Appendix A1

- Quarry and Sand Pit -

Everyday business practices can pollute our groundwater, rivers and lakes. There are many Pollution Prevention Practices that we can use to prevent water pollution. Many of these Pollution Prevention Practices are simple to do, yet are very effective in keeping chemicals and wastes from harming our environment. Pollution prevention can be inexpensive, while pollution cleanup can cost thousands of dollars. Some of the Pollution Prevention Practices that were developed by people in your industry are listed below.

- Sand and gravel pits make groundwater especially vulnerable to contamination due to the permeable nature of their deposits. Mining activities should be located away from recharge areas of aquifers needed for public water supplies.
- Quickly stabilize disturbed areas by restoring overburden, replacing topsoil, avoiding steep slopes, reproducing natural drainage patterns, and replacing vegetation.
- Topsoil and subsoil should be stripped from the operation area and kept for restoration of the area.
- Incorporate appropriate drainage systems to prevent ground and surface water contamination. Drainage should not lead directly into streams or ponds.
- Limit active gravel removal to a total of five acres at any one time to minimize the amount of surface area susceptible to erosion.
- Ensure that access roads are constructed and maintained properly so as to prevent or control erosion.
- Maintain an adequate vertical separation between the deepest depth of excavation and the maximum high water table elevation.
- Liquid Storage areas must have secondary containment to hold any spills or leaks at 10% of the total volume of the containers, or 110% of the volume of the largest container, whichever is larger.
- New and waste material storage areas should be roofed, isolated from floor drains, have sealed surfaces, and be accessible to authorized personnel only.
- Underground storage tanks (USTs) should not be used, unless required by fire codes or other regulations. Above ground storage tanks (ASTs) are preferred. Tanks should have visual gauges to monitor fluid levels. Routinely check all ASTs and USTs for leaks. Nozzles used for filling tanks should have automatic shutoff valves.
- If USTs must be used, they require secondary containment monitoring, high level and leak sensing audio/visual alarms, level indicators and overfill protection. A protective plate should be placed at the tank bottom if a dip stick is used.
- Dry wells should be eliminated. All unused wells must be abandoned (Ontario Regulation 903).
- Consider a bulletin board solely for environmental concerns.
- Employees must have WHMIS training. Train all staff on proper handling, storage and transportation procedures for WHMIS materials to reduce the risk of spills and accidents.
- Keep track of where and why spills have occurred to prevent future spills.

Regional Municipality of Waterloo – Water Services Division
Website: www.region.waterloo.on.ca/water/docs/wateresouc.html
Version 1.1, November, 1998

Water
Ours to Pr tect

- Perform preventative maintenance and manage equipment and materials to minimize opportunities for leaks, spills, evaporative losses and other releases of potentially toxic chemicals.
- An operator should be on-site at all times to monitor the filling of tanks and drums.
- Drip pans should be used under spigots of chemical and oil containers to catch spills. Empty them regularly for recycling, reuse or proper disposal.
- Develop a spill prevention and clean-up plan. Include notification procedures, site plans with storm water flow directions, and potential spill sources. Clean spills promptly and report as required. The Region's Spills reporting number is (519) 650-8200; Ontario's is 1-800-268-6060.
- Use emergency spill kits and equipment. Locate them in storage areas, loading and unloading areas, dispensing areas, and work areas.

The Regional Municipality of Waterloo has a Water Resources Protection Strategy to limit the risk of contamination of our water resources. The Region has compiled a list of Pollution Prevention Practices for most businesses in the Region. For additional information on pollution prevention and Pollution Prevention Practices contact the following:

Regional Municipality of Waterloo – Water Services Division
150 Frederick Street
7th Floor
Kitchener, ON N2G 4J3
Phone: 519-575-4426
Fax: 519-575-4424
www.region.waterloo.on.ca/water/ docs/wateresouc.html

Environmental Business Source (CTT)
437-150 Frederick Street
Kitchener, ON, N2G 4J3
Phone: 519-579-4795
Fax: 519-575-4542
Email: ebsctt@oceta.on.ca

Canadian Centre for Pollution Prevention (C2P2)
100 Charlotte Street
Sarnia, ON, N7T 4R2
Phone: 1-800-667-9790
Fax: 519-337-3486
Email: c2p2@sarnia.com
http://c2p2.sarnia.com

Environment Canada Green Lane
Web page:
www.cciw.ca/green-lane/or-home.html

1.1 NOTES ON YOUR POLLUTION PREVENTION OR BEST MANAGEMENT PRACTICES...

Appendix B1

Zimmerman, Frances E (DOT)

From: Ruehle, Jerry O (DOT)
Sent: Wednesday, May 14, 2008 4:11 PM
To: Feller, Ricky (DOT); Zimmerman, Frances E (DOT)
Cc: Dougherty, Thomas J (DOT); 'Dennis R. Linnell'
Subject: RE: Section 25 Pre-Meeting

I just ran a FHWA noise nomograph (no longer approved for use, but still a fairly useful tool) for the Section 25 haul route on Eklutna Drive to see if we could meet a 50 dBA Leq noise level as recommended by the MOA. Assuming 20 operations of heavy trucks per hour during the night time operation at a speed of 30 mph I predict an approximate exterior noise level at the property line (assuming that's 60' from the road) of about 62 dBA. If we halved the operations to 10, we'd have approximately 59 dBA Leq. At 20 mph, at 20 operations I get approximately 61 dBA and at 10 operations at this speed I get 58 dBA. From these results (assuming I prepared the Nomograph correctly), it does not appear that the recommended 50 dBA Leq or existing plus 10 dBA could be met with hauling activities.

Thinking somewhat out the box, I was wondering whether we could offer up a different proposal to the Municipality. The 50 dBA Leq they're recommending for nighttime operations is actually 2 dBA lower than the FHWA interior noise abatement criteria (NAC) of 52 dBA (51 dBA if you define 1 dBA within as approaching the NAC). Since there will be no frequent human use at the property line during the night time operations (10pm -7am), maybe an interior noise level limit would be more reasonable. Perhaps 45 dBA interior noise level would be more reasonable.(In early studies on sleep, a noise level of 45 dBA woke up about 50 percent of participants in a noise study). The Municipality would have enforcement issues with this since they probably would not go into someone's bedroom to do compliance noise measuring, but the interior noise levels from traffic could be estimated based upon exterior measurement. For example, take the 62 dBA exterior noise level, subtract 17dBA for arctic construction of the house, and the interior noise level from the traffic would be approximately 45 dBA. (Note- FHWA literature shows that arctic construction with windows closed reduces noise approximately 25 dBA, while with windows opened you get about 17dBA, I just assumed windows would be open during construction season). The Municipality seems willing to stretch the noise ordinance somewhat, maybe they would consider something like this. Also, maybe this new standard would only apply when the pit is conducting night operations rather than all the time. This may be something we want Earl Mullins to flesh out as the methodology I used is dated and he has more insight into the Noise Ordinance.

From: Feller, Ricky (DOT)
Sent: Tuesday, May 13, 2008 2:37 PM
To: Zimmerman, Frances E (DOT); Ruehle, Jerry O (DOT)
Cc: Dougherty, Thomas J (DOT); Dennis R. Linnell
Subject: Section 25 Pre-Meeting

I just spoke with Dennis in preparation for our 10:00am progress meeting with the MOA. He has forwarded all the Muni data to Earl, and Earl is available for the meeting. However, Dennis felt that the best use of Earl's time may be a discussion prior to our meeting. Dennis is going to try to get to my office by 9:30 for this pre-meeting. Tom has told me he will not be able to make the 10:00, but I hope you all can join us for the pre- and meeting. Thanks a lot.

Rick Feller
Legislative and Media Liaison
State of Alaska
Department of Transportation and Public Facilities
Central Region
4111 Aviation Avenue
P.O. Box 196900
Anchorage, Alaska 99519-6900
Office: 907.269.0772
Cell: 907.632.9198
Fax: 907.248.1573

Appendix B2

SECTION 25 GRAVEL PIT NOISE

This gravel resource is being considered for extraction starting in 2009, with a useful lifetime of about ten years. Part of the noise is the normal gravel pit operations, and a second part of the noise is the transport of the gravel. The gravel would be used to support nighttime construction projects such as roads.

The Anchorage noise ordinance very strictly limits noise at residences to an Lmax of 50 dBA at night. In this case, the muni seems willing to apply the 50 decibel limit as an Leq or hourly "average". This would allow for intermittent momentary levels that are higher than 50 dB, as long as the average for a given hour did not go over Leq 50 during the nighttime hours (10:00 pm to 7:00 am).

Gravel pit operations affecting homes on Hillcrest, Pioneer, and Almdale Roads

Typical operations from a comparable gravel extraction were reported to be similar to the ambient noise, around 47 dB at the edge of the gravel pit. The momentary maximum levels were reported at up to 68 dB as far away as 600 feet.

Ambient noise in the area during the night occurred in two general ranges: Leq 43-47 until midnight, then 35-41 during the rest of the nighttime hours. This is the normal variation for typical day-night traffic patterns. The Glenn Highway is the primary noise source in the area, supplemented by some local traffic on the access road.

Based on the limited data presented, it appears that the general operating noise from gravel pit would typically be well below Leq 50 at the homes. There will be a few moments when certain equipment makes intermittent noise that would be as high as 68 dBA at homes. This would be noticeable, but still is comparable to routinely occurring noise events in the area, such as train passbys and aircraft flyovers.

It is possible that some of the gravel from the site would need to be stockpiled in berms along the eastern edge of the property, to act as a noise barrier. During the final phase of the project, the berm could be removed. Extraction and processing would already be finished, so only the loading and transportation would occur.

As another possible mitigation measure, most of the extraction and gravel processing could be done before 10 pm, so the daytime 60 dBA noise limit would apply. Only the transport portion of the work must occur after 10 pm.

Powder Ridge Subdivision

This cluster of homes is located off Eklutna Park Drive / North Eagle River Access Road. The gravel haul trucks will be passing by these homes during the night. Projections indicate that about 20 trucks per hour will be operating during peak transport periods.

The area is exposed to a fair amount of traffic noise from the Glenn Highway, and noise from the Alaska Railroad. The overnight data collected by the muni indicates a background level of Leq 43-47 between 10 pm - 1 am, Leq 35-38 between 1 - 6 am, and Leq 42 for the 6-7 am hour. Lmax levels of 55-74 occurred throughout the nighttime hours. These are most likely aircraft flyovers, train passbys, local traffic passing near the monitor, or particularly loud vehicles on the highway. Momentary maximum levels from trucks on the haul route will be comparable to these pre-existing peak noise events. The Lmax will occur more frequently and routinely with the trucks, however.

Based on a quick calculation, heavy trucks running at the posted speed limit of 30 mph through this area, would produce noise at Leq 56 for any given hour at the setback of the nearest home, about 60 feet. Most homes near this road segment are 90-100 feet from the road, so the noise would be about 3-4 dB lower.

Based on 20 trucks per hour at night, it will not be possible to meet an Leq 50 dBA limit at the nearest homes along the haul route. 10 trucks per hour yields Leq 53. To meet Leq 50, the limit is 5 trucks per hour at the nearest home.

If we assume the façade of a typical home at 100 feet back from the road (rather than on the common property line) then 20 truck operations per hour yields Leq 52. Ten trucks per hour will create noise at Leq 49, which meets the target.

As a direct comparison, the nighttime ambient is roughly 43 dB for half of the nighttime hours. Full truck traffic will be 56 dBA at 60 feet, which is 13 decibels higher than the ambient. For the quietest hours, the increase due to trucks is about 20 dB. Truck traffic will definitely raise the perceived noise level in the neighborhood, and has to be categorized as creating an impact. It will be fairly challenging to meet the Leq 50 target and have more than ten truck operations per hour.

Indoor-Outdoor Noise Reduction

There has been some discussion of the federal limits for acceptable indoor noise. Ldn 45 is the normal limit for indoor noise levels used by FHWA, HUD, and similar agencies. The standard amount of noise attenuation for a residential façade of typical construction is 15 dBA, and that includes partially opened windows.

The most common criteria for indoor noise allows an outdoor level of Ldn 60 at homes. The resulting indoor noise level is then Ldn 45 or less, which is considered acceptable.

In this case, the haul route at 20 trucks per hour is predicted at Leq 56. But because the trucks operate at night, we must add 10 dB to these levels, yielding Leq 66 for a 20-truck hour. That means that the indoor criteria will be exceeded by about 6 decibels.

Appendix C1

Checklist of open items for Response to Comments:

1. Confirm commitment with DOT to assure one foot or more of silt and/or organics during reclamation and re-vegetate with appropriate native species.

2. The operational plan that will be developed will result in the construction of an operations area in the west that is at least 6 feet above the seasonal high water table during the development of most of the pit. The operations area will be among the last areas excavated to the eventual design bottom at the end of pit life. (Note: – To address Wheaton comments, suggest designing initial staging area east of the proposed location on ground where gravel has not yet been extracted (or on till) to minimize potential discharge of contaminants to the ARR ditch. This may increase noise, visual and dust to neighbors, however. Later, after gravel is removed from the west end, the plant can be moved and the last of the gravel extracted under the former plant site.)

3. Wheaton and neighbors recommend installing monitoring wells and mapping aquifer and seasonal variability of water table. Suggest client consider performing this work during spring breakup, 2008. Will additionally provide improved estimate of gravel resource quantity. Current estimates could be off by several hundred thousand cy.

4. We need to estimate the horizontal distance that groundwater flows through the aquifer from potential contaminant source areas (planned staging area, fueling area, asphalt plant, or stormwater collection and infiltration areas) prior to discharging at the base of the bluff near the Alaska Railroad tracks. 500 ft? 1000 ft? More is better.

5. Mr. Wheaton seems to be recommending that surface runoff from the pit surface should be directed to an area of the pit where it will pool up and gradually infiltrate to avoid excessive turbidity from entering surface water bodies. This should be addressed. As the pit is developed, this may require a phased design that makes use of varying low areas of the pit as development proceeds. It is our interpretation of the comment that implementation of the italicized items on page 6 will result in adequate control of "other, particularly soluble, contaminants". DOT should consider including these items as enforceable provisions in the development plan. Exceptions should be itemized or further guidance provided on how to respond to this item.

6. Recommend identification of BMPs applicable to this site. There aren't any directly applicable that I am aware of. The existing state guidance document focuses on surface water controls, and doesn't do much about addressing the concerns expressed. Some of the material typically contained in a SPCCC plan is more relevant.

7. Recommend DOT concur that a contingency plan for aquifer impacts is unnecessary.

8. Recommend HDL recheck whether MOA on-site records were searched for well logs. This is a time-consuming lot-by-lot search. If any are found, we could probably just enter them into the record, evaluate them, and say that they were evaluated and do not change the prior assessment. My May 7 report was vague on this topic and it should be clarified (my fuzzy recollection is that only WELTS was searched, and that is why I left it vague, but I could be wrong).

9. Recommend selection of monitoring well locations and number as part of response to comments.

10. Need to evaluate hydraulic function of drainage ditches at high water level. Will they drain off excess water so that the water table would not be expected to breach the land surface during or after extraction? Is this a good or bad thing? This may be considered a diversion of water and be of concern for subsequent availability of water.

11. Need to evaluate what should happen if groundwater rises to within 2 ft of the pit bottom, which is fairly likely, unless the year of water level measurements happens to be performed during a peak precipitation year. Stop work? There is a "Duration" issue here. I have previously commented that excursions from the two ft limit should be expected, mostly during spring and fall.

12. Hours of operation, noise limits, and dust control issues – HDL lead.

13. "Process water" and dust control. Need to define or specify water sources outside the pit area and whether there will be any return water or other water control issues. Is DOT willing to rule out a wash plant?

14. Batch plant. Operational and engineering control of contaminants should be demonstrated with regulatory verification. This may be the biggest potential source and the most difficult to control and with the greatest unknowns. A large part of my response is predicated on the general absence of contaminant sources. If batch plants are not thoroughly evaluated and addressed, opponents could blow my analysis right out of the water. Perhaps it should be sited on till at the edge of the pit.

15. Consider having a technical work session to find out what Alan Peck is talking about on a few items ("hydraulic stresses, reclamation concerns affecting water quality) and to hammer out a monitoring program including number and locations of wells and parameter lists, frequency, etc. There seems to be an ongoing lack of dialogue that is driving people a little bit crazy. Alan keeps shotgunning the same comments. Even though I have commented on them (and agreed completely with some!), they keep coming up and are not getting resolved. The public process would be improved if we focused on the few key items of concern and disagreement.

16. DOT should consider drafting a list of reasonable items that will be attached to any contract that will bind their future gravel pit operator. If operators know what they are getting into from the get-go, fewer problems can be expected down the road. Most of these items should be in the category of good housekeeping, which is not unreasonable to be expected for a gravel pit operator in an urban area. This may take more than a week to develop and would be consistent with a decision to collect more data this spring. Perhaps a list of permits/approvals that are needed would be a good start and helpful to the P and Z process.

17. Additional research regarding the "sound science" behind the 2-ft buffer may be warranted since neighbors feel that the Extraction Agreement should not be binding on the P and Z. This has come up in a lot of other jurisdictions in Alaska and around the US.

18. Additional research about "how much water levels in this aquifer might fluctuate from year to year" is warranted. This is not well studied and there is considerable uncertainty, however there are quite a few historic water level observation wells in Anchorage area that would provide a basis for the analysis. It will be hard to get this accomplished in a week's time. This would be a minor benefit for delaying the process.

Appendix C2

Communication Record

Conversation with: Dan Roth

Affiliation: Municipality of Anchorage, On-Site Water and Wastewater

Address: Anchorage, AK

Phone: (907) 343-7907

Date: April 18, 2008

Time: 12:55 to 1:15 pm

Type of conversation: Phone

Person Documenting Conversation: Alan Peck

Topic: Recommendation on vertical separation distance

Geographic Area(s): North Eagle River are, Section 25

Summary:

Mr. Roth was contacted about a memo he wrote and sent to Al Barrett, Senior Planner with MOA, in 2007. Mr. Barrett provided Mr. Roth with details on the hydrology aspects related to the DOT applicant's gravel extraction conditional use permit. The memo provided Mr. Roth's recommendations.

In our conversation, Mr. Roth said that a four ft vertical separation distance between the seasonal high water table and the excavation bottom was prudent. His familiarity with heavy equipment typically used in material excavation caused him concern if a 2 ft vertical separation was to be maintained. Given the size of equipment buckets, there is an increased risk that the water table would be inadvertently encountered. His career experience in seeing the problems encountered with water contamination associated with wastewater and septic lead him to recommend a 4 ft vertical separation which is required by the State for septic systems.

I asked Mr. Roth for a copy of the memo he sent to Al Barrett, but he was unable to locate it. He acknowledged that he did not have jurisdiction in this case and therefore it is likely he did not save a copy of the memo.

Appendix C3

Barrett, Al W. (Zoning)

From: Langdon, Margaret E.
Sent: Monday, January 28, 2008 10:59 AM
To: Barrett, Al W. (Zoning)
Cc: Wheaton, Scott R.
Subject: Birchwood gravel site

Attachments: BirchwoodPit08_Prelim.doc

Hi Al,

I still have your files on this; you may come and get them anytime.

Attached is the report of the visit Scott and I made. I previously sent you draft comments. The stormwater protection portion of those comments is still applicable.

Do you have any updates on the status of this application?

BirchwoodPit08_Prelim.doc (2 M...

Mel Langdon
907-343-7523
Municipality of Anchorage Watershed Management Services
P.O. Box 196650
Anchorage, AK 99519-6650

DATE: January 11, 2008

TO: Steve Ellis, WMS Platting Review

THRU: Kristi Bischofberger, Watershed Administrator
Watershed Management Services

FROM: Scott R. Wheaton, Watershed Scientist
Watershed Management Services

SUBJECT: Birchwood Pit Preliminary Watercourses Mapping

WMS has completed reconnaissance mapping of watercourse features generally located in the vicinity of the westward projections of Pioneer Drive and Almdale Avenue and east of the Alaska Railroad and the Fire Creek floodplain (Figure 1). Mapping was performed in response to requests for information relative to development proposals for a gravel pit in this area. Mapping results of the vicinity are summarized in the following report.

During this mapping WMS made substantial effort to accurately and completely locate important features in the target area, within the mapping guidelines and standards currently applied by WMS and in context with the requested investigation. The mapping presented in this report is believed to reasonably reflect the probable presence and location of major drainageways and stream features in the target area. However, this mapping was performed in winter with snow fully covering the ground. Additional field inspection after snow and ice in the vicinity has melted this coming spring will be required to confirm and refine the results of this current report. Municipal code prescribes the responsibility of accurate and complete mapping of watercourses to individual land owners and developers. Use of this current report without post-breakup confirmation is at the risk of the user.

Watercourse Mapping

Field reconnaissance mapping of the area was completed on January 9, 2008. Field mapping was completed by Scott R Wheaton and Mel Langdon. Field traverses were completed with about a 0.5-foot snow cover on the ground, though some ground was better exposed along ditch and cut lines. During mapping, weather was high overcast and cold (about 5° F) with daily low temperatures for much of the preceding week near 0° F. All field work proceeded without incident.

This mapping included investigation for both stream features and major drainageways. All features were approximately located in the field and on base ortho-imagery applying WMS' hydrography criteria (WMS document WMP APg04001, 'Municipal Stream Classification: Anchorage, Alaska', January 2004) and map-grade mapping standards (WMS document APg01001, 'Municipality of Anchorage Stream Mapping Standards, ver. 1.04', May 2005). Field mapping was done by walking railroad RsOW, cut-lines, and trails, and making short traverses up embankment cuts, and along ravines and other indicative landforms.

To help define feature locations, GPS data were collected at a total of 2 field points in WGS 1984 Datum using a Trimble GeoExplorer 3 mobile receiver. All GPS data were differentially corrected using Trimble Pathfinder ver. 3.10 software and base station files obtained from the Anchorage National Geodetic Survey CORS station (http://www.ngs.noaa.gov/CORS/cors-data.html). All feature points contained sufficient valid positional data for feature location analysis. Horizontal location accuracy has not yet been tested for WMS' map grade GPS methodology but is generally expected to be within 2 to 4 meters of true ground positions for the device used.

Alignments of watercourse and other features were estimated and plotted using the field GPS location data along with MOA 2006 0.3 meter ortho-imagery (Anchorage_2006.sid) and 4-foot LIDAR-based contour elevation (EagleRiver4ft.shp) and hillshade (er2ek_hs.shp) data. Locations plotted at GPS data points are estimated to have horizontal accuracies consistent with WMS' map-grade survey standards. Locations plotted without GPS supporting data are predominantly dependant upon interpretation of contour and ortho-imagery data, and may have larger horizontal error. However, despite these potential errors, mapped features are believed to reasonably represent the presence and location of watercourse and other features as delineated in Figure 1 and as otherwise limited as stated in this report.

Watercourse Mapping Results

WMS completed and reported mapping in this vicinity in 2004, 2005, and 2007 centered mostly around the west end of Almdale Avenue. Mapping identified and reported a major natural drainageway draining a large wetland southwest of Almdale, crossing Almdale south to north, and dropping down a steep bluff to enter a broad late-glacial channel feature (labeled 'Outwash Apron/Channel') in the vicinity of the west end of Pioneer Drive (Figure 1). General surface drainage continued to the west along the outwash channel feature but no surface flows or modern channels were observed at that time and reconnaissance did not continue further to the north. In these earlier investigations, intermittent surface flows were observed along the upper end of the major drainageway identified in Figure 1 but channel features with distinctive beds and banks were not. The feature was therefore classified as an important ephemeral channel feature that would carry significant flows with further vicinity development.

For the current (2008) request, field reconnaissance was completed across the surface of the large glacial outwash channel beginning from about the west end of Pioneer Drive and then proceeding generally southwest to the vicinity of the Alaska Railroad (ARR) ROW. The outwash feature is the surface expression of a floodplain cut deep into underlying glacial tills by a late-glacial meltwater stream during the last major ice age in the Anchorage vicinity. The outwash channel surface between Pioneer Drive and the ARR ROW is broad and generally planar and showed little surface pitting along our traverse. Local relief along our 2008 route consists of numerous but relatively short and discontinuous, shallow swales having depths on the order of 1 to 2 feet. These swales appeared to be ice free beneath the snow cover and displayed no signs of surface water flow. The outwash surface overall has a gradient of about 0.01 feet/feet draining from northeast to southwest (Figure 1) based on MOA LIDAR-derived elevation data. In general, during this and earlier site visits this old floodplain surface appeared well drained. Despite the snow cover present during the latest reconnaissance, we observed no surface evidence of any stream channels anywhere along this portion of our traverse, including all along the top edge of the west extent of this feature where it is cut by a steep embankment dropping down to the ARR.

However, we did observe surface flows (a total of about 0.5 cubic feet per second, cfs) in the ARR ditches located along the base of the steep embankment at the west edge of the outwash channel feature. At this point the relatively planar surface of the old outwash channel feature ends and the ground drops abruptly about 30 feet down a steep excavated embankment to the ARR ditch line (and a total of about 85 feet to the modern floodplain of Fire Creek further downslope). At the time of our investigation flows observed in the ARR ditch originated as seeps and springs extending for about 2,300 feet along the cut face of the embankment (Figure 1, 'Seepage Zones'). Surface flows in the ditches generally did not have an ice cover despite the very cold temperatures. The seeps and flowing springs feeding the ditch flows originated at elevations ranging from 0.5 to a few feet above the water surface in the ditch (or about 25 feet below the surface of the outwash floodplain). On the basis of the unfrozen surface water in the ditches and the elevation of the seeps and springs above the ditch water surface, source for the flows is inferred to be local shallow ground water intercepted by the cut banks along the ARR ROW. The greatest volume of flow during our reconnaissance entered the ditches at the southern end of the cut embankment with the contributing ground water flow volume continuously decreasing towards the north. Flows in the ditch ceased altogether beyond the north margin of the outwash channel feature despite railroad ditch elevations much lower than the ditches to the south where contributing flows were at a maximum (Figure 1).

Conclusions and Recommendations

Given that ground water flows along the ARR ditch exited only from cut embankments immediately adjacent to the outwash channel feature and were not observed even at lower ditch elevations in different adjacent terrain types, the outwash channel feature appears to provide an important local path for relatively shallow unconfined ground water flow. A high overall transmissivity to ground water for the sediments making up the outwash channel feature is reasonable based on their apparent genesis as better-sorted, gravelly, glacio-fluvial deposits and is consistent with lack of any indication of flows on the surface of the old floodplain. On the basis of the position of the largest contributing spring flows along the ARR ditch, shallow ground water flow within these sediments also appears to be preferentially concentrated at the southern margin of the old outwash feature. Based on an assumption that the outwash channel feature is cut into underlying tills having significantly lower permeabilities than the channel gravels, a further reasonable conclusion would be that the shallow ground waters discharging into the ARR ditch line are perched upon underlying less permeable glacial tills. Depths to shallow ground water along the outwash feature were not addressed in this investigation, but are anticipated to lie at depths of 10 or more feet below the old floodplain surface, given the general conditions observed.

These observations and conclusions suggest several issues relative to development of the western end of the floodplain surface for gravel extraction:

1. Based on our observations to date, there appears to be no stream or ephemeral channel features entering, crossing or exiting the outwash floodplain surface. This finding is generally consistent with the nature of the floodplain surface and its apparent sediment

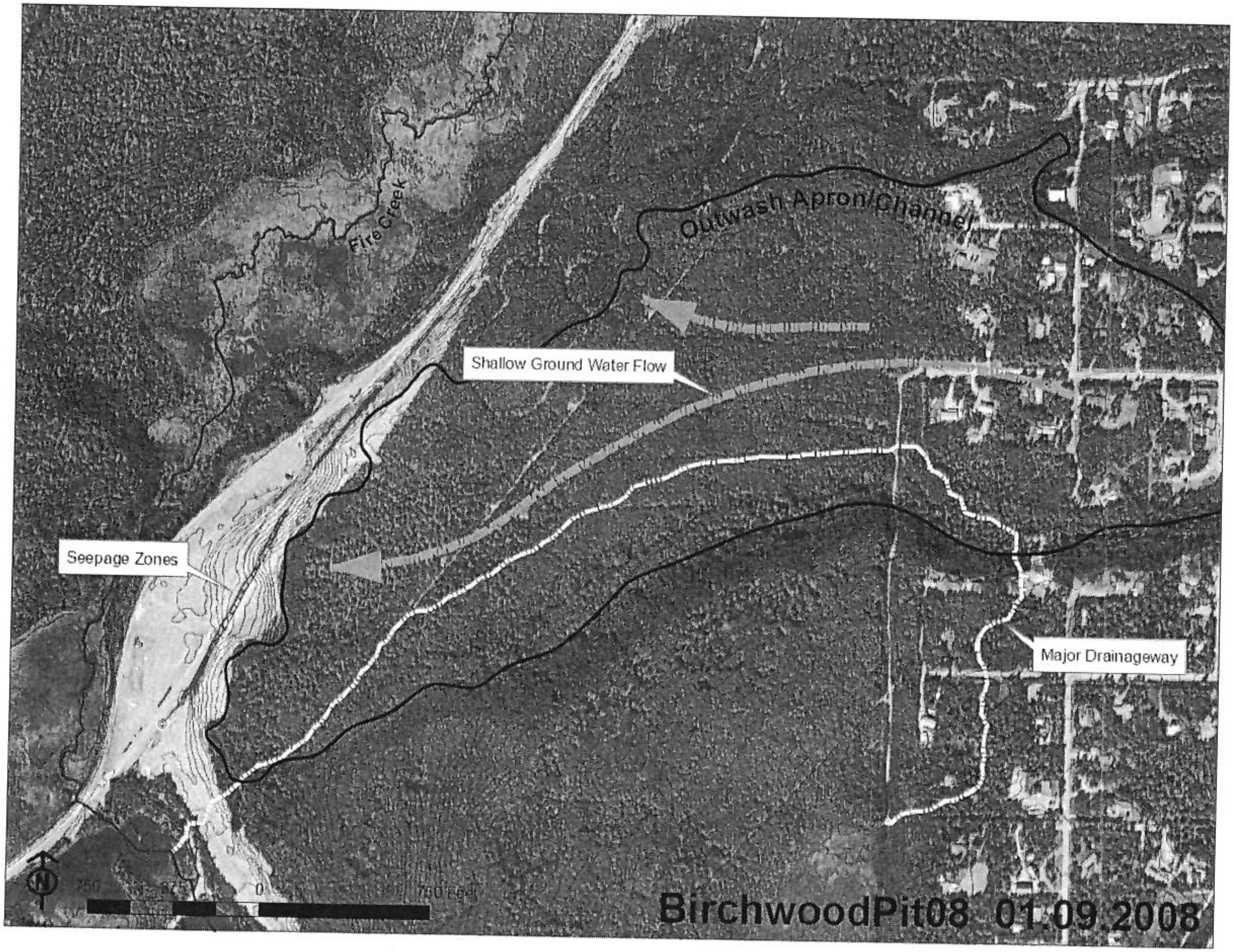
composition. Nevertheless, the only field reconnaissance to date was done under full snow cover conditions. *A final reconnaissance following melt of the snow and ice cover is required to confirm the preliminary finding of no streams.*

2. Some consideration for maintenance of continuity and control of surface drainage entering the proposed development area from the west will be required (particularly with increasing upgradient development). This will be particularly important in terms of: prevention of increased erosion along slope breaks (as at pit headwalls); control of increased runoff peaks and volumes; and prevention of deterioration of runoff water quality, particularly as these relate to protection of the Fire Creek floodplain. *Upgradient surface flows should be directed away from the open pit and across dedicated undeveloped floodplain surface.*
3. Considering the flux of shallow ground water concentrated along the outwash floodplain and the overall transmissivity of the sediments comprising it, a 2-foot vertical separation between the pit floor and the shallow ground water table is not likely to adequately protect existing hydrologic systems, including Fire Creek. Development of the pit will remove the existing protective cover of vegetation and fine grain soils from the old floodplain surface. This cover currently serves to filter surface waters that infiltrate and recharge the underlying shallow ground water system. Without this cover, infiltration into the exposed gravels will be rapid, transporting any contaminants in surface runoff much more quickly to the shallow ground water system, and will obviously be faster, the thinner the cover over the saturated zone. Potential for contamination of the shallow ground water system will be further exacerbated by proposed development activities—gravel extraction and processing. These activities will certainly include trafficking of the pit surface by heavy equipment and support vehicles, and most likely the screening, crushing, and washing of raw pit materials. Fugitive leaks, spills and process waters and wastes will be subject to leaching and mobilization with precipitation and runoff. Rate and degree of mobilization of these wastes into the shallow ground water system will be increased by a too-thin gravel cover. Once in the shallow ground water system, mobilized contaminants will be short-circuited to the surface and into nearby Fire Creek by the existing ARR ditch cut. Seasonal fluctuations in shallow ground water elevations are also likely to increase after development of the floodplain surface. Larger fluctuations will result in a significant increase in the average annual maximum elevation of the shallow ground water surface over that currently measured under undeveloped conditions. This means that if excavation proceeds to a depth based on pre-development ground water elevations, the pit surface is likely to be finished with a much smaller separation than the two-feet currently proposed. This could result in additional surface seeps and spring flows across the pit floor where surface contaminants are most likely to have accumulated. Finally, effective capping and restoration of the site after gravel depletion will be made more difficult by a thin separating gravel cover. *Detailed mapping of the average elevation and seasonal variability in the elevation of the shallow ground water table should be completed as part of preliminary development planning. This mapping should include determination of the thickness and width of the unconfined aquifer. In any event, the vertical separation distance between the finished pit floor and the highest seasonal position of the shallow ground water table should not be less than 4 feet.*

4. For all of the reasons discussed above, with poorly controlled or designed pit activities the potential is high for contaminants to enter the shallow ground water system and from there to be short-circuited to the surface and to the adjacent Fire Creek floodplain. Because potential for rapid infiltration to the shallow ground water system will be increased below the pit floor and ground water flow paths to surface discharge points are short, preventing surface runoff from the pit surface alone will not be sufficiently protective of adjacent surface water bodies. These practices may be sufficient to control excessive turbidity from the operating pit but are not likely to be adequate to control other, particularly soluble, contaminants. *Pit operations and practices should include appropriate controls for fueling, parking, and vehicle maintenance, and materials processing, including at minimum appropriately designed pads where infiltration of contaminants generated by these activities can be more readily controlled.*

SRW/srw
WMS\zzWtrcourseMppng_08/BirchwoodPit08_Prelim.doc

Figure 1: BirchwoodPit08 Watercourse Features



Appendix C4

DATE: February 19, 2008

TO: Steve Ellis, WMS Platting Review

THRU: Kristi Bischofberger, Watershed Administrator
Watershed Management Services

FROM: Scott R. Wheaton, Watershed Scientist
Watershed Management Services

SUBJECT: Birchwood Pit Revised Preliminary Watercourses Mapping

Steve, since publishing a memo dated January 11 with our preliminary findings and comments for this site, I have met with DOT consultants including their hydrologist Jim Munter on February 13th. I have also had time to briefly review technical documents prepared by DOT and its consultants, including Mr. Munter. After this additional review, our findings and recommendations remain generally the same but some important modifications to the initial memo have been made as a result of discussions at the February 13th meeting. Please note particularly additional discussions under bullet 3 and 4 in our recommendations.

Original text as modified through discussions and additional review above follows:

WMS has completed reconnaissance mapping of watercourse features generally located in the vicinity of the westward projections of Pioneer Drive and Almdale Avenue and east of the Alaska Railroad and the Fire Creek floodplain (Figure 1). Mapping was performed in response to requests for information relative to development proposals for a gravel pit in this area. Mapping results of the vicinity are summarized in the following report.

During this mapping WMS made substantial effort to accurately and completely locate important features in the target area, within the mapping guidelines and standards currently applied by WMS and in context with the requested investigation. The mapping presented in this report is believed to reasonably reflect the probable presence and location of major drainageways and stream features in the target area. However, this mapping was performed in winter with snow fully covering the ground. Additional field inspection after snow and ice in the vicinity has melted this coming spring will be required to confirm and refine the results of this current report. Municipal code prescribes the responsibility of accurate and complete mapping of watercourses to individual land owners and developers. Use of this current report without post-breakup confirmation is at the risk of the user.

Watercourse Mapping

Field reconnaissance mapping of the area was completed on January 9, 2008. Field mapping was completed by Scott R Wheaton and Mel Langdon. Field traverses were completed with about a 0.5-foot snow cover on the ground, though some ground was better exposed along ditch and cut lines. During mapping, weather was high overcast and cold (about 5^{o} F) with daily low temperatures for much of the preceding week near 0^o F. All field work proceeded without incident.

This mapping included investigation for both stream features and major drainageways. All features were approximately located in the field and on base ortho-imagery applying WMS' hydrography criteria (WMS document WMP APg04001, 'Municipal Stream Classification: Anchorage, Alaska', January 2004) and map-grade mapping standards (WMS document APg01001, 'Municipality of Anchorage Stream Mapping Standards, ver. 1.04', May 2005). Field mapping was done by walking railroad RsOW, cut-lines, and trails, and making short traverses up embankment cuts, and along ravines and other indicative landforms.

To help define feature locations, GPS data were collected at a total of 2 field points in WGS 1984 Datum using a Trimble GeoExplorer 3 mobile receiver. All GPS data were differentially corrected using Trimble Pathfinder ver. 3.10 software and base station files obtained from the Anchorage National Geodetic Survey CORS station (http://www.ngs.noaa.gov/CORS/cors-data.html). All feature points contained sufficient valid positional data for feature location analysis. Horizontal location accuracy has not yet been tested for WMS' map grade GPS methodology but is generally expected to be within 2 to 4 meters of true ground positions for the device used.

Alignments of watercourse and other features were estimated and plotted using the field GPS location data along with MOA 2006 0.3 meter ortho-imagery (Anchorage_2006.sid) and 4-foot LIDAR-based contour elevation (EagleRiver4ft.shp) and hillshade (er2ek_hs.shp) data. Locations plotted at GPS data points are estimated to have horizontal accuracies consistent with WMS' map-grade survey standards. Locations plotted without GPS supporting data are predominantly dependant upon interpretation of contour and ortho-imagery data, and may have larger horizontal error. However, despite these potential errors, mapped features are believed to reasonably represent the presence and location of watercourse and other features as delineated in Figure 1 and as otherwise limited as stated in this report.

Watercourse Mapping Results

WMS completed and reported mapping in this vicinity in 2004, 2005, and 2007 centered mostly around the west end of Almdale Avenue. Mapping identified and reported a major natural drainageway draining a large wetland southwest of Almdale, crossing Almdale south to north, and dropping down a steep bluff to enter a broad late-glacial channel feature (labeled 'Outwash Apron/Channel') in the vicinity of the west end of Pioneer Drive (Figure 1). General surface drainage continued to the west along the outwash channel feature but no surface flows or modern channels were observed at that time and reconnaissance did not continue further to the north. In these earlier investigations, intermittent surface flows were observed along the upper end of the major drainageway identified in Figure 1 but channel features with distinctive beds and banks were not. The feature was therefore classified as an important ephemeral channel feature that would carry significant flows with further vicinity development.

For the current (2008) request, field reconnaissance was completed across the surface of the large glacial outwash channel beginning from about the west end of Pioneer Drive and then proceeding generally southwest to the vicinity of the Alaska Railroad (ARR) ROW. The outwash feature is the surface expression of a floodplain cut deep into underlying glacial tills by a late-glacial meltwater stream during the last major ice age in the Anchorage vicinity. The outwash channel surface between Pioneer Drive and the ARR ROW is broad and generally planar and showed little surface pitting along our traverse. Local relief along our 2008 route consists of numerous but relatively short and discontinuous, shallow swales having depths on the order of 1 to 2 feet. These swales appeared to be ice free beneath the snow cover and displayed no signs of surface water flow. The outwash surface overall has a gradient of about 0.01 feet/feet draining from northeast to southwest (Figure 1) based on MOA LIDAR-derived elevation data. In general, during this and earlier site visits this old floodplain surface appeared well drained. Despite the snow cover present during the latest reconnaissance, we observed no surface evidence of any stream channels anywhere along this portion of our traverse, including all along the top edge of the west extent of this feature where it is cut by a steep embankment dropping down to the ARR.

However, we did observe surface flows (a total of about 0.5 cubic feet per second, cfs) in the ARR ditches located along the base of the steep embankment at the west edge of the outwash channel feature. At this point the relatively planar surface of the old outwash channel feature ends and the ground drops abruptly about 30 feet down a steep excavated embankment to the ARR ditch line (and a total of about 85 feet to the modern floodplain of Fire Creek further downslope). At the time of our investigation flows observed in the ARR ditch originated as seeps and springs extending for about 2,300 feet along the cut face of the embankment (Figure 1, ‘Seepage Zones’). Surface flows in the ditches generally did not have an ice cover despite the very cold temperatures. The seeps and flowing springs feeding the ditch flows originated at elevations ranging from 0.5 to a few feet above the water surface in the ditch (or about 25 feet below the surface of the outwash floodplain). On the basis of the unfrozen surface water in the ditches and the elevation of the seeps and springs above the ditch water surface, source for the flows is inferred to be local shallow ground water intercepted by the cut banks along the ARR ROW. The greatest volume of flow during our reconnaissance entered the ditches at the southern end of the cut embankment with the contributing ground water flow volume continuously decreasing towards the north. Flows in the ditch ceased altogether beyond the north margin of the outwash channel feature despite railroad ditch elevations much lower than the ditches to the south where contributing flows were at a maximum (Figure 1).

Conclusions and Recommendations

Given that ground water flows along the ARR ditch exited only from cut embankments immediately adjacent to the outwash channel feature and were not observed even at lower ditch elevations in different adjacent terrain types, the outwash channel feature appears to provide an important local path for relatively shallow unconfined ground water flow. A high overall transmissivity to ground water for the sediments making up the outwash channel feature is reasonable based on their apparent genesis as better-sorted, gravelly, glacio-fluvial deposits and is consistent with lack of any indication of flows on the surface of the old floodplain. On the basis of the position of the largest contributing spring flows along the ARR ditch, shallow ground water flow within these sediments also appears to be preferentially concentrated at the southern margin of the old outwash feature. Based on an assumption that the outwash channel feature is cut into underlying tills having significantly lower permeabilities than the channel gravels, a further reasonable conclusion would be that the shallow ground waters discharging into the ARR ditch line are perched upon underlying less permeable glacial tills. Depths to shallow ground water along the outwash feature were not addressed in this investigation, but are anticipated to lie at depths of 10 or more feet below the old floodplain surface, given the general conditions observed.

These observations and conclusions suggest several issues relative to development of the western end of the floodplain surface for gravel extraction:

1. Based on our observations to date, there appears to be no stream or ephemeral channel features entering, crossing or exiting the outwash floodplain surface. This finding is generally consistent with the nature of the floodplain surface and its apparent sediment composition. Nevertheless, the only field reconnaissance to date was done under full snow cover conditions.

   A final reconnaissance following melt of the snow and ice cover is required to confirm our preliminary finding of no streams.

2. Some consideration for maintenance of continuity and control of surface drainage entering the proposed development area from the west will be required (particularly with increasing upgradient development). This will be particularly important in terms of: prevention of increased erosion along slope breaks (as at pit headwalls); control of increased runoff peaks and volumes; and prevention of deterioration of runoff water quality, particularly as these relate to protection of the Fire Creek floodplain.

   Upgradient surface flows should be directed away from the open pit and across dedicated undeveloped floodplain surface. In discussions on February 13 with the applicant's consultants, construction of an upgradient dike around all or a portion of the perimeter of the pit to divert and lengthen the flow path of upgradient storm water seemed a possible alternative solution. However the effectiveness of this alternative is dependant upon little or no upgradient ditching and little or no significant impoundment of flows against the dike.

3. Considering the flux of shallow ground water concentrated along the outwash floodplain and the overall transmissivity of the sediments comprising it, the minimal 2-foot vertical separation proposed between the finished pit floor and the shallow ground water table will (a) significantly increase the sensitivity of these systems and adjacent surface receiving waters to water quality impacts and (b) significantly increase costs of restoring or using the completed pit for other landuses.

   Development of the pit will remove the existing protective cover of vegetation and thin layer of fine grain soils from the old floodplain surface. This cover currently serves to filter surface waters that infiltrate and recharge the underlying shallow ground water system. Without this cover, infiltration into the exposed gravels will be rapid, making the system much more sensitive to transport of any contaminants in surface runoff into the shallow ground water system. This shortened recharge travel path in concert with the shortened travel path through the aquifer to its surface discharge to Fire Creek significantly increases sensitivity of the system to transport of any contaminants carried by infiltrating precipitation. Mr. Munter takes the position that time of infiltration from ground surface to the shallow aquifer is already short (hours to a day or so at most), based on his observations of rapid aquifer response times he has observed at another site. However he offers no substantive evidence that the site he references is sufficiently similar to this site for use in a valid comparison and no evidence that such rapid response is not due solely or predominantly to trapped air compressed beneath the recharge pulse. Conversely calculations we have performed using conservative 2-layer surface impoundment methods (e.g., see McWhorter D.B. and Nelson, J.D., 1978, Journal of Geotechnical Division, ASCE) suggest that infiltration times under undeveloped conditions are more prolonged, on the order of days to several weeks, particularly for critical fall rains when recharge occurs as pulses. On the bases of these same calculations, at pit completion infiltration times will be greatly shortened, with recharge traveling the proposed two foot thickness in a span of time on the order of a few hours.

Changes in recharge times could also lead to seasonal fluctuations in shallow ground water elevations due to loss of attenuation of recharge pulses. Fluctuations could result in a significant increase in the average annual maximum elevation of the shallow ground water surface over that currently measured under undeveloped conditions, particularly during the spring snowmelt and fall rainy seasons. This would mean that ground water may approach closer to the finished pit than otherwise anticipated, based on pre-excavation ground water measurements. However I agree with Mr. Munter’s comment that any such fluctuations are likely to be attenuated as the discharge face along the ARR ROW is approached. In this area the water table position is likely to be more stable as a result of ongoing dewatering of the unconfined aquifer at the railroad ditchline.

Finally, a finished average water table depth of 2 feet has important implications for costs of restoration, development and maintenance for other landuses across the completed pit surface, even for simple playing field or park applications. For example, any structure requiring a permanent stable foundation (42 inches below ground surface) will require either design for a wet footing or fill to raise the base of the footer above average ground water elevation. Similar consideration will have to be given designs to prevent frost heave (e.g., for fencing, lighting, etc.). With a seasonal elevated ground water table, even surface features like paved paths may become subject to frost heave problems and maintenance of vegetation cover may be impacted as well. Though cabling and irrigation piping may be less sensitive to impacts due to their shallower required burial depths (on the order of 1.5 to 4 feet), a shallow ground water table (particularly a fluctuating one) will still have impacts on ease of burial, placement of ancillary structures (thrust blocks, bedding etc.) and potentially on corrosion. Finally a shallow ground water table will also have implications on the range of landuses that can be allowed on the finished pit surface and the controls that may be required. For example, just grading the ground surface to drain for development of dry playing fields will not be possible if the minimum separation between the surface and the shallow ground water table is to remain at two feet. Range of uses will also be limited. Because of the proposed shallow ground water position, certainly no motor sports could ever be allowed on the surface. Similarly, any paved parking facilities would require mounding to reduce the potential for frost damage and to provide sufficient burial depth for installation of special spill and storm water controls that would be required to protect nearby Fire Creek. Even unpaved parking facilities would require special parking pad designs and diking to prevent vertical infiltration or runoff of de minimus spills and chronic leaks.

A too-shallow post-development ground water table, then, represents a significantly increased sensitivity to water quality impact and increased costs or reduced opportunities for post-excavation landuse restoration and use.

Detailed mapping of the average elevation and seasonal variability in the elevation of the shallow ground water table should be completed as part of preliminary development planning. This mapping should include determination of the thickness and width of the unconfined aquifer. In any event, the vertical separation distance between the finished pit floor and the highest seasonal position of the shallow ground water table should be carefully reconsidered based on actual limitations that such a selected separation distance will have on development, maintenance and water quality protection costs for proposed restoration landuses. If post-pit landuse options are to be optimum (excluding on-site systems), minimum separation distance should be established at 42 inches.

4. Removal of the original soil and gravel cover significantly increases potential for contamination of the shallow ground water system and adjacent receiving waters, with risk increasing as the finished separation distance between the finished surface and shallow ground water decreases. The proposed location of gravel extraction and processing operations near the ARR further increases risks to adjacent Fire Creek. These activities will certainly include trafficking of the pit surface and nearby roadways by heavy equipment and support vehicles, most likely the screening, crushing, and washing of raw pit materials, and reportedly asphalt plant operations. Fugitive leaks, spills and process waters and wastes will be subject to leaching and mobilization with precipitation and runoff and, without proper control, have a high potential for directly entering Fire Creek in surface runoff. Whether as surface spills or through the shallow ground water system, mobilized contaminants would be very rapidly mobilized into nearby Fire Creek through the existing ARR ditch cut.

   For all of the reasons discussed above, with poorly controlled or designed pit activities the potential is high for contaminants to be transported directly through surface runoff in the vicinity of the ARR staging area or to enter the shallow ground water system and from there to be short-circuited to the surface and to the adjacent Fire Creek floodplain. Because potential for rapid infiltration to the shallow ground water system will be increased below the pit floor, and ground water flow paths to surface discharge points are short, preventing surface runoff from the pit surface alone will not be sufficiently protective of adjacent surface water bodies. These practices may be sufficient to control excessive turbidity from the operating pit but are not likely to be adequate to control other, particularly soluble, contaminants.

Pit operations and practices should include appropriate specialized controls for fueling, parking, and vehicle maintenance, and materials processing, including at minimum appropriately designed pads and diking so that infiltration and runoff of contaminants generated by these activities can be more readily controlled. Measures to control surface runoff and infiltration of contaminants must be most carefully considered in the proposed staging areas near the ARR where surface and subsurface paths to Fire Creek are extremely short and the shallow ground water table is likely to be very near the surface year-round. Control measures may be phased in terms of their areal extent but should be fully in place at all phases of pit development. Finally, active inspection and enforcement measures by agencies other than pit contractors should be established and in place, with required controls and good housekeeping practices explicitly stated in operational and permitting documents, prior to the start of pit development.

In general, development of the pit as proposed is possible with minimal impact to the environment but, with the minimum final separation from the shallow ground water table as proposed, pit development will also require very careful management to prevent excursions of State and federal environmental law. Similarly, the small separation distance proposed appears likely to increase post-pit re-development costs, even for basic landscaping and playing field use, may result in increased construction and maintenance costs for such uses, and may reduce or limit opportunities for other landuses. As these post-development costs and limitations will most likely be incurred substantially by the Municipality, effects of pit development as proposed should be carefully weighed and adjusted as necessary to conform with the long-term interests of the Municipality in this site.

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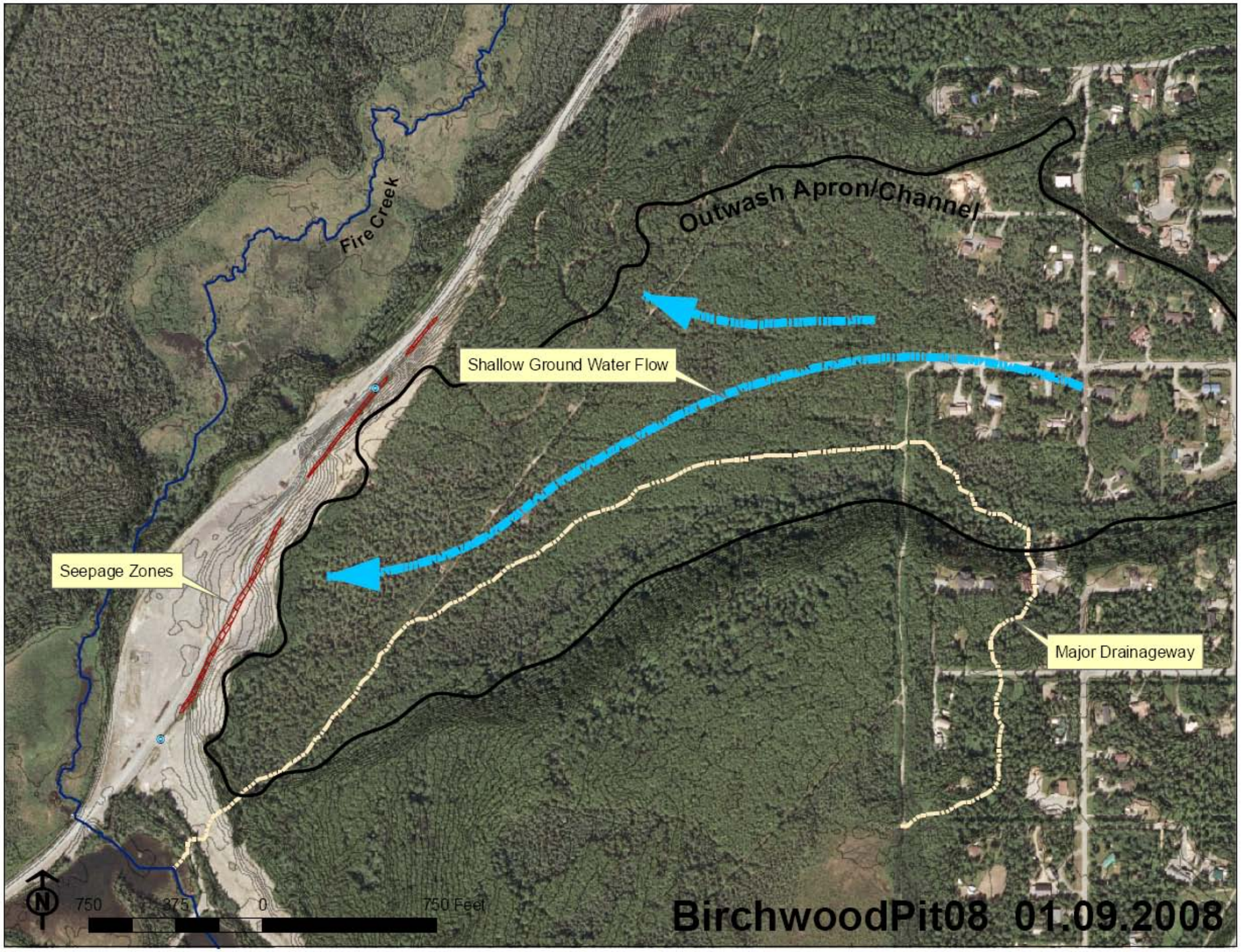
WMS\zzWtrcourseMppng_08/BirchwoodPit08_Prelim.doc

Birchwood Pit Watercourses Mapping: Revised Preliminary Findings
February 19, 2008

Figure 1: BirchwoodPit08 Watercourse Features



Appendix C5

rec
9-7-07

STATE OF ALASKA

Sarah Palin, Governor

555 Cordova Street
Anchorage, Alaska 99501
PHONE: (907) 269-7639
FAX: (907) 269-7655
http://www.dec.state.ak.us/

DEPT. OF ENVIRONMENTAL CONSERVATION

DIVISION OF ENVIRONMENTAL HEALTH

September 7, 2007

RECEIVED
SEP 07 2007

Mr. Alfred Barrett (MOA)
Senior Planner, Zoning Division
C/O Planning Dept
PO Box 196650
4700 S Bragaw
Anchorage, AK 99519-6650

Dear Mr. Barrett,

This letter is in response to the Municipality of Anchorage (MOA) request for agency comments on a conditional use permit for ADOT&PF to mine gravel. The following recommendations are made by the DEC-Drinking Water Protection Program (DWPP) for the proposed gravel extraction areas located near Eagle River, Alaska, west of the Glenn Highway., within Section 25 of Township 15 North / Range 02 West (Maps 1 and 2). The DEC-DWPP can provide recommendations as they pertain to nearby *public* water systems (PWS) only; not *private* water systems. The DEC-DWPP identified PWSs within a 1-mile radius of the proposed extraction areas, to provide a general picture of the area regarding the relative density of PWSs. The DEC-DWPP identified three PWSs within a 1-mile radius from the proposed extraction areas (Maps 1 and 2). Additionally, one PWS was identified just outside of the 1-mile radius, and approximately "downgradient" of the proposed extraction areas; the groundwater gradient is described as west and northwest in the vicinity of the proposed extraction areas by James Munter's Hydrogeological Evaluation (May 7, 2007). Attachment A includes general well information for these PWSs. If the gravel extraction project is approved, the DEC-DWPP recommends that best management practices (BMPs) be implemented in order to protect the PWSs and the aquifer used by the PWSs. Following are suggestions for your BMPs:

1. Implement BMPs applicable to the proposed project that are identified by, but not limited to the following. Refer to Attachment B (DEC's *User's Manual to Best Management Practices for Gravel Pits and the Protection of Surface Water Quality of Alaska*) and Attachment C (the Regional Municipality of Waterloo's *Aggregate Policies and Study Guidelines for Water Supply Protection – BMPs for Aggregate Operations*) for a more complete list of BMPs.

    a. Locate fluid storage tanks furthest from the estimated groundwater flow path to PWSs. For instance, for the currently proposed extraction areas, current data suggests that the most optimal location would be on the western edge of proposed extraction Area B (Map 1 or 2).

b. Implement secondary spill containment for fluid (fuel) storage areas and double-walled containers for fluid (fuel) storage containers.

c. Do not use underground storage tanks (USTs).

d. Maintain a vertical separation distance between the maximum water table level of the upper unconfined aquifer and proposed excavation activities of a minimum of 5 feet. This is greater than the 2-foot vertical separation distance that is currently proposed. However, is consistent with that used in other areas (see Research Sources).

e. Ensure that drainage is controlled and directed away from PWSs and does not directly impact surface water bodies.

f. Minimize erosion at the proposed extraction areas and for roads associated to the project.

g. Secure site. Allow only authorized personnel to access site.

2. Develop additional BMPs as it pertains to the project that are not mentioned above that will provide increased protection for the PWSs and the aquifer used by the PWSs.

Based on the limited available well data, the maximum water table level in shallow public and private wells of the shallow unconfined aquifer appears higher than that of deeper wells in the same aquifer. The DEC-DWPP recommends defining the maximum water level for the shallow aquifer system in order to adhere to the recommended 5-foot minimum vertical separation distance. The DEC-DWPP was able to find additional preexisting well data that was not included in Munter's Hydrogeological Evaluation (May 7, 2007); therefore, the DEC-DWPP recommends a more thorough well data search be performed and well data be compiled and used to help define the maximum water table level prior to implementing a 5-foot minimum vertical separation distance. Below is a list of additional well data sources identified by the DEC-DWPP:

1. U.S. Geological Survey (USGS) Ground Water database (GWSI). http://ak.water.usgs.gov/Data/gwdata.htm [Contact: Pat Strelakos, No. (907) 786-7126, pstrelak@usgs.gov].

2. MOA – Development Services. http://www.muni.org/Onsite/index.cfm

Sincerely,

Kathy Kastens
Compliance & Technical Services Manager

kk\pcp

cc: James Weise - Drinking Water Program Manager

Research Sources

A Surface Mining Reclamation Guide. City of Parish Planning Commission, Baton Rouge, Louisiana, Information Bulletin, Number 3, November 2000.

Aggregate Operators Best Management Practices Handbook for British Columbia, Volume I: Introduction and Planning (Volume II: Best Management Practices as separate printable document). British Columbia Ministry of Energy & Mines. April 2002.

Aggregate Operators Best Management Practices Handbook for British Columbia, Volume II: Best Management Practices. British Columbia Ministry of Energy & Mines. April 2002.

Aggregate Policies and Study Guidelines for Water Supply Protection, Background report No. 6, October 2004, Appendix A; Regional Municipality of Waterloo – Water Services Division. http://www.region.waterloo.on.ca/web/region.nsf/97dfc347666efede85256e590071a3d4/30BE9624B64CC0F68525706D0055EE14/$file/BG6A.pdf?openelement; Date accessed: 8/24/2007.

Hydrogeological Evaluation, Appendix C. Letter report by Mr. James Munter, Principal Hydrogeologist of J. A. Munter Consulting, Inc. Prepared for Mr. Dennis Linnell, P.E.of Hattenburg Dilley & Linnell, Engineering Consultants. May 7, 2007.

Integrating the Public Water Supply Protection into the State of Maine's Vision. The Report of the Resolve 029 Task Force. Submitted to the Joint Standing Committee on Natural Resources. Prepared by Maine Department of Health and Human Services Center for Disease Control – Division of Environmental Health – Drinking Water Program. February, 2006.

Massachusetts Nonpoint Source Pollution Management Manual, Chapter 12: Resource Extraction. Year published: unknown.

North Bend gravel Operation Water and Environmental Health Technical Report for King County, WA. URS Job No. 53-42279001.00, December 12, 2001.

User's Manual to Best Management Practices for Gravel Pits and the Protection of Surface Water Quality, by DEC, June 2006. http://www.dec.state.ak.us/water/wnpspc/pdfs/gravelpitbmp_guidance_final_063006.pdf; Date accessed: 8/24/2007.

Appendix C6

PENDING

CODE ORDINANCE

By: Borough Manager
Introduced:
Public Hearing:
Action:

MATANUSKA-SUSITNA BOROUGH
ORDINANCE SERIAL NO. 08-017

AN ORDINANCE OF THE MATANUSKA-SUSITNA BOROUGH ASSEMBLY AMENDING MSB 17.28 INTERIM MATERIALS DISTRICT, TO INCLUDE PROVISIONS FOR REGULATING EXCAVATION INTO THE SEASONAL HIGH WATER TABLE.

BE IT ENACTED:

Section 1. Classification. This ordinance is of a general and permanent nature and shall become a part of the Borough Code.

Section 2. Amendment of subsection. MSB 17.28.060(A) is hereby amended to read as follows:

(8) groundwater quality and quantity protection shall be ensured by requiring that a four-foot vertical separation between all excavation and the seasonal high water table be maintained.

Section 3. Amendment of section. MSB 17.125 is hereby amended by adding the following definition:

- **"Seasonal high water table" means the highest level to which the groundwater rises on an annual basis.**

Section 4. Effective date. This ordinance shall take effect upon adoption by the Matanuska-Susitna Borough Assembly.

ADOPTED by the Matanuska-Susitna Borough Assembly this - day of -, 2008.

CURTIS D. MENARD, Borough Mayor

ATTEST:

LONNIE R. McKECHNIE, Acting Borough Clerk

(SEAL)

Appendix C7

March 14, 2000 Price: $13.00

Division of Geological & Geophysical Surveys

PRELIMINARY INTERPRETIVE REPORT 2000-3

TECHNICAL REVIEW OF THE SEPTEMBER 1999 GROUNDWATER DISTURBANCE NEAR ESTER, ALASKA

by

Jim Vohden
Alaska Department of Natural Resources
Division of Mining, Land and Water
Alaska Hydrologic Survey

March 2000

THIS REPORT HAS NOT BEEN REVIEWED FOR TECHNICAL CONTENT (EXCEPT AS NOTED IN TEXT) OR FOR CONFORMITY TO THE EDITORIAL STANDARDS OF DGGS.

Released by

STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
Division of Geological & Geophysical Surveys
794 University Avenue, Suite 200
Fairbanks, Alaska 99709-3645

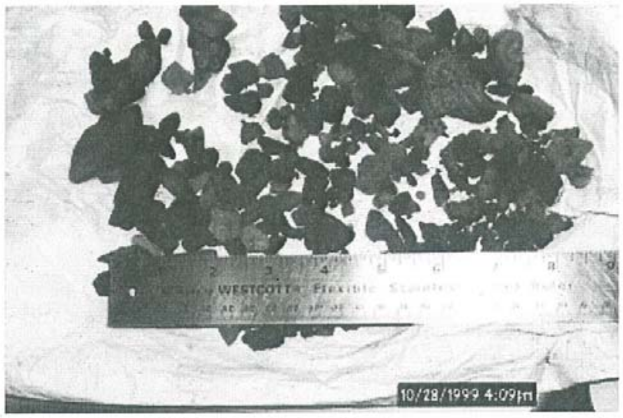


Figure 13. Material brought up during re-drilling of MW-101, from approximately 121 feet below ground surface.

drilling process was washed with clean water and contains alluvial gravels (Figure 13). Most of the wells in the Goldhill Road study area are finished at a similar depth below ground surface (although a more complete survey will confirm this); it is presumed that most of these wells are in a similar portion of the aquifer. It can be surmised that the domestic wells are completed in an ancient riverbed which is conveying water that remains perched due to the presence of a clay layer identified during the redrilling of MW-101, and described in the new well log for MW-101 (Appendix G). Similarly, the material at the bottom of the Yellow Eagle 1999 pit have been classified as "thawed and frozen gravels" by Yellow Eagle's consulting geologist. From preliminary elevation data, it is determined that the bottom of the 1999 pit is lower in elevation than the bottom of any of the wells that experienced problems in the Goldhill Road area. The only possible exception is MW-101 after it was redrilled. Further surveying, as discussed, will confirm this.

Pit Monitoring

Because Yellow Eagle was implicated as being a potential cause of the groundwater disturbance in the initial stages of this study, DMLW included monitoring of the 1999 pit as part of the investigation. As discussed previously, it was reported that the groundwater table was intercepted in the 1999 pit during the course of regular mining. Reports of the height of

DISCUSSION

Public Meetings

As stated previously, a prime objective of DMLW was to keep the public informed of the situation throughout our investigation. From the outset, rumors spread quickly and feverishly about many facets of the situation. After completing an initial review of the wells and mine site, a public meeting was scheduled on 2 November 1999 at University Park School in Fairbanks. The objective of the meeting was to provide the public with the facts that had been assembled to date. Prior to the 2 November meeting, and at the request of John Miller and Frank Saunders of Yellow Eagle, DMLW facilitated an open meeting between company representatives and the six (at that time) primarily affected homeowners on 28 October 1999. The reasons for this smaller gathering were twofold: one, the president of Yellow Eagle, John Miller, and the mine's consulting geologist, Georges Gagnon, were previously scheduled to depart Fairbanks before the 2 November public meeting was to occur. Second, Yellow Eagle and the primarily affected homeowners concurred that a smaller discussion group might be more productive in reaching resolution than would the larger group which was expected for the 2 November meeting. As all parties agreed to participate, a meeting was held at the DMLW offices on 28 October 1999. The meeting was facilitated by Jim Vohden, Hydrologist and Ryan Hull, Geologist, both of DMLW. Information that had been collected to date by DMLW was presented, the homeowners were given opportunity to discuss their own situations, and Yellow Eagle was given time to discuss their situation. Unfortunately, no firm decision was reached during this process, although it was beneficial for the homeowners and the mine to hear each others problems and concerns. The meeting was adjourned with all parties carrying a better understanding of the situation and a commitment by Yellow Eagle to provide a written statement regarding their intent to rectify the situation should it be determined that the mine was responsible for causing the disturbance in the domestic wells. A copy of the resulting letter from Yellow Eagle is included in Appendix C.

The public meeting held on 2 November 1999 at University Park School was arranged by Sharon Fisher, one of the primarily affected homeowners in the Goldhill Road area. She

Summary

The precise conditions under the surface of the earth cannot be determined within the scope of this project. However, based on the information gathered over the course of the past five months, this investigation has determined that: a) the domestic wells in the Goldhill Road area are finished in a shallow perched alluvial aquifer located approximately 100 feet below the ground surface, supported by a narrow layer of clay; b) the alluvial aquifer that these wells are finished appears to wind its way to the south and intercept the Yellow Eagle 1999 pit, then continues to what is known as the Dredge Pond, located to the south of the 1999 pit; c) water most likely is conveyed through this "conduit" of alluvial material to the Dredge Pond as part of the normal hydrologic regime (supported by reports from Yellow Eagle that the Dredge Pond turned turbid immediately after the groundwater was intercepted); d) at the time the groundwater was intercepted in the 1999 pit, the flow of water increased from the source (somewhere in the vicinity of Goldhill Road) because the hydrostatic pressure had been released in the pit. The release of hydrostatic pressure caused the wells finished upgradient in this alluvium to be depleted; e) as increased head pressure is applied by the height of the standing water column in the 1999 pit, the flow through the "conduit" of gravels to the 1999 pit has presumably reverted to previous levels, essentially "backing up" water in the alluvium, and allowing for what appears to be mid-winter recharge to the wells in the Goldhill Road area. As long as the transmissivity of the "conduit" is maintained at or below the current value, the water levels in the associated domestic wells should remain steady or recover somewhat.

CONCLUSION

DMLW will continue to collect water level information and monitor the situation near Goldhill Road. In light of the facts presented herein, the Department of Natural Resources, Division of Mining, Land and Water has come to the conclusion that the mining activities at the Yellow Eagle Mine near Ester that occurred on 25 September 1999, were the primary cause of the groundwater disturbance in the Goldhill Road area which has resulted in the dewatering of several domestic wells beyond normal use. Specifically, during the course of

Figure 1. Map of Ester/Goldhill Road area.

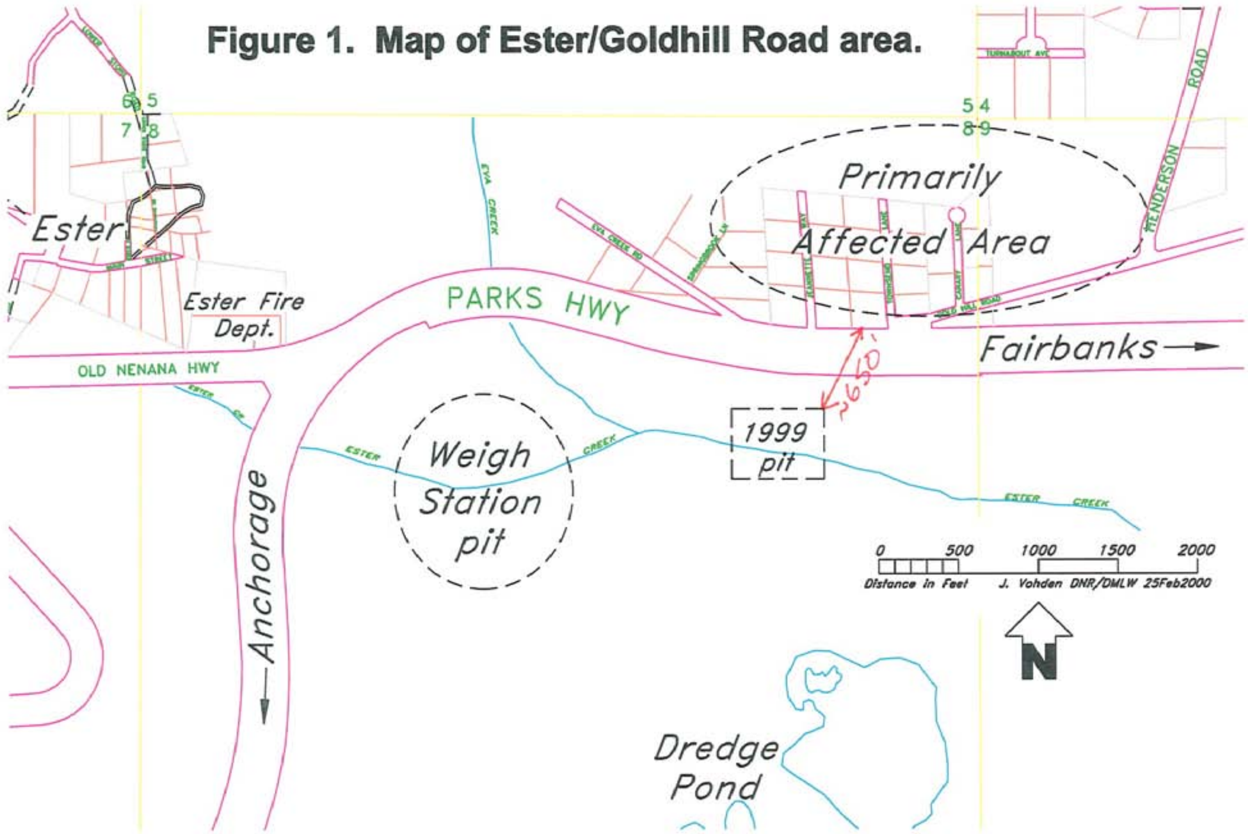
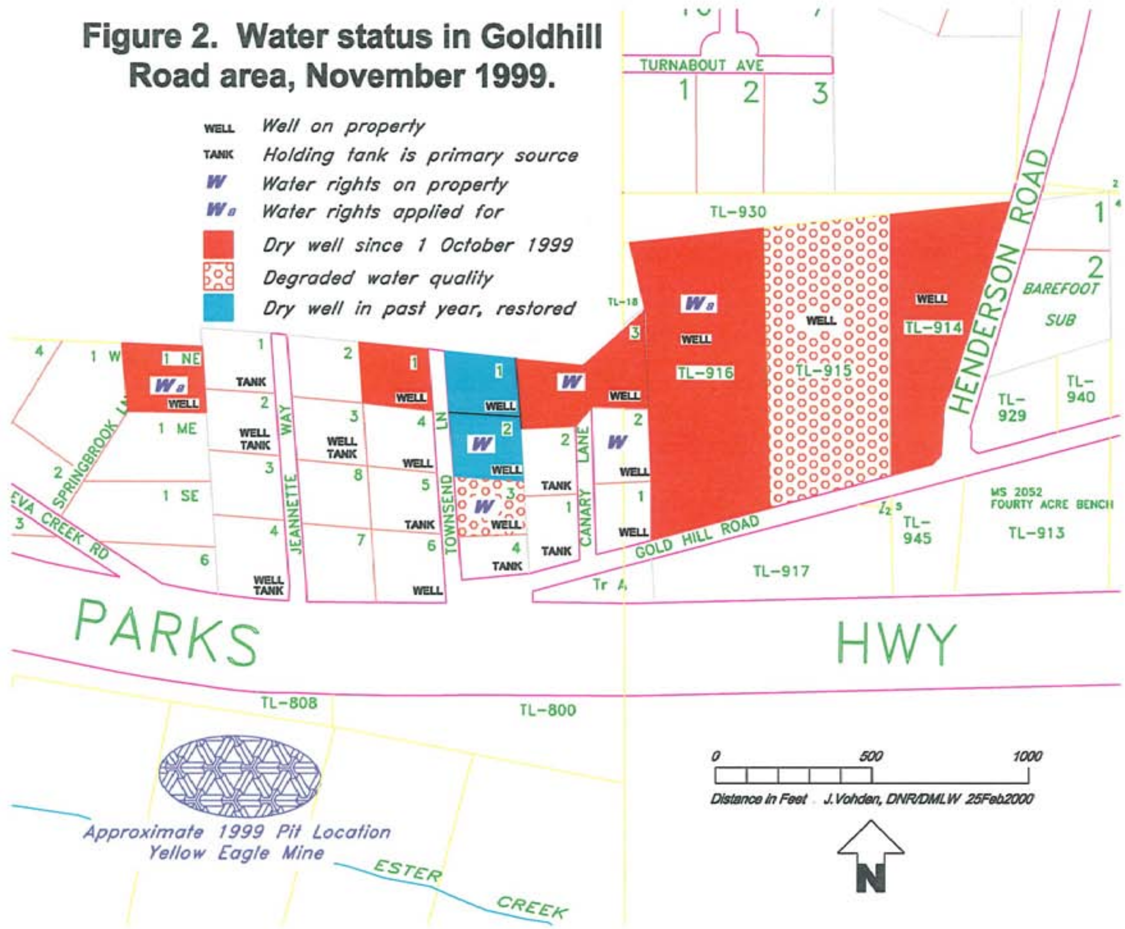


Figure 2. Water status in Goldhill Road area, November 1999.



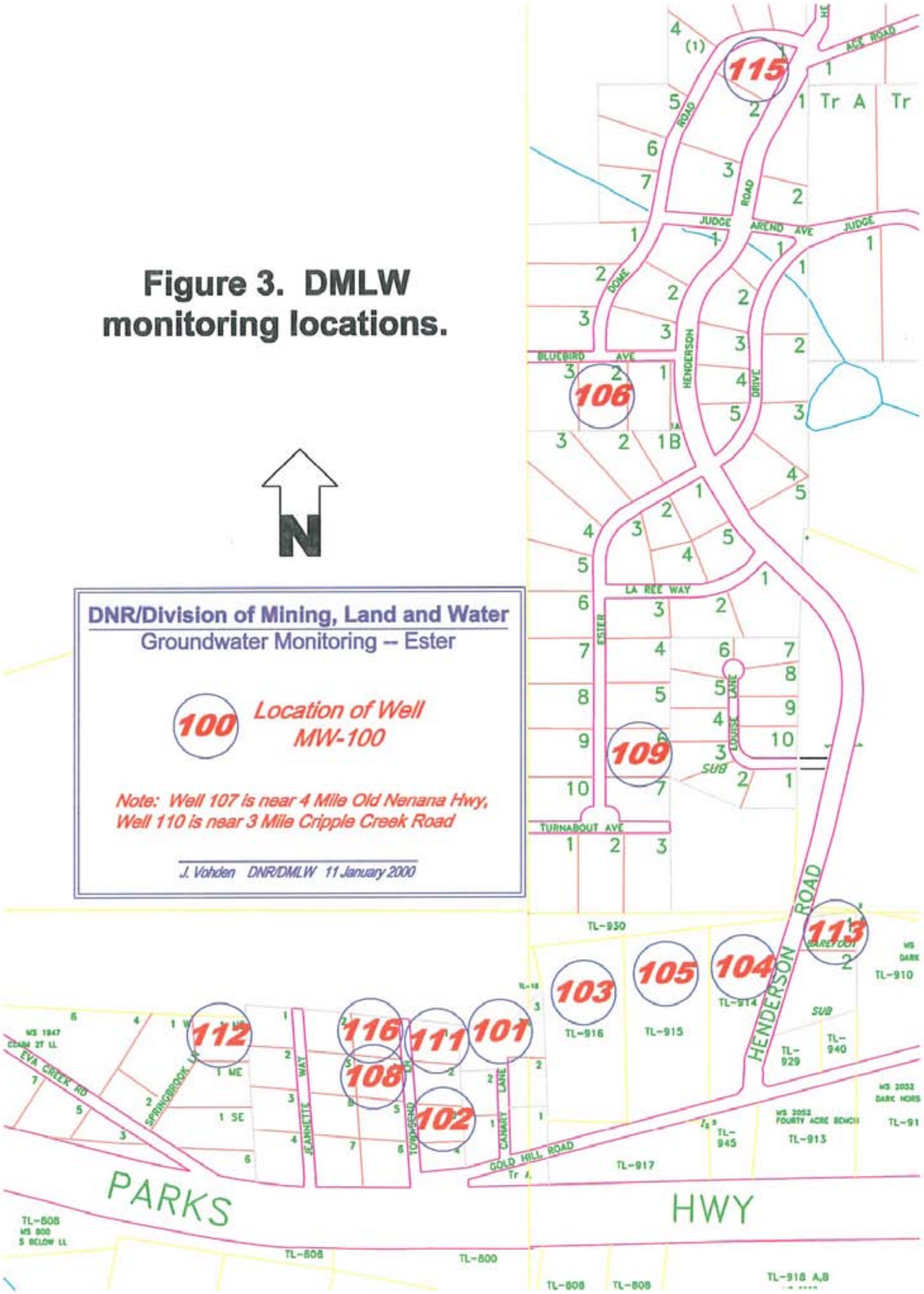


Figure 3. DMLW monitoring locations.

Appendix C8