

Section 7

Alternatives Analysis

7.1 Overview

The feasibility study considered two alternatives for removal of the Poor Farm Pond Dam. The first alternative includes a partial removal. Under this alternative, some of the existing structure is retained. In the second alternative, the entire structure will be demolished and the existing stream channel is moved slightly to the east.

Under both alternatives, sediments in the channel and the sediments immediately behind the dam would be removed. The sediments in the channel will be removed so that the invert of the brook would be restored to its original elevation before the dam was installed. This restoration of the channel would aid in fish passage and will help to restore the cold water fishery that once existed in the brook. It would also allow the brook to return to its natural state of succession and will restore the natural sediment transport processes. For this feasibility study, the channel section was assumed to be equal to the current channel width (approximately 14 feet); however, during final design “natural channel design techniques” would be employed that would maximize the depth of the flow channel passing average daily flow while providing adequate capacity for the occasional and much larger flood flows. These natural design channel techniques can be used to construct an armored channel bottom while also providing a more natural habitat for fish.

The sediments immediately behind the dam will be removed based on the sample results indicating exceedances of the MCP RCS-1 criteria. MassDEP outlined an approach for removal of the sediments closest to the dam and along the flood channel, while leaving the remaining sediments in place. All of the sediments left in place would need to be more thoroughly characterized during final design.

In both alternatives, the bridge will be removed.

7.2 Approach

To determine the preferred alternative, an evaluation was conducted in consideration of the existing resources described in Section 3, the sediment and soil characteristics described in Section 4, the hydrologic and hydraulic aspects of the brook described in Section 5, and the potential for sediment transport described in Section 6. The overall goals of the project were also considered – to reduce liability and maintenance for the City, restore the cold-water fishery, and restore the brook to a more natural state.

As noted above, a partial dam removal, as well as a more complex, full dam removal were considered as feasible for this project and evaluated further.

7.3 Existing Conditions

The dam itself no longer serves its intended purpose and is not in use. It represents a liability for the City and it prevents the brook from flowing naturally. The bridge over the dam provides little value today since access to the structure is extremely limited and required only for periodic inspections and maintenance. From the east, the bridge can be accessed via unpaved and gravel trails off of Holden

Street, behind the Worcester Sand and Gravel company. These trails are best accessed by ATV or four-wheel-drive vehicles. To the west, the only access point is adjacent to a commercial building (IBS Commodities / Schoelly Imaging) parking lot on Plantation Street. Currently, the dam is in poor condition. See Figure 7-1 for the existing conditions at the site.

The deficiencies in the dam and appurtenant structures, from upstream to downstream, are as follows:

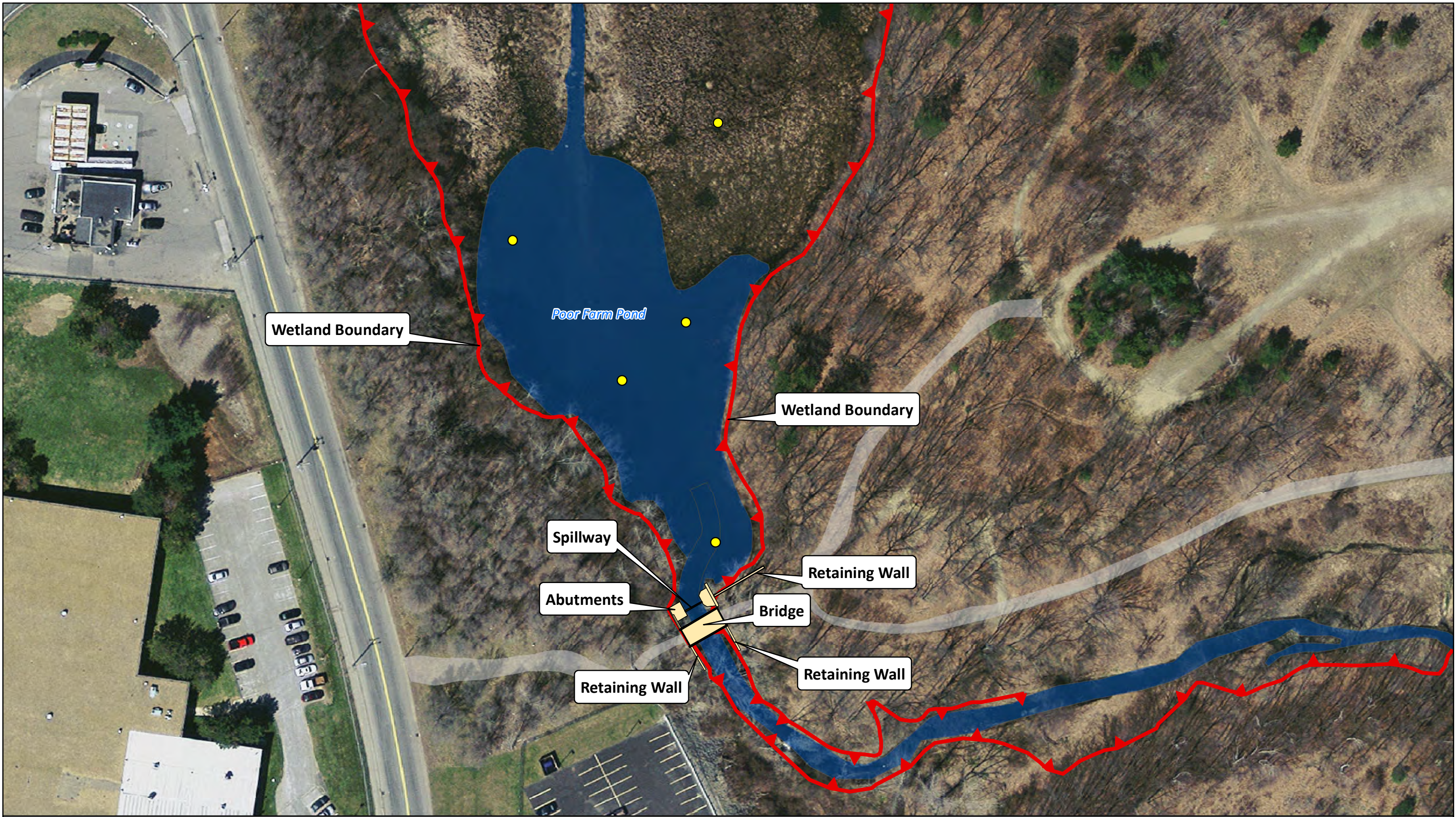
Both abutments are overgrown with trees and vegetation, with the west abutment slope being steep and severely eroded. The concrete structures at the stop log locations are in poor condition and are scoured at both sides. Multiple cracks are present at the concrete retaining wall to the east. On the west abutment there is evidence of heavy erosion, under the steel beam. The spillway is in poor condition. The training wall on the east side has significant cracks that are in need of repair. The western training wall is in better condition, but still requires repairs. Just beyond the spillway is a large hole in the masonry apron. It is apparent that the material below the apron has eroded and has left a cave below the apron with a depth of approximately 6 feet. Evidence of human activity exists on and around the apron (plank bridge and bottles/trash). The remainder of the rip rap beyond the spillway crest has significant mortar loss and is in poor condition. Downstream of the spillway, there is evidence of heavy erosion. Clusters of trees and brush can be found throughout the dam structure.

Above the structure, the bridge is in poor condition. The reinforcing steel is exposed in many locations. The concrete structure is chipped and crumbling throughout and vegetation is growing throughout this structure.

7.4 Partial Removal Alternative

The first dam removal alternative presented in this report is the partial removal option. The partial removal alternative includes the following components:

- Removal of the bridge
- Relocation of water main
- Sheet piling and backfilling of both abutments
- Slope stabilization upstream of the dam
- Flood channel construction upstream of the dam to a width of about 14.5 feet
- Slope stabilization at the dam
- Slope stabilization downstream of the dam
- Demolish and remove apron and spillway
- Rebuild the apron to match grade of the brook
- Pumping around the dam
- Access roads for construction
- Sediment disposal
- Tree clearing
- Reconditioning/repair of the concrete and stone retaining walls not removed under this alternative
- Overall site restoration including slope stabilization, where needed



Date: June 2013

● Sediment Samples	■ Road
■ Bridge & Dam	■ Pond
■ Spillway	
▲ Wetland Boundary	

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Poor Farm Pond Dam Removal Feasibility Study

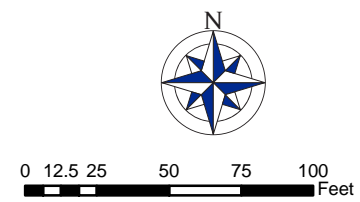


Figure 7-1
Existing Conditions

Figures 7-2, 7-3, and 7-4 provide visual representation of the improvements under the partial removal alternative. Figure 7-2 shows a plan view drawing of the dam under the partial removal alternative. Figure 7-3 shows a profile view drawing of the post removal streambed elevations (for both the partial and full removal alternatives). Figure 7-4 shows a plan view aerial photograph of the dam under the partial removal alternative.

7.4.1 Impacts to the Surrounding Area

Due to the location of the dam (behind the IBS Commodities / Schoelly Imaging commercial parking lot on Plantation Street) and the condition of the structure, the partial removal of the dam would not negatively affect any scenic views. It should be noted that the pond historically dries up in summer months on a regular basis. Since the dam is no longer in use and impoundment is not used as a water supply or recreational source, there are no recreational, cultural or business uses that would be affected by the removal of this obsolete infrastructure. Removing the spillway and maintaining a constant channel slope would eliminate the ponding north of the dam and will maintain steady flow to the south into Lake Quinsigamond. The changes would not disturb any surrounding neighborhoods and overall annual flow into Lake Quinsigamond would remain unchanged, as described in Section 5.

7.4.2 Impoundment and Brook Restoration/Stabilization

As part of the partial removal option, brush and scrub would need to be cleared as well as any trees at the site, which range from 8-inch to upwards of 24-inches in diameter or larger. Stone fill would be placed between the sheeting of the concrete abutments, where the apron and spillways currently reside, and clean soils would be imported and placed to shape the channel after the sediment is removed. The wetlands at the pond channel and abutments would be hydroseeded with native, non-invasive plants. Scour and erosion control strategies would be implemented on the side slopes.

The original channel depth would be restored, as shown in Figure 7-5 presenting the proposed flood channel location. The original depth was determined by profiling the existing brook bed using the top of sediment along with the sediment depth at each of the five sampling locations (See Figure 4-2). The slope through the dam was chosen by connecting the original brook invert at the upstream concrete apron and the toe of the stone masonry apron at the downstream end of the dam. Figure 7-3 shows the proposed brook elevation after construction.

Natural Channel Design Techniques

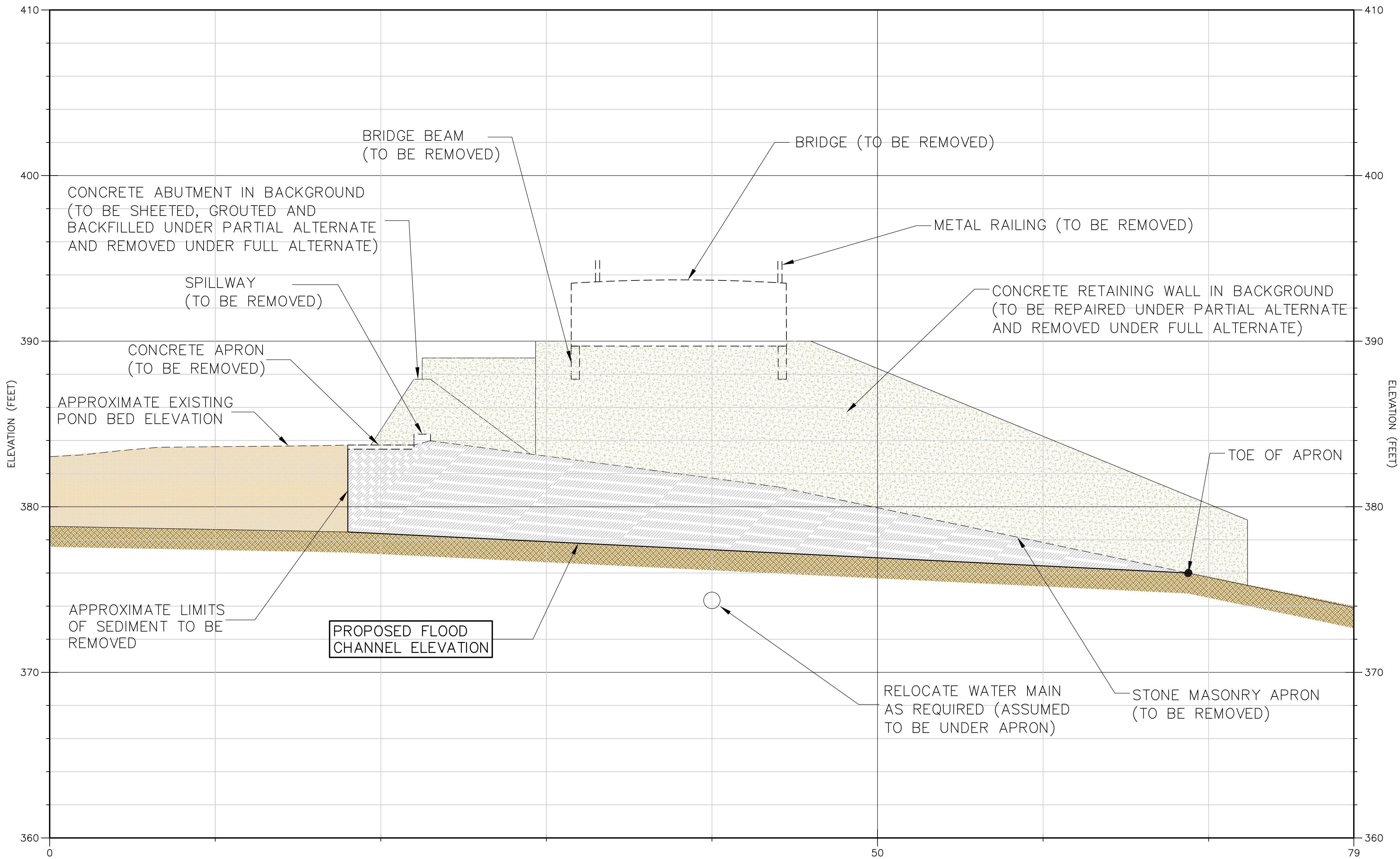
Within the 14 foot wide flood channel, a flow channel using natural channel design techniques. For average day flow, the channel design will utilize an armored channel (rip rap, stones and / well graded materials) that will provide additional depth to maximize the passage of fish and a suitable habitat. The goal of this armored channel will be to have sufficient scour protection while providing a natural habitat (including small boulders, and hiding places etc) for fish and other aquatic life.

For higher, storm flows, the full flood channel will be sized to carry all of the flows expected in a 100 year flood. The slopes and sides of this channel will be constructed with a more natural mat protection to stabilize the remaining sediments, promote natural growth and control erosion. This channel design will be revisited during design and permitting to ensure whether letting the stream more naturally develop after the dam removal is feasible. More field data needs to be gathered to confirm the feasibility of letting the stream develop naturally. The costs, however, are being carried for the more conservative design so that the owner is not faced with added costs in the future.

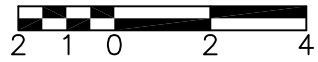
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LEGEND

- EXISTING STRUCTURE TO BE REMOVED
- CONDITIONS AFTER CONSTRUCTION
- EXISTING SEDIMENT TO BE REMOVED
- PROPOSED BROOK BED ELEVATION
- CONCRETE/STONE APRON TO BE REMOVED



SECTION C - CENTER OF DAM
ELEVATION
1"=10'



REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY:	J. RICCIO
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DATE:	JUNE, 2013

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CITY OF WORCESTER, MA
DEPARTMENT OF PUBLIC WORKS AND PARKS
POOR FARM POND DAM REMOVAL
FEASIBILITY STUDY

PROPOSED BROOK ELEVATION
AFTER CONSTRUCTION
BOTH OPTIONS




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FILE NAME:	CSDPR001.DWG
SHEET NO.	7-3



Date: June 2013



Legend

-  Wetland Boundary
-  Bridge & Dam
-  Water
-  Road

Worcester, Massachusetts
Poor Farm Pond Dam Removal Feasibility Study



0 5 10 20 Feet

Figure 7-4
Conditions after
Partial Removal

7.4.3 Construction Issues

Given the location of the dam and surrounding topography, construction access would need to be considered for this alternative. The main access would be via the trails off of Holden Street to the East of the dam. These trails are primarily unpaved and surrounded by vegetation. These trails would need to be widened by cutting and removing selected trees, and then stabilized to accommodate construction equipment. Crane mats would be placed to assure the stability of the large equipment and to limit the influence of construction activities during excavation. Sediment and erosion control methods including stone check-dams would be utilized throughout construction. A by-pass pumping method (an estimated 660 gallons per minute) would be on-hand should accommodation of the natural stream flow be necessary; however, construction would be scheduled during drier months to minimize this requirement.

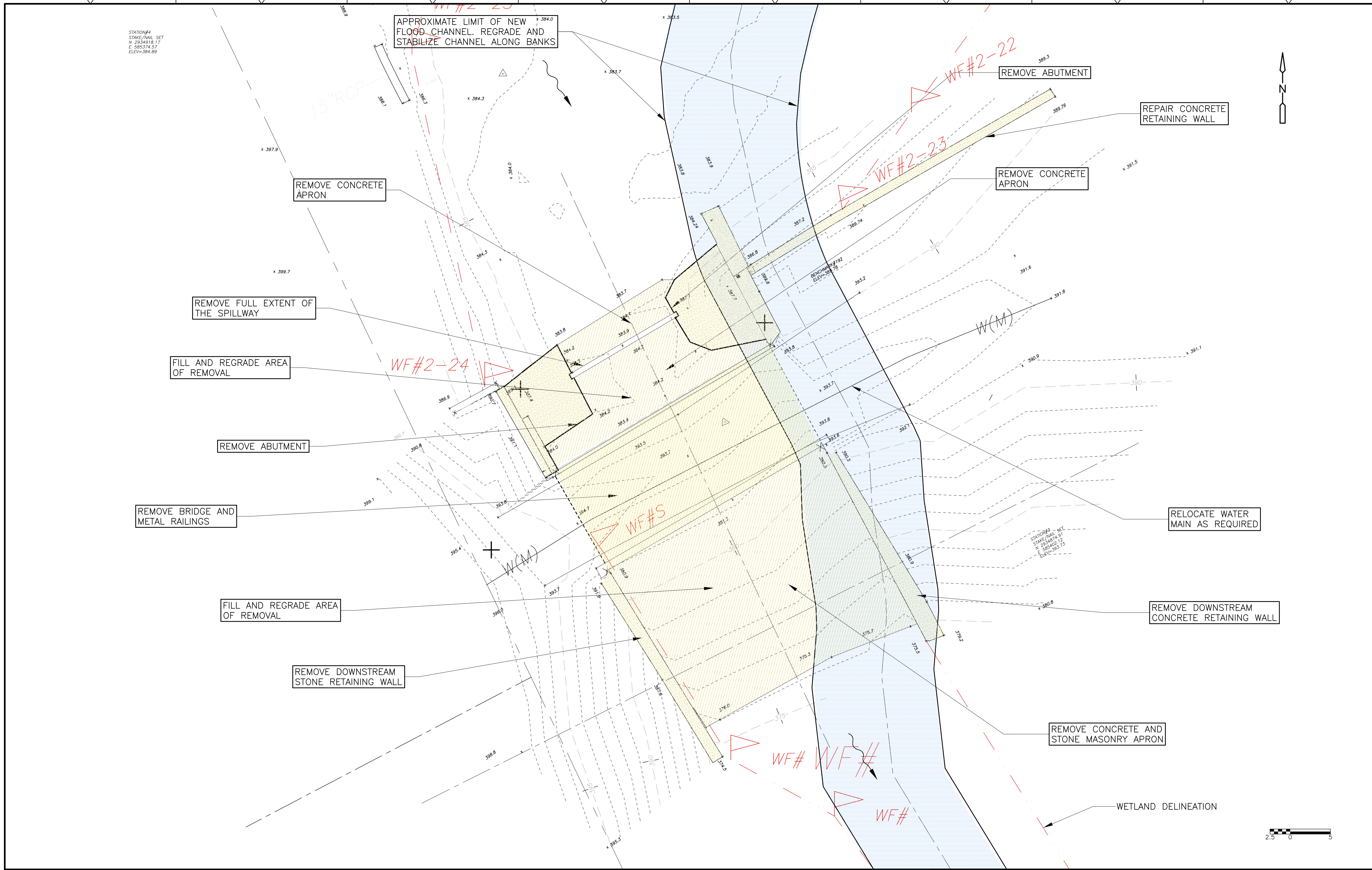
7.5 Full Removal Alternative

The second dam removal alternative evaluated in the feasibility study is full removal. The full removal alternative includes the following components:

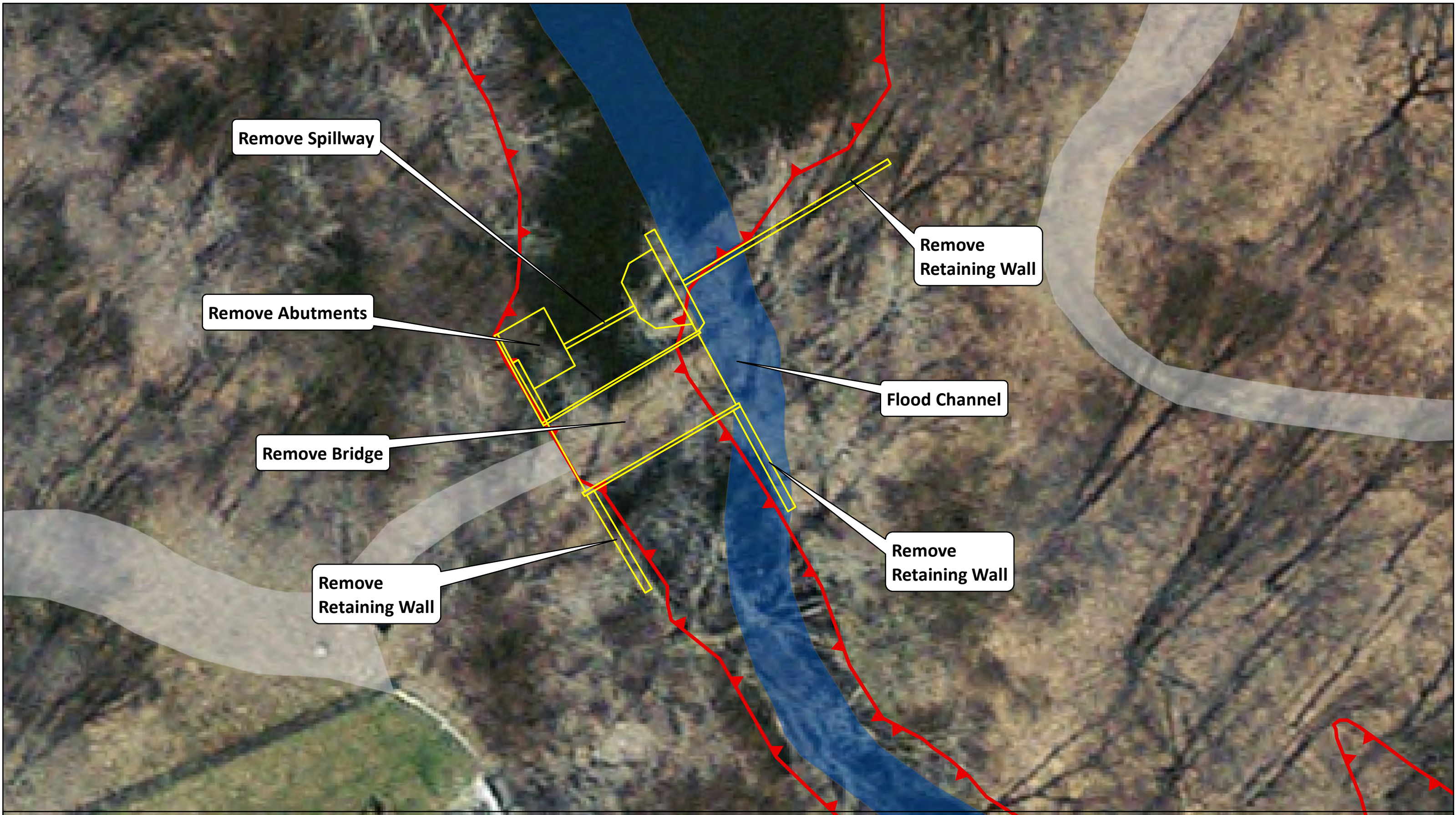
- Removal of the bridge
- Demolition and removal of all dam structures above grade (includes abutments, spillway, apron, and retaining walls)
- Relocation of water main
- Slope stabilization upstream of the dam
- Flood channel construction upstream of the dam to a width of about 14.5 feet.
- Relocation of stream bed at the dam to the east
- Slope stabilization at the dam
- Slope stabilization downstream of the dam
- Pumping around the dam
- Access roads for construction
- Sediment disposal
- Tree clearing
- Overall site restoration including slope stabilization, where needed

Figures 7-3, 7-6, 7-7 and 7-8 provide visual representation of the improvements under the full removal alternative. Figure 7-3 shows a profile view drawing of the post removal streambed elevations (for both the full and partial alternatives). Figure 7-6 shows a plan view drawing of the dam under the full removal alternative. Figure 7-7 shows a plan view aerial photo drawing of the dam under the full removal alternative. Figure 7-8 shows a profile view drawing of the east – west elevations for the full removal alternative.

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Date: June 2013

Legend

-  Wetland Boundary
-  Bridge & Dam
-  Water
-  Road



Worcester, Massachusetts
Poor Farm Pond Dam Removal Feasibility Study



0 5 10 20 Feet

Figure 7-7
Conditions after
Full Removal

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CITY OF WORCESTER, MA
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POOR FARM POND DAM REMOVAL
FEASIBILITY STUDY

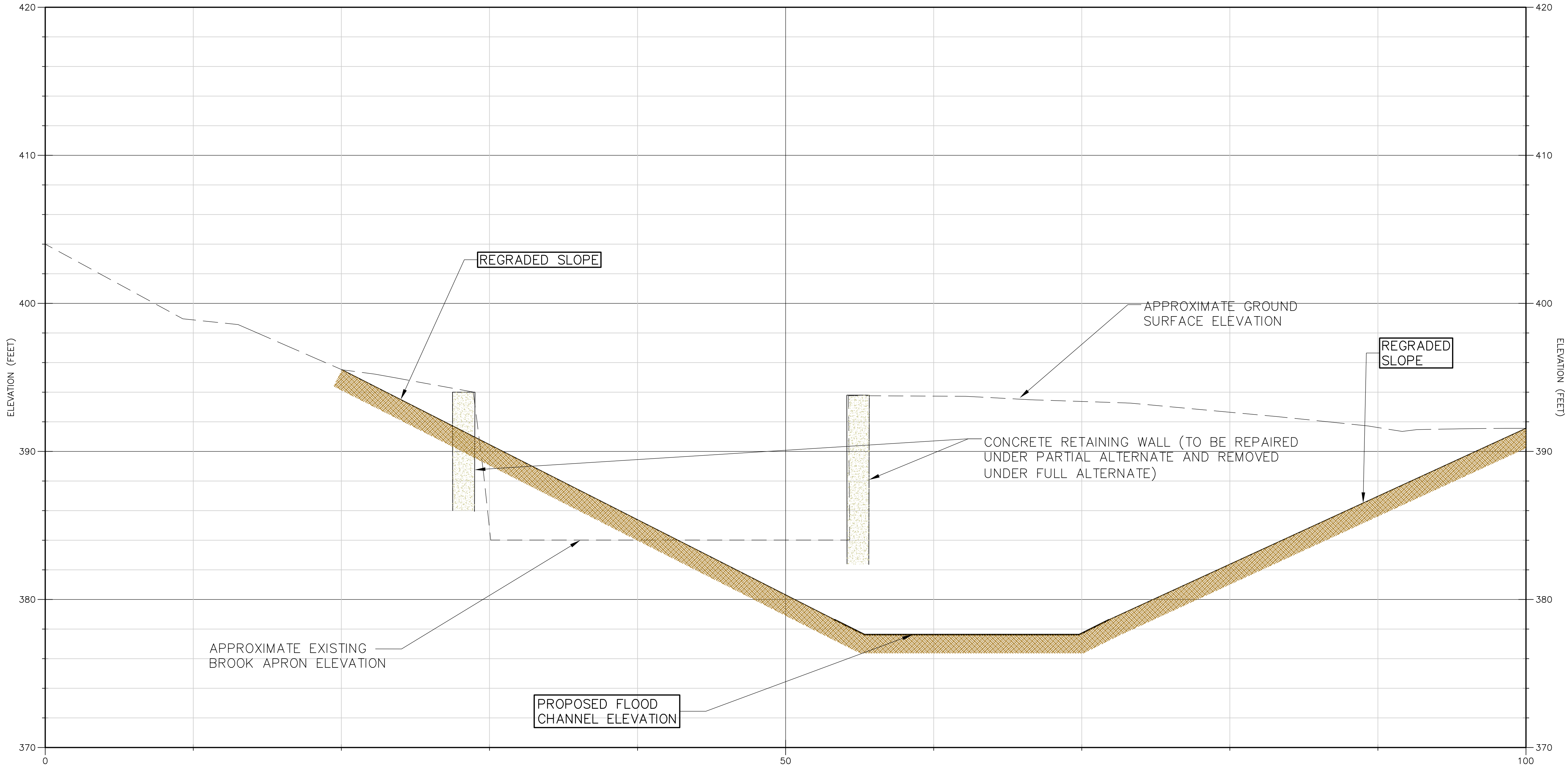
EAST-WEST CROSS SECTION
FOR THE FULL REMOVAL ALTERNATIVE

SHEET NO.
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FILE NAME:	CSDPR001.DWG

LEGEND

- EXISTING STRUCTURE TO BE REMOVED
- CONDITIONS AFTER CONSTRUCTION
- PROPOSED BROOK BED AND REGRADED SLOPE



7.5.1 Impacts to the Surrounding Area

Similar to the partial removal alternative, the full dam removal has very limited impacts to the surrounding area. Due to the location of the dam (behind the IBS Commodities / Schoelly Imaging commercial parking lot on Plantation Street) and the condition of the structure, the removal of the dam would not negatively affect any scenic views. It should be noted that the pond regularly dries up in summer months. Since the dam is no longer in use and impoundment is not used as a water supply or recreational source, there are no recreational, cultural or business uses that would be affected by the removal of this obsolete infrastructure. Removing the dam and spillway and maintaining a constant channel slope would eliminate the ponding north of the dam and will maintain steady flow to the south into Lake Quinsigamond. The changes would not disturb any surrounding neighborhoods and overall annual flow into Lake Quinsigamond would remain unchanged, as described in Section 5.

The main difference between the full removal alternative and the partial removal option is that the site would no longer have any visible concrete or stone walls or earthen embankments. Only a natural channel would be visible. The steep slope on the west side would be graded to a 3:1 slope and the location of the brook through the dam would be shifted approximately 15 feet to the east. Similar to the partial removal, the changes would not disturb any surrounding neighborhoods and overall annual flow into Lake Quinsigamond would remain unchanged.

7.5.2 Impoundment and Brook Restoration/Stabilization

With the full removal option, a greater amount of brush, shrubs and trees would need to be removed to shift the brook location slightly to the east.

Additional clean soils would be imported and placed to shape the channel after the sediment is removed. The wetlands at the pond channel and abutments would be hydroseeded with native non-invasive plants. Scour and erosion control strategies would be implemented on the side slopes.

The original channel depth would be restored as shown in Figure 7-9 presenting the proposed flood channel location. The original depth was determined by profiling the existing brook bed using the top of sediment along with the sediment depth at each of the five sampling locations (See Figure 4-2). The slope through the dam was chosen by connecting the original brook invert at the upstream concrete apron and the toe of the stone masonry apron at the downstream end of the dam. Figure 7-3 shows the proposed brook elevation after construction.

Natural Channel Design Techniques

Within the 14 foot wide flood channel, a flow channel using natural channel design techniques. For average day flow, the channel design will utilize an armored channel (rip rap, stones and / well graded materials) that will provide additional depth to maximize the passage of fish and a suitable habitat. The goal of this armored channel will be to have sufficient scour protection while providing a natural habitat (including small boulders, and hiding places etc) for fish and other aquatic life.

For higher, storm flows, the full flood channel will be sized to carry all of the flows expected in a 100 year flood. The slopes and sides of this channel will be constructed with a more natural mat protection to stabilize the remaining sediments, promote natural growth and control erosion. This channel design will be revisited during design and permitting to ensure whether letting the stream more naturally develop after the dam removal is feasible. More field data needs to be gathered to confirm the feasibility of letting the stream develop naturally. The costs, however, are being carried for the more conservative design so that the owner is not faced with added costs in the future.

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CITY OF WORCESTER, MA
DEPARTMENT OF PUBLIC WORKS AND PARKS
POOR FARM POND DAM REMOVAL
FEASIBILITY STUDY

PROPOSED FLOOD CHANNEL LOCATION FULL REMOVAL ALTERNATIVE PLAN

PROJECT NO.	0198-88068
FILE NAME:	CBRPL001.DWG
SHEET NO.	
7-9	

30% SUBMITTAL - NOT FOR CONSTRUCTION

7.5.3 Construction Issues

As with the partial removal alternative, construction access would need to be considered for the full removal option. Two main access points would be required for the full removal. The main access would be via the trails off of Holden Street to the east of the dam. These trails are primarily unpaved and are surrounded by vegetation. These trails would need to be widened by cutting and removing selected trees, and then stabilized to accommodate construction equipment. The secondary access would be from the access road to the west of dam that connects the dam to Plantation Street. The full removal would require the use a tracked vehicle (due to the slope) to access the west side of the dam via Plantation Street because of the additional activities required for relocating the stream channel.

Crane mats would be placed to assure the stability of the large equipment and to limit the influence of construction activities during excavation. Sediment and erosion control methods including stone check-dams would be utilized throughout construction. A by-pass pumping method (an estimated 660 gallons per minute) would be on-hand should accommodation of the natural stream flow be necessary; however, construction would be scheduled during the drier months to minimize this requirement.

7.6 Community Meeting

As with any major public infrastructure study, it is important to address community interests and concerns. The functionality of the dam has to be considered, as well as if there are opportunities to implement additional public benefits after the removal of the dam. Other concerns may arise from the historic sentiment of the dam.

A public meeting was held before the Lake Quinsigamond Commission on May 29, 2013 at 7:30 PM at the Shrewsbury Town Hall, located at 100 Maple Avenue. This publicly-advertized meeting was held to solicit input from citizens and address their concerns. The advertisement for the meeting can be found in Appendix E.

The result of this meeting was a positive one that included several relevant questions and talking points. The public asked whether or not the dam could be fixed, and if the bridge could remain in place for the partial removal option. Specific questions regarding the soils and sediment samples were also raised. The audience asked for specifics on the parameters sampled and the sample results for specific metals. One commenter asked that consideration be given to the former plating company and possible discharges to the pond, which could result in unexpected sediment removal costs.

Several attendees requested specific information for vegetation plans and bank stabilization issues. Others were concerned with the types of fish species that exist in the pond and what species could be expected to move in after the dam is removed. Still, others were concerned with understanding who the responsible parties are who bear the decision making responsibility for this project.

Recommendations provided for this project included the use of similar re-vegetation strategies that were used at the Quinapoxet River, located in Clinton at the entrance to the Wachusett Reservoir. The Blackstone River Coalition showed interest in exploring an opportunity to provide mixed vegetation species at the Poor Farm Pond Dam site. The full removal of the dam was supported by both the members of the Blackstone River Coalition and the Greater Worcester Land Trust.