2025-10-08_Gasco: Groundwater Restoration Modeling

Meeting Title:	Gasco: Groundwater Restoration Modeling
Date/Time:	October 8, 2025 / 12:30 - 2:00 pm
Attendees:	AQ: Halah Voges, Matt Davis, Mike Gefell, Ali Meyal EE: Rob Ede DEQ: Wes Thomas, Heidi Nelson, Dave Lacey GEI: Carissa Mason, Tom Daigle, Andy Adinolfi, Paul Jansen, Matt O'Neil
Location:	MS Teams

Meeting Notes:

- AQ reviews the meeting agenda:
  - DEQ FS comments to discuss/clarify
    - General Comment 1g
    - Specific Comments 87c; 87d, ii; 87g; 87j, ii; 87k, i
  - Factors that influence groundwater restoration potential
  - DNAPL influence on groundwater hotspot definition
  - Groundwater velocity influence on restoration potential
    - How far downgradient of DNAPL groundwater will remain impacted by dissolution.
  - Identifying general areas where it is feasible to restore groundwater in a reasonable timeframe

- AQ reviews the factors that affect groundwater restoration timeframes:
  - Types of COCs
  - COC concentrations, effective solubilities, degradation rates, and sorption/desorption characteristics
  - DNAPL compositions, saturations, and locations
  - Hydrogeologic factors (hydraulic conductivity and flow rate)
  - Different water bearing zones
  - Influence of different remedial technologies.

- AQ believes they could develop a complex 3D model that accounts for these factors, but not within the FS schedule. To be able to complete the FS within the current schedule, AQ needs to simplify the approach to resolving DEQ's comments. AQ can more qualitatively map areas where groundwater can likely be restored and areas where it likely cannot.

- AQ reviews DEQ General Comment 1g, which asks NW Natural to 'quantify' the areas and WBZs where beneficial use will be restored. AQ notes that Specific Comment 87c requests that the FS discuss restoration timeframes on a GSA/RAU-basis. AQ asks:
  - Will DEQ require that restoration timeframes be evaluated on a more detailed basis within each GSA/RAU? If so, at what level?
    - DEQ reviews the intent of the comment, which is to recognize how each RAA will affect groundwater beneficial use restoration. RAAs with less source-material treatment will result in few changes relative to current conditions. RAAs with more treatment/removal will increase the level of groundwater beneficial use restoration, and we want the FS to account for that. With respect to spatial scales, DEQ reviews two examples. In the FAMM/Spent Oxide GSA, there is very little DNAPL in the Alluvium WBZ, and the groundwater beneficial use is either unimpaired or the level of impairment is relatively minor. Evaluating restoration in that GSA at the "GSA-scale" could make sense. Conversely, when we look at Siltronic, it will likely make more sense to evaluate restoration on a smaller scale, since there are large portions of the shoreline that are more impacted, and large portions that are relatively unimpacted.
    - AQ agrees with DEQ's examples.
  - Can DEQ provide examples of where/how groundwater restoration timeframes have been quantified at other MGP/DNAPL sites?
    - DEQ notes that it is difficult to find examples analogous to Gasco, given the scale of the contamination. At other sites, the common approach is to determine what would be required to restore beneficial use (for example, the number of pore-volume flushes), and

then determine what technologies can feasible accomplish that requirement.
    - AQ agrees that Gasco is unique in terms of the scale of contamination. AQ would appreciate any examples of other MGP or creosote sites that DEQ can provide.

- AQ reviews DEQ's Specific Comment 87d,ii and asks how long DNAPL dissolution simulations should be?
    - DEQ clarifies that Appendix R does not accomplish the secondary objective it set for itself. DEQ does not require it to.

- AQ reviews DEQ's Specific Comment 87g. AQ asks if there are COCs other than benzene and naphthalene that DEQ would like to see included in the groundwater restoration evaluation.
    - DEQ thinks the FS should justify the selection of those COCs. There are a number of COCs that could be useful. For example, TPH, cyanide. These are just examples and not an exhaustive list.
    - AQ states that if there are any other specific COCs DEQ would like to see included, to follow up with that information.

- AQ reviews the Appendix R methodology. The model presented in Appendix R was a simple 2D model that included site-specific DNAPL information. The model evaluated 3 hypothetical wells, one within the middle of the DNAPL body, one at the fringe of the DNAPL body, and one at a nominal distance downgradient. Model found that the groundwater concentrations at the first two locations did not decline below cleanup levels. But at the third location, cleanup levels were never exceeded. For the first modeled area, location 3 was approximately 35 feet downgradient of the DNAPL, and for the second modeled area, location 3 was approximately 50 feet downgradient of the DNAPL. The differences in these locations varied primarily as a function of groundwater flow velocities. AQ believes these are significant findings. These results suggest that groundwater in direct contact with groundwater cannot be restored, but groundwater impacts at some distance downgradient of DNAPL may be limited.

- AQ discusses the influence DNAPL has on the definition of groundwater hot spots. AQ asks if DEQ agrees that groundwater in direct contact with DNAPL does not need to be further evaluated for restoration potential?
    - DEQ responds that the groundwater beneficial use restoration should be evaluated at a location that represents the point of exposure. For the aquatic life scenario, we have conservatively established that as the shoreline. We could be open to other attenuation modeling from the shoreline to the sediments in RD, if needed. It's unlikely that the middle of the DNAPL body or even the fringe of the DNAPL body represents the point of exposure.
    - AQ shows a map of the two modeling areas from Appendix R and notes that the model did not predict groundwater impairment at the shoreline for the two DNAPL bodies.
    - DEQ comments on empirical data in riverbank wells in those locations, noting that naphthalene exceeds the groundwater cleanup level, but it is not clear whether the two modeled DNAPL bodies are affecting those naphthalene concentrations.
    - DEQ asks if AQ has considered the application of these observations in the development of remedial alternatives? Has NW Natural considered developing a remedial alternative that would "treat all DNAPL contributing to a beneficial use impairment" with the assumption that at some distance set-back from the shoreline, DNAPL may not be resulting in an impairment at the shoreline? If that were an alternative that were considered and selected, DEQ would expect detailed modeling in RD to confirm those distances, and then require performance monitoring to verity that enough DNAPL treatment occurred to restore groundwater beneficial uses at the shoreline.
    - AQ thinks it may be feasible to look at distances from the shoreline, or in some generic downgradient direction where DNAPL would no longer produce groundwater cleanup level exceedances. That evaluation would likely be based on a function of groundwater flow velocities.

- AQ reviews DEQ Specific Comment 87j,ii. AQ asks how DEQ envisions the comment being addressed since the distance to the riverbank varies.
    - DEQ refers back to the previous conversation.
    - AQ suggests an evaluation that estimates how far downgradient cleanup levels are exceeded.
    - EE also discusses the cleanup levels that should be used in the evaluation.
    - DEQ clarifies that the PRGs for the specific beneficial uses should be used. So for the aquatic life beneficial use, the aquatic life PRGs should be used. Portland Harbor Table 17 CULs should not be used for evaluating hot spots.

    - EE suggests a similar evaluation could be done for Portland Harbor Table 17 CULs.
    - DEQ replies that the results of that evaluation will not be meaningful for hot spot evaluations and the evaluations should be kept separate.

- AQ reviews DEQ Specific Comment 87k,l.
    - DEQ clarifies that location 3 is the only location that provides a meaningful result for assessing hot spot restoration.

- AQ discusses the influence of DNAPL on groundwater restoration. In some cases, groundwater cleanup levels will not be restored very close to ISS treated DNAPL.
    - DEQ believes that distance will be significantly reduced compared to a no-treatment option. DEQ expects that ISS treatment of DNAPL will make groundwater restoration feasible. After ISS treatment, contributions to groundwater will be diffusion-limited.

- AQ asks if their evaluation can make simplifying assumptions that where DNAPL is close to the shoreline, the groundwater beneficial reuse could not be restored.
    - DEQ does not believe it is that simple. In practical terms, DNAPL treatment occurs on a 3D scale. Groundwater restoration needs to be considered near the shoreline, even if there is also DNAPL.

- AQ notes that groundwater restoration outside of DNAPL areas would need to consider:
        - Which COC?
        - Starting concentrations
        - Groundwater cleanup levels
        - Degradation rate
        - Desorption of sorbed COC mass.
    - DEQ asks if the evaluation only considers MNA.
    - AQ clarifies that it doesn't necessary only consider MNA, but where MNA can restore groundwater within 100 years, it would be logical to rely on MNA.
    - AQ also clarifies that there is a lot of evidence that benzene and naphthalene can be restored via MNA. AQ sites the rapid reduction in benzene and naphthalene concentrations downgradient of the LNG basin after the trenches came online. AQ also agrees that there are large areas where DNAPL is absent where groundwater is already relatively clean.

- AQ presents overall takeaways regarding groundwater restoration potential
    - Where groundwater is in direct contact with DNAPL, the beneficial use cannot be restored.
    - Where DNAPL is absent, groundwater can be restored.
    - Groundwater downgradient of DNAPL may or may not be able to be restored, depending on distance from DNAPL, groundwater velocity, remediation approach, and many other factors. AQ believes it is not clear how to address this scenario in the FS.
        - DEQ believes this scenario is important for the FS.

- DEQ believes that where DNAPL is treated, groundwater restoration can be restored.
- DEQ hopes that this meeting has helped to clarify our comments on the FS and the evaluation we are looking for. DEQ asks for clarification about how the desired evaluation might affect the FS schedule.
    - AQ will review move the evaluation forward based on the meeting discussion and follow up with DEQ. AQ/EE believe another meeting after AQ has completed some preliminary work may be useful.
    - DEQ agrees to another meeting, if its requested.