Central Monofill (CMS)

Supplemental Information (Handouts)

HANDOUTS

Mary Brodigan

From: Tom Adams <t.adams@lounsburyinc.com>
Sent: Wednesday, November 30, 2016 3:35 PM
To: Mary Brodigan
Subject: 12/5 PC Meeting

Mary,

I have a couple questions regarding the next meeting.....

1) I understand the Superior Court's decision required two actions by the PC
   a. Revisit the recusal of Commissioner Kendig
   b. Revisit CMS's application

At the November 7, 2016, PC meeting, Mr. Kendig recused himself and announced he would not be attending the December 5 meeting. I believe that action resolves item 1(a) above.

Regarding item 1(b), it would be my interpretation the court requires the current PC revisit the application as it was previously considered and decided by Resolution 14-33. However, page 497 includes correspondence from the applicant seeking to amend the CUP application – this is inconsistent with my understanding of the court's action. Should this be a new application?

Also, I understand there was significant discussion by the Borough and applicant attorney at the August 15, 2016, PC meeting. Please resend the meeting minutes to all commissioners for their review.

Thank you.

Tom Adams, P.E.
Planning Commissioner, District 6

Mary Brodigan

From:	Mark Whisenhunt
Sent:	Thursday, December 01, 2016 12:00 PM
To:	Mary Brodigan
Cc:	Alex Strawn; Shane Durand
Subject:	Handouts for 12-5-16 Re: CMS Remand
Attachments:	Handouts for 12-5-16 meeting.pdf
Importance:	High

Hello Mary,

The handout items which I have received to date are attached. I have also cc'd the applicant in this email for your convenience.

Thank you.

Respectfully,

Mark Whisenhunt
Planner II
Matanuska-Susitna Borough
Office: (907) 861-8527
Fax: (907) 861-7876
mark.whisenhunt@matsugov.us

Mark Whisenhunt

From: Nathan Wallace <nwallace@palmerak.org>
Sent: Thursday, December 01, 2016 10:12 AM
To: Mark Whisenhunt
Subject: City of Palmer Reso for Monofill Hearing
Attachments: City of Palmer Reso 14-038 Monofill.pdf

Mark-
Attached is the resolution the City Council of Palmer passed in 2014 addressing the monofill issue coming up next week. They discussed this at the last meeting and it remains unchanged.

I didn't see it in the packet, so wanted to make sure its included.

The Mayor and a few of the council will be attending Monday.

Thanks
-Nate

NATHAN E. WALLACE
City Manager
City of Palmer, Alaska
907-761-1317

PALMER
"Alaska at its Best!"

Introduced by: Mayor Johnson, Council Members Hanson and Best
Date: November 25, 2014
Action: Adopted
Vote: Unanimous

Yes:	No:
Erbey	
Carrington	
Combs	
DeVries	
Hanson	
Johnson	

CITY OF PALMER, ALASKA

Resolution No. 14-038

A Resolution of the Palmer City Council Requesting the Matanuska-Susitna Borough Planning Commission Deny a Conditional Use Permit for the Operation of an Inert Material Monofill on MSB Parcels 17N02E18C010 and 17N02E19B006

WHEREAS, the City of Palmer is the owner of MSB Parcel 17N02E18D002 located adjacent to the proposed Conditional Use Permit for operation of an Inert Material Monofill to be considered by the Borough Planning Commission on December 1, 2014; and

WHEREAS, the applicant's map of Proposed CMS Site Showing Adjacent Property Types incorrectly identifies the City's parcel which contains a farmhouse and leased agricultural field as an Industrial use; and

WHEREAS, the City is concerned with the applicants credibility given the Borough issued six citations charging Central Environmental Services which operates Central Recycling Services and Central Monofill Services with illegally dumping material on MSB Parcels 17N02E18C010 and 17N02E19B006 prior to approval of a Borough permit; and

WHEREAS, according to the Central Monofill Services' application not all of the actual monofill site will meet the Alaska Department of Environmental Conservation requirement that the base of the monofill is at least 10 feet above groundwater; and

WHEREAS, given the unpredictable water table underlying the proposed site due to earlier penetration of the underground aquifer, there is a potential for contaminants from the monofill to travel off the property to area wells and lakes; and

WHEREAS, the application shows that 35.5 acres of the 52 acre site will be used for the monofill and 16.5 acres will be used for recycling operations; and

WHEREAS, the 16.5 acre recycling area will include outdoor collection and storage of salvageable and reusable material such as scrap metal, broken concrete, wood, tires and recyclable windows and HDPE pipe; and

WHEREAS, an inert landfill should not become a model of the reclamation of landfills in the area; and

WHEREAS, the outdoor storage of this salvageable and reusable material is generally categorized by the Borough as a "Junkyard"; and

WHEREAS, the establishment of a new junkyard adjacent to the Glenn Highway is inconsistent with maintaining the Glenn Highway corridor as an attractive community entry to Palmer which is Goal 1, Chapter 5 of the current Palmer Comprehensive Plan and Goal 7, Chapter 6 which is to maintain and improve the visual quality of the Glenn and Palmer-Wasilla Highways corridors, and other major community roads; and

WHEREAS, this region experiences frequent multiple-day high- wind events each year since it is at the confluence of the Matanuska and Knik River valleys and loose debris and dust from the fill has and is expected to continue to scatter beyond the boundaries of the site which is incompatible with the Glenn Highway National Scenic Byway designation of this section of the Glenn Highway; and

WHEREAS, the berm currently screening a portion of this site from the Glenn Highway, may be removed as the Glenn Highway is expanded to four lanes as proposed by the Alaska Department of Transportation further causing an unsightly entry into the City and reducing the value of the Glenn Highway National Scenic Byway experience for travelers; and

WHEREAS, the Inert Material Monofill application submitted by Central Monofill Services refers to the Alaska Demolition Construction & Demolition landfill located in the Palmer City limits which has had a Conditional Use Permit; and

WHEREAS, Alaska Demolition Construction & Demolition landfill is located on a minor community road that is not visible to the travelling public and is approved to fill a pit left by a former gravel operation without stacking cells to a level above the ground level of the adjacent property; and

WHEREAS, the operation of the Alaska Demolition Construction & Demolition landfill does not include the sorting, collection, and sale of salvageable, reusable material on site similar to a junkyard and is therefore not a good comparison to the operation of the proposed inert material monofill.

NOW, THEREFORE, BE IT RESOLVED by the Palmer City Council that it requesting the Matanuska-Susitna Borough Planning Commission not approve a Conditional Use Permit for the operation of an Inert Material Monofill on MSB Parcels 17N02E18C010 and 17N02E19B006.

Passed and approved by the City Council of the City of Palmer, Alaska this twenty-fifth day of November, 2014.

DeLena Goodwin Johnson, Mayor

Janette M. Bower, MMC, City Clerk

Mark Whisenhunt

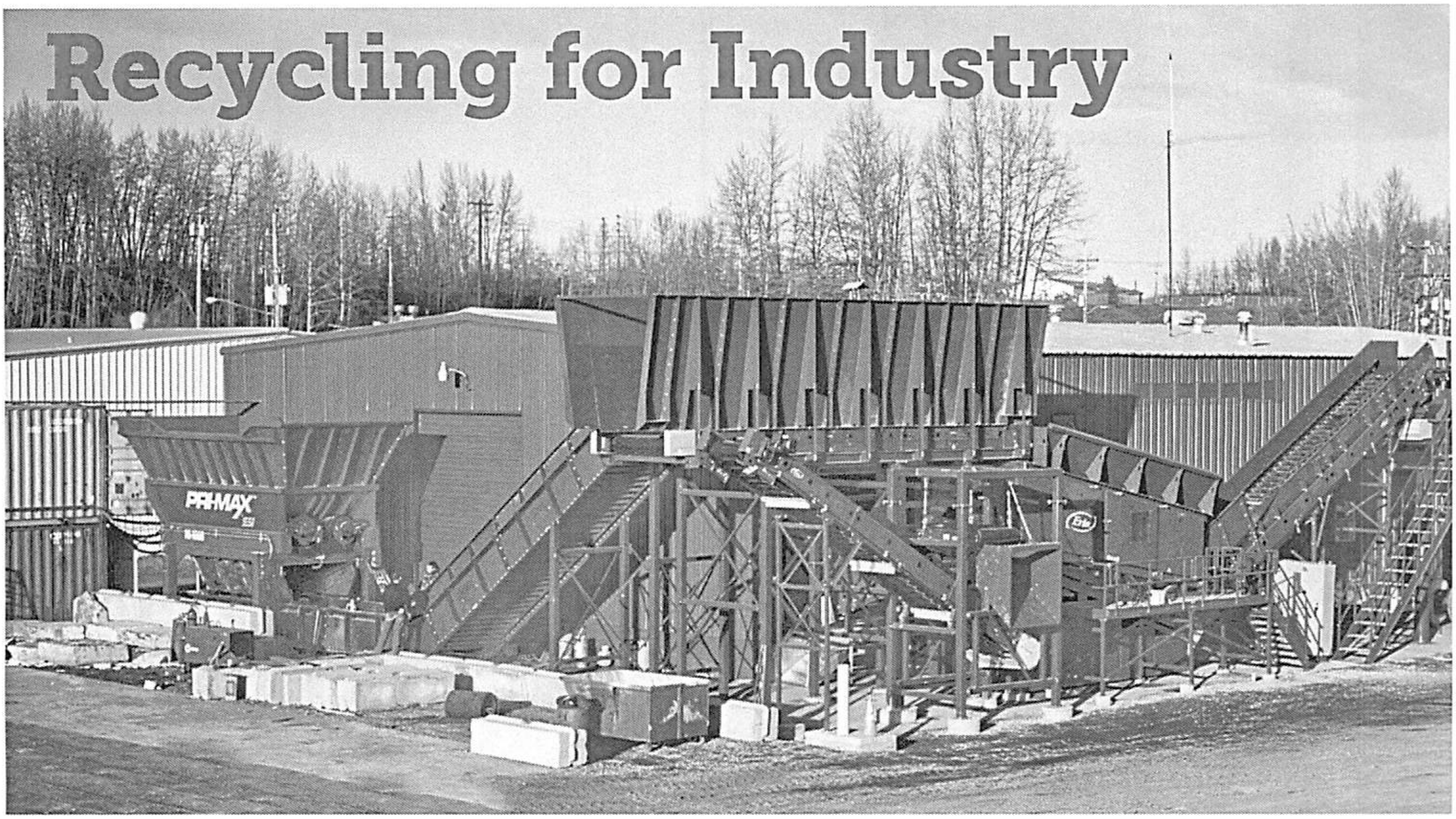
From: Stephanie Nowers <sjnowers@mtaonline.net>
Sent: Wednesday, November 30, 2016 8:35 PM
To: Alex Strawn; Mark Whisenhunt
Subject: STuart Jacques article in Alaska Business Monthly
Attachments: A_Stuart_jacques_August2016_not_really market for recycling_AKBizMonthly.pdf

I thought you might be interested in this article in Aug. 2016 Alaska Business Monthly where Stuart Jacques talks about how there is very very little market right now Central Recycling's recycled products. He particularly cites there being no market for the recycled glass and concrete products they have. It seems to contradict CMS' claims in the supplement to their CUP that their project would bring great benefits from recycling of glass, concrete and wood to the Valley. If there's no market, then where is the recycling happening?

Also for what it's worth, I know CMS has pointed to the Mat-Su Borough C&D cell as a comparison. I would say there are significant differences. The borough's C&D cell is not surrounded by water, what is being dumped there is subject to independent oversight, and it has the resources of the borough behind it if pollution should occur. Also I suspect it has a better record of cleaning up its messes without forcing the borough to take it to court. :)

Stephanie Nowers
907.229.1982

Recycling for Industry



Central Recycling Services leads the way

By Susan Harrington

In 1984, Stuart Jacques started Central Environmental, Inc., a construction company, to do asbestos abatement and hazardous materials work. Twenty years ago the company branched into demolition, and the offshoot was recycling, Jacques says, adding: "Better do recycling if you are doing demolition." They still do both hazmat and demolition as well as a wide range of other construction services—and they are the only company in Alaska with the facilities for doing actual commercial industrial recycling of any kind.

Over the years, recycling provisions became a part of contracts and a certain percentage of materials had to be recycled, starting with federal contracts and followed by state and local governments and the private sector. Those federal recycling provisions weren't strictly enforced until about ten years ago, and by then some private contracts included up to 96 percent recycling requirements for certain LEED projects.

Recycling Facility

In 2009 Jacques built a recycling plant on a six-acre site across from Ship Creek on Yakatat Street in Anchorage for Central Recycling Services (CRS), which he formed in 2008 with his partner Shane Durand. It is the only full-service construction and demolition waste recycling facility in Alaska. Central Recycling Services takes co-mingled, demolition, renovation debris and land clearing debris; clean wood and lumber; gypsum scrap; clean concrete, bricks, and stone; non-forming hard rubble; scrap metal; asphalt pavement; and loads of other recyclable material, including glass until recently.

Materials are sorted, sifted, shredded, crushed, baled, and otherwise run through the facility and become commercial grade recycled products for sale, including concrete aggregate, asphalt pavement, Type II recycled fill, landscape aggregate, animal bedding, shredded rubber, natural and colored mulch, fire logs, pallets, select scrap metal, salvaged equipment, and dimensional materials. The products are an alternative to shipping new construction materials to Alaska, though it is hard to find engineers at the state or local level willing to allow the recycled materials produced to be used.

As for the products, Jacques says there's no market for much of it now, although for a few years they took in most of the commercial and construction debris in the Municipality of Anchorage. Not now, though, because there is a limited market for the recyclable materials and no cost effective way to dispose of the residual materials. Jacques ticks off how recycling is now a marginal proposition, for the most part... "Plastics market dropped off, China is becoming much more restrictive. Paper—same way—market used to be China. Steel—price down tremendously—barely worth it."

One product, glass, recycles well and works best for pipe bedding materials, or roadway fill Jacques says. "Crushed it is round, no sharp edges." It's just silica, and even that has been very difficult to get approved for use—Muni engineers say no. "It has been a struggle," Jacques says.

Another product, recycled concrete, can also be hard to get approved to use—the state and Muni won't allow it as a material in many construction uses.. For recycling to work effectively, " It must be cheap to produce and have a large scale use," Jacques says.

When they built the recycling facility a few years ago there was no way of knowing there would be such opposition to selling the products. "We jumped into it with both feet—everybody encouraged and promoted recycling," Jacques says.

Diversified Operations

Central Environmental, Inc. and Central Recycling Services also work in the oilfields, tak-


Central Recycling Services facility in Anchorage.

Courtesy of Central Recycling Services

ing surplus materials and used tires and baling them for retaining walls that can be filled. And they still do a lot of demo work and other construction services. In addition, they provide waste disposal bins and do the recycling for contractors with federal contracts that have recycling provisions so the contractors can meet government contract compliance.

"We're mainly a construction contractor," Jacques says. "That started us down the whole recycling path. As a way to handle our waste and be profitable—we started our recycling capability in town."

They stay busy in Anchorage, Fairbanks, Prudhoe Bay, and the rest of the state. This year they haven't had much Bush work, though they did finish a project on Kodiak Island where they barged out a baler and excavator to three villages and baled metals for transport and recycle in the Lower 48.

"We're in a small market," Jacques says of Alaska—which is why they've never just worked in Alaska. The company has always had a diversified list of job sites for its up to two hundred employees. They work up and down the Western United States with work in sixteen to eighteen states, plus in Canada. In February 2015 the company took on another Alaska project that's keeping them busy here as well as investing in the future of Anchorage. They bought the old Ship Creek Power Plant and are renovating it for mixed industrial use. So far they are about 85 percent done with gutting it out and have come up with a lot of scrap metal. They've demolished the five-story boilers and huge turbines. There's a lot of work to be done with all the demolition and renovation. Jacques says they plan to keep the industrial look of the building and convert it to different uses.

The bulk of revenue will be coming from the Lower 48 this year. Recycling is not a money maker and it's slowing down and consolidating nationwide—if they were depending on only recycling they'd really be struggling.

"One thing that helps us—a lot of contractors are looking at the Lower 48—we've been there twenty-five years. We don't have to react and go there, from that regard. We can weather this storm. I was already there—we survived the eighties working in California," Jacques says. "As far as Alaska goes, we'll be focused elsewhere in 2017 and 2018."

Susan Harrington is the Managing Editor for Alaska Business Monthly.

Mark Whisenhunt

From: Jim Munter <jamunter@arctic.net>
Sent: Wednesday, November 30, 2016 4:02 PM
To: Alex Strawn
Cc: Mark Whisenhunt

Subject: final letter
Attachments: letter re Palmer monofill Nov 30 2016.pdf

Alex,

Please find attached my final letter regarding the review of the proposed Palmer monofill site that you requested. Please let me know if you need any additional information.

Regards,

Jim Munter
J. A. Munter Consulting, Inc.
907-345-0165

November 30, 2016

Mr. Alex Strawn
Planning Department
Matanuska Susitna Borough
350 E. Dahlia Avenue
Palmer, AK 99645-6488

Re: Hydrogeologic re-evaluation of a proposed monofill, Palmer, Alaska

Dear Mr. Strawn:

This letter is to provide the findings of my recent review of data and reports related to a hydrologic re-evaluation of a proposed monofill consisting primarily of shredded construction and demolition (C & D) waste near Palmer, Alaska.

This proposed development has a long history with numerous technical documents presenting information about the site hydrology and geology and varying conclusions regarding the potential for groundwater contamination. Source material for this review is referenced to the page number of the on-line packet for the December 5, 2016, public hearing on this matter (ftp://ftp.matsugov.us/departments/Planning/Permitting/PC%20Packet%2012-05-16%20(web%20version).pdf).

The October 26, 2016, submittal by the applicant raises numerous issues regarding what the true proposed development will look like because there are marked differences with the original application. Sheet B of the October 26 submittal shows the proposed limits of waste to be very nearly the same as in the original 2014 application, but they only describe filling cells C, D, and E totaling 10 acres rather than the original 35.5 acres. The title of the figure describes this proposal as "Phase 1 2017-2022" while the October 26 letter describes the site as having a 20-30 year lifespan (page 9 of 10 of the document). This creates confusion about what the long-term plans for the site are and whether this site will be the subject of additional future permitting requests for subsequent phases and whether future cells, for example, would also have liners and leachate collection systems.

The current proposed plan differs significantly from prior plans by including plans for a geosynthetic liner ("or as approved by ADEC to meet $\leq 1x\ 10^{-5}$ cm/s") and leachate collection system. Since ADEC does not currently require liners for monofills such as this, it is very confusing as to what the proposed development actually will consist of. For example, a native soil liner comprised of silt, sandy silt, or glacial till could likely meet the target of $\leq 1x\ 10^{-5}$ cm/s.

If properly designed and implemented, however, a liner and leachate collection, treatment, and disposal system could substantially alleviate concerns about groundwater contamination at this site. However, there are unaddressed engineering and construction issues and no description of what the applicant intends to do with the collected leachate. For example, the leachate collection system must be demonstrated to be leak-proof. As another example, the Central Landfill operated by the Borough, has no suitable local disposal facility for the collected leachate and the leachate is trucked to Anchorage.

Pending confirmation that there is a properly implemented leachate collection, treatment, and disposal system, it would be prudent to base this review on the analyses and comments previously prepared for the 2014 monofill application.

Regarding this proposed development, the disposition of the leachate should be specified. Should the application be approved, a suitable condition could be that 100 percent of the water be removed from the Borough until such time as an ADEC approved method of local treatment, disposal, and monitoring be approved. As described below, the quantity of leachate collected at the Phase 1 facility could be in the range of a few hundred thousand gallons per year.

Summary of Primary Technical Issues

This letter summarizes what I believe are the key technical aspects of the proposed site development. After reviewing information contained in the on-line packet including rebuttals of my previous work, I have found no compelling technical case to substantially revise or retract any of my prior comments, although a few sections of my prior reviews would benefit from some minor revisions.

1. Production of a significant amount of leachate and potential for groundwater contamination

Review of the design documents, management plans, and public comments for this site shows that there appeared to be very limited reliable methodologies employed to substantially reduce or control infiltration of rainfall and snowmelt through the waste. Thus, expected rates of infiltration are expected to be similar to those that occur elsewhere in the surrounding landscape. I have previously used the results of a recent USGS-published report for this area to estimate that approximately 1.4 inches per year of water would percolate through the waste. For the original 35 acre fill site, this would amount to about 1.3 million gallons of water per year. The USGS estimate fully considers local geologic and climate conditions, including rainfall, snowmelt, and evaporation and transpiration.

Maddox differed from this conclusion, stating that (packet page 738) "it is likely that none of the precipitation will make its way through the considerable thickness of the proposed monofill".

In contrast, Ralph Hulbert (AlaskChemEngineering) has performed a review of leachate collected from the Central landfill, located just a few miles north of this site (packet page 1271). This landfill has liners under each cell and a leachate collection system. From 2011 to 2013, when the area of cells underlain by liners was 12.7 acres, the system produced an average of 1.5 million gallons of leachate per year. Hulbert concluded that the data "apparently validates the (USGS) model for this area and by extension to the proposed monofill location, which is at the upper edge of the 0-1.4 inches/yr zone." Thus, for planning purposes, Mr. Hulbert's analysis contradicts Maddox's conclusions and supports my prior conclusions and that it would be prudent to assume that 1.4 inches of precipitation would infiltrate the ground per year at the site of the monofill. For a 10-acre area (the area of the proposed Phase 1 monofill cells), this would equate to approximately 380,000 gallons per year. Hulbert notes, however, that this amount could be reduced by construction, grading and capping techniques. Nevertheless, this assessment appears to be much more reliable and in stark contrast to Maddox's conclusion about the likelihood of no recharge or flow through the cells. For planning purposes with regard to the proposed leachate collection system and considering the potential effect of wetter than normal years, it would be prudent to assume the production of a few hundred thousand gallons per year of leachate from the proposed system.

The best explanation of why Mr. Maddox's conclusions about recharge through the waste should not be relied upon is that the climate of the Palmer area is very different than other areas. At Palmer, there are regular occurrences of precipitation events (sometimes the remnants of tropical typhoons) that last practically all day or longer during August, September, or October after the high evapotranspiration season (June-July) is past. These events, as observed during my 34 years of experience in Alaska, have considerable potential to provide substantial groundwater recharge to local aquifers.

Regarding future groundwater contamination, there is no indication in any of the planning documents that phases of the monofill after Phase 1 would have a liner and leachate collection system; thus all of the material previously presented regarding the potential for contamination of wells downgradient from the site would still apply to this proposed development.

2. Adequacy of groundwater monitoring plan.

The October 26, 2016, submittal says that groundwater monitoring will be conducted without providing additional details. One might assume (but again, it's hard to know exactly what the proposal actually is) that the plan provided by Terrasat in Appendix N of the original 2014 application (packet page 945) would be implemented.

Comparison of the groundwater flow direction map in Maddox (packet page 742) and Terrasat's proposed monitoring well locations, the two proposed "down-gradient" wells are clearly not located in a downgradient position from the proposed Phase 1waste cells. Thus, the proposed monitoring plan will not be able to fulfill its objective of "detecting potential unanticipated impacts to the groundwater in time to take corrective action to ensure a release does not occur" (Terrasat, Attachment N to CUP application, page 947).

Until such time as a groundwater monitoring plan is identified that is designed with the actual proposed monofill in mind, there should be no assurance that any useful groundwater monitoring will be conducted in association with Phase 1 of this development.

3. Separation between waste and groundwater of 12 feet.

The October 26, 2016, submittal states that there would be a 12-foot separation distance between the bottom of the waste material and groundwater. The records of groundwater levels in the record are scattered and vary with time of measurement and it is difficult to confirm that this will occur. Also, future groundwater levels could be affected by gravel mining or pond water management activities in the area. A comprehensive current report and analysis substantiating this design feature of the proposed monofill should be provided.

Should you have any questions about this report, please call me at 345-0165 or 727-6310.

Sincerely,
J. A. Munter Consulting, Inc.

James A. Munter

James A. Munter, CPG, CGWP
Principal Hydrogeologist
Certified Ground Water Professional No. 119481
Alaska Licensed Professional Geologist No. 568

Mark Whisenhunt

From:	Cobb, Charles F (DNR) <charles.cobb@alaska.gov>
Sent:	Wednesday, November 30, 2016 12:13 PM
To:	Mark Whisenhunt
Cc:	Alex Strawn; Long, Chandler J (DNR); Schade, David W (DNR)
Subject:	RE: CMS / Spillway

Hey Mark,

ADNR is discussing the subject project internally and trying to coordinate a response between the Mining and Water Sections.

We understand your schedule incentives.

Your patience is greatly appreciated.

cfc

Respectfully,

Charles F. Cobb, P. E.
State Dam Safety Engineer
Alaska Department of Natural Resources
(907) 269-8636 Desk
(907) 748-2942 Cell

Alaska Dam Safety Program

From: Mark Whisenhunt [mailto:Mark.Whisenhunt@matsugov.us]
Sent: Tuesday, November 29, 2016 3:41 PM
To: Cobb, Charles F (DNR) <charles.cobb@alaska.gov>
Cc: Alex Strawn <Alex.Strawn@matsugov.us>
Subject: CMS / Spillway
Importance: High

Good Afternoon Mr. Cobb,

Can you please send our office an update on the status of the spillway issues located on property owned by Central Monofill Services, just south of Palmer.

Thank you.

Respectfully,

Mark Whisenhunt

Planner II
Matanuska-Susitna Borough
Office: (907) 861-8527
Fax: (907) 861-7876
mark.whisenhunt@matsugov.us

Matanuska-Susitna Borough
Planning & Land Use Department
Development Services Division
350 East Dahlia Avenue
Palmer, Alaska 99645

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PALMER AK 99645-1875

Matanuska - Susitna Borough
Development Services
NOV 16 2016
Received

FIRST CLASS

The Matanuska-Susitna Borough Planning Commission will consider the following:

Application or Item: *Application for a conditional use permit for the operation of a monofill for the disposal of inert material*

Matanuska-Susitna Borough Code Section: MSB 17.60 – Conditional Uses

Applicant: Central Monofill Services

Request: *The Superior Court for the State of Alaska has ordered the Planning Commission's decision to deny Central Monofill Services (CMS) conditional use permit be reversed and the case be remanded back to the Planning Commission. CMS had submitted a conditional use permit under MSB 17.60 – Conditional Uses, for the operation of a monofill for the disposal of inert material. The debris will primarily be non-hazardous shredded material from construction and demolition waste, including Regulated Asbestos Containing Material (RACM) and Non-RACM material.*

Location: MSB Tax Parcel# 17N02E18C010 (2840 S. Glenn Hwy.) and 17N02E19B006 (2560 S. Glenn Hwy.); within Township 17 North, Range 2 East, Sections 18 & 19, Seward Meridian.

The Planning Commission will conduct a public hearing in the Borough Assembly Chambers, Palmer, Alaska, on this item on ***December 5, 2016***. The meeting begins at 6:00 p.m. ***Public hearings begin at 6:15 p.m.*** This may be the only presentation of this item before the Planning Commission and you are invited to attend.

This conditional use permit application will be introduced for public hearing at the **November 7, 2016** Planning Commission meeting. The Planning Commission members may submit questions to the Planning Commission Clerk concerning the matter or request for more information from the applicant at the time of the introduction. All questions and requests submitted by the Commission shall be in writing and copies will be provided to the applicant and made available to all interested parties and the public upon request. Answers to questions and additional material requests will be addressed in the staff report for the public hearing.

Commission members may not receive or engage in ex-parte contact with the applicant, other parties interested in the application, or members of the public concerning the application or issues presented in the application.

Application material may be viewed on-line at www.matsugov.us and clicking on 'Public Notices'. Application material may also be reviewed in the Borough Permit Center. If you have any questions or, would like to send us comments, concerning the proposed action, this form may be used for your convenience by filling in the information below and mailing it to the Matanuska-Susitna Borough, Development Services Division, Planning Department, 350 East Dahlia, Palmer, Alaska 99645. You may ... ents to 861-8158 or e-mail to *mwhisenhunt@matsugov.us*. For additional information please contact Mark Whisenhunt, Planner II, a... ments received on or before ***5 p.m., November 14, 2016*** will be included in the Planning Commission packet for the Commission... ormation. Please be advised that comments received after that date will not be included in the staff report to the Planning Com... provided as hand-outs to the Commission. If there is not enough room below, please attach this sheet to another piece of paper. ... eligible to file an appeal from a decision of the Planning **Commission, a person must be designated an *interested party*. See MSB 15.39.010 for definition of *"Interested Party"*. The procedures governing appeals to the Board of Adjustment and Appeals are contained in MSB 15.39.010-250, which is available on the Borough internet home page, (http://www.matsugov.us), in the Borough Clerk's office, or at various libraries within the borough.**

Name: Matanuska Valley Sportsman Inc. ***Address:*** P.O. Box 1875 Palmer AK 99645

Location/Legal Description of your property: 117N02E18C008

Comments: At our Board meeting on 11/10/16, the Board voted unanimously to support Central Monofill Services' application for a conditional use permit for the property immediately to the west of our facility. Their excellent safety record in their current locations suggests that they would be a good neighbor to our facility.

Earl Lackey President MVS

Note: Vicinity Map Located on Reverse Side

Mary Brodigan

From:	Mark Whisenhunt
Sent:	Thursday, December 01, 2016 4:24 PM
To:	Mary Brodigan
Cc:	Shane Durand; Alex Strawn
Subject:	Handouts for CMS Remand
Attachments:	ASG Groundwater Report.pdf

Good Afternoon,

The 2010 Brailey Report begins on page 2,735. It was discovered that the report appears to be scanned improperly, leaving out the even numbered pages. I have attached the full report for the record.

Thank you.

Respectfully,

Mark Whisenhunt
Planner II
Matanuska-Susitna Borough
Office: (907) 861-8527
Fax: (907) 861-7876
mark.whisenhunt@matsugov.us

Brailey Hydrologic Consultants

3527 North Point Drive
Anchorage, AK 99502
phone: 907-248-0058
fax: 907-243-3754

Groundwater Modeling Report, AS&G Palmer Pit

Anchorage Sand & Gravel, Inc.
Anchorage, Alaska

AUGUST 2010

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Table 5-1. Zone Budget Results 20

EXECUTIVE SUMMARY

A groundwater modeling study was performed to assess the impact of dredging at Anchorage Sand and Gravel, Inc.'s (AS&G's) Palmer gravel pit. The proposed dredging operation would create a 130-acre lake approximately 100 feet deep. The purpose of the modeling effort was to provide an objective determination of the approximate lake elevation, and to assess potential impacts on nearby lakes and wells. For transparency to reviewers, the model is intended to be as simple as possible. This was accomplished by using the minimum number of layers needed to represent the groundwater flow system: one layer for aquifer materials that will be removed by dredging, one layer for aquifer materials that will remain after dredging, and one layer for bedrock. Around the perimeter of the model, a constant head boundary is used to mimic the regional water table slope. Local changes in water table slope are reproduced using the bedrock surface mapped using AS&G drill holes and a single zone of reduced hydraulic conductivity exposed as a silt lens on the adjacent property. The model uses a regional hydraulic conductivity value based on two high-capacity pumping tests that agree both internally and with nearby well yields. A reduced hydraulic conductivity for the silt lens is supported by adjacent pond elevations and by a domestic well test where the silt lens extends onto AS&G's property. Based on these data, the model reproduces the July 8, 2010 water table configuration with an average error within 0.5 feet, and within 0.2 feet through most of the model domain.

Although the model reproduces the July 8, 2010 water table configuration remarkably well, the model's parameter values and boundary conditions do not constitute a "unique" solution to the groundwater flow problem. That is, a slightly different set of parameter values and boundary conditions might produce an equally good fit. However, the selected parameter values and boundary conditions are "transparent", based on solely on pumping test data and measured groundwater elevations. If different water table conditions or hydraulic conductivity values are identified, these conditions can be evaluated either qualitatively or quantitatively by re-running the model.

The model calibration assumed that the July 8, 2010 water table configuration represents a steady-state condition, so that the rate of precipitation and groundwater inflow are exactly balanced by the rate of groundwater outflow. In reality, natural aquifers are always responding to seasonal changes in precipitation and recharge. As a result, the

water table is expected to fluctuate upward and downward from the July 8, 2010 configuration. By limiting the analysis to a steady-state condition, we are assuming that seasonal changes in precipitation and recharge are not important relative to the long-term water table configuration.

Model results indicate dredging would produce a slight (1 to 2-foot) depression in the water table around the north end of the lake, and a corresponding water table rise around the south end of the lake. The lake would depress the water table at the Pioneer Meadows wells by about 0.5 feet, and water level changes at other wells would be less. Except for the Church well, none of the capture zones of surrounding water supply wells would intercept the lake. Due to the distance between the Church well and the lake (over 450 feet), no water quality impacts are anticipated at the Church well.

The model was used to calculate groundwater flow through the lake cells and through a cross section downgradient of the lake. Results indicate that flow through the lake cells would increase by about 7.7 million gallons per day (mgd) after dredging, and flow through the downgradient cross section would increase by about 4.4 mgd. Based on previous pump test results, this could cause a significant increase in the elevation of Wilder Pond. If a 200-foot dike was constructed between the north and south halves of the lake, the inflow to Wilder Pond would be reduced to about 1.5 mgd. At this rate of inflow, the rise in the pond surface elevation would be less than 1.5 feet.

Fine sediment accumulation would tend to reduce flow through the lake(s). By monitoring the rate of water level rise during dreding of the north lake, the effect of sediment accumulation can be evaluated.

A 1992 study concluded that irrigation withdrawals over 6 mgd are not stressing area aquifers, and that the potential water supply significantly exceeds actual use. With a dike between the north and south lakes, the increased flow due to dredging represents less than one-fourth of irrigation use. Considering that the water is recharged into the aquifer, the dredging activity should have little effect on the overall groundwater flow system. For comparison, the increased flow resulting from two lakes (1.5 mgd) represents about one-fifth of the mean annual flow of Wasilla Creek at Fishook Road, located approximately 10 miles upstream from the Palmer Hay Flats.

1.0 INTRODUCTION

This document provides the results of groundwater modeling at Anchorage Sand & Gravel, Inc's. (AS&G's) Palmer Pit. The purpose of the modeling effort is to resolve questions regarding the effects of gravel dredging on the underlying aquifer. As shown on Figure 1-1, the dredging operation would create a 130-acre lake up approximately 100 feet deep. A previous assessment concluded that the lake would cause a slight (1 to 2-foot) depression in the water table around the north end of the lake, and a corresponding water table rise around the south end of the lake (Brailey 2007). However, questions remain concerning the resulting lake levels and effects on nearby wells (Munter 2009). Specifically, these questions include:

- What is the expected lake level, and what effect will this have on the surrounding aquifer?
- How much flow will pass through the lake as compared with the undisturbed aquifer?
- How will the lake affect the capture zones of the Crimson View and Pioneer Meadows public water systems?
- What options are available to minimize changes to the surrounding groundwater flow system?

Figure 1-1. Proposed Lake at AS&G's Palmer Pit

A 3-dimensional groundwater model was prepared to specifically address these issues. The model is intended to be as simple as possible while still adequately representing the groundwater flow system. The model includes the effects of an uneven bedrock surface and the large pond(s) south of AS&G's property (Figure 1-1). The model does not consider transient water table fluctuations, focusing instead on steady-state flow conditions with and without the lake. Aquifer properties are based on measured values throughout most of the model domain, and assumed values for a silt formation that separates two ponds. The resulting calibration provides general agreement with the measured water table configuration, but does not reproduce local water level variations. Because the goals of the model are to address large-scale impacts surrounding the 130-acre lake, small-scale deviations from measured water table configurations were considered acceptable.

Groundwater modeling was performed using Visual MODFLOW v. 4.1, which includes MODFLOW-2000, a modular 3-dimensional finite-difference groundwater flow model developed by the U.S. Geological Survey (USGS; Harbaugh et al. 2000). Visual MODFLOW also includes MODPATH and Zone Budget, two USGS programs to calculate particle pathlines and subregional water budgets, respectively.

The following sections describe the regional geology and hydrology, model grid and boundary conditions, steady state calibrations, and predictive modeling results.

2.0 REGIONAL GEOLOGY AND HYDROLOGY

The Matanuska valley near Palmer is bounded by the Talkeetna Mountains on the north and the Chugach Mountains to the south and east (Figure 2-1). The Matanuska valley was formed by repeated glacial advances along a zone of faulting and deformation between metasedimentary and metaigneous rocks the Chugach Terrane on the south and granitic and sedimentary rocks the Peninsular Terrane on the north. Bedrock is exposed at the surface along the fronts of the Talkeetna and Chugach mountains, and is mantled by alluvium on the valley floor. The thickness of alluvium varies considerably, ranging up to over 200 feet near the center of the "Palmer terrace" (Pewe and Reger 1983; Figure 2-2). Local bedrock highs occur at Bodenburg Butte, a constriction of the Matanuska River near Palmer, and in the western part of the AS&G property (Figures 2-1 and 2-2).

Figure 2-1. Regional Geologic and Hydrologic Setting

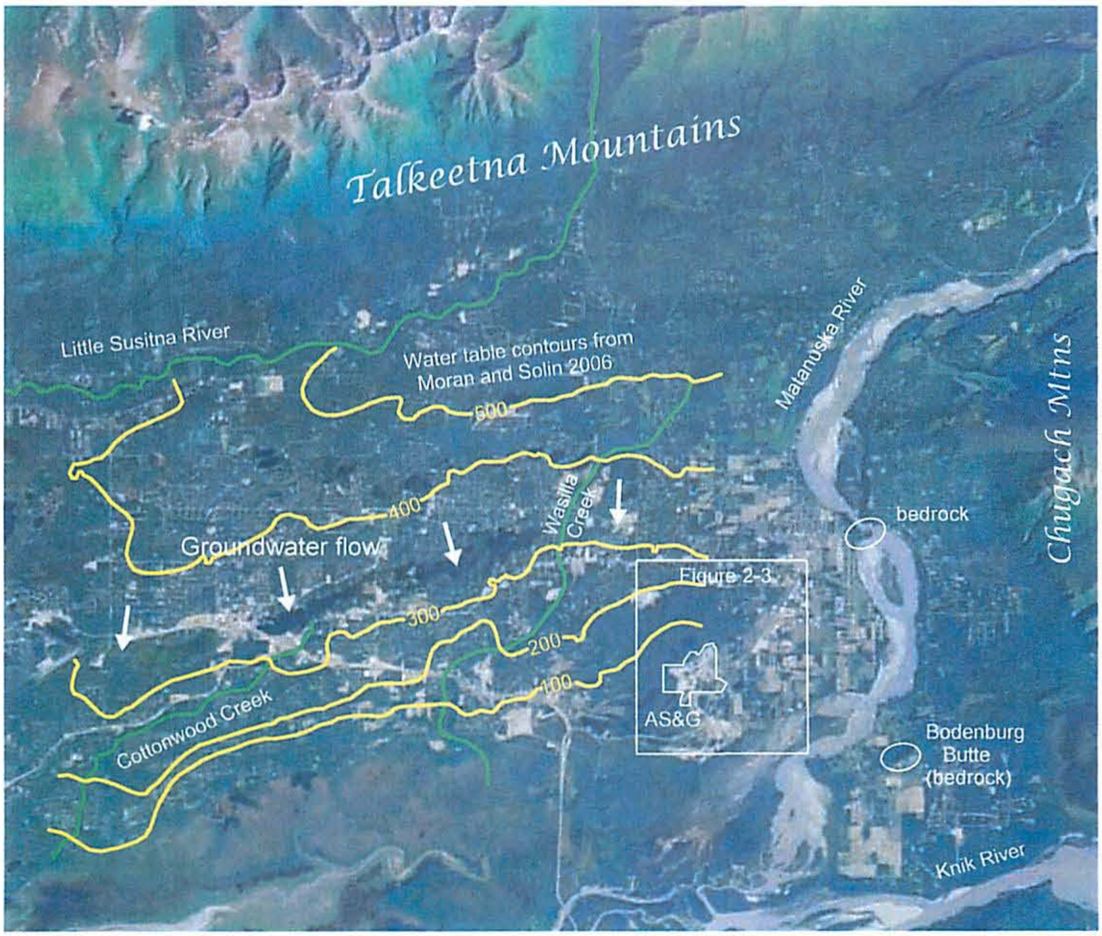
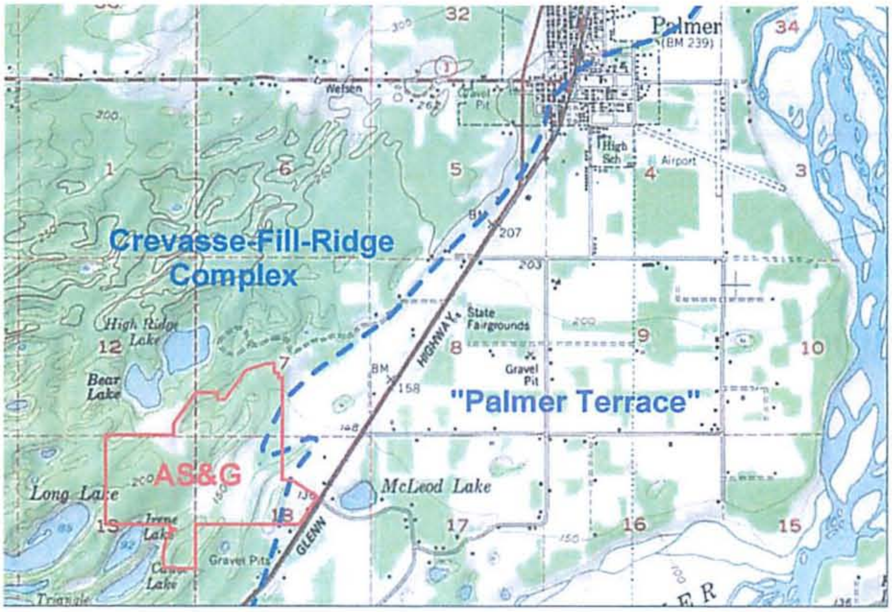
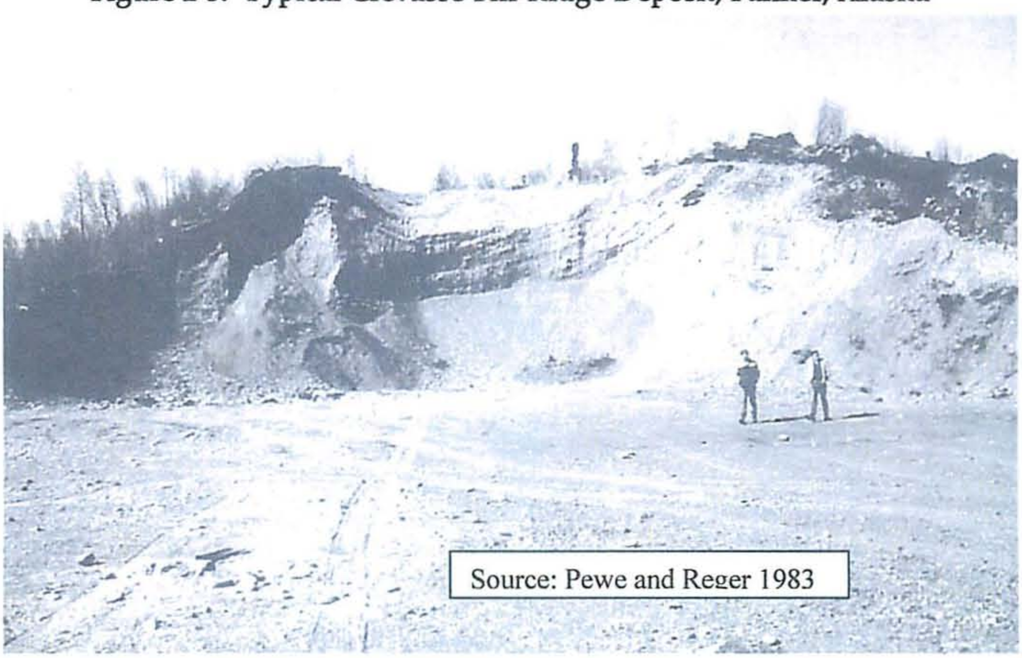


Figure 2-2. "Palmer terrace" and Crevasse-Fill-Ridge Deposits



AS&G's Palmer Pit is located in crevasse-fill-ridge deposits located immediately west of the "Palmer terrace" (Pewe and Reger 1983). These deposits formed in subparallel crevasses that developed in stagnant ice during the later stages of the Naptowne Glaciation. Although most of the ridges are comprised of marketable sand and gravel (Figure 2-3), one ridge on the west side of Wilder Pond contained a silt lens that

Figure 2-3. Typical Crevasse-Fill-Ridge Deposit, Palmer, Alaska



separated the dredge pond from a topographically depressed area to the west. The silt lens was breached in July 2004, causing flooding of the depressed area and lowering of the dredge pond by as much as 7.6 feet (Figure 2-4).

Figure 2-4. Wilder Pond in 2003 vs. 2006

The "Palmer terrace" was deposited slightly after the crevasse-fill-ridge deposits, as the Naptowne ice front retreated to the north. These outwash deposits locally overlie the crevasse-fill-ridge sediments in the vicinity of the Palmer Pit (Pewe and Reger 1994).

Based on a regional water table map prepared by the U.S. Geological Survey (Moran and Solin 2006), groundwater flow is generally southward from the Talkeetna Mountain front (Figure 2-1). In the vicinity of the Palmer Pit, groundwater occurs in an unconfined aquifer tapped by numerous domestic and community water supply wells (Figure 2-5). The aquifer is relatively thick (locally over 200 feet) and commonly exhibits high well yields. Comparison of the water table elevation with adjacent floodplain elevations (Figure 2-2) suggests that the unconfined aquifer is recharged by both the Matanuska River and by groundwater inflow from the north. Oxygen isotope studies performed by the U.S. Geological Survey indicate that the water table aquifer

Water well locations from LaSage 1992

—50— Water table contours. West half of map generalized from Moran and Solin 2006; east half generalized from Jokela et al. 1990

Figure 2-5. Water Table in the Vicinity of AS&G's Palmer Pit

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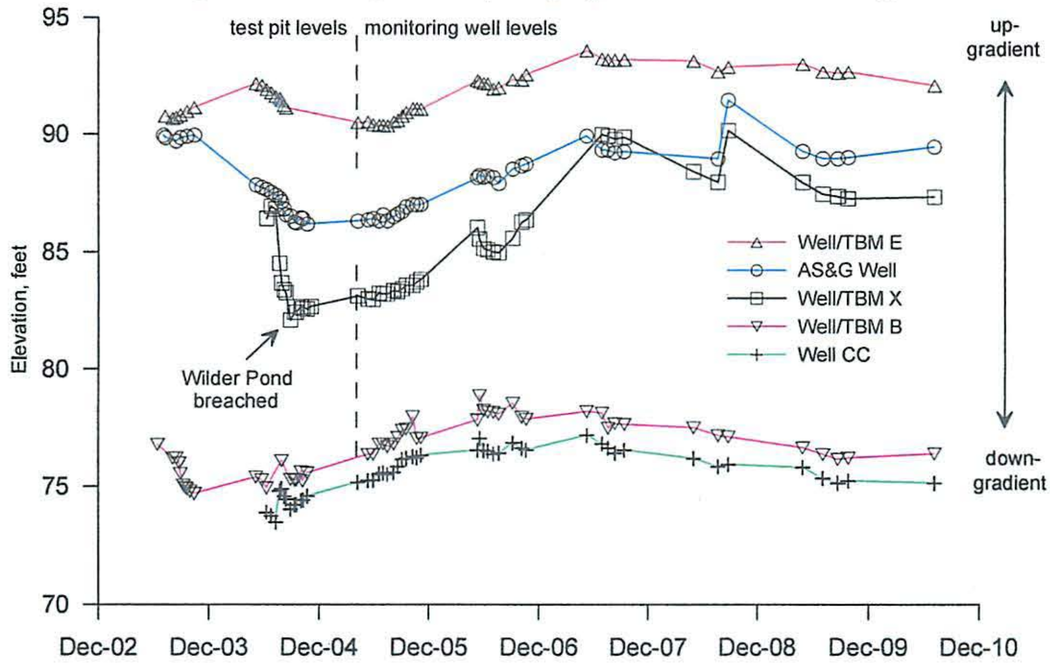
has a direct hydraulic connection to many lakes in the Palmer-Wasilla area (Moran and Solin 2006).

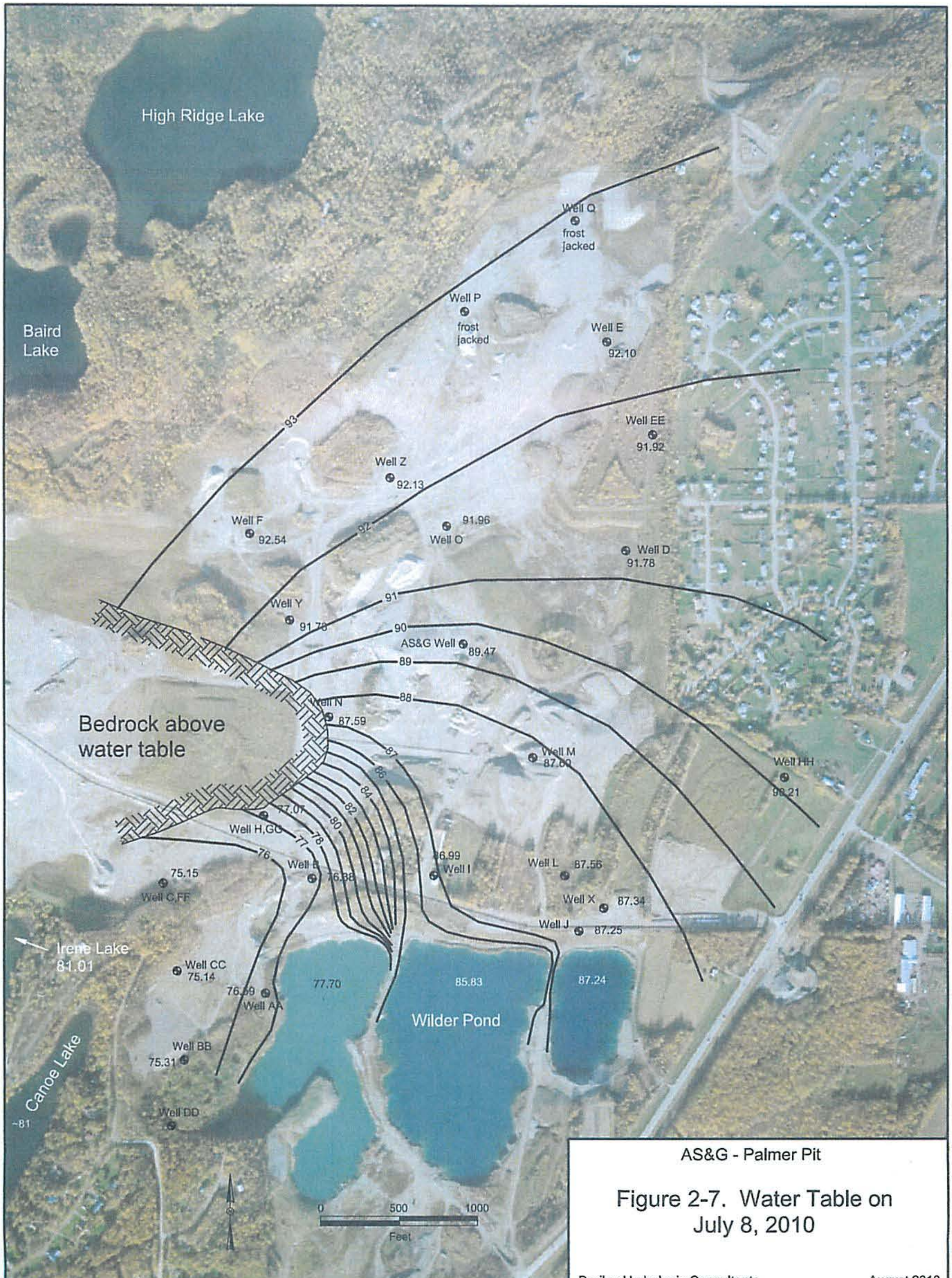
AS&G has performed periodic water level measurements at the Palmer Pit since 2003 (Figure 2-6). The initial monitoring network included a number of test pits that were replaced with monitoring wells in 2005. The current monitoring network includes 19 PVC monitoring wells, three inactive steel-cased wells, and an active domestic well. Water levels in the central Wilder Pond were monitored from 2003 to 2005, but were not available for the east and west ponds until July 2010. Similarly, concurrent water level elevations for Canoe and Irene Lakes were not available until July 2010.

Including water surface elevations for Irene Lake and the three adjacent dredge ponds, the July 8, 2010 water table configuration reflects the most complete set of water level measurements in the monitoring database. Long-term hydrographs show that the July 8, 2010 water table configuration elevation is relatively stable, having adjusted to the adjacent dredge ponds excavated in 2002 through 2007 (Figure 2-6).

Figure 2-6. Long-term Hydrographs, AS&G Monitoring Wells



The July 8, 2010 water table configuration shows a generally southward groundwater flow direction that curves around a bedrock high separating Baird and High Ridge Lakes to the north from Canoe and Irene Lakes to the south (Figure 2-7). Based on



AS&G - Palmer Pit

Figure 2-7. Water Table on July 8, 2010

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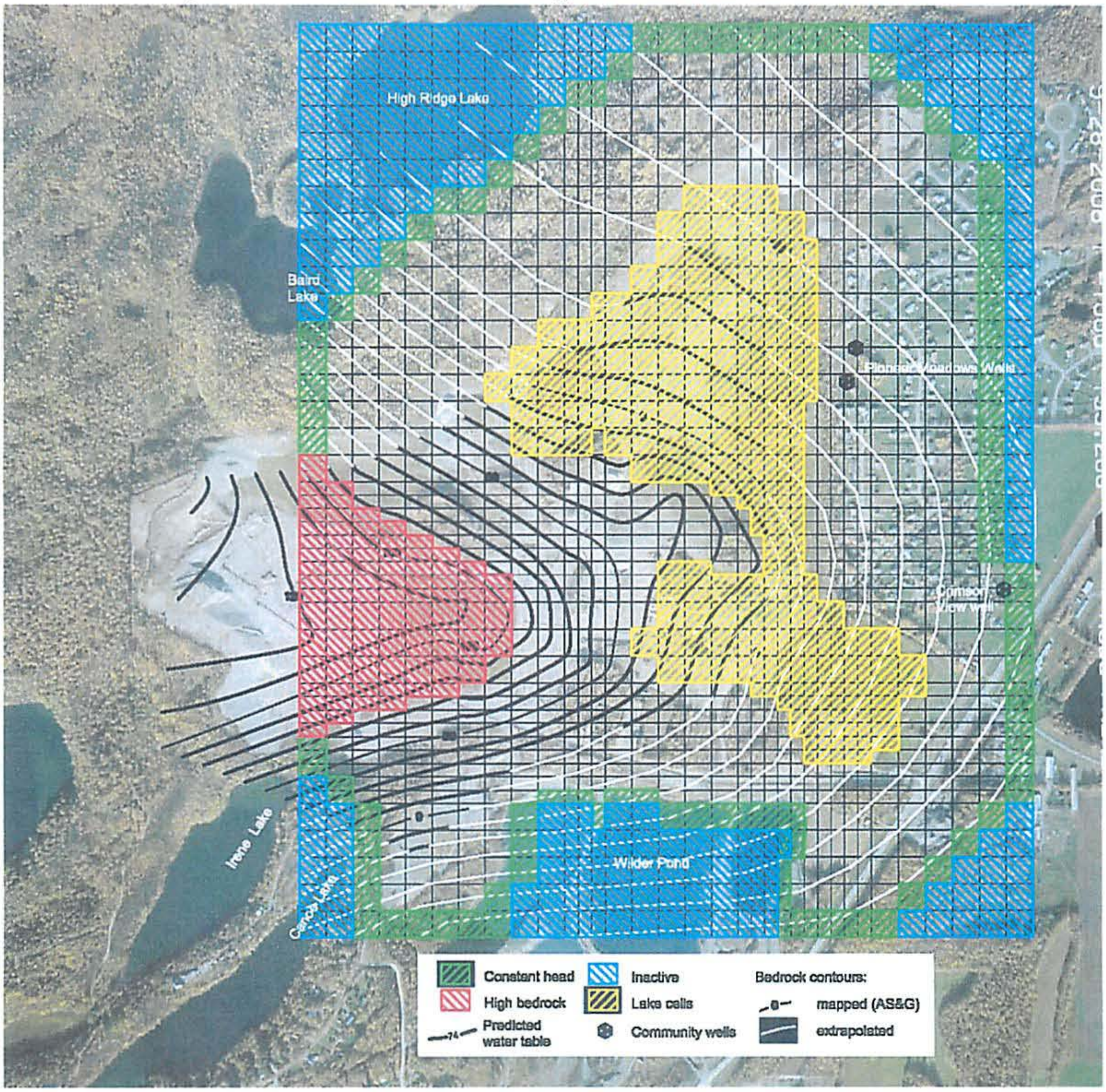
aerial photogrammetric measurements (AeroMetric 2008), the elevation difference between Baird and Irene Lakes is about 25 feet. Although the surface of Canoe and Irene Lakes is about 5 feet above the water table, the slope of the water table is consistent with the elevation difference between the lakes north and south of AS&G's property. The difference between the water table elevation and the surface of Canoe and Irene Lakes suggests that the lakes are perched by fine grained sediments lining the bottoms of the lakes. Perching of lakes and streams has long been recognized in the groundwater literature, and is commonly modeled using a reduced lake or streambed conductance relative to the underlying deposits (e.g. Merritt and Konikow 2000).

Although the unconfined aquifer generally flows southward toward discharge areas along the Matanuska River (Munter 2010), the lowest groundwater elevations occur in the southwest corner of AS&G's property (Figure 2-7). This suggests a zone of increased transmissivity south of Canoe Lake. By analogy with Echo and Kepler Lakes, Canoe and Irene Lakes were once occupied by stagnant ice masses separated by meltwater streams (Reger and Updike 1983). Flow constrictions between the stagnant ice masses could have resulted in high-permeability zones between the lakes. Fine-grained sediments and a former pond at the location of Wilder's central pond (Figure 2-2) suggest that an ice mass was present in this area. If so, meltwater flows could have been constricted between this area and the ice mass in Canoe Lake, resulting in a buried channel of high-permeability deposits.

3.0 MODEL GRID AND BOUNDARY CONDITIONS

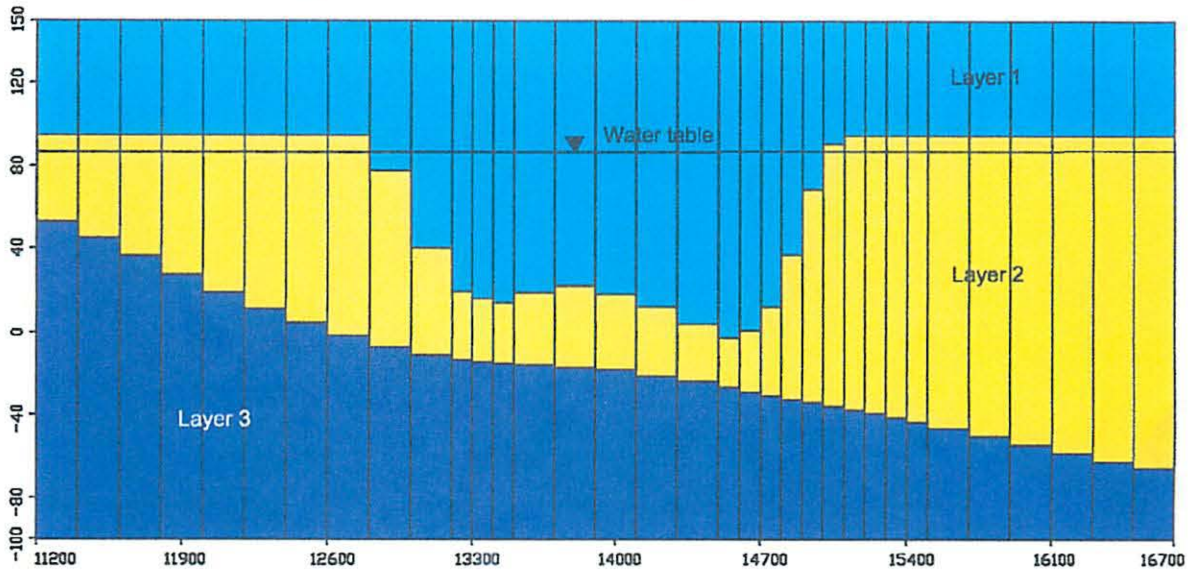
As proposed in AS&G's *Groundwater Modeling Plan* (Brailey 2009), the model grid is oriented north-south, approximately parallel to the regional groundwater flow direction (Figures 2-1 and 2-4). The grid includes three layers, each consisting of 43 rows and 34 columns. The bottom layer (Layer 3) represents bedrock, simulated using inactive cells. Geologic mapping performed by AS&G indicates a bedrock ridge beneath the western part of AS&G's property, where bedrock elevations extend up to 30 feet above the water table. The bedrock elevation is well-defined in the center and west of the model area, but required extrapolation to the north, east, and south (Figure 3-1).

Figure 3-1. Model Grid Showing Bedrock Elevation Contours



The middle layer (Layer 2) represents aquifer materials that will not be disturbed by mining, and the top layer (Layer 1) represents materials that will be removed (Figure 3-2). The model was calibrated using the same hydraulic conductivity for Layers 1 and 2, representing hydrologic conditions before mining. The effect of gravel dredging was simulated by increasing the hydraulic conductivity of Layer 1 until all of the "lake" cells exhibited the same head. This provides an unbiased estimate of the lake elevation, dependent only calculated water flows into and out of the lake.

Figure 3-2. Model Cross Section: Row 13



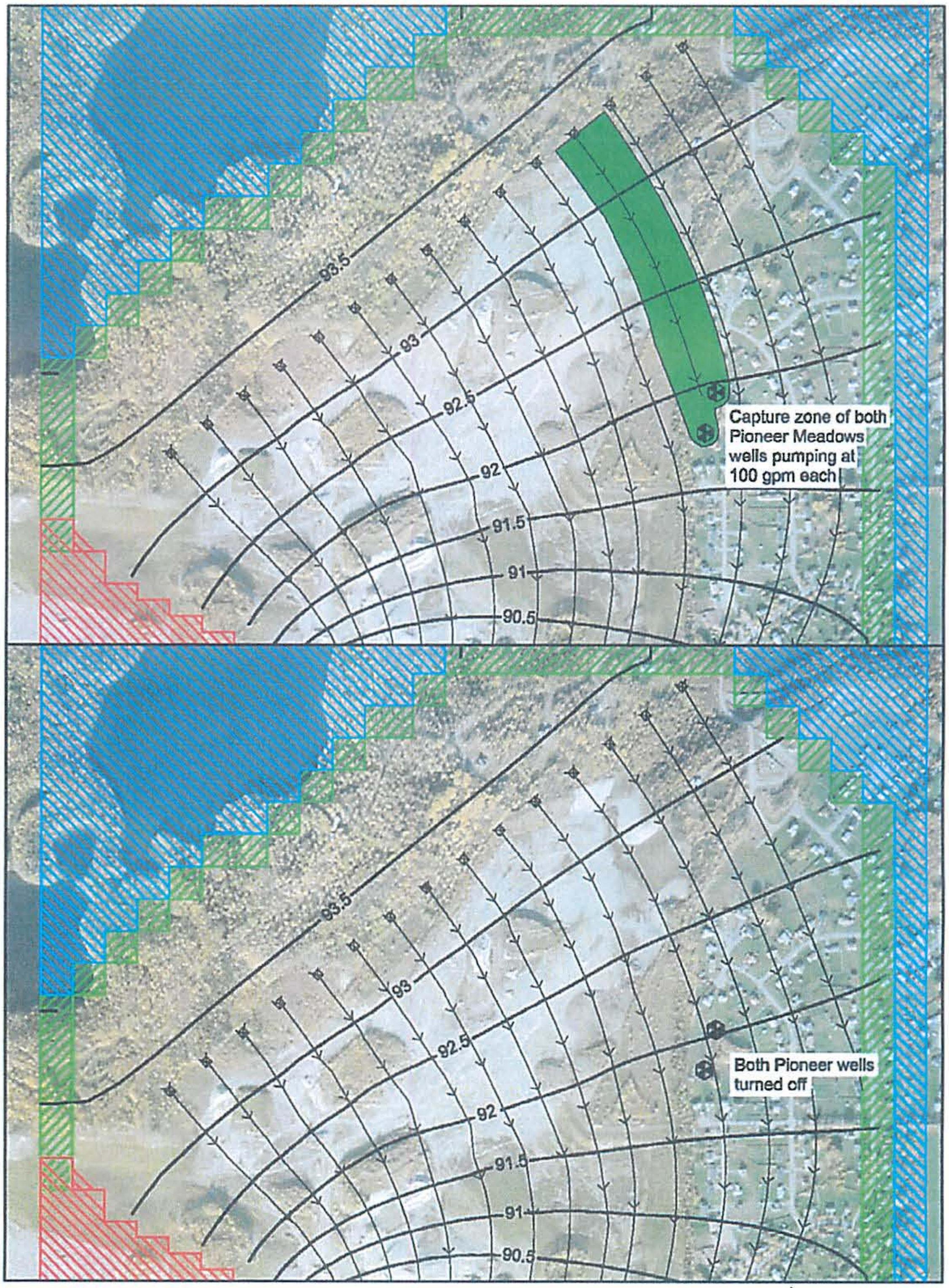
The model's lateral boundary conditions are illustrated on Figure 2-1. Except where bedrock elevations are above the water table, the perimeter of the model is a constant head boundary with head values estimated from water table maps of the monitoring network.

Groundwater recharge from precipitation was included by specifying a recharge rate of four inches per year throughout the model domain. This represents about one-fourth of annual precipitation, and is consistent with recharge values estimated by Patrick and others (1989) for lower elevations in the Anchorage Bowl. Modeling results indicate that recharge from precipitation is a relatively small component of the overall water balance.

A final boundary condition was included to assess the impact of water supply wells on the local groundwater flow system. There are five domestic wells and two community water supply systems within the model domain. The Pioneer Meadows community water supply system served 86 residents in 2001, and the Crimson View community supply system served 120 residents in 1998. The five domestic wells serve individual homes.

To evaluate the effect of water supply wells, two pumping wells were added at locations corresponding to the Pioneer Meadows wells (Figure 3-3). These wells are located such that the constant head boundary has little effect on modeled drawdown and flowlines. In contrast, the Crimson View well is located immediately adjacent to a constant head boundary. The Pioneer Meadows wells were both assigned continuous pumping rates of 100 gallons per minute (gpm), for a combined flow rate nearly ten times the Crimson View system's peak daily production for 2001. Even at these pumping rates, the model results demonstrate that the Pioneer Meadows wells have little effect on the groundwater flow system (Figure 3-3). By analogy, the Crimson View well and the five domestic wells should have little effect on the goals of the modeling effort.

Figure 3-3. Effect of the Pioneer Meadows Wells Pumping at 100 gpm Each



4.0 MODEL CALIBRATION

AS&G's *Groundwater Modeling Plan* proposed fitting the model to measured water table configurations during and after a June 2004 pumping test of Wilder Pond, using the measured pumping rate (3,300 gpm) as an additional boundary condition. Two sets of water level measurements were recorded during this period, on June 12 and June 27, 2004. As shown on Figures 4-1 and 4-2, other water level changes (unrelated to pumping) also occurred between June 12 and 23, 2004. Because the non-pumping water level changes had a significant effect on the flow rate entering Wilder Pond, the measured pumping rate could not be reproduced within reasonable parameter limits.

However, an acceptable steady-state calibration was obtained using water level measurements on July 8, 2010 (Figure 4-3). In addition to the wells measured in June 2004, the July 8, 2010 measurements included several data points near AS&G's south property boundary, including Wells H and I, the three dredge ponds south of AS&G's property, and Irene Lake. Long-term hydrographs show that the July 8, 2010 water table configuration elevation is relatively stable, having adjusted to the adjacent dredge ponds excavated in 2002 through 2007 (Figure 2-6).

Based on consistent pump test results for Wilder Pond and the AS&G Well (Appendix A), the July 8, 2010 calibration assumed a regional hydraulic conductivity of 1,400 ft/day, with a lens of reduced hydraulic conductivity paralleling Canoe and Irene Lakes (Figure 4-3). A pump test performed on Well I (Appendix A) indicates a local hydraulic conductivity of 50 ft/day on the east side of the lens, and the 8-foot difference in water levels suggests an even lower hydraulic conductivity between Wilder's central and western dredge ponds. Accordingly, the lens was assigned an hydraulic conductivity of 50 ft/day near Well I and 10 ft/day between Wilder's central and western dredge ponds. This hydraulic conductivity distribution results in an average error of +1.22 feet in predicted water table elevations west of the low permeability lens, and an average error of +0.14 feet elsewhere throughout the model. The model error west of the low permeability lens could be reduced by further increasing the local hydraulic conductivity, but this result has little effect on model outcomes.

AS&G - Palmer Pit

Figure 4-1. Measured vs. Predicted Water Table on June 12, 2004

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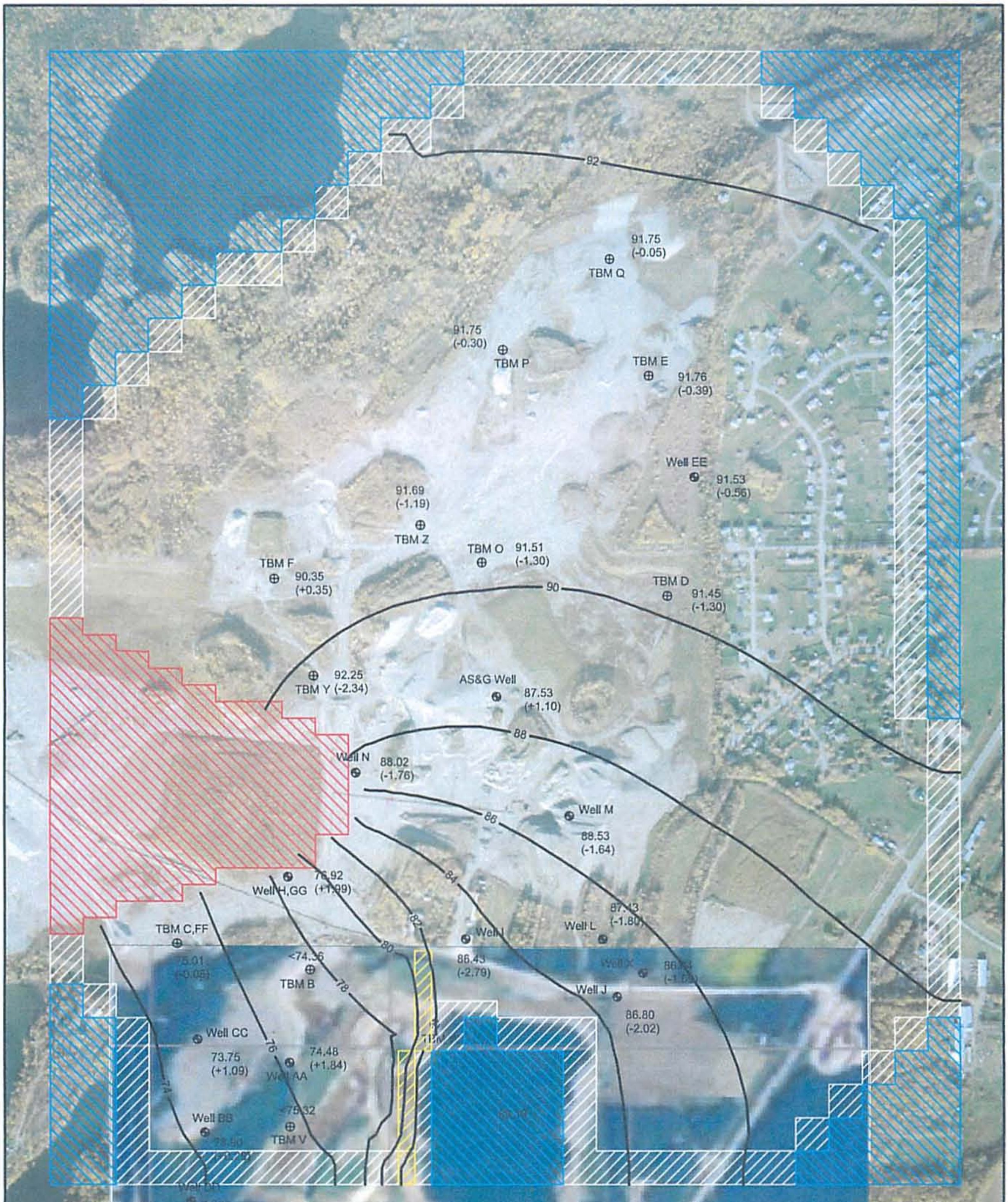

AS&G - Palmer Pit

Figure 4-2. Measured vs. Predicted Water Table on June 27, 2004

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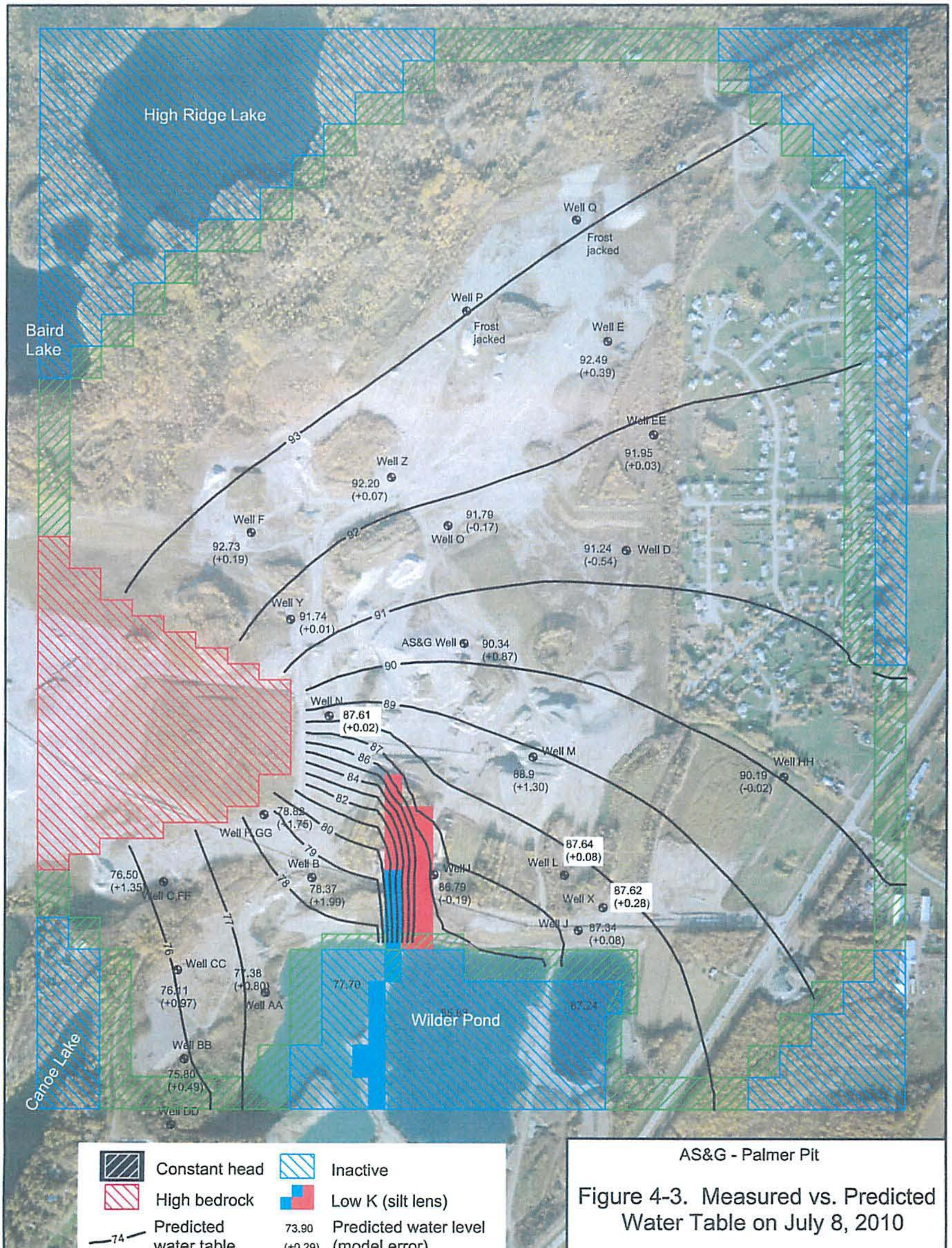
April 2010



AS&G - Palmer Pit

Figure 4-3. Measured vs. Predicted Water Table on July 8, 2010

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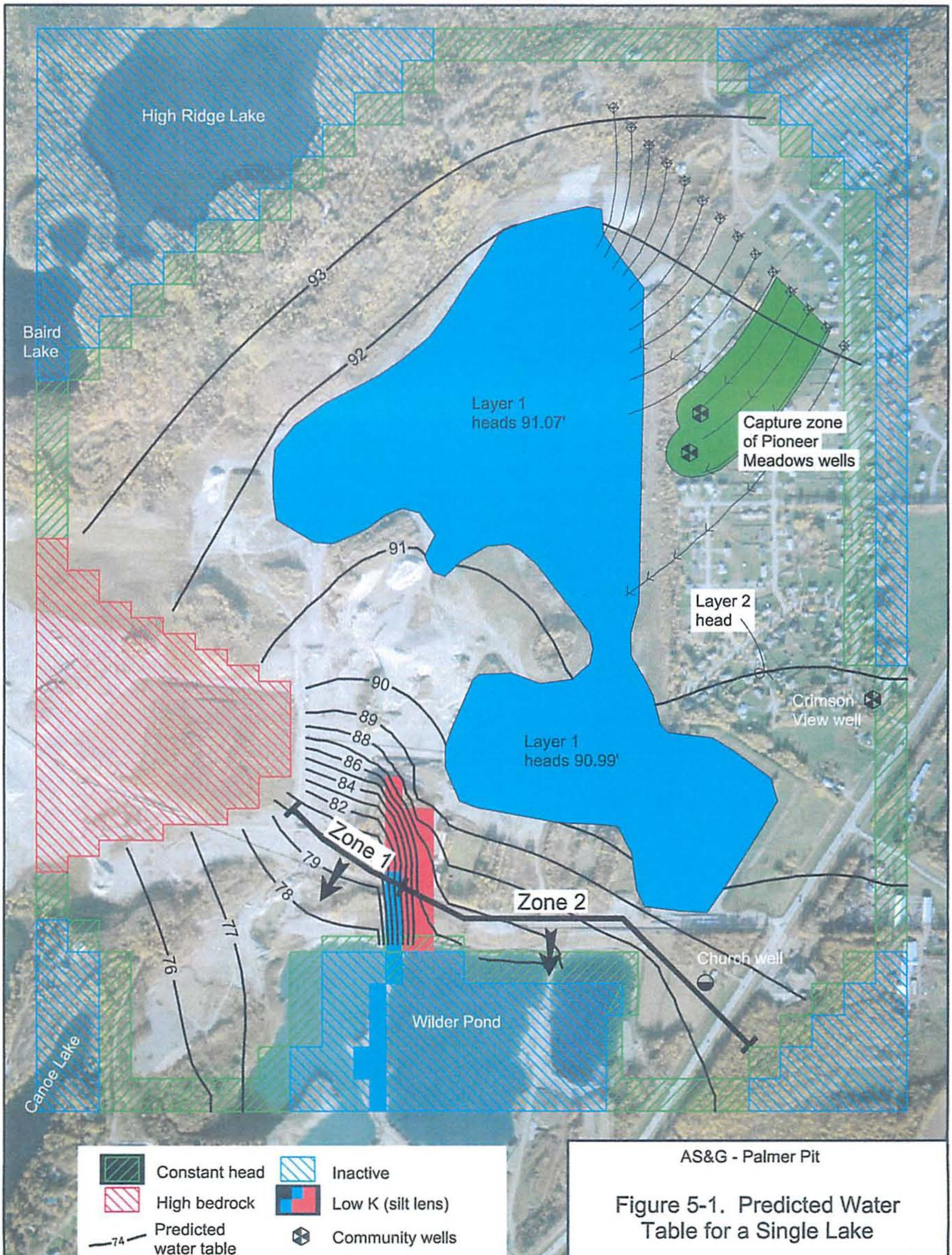
5.0 PREDICTIVE MODELING RESULTS

Predictive modeling runs were performed using the July 8, 2010 water table configuration, reflecting the current dredge pond geometry south of AS&G's property. The model runs were performed assuming steady-state conditions, which does not account for seasonal water table fluctuations or variations in pumping and recharge rates. Nevertheless, the steady-state runs illustrate the general groundwater flow changes that can be expected after dredging of the lake.

The effect of the lake was simulated by increasing the hydraulic conductivity of Layer 1 until all of the lake cells showed the same head value. In the lake's original configuration, convergent solutions were obtained using Layer 1 hydraulic conductivities up to 10,000,000 ft/day, resulting in lake head values that agreed to within 0.01 feet. However, subsequent dredging plans involved a 20 percent expansion of the south half of the lake. In this configuration, convergent solutions could only be obtained for Layer 1 hydraulic conductivities up to 5,000,000 ft/day. This configuration results in a 0.08-foot head difference between the north and south halves of the lake (Figure 5-1). In reality, there would be no difference in water surface elevations between the two ends of the lake. The 0.08-foot head difference reflects the Layer 1 hydraulic conductivity needed to achieve a convergent solution (5,000,000 ft/day), which provides more resistance to flow than an open channel. Although slightly inaccurate from a surface water standpoint, this difference does not affect the accuracy of modeled groundwater elevations and flow quantities. Rather, the modeling approach provides an unbiased estimate of the resulting lake elevation.

The modeled water table contours indicate that groundwater would enter the north half of the lake and exit via the south half (Figure 5-1). Comparison of modeled groundwater levels indicates that the lake would reduce the water table elevation at the Pioneer Meadows wells by about 0.5 feet. Because these wells are both 100 feet deep and have static water levels ranging from 27 to 30 feet (ADNR 2010), the lake would not affect their well yields. Likewise, because flow is toward the north half of the lake (Figure 5-1), the lake would not affect their water quality. Although the Crimson View well is too close to the model boundary for accurate simulation, its location suggests that there would be no change in well yield or water quality.

The closest domestic well downgradient of the proposed lake is the Church well, located approximately 450 feet from the lake's southeast corner (Figure 5-1). The presence of domestic wells between Canoe and Irene Lakes suggests that the aquifer provides



AS&G - Palmer Pit

Figure 5-1. Predicted Water Table for a Single Lake

Brailey Hydrologic Consultants August 2010 adequate filtration over horizontal distances much smaller than 450 feet. As a result, no water quality impacts are expected at the Church well.

The rate of groundwater flow through the lake was calculated using MODFLOW's Zone Budget module (Harbaugh 1990). Groundwater flow was calculated through the lake cells and through a cross section downgradient of the lake (Figure 5-1). The downgradient cross section was divided into two segments, one discharging into Wilder Pond and another discharging towards Canoe and Irene Lakes. The results shown on Table 5-1 indicate that the lake cells would transmit about 11 million gallons per day (mgd) after dredging, as compared with about 3 mgd under current conditions. Flow through the downgradient cross section would increase from 6.8 to 11 mgd, with most of the discharge entering Wilder Pond.

Table 5-1. Zone Budget Results

Dredging Option	Flow through Lake Cells (mgd[1])	Flow through Downgradient Cross Section, mgd[1]				
		West Segment	East Segment	Total	Increase Over Baseline	Percent Increase
Baseline conditions	3.0	1.6	5.2	6.8		
One Lake	10.7	1.7	9.5	11.2	4.4	65
Two Lakes	9.7	1.6	6.6	8.3	1.5	22
North Lake Only	6.2	1.6	5.6	7.2	0.5	7.0

1 mgd = million gallons per day

Although the model boundary requires a constant water level in Wilder Pond, pump test results (Appendix A) indicate that the increased flow would raise the pond level. By maintaining a lower pond elevation, the model boundary overestimates pond inflow. Nevertheless, it appears that a single lake on AS&G's property could cause a significant increase in the elevation of Wilder Pond. To reduce the inflow into Wilder Pond, a dike could be constructed between the north and south halves of the lake (Figure 5-2). Using an hydraulic conductivity of 10 feet/day, a 200-foot dike would reduce the inflow into Wilder Pond to about 1.5 mgd. Comparison with the June 2004 pump test results indicates that the additional inflow would raise the Wilder Pond level by about 1.5 feet. If dredging was limited to the north lake only, the additional inflow into Wilder Pond would be about 0.5 mgd, resulting in a pond level increase of about 0.5 feet.

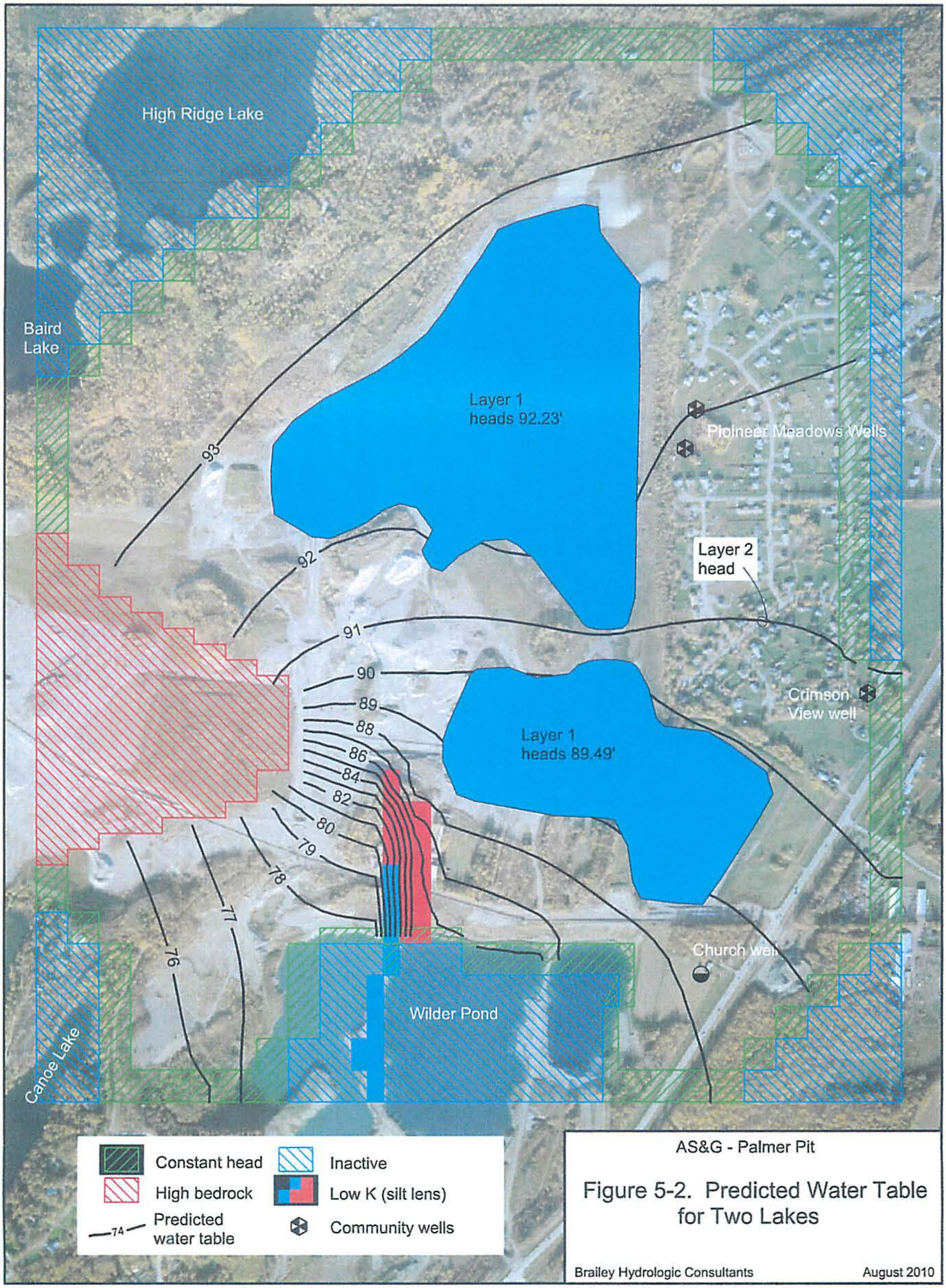


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Figure 5-2. Predicted Water Table for Two Lakes

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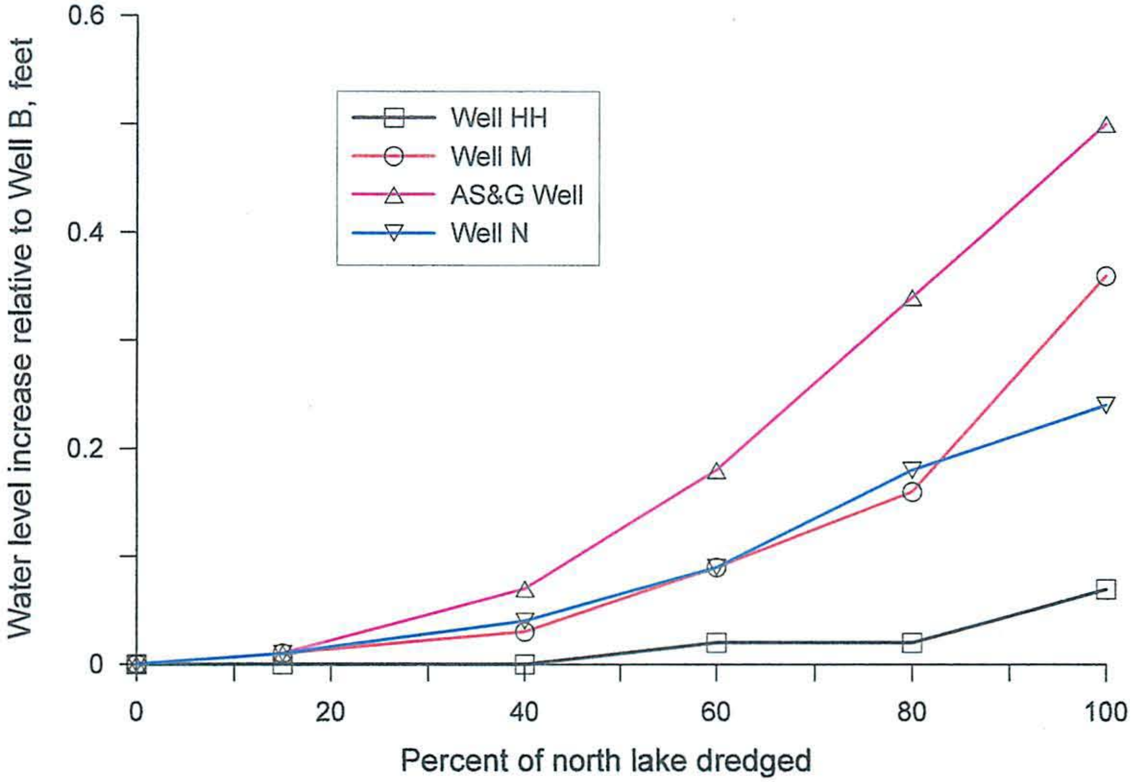
La Sage (1992) noted that the Palmer city wells are permitted for withdrawal of 2 mgd, and that irrigation use probably exceeds 6 mgd. Based on analysis of water level records, La Sage concluded that these withdrawals are not stressing area aquifers, and that the potential water supply significantly exceeds actual use. With a dike between the north and south lakes, the increased flow due to dredging (1.5 mgd) represents less than one-fourth of 1992 irrigation use. Considering that the water is recharged into the aquifer, the dredging activity should have little effect on the overall groundwater flow system.

For comparison, the increased flow resulting from two lakes (1.5 mgd) represents about one-fifth of the mean annual flow of Wasilla Creek at Fishook Road, located approximately 10 miles upstream from the Palmer Hay Flats.

The foregoing analyses assume that flow into and out of the lake will not be affected by fine-grained sediments accumulating on the lake bottom. In reality, most natural and man-made lakes develop a sediment lining that reduces groundwater exchange. For example, the water surface of Canoe Lake is perched approximately 5 feet above the water table, indicating that fine-grained sediments limit outflow into the aquifer. The dredging process will suspend fine-grained sediment in the water column, which will settle onto the lake bottom as dredging proceeds. The rate and thickness of sediment accumulation is unknown, but it will likely reduce both inflow and outflow.

AS&G plans to dredge the lakes in a north-to-south direction over a 15- to 20-year period. During this time, water levels will be monitored regularly and compared against the rate of increase predicted by the model (Figure 5-3). The resulting data will be used to assess the effect of sediment accumulation and to monitor for unforeseen adverse effects. Mitigating steps will be implemented if the data indicate any potential future problems.

Figure 5-3. Modeled Rate of Water Level Increase during Dreding of the North Lake



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APPENDIX A – GROUNDWATER PUMPING TESTS

Although the modeled water table geometry is primarily controlled by the configuration of the surrounding constant head boundary, the rate of groundwater flow through the model is dependent on the aquifer's hydraulic conductivity. To determine representative hydraulic conductivity values, groundwater pumping tests were performed on Wilder Pond and two wells located on AS&G's property. These tests are described in the following sections.

A.1 June 2004 Pumping Test on Wilder Pond

In preparation for subsequent dredging activities, Wilder Construction performed a pumping test on Wilder's central pond in June 2004. The pond was reportedly up to 200 feet deep, and was separated from a previously mined area to the west by a silt dike (Figure A-1). The silt dike was sufficiently impermeable to prevent seepage into the mined area, which was depressed up to 8 feet below the pond surface elevation. To evaluate the effect of breaching the dike (Figure 2-4), water was pumped from the central pond to another location on Wilder's property. According to flow measurements performed by Wilder, the pond was pumped at a constant rate of 3,300 gpm for 7 days. The decline in water levels due to pumping was measured using pressure transducers installed in Wilder Pond and Well AA (Figure A-2).

Figure A-1. Wilder Pond Extents, October 2003

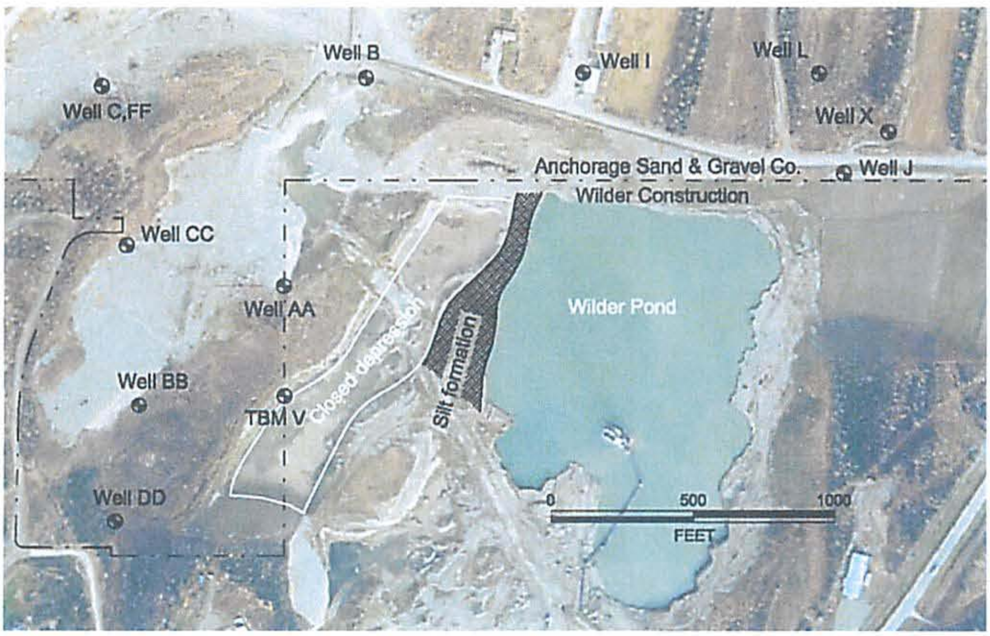
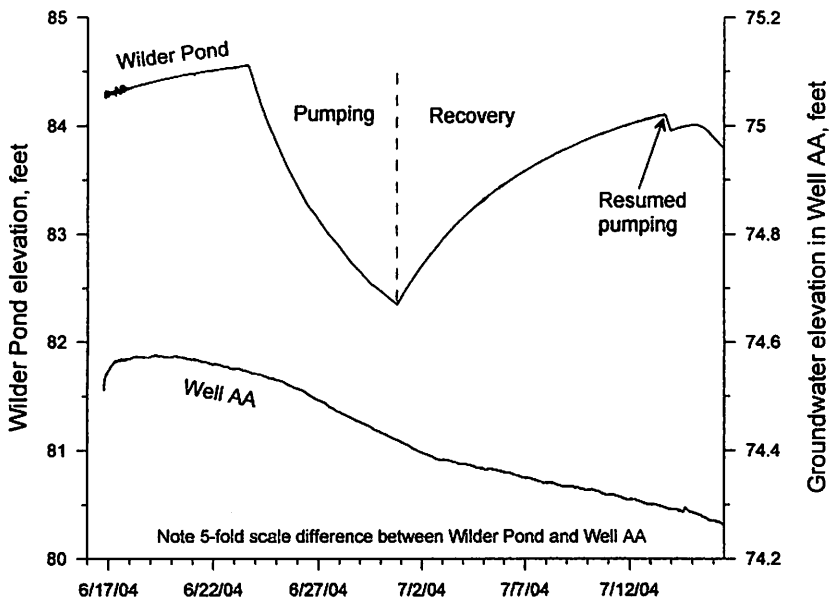
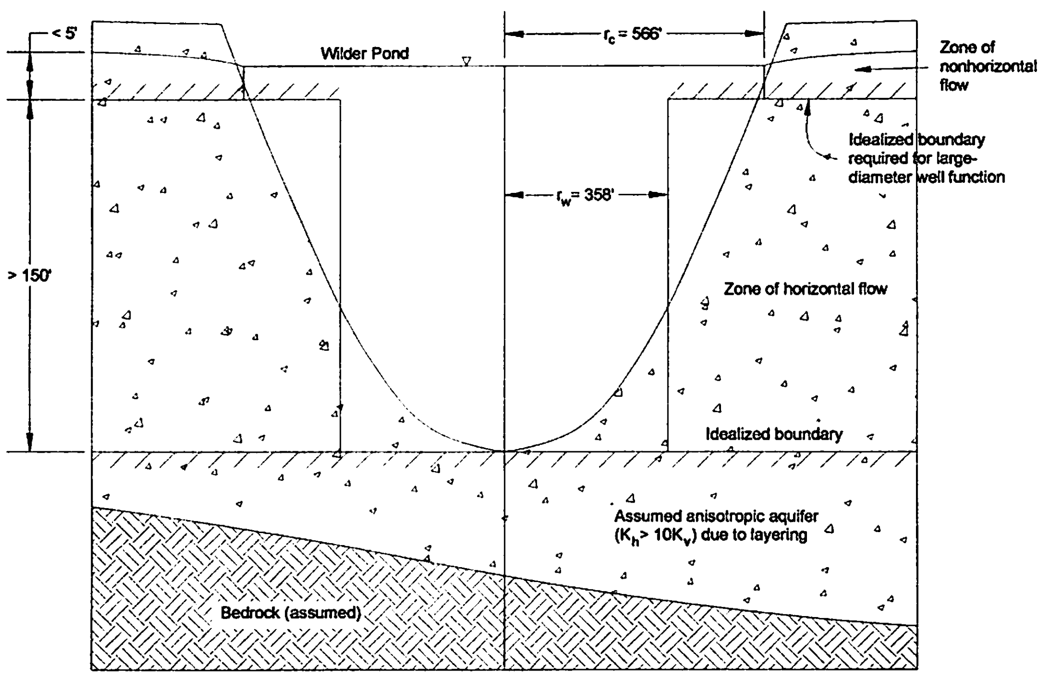


Figure A-2. Water Levels in Wilder Pond and Well AA



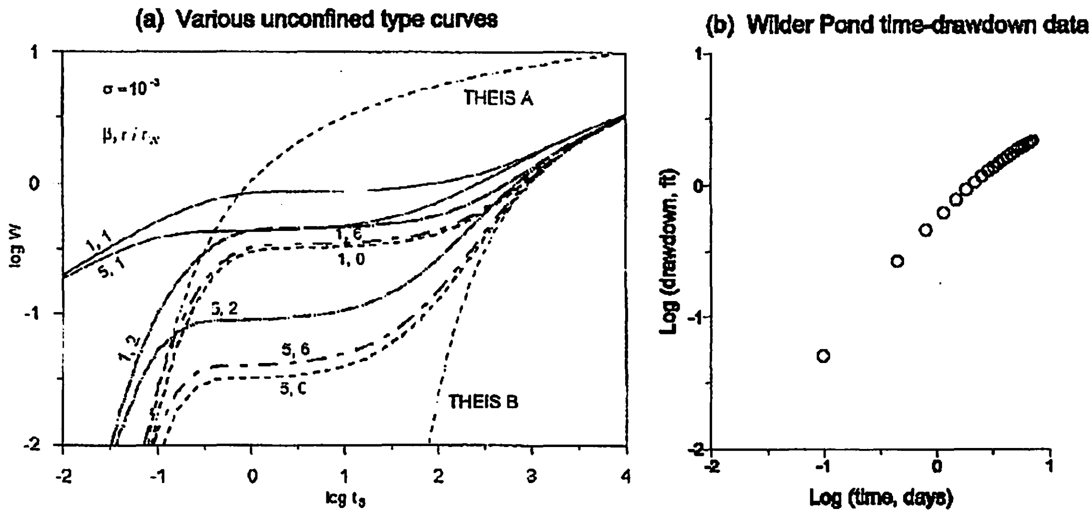
The pumping test data were analyzed using type curves for flow to a large diameter well developed by Mishra and Chachadi (1985). This approach requires the assumed geometry shown on Figure A-3, where the pond is considered to be cylindrical. The sloping sidewalls of the pond are simulated using the parameter α, defined as $\phi\,(r_w/r_c)^2$ where ϕ is porosity and r_w and r_c are the radial dimensions shown on Figure A-3. The

Figure A-3. Idealized Geometry for $\alpha = 0.1$



aquifer is assumed to be confined, with no vertical component of flow. Although the aquifer is actually unconfined, the time-drawdown curve does not show the delayed gravity response characteristic of unconfined aquifers (Figure A-4). This suggests that the effect of gravity drainage is negligible relative to horizontal flow, and water is released from the aquifer predominantly via confined aquifer mechanics. Evidence for this type of response in unconfined aquifers is discussed further by Neuman (1974).

Figure A-4. Time-Drawdown Data vs. Unconfined Type Curves



Source: Lee 1998, p. 178.

The pumping test data were evaluated by superimposing a log-log plot of drawdown vs. the reciprocal of time on type curves provided by Mishra and Chachadi (Figures A-5 through A-7). Type curves are provided for different values of α, defined as:

$$\alpha = \phi \left(\frac{r_w}{r_c} \right)^2 \qquad (1)$$

where ϕ is porosity and r_w and r_c are the radial dimensions shown on Figure 3. Selecting ψ as the x-axis value corresponding to the duration of pumping (t_p), transmissivity was calculated as:

$$T = \frac{\phi \, r_w^2}{4 \, t_p \psi} \qquad (2)$$

For each value of α, a different value of r_w was calculated by rearranging Equation (1). Results are summarized on Table A-1.

Figure A-5. Curve Fit of Pumping Test Data for α = 0.01

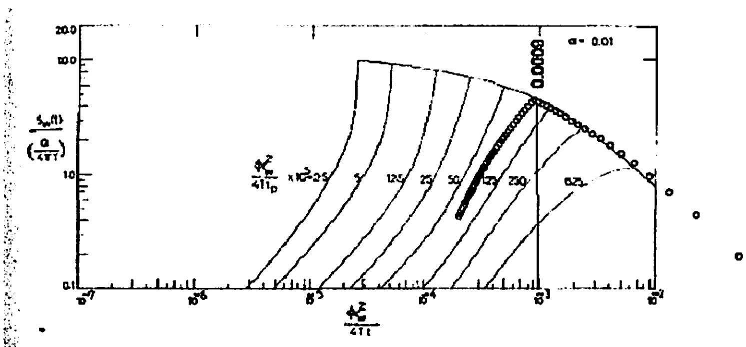


Fig. 2(b). Family of type curves: $S_W(t)/(Q/4\pi T)$ versus $\phi r_w^2/4Tt$ for $\alpha = 10^{-2}$.

Figure A-6. Curve Fit of Pumping Test Data for α = 0.001

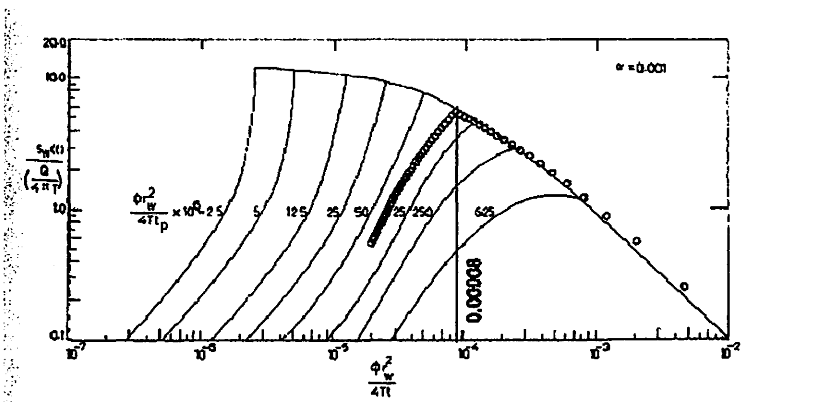


Fig. 2(c). Family of type curves: $S_W(t)/(Q/4\pi T)$ versus $\phi r_w^2/4Tt$ for $\alpha = 10^{-3}$.

Figure A-7. Curve Fit of Pumping Test Data for α = 0.0001

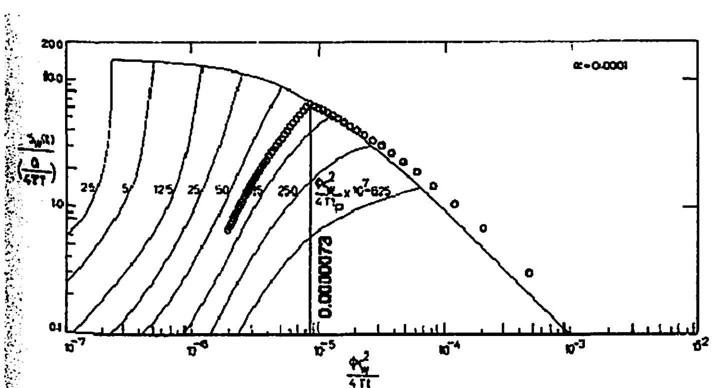


Fig. 2(d). Family of type curves: $S_W(t)/(Q/4\pi T)$ versus $\phi r_w^2/4Tt$ for $\alpha = 10^{-4}$.

Table A-1. Wilder Pond Transmissivity Calculations

Parameter	Source	Curve Fit #1 (Figure A-5)	Curve Fit #2 (Figure A-6)	Curve Fit #3 (Figure A-7)
Porosity, ϕ	Estimated	0.25	0.25	0.25
Pond radius, r_c	$[Area/\pi]^{1/2}$	566 feet	566 feet	566 feet
Deep radius, r_w	from (1)	113 feet	35.8 feet	11.3 feet
Duration of pumping, t_p	Transducer data	7.1 days	7.1 days	7.1 days
x-axis value at t_p, ψ	curve fit	0.0009	0.00008	0.0000073
Transmissivity, ft²/day	from (2)	125,335	141,002	154,522

Comparison of Figures A-5 though A-7 suggests that the best fit of pumping and recovery test data was obtained for α = 0.001 (Figure A-6), indicating an aquifer transmissivity of about 141,000 ft²/day. Assuming an aquifer thickness of 200 feet, this result corresponds to an hydraulic conductivity of 700 ft/day. However, this result assumes that flow is fully radial throughout the surrounding aquifer. In contrast, the silt lens west of Wilder Pond constitutes an hydraulic barrier that was sufficiently impermeable to prevent seepage into the adjacent depression (Figure A-2). This configuration is similar to a well located near an impermeable boundary, which is evaluated in detail by Bear (1979). For the case of a well located immediately adjacent to an impermeable boundary, the measured drawdown should be twice the drawdown in an equivalent unbounded aquifer. Because drawdown is inversely related to hydraulic conductivity, reducing drawdown by half (while maintaining a constant flow rate) is mathematically equivalent to doubling hydraulic conductivity. Thus, the actual hydraulic conductivity should be twice the value obtained using the foregoing radial flow model, or about 1,400 feet per day. If the silt lens is somewhat leaky, then the actual hydraulic conductivity may be somewhat less.

A.2 May 2010 Pumping Test on the AS&G Well

To confirm that the hydraulic conductivity on AS&G's property is comparable to that measured at Wilder Pond, a pumping test was conducted on the "AS&G Well" on May 14, 2010. Along with Wells M and N, the AS&G Well is one of three steel-cased wells in the center of the AS&G property (Figure 2-5). A well log is not available for this well, but it is 80 feet deep, with a static water level about 30 feet below ground surface. Local knowledge indicates that well has not been used since the mid-1980's, and that it may have been a high-yield well used for gravel washing operations.

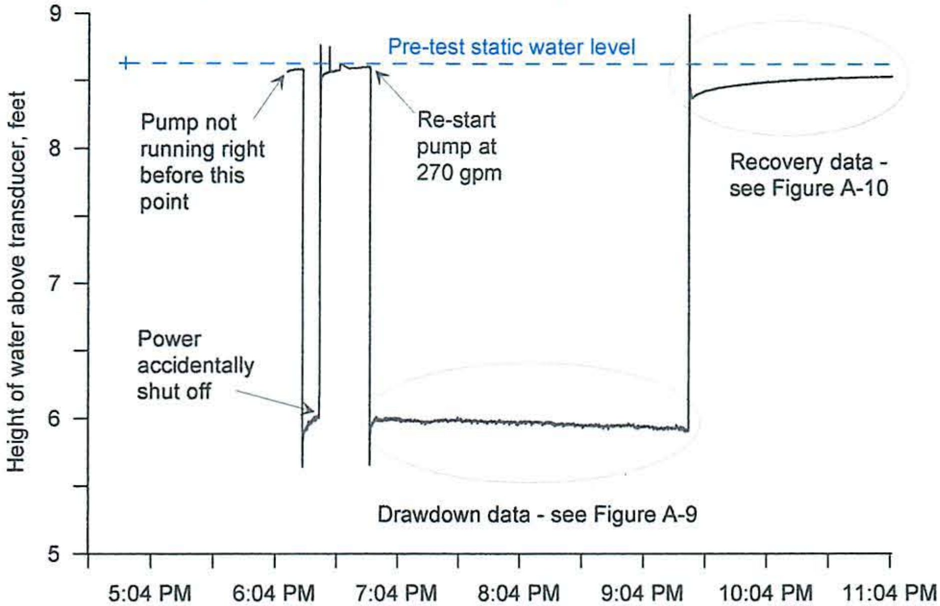
The AS&G Well is 8 inches in diameter, but has no pump or power supply. It is not known if the well is screened, perforated, or open-ended. This information is important for analysis of measured drawdowns in the pumping well, which can be exaggerated if flow is restricted as it enters the well. For this reason, additional observation wells were considered for measurement of drawdown outside the pumping well. However, the small drawdowns reported for the adjacent Pioneer Meadows wells (AWPS 2010) raised concern that drawdown might not be measurable outside the pumping well. As a result, a single-well pumping test was planned prior to installation of any observation wells.

During single-well pump tests, drawdowns in the pumping well can be affected by friction losses and by pump turbulence. However, the rise in water level after the cessation of pumping (termed recovery) can also be used to determine hydraulic conductivity. Although early-time recovery data can be affected by friction losses, the pumped well rapidly equilibrates with water levels outside the well casing, so that intermediate- and late-time recovery data reflect water levels in the surrounding aquifer. The longer the well is pumped (and the higher the pumping rate), the larger the cone of depression becomes outside the pumping well. The use of intermediate- and late-time recovery data minimizes the effect of friction losses, and provides a measure of hydraulic conductivity at a larger radial distance from the well.

Based on high nearby well yields, Anchorage Well and Pump Service installed a 30-horsepower turbine pump on May 14, 2010. The pump was powered by a 160 kilowatt (kW) generator providing 3-phase, 460-volt power. The pump was connected with four inch-diameter pipe to a totalizing flowmeter and a hose discharging downslope from the pumped well. During the test, the discharge flowed over the ground surface to the pit floor approximately 400 feet northwest.

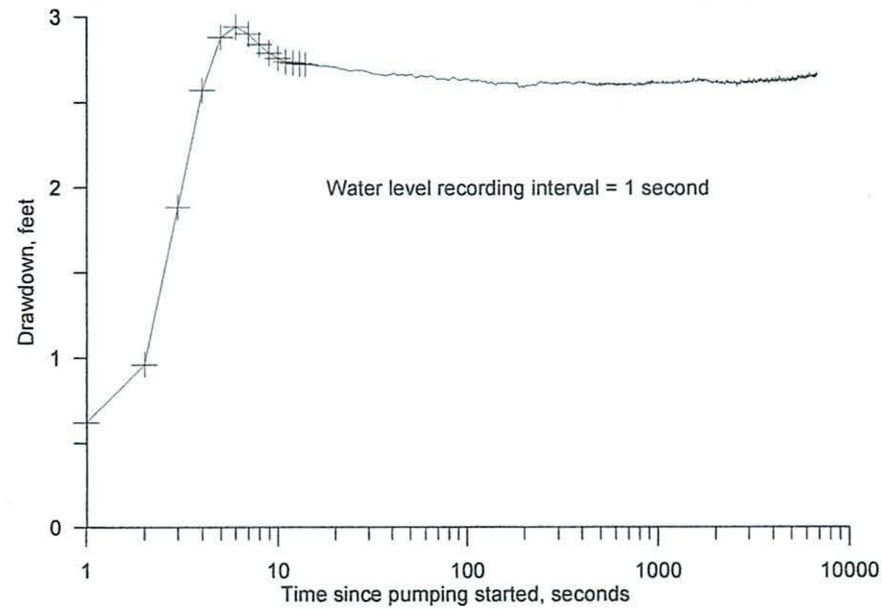
The water level in the pumped well was measured with a 5-psi pressure transducer suspended about 8 feet below the static water level. Figure A-8 shows a summary of water levels measured during pumping and the first 2 hours of recovery. The pump was first energized at 5:10 pm, but it produced only about one-tenth of its rated discharge (~300 gpm). The pump was turned off and on several times between 5:10 and 6:10 pm, during which it was determined that the pump impellers may have been plugged. Upon re-starting the pump at 6:18 pm, the pump produced a steady flow rate of 270 gpm, but the power was accidentally disconnected at 6:26 pm. The well was allowed to recover, and the pump was re-started for a final time at 6:51 pm.

Figure A-8. AS&G Well Pump Test Summary



Water level data during the drawdown cycle of the AS&G Well pumping test are shown on Figure A-9. A semilogarithmic plot is often used for drawdown analysis, during which water levels at later times should approach a straight line with a positive slope (i.e., drawdown should increase with time). In contrast, water levels during pumping

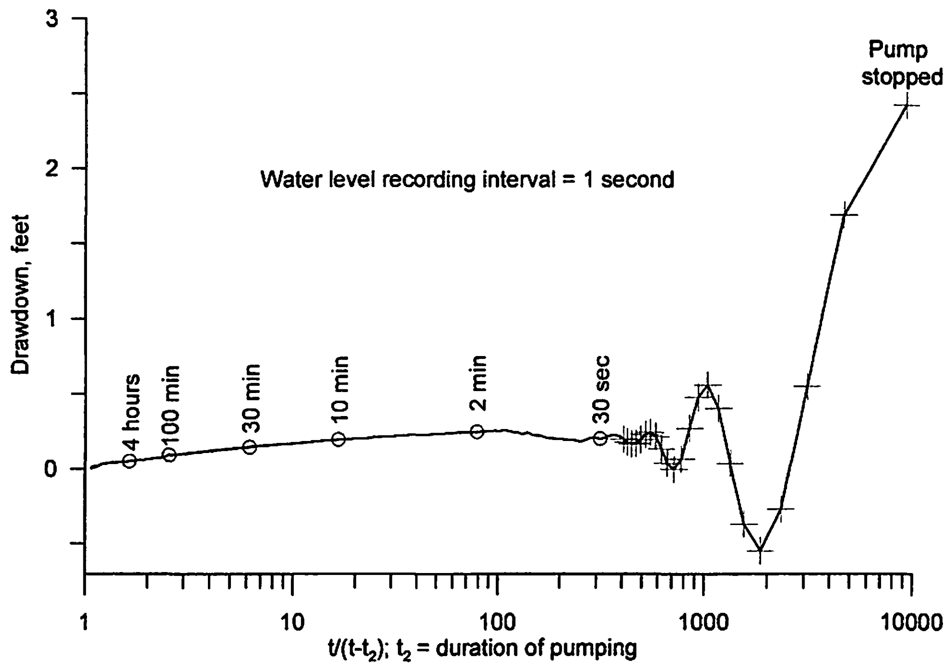
Figure A-9. Drawdown Data – AS&G Well Pumping Test



showed decreasing drawdowns after the first 6 seconds of pumping. One explanation for this behavior is that the pump used during the test may be more powerful than previous pump(s) installed in this well. This would tend to remove fine sediment from the well screen and surrounding formation, thereby increasing the hydraulic conductivity in the vicinity of the well. Because of the decrease in drawdown over time, the drawdown data were not used for to determine hydraulic conductivity.

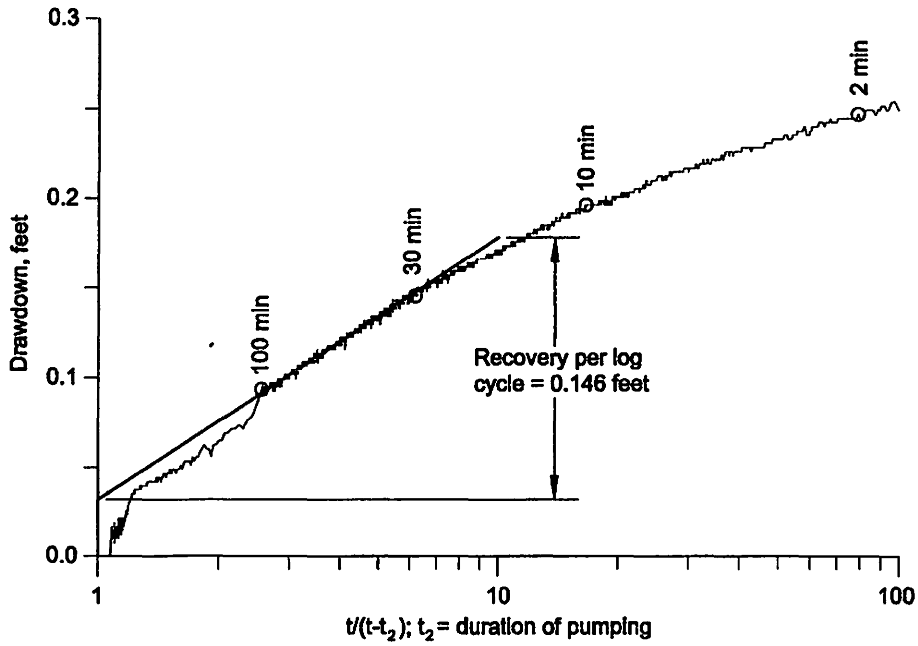
Water level data during the recovery period following the pump test are shown on Figure A-10. Recovery data are analyzed using a semilogarithmic plot of drawdown versus the quantity $t/(t\text{-}t_2)$, where t is the time since pumping started and t_2 is the duration of pumping. The recovery data show a series of oscillations after the pump was shut off, followed by a gradual water level recovery. Oscillating recoveries are commonly observed during slug tests in high-permeability aquifers (van der Kamp 1976), and are attributed to inertial forces within the well casing. In contrast, the aquifer response away from the well casing is best respresented by intermediate- and late-time recovery data, after the oscillations have ceased.

Figure A-10. Summary of AS&G Well Recovery Data



When plotted against $t/(t\text{-}t_2)$ on semilogarithmic axes, the recovery data should approximate a straight line at intermediate and late times. As shown on Figure A-11, the largest rate of recovery occurred between 30 and 100 minutes after pumping stopped, indicating an hydraulic conductivity of about 1,400 feet per day. The somewhat erratic data collected after 100 minutes appears to have been affected by retrieval and replacement of the transducer (at 11:05 pm), and by rising water levels over the course of the next day (up to 0.03 feet). These effects can be minimized by limiting the analysis to the period between 30 and 100 minutes after the cessation of pumping.

Figure A-11. Curve Fit of AS&G Well Recovery Data



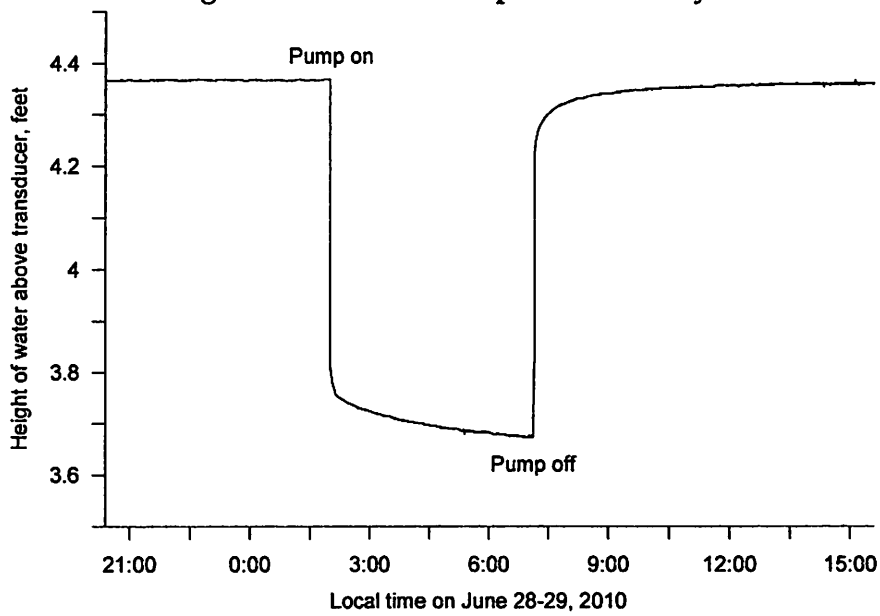
A3 June 2010 Pumping Test on Well I

Although the water table is relatively flat on the north half of AS&G's property (Figure 2-5), the slope of the water table increases to the southwest. To investigate the hydraulic conductivity in this area, a pumping test was performed on Well I. This well is equipped with a pump, and provides domestic water for the break shack adjacent to AS&G's equipment maintenance shop. A well log is not available for Well I, but it is 57 feet deep, with a static water level about 34 feet below ground surface. The well is 6 inches in diameter, and probably consists of open-ended steel casing. Based on Figure 3-1, the depth to bedrock at Well I is about 105 feet.

The pump discharge from Well I passes through about 40 feet of buried ¾-inch copper pipe before entering a pressure tank in the break shack. To maximize the flow rate, temporary piping was installed to bypass the pressure tank, discharging to the ground surface about 70 feet northeast of the well. From there the discharge flowed northeast into a vegetated area.

To check for natural water level fluctuations, water levels in Well I were recorded for about 8 hours before the test. The well was pumped at 7.2 gpm for 5 hours, and the recovery of water levels was recorded for 9 hours after the test. Unlike the AS&G Well test, drawdown increased throughout the pumping period (Figure A-12), but the resulting hydraulic conductivity values were lower than those obtained during the recovery period. Because hydraulic conductivity values obtained during pumping can be biased by friction losses, the following analysis focuses on data obtained during the recovery period.

Figure A-12. Well I Pump Test Summary



Water level recovery data following the Well I pumping test are shown on Figure A-13. This plot has the same semilogarithmic axes as those discussed for Figure A-10. Due to the lower permeability at this location, initial recovery data does not exhibit the oscillations typical of high-permeability formations (van der Kamp 1976). Rather, the drawdown data shows a rapid decline after the pump was turned off, followed by a linear water level recovery. The slope of the recovery plot between 30 minutes and 8 hours after the cessation of pumping yields an hydraulic conductivity of 53 feet per day, which is significantly lower than the values measured at Wilder Pond and the AS&G Well. This is consistent with the low yield of Well I (7.2 gpm) as compared with the AS&G Well (270 gpm) and Wilder Pond (3,300 gpm).

Figure A-13. Summary of Well I Recovery Data

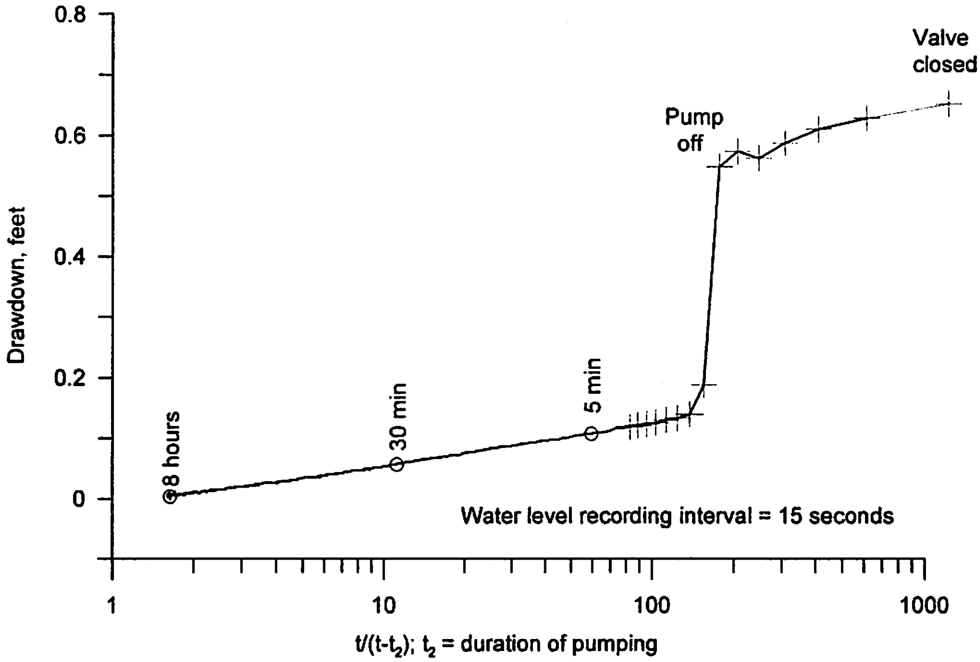
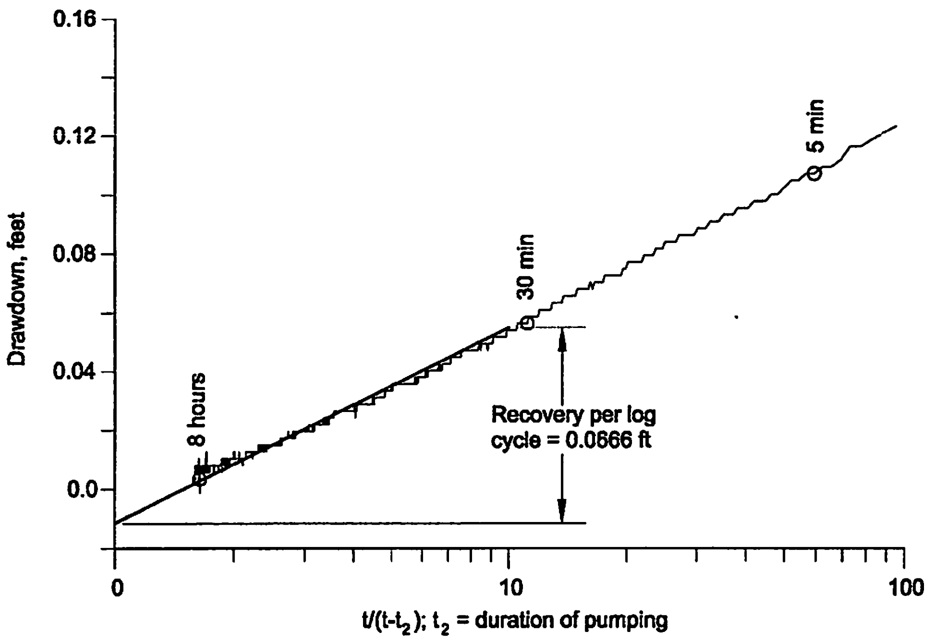


Figure A-14. Curve Fit of Well I Recovery Data



A.4 References for Appendix A

Anchorage Well and Pump Service (AWPS) 2010. Personal communication with Jim Ridgeway, Anchorage Well and Pump Service, May 2010.

Bear, J. 1979. Hydraulics of Groundwater. McGraw-Hill, Inc., 569 p.

Mishra, G.C., and Chachadi, A.G. 1985. Analysis of Flow to a Large-Diameter Well During the Recovery Period. Ground Water, Vol. 23, pp. 646-651.

Neuman, S.P. 1974. Effect of Partial Penetration on Flow in Unconfined Aquifers Considering Delayed Gravity Response. Water Resources Research, Vol. 10, pp. 303-311.

van der Kamp, G. 1976. Determining aquifer transmissivity by means of well response tests: the underdamped case. Water Resources Research, Vol. 12, pp. 71-77.

Mary Brodigan

From:	Mark Whisenhunt
Sent:	Thursday, December 01, 2016 4:53 PM
To:	Mary Brodigan
Cc:	Alex Strawn
Subject:	Handout for CMS Remand
Attachments:	Matsu Borough Central Monofill Services Response Letter 12-1-2016.pdf

Good Afternoon Mary,

Please include the attached email and document for handouts at the CMS Remand Public Hearing.

Thank you.

Respectfully,

Mark Whisenhunt
Planner II
Matanuska-Susitna Borough
Office: (907) 861-8527
Fax: (907) 861-7876
mark.whisenhunt@matsugov.us

From: Schade, David W (DNR) [mailto:david.w.schade@alaska.gov]
Sent: Thursday, December 01, 2016 3:58 PM
To: Mark Whisenhunt; Alex Strawn
Cc: Goodrum, Brent W (DNR); Cobb, Charles F (DNR); Cox, Clark A (DNR)
Subject: Water Resources Response re: Central Monofill Services Compliance with the Alaska Water Use Act.

Mr. Whisenhunt and Strawn,
Please find attach my response to your status inquiry.
If there are any other questions and/or concerns, please feel free to contact us.
Sincerely,

David W. Schade, MPA
Natural Resources Manager III
Chief, Water Resources Section
Division of Mining Land and Water
Alaska Department of Natural Resources
Phone 907-269-8645
Fax 907-269-8904
e-mail: david.w.schade@alaska.gov

THE STATE of ALASKA
GOVERNOR BILL WALKER

Department of Natural Resources

DIVISION OF MINING, LAND & WATER
Water Resources Section

550 West 7th Avenue, Suite 1020
Anchorage, Alaska 99501-3579
Main: 907.269.8600
TDD: 907.269.8411
Fax: 907.269.8947

December 1, 2016

Mark Whisenhunt
Alex Strawn
Matanuska-Susitna Borough
Planning Division
350 Dahlia Avenue
Palmer, Alaska 99645

Dear Sirs,

This letter is in response to your inquiry as to the status of Central Monofill Services compliance with issues raised by the Water Resources Section of the Alaska Department of Natural Resources concerning the diversion and waste of water between the Middle Pond and West pond across the (now de-regulated) C.P.P. Dam (AK00401) at the gravel pits near Palmer, Alaska. See our previous testimony and correspondence for additional detail.

To date, Central Monofill Services has not reported taking any actions to come into compliance with the Alaska Water Use Act. Further, we are not aware of any effort to do so. Therefore, Central Monofill Services remains non-compliant.

The Department will take further action in the future as necessary. If there are any further questions or concerns, please feel free to contact me at 907-269-8645.

Sincerely,

David W. Schade, MPA
Section Chief

Cc: Brent Goodrum, ADNR-DMLW Director
Charles Cobb, ADNR State Dam Safety Engineer
Clark Cox, ADNR Southcentral Region Land Manager

Mary Brodigan

From: Alex Strawn
Sent: Thursday, December 01, 2016 7:40 PM
To: Mary Brodigan
Cc: Mark Whisenhunt
Subject: FW: November 16, 2016 Staff report

From: Jacques, Stuart [stuart@cei-alaska.com]
Sent: Thursday, December 01, 2016 6:16 PM
To: Alex Strawn
Subject: FW: November 16, 2016 Staff report

Alex,

I must say that I feel blindsided by your last minute reversal of the staff's position on our CUP application. After working together the past few years during which time we spent months meeting with you and your staff addressing your questions and concerns, to say nothing of the tens of thousands of dollars we have spent on engineering reports, research and compiling studies - done with your involvement and encouragement, I find it difficult to believe that you would have the audacity to now take the position and endorse that me and my company are "unsuitable" to even be considered for a CUP in the MSB.

The other reasons given for your changed recommendation are similarly disturbing. There is not one new fact or evidence of any changed circumstances presented by you in this new staff report. You directly contradict your testimony at the Dec. 1, 2014 public hearing and the recommendations in the staff's 2014 report.

You claim that your reversal is based on testimony and review of additional evidence submitted during the public hearing, without identifying any specific "evidence". The issues that you use for the basis of stating the we are liars, dishonest and "unsuitable" are highly sensationalized, not completely factual and they were resolved over three years ago. The fact that we availed ourselves of our legal rights to file an appeal does not now make us "unsuitable". If you recall, BOAA ruled that this material was not "Trash" or "Junk"

We operate two permitted Monofills in Alaska which are inspected annually by ADEC and have received scores of 100% for each of the past three years inspections, with comments such as "The facility is being managed and operated excellently.." and "Thank you for running a great operation.". We are not an "unsuitable" applicant.

Of course, as we both know, no such "new evidence" was presented at the public hearing. The testimony with respect to the issues in your letter was the same as was presented in 2013 and again in 2014.

I truly believed that you would make your recommendation based on facts and science, not political pressure. While I can see this direct personal attack coming from the staff member whom obviously drafted this document (the enforcement officer drafted the staff report- ie.. procedural nepotism), I never expected it from you. I had much more faith in your professionalism and integrity. I'm profoundly disappointed.

Stuart M. Jacques
President
Central Monofill Services, Inc.
311 N. Sitka St.

Anchorage, AK 99501
(907) 561-0125
(907) 561-0178 fax
Stuart@cei-alaska.com

Mary Brodigan

From:	Mark Whisenhunt
Sent:	Friday, December 02, 2016 11:02 AM
To:	Mary Brodigan
Subject:	Handout for CMS Remand Fwd: Statement for the Planning Commission Meeting Packet
Attachments:	Toxic Dump Comments Eklutna Kepler-Bradley.pdf; ATT00001.htm

Please excuse any grammatical errors
Sent from my iPhone

Mark Whisenhunt
Planner II

Begin forwarded message:

> **From:** Marc Lamoreaux <nve.ledirector@eklutna-nsn.gov>
> **Date:** December 2, 2016 at 10:49:16 AM AKST
> **To:** <mwhisenhunt@matsugov.us>
> **Subject: Statement for the Planning Commission Meeting Packet**
>
> Dear M. Whisehunt,
>
> Attached is a letter from Native Village of Eklutna, for the Mat-Su Borough Planning Commission Meeting Packet for next Monday, December 15. It is in regards to the monofill "near Palmer" proposed by Central Monofill Services that the Commission will be considering. I was told that this is the last minute to submit it for the packet.
>
> Thank You,
>
> Marc Lamoreaux
> Land and Environment Director
> Native Village of Eklutna
> Office: 907-688-8522
> Cell: 907-242-6967

NATIVE VILLAGE OF EKLUTNA

December 1, 2016

Matanuska-Susitna Borough Planning Commission
350 E. Dahlia Avenue
Palmer, Alaska 99645

Draft: Dear Sirs and Madams:

Concerning the potential of a monofill dump proposed by Central Monofill Services near Palmer, Alaska, adjacent to the Kepler-Bradley Lakes:

Let us, the tribe of this area ask which of our traditional lands you propose to give up to unknown consequences of foreseeable and accidental discharges of toxic waste, sure to happen regardless of care taken to prevent/contain it? Where else do you see us relocating to, or what do you see replacing the aquifers of the Cook Inlet watershed when non conducive substances are discharged into it? How many tourists and family members are you willing to gamble with to place something that is not conducive to residential and tribal needs? Please do not gamble with this pristine area.

The proposed monofill may contribute contaminants to nearby waterbodies used by tribal members for cultural sustenance and recreational salmon and trout fishing. These include the Kepler-Bradley Lakes, Rabbit Slough - an anadromous waterbody with a silver salmon personal use fishery, and the Matanuska River and its side channels, which serve as productive salmon spawning habitat. The proposed site is directly adjacent to the Kepler-Bradley lake system, which according to the Alaska Department of Fish and Game is second only to Finger Lake as the most popular lake fishing area in the Mat-Su. We also hunt moose and other game between the proposed dump and the Matanuska River. And, we all appreciate the largely intact beauty of the whole area around the proposed site. These resources have enhanced our culture for as long as we can remember, and we seek to assure that our food is not contaminated and to protect these resources for future generations to enjoy.

26339 Eklutna Village Rd. • Chugiak, Alaska 99567 • (907) 688-6020 • Fax (907) 688-6021

J.A. Munter Consulting was commissioned by the Mat-Su Borough to provide an unbiased evaluation of the proposed monofill plan. The June 2013 and February 2014 Munter Reports find that the site may contaminate wells up to 1 mile away. 800,000 to 4 million gallons of water per year would be expected to flow through the fill material and enter the water table beneath the site as leachate, with an indeterminate range of contaminants, including many toxic components. In other states, these construction and demolition landfills have leached arsenic, boron, manganese, lead, and carcinogens including arsenic, vinyl chloride, and benzene. Some of these contaminants are mobile in the environment (such as arsenic, vinyl chloride, and benzene), persistent in the environment (such as antimony and lead), or bioaccumulate (such as arsenic, copper, lead, mercury, nickel, and zinc).

All of the water wells and surface water bodies in the close vicinity of the site tap the same aquifer. Groundwater has been modelled (by Terrasat) to generally flow towards the south and southwest and there are numerous wells in that general direction. There are probably more than 20 wells in the projected widening plume, within 1 mile downgradient from the proposed site (Muntner Reports). Some of the Kepler-Bradley lakes are west southwest of the proposed dump sites, one about ¼ mile away. Water levels in the Kepler-Bradley Lakes rose very quickly when the aquifer was pierced at the dump site gravel pit. The headwaters and wetland drainage for the salmon bearing Rabbit Slough are less than 1 mile south of the proposed site. A little farther south and southwest are clear water side channels of the Matanuska River, then the main Matanuska River.

The area has great value for residential use and as Glenn Highway Scenic Byway view shed at the Gateway to the Matanuska-Susitna Borough. We hope these values will not be degraded by an unsightly and environmentally deleterious dump. The proposed monofill site is also in the extremely windy Matanuska River corridor, so trash and air pollutants are likely to be blown downwind toward Eklutna Village, the immediately adjacent Glenn Highway Scenic Byway and homes as close as 500 feet away. The Palmer Toxic Dumping Opposition Group has gathered extensive information documenting these and other likely impacts.

Native Village of Eklutna requests you to decide that Central Recycling Services should find a more environmentally appropriate site for this proposed monofill.

Thank You,

by: Lee Stephan

Lee Stephan
First Chief

Mary Brodigan

From:	Ralph Hulbert <hulbert@alaska.net>
Sent:	Friday, December 02, 2016 3:24 PM
To:	Mary Brodigan
Subject:	handout for CMS CUP hearing on Monday
Attachments:	CMS CUP hearing; reply to Munter's 11-30-16 letter.pdf

Mary

I have attached a letter I hope can be included in handouts for Monday's PC meeting.

Please call if there are any questions,

Ralph Hulbert, P.E.
AlaskChem Engineering
907/746-4587

AlaskChem Engineering Ralph Hulbert, P.E.

PO Box 1846, Palmer, AK 99645 phone (907)746-4587 email hulbert@alaska.net

December 2, 2016

Mr.-Alex Strawn
Planning Department
Matanuska Susitna Borough
350 E. Dahlia Ave.
Palmer, AK 99645

Re: Proposed CMS monofill; response to Mr. Munter's comments

Mr. Munter's 11/30/2016 letter overlooks and misinterprets my May 2014 research presented in "Infiltration, Percolation, and Groundwater Recharge near Palmer" (packet page 1253).

The following issues, ignored by Mr. Munter, have substantial impact on local monofill design:

- Palmer's area wide percolation of 0-1.4 in/yr is unevenly distributed. Since NCRS measured an annual deficit of 4 inches of precipitation for the Palmer terrace, percolation is limited to certain locations and conditions. Understanding those conditions allows good design.

- Local groundwater recharge occurs primarily from runoff into small catch basins. Ditches and field ponds collect runoff in late fall, winter, and spring when evapotranspiration is minimal. Long term monitoring of local wells downgradient of field catch basins showed water level rises primarily in winter and spring, with some in late fall. Conversely, local wells showed insignificant response to the high July-August precipitation.

- Slightly sloping local fields effectively reduce underlying percolation. A monofill cap of local soil could increase run off and reduce percolation through it to much less than 1.4 in/yr. Only the uncapped working face area (~ 0.14 acre) would have the 1.4 in/yr percolation.

- Local studies and isotopic evidence show the Matanuska River is the primary source of groundwater under the Palmer terrace and CMS site. Mr. Munter mistakenly attributes this exceptionally robust aquifer to local precipitation, without mentioning the river. This omission leads to gross overestimation of groundwater impacts from local percolation.

Local hydrology forms the basis for monofill designs and risk analyses. By ignoring the above issues, Mr. Munter's comments on the CMS proposals appear unreliable and misleading.

Sincerely,

Ralph Hulbert

Ralph Hulbert, P.E.