEQ's general comment on Section 5 and our comments to Section 5.4.8 also apply here.	NR	See response to Comment No. 98. This will be added to the FS for information, but the remedial action to address this pathway has been selected by EPA and is being designed under the EPA Consent Order.
121	COCs by Medium	Tables 5-2 to 5-6	--	This series of tables organizes information for COC by GSA according to receptor group and media. The tables use an "X" to associate COCs with a receptor group and media. DEQ requests that NW Natural consider modifying the tables to provide additional clarifying information. Instead of indicating a COC with only an "X," DEQ requests that the designation indicate the exposure pathways exhibiting unacceptable risk (e.g., occupational soil contact, or vapor intrusion). DEQ requests that NW Natural use coded letters or color highlights for this purpose. Doane Creek is not included in these summary table of COCs. Although NW Natural may consider the creek to be a "low priority risk pathway" (as noted on page 42), it should be presented for completeness.	NR	This change will be made in the FS Report.
122	Identification of Principal Indicator Compounds	Section 6	57	Section 6 and Appendix J document the data evaluation process for the Gasco OU. The purpose of data analysis was to evaluate all Gasco OU COCs by chemical group in each of the GSAs on the basis of highest toxicity, greatest spatial extent, and as potential factors in remedial technology identification. The data analysis supports the hot spot determination in Section 7 and provides the basis for selecting PICs for the Gasco OU to carry forward into FS planning. Based on our review, DEQ determines that Section 6 and supporting documentation in Appendix J, including spreadsheets; allowed DEQ to complete a full review of NW Natural's data analysis process.	NR	Comment noted.

ID No.	Section Name/Topic	Section/ Table/Figure No.	Page No.	DEQ Comment	Discussed with DEQ	Response/Path Forward
123	Identification of Principal Indicator Compounds	Section 6	57	DEQ approves the data evaluation process steps developed for and presented in the Draft Interim FS. DEQ does not approve certain decisions made by NW Natural regarding data use and handling prior to and during data analysis. DEQ is not requesting NW Natural to revise and resubmit Appendix J data analyses. DEQ will approve Section 6 subject to the section being revised consistent with our comments, including revising tables 6-1 through 6-7 to include the additional PICs identified in the table attached to this letter.	NR	This comment will be discussed during the development of the PRG memorandum.
124a	Identification of Principal Indicator Compounds	Section 6	57	The data use and handling decisions that DEQ does not approve include: • Tallying ERs for COCs to determine the maximum ER in a sample or at a sample location is not conducted by chemical group, but with the purpose of identifying one maximum ER across all groups.	NR	This comment will be discussed during the development of the PRG memorandum.
124b	Identification of Principal Indicator Compounds	Section 6	57	• Removing COCs from the evaluation due to "uncertain screening levels," or for other considerations; and compounding the decision by not reassigning the maximum ER tally from one of these "uncertain" COCs to the next-highest ER for that sample or location. Removal of the maximum ER (i.e., one analyte) resulted in remaining data from the sample also being excluded from the analysis such that all data from the sample did not contribute to ER data analysis. This removal process underestimates contribution from other COCs both for toxicity and spatial extent. (Note: The IFS does not explain what constitutes uncertain screening levels, or provide the technical basis for excluding COCs previously identified in the risk assessments).	NR	This comment will be discussed during the development of the PRG memorandum.
124c	Identification of Principal Indicator Compounds	Section 6	57	• Limiting data analysis of metals in groundwater to dissolved concentrations (filtered) and not including results of total concentrations (unfiltered).	NR	This comment will be discussed during the development of the PRG memorandum.
124d	Identification of Principal Indicator Compounds	Section 6	57	• Contouring average COC concentrations and ERs over the full depth of the alluvium instead of by WBZ (i.e., Upper Alluvium WBZ, Lower Alluvium WBZ).	NR	This change will be made in future FS deliverables.
125	Identification of Principal Indicator Compounds	Section 6	57	NW Natural's decisions resulted in COCs, and/or data for COCs (e.g., total metals) not being carried through data analysis for consideration as PICs. The limited set of PICs was also relied on for the groundwater hot spot evaluation in Section 7. DEQ concludes the data analysis process did not fully evaluate potential groundwater hot spots and resulted in an incomplete list of PICs for purposes of FS planning.	NR	Comment noted.

ID No.	Section Name/Topic	Section/ Table/Figure No.	Page No.	DEQ Comment	Discussed with DEQ	Response/Path Forward
126	Identification of Principal Indicator Compounds	Section 6	57	Section 6.3.1 of the Draft Interim FS discusses the purpose and criteria for selecting PICs for the Gasco OU FS based on data analysis. DEQ concurs with NW Natural's description of PICs as being, "…a subset of the COCs that efficiently ensure the FS alternatives address all areas of unacceptable site risk;" and that, "…facilitates the development of remedial technologies and alternatives at the site." Further, DEQ concurs with NW Natural that PICs display the properties listed below (reiterated from Section 6.3.1): • PICs should represent the key risk drivers that pose the greatest potential risk to human and ecological receptors, such that designing remedial alternatives to address PICs will effectively mitigate site risk. • PICs should encompass all areas of unacceptable risk at the site, and designing remedial alternatives to address PICs should result in the cleanup of other subsidiary COCs that have lower magnitudes of exceedance and smaller areas of impact. • PICs should be selected as needed to represent chemical groups that have different physical or chemical properties and that may respond to different remedial technologies.	NR	Comment noted.
127	Identification of Principal Indicator Compounds	Section 6	57	On behalf of DEQ, state contractors analyzed the Draft Interim FS dataset to select PICs as described above (from Section 6.3.1) and without applying the data use and handling decisions listed prior to determine the completeness of PIC selection. The analysis relied on the Gasco OU data compilation and the supporting spreadsheets provided for Section 6 and Appendix J.	NR	Comment noted.
128a	Identification of Principal Indicator Compounds	Section 6	57	Results of DEQ's evaluation indicate the following: • Retaining COCs for the full data analysis determined that unrepresented chemical groups (e.g., "conventionals" and metals) have COCs that exhibit high ERs (in some cases the highest ERs for some GSAs) and significant spatial coverage for certain GSAs, media/exposure routes, and depths.	NR	Comment noted.
128b	Identification of Principal Indicator Compounds	Section 6	57	• Separation of the COC data for the Upper Alluvium WBZ and Lower Alluvium WBZ alters interpretations regarding the spatial footprints and ranking of high exceedance ratios for groundwater in the alluvium. In general, contaminant concentrations decrease with depth in the alluvium. Consequently, averaging data for the Upper Alluvium WBZ and Lower Alluvium WBZ (and sometimes the Deep Lower Alluvium WBZ) does not adequately represent data that results in the highest ERs and largest footprints for selecting PICs (dilution affect with increasing depth).	NR	This change will be made in the FS Report.
128c	Identification of Principal Indicator Compounds	Section 6	57	• Analyzing data on a GSA-basis indicates that some COCs are associated with certain GSAs and not others. The GSA-specific COCs were generally in chemical groups where PICs with similar or higher ERs and spatial footprints were also present. For example, barium has the second highest ER for a COC for ecologic exposure to alluvium groundwater under the Former Koppers/LNG Area GSA and second highest metal ER for the Former Tar Pond Area GSA. DEQ considered selecting barium as a PIC, except that iron, manganese, and aluminum have higher ERs, larger footprints, and are PICs in adjoining GSAs. So while barium could be selected as an additional PIC for the Former Koppers/LNG Area GSA and Former Tar Pond Area GSA, iron, manganese, and aluminum are PICs that provide coverage. In general, GSA-specific PICs were not selected if, like barium other COCs with high toxicity (i.e., high ERs) and similar (or larger) areas/footprints provided coverage for more GSAs.	NR	Comment noted except that the Former Koppers/LNG Area is not an ecological exposure area.

ID No.	Section Name/Topic	Section/ Table/Figure No.	Page No.	DEQ Comment	Discussed with DEQ	Response/Path Forward
128d	Identification of Principal Indicator Compounds	Section 6	57	• TPH should be included as a PIC for groundwater in the Fill WBZ, the Upper Alluvium WBZ, and Lower Alluvium WBZ under the Gasco OU. Previous evaluations and determinations have identified TPH as an important COC. Data handling, use, and analysis of TPH, including TPH fractions; is not clearly documented in the Draft Interim FS. For example, monitoring wells in the Fill WBZ with TPH, volatile petroleum hydrocarbon, and extractible petroleum hydrocarbon data available for samples collected in 2014 to 2016 (e.g. MW-01-22, MW-04-35, MW-19-22, MW-21-12, MW-23-27) are listed in Table 6 and Appendix J ER evaluation tables, but TPH data are not presented.	NR	This comment will be discussed during the development of the PRG memorandum.
129	Identification of Principal Indicator Compounds	Section 6	57	Based on the information above and results of the more comprehensive data evaluation, DEQ has developed the list of additional PICs provided in the attached table. [See pages 46–48 of 20190815-DEQ_Comments-Draft_Gasco_OU_Interim_FS.pdf.]	NR	This comment will be discussed during the development of the PRG memorandum.
130	Appendix J	Appendix J tables and figures	--	DEQ's comments to Section 6 apply here. Inconsistencies in some figures were noted, as described below. NW Natural should address inconsistencies in designating GSAs and site-wide PIC determinations and ensure consistency among supporting materials.	NR	Comment noted.
131	Principal Indicator Compounds	Tables 6-1 through 6-7	--	DEQ's comments to Section 6 apply here.	NR	Comment noted.
132	Groundwater Alluvium WBZ Site-Wide Principal Indicator Compounds – Human Health	Table 6-5	--	The table presents 1,4-dichlorobenzene as associated with a maximum ER of 7.2, yet this constituent is eliminated as a PIC. Contrary to this, Table 6-13 appears to list 1,4-dichlorobenzene as an alluvium groundwater PIC. 1,2-Dibromo-3-chloropropane is not listed in Table 6-5 or in Table 6-13.	NR	This comment appears to contain a typo. 1,2,-dibromo-3-chloropropane is listed in Tables 6-5 and 6-13. As explained in notes 1 and 2 on Table 6-5, 1,4-dichlorobenzene has a single detection and exceedance (1/84) near the analytical reporting limit and no associated impact area. 1,2-dibromo-3-chloropropane is a probable Rhone-Poulenc chemical and also has a single exceedance (1/84) and negligible impact area. Neither of these chemicals was selected as a PIC (see Tables 6-5 and 6-8). To further clarify, Tables 6-1 through 6-7 provide the basis for selecting site-wide PICs. Table 6-8 presents a summary of site-wide PICs. Tables 6-9 through 6-15 present a breakdown of maximum ER and impacted area by GSA for all COCs, including those selected as PICs. In future presentations of these tables, the titles, column headers, and notes will be updated in the FS Report to be clearer.

ID No.	Section Name/Topic	Section/ Table/Figure No.	Page No.	DEQ Comment	Discussed with DEQ	Response/Path Forward
133	Section 6, Figures	Section 6, Figures	--	The figures with exceedance areas appear to minimize impacted areas and omit some COCs and entire chemical groups for some pathways (e.g. metals). These omissions may be due to NW Natural's data use decisions (e.g., removing with uncertain screening levels), but cannot be determined as the rationale is not provided in the tables and figures. Given the primary purpose of the figures is to support selection of PICs, and our comments do not effect use of the figures for soil hot spot determinations, DEQ is not requesting the figures to be revised and resubmitted. That said, the figures may be reproduced during preparation of the Draft Gasco OU FS Report. The comments should be revisited at that time. It is important to note that exceedance ratio figures for groundwater (Figures 6-5a through 6-8b) that used the incomplete set of PICs were relied on for the groundwater hot spot evaluation described in Sections 7.3.1.1 and 7.5 (also see additional comments for the hot spot evaluation, Section 7).	NR	Comment noted.
134	Maximum Exceedance Ratios for Surface Soil – Human Health	Figure 6-2b	--	Some specific examples are provided below: • Figure 6-2b. The notes indicate Figure 6-2b represents exceedances for all chemicals of concern. An additional breakdown of exceedance ratio points would be helpful to interpret data relative to risk drivers by constituent class, for instance.	NR	Comment noted. If the figure is generated in the draft FS Report, this comment will be considered at that time.
135	COCs with Maximum Exceedance Ratios for Subsurface Soil – Human Health	Figure 6-3a	--	• Similar to comments for Figure 6-2a, it is not clear why PICs with negligible areas, such as benzene are included. COCs like arsenic and thallium with high ERs should be included in the figures (and other metals).	NR	Comment noted. If the figure is generated in the draft FS Report, this comment will be considered at that time.
136	Maximum Exceedance Ratios for Subsurface Soil – Human Health	Figure 6-3b	--	• It's not clear why sample locations DG-29, DG-32 and SB-21 are not joined to the larger body of interpolated maximum exceedance ratios from 1.1 to 10, but SS-19 is, for instance. The approach to the contouring is not fully explained.	10/2/19	As discussed in the October 2, 2019, meeting with DEQ, the maximum ERs maps are compiled from all individual ER maps along a given pathway. They are not interpolated from the maximum exceedance ratio value for each location directly. No change is needed to address this comment.
137	COCs with Maximum Exceedance Ratios for Surface Soil – Ecological	Figure 6-4a	--	• Surface Soil Ecological – Section 6.3.1.1 of the text omits iron and cyanide as PICs, but Figure 6-4a includes iron but not cyanide.	NR	The ER for cyanide was not high enough to allow it to persist into the maximum ER map for this pathway. No change is needed to address this comment.
138	COCs with Maximum Exceedance Ratios for Alluvium WBZ Groundwater – Human Health	Figure 6-6a	--	• Alluvium WBZ Groundwater Human heath – Section 6.3.1.1 of the text omits 1,2-dibromo-3chloropropane and 1,4-Dichlorobenzene as PICs, but only 1,4-dichlrobenzene is shown.	NR	In the case of 1,2-dibromo-3chloropropane, all but one location was rejected because of a 0.5×U-flagged concentration greater than the SL. One location is not enough to interpolate, so it was never interpolated. No change is needed to address this comment.

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139	COCs with Maximum Exceedance Ratios for Surface Soil – Human Health/Maximum Exceedance Ratios for Surface Soil – Human Health	Figure 6-2a/ Figure 6-2b	--	• It is unlikely that the areas impacted by TPH and naphthalene are as small as shown. Also, the white area around DG-05 appears inappropriate. In Figure 6-2b, the small green triangle in south corner appears to be an artifact. There is no associated sample location.	NR	• The areas occupied by TPH and naphthalene in this map represent the areas where those chemicals have the highest ER values among all chemicals for which ER IDW interpolations could be made. It is important to understand that this map is not an interpolated map—it is a compilation of maximum ER values that considers all COCs evaluated along the Surface Soil – Human Health pathway. The results observed in this map are consistent with the raster analyses performed on these COCs. • The area around DG-05 is not white—it has no color, indicating that the compiled maximum ER values in that area are less than 1.0. Please refer to Appendix Figures J3-1B-9 (Total cPAH TEQ [EPA 1993] [U=1/2] Exceedance Ratios in Surface Soil – Human Health) and J3-1B-10 (TPH Exceedance Ratios in Surface Soil – Human Health) where the individual contributions of ER areas greater than 1.0 for these two chemicals are presented for reference. The ER at location DG-05 for cPAH TEQ (EPA 1993) (U=1/2) is 0.9, resulting in a lack of color in the vicinity of this data point. However, the ER at location DG-05 for TPH is 1.5, resulting in the interpolation of a small circular area of ER greater than 1.0 around this point The low TPH exceedance ratio magnitude of 1.5 does not enable the interpolation of ER values greater than 1.0 to persist radially outward more than a few feet from DG-05, which results in the "halo" or absence of color observed. When OU-wide compilation maps that show maximum ER and COCs with maximum ER for this pathway are created (Figures 6-2a and 6-2b, respectively), the pixels with the highest ER values greater than 1.0 are carried forth, in consideration of all chemicals, so the results shown are entirely consistent with the results presented for each individual chemical. It is important to remember that although these maps are compiled from multiple ER interpolations, they are not interpolated themselves. No change is needed to address this comment.
140	Maximum Exceedance Ratios for Subsurface Soil – Human Health	Figure 6-3b	--	• Some of the smaller green areas appear inaccurate. For example, it may be more appropriate to connect DG-32 and DG-29 with the main area with an ER greater than 1. Similarly, the area between P-12, P-17, and P-Z, P-B, and P-Y could very well have an ER greater than 1.	10/2/19	Figure 6-3b is a cumulative raster map, not an interpolation of ER values. As described in Section 6.2.2, interpolations of ER values were performed for each COC and are shown on the individual ER maps provided in Appendix J. (ER maps for each pathway are numbered as Figures J3-#b-#. For example, for surface soil human health, ER maps are Figure J3-1b-1 through Figure J3-1b-11.) Individual rasters were overlaid to determine the maximum and calculate the mean and sum of the ERs for each raster cell. The results are shown on cumulative raster maps for each of the seven scenarios (Figures 6-2a through 6-8b). Notes on the cumulative raster maps will be revised in the FS Report to clarify that these maps depict the results of calculations (i.e., average, sum) or comparisons (i.e., maximum ER, COC with highest ER) for each grid cell of the raster and not direct interpolations.

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141	COCs with Maximum Exceedance Ratios for Fill WBZ Groundwater – Human Health/Maximum Exceedance Ratios for Fill WBZ Groundwater – Human Health	Figure 6-5a/ Figure 6-5b	--	• It may be more appropriate to connect the area of ER>10 around WS-14-36, WS-42-36, and WS-43-36 to WS-10-27. In addition, it appears more reasonable that the area between DG-32 and DG-33, and also MW-10-25 and DG-14, should be designated as ER>10. The area of ER>1 around DG-29 seems to be inappropriately limited, both to the north and also south to MW-12-36. The extent of ER>1 around NWN-11-24 could be much greater.	10/2/19	See response to Comment No. 140.
142	COCs with Maximum Exceedance Ratios for Alluvium WBZ Groundwater – Human Health/Maximum Exceedance Ratios for Alluvium WBZ Groundwater – Human Health	Figure 6-6a/Figure 6-6b	--	• The benzene area southwest of the primary Former Koppers/LNG Area benzene area appears to be an artifact. There does not appear to be a monitoring well in the vicinity. In Figure 6-6b, it is difficult to know if the impacted ER>10,000 area around MW- 50 is as limited as shown, or the ER>1,000 area around NWN-13-106.	10/2/19	The text of Section 6 will be updated in the FS Report to clarify that artifacts may occur on some maps as a result of the spatial distribution of data. However, the benzene area in Figures 6-6a and 6-6b is caused by benzene and naphthalene competing for the highest ER value. Additional discussion will be added to explain this anomaly.
143	Exceedance Ratio Figures	Appendix J	--	In many cases, there are significant artifacts resulting from the log-transformation of the data prior to interpolation. The Draft Interim FS should acknowledge artifacts and document the transformations, including how potential bias introduced during the transformations was taken into account.	NR	The text will be updated in the FS Report to include this information.
144	Combined Cyanide Concentrations (mg/L) in Alluvium WBZ Groundwater – Human Health/Free Cyanide Concentrations (mg/L) in Alluvium WBZ Groundwater – Human Health	Figure J3-5a-11/Figure J3-5a-12	--	These only show concentrations from 0 – 1.0 mg/L as a single contour interval. The cyanide screening level is 0.007 mg/L. Consequently, the figures do not adequately depict the distribution of cyanide concentration and should be revised to include more meaningful intervals.	NR	This change will be made in the FS Report.
145	Identification of Potential Hot Spots	Section 7	75	The text references the "hierarchy of risks" presented in Section 5 that covers the likelihood of exposure, in a general fashion, but it does not seem to consider the "proximity to river" for the FAMM/Former Spent Oxide Area GSA, Former Tar Pond Area GSA, or northeastern portion of the Siltronic GSA that are all adjacent to the Willamette River. Conversely, contamination in the portion of the site nearest to NW St. Helens Road, such as the Former Office GSA, Former Koppers/LNG Area, and southwestern portion of the Siltronic GSA, would be considered lower priorities for remedial action from the perspective of potential risks to river receptors.	NR	A more detailed description of the hierarchy that prioritizes proximity to the river will be added to this section in the FS Report.

ID No.	Section Name/Topic	Section/ Table/Figure No.	Page No.	DEQ Comment	Discussed with DEQ	Response/Path Forward
146	Hot Spots in Soil and Other Media	Section 7.2.2	76	DEQ requests that NW Natural fully cite the definition of hot spots in soil and other media from OAR 340-112-0115(32)(b) as follows: For media other than groundwater or surface water, (e.g., contaminated soil, debris, sediments, and sludges; drummed wastes; "pools" of dense, non-aqueous phase liquids submerged beneath groundwater or in fractured bedrock; and non-aqueous phase liquids floating on groundwater), if hazardous substances present a risk to human health or the environment exceeding the acceptable risk level, the extent to which the hazardous substances: (A) Are present in concentrations exceeding risk-based concentrations corresponding to: (i) 100 times the acceptable risk level for human exposure to each individual carcinogen; (ii) 10 times the acceptable risk level for human exposure to each individual noncarcinogen; or (iii) 10 times the acceptable risk level for exposure of individual ecological receptors or populations of ecological receptors to each individual hazardous substance. (B) Are reasonably likely to migrate to such an extent that the conditions specified in subsection (a) or paragraphs (b)(A) or (b)(C) would be created; or (C) Are not reliably containable, as determined in the feasibility study. The complete definition applies to the range of materials present at the Gasco OU.	NR	The complete definition will be cited in the FS Report.
147	Identification of Significant Adverse Effect for Beneficial Uses	Section 7.3.1.1	77	The text (and Page 2 of 2 in Table 7-1) makes reference to "ingestion of organisms only." Please clarify that this is an ambient water quality criterion based on ingestion of fish/shellfish alone and does not consider use of the Willamette River for drinking purposes (e.g., non-potable estuarine waters). Note also that incidental ingestion of water through recreation is not included in Ambient Water Quality Criteria (AWQC) and not considered significant by EPA.	NR	The text will be clarified and updated in the FS Report to include this information.
148	Determination of Reasonable Time	Section 7.3.1.2	78	DEQ notes that the default restoration time of 30-years is not likely to apply to the Gasco OU for a number of reasons, notably the magnitude and extent of contamination in the uplands, including MGP residuals and DNAPL near the river. In addition, the long-term monitoring of in-water cap performance will be a factor in developing the restoration time period. The time period for evaluations of groundwater remedies, including but not necessarily limited to the HC&C system and Fill WBZ containment measure(s), should consider the in-water cap design timeframe for preventing breakthrough of COCs (currently 100-years).	NR	As stated in the text, the FS Report will include a recommendation for the reasonable restoration time for each beneficial use identified for groundwater.
149	Identification and Assessment of Remediation Alternatives	Section 7.3.1.3	78	DEQ notes the language stating that hot spots will only be applied where "…at least one treatment technology…can reasonably be implemented and will restore or protect the use within the recommended restoration timeframe…" This can perhaps be inferred from hot spot guidance but is not explicitly stated as such. Section 2.3(2) of guidance specifies that,"…remedial alternatives developed should include, at a minimum, i) treatment of the aquifer or surface water body; and ii) hydraulic controls intended to prevent further migration of contamination." For clarification, the Gasco OU FS should consider and evaluate combinations of groundwater remedial technologies in development of RAAs for GSAs.	NR	Comment noted. OAR 340-122-0115(32) defines a groundwater hot spot in part by a determination that "treatment is reasonably likely to restore or protect […] beneficial uses within a reasonable time, as determined in the feasibility study."

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150	Potential Highly Concentrated Soil Hot Spots	Section 7.3.3.1	80	It appears that the surface area(s) for individual contaminants with the highest exceedance ratios, as presented in Figures 7-2, 7-4, and 7-6, are estimated directly from the figures. DEQ requests that the text be revised to clearly describe the methodology used to depict the areas of exceedances. Certain figures present hot spot exceedance ratios for two individual contaminants (e.g., figures 7-2 and 7-6), and others present ratios for only one contaminant (e.g., Figure 7-4). This section should be revised to provide the basis for including or excluding contaminants on figures. Although this information is found in a subsequent section (i.e., Section 7.4.2.1), the initial discussions as well as the reference to above-mentioned figures are presented in this section.	NR	The text will be updated in the FS Report to include this information.
151	Doane Creek	Section 7.3.2.2	79	DEQ acknowledges the compilation and analysis of the data for Doane Creek in the Draft Interim FS. As indicated in this section, DEQ is currently evaluating Doane Creek through the source control program. NW Natural submitted the "Doane Creek Source Control Evaluation Report" (Anchor/HAI, 2017) and DEQ's review is ongoing.	NR	Comment noted
152	Potential Highly Mobile Hot Spots	Section 7.3.3.3	81	For clarification, the last sentence of the first bullet be replaced by text similar to Note 4 from Figures 4-1c, such as: "Figure 4-1c depicts interpretations for the NW Natural-owned portion of the Gasco OU from 12-feet below ground surface to the base of the Fill WBZ, and for the Siltronic- owned portion of the Former Gasco MGP OU from 20 feet below ground surface to the base of the Fill WBZ."	NR	This change will be made in the FS Report.
153	Potential Highly Mobile Hot Spots	Section 7.3.3.3	81	Regarding the last bullet, (Shallow Soil Leaching to Groundwater) DEQ concurs with NW Natural that highly mobile hot spots associated with the leaching to groundwater pathway are present where MGP residuals are potentially in contact with, or are located below the water table (i.e., extent of MGP residuals shown by Figure 4-1c). DEQ considers the maximum extent of potential highly mobile hot spots associated with the leaching to groundwater pathway to encompass the combined extent (horizontal and vertical) of MGP residuals depicted by figure 4- 1b and 4-1c. Table 7-1 should be reviewed and revised accordingly.	NR	Table 7-1 will be updated in the FS Report with the receptor pathways, depth interval, and chemical information; however, risk levels and thresholds do not apply to MGP residuals. The potential for these residuals to leach to groundwater will be further evaluated in the FS.
154a	Potential Groundwater Hot Spots	Section 7.4.1	82	DEQ does not approve this section of the Draft Interim FS in whole for the following reasons: • The basis for the occupational worker risk exposure scenario evaluated in the Gasco Site HERA is an actual and reasonable potential land-use scenario (i.e., leasing property to a bulk-aggregate handling operation) that NW Natural considered at one time.	NR	This scenario will be incorporated into the analysis in the FS Report.
154b	Potential Groundwater Hot Spots	Section 7.4.1	82	• An evaluation to replace and/or supplement municipal water with groundwater has been completed within the Gasco OU in recent years.	NR	Comment noted.
154c	Potential Groundwater Hot Spots	Section 7.4.1	82	• Groundwater sampling and monitoring data are available at multiple depth intervals nearshore of, and offshore from the Gasco OU to assess contaminant concentrations at depths to within 5-feet of the bottom of the Willamette River.	NR	Comment noted.

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154d	Potential Groundwater Hot Spots	Section 7.4.1	82	• DEQ considers the HC&C system to be a removal action subject to performance and effectiveness evaluations in the Gasco OU FS to determine its suitability as an element of the final remedy. Performance evaluations are ongoing. Consequently, conclusions regarding the (long-term) effectiveness of the system are premature.	NR	Comment noted.
154e	Potential Groundwater Hot Spots	Section 7.4.1	82	• The Fill WBZ is currently uncontrolled.	NR	Comment noted.
154f	Potential Groundwater Hot Spots	Section 7.4.1	82	• The nature and extent of MGP residuals in the Fill WBZ, Upper Alluvium WBZ, and Lower Alluvium WBZ; and the horizontal and vertical migration of contamination; result in stable groundwater contaminant concentrations that exceed hot spot levels over large portions of the uplands and out into and under the river.	NR	Comment noted. See response to Comment No. 149. Alluvium WBZ groundwater sources have been controlled and are no longer migrating beyond the shoreline. The EPA remedy consistent with the Portland Harbor ROD will address impacts in the bank and the river.
155	Potential Groundwater Hot Spots	Section 7.4.1	82	DEQ's general comments on Section 5 and our comments to Section 5.4.8 also apply here.	NR	See responses to Comment Nos. 95, 114, and 118.
156	Potential Groundwater Hot Spots	Section 7.4.1	82	NW Natural indicates that the Gasco OU FS will further evaluate groundwater hot spots. For the reasons given in our comment to Section 5.4.8, DEQ considers currently available information sufficient to identify and evaluate groundwater remedial technologies and move forward with developing RAAs for the uplands. The GSAs along the shoreline are priorities for FS planning.	NR	Comment noted. See response to comment No. 149. Under OAR 340-122-0115(32), groundwater hot spot determinations are finalized in the FS.
157a	Potential Highly Concentrated Soil Hot Spots	Section 7.4.2.1/Figures 7-7 and 7-8	83	Please clarify the following information for the figures referenced in the section. • DEQ requests additional information regarding the use of separate depths for subsurface soil within and outside the Siltronic GSA. We understand from Table 7-1(2a) that NW Natural applied separate depths (3.5 to 12-feet bgs for the Gasco Site; 3.5 to 20-feet for the Siltronic GSA), but the notes for Figure 7-8 do not include this information.	NR	The requested information will be provided in the FS Report.
157b	Potential Highly Concentrated Soil Hot Spots	Section 7.4.2.1/Figures 7-7 and 7-8	83	• Figures 7-7 and 7-8 should be revised to make it clear they apply to human health. Please revise the figure captions/titles accordingly, and expand the Notes for the figures.	NR	The figures will be revised in the FS Report as requested.
158	Potential DNAPL Hot Spots	Section 7.4.2.3	85	Much of the content of this section discusses and presents information for MGP residuals in unsaturated soil. Figures 7-7 and 7-8 illustrate the extent of potential highly concentrated soil and subsurface hot spots considering MGP residual types, including residual and potentially mobile NAPL. To further clarify the locations of potential DNAPL hot spots, DEQ requests that the information in Section 7.4.2.2 should be referenced here. In other words, the language regarding DNAPL in the alluvium being highly-mobile hot spots, applies to this section (i.e., DNAPL in the alluvium is identified as a potential DNAPL hot spot).	NR	The requested information will be added in the FS Report.
159	Hierarchy for Prioritizing Hot Spots	Section 7.5	86	The section lacks specificity and details regarding the evaluation of hot spots from the "hierarchy" perspective. Although the "hierarchy approach" is mentioned there is no attempt to summarize information in terms of GSAs for FS planning. DEQ considers the section to be incomplete without this information.	NR	The hot spot evaluation will be revised in the FS Report to summarize hot spots by GSA.

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160	Conceptual Site Model by GSA	Section 8	87	The conceptual site models (CSMs) presented in Section 8 are in part based on information regarding the geology, hydrogeology, and nature and extent of contamination for the Gasco OU. Consequently, some of DEQ's comments on CSMs reflect those in sections 2, 3, and 4.	NR	The CSM figures will be revised in the FS Report to reflect the response to comments in Sections 2, 3, and 4.
161	Conceptual Site Model by GSA	Section 8	87	DEQ has numerous general comments on the text and figures in Section 8 that are provided below. • The section presents CSMs for each GSA within the Gasco OU. In general, the section briefly summarizes information for each GSA discussed in more detail in previous sections of the document. The section lacks information regarding the basis for establishing GSAs for purposes of the Gasco OU FS. DEQ does not approve the section without information regarding the characteristics that distinguish each GSA that are factors for FS planning.	NR	Text describing the basis for establishing the GSAs and descriptions of the characteristics that distinguish each GSA will be added.
162	Conceptual Site Model by GSA	Section 8/ Figures 8-1a through 8-1e	87	• The CSMs, presented in Figures 8-1a to Figure 8-1e, disproportionately depict above-ground attributes of each GSA more prominently than below-ground information, including the flow of contaminated groundwater coming from upgradient and/or the locations of DNAPLs in the subsurface in figures such as Figures 8-1b, Figure 8-1c and Figure 8-1d.	NR	The geology and contamination at the Gasco OU are complex. Figures 3-3a through 3-3j provide detailed information about the geology and occurrence of MGP residuals along eight cross sections. Figure 4-2 provides a detailed CSM for key subsurface processes and types of contamination. The CSMs will be revised in the FS Report to depict additional detail in the subsurface, including the direction of groundwater flow and the presence of DNAPL. References to more detailed figures (e.g., Figure 4-2) will be provided in the figure notes.
163	Conceptual Site Model by GSA	Section 8/ Figures 8-1a through 8-1e	87	• In some CSM figures the arrows for groundwater flux are hard to see as they are shown as being very small (almost missing in certain figures) and/or the color blends into the background. DEQ notes there are no arrows shown for the Office Area GSA, incorrectly indicating the absence of groundwater flux.	NR	Arrows representing groundwater flow will be revised in the FS Report to be easier to see and added to the Former Office Area.
164	Conceptual Site Model by GSA	Section 8/ Figures 8-1a through 8-1e	87	• The scales used in block models disproportionately emphasize the Basalt WBZ. Relative to the Basalt WBZ, smaller vertical intervals of the blocks are devoted to depicting the Fill WBZ and Alluvium WBZ(s). Given the greatest mass of contamination occurs in the Fill WBZ and Alluvium WBZ(s), DEQ concludes the block models do not illustrate representative of subsurface conditions important for FS planning. DEQ requests that NW Natural add Basalt WBZ A to the CSMs.	NR	The Basalt WBZ A will be added to the CSM figures, and the vertical scale will be revised in the FS Report to better illustrate representative subsurface conditions important for FS planning. See also response to Comment No. 162.
165	Conceptual Site Model by GSA	Section 8/ Figures 8-1a through 8-1e	87	• Block diagrams appear to inconsistently depict GSAs. Examples include: – Source areas of DNAPLs shown in these figures do not appear to properly represent the locations and extent of contamination in each GSA; – Distribution of the subsurface media is not properly represented; – Legends used in these figures are also not well visible (color contrast issues) and hence could be better depicted in terms of flow of contaminants; and – Lateral and vertical scales are not included on CSMs, and other than general location information there is no information provided to spatially compare features between figures.	NR	The CSM figures will be edited in the FS Report as requested in these examples. See also response to Comment No. 162.

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166	Conceptual Site Model by GSA	Section 8/ Figures 8-1a through 8-1e	87	In general, more emphasis needs to be placed on the subsurface (from the surface down to approximately 150' to 200', as appropriate) for each GSA in order to properly show key geologic and hydrogeologic elements along with contaminants types within each layer (e.g., Weathered, Residual, Potentially Mobile, Mobile DNAPL; Lampblack, Solid/Semi-solid Tar).	NR	The CSM figures will be revised in the FS Report to more clearly depict types of MGP residuals. See response to Comment No. 164. See also response to Comment No. 162.
167	Conceptual Site Model by GSA	Section 8/ Figures 8-1a through 8-1e	87	DEQ requests that the figures be revised and resubmitted to address these comments. Note that DEQ's comments to Figure 4-2 apply here.	NR	These figures will be revised and resubmitted in the FS Report.
168	Former Koppers/LNG Area	Section 8.4	90	The fourth paragraph of the section indicates that benzene and naphthalene concentrations in the Former Koppers/LNG Area GSA for both the Fill WBZ and Alluvium WBZ, exhibit the highest exceedance ratios for COCs in the Gasco OU. This interpretation is consistent with information shown on figures 6-5b and 6-6a. That said, Section 8.5 indicates that higher exceedance ratios were present in the Siltronic GSA based on the DNAPL sampling results presented in Appendix H and depicted by Figure 6-6b. The figures should be reviewed and revised as appropriate and these discrepancies should be further clarified. In addition, general information regarding DNAPL characteristics and variations across each of these areas and with depth should be described in the CSM for each GSA.	NR	The highest benzene and naphthalene exceedances of human health screening levels in the fill and the alluvium are in the Former Koppers/LNG Area and Former Tar Pond Area, respectively. The statement in Section 8.5, "Naphthalene concentrations in groundwater represent the largest, most widespread risks to human receptors in the Fill WBZ (approximately 25% of the GSA) and the Alluvium WBZ (approximately 95% of the GSA). (Figures 6-5a and 6-6a)" refers to the largest risks to human receptors in the Siltronic GSA, not the entire Gasco OU. The text will be edited in the FS Report to be clear. DNAPL characteristics and variations across each GSA will be added to the CSM for each GSA.
169	Siltronic GSA	Section 8.5	91	The first paragraph of the section indicates that groundwater within the Siltronic GSA flows toward the Willamette River. DEQ notes that Figure 8-1e also shows groundwater flow towards Doane Creek. The section should be revised to reflect the figure as water level data indicates there is a component of flow within the Fill WBZ towards Doane Creek.	NR	The text will be revised in the FS Report as requested.
170	Conceptual Site Model – Former Tar Pond Area	Figure 8-1c	--	DEQ's comments to Figure 4-2 applies here.	NR	The figures will be edited in the FS Report as requested. See responses to Comment Nos. 81 and 82.
171	Conceptual Site Model – Former Koppers/LNG Area	Figure 8-1d	--	The figure under-represents the extent of DNAPL. DEQ notes that just north of the cross-sectional side of the CSM, the extent of DNAPL at the base of the Fill WBZ occupies nearly two-thirds of the section. The figure should be revised accordingly.	NR	The figure will be revised in the FS Report as requested.
172	Remedial Action Objectives	Section 9.1	92	The first paragraph under Section 9.1 includes the statement that the remedial action objectives (RAOs) as presented in Table 9-1 "integrate upland, source control, and Portland Harbor goals." The Draft Interim FS RAOs include direct- contact exposure scenarios so that risks are acceptable to human health and ecological receptors from exposure to sediment. The RAOs do not include the indirect contact exposure routes via fish/prey consumption that are provided in the USEPA ROD for the Portland Harbor. For consistency with the ROD, Table 9-1 should be revised to include indirect routes of exposure.	NR	Table 9-1 will be revised in the FS Report to include indirect routes of exposure. The table will be footnoted to indicate that remedial actions to address Willamette River and riverbank exposure pathways, including fish consumption, were established by EPA in the Portland Harbor ROD and are being designed under the EPA Consent Order.

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173	Preliminary Remediation Goals	Section 9.2.1	93	The section discusses NW Natural's perspective on development and use preliminary remediation goals (PRGs) for the Gasco OU FS. DEQ agrees with developing PRGs for PICs identified for each GSA by media and receptor pathway. Dismissing COCs chemicals based on "uncertain SLVs" will be a factor in developing PRGs for PICs. Including the additional PICs (see attached table) in PRG development will be a topic for discussion during PRG development. DEQ is not commenting further as our comments on the Draft Interim FS are relevant to the information in the section. Discussions regarding development and use of PRGs will necessarily follow NW Natural's review of this letter.	NR	This comment will be addressed through discussion with DEQ regarding the PRG memorandum.
174	Action Levels	Section 9.2.2	93	NW Natural's perspective on action levels is discussed in this section of the Draft Interim FS. DEQ agrees in concept with action levels. That said, like PRGs many of DEQ's comments are applicable to the information in the section. Further discussions regarding action levels will occur following NW Natural's review of the letter.	NR	This comment will be addressed through discussion with DEQ regarding the PRG memorandum.
175	Regulatory Permits, Approvals, and Substantive Requirements	Section 10	95	The list of agencies for permit, approvals and substantive requirements is not complete and should include all applicable permit, approvals and substantive requirements. In addition to the agencies presented in Section 10, other potentially applicable agency requirements include, but may not be limited to state rules and statutes (e.g., Oregon Administrative Rules, Division 122; Oregon Revised Statutes, Chapter 465); federal regulations (e.g., EPA Region IX PRGs, Resource Conservation and Recovery Act requirements for hazardous materials handling and disposal; Clean Water Act, including National Pollution Discharge Elimination System permits; 40 CFR 122 and 125 for stormwater control during remedy implementation). Other local and action specific ARARs may also apply. This section should be revised accordingly. In addition, the section should indicate which ARARs apply to the Gasco OU area and are considered applicable, relevant and appropriate, or to be considered.	NR	Applicable permit approvals and substantive requirements will be identified in the FS. Oregon law does not require evaluation of or compliance with non-applicable (e.g., "relevant and appropriate") regulations or non-promulgated (e.g., "to be considered") guidance. We assume the reference in the comment to Division 122 is to OAR Chapter 340 Division 122.
176	Specific Considerations	Section 10.2	95	NW Natural states that, "the City of Portland requires management and treatment of all stormwater generated via new impervious surfaces if infiltration is not possible." The City's Stormwater Management Manual requires treatment (pollution reduction requirements) for all projects that develop or redevelop over 500-square feet of impervious area, regardless of whether that stormwater is subsequently infiltrated. The City's requirement must be examined in the Draft FS Report as appropriate, as well as in the context of stormwater source control for the Gasco OU.	NR	This requirement will be examined in the FS Report.

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177	Determination of Potential Remediation Volumes	Section 11/Section 11.2/Tables 11-2 and 11-3	97	Section 11 provides preliminary volume estimates for material that exceed risk-based screening levels, hot spot criteria, and DNAPL. DEQ concludes there is adequate data available to support preliminary volume estimates for materials in unsaturated soil in the fill and the Fill WBZ. Volume estimates will be refined further with additional data analysis. Volume estimates for DNAPL in the Upper Alluvium WBZ and Lower Alluvium WBZ are limited by lack of information regarding potential DNAPL continuity and mobility. DEQ considers the volume estimates presented for these WBZs in Section 11.2 and in Table 11-3 to be preliminary and expects the estimates to be updated based on the results of a yet to be completed data gaps investigation. That said, the preliminary estimates provide useful information regarding the relative volumes of DNAPL and potential source material by GSA and with depth. Based on the preliminary volume estimates shown in tables 11-2 and 11-3, the bulk of DNAPL occurs in the Fill WBZ and the upper Alluvium WBZ. Combining estimates for the Fill WBZ (~ 60%) with the Upper Alluvium WBZ between 0'-25' below the Fill WBZ accounts for greater than 80% of the DNAPL volume between 0' to 50' of WBZ below ground. While these DNAPL/remedial volumes may be preliminary, but the fraction of total DNAPL present under the Gasco OU and their placements offer many opportunities for remedial solutions to address MGP source material. DEQ acknowledges that no specific remedial technologies are being proposed in the Draft Interim FS, and that a thorough pre-design investigation of DNAPL remains to be completed, for the alluvium WBZs in particular. That said, the information presented in the Draft Interim FS regarding DNAPL occurrence by depth, indicates the potential for several removal and treatment approaches to be applicable. The remainder of DNAPL beneath the Gasco OU (approximately 15% to 20% DNAPL) is in the Alluvium WBZ(s) at depths of 25'- 75' below the base of the Fill WBZ and deeper (greater than 50'-75' bgs). Deeper occurrence of DNAPL is primarily beneath the northwestern end of former effluent overflow pond on the Siltronic GSA. This information suggests that management approaches involving in-situ treatment technologies and enhanced/monitored natural attenuation have potential roles to play at the site.	NR	Comment noted. We agree that the DNAPL volume estimates within the Alluvium WBZ will be refined based on the results of the data gaps work, especially with respect to potential mobility. We also note that the previous TarGOST and conventional soil borings provide a large database regarding DNAPL nature, extent, and continuity in the Alluvium WBZ.
178	Estimated Volume of Impacted Soil	Section 11.1	97	DEQ understands that the estimates of remedial volumes for soil and highly concentrated hot spots rely on areas calculated from inverse-distance weighted surfaces of COC exceedance ratios applied over the depth interval of interest. DEQ further understands that the occurrence of MGP residuals is not factored into the volume estimates. DEQ does not approve estimates of soil remedial volumes that do not consider MGP residuals. DEQ requests that the section be revised to include estimates of soil and hot spot remedial volumes based on MGP residuals to compare with the raster file approach. For this purpose, DEQ requests that soil and hot spot remedial volumes use figures 7-7 and 7-8 as the basis for estimating the areas that exceed screening levels and hot spot values.	NR	Estimates of soil, hot spot, and combined soil and hot spot volumes based on the presence of MGP residuals will be included in the estimation of remedial volumes in the FS Report. Figures 7-7 and 7-8 will be used as the initial basis for the calculations, but they will be refined based on distribution of MGP residuals as noted in boring logs (similar to data adjustment factors used for DNAPL volume estimates). MGP residuals will be identified as potential hots spots based on the toxicity, potential to migrate, or containability criteria defined in OAR 340-122-0115(32)(b).
179	Recoverable DNAPL Fraction	Section 11.2.2	100	This section discusses the occurrence and volumes of DNAPL broadly for the Gasco OU. DEQ's comments are provided below. • Information is lacking for DNAPL occurrence and migration using current information available for the range of DNAPL properties by GSA (notably Former Tar Pond GSA, Former Koppers/LNG GSA, and Siltronic GSA), including but not limited to descriptions of DNAPL density, vapor pressure, interfacial tension and viscosities, as well as soil geotechnical variabilities such as porosity, soil bulk density, moisture content, and particle size distribution.	10/2/19	Tables in Appendix H will be revised in the FS Report to show data by GSA. DNAPL data collected as part of the FS data gaps work will be incorporated into the DNAPL evaluation in the FS. In cases where DNAPL properties from a GSA are used for analyses in another GSA, discussion will be added to the text regarding the rationale (e.g., the results of a sensitivity analysis) for using these data and any limitations associated with this mode of data usage.

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180	Recoverable DNAPL Fraction	Section 11.2.2	100	• Section 11.2.2 indicates that 40% of the total estimated DNAPL volume is residual DNAPL (i.e., "non-recoverable") using hydraulic means. The section also indicates that less than half of the remaining 60% of DNAPL can be recovered. DEQ understands from this information that approximately 24%, or 900,000 gallons out of 3,900,000 gallons of DNAPL can be recovered (i.e., 40% of 2,300,000 gallons = 920,000 gallons; 920,000/3,900,000 gallons of all DNAPL = 24%). According to Appendix D, as of December 2017 approximately 4,350- gallons of DNAPL has been recovered from HC&C system monitoring wells and extraction wells (i.e., ~0.1% of estimated total DNAPL and ~0.2% of potentially mobile DNAPL).	NR	Comment noted.
181	Recoverable DNAPL Fraction	Section 11.2.2	100	• The section focuses on DNAPL recovery using the existing removal action technology implemented at the Site (i.e., removal of DNAPL accumulations from monitoring wells and extraction wells). Information is discussed in a manner that emphasizes the limitations and uncertainty associated with DNAPL removal. DEQ notes that in addition to the removal technologies referenced by NW Natural, there are several proven effective technologies that can be implemented to enhance DNAPL recovery based on the depth of occurrence. The relative recoverability of DNAPL should be described in more detail by WBZ with depth in the context of trending soil characteristics and DNAPL occurrence. Information on DNAPL accumulation compiled in the DNAPL Summary Reports in Appendix D is useful for this preliminary generalized assessment.	NR	The data gaps work will inform the DNAPL evaluations in the FS Report, including relative recoverability as a function of depth, soil characteristics, and DNAPL occurrence. The FS Report will also discuss other remedial technologies beyond those currently being used at the site.
182	Recoverable DNAPL Fraction	Section 11.2.2	100	• DEQ's review indicates that this section of the document has utilized many methodologies based on work conducted on chlorinated solvent sites (i.e., chlorinated DNAPL), and/or with petroleum LNAPL; rather than petroleum-based DNAPL such as MGP coal tar or creosote (Pankow and Cherry, 1996). The properties of solvent DNAPL and petroleum LNAPL are significantly different than the MGP DNAPL in the Gasco OU. DEQ requests that the calculation methods, parameters, and/or adjustment factors taken from solvent DNAPL and/or LNAPL information sources be identified, and potential limitations and/or uncertainties be described. DEQ also recommends that adjustments in calculations be made based on published properties of coal tar/MGP tar as much as possible.	10/2/19	See response to Comment No. 72. Discussion regarding the application of published NAPL mobility principles to MGP DNAPL and how NAPL physical properties affect mobility will be added in the FS Report. However, calculated values for DNAPL hydraulic conductivity and transmissivity that are presented in the IFS do not require adjustment, as they are based solely on site-specific data.
183	Estimated Volume of Impacted Groundwater	Section 11.3	102	The estimated range of dissolution rates should be described in this section, including the estimated mass that may be recovered in the dissolved phase over the long-term for each of the WBZs by the GSAs in the Gasco OU. Given the magnitude and extent of contamination, DEQ considers groundwater contamination to be stable in the Fill WBZ and Alluvium WBZ at concentrations that warrant remedial action. DEQ's comment to Section 3.2.5 regarding recharge to, and simulated groundwater flux in the Fill WBZ applies to the last paragraph of the section.	NR	We assume that DEQ is referring to NAPL dissolution in this comment. Estimated ranges of dissolution rates for each of the WBZ by GSAs will be included in the FS Report.
184a	Estimated Remedial Volumes – DNAPL in Fill WBZ	Table 11-2	--	DEQ comments on the table include the following: • DEQ understands the complexity and heterogeneity of the site results in inherent uncertainty in the calculation of the total volumes developed for contaminated media at the site. Consequently, it is more appropriate to use a range of specific parameters to estimate DNAPL volumes for each GSA by depth, thus the error resulting from the uncertainty is better understood and represented, based on GSA-specific values.	10/2/19	A sensitivity analysis will be conducted to evaluate the influence of parameter ranges on calculated DNAPL volumes for each GSA by depth.

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184b	Estimated Remedial Volumes – DNAPL in Fill WBZ	Table 11-2	--	• Please add a note to describe how the "Area Containing DNAPL" and the "Average Area" containing DNAPL are derived. For example, the "average" column appears to be estimated and/or rounded, however it does not appear the approach is consistent between GSAs.	10/2/19	A note will be added in the FS Report as requested in this comment.
184c	Estimated Remedial Volumes – DNAPL in Fill WBZ	Table 11-2	--	• Site-specific measured values for DNAPL saturation and porosity should be used to represent each subarea, if they are available. Furthermore, it is not clear that a site-wide effective porosity value is appropriate for all locations and soil types. The sensitivity of each of these assumptions should be considered when estimating the total volume of DNAPL at the Site. Many of the information items requested in the comments above, will be information needs for the alluvium data gaps investigation (DNAPL saturation, range of parameters for volume estimates, including porosity).	10/2/19	Site-specific DNAPL saturation and porosity values will be used for each GSA in the FS Report if available. See response to Comment No. 184a.
185	Estimated Remedial Volumes – DNAPL in Fill WBZ	Table 11-2	--	Footnote "a" states that, "The thickness of DNAPL in the fill was calculated by boring for each GSA using data presented on the existing cross sections." It is unclear whether the note is consistent with the description of average thickness in Section 11.2 that indicates the thickness is calculated as an average from the cross-sections The note should be reviewed and revised as appropriate for consistency or for clarification.	NR	This note will be edited in the FS Report for clarity and consistency.
186	Estimated Remedial Volumes – DNAPL in Alluvium WBZ	Table 11-3	--	DEQ comments include the following: • Footnote "b" states that, "The thickness of DNAPL in the alluvium was calculated by boring for each GSA using data presented on the existing cross sections." It is unclear whether the note is consistent with the description of average thickness in Section 11.2. The note should be reviewed and revised as appropriate for consistency or for clarification. • A note should be added to indicate that the depth interval of interest shown occurs within the Upper Alluvium WBZ, Lower Alluvium WBZ, Deep Lower Alluvium WBZ, or straddles the boundary between two WBZs.	NR	See response to Comment No. 185. A note indicating the WBZ for the depth interval of interest will be included in the FS Report.
187	Estimated Remedial Volumes – Groundwater	Table 11-4	--	The table presents the "Estimated Remedial Volume-Groundwater." It would be beneficial if the estimated amount of groundwater volume is presented by GSA. DEQ requests the method for estimating the remedial volume to be described in a footnote.	NR	The estimated volume of groundwater will be presented in the FS Report for each GSA, and notes describing the approach will be added to the table.

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188	Evaluation of Remedial Technologies	Section 12	105	Section 12 of the Draft Interim FS lists and describes General Response Actions (GRAs [see Section 12.1]) and identifies, briefly evaluates, and partially screens remedial technologies associated with each of the GRAs (see Section 12.2). Sections 12.1 and 12.2 are organized similar to DEQ FS guidance. In addition to DEQ guidance, DEQ's October 19, 2016 letter commenting on the Draft Gasco Site FS Work Plan identified additional criteria for organizing and identifying remedial technologies, including: • Dividing the Gasco OU into GSAs based on the type and distribution of MGP residuals present, particularly DNAPL; and the nature and extent of soil and groundwater contamination; and • Retaining any remedial technologies that are proven and effective at MGP or equivalent sites (e.g., coal tar, creosote, wood treating), including any new, developing, and/or innovative technologies that have been implemented successfully at MGP-equivalent sites. Based on our review of Section 12, the content does not fully consider these criteria. Additional information and discussion are needed to integrate GSAs into the assembly, screening, and identification of remedial technologies. In other words, screening and identifying technologies on a GSA by GSA basis. In addition, this section does not clearly identify key technologies that have been successfully used at other MGP-equivalent sites in the United States. As DEQ communicated previously, Section 12 should compile remedial technology according to GSAs for the reasons cited in our October 19, 2016 letter commenting on the Draft Gasco Site FS Work Plan. Given the scale and magnitude of contamination within the Gasco OU, DEQ directs NW Natural to organize the technology screening/identification and evaluation process around the five (5) GSAs; screen and identify remedial technologies for individual GSAs; and ultimately identify and select technologies (primary and secondary) for each impacted media within an individual GSA consistent with GSA-specific factors. DEQ also considers it to be premature to eliminate any major remedial technology for the Gasco OU that has been used successfully at MGP-equivalent sites. Major technologies that are missing or not given proper prominence in Table 12-2, include in-situ thermal treatment (ISTT), in-situ chemical oxidation (ISCO), and in-situ bioremediation. For each of these technologies, sub-categories for the technology should be identified (for instance, the main types of oxidants should be identified as sub-categories to ISCO), to aid in selection of the best technologies that may be applicable to site-specific conditions in each of the GSAs. Approaching technology/technologies identification; selecting technologies to remediate impacted media within each GSA; and ultimately expanding technologies across GSA boundaries in a step-by-step manner, will facilitate the identification of technology applications in areas of the Gasco OU that otherwise may be missed or considered infeasible for use if only assessed on a site-wide basis.	NR	The issues raised in this comment will be discussed with DEQ during development of the "Technology Assignment Technical Memorandum." We will organize the technology screening around the five GSAs as requested. However, we need to have a common understanding of what it means for a technology to have been successfully used at other MGP sites. NW Natural considers "success" as achieving RAOs or CULs for all COCs in final remedial actions (as opposed to bench scale or pilot studies). We also want to avoid redundancy in retaining technologies that have similar effectiveness and cost because only one is needed for comparison with technologies that differ in effectiveness and cost.

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189	MGP Site Summary	Table 12-1	--	The summary of sites indicates the most commonly used process options combine treatment technologies that generally include soil excavation and recovery wells, followed by in-situ-stabilization (ISS), barrier walls, and then to a lesser degree bioremediation (BIO), oxidant injection (ISCO), soil vapor extraction (SVE) and lastly, thermal treatment (ISTT). However, several references indicate MGP treatment processes that include thermal and/or oxidant injection as a component in the overall remedial strategy can greatly increase DNAPL recovery; this benefit is not discussed in this report. Based on this information there are additional relevant MGP-equivalent sites that are not listed in Table 12-1, including: • Nicor's Bloomington MGP site that deployed ISTT (ERH-based heating) thermal technology to increase subsurface to over 40C to reduce the DNAPL's viscosity and increase the DNAPL recovery. Secondary technology utilized was dual-phase extraction (PDE). • National Grid site used ISCO treatment utilizing ozone as the reagent to treat some source areas and the BTEX/PAH contaminated groundwater. • UPRR Creosote Site, Laramie, WY Creosote site treated with water flooding to remove/extract creosote along with phytoremediation for hydraulic containment, plus other synergistic technologies • The Visalia Site (Bakersfield, CA) and Port of Ridgefield Site (Ridgefield, WA) utilized thermal treatment (steam injection combined with vapor/groundwater extraction) to mobilize and remove creosote and wood-treating chemicals from the subsurface and extract and treat vapor and groundwater. • PG&E treated coal tar source area at Santa Rosa site using ISTT (ERH-based) thermal treatment as well as ISS for other areas • Presently, Ameren's Alton MGP site is treating MGP coal tar with ISTT (TCHH-based) thermal treatment. Multi-phase extraction (MPE) is also being utilized at the site. • Ameren also used ISCO utilizing sodium persulfate to treat source area material at another MGP site a few years ago in Central Illinois. • Wisconsin Energy (WEC Energy Group) used in-situ solidification (ISS) technology at several MGP sites in Wisconsin. • MidAmerican Energy utilized landfarming technique to treat MGP contaminated soils from Vandalia Road/Sioux City MGP sites in IA. The facility combined ISCO and Aerobic BIO for treatments of some of the source area soils. Table 12-1 should be reviewed and revised to add relevant information for these sites. The additional major technologies and their variety of modes of operation should be retained and carried forward into the FS.	NR	The table will be updated in the FS Report to include these sites based on publicly available information online. If DEQ has source documentation for these sites, we would appreciate it if DEQ could share that information with us. Similar to our response to Comment No. 188, did these sites attain CULs and RAOs? Did they reach closure? NW Natural believes it is important to carry forward technologies that can address all COCs at the site, not address some and leave others behind. Also, the utility industry at large has had negative experiences with ISCO.
190	Partial Preliminary Remedial Technology Screening	Table 12-2	--	Consistent with DEQ's direction to compile remedial technologies according to GSAs, instead of a single table (Table 12-2) five tables should be prepared, one for each GSA. Each table should include information relevant to screening and identifying technologies for that individual GSA. The following comments are provided for consideration during preparation of these tables.	NR	GSA-specific tables will be prepared in the FS Report.

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191	Partial Preliminary Remedial Technology Screening	Table 12-2	--	• Landfarming and biopiles should be retained for soil as the approach has been applied successfully to contaminants and waste types at MGP equivalent sites. The primary reason for not carrying the approach forward (i.e., lack of space) no longer applies given the Koppers leasehold is vacant and open.	NR	This technology will be evaluated in the "Technology Assignment Technical Memorandum" or applicable section of the FS Report.
192	Partial Preliminary Remedial Technology Screening	Table 12-2	--	• Soil flushing should be retained as a remedial technology. Water and/or hot water flushing into trenches reduces many of the difficulties identified by NW Natural as reasons to not carry the technology forward. Furthermore, the approach is proven and effective, easily implementable, and has the capacity to remove DNAPL to residual levels in the fill (e.g., Former Koppers/LNG Area GSA, and Former Tar Pond Area GSA.).	NR	This technology will be evaluated in the "Technology Assignment Technical Memorandum" or applicable section of the FS Report, including an evaluation of the risks associated with applying technologies that mobilize contaminants proximate to surface water.
193	Partial Preliminary Remedial Technology Screening	Table 12-2	--	• Chemical Oxidation (ISCO) should be retained for "Organic compounds; Soil and DNAPL," as well as groundwater. Recent implementation of this technology has shown that oxidation could enhance DNAPL recoverability and hence result in a more stable/immobile residual product. The main types of ISCO (such as Fenton's reagent, ozone, permanganate, and persulfate) should be included as subcategories in the tables.	NR	This technology will be evaluated in the "Technology Assignment Technical Memorandum" or applicable section of the FS Report for GSAs or areas within GSAs where technologies that address all compounds presenting potentially unacceptable risk are not viable or where only organic compounds present potentially unacceptable risk. However, to our knowledge, ISCO is very unlikely to remediate the zones containing NAPL to groundwater CULs. If DEQ is aware of any MGP DNAPL zone that has been remediated to the target groundwater CULs using this technology, please provide information about such sites.
194	Partial Preliminary Remedial Technology Screening	Table 12-2	--	• In-Situ Thermal Treatment (ISTT) for "SVOCs, VOCs, TPH; soil and DNAPL" should be retained at this time and include groundwater. The technology has the potential to treat multiple media most heavily impacted by MGP residuals (e.g., Siltronic GSA, Former Koppers/LNG Area GSA, and Former Tar Pond Area GSA. The main types of ISTT (such as thermal conductive heating, electrical resistance heating, and steam-enhanced thermal extraction) should be included as subcategories in the tables.	NR	This technology will be evaluated in the "Technology Assignment Technical Memorandum" or applicable section of the FS Report. for GSAs or areas within GSAs where technologies that address all compounds presenting potentially unacceptable risk are not viable, or where only organic compounds present potentially unacceptable risk. However, to our knowledge, the listed thermal technologies are very unlikely to remediate the zones containing NAPL to groundwater CULs. If DEQ is aware of any MGP DNAPL zone that has been remediated to the target groundwater CULs using this technology, please provide information about such sites.
195	Partial Preliminary Remedial Technology Screening	Table 12-2	--	• ISS and ISCO/ISS technology combines ISCO reagents (e.g., sodium persulfate) as an additional ingredient to an In-Situ Solidification (ISS) reagent mix (i.e., ISCO/ISS treatment) to promote destruction of degradable contaminants such as BTEX and naphthalene immediately after mixing, but prior to the soil stabilization/solidification.	NR	Comment noted.
196	Partial Preliminary Remedial Technology Screening	Table 12-2	--	• Aerobic biodegradation (in the presence of dissolved oxygen/air, or Aerobic BIO) has potential applications at the Gasco OU as it promotes remediation of groundwater contaminated by dissolved petroleum-based compounds, including BTEX and naphthalene, as well as for more degradable contaminants.	NR	Comment noted.

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197	Partial Preliminary Remedial Technology Screening	Table 12-2	--	In-situ chemical reduction is not retained as a remedial technology. Siltronic constructed and implemented a removal action using an enhanced in-situ bioremediation approach, using in-situ reduction (zero-valent iron) with biodegradation to reduce concentrations of chlorinated volatile organic compounds (cVOCs) in the subsurface. Releases of cVOCs, including potential DNAPL, commingle with MGP DNAPL in the Fill WBZ, and dissolved MGP constituents and cVOCs are commingled below the EIB-treatment area and migrate downgradient to the river. DEQ understands from the information in the Draft Interim FS, that given the nature and extent of MGP contamination in the portion of the Siltronic GSA where commingling occurs, NW Natural envisions using remedial technologies applicable to MGP sites to address contamination. There are several treatment technologies that do not appear in the Draft Interim FS (e.g., air-sparging, bioventing) that may represent effective components of the remedy (treatment of soil under buildings), or of a treatment technology within a treatment train system (reduce or remove volatile compounds from groundwater). Treatment technologies for ancillary media (e.g., soil gas, air off-gassing, pumped groundwater) also do not appear in the Draft Interim FS and may be considerations for remedy planning. The Draft Interim FS should acknowledge and discuss the potential for additional technologies to be considered, identified, and incorporated into remedy planning. In summary, there are a suite of major technologies which would likely be required to treat different contaminated media and MGP residual types in different GSAs, either alone or in combination with another complimentary technology. Additional treatment technologies may be required to treat secondary waste streams, such as daughter and by-product streams, residual streams, air off-gassing, vapor streams, or extracted water. DEQ anticipates that primary and secondary treatment technologies will be identified during FS planning for consideration during development of RAAs. In general, DEQ concludes that it is premature to reject any major or secondary remediation technology at this early stage of the technology screening process.	NR	This comment will be discussed during development of the "Technology Assignment Technical Memorandum." The FS Report will acknowledge and discuss the potential for additional technologies to be considered, identified, and incorporated into remedy planning. We disagree that it is premature to reject any major or secondary remediation technology during technology screening as this is the second time this information has been presented to DEQ (i.e., it is no longer "preliminary"), and the rationale for eliminating technologies has been presented. We believe using single technologies that address both multiple media and all COCs presenting potentially unacceptable risk will be more effective than attempting to apply numerous different technologies concurrently or sequentially in an area to address discrete media or discrete COCs presenting potentially unacceptable risk.
198	Proposed Path Forward in FS Process	Section 13	113	This section of the Draft Interim FS provides a proposal for a stepwise approach to complete the feasibility study beginning with NW Natural's recommended planning hierarchy, followed by the development (or assembly) of technologies as Step 1; evaluation and screening as Step 2; and detailed analysis (scoring and ranking) as Step 3. While this framework is acceptable from a process standpoint, the GSA construct and hierarchy approach are not fully integrated into the approach.	NR	Integration of the GSA construct and hierarchy approach will be discussed with DEQ during the development of the "Technology Assignment Technical Memorandum."

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199	Proposed Path Forward in FS Process	Section 13	113	Section 13 recommends protecting beneficial use, managing high priority pathways, and managing source materials as the main considerations for the planning hierarchy. DEQ recommends using the hierarchy presented in our October 19, 2016 as the framework for prioritizing site remediation. The DEQ hierarchy is based on the location, nature, and extent of contaminant sources, and includes the following considerations: 1. Proximity to sensitive receptors such as the Willamette River; 2. Presence of MGP residuals, particularly mobile DNAPL; 3. Magnitude of unacceptable risk to human health and ecological receptors; 4. Mobility of contamination; and 5. Contaminant mass. The objective of the hierarchy is to identify the "highest-ranking" source area(s) of contamination for all relevant contaminated media and use this information as the basis for identifying general response actions and screening remedial technologies within each GSA. This approach provides the framework for "linking" remedial technologies across GSA boundaries and for conducting informed evaluations of remedial alternatives across the Gasco OU.	NR	This hierarchy will be further developed through discussions with DEQ during development of the "Technology Assignment Technical Memorandum" and the FS Report.
200	Recommended Process for Developing RAAs	Section 13.1	113	DEQ's comments to Table 12-2 apply here. DEQ agrees with assembling technologies by media to address site-wide contamination. Assembly of combinations of remedial technologies should be done for each GSA by media, followed by technology screening in terms of addressing RAOs and GRAs. The screening should consider the ability of technologies to achieve remedial objectives within the hierarchy framework, either as a primary technology or a secondary technology.	NR	General Response Actions are simply more general categories or groupings of remedial technologies; they would not be used to screen technologies. Technology screening typically precedes assembly of technologies into site-wide alternatives based on an assessment of cost, effectiveness, and implementability. Alternatives are then evaluated using the balancing factors, including an evaluation of whether RAOs are met. We envision applying the hierarchy during assembly of technologies into site-wide alternatives, not to screen technologies.
201	Recommended Hierarchy for Technology Screening and Alternatives Assembly	Section 13.1.1	113	DEQ's comment regarding the October 19th hierarchy applies here. DEQ anticipates the hierarchy will be integrated into technology analyses and remedial alternatives evaluations. For example, using the hierarchy as an element of scoring or ranking technologies and alternatives. The Draft Gasco OU FS should fully discuss use and integration of the hierarchy into the FS planning process.	NR	Comment noted.
202a	Step 1 - Development of Alternatives	Section 13.1.2	114	DEQ agrees with the assembly of technologies for each GSA. Technologies should be assembled for each GSA based on the media and contaminants present in that specific GSA. Our comments in Section 12 recommending that Table 12-2 identify a wider selection of technologies apply here. In addition to describing Step 1, Section 13.1.2 discusses the remedial action components that NW Natural envisions incorporating into the evaluation of RAAs. DEQ's perspective on the status of each is provided below. Existing Source Control Measures. DEQ concurs that existing SCMs indicated here will be considerations for FS planning. The approach to incorporating existing SCMs will be clarified during preparation of the Draft Gasco OU FS.	NR	Comment noted.

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202b	Step 1 - Development of Alternatives	Section 13.1.2	114	Planned Source Control Measures. NW Natural refers to control of the Fill WBZ as a SCM. For clarification, given the Fill WBZ is being evaluated as part of the FS, technologies selected to address the pathway will be considered elements of the uplands remedy that also address source control. From DEQ's perspective, the current technology selections for the Fill WBZ (i.e., segmented trench, horizontal extraction wells) recommended in the "Fill WBZ Trench Design Evaluation Report" (Anchor, 2015) apply to each GSA along the shoreline and the Former Office Area GSA. In other words, the technologies apply to individual GSAs and to adjoining GSAs.	NR	Comment noted.
202c	Step 1 - Development of Alternatives	Section 13.1.2	114	Presumptive Elements of Remedial Alternatives. DEQ acknowledges the information regarding the ponds in the Former Tar Ponds Area GSA. Addressing the ponds represents a removal action that can be implemented independent of the FS. Groundwater evaluations are ongoing to evaluate the potential effects of lining the LNG Basin and cessation of pumping on the Fill WBZ groundwater gradient and contaminant transport. During discussions with NW Natural, DEQ has indicated that early implementation of the Fill WBZ SCM, or a purpose-specific measure may be warranted if the results of this work indicate there is the potential for contaminant migration to the river before construction of the Fill WBZ remedial action under the uplands remedial action planning and scheduling process.	NR	Comment noted.
202d	Step 1 - Development of Alternatives	Section 13.1.2	114	Vertical Barrier. DEQ acknowledges NW Natural's inclusion of a vertical barrier in the Draft Interim FS consistent with previous agreements. For clarification, the initial alignment, depth, and length of the barrier are based on assessments completed for the "Groundwater/DNAPL Source Control Focused Feasibility Study" (Anchor, 2007). The Gasco OU FS should evaluate the location and dimensions of the barrier in the context of the current uplands and in-water projects, including the current and reasonably future status of NW Natural and Siltronic operations within the Gasco OU. The Gasco OU FS should evaluate the location and dimensions of the barrier in the context of the current uplands and in-water projects, the present state of containment technology, and the needs and status of the NW Natural and Siltronic operations within the Gasco OU.	NR	Comment noted. The FS will be based on conceptual design(s) of a vertical barrier, sufficient to facilitate cost estimate and comparison of alternatives. The location and dimensions of a vertical barrier, if selected as a component of the final remedy, would be determined during engineering design.
202e	Step 1 - Development of Alternatives	Section 13.1.2	114	Coordination with Sediment Remedy. DEQ acknowledges that coordination and integration is required to align the uplands and in-water remedial actions. Coordination during remedy planning includes reconfiguring the riverbank, working around the HC&C system, and constructing the Fill WBZ measure. NW Natural has committed to designing and constructing the Fill WBZ measure with construction expected to occur subsequent to the riverbank configuration being finalized and prior to or along with the sediment remedy.	NR	Comment noted.

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203	Step 2 – Complete Screening of Alternatives	Section 13.1.3	116	DEQ agrees with the Step 2 approach to evaluating technologies assembled in Step 1. For clarification, the technology evaluations should be focused on each GSA rather than a site-wide approach. Evaluation of technologies on a GSA-basis will facilitate selection of remedial approaches (i.e., set of technologies) initially identified as being suitable for each GSA. DEQ believes that the alternative screening completed in Step 2 should be done using GSA-specific factors, and expanded in Step 3 beyond the GSA boundaries based on the applicability of technologies to adjoining GSAs. The hierarchy should also be considered in this step, and the methods for application of the hierarchy should be fully developed and presented in the Draft Gasco OU FS. The RAA evaluation process mentioned in the Draft Interim FS, can and should use a tiered evaluation approach to technology application, as Section 13 mentioned. That said, DEQ considers it important to initially screen technologies for each GSA within the framework of the hierarchy, by media, and according to RAOs. Assembly or winnowing of technologies for application site-wide is premature at this step and not preferred.	NR	Comment noted.
204	Step 3 – Detailed Analysis of Alternatives	Section 13.1.4	117	In general, DEQ agrees with the detailed analysis process described for Step 3 in which technologies assembled in Step 1 and evaluated in Step 2 are scored and ranked. Consistent with our comments above, the detailed analysis of alternatives should first be conducted on a GSA by GSA basis within the framework of the hierarchy, by media, and according to RAOs. Once established for a GSA, a solution (i.e., combination of technologies) can be evaluated for application to the adjacent GSA, and so on for the entire site. In other words, the remedial alternative analysis for the site as a whole, reflects overlapping similarities in technologies for each media within identified for each GSA. Approaching technology/technologies identification; selecting technologies to remediate impacted media within each GSA; and ultimately expanding technologies across GSA boundaries in a step-by-step manner, will facilitate the identification of technology applications across the Gasco OU, including areas that might otherwise be missed or considered to be infeasible for use if assessed on a site-wide basis.	NR	Comment noted.
205	General	--	--	DEQ recognizes the substantial effort made by NW Natural to prepare the Draft Interim FS, and acknowledges the contribution the submittal makes to moving the Gasco OU FS forward.	NR	Comment noted.

Abbreviations:
%RE: percent relative emitter
bgs: below ground surface
COC: contaminant of concern
COI: contaminant of interest
cPAH: carcinogenic polycyclic aromatic hydrocarbon
CSM: conceptual site model
CUL: cleanup level
DEQ: Oregon Department of Environmental Quality
DNAPL: dense nonaqueous phase liquid
EPA: U.S. Environmental Protection Agency
EPRI: Electric Power Research Institute
ER: exceedance ratio
FAMM: Fuel and Marine Marketing
FS: Feasibility Study
GSA: geographic subarea
HC&C: hydraulic control and containment
HERA: Human Health and Ecological Risk Assessment
HH: human health
IDW: inverse distance weighting
IFS: *Interim Feasibility Study*
ISCO: in situ chemical oxidation
ITRC: Interstate Technology and Regulatory Council
LNAPL: light nonaqueous phase liquid
LNG: liquefied natural gas
LOF: locality of facility
MGP: manufactured gas plant
NAPL: nonaqueous phase liquid
NR: not required
OAR: Oregon Administrative Rule
ORS: Oregon Revised Statutes
OU: operable unit
PIC: principal indicator compound
PRG: preliminary remediation goal
RAA: remedial action alternative
RAO: remedial action objective
RI: Remedial Investigation
ROD: Record of Decision
Siltronic: Siltronic Corporation
SL: screening level
TarGOST: Tar-Specific Green Optical Screening Tool
TEQ: toxic equivalents quotient
TPH: total petroleum hydrocarbon
WBZ: water-bearing zone

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