Draft Feasibility Report

Ulster & Delaware Corridor Revitalization Study – Shandaken Section

Prepared for

Ulster County Transportation Council

244 Fair Street
Kingston, New York 12401

Revision 2
April 2021

Barton&Loguidice

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Ulster County, New York

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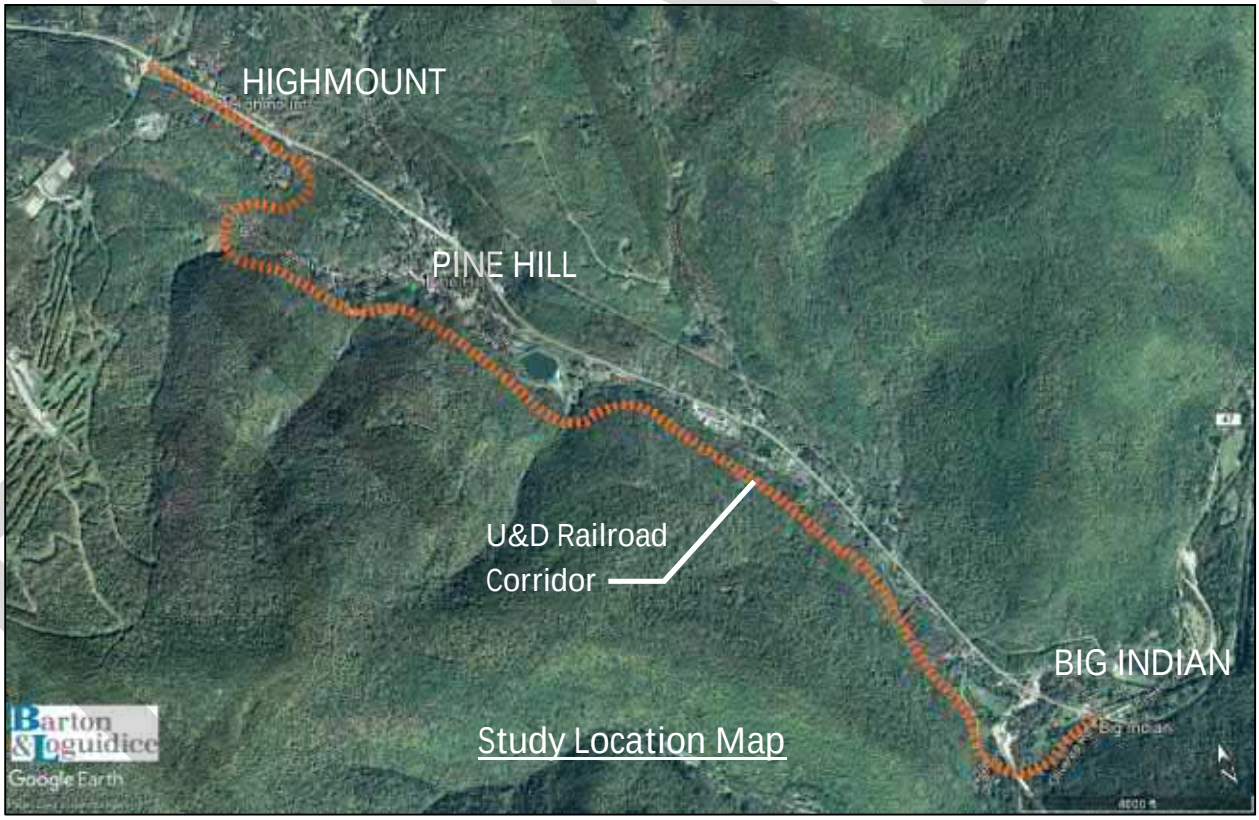
EXECUTIVE SUMMARY

Barton and Loguidice, D.P.C. ("B&L") has been retained by the Ulster County Transportation Council to provide an inventory and analysis of the existing railroad infrastructure along the former Ulster & Delaware Railroad corridor ("U&D") from Route 28 in Big Indian to Galli Curci Rd (CR 49A) in Highmount, NY. This study area was delineated for conversion to recreational trail by the Ulster County Legislature pursuant to Resolution No. 488 of 2015.

This report assesses conditions of the existing railroad infrastructure of the U&D corridor, identifies design criteria of the proposed trail, analyzes alternative design considerations, evaluates connections to existing and future trails in the area, and assess the existing environmental conditions of the corridor. This report also makes recommendations to convert the railroad corridor into a trail, including construction access locations, trailhead locations, material selection, pedestrian railing locations, bridge rehabilitation alternatives, project phasing, and estimated cost of the project.

The U&D corridor is bordered to the south by land primarily owned by the New York State Department of Environmental Conservation ("NYSDEC") and the Olympic Regional Development Authority ("ORDA"). ORDA also operates the adjacent Belleayre Mountain Ski Center at the western terminus of the project and the Belleayre Beach Day Use Facility at Pine Hill ("DUA"). These recreational facilities offer opportunities such as cross country ("XC") and downhill skiing in the winter, and hiking and mountain biking at Belleayre Mountain Ski Center, and swimming at the beach facility in the summer.



The U&D study area is approximately five miles in length and consists of railroad infrastructure including steel rails and hardware, wooden railroad ties, ballast, drainage pipes and culverts, and four standing bridge structures. The overall corridor is in poor condition and exhibits tree and vegetation overgrowth, eroded areas, deteriorated wooden ties, dilapidated drainage infrastructure, and extensive tree blowdowns from an extended period of neglect. Two large bridge structures carry the railroad over Giggle Hollow Creek and Woodchuck Hollow Creek and two additional short span structures located near Big Indian. There are also two former bridge structures located near Big Indian that were removed from the corridor, one crossing over lasher Rd and the second crossing the Esopus Creek.

Corridor conditions were evaluated based on the constructability of the proposed trail and trail user safety. There are steep embankments adjacent to the existing tracks that may require fencing to help shield future trail users. The existing drainage system, consisting of drainage swales and concrete or steel drainage culverts, will require varying levels of repair to maintain or restore functionality. The crossing of the Esopus Creek and the structural repairs needed to the Giggle Hollow and Woodchuck Hollow Bridges were identified as significant constraints that will require more costly reconstruction efforts. Other potential constraints and their recommended solutions are provided within this report.

This report includes an existing environmental resources inventory and assessment that includes an existing conditions assessment of the streams, wetlands, threatened and endangered species, hazardous materials, floodplain determinations, and historic and cultural resources. One wetland, eleven streams, and one New York State threatened or endangered species are present within the corridor. The construction of a trail will likely require a Nationwide Section 404, Section 401 Water Quality Certification, an Article 15 stream protection Permit, and a State Pollutant Discharge Elimination System ("SPDES") Permit. Coordination with New York State Historic Preservation Office ("SHPO") is was initiated in December 2020 and is currently ongoing. An official determination from their office should be obtained during the design phase of the project. Please refer to section 3.1.2 of this

This report also includes as assessment of the construction costs associated with the conversion of this railroad corridor into a trail. Anticipated costs include tree removal, track and tie removal and disposal, construction access costs, drainage improvements, bridge construction and rehabilitation, and trail construction. This report also includes costs of the suggested trailheads at Belleayre Mountain in Highmount, the Belleayre Beach DUA, and in Big Indian. The total estimated costs of the project and project phasing options to construct the project incrementally as funds become available, are included in Section 4.0 of this report.

Just recently, Ulster County completed the conversion of 11.5 miles of the same U&D railroad corridor along the Ashokan Reservoir from West Hurley to Boiceville into a world class trail. This feasibility study looks to build upon the success of the Ashokan Rail Trail while also recognizing the identity, unique features, character, and history of this Shandaken section of the U&D Corridor.

1.0 EXISTING CONDITIONS INVENTORY AND ASSESSMENT

The Ulster and Delaware Railroad Corridor was built in the late 1800's and early 1900's and provided rail transportation from Kingston to Oneonta, NY. New York City residents frequented the route to access the many luxurious hotels and resorts in the Catskill Mountains. The route was also used for freight hauling operations to transport raw materials such as lumber, stone, and even water into the Hudson Valley and to points south such as New York City. The last commercial trains traveled the corridor in the 1970's and only small tourism railroads have been in operation in limited segments along the corridor since. There are many segments of the railroad corridor that have fallen into disrepair since the last commercial trains traveled the corridor.

1.1. Data Collection Methodology

B&L personnel visited the railroad corridor on October 14, 2020 to assess and document the existing conditions found throughout the corridor. B&L staff used a handheld Trimble GPS data collection instrument to record existing conditions and to log geospatial location information along the corridor. This GPS information was used to produce preliminary mapping of the existing conditions and a preliminary cost estimate. B&L collected the following data along the corridor:

- Feasible trail width
- Width, composition, and suitability of the existing ballast as a base course
- Track, tie and tree removal requirements
- Existing stormwater flow patterns
    - Swale sizes, locations and conditions
    - Washouts
    - Stream crossings
    - Existing culvert assessment
- Access locations for:
    - Construction / staging
    - Trailheads
    - Emergency services
    - Secondary or "local" access points
- Scenic overlook locations
- Historical interpretation opportunities
- Pedestrian and Bicyclist safety concerns and potential fencing locations
- Connections to existing trail network
- Existing tree and vegetation removal needs
- Visible underground and overhead utilities

B&L also performed a separate site visit to determine the existing environmental characteristics of the corridor. This assessment is further discussed in Section 3.0. These data and measurements were used to assemble a preliminary construction estimate for the conversion of the existing railroad corridor into a multi-use trail system. The tree removal quantity was estimated by obtaining the density of trees that would need to be removed over a 50 ft. length of the corridor and extrapolating that over the stretch of the corridor with a similar density of trees.

Data such as the vertical clearance, clear width, ballast width, and the embankment width correlate with the image below. These measurements and collected data were used in the development of the preliminary cost estimate and is further discussed in Section 4.0.

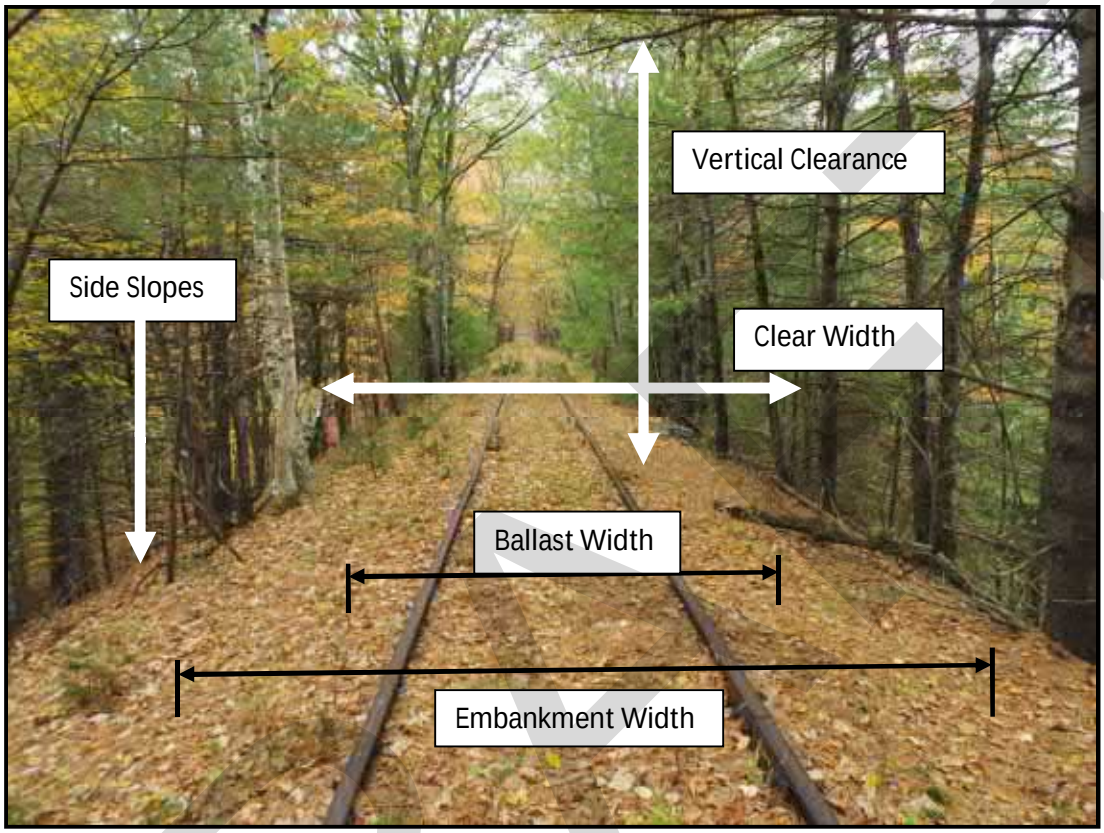


Figure 1-1: Corridor Dimensions & Measurements

1.2. Recommended Design Standards

Typical trail design standards of this nature should utilize the American Association of State Highway and Transportation Officials ("AASHTO") *Guide for the Development of Bicycle Facilities 2012*. Design standards from this guide were used to determine feasibility, impacts, constraints, and to assign estimated construction costs for the development of this multi-use trail.

Typical sections for the development of the trail including trail width, shoulder width, clear width, cross slope, maximum grade, etc. should be established using the guidelines and methodology outlined in the *AASHTO Guide for the Development of Bicycle Facilities 2012* and the *2010 ADA Standards for Accessible Design*. ADA standards applicable to the trail deign include maintaining no greater than a 1.5% cross slope of the trail and a 4.5% running slope, and providing a trail surface that is firm and stable. The table below displays the design standards used in development for this feasibility study and for use during the design of the trail:

Recommended Trail Design Standards	
Element	Standard
Minimum Design Speed	18 MPH
Multi-use Trail Width:	10 feet (Min.)* 10-14 feet (Rec.)
Multi-use Trail Shoulder Width (without railings) Slope of 1V:6H Slope of 1V:2H	2 feet (Min.) 3-5 feet (Rec.) 5.0 feet
Distance between edge of trail and top of slope without barrier	5 feet
Maximum Grade (ADA Compliance)	4.5%
Minimum Horizontal Curve Radius	120 feet
Design Cross Slope (ADA Standard):	1.5% (Max.)
Stopping Sight Distance	300 feet
Lateral Clearance (from edge of trail)	1.0 feet (to fence) 2.0 feet (to obstruction)
Vertical Clearance	8.0 feet (Min.) 10.0 feet (Rec.)
Bridge Structure Capacity (Emergency veh.)	H-20
Pedestrian Safety Rail Height	42 inches (Min.)

**Design standard established is a 10 ft. width; however, short segments with an 8 ft. width may be adequate in areas of limited physical width or other obstructions.*

The predominant section through the corridor is as shown below with a drainage swale on the right side (assuming travel from Highmount to Big Indian) of the trail, a 10 foot crushed stone trail width, and a down slope on the left side of the trail with pedestrian safety railing.

Figure 1-2: Predominant Trail Corridor Section

According to the AASHTO guidelines, pedestrian safety railing a minimum of 42" in height should be included adjacent to the trail when a clear area of 5 feet at a maximum slope of 1:6 cannot be achieved and one of the following conditions are present:

- Slope is equal to or steeper than 1:3 for a vertical drop greater than 6 feet
- Slope is equal to or steeper than 1:2 for a vertical drop greater than 4 feet
- Slope is equal to or steeper than 1:1 for a vertical drop greater than 1 feet
- Slope is equal to or steeper than 1:3 adjacent to a parallel body of water or other substantial obstacle.

Figure 1-3: Example of Safety Railing

Engineering judgement should also be considered when determining the locations of the pedestrian safety railing and the need to balancing the cost to install and maintain the railing, and the safety of the trail users if they were to veer off the trail in areas where there are steep slopes. The addition of safety railing should be evaluated by analyzing the available top of embankment width for construction of the trail and the recommended trail shoulders to establish the clear zone. Analysis should first be performed by reviewing surface contours obtained by a topographical survey. Safety railing should be located in areas that meet the criteria mentioned

above. The need to install the railing should then be confirmed by conducting a site visit and review of the locations and analyzing each location on a case by case basis based on the need identified by the guidelines and using engineering judgement.

Structural design standards and loading for the rehabilitated bridges and culverts should follow New York State Department of Transpiration ("NYSDOT") and AASHTO standards for bridge design and rehabilitation. The recommended loading for the new or rehabilitated structures on this project is H-20. This loading standard refers to a two-axle, 40,000 pound (20 ton) vehicle with 32,000 pounds loaded on the rear axle and 8,000 pounds on the front axle. Structures designed to carry H-20 loading can support the weight of most maintenance and emergency services vehicles. However, depending on the phasing of the project, and the available access points, it may become necessary for loaded construction vehicles to cross the bridges to build sections of the trail. A loaded tri-axle dump truck could easily exceed 35 tons as a fully loaded tri-axle truck typically has a 20 ton load combined with an unloaded weight of 15 tons for the truck. The potential costs of rehabilitating the structures to meet the additional loading requirements may outweigh the benefits provided by allowing construction vehicles to use the bridges and can be further discussed during design when needs and construction sequencing become more apparent. For the purposes of this study, field reviews of the bridges were completed to evaluate their ability to carry pedestrian and bicyclist loading (90 pounds per square foot). A more detailed analysis of the bridges will need to be completed during design to quantitatively determine the structural capacity of each structure and to determine their viability for various construction vehicles.

1.3. Existing Railroad Corridor Evaluation

The existing railroad corridor consists of railroad infrastructure such as steel rails, steel rail hardware, wooden railroad ties, and ballast stone. Additional railroad infrastructure throughout the corridor includes four standing bridges, drainage culverts, and swales. A detailed assessment of this additional infrastructure is included in the proceeding sections of this report.

The existing railroad corridor is a narrow single-track corridor built into the side of Belleayre Mountain. From the perspective of the railroad corridor, the south side is a slope that rises to the top of the mountain, and the north side slopes down to the Birch Creek valley. The railroad corridor descends from an elevation of 1890 ft. in Highmount to 1215 ft. in Big Indian, with an average grade of 2.6%, which is considered steep for a railroad grade. In some locations, the side slopes adjacent to the corridor are very steep on the north side of the corridor constructed at 1.5H:1V (66%) slope and exceeds over 100 ft. in elevation from the railroad corridor to the flat area at the bottom of the slope.

The existing railroad corridor was found to be in poor condition due to a lack of maintenance activities since the trains stopped running in the 1970's. The existing railroad track infrastructure was found to be in poor condition. The steel rails and steel hardware has separated from the wooden railroad ties in many areas due to the deterioration of the wood

ties. Heavy vegetation growth including grasses, weeds, and even mature trees were found to be growing within and immediately adjacent to the tracks. The composition of the ballast was also lacking the high percentage of 1" diameter or larger stone typically found in railroad ballast. The existing stone is also rounded without the sharp angles typically found in crushed granite and limestone. A heavy presence of organic material was also observed to depths greater than 1 ft. with no noticeable transition to a layer of stone free from organics (see Figure 1-4). The depth and composition of the ballast was recorded at three locations throughout the corridor and found to be consistently poor at all three locations. The ballast throughout the corridor should be assumed not suitable for use as a trail base.

Figure 1-4: Ballast Test Pit performed By B&L Staff

Figure 1-5: Mile marker K41

The historic bluestone mile markers, K37 to K41, were all found within the railroad corridor. Markers K40 and K41 are tipped over or leaning on its side and will need to be reset. Other railroad infrastructure includes a "W" post (most likely a whistle post), concrete and stone foundations, and metal sign remains are located within the corridor and do not inhibit the construction of a trail. Please see the existing condition mapping and documentation in appendix A for the specific locations of the existing railroad infrastructure.

1.4. Utilities

The corridor was observed for visible utilities within or crossing the corridor. In general, overhead electrical and telephone utilities were observed where a roadway intersects with the railroad corridor, such as Lasher Road and Station Road/Mill Street. Overhead utilities were also observed near the Belleayre snowmaking reservoir and the double

horseshoe curve. Underground utilities consist of stone drainage culverts and steel pipes (discussed in section 1.3).

Another noted underground utility is the 16" diameter waterline buried 4-6 ft. in depth and directly adjacent to the railroad tracks from the Belleayre Beach DUA to the Belleayre snowmaking reservoir in Highmount. This waterline is used by the Belleayre Ski Mountain to pump water from Pine Hill Lake for use in the snowmaking process in the winter. There are several concrete manholes/wells located throughout this segment that provide access to this waterline. This waterline and related infrastructure is not expected to have any impacts to hinder the construction of a trail through this corridor. Record plans should be obtained from ORDA (if available) and used to determine if any conflicts exist.

No other underground utilities were observed, however, coordination with Dig Safe shall be progressed by the Contractor during construction.

1.5. Drainage Assessment

The drainage assessment of the corridor was broken out into five separate categories; large culverts, small culverts, swales, washouts, and uncontrolled stream crossings. Bridge structures were also included in this study and a full in-depth assessment of the bridges is included in section 2.0. In general, the large culverts were rectangular stacked stone with mortar, the small culverts were round smooth or corrugated steel, and the swales were adjacent to the tracks and not well defined. The observed stream characteristics of the corridor also varied with perennial streams and intermittent streams. Some culverts also appeared to be installed in dry areas where the drainage characteristics have changed and the culvert may no longer needed. A detailed summary of the culverts is in included in Appendix D.

1.5.1. Large Culverts

The large culverts were constructed of laid up stone with mortar joints to form a rectangular opening. The roof of the culverts are made of large stone slabs that could span the entire width of the structure, up to 5 ft. in width. The condition of the large culverts varied throughout the corridor but were generally in good condition and will require only minor repairs.

One large culvert located near the Belleayre Mountain snowmaking reservoir and the double horseshoe curve should be replaced. This culvert is a side-by-side (double barrel) system constructed of stacked stone and mortar culverts with both originally measuring 5' x 5' at the outlet. The southern culvert is collapsed halfway through the culvert and repair attempts were made at one point to address the collapsing roof of the culvert by inserting steel railroad rails into the culvert. A large sinkhole has formed within the railroad tracks directly above this collapsed portion of the culvert. Daylight is not visible through the culvert, however, water does flow through the large voids in-between the stone within the culvert. The northern culvert has been repaired by insertion of a steel 24" diameter pipe approximately 75% of the way through the culvert. The original 5'x5' opening of the culvert was walled off with stone and mortar to direct flow into the pipe. The invert of this pipe is above the adjacent southern culvert pipe see Figure 1-3. The steel sections of pipe have become separated resulting

in a wavering flow line from end to end, rather than a straight line. This culvert carries the entire railroad tracks and embankment over the outlet of a snowmaking reservoir for Belleayre Mountain, which has twin 48" steel pipes that control the water elevation of the reservoir and outlet into the culverts under the railroad corridor. Rehabilitation of this culvert is not feasible due to the poor existing condition of the culvert. Therefore, replacement of the failed culverts is the recommended alternative. Options for replacement include a large concrete box culvert or three sided structure with a natural stream bed. The Town of Shandaken indicated that the Belleayre Mountain staff occasionally perform large volume water realeases of the reservoir which could further erosion of the embankment if the existing condition of the cuvlerts is not improved to allow water to flow freely below.

The majority of the remaining large stone culverts were found to be in good condition and would require only minor repairs to convert the railroad corridor to a trail. A detailed assessment of the existing conditions and potential repairs is included in Appendix D.

Figure 1-6: Collapsed southern culvert with repair attempts and flowing water visible (left) and inlet of double barrel culverts flowing under railroad (right).

1.5.2. Small Culverts

The observed small culverts found throughout the railroad corridor were comprised of 12 to 24 inch diameter round plate steel, corrugated steel, or vitrified clay pipe. Each of the vitrified clay pipes should be replaced as most are cracked and have reached the end of their useful life. Many of the steel based pipes are corroded and should also be replaced, additionally many pipes are not long enough to span the expected width of the trail. However, the majority of the culvert pipes are close to the surface and will not be challenging or costly to replace. Replacement of the pipes with a larger diameter and more durable material such as High Density Polyethylene ("HDPE") at least 15 inches in diameter will ensure a long lasting and functional drainage system for the new trail.

1.5.3. Swales

Drainage swales were present throughout the majority of the railroad corridor but were poorly defined. The majority of the southwestern side of the corridor should have a properly functioning swale to convey potential runoff from the mountainside into the culvert pipes and away from the trail. Trees were present within the swales as well as significant debris accumulation. Most swales were dry and did not exhibit signs of flowing water during our field observations. However, active streams were observed within the swales in some locations such as at the double horseshoe curve parallel to the tracks near the Belleayre snowmaking reservoir at milepost K40.36. The stream has caused erosion and sediment transport of the ballast under the ends of the railroad ties.

Figure 1-7: Active stream at the double horseshoe curve (left) and dry swales with no apparent flows (right).

Disturbance to this stream should be limited and the trail potentially shifted or narrowed to avoid this water course. This stream is referenced as delineated stream 3 and is further discussed in section 3.0 along with the other streams that are jurisdictional by USACE or NYSDEC.

Swale improvements should include the removal of all debris within the swale including sediment and woody materials. However, this work will need to be carefully vetted with the New York City Department of Environmental Protection ("DEP") staff in preparation of the Stormwater Pollution Prevention Plan ("SWPPP.") Work that alters an existing drainage feature may be subject to DEP regulation as this project is located within the New York City Watershed. Removal of woody debris within all swales should be performed and should be allowable under DEP Regulations. Ideally, all swales within the corridor would be shaped to provide positive drainage flow toward a culvert. This project has nearly 24,000 ft. of swales that should be cleaned or rehabilitated during the construction of the trail. Locations of existing swales and active streams are included in Appendix A.

1.5.4. Washouts

Several washouts were found throughout the corridor and ranged in size from a few feet to nearly 40 feet in width. Repair of the washouts to establish a trail is dependent on the specific washout. If no flow is observed and the washout appears to have stemmed from an isolated storm event, the washout can simply be filled in with earth imported from an off-site location and compacted. The source of the flow that caused the washout will need to be investigated and either mitigated at the source or accommodated in the repair. In areas where the washout occurs in an active drainage channel, or within a clear seasonal drainage channel, a drainage pipe or culvert should be installed to convey any potential drainage flows that may re-enter the corridor in the future.

Figure 1-8: Washout just East of Winding Mountain Road (left) and large washout at milepost K38 (right).

The above two photos depict the larger washouts found within the corridor. The photo on the left was taken just east of the Winding Mountain Road crossing where it appears that a one-time drainage flow entered the railroad corridor and washed out the ballast below the tracks for about 30 ft. before the flow turned down the side slope. A watershed analysis should be performed during the preliminary design phase to assess the likelihood that drainage flows could re-enter the washed out locations. If the washout is determined to be a one-time event, then washout could be repaired by adding fill to re-establish the desired grade. The photo on the right was taken at Milepost K38 and appears to be an intermittent stream that may only flow during large storm events. There is a defined stream channel both upstream and downstream of the crossing and the existing Pipe and a pipe upstream below a road are evidence that this is, or was at one time, part of an active stream channel. This washout likely occurred over several heavy storm events. Depending on the results of the watershed analysis, a large culvert pipe or a small concrete box culvert should be installed at this washout and a short portion of the stream should be realigned to carry the stream under the new trail.

There are other minor washouts found within the corridor that can simply be repaired by filling in the washout and armoring against repeat erosive flow or installing a culvert

pipe within the flow channel to carry future flows. These washouts are noted in the existing conditions mapping in Appendix A.

1.5.5. Uncontrolled drainage crossings

In addition to the washouts and controlled drainage crossings found throughout the corridor, there are also several active uncontrolled drainage crossings of the existing railroad tracks. This is where an active stream was observed to be flowing across the corridor either over the railroad tracks, or through the railroad ties. These drainage crossings are subject to USACE and NYSDEC review through the submission of a Joint Application for Permit submission to the agencies. A complete discussion of the potentially jurisdictional streams is located in Section 3. Culverts or pipes installed to control the stream may need to be 1.25 times the bank full width of the stream, which could lead to a large culvert crossing. In some locations, it may be advisable to install a low short span bridge over the flow rather than a concrete culvert.

Figure 1-9: Uncontrolled stream crossing west of milepost K39.

Figure 1-9 shows an uncontrolled stream crossing approximately 20 ft. in length (measured along the tracks) where a mountain side stream flows between the railroad ties. The stream also collects along the right side of the tracks and flows parallel to the tracks for approximately 100 ft. before entering a culvert pipe below the tracks and outletting down the left side slope. In this location, excavating within the right side drainage swale or installing a culvert pipe where the stream enters the railroad corridor would properly convey the stormwater flows if. Alternatives to reduce impacts within the banks of the stream, if necessary to reduce stream impacts, could be completely spanning the stream and allowing it to maintain its full width below the new trail by installing a concrete culvert or short span low bridge.

Just west of the Lasher Road overpass, the B&L team observed water flowing between the ties and parallel to the tracks within the rock cut. This water flow appears to be intermittent and was determined not to be a wetland or stream during our site visits. The saturated materials should be removed and replaced with a layer of geotextile

fabric and large interlocking stone (1.5" to 3" in diameter) that will provide a solid foundation to accommodate construction and future maintenance or emergency vehicles. The drainage flows should be directed into re-established swales that run parallel to the tracks and away from the railroad corridor. The photo below shows the water in-between the railroad ties.

Figure 1-10: Uncontrolled stream just west of Lasher Road.

If drainage infrastructure is not well maintained for extended periods of time, damage to the existing corridor may occur and wetlands may form in the depressions or swales. The wet and saturated soils can cause instability in the rail bed and degrade the infrastructure. During B&L's field investigations, one wetland (delineated Wetland A) was found within the footprint of the railroad tracks that if disturbed in its entirety, would exceed the USACE threshold for allowable wetland disturbance and would require mitigation such as the creation and monitoring of new wetlands within the corridor. This wetland is located about 1,000 ft. east of Galli Curci Road in Highmount and extends within the drainage swales and between the railroad tracks from 600-700 ft. east. Alternatives to reduce impacts to the wetland and avoid mitigation include shifting or re-routing portions of the trail within the railroad corridor, completing an on-road section of the trail along the Ulster and Delaware Turnpike, or constructing a short boardwalk to bridge the wetland and allow vegetation to grow underneath. Construction through Wetland A is feasible and the characteristics of this wetland are further discussed in Chapter 3.

1.6. Access Locations

Logical locations for trailheads, local community access and construction access are based on the site assessment performed by B&L and from recommendations received from Ulster County staff and the Technical Advisory Committee ("TAC").

1.6.1. Trailhead Locations

There are three logical trailhead locations for the trail with two of the three locations offering easy access to the potential users and straightforward construction on land

currently owned by Ulster County. From West to East, the locations recommended for trailhead are at the intersection of Galli Curci Road (CR 49A) and Route 28 in Highmount (adjacent to the Belleayre sign), at the Belleayre Beach Day Use Area in Pine Hill operated by ORDA, and at the Big Indian Town Park in Big Indian. The trailhead at the Belleayre Beach DUA is contingent on an agreement between the County and ORDA due to the configuration and operation of the facility. In the development of this feasibility study, coordination with ORDA has begun, and is expected that a mutual agreement

Figure 1-11: Trailhead Location Map with conceptual drawings.

that will compliment both facilities will be reached. See section 1.6.2 for additional discussion on this facility and ORDA's operations.

Each trailhead should consist of a no-cost parking area for approximately 20-30 vehicles for people wishing to use the trail. However, this number of spaces is ultimately dependent on available land at each location. Overflow or alternate locations within the vicinity of the trailhead could also be identified and utilized if capacity is exceeded at each trailhead on a particular day. Asphalt pavement is the preferred parking lot surface as it offers the most stable and least maintenance alternative for parking area surface treatment and is easiest to plow in the winter. Asphalt also allows pavement stripes to be installed to delineate parking stalls to help encourage efficient unattended parking. Without typical parking stall delineation, users tend to park further away from adjacent vehicles which reduces the effective number of parking stalls within each parking lot. However, the trade-off is that asphalt is an impervious surface which will require stormwater management and likely green infrastructure facilities to be constructed to mitigate the stormwater runoff. The trailheads also give the County the opportunity to install informational kiosks and signage where a trail map, information and rules and

regulations can be installed in a central location for users to see. Drawings of each of the trailheads depicting conceptual alternatives and layouts at each trailhead area are included in Appendix A and the cost associated with each trailhead is discussed in section 4.2.

1.6.2. Local Community Access Locations

Secondary or local access connections to the trail could be areas where a footpath leads to the mainline trail or where small (2-5) car parking areas are established with minimal informational signage to alert users of the rules and regulations. These locations would likely be utilized frequently by local users whereas the Route 28 access trailheads will likely consist of out of town users whom are visiting the trail for the first time.

The most desirable location for a secondary access point is within the hamlet of Pine Hill where local residents could walk, bike or drive to the trail. The most logical location for access to the trail is from Station Road/Woodchuck Hollow Road and is immediately west of the Woodchuck Hollow Bridge. A flat area located within the County Right of Way for the railroad could provide parking for 3-5 cars with improvements such as a crushed stone surface for vehicles to park on, fencing to delineate the trail from the parking area and barriers and barricades (such as wooden posts or large boulders) to deter vehicles from entering the trail.

Figure 1-12: Pine Hill local access location

Alternative locations to provide secondary access within Pine Hill are not easily feasible due to the steep slope adjacent to the railroad and private properties that boarder the County's property. Constructing a path or stairway on the steep slope could be cost prohibitive and also may direct users close or onto private property, which is generally undesirable. Private paths could be established if requested by individuals or organizations and signed appropriately to discourage the public from using these paths.

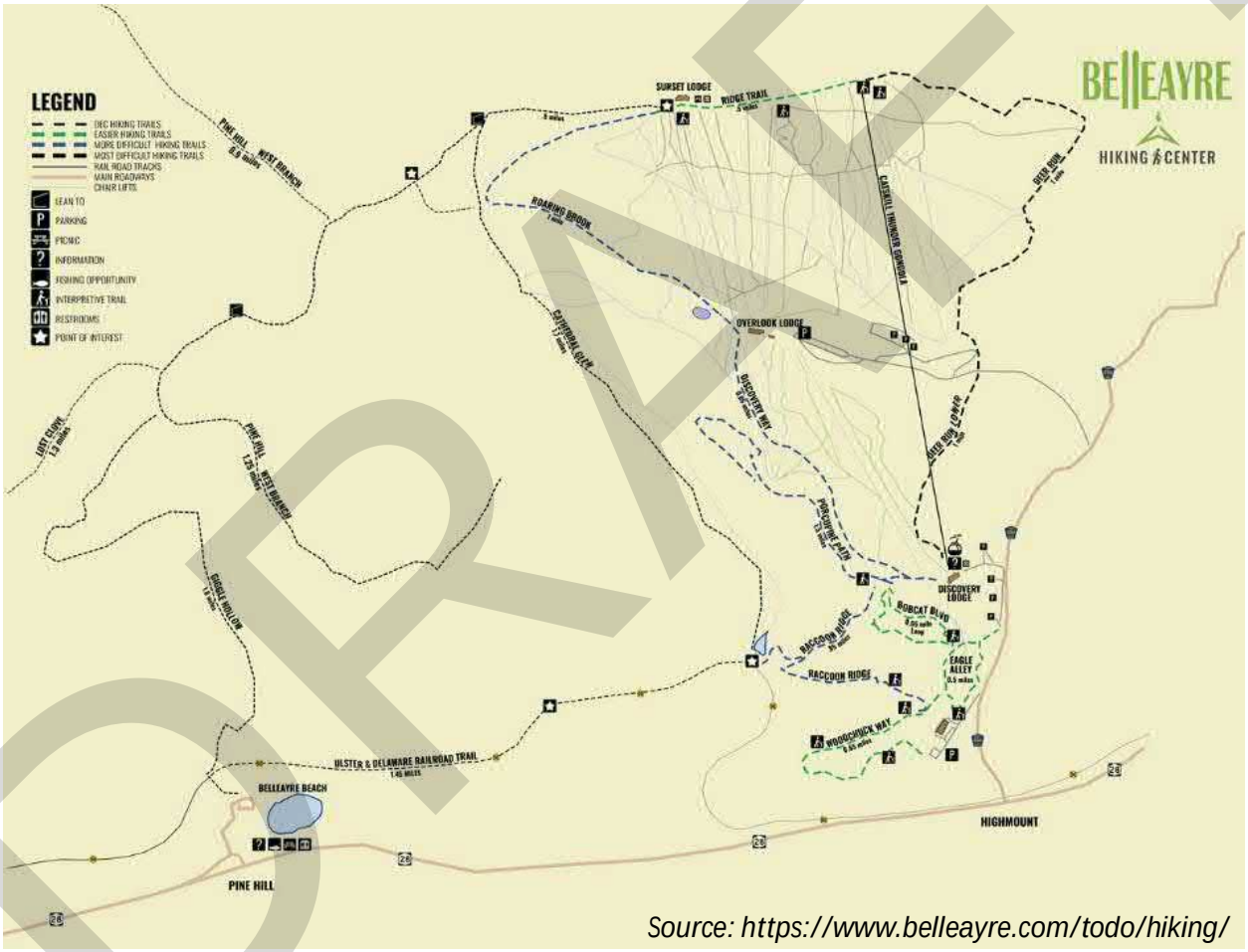
Access to Ulster and Delaware Turnpike near the western terminus in Highmount should be provided where the County ROW is immediately adjacent to the roadway ROW. A narrow 8 ft. path could be provided from the trail to the roadway and will allow the neighboring residents a location to access the trail without trespassing on private property. No formal parking spaces are recommended in this location as the users at this location will most likely consist of residents from the small neighborhood.

Depending on the Lasher Road crossing selected (see section 2.3), a local access path could also be provided here for local residents to access the trail without trespass.

1.6.3. Trail Network Connections

The NYSDEC and ORDA operate an expansive network of hiking, mountain biking, and cross country ski trails on the Belleayre Mountainside and within the surrounding Shandaken Wild Forest. This network is expanding rapidly with both organizations identifying this railroad corridor as an important link in their network of trails. ORDA is expanding their XC Ski trail network within the vicinity of the double horseshoe curve and already has a trail that runs to the railroad corridor by their snowmaking pond near the double horseshoe curve. This trail could connect to this XC Ski trail and expand the number of trails both for use by ORDA and for users of this trail, creating loops for various trail users.

Currently, there are three existing trails that connect to the railroad corridor. The Cathedral Glenn trail connects to the railroad corridor at the double horseshoe curve,



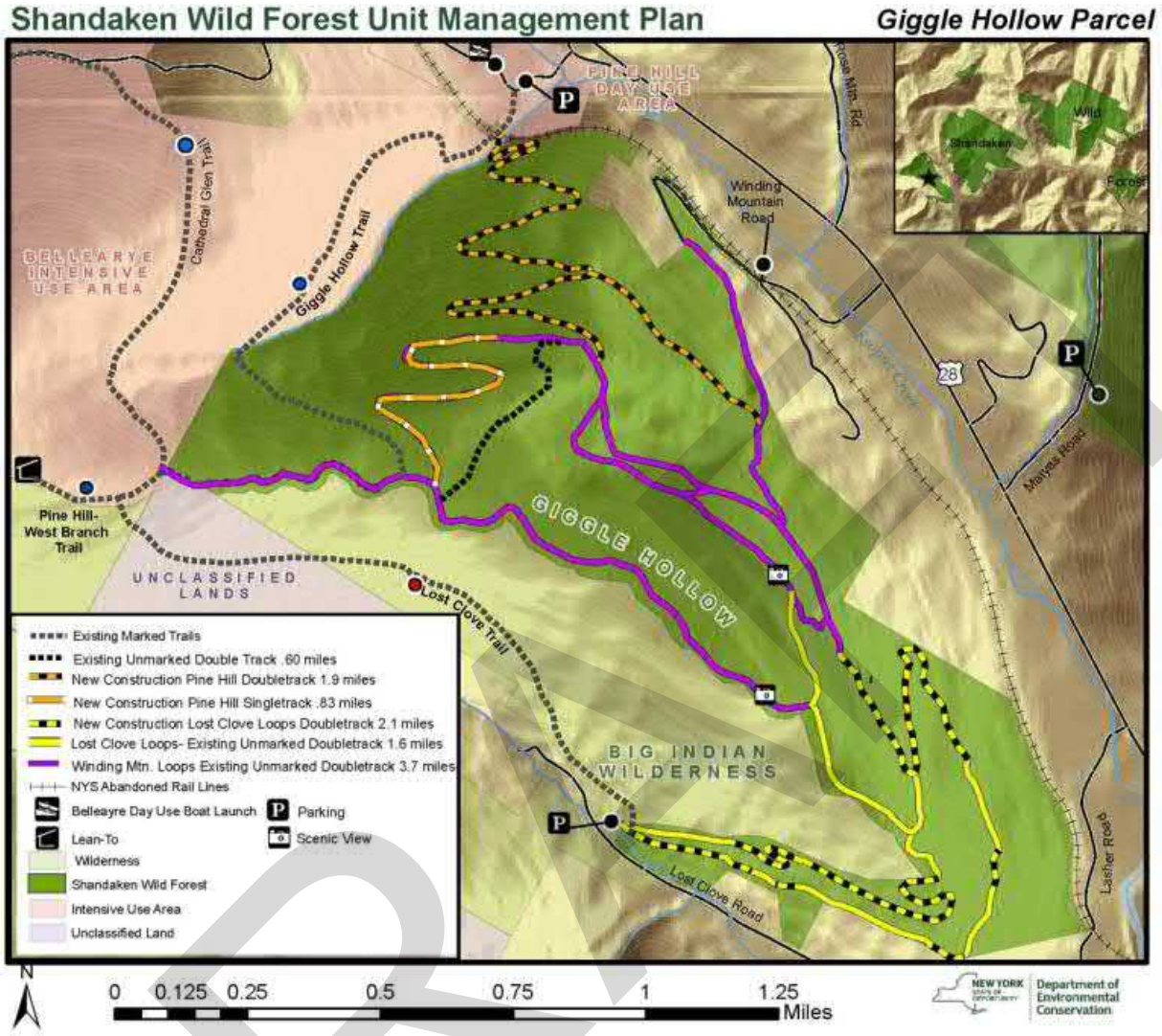
Source: https://www.belleayre.com/todo/hiking/

Figure 1-13: Belleayre Hiking and XC Ski Trails

and the Giggle Hollow trail connects at the Giggle Hollow Bridge. A third trail is operated by ORDA and connects to the railroad corridor on the double horseshoe curve by the snowmaking reservoir. This trail is primarily used as a cross country ski trail and as an access road for vehicles to get to the reservoir. Conversion of the corridor to a multi-use trail west of the Giggle Hollow Bridge provides an opportunity to make the

Cathedral Glenn trail a complete loop starting at the Belleayre Day Use Area ("DUA"). In addition, conversion of the trail to a multi-use path from the Giggle Hollow Bridge east to Lasher Road would create several opportunities for future connections to trails that have been identified by NYSDEC as part of their Shandaken Wild Forest Draft Unit Management Plan ("UMP").

The NYSDEC purchased the land bordered by Belleayre Mountain to the West, Lasher Road to the East, Lost Clove Road to the South, and the railroad corridor to the North in December 2011. This 610 acre parcel of land is known as the "Big Indian" parcel and was classified as "Wild Forest" and added into the Shandaken Wild Forest Draft Unit Management Plan ("Draft UMP") in 2020. The Draft UMP identifies 10.1 miles of trails throughout the Big Indian Parcel that consists of repurposing former logging roads and 4.1 miles of new trail construction into a trail network suitable for hiking, mountain biking, and cross country skiing. The new trails were first identified in the *Shandaken-Belleayre Mountain Bike and Cross Country Ski Trail System Concept Plan* developed by Sinuosity and Tahawus Trails, LLC. As shown on the map below, the railroad corridor would provide an ideal multi-use trail connection between the parking area at the Belleayre Beach DUA to the new Winding Mountain Loop trail and to the Lasher Road. The railroad corridor could also provide additional opportunities for trail connections included in the Tahawus report, but not included in the Draft UMP.



Source: NYSDEC 2020 Shandaken Wild Forest Draft Unit Management Plan

Figure 1-14: NYSDEC Proposed Trails in the Shandaken Wild Forest.

The Olympic Regional Development Authority ("ORDA") also a key stakeholder in the development of a trail on this section of the U&D Railroad corridor, particularly at the Belleayre Beach DUA and the western half of the corridor. ORDA operates the Belleayre Ski Center in Highmount at the western terminus of the corridor including Cross Country ("XC") Ski trails adjacent to the railroad corridor. There is currently one XC ski trail that connects to the railroad corridor with additional trails planned in the future. ORDA also maintains a network of mountain bike trails and plans to expand on their network as part of their updated Unit Management Plan for the area. One of the new trails, according to the *Shandaken-Belleayre Mountain Bike and Cross Country Ski Trail System Concept Plan* developed by Sinuosity and Tahawus Trails, LLC., proposes to utilize a short segment of the railroad corridor for its new route on Belleayre Mountain. This

study identifies the railroad corridor as a "highly valuable potential component of a trail system" due to its many connection opportunities from Big Indian to Highmount.

1.6.4. Construction Access

Access for construction vehicles is critical for the construction of the trail. Identifying access locations for the future contractor during the planning and preliminary design phases could help the contractor to identify their access locations during the bidding process and reduce some of the unknowns, which could decrease bid prices. Since this is a narrow single track corridor, contractors will only be able to have one vehicle in a section of the corridor at a time. Providing the contractor with passing zones where one vehicle can pass another or several access points would help the contractor to increase production during the grading and stone placement activities. This study identifies potential locations where a contractor could access the corridor and potential constraints that a contractor will have to consider along the route, progressing along the trail corridor from west to east. All access routes and locations provided within this study shall be reviewed in greater detail during the design phase of the project, just prior to the construction phase, as conditions of the bridges and roadways can change rapidly.

The intersection of Galli Curci Road (CR 49A) and Route 28 is a logical area for a contractor to access the railroad corridor and stage equipment and materials at the western terminus of the corridor. This will provide access to the double horseshoe curve and access for large vehicles or heavy loads at the western end of the project. Access directly to the southern double horseshoe curve could be provided by two alternate routes if needed to do the repairs to the large stone culvert. Bonnie View Avenue from Pine Hill via is an option, however, there is a bridge on Bonnie View Avenue that is load posted to 14 tons according to the NYSDOT Posted Bridges viewer. As most loaded dump trucks exceed 30 tons, this route may not be useable to a contractor unless temporary or permanent bracing or other improvements are performed to this bridge. The Ulster County DPW has scheduled bridge replacements on Bonnie View Road in 2021 and 2022. This work should be coordinated during the preliminary design phase of the project and the appropriate information should be included as part of the construction access plan. Another constraint on this route is a second stream crossing that has a steel culvert pipe with an unknown load capacity. The structural capacity of the culvert pipe should be assessed during the design process. Alternatives to improve this pipe could include an increase in fill above the pipe, a concrete pad or steel plates to better distribute loads, or even a temporary bridge structure. Access from the west may be accommodated through the Belleayre Ski area where steep slopes will be challenging and may limit the equipment that can utilize this area. Using tracked equipment could allow this area to be utilized. Coordination with ORDA would be required during final design should other less constrained areas of access not be available.

The next logical construction access point is from Station Road at the Woodchuck Hollow Bridge. This location will require vehicles to travel through the local roads within the hamlet of Pine Hill, which are narrow and will require a transportation plan with detailed routes to be developed depending on the equipment proposed to be used. Access to the corridor is from the Station Road side of the bridge as the low overpass of the railroad bridge on the Mill Street side, and the very sharp turns will restrict larger

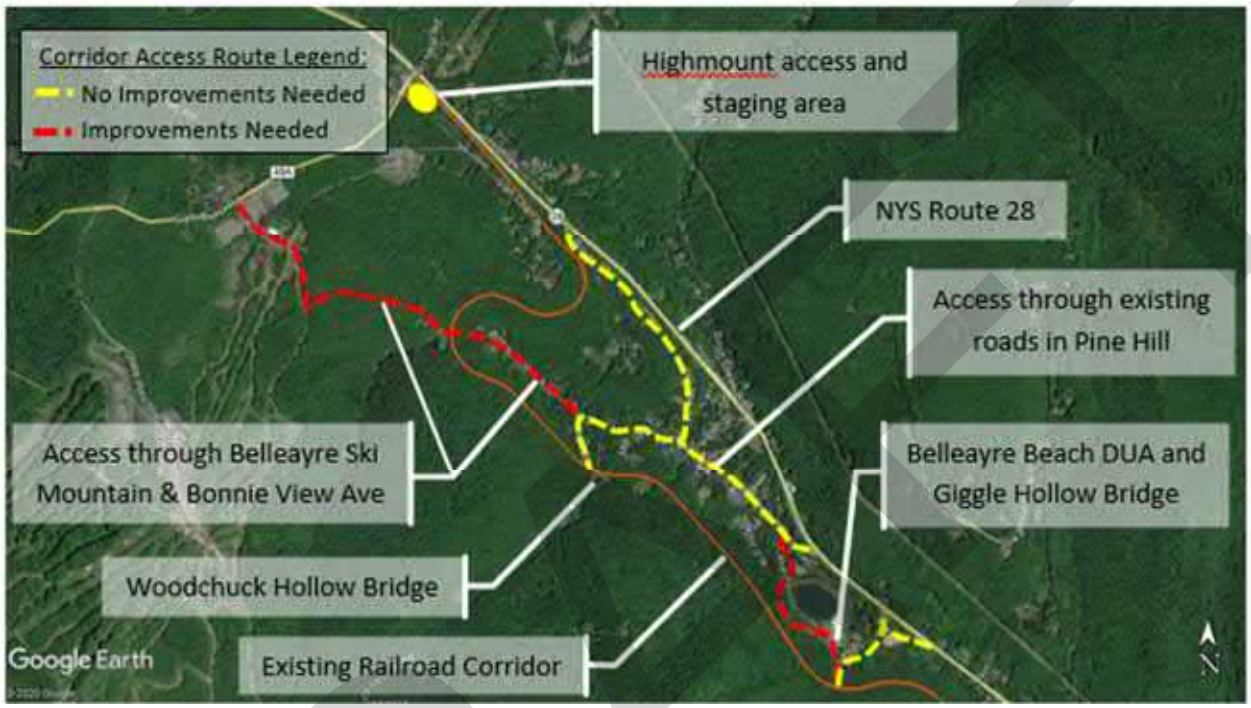


Figure 1-15: Construction Access on the West section of the corridor

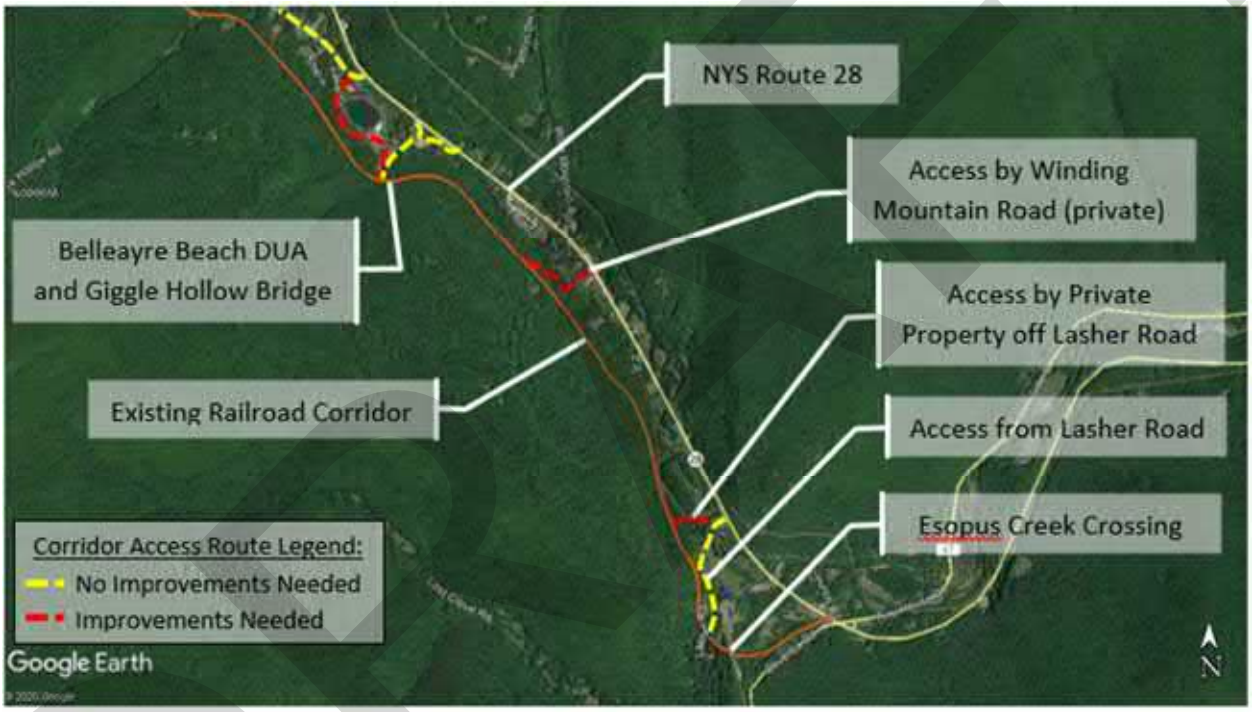
vehicles from using this route. There are no posted bridges along this route according to the NYSDOT Posted Bridges Viewer.

Between the Woodchuck Hollow Bridge and the Giggle Hollow Bridge, Lake Avenue from Pine Hill could be an option for an construction access route. However, this is a gravel road to Birch Creek with no means to cross the creek. A temporary bridge, a permanent bridge, large culvert pipes and fill, or a concrete box culvert could be utilized to cross the creek. ORDA indicated that two large pipe culverts used to be installed to cross the creek and were damaged during Hurricane Irene and Tropical Storm Lee and later removed. ORDA also indicated that construction of a permanent crossing in this location may be beneficial for their operations as a second option for their maintenance crews to access the DUA facilities without the restrictions of the covered entrance bridge and sharing that bridge with the public. The steep slopes between Lake Avenue and the railroad corridor limit the connection options between Lake Ave and the D&U railroad corridor.

Another feasible access location for construction vehicles is at the entrance to the Belleayre Beach DUA. A one lane steel girder covered bridge spanning the Birch Creek was constructed in 1992 and was constructed to New York State Department of

Transportation standards at that time. The wooden cathedral-like cover or roof will need to be modified to allow larger construction vehicles to access the DUA and then the corridor. This location will also provide access to the Giggle Hollow Bridge and locations west of this site. Accessing the east side of the corridor will require construction vehicles to either cross the Giggle Hollow stream either via a temporary structure or by utilizing the railroad bridge. Modifications to the railroad bridge will be required for this to occur prior to use. An access road will also need to be cut into the slope adjacent to the railroad in order for vehicles to access the railroad corridor to the west. This access road could be permanent and provide an access for the trail users.

The two mile stretch between the Giggle Hollow Bridge and Lasher Road provides limited opportunities for construction vehicles to access the railroad corridor. There are no major structures that need to be rehabilitated between these two points and the access at Lasher Road provides convenient access for a contractor to work. Winding



Mountain Road may be viewed as a convenient access point, however, the road is privately owned and would require a temporary bridge structure to cross Birch Creek if used for construction vehicles. Additionally, NYSDEC may have an access easement

Figure 1-16: Construction Access on the East section of the corridor

through this roadway to access their parcel of land and may be able to grant access to this roadway through their agreement with the owner of the roadway. Use of the DEC access easement and construction of a temporary bridge should be pursued during the design phase of the project.

Another potential access location through this stretch is through a vacant property owned by Crossroads Ventures, LLC., according to the Ulster County Parcel viewer. This property provides direct access from Lasher Road to the Railroad corridor and if an

agreement between Crossroads Ventures LLC and the County can be reached, could provide as a potential trailhead location until the Esopus Creek Bridge is constructed in a later phase. Preliminary discussions with the property owner indicate that use of this property is feasible and could be pursued further during design. If an agreement for a trailhead is not secured, then the contractor for the trail may wish to pursue this as a construction access route and staging area for work on the western section of the corridor.

Access to the Esopus Creek Bridge can easily be provided from the west via Lasher Road and from the East by utilizing the existing Railroad corridor from Route 28 and Oliverea Road (CR 27.) No other access locations would be necessary for construction from the Esopus Creek to Route 28.

The longest stretches of the corridor with only one potential construction access point is two miles from the Giggle Hollow Bridge to Lasher Road. The contractor will need to carefully manage their crews and operations in a linear manner from the one access point forward. Providing the contractor the option to install passing zones every quarter to half mile along the corridor and additional access points could be beneficial to improve the contractor's efficiency while working on the project. The Woodchuck Hollow Bridge to the Giggle Hollow Bridge is a one mile section with access provided at both ends of the segment. Secondary access points to the trail are limited by the steep slopes adjacent to the corridor and the private properties that boarder the corridor to the north.

B&L recommends that the above mentioned routes are considered to be included in the design plans to alert a future contractor of their potential for use. Typically, the contractor is responsible for choosing and furnishing their own access routes with approval by the project owner. Variations to this include restrictions by permitting agencies or if the County desires a potential access route to be formalized for use after construction of the trail. This could be for uses by emergency vehicles, maintenance vehicles, or for other uses.

1.6.5. Emergency Vehicle Access

Emergency vehicles could access the trail from one of the major trailheads constructed along this corridor at Highmount, Belleayre Beach DUA, and in Big Indian. Emergency Vehicles can also access the trail from Station Road/Woodchuck Hollow Road in pine Hill. These access points will allow for a distance from entry/exit points no greater than two miles along the trail. The recommended trail section and bridge improvements allow for vehicles to drive along the trail to reach their destination.

1.7. Vegetation Management

1.7.1. Existing Vegetation Assessment

Vegetation conditions and potential needs along the corridor can be separated into two segments. The west segment from the Giggle Hollow Bridge to Highmount is generally clear of vegetation that would need to be removed for a trail to be constructed. Select trees may be removed depending on connection points and work to culverts determined during the design phase, but no major clearing is required. Vegetation

between, and immediately adjacent to the tracks, is sparse and is limited to grasses, weeds, and small shrub growth.

The eastern segment from the Giggle Hollow Bridge to Route 28 in Big Indian exhibits heavy tree and vegetation growth. Trees ranging from 3 to 8 inches diameter at breast height (dbh) have grown within and adjacent to the railroad tracks and within the construction footprint of the trail. Smaller brush growth is also present along this segment. This segment also exhibits numerous large tree blowdowns that will need to be cleared prior to track and tie removal and to construct the trail.

Figure 1-17: Heavy tree growth adjacent to tracks.

The recommended clearing width will vary depending on the final trail width chosen for the trail. Generally, a minimum of 2-3 foot width free of trees and other obstructions is desired adjacent to the trail edge for errant bicyclists. If a 10 foot trail is to be used for the trail, then a minimum 14 foot width should be cleared centered on the tracks. Overhead clearance should be a minimum of 10-12 feet in height from the final trail surface elevation, although greater heights may be needed by construction vehicles to traverse the corridor.

The field assessment conducted by B&L occurred in the fall of 2020, after the leaves had dropped from the trees. We recommend that a full assessment of the ash trees within the corridor be performed while the leaves are on the trees making species identification easy. Ash trees are being ravaged by the Emerald Ash Bore throughout the County and State. Standing ash trees along the corridor will become infested and could pose a hazard to construction crews and the general public if they are not cut down before they die and start to crumble. We recommend that all ash trees that pose a threat to fall on the trail be cut down.

1.7.2. Scenic Vista Opportunities

Despite traversing through the scenic Catskill Mountains, the corridor offers few locations for scenic views of the area. The corridor traverses through a valley and along a mountain side to the south hiding any views of the top. The north side is heavily wooded, and scenic views are again blocked by the flat plateau of the mountains to the north. Views of the Birch Creek Valley to the south and west from the double horseshoe curve are blocked by heavy tree growth. However, there is an opportunity to clear a scenic vista of the Birch Creek Valley to the north of the corridor just west of the double horseshoe curve. Views from atop the Giggle Hollow Bridge to the north could also be opened up by selective tree clearing. This would also improve views of the bridge from the Belleayre Beach DUA potentially making this a highly sought after photo

opportunity. The Esopus Creek also offers picturesque photo opportunities of the Catskill Mountain wilderness if the bridge is constructed.

1.8. Project Stakeholders

1.8.1. New York State Department of Environmental Conservation

As discussed in section 1.4.3, the NYSDEC is an important stakeholder for this project. The land to South of the project is owned by the NYSDEC and has been identified in their Draft UMP for further development. Coordination between the County and NYSDEC is ongoing and is recommended throughout the planning and design process of the trail.

1.8.2. Olympic Regional Development Authority

In addition to the Belleayre Ski Center in Highmount, ORDA also owns and operates the Belleayre Beach DUA at Pine Hill. This seasonal recreational facility is a pay by use facility open from mid-June to Labor Day annually. Outside of this timeframe, the facility is gated at a one-way covered bridge crossing the Birch Creek. The bridge is the only access point to the facility from Route 28. Pedestrians are permitted to cross the bridge outside of the open season, however, they need to park their vehicles on the side of Friendship Manor Road which does not offer more than 4 or 5 vehicles to park at a time. As mentioned in section 1.3, this facility is a desirable location to provide access to the potential trail both during and after construction. Coordination with ORDA to provide full time access and parking facilities is an important element of the project and has begun as part of this feasibility study. This pay-by-use facility typically has 18,000 to 24,000 visitors seasonally from mid-June through Labor Day.

1.8.3. Delaware and Ulster Railroad

The Delaware and Ulster Railroad ("D&U RR") is a not for profit organization that operates a scenic railroad ride based out of Arkville, NY. The D&U RR has the rights to operate on 19 miles of track from Highmount to Roxbury, NY, but currently only operates on the western 13 miles of track. The D&U RR has plans to renovate the eastern 6 miles of track west of Highmount NY in the summer of 2021 and restore tourism train service to Highmount in the fall of 2021. The D&U RR plans to use the side-by-side tracks and switches in Highmount to reverse the direction of their tourist trains. Ulster County has issued a permit for the D&U RR to operate their trains for 929 ft. east of the Delaware-Ulster County line. The eastern terminus of the permit has become known as the compromise joint and is the eastern most point that the railroad is allowed to use.

If the trail is constructed, the tracks in Highmount would need remain intact and operational for the D&U RR. Coordination with the D&U RR will be necessary during the design process to ensure compatibility for both operations to function simultaneously. Potential improvements needed for the railroad to operate in Highmount include a new and potentially larger (30-40 ft.) loading platform, railroad track improvements, and a small parking facility. The D&U RR indicated that this area would not be used as a station or to load or discharge train users.

1.8.4. Town of Shandaken

The segment of the U&D corridor assessed by this study falls entirely within the Town of Shandaken. Nestled in the heart of the Catskill Mountains, the town of 3,000 residents is comprised by nearly 75% NYSDEC forestlands making this a prime location to establish a new multi-use trail. A quick visit to the Town's website highlights their emphasis on outdoor recreation and hiking. In addition, the *Comprehensive Recreation Master Plan for Town of Shandaken – 2013* recommends that the establishment of the "U&D rail corridor as a multiuse trail as a priority trail project for the community" and "establishing non-motorized trails is a cost-effective wat to foster recreation supply in Shandaken." Early discussions with the Town have indicated their full support for the development of this 5 mile stretch of the U&D corridor.

1.9. Historical Interpretation Opportunities:

There are many historical elements that could be chosen to showcase on interpretative panels throughout the corridor, beginning with the significance of the railroad on the development of the local communities such as at Highmount, Pine Hill, and in Big Indian. Existing physical elements such as the foundation adjacent to the railroad tracks at Pine Hill (figure 1-18) is just one example of an opportunity to highlight. Other examples include the Grand Hotel (figure 1-19) at Highmount, industry in Pine Hill such as the Tanneries, lodging at Inns and Hotels, the Crystal Spring Water Company, and the engineering feats of the corridor such as the grade and the significance of the segment commonly referred to as the "double horseshoe curve." A historical assessment will be further developed to highlight additional opportunities.

Figure 1-19: Foundation remains

Figure 1-18: Highmount Grand Hotel

2.0 BRIDGE ASSESSMENT

As part of this feasibility study, B&L also completed a rehabilitation needs assessment for the four existing bridges. The bridges were likely built in the late 1800's alongside the construction of the former railroad that ran along the corridor. The corridor was abandoned by the railroad in the 1970's, and the bridge structures appear to be unmaintained since that time.

Structural engineers from Barton & Loguidice completed a field inspection of the bridges on October 19, 2020 in order to assess the existing conditions, the feasibility of reuse, and the general repair needs for each structure. The integrity of the remaining bridges for re-use was taken into consideration, evaluating the extent of the repairs required to retrofit the bridges to be able to carry the loads of the proposed multi-use path, as well as site conditions and limitations where full structure replacement may be recommended.

This section discusses alternatives for repair or replacement as they apply to each individual bridge, and approximate total costs for the construction of each alternative. All of the bridges inspected will require a new deck to carry the trail. The materials considered for the decks include precast concrete, cast-in-place concrete or timber. Each material offers its own set of benefits or limitations to be considered during the selection process. Timber decking is the least expensive and more easily repaired by local forces but has a much shorter life span than concrete options, typically 20 to 30 years. Precast concrete deck panels will have a higher cost, but will allow for quicker construction and enhanced durability, with a designed lifespan of approximately 75 years. The use of precast concrete will require appropriate construction access at each location along the corridor and adequate clearances for equipment to deliver and set the panels in place. Cast-in-place concrete will typically have slightly higher costs than precast concrete, requiring longer construction time and on-site labor needs, but is similarly durable and designed for a lifespan of approximately 75 years.

During the preliminary design phase, the rehabilitation alternative chosen for each bridge should be presented to SHPO for an effect determination as required by the State Environmental Quality Review Act ("SEQRA") and Section 106. Review was initiated on the Cultural Resource Information System ("CRIS") and coordination is ongoing. The bridge structures included in this segment of the railroad corridor are approximately 120 years old and appear to be in their original condition from when the railroad was constructed.

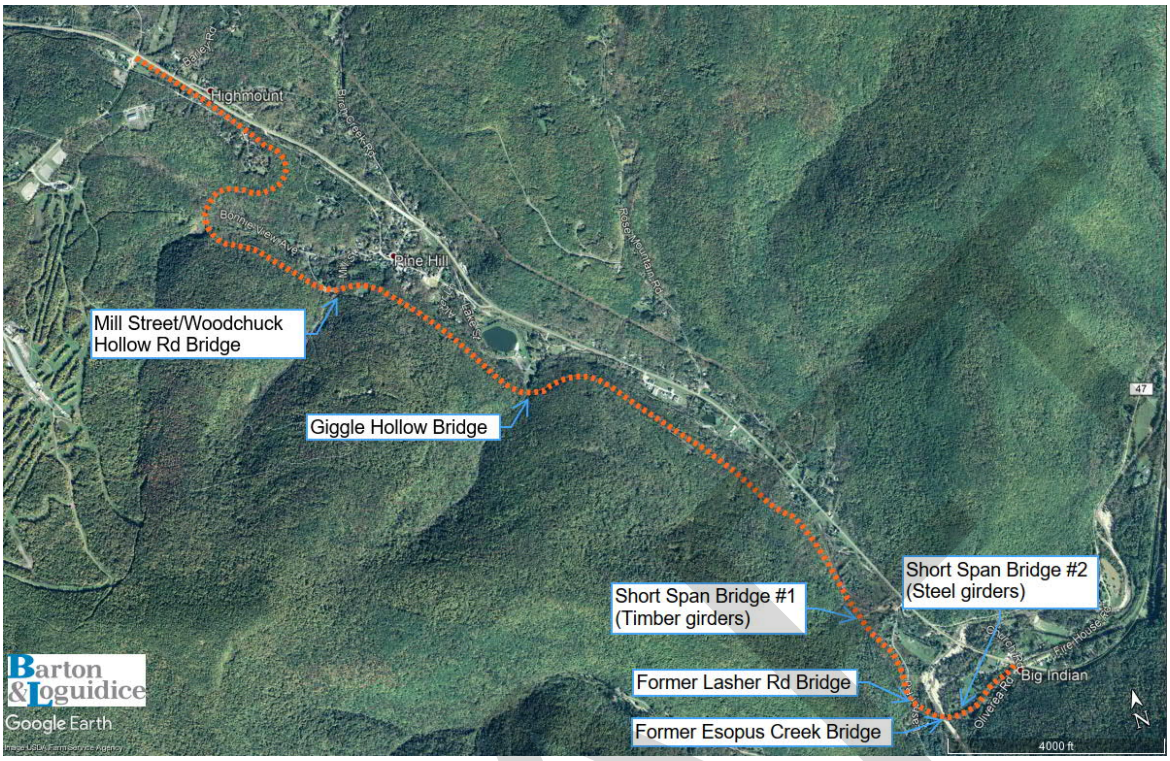


Figure 2-1: Project corridor showing structure locations

2.1. Woodchuck Hollow Bridge (Milepost K39.75)

The existing bridge (BIN 7713410) was originally built in 1896 (as evidenced from the date on the cornerstone) and carries the railroad corridor over Mill Street and an unnamed stream. The structure consists of a two-span continuous steel girder superstructure, supported by stone masonry abutments and one pier. Span 1 is approximately 23 feet in length with two steel girders spaced at 8 feet on center and are 28 inches deep. The Span 1 girders haunch down to a depth of 6 feet at the pier, where 6 feet deep girders are carried over Span 2. The length of Span

Figure 2-2: Elevation view of Woodchuck Hollow Bridge, Span 1

Figure 2-3: View of Span 2 looking toward the West Abutment

2 is approximately 64 feet. The steel girders appear to be in good condition, with no apparent signs of deterioration or section loss.

NYSDOT classifies Mill Street as a Local Rural road. The NYSDOT Bridge Design Manual and Highway Design Manual state the minimum vertical clearance for a roadway with no Vertical Clearance Posting is 14 feet, and the minimum roadway width for a Local Rural Road is 24 feet, with 10 foot travel lanes and 2 foot shoulders. The existing vertical clearance of 12 feet, between the roadway and the underside of the Span 1 girders, and the horizontal clearance of 16.5 feet, between the east abutment and the pier, do not meet the NYSDOT minimum requirements. The horizontal clearance restricts Mill Street to one lane of traffic to be carried under the bridge at a time.

There is a crack at the mortar joint between the begin abutment and begin right wingwall. The northeast wingwall also has deterioration to the stone masonry in the form of two additional full height cracks, up to 1" wide. The southeast wingwall has collapsed behind the abutment and will require reconstruction. Overall, the stone masonry joint mortar is in fair condition. Approximately 30% of the surface areas of all substructures require repointing.

Figure 2-4: Separation between East Abutment and Right Wingwall

Figure 2-5: Displacement of East Left Wingwall

Recommended Rehabilitation:
At this bridge, B&L recommends the existing substructures and steel girders remain in place, and the existing steel rails and timber rails are removed and replaced with a timber deck, precast concrete bridge deck panels, or a cast-in-place concrete deck. Rehabilitation of the substructures will include repointing the deteriorated areas of the stone masonry, repair to the full height cracks of the northeast wingwall, joint repair between the right wingwall and the begin abutment stem, and reconstruction of the collapsed begin left wingwall.

The approximate rehabilitation cost to address the deteriorations noted above and restore the substructure surfaces by repointing all grout lines is $170,000, with the addition of one of the following deck replacement options.

Deck Replacement Options:

A. Timber Deck – $200,000 (approximate total cost $370,000)
B. Precast Concrete Panels – $300,000 (approximate total cost $470,000)
C. Cast-in-Place Concrete Deck – $260,000 (approximate total cost $430,000)

Of these options, B&L recommends the existing steel girders remain in place and the stone abutments and pier be rehabilitated by repointing the entire surface area of the stone masonry, repairing cracks and joints in and between the stones, and reconstruction of the collapsed wingwall. The timber rail ties will be removed and replaced with a cast-in-place concrete deck. The approximate total construction cost for this alternative is $430,000.

2.2. Giggle Hollow Bridge (Milepost K38.91)

The existing bridge at this site carries the railroad corridor over the Giggle Hollow Creek. The structure consists of stone masonry abutments and wingwalls and a 65 foot single span steel girder superstructure. The steel girders consist of two riveted plate girders spaced 8 feet on center and 8 feet in depth. The steel girders appear to be in good condition, with no signs of deterioration or section loss.

Figure 2-6: Giggle Hollow Bridge East Abutment

Figure 2-7: Superstructure, looking toward West Abutment

The masonry abutments appear in good condition, with localized areas of deterioration. The most significant areas exist at the west abutment and west wingwalls. There are locations at both west wingwalls where a joint crack exists through multiple layers of grout. The stone masonry in these locations appears to be tipping away from the embankment. There are also signs of joint separation at the northwest cheekwall between the backwall and the wingwall at the west abutment, seen in the photo below. This is causing the stones in this location to tip and rotate away from the backwall. Overall, approximately 20% of the abutment and wingwall surface area has missing mortar between the stones.

Figure 2-8: Separation beginning at the joint between the cheekwall, backwall, and northwest wingwall at the West Abutment

Recommended Rehabilitation:
At this bridge, B&L recommends the substructures and steel girders remain in place and be rehabilitated. The existing steel rails and rail ties will be removed and replaced with a new timber deck, concrete deck panels, or a cast-in-place concrete deck. The areas of displaced stone will be removed and reset and all areas requiring mortar repointing will be repaired.

The approximate rehabilitation cost to address the rotating stones and restore the substructure surfaces by repointing all grout lines is $310,000, with the addition of one of the following deck replacement options.

Deck Replacement Options:

A. Timber Deck – $140,000 (approximate total cost $450,000)
B. Precast Concrete Panels – $230,000 (approximate total cost $540,000)
C. Cast-in-Place Concrete Deck – $200,000 (approximate total cost $510,000)

Of these options, B&L recommends the existing stone abutments and steel girders be rehabilitated and the existing steel rails and rail ties be replaced with a cast-in-place concrete deck. The stone abutments will be repointed and mortar repairs performed between the stones. The approximate total construction cost for this alternative is $510,000.

2.3. Short-Span Bridge #1 (Milepost K37.34)

This structure consists of a timber girder superstructure founded on stone masonry abutments and wingwalls. The two timber girders are spaced approximately 6 feet apart on center, measuring 24 3/4" in depth. Steel rails and timber rail ties exist over the girders. The timber beams and rail ties are heavily rotted and loose in multiples locations.

Figure 2-9: View of the rails across the structure, looking south

Figure 2-10: Elevation view of Short Span Structure #1

The stone masonry shows signs of deterioration, in the form of loose and missing mortar between adjacent stones, on approximately 50% the total surface area of each abutment and wingwall. The clear span between abutments is 8'-6".

Rehabilitation Alternatives:

Alternative 1 – New Pipe Structure

This alternative consists of removing the entire superstructure, leaving the stone substructures as is, and installing a new steel plate pipe culvert and backfilling to carry the trail over the crossing. The intent would be to use as large of a culvert pipe as possible that would fit between the abutments.

The crossing itself does not appear to pass over a stream; however, a watershed analysis should be performed to ensure the proposed culvert pipe does not negatively affect the drainage characteristics of the area and that the new pipe is sized accordingly. The feature crossed by the bridge structure appears to be an old abandoned roadway, a trail, or potentially be a cattle pass that was used when this area used to be farmed, when the railroad still used this corridor.

The approximate total cost of this alternative is $50,000.

Alternative 2 – Structure Rehabilitation

Under this alternative, the existing substructures will remain in place and would be repointed across approximately 50% of the abutment and wingwall surfaces. The timber girders and rail ties would be removed and would be replaced with new timber or steel girders, a new deck, and pedestrian bridge railings.

Steel girders have an approximate lifespan of 75 years, while timber girders have an approximate lifespan of 20 to 30 years. An additional option at this structure would be to construct a glue laminated timber beam and deck structure. This type of structure would be delivered to the site in one piece, with the timber girders and timber deck glued together into a composite section. The advantage of this option is faster construction times when compared to a standard timber deck where the boards are fastened together one at a time.

The approximate cost for rehabilitation of the substructures is $30,000, plus the addition of one of the beam replacement and deck replacement options, or the timber beam/deck system.

Beam Replacement Options:

A. Steel Beams – $40,000
B. Timber Beams – $15,000

Deck Replacement Options:

(i) Timber Deck – $35,000
(ii) Precast Concrete Bridge Deck Panel – $50,000
(iii) Cast-in-Place Concrete Deck– $45,000

Glulam Timber Beam/Deck System – $45,000

Recommended Alternative:
For this structure, B&L recommends Alternative 1, full removal and replacement with a new steel plate pipe culvert and backfilling the gap to carry the trail over the crossing. The approximate total construction cost of this alternative is $50,000.

2.4. Lasher Road Crossing (Milepost K36.90)

The existing structure at the Lasher Road crossing consists of stone-block masonry abutments with no existing superstructure. The masonry stones at each abutment and wingwall are in fair condition; however, there is missing mortar between the masonry stones across nearly the entire surface area.

The face-to-face distance between the abutments is 10'-6", allowing only one lane of traffic to pass through. The narrow constriction created by the abutments and the current roadway geometry result in poor sight distances for vehicles travelling in both directions on Lasher Road in the vicinity of this crossing.

Figure 2-12: Elevation view, showing non-standard horizontal clearance

Figure 2-11: Deterioration of the grout between the stone blocks

Rehabilitation Alternatives:

Alternative 1 – New Superstructure on Existing Abutments

This alternative consists of rehabilitating the existing substructures and constructing a new 12' span superstructure. Under this alternative the non-standard horizontal clearance between the abutments will be maintained, allowing only one lane of traffic to pass under the bridge at one time. Placement of the new superstructure would also create a non-standard vertical clearance, limiting the height for vehicles passing under the bridge to approximately 7'-6". Substructure repairs would include removal of deteriorated grout lines and vegetation and repointing.

The approximate cost for rehabilitation of the substructures will be $65,000, in addition to the one of the following beam options and deck options.

Beam Replacement Options:

A. Steel Beams – $40,000
B. Timber Beams – $15,000

Deck Replacement Options:

(i) Timber Deck – $25,000
(ii) Precast Concrete Bridge Deck Panel – $35,000
(iii) Cast-in-Place Concrete Deck – $30,000

Glulam Timber Beam/Deck System – $60,000

Alternative 2 – Full Replacement

This alternative involves the complete removal and reconstruction of the existing bridge structure crossing over Lasher Road, increasing the span length to approximately 25 feet. The existing stone abutments and wingwalls would be completely removed so that standard horizontal clearance can be obtained and allow for two lanes of traffic on Lasher Road. The trail elevation would be raised and the new superstructure would be designed to provide 14 feet of vertical clearance for vehicles on Lasher Road.

The approximate base cost for construction will be $450,000, in addition to the costs below for steel or timber beams and a timber, precast, or cast-in-place concrete deck, or the combined timber beam/deck system.

Beam Replacement Options:

A. Steel Beams – $65,000
B. Timber Beams – $45,000

Deck Replacement Options:

(i) Timber Deck – $55,000
(ii) Precast Concrete Bridge Deck Panel – $100,000
(iii) Cast-in-Place Concrete Deck– $85,000

Glulam Timber Beam/Deck System – $60,000

Alternative 3 – At-Grade Crossing

Under this alternative, the existing structure would be completely removed and an at-grade crossing would be constructed between the trail and Lasher Road.

In order to meet the maximum allowable grade of 4.5% for the trail, the excavation limits along the trail will need to extend 275 feet or more behind each of the existing abutments. The limits of excavation may extend into the properties adjacent to the crossing. Access will be maintained to driveways adjacent to the crossing and temporary utility pole relocations will be necessary during construction. Removing the existing abutments and increasing the width of the roadway at the crossing will significantly improve the sight distance, thereby improving the safety for vehicles on Lasher Road.

The most recent Traffic Volume data available by NYSDOT, collected in May 2013, shows the average daily traffic to be 43 vehicles per day (See Appendix XX). Because of the low daily vehicle volume, and improved sight distance proposed by this alternative, it is not anticipated that this at-grade crossing would contribute to conflicts between the travelling public and pedestrians on the trail.

Alternative 3 will have an approximate total construction cost of $200,000.

Alternative 4 – New Superstructure, Replace One Abutment

This alternative involves removing and replacing the existing north abutment while keeping the south abutment in place, and constructing a new superstructure with an increased span length of approximately 25 feet. The proposed north abutment would be constructed approximately 10 feet behind existing. This would allow for better sight distance, standard horizontal clearance through the bridge, and room for two lanes of traffic on Lasher Road. The remaining south abutment would be modified using stones from the north abutment. The bridge seat elevation would be increased to provide the standard 14 feet of vertical clearance between Lasher Road and the new superstructure.

The approximate base cost for construction will be $360,000, in addition to the costs below for steel or timber beams and a timber, precast, or cast-in-place concrete deck, or the combined timber beam/deck system.

Beam Replacement Options:

A. Steel Beams – $65,000
B. Timber Beams – $45,000

Deck Replacement Options:

(i) Timber Deck – $55,000
(ii) Precast Concrete Bridge Deck Panel – $100,000
(iii) Cast-in-Place Concrete Deck– $85,000

Glulam Timber Beam/Deck System – $60,000

Recommended Alternative:

B&L recommends Alternative 3, full removal of the existing abutments and construction of an at-grade crossing between the trail and Lasher Road. The approximate total construction cost of this alternative is $200,000.

2.5. Esopus Creek Crossing (Milepost K36.78)

The previous bridge that carried the Ulster and Delaware Railroad over the Esopus Creek sustained substantial damage in 2011 during Hurricane Irene and Tropical Storm Lee, and was later removed by the County. All Desithat remains of the crossing today is the west abutment. The timber piles on which the west abutment was founded are exposed and show signs of severe scour. Based on the vegetation and sediment patterns on the shoreline, it appears that the former abutment locations were constricting stream flows through the bridge opening, resulting in the severe scour which can be seen in following photos. The existing span length of the previous bridge was measured to be approximately 90 feet. This was measured from the face of the west abutment to where the east abutment was assumed to be located.

Figure 2-14: Looking east toward missing east abutment

Figure 2-13: West abutment deterioration due to scour

Replacement Alternatives:

Each of the proposed alternatives for reconstruction consist of improving the hydraulic capacity of the bridge and reducing the potential for scour by increasing the clear span of the proposed bridge.

The proposed abutments would be constructed behind the existing abutments and located away from the edges of the stream banks and away from the direct flows of the Esopus Creek.

A proposed span length of 150 feet was assumed based on data obtained from the Federal Emergency Management Agency (FEMA) National Flood Insurance Program (NFIP) Flood Rate Insurance Map (FIRM) (see Appendix B). The mapping shows a significant portion of the stream banks and adjacent land to be located within a Special Flood Hazard Area subject to inundation by the 100-year storm. The mapping shows an approximate 150 length along the railroad corridor that is not inundated by the 100-year storm, thus, the proposed span length. A complete hydraulic analysis of the crossing will need to be completed during final design in order to determine an exact span length and superstructure low chord to pass the 100-year storm and to meet the necessary freeboard criteria for the 50 year storm of 2 feet. It is important to note that a replacement bridge is feasible in this location and can meet current design standards.

<u>Alternative 1 – New Bridge with Steel Girders</u>

This alternative consists of constructing a 150 foot span, steel girder bridge. The base cost for the substructures and steel girders, is approximately $1,400,000, in addition to the one of the following deck options.

1A.	Timber Deck – $300,000	(approximate total cost $1,700,000)
1B.	Precast Concrete Deck Panels – $450,000	(approximate total cost $1,850,000)
1C.	Cast-in-Place Concrete – $400,000	(approximate total cost $1,800,000)

Alternative 2 – New Bridge with Prefabricated Steel Truss

This alternative consists of a 150 foot span, prefabricated truss superstructure. The base cost of substructures and truss is approximately $2,700,000, in addition to the one of the following deck options.

1A.	Timber Deck – $300,000	(approximate total cost $3,000,000)
1B.	Precast Concrete Deck Panels – $450,000	(approximate total cost $3,050,000)
1C.	Cast-in-Place Concrete – $400,000	(approximate total cost $3,100,000)

One advantage of using a truss instead of steel girders is the total depth of a truss is typically shallower than steel girders. Thus, with the same span length assumed, the truss low chord would be higher than the low chord of steel girders. This results in improved hydraulic conditions. Results of a hydraulic analysis may require the trail to be raised to a greater extent for Alternative 1 than Alternative 2 in order to meet a minimum low chord elevation to satisfy hydraulic requirements.

Recommended Alternative:
B&L recommends Alternative 1C, increasing the span length to improve hydraulic capacity, constructing a 150 foot span, steel girder bridge with a cast-in-place concrete deck. The approximate total construction cost of this alternative is $1,800,000.

2.6. Short-Span Bridge #2 (Milepost K36.70)

This structure consists of a steel girder superstructure founded on stone masonry abutments and wingwalls. The steel girders consist of two girders spaced approximately 6 feet apart on center. Each girder is composed of two side-by-side riveted I-beams, measuring 22 1/8" in depth. Steel rails and timber rail ties exist over the girders. The rail ties are heavily rotted and

Figure 2-15: Elevation view of Short Span Structure #2

Figure 2-16: Deterioration at the bearing area of the east abutment #2

loose in multiple locations. The steel girders appear to be in good condition and show no visible signs of section loss or deterioration.

The stone masonry substructures show signs of deterioration in the form of loose and missing mortar between adjacent stones on nearly the total surface area of each abutment and wingwall. Most notably, there is missing mortar between the stones directly below the girders, resulting in a loss of bearing area at three of the four bearing location areas. The clear span between abutments is 12'-8".

Rehabilitation Alternatives:
Alternative 1 – New Pipe Structure
This alternative will be identical to Alternative 1 of Short Span Structure #1, and will consist of removing the entire superstructure, installing a new steel plate pipe culvert and backfilling to carry the trail over the crossing. The intent would be to use as large of a culvert pipe as possible that would fit between the abutments. There is a small impoundment immediately downstream of the crossing which was partially filled with water during the site visit. The crossing itself does not pass over a NYSDEC mapped stream; however, the crossing does appear to be within the 100-year floodway of the Esopus Creek according to FEMA Mapping. Should this alternative be selected, a hydraulic study should be performed to ensure the proposed culvert pipe does not negatively affect water surface elevations upstream of the crossing.

The approximate total cost of this alternative is $50,000.

Alternative 2 – Structure Rehabilitation
Under this alternative, the existing substructures and steel girders will remain in place. Each abutment will require repointing to nearly the total surface area of the structure. Concrete repairs will be needed at the bearing areas under each steel girders to restore full contact between the bearings and the abutment. The existing timber rail ties will be removed and replaced with a timber deck or concrete bridge deck and pedestrian bridge railing.

The approximate substructure rehabilitation cost is $50,000, plus the addition of one of the following deck replacement options.

Deck Replacement Options:

2A. Timber Deck – $40,000 (approximate total cost $90,000)
2B. Precast Concrete Bridge Deck Panel – $50,000 (approximate total cost $100,000)
2C. Cast-in-Place Concrete Deck – $45,000 (approximate total cost $95,000)

Recommended Alternative:
For this structure, B&L recommends Alternative 1, full superstructure removal and installation of a new steel plate pipe culvert to carry the trail over the crossing. The approximate total construction cost of this alternative is $50,000.

3.0 ENVIRONMENTAL INFORMATION

Preliminary investigations into watercourse impacts and related permits are shown below. Additional detailed environmental investigations will be required during the design process.

3.1. Environmental Site Assessment

3.1.1. Surface Waters

The NYSDEC Environmental Resources Mapper ("ERM") was queried to determine what mapped surface waters may be encountered along the project corridor. The following stream resources were identified as crossing the trail corridor, and are presented from west to east below, starting at the trail terminus at Belleayre:

- Tributary of Birch Creek (Crystal Spring Brook - Waters Index No. H-171-52-4) – Class B with B(T) standards
- Tributary of Crystal Spring Brook (Waters Index No. H-171-52-4-1) – Class C with C Standards (Crossed twice – once at Mill Street/Woodchuck Hollow and then once just beyond Bonnie View Ave)
- Tributary of Birch Creek (Giggle Hollow Brook - Waters Index No. H-171-52-3) – Class B with B(T) standards
- The Esopus Creek (Waters Index No. H-171) – Class C with C(TS) standards

There are no NYSDEC mapped wetlands located within 500 feet of the project corridor.

National Wetland Inventory (NWI) mapping was reviewed to determine the likelihood of encountering federally jurisdictional wetlands within the proposed project limits. NWI mapping identified NYSDEC mapped streams as riverine systems. Additionally, two palustrine forested wetland complexes are shown along the Esopus Creek near Big Indian Park and immediately south of the existing U&D corridor.

A site visit was completed by B&L environmental staff on October 5, 2020 to determine the presence or absence of wetlands and watercourses within the project corridor. The boundary of one wetland identified during this site walkover was delineated in accordance with the criteria defined in the 1987 US Army Corps of Engineers' (USACE) Wetland Delineation Manual and its 2012 Northeast/North Central Regional Supplement. Additionally, 11 stream resources were identified crossing the project corridor. Details of these surface watercourses are provided below in the Streams Section.

<u>Wetlands</u>

The one wetland identified in the project corridor (Wetland A) is located along Stream 1, which is an unmapped perennial stream feature that outlets to a tributary of Emory Brook (NYSDEC Waters Index No. D-70-80- P 368g). This palustrine emergent wetland met several hydrology indicators: high water table (A2), saturation (A3), water-stained leaves (B9), shallow aquitard (D3), and the FAC neutral test (D5). Hydrophytic vegetation

in the herbaceous layer was dominated by purple loosestrife (Lythrum salicaria), an obligate wetland indicator plant species, which satisfied the rapid test and dominance test with 100% hydrophytic plant species. The hydric soil indicator redox dark surface (F6) was satisfied. The Wetland A data sheet is provided in Attachment X. This wetland qualifies for federal protection under the Clean Water Act as a Water of the United States (WOTUS) due to its hydrologic connection to the East Branch of the Delaware River, a Traditionally Navigable Water (TNW), through Emory Brook. It does not meet the definition of a regulated wetland per NYSDEC regulations.

Streams

- Stream 1: channel width of 12" – 16" and a water depth of approximately 3" – 4" at the time of the site visit. Wetland A is south of and hydrologically connected to Stream 1. The ordinary high water elevation (OHWE) of the stream was approximately 6" above base streambed elevation and the substrate was silt. Stream 1 flows through a culvert beneath Galli Curci Road to a NYSDEC mapped Emory Brook tributary (D-70-80-12-4), which is a Class B stream with B Standards.
- Stream 2: Stream 2 had a channel width of 10' and a water depth ranging from 3" – 14" at the time of the site visit. The OHWE was observed at approximately 6" above base streambed elevation, and the substrate consisted of boulder and cobble. Stream 2 corresponds with the NYSDEC mapped stream tributary of Birch Creek (Crystal Spring Brook - Waters Index No. H-171-52-4), which is a Class B stream with B(T) standards.
- Stream 3: Stream 3 had a channel width of 3' and a depth of 2" – 4" at the time of the site visit. The OHWE was approximately 5" above base streambed elevation, and the substrate was silt and cobble. Stream 3 originates from a steep embankment above the railroad to the south, and flows downhill into Stream 4.
- Stream 4: Stream 4 had a channel width of 6' – 8' and a water depth ranging from 2" – 6" at the time of the site visit. A large pool, approximately 15' across, was present downstream of a double culvert from an impoundment. The OHWE was approximately 5" above base stream elevation, and the substrate was cobble and boulder. Stream 4 corresponds with the NYSDEC mapped Crystal Spring Brook tributary (Waters Index No. H-171-52-4-1), which is a Class C stream with C Standards.
- Stream 5: Stream 5 had a channel width of 10' and a water depth between 0.5" and 2" at the time of the site visit. The OHWE was observed at 4" above base streambed elevation, and the substrate consisted of boulders. Stream 5 corresponds with the NYSDEC mapped Crystal Spring Brook stream tributary (Waters Index No. H-171-52-4-1), which is a Class C stream with C Standards.
- Stream 6: Stream 6 had a channel width of 3' with a 0.5" – 1" water depth at the time of the site visit. The OHWE was approximately 3" above base streambed elevation with silt/cobble substrate.
- Stream 7: Stream 7 had a channel width of 15' – 20' with a water depth of 4" – 12" at the time of the site visit. The OHWE was approximately 3" above base streambed elevation with a cobble/boulder substrate.

- Stream 8: Stream 8 had a channel width of 3' – 5' with a water depth of 2" with pools up to 14" at the time of the site visit. The OHWE was approximately 5" above base stream elevation. Stream 8 corresponds to a mapped NYSDEC Birch Creek tributary (Giggle Hollow Brook - Waters Index No. H-171-52-3), which is a Class B stream with B(T) standards with a cobble/boulder substrate.
- Stream 9: Stream 9 had a Channel width 1-3" with minimal water flow (less than 1/2" depth) at the time of the site visit. The OHWE was observed at 5" above streambed base elevation with cobble/gravel substrate.
- Stream 10: Stream 10 had a channel width of 6' – 10', narrowing to 3' at the culvert under the rail line at the time of the site visit. The water depth was of 0.5 – 2" and the OHWE was observed approximately 2" above base streambed elevation. The substrate consisted of cobbles and gravel.
- Stream 11: Stream 11 at Big Indian Park had a channel width of 5' – 12' and a water depth of 2" – 6" at the time of the site visit. The OHWE was observed at 5 – 7" above the streambed elevation with a cobble/gravel substrate. A large scour pool with a depth of 5' – 6' and a cobble/boulder substrate was observed near the west bank at the bridge replacement location with. Stream 11 corresponds with the mapped NYSDEC Esopus Creek (Waters Index No. H-171), which is a Class C stream with C(TS) standards.

3.1.2. Historic and Cultural Resources Coordination

A review of the New York State's Office of Historic Preservation's ("SHPO") Cultural Resource Information System ("CRIS") was completed. The trail terminus at Highmount is located in an archaeologic sensitive area. Additionally, the corridor abuts the Pine Hill Historic District (National Registration Identification: 11NR06297). The corridor contains several features which could be considered historic such as the bridge structures, the foundation remains, and the corridor itself. A query was been submitted through the CRIS system to initiate coordination with SHPO on December 7, 2020. A response from SHPO indicated that coordination with their agency cannot progress further until the SEQR process and a Lead Agency for the project has been established or coordination with a permitting agency requiring SHPO coordination such as NYSDEC or USACE has begun. This project is listed as 20PR07733 in the CRIS database and coordination should be continued upon one of their criteria for further coordination be met. Until that time, this project will remain open within the CRIS system.

3.1.3. Threatened and Endangered Species and General Habitat

<u>Federally Protected Species</u>

The United States Fish and Wildlife Service's (USFWS) New York Field Office's website was reviewed to determine whether any federally listed endangered, threatened, or candidate species are reported to inhabit the project corridor. The USFWS' Information for Planning and Consultation (IPaC) System (USFWS, 2018) reported no federally threatened species. The species resource list from the IPaC query is provided in Appendix B. It is important to note that this resource will need to be re-queried in final design to ensure compliance with the ESA.

New York State Protected Species

A query of the NYSDEC (2018) Nature Explorer website indicated the eastern terminus of the corridor is located in the vicinity of a Natural Community (Beech-maple mesic forest and Hemlock-northern hardwood forest) and Rare Animals not specifically listed by NYS. A copy of the ERM results is provided in Attachment B.

The New York Natural Heritage Program was contacted for information regarding the reported presence of any state-listed endangered species, threatened species, species of special concern, or significant natural communities within or adjacent to the project corridor. A response received on November 20, 2020 indicated that there are no records of state-listed threatened or endangered species for the project corridor. However, a rare beetle, the Appalachian tiger beetle (*Cicindela ancocisconensis*), was documented approximately 0.25 miles south of where the project is proposed to cross the Esopus Creek. It is recommended that impacts to the Esopus Creek be avoided, including from runoff and erosion, to protect the habitat for this species. The Appalachian tiger beetle can be found in Erie, Wyoming and Livingston counties in western New York; Ulster, Sullivan and Greene counties in the Catskills region; and Essex and Warren counties in the eastern Adirondacks. The species is riparian and is found in forest edge streams and prefers to inhabit gravel bars and shaded sand beaches.

Covertypes

The covertypes of the project corridor were also characterized during the site visit. The corridor is predominantly forested with mature trees including hop hornbeam (*Ostrya virginiana*) ranging from 6-12" diameter at breast height (DBH), American basswood (*Tilia americana*) ranging from 4-6" DBH, black cherry (*Prunus serotina*) ranging from 12 – 14" DBH, white ash (*Fraxinus americana)* ranging from 12 – 16" DBH, sugar maple (*Acer saccharum*) ranging from 8 – 24" DBH, eastern hemlock (*Tsuga canadensis*) and white pines (*Pinus strobus*) ranging from 4" – 24" DBH, with striped maple (*Acer pensylvanicum*) and beech (*Fagus americana*) saplings (<1" DBH) scattered throughout. Witch hazel (*Hamamelis virginiana*) was also present with DBH of 1" – 5".

It is recommended that tree removals be limited to those necessary to ensure proper safety of the trail corridor to preserve the natural communities the corridor passes through. Additionally, all stream work should be completed in accordance with all State and Federal regulations to minimize impacts to these communities and the fauna which inhabit them, including the Appalachian tiger beetle and aquatic organism populations.

3.1.4. Floodplain Analysis

A portion of the corridor surrounding the Esopus Creek is mapped within a Federal Emergency Management Agency (FEMA) 100-year floodplain. Work within this floodplain should be carefully analyzed and fully vetted with the County and the Town of Shandaken. The Town has seen an increase of severe flooding events in the past few

decades and the effects of global warming on the frequency of large storm events has been well documented. Designs within the Esopus Creek floodplain should take into consideration the impacts of global warming and the most recent and up to date NYSDOT Bridge design standards and recommendations for new structures within the floodplain.

In addition to the Esopus Creek, the Alton Creek (outflow of the Belleayre Mountain snow making pond) and a tributary to the Alton Creek are both FEMA mapped regulatory floodways. The existing and proposed culverts below the trail should be fully analyzed during the design process to determine their existing hydraulic capacity to withstand future flooding events and assess potential improvements to provide improved flood resiliency and longevity of the trail system.

All work within the mapped floodplains should be coordinated with the Town of Shandaken as a floodplain impact permit will be required for any work within the floodplains. Stormwater management needs to account for flood prone areas that receive runoff from the trail corridor. Pine Hill area and culverts should be considered in the overall plan to help mitigate flooding and may be eligible for funding.

The Upper Esopus Creek Watershed Turbidity/Suspended Sediment Monitoring Study: Biennial Status Report was completed by NYC DEP in March 2021 and identifies the project area and associated streams, such as the Birch Creek and Esopus Creek as high gradient/high energy mountain streams. Monitoring stations within the system collect stream data such as flow and turbidity and may be useful to develop a hydraulic analysis during the design of the project. The development of the U&D Trail project should be coordinated with this study and subsequent analyses, such as the Pine Hill Flood Analysis Study, to also provide benefits "downstream" of the project area. The following figure is an excerpt from the report and gives an overview of the study area.

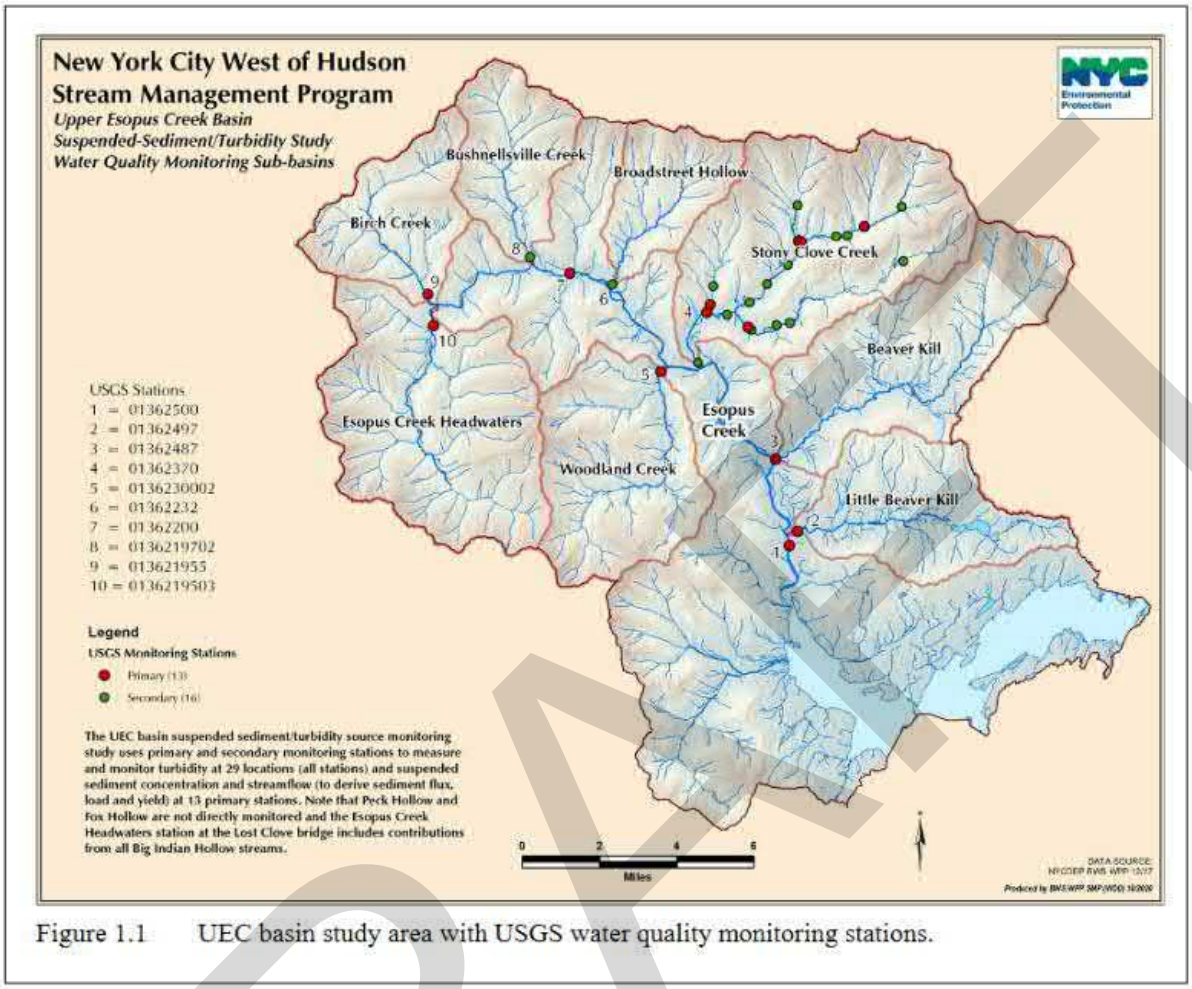


Figure 1.1 UEC basin study area with USGS water quality monitoring stations.

Figure 3-1: NYC DEP Stream Management Program map & Monitoring Stations

3.1.5. Hazardous materials

It is anticipated that hazardous materials may be encountered along the corridor due to its previous use as a railroad. As such, B&L anticipates the need to sample soils at various locations throughout the corridor to characterize and determine the need for disposal in accordance with State and Federal regulations.

Sampling of composite samples should be spaced throughout the corridor, with focus being on areas where large amounts of fill may be disturbed. The samples should be submitted to a qualified lab for the analysis of semi-volatile organic compounds (SVOCs) using EPA Method 8270D, PCBs using EPA Method 8082A, and RCRA Metals using EPA Method 6010B. Chemical parameter concentrations should be compared to the Part 375 Restricted Residential Use Soil Cleanup Objectives (SCOs).

In accordance with the provisions of NYCRR Part 360.13(c), the on-site reuse and/or disposal of the previously excavated and stockpiled soil material is deemed acceptable as long as the stockpiled soil is placed above the groundwater table and also covered with a minimum 12-inch thick layer of clean fill material or a layer of asphalt or other impermeable material. If possible, it is recommended that contaminated soils be reused on-site for grading purposes. However, should it be determined that any soil material is to be transported off site, additional analytical testing (Toxicity characteristic leaching procedure (TCLP) must be conducted in order to determine if the excavated soil material can be properly transported and disposed of at a permitted solid waste facility in accordance with State and Federal regulations.

3.2. Anticipated permits

A permit from the USACE under Section 404 of the Clean Water Act will be required for stream or wetland disturbances by the project. In addition, an Article 15 permit would be required from NYSDEC for project work disturbing State-protected streams. All streams that are not mapped by the NYSDEC flow northward into mapped stream Birch Creek (H-171-52), parallel to NYS Route 28. Birch Creek flows into the Esopus Creek, a tributary of the Hudson River, a Traditionally Navigable Water. It is likely that these hydrologic connections qualify all identified stream resources as Waters of the United States (WOTUS). Jurisdictional determinations will be made under future permit assessment efforts, but final jurisdiction is determined by the USACE. It is anticipated that any impacts to these resources will be minimized and qualify for coverage under USACE Nationwide Permit (NWP) 14 for Linear Transportation Projects. Projects authorized in New York streams by the USACE under the NWP Program also require Water Quality Certification from NYSDEC under Section 401 of the Clean Water Act. Due to the classification of Streams 1, 2, 8, and 11, an Article 15 Stream Protection Permit would also be required from NYSDEC for any activities that would affect the bed or banks of these waterbodies. A detailed permit review will be completed during project design to confirm which permits would be required. Permit requests will be submitted to the USACE and NYSDEC using a Joint Application for Permit.

This section of the D&U railroad corridor falls within the New York City Watershed and drains to the Ashokan Reservoir, which is a terminal reservoir that supplies New York City with drinking water through a series of underground aqueducts. The New York City Department of Environmental Protection ("DEP") manages this drinking water system which includes a series of regulations within the watersheds for their controlled reservoirs. This project will require the preparation of a SWPPP because the project will be disturbing more than one acre of land. This is also a requirement of the NYSDEC's Statewide Pollution Discharge Elimination System ("SPDES") permit. The SWPPP for this project will need to be submitted to DEP for their review and approval. However, no additional requirements beyond the NYSDEC requirements are expected from DEP for this project. The construction of bicycle and pedestrian path projects are exempt from the inclusion of post construction stormwater controls. The SWPPP prepared for this project will require erosion and sediment control practices such as silt fencing, fiber logs, temporary seed and mulch, and rolled erosion control blankets.

A Highway Work Permit will be required by the New York State Department of Transportation ("NYSDOT") if work occurs within the NYSDOT Right of Way of State Route 28. In addition, a County Highway Work Permits or review may be necessary for work occurring within County roadway ROW. As mentioned in Section 3.1.4, a Town of Shandaken floodplain impact permit will be required for impacts to the floodplain.

4.0 CONSTRUCTION ESTIMATE AND PHASING

Based on the existing condition assessment discussed in sections 1-3 of this report, the conversion of the existing U&D RR Corridor to a multi-use trail is feasible from an engineering and environmental perspective. The existing conditions of the corridor closely resemble the pre-construction conditions found on other rail-to-trail projects developed by Ulster County. The recommended scenario to construct the trail is to construct the entire 5.0 miles of trail from Highmount to Big Indian. This would allow for one contractor to perform all of the necessary work and provides for greater efficiency for the contractor on the project. However, B&L understands that constructing the trial in its entirety may be cost prohibitive and therefore recommends constructing the project in two or three phases progressed in logical sections based on ease of construction, access, trailhead construction, and associated costs. A complete cost estimate spreadsheet is included in Appendix C which allows for costs to be further phased and analyzed.

To convert the existing U&D corridor to a trail system, the existing railroad infrastructure such as the steel tracks and hardware, and wooden ties will need to be removed. A crushed stone base course will need to be installed throughout the entire corridor due to the poor existing railroad ballast conditions. A crushed stone top course will also need to be installed to provide a smooth ADA compliant riding and walking surface while also providing durability and minimal maintenance for the County in the future. An asphalt surface course was considered but not progressed. Asphalt surfaces are 100% impervious and DEP watershed regulations require post construction stormwater management practices are installed to collect the stormwater runoff from the asphalt surface. This would add significant cost to the project and was not considered further. Drainage improvements are necessary in various locations throughout the corridor to repair erosion damage and to rehabilitate or replace existing drainage infrastructure such as swales, drainage pipes, and the large stone culverts that carrying the various streams and storm conveyances under the corridor. A complete list of the recommended improvements to the existing drainage infrastructure is included in Appendix D. Local community connections are recommended in Pine Hill and Big Indian, however, the majority of users of the trail are anticipated to be visitors, thus requiring vehicle parking areas. Three trailheads are recommended: They are in Highmount, the Belleayre Beach DUA in Pine Hill, and at the Big Indian Town Park in Big Indian.

4.1. Suggested Construction Phasing

Constructing the trail in separate phases may be an attractive option to the County depending on funding for the project. There are logical construction termination points that may serve as limits of work for a phased project development. Under phased development, portion(s) of the trail can be built when funds become available and phases already constructed can opened to the public and used while other sections are under construction. Constructing the trail in different phases may cost more overall, however, it would not be enough to be cost prohibitive and may be beneficial to construct a portion of the trail while funding from alternative sources is secured.

To maintain logical terminations, the most readily apparent way to split this project is geographically based on the locations of the trailheads. The table below shows three segments of the trail from Highmount to the Giggle Hollow Bridge, The Giggle Hollow Bridge to Lasher Road, and finally Lasher Road to Route 28.

4.2. Trail Construction Costs:

	HIGHMOUNT TO BIG INDIAN	HIGHMOUNT TO GIGGLE HOLLOW	GIGGLE HOLLOW TO LASHER ROAD	LASHER ROAD TO ROUTE 28
MAJOR CONSTRUCTION (ITEMS):	COST	COST	COST	COST
CLEARING & GRUBBING:	$377,000	$52,000	$294,000	$35,000
RAIL, HARDWARE & TIE REMOVAL	$721,000	$369,000	$291,000	$63,000
EARTHWORK:	$173,000	$88,000	$70,000	$15,000
TRAIL STONE:	$979,000	$501,000	$395,000	$85,000
RAILING & FENCE	$411,000	$182,000	$152,000	$57,000
DRAINAGE	$760,000	$478,000	$258,000	$17,000
ACCESS ROAD IMPROVEMENTS	$280,000	$190,000	$190,000	$0
EROSION CONTROL:	$90,000	$46,000	$37,000	$8,000
LANDSCAPING, BENCHES, SIGNS/PANELS:	$172,000	$88,000	$70,000	$15,000
WOODCHUCK HOLLOW BRIDGE	$430,000	$430,000	$0	$0
GIGGLE HOLLOW BRIDGE	$510,000	$0	$510,000	$0
SHORT SPAN STRUCTURE #1	$50,000	$0	$50,000	$0
LASHER ROAD CROSSING	$200,000	$0	$200,000	$0
ESOPUS CREEK CROSSING	$1,800,000	$0	$0	$1,800,000
SHORT SPAN STRUCTURE #2	$50,000	$0	$0	$50,000
HIGHMOUNT TRAILHAED CONCEPT	$107,000	$107,000	$0	$0
BELLLEAYRE CONCEPT C	$143,000	$143,000	$0	$0
BIG INDIAN PARK MODIFICATIONS	$49,000	$0	$0	$49,000
SUBTOTAL CONSTRUCTION ITEMS	$7,302,000	$2,674,000	$2,517,000	$2,194,000
FIELD CHANGE ORDER (USE 5% of total)	$365,100	$133,700	$125,850	$109,700
SURVEY	$73,020	$26,740	$25,170	$21,940
MOBILIZATION (4%)	$292,080	$106,960	$100,680	$87,760
CONSTRUCTION (2021 DOLLARS)	$8,032,200	$2,941,400	$2,768,700	$2,413,400
INFLATION (3%/yr)	$481,932	$176,484	$166,122	$144,804
TOTAL PROJECT CONSTRUCTION COSTS (2023 DOLLARS):	$8,520,000	$3,120,000	$2,940,000	$2,560,000
ENGINEERING	$600,000	$220,000	$210,000	$180,000
CONSTRUCTION INSPECTION & ADMIN	$1,030,000	$380,000	$360,000	$310,000
ROW INCIDENTALS AND ACQUISITIONS	$0	$0	$0	$0
TOTAL COSTS:	$10,150,000	$3,720,000	$3,510,000	$3,050,000

The Access Road Improvements line includes the costs for establishment of the temporary access roadways that in B&L's opinion, will benefit the project the most. Section 1.4.4 further outlines the potential access routes that the contractor could utilize to access different portions of the project. The routes selected for inclusion with the project costs and the cost of the routes are as follows:

Access Road Construction Costs:

From Location	To Location	Cost
Lake Ave in Pine Hill	Giggle Hollow Bridge/RR Corridor	$190,000
Route 28	Winding Mountain Road/RR Corridor	$150,000
Lasher Road	Cross Roads Ventures, LLC property/ RR corridor	$40,000
Bonnie View Ave/ Pine Hill	Double Horseshoe Curve/RR Corridor	$180,000**

** Not included in cost estimate

In B&L's opinion, the cost to construct a temporary access road on Bonnie View Ave in Pine Hill would not be of value for the contractor to construct at the County's cost. The corridor can be accessed via Station Road near by the Woodchuck Hollow Bridge. The double horseshoe curve is 0.5 miles from the Woodchuck Hollow Bridge along the railroad alignment. This roadway could be included as an option to be constructed at the contractor's own cost if they see it as beneficial.

In addition to the trail construction, gravel parking areas will be necessary to be constructed for the trail. The anticipated costs for the trailheads are shown below. Conceptual drawings of the trailheads are included in Appendix A. The cost estimate for the Concept D trailhead in Big Indian was selected for inclusion in this report because it is the only feasible option that does not include ROW takings or agreements with other property owners. These proceedings can be unpredictable and costly to pursue. Ideally, the existing park in Big Indian would be used the parking area for trail access and a trail connecting the park to the rail trail would be constructed.

	HIGHMOUNT CONCEPT	BELLEAYRE CONCEPT A	BELLEAYRE CONCEPT B	BELLEAYRE CONCEPT C	BIG INDIAN CONCEPT D
MAJOR CONSTRUCTION ITEMS:	COST	COST	COST	COST	COST
CLEARING & GRUBBING:	$0	$0	$0	$0	$5,000
EARTHWORK:	$21,000	$122,000	$32,000	$47,000	$12,000
SUBBASE:	$56,000	$55,000	$32,000	$47,000	$16,000
DRAINAGE IMPROVEMENTS:	$5,000	$25,000	$25,000	$25,000	$8,000
EROSION CONTROL:	$8,000	$9,000	$10,000	$9,000	$0
LANDSCAPE IMPROVEMENTS	$17,000	$19,000	$19,000	$15,000	$8,000
FOUNTAIN REMOVAL:	$0	$100,000	$0	$0	$0
SUBTOTAL CONSTRUCTION ITEMS	$107,000	$330,000	$118,000	$143,000	$49,000
FIELD CHANGE ORDER (USE 5% of total)	$5,350	$16,500	$5,900	$7,150	$2,450
SURVEY	$1,070	$3,300	$1,180	$1,430	$490
MOBILIZATION (4%)	$4,280	$13,200	$4,720	$5,720	$1,960
CONSTRUCTION (2021 DOLLARS)	$117,700	$363,000	$129,800	$157,300	$53,900
INFLATION (3%/yr)	$7,062	$21,780	$7,788	$9,438	$3,234
TOTAL CONSTRUCTION COSTS (2023 DOLLARS):	$124,762	$384,780	$137,588	$166,738	$57,134
ENGINEERING	$10,000	$30,000	$10,000	$20,000	$10,000
CONSTRUCTION INSPECTION & ADMIN	$20,000	$50,000	$20,000	$30,000	$10,000
ROW INCIDENTALS AND ACQUISITIONS	$0	$0	$0	$0	$0
TOTAL COSTS:	$155,000	$465,000	$168,000	$217,000	$78,000

4.3. Funding Opportunities

Potential funding opportunities for the design and construction of the Shandaken trail consist of the following:

- NYS OPHRP – Recreational Trails Grant Program. Funding source is FHWA and is capped at $250k
- NYS OPRHP – Environmental Protection Fund Grant Program for Parks, Preservation and Heritage. Program is typically capped at $600k. However, if total project is over $4 Million, up to $1 Million may be requested. (Both OPHRP grants are applied for and awarded through the CFA program which is typically due annually at the end of July.)

- NYS DEC and ORDA by contacting the local legislatures and governor's office to allocate state funds for the construction of the trail. Both agencies operate facilities adjacent to the trail and would benefit greatly from its construction.
- Catskill Park Coalition
- FHWA funding administered through the NYSDOT Locally Administered Federal Aid Program.
- Private donations from organizations such as the Open Space Institute (OSI).

4.4. Potential Benefits

Over the past year, recreational trail usage and other outdoor activity throughout the US has skyrocketed due to the COVID-19 pandemic and associated lockdowns that limit indoor activities. People have flocked to outdoor facilities such as parks and trails. The nearby Ashokan Rail Trail, recently opened in October of 2019, saw over 200,000 users in 2020.

The Catskill Mountain Rail Trail Economic Impact Analysis published in 2013 by Camoin Associates assessed the economic benefits of the conversion of the entire 38 mile U&D Railroad Corridor to a Trail. The study concluded that the entire 38 miles U&D corridor would generate 140,000 annual visitors (if converted to a trail) and would account for an average of $3.1 Million in spending, or roughly $22 per visit per person. This average cost includes local users and those who visit the trail from more urban areas who would rent a bike, eat at local restaurants, and stay in local hotels for a weekend. Assuming that the trail generates 50,000 visitors annually (25% of the nearby Ashokan Rail Trail 2020 visitation), the conversion of the 5 mile corridor between Big Indian and Highmount would result in $1.1 Million in spending. This number is an interpolation using recent studies to highlight the potential benefit to converting this corridor to a trail and includes more anticipated visitors than anticipated in the Camoin Study due to the COVID pandemic.

In addition to providing an outlet for people to enjoy the outdoors, recreational trails have proven to provide both economic and health benefits to the surrounding community. In terms of health benefit, a report prepared by Stone Consulting in 2015, assessed the health benefits of the conversion of the entire U&D corridor into a trail system. The report concluded that a trail will have a $3.29/trip-mile benefit per user. For the 5 mile section between Big Indian to Highmount, the trail would account for a $411,000 benefit to the County using the $3.29/person/trip/mile and assuming an average of 2.5 miles traversed per person.

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