

MEMORANDUM | January 30, 2026

TO Wes Thomas and David Lacey, Oregon Department of Environmental Quality (DEQ)

FROM Peter Shanahan, HydroAnalysis LLC (HALLC); Jennifer Hart and Gail Fricano, Industrial Economics, Inc. (IEc)

SUBJECT Five Tribe review of “Model Refinement and Calibration Report” for the Gasco upland site, dated December 22, 2026

This memorandum, submitted on behalf of the Five Tribes,¹ reviews the *Model Refinement and Calibration Report* prepared by Anchor QEA on behalf of NW Natural (Anchor QEA 2025).

General Comments

1. Overall, the report is well prepared, and we are comfortable with the approach and most of the procedures employed for model calibration. Below we provide several specific comments; however, we have one comment, Comment #5, relating to Anchor QEA’s approach for delineating the western boundary. As this is a fundamental consideration, we request DEQ and Anchor QEA reconsider the current approach for this element of the model.
2. Further, we question the calibration of specific storage, which seems to lump the fill, lower alluvium water-bearing zones (WBZs), and upper and lower silt units into a single value for calibration purposes. As detailed in Comments #8 and #9, the upper and lower bounds assigned to this value take no account of the potentially unconfined character of the fill. This is a secondary concern since specific storage will be irrelevant for the presumably steady-state model simulations used to evaluate future remedial actions. Nonetheless, and particularly if the model is anticipated to be used in transient mode for predictive simulations, we recommend that these specific storage values be recalibrated separately.

Specific Comments

3. Section 3.3 indicates the horizontal and vertical hydraulic conductivity for model Layer 9 with two significant digits but their ratio with four significant digits, a mathematical impossibility. The anisotropy ratio should be presented as 400.
4. Figure 3-13 shows the thickness of the upper silt unit but does not include a line for zero thickness (i.e., the limit of the unit). Since the horizontal extent of the upper silt unit is an

¹ The five tribes are the Confederated Tribes of the Grand Ronde Community of Oregon, the Nez Perce Tribe, the Confederated Tribes of Siletz Indians, the Confederated Tribes of the Umatilla Indian Reservation, and the Confederated Tribes of the Warm Springs Reservation of Oregon.

important consideration for the design of site remedial actions, we recommend adding a line for zero thickness.

5. Section 4.1.2 indicates that general head boundaries are used “[t]o provide additional flexibility to simulate potential remedial systems or structures near the upgradient model boundaries.” This statement points out a potential flaw in the model: the western boundary was arbitrarily placed parallel to and only slightly offset from the property line. A far more robust strategy would have been to identify a natural hydrologic boundary such as a groundwater divide, formation pinch-out, impermeable formation, or the like. While the groundwater divide (roughly along Skyline Boulevard) is too distant to be a practical model boundary, Wells et al. (2012) shows that bedrock outcrops just west of the property line. This would create a robust, geologically-based boundary for the model. Further, Section 4.1.2 states “The upgradient GHBs [general head boundaries] in the Fill and Upper Alluvium WBZs, corresponding to inflow from those same units, were assigned heads of 40 feet COP [City of Portland datum] at a distance of 1,000 feet from the boundary cells.” According to Wells et al. (2012), those geologic units do not exist 1,000 feet to the west of the model. In summary, the GHP appears to be arbitrary and unrealistic, and as a consequence, the model would be unable to “simulate potential remedial systems or structures near the upgradient model boundaries” accurately.
6. Section 5.1.2 states “During subsurface investigations at the U.S. Moorings Project Area adjacent to the site...” We recommend a citation to the source of this information be provided.
7. Section 5.2.1.1 indicates that historical head measurements from the U.S. Moorings Project Area are likely low. We recommend Anchor QEA consider adjusting those upward based on observed river stage-groundwater relationships observed at the Gasco site.
8. Table 5-5 shows that specific storage was limited during calibration to a range of 1×10^{-7} to 1×10^{-3} for the fill, lower alluvium, and upper and lower silts. This range of values is representative of confined conditions and would seem to not be applicable to the unconfined fill unit and the semi-confined silt and alluvial units. The final calibrated value of 1×10^{-7} seems very unrealistic for these units. In contrast, both Freeze and Cherry (1979, pg. 60) and Todd and Mays (2005, pg. 58) indicate typical values for confined aquifers fall in the range 5×10^{-5} and 5×10^{-3} ; values for unconfined and semi-confined aquifers would be higher than those for confined aquifers. We recommend these values be revisited.
9. Table 5-5 implies that the specific storage of the fill, lower alluvium, and upper and lower silt units were treated as a single calibration parameter and thus constrained to have identical values of specific storage. We question whether these units of different lithology, including an unconfined fill unit, would have identical specific storage values.
10. The discussion of the model water budget in Section 6.3 is very useful, and Figure 6-11 provides a very effective summary.

References

- Anchor QEA. 2025. Gasco OU, Model Refinement and Calibration Report, Prepared for NW Natural. December 22.
- Freeze, R.A., and J.A. Cherry. 1979. *Groundwater*. Prentice Hall, Englewood Cliffs, New Jersey.

Todd, D.K., and L.W. Mays. 2005. *Groundwater Hydrology*, Third Edition. John Wiley & Sons, Hoboken, New Jersey.

Wells, R., R. Haugerud, A. Niem, W. Niem, L. Ma, R.C. Evarts, J.E. O'Connor, I. Madin, D. Sherrod, M. Beeson, T. Tolan, K.L. Wheeler, W. Hanson, and M. Sawlan, 2020. Geologic map of the greater Portland metropolitan area and surrounding region, Oregon and Washington. Scientific Investigations Map 3443. U.S. Geological Survey, Reston, Virginia. <https://pubs.usgs.gov/publication/sim3443>