# EMERGENCY TRANSPORTATION INFRASTRUCTURE RECOVERY
# WATER BASIN ASSESSMENT
# AND FLOOD HAZARD MITIGATION ALTERNATIVES

## EAST CANADA CREEK
## HERKIMER COUNTY, NEW YORK

April 2014

MMI #5231-01

Photo Source: Milone & MacBroom, Inc. (2013)

*This document was prepared for the New York State Department of Transportation, in cooperation with the New York State Department of Environmental Conservation.*

***Prepared by:***


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## ABBREVIATIONS/ACRONYMS

| | |
|---|---|
| BCA | Benefit-Cost Analysis |
| BCR | Benefit Cost Ratio |
| CFS | Cubic Feet per Second |
| CME | Creighton Manning Engineering |
| FEMA | Federal Emergency Management Agency |
| FERC | Federal Energy Regulatory Commission |
| FIRM | Flood Insurance Rate Map |
| FIS | Flood Insurance Study |
| FMA | Flood Mitigation Assistance |
| FT | Feet |
| FTP | File Transfer Protocol |
| GIS | Geographic Information System |
| HMA | Hazard Mitigation Assistance |
| HMGP | Hazard Mitigation Grant Program |
| MMI | Milone & MacBroom, Inc. |
| NFIP | National Flood Insurance Program |
| NFIRA | National Flood Insurance Reform Act |
| NOAA | National Oceanic and Atmospheric Administration |
| NWS | National Weather Service |
| NYSDEC | New York State Department of Environmental Conservation |
| NYSDOT | New York State Department of Transportation |
| PDM | Pre-Disaster Mitigation |
| SFHA | Special Flood Hazard Area |
| SQ. MI. | Square Mile |
| STA | River Station |
| U/S | Upstream |
| USACE | United States Army Corps of Engineers |
| USGS | United States Geological Survey |

# 1.0 INTRODUCTION

## 1.1 Project Background

A severe precipitation system in June 2013 caused excessive flow rates and flooding in a number of communities in the greater Utica region. As a result, the New York State Department of Transportation (NYSDOT) in consultation with the New York State Department of Environmental Conservation (NYSDEC) retained Milone & MacBroom, Inc. (MMI) through a subconsultant agreement with Creighton Manning Engineering (CME) to undertake a comprehensive water basin assessment of 13 watersheds in Herkimer, Oneida, and Montgomery Counties, including East Canada Creek. Prudent Engineering was also contracted through CME to provide support services.

Work conducted for this study included field assessment of the watersheds, streams, and rivers; analysis of flood mitigation needs in the affected areas; hydrologic assessment; and identification of long-term recommendations for mitigation of future flood hazards.

East Canada Creek drains portions of Hamilton, Fulton, Herkimer, and Montgomery Counties in east central New York. Figure 1 is a basin location map. East Canada Creek's headwaters are in the Adirondack Mountains. The creek drains an area of 290 square miles and flows into the Mohawk River between Little Falls and St. Johnsville. The drainage basin is approximately 82 percent forested, with sparse rural residential uses in the upper basin and residential and commercial land uses in towns and villages along the lower creek. East Canada Creek has an average slope of 0.92 percent over its entire stream length of 40.3 miles.

This study focusses on the section of East Canada Creek between the village of Dolgeville and the creek's outlet at the Mohawk River, a distance of 10 river miles. The most severe flood-related damages have occurred in Dolgeville. Historically, the creek has overtopped its banks on several occasions, flooding residential, commercial, and industrial areas within the village. Downstream of Dolgeville, bank erosion and sediment transport issues are evident. A high bank failure just downstream of the village of Dolgeville is threatening property and contributing sediment to the creek. The formation of a large sediment bar downstream has caused the channel to aggrade and flood the adjacent roadway.

The goals of the subject water basin assessment were to:

1. Collect and analyze information relative to the June 28, 2013 flood and other historic flooding events.

2. Identify critical areas subject to flood risk.

3. Develop and evaluate flood hazard mitigation alternatives for each high risk area within the stream corridor.


SOURCE(S):

**Figure 1: East Canada Drainage Basin Location**

LOCATION:
**Herkimer County, New York**

N

**NYDOT: Emergency Transportation Infrastructure Recovery**

**MXD:** Y:\5231-01\GIS\Maps\Figure 1 Maps\Figure 1 East Canada.mxd

**Map By:** CMP
**MMI#:** 5231-01
**Original:** 01/09/2014
**Revision:** 1/9/2014
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## 1.2 Nomenclature

In this report and associated mapping, stream stationing is used as an address to identify specific points along the watercourse. Stationing is measured in feet and begins at the mouth of East Canada Creek at STA 0+00 and continues upstream to STA 864+00, approximately 6.4 miles upstream of Dolgeville. As an example, STA 73+00 indicates a point in the channel located 7,300 linear feet upstream of the mouth. Figure 2 depicts the stream stationing along East Canada Creek.

All references to right bank and left bank in this report refer to "river right" and "river left," meaning the orientation assumes that the reader is standing in the river looking downstream.

# 2.0 DATA COLLECTION

## 2.1 Initial Data Collection

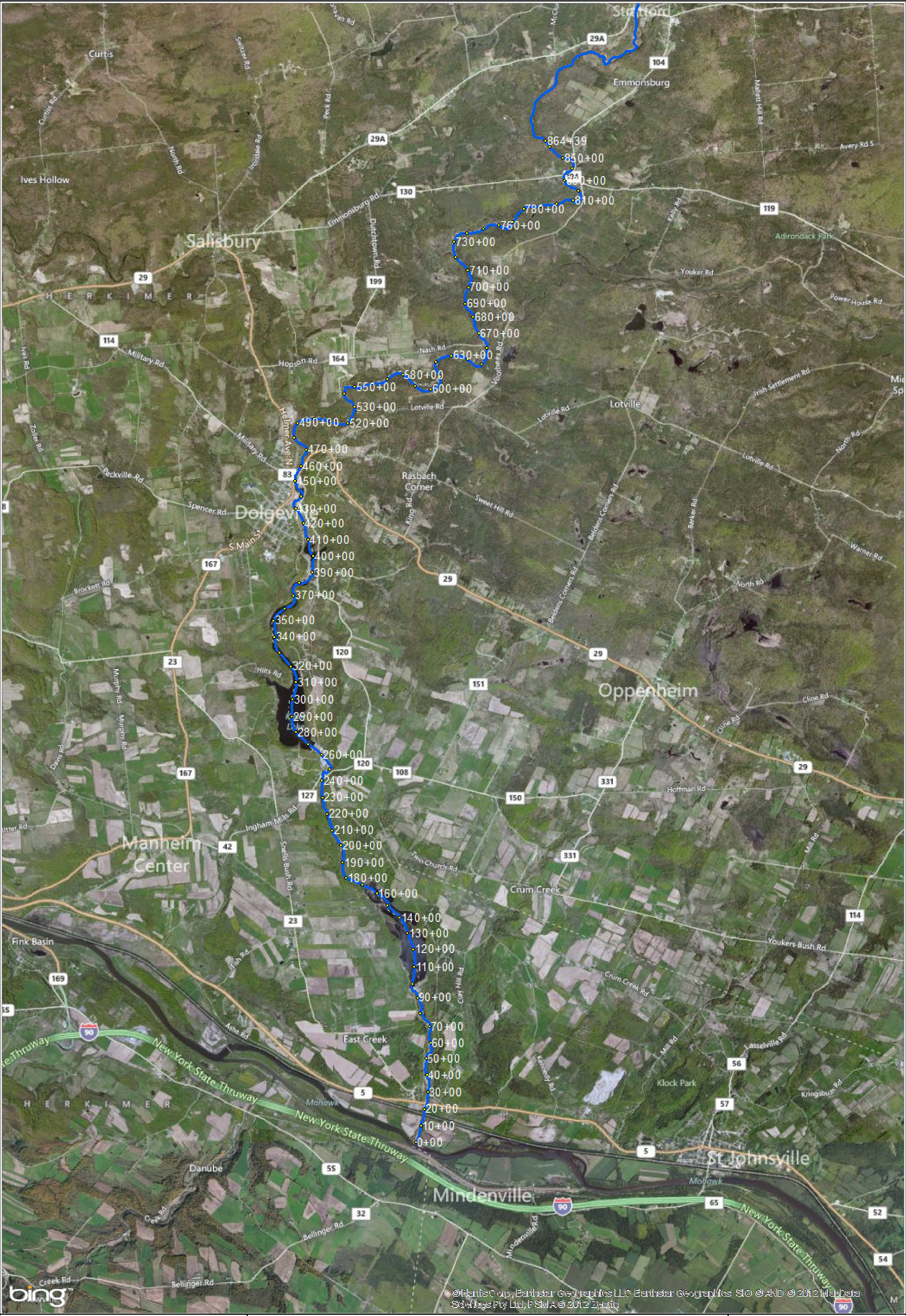
Public information pertaining to East Canada Creek was collected from previously published documents as well as through meetings with municipal, county, and state officials. Data collected includes reports, flood photographs, newspaper articles, Federal Emergency Management Agency (FEMA) Flood Insurance Studies (FIS), aerial photographs, and geographic information system (GIS) mapping. Appendix A is a summary listing of data and reports collected.

## 2.2 Public Outreach

An initial project kickoff meeting was held in early October 2013 with representatives from NYSDOT and NYSDEC, followed by public outreach meetings held in the affected communities, including a meeting held at the Dolgeville Village Hall, to discuss East Canada Creek. These meetings provided more detailed, firsthand accounts of past flooding events; identified specific areas that flooded in each community and the extent and severity of flood damage; and provided information on post-flood efforts such as bridge reconstruction, road repair, channel modification, and removal of sediments from the channel. This outreach effort assisted in the identification of target areas for field investigations and future analysis.

## 2.3 Field Assessment

Following initial data gathering and outreach meetings, field staff from Prudent Engineering and MMI undertook field data collection efforts, with special attention given to areas identified in the outreach meetings. Initial field assessment of all 13 watersheds was conducted in October and November 2013. Selected locations identified in the initial phase were assessed more closely by multiple field teams in late November 2013. Information collected during field investigations included the following:




| SOURCE(S): | Figure 2: East Canada Creek Watercourse Stationing | | Location: Herkimer County, New York |
|---|---|---|---|
| | N<br>NYDOT: Emergency Transportation Infrastructure Recovery | Map By: CMP<br>MMI#: 5231-01<br>MXD: Y:\5231-01\GIS\Maps\Figure 2 Maps\Figure 2 East Canada.mxd<br>1st Version: 01/09/2014<br>Revision: 2/24/2014<br>Scale: 1 in = 5,000 ft | MILONE & MACBROOM<br>99 Realty Drive Cheshire, CT 06410<br>(203) 271-1773 Fax: (203) 272-9733<br>www.miloneandmacbroom.com |

- Rapid "windshield" river corridor inspection
- Photo documentation of inspected areas
- Measurement and rapid hydraulic assessment of bridges, culverts, and dams
- Geomorphic classification and assessment, including measurement of bankfull channel widths and depths at key cross sections
- Field identification of potential flood storage areas
- Wolman pebble counts
- Cohesive soil shear strength measurements
- Characterization of key bank failures, headcuts, bed erosion, aggradation areas, and other unstable channel features
- Preliminary identification of potential flood hazard mitigation alternatives, including those requiring further analysis

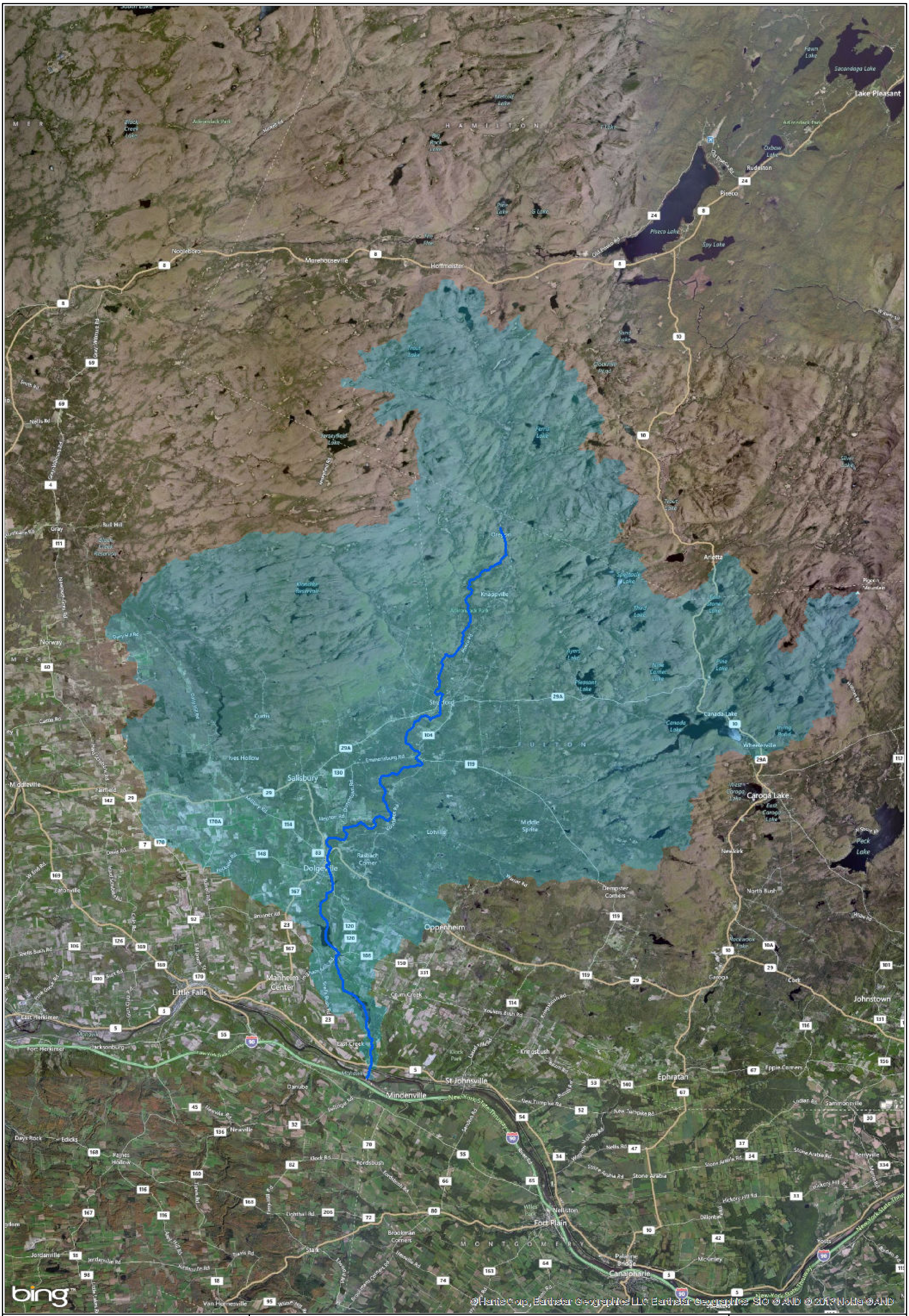
Included in Appendix B is a copy of the River Assessment Reach Data Form, River Condition Assessment Form, Bridge Waterway Inspection Form, and Wolman Pebble Count Form. Appendix C is a photo log of select locations within the river corridor. Field Data Collection Index Summary mapping has been developed to graphically depict the type and location of field data collected. Completed data sheets, field notes, photo documentation, and mapping developed for this project have been uploaded onto the NYSDOT ProjectWise system and the project-specific file transfer protocol (FTP) site. The data and mapping were also provided electronically to NYSDEC.

## 2.4 Watershed Land Use

Figure 3 is a watershed map of East Canada Creek. The drainage basin is approximately 82 percent forested, with sparse rural residential uses in the Adirondack Mountain region of the upper basin, agricultural uses lower in the basin, and residential and commercial land uses in towns and villages along the creek. The stream corridor is primarily forested upstream of Dolgeville. There are several lakes and reservoirs located high in the drainage basin.

The village of Dolgeville is located primarily on the right (west) bank of East Canada Creek, with a smaller area of the village located on the left bank. The Route 29 (East State Street) bridge spans the river and connects these two parts of the village. Upstream of the Route 29 bridge, East Canada Creek is bordered on the right by North Main Street, which is lined with residences as well as some commercial establishments. On the left, the creek flows adjacent to Route 29.

Downstream of the Route 29 bridge, the creek passes over a mill dam and through a section of the stream that is confined on both banks by mill buildings. Downstream of the mills, East Canada Creek is bordered on the right by residences along Van Buren Street and on the left by a neighborhood along Dolge Avenue. At the downstream end of Dolgeville is a hydroelectric facility at a second dam on Powerhouse Road. Downstream of Dolgeville, the creek returns to a more rural character although with a higher proportion of agricultural uses along its banks as compared to the upper basin.




| SOURCE(S): | **Figure 3: East Canada Creek Drainage Basin Aerial** | **Location:** **Herkimer County, New York** |
|---|---|---|

| N | **NYDOT: Emergency Transportation Infrastructure Recovery** | **Map By:** CMP<br>**MMI#:** 5231-01<br>**MXD:** Y:\5231-01\GIS\Maps\Figure 3 Maps\Figure 3 East Canada.mxd<br>**1st Version:** 01/09/2014<br>**Revision:** 3/7/2014<br>**Scale:** 1 in = 15,000 ft | **MILONE & MACBROOM**<br>99 Realty Drive Cheshire, CT 06410<br>(203) 271-1773 Fax: (203) 272-9733<br>www.miloneandmacbroom.com |
|---|---|---|---|

## 2.5 Geomorphology

The geomorphology of the East Canada Creek was evaluated from STA 528+00 to STA 0+00. East Canada Creek is an alluvial watercourse, as indicated by many sediment point bars, areas of floodplain, and areas where signs of historic channel migration are evident in aerial photographs. Alluvial channels adjust their width, depth, and slope in response to flow rates and sediment loads and therefore go through cycles of scour as stream flows fluctuate. However, some specific reaches of East Canada Creek flow over bedrock. These non-alluvial sections have rigid bedrock constraints that prevent erosion. This bedrock is visible in the channel at each of the dams between Dolgeville and the Mohawk River (at STA 440+50, STA 396+25, STA 266+00, and STA 98+00).

The stream banks largely remain in a natural, vegetated state over much of its length within the study area, with the exception of where the banks have been hardened with concrete and stone-masonry walls as the creek flows through Dolgeville and at hydroelectric stations downstream of Dolgeville.

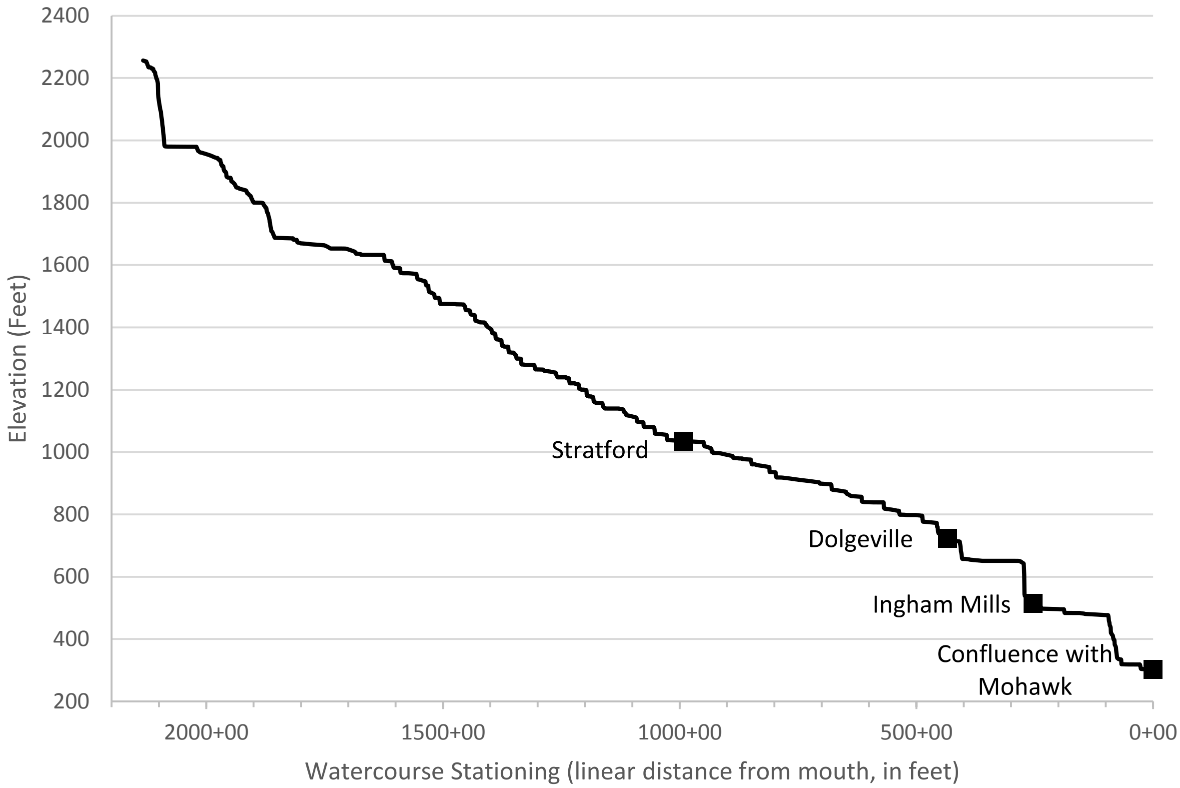
A run-of-the-river dam (i.e., a dam that has little to no flood storage) is located in Dolgeville, as well as three sets of dams with impoundments between Dolgeville and the outlet of East Canada Creek at the Mohawk River. At one time, the creek supported many grist and lumber mills and dams that were eventually converted for use in industry and hydroelectric generation.

For much of its length downstream of Dolgeville, the geomorphology of East Canada Creek is highly influenced by the operation of the hydroelectric dams and reservoirs, rather than by natural river processes. Sediment transport and deposition through these reaches are largely a function of hydromodifications due to dam operations.

There is a large bank failure downstream of Dolgeville along the left bank of East Canada Creek, between STA 388+00 and STA 384+00, that is actively contributing fine- and coarse-grained sediments and threatening a structure and property located at the top of the bank on Route 120 (Dolge Avenue). Sediments originating at this bank failure become trapped by reservoirs associated with downstream hydroelectric dams and are not likely to be contributing to flooding problems on lower East Canada Creek.

Figure 4 (on the following page) is a profile of East Canada Creek, showing the watercourse elevation versus the linear distance from the mouth of the watercourse. East Canada Creek has an average slope of 0.92 percent over its entire stream length of 40.2 miles. The creek drops a total of 1,953 vertical feet over its length, from an elevation of 2,257 feet above sea level at its headwaters in the Adirondacks to 303 feet at its mouth at the Mohawk River between Little Falls and St. Johnsville.

**FIGURE 4**
**Profile of East Canada Creek**




## 2.6 Hydrology

Alluvial river channels adjust their width and depth around a long-term dynamic equilibrium condition that corresponds to "bankfull" conditions. Extensive data sets indicate that the channel-forming or bankfull discharge in specific regions is primarily a function of watershed area. The bankfull width and depth of alluvial channels represent long-term equilibrium conditions and are important design criteria. Several reaches of East Canada Creek flow over bedrock channel, especially in the vicinity of the dams between Dolgeville and the Mohawk River. These reaches are not alluvial, and bankfull dimensions are of limited value.

Table 1 lists estimated bankfull discharge, width, and depth at several points along East Canada Creek, as derived from the United States Geological Survey (USGS) *StreamStats* program.

**TABLE 1**
**Estimated Bankfull Discharge, Width, and Depth**
**(Source: USGS *StreamStats*)**

| Location Along East Canada Creek | Station | Watershed Area (sq. mi.) | Discharge (cfs) | Bankfull Width (ft) | Bankfull Depth (ft) |
|---|---|---|---|---|---|
| Limit of Town of Dolgeville | 453+00 | 259 | 5,550 | 161 | 6.6 |
| Confluence with Mohawk River | 0+00 | 290 | 6,110 | 167 | 6.9 |

East Canada Creek narrows at specific points as it flows through Dolgeville, creating pinch points. The first pinch point is located in the vicinity of the Route 29 bridge. While the measured span of the bridge is 171 feet, the bridge is not situated perpendicular to the flow of the creek. The actual bank-to-bank measurement through this area ranges from 165 feet at the bridge to 150 feet at a point approximately 200 feet downstream of the bridge. The right creek bank through this area consists of a vertical wall, and on the left bank is a riprap slope, with no floodplain.

The second pinch point is located in the vicinity of the dam, 1,200 feet downstream of Route 29, at STA 440+50, and a pedestrian walkway located 1,800 feet downstream of the Route 29 bridge at STA 435+25. The spillway on the dam is 255 feet wide. The spillway acts to trap ice, which backs up water and causes ice jam related flooding. At the pedestrian walkway, the channel narrows to a width of 145 feet and is confined between vertical walls on both banks with no floodplain.

The third pinch point is in the vicinity of the wastewater treatment plant and hydroelectric station downstream of Dolgeville, where there is a dam at STA 396+25. Through this area, the channel is wide enough to pass flood flows under normal circumstances but, due to the configuration of the spillway, it is prone to collecting ice, resulting in ice jam related flooding.

There is an active USGS stream gauging station on East Canada Creek at East Creek, New York (USGS 01348000). There are also historic records for a USGS stream gauging station on East Canada Creek at Dolgeville (USGS 01347500), which was active from 1898 until 1913 and from 1928 until 1946.

Hydrologic data on peak flood flow rates are available from the FEMA FIS and from *StreamStats*. The most current FEMA FIS that applies to East Canada Creek is for all of Herkimer County. The study became effective on September 27, 2013. The hydrologic analysis methods employed in the FEMA study used standardized regional regression equations detailed in USGS publication 90-4197 entitled *Regionalization of Flood Discharges for Rural, Unregulated Streams in New York, Excluding Long Island*, (USGS, 1991). This regression analysis uses parameters such as mean annual precipitation and several watershed characteristics to estimate flow frequencies.

Table 2 lists estimated peak flows on East Canada Creek at each of the cross sections reported in the FEMA FIS. Similar drainage points were delineated with the *StreamStats* program, which estimated peak flows based on nearby active and historic stream gauging stations. Peak discharges reported by FEMA for the 100-year frequency flood event are in the range of 24 percent to 28 percent greater than those determined using *StreamStats*.

**TABLE 2**
**East Canada Creek FEMA and *StreamStats* Peak Discharges**

| Location | Drainage Area (sq. mi.) | 10-Yr | 50-Yr | 100-Yr | 500-Yr |
|---|---|---|---|---|---|
| | | FEMA Peak Discharges | | | |
| Confluence of East Creek (USGS Gauge 01348000) | 292 | 14,600 | 21,000 | 24,100 | 32,500 |
| U/S Montgomery County | 288 | 14,500 | 20,800 | 23,900 | 32,100 |
| At Village of Dolgeville downstream corporate limits | 265 | 13,500 | 19,500 | 22,400 | 30,100 |
| | | *StreamStats* Peak Discharges | | | |
| Confluence of East Creek | 290 | 13,100 | 17,400 | 19,400 | 24,100 |
| U/S Montgomery County | 285 | 12,900 | 17,100 | 19,000 | 23,700 |
| At Village of Dolgeville downstream limits | 262 | 11,900 | 15,700 | 17,500 | 21,800 |

## 2.7 Infrastructure

East Canada Creek passes under numerous bridges, including the Route 29, Route 108, and Route 5 bridges. Bridge spans and heights were measured as part of field investigations. Table 3 summarizes the bridge measurements collected. For the purpose of comparison, estimated bankfull widths at each structure are also included.

**TABLE 3**
**Summary of Stream Crossing Data**

| Roadway Crossing | Station | Width (ft) | Height (ft) | Bankfull Width (ft) |
|---|---|---|---|---|
| Route 29 (E. State Street) | 453+00 | 171 | 12.3 – 14.50 | 161 |
| Dolge Avenue walkway | 435+25 | 155 | 22.5 | 161 |
| Route 108 | 242+50 | 106 | 24.5 – 33.0 | 166 |
| Old State Road - Closed | 28+75 | | | 167 |
| Route 5 | 23+00 | 153.0 x 2 | 10.8 – 16.3 | 167 |

Flood profiles published in the FEMA FIS were evaluated to determine which bridges on East Canada Creek are acting as hydraulic constrictions. According to the profiles, the Route 29 bridge does not act as a hydraulic constriction, although community officials report that this bridge overtops as a result of ice jam formation at the bridge. The pedestrian walkway and associated vertical channel walls, located approximately 1,800 feet downstream of the Route 29 bridge (shown on the FEMA profiles as Dolge Avenue), act as a severe hydraulic constriction during all events modeled by FEMA. The FEMA profiles also indicate that the railroad bridge at STA 17+00 is undersized and acts as a hydraulic constriction, especially in the 100- and 500-year frequency events.

The dominant characteristic of the lower reaches of East Canada Creek are a series of older hydroelectric dams and impoundments that partially regulate flow rates and sediment continuity. Their presence alters flood water elevations by both constricting channel and floodplain widths and directly raising water elevations to generate power. Dams and their impoundments contribute to the creation of layer ice on the pools, entrapment of ice from upstream, and production of frazil ice in higher velocity discharges. Table 4 presents data on select dams along the East Canada Creek, obtained from NYDEC Dam Safety.

**TABLE 4**
**Dam Data on Lower East Canada Creek**

| Station | Name | Date | NYID | Length (ft) | Height (ft) | Hazard Class | Use | Reported Capacity |
|---|---|---|---|---|---|---|---|---|
| 440+00 | Daniel Green Co. | 1917 | 142-0586 | 300 | 20 | A – Low | Hydroelectric | --- |
| 400+00 | Dolgeville Dam | --- | 142-0582 | --- | --- | A – Low | Hydroelectric | --- |
| 270+00 | Inghams Dam | 1911 | 142-0572 | 685 | 125 | C – High | Hydropower | 21,000 |
| 100+00 | East Canada Creek | 1914 | 157-0556 | 240 | 28 | A – Low | Hydroelectric | --- |
| 100+00 | East Canada Lake | 1924 | 157-0554 | 1,032 | 65 | C – High | Hydropower | 53,340 |

# 3.0 FLOODING HAZARDS AND MITIGATION ALTERNATIVES

## 3.1 Flooding History in East Canada Creek

According to the FEMA FIS, flooding in the village of Dolgeville typically occurs in the late winter and early spring, usually as a result of ice jams combined with spring rainfall and snowmelt. Flooding has also occurred during the late summer months as a result of tropical storms tracking northward along the Atlantic coastline or due to regional thunderstorm activity. According to FEMA, the village of Dolgeville has been seriously flooded on two occasions since the 1930s. After more than a week of continuous rain and a heavy rainfall event on October 1 and 2, 1945, East Canada Creek overtopped its banks and flooded commercial and industrial areas within the village. Damages included the spillway of the Daniel Green Dam.

On March 5, 1979, an ice jam occurred at the Route 29 bridge, causing the creek to breach its west bank and inundate the adjacent residential and commercial areas. Floodwaters covered portions of North Main Street and East State Street, as well as along Van Buren Street and Dolge Avenue.

FEMA Flood Insurance Rate Maps (FIRMs) are available for the Village of Dolgeville. FEMA inundation mapping (Figure 5) indicates that during a 100-year frequency event East Canada Creek overtops its banks upstream of the Route 29 bridge, resulting in flooding that extends across North Main Street on the west bank and up to Route 29 on the east bank. Downstream of Dolgeville, the creek floods an area along Van Buren Street on the west bank and, further downstream, floods across Dolge Avenue on the east bank.

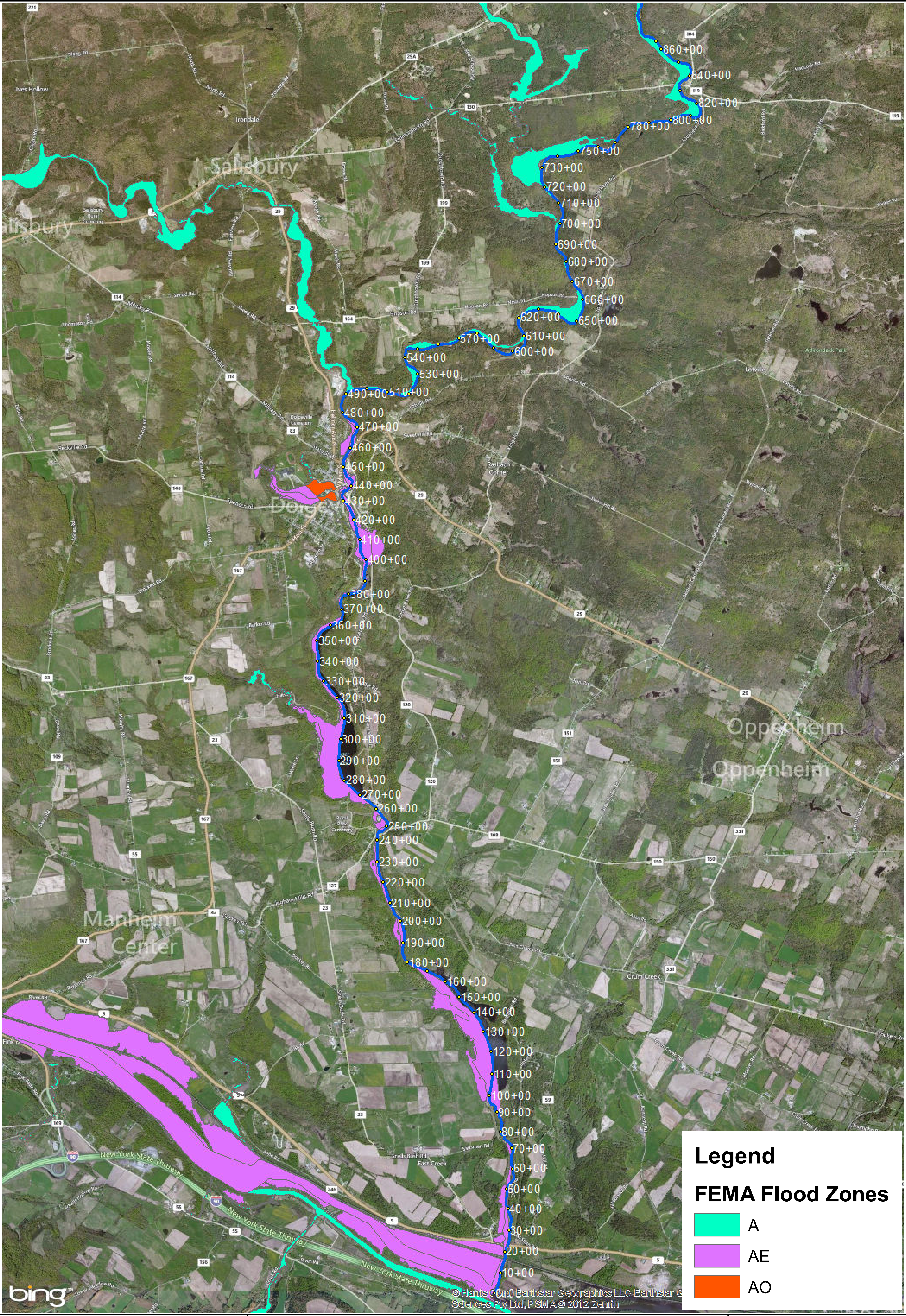
Discussions with community officials revealed that ice jams occur at the Route 29 bridge almost every year and lead to flooding in the town when East Canada Creek overtops the road and the bridge. Flooding associated with ice jams at the bridge includes houses and businesses along North Main Street on the west bank and along Route 29 on the east bank. Ice jams also occur at the Daniel Greene Company Dam associated with the hydroelectric station, at STA 396+25, resulting in flooding of homes along Van Buren Street and Dolge Avenue and of the wastewater treatment plant and the hydroelectric station.

In mid to late June and early July 2013, a severe precipitation system caused excessive flow rates and flooding in a number of communities in the greater Utica region, including in the East Canada Creek basin. Because rainfall across the region was highly varied, it is not possible to determine exact rainfall amounts within the East Canada Creek Basin.

Historic records on the National Oceanic and Atmospheric Administration's (NOAA) National Weather Service (NWS) Advanced Hydrologic Prediction Service website indicate that Herkimer County received between 10 and 15 inches of rainfall in the month of June and an additional 5 to 8 inches in July 2013. Much of this rainfall occurred over several storm events that dropped between 3.5 and 4.5 inches of rain between June 11 and 14; 5.5 to 8.5 inches between June 24 and 28; and 1.5 to 2.0 inches on July 2. In between these more severe rain events were a number of smaller rain showers that dropped trace amounts of precipitation, which prevented soils from drying out between the larger rain events.

## 3.2 Post-Flood Community Response

FEMA reports that several flood protection measures have been taken in the village of Dolgeville following the flood of October 1945. The spillway at the Daniel Green Dam was repaired, and a flood wall along the plant was reconstructed at a higher elevation. Following the March 1979 flood, the U.S. Army Corps of Engineers (USACE) was involved in strengthening and repairing the levee, which was originally constructed by the WPA in 1935. Near North Main Street, ice jams are dynamited by the Village of Dolgeville in an effort to prevent ice blockages and associated flooding. Following the heavy flooding in June 2013 and after other recent flood and ice jam events, repairs to flood-damaged structures and infrastructure were implemented in Dolgeville.




| SOURCE(S): | Figure 5: East Canada Creek FEMA Flood Zones | Location: Herkimer County, New York |
|---|---|---|
| | N<br>NYDOT: Emergency Transportation Infrastructure Recovery | Map By: CMP<br>MMI#: 5231-01<br>MXD: Y:\5231-01\GIS\Maps\FEMA FIRM Maps\East Canada FEMA.mxd<br>1st Version: 01/09/2014<br>Revision: 3/7/2014<br>Scale: 1 in = 4,000 ft |
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### 3.3 <u>High-Risk Area #1 – Dolgeville Bridges and Dam (STA 435+25 to STA 453+00)</u>

Figure 6 is a location plan of High Risk Area #1. This area encompasses East Canada Creek as it flows through the village of Dolgeville and includes two bridges and the narrow channel associated with each bridge: the Route 29 bridge (STA 453+00) and the pedestrian walkway located approximately 1,800 feet downstream of the Route 29 bridge (STA 435+25). Also included is the Dolgeville Dam located between the two bridges, located approximately 1,200 feet downstream of Route 29 (STA 440+50).

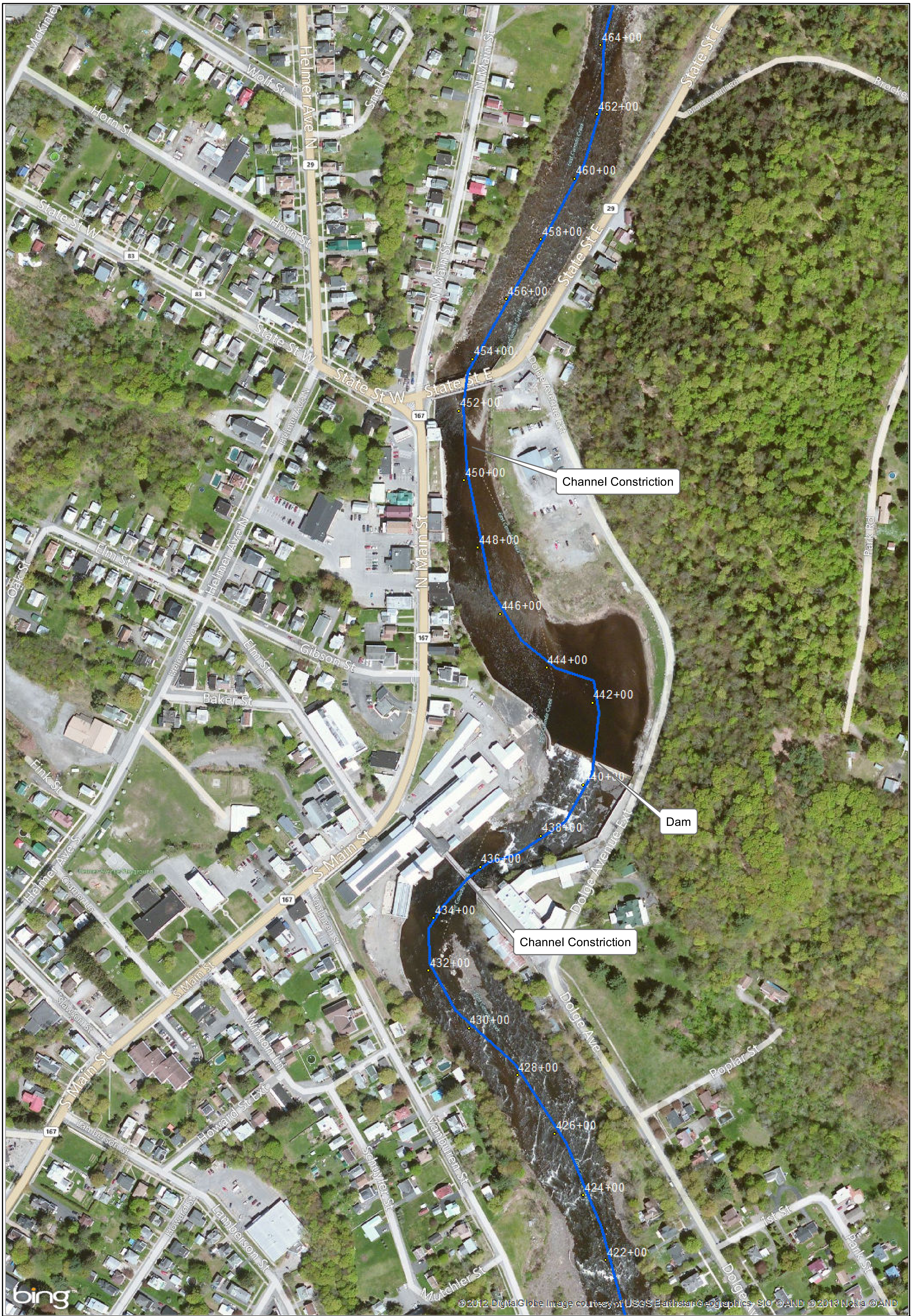
Although the FEMA flood profile in Figure 7 indicates that the Route 29 bridge is not acting as a hydraulic constriction, community officials report that floodwaters do back up at the bridge, with resulting flooding, especially when high flows combine with ice or debris jams. The channel measures 150 feet wide at a point approximately 200 feet downstream of the bridge. Both creek banks through this area consist of vertical walls, with no floodplain.

According to the FEMA profiles, water surface elevations on East Canada Creek through Dolgeville increase as a result of the dam, which is also prone to ice jams. Further investigation would be required to determine whether dam removal or modification is a viable flood mitigation alternative. Factors determining whether this is a feasible option include the current use of the dam, the willingness of the dam owner to participate, and the quality and quantity of sediment impounded behind the dam.

The FEMA profiles also indicate that the channel at the pedestrian walkway severely constricts flows. The stream at this location is lined on both banks by vertical stone masonry walls that constrict the channel. The current width at this location between its vertical walls is 145 feet. The estimated bankfull width of East Canada Creek at this location is 161 feet, indicating that the channel is of insufficient width. The problem is further compounded by the sharp bend in the creek at this location.

*<u>Alternative 1-1: Modification of Operation of the Daniel Green Company Dam (STA 440+50)</u>*

It may be possible to reduce or "draw down" water levels behind the dam by opening a low-flow outlet or removing weirs or flashboards. Drawing down of the impoundment would ideally occur when high flow events are forecast. Similarly, there may be a way to reduce occurrences of ice jams by altering the operations of the dam during periods of time when ice jams are prone to occur. Strategies such as these would require entering into a dialogue with the owners of the dam. A comprehensive understanding of the operation of the dam will be required in order to determine whether a modified operational plan would reduce ice jams and flooding.




SOURCE(S):

**Figure 6: East Canada Creek High Risk Area #1**

**Location:** **Herkimer County, New York**

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**NYDOT: Emergency Transportation Infrastructure Recovery**

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**MMI#:** 5231-01
**MXD:** Y:\5231-01\GIS\Maps\High Risk Areas\East Canada High Risk #1.mxd
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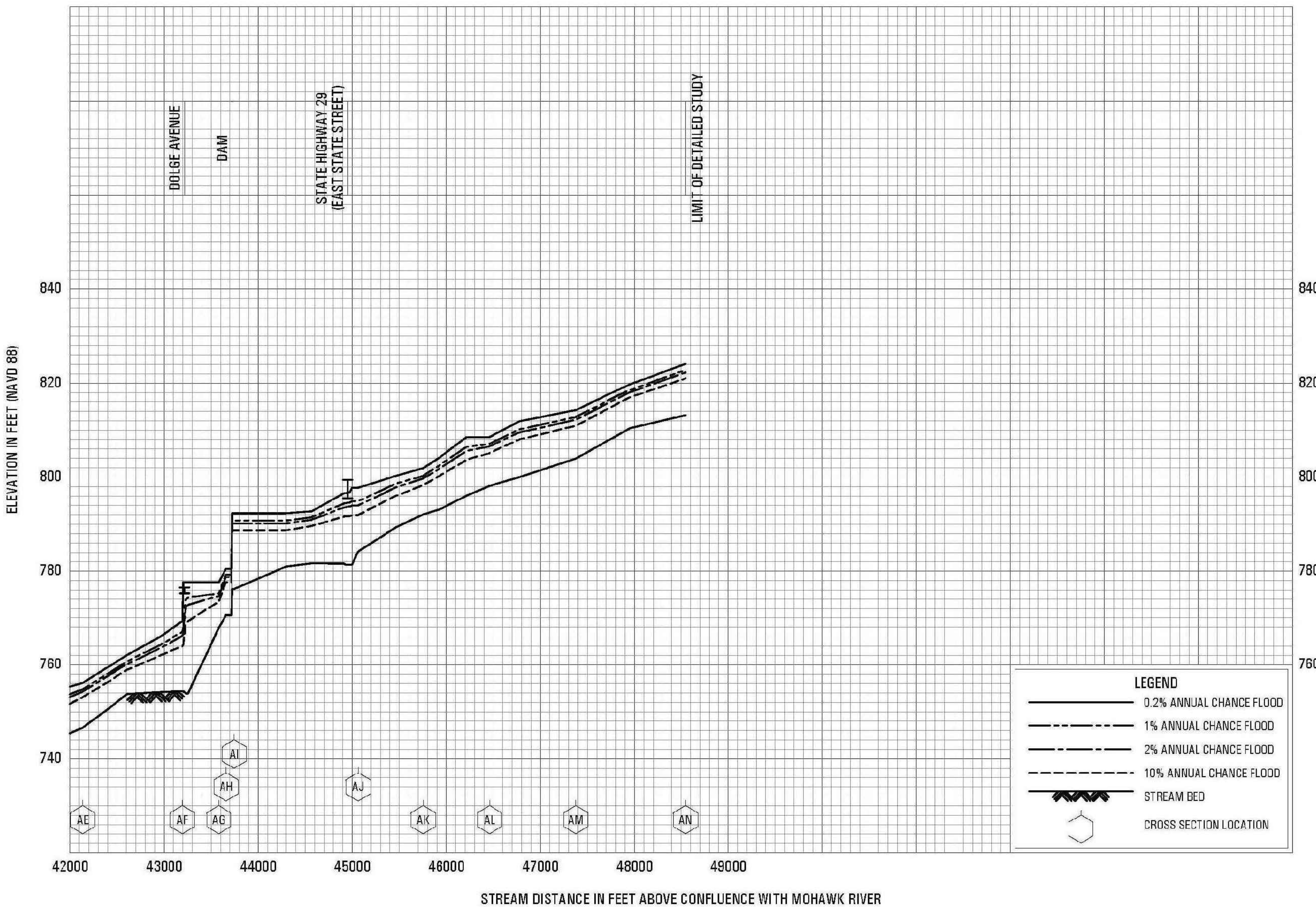


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# East Canada Creek FEMA FIS Profile

**NYDOT Emergency Transportation Infrastructure Recovery**

**Herkimer County, New York**

DRAWING NAME:

**FIG. 7**

*Alternative 1-2: Removal or Modification of the Daniel Green Company Dam*

Removal or physical modification of the dam would mitigate flooding in Dolgeville by lowering water surface elevations and by reducing the frequency and severity of ice jam related flooding. The FEMA profiles indicate that the dam is causing an increase in water surface elevations of approximately eight feet during the 100-year flow event. Because the dam is situated on bedrock, detailed survey would be required in order to more accurately determine the potential drop in water surface elevation that would result from dam removal. Similar to Alternative 1-1, this scenario would require the participation and willingness of the current dam owner. Typical modifications could include lowering the crest, a longer spillway, or use of an auxiliary spillway.

*Alternative 1-3: Bridge and Channel Modification*

The skewed steel truss pedestrian bridge (STA 435+25) at the bend is too small and is probably impacted by both the spillway backwater as well as sediment deposition, as evidenced by a delta in the pool. East Canada Creek narrows at specific points as it flows through Dolgeville, creating pinch points as follows:

1. The bank-to-bank measurement in the vicinity of the Route 29 bridge (STA 452+50) ranges from 165 feet at the bridge to 150 feet at a point approximately 200 feet downstream of the bridge. The right creek bank through this area consists of a vertical wall while on the left is a steep riprap slope. There is no floodplain on either bank.

2. The second pinch point is located at the pedestrian walkway (STA 435+25). At this point, the channel narrows to a width of 145 feet and is confined between vertical walls on both banks with no floodplain. The FEMA profiles indicate that this constriction is causing an increase in water surface elevations of approximately 8 feet during the 100-year flow event, which extend upstream to the vicinity of the dam.

Improving the channel's capacity at these pinch points will require a combination of removal of the pedestrian walkway and removal or modification of the walls that line the channel through the village in order to widen the channel and increase hydraulic capacity.

*Recommendation*

The three alternatives presented above have the potential to incrementally reduce flooding risk in Dolgeville. Alternative 1-1 would be the least costly of the three alternatives, followed by Alternative 1-2, then Alternative 1-3. It is recommended that Alternative 1-1 be fully evaluated and, if feasible, implemented. If, after implementation of Alternative 1-1, the remaining flood risk is unacceptable or not feasible, evaluation and implementation of Alternative 1-2 is recommended. Alternative 1-3 will be the most expensive scenario of the three alternatives presented and should be pursued only if Alternatives 1-1 and 1-2 are not feasible or do not reduce flood risk to an acceptable level.

## 3.4 High-Risk Area #2 – Dolgeville Hydroelectric Dam

Figure 8 is a location plan of High Risk Area #2. This area is in the vicinity of the wastewater treatment plant and hydroelectric station downstream of Dolgeville and includes the dam and spillway at STA 396+25.

This stream segment is prone to collecting ice, resulting in ice jam related flooding of homes along Van Buren Street and Dolge Avenue and of the wastewater treatment plant and hydroelectric station. The aerial photograph shows a large shallow delta at the head of the pool that will tend to trap "grounded" ice and raise floodwater levels. The spillway at the dam may be undersized.

*Alternative 2-1: Modification of Dam Operation at STA 396+25*

It is possible that occurrences of ice jams can be reduced by altering the operations of the dam during periods when ice jams are prone to occur. As discussed in relation to the dam in High Risk Area #1, this strategy will require entering into a dialogue with the owner(s) of the hydroelectric station and dam. A comprehensive understanding of the operation of the dam will be required in order to determine whether a modified operational plan would reduce ice jams and flooding.

*Alternative 2-2: Dam Removal or Modification*

Removal or physical modification of the dam would mitigate flooding by reducing the frequency and severity of ice jam related flooding but may be limited by the dam's location on natural ledge. Typical modifications could include lowering the crest, a longer spillway, or use of an auxiliary spillway. However, given the active hydroelectric operations, such alteration may not be feasible.

*Recommendation*

The two alternatives presented have the potential to incrementally reduce flooding risk; however, the feasibility of either will likely be driven by Federal Energy Regulatory Commission (FERC) regulations and the operational needs of the dam. Alternative 2-1 would be less costly than Alternative 2-2. It is recommended that Alternative 2-1 be fully evaluated and, if feasible, implemented. If, after further evaluation of Alternative 2-1, the remaining flood risk is unacceptable, evaluation of Alternative 2-2 is recommended, recognizing that it may not be feasible in the foreseeable future.

## 3.5 High-Risk Area #3 – Sediment Deposition Zone Along Saltsman Road

Figure 9 is a location plan of High Risk Area #3. After the June 2013 flood, a large sediment bar formed in the channel on East Canada Creek downstream of the dams and power plant at East Canada Lake adjacent to Saltsman Road (STA 52+00 to 42+00). A large deposit of sediment also formed at this location following a flood event in 2006.


SOURCE(S):

**Figure 8: East Canada Creek High Risk Area #2**

**Location:** Herkimer County, New York

N

**NYDOT: Emergency Transportation Infrastructure Recovery**

**Map By:** CMP
**MMI#:** 5231-01
**MXD:** Y:\5231-01\GIS\Maps\High Risk Areas\East Canada High Risk #2.mxd
**1st Version:** 01/09/2014
**Revision:** 3/3/2014
**Scale:** 1 in = 100 ft

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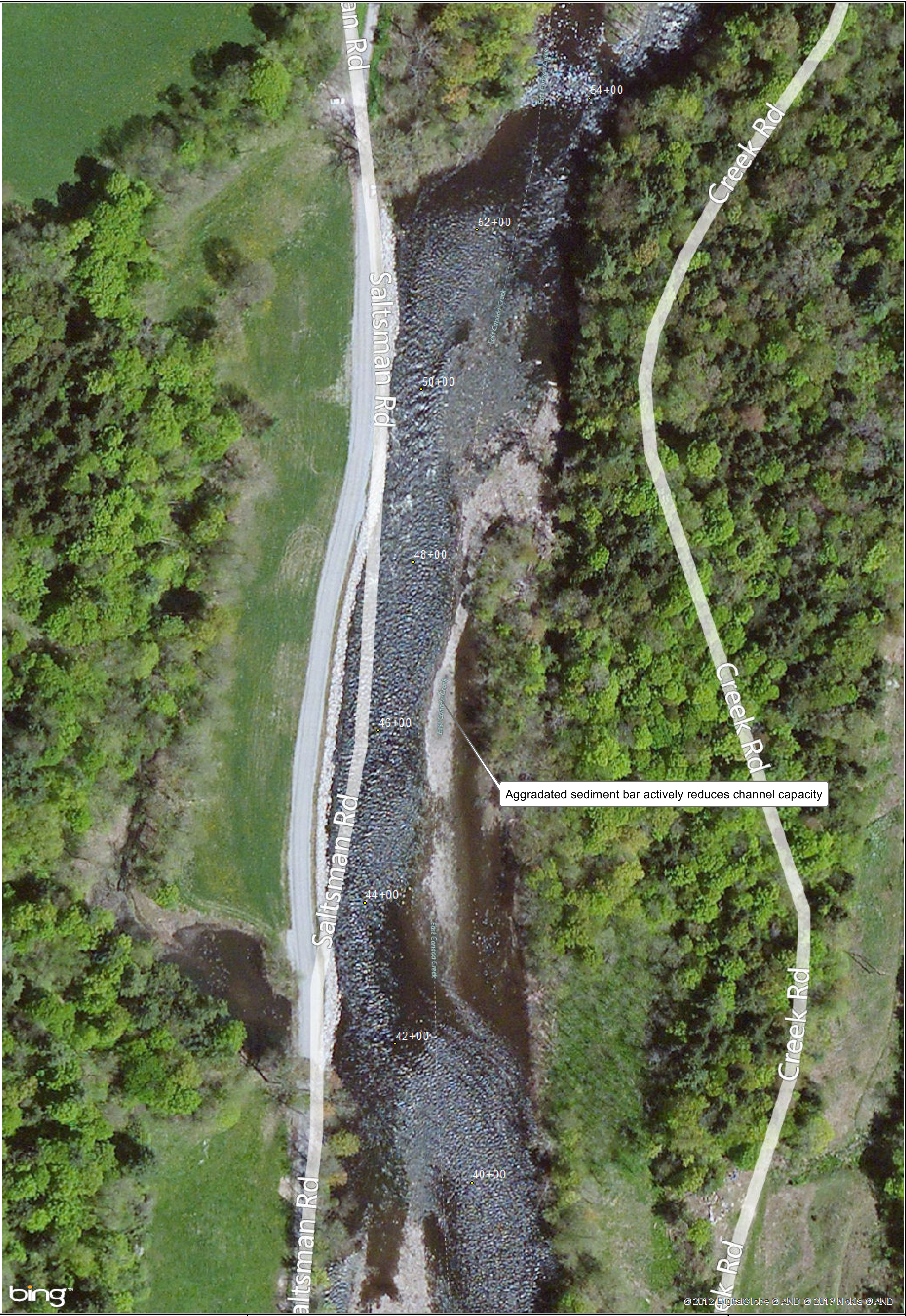



| SOURCE(S): | Figure 9: East Canada Creek High Risk Area #3 | Location: Herkimer County, New York |
|---|---|---|
| | NYDOT: Emergency Transportation Infrastructure Recovery<br>Map By: CMP<br>MMI#: 5231-01<br>MXD: Y:\5231-01\GIS\Maps\High Risk Areas\East Canada High Risk #3.mxd<br>1st Version: 01/09/2014<br>Revision: 2/17/2014<br>Scale: 1 in = 100 ft | MILONE & MACBROOM<br>99 Realty Drive Cheshire, CT 06410<br>(203) 271-1773 Fax: (203) 272-9733<br>www.miloneandmacbroom.com |

Local officials have reported that the sediment bar in the channel forms at an elevation that is higher than Saltsman Road, reducing channel capacity and resulting in flooding of the road. The source of the sediment appears to be the bed of the channel downstream of the upper dam (at STA 97+00).

Sediment transport processes on East Canada Creek in the area of Saltsman Road are dominated by the operation of the hydroelectric dam and reservoir. Based on the size and depth of the reservoir at East Canada Lake, the sediments that are being deposited along Saltsman Road do not likely originate upstream of the reservoir. The majority of coarse-grained sediments that are transported down East Canada Creek upstream of the reservoir would tend to fall out when they reached this large body of water.

The sediments that have accumulated along Saltsman Road appear to have originated in the bedrock channel between STA 97+00 and STA 78+00. It appears that this section of channel remains dry under normal flow conditions as water is diverted through a headrace for the purpose of generating hydroelectric power. During high flows when the capacity of the conduit is exceeded, it appears that high velocity flows run through this bypass section of channel. A likely scenario is that flows running through this section of channel scour the bedrock, creating coarse-grained sediments that are then deposited along Saltsman Road as the channel widens and flow velocities decrease.

*Alternative 3-1: Modification of Dam and Reservoir Operation*

A dialogue will need to be initiated with the owners of the hydroelectric station, reservoir, and dam in order to evaluate the feasibility of altering the operation of the facility to reduce the occurrence and severity of scour in this section of channel. This may include a lowering of the water surface elevation in the reservoir when high flow events are forecasted. Another alternative would involve hardening of the channel downstream of the dam to prevent scour. Modification of the operation of this system may result in reduced sediment deposition along Saltsman Road.

*Alternative 3-2: Periodically Remove Sediments from Channel*

Periodic maintenance should be undertaken to remove deposited sediments along Saltsman Road. It appears that these sediments are originating through the process of scouring of the bedrock channel between STA 97+00 and STA 78+00 during high flow events. A methodology should be developed that would allow for proper channel sizing and slope. The following guidelines are recommended:

1. Maintain the original channel slope and do not overly deepen or widen the channel. Excavation should not extend beyond the channel's estimated bankfull width unless it is to match an even wider natural channel.

2. Best available practices should be followed to control sedimentation and erosion.

3. Sediment excavation requires regulatory permits. Prior to initiation of any in-stream activities, NYSDEC should be contacted, and appropriate local, state, and federal permitting should be obtained.

4. Disposal of excavated material should always occur outside of the floodplain. If such materials are placed on the adjacent bank, they will be vulnerable to remobilization and redeposition during the next large storm event.

5. No excavation should be undertaken in areas where rare or endangered species are located.

*Recommendation*

Alternative 3-2 is recommended to be implemented on an ongoing basis while concurrently exploring the feasibility of Alternative 3-1.

## 3.6 Individual Property-Based Risk Areas

*Alternative 1-1: Strategic Acquisition of High Risk Properties*

In areas along this reach of East Canada Creek where dwellings have suffered repeated losses due to flooding, property acquisition is a potentially viable mitigation alternative either through a FEMA buyout program or governmental buyout. Such properties can be converted to passive, non-intensive land uses such as streamside parks, picnic areas, fishing access sites, or wildlife observation areas.

Specific floodprone buildings were not identified as part of this study. However, a review of the FEMA flood mapping and discussions with community officials indicate that flooding of houses and businesses occurs along North Main Street on the west bank (between STA 462+00 and STA 436+00, including the mill buildings); along Dolge Avenue Extension along the east bank (between STA 452+00 and STA 436+00, including the mill buildings); along Van Buren Street on the west bank (between STA 422+00 and STA 388+00, including the wastewater treatment plant and the hydroelectric facility); and along Dolge Avenue on the east bank (between STA 422+00 and STA 414+00).

Property acquisitions may be funded by FEMA under three grant programs: the Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation (PDM), and Flood Mitigation Assistance (FMA). The PDM Program was authorized by Part 203 of the Robert T. Stafford Disaster Assistance and Emergency Relief Act (Stafford Act) and provides funds for hazard mitigation planning and mitigation projects. The HMGP is authorized under Section 404 of the Stafford Act and provides grants to implement hazard mitigation measures after a major disaster declaration. A key purpose of the HMGP is to ensure that any opportunities to take critical mitigation measures to protect life and property from future disasters are not "lost" during the recovery and reconstruction process following a disaster.

The FMA program was created as part of the National Flood Insurance Reform Act (NFIRA) of 1994 with the goal of reducing or eliminating claims under the National Flood Insurance Program (NFIP). FEMA provides FMA funds to assist states and communities with implementing measures that reduce or eliminate the long-term risk of flood damage to buildings, homes, and other structures insurable under the NFIP. The long-term goal of FMA is to reduce or eliminate claims under the NFIP through mitigation activities.

The NFIP provides the funding for the FMA program. The PDM and FMA programs are subject to the availability of appropriation funding, as well as any program-specific directive or restriction made with respect to such funds. FEMA is the entity that dispenses funds for all three programs.

Historically, acquisitions and elevations of structures have been eligible for funding only when the project is found to be cost effective using FEMA's benefit-cost analysis (BCA) program. The BCA utilizes data from the FIS or previous flood damage claims to calculate the benefit-cost ratio (BCR) associated with the acquisition. The project cost (acquisition fees plus site restoration) must be known to determine the BCR. While this process has proved effective for funding many property acquisitions nationwide, there were many instances where BCRs above 1.0 were not computed due to site-specific challenges or data gaps.

The Biggert-Waters Flood Insurance Reform Act of 2012 made several changes to the mitigation programs, and the new Hazard Mitigation Assistance (HMA) guidance was released in July 2013. One potentially important change to the PDM, HMGP, and FMA programs is that green open space and riparian area benefits can now be included in the project BCR once the project BCR reaches 0.75 or greater. This is one potential method of bridging the gap between a BCR of 0.75 and a BCR of 1.0.

On August 15, 2013, FEMA issued new guidance for acquisitions and elevations of structures within Special Flood Hazard Areas (SFHAs). According to the guidance, acquisitions with a project cost lower than $276,000 and elevations with a project cost lower than $175,000 may be considered *automatically cost-effective for structures in SFHAs*. Although this is a new interpretation of cost effectiveness, it could mean that acquisitions and elevations may be more easily funded without consideration of the BCA.

Once a structure has been acquired and demolished, the property must remain as open space. The intent of the mitigation programs is that structures will not be built in the open space although passive recreation is permitted. To offset the loss of the structure and its occupant, the community should strive to facilitate relocation nearby in areas outside of the floodplain.

*Alternative 1-2: Floodproofing and Flood Protection of Individual Properties*

Potential measures for property protection include the following:

*Elevation of the structure.* Home elevation involves the removal of the building structure from the basement and elevating it on piers to a height such that the first floor is located above the 1 percent annual chance flood level. The basement area is abandoned and filled to be no higher than the existing grade. All utilities and appliances located within the basement must be relocated to the first-floor level.

*Construction of property improvements such as barriers, floodwalls, and earthen berms.* Such structural projects can be used to prevent shallow flooding. There may be properties within the town where implementation of such measures will serve to protect structures.

*Dry floodproofing of the structure to keep floodwaters from entering.* Dry floodproofing refers to the act of making areas below the flood level watertight. Walls may be coated with compound or plastic sheathing. Openings such as windows and vents would be either permanently closed or covered with removable shields. Flood protection should extend only 2 to 3 feet above the top of the concrete foundation because building walls and floors cannot withstand the pressure of deeper water.

*Wet floodproofing of the structure to allow floodwaters to pass through the lower area of the structure unimpeded.* Wet floodproofing refers to intentionally letting floodwater into a building to equalize interior and exterior water pressures. Wet floodproofing should only be used as a last resort. If considered, furniture and electrical appliances should be moved away or elevated above the 1 percent annual chance flood elevation.

*Performing other potential home improvements to mitigate damage from flooding.* The following measures can be undertaken to protect home utilities and belongings:

- Relocate valuable belongings above the 1 percent annual chance flood elevation to reduce the amount of damage caused during a flood event.
- Relocate or elevate water heaters, heating systems, washers, and dryers to a higher floor or to at least 12 inches above the high water mark (if the ceiling permits). A wooden platform of pressure-treated wood can serve as the base.
- Anchor the fuel tank to the wall or floor with noncorrosive metal strapping and lag bolts.
- Install a backflow valve to prevent sewer backup into the home.
- Install a floating floor drain plug at the lowest point of the lowest finished floor.
- Elevate the electrical box or relocate it to a higher floor and elevate electric outlets to at least 12 inches above the high water mark.

*Encouraging property owners to purchase flood insurance under the NFIP and to make claims when damage occurs.* While having flood insurance will not prevent flood damage, it will help a family or business put things back in order following a flood event. Property owners should be encouraged to submit claims under the NFIP whenever flooding damage occurs in order to increase the eligibility of the property for projects under the various mitigation grant programs.

*Recommendation*

Alternatives 4-1 and 4-2 are recommended concurrently as site conditions, property owner participation, and funding allow.

## 4.0 RECOMMENDATIONS

1. *Modify Operation of the Dam at STA 440+50* – It is recommended that Alternative 1-1 be fully evaluated with the owner of the dam and, if feasible, implemented. It is possible that there is a way to draw down water levels behind the dam by opening a low-flow outlet or removing weirs or flashboards. Similarly, there may be a way to reduce occurrences of ice jams by altering the operations of the dam during periods of time when ice jams are prone to occur.

2. *Remove or Modify the Dam at STA 440+50* – If, after implementation of Alternative 1-1, the remaining flood risk is unacceptable, evaluation and implementation of Alternative 1-2 (removal or physical modification of the dam) is recommended as a flood hazard mitigation solution. Since this dam does not currently provide any flood storage or flood protection benefit, its removal has the potential to lower upstream water surface elevations during flooding without negatively impacting downstream properties. Its removal is also likely to improve ice jamming conditions on the river.

3. *Modify Operation of the Dam at STA 396+25* – It is recommended that Alternative 2-1 be fully evaluated with the owner of the dam and, if feasible, implemented. There may be a way to reduce occurrences of ice jams by altering the operations of the dam during periods of time when ice jams are prone to occur.

4. *Modify Operation of the Dam at STA 97+00* – Alternative 3-1 should be fully evaluated with the owner of the dam and, if feasible, implemented. A dialogue will need to be initiated with the owners of the hydroelectric station, reservoir, and dam in order to evaluate the feasibility of altering the operation of the facility to reduce the occurrence and severity of scour in this section of channel.

5. *Remove Sediment Near Saltsman Road* – Periodically remove sediments from channel along Saltsman Road. It appears that these sediments are originating through the process of scouring of the bedrock channel between STA 97+00 and STA 78+00 during high flow events.

6. *Monitor Minor Bank Failures and Erosion* – Several areas of eroding banks, bank failures, and slumping hill slopes were observed along East Canada Creek. Most of these are of low to moderate severity, appear to be relatively stable, and at the time of the field visits were not contributing a large amount of sediment to the channel. It is recommended that these sites be monitored periodically and stabilized as necessary. A substantial bank failure has occurred along the left bank of East Canada Creek between

STA 388+00 and STA 384+00, downstream of Dolgeville. Sediments originating at this bank failure become trapped by reservoirs associated with downstream hydroelectric dams and are not considered to be contributing to flooding problems on East Canada Creek. However, the bank failure is threatening a structure and property located at the top of the bank on Route 120 (Dolge Avenue) and should be repaired.

7. *Acquisition of Floodprone Properties* – Undertaking flood mitigation alternatives that reduce the extent and severity of flooding is generally preferable to property acquisition. However, it is recognized that flood mitigation initiatives can be costly and may take years or even decades to implement. Where properties are located within the FEMA designated flood zone and are repeatedly subject to flooding damages, strategic acquisition, either through a FEMA buyout or other governmental programs, may be a viable alternative. There are a number of grant programs that make funding available for property acquisition. Such properties could be converted to passive, non-intensive land uses.

8. *Protect Individual Properties* – A variety of measures are available to protect existing public and private properties from flood damage, including elevation of structures, construction of barriers, floodwalls and earthen berms, dry or wet floodproofing, and utility modifications within the structure. While broader mitigation efforts are most desirable, they often take time and money to implement. On a case-by-case basis, where structures are at risk, individual floodproofing should be explored. Property owners within FEMA delineated floodplains should also be encouraged to purchase flood insurance under the NFIP and to make claims when damage occurs.

The above recommendations are graphically depicted on the following pages. Table 5 provides an estimated cost range for key recommendations.

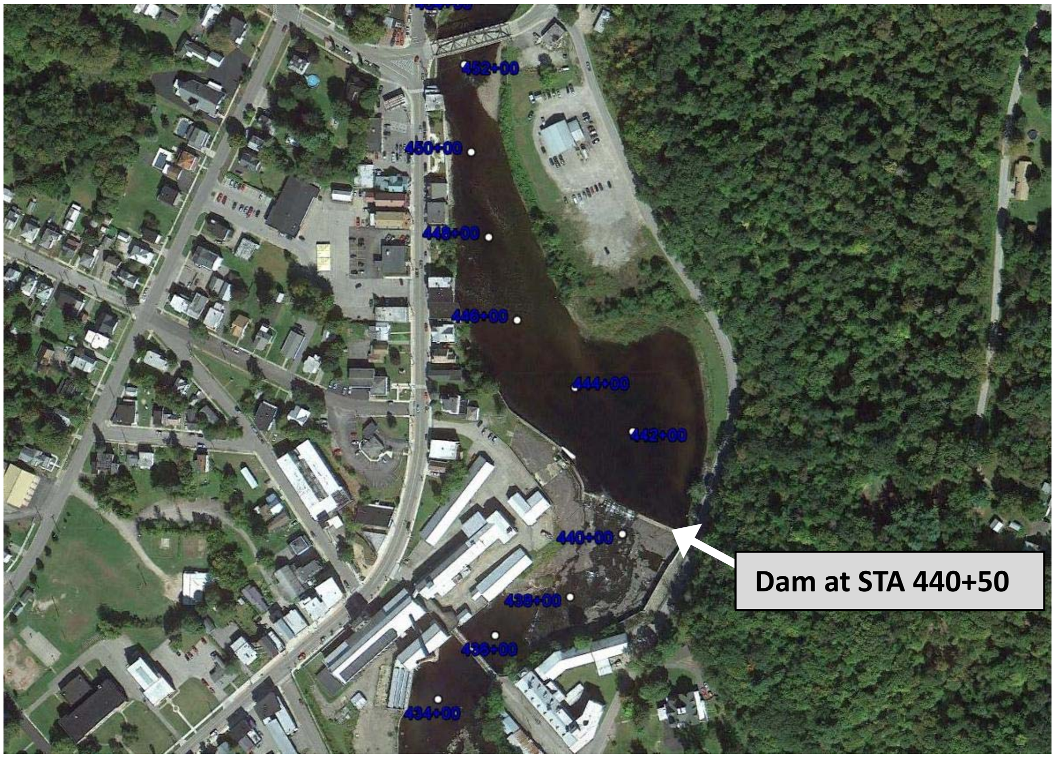
## TABLE 5
## Cost Range of Recommended Actions

| | Approximate Cost Range | | | | |
|---|---|---|---|---|---|
| **East Canada Creek Recommendations** | < $100k | $100k-$500k | $500k-$1M | $1M-$5M | >$5M |
| Modification of operation of the Daniel Green Company Dam | X | | | | |
| Removal or modification of the Daniel Green Company Dam | | X | | | |
| Bridge and channel modification | | | | X | |
| Modification of operation of the Dolgeville Hydroelectric Dam | X | | | | |
| Removal or modification of the Dolgeville Hydroelectric Dam | | | X | | |
| Sediment removal near Saltsman Road | X | | | | |

# WATER BASIN ASSESSMENT AND FLOOD HAZARD MITIGATION ALTERNATIVES
# EAST CANADA CREEK, HERKIMER COUNTY, NEW YORK

## High-Risk Area #1: Dam at STA 440+50

**Site Description:** Located in the Village of Dolgeville is a dam that contribute to local flooding issues. The dam at STA 440+50 increases water surface elevations and is the site of ice jams.




**Recommended Alternative:**

- It may be possible to reduce or "draw down" water levels behind the dam by opening a low flow outlet or removing weirs or flashboards when high flow events are forecast.
- Similarly, there may be opportunities to reduce occurrences of ice jams by altering the operations of the dam during periods when ice jams are prone to occur.
- Strategies such as these would require entering into a dialogue with the owners of the dam. A comprehensive understanding of the operation of the dam will be required in order to determine whether a modified operational plan would reduce ice jams and flooding.
- Removal or physical modification of the dam would mitigate flooding by lowering water surface elevations and reducing the frequency and severity of ice jams.

| | BENEFITS |
|---|---|
| ✓ | Improved safety |
| ✓ | Reduction in debris jams |
| ✓ | Improved hydraulic capacity |
| ✓ | Reduced flood hazard |

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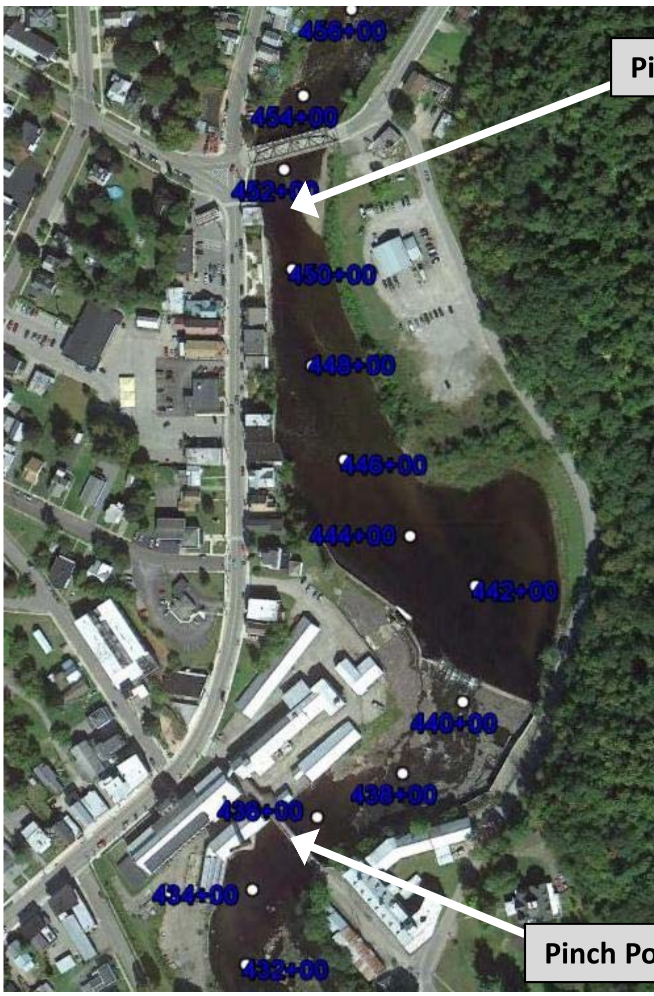
# WATER BASIN ASSESSMENT AND FLOOD HAZARD MITIGATION ALTERNATIVES
# EAST CANADA CREEK, HERKIMER COUNTY, NEW YORK

## High-Risk Area #1: Dolgeville Pinch Points

**Site Description:** East Canada Creek narrows at specific points as it flows through Dolgeville, creating pinch points:

1) The bank to bank measurement narrows to 150 feet at STA 450+20, downstream of the Route 29 Bridge. The right creek bank consist of a vertical wall; the left bank consists of a riprap slope.
2) At the pedestrian walkway (STA 435+25), the channel narrows to a width of 145 feet, and is confined between vertical walls on both banks with no floodplain.




**Pinch Point #1 at STA 450+20**


**Pinch Point #2 at STA 435+25**

**Recommended Alternative:**

- A combination of removal of the pedestrian walkway, and reconstruction of the vertical walls that line the channel through the village to increase channel capacity.

| | BENEFITS |
|---|---|
| ✓ | Reduction in debris jams |
| ✓ | Improved hydraulic capacity |
| ✓ | Reduced flood hazard |

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# WATER BASIN ASSESSMENT AND FLOOD HAZARD MITIGATION ALTERNATIVES
# EAST CANADA CREEK, HERKIMER COUNTY, NEW YORK

## High-Risk Area #2: Hydroelectric Dam (396+25)

**Site Description:** Downstream of the Village of Dolgeville is the hydroelectric dam and wastewater treatment plant. This area is prone to ice jamming, causing flooding of homes along Van Buren Street and Dolge Avenue.


**Recommended Alternative:**

- There may be opportunities to reduce occurrences of ice jams by altering the operations of the dam during periods when ice jams are prone to occur.
- Strategies such as this will require entering into a dialogue with the owners of the dam. A comprehensive understanding of the operation of the dam will be required in order to determine whether a modified operational plan would reduce ice jams.
- Removal or physical modification of the dam would mitigate flooding by reducing the frequency and severity of ice jams.

| | BENEFITS |
|---|---|
| ✓ | Improved safety |
| ✓ | Reduction in debris jams |
| ✓ | Improved hydraulic capacity |
| ✓ | Reduced flood hazard |

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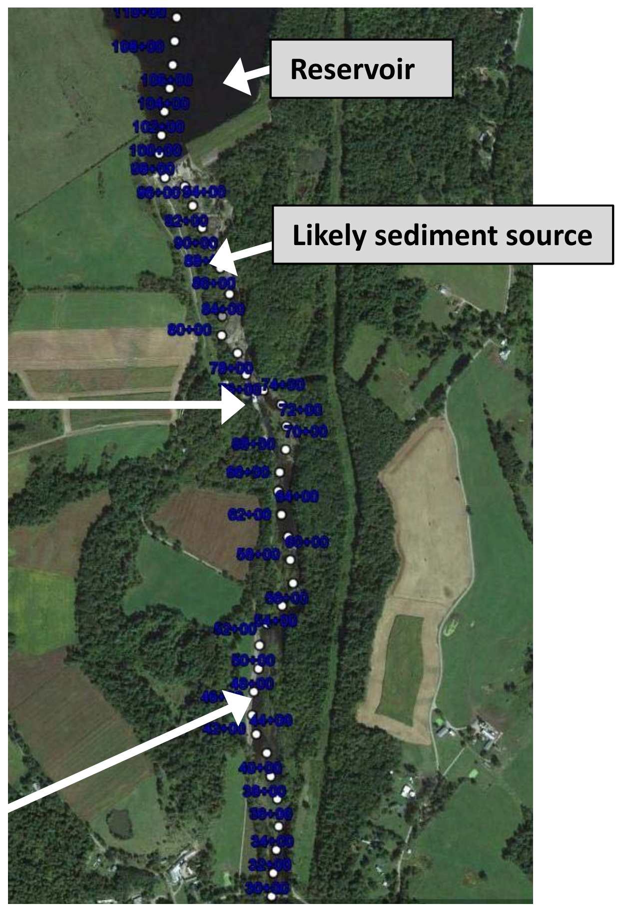
# WATER BASIN ASSESSMENT AND FLOOD HAZARD MITIGATION ALTERNATIVES
# EAST CANADA CREEK, HERKIMER COUNTY, NEW YORK

## High-Risk Area #3: Sediment Deposition Zone Along Saltsman Road

**Site Description:** Along Saltsman Road (STA 52+00 to STA 42+00), a sediment bar has formed in the channel at a similar elevation to the road. This acts to constrict the channel, resulting in overtopping of the road during high flow events.

During high flow events when the capacity of the conduit at the power station is exceeded, overflows run through a section of bedrock channel between STA 97+00 and STA 78+00, which remains dry under normal flow conditions. A likely scenario is that flows running through this section of channel at a high velocity act to scour the weathered bedrock, producing course grained sediments that are then deposited along Saltsman Road as the channel widens and flow velocities decrease.






**Recommended Alternative:**

- A dialogue will need to be initiated with the owners of the hydroelectric station, reservoir and dam in order to evaluate the feasibility of altering the operation of the facility to reduce the occurrence and severity of scour in this section of channel.
- Periodic maintenance should be undertaken to remove deposited sediments along Saltsman Road.

| | BENEFITS |
|---|---|
| ✓ | Improved hydraulic capacity |

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# APPENDIX A

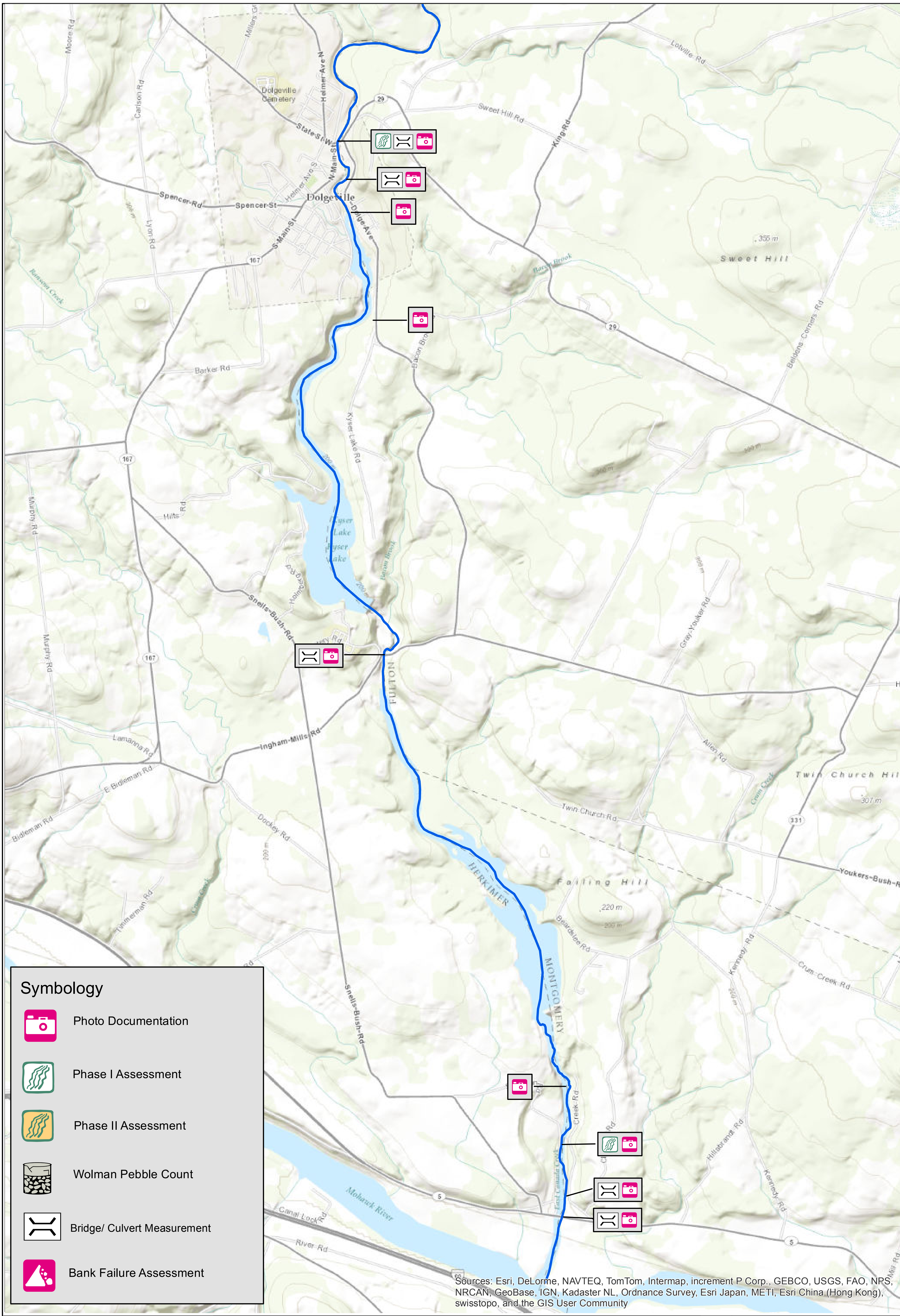
## Summary of Data and Reports Collected

# ATTACHMENT A: DATA INVENTORY

| Year | Data Type | Document Title | Author |
|---|---|---|---|
| 2013 | Presentation | Flood Control Study for Fulmer Creek | Schnabel Engineering |
| 2012 | Map | Sauquoit Creek Watershed/Floodplain Map | Herkimer-Oneida Counties Comprehensive Planning Program |
| 2011 | Report | Oriskany Creek Conceptual Plan and Feasibility Study for Watershed Project | Oneida County SWCD |
| 2009 | Presentation | Ice Jam History and Mitigation Efforts | National Weather Service, Albay NY |
| 2007 | Report | Cultural Resources Investigations of Fulmer, Moyer, and Steele Flood Control Projects | United States Army Corps of Engineers (USACE) |
| 2006 | Report | Riverine High Water Mark Collection, Unnamed Storm | Federal Emergency Management Agency (FEMA) |
| 2005 | Report | Fulmer Creek Flood Damage Control Feasibility Study | United States Army Corps of Engineers (USACE) |
| 2005 | Report | Steele Creek Flood Damage Control Feasibility Study | United States Army Corps of Engineers (USACE) |
| 2004 | Report | Fulmer Creek Basin Flood Hazard Mitigation Plan | Herkimer-Oneida Counties Comprehensive Planning Program |
| 2004 | Report | Moyer Creek Basin Flood Hazard Mitigation Plan | Herkimer-Oneida Counties Comprehensive Planning Program |
| 2004 | Report | Steele Creek Basin Flood Hazard Mitigation Plan | Herkimer-Oneida Counties Comprehensive Planning Program |
| 2003 | Report | Fulmer, Moyer, Steele Creek - Stream Bank Erosion Inventory | Herkimer-Oneida Counties Comprehensive Planning Program |
| 1997 | Report | Sauquoit Creek Watershed Management Strategy | Herkimer-Oneida Counties Comprehensive Planning Program |
| 2011 | Report | Flood Insurance Study (FIS), Herkimer County | Federal Emergency Management Agency (FEMA) |
| 2011 | Report | Flood Insurance Study (FIS), Montgomery County | Federal Emergency Management Agency (FEMA) |
| 2013 | Report | Flood Insurance Study (FIS), Oneida County | Federal Emergency Management Agency (FEMA) |
| 2010 | Report | Bridge Inspection Summaries, Multiple Bridges | National Bridge Inventory (NBI) |
| 2002 | Hydraulic Models | Flood Study Data Description and Assembly - Rain CDROM | New York Department of Enviromental Conservation (NYDEC) |
| 2013 | Data | June/July 2013 - Post-Flood Stream Assessment | New York State Department of Transportation (NYSDOT) |
| 2013 | GIS Data | LiDAR Topography, Street Mapping, Parcel Data, Utility Info, Watersheds | Herkimer-Oneida Counties Comprehensive Planning Program |
| 2013 | GIS Data | Aerial Orthographic Imagery, Basemaps | Microsoft Bing, Google Maps, ESRI |
| 2011 | GIS Data | FEMA DFIRM Layers | Federal Emergency Management Agency (FEMA) |
| 2013 | Data | Watershed Delineation and Regression Calculation | US Geological Survey (USGS) - Streamstats Program |

**APPENDIX B**

**Field Data Collection Forms**




SOURCE(S):

**Appendix B: East Canada Creek Data Collection Points**

Location: **Herkimer County, New York**

N

**NYDOT: Emergency Transportation Infrastructure Recovery**

**Map By:** CMP
**MMI#:** 5231-01
**MXD:** Y:\5231-01\GIS\Maps\Phase II Icon Maps\East Canada 12-1.mxd
**1st Version:** 12/12/2013
**Revision:** 12/12/2013
**Scale:** 1 in = 2,917 ft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**MMI Project #5231-01 Phase I River Assessment Reach Data**

River ________________ Reach _____________ U/S Station _______________ D/S Station ___________

Inspectors __________________ Date ______________ Weather ____________________________________

Photo Log ________________________________________________________________________________

---

A) Channel Dimensions: Bankfull
Width (ft) __________
Depth (ft) __________

Watershed area at D/S end of reach ($mi^2$) ___________

B) Bed Material:

| | | |
|---|---|---|
| Bedrock | Boulders | Cobble |
| Gravel | Sand | Clay |
| Concrete | Debris | Riprap |

Notes: ______________________________________________________________________

C) Bed Stability: Aggradation Degradation Stable Note: ___________________

D) Gradient: Flat Medium Steep Note: ___________________

E) Banks: Natural Channelized Note: _________________

F) Channel Type: Incised Colluvial Alluvial Bedrock Note: __________

G) Structures: Dam Levee Retaining Wall Note: ________________

H) Sediment Sources: ____________________________________________________________________________

I) Storm Damage Observations: _________________________________________________________________________

_________________________________________________________________________

J) Vulnerabilities: Riverbank Development Floodplain Development Road Trail Railroad

Utility Bridge Culvert Retaining Wall Ball field Notes: _________________

K) Bridges: Structure # _____________ Inspection Report? Y N Date _________________

Notes: ___________________________________________________________________________________________

Record span measurements if not in inspection report: _____________________________________________________

Damage, scour, debris: ____________________________________________________________________________

L) Culverts: complete culvert inspection where necessary. Size: ____________________________________________

Type: _________________ Notes: ____________________________________________________________________

_____________________________________________________________________________________________

# Phase II River Assessment
# Reach Data

River ____________________ Reach ____________ Road _____________ Station ______________

Inspector _________________ Date _____________ Town ____________ County ______________

Identification Number _____________________ GPS # ________________ Photo # ________________

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A) River Reach ID ______________________________ Drainage Area, sm ______________________________

D/S Boundary ________________________________, U/S Boundary ______________________________

D/S STA ____________________________________, U/S STA __________________________________

D/S Coordinates _____________________________, U/S Coordinates ___________________________

B) Valley Bottom Data:

| | | | |
|---|---|---|---|
| Valley Type | Confined | Semiconfined | Unconfined |
| (Circle one) | >80% L | 20-80% | <20% |
| Valley Relief | <20' | 20-100' | >100 |
| Floodplain Width | <2 $W_b$ | 2-10 $W_b$ | >10 $W_b$ |

| | Left Side | Right Side |
|---|---|---|
| Natural floodplain | _______% | _______% |
| Developed floodplain | _______% | _______% |
| Terrace | _______% | _______% |
| Floodplain Land Use | ____________ | ____________ |

C) Pattern:

| Straight | Sinuous | Meanders | Highly Meandering | Braided | Wandering | Irregular |
|---|---|---|---|---|---|---|
| S=1-1.05 | S=1.05 – 1.25 | S=1.25 – 2.0 | S>2.0 | | | |

D) Channel Profile Form: (Percent by Class in Reach)

| | | | | |
|---|---|---|---|---|
| Cascades | __________ | Alluvial | __________ | Channel Transport |
| Steep Step/Pool | __________ | Semi Alluvial | __________ | Sed. Source Area |
| Fast Rapids | __________ | Non Alluvial | __________ | Eroding |
| Tranquil Run | __________ | Channelized | __________ | Neutral |
| Pool & Riffle | __________ | Incised | __________ | Depositional |
| Slow Run | __________ | Headcuts | __________ | |

E) Channel Dimensions (FT):

| | Bankfull | Actual Top of Bank | Regional HGR |
|---|---|---|---|
| Width | __________ | __________ | __________ |
| Depth | __________ | __________ | __________ |
| Inner Channel Base Width | __________ | | |
| W/D Ratio | __________ | | |

F) Hydraulic Regime:

Mean Bed Profile Slope ________________ Ft/Ft

Observed Mean Velocity ______________________ FPS

G) Bed Controls:

| | | |
|---|---|---|
| Bedrock | Weathered Bedrock | Dam |
| Static Armor | Cohesive Substrate | Bridge |
| Boulders | Dynamic Armor | Culvert |
| Debris | Riprap | Utility Pipe/Casing |

Overall Stability _______________________

H) Bed Material:

D50 __________

| | | | | | |
|---|---|---|---|---|---|
| Bedrock | __________ | Sand | __________ | Riprap | __________ |
| Boulders | __________ | Silt and Clay | __________ | Concrete | __________ |
| Cobble and Boulder | __________ | Glacial Till | __________ | | |
| Gravel and Cobble | __________ | Organic | __________ | | |
| Sand and Gravel | __________ | | | | |

I) Flood Hazards:

| | |
|---|---|
| Developed Floodplains | Bank Erosion |
| Buildings | Aggradation |
| Utilities | Sediment Sources |
| Hyd. Structures | Widening |

## Bridge Waterway Inspection Summary

River ____________________ Reach ____________ Road _____________ Station ______________

Inspector _________________ Date _____________ NBIS Bridge Number ____________________

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NBIS Structure Rating _____________________ Year Built __________________________________

Bridge Size & Type _______________________ Skew Angle ________________________________

Waterway Width (ft) ______________________ Waterway Height (ft) _________________________

Abutment Type (circle) Vertical Spill through Wingwalls

Abutment Location (circle) In channel At bank Set back

Bridge Piers _____________________________ Pier Shape __________________________________

Abutment Material ________________________ Pier Material _________________________________

Spans % Bankfull Width ____________________ Allowance Head (ft) __________________________

Approach Floodplain Width _________________ Approach Channel Bankfull Width _______________

Tailwater Flood Depth or Elevation ___________ Flood Headloss, ft ____________________________

| | Left Abutment | Piers | Right Abutment |
|---|---|---|---|
| Bed Materials, $D_{50}$ | | | |
| Footing Exposure | | | |
| Pile Exposure | | | |
| Local Scour Depth | | | |
| Skew Angle | | | |
| Bank Erosion | | | |
| Countermeasures | | | |
| Condition | | | |
| High Water Marks | | | |
| Debris | | | |

| | | | |
|---|---|---|---|
| Bed Slope | Low | Medium | Steep |
| Vertical Channel Stability | Stable | Aggrading | Degrading |
| Observed Flow Condition | Ponded | Flow Rapid | Turbulent |

Lateral Channel Stability ________________________________________________

Fish Passage ________________________________________________

Upstream Headwater Control ________________________________________________

Project Information

| | |
|---|---|
| Project Name | |
| Project Number | |
| Stream / Station | |
| Town, State | |
| Sample Date | |
| Sampled By | |
| Sample Method | Wolman Pebble Count |

Particle Distribution (%)

| | |
|---|---|
| silt/clay | |
| sand | |
| gravel | |
| cobble | |
| boulder | |
| bedrock | |

Sample Site Descriptions by Observations

| | |
|---|---|
| Channel type | |
| Misc. Notes | |
| | |
| | |
| | |

Particle Sizes (mm)

| | |
|---|---|
| D16 | |
| D35 | |
| **D50** | |
| D84 | |
| D95 | |

(Bunte and Abt, 2001)

| Particle Name | Size Limits (mm) lower | upper | Tally | Count | Percent Passing | Cumulative % Finer |
|---|---|---|---|---|---|---|
| silt/clay | 0 | **0.063** | | | 0.0 | 0.0 |
| very fine sand | 0.063 | **0.125** | | | 0.0 | 0.0 |
| fine sand | 0.125 | **0.250** | | | 0.0 | 0.0 |
| medium sand | 0.250 | **0.500** | | | 0.0 | 0.0 |
| coarse sand | 0.500 | **1** | | | 0.0 | 0.0 |
| very coarse sand | 1 | **2** | | | 0.0 | 0.0 |
| very fine gravel | 2 | **4** | | | 0.0 | 0.0 |
| fine gravel | 4 | **5.7** | | | 0.0 | 0.0 |
| fine gravel | 5.7 | **8** | | | 0.0 | 0.0 |
| medium gravel | 8 | **11.3** | | | 0.0 | 0.0 |
| medium gravel | 11.3 | **16** | | | 0.0 | 0.0 |
| coarse gravel | 16 | **22.6** | | | 0.0 | 0.0 |
| coarse gravel | 22.6 | **32** | | | 0.0 | 0.0 |
| very coarse gravel | 32 | **45** | | | 0.0 | 0.0 |
| very coarse gravel | 45 | **60** | | | 0.0 | 0.0 |
| small cobble | 60 | **90** | | | 0.0 | 0.0 |
| medium cobble | 90 | **128** | | | 0.0 | 0.0 |
| large cobble | 128 | **180** | | | 0.0 | 0.0 |
| very large cobble | 180 | **256** | | | 0.0 | 0.0 |
| small boulder | 256 | **362** | | | 0.0 | 0.0 |
| small boulder | 362 | **512** | | | 0.0 | 0.0 |
| medium boulder | 512 | **1024** | | | 0.0 | 0.0 |
| large boulder | 1024 | **2048** | | | 0.0 | 0.0 |
| very large boulder | 2048 | **4096** | | | 0.0 | 0.0 |
| bedrock | 4096 | **-** | | | 0.0 | 0.0 |
| | | | Total | 0 | 0.0 | - |

(Wenthworth, 1922)

F-T Particle Sizes (mm)

| | |
|---|---|
| F-T n-value | 0.5 |
| D16 | |
| D5 | |

(Fuller and Thompson, 1907)

D (mm) of the largest mobile particles on bar

| | |
|---|---|
| | |
| | |
| | |
| | |
| | |
| Mean | |

Riffle Stability Index (%)

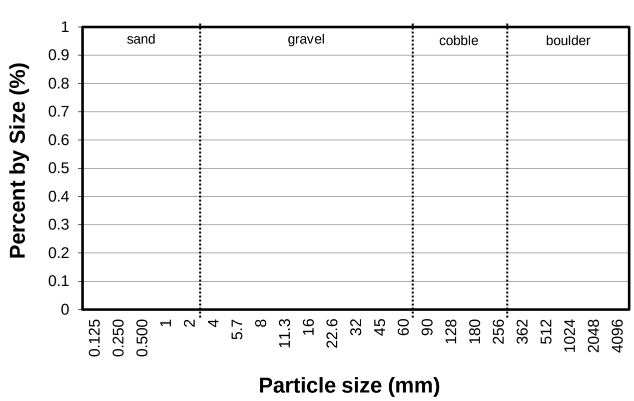
| |
|---|
| |

(Kappesser, 2002)

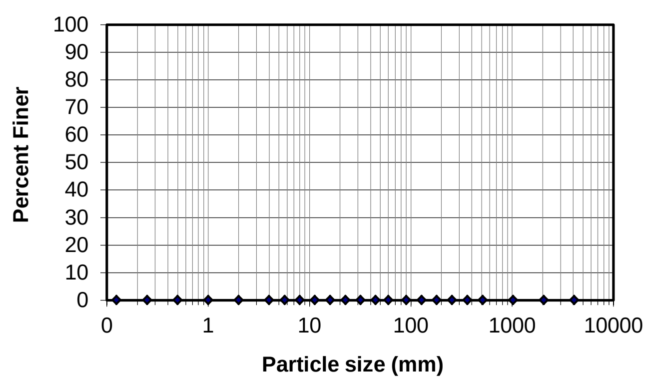
Notes

| |
|---|
| |

**Particle Size Histogram**




**Gradation Curve**



## APPENDIX C

## East Canada Creek Photo Log

Engineering,
Landscape Architecture
and Environmental Science
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99 Realty Drive
Cheshire, Connecticut 06410
(203 271-1773

# East Canada Creek High Risk Areas

## PROJECT PHOTOS

PHOTO NO.:

**1**

DESCRIPTION:

Looking downstream from approximate STA 454+00, this is the Route 29 bridge crossing in Dolgeville that is prone to ice jamming and associated flooding in the town.


PHOTO NO.:

**2**

DESCRIPTION:

Viewing from the Route 29 bridge, this photo shows the impounded area above the dam located at STA 440+50.

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# East Canada Creek High Risk Areas



| PHOTO NO.: 3 DESCRIPTION: | |
|---|---|
| Looking upstream, the hydroelectric dam at STA 396+25 can be seen, identified as High Risk Area #2. |  |

| PHOTO NO.: 4 DESCRIPTION: | |
|---|---|
| Viewing from approximate STA 49+00, this is a look from upstream along Saltsman Road with the accumulated sediment bar along the left bank of the river identified in High Risk Area #3. |  |