Cite as:
MMI, 2017. Rome Dam Engineering Study. Prepared for Essex County and the Town of Jay, New York, by Milone & MacBroom, Inc., Jay, New York.

Rome Dam Engineering Study
(NY ID #219-1082)

Jay, New York
February 28, 2017

Prepared for:
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MMI #5810-01-05

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ACKNOWLEDGEMENTS

We would like to thank those who took time to assist with this project and provide information to guide the engineering study. The following people assisted with project logistics, improved our understanding of the background of Rome Dam, and provided helpful information to complete this study.

Archie Depot, Town of Jay, New York
Robbie Lincoln, Town of Jay, New York
Sharron Hewston, Town of Jay, New York
Randy Douglas, Town of Jay, New York
Michael Mascarenas, Essex County, New York
Jim Dougan, Essex County, New York
Chris Garrow, Essex County, New York
Hannah Jacques, Essex County, New York
Amanda Hansen, New York Governor's Office of Storm Recovery
Lori Shirley, New York Governor's Office of Storm Recovery
Peter Connery, New York State Department of Environment Conservation Dam Safety
Madeleine Lyttle, U.S. Fish and Wildlife Service
Kelley Tucker, Ausable River Association
Stephen Longmire, Author, Photographer, and Historian
Steve Kirk, HGA, LLC

EXECUTIVE SUMMARY

The Rome Dam, formerly known as the J&J Rogers Pulp Mill Dam (NY ID #219-1082), is a stone masonry and concrete gravity dam located on the West Branch Ausable River in Jay, New York. The dam lies approximately 1.5 miles upstream of the confluence of the East and West Branches of the Ausable River and the village of Au Sable Forks, New York.

The dam is 38 feet tall and 103 feet long and has a concrete gravity ogee spillway. The dam was reportedly built in 1897, and its original use was to provide process water and mechanical power for local paper and pulp mills. The dam is currently owned by the Town of Jay and no longer is in use. The dam is in poor condition, is listed as unsound, and is classified as a high hazard (class C) structure.

The West Branch Ausable River watershed is mostly forest. Development exists along the banks of the West Branch Ausable River downstream of the Rome Dam, and much of the downstream floodplain contains buildings, roads, and infrastructure. Au Sable Forks is prone to flooding, especially during ice jams that originate on the East Branch of the Ausable River.

Upstream of the Rome Dam impoundment, the channel is wide, connected to a broad floodplain, and prone to sediment deposition. The submerged channel (i.e., the Rome Dam impoundment) is narrow and confined in a bedrock gorge. Downstream of the dam, the channel is narrow, disconnected from its floodplain, and dominated by sediment transport.

The bedrock gorge impoundment is partially filled with sediment. Probing shows that water depths vary moving down through the impoundment and range between 2 and 25 feet. A bedrock control was located during probing that is approximately 10 feet under the current water surface and 870 feet upstream of the dam. This suggests that a waterfall will exist in this location if the dam is lowered or removed. With the abundance of bedrock around the dam, it is likely that another bedrock falls exists near the dam.

The dam is currently storing approximately 19 acre-feet of water at the spillway elevation and is capable of storing approximately 61 acre-feet of water at the top of the dam (~14.3 feet above the spillway). Recent field survey and sediment probing data indicate that approximately 30 acre-feet (48,000 cubic yards) of accumulated sediment is currently being stored behind the dam. Therefore, the volume of sediment and water combined is approximately 49 acre-feet at the spillway and approximately 91 acre-feet at the top of the dam.

The Rome Dam impounds approximately 48,000 cubic yards (30 acre-feet) of sediment over about 1,300 feet of impounded channel. This amount of sediment is estimated to be equal to 4 years of sediment production in the watershed. Based on the information collected during the sediment sampling and analysis, sediment located behind the dam is not toxic and appears to be typical of the subsurface material found along the river bottom in the free-flowing channel. The analysis did not identify concentrations exceeding thresholds for Class A sediment. Phased sediment removal with incremental dam lowering is recommended as it is effective at reducing risks, can reduce downstream impacts since more work takes place out of flowing water, can be a cost-effective method, and is familiar to dam removal construction contractors.

Hydraulic analysis of the West Branch Ausable River was completed to estimate current risks around Rome Dam and to evaluate dam retention and removal alternatives. Spillway capacity analysis, flood-level analysis, dam-breach analysis, sediment evaluation, scour analysis, ice-jam evaluation, and an alternatives analysis were performed with the model. The model covers approximately 13,000 feet (2.5 miles) of the river channel beginning approximately 1,600 feet upstream of the dam and extending to a location that is approximately 3,600 feet downstream of the confluence of the East and West Branch Ausable Rivers. The model includes Rome Dam, the (closed) Robison Bridge, and the Main Street Bridge.

A small, Class C dam is required to have adequate spillway capacity to pass 50 percent of the Probable Maximum Flood (PMF) with a minimum of 1 foot of additional space between the design water surface and the top of dam (i.e., freeboard). The hydraulic modeling results indicate that the dam is overtopped by approximately 8.5 feet during the ½ PMF indicating that the dam's spillway does not meet New York State capacity requirements for a Class C dam.

Modeling results show the expected reduction in flood levels upstream of the dam in the bedrock gorge area with full or partial dam removal. The modeling results show a change from a flat water surface to a sloped water surface following dam removal indicative of lower flood levels and increased flow velocity. The increased flood velocity in the gorge will naturalize sediment transport in the channel, which will likely improve downstream channel stability over the long term.

Dam breach analysis shows that the "Sunny Day" breach leads to no additional downstream flood risk during clear flow (i.e., no sediment) conditions while the "Stormy Day" breach expands the edge of the ½ PMF floodplain in some areas leading to an increase in flood risk. Low-lying homes, businesses, roads, and other improved property would be at risk of increased damages should the dam fail.

The breach analysis also considers the release of stored sediment and possible increases in future flooding that both show an increased downstream flood risk. This finding potentially justifies the New York State (NYS) high hazard Class C ranking.

Modeling results indicate that flood levels and ice-jam thicknesses are reduced locally and within the impoundment with full removal of the dam. The modeling results with full dam removal indicate that there is no change in ice-jam thickness at the bridges, Grove Islands area, or near the confluence with the East Branch downstream when compared to the existing conditions with the dam in place. The results indicate that the dam has no effect on the hydraulics or the capacity to transport ice at downstream locations where there is a history of ice-jam flooding. Less ice is likely to form within the gorge if the dam is removed. Without the dam in place, the water surface will slope, and flow velocities will increase, which likely will reduce the thickness of the ice.

Six alternatives (i.e., no action, full removal, three quarters (¾) removal, half (½) removal, repair dam, and replace dam) were evaluated to identify action for the dam that best meets the following project objectives:

- Improve dam safety
- Reduce flood risk
- Reduce erosion risk
- Meet spillway requirements
- Improve water quality
- Reduce the town's financial exposure
- Control implementation costs
- Reduce maintenance costs

The results of the alternatives analysis suggest that full removal of the Rome Dam should take place to maximize safety, reduce liability, naturalize the river, and eliminate long-term costs at the site. Full removal is the only alternative that eliminates all dam safety requirements, downstream risks, and financial exposure associated with the existing dam. The main disadvantage of dam removal is loss of a historic Adirondack industrial dam. This loss can be offset with proper documentation and signage honoring the dam's existence.

Full removal is the preferred alternative as it meets the most project objectives for the lowest cost. The anticipated cost to implement this alternative is $2.5M to $3.0M. No maintenance costs will exist following dam removal. Design, permitting, and deconstruction of the dam are the next steps to complete the removal.

1.0 INTRODUCTION

1.1 Project Background

Milone & MacBroom, Inc. (MMI) was retained by the Town of Jay to perform an assessment and alternatives analysis of the Rome Dam in Jay, New York. The purpose of this study is to evaluate existing conditions and repair, replacement, or removal of the dam. The existing concrete and stone masonry dam is deteriorating and no longer in use and poses a safety hazard to the downstream village of Au Sable Forks.

The Rome Dam, formerly known as the J&J Rogers Pulp Mill Dam (NY ID #219-1082), is a stone masonry and concrete gravity dam located on the West Branch Ausable River in Jay, New York (Figure 1-1). It lies approximately 1.5 miles upstream of the confluence of the East and West Branches of the Ausable River and the village of Au Sable Forks (Figure 1-2).

The dam is 38 feet tall and 103 feet long and has a concrete gravity ogee spillway with a stone masonry upstream face and downstream toe. The right and left abutments are constructed of stone masonry and contain remnants of inlet works. The dam was reportedly built in 1897. The dam no longer serves its original function of generating mechanical power for a pulp and paper mill. The structure is listed as unsound and is classified as a high hazard (class C) structure.

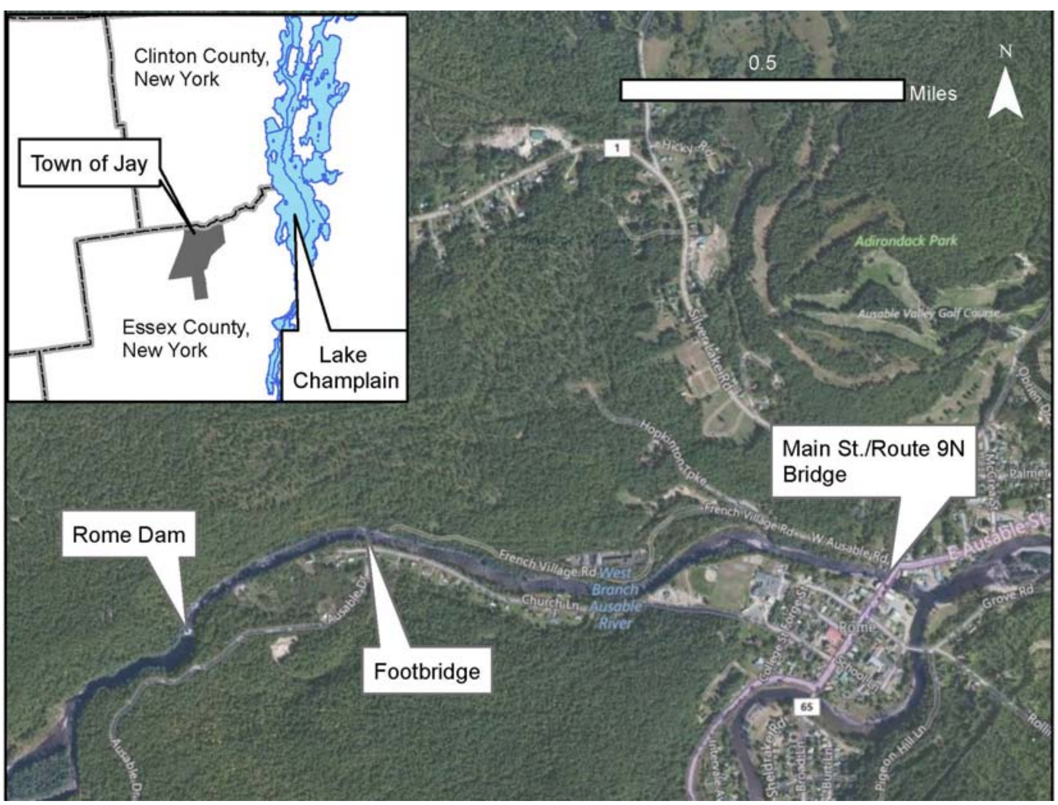


Figure 1-1: Project Location

1.2 Project Goal and Objectives

The goal of this project is to gather existing and new information to evaluate retention and removal of the Rome Dam and ultimately decide on a preferred alternative for the structure. The following project objectives will be accomplished to achieve this goal:

1. Gather and review existing information pertinent to the use, structural integrity, and safety of the current dam.
2. Perform an assessment of channel geomorphology to understand what the channel may look like after dam removal.
3. Estimate the amount and quality of the impounded sediment to understand the risks associated with dam retention and removal.
4. Perform hydrology and hydraulic calculations to evaluate flooding, spillway capacity, and dam breach impacts.
5. Assess a range of factors such as dam safety, river hydraulics, natural resources, cultural resources, costs, and aesthetics to perform an alternatives analysis.
6. Prepare a preliminary planning-level engineer's opinion of probable construction costs for the alternatives.
7. Document findings in a report.

2.0 ROME DAM

2.1 Introduction

The Rome Dam (federal ID #NY00243 and state ID #219-1082) was built in 1897 to provide mechanical power to nearby pulp and paper mills (Figure 2-1). The dam is 103 feet long and 38 feet tall to the top of the abutments. The dam has a concrete gravity ogee spillway that is approximately 29 feet tall. Stone masonry abutments exist on both sides of the spillway.

The West Branch Ausable River drains a 234-square-mile watershed at the dam site. Based on recent survey and field investigation, it is estimated that the dam is capable of storing approximately 49 acre-feet of sediment and water measured at the spillway crest and a volume of approximately 91 acre-feet measured at the top of the dam.

The dam is classified as a high hazard (Class C) dam by NYS. In the event of their failure, Class C dams are likely to result in widespread or serious damage to buildings, highways, or important utilities and substantial environmental damage such that the loss of human life or widespread substantial economic loss is likely (NYCRR Title 6 Part 673.5).

The dam is also listed as "unsound," meaning it has deficiencies of such a nature that the safety of the dam cannot be assured. These deficiencies may include seepage problems, structural stability inadequacies, or seriously inadequate spillway capacity (NYCRR Title 6, Part 673.16). The dam is currently obsolete and deteriorating. The dam has inadequate spillway capacity.

The size of Rome Dam brings it under the regulatory jurisdiction of the New York State Department of Environmental Conservation, Bureau of Flood Protection and Dam Safety (NYSDEC Dam Safety) because the height of the dam is greater than 15 feet, and it is capable of storing more than 3 million gallons (±9.2 acre-feet) of water and sediment. The dam is classified as a "small" dam by NYS since the overall height of the structure is less than 40 feet, and it impounds less than 1,000 acre-feet at the normal water surface elevation.

2.2 Historic Use

Historic use of the dam and flood history of the Au Sable Forks area are based on conversation with the Jay Town Historian and other materials supplied by the Town of Jay and NYSDEC. The Rome Dam was originally constructed in 1897 by the J & J Rogers Company to power a pulp mill. The dam's use was later expanded to also power a paper mill.

The Rome Dam was damaged in 1936 after the failure of an upstream dam where timber and debris floating downstream broke off timber flashboards and carried away the apron and stone fill for about 2/3 the length of the dam. The dam's spillway was rebuilt as a concrete ogee structure (Figure 2-2). Plans from the 1936 repairs indicate that the dam is founded on granite bedrock. The dam's use for mill power ceased in 1973. The dam has since been out of service and unmaintained.

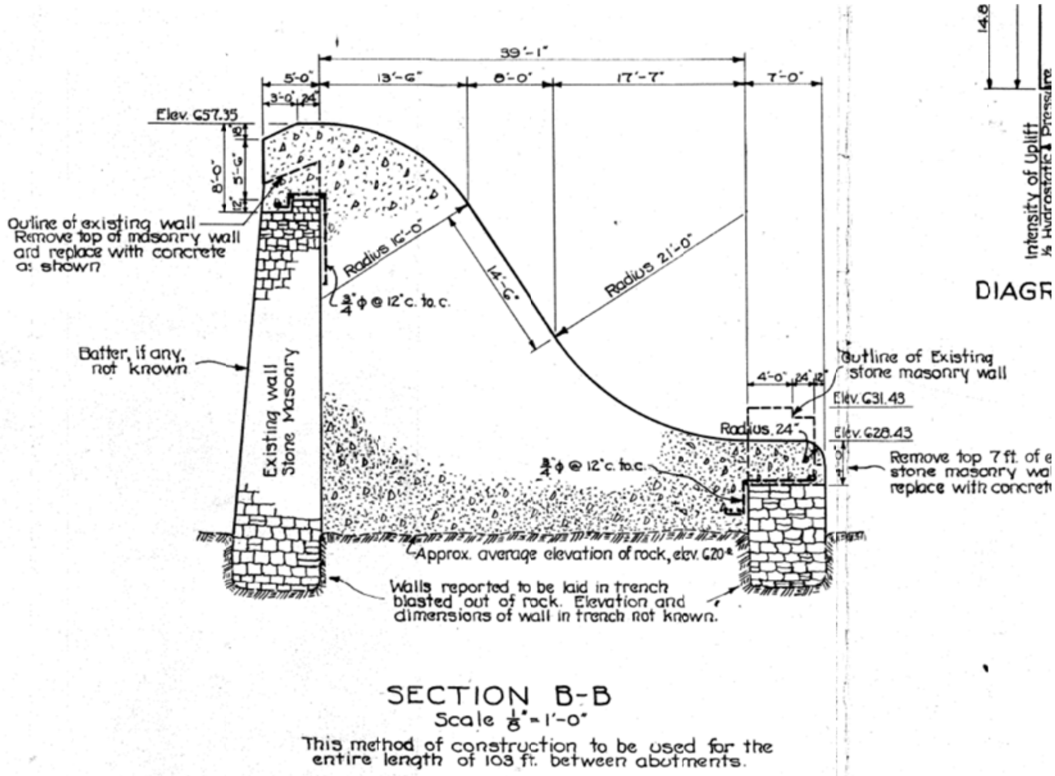


Figure 2-2: Dam Cross Section from the 1936 Repair Plans Prepared for J. and J. Rogers Company by Robert E. Horton Consulting Engineers

Several attempts were made in the 1980s to convert Rome Dam to a hydroelectric facility. For example, an application for a preliminary engineering study was submitted to the Federal Energy Regulatory Commission in 1981 by the Long Lake Energy Corporation to establish the Au Sable Forks Hydroelectric Power Project. The plan called for building a powerhouse at the paper mill location and running a penstock between the dam and the powerhouse. Hydroelectric power generation has not taken place at Rome Dam likely given the structural condition of the dam, repeat damages, and the unknown condition of the dam foundation.

2.3 Local Flooding

The Au Sable Forks area downstream of Rome Dam has a history of flooding mostly due to ice jams and to a lesser extent rain events. Ice jams are especially problematic just upstream of the Jersey Bridge on the East Branch of the Ausable River. Thick anchor ice reportedly forms in this area, which leads to flooding in the Grove and Jersey sections of the village.

Flooding caused by ice jams is historically less problematic on the West Branch Ausable River. Information about the history and extent of ice jamming was found to be limited likely because jamming is less prominent on the West Branch. It is reported that ice on the West Branch breaks as it falls over Rome Dam, which allows it to more easily pass downstream. A concern exists that the potential removal of Rome Dam may lead to increased ice jamming downstream.

2.4 Historical Context

Although deteriorating, Rome Dam has historic value as a late 1800s paper mill structure in the Adirondack region. Even with the numerous damages and substantial repairs, some remnants exist from the original structure. Given that the structure is deteriorating and showing signs that failure is possible, the structure should be documented for historic preservation. When the dam is removed or replaced, signage describing the history of the site and dam is recommended. Dr. Stephen Longmire, historian and photographer from Upper Jay, has started to document the site through a series of archival photographs. We anticipate that Dr. Longmire will be formally involved in the historic documentation process moving forward.

A Phase 1A Archaeological Sensitivity Survey was completed by Dr. Joseph Diamond of Hurley, New York, (Appendix A).

2.5 Dam Safety

2.5.1 File Review

MMI conducted a review of the NYSDEC Dam Safety file on the Rome Dam. Documents extend back to the early 20th century and describe the dam's uses and repairs. The file includes inspection reports, plans, and letters. The oldest document was a dam data sheet from 1912 while the most recent document was a 2016 letter.

The dam was last inspected by NYSDEC Dam Safety on September 14, 2015, (Appendix B). The inspection notes multiple deficiencies in the dam including seepage, undesirable plant growth, maintenance issues, surficial deterioration, voids, and cracking in the spillway and abutments. Penstocks were inoperable and leaking with the right side penstock showing heavier flow. The penstock intake structures were deteriorated on both sides with old trash racks, large wood, and sediment lodged in the intake structures. The right abutment wall was noted as having cracks and missing stone.

The dam was also inspected on October 22, 2013, by NYSDEC (See Appendix B). This inspection noted all of the deficiencies listed in the 2015 inspection and instructed the town to develop a plan to lower the impoundment until repairs or removal of the dam could take place.

Photos from the November 1996 inspection show the dam to be deteriorating with large logs and other debris lodged on the spillway and at the abutments. The left penstock was collapsed. Debris and some of the damages shown in these photographs likely resulted from the November 6, 1996, flood.

The July 20, 1994, inspection noted that the dam was severely deteriorated. The left side penstock was ruptured at the time. The right side intake was flowing, but the gates were damaged and nonfunctional. The inspection also made note of stone masonry pieces missing in the abutments, severe structural and surficial deterioration, the downstream training wall beginning to fail, and noticeable silt accumulation within the impoundment.

Past inspection records are available going back to July 22, 1971. The NYSDEC Dam Safety file review illustrates a lack of routine maintenance and upkeep on the dam.

2.5.2 Current Condition

MMI visited the dam on September 22, 2015, June 17, 2016, and August 30, 2016. Observations during site visits confirmed the deficiencies noted in prior inspections. Also noted was seepage undermining and outflanking both abutments on the downstream side of the spillway. Undermining is severe on river left where the penstock used to be located (Figure 2-3).

Figure 2-3: Rome Dam Spillway Facing Upstream (MMI, 2016)

Spalling concrete was observed on the spillway and abutments. Stone was dislocated from the upstream corners of the stone masonry portions of both abutments.

The inlet works are nonoperational, uncontrolled, and filled with sediment and debris. Vortices in the standing water at the inlet works and seepage downstream indicated uncontrolled flow through former intakes that pose a failure hazard. Outlet works were also nonoperational and uncontrolled with significant seepage in the areas of the dislocated penstocks (Figures 2-4 and 2-5).

Figure 2-4: Dislocated Stone Masonry on Left Abutment (MMI, 2016)

Figure 2-5: Right Side Inlet Works Filled with Sediment and Debris (MMI, 2016)

Three timber crib structures filled with stone were located in the impoundment upstream of the dam (Figure 2-6). They are roughly 20 feet wide, 30 feet long, and up to 20 feet tall. The age and purpose of these structures is unknown, but based on similar structures found at other dam sites in the region, they appear to be piers used to anchor log booms designed to catch and trap the annual log load. These structures may be hazardous if the dam is removed and should be demolished.

Figure 2-6: Submerged Timber Crib and Stone Structure (MMI, 2016)

2.5.3 Conclusions

The Rome Dam is currently unmaintained, has been listed as structurally unsound for at least 20 years, and continues to deteriorate. Without removal, substantial repairs or replacement will be needed.

3.0 WEST BRANCH AUSABLE RIVER

3.1 Channel Geomorphology

A channel walk and impoundment float were conducted on August 30, 2016, by MMI. Measurements of channel dimensions and other geomorphic parameters were taken during the channel walk and at two cross sections (Table 3-1 and Appendix C). Upstream of the impoundment, the channel is wide, connected to a broad floodplain, and prone to sediment deposition. The submerged channel (i.e., the Rome Dam impoundment) is narrow and confined in a bedrock gorge. Downstream of the dam, the channel is narrow, disconnected from its floodplain, and dominated by sediment transport.

TABLE 3-1
Geomorphic Measurements

Location	~2,000 Feet Upstream of Impoundment (Bkf2)	~2,500 Feet Downstream of Dam (Bkf3)
Bankfull Width (feet)	160	98
Mean Bankfull Depth (feet)	3	3
W:D ratio	80	33
Floodprone Width (feet)	325	105
Entrenchment Ratio	2.0+	1.1
Bed Form	Riffle-Pool	Plane Bed
Dominant Substrate	Cobble (104 mm)	Cobble/Boulder
Channel Type	C3	F3
Low Bank Height (feet)	5	13
Incision Ratio	1.5	4
Sinuosity	1.5	1.1
Notes	• Aggradational • Filled bedforms in some areas • Signs of transporting boulders during floods	• Straightened and confined reach that has incised • Stream type departure due to modification • Transport dominated now • Sending more sediment to confluence than natural condition • Many encroachments in floodplain

The channel located 2,000 feet upstream of the dam has riffles and pools, is a single-thread channel, and is connected to its floodplain (Figure 3-1). The channel appears to be able to spill onto its broad floodplain during a modeled 5- to 10-year flood. The channel appears to be moving large boulders during floods that are now perched on top of sediment bars. The channel is wide and possibly overwidened due to historical aggradation that may have resulted from channel smoothing and clearing for log drives or alteration of upstream hydrology and sediment load. The bed features often are covered by excess sediment buildup.

Figure 3-1: Upstream Riffle-Pool Channel (MMI, 2016)

The level of aggradation increases approaching the upstream end of the impoundment in the bedrock gorge (Figure 3-2). A delta exists for nearly 700 feet that consists of a wide cobble bed, multiple flow paths, and an overwidened channel. The sediment is held back due to a reduction of width between the channel and the beginning of the gorge where the bankfull channel width drops from approximately 160 feet to 70 feet (Figure 3-3). The pool has lower velocity and less sediment transport capacity, and water also flows directly into the bedrock wall on river left further reducing sediment transport.

Figure 3-2: Aggradation Approaching the Impoundment (MMI, 2016)

Figure 3-3: Reduction in Channel Width Heading into the Impoundment (MMI, 2016)

The impoundment is located in a narrow bedrock gorge that is partially filled with sediment (Figures 3-4 and 3-5). Probing shows that water depths vary moving down through the impoundment and range between 2 and 25 feet (Table 3-2). The thickness of deposited sediment also varies in the impoundment. The sediment is coarse moving into the impoundment from the upstream channel and gets finer moving downstream. Initial probing by MMI revealed cobble in the upstream end of the impoundment, gravel and coarse sand in the middle of the impoundment, and sand and silt in the downstream end of the impoundment near the dam.

Figure 3-4: Bedrock Gorge Impoundment (MMI, 2016)

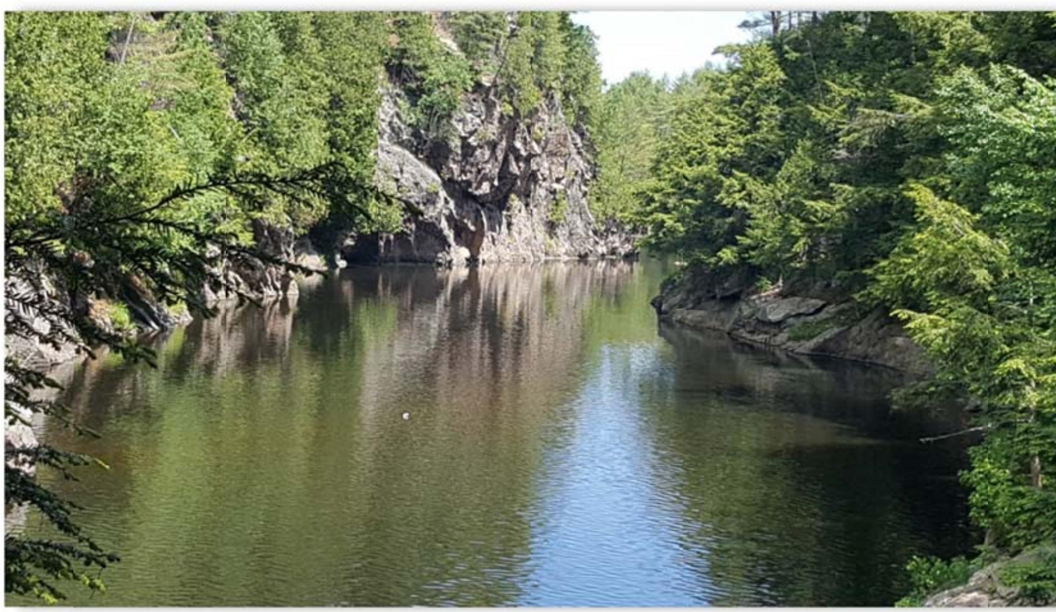


Figure 3-5: Impoundment Looking Upstream from Rome Dam (MMI, 2016)

TABLE 3-2
Approximate Water Depths in the Impoundment

Distance Down the Impoundment (feet)	Depth of Water (feet)	Notes
100	2	Shallows as sediment enters
250	5	
360	7	
500	10	Bedrock control
770	24	
1,000	13	Near timber/rock cribs
1,300	5	Dam in front of abutments

A bedrock control was located during probing that is approximately 10 feet under the current water surface and 500 feet from the upstream end of the impoundment (or 870 feet from the upstream side of the dam). This fixed channel grade control, which may have a narrow gap in the middle of the impoundment, is approximately 20 feet above the bottom of the existing dam. This suggests that a waterfall may have been submerged behind the impoundment and that a smaller pool may continue to exist in the upstream impoundment even if the dam is removed. With the abundance of bedrock around the dam, it is likely that another bedrock falls exists closer to the dam. The potential falls are also evident in a discontinuity in the survey showing a drop in the channel near the dam.

The channel 2,500 feet downstream of the dam has some riffles and pools yet is mostly a plane bed run that is narrower than the upstream channel (see Table 3-1). The channel appears to have been straightened in the past and is now confined due to down-cutting (i.e., incision). The channel is a single-thread channel and is mostly disconnected from its floodplain. The floodplain is developed and contains roads and homes.

The channel has been converted to a transport-dominated reach that passes sediment, debris, and ice downstream at excessive rates compared to a natural channel. The transported materials presumably land at the constriction at the Main Street Bridge or at the confluence with the East Branch in Au Sable Forks where transport rates are lower due to lower channel slope (Appendix D) and converging flow.

The threats along the incised reach immediately downstream of the dam are erosion hazards more than inundation hazards. If the upstream dam were to fail and pass accumulated sediment into this reach, the channel would likely attempt to remeander and could damage infrastructure and property due to erosion.

3.2 Water Quality

The West Branch Ausable River is a well-known cold-water fishery that supports healthy trout and macroinvertebrate populations. Turbidity is low, and temperature tends to be cold.

The state designates the river as drinking water class C, meaning the best usage is fishing and contact recreation (6 NYCRR Chapter X [Parts 800 – 941]). Classifications indicate that the water quality is better further upstream along the West Branch Ausable River.

3.3 Habitat

Upstream of the influence of the impoundment, the channel has diverse instream and riparian habitat structure. Submerged logs, large wood jams, riffles, deep pools, and boulder clusters can be found throughout the channel. Approaching the impoundment, the habitat features are either not present or buried due to the growing delta of sediment. Sediment transport and habitat would be improved if the dam were removed.

The downstream channel lacks finer-grained sediments that are trapped behind the dam. The boney channel lacks the full range of bed sediments that can impact macroinvertebrate and trout populations. The straightened channel limits available refugia, so trout have fewer locations to take shelter during floods or drought. Dam removal would improve downstream habitat.

3.4 Recreation

The West Branch Ausable River is a well-known trout fishery. The fishery is not only a local treasure but also an economic driver through tourism to the area. All actions taken at the dam should protect or enhance the fishery.

The West Branch Ausable River is designated as a NYS Recreational River. This river channel thus warrants additional state protection due to fish and wildlife resources, aesthetic quality, archaeological significance, and other cultural and historic features.

3.5 Aesthetics

The West Branch of the Ausable River is a scenic location. The aesthetics of the rural Adirondack channel must be protected no matter what takes place at the dam. Bedrock exists in the area and is likely under portions of the dam and much of the impoundment. Dam removal would reveal a scenic rock cascade with several bedrock drops likely.

4.0 ROME DAM IMPOUNDMENT

4.1 Impoundment Geomorphology

The impoundment is contained primarily within a bedrock gorge with steep, nearly vertical sidewalls. The channel is fully entrenched in the bedrock gorge. The width of the gorge ranges between 75 to 150 feet. The channel slope is approximately 2 percent in the impoundment. Data collection suggests that two 10-foot bedrock falls are likely to exist in the impoundment – one located at the dam and the other located 870 feet upstream of the dam.

Based on aerial imagery and field investigation, the surface area of the Rome Dam impoundment is approximately 5 acres in size under normal conditions and extends approximately 1,300 feet (0.25 miles) upstream of the dam (Figure 4-1).

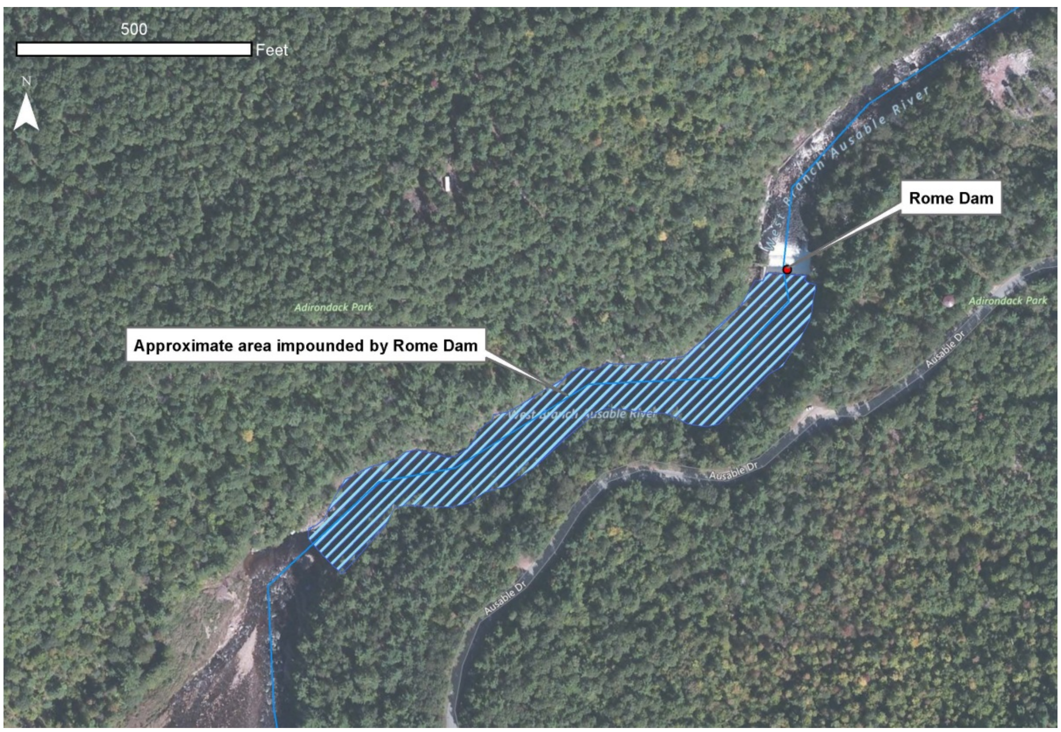


Figure 4-1: Approximate Area Impounded by Rome Dam

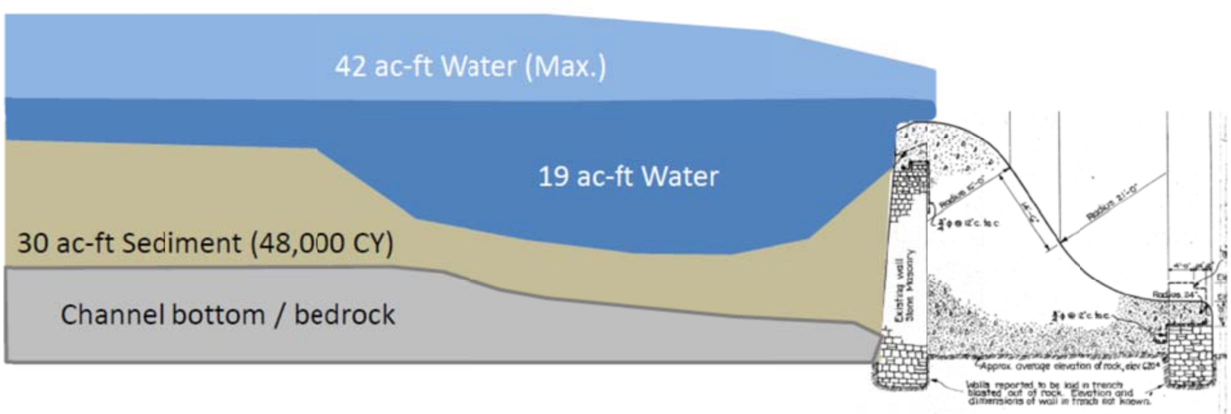
4.2 Storage Volume

Various sources have estimated the impounded volume of water and sediment to vary between 50 and 150 acre-feet. MMI has estimated that the dam can store 49 acre-feet at the top of the spillway (Table 4-1).

The dam is currently storing approximately 19 acre-feet of water at the spillway elevation and is capable of storing approximately 61 acre-feet of water at the top of the dam (~14.3 feet above the spillway). Recent field survey and sediment probing data indicate that approximately 30 acre-feet (48,000 cubic yards) of accumulated sediment is currently being stored behind the dam. Therefore, the volume of sediment and water combined is approximately 49 acre-feet at the spillway and approximately 91 acre-feet at the top of the dam (Figure 4-2).

TABLE 4-1
Estimated Impoundment Volume for Rome Dam at Spillway Crest

Estimated Impoundment Volume for Rome Dam at Spillway Crest		
Source	**Volume (acre-feet)**	**Notes**
May 29, 2016 Emergency Action Plan	10.5	
1936 Reconstruction Application	50	
November 29, 1991 Hydroelectric Application	56	
January 15, 2013 Inspection and Maintenance Plan	150	NYS Dam Safety Inventory
MMI Current Estimate	**49**	**Calculated from 2016 survey, hydraulic model, and sediment probing.**



- Storage capacity at spillway = 49 ac-ft
- Storage capacity at top of dam = 91 ac-ft

Figure 4-2: Estimated Storage of Sediment and Water at Rome Dam

5.0 SEDIMENT

5.1 Quantity

The Rome Dam impounds approximately 48,000 cubic yards (30 acre-feet) of sediment over about 1,300 feet of impounded channel. Sediments were probed by MMI and Atlantic Testing Laboratories (ATL) of Canton, New York, to estimate the thickness of the accumulated material (See Appendix C). The majority of the accumulated sediment is cobble above the submerged bedrock vane in the impoundment (length ~ 500 feet) and was difficult to probe. Downstream of the vane, the sediment was mostly sand (length ~ 800 feet), and deeper probing was possible. The upstream half of the deposit is a coarse delta growing out of the riffle heading into the impoundment.

5.2 Quality

Sediment sampling and testing were conducted by ATL as part of this study (Appendix E). Fine sediment was retrieved from above, within, and below the impoundment to identify if toxic sediment exists and to compare the chemical composition of the impounded sediment with the sediment in the river channel. The list of chemical parameters to test was initially identified from the In-Water and Riparian Management of Sediment and Dredged Material Guidelines (TOGS 5.1.9) (NYSDEC, 2004) and refined with assistance from NYSDEC and the United States Army Corps of Engineers. The analysis revealed that for the target analytes the sediment sampling did not identify concentrations exceeding TOGS 5.1.9 Thresholds for Class A Sediment. Based on the information collected during the sediment sampling and analysis, sediment located behind the dam appears to be typical of the subsurface material found along the river bottom in the free-flowing channel.

5.3 Approximate Sediment Yield

The volume of sediment that would be mobilized in the event of a sudden sediment release from dam failure, or if accumulated sediment were allowed to erode and pass downstream following dam removal, was estimated. This can be estimated by comparing the amount of impounded sediment with the amount of sediment that is produced in a watershed and transported downstream by a river channel over a year (i.e., the mean annual sediment yield) (MacBroom and Schiff, 2013). Long-term measurements of sediment yield or load do not exist on the Ausable River, so sediment yield has been approximated based on sediment gauges throughout New England that indicate a mean yield of 50 tons per year per square mile of watershed (range is 25 to 150 tons per square mile). Based on a watershed size of 234 square miles, the annual watershed yield of sediment is roughly 12,000 tons per year incident to the impoundment.

At a typical density of 75 pounds per cubic foot for loose sandy sediments, each ton of sediment is estimated to occupy a volume of 1 cubic yard of material. The total sediment volume generated by the watershed on an annual basis is thus 12,000 cubic yards, or about 30 cubic yards on average per day. Based on the estimated 48,000 cubic yards of impounded sediment, the existing material is estimated to be the product of 4 years assuming a trap efficiency of 100 percent. Reservoir trap efficiency is typically lower than 100 percent, so the amount of material present could have built up over a longer period of time.

Sediment removal will be required prior to dam removal since the release of 4 years of accumulated sediment is likely too much material to allow to move downstream. The release of this large amount of cobble and sand into the channel will likely lead to long-term habitat and water quality impacts and initiate channel movement that could threaten public infrastructure and private property.

5.4 Management

An important consideration for the removal of Rome Dam is to limit the risk of excessive downstream sedimentation since so much material is sitting in the impounded area. A rapid, unchecked sediment transport event would smother habitat and increase turbidity for a long period of time in the downstream channel. Excessive sediment transport could also lead to an unstable channel.

It is important to understand that sediment transport and deposition occur naturally and are an essential part of a river channel, even one downstream of a dam. A key objective of a successful dam removal is to restore natural sediment transport processes while maintaining or improving channel stability.

Potential sediment management options for the removal of Rome Dam include the following:

→ Do nothing and allow the river to erode the impounded sediment (with uncertain timing).
→ Partial or full sediment removal
→ A phased sediment removal that consists of alternating steps of dam and sediment removal to incrementally lower the water and then remove sediment
→ Stabilize the sediment to remain in place during and following dam removal.

Do Nothing

Due to the large amount of sediment currently stored behind Rome Dam that is estimated to be 4 years of deposition from the watershed, the unchecked erosion of this material following dam removal would smother downstream habitat and destabilize the channel. Turbidity would increase, and fish habitat and aesthetics would be impacted for an unknown period of time. Some sediment is currently transported downstream during flood flows over the run-of-river dam, yet this periodic release of material is very small relative to the amount of material stored in the impoundment. Although this is the lowest-cost sediment alternative, it is the alternative with the highest level of sediment impacts and will not likely be allowed by the United States Army Corps of Engineers and NYSDEC.

Sediment Removal

Due to concerns about downstream habitat impacts and decreased channel stability with excessive downstream sedimentation, the initial recommendation is to remove 36,000 cubic yards of sediment (75 percent of the total sediment) from above the dam. The coarser sediment in the upper impoundment would be left to slowly work its way through the newly formed channel over time, and some of the finer materials would be allowed to wash downstream during removal. This approach minimizes impacts by removing the bulk of the sediment that would be highly mobile following dam removal. The Ausable River Association plans to coordinate with the Adirondack Park Association and NYSDEC to stockpile and reuse the coarse sediment that is removed from the impoundment for river restoration projects.

Phased Sediment Removal

Incremental dam lowering coupled with phased sediment removal uses the dam removal process to lower the water and allow stored sediment to dry while also holding back sediment during excavation. Consolidation of the sediment makes the material easier to access with construction equipment and easier to haul away. A phased sediment and structure removal is a common dam removal practice implemented during construction.

The Rome Dam has inoperable gate openings on both sides of the dam that can be demolished to initiate the water drawdown process. After an initial round of sediment removal, some of the top of the dam can be demolished, and a haul road would be established to the dam and up the impoundment to move equipment to the sediment removal area further away from the dam.

This approach reduces the risk of a sudden sediment release and uncontrolled erosion since the dam remains partially in place over the course of sediment removal. This approach has the advantage of providing for water control and incremental dewatering even when functioning outlet works do not exist.

Phased sediment removal with incremental dam lowering is recommended as it is effective at reducing risks, can reduce downstream impacts since more work takes place out of flowing water, can be a cost-effective method, and is familiar to dam removal construction contractors.

Bed Sediment Stabilization

Stabilization of the current bed sediment at the existing channel slope cannot be used in place of some amount of sediment removal due to the change in elevation at the dam that would take place upon removal and the large amount of erodible sediment that exists upstream of the dam. Attempting to stabilize the sediment in place would likely be costly and futile given the confined flood flows and ice flows in the Ausable River. The grade of the channel at the dam site will likely be controlled by a bedrock ledge on which the dam is believed to sit. The bedrock ledge may be a natural barrier to fish movement.

Summary of Recommended Sediment Removal Alternative

- Remove 36,000 of 48,000 cubic yards (75 percent) of sediment by excavation.
- Use a phased sediment removal by incrementally lowering the dam.

6.0 WATERSHED

6.1 Overview

The Rome Dam is located on the West Branch Ausable River in Jay, New York. The river drains a watershed area of 234 square miles. The river originates on the north slope of Mount Marcy in the town of Keene, New York. It flows north for approximately 36 miles before joining the East Branch to form the Ausable River at Au Sable Forks. The mainstem Ausable River flows generally northeast before emptying into Lake Champlain in the town of Au Sable, New York. The West Branch Ausable River is designated as a recreational river by NYSDEC.

6.2 Geology

6.2.1 Surficial

The West Branch Ausable River watershed is dominated by glacial till in upland areas. Recent alluvium, lacustrian silt and clay, and lacustrian delta deposits fill the river valleys. Rome Dam sits on a bedrock outcrop. The project area is primarily glacial till and recent alluvium (Figure 6-1).

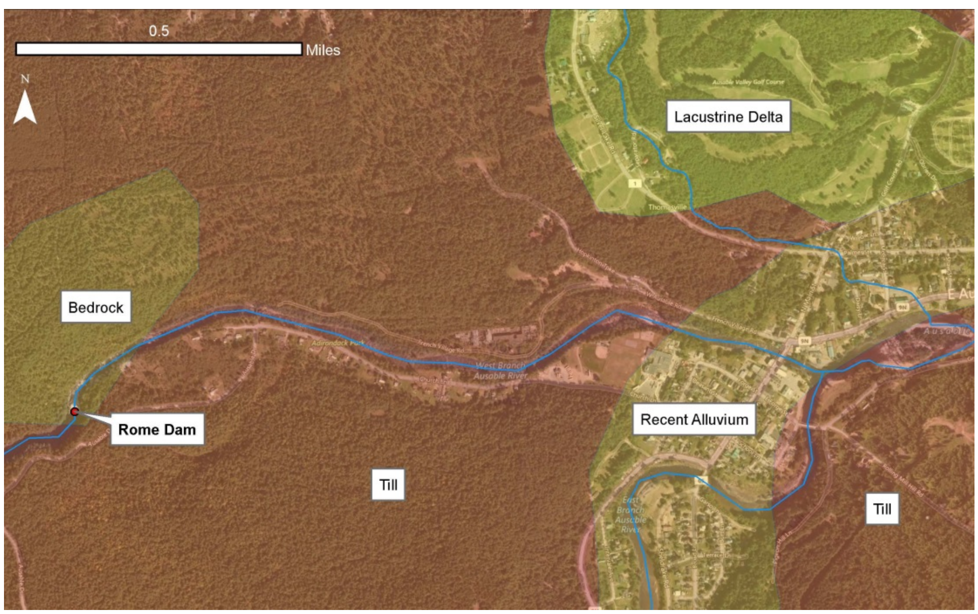


Figure 6-1: Rome Dam Area Surficial Geology

6.2.2 Bedrock

Bedrock in the West Branch Ausable River watershed is mostly comprised of gneiss formations. The project area sits on leucogranite and granite gneiss with an area of glacial and alluvial deposits just to the north (Figure 6-2).

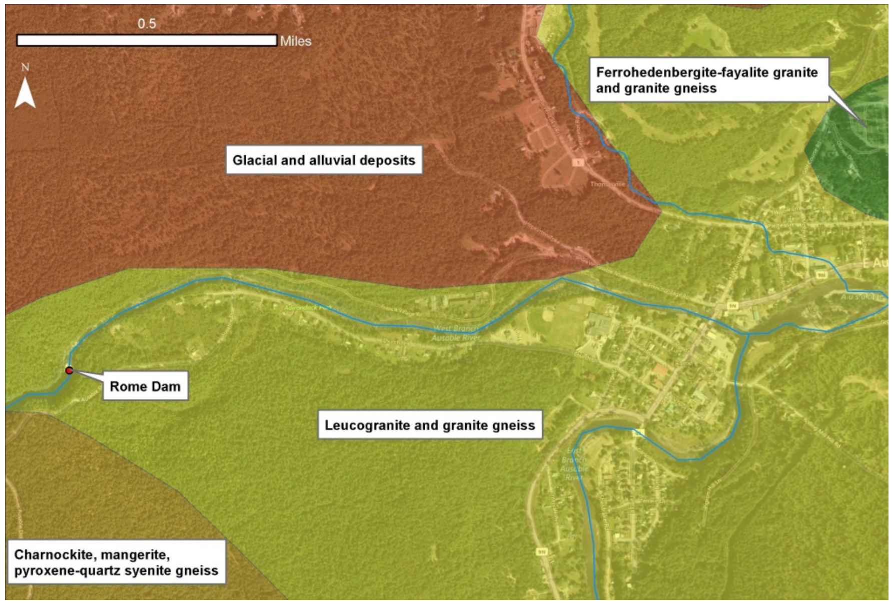


Figure 6-2: Rome Dam Area Bedrock Geology

6.3 Soils

The dominant soil types found near the dam are Champlain loamy sand on the left bank and Tunbridge-Lyman complex on the right (Figure 6-3 and Appendix F) (Natural Resources Conservations Service web soil survey (http://websoilsurvey.nrcs.usda.gov). Champlain loamy sand is well drained (hydrologic soil group A) and has a low runoff potential. It is composed of sandy glaciolacustrine deposits derived from igneous and sedimentary rock. The Tunbridge-Lyman complex is well to somewhat well drained (hydrologic soil groups B and D). It is composed of loamy till derived from gneiss.

Downstream of the dam on the right riverbank is an area of Udorthents, well-drained soils modified by urbanization. Continuing downstream, there is an area of Adams loamy sand. This soil is excessively drained (hydrologic soil group A) with a very low runoff potential. As you enter the village of Au Sable Forks, there is an area of Colton very gravelly loamy sand that is excessively drained (hydrologic soil group A).

Downstream of the dam on the left riverbank, there is an area of Cornish silt loam. This soil is somewhat poorly drained (hydrologic soil group B/D) and is composed of alluvial deposits of silt and very fine sand. Continuing downstream, the left riverbank is dominated by an urban land-Plainfield soil complex through the Au Sable Forks village area. This soil is excessively drained (hydrologic soil group A) and is composed of sandy glaciofluvial or deltaic deposits along with disturbed soils and urban fill.

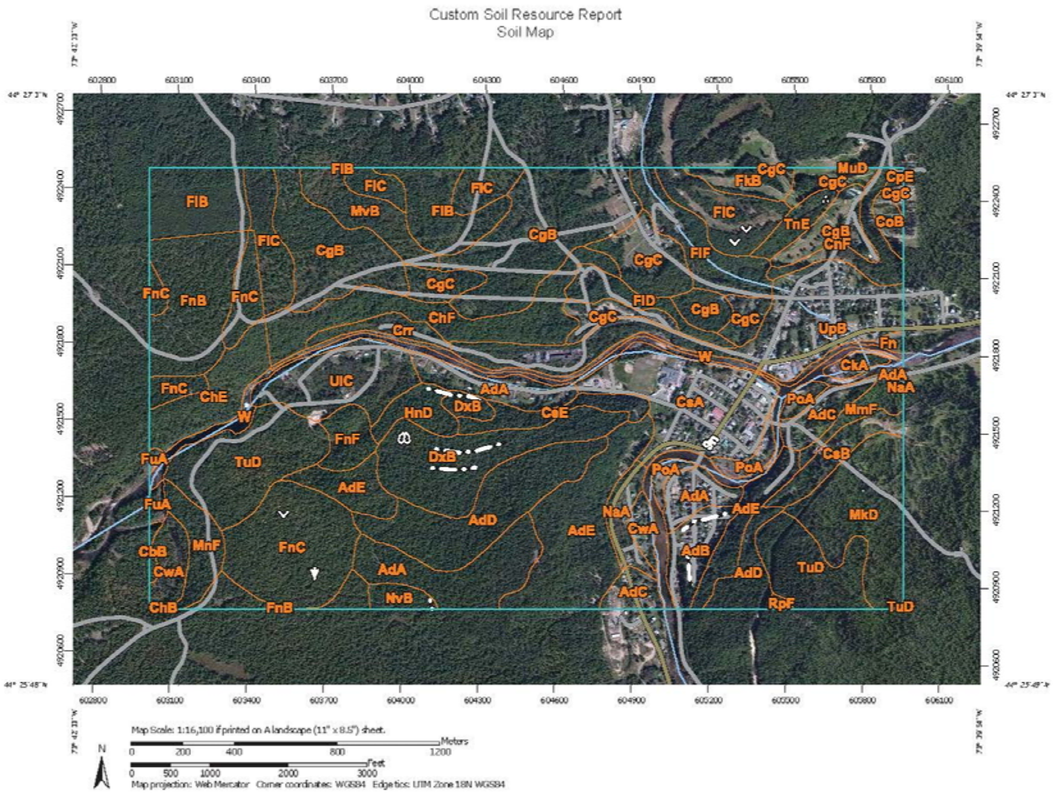


Figure 6-3: Rome Dam Area Soils

6.4 <u>Land Use</u>

The West Branch Ausable River watershed is dominated by forested land (Table 6-1 and Figure 6-4). Wetlands and light development are the next most abundant land use types in the watershed.

The Rome Dam is located upstream of the village of Au Sable Forks, which is mostly classified as light development with some areas of medium/high development. Upstream of the project area, the village of Lake Placid is mostly classified as light development with some areas of medium/high development.

TABLE 6-1
Land Use in the West Branch Ausable River Watershed

Land Use Type	Square Miles	Percent of Total
Forest	206	88%
Wetlands	8	3%
Light Development	7	3%
Water	7	3%
Shrub/Herbaceous	4	2%
Agriculture	2	1%
Med/High Development	1	Less than 1%

6.5 Transportation

Due to the steep topography of New York's North Country, roads often run along rivers in valleys. In the West Branch Ausable River watershed, 190 miles of the total 285 miles of road in the watershed (65 percent) lie within 0.25 miles of a river channel. Roads in the river valleys are at risk of flood and erosion damage.

7.0 HYDROLOGY

7.1 Introduction

Hydrologic analysis was performed to estimate a typical summer flow, a range of current flood flows, and future flood flows for the West Branch Ausable River, East Branch Ausable River, and mainstem Ausable River in the vicinity of Rome Dam. The current design flows (Table 7-1) and predicted future flows (Table 7-2) used in this study are summarized here and described in more detail below.

TABLE 7-1
West Branch Ausable River Design Flows

Recurrence Interval (year)	Design Flow (cfs)		Source	Use
	West Branch Ausable River	Mainstem Ausable River		
Normal	87	150	Estimated summer flow	A, B
2	4,190	8,110	USGS StreamSTATs	A, B
5	6,140	11,800	USGS StreamSTATs	A, B
10	7,500	14,400	USGS StreamSTATs	A, B
25	9,210	17,700	USGS StreamSTATs	A
50	10,500	20,100	USGS StreamSTATs	A, C
100	11,900	22,800	USGS StreamSTATs	A, C, D, E
500	15,100	28,800	USGS StreamSTATs	A
1/2 PMF	66,200	n/a	SCS Empirical Equations	D, E

Flow during Tropical Storm Irene was measured to be 46,500 cfs at the USGS gauge on the mainstem Ausable River, and estimated to be 15,000 cfs on the West Branch Ausable River. This flow is estimated to be near the 500-year flood.

Legend
A - Hydraulic Analysis
B - Ice Jam Analysis
C - Bridge Scour Analysis
D - Dam Breach Analysis
E - Sediment Analysis

TABLE 7-2
West Branch Ausable River Predicted Future Flows

Recurrence Interval (year)	Future Flows (cfs)		Notes	Use
	West Branch Ausable River	Ausable River Mainstem		
2	5,171	10,742	USGS Report 2015-1235	A
5	7,340	11,885	USGS Report 2015-1235	A
10	8,845	18,010	USGS Report 2015-1235	A
25	10,757	21,803	USGS Report 2015-1235	A
50	12,165	24,596	USGS Report 2015-1235	A
100	13,776	27,825	USGS Report 2015-1235	A, D, E
500	17,355	34,939	USGS Report 2015-1235	A

Legend
A - Hydraulic Analysis
B - Ice Jam Analysis
C - Bridge Scour Analysis
D - Dam Breach Analysis
E - Sediment Analysis

7.2 Federal Emergency Management Agency (FEMA) Flood Flows

For the West Branch Ausable River, the effective flows were calculated using the unit hydrograph method and estimating the contribution to the flow of the East and West Branches (FEMA, 2007)(Table 7-3).

TABLE 7-3
West Branch Ausable River FEMA Effective Flows

West Branch Ausable River at the confluence with the mainstem Ausable River	
Recurrence Interval (year)	Effective FEMA FIS Flows (cfs)
10	8,100
50	12,000
100	14,000
500	19,700

FIS = Flood Insurance Study

For the East Branch Ausable River (Table 7-4) and the mainstem Ausable River (Table 7-5), the effective flows in the published FEMA Flood Insurance Study (FIS) (FEMA, 2002) were previously calculated using regression analysis for an ungauged site and adjusted using weighted peak discharges for USGS Gauging Stations in the area.

TABLE 7-4
East Branch Ausable River FEMA Effective Flows

East Branch Ausable River at the confluence with the Ausable River	
Recurrence Interval (year)	**Effective FEMA FIS Flows (cfs)**
10	10,800
50	15,220
100	17,360
500	22,660

TABLE 7-5
Mainstem Ausable River FEMA Effective Flows

Mainstem Ausable River at Town of Jay downstream corporate limit	
Recurrence Interval (year)	**Effective FEMA FIS Flows (cfs)**
10	15,890
50	22,110
100	25,060
500	32,350

7.3 United States Geological Survey (USGS) *StreamStats* Flows

Peak flood flows were estimated for the West Branch Ausable River at Rome Dam using USGS regional regression equations on the *StreamStats* website (Lumia et al., 2006). The calculations use watershed characteristics such as drainage area, basin storage, mean annual precipitation, and forest area to estimate peak flows (Table 7-6).

TABLE 7-6
Results of the Regression Analysis

Recurrence Interval (year)	USGS StreamStats (cfs)
2	4,190
5	6,140
10	7,500
25	9,210
50	10,500
100	11,900
500	15,100

7.4 Future Flows

Predicted future peak flood flows were estimated at Rome Dam using the NYS Future Flows website that updates the variables used in the USGS regional regression equations based on climate change models (Burns et al., 2015). The predicted future flows increase between 15 and 23 percent above the USGS *StreamStats* flows (Table 7-7). Future flows were used to see how downstream flood risk would change during a dam failure if flows increase in the region as predicted.

TABLE 7-7
Results of NYS Future Flows Analysis

Flood (year)	Future Flow (cfs)	Change (cfs)*	Change (%)**
2	5,171	981	23%
5	7,340	1,200	20%
10	8,845	1,345	18%
25	10,757	1,547	17%
50	12,165	1,665	16%
100	13,776	1,876	16%
500	17,355	2,255	15%

*Change (cfs) = Predicted future flow - Streamstats flow

**Change (%) = Change (cfs) / StreamStats flow

7.5 Flood Frequency Analysis of USGS Gauge Data

A stream gauge does not exist on the West Branch Ausable River. A USGS stream gauge (USGS 04275500, Ausable River near Au Sable Forks) is located approximately 2 miles downstream of Rome Dam, downstream of the East Branch and West Branch confluence. Flood frequency analysis (USGS, 1982) was performed to estimate peak flows on the East Branch Ausable River and then scale them using drainage area to the West Branch Ausable River at Rome Dam. The analysis was performed for the full data record that started in 1911 (104 years) and for just the post-1970 record (45 years) to investigate the increasing size of floods observed in the region since 1970 (Collins, 2009; NMFS, 2011) (Table 7-8).

TABLE 7-8
Flood Frequency Analysis Results for Full and Post-1970 Record

Flood (year)	Full Record (cfs)	Post-1970 (cfs)	Change (cfs)*	Change (%)**
2	6,023	6,284	261	4%
5	8,940	10,181	1,240	14%
10	11,341	13,938	2,596	23%
25	14,983	20,475	5,492	37%
50	18,187	27,001	8,813	48%
100	21,859	35,306	13,447	62%
500	32,623	64,349	31,726	97%

*Change (cfs) = Post-1970 record - Full record
**Change (%) = Change (cfs) / Full record (cfs)

Flood frequency analysis was also performed at the gauge located on the East Branch Ausable River 0.5 miles upstream from the confluence in Au Sable Forks (USGS 04275000). The analysis shows that the East Branch has larger peak flood flows per watershed area (i.e., cfs per square mile of watershed, or csm) when considering the full data record or just the post-1970 record (Table 7-9).

TABLE 7-9
Comparison between the Mainstem and East Branch Ausable River

		Flood frequency analysis results (cfs/sq.mi.)						
Location	**Period of Record**	**2-yr**	**5-yr**	**10-yr**	**25-yr**	**50-yr**	**100-yr**	**500-yr**
Mainstem Ausable River	Full Record	22	33	41	54	66	80	119
East Branch Ausable River	Full Record	31	47	61	81	98	118	177
Mainstem Ausable River	Post-1970	23	37	51	74	98	128	234
East Branch Ausable River	Post-1970	33	50	66	92	117	147	245

7.6 Design Flow Selection

Flood frequency analysis on the East Branch and scaling to the West Branch predicted flows that are much larger than the FEMA effective flows or the flows calculated using regression equations. For example, the peak flows for the 100- and 500-year floods obtained via flood frequency analysis were more than double those obtained by the regression equations.

It is likely that the scaling of flows based on gauge data leads to overpredicting peak flow rates due to differences between the East Branch and West Branch watersheds and channels. Gauge analysis shows that the East Branch produces more runoff per watershed area than the West Branch (see Table 7-9). Furthermore, it is reported that runoff moves through the East Branch watershed and river channel much faster than in the West Branch (i.e., the East Branch is flashier) due to less storage, less access to floodplain, less riparian cover, higher levels of development, and a greater history of channel manipulation on the East Branch.

A comparison of the *StreamStats* variables calculated at the USGS gauge on the East Branch and at Rome Dam on the West Branch illustrates that the West Branch watershed has more storage (Table 7-10).

TABLE 7-10
USGS *StreamStats* Variables

	East Branch at USGS Gauge 04275000	**West Branch at Rome Dam**
Drainage area (sq.mi)	198	234
Lag Factor	0.95	0.87
Storage (%)	1.29	4.6
Forest (%)	95.3	91.9
Precip (in)	38.7	37.2

Scaling flood frequency flows were not used for the design flows since they seemed to be too high due to the differences in watersheds. The flows calculated using the regression equations were selected for the analysis.

7.7 Probable Maximum Flood (PMF)

The PMF at the Rome Dam was approximated from the probable maximum precipitation (PMP) using the Soil Conservation Service dimensionless unit hydrograph method (USACE, 1982; Dingman, 1994). The 12-hour PMP was found to be 17.2 inches while the 24-hour PMP was 19.5 inches (Schreiner and Riedel, 1978). Digital rainfall estimates in Geographic Information System (GIS) raster format were used to obtain the PMP. Time of concentration was approximated to be 7.8 hours based on the length of the watershed measured along the West Branch Ausable River channel from Rome Dam to the watershed divide and the change in elevation along the length of the watershed.

The PMF was estimated to be 132,300 cubic feet per second (cfs) for the 24-hour PMP and 182,300 cfs for the 12-hour PMP. Since the structure has been classified as a small, Class C dam, NYS Dam Safety Regulations require that 50 percent of the PMF (also referred to as the ½ PMF) with a 24-hour duration be used to evaluate the dam's spillway capacity and conduct the dam breach analysis (see Section 9.0).

8.0 HYDRAULIC MODEL

8.1 Overview

Hydraulic analysis of the West Branch Ausable River was completed using Hydrologic Engineering Center – *River Analysis System* (HEC-RAS) to estimate current risks around Rome Dam and to evaluate dam retention and removal alternatives. Once the existing conditions hydraulic model was set up and calibrated, the following analyses were conducted:

- Rome Dam spillway capacity analysis
- Flood-level analysis
- Dam-breach analysis
- Sediment evaluation
- Scour analysis
- Ice-jam evaluation
- Rome Dam removal alternatives analysis

The HEC-RAS model (USACE, 2014) is widely used to compute water surface profiles for one-dimensional, steady state, and gradually varied flow. By creating cross sections of the existing and proposed channel geometry, this model can accommodate a full network of channels, a dendritic system, or a single river reach. HEC-RAS is capable of modeling water surface profiles under subcritical, supercritical, and mixed-flow conditions. For the Rome Dam study, a mixed-flow regime was selected as is allows both subcritical (i.e., deep, smooth) and supercritical (i.e., shallow, turbulent) flow conditions that occur within the study reach.

FEMA previously studied the West Branch Ausable River from the most upstream crossing of State Route 86 in the town of Wilmington downstream to the corporate limits of the town of Jay as well as for an approximately 3,750-foot reach upstream from the confluence of the East and West Branch Ausable Rivers (FEMA, 1995, 2002). The section of the West Branch Ausable River containing the Rome Dam has not been studied by FEMA using detailed methods.

8.2 Model Setup

The model covers approximately 13,000 feet (2.5 miles) of the river channel beginning approximately 1,600 feet upstream of the dam and extending to a location that is approximately 3,600 feet downstream of the confluence of the East and West Branch Ausable Rivers. The model includes Rome Dam, the (closed) Robison Bridge, and the Main Street Bridge.

Survey data were collected at 27 cross sections and around the structures by MJ Engineering & Land Surveying, P.C. (MJ) of Clifton Park, New York, in summer 2016. The horizontal datum of the survey data is North American Datum of 1983 (NAD 83) New

York State Planes, East (feet), and the vertical datum is North American Vertical Datum of 1988 (feet NAVD 88). Deed research was performed by MJ to identify local property owners (Appendix G).

The cross sections in the hydraulic model were developed from the current survey of the wet channel sections and Light Detection and Ranging (LIDAR) (2015 USGS-USDA produced LiDAR dataset covering Essex and Clinton County, New York, and Lake Champlain) to define the floodplain (Appendix H). The cross sections were created using HEC-geoRAS (USACE, 2013) to automatically import the elevation data from GIS.

Elevations of the spillway and abutments of the dam were obtained from the 1936 dam reconstruction plans (See Figure 2-2). Elevations shown on the plans reference the National Geodetic Vertical Datum of 1929 (NGVD 29) and were converted to NAVD 88 for use in the model (NGVD29 = NAVD88 – 0.374 feet). Plans for the reconstruction of the Main Street (NY Route 9N) Bridge were used to insert the new bridge crossing geometry in the hydraulic model.

Manning's "n" roughness coefficients were selected based on field observations and aerial imagery (Table 8-1).

TABLE 8-1
Manning's "N" Values

Location	Description	Manning's N
River Channel	gravel/cobble channel	0.040
	sand/gravel/impoundment	0.030
	cobbles/boulders downstream of dam	0.050
Floodplains	wooded, little undergrowth	0.100
	wooded, brushy undergrowth	0.120
	medium brush, sparse trees	0.080
	rock ledge/gorge walls	0.035
	homes, mowed grass/lawn, sparse trees, fences	0.025
	paved road	0.013
	downtown village setting (buildings/driveways)	0.080
	abandoned mill buildings	0.120

The average slope of the river channel is 1.1 percent (a drop of 140 feet over 12,900 feet), yet the slope changes across the study reach (Appendix I). The slope within the impoundment is 0.8 percent. The channel slope immediately downstream of the dam is 1.4 percent. The slope between the Robison Bridge and Main Street Bridge is 1.1 percent. The channel slope at the downstreammost end of the study reach flattens out to 0.2 percent.

8.3 Model Calibration

Maximum water depths from the hydraulic model results were compared with MMI field observations on August 30, 2016, in the impounded area (Table 8-2). The model generally agrees with the observations during normal flows.

TABLE 8-2
Water Depth Comparison

Location	Observed Depth (feet)	Model Depth (feet)	Notes
XS 25.0	7	7.3	
XS 24.9	10	9.7	
XS 24.0	24	16.7	Observation point approximately 65 feet upstream of cross section
XS 23.0	20	19.7	Observation point approximately 45 feet downstream of cross section
XS 21.6	8	8.7	Upstream face of Rome Dam

8.4 Spillway Capacity Analysis

A small, Class C dam is required to have adequate spillway capacity to pass 50 percent of the PMF with a minimum of 1 foot of additional space between the design water surface and the top of dam (i.e., freeboard). The hydraulic modeling results indicate that the dam is overtopped by approximately 8.5 feet during the ½ PMF (Figure 8-1) indicating that the dam's spillway does not meet NYS capacity requirements for a Class C dam.

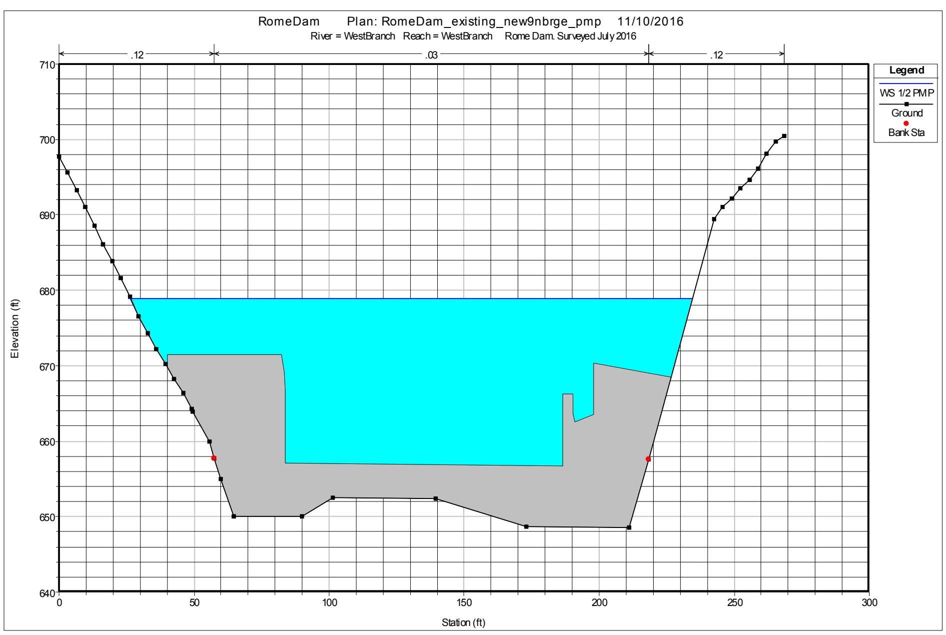


Figure 8-1: Model Cross Section of Rome Dam Showing Inadequate Spillway Capacity

Spillway capacity calculations based on the weir equation indicate that the existing spillway is capable of passing approximately 20,000 cfs with the water surface at the crest of the dam (Table 8-6).

TABLE 8-6
Spillway Capacity

Elevation (ft NAVD)	Stage (feet)	Discharge Capacity (cfs)	Notes
657.1	0.0	0	Assumes no flow through intakes
660.0	2.9	1,830	
665.0	7.9	8,235	
670.0	12.9	17,180	
670.4	13.3	17,895	At required freeboard elevation
671.4	14.3	20,050	At top of dam crest

The spillway is capable of passing a 100-year flood with approximately 3.7 feet of freeboard (Figure 8-2).

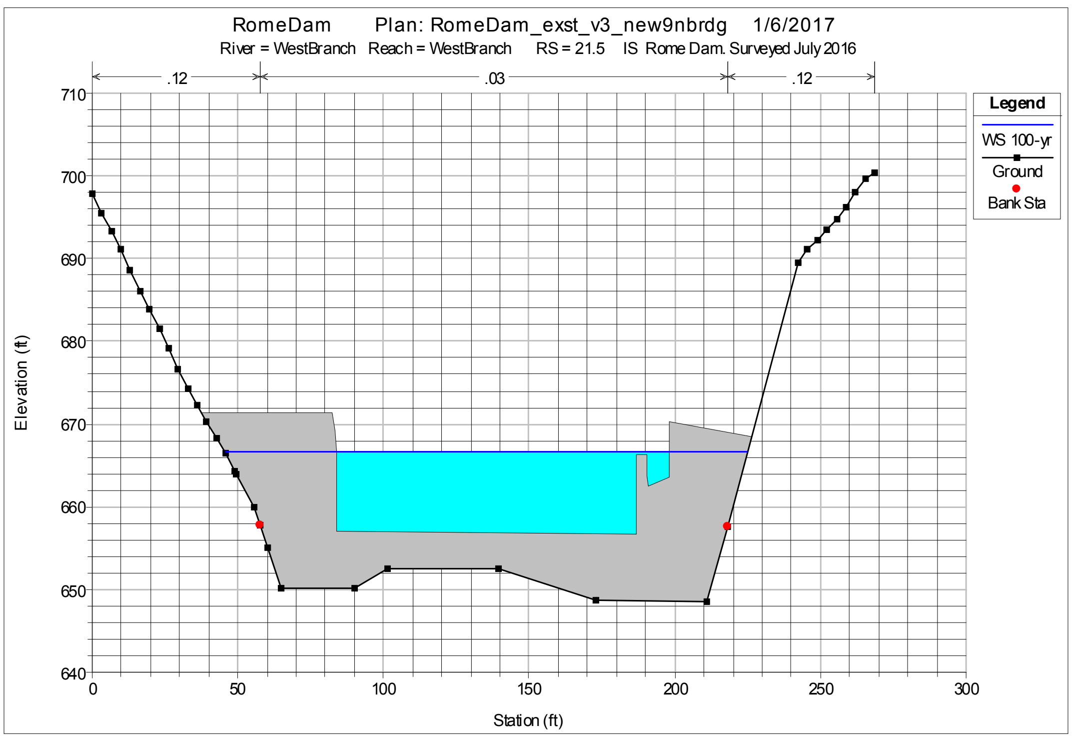


Figure 8-2: Model Cross Section of Rome Dam Showing Existing Spillway during 100-yr Flood

8.5 <u>Flood Levels</u>

Several dam removal scenarios were evaluated during the alternatives analysis (see Section 13.0) that include the following:

- Full removal
- ¾ removal
- ½ removal

Modeling results show the expected reduction in flood levels upstream of the dam in the bedrock gorge area with full or partial dam removal. Upstream flood levels drop 29 feet if the full dam is removed. Flood levels drop approximately 14 feet if half of the dam is removed.

The modeling results show a change from a flat water surface to a sloped water surface following dam removal indicative of lower flood levels and increased flow velocity. The increased flood velocity in the gorge will naturalize sediment transport in the channel, which will likely improve downstream channel stability over the long term. The increased flow velocity following dam removal will also likely reduce winter ice thickness and reduce the chances of ice jamming originating from the area around Rome Dam.

Additional information about results of the hydraulic analysis is provided in the following report sections on dam breach (9.0), scour (10.0), ice (11.0), and alternatives analysis (13.0).

9.0 DAM BREACH ANALYSIS

9.1 Clear Flow Breach Analysis (No Sediment)

9.1.1 Methods

Common dam breach analysis methods were used to evaluate the downstream risk of a failure at Rome Dam. This analysis assumes "clear flow" meaning the full impoundment volume contains water. Methods were reviewed with NYSDEC Dam Safety prior to the analysis.

The dam breach analysis for the Rome Dam was conducted assuming two failure scenarios.

1. "Sunny Day" failure – A dry-weather, sudden dam failure that releases a flood wave downstream during normal flow conditions where the water level behind the dam is located at the crest of the ogee spillway.
2. "Stormy Day" or "Rainy Day" failure – A dam failure during a large flood where many feet of water are overtopping the dam.

The dam breach analysis for Rome Dam was conducted using the Washington State Method (MGS, 2007). The methodology uses physical dimensions of the dam and impoundment to estimate the breach parameters (e.g., the size of the breach), the breach formation time (e.g., how long it takes for the breach to occur), and the peak discharge of the released flood wave. The size (reduction) of peak flood discharge with distance downstream of the dam was estimated using flood attenuation curves.

Rome Dam is classified as a small, Class C dam; therefore, the design storm for the "Stormy Day" failure is 50 percent of the PMF, also known as the ½ PMF.

9.1.2 "Sunny Day" Results

The predicted "Sunny Day" failure peak discharges along the downstream channel were inserted into the hydraulic model to compute a water surface profile of the breach flood wave and to map the extents of the inundation area (Appendix J). The peak discharge during a "Sunny Day" failure is approximately equal to a 5- to 10-year flood (Table 9-1). These flows are largely contained in the existing river channel, and thus the "Sunny Day" breach leads to no additional downstream flood risk during clear flow conditions (see Appendix J, Sheets 1 and 2).

TABLE 9-1
"Sunny Day" Failure Peak Discharge

Location	Miles Downstream of Rome Dam	"Sunny Day" Peak Discharge (cfs)
Rome Dam	0.0	7,053
Robison Bridge	0.4	6,912
J&J Rogers Paper Mill	0.9	6,559
Main Street Bridge	1.4	6,348
East Branch Confluence	1.5	6,207
Downstream Limit	2.1	5,783
5-year Design Flood on the West Branch = 6,140 cfs		
10-year Design Flood on the West Branch = 7,500 cfs		

9.1.3 "Stormy Day" Results – ½ PMF

The inundation area due to the "Stormy Day" dam failure was estimated by adding the ½ PMF at the Rome Dam to the estimated peak discharge from the dam failure flood wave and attenuating the flood wave moving downstream. The breach peak discharges are very large due to the large size of the predicted ½ PMF (e.g., four times the 500-year flood) (Table 9-2). The peak discharge estimates were inserted into the hydraulic model to compute the water surface profile of the dam breach flood wave and a map of the inundation area (see Appendix J).

TABLE 9-2
"Stormy Day" Failure Peak Discharge

Location	Miles Downstream of Rome Dam	"Stormy Day" Peak Discharge (cfs)
Rome Dam	0.0	73,253
Robison Bridge	0.4	71,788
J&J Rogers Paper Mill	0.9	68,125
Main Street Bridge	1.4	65,928
East Branch Confluence	1.5	64,463
Downstream Limit	2.1	60,067
500-year Design Flood on the West Branch = 15,100 cfs		

The predicted ½ PMF floodplain (without breach) inundates homes, businesses, and infrastructure throughout the project area. The "Stormy Day" breach expands the edge of the ½ PMF floodplain in some areas leading to a predicted increase in flood risk. For example, the dam breach shows increased flooding of buildings and roads in Au Sable Forks Village near the confluence of the East and West Branches and some more inundation in the downstream floodplain (see Appendix J, Sheets 3 and 4).

9.1.4 "Stormy Day" Results – 100-Year Flood

Given that the predicted ½ PMF is so large, the dam breach analysis was also performed with the 100-year flood as a more likely large flood event having the same order of magnitude as the Tropical Storm Irene flood.

The inundation area due to the "Stormy Day" dam failure was estimated by adding the 100-year flood at the Rome Dam to the estimated peak discharge from the dam failure flood wave and attenuating the flood wave moving downstream. The breach peak discharges are 1.6 to 1.2 times the size of the 100-year flood alone (Table 9-3). The peak discharge estimates were inserted into the hydraulic model to compute the water surface profile of the dam breach flood wave during the 100-year flood and a map of the inundation area (Appendix J).

TABLE 9-3
100-Year Flood Dam Failure Peak Discharge

Location	Miles Downstream of Rome Dam	"Stormy Day" Peak Discharge (cfs)
Rome Dam	0.0	18,953
Robison Bridge	0.4	18,574
J&J Rogers Paper Mill	0.9	17,626
Main Street Bridge	1.4	17,058
East Branch Confluence	1.5	16,679
Downstream Limit	2.1	15,541
100-Year Design Flood on the West Branch = 11,900 cfs		

The predicted 100-year floodplain (without breach) inundates homes, businesses, and infrastructure in low-lying areas particularly in Au Sable Forks Village near the confluence of the East and West Branches. The "Stormy Day" breach expands the 100-year floodplain along Ausable Drive, Church Lane, and in the village leading to a predicted increase in flood risk. A dam breach during the 100-year flood is a potentially damaging event (see Appendix J, Sheets 5 and 6).

9.1.5 Summary of Findings

The hydraulic modeling shows that a "Stormy Day" failure of Rome Dam during the ½ PMF and 100-year floods increases downstream flood risk. Low-lying homes, businesses, roads, and other improved property would be at risk of increased damages should the dam fail. This finding potentially justifies the NYS high hazard Class C ranking.

It is important to note that the above "clear flow" analysis assumes that the full impoundment volume is occupied by just water. With an estimated 48,000 cubic yards of sediment stored upstream of Rome Dam, the risk of a dam breach could change. Although less water will lead to a smaller flood wave in terms of volume, the height of the flood wave could increase as the released sediment fills the channel and displaces the floodwaters. The released sediment could also initiate downstream channel movement that could lead to erosion damages along the channel where buildings and infrastructure are located. Additional breach analysis has been performed to consider the release of sediment and water.

9.2 Breach Analysis With Sediment

9.2.1 Methods

The "clear flow" breach analysis and inundation mapping does not consider the near-term risks of a sudden release of sediment trapped upstream of Rome Dam or the long-term risk associated with an excessive amount of sediment filling the downstream. The hydraulic modeling was used to simulate expected channel filling during dam breach. Based on the results of sediment probing and observations, it is assumed that approximately two-thirds of the impounded sediment (32,000 cubic yards) would mobilize and migrate downstream during a dam failure while the other third (16,000 cubic yards) would remain in place at the edges of the impoundment.

The length of time for the impoundment to drain was estimated from the size of the breach opening and the volume stored in the impoundment. The distance that the mobilized sediment was carried downstream during a dam failure was estimated based on the time needed to drain the impoundment, the modeled channel velocity, and the channel profile. The initial pulse of sediment released during a dam failure was assumed to be deposited approximately 2,000 feet downstream of the dam near the Robison Bridge. The long-term resting spot of the sediment is expected to be upstream and downstream of the Main Street Bridge in Au Sable Forks Village where the channel slope decreases near the confluence of the East and West Branches.

9.2.2 Results

The breach analysis with an initial sediment release that fills the channel near Robison Bridge leads to increased flood levels (Figure 8-3). Sediment deposition increases flooding to properties along Church Lane and Ausable Drive during the "Sunny Day" and "Stormy Day" dam failure scenarios (see Appendix J, Sheets 7, 8, and 9). Increased channel migration is anticipated with this sediment release, and as a result, the road embankments and homes in this area would likely be damaged by erosion.

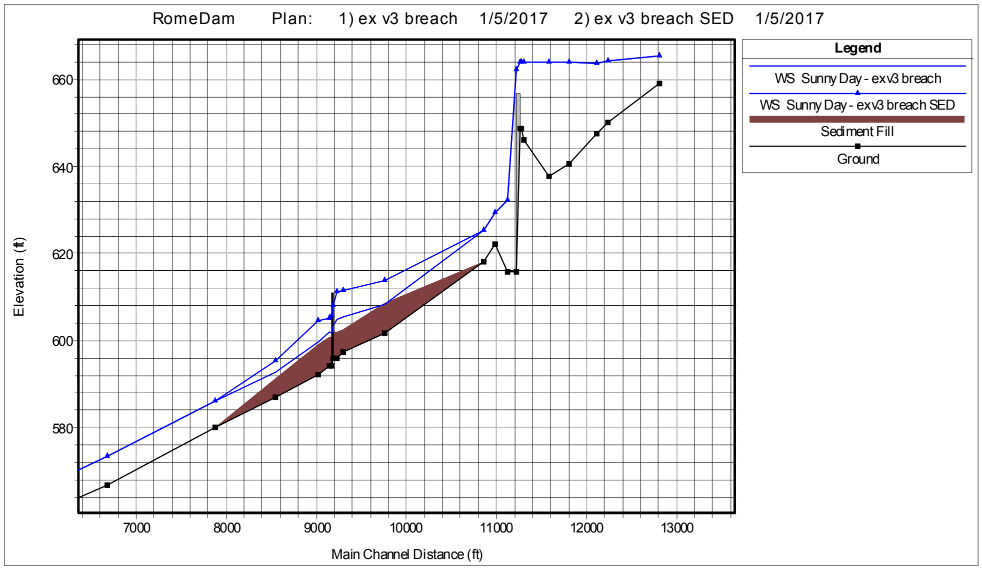


Figure 8-3: Profile with Sediment Filling Channel Near Robison Bridge and Increased Flood Levels during the "Sunny Day" Breach

If the sediment accumulates further downstream near Main Street after a dam failure, flooding and erosion hazards would increase in this area. The breach modeling shows that sediment accumulation would lead to the damage of more buildings and roads in Au Sable Forks Village during the "Sunny Day" and "Stormy Day" failure scenarios (see Appendix J, Sheets 10, 11, and 12).

9.2.3 Summary of Findings

The breach analysis that includes sediment indicates that the risk of property damage and loss of life increases during all simulations of the failure of Rome Dam. The sediment even makes the "Sunny Day" breach a dangerous event beyond the traditional clear flow analysis method. The breach analysis with the sediment illustrates that the dam is likely a high-hazard structure.

9.3 Breach Analysis with Future Flows

9.3.1 Methods

Several studies in the region suggest that the size and frequency of large floods may increase in the future (Collins, 2009; NMFS, 2011; Armstrong et al., 2012, 2014; Schiff et al., 2015). The breach analysis with the 100-year flood was repeated for the future predicted 100-year flood to see the potential change in future risks associated with a failure of Rome Dam.

The new web-based application developed by the USGS (Burns et al., 2015) was used to estimate future peak discharge rates assuming climate change. The application uses the original *StreamStats* regression equations with a new climate variable to evaluate how changes in climate might influence peak flows during a future 25-year period from 2025 to 2049. The estimated future flows were found to be approximately 15 percent to 25 percent higher than the current design flows (Table 9-4).

TABLE 9-4
Estimated Future Flow Rates

Recurrence Interval (year)	Future Flows (cfs)	
	West Branch Ausable River	Ausable River Main Stem
2	5,171	10,742
5	7,340	11,885
10	8,845	18,010
25	10,757	21,803
50	12,165	24,596
100	13,776	27,825
500	17,355	34,939

9.3.2 Results

The results of the analysis suggest that additional properties would be prone to flood and erosion damages if a dam failure were to occur during a future (larger) 100-year flood. More damages are likely at the Main Street Bridge and at the confluence of the West and East Branch Ausable River (see Appendix J, Sheets 5, 6, 9, and 12).

9.3.3 Summary of Findings

The breach analysis with estimated future flows suggests that the risks downstream of Rome Dam are likely to increase in the future.

10.0 SCOUR ANALYSIS

10.1 Methods

Bridge scour analysis was conducted using the hydraulic design functions in HEC-RAS. Bridge scour within the HEC-RAS software is based on the Federal Highway Administration's Hydraulic Engineering Circular No. 18 (HEC-18) (Richardson and Davis, 1995). Bridge scour was evaluated under existing conditions at the Robison Bridge and at the Main Street (Route 9) Bridge assuming the bridge design currently under construction was in place. As a comparison, proposed conditions were also evaluated at both bridges assuming full removal of Rome Dam.

10.2 Results

Results of the scour analysis indicate that the left abutment (looking downstream) at the Robison Bridge just downstream of Rome Dam is susceptible to large scour depths under existing conditions during all modeled flood events. The results verify conditions observed in the field where erosion and undermining of the left bridge abutment were noted. With the Rome Dam fully removed, the scour analysis indicates no change in contraction or abutment scour when compared to the existing conditions results.

A scour analysis was previously conducted as part of the bridge replacement design at the Main Street Bridge, which is currently under construction. The hydraulic data table provided on Sheet No. 51 of the bridge construction plans indicates 3 feet of scour depth potential during the 100-year design flood and 4 feet of scour depth potential during the 500-year check flood.

The results of the HEC-RAS scour analysis performed here indicate that the left abutment is more prone to scour than the right abutment during the 100-year design flood. As a check, the scour analysis was conducted assuming a 500-year flood, and results indicate close to equal scour potential at the left and right bridge abutments. With the Rome Dam fully removed, the scour analysis indicates no change in contraction or abutment scour at the Main Street Bridge during any of the floods modeled when compared to the existing conditions results.

10.3 Additional Scour Considerations

Given the poor condition of the Robison Bridge and the large predicted abutment scour depths, it is recommended that the bridge be demolished or replaced. Scour countermeasures should be considered if the bridge is to remain.

The design data provided on the bridge replacement construction plans indicate that the new abutments are to be placed on micropiles. The use of micropiles to found the bridge abutments suggests that the potential for excessive scour was a concern during design and has been taken into consideration as a countermeasure to reduce the chance of abutment failure due to undermining.

11.0 ICE-JAM FLOOD ANALYSIS

11.1 Methods

A model was developed to evaluate the influence of ice cover and ice jamming on hydraulics and flooding along the West Branch Ausable River through the project reach. The analysis was conducted using the ice cover and ice-jam algorithm in HEC-RAS (USACE, 2014).

Assumptions about the thickness of ice cover and the location of potential jamming were made based on field investigation, experience conducting ice-jamming analysis on rivers in the region, and limited information provided by project team members. On most of the river, an ice cover thickness of 0.75 feet was used. In the impoundment area upstream of Rome Dam, a thickness of 1.0 foot was used, representing the potential for more ice cover to form given the flat, slow-moving water. Ice-jam locations were specified in areas where jamming potential is highest (Table 11-1).

TABLE 11-1
Ice-Jamming Parameters – Existing Conditions

Location	Ice-Jam Length (feet)	Initial Thickness (feet)
Rome Dam and Impoundment	1,500	1.0
Upstream of Robison Bridge	550	0.75
Upstream of Main St Bridge	1,300	0.75
Grove Islands and Confluence	4,000	0.75

11.2 Results

Ice jams were simulated in the model with water flowing into and out of the jam assuming that ice cover is moving along the river such as during a thaw flood. The ice jam model shows large buildups in the impoundment upstream of the dam, at the bridges, and upstream of the Grove Islands at the confluence.

The ice jam is approximately 4 feet thick at the dam during the 5-year flood (Figure 11-1). The modeling results show that the largest accumulation of ice at the Robison Bridge occurs during normal flow conditions with a thickness of approximately 1 foot. At the Main Street Bridge, the modeling results indicate that approximately 3.5 feet of ice buildup occurs during a flood equal to roughly the 1-year event (~1,000 cfs). The ice jam is approximately 4.5 feet thick near the Grove Islands and East Branch confluence during normal flow conditions.

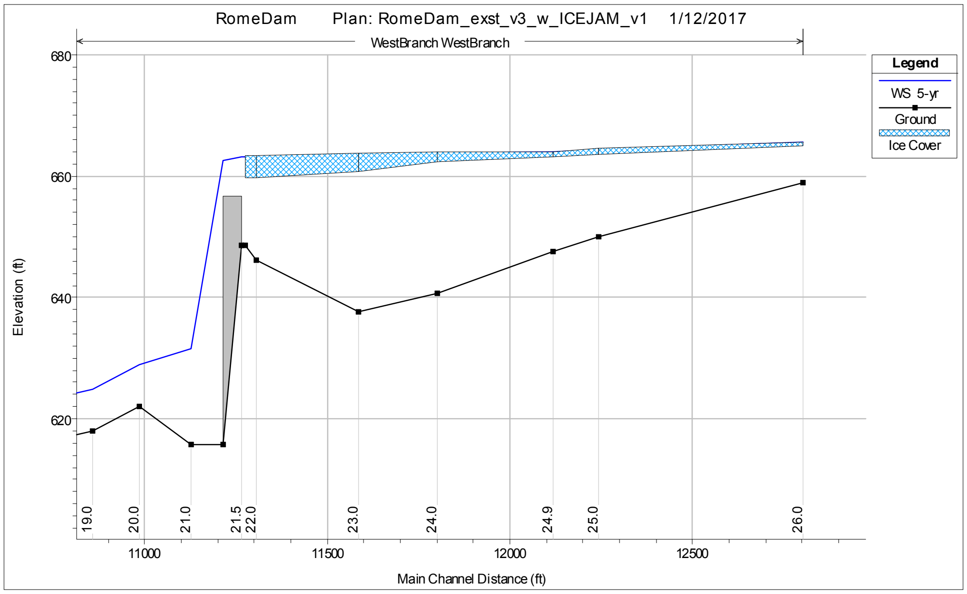


Figure 11-1: Ice Jamming at the Rome Dam during the 5-year Flood

Modeling results indicate that flood levels and ice-jam thicknesses are reduced locally and within the impoundment with full removal of the dam during the 5-year flood where the ice jam thickness is reduced to approximately 1 foot. The modeling results indicate that ice jam thickness will increase to approximately 3.5 feet after full removal under normal flow conditions (Figure 11-2). However, removal of the dam and lowering the typical water surface elevation create more storage volume available for ice, which reduces water surface levels during ice-out floods.

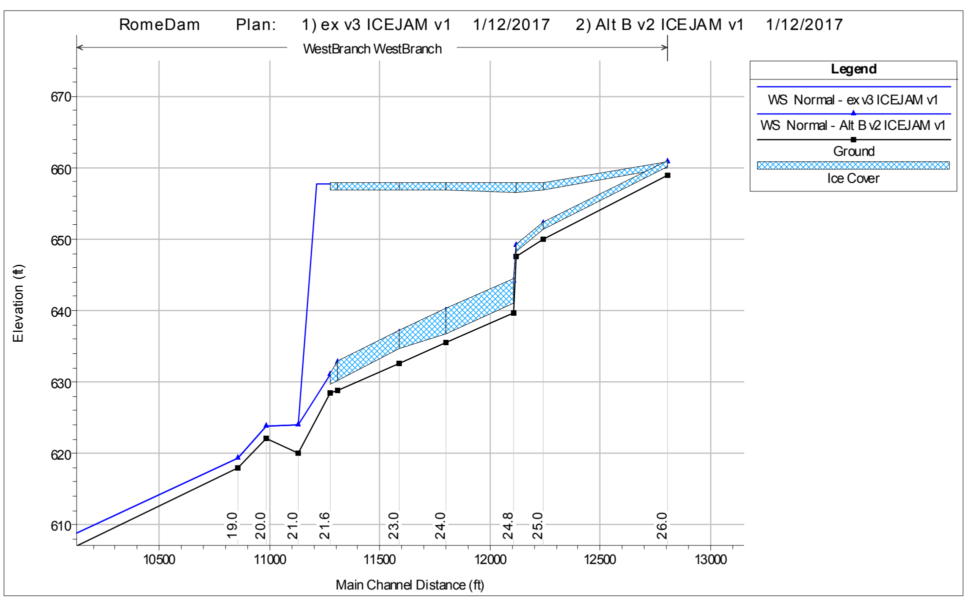


Figure 11-2: Ice Jamming at the Rome Dam with Full Removal during Normal Flow

The modeling results with full dam removal indicate that there is no change in ice-jam thickness at the bridges, Grove Islands area, or near the confluence with the East Branch downstream when compared to the existing conditions with the dam in place. The results indicate that the dam has no effect on the hydraulics or the capacity to transport ice at downstream locations where there is a history of ice-jam flooding in Au Sable Forks Village.

11.3 Additional Ice-Jam Considerations

A concern exists that the removal of Rome Dam may potentially lead to increased ice jamming downstream because sheet ice will not break up as it passes over the dam. Field observations indicate that one or potentially two boulder drops exist within the gorge upstream of the dam and are currently under water in the impoundment. The boulder drops appear to be approximately 10 feet tall and would continue to break up the ice as it flows through the gorge under free-flowing conditions without a dam.

Less ice is likely to form within the gorge if the dam is removed. Without the dam in place, the water surface will slope, and flow velocities will increase, which likely will reduce the thickness of the ice. It is reported that full ice cover typically does not occur downstream of the dam where the channel is steeper. Less ice formation (i.e., more open areas and thinner ice) is expected within the gorge and former impoundment if the dam is removed.

Removal of the dam is anticipated to increase the rate of ice erosion during thaw. Moving water and higher flow velocities will more rapidly thin and move ice as the weather turns warmer. Turbulent water flowing over the expected bedrock drops will wear away ice more quickly.

The effective width of the channel decreases approximately 100 feet moving downstream in the channel and into the upstream end of the bedrock gorge. Sheet ice originating from upstream of the project area will likely continue to jam at this large contraction in the channel whether Rome Dam is removed or remains in place. This contraction reduces downstream risks of ice jamming along the West Branch Ausable River between the existing Rome Dam and the approach to the Main Street Bridge. Ice-jam potential increases in the area of the confluence.

12.0 HYDROELECTRIC POWER CONSIDERATIONS

12.1 Background

A renewed interest is taking place in generating power at dams such as the Rome Dam to produce power without emitting carbon to the atmosphere such as by burning fossil fuels. The small-scale hydro movement comes several decades after a widespread hydroelectric development in the mid 1900s in the United State where many of the sites favorable for power generation were developed. The hydroelectric movement of today is mostly redeveloping past favorable sites or trying to outfit suboptimal sites with current technology for green energy generation.

12.2 Approximate Power Potential

An approximate first-cut calculation of hydroelectric potential was performed for Rome Dam to consider power generation potential at the dam. This initial look does not constitute a hydroelectric feasibility study (USACE, 1979) but is provided to give an initial indicator of potential power generation at the site. The potential power generated at a site is approximated by the equation $P = Q \times H \times E \times 0.085$ where P is the potential power in kilowatts (kW), Q is flow in cfs, H is head in feet, E is the overall facility efficiency typically taken as 55 percent, and 0.085 is the conversion factor for American units (ESHA, 2004; GEO, 2013).

Water surface elevations were taken from the hydraulic model and site survey. Normal flow (87 cfs) was used for the calculation to serve as an average condition. Power generation with the dam was estimated to be 140 kW.

Given the presumed presence of a bedrock ledge at the dam with a predicted height of 10 feet, some power generating potential may exist even if the dam is removed. The power potential associated with the drop across this ledge is 40 kW. The same potential power generation would exist at the ledge that was probed further upstream in the impoundment.

12.3 Additional Hydro Considerations

The "approximate power availability" has not been projected out over the flows observed during the year to get a detailed understanding of the true capacity at the site and when a hydroelectric unit could be running at the project site. The calculation to confirm and refine the initial estimate of power availability is critical for run-of-river sites such as the Rome Dam since operating gates do not exist, and power generation is therefore heavily influenced by fluctuating river flows (PSB, 1980). Operating gates would need to be installed if the dam were to be repaired to operate as a hydroelectric facility.

An intake structure in, next to, or above the dam location would be required to generate power at Rome Dam. The intake structure would need to be robust enough to withstand floods and ice flows. Water would need to be piped or funneled to a penstock or sluiceway. The existing leaky spillway and abutments would reduce power generation potential and need to be repaired. If hydroelectric power generation were to take, it is likely that the entire existing dam would need to be demolished, and a new concrete dam would need to be built. A powerhouse would also need to be constructed immediately downstream of the dam.

Given the large amount of stored sediment behind the dam, operation and maintenance would need to be implemented to allow an adequate supply of water for generating power. It is likely that a sediment dredge would need to be constructed at the dam to clean out the impoundment as sediment continues to accumulate upstream of the dam.

Hydropower facilities have negative environmental impacts on river channels that are primarily associated with dams. The project site appears to be a natural fish barrier most of the time with the 10-foot drops, yet dam removal may improve aquatic connectivity at some flows. Changes to sediment and flow regime due to dams often lead to more channel and bank erosion downstream.

13.0 ALTERNATIVES ANALYSIS

13.1 Methods

The hydraulic modeling results and data collection were used as the basis for the alternatives analysis. Modifications to the existing model were made to evaluate the changes proposed by each alternative. The alternatives were evaluated to meet the following objectives:

- Improve dam safety
- Reduce flood risk
- Reduce erosion risk
- Meet spillway requirements
- Improve water quality
- Reduce the town's financial exposure
- Control implementation costs
- Reduce maintenance costs

Full dam removal is the preferred alternative as it is the most cost-effective way to meet the majority of the project objectives and completely eliminate dam safety issues and the town's financial exposure. The results of the alternatives analysis are summarized in a matrix (Appendix K).

13.2 Alternatives

The following six alternatives were evaluated:

A. No action – maintain existing conditions
B. Full removal
C. Three-quarters (¾) removal (down to ogee bottom)
D. Half (½) removal
E. Repair dam
F. Replace dam

13.2.1 No Action

This alternative retains the existing conditions, and no changes are made at the dam. This alternative is not acceptable given the dam safety concerns of a deteriorating structure and confirmed downstream risks. The dam is in poor condition and could be in worse condition than currently known if undermining and visible erosion are also impacting the foundation of the structure.

It is unlikely that any use of the dam can take place in its current condition. For example, even if the dam is to be used for hydroelectric power generation, a complete removal and rebuild are likely needed to fully and confidently improve the structure and meet state dam safety requirements.

The dam is a high-hazard structure. The financial exposure of the town is high, insuring the structure is expensive and even may not be possible, and downstream risks are confirmed to be high. This alternative is not recommended.

Advantages

- No implementation cost
- No construction impacts
- Retained current site historic value

Disadvantages

- Downstream flood and erosion risks exist should the dam fail.
- The deteriorating spillway is undersized and has inadequate freeboard.
- Dam failure could lead to long-term channel instability that would threaten a lot of private property and public infrastructure in the downstream river corridor.
- Dam failure would impact trout habitat impacts and reduce water quality for a long period of time.
- This alternative does not address the deteriorating structure or flood risk and is likely not allowed due to dam safety requirements.
- Site hazards remain.

13.2.2 Full Dam Removal

This alternative consists of removal of the entire dam, the historic dam that is buried within the existing concrete dam, and the upstream timber/rock cribbing towers. This is the only alternative that eliminates all dam safety concerns and all financial exposure of the town.

Removal of a portion of the sediment would take place under this alternative, which would reduce flood and erosion risks downstream. The downstream channel would not likely be exposed to a large sedimentation event that could destabilize the bed and banks and lead to damages along Church Lane and in the village.

Site aesthetics will change yet will take on a wild and natural feel with a free-flowing river. Bedrock cascades will likely exist near the dam and in the current impoundment creating waterfalls that will enhance the visual appearance of the impoundment area.

Full removal is likely to reduce ice formation due to the flowing water, and ice jamming downstream is not expected to increase, and may decrease, due to the presence of the bedrock cascades that will help break ice.

The full removal of the dam will lead to the loss of a historic structure, yet it is anticipated some nearby industrial equipment in the floodplain may remain. A kiosk with photos of the dam and mills is anticipated in the vicinity of the dam to preserve the site history.

Full removal is the preferred alternative as it meets the most project objectives for the lowest cost. The anticipated cost to implement this alternative is $2.5M to $3.0M. No maintenance costs are expected.

Advantages

- Reduce downstream flood and erosion risks.
- Eliminate all dam safety concerns and requirements.
- Eliminate town's financial exposure.
- Reduce public safety hazards at the site.
- Naturalize sediment transport and improve long-term channel stability.
- Protect downstream habitat and water quality.

Disadvantages

- Loss of a historic Adirondack industrial dam

13.2.3 Three-Quarters (¾) Removal (down to ogee bottom)

This alternative lowers the majority of the dam to the elevation of the downstream portion of the ogee crest. Design plans of a dam improvement show that a stone masonry wall existed in the location before the concrete was added, so this alternative would nearly match the lower downstream wall elevation.

This alternative would establish a more uniform river profile while retaining the last "step" that is believed to exist over a bedrock drop. Downstream risks would decrease due to eliminating almost all of the storage in the impoundment.

The remaining dam in this alternative would be at or very close to the channel bottom and would thus not likely trigger state dam safety jurisdiction. Nonetheless, a structure would exist, and a foundation assessment and repairs of the remaining abutments would likely be needed. The remaining portions of the structure may require some maintenance after the project.

Site aesthetics will naturalize as for full removal with the exception that some of the dam will be visible. The reduction of ice formation and increase in ice erosion will likely be similar to full removal. Part of the historic structure will remain, and a kiosk with site history information is still recommended.

Three-quarters removal is not recommended as there is only a small possible savings compared to the full removal, and the town would be left with a structure with some long-term maintenance needs. It is unclear if the remaining structure would be insurable even though the downstream hazards would be almost eliminated under this alternative. The anticipated cost to implement this alternative is $2.0M to $2.5M, with a low level of ongoing maintenance cost.

Advantages

- Reduce downstream flood and erosion risks.
- Reduce most dam safety concerns and requirements.
- Reduce town's financial exposure.
- Reduce public safety hazards at the site.
- Naturalize sediment transport and improve long-term channel stability.
- Protect downstream habitat and water quality.
- Retain some portion of the historic Adirondack industrial dam.

Disadvantages

- Close to same cost as full removal yet left with structure that needs repairs
- Ongoing maintenance costs
- May not be insurable by the town

13.2.4 Half (½) Removal

This alternative consists of lowering the crest of the dam to try and meet the state spillway capacity requirements. In this alternative, the dam and spillway crest would be lowered approximate 13 feet. The remaining portions of the dam would need to be repaired to stabilize the structure.

This alternative would establish a more uniform river profile, yet an unnatural drop in the channel would remain that will continue to trap sediment upstream of the dam. Although reduced as compared to existing conditions, downstream risks would remain due to the remaining storage in the impoundment.

The remaining dam in this alternative would continue under the jurisdiction of NYSDEC Dam Safety. A foundation assessment and repairs of the remaining abutments would be needed. The remaining portions of the structure would require ongoing maintenance to function safely and properly after the project.

Site aesthetics will largely remain as in the existing conditions with nearly half of the dam remaining. Ice dynamics are not likely to change under this alternative. Half of the historic structure would remain, and a kiosk with site history information is still recommended.

One-half removal is not recommended as there is only a small possible savings compared to the full removal, and the town would be left with a jurisdictional structure that will be costly to insure and may not even be insurable. Long-term maintenance needs will exist with the remaining dam. Downstream hazards would remain under this alternative. The anticipated cost to implement this alternative is $2.0M to $2.5M, with low to moderate ongoing maintenance cost.

Advantages

- Lower downstream flood and erosion risks
- Achieve spillway capacity requirements.
- Reduce some dam safety concerns through repairs.
- Eliminate public safety hazards at the site through repair work.
- Retain half of the historic Adirondack industrial dam.

Disadvantages

- Financial burden remains for the town due to high hazard jurisdictional structure.
- Downstream risks remain with remaining portion of the dam.
- Close to same cost as full removal yet left with a structure that needs repairs
- Ongoing maintenance would be required.
- Sediment transport would remain disrupted.

13.2.5 Repair Dam

This alternative consists of attempting to repair the existing dam. Almost all visible components (e.g., spillway, abutments, and outlet works) would need to be repaired. The full extent of the required repairs is unknown at this time as subsurface exploration and testing of the dam foundation have not taken place.

Dam repair may not be allowed since the existing spillway will not meet dam safety requirements of passing the ½ PMF with 1 foot of freeboard, and changing the spillway configuration would lead to a large change at the dam (such as ½ or ¾ removal).

The repaired dam would remain under the jurisdiction of NYSDEC Dam Safety. The repaired structure would require ongoing maintenance, which is not being performed now, to function safely and properly after the project.

Site aesthetics will remain as in the existing conditions. Flood patterns and ice dynamics would not change. The historic structure would remain.

The cost to repair the dam is estimated to be $3 to $4M but could be larger if foundation repairs are needed. This alternative is not recommended since there is no current use of the structure, the potential exists to not be able to get a permit to complete such work and operate the dam, and the potential exists for repair costs to increase as new information is gathered about the dam foundation.

Advantages
- Retains current site historic value
- Lowers downstream risks

Disadvantages
- Large implementation cost with high level of uncertainty
- Downstream flood and erosion risks exist should the dam fail.
- The spillway is undersized, which may preclude project permitting.
- Ongoing maintenance and sediment management would be needed.

13.2.6 Replace Dam

This alternative consists of replacing the dam with a new modern structure. Full dam removal would be required before the construction. The new dam would likely have a lower spillway in order to meet dam safety requirements.

The repaired dam would remain under the jurisdiction of NYSDEC Dam Safety. The repaired structure would require ongoing maintenance, which is not being performed now, to function safely and properly after the project.

Site aesthetics will generally remain as in the existing conditions, yet the historic structure would be removed. An information kiosk to document the current dam is recommended. Flood patterns and ice dynamics would likely remain similar to existing conditions.

The cost to remove the current dam and build a new dam is estimated to be $7 to $8M but may vary depending on subsurface conditions and the dimensions of the new structure. This expensive alternative is not recommended with no current planned use of the structure. The required lowering of the spillway under the current hazard classification would reduce hydroelectric power-generating capacity.

Advantages
- Lowers downstream risks with modern structure that is less likely to fail
- Existing site aesthetics remain.

Disadvantages
- Large implementation cost that may vary
- Downstream flood and erosion risks exist should the dam fail.
- The spillway will likely need to be lowered to meet dam safety requirements, and that would reduce power-generation potential.
- Ongoing maintenance and sediment management would be needed.
- Loss of historic value

13.3 Preferred Alternative

The results of the alternatives analysis (see Appendix K) suggest that full removal of the Rome Dam should take place to maximize safety, reduce liability, naturalize the river, and eliminate long-term costs at the site. Full removal is the only alternative that eliminates all dam safety requirements, downstream risks, and financial exposure associated with the existing dam.

The following actions are recommended:

1. Design
    a. Preliminary design
        i. Delineation of the ordinary high water line
        ii. Planning for construction access and sequence
    b. Final design
    c. Pre-permit site visits with regulators
2. Permitting
    a. Historic preservation review (Section 106)
    b. USACE (joint application with above items)
    c. U.S. Fish & Wildlife review and habitat restoration agreement
    d. Adirondack Park Association jurisdictional inquiry
    e. NYSDEC Article 15 Title 5 Dams
    f. NYSDEC Article 15 Title 27 Wild, Scenic & Recreational Rivers
    g. New York State Environmental Quality Review (SEQR)
    h. NYS Section 401 Clean Water Act Water Quality Certification
3. Deconstruction

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