United States Department of Agriculture
**Natural Resources Conservation Service**

***CONNECTICUT***

## Steele Brook Watershed

# Heminway Pond Dam Removal Feasibility Analysis

*Watertown, Connecticut*

**June 2009**

***Helping People Help the Land***



**CT-TP-2009-2**

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# Steele Brook Watershed

# Heminway Pond
# Dam Removal Feasibility Analysis

## Watertown, Connecticut

(DEP-NRCS Agreement No. 67-1106-7-17)

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CT-TP-2009-2
June 2009

# EXECUTIVE SUMMARY

The purpose of the Heminway Pond Dam Removal Feasibility Analysis is to evaluate options to meet four primary goals for Steele Brook in Watertown, CT. The four primary goals are:

1. Water quality improvement in Heminway Pond and Steele Brook downstream of Heminway Pond Dam
2. Improve fish passage through the dam and pond area
3. Remove liability of an aged dam from the Town of Watertown
4. Encourage incorporation of this project with a larger Town greenway project

The primary objective for achieving these goals would be to modify the existing dam and pond area by means of removing all or part of the dam or providing a bypass channel around the dam. The feasibility of each alternative was assessed with respect to ecological resources including fisheries, wetlands, and wildlife, water quality, hydrology and hydraulics, sediment, infrastructure, sociologic issues and recreation, and cultural and historic resources.

Heminway Pond Dam is owned by the Town of Watertown. It is a dam on Steele Brook and is located just upstream of Echo Lake Road in Watertown, CT adjacent to Deland Field and Heminway Park School. The dam currently restricts fish passage in Steele Brook, creates a pond with increased water temperatures and high bacteria levels due to high geese populations, and encourages deposition of iron precipitate in the stream channel just downstream of the dam.

Four primary alternatives for achieving the project goals are presented in this Feasibility Analysis. The four alternatives are:

1. No Action
2. Leave dam in place and provide a bypass channel capable of fish migration
3. Notch the spillway and provide a ramp capable of fish migration
4. Full removal of the spillway

Alternative 1: No Action does not achieve the project goal of water quality improvement in Heminway Pond and Steele Brook, does not achieve the goal of improved fish passage through the dam and pond area, does not remove the liability of an aged dam from the Town, and is a less favorable option to incorporate this project with the Town greenway project. This alternative was used as a baseline for comparing the affects of the other alternatives. The cost estimate for this alternative is $0.00. However, there would be additional future costs related to maintenance and liability of the dam for the Town. Also, the ecological costs will be large due to the continued water quality concerns and lack of fish passage in this portion of Steele Brook.

Alternative 2: Bypass Channel does not achieve the project goal of water quality improvement in Heminway Pond and Steele Brook, marginally achieves the goal of improved fish passage through the dam and pond area, does not remove the liability of an aged dam from the Town, and is a less favorable option to incorporate this project with the Town greenway project. A cost estimate was not created for this alternative due to the fact that it does not achieve or only marginally achieves the project goals. Although technically a feasible option, this alternative will not produce the desired results based on the stated project goals.

Alternative 3: Partial Removal with Fish Ramp substantially achieves the project goal of water quality improvement in Heminway Pond and Steele Brook, substantially achieves the goal of improved fish passage through the dam and pond area, substantially achieves the goal of removing the liability of an aged dam from the Town, although a portion of the dam will remain in place and be fortified, and is a more favorable option to incorporate this project with the Town greenway project. The cost estimate for this alternative is $500,000.00.

Alternative 4: Full Removal of Spillway substantially achieves the project goal of water quality improvement in Heminway Pond and Steele Brook, substantially achieves the goal of improved fish passage through the dam and pond area, substantially achieves the goal of removing the liability of an aged dam from the Town, and is a more favorable option to incorporate this project with the Town greenway project. The cost estimate for this alternative is $1,100,000.00. Depending on the quantity of sediment that can be utilized onsite, this cost estimate may be reduced to $700,000.00.

The preferred alternative is Alternative 4: Full Removal of Spillway based on its ability to achieve the project goals and also maximize the environmental benefits associated with the project. This alternative appears to be the highest alternative in terms of cost, but cost should only be one facet to look at in the project. The added benefits of the full removal option outweigh the additional cost.

The project partners for the completion of this study includes: United States Department of Agriculture, Natural Resources Conservation Service, Connecticut Department of Environmental Protection, Town of Watertown, Watertown Fire District, Watertown Land Trust, Council of Governments of the Central Naugatuck Valley, The Siemon Company, and American Rivers. The Feasibility Analysis was completed by the United States Department of Agriculture, Natural Resources Conservation Service based in Tolland, Connecticut.

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# INTRODUCTION

## Project Description and History

Heminway Pond is an impoundment on Steele Brook within the town of Watertown, CT. It was originally constructed to supply water for a thread/string mill. The impoundment no longer has industrial use as manufacturing operations at the mill have since ceased and current adjacent businesses do not require the impoundment for water supply. The impoundment is mostly shallow with maximum depths around 4 feet. The backwater area of the pond is approximately 5.5 acres in size. The pond's location is along Steele Brook upstream of Echo Lake Road. It is adjacent to Deland Field and Heminway Park School. Significant amounts of sediment have entered the pond area and settled behind the impoundment.

The pond was last owned by The Siemon Company prior to the Town of Watertown taking ownership in 2007. The pond serves little to no purpose for local business and industry. The pond area is seen as a potential site for future active and passive recreation.

Portions of Steele Brook have been on the Connecticut Department of Environmental Protection's list of impaired water bodies since 2002. In the area directly downstream of Heminway Pond the water quality does not meet water quality standards. Between the dam and Echo Lake Road there is a major local impact to water quality through iron precipitate settlement during low flow periods. There has been a concern in this area due to orange discoloration of the water, turbidity, and loss of habitat caused by flocculation. Partial or full removal of the dam is seen as one solution to improving the water quality and therefore improving habitat in the area downstream of Heminway Pond.

Heminway Pond poses a barrier to fish passage in the area. Although there are other fish barriers along Steele Brook and the brook does not support anadromous fish passage at this time, resident fish passage is obtainable in this reach and is very beneficial to a thriving ecosystem.

The Heminway Pond Feasibility Analysis is being completed as an appendix to a larger scale Watershed Based Plan for Steele Brook Watershed. The purpose of this Feasibility Analysis is to evaluate means to achieve project goals as set forth by the Connecticut Department of Environmental Protection and other project partners through a Section 319 Grant under the Clean Water Act. These project goals include an improvement in water quality downstream of the dam and the restoration of fish passage in Steele Brook Watershed. The alternatives presented in the study were evaluated with respect to their ability to achieve the project goals as well as their potential impacts to the surrounding resources.

Potential impacts to the following resources, also named affected environments, were evaluated as part of this Feasibility Analysis:

- Ecological (including Fisheries, Wetlands, and Wildlife)
- Water Quality
- Hydrology and Hydraulics
- Sediment
- Infrastructure
- Sociologic Issues and Recreational Use
- Cultural and Historic Resources

The project partners for the completion of this study includes: United States Department of Agriculture, Natural Resources Conservation Service, Connecticut Department of Environmental Protection, Town of Watertown, Watertown Fire District, Watertown Land Trust, Council of Governments of the Central Naugatuck Valley, The Siemon Company, and American Rivers. The Feasibility Analysis was completed by the United States Department of Agriculture, Natural Resources Conservation Service.

## Project Area History (Steele Brook Watershed, Watertown, CT)

Steele Brook has a long history within the Town of Watertown, CT. Much of the significance of this history revolves around the Heminway and Sons Silk Company located along Steele Brook in the area of Heminway Pond in Watertown. Figure 1 and Figure 2 show historic photographs of the Heminway & Sons Silk Factory built and operated along Steele Brook in the vicinity of Heminway Pond. Figure 3 is a photograph of Heminway Pond looking south toward the silk factories. These photo views were used as post cards around 1900. The Heminway family and their factories were the first to wind silk thread on spools in the world (Bartkus).

Steele Brook is the central watershed for the history of Watertown. Samuel or John Steele, who purchased the area of Mattatuck from the Indians, rented or sold some land to Edward Wooster of Derby who gathered or grew wild hops along the brook. The factories and mills are along the brook due to the power produced by the brook. Steele Brook is an essential part of the Town History. The dam at Heminway Pond most likely originated in the late 1830s to 1840s when Merrit Heminway took over the wagon shop to start spooling silk (Pillis).

Steele Brook runs parallel to Northfield Road and The Florence T. Crowell Trail that was dedicated in or around 2007. This trail follows the brook for about one quarter of a mile. At the end of the trail is where Jonathan Scott, in 1720, built the first grist mill where he ground corn for local farmers. He used the brook for water power. This building was used as a factory for many years. It burned in 1930. Soon after Jonathan built his mill, his brother, David built a saw mill on Steele Brook in the Oakville section of Watertown. That building was later sold to the owners of The Wheeler and Wilson Sewing Machine Company. They, in turn, sold it to The Seymour Smith Company. Other factories built along Steele Brook are Heminway and Son's Silk Company and The Oakville Pin Company. The brook is damned in multiple locations; For Jonathan Scott's mill, Heminway's Factory, David Scott's mill and The Oakville Pin (Crowell).

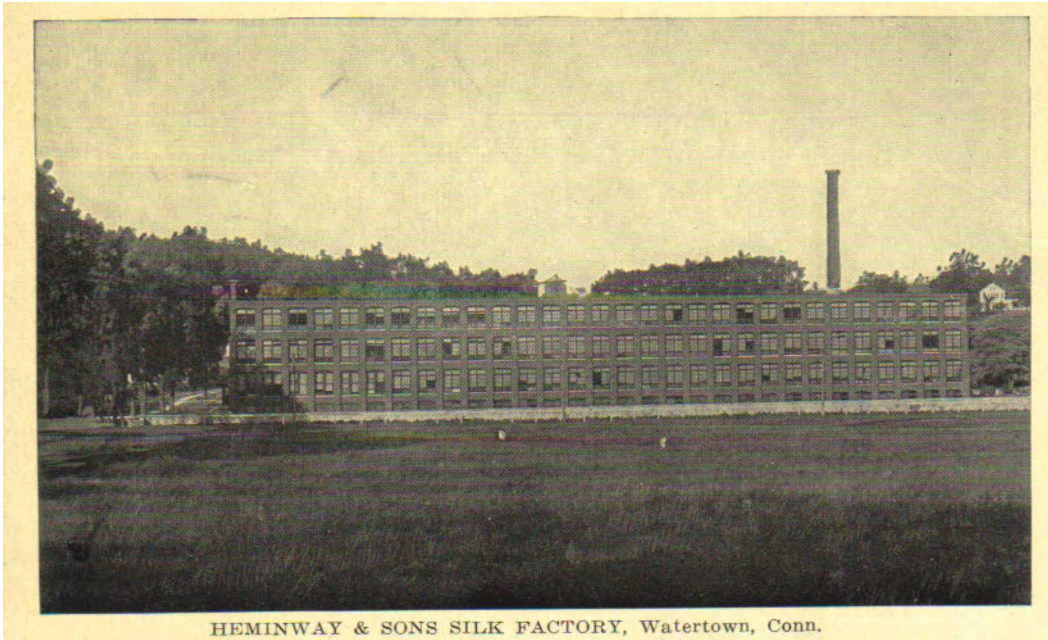


***Figure 1: Heminway & Sons Silk Factory, Watertown, CT.***
*(Photo courtesy of Mr. Stephen Bartkus)*


***Figure 2: Heminway & Sons Silk Factory, Watertown, CT.***
*(Photo courtesy of Mr. Stephen Bartkus)*

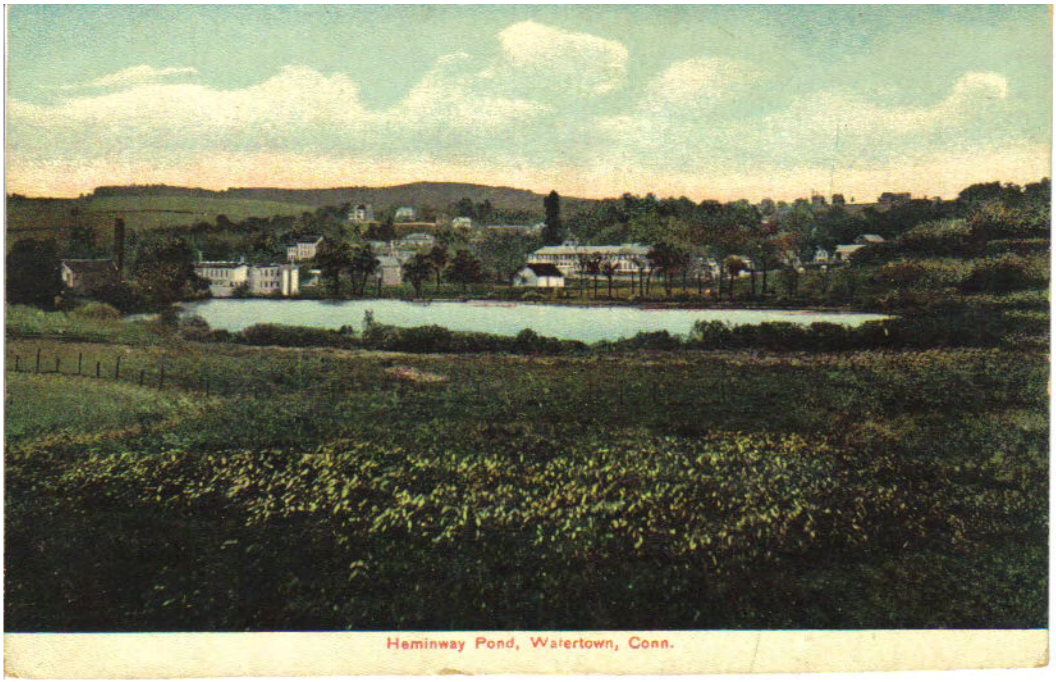


***Figure 3: View of Heminway Pond looking south, Watertown, CT.***
*(Photo courtesy of Mr. Stephen Bartkus)*

The rich history of Steele Brook and Heminway Pond is very apparent. The mills built along the brook provided employment and services to the Town and surrounding areas. Much of the history of the Town of Watertown revolves and was shaped by Steele Brook.

## Alternatives

The project partners asked NRCS to evaluate three alternatives in addition to the bench mark option of "No Action." These alternatives, therefore, included; (1) No Action, (2) Leaving the dam in place and providing a bypass channel capable of fish migration, (3) Notching the spillway and provide a ramp capable of fish migration, and (4) Full removal of the spillway. The four alternatives chosen represent an acceptable range of options for this study.

## Project Goals

There are many short and long term goals for this project ranging in scale from the pond area to town wide project goals. The removal of Heminway Pond is part of a larger, long term goal of a Town Greenway through Watertown linking the northern, rural areas of Watertown, Watertown Center, and Oakville.

The project goals for Heminway Pond are to provide a solution which accomplishes the following criteria; mitigate water quality concerns downstream of the dam, provide fish passage through the dam and pond area, remove liability of an aged dam from the Town, and encourage the creation of a greenway in this area of Watertown.

Portions of Steele Brook have been on the Connecticut Department of Environmental Protection's list of impaired water bodies since 2002. In the area directly downstream of Heminway Pond the water quality does not meet water quality standards. Between the dam and Echo Lake Road there is a major local impact to water quality through iron precipitate settlement during low flow periods. There has been a concern in this area due to orange discoloration of the water, turbidity, and loss of habitat caused by flocculation.

## Methods of Study

The purpose of the Feasibility Analysis as established by the project partners is to examine the feasibility of various alternatives to remove or partially remove the Heminway Pond Dam in order to improve water quality in the area directly downstream of the dam and also allow for restoring resident, and in the future, diadromous fish populations in Steele Brook. The process by which the Feasibility Analysis was evaluated is presented below.

The four alternatives investigated represented an acceptable range of projects involving both minor manipulation to the landscape and major removal operations. The alternatives include options to leave the dam in place and also fully remove the dam. The project partners were interested in the costs and effects of the range of alternatives.

The alternatives were evaluated using a wide range of factors. *Ecological* factors were considered including improvement of fisheries and wildlife and the protection of wetlands. *Water quality*, especially in the area between the dam and Echo Lake Road, was considered. Major changes in *hydrology and hydraulics* were evaluated. *Sediment* contained within the pond area was quantified and prior sediment sampling was evaluated. Potential impacts to adjacent *infrastructure* were evaluated. *Sociologic* factors evaluated in this study included recreational usage of Heminway Pond and other nearby areas along Steele Brook such as fishing and boating. *Cultural and Historic Resources*, including archaeological resources in the vicinity of the dam and the rock side channel, were also evaluated. A qualitative rating system was used and was based on the assignment of varying levels of intensity of those impacts and is described in detail in the Affected Environments and Other Considerations section of the analysis.

# AFFECTED ENVIRONMENTS AND OTHER CONSIDERATIONS

## Ecological Resources

There were three ecological resources evaluated for this study. These resources include fisheries, wetlands, and wildlife. There will be effects on all three resources for all of the alternatives presented.

### Fisheries

There are a number of fish species found in Steele Brook including Tessellated Darter (*Etheostoma olmstedi*), Black Nosed Dace (*Rhinichthys atratulus*), Creek Chub (*Semotilus atromaculatus*), Common Shiner (*Luxilus cornutus*), White Sucker (*Catostomus commersoni*), Red Breasted Sunfish (*Lepomis auritus*), Black Crappie (*Pomaxis annularis*), among others. Electrofishing surveys have also documented the presence of American Eel (*Anguilla rostrata*) in the watershed; however, they have not been found upstream of the Municipal Stadium sampling location. Brown Trout are also stocked in the brook. Stocking of Trout began in the spring of 2005. Fish community information has been collected at three locations since 2003. These locations are on the upstream side of the Route 6 Bridge, at Municipal Stadium, and at Echo Lake Road. Beginning in the spring of 2005, Brown Trout were stocked in two locations; upstream of the Route 6 Bridge and at Municipal Stadium. Additional stocking was completed at East Aurora Street and at West Street below the golf course in 2006 and 2007 respectively.

Water temperature data was also collected in 2003. Looking at a plot of the data, maximum summer temperature at the Municipal Stadium is about 23 degrees Celsius. At the same times that the Municipal Stadium location water temperature was 23 degrees, the Northfield Road location was 21-22 degrees Celsius. Ponding of water behind the dams, diminished riparian vegetation, and runoff from impervious surfaces are the principal contributors to the warmer water temperatures at the downstream location.

Based on the available data, fish abundance increases from upstream to downstream for more tolerant stream specialists, including the Blacknose Dace, Creek Chub, and the Common Shiner. Species richness, or the variety of fish species, tends to decline from upstream to downstream. This is not surprising given the upstream portion of the watershed is much less developed than the downstream portion. Water temperature also increases from upstream to downstream which would contribute to the declining richness of fish varieties. Survival of Brown Trout was much higher upstream of the Route 6 Bridge compared to at Municipal Stadium for all data years (2003-2007).

There is a healthier stream community upstream of the Heminway Pond dam influence for both fisheries and benthic life. Upstream of Route 6 water quality and physical habitat are superior to other locations downstream. In this area there is no influence from ponding, less development, and a wooded stream corridor contributing to enhanced habitat and cooler water temperatures compared to downstream locations. Over summer survival and year to year survival were quite impressive during the dates of testing. In 2007, ten yearling Brown Trout were captured in this location. The survival values seen in this portion of Steele Brook are not only exceptional for this particular brook but rank high compared to other streams statewide that are stocked with Brown Trout fry. Table 1 shows the numbers of fish in fish per kilometer for the different species found in Steele Brook. This table was reproduced using data provided by the CT DEP.

***Table 1: Abundance of Stream Species in Steele Brook (2003-2007).***
***(Data from CT DEP)***

Abundance of stream species (fish/km) at three standardized sampling sites in Steele Brook (2003 - 2007).

| Species | Rte 6 (upstream) | | | | | Echo Lake Rd to Dam | | | | | Municipal Stadium | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2003 | 2004 | 2005 | 2006 | 2007 | 2003 | 2004 | 2005 | 2006 | 2007 | 2003 | 2004 | 2005 | 2006 | 2007 |
| Smallmouth bass | | | | 6 | | NS | | | | | | NS | | | |
| Brown trout (stocked)* | | | 425 | 543 | 843 | | | | | | | | 56 | 312 | 248 |
| Blacknose dace | 890 | 1415 | 2037 | 675 | | | 1807 | 460 | | 102 | 2388 | | 5667 | 1156 | 3751 |
| Longnose dace | | | | | | | | | | | | | | | |
| Creek chub | 110 | 240 | 187 | 168 | | | 435 | 77 | | 141 | 171 | | 553 | 106 | 425 |
| Common Shiner | | | 6 | | | | 448 | | | 128 | 28 | | 14 | 14 | 7 |
| White sucker | 395 | 1460 | 1231 | 656 | | | 2217 | 1423 | | 423 | 57 | | 843 | 100 | 1099 |
| Tessellated darter | 110 | 416 | 512 | 118 | | | 51 | | | | | | 28 | 7 | 42 |
| American eel | | | | | | | | | | | 6 | | | | |
| Yellow perch | | 62 | | | | | 307 | 38 | | | | | | | |
| Largemouth bass | | 26 | | 18 | | | 64 | 25 | | 217 | 6 | | | 21 | |
| Redbreast sunfish | 25 | 9 | 19 | | | | 25 | | | 12 | | | | | |
| Bluegill sunfish | 30 | 9 | 12 | 18 | | | 192 | 346 | | 141 | | | 7 | | |
| Pumpkinseed sunfish | 50 | 71 | 6 | 6 | | | 282 | 167 | | 423 | | | | 7 | |
| Brown bullhead | 12 | | | | | | | 38 | | 64 | | | | | |
| Golden Shiner | | | | | | | 128 | 90 | | 38 | | | | | |

* - Brown trout fry were first stocked in the spring of 2005.

Looking closely at the data, we can see that in 2007 there were 248 Brown Trout per kilometer at the Municipal Stadium location but upstream of the Route 6 Bridge 843 Brown Trout per kilometer were present. Previous years show a comparable difference between the numbers of trout found in the upstream versus downstream locations. The Steele Brook Fisheries Summary completed by CT DEP is included in Appendix A.

The removal of barriers to fish passage, particularly dams, and the subsequent reduction in impounded water within Steele Brook will improve the connectivity of stream habitat, fish population and water quality and thereby increasing the species richness and resiliency throughout the basin.

**Wetlands**

Onsite wetland delineation was performed in April of 2008 in the Heminway Pond area by Lisa Krall and Margie Faber, Soil Scientists with the Natural Resources Conservation Service. Both Connecticut wetlands and Federal wetlands were identified during the delineation. Wetlands were delineated by making observations of soils, vegetation, and hydrology present at the site. The wetland areas were marked using a Garmin GPSmap76 equipped with a radio beacon receiver. The GPS marked points were then used to make a map of the wetland boundaries within the project area. A formal wetland delineation report and corresponding wetland boundary map can be found in Appendix C.

Two methodologies were followed for wetland delineations within the project area. First, Connecticut wetlands were identified in accordance with the Connecticut Inland Wetlands and Watercourses Act. Under this Act, wetlands are defined as "land including submerged land, which consists of any of the soil types designated as poorly drained, very poorly drained, alluvial and floodplain by the National Cooperative Soil Survey of the Natural Resources Conservation Service of the United States Department of Agriculture." Watercourses means "rivers, streams, brooks, waterways, lakes and ponds, marshes, swamps, bogs and all other bodies of water natural and artificial, vernal or intermittent, public or private, which are contained within, flow through or border upon the state or any portion thereof." Second, Federal wetlands were delineated in accordance with section 404 of the Clean Water Act. Under the federal system, wetlands are defined using the three parameter approach. Wetlands are required to exhibit the following: hydric soils, wetland hydrology and a dominance of hydrophytic vegetation. All Federal wetlands fall within the Connecticut state wetland boundary.

The site is located within and adjacent to the floodplain of the Steele Brook in Watertown, Connecticut. The area of observations included the floodplain along the west bank of Heminway Pond from the north side of Heminway Park. The northerly limit of observations was Knowlton Street and a line continuing west from Knowlton Street, across the Steele Brook, to the south edge of the residential lot off Steele Brook Road. Observations were made along the east bank the Steele Brook from Knowlton Street south to Echo Lake Road. Four distinct areas of wetlands are present within the project area; these include three areas of alluvial soils on the floodplain and an intermittent watercourse also on the floodplain. Figure 4 shows a photograph of a partially submerged wetland at the Northeast end of the pond.  This area classifies as both a Federal and Connecticut wetland.

***Figure 4: Partially submerged wetland at Northeast end of the pond.***

The floodplain and its accompanying alluvial soils represent most of the wetlands under the Connecticut definition.  Figure 5 is a map of the wetland boundaries in the vicinity of Heminway Pond.  Figure 6 shows a photograph representing the boundary between Connecticut and Federal Wetlands.  The blue ribbon marks the boundary between the Federal wetland which consists of hydric alluvial soils and the Connecticut wetlands consisting of moderately well drained alluvial soils.

*Figure 5: Heminway Pond Wetland Boundaries*

*Figure 6: Boundary between Federal and Connecticut wetlands.*

**Wildlife**

Wildlife in the area of Heminway Pond is typical of Connecticut wildlife near and in pond environments. A variety of waterfowl including ducks and geese can be seen on the pond and nearby baseball fields. Visiting suburban song birds also occupy the edge of the pond area. Warm water fish inhabit the pond area with bluegill, sunfish, and perch being the common varieties. A variety of invertebrates also are typically found in pond environments. These invertebrates can include dragonflies, mayflies, water striders, water boatman, and black flies. It can be expected that a variety of mammalian species are present including raccoons, opossums, deer, skunks, and on the edge of the water shrews. Table 2 shows a summary of inferred wildlife in and around Heminway Pond and Steele Brook. Information provided in this table was recreated from data in the draft Environmental Impact Evaluation for Steele Brook Flood Control Project completed by Baystate Environmental Consultants, inc. in 2004.

As of April 2008 there are no threatened and endangered species in the pond area. Nearby, to the northeast of the pond, there is an area of concern for threatened and endangered species as shown in Figure 7. This area is outside of the project area and the alternatives being studied will not result in any adverse affects to threatened and endangered species.

*Table 2: Summary of Inferred Wildlife in and Around Heminway Pond and Steele Brook*

| Common Name | Scientific Name |
|---|---|
| **MAMMALS** | |
| White Tailed Deer | *Odocoileus virginiana* |
| Opossum | *Didelphis virginiana* |
| Raccoon | *Procyon lotor* |
| Beaver | *Castor canadensis* |
| Woodchuck | *Marmota momax* |
| Deer Mouse | *Peromyscus maniculatus* |
| White footed mouse | *Peromyscus leucopus* |
| Grey Squirrel | *Sciurus carolinensis* |
| Eastern Chipmunk | *Tamias striatus* |
| Eastern Mole | *Scalopus aquitacus* |
| Eastern Cottontail | *Sylvilagus floridanus* |
| Meadow Vole | *Microtus pennsylvanicus* |
| Striped Skunk | *Mephitis mephitis* |
| Flying Squirrel | *Glaucomys spp.* |
| | |
| **HERPETILES** | |
| Green Frog | *Rana clamitans* |
| Bullfrog | *Rana catesbeiana* |
| Garter Snake | *Thamnophis sirtalis* |
| Northern Redbelly Snake | *Storeria occipitomaculata* |
| | |
| **AVIFAUNA** | |
| Great Blue Heron | *Ardea herodias* |
| Wild Turkey | *Meleagris gallopavo* |
| Blue Jay | *Cyanocitta cristata* |
| American Crow | *Corvus brachyrhynchos* |
| Robin | *Turdus migratorius* |
| Grackle | *Quiscalus quiscula* |
| Starling | *Sturnus vulgaris* |
| Northern Mocking Bird | *Mimus polyglottus* |
| Grey Catbird | *Dumetella caroliniensis* |
| Eastern Wood  Pewee | *Contopus virens* |
| Red Eyed Vireo | *Viero olivaceus* |
| Black Capped Chickadee | *Parus atricapillus* |
| Black Duck | *Anas rubripes* |
| Red Tailed Hawk | *Buteo jamaicaensis* |
| Downy Woodpecker | *Picoides pubescens* |
| American Goldfinch | *Carduelis pinus* |
| Mourning Dove | *Zenaida macroura* |
| Brown Thrasher | *Toxostoma rufum* |
| Field Sparrow | *Spizella pusilla* |


*Figure 7: Threatened and Endangered Species Map*

## Water Quality

Steele Brook is a high gradient stream originating in the forested area north of Watertown and flows southeasterly to its confluence with the Naugatuck River in Waterbury. The brook is designated as a Class A surface water from the headwaters to the former outfall of the Watertown Fire District sewage treatment plant upstream of Pin Shop Pond. Below this point, the brook is designated as a Class B surface water stream.

Portions of Steele Brook have been on the Connecticut Department of Environmental Protection's list of impaired water bodies since 2002 for not meeting Aquatic Life Goals. These Aquatic Life Goals are measures of the benthic macroinvertebrate community in the water body. Steele Brook, in this area, had poor benthic macroinvertebrate populations. In the area directly downstream of Heminway Pond the water quality does not meet water quality standards. Between the dam and Echo Lake Road there is a major local impact to water quality through iron precipitate settlement during low flow periods. There has been a concern in this area due to orange discoloration of the water, turbidity, and loss of habitat caused by flocculation.

There is a shift in macroinvertebrate communities which occurs below Heminway Pond in the vicinity of Echo Lake Road and extends to the mouth of Steele Brook. Sites upstream of Heminway Pond have good benthic macroinvertebrate communities and meet CT DEP Water Quality Standards.

The orange discoloration of the water exists during low flow periods in the area between the dam and Echo Lake Road. It was first observed at the outlet area of a pipe which drains from the baseball field adjacent to the pond area. Orange discoloration has also been witnessed in the bank area across from the ball field (east side of the channel) and in the rock lined channel to the west of the pond area. Figure 8 is a photograph portraying the orange discoloration in the channel downstream of the dam. Figure 9 is a photograph of the rock lined channel with orange discoloration.


***Figure 8: Steele Brook downstream of dam exhibiting high orange discoloration.***
(*Photograph courtesy of CT DEP)*

***Figure 9: Historic rock side channel exhibiting orange discoloration***

During the summer of 2001, CT DEP collected 8 rounds of ambient water chemistry from 6 sites from Route 6 to the mouth of the brook. Preliminary sediment grab samples and water chemistry were taken from 3 locations in Heminway Pond. The orange discoloration ends approximately at the end of the broken wall on the west bank of the brook. CT DEP has anecdotal evidence that the area occupied by the baseball field was once a landfill. There is also evidence that the area was at one time a wetland. Other water quality concerns, particularly elevated bacteria levels, exist within the basin. A TMDL (Total Maximum Daily Load) was developed for Steele Brook, with copper identified as the critical pollutant; however, the primary sources of copper have been addressed.

## Hydrology and Hydraulics

Steele Brook is a subregional drainage basin of approximately 17 square miles, which exhibits a dendritic drainage pattern, with approximately 36.25 miles of stream comprising the fluvial network. The watershed falls within the municipalities of Waterbury, Watertown, and Middlebury, CT. Approximately 12.4 square miles of the watershed is located within Watertown, CT. The drainage area above Heminway Pond is entirely within the Town of Watertown and consists of three local drainage areas (Steele Brook, Smith Pond Brook, and Merriman Pond Brook) totaling 5.86 square miles as shown in Figure 10.

For the purpose of this study, the stream can be divided into two sections; the section above Heminway Pond and the section below. Upstream of the impoundment, the fluvial network is comprised entirely of A, B and C stream types, classified using the Rosgen methodology. Although there have been channel manipulations, for the most part, the channel-floodplain system is still intact. The alteration of sediment transport and hydrology via instream impoundments is limited. Channel morphology is principally riffle-pool, transitioning to mostly riffle, with irregularly spaced pools as the stream transitions from the flatter slope C stream types (less than 2%) to the B stream types (2%-4%) and to the A stream types (greater than 4%).

There has been significant channel manipulation downstream of Heminway Pond to the confluence with the Naugatuck River. There are a total of 4 additional dams downstream of Heminway Pond Dam which alter sediment transport and hydrology. In addition, the majority of the channel is no longer connected to its floodplain; further altering sediment transport and hydrology and hydraulics within the channel for the entire range of storm flows. Land use in the watershed ranges from heavily forested near the headwaters to highly urbanized sections at the mouth including highly residential, commercial and industrial sites in the watershed. These developed areas adjacent to the brook are subject to repetitive flood damages.

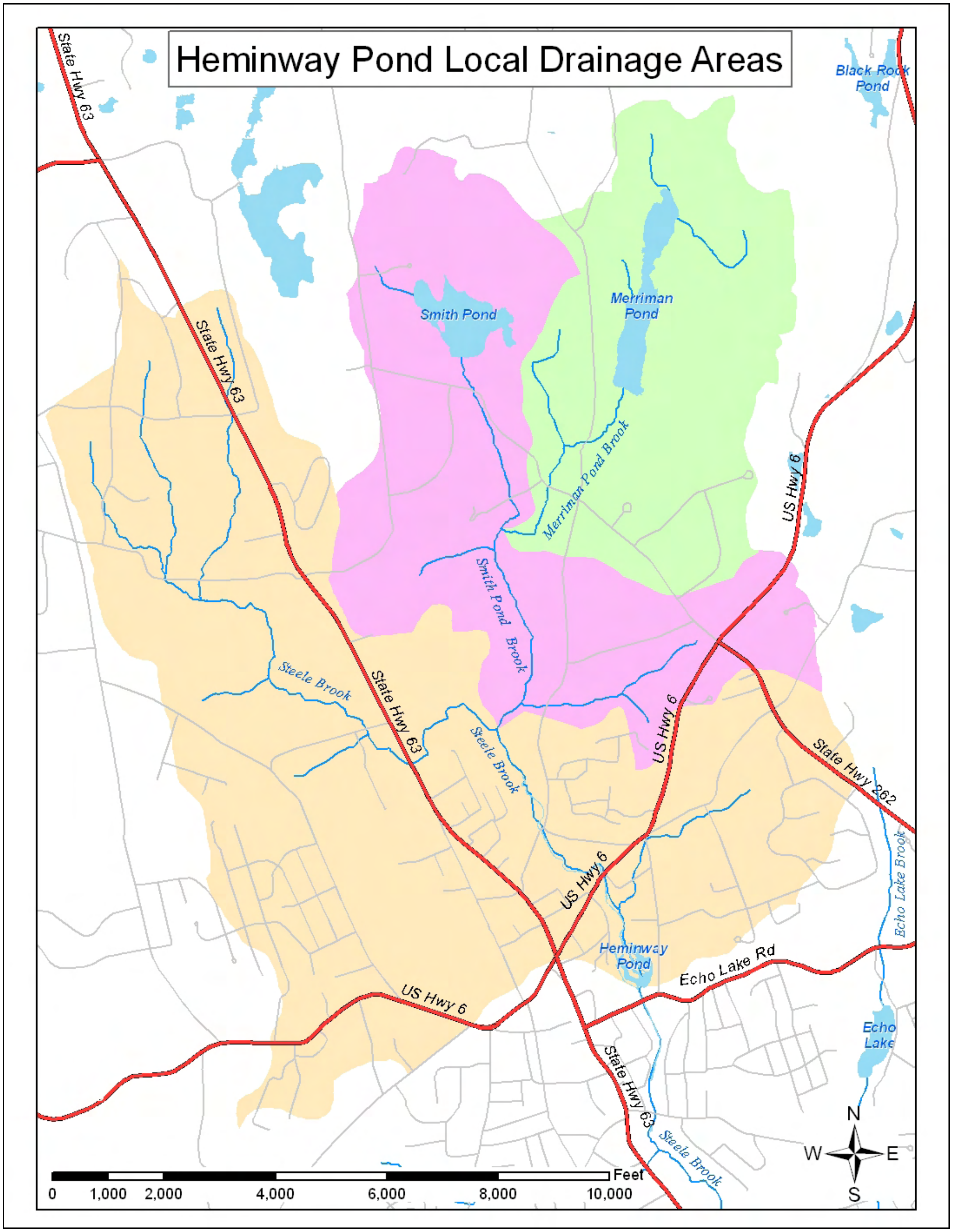


*Figure 10: Heminway Pond drainage area.*

**Hydrology**
Several existing studies on the hydrology of Steele Brook list widely variable frequency-discharge relationships. These differences are due to different methods of hydrologic analysis, input data, and dates of the studies. A comparison of discharges applicable to this analysis is discussed here and included in Table 3.

The FEMA Town of Watertown Flood Insurance Study (1980) calculated discharges for Steele Brook by multiplying the adopted discharges from the City of Waterbury Flood Insurance Study (1972) by the ratio of the drainage area at several locations on Steele Brook to the exponent of 0.7. The discharges modeled through the pond and just below the dam are quite different even though there is no major tributary entering at this point.

The town of Watertown provided a TR20 model to the NRCS for use in the Dam Removal Feasibility Analysis. TR20 is a computer program developed by the NRCS for hydrologic modeling based on rainfall input, drainage area, land use, and hydrologic soil group. This model came from the Flood Control Study Steele Brook at Watertown Plaza Knight Street Industrial Area (WMC Consulting, 1997) which was an update of the 1987 TR20 model from the Steele Brook Flood Control Study (Milone and MacBroom, 1987). A change in rainfall distribution methodology as discussed in Appendix B has slightly changed the peak discharges from the original 1987 hydrology model.

As part of this Feasibility Analysis, a bankfull discharge of 330 cfs was calculated in RIVERMorph software based on reference reach geometry just upstream of the pond. This discharge and geometry data is used to determine the channel dimensions of the feasibility future condition HEC-RAS models included in Appendix B. Discharges and dimensions used in actual designs will require more analysis. Bankfull discharges are expected to typically fall between the 1-yr and 2.5-yr recurrence intervals with a mean of 1.5-yr interval. The bankfull discharge calculated here falls between the 1-yr and 2-yr WMC discharges.

***Table 3: Comparison of Flood Discharges at Heminway Pond***

| Source\Frequency | 1-yr | 2-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr | 500-yr |
|---|---|---|---|---|---|---|---|---|
| FEMA (above dam) | - | - | - | 820 | - | 1600 | 2060 | 3600 |
| FEMA (below dam) | - | - | - | 1130 | - | 2200 | 2840 | 5000 |
| WMC TR20 1997 | 221 | 410 | 782 | 1066 | 1479 | 1842 | 2287 | - |

*(All flows in cfs)*

The Report on Stream Channel Encroachment Lines, Steele Brook, Waterbury-Watertown April-1966 (Roger C. Brown, Consulting Engineer, 1966) contains additional discharges that may be needed for hydraulic analysis during the permitting process. From Route 6 upstream to Heminway Pond Dam the Stream Channel Encroachment Line (SCEL) discharge is 1730 cfs. Below the dam and through Echo Lake Road, the SCEL discharge is 2010 cfs. The State of Connecticut Stream Channel Encroachment Line Program is older than the Flood Insurance Program and includes only segments of high flood prone major rivers. State encroachment lines usually encompass the outer floodplain limit as well as the critical floodway (not the FEMA Floodway) in the river.

The 1987 Milone & MacBroom report also calculated available flood storage in each major pond along Steele Brook. Heminway Pond was found to have little effect on peak discharges, reducing the 2-year flood peak from 421 cfs to 405 cfs (3.8%) and the 100-year flood peak from 2433 cfs to 2288 cfs (6.0%). Although these reductions in peak discharge are minimal, changes made to Heminway Pond dam may alter its storage capability.

The FEMA discharges were used for this Feasibility Analysis and are important for the permitting process. Based on discussions with the Town and CT DEP, the WMC TR20 discharges are the preferred discharges for the future design calculations. Using the TR20 discharges in the design process should produce similar results as they are similar to the FEMA discharges. The WMC discharges and Stream Channel Encroachment Line discharges are not included in this analysis but can be added to the hydraulic model as updates are made during the design and permitting process.

### Hydraulics

The FEMA Town of Watertown Flood Insurance Study used HEC-2 to create a hydraulic model to develop flood profiles for Steele Brook. In 1997 a Letter of Map Revision (LOMR) was prepared to reflect changes to an abandoned railroad bridge downstream of Echo Lake Road that was converted to a private commercial driveway. This LOMR fixed several errors in the original HEC-2 model; however, it also contained several additional errors. As part of this Feasibility Analysis the HEC-2 model was converted to HEC-RAS and corrected where errors were noticed that may affect conditions near Heminway Pond. Additional survey and GIS\topographic information was also incorporated to enhance the analysis of the pond area. The Town of Watertown performed a survey of the channel downstream of the dam and the rock lined side channel. The NRCS surveyed the pond area including top and bottom of sediment. Photogrammetric information was also provided by the Town as GIS data including two-foot contours, color digital aerial imagery, and building and infrastructure features. Additional information regarding the hydraulic model can be found in Appendix B.

## Sediment

### Sediment Quality

Sediment samples were taken by CT DEP from 7 locations in the pond area in August of 2003. For a tabular description of the sediment sampling see Table 4. For a map of sediment locations see Figure 11. The 7 samples were labeled HP 1-7. HP 1, 2, and 3 were taken in the east portion of the pond area. HP 4 was taken in the west portion of the pond, west of the island. HP 5, 6, and 7 were taken directly upstream of the dam. Sediment samples were taken at three depths designated A, B and C. ‘A’ designated samples were taken between 0-0.5’. ‘B’ designated samples were taken from 0.5-2.0’. ‘C’ designated samples were taken from depths greater than 2.0’.

*Table 4: Summary of water depth, sediment depth, core retrieval, and sample designation*

| Description | Sediment Sampling Location | | | | | | |
|---|---|---|---|---|---|---|---|
| | **HP 1** | **HP 2** | **HP 3** | **HP 4** | **HP 5** | **HP 6** | **HP7** |
| Water Depth | 37 " | 22" | 25" | 45" | 37" | 35" | 37" |
| Sediment Depth | 34" | 45" | 41" | 8" | 29.5" | 37" | 39.5" |
| Core Retrieval | 28" | 32" | 32" | 7.25" | 21.5" | 29" | 32" |
| Sediment Compaction | 6.0 " | 13" | 9" | 0.75 " | 8" | 8" | 7.5" |
| 0-0.5 ft (A layer) | HP1-A | HP2-A | HP3-A | HP4-A | HP5-A* | HP6-A | HP7-A |
| 0.5-2.5 ft (B layer) | HP1-B | HP2-B | HP3-B | None | HP5-B | HP6-B | HP7-B |
| > 2.5 ft (C layer) | HP1-C* | HP3-C | HP3-C | None | None | HP6-C | HP7-C |

* Composite with second core at same location due to lack of representative sample on first core.

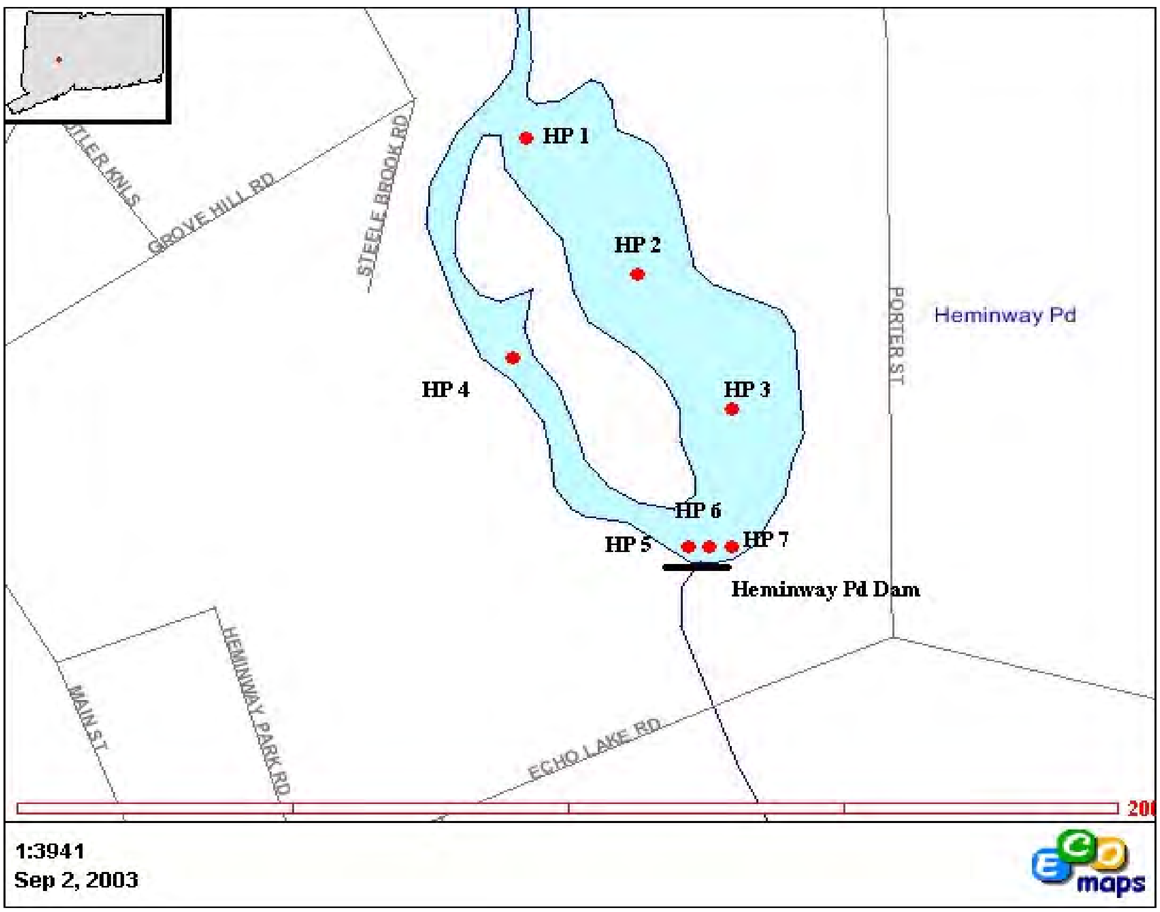


***Figure 11: Heminway Pond sediment sampling sites.***
*(Map courtesy of CT DEP)*

The sediments sampled at locations HP 1, HP 2, and HP 3 were fine grained and grey or black in color. The sediments at HP 4 were shallow and only a surface layer was able to be sampled. The sediments at HP 5, HP 6, and HP 7 contained more organic material such as leaf and plant materials. These sediments also gave off a petroleum scent and contained noticeable oil sheen when they were washed in water.

The sediments contained metals and Polynuclear Aromatic Hydrocarbons (PAHs), which are compounds derived from petroleum products. There were no pesticides or PCBs found in the sediments. Sediment quality did not vary substantially in either the sample locations or the sample depth. Sample HP 4 had the highest concentrations of metals and PAHs in comparison with the other sampling locations.

An interdepartmental memo created by Traci Iott from the CT DEP, Bureau of Water Management to Christopher Bellucci dated March 11, 2004 describes the condition of the sediment:

> "I have reviewed the sediment data collected at Heminway Pond in Watertown on August 28, 2003. Sediment samples were collected at seven locations within the Pond from three sediment horizons (0-0.5 ft, 0.5 - 2.5 ft, > 2.5 ft). The sediments contained metals and Polynuclear Aromatic Hydrocarbons (PAHs), compounds derived from petroleum products. Pesticides and PCBs were not detected in these samples. In general, sediment quality did not vary substantially either among the sampling locations or the sediment horizons. Of all the locations sampled within the pond, sample location 4 had the highest concentrations of metals and PAHs in comparison with the other sampling locations.
>
> Potential risks to both aquatic life and human health were evaluated using environmental benchmarks. The consensus-based freshwater sediment quality benchmarks developed by MacDonald *et al* were used to evaluate potential impacts to aquatic life. While the data does show elevation of some constituents above threshold benchmarks, it is unlikely, with the exception of Station 4, that these sediments pose any substantial risk to aquatic organisms even when aggregate toxicity of both metals and PAHs are considered. The sample collected at Station 4 had elevated copper and lead concentrations as well as the highest levels of PAHs. These sediments may impact aquatic organisms. However, if the dam is removed, this area may become uplands and therefore would not be of concern for aquatic life.
>
> Direct Exposure Criteria for Residential Scenarios were used to screen the sediment data for potential risks to people who may come in direct contact with the sediments. This is a conservative evaluation since these criteria are predicated upon the assumption of a daily exposure for a period of thirty years. However, some level of conservatism is warranted given that the western portion of the pond borders a town park. The concentrations of metals and most PAHs are below residential direct exposure criteria. However, these criteria were generally exceeded in most samples for benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene. In most cases, the levels of these compounds were 1.1 to 2 times the criteria values. However, samples collected at depth (>2.5 feet) at location 1 were 2.5 to 3 times greater than criteria values. This is not likely a risk to people given that the sediments are not readily accessible due to depth and location of the sample collection. Surficial sediments from location 4 were between 4 to 5 times greater than applicable criteria values. This is of greater concern since this sampling location is the closest to the town park and is most likely to become accessible as dry land once the dam is removed. I recommend that the placement of clean fill in this area be evaluated as a means of reducing potential contact with the contaminants in the sediments, should this area become accessible.

> In summary, most sediment within Heminway Pond is not likely to pose a risk to either people or aquatic organisms. Removal of sediment from the pond is not needed based on the level of chemicals within the sediments. The one exception is the sediments collected at Station 4. Isolation of these sediments, preventing direct contact, should be considered if removal of the dam is likely to allow this area to become more accessible.
>
> As consideration of the removal of the dam proceeds, releases of fine bedded sediments to downstream areas must be prevented, because such releases have deleterious impacts on valuable aquatic life habitat. "

It must be noted that HP 4 may be of concern even if removal of the dam occurs. The channel area where HP 4 lies may become the primary channel if removal or partial removal is the desired alternative. If the channel is located to the east in the main pond area, then the area near HP 4 will be upland and should be covered with clean fill as noted in the CT DEP memo. Further investigation may be necessary in this location if the design channel or accessible upland area is created in this location after the potential removal. Additional information and data regarding sediment sampling and testing is located in Appendix D.

In June of 2007, NRCS completed sediment probing and a Ground Penetrating Radar (GPR) analysis of the pond area. The Town of Watertown provided a boat to assist in the sediment probing and GPR. The purpose of this was to define the limits of the sediment and quantify the amount of sediment in the impoundment. Physical probing was completed by Rudy Chlanda, NRCS Geologist. The probe was inserted in the sediment and penetrated to refusal. The location of the probing was then recorded using a survey grade GPS unit. The GPR unit completed multiple loops of the pond taking shots along their route. The data from the GPR analysis and the sediment probing was compared to assure accuracy and perform a cross check of data.

The radar system and 200 MHz antenna were mounted in a fiberglass canoe. The canoe was powered by a small trolling motor. The canoe made eight traverses across different portions of Heminway Pond. Traverse lines were randomly located and were adjusted to avoid grounding on sand bars and entanglement in overlying tree limbs, except along the center lines of channels, which formed the two northward arms of the pond,. The canoe frequently bottomed-out on underwater sandbanks. Reference points for both GPS and GPR were recorded simultaneously at intervals of 10 seconds. Because of wave-path masking from dense vegetation, differential GPS was not always available.

The radar records were of good interpretive quality; however, there were portions of the pond where the interfaces of the pond bottom were more difficult to separate due to the distinctive layers being more ambiguous. In general, the contact between the bottom sediments and the original bottom materials was abrupt and highly contrasting, indicating substantial differences in moisture content and density. As a consequence, this interface provided a high amplitude continuous planar reflection that could be traced laterally across most portions of the radar records.

In shallower portions of Heminway Pond the surface pulse and the water/bottom of sediment interface were superimposed and difficult to differentiate. In some portions of the pond, because of slight differences in particle sizes and densities, or the occurrence of gradational boundaries, the contact between the bottom sediments provides a high amplitude reflection in the certain portions of the radar record. However, in other portions of the pond the materials have gradational and/or less contrasting dielectric properties and the interface is less obvious and more interpretive.

The radar surveying was completed in ½ day. The depths to bottom of sediments were recorded at 202 points using the GPR and GPS. Based on the GPR interpretations, the average water depth was 40 cm with a range of 10 to 134 cm. At one half of the reference points, the water depth was between 24 and 54 cm. Based on GPR interpretations, the thickness of the recent bottom sediments averaged 134 cm with a range of 49 to 270 cm. At one half of the reference points, the thickness of the bottom sediments was between 101 and 165 cm. For additional information, the complete Ground Penetrating Radar (GPR) Report has been included in Appendix E. Using data from both the GPR and also physical probing of the sediment, approximately 35,000 cubic yards of sediment were estimated to be present in the pond.

**Sediment Stability**
A limited sediment stability analysis was conducted based on the current and future condition hydraulic models developed for this feasibility analysis. It was used to evaluate the stability of the sediment in the pond, determine post removal conditions, and size appropriate construction materials for the future condition cost estimates. This study was based on very limited sediment surveying and will need to be repeated with a more in depth analysis at the design phase. Methods and results of the stability analysis are discussed in the Summary of Results section of this report.

## Infrastructure

The infrastructure in the vicinity of Heminway Pond includes the dam itself, the historic rock channel, the earthen dike separating the pond from the channel, Echo Lake Road Bridge, adjacent buildings, and baseball fields. Past use of the impoundment includes water supply for a thread/string mill. The mill no longer operates as a manufacturing facility and current adjacent businesses do not utilize the impoundment for water supply. There is currently no municipal or industrial purpose for the pond.

This Feasibility Analysis focused mostly on the dam, pond and dike in regards to infrastructure in the vicinity of Heminway Pond. It is not anticipated that the alternatives presented in this report will produce major effects to the adjacent buildings, the baseball fields or the Echo Lake Road Bridge.

Heminway Pond Dam is a rebuilt version of its former self. The original dam was destroyed during the floods of 1955. According to construction drawings, the ogee shaped dam crest was rebuilt into its current form out of cyclopean concrete, which was most likely made from the rubble of the old dam. Due to the age of the dam, there has been noticeable deterioration of the concrete in some areas and also some of the valve works. In 2008 vandals opened the valve gate which drained the impoundment. Based on verbal discussions with the Town crew, the opinion was that the valve stem may only survive one more opening prior to being in need of replacement.

The pond has been impounded since the construction of the dam. Over the years, the pond has continued to fill with sediment. This has altered the pond and has created visible deltas of sediment in the impoundment. This sediment trapping will continue with a continued reduction in sediment storage available behind the dam.

The earthen dike currently is the boundary between the pond and the historic rock channel. The dike serves as a secondary spillway to Heminway Pond as there is a partial breach in one location allowing some overflow of the pond into the side channel. There is exposed rock in this location that either serves as a core wall of the dike or is a remnant of the historic rock channel. This breach location appears unstable and has the potential to expand, circumventing flow through the historic rock channel rather than over the principle dam spillway.

The rock side channel to the west of the earthen dike is a two-stage channel approximately 5 feet deep in its present condition with about two feet of sediment over an apparent rock bottom. The west bank is a vertical mortared rock wall. The east side of the channel consists of two stacked rock walls. The low stage channel is 15 feet wide, while the high stage channel is 30 feet wide. The eastern walls are buried in many places by sediment or the earthen dike. The mortared western wall of the rock channel protects the adjacent sanitary sewer line and prevents moderate floods from flowing over the nearby school basketball courts. There are holes near the base of this wall that could either be weep holes to relieve hydrostatic pressure or tile drain outlets leading from the recreation areas. The rock channel typically has very little water at low flow. Debris at the outlet of the rock channel along with approximately 2 feet of mostly organic sediment in the bottom of the channel contribute to shallow pools of stagnant water during low flow periods. Figure 12 shows the channel looking upstream.

***Figure 12: Historic rock channel and side wall.***
*(Photo courtesy of Carol Donzella, NRCS Community Planner)*

The main channel of Steele Brook, downstream of the dam, is an oversized channel with potential to contain much more flood flow than the natural channel upstream of the pond. Downstream of the junction with the historic rock side channel, the main channel is similarly comprised of a 6 to 10 foot tall mortared rock wall to the west as seen in Figure 8. Some areas of the west wall are in poor condition. There is also a sink hole above a storm drain outlet a few feet upstream of Echo Lake Road. There are remnants of a metal rail fence along the top of this wall but it is in disrepair. The eastern side of the channel is an earthen slope abutting concrete walls, building foundations, and a gabion basket wall before entering the 30 ft wide Echo Lake Road box culvert.

## Sociologic Issues and Recreational Use

A dam and pond can often have a sociologic affect on the communities in which they exist. Often these ponds are hubs of activity including fishing, boating and other active and passive recreation. In relation to Heminway Pond, much of these items do not apply. The dam does maintain a pond with a permanent pool. There may be a few community members who feel a sociologic connection to the dam or to the pond. However, during the Heminway Pond Dam Removal Working Group Meeting held on February 7, 2008 it was discussed that the potential removal of this dam has been public knowledge and there has been no complaints made to the Town to assure the dam stays in place. Recreationally, this pond is not known to be utilized by the community. Therefore, the number of community members that are adamant about the dam and pond remaining in place can be estimated to be small in number. The lack of utilization of the pond area can be attributed to the fact that prior to the Town taking ownership of the dam and pond, this was private property owned by The Siemon Company.  Also, there is currently very poor access to the area.

The future of this location could provide additional open space in the forms of parks and walking trails or other recreational features.  All of the alternatives presented in this report encompass an educational component that could be utilized in the form of signage and other educational activities to be held on the property.  Through implementation of the alternatives presented in this study, the community will access itself to additional open space and an environmentally friendly channel design.  Future recreational opportunities include fishing, bird watching, walking trails, and other active and passive recreation.  In conjunction with the Town greenway project, which is one of the overall project goals of this study, the area in and around Heminway Pond could become a highlight along the greenway route.

## Cultural and Historic Resources

An evaluation of cultural and historic resources in the vicinity of Heminway Pond was performed as part of the Feasibility Analysis to evaluate potential impacts associated with the removal of Heminway Pond Dam.  A site visit was performed on March 20, 2008. Those attending were Nicholas Bellantoni, CT State Archaeologist, Charles Berger, Watertown Town Engineer, Joseph Kavan, NRCS Civil Engineer, Joyce Purcell, NRCS Cultural Resources Coordinator, and Carol Donzella, NRCS Community Planner.

Heminway Pond Dam is a rebuilt version of the original dam in this location that was destroyed during the floods of 1955.  It was determined that there were no adverse impacts to cultural resources associated with removal of the dam.

The rock channel along the west end of the dam shown in Figure 12 was identified as a potentially historic piece of architecture by the State Archaeologist, who planned to coordinate with the Watertown Historic Society to research the historic significance of the rock channel.  Prior to construction it was recommended that the CT Office of State Archaeology be contacted in order to photo document the channel.  The State Archaeologist was also interested in the use of signage along the rock channel if it remains intact after the chosen alternative is implemented.  According to Paul Knickerbocker, of The Siemon Company., the rock channel to the west of Heminway Pond Dam was historically the main channel of Steele Brook.  It was abandoned after the construction of the dam and dike.

> "What I know comes from conversations I had many years ago (about 20) with retired employees of the Princeton knitting mill.  I do not remember their names or know if fact or fiction but what I was told does make sense.  Around 1900 when the original Princeton building was being built they wanted to install fire protection in the building.  To provide an adequate water supply a pond was needed.  My understanding was that Steele Brook originally flowed down a stream bed where the channel now resides.  While the stream was undisturbed, a pond was dug east of the stream with a dam to create a water reservoir for the fire system of the Princeton building.  The fill from the pond was piled in the area between the original stream and the new pond.  Once completed, the new lower elevation pond was connected to the existing stream bed at the north end and the stream was

> diverted to fill the pond. When the original stream bed no longer contained water it was reconstructed as an overflow for the pond. The channel was constructed with I believe a 25 foot channel then tiered with stone blocks to open up to a 50 foot channel then another bank of stone blocks. From there it would overflow into the ball field area which was originally swamp. If needed I can show you the tiered stone blocks visible in at least one area where the pond was once breached." (Email correspondence from Paul Knickerbocker)

A copy of the NRCS Practice Description Form for Cultural Resources Review is included in Appendix F which includes the formal determination and signature of the CT State Archaeologist.

## Method of Determining Impacts on Affected Environment

The method of determining the level of intensity of the impacts on affected environments was through the use of an impact assessment. This impact assessment will be evaluated with respect to existing conditions and the established goals of the study which are improved water quality downstream of the dam, improved fish passage in Steele Brook Watershed, removal of a liability to the Town in regards to ownership of an aged dam, and incorporation with the Town greenway project. This impact assessment will be a qualitative analysis. It will measure the beneficial and adverse impacts the proposed actions will have on the affected environments. This assessment will assign varying levels of intensity to the impacts associated with each of the four alternatives. This analysis is subjective due to the qualitative nature of the study. The authors will use professional judgment in forming the intensity level assigned to the impacts.

In conjunction with this impact assessment, a rating system was devised to rate the intensity of the impacts on the affected environments. This qualitative rating system includes five levels of intensity and applies a descriptive label to the severity of the impact whether it is beneficial or adverse. The rating system and descriptive labels are as follows:

> **None (No Effect) –** No measurable effects will occur
>
> **Negligible –** The effects will be very slight and may not be measurable or observable
>
> **Minor –** Impacts would be noticeable but there would be no overall effect on the affected environment
>
> **Significant –** Impacts would be noticeable and could have a short term and long term effect on the affected environment
>
> **Major –** Impacts would be very noticeable and would have a definite short term and long term impact on the affected environment

The authors assigned a rating for each affected environment under each alternative and have presented the findings in the Analyses of Alternatives section of this report. A summary table has also been included (Table 9: Summary Table, Level of Intensity of Effects) showing the levels of intensity for each affected environment for each alternative. This impact assessment was the basis for the recommendations given in this Feasibility Analysis.

# ANALYSES OF ALTERNATIVES

## Alternative 1: No Action

### Introduction/Description

The "No Action" alternative has been included in this report as a baseline in order to evaluate the other alternatives. This alternative would include the dam remaining in place and Heminway Pond remaining virtually the same as it is today. No structural changes would be made at the site.

### Natural Stream Features

Under the No Action alternative there would be no natural stream features installed at the site. The pond area would remain the same size and would remain a pond area. The existing channel upstream and downstream of the dam would remain as it is today.

### Impacts on Affected Environment

#### *Ecological Resources: Fisheries*

Implementation of Alternative 1: No Action would result in no beneficial impacts and result in major adverse impacts to fisheries in Steele Brook and the Heminway Pond area.

The lack of beneficial impacts is related to the continuation of lack of fish passage in this reach of Steele Brook. Also, with the impoundment remaining in place, the water temperatures will continue to be elevated in the pond and with the lack of flushing in the downstream channel, this area will continue to provide slow moving, high temperature water in the channel immediately downstream of the dam.

The adverse impacts are associated with the items already listed. There will continue to be a lack of fish passage in this reach of Steele Brook and also elevated water temperatures in Heminway Pond. Neither situation is ideal for fisheries in the brook.

#### *Ecological Resources: Wetlands*

Implementation of Alternative 1: No Action would result in minor beneficial impacts and minor adverse impacts to wetlands.

The beneficial impacts would be associated with the fact that the amount of open water wetlands would remain unchanged. Dam removal options often include a reduction of open water wetlands in the former pond area. If the dam remains in place, the wetlands will remain unchanged.

The adverse impacts would be associated with the fact that the wetlands will, over time, continue to fill with sediment. Eventually, the entire impoundment will fill with sediment leaving only a pilot channel from the headwaters of the pond to the dam. This was considered minor due to the amount of time associated with this and also the fact that dredging of the pond would be an option to regain the lost wetlands to sedimentation.

***Ecological Resources: Wildlife***

Implementation of Alternative 1: No Action would result in negligible beneficial and negligible adverse impacts to wildlife in the area.

The beneficial impacts would be the result of the area continuing to provide habitat for both pond dwelling and floodplain dwelling wildlife.

The adverse impacts would be the result of the lack of fish passage in the area providing less forage for fish feeding wildlife in the area. The lack of passage and high water temperatures in the pond results in poor habitat for fisheries.

***Water Quality***

Implementation of Alternative 1: No Action would result in negligible beneficial impacts and major adverse impacts to water quality in the pond area and the stream area downstream of the dam.

The negligible beneficial impacts would be the result of the dam continuing to act as a sediment trap for the watershed. This dam reduces the amount of sedimentation in areas of low velocity downstream.

The major adverse impacts would be the result of the continuation of increased bacteria levels due to geese and other waterfowl residing in the pond area. Also, the iron precipitate would continue to settle in the channel downstream of the dam. During the dry periods that the water level in the pond is below the level of the spillway, the water in this area will remain stagnant and allow settling and orange discoloration. Also, the water temperature in the pond will continue to be elevated.

***Hydrology and Hydraulics***

Implementation of Alternative 1: No Action would result in no beneficial impacts and minor adverse impacts to the hydrology and hydraulics in the area.

There are no beneficial impacts due to the fact that the pond will continue to impound water as it does today.

The adverse impacts would be the result of a continuation of flow through the breach area in the dike along the stacked rock canal. Eventually this breached area will propagate into a full breach of the dike. If the impoundment water surface was lowered, the frequency of flow through the dike would be reduced.

***Sediment***

Implementation of Alternative 1: No Action would result in no beneficial impacts and significant adverse impacts to sediment in Steele Brook.

The lack of beneficial impacts would be the result of the fact that sediment transport would still essentially end at the pond with much of the sediment settling out in the impoundment.

The significant adverse impacts would be associated with the fact that sediment continues to settle in the pond area and interrupts the natural sediment transport of the stream. The impoundment will continue to trap sediment and result in deterioration of water quality in the pond due to increased sedimentation and the elimination of water depth and volume in the pond.

***Infrastructure***

Implementation of Alternative 1: No Action would result in no beneficial impacts and significant adverse impacts to infrastructure in the Heminway Pond area.

The lack of beneficial impacts would be the result of the dam remaining in place and the breached area of the dike would remain unchanged and therefore in disrepair. Also the stability of the dam will one day become a concern and owning an aged dam which serves essentially no purpose has no benefit.

The adverse impacts are associated with the breached portion of the dike and the condition of the dam. The dike will continue to allow flow through the partially breached area until the breach propagates and becomes a full breach of the dike. Also, the dam will deteriorate over time which will require continued maintenance if left in place.

***Sociologic Issues and Recreation***

Implementation of Alternative 1: No Action would result in no beneficial impacts and minor adverse impacts to recreation and the sociologic affect a dam can have on a community.

The lack of beneficial impacts results from the fact that the site will remain unchanged and therefore the recreational opportunities will continue to be limited and the community will continue to view the dam as they do now. Currently, the dam has little value as is.

The minor adverse impacts are the result of the lack of recreation available in the area and the increasing amount of invasive vegetation found in the area. Many of these invasive plants will continue to spread and reduce what little recreation and sociologic enjoyment the community receives from the pond and dam area.

#### *Cultural and Historic Resources*

Implementation of Alternative 1: No Action would have no beneficial and no adverse impacts to cultural and historic resources in the Heminway Pond area.

The lack of beneficial and adverse impacts is due to the fact that the area would remain unchanged. The historic stacked rock canal would continue to be viewable but not utilized.

### Level of Achievement of Project Goals

#### *Water Quality Improvement in Steele Brook in Vicinity of Heminway Pond*

Implementation of Alternative 1: No Action does not achieve the project goal of increased water quality in Heminway Pond and Steele Brook.

This alternative would continue to support waterfowl in the pond area and therefore would not alleviate the elevated levels of bacteria in the pond. Also, during dry periods, the flow may be insufficient to crest the spillway and would promote stagnant stream water downstream of the dam and encourage deposition of the iron precipitate that is currently found in the stream between the dam and Echo Lake Road.

It is worth noting that many Connecticut soils and underlying bedrock tend to have high concentrations of iron naturally occurring within them. Ground water percolating through the soils and bedrock in many cases will have elevated levels of iron in solution, which tends to precipitate out when exposed to air or oxygenated water in the stream. The combination of decaying organic material and the natural high concentration of iron in the soil and groundwater will not change due to the implementation of this alternative. Iron will continue to discharge into the stream from the natural sources. Any flushing action of the channel downstream of the dam will allow for less of the precipitate to settle but will not eliminate the addition of iron to the stream system. The pond will also continue to impound water and therefore water temperatures in the pond will remain elevated.

#### *Improved Fish Passage through the Heminway Pond Dam*

Implementation of Alternative 1: No Action does not achieve the goal of improved fish passage through the Heminway Pond Dam.

With the dam in place, there will continue to be a barrier to resident fish passage in the area. The pond area will continue to impound water with elevated water temperatures creating a less favorable environment than a cool water stream.

***Liability to Town Regarding Ownership of Dam***

Implementation of Alternative 1: No Action does not achieve the goal of eliminating the liability of the Town owning an aged dam.

Under this alternative the dam would remain in place. The Town would need to maintain the structure and provide any needed repairs to the dam.

***Incorporation of Heminway Pond with Town Greenway***

Implementation of Alternative 1: No Action is a less favorable option compared to the partial and full dam removal alternatives in regards to incorporating this project with the Town greenway project.

The pond and surrounding area would remain essentially unchanged. The pond area provides limited value to the greenway in its current state. In theory the pond area is capable of supporting a greenway, but there are few aesthetic or educational type opportunities in its current state.

**Design Considerations and Concerns**

There are no design considerations and concerns for this alternative. Under this alternative, there would be no design to complete. Heminway Pond Dam and the pond area would remain as it is today.

**Potential Permits**

There are no identified permits that would be needed under this alternative.

**Cost Estimate**

Construction costs for this alternative would be $0.00. However, this alternative does not meet the project goals of improved water quality and improved fish passage in Steele Brook. Also, there would be additional future costs related to maintenance and liability of an aged dam for the Town. The Town would be responsible for any repairs, insurance, and liability related to Heminway Pond. Even though construction costs will be the least for this alternative, there will be many financial and ecological costs associated with ownership of an aged dam and allowing for continued water quality impairments and lack of fish passage in Steele Brook.

## Alternative 2: Bypass Channel

### Introduction/Description

Alternative 2: Bypass Channel considers the option of leaving the dam in place but allowing flow to occur in an overflow channel and bypass the dam. This overflow channel would most likely be the existing rock lined channel to the west of the dam between the pond area and the baseball fields. The bypass channel would be designed to accommodate fish passage through the dam area. The dam itself, and therefore the pond, would remain in place.

The bypass channel would begin in the pond area near the breached area of the existing dike that separates the pond from the rock lined channel. This dike would be either reinforced or reconstructed with the addition of an engineered notch allowing overflow from the pond. The bypass channel would consist of a series of pools and riffles designed to facilitate fish passage. These pools and riffles would be constructed using stone and rock. A series of step pools may be necessary at the downstream end of the bypass channel to reach the grade of the downstream channel.

Tree and shrub planting on the dike is discouraged to maintain the integrity of the dike. This will reduce the shading of the bypass channel which is a negative consequence of this alternative. The current rock lined channel would be reconstructed to include the pool and riffle sequence. If possible, the mortared rock wall which encloses the channel would be left in place. This would be a tribute to the history of the area and would preserve a historic resource in the area.

### Natural Stream Features

The natural stream features of this alternative would be limited to the creation of pools and riffles within the bypass channel diverting flow around the dam. A series of step pools may also be utilized to successfully grade the bypass channel to the existing channel downstream of the dam. Since the pond area would remain inundated there are few opportunities to create natural stream features in the pool area.

### Impacts on Affected Environment

#### *Ecological Resources: Fisheries*

Implementation of Alternative 2: Bypass Channel would result in significant beneficial impacts and negligible adverse impacts to fisheries in Steele Brook and the Heminway Pond area.

The beneficial impacts would result from providing fish passage around the dam. As with most fish passage facilities (fish ladders, bypass channels) there is a reduction in passage efficiency relative to a natural stream. In addition, fish passage facilities are often constructed for a targeted fish species, and therefore may have varying passage efficiencies for the entire fish community in the river system. The fish passage facility analyzed for this alternative is what is called a “nature-like fishway”, as it emulates the riffle pool sequence of a natural stream which improves the passage efficiency. However, a reduction in passage efficiency as compared to the partial or full removal option can still be expected, as the fish will have to find the entrance and exit of the fishway to circumvent the dam. The pond area would remain largely unchanged and therefore would still present an unfavorable environment for the resident fish population as a result of elevated water temperatures in the pond.

The adverse impacts are negligible due to the fact that there is no fish passage available at the site. The bypass channel would provide some passage for fish. The current situation can only be improved in regards to fisheries in Steele Brook.

***Ecological Resources: Wetlands***

Implementation of Alternative 2: Bypass Channel would result in minor beneficial impacts and no adverse impacts to wetlands.

The minor beneficial impacts would result from increased flows within the side channel, and the elimination of stagnant water.

There are no adverse impacts to wetlands associated with implementation of this alternative. The pond elevation and area will remain the same so no wetlands will be lost. The quality and quantity of open water wetlands would remain unchanged.

***Ecological Resources: Wildlife***

Implementation of Alternative 2: Bypass Channel would result in significant beneficial impacts and no adverse impacts to wildlife in the area.

There would be significant beneficial impacts to wildlife after implementation of this alternative. These beneficial impacts would be the result of additional fish passage in the area. The additional fish migrating to and through the area would provide additional forage for fish-seeking wildlife.

There are no adverse impacts to wildlife associated with implementation of this alternative. The wildlife that currently uses the area would continue to use the area. Since there would be no major changes made to the pond area, one would expect pond dwelling wildlife to continue to thrive there.

***Water Quality***

Implementation of Alternative 2: Bypass Channel would result in minor beneficial impacts and major adverse impacts to water quality in the pond area and the stream area between the dam and Echo Lake Road.

The minor beneficial impacts would be the result of localized flushing within the side channel area and the area just downstream of this channel. During the summer months, flow into the pond may not be large enough to overcome evaporation and seepage losses and still provide enough flow for both the bypass channel and dam spillway. Constructing the bypass channel inlet slightly below the dam spillway will make year-round flow into the side channel (and fish passage) more likely and would slightly increase the flushing action within the side channel; however, it would have little or no beneficial effect on the area between the dam and Echo Lake Road.

The major adverse impacts result from the fact that the implementation of this alternative would not alter the flows downstream of the dam enough to produce the flushing needed to alleviate the iron precipitate between the dam and Echo Lake Road. During the summer months, when flow does not reach the spillway elevation, there would continue to be mostly stagnant water downstream of the dam. When compared with partial or full removal, the amount of flushing in the area between the dam and Echo Lake Road is much less.

***Hydrology and Hydraulics***

Implementation of Alternative 2: Bypass Channel would result in no beneficial impacts and minor adverse impacts to the hydrology and hydraulics in the area.

There would be no reduction in flooding after implementation of this alternative. The flow regime would be very similar or identical to what it is in its current condition. Therefore, there are no beneficial impacts associated with this alternative to hydrology and hydraulics.

The minor adverse impacts would be associated with the continued lack of flushing of the area downstream of the pond between the dam and Echo Lake Road. Sediments will also continue to accumulate behind the dam and there is also a long term concern of eutrophication of the pond.

***Sediment***

Implementation of Alternative 2: Bypass Channel would result in no beneficial impacts and significant adverse impacts to sediment in Steele Brook.

There are no beneficial impacts due to the fact that sediment will continue to deposit in the pond area and over time will essentially fill the pond with sediments. Continued deposition will result in loss of open water wetlands and loss of wildlife habitat in the long term.

The adverse impacts are significant due to the continued deposition of sediments in the pond area. As described above, a loss of wetlands and wildlife would be a long term effect of the dam staying in place as is.  It will continue to act as a sediment trap impeding natural sediment transport through Steele Brook.

### *Infrastructure*

Implementation of Alternative 2: Bypass Channel would result in major beneficial and significant adverse impacts to infrastructure in the Heminway Pond area.

The beneficial impacts are associated with the repair of the partial breach in the dike separating the pond from the side channel to the west.  It appears the dike was not an engineered dike and replacement or reinforcement is seen to be necessary to assure that proper functionality of the bypass channel is maintained.

The adverse impacts are due to the fact that an aged dam will still be in place on Steele Brook.  This dam will pose a maintenance issue for the Town.  Inspection and dam safety concerns would need to be addressed continually after the implementation of this alternative.

### *Sociologic Issues and Recreation*

Implementation of Alternative 2: Bypass Channel would result in major beneficial impacts and no adverse impacts to recreation and the sociologic affect a dam can have on a community.

The beneficial impacts are associated with the additional fish passage that would be obtained after implementation of this alternative.  Recreational fishing would be increased and improved in the area.  Other possible opportunities for this alternative to be a benefit would be the addition of educational signage and trails referencing the importance of fish passage and fish habitat in the natural environment.  Also, if there are people in the community who retain a strong emotional connection to the pond area, the pond would remain in place for their enjoyment.

There are no adverse impacts to recreation and sociologic affects of people in the community.  In its present state, the area provides little recreational or educational benefits to the community.  This alternative could lead to additional recreation in the area through fishing, hiking, educational outings, and other active and passive recreation.

### *Cultural and Historic Resources*

Implementation of Alternative 2: Bypass Channel would result in significant beneficial impacts and significant adverse impacts to cultural and historic resources in the Heminway Pond area.

The beneficial impacts would result from an attempt to keep the historic stacked rock wall, which forms a channel boundary, in its current condition.  Also, additional people would use the area for active and passive recreation which would increase the visibility of the historic channel wall.

The adverse impacts would result from the possibility of damage to or removal of the historic rock channel and wall during construction of the bypass channel. During the feasibility stage it is difficult to say to what extent the stacked rock channel and side wall will be disturbed. It can be said that the bottom of the rock channel would need to be disturbed and replaced with a natural channel to provide proper fish habitat in the bypass channel.

Connecticut State Archeologist Nicholas Bellantoni, Ph.D. visited the site and requested that prior to construction activities the wall should be photo documented to conserve in photo format the historic value of the rock lined channel and mortared stone wall.

**Level of Achievement of Project Goals**

The project goals for Heminway Pond are to provide a solution which accomplishes the following criteria; mitigate water quality concerns downstream of the dam, provide fish passage through the dam and pond area, remove liability of an aged dam from the Town, and encourage the creation of a greenway in this area of Watertown. Alternative 2: Bypass Channel was evaluated to determine the level to which it meets the overall project goals.

***Water Quality Improvement in Steele Brook in Vicinity of Heminway Pond***

Implementation of Alternative 2: Bypass Channel would not achieve the project goal of improved water quality in Heminway Pond and Steele Brook.

The small amount of flushing that would occur due to the installation of a bypass channel would be inadequate to provide enough active flow to cease the iron precipitate from settling in the brook. Also, since the pond will remain in place, the increased level of bacteria will most likely remain. One of the main bacteria sources is most likely geese waste. Since the pond and nearby athletic field would continue to foster a number of geese, it can be expected that the bacteria levels will remain elevated. Also, high water temperatures will continue to be present in the pond.

***Improved Fish Passage through the Heminway Pond Dam***

Implementation of Alternative 2: Bypass Channel would marginally achieve the project goal of improved fish passage through the Heminway Pond Dam.

As with most bypass channels and fish ladders, only a certain percentage of fish will use the bypass. Most bypass channels and fish ladders are constructed for a targeted fish species, and therefore may have varying passage efficiencies for the entire fish community in the stream system. The pond area would remain unchanged and therefore, the unfavorable habitat conditions and elevated water temperatures would still exist.

### Liability to Town Regarding Ownership of Dam

Implementation of Alternative 2: Bypass Channel would not achieve the project goal of removing liability of the Town regarding ownership of an aged dam.

The dam, under this alternative, would remain in place and largely unchanged. Therefore, the Town would be responsible for any maintenance and repairs associated with the dam. The Town would like to remove this liability.

#### *Incorporation of Heminway Pond with Town Greenway*

Implementation of Alternative 2: Bypass Channel is a less favorable option compared to the partial and full dam removal alternatives in regards to incorporating this project with the Town greenway project.

The pond area would remain essentially unchanged. The bypass channel would provide an interesting feature of the greenway, but the pond area would have limited value to the greenway in its current state. Since the pond area would remain unchanged, it is less favorable than the partial and full dam removal alternatives in regards to incorporating this area into the Town greenway project.

### Design Considerations and Concerns

This alternative has some significant design considerations and concerns. First, the rock lined channel would need to be analyzed for stability and also analyzed to determine that its capacity is satisfactory. Stability of the existing Heminway Pond Dam would need to be determined. A qualified structural engineer should be utilized to make this determination. There may be deficiencies that would need to be corrected to assure that the bypass channel option was feasible.

Due to the lack of staging area in and around the side channel, maneuverability of construction equipment may be limited. Assuming the Town would require the baseball field to be operational during construction, the large flat area above the channel would not be readily available for equipment. The access would therefore be in the channel and on the rebuilt dike only. Temporarily removing the fencing along the baseball field and using this area for staging would alleviate some of these issues.

The channel would most likely need to be re-graded to provide a feasible slope to the existing channel downstream of the dam. Most likely a series of step pools will be necessary to successfully reach the needed elevation with possible excavation and re-grading of the channel upstream. Any construction activity in this area will be a direct impact to the stacked rock channel wall.

**Potential Permits**

Recently, NRCS completed a similar project to this in Wilton, CT in the area of town known as Cannondale. This project involved a bypass channel around an existing dam. A similar pool and riffle system was created to allow fish passage through the dam area. For this project, the only permits necessary were a local inland wetland permit and a stream channel encroachment line permit. Given that this is a similar project, it can be assumed that similar permitting action would occur if this option was the chosen alternative. However, other permits may be necessary. The list of additional permits may include the following:

1. Dam Construction Permit - Any person or agency proposing to construct a dam, dike, reservoir or similar structure, or to repair, alter or remove an existing dam, dike reservoir or similar structure, must first obtain either a permit from the commissioner or a determination that such permit is not required.

2. Flood Management Certification - Any state agency proposing an activity within or affecting a floodplain or that impacts natural or man-made storm drainage facilities must submit a flood management certification. Such activities include, without limitation: a) any structure, obstruction or encroachment proposed for emplacement within the floodplain area; b) any proposal for site development which increases peak runoff rates; c) any grant or loan which affects land use, land use planning or the disposal of state properties in floodplains; or d) any program regulating flood flows within the floodplain.

3. Clean Water Act (CWA) Section 404 Dredge and Fill Permit - Most dam removals require a CWA Section 404 permit, issued by the U.S. Army Corps of Engineers (Corps) for dredging of a navigable waterway (33 U.S.C. §1344). A guideline pursuant to this statutory requirement establishes a policy of no net loss to wetlands.[1] In order to obtain Corps approval, the project: (a) should not cause or contribute to significant degradation of the waters or result in a net loss of wetlands; (b) should be designed to have minimal adverse impact; (c) should not have any practicable alternatives; and (d) should be in the public interest. In some cases, dam removal will result in a net loss of wetlands. To obtain a permit in these situations, the Corps will have to find that the benefits of dam removal outweigh the loss of wetlands.

4. Rivers and Harbors Act, Section 10 Permit - In conjunction with the Section 404 permit, the USACE will also issue a Section 10 permit for federal activities affecting navigable waterways, 33 U.S.C. 403. The permit will be issued if there is no adverse impact on interstate navigation.

5. National Environmental Policy Act Review - Actions by federal agencies (e.g., permits, funding, technical assistance) may require compliance with the National Environmental Policy Act (NEPA), 42 U.S.C. 4321 et seq. NEPA requires that an Environmental Assessment (EA) be prepared to determine whether a proposed

dam removal would have a significant effect on the quality of the environment. Depending on whether the project's impacts are considered significant, either a Finding of No Significant Impact (FONSI) would be issued or an Environmental Impact Statement (EIS) would be prepared.

6. 401 Water Quality Certification - Any applicant for a federal license or permit, including a dredge and fill permit from the U.S. Army Corps of Engineers, a bridge construction permit from the U.S. Coast Guard, or a permit from the Federal Energy Regulatory Commission (FERC) must obtain a 401 Water Quality Certificate from DEP if the proposed activity may result in any discharge into the navigable waters. Such discharges include, among other things, the discharge of dredged and fill material and stormwater during construction, incidental discharge of sediments from dredging or excavating, and the discharge of stormwater from a facility once it is constructed, and any excavation, flooding, draining, and clearing and grading in or affecting the navigable waters.

7. Inland Wetlands and Watercourses - Any state agency or instrumentality, except a local or regional board of education, proposing to conduct any operation within or use of a wetland or watercourse involving the removal or deposition of material, or any obstruction, construction, alteration or pollution of such wetlands or watercourses must apply to DEP.

8. Stream Channel Encroachment Lines - Any person proposing to place an encroachment or obstruction riverward of stream channel encroachment lines must obtain a permit. Activities which require a permit when conducted riverward of such lines include the removal or deposition of material, any alteration of the land or watercourse or construction of structures, filling, dredging, clearing, grubbing, grading, piping, installing culverts, channelizing, diverting, damming, dewatering, construction of structures, and any other activity that temporarily or permanently alters the character of the floodplain or watercourse.

9. Water Diversion - In general, any person proposing a diversion which was not registered with the Department and, which is not exempt, must apply for a permit. You must apply for a permit if, among other things, you propose to relocate, retain, detain, bypass, channelize, pipe, culvert, ditch, drain, fill, excavate, dredge, dam, impound, dike, or enlarge waters of the state.

10. Lake, Pond, and Basin Dredging - Provided other requirements are satisfied, this general permit authorizes: Dredging of a lake or pond that will restore or improve aquatic habitat or maintain the existing recreational use of such pond or lake provided: 1) such dredging shall not exceed 6,000 cubic yards of material; and 2) the area dredged shall not exceed one acre of such lake or pond. This permit is not intended to authorize dredging that will result in the conversion of an area of submerged or emergent vegetation or marsh, swamp, bog or similar such habitat to open water. Grading and placement of not greater than twenty-five (25) cubic yards of fill is allowed in a regulated area for temporary access to the site of such

activity provided that: 1) all temporary fill is removed, 2) the top of roadway is no more than one foot above existing grade and 3) any disturbed areas are restored by the completion of the project or by the expiration date of the commissioner's written authorization of such regulated activity, whichever occurs first.

11. Contaminated Soil and/or Sediment Management General Permit - This general permit authorizes the staging, transfer, and temporary storage of contaminated soil and/or sediment and is intended to address the management of these materials when they are generated during projects that are less than 2 years in duration and involve the excavation of earthen material. It establishes a uniform set of environmentally protective management procedures for stockpiling soils when they are generated during projects where contaminated soils are typically managed (held temporarily during characterization procedures to determine a final disposition) including, but not limited to remediation, construction, and utility installation projects.

Other local permits may be required such as a building permit, local floodplain permit, and a site plan review permit from the planning board. The local Land Use Administrator in the Planning and Zoning Office serves as the zoning code enforcement officer and should be consulted for other applicable municipal permits.

Dam-related activities in Connecticut are regulated by the Inland Water Resources Division of the Bureau of Water Protection and Land Reuse, which is a part of the Connecticut Department of Environmental Protection (CT DEP). The state has jurisdiction over "all dams . . . without exception and without further definition or enumeration herein, which, by breaking away or otherwise, might endanger life or property." Connecticut has created a system that, at least on the state level, is somewhat integrated, tying dam permit issuance to several other requisite permits.

An applicant must first apply for a Dam Safety Permit, which applies to all dams in Connecticut (excluding federally owned and operated dams). After submitting an application, the applicant must then provide public notice of intent to apply for the permit. CT DEP reviews the permit for safety, wetlands and fisheries considerations and will integrate any necessary permit conditions to address issues raised by the other agencies, including the disposal of contaminated sediments. Once CT DEP finds the permit acceptable, they will publish and distribute a Notice of Tentative Determination to approve the application to the public, the Inland Fisheries Division, wetland agencies and the planning, zoning and conservation commission of each town affected by the project.

The advantage to the applicant using this permit is that once the Dam Safety permit is approved, the applicant does not need to obtain a separate municipal Inland Wetland and Watercourse Permit (necessary for work affecting wetlands), a Stream Channel Encroachment Line (SCEL) Permit (a CT DEP permit necessary for any activity that temporarily or permanently alters the character of the floodplain or watercourse wherein SCEL lines are established), or a CT DEP Water Diversion Permit (necessary for any alteration of the instantaneous flow of water).

Connecticut maintains a Natural Diversity Data Base and CT DEP permit approval requires a review to determine a project's potential impact on federal and state protected species and habitat. Initial review can be made by the applicant by following directions on the Natural Diversity Data Base website. Further review by state wildlife and fisheries biologists is necessary only if a potential conflict is apparent.

This list of permits may or may not include all the necessary permits. Additional permits may be necessary. However, there are permits listed that may not be required. The Lake, Pond, and Basin Dredging permit is an example of a permit that may or may not be necessary. Also, a contaminated soil permit may not be necessary but a sediment management permit may be. If excavation activities are to occur near HP 4, where the concentration of contaminants is highest, a contaminated soil permit may be necessary. The permit requirements should be discussed with the CT DEP early in the design process to assure the necessary permits are obtained.

The list of permits and information regarding each permit was taken from NRCS prior experience, personal email correspondence with EA Engineering and American Rivers documents titled "Obtaining Permits to Remove a Dam" published in 2002 and "Permitting Dam Removal: The State of (Several) States" published in 2006 . The American Rivers documents are included in Appendix H and Appendix I respectively.

**Cost Estimate**

Due to the fact that Alternative 2: Bypass Channel does not achieve many of the project goals, a cost estimate was not created for this alternative. This alternative does not achieve the project goal of water quality improvement in the pond area and in Steele Brook downstream of Heminway Pond Dam. This alternative only marginally achieves the goal of increased fish passage through Heminway Pond Dam. The project goal of eliminating the liability of owning an aged dam is not achieved under this alternative, and it is also a less favorable alternative for successful incorporation of the pond area into the Town greenway project.

Given this alternative's lack of achievement of the overall project goals a cost estimate was deemed unnecessary. Cost estimates were created for the alternatives which achieved the project goals and therefore are more likely to be the favored alternatives.

## Alternative 3: Partial Removal with Fish Ramp

*Figure 13: Partial Removal Conceptual Rendering*

### Introduction/Description

Alternative 3: Partial Removal with Fish Ramp considers the option of partially removing the dam and the construction of a fish passable ramp downstream of the existing dam location. Figure 13 shows a conceptual rendering of the dam and upstream area for this alternative.

Although there are many possible partial removal configurations, only one is fully analyzed in this Feasibility Analysis based on criteria identified in meetings with the Town of Watertown and CT DEP. Investigation of additional configurations may require an extensive conceptual design phase if this alternative is selected. The partial removal geometry, as shown in Figure 14, was determined by extending the bankfull slope of the upstream reference reach to the dam location and cutting the entire crest to this elevation (1 foot below the current crest) to form a floodplain through the dam. Then a geomorphically sized bankfull notch 2.5 feet deep by 30 feet wide was cut into the dam with an invert at 480 ft (NAVD88).

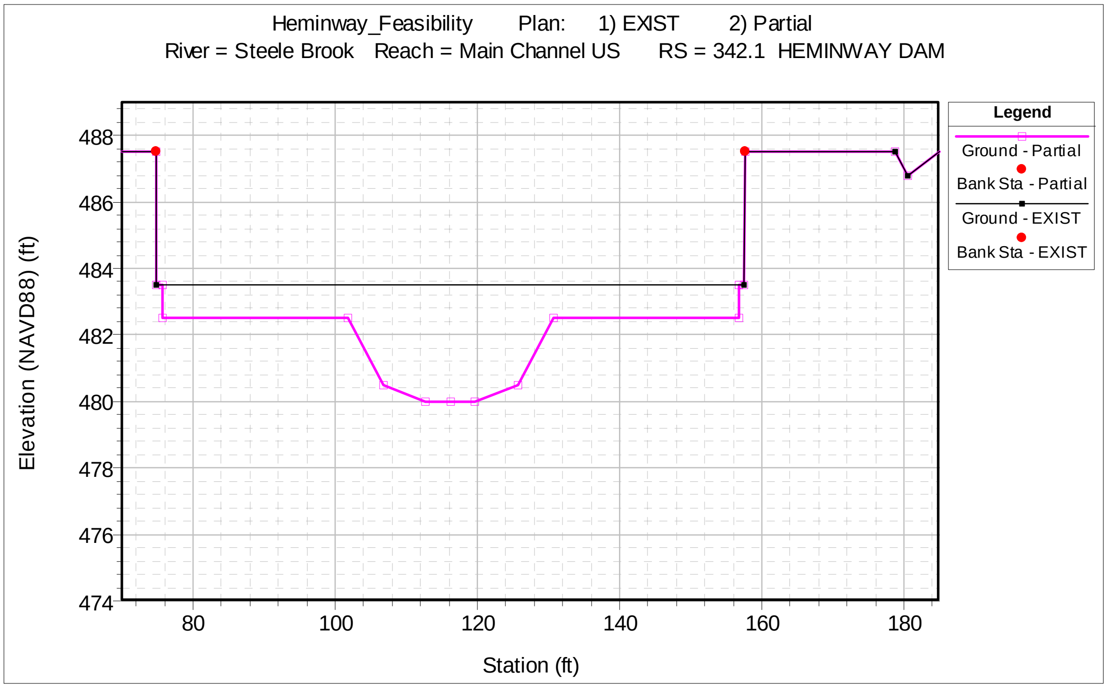


***Figure 14: Partial Removal Dam Geometry***

A fish ramp would be constructed in the main channel downstream of the dam out of rock, backfill, and boulders from the new invert of the spillway to meet the existing stream bottom of Steele Brook approximately 200 feet downstream of the dam at a 5% grade. The ramp would be a transitional reach from a more natural upstream channel to the oversized, armored channel below and would be considered a B2a stream type using Rosgen's method of stream classification. A B2a stream type can be described as a steep, moderately entrenched channel that exhibits a step-pool bed morphology (Rosgen 1996). The proposed ramp or B2a stream type would consist primarily of large boulders, with lesser amounts of cobble and gravel to fill the void space between the boulders. This ramp would consist of an armored floodplain to pass overbank flood water with a centrally located step-pool system sized to contain the calculated bankfull flow, and facilitate fish passage over a range of flows. Figure 15 shows a similar step-pool system constructed on Gulf Stream in Somers, CT. The step-pool system for the Steele Brook transitional reach would have a steeper slope in the downstream direction, while having a broader, more heavily armored floodplain with relatively flat side slopes. The armored floodplain would consist of topsoil-filled rock to promote the establishment of herbaceous vegetation. Periodic mowing will be required to prevent the establishment of woody plants, which would reduce flood flow conveyance.

***Figure 15: Similar Step-Pool System in Somers Connecticut, Gulf Stream***

In the existing pond area a C type stream would be constructed. C type streams are low gradient, meandering streams with point bars and riffle/pool series with broad, well defined flood plains (Rosgen 1996). With the pond elevation reduced to the elevation of the sediment behind the dam, it is possible to create a wide floodplain using the in place sediments. This floodplain would be graded and planted with native plants to assure stability of the floodplain. Armored riffles would be created in the constructed stream to serve as hard points and assure reasonable vertical stability of the stream in the pond area.

Since the pond water level will be reduced, the breach area of the dike will no longer be flowing during low flows. However, with the addition of the rock ramp downstream, stagnant water may develop in the rock lined channel. Also, during high flows the breach will continue to flow and may eventually propagate to a full breach through the rock core. To assure that the breach does not relocate the stream channel from the constructed channel in the former pond area to the rock lined side channel, it was planned to partially fill in the side channel with granular fill and soil. The granular fill would be placed in the bottom of the channel to retain the drainage for the adjacent baseball field. Drain pipes may also be necessary. Above the granular fill, soil would be placed which would then be seeded and appear as an extension of the adjacent field. This action eliminates the necessity to rebuild the dike and therefore will allow the mature trees to remain on the dike and provide shading to the field and current pond area. Partially filling the side channel also has the added benefits of reducing the safety hazard of the approximate 5 foot west wall close to the basketball courts and ball fields and increasing the aesthetics of this area.

**Natural Stream Features**

There are a number of natural stream features that could be included after implementation of this alternative. Most noticeably would be the channel-floodplain system created in the pond area after the spillway has been partially removed. A reference channel has been selected approximately 1000 feet upstream of Heminway Pond Dam.

In the current pond area, a C type channel would be created. This channel would include a series of pools and riffles and include a moderate amount of meandering. The meanders would encourage the creation of point bars. These pools, riffles and point bars create fish and wildlife habitat that is very desirable in stream restoration projects. Figure 16 displays a conceptual image of a typical C4 stream type and represents the type of channel to be created in the pond area.

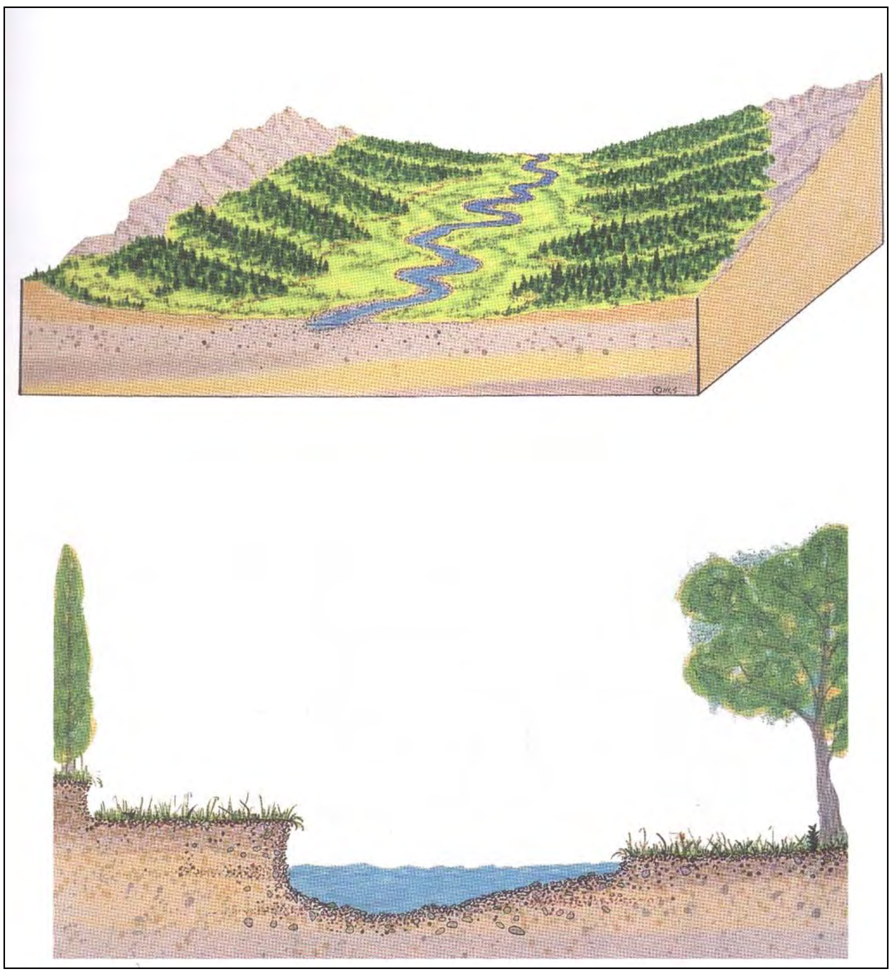

***Figure 16: Conceptual View of Typical C4 Stream Type***
*(Image from Rosgen 1996, reproduced with permission from Wildland Hydrology)*

The proposed channel will mimic the riffle and pool channel geometry identified in the reference reach. The width at bankfull will be approximately 38-40 feet wide, with a mean depth of approximately 2.4 feet, resulting in a bankfull cross-sectional area slightly less than 100 square feet. Typical with C4 stream types, the bankfull width of lateral scour pools associated with meanders tend to be narrower than the riffle cross section as a result of the formation of significant point bars. The decrease in width is associated with an increase in mean depth; however, the cross-sectional area of the stream remains relatively constant. As a result, the channel is able to maintain sufficient scour within the pool section to maintain pool depth. Adequate pool depth is an important aquatic habitat feature.

This alternative would create a connected channel-floodplain system. This system would enhance the fisheries, benthic life and also wildlife. The fisheries in the system would be enhanced due to the creation of a C channel with habitat features throughout. With the connected floodplain receiving regular flooding, it will encourage wetland creation and enhancement. This wetland recharging due to flooding would enhance the wildlife value of the area and also support needed benthic life. Figure 17 shows a conceptual aerial view of the channel, floodplain and wetland system for the partial dam removal alternative.

***Figure 17: Conceptual Aerial View of Partial Removal Conditions***

## Impacts on Affected Environment

### *Ecological Resources: Fisheries*

Implementation of Alternative 3: Partial Removal with Fish Ramp would result in major beneficial impacts and no adverse impacts to fisheries in Steele Brook and the Heminway Pond area.

The beneficial impacts would result from partial removal of a major fish barrier, Heminway Pond Dam, and the creation of a new channel-floodplain system in the pond area. The fish passable ramp downstream of the existing dam would be designed to achieve passage for the greatest number of fish species, at the widest range of flows as is reasonable. This alternative would reduce the pond area by dropping the spillway elevation. In addition, this alternative would alleviate the thermal impacts on Steele Brook, associated with the pond. A significant reduction in the surface area of the pond, increased water velocities through the pond, and the potential for streamside vegetation to shade the brook would reduce the solar radiation, and minimize temperature increases within the pond as well as the downstream reach.

There are no adverse impacts to fisheries associated with implementation of this alternative. The opportunistic habitat generalist (i.e. sunfish) that currently inhabits the pond would be able to live in the proposed stream as well. As stated, a much larger percentage of fish would utilize the fish ramp as opposed to the bypass channel. The main flow of the brook would exit the existing pond area over the partially removed dam and proceed down the ramp until it meets the grade of the existing channel downstream of the dam. This action would open this stretch of stream to passage which has not been passable since construction of the dam.

### *Ecological Resources: Wetlands*

Implementation of Alternative 3: Partial Removal with Fish Ramp would result in major beneficial impacts and significant adverse impacts to wetlands.

The beneficial impacts would be associated with the addition of emergent wetlands throughout the stream system. Also, during the design phase, if open water wetlands were a desired feature, it would be possible to create additional open water wetlands adjacent to the newly constructed stream channel. This would be completed by use of overflow channels and/or pipes to recharge submerged areas.

The adverse impacts to wetlands associated with this alternative would result from the reduction of open water wetlands. Currently, these wetlands are man made wetlands and would not exist to the current extent without the influence of the Heminway Pond Dam. The value of open water wetlands created by impoundments is debatable; however, there would be a number of open water wetland acres lost by implementation of this alternative.

### *Ecological Resources: Wildlife*

Implementation of Alternative 3: Partial Removal with Fish Ramp would result in major beneficial impacts and significant adverse impacts to wildlife in the area.

The beneficial impacts would be the result of additional fish passage through the area. Migrating fish would provide additional feeding for fish-seeking wildlife. Also, stream inhabiting wildlife would return to the area that is currently submerged by the pond. The current lacustrine environment would be replaced with a cool water stream environment. A properly developed floodplain planted with native plants would provide cover and habitat to a number of different species not currently in the area. Many species of birds inhabit shrub land which would be implemented on the floodplain.

The adverse impacts to wildlife would be the result of the loss of the pond area. The number of geese, beavers, muskrats and other species would decrease, as a result of the transformation of pond to stream. The reduction in the number of geese is considered an adverse impact to wildlife but it should be noted that a reduction in geese numbers would improve the water quality in the area which is a fundamental goal of the study.

### *Water Quality*

Implementation of Alternative 3: Partial Removal with Fish Ramp would result in major beneficial impacts and negligible adverse impacts to water quality in the pond area and the stream area downstream of the dam.

The major beneficial impacts would be the result of decreased thermal loading from the pond, and a decrease in bacterial and nutrient inputs as a result of the decrease in the waterfowl population. By elimination of the impounded water, and thereby minimizing the surface area available for solar radiation, water temperatures through the project area as well as downstream of the project area will decrease. Subsequently dissolved oxygen concentration will increase.

In addition, the continuous flow over the partially removed spillway and through the fish ramp downstream of the dam will further improve water quality as a result of increased flows within the channel and a greater flushing rate. It has been documented that during the dry months, flow is reduced to a level where there is no discharge over the spillway. By lowering the elevation of the spillway, confining the steam flow to a defined channel, eliminating the pond, and providing a ramp, stream discharge will be more likely to continuously flow through the area. The increased flow within the stream channel may aid in decreasing the amount of iron precipitate accumulating between the dam and Echo Lake Road.

However, it should be noted that many Connecticut soils and underlying bedrock tend to have high concentrations of iron naturally occurring within them. Ground water percolating through the soils and bedrock in many cases will have elevated levels of iron in solution, which tends to precipitate out when exposed to air or oxygenated water in the stream. The area of the baseball field was most likely at one time a wetland. The combination of decaying organic material and the natural high concentration of iron in the soil and groundwater will not change due to the implementation of this alternative. Iron will continue to discharge into the stream from the natural sources, much of it from the drainage pipes below the field. The increased flow within the channel after the dam is partially removed will allow for less of the precipitate to settle but will not eliminate the addition of iron to the stream system.

The negligible adverse impacts would be the result of additional runoff and sediment from areas upstream of the pond into Steele Brook downstream of the dam. Currently, the dam acts as a sediment trap not allowing sediment to continue downstream, and may allow for the attenuation of some pollutants within the impoundment, preventing them from being transported downstream. With the partial removal of the dam, this sediment can be carried downstream and depending on velocities in the channel downstream, may settle in various locations in the brook.

***Hydrology and Hydraulics***

Implementation of Alternative 3: Partial Removal with Fish Ramp would result in major beneficial impacts and minor adverse impacts to the hydrology and hydraulics in the area.

The 1987 Milone & MacBroom Steele Brook Flood Control Study shows that there is minimal storage behind the Heminway Pond Dam so any changes to flood flow amounts of the overall river system would be minimal.

Although there would be no overall reduction in flooding in the area, a properly designed C channel with access to a floodplain will replicate a natural system and provide flood relief of the channel in the pond area. The creation of a channel floodplain system in the pond area will create a more natural hydrologic condition in this area of Steele Brook.

Local flow and flood stage conditions will change as a result of cutting a notch in the dam. The notch will lower flood stages upstream and hence a larger percentage of flood flow will pass through the remaining dam rather than over the low spots of the embankment and upstream floodplain. This will lead to less flood flow being diverted to the side channel; however, the suggestion to partially fill in the side channel may result in more water flowing into the basketball courts and upstream end of the ball fields during a 50-yr flood.

The minor adverse impacts to hydrology and hydraulics are the result of a change in flow characteristics of the stream system. The rock lined side channel, which currently carries some overflow through the breached area of the dike, would no longer convey flow during drier months of the year due to the drop in normal pool elevation. The rock fish ramp may cause some minor additional flooding of the lower ball field during the 50-yr to 500-yr floods. Based on the hydraulic model, floods less than or equal to the 10-year recurrence interval should still be confined to the channel banks.

***Sediment***

Implementation of Alternative 3: Partial Removal with Fish Ramp would result in significant beneficial impacts and significant adverse impacts to sediment in Steele Brook.

The beneficial impacts are a result of the dam, which acts as a sediment trap, being partially removed therefore allowing transport of sediment through the system. This will return the stream to a more natural sediment transporting system as it was prior to the dam being built.

The adverse impacts result from the potential for large amounts of sediments to be transported downstream and potentially settled out in areas of low velocity. With the entire discharge flowing through the system the opportunity for sedimentation downstream will increase.

***Infrastructure***

Implementation of Alternative 3: Partial Removal with Fish Ramp would result in major beneficial impacts and negligible adverse impacts to infrastructure in the Heminway Pond area.

The beneficial impacts are associated with the partial removal of the aged dam at Heminway Pond and the stability introduced due to the addition of a rock fish ramp. With the dam being a liability for the Town, this alternative addresses this fact by removing the top portion of the spillway and creating a buttress of rock and boulders downstream of the dam in the form of the fish ramp. With the reduction in water surface elevation of the pond, the breached dike will also be relieved of the stress currently placed on it due to the overflow of water in the breach area. Except during flood events this breach will be higher in elevation than the flow of the brook.

The adverse impacts are associated with the wing walls to the dam. For stability reasons, the wing walls would be left in place. With the partial removal of the spillway, a high ledge would be created from the top of the wing wall to the new top of the spillway. This could result in a safety concern and it would be advisable to place safety signs or a fence near the wing walls to warn of this potential hazard. If Alternative 3 is selected, the stability of the walls should be analyzed during the design phase for the partial removal condition. A portion of the dam crest may need to remain against the wall or additional supports may need to be added. In addition, the cyclopean concrete inside the dam crest may need to be grouted or reconstructed after being notched as its stability is unknown.

***Sociologic Issues and Recreation***

Implementation of Alternative 3: Partial Removal with Fish Ramp would result in major beneficial impacts and no adverse impacts to recreation and the sociologic affect a dam can have on the community.

The beneficial impacts are associated with the additional fish passage and the return of the area to a more natural channel floodplain system. Recreational fishing would be increased and improved in the area. Other possible opportunities for this alternative to be a benefit would be the addition of educational signage and trails referencing the importance of fish passage, fish habitat, and the advantages that natural stream features create for the environment. Implementation of this alternative would result in a major stream restoration of Steele Brook and could serve as an excellent opportunity to educate the community and other visitors about the importance of stream systems and habitat.

There are no adverse impacts to recreation and sociologic affects of people in the community. In its present state, the area provides little recreational or educational benefits to the community. This alternative could lead to additional recreation in the area through fishing, hiking, educational outings, and other active and passive recreation. There may be a small fraction of the community that feels an emotional connection to the pond, but in its current state, the area serves no public service so the additional recreational opportunities would most likely be welcomed by the community.

***Cultural and Historic Resources***

Implementation of Alternative 3: Partial Removal with Fish Ramp would result in no beneficial impacts and major adverse impacts to cultural and historic resources in the Heminway Pond area.

There are no beneficial impacts to cultural and historic resources resulting from this alternative. The reason for this is due to the plan for the side channel if partial or full dam removal is chosen as the preferred alternative. The side channel would essentially be buried in granular fill and soil. This action eliminates the need to rebuild the dike but will bury the rock lined channel and mortared stone wall under fill.

The adverse impacts are related to the action of filling the channel with granular fill and soil. This cultural resource will no longer be visible.

Connecticut State Archeologist Nicholas Bellantoni, Ph.D. visited the site and requested that prior to construction activities the wall should be photo documented to conserve in photo format the historic value of the historic rock lined channel and mortared stone wall.

**Level of Achievement of Project Goals**

The project goals for Heminway Pond are to provide a solution which accomplishes the following criteria; mitigate water quality concerns downstream of the dam, provide fish passage through the dam and pond area, remove liability of an aged dam from the Town, and encourage the creation of a greenway in this area of Watertown. Alternative 3: Partial Removal with Fish Ramp was evaluated to determine the level to which it meets the overall project goals.

### *Water Quality Improvement in Steele Brook in Vicinity of Heminway Pond*

Implementation of Alternative 3: Partial Removal with Fish Ramp substantially achieves the goal of improved water quality in Heminway Pond and Steele Brook.

Lowering the spillway elevation and subsequent construction of a channel-floodplain system will eliminate the pond, and thereby minimize the associated thermal and bacterial impacts of the pond on Steele Brook. Improvements in water quality such as lower water temperatures, increased dissolved oxygen concentration, decreased bacterial loads and decreased biological oxygen demand (BOD) will result from the implementation of this alternative.

In addition, this alternative would provide for not only an increase in the volume of flow within the stream channel as compared to the existing condition or the bypass channel alternative, but also an increase in the velocity of flow. The current situation of stagnant water downstream of the dam may be improved although there may continue to be backwater conditions due to stream features farther downstream.

Again, it is worth noting that many Connecticut soils and underlying bedrock tend to have high concentrations of iron naturally occurring within them. Ground water percolating through the soils and bedrock in many cases will have elevated levels of iron in solution, which tends to precipitate out when exposed to air or oxygenated water in the stream. The combination of decaying organic material and the natural high concentration of iron in the soil and groundwater will not change due to the implementation of this alternative. Iron will continue to discharge into the stream from the natural sources
The increase in flow volume and velocity, as a result of the implementation of this alternative will allow for less of the precipitate to settle but will not eliminate the addition of iron to the stream system.

### *Improved Fish Passage through the Heminway Pond Dam*

Implementation of Alternative 3: Partial Removal with Fish Ramp substantially achieves the goal of improved fish passage through the Heminway Pond Dam.

This partial dam removal option would be much less selective in passing fish species than the bypass channel. The fish ramp would provide a safe and effective method for fish to migrate upstream and downstream of the dam. In addition, once the fish overcome the migratory barrier imposed by the dam, they are entering a more favorable stream environment. This will facilitate continued migration up and down Steele Brook, as opposed to the existing pond feature, which would remain in place under the bypass channel alternative.

A significant reduction in the surface area of the pond, increased water velocities through the pond, and the potential for streamside vegetation to shade the brook would reduce the solar radiation and minimize temperature increases within the pond as well as the downstream reach. In addition, the increased channel flow downstream of the dam, in combination with an improved width/depth ratio, will further reduce the thermal impacts associated with the area immediately downstream of the dam where there tends to be slow moving and almost stagnant water with very little flow. This reduction in temperature, the improved channel-flow characteristics, and the ability to migrate through the dam area via the partially removed dam and fish ramp will greatly increase fish passage in the vicinity of Heminway Pond Dam and throughout this area of Steele Brook.

### *Liability to Town Regarding Ownership of Dam*

Implementation of Alternative 3: Partial Removal with Fish Ramp substantially achieves the goal of eliminating the liability of the Town owning an aged dam.

It is true that this option is only a partial removal and pieces of the dam will remain in place, but the fish ramp will act as a buttress and will stabilize the remaining dam in place. The remaining dam and fish ramp together will then act as grade control for the newly constructed stream system. Due to the additional stability created by the rock fish ramp, it is felt that this option does address the issue of the future stability of the dam. Therefore, Alternative 3: Partial Removal with Fish Ramp substantially achieves the goal of eliminating the liability to the Town regarding ownership of Heminway Pond Dam. However, it is recommended that the project sponsors discuss this alternative with the State of Connecticut Dam Safety Department at the Connecticut Department of Environmental Protection to assure the Town will be cleared of any liability issues concerning a partial dam removal option versus a full dam removal.

### *Incorporation of Heminway Pond with Town Greenway*

Implementation of Alternative 3: Partial Removal with Fish Ladder is a more favorable option compared to the bypass channel alternative in regards to incorporating this project with the Town greenway project.

The newly constructed fish ramp would be a unique educational element of the area. Also, if off channel wetlands are maintained after partial removal of the spillway, there would be great diversity of wildlife in the area. Stream residing wildlife and also wetland residing wildlife would utilize the area. If the off channel wetlands are not incorporated into the final design, the area that would be deemed as floodplain area would be available for walking trails and other active and passive recreation. Educational opportunities are abundant between the increased fish migration and the newly created stream channel. These trails and educational opportunities could easily be connected to the greenway trail. The Heminway Pond area would be a highlight along the greenway trail due to the increased accessibility and recreational opportunities found there.

## Design Considerations and Concerns

This alternative has a number of design considerations and concerns associated with it. First and foremost the stakeholders must determine the level of risk they are willing to incur with a dam removal and natural stream design. There is a corresponding level of risk associated with using natural stream design versus traditional engineering practices. The more soft engineering and natural features such as bioengineering that are implemented, the greater the risk of channel mobility and instability in flood flows. As the design is moved more towards traditional engineering, this risk diminishes. Please note there is always some level of risk associated with all designs. However, traditional engineering practices such as riprap have been tested and applied for many years with a strong record of success. Natural stream restoration is a relatively new science and is continuing to be improved upon. Methods to lower the risk would include implementation of a fixed boundary or a hard armored channel. The stakeholders must assess the level of risk they are willing to incur upon themselves and the community prior to the design process. Many times a combination of natural stream features with traditional engineering proves to be the best balance of natural design and stability.

Some important questions for stakeholders to consider are as follows: Is migration of the stream acceptable and to what extent? Are in-channel hard points to limit migration acceptable? Is total armoring of the stream acceptable? Is there a design life required for the stream channel or in stream structures? What type of flood flows should the stream system adequately handle? Is a vegetated floodplain expected to act as stability and what type of maintenance and legal protection is needed to assure the floodplain is maintained as designed? It is important that the project goals and the willingness to take on a level of risk are of similar magnitude.

Another design consideration and concern is the amount of material available to create a vegetated floodplain. After partial removal of the spillway occurs, the existing sediments in the pond will become the newly created floodplain and will be planted with native floodplain plants. Depending on the new elevation of the spillway, there may not be enough material exposed to relocate and fill in the entire pond area to create the wide floodplain. Additional material may be needed from an external location to build the floodplain if there is a lack of material. Another option would be to relocate some of the sediments and allow for additional open water wetland areas. These wetlands could be linked into the stream channel using pipes or overflow channels to assure flushing and regeneration after dry periods. It should be noted that these open water wetlands will attract geese and this may increase bacteria loads in these locations but not anymore than what is occurring in its present form.

The newly developed floodplain adjacent to the constructed stream channel will face vegetative competition from the number of invasive plants in the pond area. Some type of invasive plant control should be considered for the area to allow the native plants installed on the floodplain to flourish.

Due to the lack of staging area in and around the side channel, maneuverability of construction equipment may be limited. Assuming the Town would require the baseball field to be operational during construction, the large flat area above the channel would not be readily available for equipment. The access would therefore be in the channel only. Temporarily removing the fencing along the baseball field and using this area for staging would alleviate some of these issues.

**Potential Permits**

There are a number of potential state and federal permits that would need to be acquired in order to implement this alternative. These permits would most likely include but are not limited to the following:

1. Dam Construction Permit - Any person or agency proposing to construct a dam, dike, reservoir or similar structure, or to repair, alter or remove an existing dam, dike reservoir or similar structure, must first obtain either a permit from the commissioner or a determination that such permit is not required.

2. Flood Management Certification - Any state agency proposing an activity within or affecting a floodplain or that impacts natural or man-made storm drainage facilities must submit a flood management certification. Such activities include, without limitation: a) any structure, obstruction or encroachment proposed for emplacement within the floodplain area; b) any proposal for site development which increases peak runoff rates; c) any grant or loan which affects land use, land use planning or the disposal of state properties in floodplains; or d) any program regulating flood flows within the floodplain.

3. Clean Water Act (CWA) Section 404 Dredge and Fill Permit - Most dam removals require a CWA Section 404 permit, issued by the U.S. Army Corps of Engineers (Corps) for dredging of a navigable waterway (33 U.S.C. §1344). A guideline pursuant to this statutory requirement establishes a policy of no net loss to wetlands.[1] In order to obtain Corps approval, the project: (a) should not cause or contribute to significant degradation of the waters or result in a net loss of wetlands; (b) should be designed to have minimal adverse impact; (c) should not have any practicable alternatives; and (d) should be in the public interest. In some cases, dam removal will result in a net loss of wetlands. To obtain a permit in these situations, the Corps will have to find that the benefits of dam removal outweigh the loss of wetlands.

4. Rivers and Harbors Act, Section 10 Permit - In conjunction with the Section 404 permit, the USACE will also issue a Section 10 permit for federal activities affecting navigable waterways, 33 U.S.C. 403. The permit will be issued if there is no adverse impact on interstate navigation.

5. National Environmental Policy Act Review - Actions by federal agencies (e.g., permits, funding, technical assistance) may require compliance with the National Environmental Policy Act (NEPA), 42 U.S.C. 4321 et seq. NEPA requires that an Environmental Assessment (EA) be prepared to determine whether a proposed dam removal would have a significant effect on the quality of the environment. Depending on whether the project's impacts are considered significant, either a Finding of No Significant Impact (FONSI) would be issued or an Environmental Impact Statement (EIS) would be prepared.

6. 401 Water Quality Certification - Any applicant for a federal license or permit, including a dredge and fill permit from the U.S. Army Corps of Engineers, a bridge construction permit from the U.S. Coast Guard, or a permit from the Federal Energy Regulatory Commission (FERC) must obtain a 401 Water Quality Certificate from DEP if the proposed activity may result in any discharge into the navigable waters. Such discharges include, among other things, the discharge of dredged and fill material and stormwater during construction, incidental discharge of sediments from dredging or excavating, and the discharge of stormwater from a facility once it is constructed, and any excavation, flooding, draining, and clearing and grading in or affecting the navigable waters.

7. Inland Wetlands and Watercourses - Any state agency or instrumentality, except a local or regional board of education, proposing to conduct any operation within or use of a wetland or watercourse involving the removal or deposition of material, or any obstruction, construction, alteration or pollution of such wetlands or watercourses must apply to DEP.

8. Stream Channel Encroachment Lines - Any person proposing to place an encroachment or obstruction riverward of stream channel encroachment lines must obtain a permit. Activities which require a permit when conducted riverward of such lines include the removal or deposition of material, any alteration of the land or watercourse or construction of structures, filling, dredging, clearing, grubbing, grading, piping, installing culverts, channelizing, diverting, damming, dewatering, construction of structures, and any other activity that temporarily or permanently alters the character of the floodplain or watercourse.

9. Water Diversion - In general, any person proposing a diversion which was not registered with the Department and, which is not exempt, must apply for a permit. You must apply for a permit if, among other things, you propose to relocate, retain, detain, bypass, channelize, pipe, culvert, ditch, drain, fill, excavate, dredge, dam, impound, dike, or enlarge waters of the state.

10. Lake, Pond, and Basin Dredging - Provided other requirements are satisfied, this general permit authorizes: Dredging of a lake or pond that will restore or improve aquatic habitat or maintain the existing recreational use of such pond or lake provided: 1) such dredging shall not exceed 6,000 cubic yards of material; and 2) the area dredged shall not exceed one acre of such lake or pond. This permit is not intended to authorize dredging that will result in the conversion of an area of submerged or emergent vegetation or marsh, swamp, bog or similar such habitat to open water. Grading and placement of not greater than twenty-five (25) cubic yards of fill is allowed in a regulated area for temporary access to the site of such activity provided that: 1) all temporary fill is removed, 2) the top of roadway is no more than one foot above existing grade and 3) any disturbed areas are restored by the completion of the project or by the expiration date of the commissioner's written authorization of such regulated activity, whichever occurs first.

11. Contaminated Soil and/or Sediment Management General Permit - This general permit authorizes the staging, transfer, and temporary storage of contaminated soil and/or sediment and is intended to address the management of these materials when they are generated during projects that are less than 2 years in duration and involve the excavation of earthen material. It establishes a uniform set of environmentally protective management procedures for stockpiling soils when they are generated during projects where contaminated soils are typically managed (held temporarily during characterization procedures to determine a final disposition) including, but not limited to remediation, construction, and utility installation projects.

Other local permits may be required such as a building permit or a site plan review permit from the planning board. The local Land Use Administrator in the Planning and Zoning Office serves as the zoning code enforcement officer and should be consulted for other applicable municipal permits.

Dam-related activities in Connecticut are regulated by the Inland Water Resources Division of the Bureau of Water Protection and Land Reuse, which is a part of the Connecticut Department of Environmental Protection (CT DEP). The state has jurisdiction over "all dams . . . without exception and without further definition or enumeration herein, which, by breaking away or otherwise, might endanger life or property." Connecticut has created a system that, at least on the state level, is somewhat integrated, tying dam permit issuance to several other requisite permits.

An applicant must first apply for a Dam Safety Permit, which applies to all dams in Connecticut (excluding federally owned and operated dams). After submitting an application, the applicant must then provide public notice of intent to apply for the permit. CT DEP reviews the permit for safety, wetlands and fisheries considerations and will integrate any necessary permit conditions to address issues raised by the other agencies, including the disposal of contaminated sediments. Once CT DEP finds the permit acceptable, they will publish and distribute a Notice of Tentative Determination to approve the application to the public, the Inland Fisheries Division, wetland agencies and the planning, zoning and conservation commission of each town affected by the project.

The advantage to the applicant using this permit is that once the Dam Safety permit is approved, the applicant does not need to obtain a separate municipal Inland Wetland and Watercourse Permit (necessary for work affecting wetlands), a Stream Channel Encroachment Line (SCEL) Permit (a CT DEP permit necessary for any activity that temporarily or permanently alters the character of the floodplain or watercourse wherein SCEL lines are established), or a CT DEP Water Diversion Permit (necessary for any alteration of the instantaneous flow of water).

Connecticut maintains a Natural Diversity Data Base and CT DEP permit approval requires a review to determine a project's potential impact on federal and state protected species and habitat. Initial review can be made by the applicant by following directions on the Natural Diversity Data Base website. Further review by state wildlife and fisheries biologists is necessary only if a potential conflict is apparent.

This list of permits may or may not include all the necessary permits. Additional permits may be necessary. However, there are permits listed that may not be required. The Lake, Pond, and Basin Dredging permit is an example of a permit that may or may not be necessary. Also, a contaminated soil permit may not be necessary but a sediment management permit may be. If excavation activities are to occur near HP 4, where the concentration of contaminants is highest, a contaminated soil permit may be necessary. The permit requirements should be discussed with the CT DEP early in the design process to assure the necessary permits are obtained.

The list of permits and information regarding each permit was taken from NRCS prior experience, personal email correspondence with EA Engineering, and American Rivers documents titled "Obtaining Permits to Remove a Dam" published in 2002 and "Permitting Dam Removal: The State of (Several) States" published in 2006 . The American Rivers documents are included in Appendix H and Appendix I.

**Cost Estimate**

A cost estimate was prepared for Alternative 3: Partial Removal with Fish Ramp. Please see Table 5 for an itemized list of costs. Although the final cost is reported to the nearest dollar in the Table, this is not representative of the actual level of accuracy available at the feasibility level. Due to a number of uncertainties that remain at the feasibility level, this cost estimate should be viewed with some precaution. The cost of Alternative 3: Partial Removal with Fish Ramp is estimated at $500,000.00.

*Table 5: Alternative 3 Planning Level Cost Estimate Details*

| Steele Brook Alternate 3 - Partial Dam Removal and Channel Restoration | | | | | | |
|---|---|---|---|---|---|---|
| **Item No.** | **Work or Material** | **Spec. No.** | **Est. Quant.** | **Units** | **Unit Cost** | **Amount** |
| 1 | Mobilization and Demobilization | 8 | 1 | Job | $35,000.00 | $35,000.00 |
| 2 | Clearing and Grubbing | 2 | 1 | Job | $5,000.00 | $5,000.00 |
| 3 | Dam Concrete Removal | 3 | 20 | CY | $110.00 | $2,200.00 |
| 4 | Pollution Control (included in dewatering) | 5 | 1 | Job | $0.00 | $0.00 |
| 5 | Stabilized Construction Entrance | 5 | 1 | Job | $2,250.00 | $2,250.00 |
| 6 | Temporary Mulch | 5 | 1 | Job | $0.00 | $0.00 |
| 7 | Seeding and Mulching | 6 | 23,351 | Sq.Yd. | $1.00 | $23,351.00 |
| 8 | Removal of Water | 11 | 1 | Job | $50,000.00 | $50,000.00 |
| 9 | Unclassified Excavation (all used on-site) | 21 | 2,669 | CY | $25.00 | $66,725.00 |
| 10 | Backfill under Rock Fish Ramp | 23 | 452 | CY | $50.00 | $22,600.00 |
| 11 | Backfill in Fish Ramp Riprap | 23 | 215 | CY | $65.00 | $13,975.00 |
| 12 | Topsoiling (use sandy muck on site) | 26 | 432 | CY | $10.00 | $4,320.00 |
| 13 | 24 Inch Riprap | 61 | 717 | CY | $97.00 | $69,549.00 |
| 14 | Flat Rock | 61 | 154 | CY | $200.00 | $30,800.00 |
| 15 | Channel armor | 61 | 1,745 | CY | $85.00 | $148,325.00 |
| 16 | Chain Link Fence | 91 | 60 | Ft | $20.00 | $1,200.00 |
| 17 | Trees and Shrubs | 401 | 0 | Job | $0.00 | $0.00 |
| | | | | | | |
| | | | | **Total =** | | **$475,295.00** |
| | | | | **Use =** | | **$500,000.00** |
| | **Fish Ladder Costs Alone** | | | | | |
| | | | | | | |
| | Backfill under Rock Fish Ramp | 23 | 452 | CY | $50.00 | $22,600.00 |
| | Backfill in Fish Ramp Riprap | 23 | 215 | CY | $65.00 | $13,975.00 |
| | 24 Inch Riprap | 61 | 717 | CY | $97.00 | $69,549.00 |
| | Flat Rock | 61 | 154 | CY | $192.00 | $29,568.00 |
| | | | | | | |
| | | | | **Total =** | | **$135,692.00** |

This cost estimate was produced using a variety of sources to determine estimated costs for the unit items. The primary sources of cost data and information were historic bid data from past NRCS construction projects, RSMeans Site Work & Landscape Cost Data cost estimating guide, and NRCS professional judgment.

The historic bid data was taken from projects mostly funded under the Emergency Watershed Protection Program from 2005 through present. Many of these projects included a combination of natural stream features and traditional stabilization techniques. The 2006 RSMeans Site Work & Landscape Cost Data cost estimating guide was used and adjusted for inflation using various sources including data from the publication Engineering News Record, commonly known as ENR. For those items that past data was not available and is not readily estimated from the cost estimating guides, NRCS personnel used their professional judgment based on years of experience to determine an estimated cost.

Please note that there are a number of unknowns that remain during the feasibility stage of a project. Without a final design, there may be some inherent error in the quantities and unit costs. Also, for some items, a construction technique must be assumed. After a final design is completed, these assumed techniques will need to be reevaluated for relevancy and a proper cost estimated for that practice. Therefore, please be aware that the final design costs may be substantially different than the costs quoted in this report.

## Alternative 4: Full Removal of Spillway

*Figure 18: Full Removal Conceptual Rendering*

### Introduction/Description

Alternative 4: Full Removal of Spillway considers the option of removing the majority of the dam spillway to the concrete footer (elevation 474 ft NAVD88) and constructing a stable channel upstream through the impoundment. Figure 18 shows a conceptual rendering of the dam and upstream area for this alternative.

For this option it is desirable to leave some of the dam spillway in place as shown in Figure 19. Leaving portions approximately 2 feet high by 20 ft wide to the sides of the 2 ft by 35 ft bank full channel would enhance stability of the floodplain and prevent migration of the channel. Additionally, the east abutment which is currently supported by the dam spillway may need to be stabilized. This could be accomplished by leaving a portion of the spillway in place or other alternative methods. These methods will need to be analyzed further during the design phase if this option is selected. The remaining portion of the dam may need to be grouted or reconstructed as the stability of the cyclopean concrete inside the dam crest is unknown. The west abutment wall could be lowered approximately 10 feet and replaced with a riprap slope as that abutment would no longer be necessary.

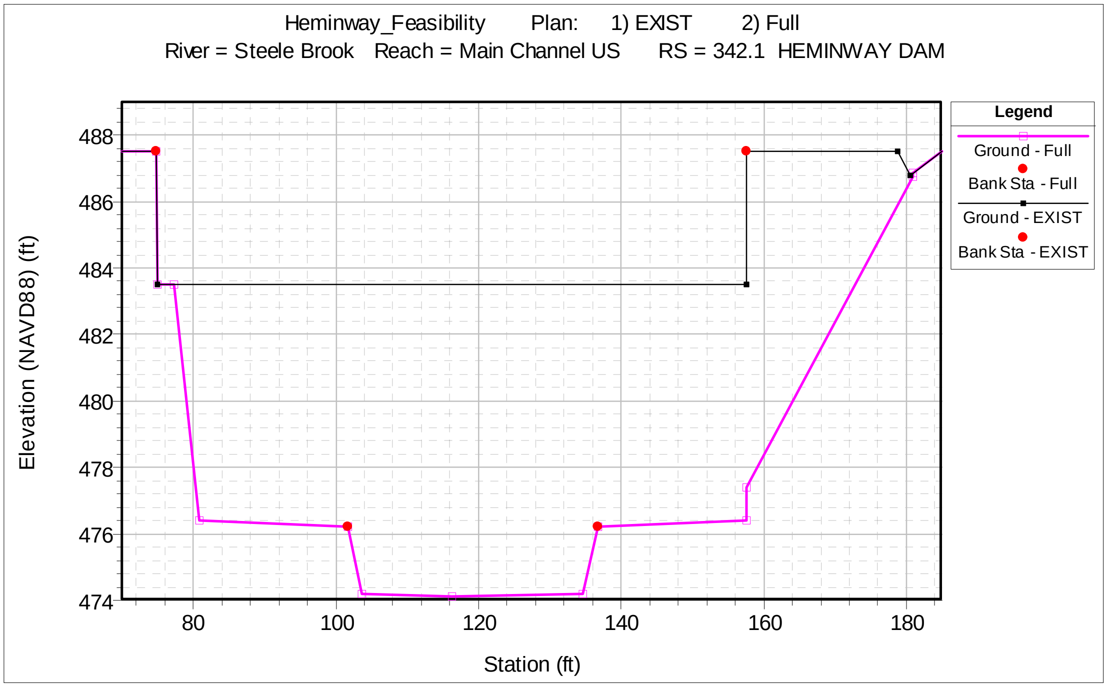


***Figure 19: Full Removal Dam Geometry***

In addition to the removal of the spillway, a stable channel would be constructed upstream of the dam as well as downstream of the dam. The channel downstream of the dam would be classified as a B3 stream type, while the channel upstream of the dam would be classified as a C3 stream type, using the Rosgen stream classification method. The B3 stream type downstream of the dam would be necessary to transition Steele Brook from the proposed C3 stream type constructed in the former impoundment to the armored channel upstream of Echo Lake Road.

It is also desirable to partially fill the rock lined side channel as described in the partial removal alternative, to reduce stagnant water and the hazard of the approximate 5 foot vertical wall near the ball fields and basketball courts.

**Natural Stream Features**

There are a number of natural stream features that could be included after implementation of this alternative. Most noticeably would be the channel-floodplain system created in the pond area after the spillway has been removed.

In the current pond area, a C3 type channel would be created. This channel would include a series of pools and riffles and include a moderate amount of meandering. The meanders would encourage the creation of point bars. These pools, riffles and point bars create fish and wildlife habitat that is very desirable in stream restoration projects. Figure 20 displays a conceptual image of a typical C3 stream type and represents the type of channel to be created in the pond area.

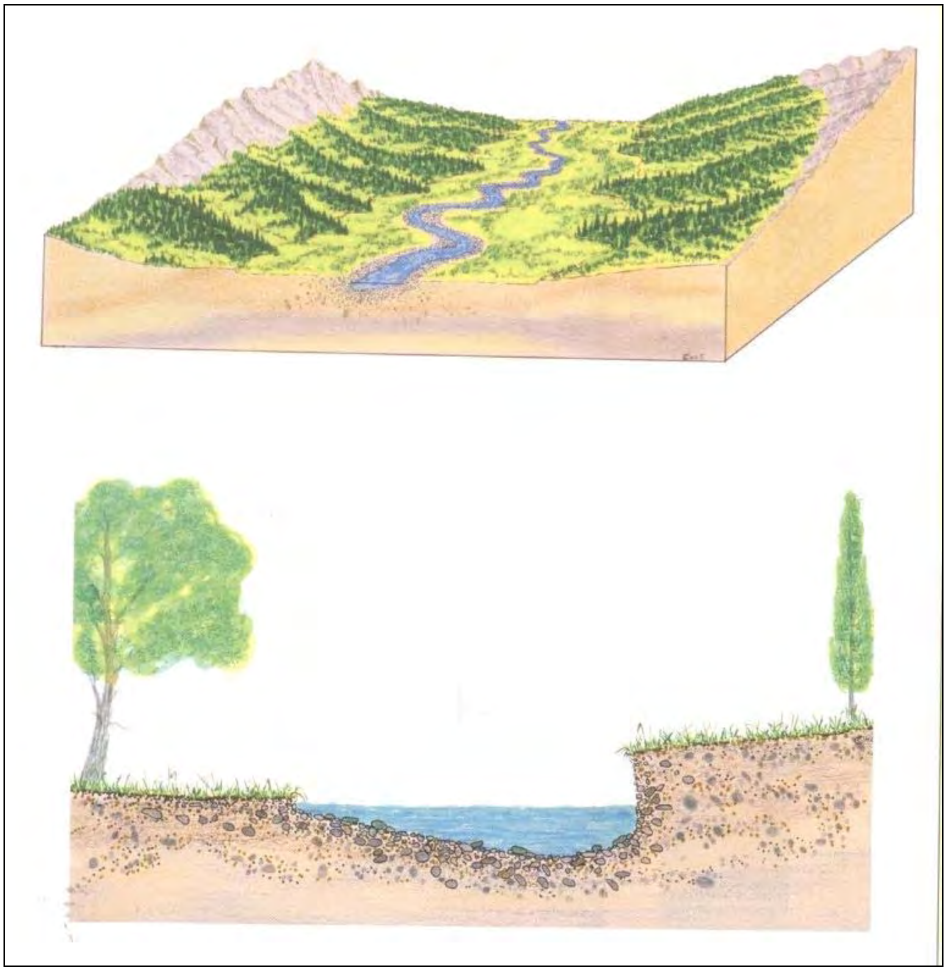

***Figure 20: Conceptual View of Typical C3 Stream Type.***
*(Image from Rosgen 1996, reproduced with permission from Wildland Hydrology)*

The proposed channel will mimic the riffle and pool channel geometry described in Alternative 3; however, the channel geometry will change slightly. These changes in channel geometry are primarily a function of the change in slope and size of the bed material (cobble) which will form the channel boundary. The width at bankfull will be approximately 33-35 feet wide, with a mean depth of approximately 2.0 feet, resulting in a bankfull cross-sectional area of slightly less than 70 square feet. The bankfull slope would be approximately 0.0083 ft/ft as opposed to a slope of 0.0035 ft/ft for the C4 stream type planned in Alternative 3. In addition, the increase in slope translates to an increase in stream power, which would require a larger sized substrate to comprise the bed material to maintain stability of the channel.

This alternative would create a connected channel-floodplain system. This system would enhance the fisheries, benthic life and also wildlife. The fisheries in the system would be enhanced due to the creation of a C channel with habitat features throughout. With the connected floodplain receiving regular flooding, it will encourage wetland creation and enhancement. This wetland recharging due to flooding would enhance the wildlife value of the area and also support needed benthic life. Figure 21 shows a conceptual aerial view of the channel, floodplain and wetland system for the full dam removal alternative.

***Figure 21: Conceptual Aerial View of Full Removal Conditions***

**Impacts on Affected Environment**

***Ecological Resources: Fisheries***

Implementation of Alternative 4: Full Removal of Spillway would result in major beneficial impacts and no adverse impacts to fisheries in Steele Brook and the Heminway Pond area.

The beneficial impacts would result from complete removal of a major fish barrier, Heminway Pond Dam, elimination the pond, and the creation of a new channel-floodplain system in the pond area. Fish passage would be accomplished due to the removal of the spillway, and the construction of a more suitable stream channel above and below the dam. The proposed channel would facilitate the unimpeded migration of the full range of fish species through the entire project reach. Subsequently, implementation of this option allows the maximum amount of fish passage possible at this site. This alternative would eliminate the thermal impacts associated with the pond and the channel between the dam and Echo Lake Road.

There are no adverse impacts to fisheries associated with implementation of this alternative. As stated, a much larger percentage of fish, more specifically a larger range of size classes would utilize the newly constructed channel system through the removed spillway as compared to the bypass channel and the partial removal option. This option, like the other alternatives, would open this stretch of stream to passage which has not been passable since construction of the dam.

***Ecological Resources: Wetlands***

Implementation of Alternative 4: Full Removal of Spillway would result in minor beneficial impacts and major adverse impacts to wetlands.

The beneficial impacts would be associated with the addition of emergent wetlands as well as a functioning floodplain wetland throughout the stream system. These emergent wetlands and floodplain wetlands would be created due to the newly constructed stream channel in the pond area.

The adverse impacts would be associated with the loss of open water wetlands due to removal of the dam. The pond area would essentially cease to exist. A new stream system would take the place of the pond area. These open water wetlands are man made wetlands and their value is debatable, but there would be a significant loss of open water wetlands due to the removal of the dam.

***Ecological Resources: Wildlife***

Implementation of Alternative 4: Full Removal of Spillway would result in minor beneficial and major adverse impacts to wildlife in the area.

The beneficial impacts would be the result of additional fish passage through the area. Migrating fish would provide additional feeding for fish-seeking wildlife. Also, stream inhabiting wildlife would return to the area that is currently submerged by the pond. The current lacustrine environment would be replaced with a cool water stream environment. A properly developed floodplain and upland area planted with native plants would provide cover and habitat to a number of different species not currently in the area. Many species of birds inhabit shrub land which would be implemented on the floodplain.

The adverse impacts to wildlife would be the result of the loss of the pond area. The number of geese, beavers, muskrats and other species would decrease in the area due to the transformation of pond to stream. The reduction in the number of geese is considered an adverse impact to wildlife but it should be noted that a reduction in geese numbers would improve the water quality in the area which is a fundamental goal of the study.

***Water Quality***

Implementation of Alternative 4: Full Removal of Spillway would result in major beneficial impacts and negligible adverse impacts to water quality in the pond area and the stream area downstream of the dam.

The major beneficial impacts would be the result of continuous flow over the fully removed spillway and through the stream channel downstream of the dam, the construction of channel-floodplain system, and a reduction in the thermal and bacterial loading as a result of the elimination of the pond.

It has been documented that during the dry months, flow is reduced to a level that there is no discharge over the spillway. By lowering the elevation of the spillway to the footer and constructing a channel-floodplain system, discharge will continuously flow through the area. This will provide for increased flows within the channel downstream of the dam. The increased flow within the stream channel may aid in decreasing the amount of iron precipitate accumulating between the dam and Echo Lake Road.

However, it should be noted that many Connecticut soils and underlying bedrock tend to have high concentrations of iron naturally occurring within them. Ground water percolating through the soils and bedrock in many cases will have elevated levels of iron in solution, which tends to precipitate out when exposed to air or oxygenated water in the stream. The area of the baseball field was most likely at one time a wetland. The combination of decaying organic material and the natural high concentration of iron in the soil and groundwater will not change due to the implementation of this alternative. Iron will continue to discharge into the stream from the natural sources, much of it from the drainage pipes below the field.

The negligible adverse impacts would be the result of additional runoff and sediment from areas upstream of the pond area to reach areas downstream of the dam. Currently, the dam acts as a sediment trap, and may allow for the attenuation of some pollutants within the impoundment, preventing them from being transported downstream. With the full removal of the dam, this sediment can be carried downstream and depending on velocities in the channel downstream, may settle in various locations in the brook.

***Hydrology and Hydraulics***

Implementation of Alternative 4: Full Removal of Spillway would result in major beneficial impacts and significant adverse impacts to the hydrology and hydraulics in the area.

The 1987 Milone & MacBroom Steele Brook Flood Control Study shows that there is minimal storage behind the Heminway Pond Dam so any changes to flood flow amounts of the overall river system would be minimal.

Although there would be no overall reduction in flooding in the area, a properly designed C3 channel with access to a floodplain will replicate a natural system and provide flood relief of the channel in the pond area. The creation of a channel floodplain system in the pond area will create a more natural hydrologic condition in this area of Steele Brook.

Local flow and flood stage conditions will change as a result of removing the spillway, which will lower flood stages upstream and hence a larger percentage of flood flow will pass through the remaining dam rather than over the low spots of the embankment and upstream floodplain. This will lead to less flood flow being diverted to the side channel, basketball courts, and ball fields. Large events may still flood the ball fields due to backwater from Echo Lake Road Bridge.

The minor adverse impacts to hydrology and hydraulics are the result of a change in flow characteristics of the stream system. The rock lined side channel, which currently carries some overflow through the breached area of the dike, would no longer convey flow during drier months of the year due to the drop in normal water elevation. Additional filling of the rock channel will also reduce conveyance of the channel.

***Sediment***

Implementation of Alternative 4: Full Removal of Spillway would result in significant beneficial impacts and major adverse impacts to sediment in Steele Brook.

The beneficial impacts are a result of the dam, which acts as a sediment trap, being fully removed therefore allowing transport of sediment through the system. This will return the stream to a more natural sediment transporting system as it was prior to the dam being built.

The adverse impacts result from the potential for large amounts of sediments to be transported downstream and potentially settled out in areas of low velocity. With the entire discharge flowing through the system, the opportunity for sedimentation downstream will increase. A stable channel-floodplain system will be designed to protect material in the former impoundment, but the normal bedload returning to the system, which is considered beneficial, may also cause adverse impacts downstream.

### *Infrastructure*

Implementation of Alternative 4: Full Removal of Spillway would result in major beneficial impacts and minor adverse impacts to infrastructure in the Heminway Pond area.

The beneficial impacts are associated with the removal of Heminway Pond Dam. This action removes the liability of ownership of an aged dam from the Town. With the reduction in water surface elevation of the pond, the breached dike will also be relieved of the stress currently placed on it due to the overflow of water in the breach area. Except during flood events this breach will be higher in elevation than the flow of the brook. Another benefit is that the west abutment and wing wall could be almost completely removed and replaced by a riprap slope up the earthen embankment allowing additional floodplain conveyance and removing the liability of the vertical wall.

The adverse impacts are associated with the east wing wall and abutment to the dam. For stability reasons, the east abutment would be left in place. With the full removal of the spillway, a high ledge would be created from the top of the abutment to the new floodplain. This could result in a safety concern and it would be advisable to place safety signs and/or a fence near the walls to warn of this potential hazard.

### *Sociologic Issues and Recreation*

Implementation of Alternative 4: Full Removal of Spillway would result in major beneficial impacts and no adverse impacts to recreation and the sociologic affect a dam can have on the community.

The beneficial impacts are associated with the additional fish passage and the return of the area to a more natural channel, floodplain and upland system. Recreational fishing would be increased and improved in the area. Other possible opportunities for this alternative to be a benefit would be the addition of educational signage and trails referencing the importance of fish passage, fish habitat, and the advantages that natural stream features create for the environment. Implementation of this alternative would result in a major stream restoration of Steele Brook and could serve as an excellent opportunity to educate the community and other visitors about the importance of stream systems and habitat.

There are no adverse impacts to recreation and sociologic affects of people in the community. In its present state, the area provides little recreational or educational benefits to the community. This alternative could lead to additional recreation in the area through fishing, hiking, educational outings, and other active and passive recreation. There may be a small fraction of the community that feels an emotional connection to the pond, but in its current state, the area serves no public service so the additional recreational opportunities would most likely be welcomed by the community.

### *Cultural and Historic Resources*

Implementation of Alternative 4: Full Removal of Spillway would result in no beneficial impacts and major adverse impacts to cultural and historic resources in the Heminway Pond area.

There are no beneficial impacts to cultural and historic resources resulting from this alternative. The reason for this is due to the plan for the side channel if partial or full dam removal is chosen as the preferred alternative. The side channel would essentially be buried in granular fill and soil. This action eliminates the need to rebuild the dike but will bury the stacked rock channel and wall under fill.

The adverse impacts are related to the action of filling the channel with granular fill and soil. This cultural resource will no longer be visible.

Connecticut State Archeologist Nicholas Bellantoni, Ph.D. visited the site and requested that prior to construction activities the wall should be photo documented to conserve in photo format the historic value of the rock lined channel and mortared stone wall.

## Level of Achievement of Project Goals

The project goals for Heminway Pond are to provide a solution which accomplishes the following criteria; mitigate water quality concerns downstream of the dam, provide fish passage through the dam and pond area, remove liability of an aged dam from the Town, and encourage the creation of a greenway in this area of Watertown. Alternative 4: Full Removal of Spillway was evaluated to determine the level to which it meets the overall project goals.

### *Water Quality Improvement in Steele Brook in Vicinity of Heminway Pond*

Implementation of Alternative 4: Full Removal of Spillway substantially achieves the goal of improved water quality in Heminway Pond and Steele Brook.

The removal of the spillway and subsequent construction of a channel-floodplain system will eliminate the pond, and thereby minimize the associated thermal and bacterial impacts of the pond on Steele Brook. Improvements in water quality such as lower water temperatures, increased dissolved oxygen concentration, decreased bacterial loads and decreased biological oxygen demand (BOD) will result from the implementation of this alternative.

In addition, this alternative would provide for not only an increase in the volume of flow within the stream channel as compared to the existing condition or the bypass channel alternative, but also an increase in the velocity of flow. With this additional channel flow, the iron precipitate which settles in the stream between the dam and Echo Lake Road will be less likely to settle and accumulate. The current situation of stagnant water downstream of the dam may be improved by implementation of this alternative, although there may continue to be backwater conditions due to stream features farther downstream.

Again, it is worth noting that many Connecticut soils and underlying bedrock tend to have high concentrations of iron naturally occurring within them. Ground water percolating through the soils and bedrock in many cases will have elevated levels of iron in solution, which tends to precipitate out when exposed to air or oxygenated water in the stream. The combination of decaying organic material and the natural high concentration of iron in the soil and groundwater will not change due to the implementation of this alternative. Iron will continue to discharge into the stream from the natural sources.

***Improved Fish Passage through the Heminway Pond Dam***

Implementation of Alternative 4: Full Removal of Spillway substantially achieves the goal of improved fish passage through Heminway Pond Dam.

Similar to the partial removal option, this option would be much less selective than the bypass channel option. The increased flushing action downstream of the dam would most likely reduce the water temperatures immediately downstream of the dam where there tends to be slow moving and almost stagnant water with very little flow. Also, with the reduction in pond area, one can expect a reduction in temperature in the pond area through the newly constructed stream channel. This reduction in temperature and ability to migrate through the dam area via the fully removed dam will greatly increase fish passage in the vicinity of Heminway Pond Dam and throughout this area of Steele Brook.

***Liability to Town Regarding Ownership of Dam***

Implementation of Alternative 4: Full Removal of Spillway substantially achieves the goal of eliminating the liability of the Town owning an aged dam.

The footer of the dam will remain in place providing grade control for the area upstream of the dam. Also, the abutments would remain in place providing further stability to the area. As mentioned in other sections of this report, due to the anticipated drop-off between the top of the abutments and the bottom of the removed spillway, safety signage or other safety features should be considered for the area. The full spillway removal achieves the goal of removing the liability of the Town owning an aged dam to a greater degree than the other alternatives mentioned.

***Incorporation of Heminway Pond with Town Greenway***

Implementation of Alternative 4: Full Removal of Spillway is a more favorable option compared to the bypass channel alternative and is similar in favorability to the partial removal alternative in regards to incorporating this project with the Town greenway project.

There would be abundant floodplain and upland area available for walking trails and other active and passive recreation. Signage relating the importance of the present land forms (stream/wetland, floodplain and upland) could be incorporated as an educational element. Other educational opportunities are abundant between the increased fish migration and the newly created stream channel. These trails and educational opportunities could easily be connected to the greenway trail. The Heminway Pond area would be a highlight along the greenway trail due to the increased accessibility and recreational opportunities found there.

**Design Considerations and Concerns**

This alternative has a number of design considerations and concerns associated with it. Many of these considerations and concerns involved in the partial dam removal and fish ramp apply to this alternative as well. First and foremost the stakeholders must determine the level of risk they are willing to incur with a dam removal and natural stream design. There is a corresponding level of risk associated with using natural stream design versus traditional engineering practices. The more soft engineering and natural features such as bioengineering that are implemented, the greater the risk of channel mobility and instability in flood flows. As the design is moved more towards traditional engineering, this risk diminishes. Please note there is always some level of risk associated with all designs. However, traditional engineering practices such as riprap have been tested and applied for many years with a strong record of success. Natural stream restoration is a relatively new science and is continuing to be improved upon. Methods to lower the risk would include implementation of a fixed boundary or a hard armored channel. The stakeholders must assess the level of risk they are willing to incur upon themselves and the community prior to the design process. Many times a combination of natural stream features with traditional engineering proves to be the best balance of natural design and stability.

Some important questions for stakeholders to consider are as follows: Is migration of the stream acceptable and to what extent? Are in-channel hard points to limit migration acceptable? Is total armoring of the stream acceptable? Is there a design life required for the stream channel or in stream structures? What type of flood flows should the stream system adequately handle? Is a vegetated floodplain expected to act as stability and what type of maintenance and legal protection is needed to assure the floodplain is maintained as designed? It is important that the project goals and the willingness to take on a level of risk are of similar magnitude.

There has been discussion within the Town regarding the reuse of the pond area as active recreational fields. The alternatives in this Feasibility Analysis were based on the creation of a naturally vegetated floodplain. The construction of active recreational fields will compromise the integrity and stability of the floodplain, require a fixed boundary channel design, reduce channel mobility and natural channel functions, and attract geese and other waterfowl perpetuating water quality impairments. It may also complicate the permitting process.

The design consideration and concern regarding the amount of material available to create a vegetated floodplain after dam removal is still relevant but there will be more material available due to the dam being removed to the elevation of the footer. After removal of the spillway occurs, the existing sediments in the pond will become the newly created floodplain and will be planted with native floodplain plants. There will most likely be a major relocation of sediments to create the floodplain. The reason for this is that the channel will be slightly more entrenched than the partial removal option. With this slightly entrenched channel, we will still want access to a floodplain when floods overtop the bank. The extent of entrenchment and access to the floodplain will be determinant on the amount of sediment that is realistically relocated. A cost comparison of stream channel entrenchment and amount of sediment relocation would be helpful to determine the most cost effective solution.

The newly developed floodplain adjacent to the constructed stream channel will face vegetative competition from the number of invasive plants in the pond area. Some type of invasive plant control should be considered for the area to allow the native plants installed on the floodplain to flourish.

Due to the lack of staging area in and around the side channel, maneuverability of construction equipment may be limited. Assuming the Town would require the baseball field to be operational during construction, the large flat area above the channel would not be readily available for equipment. The access would therefore be in the channel only. Temporarily removing the fencing along the baseball field and using this area for staging would alleviate some of these issues.

**Potential Permits**

There are a number of potential state and federal permits that would need to be acquired in order to implement this alternative. These permits would most likely include but are not limited to the following:

1. Dam Construction Permit - Any person or agency proposing to construct a dam, dike, reservoir or similar structure, or to repair, alter or remove an existing dam, dike reservoir or similar structure, must first obtain either a permit from the commissioner or a determination that such permit is not required.

2. Flood Management Certification - Any state agency proposing an activity within or affecting a floodplain or that impacts natural or man-made storm drainage facilities must submit a flood management certification. Such activities include, without limitation: a) any structure, obstruction or encroachment proposed for emplacement within the floodplain area; b) any proposal for site development which increases peak runoff rates; c) any grant or loan which affects land use,

land use planning or the disposal of state properties in floodplains; or d) any program regulating flood flows within the floodplain.

3. Clean Water Act (CWA) Section 404 Dredge and Fill Permit - Most dam removals require a CWA Section 404 permit, issued by the U.S. Army Corps of Engineers (Corps) for dredging of a navigable waterway (33 U.S.C. §1344). A guideline pursuant to this statutory requirement establishes a policy of no net loss to wetlands.[1] In order to obtain Corps approval, the project: (a) should not cause or contribute to significant degradation of the waters or result in a net loss of wetlands; (b) should be designed to have minimal adverse impact; (c) should not have any practicable alternatives; and (d) should be in the public interest. In some cases, dam removal will result in a net loss of wetlands. To obtain a permit in these situations, the Corps will have to find that the benefits of dam removal outweigh the loss of wetlands.

4. Rivers and Harbors Act, Section 10 Permit - In conjunction with the Section 404 permit, the USACE will also issue a Section 10 permit for federal activities affecting navigable waterways, 33 U.S.C. 403. The permit will be issued if there is no adverse impact on interstate navigation.

5. National Environmental Policy Act Review - Actions by federal agencies (e.g., permits, funding, technical assistance) may require compliance with the National Environmental Policy Act (NEPA), 42 U.S.C. 4321 et seq. NEPA requires that an Environmental Assessment (EA) be prepared to determine whether a proposed dam removal would have a significant effect on the quality of the environment. Depending on whether the project's impacts are considered significant, either a Finding of No Significant Impact (FONSI) would be issued or an Environmental Impact Statement (EIS) would be prepared.

6. 401 Water Quality Certification - Any applicant for a federal license or permit, including a dredge and fill permit from the U.S. Army Corps of Engineers, a bridge construction permit from the U.S. Coast Guard, or a permit from the Federal Energy Regulatory Commission (FERC) must obtain a 401 Water Quality Certificate from DEP if the proposed activity may result in any discharge into the navigable waters. Such discharges include, among other things, the discharge of dredged and fill material and stormwater during construction, incidental discharge of sediments from dredging or excavating, and the discharge of stormwater from a facility once it is constructed, and any excavation, flooding, draining, and clearing and grading in or affecting the navigable waters.

7. Inland Wetlands and Watercourses - Any state agency or instrumentality, except a local or regional board of education, proposing to conduct any operation within or use of a wetland or watercourse involving the removal or deposition of material, or any obstruction, construction, alteration or pollution of such wetlands or watercourses must apply to DEP.

8. Stream Channel Encroachment Lines - Any person proposing to place an encroachment or obstruction riverward of stream channel encroachment lines must obtain a permit. Activities which require a permit when conducted riverward of such lines include the removal or deposition of material, any alteration of the land or watercourse or construction of structures, filling, dredging, clearing, grubbing, grading, piping, installing culverts, channelizing, diverting, damming, dewatering, construction of structures, and any other activity that temporarily or permanently alters the character of the floodplain or watercourse.

9. Water Diversion - In general, any person proposing a diversion which was not registered with the Department and, which is not exempt, must apply for a permit. You must apply for a permit if, among other things, you propose to relocate, retain, detain, bypass, channelize, pipe, culvert, ditch, drain, fill, excavate, dredge, dam, impound, dike, or enlarge waters of the state.

10. Lake, Pond, and Basin Dredging - Provided other requirements are satisfied, this general permit authorizes: Dredging of a lake or pond that will restore or improve aquatic habitat or maintain the existing recreational use of such pond or lake provided: 1) such dredging shall not exceed 6,000 cubic yards of material; and 2) the area dredged shall not exceed one acre of such lake or pond. This permit is not intended to authorize dredging that will result in the conversion of an area of submerged or emergent vegetation or marsh, swamp, bog or similar such habitat to open water. Grading and placement of not greater than twenty-five (25) cubic yards of fill is allowed in a regulated area for temporary access to the site of such activity provided that: 1) all temporary fill is removed, 2) the top of roadway is no more than one foot above existing grade and 3) any disturbed areas are restored by the completion of the project or by the expiration date of the commissioner’s written authorization of such regulated activity, whichever occurs first.

11. Contaminated Soil and/or Sediment Management General Permit - This general permit authorizes the staging, transfer, and temporary storage of contaminated soil and/or sediment and is intended to address the management of these materials when they are generated during projects that are less than 2 years in duration and involve the excavation of earthen material. It establishes a uniform set of environmentally protective management procedures for stockpiling soils when they are generated during projects where contaminated soils are typically managed (held temporarily during characterization procedures to determine a final disposition) including, but not limited to remediation, construction, and utility installation projects.

Other local permits may be required such as a building permit or a site plan review permit from the planning board. The local building inspector usually serves as the zoning code enforcement officer and should be consulted for other applicable municipal permits.

Dam-related activities in Connecticut are regulated by the Inland Water Resources Division of the Bureau of Water Protection and Land Reuse, which is a part of the

Connecticut Department of Environmental Protection (CT DEP). The state has jurisdiction over "all dams . . . without exception and without further definition or enumeration herein, which, by breaking away or otherwise, might endanger life or property." Connecticut has created a system that, at least on the state level, is somewhat integrated, tying dam permit issuance to several other requisite permits.

An applicant must first apply for a Dam Safety Permit, which applies to all dams in Connecticut (excluding federally owned and operated dams). After submitting an application, the applicant must then provide public notice of intent to apply for the permit. CT DEP reviews the permit for safety, wetlands and fisheries considerations and will integrate any necessary permit conditions to address issues raised by the other agencies, including the disposal of contaminated sediments. Once CT DEP finds the permit acceptable, they will publish and distribute a Notice of Tentative Determination to approve the application to the public, the Inland Fisheries Division, wetland agencies and the planning, zoning and conservation commission of each town affected by the project.

The advantage to the applicant using this permit is that once the Dam Safety permit is approved, the applicant does not need to obtain a separate municipal Inland Wetland and Watercourse Permit (necessary for work affecting wetlands), a Stream Channel Encroachment Line (SCEL) Permit (a CT DEP permit necessary for any activity that temporarily or permanently alters the character of the floodplain or watercourse wherein SCEL lines are established), or a CT DEP Water Diversion Permit (necessary for any alteration of the instantaneous flow of water).

Connecticut maintains a Natural Diversity Data Base and CT DEP permit approval requires a review to determine a project's potential impact on federal and state protected species and habitat. Initial review can be made by the applicant by following directions on the Natural Diversity Data Base website. Further review by state wildlife and fisheries biologists is necessary only if a potential conflict is apparent.

This list of permits may or may not include all the necessary permits. Additional permits may be necessary. However, there are permits listed that may not be required. The Lake, Pond, and Basin Dredging permit is an example of a permit that may or may not be necessary. Also, a contaminated soil permit may not be necessary but a sediment management permit may be. If excavation activities are to occur near HP 4, where the concentration of contaminants is highest, a contaminated soil permit may be necessary. The permit requirements should be discussed with the CT DEP early in the design/construction process to assure the necessary permits are obtained.

The list of permits and information regarding each permit was taken from NRCS prior experience, personal email correspondence with EA Engineering and American Rivers documents titled "Obtaining Permits to Remove a Dam" published in 2002 and "Permitting Dam Removal: The State of (Several) States" published in 2006 . The American Rivers documents are included in Appendix H and Appendix I.

## Cost Estimate

A cost estimate was prepared for Alternative 4: Full Removal of Spillway. Please see Table 6 for an itemized list of costs. Although the final cost is reported to the nearest dollar in the table, this is not representative of the actual level of accuracy available at the feasibility level. Due to a number of uncertainties that remain at the feasibility level, this cost estimate should be viewed with some precaution. The cost of Alternative 4: Full Removal of Spillway is estimated at $1,100,000.00.

***Table 6: Alternative 4 Planning Level Cost Estimate Details***

**Steele Brook Alternate 4 - Full Dam Removal and Channel Restoration**

| Item No. | Work or Material | Spec. No. | Est. Quant. | Units | Unit Cost | Amount |
|---|---|---|---|---|---|---|
| 1 | Mobilization and Demobilization | 8 | 1 | Job | $35,000.00 | $35,000.00 |
| 2 | Clearing and Grubbing | 2 | 1 | Job | $6,000.00 | $6,000.00 |
| 3 | Dam Concrete Removal | 3 | 154 | CY | $110.00 | $16,940.00 |
| 4 | Pollution Control (included in dewatering) | 5 | 1 | Job | $0.00 | $0.00 |
| 5 | Stabilized Construction Entrance | 5 | 1 | Job | $2,250.00 | $2,250.00 |
| 6 | Temporary Mulch | 5 | 1 | Job | $0.00 | $0.00 |
| 7 | Seeding and Mulching | 6 | 23,351 | Sq.Yd. | $1.00 | $23,351.00 |
| 8 | Removal of Water | 11 | 1 | Job | $50,000.00 | $50,000.00 |
| 9 | Unclassified Excavation (used on-site) | 21 | 6,668 | CY | $15.00 | $100,020.00 |
| 10 | Unclassified Excavation (hauled off-site) | 21 | 18,755 | CY | $37.00 | $693,935.00 |
| 11 | Topsoiling (use sandy muck on site) | 26 | 2,500 | CY | $10.00 | $25,000.00 |
| 12 | Channel armor | 61 | 1,745 | CY | $52.00 | $90,740.00 |
| 13 | Chain Link Fence | 91 | 60 | Ft | $20.00 | $1,200.00 |
| 14 | Trees and Shrubs | 401 | 0 | Job | $0.00 | $0.00 |
| | | | | | | |
| | | | | **Total =** | | **$1,044,436.00** |
| | | | | **Use =** | | **$1,100,000.00** |

This cost estimate was produced using a variety of sources to determine estimated costs for the unit items. The primary sources of cost data and information were historic bid data from past NRCS construction projects, RSMeans Site Work & Landscape Cost Data cost estimating guide, and NRCS professional judgment.

The historic bid data was taken from projects mostly funded under the Emergency Watershed Protection Program from 2005 through present. Many of these projects included a combination of natural stream features and traditional stabilization techniques. The 2006 RSMeans Site Work & Landscape Cost Data cost estimating guide was used and adjusted for inflation using various sources including data from the publication

Engineering News Record, commonly known as ENR. For those items that past data was not available and is not readily estimated from the cost estimating guides, NRCS personnel used their professional judgment based on years of experience to determine an estimated cost.

Please note that there are a number of unknowns that remain during the feasibility stage of a project. Without a final design, there may be some inherent error in the quantities and unit costs. Also, for some items, a construction technique must be assumed. After a final design is completed, these assumed techniques will need to be reevaluated for relevancy and a proper cost estimated for that practice. Therefore, please be aware that the final design costs may be substantially different than the costs quoted in this report.

One major item to note for the cost estimate regarding this alternative is that the majority of the cost is found in hauling excess excavation offsite. In order to create an active channel-floodplain system, much of the pond sediments require excavation. This cost estimate assumes 6,668 cubic yards of excavated material is used onsite to fill the side channel and the west pond area up to the present water level. If it is desired, additional excavated material may be used onsite to create architectural and natural mounds in the floodplain. By using all of the material onsite, the cost estimate can be reduced to $700,000.00. Keep in mind that to use all of the material on site, it would require a mound on the order of 560 feet long by 35 feet wide by 27 feet tall. This is a very large amount of material and therefore unlikely that all of the material could be used on site.

# SUMMARY OF RESULTS

This Feasibility Analysis analyzed four alternatives for their affects on ecological resources including fisheries, wetlands, and wildlife, water quality, hydrology and hydraulics, sediment, infrastructure, sociologic issues and recreational use, and cultural and historic resources. It also determined the level to which each alternative achieves the overall project goals of improved water quality in Heminway Pond and Steele Brook directly downstream of the dam, improved fish passage through the dam and pond area, elimination of the liability of the Town owning and aged dam, and incorporation of the Heminway Dam Removal project with the larger Town greenway project. For a summary of the levels of achievement of the project goals and level of intensities of the beneficial and adverse impacts on the affected environments please see Table 9.

Alternative 1: No Action and Alternative 2: Bypass Channel were shown to not meet the overall project goals to an acceptable level to be considered beyond this stage of analysis. Since Alternative 3: Partial Removal with Fish Ramp and Alternative 4: Full Removal of Spillway did achieve the overall project goals and proved to obtain a number of beneficial impacts to the affected environments; they were further analyzed for stability in the existing conditions versus after implementation of the alternatives. This analysis is based on preliminary data gathered and will need additional data and refinement as the project moves into a design phase.

## Basic Stream Stability Concepts

The flowing water of streams applies an erosive force to stream beds and banks. When this erosive force is high enough, significant amounts of stream bed and bank particles can be eroded and carried downstream. This is known as bedload movement. The strength of this erosive potential as applied to a unit area of the stream bed or bank can be measured with a quantity called tractive stress. Commonly, this is designated in pounds of downstream force per each square foot of the bed or bank (pounds/square foot). Typically, tractive stress increases when stream flows get deeper or the slope of the water surface from upstream to downstream gets steeper.

Fields of study such as fluvial geomorphology and hydraulic engineering have produced various tables that show how much tractive stress must be applied to move various sizes of particles lying on stream beds and banks. Typically, the earth and rock materials on these streams have a range and distribution of particle sizes known as a gradation. Describing how diameters of these particles vary within a gradation is commonly done with a measurement concept called effective diameter. The definition of effective diameter is best done by example. The $D_{50}$ effective diameter is defined as that particle diameter within a gradation where 50 percent of the weight of the gradation is comprised of particles smaller than the $D_{50}$ diameter. Similarly, the $D_{84}$ would be defined as that particle diameter within a gradation where 84 percent of the weight of the gradation is comprised of particles smaller than the $D_{84}$ diameter.

Several tools exist to link tractive stress with the particle sizes of the bedload. One of these is the RIVERMorph computer program that catalogs and analyzes many features of fluvial geomorphology. Several graphical curves of RIVERMorph show what size particles of sand, gravel, cobble, and rock will move under various applied tractive stresses. One of these curves is based upon 50 samples of Colorado streams as measured by David Rosgen where the particles moved range from ¼ to 16 inch diameters.

## Steele Brook Geomorphology and Hydraulic Features

For many years Steele Brook has flowed into Heminway Pond. The relatively flat water slope of the pond causes the water velocity of Steele Brook to slow down as it enters the pond. In turn this causes sand and gravel carried by Steele Brook to settle out near the end of flood flows and create a delta extending nearly 2/3 of the way across the Pond. When Heminway Pond Dam is partially or fully removed as described in Alternatives 3 and 4, the water surface slopes through the pond will become much steeper. Water surface slopes of some portions of the channel just upstream of the pond may increase a bit as well. These increased water slopes will increase tractive stress applied to the new channel and parts of the old channel as well. The net result will be to increase the erosion of channel sand and gravel and consequent bedload movement.

All streams naturally carry some amount of bedload. It cannot and should not be eliminated. Much work has been done in this Feasibility Analysis to begin to characterize how much the tractive stress and bedload movement of Steele Brook will increase as the dam is partially or fully removed. To fully characterize the increases in tractive stress will require additional analysis later on in advanced conceptual stages or design stages of the Steele Brook Project. Nevertheless, a brief description of the methods and results of this tractive stress work done so far will be described next. This will be very useful to guide future conceptual and design work.

The pond and stream channels were surveyed and a topographic map was produced. Further measurements were done during a geomorphic analysis to characterize a desired natural range of stream channel widths and depths, and floodplain widths. A pebble count sample was done of the stream armor gradation at the reference riffle and the $D_{50}$ and $D_{84}$ effective diameters were calculated. Also, effective diameters on six pond sample gradations done by the CT-DEP were utilized. The preferred channel and floodplain geometry was then used to design the size and location of the new channel in Alternatives 3 and 4. Next, the flow behavior of the existing and new channels was modeled using the HEC-RAS computer program. From the water surface flow depths and slopes predicted by HEC-RAS, tractive stress was calculated at various parts of the existing and new channels. Finally, the previously mentioned Rosgen curve in RIVERMorph was used to show the effects of how tractive stress in the existing and proposed channels will move particles of various sizes.

The predicted particle sizes moved by the stream at various locations under various flood levels are summarized in Table 7 & Table 8. These tables are organized to compare particle size movement of Alternatives 3 and 4 to existing conditions. For convenience, the $D_{50}$ and $D_{84}$ effective diameters are shown at the bottom of the tables. Thus, the tables approximate how mobile the stream armor is under existing conditions and after implementation of Alternatives 3 and 4. To reduce table complexity the tractive stress causing the particle size movement is omitted. The level of particle sampling done in the channel and pond is considered reasonable for a preliminary analysis of the alternatives in this Feasibility Analysis. However, it must be mentioned more particle size sampling and gradation measurement must be done for advanced conceptual analysis and final design analysis to refine this predictive channel behavior.

Also, it must be pointed out the water surface flood profiles predicted by HEC-RAS are fairly complex. The Echo Lake Road Bridge and the narrow deep channel upstream of the bridge create flooded backwater in the existing condition of Alternatives 3 and 4. This helps reduce water surface slopes and tractive stress upstream in the pond area, thereby reducing bedload movement. In Alternatives 3 and 4, the newly created floodplain in the dam area is a transition zone and will still be narrower than the floodplain upstream. This, in turn, has a backwater effect for about 50 to 300 feet upstream that reduces bedload movement somewhat as compared to the channel further upstream.

## Channel Stability

Conclusions from Table 7 for comparing existing conditions to Alternative 3: Partial Removal with Fish Ramp and suggestions for future analysis are:

1. Particle movement from the reference riffle going upstream is essentially the same in the existing condition and in Alternative 3.
2. Upstream of the reference riffle, the stream can move 4, 7.4, and 9.0 inch particles in the respective 1 ½, 10, and 100 year flood frequency flows. The reference riffle $D_{50}$ size = 0.5 inch and the $D_{84}$ size = 2.1 inches. The particles in upstream pools are even finer. So the stream armor of this portion of the stream is fairly mobile in the existing condition and will remain so in Alternative 3.
3. In the upper 2/3 reach of the pond, Alternative 3 will have a significantly greater capability to move particles downstream than the existing condition. For example, the existing 10-year storm can move a 1.2 inch particle while Alternative 3 will be able to move a 3.1 inch particle. In both the existing case and Alternative 3, the predicted particle sizes moved are substantially larger than the existing surface particles estimated at a $D_{84}$ size of 0.22 inches. This analysis shows the armor in the pond is unstable even in the existing condition and supports why the pond delta continues to grow. Typically, at the peak of a flood bedload movement is high, and towards the end of the flood bedload settles out increasing the size of the delta.
4. In the reach 25 to 165 feet upstream of the dam, the particle sizes moved in both the existing condition and Alternative 3 are smaller than upstream. The tractive stress here is reduced from downstream backwater. Nevertheless, Alternative 3 will have significantly greater capability to move particles than the existing conditions. Also, Alternative 3 will remove most of the upstream pond that is

effective at trapping sediment on the tail end of flood flows. Hence, Alternative 3 can move much more bedload downstream as compared to the existing condition.

5. Some level of additional stream armor would be reasonable for Alternative 3. The extent of this can only be designed after stakeholders decide how much risk they are willing to assume for additional channel movement and bedload transport.

Conclusions from Table 8 for comparing existing conditions to Alternative 4: Full Removal of Spillway and suggestions for future analysis are:

1. Particle movement from the reference riffle going upstream will be greater in Alternative 4 than the existing condition.
2. In the area upstream of the reference riffle to the sewer line, the Alternative 4 channel can move 5, 8.5, and 11.5 inch cobbles in the respective 1 ½, 10, and 100 year flood frequency flows. The reference riffle $D_{50}$ size = 0.5 inch and the $D_{84}$ size = 2.1 inches. The particles in the upstream pools are even finer. So the existing stream armor of this portion of the stream is capable of becoming mobile in Alternative 4.
3. In the reach through the pond, Alternative 4 will significantly increase the size of particles that can be moved as compared to the existing condition. For example, the 10-year storm can move a 1.2 inch particle in the existing condition and this same storm will be able to move an 8.7 inch particle after implementation of Alternative 4. In both the existing case and Alternative 4, the predicted particle sizes moved are substantially larger than the existing surface particles.
4. In the reach through the dam, the particle sizes moved in Alternative 4 are larger for the 1 ½-year than the 10 and 100-year floods. This is because of backwater effects in higher floods.
5. Alternative 4 shows an even greater need for additional stream armoring than Alternative 3. Again this can only be designed after stakeholders decide how much risk they are willing to assume for additional channel movement and bedload transport.

*Table 7: Existing and Alternative 3 Particle Size Mobility vs. Flow Return Frequency*

| | --------------------------- SECTION OF STEELE BROOK ------------------------ | | | | | |
|---|---|---|---|---|---|---|
| | SEWER LINE TO REFERENCE RIFFLE | | UPSTREAM 2/3 OF THE POND | | 25' - 165' UPSTREAM OF THE DAM | |
| FLOW RETURN FREQUENCY | EXISTING CONDI-TION (INCH) | ALTER-NATE 3 (INCH) | EXISTING CONDI-TION (INCH) | ALTER-NATE 3 (INCH) | EXISTING CONDI-TION (INCH) | ALTER-NATE 3 (INCH) |
| 1 1/2 -Year | 4.0 | 4.0 | 2.0 | 3.3 | 0.31 | 0.94 |
| 10 -Year | 7.4 | 7.4 | 1.2 | 3.1 | 0.35 | 1.5 |
| 100 -Year | 9.0 | 9.0 | 1.1 | 5.2 | 0.71 | 1.9 |

Existing surface particles in the reference riffle have $D_{50}$ = 0.5 inch and $D_{84}$ = 2.1 inches.
Existing surface particles in the upstream 2/3 of the pond have $D_{84}$ = 0.22 inch.
Existing surface particles 25' - 165' upstream of the dam have $D_{50}$ = 0.0087 inch and $D_{84}$ = 0.059 inch.

*Table 8: Existing and Alternative 4 Particle Size Mobility vs. Flow Return Frequency*

| | --------------------------- SECTION OF STEELE BROOK ------------------------ | | | | | |
|---|---|---|---|---|---|---|
| | SEWER LINE TO REFERENCE RIFFLE | | THROUGH THE POND | | THROUGH THE DAM | |
| FLOW RETURN FREQUENCY | EXISTING CONDI-TION (INCH) | ALTER-NATE 4 (INCH) | EXISTING CONDI-TION (INCH) | ALTER-NATE 4 (INCH) | EXISTING CONDI-TION (INCH) | ALTER-NATE 4 (INCH) |
| 1 1/2 -Year | 4.0 | 5.0 | 0.31 - 2.0 | 6.0 | NA | 8.2 |
| 10 -Year | 7.4 | 8.5 | 0.35 - 1.2 | 8.7 | NA | 6.2 |
| 100 -Year | 9.0 | 11.5 | 0.71 - 1.1 | 9.6 | NA | 5.7 |

Existing surface particles in the reference riffle have a $D_{50}$ = 0.5 inch and a $D_{84}$ = 2.1 inches. Existing surface particles in the pond have a $D_{50}$ = .0087 inch and a $D_{84}$ that ranges from .059 to 0.2 inch through the pond. The dam is a large concrete structure.

## Rock Lined Channel and Floodplain Stability

In Alternatives 3 and 4, the rock lined channel on the west side will carry a smaller portion of Steele Brook flood flows than the present conditions. To reduce the danger of pedestrians falling from the walled sides of this channel, it is recommended the channel be filled in with earth and vegetated with grass and dogwoods to form an intermittent waterway. Tractive stress analysis shows upon initial seeding this waterway will be vulnerable to erosion. Planning level calculations show protecting this new seeding with mulch net consisting of two layers of plastic net with straw mulch sewed between the layers would be reasonable protection until a grass sod with dogwoods becomes established.

The floodplains for Alternatives 3 and 4 would be similarly vulnerable to erosion as analyzed by tractive stress methods. These floodplains would also need the straw mulch net described above for about one year until grass sod and riparian perennial hardwoods become established. This assumes that in Alternative 3 the majority of the floodplain would be relatively flat vegetated areas with a few very shallow flooded areas. If the stakeholders and permit agencies opt for small dugout ponds to act as sediment traps in this area, and it is deemed acceptable to allow for some erosion of the floodplain, than much of this temporary straw mulch net could be eliminated. In Alternative 4, the overall floodplain slope is steeper at 0.8 % and the floodplain is narrower, so it is recommended that the entire floodplain be covered with the straw mulch net.

Tractive stress calculations for the stream channel and floodplain have been included in Appendix G.

## Possible Hybrid Alternative

The possibility of a hybrid alternative between the specific Alternative 3 presented in this study and Alternative 4 would be similar in achieving the project goals as the examined alternatives. Essentially, this hybrid alternative would be a modification of Alternative 3 with an additional portion of the dam removed. As described in the Alternative 3: Partial Removal with Fish Ramp section of this report, the elevation of removal was chose by matching slopes and creating a geomorphic cross section in the dam template. By adjusting the slope and geomorphic section, the elevation of the removal may be lowered until it reaches its limit which coincides with full removal of the spillway which was analyzed as Alternative 4: Full Removal of Spillway. It is reasonable to assume the environmental impacts and costs would range between those determined for Alternative 3 and Alternative 4.

***Table 9: Summary Table, Level of Intensity of Effects***

| Project Goals | Alternative 1: No Action | | Alternative 2: Bypass Channel | | Alternative 3: Partial Dam Removal | | Alternative 4: Full Dam Removal | |
|---|---|---|---|---|---|---|---|---|
| Goal 1: Water Quality Improvement | Does not achieve | | Does not achieve | | Substantially achieves | | Substantially achieves | |
| Goal 2: Improved Fish Passage | Does not achieve | | Marginally achieves | | Substantially achieves | | Substantially achieves | |
| Goal 3: Liability of Dam on Town | Does not achieve | | Does not achieve | | Substantially achieves* | | Substantially achieves | |
| Goal 4: Incorporation with Greenway | Less favorable option | | Less favorable option | | Favorable option | | Favorable Option | |
| | **Impact Intensity** | | | | | | | |
| **Affected Environments and Other Considerations** | **Adverse Impacts** | **Beneficial Impacts** | **Adverse Impacts** | **Beneficial Impacts** | **Adverse Impacts** | **Beneficial Impacts** | **Adverse Impacts** | **Beneficial Impacts** |
| Ecological Resources: Fisheries | Major | None | Negligible | Significant | None | Major | None | Major |
| Ecological Resources: Wetlands | Minor | Minor | None | Minor | Significant | Major | Major | Minor |
| Ecological Resources: Wildlife | Negligible | Negligible | None | Significant | Significant | Major | Major | Minor |
| Water Quality | Major | Negligible | Major | Minor | Negligible | Major | Negligible | Major |
| Hydrology and Hydraulics | Minor | None | Minor | None | Minor | Major | Significant | Major |
| Sediment | Significant | None | Significant | None | Significant | Significant | Major | Significant |
| Infrastructure | Significant | None | Significant | Major | Negligible | Major | Minor | Major |
| Sociologic Issues and Recreation | Minor | None | None | Major | None | Major | None | Major |

**Description of Intensity Levels:**
*None* – No measurable effects will occur
*Negligible* – The effects will be very slight and may not be measurable or observable
*Minor* – Impacts would be noticeable but there would be no overall effect on the affected environment
*Significant* – Impacts would be noticeable and could have short term and long term effects on the affected environment
*Major* – Impacts would be very noticeable and would have a definite short term and long term impact on the affected environment

**Notes:**
*A portion of the spillway will remain in place; however, the rock ramp will buttress the remaining spillway reducing chances of a breach

# RECOMMENDATIONS

Based on the results of the Feasibility Analysis, NRCS recommends Alternative 4: Full Removal of Spillway as the favored alternative. Alternative 4 substantially achieves the project goals of improved water quality in Heminway Pond and in Steele Brook downstream of the dam, improved fish passage through the dam and pond area, removed liability of the Town owning an aged dam, and is a favorable alternative to incorporate this project into the larger Town greenway project.

Although cited to cause major adverse impacts to wetlands, much of this rating is based on decreasing open water wetlands. These wetlands are manufactured wetlands due to the presence of the dam. Also, emergent wetland creation may take place in the area around the newly constructed stream channel. Adverse impacts were also noted for wildlife; however, much of this is the result of a reduction in open water for waterfowl. Wildlife of this variety is detrimental to one of the primary goals of the project which was improved water quality. Waterfowl, including geese, utilize the pond in its current form and provide high bacteria loads to the system. Sediment also received a high rating of adverse impacts, but much of this is from the release of sediments that naturally occur in the stream system. This is seen as beneficial. The adverse impacts arise from the possibility of additional deposition of these sediments in areas downstream where stream velocities are low. The current dam provides a trap for these sediments which limits any downstream sedimentation. Overall, Alternative 4 provides net beneficial impacts to the affected environments while meeting the project goals.

Alternative 1: No Action and Alternative 2: Bypass Channel did not meet the project goals and therefore are not recommended. Alternative 3: Partial Removal with Fish Ramp does meet the project goals and has similar impacts on the affected environments as Alternative 4. The reason NRCS chose Alternative 4 as the recommended alternative stems from the stability analysis completed. It was discovered that Alternative 3 will most likely require armoring of the new stream channel. Placing this armor in the existing pond sediments to form the new stream channel will be very difficult. Also, since this armoring is required, for both Alternative 3 and 4 it was thought to be best to completely remove the dam as opposed to keeping some of the dam in place and providing a fish ramp. Although NRCS feels that by providing the fish ramp to buttress what remains of the dam Alternative 3 achieves the goal of removing the liability of owning the dam from the Town, Alternative 4 completely eliminates the dam, therefore, meeting this goal more holistically.

The cost for the recommended alternative is the larger of the two costs that were estimated in this study. It is not surprising that what is considered the best alternative is the most expensive. This is often the case. Please remember that the more pond sediments that can be utilized onsite, the smaller the cost will be to a limiting amount for this alternative. Also, please remember that this alternative provides a number of environmental benefits and achieves the goals of the project and is worthy of the cost associated with it.

There are an infinite number of possibilities for Heminway Pond. This Feasibility Analysis examined four specific alternatives. Of these four alternatives, NRCS feels Alternative 4: Full Removal of Spillway is the most appropriate.

Stakeholders should be aware and be prepared to make a number of decisions after a thorough review of this study. Prior to design, it will be necessary to review the goals, objectives, and risks related to this project. Risk will be a key component in driving design decisions as this project moves from the feasibility stage into the design stage. Stakeholders must determine the acceptable level of risk prior to beginning the design phase of this project. Please see the List of Implementation Steps section of this report for more information regarding suggested steps to take for completion of this project.

# POTENTIAL FUNDING SOURCES

As part of the Heminway Pond Dam Removal Feasibility Analysis, NRCS was requested to collaborate with the CT DEP to identify potential sources of funding for dam removal. This collaboration occurred during the February 7, 2008 Working Group meeting held in the Town of Watertown, CT. This Working Group meeting also included a representative from American Rivers. Potential funding sources that were determined during this meeting included a number of sources ranging from federal cost share programs to corporate partnerships.

## USDA-NRCS Wildlife Habitat Incentives Program (WHIP)

The Wildlife Habitat Incentives Program (WHIP) is a voluntary program for people who want to develop and improve wildlife habitat primarily on private land. Through WHIP, USDA's Natural Resources Conservation Service provides both technical assistance and financial assistance to establish and improve fish and wildlife habitat. WHIP agreements between NRCS and the participant generally last from 5 to 10 years from the date the agreement is signed.

WHIP has proven to be a highly effective and widely accepted program across the country. By targeting wildlife habitat projects on all lands and aquatic areas, WHIP provides assistance to conservation minded landowners.

The Farm Security and Rural Investment Act of 2002 reauthorized WHIP as a voluntary approach to improving wildlife habitat in our Nation. Program administration of WHIP is provided under the Natural Resources Conservation Service.

The WHIP application process consists of five steps. They are as follows:

- A landowner submits an application to an NRCS local office, conservation district office, or office of a designated cooperating entity.
- The local work group identifies local wildlife habitat priorities and then communicates these priorities to the State Technical Committee. The NRCS State Conservationist consults with the State Technical Committee to rank the applications received in the field based on the State WHIP plan and the state established ranking criteria.
- When funds are available, NRCS makes allocations to the NRCS State offices based on the expressed unfunded demand for the program, the priorities in the State WHIP plan, and the level of contribution by partner organizations.
- The NRCS State Conservationist commits allocated funds to high ranking landowner offers and enters into long-term agreements with selected participants.
- Following agreement signature by NRCS and the selected entity, funds are obligated to the project, and the participant may begin to implement the wildlife habitat development plan.

Information on the Wildlife Habitat Incentives Program was taken from the following websites:

http://www.nrcs.usda.gov/programs/farmbill/2002/pdf/WHIPPrDs.pdf

http://www.nrcs.usda.gov/programs/whip/

In May of 2008 Congress passed the Food, Conservation, and Energy Act of 2008 (2008 Farm Bill). Certain aspects of the WHIP program have changed due to this new law. WHIP funds, for the time being, are only to be used for private agricultural land and private non-industrial forest land. Please contact a USDA-NRCS office for additional information regarding the Wildlife Habitat Incentives Program.

## United States Fish and Wildlife Service (USFWS)

### National Fish Passage Program

Millions of culverts, dikes, water diversions, dams, and other artificial barriers were constructed to impound and redirect water for irrigation, flood control, electricity, drinking water, and transportation, all changing the natural features of rivers and streams. After more than two centuries of building dams and other barriers on rivers and streams, many Americans are increasingly concerned about their effects on fish and other aquatic species. Many dams are obsolete and no longer serve their original purpose. Culverts that funnel water beneath roads and train tracks often pose insurmountable barriers to fish. It is a fundamental fact: fish need to move. All river fish migrate between feeding and spawning areas and make other seasonal movements to important habitats. Barriers prevent natural fish migrations, keeping them from important habitats. As a result, some populations of native fish are gone and others are on the brink of disappearing.

In 1999, the U.S. Fish and Wildlife Service initiated the National Fish Passage Program to work with others to address this problem. The National Fish Passage Program uses a voluntary, non-regulatory approach to remove and bypass barriers. The Program addresses the problem of fish barriers on a national level, working with local communities and partner agencies to restore natural flows and fish migration. The Program is administered by National and Regional Coordinators, and delivered by Fish and Wildlife Management Assistance Offices, with their 300 biologists located across the Nation. Appropriations for the Program support the Coordinators, in-the-water fish passage projects, and the Fish Passage Decision Support System

The Program provides assistance through Service staff and cooperative partnerships. Types of assistance include providing information on fish and habitat needs and methods for fish to bypass barriers.

The Fish Passage Decision Support System will assist the service and its partners in planning and prioritizing fish passage projects. The system is a geographically-referenced database of barriers preventing fish movement, including barrier location, type, size, owner and passage capabilities, associated fish species, and habitat information. By early 2003 the system will provide an on-line data entry and mapping utility program, with analytical Geographic Information System (GIS) capabilities. Integration with GIS software increases the capabilities of fisheries scientists to make better management decisions, prioritize fish passage projects, identify critical areas, and implement projects.

Since 1999, the Fish Passage Program has:

- Supported 76 fish passage projects with over 141 different partners,
- Restored access to over 3,443 miles of river habitat and 65,088 acres of wetlands for fish spawning and growth, and
- Leveraged partner contributions totaling $6.2 million, compared to the Program investment of $2.3 million.

Information on the USFWS National Fish Passage Program was taken from the following website:

http://www.fws.gov/fisheries/FWMA/fishpassage/Overview.htm

## Supplemental Environmental Project (SEP)

A supplemental environmental project (SEP) is a project that produces environmental or public health and safety benefits beyond those required by law, for which a credit may be granted by EPA to offset partially the penalty imposed in the settlement of an enforcement action. EPA Region 1 maintains a "library" for SEP proposals that might be appropriate for implementation in the settlement of a case. In order to submit a project for possible inclusion in EPA Region 1's SEP Library, a SEP Idea Form should be completed by providing the information described in the instructions for each project or idea. The project proposals should be submitted to EPA by e-mail to Amelia Katzen (katzen.amelia@epa.gov) of EPA Region 1's Regulatory Legal Office.

When evaluating a proposed project for inclusion as a SEP in a settlement, EPA considers many factors. The most important factors are the public health or environmental benefits expected from the project and the relationship of the project to the underlying violation of the enforcement action. Other factors include such things as the project's pollutant of concern, geographic location, impacts on sensitive human populations, impacts on sensitive ecosystems, type of project, estimated cost, and length of time estimated for completion.

Appropriate SEP proposals will be posted in the Region's internal SEP Library, which can only be accessed by EPA Region 1 employees. When violators ask EPA enforcement personnel to suggest SEP ideas for consideration in particular cases, the case team is able to consult the SEP Library for relevant SEP ideas. Inclusion of a project in the SEP Library does not in any way ensure that it will be implemented in a Region 1 case, only that it will be available for consideration.

**Characteristics of SEPs**

Because SEPs are part of an enforcement settlement, they must meet certain legal requirements.

- There must be a relationship between the underlying violation and the human health or environmental benefits that will result from the SEP.
- A SEP must improve, protect, or reduce risks to public health or the environment, although in some cases a SEP may, as a secondary matter, also provide the violator with certain benefits.
- The SEP must be undertaken in settlement of an enforcement action as a project that the violator is not otherwise legally required to perform.

**SEP Guidelines**

In addition, there are several guidelines that a SEP must meet.

- A project cannot be inconsistent with any provision of the underlying statute(s).
- A SEP must advance at least one of the objectives of the environmental statute that is the basis of the enforcement action.
- EPA must not play any role in managing or controlling funds used to perform a SEP.
- The type and scope of each project should be defined in the settlement document.

**Categories of Acceptable SEPs:**

EPA has set out eight categories of projects that can be acceptable SEPs. To qualify, a SEP must fit into at least one of the following categories:

1. **Public Health**: SEPs may include examining residents in a community to determine if anyone has experienced any health problems because of the company's violations.
2. **Pollution Prevention**: These SEPs involve changes so that the company no longer generates some form of pollution. For example, a company may make its operation more efficient so that it avoids making a hazardous waste along with its product.
3. **Pollution Reduction**: These SEPs reduce the amount and/or danger presented by some form of pollution, often by providing better treatment and disposal of the pollutant.
4. **Environmental Restoration and Protection**: These SEPs improve the condition of the land, air or water in the area damaged by the violation. For example, by purchasing land or developing conservation programs for the land, a company could protect a source of drinking water.
5. **Emergency Planning and Preparedness**: These projects provide assistance to a responsible state or local emergency response or planning entity to enable these organizations to fulfill their obligations under the Emergency Planning and Community Right-to-Know Act (EPCRA.) Such assistance may include the purchase of computers and/or software, communication systems, chemical

emission detection and inactivation equipment, HAZMAT equipment, or training. Cash donations to local or state emergency response organizations are not acceptable SEPs.

6. **Assessments and Audits**: A violating company may agree to examine its operations to determine if it is causing any other pollution problems or can run its operations better to avoid violations in the future. These audits go well beyond standard business practice.
7. **Environmental Compliance Promotion**: These are SEPs in which an alleged violator provides training or technical support to other members of the regulated community to achieve, or go beyond, compliance with applicable environmental requirements. For example, the violator may train other companies on how to comply with the law.
8. **Other Types of Projects**: Other acceptable SEPs would be those that have environment merit but do not fit within the categories listed above. These types of projects must be fully consistent with all other provisions of the SEP Policy and be approved by EPA.

Information on the Supplemental Environmental Project was taken from the following websites:

http://www.epa.gov/Compliance/civil/seps/index.html

http://www.epa.gov/region1/enforcement/sep/index.html

## Coastal America and Innovative Readiness Training (IRT)

This program involves the use of military personnel and equipment to complete construction projects including dam removal. It is through a Memorandum of Understanding (MOU) that the Department of Defense (DOD) and the Department of Transportation (DOT) and partnering entities such as Coastal America are able to provide training for military members while meeting construction needs of the partnering entities. Dam removal has been a common cause for which Coastal America and the IRT has partnered to complete.

The Innovative Readiness Training (IRT) program was initiated in the 1990's. In 1992 the Senate Armed Services Committee noted that the military could provide benefits to their communities during training activities. Shortly thereafter, the Directorate of Civil-Military Programs was created within the Office of the Assistant Secretary of Defense, Reserve Affairs; also know as ASD/RA. In 1996 Congress passed legislation authorizing the military to provide support and services to eligible organizations and activities outside DOD, with incidental benefits resulting from the training activities.

The benefits of the IRT program to the public are straightforward. Training resources of the military can be focused on community efforts, saving communities the cost of going alone on a project. The benefits of this program to the military are very significant. The program gives military commanders the opportunity to get more out of their training dollars or "more bang for their buck." In addition to accomplishing required training, IRT projects contribute to improved morale and retention of military personnel because the troops are conducting training with an incidental benefit to the community. Participation in IRT projects can also result in improved public relations. Examples of Coastal America and IRT projects include the Removal of the East Machias Dam and Power Plant in Bangor, Maine and the Rains Mill Dam Removal near Raleigh, North Carolina.

The first step for involving the military in Coastal America projects is for representatives of local, state and Federal agencies or nonprofit organizations to approach their Chair of the Coastal America Regional Implementation Team to discuss their project. The team selects projects that meet the goals of Coastal America. Potential military partners are then determined.

There are a variety of funding sources available for Coastal America projects. Costs may be reimbursable to the military or there may be pre-programmed training funds available. There is also supplemental funding from OASD/RA that may be available for certain components of the project.

Information on the Coastal America and Innovative Readiness Training was taken from the following website:

http://www.coastalamerica.gov/text/military.pdf

## Corporate Wetlands Restoration Partnership

Coastal America is an action-oriented, results-driven process aimed at restoring and preserving vital coastal ecosystems and addressing our most critical environmental issues. The Coastal America Partnership was launched in 1991 by former President George H.W. Bush, and formalized in 1992 with a Memorandum of Understanding (MOU) signed by nine sub-cabinet level agency representatives. These representatives committed their agencies to work together and integrate their efforts with state, local and nongovernmental activities.

The Coastal America Partnership utilizes a number of tools and programs to facilitate its mission. These include the Corporate Wetlands Restoration Partnership (CWRP) and International Corporate Wetlands Restoration Partnership (ICWRP), the network of Coastal Ecosystem Learning Centers (CELCs), and the Coastal America Partnership Awards program.

The CWRP originated in Massachusetts in 1999 under the leadership of The Gillette Company, the Massachusetts Executive Office of Environmental Affairs, and the U.S. Environmental Protection Agency. Within six months of its initiation, 17 corporations joined the Massachusetts CWRP and raised more than $1 million in funding and services for coastal projects. Since 2000, Coastal America has facilitated the expansion of the CWRP as a national effort.

The CWRP is a way for environmentally responsible companies to reach out to their communities, beyond the boundaries of their own facilities. It is not a substitute for corporate compliance with federal permitting requirements. Instead, it allows private companies to make voluntary donations of funds or in-kind services to a non-profit organization. These funds or in-kind services are then used, at the company's direction, to help support coastal habitat restoration or public education projects that have been selected and endorsed by the Coastal America Regional Implementation Teams.

Often, companies help their communities make the required local match for federal funds for community-based restoration projects. This makes for a win–win situation for the companies, the communities, and the federal government. All parties are able to maximize the environmental benefits of each dollar provided and better serve their communities and the environment. The CWRP is structured in parallel to Coastal America, with a National Level Management Committee, Regional Advisory Councils and State Advisory Boards. Now in its fifth year of implementation, the CWRP has over 225 corporate partners and 100 non-federal partners, including environmental organizations, foundations, and state and local governments. There are 50 projects complete, with another 60 in the works. There are currently CWRP Chapters in 13 states and two other countries, with other states rapidly creating Chapters of their own.

Projects supported by CWRP include: marsh and other aquatic habitat restoration, fish passage improvements, invasive species control, threatened/endangered species protection, educational efforts, research and monitoring projects. Contributions have supported various stages of projects, including feasibility, design, and implementation. In addition, corporate employees have provided volunteer services to a variety of projects.

Information on the Corporate Wetlands Restoration Partnership was taken from the following website:

http://www.coastalamerica.gov/text/cwrp.html

## Small Town Economic Assistance Program (STEAP) Grants

The Small Town Economic Assistance Program (STEAP) funds economic development, community conservation and quality of life projects for localities that are ineligible to receive Urban Action (CGS Section 4-66c) bonds. This program is administered by the Office of Policy and Management. Like Urban Action, STEAP funds are issued by the State Bond Commission and can only be used for capital projects. Programmatic expenditures or recurring budget expenditures are not eligible for STEAP or any other state bond program. However, some projects while generally capital in nature, should not be funded with State bond money for various public policy reasons. Examples of these are: 1) Administrative improvements; and 2) communications systems, such as police radios.

Projects eligible for STEAP funds include:

- Economic development projects such as (a) constructing or rehabilitating commercial, industrial, or mixed-use structures and (b) constructing, reconstructing, or repairing roads access ways, and other site improvements

- Recreation and solid waste disposal projects

- Social service-related projects, including day care centers, elderly centers, domestic violence and emergency homeless shelters, multi purpose human resource centers, and food distribution facilities

- Housing projects

- Pilot historic preservation and redevelopment programs that leverage private funds

- Other kinds of development projects involving economic and community development, transportation, environmental protection, public safety, children and families and social service programs.

Localities may receive up to $500,000 per year if (1) they are not designated as a distressed municipality or a public investment community, and (2) the State Plan of Conservation Development does not show them as having a regional center.
Public Act 05-194 allows an Urban Act Town that is not designated as a regional center under the State Plan of Conservation and Development to opt out of the Urban Action program and become a STEAP town for a period of four years. In order to be eligible for this change, the Office of Policy and Management must receive a letter requesting the change from Urban Act to STEAP as well as proof that the legislative body has approved such a change. Minutes from the legislative session as well as a resolution are acceptable methods of verification of the approval.

Information on the Small Town Economic Assistance Program (STEAP) was taken from the following website:

http://www.ct.gov/opm/cwp/view.asp?a=2965&q=382970&opmNav_GID=1793

## Economic Development Grants

Connecticut's Community Development Block Grant (CDBG) Program, also known as the Small Cities Program, provides funding and technical support for projects that achieve local community and economic development objectives. The Small Cities Program principally benefits low and moderate-income persons. This program is only available to Connecticut towns and cities with populations of less than 50,000.

Funding for the Connecticut CDBG program is provided by the U.S. Department of Housing and Urban Development (HUD) under the guidelines of Title I of the Housing and Community Development Act of 1974, as amended. Eligible Activities must meet one of the following CDBG program National Objectives: benefiting low and moderate-income persons, eliminating slum and blight or addressing an urgent need.

The primary focus of the CDBG program is to benefit low and moderate-income persons. The Connecticut CDBG program receives and distributes over thirteen million dollars each year. Since the state took over the administration of the CDBG program in 1982, over $298,000,000 has been invested in Connecticut communities.

Communities participate in a competitive application process annually for CDBG funds to implement their proposed community and economic development projects.

Information on the Connecticut Community Development Block Grant (CDBG) Program was taken from the following website:

http://www.ct.gov/ecd/cwp/view.asp?a=1098&q=249736

## National Oceanic and Atmospheric Administration (NOAA) Open Rivers Initiative

The NOAA Open Rivers Initiative (ORI) provides funding and technical expertise for community-driven, small dam and river barrier removals, primarily in coastal states. Projects are expected to provide an economic boost for communities, enhance public safety, and improve populations of NOAA trust resources such as striped bass, Atlantic and shortnose sturgeon, Atlantic and Pacific salmon, American eel, American shad, blueback herring, and alewife. Proposals selected for funding through this solicitation will be implemented through a cooperative agreement.

More than 3,500 dams in the U.S. are unsafe due to structural deficiencies that make them more susceptible to failure. Removal of these barriers can yield significant environmental improvements as well as considerable economic and societal benefits. In 2005, NOAA created the Open Rivers Initiative to help provide communities with funding and guidance to complete barrier removal projects. The initiative is a competitive grant program focused on community-driven, small dam and river barrier removals in coastal states, with a goal of enhancing watershed health and fostering sustainable fish populations. The ORI focus is on implementing projects that will directly benefit migratory species such as salmon, sturgeon, shad, river herring, striped bass, and American eel. Projects under the initiative will also improve community vitality and public safety, and encourage economic growth.

Information on the NOAA Open Rivers Initiative was taken from the following websites:

http://www.nmfs.noaa.gov/habitat/restoration/ORI/

http://www.nmfs.noaa.gov/habitat/restoration/projects_programs/crp/partners_funding/backgroundondamremoval.htm

## Multi Barrier Removal Note

Funding provided by many of the above programs may be either more attainable or enhanced if the project would include multiple barrier removal. This is a much larger challenge and is out of the scope of this project. However, if this reach of Steele Brook was opened to diadromous fish passage, there may be additional funds available through the above funding sources or additional sources. As with most funding sources, the projects attaining the greatest number of goals of the funding program will receive the greatest amounts of funding.

## Additional Potential Funding Sources

Included in the appendices are two documents regarding funding for dam removal projects. The first document, located in Appendix J, is a report published by American Rivers titled "Paying for Dam Removal: A Guide to Selected Funding Sources." The other document, located in Appendix K, is a fact sheet created by the Commonwealth of Massachusetts Riverways Program titled "Fact Sheet: Funding Sources for Dam Removal." Information on many of the programs described above is included in these documents plus additional information on other programs available is also included.

# LIST OF IMPLEMENTATION STEPS

Below is a list of implementation steps for the Heminway Pond Dam Removal Project. The list begins with the completion of the draft of this analysis with physical construction being the end product. Be aware that each step in this list is a vital component to a successful project. Also, each step is best achieved using a multi-disciplinary approach.

1. Review Draft Heminway Pond Dam Removal Feasibility Analysis
    a. Per the agreement for services between NRCS and CT DEP, at the completion of this report the Town and CT DEP will review the draft report.

2. Provide Comments on Draft Heminway Pond Dam Removal Feasibility Analysis
    a. Per the agreement for services between NRCS and CT DEP, at the completion of this report the Town and CT DEP will provide comments on the draft report.
    b. NRCS will then review the comments and respond to the comments either through correspondence or through incorporation into the final report.

3. Delivery of Final Heminway Pond Dam Removal Feasibility Analysis
    a. At this point the analysis will be finalized.

4. Discussion of Alternatives and Recommendations
    a. If desired, a presentation may be developed by NRCS to further explain and describe the conclusions drawn in the Feasibility Analysis.
    b. Identification and discussion of NRCS' recommended alternative.
    c. Discussion of possible development of a hybrid alternative not specifically defined in the Feasibility Analysis.

5. Review Goals, Objectives, and Risks
    a. What is the overall plan for the stream system and area around the stream?
    b. Develop specific, realistic, achievable, and measurable objectives for the stream restoration.
    c. Assure goals, objectives, and risks are compatible.
    d. A Copy of National Engineering Handbook (NEH), Part 654, Chapter 2 "Goals, Objectives, and Risks" is included in Appendix L. Please review this important chapter to better understand the importance of compatible goals, objectives and risks in stream restoration design.

6. Determine Acceptable Level of Risk
    a. Is migration of the stream acceptable or is a fixed boundary preferred?
    b. What flood flows should the stream system and floodplain be designed to handle?
    c. Is additional sediment transport to areas downstream acceptable?
    d. A thorough review of the acceptable level of risk will greatly steer the design process and overall project outcomes.

7. Choose Alternative
    a. The stakeholders must choose the desired alternative in order to proceed into a design phase.
    b. The alternative should be chosen based on meeting the project goals, ecological and environmental considerations, and the overall fit with future plans for the area. Cost will also be a factor in choosing the preferred alternative but should not be the sole driving force behind the choice.

8. Determine Specific Design Features
    a. Is it desired to maintain open water wetlands in the pond area adjacent to the newly constructed stream channel?
    b. Are mounded upland features desired?
    c. Additional discussion on risk is warranted at this stage. Should the design be completed for bank full events or larger flood storms? Is a fixed boundary stream desired? There are many specifics that need to be addressed at this stage.
    d. Identify cost of conceptual design and additional data gathering.

9. Additional Data Gathering
    a. Additional survey and material sampling will be required to obtain adequate information to complete design calculations and create construction drawings.
    b. Additional geomorphic assessments will be required to finalize channel dimensions and configuration.

10. Development of Conceptual Design
    a. Use the additional data gathered and decisions made during the goals, objectives, and risk discussions to develop conceptual design.
    b. Conceptual design will give stakeholders a chance to comment on preliminary design decisions prior to creating full sets of design documents.
    c. Conceptual design will provide the first iteration of a design to assure project goals, design features, and risk assumptions are mutually supportive.
    d. Extents of the conceptual design will need to be developed but may include items such as generalized CAD drawings, generalized specification information, conceptualized views, photo rendering, and other information to assist the advisory team in making additional design decisions.

11. Review and Comment on Conceptual Design
    a. Provide review and comments on the first iteration design
    b. This will assure stakeholders and designers are in agreement prior to completing a full scale design.

c. This will also be the first check that the goals, objectives, and risks are mutually compatible. After the first iteration, it is often necessary to refine some goals, objectives, and risks. The goal is to develop a design that meets these goals, objectives, and risks to the extent possible while remaining feasible, cost effective, and constructible.
d. Identify cost of final design and permit application materials

12. Development of Draft Design and Specification Package
    a. Following the conceptual design, a draft design and specification package will be created.
    b. The draft design will include construction drawings using computer aided drafting, construction and material specifications, estimated performance time, and cost estimate.

13. Draft Permit Application Package
    a. Develop a draft permit application package for review to accompany the draft design and specification package.

14. Review and Comment on Draft Design and Specification Package and Draft Permit Application Package
    a. Town of Watertown and CT DEP review draft design and specification package and draft permit application package.
    b. Comments will be addressed or incorporated into final design package.

15. Development of Final Design and Specification Package
    a. Following review and comments of the draft design and specification package the comments will be addressed or incorporated into the final design and specification package.
    b. Upon completion of the final design and specification package, the project will include finalized construction drawings using computer aided drafting, finalized construction and material specifications, construction cost estimate and performance time.
    c. At this point, the design package will be prepared to a level in which the project is ready for competitive bidding following granting of permits.

16. Final Permit Application Package
    a. Following review and comments of the draft permit application package the comments will be addressed or incorporated into the final permit application package.
    b. At this point, the permit application package will be prepared to a level in which the project should be granted permits for implementation.

17. Granting of Permits
    a. After permit application using the final permit application package, the permits should be granted and approval granted for implementation of the project.

18. Historical Documentation of Side Channel
    a. Prior to construction, the State Archeologist requested photo documentation to be completed on the side channel which runs on the west side of the pond adjacent to the basketball courts and ball field.
    b. This should be organized and arranged with the CT State Archeologist prior to bidding of the project.

19. Apply for Funding
    a. With a finalized design package and a finalized permit application package with permits granted, funding should be sought.
    b. Please refer to the Potential Funding Sources section of this report for additional information.
    c. Additional funding sources should be sought to maximize the opportunity of funding for this project.

20. Competitive Bidding or Contractor Selection
    a. Depending on the method of contracting, when funding and permits are in hand and the design and specification package are finalized, a contractor may be selected through either a competitive process or selected from a qualified list.
    b. The fashion in which the contractor is selected will depend on the entity that completes the contract administration.
    c. It has been NRCS' experience that locally led contracting allows for more latitude in choosing qualified contractors.
    d. Contracting under the Federal Acquisition Regulations (FAR) and through the Federal Government will require a low bid competitive contracting procedure.

21. Construction and Implementation
    a. After selecting a qualified contractor and the bid price is agreed upon, construction may begin.
    b. The permits may limit the time of year in which construction activities may take place. This will have to be scheduled appropriately to complete the project on time and in compliance of the permit.

22. Ribbon Cutting and Project Celebration
    a. After construction is complete, it is time to celebrate and recognize all the hard work and the accomplishments of all parties involved.

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# Appendix A:

# DEP Fisheries Data

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**Steele Brook Fisheries Summary:**

Background:

1) Fish community information has been collected at three standard locations (Rte 6 bridge upstream; Municipal stadium; Echo Lake Rd.) in most years since 2003. Additional historic data also exists at the Municipal stadium location and at the Watertown STP bridge crossing.
2) Water temperature data were taken at three locations in 2003.
3) Brown trout fry were stocked into two locations (Rte 6 bridge upstream and Municipal Stadium) beginning in 2005.
4) One additional location was stocked in 2006 (E. Aurora St.), and another location (West St. below golf course) was stocked in 2007.

Data Summary:

1) In general, fish abundance increases from upstream to downstream locations for more tolerant stream specialists (blacknose dace, creek chub, common shiner). However, species richness declines slightly from upstream to downstream.
2) Water temperature data shows a significant increase in temperature from upstream to downstream.
3) Brown trout survival was much higher upstream of Rte 6 than that seen at the Municipal stadium location for all years.
4) Holdover brown trout (trout sampled from previous year's stocking) were only sampled within the Rte 6 sample location.
5) Survival of brown trout in 2007 was surprising given the severe drought conditions during the summer and early fall of this year.

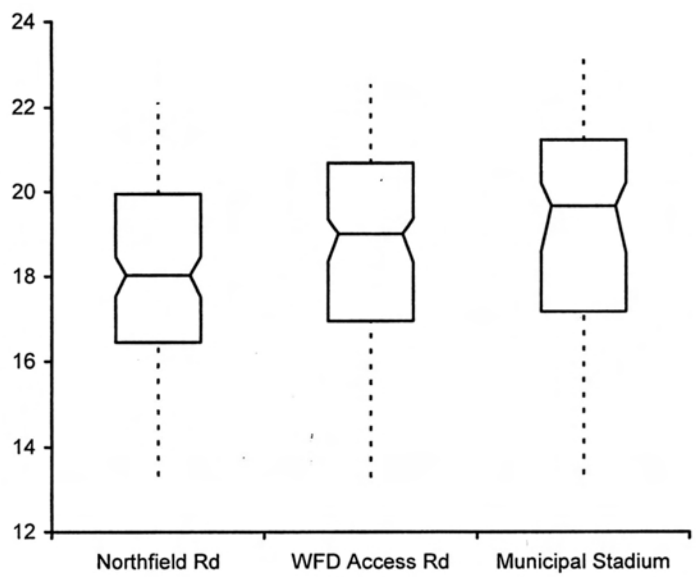
Conclusions:

1) A healthier stream community (both fish and insects) exists in the stream reaches upstream of dam influence.
2) Water temperatures measured during 2003 show a 3°C difference in maximum summer temperature between the upstream location (Northfield Rd) to the farthest downstream location (Municipal stadium). In addition, the Northfield Rd. site showed a much quicker cooling response following summer heat spells. The influence of two dams, along with an increase in impervious surfaces combine to greatly elevate water temperatures within the lower stream reaches.
3) Both water quality and physical habitat are much better upstream of Rte 6. Less pavement, no dams and a more wooded stream corridor help to keep water temperatures lower. In addition, the streams' substrate is much less impacted by sedimentation in this upstream location.
4) The stocking of brown trout in the spring of 2005 was largely experimental, but followed upgrades to both water diversion and STP effluent issues. The differences in over-summer survival from upstream (exceptionally high survival) to downstream (reduced survival) are reflective of degrading water quality and physical habitat as one moves downstream in Steele Brook.
5) It should be noted that the location above Rte 6 has demonstrated exceptional over-summer survival, and has also shown the ability to hold trout from one year

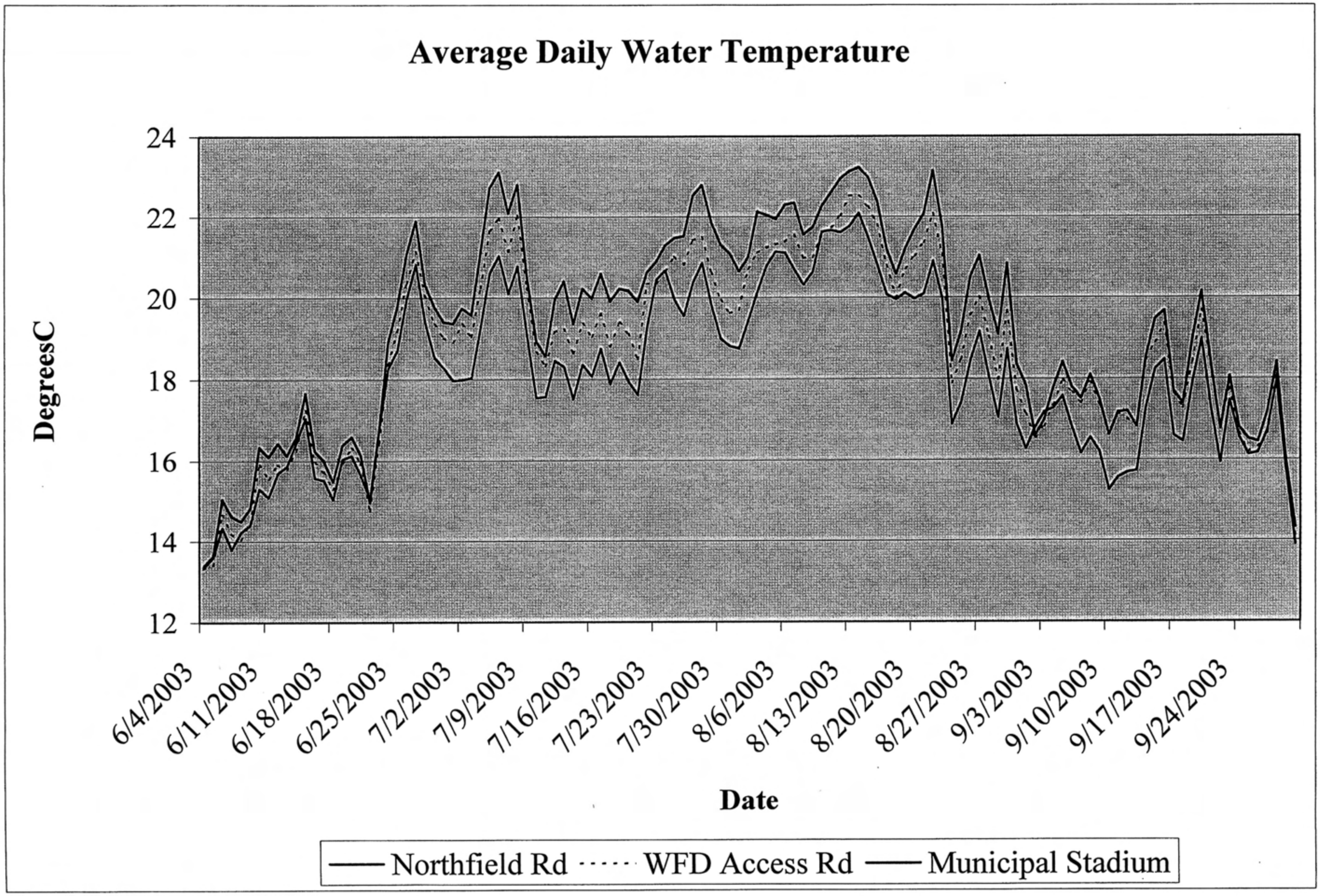
to the next, as was evident in 2007, where ten yearling brown trout were captured. The survival values seen in this stream location over the past 3 years are not only exceptional for Steele Brook, but rank high when compared to other streams statewide that are stocked with brown trout fry.

6) Note that American eels currently only occur at the stadium site, indicating that the dams are presenting a barrier to movement for these fish.

| | |
|---|---|
| **Test** | **Boxplot of Average Daily Temps** |
| **Variables** | Northfield Rd, WFD Access Rd, Municipal Stadium |
| **Performed by** | cbellucc |
| **Date** | 9 November 2007 |




| | n | Mean | SD | SE | 95% CI of Mean | Median | IQR | 95% CI of Median |
|---|---|---|---|---|---|---|---|---|
| **Northfield Rd** | 119 | 18.043 | 2.1138 | 0.1938 | 17.659 to 18.426 | 18.026 | 3.516 | 17.511 to 18.460 |
| **WFD Access Rd** | 119 | 18.691 | 2.2667 | 0.2078 | 18.279 to 19.102 | 19.012 | 3.744 | 18.333 to 19.362 |
| **Municipal Stadium** | 119 | 19.248 | 2.4936 | 0.2286 | 18.795 to 19.701 | 19.669 | 4.079 | 18.564 to 20.217 |



Average Daily Water Temperature
DegreesC
24
22
20
18
16
14
12
6/4/2003
6/11/2003
6/18/2003
6/25/2003
7/2/2003
7/9/2003
7/16/2003
7/23/2003
7/30/2003
8/6/2003
8/13/2003
8/20/2003
8/27/2003
9/3/2003
9/10/2003
9/17/2003
9/24/2003
Date
Northfield Rd
WFD Access Rd
Municipal Stadium

Abundance of stream species (fish/km) at three standardized sampling sites in Steele Brook (2003 - 2007).

| Species | Rte 6 (upstream) | | | | | Echo Lake Rd to Dam | | | | | Municipal Stadium | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2003 | 2004 | 2005 | 2006 | 2007 | 2003 | 2004 | 2005 | 2006 | 2007 | 2003 | 2004 | 2005 | 2006 | 2007 |
| Smallmouth bass | | | | 6 | | NS | | | | | | NS | | | |
| Brown trout (stocked)* | | | 425 | 543 | 843 | | | | | | | | 56 | 312 | 248 |
| Blacknose dace | 890 | 1415 | 2037 | 675 | | | 1807 | 460 | | 102 | 2388 | | 5667 | 1156 | 3751 |
| Longnose dace | | | | | | | | | | | | | | | |
| Creek chub | 110 | 240 | 187 | 168 | | | 435 | 77 | | 141 | 171 | | 553 | 106 | 425 |
| Common Shiner | | | 6 | | | | 448 | | | 128 | 28 | | 14 | 14 | 7 |
| White sucker | 395 | 1460 | 1231 | 656 | | | 2217 | 1423 | | 423 | 57 | | 843 | 100 | 1099 |
| Tessellated darter | 110 | 416 | 512 | 118 | | | 51 | | | | | | 28 | 7 | 42 |
| American eel | | | | | | | | | | | 6 | | | | |
| Yellow perch | | 62 | | | | | 307 | 38 | | | | | | | |
| Largemouth bass | | 26 | | 18 | | | 64 | 25 | | 217 | 6 | | | 21 | |
| Redbreast sunfish | 25 | 9 | 19 | | | | 25 | | | 12 | | | | | |
| Bluegill sunfish | 30 | 9 | 12 | 18 | | | 192 | 346 | | 141 | | | 7 | | |
| Pumpkinseed sunfish | 50 | 71 | 6 | 6 | | | 282 | 167 | | 423 | | | | 7 | |
| Brown bullhead | 12 | | | | | | | 38 | | 64 | | | | | |
| Golden Shiner | | | | | | | 128 | 90 | | 38 | | | | | |

* - Brown trout fry were first stocked in the spring of 2005.

# Appendix B:

# Hydrology and Hydraulic Report and Data

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# Appendix B - Hydrology & Hydraulics

## Introduction

As part of the Heminway Pond Dam Removal Feasibility Analysis, the hydrology and hydraulics of Steele Brook were modeled for current conditions and future dam removal options, Alternative 3: Partial Removal with Fish Ramp, and Alternative 4: Full Removal of Spillway. Alternative 2: Bypass Channel was not modeled as it is below the precision of these hydraulic models and would likely have negligible effects on flooding.

## Existing Information

Where possible, information from previous Steele Brook hydrologic & hydraulic studies was incorporated into this report. Previous studies include the 1980 FEMA Town of Watertown Flood Insurance Study (FIS), 1997 FEMA Letter of Map Revision (LOMR) for the Watertown Industrial Park, the Steele Brook Flood Control Study, Watertown, CT (Milone & MacBroom Engineering, Inc., 1987), and the Flood Control Study Steele Brook at Watertown Plaza Knight Street Industrial Area (WMC Consulting, 1997)

### Hydrology

FEMA hydrologic modeling for Steele Brook is based on Flood Flow Formulas for Urbanized and Non-Urbanized Areas of Connecticut (Lawrence A. Weiss 1975). These frequency-discharge relationships are regression equations and were calculated for the Steele Brook basin as part of the 1979 City of Waterbury Flood Insurance Study as far upstream Steele Brook as the town line with Watertown for the 10-yr, 50-yr, 100-yr, & 500-yr statistical recurrence intervals. These discharges were then adjusted for the Watertown FIS by multiplying them by a factor equal to the ratio of the drainage areas to a calculated exponent of 0.7 for several locations upstream. A result of the area adjustment is a large increase in discharges just downstream of the Heminway Pond dam, even though there is no major tributary at this location. Note that these values likely would have been different if the Weiss regressions had been directly applied to the smaller, less urban, drainage areas upstream of Heminway Pond.

The town of Watertown provided a TR20 model to the NRCS for use in the Dam Removal Feasibility Analysis. TR20 is a computer program developed by the NRCS for hydrologic modeling based on rainfall input, drainage area, land use and hydrologic soil group. This model came from the Flood Control Study Steele Brook at Watertown Plaza Knight Street Industrial Area (WMC Consulting, 1997) which was an update of the 1987 TR20 model from the Steele Brook Flood Control Study (Milone and MacBroom 1987). The 1987 TR20 model was based on the NRCS Type-II rainfall distribution as this was the standard design distribution for Connecticut at the time. In the 1997 model WMC Consulting Engineers updated the model with a manually entered NRCS Type-III rainfall distribution as this was the standard design rainfall distribution at the time of that study. This change in methodology has slightly changed the peak discharges from the original 1987 hydrology model.

The TR20 discharges are different than the FEMA discharges as the methods, inputs, date, and assumptions of each model are different. A summary of existing discharges near the pond are listed in Table B1.

***Table B1. Comparison of Flood Discharges at Heminway Pond. (All flows in cfs).***

| Source\Frequency | 1-yr | 2-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr | 500-yr |
|---|---|---|---|---|---|---|---|---|
| FEMA (above dam) | - | - | - | 820 | - | 1600 | 2060 | 3600 |
| FEMA (below dam) | - | - | - | 1130 | - | 2200 | 2840 | 5000 |
| WMC TR20 1997 | 221 | 410 | 782 | 1066 | 1479 | 1842 | 2287 | - |

*(All flows in cfs)*

### Hydraulics

The 1980 Watertown FIS used the HEC-2 hydraulic model software program to determine flood profiles for the different recurrence interval storms described above, as well as a 100-year floodway profile for the amount of flood plain that could be fully encroached upon while only raising water surface profiles a maximum of 1.0 ft.

The 1997 LOMR included new HEC-2 modeling to show changes in the proposed Watertown Industrial Park downstream of Echo Lake Road, which was constructed.

## Feasibility Modeling

Current Steele Brook hydraulic modeling was done in HEC-RAS 4.0. All the FEMA flood flows were modeled as well as the WMC TR20 1-yr & 2-yr flows and a bank full discharge as described below. The 1997 LOMR HEC-2 model was imported and served as the basis for model geometry with significant changes. Several errors or omissions of recent landscape changes were found in the HEC-2 model and corrected/updated in this process. Also, the LOMR model was only completed as far upstream as the Heminway Pond dam so additional information was incorporated from the 1980 FIS HEC-2 input cards.

After importing the HEC-2 model data into HEC-RAS, additional survey and GIS\topographic mapping data was used to provide more details in and near the pond area as the original data was not adequate to model changes for the desired alternatives. The Town of Watertown performed a survey of the channel downstream of the dam and the rock lined side channel. The NRCS surveyed the pond area including top and bottom of sediment. Photogrammetric information was also provided by the Town as GIS data including two-foot contours, color digital aerial imagery, and building and infrastructure features. Significant changes were made to the model including the following:

- FEMA cross sections representing the dam, pond, and nearby channel were removed and replaced with more closely spaced and detailed cross sections as seen in Figure B1.

- Manning's n roughness values were updated to reflect more current conditions in the area in and near Heminway Pond. Tables in the HEC-RAS Hydraulic Reference Manual were used as a source of n values.

- The earthen embankment on the west edge of Heminway Pond dam, which was not originally included in the dam cross section, was modeled as a lateral structure to account for flow leaving the pond and west floodplain and flowing through the ball fields and rock-lined channel around the dam spillway. HEC-RAS optimizes flow through the diversion and reduces the flow remaining in the main channel.

- The rock lined channel and ball field floodplain to the west of the pond embankment was modeled as a separate channel.

- The Echo Lake Road bridge deck was incorrectly listed as 30 ft wide. It was updated to 40 ft as estimated from recent town photogrammetry data.

- The bridge deck of the walkway to the Siemon Company building was reduced from 10 ft to 7 ft and the high flow modeling approach was changed from pressure/weir to energy only as the flood plain offers relief from any pressure that may develop.

- The Driveway to the Siemon Company bridge deck geometry was updated to more accurately reflect the true hydrologic conditions as the imported model assumed a constant deck height above the surrounding flood plain. The high flow modeling approach was changed from pressure/weir to energy only as the flood plain offers relief from any pressure that may develop.

- Additional cross sections were copied or added near the bridges downstream of Heminway Pond to correctly account for the different modeling routines from HEC-2 to HEC-RAS.

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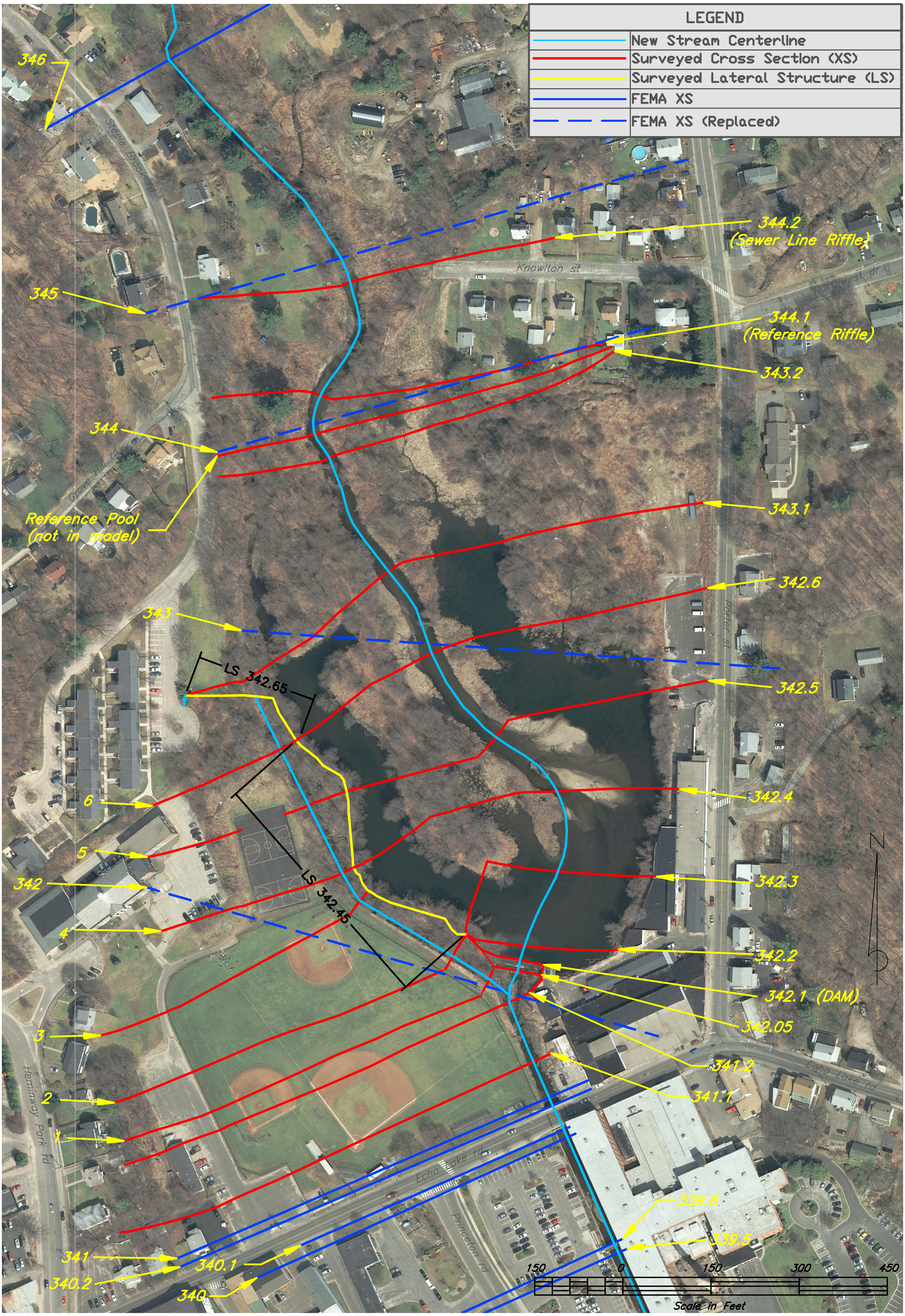


# CROSS SECTION LOCATIONS

FROM FEMA & SURVEY DATA

Page 1 of 1

HEMINWAY POND DAM REMOVAL FEASIBILITY STUDY — Litchfield County, CT

NRCS
Natural Resources Conservation Service
United States Department of Agriculture

| | | |
|---|---|---|
| | | Date |
| Designed | # | # |
| Drawn | BLS | /17/2009 |
| Checked | # | # |
| Approved | # | # |

File No. Feasibility LDD.dwg

Drawing No. Figure B1

3/20/09 2:26 PM

Sheet 1 of 1

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**Future Geometry Methods and Assumptions**

For future conditions, new channel/floodplain geometry had to be estimated. A reference reach was selected and surveyed in the Steele Brook channel upstream of the Heminway Pond pool area, below the sewer line crossing. RIVERMorph software by RIVERMorph, LLC was used to analyze this data and determine a bank full discharge and approximate channel geometry for bank full conditions.

The bank full discharge was determined to be 330 cfs. Bank full discharges are expected to typically fall between the 1-yr and 2.5-yr recurrence intervals with a mean of 1.5-yr interval. The bank full discharge calculated here falls in between the 1-yr and 2-yr WMC discharges. Discharges and dimensions used in actual designs will require more analysis.

For Alternative 3 (partial dam removal/downstream rock ramp with a fish passable weir-pool system), the upstream channel was determined to be a C-type channel, about 2.5 ft deep and 40 ft wide at bank full with a 0.35% slope. It was modeled as a trapezoidal channel with a triangular bottom and constant slope in HEC-RAS although actual channel cross sections and thalweg profile will be highly variable through the riffle-pool system that develops in the former impoundment. The rock ramp with weir-pool system was determined to be a B2a-type channel with a 5% slope and dimensions of about 2.0 ft deep and 30 ft wide at bank full. It was modeled as a trapezoidal channel with a 0.5 ft deep and 3 ft wide low flow notch. In reality the ramp would contain 15 weir-pools. A high Manning's n value of 0.065 was used to account for the hydraulic roughness caused by the weir-pools. Flood plains were left at the top of the existing sediment although some settling may occur once these sediments are dewatered and become compacted from construction equipment.

For Alternative 4 (full dam removal into the dam footer with armored upstream channel) the channel was determined to be a B-type channel, about 2.0 ft deep and 35 ft wide at bank full with a 0.83% slope. It was modeled as a trapezoidal channel with a triangular bottom in HEC-RAS although actual channel cross sections and thalweg profile will be highly variable through the riffles and pools that develop in the new armored channel in the former impoundment. Flood plain widths were maximized in the sediment pool to blend with natural ground. Slight modifications will be needed downstream of the dam to ensure fish passage over the remaining concrete footer but the majority of the downstream channel was left as is in the hydraulic model. Creation of a low flow channel/flood plain system between the dam and Echo Lake road was not modeled as it was not necessary for fish passage but would likely have very little effects on major floods. This could be analyzed during additional modeling at the design stage if it is desired.

Both Alternative 3 & 4 models were run using post construction and mature floodplain Manning's n values for use in the stability analysis.

## Results

Limited modeling results for the bank full discharge and 100-yr flood profiles are discussed below. Profiles and cross section information for additional discharges and locations is found in the plots and tables at the end of this appendix.

Given the differences in modeling routines and the changes in input data, the flood profiles of the current existing condition HEC-RAS model are different than those in the HEC-2 models for several locations. The most significant differences are noted in the area of multiple bridges downstream of Heminway Pond. These differences are transferred upstream to the dam due to backwater effects, resulting in the current 100-yr flood water surface to be approximately 2 foot less than in the Watertown FIS as seen in *Figure B1*. This difference may be enough to effect the backwater calculations through the dam. It appears that the current model is more accurate than the previous HEC-2 model in regards to downstream bridge modeling. For example, the 3.5 ft rise in water surface at the 16 inch pipe in the FEMA study is apparently overestimated as there is additional room for flow in the right floodplain. This difference sets up different backwater conditions through each additional upstream bridge.

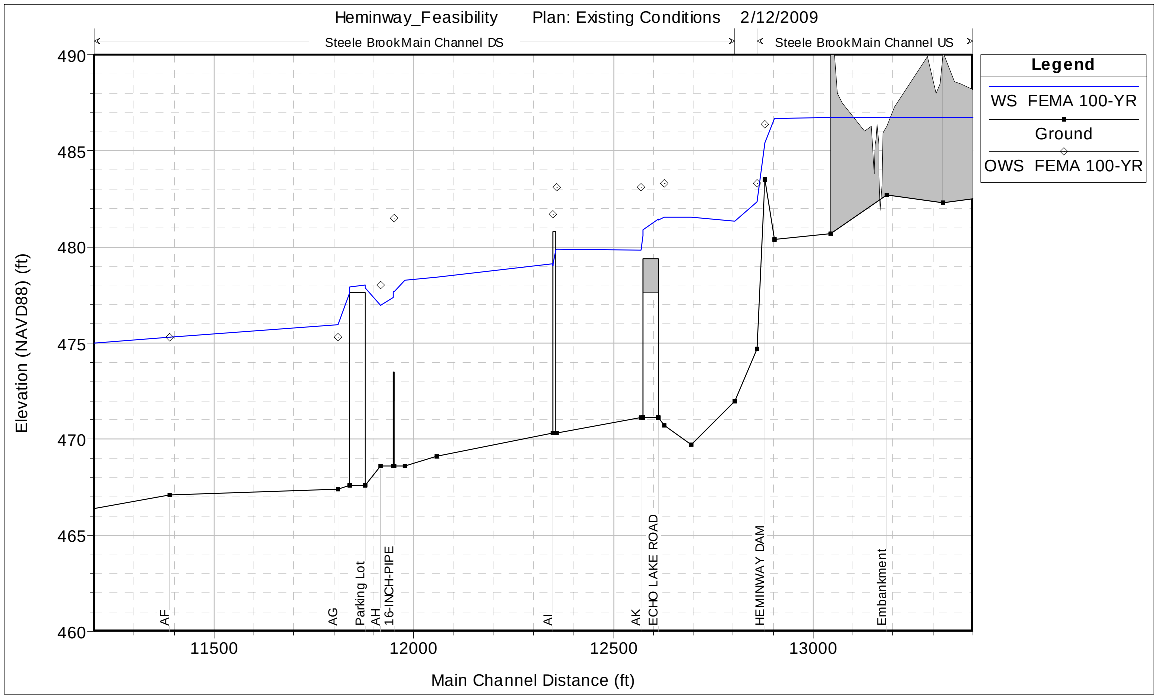


***Figure B1. 100-yr flood profile comparison for new modeling vs. published FEMA elevations.***

In the following figures, original ground is shown in pink and future ground is black. Original water surfaces are shown as green with triangles at nodes while future water surfaces are shown as blue.

For Alternative 3: Partial Removal with Fish Ramp, *Figure B2* shows that the 100-yr water surface elevation downstream of the dam increases a maximum about 0.5 ft. There is not much difference due to the backwater from Echo Lake Road in large floods. The water surface above the dam decreases about 1 ft and approaches the existing condition water surface about 1340 ft upstream of the dam. The decrease in water surface elevation in the pond results in less flood flow over the side embankment and west floodplain and more flow through the remaining dam structure. Out of the 2060 cfs upstream input, about 1270 cfs flow over the existing dam and about 1660 cfs flow over the partially removed dam.

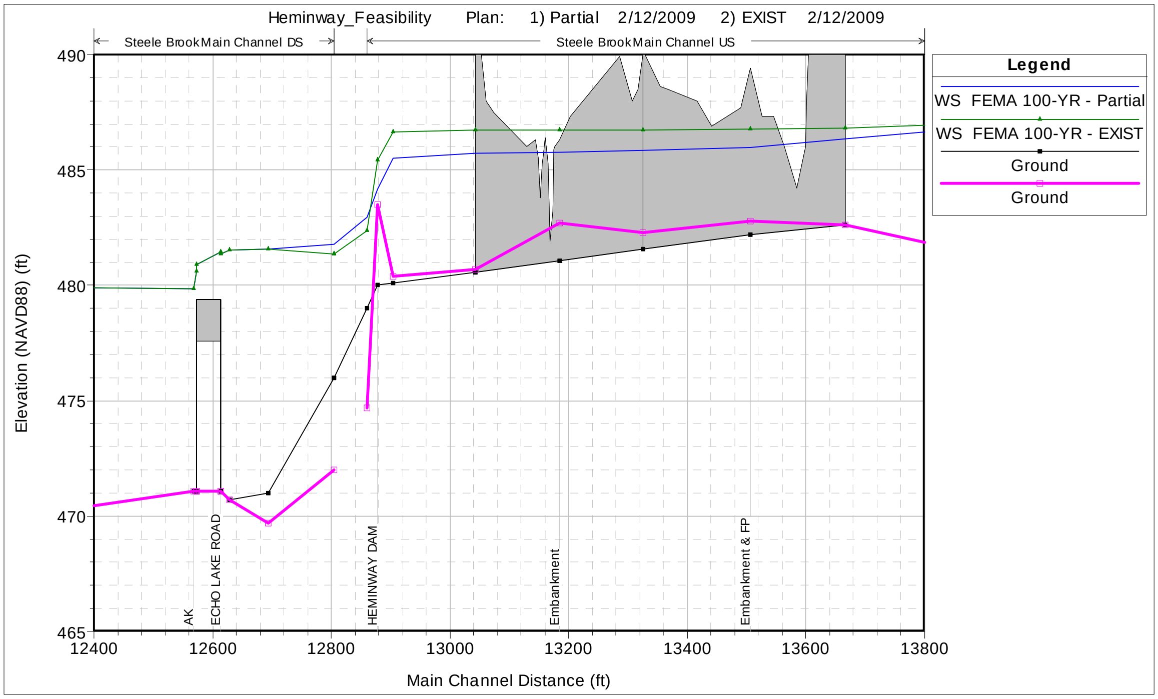


***Figure B2. 100-yr flood profile comparison for partial removal alternative #3.***

*Figure B3* shows that for bank full discharge the water surface in the new rock chute downstream of the dam increases a maximum of about 5.5 feet as is expected as the channel is being significantly filled above the existing water surface. The water surface in the pond decreases a maximum of about 1.5 ft and approaches the existing condition water surface about 1000 ft upstream of the dam. The decrease in water surface elevation in the pond results in less flow over the side embankment and west floodplain and more flow through the remaining dam structure. Out of the 330 cfs upstream input, about 240 cfs flow over the existing dam and about 310 cfs flow over the partially removed dam.

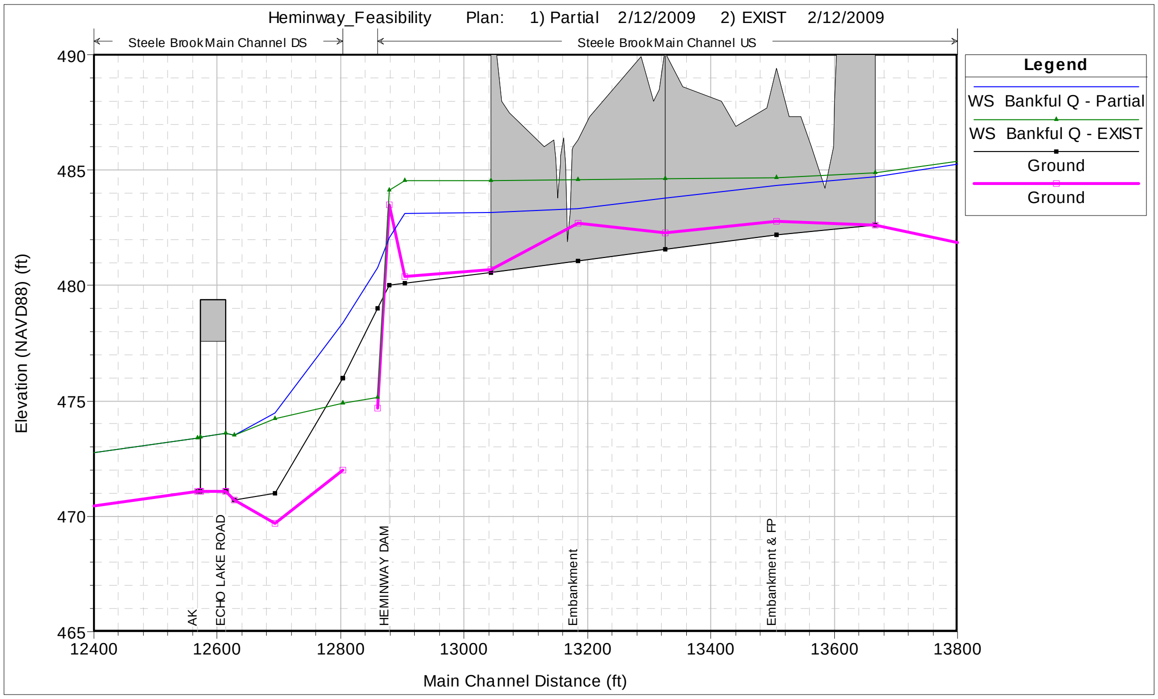

*Figure B3. Bank full discharge profile comparison for partial removal alternative #3.*

For Alternative 4: Full Removal of Spillway, Figure B4 shows that the 100-yr water surface elevation downstream of the dam is essentially identical, as it only rises about 0.1 feet,. There is not much difference due to the backwater from Echo Lake Road in large floods. The water surface above the dam decreases about 4.3 ft and approaches the existing condition water surface about 1340 ft upstream of the dam. The decrease in water surface elevation in the pond results in very little flood flow over the side embankment and west floodplain and more flow through the remaining dam structure. Out of the 2060 cfs upstream input, about 1270 cfs flow over the existing dam and about 2045 cfs flow over the fully removed dam.

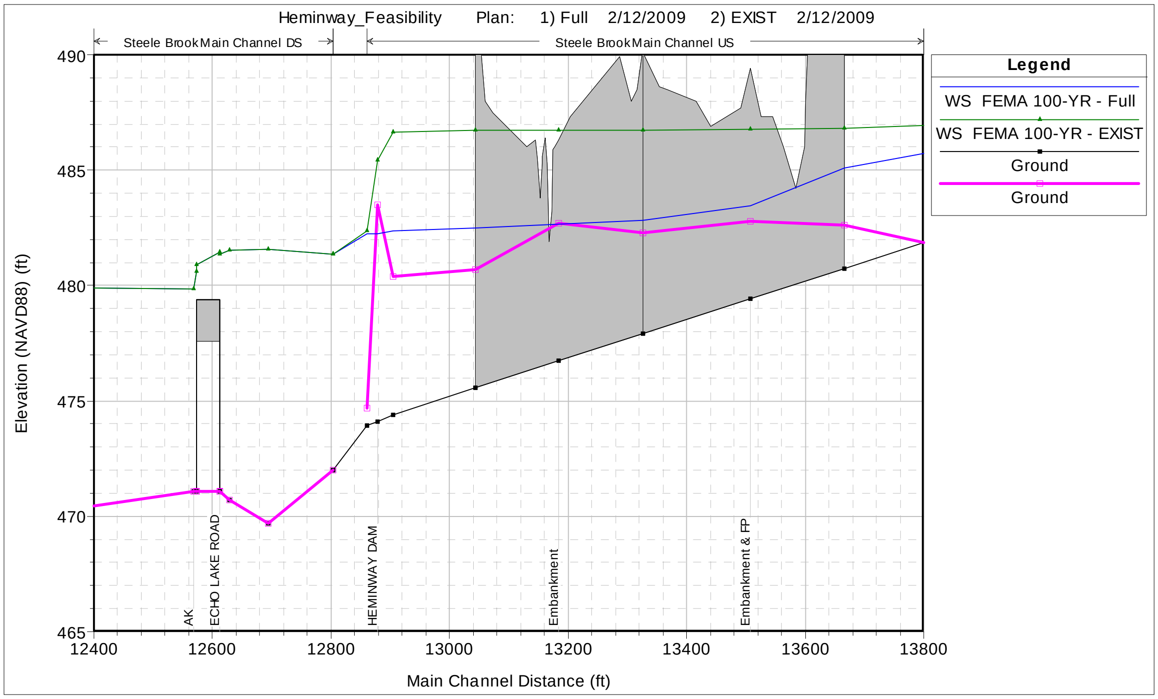


***Figure B4. 100-yr flood profile comparison for partial removal alternative #4.***

Figure B5 shows that for bank full discharge the water surface just downstream of the dam rises less than 0.5 feet, a result of the water surface no longer going supercritical below the dam. The water surface in the pond decreases a maximum of about 8.5 ft at the dam and approaches the existing condition water surface about 1800 ft upstream of the dam. The decrease in water surface elevation in the pond results in no flow over the side embankment and west floodplain and more flow through the remaining dam structure. This is to be expected that as a bank full discharge should stay close to the channel bank elevations.

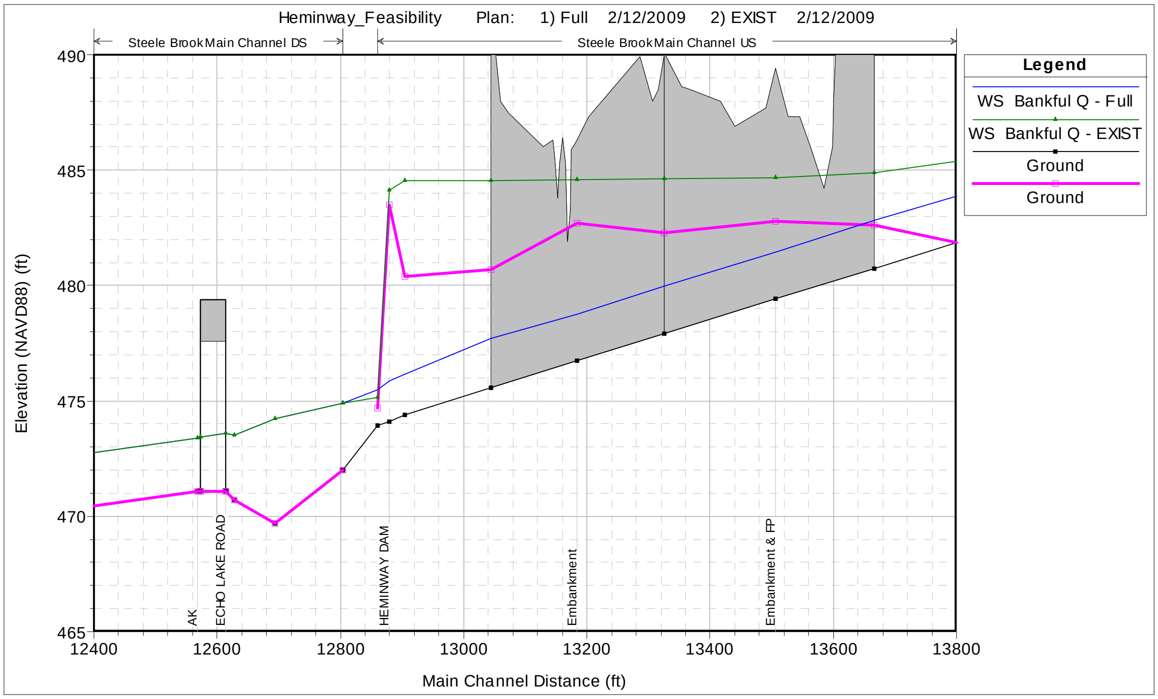


***Figure B5. Bank full discharge profile comparison for partial removal alternative #4.***

# Existing Condition
# HEC-RAS Report

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```
                    HEC-RAS Version 4.0.0 March 2008
                     U.S. Army Corps of Engineers
                    Hydrologic Engineering Center
                          609 Second Street
                          Davis, California

            X     X  XXXXXX    XXXX        XXXX      XX      XXXX
            X     X  X        X    X       X   X    X  X    X
            X     X  X        X            X   X   X    X   X
            XXXXXXX  XXXX     X      XXX   XXXX    XXXXXX    XXXX
            X     X  X        X            X  X    X    X       X
            X     X  X        X    X       X   X   X    X       X
            X     X  XXXXXX    XXXX        X    X  X    X   XXXXX

********************************************************************************
```

PROJECT DATA
Project Title: Heminway_Feasibility
Project File : Heminway_Feasibility.prj
Run Date and Time: 2/12/2009 5:00:40 PM

Project in English units

Project Description:
Heminway Pond Dam Removal Feasibility Study.  Base data from 1997 LOMR, expanded upstream with 1980 FIS geometry.  Additional and enhanced/replaced/corrected geometry in area of pond and nearby channel with 2007/2008 survey data & town GIS data.

********************************************************************************

PLAN DATA

Plan Title: Existing Conditions
Plan File : s:\Engineering\PROJECTS\STEELE_BROOK\HEC-RAS\Feasibility Draft\Heminway_Feasibility.p01

Geometry Title: Existing Conditions
Geometry File : s:\Engineering\PROJECTS\STEELE_BROOK\HEC-RAS\Feasibility Draft\Heminway_Feasibility.g01

Flow Title    : Flows
Flow File     : s:\Engineering\PROJECTS\STEELE_BROOK\HEC-RAS\Feasibility Draft\Heminway_Feasibility.f01

Plan Description:
Existing Conditions

Plan Summary Information:

| | | | | | |
|---|---|---|---|---|---|
| Number of: | Cross Sections | = 87 | Multiple Openings | = | 0 |
| | Culverts | = 0 | Inline Structures | = | 0 |
| | Bridges | = 9 | Lateral Structures | = | 2 |

```
Computational Information
    Water surface calculation tolerance  =  0.01
    Critical depth calculation tolerance =  0.01
    Maximum number of iterations         =  20
    Maximum difference tolerance         =  0.3
    Flow tolerance factor                =  0.001

Computation Options
    Critical depth computed at all cross sections
    Conveyance Calculation Method: At breaks in n values only
    Friction Slope Method:         Program Selects Appropriate method
    Computational Flow Regime:     Mixed Flow

Encroachment Data
   Equal Conveyance = True
   Left Offset      =        0
   Right Offset     =        0
```

River = Steele Brook     Reach = Main Channel US

| RS | Profile | Method | Value1 | Value2 |
|---|---|---|---|---|
| 351 | FEMA Floodway | 4 | 1 | |
| 350 | FEMA Floodway | 4 | 1 | |
| 349 | FEMA Floodway | 4 | 1 | |
| 348 | FEMA Floodway | 4 | 1 | |
| 347.2 | FEMA Floodway | 4 | 1 | |
| 347.1 | FEMA Floodway | 4 | 1 | |
| 347 | FEMA Floodway | 1 | 1353 | 1405 |
| 346 | FEMA Floodway | 1 | 1250 | 1350 |
| 345 | FEMA Floodway | 2 | 47 | |
| 344.2 | FEMA Floodway | 2 | 47 | |
| 344.1 | FEMA Floodway | 2 | 235 | |
| 343.2 | FEMA Floodway | 2 | 455 | |
| 343.1 | FEMA Floodway | 2 | 455 | |
| 342.6 | FEMA Floodway | 4 | 1 | |
| 342.5 | FEMA Floodway | 4 | 1 | |
| 342.4 | FEMA Floodway | 4 | 1 | |
| 342.3 | FEMA Floodway | 4 | 1 | |
| 342.2 | FEMA Floodway | 4 | 1 | |
| 342.1 | FEMA Floodway | 4 | 1 | |
| 342.05 | FEMA Floodway | 4 | 1 | |

River = Steele Brook     Reach = Main Channel DS

| RS | Profile | Method | Value1 | Value2 |
|---|---|---|---|---|
| 341.2 | FEMA Floodway | 4 | 1 | |
| 341.1 | FEMA Floodway | 4 | 1 | |
| 341 | FEMA Floodway | 1 | 1002 | 1277.35 |
| 340.2 | FEMA Floodway | 1 | 1000 | 1150 |
| 340.1 | FEMA Floodway | 1 | 1000 | 1120 |
| 340 | FEMA Floodway | 1 | 1000 | 1120 |
| 339.6 | FEMA Floodway | 1 | 1000 | 1120 |
| 339.56 | FEMA Floodway | 1 | 1000 | 1120 |
| 339.51 | FEMA Floodway | 1 | 1000 | 1120 |
| 339.5 | FEMA Floodway | 1 | 1000 | 1120 |
| 339.1 | FEMA Floodway | 1 | 1000 | 1120 |
| 339 | FEMA Floodway | 1 | 1320 | 1440 |
| 338.2 | FEMA Floodway | 1 | 1320 | 1440 |

| | | | | |
|---|---|---|---|---|
| 338.1 | FEMA Floodway | 1 | 1320 | 1420 |
| 337 | FEMA Floodway | 2 | 150 | |
| 336.2 | FEMA Floodway | 1 | 980 | 1010 |
| 336.1 | FEMA Floodway | 1 | 980 | 1010 |
| 336 | FEMA Floodway | 2 | 47 | |
| 335 | FEMA Floodway | 1 | 1160 | 1280 |
| 334 | FEMA Floodway | 2 | 100 | |
| 333 | FEMA Floodway | 2 | 80 | |
| 332.2 | FEMA Floodway | 1 | 1080 | 1300 |
| 332.1 | FEMA Floodway | 4 | .4 | |
| 332 | FEMA Floodway | 4 | .4 | |
| 331 | FEMA Floodway | 4 | .4 | |
| 330 | FEMA Floodway | 4 | .4 | |
| 329 | FEMA Floodway | 4 | 1 | |
| 328 | FEMA Floodway | 4 | 1 | |
| 327 | FEMA Floodway | 4 | 1 | |
| 326 | FEMA Floodway | 4 | 1 | |
| 325 | FEMA Floodway | 4 | 1 | |
| 324.2 | FEMA Floodway | 4 | 1 | |
| 324.1 | FEMA Floodway | 4 | 1 | |
| 324 | FEMA Floodway | 4 | 1 | |
| 323 | FEMA Floodway | 4 | 1 | |
| 322 | FEMA Floodway | 4 | 1 | |
| 321.1 | FEMA Floodway | 4 | 1 | |
| 321 | FEMA Floodway | 4 | 1 | |
| 320 | FEMA Floodway | 4 | 1 | |
| 319 | FEMA Floodway | 4 | 1 | |
| 318 | FEMA Floodway | 4 | 1 | |
| 317 | FEMA Floodway | 4 | 1 | |
| 316 | FEMA Floodway | 4 | 1 | |
| 315 | FEMA Floodway | 4 | 1 | |
| 314 | FEMA Floodway | 4 | 1 | |
| 313 | FEMA Floodway | 4 | 1 | |
| 312.2 | FEMA Floodway | 4 | 1 | |
| 312.1 | FEMA Floodway | 4 | 1 | |
| 312 | FEMA Floodway | 4 | 1 | |
| 311 | FEMA Floodway | 4 | 1 | |
| 310 | FEMA Floodway | 4 | 1 | |
| 309 | FEMA Floodway | 4 | 1 | |
| 308 | FEMA Floodway | 4 | 1 | |
| 307.1 | FEMA Floodway | 4 | 1 | |
| 307 | FEMA Floodway | 4 | 1 | |
| 305 | FEMA Floodway | 4 | 1 | |
| 304.2 | FEMA Floodway | 4 | 1 | |
| 304.1 | FEMA Floodway | 4 | 1 | |
| 304 | FEMA Floodway | 4 | 1 | |
| 303 | FEMA Floodway | 4 | 1 | |
| -100 | FEMA Floodway | 1 | 254.7 | 339.2 |

********************************************************************************

FLOW DATA

Flow Title: Flows
Flow File : s:\Engineering\PROJECTS\STEELE_BROOK\HEC-RAS\Feasibility Draft\Heminway_Feasibility.f01

```
Flow Data (cfs)
*******************************************************************************
*******************************************************************************
*************
* River           Reach           RS      *     FEMA 100-YR   FEMA Floodway
FEMA 10-YR      FEMA 50-YR     FEMA 500-YR       M&M 2-YR        M&M 1-YR
Bankful Q *
* Steele Brook    Main Channel US 351     *          2060            2060
820            1600            3600            405             221
330 *
* Steele Brook    Main Channel DS 341.2   *          2840            2840
1130            2200            5000            461             221
330 *
* Steele Brook    Main Channel DS 310     *          3550            3550
1410            2740            6245            796             380
330 *
* Steele Brook    Old Channel     7       *             1               1
1               1               1               1               1
1 *
*******************************************************************************
*******************************************************************************
*************

Boundary Conditions
*******************************************************************************
************************
* River           Reach           Profile          *            Upstream
Downstream    *
*******************************************************************************
************************
* Steele Brook    Main Channel US FEMA 100-YR      *              Critical
*
* Steele Brook    Main Channel US FEMA Floodway    *              Critical
*
* Steele Brook    Main Channel US FEMA 10-YR       *              Critical
*
* Steele Brook    Main Channel US FEMA 50-YR       *              Critical
*
* Steele Brook    Main Channel US FEMA 500-YR      *              Critical
*
* Steele Brook    Main Channel US M&M 2-YR         *              Critical
*
* Steele Brook    Main Channel US M&M 1-YR         *              Critical
*
* Steele Brook    Main Channel US Bankful Q        *              Critical
*
* Steele Brook    Old Channel     FEMA 100-YR      *        Normal S = 0.0001
*
* Steele Brook    Old Channel     FEMA Floodway    *        Normal S = 0.0001
*
* Steele Brook    Old Channel     FEMA 10-YR       *        Normal S = 0.0001
*
* Steele Brook    Old Channel     FEMA 50-YR       *        Normal S = 0.0001
*
* Steele Brook    Old Channel     FEMA 500-YR      *        Normal S = 0.0001
*
```

```
* Steele Brook    Old Channel     M&M 2-YR        *        Normal S = 0.0001
*
* Steele Brook    Old Channel     M&M 1-YR        *        Normal S = 0.0001
*
* Steele Brook    Old Channel     Bankful Q       *        Normal S = 0.0001
*
* Steele Brook    Main Channel DS FEMA 100-YR     *
Known WS = 356.31 *
* Steele Brook    Main Channel DS FEMA Floodway   *
Known WS = 356.44 *
* Steele Brook    Main Channel DS FEMA 10-YR      *
Known WS = 352.85 *
* Steele Brook    Main Channel DS FEMA 50-YR      *
Known WS = 353 *
* Steele Brook    Main Channel DS FEMA 500-YR     *
Known WS = 358.5 *
* Steele Brook    Main Channel DS M&M 2-YR        *
Normal S = 0.002 *
* Steele Brook    Main Channel DS M&M 1-YR        *
Normal S = 0.002 *
* Steele Brook    Main Channel DS Bankful Q       *
Normal S = 0.002 *
********************************************************************************
************************

Observed Water Surface Marks
********************************************************************************
********************************************************************************
*************
* River           Reach           RS      *     FEMA 100-YR   FEMA Floodway
FEMA 10-YR      FEMA 50-YR     FEMA 500-YR        M&M 2-YR        M&M 1-YR
Bankful Q *
* Steele BrookMain Channel US351     *          509.1
*
* Steele BrookMain Channel US350     *          503.4
*
* Steele BrookMain Channel US349     *          498.3
*
* Steele BrookMain Channel US348     *          498.1
*
* Steele BrookMain Channel US347.2   *
*
* Steele BrookMain Channel US347.1   *
*
* Steele BrookMain Channel US347     *          493.3
*
* Steele BrookMain Channel US346     *          492.4
*
* Steele Brook    Main Channel US 344.2   *          489.3
*
* Steele Brook    Main Channel US 342.1   *          486.4
*
* Steele Brook    Main Channel US 342.05  *          483.3
*
* Steele BrookMain Channel DS341     *          483.3
*
```

```
* Steele BrookMain Channel DS340     *           483.1
*
* Steele BrookMain Channel DS339.6   *           483.1
*
* Steele BrookMain Channel DS339.5   *           481.7
*
* Steele Brook    Main Channel DS 338.2   *           481.5
*
* Steele BrookMain Channel DS337     *             478
*
* Steele BrookMain Channel DS336     *           475.3
*
* Steele BrookMain Channel DS335     *           475.3
*
* Steele BrookMain Channel DS334     *           474.4
*
* Steele BrookMain Channel DS333     *           473.7
*
* Steele BrookMain Channel DS332     *           470.7
*
* Steele BrookMain Channel DS331     *           468.2
*
* Steele BrookMain Channel DS330     *           466.6
*
********************************************************************************
********************************************************************************
*************

********************************************************************************

GEOMETRY DATA

Geometry Title: Existing Conditions
Geometry File : s:\Engineering\PROJECTS\STEELE_BROOK\HEC-RAS\Feasibility
Draft\Heminway_Feasibility.g01

Reach Connection Table
********************************************************************************
*
* River            Reach            *  Upstream Boundary  * Downstream Boundary
*
********************************************************************************
*
* Steele Brook     Main Channel US  *                     *   Canal
*
* Steele Brook     Old Channel      *                     *   Canal
*
* Steele Brook     Main Channel DS  *   Canal             *
*
********************************************************************************
*

JUNCTION INFORMATION

Name: Canal
Description:
Energy computation Method
```

```
    Length across Junction            Tributary
     River           Reach              River          Reach        Length
Angle
Steele Brook    Main Channel US  to Steele Brook    Main Channel DS     56.4
Steele Brook    Old Channel      to Steele Brook    Main Channel DS    55.76

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel US    RS: 351

INPUT
Description: FEMA AU
Station Elevation Data    num=      21
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   557.1    1049   536.1    1145   531.1    1190   527.6    1250   521.1
    1297   518.6    1330   518.1    1363   508.1    1380   505.6    1382   505.3
    1408   505.3    1410   505.6    1432   507.2    1478   508.1    1585   508.6
    1735   518.1    1767   521.1    1831   521.6    1905   521.6    1940   518.1
    1975   519.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1363     .04    1432     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1363    1432             600     550     500              .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel US    RS: 350

INPUT
Description: FEMA AT
Station Elevation Data    num=      22
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   532.6    1040   529.6    1103   524.6    1160   522.1    1255   503.1
    1305   502.6    1345   503.1    1351   499.3    1352   498.1    1378   498.1
    1380   499.3    1408   502.6    1458   503.1    1534   506.6    1585   506.6
    1642   508.1    1688   507.6    1770   509.6    1800   512.1    1829   516.6
    1865   521.1    1945   516.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1345     .04    1408     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
```

```
          1345    1408              400     390     500              .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel US    RS: 349

INPUT
Description: FEMA AS
Station Elevation Data    num=      26
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   523.6    1065   523.1    1104   519.6    1141   514.6    1185   508.1
    1225   496.6    1275   496.6    1325   496.1    1365   497.6    1405   493.6
    1410   492.3    1430   492.3    1435   493.6    1450   497.6    1488   497.1
    1532   497.6    1584   498.1    1645   500.1    1705   500.6    1772   502.1
    1845   503.1    1905   506.1    1940   505.6    1980   509.3    2020   516.1
    2095   525.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1365     .04    1450     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1365    1450              550     540     400              .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel US    RS: 348

INPUT
Description: FEMA AR
Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     820   504.1     860   499.1    1000   489.6    1002   488.9    1020   488.9
    1023   489.6    1115   495.1    1176   497.6    1250   505.1    1311   500.1
    1612   514.3

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     820     .06    1000     .04    1023     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1000    1023               40      40      40              .1       .3

CROSS SECTION


RIVER: Steele Brook
```

REACH: Main Channel US    RS: 347.2

INPUT
Description: U/S FACE CUTLER STREET BRIDGE (RTE 6)
Station Elevation Data    num=       6

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 1000 | 503.9 | 1050 | 503.9 | 1052 | 489.9 | 1082 | 488.3 | 1084 | 502.7 |
| 1154 | 502.7 | | | | | | | | |

Manning's n Values        num=       3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 1000 | .06 | 1050 | .04 | 1084 | .06 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 1050 | 1084 | 70 | 70 | 70 | .3 | .5 |

Ineffective Flow     num=       2

| Sta L | Sta R | Elev | Permanent |
|---|---|---|---|
| 1000 | 1050 | 503.4 | F |
| 1084 | 1154 | 503.4 | F |

BRIDGE

RIVER: Steele Brook
REACH: Main Channel US    RS: 347.15

INPUT
Description: Route 6 Bridge
Distance from Upstream XS =      20
Deck/Roadway Width        =      30
Weir Coefficient          =     2.5
Upstream  Deck/Roadway Coordinates
num=       6

| Sta | Hi Cord | Lo Cord | Sta | Hi Cord | Lo Cord | Sta | Hi Cord | Lo Cord |
|---|---|---|---|---|---|---|---|---|
| 1000 | 503.9 | | 1050 | 503.9 | | 1052 | 503.4 | 501.2 |
| 1082 | 503.4 | 501.2 | 1084 | 502.7 | | 1154 | 502.7 | |

Upstream Bridge Cross Section Data
Station Elevation Data    num=       6

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 1000 | 503.9 | 1050 | 503.9 | 1052 | 489.9 | 1082 | 488.3 | 1084 | 502.7 |
| 1154 | 502.7 | | | | | | | | |

Manning's n Values        num=       3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 1000 | .06 | 1050 | .04 | 1084 | .06 |

| Bank Sta: Left | Right | Coeff Contr. | Expan. |
|---|---|---|---|
| 1050 | 1084 | .3 | .5 |

Ineffective Flow     num=       2

| Sta L | Sta R | Elev | Permanent |
|---|---|---|---|

```
    1000    1050   503.4       F
    1084    1154   503.4       F

Downstream  Deck/Roadway Coordinates
    num=       6
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
************************************************************************
    1000   503.9            1050   503.9            1052   503.4   501.2
    1082   503.4   501.2    1084   502.7            1154   502.7

Downstream Bridge Cross Section Data
Station Elevation Data    num=       6
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   503.9    1050   503.9    1052   489.9    1082   488.3    1084   502.7
    1154   502.7

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1050     .04    1084     .06

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1050    1084             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1050   501.2       F
    1084    1154   501.2       F

Upstream Embankment side slope             =       0 horiz. to 1.0 vertical
Downstream Embankment side slope           =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins        =
Energy head used in spillway design        =
Spillway height used in design             =
Weir crest shape                           = Broad Crested

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: Steele Brook
```

```
REACH: Main Channel US    RS: 347.1

INPUT
Description: D/S FACE CUTLER STREET BRIDGE (RTE 6)
Station Elevation Data    num=       6
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   503.9    1050   503.9    1052   489.9    1082   488.3    1084   502.7
    1154   502.7

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1050     .04    1084     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1050    1084              30      30      30              .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1050   501.2       F
    1084    1154   501.2       F

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel US    RS: 347

INPUT
Description: FEMA AQ
Station Elevation Data    num=      16
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   536.1    1053   532.1    1114   528.6    1182   521.1    1219   518.1
    1278   507.6    1319   501.6    1347   495.1    1370   488.1    1371   487.9
    1389   487.9    1390   488.1    1413   496.1    1487   498.6    1608   499.6
    1680   501.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1347     .04    1413     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1347    1413             400     410     300              .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel US    RS: 346

INPUT
Description: FEMA AP
Station Elevation Data    num=      15
```

```
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   515.1    1080   495.1    1129   491.1    1190   490.6    1250   492.6
    1295   491.1    1319   487.1    1320   486.1    1330   486.1    1335   487.1
    1350   490.1    1395   497.6    1459   498.6    1505   498.6    1623   512.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1295     .04    1350     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1295    1350              545  494.13     435             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel US    RS: 344.2

INPUT
Description: Sewer Line Riffle
Station Elevation Data    num=      32
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0     500    12.5     498    22.1     496    25.1     494    55.9     494
   125.5     492   202.1     490   271.1     490   306.5   489.5   332.6   488.3
   340.2   486.6   342.9   484.9   344.2   484.3   345.7   483.9   355.3   484.1
   359.5   483.8   364.8   483.8   371.1     484   371.9   484.1   373.5   484.6
   375.3   485.9   380.1   486.3   405.7   487.4   447.7   486.8   527.3   486.6
   560.7     488   567.2     490   572.3     492   578.9     494   587.1     496
   595.4     498   612.3     500

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
       0     .06   340.2    .035   375.3     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
         340.2   375.3              210  213.35     170             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel US    RS: 344.1

INPUT
Description: Reference Riffle
Station Elevation Data    num=      34
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0     500    30.7     498      59     496    94.8     494   132.6     492
   169.5     490   207.2     488   294.9     486   342.8     484     382   483.2
   413.3     484   474.5   485.9   479.5   486.2   481.6     484   482.7   483.9
```

```
     487   484.2   490.3     484     495   483.9     499   483.7   505.4   483.3
   507.8   482.7   511.9   482.5   516.1     483   517.3   483.4   519.6   486.6
   527.8   486.8   537.1     486   656.5     488   659.8     490   663.5     492
   667.1     494   670.9     496   677.7     498   684.7     500

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0     .06   479.5    .035   519.6     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
         479.5   519.6                70  116.18     125             .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   169.5   342.8     489       F
   342.8   479.5   486.5       F
Left Levee      Station=   479.5      Elevation=   486.2

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel US    RS: 343.2

INPUT
Description: New NRCS  (Replace FEMA 344)
Station Elevation Data    num=      28
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0     500    26.4     498    60.3     496   107.2     494   147.2     492
   182.4     490   217.6     488   269.5   487.7     331     486     388   484.5
   505.1   486.3   507.4   484.1   515.5   483.6   525.5   482.3   531.2   481.7
   534.4   481.4   537.3   484.8   651.2     484   666.8   483.7   676.9     484
   679.9     486   682.9     488   685.8     490   688.8     492   691.7     494
   696.1     496   703.5     498   710.9     500

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0     .06   505.1    .035   537.3     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
         505.1   537.3               216  220.59  266.01             .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0     331     489       F
   537.3   710.9     486       F
Left Levee      Station=   505.1      Elevation=   486.2
Right Levee     Station=   537.3      Elevation=   484.8

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel US    RS: 343.1
```

INPUT
Description: New NRCS (Replaced FEMA 343 AN)
Station Elevation Data num= 48

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 500 | 4.1 | 498 | 33 | 496 | 126.1 | 494 | 180.9 | 492 |
| 245.4 | 492 | 290.2 | 493 | 315.2 | 492 | 326.7 | 490 | 333.5 | 488 |
| 339.6 | 486 | 343.4 | 484 | 347.2 | 483.7 | 352.6 | 482.7 | 408.4 | 482.4 |
| 457.4 | 482.8 | 469.9 | 483.7 | 479.7 | 484 | 519.3 | 485.5 | 531.8 | 485.3 |
| 534.5 | 483.1 | 541.4 | 483.2 | 562 | 482.6 | 570.6 | 482.6 | 571.3 | 485.1 |
| 641.7 | 486 | 661.9 | 484.8 | 689.5 | 486 | 723.3 | 488 | 729.5 | 488.7 |
| 735.4 | 488 | 756.7 | 486 | 771.7 | 484 | 773.2 | 483.7 | 781.7 | 481.4 |
| 794.4 | 481.4 | 795.3 | 484 | 825.1 | 484 | 840.8 | 483.1 | 853.6 | 484 |
| 863.7 | 486 | 867.3 | 488 | 871 | 490 | 874.6 | 492 | 878.3 | 494 |
| 914.1 | 496 | 958.1 | 498 | 965 | 500 | | | | |

Manning's n Values num= 6

| Sta | n Val | Sta | n Val | Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|---|---|---|---|
| 0 | .06 | 343.4 | .04 | 531.8 | .035 | 571.3 | .06 | 771.7 | .04 |
| 853.6 | .06 | | | | | | | | |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 531.8 | 571.3 | 153 | 159.84 | 231.73 | .1 | .3 |

Ineffective Flow num= 2

| Sta L | Sta R | Elev | Permanent |
|---|---|---|---|
| 0 | 519.3 | 485.3 | F |
| 641.7 | 965 | 486 | F |

LATERAL STRUCTURE

RIVER: Steele Brook
REACH: Main Channel US RS: 342.65

INPUT
Description:
Lateral structure position = Right overbank
Distance from Upstream XS =
Deck/Roadway Width = 10
Weir Coefficient = 3.09
Weir Flow Reference = Energy Grade
Weir Embankment Coordinates num = 19

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 500 | 8.9 | 498 | 48 | 496 | 82.8 | 494 | 87.1 | 492 |
| 91.1 | 490 | 94.9 | 488 | 98.7 | 486 | 118.9 | 484.2 | 149.6 | 486 |
| 176.1 | 487.3 | 203.6 | 487.3 | 231.7 | 489.4 | 243 | 487.7 | 277.9 | 486.9 |
| 294.4 | 488 | 328.8 | 488.5 | 338 | 488.6 | 357.7 | 490.1 | | |

Weir crest shape = Broad Crested

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel US    RS: 342.6

INPUT
Description: New NRCS
Station Elevation Data    num=      43

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 500 | 4.2 | 498 | 8.4 | 496 | 10.8 | 494 | 40.8 | 494 |
| 77.8 | 494 | 113.9 | 492 | 117.2 | 490 | 120.5 | 488 | 123.9 | 486 |
| 225.2 | 484 | 328.1 | 484.1 | 329.9 | 483.2 | 337.1 | 482.2 | 365.7 | 481.7 |
| 406.8 | 483 | 407.8 | 483.4 | 408.8 | 484 | 425.2 | 484 | 435.5 | 484.1 |
| 453.5 | 485.3 | 460.7 | 485.8 | 463.3 | 483.6 | 478.7 | 482.8 | 495 | 483.1 |
| 505.3 | 483.3 | 509 | 484.5 | 510.9 | 484.4 | 563.2 | 484 | 599.9 | 486 |
| 605.4 | 486.1 | 610.4 | 486 | 657.7 | 484 | 658.8 | 484 | 659.9 | 483 |
| 670.6 | 481.6 | 697.5 | 481.5 | 721.1 | 481.5 | 742.9 | 481.5 | 744.2 | 483.7 |
| 746 | 484 | 752.6 | 487.5 | 759.2 | 489.4 | | | | |

Manning's n Values        num=       6

| Sta | n Val | Sta | n Val | Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|---|---|---|---|
| 0 | .06 | 328.1 | .04 | 460.7 | .035 | 509 | .06 | 657.7 | .04 |
| 746 | .06 | | | | | | | | |

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.

| | | | | | | |
|---|---|---|---|---|---|---|
| 460.7 | 509 | 152 | 181.04 | 125.98 | .1 | .3 |

Ineffective Flow     num=       3

| Sta L | Sta R | Elev | Permanent |
|---|---|---|---|
| 113.9 | 328.1 | 490 | T |
| 328.1 | 460.7 | 484 | F |
| 605.4 | 759.2 | 486 | F |

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel US    RS: 342.5

INPUT
Description: New NRCS
Station Elevation Data    num=      39

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 498 | 9.7 | 496 | 29.1 | 494 | 76.2 | 492 | 81.4 | 490 |
| 85.9 | 488 | 91 | 486 | 95.2 | 484 | 99.1 | 483.7 | 108.6 | 482.1 |
| 140.3 | 481.2 | 192.4 | 483.5 | 245.4 | 483.2 | 316.2 | 483.7 | 347.4 | 484.5 |
| 361.2 | 483.7 | 371.5 | 483 | 378.8 | 482.7 | 392.2 | 482.3 | 398.1 | 482.3 |
| 406.6 | 483.6 | 408.1 | 484 | 410.9 | 484.8 | 419.1 | 484 | 429.5 | 484.3 |
| 446.8 | 484 | 462.2 | 483.7 | 495.8 | 483.7 | 503.9 | 484 | 535.8 | 486 |
| 565.7 | 484 | 567.8 | 483.7 | 584.8 | 480.1 | 625.9 | 480.1 | 645.5 | 483.7 |
| 646.6 | 484 | 647.6 | 486 | 654.2 | 488 | 659.3 | 490.1 | | |

Manning's n Values        num=       6

| Sta | n Val | Sta | n Val | Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0 | .06 | 95.2 | .04 | 347.4 | .035 | 410.9 | .06 | 565.7 | .04 |
| 646.6 | .06 | | | | | | | | |

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

| | | | | | | |
|---|---|---|---|---|---|---|
| 347.4 | 410.9 | 151 | 141.52 | 130.33 | .1 | .3 |

Ineffective Flow num= 3

| Sta L | Sta R | Elev | Permanent |
|---|---|---|---|
| 95 | 347.4 | 484 | F |
| 410.9 | 535.8 | 484.8 | F |
| 535.8 | 647.54 | 485 | F |

LATERAL STRUCTURE

RIVER: Steele Brook
REACH: Main Channel US RS: 342.45

INPUT
Description:
Lateral structure position = Right overbank
Distance from Upstream XS =
Deck/Roadway Width = 10
Weir Coefficient = 2
Weir Flow Reference = Water Surface
Weir Embankment Coordinates num = 23

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 490.1 | 8.5 | 488.5 | 17 | 488 | 36.2 | 489.9 | 113.1 | 487.3 |
| 130.3 | 486.3 | 141.9 | 486 | 146.3 | 485.9 | 149.5 | 483.2 | 157.7 | 481.9 |
| 160.9 | 483.7 | 163.4 | 485.3 | 169.4 | 486.4 | 176.2 | 485.6 | 177.8 | 485.3 |
| 183.9 | 483.8 | 190.6 | 485.5 | 197 | 486.3 | 222.7 | 486 | 318 | 487.5 |
| 340.2 | 488 | 352.4 | 490 | 367.8 | 492 | | | | |

Weir crest shape = Broad Crested

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel US RS: 342.4

INPUT
Description: New NRCS
Station Elevation Data num= 36

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 500 | 0 | 489 | 21.6 | 488 | 23.8 | 486 | 26.1 | 484 |
| 28.5 | 483.7 | 34.8 | 483.3 | 44.1 | 481.2 | 74 | 483.8 | 99 | 483.7 |
| 115.5 | 484.1 | 134.5 | 484 | 141.7 | 484.4 | 148.7 | 484 | 176.5 | 483.7 |
| 206.4 | 482.7 | 220.7 | 483.7 | 265.1 | 484 | 278.8 | 484.6 | 292.9 | 484 |
| 316 | 483.7 | 387.4 | 483.7 | 391.8 | 484 | 398.2 | 486 | 416.3 | 488 |
| 429.5 | 488.9 | 442.5 | 488 | 463.7 | 486 | 466 | 484 | 467.3 | 483.9 |
| 477.4 | 481.2 | 534 | 481.1 | 551.2 | 480.3 | 573 | 483.7 | 574.9 | 484 |
| 587.8 | 485.8 | | | | | | | | |

```
Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
********************************************************************************
       0     .06    26.1     .04   391.8     .06     466     .04     573     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
         141.7   278.8              144  140.57  237.47             .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   278.8   429.5   484.6      F
   429.5   587.8     485      F

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel US    RS: 342.3

INPUT
Description: New NRCS
Station Elevation Data    num=      29
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0     500      .3     489    21.4     488    25.1     486    27.1     484
    29.2   483.7    40.5   481.5    49.5   480.7      74   482.3   114.1   482.9
   140.4   482.5   179.8   480.7   221.7     481   240.4   482.2   252.2   482.4
   253.6   483.8   290.2     485   314.8   484.6   315.6   482.8   329.7   481.1
   350.8   479.9   371.1   480.4   381.2     481   397.8   483.7   399.9     484
   401.7     486   410.3     488   418.5     490   420.1     492

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
********************************************************************************
       0     .06    27.1     .04   253.6     .06   315.6     .04   399.9     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          27.1   253.6              136  139.35     132             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
   290.2   420.1     485      F

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel US    RS: 342.2

INPUT
Description: New NRCS
Station Elevation Data    num=      19
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
   -42.6     497   -42.1   486.9     -33   487.3   -28.2     486   -25.1     484
   -21.4   483.7     -19     481    37.2   480.4    78.1   481.8   102.5   480.6
   118.4   481.4     147   482.1   171.5   481.3   187.4   481.6   192.2     484
```

```
   195.8     486   205.2     488   212.4     490   229.6     492

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
   -42.6     .06   -25.1     .04   192.2     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
         -25.1   192.2              29   25.65      23             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   -42.6    56.9   487.5       F
   191.9   229.6   487.5       F

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel US    RS: 342.1

INPUT
Description: HEMINWAY POND DAM (Updated by NRCS)
Station Elevation Data    num=      15
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0     497      .1   487.1     6.6   487.3      18   487.3    48.9   487.4
    51.4   487.5    74.8   487.5    74.9   483.5   157.5   483.5   157.6   487.5
   178.7   487.5   180.5   486.8     188     488   200.2     490   220.8     492

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
       0     .02    74.8     .02   157.6     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          74.8   157.6              18   18.35      18             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel US    RS: 342.05

INPUT
Description: New NRCS
Station Elevation Data    num=      14
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    17.6     497    17.7   487.1    24.2   487.3    35.6   487.3    66.5   487.4
      69   487.5    74.8   487.5    75.7   475.3   157.3   474.7   157.4     486
   159.2     486   196.8     488   209.1     490   229.6     492

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
```

| | | | | | |
|---|---|---|---|---|---|
| 17.6 | .02 | 74.8 | .02 | 157.4 | .06 |

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.

| Left | Right | Lengths: Left | Channel | Right | Contr. | Expan. |
|---|---|---|---|---|---|---|
| 74.8 | 157.4 | 0 | 0 | 0 | .1 | .3 |

CROSS SECTION

RIVER: Steele Brook
REACH: Old Channel        RS: 7

INPUT
Description: Part of LS 342.65
Station Elevation Data    num=      13

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 489.4 | 28.2 | 487.3 | 55.7 | 487.3 | 82.1 | 486 | 112.8 | 484.2 |
| 133 | 486 | 136.8 | 488 | 140.6 | 490 | 144.6 | 492 | 148.9 | 494 |
| 183.7 | 496 | 222.9 | 498 | 231.7 | 500 | | | | |

Manning's n Values        num=       3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 0 | .06 | 55.7 | .06 | 133 | .06 |

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.

| Left | Right | Lengths: Left | Channel | Right | Contr. | Expan. |
|---|---|---|---|---|---|---|
| 55.7 | 133 | 83.01 | 100.8 | 117.99 | .1 | .3 |

CROSS SECTION

RIVER: Steele Brook
REACH: Old Channel        RS: 6

INPUT
Description:
Station Elevation Data    num=      21

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 489.4 | 6.4 | 486 | 14.2 | 484 | 18.7 | 482 | 20.8 | 481.7 |
| 21 | 479.2 | 36.1 | 480.1 | 36.3 | 485.2 | 41.7 | 485.3 | 50.3 | 484.5 |
| 57 | 482.5 | 89.3 | 481.7 | 119 | 484 | 175.1 | 486 | 181.9 | 488 |
| 189 | 490 | 196.3 | 492 | 203.1 | 494 | 209 | 496 | 223.9 | 498 |
| 269.1 | 500 | | | | | | | | |

Manning's n Values        num=       3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 0 | .06 | 20.8 | .04 | 36.3 | .05 |

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.

| Left | Right | Lengths: Left | Channel | Right | Contr. | Expan. |
|---|---|---|---|---|---|---|
| 20.8 | 36.3 | 125.98 | 106.48 | 101 | .1 | .3 |

Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent

```
     119   269.1   487.1       F
Right Levee     Station=    41.7      Elevation=   485.3

CROSS SECTION


RIVER: Steele Brook
REACH: Old Channel        RS: 5

INPUT
Description:
Station Elevation Data    num=      30
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0   490.1     5.3     488     8.7     486    13.2     484      25     483
    36.8   485.6    39.9   485.3    40.6     484    48.1   483.1    58.7     483
    58.8   479.2    75.6   479.2    75.7     485   104.6   481.6   111.4   481.4
   115.3   481.6   153.6   481.7   192.1   481.4   198.3   481.6     222     482
   226.3     484   230.5     486   234.8     488     239     490   243.3     492
   247.5     494   251.9     496   326.9     498   358.2     499   358.2     515

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
       0     .06    58.7     .03    75.7     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          58.7    75.7           130.35  127.83     126              .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
   198.3   358.2   486.1       F
Right Levee     Station=    75.7      Elevation=     485

CROSS SECTION


RIVER: Steele Brook
REACH: Old Channel        RS: 4

INPUT
Description:
Station Elevation Data    num=      26
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0   486.3     4.6     484     7.1     482    11.2     481    11.5   479.3
    27.5   478.4    28.1   483.8    42.7   482.6    59.5   480.8    85.1     481
    89.2   481.3   130.9   481.3   173.7   481.3   176.9     482   184.8     482
     196     484   198.5     486   201.3     488   204.7     490   208.8     492
   215.4     494   232.9     496   280.9     498   316.3     498   342.4     498
   345.7     500

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
       0     .06    11.2     .03    28.1     .04
```

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr.
Expan.

| | | | | | | |
|---|---|---|---|---|---|---|
| 11.2 | 28.1 | 47.47 | 57.67 | 88 | .1 | .3 |

Ineffective Flow num= 1

| Sta L | Sta R | Elev | Permanent |
|---|---|---|---|
| 173.7 | 345.7 | 485.1 | F |

Right Levee Station= 28.1 Elevation= 483.8

CROSS SECTION

RIVER: Steele Brook
REACH: Old Channel RS: 3

INPUT
Description:
Station Elevation Data num= 19

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 485.3 | 10.3 | 481.7 | 11.2 | 480.4 | 20.9 | 478.5 | 28.1 | 478 |
| 28.4 | 483.5 | 32.9 | 483.2 | 38.5 | 483 | 51.2 | 480.5 | 379.2 | 482 |
| 388.2 | 484 | 397.2 | 486 | 406.3 | 488 | 467.2 | 490 | 489.2 | 492 |
| 497.7 | 494 | 506.7 | 496 | 515.3 | 498 | 524.2 | 500 | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 0 | .06 | 11.2 | .03 | 28.4 | .04 |

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr.
Expan.

| | | | | | | |
|---|---|---|---|---|---|---|
| 11.2 | 28.4 | 90 | 182.6 | 135 | .1 | .3 |

Ineffective Flow num= 1

| Sta L | Sta R | Elev | Permanent |
|---|---|---|---|
| 250 | 524.2 | 487.1 | F |

Right Levee Station= 28.4 Elevation= 483.5

CROSS SECTION

RIVER: Steele Brook
REACH: Old Channel RS: 2

INPUT
Description:
Station Elevation Data num= 30

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 492 | 10.3 | 490 | 17.8 | 488 | 25.1 | 486 | 29.6 | 484 |
| 31.8 | 482 | 34.1 | 480 | 36.4 | 479.8 | 36.5 | 476.6 | 49.3 | 476.6 |
| 49.6 | 482.4 | 57.7 | 482 | 68.5 | 480 | 75.8 | 479.7 | 144.4 | 480 |
| 266.7 | 480 | 352.9 | 479.9 | 398.2 | 480 | 518.7 | 482 | 528.3 | 484 |
| 535.1 | 485 | 550.6 | 486 | 601.8 | 488 | 626.8 | 489 | 635.1 | 490 |
| 638.5 | 492 | 641.8 | 494 | 645.2 | 496 | 648.6 | 498 | 677 | 500 |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|

```
**********************************************
       0     .06    36.4     .03    49.6     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          36.4    49.6               70   74.74      66              .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
   398.2     677   486.1       F
Right Levee     Station=    49.6      Elevation=   482.4

CROSS SECTION


RIVER: Steele Brook
REACH: Old Channel        RS: 1

INPUT
Description:
Station Elevation Data    num=      28
     Sta     Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0   487.5     2.6     486     4.5     484     6.2     482     7.9     480
    12.4   478.9    12.9     476    19.5     476    26.1     476    26.2   481.8
    32.2     482      36   482.1    44.8     480    54.5   479.4   194.2     480
   253.5     480   322.4   479.8   389.8     480   537.4     482   547.5     484
   571.5     486   635.8     488   660.7     490   665.9     492   670.7     494
   675.4     496   688.5     498   710.8     500

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
**********************************************
       0     .06    12.4     .03    26.2     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          12.4    26.2                0       0       0              .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
     450   710.8   484.1       F
Right Levee     Station=      36      Elevation=   482.1

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 341.2

INPUT
Description: Replaced by NRCS
Station Elevation Data    num=      26
     Sta     Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0   487.3      .2     478    12.2     476    19.9     474    40.1   472.2
    49.2     472    52.1   481.7    52.3   481.7    60.8     480      70   479.3
   233.2     480   297.3     480   386.4     480   560.1     482   570.8     484
     578     485   597.3     486   639.9     487   660.3     488   673.5     489
```

```
   679.7     490   696.7     492   705.9     494   716.1     496   727.2     498
   749.4     500

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
       0     .05    12.2     .05    52.1     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          12.2    52.1              109  109.82     109             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
     500   749.4   483.1       F
Right Levee     Station=    52.1      Elevation=   481.7
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
************************
   639.9   673.5   494.1

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 341.1

INPUT
Description: New NRCS
Station Elevation Data    num=      19
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0     490      .1   478.2     6.4   477.1    13.5   473.8      24   470.3
    44.9   469.7    45.2   478.3      54   478.5   342.4     480   513.3     482
     558     484   596.2     486   625.3     488   650.9     490   676.4     492
     721     494   763.6     496   783.2     498   795.1     500

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
       0     .05    13.5     .05    45.2     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          13.5    45.2               66   66.07      64             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
     475   795.1   482.6       F
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
************************
     736     762   509.1

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 341
```

```
INPUT
Description: UPDATED WITH MILONE & MACBROOM,ALSO INCREASED ROBL(shortened

ROBL, NRCS)
Station Elevation Data    num=      18
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     937   491.1     937   480.4     946   480.4     987   480.2    1000   474.6
    1002   473.7    1004   472.9    1006     472    1019   471.5    1023   470.7
    1031   471.4    1032     478    1132   478.3    1362   479.1    1484   481.1
    1544   483.7    1644   486.6    1704   491.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     937     .05    1002    .035    1032     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1002    1032                15      15      15             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 340.2

INPUT
Description: Data combined from 341 & 340 (NRCS)
 U/S FACE ECHO LAKE ROAD
             BRIDGE UPDATED DATA
Station Elevation Data    num=      13
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     937   491.1     937   480.4     946   480.4     987   480.2    1000   479.1
  1000.1   471.1    1030   471.1  1030.1   479.1    1362   479.1    1484   481.1
    1544   483.7    1644   486.6    1704   491.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     937     .05    1000     .03  1030.1     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1000  1030.1                40      40      40             .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
     937    1000   479.4       F
  1030.1    1704   479.4       F

BRIDGE


RIVER: Steele Brook
REACH: Main Channel DS    RS: 340.15
```

```
INPUT
Description: Echo Lake Road Bridge (NRCS Corrected Deck Width)

Distance from Upstream XS =      .1
Deck/Roadway Width        =    39.8
Weir Coefficient          =     2.5
Upstream  Deck/Roadway Coordinates
    num=        4
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*******************************************************************************
    1000   479.4   477.6  1030.1   479.4   477.6  1030.1   479.4   471.1
    1500   479.4   471.1

Upstream Bridge Cross Section Data
Station Elevation Data    num=      13
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
     937   491.1     937   480.4     946   480.4     987   480.2    1000   479.4
  1000.1   471.1    1030   471.1  1030.1   479.1    1362   479.1    1484   481.1
    1544   483.7    1644   486.6    1704   491.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     937     .05    1000     .03  1030.1     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1000  1030.1             .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
     937    1000   479.4       F
  1030.1    1704   479.4       F

Downstream  Deck/Roadway Coordinates
    num=        4
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*******************************************************************************
    1000   479.4   477.6  1030.1   479.4   477.6  1030.1   479.4   471.1
    1500   479.4   471.1

Downstream Bridge Cross Section Data
Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
    1000   499.1  1000.1   471.1    1030   471.1  1030.1   479.1    1230   479.4
  1230.1   478.9    1250   479.4    1270   478.9  1270.1   479.4    1300   480.4
    1500   483.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .05    1000     .03  1030.1     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1000  1030.1             .1       .3
Ineffective Flow     num=       2
```

| Sta L | Sta R | Elev | Permanent |
|---|---|---|---|
| 1000 | 1000 | 499.1 | F |
| 1030.1 | 1500 | 479.1 | F |

```
Upstream Embankment side slope             =       0 horiz. to 1.0 vertical
Downstream Embankment side slope           =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins        =   479.4
Energy head used in spillway design        =
Spillway height used in design             =
Weir crest shape                           = Broad Crested

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Energy

High Flow Method
       Pressure and Weir flow
           Submerged Inlet Cd          =
           Submerged Inlet + Outlet Cd =.8164966
           Max Low Cord                =   477.6

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line
```

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel DS    RS: 340.1

INPUT
Description: This is a REPEATED section.
D/S FACE ECHO LAKE ROAD BRIDGE
UPDATED DATA
Station Elevation Data    num=      11

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 1000 | 499.1 | 1000.1 | 471.1 | 1030 | 471.1 | 1030.1 | 479.1 | 1230 | 479.4 |
| 1230.1 | 478.9 | 1250 | 479.4 | 1270 | 478.9 | 1270.1 | 479.4 | 1300 | 480.4 |
| 1500 | 483.1 | | | | | | | | |

Manning's n Values        num=       3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 1000 | .05 | 1000 | .03 | 1030.1 | .05 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 1000 | 1030.1 | 5 | 5 | 5 | .1 | .3 |

Ineffective Flow     num=       2

```
   Sta L   Sta R    Elev  Permanent
    1000    1000   499.1       F
  1030.1    1500   479.1       F

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 340

INPUT
Description: 97 LOMR AK
Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   499.1  1000.1   471.1    1030   471.1  1030.1   479.1    1230   479.4
  1230.1   478.9    1250   479.4    1270   478.9  1270.1   479.4    1300   480.4
    1500   483.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .05    1000     .03  1030.1     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1000  1030.1              210     210     210             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 339.6

INPUT
Description: 97 LOMR AJ - This is a REPEATED section.
 U/S FACE WALKWAY OVER
             BROOK UPDATED DATA
Station Elevation Data    num=      14
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   499.1  1000.1   470.3    1030   470.3  1030.1   477.1    1035   477.1
  1035.1   477.1    1045   477.1    1230   478.9  1230.1   478.4    1250   478.9
    1270   478.4  1270.1   478.9    1400   479.1    1700   483.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .05    1000     .03  1030.1     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1000  1030.1             1.24    1.24    1.24             .1       .3

CROSS SECTION
```

```
RIVER: Steele Brook
REACH: Main Channel DS    RS: 339.56

INPUT
Description: This is a REPEATED section (NRCS)
Station Elevation Data    num=      14
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   499.1  1000.1   470.3    1030   470.3  1030.1   477.1    1035   477.1
  1035.1   477.1    1045   477.1    1230   478.9  1230.1   478.4    1250   478.9
    1270   478.4  1270.1   478.9    1400   479.1    1700   483.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .05    1000     .03  1030.1     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1000  1030.1              7.7     7.7     7.7             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
    1035    1045   482.6       T

BRIDGE


RIVER: Steele Brook
REACH: Main Channel DS    RS: 339.55

INPUT
Description: Walkway Bridge
Distance from Upstream XS =      .1
Deck/Roadway Width        =     7.5
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=       5
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
************************************************************************
    1000   484.3   482.5  1030.1   482.7   480.8    1035   482.6   480.6
  1035.1   482.6   477.1    1045   482.6   477.1

Upstream Bridge Cross Section Data
Station Elevation Data    num=      14
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   499.1  1000.1   470.3    1030   470.3  1030.1   477.1    1035   477.1
  1035.1   477.1    1045   477.1    1230   478.9  1230.1   478.4    1250   478.9
    1270   478.4  1270.1   478.9    1400   479.1    1700   483.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .05    1000     .03  1030.1     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1000  1030.1             .1       .3
```

```
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
    1035    1045   482.6       T

Downstream  Deck/Roadway Coordinates
    num=       5
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*******************************************************************************
    1000   484.3   482.5  1030.1   482.7   480.8    1035   482.6   480.6
  1035.1   482.6   477.1    1045   482.6   477.1

Downstream Bridge Cross Section Data
Station Elevation Data    num=      14
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
    1000   499.1  1000.1   470.3    1030   470.3  1030.1   477.1    1035   477.1
  1035.1   477.1    1045   477.1    1230   478.9  1230.1   478.4    1250   478.9
    1270   478.4  1270.1   478.9    1400   479.1    1700   483.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .05    1000     .03  1030.1     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1000  1030.1             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
  1035.1    1045   479.9       T

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins         =   482.7
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Energy

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION
```

RIVER: Steele Brook
REACH: Main Channel DS RS: 339.51

INPUT
Description: This is a REPEATED section (NRCS)
Station Elevation Data num= 14

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 1000 | 499.1 | 1000.1 | 470.3 | 1030 | 470.3 | 1030.1 | 477.1 | 1035 | 477.1 |
| 1035.1 | 477.1 | 1045 | 477.1 | 1230 | 478.9 | 1230.1 | 478.4 | 1250 | 478.9 |
| 1270 | 478.4 | 1270.1 | 478.9 | 1400 | 479.1 | 1700 | 483.1 | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 1000 | .05 | 1000 | .03 | 1030.1 | .05 |

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 1000 | 1030.1 | 1.1 | 1.1 | 1.1 | .1 | .3 |

Ineffective Flow num= 1

| Sta L | Sta R | Elev | Permanent |
|---|---|---|---|
| 1035.1 | 1045 | 479.9 | T |

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel DS RS: 339.5

INPUT
Description: 97 LOMR AI - D/S FACE WALKWAY OVER BROOK UPDATED DATA
Station Elevation Data num= 14

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 1000 | 499.1 | 1000.1 | 470.3 | 1030 | 470.3 | 1030.1 | 477.1 | 1035 | 477.1 |
| 1035.1 | 477.1 | 1045 | 477.1 | 1230 | 478.9 | 1230.1 | 478.4 | 1250 | 478.9 |
| 1270 | 478.4 | 1270.1 | 478.9 | 1400 | 479.1 | 1700 | 483.1 | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 1000 | .05 | 1000 | .03 | 1030.1 | .05 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 1000 | 1030.1 | 290.01 | 290.01 | 290.01 | .1 | .3 |

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel DS RS: 339.1

INPUT
Description: Obstruction added by NRCS
Station Elevation Data num= 12

```
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   499.1  1000.1   469.1    1030   469.1  1030.1   476.1    1195   477.8
  1195.1   477.3    1215   477.9    1235   477.3  1235.1   477.8    1260   479.1
    1450   481.1    1700   483.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .05    1000     .03  1030.1     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1000  1030.1               80      80      80             .1       .3
Blocked Obstructions     num=       2
   Sta L   Sta R    Elev   Sta L   Sta R    Elev
************************************************
    1228    1524   499.1    1622    1700   499.1

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 339

INPUT
Description: This is a REPEATED section. (Obstruction added by NRCS)
Station Elevation Data    num=      21
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     900   489.1    1000   483.1    1070   480.7    1124   480.7    1175   480.6
    1222   481.1    1320   478.1  1320.1   468.6    1350   468.6  1350.1   476.1
    1480   477.4  1480.1   476.9    1500   477.4    1520   476.9  1520.1   477.4
    1580   476.6    1635   477.1    1645   479.1    1740   479.1    1745   481.1
    1895   482.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     900     .05    1320     .03  1350.1     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1320  1350.1               28      28      28             .1       .3
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
************************
    1555    1759   499.1

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 338.2

INPUT
Description: This is a REPEATED section. (Obstruction added by NRCS)
```

```
 U/S FACE
             16" C.I. SAN. SEWER UPDATED DATA
Station Elevation Data    num=      21
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     900   489.1    1000   483.1    1070   480.7    1124   480.7    1175   480.6
    1222   481.1    1320   478.1  1320.1   468.6    1350   468.6  1350.1   476.1
    1480   477.4  1480.1   476.9    1500   477.4    1520   476.9  1520.1   477.4
    1580   476.6    1635   477.1    1645   479.1    1740   479.1    1745   481.1
    1895   482.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     900     .05    1320     .03  1350.1     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1320  1350.1                2       2       2             .1       .3
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
************************
    1535    1745   499.1

BRIDGE


RIVER: Steele Brook
REACH: Main Channel DS    RS: 338.15

INPUT
Description: 16-inch Pipe
Distance from Upstream XS =      .1
Deck/Roadway Width        =     1.8
Weir Coefficient          =     2.5
Upstream  Deck/Roadway Coordinates
    num=       6
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
************************************************************************
     900   473.5   468.6    1320   473.5   468.6    1320   473.5     472
  1350.1   473.5     472  1350.1   473.5   468.6    1895   473.5   468.6

Upstream Bridge Cross Section Data
Station Elevation Data    num=      21
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     900   489.1    1000   483.1    1070   480.7    1124   480.7    1175   480.6
    1222   481.1    1320   478.1  1320.1   468.6    1350   468.6  1350.1   476.1
    1480   477.4  1480.1   476.9    1500   477.4    1520   476.9  1520.1   477.4
    1580   476.6    1635   477.1    1645   479.1    1740   479.1    1745   481.1
    1895   482.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     900     .05    1320     .03  1350.1     .05
```

```
Bank Sta: Left   Right    Coeff Contr.   Expan.
          1320  1350.1            .1       .3
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
************************
    1535    1745   499.1

Downstream  Deck/Roadway Coordinates
    num=       6
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
************************************************************************
     900   473.5   468.6    1320   473.5   468.6    1320   473.5     472
  1350.1   473.5     472  1350.1   473.5   468.6    1895   473.5   468.6

Downstream Bridge Cross Section Data
Station Elevation Data    num=      21
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     900   489.1    1000   483.1    1070   480.7    1124   480.7    1175   480.6
    1222   481.1    1320   478.1  1320.1   468.6    1350   468.6  1350.1   476.1
    1480   477.4  1480.1   476.9    1500   477.4    1520   476.9  1520.1   477.4
    1580   476.6    1635   477.1    1645   479.1    1740   479.1    1745   481.1
    1895   482.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     900     .05    1320     .03  1350.1     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1320  1350.1            .1       .3
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
************************
    1535    1745   499.1

Upstream Embankment side slope             =       0 horiz. to 1.0 vertical
Downstream Embankment side slope           =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins        =   473.5
Energy head used in spillway design        =
Spillway height used in design             =
Weir crest shape                           = Broad Crested

Number of Piers =  2

Pier Data
Pier Station     Upstream=    1330    Downstream=    1330
Upstream     num=       2
    Width   Elev    Width   Elev
********************************
     1.5   468.6     1.5     472
Downstream     num=       2
    Width   Elev    Width   Elev
********************************
     1.5   468.6     1.5     472
```

```
Pier Data
Pier Station     Upstream=    1340    Downstream=    1340
Upstream     num=       2
    Width   Elev    Width   Elev
********************************
     1.5   468.6     1.5     472
Downstream     num=       2
    Width   Elev    Width   Elev
********************************
     1.5   468.6     1.5     472

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Yarnell                KVal =     1.2
Selected Low Flow Methods = Yarnell

High Flow Method
       Pressure and Weir flow
           Submerged Inlet Cd          =
           Submerged Inlet + Outlet Cd =.8164966
           Max Low Cord                =     472

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 338.1

INPUT
Description: D/S FACE 16" C.I. SAN. SEWER UPDATED DATA Obstruction added by NRCS
Station Elevation Data    num=      21
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     900   489.1    1000   483.1    1070   480.7    1124   480.7    1175   480.6
    1222   481.1    1320   478.1  1320.1   468.6    1350   468.6  1350.1   476.1
    1480   477.4  1480.1   476.9    1500   477.4    1520   476.9  1520.1   477.4
    1580   476.6    1635   477.1    1645   479.1    1740   479.1    1745   481.1
    1895   482.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     900     .05    1320     .03  1350.1     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1320  1350.1               30      30      30             .1       .3
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
```

| | | |
|---|---|---|
| 1535 | 1745 | 499.1 |

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel DS    RS: 337

INPUT
Description: 97 LOMR AH (Obstruction added by NRCS)
Station Elevation Data    num=    21

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 900 | 489.1 | 1000 | 483.1 | 1070 | 480.7 | 1124 | 480.7 | 1175 | 480.6 |
| 1222 | 481.1 | 1319 | 478.1 | 1319.1 | 468.6 | 1350 | 468.6 | 1350.1 | 476.6 |
| 1470 | 477.1 | 1470.1 | 476.6 | 1490 | 477.1 | 1510 | 476.6 | 1510.1 | 477.1 |
| 1580 | 476.1 | 1635 | 477.1 | 1640 | 479.1 | 1740 | 479.1 | 1745 | 481.1 |
| 1895 | 482.1 | | | | | | | | |

Manning's n Values    num=    3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 900 | .05 | 1319 | .03 | 1350.1 | .05 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 1319 | 1350.1 | 40 | 40 | 40 | .1 | .3 |

Blocked Obstructions    num=    1

| Sta L | Sta R | Elev |
|---|---|---|
| 1528 | 1745 | 499.1 |

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel DS    RS: 336.2

INPUT
Description: This is a REPEATED section.
U/S PROPOSED BOX CULVERT BRIDGE
Station Elevation Data    num=    19

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 620 | 489.1 | 720 | 481.6 | 779 | 480.6 | 828 | 480.6 | 940 | 479.1 |
| 980 | 479.3 | 980.1 | 467.6 | 1009.9 | 467.6 | 1010 | 479.3 | 1143 | 476.1 |
| 1160 | 476.8 | 1183 | 476.3 | 1183.1 | 476.8 | 1215 | 475.1 | 1390 | 475.1 |
| 1420 | 479.1 | 1460 | 481.1 | 1545 | 482.1 | 1765 | 483.1 | | |

Manning's n Values    num=    3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 620 | .05 | 980 | .025 | 1010 | .05 |

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.

```
           980    1010               38      38      38             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
    1010    1765   476.6       F
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
************************
    1508    1659   494.1

BRIDGE


RIVER: Steele Brook
REACH: Main Channel DS    RS: 336.15

INPUT
Description: Parking Lot Bridge (Updated by NRCS)
Distance from Upstream XS =      .1
Deck/Roadway Width        =    37.8
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=      19
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
************************************************************************
     620   489.1   489.1     720   481.6   481.6     779   480.6   480.6
     828   480.6   480.6     940   479.1   479.1     980   479.3   479.3
   980.1   479.3   477.6  1009.9   479.3   477.6    1010   479.3   479.3
    1143   476.1   476.1    1160   476.8   476.8    1183   476.3   476.3
  1183.1   476.8   476.8    1215   475.1   475.1    1390   475.1   475.1
    1420   479.1   479.1    1460   481.1   481.1    1545   482.1   482.1
    1765   483.1   483.1

Upstream Bridge Cross Section Data
Station Elevation Data    num=      19
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     620   489.1     720   481.6     779   480.6     828   480.6     940   479.1
     980   479.3   980.1   467.6  1009.9   467.6    1010   479.3    1143   476.1
    1160   476.8    1183   476.3  1183.1   476.8    1215   475.1    1390   475.1
    1420   479.1    1460   481.1    1545   482.1    1765   483.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     620     .05     980    .025    1010     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
           980    1010             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
    1010    1765   476.6       F
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
************************
    1508    1659   494.1

Downstream  Deck/Roadway Coordinates
```

```
    num=      19
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
************************************************************************
     620   489.1   489.1     720   481.6   481.6     779   480.6   480.6
     828   480.6   480.6     940   479.1   479.1     980   479.3   479.3
   980.1   479.3   477.6  1009.9   479.3   477.6    1010   479.3   479.3
    1143   476.1   476.1    1160   476.8   476.8    1183   476.3   476.3
  1183.1   476.8   476.8    1215   475.1   475.1    1390   475.1   475.1
    1420   479.1   479.1    1460   481.1   481.1    1545   482.1   482.1
    1765   483.1   483.1

Downstream Bridge Cross Section Data
Station Elevation Data    num=      19
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     620   489.1     720   481.6     779   480.6     828   480.6     940   479.1
     980   479.3   980.1   467.6  1009.9   467.6    1010   479.3    1143   476.1
    1160   476.8    1183   476.3  1183.1   476.8    1215   475.1    1390   475.1
    1420   479.1    1460   481.1    1545   482.1    1765   483.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     620     .05     980    .025    1010     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
           980    1010             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
    1010    1765   476.6       F
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
************************
    1508    1659   494.1

Upstream Embankment side slope             =       0 horiz. to 1.0 vertical
Downstream Embankment side slope           =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins        =     476
Energy head used in spillway design        =
Spillway height used in design             =
Weir crest shape                           = Broad Crested

Number of Piers =  2

Pier Data
Pier Station     Upstream=     990    Downstream=     990
Upstream     num=       2
    Width   Elev    Width   Elev
********************************
     1.5   467.6     1.5   477.6
Downstream     num=       2
    Width   Elev    Width   Elev
********************************
     1.5   467.6     1.5   477.6

Pier Data
```

```
Pier Station     Upstream=    1000    Downstream=    1000
Upstream     num=       2
    Width   Elev    Width   Elev
********************************
     1.5   467.6     1.5   477.6
Downstream     num=       2
    Width   Elev    Width   Elev
********************************
     1.5   467.6     1.5   477.6

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Yarnell                KVal =      .9
Selected Low Flow Methods = Yarnell

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 336.1

INPUT
Description: D/S PROPOSED BOX CULVERT BRIDGE
Station Elevation Data    num=      19
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     620   489.1     720   481.6     779   480.6     828   480.6     940   479.1
     980   479.3   980.1   467.6  1009.9   467.6    1010   479.3    1143   476.1
    1160   476.8    1183   476.3  1183.1   476.8    1215   475.1    1390   475.1
    1420   479.1    1460   481.1    1545   482.1    1765   483.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     620     .05     980    .025    1010     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
           980    1010              35      30      25             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
    1010    1765   476.6       F
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
***********************
    1508    1659   494.1
```

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel DS    RS: 336

INPUT
Description: 97 LOMR AG
Station Elevation Data    num=    23

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 850 | 489.1 | 1000 | 481.6 | 1059 | 480.6 | 1108 | 480.6 | 1189 | 478.6 |
| 1255 | 475.1 | 1265 | 469.1 | 1280 | 467.4 | 1290 | 468.1 | 1295 | 471.1 |
| 1320 | 475.1 | 1355 | 477.1 | 1380 | 477.1 | 1430 | 476.6 | 1430.1 | 476.1 |
| 1450 | 476.6 | 1470 | 476.1 | 1470.1 | 476.6 | 1500 | 476.1 | 1660 | 476.1 |
| 1695 | 479.1 | 1780 | 481.1 | 1875 | 481.1 | | | | |

Manning's n Values    num=    3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 850 | .07 | 1265 | .04 | 1290 | .07 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 1265 | 1290 | 530 | 420 | 300 | .1 | .3 |

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel DS    RS: 335

INPUT
Description: 97 LOMR AF
Station Elevation Data    num=    18

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 1000 | 480 | 1055 | 477.1 | 1170 | 473.1 | 1183 | 468.1 | 1198 | 467.1 |
| 1225 | 468.6 | 1230 | 471.1 | 1300 | 473.1 | 1385 | 473.1 | 1400 | 475.1 |
| 1440 | 476.1 | 1470 | 478.1 | 1470.1 | 477.6 | 1505 | 478.2 | 1540 | 477.8 |
| 1540.1 | 478.3 | 1560 | 479.1 | 1650 | 482.1 | | | | |

Manning's n Values    num=    3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 1000 | .07 | 1183 | .04 | 1225 | .07 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 1183 | 1225 | 500 | 610 | 600 | .1 | .3 |

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel DS    RS: 334

```
INPUT
Description: 97 LOMR AE
Station Elevation Data    num=      19
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     999   489.1    1000   475.1    1105   475.1    1160   473.1    1200   475.1
    1218   477.1    1253   475.7    1290   465.1    1293   464.8    1308   464.8
    1310   465.1    1319   469.1    1408   471.1    1415   473.1    1465   475.1
    1480   477.6    1540   479.1    1590   486.1    1650   499.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     999     .07    1253     .04    1319     .07

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1253    1319             350     320     300             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 333

INPUT
Description: 97 LOMR AD
Station Elevation Data    num=      17
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   477.1    1070   473.1    1100   474.6    1160   475.1    1195   474.6
    1235   465.1    1237   464.1    1247   464.1    1250   465.1    1305   473.6
    1355   472.1    1425   475.1    1485   480.1    1550   493.1    1610   503.1
    1715   511.1    1793   515.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .07    1195     .04    1305     .07

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1195    1305              15      15      15             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 332.2

INPUT
Description: U/S FACE NEW FRENCH STREET BRIDGE
Station Elevation Data    num=       8
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   479.1    1230   475.6  1230.1   464.1    1260   463.7  1260.1   475.8
```

```
    1290   476.5    1370   477.1    1450   479.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .04    1230    .025  1260.1     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1230  1260.1               60      60      60             .1       .3

BRIDGE


RIVER: Steele Brook
REACH: Main Channel DS    RS: 332.15

INPUT
Description: French Street Bridge
Distance from Upstream XS =      .1
Deck/Roadway Width        =    59.8
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=       2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
************************************************
    1000   475.6   473.5    1450   475.6   473.5

Upstream Bridge Cross Section Data
Station Elevation Data    num=       8
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   479.1    1230   475.6  1230.1   464.1    1260   463.7  1260.1   475.8
    1290   476.5    1370   477.1    1450   479.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .04    1230    .025  1260.1     .04

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1230  1260.1             .1       .3

Downstream  Deck/Roadway Coordinates
    num=       2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
************************************************
    1000   475.6   473.5    1450   475.6   473.5

Downstream Bridge Cross Section Data
Station Elevation Data    num=       8
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   479.1    1230   475.6  1230.1   463.2    1260   462.6  1260.1   475.8
    1290   476.5    1370   477.1    1450   479.1

Manning's n Values        num=       3
```

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 1000 | .04 | 1230 | .025 | 1260.1 | .04 |

| Bank Sta: Left | Right | Coeff Contr. | Expan. |
|---|---|---|---|
| 1230 | 1260.1 | .1 | .3 |

```
Upstream Embankment side slope             =       0 horiz. to 1.0 vertical
Downstream Embankment side slope           =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins        =   475.6
Energy head used in spillway design        =
Spillway height used in design             =
Weir crest shape                           = Broad Crested
```

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Energy

High Flow Method
Energy Only

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel DS    RS: 332.1

INPUT
Description: D/S FACE NEW FRENCH STREET BRIDGE
Station Elevation Data    num=       8

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 1000 | 479.1 | 1230 | 475.6 | 1230.1 | 463.2 | 1260 | 462.6 | 1260.1 | 475.8 |
| 1290 | 476.5 | 1370 | 477.1 | 1450 | 479.1 | | | | |

Manning's n Values        num=       3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 1000 | .04 | 1230 | .025 | 1260.1 | .04 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 1230 | 1260.1 | 15 | 15 | 15 | .1 | .3 |

CROSS SECTION

```
RIVER: Steele Brook
REACH: Main Channel DS    RS: 332

INPUT
Description: FEMA AC
Station Elevation Data    num=      18
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   491.6    1049   487.1    1105   478.6    1175   475.6    1235   473.1
    1260   464.6    1265   462.6    1275   462.6    1278   464.6    1293   472.1
    1338   475.1    1380   473.6    1430   474.6    1485   478.1    1540   485.1
    1650   500.6    1723   511.7    1800   515.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1235    .035    1293    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1235    1293             250     340     350             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 331

INPUT
Description: FEMA AB
Station Elevation Data    num=      19
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   492.6    1073   487.6    1129   488.1    1175   486.6    1225   480.6
    1285   471.6    1315   471.6    1350   462.1    1355   461.1    1385   461.1
    1390   462.1    1400   465.1    1465   470.1    1521   472.1    1608   476.6
    1665   487.1    1720   500.1    1773   500.1    1830   502.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1315    .035    1400    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1315    1400             450     520     650             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 330

INPUT
Description: FEMA AA
Station Elevation Data    num=      20
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
```

```
********************************************************************************
    1000   487.1    1050   481.1    1096   476.1    1149   470.1    1221   467.6
    1260   468.6    1280   460.6    1285   460.1    1300   460.1    1307   460.6
    1320   462.1    1354   463.7    1420   468.1    1473   468.7    1525   470.1
    1585   472.1    1640   472.6    1690   473.1    1770   480.1    1804   481.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1260    .035    1354    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1260    1354              350     400     400            .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 329

INPUT
Description: FEMA Z
Station Elevation Data    num=      20
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   482.1    1025   478.1    1060   473.1    1090   468.1    1180   463.6
    1245   467.1    1269   458.7    1270   457.8    1285   457.8    1289   458.7
    1340   464.6    1390   465.1    1450   463.6    1530   465.1    1605   466.6
    1670   468.6    1711   472.6    1771   478.6    1790   488.6    1860   486.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1245    .035    1340    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1245    1340              950    1010    1000            .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 328

INPUT
Description: FEMA Y
Station Elevation Data    num=      20
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   476.6    1035   473.6    1105   466.1    1141   463.1    1179   466.1
    1210   456.1    1212   455.1    1230   455.1    1232   456.1    1245   465.6
    1290   460.6    1360   461.6    1460   464.6    1538   459.1    1620   458.6
    1687   460.6    1730   463.1    1810   466.6    1879   477.1    1915   478.1

Manning's n Values        num=       3
```

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 1000 | .075 | 1179 | .035 | 1245 | .075 |

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr.
Expan.

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 1179 | 1245 | 200 | 200 | 150 | .1 | .3 |

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel DS RS: 327

INPUT
Description: FEMA X
Station Elevation Data num= 22

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 1000 | 476.1 | 1045 | 468.1 | 1080 | 465.1 | 1155 | 462.1 | 1180 | 462.1 |
| 1190 | 453.7 | 1195 | 452.9 | 1210 | 452.9 | 1213 | 453.7 | 1235 | 465.1 |
| 1264 | 460.1 | 1380 | 460.1 | 1468 | 460.1 | 1549 | 460.1 | 1610 | 460.6 |
| 1660 | 461.1 | 1715 | 461.1 | 1810 | 467.1 | 1869 | 481.1 | 1880 | 480.1 |
| 1918 | 482.1 | 1940 | 481.1 | | | | | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 1000 | .075 | 1180 | .035 | 1235 | .075 |

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr.
Expan.

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 1180 | 1235 | 700 | 740 | 800 | .1 | .3 |

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel DS RS: 326

INPUT
Description: FEMA W
Station Elevation Data num= 25

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 1000 | 470.7 | 1050 | 467.1 | 1100 | 462.1 | 1180 | 457.1 | 1255 | 457.7 |
| 1270 | 452.1 | 1275 | 451.5 | 1290 | 451.5 | 1295 | 452.1 | 1328 | 458.7 |
| 1371 | 456.7 | 1440 | 456.7 | 1470 | 451.1 | 1540 | 457.6 | 1595 | 458.1 |
| 1673 | 460.7 | 1721 | 461.1 | 1762 | 463.1 | 1805 | 467.6 | 1857 | 470.1 |
| 1894 | 470.1 | 1948 | 470.6 | 1980 | 469.6 | 2023 | 479.6 | 2046 | 479.1 |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 1000 | .075 | 1255 | .035 | 1328 | .075 |

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1255    1328              490     500     520            .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 325

INPUT
Description: FEMA V
Station Elevation Data    num=      15
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     910   469.1     920   464.1    1000   463.1    1075   458.6    1105   451.6
    1110   451.1    1135   451.1    1140   451.6    1205   456.6    1264   456.1
    1320   473.6    1365   476.1    1430   480.1    1499   480.1    1535   479.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     910    .075    1075    .035    1205    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1075    1205               40      40      40            .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 324.2

INPUT
Description: This is a REPEATED section.
 U/S FACE BRIDGE TO SEWAGE TREATMENT
             PLANT

Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   494.1    1085   466.1    1150   461.1    1200   459.1    1202   454.1
    1205     451    1225     451    1230   454.1    1232   459.1    1252   454.1
    1390   457.1    1460   471.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1200    .035    1232    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1200    1232               20      20      20            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1200   460.9       F
```

```
    1232    1460   460.9       F

BRIDGE


RIVER: Steele Brook
REACH: Main Channel DS    RS: 324.15

INPUT
Description: Treatment Plant Bridge

Distance from Upstream XS =      .1
Deck/Roadway Width        =    19.8
Weir Coefficient          =     2.5
Upstream  Deck/Roadway Coordinates
    num=      13
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
************************************************************************
    1000   494.1     -.9    1085   466.1     -.9    1150   461.1     -.9
    1200   460.9   459.2    1202   460.9   459.2    1205   460.9   459.2
    1225   460.9   459.2    1230   460.9   459.2    1232   460.9   459.1
    1252   459.1   454.1    1390   457.1     -.9    1460   471.1     -.9
    1460   471.1     -.9

Upstream Bridge Cross Section Data
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   494.1    1085   466.1    1150   461.1    1200   459.1    1202   454.1
    1205     451    1225     451    1230   454.1    1232   459.1    1252   454.1
    1390   457.1    1460   471.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1200    .035    1232    .075

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1200    1232            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1200   460.9       F
    1232    1460   460.9       F

Downstream  Deck/Roadway Coordinates
    num=      13
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
************************************************************************
    1000   494.1     -.9    1085   466.1     -.9    1150   461.1     -.9
    1200   460.9   459.2    1202   460.9   459.2    1205   460.9   459.2
    1225   460.9   459.2    1230   460.9   459.2    1232   460.9   459.1
    1252   459.1   454.1    1390   457.1     -.9    1460   471.1     -.9
    1460   471.1     -.9

Downstream Bridge Cross Section Data
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
```

```
******************************************************************************
    1000   494.1    1085   466.1    1150   461.1    1200   459.1    1202   454.1
    1205     451    1225     451    1230   454.1    1232   459.1    1252   454.1
    1390   457.1    1460   471.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1200    .035    1232    .075

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1200    1232            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1200   459.2       F
    1232    1460   459.2       F

Upstream Embankment side slope             =       0 horiz. to 1.0 vertical
Downstream Embankment side slope           =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins        =   460.9
Energy head used in spillway design        =
Spillway height used in design             =
Weir crest shape                           = Broad Crested

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Energy

High Flow Method
       Pressure and Weir flow
           Submerged Inlet Cd          =
           Submerged Inlet + Outlet Cd =.8164966
           Max Low Cord                =   459.2

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 324.1

INPUT
Description:  D/S FACE BRIDGE TO SEWAGE TREATMENT PLANT

Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
******************************************************************************
    1000   494.1    1085   466.1    1150   461.1    1200   459.1    1202   454.1
```

```
    1205     451    1225     451    1230   454.1    1232   459.1    1252   454.1
    1390   457.1    1460   471.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1200    .035    1232    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1200    1232               40      40      40             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1200   459.2       F
    1232    1460   459.2       F

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 324

INPUT
Description: FEMA U
Station Elevation Data    num=      14
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   474.6    1077   463.6    1129   460.1    1160   451.6    1162   450.9
    1188   450.9    1190   451.6    1250   461.1    1288   458.1    1325   457.1
    1390   476.7    1422   478.1    1510   478.9    1555   478.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1129    .035    1250    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1129    1250              320     380     350             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 323

INPUT
Description: FEMA T
Station Elevation Data    num=      16
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   510.6    1085   488.6    1143   486.1    1190   485.1    1230   478.7
    1255   476.1    1310   467.6    1320   461.1    1345   450.1    1350   449.1
    1365   449.1    1370   450.1    1389   456.1    1480   476.1    1520   475.1
    1562   474.6

Manning's n Values        num=       3
```

```
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1310    .035    1480    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1310    1480              440     480     520             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 322

INPUT
Description: FEMA S
Station Elevation Data    num=      15
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     999   469.1    1000   451.6    1055   451.1    1115   451.6    1150   450.1
    1180   449.3    1198   456.1    1225   445.1    1230   442.1    1250   442.1
    1254   445.1    1272   453.1    1300   450.1    1340   458.6    1435   467.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     999    .075    1198    .035    1272    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1198    1272              440     460     500             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 321.1

INPUT
Description:  SEYMOUR AND SMITH CO.

Station Elevation Data    num=       9
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   453.1    1015   450.1    1036   448.7    1037   444.5    1052   443.1
    1105   442.5    1107   446.8    1135   448.1    1150   452.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1036    .035    1107    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1036    1107               40      40      40             .1       .3

CROSS SECTION
```

```
RIVER: Steele Brook
REACH: Main Channel DS    RS: 321

INPUT
Description: FEMA R
Station Elevation Data    num=      10
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   449.6    1045   448.1    1095   456.1    1170   433.1    1180   425.6
    1210   425.6    1215   433.1    1260   448.1    1285   447.1    1304   447.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1095    .035    1260    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1095    1260              130     130     130             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 320

INPUT
Description: FEMA Q
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   476.1    1070   465.1    1110   461.6    1157   450.1    1200   436.1
    1230   427.1    1235   421.1    1255   421.1    1260   427.1    1280   440.1
    1305   443.1    1323   442.7

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1157    .035    1280    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1157    1280              340     340     340             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 319

INPUT
Description: FEMA P
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
```

```
    1000   465.1    1040   449.6    1088   441.6    1150   436.4    1195   435.1
    1225   433.1    1250   422.1    1255   417.6    1264   417.6    1265   422.1
    1345   432.6    1410   434.3

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1225    .035    1345    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1225    1345              500     380     200             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 318

INPUT
Description: FEMA O
Station Elevation Data    num=      21
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   483.1    1040   482.1    1088   473.1    1115   468.1    1144   462.6
    1180   452.1    1213   443.6    1250   430.9    1279   437.6    1315   418.1
    1320   414.1    1330   414.1    1333   418.1    1395   426.6    1495   425.4
    1563   426.1    1619   427.1    1650   427.6    1675   428.1    1780   432.1
    1820   427.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1279    .035    1395    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1279    1395              200     180     150             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 317

INPUT
Description: FEMA N
Station Elevation Data    num=      21
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   451.6    1060   444.6    1130   441.1    1192   436.1    1220   430.1
    1255   419.6    1285   422.6    1313   413.6    1315   410.6    1330   410.6
    1335   413.6    1354   420.1    1380   421.6    1425   421.1    1490   422.1
    1515   422.1    1570   423.1    1685   424.3    1730   426.6    1780   427.4
    1820   427.1

Manning's n Values        num=       3
```

```
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1285    .035    1354    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1285    1354             400     370     300             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 316

INPUT
Description: FEMA M
Station Elevation Data    num=      16
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   441.1    1035   435.1    1084   430.1    1143   426.7    1168   424.3
    1200   408.1    1208   404.4    1220   404.4    1228   408.1    1270   416.6
    1330   414.6    1410   414.3    1461   416.1    1516   417.1    1588   420.1
    1665   426.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1168    .035    1270    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1168    1270             650     620     600             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 315

INPUT
Description: FEMA L
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   420.1    1038   415.6    1097   416.1    1136   400.1    1137   398.1
    1155   398.1    1156   400.1    1193   406.1    1263   407.1    1327   407.6
    1365   409.6    1448   419.4

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1097    .035    1193    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1097    1193             600     620     650             .1       .3
```

```
CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 314

INPUT
Description: FEMA K
Station Elevation Data    num=      10
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   407.6    1040   406.6    1085   406.1    1090     391    1160     391
    1163   394.6    1182   394.6    1222   398.1    1311   404.4    1345   404.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1085    .035    1311    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1085    1311             600     490     450             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 313

INPUT
Description: FEMA J
Station Elevation Data    num=      18
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   420.9    1055   418.6    1148   412.6    1225   409.1    1288   407.6
    1385   395.6    1420   395.6    1428   388.6    1429     387    1456     387
    1457   388.6    1552   395.1    1609   395.1    1698   395.1    1770   396.6
    1871   397.6    2010   399.6    2060   405.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1420    .035    1552    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1420    1552             400     150       1             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 312.2

INPUT
Description: This is a REPEATED section.
 U/S FACE RTE 73 BRIDGE
```

```
Station Elevation Data    num=      17
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000     394    1002   384.1  1013.5     385    1014     391    1016     391
    1017     385    1030   385.9    1031     391    1032     391    1033   385.9
    1047   386.9    1048     391    1050     391    1051   386.9    1065   387.9
    1066     391    1070     394

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1000    .035    1070    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1000    1070              70      70      70             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1000     394       F
    1070    1070     394       F

BRIDGE


RIVER: Steele Brook
REACH: Main Channel DS    RS: 312.15

INPUT
Description: Main Street Bridge

Distance from Upstream XS =      .1
Deck/Roadway Width        =    69.8
Weir Coefficient          =     2.5
Upstream  Deck/Roadway Coordinates
    num=       2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
************************************************
    1000     394     391    1070     394     391

Upstream Bridge Cross Section Data
Station Elevation Data    num=      17
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000     394    1002   384.1  1013.5     385    1014     391    1016     391
    1017     385    1030   385.9    1031     391    1032     391    1033   385.9
    1047   386.9    1048     391    1050     391    1051   386.9    1065   387.9
    1066     391    1070     394

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1000    .035    1070    .075

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1000    1070            .3       .5
Ineffective Flow     num=       2
```

```
   Sta L   Sta R    Elev  Permanent
    1000    1000     394       F
    1070    1070     394       F

Downstream  Deck/Roadway Coordinates
    num=       2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
************************************************
    1000     394     391    1070     394     391

Downstream Bridge Cross Section Data
Station Elevation Data    num=      17
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000     394    1002   384.1  1013.5     385    1014     391    1016     391
    1017     385    1030   385.9    1031     391    1032     391    1033   385.9
    1047   386.9    1048     391    1050     391    1051   386.9    1065   387.9
    1066     391    1070     394

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1000    .035    1070    .075

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1000    1070             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1000     391       F
    1070    1070     391       F

Upstream Embankment side slope             =       0 horiz. to 1.0 vertical
Downstream Embankment side slope           =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins        =     394
Energy head used in spillway design        =
Spillway height used in design             =
Weir crest shape                           = Broad Crested

Number of Piers =  1

Pier Data
Pier Station     Upstream=    1035    Downstream=    1035
Upstream     num=       2
    Width   Elev    Width   Elev
********************************
     7.5   384.1     7.5     391
Downstream     num=       2
    Width   Elev    Width   Elev
********************************
     7.5   384.1     7.5     391

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Yarnell                KVal =     1.3
Selected Low Flow Methods = Yarnell
```

High Flow Method
Pressure and Weir flow
Submerged Inlet Cd =
Submerged Inlet + Outlet Cd =.8164966
Max Low Cord = 391

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel DS RS: 312.1

INPUT
Description: D/S FACE RTE 73 BRIDGE

Station Elevation Data num= 17

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 1000 | 394 | 1002 | 384.1 | 1013.5 | 385 | 1014 | 391 | 1016 | 391 |
| 1017 | 385 | 1030 | 385.9 | 1031 | 391 | 1032 | 391 | 1033 | 385.9 |
| 1047 | 386.9 | 1048 | 391 | 1050 | 391 | 1051 | 386.9 | 1065 | 387.9 |
| 1066 | 391 | 1070 | 394 | | | | | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 1000 | .075 | 1000 | .035 | 1070 | .075 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 1000 | 1070 | 30 | 30 | 30 | .3 | .5 |

Ineffective Flow num= 2

| Sta L | Sta R | Elev | Permanent |
|---|---|---|---|
| 1000 | 1000 | 391 | F |
| 1070 | 1070 | 391 | F |

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel DS RS: 312

INPUT
Description: FEMA I
Station Elevation Data num= 8

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 1000 | 399.4 | 1055 | 398.1 | 1115 | 387.6 | 1130 | 384 | 1200 | 384 |
| 1205 | 387.6 | 1310 | 395.1 | 1425 | 395.1 | | | | |

```
Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1055    .035    1310    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1055    1310                 1     140     250              .3       .5

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 311

INPUT
Description: FEMA H
Station Elevation Data    num=      14
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   399.4    1035   399.4    1060   399.1    1090   387.6    1100   383.8
    1135   383.8    1140   387.6    1195   391.6    1255   391.6    1350   392.6
    1412   392.1    1485   392.1    1545   396.1    1630   397.6

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1060     .03    1195     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1060    1195               180     150     150              .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 310

INPUT
Description: FEMA G
Station Elevation Data    num=      16
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   401.9    1030   401.9    1090   401.1    1130   386.6    1135   383.6
    1175   383.6    1180   386.6    1240   390.1    1318   391.6    1407   391.6
    1495   392.1    1583   391.6    1670   394.1    1745   394.8    1815   394.6
    1890   396.1

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1090     .03    1240     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
```

```
          1090    1240              100     130     200                .1        .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 309

INPUT
Description: FEMA F
Station Elevation Data    num=      10
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   401.6    1030   401.6    1079   402.1    1140   386.6    1145   382.6
    1525   382.6    1540   386.6    1585   391.6    1654   395.6    1725   403.6

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1079     .03    1585     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1079    1585              450     500     530                .1        .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 308

INPUT
Description: FEMA E
Station Elevation Data    num=       9
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   399.6    1035   399.6    1075   386.6    1110   376.1    1435   376.1
    1480   386.6    1505   392.6    1557   394.8    1600     397

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1035     .03    1505     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1035    1505               50      50      50                .1        .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 307.1

INPUT
Description:  PIN SHOP DAM
```

```
Station Elevation Data    num=       9
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   391.1    1025   390.4    1026   388.9    1043   388.4    1044   385.4
    1146   385.4    1147   390.1    1480   390.5    1510   391.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1043     .03    1147     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1043    1147               30      30      30             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 307

INPUT
Description: FEMA D
Station Elevation Data    num=      10
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   400.1    1040   400.1    1090   393.6    1135   375.1    1225   375.1
    1278   382.6    1365   383.6    1450   384.1    1525   387.6    1595   396.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1090     .03    1278     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1090    1278              490     520     570             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 305

INPUT
Description: FEMA C
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     999   379.1    1000   368.6    1040   369.6    1115   370.6    1240   370.6
    1310   359.1    1320   354.1    1330   354.1    1340   359.1    1377   368.6
    1410   372.6    1460   382.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     999     .06    1240     .03    1377     .06
```

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1240    1377               40      40      40             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 304.2

INPUT
Description: This is a REPEATED section.
 U/S PARKING LOT BRIDGE

Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   379.1    1001   368.3    1004   364.7    1005   361.1    1018   353.7
    1028   353.8    1045   364.6    1055   359.6    1056   364.7    1057   368.3
    1120   368.3

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1004     .03    1056     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1004    1056               20      20      20             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1004   368.3       F
    1056    1120   368.3       F

BRIDGE


RIVER: Steele Brook
REACH: Main Channel DS    RS: 304.15

INPUT
Description: Parking Lot Bridge

Distance from Upstream XS =      .1
Deck/Roadway Width        =    19.8
Weir Coefficient          =     2.5
Upstream  Deck/Roadway Coordinates
    num=       6
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
**********************************************************************
    1000   368.3   353.7    1004   368.3   353.7    1004   368.3   364.7
    1056   368.3   364.7    1056   368.3   353.7    1120   368.3   353.7

Upstream Bridge Cross Section Data
Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
```

```
*******************************************************************************
    1000   379.1    1001   368.3    1004   364.7    1005   361.1    1018   353.7
    1028   353.8    1045   364.6    1055   359.6    1056   364.7    1057   368.3
    1120   368.3

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1004     .03    1056     .06

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1004    1056             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1004   368.3       F
    1056    1120   368.3       F

Downstream  Deck/Roadway Coordinates
    num=       6
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
***********************************************************************
    1000   368.3   353.7    1004   368.3   353.7    1004   368.3   364.7
    1056   368.3   364.7    1056   368.3   353.7    1120   368.3   353.7

Downstream Bridge Cross Section Data
Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
    1000   379.1    1001   368.3    1004   364.7    1005   361.1    1018   353.7
    1028   353.8    1045   364.6    1055   359.6    1056   364.7    1057   368.3
    1120   368.3

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1004     .03    1056     .06

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1004    1056             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1004   364.7       F
    1056    1120   364.7       F

Upstream Embankment side slope             =       0 horiz. to 1.0 vertical
Downstream Embankment side slope           =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins        =   368.3
Energy head used in spillway design        =
Spillway height used in design             =
Weir crest shape                           = Broad Crested

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Energy
```

```
High Flow Method
       Pressure and Weir flow
           Submerged Inlet Cd          =
           Submerged Inlet + Outlet Cd =.8164966
           Max Low Cord                =   364.7

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 304.1

INPUT
Description:  D/S PARKING LOT BRIDGE

Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   379.1    1001   368.3    1004   364.7    1005   361.1    1018   353.7
    1028   353.8    1045   364.6    1055   359.6    1056   364.7    1057   368.3
    1120   368.3

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1004     .03    1056     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1004    1056                 40      40      40              .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1004   364.7       F
    1056    1120   364.7       F

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 304

INPUT
Description: FEMA B
Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     999   381.1    1000   363.9    1050   356.1    1055   352.1    1075   352.1
    1075   356.1    1110   359.1    1156   364.1    1215   366.6    1225   366.6
    1305   379.9
```

```
Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     999     .08    1000    .045    1110     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1000    1110              100     120     200             .3       .5

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 303

INPUT
Description: RAISED CHANNEL 20 FT ORIGINAL MODEL ERROR (BLS 2008)
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     999   389.1    1000   364.1    1029   354.1    1032   350.1    1045   350.1
    1050   354.1    1110   376.1    1157   395.1    1240   410.6    1330   420.1
    1355   424.1    1390   424.6

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     999     .08    1000    .045    1110     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1000    1110              150     180     150             .3       .5

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: -100

INPUT
Description: CORPORATE LIMITS
Station Elevation Data    num=      10
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     206   379.1     250   359.1     262   349.7     278   347.9     294   347.1
     298   353.3     565   367.1     585   371.1     590   375.1     605   379.1

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     206     .08     250    .045     298     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
           250     298                0       0       0             .3       .5
```

SUMMARY OF MANNING'S N VALUES

River:Steele Brook

| Reach | River Sta. | n1 | n2 | n3 | n4 | n5 | n6 |
|---|---|---|---|---|---|---|---|
| Main Channel US | 351 | .06 | .04 | .06 | | | |
| Main Channel US | 350 | .06 | .04 | .06 | | | |
| Main Channel US | 349 | .06 | .04 | .06 | | | |
| Main Channel US | 348 | .06 | .04 | .06 | | | |
| Main Channel US | 347.2 | .06 | .04 | .06 | | | |
| Main Channel US | 347.15 | Bridge | | | | | |
| Main Channel US | 347.1 | .06 | .04 | .06 | | | |
| Main Channel US | 347 | .06 | .04 | .06 | | | |
| Main Channel US | 346 | .06 | .04 | .06 | | | |
| Main Channel US | 344.2 | .06 | .035 | .06 | | | |
| Main Channel US | 344.1 | .06 | .035 | .06 | | | |
| Main Channel US | 343.2 | .06 | .035 | .06 | | | |
| Main Channel US | 343.1 | .06 | .04 | .035 | .06 | .04 | .06 |
| Main Channel US | 342.65 | Lat Struct | | | | | |
| Main Channel US | 342.6 | .06 | .04 | .035 | .06 | .04 | .06 |
| Main Channel US | 342.5 | .06 | .04 | .035 | .06 | .04 | .06 |
| Main Channel US | 342.45 | Lat Struct | | | | | |
| Main Channel US | 342.4 | .06 | .04 | .06 | .04 | .06 | |
| Main Channel US | 342.3 | .06 | .04 | .06 | .04 | .06 | |
| Main Channel US | 342.2 | .06 | .04 | .06 | | | |
| Main Channel US | 342.1 | .02 | .02 | .06 | | | |
| Main Channel US | 342.05 | .02 | .02 | .06 | | | |
| Old Channel | 7 | .06 | .06 | .06 | | | |

| | | | | | |
|---|---|---|---|---|---|
| Old Channel | 6 | | .06 | .04 | .05 |
| Old Channel | 5 | | .06 | .03 | .04 |
| Old Channel | 4 | | .06 | .03 | .04 |
| Old Channel | 3 | | .06 | .03 | .04 |
| Old Channel | 2 | | .06 | .03 | .04 |
| Old Channel | 1 | | .06 | .03 | .04 |
| Main Channel DS | 341.2 | | .05 | .05 | .04 |
| Main Channel DS | 341.1 | | .05 | .05 | .04 |
| Main Channel DS | 341 | | .05 | .035 | .04 |
| Main Channel DS | 340.2 | | .05 | .03 | .05 |
| Main Channel DS | 340.15 | Bridge | | | |
| Main Channel DS | 340.1 | | .05 | .03 | .05 |
| Main Channel DS | 340 | | .05 | .03 | .05 |
| Main Channel DS | 339.6 | | .05 | .03 | .05 |
| Main Channel DS | 339.56 | | .05 | .03 | .05 |
| Main Channel DS | 339.55 | Bridge | | | |
| Main Channel DS | 339.51 | | .05 | .03 | .05 |
| Main Channel DS | 339.5 | | .05 | .03 | .05 |
| Main Channel DS | 339.1 | | .05 | .03 | .05 |
| Main Channel DS | 339 | | .05 | .03 | .05 |
| Main Channel DS | 338.2 | | .05 | .03 | .05 |
| Main Channel DS | 338.15 | Bridge | | | |
| Main Channel DS | 338.1 | | .05 | .03 | .05 |
| Main Channel DS | 337 | | .05 | .03 | .05 |
| Main Channel DS | 336.2 | | .05 | .025 | .05 |
| Main Channel DS | 336.15 | Bridge | | | |
| Main Channel DS | 336.1 | | .05 | .025 | .05 |
| Main Channel DS | 336 | | .07 | .04 | .07 |

| | | | | | |
|---|---|---|---|---|---|
| Main Channel DS | 335 | | .07 | .04 | .07 |
| Main Channel DS | 334 | | .07 | .04 | .07 |
| Main Channel DS | 333 | | .07 | .04 | .07 |
| Main Channel DS | 332.2 | | .04 | .025 | .04 |
| Main Channel DS | 332.15 | Bridge | | | |
| Main Channel DS | 332.1 | | .04 | .025 | .04 |
| Main Channel DS | 332 | | .075 | .035 | .075 |
| Main Channel DS | 331 | | .075 | .035 | .075 |
| Main Channel DS | 330 | | .075 | .035 | .075 |
| Main Channel DS | 329 | | .075 | .035 | .075 |
| Main Channel DS | 328 | | .075 | .035 | .075 |
| Main Channel DS | 327 | | .075 | .035 | .075 |
| Main Channel DS | 326 | | .075 | .035 | .075 |
| Main Channel DS | 325 | | .075 | .035 | .075 |
| Main Channel DS | 324.2 | | .075 | .035 | .075 |
| Main Channel DS | 324.15 | Bridge | | | |
| Main Channel DS | 324.1 | | .075 | .035 | .075 |
| Main Channel DS | 324 | | .075 | .035 | .075 |
| Main Channel DS | 323 | | .075 | .035 | .075 |
| Main Channel DS | 322 | | .075 | .035 | .075 |
| Main Channel DS | 321.1 | | .075 | .035 | .075 |
| Main Channel DS | 321 | | .075 | .035 | .075 |
| Main Channel DS | 320 | | .075 | .035 | .075 |
| Main Channel DS | 319 | | .075 | .035 | .075 |
| Main Channel DS | 318 | | .075 | .035 | .075 |
| Main Channel DS | 317 | | .075 | .035 | .075 |
| Main Channel DS | 316 | | .075 | .035 | .075 |
| Main Channel DS | 315 | | .075 | .035 | .075 |

```
*Main Channel DS *    314          *     .075*     .035*     .075*         *
*         *
*Main Channel DS *    313          *     .075*     .035*     .075*         *
*         *
*Main Channel DS *    312.2        *     .075*     .035*     .075*         *
*         *
*Main Channel DS *    312.15       *Bridge   *        *        *        *
*        *
*Main Channel DS *    312.1        *     .075*     .035*     .075*         *
*         *
*Main Channel DS *    312          *     .075*     .035*     .075*         *
*         *
*Main Channel DS *    311          *      .06*      .03*      .06*         *
*         *
*Main Channel DS *    310          *      .06*      .03*      .06*         *
*         *
*Main Channel DS *    309          *      .06*      .03*      .06*         *
*         *
*Main Channel DS *    308          *      .06*      .03*      .06*         *
*         *
*Main Channel DS *    307.1        *      .06*      .03*      .06*         *
*         *
*Main Channel DS *    307          *      .06*      .03*      .06*         *
*         *
*Main Channel DS *    305          *      .06*      .03*      .06*         *
*         *
*Main Channel DS *    304.2        *      .06*      .03*      .06*         *
*         *
*Main Channel DS *    304.15       *Bridge   *        *        *        *
*        *
*Main Channel DS *    304.1        *      .06*      .03*      .06*         *
*         *
*Main Channel DS *    304          *      .08*     .045*      .05*         *
*         *
*Main Channel DS *    303          *      .08*     .045*      .05*         *
*         *
*Main Channel DS *    -100         *      .08*     .045*      .05*         *
*         *
********************************************************************************
***************

********************************************************************************

SUMMARY OF REACH LENGTHS

River: Steele Brook
*****************************************************************
*     Reach      *   River Sta.   *  Left   * Channel *  Right  *
*****************************************************************
*Main Channel US *    351          *      600*      550*      500*
*Main Channel US *    350          *      400*      390*      500*
*Main Channel US *    349          *      550*      540*      400*
*Main Channel US *    348          *       40*       40*       40*
*Main Channel US *    347.2        *       70*       70*       70*
*Main Channel US *    347.15       *Bridge   *        *        *
*Main Channel US *    347.1        *       30*       30*       30*
*Main Channel US *    347          *      400*      410*      300*
```

```
*Main Channel US *    346          *      545*   494.13*      435*
*Main Channel US *    344.2        *      210*   213.35*      170*
*Main Channel US *    344.1        *       70*   116.18*      125*
*Main Channel US *    343.2        *      216*   220.59*   266.01*
*Main Channel US *    343.1        *      153*   159.84*   231.73*
*Main Channel US *    342.65       *Lat Struct*         *         *
*Main Channel US *    342.6        *      152*   181.04*   125.98*
*Main Channel US *    342.5        *      151*   141.52*   130.33*
*Main Channel US *    342.45       *Lat Struct*         *         *
*Main Channel US *    342.4        *      144*   140.57*   237.47*
*Main Channel US *    342.3        *      136*   139.35*      132*
*Main Channel US *    342.2        *       29*    25.65*       23*
*Main Channel US *    342.1        *       18*    18.35*       18*
*Main Channel US *    342.05       *        0*        0*        0*
*Old Channel     *    7            *    83.01*    100.8*   117.99*
*Old Channel     *    6            *   125.98*   106.48*      101*
*Old Channel     *    5            *   130.35*   127.83*      126*
*Old Channel     *    4            *    47.47*    57.67*       88*
*Old Channel     *    3            *       90*    182.6*      135*
*Old Channel     *    2            *       70*    74.74*       66*
*Old Channel     *    1            *        0*        0*        0*
*Main Channel DS *    341.2        *      109*   109.82*      109*
*Main Channel DS *    341.1        *       66*    66.07*       64*
*Main Channel DS *    341          *       15*       15*       15*
*Main Channel DS *    340.2        *       40*       40*       40*
*Main Channel DS *    340.15       *Bridge   *         *         *
*Main Channel DS *    340.1        *        5*        5*        5*
*Main Channel DS *    340          *      210*      210*      210*
*Main Channel DS *    339.6        *     1.24*     1.24*     1.24*
*Main Channel DS *    339.56       *      7.7*      7.7*      7.7*
*Main Channel DS *    339.55       *Bridge   *         *         *
*Main Channel DS *    339.51       *      1.1*      1.1*      1.1*
*Main Channel DS *    339.5        *   290.01*   290.01*   290.01*
*Main Channel DS *    339.1        *       80*       80*       80*
*Main Channel DS *    339          *       28*       28*       28*
*Main Channel DS *    338.2        *        2*        2*        2*
*Main Channel DS *    338.15       *Bridge   *         *         *
*Main Channel DS *    338.1        *       30*       30*       30*
*Main Channel DS *    337          *       40*       40*       40*
*Main Channel DS *    336.2        *       38*       38*       38*
*Main Channel DS *    336.15       *Bridge   *         *         *
*Main Channel DS *    336.1        *       35*       30*       25*
*Main Channel DS *    336          *      530*      420*      300*
*Main Channel DS *    335          *      500*      610*      600*
*Main Channel DS *    334          *      350*      320*      300*
*Main Channel DS *    333          *       15*       15*       15*
*Main Channel DS *    332.2        *       60*       60*       60*
*Main Channel DS *    332.15       *Bridge   *         *         *
*Main Channel DS *    332.1        *       15*       15*       15*
*Main Channel DS *    332          *      250*      340*      350*
*Main Channel DS *    331          *      450*      520*      650*
*Main Channel DS *    330          *      350*      400*      400*
*Main Channel DS *    329          *      950*     1010*     1000*
*Main Channel DS *    328          *      200*      200*      150*
*Main Channel DS *    327          *      700*      740*      800*
*Main Channel DS *    326          *      490*      500*      520*
*Main Channel DS *    325          *       40*       40*       40*
```

| | | | | |
|---|---|---|---|---|
| Main Channel DS | 324.2 | 20 | 20 | 20 |
| Main Channel DS | 324.15 | Bridge | | |
| Main Channel DS | 324.1 | 40 | 40 | 40 |
| Main Channel DS | 324 | 320 | 380 | 350 |
| Main Channel DS | 323 | 440 | 480 | 520 |
| Main Channel DS | 322 | 440 | 460 | 500 |
| Main Channel DS | 321.1 | 40 | 40 | 40 |
| Main Channel DS | 321 | 130 | 130 | 130 |
| Main Channel DS | 320 | 340 | 340 | 340 |
| Main Channel DS | 319 | 500 | 380 | 200 |
| Main Channel DS | 318 | 200 | 180 | 150 |
| Main Channel DS | 317 | 400 | 370 | 300 |
| Main Channel DS | 316 | 650 | 620 | 600 |
| Main Channel DS | 315 | 600 | 620 | 650 |
| Main Channel DS | 314 | 600 | 490 | 450 |
| Main Channel DS | 313 | 400 | 150 | 1 |
| Main Channel DS | 312.2 | 70 | 70 | 70 |
| Main Channel DS | 312.15 | Bridge | | |
| Main Channel DS | 312.1 | 30 | 30 | 30 |
| Main Channel DS | 312 | 1 | 140 | 250 |
| Main Channel DS | 311 | 180 | 150 | 150 |
| Main Channel DS | 310 | 100 | 130 | 200 |
| Main Channel DS | 309 | 450 | 500 | 530 |
| Main Channel DS | 308 | 50 | 50 | 50 |
| Main Channel DS | 307.1 | 30 | 30 | 30 |
| Main Channel DS | 307 | 490 | 520 | 570 |
| Main Channel DS | 305 | 40 | 40 | 40 |
| Main Channel DS | 304.2 | 20 | 20 | 20 |
| Main Channel DS | 304.15 | Bridge | | |
| Main Channel DS | 304.1 | 40 | 40 | 40 |
| Main Channel DS | 304 | 100 | 120 | 200 |
| Main Channel DS | 303 | 150 | 180 | 150 |
| Main Channel DS | -100 | 0 | 0 | 0 |

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Steele Brook

| Reach | River Sta. | Contr. | Expan. |
|---|---|---|---|
| Main Channel US | 351 | .1 | .3 |
| Main Channel US | 350 | .1 | .3 |
| Main Channel US | 349 | .1 | .3 |
| Main Channel US | 348 | .1 | .3 |
| Main Channel US | 347.2 | .3 | .5 |
| Main Channel US | 347.15 | Bridge | |
| Main Channel US | 347.1 | .3 | .5 |
| Main Channel US | 347 | .1 | .3 |
| Main Channel US | 346 | .1 | .3 |
| Main Channel US | 344.2 | .1 | .3 |
| Main Channel US | 344.1 | .1 | .3 |
| Main Channel US | 343.2 | .1 | .3 |
| Main Channel US | 343.1 | .1 | .3 |
| Main Channel US | 342.65 | Lat Struct | |

```
*Main Channel US *    342.6   *        .1*        .3*
*Main Channel US *    342.5   *        .1*        .3*
*Main Channel US *    342.45  *Lat Struct*          *
*Main Channel US *    342.4   *        .1*        .3*
*Main Channel US *    342.3   *        .1*        .3*
*Main Channel US *    342.2   *        .3*        .5*
*Main Channel US *    342.1   *        .1*        .3*
*Main Channel US *    342.05  *        .1*        .3*
*Old Channel     *    7       *        .1*        .3*
*Old Channel     *    6       *        .1*        .3*
*Old Channel     *    5       *        .1*        .3*
*Old Channel     *    4       *        .1*        .3*
*Old Channel     *    3       *        .1*        .3*
*Old Channel     *    2       *        .1*        .3*
*Old Channel     *    1       *        .1*        .3*
*Main Channel DS *    341.2   *        .1*        .3*
*Main Channel DS *    341.1   *        .1*        .3*
*Main Channel DS *    341     *        .1*        .3*
*Main Channel DS *    340.2   *        .1*        .3*
*Main Channel DS *    340.15  *Bridge   *          *
*Main Channel DS *    340.1   *        .1*        .3*
*Main Channel DS *    340     *        .1*        .3*
*Main Channel DS *    339.6   *        .1*        .3*
*Main Channel DS *    339.56  *        .1*        .3*
*Main Channel DS *    339.55  *Bridge   *          *
*Main Channel DS *    339.51  *        .1*        .3*
*Main Channel DS *    339.5   *        .1*        .3*
*Main Channel DS *    339.1   *        .1*        .3*
*Main Channel DS *    339     *        .1*        .3*
*Main Channel DS *    338.2   *        .1*        .3*
*Main Channel DS *    338.15  *Bridge   *          *
*Main Channel DS *    338.1   *        .1*        .3*
*Main Channel DS *    337     *        .1*        .3*
*Main Channel DS *    336.2   *        .1*        .3*
*Main Channel DS *    336.15  *Bridge   *          *
*Main Channel DS *    336.1   *        .1*        .3*
*Main Channel DS *    336     *        .1*        .3*
*Main Channel DS *    335     *        .1*        .3*
*Main Channel DS *    334     *        .1*        .3*
*Main Channel DS *    333     *        .1*        .3*
*Main Channel DS *    332.2   *        .1*        .3*
*Main Channel DS *    332.15  *Bridge   *          *
*Main Channel DS *    332.1   *        .1*        .3*
*Main Channel DS *    332     *        .1*        .3*
*Main Channel DS *    331     *        .1*        .3*
*Main Channel DS *    330     *        .1*        .3*
*Main Channel DS *    329     *        .1*        .3*
*Main Channel DS *    328     *        .1*        .3*
*Main Channel DS *    327     *        .1*        .3*
*Main Channel DS *    326     *        .1*        .3*
*Main Channel DS *    325     *        .1*        .3*
*Main Channel DS *    324.2   *        .3*        .5*
*Main Channel DS *    324.15  *Bridge   *          *
*Main Channel DS *    324.1   *        .3*        .5*
*Main Channel DS *    324     *        .1*        .3*
*Main Channel DS *    323     *        .1*        .3*
*Main Channel DS *    322     *        .1*        .3*
```

```
*Main Channel DS *    321.1   *       .1*       .3*
*Main Channel DS *    321     *       .1*       .3*
*Main Channel DS *    320     *       .1*       .3*
*Main Channel DS *    319     *       .1*       .3*
*Main Channel DS *    318     *       .1*       .3*
*Main Channel DS *    317     *       .1*       .3*
*Main Channel DS *    316     *       .1*       .3*
*Main Channel DS *    315     *       .1*       .3*
*Main Channel DS *    314     *       .1*       .3*
*Main Channel DS *    313     *       .1*       .3*
*Main Channel DS *    312.2   *       .3*       .5*
*Main Channel DS *    312.15  *Bridge   *         *
*Main Channel DS *    312.1   *       .3*       .5*
*Main Channel DS *    312     *       .3*       .5*
*Main Channel DS *    311     *       .1*       .3*
*Main Channel DS *    310     *       .1*       .3*
*Main Channel DS *    309     *       .1*       .3*
*Main Channel DS *    308     *       .1*       .3*
*Main Channel DS *    307.1   *       .1*       .3*
*Main Channel DS *    307     *       .1*       .3*
*Main Channel DS *    305     *       .1*       .3*
*Main Channel DS *    304.2   *       .3*       .5*
*Main Channel DS *    304.15  *Bridge   *         *
*Main Channel DS *    304.1   *       .3*       .5*
*Main Channel DS *    304     *       .3*       .5*
*Main Channel DS *    303     *       .3*       .5*
*Main Channel DS *    -100    *       .3*       .5*
*******************************************************
```

**Existing Condition**
**Cross Section Tables**

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HEC-RAS Plan: EXIST

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Main Channel US | 348 AR | FEMA 100-YR | 2060.00 | 488.90 | 498.02 | 493.37 | 498.08 | 0.000379 | 3.12 | 1354.81 | 304.23 | 0.18 |
| Main Channel US | 348 AR | FEMA Floodway | 2060.00 | 488.90 | 497.94 | 493.31 | 498.06 | 0.000583 | 3.85 | 838.79 | 115.23 | 0.23 |
| Main Channel US | 348 AR | FEMA 10-YR | 820.00 | 488.90 | 494.17 | 491.87 | 494.26 | 0.000903 | 3.33 | 447.46 | 166.69 | 0.26 |
| Main Channel US | 348 AR | FEMA 50-YR | 1600.00 | 488.90 | 496.67 | 492.91 | 496.75 | 0.000523 | 3.29 | 972.59 | 257.47 | 0.21 |
| Main Channel US | 348 AR | FEMA 500-YR | 3600.00 | 488.90 | 501.80 | 494.54 | 501.84 | 0.000182 | 2.73 | 2704.10 | 435.80 | 0.13 |
| Main Channel US | 348 AR | M&M 2-YR | 405.00 | 488.90 | 492.42 | 491.01 | 492.53 | 0.001463 | 3.22 | 204.74 | 111.85 | 0.31 |
| Main Channel US | 348 AR | M&M 1-YR | 221.00 | 488.90 | 491.43 | 490.43 | 491.53 | 0.001950 | 2.96 | 108.83 | 80.46 | 0.33 |
| Main Channel US | 348 AR | Bankful Q | 330.00 | 488.90 | 492.04 | 490.80 | 492.15 | 0.001642 | 3.16 | 164.26 | 99.81 | 0.32 |
| | | | | | | | | | | | | |
| Main Channel US | 347.2 | FEMA 100-YR | 2060.00 | 488.30 | 496.80 | 494.32 | 497.95 | 0.005887 | 8.61 | 239.28 | 32.17 | 0.56 |
| Main Channel US | 347.2 | FEMA Floodway | 2060.00 | 488.30 | 496.75 | 494.32 | 497.92 | 0.005987 | 8.66 | 237.90 | 32.15 | 0.56 |
| Main Channel US | 347.2 | FEMA 10-YR | 820.00 | 488.30 | 493.61 | 491.94 | 494.16 | 0.004737 | 5.93 | 138.29 | 31.27 | 0.50 |
| Main Channel US | 347.2 | FEMA 50-YR | 1600.00 | 488.30 | 495.65 | 493.52 | 496.62 | 0.005765 | 7.90 | 202.66 | 31.84 | 0.55 |
| Main Channel US | 347.2 | FEMA 500-YR | 3600.00 | 488.30 | 499.94 | 496.65 | 501.66 | 0.006526 | 10.54 | 341.66 | 33.05 | 0.58 |
| Main Channel US | 347.2 | M&M 2-YR | 405.00 | 488.30 | 492.13 | 490.88 | 492.43 | 0.004004 | 4.39 | 92.27 | 30.85 | 0.45 |
| Main Channel US | 347.2 | M&M 1-YR | 221.00 | 488.30 | 491.25 | 490.28 | 491.43 | 0.003559 | 3.39 | 65.13 | 30.60 | 0.41 |
| Main Channel US | 347.2 | Bankful Q | 330.00 | 488.30 | 491.79 | 490.65 | 492.05 | 0.003852 | 4.03 | 81.93 | 30.76 | 0.43 |
| | | | | | | | | | | | | |
| Main Channel US | 347.15 ROUTE 6 | | Bridge | | | | | | | | | |
| | | | | | | | | | | | | |
| Main Channel US | 347.1 | FEMA 100-YR | 2060.00 | 488.30 | 494.39 | 494.31 | 496.88 | 0.018287 | 12.65 | 162.81 | 31.49 | 0.98 |
| Main Channel US | 347.1 | FEMA Floodway | 2060.00 | 488.30 | 494.60 | 494.31 | 496.90 | 0.016289 | 12.17 | 169.25 | 31.55 | 0.93 |
| Main Channel US | 347.1 | FEMA 10-YR | 820.00 | 488.30 | 492.78 | 491.94 | 493.61 | 0.008912 | 7.29 | 112.42 | 31.03 | 0.68 |
| Main Channel US | 347.1 | FEMA 50-YR | 1600.00 | 488.30 | 494.05 | 493.53 | 495.77 | 0.013557 | 10.53 | 152.00 | 31.39 | 0.84 |
| Main Channel US | 347.1 | FEMA 500-YR | 3600.00 | 488.30 | 496.66 | 496.66 | 500.31 | 0.018988 | 15.33 | 234.82 | 32.13 | 1.00 |
| Main Channel US | 347.1 | M&M 2-YR | 405.00 | 488.30 | 491.50 | 490.87 | 491.98 | 0.008401 | 5.56 | 72.82 | 30.67 | 0.64 |
| Main Channel US | 347.1 | M&M 1-YR | 221.00 | 488.30 | 490.63 | 490.28 | 490.98 | 0.010517 | 4.77 | 46.37 | 30.43 | 0.68 |
| Main Channel US | 347.1 | Bankful Q | 330.00 | 488.30 | 491.18 | 490.63 | 491.60 | 0.008805 | 5.24 | 63.03 | 30.58 | 0.64 |
| | | | | | | | | | | | | |
| Main Channel US | 347 AQ | FEMA 100-YR | 2060.00 | 487.90 | 494.86 | 493.28 | 495.70 | 0.005485 | 7.37 | 279.63 | 61.63 | 0.61 |
| Main Channel US | 347 AQ | FEMA Floodway | 2060.00 | 487.90 | 495.01 | 493.28 | 495.85 | 0.004703 | 7.35 | 280.15 | 52.00 | 0.56 |
| Main Channel US | 347 AQ | FEMA 10-YR | 820.00 | 487.90 | 492.82 | 491.15 | 493.19 | 0.003573 | 4.92 | 166.77 | 49.07 | 0.47 |
| Main Channel US | 347 AQ | FEMA 50-YR | 1600.00 | 487.90 | 494.31 | 492.59 | 494.96 | 0.004657 | 6.49 | 246.65 | 58.24 | 0.56 |
| Main Channel US | 347 AQ | FEMA 500-YR | 3600.00 | 487.90 | 493.32 | 495.08 | 498.78 | 0.046768 | 18.75 | 191.99 | 52.14 | 1.72 |
| Main Channel US | 347 AQ | M&M 2-YR | 405.00 | 487.90 | 491.45 | 490.06 | 491.68 | 0.003113 | 3.84 | 105.39 | 40.64 | 0.42 |
| Main Channel US | 347 AQ | M&M 1-YR | 221.00 | 487.90 | 490.53 | 489.40 | 490.68 | 0.002867 | 3.13 | 70.62 | 34.98 | 0.39 |
| Main Channel US | 347 AQ | Bankful Q | 330.00 | 487.90 | 491.11 | 489.80 | 491.31 | 0.003021 | 3.59 | 92.04 | 38.57 | 0.41 |
| | | | | | | | | | | | | |
| Main Channel US | 346 AP | FEMA 100-YR | 2060.00 | 486.10 | 492.04 | 491.95 | 492.97 | 0.008430 | 8.32 | 346.89 | 210.20 | 0.74 |
| Main Channel US | 346 AP | FEMA Floodway | 2060.00 | 486.10 | 493.36 | 491.74 | 494.02 | 0.003980 | 6.70 | 355.00 | 100.00 | 0.52 |
| Main Channel US | 346 AP | FEMA 10-YR | 820.00 | 486.10 | 490.49 | 489.86 | 491.10 | 0.008602 | 6.31 | 130.35 | 53.64 | 0.70 |
| Main Channel US | 346 AP | FEMA 50-YR | 1600.00 | 486.10 | 491.60 | 491.45 | 492.47 | 0.008574 | 7.76 | 263.59 | 176.48 | 0.74 |
| Main Channel US | 346 AP | FEMA 500-YR | 3600.00 | 486.10 | 493.13 | 493.06 | 494.15 | 0.007703 | 9.38 | 615.38 | 264.05 | 0.74 |
| Main Channel US | 346 AP | M&M 2-YR | 405.00 | 486.10 | 489.43 | 488.80 | 489.83 | 0.007965 | 5.05 | 80.13 | 41.63 | 0.64 |
| Main Channel US | 346 AP | M&M 1-YR | 221.00 | 486.10 | 488.64 | 488.10 | 488.94 | 0.007997 | 4.36 | 50.71 | 32.95 | 0.62 |
| Main Channel US | 346 AP | Bankful Q | 330.00 | 486.10 | 489.15 | 488.54 | 489.50 | 0.007922 | 4.79 | 68.82 | 38.52 | 0.63 |
| | | | | | | | | | | | | |
| Main Channel US | 344.2 | FEMA 100-YR | 2060.00 | 483.80 | 488.38 | 488.38 | 489.22 | 0.006883 | 8.96 | 428.85 | 231.15 | 0.77 |
| Main Channel US | 344.2 | FEMA Floodway | 2060.00 | 483.80 | 488.87 | 488.87 | 491.00 | 0.010596 | 11.96 | 190.16 | 47.00 | 0.97 |
| Main Channel US | 344.2 | FEMA 10-YR | 820.00 | 483.80 | 487.50 | 487.18 | 487.95 | 0.004067 | 5.88 | 231.37 | 212.57 | 0.57 |
| Main Channel US | 344.2 | FEMA 50-YR | 1600.00 | 483.80 | 488.09 | 488.09 | 488.82 | 0.006259 | 8.13 | 360.86 | 227.42 | 0.73 |
| Main Channel US | 344.2 | FEMA 500-YR | 3600.00 | 483.80 | 489.20 | 489.20 | 490.29 | 0.008094 | 10.93 | 624.93 | 251.46 | 0.86 |
| Main Channel US | 344.2 | M&M 2-YR | 405.00 | 483.80 | 486.84 | 485.75 | 487.11 | 0.002860 | 4.25 | 111.98 | 141.61 | 0.46 |
| Main Channel US | 344.2 | M&M 1-YR | 221.00 | 483.80 | 486.00 | 485.17 | 486.19 | 0.002980 | 3.45 | 64.05 | 35.39 | 0.44 |
| Main Channel US | 344.2 | Bankful Q | 330.00 | 483.80 | 486.53 | 485.53 | 486.78 | 0.002970 | 4.00 | 84.82 | 45.11 | 0.46 |
| | | | | | | | | | | | | |
| Main Channel US | 344.1 | FEMA 100-YR | 2060.00 | 482.50 | 487.26 | 486.51 | 487.53 | 0.003337 | 5.51 | 610.81 | 373.12 | 0.51 |
| Main Channel US | 344.1 | FEMA Floodway | 2060.00 | 482.50 | 487.30 | 486.60 | 487.78 | 0.005564 | 7.15 | 474.17 | 232.39 | 0.66 |
| Main Channel US | 344.1 | FEMA 10-YR | 820.00 | 482.50 | 487.31 | 486.00 | 487.35 | 0.000500 | 2.15 | 623.97 | 378.15 | 0.20 |
| Main Channel US | 344.1 | FEMA 50-YR | 1600.00 | 482.50 | 486.90 | 486.21 | 487.12 | 0.003107 | 4.95 | 517.14 | 335.67 | 0.49 |
| Main Channel US | 344.1 | FEMA 500-YR | 3600.00 | 482.50 | 488.18 | 486.88 | 488.58 | 0.003928 | 6.95 | 882.03 | 453.00 | 0.58 |
| Main Channel US | 344.1 | M&M 2-YR | 405.00 | 482.50 | 486.32 | 485.07 | 486.54 | 0.002340 | 3.79 | 110.25 | 261.46 | 0.41 |
| Main Channel US | 344.1 | M&M 1-YR | 221.00 | 482.50 | 485.47 | 484.55 | 485.61 | 0.002294 | 3.02 | 73.23 | 38.59 | 0.39 |
| Main Channel US | 344.1 | Bankful Q | 330.00 | 482.50 | 486.00 | 484.86 | 486.19 | 0.002334 | 3.51 | 93.92 | 39.64 | 0.40 |
| | | | | | | | | | | | | |
| Main Channel US | 343.2 | FEMA 100-YR | 2060.00 | 481.40 | 487.05 | 486.11 | 487.21 | 0.002382 | 4.96 | 814.61 | 388.32 | 0.44 |
| Main Channel US | 343.2 | FEMA Floodway | 2060.00 | 481.40 | 487.14 | 486.11 | 487.29 | 0.002120 | 4.75 | 846.98 | 387.91 | 0.41 |
| Main Channel US | 343.2 | FEMA 10-YR | 820.00 | 481.40 | 485.74 | 485.74 | 487.12 | 0.013999 | 9.41 | 87.15 | 173.84 | 1.00 |
| Main Channel US | 343.2 | FEMA 50-YR | 1600.00 | 481.40 | 486.67 | 484.81 | 486.82 | 0.002415 | 4.68 | 682.38 | 374.10 | 0.43 |
| Main Channel US | 343.2 | FEMA 500-YR | 3600.00 | 481.40 | 487.97 | 486.65 | 488.21 | 0.002612 | 5.97 | 1140.23 | 460.70 | 0.47 |
| Main Channel US | 343.2 | M&M 2-YR | 405.00 | 481.40 | 485.96 | 484.67 | 486.24 | 0.002701 | 4.32 | 93.84 | 174.37 | 0.44 |
| Main Channel US | 343.2 | M&M 1-YR | 221.00 | 481.40 | 485.21 | 484.04 | 485.36 | 0.002011 | 3.14 | 70.37 | 172.47 | 0.37 |
| Main Channel US | 343.2 | Bankful Q | 330.00 | 481.40 | 485.68 | 484.42 | 485.91 | 0.002450 | 3.88 | 85.05 | 173.67 | 0.42 |
| | | | | | | | | | | | | |
| Main Channel US | 343.1 | FEMA 100-YR | 2060.00 | 482.60 | 486.80 | 485.31 | 486.85 | 0.000422 | 2.04 | 1304.12 | 482.93 | 0.18 |
| Main Channel US | 343.1 | FEMA Floodway | 2060.00 | 482.60 | 486.87 | 485.31 | 486.95 | 0.000668 | 2.60 | 1050.65 | 398.93 | 0.23 |
| Main Channel US | 343.1 | FEMA 10-YR | 820.00 | 482.60 | 485.58 | 485.30 | 485.62 | 0.000573 | 1.84 | 530.64 | 401.74 | 0.20 |
| Main Channel US | 343.1 | FEMA 50-YR | 1600.00 | 482.60 | 486.42 | 485.30 | 486.46 | 0.000386 | 1.82 | 1122.76 | 470.60 | 0.17 |
| Main Channel US | 343.1 | FEMA 500-YR | 3600.00 | 482.60 | 487.71 | 485.30 | 487.78 | 0.000556 | 2.70 | 1755.91 | 512.34 | 0.22 |
| Main Channel US | 343.1 | M&M 2-YR | 405.00 | 482.60 | 485.05 | 484.44 | 485.43 | 0.005558 | 4.95 | 81.75 | 310.46 | 0.60 |
| Main Channel US | 343.1 | M&M 1-YR | 221.00 | 482.60 | 484.62 | 483.92 | 484.80 | 0.003434 | 3.40 | 64.95 | 282.08 | 0.46 |
| Main Channel US | 343.1 | Bankful Q | 330.00 | 482.60 | 484.89 | 484.24 | 485.19 | 0.004743 | 4.37 | 75.51 | 297.33 | 0.55 |
| | | | | | | | | | | | | |
| Main Channel US | 342.65 Embankment & FP | | Lat Struct | | | | | | | | | |
| | | | | | | | | | | | | |
| Main Channel US | 342.6 | FEMA 100-YR | 1684.47 | 482.80 | 486.76 | 484.48 | 486.78 | 0.000205 | 1.39 | 1392.89 | 628.59 | 0.13 |
| Main Channel US | 342.6 | FEMA Floodway | 1658.64 | 482.80 | 486.79 | 485.06 | 486.84 | 0.000457 | 2.08 | 1021.71 | 340.18 | 0.19 |
| Main Channel US | 342.6 | FEMA 10-YR | 741.70 | 482.80 | 485.49 | 484.00 | 485.53 | 0.000568 | 1.72 | 510.63 | 562.77 | 0.20 |
| Main Channel US | 342.6 | FEMA 50-YR | 1342.45 | 482.80 | 486.38 | 484.21 | 486.40 | 0.000186 | 1.22 | 1233.11 | 627.24 | 0.12 |
| Main Channel US | 342.6 | FEMA 500-YR | 2794.76 | 482.80 | 487.66 | 485.06 | 487.70 | 0.000273 | 1.86 | 1773.89 | 632.06 | 0.16 |
| Main Channel US | 342.6 | M&M 2-YR | 375.38 | 482.80 | 484.83 | 484.00 | 484.85 | 0.000413 | 1.19 | 347.34 | 489.52 | 0.16 |
| Main Channel US | 342.6 | M&M 1-YR | 216.90 | 482.80 | 484.44 | 484.00 | 484.46 | 0.000295 | 0.85 | 259.14 | 445.52 | 0.13 |
| Main Channel US | 342.6 | Bankful Q | 313.51 | 482.80 | 484.68 | 484.00 | 484.70 | 0.000380 | 1.07 | 312.87 | 473.10 | 0.15 |
| | | | | | | | | | | | | |

HEC-RAS Plan: EXIST (Continued)

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Main Channel US | 342.5 | FEMA 100-YR | 1684.47 | 482.30 | 486.75 | 484.00 | 486.76 | 0.000092 | 0.94 | 2000.34 | 560.96 | 0.09 |
| Main Channel US | 342.5 | FEMA Floodway | 1658.64 | 482.30 | 486.76 | 484.43 | 486.78 | 0.000201 | 1.41 | 1480.22 | 451.49 | 0.13 |
| Main Channel US | 342.5 | FEMA 10-YR | 741.70 | 482.30 | 485.47 | 484.00 | 485.47 | 0.000064 | 0.59 | 1293.18 | 538.83 | 0.07 |
| Main Channel US | 342.5 | FEMA 50-YR | 1342.45 | 482.30 | 486.37 | 484.00 | 486.38 | 0.000082 | 0.83 | 1789.08 | 558.75 | 0.08 |
| Main Channel US | 342.5 | FEMA 500-YR | 2755.47 | 482.30 | 487.64 | 484.39 | 487.66 | 0.000122 | 1.27 | 2506.13 | 566.21 | 0.11 |
| Main Channel US | 342.5 | M&M 2-YR | 375.38 | 482.30 | 484.80 | 484.00 | 484.80 | 0.000158 | 0.73 | 545.44 | 516.18 | 0.10 |
| Main Channel US | 342.5 | M&M 1-YR | 216.90 | 482.30 | 484.42 | 483.70 | 484.42 | 0.000117 | 0.54 | 426.16 | 493.69 | 0.08 |
| Main Channel US | 342.5 | Bankful Q | 313.51 | 482.30 | 484.65 | 484.00 | 484.66 | 0.000148 | 0.67 | 499.08 | 509.27 | 0.10 |
| | | | | | | | | | | | | |
| Main Channel US | 342.45 Embankment | | Lat Struct | | | | | | | | | |
| | | | | | | | | | | | | |
| Main Channel US | 342.4 | FEMA 100-YR | 1682.65 | 482.70 | 486.73 | 484.60 | 486.74 | 0.000118 | 0.84 | 1751.22 | 513.59 | 0.09 |
| Main Channel US | 342.4 | FEMA Floodway | 1658.01 | 482.70 | 486.72 | 481.23 | 486.75 | 0.000268 | 1.27 | 1210.87 | 376.20 | 0.13 |
| Main Channel US | 342.4 | FEMA 10-YR | 741.70 | 482.70 | 485.46 | 484.20 | 485.46 | 0.000091 | 0.51 | 1113.56 | 493.05 | 0.07 |
| Main Channel US | 342.4 | FEMA 50-YR | 1342.45 | 482.70 | 486.35 | 484.60 | 486.36 | 0.000107 | 0.74 | 1559.91 | 505.80 | 0.08 |
| Main Channel US | 342.4 | FEMA 500-YR | 2726.80 | 482.70 | 487.62 | 484.86 | 487.64 | 0.000151 | 1.13 | 2217.52 | 532.10 | 0.10 |
| Main Channel US | 342.4 | M&M 2-YR | 375.38 | 482.70 | 484.75 | 483.83 | 484.77 | 0.000519 | 0.87 | 408.74 | 484.14 | 0.15 |
| Main Channel US | 342.4 | M&M 1-YR | 216.90 | 482.70 | 484.37 | 483.38 | 484.39 | 0.001003 | 0.93 | 205.42 | 467.72 | 0.20 |
| Main Channel US | 342.4 | Bankful Q | 313.51 | 482.70 | 484.61 | 483.64 | 484.62 | 0.000572 | 0.83 | 355.14 | 482.30 | 0.15 |
| | | | | | | | | | | | | |
| Main Channel US | 342.3 | FEMA 100-YR | 1271.74 | 480.70 | 486.72 | 482.78 | 486.72 | 0.000051 | 0.76 | 1714.91 | 381.00 | 0.06 |
| Main Channel US | 342.3 | FEMA Floodway | 1261.95 | 480.70 | 486.70 | 482.78 | 486.71 | 0.000100 | 1.05 | 1296.60 | 302.46 | 0.08 |
| Main Channel US | 342.3 | FEMA 10-YR | 598.80 | 480.70 | 485.45 | 482.13 | 485.45 | 0.000031 | 0.48 | 1236.12 | 375.55 | 0.04 |
| Main Channel US | 342.3 | FEMA 50-YR | 1056.62 | 480.70 | 486.34 | 482.61 | 486.35 | 0.000046 | 0.68 | 1572.56 | 378.70 | 0.06 |
| Main Channel US | 342.3 | FEMA 500-YR | 1843.62 | 480.70 | 487.61 | 483.10 | 487.62 | 0.000061 | 0.93 | 2057.00 | 386.48 | 0.07 |
| Main Channel US | 342.3 | M&M 2-YR | 293.84 | 480.70 | 484.72 | 481.71 | 484.72 | 0.000036 | 0.45 | 662.06 | 348.13 | 0.05 |
| Main Channel US | 342.3 | M&M 1-YR | 159.85 | 480.70 | 484.31 | 481.46 | 484.31 | 0.000018 | 0.29 | 560.55 | 327.58 | 0.03 |
| Main Channel US | 342.3 | Bankful Q | 241.97 | 480.70 | 484.57 | 481.62 | 484.57 | 0.000030 | 0.39 | 624.34 | 336.09 | 0.04 |
| | | | | | | | | | | | | |
| Main Channel US | 342.2 | FEMA 100-YR | 1271.74 | 480.40 | 486.66 | 482.89 | 486.71 | 0.000273 | 1.83 | 695.92 | 229.51 | 0.14 |
| Main Channel US | 342.2 | FEMA Floodway | 1261.95 | 480.40 | 486.64 | 482.88 | 486.69 | 0.000273 | 1.82 | 693.39 | 217.30 | 0.14 |
| Main Channel US | 342.2 | FEMA 10-YR | 598.80 | 480.40 | 485.42 | 482.33 | 485.44 | 0.000151 | 1.13 | 529.41 | 222.07 | 0.10 |
| Main Channel US | 342.2 | FEMA 50-YR | 1056.62 | 480.40 | 486.29 | 482.72 | 486.33 | 0.000241 | 1.63 | 646.80 | 226.45 | 0.13 |
| Main Channel US | 342.2 | FEMA 500-YR | 1843.62 | 480.40 | 487.58 | 483.29 | 487.61 | 0.000113 | 1.34 | 1401.41 | 245.36 | 0.09 |
| Main Channel US | 342.2 | M&M 2-YR | 293.84 | 480.40 | 484.71 | 481.99 | 484.71 | 0.000071 | 0.68 | 432.64 | 219.66 | 0.07 |
| Main Channel US | 342.2 | M&M 1-YR | 159.85 | 480.40 | 484.30 | 481.76 | 484.31 | 0.000033 | 0.42 | 378.39 | 218.32 | 0.04 |
| Main Channel US | 342.2 | Bankful Q | 241.97 | 480.40 | 484.56 | 481.90 | 484.56 | 0.000056 | 0.59 | 412.84 | 219.17 | 0.06 |
| | | | | | | | | | | | | |
| Main Channel US | 342.1 HEMINWAY DAM | FEMA 100-YR | 1271.74 | 483.50 | 485.44 | 485.44 | 486.42 | 0.005009 | 7.93 | 160.29 | 82.70 | 1.00 |
| Main Channel US | 342.1 HEMINWAY DAM | FEMA Floodway | 1261.95 | 483.50 | 485.44 | 485.44 | 486.40 | 0.004941 | 7.88 | 160.20 | 82.70 | 1.00 |
| Main Channel US | 342.1 HEMINWAY DAM | FEMA 10-YR | 598.80 | 483.50 | 484.68 | 484.68 | 485.27 | 0.005671 | 6.14 | 97.58 | 82.66 | 1.00 |
| Main Channel US | 342.1 HEMINWAY DAM | FEMA 50-YR | 1056.62 | 483.50 | 485.22 | 485.22 | 486.08 | 0.005092 | 7.42 | 142.43 | 82.69 | 1.00 |
| Main Channel US | 342.1 HEMINWAY DAM | FEMA 500-YR | 1843.62 | 483.50 | 485.99 | 485.99 | 487.24 | 0.004658 | 8.96 | 205.75 | 82.72 | 1.00 |
| Main Channel US | 342.1 HEMINWAY DAM | M&M 2-YR | 293.84 | 483.50 | 484.22 | 484.22 | 484.60 | 0.006923 | 4.92 | 59.70 | 82.64 | 1.02 |
| Main Channel US | 342.1 HEMINWAY DAM | M&M 1-YR | 159.85 | 483.50 | 483.99 | 483.99 | 484.23 | 0.007645 | 3.98 | 40.13 | 82.62 | 1.01 |
| Main Channel US | 342.1 HEMINWAY DAM | Bankful Q | 241.97 | 483.50 | 484.14 | 484.14 | 484.47 | 0.007084 | 4.59 | 52.73 | 82.63 | 1.01 |
| | | | | | | | | | | | | |
| Main Channel US | 342.05 | FEMA 100-YR | 1271.74 | 474.70 | 482.36 | 476.96 | 482.43 | 0.000070 | 2.11 | 602.51 | 82.19 | 0.14 |
| Main Channel US | 342.05 | FEMA Floodway | 1261.95 | 474.70 | 482.81 | 476.95 | 482.87 | 0.000057 | 1.97 | 639.80 | 82.23 | 0.12 |
| Main Channel US | 342.05 | FEMA 10-YR | 598.80 | 474.70 | 478.49 | 476.19 | 478.56 | 0.000167 | 2.10 | 285.63 | 81.87 | 0.20 |
| Main Channel US | 342.05 | FEMA 50-YR | 1056.62 | 474.70 | 481.21 | 476.74 | 481.28 | 0.000083 | 2.08 | 508.10 | 82.09 | 0.15 |
| Main Channel US | 342.05 | FEMA 500-YR | 1843.62 | 474.70 | 482.98 | 477.51 | 483.11 | 0.000114 | 2.82 | 653.95 | 82.24 | 0.18 |
| Main Channel US | 342.05 | M&M 2-YR | 293.84 | 474.70 | 475.19 | 475.74 | 480.37 | 0.401981 | 18.26 | 16.09 | 66.16 | 6.53 |
| Main Channel US | 342.05 | M&M 1-YR | 159.85 | 474.70 | 475.08 | 475.49 | 479.40 | 0.474382 | 16.69 | 9.58 | 51.04 | 6.79 |
| Main Channel US | 342.05 | Bankful Q | 241.97 | 474.70 | 475.15 | 475.65 | 480.05 | 0.424757 | 17.76 | 13.62 | 60.88 | 6.62 |
| | | | | | | | | | | | | |
| Main Channel DS | 341.2 | FEMA 100-YR | 2840.00 | 472.00 | 481.34 | 478.91 | 482.33 | 0.006138 | 8.22 | 364.50 | 51.86 | 0.52 |
| Main Channel DS | 341.2 | FEMA Floodway | 2840.00 | 472.00 | 481.52 | 478.85 | 482.75 | 0.008096 | 8.88 | 319.71 | 39.85 | 0.55 |
| Main Channel DS | 341.2 | FEMA 10-YR | 1130.00 | 472.00 | 477.90 | 476.29 | 478.49 | 0.006745 | 6.23 | 188.19 | 50.17 | 0.51 |
| Main Channel DS | 341.2 | FEMA 50-YR | 2200.00 | 472.00 | 480.40 | 478.14 | 481.19 | 0.005626 | 7.33 | 316.10 | 51.56 | 0.49 |
| Main Channel DS | 341.2 | FEMA 500-YR | 5000.00 | 472.00 | 482.95 | 481.05 | 483.09 | 0.001139 | 3.99 | 1747.06 | 565.08 | 0.23 |
| Main Channel DS | 341.2 | M&M 2-YR | 461.00 | 472.00 | 475.45 | 474.76 | 475.92 | 0.012191 | 5.49 | 83.95 | 35.93 | 0.63 |
| Main Channel DS | 341.2 | M&M 1-YR | 221.00 | 472.00 | 474.37 | 473.99 | 474.71 | 0.015301 | 4.65 | 47.49 | 31.44 | 0.67 |
| Main Channel DS | 341.2 | Bankful Q | 330.00 | 472.00 | 474.90 | 474.37 | 475.30 | 0.013590 | 5.11 | 64.52 | 33.62 | 0.65 |
| | | | | | | | | | | | | |
| Main Channel DS | 341.1 | FEMA 100-YR | 2840.00 | 469.70 | 481.55 | 477.10 | 481.68 | 0.000959 | 3.82 | 1204.63 | 474.70 | 0.20 |
| Main Channel DS | 341.1 | FEMA Floodway | 2840.00 | 469.70 | 481.64 | 477.01 | 481.92 | 0.001896 | 4.80 | 712.21 | 159.74 | 0.26 |
| Main Channel DS | 341.1 | FEMA 10-YR | 1130.00 | 469.70 | 477.50 | 474.10 | 477.89 | 0.003114 | 5.11 | 229.94 | 41.05 | 0.35 |
| Main Channel DS | 341.1 | FEMA 50-YR | 2200.00 | 469.70 | 480.36 | 476.09 | 480.63 | 0.001840 | 4.90 | 699.44 | 372.83 | 0.28 |
| Main Channel DS | 341.1 | FEMA 500-YR | 5000.00 | 469.70 | 482.84 | 480.73 | 482.98 | 0.000944 | 4.09 | 1865.61 | 531.98 | 0.21 |
| Main Channel DS | 341.1 | M&M 2-YR | 461.00 | 469.70 | 474.84 | 472.38 | 475.03 | 0.002605 | 3.51 | 132.05 | 33.81 | 0.30 |
| Main Channel DS | 341.1 | M&M 1-YR | 221.00 | 469.70 | 473.61 | 471.49 | 473.70 | 0.001813 | 2.40 | 92.12 | 30.96 | 0.25 |
| Main Channel DS | 341.1 | Bankful Q | 330.00 | 469.70 | 474.21 | 471.93 | 474.35 | 0.002262 | 2.97 | 111.29 | 32.45 | 0.28 |
| | | | | | | | | | | | | |
| Main Channel DS | 341 AL | FEMA 100-YR | 2840.00 | 470.70 | 481.53 | 479.60 | 481.62 | 0.000431 | 3.57 | 1589.34 | 556.95 | 0.20 |
| Main Channel DS | 341 AL | FEMA Floodway | 2840.00 | 470.70 | 481.65 | 479.60 | 481.79 | 0.000664 | 3.91 | 1099.04 | 275.35 | 0.22 |
| Main Channel DS | 341 AL | FEMA 10-YR | 1130.00 | 470.70 | 476.84 | 475.25 | 477.62 | 0.003994 | 7.19 | 164.61 | 37.01 | 0.56 |
| Main Channel DS | 341 AL | FEMA 50-YR | 2200.00 | 470.70 | 480.32 | 477.24 | 480.52 | 0.000880 | 4.67 | 943.82 | 473.57 | 0.28 |
| Main Channel DS | 341 AL | FEMA 500-YR | 5000.00 | 470.70 | 482.81 | 480.50 | 482.92 | 0.000468 | 4.04 | 2323.29 | 586.57 | 0.21 |
| Main Channel DS | 341 AL | M&M 2-YR | 461.00 | 470.70 | 474.10 | 473.60 | 474.73 | 0.007597 | 6.36 | 72.68 | 30.31 | 0.71 |
| Main Channel DS | 341 AL | M&M 1-YR | 221.00 | 470.70 | 473.00 | 472.77 | 473.46 | 0.010372 | 5.41 | 40.87 | 27.50 | 0.78 |
| Main Channel DS | 341 AL | Bankful Q | 330.00 | 470.70 | 473.51 | 473.17 | 474.07 | 0.009226 | 5.98 | 55.20 | 28.85 | 0.76 |
| | | | | | | | | | | | | |
| Main Channel DS | 340.2 | FEMA 100-YR | 2840.00 | 471.10 | 481.37 | 477.64 | 481.60 | 0.000813 | 5.03 | 1295.13 | 553.34 | 0.28 |
| Main Channel DS | 340.2 | FEMA Floodway | 2840.00 | 471.10 | 480.76 | 477.64 | 481.70 | 0.002564 | 8.37 | 488.41 | 150.00 | 0.48 |
| Main Channel DS | 340.2 | FEMA 10-YR | 1130.00 | 471.10 | 476.87 | 474.64 | 477.54 | 0.002585 | 6.53 | 173.05 | 30.04 | 0.48 |
| Main Channel DS | 340.2 | FEMA 50-YR | 2200.00 | 471.10 | 479.07 | 476.60 | 480.39 | 0.003813 | 9.20 | 239.13 | 30.10 | 0.58 |
| Main Channel DS | 340.2 | FEMA 500-YR | 5000.00 | 471.10 | 482.69 | 481.15 | 482.90 | 0.000840 | 5.54 | 2041.01 | 583.62 | 0.29 |
| Main Channel DS | 340.2 | M&M 2-YR | 461.00 | 471.10 | 474.19 | 473.04 | 474.58 | 0.002872 | 4.98 | 92.64 | 29.98 | 0.50 |
| Main Channel DS | 340.2 | M&M 1-YR | 221.00 | 471.10 | 473.07 | 472.29 | 473.29 | 0.002730 | 3.75 | 58.97 | 29.95 | 0.47 |
| Main Channel DS | 340.2 | Bankful Q | 330.00 | 471.10 | 473.60 | 472.66 | 473.90 | 0.002874 | 4.41 | 74.78 | 29.96 | 0.49 |
| | | | | | | | | | | | | |
| Main Channel DS | 340.15 ECHO LAKE ROAD | | Bridge | | | | | | | | | |
| | | | | | | | | | | | | |

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Main Channel DS | 340.1 | FEMA 100-YR | 2840.00 | 471.10 | 480.59 | 477.65 | 481.38 | 0.002372 | 7.97 | 631.71 | 313.93 | 0.46 |
| Main Channel DS | 340.1 | FEMA Floodway | 2840.00 | 471.10 | 480.25 | 477.65 | 481.62 | 0.003647 | 9.69 | 371.57 | 119.93 | 0.57 |
| Main Channel DS | 340.1 | FEMA 10-YR | 1130.00 | 471.10 | 476.73 | 474.64 | 477.42 | 0.002800 | 6.71 | 168.47 | 29.99 | 0.50 |
| Main Channel DS | 340.1 | FEMA 50-YR | 2200.00 | 471.10 | 479.06 | 476.62 | 480.38 | 0.003843 | 9.22 | 238.54 | 42.93 | 0.58 |
| Main Channel DS | 340.1 | FEMA 500-YR | 5000.00 | 471.10 | 481.74 | 481.44 | 482.70 | 0.003158 | 9.77 | 1041.45 | 399.07 | 0.53 |
| Main Channel DS | 340.1 | M&M 2-YR | 461.00 | 471.10 | 474.01 | 473.04 | 474.45 | 0.003465 | 5.29 | 87.21 | 29.95 | 0.55 |
| Main Channel DS | 340.1 | M&M 1-YR | 221.00 | 471.10 | 472.90 | 472.29 | 473.16 | 0.003655 | 4.11 | 53.81 | 29.93 | 0.54 |
| Main Channel DS | 340.1 | Bankful Q | 330.00 | 471.10 | 473.41 | 472.66 | 473.77 | 0.003661 | 4.77 | 69.24 | 29.94 | 0.55 |
| | | | | | | | | | | | | |
| Main Channel DS | 340 AK | FEMA 100-YR | 2840.00 | 471.10 | 479.85 | 477.65 | 481.31 | 0.004124 | 10.06 | 413.09 | 283.47 | 0.60 |
| Main Channel DS | 340 AK | FEMA Floodway | 2840.00 | 471.10 | 480.21 | 477.65 | 481.60 | 0.003728 | 9.77 | 366.51 | 119.93 | 0.57 |
| Main Channel DS | 340 AK | FEMA 10-YR | 1130.00 | 471.10 | 476.71 | 474.64 | 477.41 | 0.002826 | 6.73 | 167.94 | 29.99 | 0.50 |
| Main Channel DS | 340 AK | FEMA 50-YR | 2200.00 | 471.10 | 479.04 | 476.62 | 480.36 | 0.003876 | 9.25 | 238.53 | 40.93 | 0.58 |
| Main Channel DS | 340 AK | FEMA 500-YR | 5000.00 | 471.10 | 481.44 | 481.44 | 482.66 | 0.003933 | 10.73 | 924.12 | 376.66 | 0.59 |
| Main Channel DS | 340 AK | M&M 2-YR | 461.00 | 471.10 | 473.99 | 473.05 | 474.43 | 0.003553 | 5.33 | 86.51 | 29.95 | 0.55 |
| Main Channel DS | 340 AK | M&M 1-YR | 221.00 | 471.10 | 472.87 | 472.28 | 473.14 | 0.003824 | 4.17 | 53.05 | 29.93 | 0.55 |
| Main Channel DS | 340 AK | Bankful Q | 330.00 | 471.10 | 473.39 | 472.66 | 473.75 | 0.003790 | 4.82 | 68.48 | 29.94 | 0.56 |
| | | | | | | | | | | | | |
| Main Channel DS | 339.6 AJ | FEMA 100-YR | 2840.00 | 470.30 | 479.90 | 476.85 | 480.42 | 0.001672 | 6.85 | 871.89 | 459.90 | 0.39 |
| Main Channel DS | 339.6 AJ | FEMA Floodway | 2840.00 | 470.30 | 480.06 | 476.85 | 480.80 | 0.002040 | 7.63 | 531.78 | 119.93 | 0.43 |
| Main Channel DS | 339.6 AJ | FEMA 10-YR | 1130.00 | 470.30 | 476.21 | 473.84 | 476.84 | 0.002423 | 6.39 | 176.90 | 30.01 | 0.46 |
| Main Channel DS | 339.6 AJ | FEMA 50-YR | 2200.00 | 470.30 | 478.65 | 475.82 | 479.55 | 0.002647 | 7.99 | 398.92 | 223.94 | 0.49 |
| Main Channel DS | 339.6 AJ | FEMA 500-YR | 5000.00 | 470.30 | 481.42 | 480.35 | 481.79 | 0.001445 | 6.87 | 1658.93 | 574.08 | 0.36 |
| Main Channel DS | 339.6 AJ | M&M 2-YR | 461.00 | 470.30 | 473.32 | 472.25 | 473.72 | 0.003113 | 5.11 | 90.27 | 29.95 | 0.52 |
| Main Channel DS | 339.6 AJ | M&M 1-YR | 221.00 | 470.30 | 472.07 | 471.49 | 472.34 | 0.003814 | 4.16 | 53.10 | 29.93 | 0.55 |
| Main Channel DS | 339.6 AJ | Bankful Q | 330.00 | 470.30 | 472.61 | 471.85 | 472.96 | 0.003688 | 4.78 | 69.08 | 29.94 | 0.55 |
| | | | | | | | | | | | | |
| Main Channel DS | 339.56 | FEMA 100-YR | 2840.00 | 470.30 | 479.81 | 476.83 | 480.41 | 0.001884 | 7.23 | 803.88 | 453.18 | 0.41 |
| Main Channel DS | 339.56 | FEMA Floodway | 2840.00 | 470.30 | 479.94 | 476.83 | 480.78 | 0.002298 | 8.05 | 488.63 | 119.93 | 0.46 |
| Main Channel DS | 339.56 | FEMA 10-YR | 1130.00 | 470.30 | 476.20 | 473.84 | 476.84 | 0.002428 | 6.39 | 176.79 | 30.01 | 0.46 |
| Main Channel DS | 339.56 | FEMA 50-YR | 2200.00 | 470.30 | 478.55 | 475.82 | 479.55 | 0.002873 | 8.28 | 364.12 | 206.72 | 0.51 |
| Main Channel DS | 339.56 | FEMA 500-YR | 5000.00 | 470.30 | 481.38 | 480.40 | 481.79 | 0.001567 | 7.14 | 1589.74 | 570.62 | 0.38 |
| Main Channel DS | 339.56 | M&M 2-YR | 461.00 | 470.30 | 473.31 | 472.25 | 473.72 | 0.003129 | 5.12 | 90.12 | 29.95 | 0.52 |
| Main Channel DS | 339.56 | M&M 1-YR | 221.00 | 470.30 | 472.07 | 471.49 | 472.34 | 0.003858 | 4.18 | 52.90 | 29.93 | 0.55 |
| Main Channel DS | 339.56 | Bankful Q | 330.00 | 470.30 | 472.60 | 471.85 | 472.96 | 0.003720 | 4.79 | 68.89 | 29.94 | 0.56 |
| | | | | | | | | | | | | |
| Main Channel DS | 339.55 WALKWAY | | Bridge | | | | | | | | | |
| | | | | | | | | | | | | |
| Main Channel DS | 339.51 | FEMA 100-YR | 2840.00 | 470.30 | 479.05 | 476.83 | 480.33 | 0.003642 | 9.62 | 488.90 | 366.10 | 0.57 |
| Main Channel DS | 339.51 | FEMA Floodway | 2840.00 | 470.30 | 479.30 | 476.83 | 480.44 | 0.003192 | 9.14 | 418.58 | 119.93 | 0.54 |
| Main Channel DS | 339.51 | FEMA 10-YR | 1130.00 | 470.30 | 476.18 | 473.84 | 476.82 | 0.002456 | 6.42 | 176.09 | 30.01 | 0.47 |
| Main Channel DS | 339.51 | FEMA 50-YR | 2200.00 | 470.30 | 478.27 | 475.82 | 479.42 | 0.003389 | 8.82 | 314.86 | 165.04 | 0.55 |
| Main Channel DS | 339.51 | FEMA 500-YR | 5000.00 | 470.30 | 481.31 | 480.43 | 481.74 | 0.001636 | 7.28 | 1568.13 | 565.78 | 0.39 |
| Main Channel DS | 339.51 | M&M 2-YR | 461.00 | 470.30 | 473.28 | 472.25 | 473.69 | 0.003235 | 5.17 | 89.16 | 29.95 | 0.53 |
| Main Channel DS | 339.51 | M&M 1-YR | 221.00 | 470.30 | 472.02 | 471.49 | 472.31 | 0.004189 | 4.29 | 51.56 | 29.93 | 0.58 |
| Main Channel DS | 339.51 | Bankful Q | 330.00 | 470.30 | 472.56 | 471.85 | 472.93 | 0.003933 | 4.88 | 67.68 | 29.94 | 0.57 |
| | | | | | | | | | | | | |
| Main Channel DS | 339.5 AI | FEMA 100-YR | 2840.00 | 470.30 | 479.11 | 476.85 | 480.29 | 0.003408 | 9.34 | 532.05 | 400.67 | 0.55 |
| Main Channel DS | 339.5 AI | FEMA Floodway | 2840.00 | 470.30 | 479.37 | 476.85 | 480.41 | 0.002942 | 8.81 | 448.94 | 119.93 | 0.52 |
| Main Channel DS | 339.5 AI | FEMA 10-YR | 1130.00 | 470.30 | 476.18 | 473.84 | 476.82 | 0.002460 | 6.42 | 175.99 | 30.01 | 0.47 |
| Main Channel DS | 339.5 AI | FEMA 50-YR | 2200.00 | 470.30 | 478.29 | 475.82 | 479.41 | 0.003283 | 8.69 | 330.53 | 167.57 | 0.54 |
| Main Channel DS | 339.5 AI | FEMA 500-YR | 5000.00 | 470.30 | 481.33 | 480.35 | 481.73 | 0.001555 | 7.10 | 1604.64 | 566.95 | 0.38 |
| Main Channel DS | 339.5 AI | M&M 2-YR | 461.00 | 470.30 | 473.27 | 472.25 | 473.69 | 0.003250 | 5.18 | 89.02 | 29.95 | 0.53 |
| Main Channel DS | 339.5 AI | M&M 1-YR | 221.00 | 470.30 | 472.02 | 471.49 | 472.30 | 0.004237 | 4.30 | 51.38 | 29.93 | 0.58 |
| Main Channel DS | 339.5 AI | Bankful Q | 330.00 | 470.30 | 472.56 | 471.85 | 472.93 | 0.003964 | 4.89 | 67.51 | 29.94 | 0.57 |
| | | | | | | | | | | | | |
| Main Channel DS | 339.1 | FEMA 100-YR | 2840.00 | 469.10 | 478.44 | 475.65 | 479.34 | 0.002577 | 8.35 | 551.15 | 227.93 | 0.48 |
| Main Channel DS | 339.1 | FEMA Floodway | 2840.00 | 469.10 | 478.67 | 475.65 | 479.58 | 0.002489 | 8.32 | 475.94 | 119.93 | 0.47 |
| Main Channel DS | 339.1 | FEMA 10-YR | 1130.00 | 469.10 | 475.65 | 472.64 | 476.16 | 0.001788 | 5.76 | 196.12 | 30.02 | 0.40 |
| Main Channel DS | 339.1 | FEMA 50-YR | 2200.00 | 469.10 | 477.45 | 474.61 | 478.48 | 0.002902 | 8.35 | 339.69 | 166.50 | 0.51 |
| Main Channel DS | 339.1 | FEMA 500-YR | 5000.00 | 469.10 | 480.43 | 479.34 | 481.16 | 0.002235 | 8.61 | 1005.45 | 227.94 | 0.45 |
| Main Channel DS | 339.1 | M&M 2-YR | 461.00 | 469.10 | 472.60 | 471.05 | 472.90 | 0.001972 | 4.41 | 104.62 | 29.96 | 0.42 |
| Main Channel DS | 339.1 | M&M 1-YR | 221.00 | 469.10 | 471.03 | 470.29 | 471.26 | 0.002918 | 3.83 | 57.74 | 29.93 | 0.49 |
| Main Channel DS | 339.1 | Bankful Q | 330.00 | 469.10 | 471.64 | 470.66 | 471.93 | 0.002747 | 4.35 | 75.85 | 29.94 | 0.48 |
| | | | | | | | | | | | | |
| Main Channel DS | 339 | FEMA 100-YR | 2840.00 | 468.60 | 478.29 | 475.13 | 479.12 | 0.002306 | 8.03 | 576.82 | 241.27 | 0.46 |
| Main Channel DS | 339 | FEMA Floodway | 2840.00 | 468.60 | 478.43 | 475.14 | 479.38 | 0.002471 | 8.35 | 464.03 | 120.00 | 0.47 |
| Main Channel DS | 339 | FEMA 10-YR | 1130.00 | 468.60 | 475.56 | 472.14 | 476.01 | 0.001494 | 5.42 | 208.59 | 30.07 | 0.36 |
| Main Channel DS | 339 | FEMA 50-YR | 2200.00 | 468.60 | 477.25 | 474.12 | 478.25 | 0.002731 | 8.20 | 333.45 | 195.71 | 0.49 |
| Main Channel DS | 339 | FEMA 500-YR | 5000.00 | 468.60 | 480.33 | 479.11 | 480.97 | 0.001849 | 8.17 | 1135.46 | 307.75 | 0.42 |
| Main Channel DS | 339 | M&M 2-YR | 461.00 | 468.60 | 472.50 | 470.55 | 472.74 | 0.001403 | 3.94 | 116.86 | 29.99 | 0.35 |
| Main Channel DS | 339 | M&M 1-YR | 221.00 | 468.60 | 470.89 | 469.79 | 471.05 | 0.001691 | 3.22 | 68.60 | 29.95 | 0.38 |
| Main Channel DS | 339 | Bankful Q | 330.00 | 468.60 | 471.50 | 470.16 | 471.73 | 0.001797 | 3.80 | 86.88 | 29.97 | 0.39 |
| | | | | | | | | | | | | |
| Main Channel DS | 338.2 | FEMA 100-YR | 2840.00 | 468.60 | 477.67 | 475.13 | 479.01 | 0.003583 | 9.63 | 417.49 | 215.00 | 0.56 |
| Main Channel DS | 338.2 | FEMA Floodway | 2840.00 | 468.60 | 478.28 | 475.14 | 479.30 | 0.002666 | 8.60 | 446.02 | 120.00 | 0.49 |
| Main Channel DS | 338.2 | FEMA 10-YR | 1130.00 | 468.60 | 475.51 | 472.14 | 475.97 | 0.001525 | 5.46 | 207.07 | 30.06 | 0.37 |
| Main Channel DS | 338.2 | FEMA 50-YR | 2200.00 | 468.60 | 477.08 | 474.12 | 478.16 | 0.002970 | 8.46 | 303.67 | 142.44 | 0.51 |
| Main Channel DS | 338.2 | FEMA 500-YR | 5000.00 | 468.60 | 480.04 | 479.13 | 480.90 | 0.002357 | 9.07 | 990.38 | 278.53 | 0.47 |
| Main Channel DS | 338.2 | M&M 2-YR | 461.00 | 468.60 | 472.46 | 470.55 | 472.70 | 0.001456 | 3.99 | 115.47 | 29.99 | 0.36 |
| Main Channel DS | 338.2 | M&M 1-YR | 221.00 | 468.60 | 470.83 | 469.79 | 471.00 | 0.001837 | 3.31 | 66.82 | 29.95 | 0.39 |
| Main Channel DS | 338.2 | Bankful Q | 330.00 | 468.60 | 471.44 | 470.16 | 471.67 | 0.001927 | 3.88 | 84.96 | 29.97 | 0.41 |
| | | | | | | | | | | | | |
| Main Channel DS | 338.15 16-INCH-PIPE | | Bridge | | | | | | | | | |
| | | | | | | | | | | | | |
| Main Channel DS | 338.1 | FEMA 100-YR | 2840.00 | 468.60 | 477.38 | 475.13 | 478.96 | 0.004244 | 10.30 | 356.11 | 210.35 | 0.61 |
| Main Channel DS | 338.1 | FEMA Floodway | 2840.00 | 468.60 | 478.05 | 475.14 | 479.24 | 0.003082 | 9.13 | 395.52 | 100.00 | 0.52 |
| Main Channel DS | 338.1 | FEMA 10-YR | 1130.00 | 468.60 | 474.02 | 472.14 | 474.77 | 0.003125 | 6.96 | 162.36 | 30.03 | 0.53 |
| Main Channel DS | 338.1 | FEMA 50-YR | 2200.00 | 468.60 | 476.53 | 474.12 | 477.85 | 0.003805 | 9.22 | 247.04 | 72.98 | 0.58 |
| Main Channel DS | 338.1 | FEMA 500-YR | 5000.00 | 468.60 | 479.89 | 479.13 | 480.82 | 0.002591 | 9.42 | 947.67 | 273.47 | 0.49 |
| Main Channel DS | 338.1 | M&M 2-YR | 461.00 | 468.60 | 471.93 | 470.55 | 472.26 | 0.002286 | 4.62 | 99.72 | 29.98 | 0.45 |
| Main Channel DS | 338.1 | M&M 1-YR | 221.00 | 468.60 | 470.77 | 469.79 | 470.95 | 0.002011 | 3.40 | 64.94 | 29.95 | 0.41 |
| Main Channel DS | 338.1 | Bankful Q | 330.00 | 468.60 | 471.35 | 470.16 | 471.60 | 0.002137 | 4.02 | 82.19 | 29.97 | 0.43 |
| | | | | | | | | | | | | |

HEC-RAS Plan: EXIST (Continued)

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Main Channel DS | 337 AH | FEMA 100-YR | 2840.00 | 468.60 | 476.97 | 475.00 | 478.80 | 0.004983 | 10.88 | 282.54 | 159.87 | 0.66 |
| Main Channel DS | 337 AH | FEMA Floodway | 2840.00 | 468.60 | 477.70 | 475.00 | 479.11 | 0.003621 | 9.71 | 340.13 | 90.55 | 0.57 |
| Main Channel DS | 337 AH | FEMA 10-YR | 1130.00 | 468.60 | 473.95 | 472.07 | 474.67 | 0.003009 | 6.82 | 165.57 | 31.02 | 0.52 |
| Main Channel DS | 337 AH | FEMA 50-YR | 2200.00 | 468.60 | 476.45 | 474.00 | 477.72 | 0.003678 | 9.04 | 243.35 | 31.08 | 0.57 |
| Main Channel DS | 337 AH | FEMA 500-YR | 5000.00 | 468.60 | 479.63 | 479.06 | 480.72 | 0.002966 | 9.94 | 872.26 | 258.46 | 0.53 |
| Main Channel DS | 337 AH | M&M 2-YR | 461.00 | 468.60 | 471.87 | 470.50 | 472.19 | 0.002250 | 4.56 | 101.16 | 30.98 | 0.44 |
| Main Channel DS | 337 AH | M&M 1-YR | 221.00 | 468.60 | 470.71 | 469.77 | 470.89 | 0.002044 | 3.39 | 65.28 | 30.95 | 0.41 |
| Main Channel DS | 337 AH | Bankful Q | 330.00 | 468.60 | 471.29 | 470.12 | 471.53 | 0.002130 | 3.97 | 83.08 | 30.96 | 0.43 |
| | | | | | | | | | | | | |
| Main Channel DS | 336.2 | FEMA 100-YR | 2840.00 | 467.60 | 477.88 | 474.16 | 478.25 | 0.000909 | 5.98 | 1003.89 | 371.64 | 0.33 |
| Main Channel DS | 336.2 | FEMA Floodway | 2840.00 | 467.60 | 477.58 | 474.16 | 478.99 | 0.002355 | 9.52 | 298.38 | 29.97 | 0.53 |
| Main Channel DS | 336.2 | FEMA 10-YR | 1130.00 | 467.60 | 473.98 | 471.15 | 474.53 | 0.001348 | 5.93 | 190.60 | 29.91 | 0.41 |
| Main Channel DS | 336.2 | FEMA 50-YR | 2200.00 | 467.60 | 476.90 | 473.14 | 477.39 | 0.001085 | 6.28 | 665.07 | 323.81 | 0.36 |
| Main Channel DS | 336.2 | FEMA 500-YR | 5000.00 | 467.60 | 480.16 | 477.77 | 480.38 | 0.000643 | 5.55 | 2050.54 | 580.03 | 0.28 |
| Main Channel DS | 336.2 | M&M 2-YR | 461.00 | 467.60 | 471.89 | 469.55 | 472.10 | 0.000734 | 3.60 | 128.13 | 29.87 | 0.31 |
| Main Channel DS | 336.2 | M&M 1-YR | 221.00 | 467.60 | 470.72 | 468.79 | 470.81 | 0.000449 | 2.37 | 93.18 | 29.85 | 0.24 |
| Main Channel DS | 336.2 | Bankful Q | 330.00 | 467.60 | 471.31 | 469.16 | 471.44 | 0.000591 | 2.99 | 110.55 | 29.86 | 0.27 |
| | | | | | | | | | | | | |
| Main Channel DS | 336.15 Parking Lot | | Bridge | | | | | | | | | |
| | | | | | | | | | | | | |
| Main Channel DS | 336.1 | FEMA 100-YR | 2840.00 | 467.60 | 477.64 | 474.16 | 478.09 | 0.001070 | 6.43 | 917.53 | 360.05 | 0.36 |
| Main Channel DS | 336.1 | FEMA Floodway | 2840.00 | 467.60 | 476.66 | 474.16 | 478.37 | 0.003101 | 10.50 | 270.59 | 29.95 | 0.62 |
| Main Channel DS | 336.1 | FEMA 10-YR | 1130.00 | 467.60 | 473.86 | 471.15 | 474.43 | 0.001430 | 6.05 | 186.83 | 29.91 | 0.43 |
| Main Channel DS | 336.1 | FEMA 50-YR | 2200.00 | 467.60 | 475.45 | 473.14 | 476.82 | 0.002800 | 9.38 | 234.46 | 214.13 | 0.59 |
| Main Channel DS | 336.1 | FEMA 500-YR | 5000.00 | 467.60 | 480.04 | 477.77 | 480.29 | 0.000691 | 5.71 | 1985.46 | 569.31 | 0.29 |
| Main Channel DS | 336.1 | M&M 2-YR | 461.00 | 467.60 | 471.87 | 469.55 | 472.07 | 0.000750 | 3.62 | 127.26 | 29.87 | 0.31 |
| Main Channel DS | 336.1 | M&M 1-YR | 221.00 | 467.60 | 470.71 | 468.79 | 470.80 | 0.000453 | 2.38 | 92.90 | 29.85 | 0.24 |
| Main Channel DS | 336.1 | Bankful Q | 330.00 | 467.60 | 471.29 | 469.16 | 471.43 | 0.000599 | 3.00 | 110.03 | 29.86 | 0.28 |
| | | | | | | | | | | | | |
| Main Channel DS | 336 AG | FEMA 100-YR | 2840.00 | 467.40 | 475.95 | 475.08 | 477.89 | 0.006773 | 12.09 | 352.52 | 96.05 | 0.76 |
| Main Channel DS | 336 AG | FEMA Floodway | 2840.00 | 467.40 | 476.39 | 474.90 | 478.23 | 0.005881 | 11.68 | 315.29 | 47.00 | 0.71 |
| Main Channel DS | 336 AG | FEMA 10-YR | 1130.00 | 467.40 | 473.58 | 472.00 | 474.34 | 0.004025 | 7.35 | 194.25 | 52.99 | 0.55 |
| Main Channel DS | 336 AG | FEMA 50-YR | 2200.00 | 467.40 | 475.24 | 474.10 | 476.70 | 0.005737 | 10.44 | 292.86 | 69.91 | 0.69 |
| Main Channel DS | 336 AG | FEMA 500-YR | 5000.00 | 467.40 | 479.97 | 478.22 | 480.26 | 0.001169 | 6.61 | 2178.07 | 598.32 | 0.34 |
| Main Channel DS | 336 AG | M&M 2-YR | 461.00 | 467.40 | 471.67 | 470.22 | 472.02 | 0.003089 | 4.85 | 107.33 | 37.84 | 0.45 |
| Main Channel DS | 336 AG | M&M 1-YR | 221.00 | 467.40 | 470.60 | 469.39 | 470.77 | 0.002350 | 3.35 | 70.91 | 31.67 | 0.37 |
| Main Channel DS | 336 AG | Bankful Q | 330.00 | 467.40 | 471.14 | 469.79 | 471.39 | 0.002733 | 4.10 | 88.28 | 33.62 | 0.41 |

HEC-RAS Plan: EXIST River: Steele Brook Reach: Old Channel

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Old Channel | 7 | FEMA 100-YR | 1.00 | 484.20 | 484.73 | 484.40 | 484.73 | 0.000598 | 0.25 | 4.00 | 15.04 | 0.09 |
| Old Channel | 7 | FEMA Floodway | 1.00 | 484.20 | 484.81 | 484.40 | 484.81 | 0.000285 | 0.19 | 5.28 | 17.29 | 0.06 |
| Old Channel | 7 | FEMA 10-YR | 1.00 | 484.20 | 484.43 | 484.40 | 484.46 | 0.048497 | 1.30 | 0.77 | 6.60 | 0.67 |
| Old Channel | 7 | FEMA 50-YR | 1.00 | 484.20 | 484.56 | 484.40 | 484.56 | 0.004855 | 0.55 | 1.82 | 10.16 | 0.23 |
| Old Channel | 7 | FEMA 500-YR | 1.00 | 484.20 | 485.59 | 484.40 | 485.59 | 0.000004 | 0.04 | 27.24 | 39.25 | 0.01 |
| Old Channel | 7 | M&M 2-YR | 1.00 | 484.20 | 484.42 | 484.40 | 484.45 | 0.069308 | 1.49 | 0.67 | 6.17 | 0.79 |
| Old Channel | 7 | M&M 1-YR | 1.00 | 484.20 | 484.41 | 484.40 | 484.45 | 0.084973 | 1.60 | 0.62 | 5.94 | 0.87 |
| Old Channel | 7 | Bankful Q | 1.00 | 484.20 | 484.41 | 484.40 | 484.45 | 0.075799 | 1.54 | 0.65 | 6.07 | 0.83 |
| | | | | | | | | | | | | |
| Old Channel | 6 | FEMA 100-YR | 376.53 | 479.20 | 484.20 | 482.36 | 484.58 | 0.004015 | 5.12 | 80.09 | 22.82 | 0.42 |
| Old Channel | 6 | FEMA Floodway | 402.36 | 479.20 | 484.30 | 482.48 | 484.72 | 0.004264 | 5.34 | 82.39 | 23.22 | 0.44 |
| Old Channel | 6 | FEMA 10-YR | 79.30 | 479.20 | 481.82 | 480.60 | 481.91 | 0.002042 | 2.40 | 33.11 | 16.19 | 0.29 |
| Old Channel | 6 | FEMA 50-YR | 258.55 | 479.20 | 484.00 | 481.73 | 484.20 | 0.002192 | 3.69 | 75.66 | 22.05 | 0.31 |
| Old Channel | 6 | FEMA 500-YR | 845.53 | 479.20 | 485.43 | 484.22 | 485.57 | 0.001807 | 3.92 | 313.78 | 150.45 | 0.29 |
| Old Channel | 6 | M&M 2-YR | 30.62 | 479.20 | 480.81 | 480.15 | 480.86 | 0.002164 | 1.74 | 17.61 | 15.26 | 0.29 |
| Old Channel | 6 | M&M 1-YR | 5.10 | 479.20 | 480.08 | 479.67 | 480.08 | 0.001463 | 0.79 | 6.46 | 14.75 | 0.21 |
| Old Channel | 6 | Bankful Q | 17.49 | 479.20 | 480.50 | 479.97 | 480.53 | 0.001909 | 1.36 | 12.88 | 15.22 | 0.26 |
| | | | | | | | | | | | | |
| Old Channel | 5 | FEMA 100-YR | 376.53 | 479.20 | 483.94 | 481.70 | 484.25 | 0.001787 | 4.51 | 99.85 | 50.02 | 0.37 |
| Old Channel | 5 | FEMA Floodway | 402.36 | 479.20 | 484.03 | 481.81 | 484.36 | 0.001901 | 4.70 | 104.28 | 51.64 | 0.38 |
| Old Channel | 5 | FEMA 10-YR | 79.30 | 479.20 | 481.70 | 480.08 | 481.76 | 0.000599 | 1.88 | 42.15 | 16.91 | 0.21 |
| Old Channel | 5 | FEMA 50-YR | 258.55 | 479.20 | 483.87 | 481.15 | 484.02 | 0.000894 | 3.16 | 96.24 | 48.20 | 0.26 |
| Old Channel | 5 | FEMA 500-YR | 845.53 | 479.20 | 485.39 | 483.95 | 485.43 | 0.000277 | 2.07 | 599.38 | 216.11 | 0.15 |
| Old Channel | 5 | M&M 2-YR | 30.62 | 479.20 | 480.68 | 479.67 | 480.71 | 0.000448 | 1.23 | 24.98 | 16.86 | 0.18 |
| Old Channel | 5 | M&M 1-YR | 5.10 | 479.20 | 480.00 | 479.34 | 480.00 | 0.000089 | 0.38 | 13.42 | 16.83 | 0.07 |
| Old Channel | 5 | Bankful Q | 17.49 | 479.20 | 480.39 | 479.52 | 480.40 | 0.000292 | 0.87 | 20.07 | 16.85 | 0.14 |
| | | | | | | | | | | | | |
| Old Channel | 4 | FEMA 100-YR | 376.53 | 478.40 | 484.03 | 481.43 | 484.04 | 0.000106 | 1.22 | 472.09 | 191.49 | 0.10 |
| Old Channel | 4 | FEMA Floodway | 402.36 | 478.40 | 484.12 | 481.55 | 484.13 | 0.000109 | 1.25 | 488.22 | 191.80 | 0.10 |
| Old Channel | 4 | FEMA 10-YR | 79.30 | 478.40 | 481.64 | 479.76 | 481.69 | 0.000434 | 1.73 | 46.52 | 19.29 | 0.18 |
| Old Channel | 4 | FEMA 50-YR | 258.55 | 478.40 | 483.91 | 480.84 | 483.92 | 0.000057 | 0.88 | 452.29 | 190.78 | 0.07 |
| Old Channel | 4 | FEMA 500-YR | 845.53 | 478.40 | 483.25 | 483.25 | 485.18 | 0.010984 | 11.29 | 80.77 | 22.50 | 0.96 |
| Old Channel | 4 | M&M 2-YR | 30.62 | 478.40 | 480.64 | 479.33 | 480.66 | 0.000267 | 1.05 | 29.12 | 16.49 | 0.14 |
| Old Channel | 4 | M&M 1-YR | 5.10 | 478.40 | 479.99 | 478.86 | 479.99 | 0.000031 | 0.28 | 18.44 | 16.30 | 0.05 |
| Old Channel | 4 | Bankful Q | 17.49 | 478.40 | 480.37 | 479.15 | 480.38 | 0.000147 | 0.71 | 24.59 | 16.41 | 0.10 |
| | | | | | | | | | | | | |
| Old Channel | 3 | FEMA 100-YR | 789.26 | 478.00 | 484.01 | 483.04 | 484.03 | 0.000176 | 1.61 | 740.52 | 384.53 | 0.13 |
| Old Channel | 3 | FEMA Floodway | 799.05 | 478.00 | 484.10 | 483.08 | 484.12 | 0.000163 | 1.57 | 764.46 | 385.25 | 0.12 |
| Old Channel | 3 | FEMA 10-YR | 222.20 | 478.00 | 480.83 | 480.69 | 481.57 | 0.010282 | 6.91 | 32.22 | 17.35 | 0.89 |
| Old Channel | 3 | FEMA 50-YR | 544.38 | 478.00 | 482.73 | 482.13 | 483.80 | 0.006686 | 8.35 | 67.67 | 21.00 | 0.76 |
| Old Channel | 3 | FEMA 500-YR | 1757.38 | 478.00 | 483.51 | 483.51 | 483.66 | 0.001555 | 4.46 | 618.37 | 380.87 | 0.37 |
| Old Channel | 3 | M&M 2-YR | 112.16 | 478.00 | 480.03 | 479.96 | 480.58 | 0.012713 | 5.94 | 18.87 | 15.11 | 0.94 |
| Old Channel | 3 | M&M 1-YR | 62.15 | 478.00 | 479.53 | 479.48 | 479.95 | 0.013657 | 5.19 | 11.97 | 12.54 | 0.94 |
| Old Channel | 3 | Bankful Q | 89.03 | 478.00 | 479.81 | 479.76 | 480.31 | 0.013255 | 5.67 | 15.71 | 13.99 | 0.94 |
| | | | | | | | | | | | | |
| Old Channel | 2 | FEMA 100-YR | 789.26 | 476.60 | 481.87 | 481.56 | 483.78 | 0.010821 | 11.23 | 75.03 | 17.62 | 0.87 |
| Old Channel | 2 | FEMA Floodway | 799.05 | 476.60 | 482.19 | 481.58 | 483.90 | 0.009171 | 10.66 | 80.74 | 18.00 | 0.80 |
| Old Channel | 2 | FEMA 10-YR | 222.20 | 476.60 | 479.10 | 478.71 | 479.84 | 0.008728 | 6.88 | 32.29 | 13.01 | 0.77 |
| Old Channel | 2 | FEMA 50-YR | 544.38 | 476.60 | 480.98 | 480.48 | 482.36 | 0.009340 | 9.48 | 59.81 | 16.55 | 0.80 |
| Old Channel | 2 | FEMA 500-YR | 1757.38 | 476.60 | 483.11 | 482.41 | 483.15 | 0.000340 | 2.26 | 1171.42 | 493.45 | 0.16 |
| Old Channel | 2 | M&M 2-YR | 112.16 | 476.60 | 478.29 | 477.93 | 478.70 | 0.007276 | 5.15 | 21.78 | 12.94 | 0.70 |
| Old Channel | 2 | M&M 1-YR | 62.15 | 476.60 | 477.78 | 477.50 | 478.04 | 0.006772 | 4.08 | 15.22 | 12.90 | 0.66 |
| Old Channel | 2 | Bankful Q | 89.03 | 476.60 | 478.08 | 477.74 | 478.42 | 0.006985 | 4.69 | 18.99 | 12.92 | 0.68 |
| | | | | | | | | | | | | |
| Old Channel | 1 | FEMA 100-YR | 789.26 | 476.00 | 481.27 | 480.84 | 482.97 | 0.009227 | 10.65 | 80.51 | 19.37 | 0.82 |
| Old Channel | 1 | FEMA Floodway | 799.05 | 476.00 | 481.83 | 480.88 | 483.21 | 0.006779 | 9.61 | 91.56 | 20.71 | 0.71 |
| Old Channel | 1 | FEMA 10-YR | 222.20 | 476.00 | 478.21 | 478.05 | 479.08 | 0.011441 | 7.49 | 29.67 | 13.62 | 0.89 |
| Old Channel | 1 | FEMA 50-YR | 544.38 | 476.00 | 480.50 | 479.76 | 481.67 | 0.007347 | 8.75 | 65.93 | 18.70 | 0.73 |
| Old Channel | 1 | FEMA 500-YR | 1757.38 | 476.00 | 483.10 | 482.10 | 483.13 | 0.000221 | 1.98 | 1436.67 | 537.69 | 0.13 |
| Old Channel | 1 | M&M 2-YR | 112.16 | 476.00 | 477.31 | 477.31 | 477.95 | 0.014880 | 6.44 | 17.42 | 13.45 | 1.00 |
| Old Channel | 1 | M&M 1-YR | 62.15 | 476.00 | 476.88 | 476.88 | 477.32 | 0.015754 | 5.29 | 11.75 | 13.37 | 0.99 |
| Old Channel | 1 | Bankful Q | 89.03 | 476.00 | 477.12 | 477.12 | 477.67 | 0.015360 | 5.98 | 14.88 | 13.41 | 1.00 |

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**Existing Condition**
**Profile Plots**

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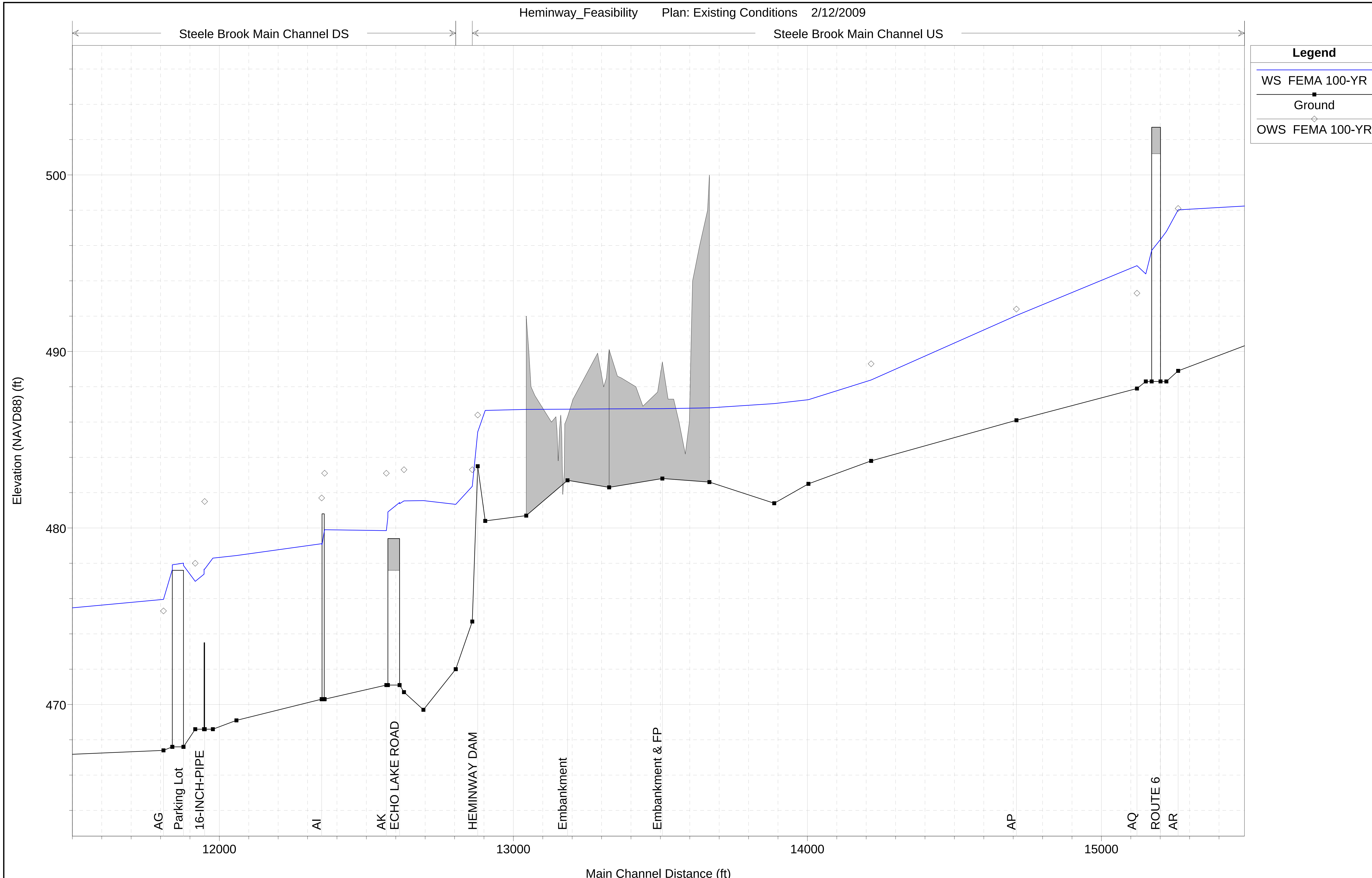
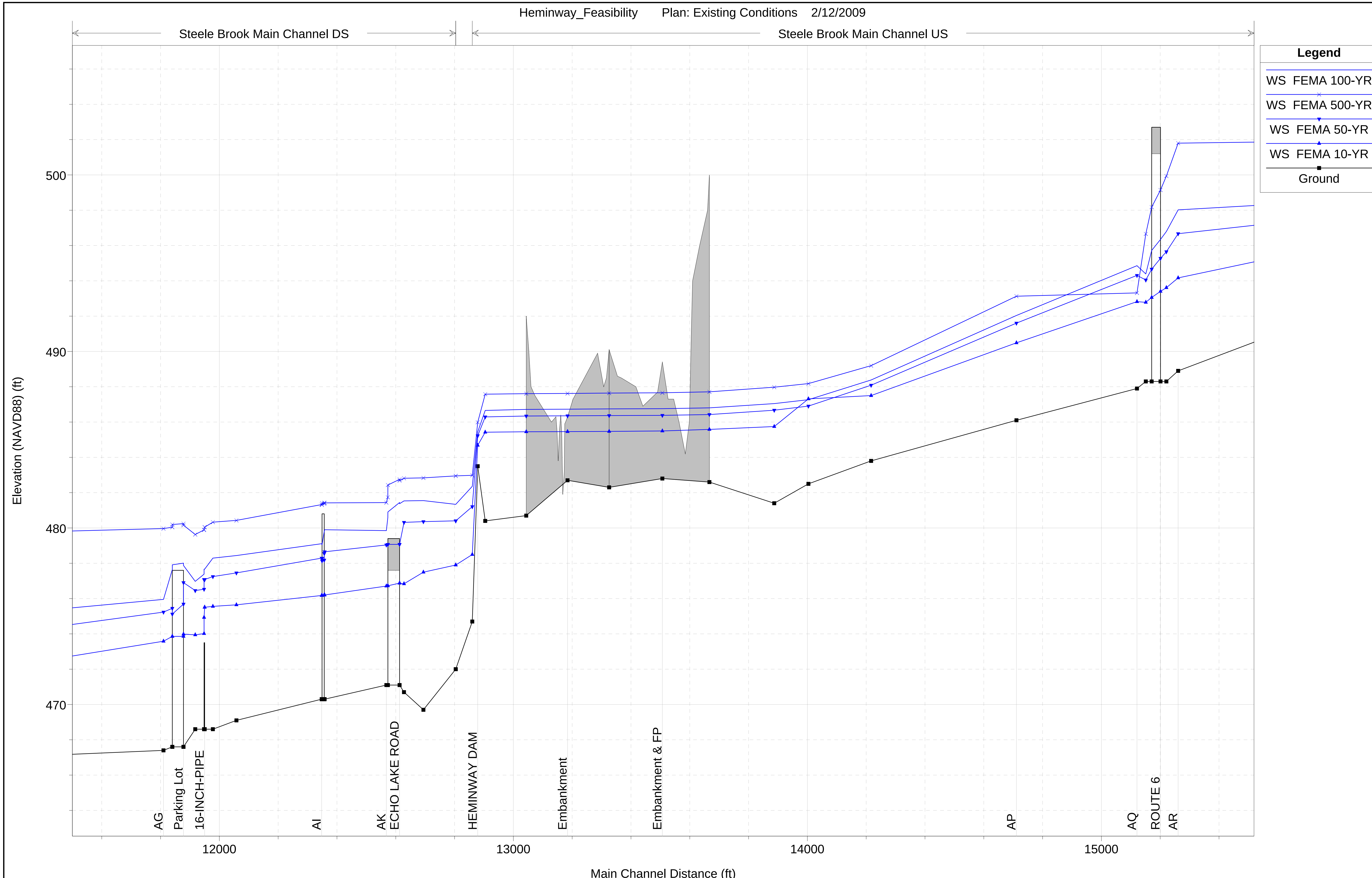
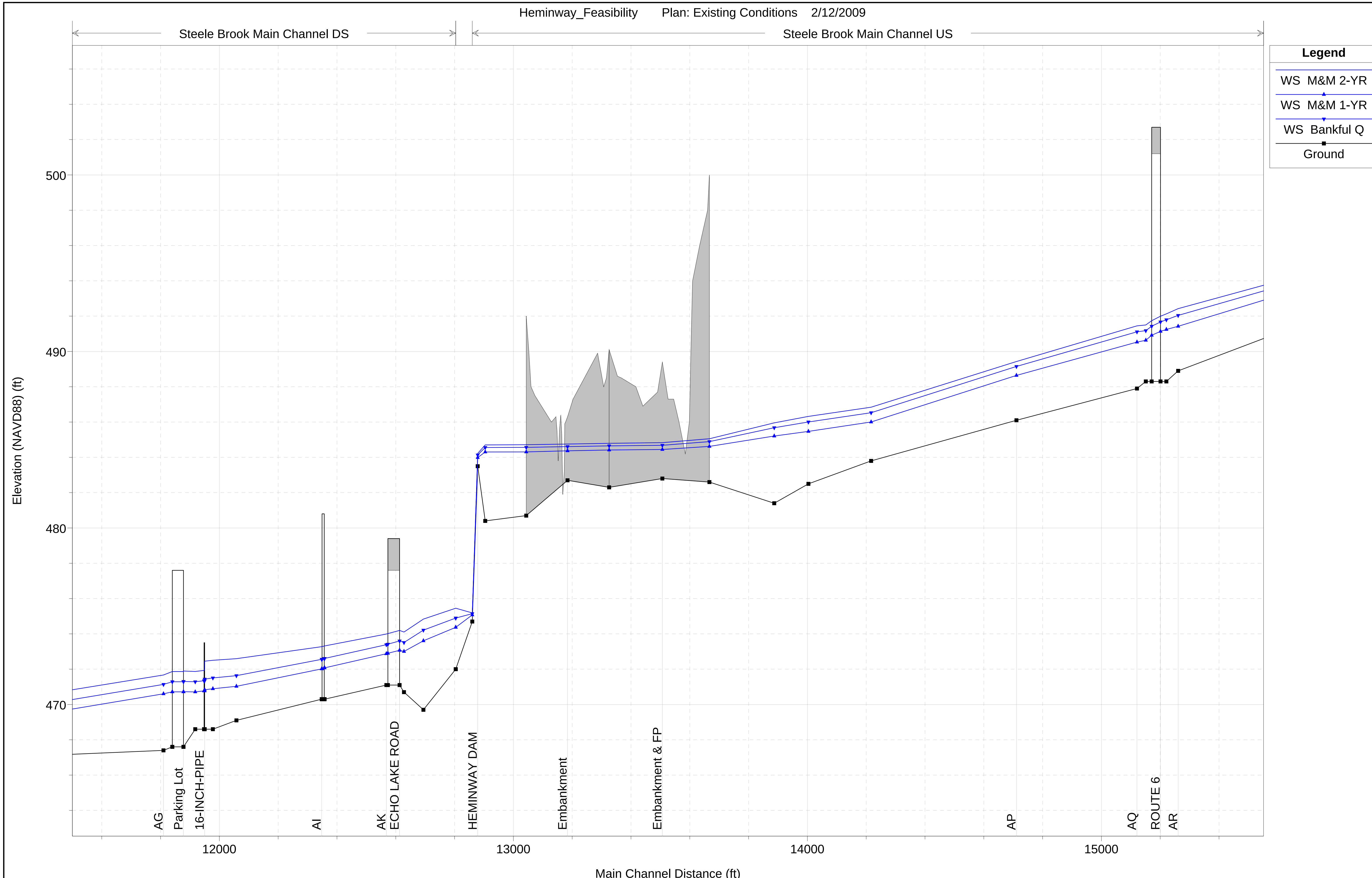


1 in Horiz. = 300 ft 1 in Vert. = 5 ft



1 in Horiz. = 300 ft 1 in Vert. = 5 ft



1 in Horiz. = 300 ft 1 in Vert. = 5 ft

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# Partial Removal
# HEC-RAS Report

**(note: geometry identical for post construction and mature n plans except for Manning's n values)**

HEC-RAS Version 4.0.0 March 2008
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX   XXXX        XXXX     XX    XXXX
X     X  X       X    X       X   X   X  X  X
X     X  X       X            X   X  X    X X
XXXXXXX  XXXX    X      XXX   XXXX   XXXXXX  XXXX
X     X  X       X            X  X   X    X     X
X     X  X       X    X       X   X  X    X     X
X     X  XXXXXX   XXXX        X    X X    X XXXXX
```

********************************************************************************

PROJECT DATA
Project Title: Heminway_Feasibility
Project File : Heminway_Feasibility.prj
Run Date and Time: 2/12/2009 5:01:12 PM

Project in English units

Project Description:
Heminway Pond Dam Removal Feasibility Study. Base data from 1997 LOMR, expanded upstream with 1980 FIS geometry. Additional and enhanced/replaced/corrected geometry in area of pond and nearby channel with 2007/2008 survey data & town GIS data.

********************************************************************************

PLAN DATA

Plan Title: Partial Removal
Plan File : s:\Engineering\PROJECTS\STEELE_BROOK\HEC-RAS\Feasibility Draft\Heminway_Feasibility.p02

Geometry Title: Partial Removal
Geometry File : s:\Engineering\PROJECTS\STEELE_BROOK\HEC-RAS\Feasibility Draft\Heminway_Feasibility.g02

Flow Title    : Flows
Flow File     : s:\Engineering\PROJECTS\STEELE_BROOK\HEC-RAS\Feasibility Draft\Heminway_Feasibility.f01

Plan Description:
Partial Removal

Plan Summary Information:
```
Number of:  Cross Sections =   87    Multiple Openings  =    0
            Culverts       =    0    Inline Structures  =    0
            Bridges        =    9    Lateral Structures =    2
```

```
Computational Information
    Water surface calculation tolerance  =  0.01
    Critical depth calculation tolerance =  0.01
    Maximum number of iterations         =  20
    Maximum difference tolerance         =  0.3
    Flow tolerance factor                =  0.001

Computation Options
    Critical depth computed at all cross sections
    Conveyance Calculation Method: At breaks in n values only
    Friction Slope Method:         Program Selects Appropriate method
    Computational Flow Regime:     Mixed Flow

Encroachment Data
   Equal Conveyance = True
   Left Offset      =        0
   Right Offset     =        0

River = Steele Brook     Reach = Main Channel US
RS      Profile           Method  Value1  Value2
351     FEMA Floodway          4       1
350     FEMA Floodway          4       1
349     FEMA Floodway          4       1
348     FEMA Floodway          4       1
347.2   FEMA Floodway          4       1
347.1   FEMA Floodway          4       1
347     FEMA Floodway          1    1353    1405
346     FEMA Floodway          1    1250    1350
345     FEMA Floodway          2      47
344.2   FEMA Floodway          2      47
344.1   FEMA Floodway          2     235
343.2   FEMA Floodway          2     455
343.1   FEMA Floodway          2     455
342.6   FEMA Floodway          4       1
342.5   FEMA Floodway          4       1
342.4   FEMA Floodway          4       1
342.3   FEMA Floodway          4       1
342.2   FEMA Floodway          4       1
342.1   FEMA Floodway          4       1
342.05  FEMA Floodway          4       1

River = Steele Brook     Reach = Main Channel DS
RS      Profile           Method  Value1  Value2
341.2   FEMA Floodway          4       1
341.1   FEMA Floodway          4       1
341     FEMA Floodway          1    1002 1277.35
340.2   FEMA Floodway          1    1000    1150
340.1   FEMA Floodway          1    1000    1120
340     FEMA Floodway          1    1000    1120
339.6   FEMA Floodway          1    1000    1120
339.56  FEMA Floodway          1    1000    1120
339.51  FEMA Floodway          1    1000    1120
339.5   FEMA Floodway          1    1000    1120
339.1   FEMA Floodway          1    1000    1120
339     FEMA Floodway          1    1320    1440
338.2   FEMA Floodway          1    1320    1440
```

| | | | | |
|---|---|---|---|---|
| 338.1 | FEMA Floodway | 1 | 1320 | 1420 |
| 337 | FEMA Floodway | 2 | 150 | |
| 336.2 | FEMA Floodway | 1 | 980 | 1010 |
| 336.1 | FEMA Floodway | 1 | 980 | 1010 |
| 336 | FEMA Floodway | 2 | 47 | |
| 335 | FEMA Floodway | 1 | 1160 | 1280 |
| 334 | FEMA Floodway | 2 | 100 | |
| 333 | FEMA Floodway | 2 | 80 | |
| 332.2 | FEMA Floodway | 1 | 1080 | 1300 |
| 332.1 | FEMA Floodway | 4 | .4 | |
| 332 | FEMA Floodway | 4 | .4 | |
| 331 | FEMA Floodway | 4 | .4 | |
| 330 | FEMA Floodway | 4 | .4 | |
| 329 | FEMA Floodway | 4 | 1 | |
| 328 | FEMA Floodway | 4 | 1 | |
| 327 | FEMA Floodway | 4 | 1 | |
| 326 | FEMA Floodway | 4 | 1 | |
| 325 | FEMA Floodway | 4 | 1 | |
| 324.2 | FEMA Floodway | 4 | 1 | |
| 324.1 | FEMA Floodway | 4 | 1 | |
| 324 | FEMA Floodway | 4 | 1 | |
| 323 | FEMA Floodway | 4 | 1 | |
| 322 | FEMA Floodway | 4 | 1 | |
| 321.1 | FEMA Floodway | 4 | 1 | |
| 321 | FEMA Floodway | 4 | 1 | |
| 320 | FEMA Floodway | 4 | 1 | |
| 319 | FEMA Floodway | 4 | 1 | |
| 318 | FEMA Floodway | 4 | 1 | |
| 317 | FEMA Floodway | 4 | 1 | |
| 316 | FEMA Floodway | 4 | 1 | |
| 315 | FEMA Floodway | 4 | 1 | |
| 314 | FEMA Floodway | 4 | 1 | |
| 313 | FEMA Floodway | 4 | 1 | |
| 312.2 | FEMA Floodway | 4 | 1 | |
| 312.1 | FEMA Floodway | 4 | 1 | |
| 312 | FEMA Floodway | 4 | 1 | |
| 311 | FEMA Floodway | 4 | 1 | |
| 310 | FEMA Floodway | 4 | 1 | |
| 309 | FEMA Floodway | 4 | 1 | |
| 308 | FEMA Floodway | 4 | 1 | |
| 307.1 | FEMA Floodway | 4 | 1 | |
| 307 | FEMA Floodway | 4 | 1 | |
| 305 | FEMA Floodway | 4 | 1 | |
| 304.2 | FEMA Floodway | 4 | 1 | |
| 304.1 | FEMA Floodway | 4 | 1 | |
| 304 | FEMA Floodway | 4 | 1 | |
| 303 | FEMA Floodway | 4 | 1 | |
| -100 | FEMA Floodway | 1 | 254.7 | 339.2 |

********************************************************************************

FLOW DATA

Flow Title: Flows
Flow File : s:\Engineering\PROJECTS\STEELE_BROOK\HEC-RAS\Feasibility Draft\Heminway_Feasibility.f01

```
Flow Data (cfs)
*******************************************************************************
*******************************************************************************
*************
* River           Reach           RS      *     FEMA 100-YR   FEMA Floodway
FEMA 10-YR      FEMA 50-YR     FEMA 500-YR       M&M 2-YR        M&M 1-YR
Bankful Q *
* Steele Brook    Main Channel US 351     *           2060            2060
820            1600           3600            405            221
330 *
* Steele Brook    Main Channel DS 341.2   *           2840            2840
1130            2200           5000            461            221
330 *
* Steele Brook    Main Channel DS 310     *           3550            3550
1410            2740           6245            796            380
330 *
* Steele Brook    Old Channel     7       *              1               1
1               1               1               1               1
1 *
*******************************************************************************
*******************************************************************************
*************

Boundary Conditions
*******************************************************************************
************************
* River           Reach           Profile          *            Upstream
Downstream    *
*******************************************************************************
************************
* Steele Brook    Main Channel US FEMA 100-YR      *              Critical
*
* Steele Brook    Main Channel US FEMA Floodway    *              Critical
*
* Steele Brook    Main Channel US FEMA 10-YR       *              Critical
*
* Steele Brook    Main Channel US FEMA 50-YR       *              Critical
*
* Steele Brook    Main Channel US FEMA 500-YR      *              Critical
*
* Steele Brook    Main Channel US M&M 2-YR         *              Critical
*
* Steele Brook    Main Channel US M&M 1-YR         *              Critical
*
* Steele Brook    Main Channel US Bankful Q        *              Critical
*
* Steele Brook    Old Channel     FEMA 100-YR      *          Normal S = 0.0001
*
* Steele Brook    Old Channel     FEMA Floodway    *          Normal S = 0.0001
*
* Steele Brook    Old Channel     FEMA 10-YR       *          Normal S = 0.0001
*
* Steele Brook    Old Channel     FEMA 50-YR       *          Normal S = 0.0001
*
* Steele Brook    Old Channel     FEMA 500-YR      *          Normal S = 0.0001
*
```

```
* Steele Brook    Old Channel     M&M 2-YR         *        Normal S = 0.0001
*
* Steele Brook    Old Channel     M&M 1-YR         *        Normal S = 0.0001
*
* Steele Brook    Old Channel     Bankful Q        *        Normal S = 0.0001
*
* Steele Brook    Main Channel DS FEMA 100-YR      *
Known WS = 356.31 *
* Steele Brook    Main Channel DS FEMA Floodway    *
Known WS = 356.44 *
* Steele Brook    Main Channel DS FEMA 10-YR       *
Known WS = 352.85 *
* Steele Brook    Main Channel DS FEMA 50-YR       *
Known WS = 353 *
* Steele Brook    Main Channel DS FEMA 500-YR      *
Known WS = 358.5 *
* Steele Brook    Main Channel DS M&M 2-YR         *
Normal S = 0.002 *
* Steele Brook    Main Channel DS M&M 1-YR         *
Normal S = 0.002 *
* Steele Brook    Main Channel DS Bankful Q        *
Normal S = 0.002 *
********************************************************************************
************************

Observed Water Surface Marks
********************************************************************************
********************************************************************************
*************
* River           Reach           RS      *     FEMA 100-YR   FEMA Floodway
FEMA 10-YR      FEMA 50-YR     FEMA 500-YR        M&M 2-YR        M&M 1-YR
Bankful Q *
* Steele BrookMain Channel US351     *          509.1
*
* Steele BrookMain Channel US350     *          503.4
*
* Steele BrookMain Channel US349     *          498.3
*
* Steele BrookMain Channel US348     *          498.1
*
* Steele BrookMain Channel US347.2   *
*
* Steele BrookMain Channel US347.1   *
*
* Steele BrookMain Channel US347     *          493.3
*
* Steele BrookMain Channel US346     *          492.4
*
* Steele Brook    Main Channel US 344.2   *          489.3
*
* Steele Brook    Main Channel US 342.1   *          486.4
*
* Steele Brook    Main Channel US 342.05  *          483.3
*
* Steele BrookMain Channel DS341     *          483.3
*
```

```
* Steele BrookMain Channel DS340     *           483.1
*
* Steele BrookMain Channel DS339.6   *           483.1
*
* Steele BrookMain Channel DS339.5   *           481.7
*
* Steele Brook    Main Channel DS 338.2   *           481.5
*
* Steele BrookMain Channel DS337     *             478
*
* Steele BrookMain Channel DS336     *           475.3
*
* Steele BrookMain Channel DS335     *           475.3
*
* Steele BrookMain Channel DS334     *           474.4
*
* Steele BrookMain Channel DS333     *           473.7
*
* Steele BrookMain Channel DS332     *           470.7
*
* Steele BrookMain Channel DS331     *           468.2
*
* Steele BrookMain Channel DS330     *           466.6
*
********************************************************************************
********************************************************************************
*************

********************************************************************************

GEOMETRY DATA

Geometry Title: Partial Removal
Geometry File : s:\Engineering\PROJECTS\STEELE_BROOK\HEC-RAS\Feasibility
Draft\Heminway_Feasibility.g02

Reach Connection Table
********************************************************************************
*
* River            Reach            *  Upstream Boundary  * Downstream Boundary
*
********************************************************************************
*
* Steele Brook     Main Channel US  *                     *   Canal
*
* Steele Brook     Old Channel      *                     *   Canal
*
* Steele Brook     Main Channel DS  *   Canal             *
*
********************************************************************************
*

JUNCTION INFORMATION

Name: Canal
Description:
Energy computation Method
```

```
    Length across Junction             Tributary
     River          Reach               River          Reach        Length
Angle
Steele Brook    Main Channel US  to Steele Brook    Main Channel DS     56.4
Steele Brook    Old Channel      to Steele Brook    Main Channel DS    55.76

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel US    RS: 351

INPUT
Description: FEMA AU
Station Elevation Data    num=      21
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   557.1    1049   536.1    1145   531.1    1190   527.6    1250   521.1
    1297   518.6    1330   518.1    1363   508.1    1380   505.6    1382   505.3
    1408   505.3    1410   505.6    1432   507.2    1478   508.1    1585   508.6
    1735   518.1    1767   521.1    1831   521.6    1905   521.6    1940   518.1
    1975   519.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1363     .04    1432     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1363    1432             600      550     500             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel US    RS: 350

INPUT
Description: FEMA AT
Station Elevation Data    num=      22
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   532.6    1040   529.6    1103   524.6    1160   522.1    1255   503.1
    1305   502.6    1345   503.1    1351   499.3    1352   498.1    1378   498.1
    1380   499.3    1408   502.6    1458   503.1    1534   506.6    1585   506.6
    1642   508.1    1688   507.6    1770   509.6    1800   512.1    1829   516.6
    1865   521.1    1945   516.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1345     .04    1408     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
```

```
          1345    1408              400     390     500             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel US    RS: 349

INPUT
Description: FEMA AS
Station Elevation Data    num=      26
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   523.6    1065   523.1    1104   519.6    1141   514.6    1185   508.1
    1225   496.6    1275   496.6    1325   496.1    1365   497.6    1405   493.6
    1410   492.3    1430   492.3    1435   493.6    1450   497.6    1488   497.1
    1532   497.6    1584   498.1    1645   500.1    1705   500.6    1772   502.1
    1845   503.1    1905   506.1    1940   505.6    1980   509.3    2020   516.1
    2095   525.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1365     .04    1450     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1365    1450              550     540     400             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel US    RS: 348

INPUT
Description: FEMA AR
Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     820   504.1     860   499.1    1000   489.6    1002   488.9    1020   488.9
    1023   489.6    1115   495.1    1176   497.6    1250   505.1    1311   500.1
    1612   514.3

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     820     .06    1000     .04    1023     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1000    1023               40      40      40             .1       .3

CROSS SECTION


RIVER: Steele Brook
```

```
REACH: Main Channel US    RS: 347.2

INPUT
Description: U/S FACE CUTLER STREET BRIDGE (RTE 6)
Station Elevation Data    num=       6
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   503.9    1050   503.9    1052   489.9    1082   488.3    1084   502.7
    1154   502.7

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1050     .04    1084     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1050    1084              70      70      70              .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1050   503.4       F
    1084    1154   503.4       F

BRIDGE


RIVER: Steele Brook
REACH: Main Channel US    RS: 347.15

INPUT
Description: Route 6 Bridge
Distance from Upstream XS =      20
Deck/Roadway Width        =      30
Weir Coefficient          =     2.5
Upstream  Deck/Roadway Coordinates
    num=       6
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*******************************************************************************
    1000   503.9            1050   503.9            1052   503.4   501.2
    1082   503.4   501.2    1084   502.7            1154   502.7

Upstream Bridge Cross Section Data
Station Elevation Data    num=       6
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   503.9    1050   503.9    1052   489.9    1082   488.3    1084   502.7
    1154   502.7

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1050     .04    1084     .06

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1050    1084            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
```

```
    1000    1050   503.4       F
    1084    1154   503.4       F

Downstream  Deck/Roadway Coordinates
    num=       6
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*************************************************************************
    1000   503.9            1050   503.9            1052   503.4   501.2
    1082   503.4   501.2    1084   502.7            1154   502.7

Downstream Bridge Cross Section Data
Station Elevation Data    num=       6
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
    1000   503.9    1050   503.9    1052   489.9    1082   488.3    1084   502.7
    1154   502.7

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1050     .04    1084     .06

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1050    1084            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1050   501.2       F
    1084    1154   501.2       F

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: Steele Brook
```

```
REACH: Main Channel US    RS: 347.1

INPUT
Description: D/S FACE CUTLER STREET BRIDGE (RTE 6)
Station Elevation Data    num=       6
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   503.9    1050   503.9    1052   489.9    1082   488.3    1084   502.7
    1154   502.7

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1050     .04    1084     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1050    1084               30      30      30              .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1050   501.2       F
    1084    1154   501.2       F

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel US    RS: 347

INPUT
Description: FEMA AQ
Station Elevation Data    num=      16
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   536.1    1053   532.1    1114   528.6    1182   521.1    1219   518.1
    1278   507.6    1319   501.6    1347   495.1    1370   488.1    1371   487.9
    1389   487.9    1390   488.1    1413   496.1    1487   498.6    1608   499.6
    1680   501.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1347     .04    1413     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1347    1413              400     410     300              .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel US    RS: 346

INPUT
Description: FEMA AP
Station Elevation Data    num=      15
```

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 1000 | 515.1 | 1080 | 495.1 | 1129 | 491.1 | 1190 | 490.6 | 1250 | 492.6 |
| 1295 | 491.1 | 1319 | 487.1 | 1320 | 486.1 | 1330 | 486.1 | 1335 | 487.1 |
| 1350 | 490.1 | 1395 | 497.6 | 1459 | 498.6 | 1505 | 498.6 | 1623 | 512.1 |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 1000 | .06 | 1295 | .04 | 1350 | .06 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 1295 | 1350 | 545 | 494.13 | 435 | .1 | .3 |

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel US RS: 344.2

INPUT
Description: Sewer Line Riffle
Station Elevation Data num= 32

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 500 | 12.5 | 498 | 22.1 | 496 | 25.1 | 494 | 55.9 | 494 |
| 125.5 | 492 | 202.1 | 490 | 271.1 | 490 | 306.5 | 489.5 | 332.6 | 488.3 |
| 340.2 | 486.6 | 342.9 | 484.9 | 344.2 | 484.3 | 345.7 | 483.9 | 355.3 | 484.1 |
| 359.5 | 483.8 | 364.8 | 483.8 | 371.1 | 484 | 371.9 | 484.1 | 373.5 | 484.6 |
| 375.3 | 485.9 | 380.1 | 486.3 | 405.7 | 487.4 | 447.7 | 486.8 | 527.3 | 486.6 |
| 560.7 | 488 | 567.2 | 490 | 572.3 | 492 | 578.9 | 494 | 587.1 | 496 |
| 595.4 | 498 | 612.3 | 500 | | | | | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 0 | .06 | 340.2 | .035 | 375.3 | .06 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 340.2 | 375.3 | 210 | 213.35 | 170 | .1 | .3 |

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel US RS: 344.1

INPUT
Description: Reference Riffle
Station Elevation Data num= 34

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 500 | 30.7 | 498 | 59 | 496 | 94.8 | 494 | 132.6 | 492 |
| 169.5 | 490 | 207.2 | 488 | 294.9 | 486 | 342.8 | 484 | 382 | 483.2 |
| 413.3 | 484 | 474.5 | 485.9 | 479.5 | 486.2 | 481.6 | 484 | 482.7 | 483.9 |

```
     487   484.2   490.3     484     495   483.9     499   483.7   505.4   483.3
   507.8   482.7   511.9   482.5   516.1     483   517.3   483.4   519.6   486.6
   527.8   486.8   537.1     486   656.5     488   659.8     490   663.5     492
   667.1     494   670.9     496   677.7     498   684.7     500

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0     .06   479.5    .035   519.6     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
         479.5   519.6                70  116.18     125             .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   169.5   342.8     489       F
   342.8   479.5   486.5       F
Left Levee      Station=   479.5      Elevation=   486.2

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel US    RS: 343.2

INPUT
Description: New NRCS  (Replace FEMA 344)
Station Elevation Data    num=      28
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0     500    26.4     498    60.3     496   107.2     494   147.2     492
   182.4     490   217.6     488   269.5   487.7     331     486     388   484.5
   505.1   486.3   507.4   484.1   515.5   483.6   525.5   482.3   531.2   481.7
   534.4   481.4   537.3   484.8   651.2     484   666.8   483.7   676.9     484
   679.9     486   682.9     488   685.8     490   688.8     492   691.7     494
   696.1     496   703.5     498   710.9     500

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0     .06   505.1    .035   537.3     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
         505.1   537.3               216  220.58     266             .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0     331     489       F
   537.3   710.9     486       F
Left Levee      Station=   505.1      Elevation=   486.2
Right Levee     Station=   537.3      Elevation=   484.8

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel US    RS: 343.1
```

INPUT
Description: New NRCS (Replaced FEMA 343 AN)
Station Elevation Data num= 48

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 500 | 4.1 | 498 | 33 | 496 | 126.1 | 494 | 180.9 | 492 |
| 245.4 | 492 | 290.2 | 493 | 315.2 | 492 | 326.7 | 490 | 333.5 | 488 |
| 339.6 | 486 | 343.4 | 484 | 347.2 | 483.7 | 352.6 | 482.7 | 408.4 | 482.4 |
| 457.4 | 482.8 | 469.9 | 483.7 | 479.7 | 484 | 519.3 | 485.5 | 531.8 | 485.3 |
| 534.5 | 483.1 | 541.4 | 483.2 | 562 | 482.6 | 570.6 | 482.6 | 571.3 | 485.1 |
| 641.7 | 486 | 661.9 | 484.8 | 689.5 | 486 | 723.3 | 488 | 729.5 | 488.7 |
| 735.4 | 488 | 756.7 | 486 | 771.7 | 484 | 773.2 | 483.7 | 781.7 | 481.4 |
| 794.4 | 481.4 | 795.3 | 484 | 825.1 | 484 | 840.8 | 483.1 | 853.6 | 484 |
| 863.7 | 486 | 867.3 | 488 | 871 | 490 | 874.6 | 492 | 878.3 | 494 |
| 914.1 | 496 | 958.1 | 498 | 965 | 500 | | | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 0 | .06 | 531.8 | .035 | 571.3 | .06 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 531.8 | 571.3 | 153 | 159.84 | 231.73 | .1 | .3 |

Ineffective Flow num= 2

| Sta L | Sta R | Elev | Permanent |
|---|---|---|---|
| 0 | 519.3 | 485.3 | F |
| 641.7 | 965 | 486 | F |

LATERAL STRUCTURE

RIVER: Steele Brook
REACH: Main Channel US RS: 342.65

INPUT
Description:
Lateral structure position = Right overbank
Distance from Upstream XS =
Deck/Roadway Width = 10
Weir Coefficient = 3.09
Weir Flow Reference = Energy Grade
Weir Embankment Coordinates num = 19

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 500 | 8.9 | 498 | 48 | 496 | 82.8 | 494 | 87.1 | 492 |
| 91.1 | 490 | 94.9 | 488 | 98.7 | 486 | 118.9 | 484.2 | 149.6 | 486 |
| 176.1 | 487.3 | 203.6 | 487.3 | 231.7 | 489.4 | 243 | 487.7 | 277.9 | 486.9 |
| 294.4 | 488 | 328.8 | 488.5 | 338 | 488.6 | 357.7 | 490.1 | | |

Weir crest shape = Broad Crested

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel US    RS: 342.6

INPUT
Description: New NRCS
Station Elevation Data    num=      46

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 500 | 4.2 | 498 | 8.4 | 496 | 10.8 | 494 | 40.8 | 494 |
| 77.8 | 494 | 113.9 | 492 | 117.2 | 490 | 120.5 | 488 | 123.9 | 486 |
| 225.2 | 484 | 328.1 | 484.1 | 329.9 | 483.2 | 337.1 | 482.2 | 365.7 | 481.7 |
| 406.8 | 483 | 407.8 | 483.4 | 408.8 | 484 | 425.2 | 484 | 435.5 | 484.1 |
| 453.5 | 485.3 | 460.7 | 485.8 | 463.3 | 483.6 | 464.14 | 483.56 | 465 | 482.7 |
| 483 | 482.2 | 501 | 482.7 | 501.53 | 483.23 | 505.3 | 483.3 | 509 | 484.5 |
| 510.9 | 484.4 | 563.2 | 484 | 599.9 | 486 | 605.4 | 486.1 | 610.4 | 486 |
| 657.7 | 484 | 658.8 | 484 | 659.9 | 483 | 670.6 | 481.6 | 697.5 | 481.5 |
| 721.1 | 481.5 | 742.9 | 481.5 | 744.2 | 483.7 | 746 | 484 | 752.6 | 487.5 |
| 759.2 | 489.4 | | | | | | | | |

Manning's n Values        num=       3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 0 | .06 | 460.7 | .035 | 509 | .06 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 460.7 | 509 | 152 | 181.04 | 125.98 | .1 | .3 |

Ineffective Flow     num=       3

| Sta L | Sta R | Elev | Permanent |
|---|---|---|---|
| 113.9 | 328.1 | 490 | T |
| 328.1 | 460.7 | 484 | F |
| 605.4 | 759.2 | 486 | F |

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel US    RS: 342.5

INPUT
Description: New NRCS
Station Elevation Data    num=      40

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 498 | 9.7 | 496 | 29.1 | 494 | 76.2 | 492 | 81.4 | 490 |
| 85.9 | 488 | 91 | 486 | 95.2 | 484 | 99.1 | 483.7 | 108.6 | 482.1 |
| 140.3 | 481.2 | 192.4 | 483.5 | 245.4 | 483.2 | 316.2 | 483.7 | 347.4 | 484.5 |
| 361.2 | 483.7 | 363.53 | 483.54 | 365 | 482.07 | 383 | 481.57 | 401 | 482.07 |
| 401.8 | 482.87 | 406.6 | 483.6 | 408.1 | 484 | 410.9 | 484.8 | 419.1 | 484 |
| 429.5 | 484.3 | 446.8 | 484 | 462.2 | 483.7 | 495.8 | 483.7 | 503.9 | 484 |
| 535.8 | 486 | 565.7 | 484 | 567.8 | 483.7 | 584.8 | 480.1 | 625.9 | 480.1 |
| 645.5 | 483.7 | 646.6 | 484 | 647.6 | 486 | 654.2 | 488 | 659.3 | 490.1 |

Manning's n Values        num=       5

| Sta | n Val | Sta | n Val | Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|---|---|---|---|
| 0 | .06 | 363.53 | .035 | 406.6 | .06 | 584.8 | .04 | 625.9 | .06 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 363.53 | 406.6 | 151 | 141.52 | 130.33 | .1 | .3 |

Ineffective Flow num= 3

| Sta L | Sta R | Elev | Permanent |
|---|---|---|---|
| 95 | 347.4 | 484 | F |
| 410.9 | 535.8 | 484.8 | F |
| 535.8 | 647.54 | 485 | F |

LATERAL STRUCTURE

RIVER: Steele Brook
REACH: Main Channel US RS: 342.45

INPUT
Description:
Lateral structure position = Right overbank
Distance from Upstream XS =
Deck/Roadway Width = 10
Weir Coefficient = 2
Weir Flow Reference = Water Surface
Weir Embankment Coordinates num = 23

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 490.1 | 8.5 | 488.5 | 17 | 488 | 36.2 | 489.9 | 113.1 | 487.3 |
| 130.3 | 486.3 | 141.9 | 486 | 146.3 | 485.9 | 149.5 | 483.2 | 157.7 | 481.9 |
| 160.9 | 483.7 | 163.4 | 485.3 | 169.4 | 486.4 | 176.2 | 485.6 | 177.8 | 485.3 |
| 183.9 | 483.8 | 190.6 | 485.5 | 197 | 486.3 | 222.7 | 486 | 318 | 487.5 |
| 340.2 | 488 | 352.4 | 490 | 367.8 | 492 | | | | |

Weir crest shape = Broad Crested

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel US RS: 342.4

INPUT
Description: New NRCS
Station Elevation Data num= 40

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 500 | 0 | 489 | 21.6 | 488 | 23.8 | 486 | 26.1 | 484 |
| 28.5 | 483.7 | 34.8 | 483.3 | 44.1 | 481.2 | 74 | 483.8 | 99 | 483.7 |
| 115.5 | 484.1 | 134.5 | 484 | 141.7 | 484.4 | 148.7 | 484 | 176.5 | 483.7 |
| 188.26 | 483.31 | 190 | 481.57 | 208 | 481.07 | 226 | 481.57 | 228 | 483.57 |
| 228 | 483.75 | 265.1 | 484 | 278.8 | 484.6 | 292.9 | 484 | 316 | 483.7 |
| 387.4 | 483.7 | 391.8 | 484 | 398.2 | 486 | 416.3 | 488 | 429.5 | 488.9 |
| 442.5 | 488 | 463.7 | 486 | 466 | 484 | 467.3 | 483.9 | 477.4 | 481.2 |
| 534 | 481.1 | 551.2 | 480.3 | 573 | 483.7 | 574.9 | 484 | 587.8 | 485.8 |

Manning's n Values num= 5

| Sta | n Val | Sta | n Val | Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0 | .06 | 188.26 | .035 | 228 | .06 | 477.4 | .04 | 551.2 | .06 |

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 188.26 | 228 | 144 | 140.57 | 237.47 | .1 | .3 |

Ineffective Flow num= 2

| Sta L | Sta R | Elev | Permanent |
|---|---|---|---|
| 278.8 | 429.5 | 484.6 | F |
| 429.5 | 587.8 | 485 | F |

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel US RS: 342.3

INPUT
Description: New NRCS
Station Elevation Data num= 33

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 500 | .3 | 489 | 21.4 | 488 | 25.1 | 486 | 27.1 | 484 |
| 29.2 | 483.7 | 40.5 | 481.5 | 49.5 | 480.7 | 74 | 482.3 | 114.1 | 482.9 |
| 140.4 | 482.5 | 148.97 | 482.11 | 150 | 481.08 | 168 | 480.58 | 176.97 | 480.83 |
| 179.8 | 480.7 | 221.7 | 481 | 240.4 | 482.2 | 252.2 | 482.4 | 253.6 | 483.8 |
| 290.2 | 485 | 314.8 | 484.6 | 315.6 | 482.8 | 329.7 | 481.1 | 350.8 | 479.9 |
| 371.1 | 480.4 | 381.2 | 481 | 397.8 | 483.7 | 399.9 | 484 | 401.7 | 486 |
| 410.3 | 488 | 418.5 | 490 | 420.1 | 492 | | | | |

Manning's n Values num= 5

| Sta | n Val | Sta | n Val | Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|---|---|---|---|
| 0 | .06 | 148.97 | .035 | 240.4 | .06 | 329.7 | .04 | 381.2 | .06 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 148.97 | 240.4 | 136 | 139.35 | 132 | .1 | .3 |

Ineffective Flow num= 1

| Sta L | Sta R | Elev | Permanent |
|---|---|---|---|
| 290.2 | 420.1 | 485 | F |

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel US RS: 342.2

INPUT
Description: New NRCS
Station Elevation Data num= 22

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| -42.6 | 497 | -42.1 | 486.9 | -33 | 487.3 | -28.2 | 486 | -25.1 | 484 |
| -21.4 | 483.7 | -19 | 481 | 37.2 | 480.4 | 78.1 | 481.8 | 102.5 | 480.6 |
| 107 | 480.59 | 125 | 480.09 | 143 | 480.59 | 144.45 | 482.04 | 147 | 482.1 |
| 171.5 | 481.3 | 187.4 | 481.6 | 192.2 | 484 | 195.8 | 486 | 205.2 | 488 |

```
   212.4     490   229.6     492

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
   -42.6     .06    78.1    .035  144.45     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          78.1  144.45               29   25.65      23             .3       .5
Ineffective Flow     num=       4
   Sta L   Sta R    Elev  Permanent
   -42.6    56.9   487.5       F
    56.9    78.1   482.5       F
     155   191.9   482.5       F
   191.9   205.2   487.5       F

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel US    RS: 342.1

INPUT
Description: HEMINWAY POND DAM (Updated by NRCS)
Station Elevation Data    num=      26
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0     497      .1   487.1     6.6   487.3      18   487.3    48.9   487.4
    51.4   487.5    74.8   487.5    74.9   483.5    75.7   483.5    75.7   482.5
   101.7   482.5   106.7   480.5   112.7     480   116.2     480   119.7     480
   125.7   480.5   130.7   482.5   156.7   482.5   156.7   483.5   157.5   483.5
   157.6   487.5   178.7   487.5   180.5   486.8     188     488   200.2     490
   220.8     492

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0     .02    74.8    .025   157.6     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          74.8   157.6               18   18.35      18             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel US    RS: 342.05

INPUT
Description: New NRCS
Station Elevation Data    num=      24
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    17.6     497    17.7   487.1    24.2   487.3    35.6   487.3    66.6   487.4
      69   487.5    74.8   487.5    75.6   483.7    80.6   481.6   100.6   481.5
```

```
   105.6   479.3     114   479.2   114.1     479   117.1     479   117.2   479.2
   125.6   479.3   130.6   481.5   152.6   481.6   157.4   483.7   157.4     486
   159.2     486   196.8     488   209.1     490   229.6     492

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    17.6     .02    74.8    .065   157.4     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          74.8   157.4                0       0       0             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Old Channel        RS: 7

INPUT
Description: Part of LS 342.65
Station Elevation Data    num=      13
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0   489.4    28.2   487.3    55.7   487.3    82.1     486   112.8   484.2
     133     486   136.8     488   140.6     490   144.6     492   148.9     494
   183.7     496   222.9     498   231.7     500

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
       0     .06    55.7     .06     133     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          55.7     133           83.01   100.8  117.99             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Old Channel        RS: 6

INPUT
Description:
Station Elevation Data    num=      20
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0   489.4     6.4     486    14.2     484    18.7     482    20.8   481.7
    36.1   481.7    36.3   485.2    41.7   485.3    50.3   484.5      57   482.5
    89.3   481.7     119     484   175.1     486   181.9     488     189     490
   196.3     492   203.1     494     209     496   223.9     498   269.1     500

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
       0     .06    20.8     .04    36.3     .05
```

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          14.2    36.3           125.98  106.48     101             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
     119   269.1   487.1       F
Right Levee     Station=    41.7      Elevation=   485.3

CROSS SECTION


RIVER: Steele Brook
REACH: Old Channel        RS: 5

INPUT
Description:
Station Elevation Data    num=      30
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0   490.1     5.3     488     8.7     486    13.2     484      25     483
    36.8   485.6    39.9   485.3    40.6     484    48.1   483.1    58.7     483
    58.8   481.4    75.6   481.4    75.7     485   104.6   481.6   111.4   481.4
   115.3   481.6   153.6   481.7   192.1   481.4   198.3   481.6     222     482
   226.3     484   230.5     486   234.8     488     239     490   243.3     492
   247.5     494   251.9     496   326.9     498   358.2     499   358.2     515

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
       0     .06    58.7     .03    75.7     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          39.9    75.7           130.35  127.83     126             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
   198.3   358.2   486.1       F
Right Levee     Station=    75.7      Elevation=     485

CROSS SECTION


RIVER: Steele Brook
REACH: Old Channel        RS: 4

INPUT
Description:
Station Elevation Data    num=      25
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0   486.3     4.6     484     7.1     482    11.2     481    27.5     481
    28.1   483.8    42.7   482.6    59.5   480.8    85.1     481    89.2   481.3
   130.9   481.3   173.7   481.3   176.9     482   184.8     482     196     484
   198.5     486   201.3     488   204.7     490   208.8     492   215.4     494
   232.9     496   280.9     498   316.3     498   342.4     498   345.7     500
```

```
Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
       0     .06    11.2     .03    28.1     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
           4.6    28.1            47.47   57.67      88             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
   173.7   345.7   485.1       F
Right Levee     Station=    28.1      Elevation=   483.8

CROSS SECTION


RIVER: Steele Brook
REACH: Old Channel         RS: 3

INPUT
Description:
Station Elevation Data    num=      18
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0   485.3    10.3   481.7    11.2   480.6    28.1   480.6    28.4   483.5
    32.9   483.2    38.5     483    51.2   480.5   379.2     482   388.2     484
   397.2     486   406.3     488   467.2     490   489.2     492   497.7     494
   506.7     496   515.3     498   524.2     500

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
       0     .06    11.2     .03    28.4     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          10.3    28.4               90   182.6     135             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
     250   524.2   487.1       F
Right Levee     Station=    28.4      Elevation=   483.5

CROSS SECTION


RIVER: Steele Brook
REACH: Old Channel         RS: 2

INPUT
Description:
Station Elevation Data    num=      30
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0     492    10.3     490    17.8     488    25.1     486    29.6     484
    31.8     482    34.1     480    36.4   479.8    36.6   479.6    49.3   479.6
    49.6   482.4    57.7     482    68.5     480    75.8   479.7   144.4     480
   266.7     480   352.9   479.9   398.2     480   518.7     482   528.3     484
```

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 535.1 | 485 | 550.6 | 486 | 601.8 | 488 | 626.8 | 489 | 635.1 | 490 |
| 638.5 | 492 | 641.8 | 494 | 645.2 | 496 | 648.6 | 498 | 677 | 500 |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 0 | .06 | 36.4 | .03 | 49.6 | .04 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 31.8 | 49.6 | 70 | 74.74 | 66 | .1 | .3 |

Ineffective Flow num= 1

| Sta L | Sta R | Elev | Permanent |
|---|---|---|---|
| 398.2 | 677 | 486.1 | F |

Right Levee Station= 49.6 Elevation= 482.4

CROSS SECTION

RIVER: Steele Brook
REACH: Old Channel RS: 1

INPUT
Description:
Station Elevation Data num= 26

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 487.5 | 2.6 | 486 | 4.5 | 484 | 6.2 | 482 | 7.9 | 480 |
| 12.4 | 478.9 | 26.1 | 478.9 | 26.2 | 481.8 | 32.2 | 482 | 36 | 482.1 |
| 44.8 | 480 | 54.5 | 479.4 | 194.2 | 480 | 253.5 | 480 | 322.4 | 479.8 |
| 389.8 | 480 | 537.4 | 482 | 547.5 | 484 | 571.5 | 486 | 635.8 | 488 |
| 660.7 | 490 | 665.9 | 492 | 670.7 | 494 | 675.4 | 496 | 688.5 | 498 |
| 710.8 | 500 | | | | | | | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 0 | .06 | 12.4 | .03 | 26.2 | .04 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 6.2 | 26.2 | 0 | 0 | 0 | .1 | .3 |

Ineffective Flow num= 1

| Sta L | Sta R | Elev | Permanent |
|---|---|---|---|
| 450 | 710.8 | 484.1 | F |

Right Levee Station= 36 Elevation= 482.1

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel DS RS: 341.2

INPUT
Description: Replaced by NRCS
Station Elevation Data num= 32

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|

```
********************************************************************************
       0   487.3      .3   480.6       5   478.6      20   478.5      25   476.6
    33.4   476.5    33.5     476    36.5     476    36.6   476.5      45   476.6
      50   478.5    51.1   478.5    52.1   481.7    52.3   481.7    60.8     480
      70   479.3   233.2     480   297.3     480   386.4     480   560.1     482
   570.8     484     578     485   597.3     486   639.9     487   660.3     488
   673.5     489   679.7     490   696.7     492   705.9     494   716.1     496
   727.2     498   749.4     500

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
       0     .05      .3    .065    52.1     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
             .3    52.1              109  109.82     109             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
     500   749.4   483.1       F
Right Levee     Station=    52.1      Elevation=   481.7
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
************************
   639.9   673.5   494.1

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 341.1

INPUT
Description: New NRCS
Station Elevation Data    num=      24
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0     490      .1   478.2     6.4   477.1      15   473.5      20   471.6
    28.4   471.5    28.5     471    31.5     471    31.6   471.5      40   471.6
      45   473.5    45.2   478.3      54   478.5   342.4     480   513.3     482
     558     484   596.2     486   625.3     488   650.9     490   676.4     492
     721     494   763.6     496   783.2     498   795.1     500

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
       0     .05      15    .065    45.2     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
             15    45.2               66   66.07      64             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
     475   795.1   482.6       F
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
************************
```

```
     736     762   509.1

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 341

INPUT
Description: UPDATED WITH MILONE & MACBROOM,ALSO INCREASED ROBL(shortened

ROBL, NRCS)
Station Elevation Data    num=      18
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     937   491.1     937   480.4     946   480.4     987   480.2    1000   474.6
    1002   473.7    1004   472.9    1006     472    1019   471.5    1023   470.7
    1031   471.4    1032     478    1132   478.3    1362   479.1    1484   481.1
    1544   483.7    1644   486.6    1704   491.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     937     .05    1002    .035    1032     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1002    1032               15      15      15             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 340.2

INPUT
Description: Data combined from 341 & 340 (NRCS)
 U/S FACE ECHO LAKE ROAD
             BRIDGE UPDATED DATA
Station Elevation Data    num=      13
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     937   491.1     937   480.4     946   480.4     987   480.2    1000   479.1
  1000.1   471.1    1030   471.1  1030.1   479.1    1362   479.1    1484   481.1
    1544   483.7    1644   486.6    1704   491.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     937     .05    1000     .03  1030.1     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1000  1030.1               40      40      40             .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
     937    1000   479.4       F
```

```
  1030.1    1704   479.4       F

BRIDGE


RIVER: Steele Brook
REACH: Main Channel DS    RS: 340.15

INPUT
Description: Echo Lake Road Bridge (NRCS Corrected Deck Width)

Distance from Upstream XS =      .1
Deck/Roadway Width        =    39.8
Weir Coefficient          =     2.5
Upstream  Deck/Roadway Coordinates
    num=       4
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*************************************************************************
    1000   479.4   477.6  1030.1   479.4   477.6  1030.1   479.4   471.1
    1500   479.4   471.1

Upstream Bridge Cross Section Data
Station Elevation Data    num=      13
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
     937   491.1     937   480.4     946   480.4     987   480.2    1000   479.4
  1000.1   471.1    1030   471.1  1030.1   479.1    1362   479.1    1484   481.1
    1544   483.7    1644   486.6    1704   491.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     937     .05    1000     .03  1030.1     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1000  1030.1             .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
     937    1000   479.4       F
  1030.1    1704   479.4       F

Downstream  Deck/Roadway Coordinates
    num=       4
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*************************************************************************
    1000   479.4   477.6  1030.1   479.4   477.6  1030.1   479.4   471.1
    1500   479.4   471.1

Downstream Bridge Cross Section Data
Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
    1000   499.1  1000.1   471.1    1030   471.1  1030.1   479.1    1230   479.4
  1230.1   478.9    1250   479.4    1270   478.9  1270.1   479.4    1300   480.4
    1500   483.1

Manning's n Values        num=       3
```

```
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .05    1000     .03  1030.1     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1000  1030.1             .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1000   499.1       F
  1030.1    1500   479.1       F

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins         =   479.4
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Energy

High Flow Method
       Pressure and Weir flow
           Submerged Inlet Cd          =
           Submerged Inlet + Outlet Cd =.8164966
           Max Low Cord                =   477.6

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 340.1

INPUT
Description: This is a REPEATED section.
 D/S FACE ECHO LAKE ROAD BRIDGE
            UPDATED DATA
Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   499.1  1000.1   471.1    1030   471.1  1030.1   479.1    1230   479.4
  1230.1   478.9    1250   479.4    1270   478.9  1270.1   479.4    1300   480.4
    1500   483.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
```

```
************************************************
    1000     .05    1000     .03  1030.1     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1000  1030.1                5       5       5             .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1000   499.1       F
  1030.1    1500   479.1       F

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 340

INPUT
Description: 97 LOMR AK
Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   499.1  1000.1   471.1    1030   471.1  1030.1   479.1    1230   479.4
  1230.1   478.9    1250   479.4    1270   478.9  1270.1   479.4    1300   480.4
    1500   483.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .05    1000     .03  1030.1     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1000  1030.1              210     210     210             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 339.6

INPUT
Description: 97 LOMR AJ - This is a REPEATED section.
 U/S FACE WALKWAY OVER
             BROOK UPDATED DATA
Station Elevation Data    num=      14
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   499.1  1000.1   470.3    1030   470.3  1030.1   477.1    1035   477.1
  1035.1   477.1    1045   477.1    1230   478.9  1230.1   478.4    1250   478.9
    1270   478.4  1270.1   478.9    1400   479.1    1700   483.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .05    1000     .03  1030.1     .05
```

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1000  1030.1             1.24    1.24    1.24             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 339.56

INPUT
Description: This is a REPEATED section (NRCS)
Station Elevation Data    num=      14
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   499.1  1000.1   470.3    1030   470.3  1030.1   477.1    1035   477.1
  1035.1   477.1    1045   477.1    1230   478.9  1230.1   478.4    1250   478.9
    1270   478.4  1270.1   478.9    1400   479.1    1700   483.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .05    1000     .03  1030.1     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1000  1030.1              7.7     7.7     7.7             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
    1035    1045   482.6       T

BRIDGE


RIVER: Steele Brook
REACH: Main Channel DS    RS: 339.55

INPUT
Description: Walkway Bridge
Distance from Upstream XS =      .1
Deck/Roadway Width        =     7.5
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=       5
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
************************************************************************
    1000   484.3   482.5  1030.1   482.7   480.8    1035   482.6   480.6
  1035.1   482.6   477.1    1045   482.6   477.1

Upstream Bridge Cross Section Data
Station Elevation Data    num=      14
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   499.1  1000.1   470.3    1030   470.3  1030.1   477.1    1035   477.1
  1035.1   477.1    1045   477.1    1230   478.9  1230.1   478.4    1250   478.9
    1270   478.4  1270.1   478.9    1400   479.1    1700   483.1
```

```
Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .05    1000     .03  1030.1     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1000  1030.1             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
    1035    1045   482.6       T

Downstream  Deck/Roadway Coordinates
    num=       5
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
************************************************************************
    1000   484.3   482.5  1030.1   482.7   480.8    1035   482.6   480.6
  1035.1   482.6   477.1    1045   482.6   477.1

Downstream Bridge Cross Section Data
Station Elevation Data    num=      14
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   499.1  1000.1   470.3    1030   470.3  1030.1   477.1    1035   477.1
  1035.1   477.1    1045   477.1    1230   478.9  1230.1   478.4    1250   478.9
    1270   478.4  1270.1   478.9    1400   479.1    1700   483.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .05    1000     .03  1030.1     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1000  1030.1             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
  1035.1    1045   479.9       T

Upstream Embankment side slope             =       0 horiz. to 1.0 vertical
Downstream Embankment side slope           =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins        =   482.7
Energy head used in spillway design        =
Spillway height used in design             =
Weir crest shape                           = Broad Crested

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Energy

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
```

```
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 339.51

INPUT
Description: This is a REPEATED section (NRCS)
Station Elevation Data    num=      14
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   499.1  1000.1   470.3    1030   470.3  1030.1   477.1    1035   477.1
  1035.1   477.1    1045   477.1    1230   478.9  1230.1   478.4    1250   478.9
    1270   478.4  1270.1   478.9    1400   479.1    1700   483.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .05    1000     .03  1030.1     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1000  1030.1              1.1     1.1     1.1             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
  1035.1    1045   479.9       T

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 339.5

INPUT
Description: 97 LOMR AI - D/S FACE WALKWAY OVER BROOK UPDATED DATA
Station Elevation Data    num=      14
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   499.1  1000.1   470.3    1030   470.3  1030.1   477.1    1035   477.1
  1035.1   477.1    1045   477.1    1230   478.9  1230.1   478.4    1250   478.9
    1270   478.4  1270.1   478.9    1400   479.1    1700   483.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .05    1000     .03  1030.1     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1000  1030.1           290.01  290.01  290.01             .1       .3

CROSS SECTION
```

```
RIVER: Steele Brook
REACH: Main Channel DS    RS: 339.1

INPUT
Description: Obstruction added by NRCS
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   499.1  1000.1   469.1    1030   469.1  1030.1   476.1    1195   477.8
  1195.1   477.3    1215   477.9    1235   477.3  1235.1   477.8    1260   479.1
    1450   481.1    1700   483.1

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .05    1000     .03  1030.1     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1000  1030.1              80      80      80             .1       .3
Blocked Obstructions     num=       2
   Sta L   Sta R    Elev   Sta L   Sta R    Elev
************************************************
    1228    1524   499.1    1622    1700   499.1

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 339

INPUT
Description: This is a REPEATED section. (Obstruction added by NRCS)
Station Elevation Data    num=      21
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     900   489.1    1000   483.1    1070   480.7    1124   480.7    1175   480.6
    1222   481.1    1320   478.1  1320.1   468.6    1350   468.6  1350.1   476.1
    1480   477.4  1480.1   476.9    1500   477.4    1520   476.9  1520.1   477.4
    1580   476.6    1635   477.1    1645   479.1    1740   479.1    1745   481.1
    1895   482.1

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     900     .05    1320     .03  1350.1     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1320  1350.1              28      28      28             .1       .3
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
************************
    1555    1759   499.1

CROSS SECTION
```

RIVER: Steele Brook
REACH: Main Channel DS RS: 338.2

INPUT
Description: This is a REPEATED section. (Obstruction added by NRCS)
U/S FACE
16" C.I. SAN. SEWER UPDATED DATA
Station Elevation Data num= 21

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 900 | 489.1 | 1000 | 483.1 | 1070 | 480.7 | 1124 | 480.7 | 1175 | 480.6 |
| 1222 | 481.1 | 1320 | 478.1 | 1320.1 | 468.6 | 1350 | 468.6 | 1350.1 | 476.1 |
| 1480 | 477.4 | 1480.1 | 476.9 | 1500 | 477.4 | 1520 | 476.9 | 1520.1 | 477.4 |
| 1580 | 476.6 | 1635 | 477.1 | 1645 | 479.1 | 1740 | 479.1 | 1745 | 481.1 |
| 1895 | 482.1 | | | | | | | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 900 | .05 | 1320 | .03 | 1350.1 | .05 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 1320 | 1350.1 | 2 | 2 | 2 | .1 | .3 |

Blocked Obstructions num= 1

| Sta L | Sta R | Elev |
|---|---|---|
| 1535 | 1745 | 499.1 |

BRIDGE

RIVER: Steele Brook
REACH: Main Channel DS RS: 338.15

INPUT
Description: 16-inch Pipe
Distance from Upstream XS = .1
Deck/Roadway Width = 1.8
Weir Coefficient = 2.5
Upstream Deck/Roadway Coordinates
num= 6

| Sta | Hi Cord | Lo Cord | Sta | Hi Cord | Lo Cord | Sta | Hi Cord | Lo Cord |
|---|---|---|---|---|---|---|---|---|
| 900 | 473.5 | 468.6 | 1320 | 473.5 | 468.6 | 1320 | 473.5 | 472 |
| 1350.1 | 473.5 | 472 | 1350.1 | 473.5 | 468.6 | 1895 | 473.5 | 468.6 |

Upstream Bridge Cross Section Data
Station Elevation Data num= 21

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 900 | 489.1 | 1000 | 483.1 | 1070 | 480.7 | 1124 | 480.7 | 1175 | 480.6 |
| 1222 | 481.1 | 1320 | 478.1 | 1320.1 | 468.6 | 1350 | 468.6 | 1350.1 | 476.1 |
| 1480 | 477.4 | 1480.1 | 476.9 | 1500 | 477.4 | 1520 | 476.9 | 1520.1 | 477.4 |
| 1580 | 476.6 | 1635 | 477.1 | 1645 | 479.1 | 1740 | 479.1 | 1745 | 481.1 |

```
    1895   482.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     900     .05    1320     .03  1350.1     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1320  1350.1             .1       .3
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
************************
    1535    1745   499.1

Downstream  Deck/Roadway Coordinates
    num=       6
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
************************************************************************
     900   473.5   468.6    1320   473.5   468.6    1320   473.5     472
  1350.1   473.5     472  1350.1   473.5   468.6    1895   473.5   468.6

Downstream Bridge Cross Section Data
Station Elevation Data    num=      21
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     900   489.1    1000   483.1    1070   480.7    1124   480.7    1175   480.6
    1222   481.1    1320   478.1  1320.1   468.6    1350   468.6  1350.1   476.1
    1480   477.4  1480.1   476.9    1500   477.4    1520   476.9  1520.1   477.4
    1580   476.6    1635   477.1    1645   479.1    1740   479.1    1745   481.1
    1895   482.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     900     .05    1320     .03  1350.1     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1320  1350.1             .1       .3
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
************************
    1535    1745   499.1

Upstream Embankment side slope             =       0 horiz. to 1.0 vertical
Downstream Embankment side slope           =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins        =   473.5
Energy head used in spillway design        =
Spillway height used in design             =
Weir crest shape                           = Broad Crested

Number of Piers =  2

Pier Data
Pier Station     Upstream=    1330    Downstream=    1330
Upstream     num=       2
    Width   Elev    Width   Elev
```

```
********************************
     1.5   468.6     1.5     472
Downstream     num=       2
    Width   Elev    Width   Elev
********************************
     1.5   468.6     1.5     472

Pier Data
Pier Station     Upstream=    1340    Downstream=    1340
Upstream     num=       2
    Width   Elev    Width   Elev
********************************
     1.5   468.6     1.5     472
Downstream     num=       2
    Width   Elev    Width   Elev
********************************
     1.5   468.6     1.5     472

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Yarnell                KVal =     1.2
Selected Low Flow Methods = Yarnell

High Flow Method
       Pressure and Weir flow
           Submerged Inlet Cd          =
           Submerged Inlet + Outlet Cd =.8164966
           Max Low Cord                =     472

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 338.1

INPUT
Description: D/S FACE 16" C.I. SAN. SEWER UPDATED DATA Obstruction added by NRCS
Station Elevation Data    num=      21
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     900   489.1    1000   483.1    1070   480.7    1124   480.7    1175   480.6
    1222   481.1    1320   478.1  1320.1   468.6    1350   468.6  1350.1   476.1
    1480   477.4  1480.1   476.9    1500   477.4    1520   476.9  1520.1   477.4
    1580   476.6    1635   477.1    1645   479.1    1740   479.1    1745   481.1
    1895   482.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
```

```
     900     .05    1320     .03  1350.1     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1320  1350.1              30      30      30             .1       .3
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
************************
    1535    1745   499.1

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 337

INPUT
Description: 97 LOMR AH (Obstruction added by NRCS)
Station Elevation Data    num=      21
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     900   489.1    1000   483.1    1070   480.7    1124   480.7    1175   480.6
    1222   481.1    1319   478.1  1319.1   468.6    1350   468.6  1350.1   476.6
    1470   477.1  1470.1   476.6    1490   477.1    1510   476.6  1510.1   477.1
    1580   476.1    1635   477.1    1640   479.1    1740   479.1    1745   481.1
    1895   482.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     900     .05    1319     .03  1350.1     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1319  1350.1              40      40      40             .1       .3
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
************************
    1528    1745   499.1

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 336.2

INPUT
Description: This is a REPEATED section.
 U/S PROPOSED BOX CULVERT BRIDGE
Station Elevation Data    num=      19
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     620   489.1     720   481.6     779   480.6     828   480.6     940   479.1
     980   479.3   980.1   467.6  1009.9   467.6    1010   479.3    1143   476.1
    1160   476.8    1183   476.3  1183.1   476.8    1215   475.1    1390   475.1
    1420   479.1    1460   481.1    1545   482.1    1765   483.1
```

```
Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
     620     .05     980    .025    1010     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
            980    1010               38      38      38              .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
    1010    1765   476.6       F
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
************************
    1508    1659   494.1

BRIDGE


RIVER: Steele Brook
REACH: Main Channel DS    RS: 336.15

INPUT
Description: Parking Lot Bridge (Updated by NRCS)
Distance from Upstream XS =      .1
Deck/Roadway Width        =    37.8
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=      19
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
***********************************************************************
     620   489.1   489.1     720   481.6   481.6     779   480.6   480.6
     828   480.6   480.6     940   479.1   479.1     980   479.3   479.3
   980.1   479.3   477.6  1009.9   479.3   477.6    1010   479.3   479.3
    1143   476.1   476.1    1160   476.8   476.8    1183   476.3   476.3
  1183.1   476.8   476.8    1215   475.1   475.1    1390   475.1   475.1
    1420   479.1   479.1    1460   481.1   481.1    1545   482.1   482.1
    1765   483.1   483.1

Upstream Bridge Cross Section Data
Station Elevation Data    num=      19
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     620   489.1     720   481.6     779   480.6     828   480.6     940   479.1
     980   479.3   980.1   467.6  1009.9   467.6    1010   479.3    1143   476.1
    1160   476.8    1183   476.3  1183.1   476.8    1215   475.1    1390   475.1
    1420   479.1    1460   481.1    1545   482.1    1765   483.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
     620     .05     980    .025    1010     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
            980    1010             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
```

```
    1010    1765   476.6       F
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
************************
    1508    1659   494.1

Downstream  Deck/Roadway Coordinates
    num=      19
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
********************************************************************
     620   489.1   489.1     720   481.6   481.6     779   480.6   480.6
     828   480.6   480.6     940   479.1   479.1     980   479.3   479.3
   980.1   479.3   477.6  1009.9   479.3   477.6    1010   479.3   479.3
    1143   476.1   476.1    1160   476.8   476.8    1183   476.3   476.3
  1183.1   476.8   476.8    1215   475.1   475.1    1390   475.1   475.1
    1420   479.1   479.1    1460   481.1   481.1    1545   482.1   482.1
    1765   483.1   483.1

Downstream Bridge Cross Section Data
Station Elevation Data    num=      19
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     620   489.1     720   481.6     779   480.6     828   480.6     940   479.1
     980   479.3   980.1   467.6  1009.9   467.6    1010   479.3    1143   476.1
    1160   476.8    1183   476.3  1183.1   476.8    1215   475.1    1390   475.1
    1420   479.1    1460   481.1    1545   482.1    1765   483.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     620     .05     980    .025    1010     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
          980    1010             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
    1010    1765   476.6       F
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
************************
    1508    1659   494.1

Upstream Embankment side slope             =       0 horiz. to 1.0 vertical
Downstream Embankment side slope           =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins        =     476
Energy head used in spillway design        =
Spillway height used in design             =
Weir crest shape                           = Broad Crested

Number of Piers =  2

Pier Data
Pier Station     Upstream=     990    Downstream=     990
Upstream     num=       2
    Width   Elev    Width   Elev
********************************
```

```
     1.5   467.6     1.5   477.6
Downstream     num=       2
    Width   Elev    Width   Elev
********************************
     1.5   467.6     1.5   477.6

Pier Data
Pier Station     Upstream=    1000    Downstream=    1000
Upstream     num=       2
    Width   Elev    Width   Elev
********************************
     1.5   467.6     1.5   477.6
Downstream     num=       2
    Width   Elev    Width   Elev
********************************
     1.5   467.6     1.5   477.6

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Yarnell                KVal =      .9
Selected Low Flow Methods = Yarnell

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 336.1

INPUT
Description: D/S PROPOSED BOX CULVERT BRIDGE
Station Elevation Data    num=      19
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     620   489.1     720   481.6     779   480.6     828   480.6     940   479.1
     980   479.3   980.1   467.6  1009.9   467.6    1010   479.3    1143   476.1
    1160   476.8    1183   476.3  1183.1   476.8    1215   475.1    1390   475.1
    1420   479.1    1460   481.1    1545   482.1    1765   483.1

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     620     .05     980    .025    1010     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
           980    1010               35      30      25             .1       .3
```

Ineffective Flow num= 1

| Sta L | Sta R | Elev | Permanent |
|---|---|---|---|
| 1010 | 1765 | 476.6 | F |

Blocked Obstructions num= 1

| Sta L | Sta R | Elev |
|---|---|---|
| 1508 | 1659 | 494.1 |

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel DS RS: 336

INPUT
Description: 97 LOMR AG
Station Elevation Data num= 23

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 850 | 489.1 | 1000 | 481.6 | 1059 | 480.6 | 1108 | 480.6 | 1189 | 478.6 |
| 1255 | 475.1 | 1265 | 469.1 | 1280 | 467.4 | 1290 | 468.1 | 1295 | 471.1 |
| 1320 | 475.1 | 1355 | 477.1 | 1380 | 477.1 | 1430 | 476.6 | 1430.1 | 476.1 |
| 1450 | 476.6 | 1470 | 476.1 | 1470.1 | 476.6 | 1500 | 476.1 | 1660 | 476.1 |
| 1695 | 479.1 | 1780 | 481.1 | 1875 | 481.1 | | | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 850 | .07 | 1265 | .04 | 1290 | .07 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 1265 | 1290 | 530 | 420 | 300 | .1 | .3 |

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel DS RS: 335

INPUT
Description: 97 LOMR AF
Station Elevation Data num= 18

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 1000 | 480 | 1055 | 477.1 | 1170 | 473.1 | 1183 | 468.1 | 1198 | 467.1 |
| 1225 | 468.6 | 1230 | 471.1 | 1300 | 473.1 | 1385 | 473.1 | 1400 | 475.1 |
| 1440 | 476.1 | 1470 | 478.1 | 1470.1 | 477.6 | 1505 | 478.2 | 1540 | 477.8 |
| 1540.1 | 478.3 | 1560 | 479.1 | 1650 | 482.1 | | | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 1000 | .07 | 1183 | .04 | 1225 | .07 |

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr.
Expan.

```
         1183    1225              500     610     600             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 334

INPUT
Description: 97 LOMR AE
Station Elevation Data    num=      19
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     999   489.1    1000   475.1    1105   475.1    1160   473.1    1200   475.1
    1218   477.1    1253   475.7    1290   465.1    1293   464.8    1308   464.8
    1310   465.1    1319   469.1    1408   471.1    1415   473.1    1465   475.1
    1480   477.6    1540   479.1    1590   486.1    1650   499.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     999     .07    1253     .04    1319     .07

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
         1253    1319              350     320     300             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 333

INPUT
Description: 97 LOMR AD
Station Elevation Data    num=      17
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   477.1    1070   473.1    1100   474.6    1160   475.1    1195   474.6
    1235   465.1    1237   464.1    1247   464.1    1250   465.1    1305   473.6
    1355   472.1    1425   475.1    1485   480.1    1550   493.1    1610   503.1
    1715   511.1    1793   515.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .07    1195     .04    1305     .07

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
         1195    1305               15      15      15             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 332.2
```

```
INPUT
Description: U/S FACE NEW FRENCH STREET BRIDGE
Station Elevation Data    num=       8
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   479.1    1230   475.6  1230.1   464.1    1260   463.7  1260.1   475.8
    1290   476.5    1370   477.1    1450   479.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .04    1230    .025  1260.1     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1230  1260.1               60      60      60             .1       .3

BRIDGE


RIVER: Steele Brook
REACH: Main Channel DS    RS: 332.15

INPUT
Description: French Street Bridge
Distance from Upstream XS =      .1
Deck/Roadway Width        =    59.8
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=       2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
************************************************
    1000   475.6   473.5    1450   475.6   473.5

Upstream Bridge Cross Section Data
Station Elevation Data    num=       8
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   479.1    1230   475.6  1230.1   464.1    1260   463.7  1260.1   475.8
    1290   476.5    1370   477.1    1450   479.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .04    1230    .025  1260.1     .04

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1230  1260.1             .1       .3

Downstream  Deck/Roadway Coordinates
    num=       2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
************************************************
    1000   475.6   473.5    1450   475.6   473.5

Downstream Bridge Cross Section Data
```

```
Station Elevation Data    num=       8
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   479.1    1230   475.6  1230.1   463.2    1260   462.6  1260.1   475.8
    1290   476.5    1370   477.1    1450   479.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .04    1230    .025  1260.1     .04

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1230  1260.1             .1       .3

Upstream Embankment side slope            =       0 horiz. to 1.0 vertical
Downstream Embankment side slope          =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins       =   475.6
Energy head used in spillway design       =
Spillway height used in design            =
Weir crest shape                          = Broad Crested

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Energy

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 332.1

INPUT
Description: D/S FACE NEW FRENCH STREET BRIDGE
Station Elevation Data    num=       8
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   479.1    1230   475.6  1230.1   463.2    1260   462.6  1260.1   475.8
    1290   476.5    1370   477.1    1450   479.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .04    1230    .025  1260.1     .04
```

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1230  1260.1              15      15      15            .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 332

INPUT
Description: FEMA AC
Station Elevation Data    num=      18
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   491.6    1049   487.1    1105   478.6    1175   475.6    1235   473.1
    1260   464.6    1265   462.6    1275   462.6    1278   464.6    1293   472.1
    1338   475.1    1380   473.6    1430   474.6    1485   478.1    1540   485.1
    1650   500.6    1723   511.7    1800   515.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1235    .035    1293    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1235    1293             250     340     350            .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 331

INPUT
Description: FEMA AB
Station Elevation Data    num=      19
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   492.6    1073   487.6    1129   488.1    1175   486.6    1225   480.6
    1285   471.6    1315   471.6    1350   462.1    1355   461.1    1385   461.1
    1390   462.1    1400   465.1    1465   470.1    1521   472.1    1608   476.6
    1665   487.1    1720   500.1    1773   500.1    1830   502.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1315    .035    1400    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1315    1400             450     520     650            .1       .3

CROSS SECTION
```

```
RIVER: Steele Brook
REACH: Main Channel DS    RS: 330

INPUT
Description: FEMA AA
Station Elevation Data    num=      20
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   487.1    1050   481.1    1096   476.1    1149   470.1    1221   467.6
    1260   468.6    1280   460.6    1285   460.1    1300   460.1    1307   460.6
    1320   462.1    1354   463.7    1420   468.1    1473   468.7    1525   470.1
    1585   472.1    1640   472.6    1690   473.1    1770   480.1    1804   481.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1260    .035    1354    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1260    1354             350     400     400             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 329

INPUT
Description: FEMA Z
Station Elevation Data    num=      20
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   482.1    1025   478.1    1060   473.1    1090   468.1    1180   463.6
    1245   467.1    1269   458.7    1270   457.8    1285   457.8    1289   458.7
    1340   464.6    1390   465.1    1450   463.6    1530   465.1    1605   466.6
    1670   468.6    1711   472.6    1771   478.6    1790   488.6    1860   486.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1245    .035    1340    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1245    1340             950    1010    1000             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 328

INPUT
Description: FEMA Y
Station Elevation Data    num=      20
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
```

```
********************************************************************************
    1000   476.6    1035   473.6    1105   466.1    1141   463.1    1179   466.1
    1210   456.1    1212   455.1    1230   455.1    1232   456.1    1245   465.6
    1290   460.6    1360   461.6    1460   464.6    1538   459.1    1620   458.6
    1687   460.6    1730   463.1    1810   466.6    1879   477.1    1915   478.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1179    .035    1245    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1179    1245              200     200     150             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 327

INPUT
Description: FEMA X
Station Elevation Data    num=      22
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   476.1    1045   468.1    1080   465.1    1155   462.1    1180   462.1
    1190   453.7    1195   452.9    1210   452.9    1213   453.7    1235   465.1
    1264   460.1    1380   460.1    1468   460.1    1549   460.1    1610   460.6
    1660   461.1    1715   461.1    1810   467.1    1869   481.1    1880   480.1
    1918   482.1    1940   481.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1180    .035    1235    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1180    1235              700     740     800             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 326

INPUT
Description: FEMA W
Station Elevation Data    num=      25
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   470.7    1050   467.1    1100   462.1    1180   457.1    1255   457.7
    1270   452.1    1275   451.5    1290   451.5    1295   452.1    1328   458.7
    1371   456.7    1440   456.7    1470   451.1    1540   457.6    1595   458.1
    1673   460.7    1721   461.1    1762   463.1    1805   467.6    1857   470.1
    1894   470.1    1948   470.6    1980   469.6    2023   479.6    2046   479.1
```

```
Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1255    .035    1328    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1255    1328              490     500     520             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 325

INPUT
Description: FEMA V
Station Elevation Data    num=      15
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     910   469.1     920   464.1    1000   463.1    1075   458.6    1105   451.6
    1110   451.1    1135   451.1    1140   451.6    1205   456.6    1264   456.1
    1320   473.6    1365   476.1    1430   480.1    1499   480.1    1535   479.6

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     910    .075    1075    .035    1205    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1075    1205               40      40      40             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 324.2

INPUT
Description: This is a REPEATED section.
 U/S FACE BRIDGE TO SEWAGE TREATMENT
             PLANT

Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   494.1    1085   466.1    1150   461.1    1200   459.1    1202   454.1
    1205     451    1225     451    1230   454.1    1232   459.1    1252   454.1
    1390   457.1    1460   471.1

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1200    .035    1232    .075
```

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1200    1232              20      20      20             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1200   460.9       F
    1232    1460   460.9       F

BRIDGE


RIVER: Steele Brook
REACH: Main Channel DS    RS: 324.15

INPUT
Description: Treatment Plant Bridge

Distance from Upstream XS =      .1
Deck/Roadway Width        =    19.8
Weir Coefficient          =     2.5
Upstream  Deck/Roadway Coordinates
    num=      13
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*********************************************************************
    1000   494.1     -.9    1085   466.1     -.9    1150   461.1     -.9
    1200   460.9   459.2    1202   460.9   459.2    1205   460.9   459.2
    1225   460.9   459.2    1230   460.9   459.2    1232   460.9   459.1
    1252   459.1   454.1    1390   457.1     -.9    1460   471.1     -.9
    1460   471.1     -.9

Upstream Bridge Cross Section Data
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*****************************************************************************
    1000   494.1    1085   466.1    1150   461.1    1200   459.1    1202   454.1
    1205     451    1225     451    1230   454.1    1232   459.1    1252   454.1
    1390   457.1    1460   471.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
**********************************************
    1000    .075    1200    .035    1232    .075

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1200    1232            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1200   460.9       F
    1232    1460   460.9       F

Downstream  Deck/Roadway Coordinates
    num=      13
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*********************************************************************
    1000   494.1     -.9    1085   466.1     -.9    1150   461.1     -.9
    1200   460.9   459.2    1202   460.9   459.2    1205   460.9   459.2
    1225   460.9   459.2    1230   460.9   459.2    1232   460.9   459.1
```

```
    1252   459.1   454.1    1390   457.1     -.9    1460   471.1     -.9
    1460   471.1     -.9

Downstream Bridge Cross Section Data
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   494.1    1085   466.1    1150   461.1    1200   459.1    1202   454.1
    1205     451    1225     451    1230   454.1    1232   459.1    1252   454.1
    1390   457.1    1460   471.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1200    .035    1232    .075

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1200    1232             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1200   459.2       F
    1232    1460   459.2       F

Upstream Embankment side slope             =       0 horiz. to 1.0 vertical
Downstream Embankment side slope           =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins        =   460.9
Energy head used in spillway design        =
Spillway height used in design             =
Weir crest shape                           = Broad Crested

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Energy

High Flow Method
       Pressure and Weir flow
           Submerged Inlet Cd          =
           Submerged Inlet + Outlet Cd =.8164966
           Max Low Cord                =   459.2

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 324.1

INPUT
```

```
Description:  D/S FACE BRIDGE TO SEWAGE TREATMENT PLANT

Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   494.1    1085   466.1    1150   461.1    1200   459.1    1202   454.1
    1205     451    1225     451    1230   454.1    1232   459.1    1252   454.1
    1390   457.1    1460   471.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1200    .035    1232    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1200    1232              40      40      40             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1200   459.2       F
    1232    1460   459.2       F

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 324

INPUT
Description: FEMA U
Station Elevation Data    num=      14
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   474.6    1077   463.6    1129   460.1    1160   451.6    1162   450.9
    1188   450.9    1190   451.6    1250   461.1    1288   458.1    1325   457.1
    1390   476.7    1422   478.1    1510   478.9    1555   478.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1129    .035    1250    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1129    1250             320     380     350             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 323

INPUT
Description: FEMA T
Station Elevation Data    num=      16
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
```

```
    1000   510.6    1085   488.6    1143   486.1    1190   485.1    1230   478.7
    1255   476.1    1310   467.6    1320   461.1    1345   450.1    1350   449.1
    1365   449.1    1370   450.1    1389   456.1    1480   476.1    1520   475.1
    1562   474.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1310    .035    1480    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1310    1480              440     480     520             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 322

INPUT
Description: FEMA S
Station Elevation Data    num=      15
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     999   469.1    1000   451.6    1055   451.1    1115   451.6    1150   450.1
    1180   449.3    1198   456.1    1225   445.1    1230   442.1    1250   442.1
    1254   445.1    1272   453.1    1300   450.1    1340   458.6    1435   467.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     999    .075    1198    .035    1272    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1198    1272              440     460     500             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 321.1

INPUT
Description:  SEYMOUR AND SMITH CO.

Station Elevation Data    num=       9
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   453.1    1015   450.1    1036   448.7    1037   444.5    1052   443.1
    1105   442.5    1107   446.8    1135   448.1    1150   452.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1036    .035    1107    .075
```

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1036    1107               40      40      40             .1       .3
```

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel DS    RS: 321

INPUT
Description: FEMA R

```
Station Elevation Data    num=      10
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   449.6    1045   448.1    1095   456.1    1170   433.1    1180   425.6
    1210   425.6    1215   433.1    1260   448.1    1285   447.1    1304   447.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1095    .035    1260    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1095    1260              130     130     130             .1       .3
```

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel DS    RS: 320

INPUT
Description: FEMA Q

```
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   476.1    1070   465.1    1110   461.6    1157   450.1    1200   436.1
    1230   427.1    1235   421.1    1255   421.1    1260   427.1    1280   440.1
    1305   443.1    1323   442.7

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1157    .035    1280    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1157    1280              340     340     340             .1       .3
```

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel DS    RS: 319

```
INPUT
Description: FEMA P
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   465.1    1040   449.6    1088   441.6    1150   436.4    1195   435.1
    1225   433.1    1250   422.1    1255   417.6    1264   417.6    1265   422.1
    1345   432.6    1410   434.3

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1225    .035    1345    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1225    1345              500     380     200             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 318

INPUT
Description: FEMA O
Station Elevation Data    num=      21
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   483.1    1040   482.1    1088   473.1    1115   468.1    1144   462.6
    1180   452.1    1213   443.6    1250   430.9    1279   437.6    1315   418.1
    1320   414.1    1330   414.1    1333   418.1    1395   426.6    1495   425.4
    1563   426.1    1619   427.1    1650   427.6    1675   428.1    1780   432.1
    1820   427.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1279    .035    1395    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1279    1395              200     180     150             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 317

INPUT
Description: FEMA N
Station Elevation Data    num=      21
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   451.6    1060   444.6    1130   441.1    1192   436.1    1220   430.1
```

```
    1255   419.6    1285   422.6    1313   413.6    1315   410.6    1330   410.6
    1335   413.6    1354   420.1    1380   421.6    1425   421.1    1490   422.1
    1515   422.1    1570   423.1    1685   424.3    1730   426.6    1780   427.4
    1820   427.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1285    .035    1354    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1285    1354              400     370     300             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 316

INPUT
Description: FEMA M
Station Elevation Data    num=      16
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   441.1    1035   435.1    1084   430.1    1143   426.7    1168   424.3
    1200   408.1    1208   404.4    1220   404.4    1228   408.1    1270   416.6
    1330   414.6    1410   414.3    1461   416.1    1516   417.1    1588   420.1
    1665   426.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1168    .035    1270    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1168    1270              650     620     600             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 315

INPUT
Description: FEMA L
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   420.1    1038   415.6    1097   416.1    1136   400.1    1137   398.1
    1155   398.1    1156   400.1    1193   406.1    1263   407.1    1327   407.6
    1365   409.6    1448   419.4

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
```

```
    1000    .075    1097    .035    1193    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1097    1193              600     620     650             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 314

INPUT
Description: FEMA K
Station Elevation Data    num=      10
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   407.6    1040   406.6    1085   406.1    1090     391    1160     391
    1163   394.6    1182   394.6    1222   398.1    1311   404.4    1345   404.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1085    .035    1311    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1085    1311              600     490     450             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 313

INPUT
Description: FEMA J
Station Elevation Data    num=      18
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   420.9    1055   418.6    1148   412.6    1225   409.1    1288   407.6
    1385   395.6    1420   395.6    1428   388.6    1429     387    1456     387
    1457   388.6    1552   395.1    1609   395.1    1698   395.1    1770   396.6
    1871   397.6    2010   399.6    2060   405.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1420    .035    1552    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1420    1552              400     150       1             .1       .3

CROSS SECTION
```

```
RIVER: Steele Brook
REACH: Main Channel DS    RS: 312.2

INPUT
Description: This is a REPEATED section.
 U/S FACE RTE 73 BRIDGE

Station Elevation Data    num=      17
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000     394    1002   384.1  1013.5     385    1014     391    1016     391
    1017     385    1030   385.9    1031     391    1032     391    1033   385.9
    1047   386.9    1048     391    1050     391    1051   386.9    1065   387.9
    1066     391    1070     394

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1000    .035    1070    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1000    1070                70      70      70              .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1000     394       F
    1070    1070     394       F

BRIDGE


RIVER: Steele Brook
REACH: Main Channel DS    RS: 312.15

INPUT
Description: Main Street Bridge

Distance from Upstream XS =      .1
Deck/Roadway Width        =    69.8
Weir Coefficient          =     2.5
Upstream  Deck/Roadway Coordinates
    num=       2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
************************************************
    1000     394     391    1070     394     391

Upstream Bridge Cross Section Data
Station Elevation Data    num=      17
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000     394    1002   384.1  1013.5     385    1014     391    1016     391
    1017     385    1030   385.9    1031     391    1032     391    1033   385.9
    1047   386.9    1048     391    1050     391    1051   386.9    1065   387.9
    1066     391    1070     394

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
```

```
************************************************
    1000    .075    1000    .035    1070    .075

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1000    1070             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1000     394       F
    1070    1070     394       F

Downstream  Deck/Roadway Coordinates
    num=       2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
************************************************
    1000     394     391    1070     394     391

Downstream Bridge Cross Section Data
Station Elevation Data    num=      17
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000     394    1002   384.1  1013.5     385    1014     391    1016     391
    1017     385    1030   385.9    1031     391    1032     391    1033   385.9
    1047   386.9    1048     391    1050     391    1051   386.9    1065   387.9
    1066     391    1070     394

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1000    .035    1070    .075

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1000    1070             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1000     391       F
    1070    1070     391       F

Upstream Embankment side slope             =       0 horiz. to 1.0 vertical
Downstream Embankment side slope           =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins        =     394
Energy head used in spillway design        =
Spillway height used in design             =
Weir crest shape                           = Broad Crested

Number of Piers =  1

Pier Data
Pier Station     Upstream=    1035    Downstream=    1035
Upstream     num=       2
    Width   Elev    Width   Elev
********************************
     7.5   384.1     7.5     391
Downstream     num=       2
    Width   Elev    Width   Elev
********************************
     7.5   384.1     7.5     391
```

```
Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Yarnell                KVal =     1.3
Selected Low Flow Methods = Yarnell

High Flow Method
       Pressure and Weir flow
           Submerged Inlet Cd          =
           Submerged Inlet + Outlet Cd =.8164966
           Max Low Cord                =     391

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 312.1

INPUT
Description:  D/S FACE RTE 73 BRIDGE

Station Elevation Data    num=      17
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000     394    1002   384.1  1013.5     385    1014     391    1016     391
    1017     385    1030   385.9    1031     391    1032     391    1033   385.9
    1047   386.9    1048     391    1050     391    1051   386.9    1065   387.9
    1066     391    1070     394

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1000    .035    1070    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1000    1070              30      30      30             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1000     391       F
    1070    1070     391       F

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 312

INPUT
```

Description: FEMA I
Station Elevation Data num= 8

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 1000 | 399.4 | 1055 | 398.1 | 1115 | 387.6 | 1130 | 384 | 1200 | 384 |
| 1205 | 387.6 | 1310 | 395.1 | 1425 | 395.1 | | | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 1000 | .075 | 1055 | .035 | 1310 | .075 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 1055 | 1310 | 1 | 140 | 250 | .3 | .5 |

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel DS RS: 311

INPUT
Description: FEMA H
Station Elevation Data num= 14

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 1000 | 399.4 | 1035 | 399.4 | 1060 | 399.1 | 1090 | 387.6 | 1100 | 383.8 |
| 1135 | 383.8 | 1140 | 387.6 | 1195 | 391.6 | 1255 | 391.6 | 1350 | 392.6 |
| 1412 | 392.1 | 1485 | 392.1 | 1545 | 396.1 | 1630 | 397.6 | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 1000 | .06 | 1060 | .03 | 1195 | .06 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 1060 | 1195 | 180 | 150 | 150 | .1 | .3 |

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel DS RS: 310

INPUT
Description: FEMA G
Station Elevation Data num= 16

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 1000 | 401.9 | 1030 | 401.9 | 1090 | 401.1 | 1130 | 386.6 | 1135 | 383.6 |
| 1175 | 383.6 | 1180 | 386.6 | 1240 | 390.1 | 1318 | 391.6 | 1407 | 391.6 |
| 1495 | 392.1 | 1583 | 391.6 | 1670 | 394.1 | 1745 | 394.8 | 1815 | 394.6 |
| 1890 | 396.1 | | | | | | | | |

Manning's n Values num= 3

```
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1090     .03    1240     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1090    1240              100     130     200             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 309

INPUT
Description: FEMA F
Station Elevation Data    num=      10
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   401.6    1030   401.6    1079   402.1    1140   386.6    1145   382.6
    1525   382.6    1540   386.6    1585   391.6    1654   395.6    1725   403.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1079     .03    1585     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1079    1585              450     500     530             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 308

INPUT
Description: FEMA E
Station Elevation Data    num=       9
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   399.6    1035   399.6    1075   386.6    1110   376.1    1435   376.1
    1480   386.6    1505   392.6    1557   394.8    1600     397

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1035     .03    1505     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1035    1505               50      50      50             .1       .3

CROSS SECTION
```

RIVER: Steele Brook
REACH: Main Channel DS RS: 307.1

INPUT
Description: PIN SHOP DAM

Station Elevation Data num= 9

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 1000 | 391.1 | 1025 | 390.4 | 1026 | 388.9 | 1043 | 388.4 | 1044 | 385.4 |
| 1146 | 385.4 | 1147 | 390.1 | 1480 | 390.5 | 1510 | 391.1 | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 1000 | .06 | 1043 | .03 | 1147 | .06 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 1043 | 1147 | 30 | 30 | 30 | .1 | .3 |

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel DS RS: 307

INPUT
Description: FEMA D
Station Elevation Data num= 10

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 1000 | 400.1 | 1040 | 400.1 | 1090 | 393.6 | 1135 | 375.1 | 1225 | 375.1 |
| 1278 | 382.6 | 1365 | 383.6 | 1450 | 384.1 | 1525 | 387.6 | 1595 | 396.6 |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 1000 | .06 | 1090 | .03 | 1278 | .06 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 1090 | 1278 | 490 | 520 | 570 | .1 | .3 |

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel DS RS: 305

INPUT
Description: FEMA C
Station Elevation Data num= 12

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 999 | 379.1 | 1000 | 368.6 | 1040 | 369.6 | 1115 | 370.6 | 1240 | 370.6 |
| 1310 | 359.1 | 1320 | 354.1 | 1330 | 354.1 | 1340 | 359.1 | 1377 | 368.6 |

```
    1410   372.6    1460   382.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     999     .06    1240     .03    1377     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1240    1377               40      40      40             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 304.2

INPUT
Description: This is a REPEATED section.
 U/S PARKING LOT BRIDGE

Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   379.1    1001   368.3    1004   364.7    1005   361.1    1018   353.7
    1028   353.8    1045   364.6    1055   359.6    1056   364.7    1057   368.3
    1120   368.3

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1004     .03    1056     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1004    1056               20      20      20             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1004   368.3       F
    1056    1120   368.3       F

BRIDGE


RIVER: Steele Brook
REACH: Main Channel DS    RS: 304.15

INPUT
Description: Parking Lot Bridge

Distance from Upstream XS =      .1
Deck/Roadway Width        =    19.8
Weir Coefficient          =     2.5
Upstream  Deck/Roadway Coordinates
    num=       6
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
**************************************************************************
```

```
    1000   368.3   353.7    1004   368.3   353.7    1004   368.3   364.7
    1056   368.3   364.7    1056   368.3   353.7    1120   368.3   353.7

Upstream Bridge Cross Section Data
Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   379.1    1001   368.3    1004   364.7    1005   361.1    1018   353.7
    1028   353.8    1045   364.6    1055   359.6    1056   364.7    1057   368.3
    1120   368.3

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1004     .03    1056     .06

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1004    1056             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1004   368.3       F
    1056    1120   368.3       F

Downstream  Deck/Roadway Coordinates
    num=       6
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
************************************************************************
    1000   368.3   353.7    1004   368.3   353.7    1004   368.3   364.7
    1056   368.3   364.7    1056   368.3   353.7    1120   368.3   353.7

Downstream Bridge Cross Section Data
Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   379.1    1001   368.3    1004   364.7    1005   361.1    1018   353.7
    1028   353.8    1045   364.6    1055   359.6    1056   364.7    1057   368.3
    1120   368.3

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1004     .03    1056     .06

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1004    1056             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1004   364.7       F
    1056    1120   364.7       F

Upstream Embankment side slope            =       0 horiz. to 1.0 vertical
Downstream Embankment side slope          =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins       =   368.3
Energy head used in spillway design       =
Spillway height used in design            =
Weir crest shape                          = Broad Crested
```

```
Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Energy

High Flow Method
       Pressure and Weir flow
           Submerged Inlet Cd          =
           Submerged Inlet + Outlet Cd =.8164966
           Max Low Cord                =   364.7

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 304.1

INPUT
Description:  D/S PARKING LOT BRIDGE

Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   379.1    1001   368.3    1004   364.7    1005   361.1    1018   353.7
    1028   353.8    1045   364.6    1055   359.6    1056   364.7    1057   368.3
    1120   368.3

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1004     .03    1056     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1004    1056              40      40      40             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1004   364.7       F
    1056    1120   364.7       F

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 304

INPUT
Description: FEMA B
```

```
Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     999   381.1    1000   363.9    1050   356.1    1055   352.1    1075   352.1
    1075   356.1    1110   359.1    1156   364.1    1215   366.6    1225   366.6
    1305   379.9

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     999     .08    1000    .045    1110     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1000    1110             100     120     200             .3       .5

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 303

INPUT
Description: RAISED CHANNEL 20 FT ORIGINAL MODEL ERROR (BLS 2008)
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     999   389.1    1000   364.1    1029   354.1    1032   350.1    1045   350.1
    1050   354.1    1110   376.1    1157   395.1    1240   410.6    1330   420.1
    1355   424.1    1390   424.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     999     .08    1000    .045    1110     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1000    1110             150     180     150             .3       .5

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: -100

INPUT
Description: CORPORATE LIMITS
Station Elevation Data    num=      10
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     206   379.1     250   359.1     262   349.7     278   347.9     294   347.1
     298   353.3     565   367.1     585   371.1     590   375.1     605   379.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
```

206 .08 250 .045 298 .05

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 250 | 298 | 0 | 0 | 0 | .3 | .5 |

*******************************************************************************

SUMMARY OF MANNING'S N VALUES

River:Steele Brook

| Reach | River Sta. | n1 | n2 | n3 | n4 | n5 |
|---|---|---|---|---|---|---|
| Main Channel US | 351 | .06 | .04 | .06 | | |
| Main Channel US | 350 | .06 | .04 | .06 | | |
| Main Channel US | 349 | .06 | .04 | .06 | | |
| Main Channel US | 348 | .06 | .04 | .06 | | |
| Main Channel US | 347.2 | .06 | .04 | .06 | | |
| Main Channel US | 347.15 | Bridge | | | | |
| Main Channel US | 347.1 | .06 | .04 | .06 | | |
| Main Channel US | 347 | .06 | .04 | .06 | | |
| Main Channel US | 346 | .06 | .04 | .06 | | |
| Main Channel US | 344.2 | .06 | .035 | .06 | | |
| Main Channel US | 344.1 | .06 | .035 | .06 | | |
| Main Channel US | 343.2 | .06 | .035 | .06 | | |
| Main Channel US | 343.1 | .06 | .035 | .06 | | |
| Main Channel US | 342.65 | Lat Struct | | | | |
| Main Channel US | 342.6 | .06 | .035 | .06 | | |
| Main Channel US | 342.5 | .06 | .035 | .06 | .04 | .06 |
| Main Channel US | 342.45 | Lat Struct | | | | |
| Main Channel US | 342.4 | .06 | .035 | .06 | .04 | .06 |
| Main Channel US | 342.3 | .06 | .035 | .06 | .04 | .06 |
| Main Channel US | 342.2 | .06 | .035 | .06 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Main Channel US | 342.1 | | .02 | .025 | .06 | |
| Main Channel US | 342.05 | | .02 | .065 | .06 | |
| Old Channel | 7 | | .06 | .06 | .06 | |
| Old Channel | 6 | | .06 | .04 | .05 | |
| Old Channel | 5 | | .06 | .03 | .04 | |
| Old Channel | 4 | | .06 | .03 | .04 | |
| Old Channel | 3 | | .06 | .03 | .04 | |
| Old Channel | 2 | | .06 | .03 | .04 | |
| Old Channel | 1 | | .06 | .03 | .04 | |
| Main Channel DS | 341.2 | | .05 | .065 | .04 | |
| Main Channel DS | 341.1 | | .05 | .065 | .04 | |
| Main Channel DS | 341 | | .05 | .035 | .04 | |
| Main Channel DS | 340.2 | | .05 | .03 | .05 | |
| Main Channel DS | 340.15 | Bridge | | | | |
| Main Channel DS | 340.1 | | .05 | .03 | .05 | |
| Main Channel DS | 340 | | .05 | .03 | .05 | |
| Main Channel DS | 339.6 | | .05 | .03 | .05 | |
| Main Channel DS | 339.56 | | .05 | .03 | .05 | |
| Main Channel DS | 339.55 | Bridge | | | | |
| Main Channel DS | 339.51 | | .05 | .03 | .05 | |
| Main Channel DS | 339.5 | | .05 | .03 | .05 | |
| Main Channel DS | 339.1 | | .05 | .03 | .05 | |
| Main Channel DS | 339 | | .05 | .03 | .05 | |
| Main Channel DS | 338.2 | | .05 | .03 | .05 | |
| Main Channel DS | 338.15 | Bridge | | | | |
| Main Channel DS | 338.1 | | .05 | .03 | .05 | |
| Main Channel DS | 337 | | .05 | .03 | .05 | |
| Main Channel DS | 336.2 | | .05 | .025 | .05 | |

```
*Main Channel DS *    336.15      *Bridge    *         *         *         *
*
*Main Channel DS *    336.1       *       .05*      .025*       .05*          *
*
*Main Channel DS *    336         *       .07*       .04*       .07*          *
*
*Main Channel DS *    335         *       .07*       .04*       .07*          *
*
*Main Channel DS *    334         *       .07*       .04*       .07*          *
*
*Main Channel DS *    333         *       .07*       .04*       .07*          *
*
*Main Channel DS *    332.2       *       .04*      .025*       .04*          *
*
*Main Channel DS *    332.15      *Bridge    *         *         *         *
*
*Main Channel DS *    332.1       *       .04*      .025*       .04*          *
*
*Main Channel DS *    332         *      .075*      .035*      .075*          *
*
*Main Channel DS *    331         *      .075*      .035*      .075*          *
*
*Main Channel DS *    330         *      .075*      .035*      .075*          *
*
*Main Channel DS *    329         *      .075*      .035*      .075*          *
*
*Main Channel DS *    328         *      .075*      .035*      .075*          *
*
*Main Channel DS *    327         *      .075*      .035*      .075*          *
*
*Main Channel DS *    326         *      .075*      .035*      .075*          *
*
*Main Channel DS *    325         *      .075*      .035*      .075*          *
*
*Main Channel DS *    324.2       *      .075*      .035*      .075*          *
*
*Main Channel DS *    324.15      *Bridge    *         *         *         *
*
*Main Channel DS *    324.1       *      .075*      .035*      .075*          *
*
*Main Channel DS *    324         *      .075*      .035*      .075*          *
*
*Main Channel DS *    323         *      .075*      .035*      .075*          *
*
*Main Channel DS *    322         *      .075*      .035*      .075*          *
*
*Main Channel DS *    321.1       *      .075*      .035*      .075*          *
*
*Main Channel DS *    321         *      .075*      .035*      .075*          *
*
*Main Channel DS *    320         *      .075*      .035*      .075*          *
*
*Main Channel DS *    319         *      .075*      .035*      .075*          *
*
*Main Channel DS *    318         *      .075*      .035*      .075*          *
*
```

```
*Main Channel DS *    317         *     .075*     .035*     .075*          *
*
*Main Channel DS *    316         *     .075*     .035*     .075*          *
*
*Main Channel DS *    315         *     .075*     .035*     .075*          *
*
*Main Channel DS *    314         *     .075*     .035*     .075*          *
*
*Main Channel DS *    313         *     .075*     .035*     .075*          *
*
*Main Channel DS *    312.2       *     .075*     .035*     .075*          *
*
*Main Channel DS *    312.15      *Bridge   *         *        *        *
*
*Main Channel DS *    312.1       *     .075*     .035*     .075*          *
*
*Main Channel DS *    312         *     .075*     .035*     .075*          *
*
*Main Channel DS *    311         *      .06*      .03*      .06*          *
*
*Main Channel DS *    310         *      .06*      .03*      .06*          *
*
*Main Channel DS *    309         *      .06*      .03*      .06*          *
*
*Main Channel DS *    308         *      .06*      .03*      .06*          *
*
*Main Channel DS *    307.1       *      .06*      .03*      .06*          *
*
*Main Channel DS *    307         *      .06*      .03*      .06*          *
*
*Main Channel DS *    305         *      .06*      .03*      .06*          *
*
*Main Channel DS *    304.2       *      .06*      .03*      .06*          *
*
*Main Channel DS *    304.15      *Bridge   *         *        *        *
*
*Main Channel DS *    304.1       *      .06*      .03*      .06*          *
*
*Main Channel DS *    304         *      .08*     .045*      .05*          *
*
*Main Channel DS *    303         *      .08*     .045*      .05*          *
*
*Main Channel DS *    -100        *      .08*     .045*      .05*          *
*
********************************************************************************
*****

********************************************************************************

SUMMARY OF REACH LENGTHS

River: Steele Brook
****************************************************************************
*     Reach      *   River Sta.   *  Left   * Channel *  Right  *
****************************************************************************
*Main Channel US *    351         *      600*      550*      500*
*Main Channel US *    350         *      400*      390*      500*
```

| | | | | |
|---|---|---|---|---|
| Main Channel US | 349 | 550 | 540 | 400 |
| Main Channel US | 348 | 40 | 40 | 40 |
| Main Channel US | 347.2 | 70 | 70 | 70 |
| Main Channel US | 347.15 | Bridge | | |
| Main Channel US | 347.1 | 30 | 30 | 30 |
| Main Channel US | 347 | 400 | 410 | 300 |
| Main Channel US | 346 | 545 | 494.13 | 435 |
| Main Channel US | 344.2 | 210 | 213.35 | 170 |
| Main Channel US | 344.1 | 70 | 116.18 | 125 |
| Main Channel US | 343.2 | 216 | 220.58 | 266 |
| Main Channel US | 343.1 | 153 | 159.84 | 231.73 |
| Main Channel US | 342.65 | Lat Struct | | |
| Main Channel US | 342.6 | 152 | 181.04 | 125.98 |
| Main Channel US | 342.5 | 151 | 141.52 | 130.33 |
| Main Channel US | 342.45 | Lat Struct | | |
| Main Channel US | 342.4 | 144 | 140.57 | 237.47 |
| Main Channel US | 342.3 | 136 | 139.35 | 132 |
| Main Channel US | 342.2 | 29 | 25.65 | 23 |
| Main Channel US | 342.1 | 18 | 18.35 | 18 |
| Main Channel US | 342.05 | 0 | 0 | 0 |
| Old Channel | 7 | 83.01 | 100.8 | 117.99 |
| Old Channel | 6 | 125.98 | 106.48 | 101 |
| Old Channel | 5 | 130.35 | 127.83 | 126 |
| Old Channel | 4 | 47.47 | 57.67 | 88 |
| Old Channel | 3 | 90 | 182.6 | 135 |
| Old Channel | 2 | 70 | 74.74 | 66 |
| Old Channel | 1 | 0 | 0 | 0 |
| Main Channel DS | 341.2 | 109 | 109.82 | 109 |
| Main Channel DS | 341.1 | 66 | 66.07 | 64 |
| Main Channel DS | 341 | 15 | 15 | 15 |
| Main Channel DS | 340.2 | 40 | 40 | 40 |
| Main Channel DS | 340.15 | Bridge | | |
| Main Channel DS | 340.1 | 5 | 5 | 5 |
| Main Channel DS | 340 | 210 | 210 | 210 |
| Main Channel DS | 339.6 | 1.24 | 1.24 | 1.24 |
| Main Channel DS | 339.56 | 7.7 | 7.7 | 7.7 |
| Main Channel DS | 339.55 | Bridge | | |
| Main Channel DS | 339.51 | 1.1 | 1.1 | 1.1 |
| Main Channel DS | 339.5 | 290.01 | 290.01 | 290.01 |
| Main Channel DS | 339.1 | 80 | 80 | 80 |
| Main Channel DS | 339 | 28 | 28 | 28 |
| Main Channel DS | 338.2 | 2 | 2 | 2 |
| Main Channel DS | 338.15 | Bridge | | |
| Main Channel DS | 338.1 | 30 | 30 | 30 |
| Main Channel DS | 337 | 40 | 40 | 40 |
| Main Channel DS | 336.2 | 38 | 38 | 38 |
| Main Channel DS | 336.15 | Bridge | | |
| Main Channel DS | 336.1 | 35 | 30 | 25 |
| Main Channel DS | 336 | 530 | 420 | 300 |
| Main Channel DS | 335 | 500 | 610 | 600 |
| Main Channel DS | 334 | 350 | 320 | 300 |
| Main Channel DS | 333 | 15 | 15 | 15 |
| Main Channel DS | 332.2 | 60 | 60 | 60 |
| Main Channel DS | 332.15 | Bridge | | |
| Main Channel DS | 332.1 | 15 | 15 | 15 |
| Main Channel DS | 332 | 250 | 340 | 350 |
| Main Channel DS | 331 | 450 | 520 | 650 |

| | | | | | |
|---|---|---|---|---|---|
| Main Channel DS | 330 | | 350 | 400 | 400 |
| Main Channel DS | 329 | | 950 | 1010 | 1000 |
| Main Channel DS | 328 | | 200 | 200 | 150 |
| Main Channel DS | 327 | | 700 | 740 | 800 |
| Main Channel DS | 326 | | 490 | 500 | 520 |
| Main Channel DS | 325 | | 40 | 40 | 40 |
| Main Channel DS | 324.2 | | 20 | 20 | 20 |
| Main Channel DS | 324.15 | Bridge | | | |
| Main Channel DS | 324.1 | | 40 | 40 | 40 |
| Main Channel DS | 324 | | 320 | 380 | 350 |
| Main Channel DS | 323 | | 440 | 480 | 520 |
| Main Channel DS | 322 | | 440 | 460 | 500 |
| Main Channel DS | 321.1 | | 40 | 40 | 40 |
| Main Channel DS | 321 | | 130 | 130 | 130 |
| Main Channel DS | 320 | | 340 | 340 | 340 |
| Main Channel DS | 319 | | 500 | 380 | 200 |
| Main Channel DS | 318 | | 200 | 180 | 150 |
| Main Channel DS | 317 | | 400 | 370 | 300 |
| Main Channel DS | 316 | | 650 | 620 | 600 |
| Main Channel DS | 315 | | 600 | 620 | 650 |
| Main Channel DS | 314 | | 600 | 490 | 450 |
| Main Channel DS | 313 | | 400 | 150 | 1 |
| Main Channel DS | 312.2 | | 70 | 70 | 70 |
| Main Channel DS | 312.15 | Bridge | | | |
| Main Channel DS | 312.1 | | 30 | 30 | 30 |
| Main Channel DS | 312 | | 1 | 140 | 250 |
| Main Channel DS | 311 | | 180 | 150 | 150 |
| Main Channel DS | 310 | | 100 | 130 | 200 |
| Main Channel DS | 309 | | 450 | 500 | 530 |
| Main Channel DS | 308 | | 50 | 50 | 50 |
| Main Channel DS | 307.1 | | 30 | 30 | 30 |
| Main Channel DS | 307 | | 490 | 520 | 570 |
| Main Channel DS | 305 | | 40 | 40 | 40 |
| Main Channel DS | 304.2 | | 20 | 20 | 20 |
| Main Channel DS | 304.15 | Bridge | | | |
| Main Channel DS | 304.1 | | 40 | 40 | 40 |
| Main Channel DS | 304 | | 100 | 120 | 200 |
| Main Channel DS | 303 | | 150 | 180 | 150 |
| Main Channel DS | -100 | | 0 | 0 | 0 |

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Steele Brook

| Reach | River Sta. | | Contr. | Expan. |
|---|---|---|---|---|
| Main Channel US | 351 | | .1 | .3 |
| Main Channel US | 350 | | .1 | .3 |
| Main Channel US | 349 | | .1 | .3 |
| Main Channel US | 348 | | .1 | .3 |
| Main Channel US | 347.2 | | .3 | .5 |
| Main Channel US | 347.15 | Bridge | | |
| Main Channel US | 347.1 | | .3 | .5 |
| Main Channel US | 347 | | .1 | .3 |

```
*Main Channel US *    346     *       .1*       .3*
*Main Channel US *    344.2   *       .1*       .3*
*Main Channel US *    344.1   *       .1*       .3*
*Main Channel US *    343.2   *       .1*       .3*
*Main Channel US *    343.1   *       .1*       .3*
*Main Channel US *    342.65  *Lat Struct*         *
*Main Channel US *    342.6   *       .1*       .3*
*Main Channel US *    342.5   *       .1*       .3*
*Main Channel US *    342.45  *Lat Struct*         *
*Main Channel US *    342.4   *       .1*       .3*
*Main Channel US *    342.3   *       .1*       .3*
*Main Channel US *    342.2   *       .3*       .5*
*Main Channel US *    342.1   *       .1*       .3*
*Main Channel US *    342.05  *       .1*       .3*
*Old Channel     *    7       *       .1*       .3*
*Old Channel     *    6       *       .1*       .3*
*Old Channel     *    5       *       .1*       .3*
*Old Channel     *    4       *       .1*       .3*
*Old Channel     *    3       *       .1*       .3*
*Old Channel     *    2       *       .1*       .3*
*Old Channel     *    1       *       .1*       .3*
*Main Channel DS *    341.2   *       .1*       .3*
*Main Channel DS *    341.1   *       .1*       .3*
*Main Channel DS *    341     *       .1*       .3*
*Main Channel DS *    340.2   *       .1*       .3*
*Main Channel DS *    340.15  *Bridge   *        *
*Main Channel DS *    340.1   *       .1*       .3*
*Main Channel DS *    340     *       .1*       .3*
*Main Channel DS *    339.6   *       .1*       .3*
*Main Channel DS *    339.56  *       .1*       .3*
*Main Channel DS *    339.55  *Bridge   *        *
*Main Channel DS *    339.51  *       .1*       .3*
*Main Channel DS *    339.5   *       .1*       .3*
*Main Channel DS *    339.1   *       .1*       .3*
*Main Channel DS *    339     *       .1*       .3*
*Main Channel DS *    338.2   *       .1*       .3*
*Main Channel DS *    338.15  *Bridge   *        *
*Main Channel DS *    338.1   *       .1*       .3*
*Main Channel DS *    337     *       .1*       .3*
*Main Channel DS *    336.2   *       .1*       .3*
*Main Channel DS *    336.15  *Bridge   *        *
*Main Channel DS *    336.1   *       .1*       .3*
*Main Channel DS *    336     *       .1*       .3*
*Main Channel DS *    335     *       .1*       .3*
*Main Channel DS *    334     *       .1*       .3*
*Main Channel DS *    333     *       .1*       .3*
*Main Channel DS *    332.2   *       .1*       .3*
*Main Channel DS *    332.15  *Bridge   *        *
*Main Channel DS *    332.1   *       .1*       .3*
*Main Channel DS *    332     *       .1*       .3*
*Main Channel DS *    331     *       .1*       .3*
*Main Channel DS *    330     *       .1*       .3*
*Main Channel DS *    329     *       .1*       .3*
*Main Channel DS *    328     *       .1*       .3*
*Main Channel DS *    327     *       .1*       .3*
*Main Channel DS *    326     *       .1*       .3*
*Main Channel DS *    325     *       .1*       .3*
```

```
*Main Channel DS *    324.2    *        .3*        .5*
*Main Channel DS *    324.15  *Bridge   *          *
*Main Channel DS *    324.1    *        .3*        .5*
*Main Channel DS *    324      *        .1*        .3*
*Main Channel DS *    323      *        .1*        .3*
*Main Channel DS *    322      *        .1*        .3*
*Main Channel DS *    321.1    *        .1*        .3*
*Main Channel DS *    321      *        .1*        .3*
*Main Channel DS *    320      *        .1*        .3*
*Main Channel DS *    319      *        .1*        .3*
*Main Channel DS *    318      *        .1*        .3*
*Main Channel DS *    317      *        .1*        .3*
*Main Channel DS *    316      *        .1*        .3*
*Main Channel DS *    315      *        .1*        .3*
*Main Channel DS *    314      *        .1*        .3*
*Main Channel DS *    313      *        .1*        .3*
*Main Channel DS *    312.2    *        .3*        .5*
*Main Channel DS *    312.15  *Bridge   *          *
*Main Channel DS *    312.1    *        .3*        .5*
*Main Channel DS *    312      *        .3*        .5*
*Main Channel DS *    311      *        .1*        .3*
*Main Channel DS *    310      *        .1*        .3*
*Main Channel DS *    309      *        .1*        .3*
*Main Channel DS *    308      *        .1*        .3*
*Main Channel DS *    307.1    *        .1*        .3*
*Main Channel DS *    307      *        .1*        .3*
*Main Channel DS *    305      *        .1*        .3*
*Main Channel DS *    304.2    *        .3*        .5*
*Main Channel DS *    304.15  *Bridge   *          *
*Main Channel DS *    304.1    *        .3*        .5*
*Main Channel DS *    304      *        .3*        .5*
*Main Channel DS *    303      *        .3*        .5*
*Main Channel DS *    -100     *        .3*        .5*
*******************************************************
```

Partial Removal - Mature n
(Plan and Manning's n values only. Flow & other geometry identical to Partial Removal)

```
                    HEC-RAS Version 4.0.0 March 2008
                      U.S. Army Corps of Engineers
                     Hydrologic Engineering Center
                           609 Second Street
                           Davis, California

            X     X  XXXXXX    XXXX        XXXX       XX      XXXX
            X     X  X        X    X       X   X     X  X    X
            X     X  X        X            X   X    X    X   X
            XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
            X     X  X        X            X  X     X    X       X
            X     X  X        X    X       X   X    X    X       X
            X     X  XXXXXX    XXXX        X    X   X    X   XXXXX

********************************************************************************

PROJECT DATA
Project Title: Heminway_Feasibility
Project File : Heminway_Feasibility.prj
Run Date and Time: 2/12/2009 5:01:44 PM

Project in English units

Project Description:
Heminway Pond Dam Removal Feasibility Study.  Base data from 1997 LOMR,
expanded upstream with 1980 FIS geometry.  Additional and
enhanced/replaced/corrected geometry in area of pond and nearby channel with
2007/2008 survey data & town GIS data.


********************************************************************************

PLAN DATA

Plan Title: Partial Removal - Mature n
Plan File : s:\Engineering\PROJECTS\STEELE_BROOK\HEC-RAS\Feasibility
Draft\Heminway_Feasibility.p03

           Geometry Title: Partial Removal - Mature n
           Geometry File : s:\Engineering\PROJECTS\STEELE_BROOK\HEC-
RAS\Feasibility Draft\Heminway_Feasibility.g04

           Flow Title    : Flows
           Flow File     : s:\Engineering\PROJECTS\STEELE_BROOK\HEC-
RAS\Feasibility Draft\Heminway_Feasibility.f01

Plan Description:
Partial Removal - Mature n Values


Plan Summary Information:
Number of:  Cross Sections =   87    Multiple Openings  =    0
            Culverts       =    0    Inline Structures  =    0
            Bridges        =    9    Lateral Structures =    2
```

Partial Removal - Mature n

(Plan and Manning's n values only. Flow & other geometry identical to Partial Removal)

```
Computational Information
    Water surface calculation tolerance  =  0.01
    Critical depth calculation tolerance =  0.01
    Maximum number of iterations         =  20
    Maximum difference tolerance         =  0.3
    Flow tolerance factor                =  0.001

Computation Options
    Critical depth computed at all cross sections
    Conveyance Calculation Method: At breaks in n values only
    Friction Slope Method:         Program Selects Appropriate method
    Computational Flow Regime:     Mixed Flow

Encroachment Data
   Equal Conveyance = True
   Left Offset      =        0
   Right Offset     =        0
```

River = Steele Brook     Reach = Main Channel US

| RS | Profile | Method | Value1 | Value2 |
|---|---|---|---|---|
| 351 | FEMA Floodway | 4 | 1 | |
| 350 | FEMA Floodway | 4 | 1 | |
| 349 | FEMA Floodway | 4 | 1 | |
| 348 | FEMA Floodway | 4 | 1 | |
| 347.2 | FEMA Floodway | 4 | 1 | |
| 347.1 | FEMA Floodway | 4 | 1 | |
| 347 | FEMA Floodway | 1 | 1353 | 1405 |
| 346 | FEMA Floodway | 1 | 1250 | 1350 |
| 345 | FEMA Floodway | 2 | 47 | |
| 344.2 | FEMA Floodway | 2 | 47 | |
| 344.1 | FEMA Floodway | 2 | 235 | |
| 343.2 | FEMA Floodway | 2 | 455 | |
| 343.1 | FEMA Floodway | 2 | 455 | |
| 342.6 | FEMA Floodway | 4 | 1 | |
| 342.5 | FEMA Floodway | 4 | 1 | |
| 342.4 | FEMA Floodway | 4 | 1 | |
| 342.3 | FEMA Floodway | 4 | 1 | |
| 342.2 | FEMA Floodway | 4 | 1 | |
| 342.1 | FEMA Floodway | 4 | 1 | |
| 342.05 | FEMA Floodway | 4 | 1 | |

River = Steele Brook     Reach = Main Channel DS

| RS | Profile | Method | Value1 | Value2 |
|---|---|---|---|---|
| 341.2 | FEMA Floodway | 4 | 1 | |
| 341.1 | FEMA Floodway | 4 | 1 | |
| 341 | FEMA Floodway | 1 | 1002 | 1277.35 |
| 340.2 | FEMA Floodway | 1 | 1000 | 1150 |
| 340.1 | FEMA Floodway | 1 | 1000 | 1120 |
| 340 | FEMA Floodway | 1 | 1000 | 1120 |
| 339.6 | FEMA Floodway | 1 | 1000 | 1120 |
| 339.56 | FEMA Floodway | 1 | 1000 | 1120 |
| 339.51 | FEMA Floodway | 1 | 1000 | 1120 |
| 339.5 | FEMA Floodway | 1 | 1000 | 1120 |
| 339.1 | FEMA Floodway | 1 | 1000 | 1120 |
| 339 | FEMA Floodway | 1 | 1320 | 1440 |
| 338.2 | FEMA Floodway | 1 | 1320 | 1440 |

| | | | | |
|---|---|---|---|---|
| 338.1 | FEMA Floodway | 1 | 1320 | 1420 |
| 337 | FEMA Floodway | 2 | 150 | |
| 336.2 | FEMA Floodway | 1 | 980 | 1010 |
| 336.1 | FEMA Floodway | 1 | 980 | 1010 |
| 336 | FEMA Floodway | 2 | 47 | |
| 335 | FEMA Floodway | 1 | 1160 | 1280 |
| 334 | FEMA Floodway | 2 | 100 | |
| 333 | FEMA Floodway | 2 | 80 | |
| 332.2 | FEMA Floodway | 1 | 1080 | 1300 |
| 332.1 | FEMA Floodway | 4 | .4 | |
| 332 | FEMA Floodway | 4 | .4 | |
| 331 | FEMA Floodway | 4 | .4 | |
| 330 | FEMA Floodway | 4 | .4 | |
| 329 | FEMA Floodway | 4 | 1 | |
| 328 | FEMA Floodway | 4 | 1 | |
| 327 | FEMA Floodway | 4 | 1 | |
| 326 | FEMA Floodway | 4 | 1 | |
| 325 | FEMA Floodway | 4 | 1 | |
| 324.2 | FEMA Floodway | 4 | 1 | |
| 324.1 | FEMA Floodway | 4 | 1 | |
| 324 | FEMA Floodway | 4 | 1 | |
| 323 | FEMA Floodway | 4 | 1 | |
| 322 | FEMA Floodway | 4 | 1 | |
| 321.1 | FEMA Floodway | 4 | 1 | |
| 321 | FEMA Floodway | 4 | 1 | |
| 320 | FEMA Floodway | 4 | 1 | |
| 319 | FEMA Floodway | 4 | 1 | |
| 318 | FEMA Floodway | 4 | 1 | |
| 317 | FEMA Floodway | 4 | 1 | |
| 316 | FEMA Floodway | 4 | 1 | |
| 315 | FEMA Floodway | 4 | 1 | |
| 314 | FEMA Floodway | 4 | 1 | |
| 313 | FEMA Floodway | 4 | 1 | |
| 312.2 | FEMA Floodway | 4 | 1 | |
| 312.1 | FEMA Floodway | 4 | 1 | |
| 312 | FEMA Floodway | 4 | 1 | |
| 311 | FEMA Floodway | 4 | 1 | |
| 310 | FEMA Floodway | 4 | 1 | |
| 309 | FEMA Floodway | 4 | 1 | |
| 308 | FEMA Floodway | 4 | 1 | |
| 307.1 | FEMA Floodway | 4 | 1 | |
| 307 | FEMA Floodway | 4 | 1 | |
| 305 | FEMA Floodway | 4 | 1 | |
| 304.2 | FEMA Floodway | 4 | 1 | |
| 304.1 | FEMA Floodway | 4 | 1 | |
| 304 | FEMA Floodway | 4 | 1 | |
| 303 | FEMA Floodway | 4 | 1 | |
| -100 | FEMA Floodway | 1 | 254.7 | 339.2 |

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SUMMARY OF MANNING'S N VALUES

River:Steele Brook
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Partial Removal - Mature n

(Plan and Manning's n values only. Flow & other geometry identical to Partial Removal)

| Reach | River Sta. | n1 | n2 | n3 | n4 | n5 |
|---|---|---|---|---|---|---|
| Main Channel US | 351 | .06 | .04 | .06 | | |
| Main Channel US | 350 | .06 | .04 | .06 | | |
| Main Channel US | 349 | .06 | .04 | .06 | | |
| Main Channel US | 348 | .06 | .04 | .06 | | |
| Main Channel US | 347.2 | .06 | .04 | .06 | | |
| Main Channel US | 347.15 | Bridge | | | | |
| Main Channel US | 347.1 | .06 | .04 | .06 | | |
| Main Channel US | 347 | .06 | .04 | .06 | | |
| Main Channel US | 346 | .06 | .04 | .06 | | |
| Main Channel US | 344.2 | .06 | .035 | .06 | | |
| Main Channel US | 344.1 | .06 | .035 | .06 | | |
| Main Channel US | 343.2 | .06 | .035 | .06 | | |
| Main Channel US | 343.1 | .1 | .035 | .1 | | |
| Main Channel US | 342.65 | Lat Struct | | | | |
| Main Channel US | 342.6 | .1 | .035 | .1 | | |
| Main Channel US | 342.5 | .1 | .035 | .1 | .04 | .1 |
| Main Channel US | 342.45 | Lat Struct | | | | |
| Main Channel US | 342.4 | .1 | .035 | .1 | .04 | .1 |
| Main Channel US | 342.3 | .1 | .035 | .1 | .04 | .1 |
| Main Channel US | 342.2 | .1 | .035 | .1 | | |
| Main Channel US | 342.1 | .02 | .025 | .06 | | |
| Main Channel US | 342.05 | .02 | .065 | .06 | | |
| Old Channel | 7 | .06 | .06 | .06 | | |
| Old Channel | 6 | .06 | .04 | .05 | | |
| Old Channel | 5 | .06 | .03 | .04 | | |
| Old Channel | 4 | .06 | .03 | .04 | | |

Partial Removal - Mature n

(Plan and Manning’s n values only. Flow & other geometry identical to Partial Removal)

```
*Old Channel     *    3           *       .06*       .03*       .04*          *
*
*Old Channel     *    2           *       .06*       .03*       .04*          *
*
*Old Channel     *    1           *       .06*       .03*       .04*          *
*
*Main Channel DS *    341.2       *       .05*      .065*       .04*          *
*
*Main Channel DS *    341.1       *       .05*      .065*       .04*          *
*
*Main Channel DS *    341         *       .05*      .035*       .04*          *
*
*Main Channel DS *    340.2       *       .05*       .03*       .05*          *
*
*Main Channel DS *    340.15      *Bridge   *         *         *         *
*
*Main Channel DS *    340.1       *       .05*       .03*       .05*          *
*
*Main Channel DS *    340         *       .05*       .03*       .05*          *
*
*Main Channel DS *    339.6       *       .05*       .03*       .05*          *
*
*Main Channel DS *    339.56      *       .05*       .03*       .05*          *
*
*Main Channel DS *    339.55      *Bridge   *         *         *         *
*
*Main Channel DS *    339.51      *       .05*       .03*       .05*          *
*
*Main Channel DS *    339.5       *       .05*       .03*       .05*          *
*
*Main Channel DS *    339.1       *       .05*       .03*       .05*          *
*
*Main Channel DS *    339         *       .05*       .03*       .05*          *
*
*Main Channel DS *    338.2       *       .05*       .03*       .05*          *
*
*Main Channel DS *    338.15      *Bridge   *         *         *         *
*
*Main Channel DS *    338.1       *       .05*       .03*       .05*          *
*
*Main Channel DS *    337         *       .05*       .03*       .05*          *
*
*Main Channel DS *    336.2       *       .05*      .025*       .05*          *
*
*Main Channel DS *    336.15      *Bridge   *         *         *         *
*
*Main Channel DS *    336.1       *       .05*      .025*       .05*          *
*
*Main Channel DS *    336         *       .07*       .04*       .07*          *
*
*Main Channel DS *    335         *       .07*       .04*       .07*          *
*
*Main Channel DS *    334         *       .07*       .04*       .07*          *
*
*Main Channel DS *    333         *       .07*       .04*       .07*          *
*
```

Partial Removal - Mature n

(Plan and Manning's n values only. Flow & other geometry identical to Partial Removal)

```
*Main Channel DS *    332.2       *      .04*     .025*      .04*         *
*
*Main Channel DS *    332.15      *Bridge   *        *         *        *
*
*Main Channel DS *    332.1       *      .04*     .025*      .04*         *
*
*Main Channel DS *    332         *     .075*     .035*     .075*         *
*
*Main Channel DS *    331         *     .075*     .035*     .075*         *
*
*Main Channel DS *    330         *     .075*     .035*     .075*         *
*
*Main Channel DS *    329         *     .075*     .035*     .075*         *
*
*Main Channel DS *    328         *     .075*     .035*     .075*         *
*
*Main Channel DS *    327         *     .075*     .035*     .075*         *
*
*Main Channel DS *    326         *     .075*     .035*     .075*         *
*
*Main Channel DS *    325         *     .075*     .035*     .075*         *
*
*Main Channel DS *    324.2       *     .075*     .035*     .075*         *
*
*Main Channel DS *    324.15      *Bridge   *        *         *        *
*
*Main Channel DS *    324.1       *     .075*     .035*     .075*         *
*
*Main Channel DS *    324         *     .075*     .035*     .075*         *
*
*Main Channel DS *    323         *     .075*     .035*     .075*         *
*
*Main Channel DS *    322         *     .075*     .035*     .075*         *
*
*Main Channel DS *    321.1       *     .075*     .035*     .075*         *
*
*Main Channel DS *    321         *     .075*     .035*     .075*         *
*
*Main Channel DS *    320         *     .075*     .035*     .075*         *
*
*Main Channel DS *    319         *     .075*     .035*     .075*         *
*
*Main Channel DS *    318         *     .075*     .035*     .075*         *
*
*Main Channel DS *    317         *     .075*     .035*     .075*         *
*
*Main Channel DS *    316         *     .075*     .035*     .075*         *
*
*Main Channel DS *    315         *     .075*     .035*     .075*         *
*
*Main Channel DS *    314         *     .075*     .035*     .075*         *
*
*Main Channel DS *    313         *     .075*     .035*     .075*         *
*
*Main Channel DS *    312.2       *     .075*     .035*     .075*         *
*
```

```
*Main Channel DS *    312.15      *Bridge   *        *        *        *
*
*Main Channel DS *    312.1       *      .075*     .035*     .075*          *
*
*Main Channel DS *    312         *      .075*     .035*     .075*          *
*
*Main Channel DS *    311         *       .06*      .03*      .06*          *
*
*Main Channel DS *    310         *       .06*      .03*      .06*          *
*
*Main Channel DS *    309         *       .06*      .03*      .06*          *
*
*Main Channel DS *    308         *       .06*      .03*      .06*          *
*
*Main Channel DS *    307.1       *       .06*      .03*      .06*          *
*
*Main Channel DS *    307         *       .06*      .03*      .06*          *
*
*Main Channel DS *    305         *       .06*      .03*      .06*          *
*
*Main Channel DS *    304.2       *       .06*      .03*      .06*          *
*
*Main Channel DS *    304.15      *Bridge   *        *        *        *
*
*Main Channel DS *    304.1       *       .06*      .03*      .06*          *
*
*Main Channel DS *    304         *       .08*     .045*      .05*          *
*
*Main Channel DS *    303         *       .08*     .045*      .05*          *
*
*Main Channel DS *    -100        *       .08*     .045*      .05*          *
*
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**Partial Removal**
**Cross Section Tables**

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HEC-RAS Plan: EXIST

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Main Channel US | 348 AR | FEMA 100-YR | 2060.00 | 488.90 | 498.02 | 493.37 | 498.08 | 0.000379 | 3.12 | 1354.81 | 304.23 | 0.18 |
| Main Channel US | 348 AR | FEMA Floodway | 2060.00 | 488.90 | 497.94 | 493.31 | 498.06 | 0.000583 | 3.85 | 838.79 | 115.23 | 0.23 |
| Main Channel US | 348 AR | FEMA 10-YR | 820.00 | 488.90 | 494.17 | 491.87 | 494.26 | 0.000903 | 3.33 | 447.46 | 166.69 | 0.26 |
| Main Channel US | 348 AR | FEMA 50-YR | 1600.00 | 488.90 | 496.67 | 492.91 | 496.75 | 0.000523 | 3.29 | 972.59 | 257.47 | 0.21 |
| Main Channel US | 348 AR | FEMA 500-YR | 3600.00 | 488.90 | 501.80 | 494.54 | 501.84 | 0.000182 | 2.73 | 2704.10 | 435.80 | 0.13 |
| Main Channel US | 348 AR | M&M 2-YR | 405.00 | 488.90 | 492.42 | 491.01 | 492.53 | 0.001463 | 3.22 | 204.74 | 111.85 | 0.31 |
| Main Channel US | 348 AR | M&M 1-YR | 221.00 | 488.90 | 491.43 | 490.43 | 491.53 | 0.001950 | 2.96 | 108.83 | 80.46 | 0.33 |
| Main Channel US | 348 AR | Bankful Q | 330.00 | 488.90 | 492.04 | 490.80 | 492.15 | 0.001642 | 3.16 | 164.26 | 99.81 | 0.32 |
| | | | | | | | | | | | | |
| Main Channel US | 347.2 | FEMA 100-YR | 2060.00 | 488.30 | 496.80 | 494.32 | 497.95 | 0.005887 | 8.61 | 239.28 | 32.17 | 0.56 |
| Main Channel US | 347.2 | FEMA Floodway | 2060.00 | 488.30 | 496.75 | 494.32 | 497.92 | 0.005987 | 8.66 | 237.90 | 32.15 | 0.56 |
| Main Channel US | 347.2 | FEMA 10-YR | 820.00 | 488.30 | 493.61 | 491.94 | 494.16 | 0.004737 | 5.93 | 138.29 | 31.27 | 0.50 |
| Main Channel US | 347.2 | FEMA 50-YR | 1600.00 | 488.30 | 495.65 | 493.52 | 496.62 | 0.005765 | 7.90 | 202.66 | 31.84 | 0.55 |
| Main Channel US | 347.2 | FEMA 500-YR | 3600.00 | 488.30 | 499.94 | 496.65 | 501.66 | 0.006526 | 10.54 | 341.66 | 33.05 | 0.58 |
| Main Channel US | 347.2 | M&M 2-YR | 405.00 | 488.30 | 492.13 | 490.88 | 492.43 | 0.004004 | 4.39 | 92.27 | 30.85 | 0.45 |
| Main Channel US | 347.2 | M&M 1-YR | 221.00 | 488.30 | 491.25 | 490.28 | 491.43 | 0.003559 | 3.39 | 65.13 | 30.60 | 0.41 |
| Main Channel US | 347.2 | Bankful Q | 330.00 | 488.30 | 491.79 | 490.65 | 492.05 | 0.003852 | 4.03 | 81.93 | 30.76 | 0.43 |
| | | | | | | | | | | | | |
| Main Channel US | 347.15 ROUTE 6 | | Bridge | | | | | | | | | |
| | | | | | | | | | | | | |
| Main Channel US | 347.1 | FEMA 100-YR | 2060.00 | 488.30 | 494.39 | 494.31 | 496.88 | 0.018287 | 12.65 | 162.81 | 31.49 | 0.98 |
| Main Channel US | 347.1 | FEMA Floodway | 2060.00 | 488.30 | 494.60 | 494.31 | 496.90 | 0.016289 | 12.17 | 169.25 | 31.55 | 0.93 |
| Main Channel US | 347.1 | FEMA 10-YR | 820.00 | 488.30 | 492.78 | 491.94 | 493.61 | 0.008912 | 7.29 | 112.42 | 31.03 | 0.68 |
| Main Channel US | 347.1 | FEMA 50-YR | 1600.00 | 488.30 | 494.05 | 493.53 | 495.77 | 0.013557 | 10.53 | 152.00 | 31.39 | 0.84 |
| Main Channel US | 347.1 | FEMA 500-YR | 3600.00 | 488.30 | 496.66 | 496.66 | 500.31 | 0.018988 | 15.33 | 234.82 | 32.13 | 1.00 |
| Main Channel US | 347.1 | M&M 2-YR | 405.00 | 488.30 | 491.50 | 490.87 | 491.98 | 0.008401 | 5.56 | 72.82 | 30.67 | 0.64 |
| Main Channel US | 347.1 | M&M 1-YR | 221.00 | 488.30 | 490.63 | 490.28 | 490.98 | 0.010517 | 4.77 | 46.37 | 30.43 | 0.68 |
| Main Channel US | 347.1 | Bankful Q | 330.00 | 488.30 | 491.18 | 490.63 | 491.60 | 0.008805 | 5.24 | 63.03 | 30.58 | 0.64 |
| | | | | | | | | | | | | |
| Main Channel US | 347 AQ | FEMA 100-YR | 2060.00 | 487.90 | 494.86 | 493.28 | 495.70 | 0.005485 | 7.37 | 279.63 | 61.63 | 0.61 |
| Main Channel US | 347 AQ | FEMA Floodway | 2060.00 | 487.90 | 495.01 | 493.28 | 495.85 | 0.004703 | 7.35 | 280.15 | 52.00 | 0.56 |
| Main Channel US | 347 AQ | FEMA 10-YR | 820.00 | 487.90 | 492.82 | 491.15 | 493.19 | 0.003573 | 4.92 | 166.77 | 49.07 | 0.47 |
| Main Channel US | 347 AQ | FEMA 50-YR | 1600.00 | 487.90 | 494.31 | 492.59 | 494.96 | 0.004657 | 6.49 | 246.65 | 58.24 | 0.56 |
| Main Channel US | 347 AQ | FEMA 500-YR | 3600.00 | 487.90 | 493.32 | 495.08 | 498.78 | 0.046768 | 18.75 | 191.99 | 52.14 | 1.72 |
| Main Channel US | 347 AQ | M&M 2-YR | 405.00 | 487.90 | 491.45 | 490.06 | 491.68 | 0.003113 | 3.84 | 105.39 | 40.64 | 0.42 |
| Main Channel US | 347 AQ | M&M 1-YR | 221.00 | 487.90 | 490.53 | 489.40 | 490.68 | 0.002867 | 3.13 | 70.62 | 34.98 | 0.39 |
| Main Channel US | 347 AQ | Bankful Q | 330.00 | 487.90 | 491.11 | 489.80 | 491.31 | 0.003021 | 3.59 | 92.04 | 38.57 | 0.41 |
| | | | | | | | | | | | | |
| Main Channel US | 346 AP | FEMA 100-YR | 2060.00 | 486.10 | 492.04 | 491.95 | 492.97 | 0.008430 | 8.32 | 346.89 | 210.20 | 0.74 |
| Main Channel US | 346 AP | FEMA Floodway | 2060.00 | 486.10 | 493.36 | 491.74 | 494.02 | 0.003980 | 6.70 | 355.00 | 100.00 | 0.52 |
| Main Channel US | 346 AP | FEMA 10-YR | 820.00 | 486.10 | 490.49 | 489.86 | 491.10 | 0.008602 | 6.31 | 130.35 | 53.64 | 0.70 |
| Main Channel US | 346 AP | FEMA 50-YR | 1600.00 | 486.10 | 491.60 | 491.45 | 492.47 | 0.008574 | 7.76 | 263.59 | 176.48 | 0.74 |
| Main Channel US | 346 AP | FEMA 500-YR | 3600.00 | 486.10 | 493.13 | 493.06 | 494.15 | 0.007703 | 9.38 | 615.38 | 264.05 | 0.74 |
| Main Channel US | 346 AP | M&M 2-YR | 405.00 | 486.10 | 489.43 | 488.80 | 489.83 | 0.007965 | 5.05 | 80.13 | 41.63 | 0.64 |
| Main Channel US | 346 AP | M&M 1-YR | 221.00 | 486.10 | 488.64 | 488.10 | 488.94 | 0.007997 | 4.36 | 50.71 | 32.95 | 0.62 |
| Main Channel US | 346 AP | Bankful Q | 330.00 | 486.10 | 489.15 | 488.54 | 489.50 | 0.007922 | 4.79 | 68.82 | 38.52 | 0.63 |
| | | | | | | | | | | | | |
| Main Channel US | 344.2 | FEMA 100-YR | 2060.00 | 483.80 | 488.38 | 488.38 | 489.22 | 0.006883 | 8.96 | 428.85 | 231.15 | 0.77 |
| Main Channel US | 344.2 | FEMA Floodway | 2060.00 | 483.80 | 488.87 | 488.87 | 491.00 | 0.010596 | 11.96 | 190.16 | 47.00 | 0.97 |
| Main Channel US | 344.2 | FEMA 10-YR | 820.00 | 483.80 | 487.50 | 487.18 | 487.95 | 0.004067 | 5.88 | 231.37 | 212.57 | 0.57 |
| Main Channel US | 344.2 | FEMA 50-YR | 1600.00 | 483.80 | 488.09 | 488.09 | 488.82 | 0.006259 | 8.13 | 360.86 | 227.42 | 0.73 |
| Main Channel US | 344.2 | FEMA 500-YR | 3600.00 | 483.80 | 489.20 | 489.20 | 490.29 | 0.008094 | 10.93 | 624.93 | 251.46 | 0.86 |
| Main Channel US | 344.2 | M&M 2-YR | 405.00 | 483.80 | 486.84 | 485.75 | 487.11 | 0.002860 | 4.25 | 111.98 | 141.61 | 0.46 |
| Main Channel US | 344.2 | M&M 1-YR | 221.00 | 483.80 | 486.00 | 485.17 | 486.19 | 0.002980 | 3.45 | 64.05 | 35.39 | 0.44 |
| Main Channel US | 344.2 | Bankful Q | 330.00 | 483.80 | 486.53 | 485.53 | 486.78 | 0.002970 | 4.00 | 84.82 | 45.11 | 0.46 |
| | | | | | | | | | | | | |
| Main Channel US | 344.1 | FEMA 100-YR | 2060.00 | 482.50 | 487.26 | 486.51 | 487.53 | 0.003337 | 5.51 | 610.81 | 373.12 | 0.51 |
| Main Channel US | 344.1 | FEMA Floodway | 2060.00 | 482.50 | 487.30 | 486.60 | 487.78 | 0.005564 | 7.15 | 474.17 | 232.39 | 0.66 |
| Main Channel US | 344.1 | FEMA 10-YR | 820.00 | 482.50 | 487.31 | 486.00 | 487.35 | 0.000500 | 2.15 | 623.97 | 378.15 | 0.20 |
| Main Channel US | 344.1 | FEMA 50-YR | 1600.00 | 482.50 | 486.90 | 486.21 | 487.12 | 0.003107 | 4.95 | 517.14 | 335.67 | 0.49 |
| Main Channel US | 344.1 | FEMA 500-YR | 3600.00 | 482.50 | 488.18 | 486.88 | 488.58 | 0.003928 | 6.95 | 882.03 | 453.00 | 0.58 |
| Main Channel US | 344.1 | M&M 2-YR | 405.00 | 482.50 | 486.32 | 485.07 | 486.54 | 0.002340 | 3.79 | 110.25 | 261.46 | 0.41 |
| Main Channel US | 344.1 | M&M 1-YR | 221.00 | 482.50 | 485.47 | 484.55 | 485.61 | 0.002294 | 3.02 | 73.23 | 38.59 | 0.39 |
| Main Channel US | 344.1 | Bankful Q | 330.00 | 482.50 | 486.00 | 484.86 | 486.19 | 0.002334 | 3.51 | 93.92 | 39.64 | 0.40 |
| | | | | | | | | | | | | |
| Main Channel US | 343.2 | FEMA 100-YR | 2060.00 | 481.40 | 487.05 | 486.11 | 487.21 | 0.002382 | 4.96 | 814.61 | 388.32 | 0.44 |
| Main Channel US | 343.2 | FEMA Floodway | 2060.00 | 481.40 | 487.14 | 486.11 | 487.29 | 0.002120 | 4.75 | 846.98 | 387.91 | 0.41 |
| Main Channel US | 343.2 | FEMA 10-YR | 820.00 | 481.40 | 485.74 | 485.74 | 487.12 | 0.013999 | 9.41 | 87.15 | 173.84 | 1.00 |
| Main Channel US | 343.2 | FEMA 50-YR | 1600.00 | 481.40 | 486.67 | 484.81 | 486.82 | 0.002415 | 4.68 | 682.38 | 374.10 | 0.43 |
| Main Channel US | 343.2 | FEMA 500-YR | 3600.00 | 481.40 | 487.97 | 486.65 | 488.21 | 0.002612 | 5.97 | 1140.23 | 460.70 | 0.47 |
| Main Channel US | 343.2 | M&M 2-YR | 405.00 | 481.40 | 485.96 | 484.67 | 486.24 | 0.002701 | 4.32 | 93.84 | 174.37 | 0.44 |
| Main Channel US | 343.2 | M&M 1-YR | 221.00 | 481.40 | 485.21 | 484.04 | 485.36 | 0.002011 | 3.14 | 70.37 | 172.47 | 0.37 |
| Main Channel US | 343.2 | Bankful Q | 330.00 | 481.40 | 485.68 | 484.42 | 485.91 | 0.002450 | 3.88 | 85.05 | 173.67 | 0.42 |
| | | | | | | | | | | | | |
| Main Channel US | 343.1 | FEMA 100-YR | 2060.00 | 482.60 | 486.80 | 485.31 | 486.85 | 0.000422 | 2.04 | 1304.12 | 482.93 | 0.18 |
| Main Channel US | 343.1 | FEMA Floodway | 2060.00 | 482.60 | 486.87 | 485.31 | 486.95 | 0.000668 | 2.60 | 1050.65 | 398.93 | 0.23 |
| Main Channel US | 343.1 | FEMA 10-YR | 820.00 | 482.60 | 485.58 | 485.30 | 485.62 | 0.000573 | 1.84 | 530.64 | 401.74 | 0.20 |
| Main Channel US | 343.1 | FEMA 50-YR | 1600.00 | 482.60 | 486.42 | 485.30 | 486.46 | 0.000386 | 1.82 | 1122.76 | 470.60 | 0.17 |
| Main Channel US | 343.1 | FEMA 500-YR | 3600.00 | 482.60 | 487.71 | 485.30 | 487.78 | 0.000556 | 2.70 | 1755.91 | 512.34 | 0.22 |
| Main Channel US | 343.1 | M&M 2-YR | 405.00 | 482.60 | 485.05 | 484.44 | 485.43 | 0.005558 | 4.95 | 81.75 | 310.46 | 0.60 |
| Main Channel US | 343.1 | M&M 1-YR | 221.00 | 482.60 | 484.62 | 483.92 | 484.80 | 0.003434 | 3.40 | 64.95 | 282.08 | 0.46 |
| Main Channel US | 343.1 | Bankful Q | 330.00 | 482.60 | 484.89 | 484.24 | 485.19 | 0.004743 | 4.37 | 75.51 | 297.33 | 0.55 |
| | | | | | | | | | | | | |
| Main Channel US | 342.65 Embankment & FP | | Lat Struct | | | | | | | | | |
| | | | | | | | | | | | | |
| Main Channel US | 342.6 | FEMA 100-YR | 1684.47 | 482.80 | 486.76 | 484.48 | 486.78 | 0.000205 | 1.39 | 1392.89 | 628.59 | 0.13 |
| Main Channel US | 342.6 | FEMA Floodway | 1658.64 | 482.80 | 486.79 | 485.06 | 486.84 | 0.000457 | 2.08 | 1021.71 | 340.18 | 0.19 |
| Main Channel US | 342.6 | FEMA 10-YR | 741.70 | 482.80 | 485.49 | 484.00 | 485.53 | 0.000568 | 1.72 | 510.63 | 562.77 | 0.20 |
| Main Channel US | 342.6 | FEMA 50-YR | 1342.45 | 482.80 | 486.38 | 484.21 | 486.40 | 0.000186 | 1.22 | 1233.11 | 627.24 | 0.12 |
| Main Channel US | 342.6 | FEMA 500-YR | 2794.76 | 482.80 | 487.66 | 485.06 | 487.70 | 0.000273 | 1.86 | 1773.89 | 632.06 | 0.16 |
| Main Channel US | 342.6 | M&M 2-YR | 375.38 | 482.80 | 484.83 | 484.00 | 484.85 | 0.000413 | 1.19 | 347.34 | 489.52 | 0.16 |
| Main Channel US | 342.6 | M&M 1-YR | 216.90 | 482.80 | 484.44 | 484.00 | 484.46 | 0.000295 | 0.85 | 259.14 | 445.52 | 0.13 |
| Main Channel US | 342.6 | Bankful Q | 313.51 | 482.80 | 484.68 | 484.00 | 484.70 | 0.000380 | 1.07 | 312.87 | 473.10 | 0.15 |
| | | | | | | | | | | | | |

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Main Channel US | 342.5 | FEMA 100-YR | 1684.47 | 482.30 | 486.75 | 484.00 | 486.76 | 0.000092 | 0.94 | 2000.34 | 560.96 | 0.09 |
| Main Channel US | 342.5 | FEMA Floodway | 1658.64 | 482.30 | 486.76 | 484.43 | 486.78 | 0.000201 | 1.41 | 1480.22 | 451.49 | 0.13 |
| Main Channel US | 342.5 | FEMA 10-YR | 741.70 | 482.30 | 485.47 | 484.00 | 485.47 | 0.000064 | 0.59 | 1293.18 | 538.83 | 0.07 |
| Main Channel US | 342.5 | FEMA 50-YR | 1342.45 | 482.30 | 486.37 | 484.00 | 486.38 | 0.000082 | 0.83 | 1789.08 | 558.75 | 0.08 |
| Main Channel US | 342.5 | FEMA 500-YR | 2755.47 | 482.30 | 487.64 | 484.39 | 487.66 | 0.000122 | 1.27 | 2506.13 | 566.21 | 0.11 |
| Main Channel US | 342.5 | M&M 2-YR | 375.38 | 482.30 | 484.80 | 484.00 | 484.80 | 0.000158 | 0.73 | 545.44 | 516.18 | 0.10 |
| Main Channel US | 342.5 | M&M 1-YR | 216.90 | 482.30 | 484.42 | 483.70 | 484.42 | 0.000117 | 0.54 | 426.16 | 493.69 | 0.08 |
| Main Channel US | 342.5 | Bankful Q | 313.51 | 482.30 | 484.65 | 484.00 | 484.66 | 0.000148 | 0.67 | 499.08 | 509.27 | 0.10 |
| | | | | | | | | | | | | |
| Main Channel US | 342.45 Embankment | | Lat Struct | | | | | | | | | |
| | | | | | | | | | | | | |
| Main Channel US | 342.4 | FEMA 100-YR | 1682.65 | 482.70 | 486.73 | 484.60 | 486.74 | 0.000118 | 0.84 | 1751.22 | 513.59 | 0.09 |
| Main Channel US | 342.4 | FEMA Floodway | 1658.01 | 482.70 | 486.72 | 481.23 | 486.75 | 0.000268 | 1.27 | 1210.87 | 376.20 | 0.13 |
| Main Channel US | 342.4 | FEMA 10-YR | 741.70 | 482.70 | 485.46 | 484.20 | 485.46 | 0.000091 | 0.51 | 1113.56 | 493.05 | 0.07 |
| Main Channel US | 342.4 | FEMA 50-YR | 1342.45 | 482.70 | 486.35 | 484.60 | 486.36 | 0.000107 | 0.74 | 1559.91 | 505.80 | 0.08 |
| Main Channel US | 342.4 | FEMA 500-YR | 2726.80 | 482.70 | 487.62 | 484.86 | 487.64 | 0.000151 | 1.13 | 2217.52 | 532.10 | 0.10 |
| Main Channel US | 342.4 | M&M 2-YR | 375.38 | 482.70 | 484.75 | 483.83 | 484.77 | 0.000519 | 0.87 | 408.74 | 484.14 | 0.15 |
| Main Channel US | 342.4 | M&M 1-YR | 216.90 | 482.70 | 484.37 | 483.38 | 484.39 | 0.001003 | 0.93 | 205.42 | 467.72 | 0.20 |
| Main Channel US | 342.4 | Bankful Q | 313.51 | 482.70 | 484.61 | 483.64 | 484.62 | 0.000572 | 0.83 | 355.14 | 482.30 | 0.15 |
| | | | | | | | | | | | | |
| Main Channel US | 342.3 | FEMA 100-YR | 1271.74 | 480.70 | 486.72 | 482.78 | 486.72 | 0.000051 | 0.76 | 1714.91 | 381.00 | 0.06 |
| Main Channel US | 342.3 | FEMA Floodway | 1261.95 | 480.70 | 486.70 | 482.78 | 486.71 | 0.000100 | 1.05 | 1296.60 | 302.46 | 0.08 |
| Main Channel US | 342.3 | FEMA 10-YR | 598.80 | 480.70 | 485.45 | 482.13 | 485.45 | 0.000031 | 0.48 | 1236.12 | 375.55 | 0.04 |
| Main Channel US | 342.3 | FEMA 50-YR | 1056.62 | 480.70 | 486.34 | 482.61 | 486.35 | 0.000046 | 0.68 | 1572.56 | 378.70 | 0.06 |
| Main Channel US | 342.3 | FEMA 500-YR | 1843.62 | 480.70 | 487.61 | 483.10 | 487.62 | 0.000061 | 0.93 | 2057.00 | 386.48 | 0.07 |
| Main Channel US | 342.3 | M&M 2-YR | 293.84 | 480.70 | 484.72 | 481.71 | 484.72 | 0.000036 | 0.45 | 662.06 | 348.13 | 0.05 |
| Main Channel US | 342.3 | M&M 1-YR | 159.85 | 480.70 | 484.31 | 481.46 | 484.31 | 0.000018 | 0.29 | 560.55 | 327.58 | 0.03 |
| Main Channel US | 342.3 | Bankful Q | 241.97 | 480.70 | 484.57 | 481.62 | 484.57 | 0.000030 | 0.39 | 624.34 | 336.09 | 0.04 |
| | | | | | | | | | | | | |
| Main Channel US | 342.2 | FEMA 100-YR | 1271.74 | 480.40 | 486.66 | 482.89 | 486.71 | 0.000273 | 1.83 | 695.92 | 229.51 | 0.14 |
| Main Channel US | 342.2 | FEMA Floodway | 1261.95 | 480.40 | 486.64 | 482.88 | 486.69 | 0.000273 | 1.82 | 693.39 | 217.30 | 0.14 |
| Main Channel US | 342.2 | FEMA 10-YR | 598.80 | 480.40 | 485.42 | 482.33 | 485.44 | 0.000151 | 1.13 | 529.41 | 222.07 | 0.10 |
| Main Channel US | 342.2 | FEMA 50-YR | 1056.62 | 480.40 | 486.29 | 482.72 | 486.33 | 0.000241 | 1.63 | 646.80 | 226.45 | 0.13 |
| Main Channel US | 342.2 | FEMA 500-YR | 1843.62 | 480.40 | 487.58 | 483.29 | 487.61 | 0.000113 | 1.34 | 1401.41 | 245.36 | 0.09 |
| Main Channel US | 342.2 | M&M 2-YR | 293.84 | 480.40 | 484.71 | 481.99 | 484.71 | 0.000071 | 0.68 | 432.64 | 219.66 | 0.07 |
| Main Channel US | 342.2 | M&M 1-YR | 159.85 | 480.40 | 484.30 | 481.76 | 484.31 | 0.000033 | 0.42 | 378.39 | 218.32 | 0.04 |
| Main Channel US | 342.2 | Bankful Q | 241.97 | 480.40 | 484.56 | 481.90 | 484.56 | 0.000056 | 0.59 | 412.84 | 219.17 | 0.06 |
| | | | | | | | | | | | | |
| Main Channel US | 342.1 HEMINWAY DAM | FEMA 100-YR | 1271.74 | 483.50 | 485.44 | 485.44 | 486.42 | 0.005009 | 7.93 | 160.29 | 82.70 | 1.00 |
| Main Channel US | 342.1 HEMINWAY DAM | FEMA Floodway | 1261.95 | 483.50 | 485.44 | 485.44 | 486.40 | 0.004941 | 7.88 | 160.20 | 82.70 | 1.00 |
| Main Channel US | 342.1 HEMINWAY DAM | FEMA 10-YR | 598.80 | 483.50 | 484.68 | 484.68 | 485.27 | 0.005671 | 6.14 | 97.58 | 82.66 | 1.00 |
| Main Channel US | 342.1 HEMINWAY DAM | FEMA 50-YR | 1056.62 | 483.50 | 485.22 | 485.22 | 486.08 | 0.005092 | 7.42 | 142.43 | 82.69 | 1.00 |
| Main Channel US | 342.1 HEMINWAY DAM | FEMA 500-YR | 1843.62 | 483.50 | 485.99 | 485.99 | 487.24 | 0.004658 | 8.96 | 205.75 | 82.72 | 1.00 |
| Main Channel US | 342.1 HEMINWAY DAM | M&M 2-YR | 293.84 | 483.50 | 484.22 | 484.22 | 484.60 | 0.006923 | 4.92 | 59.70 | 82.64 | 1.02 |
| Main Channel US | 342.1 HEMINWAY DAM | M&M 1-YR | 159.85 | 483.50 | 483.99 | 483.99 | 484.23 | 0.007645 | 3.98 | 40.13 | 82.62 | 1.01 |
| Main Channel US | 342.1 HEMINWAY DAM | Bankful Q | 241.97 | 483.50 | 484.14 | 484.14 | 484.47 | 0.007084 | 4.59 | 52.73 | 82.63 | 1.01 |
| | | | | | | | | | | | | |
| Main Channel US | 342.05 | FEMA 100-YR | 1271.74 | 474.70 | 482.36 | 476.96 | 482.43 | 0.000070 | 2.11 | 602.51 | 82.19 | 0.14 |
| Main Channel US | 342.05 | FEMA Floodway | 1261.95 | 474.70 | 482.81 | 476.95 | 482.87 | 0.000057 | 1.97 | 639.80 | 82.23 | 0.12 |
| Main Channel US | 342.05 | FEMA 10-YR | 598.80 | 474.70 | 478.49 | 476.19 | 478.56 | 0.000167 | 2.10 | 285.63 | 81.87 | 0.20 |
| Main Channel US | 342.05 | FEMA 50-YR | 1056.62 | 474.70 | 481.21 | 476.74 | 481.28 | 0.000083 | 2.08 | 508.10 | 82.09 | 0.15 |
| Main Channel US | 342.05 | FEMA 500-YR | 1843.62 | 474.70 | 482.98 | 477.51 | 483.11 | 0.000114 | 2.82 | 653.95 | 82.24 | 0.18 |
| Main Channel US | 342.05 | M&M 2-YR | 293.84 | 474.70 | 475.19 | 475.74 | 480.37 | 0.401981 | 18.26 | 16.09 | 66.16 | 6.53 |
| Main Channel US | 342.05 | M&M 1-YR | 159.85 | 474.70 | 475.08 | 475.49 | 479.40 | 0.474382 | 16.69 | 9.58 | 51.04 | 6.79 |
| Main Channel US | 342.05 | Bankful Q | 241.97 | 474.70 | 475.15 | 475.65 | 480.05 | 0.424757 | 17.76 | 13.62 | 60.88 | 6.62 |
| | | | | | | | | | | | | |
| Main Channel DS | 341.2 | FEMA 100-YR | 2840.00 | 472.00 | 481.34 | 478.91 | 482.33 | 0.006138 | 8.22 | 364.50 | 51.86 | 0.52 |
| Main Channel DS | 341.2 | FEMA Floodway | 2840.00 | 472.00 | 481.52 | 478.85 | 482.75 | 0.008096 | 8.88 | 319.71 | 39.85 | 0.55 |
| Main Channel DS | 341.2 | FEMA 10-YR | 1130.00 | 472.00 | 477.90 | 476.29 | 478.49 | 0.006745 | 6.23 | 188.19 | 50.17 | 0.51 |
| Main Channel DS | 341.2 | FEMA 50-YR | 2200.00 | 472.00 | 480.40 | 478.14 | 481.19 | 0.005626 | 7.33 | 316.10 | 51.56 | 0.49 |
| Main Channel DS | 341.2 | FEMA 500-YR | 5000.00 | 472.00 | 482.95 | 481.05 | 483.09 | 0.001139 | 3.99 | 1747.06 | 565.08 | 0.23 |
| Main Channel DS | 341.2 | M&M 2-YR | 461.00 | 472.00 | 475.45 | 474.76 | 475.92 | 0.012191 | 5.49 | 83.95 | 35.93 | 0.63 |
| Main Channel DS | 341.2 | M&M 1-YR | 221.00 | 472.00 | 474.37 | 473.99 | 474.71 | 0.015301 | 4.65 | 47.49 | 31.44 | 0.67 |
| Main Channel DS | 341.2 | Bankful Q | 330.00 | 472.00 | 474.90 | 474.37 | 475.30 | 0.013590 | 5.11 | 64.52 | 33.62 | 0.65 |
| | | | | | | | | | | | | |
| Main Channel DS | 341.1 | FEMA 100-YR | 2840.00 | 469.70 | 481.55 | 477.10 | 481.68 | 0.000959 | 3.82 | 1204.63 | 474.70 | 0.20 |
| Main Channel DS | 341.1 | FEMA Floodway | 2840.00 | 469.70 | 481.64 | 477.01 | 481.92 | 0.001896 | 4.80 | 712.21 | 159.74 | 0.26 |
| Main Channel DS | 341.1 | FEMA 10-YR | 1130.00 | 469.70 | 477.50 | 474.10 | 477.89 | 0.003114 | 5.11 | 229.94 | 41.05 | 0.35 |
| Main Channel DS | 341.1 | FEMA 50-YR | 2200.00 | 469.70 | 480.36 | 476.09 | 480.63 | 0.001840 | 4.90 | 699.44 | 372.83 | 0.28 |
| Main Channel DS | 341.1 | FEMA 500-YR | 5000.00 | 469.70 | 482.84 | 480.73 | 482.98 | 0.000944 | 4.09 | 1865.61 | 531.98 | 0.21 |
| Main Channel DS | 341.1 | M&M 2-YR | 461.00 | 469.70 | 474.84 | 472.38 | 475.03 | 0.002605 | 3.51 | 132.05 | 33.81 | 0.30 |
| Main Channel DS | 341.1 | M&M 1-YR | 221.00 | 469.70 | 473.61 | 471.49 | 473.70 | 0.001813 | 2.40 | 92.12 | 30.96 | 0.25 |
| Main Channel DS | 341.1 | Bankful Q | 330.00 | 469.70 | 474.21 | 471.93 | 474.35 | 0.002262 | 2.97 | 111.29 | 32.45 | 0.28 |
| | | | | | | | | | | | | |
| Main Channel DS | 341 AL | FEMA 100-YR | 2840.00 | 470.70 | 481.53 | 479.60 | 481.62 | 0.000431 | 3.57 | 1589.34 | 556.95 | 0.20 |
| Main Channel DS | 341 AL | FEMA Floodway | 2840.00 | 470.70 | 481.65 | 479.60 | 481.79 | 0.000664 | 3.91 | 1099.04 | 275.35 | 0.22 |
| Main Channel DS | 341 AL | FEMA 10-YR | 1130.00 | 470.70 | 476.84 | 475.25 | 477.62 | 0.003994 | 7.19 | 164.61 | 37.01 | 0.56 |
| Main Channel DS | 341 AL | FEMA 50-YR | 2200.00 | 470.70 | 480.32 | 477.24 | 480.52 | 0.000880 | 4.67 | 943.82 | 473.57 | 0.28 |
| Main Channel DS | 341 AL | FEMA 500-YR | 5000.00 | 470.70 | 482.81 | 480.50 | 482.92 | 0.000468 | 4.04 | 2323.29 | 586.57 | 0.21 |
| Main Channel DS | 341 AL | M&M 2-YR | 461.00 | 470.70 | 474.10 | 473.60 | 474.73 | 0.007597 | 6.36 | 72.68 | 30.31 | 0.71 |
| Main Channel DS | 341 AL | M&M 1-YR | 221.00 | 470.70 | 473.00 | 472.77 | 473.46 | 0.010372 | 5.41 | 40.87 | 27.50 | 0.78 |
| Main Channel DS | 341 AL | Bankful Q | 330.00 | 470.70 | 473.51 | 473.17 | 474.07 | 0.009226 | 5.98 | 55.20 | 28.85 | 0.76 |
| | | | | | | | | | | | | |
| Main Channel DS | 340.2 | FEMA 100-YR | 2840.00 | 471.10 | 481.37 | 477.64 | 481.60 | 0.000813 | 5.03 | 1295.13 | 553.34 | 0.28 |
| Main Channel DS | 340.2 | FEMA Floodway | 2840.00 | 471.10 | 480.76 | 477.64 | 481.70 | 0.002564 | 8.37 | 488.41 | 150.00 | 0.48 |
| Main Channel DS | 340.2 | FEMA 10-YR | 1130.00 | 471.10 | 476.87 | 474.64 | 477.54 | 0.002585 | 6.53 | 173.05 | 30.04 | 0.48 |
| Main Channel DS | 340.2 | FEMA 50-YR | 2200.00 | 471.10 | 479.07 | 476.60 | 480.39 | 0.003813 | 9.20 | 239.13 | 30.10 | 0.58 |
| Main Channel DS | 340.2 | FEMA 500-YR | 5000.00 | 471.10 | 482.69 | 481.15 | 482.90 | 0.000840 | 5.54 | 2041.01 | 583.62 | 0.29 |
| Main Channel DS | 340.2 | M&M 2-YR | 461.00 | 471.10 | 474.19 | 473.04 | 474.58 | 0.002872 | 4.98 | 92.64 | 29.98 | 0.50 |
| Main Channel DS | 340.2 | M&M 1-YR | 221.00 | 471.10 | 473.07 | 472.29 | 473.29 | 0.002730 | 3.75 | 58.97 | 29.95 | 0.47 |
| Main Channel DS | 340.2 | Bankful Q | 330.00 | 471.10 | 473.60 | 472.66 | 473.90 | 0.002874 | 4.41 | 74.78 | 29.96 | 0.49 |
| | | | | | | | | | | | | |
| Main Channel DS | 340.15 ECHO LAKE ROAD | | Bridge | | | | | | | | | |
| | | | | | | | | | | | | |

HEC-RAS Plan: EXIST (Continued)

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Main Channel DS | 340.1 | FEMA 100-YR | 2840.00 | 471.10 | 480.59 | 477.65 | 481.38 | 0.002372 | 7.97 | 631.71 | 313.93 | 0.46 |
| Main Channel DS | 340.1 | FEMA Floodway | 2840.00 | 471.10 | 480.25 | 477.65 | 481.62 | 0.003647 | 9.69 | 371.57 | 119.93 | 0.57 |
| Main Channel DS | 340.1 | FEMA 10-YR | 1130.00 | 471.10 | 476.73 | 474.64 | 477.42 | 0.002800 | 6.71 | 168.47 | 29.99 | 0.50 |
| Main Channel DS | 340.1 | FEMA 50-YR | 2200.00 | 471.10 | 479.06 | 476.62 | 480.38 | 0.003843 | 9.22 | 238.54 | 42.93 | 0.58 |
| Main Channel DS | 340.1 | FEMA 500-YR | 5000.00 | 471.10 | 481.74 | 481.44 | 482.70 | 0.003158 | 9.77 | 1041.45 | 399.07 | 0.53 |
| Main Channel DS | 340.1 | M&M 2-YR | 461.00 | 471.10 | 474.01 | 473.04 | 474.45 | 0.003465 | 5.29 | 87.21 | 29.95 | 0.55 |
| Main Channel DS | 340.1 | M&M 1-YR | 221.00 | 471.10 | 472.90 | 472.29 | 473.16 | 0.003655 | 4.11 | 53.81 | 29.93 | 0.54 |
| Main Channel DS | 340.1 | Bankful Q | 330.00 | 471.10 | 473.41 | 472.66 | 473.77 | 0.003661 | 4.77 | 69.24 | 29.94 | 0.55 |
| | | | | | | | | | | | | |
| Main Channel DS | 340 AK | FEMA 100-YR | 2840.00 | 471.10 | 479.85 | 477.65 | 481.31 | 0.004124 | 10.06 | 413.09 | 283.47 | 0.60 |
| Main Channel DS | 340 AK | FEMA Floodway | 2840.00 | 471.10 | 480.21 | 477.65 | 481.60 | 0.003728 | 9.77 | 366.51 | 119.93 | 0.57 |
| Main Channel DS | 340 AK | FEMA 10-YR | 1130.00 | 471.10 | 476.71 | 474.64 | 477.41 | 0.002826 | 6.73 | 167.94 | 29.99 | 0.50 |
| Main Channel DS | 340 AK | FEMA 50-YR | 2200.00 | 471.10 | 479.04 | 476.62 | 480.36 | 0.003876 | 9.25 | 238.53 | 40.93 | 0.58 |
| Main Channel DS | 340 AK | FEMA 500-YR | 5000.00 | 471.10 | 481.44 | 481.44 | 482.66 | 0.003933 | 10.73 | 924.12 | 376.66 | 0.59 |
| Main Channel DS | 340 AK | M&M 2-YR | 461.00 | 471.10 | 473.99 | 473.05 | 474.43 | 0.003553 | 5.33 | 86.51 | 29.95 | 0.55 |
| Main Channel DS | 340 AK | M&M 1-YR | 221.00 | 471.10 | 472.87 | 472.28 | 473.14 | 0.003824 | 4.17 | 53.05 | 29.93 | 0.55 |
| Main Channel DS | 340 AK | Bankful Q | 330.00 | 471.10 | 473.39 | 472.66 | 473.75 | 0.003790 | 4.82 | 68.48 | 29.94 | 0.56 |
| | | | | | | | | | | | | |
| Main Channel DS | 339.6 AJ | FEMA 100-YR | 2840.00 | 470.30 | 479.90 | 476.85 | 480.42 | 0.001672 | 6.85 | 871.89 | 459.90 | 0.39 |
| Main Channel DS | 339.6 AJ | FEMA Floodway | 2840.00 | 470.30 | 480.06 | 476.85 | 480.80 | 0.002040 | 7.63 | 531.78 | 119.93 | 0.43 |
| Main Channel DS | 339.6 AJ | FEMA 10-YR | 1130.00 | 470.30 | 476.21 | 473.84 | 476.84 | 0.002423 | 6.39 | 176.90 | 30.01 | 0.46 |
| Main Channel DS | 339.6 AJ | FEMA 50-YR | 2200.00 | 470.30 | 478.65 | 475.82 | 479.55 | 0.002647 | 7.99 | 398.92 | 223.94 | 0.49 |
| Main Channel DS | 339.6 AJ | FEMA 500-YR | 5000.00 | 470.30 | 481.42 | 480.35 | 481.79 | 0.001445 | 6.87 | 1658.93 | 574.08 | 0.36 |
| Main Channel DS | 339.6 AJ | M&M 2-YR | 461.00 | 470.30 | 473.32 | 472.25 | 473.72 | 0.003113 | 5.11 | 90.27 | 29.95 | 0.52 |
| Main Channel DS | 339.6 AJ | M&M 1-YR | 221.00 | 470.30 | 472.07 | 471.49 | 472.34 | 0.003814 | 4.16 | 53.10 | 29.93 | 0.55 |
| Main Channel DS | 339.6 AJ | Bankful Q | 330.00 | 470.30 | 472.61 | 471.85 | 472.96 | 0.003688 | 4.78 | 69.08 | 29.94 | 0.55 |
| | | | | | | | | | | | | |
| Main Channel DS | 339.56 | FEMA 100-YR | 2840.00 | 470.30 | 479.81 | 476.83 | 480.41 | 0.001884 | 7.23 | 803.88 | 453.18 | 0.41 |
| Main Channel DS | 339.56 | FEMA Floodway | 2840.00 | 470.30 | 479.94 | 476.83 | 480.78 | 0.002298 | 8.05 | 488.63 | 119.93 | 0.46 |
| Main Channel DS | 339.56 | FEMA 10-YR | 1130.00 | 470.30 | 476.20 | 473.84 | 476.84 | 0.002428 | 6.39 | 176.79 | 30.01 | 0.46 |
| Main Channel DS | 339.56 | FEMA 50-YR | 2200.00 | 470.30 | 478.55 | 475.82 | 479.55 | 0.002873 | 8.28 | 364.12 | 206.72 | 0.51 |
| Main Channel DS | 339.56 | FEMA 500-YR | 5000.00 | 470.30 | 481.38 | 480.40 | 481.79 | 0.001567 | 7.14 | 1589.74 | 570.62 | 0.38 |
| Main Channel DS | 339.56 | M&M 2-YR | 461.00 | 470.30 | 473.31 | 472.25 | 473.72 | 0.003129 | 5.12 | 90.12 | 29.95 | 0.52 |
| Main Channel DS | 339.56 | M&M 1-YR | 221.00 | 470.30 | 472.07 | 471.49 | 472.34 | 0.003858 | 4.18 | 52.90 | 29.93 | 0.55 |
| Main Channel DS | 339.56 | Bankful Q | 330.00 | 470.30 | 472.60 | 471.85 | 472.96 | 0.003720 | 4.79 | 68.89 | 29.94 | 0.56 |
| | | | | | | | | | | | | |
| Main Channel DS | 339.55 WALKWAY | | Bridge | | | | | | | | | |
| | | | | | | | | | | | | |
| Main Channel DS | 339.51 | FEMA 100-YR | 2840.00 | 470.30 | 479.05 | 476.83 | 480.33 | 0.003642 | 9.62 | 488.90 | 366.10 | 0.57 |
| Main Channel DS | 339.51 | FEMA Floodway | 2840.00 | 470.30 | 479.30 | 476.83 | 480.44 | 0.003192 | 9.14 | 418.58 | 119.93 | 0.54 |
| Main Channel DS | 339.51 | FEMA 10-YR | 1130.00 | 470.30 | 476.18 | 473.84 | 476.82 | 0.002456 | 6.42 | 176.09 | 30.01 | 0.47 |
| Main Channel DS | 339.51 | FEMA 50-YR | 2200.00 | 470.30 | 478.27 | 475.82 | 479.42 | 0.003389 | 8.82 | 314.86 | 165.04 | 0.55 |
| Main Channel DS | 339.51 | FEMA 500-YR | 5000.00 | 470.30 | 481.31 | 480.43 | 481.74 | 0.001636 | 7.28 | 1568.13 | 565.78 | 0.39 |
| Main Channel DS | 339.51 | M&M 2-YR | 461.00 | 470.30 | 473.28 | 472.25 | 473.69 | 0.003235 | 5.17 | 89.16 | 29.95 | 0.53 |
| Main Channel DS | 339.51 | M&M 1-YR | 221.00 | 470.30 | 472.02 | 471.49 | 472.31 | 0.004189 | 4.29 | 51.56 | 29.93 | 0.58 |
| Main Channel DS | 339.51 | Bankful Q | 330.00 | 470.30 | 472.56 | 471.85 | 472.93 | 0.003933 | 4.88 | 67.68 | 29.94 | 0.57 |
| | | | | | | | | | | | | |
| Main Channel DS | 339.5 AI | FEMA 100-YR | 2840.00 | 470.30 | 479.11 | 476.85 | 480.29 | 0.003408 | 9.34 | 532.05 | 400.67 | 0.55 |
| Main Channel DS | 339.5 AI | FEMA Floodway | 2840.00 | 470.30 | 479.37 | 476.85 | 480.41 | 0.002942 | 8.81 | 448.94 | 119.93 | 0.52 |
| Main Channel DS | 339.5 AI | FEMA 10-YR | 1130.00 | 470.30 | 476.18 | 473.84 | 476.82 | 0.002460 | 6.42 | 175.99 | 30.01 | 0.47 |
| Main Channel DS | 339.5 AI | FEMA 50-YR | 2200.00 | 470.30 | 478.29 | 475.82 | 479.41 | 0.003283 | 8.69 | 330.53 | 167.57 | 0.54 |
| Main Channel DS | 339.5 AI | FEMA 500-YR | 5000.00 | 470.30 | 481.33 | 480.35 | 481.73 | 0.001555 | 7.10 | 1604.64 | 566.95 | 0.38 |
| Main Channel DS | 339.5 AI | M&M 2-YR | 461.00 | 470.30 | 473.27 | 472.25 | 473.69 | 0.003250 | 5.18 | 89.02 | 29.95 | 0.53 |
| Main Channel DS | 339.5 AI | M&M 1-YR | 221.00 | 470.30 | 472.02 | 471.49 | 472.30 | 0.004237 | 4.30 | 51.38 | 29.93 | 0.58 |
| Main Channel DS | 339.5 AI | Bankful Q | 330.00 | 470.30 | 472.56 | 471.85 | 472.93 | 0.003964 | 4.89 | 67.51 | 29.94 | 0.57 |
| | | | | | | | | | | | | |
| Main Channel DS | 339.1 | FEMA 100-YR | 2840.00 | 469.10 | 478.44 | 475.65 | 479.34 | 0.002577 | 8.35 | 551.15 | 227.93 | 0.48 |
| Main Channel DS | 339.1 | FEMA Floodway | 2840.00 | 469.10 | 478.67 | 475.65 | 479.58 | 0.002489 | 8.32 | 475.94 | 119.93 | 0.47 |
| Main Channel DS | 339.1 | FEMA 10-YR | 1130.00 | 469.10 | 475.65 | 472.64 | 476.16 | 0.001788 | 5.76 | 196.12 | 30.02 | 0.40 |
| Main Channel DS | 339.1 | FEMA 50-YR | 2200.00 | 469.10 | 477.45 | 474.61 | 478.48 | 0.002902 | 8.35 | 339.69 | 166.50 | 0.51 |
| Main Channel DS | 339.1 | FEMA 500-YR | 5000.00 | 469.10 | 480.43 | 479.34 | 481.16 | 0.002235 | 8.61 | 1005.45 | 227.94 | 0.45 |
| Main Channel DS | 339.1 | M&M 2-YR | 461.00 | 469.10 | 472.60 | 471.05 | 472.90 | 0.001972 | 4.41 | 104.62 | 29.96 | 0.42 |
| Main Channel DS | 339.1 | M&M 1-YR | 221.00 | 469.10 | 471.03 | 470.29 | 471.26 | 0.002918 | 3.83 | 57.74 | 29.93 | 0.49 |
| Main Channel DS | 339.1 | Bankful Q | 330.00 | 469.10 | 471.64 | 470.66 | 471.93 | 0.002747 | 4.35 | 75.85 | 29.94 | 0.48 |
| | | | | | | | | | | | | |
| Main Channel DS | 339 | FEMA 100-YR | 2840.00 | 468.60 | 478.29 | 475.13 | 479.12 | 0.002306 | 8.03 | 576.82 | 241.27 | 0.46 |
| Main Channel DS | 339 | FEMA Floodway | 2840.00 | 468.60 | 478.43 | 475.14 | 479.38 | 0.002471 | 8.35 | 464.03 | 120.00 | 0.47 |
| Main Channel DS | 339 | FEMA 10-YR | 1130.00 | 468.60 | 475.56 | 472.14 | 476.01 | 0.001494 | 5.42 | 208.59 | 30.07 | 0.36 |
| Main Channel DS | 339 | FEMA 50-YR | 2200.00 | 468.60 | 477.25 | 474.12 | 478.25 | 0.002731 | 8.20 | 333.45 | 195.71 | 0.49 |
| Main Channel DS | 339 | FEMA 500-YR | 5000.00 | 468.60 | 480.33 | 479.11 | 480.97 | 0.001849 | 8.17 | 1135.46 | 307.75 | 0.42 |
| Main Channel DS | 339 | M&M 2-YR | 461.00 | 468.60 | 472.50 | 470.55 | 472.74 | 0.001403 | 3.94 | 116.86 | 29.99 | 0.35 |
| Main Channel DS | 339 | M&M 1-YR | 221.00 | 468.60 | 470.89 | 469.79 | 471.05 | 0.001691 | 3.22 | 68.60 | 29.95 | 0.38 |
| Main Channel DS | 339 | Bankful Q | 330.00 | 468.60 | 471.50 | 470.16 | 471.73 | 0.001797 | 3.80 | 86.88 | 29.97 | 0.39 |
| | | | | | | | | | | | | |
| Main Channel DS | 338.2 | FEMA 100-YR | 2840.00 | 468.60 | 477.67 | 475.13 | 479.01 | 0.003583 | 9.63 | 417.49 | 215.00 | 0.56 |
| Main Channel DS | 338.2 | FEMA Floodway | 2840.00 | 468.60 | 478.28 | 475.14 | 479.30 | 0.002666 | 8.60 | 446.02 | 120.00 | 0.49 |
| Main Channel DS | 338.2 | FEMA 10-YR | 1130.00 | 468.60 | 475.51 | 472.14 | 475.97 | 0.001525 | 5.46 | 207.07 | 30.06 | 0.37 |
| Main Channel DS | 338.2 | FEMA 50-YR | 2200.00 | 468.60 | 477.08 | 474.12 | 478.16 | 0.002970 | 8.46 | 303.67 | 142.44 | 0.51 |
| Main Channel DS | 338.2 | FEMA 500-YR | 5000.00 | 468.60 | 480.04 | 479.13 | 480.90 | 0.002357 | 9.07 | 990.38 | 278.53 | 0.47 |
| Main Channel DS | 338.2 | M&M 2-YR | 461.00 | 468.60 | 472.46 | 470.55 | 472.70 | 0.001456 | 3.99 | 115.47 | 29.99 | 0.36 |
| Main Channel DS | 338.2 | M&M 1-YR | 221.00 | 468.60 | 470.83 | 469.79 | 471.00 | 0.001837 | 3.31 | 66.82 | 29.95 | 0.39 |
| Main Channel DS | 338.2 | Bankful Q | 330.00 | 468.60 | 471.44 | 470.16 | 471.67 | 0.001927 | 3.88 | 84.96 | 29.97 | 0.41 |
| | | | | | | | | | | | | |
| Main Channel DS | 338.15 16-INCH-PIPE | | Bridge | | | | | | | | | |
| | | | | | | | | | | | | |
| Main Channel DS | 338.1 | FEMA 100-YR | 2840.00 | 468.60 | 477.38 | 475.13 | 478.96 | 0.004244 | 10.30 | 356.11 | 210.35 | 0.61 |
| Main Channel DS | 338.1 | FEMA Floodway | 2840.00 | 468.60 | 478.05 | 475.14 | 479.24 | 0.003082 | 9.13 | 395.52 | 100.00 | 0.52 |
| Main Channel DS | 338.1 | FEMA 10-YR | 1130.00 | 468.60 | 474.02 | 472.14 | 474.77 | 0.003125 | 6.96 | 162.36 | 30.03 | 0.53 |
| Main Channel DS | 338.1 | FEMA 50-YR | 2200.00 | 468.60 | 476.53 | 474.12 | 477.85 | 0.003805 | 9.22 | 247.04 | 72.98 | 0.58 |
| Main Channel DS | 338.1 | FEMA 500-YR | 5000.00 | 468.60 | 479.89 | 479.13 | 480.82 | 0.002591 | 9.42 | 947.67 | 273.47 | 0.49 |
| Main Channel DS | 338.1 | M&M 2-YR | 461.00 | 468.60 | 471.93 | 470.55 | 472.26 | 0.002286 | 4.62 | 99.72 | 29.98 | 0.45 |
| Main Channel DS | 338.1 | M&M 1-YR | 221.00 | 468.60 | 470.77 | 469.79 | 470.95 | 0.002011 | 3.40 | 64.94 | 29.95 | 0.41 |
| Main Channel DS | 338.1 | Bankful Q | 330.00 | 468.60 | 471.35 | 470.16 | 471.60 | 0.002137 | 4.02 | 82.19 | 29.97 | 0.43 |
| | | | | | | | | | | | | |

HEC-RAS Plan: EXIST (Continued)

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Main Channel DS | 337 AH | FEMA 100-YR | 2840.00 | 468.60 | 476.97 | 475.00 | 478.80 | 0.004983 | 10.88 | 282.54 | 159.87 | 0.66 |
| Main Channel DS | 337 AH | FEMA Floodway | 2840.00 | 468.60 | 477.70 | 475.00 | 479.11 | 0.003621 | 9.71 | 340.13 | 90.55 | 0.57 |
| Main Channel DS | 337 AH | FEMA 10-YR | 1130.00 | 468.60 | 473.95 | 472.07 | 474.67 | 0.003009 | 6.82 | 165.57 | 31.02 | 0.52 |
| Main Channel DS | 337 AH | FEMA 50-YR | 2200.00 | 468.60 | 476.45 | 474.00 | 477.72 | 0.003678 | 9.04 | 243.35 | 31.08 | 0.57 |
| Main Channel DS | 337 AH | FEMA 500-YR | 5000.00 | 468.60 | 479.63 | 479.06 | 480.72 | 0.002966 | 9.94 | 872.26 | 258.46 | 0.53 |
| Main Channel DS | 337 AH | M&M 2-YR | 461.00 | 468.60 | 471.87 | 470.50 | 472.19 | 0.002250 | 4.56 | 101.16 | 30.98 | 0.44 |
| Main Channel DS | 337 AH | M&M 1-YR | 221.00 | 468.60 | 470.71 | 469.77 | 470.89 | 0.002044 | 3.39 | 65.28 | 30.95 | 0.41 |
| Main Channel DS | 337 AH | Bankful Q | 330.00 | 468.60 | 471.29 | 470.12 | 471.53 | 0.002130 | 3.97 | 83.08 | 30.96 | 0.43 |
| | | | | | | | | | | | | |
| Main Channel DS | 336.2 | FEMA 100-YR | 2840.00 | 467.60 | 477.88 | 474.16 | 478.25 | 0.000909 | 5.98 | 1003.89 | 371.64 | 0.33 |
| Main Channel DS | 336.2 | FEMA Floodway | 2840.00 | 467.60 | 477.58 | 474.16 | 478.99 | 0.002355 | 9.52 | 298.38 | 29.97 | 0.53 |
| Main Channel DS | 336.2 | FEMA 10-YR | 1130.00 | 467.60 | 473.98 | 471.15 | 474.53 | 0.001348 | 5.93 | 190.60 | 29.91 | 0.41 |
| Main Channel DS | 336.2 | FEMA 50-YR | 2200.00 | 467.60 | 476.90 | 473.14 | 477.39 | 0.001085 | 6.28 | 665.07 | 323.81 | 0.36 |
| Main Channel DS | 336.2 | FEMA 500-YR | 5000.00 | 467.60 | 480.16 | 477.77 | 480.38 | 0.000643 | 5.55 | 2050.54 | 580.03 | 0.28 |
| Main Channel DS | 336.2 | M&M 2-YR | 461.00 | 467.60 | 471.89 | 469.55 | 472.10 | 0.000734 | 3.60 | 128.13 | 29.87 | 0.31 |
| Main Channel DS | 336.2 | M&M 1-YR | 221.00 | 467.60 | 470.72 | 468.79 | 470.81 | 0.000449 | 2.37 | 93.18 | 29.85 | 0.24 |
| Main Channel DS | 336.2 | Bankful Q | 330.00 | 467.60 | 471.31 | 469.16 | 471.44 | 0.000591 | 2.99 | 110.55 | 29.86 | 0.27 |
| | | | | | | | | | | | | |
| Main Channel DS | 336.15 Parking Lot | | Bridge | | | | | | | | | |
| | | | | | | | | | | | | |
| Main Channel DS | 336.1 | FEMA 100-YR | 2840.00 | 467.60 | 477.64 | 474.16 | 478.09 | 0.001070 | 6.43 | 917.53 | 360.05 | 0.36 |
| Main Channel DS | 336.1 | FEMA Floodway | 2840.00 | 467.60 | 476.66 | 474.16 | 478.37 | 0.003101 | 10.50 | 270.59 | 29.95 | 0.62 |
| Main Channel DS | 336.1 | FEMA 10-YR | 1130.00 | 467.60 | 473.86 | 471.15 | 474.43 | 0.001430 | 6.05 | 186.83 | 29.91 | 0.43 |
| Main Channel DS | 336.1 | FEMA 50-YR | 2200.00 | 467.60 | 475.45 | 473.14 | 476.82 | 0.002800 | 9.38 | 234.46 | 214.13 | 0.59 |
| Main Channel DS | 336.1 | FEMA 500-YR | 5000.00 | 467.60 | 480.04 | 477.77 | 480.29 | 0.000691 | 5.71 | 1985.46 | 569.31 | 0.29 |
| Main Channel DS | 336.1 | M&M 2-YR | 461.00 | 467.60 | 471.87 | 469.55 | 472.07 | 0.000750 | 3.62 | 127.26 | 29.87 | 0.31 |
| Main Channel DS | 336.1 | M&M 1-YR | 221.00 | 467.60 | 470.71 | 468.79 | 470.80 | 0.000453 | 2.38 | 92.90 | 29.85 | 0.24 |
| Main Channel DS | 336.1 | Bankful Q | 330.00 | 467.60 | 471.29 | 469.16 | 471.43 | 0.000599 | 3.00 | 110.03 | 29.86 | 0.28 |
| | | | | | | | | | | | | |
| Main Channel DS | 336 AG | FEMA 100-YR | 2840.00 | 467.40 | 475.95 | 475.08 | 477.89 | 0.006773 | 12.09 | 352.52 | 96.05 | 0.76 |
| Main Channel DS | 336 AG | FEMA Floodway | 2840.00 | 467.40 | 476.39 | 474.90 | 478.23 | 0.005881 | 11.68 | 315.29 | 47.00 | 0.71 |
| Main Channel DS | 336 AG | FEMA 10-YR | 1130.00 | 467.40 | 473.58 | 472.00 | 474.34 | 0.004025 | 7.35 | 194.25 | 52.99 | 0.55 |
| Main Channel DS | 336 AG | FEMA 50-YR | 2200.00 | 467.40 | 475.24 | 474.10 | 476.70 | 0.005737 | 10.44 | 292.86 | 69.91 | 0.69 |
| Main Channel DS | 336 AG | FEMA 500-YR | 5000.00 | 467.40 | 479.97 | 478.22 | 480.26 | 0.001169 | 6.61 | 2178.07 | 598.32 | 0.34 |
| Main Channel DS | 336 AG | M&M 2-YR | 461.00 | 467.40 | 471.67 | 470.22 | 472.02 | 0.003089 | 4.85 | 107.33 | 37.84 | 0.45 |
| Main Channel DS | 336 AG | M&M 1-YR | 221.00 | 467.40 | 470.60 | 469.39 | 470.77 | 0.002350 | 3.35 | 70.91 | 31.67 | 0.37 |
| Main Channel DS | 336 AG | Bankful Q | 330.00 | 467.40 | 471.14 | 469.79 | 471.39 | 0.002733 | 4.10 | 88.28 | 33.62 | 0.41 |

HEC-RAS Plan: EXIST River: Steele Brook Reach: Old Channel

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Old Channel | 7 | FEMA 100-YR | 1.00 | 484.20 | 484.73 | 484.40 | 484.73 | 0.000598 | 0.25 | 4.00 | 15.04 | 0.09 |
| Old Channel | 7 | FEMA Floodway | 1.00 | 484.20 | 484.81 | 484.40 | 484.81 | 0.000285 | 0.19 | 5.28 | 17.29 | 0.06 |
| Old Channel | 7 | FEMA 10-YR | 1.00 | 484.20 | 484.43 | 484.40 | 484.46 | 0.048497 | 1.30 | 0.77 | 6.60 | 0.67 |
| Old Channel | 7 | FEMA 50-YR | 1.00 | 484.20 | 484.56 | 484.40 | 484.56 | 0.004855 | 0.55 | 1.82 | 10.16 | 0.23 |
| Old Channel | 7 | FEMA 500-YR | 1.00 | 484.20 | 485.59 | 484.40 | 485.59 | 0.000004 | 0.04 | 27.24 | 39.25 | 0.01 |
| Old Channel | 7 | M&M 2-YR | 1.00 | 484.20 | 484.42 | 484.40 | 484.45 | 0.069308 | 1.49 | 0.67 | 6.17 | 0.79 |
| Old Channel | 7 | M&M 1-YR | 1.00 | 484.20 | 484.41 | 484.40 | 484.45 | 0.084973 | 1.60 | 0.62 | 5.94 | 0.87 |
| Old Channel | 7 | Bankful Q | 1.00 | 484.20 | 484.41 | 484.40 | 484.45 | 0.075799 | 1.54 | 0.65 | 6.07 | 0.83 |
| | | | | | | | | | | | | |
| Old Channel | 6 | FEMA 100-YR | 376.53 | 479.20 | 484.20 | 482.36 | 484.58 | 0.004015 | 5.12 | 80.09 | 22.82 | 0.42 |
| Old Channel | 6 | FEMA Floodway | 402.36 | 479.20 | 484.30 | 482.48 | 484.72 | 0.004264 | 5.34 | 82.39 | 23.22 | 0.44 |
| Old Channel | 6 | FEMA 10-YR | 79.30 | 479.20 | 481.82 | 480.60 | 481.91 | 0.002042 | 2.40 | 33.11 | 16.19 | 0.29 |
| Old Channel | 6 | FEMA 50-YR | 258.55 | 479.20 | 484.00 | 481.73 | 484.20 | 0.002192 | 3.69 | 75.66 | 22.05 | 0.31 |
| Old Channel | 6 | FEMA 500-YR | 845.53 | 479.20 | 485.43 | 484.22 | 485.57 | 0.001807 | 3.92 | 313.78 | 150.45 | 0.29 |
| Old Channel | 6 | M&M 2-YR | 30.62 | 479.20 | 480.81 | 480.15 | 480.86 | 0.002164 | 1.74 | 17.61 | 15.26 | 0.29 |
| Old Channel | 6 | M&M 1-YR | 5.10 | 479.20 | 480.08 | 479.67 | 480.08 | 0.001463 | 0.79 | 6.46 | 14.75 | 0.21 |
| Old Channel | 6 | Bankful Q | 17.49 | 479.20 | 480.50 | 479.97 | 480.53 | 0.001909 | 1.36 | 12.88 | 15.22 | 0.26 |
| | | | | | | | | | | | | |
| Old Channel | 5 | FEMA 100-YR | 376.53 | 479.20 | 483.94 | 481.70 | 484.25 | 0.001787 | 4.51 | 99.85 | 50.02 | 0.37 |
| Old Channel | 5 | FEMA Floodway | 402.36 | 479.20 | 484.03 | 481.81 | 484.36 | 0.001901 | 4.70 | 104.28 | 51.64 | 0.38 |
| Old Channel | 5 | FEMA 10-YR | 79.30 | 479.20 | 481.70 | 480.08 | 481.76 | 0.000599 | 1.88 | 42.15 | 16.91 | 0.21 |
| Old Channel | 5 | FEMA 50-YR | 258.55 | 479.20 | 483.87 | 481.15 | 484.02 | 0.000894 | 3.16 | 96.24 | 48.20 | 0.26 |
| Old Channel | 5 | FEMA 500-YR | 845.53 | 479.20 | 485.39 | 483.95 | 485.43 | 0.000277 | 2.07 | 599.38 | 216.11 | 0.15 |
| Old Channel | 5 | M&M 2-YR | 30.62 | 479.20 | 480.68 | 479.67 | 480.71 | 0.000448 | 1.23 | 24.98 | 16.86 | 0.18 |
| Old Channel | 5 | M&M 1-YR | 5.10 | 479.20 | 480.00 | 479.34 | 480.00 | 0.000089 | 0.38 | 13.42 | 16.83 | 0.07 |
| Old Channel | 5 | Bankful Q | 17.49 | 479.20 | 480.39 | 479.52 | 480.40 | 0.000292 | 0.87 | 20.07 | 16.85 | 0.14 |
| | | | | | | | | | | | | |
| Old Channel | 4 | FEMA 100-YR | 376.53 | 478.40 | 484.03 | 481.43 | 484.04 | 0.000106 | 1.22 | 472.09 | 191.49 | 0.10 |
| Old Channel | 4 | FEMA Floodway | 402.36 | 478.40 | 484.12 | 481.55 | 484.13 | 0.000109 | 1.25 | 488.22 | 191.80 | 0.10 |
| Old Channel | 4 | FEMA 10-YR | 79.30 | 478.40 | 481.64 | 479.76 | 481.69 | 0.000434 | 1.73 | 46.52 | 19.29 | 0.18 |
| Old Channel | 4 | FEMA 50-YR | 258.55 | 478.40 | 483.91 | 480.84 | 483.92 | 0.000057 | 0.88 | 452.29 | 190.78 | 0.07 |
| Old Channel | 4 | FEMA 500-YR | 845.53 | 478.40 | 483.25 | 483.25 | 485.18 | 0.010984 | 11.29 | 80.77 | 22.50 | 0.96 |
| Old Channel | 4 | M&M 2-YR | 30.62 | 478.40 | 480.64 | 479.33 | 480.66 | 0.000267 | 1.05 | 29.12 | 16.49 | 0.14 |
| Old Channel | 4 | M&M 1-YR | 5.10 | 478.40 | 479.99 | 478.86 | 479.99 | 0.000031 | 0.28 | 18.44 | 16.30 | 0.05 |
| Old Channel | 4 | Bankful Q | 17.49 | 478.40 | 480.37 | 479.15 | 480.38 | 0.000147 | 0.71 | 24.59 | 16.41 | 0.10 |
| | | | | | | | | | | | | |
| Old Channel | 3 | FEMA 100-YR | 789.26 | 478.00 | 484.01 | 483.04 | 484.03 | 0.000176 | 1.61 | 740.52 | 384.53 | 0.13 |
| Old Channel | 3 | FEMA Floodway | 799.05 | 478.00 | 484.10 | 483.08 | 484.12 | 0.000163 | 1.57 | 764.46 | 385.25 | 0.12 |
| Old Channel | 3 | FEMA 10-YR | 222.20 | 478.00 | 480.83 | 480.69 | 481.57 | 0.010282 | 6.91 | 32.22 | 17.35 | 0.89 |
| Old Channel | 3 | FEMA 50-YR | 544.38 | 478.00 | 482.73 | 482.13 | 483.80 | 0.006686 | 8.35 | 67.67 | 21.00 | 0.76 |
| Old Channel | 3 | FEMA 500-YR | 1757.38 | 478.00 | 483.51 | 483.51 | 483.66 | 0.001555 | 4.46 | 618.37 | 380.87 | 0.37 |
| Old Channel | 3 | M&M 2-YR | 112.16 | 478.00 | 480.03 | 479.96 | 480.58 | 0.012713 | 5.94 | 18.87 | 15.11 | 0.94 |
| Old Channel | 3 | M&M 1-YR | 62.15 | 478.00 | 479.53 | 479.48 | 479.95 | 0.013657 | 5.19 | 11.97 | 12.54 | 0.94 |
| Old Channel | 3 | Bankful Q | 89.03 | 478.00 | 479.81 | 479.76 | 480.31 | 0.013255 | 5.67 | 15.71 | 13.99 | 0.94 |
| | | | | | | | | | | | | |
| Old Channel | 2 | FEMA 100-YR | 789.26 | 476.60 | 481.87 | 481.56 | 483.78 | 0.010821 | 11.23 | 75.03 | 17.62 | 0.87 |
| Old Channel | 2 | FEMA Floodway | 799.05 | 476.60 | 482.19 | 481.58 | 483.90 | 0.009171 | 10.66 | 80.74 | 18.00 | 0.80 |
| Old Channel | 2 | FEMA 10-YR | 222.20 | 476.60 | 479.10 | 478.71 | 479.84 | 0.008728 | 6.88 | 32.29 | 13.01 | 0.77 |
| Old Channel | 2 | FEMA 50-YR | 544.38 | 476.60 | 480.98 | 480.48 | 482.36 | 0.009340 | 9.48 | 59.81 | 16.55 | 0.80 |
| Old Channel | 2 | FEMA 500-YR | 1757.38 | 476.60 | 483.11 | 482.41 | 483.15 | 0.000340 | 2.26 | 1171.42 | 493.45 | 0.16 |
| Old Channel | 2 | M&M 2-YR | 112.16 | 476.60 | 478.29 | 477.93 | 478.70 | 0.007276 | 5.15 | 21.78 | 12.94 | 0.70 |
| Old Channel | 2 | M&M 1-YR | 62.15 | 476.60 | 477.78 | 477.50 | 478.04 | 0.006772 | 4.08 | 15.22 | 12.90 | 0.66 |
| Old Channel | 2 | Bankful Q | 89.03 | 476.60 | 478.08 | 477.74 | 478.42 | 0.006985 | 4.69 | 18.99 | 12.92 | 0.68 |
| | | | | | | | | | | | | |
| Old Channel | 1 | FEMA 100-YR | 789.26 | 476.00 | 481.27 | 480.84 | 482.97 | 0.009227 | 10.65 | 80.51 | 19.37 | 0.82 |
| Old Channel | 1 | FEMA Floodway | 799.05 | 476.00 | 481.83 | 480.88 | 483.21 | 0.006779 | 9.61 | 91.56 | 20.71 | 0.71 |
| Old Channel | 1 | FEMA 10-YR | 222.20 | 476.00 | 478.21 | 478.05 | 479.08 | 0.011441 | 7.49 | 29.67 | 13.62 | 0.89 |
| Old Channel | 1 | FEMA 50-YR | 544.38 | 476.00 | 480.50 | 479.76 | 481.67 | 0.007347 | 8.75 | 65.93 | 18.70 | 0.73 |
| Old Channel | 1 | FEMA 500-YR | 1757.38 | 476.00 | 483.10 | 482.10 | 483.13 | 0.000221 | 1.98 | 1436.67 | 537.69 | 0.13 |
| Old Channel | 1 | M&M 2-YR | 112.16 | 476.00 | 477.31 | 477.31 | 477.95 | 0.014880 | 6.44 | 17.42 | 13.45 | 1.00 |
| Old Channel | 1 | M&M 1-YR | 62.15 | 476.00 | 476.88 | 476.88 | 477.32 | 0.015754 | 5.29 | 11.75 | 13.37 | 0.99 |
| Old Channel | 1 | Bankful Q | 89.03 | 476.00 | 477.12 | 477.12 | 477.67 | 0.015360 | 5.98 | 14.88 | 13.41 | 1.00 |

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**Partial Removal**
**Profile Plots**

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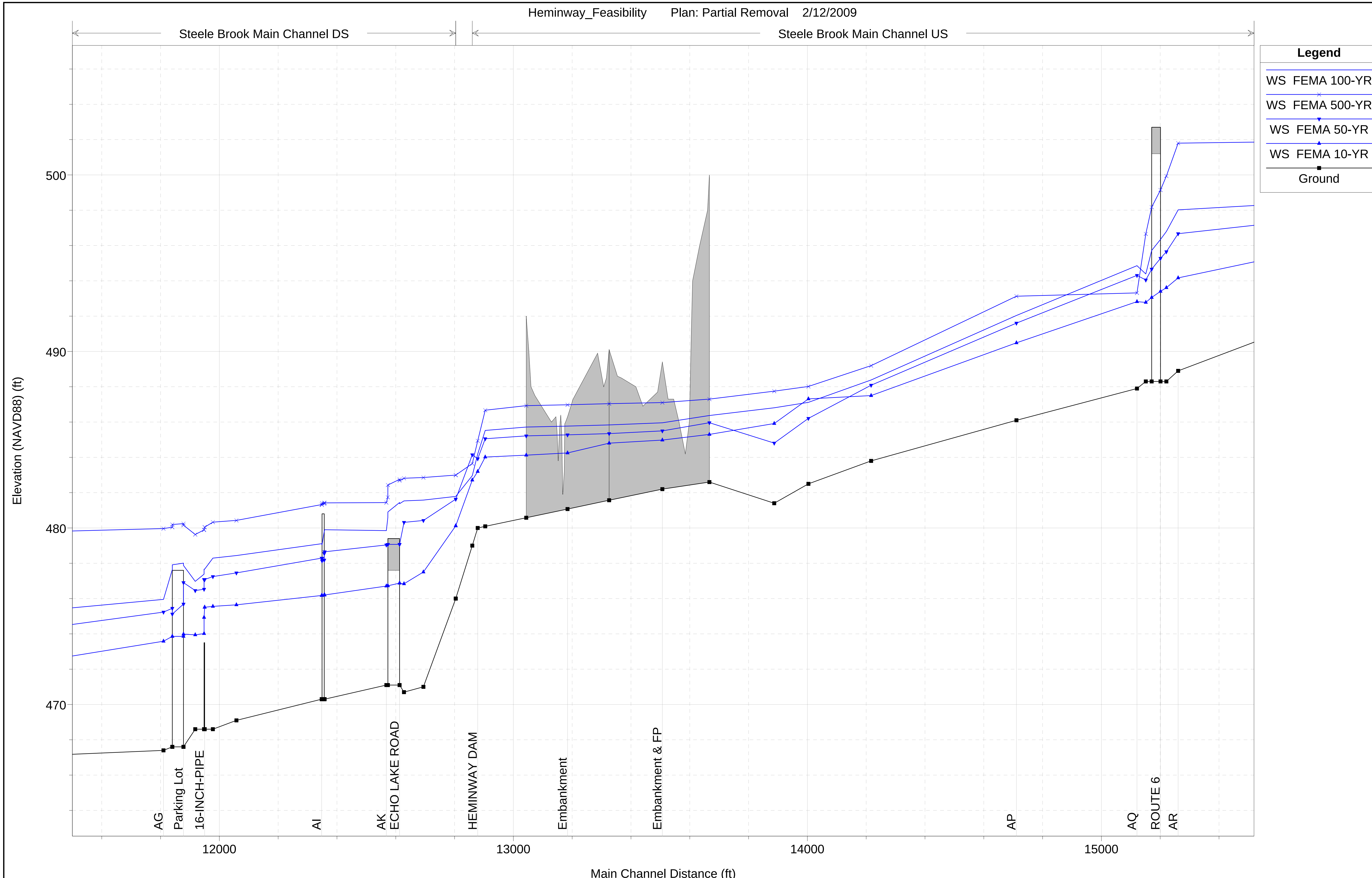
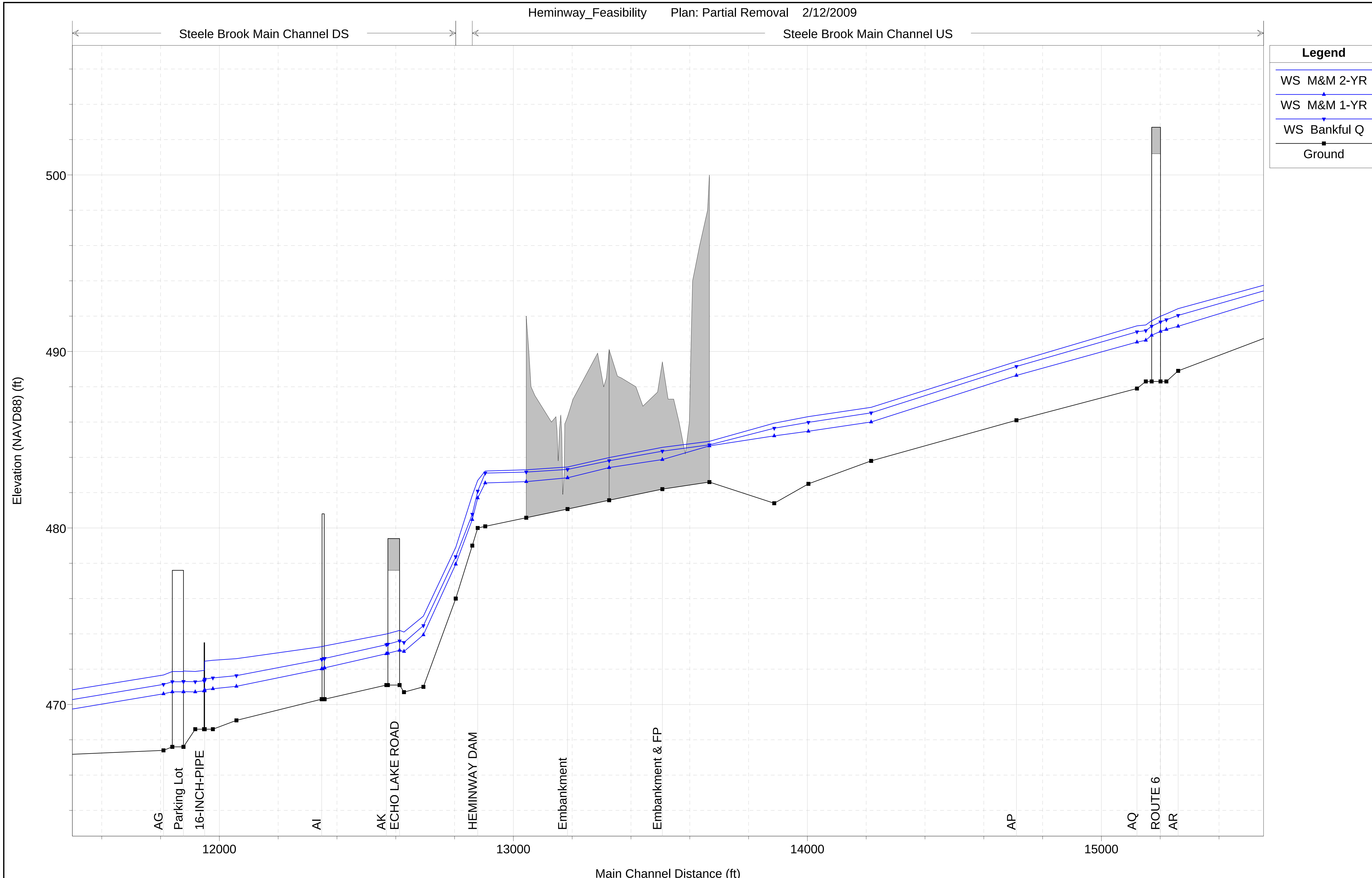
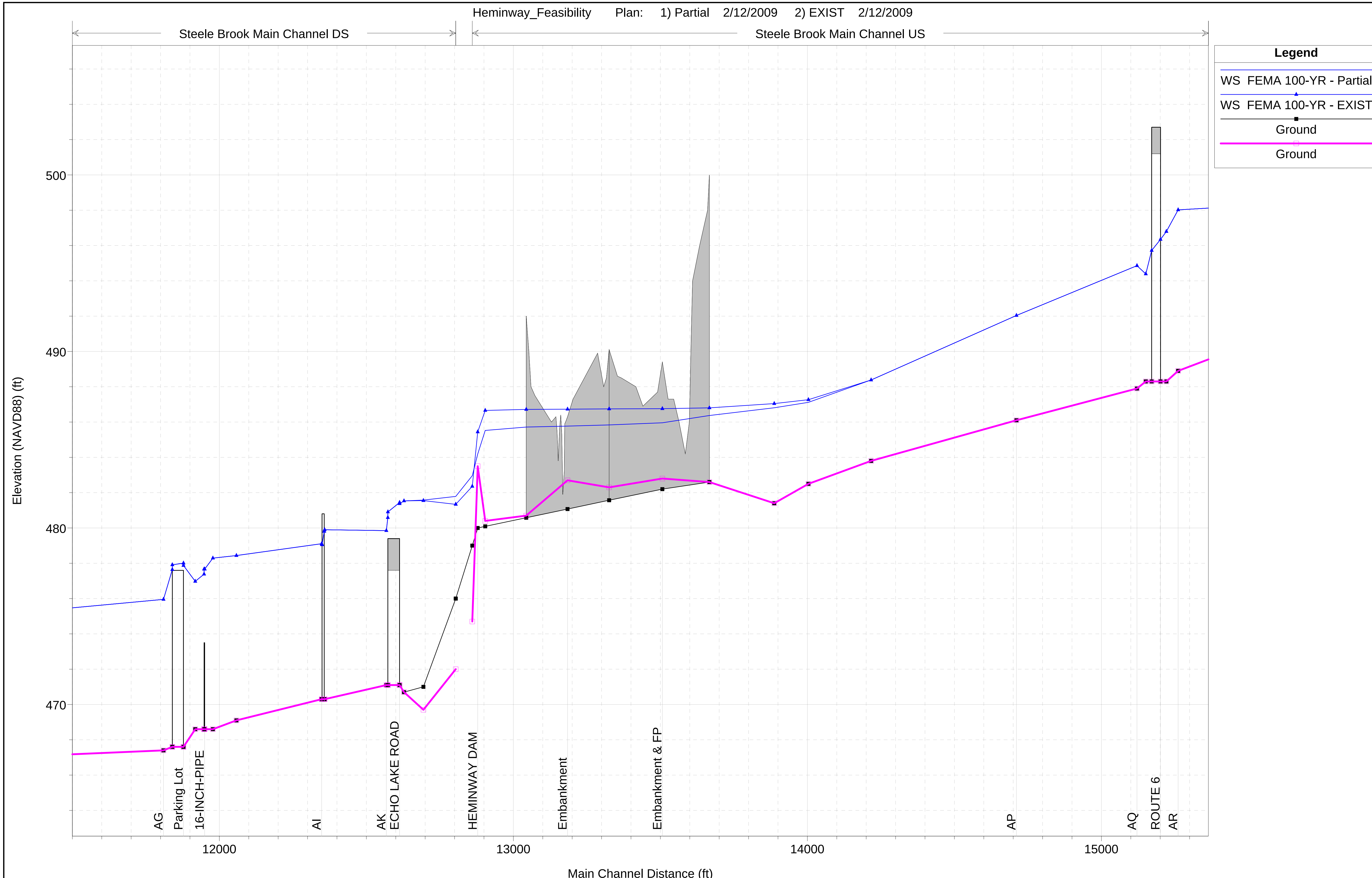


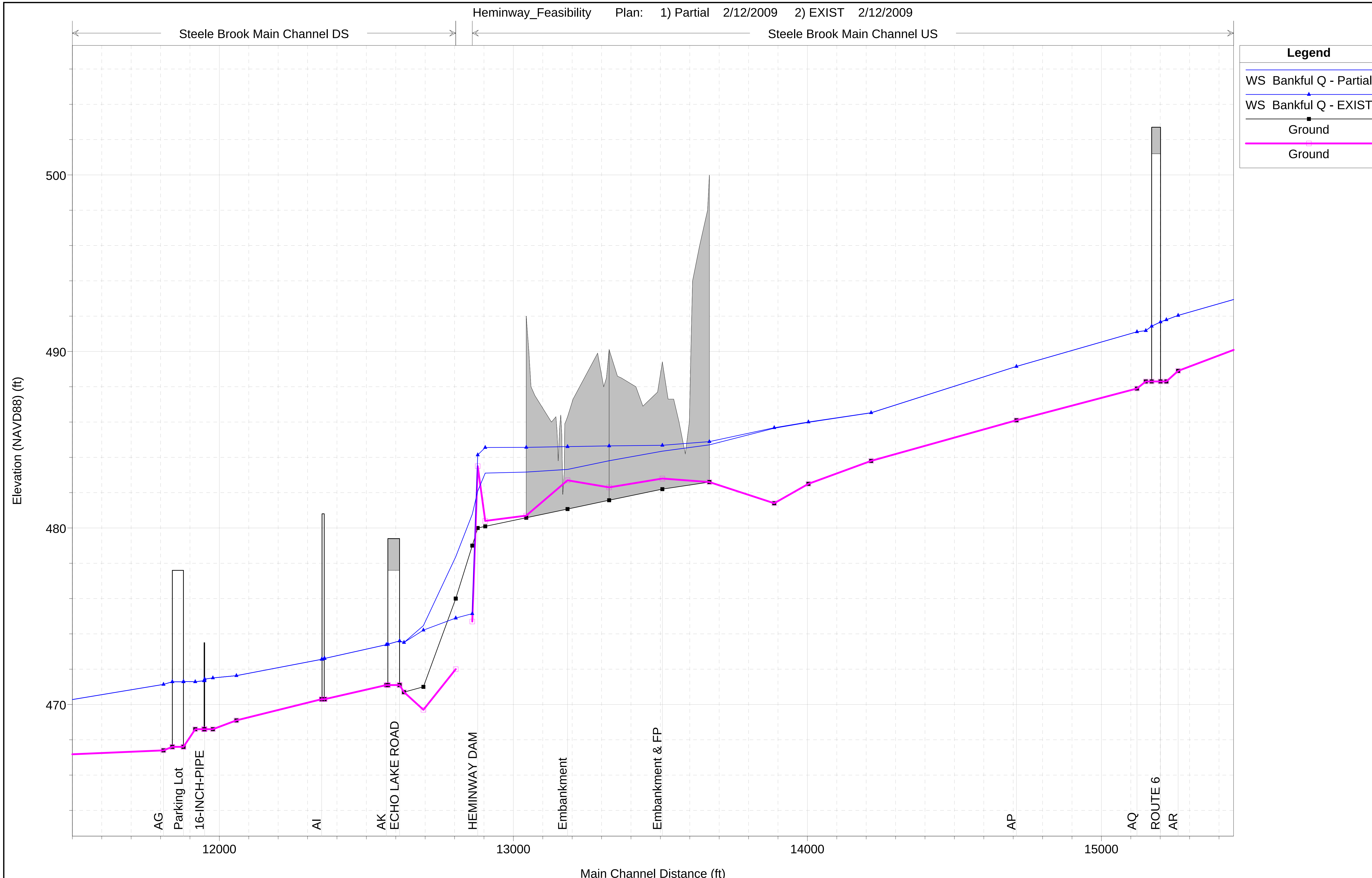
1 in Horiz. = 300 ft 1 in Vert. = 5 ft



1 in Horiz. = 300 ft 1 in Vert. = 5 ft



1 in Horiz. = 300 ft 1 in Vert. = 5 ft



1 in Horiz. = 300 ft 1 in Vert. = 5 ft

# Full Removal
# HEC-RAS Report

**(note: geometry identical for post construction and mature n plans except for Manning's n values)**

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```
                  HEC-RAS Version 4.0.0 March 2008
                  U.S. Army Corps of Engineers
                 Hydrologic Engineering Center
                       609 Second Street
                       Davis, California

      X     X  XXXXXX    XXXX        XXXX       XX      XXXX
      X     X  X        X    X       X   X     X  X    X
      X     X  X        X            X   X    X    X   X
      XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
      X     X  X        X            X  X     X    X        X
      X     X  X        X    X       X   X    X    X        X
      X     X  XXXXXX    XXXX        X    X   X    X   XXXXX
```

```
********************************************************************************
```

PROJECT DATA
Project Title: Heminway_Feasibility
Project File : Heminway_Feasibility.prj
Run Date and Time: 2/12/2009 5:02:27 PM

Project in English units

Project Description:
Heminway Pond Dam Removal Feasibility Study.  Base data from 1997 LOMR, expanded upstream with 1980 FIS geometry.  Additional and enhanced/replaced/corrected geometry in area of pond and nearby channel with 2007/2008 survey data & town GIS data.

```
********************************************************************************
```

PLAN DATA

Plan Title: Full Removal
Plan File : s:\Engineering\PROJECTS\STEELE_BROOK\HEC-RAS\Feasibility Draft\Heminway_Feasibility.p04

Geometry Title: Full Removal
Geometry File : s:\Engineering\PROJECTS\STEELE_BROOK\HEC-RAS\Feasibility Draft\Heminway_Feasibility.g05

Flow Title    : Flows
Flow File     : s:\Engineering\PROJECTS\STEELE_BROOK\HEC-RAS\Feasibility Draft\Heminway_Feasibility.f01

Plan Description:
Full Removal

Plan Summary Information:

| Number of: | | | | | |
|---|---|---|---|---|---|
| | Cross Sections | = 87 | Multiple Openings | = | 0 |
| | Culverts | = 0 | Inline Structures | = | 0 |
| | Bridges | = 9 | Lateral Structures | = | 2 |

```
Computational Information
    Water surface calculation tolerance  =  0.01
    Critical depth calculation tolerance =  0.01
    Maximum number of iterations         =  20
    Maximum difference tolerance         =  0.3
    Flow tolerance factor                =  0.001

Computation Options
    Critical depth computed at all cross sections
    Conveyance Calculation Method: At breaks in n values only
    Friction Slope Method:         Program Selects Appropriate method
    Computational Flow Regime:     Mixed Flow

Encroachment Data
   Equal Conveyance = True
   Left Offset      =        0
   Right Offset     =        0

River = Steele Brook     Reach = Main Channel US
RS      Profile           Method  Value1  Value2
351     FEMA Floodway          4       1
350     FEMA Floodway          4       1
349     FEMA Floodway          4       1
348     FEMA Floodway          4       1
347.2   FEMA Floodway          4       1
347.1   FEMA Floodway          4       1
347     FEMA Floodway          1    1353    1405
346     FEMA Floodway          1    1250    1350
345     FEMA Floodway          2      47
344.2   FEMA Floodway          2      47
344.1   FEMA Floodway          2     235
343.2   FEMA Floodway          2     455
343.1   FEMA Floodway          2     455
342.6   FEMA Floodway          4       1
342.5   FEMA Floodway          4       1
342.4   FEMA Floodway          4       1
342.3   FEMA Floodway          4       1
342.2   FEMA Floodway          4       1
342.1   FEMA Floodway          4       1
342.05  FEMA Floodway          4       1

River = Steele Brook     Reach = Main Channel DS
RS      Profile           Method  Value1  Value2
341.2   FEMA Floodway          4       1
341.1   FEMA Floodway          4       1
341     FEMA Floodway          1    1002 1277.35
340.2   FEMA Floodway          1    1000    1150
340.1   FEMA Floodway          1    1000    1120
340     FEMA Floodway          1    1000    1120
339.6   FEMA Floodway          1    1000    1120
339.56  FEMA Floodway          1    1000    1120
339.51  FEMA Floodway          1    1000    1120
339.5   FEMA Floodway          1    1000    1120
339.1   FEMA Floodway          1    1000    1120
339     FEMA Floodway          1    1320    1440
338.2   FEMA Floodway          1    1320    1440
```

| | | | | |
|---|---|---|---|---|
| 338.1 | FEMA Floodway | 1 | 1320 | 1420 |
| 337 | FEMA Floodway | 2 | 150 | |
| 336.2 | FEMA Floodway | 1 | 980 | 1010 |
| 336.1 | FEMA Floodway | 1 | 980 | 1010 |
| 336 | FEMA Floodway | 2 | 47 | |
| 335 | FEMA Floodway | 1 | 1160 | 1280 |
| 334 | FEMA Floodway | 2 | 100 | |
| 333 | FEMA Floodway | 2 | 80 | |
| 332.2 | FEMA Floodway | 1 | 1080 | 1300 |
| 332.1 | FEMA Floodway | 4 | .4 | |
| 332 | FEMA Floodway | 4 | .4 | |
| 331 | FEMA Floodway | 4 | .4 | |
| 330 | FEMA Floodway | 4 | .4 | |
| 329 | FEMA Floodway | 4 | 1 | |
| 328 | FEMA Floodway | 4 | 1 | |
| 327 | FEMA Floodway | 4 | 1 | |
| 326 | FEMA Floodway | 4 | 1 | |
| 325 | FEMA Floodway | 4 | 1 | |
| 324.2 | FEMA Floodway | 4 | 1 | |
| 324.1 | FEMA Floodway | 4 | 1 | |
| 324 | FEMA Floodway | 4 | 1 | |
| 323 | FEMA Floodway | 4 | 1 | |
| 322 | FEMA Floodway | 4 | 1 | |
| 321.1 | FEMA Floodway | 4 | 1 | |
| 321 | FEMA Floodway | 4 | 1 | |
| 320 | FEMA Floodway | 4 | 1 | |
| 319 | FEMA Floodway | 4 | 1 | |
| 318 | FEMA Floodway | 4 | 1 | |
| 317 | FEMA Floodway | 4 | 1 | |
| 316 | FEMA Floodway | 4 | 1 | |
| 315 | FEMA Floodway | 4 | 1 | |
| 314 | FEMA Floodway | 4 | 1 | |
| 313 | FEMA Floodway | 4 | 1 | |
| 312.2 | FEMA Floodway | 4 | 1 | |
| 312.1 | FEMA Floodway | 4 | 1 | |
| 312 | FEMA Floodway | 4 | 1 | |
| 311 | FEMA Floodway | 4 | 1 | |
| 310 | FEMA Floodway | 4 | 1 | |
| 309 | FEMA Floodway | 4 | 1 | |
| 308 | FEMA Floodway | 4 | 1 | |
| 307.1 | FEMA Floodway | 4 | 1 | |
| 307 | FEMA Floodway | 4 | 1 | |
| 305 | FEMA Floodway | 4 | 1 | |
| 304.2 | FEMA Floodway | 4 | 1 | |
| 304.1 | FEMA Floodway | 4 | 1 | |
| 304 | FEMA Floodway | 4 | 1 | |
| 303 | FEMA Floodway | 4 | 1 | |
| -100 | FEMA Floodway | 1 | 254.7 | 339.2 |

********************************************************************************

FLOW DATA

Flow Title: Flows
Flow File : s:\Engineering\PROJECTS\STEELE_BROOK\HEC-RAS\Feasibility Draft\Heminway_Feasibility.f01

```
Flow Data (cfs)
*******************************************************************************
*******************************************************************************
*************
* River           Reach           RS      *     FEMA 100-YR   FEMA Floodway
FEMA 10-YR      FEMA 50-YR     FEMA 500-YR        M&M 2-YR        M&M 1-YR
Bankful Q *
* Steele Brook    Main Channel US 351     *          2060            2060
820            1600           3600             405             221
330 *
* Steele Brook    Main Channel DS 341.2   *          2840            2840
1130            2200           5000             461             221
330 *
* Steele Brook    Main Channel DS 310     *          3550            3550
1410            2740           6245             796             380
330 *
* Steele Brook    Old Channel     7       *             1               1
1               1              1               1               1
1 *
*******************************************************************************
*******************************************************************************
*************

Boundary Conditions
*******************************************************************************
************************
* River           Reach           Profile         *            Upstream
Downstream    *
*******************************************************************************
************************
* Steele Brook    Main Channel US FEMA 100-YR      *             Critical
*
* Steele Brook    Main Channel US FEMA Floodway    *             Critical
*
* Steele Brook    Main Channel US FEMA 10-YR       *             Critical
*
* Steele Brook    Main Channel US FEMA 50-YR       *             Critical
*
* Steele Brook    Main Channel US FEMA 500-YR      *             Critical
*
* Steele Brook    Main Channel US M&M 2-YR         *             Critical
*
* Steele Brook    Main Channel US M&M 1-YR         *             Critical
*
* Steele Brook    Main Channel US Bankful Q        *             Critical
*
* Steele Brook    Old Channel     FEMA 100-YR      *        Normal S = 0.0001
*
* Steele Brook    Old Channel     FEMA Floodway    *        Normal S = 0.0001
*
* Steele Brook    Old Channel     FEMA 10-YR       *        Normal S = 0.0001
*
* Steele Brook    Old Channel     FEMA 50-YR       *        Normal S = 0.0001
*
* Steele Brook    Old Channel     FEMA 500-YR      *        Normal S = 0.0001
*
```

```
* Steele Brook    Old Channel     M&M 2-YR        *        Normal S = 0.0001
*
* Steele Brook    Old Channel     M&M 1-YR        *        Normal S = 0.0001
*
* Steele Brook    Old Channel     Bankful Q       *        Normal S = 0.0001
*
* Steele Brook    Main Channel DS FEMA 100-YR      *
Known WS = 356.31 *
* Steele Brook    Main Channel DS FEMA Floodway    *
Known WS = 356.44 *
* Steele Brook    Main Channel DS FEMA 10-YR       *
Known WS = 352.85 *
* Steele Brook    Main Channel DS FEMA 50-YR       *
Known WS = 353 *
* Steele Brook    Main Channel DS FEMA 500-YR      *
Known WS = 358.5 *
* Steele Brook    Main Channel DS M&M 2-YR         *
Normal S = 0.002 *
* Steele Brook    Main Channel DS M&M 1-YR         *
Normal S = 0.002 *
* Steele Brook    Main Channel DS Bankful Q        *
Normal S = 0.002 *
********************************************************************************
************************

Observed Water Surface Marks
********************************************************************************
********************************************************************************
*************
* River          Reach           RS      *     FEMA 100-YR   FEMA Floodway
FEMA 10-YR      FEMA 50-YR     FEMA 500-YR        M&M 2-YR        M&M 1-YR
Bankful Q *
* Steele BrookMain Channel US351     *           509.1
*
* Steele BrookMain Channel US350     *           503.4
*
* Steele BrookMain Channel US349     *           498.3
*
* Steele BrookMain Channel US348     *           498.1
*
* Steele BrookMain Channel US347.2   *
*
* Steele BrookMain Channel US347.1   *
*
* Steele BrookMain Channel US347     *           493.3
*
* Steele BrookMain Channel US346     *           492.4
*
* Steele Brook    Main Channel US 344.2   *           489.3
*
* Steele Brook    Main Channel US 342.1   *           486.4
*
* Steele Brook    Main Channel US 342.05  *           483.3
*
* Steele BrookMain Channel DS341     *           483.3
*
```

```
* Steele BrookMain Channel DS340     *           483.1
*
* Steele BrookMain Channel DS339.6   *           483.1
*
* Steele BrookMain Channel DS339.5   *           481.7
*
* Steele Brook    Main Channel DS 338.2   *           481.5
*
* Steele BrookMain Channel DS337     *             478
*
* Steele BrookMain Channel DS336     *           475.3
*
* Steele BrookMain Channel DS335     *           475.3
*
* Steele BrookMain Channel DS334     *           474.4
*
* Steele BrookMain Channel DS333     *           473.7
*
* Steele BrookMain Channel DS332     *           470.7
*
* Steele BrookMain Channel DS331     *           468.2
*
* Steele BrookMain Channel DS330     *           466.6
*
********************************************************************************
********************************************************************************
*************

********************************************************************************

GEOMETRY DATA

Geometry Title: Full Removal
Geometry File : s:\Engineering\PROJECTS\STEELE_BROOK\HEC-RAS\Feasibility
Draft\Heminway_Feasibility.g05

Reach Connection Table
********************************************************************************
*
* River            Reach            *  Upstream Boundary  * Downstream Boundary
*
********************************************************************************
*
* Steele Brook     Main Channel US  *                     *   Canal
*
* Steele Brook     Old Channel      *                     *   Canal
*
* Steele Brook     Main Channel DS  *   Canal             *
*
********************************************************************************
*

JUNCTION INFORMATION

Name: Canal
Description:
Energy computation Method
```

```
    Length across Junction            Tributary
     River           Reach              River           Reach        Length
Angle
Steele Brook    Main Channel US  to Steele Brook    Main Channel DS     56.4
Steele Brook    Old Channel      to Steele Brook    Main Channel DS    55.76

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel US    RS: 351

INPUT
Description: FEMA AU
Station Elevation Data    num=      21
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   557.1    1049   536.1    1145   531.1    1190   527.6    1250   521.1
    1297   518.6    1330   518.1    1363   508.1    1380   505.6    1382   505.3
    1408   505.3    1410   505.6    1432   507.2    1478   508.1    1585   508.6
    1735   518.1    1767   521.1    1831   521.6    1905   521.6    1940   518.1
    1975   519.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1363     .04    1432     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1363    1432             600     550     500             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel US    RS: 350

INPUT
Description: FEMA AT
Station Elevation Data    num=      22
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   532.6    1040   529.6    1103   524.6    1160   522.1    1255   503.1
    1305   502.6    1345   503.1    1351   499.3    1352   498.1    1378   498.1
    1380   499.3    1408   502.6    1458   503.1    1534   506.6    1585   506.6
    1642   508.1    1688   507.6    1770   509.6    1800   512.1    1829   516.6
    1865   521.1    1945   516.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1345     .04    1408     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
```

```
          1345    1408              400     390     500             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel US    RS: 349

INPUT
Description: FEMA AS
Station Elevation Data    num=      26
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   523.6    1065   523.1    1104   519.6    1141   514.6    1185   508.1
    1225   496.6    1275   496.6    1325   496.1    1365   497.6    1405   493.6
    1410   492.3    1430   492.3    1435   493.6    1450   497.6    1488   497.1
    1532   497.6    1584   498.1    1645   500.1    1705   500.6    1772   502.1
    1845   503.1    1905   506.1    1940   505.6    1980   509.3    2020   516.1
    2095   525.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1365     .04    1450     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1365    1450              550     540     400             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel US    RS: 348

INPUT
Description: FEMA AR
Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     820   504.1     860   499.1    1000   489.6    1002   488.9    1020   488.9
    1023   489.6    1115   495.1    1176   497.6    1250   505.1    1311   500.1
    1612   514.3

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     820     .06    1000     .04    1023     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1000    1023               40      40      40             .1       .3

CROSS SECTION


RIVER: Steele Brook
```

```
REACH: Main Channel US    RS: 347.2

INPUT
Description: U/S FACE CUTLER STREET BRIDGE (RTE 6)
Station Elevation Data    num=       6
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   503.9    1050   503.9    1052   489.9    1082   488.3    1084   502.7
    1154   502.7

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1050     .04    1084     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1050    1084              70      70      70             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1050   503.4       F
    1084    1154   503.4       F

BRIDGE


RIVER: Steele Brook
REACH: Main Channel US    RS: 347.15

INPUT
Description: Route 6 Bridge
Distance from Upstream XS =      20
Deck/Roadway Width        =      30
Weir Coefficient          =     2.5
Upstream  Deck/Roadway Coordinates
    num=       6
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
************************************************************************
    1000   503.9           1050   503.9           1052   503.4   501.2
    1082   503.4   501.2    1084   502.7           1154   502.7

Upstream Bridge Cross Section Data
Station Elevation Data    num=       6
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   503.9    1050   503.9    1052   489.9    1082   488.3    1084   502.7
    1154   502.7

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1050     .04    1084     .06

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1050    1084             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
```

```
    1000    1050   503.4       F
    1084    1154   503.4       F

Downstream  Deck/Roadway Coordinates
    num=       6
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
************************************************************************
    1000   503.9            1050   503.9            1052   503.4   501.2
    1082   503.4   501.2    1084   502.7            1154   502.7

Downstream Bridge Cross Section Data
Station Elevation Data    num=       6
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   503.9    1050   503.9    1052   489.9    1082   488.3    1084   502.7
    1154   502.7

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1050     .04    1084     .06

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1050    1084             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1050   501.2       F
    1084    1154   501.2       F

Upstream Embankment side slope             =       0 horiz. to 1.0 vertical
Downstream Embankment side slope           =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins        =
Energy head used in spillway design        =
Spillway height used in design             =
Weir crest shape                           = Broad Crested

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: Steele Brook
```

```
REACH: Main Channel US    RS: 347.1

INPUT
Description: D/S FACE CUTLER STREET BRIDGE (RTE 6)
Station Elevation Data    num=      6
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   503.9    1050   503.9    1052   489.9    1082   488.3    1084   502.7
    1154   502.7

Manning's n Values        num=      3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1050     .04    1084     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1050    1084              30      30      30              .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1050   501.2       F
    1084    1154   501.2       F

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel US    RS: 347

INPUT
Description: FEMA AQ
Station Elevation Data    num=     16
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   536.1    1053   532.1    1114   528.6    1182   521.1    1219   518.1
    1278   507.6    1319   501.6    1347   495.1    1370   488.1    1371   487.9
    1389   487.9    1390   488.1    1413   496.1    1487   498.6    1608   499.6
    1680   501.1

Manning's n Values        num=      3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1347     .04    1413     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1347    1413             400     410     300              .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel US    RS: 346

INPUT
Description: FEMA AP
Station Elevation Data    num=     15
```

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 1000 | 515.1 | 1080 | 495.1 | 1129 | 491.1 | 1190 | 490.6 | 1250 | 492.6 |
| 1295 | 491.1 | 1319 | 487.1 | 1320 | 486.1 | 1330 | 486.1 | 1335 | 487.1 |
| 1350 | 490.1 | 1395 | 497.6 | 1459 | 498.6 | 1505 | 498.6 | 1623 | 512.1 |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 1000 | .06 | 1295 | .04 | 1350 | .06 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 1295 | 1350 | 545 | 494.13 | 435 | .1 | .3 |

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel US RS: 344.2

INPUT
Description: Sewer Line Riffle
Station Elevation Data num= 32

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 500 | 12.5 | 498 | 22.1 | 496 | 25.1 | 494 | 55.9 | 494 |
| 125.5 | 492 | 202.1 | 490 | 271.1 | 490 | 306.5 | 489.5 | 332.6 | 488.3 |
| 340.2 | 486.6 | 342.9 | 484.9 | 344.2 | 484.3 | 345.7 | 483.9 | 355.3 | 484.1 |
| 359.5 | 483.8 | 364.8 | 483.8 | 371.1 | 484 | 371.9 | 484.1 | 373.5 | 484.6 |
| 375.3 | 485.9 | 380.1 | 486.3 | 405.7 | 487.4 | 447.7 | 486.8 | 527.3 | 486.6 |
| 560.7 | 488 | 567.2 | 490 | 572.3 | 492 | 578.9 | 494 | 587.1 | 496 |
| 595.4 | 498 | 612.3 | 500 | | | | | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 0 | .06 | 340.2 | .035 | 375.3 | .06 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 340.2 | 375.3 | 210 | 213.35 | 170 | .1 | .3 |

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel US RS: 344.1

INPUT
Description: Reference Riffle
Station Elevation Data num= 34

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 500 | 30.7 | 498 | 59 | 496 | 94.8 | 494 | 132.6 | 492 |
| 169.5 | 490 | 207.2 | 488 | 294.9 | 486 | 342.8 | 484 | 382 | 483.2 |
| 413.3 | 484 | 474.5 | 485.9 | 479.5 | 486.2 | 481.6 | 484 | 482.7 | 483.9 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 487 | 484.2 | 490.3 | 484 | 495 | 483.9 | 499 | 483.7 | 505.4 | 483.3 |
| 507.8 | 482.7 | 511.9 | 482.5 | 516.1 | 483 | 517.3 | 483.4 | 519.6 | 486.6 |
| 527.8 | 486.8 | 537.1 | 486 | 656.5 | 488 | 659.8 | 490 | 663.5 | 492 |
| 667.1 | 494 | 670.9 | 496 | 677.7 | 498 | 684.7 | 500 | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 0 | .06 | 479.5 | .035 | 519.6 | .06 |

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 479.5 | 519.6 | 70 | 116.18 | 125 | .1 | .3 |

Ineffective Flow num= 2

| Sta L | Sta R | Elev | Permanent |
|---|---|---|---|
| 169.5 | 342.8 | 489 | F |
| 342.8 | 479.5 | 486.5 | F |

Left Levee Station= 479.5 Elevation= 486.2

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel US RS: 343.2

INPUT
Description: New NRCS (Replace FEMA 344)
Station Elevation Data num= 27

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 500 | 26.4 | 498 | 60.3 | 496 | 107.2 | 494 | 147.2 | 492 |
| 182.4 | 490 | 217.6 | 488 | 269.5 | 487.7 | 331 | 486 | 388 | 484.5 |
| 399.28 | 484.67 | 502.6 | 484.57 | 504.5 | 482.67 | 520 | 482.57 | 535.5 | 482.67 |
| 537.32 | 484.8 | 651.2 | 484 | 666.8 | 483.7 | 676.9 | 484 | 679.9 | 486 |
| 682.9 | 488 | 685.8 | 490 | 688.8 | 492 | 691.7 | 494 | 696.1 | 496 |
| 703.5 | 498 | 710.9 | 500 | | | | | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 0 | .06 | 502.6 | .04 | 651.2 | .06 |

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 502.6 | 537.32 | 216 | 220.58 | 266 | .1 | .3 |

Ineffective Flow num= 2

| Sta L | Sta R | Elev | Permanent |
|---|---|---|---|
| 0 | 331 | 489 | F |
| 537.3 | 710.9 | 486 | F |

Right Levee Station= 537.3 Elevation= 484.8

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel US RS: 343.1

INPUT
Description: New NRCS (Replaced FEMA 343 AN)
Station Elevation Data num= 47

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 500 | 4.1 | 498 | 33 | 496 | 126.1 | 494 | 180.9 | 492 |
| 245.4 | 492 | 290.2 | 493 | 315.2 | 492 | 326.7 | 490 | 333.5 | 488 |
| 339.6 | 486 | 343.4 | 484 | 347.2 | 483.7 | 352.6 | 482.7 | 408.4 | 482.4 |
| 457.4 | 482.8 | 457.44 | 482.8 | 520.6 | 482.74 | 522.5 | 480.84 | 538 | 480.74 |
| 553.5 | 480.84 | 555.4 | 482.74 | 571.4 | 485.09 | 571.53 | 485.1 | 641.7 | 486 |
| 661.9 | 484.8 | 689.5 | 486 | 723.3 | 488 | 729.5 | 488.7 | 735.4 | 488 |
| 756.7 | 486 | 771.7 | 484 | 773.2 | 483.7 | 781.7 | 481.4 | 794.4 | 481.4 |
| 795.3 | 484 | 825.1 | 484 | 840.8 | 483.1 | 853.6 | 484 | 863.7 | 486 |
| 867.3 | 488 | 871 | 490 | 874.6 | 492 | 878.3 | 494 | 914.1 | 496 |
| 958.1 | 498 | 965 | 500 | | | | | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 0 | .06 | 520.6 | .04 | 553.5 | .06 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 520.6 | 555.4 | 153 | 159.84 | 231.73 | .1 | .3 |

Ineffective Flow num= 1

| Sta L | Sta R | Elev | Permanent |
|---|---|---|---|
| 641.7 | 965 | 486 | F |

LATERAL STRUCTURE

RIVER: Steele Brook
REACH: Main Channel US RS: 342.65

INPUT
Description:
Lateral structure position = Right overbank
Distance from Upstream XS =
Deck/Roadway Width = 10
Weir Coefficient = 3.09
Weir Flow Reference = Energy Grade
Weir Embankment Coordinates num = 19

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 500 | 8.9 | 498 | 48 | 496 | 82.8 | 494 | 87.1 | 492 |
| 91.1 | 490 | 94.9 | 488 | 98.7 | 486 | 118.9 | 484.2 | 149.6 | 486 |
| 176.1 | 487.3 | 203.6 | 487.3 | 231.7 | 489.4 | 243 | 487.7 | 277.9 | 486.9 |
| 294.4 | 488 | 328.8 | 488.5 | 338 | 488.6 | 357.7 | 490.1 | | |

Weir crest shape = Broad Crested

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel US RS: 342.6

INPUT
Description: New NRCS
Station Elevation Data num= 43

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 500 | 4.2 | 498 | 8.4 | 496 | 10.8 | 494 | 40.8 | 494 |
| 77.8 | 494 | 113.9 | 492 | 117.2 | 490 | 120.5 | 488 | 123.9 | 486 |
| 225.2 | 484 | 328.1 | 484.1 | 329.9 | 483.2 | 336.96 | 482.22 | 337.6 | 482.06 |
| 355.14 | 481.88 | 365.7 | 481.7 | 367.6 | 481.76 | 402.6 | 481.41 | 404.5 | 479.51 |
| 420 | 479.41 | 435.5 | 479.51 | 437.4 | 481.41 | 499.4 | 482.03 | 504.41 | 483.28 |
| 505.3 | 483.3 | 509 | 484.5 | 510.9 | 484.4 | 563.2 | 484 | 599.9 | 486 |
| 605.4 | 486.1 | 610.4 | 486 | 657.7 | 484 | 658.8 | 484 | 659.9 | 483 |
| 670.6 | 481.6 | 697.5 | 481.5 | 721.1 | 481.5 | 742.9 | 481.5 | 744.2 | 483.7 |
| 746 | 484 | 752.6 | 487.5 | 759.2 | 489.4 | | | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 0 | .06 | 402.6 | .04 | 437.4 | .06 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 402.6 | 437.4 | 152 | 181.04 | 125.98 | .1 | .3 |

Ineffective Flow num= 2

| Sta L | Sta R | Elev | Permanent |
|---|---|---|---|
| 113.9 | 328.1 | 490 | T |
| 605.4 | 759.2 | 486 | F |

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel US RS: 342.5

INPUT
Description: New NRCS
Station Elevation Data num= 36

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 498 | 9.7 | 496 | 29.1 | 494 | 76.2 | 492 | 81.4 | 490 |
| 85.9 | 488 | 91 | 486 | 95.2 | 484 | 99.1 | 483.7 | 108.6 | 482.1 |
| 140.3 | 481.2 | 140.59 | 481.21 | 140.6 | 481.21 | 284.6 | 479.91 | 286.5 | 478.01 |
| 302 | 477.91 | 317.5 | 478.01 | 319.4 | 479.91 | 394.4 | 480.66 | 405.47 | 483.43 |
| 419.1 | 484 | 429.5 | 484.3 | 446.8 | 484 | 462.2 | 483.7 | 495.8 | 483.7 |
| 503.9 | 484 | 535.8 | 486 | 565.7 | 484 | 567.8 | 483.7 | 584.8 | 480.1 |
| 625.9 | 480.1 | 645.5 | 483.7 | 646.6 | 484 | 647.6 | 486 | 654.2 | 488 |
| 659.3 | 490.1 | | | | | | | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 0 | .06 | 284.6 | .04 | 319.4 | .06 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 284.6 | 319.4 | 151 | 141.52 | 130.33 | .1 | .3 |

Ineffective Flow num= 1

| Sta L | Sta R | Elev | Permanent |
|---|---|---|---|
| 535.8 | 647.54 | 485 | F |

LATERAL STRUCTURE

RIVER: Steele Brook
REACH: Main Channel US RS: 342.45

INPUT
Description:
Lateral structure position = Right overbank
Distance from Upstream XS =
Deck/Roadway Width = 10
Weir Coefficient = 2
Weir Flow Reference = Water Surface
Weir Embankment Coordinates num = 23

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 490.1 | 8.5 | 488.5 | 17 | 488 | 36.2 | 489.9 | 113.1 | 487.3 |
| 130.3 | 486.3 | 141.9 | 486 | 146.3 | 485.9 | 149.5 | 483.2 | 157.7 | 481.9 |
| 160.9 | 483.7 | 163.4 | 485.3 | 169.4 | 486.4 | 176.2 | 485.6 | 177.8 | 485.3 |
| 183.9 | 483.8 | 190.6 | 485.5 | 197 | 486.3 | 222.7 | 486 | 318 | 487.5 |
| 340.2 | 488 | 352.4 | 490 | 367.8 | 492 | | | | |

Weir crest shape = Broad Crested

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel US RS: 342.4

INPUT
Description: New NRCS
Station Elevation Data num= 33

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 500 | 0 | 489 | 21.6 | 488 | 23.8 | 486 | 26.1 | 484 |
| 28.5 | 483.7 | 34.8 | 483.3 | 44.1 | 481.2 | 44.43 | 481.23 | 51.1 | 479.56 |
| 132.6 | 478.74 | 134.5 | 476.84 | 150 | 476.74 | 165.5 | 476.84 | 167.4 | 478.74 |
| 301.4 | 480.08 | 315.89 | 483.7 | 316 | 483.7 | 387.4 | 483.7 | 391.8 | 484 |
| 398.2 | 486 | 416.3 | 488 | 429.5 | 488.9 | 442.5 | 488 | 463.7 | 486 |
| 466 | 484 | 467.3 | 483.9 | 477.4 | 481.2 | 534 | 481.1 | 551.2 | 480.3 |
| 573 | 483.7 | 574.9 | 484 | 587.8 | 485.8 | | | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 0 | .06 | 132.6 | .04 | 167.4 | .06 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 132.6 | 167.4 | 144 | 140.57 | 237.47 | .1 | .3 |

Ineffective Flow num= 1

| Sta L | Sta R | Elev | Permanent |
|---|---|---|---|
| 429.5 | 587.8 | 485 | F |

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel US    RS: 342.3

INPUT
Description: New NRCS
Station Elevation Data    num=      31

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 500 | .3 | 489 | 21.4 | 488 | 25.1 | 486 | 27.1 | 484 |
| 29.2 | 483.7 | 40.5 | 481.5 | 40.9 | 481.46 | 53.6 | 478.29 | 125.6 | 477.57 |
| 127.5 | 475.67 | 143 | 475.57 | 158.5 | 475.67 | 160.4 | 477.57 | 235.4 | 478.32 |
| 251.68 | 482.39 | 252.2 | 482.4 | 253.6 | 483.8 | 290.2 | 485 | 314.8 | 484.6 |
| 315.6 | 482.8 | 329.7 | 481.1 | 350.8 | 479.9 | 371.1 | 480.4 | 381.2 | 481 |
| 397.8 | 483.7 | 399.9 | 484 | 401.7 | 486 | 410.3 | 488 | 418.5 | 490 |
| 420.1 | 492 | | | | | | | | |

Manning's n Values        num=       3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 0 | .06 | 125.6 | .04 | 160.4 | .06 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 125.6 | 160.4 | 136 | 139.35 | 132 | .1 | .3 |

Ineffective Flow     num=       1

| Sta L | Sta R | Elev | Permanent |
|---|---|---|---|
| 290.2 | 420.1 | 485 | F |

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel US    RS: 342.2

INPUT
Description: New NRCS
Station Elevation Data    num=      22

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| -42.6 | 497 | -42.1 | 486.9 | -33 | 487.3 | -28.2 | 486 | -25.1 | 484 |
| -21.4 | 483.7 | -19 | 481 | -18.46 | 480.99 | -4.4 | 477.48 | 102.6 | 476.41 |
| 104.5 | 474.51 | 120 | 474.41 | 135.5 | 474.51 | 137.4 | 476.41 | 167.4 | 476.71 |
| 186.92 | 481.59 | 187.4 | 481.6 | 192.2 | 484 | 195.8 | 486 | 205.2 | 488 |
| 212.4 | 490 | 229.6 | 492 | | | | | | |

Manning's n Values        num=       3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| -42.6 | .06 | 102.6 | .04 | 137.4 | .06 |

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
         102.6   137.4               29   25.65      23             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
   -42.6    56.9   487.5       F
   191.9   229.6   487.5       F

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel US    RS: 342.1

INPUT
Description: HEMINWAY POND DAM (Updated by NRCS)
Station Elevation Data    num=      22
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0     497      .1   487.1     6.6   487.3      18   487.3    48.9   487.4
    51.4   487.5    74.8   487.5    74.9   483.5   77.25   483.5    80.8  476.41
   101.7   476.2   103.7   474.2   116.2   474.1   134.7   474.2   136.7   476.2
   157.5  476.41   157.5  477.41  180.88  486.76  180.88  486.86     188     488
   200.2     490   220.8     492

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
       0     .02    74.8     .03  180.88     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
         101.7   136.7               18   18.35      18             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel US    RS: 342.05

INPUT
Description: New NRCS
Station Elevation Data    num=      23
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    17.6     497    17.7   487.1    24.2   487.3    35.6   487.3    66.5   487.4
      69   487.5    74.7   487.5    74.7  487.35    74.8  483.35   77.15  483.35
    80.7  476.26   101.6  476.05   103.6  474.05   116.1  473.95   134.6  474.05
   136.6  476.05   157.4  476.26   157.4  477.26  180.78  486.61  180.78  487.15
   196.8     488   209.1     490   229.6     492

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    17.6     .02    74.7     .03  180.78     .06
```

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
         101.6   136.6                0       0       0             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Old Channel        RS: 7

INPUT
Description: Part of LS 342.65
Station Elevation Data    num=      13
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0   489.4    28.2   487.3    55.7   487.3    82.1     486   112.8   484.2
     133     486   136.8     488   140.6     490   144.6     492   148.9     494
   183.7     496   222.9     498   231.7     500

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
       0     .06    55.7     .06     133     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          55.7     133           83.01   100.8  117.99             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Old Channel        RS: 6

INPUT
Description:
Station Elevation Data    num=      20
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0   489.4     6.4     486    14.2     484    18.7     482    20.8   481.7
    36.1   481.7    36.3   485.2    41.7   485.3    50.3   484.5      57   482.5
    89.3   481.7     119     484   175.1     486   181.9     488     189     490
   196.3     492   203.1     494     209     496   223.9     498   269.1     500

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
       0     .06    20.8     .04    36.3     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          14.2    36.3          125.98  106.48     101             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
     119   269.1   487.1       F
Right Levee     Station=    41.7      Elevation=   485.3
```

CROSS SECTION

RIVER: Steele Brook
REACH: Old Channel RS: 5

INPUT
Description:
Station Elevation Data num= 30

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 490.1 | 5.3 | 488 | 8.7 | 486 | 13.2 | 484 | 25 | 483 |
| 36.8 | 485.6 | 39.9 | 485.3 | 40.6 | 484 | 48.1 | 483.1 | 58.7 | 483 |
| 58.8 | 481.4 | 75.6 | 481.4 | 75.7 | 485 | 104.6 | 481.6 | 111.4 | 481.4 |
| 115.3 | 481.6 | 153.6 | 481.7 | 192.1 | 481.4 | 198.3 | 481.6 | 222 | 482 |
| 226.3 | 484 | 230.5 | 486 | 234.8 | 488 | 239 | 490 | 243.3 | 492 |
| 247.5 | 494 | 251.9 | 496 | 326.9 | 498 | 358.2 | 499 | 358.2 | 515 |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 0 | .06 | 58.7 | .03 | 75.7 | .04 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 39.9 | 75.7 | 130.35 | 127.83 | 126 | .1 | .3 |

Ineffective Flow num= 1

| Sta L | Sta R | Elev | Permanent |
|---|---|---|---|
| 198.3 | 358.2 | 486.1 | F |

Right Levee Station= 75.7 Elevation= 485

CROSS SECTION

RIVER: Steele Brook
REACH: Old Channel RS: 4

INPUT
Description:
Station Elevation Data num= 25

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 486.3 | 4.6 | 484 | 7.1 | 482 | 11.2 | 481 | 27.5 | 481 |
| 28.1 | 483.8 | 42.7 | 482.6 | 59.5 | 480.8 | 85.1 | 481 | 89.2 | 481.3 |
| 130.9 | 481.3 | 173.7 | 481.3 | 176.9 | 482 | 184.8 | 482 | 196 | 484 |
| 198.5 | 486 | 201.3 | 488 | 204.7 | 490 | 208.8 | 492 | 215.4 | 494 |
| 232.9 | 496 | 280.9 | 498 | 316.3 | 498 | 342.4 | 498 | 345.7 | 500 |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 0 | .06 | 11.2 | .03 | 28.1 | .04 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 4.6 | 28.1 | 47.47 | 57.67 | 88 | .1 | .3 |

Ineffective Flow num= 1

| Sta L | Sta R | Elev | Permanent |
|---|---|---|---|
| 173.7 | 345.7 | 485.1 | F |

Right Levee Station= 28.1 Elevation= 483.8

CROSS SECTION

RIVER: Steele Brook
REACH: Old Channel RS: 3

INPUT
Description:
Station Elevation Data num= 18

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 485.3 | 10.3 | 481.7 | 11.2 | 480.6 | 28.1 | 480.6 | 28.4 | 483.5 |
| 32.9 | 483.2 | 38.5 | 483 | 51.2 | 480.5 | 379.2 | 482 | 388.2 | 484 |
| 397.2 | 486 | 406.3 | 488 | 467.2 | 490 | 489.2 | 492 | 497.7 | 494 |
| 506.7 | 496 | 515.3 | 498 | 524.2 | 500 | | | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 0 | .06 | 11.2 | .03 | 28.4 | .04 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 10.3 | 28.4 | 90 | 182.6 | 135 | .1 | .3 |

Ineffective Flow num= 1

| Sta L | Sta R | Elev | Permanent |
|---|---|---|---|
| 250 | 524.2 | 487.1 | F |

Right Levee Station= 28.4 Elevation= 483.5

CROSS SECTION

RIVER: Steele Brook
REACH: Old Channel RS: 2

INPUT
Description:
Station Elevation Data num= 30

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 492 | 10.3 | 490 | 17.8 | 488 | 25.1 | 486 | 29.6 | 484 |
| 31.8 | 482 | 34.1 | 480 | 36.4 | 479.8 | 36.6 | 479.6 | 49.3 | 479.6 |
| 49.6 | 482.4 | 57.7 | 482 | 68.5 | 480 | 75.8 | 479.7 | 144.4 | 480 |
| 266.7 | 480 | 352.9 | 479.9 | 398.2 | 480 | 518.7 | 482 | 528.3 | 484 |
| 535.1 | 485 | 550.6 | 486 | 601.8 | 488 | 626.8 | 489 | 635.1 | 490 |
| 638.5 | 492 | 641.8 | 494 | 645.2 | 496 | 648.6 | 498 | 677 | 500 |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 0 | .06 | 36.4 | .03 | 49.6 | .04 |

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 31.8 | 49.6 | 70 | 74.74 | 66 | .1 | .3 |

Ineffective Flow num= 1

| Sta L | Sta R | Elev | Permanent |
|---|---|---|---|
| 398.2 | 677 | 486.1 | F |

Right Levee Station= 49.6 Elevation= 482.4

CROSS SECTION

RIVER: Steele Brook
REACH: Old Channel RS: 1

INPUT
Description:
Station Elevation Data num= 26

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 487.5 | 2.6 | 486 | 4.5 | 484 | 6.2 | 482 | 7.9 | 480 |
| 12.4 | 478.9 | 26.1 | 478.9 | 26.2 | 481.8 | 32.2 | 482 | 36 | 482.1 |
| 44.8 | 480 | 54.5 | 479.4 | 194.2 | 480 | 253.5 | 480 | 322.4 | 479.8 |
| 389.8 | 480 | 537.4 | 482 | 547.5 | 484 | 571.5 | 486 | 635.8 | 488 |
| 660.7 | 490 | 665.9 | 492 | 670.7 | 494 | 675.4 | 496 | 688.5 | 498 |
| 710.8 | 500 | | | | | | | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 0 | .06 | 12.4 | .03 | 26.2 | .04 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 6.2 | 26.2 | 0 | 0 | 0 | .1 | .3 |

Ineffective Flow num= 1

| Sta L | Sta R | Elev | Permanent |
|---|---|---|---|
| 450 | 710.8 | 484.1 | F |

Right Levee Station= 36 Elevation= 482.1

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel DS RS: 341.2

INPUT
Description: Replaced by NRCS
Station Elevation Data num= 26

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 487.3 | .2 | 478 | 12.2 | 476 | 19.9 | 474 | 40.1 | 472.2 |
| 49.2 | 472 | 52.1 | 481.7 | 52.3 | 481.7 | 60.8 | 480 | 70 | 479.3 |
| 233.2 | 480 | 297.3 | 480 | 386.4 | 480 | 560.1 | 482 | 570.8 | 484 |
| 578 | 485 | 597.3 | 486 | 639.9 | 487 | 660.3 | 488 | 673.5 | 489 |
| 679.7 | 490 | 696.7 | 492 | 705.9 | 494 | 716.1 | 496 | 727.2 | 498 |
| 749.4 | 500 | | | | | | | | |

```
Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
       0     .05    12.2     .05    52.1     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          12.2    52.1              109  109.82     109             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
     500   749.4   483.1       F
Right Levee     Station=    52.1      Elevation=   481.7
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
************************
   639.9   673.5   494.1

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 341.1

INPUT
Description: New NRCS
Station Elevation Data    num=      19
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0     490      .1   478.2     6.4   477.1    13.5   473.8      24   470.3
    44.9   469.7    45.2   478.3      54   478.5   342.4     480   513.3     482
     558     484   596.2     486   625.3     488   650.9     490   676.4     492
     721     494   763.6     496   783.2     498   795.1     500

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
       0     .05    13.5     .05    45.2     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          13.5    45.2               66   66.07      64             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
     475   795.1   482.6       F
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
************************
     736     762   509.1

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 341

INPUT
Description: UPDATED WITH MILONE & MACBROOM,ALSO INCREASED ROBL(shortened
```

```
ROBL, NRCS)
Station Elevation Data    num=      18
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     937   491.1     937   480.4     946   480.4     987   480.2    1000   474.6
    1002   473.7    1004   472.9    1006     472    1019   471.5    1023   470.7
    1031   471.4    1032     478    1132   478.3    1362   479.1    1484   481.1
    1544   483.7    1644   486.6    1704   491.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     937     .05    1002    .035    1032     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1002    1032               15      15      15             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 340.2

INPUT
Description: Data combined from 341 & 340 (NRCS)
 U/S FACE ECHO LAKE ROAD
             BRIDGE UPDATED DATA
Station Elevation Data    num=      13
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     937   491.1     937   480.4     946   480.4     987   480.2    1000   479.1
  1000.1   471.1    1030   471.1  1030.1   479.1    1362   479.1    1484   481.1
    1544   483.7    1644   486.6    1704   491.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     937     .05    1000     .03  1030.1     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1000  1030.1               40      40      40             .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
     937    1000   479.4       F
  1030.1    1704   479.4       F

BRIDGE


RIVER: Steele Brook
REACH: Main Channel DS    RS: 340.15

INPUT
Description: Echo Lake Road Bridge (NRCS Corrected Deck Width)
```

Distance from Upstream XS = .1
Deck/Roadway Width = 39.8
Weir Coefficient = 2.5
Upstream Deck/Roadway Coordinates
num= 4

| Sta | Hi Cord | Lo Cord | Sta | Hi Cord | Lo Cord | Sta | Hi Cord | Lo Cord |
|---|---|---|---|---|---|---|---|---|
| 1000 | 479.4 | 477.6 | 1030.1 | 479.4 | 477.6 | 1030.1 | 479.4 | 471.1 |
| 1500 | 479.4 | 471.1 | | | | | | |

Upstream Bridge Cross Section Data
Station Elevation Data num= 13

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 937 | 491.1 | 937 | 480.4 | 946 | 480.4 | 987 | 480.2 | 1000 | 479.4 |
| 1000.1 | 471.1 | 1030 | 471.1 | 1030.1 | 479.1 | 1362 | 479.1 | 1484 | 481.1 |
| 1544 | 483.7 | 1644 | 486.6 | 1704 | 491.1 | | | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 937 | .05 | 1000 | .03 | 1030.1 | .05 |

| Bank Sta: Left | Right | Coeff Contr. | Expan. |
|---|---|---|---|
| 1000 | 1030.1 | .1 | .3 |

Ineffective Flow num= 2

| Sta L | Sta R | Elev | Permanent |
|---|---|---|---|
| 937 | 1000 | 479.4 | F |
| 1030.1 | 1704 | 479.4 | F |

Downstream Deck/Roadway Coordinates
num= 4

| Sta | Hi Cord | Lo Cord | Sta | Hi Cord | Lo Cord | Sta | Hi Cord | Lo Cord |
|---|---|---|---|---|---|---|---|---|
| 1000 | 479.4 | 477.6 | 1030.1 | 479.4 | 477.6 | 1030.1 | 479.4 | 471.1 |
| 1500 | 479.4 | 471.1 | | | | | | |

Downstream Bridge Cross Section Data
Station Elevation Data num= 11

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 1000 | 499.1 | 1000.1 | 471.1 | 1030 | 471.1 | 1030.1 | 479.1 | 1230 | 479.4 |
| 1230.1 | 478.9 | 1250 | 479.4 | 1270 | 478.9 | 1270.1 | 479.4 | 1300 | 480.4 |
| 1500 | 483.1 | | | | | | | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 1000 | .05 | 1000 | .03 | 1030.1 | .05 |

| Bank Sta: Left | Right | Coeff Contr. | Expan. |
|---|---|---|---|
| 1000 | 1030.1 | .1 | .3 |

Ineffective Flow num= 2

| Sta L | Sta R | Elev | Permanent |
|---|---|---|---|
| 1000 | 1000 | 499.1 | F |
| 1030.1 | 1500 | 479.1 | F |

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins = 479.4
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Energy

High Flow Method
Pressure and Weir flow
Submerged Inlet Cd =
Submerged Inlet + Outlet Cd =.8164966
Max Low Cord = 477.6

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel DS RS: 340.1

INPUT
Description: This is a REPEATED section.
D/S FACE ECHO LAKE ROAD BRIDGE
UPDATED DATA
Station Elevation Data num= 11

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 1000 | 499.1 | 1000.1 | 471.1 | 1030 | 471.1 | 1030.1 | 479.1 | 1230 | 479.4 |
| 1230.1 | 478.9 | 1250 | 479.4 | 1270 | 478.9 | 1270.1 | 479.4 | 1300 | 480.4 |
| 1500 | 483.1 | | | | | | | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 1000 | .05 | 1000 | .03 | 1030.1 | .05 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 1000 | 1030.1 | 5 | 5 | 5 | .1 | .3 |

Ineffective Flow num= 2

| Sta L | Sta R | Elev | Permanent |
|---|---|---|---|
| 1000 | 1000 | 499.1 | F |
| 1030.1 | 1500 | 479.1 | F |

```
CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 340

INPUT
Description: 97 LOMR AK
Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   499.1  1000.1   471.1    1030   471.1  1030.1   479.1    1230   479.4
  1230.1   478.9    1250   479.4    1270   478.9  1270.1   479.4    1300   480.4
    1500   483.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .05    1000     .03  1030.1     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1000  1030.1              210     210     210             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 339.6

INPUT
Description: 97 LOMR AJ - This is a REPEATED section.
 U/S FACE WALKWAY OVER
             BROOK UPDATED DATA
Station Elevation Data    num=      14
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   499.1  1000.1   470.3    1030   470.3  1030.1   477.1    1035   477.1
  1035.1   477.1    1045   477.1    1230   478.9  1230.1   478.4    1250   478.9
    1270   478.4  1270.1   478.9    1400   479.1    1700   483.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .05    1000     .03  1030.1     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1000  1030.1             1.24    1.24    1.24             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 339.56
```

```
INPUT
Description: This is a REPEATED section (NRCS)
Station Elevation Data    num=      14
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   499.1  1000.1   470.3    1030   470.3  1030.1   477.1    1035   477.1
  1035.1   477.1    1045   477.1    1230   478.9  1230.1   478.4    1250   478.9
    1270   478.4  1270.1   478.9    1400   479.1    1700   483.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .05    1000     .03  1030.1     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1000  1030.1              7.7     7.7     7.7             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
    1035    1045   482.6       T

BRIDGE


RIVER: Steele Brook
REACH: Main Channel DS    RS: 339.55

INPUT
Description: Walkway Bridge
Distance from Upstream XS =      .1
Deck/Roadway Width        =     7.5
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=       5
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
************************************************************************
    1000   484.3   482.5  1030.1   482.7   480.8    1035   482.6   480.6
  1035.1   482.6   477.1    1045   482.6   477.1

Upstream Bridge Cross Section Data
Station Elevation Data    num=      14
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   499.1  1000.1   470.3    1030   470.3  1030.1   477.1    1035   477.1
  1035.1   477.1    1045   477.1    1230   478.9  1230.1   478.4    1250   478.9
    1270   478.4  1270.1   478.9    1400   479.1    1700   483.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .05    1000     .03  1030.1     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1000  1030.1             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
    1035    1045   482.6       T
```

```
Downstream  Deck/Roadway Coordinates
    num=       5
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*******************************************************************************
    1000   484.3   482.5  1030.1   482.7   480.8    1035   482.6   480.6
  1035.1   482.6   477.1    1045   482.6   477.1

Downstream Bridge Cross Section Data
Station Elevation Data    num=      14
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   499.1  1000.1   470.3    1030   470.3  1030.1   477.1    1035   477.1
  1035.1   477.1    1045   477.1    1230   478.9  1230.1   478.4    1250   478.9
    1270   478.4  1270.1   478.9    1400   479.1    1700   483.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .05    1000     .03  1030.1     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1000  1030.1             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
  1035.1    1045   479.9       T

Upstream Embankment side slope             =       0 horiz. to 1.0 vertical
Downstream Embankment side slope           =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins        =   482.7
Energy head used in spillway design        =
Spillway height used in design             =
Weir crest shape                           = Broad Crested

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Energy

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 339.51
```

```
INPUT
Description: This is a REPEATED section (NRCS)
Station Elevation Data    num=      14
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
********************************************************************************
    1000    499.1   1000.1    470.3     1030    470.3   1030.1    477.1     1035    477.1
  1035.1    477.1     1045    477.1     1230    478.9   1230.1    478.4     1250    478.9
    1270    478.4   1270.1    478.9     1400    479.1     1700    483.1

Manning's n Values        num=       3
     Sta    n Val      Sta    n Val      Sta    n Val
************************************************
    1000      .05     1000      .03   1030.1      .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1000  1030.1              1.1      1.1      1.1              .1        .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
  1035.1    1045   479.9       T

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 339.5

INPUT
Description: 97 LOMR AI - D/S FACE WALKWAY OVER BROOK UPDATED DATA
Station Elevation Data    num=      14
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
********************************************************************************
    1000    499.1   1000.1    470.3     1030    470.3   1030.1    477.1     1035    477.1
  1035.1    477.1     1045    477.1     1230    478.9   1230.1    478.4     1250    478.9
    1270    478.4   1270.1    478.9     1400    479.1     1700    483.1

Manning's n Values        num=       3
     Sta    n Val      Sta    n Val      Sta    n Val
************************************************
    1000      .05     1000      .03   1030.1      .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1000  1030.1           290.01   290.01   290.01              .1        .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 339.1

INPUT
Description: Obstruction added by NRCS
Station Elevation Data    num=      12
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
********************************************************************************
    1000    499.1   1000.1    469.1     1030    469.1   1030.1    476.1     1195    477.8
```

```
  1195.1   477.3    1215   477.9    1235   477.3  1235.1   477.8    1260   479.1
    1450   481.1    1700   483.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .05    1000     .03  1030.1     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1000  1030.1              80      80      80             .1       .3
Blocked Obstructions     num=       2
   Sta L   Sta R    Elev   Sta L   Sta R    Elev
************************************************
    1228    1524   499.1    1622    1700   499.1

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 339

INPUT
Description: This is a REPEATED section. (Obstruction added by NRCS)
Station Elevation Data    num=      21
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     900   489.1    1000   483.1    1070   480.7    1124   480.7    1175   480.6
    1222   481.1    1320   478.1  1320.1   468.6    1350   468.6  1350.1   476.1
    1480   477.4  1480.1   476.9    1500   477.4    1520   476.9  1520.1   477.4
    1580   476.6    1635   477.1    1645   479.1    1740   479.1    1745   481.1
    1895   482.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     900     .05    1320     .03  1350.1     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1320  1350.1              28      28      28             .1       .3
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
************************
    1555    1759   499.1

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 338.2

INPUT
Description: This is a REPEATED section. (Obstruction added by NRCS)
 U/S FACE
             16" C.I. SAN. SEWER UPDATED DATA
Station Elevation Data    num=      21
```

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 900 | 489.1 | 1000 | 483.1 | 1070 | 480.7 | 1124 | 480.7 | 1175 | 480.6 |
| 1222 | 481.1 | 1320 | 478.1 | 1320.1 | 468.6 | 1350 | 468.6 | 1350.1 | 476.1 |
| 1480 | 477.4 | 1480.1 | 476.9 | 1500 | 477.4 | 1520 | 476.9 | 1520.1 | 477.4 |
| 1580 | 476.6 | 1635 | 477.1 | 1645 | 479.1 | 1740 | 479.1 | 1745 | 481.1 |
| 1895 | 482.1 | | | | | | | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 900 | .05 | 1320 | .03 | 1350.1 | .05 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 1320 | 1350.1 | 2 | 2 | 2 | .1 | .3 |

Blocked Obstructions num= 1

| Sta L | Sta R | Elev |
|---|---|---|
| 1535 | 1745 | 499.1 |

BRIDGE

RIVER: Steele Brook
REACH: Main Channel DS RS: 338.15

INPUT
Description: 16-inch Pipe
Distance from Upstream XS = .1
Deck/Roadway Width = 1.8
Weir Coefficient = 2.5
Upstream Deck/Roadway Coordinates
num= 6

| Sta | Hi Cord | Lo Cord | Sta | Hi Cord | Lo Cord | Sta | Hi Cord | Lo Cord |
|---|---|---|---|---|---|---|---|---|
| 900 | 473.5 | 468.6 | 1320 | 473.5 | 468.6 | 1320 | 473.5 | 472 |
| 1350.1 | 473.5 | 472 | 1350.1 | 473.5 | 468.6 | 1895 | 473.5 | 468.6 |

Upstream Bridge Cross Section Data
Station Elevation Data num= 21

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 900 | 489.1 | 1000 | 483.1 | 1070 | 480.7 | 1124 | 480.7 | 1175 | 480.6 |
| 1222 | 481.1 | 1320 | 478.1 | 1320.1 | 468.6 | 1350 | 468.6 | 1350.1 | 476.1 |
| 1480 | 477.4 | 1480.1 | 476.9 | 1500 | 477.4 | 1520 | 476.9 | 1520.1 | 477.4 |
| 1580 | 476.6 | 1635 | 477.1 | 1645 | 479.1 | 1740 | 479.1 | 1745 | 481.1 |
| 1895 | 482.1 | | | | | | | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 900 | .05 | 1320 | .03 | 1350.1 | .05 |

| Bank Sta: Left | Right | Coeff Contr. | Expan. |
|---|---|---|---|
| 1320 | 1350.1 | .1 | .3 |

Blocked Obstructions num= 1

```
   Sta L   Sta R    Elev
************************
    1535    1745   499.1

Downstream  Deck/Roadway Coordinates
    num=       6
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
************************************************************************
     900   473.5   468.6    1320   473.5   468.6    1320   473.5     472
  1350.1   473.5     472  1350.1   473.5   468.6    1895   473.5   468.6

Downstream Bridge Cross Section Data
Station Elevation Data    num=      21
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     900   489.1    1000   483.1    1070   480.7    1124   480.7    1175   480.6
    1222   481.1    1320   478.1  1320.1   468.6    1350   468.6  1350.1   476.1
    1480   477.4  1480.1   476.9    1500   477.4    1520   476.9  1520.1   477.4
    1580   476.6    1635   477.1    1645   479.1    1740   479.1    1745   481.1
    1895   482.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     900     .05    1320     .03  1350.1     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1320  1350.1             .1       .3
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
************************
    1535    1745   499.1

Upstream Embankment side slope             =       0 horiz. to 1.0 vertical
Downstream Embankment side slope           =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins        =   473.5
Energy head used in spillway design        =
Spillway height used in design             =
Weir crest shape                           = Broad Crested

Number of Piers =  2

Pier Data
Pier Station     Upstream=    1330    Downstream=    1330
Upstream     num=       2
    Width   Elev    Width   Elev
********************************
     1.5   468.6     1.5     472
Downstream     num=       2
    Width   Elev    Width   Elev
********************************
     1.5   468.6     1.5     472

Pier Data
Pier Station     Upstream=    1340    Downstream=    1340
Upstream     num=       2
```

```
    Width   Elev    Width   Elev
********************************
     1.5   468.6     1.5     472
Downstream     num=       2
    Width   Elev    Width   Elev
********************************
     1.5   468.6     1.5     472

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Yarnell                KVal =     1.2
Selected Low Flow Methods = Yarnell

High Flow Method
       Pressure and Weir flow
           Submerged Inlet Cd          =
           Submerged Inlet + Outlet Cd =.8164966
           Max Low Cord                =     472

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 338.1

INPUT
Description: D/S FACE 16" C.I. SAN. SEWER UPDATED DATA Obstruction added by NRCS
Station Elevation Data    num=      21
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     900   489.1    1000   483.1    1070   480.7    1124   480.7    1175   480.6
    1222   481.1    1320   478.1  1320.1   468.6    1350   468.6  1350.1   476.1
    1480   477.4  1480.1   476.9    1500   477.4    1520   476.9  1520.1   477.4
    1580   476.6    1635   477.1    1645   479.1    1740   479.1    1745   481.1
    1895   482.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     900     .05    1320     .03  1350.1     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1320  1350.1              30      30      30             .1       .3
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
************************
    1535    1745   499.1
```

```
CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 337

INPUT
Description: 97 LOMR AH (Obstruction added by NRCS)
Station Elevation Data    num=      21
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     900   489.1    1000   483.1    1070   480.7    1124   480.7    1175   480.6
    1222   481.1    1319   478.1  1319.1   468.6    1350   468.6  1350.1   476.6
    1470   477.1  1470.1   476.6    1490   477.1    1510   476.6  1510.1   477.1
    1580   476.1    1635   477.1    1640   479.1    1740   479.1    1745   481.1
    1895   482.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     900     .05    1319     .03  1350.1     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1319  1350.1              40      40      40             .1       .3
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
************************
    1528    1745   499.1

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 336.2

INPUT
Description: This is a REPEATED section.
 U/S PROPOSED BOX CULVERT BRIDGE
Station Elevation Data    num=      19
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     620   489.1     720   481.6     779   480.6     828   480.6     940   479.1
     980   479.3   980.1   467.6  1009.9   467.6    1010   479.3    1143   476.1
    1160   476.8    1183   476.3  1183.1   476.8    1215   475.1    1390   475.1
    1420   479.1    1460   481.1    1545   482.1    1765   483.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     620     .05     980    .025    1010     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
           980    1010              38      38      38             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
```

```
    1010    1765   476.6       F
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
************************
    1508    1659   494.1

BRIDGE


RIVER: Steele Brook
REACH: Main Channel DS    RS: 336.15

INPUT
Description: Parking Lot Bridge (Updated by NRCS)
Distance from Upstream XS =      .1
Deck/Roadway Width        =    37.8
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=      19
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
***********************************************************************
     620   489.1   489.1     720   481.6   481.6     779   480.6   480.6
     828   480.6   480.6     940   479.1   479.1     980   479.3   479.3
   980.1   479.3   477.6  1009.9   479.3   477.6    1010   479.3   479.3
    1143   476.1   476.1    1160   476.8   476.8    1183   476.3   476.3
  1183.1   476.8   476.8    1215   475.1   475.1    1390   475.1   475.1
    1420   479.1   479.1    1460   481.1   481.1    1545   482.1   482.1
    1765   483.1   483.1

Upstream Bridge Cross Section Data
Station Elevation Data    num=      19
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     620   489.1     720   481.6     779   480.6     828   480.6     940   479.1
     980   479.3   980.1   467.6  1009.9   467.6    1010   479.3    1143   476.1
    1160   476.8    1183   476.3  1183.1   476.8    1215   475.1    1390   475.1
    1420   479.1    1460   481.1    1545   482.1    1765   483.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     620     .05     980    .025    1010     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
           980    1010             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
    1010    1765   476.6       F
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
************************
    1508    1659   494.1

Downstream  Deck/Roadway Coordinates
    num=      19
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
***********************************************************************
```

```
     620   489.1   489.1     720   481.6   481.6     779   480.6   480.6
     828   480.6   480.6     940   479.1   479.1     980   479.3   479.3
   980.1   479.3   477.6  1009.9   479.3   477.6    1010   479.3   479.3
    1143   476.1   476.1    1160   476.8   476.8    1183   476.3   476.3
  1183.1   476.8   476.8    1215   475.1   475.1    1390   475.1   475.1
    1420   479.1   479.1    1460   481.1   481.1    1545   482.1   482.1
    1765   483.1   483.1

Downstream Bridge Cross Section Data
Station Elevation Data    num=      19
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     620   489.1     720   481.6     779   480.6     828   480.6     940   479.1
     980   479.3   980.1   467.6  1009.9   467.6    1010   479.3    1143   476.1
    1160   476.8    1183   476.3  1183.1   476.8    1215   475.1    1390   475.1
    1420   479.1    1460   481.1    1545   482.1    1765   483.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     620     .05     980    .025    1010     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
           980    1010             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
    1010    1765   476.6       F
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
************************
    1508    1659   494.1

Upstream Embankment side slope             =       0 horiz. to 1.0 vertical
Downstream Embankment side slope           =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins        =     476
Energy head used in spillway design        =
Spillway height used in design             =
Weir crest shape                           = Broad Crested

Number of Piers =  2

Pier Data
Pier Station     Upstream=     990    Downstream=     990
Upstream     num=       2
    Width   Elev    Width   Elev
********************************
     1.5   467.6     1.5   477.6
Downstream     num=       2
    Width   Elev    Width   Elev
********************************
     1.5   467.6     1.5   477.6

Pier Data
Pier Station     Upstream=    1000    Downstream=    1000
Upstream     num=       2
    Width   Elev    Width   Elev
```

```
********************************
     1.5   467.6     1.5   477.6
Downstream     num=       2
    Width   Elev    Width   Elev
********************************
     1.5   467.6     1.5   477.6

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Yarnell                KVal =      .9
Selected Low Flow Methods = Yarnell

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 336.1

INPUT
Description: D/S PROPOSED BOX CULVERT BRIDGE
Station Elevation Data    num=      19
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     620   489.1     720   481.6     779   480.6     828   480.6     940   479.1
     980   479.3   980.1   467.6  1009.9   467.6    1010   479.3    1143   476.1
    1160   476.8    1183   476.3  1183.1   476.8    1215   475.1    1390   475.1
    1420   479.1    1460   481.1    1545   482.1    1765   483.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     620     .05     980    .025    1010     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
           980    1010               35      30      25             .1       .3
Ineffective Flow      num=       1
   Sta L   Sta R    Elev  Permanent
    1010    1765   476.6       F
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
************************
    1508    1659   494.1

CROSS SECTION
```

RIVER: Steele Brook
REACH: Main Channel DS RS: 336

INPUT
Description: 97 LOMR AG
Station Elevation Data num= 23

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 850 | 489.1 | 1000 | 481.6 | 1059 | 480.6 | 1108 | 480.6 | 1189 | 478.6 |
| 1255 | 475.1 | 1265 | 469.1 | 1280 | 467.4 | 1290 | 468.1 | 1295 | 471.1 |
| 1320 | 475.1 | 1355 | 477.1 | 1380 | 477.1 | 1430 | 476.6 | 1430.1 | 476.1 |
| 1450 | 476.6 | 1470 | 476.1 | 1470.1 | 476.6 | 1500 | 476.1 | 1660 | 476.1 |
| 1695 | 479.1 | 1780 | 481.1 | 1875 | 481.1 | | | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 850 | .07 | 1265 | .04 | 1290 | .07 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 1265 | 1290 | 530 | 420 | 300 | .1 | .3 |

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel DS RS: 335

INPUT
Description: 97 LOMR AF
Station Elevation Data num= 18

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 1000 | 480 | 1055 | 477.1 | 1170 | 473.1 | 1183 | 468.1 | 1198 | 467.1 |
| 1225 | 468.6 | 1230 | 471.1 | 1300 | 473.1 | 1385 | 473.1 | 1400 | 475.1 |
| 1440 | 476.1 | 1470 | 478.1 | 1470.1 | 477.6 | 1505 | 478.2 | 1540 | 477.8 |
| 1540.1 | 478.3 | 1560 | 479.1 | 1650 | 482.1 | | | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 1000 | .07 | 1183 | .04 | 1225 | .07 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 1183 | 1225 | 500 | 610 | 600 | .1 | .3 |

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel DS RS: 334

INPUT
Description: 97 LOMR AE

Station Elevation Data num= 19

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 999 | 489.1 | 1000 | 475.1 | 1105 | 475.1 | 1160 | 473.1 | 1200 | 475.1 |
| 1218 | 477.1 | 1253 | 475.7 | 1290 | 465.1 | 1293 | 464.8 | 1308 | 464.8 |
| 1310 | 465.1 | 1319 | 469.1 | 1408 | 471.1 | 1415 | 473.1 | 1465 | 475.1 |
| 1480 | 477.6 | 1540 | 479.1 | 1590 | 486.1 | 1650 | 499.1 | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 999 | .07 | 1253 | .04 | 1319 | .07 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 1253 | 1319 | 350 | 320 | 300 | .1 | .3 |

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel DS RS: 333

INPUT
Description: 97 LOMR AD
Station Elevation Data num= 17

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 1000 | 477.1 | 1070 | 473.1 | 1100 | 474.6 | 1160 | 475.1 | 1195 | 474.6 |
| 1235 | 465.1 | 1237 | 464.1 | 1247 | 464.1 | 1250 | 465.1 | 1305 | 473.6 |
| 1355 | 472.1 | 1425 | 475.1 | 1485 | 480.1 | 1550 | 493.1 | 1610 | 503.1 |
| 1715 | 511.1 | 1793 | 515.6 | | | | | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 1000 | .07 | 1195 | .04 | 1305 | .07 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 1195 | 1305 | 15 | 15 | 15 | .1 | .3 |

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel DS RS: 332.2

INPUT
Description: U/S FACE NEW FRENCH STREET BRIDGE
Station Elevation Data num= 8

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 1000 | 479.1 | 1230 | 475.6 | 1230.1 | 464.1 | 1260 | 463.7 | 1260.1 | 475.8 |
| 1290 | 476.5 | 1370 | 477.1 | 1450 | 479.1 | | | | |

Manning's n Values num= 3

```
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .04    1230    .025  1260.1     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1230  1260.1               60      60      60             .1       .3

BRIDGE


RIVER: Steele Brook
REACH: Main Channel DS    RS: 332.15

INPUT
Description: French Street Bridge
Distance from Upstream XS =      .1
Deck/Roadway Width        =    59.8
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=       2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
************************************************
    1000   475.6   473.5    1450   475.6   473.5

Upstream Bridge Cross Section Data
Station Elevation Data    num=       8
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   479.1    1230   475.6  1230.1   464.1    1260   463.7  1260.1   475.8
    1290   476.5    1370   477.1    1450   479.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .04    1230    .025  1260.1     .04

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1230  1260.1             .1       .3

Downstream  Deck/Roadway Coordinates
    num=       2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
************************************************
    1000   475.6   473.5    1450   475.6   473.5

Downstream Bridge Cross Section Data
Station Elevation Data    num=       8
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   479.1    1230   475.6  1230.1   463.2    1260   462.6  1260.1   475.8
    1290   476.5    1370   477.1    1450   479.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .04    1230    .025  1260.1     .04
```

```
Bank Sta: Left   Right    Coeff Contr.   Expan.
          1230  1260.1             .1       .3

Upstream Embankment side slope            =       0 horiz. to 1.0 vertical
Downstream Embankment side slope          =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins       =   475.6
Energy head used in spillway design       =
Spillway height used in design            =
Weir crest shape                          = Broad Crested

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Energy

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 332.1

INPUT
Description: D/S FACE NEW FRENCH STREET BRIDGE
Station Elevation Data    num=       8
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   479.1    1230   475.6  1230.1   463.2    1260   462.6  1260.1   475.8
    1290   476.5    1370   477.1    1450   479.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .04    1230    .025  1260.1     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1230  1260.1              15      15      15            .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 332
```

```
INPUT
Description: FEMA AC
Station Elevation Data    num=      18
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   491.6    1049   487.1    1105   478.6    1175   475.6    1235   473.1
    1260   464.6    1265   462.6    1275   462.6    1278   464.6    1293   472.1
    1338   475.1    1380   473.6    1430   474.6    1485   478.1    1540   485.1
    1650   500.6    1723   511.7    1800   515.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1235    .035    1293    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1235    1293              250     340     350             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 331

INPUT
Description: FEMA AB
Station Elevation Data    num=      19
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   492.6    1073   487.6    1129   488.1    1175   486.6    1225   480.6
    1285   471.6    1315   471.6    1350   462.1    1355   461.1    1385   461.1
    1390   462.1    1400   465.1    1465   470.1    1521   472.1    1608   476.6
    1665   487.1    1720   500.1    1773   500.1    1830   502.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1315    .035    1400    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1315    1400              450     520     650             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 330

INPUT
Description: FEMA AA
Station Elevation Data    num=      20
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   487.1    1050   481.1    1096   476.1    1149   470.1    1221   467.6
    1260   468.6    1280   460.6    1285   460.1    1300   460.1    1307   460.6
```

```
    1320   462.1    1354   463.7    1420   468.1    1473   468.7    1525   470.1
    1585   472.1    1640   472.6    1690   473.1    1770   480.1    1804   481.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1260    .035    1354    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1260    1354              350     400     400            .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 329

INPUT
Description: FEMA Z
Station Elevation Data    num=      20
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   482.1    1025   478.1    1060   473.1    1090   468.1    1180   463.6
    1245   467.1    1269   458.7    1270   457.8    1285   457.8    1289   458.7
    1340   464.6    1390   465.1    1450   463.6    1530   465.1    1605   466.6
    1670   468.6    1711   472.6    1771   478.6    1790   488.6    1860   486.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1245    .035    1340    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1245    1340              950    1010    1000            .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 328

INPUT
Description: FEMA Y
Station Elevation Data    num=      20
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   476.6    1035   473.6    1105   466.1    1141   463.1    1179   466.1
    1210   456.1    1212   455.1    1230   455.1    1232   456.1    1245   465.6
    1290   460.6    1360   461.6    1460   464.6    1538   459.1    1620   458.6
    1687   460.6    1730   463.1    1810   466.6    1879   477.1    1915   478.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1179    .035    1245    .075
```

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

| | | | | | | |
|---|---|---|---|---|---|---|
| 1179 | 1245 | 200 | 200 | 150 | .1 | .3 |

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel DS RS: 327

INPUT
Description: FEMA X
Station Elevation Data num= 22

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 1000 | 476.1 | 1045 | 468.1 | 1080 | 465.1 | 1155 | 462.1 | 1180 | 462.1 |
| 1190 | 453.7 | 1195 | 452.9 | 1210 | 452.9 | 1213 | 453.7 | 1235 | 465.1 |
| 1264 | 460.1 | 1380 | 460.1 | 1468 | 460.1 | 1549 | 460.1 | 1610 | 460.6 |
| 1660 | 461.1 | 1715 | 461.1 | 1810 | 467.1 | 1869 | 481.1 | 1880 | 480.1 |
| 1918 | 482.1 | 1940 | 481.1 | | | | | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 1000 | .075 | 1180 | .035 | 1235 | .075 |

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

| | | | | | | |
|---|---|---|---|---|---|---|
| 1180 | 1235 | 700 | 740 | 800 | .1 | .3 |

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel DS RS: 326

INPUT
Description: FEMA W
Station Elevation Data num= 25

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 1000 | 470.7 | 1050 | 467.1 | 1100 | 462.1 | 1180 | 457.1 | 1255 | 457.7 |
| 1270 | 452.1 | 1275 | 451.5 | 1290 | 451.5 | 1295 | 452.1 | 1328 | 458.7 |
| 1371 | 456.7 | 1440 | 456.7 | 1470 | 451.1 | 1540 | 457.6 | 1595 | 458.1 |
| 1673 | 460.7 | 1721 | 461.1 | 1762 | 463.1 | 1805 | 467.6 | 1857 | 470.1 |
| 1894 | 470.1 | 1948 | 470.6 | 1980 | 469.6 | 2023 | 479.6 | 2046 | 479.1 |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 1000 | .075 | 1255 | .035 | 1328 | .075 |

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

| | | | | | | |
|---|---|---|---|---|---|---|
| 1255 | 1328 | 490 | 500 | 520 | .1 | .3 |

```
CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 325

INPUT
Description: FEMA V
Station Elevation Data    num=      15
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     910   469.1     920   464.1    1000   463.1    1075   458.6    1105   451.6
    1110   451.1    1135   451.1    1140   451.6    1205   456.6    1264   456.1
    1320   473.6    1365   476.1    1430   480.1    1499   480.1    1535   479.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     910    .075    1075    .035    1205    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1075    1205               40      40      40              .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 324.2

INPUT
Description: This is a REPEATED section.
 U/S FACE BRIDGE TO SEWAGE TREATMENT
             PLANT

Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   494.1    1085   466.1    1150   461.1    1200   459.1    1202   454.1
    1205     451    1225     451    1230   454.1    1232   459.1    1252   454.1
    1390   457.1    1460   471.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1200    .035    1232    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1200    1232               20      20      20              .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1200   460.9       F
    1232    1460   460.9       F

BRIDGE
```

```
RIVER: Steele Brook
REACH: Main Channel DS    RS: 324.15

INPUT
Description: Treatment Plant Bridge

Distance from Upstream XS =      .1
Deck/Roadway Width        =    19.8
Weir Coefficient          =     2.5
Upstream  Deck/Roadway Coordinates
    num=      13
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*******************************************************************************
    1000   494.1     -.9    1085   466.1     -.9    1150   461.1     -.9
    1200   460.9   459.2    1202   460.9   459.2    1205   460.9   459.2
    1225   460.9   459.2    1230   460.9   459.2    1232   460.9   459.1
    1252   459.1   454.1    1390   457.1     -.9    1460   471.1     -.9
    1460   471.1     -.9

Upstream Bridge Cross Section Data
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
    1000   494.1    1085   466.1    1150   461.1    1200   459.1    1202   454.1
    1205     451    1225     451    1230   454.1    1232   459.1    1252   454.1
    1390   457.1    1460   471.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1200    .035    1232    .075

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1200    1232             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1200   460.9       F
    1232    1460   460.9       F

Downstream  Deck/Roadway Coordinates
    num=      13
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*******************************************************************************
    1000   494.1     -.9    1085   466.1     -.9    1150   461.1     -.9
    1200   460.9   459.2    1202   460.9   459.2    1205   460.9   459.2
    1225   460.9   459.2    1230   460.9   459.2    1232   460.9   459.1
    1252   459.1   454.1    1390   457.1     -.9    1460   471.1     -.9
    1460   471.1     -.9

Downstream Bridge Cross Section Data
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
    1000   494.1    1085   466.1    1150   461.1    1200   459.1    1202   454.1
    1205     451    1225     451    1230   454.1    1232   459.1    1252   454.1
    1390   457.1    1460   471.1
```

```
Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1200    .035    1232    .075

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1200    1232             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1200   459.2       F
    1232    1460   459.2       F

Upstream Embankment side slope            =       0 horiz. to 1.0 vertical
Downstream Embankment side slope          =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins       =   460.9
Energy head used in spillway design       =
Spillway height used in design            =
Weir crest shape                          = Broad Crested

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Energy

High Flow Method
       Pressure and Weir flow
           Submerged Inlet Cd          =
           Submerged Inlet + Outlet Cd =.8164966
           Max Low Cord                =   459.2

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 324.1

INPUT
Description:  D/S FACE BRIDGE TO SEWAGE TREATMENT PLANT

Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   494.1    1085   466.1    1150   461.1    1200   459.1    1202   454.1
    1205     451    1225     451    1230   454.1    1232   459.1    1252   454.1
    1390   457.1    1460   471.1

Manning's n Values        num=       3
```

```
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1200    .035    1232    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1200    1232              40      40      40             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1200   459.2       F
    1232    1460   459.2       F

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 324

INPUT
Description: FEMA U
Station Elevation Data    num=      14
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   474.6    1077   463.6    1129   460.1    1160   451.6    1162   450.9
    1188   450.9    1190   451.6    1250   461.1    1288   458.1    1325   457.1
    1390   476.7    1422   478.1    1510   478.9    1555   478.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1129    .035    1250    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1129    1250             320     380     350             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 323

INPUT
Description: FEMA T
Station Elevation Data    num=      16
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   510.6    1085   488.6    1143   486.1    1190   485.1    1230   478.7
    1255   476.1    1310   467.6    1320   461.1    1345   450.1    1350   449.1
    1365   449.1    1370   450.1    1389   456.1    1480   476.1    1520   475.1
    1562   474.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1310    .035    1480    .075
```

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1310    1480              440     480     520             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 322

INPUT
Description: FEMA S
Station Elevation Data    num=      15
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     999   469.1    1000   451.6    1055   451.1    1115   451.6    1150   450.1
    1180   449.3    1198   456.1    1225   445.1    1230   442.1    1250   442.1
    1254   445.1    1272   453.1    1300   450.1    1340   458.6    1435   467.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     999    .075    1198    .035    1272    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1198    1272              440     460     500             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 321.1

INPUT
Description:  SEYMOUR AND SMITH CO.

Station Elevation Data    num=       9
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   453.1    1015   450.1    1036   448.7    1037   444.5    1052   443.1
    1105   442.5    1107   446.8    1135   448.1    1150   452.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1036    .035    1107    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1036    1107               40      40      40             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 321
```

```
INPUT
Description: FEMA R
Station Elevation Data    num=      10
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
********************************************************************************
    1000    449.6     1045    448.1     1095    456.1     1170    433.1     1180    425.6
    1210    425.6     1215    433.1     1260    448.1     1285    447.1     1304    447.6

Manning's n Values        num=       3
     Sta    n Val      Sta    n Val      Sta    n Val
************************************************
    1000     .075     1095     .035     1260     .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1095    1260              130      130      130              .1        .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 320

INPUT
Description: FEMA Q
Station Elevation Data    num=      12
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
********************************************************************************
    1000    476.1     1070    465.1     1110    461.6     1157    450.1     1200    436.1
    1230    427.1     1235    421.1     1255    421.1     1260    427.1     1280    440.1
    1305    443.1     1323    442.7

Manning's n Values        num=       3
     Sta    n Val      Sta    n Val      Sta    n Val
************************************************
    1000     .075     1157     .035     1280     .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1157    1280              340      340      340              .1        .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 319

INPUT
Description: FEMA P
Station Elevation Data    num=      12
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
********************************************************************************
    1000    465.1     1040    449.6     1088    441.6     1150    436.4     1195    435.1
    1225    433.1     1250    422.1     1255    417.6     1264    417.6     1265    422.1
    1345    432.6     1410    434.3
```

```
Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1225    .035    1345    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1225    1345              500     380     200              .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 318

INPUT
Description: FEMA O
Station Elevation Data    num=      21
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   483.1    1040   482.1    1088   473.1    1115   468.1    1144   462.6
    1180   452.1    1213   443.6    1250   430.9    1279   437.6    1315   418.1
    1320   414.1    1330   414.1    1333   418.1    1395   426.6    1495   425.4
    1563   426.1    1619   427.1    1650   427.6    1675   428.1    1780   432.1
    1820   427.1

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1279    .035    1395    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1279    1395              200     180     150              .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 317

INPUT
Description: FEMA N
Station Elevation Data    num=      21
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   451.6    1060   444.6    1130   441.1    1192   436.1    1220   430.1
    1255   419.6    1285   422.6    1313   413.6    1315   410.6    1330   410.6
    1335   413.6    1354   420.1    1380   421.6    1425   421.1    1490   422.1
    1515   422.1    1570   423.1    1685   424.3    1730   426.6    1780   427.4
    1820   427.1

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1285    .035    1354    .075
```

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1285    1354             400     370     300             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 316

INPUT
Description: FEMA M
Station Elevation Data    num=      16
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   441.1    1035   435.1    1084   430.1    1143   426.7    1168   424.3
    1200   408.1    1208   404.4    1220   404.4    1228   408.1    1270   416.6
    1330   414.6    1410   414.3    1461   416.1    1516   417.1    1588   420.1
    1665   426.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1168    .035    1270    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1168    1270             650     620     600             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 315

INPUT
Description: FEMA L
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   420.1    1038   415.6    1097   416.1    1136   400.1    1137   398.1
    1155   398.1    1156   400.1    1193   406.1    1263   407.1    1327   407.6
    1365   409.6    1448   419.4

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1097    .035    1193    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1097    1193             600     620     650             .1       .3

CROSS SECTION


RIVER: Steele Brook
```

```
REACH: Main Channel DS    RS: 314

INPUT
Description: FEMA K
Station Elevation Data    num=      10
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   407.6    1040   406.6    1085   406.1    1090     391    1160     391
    1163   394.6    1182   394.6    1222   398.1    1311   404.4    1345   404.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1085    .035    1311    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1085    1311             600     490     450             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 313

INPUT
Description: FEMA J
Station Elevation Data    num=      18
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   420.9    1055   418.6    1148   412.6    1225   409.1    1288   407.6
    1385   395.6    1420   395.6    1428   388.6    1429     387    1456     387
    1457   388.6    1552   395.1    1609   395.1    1698   395.1    1770   396.6
    1871   397.6    2010   399.6    2060   405.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1420    .035    1552    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1420    1552             400     150       1             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 312.2

INPUT
Description: This is a REPEATED section.
 U/S FACE RTE 73 BRIDGE

Station Elevation Data    num=      17
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
```

```
    1000     394    1002   384.1  1013.5     385    1014     391    1016     391
    1017     385    1030   385.9    1031     391    1032     391    1033   385.9
    1047   386.9    1048     391    1050     391    1051   386.9    1065   387.9
    1066     391    1070     394

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1000    .035    1070    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1000    1070               70      70      70             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1000     394       F
    1070    1070     394       F

BRIDGE


RIVER: Steele Brook
REACH: Main Channel DS    RS: 312.15

INPUT
Description: Main Street Bridge

Distance from Upstream XS =      .1
Deck/Roadway Width        =    69.8
Weir Coefficient          =     2.5
Upstream  Deck/Roadway Coordinates
    num=      2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
************************************************
    1000     394     391    1070     394     391

Upstream Bridge Cross Section Data
Station Elevation Data    num=      17
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000     394    1002   384.1  1013.5     385    1014     391    1016     391
    1017     385    1030   385.9    1031     391    1032     391    1033   385.9
    1047   386.9    1048     391    1050     391    1051   386.9    1065   387.9
    1066     391    1070     394

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1000    .035    1070    .075

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1000    1070             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1000     394       F
    1070    1070     394       F
```

```
Downstream  Deck/Roadway Coordinates
    num=       2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
************************************************
    1000     394     391    1070     394     391

Downstream Bridge Cross Section Data
Station Elevation Data    num=      17
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000     394    1002   384.1  1013.5     385    1014     391    1016     391
    1017     385    1030   385.9    1031     391    1032     391    1033   385.9
    1047   386.9    1048     391    1050     391    1051   386.9    1065   387.9
    1066     391    1070     394

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1000    .035    1070    .075

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1000    1070             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1000     391       F
    1070    1070     391       F

Upstream Embankment side slope             =       0 horiz. to 1.0 vertical
Downstream Embankment side slope           =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins        =     394
Energy head used in spillway design        =
Spillway height used in design             =
Weir crest shape                           = Broad Crested

Number of Piers =  1

Pier Data
Pier Station     Upstream=    1035    Downstream=    1035
Upstream     num=       2
    Width   Elev    Width   Elev
********************************
     7.5   384.1     7.5     391
Downstream     num=       2
    Width   Elev    Width   Elev
********************************
     7.5   384.1     7.5     391

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Yarnell                KVal =     1.3
Selected Low Flow Methods = Yarnell

High Flow Method
       Pressure and Weir flow
           Submerged Inlet Cd          =
```

```
            Submerged Inlet + Outlet Cd =.8164966
            Max Low Cord                =     391

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 312.1

INPUT
Description:  D/S FACE RTE 73 BRIDGE

Station Elevation Data    num=      17
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000     394    1002   384.1  1013.5     385    1014     391    1016     391
    1017     385    1030   385.9    1031     391    1032     391    1033   385.9
    1047   386.9    1048     391    1050     391    1051   386.9    1065   387.9
    1066     391    1070     394

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000    .075    1000    .035    1070    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1000    1070              30      30      30             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1000     391       F
    1070    1070     391       F

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 312

INPUT
Description: FEMA I
Station Elevation Data    num=       8
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   399.4    1055   398.1    1115   387.6    1130     384    1200     384
    1205   387.6    1310   395.1    1425   395.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
```

```
    1000    .075    1055    .035    1310    .075

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1055    1310                1     140     250             .3       .5

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 311

INPUT
Description: FEMA H
Station Elevation Data    num=      14
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   399.4    1035   399.4    1060   399.1    1090   387.6    1100   383.8
    1135   383.8    1140   387.6    1195   391.6    1255   391.6    1350   392.6
    1412   392.1    1485   392.1    1545   396.1    1630   397.6

Manning's n Values        num=      3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1060     .03    1195     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1060    1195              180     150     150             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 310

INPUT
Description: FEMA G
Station Elevation Data    num=      16
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   401.9    1030   401.9    1090   401.1    1130   386.6    1135   383.6
    1175   383.6    1180   386.6    1240   390.1    1318   391.6    1407   391.6
    1495   392.1    1583   391.6    1670   394.1    1745   394.8    1815   394.6
    1890   396.1

Manning's n Values        num=      3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1090     .03    1240     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1090    1240              100     130     200             .1       .3

CROSS SECTION
```

RIVER: Steele Brook
REACH: Main Channel DS RS: 309

INPUT
Description: FEMA F
Station Elevation Data num= 10

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 1000 | 401.6 | 1030 | 401.6 | 1079 | 402.1 | 1140 | 386.6 | 1145 | 382.6 |
| 1525 | 382.6 | 1540 | 386.6 | 1585 | 391.6 | 1654 | 395.6 | 1725 | 403.6 |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 1000 | .06 | 1079 | .03 | 1585 | .06 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 1079 | 1585 | 450 | 500 | 530 | .1 | .3 |

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel DS RS: 308

INPUT
Description: FEMA E
Station Elevation Data num= 9

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 1000 | 399.6 | 1035 | 399.6 | 1075 | 386.6 | 1110 | 376.1 | 1435 | 376.1 |
| 1480 | 386.6 | 1505 | 392.6 | 1557 | 394.8 | 1600 | 397 | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 1000 | .06 | 1035 | .03 | 1505 | .06 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 1035 | 1505 | 50 | 50 | 50 | .1 | .3 |

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel DS RS: 307.1

INPUT
Description: PIN SHOP DAM

Station Elevation Data num= 9

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 1000 | 391.1 | 1025 | 390.4 | 1026 | 388.9 | 1043 | 388.4 | 1044 | 385.4 |

```
    1146   385.4    1147   390.1    1480   390.5    1510   391.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1043     .03    1147     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1043    1147              30      30      30             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 307

INPUT
Description: FEMA D
Station Elevation Data    num=      10
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   400.1    1040   400.1    1090   393.6    1135   375.1    1225   375.1
    1278   382.6    1365   383.6    1450   384.1    1525   387.6    1595   396.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1090     .03    1278     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1090    1278             490     520     570             .1       .3

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 305

INPUT
Description: FEMA C
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     999   379.1    1000   368.6    1040   369.6    1115   370.6    1240   370.6
    1310   359.1    1320   354.1    1330   354.1    1340   359.1    1377   368.6
    1410   372.6    1460   382.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     999     .06    1240     .03    1377     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1240    1377              40      40      40             .1       .3
```

CROSS SECTION

RIVER: Steele Brook
REACH: Main Channel DS    RS: 304.2

INPUT
Description: This is a REPEATED section.
U/S PARKING LOT BRIDGE

Station Elevation Data    num=      11

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 1000 | 379.1 | 1001 | 368.3 | 1004 | 364.7 | 1005 | 361.1 | 1018 | 353.7 |
| 1028 | 353.8 | 1045 | 364.6 | 1055 | 359.6 | 1056 | 364.7 | 1057 | 368.3 |
| 1120 | 368.3 | | | | | | | | |

Manning's n Values        num=       3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 1000 | .06 | 1004 | .03 | 1056 | .06 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 1004 | 1056 | 20 | 20 | 20 | .3 | .5 |

Ineffective Flow     num=       2

| Sta L | Sta R | Elev | Permanent |
|---|---|---|---|
| 1000 | 1004 | 368.3 | F |
| 1056 | 1120 | 368.3 | F |

BRIDGE

RIVER: Steele Brook
REACH: Main Channel DS    RS: 304.15

INPUT
Description: Parking Lot Bridge

Distance from Upstream XS =      .1
Deck/Roadway Width        =    19.8
Weir Coefficient          =     2.5
Upstream  Deck/Roadway Coordinates
num=       6

| Sta | Hi Cord | Lo Cord | Sta | Hi Cord | Lo Cord | Sta | Hi Cord | Lo Cord |
|---|---|---|---|---|---|---|---|---|
| 1000 | 368.3 | 353.7 | 1004 | 368.3 | 353.7 | 1004 | 368.3 | 364.7 |
| 1056 | 368.3 | 364.7 | 1056 | 368.3 | 353.7 | 1120 | 368.3 | 353.7 |

Upstream Bridge Cross Section Data
Station Elevation Data    num=      11

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 1000 | 379.1 | 1001 | 368.3 | 1004 | 364.7 | 1005 | 361.1 | 1018 | 353.7 |
| 1028 | 353.8 | 1045 | 364.6 | 1055 | 359.6 | 1056 | 364.7 | 1057 | 368.3 |
| 1120 | 368.3 | | | | | | | | |

```
Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1004     .03    1056     .06

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1004    1056             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1004   368.3       F
    1056    1120   368.3       F

Downstream  Deck/Roadway Coordinates
    num=       6
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
************************************************************************
    1000   368.3   353.7    1004   368.3   353.7    1004   368.3   364.7
    1056   368.3   364.7    1056   368.3   353.7    1120   368.3   353.7

Downstream Bridge Cross Section Data
Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   379.1    1001   368.3    1004   364.7    1005   361.1    1018   353.7
    1028   353.8    1045   364.6    1055   359.6    1056   364.7    1057   368.3
    1120   368.3

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1004     .03    1056     .06

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1004    1056             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1004   364.7       F
    1056    1120   364.7       F

Upstream Embankment side slope             =       0 horiz. to 1.0 vertical
Downstream Embankment side slope           =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins        =   368.3
Energy head used in spillway design        =
Spillway height used in design             =
Weir crest shape                           = Broad Crested

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Energy

High Flow Method
       Pressure and Weir flow
           Submerged Inlet Cd          =
```

```
            Submerged Inlet + Outlet Cd =.8164966
            Max Low Cord                =   364.7

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 304.1

INPUT
Description:  D/S PARKING LOT BRIDGE

Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
    1000   379.1    1001   368.3    1004   364.7    1005   361.1    1018   353.7
    1028   353.8    1045   364.6    1055   359.6    1056   364.7    1057   368.3
    1120   368.3

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
    1000     .06    1004     .03    1056     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1004    1056              40      40      40             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1000    1004   364.7       F
    1056    1120   364.7       F

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 304

INPUT
Description: FEMA B
Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     999   381.1    1000   363.9    1050   356.1    1055   352.1    1075   352.1
    1075   356.1    1110   359.1    1156   364.1    1215   366.6    1225   366.6
    1305   379.9

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
```

```
     999     .08    1000    .045    1110     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1000    1110              100     120     200             .3       .5

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: 303

INPUT
Description: RAISED CHANNEL 20 FT ORIGINAL MODEL ERROR (BLS 2008)
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     999   389.1    1000   364.1    1029   354.1    1032   350.1    1045   350.1
    1050   354.1    1110   376.1    1157   395.1    1240   410.6    1330   420.1
    1355   424.1    1390   424.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     999     .08    1000    .045    1110     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
          1000    1110              150     180     150             .3       .5

CROSS SECTION


RIVER: Steele Brook
REACH: Main Channel DS    RS: -100

INPUT
Description: CORPORATE LIMITS
Station Elevation Data    num=      10
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
     206   379.1     250   359.1     262   349.7     278   347.9     294   347.1
     298   353.3     565   367.1     585   371.1     590   375.1     605   379.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
     206     .08     250    .045     298     .05

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.
Expan.
           250     298                0       0       0             .3       .5

********************************************************************************

SUMMARY OF MANNING'S N VALUES
```

River:Steele Brook

| Reach | River Sta. | n1 | n2 | n3 |
|---|---|---|---|---|
| Main Channel US | 351 | .06 | .04 | .06 |
| Main Channel US | 350 | .06 | .04 | .06 |
| Main Channel US | 349 | .06 | .04 | .06 |
| Main Channel US | 348 | .06 | .04 | .06 |
| Main Channel US | 347.2 | .06 | .04 | .06 |
| Main Channel US | 347.15 | Bridge | | |
| Main Channel US | 347.1 | .06 | .04 | .06 |
| Main Channel US | 347 | .06 | .04 | .06 |
| Main Channel US | 346 | .06 | .04 | .06 |
| Main Channel US | 344.2 | .06 | .035 | .06 |
| Main Channel US | 344.1 | .06 | .035 | .06 |
| Main Channel US | 343.2 | .06 | .04 | .06 |
| Main Channel US | 343.1 | .06 | .04 | .06 |
| Main Channel US | 342.65 | Lat Struct | | |
| Main Channel US | 342.6 | .06 | .04 | .06 |
| Main Channel US | 342.5 | .06 | .04 | .06 |
| Main Channel US | 342.45 | Lat Struct | | |
| Main Channel US | 342.4 | .06 | .04 | .06 |
| Main Channel US | 342.3 | .06 | .04 | .06 |
| Main Channel US | 342.2 | .06 | .04 | .06 |
| Main Channel US | 342.1 | .02 | .03 | .06 |
| Main Channel US | 342.05 | .02 | .03 | .06 |
| Old Channel | 7 | .06 | .06 | .06 |
| Old Channel | 6 | .06 | .04 | .05 |
| Old Channel | 5 | .06 | .03 | .04 |
| Old Channel | 4 | .06 | .03 | .04 |
| Old Channel | 3 | .06 | .03 | .04 |
| Old Channel | 2 | .06 | .03 | .04 |
| Old Channel | 1 | .06 | .03 | .04 |
| Main Channel DS | 341.2 | .05 | .05 | .04 |
| Main Channel DS | 341.1 | .05 | .05 | .04 |
| Main Channel DS | 341 | .05 | .035 | .04 |
| Main Channel DS | 340.2 | .05 | .03 | .05 |
| Main Channel DS | 340.15 | Bridge | | |
| Main Channel DS | 340.1 | .05 | .03 | .05 |
| Main Channel DS | 340 | .05 | .03 | .05 |
| Main Channel DS | 339.6 | .05 | .03 | .05 |
| Main Channel DS | 339.56 | .05 | .03 | .05 |
| Main Channel DS | 339.55 | Bridge | | |
| Main Channel DS | 339.51 | .05 | .03 | .05 |
| Main Channel DS | 339.5 | .05 | .03 | .05 |
| Main Channel DS | 339.1 | .05 | .03 | .05 |
| Main Channel DS | 339 | .05 | .03 | .05 |
| Main Channel DS | 338.2 | .05 | .03 | .05 |
| Main Channel DS | 338.15 | Bridge | | |
| Main Channel DS | 338.1 | .05 | .03 | .05 |
| Main Channel DS | 337 | .05 | .03 | .05 |
| Main Channel DS | 336.2 | .05 | .025 | .05 |
| Main Channel DS | 336.15 | Bridge | | |
| Main Channel DS | 336.1 | .05 | .025 | .05 |
| Main Channel DS | 336 | .07 | .04 | .07 |
| Main Channel DS | 335 | .07 | .04 | .07 |
| Main Channel DS | 334 | .07 | .04 | .07 |

| | | | | |
|---|---|---|---|---|
| Main Channel DS | 333 | .07 | .04 | .07 |
| Main Channel DS | 332.2 | .04 | .025 | .04 |
| Main Channel DS | 332.15 | Bridge | | |
| Main Channel DS | 332.1 | .04 | .025 | .04 |
| Main Channel DS | 332 | .075 | .035 | .075 |
| Main Channel DS | 331 | .075 | .035 | .075 |
| Main Channel DS | 330 | .075 | .035 | .075 |
| Main Channel DS | 329 | .075 | .035 | .075 |
| Main Channel DS | 328 | .075 | .035 | .075 |
| Main Channel DS | 327 | .075 | .035 | .075 |
| Main Channel DS | 326 | .075 | .035 | .075 |
| Main Channel DS | 325 | .075 | .035 | .075 |
| Main Channel DS | 324.2 | .075 | .035 | .075 |
| Main Channel DS | 324.15 | Bridge | | |
| Main Channel DS | 324.1 | .075 | .035 | .075 |
| Main Channel DS | 324 | .075 | .035 | .075 |
| Main Channel DS | 323 | .075 | .035 | .075 |
| Main Channel DS | 322 | .075 | .035 | .075 |
| Main Channel DS | 321.1 | .075 | .035 | .075 |
| Main Channel DS | 321 | .075 | .035 | .075 |
| Main Channel DS | 320 | .075 | .035 | .075 |
| Main Channel DS | 319 | .075 | .035 | .075 |
| Main Channel DS | 318 | .075 | .035 | .075 |
| Main Channel DS | 317 | .075 | .035 | .075 |
| Main Channel DS | 316 | .075 | .035 | .075 |
| Main Channel DS | 315 | .075 | .035 | .075 |
| Main Channel DS | 314 | .075 | .035 | .075 |
| Main Channel DS | 313 | .075 | .035 | .075 |
| Main Channel DS | 312.2 | .075 | .035 | .075 |
| Main Channel DS | 312.15 | Bridge | | |
| Main Channel DS | 312.1 | .075 | .035 | .075 |
| Main Channel DS | 312 | .075 | .035 | .075 |
| Main Channel DS | 311 | .06 | .03 | .06 |
| Main Channel DS | 310 | .06 | .03 | .06 |
| Main Channel DS | 309 | .06 | .03 | .06 |
| Main Channel DS | 308 | .06 | .03 | .06 |
| Main Channel DS | 307.1 | .06 | .03 | .06 |
| Main Channel DS | 307 | .06 | .03 | .06 |
| Main Channel DS | 305 | .06 | .03 | .06 |
| Main Channel DS | 304.2 | .06 | .03 | .06 |
| Main Channel DS | 304.15 | Bridge | | |
| Main Channel DS | 304.1 | .06 | .03 | .06 |
| Main Channel DS | 304 | .08 | .045 | .05 |
| Main Channel DS | 303 | .08 | .045 | .05 |
| Main Channel DS | -100 | .08 | .045 | .05 |

SUMMARY OF REACH LENGTHS

River: Steele Brook

| Reach | River Sta. | Left | Channel | Right |
|---|---|---|---|---|
| Main Channel US | 351 | 600 | 550 | 500 |
| Main Channel US | 350 | 400 | 390 | 500 |

| | | | | | |
|---|---|---|---|---|---|
| *Main Channel US * | 349 | * | 550* | 540* | 400* |
| *Main Channel US * | 348 | * | 40* | 40* | 40* |
| *Main Channel US * | 347.2 | * | 70* | 70* | 70* |
| *Main Channel US * | 347.15 | *Bridge | * | * | * |
| *Main Channel US * | 347.1 | * | 30* | 30* | 30* |
| *Main Channel US * | 347 | * | 400* | 410* | 300* |
| *Main Channel US * | 346 | * | 545* | 494.13* | 435* |
| *Main Channel US * | 344.2 | * | 210* | 213.35* | 170* |
| *Main Channel US * | 344.1 | * | 70* | 116.18* | 125* |
| *Main Channel US * | 343.2 | * | 216* | 220.58* | 266* |
| *Main Channel US * | 343.1 | * | 153* | 159.84* | 231.73* |
| *Main Channel US * | 342.65 | *Lat Struct* | | * | * |
| *Main Channel US * | 342.6 | * | 152* | 181.04* | 125.98* |
| *Main Channel US * | 342.5 | * | 151* | 141.52* | 130.33* |
| *Main Channel US * | 342.45 | *Lat Struct* | | * | * |
| *Main Channel US * | 342.4 | * | 144* | 140.57* | 237.47* |
| *Main Channel US * | 342.3 | * | 136* | 139.35* | 132* |
| *Main Channel US * | 342.2 | * | 29* | 25.65* | 23* |
| *Main Channel US * | 342.1 | * | 18* | 18.35* | 18* |
| *Main Channel US * | 342.05 | * | 0* | 0* | 0* |
| *Old Channel * | 7 | * | 83.01* | 100.8* | 117.99* |
| *Old Channel * | 6 | * | 125.98* | 106.48* | 101* |
| *Old Channel * | 5 | * | 130.35* | 127.83* | 126* |
| *Old Channel * | 4 | * | 47.47* | 57.67* | 88* |
| *Old Channel * | 3 | * | 90* | 182.6* | 135* |
| *Old Channel * | 2 | * | 70* | 74.74* | 66* |
| *Old Channel * | 1 | * | 0* | 0* | 0* |
| *Main Channel DS * | 341.2 | * | 109* | 109.82* | 109* |
| *Main Channel DS * | 341.1 | * | 66* | 66.07* | 64* |
| *Main Channel DS * | 341 | * | 15* | 15* | 15* |
| *Main Channel DS * | 340.2 | * | 40* | 40* | 40* |
| *Main Channel DS * | 340.15 | *Bridge | * | * | * |
| *Main Channel DS * | 340.1 | * | 5* | 5* | 5* |
| *Main Channel DS * | 340 | * | 210* | 210* | 210* |
| *Main Channel DS * | 339.6 | * | 1.24* | 1.24* | 1.24* |
| *Main Channel DS * | 339.56 | * | 7.7* | 7.7* | 7.7* |
| *Main Channel DS * | 339.55 | *Bridge | * | * | * |
| *Main Channel DS * | 339.51 | * | 1.1* | 1.1* | 1.1* |
| *Main Channel DS * | 339.5 | * | 290.01* | 290.01* | 290.01* |
| *Main Channel DS * | 339.1 | * | 80* | 80* | 80* |
| *Main Channel DS * | 339 | * | 28* | 28* | 28* |
| *Main Channel DS * | 338.2 | * | 2* | 2* | 2* |
| *Main Channel DS * | 338.15 | *Bridge | * | * | * |
| *Main Channel DS * | 338.1 | * | 30* | 30* | 30* |
| *Main Channel DS * | 337 | * | 40* | 40* | 40* |
| *Main Channel DS * | 336.2 | * | 38* | 38* | 38* |
| *Main Channel DS * | 336.15 | *Bridge | * | * | * |
| *Main Channel DS * | 336.1 | * | 35* | 30* | 25* |
| *Main Channel DS * | 336 | * | 530* | 420* | 300* |
| *Main Channel DS * | 335 | * | 500* | 610* | 600* |
| *Main Channel DS * | 334 | * | 350* | 320* | 300* |
| *Main Channel DS * | 333 | * | 15* | 15* | 15* |
| *Main Channel DS * | 332.2 | * | 60* | 60* | 60* |
| *Main Channel DS * | 332.15 | *Bridge | * | * | * |
| *Main Channel DS * | 332.1 | * | 15* | 15* | 15* |
| *Main Channel DS * | 332 | * | 250* | 340* | 350* |
| *Main Channel DS * | 331 | * | 450* | 520* | 650* |

```
*Main Channel DS *    330          *      350*      400*      400*
*Main Channel DS *    329          *      950*     1010*     1000*
*Main Channel DS *    328          *      200*      200*      150*
*Main Channel DS *    327          *      700*      740*      800*
*Main Channel DS *    326          *      490*      500*      520*
*Main Channel DS *    325          *       40*       40*       40*
*Main Channel DS *    324.2        *       20*       20*       20*
*Main Channel DS *    324.15       *Bridge   *         *         *
*Main Channel DS *    324.1        *       40*       40*       40*
*Main Channel DS *    324          *      320*      380*      350*
*Main Channel DS *    323          *      440*      480*      520*
*Main Channel DS *    322          *      440*      460*      500*
*Main Channel DS *    321.1        *       40*       40*       40*
*Main Channel DS *    321          *      130*      130*      130*
*Main Channel DS *    320          *      340*      340*      340*
*Main Channel DS *    319          *      500*      380*      200*
*Main Channel DS *    318          *      200*      180*      150*
*Main Channel DS *    317          *      400*      370*      300*
*Main Channel DS *    316          *      650*      620*      600*
*Main Channel DS *    315          *      600*      620*      650*
*Main Channel DS *    314          *      600*      490*      450*
*Main Channel DS *    313          *      400*      150*        1*
*Main Channel DS *    312.2        *       70*       70*       70*
*Main Channel DS *    312.15       *Bridge   *         *         *
*Main Channel DS *    312.1        *       30*       30*       30*
*Main Channel DS *    312          *        1*      140*      250*
*Main Channel DS *    311          *      180*      150*      150*
*Main Channel DS *    310          *      100*      130*      200*
*Main Channel DS *    309          *      450*      500*      530*
*Main Channel DS *    308          *       50*       50*       50*
*Main Channel DS *    307.1        *       30*       30*       30*
*Main Channel DS *    307          *      490*      520*      570*
*Main Channel DS *    305          *       40*       40*       40*
*Main Channel DS *    304.2        *       20*       20*       20*
*Main Channel DS *    304.15       *Bridge   *         *         *
*Main Channel DS *    304.1        *       40*       40*       40*
*Main Channel DS *    304          *      100*      120*      200*
*Main Channel DS *    303          *      150*      180*      150*
*Main Channel DS *    -100         *        0*        0*        0*
*****************************************************************

*******************************************************************************

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Steele Brook

*******************************************************
*     Reach      *   River Sta.   * Contr.  * Expan.  *
*******************************************************
*Main Channel US *    351      *       .1*       .3*
*Main Channel US *    350      *       .1*       .3*
*Main Channel US *    349      *       .1*       .3*
*Main Channel US *    348      *       .1*       .3*
*Main Channel US *    347.2    *       .3*       .5*
*Main Channel US *    347.15   *Bridge   *         *
*Main Channel US *    347.1    *       .3*       .5*
*Main Channel US *    347      *       .1*       .3*
```

```
*Main Channel US *    346     *       .1*       .3*
*Main Channel US *    344.2   *       .1*       .3*
*Main Channel US *    344.1   *       .1*       .3*
*Main Channel US *    343.2   *       .1*       .3*
*Main Channel US *    343.1   *       .1*       .3*
*Main Channel US *    342.65  *Lat Struct*         *
*Main Channel US *    342.6   *       .1*       .3*
*Main Channel US *    342.5   *       .1*       .3*
*Main Channel US *    342.45  *Lat Struct*         *
*Main Channel US *    342.4   *       .1*       .3*
*Main Channel US *    342.3   *       .1*       .3*
*Main Channel US *    342.2   *       .3*       .5*
*Main Channel US *    342.1   *       .1*       .3*
*Main Channel US *    342.05  *       .1*       .3*
*Old Channel     *    7       *       .1*       .3*
*Old Channel     *    6       *       .1*       .3*
*Old Channel     *    5       *       .1*       .3*
*Old Channel     *    4       *       .1*       .3*
*Old Channel     *    3       *       .1*       .3*
*Old Channel     *    2       *       .1*       .3*
*Old Channel     *    1       *       .1*       .3*
*Main Channel DS *    341.2   *       .1*       .3*
*Main Channel DS *    341.1   *       .1*       .3*
*Main Channel DS *    341     *       .1*       .3*
*Main Channel DS *    340.2   *       .1*       .3*
*Main Channel DS *    340.15  *Bridge   *         *
*Main Channel DS *    340.1   *       .1*       .3*
*Main Channel DS *    340     *       .1*       .3*
*Main Channel DS *    339.6   *       .1*       .3*
*Main Channel DS *    339.56  *       .1*       .3*
*Main Channel DS *    339.55  *Bridge   *         *
*Main Channel DS *    339.51  *       .1*       .3*
*Main Channel DS *    339.5   *       .1*       .3*
*Main Channel DS *    339.1   *       .1*       .3*
*Main Channel DS *    339     *       .1*       .3*
*Main Channel DS *    338.2   *       .1*       .3*
*Main Channel DS *    338.15  *Bridge   *         *
*Main Channel DS *    338.1   *       .1*       .3*
*Main Channel DS *    337     *       .1*       .3*
*Main Channel DS *    336.2   *       .1*       .3*
*Main Channel DS *    336.15  *Bridge   *         *
*Main Channel DS *    336.1   *       .1*       .3*
*Main Channel DS *    336     *       .1*       .3*
*Main Channel DS *    335     *       .1*       .3*
*Main Channel DS *    334     *       .1*       .3*
*Main Channel DS *    333     *       .1*       .3*
*Main Channel DS *    332.2   *       .1*       .3*
*Main Channel DS *    332.15  *Bridge   *         *
*Main Channel DS *    332.1   *       .1*       .3*
*Main Channel DS *    332     *       .1*       .3*
*Main Channel DS *    331     *       .1*       .3*
*Main Channel DS *    330     *       .1*       .3*
*Main Channel DS *    329     *       .1*       .3*
*Main Channel DS *    328     *       .1*       .3*
*Main Channel DS *    327     *       .1*       .3*
*Main Channel DS *    326     *       .1*       .3*
*Main Channel DS *    325     *       .1*       .3*
```

```
*Main Channel DS *    324.2   *        .3*        .5*
*Main Channel DS *    324.15  *Bridge   *          *
*Main Channel DS *    324.1   *        .3*        .5*
*Main Channel DS *    324     *        .1*        .3*
*Main Channel DS *    323     *        .1*        .3*
*Main Channel DS *    322     *        .1*        .3*
*Main Channel DS *    321.1   *        .1*        .3*
*Main Channel DS *    321     *        .1*        .3*
*Main Channel DS *    320     *        .1*        .3*
*Main Channel DS *    319     *        .1*        .3*
*Main Channel DS *    318     *        .1*        .3*
*Main Channel DS *    317     *        .1*        .3*
*Main Channel DS *    316     *        .1*        .3*
*Main Channel DS *    315     *        .1*        .3*
*Main Channel DS *    314     *        .1*        .3*
*Main Channel DS *    313     *        .1*        .3*
*Main Channel DS *    312.2   *        .3*        .5*
*Main Channel DS *    312.15  *Bridge   *          *
*Main Channel DS *    312.1   *        .3*        .5*
*Main Channel DS *    312     *        .3*        .5*
*Main Channel DS *    311     *        .1*        .3*
*Main Channel DS *    310     *        .1*        .3*
*Main Channel DS *    309     *        .1*        .3*
*Main Channel DS *    308     *        .1*        .3*
*Main Channel DS *    307.1   *        .1*        .3*
*Main Channel DS *    307     *        .1*        .3*
*Main Channel DS *    305     *        .1*        .3*
*Main Channel DS *    304.2   *        .3*        .5*
*Main Channel DS *    304.15  *Bridge   *          *
*Main Channel DS *    304.1   *        .3*        .5*
*Main Channel DS *    304     *        .3*        .5*
*Main Channel DS *    303     *        .3*        .5*
*Main Channel DS *    -100    *        .3*        .5*
*******************************************************
```

# Full Removal - Mature n

(Plan and Manning's n values only. Flow & other geometry identical to Full Removal)

```
                    HEC-RAS Version 4.0.0 March 2008
                      U.S. Army Corps of Engineers
                     Hydrologic Engineering Center
                           609 Second Street
                           Davis, California

         X     X  XXXXXX    XXXX        XXXX       XX      XXXX
         X     X  X        X    X       X   X     X  X    X
         X     X  X        X            X   X    X    X   X
         XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
         X     X  X        X            X  X     X    X        X
         X     X  X        X    X       X   X    X    X        X
         X     X  XXXXXX    XXXX        X    X   X    X   XXXXX

********************************************************************************
```

PROJECT DATA
Project Title: Heminway_Feasibility
Project File : Heminway_Feasibility.prj
Run Date and Time: 2/12/2009 5:04:28 PM

Project in English units

Project Description:
Heminway Pond Dam Removal Feasibility Study.  Base data from 1997 LOMR, expanded upstream with 1980 FIS geometry.  Additional and enhanced/replaced/corrected geometry in area of pond and nearby channel with 2007/2008 survey data & town GIS data.

```
********************************************************************************
```

PLAN DATA

Plan Title: Full Removal - Mature n
Plan File : s:\Engineering\PROJECTS\STEELE_BROOK\HEC-RAS\Feasibility Draft\Heminway_Feasibility.p06

Geometry Title: Full Removal - Mature n
Geometry File : s:\Engineering\PROJECTS\STEELE_BROOK\HEC-RAS\Feasibility Draft\Heminway_Feasibility.g07

Flow Title    : Flows
Flow File     : s:\Engineering\PROJECTS\STEELE_BROOK\HEC-RAS\Feasibility Draft\Heminway_Feasibility.f01

Plan Description:
Full Removal

```
Plan Summary Information:
Number of:  Cross Sections =   87    Multiple Openings  =    0
            Culverts       =    0    Inline Structures  =    0
```

Full Removal - Mature n

(Plan and Manning's n values only. Flow & other geometry identical to Full Removal)

```
            Bridges        =    9    Lateral Structures =    2

Computational Information
    Water surface calculation tolerance  =  0.01
    Critical depth calculation tolerance =  0.01
    Maximum number of iterations         =  20
    Maximum difference tolerance         =  0.3
    Flow tolerance factor                =  0.001

Computation Options
    Critical depth computed at all cross sections
    Conveyance Calculation Method: At breaks in n values only
    Friction Slope Method:         Program Selects Appropriate method
    Computational Flow Regime:     Mixed Flow

Encroachment Data
   Equal Conveyance = True
   Left Offset      =        0
   Right Offset     =        0
```

River = Steele Brook     Reach = Main Channel US

| RS | Profile | Method | Value1 | Value2 |
|---|---|---|---|---|
| 351 | FEMA Floodway | 4 | 1 | |
| 350 | FEMA Floodway | 4 | 1 | |
| 349 | FEMA Floodway | 4 | 1 | |
| 348 | FEMA Floodway | 4 | 1 | |
| 347.2 | FEMA Floodway | 4 | 1 | |
| 347.1 | FEMA Floodway | 4 | 1 | |
| 347 | FEMA Floodway | 1 | 1353 | 1405 |
| 346 | FEMA Floodway | 1 | 1250 | 1350 |
| 345 | FEMA Floodway | 2 | 47 | |
| 344.2 | FEMA Floodway | 2 | 47 | |
| 344.1 | FEMA Floodway | 2 | 235 | |
| 343.2 | FEMA Floodway | 2 | 455 | |
| 343.1 | FEMA Floodway | 2 | 455 | |
| 342.6 | FEMA Floodway | 4 | 1 | |
| 342.5 | FEMA Floodway | 4 | 1 | |
| 342.4 | FEMA Floodway | 4 | 1 | |
| 342.3 | FEMA Floodway | 4 | 1 | |
| 342.2 | FEMA Floodway | 4 | 1 | |
| 342.1 | FEMA Floodway | 4 | 1 | |
| 342.05 | FEMA Floodway | 4 | 1 | |

River = Steele Brook     Reach = Main Channel DS

| RS | Profile | Method | Value1 | Value2 |
|---|---|---|---|---|
| 341.2 | FEMA Floodway | 4 | 1 | |
| 341.1 | FEMA Floodway | 4 | 1 | |
| 341 | FEMA Floodway | 1 | 1002 | 1277.35 |
| 340.2 | FEMA Floodway | 1 | 1000 | 1150 |
| 340.1 | FEMA Floodway | 1 | 1000 | 1120 |
| 340 | FEMA Floodway | 1 | 1000 | 1120 |
| 339.6 | FEMA Floodway | 1 | 1000 | 1120 |
| 339.56 | FEMA Floodway | 1 | 1000 | 1120 |
| 339.51 | FEMA Floodway | 1 | 1000 | 1120 |
| 339.5 | FEMA Floodway | 1 | 1000 | 1120 |
| 339.1 | FEMA Floodway | 1 | 1000 | 1120 |

| | | | | |
|---|---|---|---|---|
| 339 | FEMA Floodway | 1 | 1320 | 1440 |
| 338.2 | FEMA Floodway | 1 | 1320 | 1440 |
| 338.1 | FEMA Floodway | 1 | 1320 | 1420 |
| 337 | FEMA Floodway | 2 | 150 | |
| 336.2 | FEMA Floodway | 1 | 980 | 1010 |
| 336.1 | FEMA Floodway | 1 | 980 | 1010 |
| 336 | FEMA Floodway | 2 | 47 | |
| 335 | FEMA Floodway | 1 | 1160 | 1280 |
| 334 | FEMA Floodway | 2 | 100 | |
| 333 | FEMA Floodway | 2 | 80 | |
| 332.2 | FEMA Floodway | 1 | 1080 | 1300 |
| 332.1 | FEMA Floodway | 4 | .4 | |
| 332 | FEMA Floodway | 4 | .4 | |
| 331 | FEMA Floodway | 4 | .4 | |
| 330 | FEMA Floodway | 4 | .4 | |
| 329 | FEMA Floodway | 4 | 1 | |
| 328 | FEMA Floodway | 4 | 1 | |
| 327 | FEMA Floodway | 4 | 1 | |
| 326 | FEMA Floodway | 4 | 1 | |
| 325 | FEMA Floodway | 4 | 1 | |
| 324.2 | FEMA Floodway | 4 | 1 | |
| 324.1 | FEMA Floodway | 4 | 1 | |
| 324 | FEMA Floodway | 4 | 1 | |
| 323 | FEMA Floodway | 4 | 1 | |
| 322 | FEMA Floodway | 4 | 1 | |
| 321.1 | FEMA Floodway | 4 | 1 | |
| 321 | FEMA Floodway | 4 | 1 | |
| 320 | FEMA Floodway | 4 | 1 | |
| 319 | FEMA Floodway | 4 | 1 | |
| 318 | FEMA Floodway | 4 | 1 | |
| 317 | FEMA Floodway | 4 | 1 | |
| 316 | FEMA Floodway | 4 | 1 | |
| 315 | FEMA Floodway | 4 | 1 | |
| 314 | FEMA Floodway | 4 | 1 | |
| 313 | FEMA Floodway | 4 | 1 | |
| 312.2 | FEMA Floodway | 4 | 1 | |
| 312.1 | FEMA Floodway | 4 | 1 | |
| 312 | FEMA Floodway | 4 | 1 | |
| 311 | FEMA Floodway | 4 | 1 | |
| 310 | FEMA Floodway | 4 | 1 | |
| 309 | FEMA Floodway | 4 | 1 | |
| 308 | FEMA Floodway | 4 | 1 | |
| 307.1 | FEMA Floodway | 4 | 1 | |
| 307 | FEMA Floodway | 4 | 1 | |
| 305 | FEMA Floodway | 4 | 1 | |
| 304.2 | FEMA Floodway | 4 | 1 | |
| 304.1 | FEMA Floodway | 4 | 1 | |
| 304 | FEMA Floodway | 4 | 1 | |
| 303 | FEMA Floodway | 4 | 1 | |
| -100 | FEMA Floodway | 1 | 254.7 | 339.2 |

********************************************************************************

SUMMARY OF MANNING'S N VALUES

Full Removal - Mature n

(Plan and Manning's n values only. Flow & other geometry identical to Full Removal)

River:Steele Brook

| Reach | River Sta. | n1 | n2 | n3 |
|---|---|---|---|---|
| Main Channel US | 351 | .06 | .04 | .06 |
| Main Channel US | 350 | .06 | .04 | .06 |
| Main Channel US | 349 | .06 | .04 | .06 |
| Main Channel US | 348 | .06 | .04 | .06 |
| Main Channel US | 347.2 | .06 | .04 | .06 |
| Main Channel US | 347.15 | Bridge | | |
| Main Channel US | 347.1 | .06 | .04 | .06 |
| Main Channel US | 347 | .06 | .04 | .06 |
| Main Channel US | 346 | .06 | .04 | .06 |
| Main Channel US | 344.2 | .06 | .035 | .06 |
| Main Channel US | 344.1 | .06 | .035 | .06 |
| Main Channel US | 343.2 | .1 | .04 | .1 |
| Main Channel US | 343.1 | .1 | .04 | .1 |
| Main Channel US | 342.65 | Lat Struct | | |
| Main Channel US | 342.6 | .1 | .04 | .1 |
| Main Channel US | 342.5 | .1 | .04 | .1 |
| Main Channel US | 342.45 | Lat Struct | | |
| Main Channel US | 342.4 | .1 | .04 | .1 |
| Main Channel US | 342.3 | .1 | .04 | .1 |
| Main Channel US | 342.2 | .1 | .04 | .1 |
| Main Channel US | 342.1 | .02 | .03 | .1 |
| Main Channel US | 342.05 | .02 | .03 | .1 |
| Old Channel | 7 | .06 | .06 | .06 |
| Old Channel | 6 | .06 | .04 | .05 |
| Old Channel | 5 | .06 | .03 | .04 |
| Old Channel | 4 | .06 | .03 | .04 |
| Old Channel | 3 | .06 | .03 | .04 |
| Old Channel | 2 | .06 | .03 | .04 |
| Old Channel | 1 | .06 | .03 | .04 |
| Main Channel DS | 341.2 | .05 | .05 | .04 |
| Main Channel DS | 341.1 | .05 | .05 | .04 |
| Main Channel DS | 341 | .05 | .035 | .04 |
| Main Channel DS | 340.2 | .05 | .03 | .05 |
| Main Channel DS | 340.15 | Bridge | | |
| Main Channel DS | 340.1 | .05 | .03 | .05 |
| Main Channel DS | 340 | .05 | .03 | .05 |
| Main Channel DS | 339.6 | .05 | .03 | .05 |
| Main Channel DS | 339.56 | .05 | .03 | .05 |
| Main Channel DS | 339.55 | Bridge | | |
| Main Channel DS | 339.51 | .05 | .03 | .05 |
| Main Channel DS | 339.5 | .05 | .03 | .05 |
| Main Channel DS | 339.1 | .05 | .03 | .05 |
| Main Channel DS | 339 | .05 | .03 | .05 |
| Main Channel DS | 338.2 | .05 | .03 | .05 |
| Main Channel DS | 338.15 | Bridge | | |
| Main Channel DS | 338.1 | .05 | .03 | .05 |
| Main Channel DS | 337 | .05 | .03 | .05 |
| Main Channel DS | 336.2 | .05 | .025 | .05 |
| Main Channel DS | 336.15 | Bridge | | |
| Main Channel DS | 336.1 | .05 | .025 | .05 |
| Main Channel DS | 336 | .07 | .04 | .07 |
| Main Channel DS | 335 | .07 | .04 | .07 |

Full Removal - Mature n

(Plan and Manning's n values only. Flow & other geometry identical to Full Removal)

```
*Main Channel DS *    334          *       .07*      .04*      .07*
*Main Channel DS *    333          *       .07*      .04*      .07*
*Main Channel DS *    332.2        *       .04*     .025*      .04*
*Main Channel DS *    332.15       *Bridge   *         *         *
*Main Channel DS *    332.1        *       .04*     .025*      .04*
*Main Channel DS *    332          *      .075*     .035*     .075*
*Main Channel DS *    331          *      .075*     .035*     .075*
*Main Channel DS *    330          *      .075*     .035*     .075*
*Main Channel DS *    329          *      .075*     .035*     .075*
*Main Channel DS *    328          *      .075*     .035*     .075*
*Main Channel DS *    327          *      .075*     .035*     .075*
*Main Channel DS *    326          *      .075*     .035*     .075*
*Main Channel DS *    325          *      .075*     .035*     .075*
*Main Channel DS *    324.2        *      .075*     .035*     .075*
*Main Channel DS *    324.15       *Bridge   *         *         *
*Main Channel DS *    324.1        *      .075*     .035*     .075*
*Main Channel DS *    324          *      .075*     .035*     .075*
*Main Channel DS *    323          *      .075*     .035*     .075*
*Main Channel DS *    322          *      .075*     .035*     .075*
*Main Channel DS *    321.1        *      .075*     .035*     .075*
*Main Channel DS *    321          *      .075*     .035*     .075*
*Main Channel DS *    320          *      .075*     .035*     .075*
*Main Channel DS *    319          *      .075*     .035*     .075*
*Main Channel DS *    318          *      .075*     .035*     .075*
*Main Channel DS *    317          *      .075*     .035*     .075*
*Main Channel DS *    316          *      .075*     .035*     .075*
*Main Channel DS *    315          *      .075*     .035*     .075*
*Main Channel DS *    314          *      .075*     .035*     .075*
*Main Channel DS *    313          *      .075*     .035*     .075*
*Main Channel DS *    312.2        *      .075*     .035*     .075*
*Main Channel DS *    312.15       *Bridge   *         *         *
*Main Channel DS *    312.1        *      .075*     .035*     .075*
*Main Channel DS *    312          *      .075*     .035*     .075*
*Main Channel DS *    311          *       .06*      .03*      .06*
*Main Channel DS *    310          *       .06*      .03*      .06*
*Main Channel DS *    309          *       .06*      .03*      .06*
*Main Channel DS *    308          *       .06*      .03*      .06*
*Main Channel DS *    307.1        *       .06*      .03*      .06*
*Main Channel DS *    307          *       .06*      .03*      .06*
*Main Channel DS *    305          *       .06*      .03*      .06*
*Main Channel DS *    304.2        *       .06*      .03*      .06*
*Main Channel DS *    304.15       *Bridge   *         *         *
*Main Channel DS *    304.1        *       .06*      .03*      .06*
*Main Channel DS *    304          *       .08*     .045*      .05*
*Main Channel DS *    303          *       .08*     .045*      .05*
*Main Channel DS *    -100         *       .08*     .045*      .05*
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**Full Removal**
**Cross Section Tables**

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HEC-RAS  Plan: EXIST

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Main Channel US | 348 AR | FEMA 100-YR | 2060.00 | 488.90 | 498.02 | 493.37 | 498.08 | 0.000379 | 3.12 | 1354.81 | 304.23 | 0.18 |
| Main Channel US | 348 AR | FEMA Floodway | 2060.00 | 488.90 | 497.94 | 493.31 | 498.06 | 0.000583 | 3.85 | 838.79 | 115.23 | 0.23 |
| Main Channel US | 348 AR | FEMA 10-YR | 820.00 | 488.90 | 494.17 | 491.87 | 494.26 | 0.000903 | 3.33 | 447.46 | 166.69 | 0.26 |
| Main Channel US | 348 AR | FEMA 50-YR | 1600.00 | 488.90 | 496.67 | 492.91 | 496.75 | 0.000523 | 3.29 | 972.59 | 257.47 | 0.21 |
| Main Channel US | 348 AR | FEMA 500-YR | 3600.00 | 488.90 | 501.80 | 494.54 | 501.84 | 0.000182 | 2.73 | 2704.10 | 435.80 | 0.13 |
| Main Channel US | 348 AR | M&M 2-YR | 405.00 | 488.90 | 492.42 | 491.01 | 492.53 | 0.001463 | 3.22 | 204.74 | 111.85 | 0.31 |
| Main Channel US | 348 AR | M&M 1-YR | 221.00 | 488.90 | 491.43 | 490.43 | 491.53 | 0.001950 | 2.96 | 108.83 | 80.46 | 0.33 |
| Main Channel US | 348 AR | Bankful Q | 330.00 | 488.90 | 492.04 | 490.80 | 492.15 | 0.001642 | 3.16 | 164.26 | 99.81 | 0.32 |
| | | | | | | | | | | | | |
| Main Channel US | 347.2 | FEMA 100-YR | 2060.00 | 488.30 | 496.80 | 494.32 | 497.95 | 0.005887 | 8.61 | 239.28 | 32.17 | 0.56 |
| Main Channel US | 347.2 | FEMA Floodway | 2060.00 | 488.30 | 496.75 | 494.32 | 497.92 | 0.005987 | 8.66 | 237.90 | 32.15 | 0.56 |
| Main Channel US | 347.2 | FEMA 10-YR | 820.00 | 488.30 | 493.61 | 491.94 | 494.16 | 0.004737 | 5.93 | 138.29 | 31.27 | 0.50 |
| Main Channel US | 347.2 | FEMA 50-YR | 1600.00 | 488.30 | 495.65 | 493.52 | 496.62 | 0.005765 | 7.90 | 202.66 | 31.84 | 0.55 |
| Main Channel US | 347.2 | FEMA 500-YR | 3600.00 | 488.30 | 499.94 | 496.65 | 501.66 | 0.006526 | 10.54 | 341.66 | 33.05 | 0.58 |
| Main Channel US | 347.2 | M&M 2-YR | 405.00 | 488.30 | 492.13 | 490.88 | 492.43 | 0.004004 | 4.39 | 92.27 | 30.85 | 0.45 |
| Main Channel US | 347.2 | M&M 1-YR | 221.00 | 488.30 | 491.25 | 490.28 | 491.43 | 0.003559 | 3.39 | 65.13 | 30.60 | 0.41 |
| Main Channel US | 347.2 | Bankful Q | 330.00 | 488.30 | 491.79 | 490.65 | 492.05 | 0.003852 | 4.03 | 81.93 | 30.76 | 0.43 |
| | | | | | | | | | | | | |
| Main Channel US | 347.15 ROUTE 6 | | Bridge | | | | | | | | | |
| | | | | | | | | | | | | |
| Main Channel US | 347.1 | FEMA 100-YR | 2060.00 | 488.30 | 494.39 | 494.31 | 496.88 | 0.018287 | 12.65 | 162.81 | 31.49 | 0.98 |
| Main Channel US | 347.1 | FEMA Floodway | 2060.00 | 488.30 | 494.60 | 494.31 | 496.90 | 0.016289 | 12.17 | 169.25 | 31.55 | 0.93 |
| Main Channel US | 347.1 | FEMA 10-YR | 820.00 | 488.30 | 492.78 | 491.94 | 493.61 | 0.008912 | 7.29 | 112.42 | 31.03 | 0.68 |
| Main Channel US | 347.1 | FEMA 50-YR | 1600.00 | 488.30 | 494.05 | 493.53 | 495.77 | 0.013557 | 10.53 | 152.00 | 31.39 | 0.84 |
| Main Channel US | 347.1 | FEMA 500-YR | 3600.00 | 488.30 | 496.66 | 496.66 | 500.31 | 0.018988 | 15.33 | 234.82 | 32.13 | 1.00 |
| Main Channel US | 347.1 | M&M 2-YR | 405.00 | 488.30 | 491.50 | 490.87 | 491.98 | 0.008401 | 5.56 | 72.82 | 30.67 | 0.64 |
| Main Channel US | 347.1 | M&M 1-YR | 221.00 | 488.30 | 490.63 | 490.28 | 490.98 | 0.010517 | 4.77 | 46.37 | 30.43 | 0.68 |
| Main Channel US | 347.1 | Bankful Q | 330.00 | 488.30 | 491.18 | 490.63 | 491.60 | 0.008805 | 5.24 | 63.03 | 30.58 | 0.64 |
| | | | | | | | | | | | | |
| Main Channel US | 347 AQ | FEMA 100-YR | 2060.00 | 487.90 | 494.86 | 493.28 | 495.70 | 0.005485 | 7.37 | 279.63 | 61.63 | 0.61 |
| Main Channel US | 347 AQ | FEMA Floodway | 2060.00 | 487.90 | 495.01 | 493.28 | 495.85 | 0.004703 | 7.35 | 280.15 | 52.00 | 0.56 |
| Main Channel US | 347 AQ | FEMA 10-YR | 820.00 | 487.90 | 492.82 | 491.15 | 493.19 | 0.003573 | 4.92 | 166.77 | 49.07 | 0.47 |
| Main Channel US | 347 AQ | FEMA 50-YR | 1600.00 | 487.90 | 494.31 | 492.59 | 494.96 | 0.004657 | 6.49 | 246.65 | 58.24 | 0.56 |
| Main Channel US | 347 AQ | FEMA 500-YR | 3600.00 | 487.90 | 493.32 | 495.08 | 498.78 | 0.046768 | 18.75 | 191.99 | 52.14 | 1.72 |
| Main Channel US | 347 AQ | M&M 2-YR | 405.00 | 487.90 | 491.45 | 490.06 | 491.68 | 0.003113 | 3.84 | 105.39 | 40.64 | 0.42 |
| Main Channel US | 347 AQ | M&M 1-YR | 221.00 | 487.90 | 490.53 | 489.40 | 490.68 | 0.002867 | 3.13 | 70.62 | 34.98 | 0.39 |
| Main Channel US | 347 AQ | Bankful Q | 330.00 | 487.90 | 491.11 | 489.80 | 491.31 | 0.003021 | 3.59 | 92.04 | 38.57 | 0.41 |
| | | | | | | | | | | | | |
| Main Channel US | 346 AP | FEMA 100-YR | 2060.00 | 486.10 | 492.04 | 491.95 | 492.97 | 0.008430 | 8.32 | 346.89 | 210.20 | 0.74 |
| Main Channel US | 346 AP | FEMA Floodway | 2060.00 | 486.10 | 493.36 | 491.74 | 494.02 | 0.003980 | 6.70 | 355.00 | 100.00 | 0.52 |
| Main Channel US | 346 AP | FEMA 10-YR | 820.00 | 486.10 | 490.49 | 489.86 | 491.10 | 0.008602 | 6.31 | 130.35 | 53.64 | 0.70 |
| Main Channel US | 346 AP | FEMA 50-YR | 1600.00 | 486.10 | 491.60 | 491.45 | 492.47 | 0.008574 | 7.76 | 263.59 | 176.48 | 0.74 |
| Main Channel US | 346 AP | FEMA 500-YR | 3600.00 | 486.10 | 493.13 | 493.06 | 494.15 | 0.007703 | 9.38 | 615.38 | 264.05 | 0.74 |
| Main Channel US | 346 AP | M&M 2-YR | 405.00 | 486.10 | 489.43 | 488.80 | 489.83 | 0.007965 | 5.05 | 80.13 | 41.63 | 0.64 |
| Main Channel US | 346 AP | M&M 1-YR | 221.00 | 486.10 | 488.64 | 488.10 | 488.94 | 0.007997 | 4.36 | 50.71 | 32.95 | 0.62 |
| Main Channel US | 346 AP | Bankful Q | 330.00 | 486.10 | 489.15 | 488.54 | 489.50 | 0.007922 | 4.79 | 68.82 | 38.52 | 0.63 |
| | | | | | | | | | | | | |
| Main Channel US | 344.2 | FEMA 100-YR | 2060.00 | 483.80 | 488.38 | 488.38 | 489.22 | 0.006883 | 8.96 | 428.85 | 231.15 | 0.77 |
| Main Channel US | 344.2 | FEMA Floodway | 2060.00 | 483.80 | 488.87 | 488.87 | 491.00 | 0.010596 | 11.96 | 190.16 | 47.00 | 0.97 |
| Main Channel US | 344.2 | FEMA 10-YR | 820.00 | 483.80 | 487.50 | 487.18 | 487.95 | 0.004067 | 5.88 | 231.37 | 212.57 | 0.57 |
| Main Channel US | 344.2 | FEMA 50-YR | 1600.00 | 483.80 | 488.09 | 488.09 | 488.82 | 0.006259 | 8.13 | 360.86 | 227.42 | 0.73 |
| Main Channel US | 344.2 | FEMA 500-YR | 3600.00 | 483.80 | 489.20 | 489.20 | 490.29 | 0.008094 | 10.93 | 624.93 | 251.46 | 0.86 |
| Main Channel US | 344.2 | M&M 2-YR | 405.00 | 483.80 | 486.84 | 485.75 | 487.11 | 0.002860 | 4.25 | 111.98 | 141.61 | 0.46 |
| Main Channel US | 344.2 | M&M 1-YR | 221.00 | 483.80 | 486.00 | 485.17 | 486.19 | 0.002980 | 3.45 | 64.05 | 35.39 | 0.44 |
| Main Channel US | 344.2 | Bankful Q | 330.00 | 483.80 | 486.53 | 485.53 | 486.78 | 0.002970 | 4.00 | 84.82 | 45.11 | 0.46 |
| | | | | | | | | | | | | |
| Main Channel US | 344.1 | FEMA 100-YR | 2060.00 | 482.50 | 487.26 | 486.51 | 487.53 | 0.003337 | 5.51 | 610.81 | 373.12 | 0.51 |
| Main Channel US | 344.1 | FEMA Floodway | 2060.00 | 482.50 | 487.30 | 486.60 | 487.78 | 0.005564 | 7.15 | 474.17 | 232.39 | 0.66 |
| Main Channel US | 344.1 | FEMA 10-YR | 820.00 | 482.50 | 487.31 | 486.00 | 487.35 | 0.000500 | 2.15 | 623.97 | 378.15 | 0.20 |
| Main Channel US | 344.1 | FEMA 50-YR | 1600.00 | 482.50 | 486.90 | 486.21 | 487.12 | 0.003107 | 4.95 | 517.14 | 335.67 | 0.49 |
| Main Channel US | 344.1 | FEMA 500-YR | 3600.00 | 482.50 | 488.18 | 486.88 | 488.58 | 0.003928 | 6.95 | 882.03 | 453.00 | 0.58 |
| Main Channel US | 344.1 | M&M 2-YR | 405.00 | 482.50 | 486.32 | 485.07 | 486.54 | 0.002340 | 3.79 | 110.25 | 261.46 | 0.41 |
| Main Channel US | 344.1 | M&M 1-YR | 221.00 | 482.50 | 485.47 | 484.55 | 485.61 | 0.002294 | 3.02 | 73.23 | 38.59 | 0.39 |
| Main Channel US | 344.1 | Bankful Q | 330.00 | 482.50 | 486.00 | 484.86 | 486.19 | 0.002334 | 3.51 | 93.92 | 39.64 | 0.40 |
| | | | | | | | | | | | | |
| Main Channel US | 343.2 | FEMA 100-YR | 2060.00 | 481.40 | 487.05 | 486.11 | 487.21 | 0.002382 | 4.96 | 814.61 | 388.32 | 0.44 |
| Main Channel US | 343.2 | FEMA Floodway | 2060.00 | 481.40 | 487.14 | 486.11 | 487.29 | 0.002120 | 4.75 | 846.98 | 387.91 | 0.41 |
| Main Channel US | 343.2 | FEMA 10-YR | 820.00 | 481.40 | 485.74 | 485.74 | 487.12 | 0.013999 | 9.41 | 87.15 | 173.84 | 1.00 |
| Main Channel US | 343.2 | FEMA 50-YR | 1600.00 | 481.40 | 486.67 | 484.81 | 486.82 | 0.002415 | 4.68 | 682.38 | 374.10 | 0.43 |
| Main Channel US | 343.2 | FEMA 500-YR | 3600.00 | 481.40 | 487.97 | 486.65 | 488.21 | 0.002612 | 5.97 | 1140.23 | 460.70 | 0.47 |
| Main Channel US | 343.2 | M&M 2-YR | 405.00 | 481.40 | 485.96 | 484.67 | 486.24 | 0.002701 | 4.32 | 93.84 | 174.37 | 0.44 |
| Main Channel US | 343.2 | M&M 1-YR | 221.00 | 481.40 | 485.21 | 484.04 | 485.36 | 0.002011 | 3.14 | 70.37 | 172.47 | 0.37 |
| Main Channel US | 343.2 | Bankful Q | 330.00 | 481.40 | 485.68 | 484.42 | 485.91 | 0.002450 | 3.88 | 85.05 | 173.67 | 0.42 |
| | | | | | | | | | | | | |
| Main Channel US | 343.1 | FEMA 100-YR | 2060.00 | 482.60 | 486.80 | 485.31 | 486.85 | 0.000422 | 2.04 | 1304.12 | 482.93 | 0.18 |
| Main Channel US | 343.1 | FEMA Floodway | 2060.00 | 482.60 | 486.87 | 485.31 | 486.95 | 0.000668 | 2.60 | 1050.65 | 398.93 | 0.23 |
| Main Channel US | 343.1 | FEMA 10-YR | 820.00 | 482.60 | 485.58 | 485.30 | 485.62 | 0.000573 | 1.84 | 530.64 | 401.74 | 0.20 |
| Main Channel US | 343.1 | FEMA 50-YR | 1600.00 | 482.60 | 486.42 | 485.30 | 486.46 | 0.000386 | 1.82 | 1122.76 | 470.60 | 0.17 |
| Main Channel US | 343.1 | FEMA 500-YR | 3600.00 | 482.60 | 487.71 | 485.30 | 487.78 | 0.000556 | 2.70 | 1755.91 | 512.34 | 0.22 |
| Main Channel US | 343.1 | M&M 2-YR | 405.00 | 482.60 | 485.05 | 484.44 | 485.43 | 0.005558 | 4.95 | 81.75 | 310.46 | 0.60 |
| Main Channel US | 343.1 | M&M 1-YR | 221.00 | 482.60 | 484.62 | 483.92 | 484.80 | 0.003434 | 3.40 | 64.95 | 282.08 | 0.46 |
| Main Channel US | 343.1 | Bankful Q | 330.00 | 482.60 | 484.89 | 484.24 | 485.19 | 0.004743 | 4.37 | 75.51 | 297.33 | 0.55 |
| | | | | | | | | | | | | |
| Main Channel US | 342.65 Embankment & FP | | Lat Struct | | | | | | | | | |
| | | | | | | | | | | | | |
| Main Channel US | 342.6 | FEMA 100-YR | 1684.47 | 482.80 | 486.76 | 484.48 | 486.78 | 0.000205 | 1.39 | 1392.89 | 628.59 | 0.13 |
| Main Channel US | 342.6 | FEMA Floodway | 1658.64 | 482.80 | 486.79 | 485.06 | 486.84 | 0.000457 | 2.08 | 1021.71 | 340.18 | 0.19 |
| Main Channel US | 342.6 | FEMA 10-YR | 741.70 | 482.80 | 485.49 | 484.00 | 485.53 | 0.000568 | 1.72 | 510.63 | 562.77 | 0.20 |
| Main Channel US | 342.6 | FEMA 50-YR | 1342.45 | 482.80 | 486.38 | 484.21 | 486.40 | 0.000186 | 1.22 | 1233.11 | 627.24 | 0.12 |
| Main Channel US | 342.6 | FEMA 500-YR | 2794.76 | 482.80 | 487.66 | 485.06 | 487.70 | 0.000273 | 1.86 | 1773.89 | 632.06 | 0.16 |
| Main Channel US | 342.6 | M&M 2-YR | 375.38 | 482.80 | 484.83 | 484.00 | 484.85 | 0.000413 | 1.19 | 347.34 | 489.52 | 0.16 |
| Main Channel US | 342.6 | M&M 1-YR | 216.90 | 482.80 | 484.44 | 484.00 | 484.46 | 0.000295 | 0.85 | 259.14 | 445.52 | 0.13 |
| Main Channel US | 342.6 | Bankful Q | 313.51 | 482.80 | 484.68 | 484.00 | 484.70 | 0.000380 | 1.07 | 312.87 | 473.10 | 0.15 |
| | | | | | | | | | | | | |

HEC-RAS Plan: EXIST (Continued)

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Main Channel US | 342.5 | FEMA 100-YR | 1684.47 | 482.30 | 486.75 | 484.00 | 486.76 | 0.000092 | 0.94 | 2000.34 | 560.96 | 0.09 |
| Main Channel US | 342.5 | FEMA Floodway | 1658.64 | 482.30 | 486.76 | 484.43 | 486.78 | 0.000201 | 1.41 | 1480.22 | 451.49 | 0.13 |
| Main Channel US | 342.5 | FEMA 10-YR | 741.70 | 482.30 | 485.47 | 484.00 | 485.47 | 0.000064 | 0.59 | 1293.18 | 538.83 | 0.07 |
| Main Channel US | 342.5 | FEMA 50-YR | 1342.45 | 482.30 | 486.37 | 484.00 | 486.38 | 0.000082 | 0.83 | 1789.08 | 558.75 | 0.08 |
| Main Channel US | 342.5 | FEMA 500-YR | 2755.47 | 482.30 | 487.64 | 484.39 | 487.66 | 0.000122 | 1.27 | 2506.13 | 566.21 | 0.11 |
| Main Channel US | 342.5 | M&M 2-YR | 375.38 | 482.30 | 484.80 | 484.00 | 484.80 | 0.000158 | 0.73 | 545.44 | 516.18 | 0.10 |
| Main Channel US | 342.5 | M&M 1-YR | 216.90 | 482.30 | 484.42 | 483.70 | 484.42 | 0.000117 | 0.54 | 426.16 | 493.69 | 0.08 |
| Main Channel US | 342.5 | Bankful Q | 313.51 | 482.30 | 484.65 | 484.00 | 484.66 | 0.000148 | 0.67 | 499.08 | 509.27 | 0.10 |
| | | | | | | | | | | | | |
| Main Channel US | 342.45 Embankment | | Lat Struct | | | | | | | | | |
| | | | | | | | | | | | | |
| Main Channel US | 342.4 | FEMA 100-YR | 1682.65 | 482.70 | 486.73 | 484.60 | 486.74 | 0.000118 | 0.84 | 1751.22 | 513.59 | 0.09 |
| Main Channel US | 342.4 | FEMA Floodway | 1658.01 | 482.70 | 486.72 | 481.23 | 486.75 | 0.000268 | 1.27 | 1210.87 | 376.20 | 0.13 |
| Main Channel US | 342.4 | FEMA 10-YR | 741.70 | 482.70 | 485.46 | 484.20 | 485.46 | 0.000091 | 0.51 | 1113.56 | 493.05 | 0.07 |
| Main Channel US | 342.4 | FEMA 50-YR | 1342.45 | 482.70 | 486.35 | 484.60 | 486.36 | 0.000107 | 0.74 | 1559.91 | 505.80 | 0.08 |
| Main Channel US | 342.4 | FEMA 500-YR | 2726.80 | 482.70 | 487.62 | 484.86 | 487.64 | 0.000151 | 1.13 | 2217.52 | 532.10 | 0.10 |
| Main Channel US | 342.4 | M&M 2-YR | 375.38 | 482.70 | 484.75 | 483.83 | 484.77 | 0.000519 | 0.87 | 408.74 | 484.14 | 0.15 |
| Main Channel US | 342.4 | M&M 1-YR | 216.90 | 482.70 | 484.37 | 483.38 | 484.39 | 0.001003 | 0.93 | 205.42 | 467.72 | 0.20 |
| Main Channel US | 342.4 | Bankful Q | 313.51 | 482.70 | 484.61 | 483.64 | 484.62 | 0.000572 | 0.83 | 355.14 | 482.30 | 0.15 |
| | | | | | | | | | | | | |
| Main Channel US | 342.3 | FEMA 100-YR | 1271.74 | 480.70 | 486.72 | 482.78 | 486.72 | 0.000051 | 0.76 | 1714.91 | 381.00 | 0.06 |
| Main Channel US | 342.3 | FEMA Floodway | 1261.95 | 480.70 | 486.70 | 482.78 | 486.71 | 0.000100 | 1.05 | 1296.60 | 302.46 | 0.08 |
| Main Channel US | 342.3 | FEMA 10-YR | 598.80 | 480.70 | 485.45 | 482.13 | 485.45 | 0.000031 | 0.48 | 1236.12 | 375.55 | 0.04 |
| Main Channel US | 342.3 | FEMA 50-YR | 1056.62 | 480.70 | 486.34 | 482.61 | 486.35 | 0.000046 | 0.68 | 1572.56 | 378.70 | 0.06 |
| Main Channel US | 342.3 | FEMA 500-YR | 1843.62 | 480.70 | 487.61 | 483.10 | 487.62 | 0.000061 | 0.93 | 2057.00 | 386.48 | 0.07 |
| Main Channel US | 342.3 | M&M 2-YR | 293.84 | 480.70 | 484.72 | 481.71 | 484.72 | 0.000036 | 0.45 | 662.06 | 348.13 | 0.05 |
| Main Channel US | 342.3 | M&M 1-YR | 159.85 | 480.70 | 484.31 | 481.46 | 484.31 | 0.000018 | 0.29 | 560.55 | 327.58 | 0.03 |
| Main Channel US | 342.3 | Bankful Q | 241.97 | 480.70 | 484.57 | 481.62 | 484.57 | 0.000030 | 0.39 | 624.34 | 336.09 | 0.04 |
| | | | | | | | | | | | | |
| Main Channel US | 342.2 | FEMA 100-YR | 1271.74 | 480.40 | 486.66 | 482.89 | 486.71 | 0.000273 | 1.83 | 695.92 | 229.51 | 0.14 |
| Main Channel US | 342.2 | FEMA Floodway | 1261.95 | 480.40 | 486.64 | 482.88 | 486.69 | 0.000273 | 1.82 | 693.39 | 217.30 | 0.14 |
| Main Channel US | 342.2 | FEMA 10-YR | 598.80 | 480.40 | 485.42 | 482.33 | 485.44 | 0.000151 | 1.13 | 529.41 | 222.07 | 0.10 |
| Main Channel US | 342.2 | FEMA 50-YR | 1056.62 | 480.40 | 486.29 | 482.72 | 486.33 | 0.000241 | 1.63 | 646.80 | 226.45 | 0.13 |
| Main Channel US | 342.2 | FEMA 500-YR | 1843.62 | 480.40 | 487.58 | 483.29 | 487.61 | 0.000113 | 1.34 | 1401.41 | 245.36 | 0.09 |
| Main Channel US | 342.2 | M&M 2-YR | 293.84 | 480.40 | 484.71 | 481.99 | 484.71 | 0.000071 | 0.68 | 432.64 | 219.66 | 0.07 |
| Main Channel US | 342.2 | M&M 1-YR | 159.85 | 480.40 | 484.30 | 481.76 | 484.31 | 0.000033 | 0.42 | 378.39 | 218.32 | 0.04 |
| Main Channel US | 342.2 | Bankful Q | 241.97 | 480.40 | 484.56 | 481.90 | 484.56 | 0.000056 | 0.59 | 412.84 | 219.17 | 0.06 |
| | | | | | | | | | | | | |
| Main Channel US | 342.1 HEMINWAY DAM | FEMA 100-YR | 1271.74 | 483.50 | 485.44 | 485.44 | 486.42 | 0.005009 | 7.93 | 160.29 | 82.70 | 1.00 |
| Main Channel US | 342.1 HEMINWAY DAM | FEMA Floodway | 1261.95 | 483.50 | 485.44 | 485.44 | 486.40 | 0.004941 | 7.88 | 160.20 | 82.70 | 1.00 |
| Main Channel US | 342.1 HEMINWAY DAM | FEMA 10-YR | 598.80 | 483.50 | 484.68 | 484.68 | 485.27 | 0.005671 | 6.14 | 97.58 | 82.66 | 1.00 |
| Main Channel US | 342.1 HEMINWAY DAM | FEMA 50-YR | 1056.62 | 483.50 | 485.22 | 485.22 | 486.08 | 0.005092 | 7.42 | 142.43 | 82.69 | 1.00 |
| Main Channel US | 342.1 HEMINWAY DAM | FEMA 500-YR | 1843.62 | 483.50 | 485.99 | 485.99 | 487.24 | 0.004658 | 8.96 | 205.75 | 82.72 | 1.00 |
| Main Channel US | 342.1 HEMINWAY DAM | M&M 2-YR | 293.84 | 483.50 | 484.22 | 484.22 | 484.60 | 0.006923 | 4.92 | 59.70 | 82.64 | 1.02 |
| Main Channel US | 342.1 HEMINWAY DAM | M&M 1-YR | 159.85 | 483.50 | 483.99 | 483.99 | 484.23 | 0.007645 | 3.98 | 40.13 | 82.62 | 1.01 |
| Main Channel US | 342.1 HEMINWAY DAM | Bankful Q | 241.97 | 483.50 | 484.14 | 484.14 | 484.47 | 0.007084 | 4.59 | 52.73 | 82.63 | 1.01 |
| | | | | | | | | | | | | |
| Main Channel US | 342.05 | FEMA 100-YR | 1271.74 | 474.70 | 482.36 | 476.96 | 482.43 | 0.000070 | 2.11 | 602.51 | 82.19 | 0.14 |
| Main Channel US | 342.05 | FEMA Floodway | 1261.95 | 474.70 | 482.81 | 476.95 | 482.87 | 0.000057 | 1.97 | 639.80 | 82.23 | 0.12 |
| Main Channel US | 342.05 | FEMA 10-YR | 598.80 | 474.70 | 478.49 | 476.19 | 478.56 | 0.000167 | 2.10 | 285.63 | 81.87 | 0.20 |
| Main Channel US | 342.05 | FEMA 50-YR | 1056.62 | 474.70 | 481.21 | 476.74 | 481.28 | 0.000083 | 2.08 | 508.10 | 82.09 | 0.15 |
| Main Channel US | 342.05 | FEMA 500-YR | 1843.62 | 474.70 | 482.98 | 477.51 | 483.11 | 0.000114 | 2.82 | 653.95 | 82.24 | 0.18 |
| Main Channel US | 342.05 | M&M 2-YR | 293.84 | 474.70 | 475.19 | 475.74 | 480.37 | 0.401981 | 18.26 | 16.09 | 66.16 | 6.53 |
| Main Channel US | 342.05 | M&M 1-YR | 159.85 | 474.70 | 475.08 | 475.49 | 479.40 | 0.474382 | 16.69 | 9.58 | 51.04 | 6.79 |
| Main Channel US | 342.05 | Bankful Q | 241.97 | 474.70 | 475.15 | 475.65 | 480.05 | 0.424757 | 17.76 | 13.62 | 60.88 | 6.62 |
| | | | | | | | | | | | | |
| Main Channel DS | 341.2 | FEMA 100-YR | 2840.00 | 472.00 | 481.34 | 478.91 | 482.33 | 0.006138 | 8.22 | 364.50 | 51.86 | 0.52 |
| Main Channel DS | 341.2 | FEMA Floodway | 2840.00 | 472.00 | 481.52 | 478.85 | 482.75 | 0.008096 | 8.88 | 319.71 | 39.85 | 0.55 |
| Main Channel DS | 341.2 | FEMA 10-YR | 1130.00 | 472.00 | 477.90 | 476.29 | 478.49 | 0.006745 | 6.23 | 188.19 | 50.17 | 0.51 |
| Main Channel DS | 341.2 | FEMA 50-YR | 2200.00 | 472.00 | 480.40 | 478.14 | 481.19 | 0.005626 | 7.33 | 316.10 | 51.56 | 0.49 |
| Main Channel DS | 341.2 | FEMA 500-YR | 5000.00 | 472.00 | 482.95 | 481.05 | 483.09 | 0.001139 | 3.99 | 1747.06 | 565.08 | 0.23 |
| Main Channel DS | 341.2 | M&M 2-YR | 461.00 | 472.00 | 475.45 | 474.76 | 475.92 | 0.012191 | 5.49 | 83.95 | 35.93 | 0.63 |
| Main Channel DS | 341.2 | M&M 1-YR | 221.00 | 472.00 | 474.37 | 473.99 | 474.71 | 0.015301 | 4.65 | 47.49 | 31.44 | 0.67 |
| Main Channel DS | 341.2 | Bankful Q | 330.00 | 472.00 | 474.90 | 474.37 | 475.30 | 0.013590 | 5.11 | 64.52 | 33.62 | 0.65 |
| | | | | | | | | | | | | |
| Main Channel DS | 341.1 | FEMA 100-YR | 2840.00 | 469.70 | 481.55 | 477.10 | 481.68 | 0.000959 | 3.82 | 1204.63 | 474.70 | 0.20 |
| Main Channel DS | 341.1 | FEMA Floodway | 2840.00 | 469.70 | 481.64 | 477.01 | 481.92 | 0.001896 | 4.80 | 712.21 | 159.74 | 0.26 |
| Main Channel DS | 341.1 | FEMA 10-YR | 1130.00 | 469.70 | 477.50 | 474.10 | 477.89 | 0.003114 | 5.11 | 229.94 | 41.05 | 0.35 |
| Main Channel DS | 341.1 | FEMA 50-YR | 2200.00 | 469.70 | 480.36 | 476.09 | 480.63 | 0.001840 | 4.90 | 699.44 | 372.83 | 0.28 |
| Main Channel DS | 341.1 | FEMA 500-YR | 5000.00 | 469.70 | 482.84 | 480.73 | 482.98 | 0.000944 | 4.09 | 1865.61 | 531.98 | 0.21 |
| Main Channel DS | 341.1 | M&M 2-YR | 461.00 | 469.70 | 474.84 | 472.38 | 475.03 | 0.002605 | 3.51 | 132.05 | 33.81 | 0.30 |
| Main Channel DS | 341.1 | M&M 1-YR | 221.00 | 469.70 | 473.61 | 471.49 | 473.70 | 0.001813 | 2.40 | 92.12 | 30.96 | 0.25 |
| Main Channel DS | 341.1 | Bankful Q | 330.00 | 469.70 | 474.21 | 471.93 | 474.35 | 0.002262 | 2.97 | 111.29 | 32.45 | 0.28 |
| | | | | | | | | | | | | |
| Main Channel DS | 341 AL | FEMA 100-YR | 2840.00 | 470.70 | 481.53 | 479.60 | 481.62 | 0.000431 | 3.57 | 1589.34 | 556.95 | 0.20 |
| Main Channel DS | 341 AL | FEMA Floodway | 2840.00 | 470.70 | 481.65 | 479.60 | 481.79 | 0.000664 | 3.91 | 1099.04 | 275.35 | 0.22 |
| Main Channel DS | 341 AL | FEMA 10-YR | 1130.00 | 470.70 | 476.84 | 475.25 | 477.62 | 0.003994 | 7.19 | 164.61 | 37.01 | 0.56 |
| Main Channel DS | 341 AL | FEMA 50-YR | 2200.00 | 470.70 | 480.32 | 477.24 | 480.52 | 0.000880 | 4.67 | 943.82 | 473.57 | 0.28 |
| Main Channel DS | 341 AL | FEMA 500-YR | 5000.00 | 470.70 | 482.81 | 480.50 | 482.92 | 0.000468 | 4.04 | 2323.29 | 586.57 | 0.21 |
| Main Channel DS | 341 AL | M&M 2-YR | 461.00 | 470.70 | 474.10 | 473.60 | 474.73 | 0.007597 | 6.36 | 72.68 | 30.31 | 0.71 |
| Main Channel DS | 341 AL | M&M 1-YR | 221.00 | 470.70 | 473.00 | 472.77 | 473.46 | 0.010372 | 5.41 | 40.87 | 27.50 | 0.78 |
| Main Channel DS | 341 AL | Bankful Q | 330.00 | 470.70 | 473.51 | 473.17 | 474.07 | 0.009226 | 5.98 | 55.20 | 28.85 | 0.76 |
| | | | | | | | | | | | | |
| Main Channel DS | 340.2 | FEMA 100-YR | 2840.00 | 471.10 | 481.37 | 477.64 | 481.60 | 0.000813 | 5.03 | 1295.13 | 553.34 | 0.28 |
| Main Channel DS | 340.2 | FEMA Floodway | 2840.00 | 471.10 | 480.76 | 477.64 | 481.70 | 0.002564 | 8.37 | 488.41 | 150.00 | 0.48 |
| Main Channel DS | 340.2 | FEMA 10-YR | 1130.00 | 471.10 | 476.87 | 474.64 | 477.54 | 0.002585 | 6.53 | 173.05 | 30.04 | 0.48 |
| Main Channel DS | 340.2 | FEMA 50-YR | 2200.00 | 471.10 | 479.07 | 476.60 | 480.39 | 0.003813 | 9.20 | 239.13 | 30.10 | 0.58 |
| Main Channel DS | 340.2 | FEMA 500-YR | 5000.00 | 471.10 | 482.69 | 481.15 | 482.90 | 0.000840 | 5.54 | 2041.01 | 583.62 | 0.29 |
| Main Channel DS | 340.2 | M&M 2-YR | 461.00 | 471.10 | 474.19 | 473.04 | 474.58 | 0.002872 | 4.98 | 92.64 | 29.98 | 0.50 |
| Main Channel DS | 340.2 | M&M 1-YR | 221.00 | 471.10 | 473.07 | 472.29 | 473.29 | 0.002730 | 3.75 | 58.97 | 29.95 | 0.47 |
| Main Channel DS | 340.2 | Bankful Q | 330.00 | 471.10 | 473.60 | 472.66 | 473.90 | 0.002874 | 4.41 | 74.78 | 29.96 | 0.49 |
| | | | | | | | | | | | | |
| Main Channel DS | 340.15 ECHO LAKE ROAD | | Bridge | | | | | | | | | |
| | | | | | | | | | | | | |

HEC-RAS Plan: EXIST (Continued)

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Main Channel DS | 340.1 | FEMA 100-YR | 2840.00 | 471.10 | 480.59 | 477.65 | 481.38 | 0.002372 | 7.97 | 631.71 | 313.93 | 0.46 |
| Main Channel DS | 340.1 | FEMA Floodway | 2840.00 | 471.10 | 480.25 | 477.65 | 481.62 | 0.003647 | 9.69 | 371.57 | 119.93 | 0.57 |
| Main Channel DS | 340.1 | FEMA 10-YR | 1130.00 | 471.10 | 476.73 | 474.64 | 477.42 | 0.002800 | 6.71 | 168.47 | 29.99 | 0.50 |
| Main Channel DS | 340.1 | FEMA 50-YR | 2200.00 | 471.10 | 479.06 | 476.62 | 480.38 | 0.003843 | 9.22 | 238.54 | 42.93 | 0.58 |
| Main Channel DS | 340.1 | FEMA 500-YR | 5000.00 | 471.10 | 481.74 | 481.44 | 482.70 | 0.003158 | 9.77 | 1041.45 | 399.07 | 0.53 |
| Main Channel DS | 340.1 | M&M 2-YR | 461.00 | 471.10 | 474.01 | 473.04 | 474.45 | 0.003465 | 5.29 | 87.21 | 29.95 | 0.55 |
| Main Channel DS | 340.1 | M&M 1-YR | 221.00 | 471.10 | 472.90 | 472.29 | 473.16 | 0.003655 | 4.11 | 53.81 | 29.93 | 0.54 |
| Main Channel DS | 340.1 | Bankful Q | 330.00 | 471.10 | 473.41 | 472.66 | 473.77 | 0.003661 | 4.77 | 69.24 | 29.94 | 0.55 |
| | | | | | | | | | | | | |
| Main Channel DS | 340 AK | FEMA 100-YR | 2840.00 | 471.10 | 479.85 | 477.65 | 481.31 | 0.004124 | 10.06 | 413.09 | 283.47 | 0.60 |
| Main Channel DS | 340 AK | FEMA Floodway | 2840.00 | 471.10 | 480.21 | 477.65 | 481.60 | 0.003728 | 9.77 | 366.51 | 119.93 | 0.57 |
| Main Channel DS | 340 AK | FEMA 10-YR | 1130.00 | 471.10 | 476.71 | 474.64 | 477.41 | 0.002826 | 6.73 | 167.94 | 29.99 | 0.50 |
| Main Channel DS | 340 AK | FEMA 50-YR | 2200.00 | 471.10 | 479.04 | 476.62 | 480.36 | 0.003876 | 9.25 | 238.53 | 40.93 | 0.58 |
| Main Channel DS | 340 AK | FEMA 500-YR | 5000.00 | 471.10 | 481.44 | 481.44 | 482.66 | 0.003933 | 10.73 | 924.12 | 376.66 | 0.59 |
| Main Channel DS | 340 AK | M&M 2-YR | 461.00 | 471.10 | 473.99 | 473.05 | 474.43 | 0.003553 | 5.33 | 86.51 | 29.95 | 0.55 |
| Main Channel DS | 340 AK | M&M 1-YR | 221.00 | 471.10 | 472.87 | 472.28 | 473.14 | 0.003824 | 4.17 | 53.05 | 29.93 | 0.55 |
| Main Channel DS | 340 AK | Bankful Q | 330.00 | 471.10 | 473.39 | 472.66 | 473.75 | 0.003790 | 4.82 | 68.48 | 29.94 | 0.56 |
| | | | | | | | | | | | | |
| Main Channel DS | 339.6 AJ | FEMA 100-YR | 2840.00 | 470.30 | 479.90 | 476.85 | 480.42 | 0.001672 | 6.85 | 871.89 | 459.90 | 0.39 |
| Main Channel DS | 339.6 AJ | FEMA Floodway | 2840.00 | 470.30 | 480.06 | 476.85 | 480.80 | 0.002040 | 7.63 | 531.78 | 119.93 | 0.43 |
| Main Channel DS | 339.6 AJ | FEMA 10-YR | 1130.00 | 470.30 | 476.21 | 473.84 | 476.84 | 0.002423 | 6.39 | 176.90 | 30.01 | 0.46 |
| Main Channel DS | 339.6 AJ | FEMA 50-YR | 2200.00 | 470.30 | 478.65 | 475.82 | 479.55 | 0.002647 | 7.99 | 398.92 | 223.94 | 0.49 |
| Main Channel DS | 339.6 AJ | FEMA 500-YR | 5000.00 | 470.30 | 481.42 | 480.35 | 481.79 | 0.001445 | 6.87 | 1658.93 | 574.08 | 0.36 |
| Main Channel DS | 339.6 AJ | M&M 2-YR | 461.00 | 470.30 | 473.32 | 472.25 | 473.72 | 0.003113 | 5.11 | 90.27 | 29.95 | 0.52 |
| Main Channel DS | 339.6 AJ | M&M 1-YR | 221.00 | 470.30 | 472.07 | 471.49 | 472.34 | 0.003814 | 4.16 | 53.10 | 29.93 | 0.55 |
| Main Channel DS | 339.6 AJ | Bankful Q | 330.00 | 470.30 | 472.61 | 471.85 | 472.96 | 0.003688 | 4.78 | 69.08 | 29.94 | 0.55 |
| | | | | | | | | | | | | |
| Main Channel DS | 339.56 | FEMA 100-YR | 2840.00 | 470.30 | 479.81 | 476.83 | 480.41 | 0.001884 | 7.23 | 803.88 | 453.18 | 0.41 |
| Main Channel DS | 339.56 | FEMA Floodway | 2840.00 | 470.30 | 479.94 | 476.83 | 480.78 | 0.002298 | 8.05 | 488.63 | 119.93 | 0.46 |
| Main Channel DS | 339.56 | FEMA 10-YR | 1130.00 | 470.30 | 476.20 | 473.84 | 476.84 | 0.002428 | 6.39 | 176.79 | 30.01 | 0.46 |
| Main Channel DS | 339.56 | FEMA 50-YR | 2200.00 | 470.30 | 478.55 | 475.82 | 479.55 | 0.002873 | 8.28 | 364.12 | 206.72 | 0.51 |
| Main Channel DS | 339.56 | FEMA 500-YR | 5000.00 | 470.30 | 481.38 | 480.40 | 481.79 | 0.001567 | 7.14 | 1589.74 | 570.62 | 0.38 |
| Main Channel DS | 339.56 | M&M 2-YR | 461.00 | 470.30 | 473.31 | 472.25 | 473.72 | 0.003129 | 5.12 | 90.12 | 29.95 | 0.52 |
| Main Channel DS | 339.56 | M&M 1-YR | 221.00 | 470.30 | 472.07 | 471.49 | 472.34 | 0.003858 | 4.18 | 52.90 | 29.93 | 0.55 |
| Main Channel DS | 339.56 | Bankful Q | 330.00 | 470.30 | 472.60 | 471.85 | 472.96 | 0.003720 | 4.79 | 68.89 | 29.94 | 0.56 |
| | | | | | | | | | | | | |
| Main Channel DS | 339.55 WALKWAY | | Bridge | | | | | | | | | |
| | | | | | | | | | | | | |
| Main Channel DS | 339.51 | FEMA 100-YR | 2840.00 | 470.30 | 479.05 | 476.83 | 480.33 | 0.003642 | 9.62 | 488.90 | 366.10 | 0.57 |
| Main Channel DS | 339.51 | FEMA Floodway | 2840.00 | 470.30 | 479.30 | 476.83 | 480.44 | 0.003192 | 9.14 | 418.58 | 119.93 | 0.54 |
| Main Channel DS | 339.51 | FEMA 10-YR | 1130.00 | 470.30 | 476.18 | 473.84 | 476.82 | 0.002456 | 6.42 | 176.09 | 30.01 | 0.47 |
| Main Channel DS | 339.51 | FEMA 50-YR | 2200.00 | 470.30 | 478.27 | 475.82 | 479.42 | 0.003389 | 8.82 | 314.86 | 165.04 | 0.55 |
| Main Channel DS | 339.51 | FEMA 500-YR | 5000.00 | 470.30 | 481.31 | 480.43 | 481.74 | 0.001636 | 7.28 | 1568.13 | 565.78 | 0.39 |
| Main Channel DS | 339.51 | M&M 2-YR | 461.00 | 470.30 | 473.28 | 472.25 | 473.69 | 0.003235 | 5.17 | 89.16 | 29.95 | 0.53 |
| Main Channel DS | 339.51 | M&M 1-YR | 221.00 | 470.30 | 472.02 | 471.49 | 472.31 | 0.004189 | 4.29 | 51.56 | 29.93 | 0.58 |
| Main Channel DS | 339.51 | Bankful Q | 330.00 | 470.30 | 472.56 | 471.85 | 472.93 | 0.003933 | 4.88 | 67.68 | 29.94 | 0.57 |
| | | | | | | | | | | | | |
| Main Channel DS | 339.5 AI | FEMA 100-YR | 2840.00 | 470.30 | 479.11 | 476.85 | 480.29 | 0.003408 | 9.34 | 532.05 | 400.67 | 0.55 |
| Main Channel DS | 339.5 AI | FEMA Floodway | 2840.00 | 470.30 | 479.37 | 476.85 | 480.41 | 0.002942 | 8.81 | 448.94 | 119.93 | 0.52 |
| Main Channel DS | 339.5 AI | FEMA 10-YR | 1130.00 | 470.30 | 476.18 | 473.84 | 476.82 | 0.002460 | 6.42 | 175.99 | 30.01 | 0.47 |
| Main Channel DS | 339.5 AI | FEMA 50-YR | 2200.00 | 470.30 | 478.29 | 475.82 | 479.41 | 0.003283 | 8.69 | 330.53 | 167.57 | 0.54 |
| Main Channel DS | 339.5 AI | FEMA 500-YR | 5000.00 | 470.30 | 481.33 | 480.35 | 481.73 | 0.001555 | 7.10 | 1604.64 | 566.95 | 0.38 |
| Main Channel DS | 339.5 AI | M&M 2-YR | 461.00 | 470.30 | 473.27 | 472.25 | 473.69 | 0.003250 | 5.18 | 89.02 | 29.95 | 0.53 |
| Main Channel DS | 339.5 AI | M&M 1-YR | 221.00 | 470.30 | 472.02 | 471.49 | 472.30 | 0.004237 | 4.30 | 51.38 | 29.93 | 0.58 |
| Main Channel DS | 339.5 AI | Bankful Q | 330.00 | 470.30 | 472.56 | 471.85 | 472.93 | 0.003964 | 4.89 | 67.51 | 29.94 | 0.57 |
| | | | | | | | | | | | | |
| Main Channel DS | 339.1 | FEMA 100-YR | 2840.00 | 469.10 | 478.44 | 475.65 | 479.34 | 0.002577 | 8.35 | 551.15 | 227.93 | 0.48 |
| Main Channel DS | 339.1 | FEMA Floodway | 2840.00 | 469.10 | 478.67 | 475.65 | 479.58 | 0.002489 | 8.32 | 475.94 | 119.93 | 0.47 |
| Main Channel DS | 339.1 | FEMA 10-YR | 1130.00 | 469.10 | 475.65 | 472.64 | 476.16 | 0.001788 | 5.76 | 196.12 | 30.02 | 0.40 |
| Main Channel DS | 339.1 | FEMA 50-YR | 2200.00 | 469.10 | 477.45 | 474.61 | 478.48 | 0.002902 | 8.35 | 339.69 | 166.50 | 0.51 |
| Main Channel DS | 339.1 | FEMA 500-YR | 5000.00 | 469.10 | 480.43 | 479.34 | 481.16 | 0.002235 | 8.61 | 1005.45 | 227.94 | 0.45 |
| Main Channel DS | 339.1 | M&M 2-YR | 461.00 | 469.10 | 472.60 | 471.05 | 472.90 | 0.001972 | 4.41 | 104.62 | 29.96 | 0.42 |
| Main Channel DS | 339.1 | M&M 1-YR | 221.00 | 469.10 | 471.03 | 470.29 | 471.26 | 0.002918 | 3.83 | 57.74 | 29.93 | 0.49 |
| Main Channel DS | 339.1 | Bankful Q | 330.00 | 469.10 | 471.64 | 470.66 | 471.93 | 0.002747 | 4.35 | 75.85 | 29.94 | 0.48 |
| | | | | | | | | | | | | |
| Main Channel DS | 339 | FEMA 100-YR | 2840.00 | 468.60 | 478.29 | 475.13 | 479.12 | 0.002306 | 8.03 | 576.82 | 241.27 | 0.46 |
| Main Channel DS | 339 | FEMA Floodway | 2840.00 | 468.60 | 478.43 | 475.14 | 479.38 | 0.002471 | 8.35 | 464.03 | 120.00 | 0.47 |
| Main Channel DS | 339 | FEMA 10-YR | 1130.00 | 468.60 | 475.56 | 472.14 | 476.01 | 0.001494 | 5.42 | 208.59 | 30.07 | 0.36 |
| Main Channel DS | 339 | FEMA 50-YR | 2200.00 | 468.60 | 477.25 | 474.12 | 478.25 | 0.002731 | 8.20 | 333.45 | 195.71 | 0.49 |
| Main Channel DS | 339 | FEMA 500-YR | 5000.00 | 468.60 | 480.33 | 479.11 | 480.97 | 0.001849 | 8.17 | 1135.46 | 307.75 | 0.42 |
| Main Channel DS | 339 | M&M 2-YR | 461.00 | 468.60 | 472.50 | 470.55 | 472.74 | 0.001403 | 3.94 | 116.86 | 29.99 | 0.35 |
| Main Channel DS | 339 | M&M 1-YR | 221.00 | 468.60 | 470.89 | 469.79 | 471.05 | 0.001691 | 3.22 | 68.60 | 29.95 | 0.38 |
| Main Channel DS | 339 | Bankful Q | 330.00 | 468.60 | 471.50 | 470.16 | 471.73 | 0.001797 | 3.80 | 86.88 | 29.97 | 0.39 |
| | | | | | | | | | | | | |
| Main Channel DS | 338.2 | FEMA 100-YR | 2840.00 | 468.60 | 477.67 | 475.13 | 479.01 | 0.003583 | 9.63 | 417.49 | 215.00 | 0.56 |
| Main Channel DS | 338.2 | FEMA Floodway | 2840.00 | 468.60 | 478.28 | 475.14 | 479.30 | 0.002666 | 8.60 | 446.02 | 120.00 | 0.49 |
| Main Channel DS | 338.2 | FEMA 10-YR | 1130.00 | 468.60 | 475.51 | 472.14 | 475.97 | 0.001525 | 5.46 | 207.07 | 30.06 | 0.37 |
| Main Channel DS | 338.2 | FEMA 50-YR | 2200.00 | 468.60 | 477.08 | 474.12 | 478.16 | 0.002970 | 8.46 | 303.67 | 142.44 | 0.51 |
| Main Channel DS | 338.2 | FEMA 500-YR | 5000.00 | 468.60 | 480.04 | 479.13 | 480.90 | 0.002357 | 9.07 | 990.38 | 278.53 | 0.47 |
| Main Channel DS | 338.2 | M&M 2-YR | 461.00 | 468.60 | 472.46 | 470.55 | 472.70 | 0.001456 | 3.99 | 115.47 | 29.99 | 0.36 |
| Main Channel DS | 338.2 | M&M 1-YR | 221.00 | 468.60 | 470.83 | 469.79 | 471.00 | 0.001837 | 3.31 | 66.82 | 29.95 | 0.39 |
| Main Channel DS | 338.2 | Bankful Q | 330.00 | 468.60 | 471.44 | 470.16 | 471.67 | 0.001927 | 3.88 | 84.96 | 29.97 | 0.41 |
| | | | | | | | | | | | | |
| Main Channel DS | 338.15 16-INCH-PIPE | | Bridge | | | | | | | | | |
| | | | | | | | | | | | | |
| Main Channel DS | 338.1 | FEMA 100-YR | 2840.00 | 468.60 | 477.38 | 475.13 | 478.96 | 0.004244 | 10.30 | 356.11 | 210.35 | 0.61 |
| Main Channel DS | 338.1 | FEMA Floodway | 2840.00 | 468.60 | 478.05 | 475.14 | 479.24 | 0.003082 | 9.13 | 395.52 | 100.00 | 0.52 |
| Main Channel DS | 338.1 | FEMA 10-YR | 1130.00 | 468.60 | 474.02 | 472.14 | 474.77 | 0.003125 | 6.96 | 162.36 | 30.03 | 0.53 |
| Main Channel DS | 338.1 | FEMA 50-YR | 2200.00 | 468.60 | 476.53 | 474.12 | 477.85 | 0.003805 | 9.22 | 247.04 | 72.98 | 0.58 |
| Main Channel DS | 338.1 | FEMA 500-YR | 5000.00 | 468.60 | 479.89 | 479.13 | 480.82 | 0.002591 | 9.42 | 947.67 | 273.47 | 0.49 |
| Main Channel DS | 338.1 | M&M 2-YR | 461.00 | 468.60 | 471.93 | 470.55 | 472.26 | 0.002286 | 4.62 | 99.72 | 29.98 | 0.45 |
| Main Channel DS | 338.1 | M&M 1-YR | 221.00 | 468.60 | 470.77 | 469.79 | 470.95 | 0.002011 | 3.40 | 64.94 | 29.95 | 0.41 |
| Main Channel DS | 338.1 | Bankful Q | 330.00 | 468.60 | 471.35 | 470.16 | 471.60 | 0.002137 | 4.02 | 82.19 | 29.97 | 0.43 |
| | | | | | | | | | | | | |

HEC-RAS Plan: EXIST (Continued)

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Main Channel DS | 337 AH | FEMA 100-YR | 2840.00 | 468.60 | 476.97 | 475.00 | 478.80 | 0.004983 | 10.88 | 282.54 | 159.87 | 0.66 |
| Main Channel DS | 337 AH | FEMA Floodway | 2840.00 | 468.60 | 477.70 | 475.00 | 479.11 | 0.003621 | 9.71 | 340.13 | 90.55 | 0.57 |
| Main Channel DS | 337 AH | FEMA 10-YR | 1130.00 | 468.60 | 473.95 | 472.07 | 474.67 | 0.003009 | 6.82 | 165.57 | 31.02 | 0.52 |
| Main Channel DS | 337 AH | FEMA 50-YR | 2200.00 | 468.60 | 476.45 | 474.00 | 477.72 | 0.003678 | 9.04 | 243.35 | 31.08 | 0.57 |
| Main Channel DS | 337 AH | FEMA 500-YR | 5000.00 | 468.60 | 479.63 | 479.06 | 480.72 | 0.002966 | 9.94 | 872.26 | 258.46 | 0.53 |
| Main Channel DS | 337 AH | M&M 2-YR | 461.00 | 468.60 | 471.87 | 470.50 | 472.19 | 0.002250 | 4.56 | 101.16 | 30.98 | 0.44 |
| Main Channel DS | 337 AH | M&M 1-YR | 221.00 | 468.60 | 470.71 | 469.77 | 470.89 | 0.002044 | 3.39 | 65.28 | 30.95 | 0.41 |
| Main Channel DS | 337 AH | Bankful Q | 330.00 | 468.60 | 471.29 | 470.12 | 471.53 | 0.002130 | 3.97 | 83.08 | 30.96 | 0.43 |
| | | | | | | | | | | | | |
| Main Channel DS | 336.2 | FEMA 100-YR | 2840.00 | 467.60 | 477.88 | 474.16 | 478.25 | 0.000909 | 5.98 | 1003.89 | 371.64 | 0.33 |
| Main Channel DS | 336.2 | FEMA Floodway | 2840.00 | 467.60 | 477.58 | 474.16 | 478.99 | 0.002355 | 9.52 | 298.38 | 29.97 | 0.53 |
| Main Channel DS | 336.2 | FEMA 10-YR | 1130.00 | 467.60 | 473.98 | 471.15 | 474.53 | 0.001348 | 5.93 | 190.60 | 29.91 | 0.41 |
| Main Channel DS | 336.2 | FEMA 50-YR | 2200.00 | 467.60 | 476.90 | 473.14 | 477.39 | 0.001085 | 6.28 | 665.07 | 323.81 | 0.36 |
| Main Channel DS | 336.2 | FEMA 500-YR | 5000.00 | 467.60 | 480.16 | 477.77 | 480.38 | 0.000643 | 5.55 | 2050.54 | 580.03 | 0.28 |
| Main Channel DS | 336.2 | M&M 2-YR | 461.00 | 467.60 | 471.89 | 469.55 | 472.10 | 0.000734 | 3.60 | 128.13 | 29.87 | 0.31 |
| Main Channel DS | 336.2 | M&M 1-YR | 221.00 | 467.60 | 470.72 | 468.79 | 470.81 | 0.000449 | 2.37 | 93.18 | 29.85 | 0.24 |
| Main Channel DS | 336.2 | Bankful Q | 330.00 | 467.60 | 471.31 | 469.16 | 471.44 | 0.000591 | 2.99 | 110.55 | 29.86 | 0.27 |
| | | | | | | | | | | | | |
| Main Channel DS | 336.15 Parking Lot | | Bridge | | | | | | | | | |
| | | | | | | | | | | | | |
| Main Channel DS | 336.1 | FEMA 100-YR | 2840.00 | 467.60 | 477.64 | 474.16 | 478.09 | 0.001070 | 6.43 | 917.53 | 360.05 | 0.36 |
| Main Channel DS | 336.1 | FEMA Floodway | 2840.00 | 467.60 | 476.66 | 474.16 | 478.37 | 0.003101 | 10.50 | 270.59 | 29.95 | 0.62 |
| Main Channel DS | 336.1 | FEMA 10-YR | 1130.00 | 467.60 | 473.86 | 471.15 | 474.43 | 0.001430 | 6.05 | 186.83 | 29.91 | 0.43 |
| Main Channel DS | 336.1 | FEMA 50-YR | 2200.00 | 467.60 | 475.45 | 473.14 | 476.82 | 0.002800 | 9.38 | 234.46 | 214.13 | 0.59 |
| Main Channel DS | 336.1 | FEMA 500-YR | 5000.00 | 467.60 | 480.04 | 477.77 | 480.29 | 0.000691 | 5.71 | 1985.46 | 569.31 | 0.29 |
| Main Channel DS | 336.1 | M&M 2-YR | 461.00 | 467.60 | 471.87 | 469.55 | 472.07 | 0.000750 | 3.62 | 127.26 | 29.87 | 0.31 |
| Main Channel DS | 336.1 | M&M 1-YR | 221.00 | 467.60 | 470.71 | 468.79 | 470.80 | 0.000453 | 2.38 | 92.90 | 29.85 | 0.24 |
| Main Channel DS | 336.1 | Bankful Q | 330.00 | 467.60 | 471.29 | 469.16 | 471.43 | 0.000599 | 3.00 | 110.03 | 29.86 | 0.28 |
| | | | | | | | | | | | | |
| Main Channel DS | 336 AG | FEMA 100-YR | 2840.00 | 467.40 | 475.95 | 475.08 | 477.89 | 0.006773 | 12.09 | 352.52 | 96.05 | 0.76 |
| Main Channel DS | 336 AG | FEMA Floodway | 2840.00 | 467.40 | 476.39 | 474.90 | 478.23 | 0.005881 | 11.68 | 315.29 | 47.00 | 0.71 |
| Main Channel DS | 336 AG | FEMA 10-YR | 1130.00 | 467.40 | 473.58 | 472.00 | 474.34 | 0.004025 | 7.35 | 194.25 | 52.99 | 0.55 |
| Main Channel DS | 336 AG | FEMA 50-YR | 2200.00 | 467.40 | 475.24 | 474.10 | 476.70 | 0.005737 | 10.44 | 292.86 | 69.91 | 0.69 |
| Main Channel DS | 336 AG | FEMA 500-YR | 5000.00 | 467.40 | 479.97 | 478.22 | 480.26 | 0.001169 | 6.61 | 2178.07 | 598.32 | 0.34 |
| Main Channel DS | 336 AG | M&M 2-YR | 461.00 | 467.40 | 471.67 | 470.22 | 472.02 | 0.003089 | 4.85 | 107.33 | 37.84 | 0.45 |
| Main Channel DS | 336 AG | M&M 1-YR | 221.00 | 467.40 | 470.60 | 469.39 | 470.77 | 0.002350 | 3.35 | 70.91 | 31.67 | 0.37 |
| Main Channel DS | 336 AG | Bankful Q | 330.00 | 467.40 | 471.14 | 469.79 | 471.39 | 0.002733 | 4.10 | 88.28 | 33.62 | 0.41 |

HEC-RAS Plan: EXIST River: Steele Brook Reach: Old Channel

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Old Channel | 7 | FEMA 100-YR | 1.00 | 484.20 | 484.73 | 484.40 | 484.73 | 0.000598 | 0.25 | 4.00 | 15.04 | 0.09 |
| Old Channel | 7 | FEMA Floodway | 1.00 | 484.20 | 484.81 | 484.40 | 484.81 | 0.000285 | 0.19 | 5.28 | 17.29 | 0.06 |
| Old Channel | 7 | FEMA 10-YR | 1.00 | 484.20 | 484.43 | 484.40 | 484.46 | 0.048497 | 1.30 | 0.77 | 6.60 | 0.67 |
| Old Channel | 7 | FEMA 50-YR | 1.00 | 484.20 | 484.56 | 484.40 | 484.56 | 0.004855 | 0.55 | 1.82 | 10.16 | 0.23 |
| Old Channel | 7 | FEMA 500-YR | 1.00 | 484.20 | 485.59 | 484.40 | 485.59 | 0.000004 | 0.04 | 27.24 | 39.25 | 0.01 |
| Old Channel | 7 | M&M 2-YR | 1.00 | 484.20 | 484.42 | 484.40 | 484.45 | 0.069308 | 1.49 | 0.67 | 6.17 | 0.79 |
| Old Channel | 7 | M&M 1-YR | 1.00 | 484.20 | 484.41 | 484.40 | 484.45 | 0.084973 | 1.60 | 0.62 | 5.94 | 0.87 |
| Old Channel | 7 | Bankful Q | 1.00 | 484.20 | 484.41 | 484.40 | 484.45 | 0.075799 | 1.54 | 0.65 | 6.07 | 0.83 |
| | | | | | | | | | | | | |
| Old Channel | 6 | FEMA 100-YR | 376.53 | 479.20 | 484.20 | 482.36 | 484.58 | 0.004015 | 5.12 | 80.09 | 22.82 | 0.42 |
| Old Channel | 6 | FEMA Floodway | 402.36 | 479.20 | 484.30 | 482.48 | 484.72 | 0.004264 | 5.34 | 82.39 | 23.22 | 0.44 |
| Old Channel | 6 | FEMA 10-YR | 79.30 | 479.20 | 481.82 | 480.60 | 481.91 | 0.002042 | 2.40 | 33.11 | 16.19 | 0.29 |
| Old Channel | 6 | FEMA 50-YR | 258.55 | 479.20 | 484.00 | 481.73 | 484.20 | 0.002192 | 3.69 | 75.66 | 22.05 | 0.31 |
| Old Channel | 6 | FEMA 500-YR | 845.53 | 479.20 | 485.43 | 484.22 | 485.57 | 0.001807 | 3.92 | 313.78 | 150.45 | 0.29 |
| Old Channel | 6 | M&M 2-YR | 30.62 | 479.20 | 480.81 | 480.15 | 480.86 | 0.002164 | 1.74 | 17.61 | 15.26 | 0.29 |
| Old Channel | 6 | M&M 1-YR | 5.10 | 479.20 | 480.08 | 479.67 | 480.08 | 0.001463 | 0.79 | 6.46 | 14.75 | 0.21 |
| Old Channel | 6 | Bankful Q | 17.49 | 479.20 | 480.50 | 479.97 | 480.53 | 0.001909 | 1.36 | 12.88 | 15.22 | 0.26 |
| | | | | | | | | | | | | |
| Old Channel | 5 | FEMA 100-YR | 376.53 | 479.20 | 483.94 | 481.70 | 484.25 | 0.001787 | 4.51 | 99.85 | 50.02 | 0.37 |
| Old Channel | 5 | FEMA Floodway | 402.36 | 479.20 | 484.03 | 481.81 | 484.36 | 0.001901 | 4.70 | 104.28 | 51.64 | 0.38 |
| Old Channel | 5 | FEMA 10-YR | 79.30 | 479.20 | 481.70 | 480.08 | 481.76 | 0.000599 | 1.88 | 42.15 | 16.91 | 0.21 |
| Old Channel | 5 | FEMA 50-YR | 258.55 | 479.20 | 483.87 | 481.15 | 484.02 | 0.000894 | 3.16 | 96.24 | 48.20 | 0.26 |
| Old Channel | 5 | FEMA 500-YR | 845.53 | 479.20 | 485.39 | 483.95 | 485.43 | 0.000277 | 2.07 | 599.38 | 216.11 | 0.15 |
| Old Channel | 5 | M&M 2-YR | 30.62 | 479.20 | 480.68 | 479.67 | 480.71 | 0.000448 | 1.23 | 24.98 | 16.86 | 0.18 |
| Old Channel | 5 | M&M 1-YR | 5.10 | 479.20 | 480.00 | 479.34 | 480.00 | 0.000089 | 0.38 | 13.42 | 16.83 | 0.07 |
| Old Channel | 5 | Bankful Q | 17.49 | 479.20 | 480.39 | 479.52 | 480.40 | 0.000292 | 0.87 | 20.07 | 16.85 | 0.14 |
| | | | | | | | | | | | | |
| Old Channel | 4 | FEMA 100-YR | 376.53 | 478.40 | 484.03 | 481.43 | 484.04 | 0.000106 | 1.22 | 472.09 | 191.49 | 0.10 |
| Old Channel | 4 | FEMA Floodway | 402.36 | 478.40 | 484.12 | 481.55 | 484.13 | 0.000109 | 1.25 | 488.22 | 191.80 | 0.10 |
| Old Channel | 4 | FEMA 10-YR | 79.30 | 478.40 | 481.64 | 479.76 | 481.69 | 0.000434 | 1.73 | 46.52 | 19.29 | 0.18 |
| Old Channel | 4 | FEMA 50-YR | 258.55 | 478.40 | 483.91 | 480.84 | 483.92 | 0.000057 | 0.88 | 452.29 | 190.78 | 0.07 |
| Old Channel | 4 | FEMA 500-YR | 845.53 | 478.40 | 483.25 | 483.25 | 485.18 | 0.010984 | 11.29 | 80.77 | 22.50 | 0.96 |
| Old Channel | 4 | M&M 2-YR | 30.62 | 478.40 | 480.64 | 479.33 | 480.66 | 0.000267 | 1.05 | 29.12 | 16.49 | 0.14 |
| Old Channel | 4 | M&M 1-YR | 5.10 | 478.40 | 479.99 | 478.86 | 479.99 | 0.000031 | 0.28 | 18.44 | 16.30 | 0.05 |
| Old Channel | 4 | Bankful Q | 17.49 | 478.40 | 480.37 | 479.15 | 480.38 | 0.000147 | 0.71 | 24.59 | 16.41 | 0.10 |
| | | | | | | | | | | | | |
| Old Channel | 3 | FEMA 100-YR | 789.26 | 478.00 | 484.01 | 483.04 | 484.03 | 0.000176 | 1.61 | 740.52 | 384.53 | 0.13 |
| Old Channel | 3 | FEMA Floodway | 799.05 | 478.00 | 484.10 | 483.08 | 484.12 | 0.000163 | 1.57 | 764.46 | 385.25 | 0.12 |
| Old Channel | 3 | FEMA 10-YR | 222.20 | 478.00 | 480.83 | 480.69 | 481.57 | 0.010282 | 6.91 | 32.22 | 17.35 | 0.89 |
| Old Channel | 3 | FEMA 50-YR | 544.38 | 478.00 | 482.73 | 482.13 | 483.80 | 0.006686 | 8.35 | 67.67 | 21.00 | 0.76 |
| Old Channel | 3 | FEMA 500-YR | 1757.38 | 478.00 | 483.51 | 483.51 | 483.66 | 0.001555 | 4.46 | 618.37 | 380.87 | 0.37 |
| Old Channel | 3 | M&M 2-YR | 112.16 | 478.00 | 480.03 | 479.96 | 480.58 | 0.012713 | 5.94 | 18.87 | 15.11 | 0.94 |
| Old Channel | 3 | M&M 1-YR | 62.15 | 478.00 | 479.53 | 479.48 | 479.95 | 0.013657 | 5.19 | 11.97 | 12.54 | 0.94 |
| Old Channel | 3 | Bankful Q | 89.03 | 478.00 | 479.81 | 479.76 | 480.31 | 0.013255 | 5.67 | 15.71 | 13.99 | 0.94 |
| | | | | | | | | | | | | |
| Old Channel | 2 | FEMA 100-YR | 789.26 | 476.60 | 481.87 | 481.56 | 483.78 | 0.010821 | 11.23 | 75.03 | 17.62 | 0.87 |
| Old Channel | 2 | FEMA Floodway | 799.05 | 476.60 | 482.19 | 481.58 | 483.90 | 0.009171 | 10.66 | 80.74 | 18.00 | 0.80 |
| Old Channel | 2 | FEMA 10-YR | 222.20 | 476.60 | 479.10 | 478.71 | 479.84 | 0.008728 | 6.88 | 32.29 | 13.01 | 0.77 |
| Old Channel | 2 | FEMA 50-YR | 544.38 | 476.60 | 480.98 | 480.48 | 482.36 | 0.009340 | 9.48 | 59.81 | 16.55 | 0.80 |
| Old Channel | 2 | FEMA 500-YR | 1757.38 | 476.60 | 483.11 | 482.41 | 483.15 | 0.000340 | 2.26 | 1171.42 | 493.45 | 0.16 |
| Old Channel | 2 | M&M 2-YR | 112.16 | 476.60 | 478.29 | 477.93 | 478.70 | 0.007276 | 5.15 | 21.78 | 12.94 | 0.70 |
| Old Channel | 2 | M&M 1-YR | 62.15 | 476.60 | 477.78 | 477.50 | 478.04 | 0.006772 | 4.08 | 15.22 | 12.90 | 0.66 |
| Old Channel | 2 | Bankful Q | 89.03 | 476.60 | 478.08 | 477.74 | 478.42 | 0.006985 | 4.69 | 18.99 | 12.92 | 0.68 |
| | | | | | | | | | | | | |
| Old Channel | 1 | FEMA 100-YR | 789.26 | 476.00 | 481.27 | 480.84 | 482.97 | 0.009227 | 10.65 | 80.51 | 19.37 | 0.82 |
| Old Channel | 1 | FEMA Floodway | 799.05 | 476.00 | 481.83 | 480.88 | 483.21 | 0.006779 | 9.61 | 91.56 | 20.71 | 0.71 |
| Old Channel | 1 | FEMA 10-YR | 222.20 | 476.00 | 478.21 | 478.05 | 479.08 | 0.011441 | 7.49 | 29.67 | 13.62 | 0.89 |
| Old Channel | 1 | FEMA 50-YR | 544.38 | 476.00 | 480.50 | 479.76 | 481.67 | 0.007347 | 8.75 | 65.93 | 18.70 | 0.73 |
| Old Channel | 1 | FEMA 500-YR | 1757.38 | 476.00 | 483.10 | 482.10 | 483.13 | 0.000221 | 1.98 | 1436.67 | 537.69 | 0.13 |
| Old Channel | 1 | M&M 2-YR | 112.16 | 476.00 | 477.31 | 477.31 | 477.95 | 0.014880 | 6.44 | 17.42 | 13.45 | 1.00 |
| Old Channel | 1 | M&M 1-YR | 62.15 | 476.00 | 476.88 | 476.88 | 477.32 | 0.015754 | 5.29 | 11.75 | 13.37 | 0.99 |
| Old Channel | 1 | Bankful Q | 89.03 | 476.00 | 477.12 | 477.12 | 477.67 | 0.015360 | 5.98 | 14.88 | 13.41 | 1.00 |

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# Full Removal
# Profile Plots

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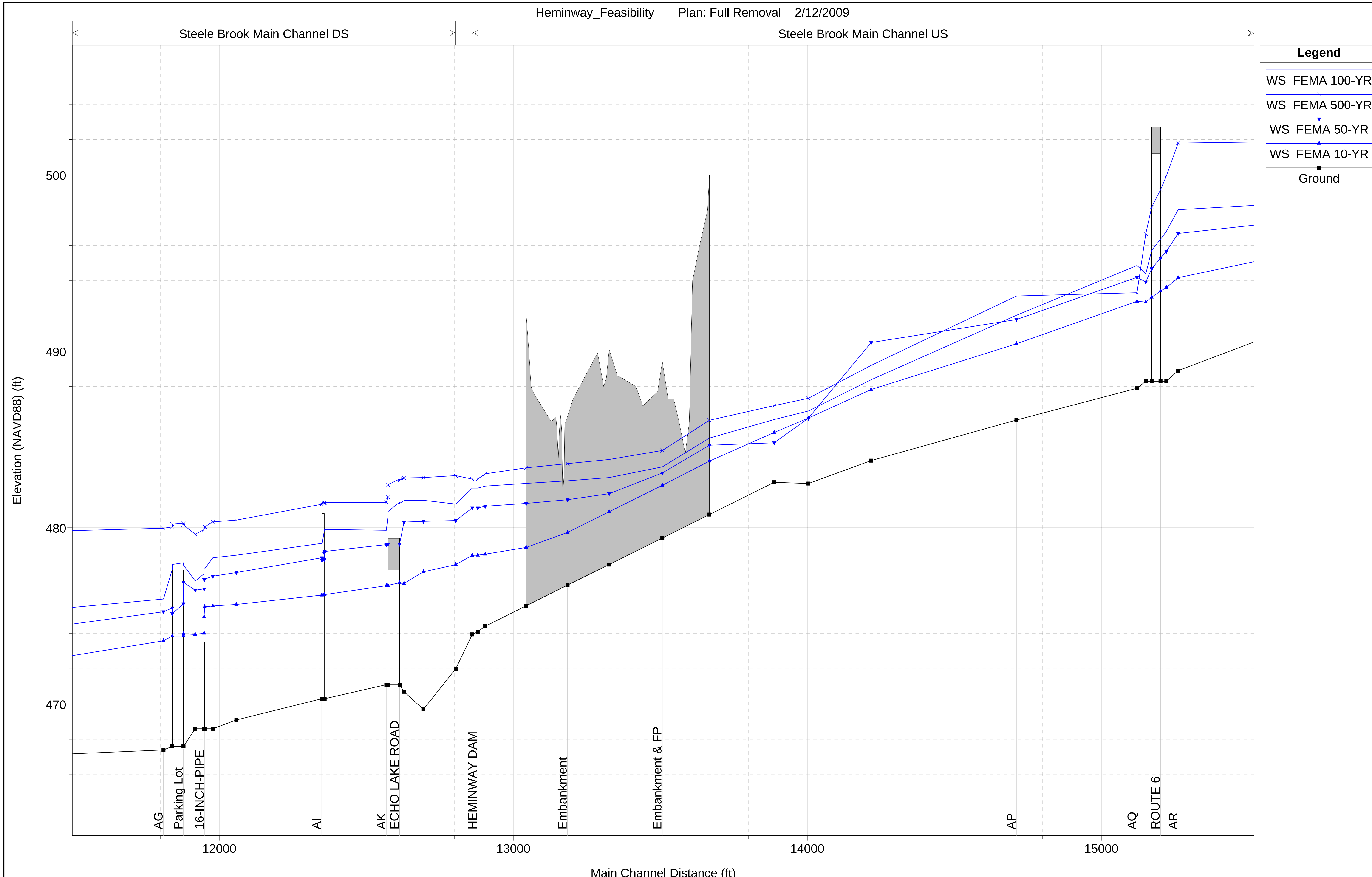
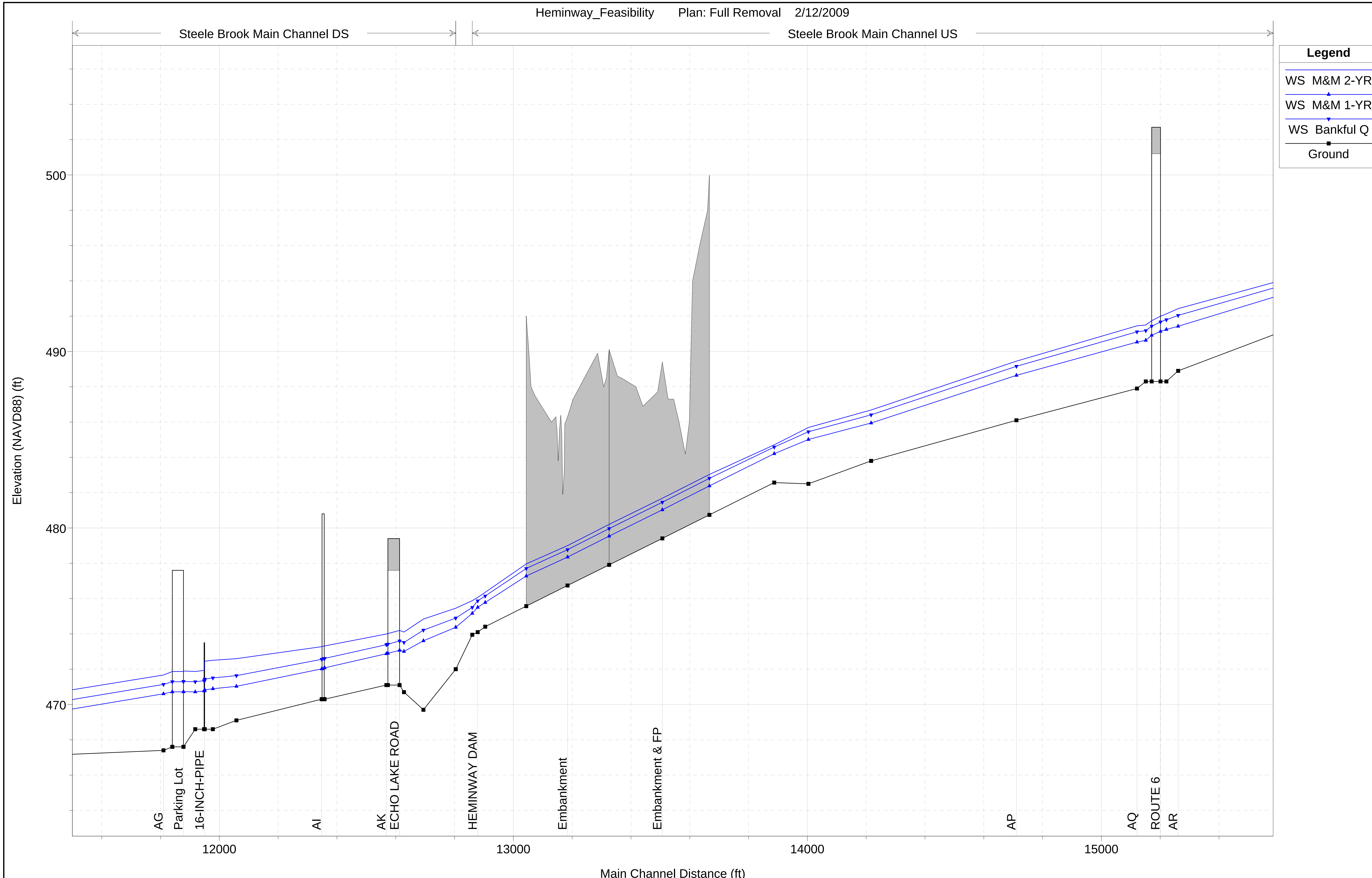
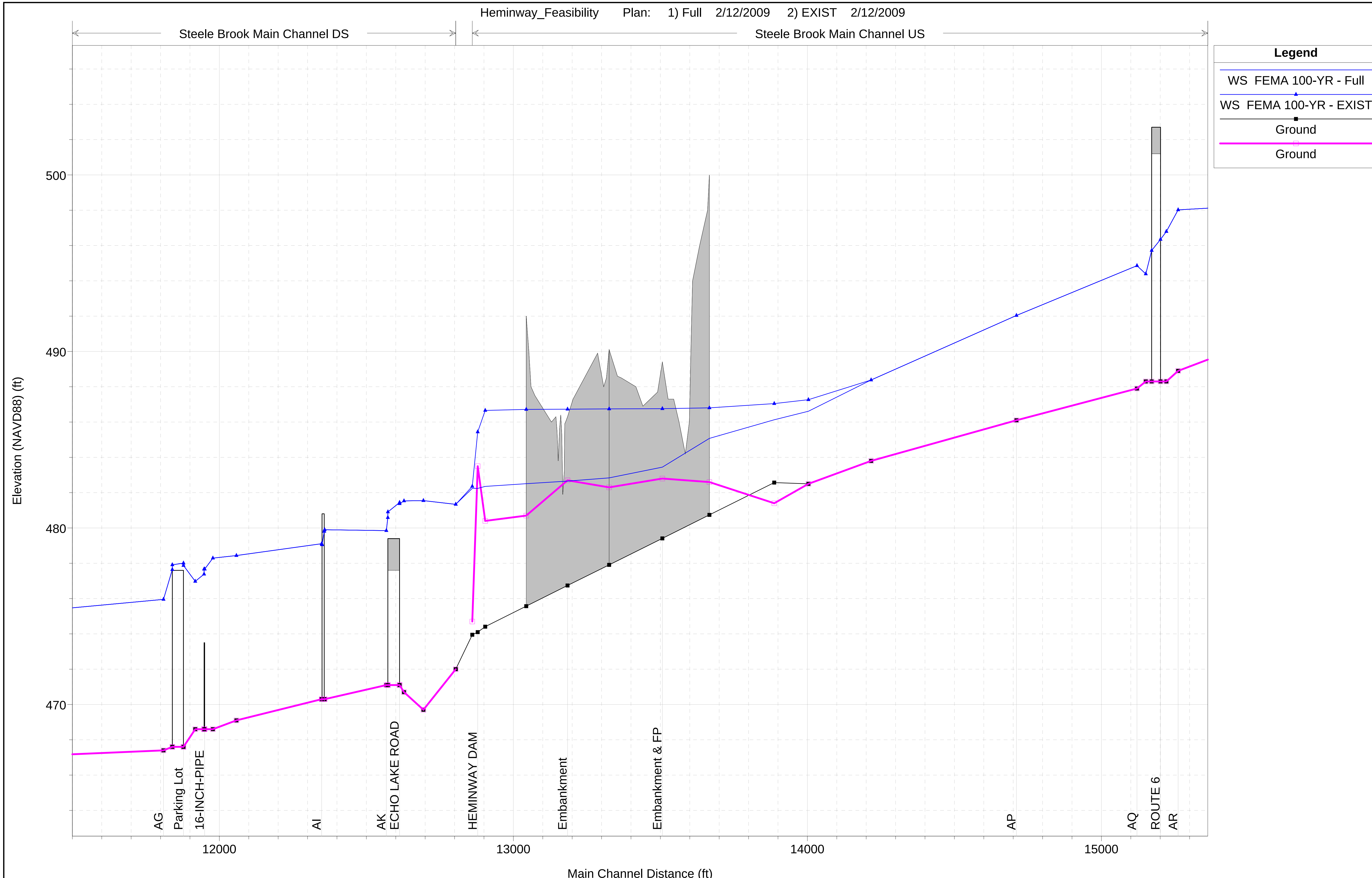


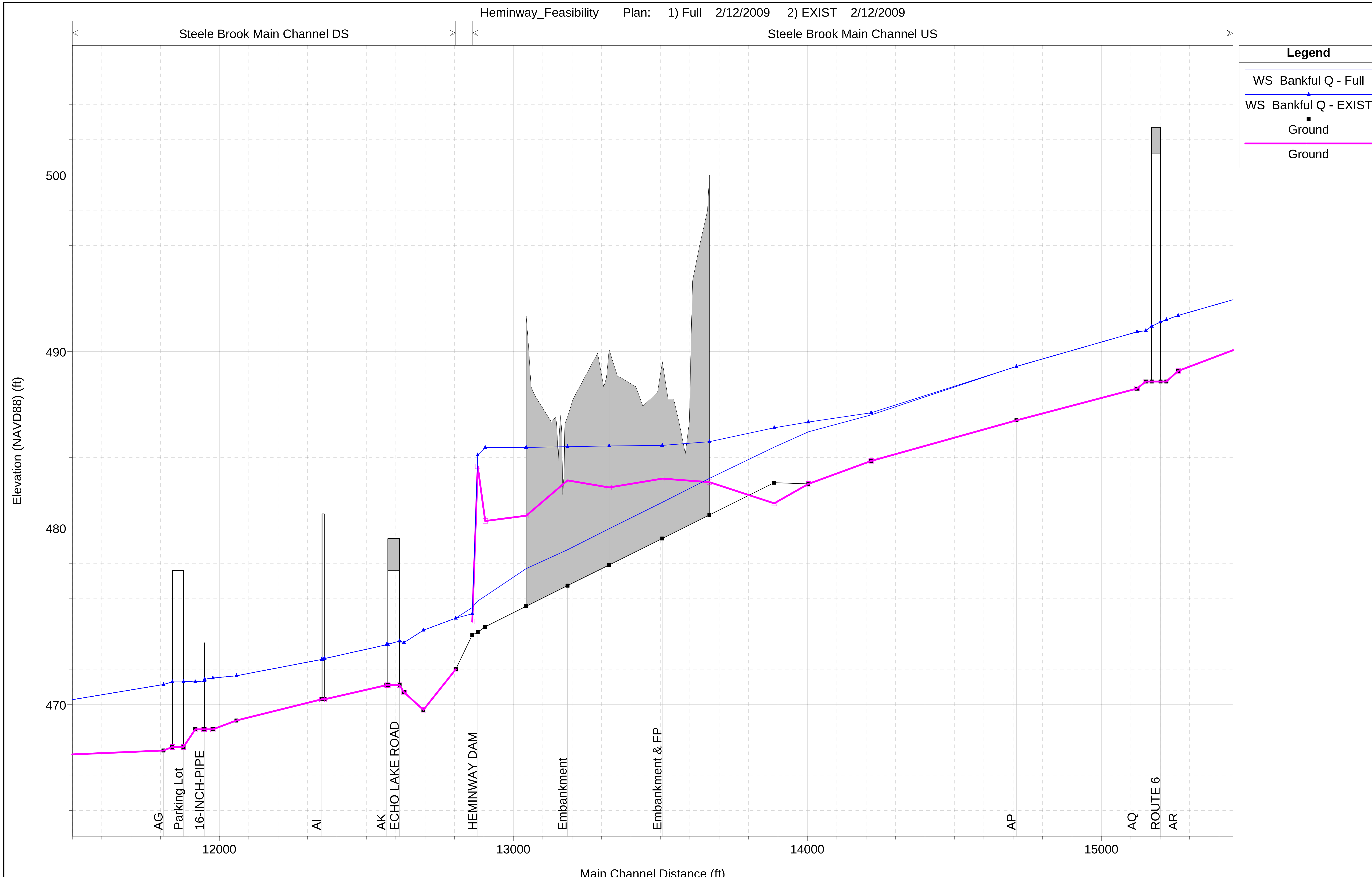
1 in Horiz. = 300 ft 1 in Vert. = 5 ft



1 in Horiz. = 300 ft 1 in Vert. = 5 ft




1 in Horiz. = 300 ft 1 in Vert. = 5 ft




1 in Horiz. = 300 ft 1 in Vert. = 5 ft