ANALYSIS OF PRACTICABLE ALTERNATIVES

1.0 INTRODUCTION

Project Purpose: The purpose of the proposed Mine 47, as defined by the applicant, is to extract and market sand and gravel from properties owned and/or leased by Glacial Sand and Gravel Co (Glacial) in a manner which enables Glacial to comply with applicable requirements while still generating a reasonable return on its investment in its property and leases. The Mine 47 site is located in Worth Township, Butler County, Pennsylvania. The site is bounded on the west by Swope Road (T-382) and Mount Union road (T-861). West Liberty Road (T-860) runs through the center of the site, and Moore Road (T-396) borders the eastern edge of the permit boundary. The mine site is approximately 77.6 acres in size.

This development will impact wetlands and other jurisdictional waters at the proposed site. The USEPA's Section 404(b)(1) Guidelines require that practicable alternatives be considered for such projects. These regulations require a demonstration that there are no practicable offsite alternatives to the proposed development, and that there is no practicable mining plans that avoids or minimizes wetland or stream impacts and still meets the basic project purpose. An onsite or offsite alternative is considered practicable if it is available and capable of being implemented after taking into consideration site constraints such as construction cost, existing technology, and logistics in light of overall project purposes.

During the planning phases for this project, the site owners and consultants evaluated alternative site locations as well as alternative designs for the proposed mine site. The following sections discuss the effort made during site planning to minimize stream and wetland impacts to the extent practical, while still fulfilling the project purpose. Consideration of the presence of existing mineral resources and conformance with regulatory criteria has played a critical role in site design. Contained herein is a summary of the process of site redesign to include avoidance and minimization of impacts to site aquatic resources.

2.0 OFFSITE PROJECT ALTERNATIVES

The purpose of this exercise is to evaluate offsite alternatives for the proposed mine. One of the most critical factors in the development of this mine is the presence of existing mineral reserves of type, quantity and quality needed to meet the project's purpose. For example, offsite properties are not viable alternatives if they do not contain recoverable sand and gravel reserves or such reserves in sufficient quality and quantity to make mining economically practicable. Before proposing to mine sand and gravel at the current Mine 47 location, Glacial explored mining options at several nearby properties.

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Among these alternative offsite locations were Mine 31 and properties owned by [redacted] Due to the proprietary nature of the geologic explorations conducted at these sites, specifics related to the quantity or quality of mineral deposits will not be discussed. However, Glacial is willing to disclose that the [redacted] properties contain limestone and coal deposits rather than sand and gravel, and consequently, are not suitable for this project.

Although the [redacted] properties do contain deposits of sand and gravel, several issues eliminated these properties from consideration. Specifically, the [redacted] south of the Mine 31 site, lies along Hogue Run and an Unnamed Tributary (UNT) to Hogue Run. Approximately 7.9 acres of riparian wetlands surround these streams within the property and are part of a larger wetland complex that extends beyond the property boundary. Large impacts to these aquatic resources would be necessary to mine the marketable deposits of sand and gravel on this property. Sand and gravel deposits on the [redacted] property to not meet specifications for PennDot and are not marketable to Glacial's customers. Finally, the owners of the [redacted] previously enrolled their property in an agriculture preservation program and will not sign a lease with Glacial for sand and gravel removal.

3.0 ONSITE MINING ALTERNATIVES

The proposed project site and proposed development both in the terms of mining and commercial development of the associated plant must comply with all federal, state and local regulatory requirements. Accordingly the Worth Township Land Development Ordinance requires the following unique site criteria be applied to the development:

- Haul roads shall have a maximum grade less than or equal to nine percent (9%).
- Haul roads shall have a minimum sight distance and a minimum radius of curvature of two hundred fifty (250) feet.
- Land containing significant areas of slopes greater than sixteen percent (16%) is unsuitable for development.
- No final grading, fill, or cut shall be permitted with a cut face steeper in slope than two (2) horizontal to one (1) vertical.

Township officials also requested that access to the Mine 47 site minimize use of township roads and utilize a direct route to marketing locations (SR 108/Interstate 79). As a result, the site access road was located to connect with Swope Road after crossing West Liberty Road.

In addition to local government ordinances, the proposed mining plan is subject to the following DEP design criteria and regulations:

- Air quality – shelter from wind (avoid hilltops)
- Ponds – adequate detention time dictates pond sizing

An additional restriction dictating the layout of the proposed plant is the need for stockpile areas surrounding the plant. At the currently operating Elliott Plant, approximately 6.7 acres of stockpile areas are being utilized. At the proposed site, only about 3.5 acres are available given the close proximity of wetlands and steep slopes surrounding the plant site.

The following narrative, accompanied by Figures A-1, A-2, and A-3 presents the onsite design alternatives for Mine 47. Included herein is a description of each mining plan and an analysis of the extent to which it could meet the the stated project purpose. Also included is a summary of the impacts to the site's aquatic resources and avoidance and minimization measures for each alternative. Compensatory mitigation for unavoidable impacts is specified in the Mitigation Plan included with this permit application.

The following alternatives were analyzed:

- Alternative 1 - Original Mining Plan (Figure A-1)
- Alternative 2 - Minimal Impact Mining Plan (Figure A-2)
- Alternative 3 - Preferred Mining Plan (Figure A-3)

A detailed description of each alternative, a statement of the benefit associated with each alternative, and an explanation of criteria that precludes the use of an alternative, is summarized in the tables below and discussed in the following narrative.

3.1 Alternative 1 – Original Mining Plan

Description: The purpose of the original mining plan is to provide a mining plan that maximized the extent to which the project purpose could be met. This alternative is designed to maximize the extraction of reserves while accounting for physical site constraints and regulatory criteria. This site configuration is illustrated on Figure A-1 and includes a mining area of 161.8 acres.

Impacts: The original mining plan would impact 66.9 acres of wetlands and 1,576 linear feet of streams. Unavoidable wetland encroachment that is reflected in this alternative would result from the construction of the access roads, fill slopes, and mineral extraction. The following Table 3.1a provides a summary of the wetland impacts associated with this alternative. Table 3.1b provides similar information for impacts to onsite stream channels.

Table 3.1a
Original Mining Plan - Impacts to Individual Wetlands

Wetland ID	Onsite Wetland Area (acres)	Proposed Impacts (acres)
1	66.90	66.90
2	2.30	2.30
3	0.19	0.19
4	0.31	0.02
Total	**69.70**	**69.40 (99.6%)**

Table 3.1b
Original Mining Plan - Impacts to Individual Streams

Stream Name	Onsite Stream Length (ft)	Proposed Impacts (ft)
UNT 1	780	0
UNT 2	996	996
UNT 3	580	580
Total	**2,356**	**1,576 (67%)**

Benefits: This alternative meets the project purpose and objectives by providing the maximum amount of sand and gravel extraction. Adequate space is available for ponds and stockpiles due to the wetland impacts.

Exclusionary Criteria: This mining plan would impact approximately 99 percent of wetlands and 67 percent of streams within the project site. Among these aquatic impacts would be large impacts to Wetland 1. Among the functions and values that could be reduced or eliminated are: food chain and general habitat functions, maintenance of natural drainage patterns and flushing characteristics, groundwater discharge areas, storm and flood water storage and control, pollution prevention and natural water filtration, sediment control, and wildlife observation areas.

Mitigation: Mitigation would be required for both the stream and wetland impacts associated with this alternative. As noted in this permit application, 69.4 acres of wetlands and 1,576 linear feet of stream channel would be impacted by selecting the original mining plan. Wetland compensation would be in the form of constructed wetlands at a minimum of 1:1 ratio, or greater, likely resulting in over 70 acres of wetland mitigation and approximately 1,576 feet of

stream mitigation or channel restoration. Constructing replacement wetlands of this magnitude would be challenging, and due to the large area necessary, would require wetlands to be constructed offsite.

3.2 Alternative 2 – Minimal Impact Mining Plan

Description: This alternative reflects a mining plan that attempts to minimize impacts to aquatic resources. This site configuration is illustrated in Figure A-2 and includes 77.6 acres. In addition to minimizing direct impacts to wetlands, this alternative would ensure that indirect impacts to wetlands (i.e. loss of hydrology) were not a result of mining. To accomplish this, mining north of West Liberty Road would be limited to keep the pit floor above the water table. Consequently, hydrology to Wetland 1 would not be impacted. This alternative requires that the treatment ponds be reduced in size and relocated to avoid impacts to Wetland 2.

Impacts: This alternative mining plan would virtually eliminate impacts to wetlands and streams. Unavoidable stream encroachment that is reflected in this alternative would result from the construction and grading of the site access road. The following Table 3.2a provides a summary of the wetland impacts associated with this alternative. Table 3.2b provides similar information for impacts to onsite stream channels.

Table 3.2a
Minimal Impact Mining Plan - Impacts to Individual Wetlands

Wetland ID	Onsite Wetland Area (acres)	Proposed Impacts (acres)
1	2.49	0.00
2	2.30	0.00
3	0.19	0.00
4	0.31	0.00
Total	**5.29**	**0.00 (0 %)**

Table 3.2b
Minimal Impact Mining Plan - Impacts to Individual Streams

Stream Name	Onsite Stream Length (ft)	Proposed Impacts (ft)
UNT 1	780	0
UNT 2	996	0
UNT 3	580	56
Total	**2,356**	**56 (2%)**

Benefits: This alternative would effectively minimize project impacts to onsite wetlands and streams. Over 69 acres of wetlands and 1,520 linear feet of stream channel would be preserved through this alternative when compared to the original mining plan. Eliminating all impacts to Wetland 1 is the largest benefit provided by this mining plan. Preserving wetlands and natural stream channels would also help protect the ecosystem functions provided by these aquatic resources. In addition, the substantial reduction in impacts to aquatic resources would greatly reduce mitigation costs.

Exclusionary Criteria: The most significant drawback to the minimal impact alternative is the huge loss of marketable sand and gravel deposits. In order to avoid all wetland impacts, the plant must either be moved upslope or treatment pond sizes must be reduced. Since the area south of the plant contains slopes greater than 16%, moving the plant location is not feasible, not simply because of the slope constraints, but also due to air quality issues related to not siting this facility in elevated areas. Treatment pond sizes can be reduced, but not without limiting the operative capacity of the plant, as well as its lifespan. In addition, the area available for treatment ponds is also located above marketable sand and gravel reserves, a result that is completely at odds with the project purpose. The storage capacity of the two treatment ponds shown in this alternative is 74,138 ft^3. This is approximately a 160% reduction in storage capacity when compared to the 195,000 ft^3 provided by the four treatment ponds in the original and preferred mining plans.

Mitigation: The minimal impact alternative would limit aquatic impacts to 56' linear feet of stream channel. Mitigation for these small impacts could be achieved with stream bank enhancement/plantings along the onsite streams.

3.3 Alternative 3 – Preferred Mining Plan

Description: The purpose of the preferred alternative is to provide a mining plan that thoroughly meets the project purpose and need while minimizing impacts to aquatic resources. This alternative is designed to provide an adequate amount of extraction of mineral reserves while accounting for physical site constraints and regulatory criteria. This site configuration is illustrated on Figure A-3 and includes a permit area of 77.6 acres. Water table elevations are currently being monitored within the area proposed for mining north of West Liberty Road. At the time of mining, the pit floor will be limited to a depth approximately five feet above seasonal water table elevations to ensure that there are no impacts to hydrology sources to Wetland 1.

Impacts: This mining alternative would permanently impact 1.89 acres of wetlands and approximately 246 linear feet of stream channel. Unavoidable wetland and stream encroachment reflected in this alternative result from the construction and grading of the access road and water treatment ponds. The following Table 3.3a provides a summary of the permanent wetland impacts associated with this alternative. Table 3.3b provides similar information for impacts to onsite stream channels.

Table 3.3a
Preferred Mining Plan - Impacts to Individual Wetlands

Wetland ID	Onsite Wetland Area (acres)	Proposed Impacts (acres)
1	2.49	0.00
2	2.30	1.70
3	0.19	0.19
4	0.31	0.00
Total	**5.29**	**1.89 (36 %)**

Table 3.3b
Preferred Mining Plan - Impacts to Individual Streams

Stream Name	Onsite Stream Length (ft)	Proposed Impacts (ft)
UNT 1	780	0
UNT 2	0	0
UNT 3	580	246
Total	**1,360**	**246 (18 %)**

Benefits: This alternative effectively meets the project purpose and objectives by providing adequate mineral extraction and while minimizing impacts to aquatic resources. This alternative preserves approximately 64% of wetlands and 82% of streams, and ensures that there are no impacts to the hydrology of Wetland 1. Almost 68 acres of wetlands and 1,330 linear feet of stream channel would be preserved through this alternative when compared to the original mining plan. In addition to enable the overall project purpose to be achieved, eliminating all impacts to Wetland 1, and dramatically reducing impacts to other wetland/stream areas, are the largest benefits provided by this mining plan. In addition, the substantial reduction in wetland and stream channel impacts would allow replacement wetlands to be constructed onsite and would greatly reduce mitigation costs.

Exclusionary Criteria: This mining alternative would impact 1.89 acres of wetlands and 246 linear feet of streams. Although studies have shown that the aquatic resources proposed to be impacted do not necessarily provide unique or critical ecosystem functions, some local hydrological and ecological benefits would be temporarily lost until mitigation was completed. Among those benefits that would be so affected are: maintenance of natural drainage patterns and provision of groundwater discharge areas. However, these impacts will be effectively mitigated through the construction of replacement wetlands onsite.

Mitigation: The preferred alternative would require design, construction, and monitoring of a replacement wetland site. Wetland compensation would be in the form of constructed onsite wetlands at a minimum of 1:1 ratio resulting in 2.0 acres of wetland mitigation. The proposed mitigation site would be located north of West Liberty Road near the intersection with Swope Road. The site's proximity to Wetland 1 ensures a reliable source of hydrology and will ensure the replacement of ecological functions and values.

4.0 CONCLUSIONS

After evaluating the above alternatives, the applicant has chosen to proceed with the Preferred Mining Plan. This decision is supported by the attached documentation. Specifically, the Original Mining Plan could not be constructed without causing far more significant impacts to the onsite aquatic resources than the Preferred Mining Plan. Required mitigation for such extensive impacts also would not be practical from an economic standpoint. Additionally, the Minimal Impact Mining Plan is also not feasible due to the loss of sand and gravel reserves under the treatment ponds and the reduced capacity of those ponds, which limits the operative capacity of the plant, as well as its lifespan, which would also be cost prohibitive to the project as proposed. The Preferred Mining Plan achieves the project purpose while maintaining manageable impacts to the site's aquatic resources.