Lackawanna Cut-Off Restoration – Commuter Rail Study

December 2019 – Final Report

Prepared For:

Pennsylvania Northeast Regional Railroad Authority

Pennsylvania Northeast Regional
Railroad Authority
280 Cliff Street
Scranton, PA 18503

Lackawanna County Department of
Planning and Economic Development
135 Jefferson Ave, #200
Scranton, PA 18503

Prepared By:

GPI

Greenman-Pedersen, Inc.
52 Glenmaura National Blvd., Suite 302
Scranton, PA 18505

TABLE OF CONTENTS

List of Figures

List of Tables

List of Appendices

EXECUTIVE SUMMARY

Passenger rail service from northeast Pennsylvania to Hoboken, New Jersey via the rail section known as the "Lackawanna Cut-Off" ceased operations in January 1970. In the late 1980s as Conrail was going through bankruptcy and dissolution, 28 miles of rail from the Delaware River Bridge to Port Morris, NJ was torn up and removed from the rail line.

Studies have shown that 28,000 people commute daily between Northeast PA and the Northern New Jersey/New York Metro area. Passenger rail service can provide an alternative transportation mode for these trips, thereby reducing highway traffic congestion. The vision for the future of the Lackawanna Cut-Off is to restore the missing 28-mile section and restore commuter service to New Jersey/Metro New York. Track is currently being laid on the first seven miles of the missing section with the first new station being constructed in Andover, New Jersey.

The Pennsylvania Northeast Regional Rail Authority (PNRRA) in conjunction with Lackawanna County authorized this work to evaluate high level engineering issues and costs associated with restoring commuter rail service along a portion of the railroad owned and operated by the Pennsylvania Northeast Regional Railroad Authority. The corridor studied runs from Delaware Water Gap, PA through Slateford, PA. and to Andover, New Jersey. See the inset Location Map. Greenman-Pedersen, Inc. (GPI) was contracted to perform the work, supported by sub-consultant Gannett Fleming, Inc. The scope of work included:

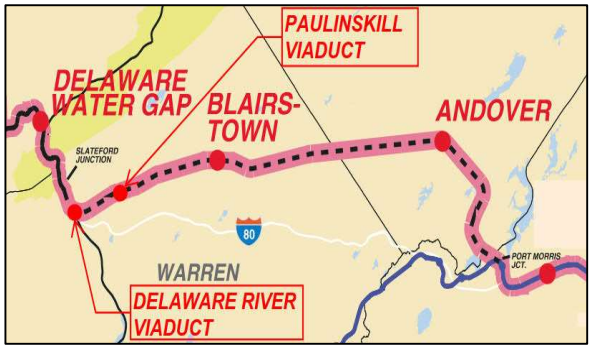

Figure 1 - Location Map (Lackawanna Cut-Off Restoration)

- A condition assessment of the Delaware River Viaduct and the Paulinskill Viaduct
- Conceptual evaluation of a rail station and parking garage layout at Delaware Water Gap.
- Desk-top assessment of track geometry and rail operating speeds along the corridor
- Desk-top assessment of signaling and Positive Train Control needs in the corridor
- Assessments of the existing track, drainage and railroad bed condition in the corridor
- Conceptual layout of a bridge to carry Slateford Road over the restored passenger rail line
- Underwater inspection of the three river piers of the Delaware River Viaduct.
- Conceptual and updated cost estimates for the anticipated improvements.

Based on the conceptual layouts and assessments performed under this scope of work, conceptual costs associated with restoring the rail corridor from Andover, NJ to Delaware Water Gap, PA are shown in the table on the next page.

TABLE 1 – Conceptual Cost Estimate

Lackawanna Cutoff - Conceptual Construction Costs	
CONSTRUCTION ITEM	TOTAL
Water Gap Rail Station (1)	$32,630,000
Right of Way Acquisition, Delaware Water Gap Rail Station	$1,500,000
Slateford Bridge Construction and nearby Culvert Repairs (1)	$3,320,000
Signals and Positive Train Control (2)	$8,190,000
PA Track Restoration (2)	$16,610,000
NJ Track Restoration - Andover NJ to Delaware River Bridge (3)	$112,600,000
Delaware River Viaduct Rehabilitation	$54,000,000
Paulinskill Viaduct Rehabilitation	$16,000,000
Design, Environmental and Engineering Costs (4)	$44,080,000
Preliminary Total:	**$288,930,000**

Notes:

(1) Construction Management/Construction Inspection included at 12% of Conceptual Construction Costs

(2) Track and Signal estimates based on desktop study. Additional field verification of existing conditions recommended to refine estimate. Estimate includes drainage and maintenance upgrades along track corridor.

(3) Estimate includes conceptual costs for restoration of the 20 mile segment in NJ from Andover to the Delaware River crossing, excluding major structure rehabilitiations, based on the following:

*** A 2016 NJ Transit estimate of cost to complete the 7.3 mile segment from Port Morris to Andover, NJ was $61.6m which includes the $24m Roseville Tunnel rehabilitation**

*** Inflation factor from 2016 to 2019 @ 3% per year = 9.3%**

*** Conceptual track restoration cost per mile (not including major structures) = ($61.6m-$24.0m)*1.093/7.3 mile = $5.63 million/mile**

*** Note that track restoration costs may vary depending on proposed operational concepts**

(4) Conceptual Soft Costs estimated as follows:

*** Environmental Clearance/Public Involvement/Permitting @8% of Construction cost**

*** Preliminary Design/Final Design @10% of Construction cost**

(5) Conceptual Estimates in 2019 dollars

SECTION 1:
WATER GAP STATION

A. SITE DESCRIPTION

The Delaware Water Gap Area has been identified as a potential location for a passenger rail station with associated parking garage. See Figure 2 for a location map of the area

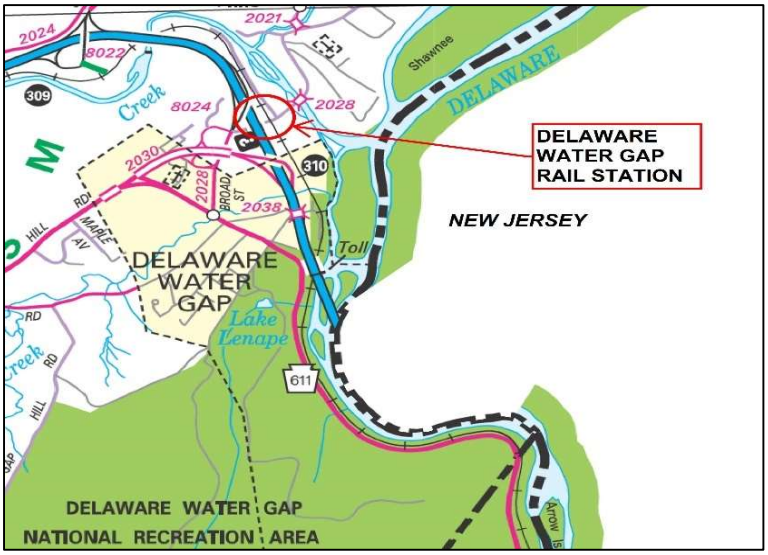

Figure 2 - Location Map (Delaware Water Gap Station)

1. EXISTING CONDITIONS

Development has occurred within the area considered for the passenger rail station over the last decade. The Pennsylvania Welcome Center was constructed along River Road. In addition, a park and ride facility was subsequently built across the street (Broad St) from the welcome center. Drainage from the park and ride and the welcome center facility drains to a detention basin located adjacent to Interstate 80 (I-80). A sewer pump station is located at the northeast corner of the Welcome Center parcel near the bridge that carries I-80 over River Road.

A roundabout was recently constructed to the north of the welcome center at the intersection of Broad Street (SR 2028) with River Road (T-663) and SR 8024 (Ramps C, D, E, & F).

LIDAR contours, break lines, and imagery were obtained through the Pennsylvania Spatial Data Access (PASDA) website to further evaluate these areas, in the absence of topographical survey.

GIS property owner parcel information was obtained from Monroe County to verify ownership of parcels in the area. Property owners in the surrounding area include:

- Commonwealth of Pennsylvania
- Smithfield Township
- Sujit Ranu Khakal

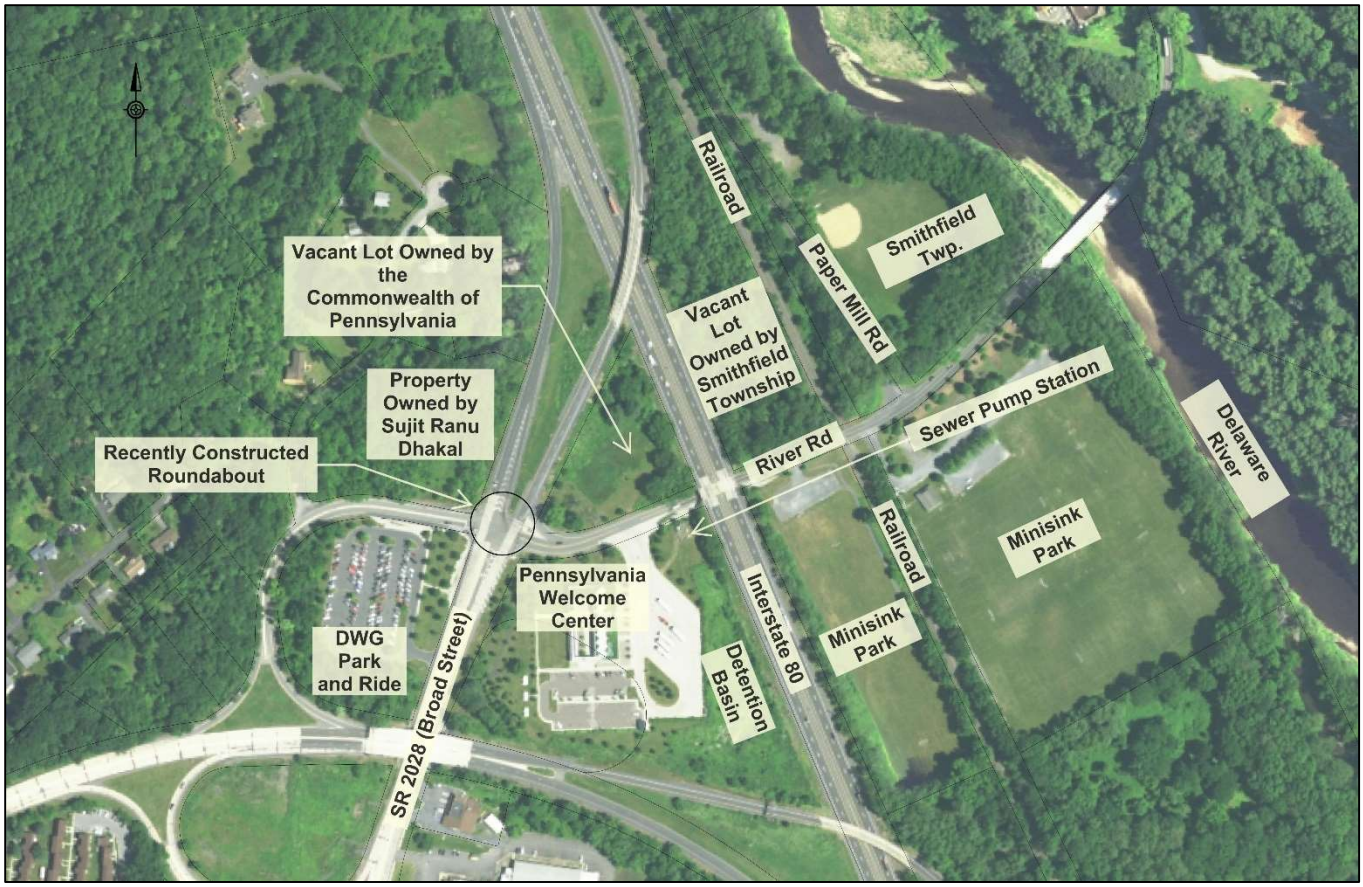

Figure 3 - Water Gap Station Aerial View (2018)

2. ENVIRONMENTAL RESOURCES

Conceptual sites for the rail station are outlined in the next section. Potential environmental impacts were researched and some of the results are summarized below.

- WETLANDS - A search of the National Wetland (NWI) Inventory indicates that both potential station sites investigated do not contain any mapped wetlands.

- FLOODPLAIN - The 100 year-floodplain map for this area was updated on May 2, 2013. According to the Flood Insurance Rate Map (FIRM), both conceptual sites are within the 100-year floodplain and would therefore require Chapter 106 permitting through the Pennsylvania Department of Environmental Protection. In addition, building within the floodplain may require additional considerations for maintenance of the site and possible damage to property and building utilities.

Refer to APPENDIX A for additional environmental information.

B. CONCEPTUAL LAYOUT

Two (2) alternative layouts were investigated in the surrounding area to provide a station for the passenger rail line.

The parking garage size was determined by assuming the following:

- Approximately 900 parking spaces
- 9' x 18' stall size
- Additional area for stairs, elevators, ticket booths, etc.
- 5 to 6 story parking garage

A review of Smithfield Township's Zoning and Subdivision and Land Development Ordinances did not identify any particular requirements for parking garage or rail platform facilities. However, the construction of the passenger rail station would need to follow any applicable ordinances or obtain variances as necessary.

1. PARKING GARAGE AND RAIL STATION - ALTERNATE 1

The first option evaluated (Alternate 1) was to install the parking garage on the same parcel as the Pennsylvania Welcome Center. Pad locations were evaluated in the area surrounding the existing welcome center while minimizing the impacts to the remainder of the parcel. The parking garage on this parcel will replace the existing car parking lot. Use of this parcel would need to be coordinated through PennDOT's Central Office. The rail platform will be located along the rail line adjacent to Minisink Park. Passengers would need to walk from the parking garage to the platform on the other side of I-80. A walkway and an elevator with a pedestrian bridge over I-80 could be constructed. Alternatively, if the bridge carrying I-80 over River Road is reconstructed, the elevator and pedestrian bridge over the highway could be eliminated. A reconstructed bridge would allow for a longer span and wider sidewalks underneath I-80 to accommodate pedestrians. In either case, pedestrians would need to walk approximately 950 feet from the parking garage to the rail platform.

This option would maintain the general drainage footprint and would maintain the outlet structure of the detention basin. However, the Welcome Center would be impacted during construction.

Utility infrastructure currently exists on the parcel for the welcome center building (electric, telephone, sanitary sewer, water). The parking garage would require electric service for the elevators, lights, ticket booths, etc. Water service would likely be needed for fire protection. It is assumed that restroom facilities would be desired, so sanitary lines would be needed as well. The utility services that are in place for the welcome center would be added onto or upgraded as necessary to service the parking garage.

Refer to APPENDIX A for a map of the Alternate 1 Water Gap Station parking garage location.

2. PARKING GARAGE AND RAIL STATION - ALTERNATE 2

The second option evaluated (Alternate 2) was to install the parking garage and platform on the vacant lot owned by Smithfield Township. This parcel, adjacent to I-80, would need to be purchased from and coordinated through Smithfield Township. The parcel is currently shown as conservation land on the official Smithfield Township map. The parking garage would be located immediately adjacent to the rail platform with this option. This would minimize the distance pedestrians would need to travel between the parking garage and platform. In addition, it would eliminate the need for passengers to cross under/over I-80.

Under Alternative 2, the parcel would be cleared of trees and stormwater management facilities would be constructed. Drainage facilities would likely outlet to Brodhead Creek. A drainage easement would be needed to outlet through adjacent properties or the drainage pipes could possibly be run along River Road to the creek.

The site would be graded to accommodate the development. I-80 and the railroad bed sit at higher elevations on either side of the parcel. It is anticipated that fill would be placed to raise the bottom floor of the parking garage above the 100-year flood elevation. The elevation of the first floor would be above the railroad platform. The platform would then be accessible from the first floor of the parking garage via an elevator or stairs. Flood events that close the rail line would also result in closure of the garage.

New service lines and appurtenances are needed for all utilities for this parcel. Sanitary sewer, water, and electric services would be needed at a minimum.

The Alternate 2 station was chosen for more detailed evaluation since the garage can be more integrated with the rail station operations.

Refer to APPENDIX A for a more detailed discussion and plan layout of the of Alternate 2 Water Gap Station.

3. TRAFFIC ANALYSIS

A preliminary traffic analysis was conducted to evaluate potential traffic impacts associated with development of the Alternate 2 parking garage and rail station. Upon full build-out, the site is estimated to generate 290 vehicle trips during the Weekday AM Peak Hour and 290 vehicle trips during the Weekday PM peak hour.

The project site will be served by one (1) site access location; an enter-exit driveway on River Road (T-663). The driveway will be located roughly across from the existing Minisink Park western driveway.

Based on the analyses in APPENDIX B, the following initial conclusions are presented:

1. The measured sight distance at the garage/station access driveway will meet or exceed the minimum required PennDOT Safe Stopping Sight Distance (SSSD) requirements.
2. Roadway capacity analyses found that the study area intersections will operate within the Levels of Service criteria outlined in PennDOT's Traffic Impact Study guidelines without mitigation.
3. Left-turn lane warrants were evaluated for the garage access driveway intersection along River Road. A left turn lane, although warranted, is likely not required as there is no significant delay for this movement in the Build condition as compared to the No-Build condition. If constructed, the left lane minimum length is 175 ft, which would require reconstruction of the I-80 overpass bridge near the site. Since the left turn lane is likely not required, cost of construction of this lane and reconstruction of the I-80 bridge is not included in the conceptual cost estimates in this report.
4. An evaluation of signal warrants found that signals are not required under the 2030 build conditions for the garage access drive on River Road.

4. VEHICLE ACCESS AND USER ACCOMMODATIONS

Issues related to vehicle access and user accommodations for the parking garage and Rail Station (Alternate 2) at Delaware Water Gap, PA were examined. A summary of the evaluation is discussed below (reference Appendix B for additional detail):

PART A: VEHICLE ACCESS

The following parameters were assumed: Trains will operate on 45-minute headways during peak periods and two to three hours headways during non-peak periods. The most heavily utilized train departing Delaware Water Gap at 6:07 AM on its way to Mid-Town Manhattan will carry 297 passengers. To accommodate peak morning demand at the parking garage, two to three entrance gates would be needed. For purposes of the conceptual costs developed for this study, a ticket dispensing system is assumed. Using a single reversible lane will allow this system to operate within a three-lane cross section as shown in the conceptual site plans presented in Appendix A.

Refer to APPENDIX B for a detailed discussion on trip generation, entrance control alternatives, queue storage requirements, revenue collection methods, and multi-modal arrival accommodations.

PART B: USER ACCOMMODATIONS

Parking garage development should account for the anticipated transportation and technology changes and accommodate multiple transportation modes. The following are considerations for the facility:

Multimodality

- Suitability to serve as a local or regional mobility center - accommodating and providing supporting infrastructure for public transit; coach buses; shuttles; ride sharing (Uber, Lyft, etc.); car sharing (Zipcar, etc.); bike sharing; other micro-mobility, such as e-scooters; cycling; walking
- Integration of electric vehicle (EV) charging stations
- Development of support infrastructure for active transportation modes:
    - walking – protected walkways within and outside the parking garage; seating areas, benches;
    - cycling – protected bike lanes; bike racks; bicycle repair station/service; bicycle rental
    - bus/train – protected waiting areas; shade and shelter
- Wayfinding to parking garage for drivers, cyclists and pedestrians as well as wayfinding for cyclists and pedestrians from the garage to points of interest
- Design implications of anticipated modal share increase of autonomous vehicles (passenger drop off and pick up areas; vehicle storage; vehicle maintenance areas)
- Role of the Pennsylvania Welcome center.
- Role the Delaware Water Gap Park & Ride serves to regional shuttles, such as the River Runner Shuttle, and the feasibility of adding the parking garage as an additional shuttle spot or relocating the P&R stop to the parking garage
- Need for shuttle (and dedicated parking garage zone) to service resorts and local attractions
- Provision of real-time information on bus and train arrival and departure times
- Design of transit stops centrally located with walkways leading to all facility entrances

- Design of safe drop-off and pick-up zones, including for ride share services
- Provision complementary vehicle maintenance/service station

Refer to APPENDIX B for additional discussion of multimodal, mobility, accessibility, and building functionality considerations for the facility.

5. ADDITIONAL STATION ALTERNATIVES

Although additional sites have not been investigated in this report, additional potential train station alternatives may exist along the existing rail line north of Delaware Water Gap. The additional sites have the disadvantage of requiring additional travel time for passengers heading east to New Jersey and New York. However, sites in the vicinity of Analomink or East Stroudsburg could be considered.

C. FUTURE PLANNING

A meeting was held with PennDOT staff from Engineering District 5-0 on June 12, 2019 to discuss options for the passenger rail station. Options for the station along with future plans for I-80 were discussed. It was indicated that coordination with the PennDOT Central Office's facility manager would be required to discuss alterations to the use of the welcome center parcel. In addition, PennDOT representatives confirmed that there are no immediate plans (within the next 20 years) to replace the bridge carrying I-80 over River Road.

D. COST ESTIMATE

A conceptual cost estimate was developed for the Alternate 2 Water Gap Station described above. RS Means data from 2018, along with PennDOT item price histories and similar project price histories were utilized in preparing the conceptual cost estimates. A contingency of 25% was used and the cost is given in present value (2019).

Refer to APPENDIX K for the cost estimate for the Water Gap Station.

SECTION 2:
RAILROAD SPEED AND SIGNALING/PTC ANALYSIS - WATER GAP STATION TO DELAWARE RIVER BRIDGE CORRIDOR

A. TRACK GEOMETRY/SPEED ANALYSIS

A desktop study was performed to determine the maximum speeds that may be feasible for the track between the Delaware Water Gap Station and the Delaware River. The existing track geometry for the line was taken from existing real estate valuation maps and from old Conrail track charts. This includes the area from Slateford Junction to the Delaware River where the track has been removed. This study is conceptual and was performed without benefit of detailed field survey or an examination of the site.

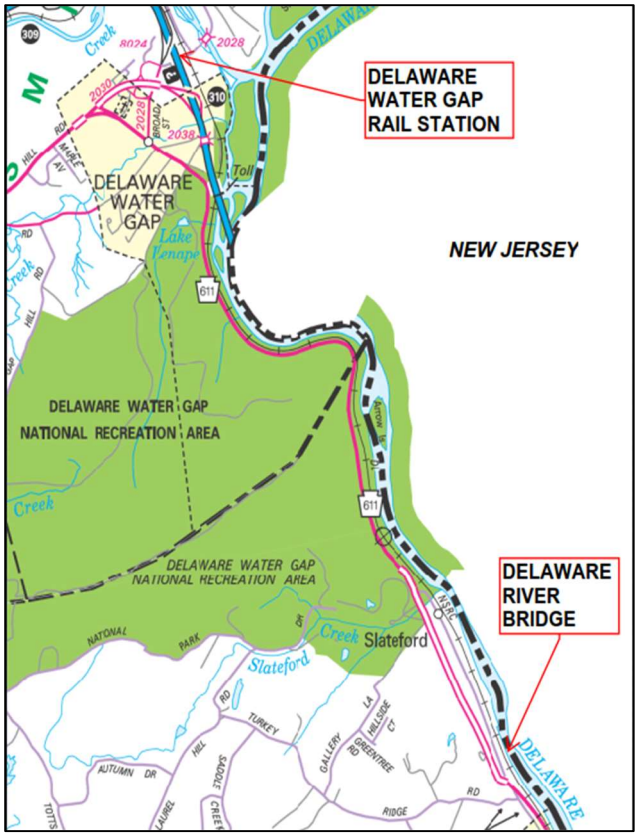

Figure 4 - Location Map (Water Gap to Delaware River Bridge)

As the line is currently configured, it can be assumed that FRA Class 2 speeds can be achieved on the line, but FRA Class 4 speeds cannot be achieved. To achieve higher speeds, it would be necessary to flatten the curves by relocating them inwards. The tracks could be physically improved with new ties and rail to meet Class 4 standards, but the tracks through this area would still be under slow order speeds due to the curvature.

Refer to APPENDIX C for a more detailed explanation of the track geometry and chart of the track speed analysis.

B. SIGNALING/POSITIVE TRAIN CONTROL

A Signaling and Positive Train Control (PTC) System was evaluated for the extension of New Jersey Transit (NJT) commuter train service to the train station at Delaware Water Gap, Pennsylvania. The conceptual desktop study was conducted utilizing old Conrail Track Charts and Google Earth maps for the location of necessary signaling and PTC facilities.

Passenger service will follow the former Lackawanna Cut-off track from the Delaware River Bridge and connect to the existing Pennsylvania Northeast Regional Rail Authority (PNRRA) freight track at Slateford Junction Interlocking at Milepost 2.62. From there it will continue approximately 3.6 miles to the North and terminate at a new passenger station at Delaware Water Gap Borough. All new signal

and PTC equipment and all construction required to begin revenue train operations on the portion of track from the Delaware River bridge to the new station would follow NJT signal design criteria, adhere to AREMA Standards and FRA regulations, and follow NORAC train operating rules which are currently employed for all NJT rail operations and freight Carriers in the region.

Refer to APPENDIX D for a more detailed discussion of the signaling and positive train control and the railroad signal map.

C. COST ESTIMATE

1. TRACK UPGRADES

A conceptual cost estimate has been prepared in two parts. The first part is an estimate to restore the passenger line to FRA Class 2 condition, from the Delaware River Bridge to the Delaware Water Gap Station at River Road. This estimate assumes that the existing track from Slateford Junction to River Road would be rehabilitated with 30% new ties and lined and surfaced with additional ballast. The section from Slateford Junction to the Delaware River Bridge would be completely rebuilt with new welded rail, wood ties and ballast.

The second part of the estimate is to restore the passenger line to FRA Class 4 conditions. This estimate assumes the complete re-construction of the track from the Delaware River Bridge to River Road with new welded rail, wood ties and ballast. Even though the track structure could be constructed to Class 4 standards, this part of the passenger line could not maintain Class 4 track speeds due to the excessive curvature of the line and would have to be slow ordered. Both estimates include a no. 15 turnout connecting to the freight line at Slateford Junction, complete reconstruction of the grade crossing at River Road, and ditching and drainage improvements.

Refer to APPENDIX K for the cost estimate of both track upgrade alternates.

2. SIGNALING/POSITIVE TRAIN CONTROL

It is assumed that track speed on the existing alignment will be 30 MPH, if the civil speeds are increased after track improvements, signal design can be modified at that time for increased speeds. The Conceptual Cost Estimate is based upon this assumption.

Refer to APPENDIX K for the signal cost estimate.

SECTION 3:
DRAINAGE ANALYSIS – WATER GAP STATION TO DELAWARE RIVER BRIDGE CORRIDOR

DRAINAGE CONDITIONS – ACTIVE FREIGHT LINE

The railroad is aligned north to south and paralleled to the east by the Delaware River, which receives all drainage passing through the railroad right-of-way. Drainage generally flows east from the Appalachian Mountains and is conveyed beneath the railroad by various drainage structures. Interstate 80 is located west of the railroad from Station 00+00 to Station 42+00 (Drainage Baseline), at which point the interstate crosses over the railroad and into New Jersey. From Station 42+00 to the southern project limit, the railroad is situated downslope of, and parallel to, SR 0611 (Main Street). Cross pipes connected to the drainage system along Slateford Road convey runoff from STA 212+50 to STA 229+00 to a swale west of the active freight line which is drained by a single cross pipe at station 222+50, to the Delaware River. From STA 229+00 to the southern project limit, runoff sheet flows off Slateford Road toward the river or is conveyed by a swale on the eastern shoulder of Slateford Road into a stone masonry box beneath the active freight line at STA 235+75 and discharged to the Delaware River.

Refer to Tables 1 and 6 in APPENDIX E.1 for a summary of the drainage structures observed north of Slateford Junction and south of Slateford Junction, respectively**.** The active freight line crosses three perennial tributaries to the Delaware River within the project limits: Cherry Creek at Station 19+75, Caledonia Creek at Station 51+50, and Slateford Creek at STA 205+75. Refer to APPENDIX E.1 for a description of the topography and its effect on drainage.

Most drainage features convey runoff from drainage areas of 40 acres or smaller. Features conveying runoff from drainage areas larger than 50 acres were considered major drainage structures and are outlined in Tables 2 and 7 in APPENDIX E.1 for the portions of the corridor north of Slateford Junction and South of Slateford Junction, respectively.

Officials from Upper Mount Bethel Township were contacted and did not indicate that there are chronic or notable drainage problems in the town of Slateford.

DRAINAGE CONDITIONS - INACTIVE RAIL LINE

The inactive line extends approximately 4,600 feet south of Slateford Junction, before turning east and crossing over the active freight line and the Delaware River. This inactive line is covered by fill at the intersection of Slateford Road and SR 0611. From STA 201+00 to STA 238+00, cross pipes convey runoff from a swale along the western shoulder of the inactive rail line downslope of SR 0611, and discharge to the drainage system east of the inactive rail line. At most locations where a pipe was found protruding from the east side of the railroad embankment, a corresponding inlet box was discovered in the swale. Where an inlet was not discovered, it was assumed the inlet was buried.

At STA 238+00, a concrete arch conveys flow beneath the inactive rail line and into a channel which crosses beneath Slateford Road further downstream. A swale extending from STA 239+00 to STA 244+00 along the western side of the inactive rail conveys runoff from SR 0611 to a box culvert beneath Slateford Road, south of the Delaware River Bridge.

DRAINAGE CAPACITY

The capacity analysis determined that just two pipes (Pipe 18 and Pipe 21) out of the thirty pipes analyzed do not have the capacity to convey the 10-year discharge (7% of the pipe network is under capacity). See APPENDIX E.1 for the methodology of the capacity analysis and APPENDIX E.5 for the Drainage Capacity Calculations.

PRIMARY DRAINAGE ISSUES – ACTIVE FREIGHT LINE

The primary drainage issue north of Slateford Junction is the blocking or complete burying of pipes with sediment, stone, and debris. Other drainage problems include the instability of the channels downstream of drainage structures, and significant ponding between the railroad and the SR 0611 embankment. At several points along the railroad, the topography suggests a cross pipe should be present, but a pipe was not located. Refer to Table 3 in APPENDIX E.1 for a list of Inadequate or Buried Drainage Structures.

The primary drainage issue south of Slateford Junction is the poorly-graded swale west of the active freight line, drained by a single 18" pipe at STA 222+50. Another drainage problem occurs at STA 244+00, where three parallel pipes discharge directly toward a pier of the bridge carrying the inactive rail line over the Delaware River. At the toe of the eastern embankment of the active freight line near STA 229+00 where the embankment was destabilized, a residential driveway downslope of the embankment, and to the north of the problem area, was also eroded by drainage flowing to the river. Refer to APPENDIX E.1 for a potential solution for each of these issues.

PRIMARY DRAINAGE ISSUES-INACTIVE LINE

The primary drainage issue along the inactive line is the blockage of the inlets and irregular topography of the swale west of the inactive line, which allow ponding to occur along the western shoulder of the inactive line.

DRAINAGE CATEGORY

Each drainage structure was assigned a Drainage Category from 1 to 4, with Category 4 structures requiring the most effort to restore function. Four (4) structures were identified as a Category 4, and twenty (20) were identified as Category 3. Refer to Tables 5 and 8 in APPENDIX E.1 for a quantification of the pipes classified in each Drainage Category for the corridor north of Slateford Junction and south of Slateford Junction, respectively.

DRAINAGE IMPROVEMENTS AND PERMITTING

Category 4 pipes are damaged beyond repair or inhibited by physical features and may present risk to nearby infrastructure. Replacing these pipes would reduce the potential for ponding, erosion, and rail bed destabilization. Several Category 3 pipes require only cleaning or downstream channel grading. However, replacing Category 3 pipes that do not convey the 10-year flow or are completely buried would further improve the drainage network. Assuming the replacement of half the Category 3 pipes is a conservative estimate. See APPENDIX E.3 for the Drainage Catalog.

The reactivation of the inactive rail line will occur within the limits of the railroad Legal Right-of-Way and will consist of activities classified by PennDOT as Roadway Maintenance Activities. Therefore, a National Pollutant Discharge Elimination System (NPDES) permit will not be required. Refer to APPENDIX E.1 for a description of the applicable non-structural Best Management Practices for reconstruction.

SECTION 4:
EXISTING RAIL BED ASSESSMENT - WATER GAP STATION TO SLATEFORD JUNCTION CORRIDOR

A. SITE DESCRIPTION

The section of the study consists of the railroad corridor from Water Gap Station to Slateford Junction. The railroad through this section consists of a single track, which is active with freight traffic. The alignment winds along the Delaware River through this section and is located between the river on the east and SR 0611 on the west.

Figure 5 - Location Map (Water Gap to Slateford Junction)

1. PROPERTY RESEARCH

GIS Parcel data was obtained from Monroe County for the parcels surrounding the PNNRA rail line from Water Gap in the north to the Monroe Count/Northampton County line in the south. In addition, GIS Parcel data was obtained for the entirety of Northampton County, which covered the remainder of the properties in this section to Slateford Junction.

2. MAPPING

LIDAR mapping was obtained from the Pennsylvania Spatial Data Access (PASDA) for this section of the railroad. The data utilized included aerial imagery, contours, and break lines. This section of the corridor occurs at the overlap from the PA State Plane North Zone to PA State Plane South Zone (Monroe County - Northampton County border). All of the data for the area along this section of corridor was available in the North Zone, but it was not all available in the South Zone. Therefore, North Zone data was used for the mapping from Water Gap Station to Slateford Junction.

B. EXISTING CONDITION ASSESSMENTS

1. RAIL BED TYPICAL SECTION

Throughout most of this corridor the railroad is located between steep rock cut to the west of the rail and Delaware River, downslope to the east. The railbed itself is somewhat flat consisting of a single track with ballast on either side of the track. In certain locations the river is somewhat close, laterally, to the railroad embankment with the embankment supported by large diameter rocks in these sections. Generally, the rail bed section presents no notable patterns of fill slope settlement, slope failure, or rail bed settlement. The railbed is mostly free of significant vegetation and there are no locations where rock or other debris was observed to have fallen onto the track from the rock cuts to the west. Therefore, there is limited risk presented to nearby properties or roadways with regards to the rail bed configuration.

SECTION 5:
EXISTING RAIL BED AND STRUCTURAL ASSESMENT - SLATEFORD JUNCTION TO DELAWARE RIVER BRIDGE CORRIDOR

A. SITE DESCRIPTION

This section of the study includes the inactive rail bed from Slateford Junction in the north, through the town of Slateford, and ending at the Delaware River crossing at the south. The rail tracks were removed within this section of the study in the 1980's. However, PNRRA continues to own legal right-of-way through this area.

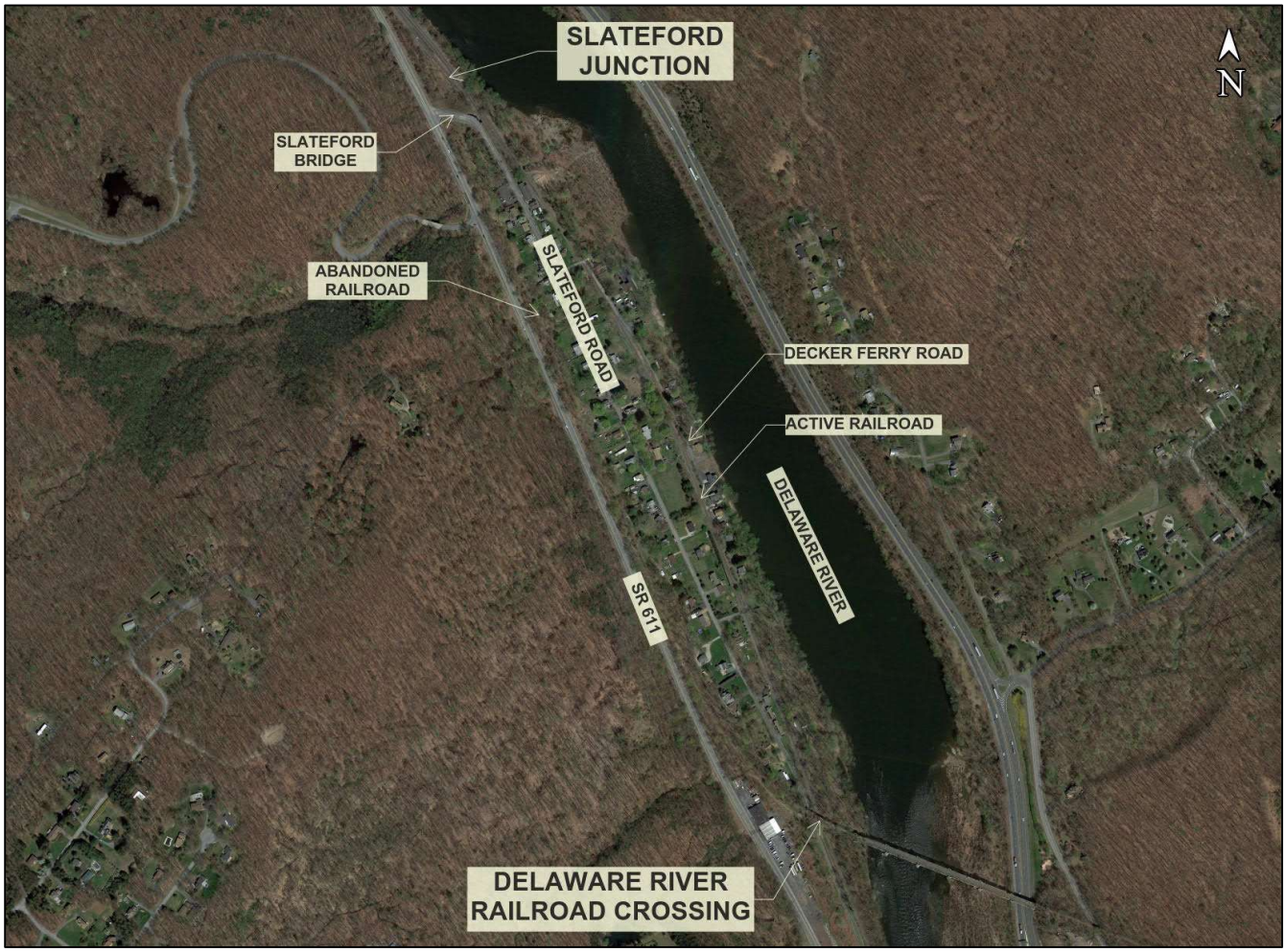

Figure 6 - Location Map (Slateford Junction to Delaware River Bridge Corridor)

1. PROPERTY RESEARCH

Right-of-Way and property research was performed for the corridor starting at Slateford Yard in the north and extending south to the Delaware River crossing. This section includes the inactive rail bed of the Lackawanna cut-off. Railroad valuation maps were obtained along with as-built plans for SR 0611. Topographic survey was obtained for the area around Slateford Yard and the northern portion of Slateford Road. LIDAR break lines, contours, and aerial imagery was obtained through PASDA and was used for the remainder of the corridor. The Lackawanna cut-off rail line and SR 0611 Right-of-Way centerlines were re-created based on information contained in the as-built plans and railroad valuation maps. The alignment geometry (curve radii, deflection angles, etc.) was maintained and the alignment was best fit to the survey and LIDAR data. Right-of-Way was plotted for the length of the corridor based on the plans and these alignments. Upper Mount Bethel Township was contacted to confirm the Right-of-Way width along Slateford Road (33.5'). The Right-of-Way width was transitioned along Slateford Road from 33' to 50' near the northern intersection with SR 0611 based on the GIS Parcel data, as-built plans, and valuation maps.

The eastern Right-of-Way line for the railroad is generally 50' from the Right-of-Way centerline. The Right-of-Way line along the western portion of the inactive rail bed overlapped the SR 0611 roadway and Right-of-Way on the SR 0611 as-built plans. The railroad valuation maps show a western railroad Right-of-Way line in the same approximate location as the SR 0611 Right-of-Way on the roadway as-built plans. However, there is no dimension to the Right-of-Way line shown on the valuation map. Therefore, the SR 0611 Right-of-Way line was plotted from the roadway as-built plans and is shown as the dividing Right-of-Way line between the roadway and the railroad. The total width between the eastern railroad Right-of-Way line and the SR 0611 Right-of-Way line along the tangent portion of the railroad varies from approximately 88' to 111'.

Current property owners were identified along this corridor using the online tax parcel viewer from Northampton County. Deeds and GIS parcel data were then purchased from Northampton County. Deeds were plotted for each parcel and were stitched together to create an approximate property mosaic along the corridor. Surveyed topography (including property pins and walls) was used at the northern end to form the basis for the property boundaries. LIDAR break lines and aerial imagery was used to aid in the placement of the properties through the remainder of the corridor

B. EXISTING CONDITIONS ASSESSMENT

The existing cast-in-place concrete twin cell culvert on Slateford Road is approximately 550' south from the Northern intersection of Slateford Road and SR 0611. Built in 1909, the structure consists of (2) 14'-0" spans for a total length of 30'-6". The existing culvert carries both Slateford Road (to the west) and PNRRA (to the east) over Slateford Creek, dividing the culvert into two (2) distinct sections. See Section 5.B.2 for additional information regarding the existing culvert.

The retaining walls along SR 0611 support the steep slopes from the edge of roadway down to the PNRRA Right-of-Way, approximately ½ mile south of the Slateford Creek culvert. The retaining wall, approximately 950' in length, is constructed of (3) distinct sections. See Section 5.B.2 for additional information regarding the retaining walls.

1. ENCROACHMENT ANALYSIS

The Lackawanna Cut-Off railroad Right-of-Way was visually inspected for encroachments from the adjacent property owners. Movable objects encroaching on the railroad Right-of-Way include:

- Boat (Carlos A. Rodriquez/Glen E. Weaver properties)

- Trampoline (Jose Sabordio property)
- Overlook with chair (Margaret Niemoczynski property)
- Playground (Roberts property)
- Playground (Grace M. and Walter S. Zalewski property)
- Trailer (James Futchko & Janet Futchko property)

Additional encroachments of a more significant nature include the following:

- Shed (Glen E. Weaver property)
- Stairs (Newport Enterprises, LLC)
- Embankment slope (Kelly Taylor property)

The Legal Right-of-Way, property mosaic, and Right-of-Way encroachments are shown on the plan included in APPENDIX F.

2. STRUCTURAL ANALYSIS

GPI's analysis of the concrete twin-cell culvert along Slateford Road began with an in-depth inspection of the entire structure (both PNRRA-owned and PennDOT owned sections). Our evaluation focused on the PNRRA-owned culvert section (downstream) and included a load rating analysis and cost estimate for repair and/or recommended maintenance.

GPI also performed a visual inspection of the existing stone masonry retaining walls along SR 0611. Results of the visual inspection are summarized below.

CULVERT INSPECTION

GPI performed an inspection of the entire length of the existing twin cell culvert. The following summary of findings pertains to the PNRRA-owned section only.

- The PNRRA Right-of-Way on top of the culvert and in approach to the culvert is heavily vegetated and overgrown with tree growth.
- The top slab on the culvert has an area of fine map cracking with efflorescence and stalactites along the downstream end of both spans. Several of the top slab construction joints along the culvert exhibit efflorescence with stalactites, active water seepage, and areas of scale.
- The cast-in-place reinforced concrete sidewalls of the PNRRA section exhibit areas of hairline to fine map cracking with some efflorescence and associated delamination along the downstream ends of both spans. The walls also have areas of scale along with light water seepage adjacent to a few of the construction joints. The base of the walls exhibits a band of concrete scaling and abrasion, with the worst area at the downstream end of the middle wall.
- The cast-in-place concrete floor exhibits heavy concrete scale with exposed aggregate and a few 1/8" to 1/4" wide cracks.
- The cast-in-place reinforced concrete headwall on the downstream section exhibits several fine to 1/16" wide horizontal and scattered hairline cracks.
- The northeast and northwest non-integral cast-in-place reinforced concrete wingwalls exhibit a few fine scattered cracks with efflorescence.
- The Slateford Creek channel flows from west to east with fair to poor alignment. A large pile of debris directs flow primarily through Span 1 with minor scour along the inlet. Heavy scour at the outlet undermines the cast-in-place concrete apron up to 1'-0" high and 1'-0"

deep. The stream banks are steep and heavily vegetated with rip rap protection lining the downstream channel.

Additional inspection findings can be found in the attached Inspection and Analysis Report included in APPENDIX G.

BRIDGE LOAD RATING

GPI performed a rating analysis on the approximate 60' section of the PNRRA-owned portion of the existing culvert using PennDOT's BXLRFD program. The culvert was analyzed as a cast-in-place reinforced concrete rigid frame structure. As no records for the as-built condition of this culvert section were found, a number of assumptions were made in order to achieve a rating.

The downstream portion of the existing culvert was rated by assuming the following:

- PNRRA Railroad culvert section has same reinforcing and dimensions as the PennDOT-owned culvert section
- Earth cover over the entire culvert is approximately 2'-4"
- Structure was analyzed as a rigid frame on spread footings
- Cooper E80 loading was input as a Special Live Load

The analysis showed an Inventory Rating (IR) of 0.61 and an Operating Rating (OR) of 0.79 for the PNRRA Railroad-owned section. Additional information regarding the load rating analysis can be found in APPENDIX G.

RETAINING WALLS

GPI performed a visual inspection of the existing stone masonry retaining wall along SR 0611. As noted above, the wall was constructed in three (3) distinct sections. The northernmost section of the wall is round stacked stone, 3' to 4' in height, and approximately 200' long. This section of the retaining wall is in fair condition overall and requires approximately 50 SF of reconstruction.

The middle section of the retaining wall is a stone masonry wall, 4' to 7' in height, and approximately 500' long. This section of the wall is in satisfactory condition overall and requires approximately 200 LF to 300 LF of repointing.

The southernmost section of the wall is stacked stone, 3' to 4' in height, and approximately 250' long. This section of the wall is also in satisfactory condition overall and requires approximately 50 SF of reconstruction.

Due to the overall general condition of the stone masonry retaining wall, the maintenance and reconstruction noted above is not considered a priority and therefore not included in the cost estimate. Additional information regarding the stone masonry retaining wall inspection can be found in APPENDIX G.

C. RAIL BED TYPICAL SECTION

The active rail line is generally at grade with residential structures and yard areas typically situated on either side of the rail. Conversely, the inactive section of the railroad is located in a wooded area, at the toe of the SR 0611 road embankment to the west and is generally located on an embankment above residential properties to the east. In most sections the former rails are missing, and the railbed has been

disturbed such that it is unrecognizable, with the topography varying from relatively flat and uniform to somewhat sloped and irregular along the former railbed. Generally, the rail bed typical section presents no significant patterns of fill slope settlement, slope failure, erosion or stability issues. No risks to adjacent roadways or properties are anticipated with regards to the former rail bed.

D. ASSESSMENT SUMMARY

RIGHT-OF-WAY

Encroachments on the Right-of-Way of PNNRA railroad exist through the town of Slateford as summarized in detail above. Encroachments should be verified through a full property boundary survey, to confirm and mark out the current location of property corners. Doing so will also require coordination with property owners of those parcels which currently include temporary and permanent encroachments.

STRUCTURE MAINTENANCE

Culvert High Priority Maintenance items include cleaning and repair of the heavily deteriorated top slab concrete adjacent to the drainage inlets in both spans at the construction joint between the PNRRA and PennDOT culvert sections. Also included is filling in the 3'-0" deep scour hole that is undermining the apron just downstream of the PNRRA-owned culvert section. Additional Culvert Maintenance items include repair of the scaling concrete along the waterline and the delaminated and cracked concrete at the construction joints and along the east fascia walls and top slab on the railroad owned section. Repaving of the heavily scaled concrete floor throughout both spans is also recommended. Total cost for these recommended items is approximately $161,000.00.

Additional information regarding maintenance items (some of which require coordination with PennDOT District 5-0), including a breakdown of maintenance and repair costs for the concrete culvert, can be found in APPENDIX K.

SECTION 6:
SLATEFORD ROAD BRIDGE

A. SITE DESCRIPTION

This site is located on Slateford Road, just east of its intersection with SR 0611 and is approximately 600 feet south of the switch tower. There was originally a structure carrying Slateford Road over an active rail line in this area. However, the rail line immediately adjacent to the original structure was removed, and the structure has since been filled in with embankment. Multiple retaining walls also exist in this area, on either side of the Slateford Road embankment. Restoration of the passenger rail line through this area will require the construction of a new bridge carrying Slateford Road over the restored rail line. This construction will also include reconstruction of a portion of the approach roadways of Slateford Road, improvements to drainage, and installation of guide rail.

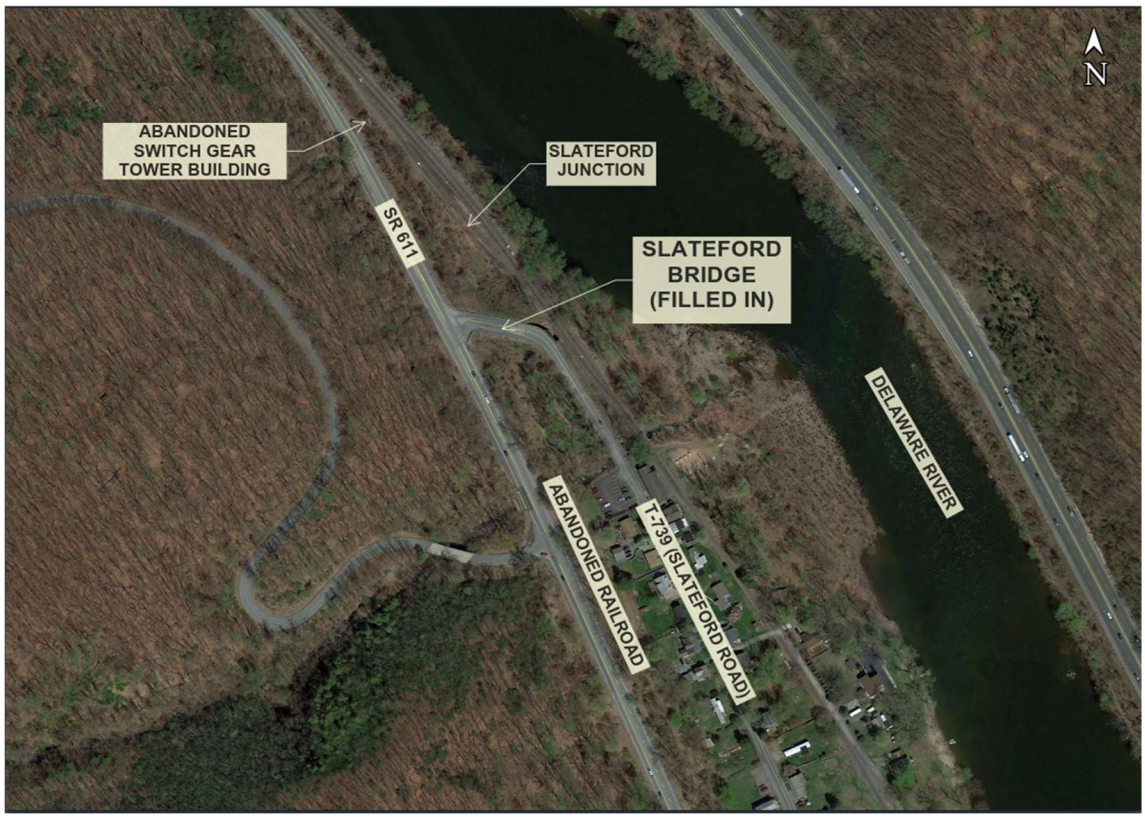

Figure 7 – Location Map (Slateford Road Bridge)

Figure 8 - Looking South at Filled-in Slateford Bridge and track remnants

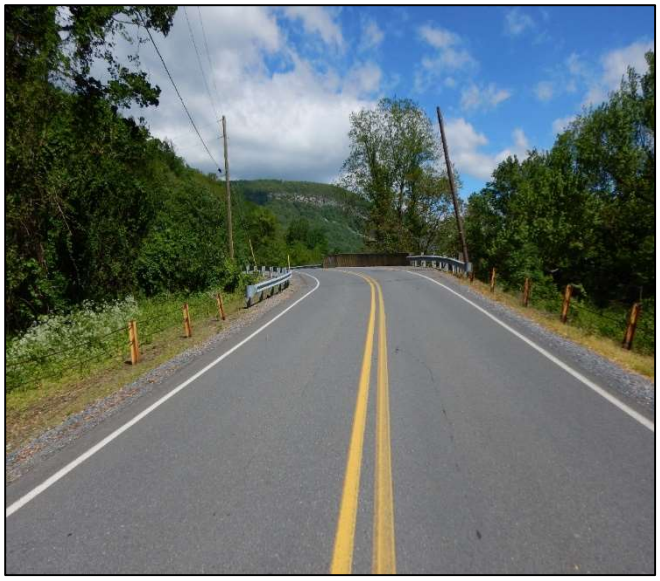

Figure 9 - Looking North along Slateford Road towards Filled-in Slateford Bridge

B. EXISTING CONDITIONS ASSESSMENT

1. BRIDGE

There were no records of the original structure found and therefore little is known about the original structure type or if any portions of it were removed prior to being filled in. Existing fill in the area of the Slateford Road bridge will require excavation to allow construction of a new structure. Although little is known about the remnants of the existing bridge, a cost for removal of the existing bridge structure has been included in the cost estimate for the Slateford Road bridge as a conservative approach.

A concrete retaining wall parallels Slateford Road along the length of the eastern approach. This retaining wall supports Slateford Road to the south with multiple sets of PNRRA tracks at the base of the wall. The tracks run in a NW/SE direction, paralleling Slateford Road and running through the town of Slateford to the southeast. Northwest of the project site, the PNRRA tracks widen into the beginning of Slateford Junction.

There is an existing concrete wall on each side of Slateford Road on the western approach. The walls are located at the edge of pavement where Slateford Road begins to widen into the intersection with SR 0611. The wall on the right side of Slateford Road (Sta. Ahead) is less than 1’ in height and approximately 40’ long. It carries guide rail from SR 0611 (bolted on top) into the PNRRA retaining wall. The wall on the left side of Slateford Road (Sta. Ahead) is approximately 4’ in height and 20’ in length, breaking up the guide rail running along SR 0611 and onto Slateford Road. The walls do not appear to serve a current function and are believed to be related to the original bridge structure over the original railway.

2. ROADWAY DESIGNATION

Slateford Road is classified as a local road with a land use context of town/village neighborhood. The road travels through the village of Slateford and intersects SR 611, N. Delaware Drive, at both

ends of the roadway. The posted speed limit is 25 mph. The roadway is 1.2 miles in length with a rolling terrain. The estimated current ADT is 212, with a truck percentage of 1 (per PennDOT One Map).

3. ROADWAY GEOMETRY

TYPICAL SECTION

The existing roadway over the filled-in bridge consists of two 10' lanes with 3' paved shoulders. There is an additional 6' to 7' of gravel shoulder for a total width between the existing guide rails of 40'. However, the approach roadway is 26' from edge of pave to edge of pave (with no gravel shoulder). The existing cross-slopes vary along the corridor, ranging from 0.00% to roughly 7.70% inside the travel lanes, and from 0.00% to 15.50% along the shoulders. The existing cross-slopes do not match on either side of the roadway.

HORIZONTAL GEOMETRY

The horizontal alignment was best fit to the centerline of the existing roadway based on surveyed topography, since no as-built drawings for Slateford Road were available. The existing horizontal geometry is sub-standard at the curve located at Sta 106+53.13 since the existing radius (R=125') is sharper than the required radius (R = 144' @ 6% superelevation). Slateford Road intersects SR 0611 at an angle of approximately 52 degrees.

VERTICAL GEOMETRY

The existing vertical grades for Slateford Road vary from 0.62% to 7.53%. The grades are acceptable for a local road, per the AASHTO Greenbook (2011) Table 5-2. A crest vertical curve is present on the near bridge approach, which meets criteria for a 25-mph design speed respective to stopping sight distance and rate of vertical curvature (i.e. driver comfort).

4. GUIDE RAIL

Existing Type 2-S guide rail is present on both east and west sides of Slateford Road and continues onto Slateford Road from the guide rail along SR 0611. In the southwest quadrant of the Slateford Road bridge, the guide rail connects to a short section of concrete barrier, and then continues as Type 2-S guide rail across the bridge location. In the northwest quadrant, the guide rail begins as Type 2-S along SR 0611. It then continues along Slateford Road where it connects to a short section of concrete barrier. Following the barrier, the guide rail continues as Type 2-S. A short section of metal railing is located behind the Type 2-S guide rail in the northeast quadrant. The guide rail then transitions to cable guide rail to the east of the of the filled-in bridge.

C. CONCEPTUAL LAYOUT

Passenger rail service is possible through this area with construction of a new bridge. The bridge structure will carry Slateford Road (T-739) over the restored railway. The single span structure will meet all required horizontal and vertical clearances, as determined by the Public Utility Commission (PUC) and PennDOT criteria. Alternative structures were investigated for two different span lengths. The first span length accounts for a single line of tracks along with a possible future access road paralleling the tracks. The second span length considers a possible second set of parallel tracks with the same future access road.

The structure alternatives were determined by assuming the following:

- Minimum 12'-0" clear zone between track centerline and any obstruction (PUC minimum criteria)
- The structure span will accommodate a possible future 10' wide access road parallel to the track on the eastern side.
- Edge of access road will be offset 5' from centerline of track
- A 5'-0" clearance between the edge of access road and front face of abutment on Abutment 1 (east) side of the structure to accommodate drainage
- A 17' offset of the centerline of tracks for the two-track alternative
- Required vertical clearance from top of rail to bottom of beam is 23'-0" (PennDOT minimum criteria)
- Top of rail elevation was set to match the survey shot elevations of top of rail for the remaining section of existing track to the north of the bridge location
- Horizontal & vertical geometry of Slateford Road will closely match existing
- Two 10' lanes w/ 3' shoulders will be carried across structure for a curb-to-curb width of 26'.

1. SINGLE-TRACK ALTERNATIVE – ALTERNATE 1

The first option evaluated was for a single set of tracks with access road, as described in the previous section. The location of the single track minimizes disturbance along Slateford Road and outside of the existing SR 0611 and Slateford Road Legal Rights-of-Way.

BRIDGE ALTERNATIVES (SINGLE-TRACK)

Both steel and concrete bridge structures were investigated in order to minimize the overall superstructure depth and attempt to achieve the required 23' vertical clearance. To achieve the required clearance, the profile of Slateford Road will need to be raised approximately 14". This type of profile adjustment to Slateford Road would require full depth reconstruction of the approach roadway for several hundred feet, including reconstruction of the Slateford Road / SR 0611 intersection.

2. TWO-TRACK ALTERNATIVE – ALTERNATE 2

The second option evaluated was for a single track with enough room for a future second track with access road, as described above. The location for the western-most set of tracks was shifted toward SR 0611 in an effort to reduce the limits of work along Slateford Road and required disturbance outside of the Legal Right-of-Way. The required span (CL-to-CL Bearing) to accommodate Alternate 2 is approximately 62'.

BRIDGE ALTERNATIVES (TWO-TRACK)

Both steel and concrete bridge structures were investigated in order to minimize the overall superstructure depth and attempt to achieve the required 23' vertical clearance. To achieve the required clearance, the profile of Slateford Road would need to be raised approximately 22". This type of profile adjustment to Slateford Road would require full depth reconstruction of the approach roadway for several hundred feet. In addition, grade adjustments would be required for SR 0611 through the intersection due to such an increase in the Slateford Road profile

3. ACCESS/SAFETY

TRAFFIC CONTROL

While the bridge is being constructed along Slateford Road, a portion of the roadway will be closed to traffic resulting in the use of a detour route. The detour route will be approximately 2.4 miles. Beginning at the intersection of SR 0611 and Slateford Road, traffic will follow SR 0611 south for approximately 1.2 miles. Then, a left turn can be made onto the southern end of Slateford Road, where traffic can travel approximately 1.2 miles to reach the opposite side of the road closure. The southern intersection of Slateford Road also intersects SR 0611 at a sharp skew. However, it is not expected that this would pose a significant problem because of the low volume of detoured traffic.

Refer to APPENDIX H for the Conceptual Detour Plan.

GUIDE RAIL

Type 31-S guide rail will be provided on all four quadrants of the structure along with appropriate transitions to the bridge barrier. It is anticipated that the existing concrete walls around the intersection are remnants from the previous bridge and will be removed or cut-off below grade. The guide rail will, therefore, continue around the intersection and transition into the existing Type 2-S guide rail along SR 0611. The guide rail will terminate with MASH compliant impact attenuators on the eastern approach.

STOPPING SIGHT DISTANCE/INTERSECTION SIGHT DISTANCE

The horizontal alignment of Slateford Road and associated horizontal sight distance at the Slateford Road / SR 0611 intersection will not change as part of the bridge replacement. However, a vertical adjustment of approximately 2' will be needed over the structure to provide the required underclearance for the railroad. The stopping sight distance and headlight sight distance will meet required values for a 25-mph speed limit (155').

4. ROADWAY GEOMETRICS

DRIVER EXPECTANCY/DESIGN SPEED

The design speed (posted speed limit) is 25 mph throughout Slateford Road. The speed is consistent with driver expectancy for a local road through a small town. Vertical and horizontal geometry will meet the required design criteria and driver expectancy for a roadway of this type.

TYPICAL SECTION/BRIDGE WIDTH

The typical section along Slateford Road will consist of a two-lane, non-curbed undivided roadway with an approximate total width of 26 feet. The travel lanes are each 10 feet wide, with 3-foot-wide shoulders on each side of the roadway. There is no existing sidewalk and no sidewalk is anticipated over the structure.

HORIZONTAL ALIGNMENT

The horizontal alignment for Slateford Road near the bridge matches the existing. The alignment generally follows the center of the paved roadway, with equal lane and shoulder widths on each side of the roadway. Improving the intersection skew between Slateford Road and SR 0611 would require a realignment of Slateford Road and is not anticipated.

Refer to APPENDIX H for the conceptual roadway plan and profile.

5. MISCELLANEOUS

UTILITIES

Aerial and Underground Utilities are present throughout the project area. Utilities which are documented in the PA One Call System include:

Aerial

- Met Ed (Electric)
- Frontier Communications (Telephone)
- Service Electric Cable TV Inc. (Cable TV)
- PPL Electric (Electric) – No Known Location near Slateford bridge.

Utility poles are primarily located on the east side of SR 0611 (N Delaware Rd) and on the east side of T-739 (Slateford Rd).

Underground

- East Bangor Municipal Authority (Water)
- East Bangor Municipal Authority (Sewer) – No Known Location near Slateford bridge.
- Portland Contractors Municipal Authority (Sewer) – No Known Location near Slateford Bridge.
- AmeriGas (Gas) – No Known Location near Slateford Bridge.

The water line in the area runs through the culvert that carries SR 0611 over Slateford Creek before running down T-739 (Slateford Rd).

Construction of the bridge may require temporary/permanent relocations of aerial utilities for construction. Underground utility relocations are not anticipated. However, further coordination with utility owners would be needed to verify impacts as design is progressed.

LOCAL BUSINESSES

The Slateford Inn is a local bar and pool hall located at 667 Slateford Rd, Mount Bethel, PA 18343. The business is located near Slateford Creek, and has a parking lot opposite the building, across Slateford Road. Traffic would need to follow the detour route in order to access the property during the construction of the bridge.

PERMITS

A Highway Occupancy Permit would be required from PennDOT for the roadway work (paving, guide rail, line striping, etc.) within the Right-of-Way of SR 0611. In addition, the traffic control required for the work along SR 0611 along with the detour will need to be coordinated with PennDOT.

D. COST ESTIMATE

A conceptual cost estimate was prepared for the bridge construction and associated roadway approach work. A contingency of 25% was added and the cost estimate was is given in present value (2019).

Refer to APPENDIX K for the cost estimate.

SECTION 7: UNDERWATER INSPECTION OF THE THREE RIVER PIERS OF THE DELAWARE RIVER VIADUCT

A. UNDERWATER INSPECTION RESULTS

The existing Delaware River Viaduct is an inactive railroad bridge over the Delaware River just north of Portland, Pennsylvania along Slateford Road. The structure is a nine-span concrete spandrel arch structure with concrete piers founded on concrete footings.

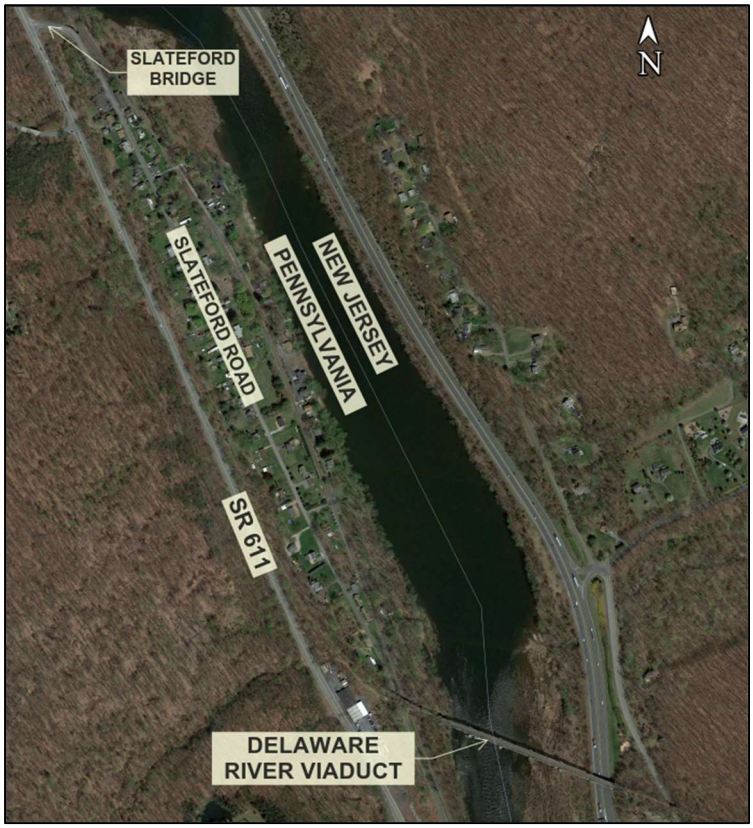

Figure 10 - Location Map (Delaware River Viaduct)

The underwater inspection was performed by Greenman Pedersen Inc. on October 10, 2019. With no previous known underwater inspection reports, this inspection was performed by utilizing a qualified dive team, including a professional engineer (PA and NJ). The inspection focused on the submerged elements of the pier up to indications of a high-water mark utilizing 100% Level I (visual/tactile) and a 10% Level II (cleaning of select areas) inspection techniques.

Portions of the substructure that were inspected underwater appear to be in fair condition with no undermining or major deterioration. Water flow has abraded the concrete causing scaling and exposed concrete aggregate which does not affect structural capacity. The concrete pier walls had areas of small cracks that should be repaired to prevent entrance of water that could freeze and spall the concrete. One wide crack on the downstream end of Pier 3 has a large section of delaminated concrete and should be repaired. It is unclear if the load carrying capacity of the pier has been reduced due to this crack and this should be investigated through a structural analysis. Mortar between masonry blocks should be repaired after removing vegetation.

It is recommended that the submerged substructure units be inspected at the normal maximum recommended interval of five (5) years per National Bridge Inspection Standards or after a significant event such as a flood, impact or other phenomenon that could affect the structural integrity of the bridge.

Refer to APPENDIX I for the full underwater inspection report.

B. COST ESTIMATE

A specific cost estimate for the underwater inspection of the Delaware River Viaduct was not prepared. However, the overall cost to rehabilitate the structure is discussed in Section 8 and APPENDIX K.

SECTION 8:
DELAWARE RIVER VIADUCT AND PAULINSKILL VIADUCT ASSESSMENT

A. VIADUCT ASSESSMENTS

GPI completed field condition assessments of the Delaware River and Paulinskill viaducts to evaluate the extent of repairs needed to return them to active rail service in connection with the Lackawanna Cutoff Passenger Rail Project. A visual overview was performed of the bridges. A records search for existing plans was also completed to help quantify repairs. Refer to APPENDIX J for additional information on the assessment and anticipated repairs.

B. COST ESTIMATE

A conceptual cost estimate was developed for the rehabilitation of the structures described above. A contingency of 20% was used and the cost is given in present value (2019). Refer to APPENDIX K for the cost estimate for the Delaware River and Paulinskill viaduct rehabilitations.