

**ASSESSMENT OF THE HAWKINSVILLE DAM**  
**ON THE BLACK RIVER**

**BOONVILLE, NEW YORK**

March 12, 2012

MMI #3967-01



***Prepared for:***

State of New York  
Hudson River – Black River Regulating District  
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## **1.0 INTRODUCTION**

### **1.1 Project Background**

The Hawkinsville Dam, located on the Black River, is owned by the State of New York and is operated and maintained by the Hudson River-Black River Regulating District (the District). The dam was originally constructed in 1915 to provide operating power to the Brant Excelsior Company and was rebuilt in 1929. Ownership was subsequently transferred to the State of New York. The District retained Milone & MacBroom, Inc. (MMI) to evaluate the dam relative to the potential benefits and cost for its repair or removal.

The Hawkinsville Dam is located on the Black River in the town of Boonville, hamlet of Hawkinsville, Oneida County, New York. It is registered with the New York State Department of Environmental Conservation (NYSDEC) Office of Dam Safety as a "Class B – Intermediate Hazard" and has been identified as not meeting the current safety requirements for such a classification. Figure 1 is a location plan of the dam and surrounding area.

The specific work tasks undertaken in the subject assessment include the following:

- Review existing data and reports
- Conduct a visual inspection of the dam and impoundment
- Characterize the physical quality of sediment in the upstream impoundment
- Assess watershed hydrology
- Evaluate spillway capacity
- Develop a cost opinion for dam rehabilitation
- Develop a cost opinion for dam removal
- Identify likely permitting requirements
- Present results to the District



**SOURCE:**  
 USGS Topographic Maps:  
 Copyright:© 2011 National Geographic Society, i-cubed  
 via ArcGIS Plug-In (ArcGIS on services.arcgisonline.com)

**LOCATION MAP**

**LOCATION:**  
 Black River, Boonville, NY

**Figure 1**



**ASSESSMENT OF THE  
 HAWKINSVILLE DAM**

**Map By:** SMG  
**MMI#:** 3967-01  
**MXD:** P:\Location.mxd  
**Date:** August 2, 2011  
**Scale:** 1 inch = 2,000 feet


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## 1.2 Existing Data and Reports

As part of the National Dam Safety Program (NDSP), in 1981 the New York District of the U.S. Army Corps of Engineers (USACE) prepared a Phase I Inspection Report of the Hawkinsville Dam (No. NY-895). This report found the dam to be "unsafe" due to insufficient spillway capacity and suggested that a severe storm could overtop the dam, potentially causing failure of the structure. Subsequent routine inspections of the dam performed by the NYSDEC in 2001 and 2007 found structural deficiencies including seepage, cracking, and undesirable vegetative growth, indicating the dam was in need of maintenance. In 2007, the NYSDEC alerted the District of these deficiencies and requested that they be corrected in accordance with the NYSDEC dam safety regulations.

A number of independent consultants and governmental agencies have since undertaken analysis of the structure, its impoundment, and of the Black River in general. A summary of this work is presented below.

- State of New York District Corps of Engineers, 1981. Hawkinsville Dam, New York, Inventory No. NY-895, Phase 1 Inspection Report National Dam Safety Program.
- Gomez and Sullivan Engineers, P.C., 2006. Report on the Hydrology and Hydraulic Study for Hawkinsville Dam, Black River, Boonville, NY.
- Kleinschmidt, 2007. Hawkinsville Dam Breach Analysis, NatDam No. NY008695, Summary of Study and Analysis to Determine Spillway Design Flood.
- Department of the Army, Corps of Engineers, 2011. National Inventory of Dams.

## **2.0 EXISTING CONDITIONS**

### **2.1 Hydrologic Setting**

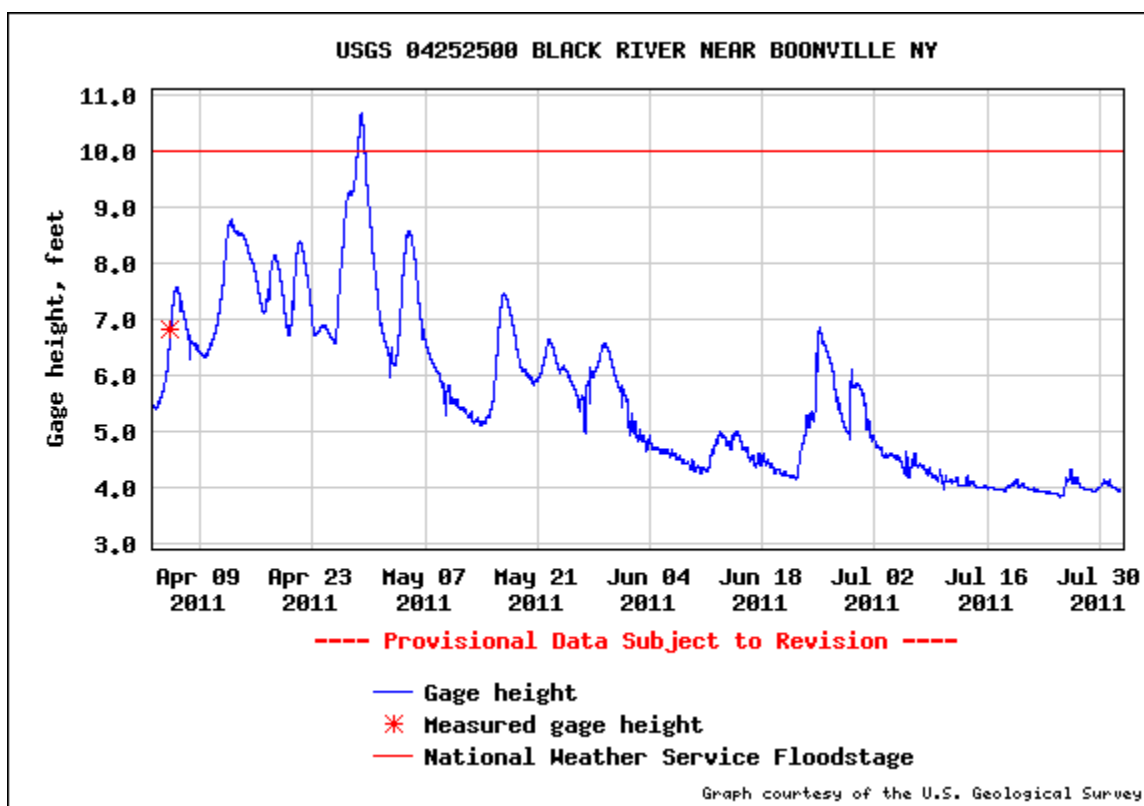
The drainage area of the Black River at the Hawkinsville Dam is estimated to be 270 square miles (Gomez and Sullivan, 2006). The United States Geological Survey (USGS) has continuously operated a stream flow gauge on the Black River (Gauge No. 04252500 near Boonville, New York, Latitude: 43°30'42", Longitude: 75°18'25") approximately 3.8 miles downstream of the Hawkinsville Dam. The drainage area at the USGS gauge is larger than at the dam. As such, measured flows at the gauge provide a conservative estimate of flows at the dam. The period of record of the gauge extends back to 1911. Figure 2 shows recent flows at the Boonville USGS gauge.

The Black River generally flows from east to west along its course. The upper portion of the river's 270 square mile watershed starts in the southwestern Adirondack Mountains. The watershed is primarily forested, with very little development throughout. The USGS *StreamStats* program estimates that 80.5% of the watershed area is forested, and 17.0% consists of lakes, ponds, and swampland.

Below the Hawkinsville Dam, the Black River flows another 75 miles north and west, through the city of Watertown, New York, draining to Black River Bay of Lake Ontario.

According to the USGS, river flow to the Hawkinsville Dam is occasionally regulated by several upstream reservoirs, the closest of which is approximately six miles upstream of the Hawkinsville Dam, known as Forestport Reservoir.

**FIGURE 2**  
**USGS Gauge No. 04252500, Black River at Boonville, New York**



In 2006, Gomez and Sullivan performed a hydrologic study using USGS gauge data. The annual peak records were assessed using a log-Pearson Type III distribution analysis, following the USGS *Guidelines for Determining Flood Flow Frequency* (Bulletin 17b). The results of that analysis were used to estimate the 100-year return frequency flood flow (1% chance recurrence flow) of 14,300 cubic feet per second (cfs).

Two alternative methods of hydrologic computation were conducted by MMI for this site. The USACE's Hydrologic Engineering Center Statistical Software Package (HEC-SSP) was used to perform a Bulletin 17b analysis using the same gauge data analyzed in 2006 but updated through 2011. As expected, this analysis produced results similar to those computed in the previous study, estimating a 1% chance recurrence flow at 14,258 cfs.

The USGS *StreamStats* program was also run to assess the drainage area based on the available USGS quadrangle topography. The *StreamStats* program uses watershed characteristics and regional regression equations based on data from all regional streams and rivers to predict flood flows of ungauged rivers based upon the regional averages. Results from all three analyses are presented in Table 1. Documentation of the analysis is included in Appendix A.

**TABLE 1**  
**Comparison of Hydrologic Computation Results**

|                            | <b>Drainage Area<br/>(sq. mi.)</b> | <b>2-Year<br/>(cfs)</b> | <b>10-Year<br/>(cfs)</b> | <b>50-Year<br/>(cfs)</b> | <b>100-Year<br/>(cfs)</b> | <b>500-Year<br/>(cfs)</b> |
|----------------------------|------------------------------------|-------------------------|--------------------------|--------------------------|---------------------------|---------------------------|
| Gomez and Sullivan         | 270                                | -                       | -                        | -                        | 14,300                    | -                         |
| HEC-SSP<br>(Bulletin 17b)  | 304                                | 5,765                   | 9,096                    | 12,592                   | 14,259                    | 18,624                    |
| USGS<br><i>StreamStats</i> | 259                                | 5,710                   | 8,940                    | 11,800                   | 13,300                    | 16,400                    |

\*Note: USGS gauge reports contributing watershed area of 304 square miles.

## 2.2 Hawkinsville Dam

The Hawkinsville Dam is a run-of-the-river dam consisting of a 300-foot long by 12-foot high concrete spillway section abutted by two concrete training walls and two short earthen embankments (see Photo 1). The concrete training walls rise approximately five feet above the spillway elevation. The spillway is oriented east-west, and the Black River flows in a northerly direction over the spillway. Located on the left bank (looking downstream, or "river-left") are two abandoned three-foot wide by four-foot high timber sluice gates that were once used to control water flow through a 5.5-



*Photo 1 – The Hawkinsville Dam as viewed from the river-left bank.*

foot diameter steel penstock outlet pipe and a concrete low-level drain, respectively. The gate structure has been filled in, and its operability is not known. The penstock was used to supply water power for the operation of machinery at a mill located downstream on the left bank (see Photo 2). The mill structure has since been demolished and removed; however, concrete portions of the building's foundation remain. The right bank near the dam is composed of a poorly defined man-made earthen embankment, which is lower in elevation than the concrete training walls.

The Hawkinsville Dam is located approximately 315 feet upstream of the Hawkinsville Road (County Road 61/Woodgate Drive) bridge and is situated at the head of a naturally occurring rapids section of the Black River. The dam was constructed on a bedrock outcrop, which forms the rapids (see Photo 3).



*Photo 2 – Low-level impoundment drain and penstock on river-left bank.*



*Photo 3 – Ledge outcropping downstream of the Hawkinsville Dam.*

A historic stone masonry bridge abutment is located downstream of the dam on the river-right bank (see Photo 4), which likely supported a bridge that connected Edmonds Road to Hawkinsville Road. The bridge was likely replaced with the more modern bridge carrying Hawkinsville Road over the Black River.



*Photo 4 – Historic bridge abutment downstream of the Hawkinsville Dam, river-right bank.*

The first dam constructed on the Black River at the location of the present-day Hawkinsville Dam was built in 1823 and made entirely of wood. The dam was situated at the top of rapids and generated water power for a number of local industries and mills. This spurred development around the dam, including a chair factory, a tannery, a wagon shop, two cheese factories, three stores, four blacksmith shops, and numerous hotels and saloons (Boonville Herald, 1966).

In 1846, the Black River canal was constructed, and a feeder was planned through the center of the hamlet of Hawkinsville. In 1890, the excelsior mill was constructed by Mr. E. C. West from Lowville, New York. In the early 20th century, production and export of excelsior (fine wood shavings) in the state of New York was a growing industry. Only two other states surpassed New York's production of the product. The excelsior being produced by the mill at that time was used by drug companies, casket makers, glue manufacturers, packaging, and stuffing for toys and furniture.

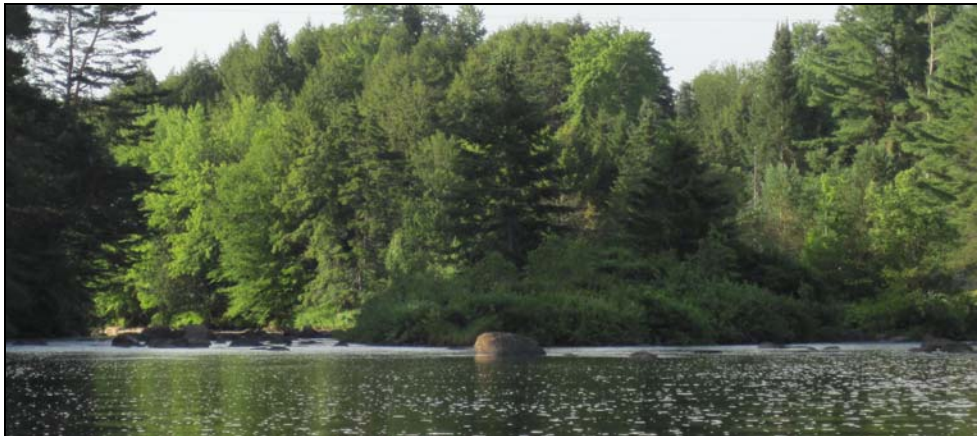
The current Hawkinsville Dam was constructed in 1915 by the Brant Excelsior Company to operate machinery in the mill. The mill was damaged by a fire and rebuilt in 1929. The mill closed in July 1966. The last bale of excelsior produced by the mill is kept at the Adirondack Museum at Blue Mountain Lake, and the shredding machine that produced it sits beside it.

### **2.3 Impoundment Characteristics**

The Hawkinsville Dam impoundment has been reported as being  $\pm 6,340$  feet long, with 1,100 acre-feet of storage between the top of spillway and the top of dam (New York District Corps of Engineers, 1981). Field assessment by MMI staff during normal flow conditions (July 27, 2011), with approximately two inches of water flowing over the spillway, determined that the impoundment extends upstream from the dam approximately 7,000 feet. The upstream end of the impoundment is just downstream of a mid-channel island where supercritical flow was observed through a section of rapids (see Photos 5 and 6).



*Photo 5 – Aerial view of the Hawkinsville Dam impoundment.*



*Photo 6 – Looking upstream at mid-stream island and rapids (upstream end of the impoundment).*

The Hawkinsville Dam's impoundment is linear in shape, fairly uniform in width, and only marginally impounded. Detailed survey, hydraulic modeling, and mapping would be necessary to definitively quantify changes in upstream water surface elevations; however, initial field assessment indicates that were the dam to be removed changes in river width would be modest.

The impoundment was surveyed by MMI using a global positioning system (GPS) to quantify the depth of water and thickness/types of sediment. Measurements were taken at 11 transects

(cross sections), designated as CS1 through CS11 (numbered from upstream to downstream). Figure 3 provides a visual representation of the water depth at each surveyed location; Figure 4 presents the sediment types; and Figure 5 presents the thickness of the sediment layer. Figure 6 presents this data in tabular format.

Water depths in the impoundment ranged from two to 10 feet. Generally, the deepest water was closest to the dam, extending upstream approximately 2,000 feet, where depths were generally between five and 10 feet.

Water depths at CS1 ranged from four to five feet, the channel at this location approximately 150 feet wide. The banks were steep but vegetated and stable. There was no sign of in-water vegetation. Water velocities were observed to be higher at the head of the impoundment. The straight section of the impoundment between CS2 and CS6 shared similar characteristics. Channel width was approximately 200 feet, and water depths were between four and six feet. Small amounts of in-water vegetation were observed along the river-left bank where water depths were slightly shallower, and the sediment layer was slightly thicker.

## **2.4 Sediment Assessment**

On July 28, 2011, MMI investigated sediments in the Hawkinsville Dam impoundment extending approximately 7,000 feet upstream of the dam and ending just downstream of an existing mid-channel island. Transects were established across the river at a spacing of 300 to 800 feet. At each transect, the sediment was probed manually using a calibrated metal rod to refusal. Points were GPS located, and depth to refusal was recorded. This data is depicted in Figure 3.



**Legend**

**Water Depth**

- 0.0' - 2.0'
- 2.1' - 4.0'
- 4.1' - 6.0'
- 6.1' - 8.0'
- 8.1' - 9.8'

HAWKINSVILLE DAM

BLACK RIVER

FLOW

CS 11

CS 10

CS 9

CS 8

CS 7

CS 6

CS 5

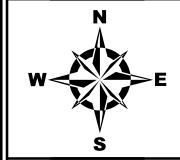
CS 4

CS 3

CS 2

CS 1

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SOURCE:  
 Aerial: Microsoft Virtual Earth (2007-2008)  
 Sediment Layer Type: Measured by MMI Engineers during a data collection site visit on 7/28/11.

**SURVEYED WATER DEPTHS (JULY 28, 2011)**  
**ASSESSMENT OF THE HAWKINSVILLE DAM**  
**BLACK RIVER, BOONVILLE, NEW YORK**

Map By: SMG  
 MMI#: 3967-01  
 MXD: P:\Depths.mxd  
 Date: 08/01/2011  
 Scale: 1 inch = 400 feet

**Figure 3**



**Legend**

**Sediment Layer Type**

- Bedrock
- Cobble
- Muck
- Sand w/ trace Gravel, Cobble, Silt

**HAWKINSVILLE DAM**

**BLACK RIVER**

**FLOW**

CS 11

CS 10

CS 9

CS 8

CS 7

CS 6

CS 5

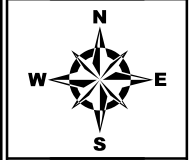
CS 4

CS 3

CS 2

CS 1

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**SOURCE:**  
 Aerial: Microsoft Virtual Earth (2007-2008)  
 Sediment Layer Type: Measured by MMI Engineers during a data collection site visit on 7/28/11.

**SURVEYED SEDIMENT TYPE (JULY 28, 2011)**  
**ASSESSMENT OF THE HAWKINSVILLE DAM**  
**BLACK RIVER, BOONVILLE, NEW YORK**

Map By: SMG  
 MMI#: 3967-01  
 MXD:  
 P:\Sed\_Type.mxd  
 Date: 08/02/2011  
 Scale: 1 inch = 400 feet

**Figure 4**

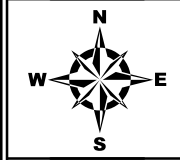


**Legend**

**Sediment Thickness**

- 0.0' - 0.5'
- 0.6' - 1.0'
- 1.1' - 2.0'
- 2.1' - 3.0'
- 3.1' - 4.1'

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**SOURCE:**  
 Aerial: Microsoft Virtual Earth (2007-2008)  
 Sediment Thickness: Measured by MMI Engineers during a data collection site visit on 7/28/11.

**SURVEYED SEDIMENT THICKNESS (JULY 28, 2011)**  
**ASSESSMENT OF THE HAWKINSVILLE DAM**  
**BLACK RIVER, BOONVILLE, NEW YORK**

Map By: SMG  
 MMI#: 3967-01  
 MXD:  
 P:\Sed\_Thick.mxd  
 Date: 08/02/2011  
 Scale: 1 inch = 400 feet

**Figure 5**



**Figure 6**

| Cross Section (CS #) | Point No. | Water Depth (ft) | Sediment Type                      | Sediment Type Thickness (ft) |
|----------------------|-----------|------------------|------------------------------------|------------------------------|
| CS 1                 | 1         | 4.0              | Sand and Gravel, with trace Cobble | 0.0                          |
|                      | 2         | 5.0              | Sand and Gravel, with trace Cobble | 0.0                          |
|                      | 3         | 4.0              | Sand and Gravel, with trace Cobble | 0.0                          |
|                      | 4         | 4.0              | Sand and Gravel, with trace Cobble | 0.0                          |
|                      | 5         | 3.0              | Sand and Gravel, with trace Cobble | 0.0                          |
| CS 2                 | 8         | 5.2              | Sand and Silt                      | 0.3                          |
|                      | 9         | 6.0              | Sand and Silt                      | 0.3                          |
|                      | 10        | 4.9              | Sand and Silt                      | 0.2                          |
|                      | 11        | 4.9              | Sand and Silt                      | 0.3                          |
|                      | 12        | 5.8              | Sand and Silt                      | 0.6                          |
| CS 3                 | 15        | 4.0              | Sand and Silt                      | 3.2                          |
|                      | 16        | 3.9              | Sand and Silt                      | 1.5                          |
|                      | 17        | 5.0              | Sand and Silt                      | 0.5                          |
|                      | 18        | 5.7              | Sand and Gravel                    | 2.2                          |
| CS 4                 | 21        | 5.6              | Sand                               | 1.6                          |
|                      | 22        | 5.7              | Sand                               | 3.1                          |
|                      | 23        | 6.5              | Sand                               | 1.7                          |
| CS 5                 | 26        | 8.2              | Muck                               | 0.9                          |
|                      | 27        | 7.5              | Sand                               | 1.6                          |
|                      | 28        | 5.7              | Sand                               | 3.3                          |
|                      | 29        | 4.5              | Sand                               | 3.6                          |
| CS 6                 | 33        | 4.8              | Muck                               | 2.8                          |
|                      | 34        | 5.0              | Sand                               | 4.1                          |
|                      | 35        | 6.8              | Sand                               | 1.6                          |
|                      | 36        | 9.8              | Muck                               | 1.4                          |
| CS 7                 | 39        | 8.4              | Sand                               | 0.2                          |
|                      | 40        | 7.1              | Sand and Gravel, with trace Cobble | 0.0                          |
|                      | 41        | 6.9              | Sand and Gravel, with trace Cobble | 0.0                          |
|                      | 42        | 4.2              | Sand and Gravel, with trace Cobble | 0.0                          |
| CS 8                 | 46        | 4.9              | Sand and Gravel, with trace Cobble | 0.0                          |
|                      | 47        | 6.7              | Sand and Gravel, with trace Cobble | 0.0                          |
|                      | 48        | 7.4              | Sand and Gravel, with trace Cobble | 0.0                          |
|                      | 49        | 6.0              | Sand                               | 0.3                          |
| CS 9                 | 53        | 5.5              | Cobble                             | 0.0                          |
|                      | 54        | 6.3              | Cobble                             | 0.0                          |
|                      | 55        | 6.8              | Cobble                             | 0.0                          |
|                      | 56        | 7.4              | Sand and Gravel, with trace Cobble | 0.0                          |
|                      | 57        | 5.6              | Cobble                             | 0.0                          |
|                      | 58        | 4.8              | Sand and Gravel, with trace Cobble | 0.0                          |
|                      | 59        | 3.8              | Bedrock                            | 0.0                          |
| CS 10                | 62        | 6.5              | Cobble                             | 0.0                          |
|                      | 63        | 7.4              | Cobble                             | 0.0                          |
|                      | 64        | 8.8              | Cobble                             | 0.0                          |
|                      | 65        | 7.8              | Cobble                             | 0.0                          |
|                      | 66        | 7.1              | Cobble                             | 0.0                          |
|                      | 67        | 6.5              | Cobble                             | 0.0                          |
| CS 11                | 70        | 8.5              | Muck                               | 0.8                          |
|                      | 71        | 8.0              | Sand and Gravel, with trace Cobble | 0.0                          |
|                      | 72        | 6.0              | Sand and Gravel                    | 3.4                          |
|                      | 73        | 3.1              | Sand and Gravel, with trace Cobble | 0.0                          |
|                      | 74        | 4.6              | Sand                               | 0.9                          |
|                      | 75        | 3.0              | Sand                               | 1.3                          |
|                      | 76        | 0.8              | Sand                               | 0.9                          |
|                      | 77        | 3.2              | Sand                               | 0.3                          |

Cross section 1 (CS1) at the upstreammost end of the impoundment showed little to no sediment deposit. The substrate of the riverbed was primarily gravel, cobble, and boulders indicative of natural riverbed armoring. Sediment in the straight section of the impoundment between CS2 and CS6 consisted mostly of sand, with some gravel and cobble. Sediment depths ranged from 0.5 feet to three feet.

The section of the river closest to the dam was deeper and had less sediment deposition than the upstream section. Beginning at CS6 and extending to CS10, sediment deposition began to lessen and transitioned to an armored bottom, similar to that found in CS1.

The final section just upstream of the dam showed greater sediment deposits and shallower water depths. The sediment there was similar to that found in the upper reaches of the impoundment in that it was primarily sand with some gravel and trace silt, and this layer was underlain with the same cobble and boulder channel armoring found upstream.

A composite sample of the sandy sediment was collected across the back of the dam along CS11. The sample consisted of mostly sand with traces of gravel. Downstream of the dam, the substrate is comprised of gravel and cobble with some boulders. Water is fast moving, characterized by riffles and white water. Multiple ledge outcroppings characterize the river-right portion of the channel. The Hawkinsville Road bridge, which is approximately 315 feet downstream of the dam, appears to have been constructed on bedrock.

### **3.0 DAM REPAIR ASSESSMENT**

#### **3.1 Size/Hazard Classification**

The Hawkinsville Dam is registered with the NYSDEC Bureau of Dam Safety as a "Class B - Intermediate Hazard," which indicates that a failure of the dam could potentially cause damage to homes, main highways, or minor railroads or interrupt the use or service of relatively

important public utilities. It was identified as not meeting the current safety requirements for such a classification. Specifically, the spillway of the dam was found to be inadequate to contain the design storm (spillway design flow, or SDF) of 150% of the 100-year flood flow, or 21,450 cfs.

### **3.2 Condition**

Based upon visual inspection by MMI, the Hawkinsville Dam is in fair condition. The concrete spillway is 300 feet long and approximately 12 feet high but is approximately 95 years old and showing signs of moderate deterioration. The left concrete training wall and outlet works show signs of cracking, spalling, and efflorescence. Although no major structural defects were noted, the condition of the majority of the spillway was difficult to ascertain due to spilling water.

An inspection performed in August 1981 by the New York District Corps of Engineers reported the following findings:

- The river-right earthen abutment is heavily overgrown with trees and brush. This abutment is poorly defined and is not at a consistent elevation. This area is referred to throughout this report as the low-lying land to the east of the spillway.
- The crest elevation of the river-right earthen abutment is lower in elevation than the top of the concrete training wall at the right abutment.
- Minor seepage occurs near the center of the earth-filled portion at the right abutment.
- The concrete surfaces at the left abutment of the spillway section are deteriorating.

Inspection of the present-day condition of the dam yields the same conclusions but to a more advanced degree. Deterioration of the concrete is more advanced, and seepage is still occurring.

A letter dated October 2, 2007 from the NYSDEC Bureau of Flood Protection and Dam Safety summarizes the results of an August 2007 dam inspection report stating: "The dam's condition has further deteriorated over time and needs attention to maintenance."

### **3.3 Repair Options**

Due to the condition of the spillway and earthen abutments, repair of the Hawkinsville Dam will be required if it is to remain in place. Repairs will require permitting through the NYSDEC Bureau of Dam Safety. Aside from minor structural defects such as the spalling concrete and/or seepage through the abutment, regulations stipulate that the dam be repaired to meet stability and structural requirements and sized to safely pass the spillway design storm as dictated by its hazard classification. Because the Hawkinsville Dam is classified as a "Class B – Intermediate Hazard," the spillway of the dam must safely pass the SDF of 150% of the 100-year flood flow, or 21,450 cfs, with one foot of freeboard.

In addition to providing the necessary capacity, repairs to the dam need to ensure the structural integrity of the spillway concrete and embankment as well as adequate scour protection. The NYSDEC Dam Safety Section also requires that the construction of any dam repairs include the installation or repairs to a functioning low-level outlet. Accordingly, deteriorating concrete on the river-left training wall would need to be repaired, and seepage through the eastern abutment area would have to be corrected. The current spillway is approximately 300 feet long and spans approximately 1.5 times the normal width of the river. The inadequate spillway capacity causes high river flows to bypass the spillway to the east, posing a moderate failure risk. The condition of the spillway itself was difficult to ascertain during the July 2011 inspections due to the water flow; however, it is possible that the spillway could be in need of structural repairs as well.

The spillway has a capacity of 12,600 cfs before it will overtop the training walls. The adjacent earthen abutment on the river-right bank is lower in elevation than the training walls and, therefore, could cause a failure even before this stage is reached. Bringing the dam into compliance with current dam safety regulations will require a substantial increase in the spillway capacity. The capacity of the spillway would need to be increased to be able to safely contain the SDF with the required one foot of freeboard and without overtopping the adjacent earthen abutments.

The following methods of repair have been assessed as part of the subject assessment:

- Increase the elevation of the earthen abutments to increase freeboard
- Lower the spillway elevation to increase freeboard
- Increase the spillway length to increase flow area
- Manually manipulate the spillway height to increase freeboard during flood events

The dam repair options are described in detail below.

#### Option 1 – Increase the Elevation of the Training Walls/Earthen Abutments

Land to the east of the concrete spillway is lower in elevation than the top of the training walls, likely due to erosion or settlement. In order to ensure that flow does not bypass the spillway during a significant flood, grade would have to be raised in the low-lying land to the east of the spillway such that 100% of the spillway design flow could be passed over the spillway with one foot of freeboard.

Based on a review of stage-discharge rating computations by Gomez and Sullivan (2006) and supplemented by computations performed by MMI (see spillway stage-discharge rating computations in Appendix B), the spillway as currently configured would require approximately 6.8 feet of head plus the minimum freeboard (7.8 feet in total) in order to safely pass the SDF. The existing training walls provide five feet of clearance; therefore, the training walls would need to be increased by approximately three feet, and the adjacent lands abutting the spillway would have to be raised by six feet in order to meet the elevation of the training walls.

Existing survey information is inadequate to determine the volume of fill that would be required to raise the land elevation eight feet above the spillway and at what point the proposed berm could tie into existing grade. The top of the spillway was found to be at elevation 1,044.25 feet NGVD29; therefore, the adjacent land would have to be continuously raised to elevation

1,052.05 feet NGVD29 until the fill area met with existing grade. However, based upon available topographic data, it appears that the closest high point at which to tie in is 500 feet away from the spillway on the opposite side of Edmonds Road. Implementation of this alternative would require a section of Edmonds Road to be raised by approximately three feet and would require easements over private land on the other side of Edmonds Road to facilitate the construction and maintenance of the earthen berm. The construction of the berm would physically impact these private properties. Additionally, they may be subject to increased flooding during certain design storms.

Ground water seepage from this low-lying area was also noted during multiple dam inspections due to a surcharge effect the impoundment has on the ground water table. Seepage can be mitigated with removal of unsuitable material and replacement with compacted impervious fill or by driving sheet piling through the affected area. This would require clearing of established vegetation and procurement of easements over private land along the river-right bank where clearing, access, and improvements are necessary.

Raising the adjacent earthen berms by three feet could raise water surface elevations upstream by up to (but not more than) three feet during a severe flood. Everyday water elevations that stay completely within the spillway would not be affected. Smaller flood discharges would be affected when the impoundment stage rises high enough to reach the abutments. Hydraulic modeling would have to be performed to truly determine the extent and magnitude of the upstream impacts. This option will impact property other than land owned by the state and under the Regulating District's jurisdiction.

#### Option 2 – Lower Spillway Elevation to Training Wall Elevation (Partial Dam Removal)

A reduction in the spillway elevation (partial dam removal) could achieve the same goal as raising the earthen abutments by providing the necessary freeboard over the spillway crest. Based on computations performed by MMI (see spillway stage-discharge rating computations in

Appendix B), the spillway would require approximately 6.8 feet of hydraulic head plus a minimum of one foot of freeboard (total of 7.8 feet) in order to safely pass the SDF.

The existing training walls provide five feet of clearance over the spillway; therefore, the spillway would have to be lowered by a minimum of 2.8 feet (to elevation 1,041.45 feet NGVD29) to achieve the necessary freeboard to pass the SDF below the training walls.

Although the extent and height of fill would be substantially less than Option 1, low-lying land east of the spillway would still have to be raised by up to three feet to elevation 1,049.25 feet NGVD29 in order to meet the elevation of the training walls. A four-foot high earthen berm would need to be constructed from the back side of the right training wall, approximately 250 linear feet to tie into the existing grade adjacent to the gravel parking lot (east of the dam).

### Option 3 – Increase Spillway Length

An increase in the spillway length could lower the headwater elevation by increasing the flow area over the dam. In order to lower the water surface of the SDF to remain within the existing training walls and also provide one foot of freeboard, the spillway would have to be lengthened by a minimum of 431 feet to a total length of 731 feet (see spillway stage-discharge rating computations in Appendix B).

The spillway currently spans 1.5 times the normal width of the river. Lengthening the spillway to achieve the desired length would require a significant amount of disturbance to the adjacent forested land unless the added length was constructed within the footprint of the existing impoundment. The spillway could be reconfigured to achieve added length by changing the shape to a horseshoe, W-shaped, or V-shaped spillway.

### Option 4 – Manual Spillway Height Regulation

Lowering the elevation of the spillway (partial dam removal, Option 2) could provide enough freeboard to pass the SDF but would lower the water surface elevations in the upstream

impoundment. This may have an undesirable effect on private property owners who own docks on the river and use the impoundment recreationally. The addition of inflatable or adjustable weirboards could allow the water surface elevation to be unchanged from existing conditions. However, installation of an adjustable weirboard system could be costly, and regulation of the dam could add significant long-term maintenance/management costs.

### **3.4 Permitting Considerations**

Dam repairs are regulated by the NYSDEC Dam Safety Section. The DEC issues permits based upon formal designs and would require that all work be performed under the supervision of a professional engineer. Further, many of the modification options discussed herein involve modification of the spillway combined with wetland and upland disturbance (particularly on the eastern bank). Other potential regulating programs include local Town of Boonville approvals, Section 404 and/or Section 10 permits from the USACE, Section 401 Water Quality Certification from the NYSDEC, Article 15 Protection of Waters permit, Stormwater Pollution Prevention Plan, or Federal Emergency Management Agency (FEMA) approval.

Floodplain mapping by FEMA upstream of a dam is delineated based upon the functional spillway. The floodplain shown on the Flood Insurance Rate Map (FIRM) would not likely change if the dam is repaired; however, some of the repair options considered could raise water surface elevations for upstream property owners in the event of a flood when compared to those that are seen under current conditions. If necessary, revisions to the mapping are processed by requesting a Conditional Letter of Map Revision (CLOMR).

The FEMA CLOMR process is a method for updating flood mapping and is warranted when flood elevations are affected by river conditions or changes such as discharge capacity at dams. The CLOMR process requires development of hydraulic models and the revision of Flood Insurance Rate Maps with revised flood lines (updated, postproject floodplain maps).

### 3.5 Summary of Repair Options

Dam repairs will be extensive and likely involve reconstruction of the spillway as well as filling in low-lying land abutting the spillway to the east. Repair options 1 and 2 require construction of a berm on the eastern abutment a minimum of four feet high and 250 feet long or higher/longer. Raising the elevation of the low-lying land abutting the spillway on the east bank could be costly and cause significant disturbance to well-established forested wetlands along the east bank. Only a portion of this land is located on property owned by the District. A property boundary survey prepared by a licensed land surveyor would be required in order to determine the adjacent landowners.

Options 1, 3, and 4 maintain the existing upstream pool at its current elevation. Option 2 would lower the upstream elevation by 2.8 feet and would be dependent upon the structural integrity of the existing spillway core and the ability to retrofit it. Option 3 is prohibitively expensive. Option 4 would require the most operation and maintenance. Table 2 provides a planning level cost opinion for each of the alternatives.

**TABLE 2**  
**Estimated Costs of Dam Repair Alternatives**

| <b>Option</b>   | <b>Estimated Cost</b> |
|---|-----------------------|
| Option 1 – Raise Earthen Berm and Training Walls            | \$1,418,000           |
| Option 2 – Lower Spillway and Raise Earthen Berm            | \$1,022,000           |
| Option 3 – Increase Spillway Length                         | \$7,032,000           |
| Option 4 – Spillway Height Regulation With Inflatable Crest | \$1,604,000           |

**NOTE: COSTS DO NOT INCLUDE ENGINEERING DESIGN OR PERMITTING.**

Regulatory approval to complete the work will likely be necessary from the Town of Boonville, State of New York, USACE, and FEMA. The costs for engineering design and permitting for each of the alternatives above can vary widely. Further survey, and hydraulic modeling would

be necessary to understand the impacts of each project, which would affect what regulatory approvals would be necessary and what level of design/analysis would be required.

#### **4.0 DAM REMOVAL ASSESSMENT**

##### **4.1 Removal Considerations**

For the purpose of this analysis, dam removal assessment explores the full removal of the concrete spillway, with all other portions of the man-made structure remaining in place. The following factors were considered in the preliminary assessment of the feasibility and cost of dam removal:

Size and Construction Material of Structure – The Hawkinsville Dam is comprised of the concrete spillway (approximately 300 feet long and 12 feet high), concrete training walls, the outlet works, and earthen embankments located on both ends of the dam.

Water Control – Two low-level outlet gates are present. Their capacities are not known but may be available for water control during construction. If these are not functional, managing water throughout the duration of construction will be a significant factor in construction costs for a partial or full dam removal. If dewatering through the use of existing outlet/gates is not possible, pumping or temporary cofferdams may be necessary to provide a dry work area.

Sediment Management – Dam removal often requires sediment removal and disposal or in-situ management. Methods of sediment removal can include excavation, mechanical or hydraulic dredging, on-site relocation, and/or partial removal of sediments through staged breaching and removal through natural erosion. The Hawkinsville Dam impoundment has very little sediment near the dam but does have a fair amount of sandy sediment in the upper half of the impoundment. The removal of sediment is contingent upon a number of factors such as its shear strength/mobility, its exposure and configuration after the impoundment is lowered, its level of contamination (if any), and regulatory concerns. These factors are highly variable and, without

performing additional survey, hydraulic modeling, and pursuing regulatory approval, no recommendation as to the treatment of sediment can be made at this time. The goal, however, would be to stabilize as much of this material as possible in place to minimize excavation and disposal.

Construction Access – Equipment access into the Black River from both the eastern and western banks would be necessary to complete the dam removal. The site of the former mill building on the western bank remains cleared and is maintained lawn. Although the eastern bank has light vegetation, construction access to the spillway could be provided through a grassed area to the east of the spillway.

Adjacent Land Uses – Land around the dam is sparsely developed with residential homes. There is a residential structure on the western bank approximately 160 feet from the spillway. The eastern bank provides an unimproved public access point to the river and spillway. The property ownership of both banks would have to be researched prior to development of design drawings and dam removal.

Extent and Use of Upstream Impoundment – The Hawkinsville Dam once supplied energy to a mill building located on its western bank just downstream of the spillway but has long since been removed. Today, the upstream impoundment does not serve any industrial or economic purpose. If dam modification or removal was pursued, a number of homes (approximately 20) with water frontage on the impounded portion of the Black River would likely be impacted by a lowering of water surface elevation. The extent of this impact would need to be further evaluated through hydraulic modeling.

Potential Utility Conflicts – No utilities are known to exist within the spillway or impoundment; however, this would be verified during the design of any dam removal project and further verified by "Dig Safely New York" upon start of construction.

Historical Resources – It is possible that aspects of the dam and surroundings may hold archeological significance, especially due to the presence of the historic mill on the site. A formal review would need to be coordinated with the New York Archeological Council.

Drinking Water Supply Wells – Approximately 20 residential structures are located within the impounded portion of the Black River above the Hawkinsville Dam. The water supply for these structures is likely from private drinking water wells. The extent of the drawdown in the impoundment caused by dam modification/removal would need to be evaluated during detailed design; however, impacts are not expected to be significant.

Ecological Considerations – The benefits associated with dam removal include the restoration of aquatic habitat, improved conditions for sediment transport and natural flow regimes, improved water quality, elimination of debris that typically accumulates in impoundments, increased public safety, and the provision of recreational boat passage. With any dam removal, there is a possibility that wetlands or aquatic habitat could be negatively impacted. Specific ecological benefits and/or impacts would need to be assessed through additional data collection, hydraulic analysis, and a formal feasibility study. Given the initial field reconnaissance, no obvious or insurmountable physical or ecological impediments to dam removal are evident. Additional data collection and hydraulic modeling would be necessary to quantify the extent and magnitude of impacts to upstream recreation and/or wetland resources.

Construction Approach and Cost – Full removal of the spillway would require site access from both the eastern and western banks. A suitable location for concrete and masonry debris from the deconstruction of the spillway must be located, and trucking to/from the site must be safely facilitated. Formal haul roads would be constructed to provide trucking routes for off-site debris disposal, and traffic control may be required.

The estimated cost for full dam removal is approximately \$504,000.

## 5.0 COMPARISON OF OPTIONS

Dam reconstruction involves the removal of the old dam and replacement with a new one (in essence doubling the construction costs). Because the bulk of assessment, design, and construction costs are shared between full dam removal and partial dam removal, the initial investment between the options is approximately the same.

The dam repair option will require ongoing operation and maintenance costs, future (as of yet unquantified) potential repairs, and the ongoing liability of dam ownership whereas dam removal will not.

Table 3 compares the dam repair and removal options. They are as follows:

- Repair Option 1 – Increase the Elevation of the Earthen Abutments
- Repair Option 2 – Lower Spillway Elevation to Training Wall Elevation
- Repair Option 3 – Increase Spillway Length
- Repair Option 4 – Manual Spillway Height Regulation
- Dam Removal

Ecological conditions including riparian connectivity, water quality, fish passage, sediment transport, and hydraulic flow regime would expect to be improved under the dam removal option. These natural functions have been interrupted by and degraded as a result of the dam. Upstream flows would likely transition from deep slow moving flow to a faster moving free-flowing channel. The magnitude and extent of this effect can only be evaluated through further hydraulic analysis to predict stream channel width, water depths, and velocities under a postremoval condition. Likewise, potential impacts on individual docks and the existing boat launch require further evaluation. However, it would result in an overall lowering and shortening of the upstream impoundment. Further exploration of the structural condition of the dam and the upstream ecological and residential impacts would be required for all options considered.

**TABLE 3  
Comparison of Options**

|   | Dam Repair Options |      |            |        | Dam Removal |
|---|--------------------|------|------------|--------|-------------|
|   | #1                 | #2   | #3         | #4     |             |
| Technically Feasible                        | Y                  | Y    | Y          | Y      | Y           |
| Anticipated Upfront Costs                   | \$\$               | \$\$ | \$\$\$\$\$ | \$\$\$ | \$          |
| Ongoing Maintenance Costs                   | \$                 | \$   | \$         | \$\$   | None        |
| Permitting Complexity<br>(3 = most complex) | 1                  | 3    | 3          | 1      | 3           |
| Sediment Management Required                | N                  | N    | N          | N      | Y           |
| Ongoing Liability                           | Y                  | Y    | Y          | Y      | N           |
| Potential for Floodplain Impacts            | N                  | N    | N          | N      | N           |
| Improved Ecological Conditions              | N                  | N    | N          | N      | Y           |
| Potential Impacts to Upstream Recreation    | N                  | Y    | N          | N      | Y           |

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**Appendix A**

***StreamStats* Computations**

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## Basin Characteristics Report

Date: Mon Aug 1 2011 11:33:17 Mountain Daylight Time

NAD27 Latitude: 43.4940 (43 29 38)

NAD27 Longitude: -75.2761 (-75 16 34)

NAD83 Latitude: 43.4940 (43 29 38)

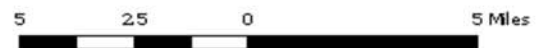
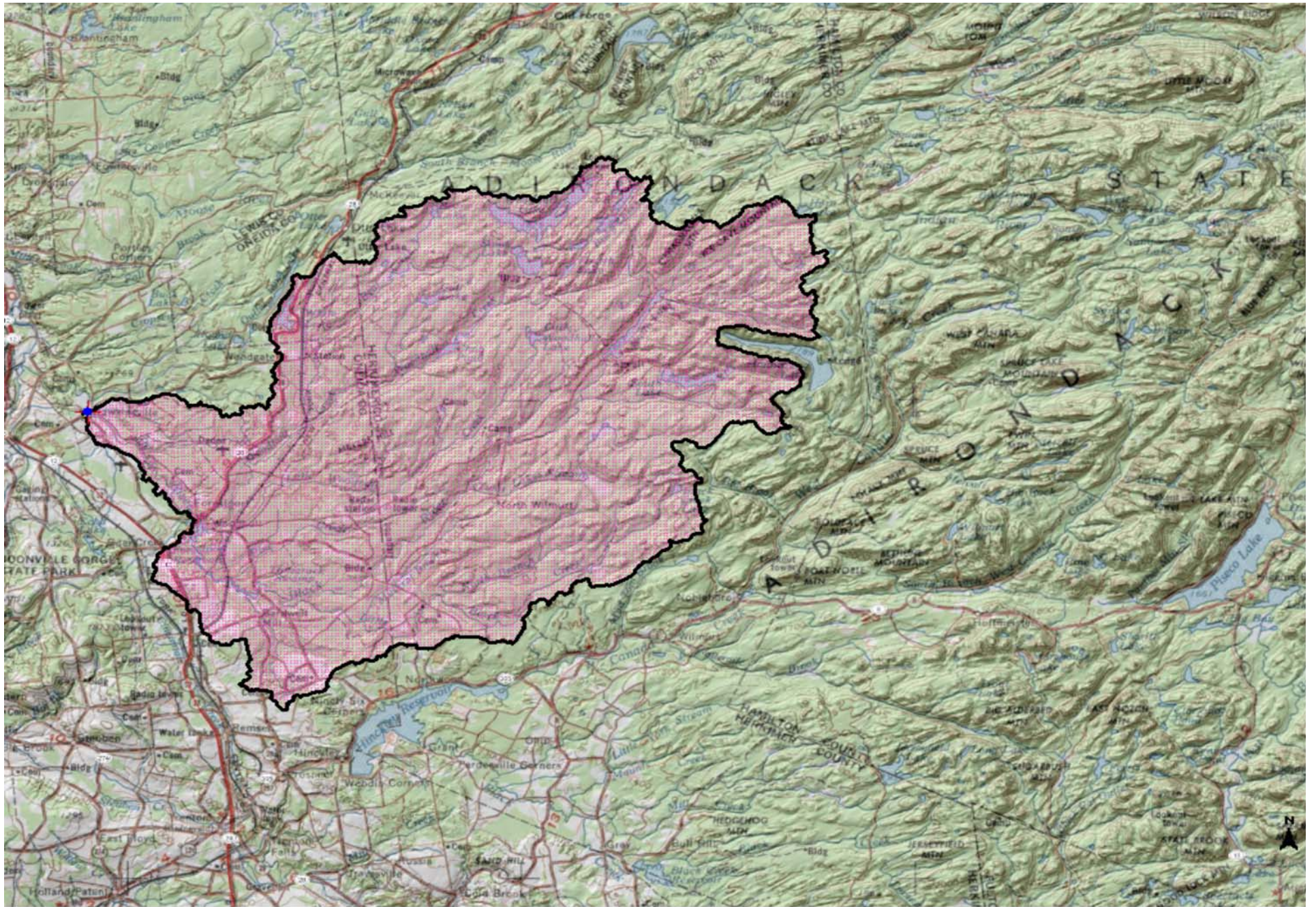
NAD83 Longitude: -75.2757 (-75 16 33)

ReachCode: 04150101001974

Measure: 58.41

| Parameter   | Value  |
|---|--------|
| Area that drains to a point on a stream in square miles.                          | 259    |
| Main-channel 10-85 slope, in feet per mile  | 25.6   |
| Main-channel stream length, in miles  | 44.2   |
| 10-85 slope of lower half of main channel in feet per mile.                       | 14.2   |
| 10-85 slope of upper half of main channel in feet per mile.                       | 48.6   |
| Total length of all elevation contours in drainage area in miles                  | 1100   |
| Average basin slope, in feet per mile.  | 425    |
| Slope ratio. Ratio of main channel slope to basin slope                           | 0.0604 |
| Basin Lag factor.   | 1.61   |
| Percentage of basin at or above 1200 ft elevation                                 | 93.6   |
| Basin storage. Percentage of total drainage area shown as lakes, ponds and swamps | 17     |
| Percent of area covered by forest   | 80.5   |
| Mean annual runoff in inches.   | 32.5   |
| Seasonal maximum snow depth, 50th percentile, in inches                           | 27.7   |
| Mean annual precipitation in inches.  | 49.2   |

# HAWKINSVILLE DAM - BLACK RIVER





### Streamstats Ungaged Site Report

Date: Mon Aug 1 2011 11:34:10 Mountain Daylight Time

Site Location: New\_York

NAD27 Latitude: 43.4940 (43 29 38)

NAD27 Longitude: -75.2761 (-75 16 34)

NAD83 Latitude: 43.4940 (43 29 38)

NAD83 Longitude: -75.2757 (-75 16 33)

ReachCode: 04150101001974

Measure: 58.41

Drainage Area: 259 mi<sup>2</sup>

Percent Urban: 0.46 %

#### Peak Flows Region Grid Basin Characteristics

100% 2006 Full Region 1 (259 mi<sup>2</sup>)

| Parameter                          | Value | Regression Equation Valid Range |        |
|------------------------------------|-------|---------------------------------|--------|
|                                    |       | Min                             | Max    |
| Drainage Area (square miles)       | 259   | 0.54                            | 4500   |
| Lag Factor (dimensionless)         | 1.61  | 0.004                           | 15.229 |
| Percent Storage (percent)          | 17    | 0                               | 28.92  |
| Percent Forest (percent)           | 80.5  | 23.83                           | 99.61  |
| Mean Annual Precipitation (inches) | 49.2  | 29.49                           | 56.1   |

#### Peak Flows Region Grid Streamflow Statistics

| Statistic | Flow (ft <sup>3</sup> /s) | Prediction Error (percent) | Equivalent years of record | 90-Percent Prediction Interval |         |
|-----------|---------------------------|----------------------------|----------------------------|--------------------------------|---------|
|           |                           |                            |                            | Minimum                        | Maximum |
| PK1_25    | 4390                      | 32                         | 2.2                        |                                |         |
| PK1_5     | 4990                      | 30                         | 2                          |                                |         |
| PK2       | 5710                      | 29                         | 2.1                        |                                |         |
| PK5       | 7620                      | 27                         | 3.6                        |                                |         |
| PK10      | 8940                      | 27                         | 5.1                        |                                |         |
| PK25      | 10600                     | 28                         | 6.9                        |                                |         |
| PK50      | 11800                     | 29                         | 8                          |                                |         |
| PK100     | 13300                     | 31                         | 8.8                        |                                |         |
| PK200     | 14500                     | 33                         | 9.4                        |                                |         |
| PK500     | 16400                     | 35                         | 9.8                        |                                |         |

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**Appendix B**

**Stage-Discharge Rating Curves**

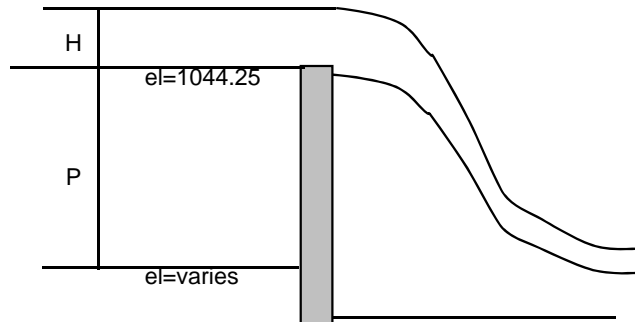
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## Existing Conditions Stage-Discharge Rating Curve

**100-Year Flood Analysis**  
**Q= 21,450 cfs      K=0.4+0.05(H/P)**

**Flow Over Spillway:**  
**C=K√(2g)**  
**Q=CLH^(3/2)**



| H     | P   | L   | K    | 2g   | C       | Q=        |               |
|-------|-----|-----|------|------|---------|-----------|---------------|
| 0     | 3.5 | 300 | 0.40 | 64.4 | 3.20998 | 0.00      |               |
| 0.5   | 3.5 | 300 | 0.41 | 64.4 | 3.26731 | 346.55    |               |
| 1     | 3.5 | 300 | 0.41 | 64.4 | 3.32463 | 997.39    |               |
| 1.5   | 3.5 | 300 | 0.42 | 64.4 | 3.38195 | 1,863.91  |               |
| 2     | 3.5 | 300 | 0.43 | 64.4 | 3.43927 | 2,918.32  |               |
| 2.5   | 3.5 | 300 | 0.44 | 64.4 | 3.49659 | 4,146.45  |               |
| 3     | 3.5 | 300 | 0.44 | 64.4 | 3.55391 | 5,540.00  |               |
| 3.5   | 3.5 | 300 | 0.45 | 64.4 | 3.61123 | 7,093.80  |               |
| 4     | 3.5 | 300 | 0.46 | 64.4 | 3.66855 | 8,804.53  |               |
| 4.5   | 3.5 | 300 | 0.46 | 64.4 | 3.72587 | 10,670.09 |               |
| 5     | 3.5 | 300 | 0.47 | 64.4 | 3.7832  | 12,689.22 |               |
| 5.5   | 3.5 | 300 | 0.48 | 64.4 | 3.84052 | 14,861.24 |               |
| 6     | 3.5 | 300 | 0.49 | 64.4 | 3.89784 | 17,185.89 |               |
| 6.5   | 3.5 | 300 | 0.49 | 64.4 | 3.95516 | 19,663.25 |               |
| 6.843 | 3.5 | 300 | 0.50 | 64.4 | 3.99448 | 21,451.20 | * 150% of the |
| 7     | 3.5 | 300 | 0.50 | 64.4 | 4.01248 | 22,293.65 | 100-Year Flow |
| 7.5   | 3.5 | 300 | 0.51 | 64.4 | 4.0698  | 25,077.62 |               |
| 8     | 3.5 | 300 | 0.51 | 64.4 | 4.12712 | 28,015.84 |               |
| 8.5   | 3.5 | 300 | 0.52 | 64.4 | 4.18444 | 31,109.10 |               |
| 9     | 3.5 | 300 | 0.53 | 64.4 | 4.24177 | 34,358.30 |               |
| 9.5   | 3.5 | 300 | 0.54 | 64.4 | 4.29909 | 37,764.42 |               |
| 10    | 3.5 | 300 | 0.54 | 65.4 | 4.3901  | 41,648.15 |               |
| 10.5  | 3.5 | 300 | 0.55 | 66.4 | 4.48174 | 45,745.87 |               |
| 11    | 3.5 | 300 | 0.56 | 67.4 | 4.574   | 50,061.84 |               |

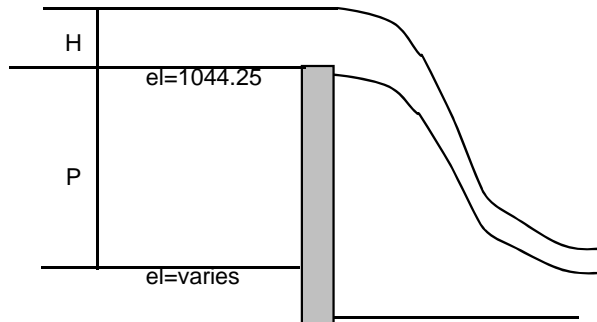
## Lower Spillway

- ▶ Existing training walls / abutments are 5 feet higher than spillway elevation. In order to meet current dam safety requirements, the spillway must pass 21,250 cfs within four feet of elevation (one foot of freeboard).
- ▶ To safely pass the SDF with one foot of freeboard, and avoid abutment/earthen dam improvements, spillway would have to be lowered by a minimum of 5.1 feet to pass the 100-year flood with one foot of freeboard beneath the lowest point in the adjacent ground (to the east of the spillway).

## Proposed Alternative - Lengthen Spillway Spillway Stage-Discharge Rating Curve

**100-Year Flood Analysis**  
Q= 21,450 cfs      K=0.4+0.05(H/P)

**Flow Over Spillway:**  
C=K√(2g)  
Q=CLH^(3/2)



| H        | P          | L          | K    | 2g   | C       | Q=         |
|----------|------------|------------|------|------|---------|------------|
| 0        | 3.5        | 731        | 0.40 | 64.4 | 3.20998 | 0.00       |
| 0.5      | 3.5        | 731        | 0.41 | 64.4 | 3.26731 | 844.43     |
| 1        | 3.5        | 731        | 0.41 | 64.4 | 3.32463 | 2,430.30   |
| 1.5      | 3.5        | 731        | 0.42 | 64.4 | 3.38195 | 4,541.73   |
| 2        | 3.5        | 731        | 0.43 | 64.4 | 3.43927 | 7,110.96   |
| 2.5      | 3.5        | 731        | 0.44 | 64.4 | 3.49659 | 10,103.51  |
| 3        | 3.5        | 731        | 0.44 | 64.4 | 3.55391 | 13,499.13  |
| 3.5      | 3.5        | 731        | 0.45 | 64.4 | 3.61123 | 17,285.22  |
| <b>4</b> | <b>3.5</b> | <b>731</b> | 0.46 | 64.4 | 3.66855 | 21,453.70  |
| 4.5      | 3.5        | 731        | 0.46 | 64.4 | 3.72587 | 25,999.46  |
| 5        | 3.5        | 731        | 0.47 | 64.4 | 3.7832  | 30,919.41  |
| 5.5      | 3.5        | 731        | 0.48 | 64.4 | 3.84052 | 36,211.88  |
| 6        | 3.5        | 731        | 0.49 | 64.4 | 3.89784 | 41,876.28  |
| 6.5      | 3.5        | 731        | 0.49 | 64.4 | 3.95516 | 47,912.78  |
| 7        | 3.5        | 731        | 0.50 | 64.4 | 4.01248 | 54,322.20  |
| 7.5      | 3.5        | 731        | 0.51 | 64.4 | 4.0698  | 61,105.81  |
| 8        | 3.5        | 731        | 0.51 | 64.4 | 4.12712 | 68,265.26  |
| 8.5      | 3.5        | 731        | 0.52 | 64.4 | 4.18444 | 75,802.50  |
| 9        | 3.5        | 731        | 0.53 | 64.4 | 4.24177 | 83,719.72  |
| 9.5      | 3.5        | 731        | 0.54 | 64.4 | 4.29909 | 92,019.30  |
| 10       | 3.5        | 731        | 0.54 | 65.4 | 4.3901  | 101,482.65 |
| 10.5     | 3.5        | 731        | 0.55 | 66.4 | 4.48174 | 111,467.45 |
| 11       | 3.5        | 731        | 0.56 | 67.4 | 4.574   | 121,984.01 |

\* 150% of the 100-Year Flow

- ▶ To safely pass the SDF with one foot of freeboard by only lengthening the spillway, and avoid abutment/earthen dam improvements, spillway would have to be lengthened to a minimum of 731 linear feet.

## Proposed Conditions - Fuse Plug Stage-Discharge Rating Curve

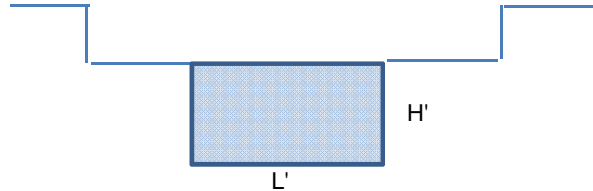
### 100-Year Flood Analysis

Q= 21,450 cfs      K=0.4+0.05(H/P)

### Flow Over Spillway:

$$C = K\sqrt{2g}$$

$$Q = CLH^{3/2}$$



| H   | P   | L   | K    | 2g   | C       | Q=       |
|-----|-----|-----|------|------|---------|----------|
| 0   | 3.5 | 300 | 0.40 | 64.4 | 3.20998 | 0.00     |
| 0.5 | 3.5 | 300 | 0.41 | 64.4 | 3.26731 | 346.55   |
| 1   | 3.5 | 300 | 0.41 | 64.4 | 3.32463 | 997.39   |
| 1.5 | 3.5 | 300 | 0.42 | 64.4 | 3.38195 | 1,863.91 |
| 2   | 3.5 | 300 | 0.43 | 64.4 | 3.43927 | 2,918.32 |
| 2.5 | 3.5 | 300 | 0.44 | 64.4 | 3.49659 | 4,146.45 |
| 3   | 3.5 | 300 | 0.44 | 64.4 | 3.55391 | 5,540.00 |
| 3.5 | 3.5 | 300 | 0.45 | 64.4 | 3.61123 | 7,093.80 |
| 4   | 3.5 | 300 | 0.46 | 64.4 | 3.66855 | 8,804.53 |

| H'    | P   | L'  | K    | 2g   | C       | Q=        | Qtot=     |
|-------|-----|-----|------|------|---------|-----------|-----------|
| 0     | 3.5 | 100 | 0.40 | 64.4 | 3.20998 | 0.00      | 8,804.53  |
| 1     | 3.5 | 100 | 0.41 | 64.4 | 3.32463 | 332.46    | 9,136.99  |
| 2     | 3.5 | 100 | 0.43 | 64.4 | 3.43927 | 972.77    | 9,777.30  |
| 3     | 3.5 | 100 | 0.44 | 64.4 | 3.55391 | 1,846.67  | 10,651.20 |
| 4     | 3.5 | 100 | 0.46 | 64.4 | 3.66855 | 2,934.84  | 11,739.37 |
| 5     | 3.5 | 100 | 0.47 | 64.4 | 3.7832  | 4,229.74  | 13,034.27 |
| 6     | 3.5 | 100 | 0.49 | 64.4 | 3.89784 | 5,728.63  | 14,533.16 |
| 7     | 3.5 | 100 | 0.50 | 64.4 | 4.01248 | 7,431.22  | 16,235.75 |
| 8     | 3.5 | 100 | 0.51 | 64.4 | 4.12712 | 9,338.61  | 18,143.14 |
| 9     | 3.5 | 100 | 0.53 | 64.4 | 4.24177 | 11,452.77 | 20,257.29 |
| 9.525 | 3.5 | 100 | 0.54 | 64.4 | 4.30195 | 12,646.29 | 21,450.82 |

### Fuse Plug / Break-away section

- ▶ To safely pass the SDF with one foot of freeboard by installing a break-away section of the spillway (fuse plug), the rough opening of the fuse plug would have to be approximately 100 feet long by 9.53 feet high.

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**Appendix C**

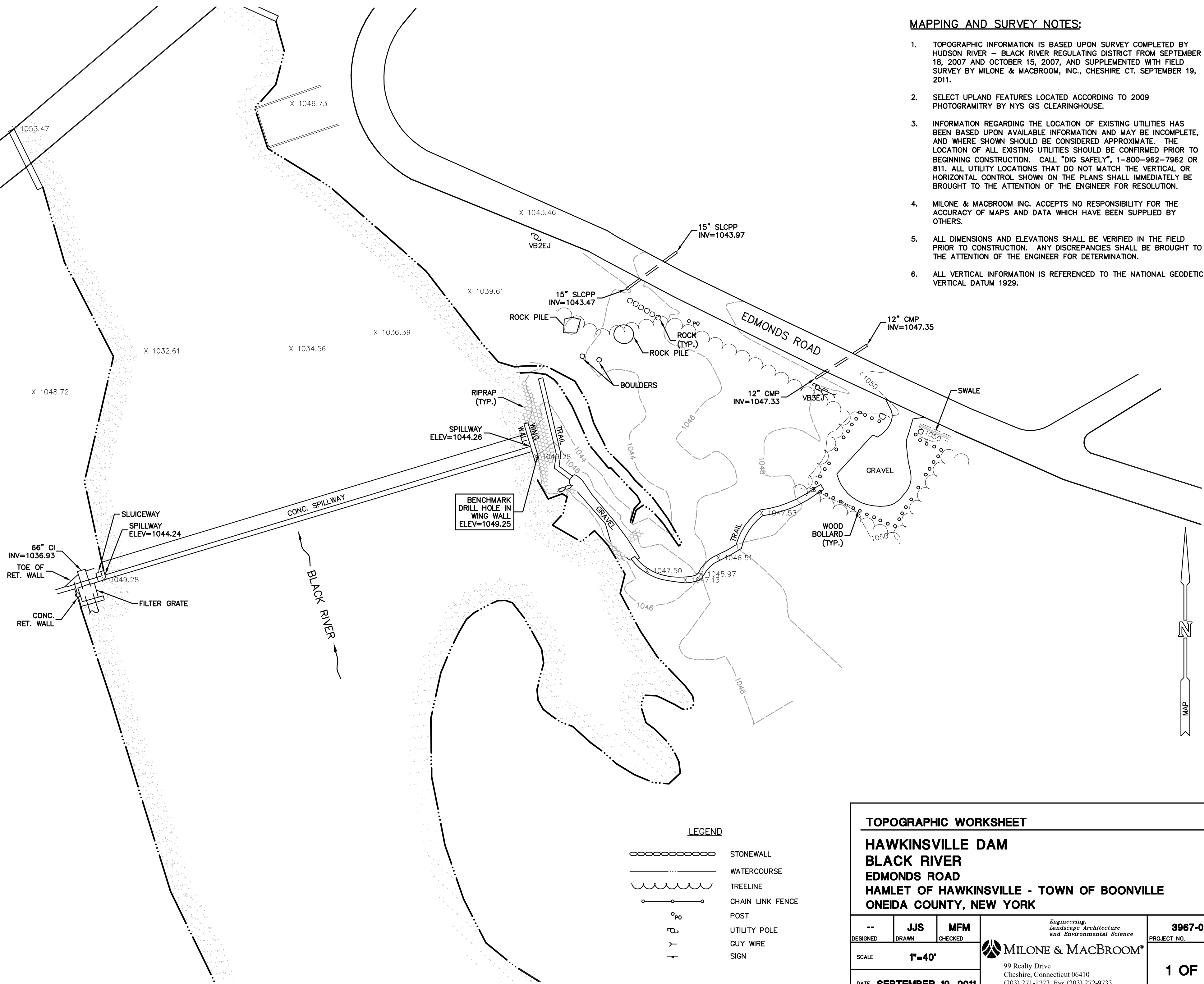
**September 2011 Topographic Survey**

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**MAPPING AND SURVEY NOTES:**

1. TOPOGRAPHIC INFORMATION IS BASED UPON SURVEY COMPLETED BY HUDSON RIVER - BLACK RIVER REGULATING DISTRICT FROM SEPTEMBER 18, 2007 AND OCTOBER 15, 2007, AND SUPPLEMENTED WITH FIELD SURVEY BY MILONE & MACBROOM, INC., CHESHIRE CT. SEPTEMBER 19, 2011.
2. SELECT UPLAND FEATURES LOCATED ACCORDING TO 2009 PHOTOGRAMITRY BY NYS GIS CLEARINGHOUSE.
3. INFORMATION REGARDING THE LOCATION OF EXISTING UTILITIES HAS BEEN BASED UPON AVAILABLE INFORMATION AND MAY BE INCOMPLETE, AND WHERE SHOWN SHOULD BE CONSIDERED APPROXIMATE. THE LOCATION OF ALL EXISTING UTILITIES SHOULD BE CONFIRMED PRIOR TO BEGINNING CONSTRUCTION. CALL "DIG SAFELY", 1-800-962-7962 OR 811. ALL UTILITY LOCATIONS THAT DO NOT MATCH THE VERTICAL OR HORIZONTAL CONTROL SHOWN ON THE PLANS SHALL IMMEDIATELY BE BROUGHT TO THE ATTENTION OF THE ENGINEER FOR RESOLUTION.
4. MILONE & MACBROOM INC. ACCEPTS NO RESPONSIBILITY FOR THE ACCURACY OF MAPS AND DATA WHICH HAVE BEEN SUPPLIED BY OTHERS.
5. ALL DIMENSIONS AND ELEVATIONS SHALL BE VERIFIED IN THE FIELD PRIOR TO CONSTRUCTION. ANY DISCREPANCIES SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER FOR DETERMINATION.
6. ALL VERTICAL INFORMATION IS REFERENCED TO THE NATIONAL GEODETIC VERTICAL DATUM 1929.



**LEGEND**

- STONEWALL
- WATERCOURSE
- TREELINE
- CHAIN LINK FENCE
- POST
- UTILITY POLE
- GUY WIRE
- SIGN

**TOPOGRAPHIC WORKSHEET**

**HAWKINSVILLE DAM  
BLACK RIVER  
EDMONDS ROAD  
HAMLET OF HAWKINSVILLE - TOWN OF BOONVILLE  
ONEIDA COUNTY, NEW YORK**

|          |                           |     |   |             |                |
|----------|---------------------------|-----|---|-------------|----------------|
| DESIGNED | JJS                       | MFM | <i>Engineering,<br/>Landscape Architecture<br/>and Environmental Science</i><br><b>MILONE &amp; MACBROOM®</b><br>99 Realty Drive<br>Cheshire, Connecticut 06410<br>(203) 271-1773 Fax (203) 272-9733<br>www.MiloneandMacBroom.com | PROJECT NO. | <b>3967-01</b> |
| SCALE    | <b>1"=40'</b>             |     |   |             | <b>1 OF 1</b>  |
| DATE     | <b>SEPTEMBER 19, 2011</b> |     |   | SHEET NO.   |                |