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April 26, 2012

FEMA LOMC Clearinghouse  
7390 Coca Cola Drive, Suite 204  
Hanover, MD 21076

**BELL BEND NUCLEAR POWER PLANT  
DATA TO SUPPORT THE  
NBSR CLOMR REQUEST  
BNP-2012-079                      Docket No. 52-039**

- Reference: 1) Case No.: 11-03-1701R  
Susquehanna River  
Communities: Township of Salem, and Township of Conyngham, PA  
Community Nos.: 420625 and 420600
- 2) FEMA-2012-047, B. Kaiser, FEMA, to B. Ehrhart, LSI, "Summary of Additional Data Required to Support a Conditional Letter of Map Revision, Case No.: 11-03-1701R", dated February 6, 2012.

We have received the request for additional data (February 6, 2012) required to support the Conditional Letter of Map Revision (CLOMR) review for the above-referenced case. This CLOMR request is in support of the proposed Bell Bend Nuclear Power Plant in Salem Township, Luzerne County, PA. Listed below are the comments received, followed by our responses to those comments.

1. *The submitted topographic work map entitled "100 year Floodplain Map Flood Study – Susquehanna River," prepared by LandStudies and received on January 23, 2012 does not provide the essential information required to complete our review of this request. Please submit a topographic work map, certified by a registered Professional Engineer that shows, at a sufficient scale, all applicable items listed in Section C of Application/Certification Form 2, entitled "Riverine Hydrology and Hydraulics Form," including the following information:*
  - a) *Please provide the complete boundary delineations of the proposed conditions 1-percent-annual-chance (base) floodplain, 0.2-percent-annual-chance floodplain, and regulatory floodway within the Township of Conyngham*

Flood boundary delineations of the proposed conditions 1-percent-annual-chance (base) floodplain, 0.2-percent-annual-chance floodplain, and regulatory floodway within the Township of Conyngham have been provided on the revised Floodplain Map. The map is provided in Appendix B of Enclosure 1, and is stamped by Benjamin Ehrhart, P.E.

- b) Please provide the complete boundary delineations of the currently effective base floodplain, 0.2-percent-annual-chance floodplain, and regulatory floodway within the Township of Conyngham. Please contact the Luzerne County Planning Commission to obtain a copy of the effective maps for the Township of Conyngham*

Only the index map was available at the Luzerne County Planning Commission office. Therefore, the current effective floodplain and floodway delineations could not be added to the revised Floodplain Map. The FEMA reviewer has agreed that plotting the proposed flood boundaries and floodway on the index map is the only option available given the lack of FBFM and FIRM maps.

- c) Please ensure that the geometry of the cross sections used in the hydraulic model is consistent with the topography shown on the work map. For all cross sections the top width computed in the hydraulic model is delineated correctly in the work map.*

Minor adjustments have been made to the proposed cross section geometry at the proposed intake structure location (RS 133138) so that it is consistent with the existing and proposed topography. All flood delineations have been verified.

- d) Please show the flow line used in the hydraulic model.*

The flow line used in the hydraulic model has been shown on the revised Floodplain Map.

- 2. To aid in accuracy and to expedite the mapping process, please continue to provide digital Computer-Aided Design (CAD) or Geographic Information System (GIS) data along with the paper copy of the certified topographic work map. Please ensure the digital data are spatially referenced, and cite what projection (coordinate system, example: UTM/State Plane) was used.*

Updated CAD files are provided on the enclosed DVD. The drawing is referenced to the UTM/State Plane coordinate system.

- 3. Based on the revised work map, please submit a revised annotated Flood Insurance Rate Map (FIRM) Panel panels for 4206250020B, 4206000005B, 4206000010B, 4206000011B, and 4206000012B and Flood Boundary and Floodway Map (FBFM) panels 4206250020, 4206000005, 4206000010, 4206000011, and 4206000012, at the scale of the effective FIRM and FBFM, that shows the revised boundary delineations of the base floodplain, 0.2 percent-annual-chance floodplain, and regulatory floodway shown on the submitted work map, and how they tie-in to the boundary delineations shown on the effective FIRM at the downstream and upstream ends of the revised reach.*

Appropriate revisions have been made to the Salem Township FIRM and FBFM Panels (4206250020B) based on the flood model revisions. Because only the Map Index is available for Conyngham Township, the Map Index has been annotated. Note that the proposed changes only affect panel 426000012.

In addition to the comments received in the February 6, 2012 letter, additional items were addressed in response to requests received via a series of e-mails from the reviewer:

- The scope of the flood models was reduced to only include the reach between cross sections CR and CS.
- The proposed floodplain delineations on the Floodplain Plan have been adjusted to show smooth tie-ins to the current effective floodplain lines.
- The geometry data was updated to reflect adjustments to the cross section alignments which were made to more closely match the cross sections shown on the Current Effective FBFM.

Respectfully,



Michael J. Caverly

MJC/kw

Enclosures: 1) Susquehanna River Flood Study, Rev. 5  
2) Data DVD (FEMA Only)

cc: (w/ Enclosure 1 only on Disc)

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Susquehanna River Basin Commission  
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Harrisburg, PA 17102

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Enclosure 1

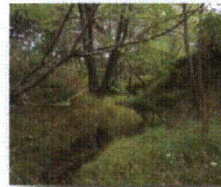
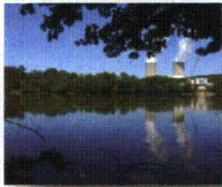
Susquehanna River Flood Study, Rev. 5

Enclosure 2

Data DVD (FEMA Only)

# Bell Bend Nuclear Power Plant Flood Study Report Susquehanna River

Salem Township, Luzerne County, PA  
LSI Doc. No. FS-SR-001



*Prepared for:*  
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*Prepared by:*



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Rev.5, April 11, 2012



# Susquehanna River Flood Study Report

PPL Bell Bend Nuclear Power Plant  
Salem Township, Luzerne County, PA  
Rev 5, April 11, 2012

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## A RECORD OF REVISIONS

Revision	Date	Pages/Sections Changed	Brief Description
0	October 2010	All	Initial release
1	November 2010	All	Replaced the duplicate effective model, which was previously based on the HEC-2 flood model used for the FEMA FIS, with the more recent HEC-RAS model developed by the US Army Corps of Engineers and adopted by FEMA
2	May 2011	Appendix H	Replaced intake structure figures in Appendix H with updated figures from the Joint Permit Plan set by Pennoni Associates, dated May 2011
3	September 2011	All	Used 1977 SRBC current effective model, removed Pending ACOE model
3	September 2011	Appendix E	Added HEC-2 version of Duplicate Effective Model
3	September 2011	Section 3, Appendix I	Added Encroachment Analysis
3	September 2011	Appendix H, Appendix I	All Levees have been removed from the Existing and Proposed Models.
3	September 2011	All	The downstream limit of the Flood Study was moved to Cross Section CU, which is upstream of the Wapwallopen Creek.
3	September 2011	Appendix B	The floodway and 0.2-percent-annual-chance flood delineations have been added to the Floodplain Map in Appendix B.
3	September 2011	Appendix B	Tie-ins from the effective flood hazard boundaries to the proposed delineations have been provided at the upstream and downstream ends of the study reach.
3	September 2011	Appendix B	Annotated FIRM panels have been added in Appendix C
4	December 2011	Appendix H,I	Delete interpolated cross sections in existing and proposed models
4	December 2011	Section 3, Appendix B	Correct Datum Conversion to -0.71 ft.
4	December 2011	Appendix B	Update Floodplain Map per other changes
4	December 2011	Appendix C	Provide more detailed annotated FIRM and FBFM
5	April 2012	Appendix B	Add delineation of 100-yr and 500-yr Floodplain and Regulatory Floodway to Conyngham Township side of River
5	April 2012	Appendix C	Add annotated Conyngham Township Flood Map Index
5	April 2012	Appendix I	Refined proposed cross section geometry at proposed intake structure
5	April 2012	Appendix H, I	Revised geometry of existing and proposed cross sections 133431 and 133138 on left side of River based on GIS topography
5	April 2012	All	Reduced the modeled reach to include only Cross Section CS to CP



## 1 Introduction

PPL is proposing a new facility, the Bell Bend Nuclear Power Plant (BBNPP), on a site near Berwick, PA. The site is located in Salem Township, Luzerne County, northeast of Berwick near the existing Susquehanna Steam Electric Station (SSES) nuclear power plant. The water intake structure for the proposed facility will be located directly east of the proposed site along the Susquehanna River, downstream of the intake structure of the existing plant. The location is approximately 22 miles downstream of Wilkes-Barre, PA and 5 miles upstream of Berwick, PA. A FEMA Flood Study exists for the section of the Susquehanna River that will be impacted by the proposed intake structure. The FEMA study cross-sections were used as a basis for the flood analysis.

The objectives of this study are to determine the hydraulic effect of the proposed intake structure on the Susquehanna River and to determine the extent of the 100-year floodplain. This report presents the existing (pre-construction) floodplain characteristics modeled in HEC-RAS and how they compare to both the original FEMA floodplain characteristics taken from the HEC-2 model and to the proposed (post-construction) floodplain characteristics modeled in HEC-RAS.

### 1.1 Model Inputs

The following inputs were used in this study:

- Flood Insurance Study, Township of Salem, Pennsylvania, Luzerne County, 1979, FEMA Federal Insurance Administration

- FEMA FIS HEC-2 input data was acquired from the FEMA Engineering Library in the form of scans of output files.

- HEC-RAS River Analysis System Hydraulic Reference Manual, Version 4.0, March 2008, US Army Corps of Engineers Hydraulic Engineering Center

- Precipitation Frequency Data Server, National Oceanic and Atmospheric Administration (NOAA) National Weather Service Hydrometeorological Designs Studies Center, Website <http://hdsc.nws.noaa.gov/hdsc/pfds/>

- Soil Map 2, Penn State University College of Agricultural Sciences Cooperative Extension Geospatial Technology Program, Website [www.soilmap.psu.edu](http://www.soilmap.psu.edu)

- One (1) foot topographic mapping produced by Peters Consultants, Inc. in November 2007, January 2008, and April 2010.



Susquehanna River Bathymetry Data from "Ecological Studies of the Susquehanna River in the vicinity of the Susquehanna Steam Electric Station." Ecology III, August 1983.

Proposed contours, walls, bridges, and intake structure, as provided by Pennoni and as included in the Joint Permit Drawings for BBNPP dated October 28, 2011

Vertical Datum conversion from NGVD29 to NAVD88 provided by National Geodetic Survey VERTCON process based on Latitude/ Longitude of site.

## 2 Hydrology

Soils information and geology at the proposed BBNPP site and surrounding area were determined from Penn State University's online soil map tool ([www.soilmap.psu.edu](http://www.soilmap.psu.edu)). Soils existing in the region of the proposed intake structure include Pope soils and Holly Silt Loams (hydrologic soil groups "B" and "D", respectively). A soils map is included in Appendix A.

The Hamilton Group geologic formation exists beneath the proposed intake structure site. It is an east to west trending band of the lower and middle Devonian-age Hamilton Group and is made up of two formations: the Mahantango Formation and the Marcellus Formation. The Mahantango Formation is composed of gray, brown and olive shale and siltstone while the Marcellus Formation is composed of black, carbonaceous shale. See the geologic map in Appendix A.

The Susquehanna River is 444 miles long, with its headwaters in New York. The entire Susquehanna River Basin covers 27,510 mi<sup>2</sup>; however, the drainage area to the location of the proposed intake structure equals approximately 10,600 mi<sup>2</sup>. The 100-year peak flow used in the FEMA Flood Insurance Study (FIS) for this drainage area is 260,000 cfs. The maximum recorded flow rate was 345,000 cfs at the Wilkes-Barre gauging station (24 miles upstream) and 363,000 cfs at the Danville gauging station (28 mi downstream) during Hurricane Agnes, which is similar to the 500 year flow rate (340,000 cfs) used in the FIS.

## 3 Hydraulics

### 3.1 General Description

The US Army Corps of Engineers HEC-RAS Version 4.1.0 software was used for the hydraulic analysis. HEC-RAS is intended for calculating water-surface profiles for steady or unsteady flow in natural or man-made channels. The computational procedure is based on the solution of the one-dimensional energy equation with energy loss due to friction computed using Manning's equation. The computational procedure is generally known as the Standard Step Method and can be used for subcritical as well as supercritical flow conditions. For this project, the water-surface profile for steady, subcritical flow was calculated.



The original FEMA FIS study was conducted in the vertical datum NGVD 29; therefore, the Existing and Proposed HEC-RAS Conditions were both modeled in the NGVD 29 vertical datum for comparison purposes. To illustrate the 100-year floodplain line in planform, however, the water surface elevations from each study were converted to vertical datum NAVD 88 to correspond to the most recent topographical information available. The conversion factor from NGVD 29 to NAVD 88 is -0.71 ft based on the National Geodetic Survey VERTCON process and the latitude and longitude of the site. Datum conversion documentation is provided in Appendix D.

### **3.2 FEMA Flood Insurance Study (FIS) HEC-2 Model (Duplicate Effective Model A)**

The FEMA FIS HEC-2 input data text file was acquired from the Susquehanna River Basin Commission (SRBC), which conducted the original study. The HEC-2 Input file was truncated to only include the cross sections included in this study. These included Cross Sections CR to CS from the FIS, which were labeled Cross Sections 9 and 10 in the HEC-2 Model. The HEC-2 input file was then run in HEC-2, as required by FEMA to create a "Duplicate Effective Model." The intent of this model was to recreate the original study, with the original software, on our equipment. Because Cross Section CR was the downstream limit of Duplicate Effective Model A, downstream boundary conditions at Section CR were set to match the modeled water surface elevations from the original FIS at this cross section for each profile. The HEC-2 input data and output text files for Duplicate Effective Model A are located in Appendix E.

### **3.3 FEMA (FIS) HEC-RAS Model (Duplicate Effective Model B)**

The FEMA FIS HEC-2 input data was entered into HEC-RAS to develop a "control" model for comparison with the more detailed existing and proposed models to be discussed later. The model includes HEC-2 cross-sections extending from Station 1324+50 (FEMA FIS XS "CR"; HEC-2 cross section 9) to Station 1346+00 (FEMA FIS XS "CS"; HEC-2 cross section 10). The 100-year peak flow used in the FEMA FIS was applied to the model and the 100-year water surface elevation of 512.9 ft was used as the 100-year downstream boundary condition. A subcritical flow regime was selected, as used in the HEC-2 analysis. HEC-RAS data for Duplicate Effective Model B is provided in Appendix F.

### **3.4 Corrected Effective Model**

The Duplicate Effective Model B geometry was enhanced with more accurate topographic data to create a Corrected Effective Model. The FEMA cross-sections were enhanced on the west side of the Susquehanna River with existing topography from an aerial survey supplemented with available GIS data. The river bottom of each cross-section was also supplemented with bathymetry data from the Ecology III report entitled "Ecological Studies of the Susquehanna River in the vicinity of the Susquehanna Steam Electric Station" (August, 1983). The 1983 bathymetry data by Ecology III (formerly Ichthyological Associates, Inc.) was used in this flood study over other bathymetry reports for its accuracy, detail and long span of studied river in the area of the SSES and proposed BBNPP facilities (see Appendix J). The



corrected effective model included the same cross sections as the duplicate effective model and utilized more accurate geometry data, but did not include any man-made features.

### 3.5 Existing Conditions

The existing conditions model is the basis for comparison for the evaluation of potential changes that could be caused by the proposed BBNPP intake structure. To accurately model the river hydraulics for comparison, two cross sections were added to the corrected effective model. One cross section was added at the location of the existing intake structure for SSES, and one cross section was added at the location of the proposed BBNPP intake. These cross sections were developed based on available one-foot topographical data on the project site, bathymetry data as described above, and available 2-foot GIS contours on the east side of the River. The existing intake structure was modeled as a flow obstruction. The structure dimensions and invert for the water intake were determined from figures 8C, 8D, 8E, and 8F on sheets 3204 and 3205 of the Joint Permit Drawings by Pennoni Associates. Design drawings and photographs of the existing intake structure are provided in Appendix K. Existing Manning's 'n' values were kept consistent with the FEMA FIS Manning's 'n' values.

The 100-year peak flow from the FEMA FIS of 260,000 cfs was used in the HEC-RAS existing conditions model. The downstream boundary condition was the known 100-year water surface elevation taken from the FEMA FIS (512.9 ft). A subcritical flow regime was assumed in the HEC-RAS analysis, consistent with the original model. Based on the model output, the subcritical flow assumption was verified. An encroachment analysis was also included in the Existing Conditions Model to establish the Floodway based on the more accurate geometry data used in this study. The Existing Conditions data is located in Appendix H.

### 3.6 Proposed Conditions

In the Proposed Conditions model, the existing conditions geometry was altered at Station 1331+38 to reflect the proposed intake structure conditions. The proposed structure was represented by an obstructed area within the cross-sectional geometry. The grading near the structure was also altered in the model; specifically the river bottom elevation was lowered to correctly represent the dredging to occur for the structure's intake invert, and fill was added to reflect the access drive and pad behind the structure. For details of the proposed intake structure, see Appendix K. Floodplain Manning's 'n' values were decreased from existing condition's values to reflect the parking lot/impervious surfaces in proposed conditions.

The same flow information and boundary condition used in the existing conditions model were used in proposed conditions ( $Q_{100} = 260,000$  cfs, downstream  $WSEL_{100} = 512.9$  ft). An encroachment analysis was also included in the Proposed Conditions Model for comparison with the Existing Conditions Floodway. Proposed Conditions data can be found in Appendix I.

## 4 Results and Conclusions

A summary of 100-year flood elevations and velocities for all of the above models is provided in Appendix D. Duplicate Effective Model A successfully duplicates the flood elevations reported in the current FIS. Duplicate Effective Model B reports higher water surface elevations and lower velocities than Duplicate Effective Model A. It would appear that this is a result of slightly different modeling routines in HEC-2 and HEC-RAS. The Corrected Effective Model is actually closer to the Duplicate Effective Model A at the upstream limit of the study, with the BFE only 0.05 ft higher.

The Existing Conditions model shows a slight increase in BFE above the existing structure when compared to the Corrected Effective Model. This increase is apparently a result of the addition of the two cross sections at the existing and proposed intake structures, which includes the obstruction created by the existing intake structure.

The Proposed Conditions Model was compared to the Existing Conditions Model to determine the effect of the proposed intake structure on the 100-year flood elevation. The proposed BFE is identical to the BFE in the Existing Conditions model at all cross sections except the proposed intake structure. At the proposed intake structure, the model shows a 100-year WSE decrease of 0.01 ft, and a velocity increase of 0.05 ft/s. The intake structure itself, although modeled as an obstruction, is located primarily in an area that was shown as ineffective flow area in the Existing Conditions model.

Since the proposed water surface elevations are equal to or lower than the existing water surface elevations, it can be concluded that the proposed intake structure for the BBNPP will have no negative hydraulic effect on the Susquehanna River and its floodplain. The elevation and extent of the 100-year floodplain will not be measurably increased at any location as a result of this project.

The Floodway in the Proposed Condition model is identical to that of the Existing Conditions model with the exception of Station 133138, where the Floodway shifts inward slightly to match the face of the proposed intake structure.

The existing and proposed 100-year and 500-year floodplain as well as the Floodway are plotted on the Floodplain Map in Appendix B. The plan vertical datum is NAVD 88. Because all models were prepared based on the NGVD 29 vertical datum, a conversion table is provided in Appendix D.

## Appendix A: Maps

- Location Map
- Soils Map
- Geology Map





Source: Berwick, PA USGS 7.5-minute topographic quadrangle

Location

Scale

1" = 2000'

### Project Location Map

BBNPP Intake Structure on the Susquehanna River



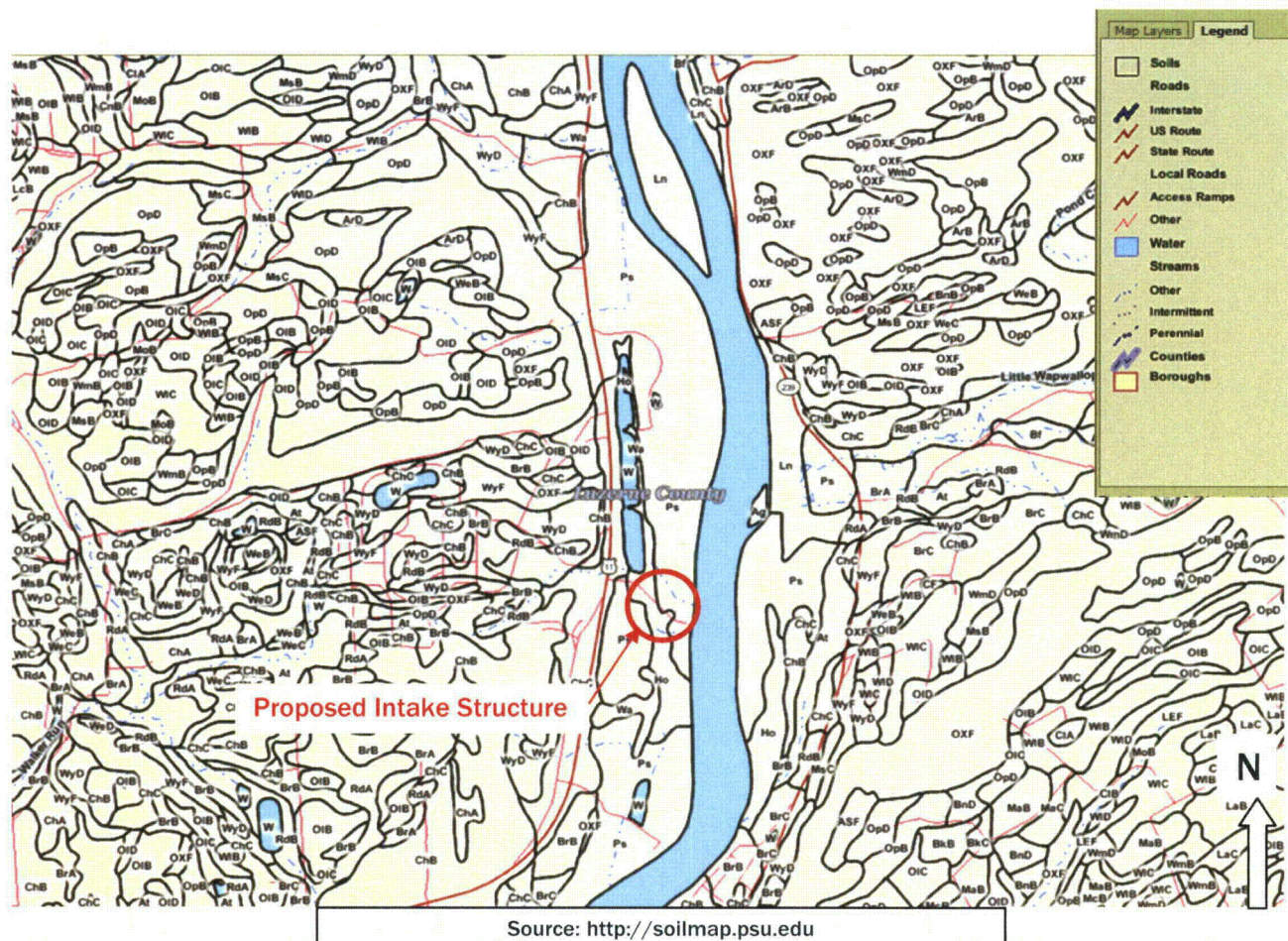
## Susquehanna River Flood Study Report

Bell Bend Nuclear Power Plant

Salem Township, Luzerne County, PA

November 2010





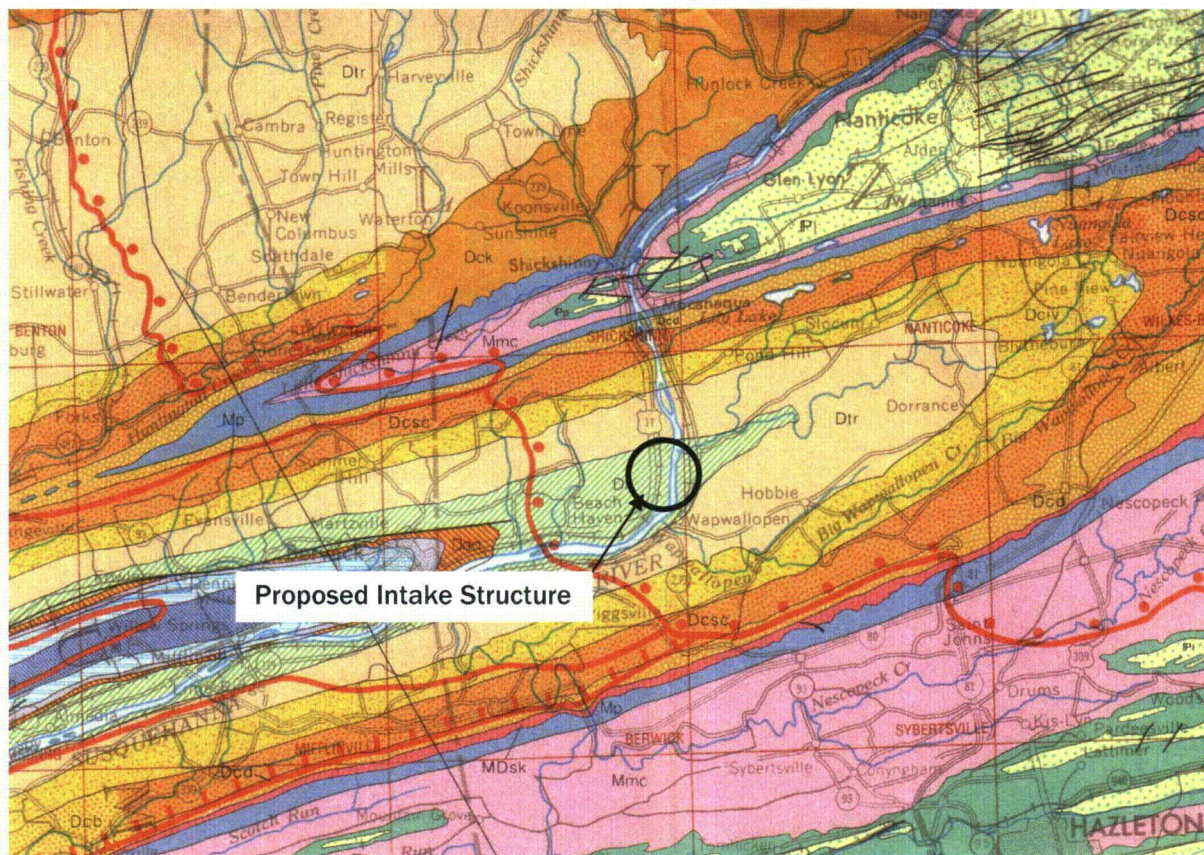
## Location

### Scale

## Soils Location Map







### Geologic Formation

Dh = Hamilton Group

### Location

41°05'17" N, 76°07'54" W

### Scale

1:250,000

### Geology Map

BBNPP Intake Structure on the Susquehanna River



## Susquehanna River Flood Study Report

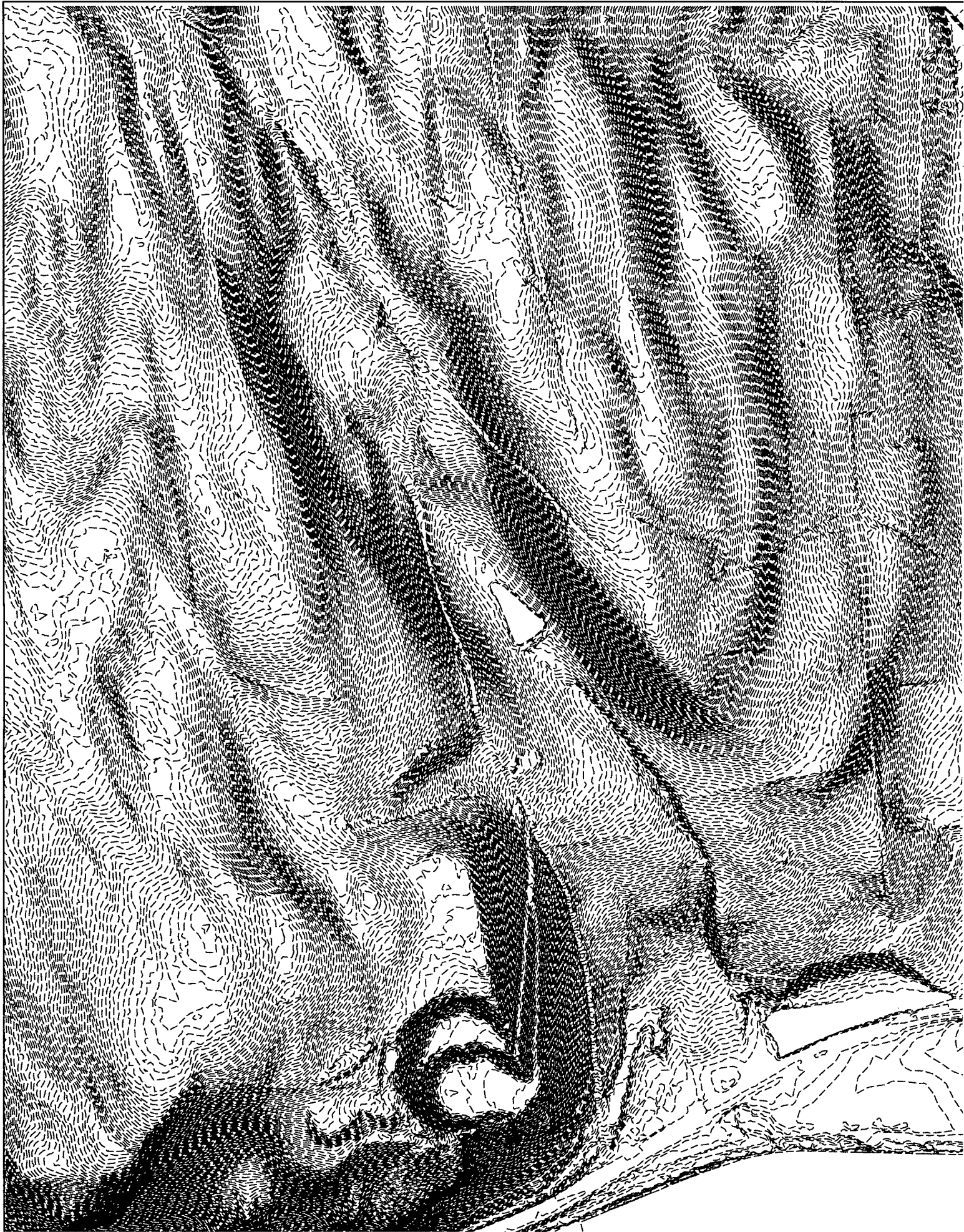
Bell Bend Nuclear Power Plant

Salem Township, Luzerne County, PA

November 2010



**Appendix B:**  
**Floodplain Map**

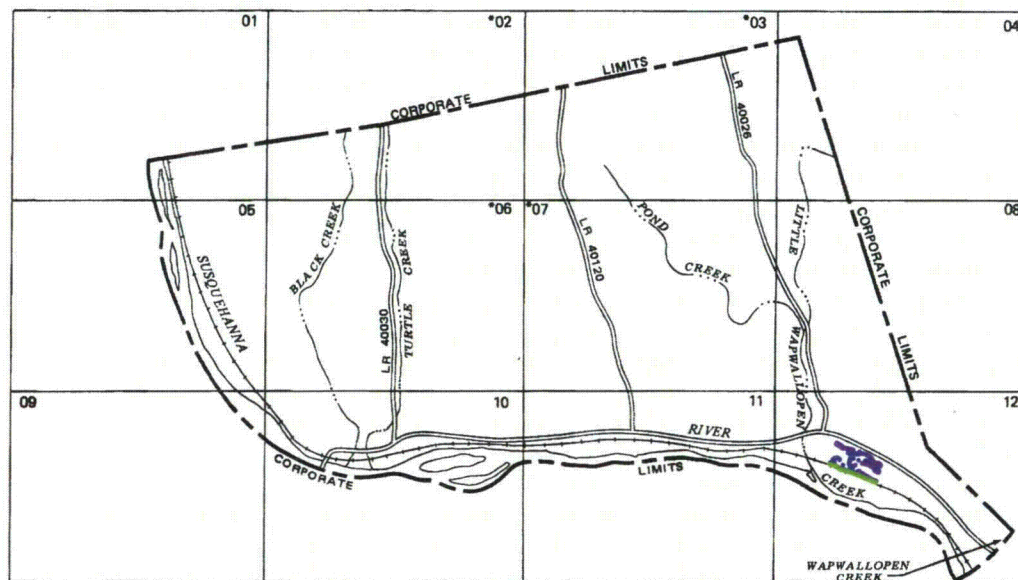


**Appendix C:**  
**Annotated FIRM**









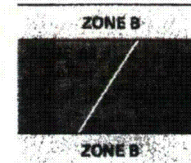
\*NOT PRINTED-ALL AREA IN ZONE C  
PANEL 01E -ELEVATION REFERENCE MARKS

### Legend

- Proposed 100 Year Floodplain
- Proposed 500 Year Floodplain
- Proposed Floodway



### KEY TO SYMBOLS



ZONE DESIGNATIONS\* WITH  
DATE OF IDENTIFICATION  
M., 12/2/74

Base Flood Elevation Line -----513-----

Base Flood Elevation (513' MSL)

Elevation Reference Mark RM7<sub>x</sub>

River Mile - M1.5

### \*EXPLANATION OF ZONE DESIGNATIONS

A flood insurance map displays the zone designations for a community according to areas of designated flood hazards. The zone designations used by FIA are:

Zone Symbol	Category
A	Area of special flood hazards (SFH) and without base flood elevations determined.
A1 through A30	Area of special flood hazards (SFH) with base flood elevations. Zones are assigned according to flood hazard factors, and dates of SFH identification.
AO	Area of special flood hazards that have shallow flood depths (less than two feet) and/or unpredictable flow paths. Base flood elevations are not determined.
V	Area of special flood hazards, with velocity, that are inundated by tidal floods. Zones are assigned according to flood hazard factors and dates of SFH identification.
B	Area of moderate flood hazards.
C	Area of minimal flood hazards.
D	Area of undetermined, but possible, flood hazards.

CONSULT NFIA SERVICING COMPANY OR LOCAL INSURANCE AGENT OR BROKER TO DETERMINE IF PROPERTIES IN THIS COMMUNITY ARE ELIGIBLE FOR FLOOD INSURANCE.

INITIAL IDENTIFICATION DATE:

MAY 3, 1974 AND MAY 7, 1976

CONVERSION TO REGULAR PROGRAM:

FEBRUARY 18, 1977

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT  
Federal Insurance Administration

FLOOD HAZARD BOUNDARY MAP H - 01 - 12  
FLOOD INSURANCE RATE MAP I - 01 - 12

### MAP INDEX

TOWNSHIP OF CONYNGHAM, PA  
(LUZERNE CO.)

COMMUNITY NO. 420600B

Appendix D:  
Flood Model Summary Table





# Susquehanna River Flood Study Report

Bell Bend Nuclear Power Plant  
Salem Township, Luzerne County, PA  
April 2012

**Flood Model Summary Table**

(all elevations are NGVD 1929)

River Station/ Cross Section	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Δ WSE (ft)	Vel Chnl (ft/s)	Δ V (ft/s)
134600 HEC-2 XS 10, CS	FEMA (FIS)	260000		513.7		N/A	
	Duplicate Effective A (HEC-2)	260000		513.78	0.08	8.26	N/A
	Duplicate Effective B (HEC-RAS)	260000		514.15	0.37	8.22	-0.04
	Corrected Effective	260000		513.82	-0.33	8.03	-0.19
	Existing Conditions	260000	477.20	514.01	0.19	7.97	-0.06
	Proposed Conditions	260000	477.20	514.01	0.00	7.97	0.00
133431 HEC-2 XS 9.2	Existing Conditions	260000	472.50	513.29		8.49	
	Proposed Conditions	260000	472.50	513.29	0.00	8.49	0.00
133138 HEC-2 XS 9.1	Existing Conditions	260000	474.40	513.03		8.84	
	Proposed Conditions	260000	474.40	513.02	-0.01	8.89	0.05
132450 HEC-2 XS 9, CR	FEMA (FIS)	260000		512.9		N/A	
	Duplicate Effective A (HEC-2)	260000		512.90	0.00	8.69	N/A
	Duplicate Effective B (HEC-RAS)	260000		512.90	0.00	8.60	-0.09
	Corrected Effective	260000		512.90	0.00	7.88	-0.72
	Existing Conditions	260000	467.20	512.90	0.00	7.88	0.00
	Proposed Conditions	260000	467.20	512.90	0.00	7.88	0.00



# Susquehanna River Flood Study Report

PPL Bell Bend Nuclear Power Plant

Salem Township, Luzerne County, PA

April 2012

## Vertical Datum Conversion Table (100-yr WSE)

River Station/ Cross Section	Plan	NGVD 29 W.S. Elev (ft)	NAVD 88 W.S. Elev (ft)
134600 HEC-2 XS 10, CS	Existing Conditions	514.01	513.30
	Proposed Conditions	514.01	513.30
133431 (Existing Intake)	Existing Conditions	513.29	512.58
	Proposed Conditions	513.29	512.58
133138 (Proposed Intake)	Existing Conditions	513.03	512.32
	Proposed Conditions	513.02	512.31
132450 HEC-2 XS 9, CR	Existing Conditions	512.90	512.19
	Proposed Conditions	512.90	512.19

Questions concerning the VERTCON process may be mailed to NGS

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Latitude: 041 05 21.19

Longitude: 076 09 57.34

NGVD 29 height:

Datum shift (NAVD 88 minus NGVD 29): -0.216 meter = -0.708 ft.

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## Appendix E: Duplicate Effective Model A

- HEC-2 Input Data
- HEC-2 Output Data

DUPLICATE EFFECTIVE A - INPUT.TXT										
T1	SRBC	SHICKSHINNY PA	SITE UPDATE		EAA PROJECT NO 16213.02					
T2	SECTIONS	9 THRU 10	APRIL 11, 2012							
T3	SUSQUEHANNA RIVER	100-YEAR								
J1	4								512.9	
J2	+1.0	0	-1.0			- .80				
J3	38	43	1	8	26	3	51	52	4	39
J3	0	201								
NC	.080	.080	.040	0.10	0.30					
QT	4	167000	232000	260000	340000					
ET	9					9.1			1758	2869
X1	9	86	1921	2869	2030	1650	2050			
GR	575.0	0000	553.9	0056	553.9	0072	544.9	0107	531.8	0190
GR	522.2	0263	518.7	0331	514.0	0404	509.6	0451	509.6	0526
GR	509.6	0595	514.9	0625	518.8	0686	520.6	0743	529.0	0821
GR	530.9	0892	531.8	0979	531.7	1003	516.4	1045	516.9	1052
GR	516.9	1053	516.9	1057	515.2	1074	503.1	1103	501.9	1146
GR	501.9	1210	503.5	1244	503.4	1324	504.9	1410	504.9	1513
GR	503.0	1548	504.7	1602	505.2	1661	505.2	1712	504.0	1794
GR	502.2	1856	505.5	1921	503.2	1950	487.5	1978	481.4	1988
GR	481.1	2798	487.5	2816	507.6	2869	507.6	2956	509.8	3016
GR	506.5	3089	505.7	3175	506.8	3264	506.2	3321	505.1	3387
GR	511.8	3395	511.8	3402	504.9	3421	504.9	3451	510.0	3472
GR	512.1	3541	512.2	3637	511.5	3716	513.3	3819	517.5	3918
GR	520.4	3964	520.0	3975	520.7	3981	520.7	3983	520.7	3987
GR	520.4	3996	521.4	4026	524.9	4107	526.9	4175	527.5	4213
GR	527.5	4223	530.8	4305	534.2	4377	537.0	4473	540.1	4535
GR	541.9	4547	541.9	4584	541.0	4596	544.1	4602	546.6	4648
GR	556.2	4740	565.0	4831	570.9	4862	573.5	4908	573.5	4923
GR	575.0	4933								
NC	.060	.060								
ET	10					9.1			2139	3228
X1	10	86	2278	3228	2075	2160	2125			
GR	575.0	0000	571.9	0049	570.1	0102	562.3	0168	540.0	0251
GR	540.0	0266	531.1	0335	522.3	0421	516.0	0493	510.8	0554
GR	510.5	0592	510.5	0605	510.9	0679	513.1	0770	512.9	0868
GR	513.3	0969	513.3	1056	513.1	1157	512.1	1228	511.4	1248
GR	511.4	1264	512.9	1282	512.4	1339	515.1	1356	515.5	1362
GR	515.1	1370	514.8	1395	510.3	1406	509.1	1489	508.0	1576
GR	506.2	1679	506.2	1720	506.1	1826	508.1	1946	505.9	2005
GR	504.8	2073	501.1	2140	500.9	2200	500.7	2278	493.7	2301
GR	487.7	2348	480.0	2489	480.0	3141	487.7	3174	517.0	3228
GR	517.9	3247	517.9	3255	517.7	3323	517.5	3401	516.4	3492
GR	516.0	3602	512.9	3701	510.1	3806	507.3	3870	505.4	3951
GR	504.0	3990	504.0	4013	505.2	4034	512.1	4041	512.1	4049
GR	504.9	4064	504.9	4089	513.9	4110	513.9	4115	512.5	4123
GR	512.5	4529	516.6	4541	515.1	4555	517.5	4567	518.0	4572
GR	517.5	4580	513.1	4594	515.8	4602	513.2	4618	522.6	4660
GR	525.4	4698	525.6	4700	525.6	4737	525.1	4761	522.9	4819
GR	530.9	4881	544.1	4943	547.5	4985	550.1	5023	563.2	5096
GR	575.0	5162								
EJ										
ER										

1\*\*\*\*\*  
 \* HEC-2 WATER SURFACE PROFILES \*  
 \* \*  
 \* Version 4.6.2; May 1991 \*  
 \* \*  
 \* RUN DATE 12APR12 TIME 10:01:08 \*  
 \*\*\*\*\*

\*\*\*\*\*  
 \* U.S. ARMY C \*  
 \* HYDROLOGIC \*  
 \* 609 SECOND \*  
 \* DAVIS, CALI \*  
 \* (91 \*  
 \*\*\*\*\*

```

X      X  XXXXXXXX  XXXXX      XXXXX
X      X  X        X      X      X      X
X      X  X        X      X      X      X
XXXXXXX XXXX      X      XXXXX  XXXXX
X      X  X        X      X      X      X
X      X  X        X      X      X      X
X      X  XXXXXXXX  XXXXX      XXXXXXXX
  
```

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THIS RUN EXEC

\*\*\*\*\*  
 HEC-2 WATER SURFACE PROFILES  
 Version 4.6.2; May 1991  
 \*\*\*\*\*

T1 SRBC SHICKSHINNY PA SITE UPDATE EAA PROJECT NO 16213.02  
 T2 SECTIONS 9 THRU 10 APRIL 11, 2012  
 T3 SUSQUEHANNA RIVER 100-YEAR

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
		4							512.9	
J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITR
	+1.0	0	-1.0			- .80				

J3 VARIABLE CODES FOR SUMMARY PRINTOUT

	38	43	1	8	26	3	51	52	4
	0	201							
NC	.080	.080	.040	0.10	0.30				
QT	4	167000	232000	260000	340000				
ET	9					9.1			

DUPLICATE EFFECTIVE A - OUTPUT.TXT

X1	9	86	1921	2869	2030	1650	2050	
GR	575.0	0000	553.9	0056	553.9	0072	544.9	0107
GR	522.2	0263	518.7	0331	514.0	0404	509.6	0451
GR	509.6	0595	514.9	0625	518.8	0686	520.6	0743
GR	530.9	0892	531.8	0979	531.7	1003	516.4	1045
GR	516.9	1053	516.9	1057	515.2	1074	503.1	1103
GR	501.9	1210	503.5	1244	503.4	1324	504.9	1410
GR	503.0	1548	504.7	1602	505.2	1661	505.2	1712
GR	502.2	1856	505.5	1921	503.2	1950	487.5	1978
GR	481.1	2798	487.5	2816	507.6	2869	507.6	2956
GR	506.5	3089	505.7	3175	506.8	3264	506.2	3321
GR	511.8	3395	511.8	3402	504.9	3421	504.9	3451
GR	512.1	3541	512.2	3637	511.5	3716	513.3	3819
GR	520.4	3964	520.0	3975	520.7	3981	520.7	3983
GR	520.4	3996	521.4	4026	524.9	4107	526.9	4175
GR	527.5	4223	530.8	4305	534.2	4377	537.0	4473
GR	541.9	4547	541.9	4584	541.0	4596	544.1	4602
GR	556.2	4740	565.0	4831	570.9	4862	573.5	4908
GR	575.0	4933						

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NC	.060	.060						
ET	10					9.1		
X1	10	86	2278	3228	2075	2160	2125	
GR	575.0	0000	571.9	0049	570.1	0102	562.3	0168
GR	540.0	0266	531.1	0335	522.3	0421	516.0	0493
GR	510.5	0592	510.5	0605	510.9	0679	513.1	0770
GR	513.3	0969	513.3	1056	513.1	1157	512.1	1228
GR	511.4	1264	512.9	1282	512.4	1339	515.1	1356
GR	515.1	1370	514.8	1395	510.3	1406	509.1	1489
GR	506.2	1679	506.2	1720	506.1	1826	508.1	1946
GR	504.8	2073	501.1	2140	500.9	2200	500.7	2278
GR	487.7	2348	480.0	2489	480.0	3141	487.7	3174
GR	517.9	3247	517.9	3255	517.7	3323	517.5	3401
GR	516.0	3602	512.9	3701	510.1	3806	507.3	3870
GR	504.0	3990	504.0	4013	505.2	4034	512.1	4041
GR	504.9	4064	504.9	4089	513.9	4110	513.9	4115
GR	512.5	4529	516.6	4541	515.1	4555	517.5	4567
GR	517.5	4580	513.1	4594	515.8	4602	513.2	4618
GR	525.4	4698	525.6	4700	525.6	4737	525.1	4761
GR	530.9	4881	544.1	4943	547.5	4985	550.1	5023
GR	575.0	5162						

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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-B
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-B
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SST
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	END

\*PROF 1



0

CCHV=.100 CEHV=.300  
\*SECNO 9.000

3265 DIVIDED FLOW

9.000	31.80	512.90	.00	512.90	514.00	1.10	.00	.00	505
260000.0	12315.1	243182.3	4502.6	8049.9	27988.7	3902.7	.0	.0	507
.00	1.53	8.69	1.15	.080	.032	.080	.000	481.10	415
.000389	2030.	2050.	1650.	0	0	0	.00	2914.53	3796

\*SECNO 10.000

3265 DIVIDED FLOW

10.000	33.78	513.78	.00	.00	514.77	.99	.76	.01	500
260000.0	13750.9	242116.0	4133.1	8003.7	29323.4	2921.4	1949.5	156.0	517
.08	1.72	8.26	1.41	.060	.032	.060	.000	480.00	519
.000328	2075.	2125.	2160.	2	0	0	.00	3517.28	4620

1

12APR12 10:01:08

THIS RUN EXEC

\*\*\*\*\*  
HEC-2 WATER SURFACE PROFILES  
Version 4.6.2; May 1991  
\*\*\*\*\*

NOTE- ASTERISK (\*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

SUSQUEHANNA RIVER 1

SUMMARY PRINTOUT

SECNO	Q	CWSEL	DEPTH	VCH	EG	DIFWSX	DIFKWS	TOPWID	X
9.000	260000.00	512.90	31.80	8.69	514.00	.00	.00	2914.53	
10.000	260000.00	513.78	33.78	8.26	514.77	.88	.00	3517.28	21

1

12APR12 10:01:08

SUMMARY OF ERRORS AND SPECIAL NOTES

1

12APR12 10:01:08

FLOOD INSURANCE ZONE DATA FOR SUSQUEHANNA RIVER 1

FLOOD HAZARD FACTOR FOR ENTIRE REACH USING SECTIONS

SECTION NUMBER	CUMULATIVE DISTANCE	ELEVATION DIFFERENCE BETWEEN BASE FLOOD AND		
		10	2	0.2
9.000	0.	512.90	.00	.00
10.000	2125.	513.78	.00	.00
-----				
WEIGHTED AVG FOR REACH		513.33	.00	.00

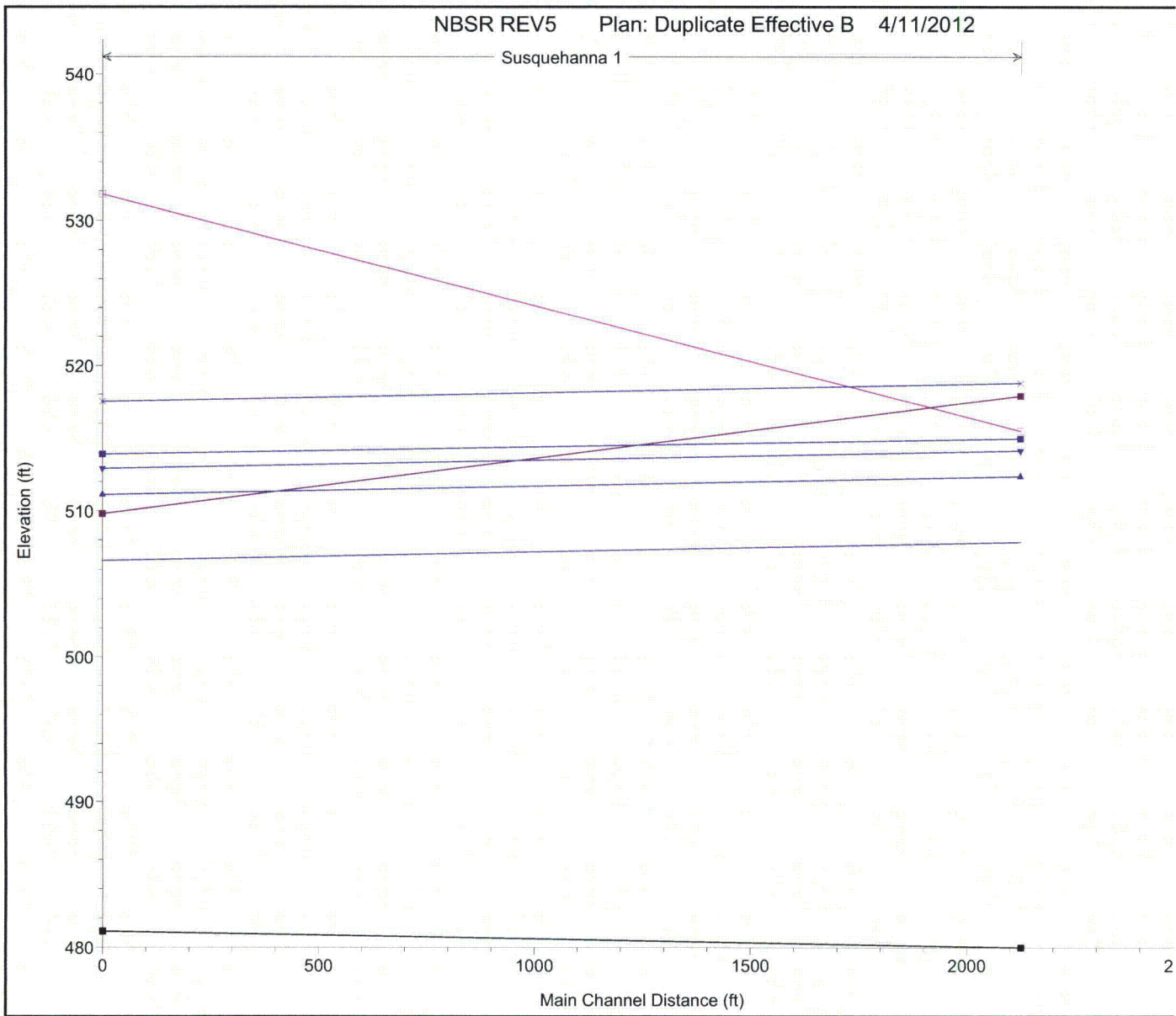
FHF FOR THE REACH = 005 WITH 100.0 PERCENT OF THE REACH WITHIN .5 FEET  
 ZONE FOR THE REACH = A 1

## Appendix F: Duplicate Effective Model B

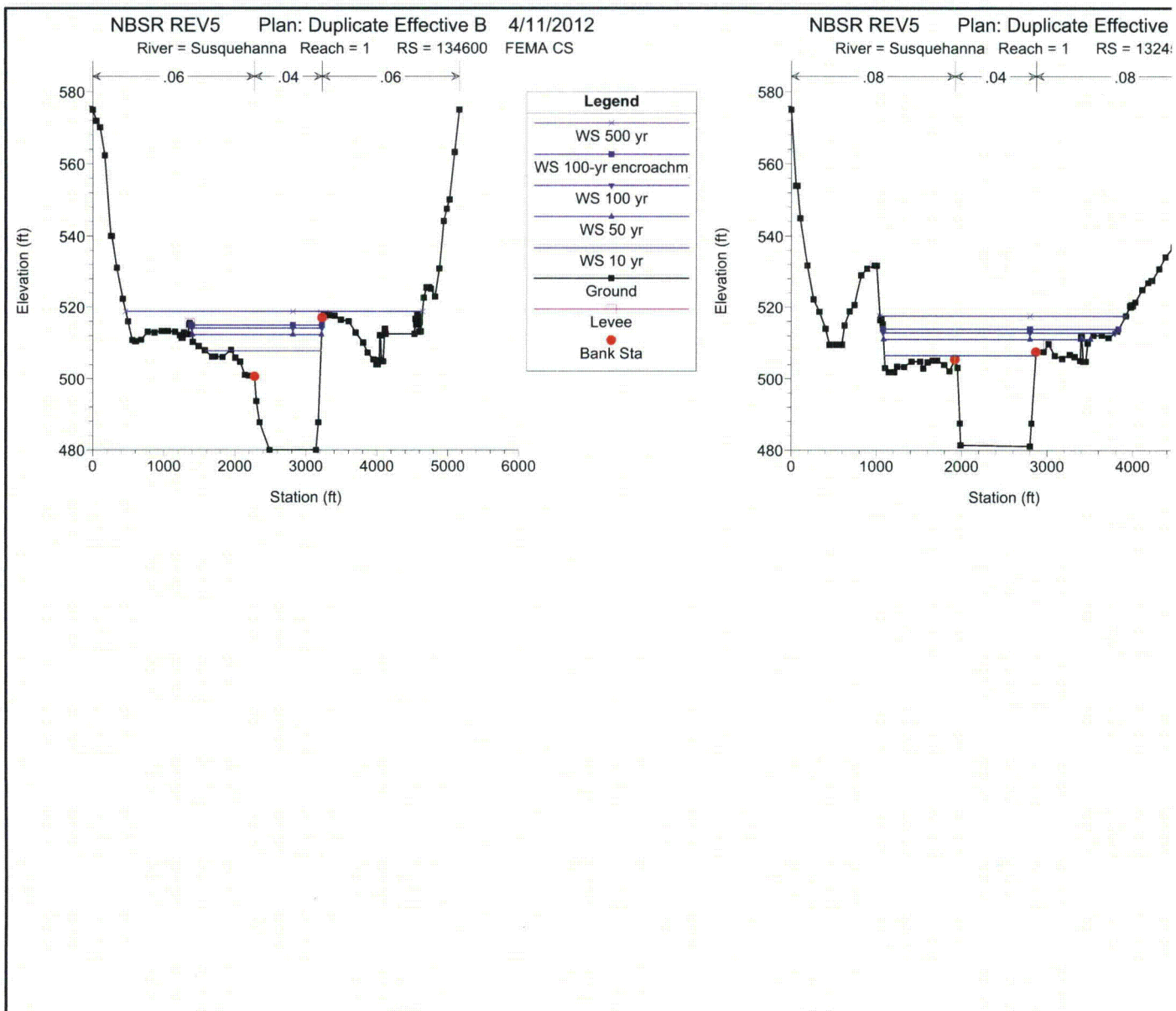
- HEC-RAS Reports
- HEC-RAS Cross-Sections
- HEC-RAS Profiles

HEC-RAS Plan: DUP B River: Susquehanna Reach: 1

Reach	River Sta.	Profile	Q Total (cfs)	Min Chl El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	134600	10-yr	167000.00	480.00	507.88	491.71	508.61	0.000467	6.91	25737.34	1609.40	0.24
1	134600	50-yr	232000.00	480.00	512.37	494.35	513.29	0.000497	7.90	33647.18	1818.51	0.26
1	134600	100-yr	260000.00	480.00	514.15	495.40	515.13	0.000500	8.22	36889.98	1826.14	0.26
1	134600	500-yr	340000.00	480.00	518.79	498.16	519.73	0.000440	8.41	59471.97	4181.88	0.25
1	134600	100-yr encroachm	260000.00	480.00	514.98	495.40	515.90	0.000453	7.95	38411.26	1844.11	0.25
1	132450	10-yr	167000.00	481.10	506.60	492.11	507.46	0.000621	7.49	24249.56	1771.75	0.27
1	132450	50-yr	232000.00	481.10	511.10	494.73	512.12	0.000609	8.33	34761.61	2414.55	0.28
1	132450	100-yr	260000.00	481.10	512.90	495.80	513.97	0.000597	8.60	39377.18	2716.60	0.28
1	132450	500-yr	340000.00	481.10	517.50	498.59	518.66	0.000561	9.19	52236.36	2876.02	0.28
1	132450	100-yr encroachm	260000.00	481.10	513.90	495.80	514.86	0.000521	8.22	42117.54	2756.03	0.26







HEC-RAS Version 4.1.0 Jan 2010  
U.S. Army Corps of Engineers  
Hydrologic Engineering Center  
609 Second Street  
Davis, California

```

X   X XXXXXX   XXXX   XXXX   XX   XXXX
X   X X X     X   X   X   X   X   X
X   X X X     X   X   X   X   X   X
XXXXXXXX XXXX   X   XXX XXXX   XXXXXX   XXXX
X   X X X     X   X   X   X   X   X
X   X X X     X   X   X   X   X   X
X   X XXXXXX   XXXX   X   X   X   X   XXXXX

```

PROJECT DATA

Project Title: NBSR REV5  
Project File : NBSRREV5.prj  
Run Date and Time: 4/11/2012 4:18:30 PM

Project in English units

PLAN DATA

Plan Title: Duplicate Effective B  
Plan File : p:\PROJECTS\Environmental\PPL - Wetland Permitting Oversight E-726-L8\TASKS\Task 10 -  
Floodplain\Study and Revisions NBSR\NBSR Revisions Feb 2012\Preliminary files to FEMA\4-10-  
12\HECRAS\NBSRREV5.p07

Geometry Title: Existing HEC2 FEMA

Geometry File : p:\PROJECTS\Environmental\PPL - Wetland Permitting Oversight E-726-L8\TASKS\Task 10  
- Floodplain\Study and Revisions NBSR\NBSR Revisions Feb 2012\Preliminary files to FEMA\4-10-  
12\HECRAS\NBSRREV5.g05

Flow Title : FEMA Ex Flow

Flow File : p:\PROJECTS\Environmental\PPL - Wetland Permitting Oversight E-726-L8\TASKS\Task 10  
- Floodplain\Study and Revisions NBSR\NBSR Revisions Feb 2012\Preliminary files to FEMA\4-10-  
12\HECRAS\NBSRREV5.f02

Plan Summary Information:

Number of:	Cross Sections =	2	Multiple Openings =	0
	Culverts =	0	Inline Structures =	0
	Bridges =	0	Lateral Structures =	0

Computational Information

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

Computation Options

Critical depth computed only where necessary  
Conveyance Calculation Method: At breaks in n values only  
Friction Slope Method: Average Conveyance  
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: FEMA Ex Flow  
Flow File : p:\PROJECTS\Environmental\PPL - Wetland Permitting Oversight E-726-L8\TASKS\Task 10 -  
Floodplain\Study and Revisions NBSR\NBSR Revisions Feb 2012\Preliminary files to FEMA\4-10-  
12\HECRAS\NBSRREV5.f02

Flow Data (cfs)

River	Reach	RS	10 yr	50 yr	100 yr	500
yr100-yr encroachment						
Susquehanna	1	134600	167000	232000	260000	340000
260000						

## Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Susquehanna	1	10 yr	Critical	Known WS = 506.6
Susquehanna	1	50 yr	Critical	Known WS = 511.1
Susquehanna	1	100 yr	Critical	Known WS = 512.9
Susquehanna	1	500 yr	Critical	Known WS = 517.5
Susquehanna	1	100-yr encroachment	Critical	Known WS = 513.9

## GEOMETRY DATA

Geometry Title: Existing HEC2 FEMA

Geometry File : p:\PROJECTS\Environmental\PPL - Wetland Permitting Oversight E-726-L8\TASKS\Task 10 -  
Floodplain\Study and Revisions NBSR\NBSR Revisions Feb 2012\Preliminary files to FEMA\4-10-  
12\HECRAS\NBSRREV5.g05

## CROSS SECTION

RIVER: Susquehanna

REACH: 1 RS: 134600

## INPUT

Description: FEMA CS

Station Elevation Data		num=		86					
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	575	49	571.9	102	570.1	168	562.3	251	540
266	540	335	531.1	421	522.3	493	516	554	510.8
592	510.5	605	510.5	679	510.9	770	513.1	868	512.9
969	513.3	1056	513.3	1157	513.1	1228	512.1	1248	511.4
1264	511.4	1282	512.9	1339	512.4	1356	515.1	1362	515.5
1370	515.1	1395	514.8	1406	510.3	1489	509.1	1576	508
1679	506.2	1720	506.2	1826	506.1	1946	508.1	2005	505.9
2073	504.8	2140	501.1	2200	500.9	2278	500.7	2301	493.7
2348	487.7	2489	480	3141	480	3174	487.7	3228	517
3247	517.9	3255	517.9	3323	517.7	3401	517.5	3492	516.4
3602	516	3701	512.9	3806	510.1	3870	507.3	3951	505.4
3990	504	4013	504	4034	505.2	4041	512.1	4049	512.1
4064	504.9	4089	504.9	4110	513.9	4115	513.9	4123	512.5
4529	512.5	4541	516.6	4555	515.1	4567	517.5	4572	518
4580	517.5	4594	513.1	4602	515.8	4618	513.2	4660	522.6
4698	525.4	4700	525.6	4737	525.6	4761	525.1	4819	522.9
4881	530.9	4943	544.1	4985	547.5	5023	550.1	5096	563.2
5162	575								

Manning's n Values		num=		3	
Sta	n Val	Sta	n Val	Sta	n Val
0	.06	2278	.04	3228	.06

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff Contr.	Expan.
	2278	3228		2075 2125	2160	.1	.3
Left Levee	Station=		1362	Elevation=	515.5		
Right Levee	Station=		3247	Elevation=	517.9		

## CROSS SECTION

RIVER: Susquehanna

REACH: 1 RS: 132450

## INPUT

Description: FEMA CR

Station Elevation Data		num=		86					
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	575	56	553.9	72	553.9	107	544.9	190	531.8
263	522.2	331	518.7	404	514	451	509.6	526	509.6
595	509.6	625	514.9	686	518.8	743	520.6	821	529
892	530.9	979	531.8	1003	531.7	1045	516.4	1052	516.9
1053	516.9	1057	516.9	1074	515.2	1103	503.1	1146	501.9
1210	501.9	1244	503.5	1324	503.4	1410	504.9	1513	504.9
1548	503	1602	504.7	1661	505.2	1712	505.2	1794	504
1856	502.2	1921	505.5	1950	503.2	1978	487.5	1988	481.4
2798	481.1	2816	487.5	2869	507.6	2956	507.6	3016	509.8
3089	506.5	3175	505.7	3264	506.8	3321	506.2	3387	505.1
3395	511.8	3402	511.8	3421	504.9	3451	504.9	3472	510
3541	512.1	3637	512.2	3716	511.5	3819	513.3	3918	517.5
3964	520.4	3975	520	3981	520.7	3983	520.7	3987	520.7

3996	520.4	4026	521.4	4107	524.9	4175	526.9	4213	527.5
4223	527.5	4305	530.8	4377	534.2	4473	537	4535	540.1
4547	541.9	4584	541.9	4596	541	4602	544.1	4648	546.6
4740	556.2	4831	565	4862	570.9	4908	573.5	4923	573.5
4933	575								

Manning's n Values		num=		3	
Sta	n Val	Sta	n Val	Sta	n Val
0	.08	1921	.04	2869	.08

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	1921	2869		6415.01	5590		.1	.3
Left Levee	Station=	979		Elevation=	531.8			
Right Levee	Station=	3016		Elevation=	509.8			



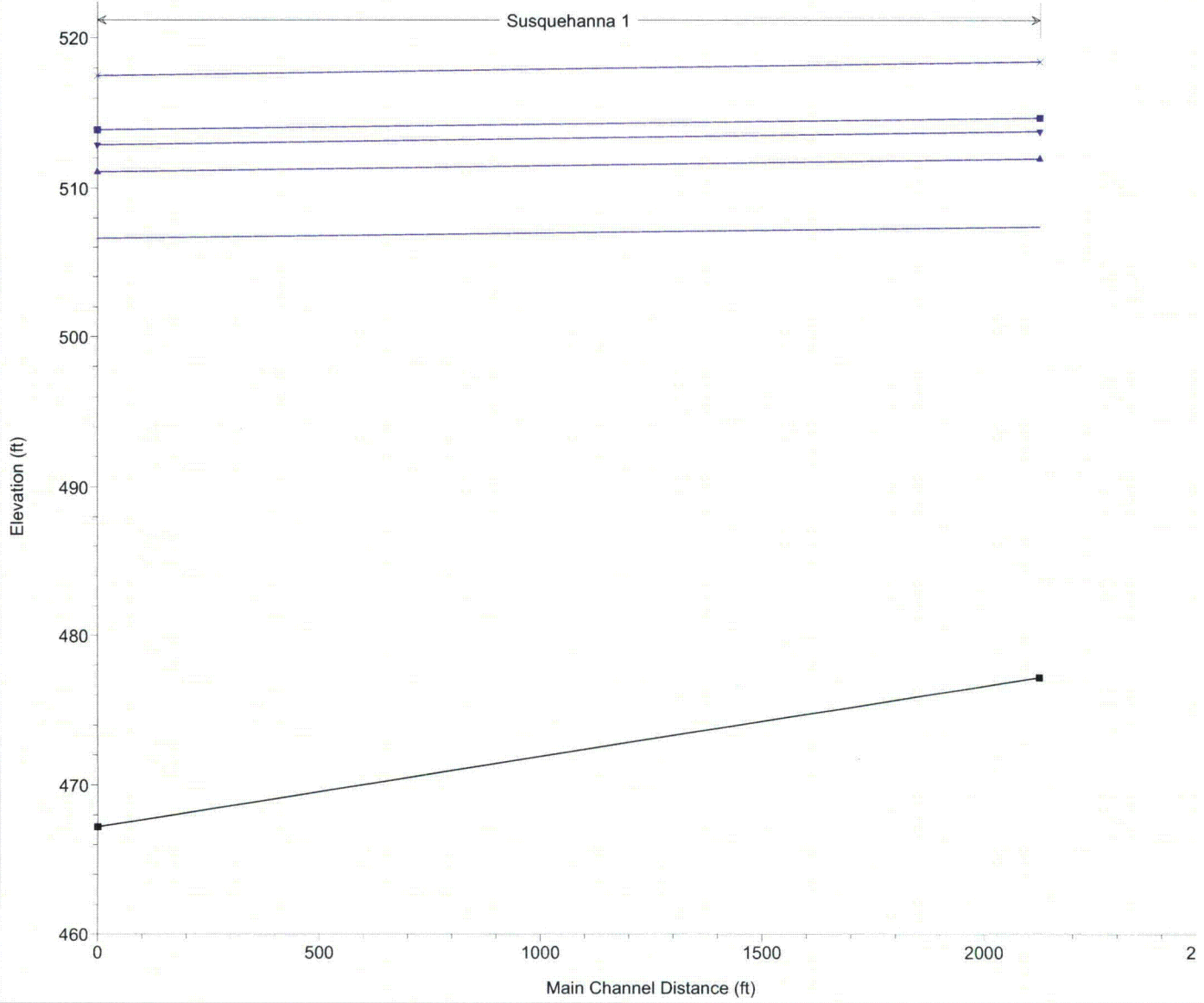
## Appendix G: Corrected Effective Model

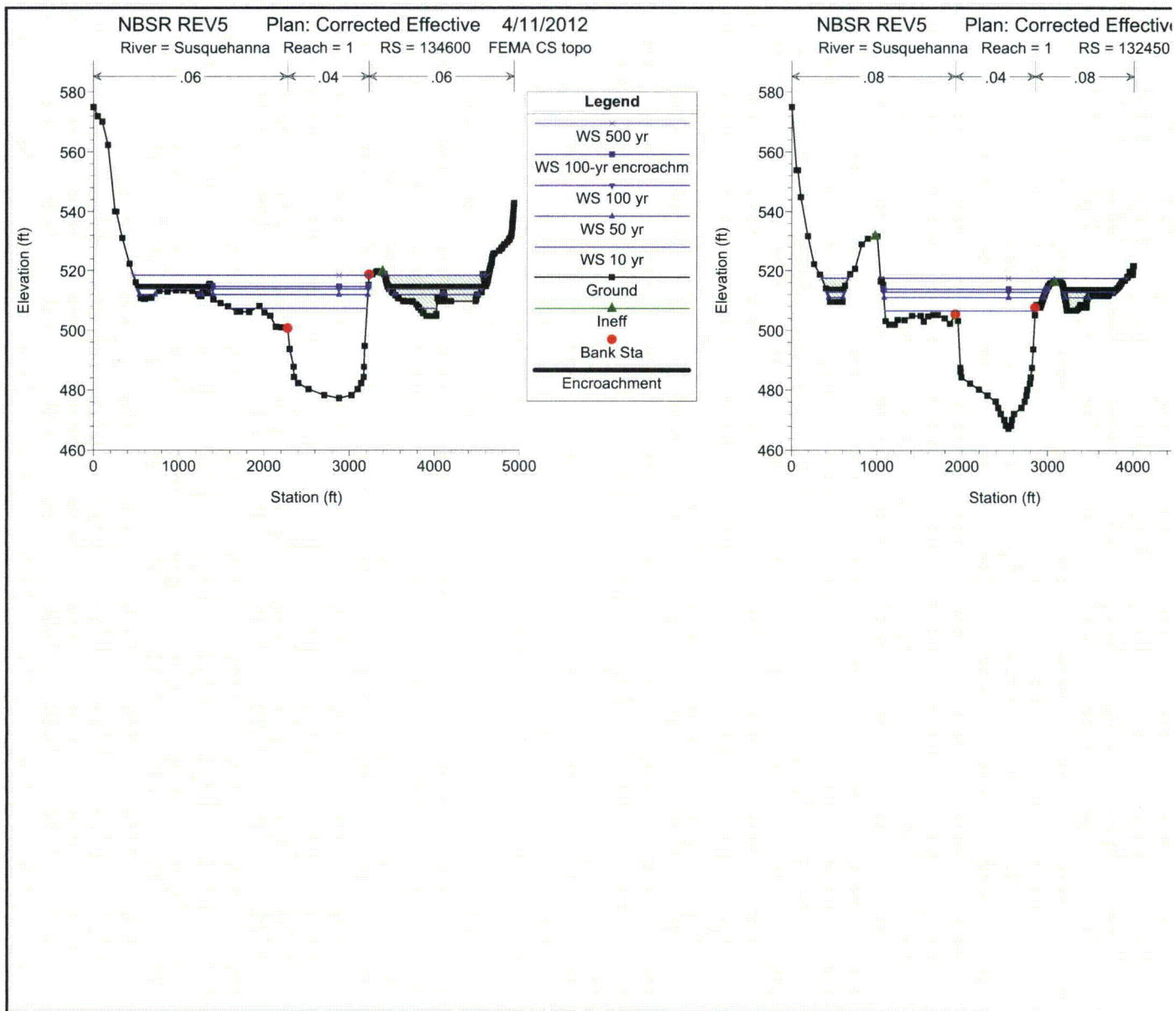
- HEC-RAS Reports
- HEC-RAS Cross-Sections
- HEC-RAS Profiles

HEC-RAS Plan: CORR River: Susquehanna Reach: 1

Reach	River Sta	Profile	Q Total	Min. Ch El	W. S. Elev	Crit W. S.	E. G. Elev	E. G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	134600	10-yr	167000.00	477.20	507.41	490.34	508.11	0.000430	6.75	26083.08	1745.93	0.23
1	134600	50-yr	232000.00	477.20	511.99	493.01	512.89	0.000463	7.74	34266.74	3008.67	0.25
1	134600	100-yr	260000.00	477.20	513.82	494.08	514.76	0.000464	8.03	38517.36	3747.31	0.25
1	134600	500-yr	340000.00	477.20	518.44	496.89	519.49	0.000460	8.69	51120.23	3979.27	0.25
1	134600	100-yr encroachment	260000.00	477.20	514.72	494.10	515.60	0.000420	7.78	39024.80	1833.93	0.24
1	132450	10-yr	167000.00	467.20	506.60	487.76	507.25	0.000374	6.48	27768.00	1757.05	0.22
1	132450	50-yr	232000.00	467.20	511.10	490.43	511.95	0.000412	7.52	35946.14	2307.98	0.23
1	132450	100-yr	260000.00	467.20	512.90	491.50	513.82	0.000420	7.88	39331.48	2671.23	0.24
1	132450	500-yr	340000.00	467.20	517.50	494.34	518.56	0.000426	8.64	53289.80	3195.69	0.25
1	132450	100-yr encroachment	260000.00	467.20	513.90	491.50	514.75	0.000376	7.60	41234.68	1912.36	0.23

NBSR REV5 Plan: Corrected Effective 4/11/2012







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U.S. Army Corps of Engineers  
Hydrologic Engineering Center  
609 Second Street  
Davis, California

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X   X X   X   X   X   X X   X   X
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PROJECT DATA

Project Title: NBSR REV5  
Project File : NBSRREV5.prj  
Run Date and Time: 4/11/2012 4:18:39 PM

Project in English units

PLAN DATA

Plan Title: Corrected Effective

Plan File : p:\PROJECTS\Environmental\PPL - Wetland Permitting Oversight E-726-L8\TASKS\Task 10 -  
Floodplain\Study and Revisions NBSR\NBSR Revisions Feb 2012\Preliminary files to FEMA\4-10-  
12\HECRAS\NBSRREV5.p06

Geometry Title: Corrected Effective

Geometry File : p:\PROJECTS\Environmental\PPL - Wetland Permitting Oversight E-726-L8\TASKS\Task 10  
- Floodplain\Study and Revisions NBSR\NBSR Revisions Feb 2012\Preliminary files to FEMA\4-10-  
12\HECRAS\NBSRREV5.g04

Flow Title : FEMA Ex Flow

Flow File : p:\PROJECTS\Environmental\PPL - Wetland Permitting Oversight E-726-L8\TASKS\Task 10  
- Floodplain\Study and Revisions NBSR\NBSR Revisions Feb 2012\Preliminary files to FEMA\4-10-  
12\HECRAS\NBSRREV5.f02

Plan Summary Information:

Number of:	Cross Sections =	2	Multiple Openings =	0
	Culverts =	0	Inline Structures =	0
	Bridges =	0	Lateral Structures =	0

Computational Information

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

Computation Options

Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

Encroachment Data

Equal Conveyance	=	True
Left Offset	=	0
Right Offset	=	0

River = Susquehanna	Reach = 1
RS Profile	Method Value1 Value2
139600 50 yr	0 0 0
137275 50 yr	0 0 0
134600 50 yr	0 0 0
133431 50 yr	0 0 0
133138 50 yr	0 0 0
132450 50 yr	0 0 0
130400 50 yr	0 0 0
128690 50 yr	0 0 0
127800 50 yr	0 0 0

River = Susquehanna Reach = 1

RS	Profile	Method	Value1	Value2
139600	100 yr	0	0	0
137275	100 yr	0	0	0
134600	100 yr	0	0	0
133431	100 yr	0	0	0
133138	100 yr	0	0	0
132450	100 yr	0	0	0
130400	100 yr	0	0	0
128690	100 yr	0	0	0
127800	100 yr	0	0	0

River = Susquehanna      Reach = 1

RS	Profile	Method	Value1	Value2
139600	500 yr	0	0	0
137275	500 yr	0	0	0
134600	500 yr	0	0	0
133431	500 yr	0	0	0
133138	500 yr	0	0	0
132450	500 yr	0	0	0
130400	500 yr	0	0	0
128690	500 yr	0	0	0
127800	500 yr	0	0	0

River = Susquehanna      Reach = 1

RS	Profile	Method	Value1	Value2
139600	100-yr encroachment	1	89	1118
137275	100-yr encroachment	1	387	1725
134600	100-yr encroachment	1	1350	3310
133431	100-yr encroachment	1	1075	2965.8
133138	100-yr encroachment	1	1165	3005
132450	100-yr encroachment	1	1065	3078.44
130400	100-yr encroachment	1	1060	2985
128690	100-yr encroachment	1	860	2090
127800	100-yr encroachment	1	892	2242

#### FLOW DATA

Flow Title: FEMA Ex Flow  
Flow File : p:\PROJECTS\Environmental\PPL - Wetland Permitting Oversight E-726-L8\TASKS\Task 10 - Floodplain\Study and Revisions NBSR\NBSR Revisions Feb 2012\Preliminary files to FEMA\4-10-12\HECRAS\NBSRREV5.f02

#### Flow Data (cfs)

River	Reach	RS	10 yr	50 yr	100 yr	500 yr
yr100-yr encroachment						
Susquehanna	1	134600	167000	232000	260000	340000
260000						

#### Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Susquehanna	1	10 yr	Critical	Known WS = 506.6
Susquehanna	1	50 yr	Critical	Known WS = 511.1
Susquehanna	1	100 yr	Critical	Known WS = 512.9
Susquehanna	1	500 yr	Critical	Known WS = 517.5
Susquehanna	1	100-yr encroachment	Critical	Known WS = 513.9

#### GEOMETRY DATA

Geometry Title: Corrected Effective  
Geometry File : p:\PROJECTS\Environmental\PPL - Wetland Permitting Oversight E-726-L8\TASKS\Task 10 - Floodplain\Study and Revisions NBSR\NBSR Revisions Feb 2012\Preliminary files to FEMA\4-10-12\HECRAS\NBSRREV5.g04

#### CROSS SECTION

RIVER: Susquehanna  
REACH: 1      RS: 134600

INPUT  
Description: FEMA CS topo

Station Elevation Data				num=	200				
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	575	49	571.9	102	570.1	168	562.3	251	540
266	540	335	531.1	421	522.3	493	516	554	510.8
592	510.5	605	510.5	679	510.9	770	513.1	868	512.9
969	513.3	1056	513.3	1157	513.1	1228	512.1	1248	511.4
1264	511.4	1282	512.9	1339	512.4	1356	515.1	1362	515.5
1370	515.1	1395	514.8	1406	510.3	1489	509.1	1576	508
1679	506.2	1720	506.2	1826	506.1	1946	508.1	2005	505.9
2073	504.8	2140	501.1	2200	500.9	2278	500.7	2301	493.7
2348	487.7	2351	484.2	2401	482.2	2521	480.2	2706	478.2
2881	477.2	3026	478.2	3101	480.2	3141	482.2	3171	484.2
3174	487.7	3182.5	494.71	3226.5	515.17	3234.13	518.71	3241.76	518.71
3270	518.71	3313.01	519.44	3328.61	519.71	3339.87	519.71	3382.78	519.71
3409.31	518.86	3414.11	518.71	3416.02	518.55	3426.3	517.71	3432.19	516.86
3433.22	516.71	3434.27	516.57	3440.7	515.71	3451.05	514.85	3452.7	514.71
3454.99	514.57	3468.56	513.71	3499.79	512.91	3507.41	512.71	3514.92	512.51
3544.48	511.71	3574.42	510.91	3581.73	510.71	3632.47	509.87	3641.81	509.71
3651.94	509.71	3705.77	509.71	3731.74	509.71	3738.37	509.71	3748.83	509.51
3789.46	508.71	3810.99	507.87	3815.03	507.71	3819.94	507.54	3843.93	506.71
3866.07	505.8	3868.29	505.71	3871.45	505.63	3908.53	504.71	3913.05	504.71
3936.08	504.71	3945.32	504.71	3977.47	504.71	4015.94	504.71	4022.1	504.71
4023.99	505.45	4037.31	510.71	4049.85	510.71	4051.64	510.71	4051.85	510.58
4053.27	509.71	4060	509.71	4095.03	509.71	4096.46	510.49	4096.84	510.71
4097.29	510.92	4098.88	511.71	4103.08	512.57	4103.79	512.71	4105	512.71
4112.67	512.71	4116.31	511.84	4116.85	511.71	4117.26	511.59	4119.96	510.71
4120.39	510.57	4123.07	509.71	4196.58	509.71	4485.69	509.71	4490.82	510.45
4492.63	510.71	4494.43	510.94	4500.32	511.71	4514.26	511.96	4555.91	512.71
4560.2	514.43	4571	518.71	4578.11	518.71	4579.56	518.71	4582.84	517.85
4583.41	517.71	4584.21	517.42	4589.01	515.71	4591.69	514.89	4592.25	514.71
4594.26	514.71	4604.18	514.71	4606.69	514.85	4622.12	515.71	4627.16	516.51
4628.41	516.71	4629.51	516.91	4634.07	517.71	4639.1	518.56	4640.02	518.71
4641.3	518.86	4648.43	519.71	4655.73	520.63	4656.34	520.71	4657	520.78
4665.12	521.71	4672.47	522.58	4673.59	522.71	4677.09	523.59	4677.59	523.71
4678.08	523.83	4681.55	524.71	4693.59	525.55	4695.91	525.71	4708.29	525.9
4762	526.71	4785.38	527.47	4792.78	527.71	4798.59	527.93	4818.67	528.71
4828.41	528.96	4857.39	529.71	4875.48	530.46	4881.63	530.71	4886.22	530.95
4900.74	531.71	4906.35	532.46	4908.21	532.71	4909.19	532.95	4912.63	533.71
4915.09	534.58	4915.46	534.71	4915.82	534.83	4918.26	535.71	4920.96	536.62
4921.25	536.71	4923.9	537.62	4924.17	537.71	4926.3	538.62	4926.52	538.71
4926.73	538.8	4928.83	539.71	4930.96	540.61	4931.17	540.71	4933.36	541.63
4933.54	541.71	4936.18	542.65	4936.35	542.71	4936.93	542.77	4937.83	542.87

Manning's n Values				num=	3
Sta	n Val	Sta	n Val	Sta	n Val
0	.06	2278	.04	3234.13	.06

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff Contr.	Expan.
	2278	3234.13		2075	2125	.1	.3
Ineffective Flow	num=		1				
Sta L	Sta R	Elev	Permanent				
3391.55	4937.83	519.7	F				

CROSS SECTION

RIVER: Susquehanna  
 REACH: 1 RS: 132450

INPUT

Description: FEMA CR topo

Station Elevation Data				num=	174				
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	575	56	553.9	72	553.9	107	544.9	190	531.8
263	522.2	331	518.7	404	514	451	509.6	526	509.6
595	509.6	625	514.9	686	518.8	743	520.6	821	529
892	530.9	979	531.8	1003	531.7	1045	516.4	1052	516.9
1053	516.9	1057	516.9	1074	515.2	1103	503.1	1146	501.9
1210	501.9	1244	503.5	1324	503.4	1410	504.9	1513	504.9
1548	503	1602	504.7	1661	505.2	1712	505.2	1794	504
1856	502.2	1921	505.5	1950	503.2	1978	487.5	1980	486.2
1992	484.2	2092	482.2	2197	480.2	2296	478.2	2392	476.2
2422	474.2	2452	472.2	2492	470.2	2512	468.2	2542	467.2
2572	468.2	2582	470.2	2607	472.2	2692	474.2	2732	476.2
2752	478.2	2762	480.2	2792	482.2	2802	484.2	2816	487.5
2831	493.71	2849.23	505.09	2853.45	507.71	2856.17	507.93	2866.02	508.71
2870.17	508.71	2871.47	508.71	2877.93	508.49	2900	507.71	2903.48	507.71
2914.15	507.71	2922.04	508.45	2924.85	508.71	2927.78	508.99	2935.2	509.71
2942.21	510.41	2945.18	510.71	2949.08	510.99	2958.95	511.71	2967.35	512.39
2971.21	512.71	2981.71	513.42	2986.11	513.71	2991.24	514	3003.66	514.71
3010.33	515.01	3025.96	515.71	3039.96	515.88	3064.99	516.17	3139.88	516.19

3156.23	515.91	3168.13	515.71	3175.36	515.03	3178.75	514.71	3180.79	514.33
3184.13	513.71	3186.8	513.21	3189.08	512.71	3193.43	512.07	3195.92	511.71
3198.41	511.39	3203.25	510.71	3207.11	510.19	3210.75	509.71	3212.99	509.32
3215.97	508.71	3218.76	508.15	3221.11	507.71	3222.88	507.33	3225.57	506.71
3294.57	506.71	3334.97	506.71	3353.92	507.2	3374.05	507.71	3376.75	508.1
3380.99	508.71	3390.31	508.71	3396.63	508.71	3397.78	508.29	3399.33	507.71
3431.15	507.71	3451.67	507.71	3452.07	508.01	3452.98	508.71	3453.85	509.38
3454.16	509.71	3457.13	510.04	3463.14	510.71	3480.65	511.39	3489.1	511.71
3522.7	511.71	3543.97	511.71	3558.76	511.71	3610.95	511.71	3622.71	511.71
3639.45	511.71	3647.95	511.71	3657.57	511.71	3676.52	511.71	3686.6	511.71
3697.67	511.71	3700.1	511.71	3713.24	511.93	3759.7	512.71	3781.23	513.27
3797.91	513.71	3814.7	514.2	3831.98	514.71	3843.13	515.19	3854.99	515.71
3862.77	516.19	3871.44	516.71	3891.77	516.71	3896.79	516.71	3901.28	516.85
3928.22	517.71	3933.77	518.14	3954.14	519.71	3968.51	519.71	3973.63	519.71
3982.44	519.71	3985.5	519.71	3986.37	519.44	3988.89	518.71	3989.16	518.71
3990.3	518.71	3991.93	519.51	3992.4	519.71	3992.87	519.9	3994.47	520.71
3996.01	521.49	3996.37	521.71	4003.41	521.71	4004.89	521.71		

Manning's n Values		num= 3	
Sta	n Val	Sta	n Val
0	.08	1921	.04
		2853.45	.08

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	1921	2853.45		6415	5590		.1	.3
Ineffective Flow	num= 2							
Sta L	Sta R	Elev	Permanent					
0	979	531.8	F					
3078.44	4004.89	516.17	F					

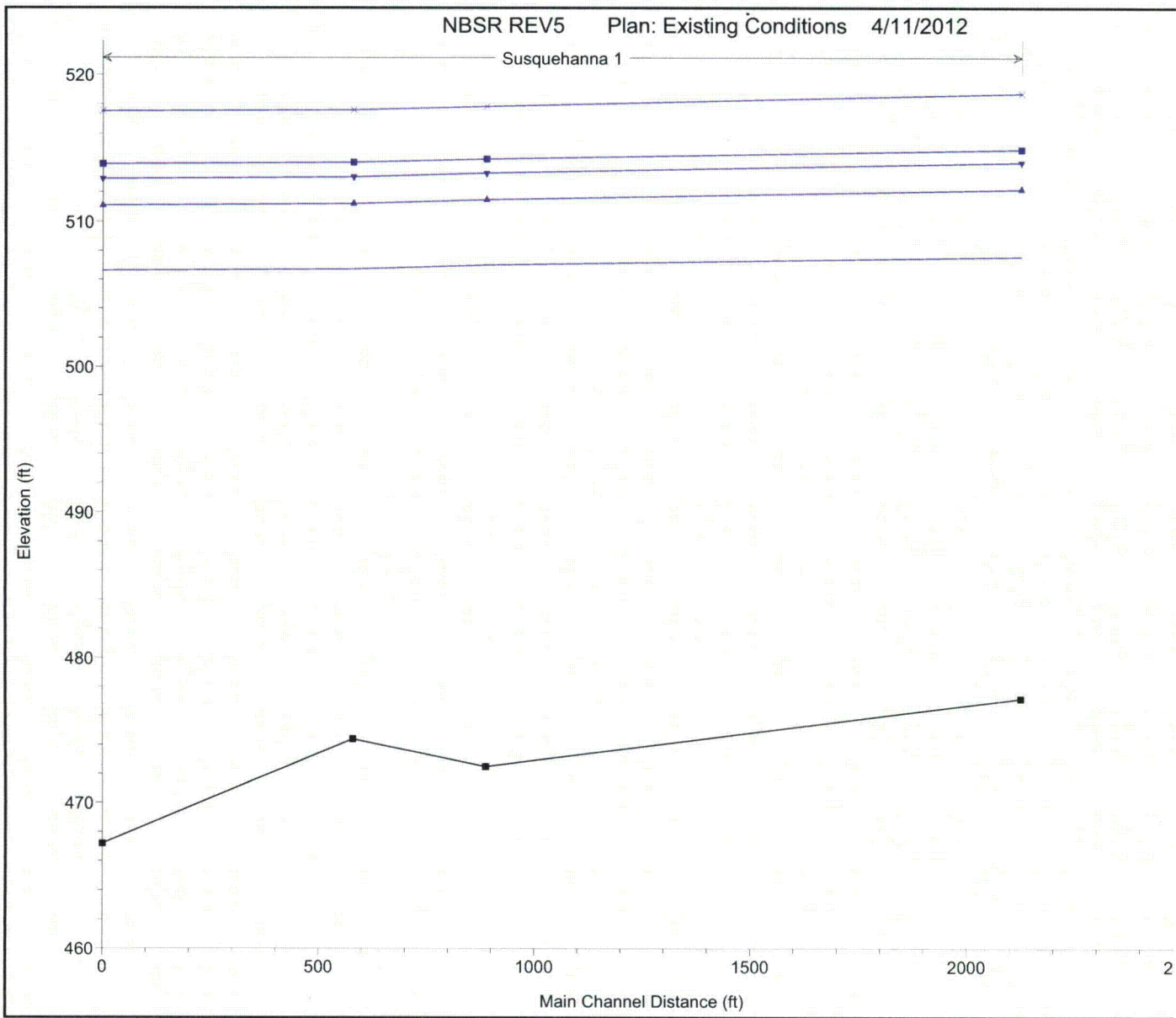


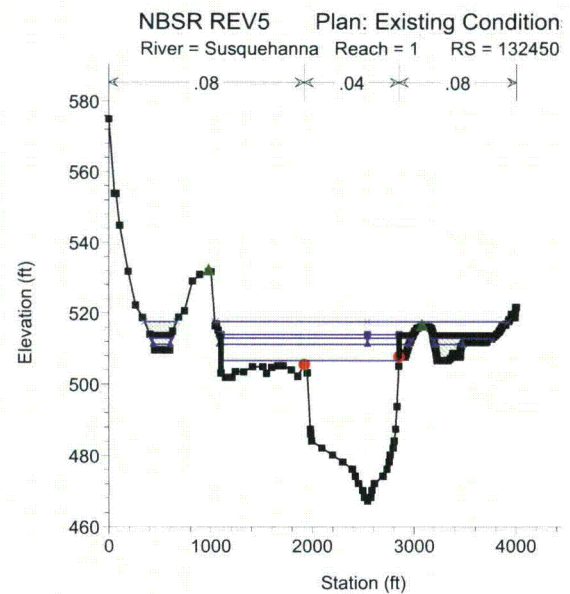
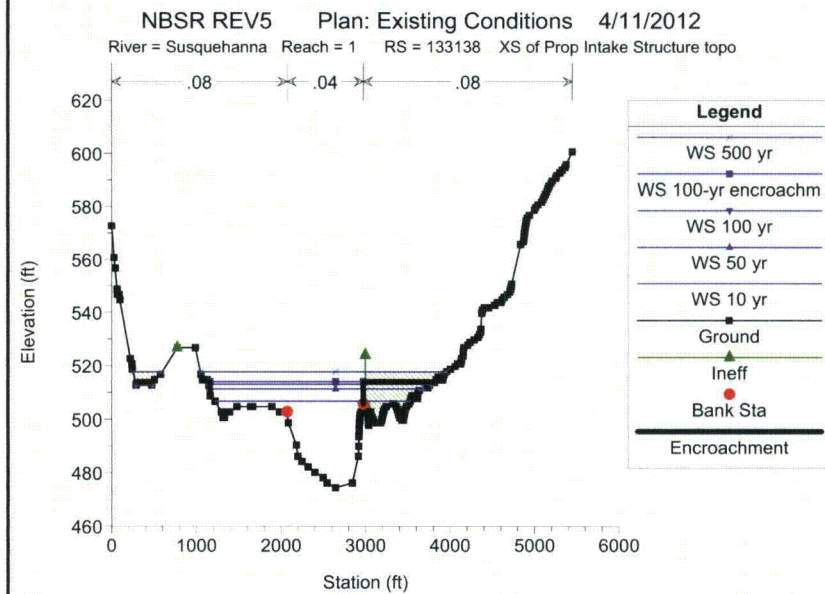
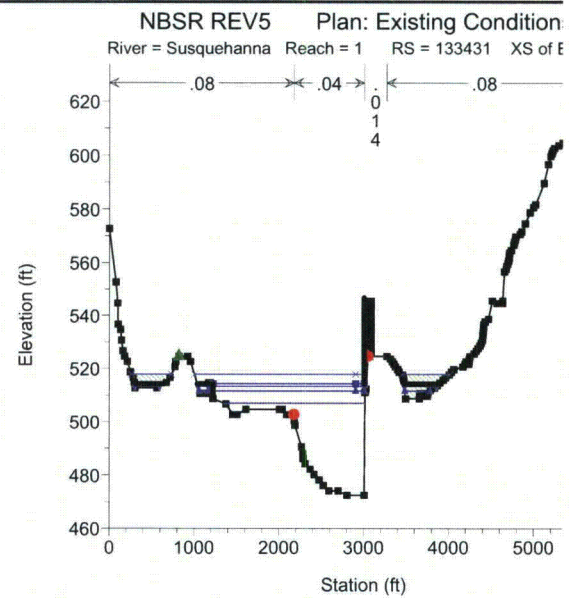
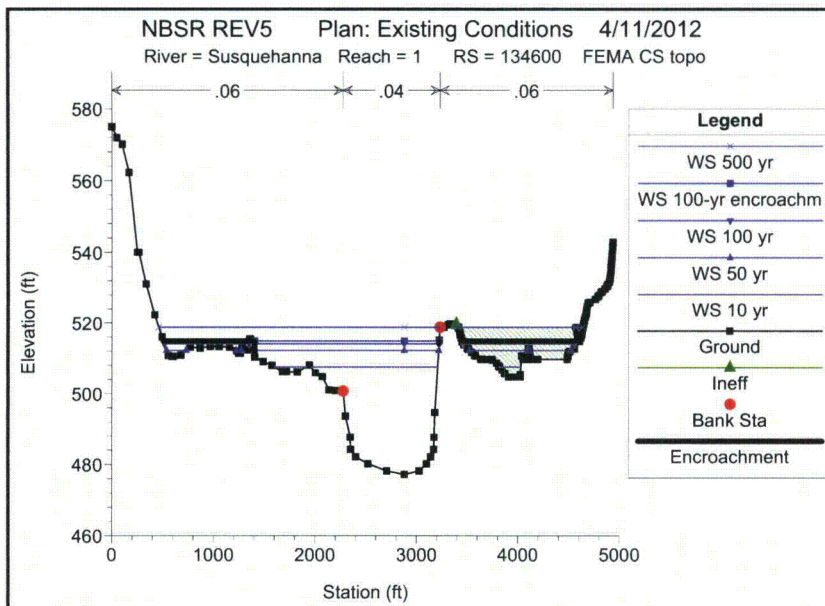
## Appendix H: Existing Conditions Model

- HEC-RAS Reports
- HEC-RAS Cross-Sections
- HEC-RAS Profiles

HEC-RAS Plan: EX River: Susquehanna Reach: 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	134600	10-yr	167000.00	477.20	507.58	490.34	508.27	0.000421	6.70	26344.15	1775.79	0.23
1	134600	50-yr	232000.00	477.20	512.18	493.01	513.06	0.000453	7.68	34642.04	3048.43	0.24
1	134600	100-yr	260000.00	477.20	514.01	494.08	514.94	0.000453	7.97	39034.34	3755.26	0.25
1	134600	500-yr	340000.00	477.20	518.70	496.89	519.73	0.000446	8.59	51847.46	3989.25	0.25
1	134600	100-yr encroachm	260000.00	477.20	514.90	494.10	515.77	0.000411	7.72	39320.50	1818.01	0.24
1	133431	10-yr	167000.00	472.50	507.00	487.77	507.74	0.000422	6.96	26026.08	1650.64	0.23
1	133431	50-yr	232000.00	472.50	511.49	490.75	512.47	0.000475	8.11	34012.39	2188.53	0.25
1	133431	100-yr	260000.00	472.50	513.29	491.98	514.35	0.000488	8.49	37436.19	2591.81	0.25
1	133431	500-yr	340000.00	472.50	517.83	495.20	519.11	0.000521	9.48	46404.91	3031.54	0.27
1	133431	100-yr encroachm	260000.00	472.50	514.25	491.98	515.23	0.000440	8.21	38829.16	1782.50	0.24
1	133138	10-yr	167000.00	474.40	506.71	490.64	507.58	0.000585	7.51	24329.00	2306.42	0.27
1	133138	50-yr	232000.00	474.40	511.23	493.68	512.30	0.000598	8.50	32554.30	2524.07	0.28
1	133138	100-yr	260000.00	474.40	513.03	494.87	514.17	0.000596	8.84	35882.32	2826.57	0.28
1	133138	500-yr	340000.00	474.40	517.59	498.04	518.94	0.000601	9.73	44577.62	3248.45	0.29
1	133138	100-yr encroachm	260000.00	474.40	514.03	494.87	515.08	0.000534	8.50	37494.70	1811.64	0.27
1	132450	10-yr	167000.00	467.20	506.60	487.76	507.25	0.000374	6.48	27768.00	1757.05	0.22
1	132450	50-yr	232000.00	467.20	511.10	490.43	511.95	0.000412	7.52	35946.14	2307.98	0.23
1	132450	100-yr	260000.00	467.20	512.90	491.50	513.82	0.000420	7.88	39331.48	2671.23	0.24
1	132450	500-yr	340000.00	467.20	517.50	494.34	518.56	0.000426	8.64	53289.80	3195.69	0.25
1	132450	100-yr encroachm	260000.00	467.20	513.90	491.50	514.76	0.000381	7.62	40530.64	1750.45	0.23







HEC-RAS Version 4.1.0 Jan 2010  
U.S. Army Corps of Engineers  
Hydrologic Engineering Center  
609 Second Street  
Davis, California

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X   X XXXXXX   XXXX   XXXX   XX   XXXX
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X   X X   X   X   X   X   X   X   X
X   X X   X   X   X   X   X   X   X
X   X XXXXXX   XXXX   X   X   X   X   XXXXX

```

PROJECT DATA

Project Title: NBSR REV5  
Project File : NBSRREV5.prj  
Run Date and Time: 4/11/2012 4:16:34 PM

Project in English units

PLAN DATA

Plan Title: Existing Conditions

Plan File : p:\PROJECTS\Environmental\PPL - Wetland Permitting Oversight E-726-L8\TASKS\Task 10 -  
Floodplain\Study and Revisions NBSR\NBSR Revisions Feb 2012\Preliminary files to FEMA\4-10-  
12\HECRAS\NBSRREV5.p04

Geometry Title: Existing Conditions

Geometry File : p:\PROJECTS\Environmental\PPL - Wetland Permitting Oversight E-726-L8\TASKS\Task 10 -  
Floodplain\Study and Revisions NBSR\NBSR Revisions Feb 2012\Preliminary files to FEMA\4-10-  
12\HECRAS\NBSRREV5.g03

Flow Title : FEMA Ex Flow

Flow File : p:\PROJECTS\Environmental\PPL - Wetland Permitting Oversight E-726-L8\TASKS\Task 10 -  
Floodplain\Study and Revisions NBSR\NBSR Revisions Feb 2012\Preliminary files to FEMA\4-10-  
12\HECRAS\NBSRREV5.f02

Plan Summary Information:

Number of:	Cross Sections =	4	Multiple Openings =	0
	Culverts =	0	Inline Structures =	0
	Bridges =	0	Lateral Structures =	0

Computational Information

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

Computation Options

Critical depth computed only where necessary  
Conveyance Calculation Method: At breaks in n values only  
Friction Slope Method: Average Conveyance  
Computational Flow Regime: Subcritical Flow

Encroachment Data

Equal Conveyance = True  
Left Offset = 0  
Right Offset = 0

River = Susquehanna	Reach = 1			
RS Profile	Method	Value1	Value2	
134600 50 yr	0	0	0	
133431 50 yr	0	0	0	
133138 50 yr	0	0	0	
132450 50 yr	0	0	0	

River = Susquehanna	Reach = 1			
RS Profile	Method	Value1	Value2	
134600 100 yr	0	0	0	
133431 100 yr	0	0	0	
133138 100 yr	0	0	0	
132450 100 yr	0	0	0	

RS	Profile	Method	Value1	Value2
134600	100-yr encroachment	1	1406	3224.01
133431	100-yr encroachment	1	1223.1	3005.6
133138	100-yr encroachment	1	1161.6	2973.24
132450	100-yr encroachment	1	1103	2853.45

Station	Elevation	Data	num=	200						
	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
	0	575	49	571.9	102	570.1	168	562.3	251	540
	266	540	335	531.1	421	522.3	493	516	554	510.8
	592	510.5	605	510.5	679	510.9	770	513.1	868	512.9
	969	513.3	1056	513.3	1157	513.1	1228	512.1	1248	511.4
	1264	511.4	1282	512.9	1339	512.4	1356	515.1	1362	515.5
	1370	515.1	1395	514.8	1406	510.3	1489	509.1	1576	508
	1679	506.2	1720	506.2	1826	506.1	1946	508.1	2005	505.9
	2073	504.8	2140	501.1	2200	500.9	2278	500.7	2301	493.7
	2348	487.7	2351	484.2	2401	482.2	2521	480.2	2706	478.2
	2881	477.2	3026	478.2	3101	480.2	3141	482.2	3171	484.2
	3174	487.7	3182.5	494.71	3226.5	515.17	3234.13	518.71	3241.76	518.71
	3270	518.71	3313.01	519.44	3328.61	519.71	3339.87	519.71	3382.78	519.71
	3409.31	518.86	3414.11	518.71	3416.02	518.55	3426.3	517.71	3432.19	516.86
	3433.22	516.71	3434.27	516.57	3440.7	515.71	3451.05	514.85	3452.7	514.71
	3454.99	514.57	3468.56	513.71	3499.79	512.91	3507.41	512.71	3514.92	512.51
	3544.48	511.71	3574.42	510.91	3581.73	510.71	3632.47	509.87	3641.81	509.71
	3651.94	509.71	3705.77	509.71	3731.74	509.71	3738.37	509.71	3748.83	509.51
	3789.46	508.71	3810.99	507.87	3815.03	507.71	3819.94	507.54	3843.93	506.71

3866.07	505.8	3868.29	505.71	3871.45	505.63	3908.53	504.71	3913.05	504.71
3936.08	504.71	3945.32	504.71	3977.47	504.71	4015.94	504.71	4022.1	504.71
4023.99	505.45	4037.31	510.71	4049.85	510.71	4051.64	510.71	4051.85	510.58
4053.27	509.71	4060	509.71	4095.03	509.71	4096.46	510.49	4096.84	510.71
4097.29	510.92	4098.88	511.71	4103.08	512.57	4103.79	512.71	4105	512.71
4112.67	512.71	4116.31	511.84	4116.85	511.71	4117.26	511.59	4119.96	510.71
4120.39	510.57	4123.07	509.71	4196.58	509.71	4485.69	509.71	4490.82	510.45
4492.63	510.71	4494.43	510.94	4500.32	511.71	4514.26	511.96	4555.91	512.71
4560.2	514.43	4571	518.71	4578.11	518.71	4579.56	518.71	4582.84	517.85
4583.41	517.71	4584.21	517.42	4589.01	515.71	4591.69	514.89	4592.25	514.71
4594.26	514.71	4604.18	514.71	4606.69	514.85	4622.12	515.71	4627.16	516.51
4628.41	516.71	4629.51	516.91	4634.07	517.71	4639.1	518.56	4640.02	518.71
4641.3	518.86	4648.43	519.71	4655.73	520.63	4656.34	520.71	4657	520.78
4665.12	521.71	4672.47	522.58	4673.59	522.71	4677.09	523.59	4677.59	523.71
4678.08	523.83	4681.55	524.71	4693.59	525.55	4695.91	525.71	4708.29	525.9
4762	526.71	4785.38	527.47	4792.78	527.71	4798.59	527.93	4818.67	528.71
4828.41	528.96	4857.39	529.71	4875.48	530.46	4881.63	530.71	4886.22	530.95
4900.74	531.71	4906.35	532.46	4908.21	532.71	4909.19	532.95	4912.63	533.71
4915.09	534.58	4915.46	534.71	4915.82	534.83	4918.26	535.71	4920.96	536.62
4921.25	536.71	4923.9	537.62	4924.17	537.71	4926.3	538.62	4926.52	538.71
4926.73	538.8	4928.83	539.71	4930.96	540.61	4931.17	540.71	4933.36	541.63
4933.54	541.71	4936.18	542.65	4936.35	542.71	4936.93	542.77	4937.83	542.87

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	2278	.04	3234.13	.06

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

Left	Right	Left	Channel	Right	Coeff	Contr.	Expan.
2278	3234.13	1136	1237	1231	.1	.3	

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
3391.55	4937.83	519.7	F

CROSS SECTION

RIVER: Susquehanna  
REACH: 1 RS: 133431

INPUT

Description: XS of Ex Intake Structure topo

Station	Elevation	Data	num=	156
Sta	Elev	Sta	Elev	Sta
0	572.7	78.8	552.7	97.8
144.6	530.7	162.9	526.7	180.5
279.8	516.7	294	514.7	303.4
716.2	516.7	774.5	520.7	783.9
959	522.7	1070.5	510.7	1163
1210.3	512.7	1223.1	508.7	1378.2
1611.8	504.7	2007.6	504.7	2036
2103.6	502.7	2121.6	502.7	2159.6
2189.7	498.7	2268.3	490.51	2282.3
2370.8	482.2	2415.8	480.2	2475.8
2700	474.2	2805.8	472.5	3005.8
3025.91	512.4	3051	524.7	3271
3355	521.7	3374	520.7	3400
3465	516.7	3472	515.7	3494
3664	510.7	3672	510.7	3674
3743	510.7	3747	509.7	3750.5
3833	512.7	3867.89	513.7	3898.07
4008.15	517.7	4032.18	518.7	4060.25
4202.83	522.7	4209.04	522.7	4211.99
4235.95	521.7	4238.63	522.7	4241.08
4323.46	526.7	4346	527.7	4367.77
4400.48	531.7	4402.86	532.7	4404.9
4410.47	536.7	4427.21	537.7	4467.33
4601.96	544.7	4610.4	544.7	4633.16
4676.76	557.7	4680.01	558.7	4696.02
4714.25	562.7	4717.63	563.7	4735.2
4782.1	568.7	4789.08	569.7	4839.38
4956.02	578.7	4996.76	580.7	5019.06
5195.73	599.7	5209.67	600.7	5221.75
5338.74	604.7	5378.85	605.7	5402.62
5451.28	609.7	5474.31	610.7	5495.7
5564.83	614.7			

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	2178.8	.04	3005.8	.014

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

2178.8 3051 308 308 308 .1 .3  
 Ineffective Flow num= 2  
 Sta L Sta R Elev Permanent  
 0 822.6 524.7 F  
 3051 5564.83 524.7 F  
 Blocked Obstructions num= 1  
 Sta L Sta R Elev  
 3005.6 3126.6 546.76

CROSS SECTION

RIVER: Susquehanna  
 REACH: 1 RS: 133138

INPUT

Description: XS of Prop Intake Structure topo

Station	Elevation	Data	num=	189
Sta	Elev	Sta	Elev	Sta
0	572.7	26.7	560.7	40.7
87.5	546.7	96.2	544.7	218.1
287.7	512.7	473	512.7	505.4
989.6	526.7	1053.6	516.7	1072.1
1148.6	512.7	1161.6	508.7	1221.5
1331.2	500.7	1357.7	502.7	1388.1
1641.5	504.7	1664.8	504.7	1891
2034.9	502.7	2047.1	502.7	2073.5
2198.91	486.2	2248.91	484.2	2318.91
2543.91	476.2	2643.91	474.4	2843.91
2918.86	493.7	2920.32	494.7	2921.8
2927.36	498.7	2929.67	499.7	2932.05
2963.06	503.7	2969.04	504.7	2973.24
3013.57	503.7	3026	502.7	3028.68
3033.87	498.7	3035.51	497.7	3037.66
3041.11	500.7	3042.22	501.7	3043.38
3073.93	500.7	3090.68	499.7	3126.35
3196.95	500.7	3203.57	501.7	3210.79
3324.78	505.7	3332.28	505.7	3361.51
3395.37	501.7	3405.85	500.7	3429.02
3457.93	501.7	3463.46	502.7	3468.3
3527.37	506.7	3535.95	507.7	3547.43
3612.45	507.7	3615.63	508.7	3618.81
3739.9	511.7	3759.44	512.7	3815.92
3887.84	515.7	3895.56	514.7	3911.24
3957.67	517.7	4004.78	518.7	4059.33
4134.94	521.7	4137.66	522.7	4153.41
4160.73	526.7	4207.72	527.7	4235.73
4348.11	531.7	4361.63	532.7	4363.45
4404.88	541.7	4425.38	541.7	4454.79
4603.66	543.7	4616.66	544.7	4639.94
4716.57	548.7	4723.67	549.7	4730.77
4874.35	567.7	4877.98	568.7	4881.31
4893.86	572.7	4899.45	573.7	4903.98
4999.83	578.7	5013.48	579.7	5041.8
5116.5	583.7	5131.22	584.7	5146.88
5196.94	588.7	5211.66	589.7	5250.61
5327.25	593.7	5362.32	594.7	5375.44
			595.7	5448.65
			600.7	

Manning's n Values num= 3  
 Sta n Val Sta n Val  
 0 .08 2073.5 .04 2973.24 .08

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.  
 2073.5 2973.24 631 580 621 .1 .3  
 Ineffective Flow num= 2  
 Sta L Sta R Elev Permanent  
 0 773.6 526.7 F  
 2994.64 5448.65 524 T

CROSS SECTION

RIVER: Susquehanna  
 REACH: 1 RS: 132450

INPUT

Description: FEMA CR topo

Station	Elevation	Data	num=	174
Sta	Elev	Sta	Elev	Sta
0	575	56	553.9	72
263	522.2	331	518.7	404
			514	451
			509.6	526
			509.6	509.6



595	509.6	625	514.9	686	518.8	743	520.6	821	529
892	530.9	979	531.8	1003	531.7	1045	516.4	1052	516.9
1053	516.9	1057	516.9	1074	515.2	1103	503.1	1146	501.9
1210	501.9	1244	503.5	1324	503.4	1410	504.9	1513	504.9
1548	503	1602	504.7	1661	505.2	1712	505.2	1794	504
1856	502.2	1921	505.5	1950	503.2	1978	487.5	1980	486.2
1992	484.2	2092	482.2	2197	480.2	2296	478.2	2392	476.2
2422	474.2	2452	472.2	2492	470.2	2512	468.2	2542	467.2
2572	468.2	2582	470.2	2607	472.2	2692	474.2	2732	476.2
2752	478.2	2762	480.2	2792	482.2	2802	484.2	2816	487.5
2831	493.71	2849.23	505.09	2853.45	507.71	2856.17	507.93	2866.02	508.71
2870.17	508.71	2871.47	508.71	2877.93	508.49	2900	507.71	2903.48	507.71
2914.15	507.71	2922.04	508.45	2924.85	508.71	2927.78	508.99	2935.2	509.71
2942.21	510.41	2945.18	510.71	2949.08	510.99	2958.95	511.71	2967.35	512.39
2971.21	512.71	2981.71	513.42	2986.11	513.71	2991.24	514	3003.66	514.71
3010.33	515.01	3025.96	515.71	3039.96	515.88	3064.99	516.17	3139.88	516.19
3156.23	515.91	3168.13	515.71	3175.36	515.03	3178.75	514.71	3180.79	514.33
3184.13	513.71	3186.8	513.21	3189.08	512.71	3193.43	512.07	3195.92	511.71
3198.41	511.39	3203.25	510.71	3207.11	510.19	3210.75	509.71	3212.99	509.32
3215.97	508.71	3218.76	508.15	3221.11	507.71	3222.88	507.33	3225.57	506.71
3294.57	506.71	3334.97	506.71	3353.92	507.2	3374.05	507.71	3376.75	508.1
3380.99	508.71	3390.31	508.71	3396.63	508.71	3397.78	508.29	3399.33	507.71
3431.15	507.71	3451.67	507.71	3452.07	508.01	3452.98	508.71	3453.85	509.38
3454.16	509.71	3457.13	510.04	3463.14	510.71	3480.65	511.39	3489.1	511.71
3522.7	511.71	3543.97	511.71	3558.76	511.71	3610.95	511.71	3622.71	511.71
3639.45	511.71	3647.95	511.71	3657.57	511.71	3676.52	511.71	3686.6	511.71
3697.67	511.71	3700.1	511.71	3713.24	511.93	3759.7	512.71	3781.23	513.27
3797.91	513.71	3814.7	514.2	3831.98	514.71	3843.13	515.19	3854.99	515.71
3862.77	516.19	3871.44	516.71	3891.77	516.71	3896.79	516.71	3901.28	516.85
3928.22	517.71	3933.77	518.14	3954.14	519.71	3968.51	519.71	3973.63	519.71
3982.44	519.71	3985.5	519.71	3986.37	519.44	3988.89	518.71	3989.16	518.71
3990.3	518.71	3991.93	519.51	3992.4	519.71	3992.87	519.9	3994.47	520.71
3996.01	521.49	3996.37	521.71	4003.41	521.71	4004.89	521.71		

Manning's n Values      num=      3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	1921	.04	2853.45	.08

Bank Sta: Left      Right      Coeff Contr.      Expan.

1921	2853.45	.1	.3
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Ineffective Flow      num=      2

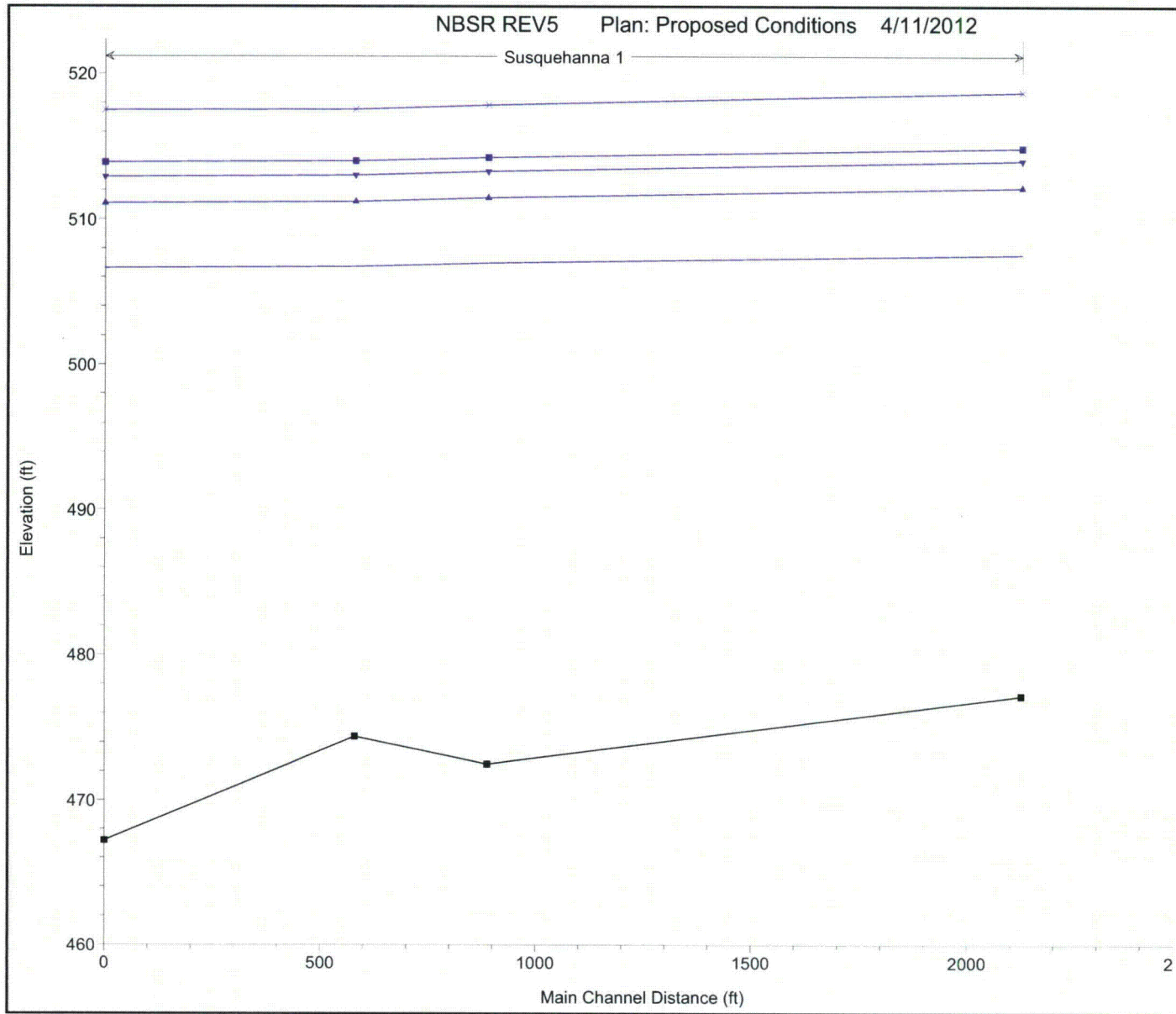
Sta L	Sta R	Elev	Permanent
0	979	531.8	F
3078.44	4004.89	516.17	F

## Appendix I: Proposed Conditions Model

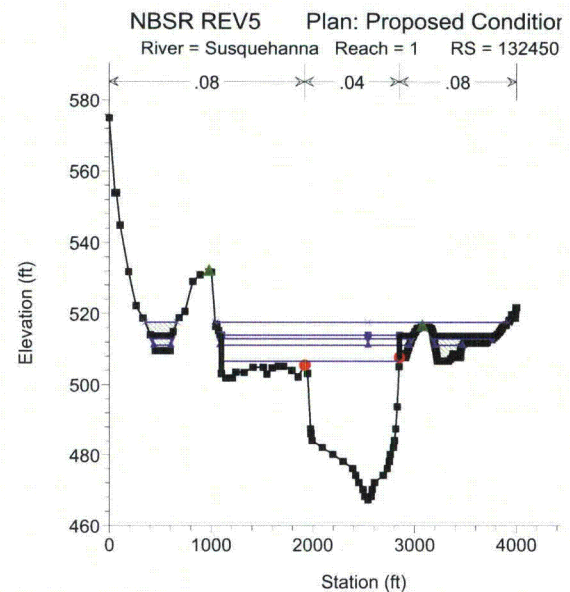
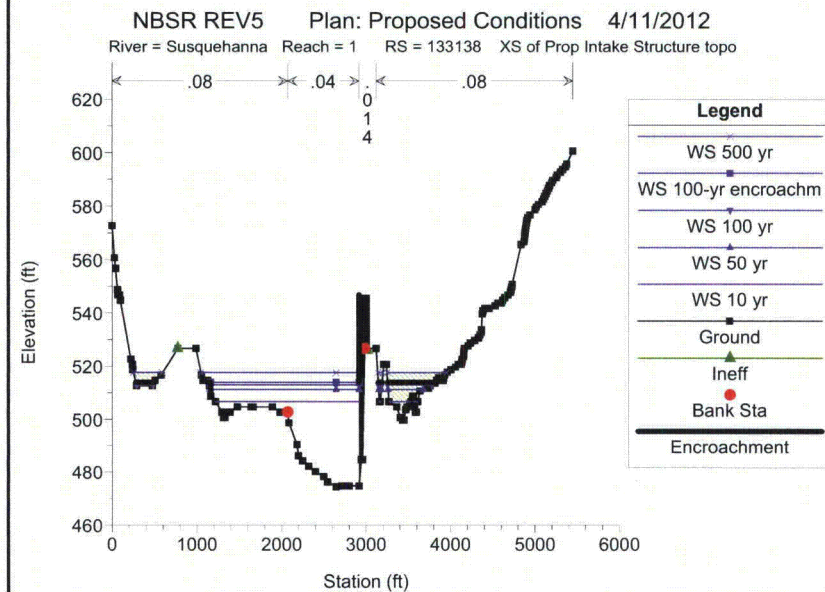
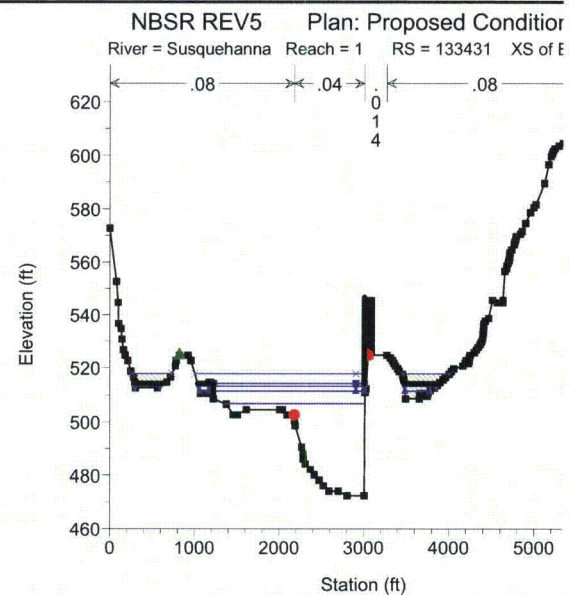
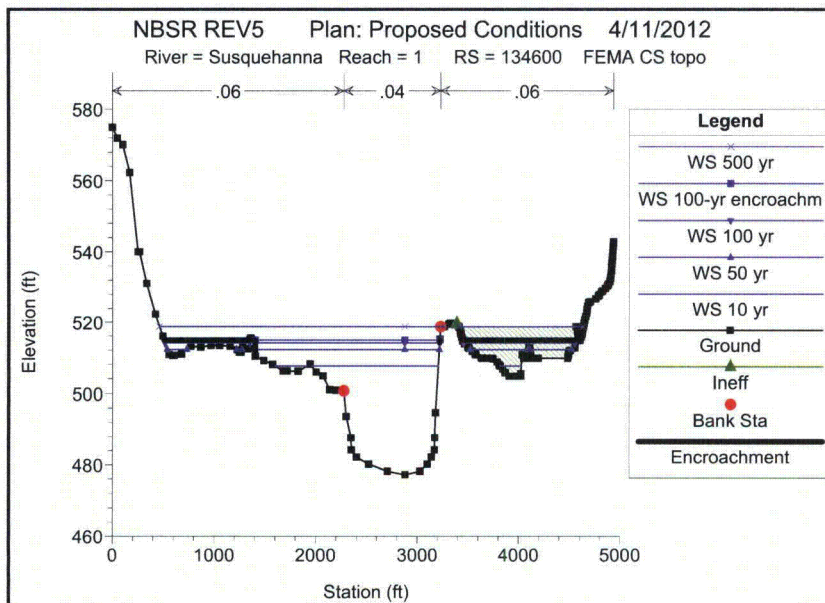
- HEC-RAS Reports
- HEC-RAS Cross-Sections
- HEC-RAS Profiles

HEC-RAS Plan: PRO River: Susquehanna Reach: 1

Reach	River/Sta	Profile	Q Total	Min Ch Elev	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq.ft)	(ft)	
1	134600	10-yr	167000.00	477.20	507.56	490.34	508.25	0.000422	6.71	26306.08	1771.47	0.23
1	134600	50-yr	232000.00	477.20	512.17	493.01	513.05	0.000453	7.69	34630.58	3047.08	0.24
1	134600	100-yr	260000.00	477.20	514.01	494.08	514.94	0.000453	7.97	39039.53	3755.34	0.25
1	134600	500-yr	340000.00	477.20	518.72	496.89	519.75	0.000445	8.58	51901.27	4035.43	0.25
1	134600	100-yr encroachment	260000.00	477.20	514.90	494.10	515.77	0.000411	7.72	39322.05	1818.01	0.24
1	133431	10-yr	167000.00	472.50	506.97	487.77	507.72	0.000424	6.96	25982.84	1648.61	0.23
1	133431	50-yr	232000.00	472.50	511.49	490.75	512.47	0.000476	8.11	34001.01	2188.25	0.25
1	133431	100-yr	260000.00	472.50	513.29	491.98	514.35	0.000488	8.49	37440.19	2592.06	0.25
1	133431	500-yr	340000.00	472.50	517.85	495.20	519.13	0.000519	9.48	46446.08	3033.60	0.27
1	133431	100-yr encroachment	260000.00	472.50	514.25	491.98	515.23	0.000440	8.21	38830.79	1782.50	0.24
1	133138	10-yr	167000.00	474.40	506.72	489.81	507.56	0.000535	7.42	24580.08	2008.69	0.25
1	133138	50-yr	232000.00	474.40	511.22	492.82	512.30	0.000575	8.52	32425.30	2212.26	0.27
1	133138	100-yr	260000.00	474.40	513.02	494.05	514.18	0.000582	8.89	35600.79	2526.90	0.27
1	133138	500-yr	340000.00	474.40	517.56	497.22	518.95	0.000608	9.87	43907.57	2980.38	0.28
1	133138	100-yr encroachment	260000.00	474.40	514.01	494.02	515.08	0.000519	8.56	37291.52	1750.00	0.26
1	132450	10-yr	167000.00	467.20	506.60	487.76	507.25	0.000374	6.48	27768.00	1757.05	0.22
1	132450	50-yr	232000.00	467.20	511.10	490.43	511.95	0.000412	7.52	35946.14	2307.98	0.23
1	132450	100-yr	260000.00	467.20	512.90	491.50	513.82	0.000420	7.88	39331.48	2671.23	0.24
1	132450	500-yr	340000.00	467.20	517.50	494.34	518.56	0.000426	8.64	53289.80	3195.69	0.25
1	132450	100-yr encroachment	260000.00	467.20	513.90	491.50	514.76	0.000381	7.62	40530.64	1750.45	0.23







HEC-RAS Version 4.1.0 Jan 2010  
U.S. Army Corps of Engineers  
Hydrologic Engineering Center  
609 Second Street  
Davis, California

```

X      X  XXXXXX   XXXX      XXXX      XX      XXXX
X      X  X      X  X      X  X      X  X      X
X      X  X      X  X      X  X      X  X      X
XXXXXXXX XXXX      X      XXX XXXX      XXXXXX   XXXX
X      X  X      X  X      X  X      X  X      X
X      X  X      X  X      X  X      X  X      X
X      X  XXXXXX   XXXX      X  X      X  X      XXXXXX

```

PROJECT DATA

Project Title: NBSR REV5  
Project File : NBSRREV5.prj  
Run Date and Time: 4/11/2012 4:16:29 PM

Project in English units

PLAN DATA

Plan Title: Proposed Conditions  
Plan File : p:\PROJECTS\Environmental\PPL - Wetland Permitting Oversight E-726-L8\TASKS\Task 10 - Floodplain\Study and Revisions NBSR\NBSR Revisions Feb 2012\Preliminary files to FEMA\4-10-12\HECRAS\NBSRREV5.p05

Geometry Title: Proposed Conditions

Geometry File : p:\PROJECTS\Environmental\PPL - Wetland Permitting Oversight E-726-L8\TASKS\Task 10 - Floodplain\Study and Revisions NBSR\NBSR Revisions Feb 2012\Preliminary files to FEMA\4-10-12\HECRAS\NBSRREV5.g02

Flow Title : FEMA Ex Flow

Flow File : p:\PROJECTS\Environmental\PPL - Wetland Permitting Oversight E-726-L8\TASKS\Task 10 - Floodplain\Study and Revisions NBSR\NBSR Revisions Feb 2012\Preliminary files to FEMA\4-10-12\HECRAS\NBSRREV5.f02

Plan Summary Information:

Number of:	Cross Sections =	4	Multiple Openings =	0
	Culverts =	0	Inline Structures =	0
	Bridges =	0	Lateral Structures =	0

Computational Information

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

Computation Options

Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

Encroachment Data

Equal Conveyance	=	True
Left Offset	=	0
Right Offset	=	0

River = Susquehanna	Reach = 1
RS Profile	Method Value1 Value2
134600 50 yr	0 0 0

133431	50 yr	0	0	0
133138	50 yr	0	0	0
132450	50 yr	0	0	0

River = Susquehanna		Reach = 1		
RS	Profile	Method	Value1	Value2
134600	100 yr	0	0	0
133431	100 yr	0	0	0
133138	100 yr	0	0	0
132450	100 yr	0	0	0

River = Susquehanna		Reach = 1		
RS	Profile	Method	Value1	Value2
134600	500 yr	0	0	0
133431	500 yr	0	0	0
133138	500 yr	0	0	0
132450	500 yr	0	0	0

River = Susquehanna		Reach = 1		
RS	Profile	Method	Value1	Value2
134600	100-yr encroachment	1	1406	3224.01
133431	100-yr encroachment	1	1223.1	3005.6
133138	100-yr encroachment	1	1165	2915
132450	100-yr encroachment	1	1103	2853.45

#### FLOW DATA

Flow Title: FEMA Ex Flow

Flow File : p:\PROJECTS\Environmental\PPL - Wetland Permitting Oversight E-726-L8\TASKS\Task 10 - Floodplain\Study and Revisions NBSR\NBSR Revisions Feb 2012\Preliminary files to FEMA\4-10-12\HECRAS\NBSRREV5.f02

Flow Data (cfs)

River	Reach	RS	10 yr	50 yr	100 yr
500 yr100-yr encroachment					
Susquehanna	1	134600	167000	232000	260000
340000	260000				

#### Boundary Conditions

River	Reach	Profile	Upstream	
Downstream				
Susquehanna	1	10 yr	Critical	Known WS =
506.6				
Susquehanna	1	50 yr	Critical	Known WS =
511.1				
Susquehanna	1	100 yr	Critical	Known WS =
512.9				
Susquehanna	1	500 yr	Critical	Known WS =
517.5				
Susquehanna	1	100-yr encroachment	Critical	Known
WS = 513.9				

#### GEOMETRY DATA

Geometry Title: Proposed Conditions

Geometry File : p:\PROJECTS\Environmental\PPL - Wetland Permitting Oversight E-726-L8\TASKS\Task 10 - Floodplain\Study and Revisions NBSR\NBSR Revisions Feb 2012\Preliminary files to FEMA\4-10-12\HECRAS\NBSRREV5.g02

#### CROSS SECTION

RIVER: Susquehanna  
REACH: 1

RS: 134600

INPUT

Description: FEMA CS topo

Station Elevation Data		num= 200							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	575	49	571.9	102	570.1	168	562.3	251	540
266	540	335	531.1	421	522.3	493	516	554	510.8
592	510.5	605	510.5	679	510.9	770	513.1	868	512.9
969	513.3	1056	513.3	1157	513.1	1228	512.1	1248	511.4
1264	511.4	1282	512.9	1339	512.4	1356	515.1	1362	515.5
1370	515.1	1395	514.8	1406	510.3	1489	509.1	1576	508
1679	506.2	1720	506.2	1826	506.1	1946	508.1	2005	505.9
2073	504.8	2140	501.1	2200	500.9	2278	500.7	2301	493.7
2348	487.7	2351	484.2	2401	482.2	2521	480.2	2706	478.2
2881	477.2	3026	478.2	3101	480.2	3141	482.2	3171	484.2
3174	487.7	3182.5	494.71	3226.5	515.17	3234.13	518.71	3241.76	518.71
3270	518.71	3313.01	519.44	3328.61	519.71	3339.87	519.71	3382.78	519.71
3409.31	518.86	3414.11	518.71	3416.02	518.55	3426.3	517.71	3432.19	516.86
3433.22	516.71	3434.27	516.57	3440.7	515.71	3451.05	514.85	3452.7	514.71
3454.99	514.57	3468.56	513.71	3499.79	512.91	3507.41	512.71	3514.92	512.51
3544.48	511.71	3574.42	510.91	3581.73	510.71	3632.47	509.87	3641.81	509.71
3651.94	509.71	3705.77	509.71	3731.74	509.71	3738.37	509.71	3748.83	509.51
3789.46	508.71	3810.99	507.87	3815.03	507.71	3819.94	507.54	3843.93	506.71
3866.07	505.8	3868.29	505.71	3871.45	505.63	3908.53	504.71	3913.05	504.71
3936.08	504.71	3945.32	504.71	3977.47	504.71	4015.94	504.71	4022.1	504.71
4023.99	505.45	4037.31	510.71	4049.85	510.71	4051.64	510.71	4051.85	510.58
4053.27	509.71	4060	509.71	4095.03	509.71	4096.46	510.49	4096.84	510.71
4097.29	510.92	4098.88	511.71	4103.08	512.57	4103.79	512.71	4105	512.71
4112.67	512.71	4116.31	511.84	4116.85	511.71	4117.26	511.59	4119.96	510.71
4120.39	510.57	4123.07	509.71	4196.58	509.71	4485.69	509.71	4490.82	510.45
4492.63	510.71	4494.43	510.94	4500.32	511.71	4514.26	511.96	4555.91	512.71
4560.2	514.43	4571	518.71	4578.11	518.71	4579.56	518.71	4582.84	517.85
4583.41	517.71	4584.21	517.42	4589.01	515.71	4591.69	514.89	4592.25	514.71
4594.26	514.71	4604.18	514.71	4606.69	514.85	4622.12	515.71	4627.16	516.51
4628.41	516.71	4629.51	516.91	4634.07	517.71	4639.1	518.56	4640.02	518.71
4641.3	518.86	4648.43	519.71	4655.73	520.63	4656.34	520.71	4657	520.78
4665.12	521.71	4672.47	522.58	4673.59	522.71	4677.09	523.59	4677.59	523.71
4678.08	523.83	4681.55	524.71	4693.59	525.55	4695.91	525.71	4708.29	525.9
4762	526.71	4785.38	527.47	4792.78	527.71	4798.59	527.93	4818.67	528.71
4828.41	528.96	4857.39	529.71	4875.48	530.46	4881.63	530.71	4886.22	530.95
4900.74	531.71	4906.35	532.46	4908.21	532.71	4909.19	532.95	4912.63	533.71
4915.09	534.58	4915.46	534.71	4915.82	534.83	4918.26	535.71	4920.96	536.62
4921.25	536.71	4923.9	537.62	4924.17	537.71	4926.3	538.62	4926.52	538.71
4926.73	538.8	4928.83	539.71	4930.96	540.61	4931.17	540.71	4933.36	541.63
4933.54	541.71	4936.18	542.65	4936.35	542.71	4936.93	542.77	4937.83	542.87

Manning's n Values		num= 3	
Sta	n Val	Sta	n Val
0	.06	2278	.04
		3234.13	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
2278	3234.13	1136	1237	1231	.1	.3
Ineffective Flow		num= 1				
Sta L	Sta R	Elev	Permanent			
3391.55	4937.83	519.7	F			

CROSS SECTION

RIVER: Susquehanna  
REACH: 1

RS: 133431

INPUT

Description: XS of Ex Intake Structure topo

Station Elevation Data		num= 156							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	572.7	78.8	552.7	97.8	544.7	104.6	536.7	133.7	534.7
144.6	530.7	162.9	526.7	180.5	524.7	213.2	522.7	250	518.7

279.8	516.7	294	514.7	303.4	512.7	560.7	512.7	672.3	514.7
716.2	516.7	774.5	520.7	783.9	522.7	822.6	524.7	924.2	524.7
959	522.7	1070.5	510.7	1163	510.7	1174.4	514.7	1190.3	514.7
1210.3	512.7	1223.1	508.7	1378.2	506.7	1458.6	502.7	1506.7	502.7
1611.8	504.7	2007.6	504.7	2036	504.7	2041	504.7	2095.3	502.7
2103.6	502.7	2121.6	502.7	2159.6	502.7	2178.8	502.7	2182.2	500.7
2189.7	498.7	2268.3	490.51	2282.3	488	2285.8	486.2	2310.8	484.2
2370.8	482.2	2415.8	480.2	2475.8	478.2	2525.8	476.2	2590.8	474.2
2700	474.2	2805.8	472.5	3005.8	472.5	3013.97	510.98	3017.05	511.32
3025.91	512.4	3051	524.7	3271	524.7	3314	523.7	3336	522.7
3355	521.7	3374	520.7	3400	519.7	3419	518.7	3456	517.7
3465	516.7	3472	515.7	3494	508.7	3656	508.7	3660	509.7
3664	510.7	3672	510.7	3674	509.7	3727	509.7	3729	510.7
3743	510.7	3747	509.7	3750.5	509.7	3758	510.7	3786	511.7
3833	512.7	3867.89	513.7	3898.07	514.7	3935.72	515.7	3961.61	516.7
4008.15	517.7	4032.18	518.7	4060.25	519.7	4166.52	520.7	4192.59	521.7
4202.83	522.7	4209.04	522.7	4211.99	521.7	4218.88	521.7	4231.51	521.7
4235.95	521.7	4238.63	522.7	4241.08	523.7	4251.65	524.7	4300.67	525.7
4323.46	526.7	4346	527.7	4367.77	528.7	4384.01	529.7	4396.02	530.7
4400.48	531.7	4402.86	532.7	4404.9	533.7	4406.76	534.7	4408.69	535.7
4410.47	536.7	4427.21	537.7	4467.33	538.7	4511.16	545.7	4569.94	544.7
4601.96	544.7	4610.4	544.7	4633.16	544.7	4634.55	545.7	4655.95	556.7
4676.76	557.7	4680.01	558.7	4696.02	559.7	4703.83	560.7	4711.25	561.7
4714.25	562.7	4717.63	563.7	4735.2	564.7	4766.09	566.7	4773.17	567.7
4782.1	568.7	4789.08	569.7	4839.38	570.7	4858.91	571.7	4897.71	574.7
4956.02	578.7	4996.76	580.7	5019.06	581.7	5120.46	589.7	5169.94	596.7
5195.73	599.7	5209.67	600.7	5221.75	601.7	5239.58	602.7	5289.72	603.7
5338.74	604.7	5378.85	605.7	5402.62	606.7	5413.39	607.7	5425.65	608.7
5451.28	609.7	5474.31	610.7	5495.7	611.7	5510.05	612.7	5540.31	613.7
5564.83	614.7								

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	2178.8	.04	3005.8	.014	3271	.08

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

2178.8	3051	308	308	308	.1	.3
--------	------	-----	-----	-----	----	----

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	822.6	524.7	F
3051	5564.83	524.7	F

Blocked Obstructions num= 1

Sta L	Sta R	Elev
3005.6	3126.6	546.76

CROSS SECTION

RIVER: Susquehanna

REACH: 1 RS: 133138

INPUT

Description: XS of Prop Intake Structure topo

Station	Elevation	Data	num=	149					
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	572.7	26.7	560.7	40.7	556.7	64	548.7	67.2	546.7
87.5	546.7	96.2	544.7	218.1	522.7	236.2	520.7	242.4	518.7
287.7	512.7	473	512.7	505.4	514.7	574.9	516.7	773.6	526.7
989.6	526.7	1053.6	516.7	1072.1	514.7	1109.6	514.7	1126	514.7
1148.6	512.7	1161.6	508.7	1221.5	506.7	1294.6	502.7	1312.9	500.7
1331.2	500.7	1357.7	502.7	1388.1	502.7	1392.4	502.7	1477.3	504.7
1641.5	504.7	1664.8	504.7	1891	504.7	1982.3	502.7	2007.9	502.7
2034.9	502.7	2047.1	502.7	2073.5	502.7	2085.9	498.7	2181.41	490.51
2198.91	486.2	2248.91	484.2	2318.91	482.2	2398.91	480.2	2498.91	478.2
2543.91	476.2	2643.91	474.4	2715	474.71	2797.8	474.71	2915	474.71
2942.97	484.71	2957.05	484.71	2980.09	526.7	3117.38	526.7	3156.65	506.7
3166.98	506.7	3208.05	520.7	3238.19	520.7	3268.24	506.7	3361.51	504.7
3405.85	500.7	3429.02	499.7	3445.28	499.7	3468.3	503.7	3485.04	504.7
3513.79	505.7	3527.37	506.7	3548.92	508.7	3556.56	508.7	3572.62	504.7
3581.6	502.7	3595.46	502.7	3609.31	506.7	3635.96	510.7	3714.53	511.7
3740.39	511.7	3759.44	512.7	3815.92	513.7	3835.52	514.7	3859.17	515.7



3887.84	515.7	3895.56	514.7	3911.24	514.7	3917.73	515.7	3928.88	516.7
3957.67	517.7	4004.78	518.7	4059.33	519.7	4089.71	520.7	4126.51	520.7
4134.94	521.7	4137.66	522.7	4153.41	523.7	4155.79	524.7	4158.26	525.7
4160.73	526.7	4207.72	527.7	4235.73	528.7	4283.39	529.7	4328.9	530.7
4348.11	531.7	4361.63	532.7	4363.45	533.7	4374.29	539.7	4383.63	540.7
4404.88	541.7	4425.38	541.7	4454.79	541.7	4527.03	542.7	4562.7	543.7
4603.66	543.7	4616.66	544.7	4639.94	545.7	4678.93	546.7	4710.52	547.7
4716.57	548.7	4723.67	549.7	4730.77	550.7	4834.9	565.7	4871.02	566.7
4874.35	567.7	4877.98	568.7	4881.31	569.7	4884.79	570.7	4889.17	571.7
4893.86	572.7	4899.45	573.7	4903.98	574.7	4912.29	575.7	4942.27	576.7
4999.83	578.7	5013.48	579.7	5041.8	580.7	5085.44	581.7	5101.37	582.7
5116.5	583.7	5131.22	584.7	5146.88	585.7	5160.4	586.7	5172.98	587.7
5196.94	588.7	5211.66	589.7	5250.61	590.7	5262.52	591.7	5299.54	592.7
5327.25	593.7	5362.32	594.7	5375.44	595.7	5448.65	600.7		

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	2073.5	.04	2915	.014	3117.38	.08

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

2073.5	2980.09	631	580	621	.1	.3
--------	---------	-----	-----	-----	----	----

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	773.6	526.7	F
3009.5	5448.65	526.18	T

Blocked Obstructions num= 1

Sta L	Sta R	Elev
2915	3039	546.76

# CROSS SECTION

RIVER: Susquehanna  
 REACH: 1 RS: 132450

## INPUT

Description: FEMA CR topo

Station	Elevation	Data	num=	174					
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	575	56	553.9	72	553.9	107	544.9	190	531.8
263	522.2	331	518.7	404	514	451	509.6	526	509.6
595	509.6	625	514.9	686	518.8	743	520.6	821	529
892	530.9	979	531.8	1003	531.7	1045	516.4	1052	516.9
1053	516.9	1057	516.9	1074	515.2	1103	503.1	1146	501.9
1210	501.9	1244	503.5	1324	503.4	1410	504.9	1513	504.9
1548	503	1602	504.7	1661	505.2	1712	505.2	1794	504
1856	502.2	1921	505.5	1950	503.2	1978	487.5	1980	486.2
1992	484.2	2092	482.2	2197	480.2	2296	478.2	2392	476.2
2422	474.2	2452	472.2	2492	470.2	2512	468.2	2542	467.2
2572	468.2	2582	470.2	2607	472.2	2692	474.2	2732	476.2
2752	478.2	2762	480.2	2792	482.2	2802	484.2	2816	487.5
2831	493.71	2849.23	505.09	2853.45	507.71	2856.17	507.93	2866.02	508.71
2870.17	508.71	2871.47	508.71	2877.93	508.49	2900	507.71	2903.48	507.71
2914.15	507.71	2922.04	508.45	2924.85	508.71	2927.78	508.99	2935.2	509.71
2942.21	510.41	2945.18	510.71	2949.08	510.99	2958.95	511.71	2967.35	512.39
2971.21	512.71	2981.71	513.42	2986.11	513.71	2991.24	514	3003.66	514.71
3010.33	515.01	3025.96	515.71	3039.96	515.88	3064.99	516.17	3139.88	516.19
3156.23	515.91	3168.13	515.71	3175.36	515.03	3178.75	514.71	3180.79	514.33
3184.13	513.71	3186.8	513.21	3189.08	512.71	3193.43	512.07	3195.92	511.71
3198.41	511.39	3203.25	510.71	3207.11	510.19	3210.75	509.71	3212.99	509.32
3215.97	508.71	3218.76	508.15	3221.11	507.71	3222.88	507.33	3225.57	506.71
3294.57	506.71	3334.97	506.71	3353.92	507.2	3374.05	507.71	3376.75	508.1
3380.99	508.71	3390.31	508.71	3396.63	508.71	3397.78	508.29	3399.33	507.71
3431.15	507.71	3451.67	507.71	3452.07	508.01	3452.98	508.71	3453.85	509.38
3454.16	509.71	3457.13	510.04	3463.14	510.71	3480.65	511.39	3489.1	511.71
3522.7	511.71	3543.97	511.71	3558.76	511.71	3610.95	511.71	3622.71	511.71
3639.45	511.71	3647.95	511.71	3657.57	511.71	3676.52	511.71	3686.6	511.71
3697.67	511.71	3700.1	511.71	3713.24	511.93	3759.7	512.71	3781.23	513.27
3797.91	513.71	3814.7	514.2	3831.98	514.71	3843.13	515.19	3854.99	515.71
3862.77	516.19	3871.44	516.71	3891.77	516.71	3896.79	516.71	3901.28	516.85
3928.22	517.71	3933.77	518.14	3954.14	519.71	3968.51	519.71	3973.63	519.71

3982.44	519.71	3985.5	519.71	3986.37	519.44	3988.89	518.71	3989.16	518.71
3990.3	518.71	3991.93	519.51	3992.4	519.71	3992.87	519.9	3994.47	520.71
3996.01	521.49	3996.37	521.71	4003.41	521.71	4004.89	521.71		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	1921	.04	2853.45	.08

Bank Sta: Left Right Coeff Contr. Expan.

	1921	2853.45	.1	.3
--	------	---------	----	----

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	979	531.8	F
3078.44	4004.89	516.17	F

**Appendix J:**  
**Bathymetry Data**

ECOLOGICAL STUDIES OF THE SUSQUEHANNA RIVER  
IN THE VICINITY OF THE  
SUSQUEHANNA STEAM ELECTRIC STATION

1983 Annual Report

Theodore V. Jacobsen, Project Director and Editor  
Susquehanna SES Biological Laboratory  
R.D. 1, Berwick, Pennsylvania 18603

Prepared For

Pennsylvania Power and Light Company  
Two North Ninth Street  
Allentown, Pennsylvania 18101

Ichthyological Associates, Inc.  
301 Forest Drive  
Ithaca, New York 14850

August 1984

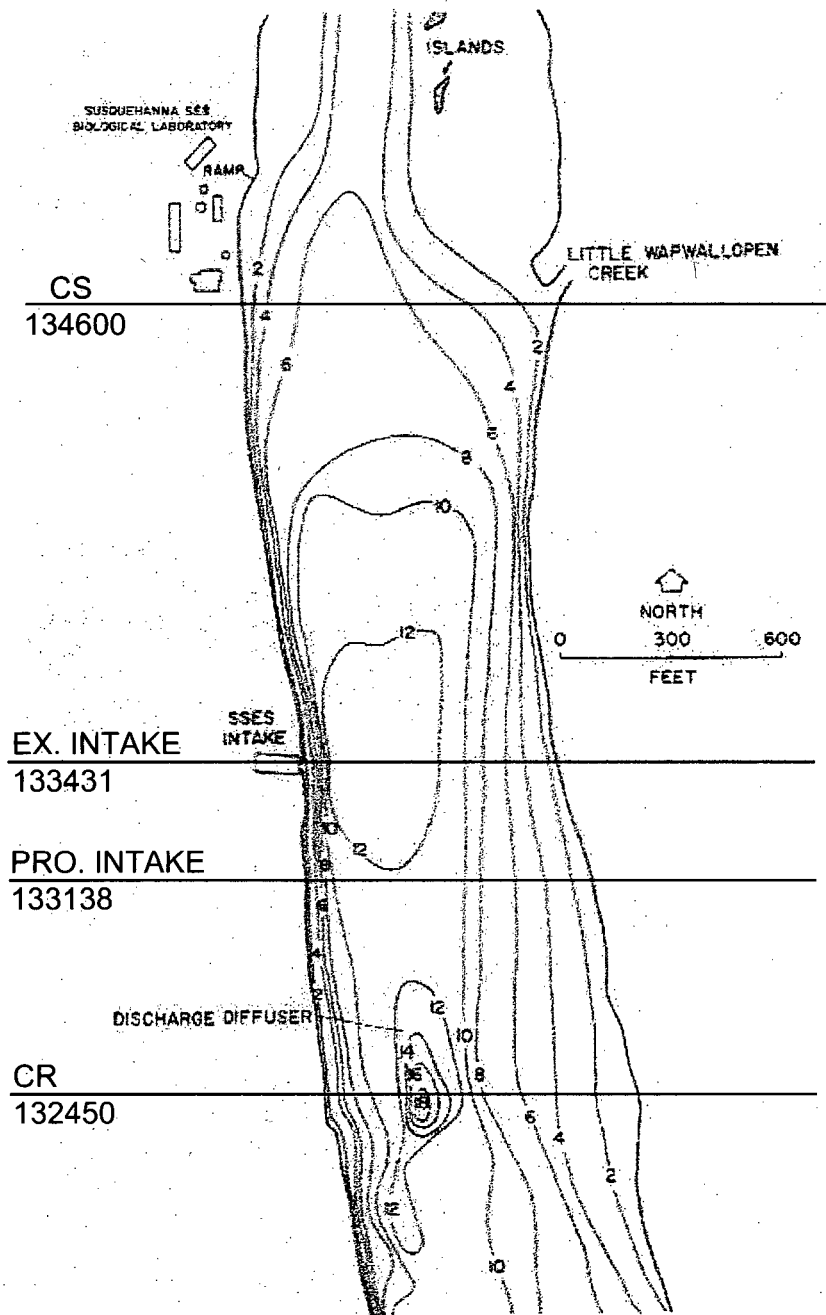


Fig. A-4

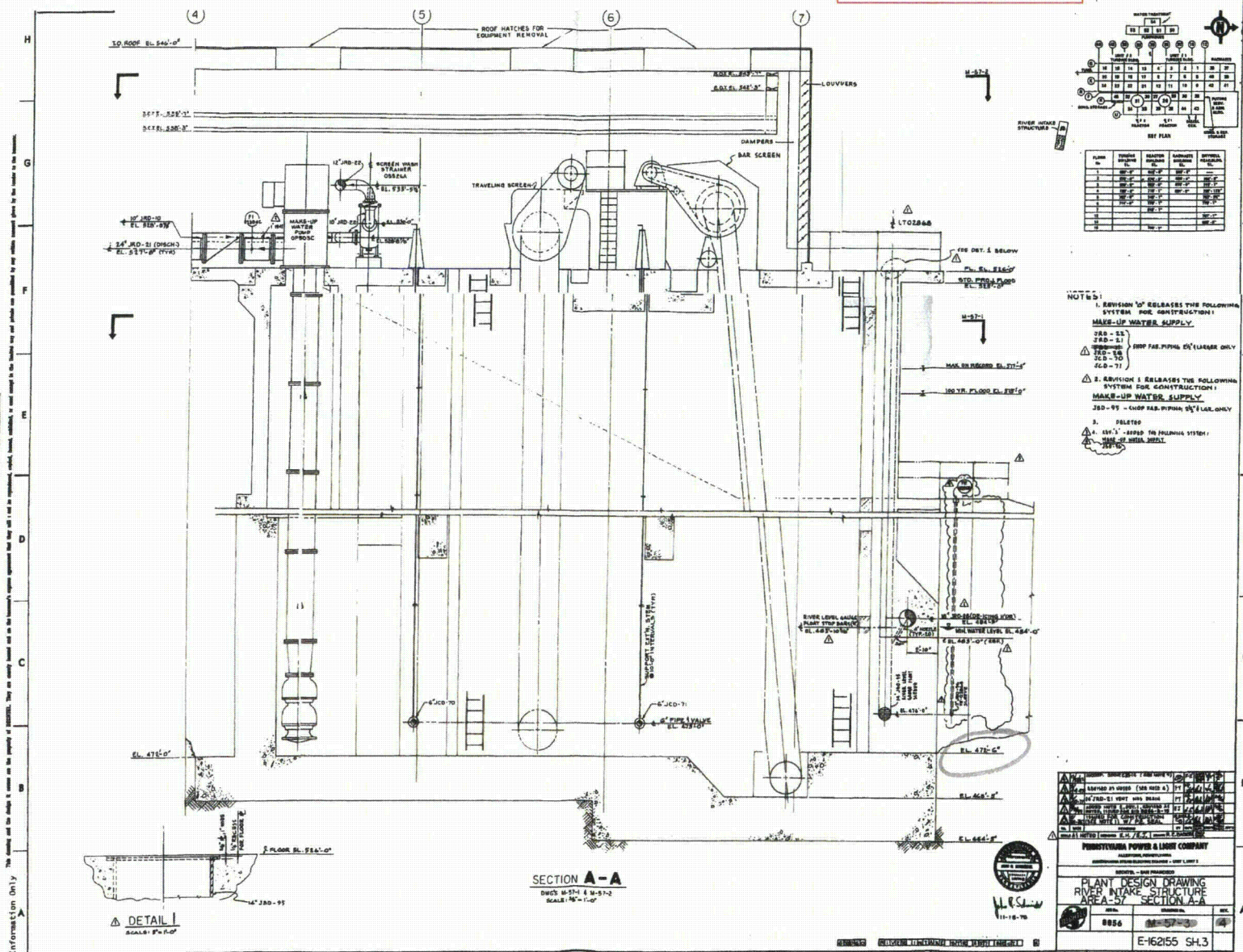
Section B (see Fig. A-2) depth contours (2-ft intervals) of the Susquehanna River, 1983.



**Appendix K:**  
**Supplemental Intake Structure Information**

- Existing Structure Detail
- Photographs of Existing and Proposed Site
- Details of Proposed Structure

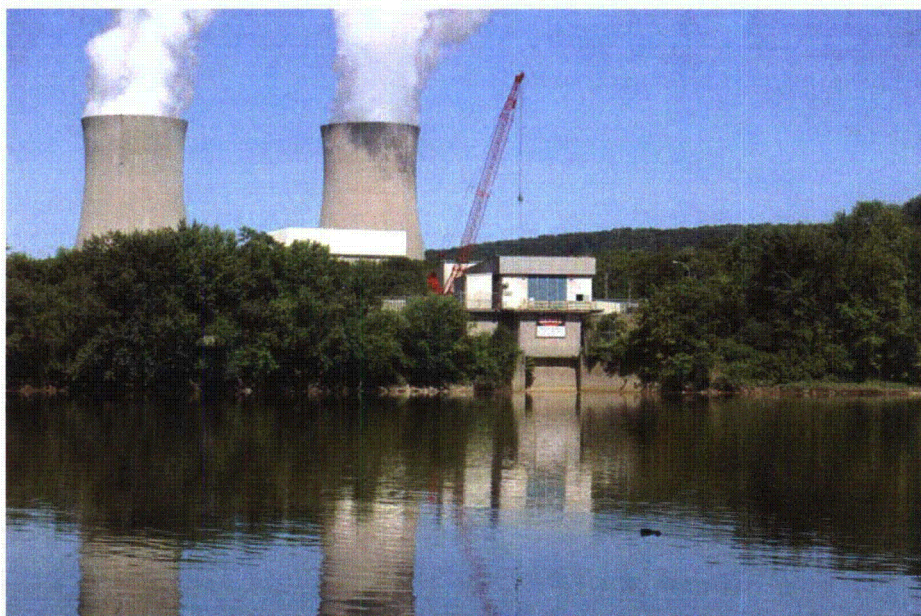
# Existing Intake Structure Detail







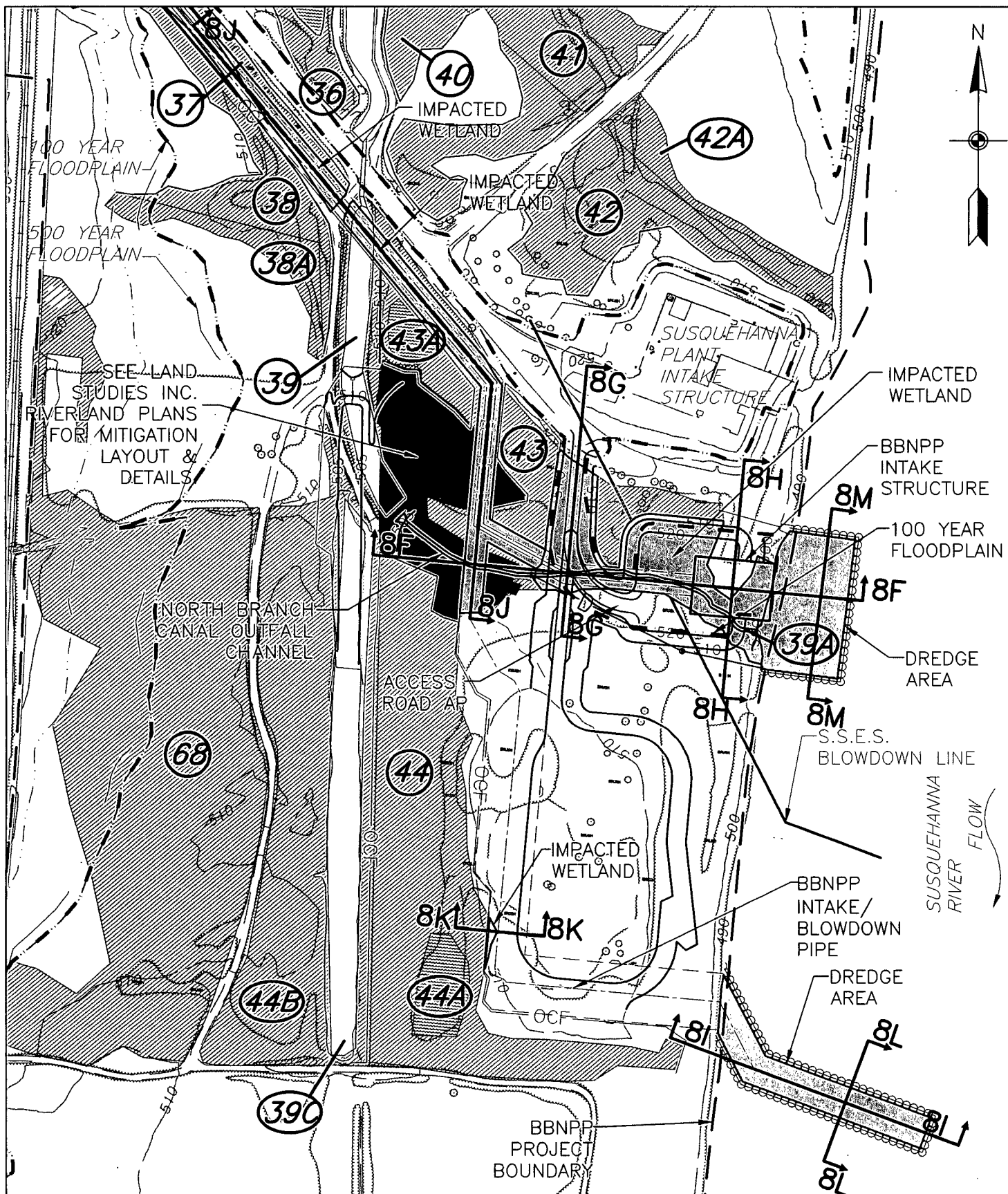
**Intake Structure Photograph Log**  
**Susquehanna River Flood Study Report**  
**Bell Bend Nuclear Power Plant**  
**November 2010**



**Existing Intake Structure on the Susquehanna River, Station 1334+31**



**Susquehanna River, looking upstream of the Existing Intake Structure**



**Pennoni**

Pennoni Associates Inc.  
100 N. Wilkes-Barre Blvd.  
Wilkes-Barre, PA 18702

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DRAWN BY: WCK

CHECKED BY: LGB

JOB No. PPLS 0902

SCALE: HORIZ. 1"=200'  
VERT. N/A

DATE: 06/15/2011

JPA PERMIT SUBMITTAL

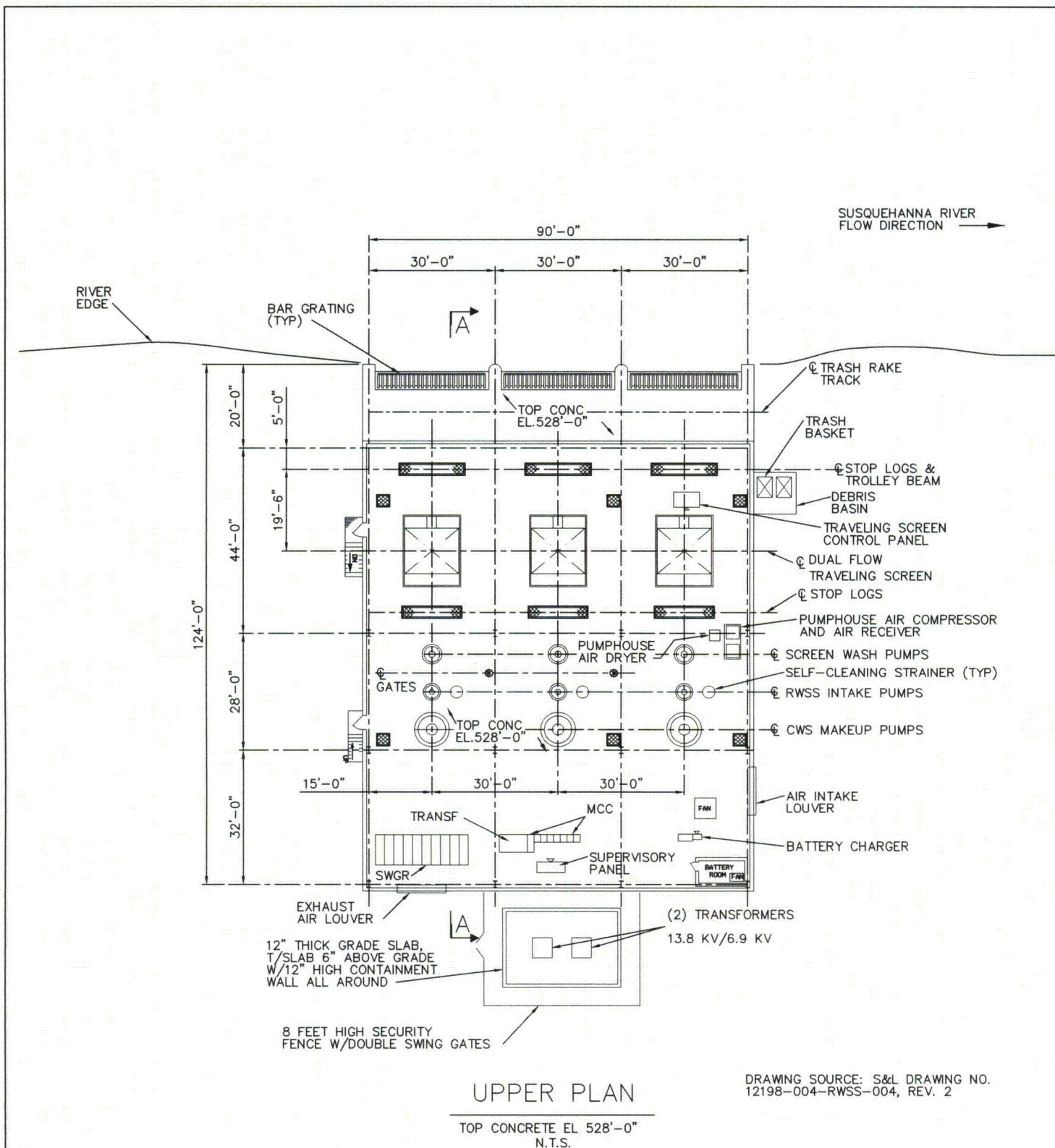
BELL BEND NUCLEAR POWER PLANT  
LUZERNE COUNTY, PENNSYLVANIA

APPLICATION BY:  
PPL NUCLEAR DEVELOPMENT, LLC

FIGURE 8A - SITE LAYOUT

REV 1 : 10/28/2011 REV. STREAM NAME/PROJECT BND/ FLOOD LINES  
REV 0 : 06/15/2011 INITIAL SUBMISSION





DRAWING SOURCE: S&L DRAWING NO. 12198-004-RWSS-004, REV. 2

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DRAWN BY: WCK

SCALE: NTS

DATE: 06/15/2011

CHECKED BY: LGB

JPA PERMIT SUBMITTAL

JOB No. PPLS 0902

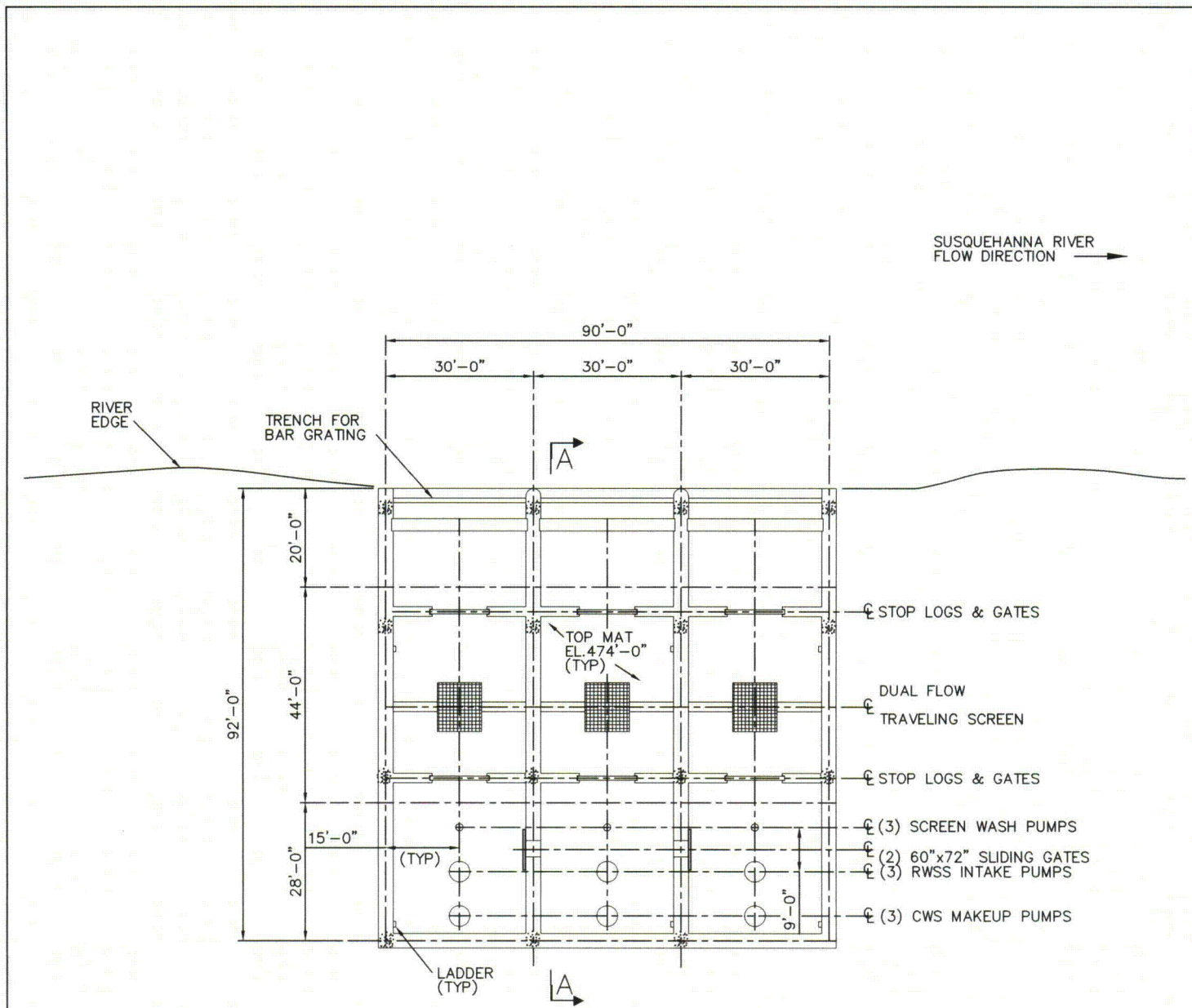
BELL BEND NUCLEAR POWER PLANT  
LUZERNE COUNTY, PENNSYLVANIA

APPLICATION BY:  
PPL NUCLEAR DEVELOPMENT, LLC

FIGURE 8C - INTAKE STRUCTURE PLAN

REV 0 : 06/15/2011 INITIAL SUBMISSION





# LOWER PLAN

TOP OF MAT EL 474'-0"  
N.T.S.

FOR SECTION A-A  
SEE FIGURE 8E

DRAWING SOURCE: S&L DRAWING NO.  
12198-004-RWSS-004, REV. 2

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SCALE: NTS

DATE: 06/15/2011

CHECKED BY: LGB

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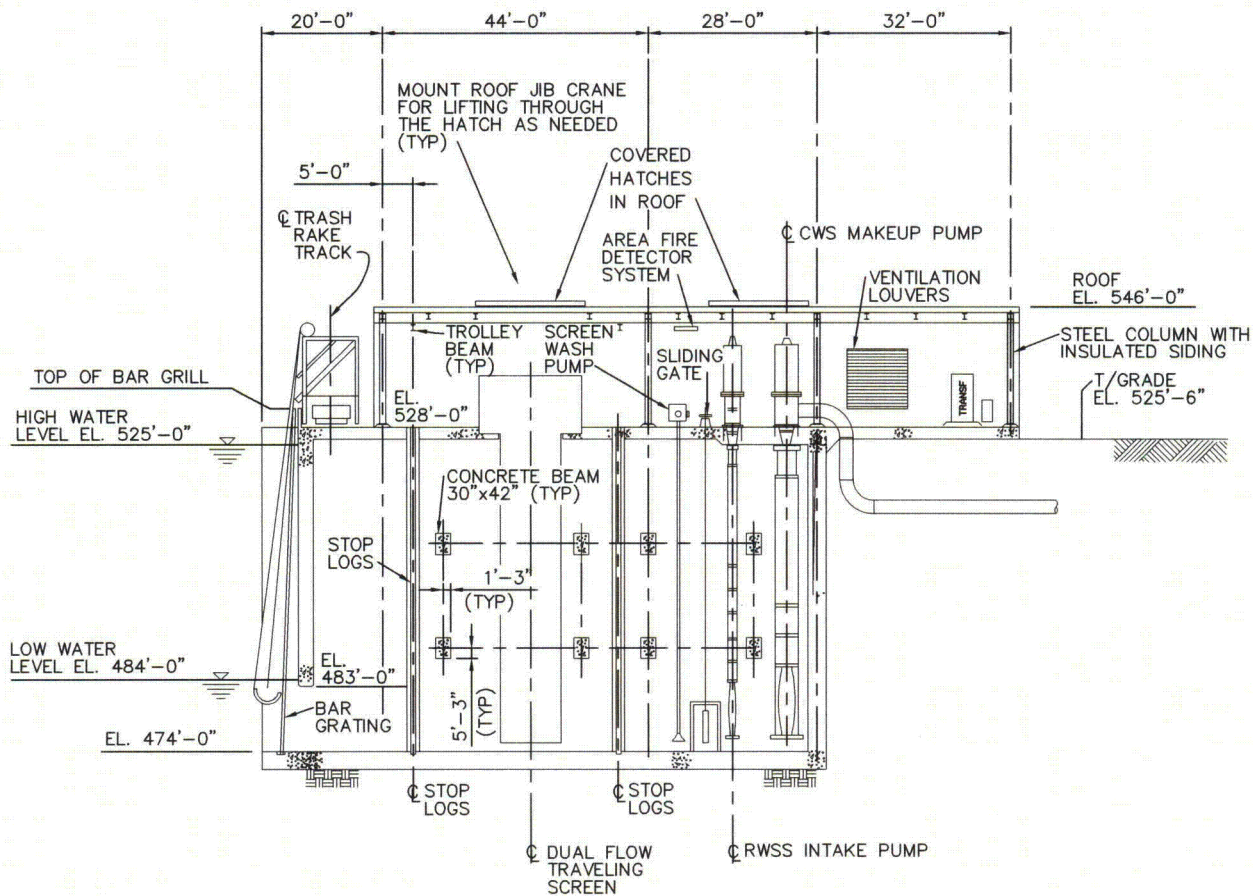
JOB No. PPLS 0902

BELL BEND NUCLEAR POWER PLANT  
LUZERNE COUNTY, PENNSYLVANIA

APPLICATION BY:  
PPL NUCLEAR DEVELOPMENT, LLC

FIGURE 8D - INTAKE STRUCTURE PLAN

REV 0 : 06/15/2011 INITIAL SUBMISSION



## SECTION A-A

N.T.S.

FOR SECTION LOCATION  
SEE FIGURE 8D

DRAWING SOURCE: S&L DRAWING NO.  
12198-004-RWSS-004, REV. 2

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DRAWN BY: WCK

SCALE: NTS

DATE: 06/15/2011

CHECKED BY: LGB

JPA PERMIT SUBMITTAL

JOB No. PPLS 0902

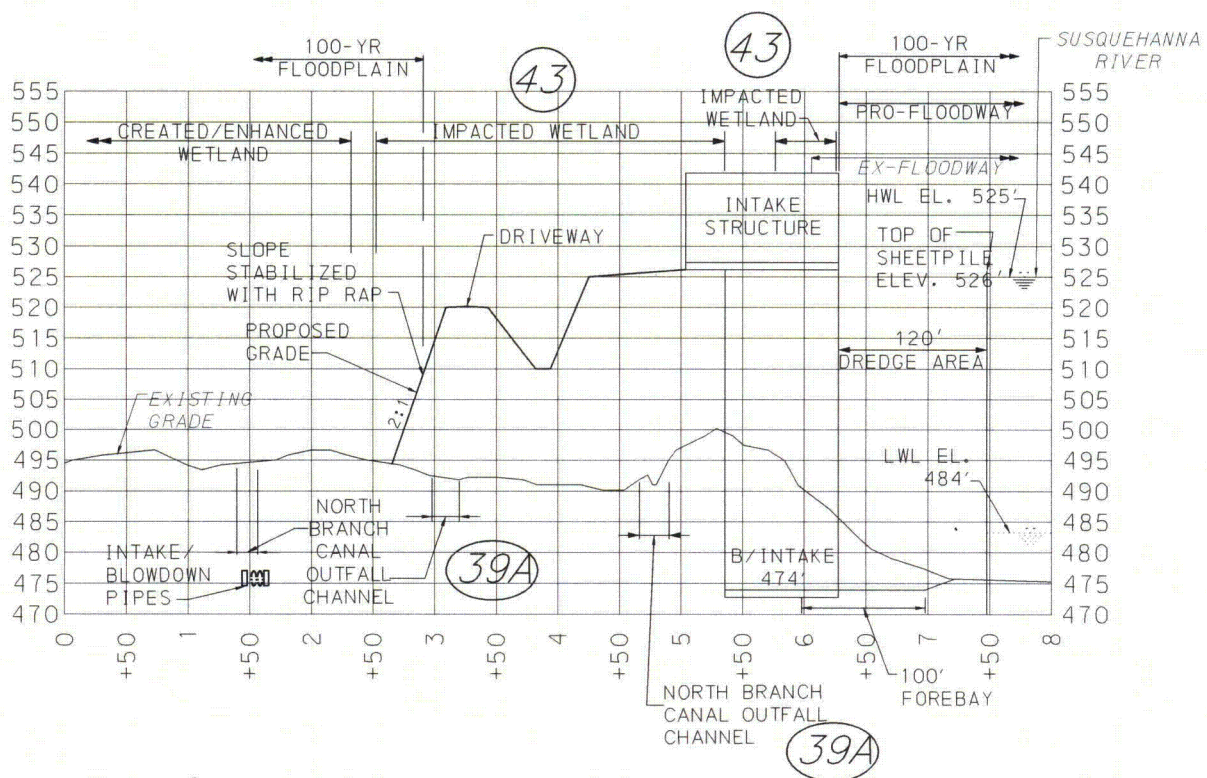
BELL BEND NUCLEAR POWER PLANT  
LUZERNE COUNTY, PENNSYLVANIA

APPLICATION BY:  
PPL NUCLEAR DEVELOPMENT, LLC

FIGURE 8E - INTAKE STRUCTURE PLAN

REV 0 : 06/15/2011 INITIAL SUBMISSION





NOTE: FLOOD ELEVATION FROM  
FEMA FIRM MAP PANEL NUMBER  
420625 0020 B IS 512.5.

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EXPOSURE TO PENNONI ASSOCIATES; AND OWNER  
SHALL INDEMNIFY AND HOLD HARMLESS PENNONI  
ASSOCIATES FROM ALL CLAIMS, DAMAGES, LOSSES AND  
EXPENSES ARISING OUT OF OR RESULTING THEREFROM

DRAWN BY: WCK

CHECKED BY: LGB

JOB No. PPLS 0902

SCALE: HORZ. 1"=150'  
VERT. 1"=30'

DATE: 06/15/2011

JPA PERMIT SUBMITTAL

BELL BEND NUCLEAR POWER PLANT  
LUZERNE COUNTY, PENNSYLVANIA

APPLICATION BY:  
PPL NUCLEAR DEVELOPMENT, LLC

FIGURE 8F - INTAKE STRUCTURE  
CROSS SECTION

REV 1 : 10/28/2011 REVISED STREAM NAME / FLOODWAY  
REV 0 : 06/15/2011 INITIAL SUBMISSION