



**WASHINGTON STATE DEPARTMENT OF ECOLOGY
MEMORANDUM**

November 20, 2002

TO: Josh Peters, Associate Planner, Jefferson County Dept. of Community Development

FROM: Tom Culhane

SUBJECT: Proposed amendment to designate a Mineral Resource Lands (MRL) overlay district to the Jefferson County Comprehensive Plan

At your request I have reviewed a November 1, 2002 letter report and associated materials produced by GeoResources, LLC regarding a proposal by Fred Hill Materials (FHM) to change to the Jefferson County Comprehensive Plan. As requested, I specifically reviewed this proposal from a water resources perspective, including the possibility that the proposed change could lead to the puncturing of an aquifer similar to that which occurred in Snohomish County at a Cadman, Inc. gravel mining operation. In addition, I addressed some of the water quality concerns, as these were evaluated in several of the reports.

The proposed MRL change relates to plans by FHM to expand its current gravel mining operations in the County. Beyond the above GeoResources report I reviewed:

- A Jefferson County memorandum regarding Mineral Resource Lands, Mineral Extraction, and MLA02-235 dated October 25, 2002
- A Jefferson County Department of Community Development Staff Report and Draft Supplemental Environmental Impact Statement (DEIS) dated August 21, 2002
- A Robinson & Noble, Inc. (R & N) letter addressing potential impacts of Ace Paving asphalt batch plant (Shine Pit) on the aquifer serving Bridgehaven dated June 3, 1999
- A Robinson & Noble, Inc. report entitled, "Critical Aquifer recharge Area report for Ace Paving" dated February 1999

Additionally, my review relied on information presented in:

Economic and Engineering Services (EES) and Pacific Groundwater Group (PGG), 1994, Eastern Jefferson County groundwater characterization study: Prepared for Jefferson County Public Utility District Number 1.

Grimstad, P. and Carson, R. J., 1981. Geology and ground water resources of Eastern Jefferson County, Washington: Department of Ecology Water Supply Bulletin 54.

Parametrix, Pacific Groundwater Group, Montgomery Water Group, and Caldwell Associates, 2000, Stage 1 Technical Assessment Water Resource Inventory Area 17: Prepared for the Water Resource Inventory Area 17 Planning Unit.

I also visited the proposed MRL overlay district vicinity on November 15, 2002, during which I visited wells 5, 7, 9, 10, 14, 18 and 19 and received a tour of the existing FHM pit.

The original proposal was to designate a 6,240 acre MRL overlay district, but in response to a subsequent offer by FHM, the County's recommendation has been scaled back. The size of the scaled-back proposal was initially 765 acres, but this was further reduced to 690 acres based on the desire to maintain a 500 foot buffer near Thorndyke Creek. My analysis below focuses mainly on the 690 acre scaled-back version.

Background

The August 21, 2002 DEIS includes a subsection with a very general discussion of the considerations for the proposed change to the County's Comprehensive Plan. One important statement in this is that, "Approval of an MRL overlay designation does not constitute approval of any site-specific mineral extraction or related activity."

The October 25, 2002 Jefferson County memorandum has a brief section entitled "Aquifer Protection". This section discusses the potential impacts that mineral extraction activities within the proposed MRL overlay area could have on the aquifer used by the Bridgehaven community and neighbors. The memorandum also points out that if the proposed MRL change does occur and a specific mining activity is proposed, the potential effects to ground water will then be considered during the actual permitting process.

Hydrogeology

Based on the 1994 EES/PGG report, from oldest to youngest the geology in the subject area consists of undifferentiated pre-Vashon glacial and interglacial sediments, overlain by Vashon advance outwash, overlain by Vashon glacial till (hardpan), overlain by Vashon recessional outwash sediments. Older glacial and interglacial sediments are exposed along portions of the Hood Canal shoreline bluff located east and south of the TMR area. Within the outwash channel areas, the glacial till is often thin or absent as a result of non-deposition or removal by later erosion of the scouring melt water. Where this occurred, recessional sand and gravel deposits were deposited directly over the advance sand and gravel deposits, resulting in a thick section of high quality aggregate material that is economical for extraction purposes.

In a report addressing critical aquifer recharge occurring in the vicinity of the Shine pit, the February 1999 R & N report states that:

The previous studies, as well as the present work, found that there are generally two units in the region used for groundwater production: the Vashon advance outwash and the Double Bluff Drift. The two units are separated by a very thick confining layer formed by the Vashon lacustrine deposits and the Whidbey Formation. The extension of the lacustrine deposits, the Whidbey Formation, and the Double Bluff Drift into the Site area has not been proven due to a lack of deep well drilling in the area, but their existence beneath the advance outwash in the area is very probable.

This R & N report goes on to state that:

In the Shine area, the majority of both domestic and purveyor wells produce water from the deep aquifer. A few domestic wells also produce from the advance outwash aquifer.

The June 3, 1999 R & N report includes a mainly north-south cross section (through the Shine pit and Bridgehaven well) that suggests an elevation roughly 120 feet above MSL for the top of a combined Vashon lacustrine/Whidbey Formation unit. The bottom of this unit and thus the top of the Double Bluff Drift is depicted at about 60 feet below MSL near the Bridgehaven well.

The November 1, 2002 GeoResources report was provided with 2 maps, 2 cross sections, and 19 well logs. The existence of a thick, pre-Vashon clay layer is significant both with regard to potential ground water resources (quantity) issues and contamination risk for wells east of the proposed MRL lands area. Unfortunately, most of the wells installed by GeoResources only went deep enough to define the nature and extent of the material to be mined and did not encounter this deeper layer. Information on the 5 deepest wells is as follows:

- Well 10 - total depth 200 feet, the only aquitard material encountered is described as gray clay 195 to 200 feet, the log indicates SWL "NOT ALLOWED"
- Well 13 - total depth 180 feet, the only aquitard material encountered is described as brown clay 175 to 180 feet, the log indicates SWL "NOT ALLOWED"
- Well 14 - total depth 240 feet, the only aquitard material encountered is described as very fine sand with some clay 120 - 235 feet (underlain by clean sand with gravel 235 to 240 feet, the log indicates the SWL is 72 feet down
- Well 18 - total depth 420 feet, the only aquitard material encountered is described as very fine sand with clay 330 to 420 feet, the log indicates never hit water.
- Well 19 - total depth 260 feet, aquitard material was never encountered, the log indicates no SWL information

Cross section A-A" in the GeoResources report runs primarily north-south through the area suggested for the scaled-back MRL proposals and over much of the lower portions of Thorndyke Creek. Unfortunately, the locations of only one well (14) is indicated on this cross section. The cross section suggests a 4-layer system, with a sand and gravel unit at the top, underlain by a sand layer, underlain by a silty fine sand layer, underlain by a coarse sand and gravel layer. The inference of the deepest coarse sand and gravel layer is apparently based on Well 14 data alone, and there is a discrepancy between this log (which indicates very fine sand with clay overlying aquitard) and the cross section (which describes a silty fine sand layer overlying aquitard). The GeoResources report suggests that evidence for the aquitard also includes artesian conditions in Well 14 and the FHM process area well. The report specifically notes that the water level in Well 14 rose approximately 150 feet after the well's completion.

The log for Well 18 is also interesting because it only indicates "Very Fine Sand with Clay" for the bottom 330 to 420 feet, even though other information suggests that the pre-Vashon aquifer would have been encountered by that depth. GeoResources cross section B-B' runs through this well, but neither of the other wells used to construct this were drilled deep enough to penetrate the aquitard overlying the pre-Vashon aquifer system.

With regard to the deepest wells drilled, the information on the logs for wells 10 and 13 is simplest to interpret. These two wells are located considerably to the south and their logs indicate that an actual clay layer was encountered in an area where the land surface is lower and thus there is less material overlying the confining unit.

Potential Effects on Surface Water

Based on the information provided, it appears the seasonal wetlands and small lakes in the area are perched in overlying till and thus are hydraulically de-coupled from the Vashon water table. Consequently, the water levels in these should not be adversely affected by mining if proper setbacks are adhered to.

Surface water occurs seasonally within Thorndyke Creek, located west of even the 690 acre proposed MRL. Shine Creek flows near the eastern edge of the original proposed 6,240 acre area. No streams within WRIA 17 have minimum instream flows (MIFs) set in administrative rules. The 2000 Stage 1 WRIA 17 technical assessment by Parametrix, however, indicates that MIFs have been recommended for both Shine and Thorndyke creeks. The water table aquifer encountered at the proposed mine site occurs within Vashon outwash materials. Based on the water levels measured, the GeoResources report acknowledges that ground water flow in this aquifer is to the south and that the aquifer likely provides spring flow to Thorndyke Creek. The Parametrix report also assigns a "high" relative hydraulic continuity potential for portions of Thorndyke Creek and Shine Creek, as these creeks have incised pre-Vashon principal aquifer materials.

If a water right for ground water withdrawals in the 690 acre scaled-back area was required for mining operations in the future, any water right applications would face substantial hurdles due to potential effects on MIFs for Thorndyke Creek. Furthermore, even if a water right was not required, it would remain important to try and maintain these MIFs. Fortunately, if any future mining remains a minimum of 10 feet above the water table and proper stream setbacks are maintained, as suggested, then it seems unlikely that the scaled-back proposal would result in decreased creek flows due to mining.

Water Quality

With respect to concerns regarding over the Bridgehaven water supply and a proposed paving and asphalt batch plant at the Shine pit, a June 3, 1999 R & N report concluded adverse effects were unlikely because:

- Contamination from the batch plant is unlikely.
- The aquifer supplying the Bridgehaven wells is protected from the water table aquifer by a clay unit that is more than 200 feet thick.
- If contamination did migrate to the ground water, it should be limited to the water table aquifer beneath the batch plant site and naturally migrate a short distance eastward where it would discharge to the surface at natural springs.
- The recharge area for the aquifer in the Bridgehaven area is distant from and in a different direction than the batch plant.

The new MRL proposals, however, present changed conditions to those addressed by R & N. As for the third assertion, some wells located in the Shine and Bridgehaven vicinities are completed in the Vashon water-table aquifer. With regard to the fourth point, mining under the new MRL proposals could occur closer (particularly with the 6,240 acre proposal) or up-gradient (under both proposals), as compared with the conditions analyzed by R & N relative to the Bridgehaven Community wells.

GeoResources cross section B-B' and cross section E-E' in the 1994 EES/PGG report suggest an east-west mantling to the various glacial and interglacial sediments. This interpretation agrees with information on wells 10 and 13, which are located only about ½ mile apart and yet

which encountered the clay layer at a vertical elevation difference of over 100 feet. These north-south aspects of the subsurface geology take on even greater significance when analyzing potential water quality concerns for proposed mining which could be located just east of these communities.

CONCLUSIONS

Obviously, if the size of the MRL overlay was designated 690 gross acres rather than 6,240 acres originally proposed, this would pose much less of a potential threat to the quantity and quality of water resources in the area. Based on the information that was provided, the following conclusions can be made relative to either the 765 acre or the 690 acre proposals. If the 6,240 acre proposal is still to be considered, however, I would suggest that additional information and analyses be provided.

Specifically, I was asked to address concerns that the proposed MRL overlay area designation might lead to a similar situation to that which occurred at the Cadman Snohomish County site, where a gravel mining operation mistakenly punctured an aquifer. Based on the fact that future mining in this portion of the County would occur in the uppermost Vashon gravel deposits and well above the regional confining unit, there appears to be little risk that a Cadman-type puncture would occur. Furthermore, an even higher level of protection would be provided if mining were at all times to remain 10 feet above the Vashon water table aquifer, as suggested. Even though the GeoResources report indicates that observation wells were monitored for up to 2 years, no time-dependant/seasonal static water-level (SWL) data were provided. Therefore if this MRL overlay change does occur and a subsequent site-specific mining proposal undergoes permit review, it would be very helpful to have additional water-level data and associated analyses provided to verify the seasonal high water table.

With regard to other potential adverse water quantity effects from possible future mining, the most likely concern appears to be the possibility of decreased recharge to aquifers tapped by wells in the Shine or Bridgehaven communities. Based on the information provided, however, it appears unlikely that recharge to either the pre-Vashon or Vashon aquifers would be adversely affected as a result of the scaled-back proposals. The limited subsurface data and the nature of the proposal suggest that mining would remain within permeable deposits at a minimum of 10 feet above the water table and that a high level of recharge would continue to occur even if the pit was constructed. Furthermore the GeoResources report suggests that observation wells in the area would be used to monitor groundwater levels prior to and during mining operations.

Much more uncertainty exists with regard to potential adverse effects on water quantity that might result from the 6,240 acre MRL proposal. As indicated, some data suggest significant dips in tops and bottoms of units and water levels to the east and west as compared to the north and south. This information, combined with the low level of effort spent on defining the hydrogeology of Shine or Bridgehaven areas in the GeoResources report leaves open the possibility that recharge could be adversely affected in the Vashon aquifer due to mining in close proximity to these communities.

As long as future mining remained a minimum of 10 feet above the water table and proper stream setbacks were adhered to, it seems unlikely that mining under either of the scaled-back proposals would result in significant changes in Thorndyke Creek flows. With regard to the original 6,240 proposal, however, too much uncertainty remains to make such conclusions. If ground water pumping were to occur associated mining under either of the scaled-back

proposals, however, then the flows in Thorndyke Creek could be affected. Consequently, if a water right was required for such mining operations at some point in the future, it is important to recognize these applications would face substantial hurdles.

With regard to potential effects on water quality, the conclusions by R & N specifically address concerns over potential contamination of the deep Bridgehaven Community wells from a proposed asphalt batch plant at the existing Shine pit. Obviously the new MRL proposals present different concerns. With regard to R&N's assumption that potential contamination would remain in the water table aquifer, migrate eastward, and discharge to natural springs north of Bridgehaven, it must now be considered that mining could occur due east of this community. With regard to R & N's assumption that the recharge area for the Bridgehaven deep wells is distant from and in a different direction than the batch plant, this too may no longer be true.

As pointed out in the August 21, 2002 DEIS, an approval of an MRL overlay designation would not constitute approval for any site-specific mineral extraction or related activities. Therefore, bearing in mind the differences between the situation addressed by R & N, a new site specific environmental review should occur before any particular mining proposal be allowed to proceed. These new analyses could take into consideration such things as the north-south aspects of the subsurface geology, which could be significant when analyzing potential water quality concerns. As for the existence of a thick, regionally extensive, clay layer, some additional test drilling could help verify the actual extent of this pre-Vashon aquitard.

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