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Knife River Outline for Responses to Groundwater Questions
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1. Water Quantity Concerns- During Mining
 - a. All groundwater management strategies used at proposed mine must be approved by the Oregon Department of Geology and Mineral Industries (DOGAMI).
 - b. Recharge trenches will only be used while mining is taking place and are not intended for reclamation.
 - c. All recharge trenches will be constructed by stripping overburden to expose the underlying sand and gravel below and no new material will be brought into the recharge trenches.
 - d. The recharge trenches will be completed above the water table and water removed from the aquifer upgradient will be replaced into the aquifer downgradient and by so doing will protect local water wells from water level reduction.
 - e. The aquifer downgradient of the active mining area and downgradient of the recharge trench will be monitored to ensure the recharge trench is operating as planned.
 - f. The water removed from the mine cell and placed into the recharge trench will be "clean". Knife River will monitor water levels continuously and water quality quarterly to ensure compliance with their commitment. No change to the quality of water filtration is expected as a result.
 - g. Recharge trenches will be mined through, except where placed within setbacks. Any not mined through would be reclaimed.
 - h. A recharge trench will also be placed along the southern property boundary at Vanier to protect shallow wells to the south. The recharge trench location map has been updated to reflect this addition.
 - i. Recharge trenches have been approved by DOGAMI, have been successful in the mitigation of groundwater impacts and have been successfully used by Knife River.
 - j. Any hydrocarbon spills will be cleaned up immediately as required by state and federal law.

2. Water Quantity Concerns Post Mining
 - a. Knife River has committed to stripping topsoil separately from overburden:
 - b. Knife River has committed to "mining by smaller cells" and "contemporaneous reclamation of those cells"
 - c. What this means is that when mining is completed in Cell 1, it will be immediately reclaimed. The overburden removed from Cell 2 will be placed in Cell 1 and this earlier mine cell will be shaped with the overburden. Then the topsoil which is removed from Cell 2 will be directly placed on the overburden of Cell 1. The topsoil will be "live", "will contain organic matter and soil organisms and will not require large amounts of fertilizer-if any. Knife River testing of both overburden and topsoil suggest that this reclamation technique will work.

- d. Groundwater will generally flow around the overburden used to backfill the mine cells, but some will continue to flow through. The sand and gravel that KRC has not mined has a higher permeability and will continue to provide the groundwater a preferred pathway to move. Groundwater will flow through the overburden material, but at a reduced rate given its lower permeability.
- e. Groundwater recharge in the area includes: snowfall and rainfall to terrace deposits in the area and to the northeast; and leakage from existing ditches, ponds, and the stream valley. Mining will not disturb recharge to wells. There may be local changes in flow path, but overall recharge will remain the same.
- f. Shallow wells and springs adjacent to the mine will be protected by the recharge trenches during mining and will still receive groundwater following reclamation. Groundwater flow direction to those wells may change but groundwater movement is multi-directional.
- g. KRC is offering a "Groundwater Guaranty" and will deepen or replace any well that is impacted by their mining operation.

3. Water Quality Concerns

- a. Water quality of wells onsite will be monitored quarterly
- b. Quality will be monitored for GRO, DRO, turbidity, total dissolved solids, iron, manganese, pH, conductivity, and temperature. The mining and reclamation operation will not introduce nitrates and phosphates. Our past experience suggests that our practice of contemporaneous reclamation, minimizes the need for the introduction of large volumes of fertilizer.
- c. Overburden material placed within the reclaimed mine cells will have lower permeability and will contain silts and clays that will not only retard the downward movement of nitrates, but will also serve to chelate or absorb nitrates.
- d. Overburden and topsoil will provide filtration of the groundwater, but groundwater will not move through these materials as quickly as it did through the sand and gravel.
- e. Five wells and springs in close proximity to the site are proposed for baseline monitoring as shown on the map provided.
- f. A 100-foot leave strip will remain in place and will separate the mining area from non-owned properties. This leave strip will be undisturbed and should there be an unlikely source of contamination that originated on the property, the leave strip would serve to filter all contaminants- similar to a conventional water filtration plant.

4. Baseline Wells/Springs for Monitoring

These two springs on Davis property along the northern property line and three wells were selected because they are located in very close proximity to the Vanier permit boundary. They were also selected because their water source is the shallow aquifer that KRC will be mining into. As such, these five locations are the most vulnerable to any impacts associated with KRC's mining.