Rodgers Plant/Mine 47 Hydrology Report

Introduction:

In October of 2007 Glacial Sand and Gravel Company submitted a Surface Mine Permit Application for Mine 47 to the Department of Environmental Protection, Bureau of Mining and Reclamation for their review (SMP Application # 10070304). The Department issued a review letter in December of 2007 and a public hearing on the permit was held in February of 2008. Additionally, numerous written comments were also filed with the department.

Subsequent to the public hearing and after review of the written comments the department requested the participation of additional governmental agencies in the review of the permit including, the U.S. Army Corp of Engineers to assess the wetlands present at the site, the Pennsylvania Fish and Boat and Game Commissions, the US Fish and Wildlife Service and private biologists. Representatives from all these agencies were among those invited to a meeting in April of 2008 at the site.

It was determined that a 404 permit should be applied for and approved as part of the surface mine permit and a 404 permit application was prepared and submitted to the Army Corps on February 20, 2009. Their review letter was received in September of 2009 and a meeting to discuss the Army Corps comments was held in November of 2009.

Glacial Sand and Gravel, Inc. has engaged biologists, archeologists, and other specialists to address the concerns raised by the various commenter's.

Concurrent with this activity an NPDES PAG 2 permit was applied for and approved. (PAG2-0010-08-011). Since the approval of that permit by the Butler County Conservation District comments have been received by the Bureau of Water Quality reiterating many of the same comments submitted to the Department of Environmental Protection, Bureau of Mining and Reclamation and Bureau of Water Quality, and the Army Corp of Engineers.

This report and accompanying documentation address the various comments submitted by the regulatory community and the private sector which relate to the impact of the proposed project (operation of a sand and gravel quarry and processing facility) on site hydrology and nearby wetland areas.

A. History

It is important to recognize that natural systems are not static communities, but are constantly evolving and changing over time. Numerous factors contribute to these changes, both natural and man-made.

I. Wetlands # 1/Tamarac Lake:

Historic photos show the "wetlands" were farmed or used as pasture as recently as 50 years ago (1958 and 1967 photos). A portion of the Brozenic driveway was once part of Swope Road, with Swope Road being realigned between 1958 and 1967. This action seems to have triggered the evolution of the emergent wetlands. Prior to that time the area shows evidence of riparian vegetation along a stream corridor and the site probably exhibited seasonal high water inundation; however, the primary land use was still agricultural. During the period from 1967 through 1993 the lack of aerial photos does not allow a record of the full evolution of the site from an agricultural use to that of a wetland complex. The succeeding photos reveal that the wetlands and open water are in flux depending on numerous factors which would include animal activities (i.e. beavers), drought, excessive rainfall, backwater from Tamarac Lake and human improvements and routine maintenance practices along the driveway bisecting the wetlands and the culverts under Swope Road.

Tamarac Lake did not exist before 1940 and was probably created due to mining/excavation activities by the landowner. The photo taken in 1958 shows the lake with what appears to be mining activities taking place along the northeastern shore. Historic photos show the lake has also evolved over the years, with the northern shore "filling" in and/or flooding. The dynamics behind the fluxuation in the water levels are not known, but could be from rainfall, obstructions to the downstream outfall of the lake, and/or upstream influences.

Because there is a constant natural evolution at the site, it cannot be said that the habitat there today will not change in time. What can be determined however, is that the mining of the sand and gravel at the Mine 47 site will not cause an "artificial" change in the hydrology of the existing system. (Please see Appendix A for copies of the photos).

B. Hydrology:

There are three groundwater systems present within the study area which, in theory, could be affected by the proposed project. Two are shallow systems that mimic local topographic features as normally expected. The third system is related to the regional groundwater system found in the Homewood Sandstone formation.

The two shallow systems are identified as the springs and flows draining to the unnamed tributary ("UNT") # 2 to Black Run, which is north of West Liberty Road and which is associated with the Wetland #1 area; and the springs and flows draining to UNT #3 to Black Run, which is south of West Liberty Road, and which is associated with the Wetland #2 area. These systems are generally separated by the topographic high along parts of the esker and West Liberty Road in this area.

Originally, to assist in defining these groundwater systems, four monitoring wells (MW1-MW4) were installed within the permit area south of West Liberty Road and sampling of all springs, seeps, streams, and domestic wells within 1000 feet of the permit area and any that could possibly be impacted by the proposed activity was done. In July of 2009 an additional three wells were drilled, with double Piezometers in two of the wells, to further define, assess, and monitor site hydrology generally and, in particular, the shallow system north of West Liberty Road that contributes to Wetland # 1.

MW 5 was drilled at the highest point in the esker to a minimum of 10' below the current wetland static water levels associated with the wetland complex. During the drilling operations, the material which came to the surface was dry until the 1204 MSL was reached, reflecting the groundwater levels in that area on that day. The clay layer which is evident in other areas of the site was not encountered at this location. The "base" of the esker is at the 1210-1200 elevation based on aerial photography. Piezometers 7 and 9 were drilled to just above the confining clay layer, Piezometers 6 and 8 extend approximately 20' below the confining layer. These wells are sealed and cannot communicate with each other.

In addition to the monitoring wells two springs have also been monitored, 5B and 1d. Spring 5B is located north of West Liberty Road and is down-gradient of the eastern most area of mining proposed and is associated with shallow system connected to the Wetland #1 area. Spring 1d is also located north of West Liberty Road and is down gradient of the western area of proposed disturbance and similarly associated with Wetland #1.

A marker to monitor the open water levels of the wetland was also constructed as shown on the attached Exhibit Map. This marker has also been monitored to determine the surface water level of the open water within the wetland complex.

(Please see Appendix B for drill logs and well construction details).

<u>Shallow ground water System – UNT # 2 and Wetland # 1.</u>

This system has a 339 acre drainage/recharge area which includes ± 66 acres of Wetland #1. Water levels in the new Monitoring Wells and spring elevations indicate the movement of the ground water is primarily to the west. The gradient of the water table as determined by the surface elevation at the Spring 5B to the Wetland elevation at the Wetland Elevation Marker is ± 1.27%. to the west to northwest. A similar gradient is found between spring 5B and Spring 1d located north of the terminus of the esker. It has been calculated at 1.38%.

Since drilling the monitoring wells on the North Side of West Liberty Road and the measurements of the springs, there has been a seasonal variation in the water levels emerging. Preliminary correlation with rainfall data (received from the Slippery Rock University/PSU rainfall web site) shows an increase in the spring discharge volumes due to rainfall/snowmelt events which would be expected. The levels in the monitoring wells are indicative of a stable groundwater regime.

The static water levels in Monitoring Well #5 have been as low as five feet (5)' below the base of the esker to within a few inches. The level in MW 5 is approximately "mid way" between the water levels found in MW's 8 and 9 and 6 and 7, which would reflect the westward gradient of the groundwater at this portion of the site.

The recharge area to the spring at 1d is 3-5 acres, while the recharge area for spring 5b is approximately 9.0 acres. Both springs have almost a water year of data collected and have base flows of 2.5 and 6 gallons per minute, respectively. Of the 9 acre recharge area for Spring 5B less than 2 acres would be included in the mining area. The recharge area to Spring 1d could include a portion of the groundwater found at the base of the esker, which as discussed, *infra*, will not be encountered by mining.

The more than normal rainfall during June and July, followed by the drier fall months have not shown a significant change in any of the static water levels at the site. Analysis of the rainfall data for 7 and 14 days prior to sampling show some response in the spring flows, but not as marked effect in the monitoring wells. (Please See Appendix C).

It should be noted of the 339 acre recharge area, the flows beneath the portion of the Esker within the permit area account for approximately 3-5 acres or only 1% to 1.5% of the total recharge to the wetland complex.

<u>Shallow Groundwater System – Unnamed Trib. #3 and wetland #2</u>

The 2.3 acre wetland located south of West Liberty Road is identified as Wetland # 2 (and are also referred to as the "Tempalski" Wetlands). The delineation of this wetland was accepted by the ACOE in the spring of 2008. Its functions and values have been determined to be low to moderate. The wetland is predominantly found

between 1220 to 1226 MSL elevation with a small "finger" extending to the 1234 MSL elevation in the southeast portion of the wetland. There are two (2) ephemeral springs which contribute to the wetland hydrology, both of which have been observed flowing only in early to mid spring. (Background points 6b and 6c) emerging at approximately the 1224 MSL elevation. The UNT # 3 to Blacks Run, which is connected to the Wetland is also intermittent in nature, having no flows during dry periods. This tributary and shallow ground water system also has a western gradient.

Wetland #2 is supported primarily by a perched system created by a clay layer found extensively over the site. The elevation of the clay ranges from the 1186 MSL elevation (at MW 3) to 1210 MSL elevation (at MW 1) and 1188 MSL elevation in MW # 4. Test pits 1 and 2, upslope of the wetlands show the clay to be at the 1224 and 1220 MSL respectfully. Moving further upslope and to the south, Test Pit 18 logged the clay at 1238. The clay layer is not a "continuous sheet" over the entire site which could result in groundwater flowing through the sand and gravel deposits as well.

Chemistry Comparison

Further evidence that the two shallow systems are separate with different recharge areas and supportive of separate and distinct Wetland areas, is that the water chemistry between the two systems are distinctly different. Samples for the springs 1d and 5B (associated with shallow system which contributes to Wetland # 1) both show a pH ranging from the high 6's to mid 7's. Their akalinity values are in the 150-175 range with sulfates in the mid 50's to 100 mg/l. Conductivities are also consistently in the high 400's to mid 500's. Sample point 1a has slightly lower values (probably due to the dilution occurring in the backwaters of the beaver dam), but have higher alkalinity and Specific Conductivity values when compared to the samples obtained south of West Liberty Road from areas associated with Wetland #2.

The ephemeral springs discharging to Wetland # 2 (6b an 6c) as well as 1e (UNT # 3) have lower pH values (mid to high 6) than those of the springs associated with Wetland #1, and with a comparatively much lower conductivity (no higher than 62) and lower sulfates.. (Please See Appendix D for Water Quality Data).

This distinct difference in water chemistry further confirms that the two shallow systems present on site do not communicate and, therefore, impacts to one will have no material impact on the other.

C. Impacts of Mining on the Groundwater System

The mining of the sand and gravel deposits, below the water table will be dredged and will not be pumped to create a dry pit for the mining operations. This will ensure that the existing shallow groundwater system remains intact as the water

will continue to pass through the sand and gravel deposits surrounding the area to be mined. The formation of the permanent pool in the mined out areas will not destabilize the existing perched system at the site. The recirculation of water within the pit for the washing of product at the plant also will not have an negative effect on the groundwater levels at the site.

Historic literature and previous mining activities at nearby sites demonstrate that during the removal of sand and gravel the hydraulic gradient will stabilize at the mean between the upslope levels and the downslope extent of mining. The result is a slight lowering of the upslope water levels and a minor rise to the downslope levels. It is anticipated that the final pool elevation will be at the approximately 1200-1210 elevation, which is consistent with the water levels in the spring at 1d and the Static Water levels in MW's 8 and 9, which are directly "in line" with the proposed mining activities South of West Liberty Road reflecting the westward (not northerly) groundwater movement associated with these two systems.

In the area north of West Liberty road, the mining depth will be restricted to stay above the water table. Both during and following mining and reclamation the surface topography and corresponding recharge remain will remain part of the shallow ground water system north of the road and wetland #1.

There are no anticipated impacts to the water quality of either the Unnamed Tributaries to Blacks Run on the southern side of West Liberty Road or to the Wetland # 1 complex There will be no discharges from the mining area to the streams.

D . Regional System.

The following report was submitted as part of the Surface Miner Permit Application. There has been no new data which would alter the original report or its conclusions. The Charts and Graphs Referenced in the Report are found in Appendix E

Pump Test Report (As Submitted with SMP Application)

Introduction

In order to determine the hydrologic properties of the site and to assure that the proposed pumping for makeup water during the production of the sand and gravel will not have an adverse impact, four (4) monitoring wells were drilled in March of 2007. As the attached drill logs show the wells were developed into the bedrock at the site and vary in depth from 130' to 75'. All sand and gravel deposits were cased off. Because the sand and gravel deposits did not appear to have a sustainable water table associated with them, their exclusion enabled a clearer picture of the water bearing zones which could be tapped for the production well (MW 1) and were also associated with those supplying the adjacent private water supplies.

Well Construction and Lithology

Monitoring Well 1 (Surface Elevation 1221.6) located at the northwestern corner of the site was drilled to a total depth of 131' terminating a the 1090 MSL. Casing terminated at 58' within a gray sandstone unit. The drillers reported 25-30 gpm at the 62' elevation with 80-100 gpm at the final depth of 1090. This correlates well with the depths of the two private water supplies, the Tempalski Well (6A) which has a total depth of ± 1120 MSL and the Rea Well (13A) which terminates at ± 1085 MSL. It can be assumed that these private water supplies draw from the same aquifers as that of MW 1.

Monitoring Well #2 (Surface Elevation 1308.6) is located in the southwest corner of the permit area and is located mid-way between the Pizor Well (3A) and the Barron Well (7A). This well was developed to the 1168 MSL and cased to the 1175 MSL. This well also was terminated in a brown sandstone layer. Water encountered as reported by the drillers was 130-140 gpm at the completion of the well (zones between 1175 and 1168 MSL). During the preparation of the adjacent Mine 31 (SMP 10010305) a pump test on the Pizor well was completed and showed a 0.1' drop in water levels at 5 gpm. (Please see attached copy of the report submitted as part of the Mine 31 hydrologic impact study).

Monitoring Well # 3 (Surface Elevation 1239.9) is located in the North Central portion of the permit area. This well was drilled to a total depth of 75' (MSL 1164) and cased to the 1169, terminating in a brown and gray Sandstone. The volume of water encountered during the completion of the well was reported to be 50 gpm.

Monitoring Well # 4, (Surface Elevation 1243.6) located near the eastern terminus of the proposed mining area. It was drilled to a total depth of 131' (MSL 1112.6) and was cased to the 120' mark (1128.6). According to the driller's logs this well terminates in a brown shale member and the volume of water encountered at the termination of drilling was report to be 100 gpm.

Pre-Test Data

It had been proposed and accepted by the PA DEP that data loggers be installed in the two private water supplies a week prior to the initiation of the pump test scheduled to be conducted on MW 1 scheduled for May 21, 2007 The data loggers used were Aquitest Models PT2X capable of recording data to 200' in depth. They were set to record the static water levels in the wells at one minute intervals. All wells which had data loggers installed were also monitored with the wire line static water level before, during and after the pump test. On May 15, 2007 a data logger was installed in the Rea Well (13A) located to the Northwest of MW 1. The data logger was installed into a 1" PVC pipe lowered to the bottom of the well and was calibrated using readings obtained from a static water level wire line probe and the data wires secured to the PVC pipe. During the weeks test period, the Rea's used their water for normal domestic use, including the filling of the swimming pool on two separate days. These events are visible on the graph (see Page 8-36). As the graph shows, the water was run continuously for approximately three (3.0) hours. In order to quantify the amount of water used during the filling of the pool the Rea well was re-visited in July of 2007 and the same hose used to fill the pool connected to the outside spigot. The water was turned on and run into a five (5) gallon bucket. The time to fill the bucket was obtained, and it was determined that the hose/pump capacity was 5.5 gallons per minute By simple multiplication, the volume of water pumped from the well during filling of the pool was 1232 gallons. The well rebounded to pre-use levels within 2 minutes. This pre-test data was recorded and is attached. It should be noted that due to the heat, the tape holding the data logger probe in place at the top of the well slipped on the PVC pipe and the "base" elevation of the water levels were slightly skewed. This slippage was adjusted in the final report by adjusting the data logger elevation with those of the actual wire line readings taken while the data logger was in the well.

A second data logger was to be installed at the Tempalski Well (6A) to the east of Monitoring Well #1, however, a spacer or other obstruction was encountered at a depth of 50.0' and the 1" PVC pipe could not be lowered into the well. In order to obtain the characteristics of the well without the benefit of the data logger a one (1) hour pump test was conducted on May 15, 2007. Because there was no external water source, the kitchen faucet was turned on (approximately 1.5 gallons/minute) and allowed to run without interruption. As the attached data shows, the well drew down approximately 4.0' before the pump would turn on. Once the pump turned on (presumably from the pressure tank) the water levels would rebound close to the pre-testing levels immediately. A draw-down of 0.4' was recorded between the initial static water level and the final static water level. Because the water was drawn primarily from the borehole storage specific capacity and yield calculations were not computed. Please see attached pumping data. (Page 8-38 and 39)

On the day of the test a data logger was installed in MW 3 and static water elevations taken in MW 2 and MW 4. The same problem with slippage of the data logger being taped to the PVC pipe occurred with MW #3. The data has been corrected to reflect the calibration with the wire line static water meter.

Pump Test

On May 21, 2007 the 48 hour pump test for MW1 was initiated. A 4" pump was lowered and set at 125', or 6' from the bottom of the well. A flow meter was attached to the discharge line near the top of the well. The pump test was started at 12:00 noon. Continual measurements were obtained throughout the 48 hour test on the well (please see attached). In addition, the Rea Well was logged using the data logger for the duration of the test as was MW 3. The Tempalski Well (6A) was manually measured during the first 5 hours of the pump test and MW 2 and 4 measured hourly for the first 5 hours. Because the impact to the surrounding supplies was minimal continual manual measurements were terminated 6 hours into the test. The wells which required manual measurements were checked again on May 22 and finally at the end of the test on May 23, 2007.

Results:

The test conducted from May 21 through May 23, 2007 resulted in the initial drawdown of Monitoring Well 1 about 20.0' which held steady over 48 hours of pumping at 72.4 gallons per minute. Once the pump was turned off, the well re-bounded to within 90% of the original static water levels within in 5 minutes. The observation wells showed a slight decline (< 1.0') (the Rea Wells (13A) and The Tempalski Well (6a). The other monitoring wells showed no impact at all. Small fluxuations (± 0.1') are probably attributable to the changes in the atmospheric pressure and/or measurement technique. These results, coupled with the pump tests conducted independently on the two observation wells (the Tempalski well on May 15, 2007 and the Rea Well on May 15 as the data logger recorded the 3 hour withdrawal during the pool filling) indicate a strong aquifer with excellent recharge available for all proposed uses. Rebound in all wells once pumping was stopped was immediate and over 90%.

It should be remembered that the 48 hour test does not represent the probable use of the production well (MW #1). The well will be used for makeup water and run only when necessary to replenish process water due to operational losses. It would be under extraordinary circumstances that the well would be used for prolonged periods of time. The pump test was purposely designed to tax the groundwater system in as much as possible to evaluate stresses associated with prolonged pumping.

Pump Test Conclusions

Based on the data gathered during the pump test and with the use of the data loggers, there should be no negative impacts to the surrounding private water supplies or wetland complex adjacent to the site or within 1,000'. Monitoring Well #1 draws on the aquifer located identified at that 1160 MSL as well as the deep aquifer at 1090. The Rea Well shares the same aquifers as the Tempalski Well. There is a surface aquifer,

which is perched by the gray silt layer and supports the shallow wetlands on the Tempalski property and across West Liberty Road will not be effected by the production well usage.

Plant Operations

As stated above, the Monitoring Well #1 would be used for makeup water at the site during the processing of the sand and gravel. The single existing pond currently built (Pond 5) will be used for storage once the plant area construction has been completed and stabilized. Monitoring Well #1 will only be used as originally designed, as “makeup” water during the normal wash loss. This well is also the only well which was drilled to be able to be used for the pumping of water. The other wells have a narrower diameter and would not be suitable for use for makeup water for the processing facility.

Erosion and Sedimentation Controls

Control of Erosion and Sedimentation at the site have been/will be designed to protect the natural waterways as well as the wetlands using best management practices. All structures will be under the jurisdiction of the Department of Environmental Protection. The proposed process ponds will have a forebay installed to capture sediment prior to the release into the ponds. Sediments which are captured will be cleaned out on a regular basis.

Conclusions:

The additional hydrologic investigations implemented since the Surface Mine Permit submittal have reinforced the original conclusion that the mining of the sand and gravel and the construction of the processing plant will not have a negative impact on the water-resources downstream of the Site or to Wetland # 1. While natural events, as discussed at the beginning of this report, may alter the hydrologic regime within the Wetland #1 complex, the mining activities will not have an negative impact on the system.

Appendix A

Historic Photos

Appendix B

Drill Logs and Well Construction

Appendix C

Static Water Levels and Spring Flows

Appendix D

Water Data

Appendix E
Graphs and Charts from 48 Hour Drawdown Test
On Monitoring Well #1

REFERENCES:

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