Gannett Fleming

*Excellence Delivered* ***As Promised***

March 17, 2017

Mr. Rick Smith, Jr., Township Manager
East Goshen Township
1580 Paoli Pike
West Chester, PA 19380-6199

Dear Mr. Smith,

Subject: **Dam Related Engineering Services for East Goshen Township**
**Hershey Mill Dam (DEP ID No. D15-125)**
**Construction Cost Estimate for Dam Rehabilitation**

In accordance with Service Authorization No. 9, as approved by East Goshen Township (Township) on February 22, 2017, we are pleased to provide the Township with an independent engineer's estimate of probable construction costs for the Hershey's Mill Dam rehabilitation design as depicted on the drawings prepared by Edward B. Walsh & Associates, Inc., dated April 10, 2012, last revised on June 11, 2014 and which was approved by DEP Dam Safety for construction on July 15, 2014. The following letter report defines our scope of services, identifies the assumptions used within the analysis, and summarizes our findings.

## 1.0 Scope of Services

The intent of this assignment is to prepare an independent construction cost estimate for the dam rehabilitation design prepared by Edward B. Walsh & Associates and compare those costs to the estimated construction costs associated with decommissioning Hershey's Mill Dam. Quantities will be estimated from the drawing set and/or from the AutoCAD files previously provided by the Township. Unit cost information will be estimated from published cost data (i.e, RS Means), past construction bid tabs and engineering judgement, and were applicable, shall be consistent with the unit prices used to estimate the dam decommissioning options which Gannett Fleming presented to the Township at the Board of Supervisors meetings held on January 10, 2017 and January 17, 2017. In this manner, the Township will be able to better compare the costs of the two projects.

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If appropriate, Gannett Fleming will identify areas of the design where additional field investigations, engineering analysis and/or modifications of the rehabilitation design may be warranted. Likewise, opportunities to simplify the design, resulting in cost savings to the Township, will also be identified.

## 2.0 Description of the Projects

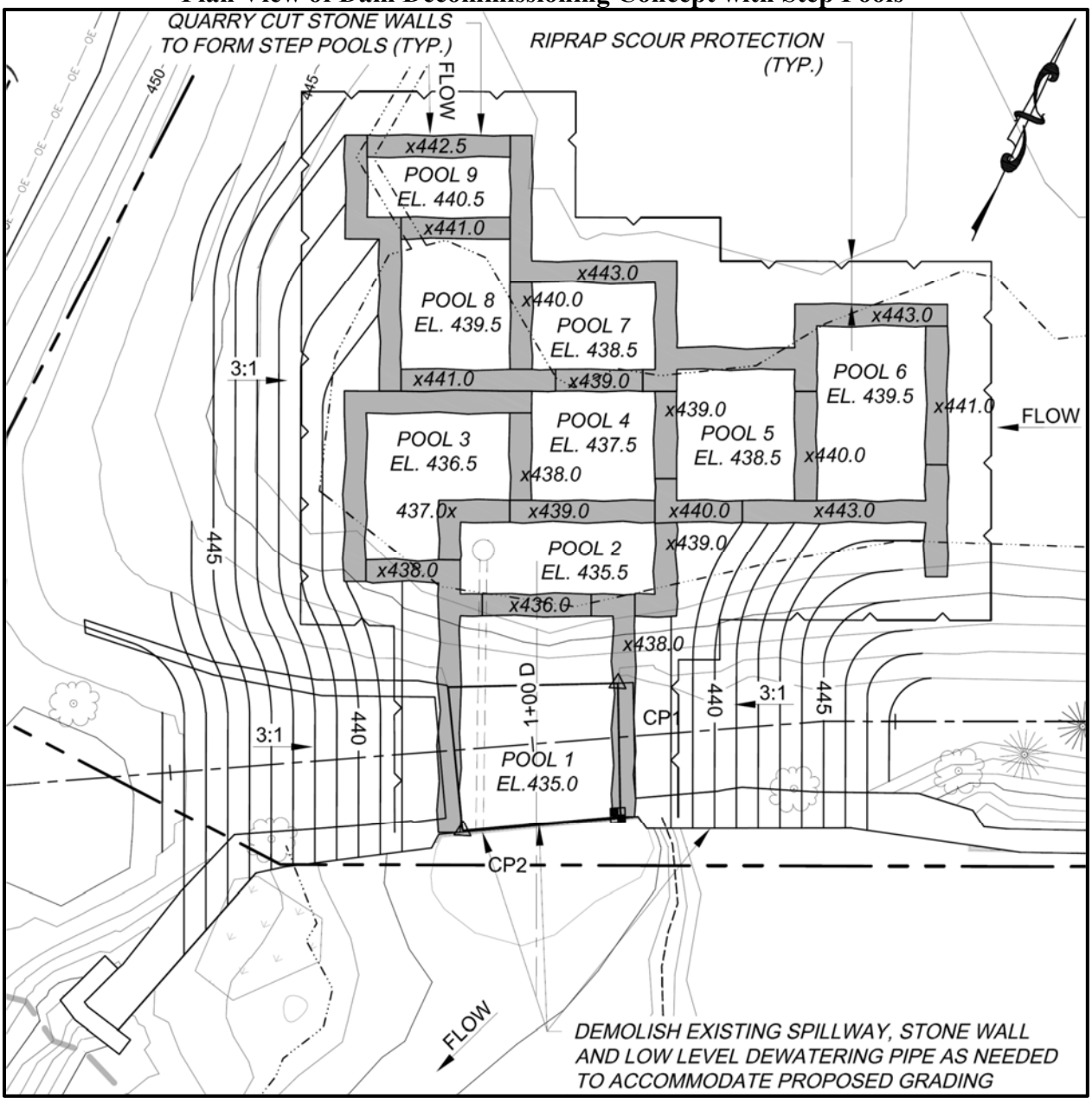
The following provides a brief description of the Dam Rehabilitation and Dam Decommissioning projects under consideration by the Township.

Dam Rehabilitation as designed by Edward B. Walsh & Associates, Inc.: The rehabilitation design is intended to increase the conveyance capacity of Hershey's Mill Dam such that the dam can safety pass the 100-year storm event without overtopping the earth embankments. To accomplish this, the proposed improvements include: (1) the addition of a 58-foot-wide auxiliary spillway located immediately to the left and approximately four inches above the existing 22-foot-wide principal spillway, and (2) raising the top of dam embankments by as much as 1.5-feet in some areas to increase the freeboard needed to pass the 100-year storm event. The auxiliary spillway is formed by a concrete foundation slab, vertical concrete walls with a stone façade on the exposed downstream face, and a concrete slab on the spillway crest. The spillway is to be backfilled with soil blended with cement. A short filter diaphragm is proposed at the left side of the auxiliary spillway to collect and filter seepage from the immediate area. A concrete slab and riprap are used in combination as scour protection downstream of the new auxiliary spillway and are configured to direct flows back into the unnamed tributary of Ridley Creek. Masonry stone work will be required to raise the existing principal spillway walls to the new top of dam elevation and grouting under the existing spillway slab is proposed to address the observed subsidence issues. Excavation activities for the auxiliary spillway would require the existing principal spillway to be removed due to the close proximity of these two structures. In order to support and protect the existing principal spillway during construction of the auxiliary spillway, a sheet pile wall is proposed immediately to the left of the principal spillway running upstream-downstream.

Dam Decommissioning: Dam decommissioning refers to the full or partial removal (i.e., breach) of a dam and its associated structures such that the receiving watercourse can flow freely through the breach and the remaining structure, if any, no long longer poses downstream consequences in the event of a failure. In the case of Hershey's Mill Dam, the proposed decommissioning involves a breach located at the existing spillway. The breach would have a 15- to 20-foot bottom width which would be carried through the embankment where a series of step pools, constructed of large quarry cut stone, would be used to provide a hydraulic connection between the downstream channel and the existing grades within the reservoir. A series of nine step pools

are proposed with each pool rising in elevation 12- to 18-inches. Refer to Exhibit 1 for a plan view of the proposed decommissioning configuration. As previously mentioned, the breach concept presented in Exhibit 1 includes a series of step pools which differs from the concept presented at the Board of Supervisors meetings in January 2017. The step pools, which were proposed by Simone Collins Landscape Architecture, have been added to the design based on positive feedback from both the Township and DEP Dam Safety.

**Exhibit 1**
**Plan View of Dam Decommissioning Concept with Step Pools**



The construction cost estimate prepared by Edward B. Walsh & Associates for the rehabilitation project as described above is $302,025. As noted in Gannett Fleming's letter to the Township dated May 13, 2016, this cost estimate appears to underestimate items such as care and diversion of water, foundation dewatering, foundation preparation and the need for a more comprehensive seepage collection, filter and conveyance system. The construction cost estimate prepared by Gannett Fleming for the design prepared by Edward B. Walsh (refer to Section 4.0, Tables 1 and 2) provides an allocation for care and diversion of water and foundation dewatering. Section 5.0 provides additional recommendations to the design prepared by Edward B. Walsh to further improve the design and where applicable, reduce the complexity and construction costs associated with the rehabilitation project.

## 3.0 Assumptions

It is noted that construction cost estimates are based on the best available information at the time the estimate is prepared. Actual contractor bids are affected by a number of factors beyond the control of the Township and Engineer, such as the supply and demand for materials, weather conditions, global and local economic conditions, etc. In addition, work in and around waterways caries substantial flooding risk to the contractor, who is responsible for care and diversion of water throughout the duration of the project. The contactor must establish how much risk he is willing to accept, and his bid will reflect those risks. Consequently, actual contractor bids may vary significantly from the estimated construction costs.

As such, this analysis is intended to be used as a basis for comparing relative costs between the two evaluated projects. The following assumptions were made as part of this construction cost comparison:

Mobilization and Demobilization Costs: Contractor mobilization and demobilization is assumed to be seven (7) percent of the estimated construction costs.

Bonds and Insurances: Contractor required bonds and insurances are assumed to be two (2) percent of the estimated construction costs.

Pre-Construction Site Preparation and Surveys: It is assumed that pre-construction activities will include establishing staging areas and haul roads as needed to allow the contractor to perform the proposed work activities. It is assumed that all areas used for staging, stockpiling of materials, and those areas which will receive vehicular traffic will be stabilized with aggregate. While not shown on the plans by Edward B. Walsh, it is assumed that haul routes will be required within the reservoir to allow construction access from the borrow area to both the left and right embankment work areas. The erosion control plan prepared by

Edward B. Walsh indicates that the construction access route from Greenhill Lane is to traverse over the left embankment by constructing an earthen ramp (the access ramp is not to be excavated into the existing embankment). It has been assumed that offsite fill material will be used to construct this ramp and that the ramp will have an eight (8) percent grade to overcome the height of the left embankment. Likewise, the dam decommissioning project assumes that an earthen access ramp will be required off of Hershey Mill Road to access the bottom of the reservoir. It is assumed that signage will be required at each ingress/egress location to warn the traveling public of the construction entrance(s) and an allocation has been made to account for construction surveys (i.e., initial stakeout, intermediate surveys during construction, and as-built surveys at the completion of the project).

Erosion and Sediment Control: Temporary erosion control measures will be required to collect and filter sediment-laden runoff from the project site. For both projects, it is assumed that the primary measures for controlling sediment will be compost filter sock, rock construction entrances and erosion control matting. An allocation for temporary stabilization has been made for each project.

Management of Water: Each project will require temporary diversion of water to safely pass upstream flows around or through the work area. The plan by Edward B. Walsh calls for a sandbag cofferdam system to divert upstream flows through the existing low level dewatering system and the existing principal spillway, thus protecting the left and right embankments during the construction period. Based on the length and height of the cofferdam needed to provide this level of protection, the cost estimate has assumed the use of a port-a-dam system which is believed to be more economical for the given site configuration. For the decommissioning option, the low level dewatering system will not be available as a means for passing flow through the work area. For this option, the cost estimate assumes that temporary pumping and/or gravity piping will be required to pass upstream flows around/through the work area.

The cost estimate assumes that some form of dewatering will be required to maintain a dry foundation for the construction of the auxiliary spillway. It is anticipated that seepage and/or groundwater which interferes with construction will be collected in localized sump pit(s) and pumped to a point downstream of the work area. Similar dewatering activities may be necessary for the dam decommissioning option to produce a dry foundation for the quarry cut stone walls that form the step pools.

Site Cleanup Activities: An allocation has been made to capture the costs associated with removal of temporary facilities, including erosion control measures, staging areas and access ramps. One acre of permanent stabilization is assumed for each project.

Contingency: A twenty (20) percent contingency has been applied to all construction related items. This contingency is intended to account for unlisted items, items which are not yet designed, quantity uncertainties, changes in site conditions, and other unknowns.

## 4.0 Summary of Findings

The estimated construction costs for the dam rehabilitation option as designed by Edward B. Walsh and the dam decommissioning option as shown in Exhibit 1 are summarized in Table 1. A detailed breakdown of the construction costs for each project are provided in Tables 2 and 3, respectively.

**Table 1**
**Summary of Construction Costs**

| Project Description | Estimated Construction Costs |
|---|---|
| Dam Rehabilitation per Edward B. Walsh | $580,000 to $690,000(1) |
| Dam Decommissioning with Step Pools | $360,000 to $430,000 |

Table 1 Notes:
1. The Dam Rehabilitation costs presented in Table 1 reflect the project as shown on the drawings prepared by Edward B. Walsh. Refer to Section 5 for additional recommendations/modifications and the associated construction cost for the Dam Rehabilitation option.

## Table 2
## Estimated Construction Costs for Dam Rehabilitation (Edward B. Walsh Design)

| Item No. | Item Description | Estimated Quantity | Unit | Unit Price | Amount |
|---|---|---|---|---|---|
| **Mobilization & Demobilization** | | | | | **$47,556** |
| 1. | Mobilization & Demobilization | | | | |
| | a. General Mob/Demob (~7% of Contract Price) | 1 | LS | XXX | $36,988 |
| | b. Bonds & Insurances (~2% of Contract Price) | 1 | LS | XXX | $10,568 |
| **Site Preparation** | | | | | **$53,600** |
| 2. | Pre-Construction Site Development | | | | |
| | a. On-Site Access/Haul Roads & Staging Areas | 1,550 | SY | 12.00 | $18,600 |
| | b. Fill (Offsite) for Site Access Road off of Greenhill Lane | 900 | CY | 20.00 | $18,000 |
| | c. Traffic Control Signage, Flagmen, Etc. (Per Entrance) | 2 | EA | 1,000.00 | $2,000 |
| 3. | Field Surveys | | | | |
| | a. Construction Stakeout, Quantity Verification, As-Builts, Etc. | 1 | LS | 15,000.00 | $15,000 |
| **Erosion Control and Diversion of Water** | | | | | **$139,060** |
| 4. | Miscellaneous Erosion Control Measures | | | | |
| | a. Rock Construction Entrance | 2 | EA | 4,000.00 | $8,000 |
| | b. Compost Filter Sock | 880 | LF | 17.00 | $14,960 |
| | c. Protective Fence | 0 | LF | 6.00 | $0 |
| | d. Temporary Stabilization (Assume 0.5 acres) | 0.5 | AC | 3,000.00 | $1,500 |
| | e. Erosion Control Matting | 420 | SY | 5.00 | $2,100 |
| 5. | Management of Water | | | | |
| | a. Diverting Surface Water | 1 | LS | 100,000.00 | $100,000 |
| | b. Foundation Dewatering | 1 | LS | 7,500.00 | $7,500 |
| | c. Temporary Stream Crossing | 1 | LS | 5,000.00 | $5,000 |
| **Addition of Auxiliary Spillway** | | | | | **$311,980** |
| 6. | Demolition Activities | | | | |
| | a. Strip and Stockpile Topsoil (Assume 6" Thickness) | 315 | CY | 12.00 | $3,780 |
| | b. Individual Tree Removal | 15 | EA | 500.00 | $7,500 |
| 7. | Earthwork Activities | | | | |
| | a. Earth Excavation for Auxiliary Spillway | 1,930 | CY | 10.00 | $19,300 |
| | b. Riprap (R-7) | 80 | CY | 75.00 | $6,000 |
| | c. Aggregate Bedding for Riprap (Assume 6-Inches) | 10 | CY | 60.00 | $600 |
| | d. Earth Backfill of Auxiliary Spillway (Blended with Cement) | 1,230 | CY | 30.00 | $36,900 |
| | e. Earth Fill along Left and Right Embankments | 390 | CY | 10.00 | $3,900 |
| | f. Topsoil Placement (Assume 6" Thickness) | 260 | CY | 30.00 | $7,800 |
| | g. Temporary Sheetpile (25' Long x 30' Depth) | 750 | SF | 30.00 | $22,500 |
| | h. Embankment Diaphragm | 25 | CY | 80.00 | $2,000 |
| 8. | Concrete Work | | | | |
| | a. Formed Concrete - Walls | 65 | CY | 1,150.00 | $74,750 |
| | b. Formed Concrete - Slabs | 150 | CY | 450.00 | $67,500 |
| | c. Steel Reinforcing | 39,000 | LS | 1.15 | $44,850 |
| | d. Stone Masonry Facing / Wall Extensions | 650 | SF | 20.00 | $13,000 |
| | e. Flowable Fill Under Existing Spillway Slab | 8 | CY | 200.00 | $1,600 |
| **Site Clenaup Activities** | | | | | **$23,760** |
| 9. | Remove Compost Filter Sock | 880 | LF | 2.00 | $1,760 |
| 10. | Remove Protective Fence | 0 | LF | 2.00 | $0 |
| 11. | Remove Temporary Fill and Rock Construction Entrance | 900 | CY | 20.00 | $18,000 |
| 12. | Remove Rock Construction Entrance | 2 | EA | 500.00 | $1,000 |
| 13. | Seed and Mulch all Disturbed Areas | 1 | AC | 3,000.00 | $3,000 |
| | **Total Construction Cost (Items Nos. 1 through 13, inclusive):** | | | | **$575,956** |
| | **Contingency (Assume 20 Percent):** | | | | **$115,191** |
| | **Estimated Construction Cost for Rehabilitation of Hershey's Mill Dam:** | | | | **$691,000** |

## Table 3
## Estimated Construction Costs for Dam Decommissioning with Step Pools

| Item No. | Item Description | Estimated Quantity | Unit | Unit Price | Amount |
|---|---|---|---|---|---|
| **Mobilization & Demobilization** | | | | | **$29,618** |
| 1. | Mobilization & Demobilization | | | | |
| | a. General Mob/Demob (~7% of Contract Price) | 1 | LS | XXX | $23,036 |
| | b. Bonds & Insurances (~2% of Contract Price) | 1 | LS | XXX | $6,582 |
| **Site Preparation** | | | | | **$38,400** |
| 2. | Pre-Construction Site Development | | | | |
| | a. On-Site Access/Haul Roads & Staging Areas | 950 | SY | 12.00 | $11,400 |
| | b. Fill (Offsite) for Site Access Road off of Hershey Hill Road | 550 | CY | 20.00 | $11,000 |
| | c. Traffic Control Signage, Flagmen, Etc. | 1 | LS | 1,000.00 | $1,000 |
| 3. | Field Surveys | | | | |
| | a. Construction Stakeout, Quantity Verification, As-Builts, Etc. | 1 | LS | 15,000.00 | $15,000 |
| **Erosion and Sediment Control** | | | | | **$130,200** |
| 4. | Miscellaneous Erosion Control Measures | | | | |
| | a. Rock Construction Entrance | 1 | EA | 4,000.00 | $4,000 |
| | b. Compost Filter Sock | 500 | LF | 17.00 | $8,500 |
| | c. Protective Fence (Wetland Protection) | 150 | LF | 6.00 | $900 |
| | d. Temporary Stabilization (Assume 0.5 acres) | 0.5 | AC | 3,000.00 | $1,500 |
| | e. Erosion Control Matting | 560 | SY | 5.00 | $2,800 |
| 5. | Management of Water | | | | |
| | a. Diverting Surface Water | 1 | LS | 100,000.00 | $100,000 |
| | b. Foundation Dewatering | 1 | LS | 7,500.00 | $7,500 |
| | c. Temporary Stream Crossing | 1 | LS | 5,000.00 | $5,000 |
| **Breach Activities** | | | | | **$83,340** |
| 6. | Demolition Activities | | | | |
| | a. Strip and Stockpile Topsoil (Assume 6" Thickness) | 375 | CY | 12.00 | $4,500 |
| | b. Remove Existing 24-Inch Low Level Dewatering Pipe | 38 | LF | 30.00 | $1,140 |
| | c. Individual Tree Removal | 3 | EA | 500.00 | $1,500 |
| | d. Steel Plate Removal (Cut or Complete Removal) | 1 | LS | 500.00 | $500 |
| | e. Concrete Slab Removal | 10 | CY | 125.00 | $1,250 |
| 7. | Earthwork Activities | | | | |
| | a. Earth Excavation | 2,750 | CY | 10.00 | $27,500 |
| | b. Riprap (R-5) | 200 | CY | 75.00 | $15,000 |
| | c. Aggregate Bedding for Riprap (Assume 6-Inches) | 50 | CY | 60.00 | $3,000 |
| | d. Spoil Excess Material Onsite | 2,440 | CY | 5.00 | $12,200 |
| | e. Masonry Cap for Wall to Remain | 1 | LS | 10,000.00 | $10,000 |
| | f. Topsoil Placement (Assume 6" Thickness) | 375 | CY | 30.00 | $11,250 |
| **Large Boulder Step Pools** | | | | | **$61,850** |
| 8. | Large Boulder Step Pools | | | | |
| | a. Aggregate Bedding (PennDOT 2A) | 100 | CY | 60.00 | $6,000 |
| | b. Drainage Media Behind Walls | 65 | CY | 60.00 | $3,900 |
| | c. Geotextile Behind Walls | 270 | SY | 5.00 | $1,350 |
| | d. Large Boulder Walls (Ton) | 400 | Ton | 100.00 | $40,000 |
| | e. Step Pool - Earth Backfill within Pool | 310 | CY | 10.00 | $3,100 |
| | f. Step Pool - Rock Scour Protection within Pool (Assume R-3) | 100 | CY | 75.00 | $7,500 |
| **Site Clenaup Activities** | | | | | **$15,300** |
| 9. | Remove Compost Filter Sock | 500 | LF | 2.00 | $1,000 |
| 10. | Remove Protective Fence | 150 | LF | 2.00 | $300 |
| 11. | Remove Temporary Fill and Rock Construction Entrance | 550 | CY | 20.00 | $11,000 |
| 12. | Seed and Mulch all Disturbed Areas | 1 | AC | 3,000.00 | $3,000 |
| | **Total Construction Cost (Items Nos. 1 through 12, inclusive):** | | | | **$358,708** |
| | **Contingency (Assume 20 Percent):** | | | | **$71,742** |
| | **Estimated Construction Costs for Decommissioning of Hershey's Mill Dam with Step Pools:** | | | | **$430,000** |

It is our understanding that the Township is currently working with the local residents to develop a plan for the dewatered reservoir which may include improvements such as walking trails, boardwalks, landscaping, etc. The estimated construction costs for the Dam Decommissioning option as shown in Tables 1 and 3 do not include these improvements. The reservoir improvement costs should be added to the Dam Decommissioning costs to determine the total construction costs associated with this option.

## 5.0 Recommended Modifications to the Dam Rehabilitation Option

As noted in Gannett Fleming's letter to the Township dated May 13, 2016, in the absence of supporting calculations for the dam rehabilitation option, there appear to be certain components of the design that may require additional investigation/design, potentially resulting in additional construction costs. There are also possible modifications to the design which may reduce construction costs associated with the dam rehabilitation project. The following observations are made:

Downstream Embankment Slopes: The downstream left embankment contains steep slopes and a deteriorating hand-laid stone wall. In order to improve embankment stability, it is recommended that the slope of the downstream left embankment be reduced to 3H:1V or flatter. Shifting the embankment to the south and using slopes steeper than 3H:1V would reduce embankment earthwork costs and would be acceptable if supported by a geotechnical stability analysis.

Use of Alternate Construction Material for the Auxiliary Spillway Retaining Wall: The auxiliary spillway design calls for a concrete foundation slab, vertical concrete walls and a concrete slab across the crest of the spillway and the spillway excavation is to be backfilled with on-site soils blended with cement. It appears that the design could be simplified by using a large block retaining wall system which would reduce the volume of concrete required and reduce the construction duration. Many of these retaining wall systems can be provided with an exposed face that looks like hand laid stone, eliminating the cost associated with placing a stone façade on the downstream face of the retaining wall. Exhibits 2 and 3 provide an example of a large block retaining wall used to form the downstream face of an 80-foot long, 10-foot high principal spillway. This example is very similar to the situation at Hershey's Mill Dam which proposes an auxiliary spillway that is approximately 60-feet wide and 15-feet high.

Blending on-site soil with cement is not recommended as a cost effective means for reducing seepage through the embankment. A more effective solution would be to screen the on-site soils to produce a soil gradation that meets the required soil permeability. However, based on the small volume of soil needed to backfill the spillway, mobilization of a screening plant would not be a cost effective solution. Assuming that the onsite soils are not acceptable as backfill material, it is recommended that off-site impervious soil material be imported for use in backfilling excavations and constructing new embankment areas.

**Exhibit 2**
**Example of Large Block Retaining Wall Used for a Spillway Structure**
**(Wall Under Construction)**

**Exhibit 3**
**Example of Large Block Retaining Wall used for a Spillway Structure**
**(Wall Construction Complete)**

Elimination of the Sheet Pile Support Wall: The installation of the sheet pile support wall creates a discontinuity within the earth embankment and introduces a penetration and potential seepage path through the embankment. As a cost savings and seepage reduction measure, it is recommended that the sheet pile support wall be eliminated by moving the location of the new auxiliary spillway to the left a sufficient distance such that the excavation needed to construct the foundation of this structure will not undermine the existing principal spillway. It is anticipated that the auxiliary spillway would need to be moved approximately 40 feet to the left to provide adequate separation to allow the sheet pile support wall to be eliminated (refer to Exhibit 4 for a plan view showing the relocation of the auxiliary spillway to the left).

Seepage Collection and Filter System: The drawings indicate the addition of a short filter diaphragm at the left end of the proposed auxiliary spillway to collect seepage which may occur around the left end of the spillway. No seepage collection and filtering system is shown under the spillway or in any other areas of the embankment. It is recommended that this feature be considered in the design, especially if the auxiliary spillway is founded on erodible material.

Flattening of the downstream left embankment (as described above) provides the opportunity to incorporate a blanket and toe drain system into the left embankment for collecting and filtering seepage through the earth embankment (refer to Exhibit 5). The seepage collection and filter system could also be incorporated/extended into the backfilling activities for the large block retaining wall system that supports the auxiliary spillway.

Repair of Existing Principal Spillway: The existing spillway slab contains significant transverse cracking which has propagated through the left and right hand-laid stone spillway abutment walls. The design by Edward B. Walsh proposes to place flowable concrete fill beneath the existing slab to fill any voids which may be present. Based on historic photographs of the spillway reconstruction which occurred in the 1970s, it appears that the existing spillway slab is supported on the downstream end by the hand-laid stone wall which forms the spillway and on the upstream end by a steel plate wall which appears to have been installed as a form of seepage control. It is believed that poor compaction of the backfill material placed between these two support systems has resulted in settlement and subsequent cracking of the concrete spillway slab. Based on the available information, it is recommended that the existing spillway slab and hand-laid stone abutment walls be removed and reconstructed in their entirety to allow for proper treatment of the underlying soils. As a potential cost savings measure, consideration should be given to reconstructing the left and right spillway training walls using conventional concrete with a form liner to mimic the look of hand-laid stone.

Unknown Foundation Conditions: It is unclear if subsurface investigations have been performed to sample foundation materials, locate bedrock and classify the soils located within/under the proposed auxiliary spillway. Therefore the foundation conditions for the auxiliary spillway appear to be unknown. Understanding the foundation conditions for the

auxiliary spillway is important. If the spillway is founded on erodible overburden material, which appears to be the case, the auxiliary spillway design should include a seepage analysis and would likely require a seepage cutoff wall and filtered drain system to control seepage under the structure and prevent a piping failure. If the auxiliary spillway structure is founded on bedrock, foundation treatment would include additional excavation and effort to clean and inspect the foundation rock, and place backfill concrete to the desired foundation grade. Should the Township choose to rehabilitate Hershey's Mill Dam, it is recommended that a geotechnical subsurface exploration program be implemented to verify the existing site conditions and support the design of the proposed improvements.

In areas where new embankment fill is placed within the reservoir, it is recommended that all sediment beneath the footprint of the new embankment be removed so that the new embankment can be founded on suitable material and will be constructed entirely of engineered fill (i.e., impervious material).

The recommendations described above are conceptualized in Exhibits 4, 5 and 6 which provide a plan view, typical cross section through the left embankment and a typical cross section through the auxiliary spillway, respectively. The construction cost for the dam reconstruction as depicted on Exhibits 4, 5, and 6 is estimated to be between $720,000 and $860,000. Engineering costs to support and permit the dam rehabilitation design may be in the range of $75,000 to $150,000.

**Exhibit 4**
**Plan View of Hershey's Mill Dam Rehabilitation (Modified)**

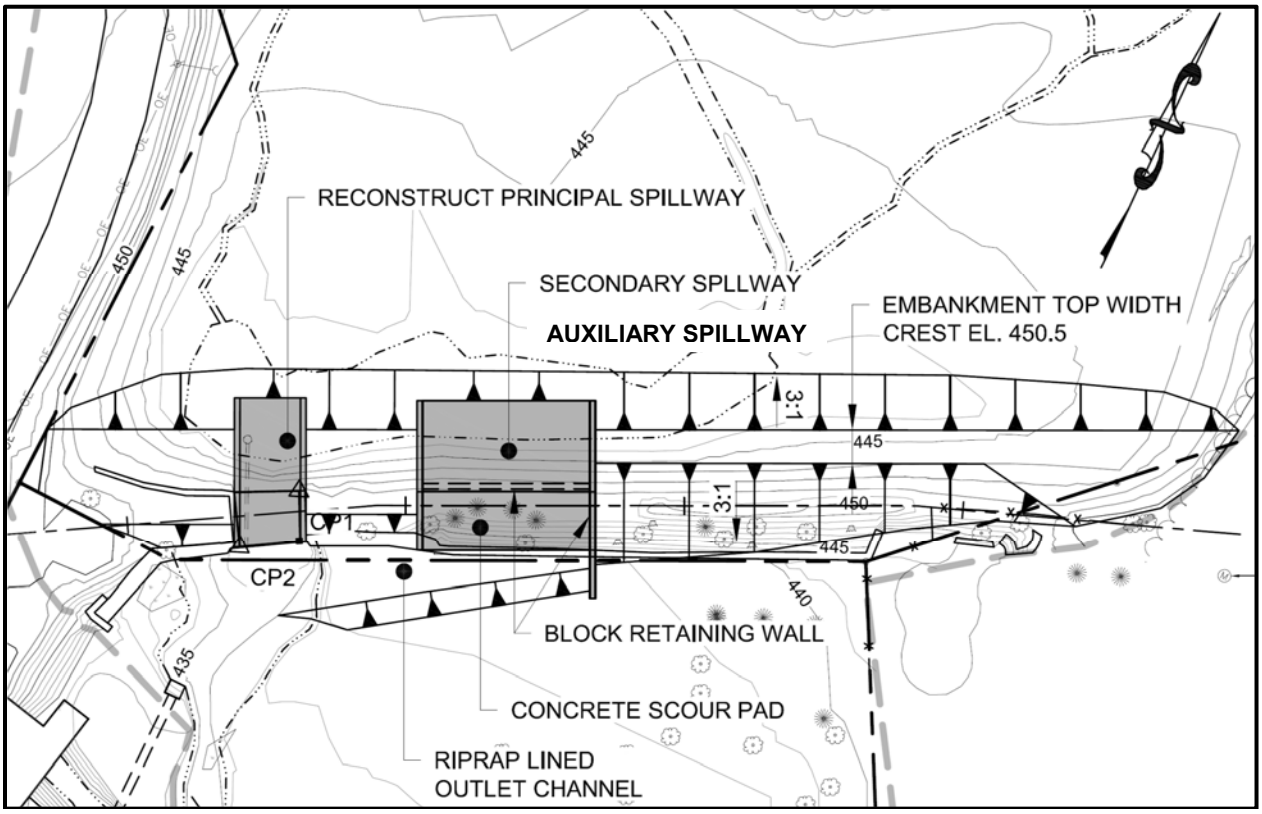


**Exhibit 5**
**Typical Cross Section through Left Embankment**

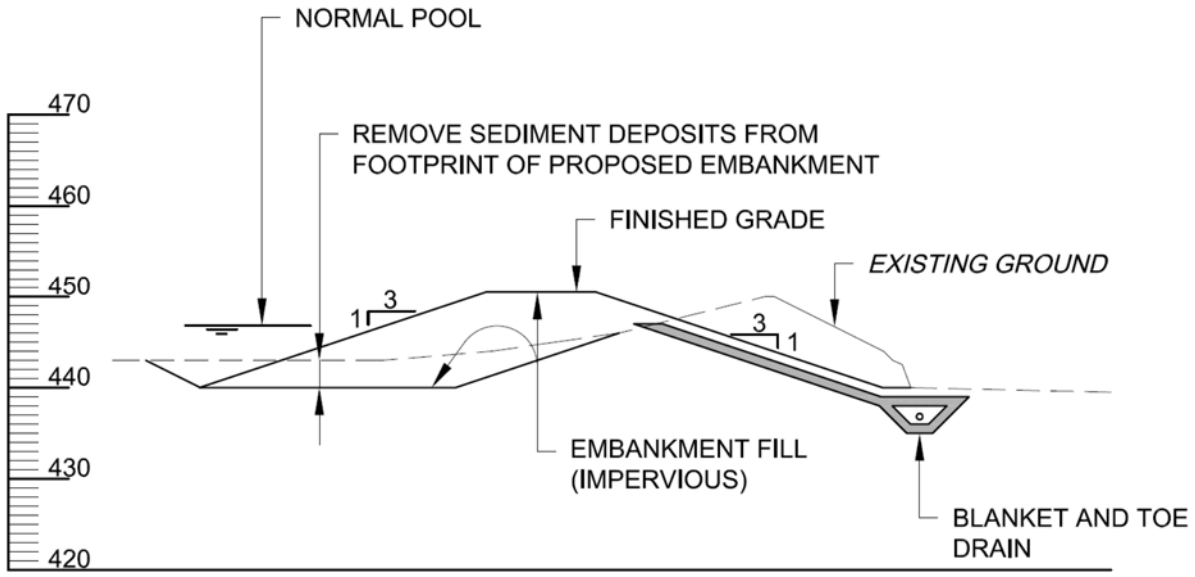
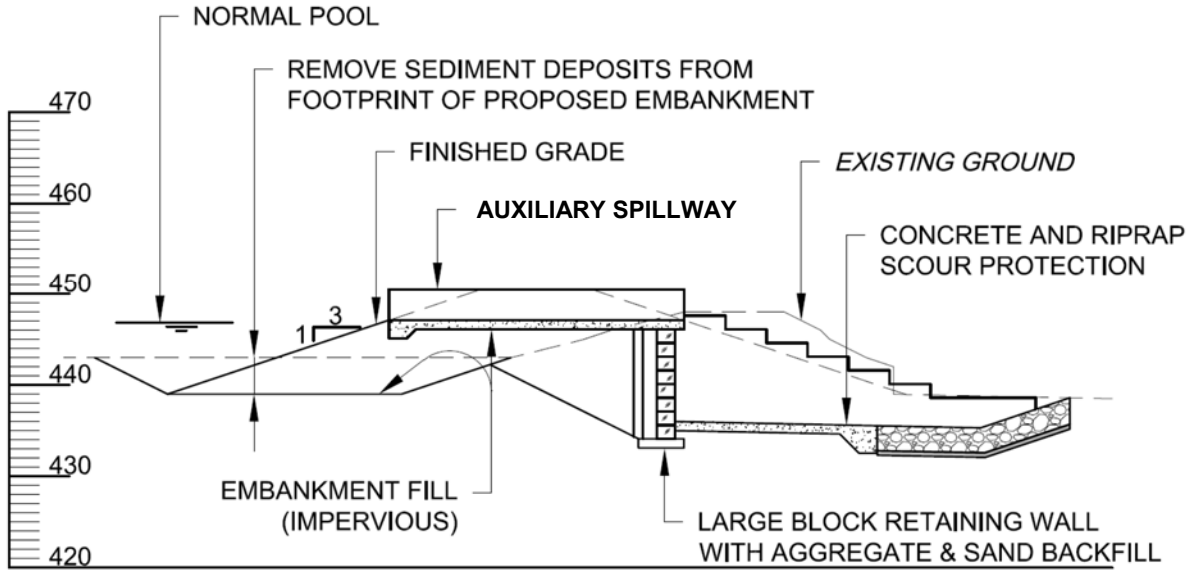



**Exhibit 6**
**Typical Cross Section through Auxiliary Spillway**



If you have any questions or need additional information, please do not hesitate to call me or Paul Schweiger at 717-763-7212, extensions 2828 and 2504, respectively.

Sincerely,

GANNETT FLEMING, INC.
Environmental Resources Division

Eric C. Neast

ERIC C. NEAST, P.E.
Project Manager
Dams and Hydraulics Section