EPA Comments and Responses on Draft In Situ Stabilization and Solidification Laboratory Pilot Study Work Plan (dated October 31, 2022), Revised In Situ Stabilization and Solidification Bench Scale Treatability Study Work Plan (dated February 16, 2023), Revised In Situ Stabilization and Solidification Bench Scale Treatability Study Work Plan Addendum (dated March 13, 2023) and Additional Revised In Situ Stabilization and Solidification Bench Scale Treatability Study Work Plan (dated May 19, 2023)
Gasco Sediments Site
EPA Response dated June 29, 2023

This is U.S. Environmental Protection Agency's (EPA's) conditional approval of the Additional Revised In Situ Stabilization and Solidification Bench Scale Treatability Study Work Plan (additional revised TSWP). The additional revised TSWP was prepared by Anchor QEA, LLC (Anchor QEA) on behalf of NW Natural. The TSWP is a deliverable prepared for NW Natural under the Administrative Settlement Agreement and Order on Consent, CERCLA Docket No. 10-2009-0255, executed between EPA and NW Natural. Approval of the additional revised TSWP is conditioned on NW Natural adequately addressing EPA's responses as described below.

EPA Comments on the Additional Revised TSWP

Unless otherwise noted, NW Natural's responses to EPA's comments on the TSWP and TSWP addendum and associated updates to the additional revised TSWP are acceptable. However, clarification and supplemental information is provided below for the following comments: TSWP EPA General Comment 3a, TSWP EPA To Be Considered Comment 3, TSWP Addendum EPA General Comment 1, TSWP Addendum EPA Specific Comment 2, and TSWP Addendum EPA Specific Comment 3. In addition, five comments are provided on redline text added to the Additional Revised TSWP not directly related to EPA's comments on the TSWP and TSWP addendum.

TSWP EPA General Comment 3a (January 18, 2023)

Considerations for Sample Location Selection: Sampling of sediment containing higher concentrations of benzene and chlorinated volatile organic compounds should be considered in order to evaluate long-term leachability of these contaminants from treated sediments and potentially inform design of a cap, if needed. Sediment known to contain higher concentrations of metals which are expected to be impacted by changes in pH should also be sampled to evaluate construction-related impacts to surface water and porewater quality.

NW Natural Response (February 16, 2023)

NW Natural agrees that collection of the information EPA identifies in this comment is among the objectives for the treatability study. The Work Plan has been revised to provide further rationale for sample locations relative to the various considerations identified in the comment.

EPA Response (March 14, 2023)
The response is acceptable; however, item 2.a.iv in Section 2.1 states that: "Anchor QEA confirmed that metals sediment concentrations at the four proposed sample locations and depth intervals are generally representative of the central tendency of metals concentrations within the ISS treatment area." For completeness, revise the text or include a table to provide the range of metals sediment concentrations at each of the four proposed sediment sample locations along with the central tendency statistics within the ISS treatment area.

NW Natural Response (May 19, 2023)
The Work Plan has been revised to state, "Anchor QEA confirmed that metals sediment concentrations at the four proposed sample locations and depth intervals are generally representative of the metals concentrations within the ISS treatment area, as shown in Table 2b."

EPA Response (June 29, 2023)
Table 2-2 includes the average metal concentrations but not the range of concentrations requested by the EPA comment. Revise the table include the minimum and maximum concentrations measured for each metal within the ISS treatment area.

TSWP EPA To Be Considered Comment 3 (January 18, 2023)
Sample Size: The ISSLPS Work Plan should provide more justification for the proposed number of samples to be tested in each phase of testing. For example, the ISSLPS Work Plan provides only one sampling location per soil sample type ("One sampling location and depth interval was selected from each WBZ [water bearing zone]"—i.e., the Fill WBZ, upper alluvium, and lower alluvium) and only two sampling locations for each of two in-water sediment sample depths. NW Natural should confirm that the number and type of samples will be sufficient to select the most representative grout blend design.

NW Natural Response (February 16, 2023)
Sediment and soil sample locations were selected to be representative of Project Area and upland site conditions (see response to EPA General Comment 3 and EPA TBC Comment 2). However, at the request of DEQ (DEQ General Comment 6), two additional sampling locations (collocated with existing MW-21-165 and PW-10L) were added to the top of riverbank barrier wall soil sampling scope. One composite sample representative of the full soil boring depth will be collected at each soil boring location. This is intended to represent conditions during barrier wall installation using the revised DeWind OnePass technology. This technology homogenizes the soil to the full depth of the deep ISS treatment barrier wall. Additional detail regarding this revised design concept is provided below and will be further detailed in NW Natural's future submittal to DEQ for the Revised Source Control Addendum.

The design concept for the ISS treatment barrier wall has been updated based on further preliminary design evaluations and detailed discussions with equipment vendors. As described in the Source Control Addendum Report (Anchor QEA 2022a), the original barrier wall design concept was to extend two rows of top of riverbank ISS columns to the depths required to form a continuous wall of overlapping columns with the directly adjacent riverbank ISS columns. The overlaps in the double row were intended to ensure that there would be no gaps left in the wall due to column deviations. This design concept is depicted in Figures 4-2 through 4-3e of the *Source Control Addendum Report*.

The maximum depth of the barrier wall will be as much as 155 feet below existing ground surface. After consultation with equipment vendors and review of this auger technology at other sites, including those constructed by members of the Design Team, NW Natural had concerns about the feasibility of this process to such depths and the difficulty of maintaining continuity between columns that might deviate from vertical. DEQ comments on the *Source Control Addendum Report* (see Comment 7a; DEQ 2022) identified similar implementability concerns associated with the previous ISS auger technology design concept to the significantly deep target depths. These concerns led to the identification of an upland field pilot test to field verify that this technology could achieve the design objectives to the target depths.

To minimize the identified risks by the Design Team and address the concerns expressed in the DEQ comment letter, the Design Team contacted DeWind OnePass Inc. to discuss their capabilities to construct a completely mixed soil-ISS barrier wall to the target depths. While other companies have similar equipment, only DeWind has developed equipment with the power and proven capacity to reach the target depths. The basic concept is a gigantic chainsaw that cuts through the ground as it combines grout and other additives into a soil-mix blend. During the machine's progress, the vertical profile is completely homogenized and mixed into a semi-fluid state with a thickness of 3 feet. After the machine passes, the homogenized blend sets up and attains the required design parameters. Information about the equipment can be found on DeWind's website.1 Videos of the machine at work are available on YouTube, with one example at a depth of 145 feet deep.2 DeWind has been continuing to extend the power and depth range of its equipment. For this project, their current capacity of 145 feet below ground surface will achieve the target depths—the work platform can be degraded slightly to bring the design depth of 155 feet below existing grade within reach.

This technology has the obvious technical advantage that the massive treatment blade must pass through the entirety of the soil profile with no possibility of leaving "windows" of untreated soils behind. In addition, there is no open trench at any time since it is always full of mixed soil-cement. This homogenization is accounted for in the revised soil sampling method of compositing the entirety of the soil column to the bottom depth of the barrier wall at each of the proposed five upland locations, as described in Section 2.2 of the Work Plan.

The Design Team member Sevenson Environmental Services has used this technology on a series of environmental containment projects, including one at a depth of more than 100 feet:

- Glassboro South Jersey Gas Former MGP—Glassboro, New Jersey (2022): Soil-cement bentonite wall with dimensions 200 feet long by 87 feet deep by 3 feet wide
- Harrison MGP Site—Harrison, New Jersey (2021): Soil-bentonite wall with dimensions 2,200 feet long by 76 to 104 feet deep by 3 feet wide
- Former Koppers Wood Treating Facility—Carbondale, Illinois (2004): Groundwater collection trench with dimensions 931 feet long by 35 feet deep with installed 4-inch HDPE SDR-11
- Newport S. Landfill Superfund Site—Newport, Delaware (2002): Permeable reactive barrier-ZVI wall with dimensions 1,887 feet long by 25 feet deep

DeWind projects exceeding 100 feet include the following:

- Pittsburg Landfill—Antioch, California (2021): Soil-bentonite wall with dimensions 3,800 feet long by 90 to 145 feet deep by 3 feet wide

- K+S Potash—Bethune, Saskatchewan, Canada (2020): Soil-bentonite wall with dimensions 2,297 feet long by 68 to 96 feet deep by 3 feet wide with a test section to 135 feet deep
- Mosaic-New Wales Potash Facility—Mulberry, Florida (2019): Soil-bentonite wall with dimensions 5,200 feet long by 55 to 100 feet deep
- Cleveland-Cliffs, Hibbing Taconite Mine—Hibbing, Minnesota (2018): Soil-bentonite wall with dimensions 3,910 feet long by 50 to 100 feet deep

Another significant advantage of the proven track record of this technology is that it should not require a pilot scale project to prove its feasibility.

EPA Response (March 14, 2023)

The revised TSWP does not propose testing of material representative of riverbank soils. The riverbanks included within the Gasco Sediments Site vary between the Gasco property and the Siltronic property, as a result of placement of different fill materials over different time periods. While the Revised TSWP proposes collection of upland soils that would include these fill materials, NW Natural has proposed compositing soils over the full depth of the proposed barrier wall, and not testing of discrete hydrogeologic units. The properties of riverbanks soil could differ enough from the proposed sediment samples and composited upland soil samples to warrant treatability testing to identify an appropriate grout mix design for that region. EPA recommends at least one treatability testing sample be collected from both the Gasco property riverbank and Siltronic property riverbank.

Note that EPA understands DEQ plans to require NW Natural to collect and test upland fill soils separately from the composite samples.

NW Natural Response (May 19, 2023)

As requested, the Work Plan has been revised to include two riverbank treatability testing samples, one from the Gasco property and one from the Siltronic property.

EPA Response (June 29, 2023)

EPA acknowledges that NW Natural has added the requested number of riverbank soil sampling locations (one on the Gasco property and one on the Siltronic property). As noted in Section 2.2, PTW-NAPL was only observed in one of the 2019 pre-design investigation (PDI) angled riverbank borings (PDI-137), which was located on the Gasco property (approximately 650 feet north of the Siltronic property boundary). However, NW Natural did not propose a riverbank soil location co-located with PDI-137, favoring instead a location co-located with PDI-134, which was observed to contain varying amounts of lampblack and tar. EPA recommends adding a riverbank sampling location co-located with PDI-137 or moving the proposed riverbank location co-located with PDI-134 to PDI-137 to inform the ISS design for riverbank soils where PTW-NAPL may be present.

Additionally, NW Natural should consider advancing riverbank borings at a 45-degree angle due to the following reasons:

i. As noted in Section 2.2 of the Additional Revised TSWP, both physical and chemical results are available for the 2019 PDI angled borings, but only visual/olfactory observations are available for the 2023 depth of contamination borings (advanced at a 20-degree angle). We note that Appendix D of the Additional Revised TSWP only includes the 2019 boring logs, and so we are unable

to confirm that the observations from the 2023 boring were similar to the observations made in the 2019 boring. Further, PTW-NAPL was previously encountered in one of the PDI angled borings advanced at 45-degrees. We believe that physical and chemical data, in addition to known PTW-NAPL observations, serve as more reliable lines of evidence to determine appropriate sampling intervals for treatability testing compared to visual/olfactory observations alone.

ii. A 45-degree angled boring would target riverbank soils more representative of the riverbank/surface water interface compared to a 20-degree angled boring. We believe that testing of shallower riverbank soils that are more representative of the riverbank/surface water interface would provide information more useful for the remedial design, as it better represents direct contact and COC leaching risk pathways for submerged portions of the riverbank, where COC leaching or diffusive flux would be of more concern.

iii. Figures A-3a through A-3b of the *Final Revised Additional Depth of Contamination Characterization Addendum within the Gasco Sediments Site Project Area* (DOC Characterization Addendum) illustrate the differences between borings advanced at 45-degree and 20-degree angles. As shown in those figures, 45-degree borings would produce a shorter sampling interval, reducing the variability in the nature of riverbank soil and the risk of incorporating underlying materials (e.g., the upper silt unit, the upper alluvium water-bearing zone [WBZ]) that could have much different physical properties compared to the fill/Fill WBZ. We note that the last paragraph of Section 2.2 states NW Natural's intent to target materials representative of the Fill WBZ. Given that NW Natural is proposing to composite soil collected from the entire riverbank boring length, we think reducing the potential to encounter multiple or varying material types will improve the certainty that the grout mix design will reliably achieve the design criteria.

If a 45-degree angle for riverbank boings is not expected to achieve the study objectives, the text should be revised to provide additional clarification.

TSWP Addendum EPA General Comment 1 (April 14, 2023)

Analytical Suite Rationale: The rationale provided for the selected Phase IV testing analytes defers to the findings in the Pre-Remedial Basis of Design Technical Evaluations Work Plan (TEWP; Anchor QEA 2019). Presumably, this is a reference to the discussion of candidate chemicals for consideration in cap design modeling in TEWP Appendix D. This screening was based on evaluation of cleanup level (CUL) exceedance ratios and mobility based on partitioning coefficients for each Table 17 contaminant with a groundwater CUL. The former is still a reasonable line of evidence for screening contaminants; however, it is unclear if the sediment-porewater partitioning behavior provides information related to ISS leachability. Instead of deferring to the TEWP discussion, which was developed for cap design, the ISS TSWP Addendum should be revised to discuss the rationale for excluding PCBs, pesticides, herbicides, semivolatile organics, and perchlorate as it relates to ISS treatment and the overall Gasco conceptual site model (CSM).

As noted in EPA's March 14, 2023 response to Specific Comment 11 on the In Situ Stabilization and Solidification Bench Scale Treatability Study Work Plan (revised document dated February 16, 2023), C10-C12 aliphatic hydrocarbons should be analyzed using a lab that can achieve reasonably low detection limits as close as practicable to the CUL of 2.6 µg/L.

NW Natural Response (May 19, 2023)

The Work Plan has been revised to discuss the rationale for excluding PCBs, pesticides, herbicides, SVOCs, C10-C12 aliphatic hydrocarbons, and perchlorate as it relates to ISS treatment and the overall Gasco CSM for treated sediments. See response to EPA Specific Comment 1 (April 14, 2023) regarding not including untreated sediment samples in the Phase IV leachability testing.

EPA Response (June 29, 2023)

The TSWP was not revised to discuss the rationale for excluding PCBs, pesticides, herbicides, SVOCs, C10-C12 aliphatic hydrocarbons, and perchlorate as indicated by NW Natural's response. The added discussion of determining diffusive flux estimates for non-target COCs is helpful; however, the basis for determining target vs non-target COCs for Phase IV is still unclear. Revise Sections 3.6.2.1 and 3.6.2.2 to discuss the rationale for the selected Phase IV target COCs and COCs identified as non-target, using TEWP Appendix D evaluations to support the discussion as needed.

In the absence of supporting information to justify the analyte list for Phase IV testing, EPA remains concerned that this decision is being driven by cost and may lead to data gaps for remedial design. Therefore, additional clarification is needed to support NW Natural's assertion that Phase IV testing of additional Table 17 contaminants is "technically unnecessary".

Additionally, EPA recommends including analysis of C10-C12 aliphatic hydrocarbons for Phase III leachability testing. EPA also notes that Appendix A, Table A-5 includes analysis of C10-C12 aliphatic hydrocarbons for Phase IV leachability testing. The TSWP and Appendix A FSP text should be revised consistent with the analytes listed in Table A-5.

TSWP Addendum EPA Specific Comment 2 (April 14, 2023)

Revised Phase IV Sediment Laboratory Testing Program, second paragraph, page 2: In addition to the discussion of cost considerations, literature information on leachability of Table 17 contaminants with groundwater CULs not included in the Phase IV testing analytical suite should be discussed, if available.

NW Natural Response (May 19, 2023)

Section 3.6.2 of the Work Plan has been revised to discuss how estimated effective diffusion coefficients calculated from Phase IV testing of ROD Table 17 contaminants with groundwater CULs target COCs will be used in combination with sediment-water partitioning values (see Appendix G of the Combined BOD-PDR; Anchor QEA 2021) for non-target COCs to assess the potential diffusive flux of non-target COCs. In addition, sampling is proposed after the completion of the ISS field pilot study for ROD Table 17 contaminants with groundwater CULs not included in the Phase IV leachability testing.

EPA Response (June 29, 2023)

See response to TSWP Addendum EPA General Comment 1.

TSWP Addendum EPA Specific Comment 3 (April 14, 2023)

Phase IV Soil Laboratory Testing Program Is Unnecessary and Should Be Eliminated, pages 2 through 3: The text states that the design team determined that testing untreated and treated Phase IV soil samples is unnecessary. The text goes on to state that, "Unlike ISS in subaqueous sediments, the ISS treatment barrier wall remedial design does not require analysis of soil leachate concentrations to estimate the reduction in diffusive mass flux in ISS-treated soils over time." However, additional clarification is

needed as to explain this determination. If NWN intends for upland soil to be representative of riverbank soils, then it will need to be determined if the ISS treated riverbank soil leaches contamination to the river. This could have the potential to impact the effectiveness of the in-water remedy and the expectations for reducing recontamination of the remedy from riverbanks. Revise the text to provide technical justification to support the design team's determination that Phase IV soil testing is not required.

NW Natural Response (May 19, 2023)
As discussed in NW Natural's May 19, 2023 response to EPA's March 14, 2023 To Be Considered Comment 3, the Work Plan has been revised to include baseline characterization of untreated riverbank soil and Phase I through III testing of untreated and treated riverbank soil samples to be collected at two riverbank angled borings on the Gasco and Siltronic properties. In addition, technical justification is provided to support why Phase IV testing will only be conducted for treated sediment.

EPA Response (June 29, 2023)
The justification to exclude Phase IV testing provided in the last paragraph of Section 3.6 is insufficient. The objective of Phase IV testing is to quantify the diffusive mass flux of contaminants from treated sediment/soil. Revise Section 3.6 to clarify why/how the diffusive mass flux estimates generated from sediment data will inform diffusion from treated riverbank soil that is submerged, clearly discussing any differences in the porosity and tortuosity of riverbank soil compared to sediments.

EPA Comments on redline text added to the Additional Revised TSWP

EPA reviewed redline text added to the additional revised TSWP not directly related to EPA's comments on the TSWP and TSWP addendum and has the following comments.

General Comments on Additional Revised TSWP:

1. As noted by EPA during a meeting between EPA, DEQ, and NW Natural on April 24, 2023, the ISS barrier wall is not considered an element of the in-water remedy. The information in Sections 1 and 1.1 still describes the ISS barrier wall as an integral or necessary component of the sediment remedy. EPA understands that the ISS barrier wall may provide ancillary benefits to the in-water remedy (e.g., improved seismic stability beyond what is achieved with ISS of sediments); however, the barrier wall is an upland remedial measure to be evaluated under DEQ's regulatory program. To ensure that the TSWP is focused on the in-water remedy, the following statements should be removed or revised accordingly:

    - **Section 1:** "The preferred design includes an ISS treatment barrier wall that will only be included if EPA approves the ISS technology in the design for the nearshore area."
    - **Section 1.1:** "This design alternative includes an integrated deep ISS treatment barrier wall, groundwater interceptor trench, and network of monitoring wells that are all necessary components of the ISS sediment remedy as well as functioning as an alternative source control approach proposed to DEQ."
    - **Section 1.1:** "An integrated deep ISS barrier wall along the shared US Moorings and Gasco property line is an important component of the integrated design, included to promote structural stability of the sediment remedy along this portion of the riverbank and serve as an additional alternative source control approach proposed to DEQ."

Specific Comments on Additional Revised TSWP:

1. **Section 1.1 Background:** The placement of Footnote 3 after "an integrated deep ISS treatment barrier wall in the Gasco OU at the top of riverbank" suggests that the ISS barrier wall is included as an element of the Portland Harbor Superfund Site (PHSS) Record of Decision (ROD) selected remedy. Revise the footnote to clarify that the ROD did not select groundwater barrier walls as an element of the PHSS remedy, and that the footnote applies only to the navigation channel, intermediate, shallow, and riverbank (riverward of the top of riverbank) regions of PHSS. Also see General Comment 1 above.

2. **Section 2.2 Riverbank Soil Sample Locations:** EPA has the following comments on this section and the TSWP should be revised accordingly

    a. Revise the last sentence of the second paragraph to clarify that the riverbank borings proposed adjacent to the Siltronic property were collected in May 2023.

    b. The last paragraph states that: "Consistent with the approach identified in the EPA-approved *Final Revised Additional Depth of Contamination Characterization Addendum* within the Gasco Sediments Site Project Area (Anchor QEA 2023), the riverbank borings will be advanced at an approximately 20-degree angle to at least the visual/olfactory depth of contamination identified during the sampling work performed by Anchor QEA in April 2023." The referenced sampling was conducted in April and May 2023, not just April.

3. **Section 3.6.2.2 Application of Phase IV Test Results to Estimate Diffusive Mass Flux for Non-Target COCs:** While EPA understands the methodology for estimating diffusive flux for non-target COCs, variability in the measured diffusive flux coefficient for target COCs can be expected from cylinder to cylinder. The calculated θ/τ term is also expected to vary for different target COCs for each cylinder. NW Natural should consider appropriate data handling in remedial design that evaluates the observed variability so that a reasonably conservative effective diffusion coefficient is calculated for non-target COCs. Further, NW Natural should assess whether the porosity and tortuosity achieved by field scale equipment is similar to what is achieved using bench scale equipment.

4. **Table 2-1:** This table includes key information supporting the selection of sediment sample locations and depth intervals for treatability testing. EPA recommends that this table be expanded, or a new table be added, to include similar information for the riverbank soil samples.