NAVIGATIONAL HAZARDS FOR SMALL BOATS IN THE BLACK RIVER BETWEEN LYONS FALLS AND CARTHAGE, NEW YORK, 2006

Prepared For:

River Area Council of Governments

Tug Hill Commission

Town/Villages of Carthage, West Carthage, Champion, Greig, Lowville, Lyons Fall, Martinsburg, New Bremen, and Wilna

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EXECUTIVE SUMMARY

On September 23, 2003, the River Area Council of Governments requested that the U.S. Army Corps of Engineers, Buffalo District, conduct a Section 22 Planning Assistance to States study of the Black River along the 42-mile stretch between Lyons Falls and Carthage, New York. The purpose of the study was to: (1) document the small boat navigation hazards, and (2) recommend remedial alternatives. Of concern is the recreational use of the river during the low-flow summer river conditions by small boats, particularly canoes, kayaks, and even motorized (< 25 horsepower) fishing boats.

Representatives from the Tug Hill Commission, the Lewis County Soil and Water Conservation District, and local guides led Corps members to sites for inspection and documentation during the summer of 2005. Sites were accessed either by boat or vehicle and, in many cases, located using a hand-held Geographic Positioning System. Information about each of the 23 sites is summarized on site-specific datasheets. These data were combined with existing information and mapped using a Geographic Information System.

The study revealed there are generally two types of navigation hazards: (1) man-made/intransient and (2) natural/transient. Seventeen of the 23 sites had "type 1" hazards that included abutments, boulders, bridge debris, dam remnants, and piles. Nine of the type 1 sites are either lock and dam remnants or timber piles that were used as river control or training structures on the historic Black River Canal. These mid- to late 1800s structures were designed to maintain the navigation channel in the Black River Canal. This study focused on type 1 sites because these appear to be the most hazardous. The six "type 2" hazards are predominantly shoals, sometimes with deadheads (semi-submerged trees), that vary in location from year to year.

Both general and site-specific remedial alternatives are discussed. Most sites have one to three site-specific alternatives. Alternatives are arranged from the least to the most complex and costly. At a minimum, recreational use of the Black River Flats will require a well maintained system of channel/hazard markers and signage. In addition, the mechanical alteration of approximately five higher priority sites would greatly improve boater safety and/or bi-directional movement along the river. The cost estimates for various remedial plans range from about $35,000 to $122,000.

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SECTION 1 – INTRODUCTION

1.1 STUDY AUTHORITY

On September 23, 2003, the River Area Council of Governments (RACOG) requested that the U.S. Army Corps of Engineers (USACE), Buffalo, District (Corps), conduct a Section 22 Planning Assistance to States (PAS) study of the Black River. PAS studies are for general water resource related planning but not construction. The study objectives were outlined in a Letter of Agreement and the Project Management Plan between the Tug Hill Commission and the Corps. The total cost of the study was $100,000, which was cost shared 50 percent Federal and 50 percent non-Federal. Fifty percent of the non-Federal portion was provided as in-kind services (e.g., public meetings, GIS services). The deliverable for the study is this report.

1.2 PROBLEM STATEMENT

The 112-mile Black River drains a 1,916 square mile watershed in upstate New York State (Figure 1). The 42-mile stretch from Lyons Falls to Carthage is locally known as the "Black River Flats" because of the relatively gentle grade and wide floodplain (Figure 2). During low flow periods, the "Flats" offers good fishing, good water quality, sandy shoals and a modest river current that is well suited for "small" boat recreation. In this report, small boats refer to canoes, kayaks, and shallow-draft motorized (< 25 HP) fishing boats.

Regional organizations (e.g., New York State Department of Environmental Conservation, Tug Hill Commission, Soil Conservation Districts), river communities (e.g, Carthage, West Carthage, Champion, Greig, Lowville, Lyons Falls, Martinsburg, New Bremen, Wilna), and local sportsmen are interested in improving and promoting the Black River as a small boat, slow water, outdoor recreational destination (Lewis County Chamber of Commerce 2005). Ideally, study sponsors would prefer bi-directional boat movement during the summer low flow period. However, recreational uses are impeded by navigational hazards along the river that are generally categorized into two types: (1) man-made/intransient and (2) natural/transient. This field investigation identified 17 sites with "type 1" hazards that included abutments, boulders, bridge debris, dam remnants, and piles. Nine of these sites are either dam remnants or timber piles that were used as river control or training structures on the historic Black River Canal. Ironically, these mid- to late 1800s structures were designed to maintain the navigation channel in the Black River Canal. The six "type 2" hazards are predominantly shoals, sometimes with deadheads (semi-submerged trees), that vary in location from year to year.

Most sites have more than one remedial alternative. Decision-makers from these predominantly rural communities seek some qualitative guidance to develop recreational objectives for this recovering water resource.

Figure 1.

Figure 2.

1.3 STUDY OBJECTIVES

The objectives for this study are to:

- Inspect, map, and document the navigation hazards.
- Propose site specific remedial alternatives.
- Describe qualitatively the major advantages/disadvantages, Federal regulatory permit requirements, cost range, and other considerations for each site.

1.4 APPROACH

The study approach is a synthesis of existing literature and preliminary field investigations. The literature sources include historical documents about the Black River Canal (e.g., Whitford 1905), former Corps studies in the region (USACE 1949, 1974, 1974a, 1977, 1989, 1992, 1994, 2001, 2006) and recent factsheets from regional organizations and municipal sources (Tug Hill Commission 2005; Lewis County Chamber of Commerce 2005).

In 1994, Corps personnel completed an initial field reconnaissance visit to several sites along the Black River (PAS Memorandum, Appendix 4.1). For this study, local river guides led Corps personnel on three occasions in the summer and fall of 2005 to an expanded number of sites for inspection and documentation. Sites were accessed by boat and/or vehicle and, in some cases, located using a hand-held Geographic Positioning System (GPS). These GPS data were entered into the Tug Hill Commission's Geographic Information System (GIS). Site data were collectively reviewed by a Corp Project Delivery Team and entered into site-specific datasheets (Appendix 4.2).

1.5 SITE DESCRIPTION

1.5.1 General

The Black River watershed drains 1,916 square miles of the western Adirondack Mountains and the eastern Tug Hill Plateau before eventually discharging northward into Lake Ontario (Figure 1).

In the 42-mile stretch between Lyons Falls and Carthage, the river enters a relatively wide, flat, agricultural valley, known locally as the "Black River Flats" (Figure 2). The upstream section of the Flats, between Lyons Falls and Beach's Bridge, is generally more incised, sinuous, shallow, and flows faster than the downstream portion. The upstream river naturally promotes canoe and kayak use, while the downstream section, with its occasional sandy shoal, offers very good fishing, swimming, and more motorized boating opportunities.

The climate of the Black River watershed is classified as humid continental, but with a definite "maritime" flavor due to strong modification from the Great Lakes. Extremes of hot and cold occur regularly throughout the region, with short moderately cool summers and relatively long cold winters. The annual mean temperature varies from about 45°F at Watertown to 40°F at higher elevations. The prevailing wind direction is from the west, with an average wind velocity of about 10 mph.

The Basin's average annual precipitation rate is among the highest of any watershed in New York State. Average annual precipitation at Watertown from 1920-2000 was 40.2 inches. Other portions of the Basin can average an additional 5 inches annually. Precipitation is distributed relatively uniformly throughout the year, with the majority of the precipitation in the winter occurring as snowfall. Average annual snowfall at Watertown from 1931-2000 was 106.4 inches.

The "Flats" transects portions of several polities, including Jefferson, Lewis, Herkimer, Hamilton, and Oneida counties, and several villages such as Carthage, West Carthage, Lowville, and Boonville. Boat access is limited to seven public boat launches. Four of the launches are improved or newly constructed and are usable by most vehicles (Beaches Bridge, Carthage, Castorland, Glenfield). Besides these few boat launches, accessing the river from shore is generally difficult because of private property restrictions (posted), steep embankments, working landscapes (pasture, cropping), forest cover, wetlands, or railroad tracks. Limited access and multiple polities may complicate the selection of certain remedial alternatives.

1.5.2 Black River Hydrology

There are numerous hydrologic studies of the Black River dating back to the construction of the Black River Canal in the mid-1800s (as documented in Whitford 1905) to more recent investigations of flooding and water resource needs in the basin (USACE, 1949, 1974, 1977, 1989, 1992).

The Black River Basin drains the westerly slopes of the Adirondacks, as well as the Tug Hill Plateau (Figure 1). The majority of the watershed lies east of the Black River, where a series of parallel streams enter from the Adirondacks, including the Moose, Beaver and Independence Rivers and Otter Creek. Numerous smaller, steep tributaries drain the Tug Hill Plateau, such as the Deer River, the Sugar River, and Roaring Brook. In addition to the large number of streams in the Basin, there is an abundance of lakes, ponds, and wetlands. Major bodies of water include Stillwater Reservoir, the Fulton Chain of Lakes, and Lila, Big Moose, Woodhull, Little Moose, Nehasane, and South Lakes.

The Black River Basin has a total area of 1,916 square miles and extends from Lake Ontario to the Adirondacks in northeastern New York State. Over one-half of the basin's area is included within the Adirondack Park boundary. The Black River is 112 miles long and flows in the divide between the sparsely populated Tug Hill Plateau to the west and the rugged Adirondack Highlands to the east. The river rises in the eastern-central portion of Herkimer County, flows southwesterly 20 miles to Forestville, then northerly for about 65 miles to Carthage. It then flows westerly through the city of Watertown to the northeastern end of Lake Ontario. The topography of the Black River Basin divides the river naturally into three reaches. The upper reach, extending upstream from Lyons Falls, is a mountainous area where the river drops 1,023 feet over a 40-mile distance (Figure 3). A 64-foot drop at Lyons Falls carries the river into the middle reach, a 42-mile stretch locally known as the Black River Flats. The river drops less than 15 feet through this region before reaching Carthage, where it enters a well-defined channel in the lower reach. Here it drops 480 feet in about 30 miles as it flows west over

rolling terrain to Lake Ontario. Rapids and falls are common in both the lower and upper reaches. In the study area, which is the 42-mile "Flats" between Lyons Falls and Carthage, the river meanders through a wide, flat valley that varies from 2 to 5 miles wide, where the primary land use is dairy farming.

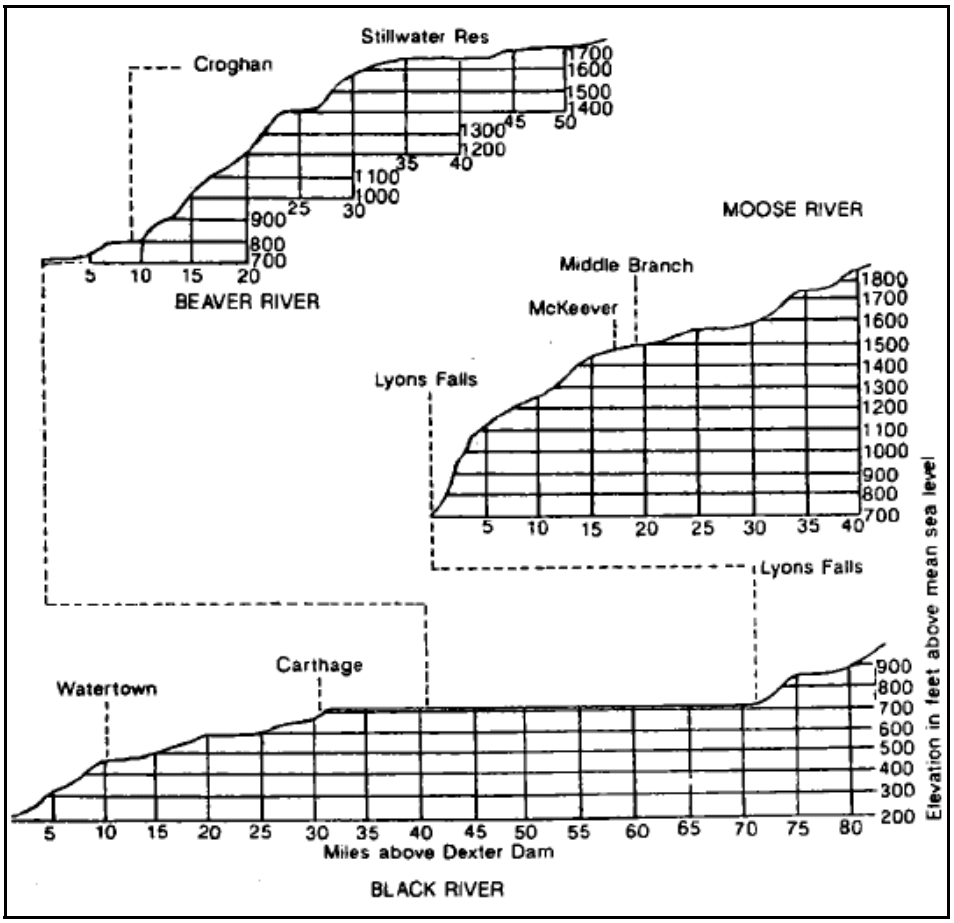


Figure 3. Stream Profiles of Black River and Tributaries (excerpted from USACE 1989).

The National Inventory of Dams lists 93 dams in the Black River Watershed (USACE 2006). Among the most significant are the Stillwater Reservoir dam on the Beaver River, and the dams at Sixth Lake and Old Forge on the Fulton Chain of Lakes. These reservoirs are operated by the Hudson River – Black River Regulating District, and their combined storage capacity is over forty billion gallons. Together, this network of dams and reservoirs has greatly reduced flooding and is integral to hydroelectric generation and industrial operations in Jefferson, Lewis and Herkimer Counties. In addition, the State Dam at Carthage is believed to provide important protection from minor flood events for downstream floodplain areas.

The "flashy" character of flow in the Black River is attributable to the relatively steep and rocky terrain of the watershed. The summer low median daily stream flow and mean annual peak flow at the Watertown gage are 1,340 and 21,800 cubic feet per second (cfs), respectively (see USACE reports).

The greatest potential and frequency for floods within the study area occurs in the early spring when rain combines with snowmelt. Flooding is a persistent problem in the Black River Basin, and agricultural and urban flooding is identified as the primary water resource concern in the Reconnaissance Report for the Black River Basin (USACE 1989). Agricultural flooding is concentrated in the Black River Flats area and was estimated to cause an average of $209,000 (1989 dollars) in flood damages each year, as well as under-utilization of the most fertile farmland. Urban flooding concentrated in the south side of the village of Carthage was found to cause an average of $73,000 (1989 dollars) in annual flood damages. Larger flood events also affect urban areas downstream of Carthage to Watertown.

The US Geological Survey operates stream flow measurement gages on the Black River downstream of the project area at Watertown, and upstream at Boonville. The drainage areas at the gages are 1,864 square miles and 304 square miles respectively. During the Corps site visit on September 12 and 13, 2005, the average daily flows were 193 and 180 cfs at the Boonville gage, and 1440 and 1420 cfs at the Watertown gage. Interpolation of these flows indicates that during the site visit flow in the Black River varied from approximately 500 cfs at Lyons Falls to 1370 cfs at Carthage.

1.5.3 Regulatory Authority

The U.S. Army Corps of Engineers, under Section 10 of the Rivers and Harbors Act of 1899, and Section 404 of the Clean Water Act, has regulatory authority over construction, excavation, or deposition of materials in, over or under navigable waters of the United States, which includes the Black River.

The New York State Department of Environmental Conservation (NYSDEC), under Tile 5 of Article 15 in New York's Environmental Conservation Law, states the NYSDEC regulates activities within the Black River, which is designated as a navigable Class C stream within the project stretch.

The Black River Commission is the Regulating District that operates reservoirs on two main Black River tributaries, the Moose and Beaver Rivers. On the Beaver River, the Regulating District operates the Stillwater Reservoir, and on the Moose River, they operate the Fulton Chain of Lakes via dams at Old Forge and Sixth Lake. This network of dams provides some flood control, water supply, and hydroelectric generation.

The New York State Canal Corporation (NYSCC) is a subsidiary of the New York State Thruway Authority. The NYSCC claims no jurisdiction over the Lyons Falls to Carthage stretch, including the former canal system on the Black River (personal communication, Howard Reese, NYSCC).

SECTION 2 – METHODS AND RESULTS

2.1 SITE FIELD DATA

Local area guides led Corps personnel to representative sites on three occasions for inspection and documentation in the summer and fall of 2005. Sites were accessed by boat and/or vehicle and, in most cases, located using a hand-held Geographic Positioning System (GPS). These GPS data were entered into the Tug Hill Commission's Geographic Information System (GIS). Figure 2 shows the location of the significant hazards to small boat navigation during this typical low flow period. Site characteristics are briefly summarized in field datasheets (Appendix 4.2). The following information is entered about each site:

- Site Number (ID)
- Site Location
- Type of Navigation Hazard
- Dimensions
- Water Depth

The site location is usually a local name or landmark, but the river mile (nearest $1/10^{th}$) above the State Dam at Carthage is also provided. Photographs of several typical sites are provided in Appendix 4.3.

The type of navigational hazard is characterized by the category and dominant material/composition observable at the site. The categories include abutments, boulders, bridge debris, dam remnants, piles, and shoals. The material/composition is predominantly rock, gravel, sand, timber, steel, or stone.

The dimensions of the hazard are the significant length, area or volume of the structure. The water depth is an estimate of the approach (max) and in-situ (min) water depth, which may be an important consideration related to site access.

2.2 REMEDIAL ALTERNATIVES

This section describes some general approaches to navigation restoration, as well as site specific remedial alternatives. Given the scope of this study, these are qualitative descriptions primarily intended to assist local decision-makers.

2.2.1 General Approaches

2.2.1.1 Restoration

One alternative which has the potential to comprehensively improve navigation in the project area would be to restore the locks and dams at Otter Creek and Bushes Landing. These facilities rendered the river navigable when it served as part of the NYS Barge Canal System, and would do so again if restored. A navigable pool with a minimum design draft would be provided upstream of each dam, and the locks would provide for passage around

the dams. As in Europe, these locks could be operated by users or lock operators. In conjunction with this work, some of the relic river training structures observed in the Black River may also require restoration to minimize shoaling and maintain a navigable depth. In addition to the navigation improvements, this alternative would constitute the reconstruction of a historic cultural resource, and would potentially create economic opportunities by generating tourism.

However, there are also significant difficulties that would be associated with this alternative, not the least being high initial and operating costs, increased flooding, and environmental impacts. The initial cost for restoration of these facilities has not been rigorously estimated but could be in the range of five to ten million dollars. If these locks have operators, there are annual personnel as well as maintenance costs. The restoration of the dams would increase the water surface elevation in the Black River, which would likely cause an increase in the frequency and depth of flooding during high flows. This is problematic since flooding is considered by many residents as the significant water resource issue in the area. To mitigate this, it would likely be necessary to purchase property or flooding easements and/or to construct flood protection works. The reconstructed dams would also act as barriers to fish migration, and the resulting altered hydrologic regime of the river could create water quality and sedimentation problems. Finally, a lock facility is likely uneconomical and only provide a greater impediment to the existing daily bi-directional small boat traffic. Given these difficulties, an alternative based on restoration of the former Black River Canal structures seems unrealistic and is therefore not recommended.

2.2.1.2 River Training Structures

This report focuses on the man-made/intransient navigation hazards; however, many stretches have insufficient navigation depth due to shoaling (Appendix 4.3). It may be possible to reduce or eliminate shoaling at some locations by using river training structures (RTS) such as spur dikes, vane dikes, L-head dikes, or bendway weirs (see Biedenharn 1997; USACE 1997). RTS may be the best remedial alternative at several sites. These structures act to increase local flow velocity by constricting the active flow area of the channel, resulting in reduced sedimentation and potentially inducing scouring of existing shoal deposits. Some of the wooden piles that currently present a navigation hazard in the river are believed to be remnants of river training structures constructed to improve the river for navigation as part of the Black River Canal. In fact, a river historian has indicated this is the best example of a slack water scheme, where natural waterways rather than mostly artificial ditches are used (Appendix 4.1). Modern river training structures can be designed to incorporate bioengineering features and increase aquatic habitat diversity, thus providing ecological and navigation benefits. These structures can also be used to abate stream bank erosion by redirecting stream velocities away from the bank toward the center of the channel. Channel markers may also be required, since some of these types of structures are constructed at or just below normal water surface elevation.

2.2.1.3 Partial Dam Removal

Just below Lyons Falls, at Bushes Landing and Otter Creek, there are remnant lock dams that present barriers to navigation. One alternative to facilitate boat traffic at these locations would be to remove a 20 to 30 ft section of dam rubble to a depth sufficient to provide

passage. This alternative would have the added ecological benefit of improving fish passage on the river.

The construction or removal of a dam affects the riverine system in many ways, and requires careful study to ensure that negative impacts are anticipated and addressed. Some of the negative impacts frequently associated with dam removal include:

- Release of sediments trapped behind the dam, and any associated pollutants.
- Increased downstream flooding due to peak flow increases or ice jams.
- Stream bank erosion due to lowered upstream water levels and increased stream slope.
- Hazards to navigation created by lowered upstream water levels.
- Others as listed in the American Society of Civil Engineers (1997), USACE (2001), and White and Moore (2002).

A detailed assessment of the risk of negative impacts with removal of these dams is beyond the scope of this qualitative study, but would be recommended before dam removal was undertaken. Conversely, all three of these structures are low remnants of the original dams and have comparatively little sediment stored behind them. The historically recent absence of modern heavy industry upstream of the dams today implies that existing sediment may be relatively clean. Because the dams are so low their effect on flood flows and ice jams is likely negligible. Furthermore, rough calculations indicate that removal of a 30 ft section for boat passage would likely lead to a drop in the upstream water surface elevation of no more than 2 to 3 inches under low flow conditions.

2.2.1.4 Dredging

Another alternative for providing a navigable channel in the project area would be dredging. This alternative consists of mechanically removing material from the river bottom to provide additional channel depth where required for navigation. Periodic dredging of the "Flats" reach was performed during the Black River Canal era.

In addition to the benefits to navigation, dredging would likely add some flood control benefit since it would provide increased flow capacity in the main channel. A previous study (USACE 1949) of alternatives for flood control improvement in the project area concluded that deepening and enlargement of the channel was the most practicable alternative, but found that the cost of the improvements exceeded the probable benefits, thus recommended no improvements. However, dredging for small craft navigation would likely cost much less than that required for significant flood control benefits. Furthermore, dredging the channel would lower average flow velocities, resulting in a reduction in sediment transport capacity in a reach where transport is already limited due to low slope. Under these conditions, frequent dredging would likely be required to maintain the channel at navigable depth. Dredging also requires a site for the safe disposal of dredged materials. Disposal sites can be expensive to permit, construct, and operate. Dredging operations in the project area would also be expensive. Land based equipment will probably be required since the draft of the typical floating platform dredge vessel will probably exceed the dredged navigable depth of the Black River. In addition, the potential to encounter contaminated sediments exists at a few sites. In summary, the environmental effects of dredging in terms of disturbance of the

Black River ecosystem are unlikely to be deemed acceptable. Therefore, dredging is judged as an impracticable alternative for improving navigation in this section of the Black River; we did not provide a cost estimate for dredging.

2.2.1.5 Portage

One method of providing for small boat navigation at obstructions that cannot otherwise be safely passed is to provide a portage. This method is only applicable for craft that can be carried or dragged out of the water and re-launched within reasonable limits of physical exertion, and is not applicable to larger motorized pleasure-craft which require a mechanical lift or lock. In its simplest form, a portage at one of the remnant dam sites might consist of safe landing and launching zones on the river bank upstream and downstream of the obstruction, connected by a short flat stretch of stream bank. Portage facilities should be adequately marked in advance to allow sufficient time for boaters to maneuver to the designated landing area. Guidance on design of portage facilities can be found in National Park Service (2004).

2.2.2 Site Specific Alternatives

Site specific alternatives proposed in the report include markers (channel, shoals, portage), cutting tools (for piles), demolition, local dredging, mechanical excavation (shore or water access), partial dam removal, and river training structures. Many sites have more than one plausible remedial option and are generally arranged from least to more complex and costly. These alternatives are qualitative, in part, because some options would require a site specific investigation.

For the piles, jetty dam, and dam remnants, the most practical methods include cutting and excavation. The recommended cutting tool for piles is a pneumatic or hydraulic chainsaw that can be operated by a diver and tender from a small boat/raft equipped with an air compressor/hydraulic pump and a generator. Alternatively, if a barge with a backhoe can access the pilings, a hydraulic rotating shear can be used to cut the piles at the river bed. The jetty dam and lock dam remnants will likely need to be accessed by backhoe or floating plant.

2.2.3 Advantages/Disadvantages

A major advantage and disadvantage from the resource manager's perspective is listed in the datasheets (Appendix 4.2). The most common advantages include increased boater awareness, safety, and bi-directional boat movement. Typical disadvantages include moderate to high cost and maintenance. Other secondary benefits or concerns are briefly discussed in the comments section.

2.2.4 Environmental Permitting

All the alternatives involve in-water work, therefore, permits from the U.S. Army Corps of Engineers and the New York State Department of Environmental Conservation will be required. The following section identifies permitting needs for the various alternatives, and also identifies additional coordination that would be necessary during the permit process with

the New York State Office of Parks, Recreation, Historic Preservation (NYSOPRHP) and the U.S. Fish and Wildlife Service (Service).

2.2.4.1 U.S. Army Corps of Engineers

Various activities have been proposed to improve navigation, all of which would be regulated by the U.S. Army Corps of Engineers, Regulatory Branch. In general, these activities include the removal of dams, shoals, and wooden piles, and the placement of channel markings. The application process is flexible but also influenced by factors such as the timing and expertise of the applicant. The examples below illustrate two common approaches:

(1) All of the proposed activities could be incorporated into one application, and one entity would be responsible for the permit (e.g., Tug Hill Commission). The application would then be processed through the Standard Permit process, in which a public notice would be sent to all adjacent landowners, interested parties, and appropriate Federal and state agencies. The typical review time for this type of project is 120 days from the date that a complete application is received. This type of permit would be issued for 3 years, with the potential to extend it up to 10 years.

(2) Alternatively, there are several activities that could be implemented prior to and separate from the Standard Permit process. For example, channel markers and buoys could be installed under Nationwide Permit (NWP) No. 1, Aids to Navigation (see USACE 2006a), which does not require an application package and approval from the Corps. The removal of man-made structures such as the wooden pilings could be authorized by NWP No. 22, Removal of Vessels (USACE 2006a), again without an application or Corps approval. Other portions of the project, specifically, cofferdam removal and shoal excavation would have to be processed under the Individual Standard Permit process.

The Individual Standard Permit application would evaluate such concerns as potential to encounter contaminated sediments and impacts associated with removing a portion of a dam. The removal of portions of cofferdams and shoals can cause modifications upstream (e.g., headcutting, changes in water levels, and affects aquatic organisms). River training structures designed to minimize future 'shoaling' could be evaluated under this process.

The removal of woody debris (e.g., hand removal, cutting) would not require a permit from the Corps. Any fills associated with access roads or work pads to clear debris would require a permit if located within a wetland, stream, or the Black River. In addition, any temporary structures or fills placed in the river to isolate flows (cofferdams) during construction would require a Corps permit.

A Joint Application for Permit and a list of required drawings elements is provided in Appendix 4.1.

2.2.4.2 New York State Department of Environmental Conservation

A NYSDEC Protection of Waters Permit is required for excavating or placing fill in navigable waters of the State below the mean high water level. The cutting and removal of

downed trees, woody debris, and timber pilings would not require a NYSDEC permit if done in a manner that does not necessitate excavation. In addition, the placement of channel markers would not require a permit from the NYSDEC.

The NYSDEC has noted that in-water work be prohibited between April 1 and July 31 to preclude adverse impacts on the spawning, nursery, and feeding activities of indigenous fish species. To further minimize impacts, in-water work should be scheduled during low water periods, which generally occur on the Black River in July and August.

2.2.4.3 New York State Office of Parks, Recreation and Historic Preservation

The New York State Office of Parks, Recreation and Historic Preservation have provided clarification on two Black River concerns. First, NYSOPRHP, Marine Services Unit, does mark navigation channels on heavily used inland waterways, but the Black River does not meet their criteria. In 2005, NYSOPRHP assisted some communities on the Black River with channel marking and is willing to provide some equipment and training in the future (personal communication, Brian Kemp, OPRHP, 716-473-0179). Second, NYSOPRHP indicates by way of written general comments that removal of historic canal features will need to be reviewed more fully as part of a formal work proposal (Appendix 4.1).

The Black River Canal is eligible for listing in the National Register of Historic Places. The NYSOPRHP has indicated that activities such as the removal of debris and shoal excavation not associated with the historic design or use of the canal should not impact the characteristics of the canal. Work affecting the original features of the historic canal (cofferdams, etc.) will require review by the NYSOPRHP during formal application. The NYSOPRHP has provided written support of the concept of improved water-borne access to the historic resource, as it will raise public awareness of the canal system.

2.2.4.4 U.S. Fish and Wildlife Service Endangered Species Review

Federal agencies have responsibilities under the Endangered Species Act to consult with the U.S. Fish and Wildlife Service regarding projects that may affect federally-listed species or "critical habitat," and confer with the Service regarding projects that may affect federally-proposed species or proposed "critical habitat" (Appendix 4.1). The Service has indicated that there is potential for the federally- and state-listed endangered Indiana bat (*Mytis sodalist*) to occur within the proposed project area. Except for the Indiana bat, no other federally-listed or proposed endangered species under the Services jurisdiction are known to exist in the project area. Any project plan should be coordinated with both the Service and NYSDEC for an evaluation of potential impacts to the Indiana bat.

2.2.5 Cost Estimate

Table 1 shows a first order cost estimate for each remedial alternative per location based on in-house assumptions and typical unit costs associated with government contracts. The estimate includes labor, equipment, materials, and assumptions (Appendix 4.4).

Table 1. Cost estimate of remedial alternatives along the Black River Flats.

Remedial Alternative Type	Remedial cost per Location	Plan 1. Lower Cost Alternatives (Site Numbers)	Plan 2. Medium Cost Alternatives (Site Numbers)	Plan 3. Higher Cost Alternatives (Site Numbers)
Channel Marker Buoys	$1,132	1,3,4,5,6,7,8,9,10,12, 14,15,16,17,18,19,20, 21,22,23	1,3,4,5,7,8,9,10,11,15,16, 17,18,19,20,21,22,23	1,21,22,23
Portage, Buoys, and Signage	$4,260	2,11,13		
Pile Removal and Buoys	$5,294		6,14	6,8,9,12
Partial Dam, Debris Removal	$10,331		2,11,13	2,5,11,13
Excavate Shoals, Boulders	$3,203			3,10,15,16,17,18,19
River Training Structures (2-ft)	$6,497			6,7
River Training Structures (4-ft)	$9,790			14,20
Total Cost		**$35,420**	**$61,957**	**$122,023**

The cost estimates do not reflect economies of scale for performing sequential tasks. These estimates are primarily for comparison and planning purpose. Local contractor prices may vary significantly from our estimates. Plan 1 represents the minimum action needed to promote safe navigation, primarily through the use of channel markers (navigational aids) and signage. Plan 2 promotes boater safety and bidirectional river passage, but requires mechanical removal of hazards at five priority sites. Plan 3 is similar to Plan 2, but many hazards would be permanently removed and longer-term, lower maintenance training structure may be constructed.

2.2.6 Additional Considerations

The comments by Henry Baxter and the State Historic Preservation Office suggest that the locks and wooden pile structures have some significant historic value that will impact the planning process. Henry Baxter, a retired engineer and amateur canal historian, was contacted by the Corps to inspect the structure; he wrote (Appendix 4.1):

> First of all we should say that the existing Black River Improvement is the best example we have of an 19th century NYS navigation that made use of the slack water scheme, that is, used natural waterways rather than mostly artificial ditches such as the Erie or Black River Canals. This suggest its worthiness for preservation.

The intrinsic quality of the hand laid stone structure at Otter Creek Lock, despite ice jams and periodic flooding, is quite remarkable. Preserving parts of the structure might enhance the boating experience and provide a marketable destination.

A potentially complex legal question remains regarding whether NYS is completely absolved from all responsibility of the Black River Canal, because the canal was included in the 1875 and 1882 Constitutional acts declaring "the canals be perpetually maintained by the State." The Corps has requested the NYS Attorney General's office (i.e., John Sullivan in Watertown) determine ownership of these structures.

SECTION 3 – SUMMARY AND RECOMMENDATIONS

3.1 SUMMARY

The improving water quality in the stretch known as the Black River Flats has led to a corresponding increase in recreational use by canoeist, kayakers, and fishermen. The recreational opportunities during the summer low flow conditions are, to varying degrees, limited by 23 or more sites that pose navigational hazards to the casual boater. These hazards are locally known to damage hulls, outboard motors, and even injure boat occupants. The majority of these hazards are man-made and some are relics from the Black River Canal. The primary hazards are generally dam remnants and timber piles in the upper reach and submerged former abutments/piers in the lower stretches. Improving recreational opportunities is feasible along the Black River, but it will require coordination amongst communities and policy-makers to optimize their limited financial resources.

3.2 RECOMMENDATIONS

(1) At a minimum, develop a river-wide, well maintained system of channel/portage markers along with educational signage (Plan A.). This step alone will increase boater awareness and potentially reduce the risk at many sites. A local agency, not the state, must be designated and funded to maintain this system.

(2) Alternatively, Plan B requires the mechanical removal of hazardous features at five high priority sites where boater avoidance is difficult, thus reducing risk. Remedial alternatives at the jetty dam, dam remnants, or timber piles will require environmental permits from the Federal and state agencies and coordination with NYSOPRHP, thus the process may take additional time after community consensus is reached.

(3) Lastly, as recreational use increases, communities will need to develop a river recreation plan that addresses such concerns as landownership, camping facilities, educational signage, portage areas, law enforcement, buoy maintenance, river closures, and the enhancement of historic sites.

SECTION 4 – APPENDICES

4.1 PROJECT DOCUMENTS AND CORRESPONDENCE

CENCB-PE-SD September 6, 1994

MEMORANDUM FOR: Files

SUBJECT: PAS - Site Visit to Black River, Lewis County, NY and Recommendations

1. At approximately 11:30 am on 1 September 1994, I arrived at the NYSDEC office just outside of Lowville, NY. There I met with Dave Zembiec of the NYS Tug Hill Commission and Bernie Davies of the DEC. Bernie gave a quick overview of the problems to boaters and canoeists along the Black River. We then left for the river at approximately 12:00 pm.

2. The first site we arrived at was Otter Creek Lock and Dam. The problem at this site are the rocks and metal rods in the dam which can catch and damage canoes. During the site visit the drop in head over the over dam was only a few inches although the current did increase in velocity significantly over the dam. The dam is approximately 100 feet long and was completely submerged except for a few rocks sticking above the water surface. Bernie and myself canoed up and down over the dam in order to observe any hazards to navigation. The only hazards observed were the few rocks above or just below the water surface located from the center to the left side of the dam. We were able to safely canoe by these rocks where the average water depth is about one foot. We did not observe any metal rods in the dam but did notice what appeared to be parts of timber cribbing. On the leftside of the dam over at least a 10 to 15 foot length of dam, the water depth was at least 3 to 4 feet deep based on soundings taken with our paddles. We then canoed through the old lock that runs along the left bank. Various debris (mostly timber) was scattered throughout the lock. The following recommendations are made to improvement navigation the Otter Creek Dam.

a. The deep water over the left side of the dam should be marked by buoys or overhead markers to channel canoeists through this area. This would provide a point of safe passage over the dam. This solution was first suggested by Bernie Davies, he thought a 10 foot wide channel would be sufficient. It does not appear to be necessary to relocate any rocks or timbers in this area. However, yearly inspections of this area should be made to insure that is clear of obstructing debris. Any debris could be removed by winching from shore during low flow periods.

b. For additional safety, in case someone does not go through the marked channel, the metal rods could be located over the entire length of the dam and cut off with a welder's torch.

3. The next site inspected was Bush's Landing Lock and Dam. This site was only inspected from the right river bank. This lock and dam is similar to the one at Otter Creek except the dam is approximately 200 feet long. The hazards to navigation are also similar. The drop in head over the over dam was only a few inches. The following recommendations are made to improve navigation through the Bush's Landing Dam.

a. The best and cheapest solution would be to provide a marked channel similar to that recommended for Otter Creek. At this time the location for this channel is not known. At a low flow period, visual observations by canoe should be made to locate the best location.

Surveying with a transit and rod could also be done if a more detailed map of the dam and creek bottom is desired. Moving of any obstructing rocks in the proposed channel area could be accomplished by winching from shore. The amount of rocks to be moved would be minimal. This would be much more cheaper than using excavating equipment on a barge.

b. Any exposed metal rods in the proposed marked channel (and if desired, over the entire length of dam) could be cut by welders torch.

4. Next, one of the areas of river with wooden pilings was inspected. All the pilings were submerged and could not directly observed. Breaks in flow caused by the pilings were noticed. Pilings that are determined to be a hazard to navigation could be either marked with buoys or removed. The most economical method of removal would be to cut them off at a safe depth by using an underwater saw. Removal by pulling is not recommended. This would require a barge and pile extracting equipment, be very expensive and possibly unfeasible at least in certain locations. Observations during low flow, underwater inspections with divers and/or sonar sounding equipment could be used to locate pilings. Depending on the number of pilings this could be a very time consuming task.

5. Lastly, the remains of the original Ellingsworth Bridge was inspected. The inspection was performed from both the Route 812 Bridge and from canoe. Submerged rock abutments nears the river banks and a rock pier near the center of the river was observed from the Route 812 Bridge. Only the left abutment and center pier were observed from the canoe and were found to be less than 2 feet below the water surface. These submerged structures could cause damage to boats and their props. The inspection of these structures was concluded at 4:30 pm. The cheapest solution to eliminating these hazards would be to mark them. The river is wide and slow in this reach. It would be easy for boats to navigate around the markers. Removing these structures would be more expensive. This could be done by barge or possibly from the Route 812 Bridge or shore depending on the type of equipment used. An excavator or a crane with a clam-shell would probably have to be used for any removal operations.

6. Most of the solutions recommended above are relatively inexpensive and could probably be accomplished by unskilled labor. Only the piling cutting and removal of the original Ellingsworth Bridge solutions would required a contractor or experienced labor with the proper equipment. Marking areas of safe passage and underwater hazards appears to be very feasible and workable in most of the problem areas. The cost for this work would be low and could be accomplished quickly. Removal of underwater hazards could be limited to areas where space for navigation is limited and unsafe flow conditions exists.

Frank Lewandowski
Chief, Civil/Structural Design Section

BLACK RIVER PHOTOS -9/1/94

1. River just upstream of Otter Cr. Dam.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
3817 Luker Road
Cortland, NY 13045

March 6, 2006

Ms. Margaret Crawford
Biologist
Auburn Field Office
U.S. Army Corps of Engineers
7413 County House Road
Auburn, NY 13021

Dear Ms. Crawford:

This responds to your February 16, 2006, electronic mail requesting information on the presence of endangered or threatened species within the vicinity of the proposed Black River Navigation Study along a 40-mile stretch between the Town of Lyons Falls, Jefferson County, and the Town of Carthage, Lewis County, New York. We understand the U.S. Army Corps of Engineers (Corps) is conducting a Section 22 Planning Assistance to States study to identify, prioritize, and suggest remedial strategies to improve small boat navigation on this section of the Black River. As you are aware, Federal agencies have responsibilities under Section 7(a)(2) of the Endangered Species Act of 1973 (ESA) (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) to consult with the U.S. Fish and Wildlife Service (Service) regarding projects that may affect Federally-listed species or "critical habitat," and confer with the Service regarding projects that may affect Federally-proposed species or proposed "critical habitat."

There is potential for the Federally- and State-listed endangered Indiana bat (*Myotis sodalis*) to occur within the proposed project area, which is approximately 16 miles from known roosts and approximately 17 miles from known hibernacula in Jefferson County at its closest point. Please visit our website at http://www.fws.gov/northeast/nyfo/es/section7.htm for more information on Indiana bats.

Except for the potential for Indiana bat and occasional transient individuals, no other Federally-listed or proposed endangered or threatened species under our jurisdiction are known to exist in the project action area. In addition, no habitat in the project area is currently designated or proposed "critical habitat" in accordance with provisions of the ESA. Should project plans change, or if additional information on listed or proposed species or critical habitat becomes available, this determination may be reconsidered. The most recent compilation of Federally-listed and proposed endangered and threatened species in New York* is available for your information. If the proposed project is not completed within one year from the date of this letter, we recommend the Corps contact us to ensure that listed species presence/absence information for the proposed project is current.

The above comments pertaining to endangered species under our jurisdiction are provided as technical assistance pursuant to the ESA. This response does not preclude additional Service comments under other legislation.

As stated above, the Indiana bat is listed as endangered by the State of New York. Any additional project plans should be coordinated with both this office and with the New York State Department of Environmental Conservation (NYSDEC). The NYSDEC contact for the Endangered Species Program is Mr. Peter Nye, Endangered Species Unit, 625 Broadway, Albany, NY 12233 (telephone: [518] 402-8859).

For additional information on fish and wildlife resources or State-listed species, we suggest you contact the appropriate NYSDEC regional office(s)* and the New York Natural Heritage Program Information Services.*

Thank you for your time. If you require additional information please contact Robyn Niver at (607) 753-9334. Future correspondence with us on this project should reference project file 60762.

Sincerely,

David A. Stilwell
Field Supervisor

cc: NYSDEC, Watertown, NY (Attn: Env. Permits)
NYSDEC, Albany, NY (Endangered Species; Attn: P. Nye)

OFFICE OF PARKS · RECREATION · HISTORIC PRESERVATION
NEW YORK STATE
Bernadette Castro
Commissioner

New York State Office of Parks, Recreation and Historic Preservation
Historic Preservation Field Services Bureau
Peebles Island, PO Box 189, Waterford, New York 12188-0189 518-237-8643

February 21, 2006

RECEIVED
27 Feb 2006
BY: Auburn FO

Margaret A. Crawford
Biologist, U.S. Army Corps of Engineers
Auburn Field Office
7413 County House Road
Auburn, New York 13021

Re: USACE
Black River Canal
Navigation Improvements
Lyons Falls to Carthage

Dear Ms. Crawford:

Thank you for requesting the comments of the State Historic Preservation Office (SHPO) regarding proposed work to improve navigation on the National Register of Historic Places eligible Black River Canal between Lyons Falls and Carthage. Although no specific work items have been proposed, we are pleased to offer the following preliminary response in accordance with Section 106 of the National Historic Preservation Act.

In general, the removal of debris, shoal excavation and removal of pilings not associated with the historic design and usage of the canal will not impact those characteristics of the canal by which it is found to be National Register eligible.

Our primary concern is for the preservation of historic canal features such as locks, basins, tow paths and the integrity of the canal "prism," the original excavated section of the canal. More substantial work such as the removal of coffer dams, extensive dredging or grading for public access points will need to be reviewed more fully as part of a formal work proposal.

The SHPO supports the concept of improved water-borne access to this historic resource to raise public awareness of the history of New York State's canal system and to promote its ongoing maintenance. We look forward to working with you and the project sponsor in developing a sensitive approach to enhanced navigation on the canal.

If you have any questions regarding this review, please call me at (518) 237-8643, extension 3283 or email me at james.warren@oprhp.state.ny.us.

Sincerely,

James Warren
Historic Sites Restoration Coordinator

95-19-3 (8/00) ptp

JOINT APPLICATION FOR PERMIT

New York State
United States Army Corps of Engineers

Applicable to agencies and permit categories listed in Item 1. Please read all instructions on back. Attach additional information as needed. Please print legibly or type.

1. Check permits applied for:

NYS Dept. of Environmental Conservation
- ☐ Stream Disturbance (Bed and Banks)
- ☐ Navigable Waters (Excavation and Fill)
- ☐ Docks, Moorings or Platforms (Construct or Place)
- ☐ Dams and Impoundment Structures (Construct, Reconstruct or Repair)
- ☐ Freshwater Wetlands
- ☐ Tidal Wetlands
- ☐ Coastal Erosion Control
- ☐ Wild, Scenic and Recreational Rivers
- ☐ 401 Water Quality Certification
- ☐ Potable Water Supply
- ☐ Long Island Wells
- ☐ Aquatic Vegetation Control
- ☐ Aquatic Insect Control
- ☐ Fish Control

NYS Office of General Services (State Owned Lands Under Water)
- ☐ Lease, License, Easement or other Real Property Interest
- Utility Easement (pipelines, conduits, cables, etc.)
- ☐ Docks, Moorings or Platforms (Construct or Place)

Adirondack Park Agency
- ☐ Freshwater Wetlands Permit
- ☐ Wild, Scenic and Recreational Rivers

Lake George Park Commission
- ☐ Docks (Construct or Place)
- ☐ Moorings (Establish)

US Army Corps of Engineers
- ☐ Section 404 (Waters of the United States)
- ☐ Section 10 (Rivers and Harbors Act)
- ☐ Nationwide Permit (s) Identify Number(s)

For Agency Use Only:
DEC APPLICATION NUMBER

US ARMY CORPS OF ENGINEERS

2. Name of Applicant (Use full name) | Telephone Number (daytime)

Mailing Address

Post Office | State | Zip Code

3. Taxpayer ID (If applicant is not an individual)

4. Applicant is a/an: (check as many as apply)
☐ Owner ☐ Operator ☐ Lessee ☐ Municipality / Governmental Agency

5. If applicant is not the owner, identify owner here - otherwise, you may provide Agent/Contact Person information.
Owner or Agent/Contact Person ☐ Owner ☐ Agent /Contact Person | Telephone Number (daytime)

Mailing Address

Post Office | State | Zip Code

6. Project / Facility Location (mark location on map, see instruction 1a.)
County: Town/City/Village: Tax Map Section/ Block /Lot Number:

Location (including Street or Road) | Telephone Number (daytime)

Post Office | State | Zip Code | 7. Name of Stream or Waterbody (on or near project site)

8. Name of USGS Quad Map: Location Coordinates:
NYTM-E NYTM-N 4

9. Project Description and Purpose: (Category of Activity e.g. new construction/installation, maintenance or replacement; Type of Structure or Activity e.g. bulkhead, dredging, filling, dam, dock, taking of water; Type of Materials and Quantities; Structure and Work Area Dimensions; Need or Purpose Served)

10. Proposed Use:	11. Will Project Occupy State Land?	12. Proposed Start Date:	13. Estimated Completion Date:
☐ Private ☐ Public ☐ Commercial	☐ Yes ☐ No		

14. Has Work Begun on Project? (If yes, attach explanation of why work was started without permit.) ☐ Yes ☐ No

15. List Previous Permit / Application Numbers and Dates: (If Any)

16. Will this Project Require Additional Federal, State, or Local Permits? ☐ Yes ☐ No If Yes, Please List:

17. If applicant is not the owner, both must sign the application
I hereby affirm that information provided on this form and all attachments submitted herewith is true to the best of my knowledge and belief. False statements made herein are punishable as a Class A misdemeanor pursuant to Section 210.45 of the Penal Law. Further, the applicant accepts full responsibility for all damage, direct or indirect, of whatever nature, and by whomever suffered, arising out of the project described herein and agrees to indemnify and save harmless the State from suits, actions, damages and costs of every name and description resulting from said project. In addition, Federal Law, 18 U.S.C., Section 1001 provides for a fine of not more than $10,000 or imprisonment for not more than 5 years, or both where an applicant knowingly and willingly falsifies, conceals, or covers up a material fact; or knowingly makes or uses a false, fictitious or fraudulent statement.

Date _____ Signature of Applicant _____ Title _____

Date _____ Signature of Owner _____ Title _____

RESET

HENRY H. BAXTER, P. E.
3 MAYFAIR LANE
BUFFALO, NEW YORK 14201

U.S. Army Corps of Engineers
1776 Niagara Street
Buffalo, N.Y&. 14207-3199

3 December 2005

Attn: Brad Guay, Ph.D.

Re: Black River Navigation Improvements

We understand your project is to restore navigation on the Black River from Lyons Falls to Carthage to accommadate small pleasure craft and that you would like our comments as to how this would relate, from a historic standpoint, to the previous improvements, (1861-1922)

First of all we should say that the existing Black River Improvement is the best example we have of an 19th century NYS navigation that made use of the slackwater scheme, that is used natural waterways rather than mostly artifical ditches such as the Erie or Black River Canals. This suggests its worthiness for preservation.

It provided slackwater navigation from the northern terminus of the Black River Canal at Lyons Falls north to Carthage, a distance of 42 miles for steamboats about 150' x 23' and 4' draft. Most of the 12' change in elevation was accomplished by locks at Otter Creek and Bush's Landing. The river was also improved by dredging and by wing dams intended to concentrate the water flow to give a scouring action for maintaining channel depth.

Regarding the project now being planned we suggest that as much as possible of the historic 1861 work be retained including the two locks and dams along with examples of the wing dams.

For a minimum project, small portions of the lock dams could be removed sufficient to provide a navigable channel and the wing dams retained in their present state or if necessary improved to achieve their channel scouring function. Navigational aids would be necessary.

A preferred alternative improvement would be the restoration of the locks and dams but with the locks reduced to a size sufficient to handle recreational traffic say 40' x 18' x 4' depth as opposed to the original 160' x 30' x 5'. This would have the merit of sufficiently submerging some of the obstructions so that they would not require removal as with the lessor plan. Some wing dam restoration might be required

and again of course navigational aids are needed. Lock operation could be manual as opposed to electric or hydraulic power.

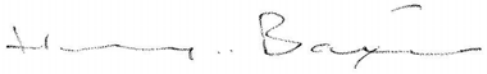
The problem of additional flooding would have to be dealt with.

The writer has been joined in this study by Mr. Howard Card, now retired from the Board of Directors of the CSNYS and the owner of a mill in Crogan, N.Y., and by Mr. George Cataldo owner of a saw mill on the Independence River and a log time Black River Man.

Thanks for the use of the map having river condition notations which we are returning. We appreciate the opportunity for involvement in the project.

Let us know if we can add to this. We have observed some of the sites from land and hope to get a better look when river conditions permit.

Sincerely,



References:

NYS Engineer and Surveyors Report 1905, History of New York Canals, (Whitford).

Snubbing Posts, Thomas C. O'Donnell, Black River Books, 1949

Topo maps

The Emily Madden Index of NYS Canal Maps.

cc: William S. Siener, BECHS
Howard Card
George Cataldo
Tom Grasso
Craig Willams

4.2 SITE SPECIFIC DATASHEETS

Site Information				
Site ID	Site Location Name	River Mile Upstream of Carthage	Local Priority	Site Photo No.
1	Lyons Falls sewer line	42.7	Low	1

Site Description					
Hazard Type	Material(s)	Water Depth near Structure (ft)		Boat/Shore Construction Access	Length/Area/Volume
		Max	Min		
Shoals	Gravel bar/rock	2	0.5	Good/Fair	River width

Remedial Alternatives		
Alternative 1	Alternative 2	Alternative 3
Channel markers	River training structures	
Major Advantage		
Increased boater awareness	Bi-directional boat movement	
Major Disadvantage		
Moderate maintenance	High cost	
Environmental Permits		
Simple	Complex	
Cost Range		
$1,132	$6,497	
Comments		
	High initial cost, low annual maintenance; can include fish habitat improvements; riverbed substrate (bedrock) may render infeasible	

Site Information				
Site ID	Site Location Name	River Mile Upstream of Carthage	Local Priority	Site Photo No.
2	Jetty Dam below First Creek	42.4	High	2

Site Description					
Hazard Type	Material(s)	Water Depth near Structure (ft)		Boat/Shore Construction Access	Length/Area/Volume
		Max	Min		
Dam remnants	Timber/metal	3	0.5	Fair/Fair	River width

Remedial Alternatives		
Alternative 1	Alternative 2	Alternative 3
Portage markers and signage	Partial dam removal (floating plant)	
Major Advantage		
Increased safety	Bi-directional boat movement	
Major Disadvantage		
Moderate cost and maintenance	Moderate cost	
Environmental Permits		
Simple	Complex	
Cost Range		
$100-1000	$10,331	
Comments		
Landowner consent required; loss of navigable river miles or boater inconvenience	Contingent on sediment sampling/analysis; sediment removal may be required; Potential for lowering upstream river levels; channel markers needed	

Site Information				
Site ID	Site Location Name	River Mile Upstream of Carthage	Local Priority	Site Photo No.
3	Second Creek	41.7	Low	3

Site Description					
Hazard Type	Material(s)	Water Depth near Structure (ft)		Boat/Shore Construction Access	Length/Area/Volume
		Max	Min		
Shoals	Gravel bar	4	0	Good/Poor	15’ channel

Remedial Alternatives		
Alternative 1	Alternative 2	Alternative 3
Channel markers	Excavate (floating plant)	River training structures
Major Advantage		
Increased boater awareness	Increased safety	Bi-directional boat movement
Major Disadvantage		
Moderate maintenance	High cost	High Cost
Environmental Permits		
Simple	Complex	Complex
Cost Range		
$1,132	$3,203	$9,790
Comments		
Narrow channel but generally navigable	Second Creek discharges into river at this location and channel widening would require periodic maintenance	Shoals result from deposition of Second Creek; bank protection and RTS provide long-term alternative; high initial cost, low annual maintenance; can include fish habitat improvements; riverbed substrate appears to be gravel

Site Information				
Site ID	Site Location Name	River Mile Upstream of Carthage	Local Priority	Site Photo No.
4	None	41.4	Medium	4,5

Site Description					
Hazard Type	Material(s)	Water Depth near Structure (ft)		Boat/Shore Construction Access	Length/Area/Volume
		Max	Min		
Piles	Timber	8	3	Good/Good	3,960 ft in length

Remedial Alternatives		
Alternative 1	Alternative 2	Alternative 3
Channel markers	Cutting tool, channel markers	River training structures
Major Advantage		
Increased boater awareness	Increased safety	Bi-directional boat movement
Major Disadvantage		
Moderate maintenance	Moderate cost	High cost
Environmental Permits		
Simple	Simple	Complex
Cost Range		
$1,132	$4,260	$9,790
Comments		
Proper markings may deter novice boaters from approaching piles	Use underwater pneumatic/hydraulic chainsaw to remove three 20' sections; water depth may be less than draft on typical floating plant; these are historical elements of the Black River Canal system, contact NYSOPRHP	High initial cost, low annual maintenance; can include fish habitat improvements; riverbed substrate appears to be sandy

Site Information				
Site ID	Site Location Name	River Mile Upstream of Carthage	Local Priority	Site Photo No.
5	Whittlesley Bridge	40.6	Low	6,7

Site Description					
Hazard Type	Material(s)	Water Depth near Structure (ft)		Boat/Shore Construction Access	Length/Area/Volume
		Max	Min		
Bridge debris	Rock/steel cable	4	0	Good/Poor	15’ channel

Remedial Alternatives		
Alternative 1	Alternative 2	Alternative 3
Channel markers	Excavate (floating plant)	
Major Advantage		
Increased boater awareness	Increased safety	
Major Disadvantage		
Moderate maintenance	High cost	
Environmental Permits		
Simple	Complex	
Cost Range		
$1,132	$10,331	
Comments		
Narrow channel but generally navigable	Much of the debris can remain as long a center channel is marked; ownership of structure should be determined.	

Site Information				
Site ID	Site Location Name	River Mile Upstream of Carthage	Local Priority	Site Photo No.
6	Down stream of Whittlesley Bridge	40.5	High	8

Site Description					
Hazard Type	Material(s)	Water Depth near Structure (ft)		Boat/Shore Construction Access	Length/Area/Volume
		Max	Min		
Piles	Timber	2	0.5	Good/Fair	1,003 ft in length

Remedial Alternatives		
Alternative 1	Alternative 2	Alternative 3
Channel markers	Cutting tool, channel markers	River training structures
Major Advantage		
Increased boater awareness	Increased safety	Bi-directional boat movement
Major Disadvantage		
Moderate maintenance	Moderate cost	High cost
Environmental Permits		
Simple	Simple	Complex
Cost Range		
$1,132	$5,294	$6,497
Comments		
This hazard cannot be avoided by most novice boaters; plus, stretch lacks channel due to sedimentation (sand)	Use underwater pneumatic/hydraulic chainsaw to remove three 20' sections; water depth may be less than draft on typical floating plant; these are historical elements of the Black River Canal system, contact NYSOPRHP	High initial cost, low annual maintenance; can include fish habitat improvements; riverbed substrate appears to be sandy

Site Information				
Site ID	Site Location Name	River Mile Upstream of Carthage	Local Priority	Site Photo No.
7	None	40	Low	None

Site Description					
Hazard Type	Material(s)	Water Depth near Structure (ft)		Boat/Shore Construction Access	Length/Area/Volume
		Max	Min		
Shoals	Sand	2	0	Good/Unknown	River width

Remedial Alternatives		
Alternative 1	Alternative 2	Alternative 3
Channel markers	Dredging	River training structures
Major Advantage		
Increased boater awareness	Bi-directional boat movement	Bi-directional boat movement
Major Disadvantage		
Moderate maintenance	High cost, maintenance, environ. Permits	High cost
Environmental Permits		
Simple	Complex	Complex
Cost Range		
$1,132	$N/A	$6,497
Comments		
Narrow channel but generally navigable	Presumed sandy substrate; repeat dredging and disposal are typically required	High initial cost, low annual maintenance; can include fish habitat improvements; riverbed substrate appears to be sandy

Site Information				
Site ID	Site Location Name	River Mile Upstream of Carthage	Local Priority	Site Photo No.
8	None	39.9	Medium	None

Site Description					
Hazard Type	Material(s)	Water Depth near Structure (ft)		Boat/Shore Construction Access	Length/Area/Volume
		Max	Min		
Piles	Timber		1	Poor/Good	1,109 ft in length

Remedial Alternatives		
Alternative 1	Alternative 2	Alternative 3
Channel markers	Cutting tool, channel markers	
Major Advantage		
Increased boater awareness	Increased safety	
Major Disadvantage		
Moderate maintenance	Moderate cost	
Environmental Permits		
Simple	Simple	
Cost Range		
$1,132	$5,294	
Comments		
Novice boaters can generally navigate past these piles except in south where they approach thalwag	Use underwater pneumatic/hydraulic chainsaw to remove appropriate number of 20' sections; these are historical elements of the Black River Canal system, contact NYSOPRHP	

Site Information				
Site ID	Site Location Name	River Mile Upstream of Carthage	Local Priority	Site Photo No.
9	None	37.9	Low	9

Site Description					
Hazard Type	Material(s)	Water Depth near Structure (ft)		Boat/Shore Construction Access	Length/Area/Volume
		Max	Min		
Piles	Timber	8	3	Good/Good	2,587 ft in length

Remedial Alternatives		
Alternative 1	Alternative 2	Alternative 3
Channel markers	Cutting tool, channel markers	
Major Advantage		
Increased boater awareness	Increased safety	
Major Disadvantage		
Moderate maintenance	Moderate cost	
Environmental Permits		
Simple	Simple	
Cost Range		
$1,132	$5,294	
Comments		
Novice boaters can generally navigate past these piles; three nondescript buoys are in place	Use underwater pneumatic/hydraulic chainsaw to remove appropriate number of 20' sections; these are historical elements of the Black River Canal system, contact NYSOPRHP	

Site Information				
Site ID	Site Location Name	River Mile Upstream of Carthage	Local Priority	Site Photo No.
10	Glenfield Bridge	33.9	Low	None

Site Description					
Hazard Type	Material(s)	Water Depth near Structure (ft)		Boat/Shore Construction Access	Length/Area/Volume
		Max	Min		
Boulder(s)	Rock	6	0	Good/Fair	~ 8' x 8'

Remedial Alternatives		
Alternative 1	Alternative 2	Alternative 3
Channel markers	Demolition	
Major Advantage		
Increased boater awareness	Increased safety	
Major Disadvantage		
Moderate maintenance	Moderate cost, environmental permits	
Environmental Permits		
Simple	Complex	
Cost Range		
$1,132	$3,203	
Comments		
Serious prop hazard located about 50 ft north of bridge	Fracture rock in place; training site for Army Reserve?	

Site Information				
Site ID	Site Location Name	River Mile Upstream of Carthage	Local Priority	Site Photo No.
11	Otter Creek Lock and Dam	32.5	High	10

Site Description					
Hazard Type	Material(s)	Water Depth near Structure (ft)		Boat/Shore Construction Access	Length/Area/Volume
		Max	Min		
Dam Remnants	Rock/stone	4	0.5	Good/Good	River width

Remedial Alternatives		
Alternative 1	Alternative 2	Alternative 3
Portage markers and signage	Partial dam removal (floating plant)	
Major Advantage		
Increased safety	Bi-directional boat movement	
Major Disadvantage		
Moderate cost and maintenance	Moderate cost	
Environmental Permits		
Simple	Complex	
Cost Range		
$4,260	$10,331	
Comments		
Landowner consent required, boater inconvenience; needs warning buoys and portage area signs; stone replacement needed for path; river banks are steep; adjacent lock is attractive historical structure and boater destination	May be accessible from adjacent private property; potential for lowering upstream river levels; channel markers needed; provides fishing access to down stream areas; contact NYSOPRHP	

Site Information				
Site ID	Site Location Name	River Mile Upstream of Carthage	Local Priority	Site Photo No.
12	Roaring Brook	29.9	Medium	None

Site Description					
Hazard Type	Material(s)	Water Depth near Structure (ft)		Boat/Shore Construction Access	Length/Area/Volume
		Max	Min		
Piles	Timber	--	--	Good/Unknown	N/A

Remedial Alternatives		
Alternative 1	Alternative 2	Alternative 3
Channel markers	Cutting tool, channel markers	
Major Advantage		
Increased boater awareness	Increased safety	
Major Disadvantage		
Moderate maintenance	Moderate Cost	
Environmental Permits		
Simple	Simple	
Cost Range		
$1,132	$5,294	
Comments		
Site was not inspected by Corps; hazard needs further evaluation	Use underwater pneumatic/hydraulic chainsaw to remove appropriate number of 20' sections; these are historical elements of the Black River Canal system, contact NYSOPRHP	

Site Information				
Site ID	Site Location Name	River Mile Upstream of Carthage	Local Priority	Site Photo No.
13	Bushes Landing Lock and Dam	26.7	High	11

Site Description					
Hazard Type	Material(s)	Water Depth near Structure (ft)		Boat/Shore Construction Access	Length/Area/Volume
		Max	Min		
Dam Remnants	Rock/stone	4	0	Fair/Good	River width

Remedial Alternatives		
Alternative 1	Alternative 2	Alternative 3
Portage markers and signage	Partial dam removal (floating plant)	
Major Advantage		
Increased safety	Bi-directional boat movement	
Major Disadvantage		
Moderate cost and maintenance	Moderate cost	
Environmental Permits		
Simple	Complex	
Cost Range		
$4,260	$10,331	
Comments		
Landowner consent required, boater inconvenience; needs warning buoys and portage area signs; sandbars provide natural portage sites; river banks are steep/slippery; adjacent lock is attractive historical structure and boater destination	No easy access from river bank; potential for lowering upstream river levels; channel markers needed; provides fishing access to upstream areas; contact NYSOPRHP	

Site Information				
Site ID	Site Location Name	River Mile Upstream of Carthage	Local Priority	Site Photo No.
14	Number 4 Rd Bridge	23.1	Medium	12

Site Description					
Hazard Type	Material(s)	Water Depth near Structure (ft)		Boat/Shore Construction Access	Length/Area/Volume
		Max	Min		
Piles	Timber	6	1	Good/Fair	300' in length

Remedial Alternatives		
Alternative 1	Alternative 2	Alternative 3
Channel markers	Cutting tool, channel markers	River training structures
Major Advantage		
Increased boater awareness	Increased safety	Bi-directional boat movement
Major Disadvantage		
Moderate maintenance	Moderate cost	High cost
Environmental Permits		
Simple	Simple	Complex
Cost Range		
$1,132	$5,294	$9,790
Comments		
This hazard cannot be avoided by most novice boaters; local guide indicates current in this bend forces canoeist against piles	Use underwater pneumatic/hydraulic chainsaw to remove appropriate number of 20' sections; these are historical elements of the Black River Canal system, contact NYSOPRHP	High initial cost, low annual maintenance; can include fish habitat improvements; riverbed substrate appears to be sand over clay; contact NYSOPRHP

Site Information				
Site ID	Site Location Name	River Mile Upstream of Carthage	Local Priority	Site Photo No.
15	Ellingsworth Bridge (Rt 812)	17.5	Low	13

Site Description					
Hazard Type	Material(s)	Water Depth near Structure (ft)		Boat/Shore Construction Access	Length/Area/Volume
		Max	Min		
Abutments	Stone	6	1	Unknown/Good	~ 5 rock piles, ea. 50 ft^3

Remedial Alternatives		
Alternative 1	Alternative 2	Alternative 3
Channel markers	Excavate (floating plant)	
Major Advantage		
Increased boater awareness	Increased safety	
Major Disadvantage		
Moderate maintenance	High cost	
Environmental Permits		
Simple	Complex	
Cost Range		
$1,132	$3,203	
Comments		
Two rock piles located in main channel, prop hazard, warning buoys would be sufficient for most boaters	Work may be done from shore if inaccessible by floating plant	

Site Information				
Site ID	Site Location Name	River Mile Upstream of Carthage	Local Priority	Site Photo No.
16	Halls Farm	12.7	Medium	None

Site Description					
Hazard Type	Material(s)	Water Depth near Structure (ft)		Boat/Shore Construction Access	Length/Area/Volume
		Max	Min		
Boulder(s)	Rock	3	0.5	Good/Unknown	~ 3' x 3' ea.

Remedial Alternatives		
Alternative 1	Alternative 2	Alternative 3
Channel markers	Excavate (shore)	
Major Advantage		
Increased boater awareness	Increased safety	
Major Disadvantage		
Moderate maintenance	Moderate cost	
Environmental Permits		
Simple	Simple-Complex	
Cost Range		
$1,132	$3,203	
Comments		
1 to 2 submerged boulders that are serious prop hazards and difficult to detect due to slack water	Backhoe could winch from shore	

Site Information				
Site ID	Site Location Name	River Mile Upstream of Carthage	Local Priority	Site Photo No.
17	VanAmber Brothers Sawmill	12.5	Medium	14

Site Description					
Hazard Type	Material(s)	Water Depth near Structure (ft)		Boat/Shore Construction Access	Length/Area/Volume
		Max	Min		
Abutments	Rock	3	0	Good/Unknown	~ 400 ft^3

Remedial Alternatives		
Alternative 1	Alternative 2	Alternative 3
Channel markers	Excavate (shore or floating plant)	
Major Advantage		
Increased boater awareness	Increased safety	
Major Disadvantage		
Moderate maintenance	High cost	
Environmental Permits		
Simple	Simple – Complex	
Cost Range		
$1,132	$3,203	
Comments		
Rock pile, maybe former pier; prop hazard, buoy present during inspection but not visible at night	Work may be done from shore with landowner permission	

Site Information				
Site ID	Site Location Name	River Mile Upstream of Carthage	Local Priority	Site Photo No.
18	None	12.0	Medium	None

Site Description					
Hazard Type	Material(s)	Water Depth near Structure (ft)		Boat/Shore Construction Access	Length/Area/Volume
		Max	Min		
Boulder(s)	Rock	3	0.5	Good/Unknown	~ 3' x 3' ea.

Remedial Alternatives		
Alternative 1	Alternative 2	Alternative 3
Channel markers	Excavate (shore)	
Major Advantage		
Increased boater awareness	Increased safety	
Major Disadvantage		
Moderate maintenance	Moderate cost	
Environmental Permits		
Simple	Simple–Complex	
Cost Range		
$1,132	$3,203	
Comments		
1 to 2 submerged boulders that are serious prop hazards and difficult to detect due to slack water; located across from Karl Kruenig's residence	Backhoe could winch from shore	

Site Information				
Site ID	Site Location Name	River Mile Upstream of Carthage	Local Priority	Site Photo No.
19	Basselin's Sawmill	11.6	Medium	15

Site Description					
Hazard Type	Material(s)	Water Depth near Structure (ft)		Boat/Shore Construction Access	Length/Area/Volume
		Max	Min		
Abutments	Timber/Rock	4	0	Good/Unknown	~ 400 ft^3

Remedial Alternatives		
Alternative 1	Alternative 2	Alternative 3
Channel markers	Excavate (shore or floating plant)	
Major Advantage		
Increased boater awareness	Increased safety	
Major Disadvantage		
Moderate maintenance	High cost	
Environmental Permits		
Simple	Simple – Complex	
Cost Range		
$1,132	$3,203	
Comments		
Rock pile, maybe former pier; prop hazard, buoy present during inspection but not visible at night	Work may be done from shore with landowner permission	

Site Information				
Site ID	Site Location Name	River Mile Upstream of Carthage	Local Priority	Site Photo No.
20	None	8.4	Low	16

Site Description					
Hazard Type	Material(s)	Water Depth near Structure (ft)		Boat/Shore Construction Access	Length/Area/Volume
		Max	Min		
Shoals	Sand	2	0	Good/Unknown	¾ river width

Remedial Alternatives		
Alternative 1	Alternative 2	Alternative 3
Channel markers	Dredging	River training structures
Major Advantage		
Increased boater awareness	Bi-directional boat movement	Bi-directional boat movement
Major Disadvantage		
Moderate maintenance	High cost, maintenance, environ. Permits	High cost
Environmental Permits		
Simple	Complex	Complex
Cost Range		
$1,132	$N/A	$6,497
Comments		
Channel difficult to locate; local sediment transport capacity low with shifting sandbars and aquatic vegetation	Presumed sandy substrate; repeat dredging and disposal are typically required	High initial cost, permanent, low maintenance; can include fish habitat improvements; riverbed substrate appears to be sand; possibly good site for RTS

Site Information				
Site ID	Site Location Name	River Mile Upstream of Carthage	Local Priority	Site Photo No.
21	Carthage rod and gun club	6.2	Medium	17

Site Description					
Hazard Type	Material(s)	Water Depth near Structure (ft)		Boat/Shore Construction Access	Length/Area/Volume
		Max	Min		
Abutments	Rock	3	0	Good/Good	~ 200 ft^3

Remedial Alternatives		
Alternative 1	Alternative 2	Alternative 3
Channel markers	River training structures	
Major Advantage		
Increased boater awareness	Bi-directional boat movement	
Major Disadvantage		
Moderate maintenance	High cost	
Environmental Permits		
Simple	Simple – Complex	
Cost Range		
$1,132	$6,497	
Comments		
1 to 2 rock piles, maybe former pier; prop hazard, buoy not present during inspection; bedrock outcrops in river bottom	High initial cost, low annual maintenance; can include fish habitat improvements; riverbed substrate (bedrock) may render infeasible	

Site Information				
Site ID	Site Location Name	River Mile Upstream of Carthage	Local Priority	Site Photo No.
22	Ferry crossing	5.2	Low	None

Site Description					
Hazard Type	Material(s)	Water Depth near Structure (ft)		Boat/Shore Construction Access	Length/Area/Volume
		Max	Min		
Abutments	Rock	--	--	--	--

Remedial Alternatives		
Alternative 1	Alternative 2	Alternative 3
Channel markers		
Major Advantage		
Increased boater awareness		
Major Disadvantage		
Moderate maintenance		
Environmental Permits		
Simple		
Cost Range		
$1,132		
Comments		
Feature was not easily observed from shore but considered a hazards by local; needs further investigation		

Site Information				
Site ID	Site Location Name	River Mile Upstream of Carthage	Local Priority	Site Photo No.
23	Squash hole	2.8	Low	None

Site Description					
Hazard Type	Material(s)	Water Depth near Structure (ft)		Boat/Shore Construction Access	Length/Area/Volume
		Max	Min		
Shoals	Rock	--	--	--	--

Remedial Alternatives		
Alternative 1	Alternative 2	Alternative 3
Channel markers		
Major Advantage		
Increased boater awareness		
Major Disadvantage		
Moderate maintenance		
Environmental Permits		
Simple		
Cost Range		
$1,132		
Comments		
Feature was not easily observed from shore but considered a hazards by local; needs further investigation		

4.3 SITE PHOTOGRAPHS

Photograph 1. Shoals below Lyons Falls Dam near sewer line (Site 1).

Photograph 2. Jetty Dam below First Creek with timbers and metal spikes (Site 2).

Photograph 3. Second Creek gravel shoals (Site 3, note deadhead on far bank).

Photograph 4. Timber piles and former training structure (Site 4).

Photograph 5. Timber piles with rock jetties (Site 4, looking south).

Photograph 6. Collapsed Old Whittlesley Bridge (Site 5).

Photograph 7. Old Whittlesley Bridge remnants.

Photograph 8. Timber piles below Whittlesley Bridge (Site 6).

Photograph 9. Timber piles with buoy (Site 9).

Photograph 10. Otter Creek lock (see below) and dam remnants.

Photograph 11. Bushes landing lock and dam remnants (Site 13).

Photograph 12. Number 4 Road Bridge (Site 14).

Photograph 13. Ellingsworth Bridge (Site 15).

Photograph 14. VanAmber Brothers Sawmill (Site 17).

Photograph 15. Basselin's Sawmill (Site 19).

Photograph 16. Shoals downstream of Castorland boat launch (Site 20).

Photograph 17. Carthage rod and gun club with rock abutment/shoals (Site 21).

4.4 COST ESTIMATE DETAILS

Channel Marker Buoy Installation Cost Estimate (per hazard location)				
Labor				
Item[1]	Unit	Quantity	Unit Price	Extension
Laborer - unskilled (LABO0322-002)[1]	manhour	8	$27.13	$217
			Labor Total:	$217
Equipment				
Item[2]	Unit	Quantity	Unit Price[3]	Extension
Marine Equipment, Boats & Launches, 13' Runabout, 5' Beam, Outboard Engine (M10XX009)	hour	4	$10.38	$42
Truck, Highway, Conventional, 1/2 ton pickup, 4x2 (T50XX001)	hour	4	$8.54	$34
Truck Trailer, Miscellaneous/Utility, Tilt Bed, 12-ton, 2 axle (T45XX026)	hour	4	$3.21	$13
			Equipment Total:	$88
Materials				
Item	Unit	Quantity	Unit Price[4, 5]	Extension
SUR-MARK II Marker Buoy (P/N: TMP46103)	EA	3	$129.95	$390
SUR-MARK Buoy Labels (P/N: various)	EA	3	$15.98	$48
Seachoice Mushroom Anchor (P/N: 41260)	EA	3	$26.06	$78
1/4" Galvanized Anchor Chain (P/N: 50074734)	FT	18	$1.31	$24
1/4" Galvanized Anchor Shackle (P/N: 43050)	EA	6	$0.97	$6
			Materials Total:	$545
			Total Direct Costs:	$851
			Contractor Overhead (10%)	$85
			Contractor Profit (10%)	$94
			Contingency (10%)	$103
			Total Estimated Cost:	**$1,132**

Notes:
[1] Davis-Bacon Wage Determination for Lewis and St. Lawrence Counties NY030010 10/06/2006 NY10.
[2] USACE EP 1110-1-8 (31 July 2005).
[3] Unit prices have been escalated from July 2005 to October 2006 using ENR cost index (7883/7422).
[4] Unit prices do not include sales tax. It is assumed that purchasing entity will be sales tax exempt.
[5] Unit prices do not include shipping costs. It is assumed that items will be purchased in a large enough quantity to qualify for free shipping from the vendor(s).

Assumptions:
1. A total of three (3) channel marker buoys will be installed at each hazard location. One warning marker buoy upstream of the hazard, one hazard marker buoy at the hazard location, and one warning buoy downstream of the hazard.
2. An average of 6 feet of anchor chain will be sufficient to secure the channel marker buoys to the buoy anchors.
3. Installation of channel marker buoys at any hazard location will included mobilization to the hazard site, launching a rowboat or canoe, installing three (3) channel marker buoys, loading a rowboat or canoe onto a trailer, and demobilization from the hazard location.
4. For safety concerns, the channel marker buoy installation crew will consist of two (2) laborers.
5. The two-person channel marker buoy installation crew can install marker buoys at one hazard location in 4 hours.
6. This cost estimate includes the initial installation costs only. It does not include any design, permitting, operation, maintenance, or replacement costs.

Portage, Markers & Signage Cost Estimate (per hazard location)

Labor

Item	Unit	Quantity	Unit Price	Extension
Laborer - unskilled (LABO0322-002)[1]	manhour	16	$27.13	$434.08
Power Equipment Operator[1.]	manhour	16	$44.20	$707.20
Truck Driver[1]	manhour	4	$23.97	$95.88
			Labor Total:	$1,237.16

Equipment

Item[2]	Unit	Quantity	Unit Price[3]	Extension
Miscellaneous hand tools - assume 10% of labor	lump sum	1	$123.72	$123.72
Chain saw, 16" - 42" bar, 6 HP	hour	8	$2.70	$21.58
Hydraulic excavator, crawler, 43,800 lbs., 1.50 CY bucket, 21.75' max digging, 320C (H25CA022)	hour	8	$47.41	$379.30
Tractor, crawler (dozer), 80 hp, low ground pressure, w/2.39 CY semi-u blade, D-4G LGP (T15CA005)	hour	8	$31.46	$251.68
Marine Equipment, Boats & Launches, 13' Runabout, 5' Beam, Outboard Engine (M10XX009)	hour	8	$10.38	$83.01
Truck, Highway, Conventional, 1/2 ton pickup, 4x2 (T50XX001)	hour	8	$8.54	$68.32
Truck Trailer, Miscellaneous/Utility, Tilt Bed, 12-ton, 2 axle (T45XX026)	hour	8	$3.21	$25.66
Truck, Highway, 75,000 lbs GVW (T50XX031)	hour	8	$46.51	$372.08
Trailer, lowboy, 50 ton, 3 axle (T45XX016)	hour	8	$8.70	$69.59
			Equipment Total:	$1,394.94

Materials

Item	Unit	Quantity	Unit Price[4, 5]	Extension
SUR-MARK II Marker Buoy (P/N: TMP46103)	EA	2	$129.95	$259.90
SUR-MARK Buoy Labels (P/N: various)	EA	2	$15.98	$31.95
Seachoice Mushroom Anchor (P/N: 41260)	EA	2	$26.06	$52.12
1/4" Galvanized Anchor Chain (P/N: 50074734)	FT	12	$1.31	$15.69
1/4" Galvanized Anchor Shackle (P/N: 43050)	EA	4	$0.97	$3.88
Portage Treminus Sign, 30" x 30", reflectorized[6.]	EA	2	$72.86	$145.72
Steel Posts, galvanized, 10'-0" upright, bolted[7.]	EA	4	$14.73	$58.90
			Materials Total:	$568
			Total Direct Costs:	$3,200
			Contractor Overhead (10%)	$320
			Contractor Profit (10%)	$352
			Contingency (10%)	$387
			Total Estimated Cost:	**$4,260**

(Continued)

(Concluded)

Notes:

[1] Davis-Bacon Wage Determination for Lewis and St. Lawrence Counties NY030010 10/06/2006 NY10.
[2] USACE EP 1110-1-8 (31 July 2005).
[3] Unit prices have been escalated from July 2005 to October 2006 using ENR cost index (7883/7422).
[4] Unit prices do not include sales tax. It is assumed that purchasing entity will be sales tax exempt.
[5] Unit prices do not include shipping costs. It is assumed that items will be purchased in a large enough quantity to qualify for free shipping from the vendor(s).
[6] RS Means 02890 100 0300; unit price escalated from Dec 2003 to October 2006 using ENR cost index (7883/7682).
[7] RS Means 02890 100 1500; unit price escalated from Dec 2003 to October 2006 using ENR cost index (7883/7682).

Assumptions:

1. Two Power Equipment Operators using a hydraulic excavator and a bulldozer can clear and shape the portage shoreline access points and the connecting trail in an 8-hour day. A laborer with a chainsaw will cut trees as needed.
2. A total of two (2) warning buoys will be installed at each portage location. One warning buoy upstream of the river obstruction and one warning buoy downstream of the river obstruction.
3. An average of 6 feet of anchor chain will be sufficient to secure the channel marker buoys to the buoy anchors.
4. A total of two (2) signs will be installed on the shoreline, one at each end of the portage.
5. Installation of warning buoys at any portage location will included mobilization to the portage site, launching a rowboat or canoe, installing two (2) channel marker buoys, loading a rowboat or canoe onto a trailer, installation of two (2) portage terminus signs on the shoreline and demobilization from the site.
6. For safety concerns, the channel marker buoy and shoreline signage installation crew will consist of two (2) laborers.
7. The two-person channel marker buoy and shoreline signage installation crew can install marker buoys and shoreline signage at one hazard location in 6 hours.
8. This cost estimate includes the initial installation costs only. It does not include any design, permitting, operation, maintenance or replacement costs.
9. This cost estimate does not include any costs for securing real estate rights of entry, or for the purchase of real estate.
10. Sufficient suitable soil materials exist on site; i.e., soil cut to fill is in balance.

Remove Piles & Install Channel Marker Buoys (per hazard location)

Labor

Item	Unit	Quantity	Unit Price	Extension
Power Equipment Operator[1]	manhour	8	$44.20	$353.60
Laborer - unskilled[1]	manhour	8	$27.13	$217.04
Diver[1a]	manhour	8	$51.31	$410.46
Standby Diver[1a]	manhour	8	$36.67	$293.36
Truck Driver[1]	manhour	4	$23.97	$95.88
			Labor Total:	$1,370.33

Equipment

Item[2]	Unit	Quantity	Unit Price[3]	Extension
Dive equipment - assume 20% of dive labor	lump sum	1	$140.76	$140.76
Pneumatic chainsaw	hour	8	$8.10	$64.80
Air compressor, 300 CFM, 150 PSI (A15IA002)	hour	8	$18.70	$149.63
Air hose, 0.75", 100' (A20XX001)	hour	16	$1.03	$16.48
Tractor, Crawler Dozer, D-6R (T15CA023)	hour	8	$85.55	$684.43
Power winch w/cable for D6 (T10CA011)	hour	8	$7.80	$62.37
Truck, Highway, Conventional, 1/2 ton pickup, 4x2 (T50XX001)	hour	16	$8.54	$136.63
Marine Equipment, Boats & Launches, 13' Runabout, 5' Beam, Outboard Engine (M10XX009)	hour	8	$10.38	$83.01
Truck Trailer, Miscellaneous/Utility, Tilt Bed, 12-ton, 2 axle (T45XX026)	hour	8	$3.21	$25.66
Truck, Highway, 75,000 lbs GVW (T50XX031)	hour	4	$46.51	$186.04
Trailer, lowboy, 50 ton, 3 axle (T45XX016)	hour	4	$8.70	$34.79
			Equipment Total:	$1,584.61

Materials

Item	Unit	Quantity	Unit Price[4, 5]	Extension
SUR-MARK II Marker Buoy (P/N: TMP46103)	EA	3	$129.95	$389.85
SUR-MARK Buoy Labels (P/N: various)	EA	3	$15.98	$47.93
Seachoice Mushroom Anchor (P/N: 41260)	EA	3	$26.06	$78.18
1/4" Galvanized Anchor Chain (P/N: 50074734)	FT	18	$1.31	$23.54
1/4" Galvanized Anchor Shackle (P/N: 43050)	EA	6	$0.97	$5.83
			Materials Total:	$545
			Total Direct Costs:	$3,500
			Contractor Overhead (10%)	$350
			Contractor Profit (10%)	$385
			Contingency (25%)	$1,059
			Total Estimated Cost:	**$5,294**

(Continued)

(Concluded)

Notes:

[1] Davis-Bacon Wage Determination for Lewis and St. Lawrence Counties NY030010 10/06/2006 NY10.

[1a] Davis-Bacon Wage Determination for New York NY030001 09/29/2006.

[2] USACE EP 1110-1-8 (31 July 2005).

[3] Unit prices have been escalated from July 2005 to October 2006 using ENR cost index (7883/7422).

[4] Unit prices do not include sales tax. It is assumed that purchasing entity will be sales tax exempt.

[5] Unit prices do not include shipping costs. It is assumed that items will be purchased in a large enough quantity to qualify for free shipping from the vendor(s).

Assumptions:

1. One diver using self-contained underwater breathing apparatus will enter the water from a rowboat or canoe and cut the timber piles using a pneumatic chainsaw. The diver will attach a winch cable to the cut pile so it can be winched to shore.
2. One stand-by diver will assist the diver and affect a rescue should one be necessary.
3. One power equipment operator will operate the air compressor on shore for the pneumatic chainsaw and will operate dozer w/ winch to winch the cut piles to shore.
4. One laborer will assist the divers and the power equipment operator as needed.
5. Sufficient number of piles can be removed by selected crew during an 8-hour work day. Installation of channel marker buoys is incidental to pile removal.
6. Pneumatic chainsaw hourly operating rate was estimated based on a 6 HP Timberking 17" Pneumatic chainsaw with a purchase price of $1,900.00 US. Purchase price - hourly rate ratio ($596/$2.54) of Olympyk 6 HP chainsaw (EP 1110-1-8 C05OL004) was applied.
7. Assumes that cut piles can be left on site or disposed of at no cost.
8. A total of three (3) channel marker buoys will be installed at each hazard location. One warning marker buoy upstream of the hazard, one hazard marker buoy at the hazard location, and one warning buoy downstream of the hazard.
9. This cost estimate includes the initial installation costs only. It does not include any design, permitting, operation, maintenance or replacement costs.

Partial Dam / Debris Removal Cost Estimate (per hazard location)

Labor

Item	Unit	Quantity	Unit Price	Extension
Laborer - unskilled (LABO0322-002)[1]	manhour	16	$27.13	$434.08
Power Equipment Operator[1]	manhour	16	$44.20	$707.20
Truck Driver[1]	manhour	24	$23.97	$575.28
			Labor Total:	$1,716.56

Equipment

Item[2]	Unit	Quantity	Unit Price[3]	Extension
Miscellaneous hand tools - assume 10% of labor	lump sum	1	$171.66	$171.66
Hydraulic excavator, crawler, 43,800 lbs., 1.50 CY bucket, 21.75' max digging, 320C (H25CA022)	hour	16	$47.41	$758.60
Hydraulic excavator, attachment, material handling grapple, 3.50 cy, 4-tine / 5-tine (add 45,000 lb hydraulic excavator)	hour	8	$6.92	$55.40
Marine Equipment, Boats & Launches, 13' Runabout, 5' Beam, Outboard Engine (M10XX009)	hour	8	$10.38	$83.01
Truck, Highway, Conventional, 1/2 ton pickup, 4x2 (T50XX001)	hour	8	$8.54	$68.32
Truck Trailer, Miscellaneous/Utility, Tilt Bed, 12-ton, 2 axle (T45XX026)	hour	8	$3.21	$25.66
Truck, highway, 70,000 lbs GVW, 2 axle, 6x6 (chassis only - add options)(T50XX030)	hour	16	$44.31	$708.98
Truck options, dump body, rear, 16 - 23.5 cy dump body (w/hoist)(add 36,000 GVW truck)	hour	16	$2.49	$39.77
Truck, Highway, 75,000 lbs GVW (T50XX031)	hour	8	$46.51	$372.08
Trailer, lowboy, 50 ton, 3 axle (T45XX016)	hour	8	$8.70	$69.59
			Equipment Total:	$2,353.07

Materials

Item	Unit	Quantity	Unit Price[4, 5]	Extension
6-inch stone from local quarry (delivered)	ton	100	$25.00	$2,500.00
SUR-MARK II Marker Buoy (P/N: TMP46103)	EA	3	$129.95	$389.85
SUR-MARK Buoy Labels (P/N: various)	EA	3	$15.98	$47.93
Seachoice Mushroom Anchor (P/N: 41260)	EA	3	$26.06	$78.18
1/4" Galvanized Anchor Chain (P/N: 50074734)	FT	18	$1.31	$23.54
1/4" Galvanized Anchor Shackle (P/N: 43050)	EA	6	$0.97	$5.83
			Materials Total:	$3,045
			Total Direct Costs:	$7,115
			Contractor Overhead (10%)	$711
			Contractor Profit (10%)	$783
			Contingency (20%)	$1,722
			Total Estimated Cost:	**$10,331**

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(Concluded)

Notes:

[1] Davis-Bacon Wage Determination for Lewis and St. Lawrence Counties NY030010 10/06/2006 NY10

[2] USACE EP 1110-1-8 (31 July 2005).

[3] Unit prices have been escalated from July 2005 to October 2006 using ENR cost index (7883/7422).

[4] Unit prices do not include sales tax. It is assumed that purchasing entity will be sales tax exempt.

[5] Unit prices do not include shipping costs, unless otherwise noted. It is assumed that items will be purchased in a large enough quantity to qualify for free shipping from the vendor(s).

Assumptions:

1. Two Power Equipment Operators using hydraulic excavators, one equipped with a bucket and the other equipped with a grapple, can remove / excavate sufficient material from the channel during an 8-hour day.
2. Imported stone will be used to ramp access for hydraulic excavators to get to river obstruction. Stone will be removed at completion of excavation / removal.
3. Two laborers will cut and handle timber and metal debris to facilitate removal. Laborers will also direct / spot dump trucks for loading of excavated material.
4. Excavated material will be hauled to another location on site, or off site, and dumped. Assume no cost for disposal of excavated / removed material.
5. A total of three (3) channel marker buoys will be installed at each hazard location. One warning marker buoy upstream of the hazard, one hazard marker buoy at the hazard location, and one warning buoy downstream of the hazard.
6. An average of 6 feet of anchor chain will be sufficient to secure the channel marker buoys to the buoy anchors.
7. This cost estimate includes the initial installation costs only. It does not include any design, permitting, operation, maintenance or replacement costs.
8. This cost estimate does not include any costs for securing real estate rights of entry, or for the purchase of real estate.

Excavate Shoals, Boulders, Rock (per hazard location)

Labor

Item	Unit	Quantity	Unit Price	Extension
Laborer - unskilled (LABO0322-002)[1.]	manhour	16	$27.13	$434.08
Power Equipment Operator[1]	manhour	8	$44.20	$353.60
Truck Driver[1]	manhour	4	$23.97	$95.88
			Labor Total:	$883.56

Equipment

Item[2]	Unit	Quantity	Unit Price[3]	Extension
Hydraulic excavator, crawler, 43,800 lbs., 1.50 CY bucket, 21.75' max digging, 320C (H25CA022)	hour	8	$47.41	$379.30
Marine Equipment, Boats & Launches, 13' Runabout, 5' Beam, Outboard Engine (M10XX009)	hour	8	$10.38	$83.01
Truck, Highway, Conventional, 1/2 ton pickup, 4x2 (T50XX001)	hour	8	$8.54	$68.32
Truck Trailer, Miscellaneous/Utility, Tilt Bed, 12-ton, 2 axle (T45XX026)	hour	8	$3.21	$25.66
Truck, Highway, 75,000 lbs GVW (T50XX031)	hour	4	$46.51	$186.04
Trailer, lowboy, 50 ton, 3 axle (T45XX016)	hour	4	$8.70	$34.79
			Equipment Total:	$777.13

Materials

Item	Unit	Quantity	Unit Price[4, 5]	Extension
SUR-MARK II Marker Buoy (P/N: TMP46103)	EA	3	$129.95	$389.85
SUR-MARK Buoy Labels (P/N: various)	EA	3	$15.98	$47.93
Seachoice Mushroom Anchor (P/N: 41260)	EA	3	$26.06	$78.18
1/4" Galvanized Anchor Chain (P/N: 50074734)	FT	18	$1.31	$23.54
1/4" Galvanized Anchor Shackle (P/N: 43050)	EA	6	$0.97	$5.83
			Materials Total:	$545
			Total Direct Costs:	$2,206
			Contractor Overhead (10%)	$221
			Contractor Profit (10%)	$243
			Contingency (20%)	$534
			Total Estimated Cost:	**$3,203**

(Continued)

(Concluded)

Notes:

[1] Davis-Bacon Wage Determination for Lewis and St. Lawrence Counties NY030010 10/06/2006 NY10.

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[3] Unit prices have been escalated from July 2005 to October 2006 using ENR cost index (7883/7422).

[4] Unit prices do not include sales tax. It is assumed that purchasing entity will be sales tax exempt.

[5] Unit prices do not include shipping costs, unless otherwise noted. It is assumed that items will be purchased in a large enough quantity to qualify for free shipping from the vendor(s).

Assumptions:

1. One Power Equipment Operator using a hydraulic excavator equipped with a bucket can excavate sufficient shoal material from the channel during an 8-hour day. Direct access to the obstruction by the excavator will be possible during low flow conditions.
2. Excavated shoal material can be sidecast on the shoreline. Assume no cost for hauling and disposal of excavated shoal material.
3. A total of three (3) channel marker buoys will be installed at each hazard location. One warning marker buoy upstream of the hazard, one hazard marker buoy at the hazard location, and one warning buoy downstream of the hazard.
6. An average of 6 feet of anchor chain will be sufficient to secure the channel marker buoys to the buoy anchors.
7. This cost estimate includes the initial installation costs only. It does not include any design, permitting, operation, maintenance or replacement costs.
8. This cost estimate does not include any costs for securing real estate rights of entry, or for the purchase of real estate.

Fracture Rock In Place (per hazard location)

Labor

Item	Unit	Quantity	Unit Price	Extension
Laborer - unskilled (LABO0322-002)[1]	manhour	16	$27.13	$434.08
Power Equipment Operator[1]	manhour	8	$44.20	$353.60
Truck Driver[1]	manhour	4	$23.97	$95.88
			Labor Total:	$883.56

Equipment

Item[2]	Unit	Quantity	Unit Price[3]	Extension
Hydraulic excavator, crawler, 43,800 lbs., 1.50 CY bucket, 21.75' max digging, 320C (H25CA022)	hour	8	$47.41	$379.30
Hammer, hydraulic, 5500 ft-lbs, impact frequency 500 BPM (add 28-43 ton hydraulic excavator)(H10NP016)	hour	8	$31.50	$252.02
Marine Equipment, Boats & Launches, 13' Runabout, 5' Beam, Outboard Engine (M10XX009)	hour	8	$10.38	$83.01
Truck, Highway, Conventional, 1/2 ton pickup, 4x2 (T50XX001)	hour	8	$8.54	$68.32
Truck Trailer, Miscellaneous/Utility, Tilt Bed, 12-ton, 2 axle (T45XX026)	hour	8	$3.21	$25.66
Truck, Highway, 75,000 lbs GVW (T50XX031)	hour	4	$46.51	$186.04
Trailer, lowboy, 50 ton, 3 axle (T45XX016)	hour	4	$8.70	$34.79
			Equipment Total:	$1,029.14

Materials

Item	Unit	Quantity	Unit Price[4, 5]	Extension
SUR-MARK II Marker Buoy (P/N: TMP46103)	EA	3	$129.95	$389.85
SUR-MARK Buoy Labels (P/N: various)	EA	3	$15.98	$47.93
Seachoice Mushroom Anchor (P/N: 41260)	EA	3	$26.06	$78.18
1/4" Galvanized Anchor Chain (P/N: 50074734)	FT	18	$1.31	$23.54
1/4" Galvanized Anchor Shackle (P/N: 43050)	EA	6	$0.97	$5.83
			Materials Total:	$545
			Total Direct Costs:	$2,458
			Contractor Overhead (10%)	$246
			Contractor Profit (10%)	$270
			Contingency (20%)	$595
			Total Estimated Cost:	**$3,569**

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(Concluded)

Notes:

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[3] Unit prices have been escalated from July 2005 to October 2006 using ENR cost index (7883/7422).

[4] Unit prices do not include sales tax. It is assumed that purchasing entity will be sales tax exempt.

[5] Unit prices do not include shipping costs, unless otherwise noted. It is assumed that items will be purchased in a large enough quantity to qualify for free shipping from the vendor(s).

Assumptions:

1. One Power Equipment Operator using a hydraulic excavator equipped with a hydraulic hammer can fracture sufficient material in the channel during an 8-hour day. Direct access to the obstruction by the excavator will be possible during low flow conditions.
2. Fractured material will be dispersed along the riverbed. Assume no cost for hauling and disposal of fractured material.
3. A total of three (3) channel marker buoys will be installed at each hazard location. One warning marker buoy upstream of the hazard, one hazard marker buoy at the hazard location, and one warning buoy downstream of the hazard.
4. An average of 6 feet of anchor chain will be sufficient to secure the channel marker buoys to the buoy anchors.
5. This cost estimate includes the initial installation costs only. It does not include any design, permitting, operation, maintenance or replacement costs.
6. This cost estimate does not include any costs for securing real estate rights of entry, or for the purchase of real estate.

River Training Structure 2-foot (per hazard location)				
Labor				
Item	Unit	Quantity	Unit Price	Extension
Laborer - unskilled (LABO0322-002)[1]	manhour	24	$27.13	$651.12
Power Equipment Operator[1]	manhour	16	$44.20	$707.20
Truck Driver[1]	manhour	4	$23.97	$95.88
			Labor Total:	$1,454.20
Equipment				
Item[2]	Unit	Quantity	Unit Price[3]	Extension
Hydraulic excavator, crawler, 43,800 lbs., 1.50 CY bucket, 21.75' max digging, 320C (H25CA022)	hour	16	$47.41	$758.60
Marine Equipment, Boats & Launches, 13' Runabout, 5' Beam, Outboard Engine (M10XX009)	hour	8	$10.38	$83.01
Truck, Highway, Conventional, 1/2 ton pickup, 4x2 (T50XX001)	hour	16	$8.54	$136.63
Truck Trailer, Miscellaneous/Utility, Tilt Bed, 12-ton, 2 axle (T45XX026)	hour	8	$3.21	$25.66
Truck, Highway, 75,000 lbs GVW (T50XX031)	hour	4	$46.51	$186.04
Trailer, lowboy, 50 ton, 3 axle (T45XX016)	hour	4	$8.70	$34.79
			Equipment Total:	$1,224.74
Materials				
Item	Unit	Quantity	Unit Price[4, 5]	Extension
6-inch stone from local quarry (delivered)[6]	ton	50	$25.00	$1,250.00
SUR-MARK II Marker Buoy (P/N: TMP46103)	EA	3	$129.95	$389.85
SUR-MARK Buoy Labels (P/N: various)	EA	3	$15.98	$47.93
Seachoice Mushroom Anchor (P/N: 41260)	EA	3	$26.06	$78.18
1/4" Galvanized Anchor Chain (P/N: 50074734)	FT	18	$1.31	$23.54
1/4" Galvanized Anchor Shackle (P/N: 43050)	EA	6	$0.97	$5.83
			Materials Total:	$1,795
			Total Direct Costs:	$4,474
			Contractor Overhead (10%)	$447
			Contractor Profit (10%)	$492
			Contingency (20%)	$1,083
			Total Estimated Cost:	**$6,497**
				(Continued)

(Continued)

Notes:

[1] Davis-Bacon Wage Determination for Lewis and St. Lawrence Counties NY030010 10/06/2006 NY10.

[2] USACE EP 1110-1-8 (31 July 2005).

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[4] Unit prices do not include sales tax. It is assumed that purchasing entity will be sales tax exempt.

[5] Unit prices do not include shipping costs, unless otherwise noted. It is assumed that items will be purchased in a large enough quantity to qualify for free shipping from the vendor(s).

[6] Unit price is based on estimator's judgment.

Assumptions:

1. River training structure will consist of a v-shaped rock weir, extending approximately 50 feet from each shoreline downstream at an oblique angle into the river. The minimum separation distance between the downstream ends of the weir will be established during final design.
2. River training structures will be constructed of 6-inch and larger rock, have a trapezoidal cross section 2-feet high, with a 2-foot top width. Side slopes will be 1H:1V.
3. Equipment access to the river training structure location will be from the shore(s).
4. One Power Equipment Operator using a hydraulic excavator equipped with a bucket can place the river training structure during two 8-hour days. Direct access to the river training structure alignment by the excavator will be possible during low flow conditions.
5. A total of three (3) channel marker buoys will be installed at each river training structure location. One warning marker buoy upstream of the structure, one hazard marker buoy at the structure location, and one warning buoy downstream of the structure.
6. An average of 6 feet of anchor chain will be sufficient to secure the channel marker buoys to the buoy anchors.
7. This cost estimate includes the initial installation costs only. It does not include any design, permitting, operation, maintenance or replacement costs.
8. This cost estimate does not include any costs for securing real estate rights of entry, or for the purchase of real estate.

River Training Structure 4-foot (per hazard location)

Labor

Item	Unit	Quantity	Unit Price	Extension
Laborer - unskilled (LABO0322-002)[1]	manhour	32	$27.13	$868.16
Power Equipment Operator[1]	manhour	24	$44.20	$1,060.80
Truck Driver[1]	manhour	4	$23.97	$95.88

Equipment

Item[2]	Unit	Quantity	Unit Price[3]	Extension
Hydraulic excavator, crawler, 43,800 lbs., 1.50 CY bucket, 21.75' max digging, 320C (H25CA022)	hour	24	$47.41	$1,137.90
Marine Equipment, Boats & Launches, 13' Runabout, 5' Beam, Outboard Engine (M10XX009)	hour	8	$10.38	$83.01
Truck, Highway, Conventional, 1/2 ton pickup, 4x2 (T50XX001)	hour	24	$8.54	$204.95
Truck Trailer, Miscellaneous/Utility, Tilt Bed, 12-ton, 2 axle (T45XX026)	hour	8	$3.21	$25.66
Truck, Highway, 75,000 lbs GVW (T50XX031)	hour	4	$46.51	$186.04
Trailer, lowboy, 50 ton, 3 axle (T45XX016)	hour	4	$8.70	$34.79
			Equipment Total:	$1,672.36

Materials

Item	Unit	Quantity	Unit Price[4, 5]	Extension
6-inch stone from local quarry (delivered)[6]	ton	100	$25.00	$2,500.00
SUR-MARK II Marker Buoy (P/N: TMP46103)	EA	3	$129.95	$389.85
SUR-MARK Buoy Labels (P/N: various)	EA	3	$15.98	$47.93
Seachoice Mushroom Anchor (P/N: 41260)	EA	3	$26.06	$78.18
1/4" Galvanized Anchor Chain (P/N: 50074734)	FT	18	$1.31	$23.54
1/4" Galvanized Anchor Shackle (P/N: 43050)	EA	6	$0.97	$5.83
			Materials Total:	$3,045
			Total Direct Costs:	$6,743
			Contractor Overhead (10%)	$674
			Contractor Profit (10%)	$742
			Contingency (20%)	$1,632
			Total Estimated Cost:	**$9,790**

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(Concluded)

Notes:

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[5] Unit prices do not include shipping costs, unless otherwise noted. It is assumed that items will be purchased in a large enough quantity to qualify for free shipping from the vendor(s).
[6] Unit price is based on estimator's judgment.

Assumptions:

1. River training structure will consist of a v-shaped rock weir, extending approximately 50 feet from each shoreline downstream at an oblique angle into the river. The minimum separation distance between the downstream ends of the weir will be established.
2. River training structures will be constructed of 6-inch and larger rock, have a trapezoidal cross section 4-feet high, with a 4-foot top width. Side slopes will be 1H:1V.
3. Equipment access to the river training structure location will be from the shore(s).
4. One Power Equipment Operator using a hydraulic excavator equipped with a bucket can place the river training structure during three 8-hour days. Direct access to the river training structure alignment by the excavator will be possible during low flow conditions.
5. A total of three (3) channel marker buoys will be installed at each river training structure location. One warning marker buoy upstream of the structure, one hazard marker buoy at the structure location, and one warning buoy downstream of the structure.
6. An average of 6 feet of anchor chain will be sufficient to secure the channel marker buoys to the buoy anchors.
7. This cost estimate includes the initial installation costs only. It does not include any design, permitting, operation, maintenance or replacement costs.
8. This cost estimate does not include any costs for securing real estate rights of entry, or for the purchase of real estate.

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