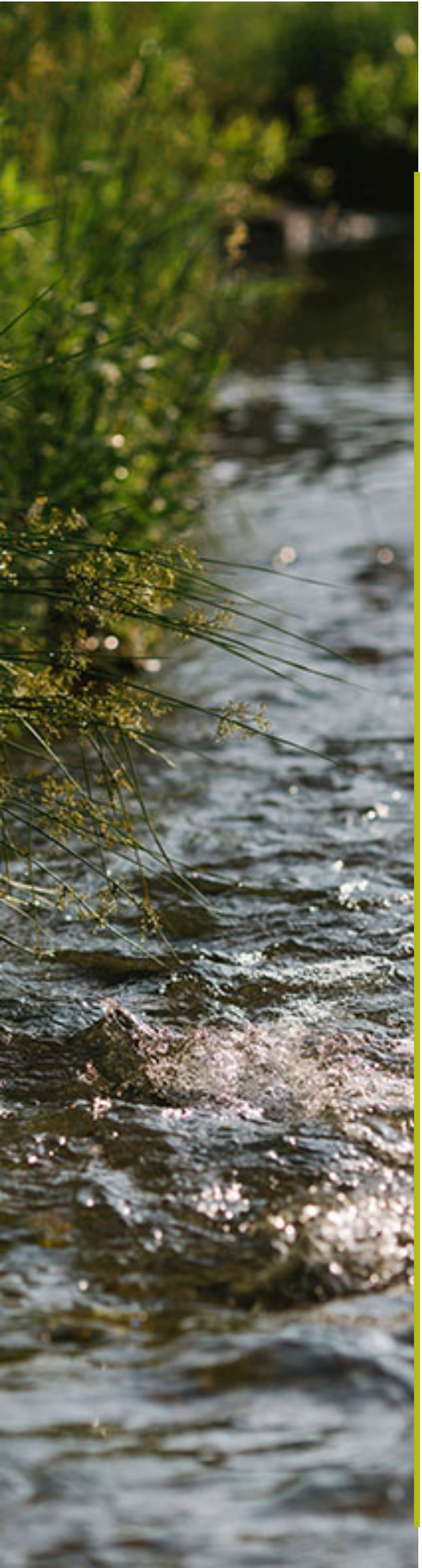

Middle Creek Watershed Assessment Report

Schuylkill County, Pennsylvania

October 18, 2023

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Appendix A: Middle Creek Watershed Strategic Restoration Plan
Appendix B: Concept Plan for Phase 1A, 1C, and 1D

Record of Revisions

Revision	*Date*	*Pages/Sections Changed*	*Description*
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1 Introduction

Middle Creek is a 5.9 square mile watershed in Schuylkill County, Pennsylvania. Middle Creek flows into Good Spring Creek, a tributary to Swatara Creek, which ultimately flows into the Susquehanna River and Chesapeake Bay. The majority of the watershed is within Frailey and Reilly Townships with parts of the watershed extending into Foster Township (to the north) as well as Tremont Township and Tremont Borough (both to the south). All streams within the Middle Creek watershed are considered Warm Water Fisheries (WWF) and are listed as impaired for aquatic life due to siltation and acid mine drainage with a “high” TMDL development priority (Pennsylvania Department of Environmental Protection, 2021).

Overall, 84% of the watershed is forested and only 4% urban, with no carbonate or karst topography or agricultural land (United States Geological Survey, 2021). Middle Creek and its tributaries including Gebhard Run and Coal Run have a long history of human stresses including timbering, milling operations, and coal mining that have a demonstrated impact to the water resources. The lasting impact of these unmitigated historical impairments is a loss of system resilience serving to exacerbate and often overshadow impacts from present day land uses and resource management in the watershed.

This narrative outlines an understanding of watershed impairments, present and historical impacts, and potential future problem areas. The assessment findings were used to define and prioritize restoration reaches that maximize benefits. Prioritized benefits include reducing sedimentation in the downstream watershed particularly within Tremont Borough to alleviate nuisance flooding; improve water quality; mitigate risks to existing and planned infrastructure; habitat creation; and prioritizing restoration approaches with multiple benefits to attract diverse funding sources. These reaches are highlighted on the Middle Creek Watershed Strategic Restoration Plan (see Appendix A).

2 Historical Impacts

The landscape and landform within the Middle Creek Watershed visible today are the result of numerous land use changes and manipulations over time. Such historical modifications include straightening, ditching, and general relocation of stream channels; deforestation; impoundments associated with mill operations; infrastructure such as railroads, roads, bridges, and culverts; topographic alterations related to coal mining, and acid mine drainage. These impacts have resulted in significant degradation of floodplains, wetlands, and stream systems in terms of both stability and water quality.

The manipulation of the watershed is illustrated by historical atlases (*see Figures 2-1, 2-2, 2-3*). While these maps are not an exhaustive summary of human manipulation of the Middle Creek Watershed, they do offer an opportunity to recognize the documented pressure on these streams when these maps were created. Historical aerial photography was also utilized to compare the magnitude of manipulation Middle Creek has experienced since 1939 when the earliest aerial photography of the area was obtained.

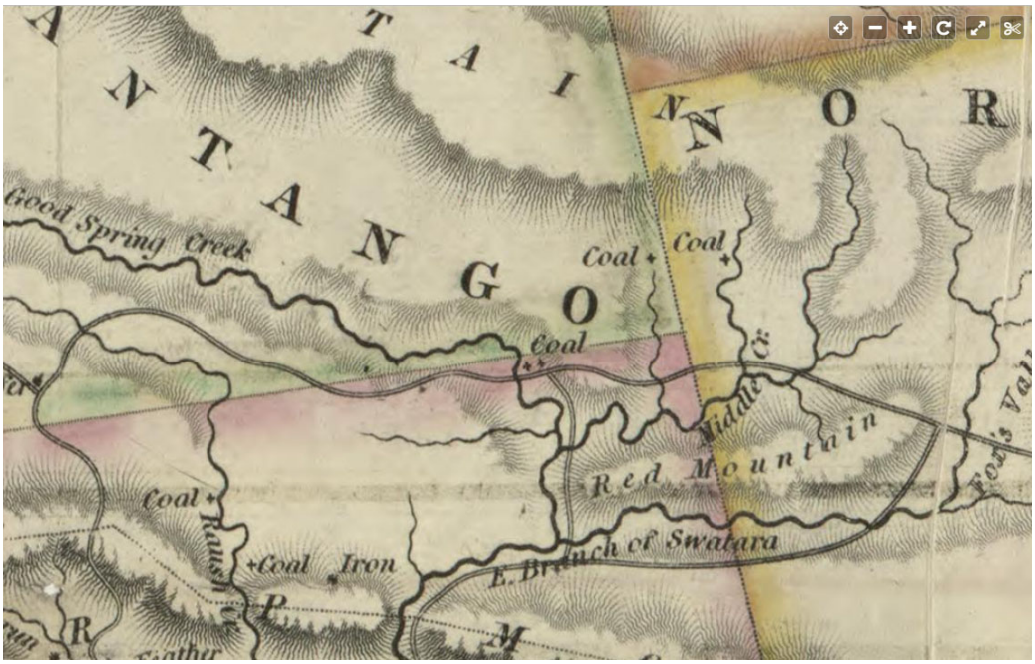

Figure 2-1. 1830 Historic Atlas of Schuylkill County (Library of Congress; www.loc.gov).

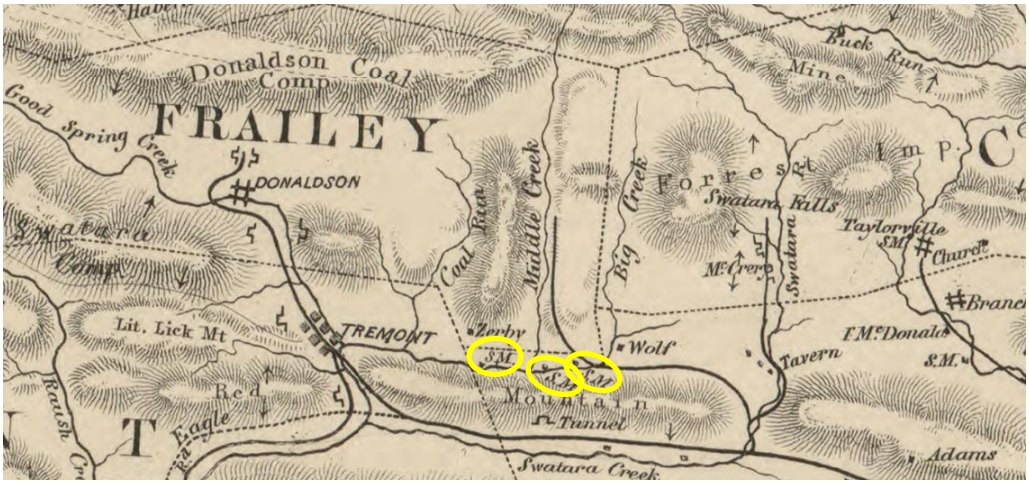

Figure 2-2. 1855 Historic Atlas of Schuylkill County (Library of Congress; www.loc.gov).

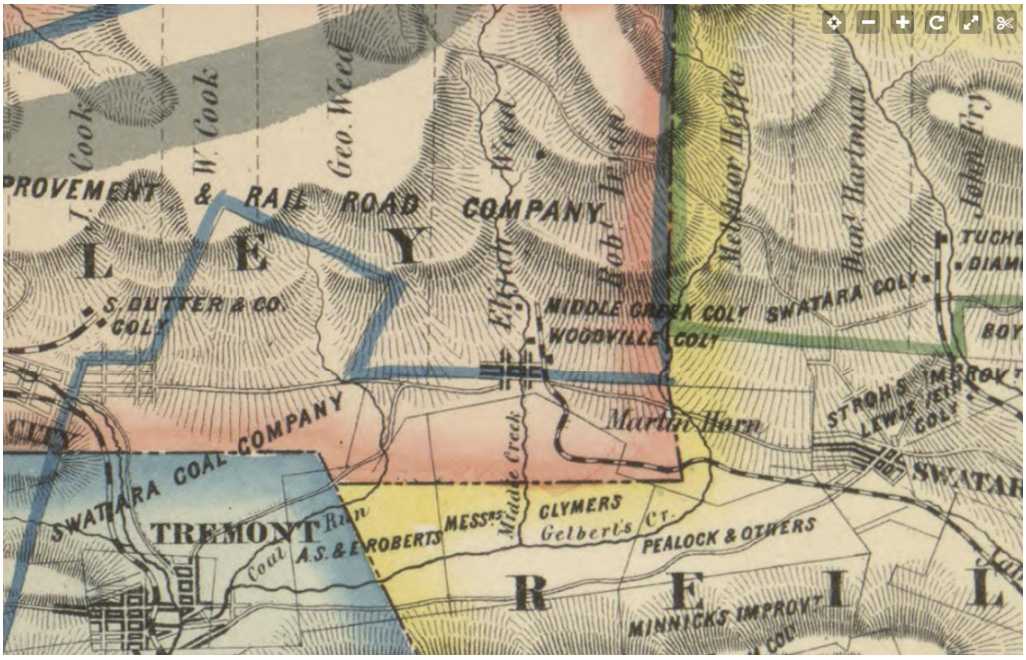

Figure 2-3. 1863 Historic Atlas of Schuylkill County (Library of Congress; www.loc.gov).

Today, stream channels within the watershed are vertically incised and disconnected from the historical floodplain elevation, resulting in severe streambank and bed erosion, as well as transport of sediment and pollutants downstream into Tremont Borough. The extent of sediment carried downstream has resulted in significant deposition near the confluence with Good Spring Creek, which contributes to flooding of existing infrastructure within the Borough. To mitigate flooding, the Borough currently engages in costly routine dredging. Addressing these issues will provide cost-effective flood mitigation within the Borough while encouraging a more ecologically robust watershed.

3 Watershed Assessment

The watershed assessment was conducted to identify and verify sources of impairments to Middle Creek, Gebhard Run, and tributaries to each, prioritizing areas where there are potential conflicts with infrastructure, increased sediment and nutrient loading and opportunities to improve or mitigate these issues in the watershed. Overall, the amount of overburden associated with past coal operations is extensive throughout the watershed. The presence of legacy sediment associated with impoundments prior to coal mining is a factor but to a lesser degree compared to the overburden. As such, the bank erosion potential and ecological impairment is similar throughout the majority of the watershed.

3.1 Base Level Control

Base level control is an evaluation of the potential that a channel will continue to incise (become deeper). This is the first step in the channel degradation process when controlling features such as culverts, dams, etc. are altered or removed. This step is generally followed by widening of the channel, then aggressive lateral migration. Opportunities to restore or repair a stream are dependent on the stage of the channel evolution process.

In general, base level control in the watershed is limited to culvert crossings. Observed culvert crossings exist at PA Route 209 (Middle Creek) in Tremont Borough, PA Route 571 (Middle Creek, Gebhard Run, and Coal Run), and PA Route 25 (Middle Creek and Gebhard Run). An existing dam along Gebhard Run just downstream of PA Route 25 also provides base level control as long as it remains intact. While some active headcuts were observed within the watershed, most incision appears to have already occurred between the culvert crossings mentioned above. As a result, significant lateral erosion is widespread throughout the watershed.

3.2 Sediment Supply

The primary source of sediment within the watershed appears to be due to erosion of overburden that was placed within the stream valleys during coal mining activities. The overburden is composed of material of various sizes ranging from silt to boulders, which is reflected by channel bed materials throughout the watershed. Some channel segments that appear at first to have immobile bed loads are actually still incising as finer materials are continuously eroded out from beneath larger materials during high flow events. The high banks along the channel increase the likelihood of banks devoid of vegetation. These banks are also susceptible to freeze-thaw processes that detach sediment from the banks and deposit it directly in the stream channel. The magnitude of bank erosion due to freeze-thaw processes is generally dependent on the number of freeze-thaw cycles the bank experiences rather than the number or magnitude of storm events.

4 Strategic Restoration Plan

Information collected during the watershed assessment was used to develop a comprehensive strategic restoration plan. This plan shows the entire Middle Creek watershed including demarcation of sub-watersheds, municipal boundaries, existing stream locations, prioritized reaches, photos of existing conditions and other pertinent information.

The following criteria were identified as key elements to measure and prioritize potential restoration opportunities to reduce sedimentation in Tremont Borough:

- Encourage retention of flood waters, stormwater, sediment, carbon (such as woody material and leaves), and nutrients within the valley bottom, where possible.
- Reduce streambank and bed erosion and resultant sediment loading downstream by improving channel stability.
- Improve natural functions of the stream and floodplain corridor.

Prioritized reaches have been categorized as either primary or secondary opportunities. In general, primary opportunities are along transport reaches positioned lower in the watershed that could be converted into retention reaches by reconnecting the stream and floodplain. Secondary opportunities are along segments that are either higher in the watershed and have some kind of downstream control that slows (not necessarily eliminates) the transport of coarse-grained sediment (gravel, cobble) or exhibiting impairments less severe than other reaches. This categorization is intended to provide a general framework and guide for planning the implementation of improvement projects in the watershed. Projects do not need to be implemented in a specific order as there are numerous factors (landowner consent, funding, etc.) that may influence when (or if) a particular project can be completed. Subsequently, the limits of a particular priority reach may be modified for the same reasons.

Public engagement and strategic partnerships are a common thread connecting each of the opportunities presented and should be considered a critical component to all future watershed improvement efforts. Educating landowners and community groups on the importance of protecting and enhancing our regional resources helps to build an informed citizenship and will lead to greater opportunities and support to meet future challenges. Public-private partnerships between government entities, public agencies, landowners, and private interests are strongly encouraged in planning efforts.

5 Recommended Improvement Approaches

Recommended improvements generally fall into five categories including four types of full-scale restoration approaches where there is enough space available to achieve a sustainable floodplain without the need for excessive armoring and one stabilization-focused approach where there is not enough available space to provide adequate access to the floodplain.

5.1 Restoration Approach

Depending on the reach, restoration approaches would involve at least one of the following situations: 1) raise the channel bed to match abandoned floodplain elevations; 2) a combination of raising the channel and lowering the floodplain; 3) lower the

floodplain; and 4) relocate the stream/floodplain to more appropriate position within the valley. The objective of all restoration approaches is to create a shallower and more sustainable, lower stress system by re-connecting the groundwater and stream base flow with the rooting depth of the floodplain vegetation. This proposed condition will allow flows higher than the average seasonal high base flow to access the full width of the floodplain thereby reducing erosive shear stresses on the bed and banks for all storm events, not just large events. Proposed floodplain vegetation will have a dependable source of hydrology as the floodplain will be near the groundwater, which will promote wetland establishment. A new, stable channel system will be created that will disperse baseflow across the full width of the proposed floodplain. Numerous wood structures (log sills and buried logs) will be installed across the floodplain and channel to provide grade control that will protect the proposed channel and floodplain from vertical degradation. Woody material will be partially buried in various locations across the floodplain and within the baseflow channel to provide additional floodplain roughness, increased habitat, grade control, and an additional source of organic carbon. Installation of native wet-tolerant herbaceous and woody vegetation will be planted to provide additional habitat, nutrient uptake, additional soil stabilization, erosion control, and overhead cover for aquatic organisms along the restored stream channel and within the floodplain corridor. Overall, the restoration design will reduce sediment and nutrient export and encourage the retention of sediment and nutrients within the floodplain and the retention of organic carbon (woody debris and leaf litter) within the channel, which is a key component of freshwater aquatic ecosystems. Storage of coarse grain material (sand, gravel, and cobble) will occur at the upper extent of each restored reach further reducing bar formation and resulting lateral migration in the downstream waters. A high-quality wetland complex is expected to develop across the full width of the floodplain at close vertical proximity to the existing water table.

5.2 Stabilization Approach

Along prioritized reaches where space is limited due to site constraints (i.e. infrastructure or other floodplain encroachments, geology, etc.), proposed improvements would be limited to bed and bank stabilization. This would involve the use of rock bed armoring (rip-rap and/or boulders) along the channel bed to provide grade control intended to minimize future channel incision. Eroding banks would be stabilized using a combination of bank grading and either rock armoring or bio-engineering techniques designed to withstand flows up to and including 100-year storm event (or even higher if possible). Where possible, some degree of channel/floodplain grading would be proposed to provide increased floodplain access. It is important to note that these stabilization techniques are considered a short-term “band-aid” approach that will eventually require maintenance, repairs, or replacement over time. It will not provide the same level of sustainability or benefits as the forementioned restoration approaches.

6 Summary of Prioritized Reaches & Improvement Recommendations

6.1.1 Site 1A: Middle Creek – Confluence with Coal Run to Tremont Borough (~2,155 LF)

Summary of Assessment Reach

This channel reach is disconnected from the floodplain due to incision and displays active bank erosion which contributes to sediment deposition downstream, in-channel deposition, and debris jams. Most of the reach is pinned against the valley wall to the southeast where it flows adjacent to property owned by a sportsmen's club. The adjacent floodplain surface is dominated by wetlands positioned on large cobble and boulder material. This reach serves as a transport reach that conveys sediment downstream into Tremont.

Improvement Recommendation

The recommended restoration approach is to raise the elevations of the existing channel bed to match elevations of the adjacent floodplain, thus resulting in a wide, stable wetland meadow. This meadow will provide a multitude of benefits, including peak discharge reduction, sediment capture and storage, nutrient filtration, as well as the improvement of aquatic and terrestrial wetland habitat for native species.

6.1.2 Site 1B: Gebhard Run – Indian Head Entrance to Confluence with Middle Creek (~4,867 LF)

Summary of Assessment Reach

This channel reach is disconnected from the floodplain due to incision and displays active bank erosion which contributes to sediment deposition downstream, in-channel deposition, and debris jams.

Improvement Recommendation

Recommended improvements for this reach include raising the channel to match the floodplain, similarly to Site 1A. In addition, there is potential for treatment of aluminum discharges from nearby mining operations by creating a series of treatment ponds along the margin of the right valley separate from the restored channel and floodplain.

6.1.3 Site 1C: Middle Creek – Concrete Flume to Confluence with Coal Run (~2,507 LF)

Summary of Assessment Reach

Based on a comparison of the current stream location to historic mapping, this reach of Middle Creek was relocated into the Coal Run sub-watershed from its previous location, which is currently an active coal mining/sorting operation (Indian Head). The reach is straight and flows along concrete lining positioned along the valley margin high above the original valley bottom. This reach exhibits extreme vertical and lateral degradation beginning at the terminus of the concrete flume, where the channel can be seen downcutting through the bedrock. This reach is at risk of substantial slope failure and is a significant source of sediment in the watershed.

Improvement Recommendation

The recommended restoration approach for this reach includes abandoning the lower half of concrete-lining and relocating the stream to a more appropriate location within a lower-lying portion of the exiting valley to the southeast. This would require significant excavation of overburden material in an area that appears to be inactive within the Indian Head coal operation. As such, the recommended restoration hinges upon the landowner's willingness to allow this work to be performed on their property. If allowable, the restoration would involve establishing a new floodplain that would be resilient to large flow events (100-year storm minimum) and a stable baseflow channel system that would tie into the existing Middle Creek channel near the confluence with Coal Run. Ideally, the restored floodplain would encompass the existing outflow channel from an adjacent AMD Treatment Facility (Site 9). The restored floodplain will provide numerous benefits, including eliminating a significant source of sediment, peak discharge reduction, sediment/nutrient/carbon capture and storage and significantly improved aquatic and terrestrial wetland habitat. Excavated material would be used to fill the abandoned channel segment.

6.1.4 Site 1D: Coal Run – Between Route 571 and Confluence with Middle Creek (~2,310 LF)

Summary of Assessment Reach

This reach demonstrates significant erosion where the channel was relocated around acid mine drainage treatment ponds. The banks show active erosion, which contributes to sediment deposition downstream, in-channel deposition, and debris jams. Additionally, the reach is in the beginning stages of lateral migration and will eventually begin to encroach upon the acid mine drainage treatment ponds.

Improvement Recommendation

Alteration of the historical flow path of this section has resulted in a concentrated, incised channel with high erosive potential. This section is of particular importance due to the stream's encroachment into the adjacent acid mine drainage treatment pond berm. It is critical that this berm remains structurally stable due to the importance of the facility. Site constraints, including the AMD Treatment Facility to the east and the valley margin to the west, prevent the feasibility of significant floodplain restoration along this reach. As such, recommended improvements would be limited to bed and bank armoring in combination with some level of grading to establish floodplain benches to help alleviate some of the erosive stresses occurring along the reach.

6.1.5 Site 2A: Gebhard Run – Confluence with unnamed Tributary to Indian Head Entrance (~3,959 LF)

Summary of Assessment Reach

This reach is a straightened and entrenched transport reach running parallel to PA Route 209. There is a well-established wetland system between the transport reach to the south and the base of existing culm piles to the north. The channel is disconnected

from the floodplain and displays active bank erosion, but most importantly this reach conveys the majority of all sediment it receives, which contributes to sediment deposition downstream.

Improvement Recommendation

It is recommended that the transport reach be abandoned, and the flow be relocated into the existing wetland system adjacent to the reach. Along the lower one-third of the reach (downstream of where the relocated segment ties back into the existing stream), the elevations of the existing channel bed would be raised to match elevations of the adjacent floodplain, thus resulting in a wide, accessible floodplain. Excavation would be limited to the downstream tie-in to create a gradual, stable transition between the raised channel bed and existing channel bed elevations near the Indian Head entrance.

6.1.6 Site 2B: Gebhard Run – Route 571 to Confluence with Unnamed Tributary (~2,066 LF)

Summary of Assessment Reach

This reach begins at a culvert crossing under PA Route 571 and flows west to east and parallel to the road for approximately 800 linear feet before a hard 90-degree meander where the stream begins to flow south for another segment approximately 1,200 linear feet in length. At one point, a railroad grade (now abandoned) crossed the lower segment of the reach. Overall, this reach exhibits extreme vertical and lateral degradation, especially through the downstream segment and is a significant source of sediment in the watershed.

Improvement Recommendation

The recommended restoration approach would involve relocating the channel (beginning at the hard right meander) to a lower lying portion of the valley to the east where frequent access to the floodplain would be possible. Ideally, a portion of the abandoned railroad berm that dissects the valley could be removed to maximize the length of an uninterrupted floodplain; however, if this is not allowable by the landowner, it is likely that the restoration approach is still doable by incorporating a culvert through the berm. The upstream segment would require significant excavation into coal overburden to create an accessible floodplain. If this is not achievable (due to cost or landowner's consent), bed and bank armoring would be proposed.

6.1.7 Site 3: Middle Creek – Upstream of Route 571 (~4,261 LF)

Summary of Assessment Reach

This reach flows through a mine reclamation area that is now utilized as a long-distance firing range where there is an on-line pond filled with sediment. There are numerous abandoned mine pits adjacent to the valley. An abandoned railroad grade crosses the reach in two separate locations within 300 feet of each other. The reach displays extreme vertical and lateral degradation and is a significant source of sediment in the watershed.

Improvement Recommendation

The recommended improvement strategy would include a combination of raising the incised channel bed to match floodplain elevation and excavating existing mining overburden to create a wide, accessible floodplain that would be sustainable during high flow events (100-year storm minimum). Particular attention would be given to ensuring flow would not be lost into existing mine pits within and adjacent to the grading area. Additionally, opportunities for filling some of the abandoned mine pits with excavated material would be explored.

6.1.8 Site 4: Gebhard Run – Between Route 25 and Route 571 (~6,799 LF)

Summary of Assessment Reach

This reach begins at a severely scoured outfall at PA Route 25 and flows down a steep valley into an existing pond on property owned by a sportsmen's club. The stream exits the pond perched upon a concrete lining. This reach exhibits extreme vertical and lateral erosion beginning at the terminus of the concrete lining. A collapsed culvert along the old access road has rerouted flow down the access road and caused significant incision and bank scouring as flows rejoin the channel approximately 1,600 feet downstream. This reach is a significant source of sediment; however, it appears that a large amount of coarse-grained material is depositing upstream of PA Route 571 due to the backwater condition caused by the existing culvert crossing.

Improvement Recommendation

The recommended restoration approach would involve relocating the channel (beginning at the pond outfall) to a lower lying portion of the valley to the east where frequent access to the floodplain would be possible. Excavated material would be used to fill the abandoned channel segment. The new floodplain would be resilient to large flow events (100-year storm minimum) and would have a stable baseflow channel system that would tie into the existing Gebhard Run channel near the location of the collapsed culvert, which would be removed. Downstream of the collapsed culvert, the elevations of the existing channel bed would be raised to match elevations of the adjacent floodplain, thus resulting in a wide, accessible floodplain. Excavation would be limited to the downstream tie-in to create a gradual, stable transition between the raised channel bed and existing channel bed elevations. The restored floodplain will provide numerous benefits, including eliminating a significant source of sediment, peak discharge reduction, sediment retention and significantly improved aquatic and terrestrial wetland habitat.

6.1.9 Site 5: Unnamed Tributary to Gebhard Run – Abandoned Railroad Berm to Confluence with Gebhard Run (~2,461 LF)

Summary of Assessment Reach

This reach begins after a culverted segment under Newtown and ends at the confluence with Gebhard Run. The downstream half of the reach is moderately incised (2- to 3-foot-high banks) with active bank erosion. The remnants of an earthen dam were observed approximately 1,300 feet upstream of the confluence. Legacy sediment is stored

upstream within an area that was likely ponded at some point. The stream has incised through the legacy sediment and is eroding laterally upstream of the pond. Many invasive species were observed along this reach, especially upstream of the dam.

Improvement Recommendation
Upstream of the remnant dam, a combination of raising the existing channel elevation and excavation of legacy sediment is recommended. Downstream of the dam, the existing channel would be raised to match the floodplain. The remnant dam would be removed as part of the restoration.

6.1.10 Site 6: Unnamed Tributary to Middle Creek (~1,131 LF)

Summary of Assessment Reach
This reach is a deeply incised ephemeral ditch that conveys stormwater from I-81 and PA Route 25.

Improvement Recommendation
It is recommended that fill be placed to raise the channel elevation and reliable grade control be installed to prevent future incision.

6.1.11 Site 7: Coal Run – Upstream of Route 571 (~2,219 LF)

Summary of Assessment Reach
This reach is moderately incised (3-foot-high banks) with active lateral erosion. A man-made berm, possibly old spoil piles, exists along most of the right floodplain.

Improvement Recommendation
The recommended improvements would include a combination of raising channel bed elevations and lowering floodplain elevations.

6.1.12 Site 8: Middle Creek – Within Tremont Borough

Summary of Assessment Reach
Sections of this reach include failing rock and concrete retaining walls and deposition of coarse-grained and fine-grained sediment within the channel. The accumulation of sediment reduces flood flow conveyance, which causes frequent flooding of existing buildings and other infrastructure.

Improvement Recommendation
Existing floodplain encroachments associated with the urban setting limit the potential for implementation of stream / floodplain improvements without purchasing properties along the reach. Otherwise, improvements would be limited to repairing failing retaining walls.

6.1.13 Site 9: AMD Treatment Facility – Between Middle Creek and Coal Run

Summary of Assessment Reach

This reach is the outflow channel from existing acid mine drainage treatment facility located between Middle Creek and Coal Run. It is currently receiving overflow from Middle Creek during flood events, which has caused severe channel incision and bank erosion. Water within the channel contains significant iron precipitate that appears to be escaping the treatment ponds, possibly leaching through one of the pond berms as it erodes.

Improvement Recommendation

Further study should be conducted to determine the source of the iron precipitate observed within the outfall channel and assess whether improvements to the AMD Treatment Facility are warranted. Otherwise, it is recommended that the outfall channel be incorporated into the footprint of Site 1C restoration, which would address stability issues and provide opportunities for additional treatment of acid mine drainage within the restored floodplain.

6.1.14 Site 10: AMD Discharges to Coal Run (~1,030 LF)

Summary of Assessment Reach

This reach is the outflow channel from a series of existing acid mine discharges located north of PA Route 571. It is slightly to moderately incised with some bank erosion.

Improvement Recommendation

Recommended improvements to this reach involve the construction of a series of treatment ponds.

7 Concept Plan

A Concept Plan (see Appendix B) was developed to illustrate proposed improvements along a series of prioritized reaches (Sites 1A, 1C, and 1D) in one specific region of the Middle Creek Watershed. This area was chosen for the initial concept as it is a primary opportunity and represents all restoration approaches described earlier. The Concept Plan is intended to serve as a planning tool and/or centerpiece for discussion for communicating the restoration approach to landowners, potential stakeholders, and/or funding opportunities. It may also be used as a model for developing concept plans for other priority reaches as necessary.

8 Design and Permitting Considerations

While developing the strategic restoration plan for the Middle Creek Watershed, PADEP was consulted to provide feedback on the best way to navigate the State permitting process. Because the watershed is being looked at comprehensively, PADEP indicated

that a “watershed-wide” permit is most appropriate for the situation. This process will involve developing “prototype” designs for each improvement approach (as described earlier) rather than detailed designs specific to individual sites. Each prototype will involve developing a design for a portion of a potential project reach that correlate to a particular approach. A site assessment will be conducted at each site where a specific prototype design will be applied. This will include topographic survey of existing terrain; a detailed channel survey to determine existing slopes specifically at upstream and downstream tie-in locations; a cursory Waters of the U.S. investigation (presence / absence); and an evaluation of sediment supply, sediment transport, downstream base level controls, and subsurface stratigraphy. For each representative portion of the site, an iterative process of grading and two-dimensional hydraulic modeling will be performed to either determine a proposed project footprint that will be sustainable up to the 1% recurrence interval flow event or inform the extent and size of bed / bank armoring if available space is limited for a particular prototype (i.e. stream stabilization).

The watershed-wide permit application will include a set of prototype design drawings that will include a grading plan, profile, cross-sections, design details and cursory landscape plan for all prototype designs. The preliminary plans will not include an erosion and sedimentation plan or detailed landscape plan as these efforts would be part of the final design deliverable. A design report summarizing each prototype design approach will also be included along with any other forms, notifications, clearances required for the permit application.

In addition to the PADEP watershed-wide permit, it is anticipated that a US Army Corps of Engineers (USACE) – Section 404 (Clean Water Act regulating dredge and fill material in waterways) PASPGP-5 or Nationwide Permit 27 will be required, although it still needs to be determined whether this federal authorization will be handled on a watershed-wide basis or if separate permits will be required for each site. Prior to submitting any permit applications, a pre-application meeting will be held with both PADEP and USACE to further discuss how state and federal permitting will interface.

After the watershed-wide permit is approved, project partners will determine the best project site(s) to move forward with using the Middle Creek Watershed Strategic Restoration Plan as a guide. As specific project reaches are identified and funding has been acquired for implementation, final construction drawings will be developed for the full extent of each project reach. Construction drawings will be submitted to the appropriate regulating agencies for review and approval, however this review will be more streamlined and will not require a public comment period. As such, this permitting approach will expedite construction implementation by avoiding the need to permit each site on an individual basis since the prototype designs would already have been approved during the watershed-wide permit review process.

9 Cost Opinion

Ballpark cost opinions for prioritized reaches are provided in Table 9-1. The cost opinions were developed using a combination of parameters including estimated project reach length, area, and anticipated excavation, which were then compared to historic cost ranges for projects of similar size and approach. The cost ranges provided should be considered approximate and are intended to be used for long-range planning purposes only.

Table 9-1. Project Cost Opinion Summary

Prioritized Reach	Final Design & Permitting*	Construction	Monitoring & Maintenance (5 Years)	Total Cost**
Site 1A	$110,000 - $130,000	$1,100,000 - $1,350,000	$80,000 - $100,000	$1,290,000 - $1,580,000
Site 1B	$110,000 - $130,000	$1,300,000 - $1,600,000	$80,000 - $100,000	$1,490,000 - $1,830,000
Site 1C	$130,000 - $150,000	$3,200,000 - $4,000,000	$80,000 - $100,000	$3,410,000 - $4,250,000
Site 1D	$90,000 - $110,000	$600,000 - $750,000	$70,000 - $90,000	$760,000 - $950,000
Site 2A	$120,000 - $140,000	$800,000 - $1,000,000	$80,000 - $100,000	$1,000,000 - $1,240,000
Site 2B	$120,000 - $140,000	$900,000 - $1,100,000	$70,000 - $90,000	$1,090,000 - $1,330,000
Site 3	$150,000 - $170,000	$4,400,000 - $5,500,000	$80,000 - $100,000	$4,630,000 - $5,770,000
Site 4	$150,000 - $170,000	$5,600,000 - $7,000,000	$80,000 - $100,000	$5,830,000 - $7,270,000
Site 5	$120,000 - $140,000	$500,000 - $600,000	$70,000 - $90,000	$690,000 - $830,000
Site 6	$90,000 - $110,000	$350,000 - $450,000	$60,000 - $80,000	$500,000 - $640,000
Site 7	$110,000 - $130,000	$700,000 - $850,000	$70,000 - $90,000	$880,000 - $1,070,000
Site 8	More information needed to provide estimate			
Site 9	More information needed to provide estimate			
Site 10	More information needed to provide estimate			

*Cost range does not include prototype design or watershed-wide permitting.

**Combining multiple sites into one cohesive project could reduce total project costs up to 15%.

DISCLAIMER: The cost ranges provided do not constitute a quote, contract, or proposal for services by LandStudies, Inc. Cost data is derived from current and past market data for similar projects and does not include a factor for future price inflation.

Construction cost estimates assume that all cut material will be either used as fill on-site or be hauled with off-road haul trucks to spoil areas that are contiguous with the project site. Based on the nature of the region, it was determined that this is a valid assumption and will certainly be more cost effective than if material needs to be exported from the site. These numbers also assume that landowners support implementation of the work on their property.

Post-construction monitoring and maintenance will include regular site inspections and maintenance to ensure site stability, native vegetation establishment, and invasive species management. These tasks will be a requirement of the applicable permit authorizations and typically includes submitting annual inspection and maintenance reports to PADEP and/or USACE for 5 years following construction. Since continued site maintenance takes place over an extended timeframe, costs for 5 years of monitoring & maintenance are presented independently from the construction costs. However, because this task is critical to achieving permanent stabilization (and fulfilling associated regulatory obligations), this effort should be considered an extension of the construction effort and as essential to project success as every other construction task.

10 Conclusion

The Middle Creek Watershed has experienced a long history of industrial coal mining and logging that have significantly impacted channel stability and water quality. Wide-spread bed and bank erosion has led to the export of massive volumes of sediment that have continuously deposited in flatter channel segments within Tremont Borough. This deposition affects the channel's ability to convey flood flows, which in turn has led to frequent flooding that damages existing infrastructure on public and private properties. Damages caused by the flooding and routine dredging operations to remove accumulated sediment have been extremely costly to property owners and the municipality for decades. A watershed assessment was performed to identify sources of sediment and other stability or water quality issues along Middle Creek and its tributary drainage areas including Gebhard Run and Coal Run. This narrative summarizes observations from a watershed assessment and provides recommended improvements that if implemented would help to alleviate stability and sedimentation issues experienced within the watershed.

Appendix A

Middle Creek Watershed Strategic Restoration Plan

Appendix B

Concept Plan for Phase 1A, 1C, and 1D