

Appendix A:

Analysis of the Former Black River Canal

A stylized, light blue line drawing of a river or canal winding through a landscape. The line starts from the left edge, curves around the 'C' in 'CONNECTS', and then continues towards the bottom left corner.

LYONS FALLS
CONNECTS
RECREATION · BUSINESS · HISTORY

Lyons Falls Brownfield Opportunity Area

Step 3 Implementation Strategy

March 14, 2017

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Attachments

Attachment A: Historic Documents
Attachment B: South Segment Site Visit #1 Photos
Attachment C: North Segment Site Visit #1 Photos
Attachment D: Site Visit #1 Sketches and Measurements
Attachment E: Site Visit #2 Pipe Inspection Photos
Attachment F: Storm Sewer Inspection Figures
Attachment G: Preliminary Cost Estimate

1

INTRODUCTION

The purpose of this analysis is to:

- Assess the condition and function of the 36" storm sewer within the former Black River Canal and the function of the Turning Basin
- Identify potential barriers to redevelopment related to the former Canal.
- Assess condition of lock structures north of the Turning Basin.

BACKGROUND

1.1

The Black River Canal (the Canal) in Lyons Falls, NY was constructed in 1858. Seven (7) locks (Locks 103 – 109) were constructed along the Canal to match the 70 foot drop at the falls of the Black River in Lyons Falls. In the 1940's the southern portion of the Canal, between the Black River and the Turning Basin, was filled in to provide more space for buildings to be used for paper mill production. North of the Turning Basin, the Canal was left intact. This portion of the Canal is fed by two tributaries that formerly outlet into the Black River. Tributary #1 enters the west end of the Turning Basin and has a drainage area of 2 square miles. Tributary #2 enters the Canal between Locks 107 & 108 with a drainage area of nearly 0.5 square miles. The Turning Basin, a former canal feature, is now used as a part of the fire protection system for the Village of Lyons Falls.

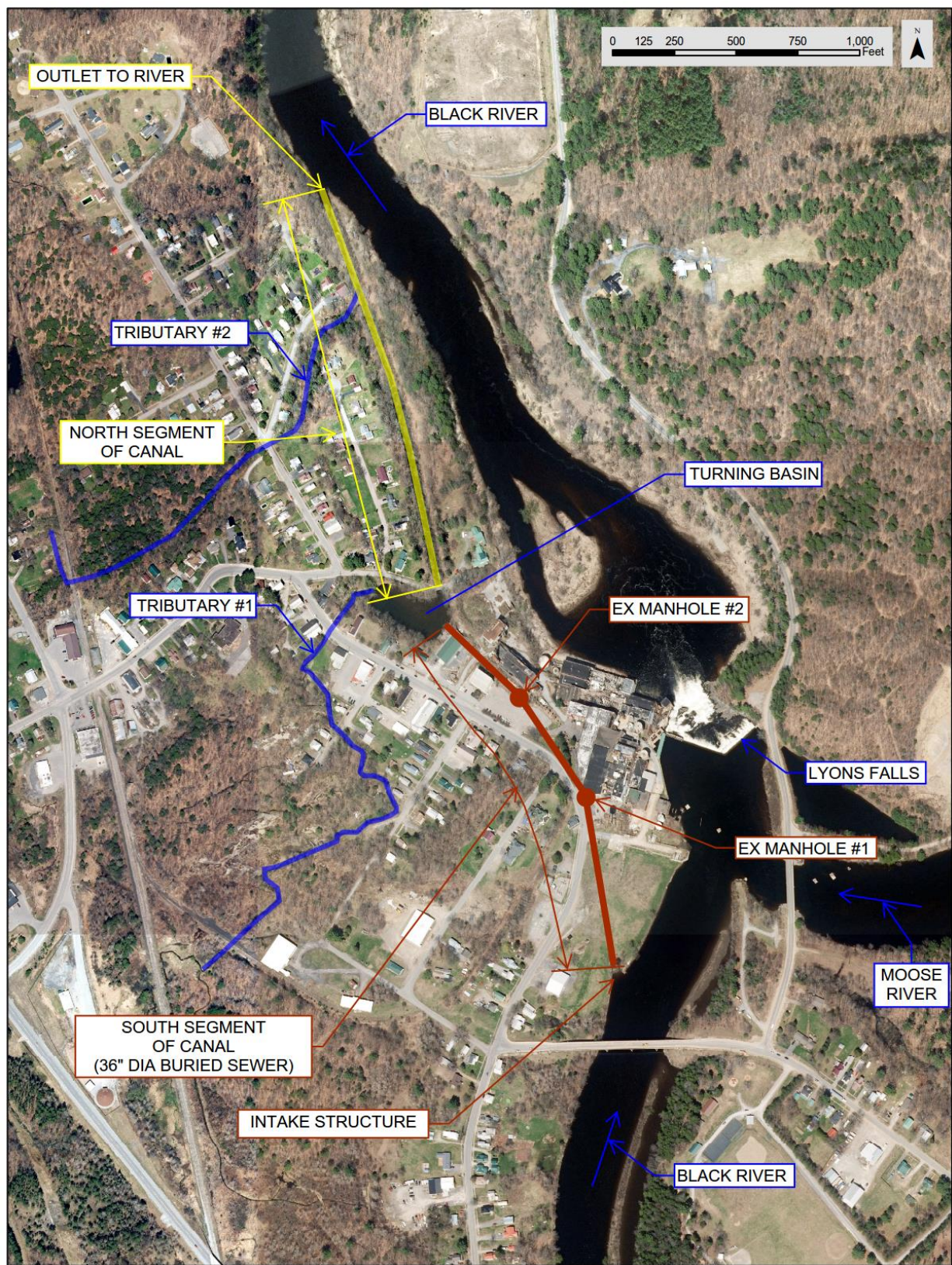
1.2

ANALYSIS BOUNDARY

Figure 1 illustrates the extent of the analysis boundary. The southern end of the analysis boundary is the inlet from the Black River. The northern end of the boundary is located at the outlet into the Black River. The existing conditions analysis is divided into two segments of the Canal (South and North), illustrated in Figure 1.

- The **South Segment** extends from the canal intake structure on the Black River south of Lyons Falls to the Turning Basin. This section formerly included Locks 103 – 105. Currently, river water is diverted into a 36" buried pipe system leading to the Turning Basin.
- The **North Segment** extends from the Turning Basin to the Black River north of Lyons Falls and includes Locks 106 – 109. This section of the Canal remains largely intact.

Figure 1 Boundary and Segment Map



METHODOLOGY

The following methodology was used to complete the analysis.

Review of Historic Documents

1.3

The Village of Lyons Falls provided historic information and photographs of the Black River Canal and the former Pulp and Paper Mill. The information provides details of the location, original construction and the demolition of the locks as well as the filling of portions of the canal. This historic information gives insight regarding previous uses of the canal and modifications to its structures. The historic documents listed below can be found in Attachment A.

- Plan views of the Canal alignment along with original and current property boundaries. The Black River Canal currently travels through at least 8 residential property boundaries before it ties back into the Black River. These properties begin from Edgewood Drive and extend through the canal and to the towpath on the east side of the canal. Because of this, permission must be granted to access the Canal;
- Historical photos of the Black River Canal, the Turning Basin and Paper Mill activities alongside the Canal;

Field Investigation

Field investigations were completed over the course of two site visits:

- Site Visit #1 (June 7, 2016) was conducted in order to gather historical information, complete an initial visual inspection, and interview community members familiar with the Canal in relation to the Paper Mill. The purpose of the field investigation was twofold: (1) locate the storm sewer and mark the manholes of the infilled portion of the Canal; and (2) locate the lock walls for survey purposes and measure and visually assess the existing conditions of the lock walls. Select photos from the site visit are including in Attachment B and C for the South and North Segments of the Canals, respectively. Attachment D includes sketches locating the existing manholes along the historical Canal alignment.
- Site Visit #2 (September 13th and 14th, 2016) involved obtaining a closed caption television (CCTV) video of the interior of the storm sewer in the south segment of the Canal. A high resolution video camera, attached to a remote controlled crawler robot, was used to capture the video. The efforts to obtain video of the storm sewer included:
 - Sandbagging and dewatering the inlet to the storm sewer from the Black River;
 - Cleaning sediment and debris from the storm sewer to gain access for the remote controlled video camera robot; and
 - Dewatering at the outlet of the storm sewer pipe in the Turning Basin.

Access to the storm sewer inlet was provided by Todd Ossont of the Village of Lyons Falls DPW, and access to the outlet by Robert (Dave) Pettey at 7118 McAlpine Street. The information gathered from the video inspection was used to provide an assessment of conditions of the Black River Canal storm sewer and Turning Basin. Attachment E includes select photos from the pipe inspection.

Hydraulic Analysis and Mapping:

Using the provided historical documents regarding operations at the Black River Canal and the previously discussed field investigations, a hydraulic analysis of the storm sewer pipe detailing the expected flow into the Turning Basin for the original design and existing conditions was completed.

Results of the field investigations and mapping were used to determine that there are two bends in the sewer alignment, at the manholes, and three changes to the vertical profile, all located in the segment between Manhole #2 (MH-2) and the Turning Basin (see Attachment D). This analysis was helpful in determining the potential future capacity of the storm sewer in the current alignment and profile. The low slope of the storm sewer profile suggests that the section from the intake structure to MH-2 controls the hydraulics of the entire storm sewer. Results of the hydraulic capacity of the storm sewer assuming varied levels of blockage are shown in Figure 2.

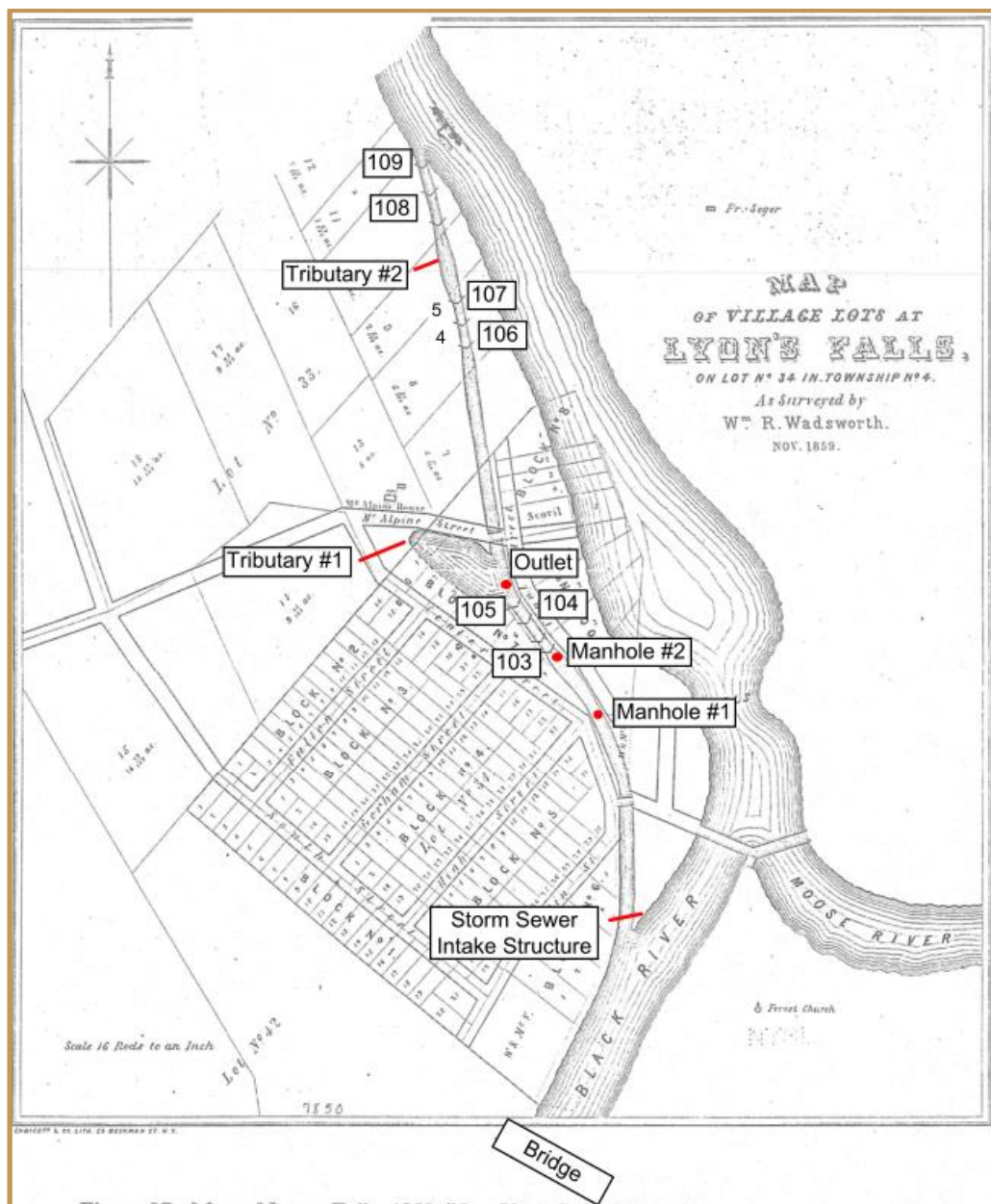
Figure 2 Summary of Storm Sewer Discharges

| 36-INCH STORM SEWER RESULTS (INTAKE TO MH-2) | | |
|--|--------------------|-------------------------------------|
| PIPE CONDITION | PEAK FLOW (cfs) | % DIFFERENCE FROM ORIGINAL |
| ORIGINAL DESIGN (POTENTIAL FUTURE CONDITION) | 43 | 0% |
| 12-INCHES OF DEBRIS | 22 | 49% |
| 18-INCHES OF DEBRIS | 9 | 79% |
| 24-INCHES OF DEBRIS | 4 | 91% |
| *ASSUMING PEAK HEADWATER IS 809.4' (NAVD88) | | |

2 EXISTING CONDITIONS

This chapter includes a detailed description of observations of the existing storm sewer, Turning Basin, and canal lock structures. Observations were completed during a site visit conducted on June 7th, 2016. Descriptions of the site visit findings are organized by each segment of the former canal. Photos are included in Attachments B and C. Figure 3 below shows the approximate location of the lock structures, manholes and sewer features located in the field compared to the original canal alignment.

Figure 3 Existing Conditions Features Map



SOUTH SEGMENT

2.1 South of the Turning Basin, the site visit focused on locating remaining features of Locks 103 – 105 and locating the manholes for the storm sewer through the filled-in canal. When the southern portion of the Canal was filled in the 1940's, a storm sewer (estimated to be 30-36 inches based on visual observation of the outfall at the Turning Basin) was installed to maintain flow to the Turning Basin and the northern portion of the Canal. The site visit findings are documented below. Referenced photos for the south segment can be found in Attachment B.

Storm Sewer Manholes

Four (4) locations provide access to the storm sewer that feeds the Turning Basin from the Black River. These locations are described below:

- *The Intake Structure:* The intake structure to the storm sewer is a sluice gate located at the inlet bay off of the Black River approximately 300 feet north of the Laura Street bridge on the left bank of the river. The gate operator is chained and locked to prevent operation, except by authorized personnel. It is assumed the Village of Lyons Falls officials can unlock this gate. The opening of the gate was submerged at the time of inspection, and the water surface was stagnant, with no evidence of inflow (photos 1 & 2 in Attachment B). The gate position cannot be determined until either the operator is unlocked or the inlet bay is dewatered. There is approximately 0.4 feet of sediment above the inlet bay channel bottom approximately 2 feet upstream from the pipe.

According to a local resident, the gate is locked in the open position and there is sediment buildup along the invert of the storm sewer. Reportedly, when water in the Black River is low there is no flow through the storm sewer. According to the USGS No. 04252500 on the Black River near Boonville, NY, approximately 10 miles upstream of the intake structure, the river was experiencing higher than normal flows during the June 6, 2017 site visit.

- *Manhole #1:* MH-1 is an open grate manhole located in the driveway area of the former Pulp and Paper Mill building at the corner of Center Street and Franklin Street. The team was not able to remove the grate during the site visit, but the manhole was estimated to be greater than 10 feet deep. Standing water was observed in the manhole. The manhole grate is flagged and has two white paint marks (photo 3 in Attachment B). Refer to Attachment D for a location sketch of Manhole #1.
- *Manhole #2:* MH-2 is a square manhole located in the parking lot southeast of 4012 Center St. The manhole is approximately 6 feet from the beginning of the west wall of Lock 103 (photos 4-6 Attachment B). This manhole has a plastic grate and yellow safety railing that are in disrepair. The safety railing is broken and leaning over the top of the manhole and the grate deflects under foot loads. Rushing water was audible from this manhole.

According to a local resident, when the water level in the river is raised, flow through the storm sewer pipe is audible at this manhole. At the time of the inspection, the resident believed the elevation of the Black River upstream of Lyons Falls was raised, this was confirmed by the USGS gage upstream. Refer to Attachment D for location sketch of MH-2.

- ***Storm Sewer Outlet to the Turning Basin:*** The fourth location is the storm sewer outlet into the Turning Basin. A locked chain-link gate blocks the possible access from McAlpine Street and no access was allowed to this area through the True Value Hardware store property south of the Turning Basin. The True Value store sits immediately south of the Turning Basin.

The outlet can be seen from the north side of the Turning Basin (). The outlet is visible and appears to be in satisfactory condition. The storm sewer outlet appeared to be nearly half submerged. Although there was audible flowing water at MH-2, there was no visible evidence of flow into the Turning Basin from the outlet.

Figure 4 Storm Sewer Outlet into the Turning Basin



Canal Locks

Lock 103 begins immediately adjacent to MH-2. The west wall of the canal is visible through heavy vegetation growth (photo 6 Attachment B). The original lock wall stones extend from the manhole to the north approximately 127 feet. The next 74 feet appears to have been reconstructed with concrete and smaller masonry blocks. At the end of the

repaired section, there is a locked gate and yellow safety railing, a total of 201 feet from MH-2. There are no record plans to help delineate the locations where Lock 103 ends and turns into Lock 104 or Lock 105. Beyond this area, there are no apparent remaining lock walls.

The east lock walls are either damaged or removed. A building and storage tanks appear to have been built at the approximate location of the east walls. Photos 16, 17 & 18 (Attachment B) show the outside wall of a building near the location where the Lock 103 east wall would have been positioned. The team was not able to access this area and could not verify if there is evidence of remaining lock walls in this area.

NORTH SEGMENT

2.2

The Turning Basin marks the division between the North and South segments of the Black River Canal. For the North segment, the team evaluated the Turning Basin and existing Locks 106 – 109. The site visit findings are documented below. Referenced photos can be found in Attachment C.

Turning Basin

Tributary #1 discharges into the Turning Basin at the northwest end. The Turning Basin is a manmade pond that was formed by blocking the original outlet at the east bank of the Black River Canal. Prior to the canal construction, the tributary into the Turning Basin flowed directly to the Black River. From the High Falls Figure A-17 in Attachment A, it appears that a retaining wall was constructed at the east bank of the Black River Canal. The team was not able to access this area to investigate whether there is evidence of remains of a retaining wall.

Based on observed measurements of width, average depth and velocity, the flow from Tributary #1 into the Turning Basin was estimated to be approximately 2 cubic feet per second (cfs). The watershed area for Tributary #1 is 2 square miles. There is sedimentation throughout the basin and several areas are stagnant due to insufficient mixing of flow. Figures 5 & 6 show photographs of the Turning Basin.

Figure 5 Historical Photo - Looking south at the Turning Basin

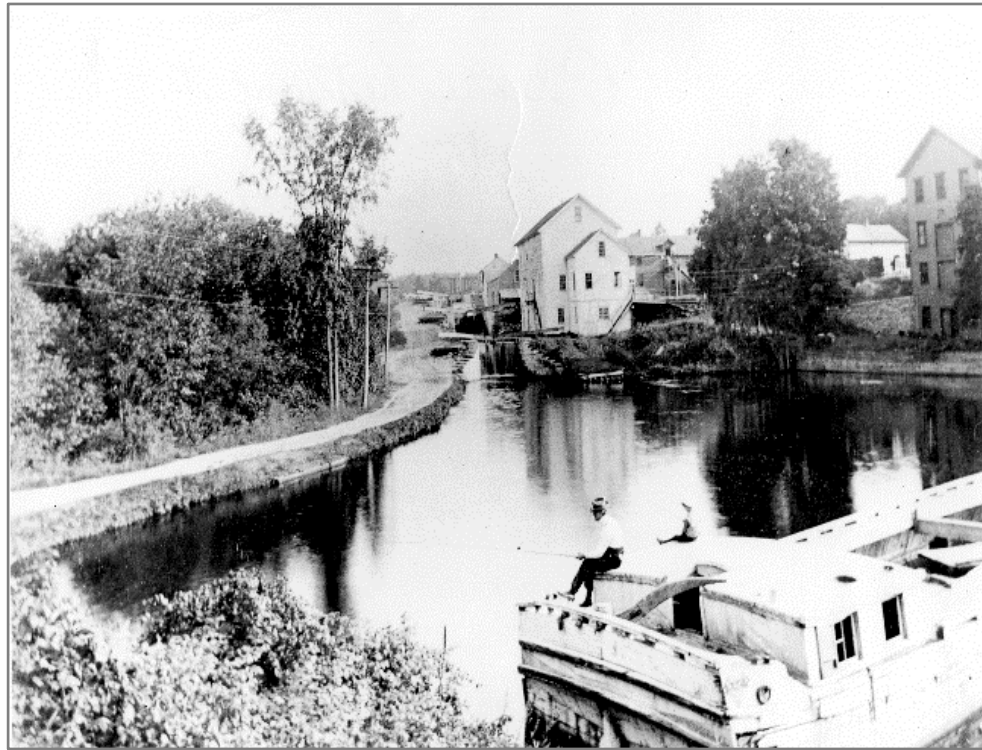


Figure 6 Current Photo - Looking southeast at the Turning Basin



Canal Locks

There are four Locks (106 – 109) on the abandoned Black River Canal between the Turning Basin and the Black River. A towpath extends from the Turning Basin to Lock 106. Downstream of Lock 106, vegetation has been left untouched. The canal appeared to be symmetrical, unless otherwise noted on the annotated lock figures in Attachment D. The west side of the canal was generally steep with moderately dense vegetation.

In general, the top width of the lock walls was 3 feet 3 inches and the recesses in the gate locations were 16 inches. The top width of the canal ranged from 14.4 feet to 16 feet. This suggests minor tilting of the lock walls.

Lock 106, the most upstream lock, has had concrete repairs. Joints for monolith pours were approximately 20 feet apart. Spalled concrete was present at several locations on both lock walls. There were no signs of remaining masonry stones in Lock 106. The inlet sill is approximately 4.5 feet higher than the original sill elevation, upstream of the gate recess (photos 6 & 7 Attachment C). This sill raises the water surface to impound water in the Turning Basin. A section of chain-link fence was located on the east side of the canal at the beginning of Lock 106.

Lock 107 is immediately downstream of Lock 106 and showed no signs of previous concrete repairs. Masonry stone was in good condition with limited joint separation and vegetation growth. An area with minor to moderate joint separation was present on the west wall near the upstream end of the lock. There was also efflorescence staining at this location (photo 10 Attachment C). Tributary #2 enters the Canal between the Locks 107 and 108 (photo 14 Attachment C).

Lock 108 has an angled wing wall and a masonry sill at the lock inlet. Concrete repairs to this wing wall appeared in good condition (photo 16 Attachment C). There were two displaced stone blocks near the beginning of the east lock wall. One was behind the wall and the other was in the lock. The remaining masonry stone of the lock walls was in good condition with tight joints and limited vegetation growth through joints. There were several small areas showing evidence of water intrusion through the lock wall. At the time of the site visit, the water upstream of Lock 108 was very shallow, so this area may provide access to the west bank should it be necessary and property owners can be notified. Both Locks 108 and 109 had too much dirt and debris covering the east wall to measure the width of the wall.

Lock 109 is immediately downstream of Lock 108 and exhibited no signs of repairs to the lock walls. Similar to Lock 108, the masonry stone of the lock appeared to be in good condition with tight joints and limited vegetation growth through joints. This is the final lock on the Canal. The Canal outlets to the Black River a short distance downstream (photo 21 Attachment C).

2.3

SUMMARY OF KEY FINDINGS

This section includes a summary of key findings and conclusions based on the existing conditions analysis.

South Segment

The intake structure does not function as intended and promotes sediment accumulation in the pipe as well as the inlet basin. Sediment accumulation in the pipe reduces flow through the storm sewer, especially during low flow conditions on the river, where the head is not high enough to drive flow through the pipe. The low volume of flow through the pipe leads to the diminished water quality in the Turning Basin.

The 36-inch storm sewer pipe and canal lock wall remnants are currently located on the former Pulp & Paper Mill site, which could potentially limit redevelopment opportunities. Public access and maintenance easements would likely be required along the storm sewer alignment. These easements would limit the amount of available development space, configurations and usage.

North Segment

The Turning Basin is largely stagnant water. There was little active inflow noted during the site visits. The Turning Basin has also, over time, accumulated sediment along the bottom reducing the basin depth. The combination of standing water with low depths leads to low water quality.

The existing masonry lock chambers are visible and in satisfactory condition. Concrete repairs are evident. Small and large vegetation in and adjacent to structures will have an increasingly detrimental effect on the condition of the structures in the long-term. Most of the canal features and towpath are on private property, which currently prohibits public access to the canal and may prevent future development of a public trail or other publicly accessible recreational/historic amenities.

3 REHABILITATION OPTIONS

Given the community's goals of improving water quality in the Turning Basin, maintaining the function of the storm sewer, and addressing potential barriers to redevelopment at the Pulp & Paper Mill Site, two rehabilitation options were identified, both of which can achieve the Village's overarching goals.

ANALYSIS OF OPTIONS

3.1 This section describes rehabilitation options for each individual component of the Canal and Turning Basin. Two primary options for each storm sewer component are summarized into options (A and B) to facilitate review and discussion. Chapter 4 includes a summary of the options described below.

Storm Sewer Intake Structure

The existing storm sewer intake structure serves as a trash rack to prevent large floating debris from entering the storm sewer. A hand operated sluice gate is locked in the open position at the intake structure. Our team's inspection of the storm sewer revealed a significant amount of sedimentation in the storm sewer, which suggests the current intake structure is not effectively keeping sediment from flowing into the storm sewer.

Both rehabilitation options include the following work for this section:

- Remove the existing intake structure and sluice gate;
- Remove accumulated sediment from the inlet basin;
- Design and Install an intake drop structure system that will allow only spill through flow at an elevation equal to the crown (top) of the storm sewer inlet pipe which will help reduce the amount of sediment deposited in the pipe;
- Install a new trash rack to prevent floating debris from entering the storm sewer; and
- Install a new gate for the storm sewer inlet to be able to control flows to the Turning Basin.

Storm Sewer Inlet to MH-1

The existing storm sewer in this section is 618 linear feet of 36" diameter reinforced concrete pipe (RCP) with significant sedimentation. The storm sewer begins at the intake structure on the Black River, heads north into the former Pulp and Paper Mill property (see Figure 1). This section of the pipe was not able to be inspected due to the volume of sediment at the inlet end of the pipe and because access could not be gained at MH-1. MH-1 appears to have been modified or extended vertically. The manhole grate at ground level near the corner of Center and Franklin Streets is too narrow for a person to make an entry.

Both rehabilitation options include the following work for this section:

- Cleaning of the storm sewer is required to remove the sediment volume. Shallow sections of storm sewer pipe may be uncovered and removed to provide access points for sediment removal in this section of pipe. Inspect the storm sewer to determine whether rehabilitation via slip-lining or by digging and replacing damaged sections of pipe is necessary. Inspect and rebuild at least the top 10-vertical feet of MH-1, in order to allow human access to the storm sewer.

Storm Sewer MH-1 to MH-2

The existing storm sewer in this section is 477 linear feet of 36" diameter RCP with significant sedimentation. This storm sewer is located on the Pulp and Paper Mill site (with the exception of a small portion of the sewer that crosses the Center Street right-of-way (ROW)). Approximately 200 linear feet of storm sewer was inspected upstream of MH-2 before significant sediment deposition prevented further inspection. Access could not be gained through MH-1. The portion of the pipe inspected appeared to be in good/fair condition, with occasional cracks and offset joints. **MH-2 is a drop manhole with a flat bench at the upstream invert, which was used to place a removable gate to divert flows to the storm sewer under Center Street.**

There are two different rehabilitation options for this segment:

- Option A, Figure 7, includes cleaning to remove sediment and completing the inspection of the remainder of the pipe; rehabilitating the existing pipe with a trenchless repair option, i.e., slip lining or CIPP lining; and installing a lockable access hatch at MH-2.
- Option B, , would involve relocating portions of the storm sewer downstream of MH-1 to outlet further upstream in Tributary #1 rather than the Turning Basin. Approximately 200 feet of the existing storm sewer just downstream of MH-1 would remain and need to be cleaned and rehabilitated, likely using a trenchless repair option. A new manhole would need to be installed in the Center Street ROW to intercept the existing storm sewer. Approximately 1,100 linear feet of storm sewer and 3 additional manholes would need to be installed, within existing ROW, to re-route the storm sewer along Center Street, Church Street and Gorham Street over to Tributary #1. A new outfall would need to be installed outlet the sewer into Tributary #1. The remaining sections of the existing storm sewer pipe and MH-2 would be filled and abandoned in place.

Storm Sewer MH-2 to the Turning Basin Outlet

The existing storm sewer in this section is 441 linear feet of 36" diameter RCP and 33" diameter corrugated metal pipe (CMP). This section of storm sewer begins on the Pulp and Paper Mill site and extends to the Dolhof property where it outfalls into the Turning Basin, as shown in Figure 1. Approximately 220 linear feet of this section of the storm sewer was inspected (see Appendix F). The inspection showed moderate to significant pipe degradation with vegetation root intrusions through several pipe joints. The pipe profile is broken back with two nearly 0% slope pipe runs connected by a steep pipe run

in the middle, as depicted in Appendix D. The portion of storm sewer inspected at the outlet to the Turning Basin appears to be in fair condition.

The west lock walls for Locks 103, 104 & 105 are still present and can be seen from MH-2. The stone masonry that is visible appears to be in good condition. The foundation sills and the east lock wall are not present.

There are two different rehabilitation options for this segment:

- Option A includes cleaning of the storm sewer to remove sediment, inspection of the pipe condition, and rehabilitation, likely with trenchless repair options. Two new manholes would need to be installed at the profile change locations.
- Option B, as described above, includes filling and abandoning the entire section of existing storm sewer pipe and reconnecting any existing laterals connections to the new, realigned pipe.

Turning Basin Storm Sewer Outlet

The storm sewer outlet as described above is a 33" diameter CMP, which is approximately halfway submerged in the Turning Basin. The outlet is pictured in Figure 4.

There are two different rehabilitation options in this segment:

- Option A includes deflecting the storm sewer inflow into the Turning Basin to prevent short-circuiting of flow and length detention times in the Basin. In order to do this, an extension a minimum of 50 linear feet of storm sewer pipe connected to the existing storm sewer outlet would be constructed and directed to the west end of the Turning Basin. This would help to deflect flow towards the west end of the Basin, rather than short circuiting directly out through the Canal. This would help engage more of the Basin waters and provide more circulation.
- Option B, as described above, includes abandoning the outfall into the Turning Basin. This can be either partial removal of or fill and burying the storm sewer outlet. By directing all inflow through Tributary #1 at the west end of the Basin, more of the Basin area is brought into circulation, reducing the amount of stagnant water and increasing water quality.

Turning Basin

The Turning Basin is a man-made pond that was formed by blocking the original outlet of Tributary #1 at the east bank of the Black River Canal. Prior to the Canal construction, Tributary #1 traveled directly to the Black River (refer to Attachment A). The normal discharge in Tributary #1 is very low; that, combined with the shallow water depths as a result of sedimentation, results in stagnant water and poor water quality in the Turning Basin.

Both rehabilitation options include the following work for this section:

- Installation of a stop-log system underneath the bridge on McAlpine Street that can be used to raise the Turning Basin water surface elevation by 12 inches.

Increasing the depth of the Turning Basin can aid in water quality. Dredging of the Basin would also increase the depth; however, is very costly and would require sediment sampling, permits and continued maintenance whereas the stop-logs are a simple, cost effective feature that can be adjusted and causes little to no impact to the environment.

- Additionally, it would be beneficial to provide overflow relief from the Turning Basin directly to the Black River during extreme storm events (instead of all flow being conveyed through the Canal). Reducing the high velocity, high discharge flows through the Canal would help preserve the condition of the canal features and lock structures. The historical plan view of the Turning Basin (Attachment A) shows how Tributary #1 was converted into the Turning Basin. It is possible that an overflow condition could be created to allow some extreme events to overflow through that former tributary alignment, or alternately a culvert, directly into the Black River.

Figure 7 Rehabilitation Option A Figure 8 Rehabilitation Option B



Figure 9 Rehabilitation Option B



4

SUMMARY AND CONCLUSION

SUMMARY OF OPTIONS

4.1

The previous chapter described rehabilitation options for each individual component of the canal and Turning Basin within the Village of Lyons Falls. To facilitate discussion and decision-making, the rehabilitation options have been consolidated into two primary options (Option A and Option B), which are summarized in this chapter.

Both rehabilitation options presented below will achieve the identified goals of improving water flow and quality in the Turning Basin. Both options include replacement of the intake structure, installation of a gate to limit flows, and some level of cleaning and rehabilitation of the storm sewer pipe and manholes. Option A increases flow to the Turning Basin, has a lower initial cost, and does not interfere with traffic during construction. However, the completed rehabilitation with Option A may affect future redevelopment options on the Pulp & Paper Mill, as the pipe location would reduce the overall buildable area, and salable property, on the site and would require an access easement for maintenance and repairs. Additionally, Option A will result in less improvement to circulation within the Turning Basin than Option B. Option B would relocate the storm sewer primarily into public right-of-way, thus opening up additional developable property on the Pulp & Paper Mill site and eliminating the need for an access/maintenance easement on private property. This option would provide improved aeration and circulation of water into the Turning Basin and enhance the future recreational opportunities in the Turning Basin. Further, this option would potentially provide additional redevelopment flexibility at the Pulp & Paper Mill Site. The cost for Option B is higher and construction along Center, Church and Gorham Streets will disrupt traffic. Unknown conditions of locations of storm sewer lateral connections and the elevation of rock in relation to the new storm sewer alignment and profile could also significantly raise the cost of construction.

Option A – Clean and Rehabilitate the Existing Storm Sewer

This option involves cleaning and rehabilitation of the 36" diameter storm sewer from the intake bay to the outlet at the Turning Basin. The manholes for the storm sewer would also need to be cleaned and or replaced. Approximately 50 linear feet of 36" diameter pipe would be installed at the storm sewer outlet to direct the flow to the west in an effort to prevent short-circuiting of flow within the Turning Basin.

Option B – Replace the Storm Sewer along a partially new alignment within the ROW

This option includes installation of a new storm sewer along a new alignment within the Center Street and Gorham Street. This option would require abandoning and filling approximately 900 linear feet of the existing storm sewer, and removing the outlet to the Turning Basin. Additional work that is unknown but estimated includes the potential for excavation through rock for the new storm sewer alignment, and the reconnection of

storm sewer laterals connected to the abandoned portion of the storm sewer. Although it may have a higher initial cost, Option B would result in the most available space for development of the Pulp & Paper Mill, and therefore a higher potential salable property value. This option also provides the greatest improvement to water quality in the Turning basin, which would enhance the potential recreational opportunities of the Turning Basin in the future.

Figures 7 and 8 illustrate both options. Figure 9 provides a summary of options.

Figure 10 Summary of Rehabilitation Options

| SECTION | | | |
|-----------------|--------|--|--|
| | | OPTION A | OPTION B |
| SEWER INTAKE | | INSTALL NEW INTAKE DROP STRUCTURE WITH TRASH RACK AND GATE | INSTALL NEW INTAKE DROP STRUCTURE WITH TRASH RACK AND GATE |
| INLET TO MH #1 | | CLEAN AND REHABILITATE STORM SEWER & MANHOLE #1 | CLEAN AND REHABILITATE STORM SEWER & MANHOLE #1 |
| MH #1 TO MH #2 | | CLEAN AND REHABILITATE STORM SEWER & MANHOLE #2 | CLEAN APPROX. 200 LF OF SEWER, INSTALL NEW STORM SEWER WITHIN ROW ALONG CENTER ST AND GORHAM ST TO NEW OUTFALL TO TRIBUTARY #1 (MAY INCLUDE ROCK EXCAVATION) |
| MH #2 TO OUTLET | | CLEAN AND REHABILITATE STORM SEWER AND INSTALL MANHOLES AT PROFILE CHANGE LOCATIONS | ABANDON AND FILL APPROX. 720 LF OF STORM SEWER AND RECONNECT EXISTING STORM SEWER LATERALS |
| TURNING BASIN | OUTLET | INSTALL APPROX. 50 LF OF STORM SEWER TO DEFLECT FLOWS WEST INTO THE TURNING BASIN | REMOVE STORM SEWER OUTLET |
| | BRIDGE | RAISE THE TURNING BASIN SPILL THROUGH ELEVATION UNDERNEATH BRIDGE | RAISE THE TURNING BASIN SPILL THROUGH ELEVATION UNDERNEATH BRIDGE |
| EVALUATION | | | |
| PROS | | 1. INCREASES FLOW TO THE TURNING BASIN | 1. MOVES STORM SEWER INTO ROW THEREFORE NO EASEMENT IS REQUIRED FOR FUTURE DEVELOPMENTS |
| | | 2. LOWER INITIAL COST | 2. PROVIDES IMPROVED TURNING BASIN AERATION AND CIRCULATION |
| | | 3. CONSTRUCTION DOES NOT INTERFERE WITH TRAFFIC | 3. ENHANCES RECREATIONAL OPPORTUNITIES FOR THE TURNING BASIN DUE TO IMPROVED WATER QUALITY |
| | | | 4. MAY IMPROVE FLEXIBILITY FOR REDEVELOPMENT ON THE FORMER PULP & PAPER MILL SITE |
| | | | |
| CONS | | 1.MAY REQUIRE FUTURE EASEMENT FOR ACCESS TO STORM SEWER, COULD IMPACT FUTURE DEVELOPMENT OPTIONS | 1. HIGHER COST (DUE TO CONSTRUCTION UNKNOWN, ROCK EXCAVATION & NUMBER OF STORM SEWER CONNECTIONS TO RE-ESTABLISH) |
| | | 2. WON'T SIGNIFICANTLY IMPROVE CIRCULATION OR WATER QUALITY WITHIN THE TURNING BASIN | 2. CONSTRUCTION IN THE STREET ROW WILL TEMPORARILY DISRUPT TRAFFIC |

OPINION OF PROBABLE COSTS

The costs presented below are opinions based on current construction costs, for showing the order of magnitude difference between the two discussed rehabilitation options. The costs do not include prices for hauling and disposing of contaminated materials. This cost may reach up to \$50,000 based on the existing storm sewer being 10% – 40% full of sediment and debris. Each option has a percentage based engineering and permitting fee associated with it. The elevation of subsurface rock in the area is unknown. The costs for Option B account for an assumed 5-Foot wide by 3-Foot deep prism of rock excavation for the length of the new sewer. Additional investigation is required to determine more accurately the amount of rock excavation anticipated and the cost associated with rock excavation in the area.

Option A Walls would cost approximately \$478,000. The work estimated includes:

- Installing a new Intake Structure to limit sedimentation in the storm sewer;
- Cleaning and televising the existing storm sewer;
- Rehabilitating a portion of the storm sewer in its current alignment;
- Installing additional pipe to the existing outlet to divert flow into the Turning Basin and promote circulation;
- Providing additional storage within the Turning Basin and
- Performing a detailed evaluation of the remaining Lock walls.

Option B would cost approximately \$1,060,000. The work estimated includes:

- Installing a new Intake Structure to limit sedimentation in the storm sewer;
- Realigning the storm sewer within the Lyons Falls ROW including rehabilitation of one and the addition of 4 manholes, reconnection of existing storm sewer laterals and assumed rock excavation;
- Evaluating Tributary #1 hydraulics and reestablishing an outlet to this tributary to the Turning Basin;
- Providing additional storage within the Turning Basin by raising the spill through elevation underneath the McAlpine St bridge and
- Performing a detailed evaluation of the remaining Lock Walls.

Attachment G contains an itemized Opinion of Probable Costs for each option.

CONCLUSION

The options presented in this memo are to (A) clean and repair the existing storm sewer to the Turning Basin to improve water quality in the Turning Basin, or (B) clean and repair some of the existing storm sewer and construct a new sewer to a former outfall location that is tributary to the Turning Basin. Both are viable options for future development of the former Pulp and Paper Mill site. The steering Committee should consider the following next steps:

4.3

- Install a new Intake Structure with trash rack and gate;
- Repair Manhole #1 to allow access to the storm sewer;
- Clean and Televiser the storm sewer between the inlet and Manhole #2;
- Perform a structural inspection of the remaining lock walls in the abandoned (north) segment of the canal.