Attachment 2 – Project Location Photographs

Plate 1. View upstream of turf and fill covering the Broad Street culvert.

Plate 2. View downstream of turf and fill covering the Broad Street culvert.

Plate 3. View upstream showing the collapsed culvert roof section.

Plate 4. Location of the collapsed culvert roof section.

Attachment 3 – Cost Estimates for all Alternatives

Date: 11/30/2006

ASSUNPINK CREEK - BROAD STREET CULVERT REMOVAL

PRELIMINARY CONSTRUCTION COST SPREADSHEET

			Alternative 1			Alternative 2			Alternative 3			Alternative 4		
Item	Description	Unit	Contract Quantity	Unit price $	Amount $	Contract Quantity	Unit price $	Amount $	Contract Quantity	Unit price $	Amount $	Contract Quantity	Unit price $	Amount $
1	Clearing Site, Structure	LS	1	10000	10000	1	10000	10000	1	10000	10000	1	10000	10000
2	Demolition and removal (Conc)	CY	1065	350	372750	1180	350	413000	1241	350	434350	1980	350	693000
3	Earth Excavation, Subsurface Structures	CY	5140	50	257000	11300	50	565000	13800	50	690000	18060	50	903000
4	Borrow Excavation, Zone 1	CY	910	100	91000	4000	100	400000	5200	100	520000	7400	100	740000
5	Sheeting left in place	SF	9200	8	73600	4600	8	36800	1800	8	14400	0	8	0
6	Riprap Stone Slope Protection, 12" thick (D50=4")	SY	0	50	0	227	50	11350	283	50	14150	0	50	0
7	Riprap Stone Slope Protection, 18" thick (D50=6")	SY	0	80	0	0	80	0	0	80	0	2900	80	232000
8	Boulder, 2'-3'	Unit	0	300	0	0	300	0	0	300	0	100	300	30000
9	Boulder, 3'-4'	Unit	0	350	0	30	350	10500	30	350	10500	30	350	10500
10	Boulder, 5'-6'	Unit	0	450	0	10	450	4500	10	450	4500	10	450	4500
11	Geotextile	SY	737	100	73700	2800	100	280000	3100	100	310000	3740	100	374000
12	Topsoiling, 4" thick	SY	737	10	7370	2800	10	28000	3100	10	31000	3740	10	37400
13	Topsoil Stabilization Matting	SY	737	10	7370	2800	10	28000	3100	10	31000	3740	10	37400
14	Fertilizing and seeding	SY	737	1	737	2800	1	2800	3100	1	3100	3740	1	3740
15	Bentonite layer	SF	0	22	0	0	22	0	0	22	0	25500	22	561000
16	Dense graded aggregate base course, 10" thick	SY	0	20	0	0	20	0	0	20	0	2833	20	56660
17	Soil Investigation	LS	1	20000	20000	1	20000	20000	1	20000	20000	1	20000	20000
18	Foundation Excavation	CY	100	20	2000	200	20	4000	300	20	6000	0	20	0
19	Concrete in Structures, Retaining walls	CY	50	1000	50000	100	1000	100000	100	1000	100000	0	1000	0
20	Concrete in Structures, Sidewalks	CY	20	2000	40000	20	2000	40000	30	2000	60000	0	2000	0
21	Reinforcement Steel in Structures, Epoxy Coated	LBS	2500	2	5000	5000	2	10000	3000	2	6000	0	2	0
22	In-Fill Soil	CY	200	60	12000	450	60	27000	450	60	27000	0	60	0
23	Architectural Finish	SF	10200	60	612000	10200	60	612000	10200	60	612000	0	60	0
24	Tree Plantation, Preparation etc	LS	1	40000	40000	1	40000	40000	1	40000	40000	1	40000	40000
25	4-Bar Open Steel Bridge railing	LF	1000	300	300000	600	300	180000	450	300	135000	0	300	0
26	Stream Diversion	Unit	1	20000	20000	1	20000	20000	1	20000	20000	10	20000	200000
27	Surveying	LS	1	20000	20000	1	20000	20000	1	20000	20000	1	20000	20000
	Sum				$2,014,527			$2,862,950			$3,119,000			$3,973,200
	Relocation of Exist. Utilities Contigency				$700,000			$700,000			$700,000			$700,000
	Contingencies: 10%	10			$201,453			$286,295			$311,900			$397,320
	Mobilization: 15%	15			$302,179			$429,443			$467,850			$595,980
	TOTAL				**$3,218,159**			**$4,278,688**			**$4,598,750**			**$5,666,500**

Attachment 4 – Phase 1A Cultural Resource Reconnaissance Report – Summary and Recommendations

Chapter 5

SUMMARY AND RECOMMENDATIONS

To a large degree the Assunpink Creek corridor represents the backbone of historic Trenton. For several thousand years, the opportunity to access and utilize both the waters of the creek and the Delaware River has attracted people to the lands surrounding the confluence of the two waterways. With the arrival of the first permanent settlers of European background in the late 1670s, the seeds of Trenton's urban growth were planted. The Assunpink Creek as one of the defining features of the local physical landscape has played an important role in the history of Trenton ever since. Trenton's population has at various times relied on the creek as a significant source of hydropower and as an important recreational asset. In spite of this, over the course of the 19th and 20th centuries, the city gradually encroached upon the creek corridor and left it a narrow strip that winds through the urban fabric of modern Trenton. Each of these many chapters of the long history of Trenton has left its own unique evidence in the landscape of the Assunpink Creek Corridor. The result is that the current project area is scattered throughout with potentially significant cultural resources.

A. HISTORIC ARCHITECTURAL RESOURCES

From a historic architectural perspective, quite a large number of potential resources have been identified. These include individual historic buildings and bridges, factory and recreational complexes and historic districts.

Only two National Register-listed historic architectural resources have been identified within the project area. These are the Mill Hill Historic District (SR 4/13/1977 NR 12/12/1977) and the Delaware and Raritan Canal Historic District (NJ 11/30/1972 NR 5/11/1973). Several other historic architectural resources within the project area have been evaluated as being eligible for listing on the National Register by New Jersey Historic Preservation Office opinion. These are the South Broad Street Bridge [D1] (NJHPO opinion 5/31/1980), The South Clinton Avenue Stone Arch Bridge over the Assunpink Creek[F1] (NJHPO opinion 10/8/1997), the South Clinton Avenue Pratt Thru Truss Bridge (NJHPO opinion 10/8/1997)[F2], the Pennsylvania Railroad New York to Philadelphia Historic District/ Camden and Amboy Trenton to New Brunswick Line [F17] (NJHPO opinion 5/9/2002).

The Yard Avenue Historic District is a locally certified historic district established by the City of Trenton on 10/12/1983. The district has suffered such an extensive loss of historic fabric that it would not qualify for listing on the New Jersey or National Registers of Historic Places.

Field survey activities have identified eight additional historic architectural resources that may be eligible for listing on the National Register of Historic Places. These include the Norman Druck Motor Company/Mandeville Motor Company buildings [F30, F31 and F32], the Belvidere and Delaware Railroad/Belvidere Delaware Railroad Bridge over the Assunpink Creek [G6], the Oak Street Bridge [G15], the Murray, Whitehead and Murray Rubber Company/Joseph Stokes Rubber Company Complex [G22], the Star Rubber Works/ Empire Rubber Works Complex [H14 and H15], the De Laval Steam Turbine Company facility [H16], the Hetzel Park and the Hetzel Park Bridge over the Assunpink [H8 and H9] and the William Baker Machine Shop/Globe Porcelain Company Building [I6].

Additional work would need to be undertaken in order to make full evaluations of National Register eligibility particularly with reference to the several multi-component resources [F30, F31 and F32, G6, G22, H14 and H15 and H16]. It is impossible to fully assess project impacts on any of these resources in the absence of more developed project plans, however, a few general statements can be made at this time. From a historic architectural standpoint, simple recontouring of the creek banks would have little or no impact on individually eligible standing buildings. Grading/environmental restoration could impact historic architectural resources with associated archaeological components and could have an adverse effect within eligible or listed historic districts. The Mill Hill Historic District would be particularly sensitive to activities such as these. Demolition of any listed or eligible historic buildings or structures or any contributing buildings, structures, objects or sites within the bounds of a historic district would constitute an adverse effect. The proposed demolition of any of the buildings or structures identified by this survey as being potentially eligible for listing would require intensive level historic architectural survey to confirm their eligibility.

B. ARCHAEOLOGICAL RESOURCES

Potential archaeological resources have been identified throughout the study area, but once more detailed plans of the proposed environmental restoration are produced, Phase IB testing and research can focus in on the actual areas of potential effect. Some of this work may require manual test excavation or machine-assisted excavation while work in other areas may be accomplished by archaeological monitoring during construction.

Surface grading to restore the riparian habitat adjacent to the Assunpink Creek would likely encounter a variety of sites and would most likely require monitoring. The potential opening of the 500-foot culvert downstream from the South Broad Street Bridge, (Section B) would undoubtedly uncover a host of archaeological resources including the Eagle Cotton Factory [B23]. The projected removal of two railroad bridges would most likely require some level of archaeological recordation when they are identified.

The project area contains many resources with varying degrees of historical and archaeological importance. These resources fall into several categories of archaeological interest such as prehistoric, historic, industrial, transportation and mortuary sites. Archaeological sites within the four recognized historic districts may have added significance as contributing resources to these districts.

1. Prehistoric Sites

Although only two prehistoric sites have been recorded within the limits of the project area, the probability of finding additional sites along the surviving sections of the first terrace are high. Elsewhere in the City of Trenton, prehistoric resources have been recorded in areas of intense industrial and residential development (Hunter Research, Inc. 1996, 2002b). Surface grading to restore the riparian habitat along the first terrace adjacent to the Assunpink Creek would likely encounter additional prehistoric archaeological deposits.

2. Historic Sites

Historic sites consist of residential properties such as individual homes, row homes, and unidentified buildings likely to be residential and/or commercial buildings. At this level of study, residential resources of note are located within the boundaries two historic districts, the Mill Hill Historic District, and the Yard Avenue Local Historic District (Study Sections C, D and F). In the Mill Hill Historic District Several unidentified buildings are shown on the 1714 map of Trenton, and most likely represent the individual homes of some of the city's earliest inhabitants and therefore likely to be considered significant archaeological sites. Other house sites and sites thought to be residential would require additional research to determine their significance.

Commercial sites identified within the Mill Hill Historic District (Study Sections C & D) are also considered potentially significance resources (Assunpink Block [C3], D.Wolff Company [C8], Fitzgerald Company [C9], T.S. Evertt's Livery [D14], an ice house later identified as Whittakers [D17] and a store building identified as "Wilson" [D18]). These sites could potentially provide useful data concerning the commerce and economics of the City of Trenton.

3. Industrial Sites

Industrial sites represent the largest number of resources recorded within the study limits. Industrial sites include factories/mills, and structural modifications made to the creek to generate power or protect against flooding. The remains of these sites offer important information regarding the layout and operation of these facilities. Information gained from artifacts discarded by these manufacturing facilities would also be significant.

Important resources of note are the Golding's Flint and Spar Mill [A11], Stryker's Flour Mill [A21], the Moore Flour Mill/Trenton Roller Mills [B2], the Moore Oil Mill and raceway [B3 and B4] the Trenton Cotton Factory/Wilson Woolen Mill [B10], the Eagle Cotton Factory [B23], the Stacy Gristmill [C2], the Speeler Pottery Company ceramic waster dump [D13], Green's ironworks [F14], and Samuel Henry's Mill and raceway [H11 and 12]. Viewed as a whole, the entire length of the study area could potentially be considered an industrial archaeological district. Although such a determination would require additional investigation.

4. Transportation Sites

Transportation sites consist of canals, railroads, trolleys, bridges and associated buildings or structures. Potentially eligible transportation related resources lie within the Delaware and Raritan Canal District (Section E) and the Pennsylvania Railroad New York to Philadelphia District (Camden and Amboy Railroad Branch Line Historic District) (Sections E and F). Archaeological resources within these districts may potentially be considered contributing resources and be eligible for listing on the National Register of Historic Places.

5. Mortuary Sites

Two mortuary sites lie within the study limits. The portion of the Mercer Cemetery adjacent to the Assunpink Creek does not appear to have been used for burials. However, ground-penetrating radar (GPR) should be used in this area to look for possible unrecorded or unmarked grave shafts if ground-disturbing activities are planned. An African-American cemetery known as the Locust Hill Cemetery consists of an unknown number of individuals buried in unmarked graves. GPR would be a prudent step in establishing the locations of fallen headstones and unmarked grave shafts as well as establishing boundaries for the cemetery.

C. CONCLUSIONS

While this survey has preliminarily identified a large number of potential historic architectural and archaeological cultural resources within the project area, the number that will likely be impacted by the actual project undertaking should be significantly less. The development of more detailed project plans will help to exclude many of these from potential project related impacts. Selective intensive level architectural survey and, where necessary, Phase IB archaeological investigations will help to further winnow this list.

Attachment 5 – Clean Water Act Section 404(b)(1) Evaluation

Clean Water Act Section 404(b)(1) Evaluation

I. Project Description

a. Location

The Lower Assunpink Creek Ecosystem Restoration Project study area is located along a 3-mile section of the Lower Assunpink Creek in Trenton, New Jersey. Assunpink Creek is 25 miles long, and drains approximately 91 square miles in central New Jersey. The main tributaries that feed Assunpink Creek are Shabakunk Creek and Miry Run. The headwaters begin in Millstone Township, in Monmouth County, and flow into the Delaware River in Trenton. The project area for the proposed action evaluated for this report encompasses a 500-foot section of the Lower Assunpink Creek in downtown Trenton where the creek is contained within a box culvert.

b. General Description

The goal of the Lower Assunpink Creek Ecosystem Restoration Project is to restore migratory fish habitat, develop recreational opportunities, and improve the overall stream ecology of Assunpink Creek. These goals coincide with interstate management plans developed by the Atlantic States Marine Fisheries Commission (ASMFC) in 1985 to restore herring stocks in streams experiencing stream blockages.

The Broad Street culvert recently experienced a structural failure, which increased the urgency to implement a restoration action that would also address a public safety hazard. For this reason, this report documents the evaluation of alternatives for removal or "day lighting" of the Broad Street culvert along Assunpink Creek between South Broad Street and South Warren Street. The Broad Street culvert is a box culvert approximately 500 feet long, with two 9- by 22-foot flumes separated by a 3-foot center wall. The culvert contains a roof structure of 8-inch precast, hollow-core concrete deck slabs that are covered in soil, averaging 3 feet in the center of the culvert to 6 feet near the New Jersey Department of Human Services (DHS) building. The area over the culvert is mowed turf.

The full range of reasonable alternatives was considered during the National Environmental Policy Act (NEPA) process, resulting in the systematic elimination of alternatives that did not meet the purpose of and need for the action. The alternative that best met the environmental and technical criteria for this project site was selected as the proposed action. The proposed action was selected based on an evaluation of ecological benefits, structural stability, expected long term maintenance requirements, recreational benefits and construction cost estimates.

The proposed action will provide an open channel configuration for Assunpink Creek where it is currently contained within a buried concrete culvert. This will be accomplished through the complete removal of the culvert structure and the realignment of the creek into a natural channel. The channel dimension, or cross-section, will generally be narrowed and deepened. The project will incorporate instream structures such as log and rock cross-vanes and J-hooks, that center the flow, control the grade, and vary the channel bottom or profile. Both banks will be planted with riparian trees and shrubs to provide stability.

To enable work to be accomplished with minimal impacts to water quality, stream flows will be diverted into the northern culvert flume. This will allow for the southern flume be demolished under dry conditions and for excavation and grading of the realigned channel. The alignment of the new channel will be shifted away from the existing building's infrastructure while considering the egress and ingress of the creek to the South Broad Street and South Warren Street Bridges. Flows will be diverted into a temporary diversion channel to allow for the demolition of the northern flume.

There will be opportunities to create fish-spawning habitat and other aquatic habitat through channel design, instream structures, and creation of pools and riffles. Removal of the concrete bottom slab will also increase fishery migration opportunities by creating a varied substrate and will increase biodiversity through increased macroinvertebrate habitat. Other benefits include a restored riparian zone, providing a beneficial transition buffer between existing water and human land uses; improved habitats, including foraging and nesting areas, for fish-eating birds, small mammals, and aquatic wildlife species; improved runoff water quality by acting as a sediment and pollutant filter; and improved aesthetic and recreational value of the project area. A more-diverse ecosystem conducive to sustaining aquatic and wildlife species will result.

c. Authority and Purpose

The United States Army Corps of Engineers (USACE), Philadelphia District has initiated an environmental restoration project for the lower Assunpink Creek under authority of Section 1135 of the Water Resources Development Act of 1986. As amended, the Act provides authority for modifying the structure or operation of an existing USACE project, for the purpose of improving the quality of the environment in the public interest and to determine if the operation of such projects has contributed to the degradation of the quality of the environment. The City of Trenton, New Jersey, has agreed to serve as the project sponsor.

d. General Description of the Discharge Material

(1) Characteristics of Fill Material

Once the culvert structure is removed, stone boulders and riprap will be placed within the new channel.

(2) Fill materials

The proposed project would involve the addition of stone boulders and riprap placed within the realigned channel.

e. Description of Proposed Discharged Site

The discharge site is a 500-foot section of the lower Assunpink Creek in downtown Trenton where the creek is contained within a box culvert.

f. Description of Disposal Method

All materials removed from the site for disposal will be disposed of in accordance with all appropriate local, state and Federal rules and regulations.

II. Factual Determination

a. Physical Substrate Determination

Where the existing culvert is removed, stabilized native soil will provide the channel bank substrate.

b. Water Circulation, Fluctuation, and Salinity Determinations

Water chemistry, clarity, color, odor, taste, dissolved gas levels, nutrients, eutrophication, and other physical water quality factors would not be affected by the proposed project. Salinity determinations are not applicable to the proposed action.

c. Suspended Particulate/Turbidity Determination

The proposed action is expected to only temporarily increase suspended sediments and turbidity locally in the Assunpink Creek during construction of the project. No noticeable impacts to dissolved oxygen levels, toxic metals, organics, or pathogens would be anticipated. Impacts to photosynthetic, filter feeder, and sight feeders are expected to be minimal to nonexistent. During construction, stream flows will be diverted to the extent practical to isolate the work area from stream flows and minimize sedimentation. Long term benefits to the aquatic ecology and water quality would result from the proposed action.

d. Contaminant Determinations

Materials for construction of the project would be chemically stable and non-contaminating. Construction would take place in areas where the soil is not considered likely to be contaminated. Neither the fill or its placement would cause relocation or increases of contaminants in the aquatic ecosystem. Certification of the project under Section 401 will be requested from the New Jersey Department of Environmental Protection, and all requirements would be met prior to construction.

e. Aquatic Ecosystem and Organism Determinations

The proposed action should have no significant effects on the aquatic ecosystem. The proposed action is expected to enhance the aquatic ecosystem and to promote anadromous fish migration into the Assunpink Creek from the Delaware River. Adverse impacts resulting from the proposed action will be short-term and minor. Most aquatic species found in the project area are mobile, and it is anticipated that any species displaced during construction will return to utilize the area. As the project effects are temporary and short-term in nature, the project is not anticipated to adversely impact any state or Federally listed species.

f. Proposed Disposal Site Determinations

No violations of water quality standards are likely to occur as a result of the proposed project. The proposed action would have no adverse effect on municipal or private water supplies, recreational or commercial fisheries, water-related recreation, aesthetics, parks, national historic monuments, or similar preserves. The project would likely enhance water quality locally and would increase recreational opportunities for the public.

g. Determination of Cumulative Effects on the Aquatic Ecosystem

Because of the restorative nature of the proposed project, it is not anticipated to act in concert with other typical area construction activities in adversely impacting local aquatic or terrestrial ecosystems.

h. Determination of Secondary Effects on the Aquatic Ecosystem

No significant detrimental secondary effects are anticipated as a result of the proposed action.

III. Actions Taken to Minimize Adverse Impacts

1. To enable work to be accomplished with minimal impacts to water quality, stream flows will be diverted into the opposite culvert flume for which work is occurring. This will allow for demolition of existing structures to occur under dry conditions. Where the existing concrete culvert wall is removed, existing native soil will be stabilized and planted with native riparian and upland vegetation. No impacts to vegetated wetlands will occur during construction of the proposed project.

IV. Finding of Compliance

1. No adaptations of the Section 404(b)(1) guidelines were made relative to this evaluation.

2. The alternative of no Federal action was not feasible. If the Broad Street culvert is not restored to an open channel, it would continue to be present a public safety hazard and would continue to be a significant barrier to anadromous fish migration.

3. Certification under Section 401 will be applied for from the State of New Jersey. Certification will be obtained prior to construction.

4. The project would not introduce toxic substances into Assunpink Creek.

5. No significant impacts to Federal or state listed threatened and endangered species would result from the project.

6. No municipal or private water supplies would be affected by the proposed project. No sensitive or critical habitats would be affected, and no long-term

adverse impacts would occur to these habitats. Local water quality and aquatic habitat will be enhanced by the project.

7. Project construction materials would be chemically and physically stable.

8. The selected alternative has been reviewed for environmental impacts in an Environmental Assessment (EA). The EA supports the determination that the proposed action would lead to a Finding of No Significant Impact, pending public review and comment.

9. When compared to the other alternatives, the selected alternative provided the best combination of environmental benefits while minimizing environmental impacts.

10. The proposed actions would not significantly affect water quality and the aquatic ecosystem, and are found to be in compliance with the requirements of guidelines for Sections 404(b)(1) of the Clean Water Act, as amended.

Attachment 6 – Record of Non-Applicability

GENERAL CONFORMITY – RECORD OF NON-APPLICABILITY

Project/Action Name: Lower Assunpink Creek Ecosystem Restoration Project - Broad Street Culvert

Project/Action Identification Number: PWI# 167859

Project/Action Point of Contact: Brian Mulvenna

Phone: 215-656-6599

Project Begin Date: Fall 2007
Project End Date: Spring 2008

General Conformity under the Clean Air Act, Section 176 has been evaluated for the project described above according to the requirements of 40 CFR 93, Subpart B. The requirements of this rule are not applicable to this project/action because:

__XX__ The project/action is an exempt action under 40 CFR 93.153(c)(1).

Supporting documentation and emission estimates are

(__) ATTACHED
(__) APPEAR IN THE NEPA DOCUMENTATION
(_X_) OTHER: Not Required

.

SIGNED ______________________________
Environmental Coordinator

Attachment 7 – Qualitative Stream Evaluation Forms

Ohio EPA Qualitative Habitat Evaluation Index Field Sheet QHEI Score: 17/90

River Code: ____ RM: ____ Stream: ASS Unpink Creek - Broad St Culvert
Date: 11/13/06 Location: Alt 1 - top removal
Scorers Full Name: Davenport/Miller Affiliation: CH2M HILL

1] SUBSTRATE (Check ONLY Two SubstrateTYPE BOXES; Estimate % present)

TYPE	POOL	RIFFLE	TYPE	POOL	RIFFLE	SUBSTRATE ORIGIN	SUBSTRATE QUALITY
☐☐-BLDR /SLBS[10]			☐☐-GRAVEL [7]			Check ONE (OR 2 & AVERAGE)	Check ONE (OR 2 & AVERAGE)
☐☐-BOULDER [9]			☐☐-SAND [6]			☐ -LIMESTONE [1]	SILT: ☐- SILT HEAVY [-2]
☐☐-COBBLE [8]			☐☐-BEDROCK[5]			☐ -TILLS [1]	☐ -SILT MODERATE [-1]
☐☐-HARDPAN [4]			☐☐-DETRITUS[3]			☐ -WETLANDS[0]	☐ -SILT NORMAL [0]
☐☐-MUCK [2]			☒☒-ARTIFICIAL[0]	100	100	☒ -HARDPAN [0]	☐ -SILT FREE [1]
☐☐-SILT [2]			NOTE: Ignore Sludge Originating From Point Sources			☐ -SANDSTONE [0]	EMBEDDEDNESS: ☐ -EXTENSIVE [-2]
						☐ -RIP/RAP [0]	☐ -MODERATE [-1]
						☐ -LACUSTRINE [0]	☒ -NORMAL [0]
						☐ -SHALE [-1]	☐ -NONE [1]
						☐ -COAL FINES [-2]	

NUMBER OF SUBSTRATE TYPES: ☐-4 or More [2] ☐-3 or Less [0]
(High Quality Only, Score 5 or >)

COMMENTS: Open top concrete box

Substrate: 0 (Max 20)

2] INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions)
(Structure) TYPE: Score All That Occur

0 UNDERCUT BANKS [1] | 0 POOLS> 70 cm [2] | 0 OXBOWS, BACKWATERS [1]
0 OVERHANGING VEGETATION [1] | 0 ROOTWADS [1] | 0 AQUATIC MACROPHYTES [1]
0 SHALLOWS (IN SLOW WATER) [1] | 0 BOULDERS [1] | 0 LOGS OR WOODY DEBRIS [1]
0 ROOTMATS [1] COMMENTS: ____

AMOUNT: (Check ONLY One or check 2 and AVERAGE)
☐ - EXTENSIVE > 75% [11]
☐ - MODERATE 25-75% [7]
☐ - SPARSE 5-25% [3]
☒ - NEARLY ABSENT < 5%[1]

Cover: 1 (Max 20)

3] CHANNEL MORPHOLOGY: (Check ONLY One PER Category OR check 2 and AVERAGE)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY	MODIFICATIONS/OTHER	
☐ - HIGH [4]	☐ - EXCELLENT [7]	☐ - NONE [6]	☒ - HIGH [3]	☐ - SNAGGING	☐ - IMPOUND.
☐ - MODERATE [3]	☐ - GOOD [5]	☐ - RECOVERED [4]	☐ - MODERATE [2]	☒ - RELOCATION	☐ - ISLANDS
☒ - LOW [2]	☐ - FAIR [3]	☐ - RECOVERING [3]	☐ - LOW [1]	☐ - CANOPY REMOVAL	☐ - LEVEED
☐ - NONE [1]	☒ - POOR [1]	☒ - RECENT OR NO RECOVERY [1]		☐ - DREDGING	☐ - BANK SHAPING
				☐ - ONE SIDE CHANNEL MODIFICATIONS	

COMMENTS: ____

Channel: 7 (Max 20)

4]. RIPARIAN ZONE AND BANK EROSION (check ONE box per bank or check 2 and AVERAGE per bank) River Right Looking Downstream

RIPARIAN WIDTH	FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN)		BANK EROSION
L R (Per Bank)	L R (Most Predominant Per Bank)	L R	L R (Per Bank)
☐☐- WIDE > 50m [4]	☐ ☐-FOREST, SWAMP [3]	☐ ☐-CONSERVATION TILLAGE [1]	☒ ☒-NONE/LITTLE [3]
☐☐- MODERATE 10-50m [3]	☐ ☐-SHRUB OR OLD FIELD [2]	☒ ☒-URBAN OR INDUSTRIAL [0]	☐ ☐-MODERATE [2]
☒☒- NARROW 5-10 m [2]	☐ ☐-RESIDENTIAL, PARK, NEW FIELD [1]	☐ ☐-OPEN PASTURE, ROWCROP [0]	☐ ☐-HEAVY/SEVERE[1]
☐☐- VERY NARROW <5 m[1]	☐ ☐-FENCED PASTURE [1]	☐ ☐-MINING/CONSTRUCTION [0]	
☐☐- NONE [0]			

COMMENTS: ____

Riparian: 5 (Max 10)

5.]POOL/GLIDE AND RIFFLE/RUN QUALITY

MAX. DEPTH	MORPHOLOGY	CURRENT VELOCITY [POOLS & RIFFLES!]	
(Check 1 ONLY!)	(Check 1 or 2 & AVERAGE)	(Check All That Apply)	
☐ - >1m [6]	☐ -POOL WIDTH > RIFFLE WIDTH [2]	☐ -EDDIES[1]	☐ -TORRENTIAL[-1]
☐ - 0.7-1m [4]	☒ -POOL WIDTH = RIFFLE WIDTH [1]	☒ -FAST[1]	☐ -INTERSTITIAL[-1]
☐ - 0.4-0.7m [2]	☐ -POOL WIDTH < RIFFLE W. [0]	☒ -MODERATE [1]	☐ -INTERMITTENT[-2]
☐ - 0.2- 0.4m [1]		☐ -SLOW [1]	☒ -VERY FAST[1]
☒ - < 0.2m [POOL=0]	COMMENTS: ____		

Pool/Current: 4 (Max 12)

CHECK ONE OR CHECK 2 AND AVERAGE

RIFFLE DEPTH	RUN DEPTH	RIFFLE/RUN SUBSTRATE	RIFFLE/RUN EMBEDDEDNESS
☐ - *Best Areas >10 cm [2]	☐ - MAX > 50 [2]	☐-STABLE (e.g.,Cobble, Boulder) [2]	☐ - NONE [2]
☐ - Best Areas 5-10 cm[1]	☐ - MAX < 50[1]	☐-MOD. STABLE (e.g.,Large Gravel) [1]	☐ - LOW [1]
☐ - Best Areas < 5 cm [RIFFLE=0]		☐-UNSTABLE (Fine Gravel,Sand) [0]	☐ - MODERATE [0]
			☐ - EXTENSIVE [-1]

COMMENTS: Open top concrete box ☒ - NO RIFFLE [Metric=0]

Riffle/Run: 0 (Max 8)

Gradient: ____ (Max 10)

6] GRADIENT (ft/mi): ____ DRAINAGE AREA (sq.mi.): ~90

%POOL: 0 %GLIDE: 0
%RIFFLE: 0 %RUN: 100

*- Best areas must be large enough to support a population of riffle-obligate species

Ohio EPA Qualitative Habitat Evaluation Index Field Sheet QHEI Score: 30.6/90

River Code: ______ RM: ______ Stream: Assunpink Creek - Broad St Culvert
Date: ______ Location: Alts 2 + 3 partial wall removals
Scorers Full Name: Davenport/Miller Affiliation: CH2M HILL

1] SUBSTRATE (Check ONLY Two SubstrateTYPE BOXES; Estimate % present

TYPE	POOL	RIFFLE	TYPE	POOL	RIFFLE	SUBSTRATE ORIGIN	SUBSTRATE QUALITY
						Check ONE (OR 2 & AVERAGE)	Check ONE (OR 2 & AVERAGE)
☐☐-BLDR /SLBS[10]			☐☐-GRAVEL [7]			☐ -LIMESTONE [1]	SILT: ☐- SILT HEAVY [-2]
☐☒-BOULDER [9]	0	100	☐☐-SAND [6]			☐ -TILLS [1]	☐ -SILT MODERATE [-1]
☐☐-COBBLE [8]			☐☐-BEDROCK[5]			☐ -WETLANDS[0]	☐ -SILT NORMAL [0]
☐☐-HARDPAN [4]			☐☐-DETRITUS[3]			☒ -HARDPAN [0]	☐ -SILT FREE [1]
☐☐-MUCK [2]			☒☐-ARTIFICIAL[0]	20	80	☐ -SANDSTONE [0]	EMBEDDEDNESS: ☐ -EXTENSIVE [-2]
☐☐-SILT [2]			NOTE: Ignore Sludge Originating From Point Sources			☒-RIP/RAP [0]	☐ -MODERATE [-1]
						☐ -LACUSTRINE [0]	☒ -NORMAL [0]
						☐ -SHALE [-1]	☐ -NONE [1]
						☐-COAL FINES [-2]	

NUMBER OF SUBSTRATE TYPES: ☐-4 or More [2] ☐-3 or Less [0]
(High Quality Only, Score 5 or >)

COMMENTS: concrete bottom

Substrate: 9 (Max 20)

2] INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions)
(Structure) TYPE: Score All That Occur

- 0 UNDERCUT BANKS [1]
- 1 OVERHANGING VEGETATION [1]
- 0 SHALLOWS (IN SLOW WATER) [1]
- 0 ROOTMATS [1]
- 0 POOLS> 70 cm [2]
- 0 ROOTWADS [1]
- 1 BOULDERS [1]
- 0 OXBOWS, BACKWATERS [1]
- 0 AQUATIC MACROPHYTES [1]
- 0 LOGS OR WOODY DEBRIS [1]

COMMENTS: placed/secured boulders

AMOUNT: (Check ONLY One or check 2 and AVERAGE)
- ☐ - EXTENSIVE > 75% [11]
- ☐ - MODERATE 25-75% [7]
- ☒ - SPARSE 5-25% [3]
- ☐ - NEARLY ABSENT < 5%[1]

Cover: 3.6 (Max 20)

3] CHANNEL MORPHOLOGY: (Check ONLY One PER Category OR check 2 and AVERAGE)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY	MODIFICATIONS/OTHER	
☐ - HIGH [4]	☐ - EXCELLENT [7]	☐ - NONE [6]	☒ - HIGH [3]	☐ - SNAGGING	☐ - IMPOUND.
☐ - MODERATE [3]	☐ - GOOD [5]	☐ - RECOVERED [4]	☐ - MODERATE [2]	☒ - RELOCATION	☐ - ISLANDS
☒ - LOW [2]	☐ - FAIR [3]	☐ - RECOVERING [3]	☐ - LOW [1]	☐ - CANOPY REMOVAL	☐ - LEVEED
☐ - NONE [1]	☒ - POOR [1]	☒ - RECENT OR NO RECOVERY [1]		☐ - DREDGING	☐ - BANK SHAPING
				☐ - ONE SIDE CHANNEL MODIFICATIONS	

COMMENTS:

Channel: 7 (Max 20)

4]. RIPARIAN ZONE AND BANK EROSION (check ONE box per bank or check 2 and AVERAGE per bank) River Right Looking Downstream

RIPARIAN WIDTH L R (Per Bank)	FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) L R (Most Predominant Per Bank)	L R	BANK EROSION L R (Per Bank)
☐☐ - WIDE > 50m [4]	☐ ☐-FOREST, SWAMP [3]	☐ ☐-CONSERVATION TILLAGE [1]	☒ ☒-NONE/LITTLE [3]
☐☐ - MODERATE 10-50m [3]	☐ ☐-SHRUB OR OLD FIELD [2]	☒ ☒-URBAN OR INDUSTRIAL [0]	☐ ☐-MODERATE [2]
☒☒ - NARROW 5-10 m [2]	☐ ☐-RESIDENTIAL,PARK,NEW FIELD [1]	☐ ☐-OPEN PASTURE,ROWCROP [0]	☐ ☐-HEAVY/SEVERE[1]
☐☐ - VERY NARROW <5 m[1]	☐ ☐-FENCED PASTURE [1]	☐ ☐-MINING/CONSTRUCTION [0]	
☐☐ - NONE [0]			

COMMENTS:

Riparian: 5 (Max 10)

5.]POOL/GLIDE AND RIFFLE/RUN QUALITY

MAX. DEPTH (Check 1 ONLY!)	MORPHOLOGY (Check 1 or 2 & AVERAGE)	CURRENT VELOCITY [POOLS & RIFFLES!] (Check All That Apply)	
☐ - >1m [6]	☐-POOL WIDTH > RIFFLE WIDTH [2]	☒-EDDIES[1]	☐-TORRENTIAL[-1]
☐ - 0.7-1m [4]	☒-POOL WIDTH = RIFFLE WIDTH [1]	☒-FAST[1]	☐-INTERSTITIAL[-1]
☐ - 0.4-0.7m [2]	☐-POOL WIDTH < RIFFLE W. [0]	☒-MODERATE [1]	☐-INTERMITTENT[-2]
☒ - 0.2- 0.4m [1]		☒-SLOW [1]	☐-VERY FAST[1]
☐ - < 0.2m [POOL=0]	COMMENTS:		

Pool/Current: 6 (Max 12)

CHECK ONE OR CHECK 2 AND AVERAGE

RIFFLE DEPTH	RUN DEPTH	RIFFLE/RUN SUBSTRATE	RIFFLE/RUN EMBEDDEDNESS
☐ - *Best Areas >10 cm [2]	☐ - MAX > 50 [2]	☐-STABLE (e.g.,Cobble, Boulder) [2]	☐ - NONE [2]
☐ - Best Areas 5-10 cm[1]	☐ - MAX < 50[1]	☐-MOD. STABLE (e.g.,Large Gravel) [1]	☐ - LOW [1]
☐ - Best Areas < 5 cm [RIFFLE=0]		☐-UNSTABLE (Fine Gravel,Sand) [0]	☐ - MODERATE [0]
			☐ - EXTENSIVE [-1]

COMMENTS: ☒ - NO RIFFLE [Metric=0]

Riffle/Run: 0 (Max 8)

Gradient: (Max 10)

6] GRADIENT (ft/mi): ______ DRAINAGE AREA (sq.mi.) : ~90

%POOL: 10 %GLIDE:
%RIFFLE: %RUN: 90

*' Best areas must be large enough to support a population of riffle-obligate species

Ohio EPA Qualitative Habitat Evaluation Index Field Sheet QHEI Score: [ ]

River Code: RM: Stream: Assunpink Creek - Broad St Culvert 60.3/90

Date: 11/13/06 Location: Alt 4 culvert removal + stream realignment

Scorers Full Name: Davenport/Miller Affiliation: CH2M HILL

1] SUBSTRATE (Check ONLY Two SubstrateTYPE BOXES; Estimate % present

TYPE	POOL	RIFFLE	TYPE	POOL	RIFFLE	SUBSTRATE ORIGIN	SUBSTRATE QUALITY
☐☐-BLDR /SLBS[10]			☐☒-GRAVEL [7]	90	10	Check ONE (OR 2 & AVERAGE)	Check ONE (OR 2 & AVERAGE)
☒☐-BOULDER [9]	10	90	☐☐-SAND [6]			☐ -LIMESTONE [1]	SILT: ☐- SILT HEAVY [-2]
☐☐-COBBLE [8]			☐☐-BEDROCK[5]			☐ -TILLS [1]	☐ -SILT MODERATE [-1]
☐☐-HARDPAN [4]			☐☐-DETRITUS[3]			☐ -WETLANDS[0]	☐ -SILT NORMAL [0]
☐☐-MUCK [2]			☐☐-ARTIFICIAL[0]			☐ -HARDPAN [0]	☐ -SILT FREE [1]
☐☐-SILT [2]			NOTE: Ignore Sludge Originating From Point Sources			☐ -SANDSTONE [0]	EMBEDDEDNESS: ☐ -EXTENSIVE [-2]
						☒ -RIP/RAP [0]	☐ -MODERATE [-1]
NUMBER OF SUBSTRATE TYPES: (High Quality Only, Score 5 or >)			☒-4 or More [2]			☐ -LACUSTRINE [0]	☐ -NORMAL [0]
			☐-3 or Less [0]			☐ -SHALE [-1]	☐ -NONE [1]
						☐-COAL FINES [-2]	

COMMENTS natural channel design

Substrate: 18 (Max 20)

2] INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions)

(Structure) TYPE: Score All That Occur

- 0 UNDERCUT BANKS [1]
- 2 OVERHANGING VEGETATION [1]
- 1 SHALLOWS (IN SLOW WATER) [1]
- 0 ROOTMATS [1]
- 3 POOLS> 70 cm [2]
- 0 ROOTWADS [1]
- 3 BOULDERS [1]
- 0 OXBOWS, BACKWATERS [1]
- 0 AQUATIC MACROPHYTES [1]
- 1 LOGS OR WOODY DEBRIS [1]

COMMENTS:

AMOUNT: (Check ONLY One or check 2 and AVERAGE)
- ☐ - EXTENSIVE > 75% [11]
- ☒ - MODERATE 25-75% [7]
- ☐ - SPARSE 5-25% [3]
- ☐ - NEARLY ABSENT < 5%[1]

Cover: 11.3 (Max 20)

3] CHANNEL MORPHOLOGY: (Check ONLY One PER Category OR check 2 and AVERAGE)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY	MODIFICATIONS/OTHER	
☐ - HIGH [4]	☐ - EXCELLENT [7]	☐ - NONE [6]	☐ - HIGH [3]	☐ - SNAGGING	☐ - IMPOUND.
☐ - MODERATE [3]	☐ - GOOD [5]	☐ - RECOVERED [4]	☒ - MODERATE [2]	☐ - RELOCATION	☐ - ISLANDS
☒ - LOW [2]	☒ - FAIR [3]	☒ - RECOVERING [3]	☐ - LOW [1]	☐ - CANOPY REMOVAL	☐ - LEVEED
☐ - NONE [1]	☐ - POOR [1]	☐ - RECENT OR NO RECOVERY [1]		☐ - DREDGING	☐ - BANK SHAPING
				☐ - ONE SIDE CHANNEL MODIFICATIONS	

COMMENTS:

Channel: 10 (Max 20)

4]. RIPARIAN ZONE AND BANK EROSION (check ONE box per bank or check 2 and AVERAGE per bank) River Right Looking Downstream

RIPARIAN WIDTH L R (Per Bank)	FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) L R (Most Predominant Per Bank)	L R	BANK EROSION L R (Per Bank)
☐☐ - WIDE > 50m [4]	☐ ☐-FOREST, SWAMP [3]	☐ ☐-CONSERVATION TILLAGE [1]	☒ ☒-NONE/LITTLE [3]
☐☐ - MODERATE 10-50m [3]	☐ ☐-SHRUB OR OLD FIELD [2]	☒ ☒-URBAN OR INDUSTRIAL [0]	☐ ☐-MODERATE [2]
☒☒ - NARROW 5-10 m [2]	☐ ☐-RESIDENTIAL,PARK,NEW FIELD [1]	☐ ☐-OPEN PASTURE,ROWCROP [0]	☐ ☐-HEAVY/SEVERE[1]
☐☐ - VERY NARROW <5 m[1]	☐ ☐-FENCED PASTURE [1]	☐ ☐-MINING/CONSTRUCTION [0]	
☐☐ - NONE [0]			

COMMENTS:

Riparian: 5 (Max 10)

5.]POOL/GLIDE AND RIFFLE/RUN QUALITY

MAX. DEPTH (Check 1 ONLY!)	MORPHOLOGY (Check 1 or 2 & AVERAGE)	CURRENT VELOCITY [POOLS & RIFFLES!] (Check All That Apply)	
☐ - >1m [6]	☐ -POOL WIDTH > RIFFLE WIDTH [2]	☒ -EDDIES[1]	☐ -TORRENTIAL[-1]
☒ - 0.7-1m [4]	☒ -POOL WIDTH = RIFFLE WIDTH [1]	☒ -FAST[1]	☐ -INTERSTITIAL[-1]
☐ - 0.4-0.7m [2]	☐ -POOL WIDTH < RIFFLE W. [0]	☒ -MODERATE [1]	☐ -INTERMITTENT[-2]
☐ - 0.2- 0.4m [1]		☒ -SLOW [1]	☐ -VERY FAST[1]
☐ - < 0.2m [POOL=0]	COMMENTS:		

Pool/Current: 9 (Max 12)

CHECK ONE OR CHECK 2 AND AVERAGE

RIFFLE DEPTH	RUN DEPTH	RIFFLE/RUN SUBSTRATE	RIFFLE/RUN EMBEDDEDNESS
☒ - Best Areas >10 cm [2]	☒ - MAX > 50 [2]	☒-STABLE (e.g.,Cobble, Boulder) [2]	☐ - NONE [2]
☐ - Best Areas 5-10 cm[1]	☐ - MAX < 50[1]	☐-MOD. STABLE (e.g.,Large Gravel) [1]	☒ - LOW [1]
☐ - Best Areas < 5 cm [RIFFLE=0]		☐-UNSTABLE (Fine Gravel,Sand) [0]	☐ - MODERATE [0]
			☐ - EXTENSIVE [-1]

COMMENTS: ☐ - NO RIFFLE [Metric=0]

Riffle/Run: 7 (Max 8)

Gradient: [ ] (Max 10)

6] GRADIENT (ft/mi): ______ DRAINAGE AREA (sq.mi.) : ~90

%POOL: 40 %GLIDE: 10

%RIFFLE: 20 %RUN: 30

*Best areas must be large enough to support a population of riffle-obligate species

Ohio EPA Qualitative Habitat Evaluation Index Field Sheet QHEI Score: [ ] 15/90

River Code: ____ **RM:** ____ **Stream:** Assunpink Creek - Broad St Culvert
Date: 11/18/06 **Location:** Alt 5 - No Action Alternative (Existing Conditions)
Scorers Full Name: Davenport/Miller **Affiliation:** CH2M HILL

1] SUBSTRATE (Check ONLY Two SubstrateTYPE BOXES; Estimate % present

TYPE	POOL	RIFFLE	TYPE	POOL	RIFFLE	SUBSTRATE ORIGIN	SUBSTRATE QUALITY
						Check ONE (OR 2 & AVERAGE)	Check ONE (OR 2 & AVERAGE)
☐☐-BLDR /SLBS[10]			☐☐-GRAVEL [7]			☐ -LIMESTONE [1]	SILT: ☐- SILT HEAVY [-2]
☐☐-BOULDER [9]			☐☐-SAND [6]			☐ -TILLS [1]	☐ -SILT MODERATE [-1]
☐☐-COBBLE [8]			☐☐-BEDROCK[5]			☐ -WETLANDS[0]	☐ -SILT NORMAL [0]
☐☐-HARDPAN [4]			☐☐-DETRITUS[3]			☒ -HARDPAN [0]	☐ -SILT FREE [1]
☐☐-MUCK [2]			☒☒-ARTIFICIAL[0]	100	100	☐ -SANDSTONE [0]	EMBEDDEDNESS: ☐ -EXTENSIVE [-2]
☐☐-SILT [2]			NOTE: Ignore Sludge Originating From Point Sources			☐ -RIP/RAP [0]	☐ -MODERATE [-1]
						☐ -LACUSTRINE [0]	☒ -NORMAL [0]
						☐ -SHALE [-1]	☐ -NONE [1]
						☐ -COAL FINES [-2]	

NUMBER OF SUBSTRATE TYPES: ☐-4 or More [2] ☐-3 or Less [0]
(High Quality Only, Score 5 or >)
COMMENTS: Concrete Culvert

Substrate: 0 (Max 20)

2] INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions)
(Structure) **TYPE:** Score All That Occur

- 0 UNDERCUT BANKS [1]
- 0 OVERHANGING VEGETATION [1]
- 0 SHALLOWS (IN SLOW WATER) [1]
- 0 ROOTMATS [1]
- 0 POOLS> 70 cm [2]
- 0 ROOTWADS [1]
- 0 BOULDERS [1]
- 0 OXBOWS, BACKWATERS [1]
- 0 AQUATIC MACROPHYTES [1]
- 0 LOGS OR WOODY DEBRIS [1]

COMMENTS:

AMOUNT: (Check ONLY One or check 2 and AVERAGE)
- ☐ - EXTENSIVE > 75% [11]
- ☐ - MODERATE 25-75% [7]
- ☐ - SPARSE 5-25% [3]
- ☒ - NEARLY ABSENT < 5%[1]

Cover: 1 (Max 20)

3] CHANNEL MORPHOLOGY: (Check ONLY One PER Category OR check 2 and AVERAGE)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY	MODIFICATIONS/OTHER	
☐ - HIGH [4]	☐ - EXCELLENT [7]	☐ - NONE [6]	☒ - HIGH [3]	☐ - SNAGGING	☐ - IMPOUND.
☐ - MODERATE [3]	☐ - GOOD [5]	☐ - RECOVERED [4]	☐ - MODERATE [2]	☒ - RELOCATION	☐ - ISLANDS
☒ - LOW [2]	☐ - FAIR [3]	☐ - RECOVERING [3]	☐ - LOW [1]	☐ - CANOPY REMOVAL	☐ - LEVEED
☐ - NONE [1]	☒ - POOR [1]	☒ - RECENT OR NO RECOVERY [1]		☐ - DREDGING	☐ - BANK SHAPING
				☐ - ONE SIDE CHANNEL MODIFICATIONS	

COMMENTS:

Channel: 7 (Max 20)

4]. RIPARIAN ZONE AND BANK EROSION (check ONE box per bank or check 2 and AVERAGE per bank) River Right Looking Downstream

RIPARIAN WIDTH L R (Per Bank)	FLOOD PLAIN QUALITY (*PAST 100 Meter RIPARIAN*) L R (Most Predominant Per Bank)	L R	BANK EROSION L R (Per Bank)
☐☐- WIDE > 50m [4]	☐ ☐-FOREST, SWAMP [3]	☐ ☐-CONSERVATION TILLAGE [1]	☒ ☒-NONE/LITTLE [3]
☐☐- MODERATE 10-50m [3]	☐ ☐-SHRUB OR OLD FIELD [2]	☒ ☒-URBAN OR INDUSTRIAL [0]	☐ ☐-MODERATE [2]
☐☐- NARROW 5-10 m [2]	☐ ☐-RESIDENTIAL,PARK,NEW FIELD [1]	☐ ☐-OPEN PASTURE,ROWCROP [0]	☐ ☐-HEAVY/SEVERE[1]
☐☐- VERY NARROW <5 m[1]	☐ ☐-FENCED PASTURE [1]	☐ ☐-MINING/CONSTRUCTION [0]	
☒☒ - NONE [0]			

COMMENTS:

Riparian: 3 (Max 10)

5.]POOL/GLIDE AND RIFFLE/RUN QUALITY

MAX. DEPTH (Check 1 ONLY!)	MORPHOLOGY (Check 1 or 2 & AVERAGE)	CURRENT VELOCITY [POOLS & RIFFLES!] (Check All That Apply)	
☐ - >1m [6]	☐ -POOL WIDTH > RIFFLE WIDTH [2]	☐ -EDDIES[1]	☐ -TORRENTIAL[-1]
☐ - 0.7-1m [4]	☒ -POOL WIDTH = RIFFLE WIDTH [1]	☒ -FAST[1]	☐ -INTERSTITIAL[-1]
☐ - 0.4-0.7m [2]	☐ -POOL WIDTH < RIFFLE W. [0]	☒ -MODERATE [1]	☐ -INTERMITTENT[-2]
☐ - 0.2- 0.4m [1]		☐ -SLOW [1]	☒ -VERY FAST[1]
☒ - < 0.2m [POOL=0]	COMMENTS:		

Pool/Current: 4 (Max 12)

CHECK ONE OR CHECK 2 AND AVERAGE

RIFFLE DEPTH	RUN DEPTH	RIFFLE/RUN SUBSTRATE	RIFFLE/RUN EMBEDDEDNESS
☐ - *Best Areas >10 cm [2]	☐ - MAX > 50 [2]	☐-STABLE (e.g.,Cobble, Boulder) [2]	☐ - NONE [2]
☐ - Best Areas 5-10 cm[1]	☐ - MAX < 50[1]	☐-MOD. STABLE (e.g.,Large Gravel) [1]	☐ - LOW [1]
☐ - Best Areas < 5 cm [RIFFLE=0]		☐-UNSTABLE (Fine Gravel,Sand) [0]	☐ - MODERATE [0]
			☐ - EXTENSIVE [-1]

COMMENTS: ☒ - NO RIFFLE [Metric=0]

Riffle/Run: 0 (Max 8)

Gradient: [ ] (Max 10)

6] GRADIENT (ft/mi): ______ DRAINAGE AREA (sq.mi.) : ~90

%POOL: [ ] %GLIDE: [ ]
%RIFFLE: [ ] %RUN: 100

*' Best areas must be large enough to support a population of riffle-obligate species

Is Sampling Reach Representative of the Stream (Y/N)___ If Not, Explain:

Subjective Rating (1-10): ☐

Aesthetic Rating (1-10): ☐

Gradient: ☐ - Low, ☐ - Moderate, ☐ -High

	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy -% Open
First Sampling Pass					

Stream Measurements:

Average Width	Average Depth	Maximum Depth	Av. Bankfull Width	Bankfull Mean Depth	W/D Ratio	Bankfull Max Depth	Floodprone Area Width	Entrench. Ratio

Major Suspected Sources of Impacts (Check All That Apply):
- None ☐
- Industrial ☒
- WWTP ☐
- Ag ☐
- Livestock ☐
- Silviculture ☐
- Construction ☐
- Urban Runoff ☒
- CSOs ☐
- Suburban Impacts ☐
- Mining ☐
- Channelization ☒
- Riparian Removal ☒
- Landfills ☐
- Natural ☐
- Dams ☐
- Other Flow Alteration ☒
- Other: Culvert

Stream Drawing:

Instructions for scoring the alternate cover metric: Each cover type should receive a score of between 0 and 3, Where: 0 - Cover type absent; 1 - Cover type present in very small amounts or if more common of marginal quality; 2 - Cover type present in moderate amounts, but not of highest quality or in small amounts of highest quality; 3 - Cover type of highest quality in moderate or greater amounts. Examples of highest quality include very large boulders in deep or fast water, large diameter logs that are stable, well developed rootwads in deep/fast water, or deep, well-defined, functional pools.

Yes	No	
☐	☒	Is Stream Ephemeral (no pools, totally dry or only damp spots)?
☒	☐	Is there water upstream? How Far: 90 sq mi DA
☒	☐	Is There Water Close Downstream? How Far: Delaware River
☐	☒	Is Dry Channel Mostly Natural?

Appendix A – Birdsall Engineering, Inc. Letter Report, September 5, 2006

BIRDSALL ENGINEERING, INC.
CONSULTING & ENVIRONMENTAL ENGINEERS

A BIRDSALL SERVICES GROUP COMPANY

Via Facsimile (609)-633-8598

State of New Jersey
Department of Human Services
Office of Facilities Support
P.O. Box 700
Trenton, NJ 08625-0700

September 5, 2006
Proposal No. BEI060905RCM1

Attn: William Schaffer

Re: **Capital Place One**
222 South Warren Street
Trenton, NJ

Dear Mr. Schaffer:

Per your request, Birdsall Engineering Inc. (BEI) responded to a structural failure that occurred directly adjacent to the Capital Place One office building, which is occupied by the State of New Jersey, Department of Human Services. The structural failure consisted of a large 'sinkhole' in the ground abutting the Southeast corner of the building. It was first noticed in the morning of September 3, 2006. BEI personnel consisting of Thomas K. Rospos, P.E., Richard C. Maloney, P.E. and Nicolas Dicotiis, were onsite to inspect the 'sinkhole' at 3:30 p.m. on September 3, 2006.

Observation revealed that the 'sinkhole' is the result of a failure of the roof structure of an underground culvert that carries the Assunpink Creek from South Broad Street past South Warren Street. Plans of the building's recent renovation (Sheets T-3 and A-100, prepared by Ronald Schmidt & Associates, P.C., dated 2-22-00) and field inspection show that this culvert runs from the bridge at South Broad Street and traverses the open field located to the East and South of Capital Place One, and literally passes "right by" the Southeast corner of the building. The original structural plans of the building (prepared by Gleit, Olenek & Associates P.C., dated 4/20/77) show that the culvert wall abuts that actual corner of the building's foundation. Water was flowing through both flumes of the culvert at the time of the inspection.

Inspection at the culvert ends indicate that the culvert structure is made up of two concrete sidewalls and a concrete center wall which divides the culvert into two 22' +/- wide flume openings. The culvert contains a roof structure that consists of 8" deep precast, hollow-core concrete deck slabs, spanning each 22' wide half of the culvert. The precast deck slabs contain a reinforced concrete topping (thickness unknown). The culvert roof is then covered with soil. The areas of the culvert around Capital Place One and along South Warren Street also contain concrete walls and brick patios over the culvert roof. The height of soil and structure over the culvert roof ranges from approximately 3' in the open field to over 6' in the areas of the brick patios.

Inspection revealed that the structural failure consisted of the culvert roof structure in an approximately 24' by 35' area directly at the patio and stairs to the South of Capital Place One.

☒ 611 Industrial Way West, Eatontown, NJ 07724-2213, P 732.380.1700, F 732.380.1701
☐ 529 Route 9, Barnegat, NJ 08005-2120, P 609.698.1144
☐ 95A Connecticut Drive, Burlington, NJ 08016, P 609.239.4378
☐ 560 Hudson Street, Hackensack, NJ 07601, P 201.562.1500

BIRDSALL ENGINEERING, INC.
CONSULTING & ENVIRONMENTAL ENGINEERS

A BIRDSALL SERVICES GROUP COMPANY

The roof deck slabs over the northern flume of the culvert collapsed into the culvert. The collapse of the deck slabs removed support for the soil and structure above, which in turn collapsed into the culvert. Sections of the wall and stair structure above the roof collapse still remain in place, however these sections are extremely unstable and could collapse into the culvert at any time. The use of precast hollow-core slabs in a buried condition is a very questionably application and the failure of the deck slabs can most likely be attributed to some combination of the following three conditions.

Hollow-core slabs contain large voids inside the slabs and gain their strength from high-strength strands of steel that are located in the bottom segments of the deck slab. In an exterior application, especially a buried application, the deck slab is exposed to continual moisture and water infiltration. In this application, the slabs are exposed to the creek below and continual water seepage through joints from the soil above. Evidence of water seepage was seen on the exposed walls in the collapsed area. The steel strands usually contain only about 1 ¼" of concrete cover and when exposed to such moist conditions, the possibility of eventual corrosion of the strands is great. When the strands corrode, they expand and cause the concrete to spall, only accelerating the corrosion process and reducing the bonding strength of the strand to the deck slab. Both of these conditions can eventually lead to sudden collapse. Secondly, when hollow-core deck slabs are not properly installed with weep holes and are then exposed to freezing, the cores which inevitably collect water are subject to freezing which can also cause catastrophic damage to the structural integrity of the deck slabs. Finally, 8" deck slabs spanning approximately 22' have allowable load carrying capacities that are lower than the conditions that appear to exist at this site. The load of three feet of soil alone is on the order of 350 pounds per square foot, which is beyond the traditional carrying capacities for 8" decks. This load only rises at the areas of the raised patios and walls, and also does not include the load of the reported ponds of water that collect in the open field during heavy rains.

From our visual inspection, we have determined that the collapse is from the failure of the culvert roof deck slabs. Further, based on the reasons outlined above, we have concern that other sections of the culvert roof may contain highly questionably structural integrity with the potential for sudden collapse. While walking the open field over the culvert, one section of grass appeared to have settled over the culvert roof only strengthening our concern of the roof's integrity. **BEI highly recommends that the entire culvert roof area including a minimum buffer of 10 feet on each side of the culvert be pardoned off to any access. No access should be allowed on top of the culvert until the entire culvert roof structure can be inspected and properly repaired.** Our inspection was limited to visual observations as made from the ground surface and did not include any inspection of the actual roof of the culvert, which will require access into the culvert to perform. It is our understanding that the actual culvert belongs to the City of Trenton. This letter assumes that further inspection of the culvert will be the responsibility of the City of Trenton including investigation into the items mentioned above.

BIRDSALL ENGINEERING, INC.
CONSULTING & ENVIRONMENTAL ENGINEERS

A BIRDSALL SERVICES GROUP COMPANY

William Schaffer

September 5, 2006
Proposal No. BEI060905RCM1

We informed Mr. M. Sean Semple, Acting Director of the Division of Traffic and Transportation for the City of Trenton, who was present on site at the time of the inspection, of our findings and recommendations. We further informed Mr. Semple of the fact that South Warren Street was located over the culvert. He stated that this section of the culvert did in fact contain a reinforced concrete roof and not the precast deck slabs observed at the 'sinkhole' location and at the beginning of the culvert at South Broad Street. We further request through this letter that the State of New Jersey send a copy of this letter to the City of Trenton formalizing our recommendations of their structure.

With regards to the actual building, Capital Place One, review of the structural drawings indicate that the building structure is supported on steel H-piles that extend down to "ledge rock". The perimeter grade beam of the building is thickened to 12'-6" at the Southeast corner of the building to apparently address the existence of the culvert structure. With the failure being related to the culvert roof slabs and the building being independently supported on its own deep foundation system, the structural failure of the culvert roof does not compromise the structural integrity or safety of the building structure. It is our professional opinion that it is safe to occupy and use Capital Place One as long as external access is restricted from the areas over the culvert roof and a 10' buffer on each side of the culvert as was outlined in the field at the time of the inspection and as marked on the attached plan of the building site.

We trust that this inspection letter addresses your immediate concerns. If you need further assistance as this issue proceeds or if you have any questions, please do not hesitate to contact either Thomas Rospos at 732-380-1700, extension 1201, or the undersigned at extension 1274.

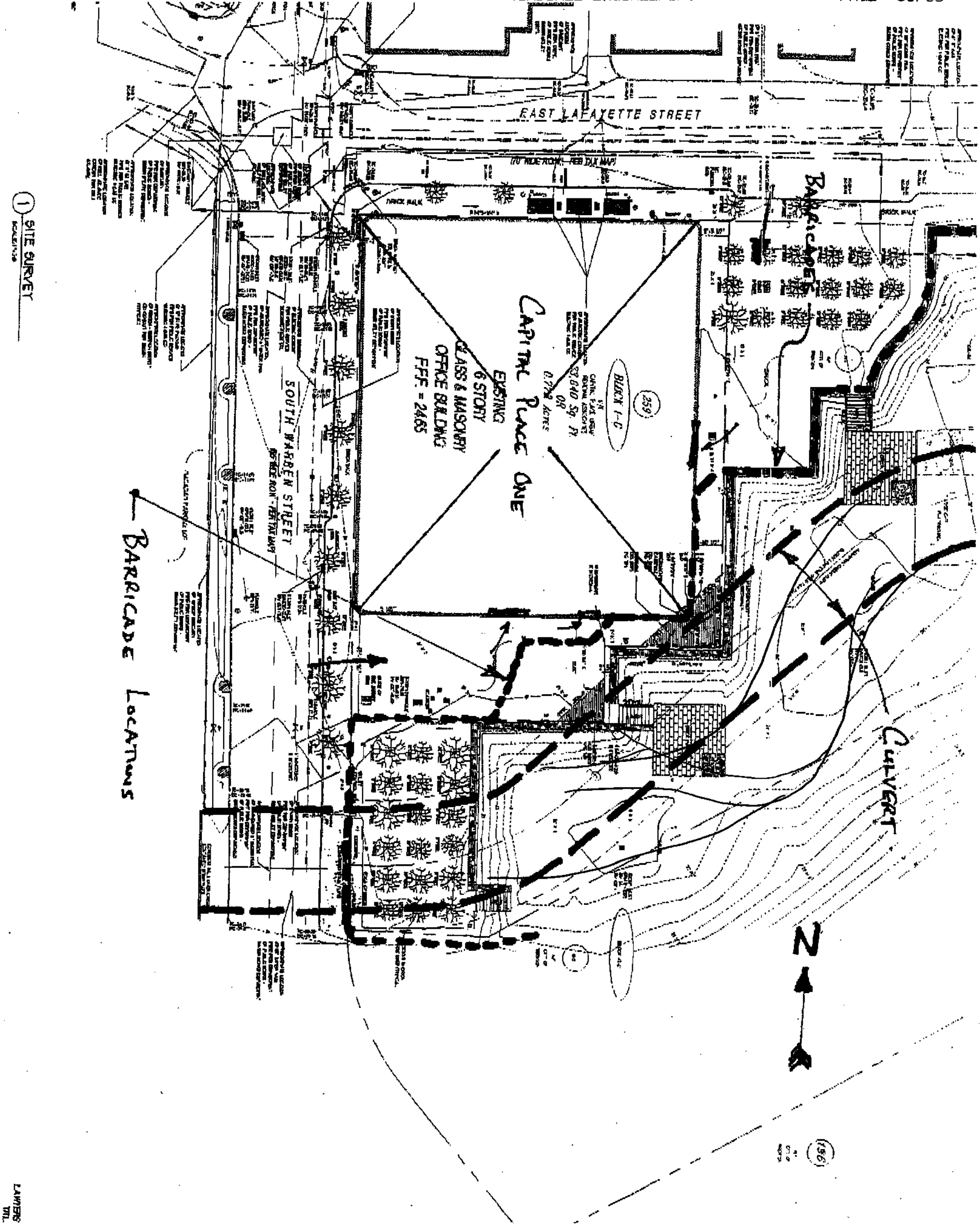
Very truly yours,

BIRDSALL ENGINEERING, INC.

Richard C. Maloney, P.E.
Vice President

RCM:aic
Attachment

cc: Thomas K. Rospos, P.E., Executive Vice President, BEI
William T. Birdsall, P.E., Senior Vice President, BEI


EAST LAFAYETTE STREET
SOUTH WARREN STREET
CAPITAL PLACE ONE
EXISTING
6 STORY
GLASS & MASONRY
OFFICE BUILDING
BLOCK 1-C
BARRICADES
BARRICADE LOCATIONS
CULVERT
N
SITE SURVEY

Appendix B – NJDEP Division of Fish and Wildlife Correspondence

Murphy, Kate/PHL

From: Lisa Barno [Lisa.Barno@dep.state.nj.us]
Sent: Friday, September 08, 2006 9:21 AM
To: Murphy, Kate/PHL
Cc: Christopher Smith
Subject: Assunpink Creek

Hi Kate -

As far as the benefits of removing the culvert - it would greatly enhance anadromous fisheries runs into Assunpink Creek from the Delaware River for American shad, alewife and bluback herring. Those species, in particular Am shad will not pass through a dark culvert, particulalrly considering the extensive length of the cuilvert on Assunpink. It will also benefit other resident fish species by improving in-stream habitat. Of course, this will all depend on how well a channel design is developed for the project - need to get away from the trapezoidal, straight channel design which only benefits getting water from point A to point B but does nothing for creating viable stream habitat. Will need curves, bends, deeper pool areas, and shallow stretches with substrate which remain in tact but is not rip rap from one side of the bank to the other. Of course riparian vegetation along the banks of the new channel will do well of additional habitat, as well as water temperatures. Rock and boulders, as well as log structures will also increase fish habitat as well as macroinvertebrate populations.

As for the negatives, there are always the impacts, sedimentation etc associated during the construction phase, and again good channel design, is critical to the success of the project.

Hope this is helpful. Unfortunately, although just returning from vacation I will be at a conference next week but Chris Smith is the regional biologist and is very familiar with Assunpink Creek. He can be reached at 856 629 0450 if you have any additional questions.

Lisa Barno
Chief, Freshwater Fisheries

Lisa Barno

Murphy, Kate/PHL

From: Lisa Barno [Lisa.Barno@dep.state.nj.us]
Sent: Friday, September 08, 2006 10:25 AM
To: Murphy, Kate/PHL
Subject: RE: Assunpink Creek

Benefits are HUGE to get the bottom removed

Lisa Barno

>>> <Kate.Murphy@CH2M.com> 09/08/06 10:10 AM >>>
One additional question to follow up: The culvert does not have a natural bottom, and therefore the water travels at a faster rate at this point. There are two options if the culvert is removed, which are: to remove the entire culvert, cement bottom included, or to remove just the top and the majority of the side walls. How would not removing the bottom of the cement culvert impact fish species and other in stream habitat (if they choose this option, they would most likely do something to slow down the water at this point). Are the benefits much greater to remove the entire bottom to create a natural bottom, or do you feel the fish would still be able to pass? Basically, we are trying to obtain information for a cost benefit analysis.

Thank you so much for all of the information you have provided. I appreciate you taking the time for this!

I hope you enjoyed your vacation-

Thanks,

Kate

-----Original Message-----
From: Lisa Barno [mailto:Lisa.Barno@dep.state.nj.us]
Sent: Friday, September 08, 2006 9:21 AM
To: Murphy, Kate/PHL
Cc: Christopher Smith
Subject: Assunpink Creek

Hi Kate -

As far as the benefits of removing the culvert - it would greatly enhance anadromous fisheries runs into Assunpink Creek from the Delaware River for American shad, alewife and bluback herring. Those species, in particular Am shad will not pass through a dark culvert, particulalrly considering the extensive length of the cuilvert on Assunpink. It will also benefit other resident fish species by improving in-stream habitat.
Of course, this will all depend on how well a channel design is developed for the project - need to get away from the trapezoidal, straight channel design which only benefits getting water from point A to point B but does nothing for creating viable stream habitat. Will need curves, bends, deeper pool areas, and shallow stretches with substrate which remain in tact but is not rip rap from one side of the bank to the other. Of course riparian vegetation along the banks of the new channel will do well of additional habitat, as well as water temperatures. Rock and boulders, as well as log structures will also increase fish habitat as well as macroinvertebrate populations.

As for the negatives, there are always the impacts, sedimentation etc associated during the construction phase, and again good channel design, is critical to the success of the project.

Hope this is helpful. Unfortunately, although just returning from vacation I will be at a conference next week but Chris Smith is the regional biologist and is very familiar with Assunpink Creek. He can be reached at 856 629 0450 if you have any additional questions.

Lisa Barno

Murphy, Kate/PHL

From: Christopher Smith [Christopher.Smith@dep.state.nj.us]
Sent: Friday, September 08, 2006 3:25 PM
To: Murphy, Kate/PHL
Subject: Assunpink Creek

Kate

Lisa Barno asked that I contact you regarding the potential Assunpink Creek project. I have read the correspondence between yourself and Lisa about the proposed project. As Lisa has stated that any removal of impediments and underground culverts/pipes will great increase the passage of migratory fish such as river herring, American shad, American eel to name a few. Additionally, the warmwater fish population (largemouth bass, smallmouth bass, bluegill, perch, etc.) will also benefit by increased and improved habitat.

My first question is what specific section of the creek is proposed for culvert removal? All or just selected segments?

To answer some of the questions that have been raised regarding recreation usage of the area following a stream restoration; this really depends on the level of restoration. If all obstructions were removed within the vicinity of Trenton, fish would have about 3.5 miles of habitat before they reach the first impediment at Whitehead Pond Dam. Anadromous fish, river herring, were collected in 1975 at the Warren St. bridge however have never been collected farther upstream. Boat access would depend on tidal stage and water depth but would essentially provide about 3.5 miles of stream. Shoreline access would depend on ownership of neighboring property.

It is difficult to say exactly how many species would utilize the creek once restoration was completed but the removal of obstructions would provide the potential for a full range of warmwater and anadromous species to use the creek.

I know that I have only scratch the surface of the questions. Please contact me directly with anymore questions.

Chris

Christopher Smith
Senior Fisheries Biologist
New Jersey Department of Environmental Protection Division of Fish and Wildlife Bureau of Freshwater Fisheries 220 Blue Anchor Rd.
Sicklerville, NJ 08081
(856) 629-4950

Appendix C – Assunpink Creek Hydraulic Model Technical Memorandum

Hydraulic Modeling of Lower Assunpink Creek

PREPARED FOR:	Brian Mulvenna/USACE
PREPARED BY:	CH2M HILL
COPIES:	Scott Oppelt/CH2M HILL Aditya Tyagi/CH2M HILL
DATE:	September 28, 2006

Objective and Scope

The objective of this technical memorandum is to present the results of the hydraulic modeling of the Lower Assunpink Creek for three continuous miles between the confluence with the Delaware River to the upstream corporate limit of the City of Trenton. There are two main purposes of this hydraulic modeling effort: (1) to study various alternatives of culvert removal at the Broad Street and its potential impacts on flooding and determine the best alternative, and (2) to provide flow velocities and corresponding shear stresses required for stream restoration improvement efforts such as designing appropriate stream cross sections and bank stabilization projects.

HEC-RAS Model and Input Data Requirements

HEC-RAS is a hydraulic model developed by the Hydrologic Engineering Center (HEC) of the U.S. Army Corps of Engineers. HEC-RAS is a one-dimensional model, intended for computation of water surface profile computations. The system is capable of modeling subcritical, supercritical, and mixed-flow regimes for streams consisting of a full network of channels, a dendritic system, or a single river reach for both steady and unsteady flows. The model results are typically applied in floodplain management and flood insurance studies to evaluate the effects of floodplain encroachment. The function of the HEC-RAS model is to determine water surface elevations at all locations of interest. The data needed to perform these computations are separated into geometric data, steady flow data, and boundary conditions.

Geometric Data

The basic geometric data used by HEC-RAS for hydraulic analysis consist of layout and dimensions of river reaches stream channel cross sections at various locations along the stream, reach length, and hydraulic structures such as bridges and culverts. In each cross section, the locations of the stream banks are identified and used to define the left floodplain, main channel, and right floodplain (Figure 1). HEC-RAS subdivides the cross sections in this manner because of differences in hydraulic parameters. For example, the wetted perimeter in the floodplain is much higher than in the main channel. Thus, friction forces between the water and channel bed have a greater influence in flow resistance in the floodplain. As a result, the flow velocity and conveyance are substantially higher in the main channel than in the floodplain.

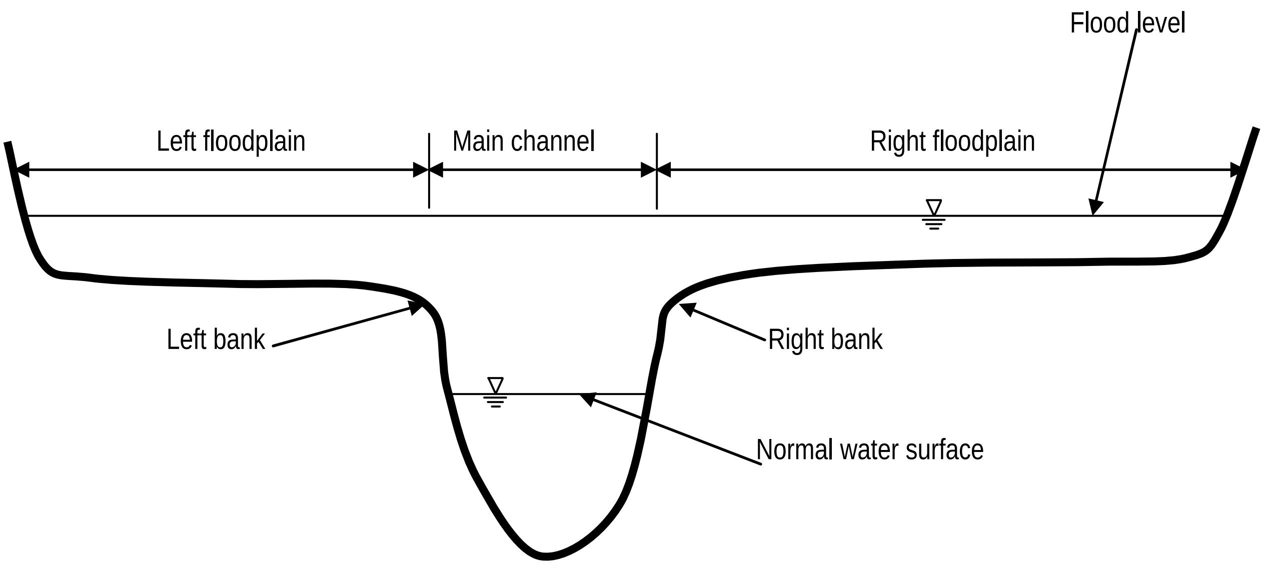


Figure 1: A typical stream cross section

At each cross section, HEC-RAS uses several input parameters to describe shape, elevation, and relative location along the stream:

1. River station (cross section) number
2. Horizontal (station) and vertical (elevation) coordinates for each terrain point describing the cross section
3. Left and right bank station locations
4. Reach lengths between the left floodplain, stream centerline, and right floodplain of adjacent cross sections (The three reach lengths represent the average flow path between two adjacent cross sections. As such, the three reach lengths between adjacent cross sections may differ in magnitude due to bends in the stream.
5. Manning's roughness coefficients
6. Channel contraction and expansion coefficients
7. Geometric description of any hydraulic structures, such as bridges, culverts, and weirs.

Flow Regime, Discharge Data, and Boundary Conditions

The flow regime needs to be specified in order to conduct a desired hydraulic analysis. Computations proceed upstream for subcritical flow and downstream for supercritical flow. In cases where the flow regime changes from subcritical to super critical or super critical to subcritical, the program is run in a mixed flow regime mode.

Discharge information is required at each cross section starting from upstream to down stream for each reach. The flow rate can be changed at any cross section within a reach.

Boundary conditions are necessary to establish the starting water surface elevations at the ends of the river system. The water surface is specified at the downstream end for subcritical regime, at the upstream end for the supercritical regime, and at both downstream and upstream for mixed flow regime.

HEC-RAS Model Development for the Lower Assunpink Creek

GIS layers including the digital terrain model (DTM) of the river system, corporate boundaries, spot elevations, hydrography, and roads were processed to develop geometric data for HEC-

RAS. Additional layers were created to define the stream centerline, flow paths, main channel banks, and cross section cut lines at approximately 200-foot intervals as shown in Figure 2.

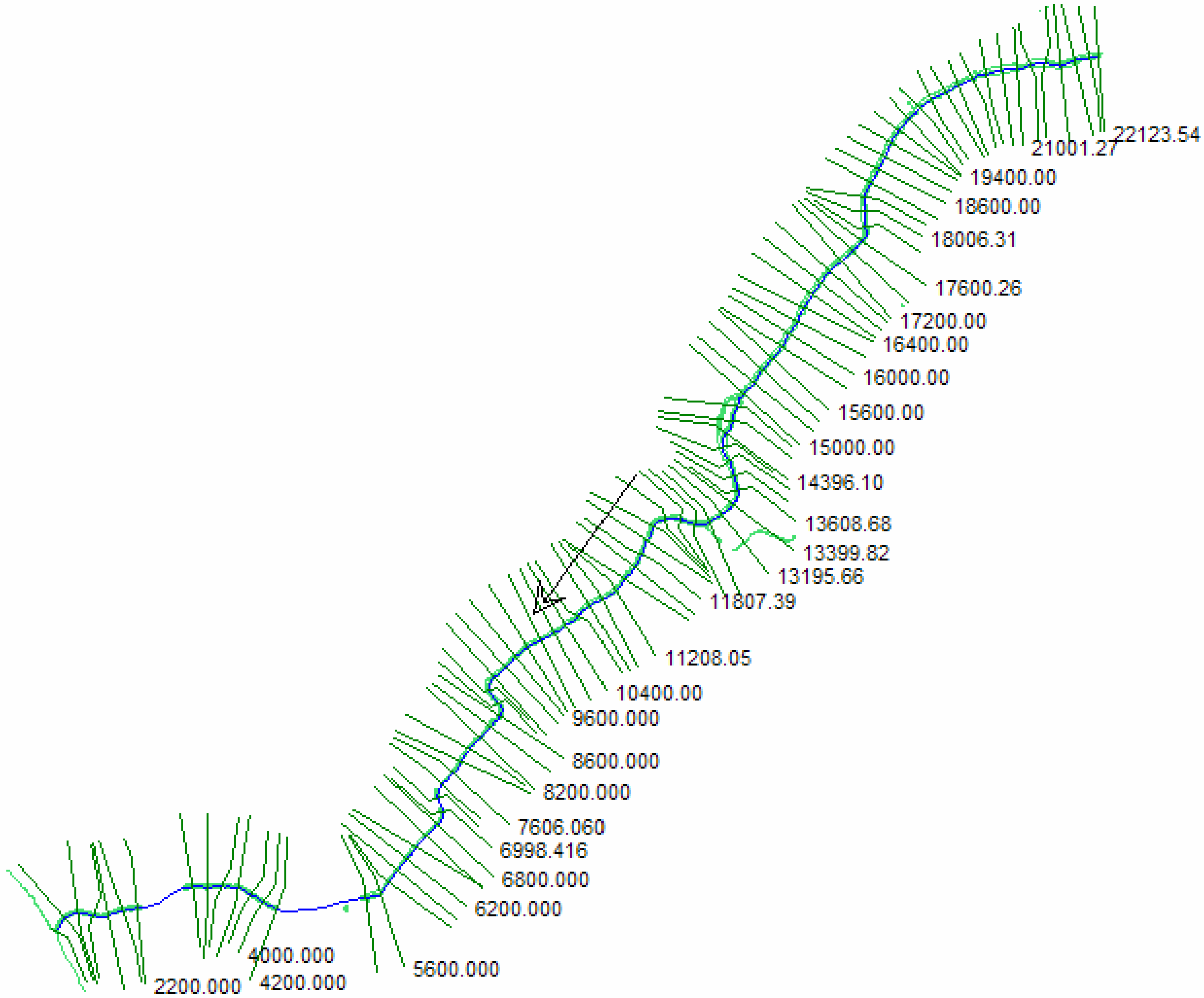


Figure 2: Lower Assunpink Creek Cross sections Cut Lines.

With the use of GIS terrain data, cross sections can contain many more points than actually necessary to describe the terrain. HEC-RAS has a limit of 500 points in any cross section. Because of this limit, unnecessary points were eliminated first by using HEC-RAS's points filter tool and second by manually by checking the cross section features with the contour maps created from the DTM. The cross section point filter performs two different types of filtering on each cross section. The first type is called a Near Points Filter that searches for points that are close together. If two points are found to be within the horizontal and vertical distance tolerance, one of them is removed. The second type of filter is a Collinear Points Filter, which searches for points that are in a straight line, or nearly in a straight line. This filter searches to find three consecutive points that may be in a straight line. If a line is connected between points one and three, and point two is within a predefined tolerance from that line, then point two can be removed. A second check is done to ensure that the slope of the line that connects point one and two does not change significantly when point one and three are connected. After the filtering operation each cross section was checked manually for its correctness and more unnecessary data points were removed. The obtained profile of the Assunpink Creek thalweg is presented in Figure 3.

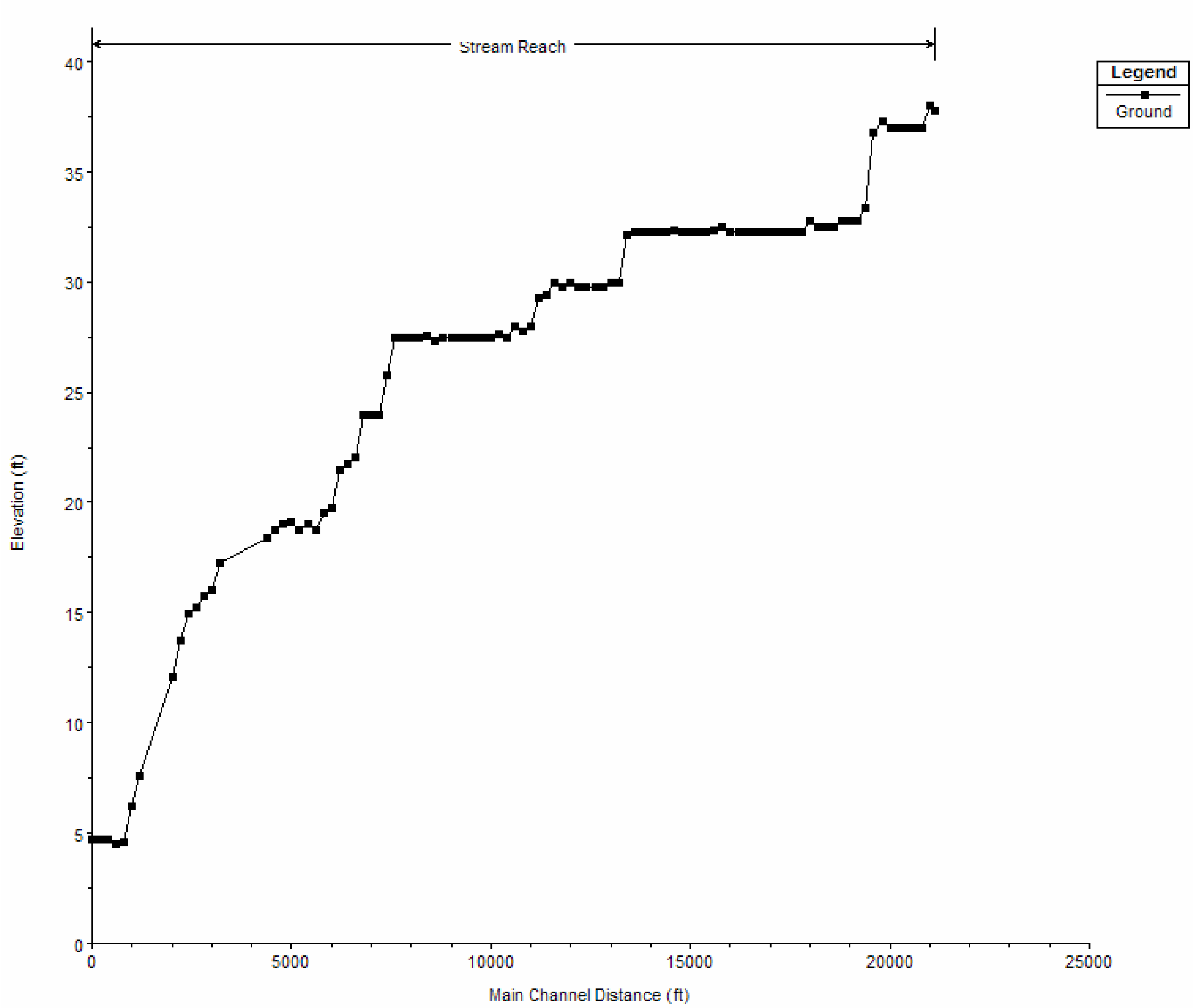


Figure 3: Lower Assunpink Creek Thalweg Profile.

Once all of the necessary cross section data have been entered and checked for accuracy, the bridges and culverts were added into the model. HEC-RAS computes energy losses caused by structures such as bridges and culverts in three components. One component consists of losses that occur in the reach immediately downstream from the structure where an expansion of flow takes place. The second component is the losses at the structure itself, which can be modeled by several different methods. The third component consists of losses that occur in the reach immediately upstream of the structure where the flow is contracting to pass through the opening. The routines in HEC-RAS allow bridge analysis with several different methods without changing the bridge geometry. Based on the survey data in Appendix 1, the bridges and culverts were added to the model. Figure 4 shows the schematic of the Lower Assunpink Creek after entering the hydraulic structure data.

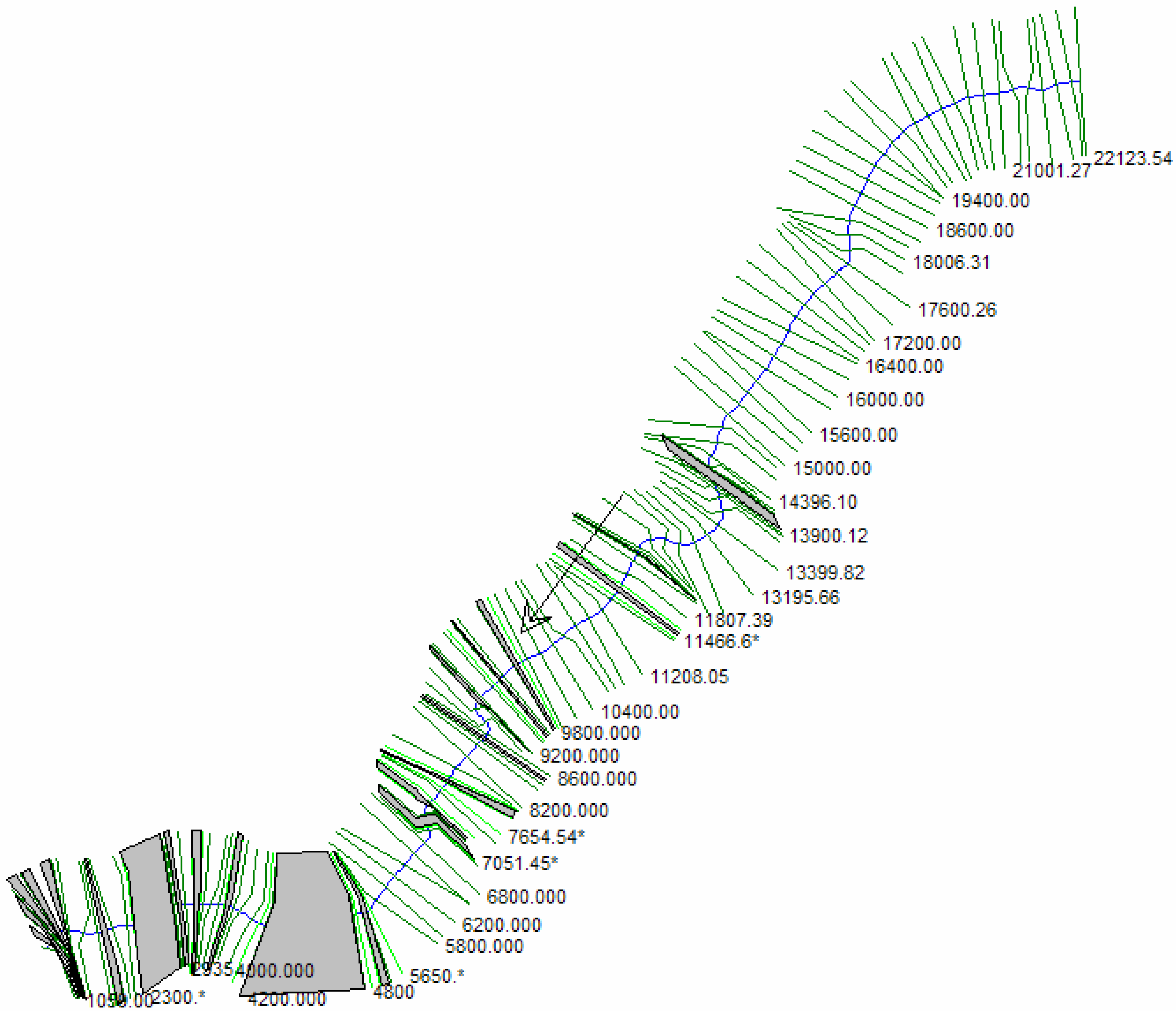


Figure 4: Lower Assunpink Creek schematic showing location of bridges and culverts

While entering the bridge and culvert data into the model, it was observed that most GIS-based cross sections do not match the surveyed cross sections. The surveyed cross sections consist of only a few data points and most of the stream beds were defined with 2-3 straight lines by joining the surveyed points. On the other hand, the GIS-based cross sections consist of many data points and the shape of stream bed is made of many small straight lines. Thus, in entering the bridge and culvert data, the GIS-terrain data was used to define the cross section when the survey data was not deemed sufficiently accurate. Further, it was observed that the information of the upper chord elevation at several bridge locations was missing in the survey sheets (Appendix 1). In these cases approximate upper chord elevations were assumed based on a previous bridge survey. Table 1 lists the name of the hydraulic structures, their location (river station), their width, and upstream and downstream distances as entered into the model.

TABLE 1
Location of Bridges and Culverts, their Width and Upstream, Downstream Distance

S. No.	Bridge and Culvert Name	River Station	Upstream Dist (ft)	Bridge Width (ft)	Downstream Dist (ft)
1	Nottingham Way Bridge	13923.61	5	50.97	11
2	Assunpink Park Foot Bridge	12127.11	2	6	2
3	N. Olden Ave. Bridge	11566.65	5.835	55	5.835
4	Oak Street	9833.33	5	56.675	4.995
5	South of Oak Street Covered Bridge	9546.97	2.5	26	2.5
6	Belvidere Railroad Bridge 8	9156	5	38	5
7	Lincoln Ave. Bridge	8517.5	5	55	55
8	Monmouth St. Bridge	7775.755	5	38.49	5
9	Wall St. Bridge	7363.801	5	54	5
10	E. State St. Bridge	7126.452	7.5	135	7.5
11	Clinton Ave. Bridge	5562.5	5	65	5
12	Market St. Bridge	4800	10	1180	10
13	S. Montgomery St. Bridge	3612	5	62	5
14	Jackson St. Bridge	3200	5	65	5
15	Broad St. Bridge	2967.5	5	55	5
16	South of Broad St. Culvert	2495	10	570	10
17	Memorial Road Bridge	1891.11	8.5	70.825	8.495
18	Parking Lot Bridge S. of Memorial Rd.	1353.59	2.5	38.115	2.505
19	Bridge # 23	1273.52	2.72	34	2.72
20	North Bound Lanes of John Fitch Pwy	1213.798	2.5	45	2.5
21	South Bound Lanes of John Fitch Pwy	1118.798	2.5	45	2.5
22	South Bound on-ramp to John Fitch Pwy	1041.5	2.5	30	2.5

After completing the addition of hydraulic structures, levees and ineffective areas were defined at appropriate locations based on cross section geometry throughout the model reach. It is important to mention that the locations and elevations of both levees and ineffective areas were defined based on assumptions as the detailed survey data was not available to define these features into the model very accurately.

Manning's Roughness Coefficients

For the majority of hydraulic studies, Manning's roughness coefficient n is the most important of the energy loss parameters. The value of n depends on surface roughness, vegetation, channel irregularities, channel alignment, scour and deposition, obstructions, size and shape of channel, stage and discharge, seasonal changes, temperature, and suspended material and bedload. The variation of water surface elevations along a stream is largely a function of the channel boundary roughness and the stream energy required to overcome friction losses. Unfortunately, Manning's n can seldom be calculated directly with great accuracy and is typically estimated through detailed field inspections and engineering judgment. For the current study, no field investigation was conducted to determine the Manning's *n* values. Thus, recent photographs and existing literature values from earlier studies were used to estimate the *n* values. Due to many channel irregularities in cross sections across the floodplain throughout the study channel, the values of Manning's *n* should be allowed to vary horizontally. However, due to unavailability of field data, the Manning's *n* was instead lumped into three parts: main channel, left overbank, and right overbank. Based on the Flood Insurance Study (FEMA, 1990), the Assunpink Creek *n* values ranged from 0.04 to 0.08 for the main channel and from 0.05 to 0.15 for the overbanks.

Contraction and Expansion Coefficients

Contraction and expansion of flow due to changes in the cross section is a common cause of energy loss. Whenever this occurs, the loss is computed from the contraction and expansion coefficients specified at various cross sections into the model. In most stream cross sections where changes in the flow area are small, the contraction and expansion coefficients were assumed to be 0.1 and 0.3, respectively. When the change in the effective cross section area is abrupt such as bridges, contraction and expansion coefficients were assumed to be 0.3 and 0.5, respectively. Further, the contraction and expansion coefficients around bridges and culverts where more severe constriction was apparent, the coefficients were assumed as 0.6 and 0.8.

Lower Assunpink Creek Flow Regime, Discharge Data, and Boundary Conditions

A subcritical flow regime was assumed to perform the current hydraulic analysis. Based on the Flood Insurance Study (FEMA, 1990), the discharge data and downstream boundary conditions in Table 2 were assumed.

TABLE 2
Flow and Boundary Condition Data

	Assunpink Creek Flow (cfs)		
Storm Event	Upstream of Stockton Street Culvert; Cross section # 12999.64	Upstream of Confluence with Pond Run; Cross section # 22123.54	Downstream Boundary Condition (Delaware River stage, ft)
10	2400	2150	23.00
50	3400	3000	24.48
100	3850	3400	24.50
500	4800	4300	28.50
July 1975 Event*	5454	3000	27.50

Note: July 1975 Event data was taken from USGS (1976)

Model Calibration

After entering the study reach input data and assembling the hydraulic model, the model was run for several discharges and the input data were corrected as necessary. Close inspection was given to effective flow area transitions between adjacent cross sections and profiles through bridges to detect modeling anomalies and address all warnings and error messages. Once the model was found to perform reasonably well, the calibration process was initiated to match model results to available data. The reliability of the results of a hydraulic model study depends on the applicability of the model to the physical situation, and the quality of the data used to model the study reach and calibrate the model. This process consists of three main steps: (1) obtaining the relevant data and translating it into model input, (2) calibrating the model, and (3) verifying the model.

As mentioned in the preceding paragraph, the calibration process focuses on matching the computed water surface elevations with available water surface elevations for a given discharge and boundary conditions. In this case, the model was calibrated by comparing against the water surface elevation data available for the 100-year event from the Flood Insurance Study (FEMA, 1990). The model was then verified against other events in the FIS and an actual event that occurred in July 1975. The "observed" water surface elevation data for the 10-, 50-, 100-, and 500-year events were obtained from the flood profiles presented in the Flood Insurance Study (FEMA, 1990), whereas, the data for the flood of July 1975 was taken from the USGS study (USGS, 1976). The pertinent data are summarized in Tables 3 and 4.

TABLE 3
Flood Profiles Based on the Flood Insurance Study

		Elevation (ft)				
Station Name	**Distance (ft)**	**Stream Bed**	**10-year Flood**	**50-year Flood**	**100-year Flood**	**500-year Flood**
Nottingham Way	12800	27.5	41.5	44	44.7	46.5
South Olden Ave.	10500	27.5	40	42.5	43.5	44.5
Oak Street	8830	27.5	37.7	40	40.5	42
Monmouth St	6920	25.5	34	36.75	37.5	38.25
Wall St	6500	225	33.25	35.5	36	37
East State St	6240	22	33.25	35.5	36	37
South Clinton Ave	4720	18.5	29	31.5	32.2	33.5
Delaware River	2070	13.25	26	24	24.5	28.5

Source: FEMA (1990)

The 100-year event was used to calibrate the model. As no field data is available for Manning's *n* and the stream reach is only about 3 miles long, the Manning's *n* values for the main channel were not varied along the reach. Similarly, overbank *n* values were not varied along the reach. Thus, the Manning's *n* values at all cross sections were assumed to be the same. This may not be true if some parts of the stream are lined or have some other roughness characteristics. To calibrate the model for the 100-year event, the model was ran for various assumed *n*-values and the calculated water surface profiles were compared with the flood profile corresponding to 100-year event given in Table 3. The best match as shown in Figure 5 was selected as the calibration set.

TABLE 4
Flood Profile during the July 21, 1975 Event

Street and Location	Distance from confluence with the Delaware River (ft)	Elevation (ft)
70 ft downstream from Nottingham Way Street	12144	47
65 ft downstream from North Olden avenue	10032	44.75
500 ft downstream from Olden avenue	9504	43.7
Upstream of Oak Street	8448	42.35
100 ft upstream Penn Central RR Supr-line Bridge	7920	40.7
USGS Gaging Station Upstream of Chambers Street	7392	39.4
30 ft upstream from Monmouth Street	6336	38.2
340 ft upstream from South Clinton Avenue	5808	36.3
150 ft downstream from entrance to culvert under Stockton Street - US Highway 1 Interchange	4752	34.8
40 ft upstream from Peace Street	4224	34
220 ft upstream from Montgomery Street	2640	27.8
175 ft upstream from South Broad Street	2112	24.9
150 ft downstream from Peace Street	528	13.3

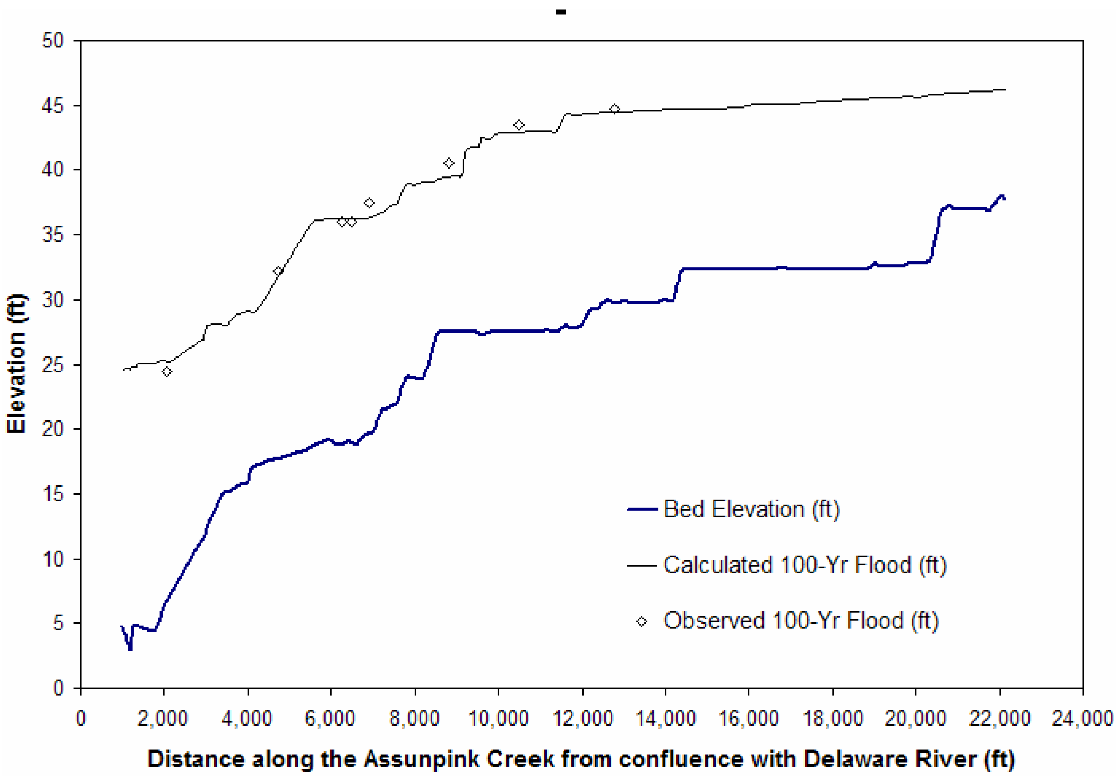


Figure 5: Lower Assunpink Creek Hydraulic Modeling Calibration Run: 100-year Event

The calibrated Manning's *n* values were used to calculate water surface profiles for the 10-, 50-, and 500-year storms and the July 1975 event as shown in Figures 6 to 9.

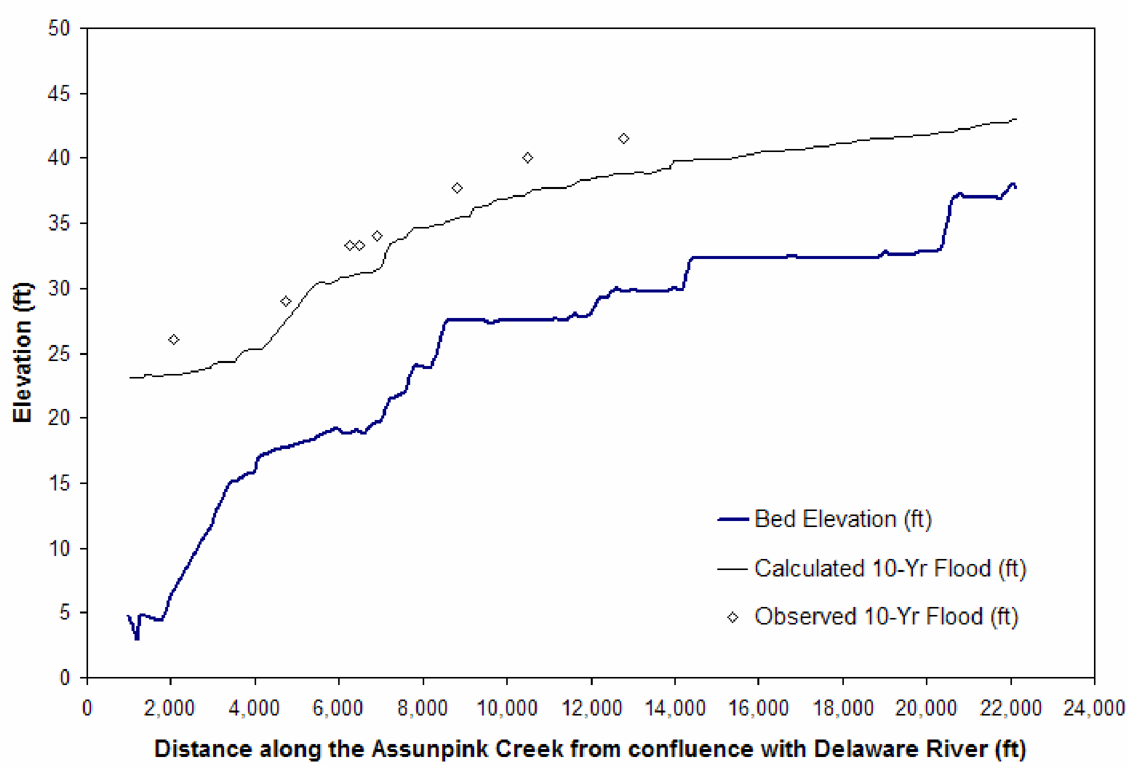


Figure 6: Lower Assunpink Creek Hydraulic Modeling, Model Verification Run: 10-year Event

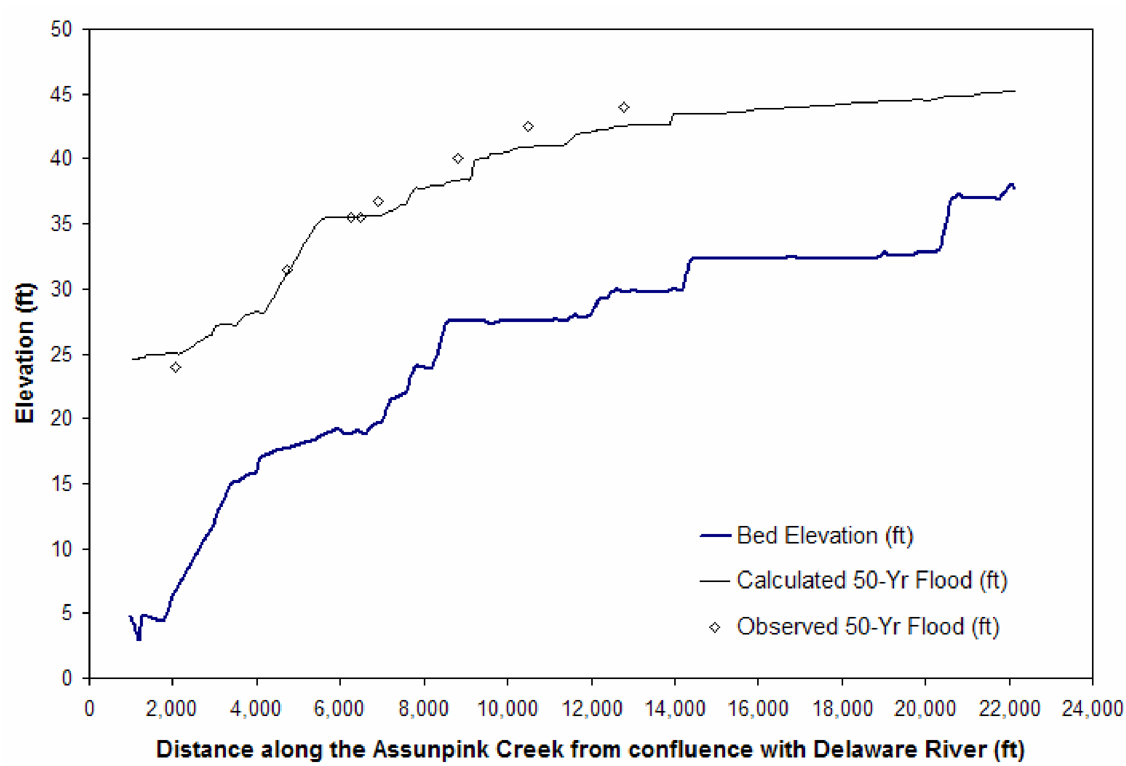


Figure 7: Lower Assunpink Creek Hydraulic Modeling, Model Verification Run: 50-year Event

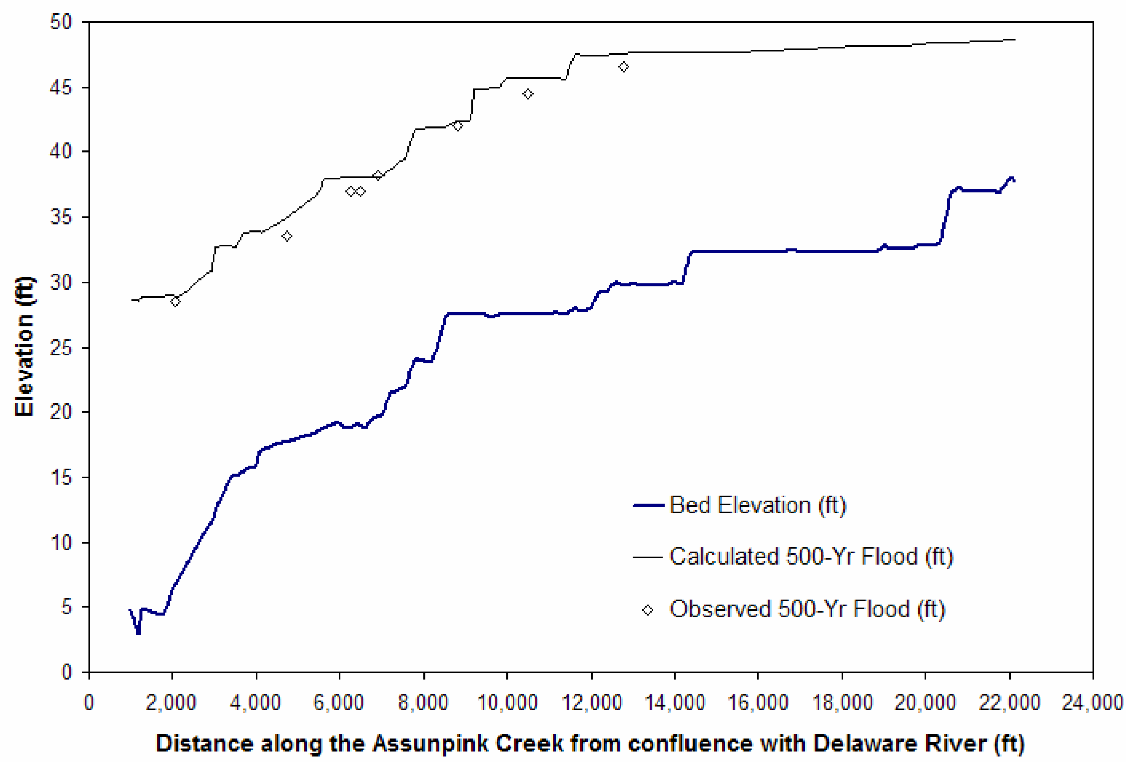


Figure 8: Lower Assunpink Creek Hydraulic Modeling, Model Verification Run: 500-year Event

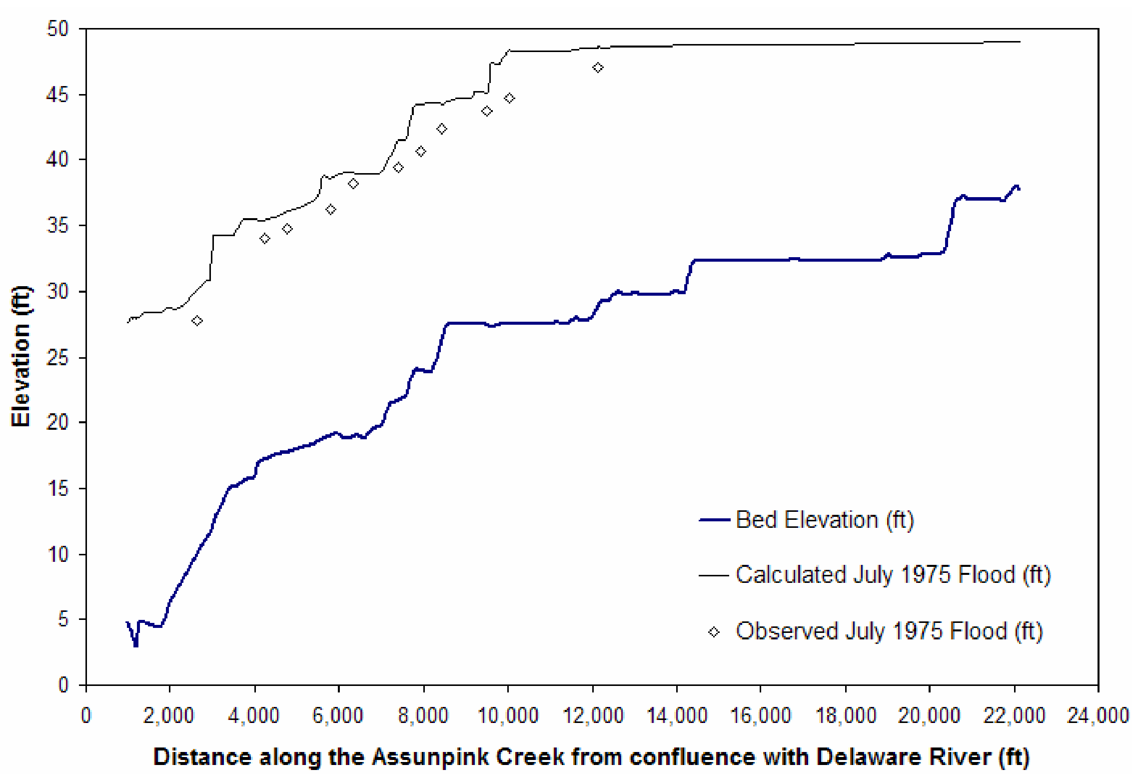


Figure 9: Lower Assunpink Creek Hydraulic Modeling, Model Verification Run: July 1975 Event

The detailed graphical outputs of the HEC-RAS model for the calibration and verification storm events are presented in Appendix 1. From Figures 5 to 9 of Appendix 1, it can be noticed that the hydraulic model is a reasonable representation for all events except the 10-year event for which the model underestimates the water surface elevations. To match the 10-year event flood profile with the observed profile the Manning's *n* needs to be further refined by varying it horizontally across the cross sections and along the stream reach. Additional improvement can be attained by refining the assumptions in defining levees and ineffective areas. Thus, additional field work is necessary for further refinement of the model. However, the accuracy needed depends on the objective of the study. As far as the impact of removing some hydraulic structures (such as a culvert) is concerned, the model accuracy seems to be sufficient as it is predicting the trends of water surface profile reasonably well. It is important to mention here that all the bridges on Assunpink Creek between its confluence with the Delaware River and Market Street (Bridges 12 to 22 in Table 1) are submerged due to the backwater from the Delaware River during all the storms except the 10-year event.

References

Federal Emergency Management Agency (1990). "Flood Insurance Study," City of Trenton, New Jersey, Mercer County.

US Geological Survey (1976). "Flood of July 21, 1975 in Mercer County, New Jersey," USGS Water Resources Investigation report 51-75, prepared in cooperation with New Jersey Department of Environmental Protection, Division of Water Resources.

Appendix-1: HEC-RAS Profiles Plots

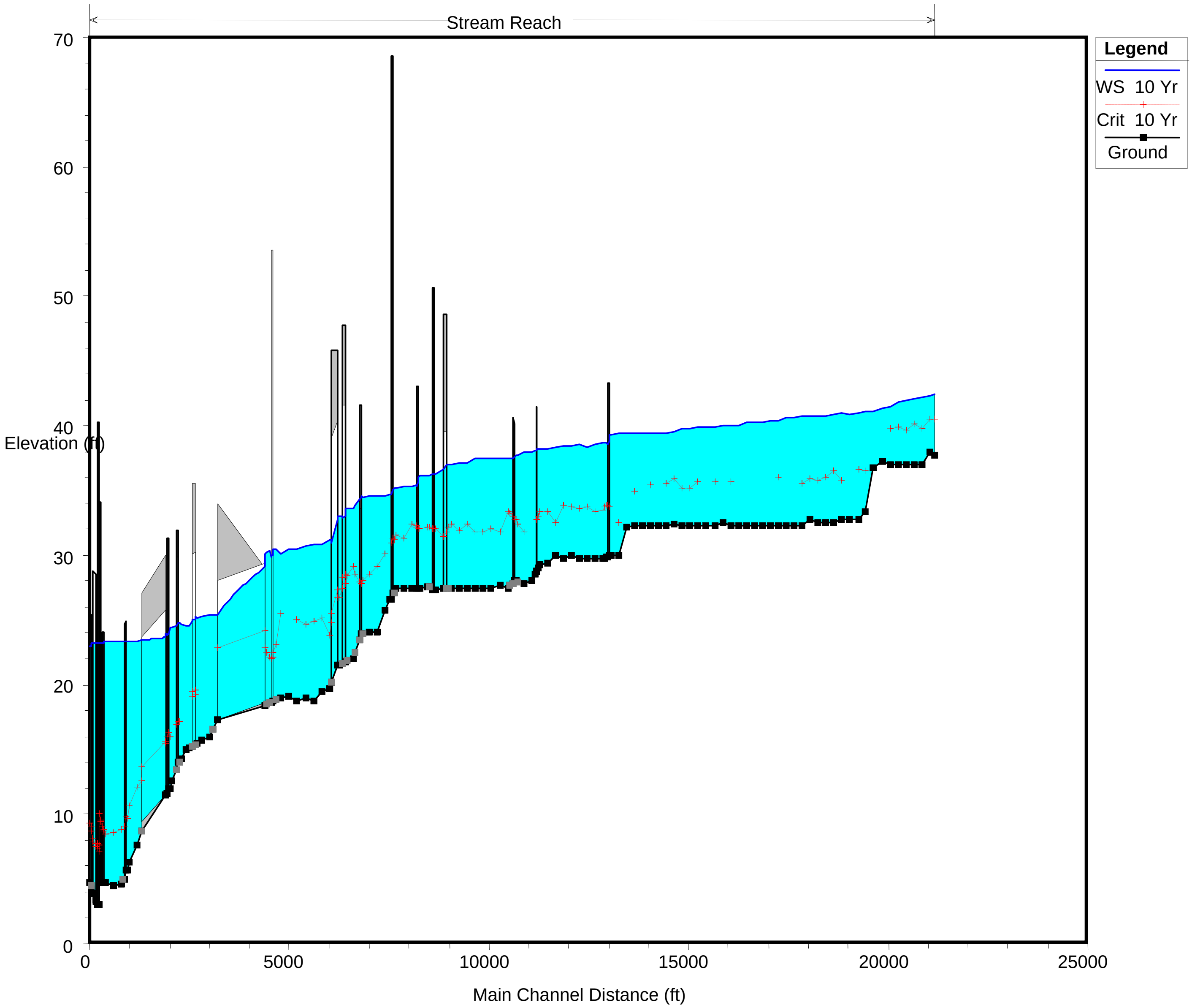


Figure : 10-year Flood Profile Plot

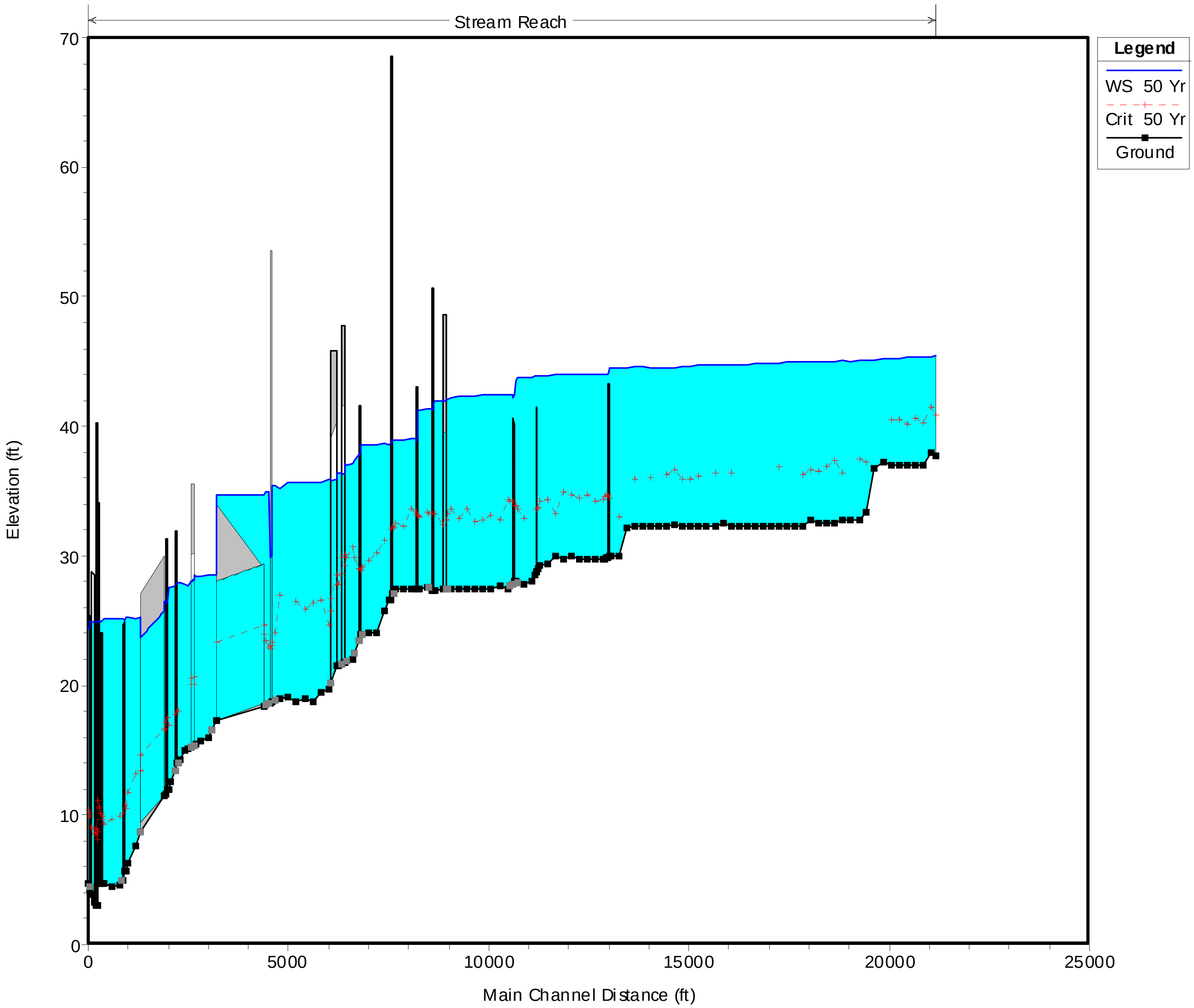


Figure : 50-year Flood Profile Plot

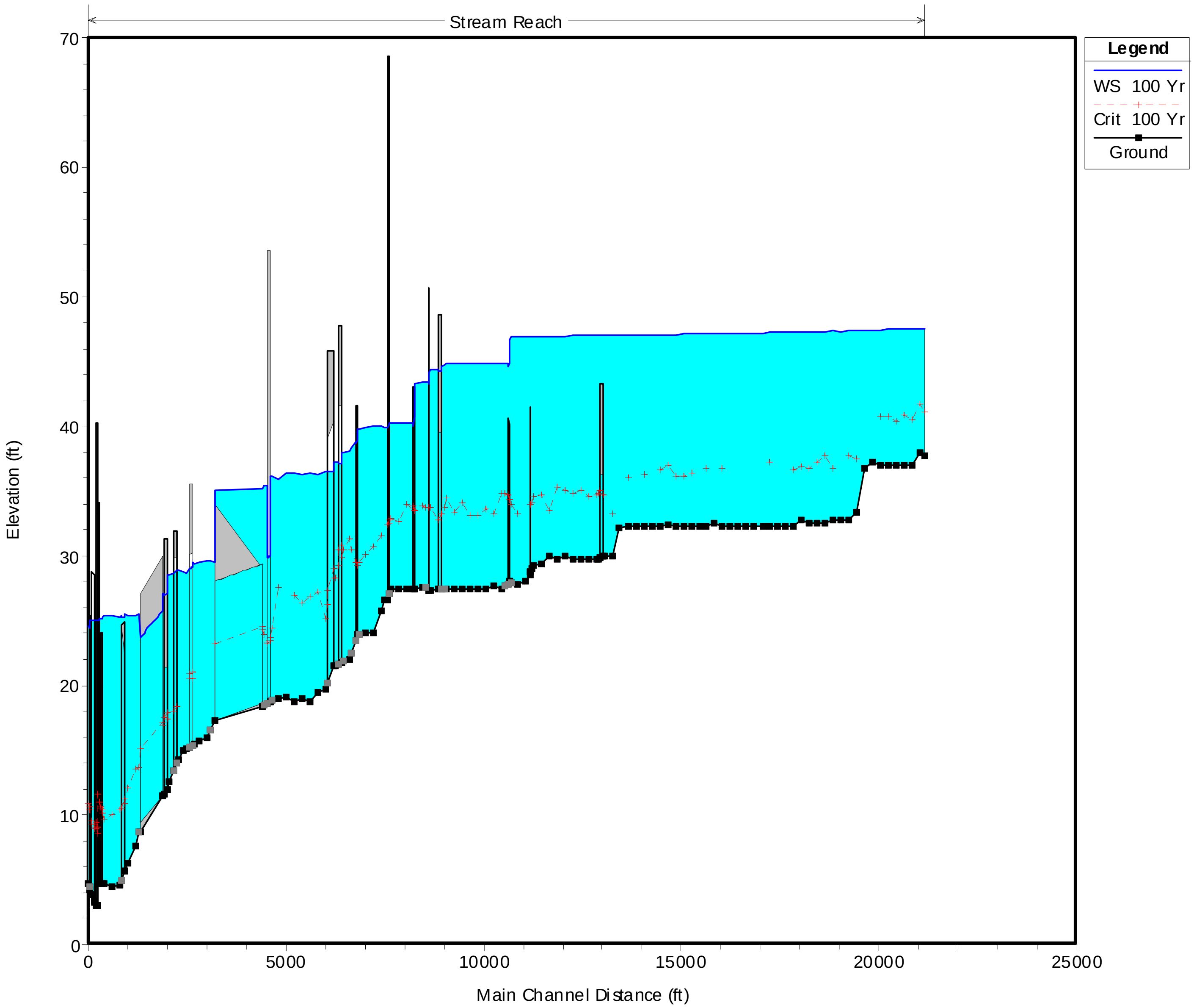


Figure : 100-year Flood Profile Plot

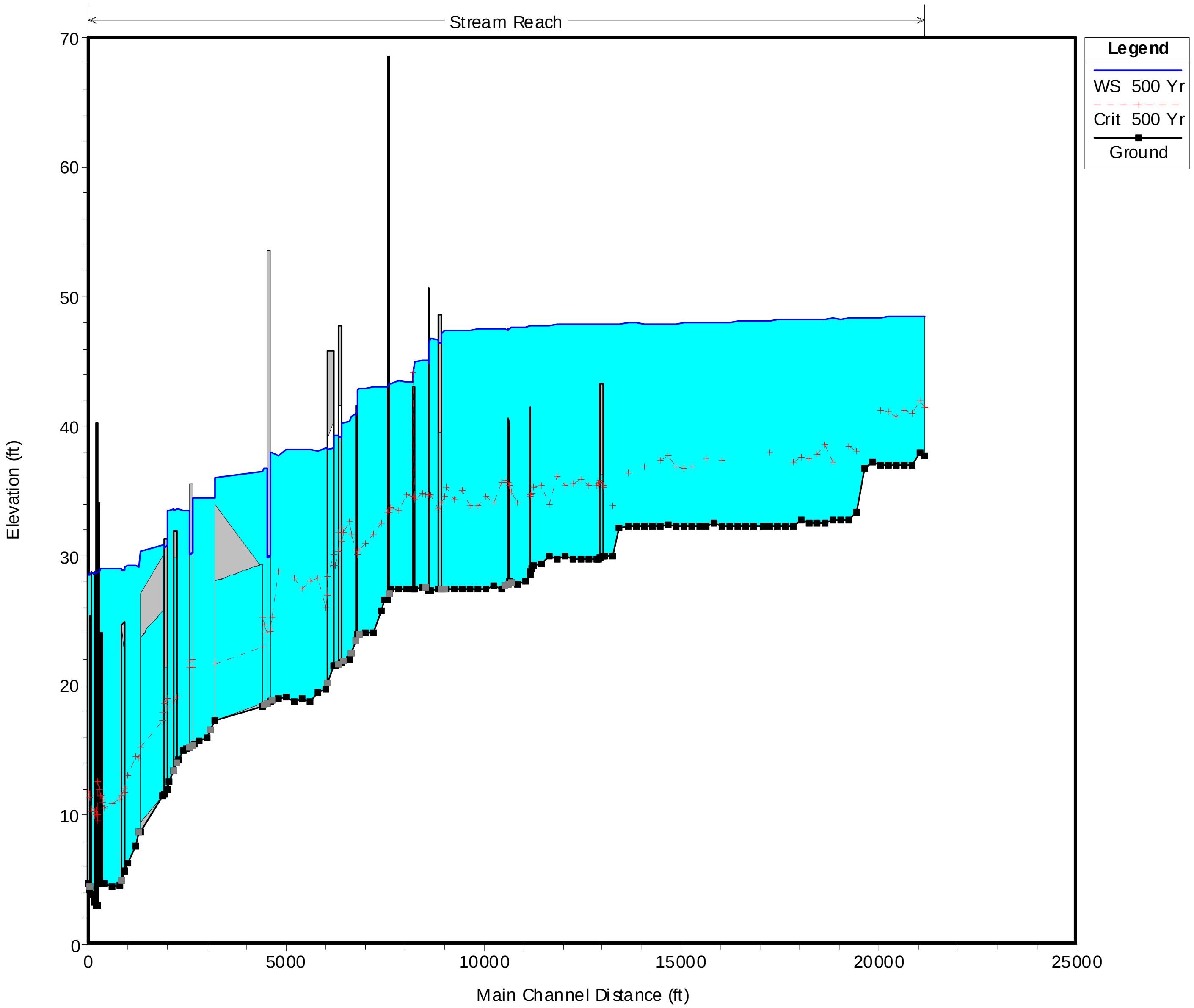


Figure : 500-year Flood Profile Plot

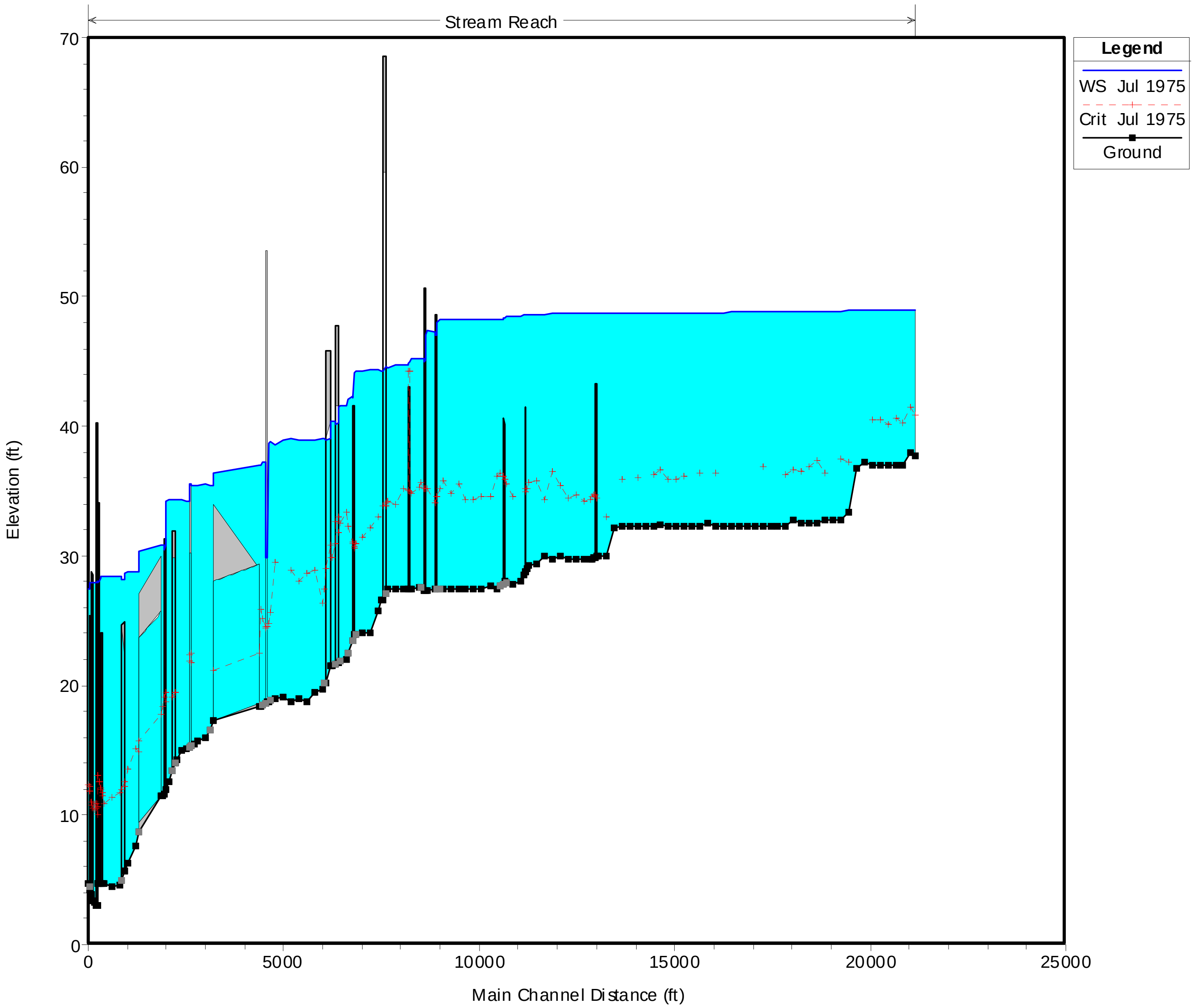


Figure : July 1975 Event Flood Profile Plot

Appendix D – Threatened and Endangered Species Correspondence

United States Department of the Interior

FISH AND WILDLIFE SERVICE

New Jersey Field Office
Ecological Service
927 North Main Street, Building D
Pleasantville, New Jersey 08232
Tel: 609-646-9310
Fax: 609-646-0352
http://njfieldoffice.fws.gov

IN REPLY REFER TO:
ES-03/NE159

Danielle Trittenbach, Environmental Scientist
CH2M Hill
1700 Market Street, Suite 1600
Philadelphia, Pennsylvania 19103-3916
Fax number: (215) 563-3828

Reference: Threatened and endangered species review within the vicinity of the proposed Assunpink Creek Ecosystem Restoration Project located within City of Trenton (Municipality), Mercer (County), New Jersey.

The U.S. Fish and Wildlife Service (Service) has reviewed the above-referenced proposed project pursuant to Section 7 of the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) to ensure the protection of federally listed endangered and threatened species. The following comments do not address all Service concerns for fish and wildlife resources and do not preclude separate review and comment by the Service as afforded by other applicable environmental legislation.

Except for an occasional transient bald eagle (*Haliaeetus leucocephalus*), no other federally listed or proposed endangered or threatened flora or fauna under Service jurisdiction are known to occur within the vicinity of the proposed project site. Therefore, no further consultation pursuant to Section 7 of the Endangered Species Act is required by the Service. This determination is based on the best available information. If additional information on federally listed species becomes available, or if project plans change, this determination may be reconsidered. Please be aware that this determination is valid for 90 days; therefore, if the project is not initiated within this time, the Service should be contacted prior to project implementation to verify the accuracy of this information. The Service will review current information to ensure that no federally listed threatened or endangered species will be adversely affected by the proposed project.

Enclosed is current information regarding federally listed and candidate species occurring in New Jersey. The Service encourages federal agencies and other planners to consider candidate species in project planning. The addresses of State agencies that may be contacted for current site-specific information regarding federal candidate and State-listed species are also enclosed.

Authorizing Supervisor: ____________________

Enclosures: Current summaries of federally listed and candidate species in New Jersey
Addresses for additional information on candidate and State-listed species

Sect 7 (es-NEsot7.fax) 11/24/03

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
One Blackburn Drive
Gloucester, MA 01930-2298

JAN 15 2004

Danielle Trittenbach
CH2M HILL
99 Cherry Hill Road
Suite 304
Parsippany, NJ 07054-1102

Dear Ms. Trittenbach,

This correspondence is in response to your letter dated January 7, 2004 requesting information on the presence of any federally listed threatened or endangered species and/or designated critical habitat for listed species under the jurisdiction of the National Marine Fisheries Service (NOAA Fisheries) in the vicinity of a proposed stream improvement and ecosystem restoration project along Assunpink Creek in Trenton, New Jersey. The proposed project will encompass a 3 mile stretch of the creek, between the Delaware River and the Trenton City limits.

Federally endangered shortnose sturgeon are known to occur in the Delaware River from the lower bay upstream to at least Lambertville, New Jersey. Assunpink Creek is a tributary to the Delaware River. Tagging studies by O'Herron et al. (1993) show that the most heavily used portion of the river appears to be between river mile 118 below Burlington Island and the Trenton Rapids at river mile 137. Shortnose sturgeon overwinter in dense sedentary aggregations in the upper tidal reaches of the Delaware River between river mile 118 and river mile 131, with large concentrations around Newbold Island and Duck Island. During the late summer months, shortnose sturgeon are more dispersed and are thought to be more widely distributed throughout the river and estuary than in the winter months.

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended, states that each Federal agency shall, in consultation with the Secretary, insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. Because federally endangered shortnose sturgeon are present in the Delaware River, any discretionary federal action that may affect this species must undergo section 7 consultation. The federal action agency, in this case the Army Corps of Engineers (ACOE), would be responsible for initiating section 7 consultation, at which time the project details would be submitted to NOAA Fisheries, Northeast Regional Office, One Blackburn Drive, Gloucester, MA 01930. An assessment of the project's impacts to federally endangered shortnose sturgeon should be included with the project details. After reviewing this information, NOAA Fisheries would then be able to conduct a consultation under section 7 of the ESA.

If you have not already done so, it is recommended that you also contact the U.S. Fish and Wildlife Service for federally listed threatened or endangered species within their jurisdiction. The contact number for the Northeast Regional office is (413) 253-8200.

We look forward to your continued cooperation with consultation matters. Should you have any questions about these comments or about the section 7 consultation process in general, please contact Julie Crocker at (978)281-9328 ext. 6530.

Sincerely,

Mary A. Colligan
Assistant Regional Administrator
for Protected Resources

File Code: Sec 7 (ACOE) – spp. present DE River

State of New Jersey

James E. McGreevey
Governor

Department of Environmental Protection
Division of Parks and Forestry
Office of Natural Lands Management
Natural Heritage Program
P.O. Box 404
Trenton, NJ 08625-0404
Tel. #609-984-1339
Fax. #609-984-1427

Bradley M. Campbell
Commissioner

January 12, 2004

Danielle Trittenbach
CH2M Hill
1700 Market Street, Suite 1600
Philadelphia, PA 19103-3916

Re: Lower Assunpink Creek Environmental Restoration Project

Dear Ms. Trittenbach:

Thank you for your data request regarding rare species information for the above referenced project site in Hamilton Township and Trenton City, Mercer County.

Searches of the Natural Heritage Database and the Landscape Project are based on a representation of the boundaries of your project site in our Geographic Information System (GIS). We make every effort to accurately transfer your project bounds from the topographic map(s) submitted with the Request for Data into our Geographic Information System. We do not verify that your project bounds are accurate, or check them against other sources. Landscape patches are searched using the boundary depicted on your map buffered by 15 meters. The 15-meter buffer is to accommodate for inherent GIS mapping imprecision.

Neither the Natural Heritage Database nor the Landscape Project has records for any rare wildlife species on the referenced site.

We have also checked the Natural Heritage Database and the Landscape Project habitat mapping for occurrences of any rare wildlife species or wildlife habitat within 1/4 mile of the referenced site. Please see the table below for species list and conservation status.

Species within 1/4 mile of referenced site.

Common Name	Scientific Name	Federal Status	State Status	Grank	Srank
dwarf wedgemussel	*Alasmidonta heterodon*	LE	E	G1G2	S1
green floater	*Lasmigona subviridis*		E	G3	S1
shortnose sturgeon	*Acipenser brevirostrum*	LE	E	G3	S3
yellow lampmussel	*Lampsilis cariosa*		T	G3G4	S1

We have also checked the Natural Heritage Database for occurrences of rare plant species or natural communities. The Natural Heritage Data Base has a record for an occurrence of *Agastache scrophulariifolia* that may be on or in the immediate vicinity of the site. The attached list provides more information about this occurrence. **Because some species are sensitive to disturbance or sought by collectors, this information is provided to you on the condition that no specific locational data are released to the general public. This is not intended to preclude your submission of this information to regulatory agencies from which you are seeking permits.**

Also attached is a list of rare species and natural communities that have been documented from Mercer County. If suitable habitat is present at the project site, these species have potential to be present.

Status and rank codes used in the tables and lists are defined in the attached EXPLANATION OF CODES USED IN NATURAL HERITAGE REPORTS.

If you have questions concerning the wildlife records or wildlife species mentioned in this response, we recommend that you visit the interactive I-Map-NJ website at the following URL, http://www.state.nj.us/dep/gis/imapnj/imapnj.htm or contact the Division of Fish and Wildlife, Endangered and Nongame Species Program.

New Jersey is an Equal Opportunity Employer
Recycled Paper

PLEASE SEE THE ATTACHED 'CAUTIONS AND RESTRICTIONS ON NHP DATA'.

Thank you for consulting the Natural Heritage Program. The attached invoice details the payment due for processing this data request. Feel free to contact us again regarding any future data requests.

Sincerely,

Herbert A. Lord

Herbert A. Lord
Data Request Specialist

cc: Robert J. Cartica
Lawrence Niles
NHP File No. 04-4007426