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July 3, 2024

Bob Wyatt
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via electronic delivery (email)

Re: Gasco OU Interim Removal Action Decision
Former Gasco Manufactured Gas Plant Operable Unit
Portland, Oregon
ECSI# 84 and # 183

Bob Wyatt:

The Oregon Department of Environmental Quality (DEQ) has prepared this letter to notify NW Natural of our decision regarding the proposed Interim Removal Action Measure (IRAM) at the Former Gasco Manufactured Gas Plant Operable Unit (Gasco OU). DEQ's decision considers information presented in the *Revised Source Control Addendum Report*[1] (Revised SCA), the *Source Control Interim Remedial Action Measure Concept and Agreement to Move into Design*[2] (IRAM Concept) letter, and meetings between DEQ, NW Natural, Anchor QEA, LLC, and Ede Environmental, LLC on January 30, 2024, February 20, 2024, and April 11, 2024. Anchor QEA, LLC and Ede Environmental, LLC prepared the Revised SCA and IRAM Concept letter, respectively, on behalf of NW Natural, under the Voluntary Agreement for Remedial Investigation/Feasibility Study, as amended[3,4,5].

Interim Removal Action Measure Decision

In concept, the IRAM includes the following elements:

- An in-situ stabilization and solidification (ISS) barrier wall that extends along the full length of the northern Gasco OU boundary shared with the U.S. Moorings facility. The ISS barrier wall along this segment extends from the ground surface to the basalt bedrock.
- An ISS barrier wall along the Gasco OU shoreline that is contiguous with the ISS barrier wall along the Gasco OU/U.S. Moorings facility boundary and extends south onto the adjacent Siltronic property to a location that coincides with the lateral extent of dense non-aqueous phase liquid (DNAPL) in the Alluvium water-bearing zone (WBZ). The ISS barrier wall along this segment extends from the ground surface to the basalt bedrock along the northern portion of the shoreline or the lower silt unit, where present, along the remainder of the shoreline. Where the lower silt unit is absent, the ISS barrier wall will extend to depths necessary to achieve the IRAM source control and removal action

[1] Anchor QEA, LLC. 2023. Revised Source Control Addendum Report, Gasco OU, ECSI No. 84. Prepared for NW Natural. November 2.
[2] Ede Environmental, LLC. 2024. Letter to Wes Thomas (DEQ), Subject: Source Control Interim Remedial Action Measure Concept and Agreement to Move into Design, NW Natural Gasco Site, 7900 NW St. Helens Road, Portland, Oregon. May 9.
[3] DEQ. 1994. Voluntary Agreement for Remedial Investigation/Feasibility Study. DEQ No. WMCVC-NWR-94-13. August 8.
[4] DEQ. 2006. First Addendum to Voluntary Agreement for Remedial Investigation/Feasibility Study. DEQ No. WMCVC-NWR-94-13. July 19.
[5] DEQ. 2016. Second Addendum to Voluntary Agreement for Remedial Investigation/Feasibility Study. DEQ No. WMCVC-NWR-94-13. October 11.

objectives (SC/RAOs). The IRAM design will include the design for breaching the ISS barrier wall in the future in areas where the surface water recharge beneficial groundwater use is unimpaired and/or restored.

- Hydraulic controls in the Fill and Alluvium WBZs sufficient to achieve IRAM SC/RAOs.
- Bulk ISS treatment of upland DNAPL in a zone adjacent to the shoreline beneath the hydraulic control and containment (HC&C) system alignment (herein referred to as the "nearshore upland ISS area of interest").
- DNAPL and groundwater monitoring and sampling necessary to demonstrate that IRAM SC/RAOs are achieved and maintained.

The specific layout and location of the conceptual IRAM elements described above may be adjusted, with DEQ's approval, based on several factors, including IRAM data gaps investigation results, IRAM design evaluations, additional source control evaluations, and the Gasco OU Feasibility Study (FS).

DEQ establishes the following source control objectives for the IRAM:

1) Prevent DNAPL migration beyond the top of the riverbank along the Gasco OU from the Fill and Alluvium WBZs (consistent with portions of the Gasco OU FS Remedial Action Objective [FS-RAO] #7).

2) Control migration of contaminated groundwater from the Fill and Alluvium WBZs to Willamette River sediments, porewater, and surface water to:

    a) Prevent recontamination of the Portland Harbor Superfund Site (PHSS) sediments above remedial action levels or principal threat waste thresholds; and,

    b) Prevent impairing long-term PHSS remedial action objective attainment.

In addition, DEQ establishes the following removal action objectives for the IRAM:

3) Excavate or treat DNAPL within the nearshore upland ISS area of interest by reducing its concentration, volume, toxicity, and mobility, and reduce leaching of contaminants of concern (COCs) from DNAPL to Fill WBZ and Alluvium WBZ groundwater (consistent with portions of the Gasco OU FS-RAO #7).

4) Prevent the migration/exacerbation of upland DNAPL and contaminated groundwater laterally and vertically along the shoreline to uncontaminated or minimally contaminated areas, including from the Fill WBZ to the Alluvium WBZ. This objective includes protecting groundwater quality in areas where its beneficial use is currently unimpaired or where it is feasible to restore its beneficial use within a reasonable timeframe.

5) Minimize DNAPL migration around, below, or between ISS-treated soils within the nearshore upland ISS area of interest.

These IRAM SC/RAOs replace the objectives assigned to the existing HC&C system[6]. In addition to the IRAM SC/RAOs, DEQ understands that the Gasco OU FS will necessarily evaluate and recommend a remedial alternative that removes and/or treats upland hot spots to the extent feasible, as required by Oregon Revised Statute (ORS) 465.315(1)(e). These include non-DNAPL hot spots within the nearshore

[6] DEQ. 2011. Letter to Robert J. Wyatt (NW Natural), Regarding: Draft Groundwater Source Control Measures Final Design Report, Shoreline Segments 1 and 2, NW Natural Property and the Northern Portion of the Siltronic Corporation Property, Portland, Oregon, ECSI Nos. 84 and 183. September 22.

upland ISS area of interest (e.g., tar, soil, spent oxides, lampblack) that are not addressed as part of the IRAM. These also include any DNAPL that migrates around, below, or between ISS-treated soils within the nearshore upland ISS area of interest in the period between implementing the IRAM and the final remedial action.

Background Information

NW Natural is responsible for implementing groundwater and DNAPL source control at the Gasco OU. The *Groundwater/DNAPL Source Control Focused Feasibility Study*[7] (GWFFS) recommended a HC&C system and a vertical barrier constructed along a portion of the NW Natural property shoreline (generally in front of the former tar ponds). DEQ approved[8] the GWFFS in March 2008. In our approval letter, DEQ commented that the GWFFS did not include groundwater control of the Fill WBZ. In the May 2011 *Draft Groundwater Source Control Final Design Report*[9] (considered the Revised Interim Design by DEQ), NW Natural added a groundwater interceptor trench to the scope of the HC&C system to provide groundwater source control for the Fill WBZ. The Revised Interim Design also recognized the potential for riverbank excavations conducted as part of the in-water remedy to interfere with the Fill WBZ trenches and proposed that the Fill WBZ source control measure be installed concurrent with riverbank cleanup. In addition, during the design of the DEQ-approved source control measure, DEQ and NW Natural agreed to postpone constructing a vertical barrier as part of a source control measure, and to further evaluate the vertical barrier in the Gasco OU FS. In 2015, NW Natural prepared the *Fill WBZ Trench Design Evaluation Report*[10] (Trench Evaluation Report) to compare different trench and/or well alignments to best achieve source control objectives in the Fill WBZ. NW Natural completed construction of the HC&C system for the Alluvium WBZs in 2013 and the HC&C system began full scale operation in 2015. Since that time, the HC&C system has generally achieved its source control design objectives for the Alluvium WBZ.

In 2022, NW Natural introduced a new upland source control approach consisting of an upland ISS barrier wall and hydraulic controls during meetings with EPA and DEQ. On November 10, 2022, NW Natural submitted the draft *Source Control Addendum Report*[11] (draft SCA). The draft SCA compares the ISS barrier wall and hydraulic control concept to the existing source control approach. On December 23, 2022, DEQ responded with comments[12] on the draft SCA and conditions for moving forward with the new source control measure concept. In parallel with revising the SCA, NW Natural submitted the *In Situ Stabilization and Solidification Bench Scale Treatability Study Work Plan*[13] (TSWP) describing treatability testing to support design of the ISS barrier wall in addition to ISS treatment of sediments conducted under EPA oversight. DEQ reviewed and commented[14] on the TSWP in advance of approving a revised SCA to accommodate a more efficient design schedule with the understanding that treatability testing takes a long time to complete and is necessary for informing the ISS barrier wall design. After

[7] Anchor Environmental, LLC. 2007. Groundwater/DNAPL Source Control Focused Feasibility Study, NW Natural 'Gasco' Site. Prepared for NW Natural. November.
[8] DEQ. 2008. Letter to Robert J. Wyatt (NW Natural), Regarding: Groundwater/DNAPL Focused Feasibility Study Shoreline Segments 1 and 2, NW Natural Property and Northern Portion of Siltronic Corporation Property, NW Natural Gas Company, Portland, Oregon, ECSI No. 183. March 21.
[9] Anchor QEA, LLC. 2011. Draft Groundwater Source Control Final Design Report, NW Natural Gasco Site. Prepared for NW Natural. May 5.
[10] Anchor QEA, LLC. 2015. Fill WBZ Trench Design Evaluation Report, Gasco/Siltronic. Prepared for NW Natural. April 8.
[11] Anchor QEA, LLC. 2022. Source Control Addendum Report, NW Natural Gasco Site, ECSI No. 84. Prepared for NW Natural. November 10.
[12] DEQ. 2022. Letter to Bob Wyatt (NW Natural), Regarding: DEQ Comments on the Source Control Addendum Report, Former Gasco Manufactured Gas Plant Operable Unit, Portland, Oregon, ECSI #84, ECSI #183. December 23.
[13] Anchor QEA, LLC. 2023. Revised In Situ Stabilization and Solidification Bench Scale Treatability Study Work Plan, Gasco Sediments Cleanup Action. Prepared on behalf of NW Natural. February 16.
[14] DEQ. 2022. Letter to: Bob Wyatt, NW Natural, Regarding: DEQ Comments on the Revised In Situ Stabilization and Solidification Bench Scale Treatability Study Work Plan, Former Gasco Manufactured Gas Plant Operable Unit, Portland, Oregon, ECSI #84 and #183. March 15.

receiving our comments, NW Natural deferred upland treatability testing until DEQ approved moving forward with the upland ISS work.

The Revised SCA incorporates revisions intended to resolve DEQ's comments on the draft SCA. After reviewing the Revised SCA, DEQ requested meetings with NW Natural to clarify the role/purpose of the ISS barrier wall along certain portions of the shoreline, particularly areas where DNAPL is absent in the Alluvium WBZ (or where DNAPL could feasibly be treated) and the groundwater beneficial use is either unimpaired or feasible to restore within a reasonable time period. During a series of meetings between NW Natural and DEQ, the scope of work proposed in the Revised SCA was modified to include new elements, which NW Natural summarized in the IRAM Concept letter. DEQ's comments on the Revised SCA and the IRAM Concept letter are attached to this decision letter.

Path Forward

In our comments on the TSWP, DEQ identified an IRAM design process that begins with a Design Work Plan and Basis of Design Report (BODR). For efficiency, DEQ agrees to combine the scope of the Design Work Plan and BODR into a single comprehensive IRAM BODR. DEQ does not require NW Natural to revise the Revised SCA or IRAM Concept letter. Instead, NW Natural should address our comments on these deliverables in the IRAM BODR and subsequent design deliverables. In addition to addressing our comments, the IRAM BODR should include the following information:

- Proposed design criteria and performance objectives to achieve and maintain the IRAM SC/RAOs (e.g., groundwater gradient control requirements for each WBZ). The IRAM BODR should explain how NW Natural developed or derived the proposed design criteria and performance objectives.
- Describe each IRAM design element and the design basis and approach for evaluating each design element. Describe anticipated design evaluations for each design element.
- Describe data needs to support design evaluations, evaluation of potential data gaps, and proposed investigations, including treatability studies, to collect the necessary data to support design evaluations.
- Describe anticipated construction methods and equipment.
- Identify any anticipated special design/implementation challenges and how they will be addressed. Include any special technical problems, anticipated community relations issues, access, transportation, utilities, material handling and logistics challenges. These challenges should include addressing implementation risks, minimizing risks to construction workers, and minimizing undesirable changes in physical and geochemical conditions.
- Identify and list of federal, state, or local laws, regulations, or guidance applicable to or associated with the IRAM and an explanation of how they will be incorporated into its design and implementation.
- Assess permitting requirements, including identifying any permitting or procedural requirements exempted pursuant to ORS 465.315(3), and a plan for satisfying any applicable substantive or non-exempted permitting/procedural requirements.
- Incorporate green remediation best management practices[15].

[15] DEQ. 2011.Oregon Department of Environmental Quality – Land Quality Division: Green Remediation Policy. November 2.

- Include a project management plan indicating the anticipated design deliverable milestones, the information anticipated at these milestones, and a high-level timeline for completing the IRAM design and construction.

Please contact me at (971) 263-8822 or Wesley.Thomas@deq.oregon.gov if you have questions regarding this letter.

Sincerely,

Wesley A. Thomas
Project Manager
NWR Cleanup Section

Attachments
Attachment 1: DEQ Comments on the IRAM Concept Letter
Attachment 2: DEQ Comments on the Revised Source Control Addendum Report
Attachment 3: EPA Comments on the Revised Source Control Addendum Report

EC: Dan Hafley, DEQ
Heidi Nelson, DEQ
Sarah Van Glubt, DEQ
Amber Lutey, DEQ
Dave Lacey, DEQ
Amanda Wozab, DEQ
Lisa Reyenga, GEI Consultants
Patty Dost, Pearl Legal Group
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Matt Davis, Anchor QEA
Jen Mott, Anchor QEA
Rob Ede, Ede Environmental
Mike Crystal, Sevenson Environmental Services
Hunter Young, EPA
Laura Hanna, EPA
Elizabeth Bingold, Siltronic Corporation
Traci Parker, Siltronic Corporation
David Rabbino, Jordan Ramis
Myron Burr, Restoration Strategies

CC: ECSI No. 84 File
ECSI No. 183 File

Gasco OU Interim Removal Action Decision – Attachment 1
DEQ Comments on the IRAM Concept Letter

Introduction

DEQ reviewed the IRAM Concept letter for the Gasco OU. Ede Environmental, LLC prepared the IRAM Concept letter on behalf of NW Natural, under the Voluntary Agreement for Remedial Investigation/ Feasibility Study, as amended. The IRAM Concept letter was prepared to describe revisions to the scope of the IRAM that were discussed during meetings between DEQ and NW Natural, Anchor QEA, LLC, and Ede Environmental, LLC on January 30, 2024, February 20, 2024, and April 11, 2024. Our review of the IRAM Concept letter identified the need for clarifications. DEQ requires that future IRAM deliverables incorporate these clarifications.

Comments and Clarifications

1) **Introduction.** The second introductory paragraph states that "[the] IRAM source control elements will physically and chemically eliminate the potential for future DNAPL and dissolved phase migration from the uplands." DEQ disagrees with this statement and clarifies that the IRAM will be designed to achieve the IRAM SC/RAOs established in our Gasco OU IRAM Decision letter.

2) **IRAM Elements.** DEQ has the following comments and clarifications:

    a) The first paragraph states that the IRAM will "[eliminate] any potential for upland DNAPL or dissolved phase groundwater contaminant migration from the Gasco OU into the Gasco Sediments Site Refined Project Area." DEQ disagrees with this statement and clarifies that the IRAM will be designed to achieve the IRAM SC/RAOs established in our Gasco OU IRAM Decision letter.

    b) Item 2 states that the ISS barrier wall will "[extend] a minimum of approximately 350 feet onto the Siltronic property." DEQ clarifies that the ISS barrier wall will extend to a location that coincides with the southern extent of DNAPL along the shoreline in the Alluvium WBZ. We understand that NW Natural has estimated that distance to be approximately 350 feet onto the Siltronic property, and that NW Natural is currently revising DNAPL maps for the Gasco OU. The boundary corresponding with the extent of DNAPL within the Alluvium WBZ should be adjusted based on the revised DNAPL maps.

    c) Item 2a states that the ISS barrier wall will be extended "to the Lower Silt Unit." DEQ clarifies that the Lower Silt Unit is absent along portions of the shoreline. We understand that the ISS barrier wall in these sections will extend to elevations necessary to achieve the IRAM SC/RAOs established in our Gasco OU IRAM Decision letter.

    d) Item 3 states that the Fill WBZ hydraulic controls along the Gasco OU shoreline will "control mounding of groundwater on the upland side of the ISS barrier wall." The IRAM BODR should further evaluate the necessary hydraulic control performance requirements to demonstrate that the hydraulic controls will achieve the IRAM SC/RAOs established in our Gasco OU IRAM Decision letter in addition to controlling groundwater mounding.

    e) Item 4 states that additional Alluvium WBZ extraction wells will be installed, where needed, to control groundwater gradients on the upland side of the ISS barrier wall. Figure 1 includes a conceptual depiction of additional extraction wells. We understand that detailed hydraulic evaluations and modeling during the IRAM design will determine the necessary extraction well configuration required to reliably achieve the IRAM SC/RAOs.

    f) Item 5 states that ISS treatment beneath the HC&C system alignment will be conducted to "treat hot spot soils containing DNAPL." DEQ clarifies that the ISS will be conducted to treat DNAPL

hot spots within the nearshore upland ISS area of interest. ISS treatment does not appear to treat non-DNAPL hot spots (e.g., tar, spent oxides, lampblack, and soils). DEQ understands that NW Natural will propose additional remedial actions to remove or treat those hot spots to the extent feasible in the Gasco OU FS.

g) Item 5a states that the boundaries and depths for the targeted ISS treatment have been "reviewed" by DEQ and "it is concluded that these prisms form the correct basis for moving this IRAM component into the design phase." For clarification, NW Natural presented the ISS treatment prisms to DEQ during our April 11, 2024 meeting and included the prisms as Figure 2 of the IRAM Concept letter. However, we have not reviewed them to determine if they are correct. NW Natural has not yet submitted final versions of DNAPL maps that update the MGP residuals figures presented in the *Interim Feasibility Study*[16]. Based on our discussions on April 11th, we understand that the ISS prisms presented on Figure 2 exclude some areas containing DNAPL, and that NW Natural plans to justify excluding those locations using a line-of-evidence approach during the IRAM design process. DEQ will review these lines of evidence once they are presented to us during the IRAM design. Excluding any DNAPL observations, new or existing, from the ISS treatment prism is subject to DEQ approval.

h) Item 5a states that "further refinement of the defined treatment boundaries and depths is not needed." For clarification, we expect the IRAM BODR to include an evaluation of data gaps and anticipate further investigation of DNAPL nature and extent to fill data gaps. We anticipate that refinement of the ISS treatment prism (boundaries and depths) will require refinement after collection of new data, and review of the lines-of-evidence supporting exclusion of certain previous DNAPL observations.

3) **Attachment 1, Example TarGOST Response Logs: Depth of Interest Excluded from ISS Treatment Prism**. DEQ has not yet agreed to exclude the examples provided in this attachment. Refer to Comment 2h above.

[16] Anchor QEA, LLC. 2018. Draft Interim Feasibility Study. Gasco OU. Prepared for NW Natural. November 18 (final content received January 11, 2019).

Gasco OU Interim Removal Action Decision – Attachment 2
DEQ Comments on the Revised Source Control Addendum Report

Introduction

DEQ reviewed the Revised SCA for the Gasco OU. Anchor QEA, LLC prepared the Revised SCA on behalf of NW Natural, under the Voluntary Agreement for Remedial Investigation/Feasibility Study, as amended. Our comments on the Revised SCA are provided below.

General Comments

1) DEQ understands that NW Natural plans to revise and recalibrate the *Gasco Groundwater Model*[17] (groundwater model) to support the Gasco OU FS and IRAM design. NW Natural's technical team discussed some of the proposed groundwater model revisions with DEQ during a meeting on September 12, 2023, but have not yet submitted a report documenting model revisions and recalibration for DEQ's review and approval. DEQ cannot agree with groundwater modeling evaluations until NW Natural provides a detailed and complete description of the revised and recalibrated model, including changes to boundary conditions, hydraulic conductivities, consideration of local discontinuities in the Lower Silt Unit, groundwater recharge assumptions, recalibration/validation results, and any model updates intended to simulate ISS treatment of riverbank soils and shallow/intermediate zone sediments. We understand that NW Natural will include this information in an Appendix to the Gasco OU FS, which will precede the IRAM BODR.

2) Discussions of the preliminary groundwater model simulations included in the Revised SCA lack sufficient detail to support the conceptual expanded HC&C system design. The IRAM design must present groundwater modeling simulation results to support the proposed hydraulic controls design, including revised water balances, 3D capture zones, anticipated horizontal and vertical gradients induced by pumping over a range of conditions, and particle tracking and a sensitivity analysis to evaluate for the potential for lateral flow and underflow around and under the ISS barrier wall, respectively.

3) DEQ does not necessarily agree with the expanded HC&C system performance/design objectives presented in the Revised SCA. The IRAM BODR must develop performance objectives and design criteria for the expanded HC&C system based on the IRAM SC/RAOs established in the Gasco OU IRAM Decision letter.

4) Conceptually, an ISS barrier wall and hydraulic controls could be an effective long-term DNAPL source control measure if it is constructable and coupled with other necessary upland remedial measures. However, the IRAM feasibility evaluation provided in the Revised SCA is overly simplistic and lacks the necessary technical support to demonstrate IRAM feasibility. DEQ requires the IRAM design to address the following comments:

    a) Our comments on the draft SCA noted that in the absence of a field pilot study, the ability to construct the ISS barrier wall to the proposed depths would remain uncertain. NW Natural's response to our comments on the draft SCA deem a field pilot study unnecessary. While the Revised SCA identifies a drill rig capable of achieving the proposed ISS barrier wall depths, the case study links provided in the Revised SCA lack enough detail to understand whether they are representative of site-specific conditions (e.g., similar stratigraphy, high groundwater flow conditions at depth, space/accessibility constraints). None of the case studies completed construction of permanent hanging walls at the scale proposed for the Gasco OU. Therefore, NW Natural's ability to construct a contiguous ISS barrier wall to the proposed depths remains uncertain to DEQ. DEQ recommends NW Natural reconsider a field pilot study to further

[17] Anchor QEA, LLC. 2017. Gasco Groundwater Modeling Report, NW Natural Gasco Site. Prepared for NW Natural. February 17.

evaluate the ability to construct the ISS barrier wall to the proposed depths and alignment. If NW Natural does not elect to conduct a field pilot, DEQ will require an initial field trial phase at the beginning of full-scale construction and adjustment of full-scale construction means and methods as necessary based on the results of the field trial phase.

b) The Lower Alluvium WBZ hydraulic conductivity, which ranges between 100 to 1,250 feet per day, will present challenges to constructing the ISS barrier wall. The IRAM design should evaluate the ability of ISS amendments to set and remain in-place under these conditions. In addition, treatability testing should consider/evaluate grout stability under higher groundwater flow conditions. A field pilot study or initial field trial should further evaluate methods to achieve ISS design criteria and performance objectives under higher groundwater flow conditions, consistent with General Comment #4a.

c) The spacing of borings extending to and below the Lower Silt Unit are infrequent in areas where DNAPL is the deepest, making the Lower Silt Unit nature and continuity uncertain in these areas. In addition, the infrequency of borings extending to the Lower Silt Unit contributes to uncertainty in the delineation of DNAPL close to the base of the ISS barrier wall. The IRAM design should address uncertainty in the Lower Silt Unit continuity and competency and DNAPL extent close to the base of the ISS barrier wall.

d) The IRAM has the potential to change groundwater flux and gradient direction(s). These changes, if not properly controlled, could mobilize DNAPL and/or higher concentrations of dissolved contamination into uncontaminated areas or areas with lower levels of contamination based on current conditions. The IRAM design must fully evaluate predicted groundwater flux and gradients after the IRAM is constructed and prevent lateral or vertical migration of higher concentrations of dissolved phase contamination consistent with the IRAM SC/RAOs.

e) The IRAM has the potential to change DNAPL migration patterns laterally and vertically. The Lower Silt Unit is notably thin, discontinuous, and/or absent near the NW Natural/Siltronic property boundary along the shoreline. DEQ considers it critical that the IRAM prevent DNAPL (or associated dissolved phase contamination) migration to the DLA WBZ because of conditions created by the IRAM. The IRAM design must include the necessary measures to prevent downward DNAPL migration after implementing the IRAM that considers DNAPL nature and extent, DNAPL physical properties, reasonably anticipated DNAPL saturations, hydrogeologic conditions and soil textures, and the potential for DNAPL mounding behind the wall or adjacent to bulk ISS treated areas. The IRAM design must also identify contingency actions that will be implemented if there is evidence of ongoing downward contaminant transport towards or into the DLA WBZ.

Specific Comments

1) **Section 1, Introduction**. DEQ has the following comments:

a) The first two paragraphs identify potential pathways for sources of contamination in the Gasco OU uplands to Portland Harbor Superfund Site. DEQ clarifies that DNAPL in the Fill WBZ is also an applicable source control pathway.

b) The fourth paragraph states that EPA has incorporated the riverbank erosion pathway into the Gasco Sediments Site Project Area remedy. DEQ clarifies that the *Administrative Settlement*

Agreement and Order on Consent for Removal Action[18] (ASAOC) Statement of Work also requires NW Natural to incorporate the need for riverbank remediation consistent with the upland risk assessment into the Gasco Sediments Site Project Area remedy.

c) The seventh paragraph states that DEQ agrees with various elements of NW Natural's *Framework for EPA Sediment Design and DEQ Source Control Measure FFS and IRAM Design*[19] (Framework Document). DEQ clarifies that we did not provide approval of or agreement with the Framework Document in its entirety. Although not referenced in the Revised SCA, DEQ provided comments[20] on the draft Framework Document[21] that provided additional clarification about certain topics that were not included in the final clean version of the Framework Document referenced in the Revised SCA. Future deliverables should clarify that DEQ acknowledges the Framework Document subject to the clarifications we provided on the draft Framework Document.

2) **Section 2.1, Upper and Lower Alluvium WBZ Groundwater and DNAPL**. As stated in the fifth paragraph, the objectives for the HC&C system are to prevent migration of contaminated groundwater from the uplands to the Willamette River along shoreline Segments 1 and 2 in a manner that minimizes DNAPL mobilization resulting from groundwater source control measures wherever DNAPL occurs. This objective superseded and replaced the 'primary physical removal action goals' from the GWFFS listed in the first paragraph. The IRAM SC/RAOs listed in the Gasco OU IRAM Decision letter replace the objectives assigned to the HC&C system.

3) **Section 4, Revised Recommended Source Control Approach for Groundwater and DNAPL**. DEQ has the following comments:

a) The third sentence of this section states that the ISS barrier wall will "significantly reduce the long-term risk of recontamination of sediments." DEQ clarifies that the IRAM is intended to achieve the IRAM SC/RAOs listed in the Gasco OU IRAM Decision letter.

b) The last sentence of this section states that the ISS barrier wall will reduce the potential for sediment remedy recontamination from all upland contaminant migration pathways. DEQ clarifies that the ISS barrier wall is only relevant to the groundwater/DNAPL pathway.

4) **Section 4.1.1, Deep ISS Barrier Wall**. DEQ has the following comments:

a) The first paragraph states that the vertical barrier wall recommended in the GWFFS is insufficient because it could not be integrated with the sediment remedy. DEQ disagrees with this rationale and requires NW Natural to remove similar statements from future deliverables. DEQ does not believe that physical connection between ISS barrier wall and the in-water remedy is necessary to accomplish effective integration between upland source control and the in-water remedy, nor that physical or structural connection between upland and in-water remedies guarantee that they are effectively integrated.

b) The sixth paragraph states that the cutter soil mixing (CSM) approach involves construction of laterally overlapping panels. The Revised SCA does not indicate the amount of overlap

[18] EPA. 2009. Administrative Settlement Agreement and Order on Consent for Removal Action, U.S. Environmental Protection Agency Region 10, CERCLA Docket No. 10-2009-0255. September 9
[19] NW Natural. 2023. NW Natural's Framework for EPA Sediment Design and DEQ Source Control Measure FFS and IRAM Design. July 21.
[20] DEQ. 2023. DEQ Comments on NW Natural's Framework for EPA Sediment Design and DEQ Source Control Measure FFS and IRAM Design. July 6.
[21] NW Natural. 2023. NW Natural's Framework for EPA Sediment Design and DEQ Source Control Measure FFS and IRAM Design. June 29.

envisioned between panels or the rationale for assuming that one row of panels is sufficient. The IRAM design must establish the basis for panel overlaps and ISS barrier wall width.

c) The eleventh paragraph lists some anticipated benefits of the ISS barrier wall, including reducing the volume of groundwater pumped and treated by the HC&C system and improved seismic stability to the Riverbank region. The Revised SCA does not present modeling or other supporting evaluations to support these statements. Therefore, assumptions that the ISS barrier wall will reduce groundwater pumping volumes are premature. Further, DEQ questions the extent of added seismic stability provided by the ISS barrier wall. While addition of pozzolanic materials (e.g., Portland cement) will improve the compressive strength of the soil within the ISS footprint, a single 2- to 4-foot-wide panel will likely crack or crumble quickly during a seismic event, offering little improvement against shear forces and lateral spreading of liquifiable upland fill. The IRAM design must either remove statements related to seismic stability or include supporting engineering evaluations.

5) **Section 4.1.2, HC&C System Expansion**. DEQ has the following comments:

a) The second paragraph states that groundwater would mound behind the barrier wall in the absence of hydraulic capture and flow around the wall to the river. DEQ clarifies that groundwater could also flow below the wall to the river.

b) The second paragraph states that the expanded HC&C system would function to maintain upward vertical gradients in the Lower Alluvium and DLA WBZs. DEQ clarifies that upward vertical gradients are currently required between the Lower and Upper WBZs along portions of the shoreline where DNAPL is present. DEQ notes that the HC&C system has not always reliably maintained upward vertical gradients in these areas[22,23,24,25]. After the ISS barrier wall is constructed, DEQ requires NW Natural to maintain the necessary upward vertical gradients between the DLA and Lower Alluvium WBZs and between the Lower and Upper Alluvium WBZs to achieve IRAM SC/RAOs.

6) **Section 4.1.2.2, HC&C System Expansion Wells – Fill WBZ**. DEQ has the following comments:

a) The Revised SCA does not provide enough information to determine the number of vertical wells required to achieve source control objectives. Refer to General Comments #1 and 2.

b) The IRAM design must further evaluate Fill WBZ well design to consider the heterogenous nature of the fill and avoid completely penetrating the Upper Silt Unit. Well screens and filter pack materials must not impede DNAPL migration into the well.

7) **Section 4.3.1, Information from Operation of the HC&C System**. The last paragraph describes potential advantages that vertical wells may have over horizontal wells or trenches, based on lessons learned with the HC&C system vertical wells. However, the potential yield losses associated with fouling seem more applicable to horizontal wells than trenches. In addition, the existing Liquified Natural Gas (LNG) Basin Fill WBZ trench system appears to be incorporated into the proposed

[22] DEQ. 2022. Letter to Bob Wyatt (NW Natural). Regarding: 2020 Hydraulic Control and Containment System Annual Report, Former Gasco Manufactured Gas Plant Operable Unit, Portland, Oregon, ECSI #84. January 19.
[23] DEQ. 2022. Letter to Bob Wyatt (NW Natural). Regarding: Revised 2020 Hydraulic Control and Containment System Annual Report, Former Gasco Manufactured Gas Plant Operable Unit, Portland, Oregon, ECSI #84. April 25.
[24] DEQ. 2022. Letter to Bob Wyatt (NW Natural). Regarding: Draft 2021 Hydraulic Control and Containment System Annual Report, Former Gasco Manufactured Gas Plant Operable Unit, Portland, Oregon, ECSI #84. October 10.
[25] DEQ. 2023. Letter to Bob Wyatt (NW Natural). Regarding: DEQ Comments on the 2022 Hydraulic Control and Containment System Annual Report, Former Gasco Manufactured Gas Plant Operable Unit, Portland, Oregon, ECSI #84, ECSI #183. September 28.

IRAM hydraulic controls for the Fill WBZ. DEQ requires further design evaluation to determine the appropriate hydraulic control technology(s) for the Fill WBZ.

8) **Section 5.1, Performance Standards and Design Objectives**. This section prematurely proposes performance standards and design objectives for the ISS barrier wall and the expanded HC&C system. The IRAM BODR should re-evaluate proposed design criteria and performance standards to consider the IRAM SC/RAOs established in the Gasco OU IRAM Decision letter. The IRAM BODR should provide additional support for the proposed design criteria and performance standards based on available literature, guidance, site-specific analysis, and consider the following:

   a) Proposed performance standards need to provide a measurable standard that addresses each design objective. The IRAM design must include information about quality control and quality assurance measures that will assess achievement of design criteria and performance standards.

   b) The Revised SCA does not define 'pre-remedy average conditions' (e.g., average groundwater elevations versus average difference between Fill WBZ and river elevations) in order to evaluate Fill WBZ groundwater mounding behind the ISS barrier wall. In addition, the IRAM BODR should evaluate whether the proposed hydraulic performance standards for the Fill WBZ are sufficient for achieving the IRAM SC/RAOs.

   c) The IRAM BODR must include leaching to groundwater performance standard for ISS treatment.

   d) DEQ does not consider enhanced seismic stability or physical connection to the in-water project as design objectives for the ISS barrier wall.

9) **Section 5.2.2, Integration with the Gasco OU Uplands**. The considerations included in this section are cursory and incomplete. The IRAM design should expand discussion related to integrating the IRAM with Gasco OU, and address the following comments:

   a) The IRAM design must further evaluate grout cure times and their impact on the performance of Fill, Upper Alluvium, Lower Alluvium WBZ extraction wells. The design should include a quality assurance/quality control testing approach to demonstrate that the grout installed in WBZs with high hydraulic conductivity will achieve permeability design criteria necessary to meet the IRAM SC/RAOs. Refer to General Comment #4b.

   b) The IRAM design must discuss any potential restrictions that the IRAM may pose to future remedial action, if any, including the ISS barrier wall stability during future excavation of adjacent soils and the ability for future ISS to tie into or connect with the ISS barrier wall or bulk ISS treatment prisms.

   c) The Revised SCA does not substantiate the discussion related to mass loading to the groundwater treatment system and system capacity. The IRAM design must include detailed analyses to determine the ability of the groundwater treatment system to manage changing influent groundwater quality.

10) **Section 5.2.3.2, Depth of the ISS Barrier Wall**. This section provides links to four case studies where CSM technology was used to construct deeper barrier walls. None of the case studies appear to be representative of the proposed application at the Gasco OU, and none of the case studies resolve implementability uncertainty for constructing the proposed ISS barrier wall at the Gasco OU (Refer to General Comment #4a). DEQ has the following comments:

a) The Humbolt Bay Power Plant Decommissioning project involved construction of five overlapping CSM rings, with the deepest of the five extending to 174 feet below the ground surface to cutoff groundwater. With an approximate inside diameter of 110 feet, the circumference of the deep wall was approximately 350 feet and provided temporary groundwater cutoff. The case study does not include any information about the stratigraphy or hydrogeology of the site or the presence of debris or obstructions along the wall alignment, and the walls were only used temporarily to cutoff groundwater from flowing into an excavation. DEQ notes that the photos of the case study show water migrating through the wall and into the excavation. This case study does not appear representative of the scale and permanence of the proposed ISS barrier wall or the subsurface conditions at the Gasco OU.

b) The UK Tideway Sewer Project description misinterprets the depth of the CSM walls constructed. The case study clarifies that the CSM walls for the project did not extend more than 20 meters (~65 feet) below the ground surface. A diaphragm wall was constructed to 60 meters (~197 feet) below the ground surface; however, NW Natural is not proposing to construct a diaphragm wall along the shoreline. This case study is not representative of the proposed ISS barrier wall depths using CSM technology.

c) The 200 Park Avenue and Oceanwide Center case studies describe using CSM technologies to construct temporary groundwater cutoff to support groundwater dewatering during building construction. The case studies do not include any information about the stratigraphy or hydrogeology of the site or the presence of debris or obstructions along the wall alignment, and the walls were only used temporarily to cutoff groundwater from flowing into an excavation. These case studies do not appear representative of the scale or permanence of the proposed ISS barrier wall or the subsurface conditions at the Gasco OU.

d) The Shanghai test panel installation case study does not contain meaningful information.

11) **Section 5.2.4, Debris or Obstructions During Installation**. This section concludes that subsurface conditions below the proposed ISS barrier wall footprint do not contain debris or obstructions that would be detrimental to the CSM technology deployed with the BG 72 drill rig. The IRAM design must define the conditions that would/would not be considered detrimental to the ISS construction methods. NW Natural should include a debris and obstruction survey for the proposed ISS barrier wall alignment and the bulk ISS treatment zone as part of a pre-design investigation.

12) **Section 5.2.5, Utilities and Infrastructure.** DEQ has the following comments:

a) The IRAM design must expand consideration of utilities and infrastructure to consider the space requirements for ISS equipment assembly and take down.

b) The IRAM design must consider ISS cure time when developing criteria for restarting HC&C system extraction wells.

13) **Section 5.2.6, Geotechnical Analysis**. The proposed geotechnical analysis appears incomplete. The IRAM design must further evaluate the potential effect of ISS wall construction on formation disturbances from liquefaction or vibration, and the effect of Fill WBZ hydraulic controls on fill consolidation. In addition, the IRAM BODR should identify data needs and data gaps and propose pre-design investigations to fill data gaps to support the proposed geotechnical analyses.

14) **Section 5.2.7, Bench Scale ISS Laboratory Testing**. DEQ agrees that ISS design must consider bench-scale treatability testing results. DEQ previously commented on work plans describing bench-

scale treatability testing. We anticipate the treatability testing will evaluate the effect of DNAPL with varying compositions and saturation ranges on the grout mix design, evaluate the effect of other MGP residuals (e.g., tar, spent oxides) on the grout mix design, include collection of representative samples from each geologic unit for testing, evaluate leaching for Gasco OU groundwater COCs, and evaluate material cure time compared to groundwater flow velocities.

15) **Section 5.2.8, Swell Management**. DEQ's comments on the draft SCA requested discussion of potential options for managing swell and waste materials, including quantities, conceptual on-site handling and staging approaches, and long-term material management/disposal options. The discussion in this section does not consider the range of potential infrastructure improvements and logistics that would be required to provide equipment access along the ISS barrier wall alignment or manage a substantial amount of swell material. DEQ expects these factors to be discussed in the IRAM design. In addition, the last sentence states that potential beneficial reuse of swell material on-site will be evaluated during design. Beneficial reuse of swell material shall not interfere with, limit, or constrain future upland remedial action and is subject to DEQ approval.

16) **Section 6, Remedy Selection Balancing Factors**. The second paragraph states that the previously approved source control approach, once implemented, does not include a physical barrier to potential DNAPL migration. DEQ clarifies that a physical barrier was included in the previously approved source control approach; however, NW Natural and DEQ agreed to further evaluate the DNAPL barrier in the Gasco OU FS along with other remedial alternatives for DNAPL remediation.

17) **Section 6.1, Effectiveness.** As stated in our comments on the draft SCA, DEQ considers both source control alternatives equally effective. The Revised SCA effectiveness discussion does not adequately support a conclusion that the proposed IRAM would be more effective for achieving source control objectives.

18) **Section 6.2, Long-Term Reliability.** The first paragraph states that a direct comparison of long-term reliability between the source control alternatives cannot be performed because the existing source control approach defers key elements to the final upland remedial action. DEQ clarifies that both source control alternatives defer key elements to the final upland remedial action. Both source control alternatives rely on future DNAPL removal/treatment to the extent feasible and long-term operation and maintenance of hydraulic controls. The existing source control approach likely provides more flexibility for reducing the scope of hydraulic controls over time as groundwater beneficial use(s) are restored, whereas the proposed ISS barrier wall would require either operating and maintaining hydraulic controls in perpetuity in areas where groundwater beneficial use is restored or breaching the ISS barrier wall.

19) **Section 6.3.1, HC&C System Components.** DEQ has the following comments:

    a) The Revised SCA only discusses challenges associated with constructing and operating horizontal wells but excludes discussion of trenches. In general, DEQ does not consider horizontal wells to be ineffective or unreliable if properly designed. The IRAM design should further evaluate groundwater extraction trenches, or combinations of trenches, vertical, and horizontal wells, for controlling the Fill WBZ.

    b) The last sentence of this section states that coupling vertical extraction wells in the Fill WBZ with a barrier wall reduces concerns regarding a relatively small radius of influence associated with vertical wells. The Revised SCA lacks rationale or support for this statement. Hydraulic controls must be designed to achieve the IRAM SC/RAOs established in the Gasco OU IRAM Decision

letter across the entire shoreline. The relatively small radius of influence associated with vertical wells may make reliably achieving IRAM SC/RAOs difficult, with or without the wall. Refer to General Comments #1 and 2.

20) **Section 6.4, Implementation Risk.** This section does not adequately identify the range of implementation risks or indicate specific measures to mitigate risks. The IRAM BODR must identify all potential implementation risks associated with the IRAM. The IRAM design must determine how they will be appropriately mitigated.

21) **Table 5-1, Monitoring Wells Anticipated to Be Impacted by Deep ISS Barrier Wall**. This table designates the wells that will be protected or decommissioned/replaced/relocated due to ISS barrier wall construction; however, the table lacks the rationale and criteria for removing wells from the monitoring network. Other criteria that NW Natural should consider include the availability of nearby installations that provide representative groundwater chemistry/elevation data and/or information regarding accumulations of DNAPL. DEQ acknowledges that the information in this table will be adjusted based on the expanded scope of the IRAM. The IRAM design should include more information about the rationale and criteria used to make these designations.

22) **Table 6-1, Source Control Alternatives Comparison.** DEQ has the following comments:

    a) DEQ clarifies that the IRAM will control advective flux of Fill, Upper Alluvium, and Lower Alluvium WBZ COCs.

    b) The Revised SCA does not include enough information to demonstrate that it will improve seismic stability.

    c) The Revised SCA does not include enough information to demonstrate that the IRAM would provide greater protection of the in-water remedy in the event of an emergency resulting in significant downtime of hydraulic controls.

    d) DEQ clarifies that 1) NW Natural is not required to integrate source control into the sediment remedy, and 2) both source control alternatives appropriately integrate source control with the in-water remedy.

    e) DEQ clarifies that the IRAM does not eliminate the need for future DNAPL migration assessments.

23) **Table 6-2, Detailed Comparison of Alternatives**. DEQ has the following comments and clarifications.

    a) Performance monitoring would be needed to verify effectiveness for both alternatives.

    b) The Revised SCA does not provide enough information to demonstrate that the IRAM provides complete containment of groundwater COCs in the Fill or Alluvium WBZs or that it eliminates the potential for future DNAPL migration to the Willamette River.

    c) Both source control alternatives appropriately integrate source control with the in-water remedy.

    d) While the proposed ISS equipment can achieve the required depths, the Revised SCA does not evaluate its ability to construct a contiguous wall over more than 2,700 feet to the required depths under site-specific conditions.

    e) The Revised SCA inadequately evaluates implementation risk.

24) **Figures**. Consistent with previous agreements, future deliverables should replace references to the "Lower Silt Aquitard" with "Lower Silt Unit."

25) **Appendix C2, Response to Comments**. DEQ does not intend to reply to NW Natural's comment responses. The absence of a reply does not imply DEQ agreement with NW Natural's comment response.

26) **Appendix E, Deep Lower Alluvium WBZ Source Control Evaluation.** The DLA SCE should be revised and resubmitted with the IRAM BODR to address the comments provided herein. DEQ has the following general comments:

    a) The DLA source control evaluation lines of evidence support the interpretation that trace-level organic COC concentrations in the DLA WBZ are likely a result of incidental cross-contamination from overlying WBZs during well installation activities and that residual organic COC detections are unlikely to migrate to the Willamette River at concentrations that would recontaminate sediments or impair Portland Harbor RAOs.

    b) The DLA source control evaluation recommends that DEQ formally determine that no source control measure is necessary for groundwater in the DLA WBZ. DEQ has identified a risk of DNAPL or dissolved phase contamination migration to the DLA WBZ because of conditions created by the IRAM. The DLA WBZ groundwater source control status depends upon preventing potential future migration of contamination to the DLA WBZ. Refer to General Comment# 4e.

    c) DEQ and EPA comments on the draft SCA requested that NW Natural evaluate the potential for DLA WBZ groundwater flux to mobilize groundwater contamination already below the Gasco Sediments Site. In their responses to these comments, NW Natural agreed to evaluate fate and transport of contamination below the sediment ISS zone during the sediment remedy design process. However, NW Natural provided conflicting information in the recent *Revised Sediment Remedy Basis of Design Report.*[26] DEQ believes it is appropriate for NW Natural to complete the fate and transport evaluation as part of the Gasco Sediments Site remedial design to ensure that relinquishing control of groundwater flux from the DLA WBZ by constructing the ISS barrier wall will not cause groundwater contamination in the river to impair Portland Harbor remedial action objectives. DEQ recognizes that the DLA source control status may need to be re-evaluated based on the outcome of NW Natural's fate and transport evaluation.

    d) The DLA source control evaluation states that that COCs present in the DLA WBZ do not present a current or potential future risk to human health or the environment. DEQ clarifies that the purpose of the DLA WBZ source control evaluation is to evaluate whether the DLA WBZ groundwater pathway poses a risk of recontaminating sediments or impairing Portland Harbor RAOs. The Gasco OU FS must address other risk pathways and beneficial use scenarios that apply to the DLA WBZ.

27) **Appendix E, Deep Lower Alluvium WBZ Source Control Evaluation, Section 3**. The discussion of metals includes a reference to the *Groundwater Quality Report for the Willamette Basin*[27] (Willamette Basin Groundwater Report). DEQ understands that this reference was incorporated to contextualize the range of metals concentrations in Gasco OU groundwater. DEQ clarifies that the

[26] Anchor QEA, LLC. 2023. Revised Sediment Remedy Basis of Design Report. Gasco Sediments Project Area. December 7.
[27] DEQ. 2004. Groundwater Quality Report for the Willamette Basin, Oregon. DEQ Water Quality and Laboratory Divisions. March.

Willamette Basin Groundwater Report does not establish 'background' metals concentrations relevant to the Gasco OU as it does not consider localized conditions.

28) **Appendix E, Deep Lower Alluvium WBZ Source Control Evaluation, Sections 5.5, 5.6, and 5.7**. In general, discussion related to COCs that remain after the third evaluation step is brief and vague. These sections should discuss the spatial distribution of metals at concentrations that exceed Portland Harbor Record of Decision cleanup levels, include information showing that COC concentrations in the DLA WBZ are lower than groundwater concentrations already present below the river, and additional information to support NW Natural's interpretation that COCs in the DLA WBZ are a result of cross-contamination during well installation activities. While DEQ questioned the fate and transport modeling presented in the draft SCA, DEQ recommends that NW Natural include some literature-supported discussion of residual organic COC mobility.

29) **Appendix E, Deep Lower Alluvium WBZ Source Control Evaluation, Sections 5.6 and 5.7**. These sections suggest that DEQ determined that clams have not been found in the navigation channel, where the Deep Lower Alluvium WBZ groundwater would discharge. DEQ has not made such a determination. However, DEQ did indicate that clam harvesting in the navigation channel is a less likely scenario compared to aquatic life exposure, and that evaluating both pathways separately would provide useful context for the DLA source control evaluation.

REGION 10
SEATTLE, WA 98101

January 9, 2024

MEMORANDUM

SUBJECT: EPA Comments on the Revised Source Control Addendum Report
NW Natural Gasco, Portland, Oregon
ECSI # 84
November 2, 2023

FROM: Laura Hanna, RG, Remedial Project Manager
Superfund and Emergency Management Division

TO: Wesley Thomas, PE, Project Manager
NWR Cleanup, Oregon Department of Environmental Quality

The following are the U.S. Environmental Protection Agency's (EPA's) comments on the document titled *Revised Source Control Addendum Report* (revised report). The revised report was prepared by Anchor QEA, LLC (Anchor QEA) for the NW Natural Gasco Site (the site) as a revision to the *2022 Source Control Addendum Report* (2022 report; Anchor QEA, 2022). The site is located at 7900 NW St. Helens Rd. in Portland, Oregon, and listed in Oregon Department of Environmental Quality's cleanup program as ECSI 84. The site is located upland of Willamette River mile 6 west, which is upland of the in-water Gasco project area within the Portland Harbor Superfund Site (PHSS). The revised report focuses on the groundwater upland source contaminant transport pathway. The site has a complete groundwater pathway to the Willamette River via direct groundwater discharge to the river and through groundwater preferential pathways within the fill zone, upper and lower alluvium strata.

EPA's comments are categorized as "Primary," which identify concerns that must be resolved to achieve the objective.

NW Natural's Response to EPA Primary Comments on the *2022 Source Control Addendum Report*
NW Natural's response to EPA comments (EPA, 2022) on the 2022 report are adequate except for the response to EPA primary comment 1, identified as EPA comment 1a in the revised report Appendix C2 comment and response matrix table.

EPA comment 1 (1a) was intended to point out the following concerns with the 2022 report:

- The total flux requiring capture hydraulically upgradient of the proposed barrier wall appeared to be underestimated, which leads to incorrect conclusions on costs and implementability for this remedial technology component that may not support its selection over other alternative remedial technologies.
- NW Natural's conclusion that the barrier wall "will significantly reduce the amount of groundwater extraction necessary to maintain hydraulic control" is not presented with sufficient information to understand how this conclusion is supported technically.

The response does not recognize EPA's concerns, nor does it provide any substantive information to prove their assertions in the response.

The NW Natural response states: "*The basis of the 447 gpm flow rate in this comment is unclear, but it is important to note that the fluxes in Figure 3-26 pertain to the entire model domain, not only the portion of the domain that is in the area of interest*. *The only illustrated fluxes that pertain specifically to the zone within the proposed barrier wall are the HC&C system flux (249 gpm) and the contribution of river to HC&C system pumping (27 gpm).*"

The EPA estimated flow rate of 447 gpm flow rate is based on the calibrated numerical model water balance provided in the figure included in the EPA comment and it is derived from the total of site recharge (310 gpm) plus discharges in the upper alluvium (130 gpm), lower alluvium (39 gpm) and deep lower alluvium (73) minus the discharge out of the groundwater system from Doane Creek (90 gpm) and the LNG basin (14 gpm) which equals a total of 448 gpm[1]. EPA expects NW Natural to provide a similar evaluation, using the calibrated numerical groundwater model that incorporates the seasonal maximum discharge to the barrier wall with the revised remedy components. For instance, the flux from the fill and silt water bearing zone was not included in this calculation because the 2022 report was proposing a dewatering trench to address this flux. Now that the trench is not being considered, this flux also needs to be added.

EPA believes these discharge flux values in the calibrated model water balance **are pertinent** and should not be ignored given the hydraulic barrier wall extends largely over the extent of the model domain. It is also important to recognize that the current HC&C system is intermittent and operates to maintain a gradient reversal only when the river stage is less than groundwater heads (gaining river condition). With a barrier wall in place, management of the groundwater discharge to the wall across four hydrostratigraphic zones will require near constant pumping of the HC&C system to maintain pre-wall hydrostatic heads and prevent groundwater mounding.

[1] The 448 gpm total is a slight difference from the 447 presented in the comment, but this total is generally the basis of what EPA believes could be the amount of flux that will need to be addressed with the HC&C system to maintain heads upgradient of the barrier wall during a wet season as presented in Figure 3-26 in the *NW Natural Groundwater Model Update Report* (Anchor QEA, 2017).

New Primary Comments on the *Revised Source Control Addendum Report*

1. While the lessons learned in Section 4.3.1 describe issues with well performance and how they were addressed, including an assurance that any well that could not be restored with well rehabilitation would be replaced, the existing O&M document for the HC&C system should be updated based on the proposed modifications. Critical to this update is the timing of this well rehabilitation/replacement process and planning out the backup plan for maintaining required extraction rates when extraction wells are taken out of service, or are in the process of being replaced.

2. Removal of approximately 500 feet of the barrier wall along the Gasco-U.S. Moorings property must be explained and evaluated, as its absence is likely to increase contaminated groundwater flow towards and into the US Moorings property.

3. The revised report Appendix D groundwater model simulations, used to evaluate and estimate the amount of water required to be managed with the HC&C system when the barrier wall and shallow vertical extraction wells are installed, needs additional quantitative and visual information so that its conclusion can be understood and verified. This additional visual quantitative information includes:

    a. The total flux anticipated to enter the system that will be captured by the barrier wall based on the 2014 to 2017 average recharge conditions.

    b. The reduced amount of site recharge assumed in the second scenario in similar units (gpm) that were presented in the *Gasco Groundwater Modeling Report* (Anchor QEA, 2017).

    c. Operational rates assumed for the existing and new HC&C wells modeled and a comparison to existing extraction rates of the HC&C system in total and by extraction wells in each water bearing zone to verify that the simulation assumptions are reasonable.

    d. Water balance cross sections and water level head evaluations similar to those provided in the *Gasco Groundwater Modeling Report* (Anchor QEA, 2017) with the added remedy components (e.g. Barrier Wall, additional fill and alluvium WBZ extraction wells).

    e. The basis for the 25% efficiency factor assumed for the fill water bearing zone wells and what efficiency factors are applied to the upper and lower alluvium water bearing zone wells.

4. In general, NW Natural should utilize their calibrated numerical flow model to inform the design of the GW barrier wall. Simulations that include particle tracking in both horizontal (map view) and vertical (cross-sections) flow paths should be run to understand pathways of the groundwater under various configurations of the wall to help improve design and ensure effectiveness of COC

capture. At a minimum, the use of this calibrated flow model in the pre-design stage would address the questions and concerns that currently exist namely:

1. A comprehensive accounting of the water volume that will need to be managed (via pumping and treating) upgradient of the wall.

2. What level of flux remains from the deep alluvium not contained by the barrier wall that has the potential to mobilize and transport contaminants of concern into the river from contaminated sediment documented to exist within the riverbed.

References

Anchor QEA. February 17, 2017. Gasco Groundwater Modeling Report, NW Natural Gasco Site.

Anchor QEA. November 10, 2022. Source Control Addendum Report, NW Natural Gasco Site.

EPA. December 21, 2022. EPA Comments on the Source Control Addendum Report for the NW Natural Gasco Site.

cc: Dave Lacey, DEQ
Hunter Young, EPA