7.0 WATER DEPTH MANAGEMENT ALTERNATIVES ANALYSIS

The results of the public outreach described in this document support an assessment of the potential feasibility of increasing water depths in the Upper Collinsville Mill Pond. When the question of an "appropriate" water depth for recreational uses is posed to a user of the impoundment, the answer is generally qualitative and depends on the needs of the user. A range of depths is desired for swimming, from wading areas to deeper areas where an individual's feet would not touch the bottom if he or she were swimming. A range of depths is also desirable for paddling, with shallow depths needed for a launch and deeper areas to provide some paddling that is less strenuous.

According to a member of the Upper Collinsville Mill Pond Master Plan Steering Committee, a paddler will experience drag when depths are less than eight feet. The force of the drag increases as depth decreases below eight feet. At very shallow depths (less than two feet), the potential for hitting the bottom of the impoundment with paddles is a concern. An average of the two thresholds (two feet and eight feet) is five feet. Five feet is also appropriate for casual swimming. A five-foot depth was therefore selected as the basis for the planning-level evaluations in this study.

There are generally two methods of increasing water depths: raising the normal pool water surface elevation (the elevation of the water impounded by the dam) and removing sediment through dredging or conventional excavation. Although an increase in the water surface elevation has been evaluated to facilitate hydropower development, it could be accomplished separately if hydropower is ultimately not pursued by the Town of Canton.

7.1 Methods of Raising the Normal Pool Elevation

Although the most commonly discussed method for increasing the water surface elevation is to replace the flashboards that were used as recently as 2003, there are three additional methods of raising the water surface. The four methods were described in Section 3.2.2 of the report "Pre-Feasibility Study for Re-Powering the Upper and Lower Collinsville Dam Along the Farmington River":

- Flashboards can be installed on the crest of the dam spillway as they were in the past. The flashboards would give way during flooding conditions and need to be replaced.

- Stoplogs can be installed instead. Unlike flashboards, stoplogs would be expected to remain in place during flooding conditions, potentially increasing upstream water surface elevations during the base flood and lesser flood events.

- A rubber bladder dam can be installed in the dam to allow for greater control over the timing and duration of raised water surfaces.

- A crest gate can be installed in the dam to allow for control over the timing and duration of raised water surfaces that is similar to that allowed with a bladder dam.

The Pre-Feasibility Study report described advantages and disadvantages to each approach. The main disadvantage associated with the flashboard approach is the need to replace, repair, and maintain the flashboard system. This can be expensive and time consuming. At times when the flashboards have failed or are not installed, shallow depths will return and may affect future improvements of the impoundment such as a fish ladder or fish habitat enhancement structures. While some of these issues are avoided with the more durable stoplog approach, the stoplogs will cause increased head during flooding conditions and exacerbate flooding upstream of the dam.

The bladder and crest gate approaches are superior in their ability to allow for water level control during times of low and high flows or flood flows, but these require dam modifications for installation and are therefore more expensive. Ancillary equipment such as air pumps (for the bladder) and electricity to operate the equipment are also needed.

7.2 Methods of Sediment Removal

Two general methods of sediment removal are available. These are hydraulic dredging and conventional excavation. In some cases, both methods are used for removing sediment from impoundments.

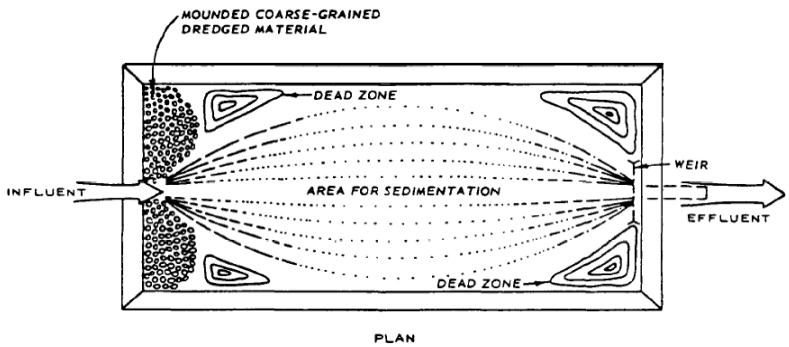
Hydraulic Dredging

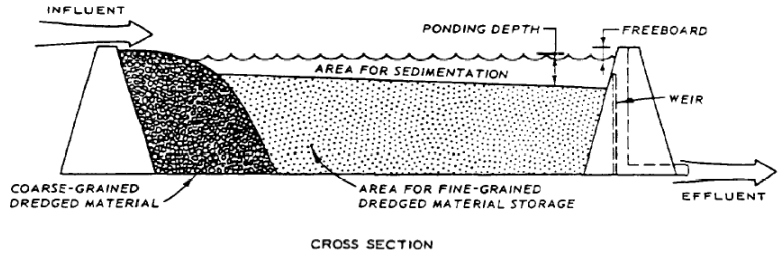
Dredging by hydraulic methods can be conducted while the impoundment water level remains at its normal elevation. Dredging equipment is mounted on a floating barge. A cutter blade mounted on a mobile swing arm dislodges the sediment at the impoundment bottom and an onboard pump transports the slurry to shore. The slurry is then piped to a containment basin on land, where it is left for a period of time to allow the sediments to dewater. The picture below depicts a hydraulic dredging operation.

Recent hydraulic dredging in Cheshire, Connecticut

Because the slurry sediment/water mixture being pumped out of an impoundment is typically about 80% water, the dewatering basin must be sized to be able to provide enough volume for the dredged sediment as well as the water that will be carried with it. As more slurry is pumped into the basin and more sediment settles to the bottom, the capacity of the basin decreases. The land on which these basins are constructed must be relatively level, with earthen dikes constructed around all sides to retain the water/sediment mixture. If a site is not level, it must be graded to suitable level conditions.

The figures below illustrate the mechanics of a dewatering basin. Typically, the gravels and heavier sands will fall to the bottom of the basin first, crowding the inlet area as the accumulation becomes larger. The smaller silts, clays, and organics progress further into the basin, eventually settling near the outlet.





Typical Sediment Containment Area (USACE EM1110-2-5025, 1983)

The dewatering basins for the dredging operation pictured above are shown in the photographs below. Even for the small scale of the project, significant space was necessary for the dewatering basins.

View downgradient along dewatering basin sequence

View upgradient along dewatering basin sequence

Hydraulic dredging can typically be completed more rapidly as compared to dry mechanical excavation. Because of its expediency, it can sometimes be more cost effective. If a suitable dewatering basin/disposal site can be located in close proximity to the dredge site, it will eliminate the need to have trucks traversing back and forth from the work site to containment areas and can alleviate disruptions to the normal traffic flow of the area, providing for less overall impact to the neighboring community.

The use of turbidity control curtains to isolate the dredging activities can sometimes allow the remainder of an impoundment to continue to function as a habitat for the waterfowl, fish, and other aquatic flora and fauna.

Although it is not uncommon to pipe slurry a significant distance to a suitable location, it becomes less cost effective as the pumping distance increases. As the distance and elevation to the containment site increase, the size and power requirements of the pump also increase, generally adding to the equipment and power expenses. The operational flow rates will decrease as well, prolonging the project duration.

Finally, the permeability of the soil at the containment area has a greater effect when utilizing hydraulic dredging methods as compared to conventional dry excavation. Because of the large amount of dewatering that takes place in the containment area, the supporting soils must be permeable enough to allow for the infiltration of water from the basin. The slower the soils permeate, the larger the basin must be to accommodate the water that does not infiltrate or outflow in a timely fashion.

In recent years, some hydraulic dredging projects have utilized "envirotubes" consisting of filter fabric. The slurry is pumped into the tubes and allowed to dewater. However, the tubes have requirements similar to the dewatering basins such as a need for gentle slopes and significant space.

The suitability of the physical composition of the pond sediment was also considered in evaluating hydraulic dredging methods. One of the limitations of hydraulic dredging is that it is difficult to accommodate boulders, debris (such as stumps), or typically even gravel greater than two inches in diameter although some pumps can handle cobbles up to six inches in diameter (http://www.hydraulic-dredge.com/questionsanswers.html).

Sediment sampling conducted as part of this plan (Section 7.3) revealed that the majority of the impoundment bottom consists of sand. Hydraulic dredging methods are likely feasible for some parts of the Upper Collinsville Mill Pond. Specifically, the areas of soft sediment and sand could be dredged using hydraulic methods. The armored cobble portions of the impoundment bottom would be more difficult to dredge using hydraulic methods.

Furthermore, reports of other debris in river sediments have been received from the public throughout this study. While direct evidence has not been observed, residents have indicated that debris from buildings and structures may have been buried in river sediments during flood events. The presence of such debris would impede hydraulic dredging efforts.

Access to the pond and maneuverability within the impoundment are also important considerations. The impoundment will be easy to access by laying a temporary construction road. However, the depth of water may not readily accommodate a floating barge in all locations. This problem would be mitigated by launching the barge in a deeper location and dredging from the deeper water toward the shallower areas. It appears that impoundment access and maneuverability would not be an issue for a small floating barge.

The primary drawback of hydraulic dredging for the Upper Collinsville Mill Pond is the need for significant dewatering space. Based on the land use and composition of land ownership around the impoundment, the only feasible locations for dewatering basins or envirotubes would be the town-owned land north and south of the WPCF consisting of the Town Garage and the park with the gazebo, respectively. A test boring completed by the Connecticut Department of Transportation in 1957 encountered fill material, sand,

and gravel in this area, consistent with the history of municipal uses and the alluvial riverbank located along the east side of the river. Infiltration capacities of the alluvial soils on the town-owned land are probably sufficient for dewatering.

To utilize either town-owned property, the dredge slurry line would need to cross the busy trail alignment, which may be incompatible with continued recreation during a dredging project.

Despite the dewatering requirements, the primary advantage to hydraulic dredging is that overall water control is not as challenging as it is for conventional excavation, described below.

Conventional Excavation

Use of conventional earth moving equipment such as bulldozers and front-end loaders to excavate impoundments is practical where the water can be removed and a firm bottom exists. For the Upper Collinsville Mill Pond, this would require an initial drawdown as well as ongoing water control for the duration of the project. Conventional earth excavation equipment such as long boom backhoes and grade-alls can work in a wet or soft soil environment if they are supported on firm pads or temporary haul roads. The following photograph shows a recent sediment removal effort for a large public water supply reservoir in Connecticut. The reservoir was largely dewatered, and the sediment was allowed to dry in place before excavation.

Conventional sediment removal from Mackenzie Reservoir in Wallingford, Connecticut

The Upper Collinsville Mill Pond sediments are very well suited for conventional excavation methods based on the sand, gravel, and cobble composition. However, the ability to draw the impoundment down is limited by the controls located at the dam and raceway. Furthermore, water control would be very challenging. The following

photograph depicts a different section of the dewatered reservoir pictured above. The influent river is visible flowing in a temporary channel while adjacent areas are excavated. The same arrangement would be required for the Upper Collinsville Mill Pond. If conventional excavation were pursued, the Farmington River would need to be constrained to a temporary channel within the boundaries of the impoundment.

Channelization of Muddy River through Mackenzie Reservoir during sediment removal project

The following two photographs show the influent river to the reservoir where it first enters the impoundment. In the first picture, the reservoir is full. In the next picture, the reservoir is dewatered, and the influent river is lower and flowing at a steeper gradient.

Influent river prior to sediment removal

Influent river during sediment removal project

A similar situation would likely develop if the Upper Collinsville Mill Pond were lowered for the purpose of sediment excavation. At some point in the vicinity of Flaherty's Rock, the water surface would decrease, and the river would retreat from the

banks of the impoundment, forming a riffle that would essentially be a continuation of the riffle located on the northeast side of the nearby island.

7.3 Sediment Sampling Program

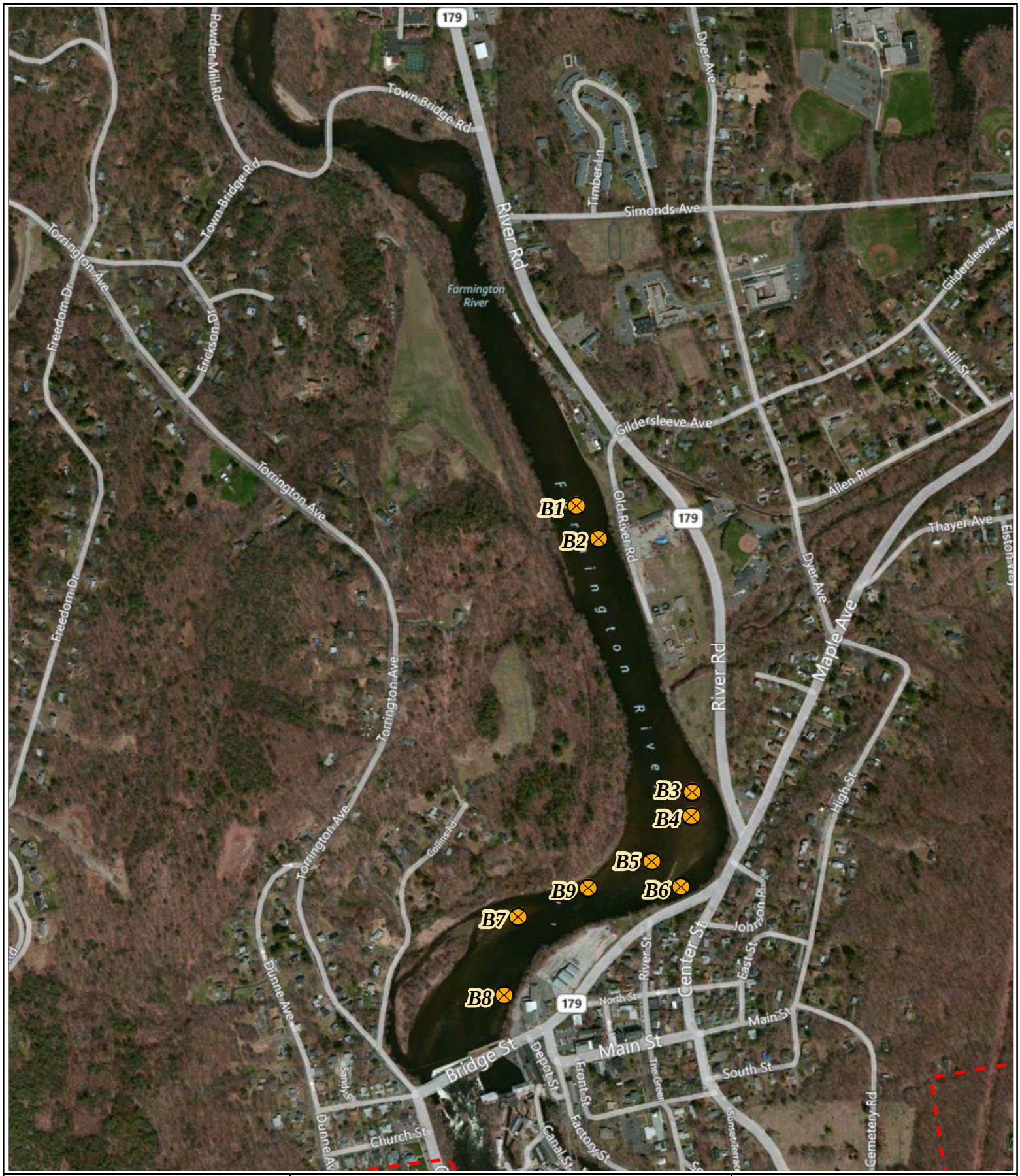
A sediment sampling program was developed to characterize the quality of the sediment in the bottom of the Upper Collinsville Mill Pond. Sampling and sediment characterization are necessary to evaluate the appropriateness of removing sediment based on the quality of the material removed and the quality of the material left in place. Ten locations were selected, representing potential areas of sediment removal with the understanding that project objectives could shift during and after the sampling program. Drilling methods were proposed in order to achieve greater depths than would be possible using manual sampling methods.

A sediment sampling plan was submitted to the DEEP in early June 2011, and comments were received at the end of August 2011. Comments from the DEEP were focused on the testing that would be appropriate for evaluating the toxicity of sediment relative to benthic organisms. In contrast, the town's interest was to characterize sediment quality as necessary to evaluate disposal or reuse options subsequent to dredging.

Ultimately, the sampling program was modified to allow for meeting both objectives, with samples collected at various depths in order to characterize sediment that could be removed as well as sediment that could remain in place.

Nine borings were completed by General Borings on September 21 and 22, 2011. Borings were completed by driving casing rather than auger drilling. Borings were concentrated in the areas of greatest interest for sediment characterization. In other words, areas that were *not likely to be considered* for dredging, sediment removal, or other activities were not targeted for sampling and were not drilled. Locations are depicted in Figure 7-1.

Boring raft utilized by General Borings



SOURCE:
Basemap:
Bing Maps Hybrid Datalayer (c) 2010
Microsoft Corporation and its data suppliers

Funding provided by the Farmington River Enhancement Grants adminstered by the Connecticut Department of Energy and Environmental Protection.

Figure 7-1: Boring Locations

LOCATION:
Village of Collinsville
Canton, CT

N

Upper Collinsville Mill Pond Master Plan

Map By: SMG
MMI#: 1752-13
MXD: P:\Fig_7-1.mxd
Date: October 20, 2011
Revised: November 14, 2011
Scale: 1 inch = 700 feet

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Findings

Table 7-1 presents a summary of information from the nine borings. Appendix F contains driller's logs for the borings.

TABLE 7-1
Summary of Boring Program

Boring	Location	Water Depth (feet)	Materials	Total Depth Drilled (feet)	Refusal (feet)
B1	Mid channel along Old River Road	2.34	Sand and gravel	10	Not reached
B2	Adjacent to public access point near Town Garage	3.92	Sand and gravel	4	4 (boulder or bedrock)
B3	Northern end of sandbars	1.96	Sand and gravel	4	4 (boulder or bedrock)
B4	Upstream end of islands	1.63	Sand and gravel	12	Not reached
B5	Southwest end of sandbars	3.44	Sand and gravel	8	Not reached
B6	Inner channel near sandbars	2.96	Fine sand/organics	10	Not reached
B7	Upstream end of sandbar below abutments	1.92	Sand and gravel	8	8 (boulder or bedrock)
B8	Near small dock toward dam	4.63	Sand and gravel	8	Not reached
B9	Far side of river opposite canoe store	5.00	Sand and gravel	8	Not reached

- Boring B1 was conducted in the middle of the channel where depths are shallow. This is an important area of transit between the northern and southern ends of the impoundment. Sediment removal in this area could achieve a deeper passage for kayaks, canoes, etc. The upper materials included coarse sand and gravel. The channel is known to have cobble armor in this area. The samples from zero to two feet and two to four feet were combined in order to provide a sufficient volume of material for laboratory analysis. The sample from four to six feet was submitted for analysis as well although it is likely deeper than an ideal future-conditions benthic sample.

- Boring B2 was conducted near the small area used as a beach. The upper materials included coarse sand and gravel. The channel is known to have cobble armor in this area. The samples from zero to two feet and two to four feet were combined in order to provide a sufficient volume of material for laboratory analysis. Because refusal was encountered at four feet, no further samples were available. Refusal is believed to be a boulder although its elevation (278 feet) could indicate bedrock.

- Boring B3 was conducted on a sandbar with shallow depth. Material was sandy. The samples from zero to two feet and two to four feet were combined in order to provide a sufficient volume of material for laboratory analysis. Because refusal was encountered at four feet, no further samples were available. Refusal is believed to be a boulder because its elevation (280 feet) is likely too high to represent bedrock.

- Boring B4 was conducted on a sandbar with shallow depth. Material was sandy. The samples from zero to two feet and two to four feet were combined in order to provide a sufficient volume of material for laboratory analysis. The sample from four to six feet was submitted for analysis as well although it is likely deeper than an ideal future-conditions benthic sample.

- Boring B5 was conducted further into the middle of the channel but near the sandbars. The boring produced sediments with a petroleum odor from zero to four feet (moderate odor) and four to six feet (mild odor). The odor is not believed to be indicative of cross-contamination given its strength. The samples from zero to two feet and two to four feet were combined in order to provide a sufficient volume of material for laboratory analysis. The sample from four to six feet was submitted for analysis as well although it is much deeper than a future-conditions benthic sample.

- Boring B6 was the only boring to produce fine-grained material with high organic content. The samples from zero to two feet and two to four feet were combined in order to provide a sufficient volume of material for laboratory analysis.

- Boring B7 was conducted on a sandbar. Material was sandy. The samples from zero to two feet and two to four feet were combined in order to provide a sufficient volume of material for laboratory analysis. The sample from four to six feet was submitted for analysis as well although it is likely deeper than an ideal future-conditions benthic sample.

- Boring B8 appeared to return coarse-grained gravel and cobble fill material with many angular and broken rocky materials. Given its location adjacent to the land that is believed to be fill material, the boring could have been completed in fill. Very poor recovery in the upper four feet of casing (zero to two and two to four feet) prevented any ability to submit the sediment for analysis.

- Boring B9 was conducted in an area of deeper water where sediment removal would be unlikely, but the area represents a gap where data collection was desired. The upper sediment sample from zero to two feet was submitted for analysis.

All materials (with the exception of those from B6) consisted of coarse sand, gravel, and cobbles. The materials from B6 were fine grained and contained organic matter related to the decomposition of aquatic vegetation. However, insufficient volumes of material were available across the board for grain size analysis. As a result, a separate visit to the impoundment was conducted to retrieve shallow sediments for grain size analysis.

Results of Laboratory Analysis

A total of 12 samples was submitted for laboratory analysis. Of those, two samples (the lower sediments from B1 and B4) were submitted strictly for analysis of interest to benthic concerns. The other 10 samples were submitted for evaluation of dredging disposal options as well as benthic concerns. Appendix G contains copies of the laboratory analytical reports.

The sediment samples were analyzed for parameters that could influence the decision-making process regarding disposal should dredging be considered. These parameters included total metals, leachable metals in accordance with both Toxicity Characteristic Leaching Procedure (TCLP) and Synthetic Precipitation Leaching Procedure (SPLP) methods, Polycyclic aromatic hydrocarbons (PAHs), PCBs, pesticides, and extractable total petroleum hydrocarbons (ETPH).

Total Metals

The laboratory results associated with the total metals analysis suggest that the sediment located throughout the areal extent of the impoundment as well as the investigated vertical extent of soft sediment contains concentrations typical of naturally occurring background metals. Only slight variations were noted in the individual metals concentrations. The one exception to this finding was the noted concentration of lead at sample location B7 4-6', which was determined to be 145 mg/kg, which was approximately 17 times greater than the next highest concentration. Other metals at this location did not exhibit similar increases. One possible explanation for the increased concentration may be that the sample was obtained from an area containing an old fishing sinker or weighted lure, which were commonly manufactured from lead alloys. Despite the elevated concentration of lead at location B7, all analyzed sediment samples were determined to contain levels of metals less than the applicable Residential Direct Exposure Criteria.

Leachable Metals – TCLP

The sediment samples were analyzed for leachable metals in accordance with TCLP methods to determine if they might, upon removal, exhibit toxicity characteristics that would cause the sediment to be classified as hazardous waste. Generally, only the sediment within the upper four feet of the riverbed materials would potentially be removed. None of the analyzed samples contained leachable concentrations of metals that would cause them to be classified as hazardous waste upon removal. TCLP analysis was only performed on one sample collected from the four to six foot depth. This sample was collected at location B5. TCLP analysis was not performed at sample location B7 4-6', which was determined to contain a total lead concentration of 145 mg/kg.

Leachable Metals – SPLP

The sediment samples were analyzed for leachable metals in accordance with SPLP methods to allow for a comparison to the CT DEEP pollutant mobility criteria. Compliance with this criteria is important should sediment be removed and be designated for beneficial reuse as opposed to being transported to a disposal facility. As noted above, only the sediment within the upper four feet of the riverbed materials would potentially be removed. All results except for the leachable lead concentration at B5 4-6' were determined to be less than the applicable GA Pollutant Mobility Criteria. The noted leachable lead concentration was 0.016 mg/L, which marginally exceeds the pollutant mobility criteria of 0.015 mg/L. The average of all leachable lead concentrations, including the result from B5 4-6', was less than the criteria.

Polychlorinated Biphenyls (PCBs)

PCBs were not detected in any of the analyzed sediment samples.

Chlorinated Pesticides

Chlorinated pesticides were not detected in any of the analyzed sediment samples.

Extractable Petroleum Hydrocarbons

Extractable petroleum hydrocarbons were detected only in sample B6 0-4'. The noted concentration was 54 mg/kg, which is less than the applicable Residential Direct Exposure Criteria.

PAHs

PAHs were detected in all analyzed sediment samples except those obtained at location B1. The sum of all PAHs noted at each of the remaining sample locations ranged from a low of 0.354 mg/kg in sample B2 0-4' to a high of 12.458 mg/kg in sample B4 4-6'. All individual results except for the concentration of benzo(a)pyrene at B4 4-6' (1.020 mg/kg) were less than the applicable CT DEEP residential direct exposure criteria.

PAHs originate from either pyrogenic (combustion) or petrogenic (petroleum) sources. The distribution of individual PAH compounds in the sediment is suggestive of a pyrogenic source and may, therefore, be related to the possible presence of ash or cinders in the sediment.

Sediment Disposal Options

The analytical results of the sediment samples suggest that if the upper four feet of sediment is removed from the impoundment that this material could be designated for beneficial reuse in accordance with draft CT DEEP regulations. The removed material

would likely meet the definition of "conditional fill" and, as such, would be deemed suitable for "use, reuse, or recycling as fill, including as structural fill, or as a grading material…." Given the draft status of the regulatory provisions, it is expected that the approval by the Commissioner of the DEEP will be required for any potential reuse of dredged sediment; however, at this time, it appears that little or no restrictions would apply to its reuse.

In-situ Sediment Quality

The dredging of sediment in the Farmington River impoundment has the potential to expose previously inaccessible sediment to sediment-dwelling organisms. Therefore, it is important to determine whether underlying sediment contains levels of contaminants that would be detrimental to these organisms.

Several methods are available for this type of evaluation; however, most appear to be related to consensus-based sediment quality guidelines developed by MacDonald, et al. (2000). Specific guidances based upon the MacDonald study were developed by the Ohio Environmental Protection Agency in 2010 and were used to evaluate the quality of the sediment samples collected as part of this study. The results obtained during the recent sampling activities were evaluated based upon the Ohio methods, including normalizing the data based upon the fraction of organic carbon and comparing to published chronic values. This data is presented in the appended tables for all sediment samples that contained detectable concentrations of PAH compounds, including those that are currently accessible to sediment-dwelling organisms.

The calculations associated with the Equilibrium Sediment Benchmark Toxic Units (ESBTUs) were based upon an assumed minimum total organic carbon (TOC) concentration of 0.5%. The results of the laboratory analyses indicated that only one sample contained a detectable concentration of TOC based upon a reporting limit of 0.5%. Therefore, for the purposes of this evaluation, the reporting limit was assumed to represent an approximation of the actual concentration. In addition, the calculated data was adjusted based upon a 95th percentile adjustment factor based upon the number of PAH compounds for which laboratory analysis was conducted. Individual ESBTUs were summed, adjusted based upon the adjustment factor, and evaluated against a threshold ESBTU of 1.0. The studies referenced by the Ohio DEP suggest that if the adjusted ∑ESBTU is less than 1.0 it is likely that the sediment will not be toxic to aquatic life. Similarly, if the adjusted ∑ESBTU is greater than 1.0, the sediment *may* be toxic to some sediment-dwelling organisms.

The following ∑ESBTUs were calculated for the collected sediment samples.

B2 0-4'	0.3971
B3 0-4'	6.6720
B4 0-4'	7.0563
B5 0-4'	1.0361

B6 0-4’	2.0480
B7 0-4’	2.4640
B9 0-4’	3.6873
B4 4-6’	13.4456
B5 4-6’	2.1361
B7 4-6’	3.9683

All sediment within the impoundment except that at location B2 could be expected to exhibit some degree of toxicity to sediment-dwelling organisms based upon the calculated ∑ESBTUs. It also appears that if sediment at location B4 at a depth of four to six feet is exposed there may exist some potential for increased toxicity at this specific location. Overall, the expected net toxicity change based upon a postdredging scenario appears to be negligible based upon these calculations.

An evaluation was not performed based upon total metals concentrations due to the fact that the horizontal and vertical distributions of metals were relatively uniform and believed to largely represent background conditions although a basic comparison to the MacDonald Probable Effects Concentrations was made. All observed concentrations were less than the consensus-based probable effects concentrations. Although some minor toxicity may be represented by the metals present, it is unlikely that sediment removal would substantially change the current or future anticipated conditions with respect to metals toxicity and, therefore, would add little to the overall discussion regarding sediment removal alternatives.

Grain Size Analysis

As noted above, a separate visit to the impoundment was conducted to retrieve shallow sediments for grain size analysis. Samples were retrieved manually from a kayak. Four samples were collected from the area of islands and sandbars in the river bend, and three samples were collected from the channel adjacent to Riverside Nursery and the Town Garage. The four samples from the area of islands and sandbars (S1, S2, S3, and S4) were submitted for grain size analysis, but the three collected upstream (S5, S6, and S7) were not submitted. Instead, material remaining from boring B1 was consolidated and submitted for grain size analysis because it more appropriately represented an area of potential sediment removal.

Refer to Appendix G for grain size laboratory reports, a table of results, and graphs prepared for each sample. The sample from B1 returned 36% gravel and 59% sand with 5% silt. This is consistent with the armored cobble channel and coarse grains in the sediment. Samples S1, S3, and S4 from the mid-portion of the channel near the islands and sandbars returned gravel of 3% or lower and sand of 96% or higher. Silt content was 1% or less for these three samples. All of them can be characterized as sand, consistent with the observed sand bars in this area. Sample S2 consisted of 77% sand and 22% gravel, which indicates that small pockets of gravel may be found throughout the sand.

7.4 Analysis of Alternatives for Increased Depths

Five sediment removal alternatives were considered ranging from the null alternative to a maximum dredging footprint:

1. Null/Do Nothing – Consideration of this alternative is necessary should the Town of Canton decide to proceed with the master plan without pursuing sediment removal.

2. "Maximum Sediment Removal" – Remove sediment from all areas where depth is less than five feet, excluding islands and not further upstream than the diagonal ledge outcrop between Riverside Nursery and Flaherty's Rock.

3. Upstream Sediment Removal – Create a deeper channel from the Town Garage parcel extending upstream along the nursery to the diagonal ledge outcrop.

4. Middle Sediment Removal – Create a deep, wide channel between the islands/ sandbars and the west side of the river.

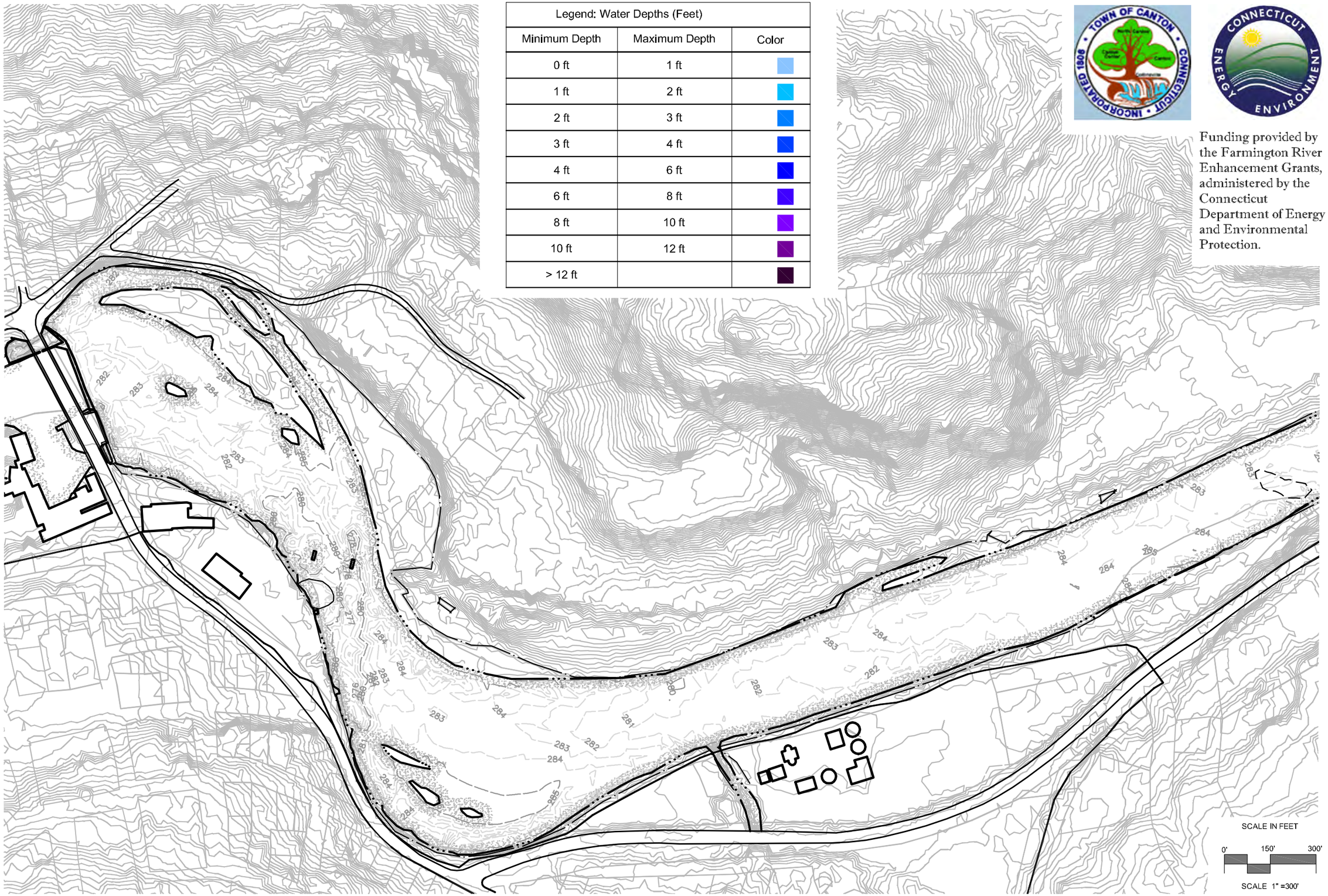
5. Expanded Middle Sediment Removal – Create a deep, wide channel between the islands/sandbars and the west side of the river but also remove large areas of the sandbars.

Appended Figure II is a master plan of the sediment removal alternatives. Alternatives 1 through 5 are individually depicted in Figures 7-2 through 7-6 and described below.

The null alternative is to do nothing relative to sediment removal. Existing depths would remain until such time that natural processes caused additional deposition or erosion. Recreational usage would continue in its present forms and capacities.

The Maximum Sediment Removal alternative is considered the opposite of the null alternative. Sediment would be removed from all areas where depth is less than five feet, excluding islands and not further upstream than the diagonal ledge outcrop between Riverside Nursery and Flaherty's Rock. The goal would be to convert shallow areas to uniform areas of five feet depth. Areas already deeper than five feet would remain deep. This would facilitate swimming and boating downstream of the old bridge abutments to the dam and upstream of the abutments to the diagonal ledge outcrop between Riverside Nursery and Flaherty's Rock. The outcrop serves as a barrier where sediment could not be removed. Furthermore, deep areas are found just upstream of the outcrop.

The volume of sediment to be removed for the Maximum Sediment Removal Alternative would be 82,000 cubic yards. This volume would include sand, gravel, and cobbles. If building debris were encountered, it would need to be removed as well. This weakness of this alternative is that it increases water depths where such action is not necessary. The part of the impoundment downstream of the old railroad bridge abutments is seldom used for recreation.



Legend: Water Depths (Feet)		
Minimum Depth	Maximum Depth	Color
0 ft	1 ft	
1 ft	2 ft	
2 ft	3 ft	
3 ft	4 ft	
4 ft	6 ft	
6 ft	8 ft	
8 ft	10 ft	
10 ft	12 ft	
> 12 ft		

Funding provided by the Farmington River Enhancement Grants, administered by the Connecticut Department of Energy and Environmental Protection.

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REVISIONS

ALTERNATIVE 1 - DO NOTHING

UPPER COLLINSVILLE MILL POND
MASTER PLAN

FARMINGTON RIVER
CANTON, CONNECTICUT

JCM	JCM	DM
DESIGNED	DRAWN	CHECKED

SCALE 1"=300'

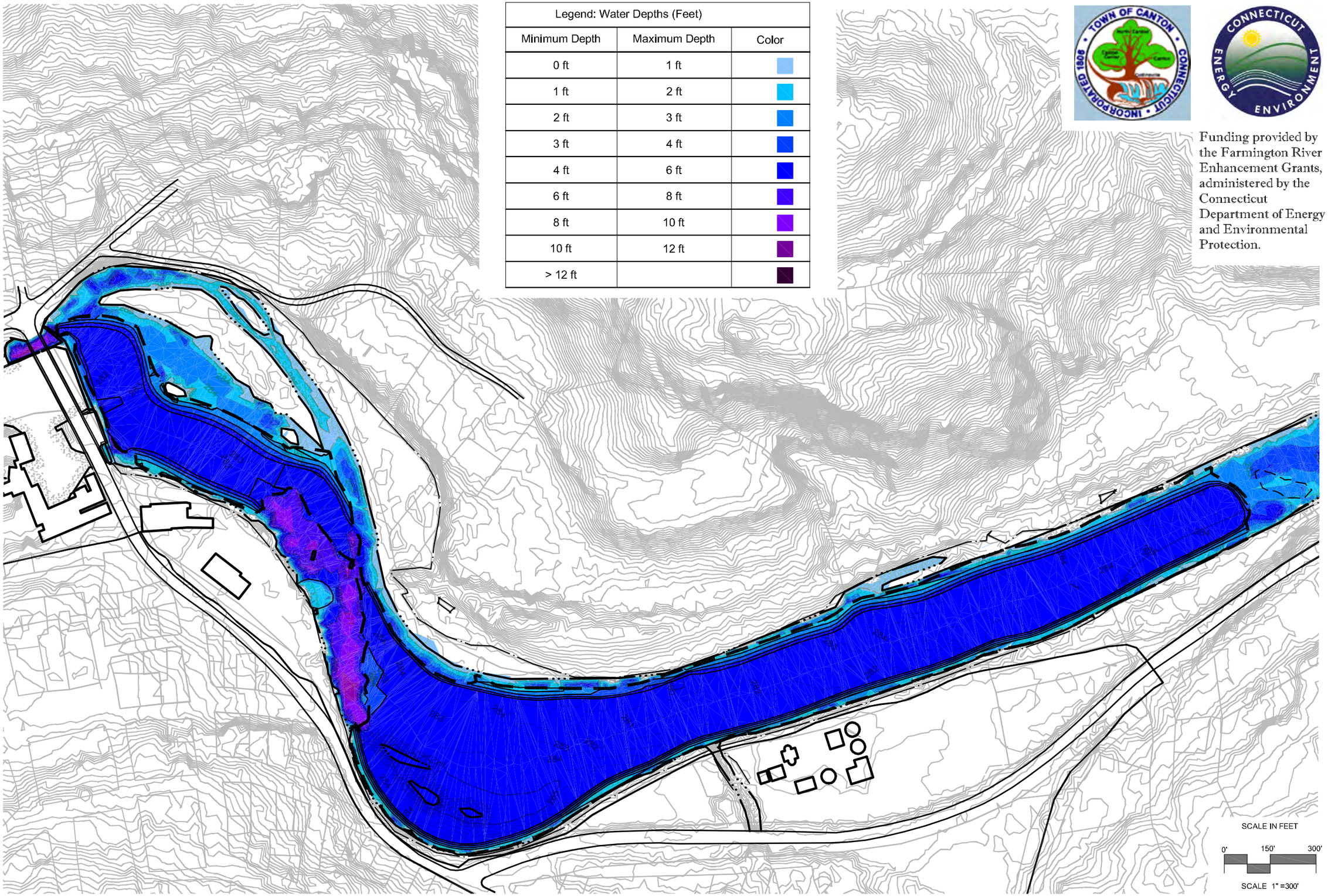
DATE NOVEMBER 23, 2011

PROJECT NO. 1752-13

SHEET NO. FIG. 7-2

Plotted by: DANME On this date: Mon, 2011 November 14 - 2:14pm
Drawing: P:\1752-13\DESIGN\CAD\DWG\Y-SURFACE.DWG Layout Tab:11X17 1

Legend: Water Depths (Feet)		
Minimum Depth	Maximum Depth	Color
0 ft	1 ft	
1 ft	2 ft	
2 ft	3 ft	
3 ft	4 ft	
4 ft	6 ft	
6 ft	8 ft	
8 ft	10 ft	
10 ft	12 ft	
> 12 ft		



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REVISIONS

ALTERNATIVE 2 - MAXIMUM SEDIMENT REMOVAL

UPPER COLLINSVILLE MILL POND
MASTER PLAN

FARMINGTON RIVER
CANTON, CONNECTICUT

JCM	JCM	DM
DESIGNED	DRAWN	CHECKED

SCALE 1"=300'

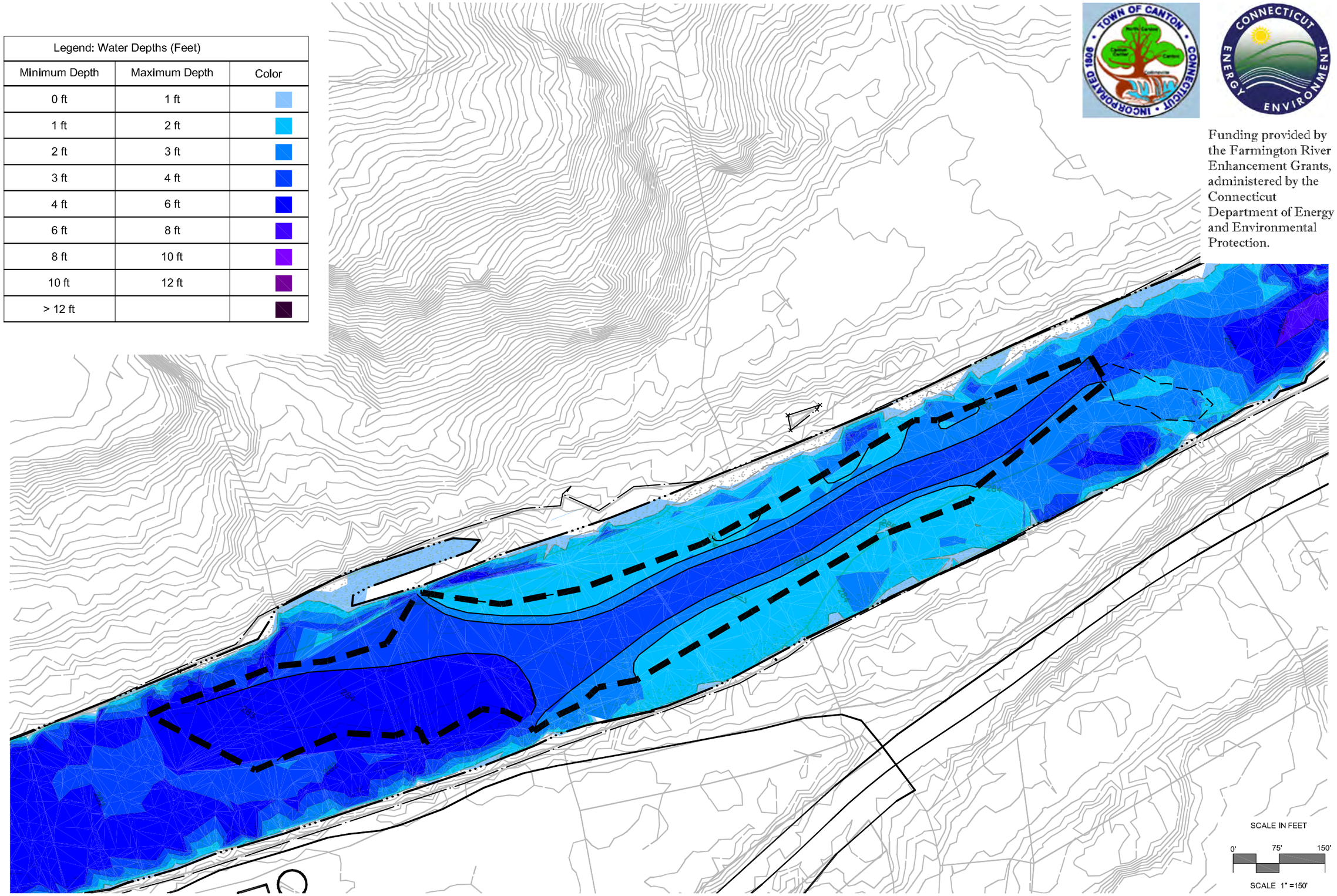
DATE NOVEMBER 23, 2011

PROJECT NO. 1752-13

SHEET NO. FIG. 7-3

Drawing: P:\1752-13\DESIGN\CAD\DWGS\Y-SURFACE.DWG Layout Tab:1X17 2
Plotted by: DANME On this date: Mon, 2011 November 14 - 3:25pm

Legend: Water Depths (Feet)		
Minimum Depth	Maximum Depth	Color
0 ft	1 ft	
1 ft	2 ft	
2 ft	3 ft	
3 ft	4 ft	
4 ft	6 ft	
6 ft	8 ft	
8 ft	10 ft	
10 ft	12 ft	
> 12 ft		



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REVISIONS

ALTERNATIVE 3 - SEDIMENT REMOVAL IN UPSTREAM AREA

UPPER COLLINSVILLE MILL POND
MASTER PLAN

FARMINGTON RIVER
CANTON, CONNECTICUT

JCM	JCM	DM
DESIGNED	DRAWN	CHECKED

SCALE 1"=150'

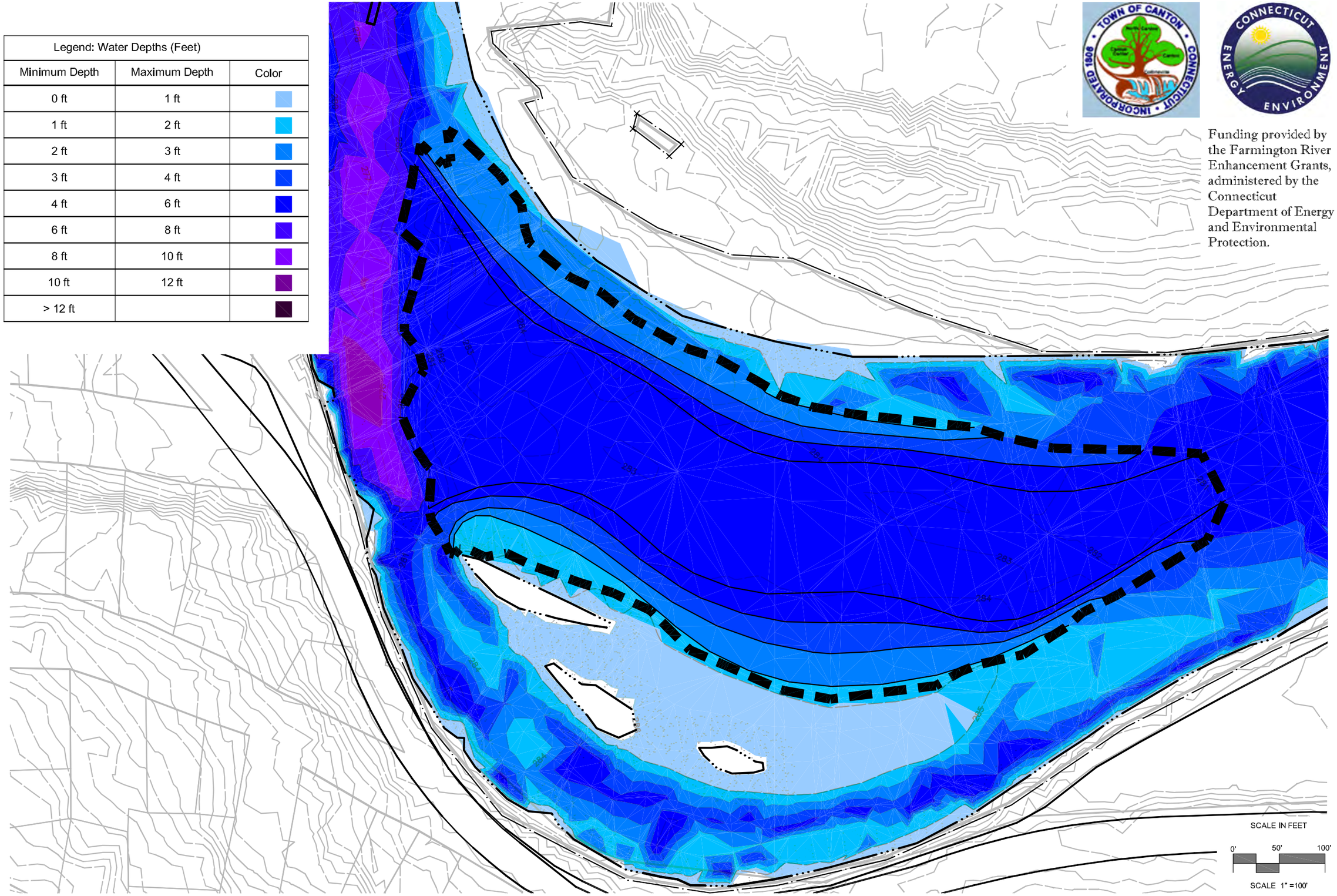
DATE NOVEMBER 23, 2011

PROJECT NO. 1752-13

SHEET NO. FIG. 7-4

Drawing: P:\1752-13\DESIGN\CAD\DWG\Y-SURFACE.DWG Layout: 1obx11X17_3
Plotted by: DANME On this date: Mon, 2011 November 14 – 2:14pm

Legend: Water Depths (Feet)		
Minimum Depth	Maximum Depth	Color
0 ft	1 ft	
1 ft	2 ft	
2 ft	3 ft	
3 ft	4 ft	
4 ft	6 ft	
6 ft	8 ft	
8 ft	10 ft	
10 ft	12 ft	
> 12 ft		



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REVISIONS

ALTERNATIVE 4 - SEDIMENT REMOVAL IN MIDDLE AREA

UPPER COLLINSVILLE MILL POND
MASTER PLAN

FARMINGTON RIVER
CANTON, CONNECTICUT

JCM	JCM	DM
DESIGNED	DRAWN	CHECKED

SCALE 1"=100'

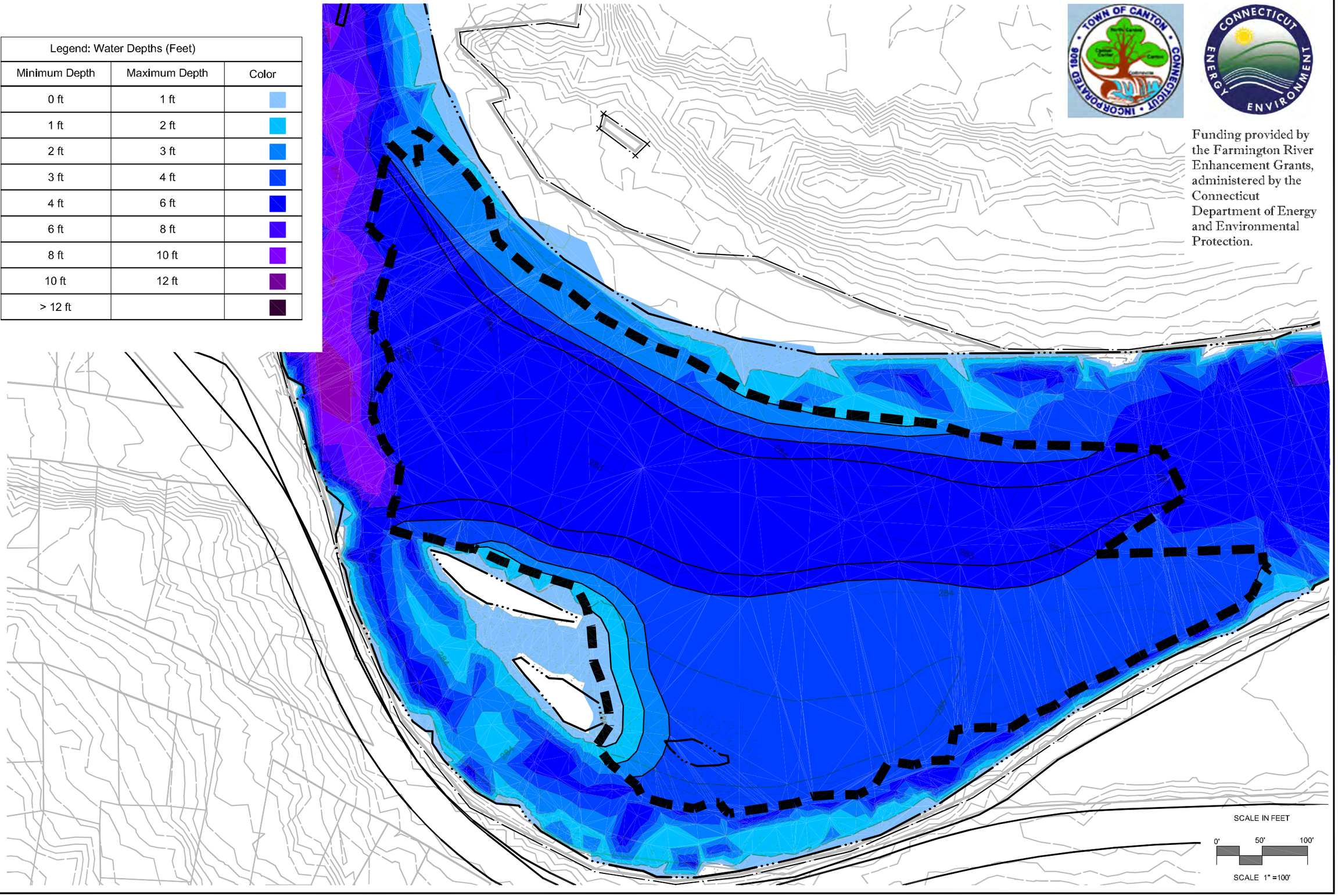
DATE NOVEMBER 23, 2011

PROJECT NO. 1752-13

SHEET NO. FIG. 7-5

Drawing: P:\1752-13\DESIGN\CAD\DWG\Y-SURFACE.DWG Layout: Tab:11X17 4
Plotted by: DANME On this date: Mon, 2011 November 14 – 2:14pm

Legend: Water Depths (Feet)		
Minimum Depth	Maximum Depth	Color
0 ft	1 ft	
1 ft	2 ft	
2 ft	3 ft	
3 ft	4 ft	
4 ft	6 ft	
6 ft	8 ft	
8 ft	10 ft	
10 ft	12 ft	
> 12 ft		



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REVISIONS

ALTERNATIVE 5 - SEDIMENT REMOVAL IN EXPANDED MIDDLE AREA

UPPER COLLINSVILLE MILL POND
MASTER PLAN

FARMINGTON RIVER
CANTON, CONNECTICUT

JCM	JCM	DM
DESIGNED	DRAWN	CHECKED

SCALE 1"=100'

DATE NOVEMBER 23, 2011

PROJECT NO. 1752-13

SHEET NO. FIG. 7-6

Drawing: P:\1752-13\DESIGN\CAD\DWG\Y-SURFACE.DWG Layout: Tab:11X17 S
Plotted by: DANME On this date: Mon, 2011 November 14 - 2:14pm

The Upstream Sediment Removal alternative would create a deeper channel from the Town Garage parcel extending upstream along the nursery to the diagonal ledge outcrop. This alternative was developed with the goal of enhancing kayak and canoe passage between downstream areas and the upstream island, riffles, and Flaherty's Rock. Swimming opportunities could also be improved adjacent to the Town Garage site. This alternative could be selected if there was a desire to mainly improve conditions for paddlers that prefer to move upstream and downstream along the impoundment between the canoe store/boat launch and Flaherty's Rock or the beaches near Town Bridge Road.

The volume of sediment to be removed for the Upstream Sediment Removal alternative would be 10,000 cubic yards. Because the channel is armored in this area, this volume would include sand, gravel, and cobbles. This is consistent with the grain size analysis from sample B1. Due to channel morphology, the presence of building debris in sediments would be unlikely in this area.

The Middle Sediment Removal alternative would create a deep, wide channel between the islands/sandbars and the west side of the river. The goal would be to enhance swimming, canoeing, and kayaking in close proximity to the existing boat ramp and the canoe store. This would benefit those individuals who choose to remain near the boat ramp and canoe store.

The volume of sediment to be removed for the Middle Sediment Removal alternative would be 13,000 cubic yards. This volume would include mainly sand, consistent with the grain size analysis for samples S1, S2, and S3. If building debris were encountered, it would need to be removed as well.

The Expanded Middle Sediment Removal alternative would create a deep, wide channel between the islands/sandbars and the west side of the river but also remove large areas of the sandbars. This alterative has similar goals as those described above, with the added goal of improving aesthetic conditions for individuals utilizing the trail system and viewing the water. Many of these individuals would prefer viewing open water instead of sandbars. Although islands would remain, the sand flats that become exposed at low water would be eliminated.

The volume of sediment to be removed for the Expanded Middle Sediment Removal alternative would be 20,000 cubic yards. This volume would include mainly sand, consistent with the grain size analysis for samples S1, S2, S3, and S4. If building debris were encountered, it would need to be removed as well.

Sediment removal alternatives were not considered near the bridge abutments and upstream of the outcrop near the nursery. Depths already exceed five feet near the abutments and immediately upstream of the outcrop offshore from Flaherty's Rock. Further upstream, sediment removal would be environmentally inappropriate in the riffle along the east side of the island, as it would be in the shallow to dry riffle on the west side of the island. Finally, a variety of depths is already found near Town Bridge Road.

But perhaps most importantly, none of these areas shows signs of excessive sediment deposition that would signal a need for removing sediment.

The volumes of sediment described above range from 10,000 cubic yards to 82,000 cubic yards. For hydraulic dredging dewatering basins of depth (or height) five feet, the corresponding area of necessary dewatering basins would range from 54,000 square feet to 442,800 square feet (one to ten acres). The upper end of this range is clearly not attainable on the town-owned properties identified for dewatering in Section 7.2. The Town Garage site likely has two acres available for dewatering, whereas the smaller parcel south of Rattlesnake Brook like has one acre available. At best, a total of three acres would be available if both sites were used for dewatering.

If envirotubes were used for hydraulic dredge dewatering instead of basins, a moderate space savings could be realized because the bags can be six, seven, or eight feet high. Nevertheless, the two town-owned sites could likely only accommodate dewatering of sediments for up to 20,000 cubic yards at a time. These space constraints would render the Maximum Sediment Removal alternative infeasible unless it was completed in several phases over a few years. The Expanded Middle, Middle, and Upper Sediment Removal alternatives could be more easily conducted with the space available for dewatering.

An alternative to sediment removal is to increase the water surface elevation to 289 feet. Appended Figure III depicts the depths that would result from this action. The effect of raising the water surface is to uniformly create deeper water in all areas whereas the sediment removal concepts would result in only selective deepening of the Upper Collinsville Mill Pond. Raising the water surface elevation would also increase the area of the impoundment, inundating land higher than elevation 286 feet but lower than elevation 289 feet. At least six acres of wetlands would be inundated if the water surface were raised three feet. This has regulatory implications that are described in Section 9.0.

7.5 Cost Estimates

Planning-level cost estimates were developed for the sediment removal and raised water surface alternatives and are listed in Table 7-2. Refer to Appendix H for the sediment removal cost estimates. Note that cost adjustments were not included for potential resale or beneficial reuse of the sediment. Instead, the estimates assume that a contractor would remove the sediment, and its fate would be determined by the contractor. Costs for the dam modifications were taken from Section 6.1 of the Pre-Feasibility Study report.

TABLE 7-2
Planning-Level Cost Estimates for Increased Water Depths

Sediment Removal	Conventional Sediment Removal Cost	Hydraulic Dredging Cost
Null/Do Nothing	$0	$0
Maximum Sediment Removal	$1,900,000	$1,800,000
Upstream Sediment Removal	$557,000	$350,000
Middle Sediment Removal	$590,000	$410,000
Expanded Middle Sediment Removal	$670,000	$550,000
Raise Water Surface to Elevation 289 Feet	**Approximate Cost***	
Flashboards	$50,000	
Stoplogs	$50,000	
Rubber Bladder Dam	$1,500,000	
Crest Gate	$4,000,000	

**Refer to Section 6.1 of the Pre-Feasibility Study For Re-Powering the Upper and Lower Collinsville Dams (2011)*

Potential cost increases are more likely for the hydraulic dredging options, as stumps and building debris are not removable by the hydraulic dredging methods. These objects could impede the dredging effort. The cost exposure is lower for conventional excavation methods because the equipment can removed debris embedded in the river sediment.

Ongoing operations and maintenance costs would be applicable to all of the above alternatives with the exception of the null alternative. For the sediment removal alternatives, future costs would include repeated sediment removal although the number of years between sediment removal projects could be 20 or greater, depending on the town's tolerance for sedimentation. The flashboard and stoplog options would require installations and maintenance every year whereas the bladder dam and crest gate options would include maintenance as well as operational costs such as electricity.