Bell Bend Nuclear Power Plant
Wetland Mitigation Design Report
Riverlands Site

Salem Township, Luzerne County, PA




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Rev 0, November 2010

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1 Introduction

The Riverlands Mitigation Site will provide 1.24 acres of compensatory wetland mitigation for unavoidable wetland impacts associated with the proposed Bell Bed Nuclear Power Plant. This mitigation site is located adjacent to the North Branch Canal, immediately south of the existing access drive to the Susquehanna Steam Electric Station intake structure (Figure 1). This project will also provide conveyance for base flow and storm flow that currently flows through the canal outfall channel which will be filled for the construction of the proposed intake structure (Figure 2). The historical alignment of the North Branch Canal has been interrupted and base flow is diverted over a weir into a heavily incised man made channel and into the North Branch of Susquehanna River. The Riverlands Mitigation Site consists of hydraulically re-connecting the North Branch Canal, restoring the original tow path, and repairing and maintaining the existing control structure that supports the Susquehanna Riverlands Wetlands Nature Area.

The Susquehanna Riverlands Wetlands Nature Area is a nature preserve that was designed and constructed in the early 1980's. The North Branch Canal flows south from the mitigation site through the Wetlands Nature Area, bisecting the constructed wetlands. Therefore, the redirection of the canal baseflow back into the canal will affect the hydrology of the constructed wetlands to a certain extent. In addition to the construction for the Riverlands Mitigation Site, the existing control structure that maintains hydraulic grade at the southernmost point of the Susquehanna Riverlands Wetlands Nature Area must be repaired and adjusted to maintain the desired water surface elevation in the wetlands.

The purpose of this narrative is to describe background data, present design methodology, and summarize design calculations involved with the restoration design of the Riverlands Mitigation Site. The specific design objectives include maintaining a stable water surface elevation in the canal, directing canal flows to the Susquehanna Riverlands Wetlands Nature Area, enhancing/restoring the historical value of the canal and tow path while enhancing 1.24 acres of existing wetlands by removing invasive species and planting native vegetation.

These objectives will be achieved by restoring the original alignment of the canal and installing a stop log structure that will be used to maintain water surface elevations upstream into the Riverlands Recreational Area adjacent to Lake Took-A-While. The project will also re-connect the original canal and tow path and create a walking trail on the original tow path and a pedestrian crossing at the stop log structure. The eroded gulleys in the canal outfall channel will be filled with amended topsoil and planted with native species of wetland plants. An overflow pipe will be installed to maintain the hydrology behind the proposed intake structure fill material.

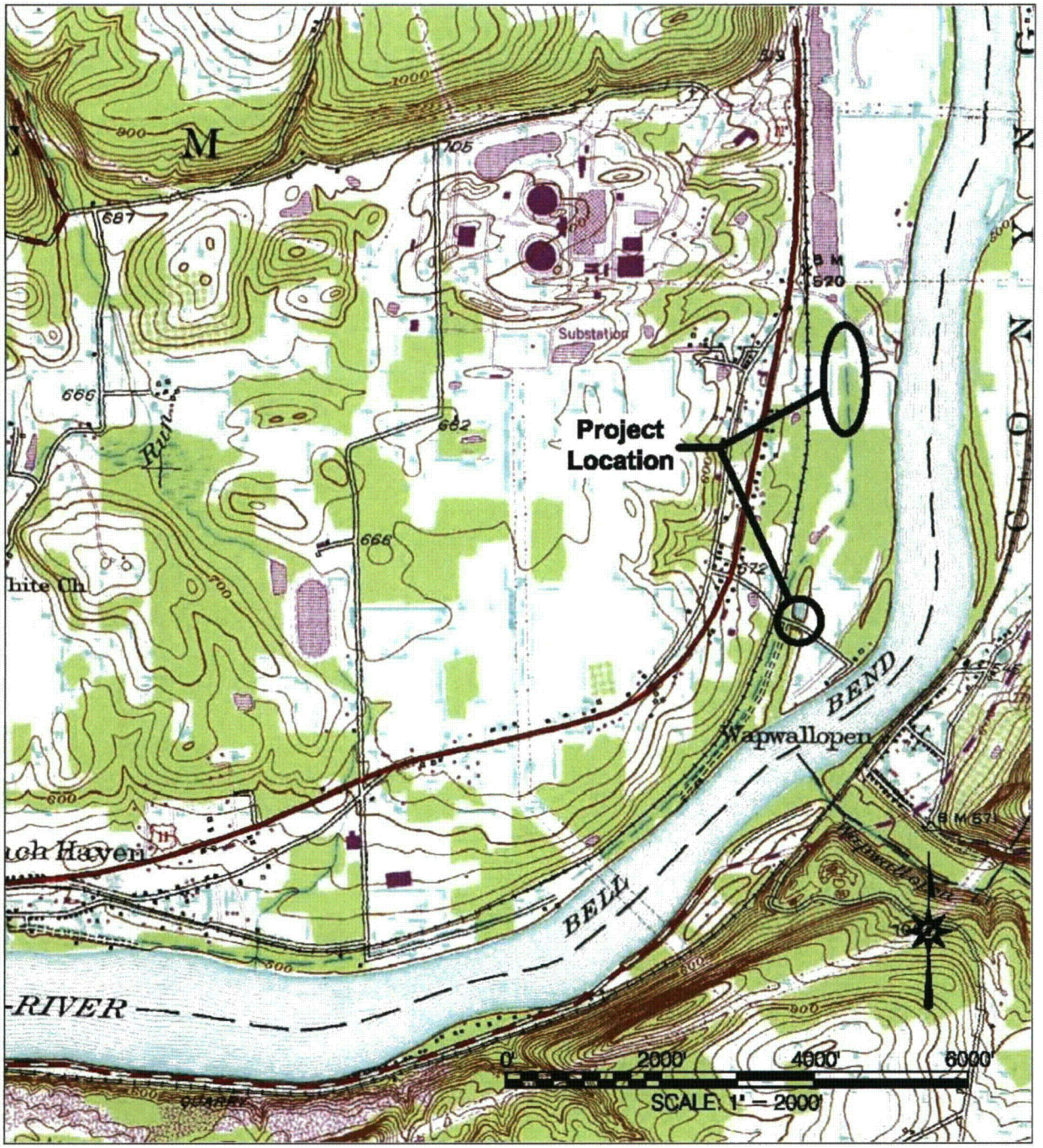

Figure 1 – Project Location Map

Riverlands Mitigation Project

Scale: 1" = 2,000'
Location: 41° 05' 17" N 76° 08' 02" W
Souce: USGS 7.5 minute Quadrangle - Berwick, PA

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Figure 2 – Present Canal Configuration

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2 Physiographic Region, Geology, Hydrology and Existing Land Use

2.1 Physiographic Region

The project site is part of the Susquehanna Lowland Section of the Ridge and Valley physiographic province (see Figure 3), which characterized by a distinctive series of linear ridges and valleys that are the result of differential erosion of folded sedimentary rocks with varying degrees of resistance to weathering and erosion. Valleys are composed of less resistant rocks such as limestone and shale, whereas ridges and uplands are composed of more resistant rocks, particularly sandstone and siltstone. The Susquehanna River has incised into and crosses these ridges as it flows generally from north to south, and its numerous tributaries form a trellis drainage network pattern as they flow along the valleys with less resistant rocks.

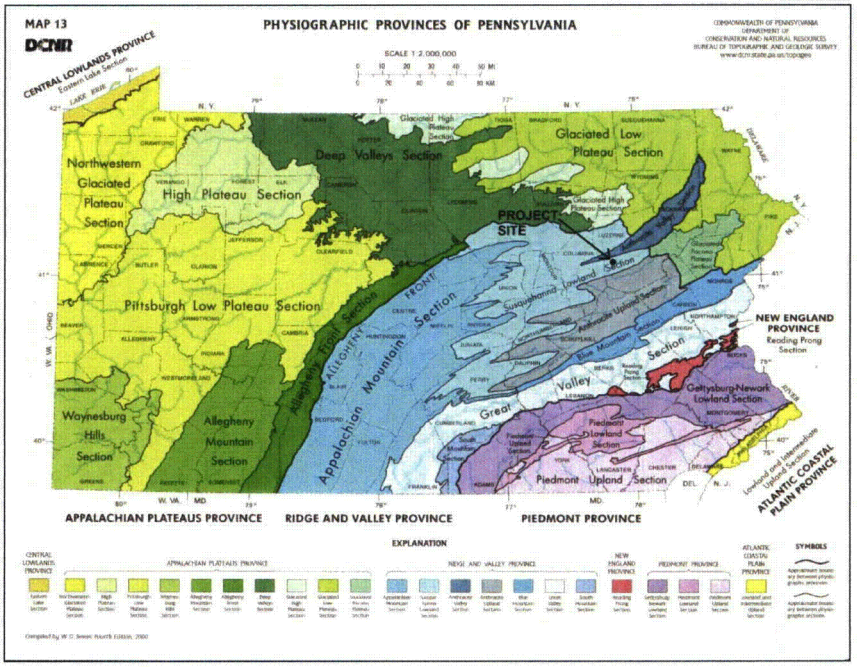

Figure 3 – Physiographic Provinces Map of Pennsylvania

2.2 Geology

This watershed consists of five different classes of surficial geology (Figure 4). A Holocene Alluvium is the most prevalent immediately around the Riverlands Mitigation project location. The watershed is primarily comprised of a Woodsfordian Kame Terrace and Outwash (undivided) and Woodsfordian Ground Moraine, both of Pleistoscene Age. Woodfordian End Moraine and Eolian Mantle are also present in the in the watershed. The base geology of the majority of the watershed and all of the Riverlands Mitigation project site consists of a Mahantango Formation (Figure 5). The northern portion of the watershed is a Trimmers Rock Formation and there are small strips of Harrell Formation and Mahantango Formation (Tully Member), all of the Devonian Age.

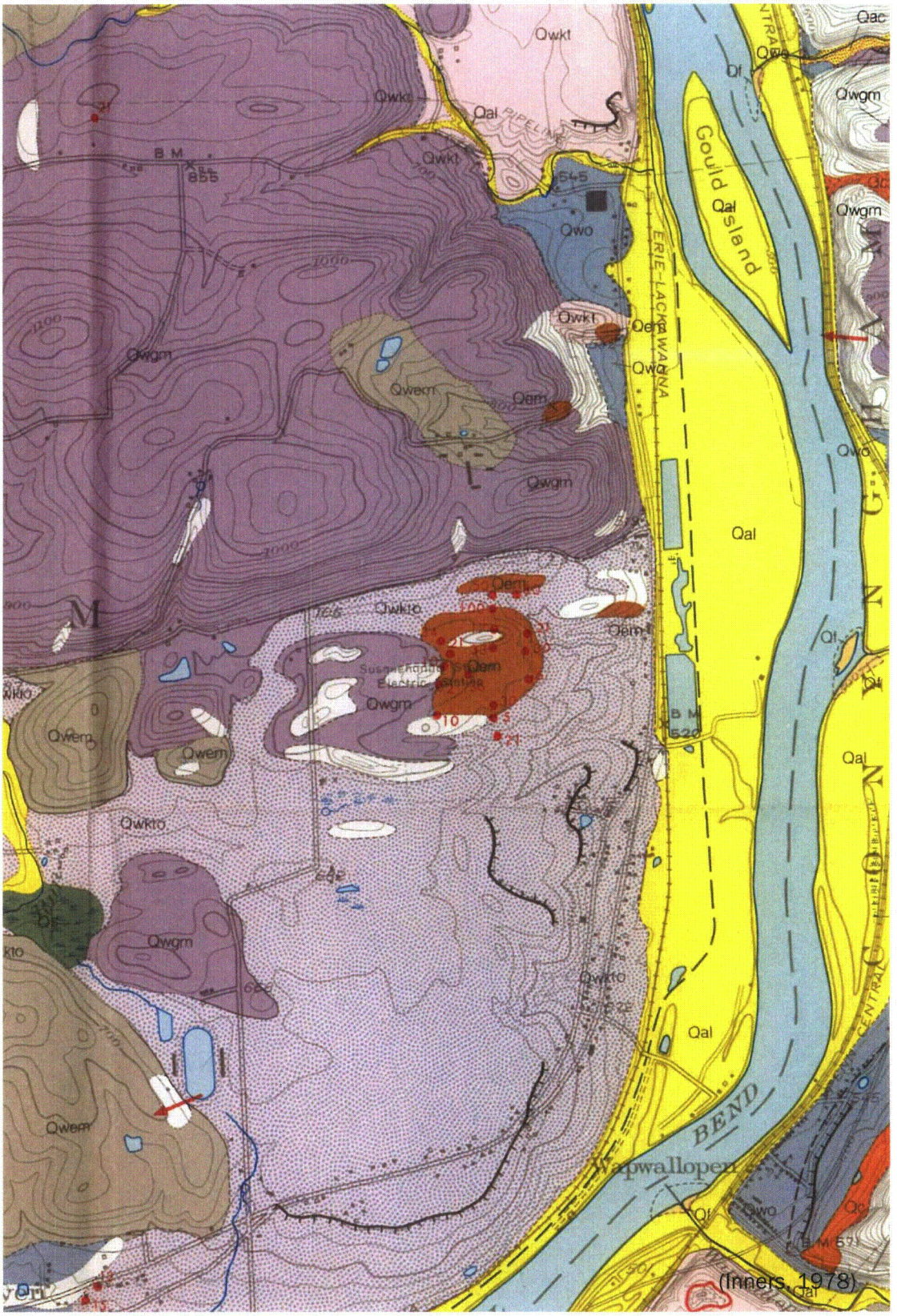

Figure 4 – Surficial Geology Map of Watershed

Figure 5 – Bedrock Geology Map of Watershed

2.3 General Site Hydrology

The Riverlands Mitigation Site watershed is approximately 1.2 square miles, consisting mainly of woods but also includes the majority of the footprint of the existing Susquehanna Steam Electric Station (SSES) and Lake Took-A-While (Figure 6). Flow in the watershed is generally in a west to east direction towards the abandoned North Branch Canal which then flows from north to south.

Stormwater flow from the SSES flows into the southern end of Lake Took-A-While via an unnamed tributary. The water surface elevation in Lake Took-A-While is controlled by a weir at the north end of the lake. The canal receives storm flow from Lake Took-A-While (Area A) as well as the forested portion of the watershed north of the SSES (Area B). The canal was used to bypass a segment of the North Branch of the Susquehanna River. The northern end of the canal is still visibly connected to the River, but the canal is filled and does not support any base flow from the River. Flood events from the Susquehanna River may overtop the earthen fill and contribute to the flow in the canal.

The water surface elevation in the canal is controlled by a weir and separate stoplog structure in a culvert south of Lake Took-A-While, near the existing SSES intake structure. The stoplog structure controls the water flowing to Riverlands Nature Area and the weir controls the flows that are directed to the North Branch of the Susquehanna River. See Figure 2 for the locations of these structures. The stoplogs for both structures are set at elevations according to the needs of the Riverlands facility operators and adjusted accordingly to maintain the desired water surface upstream into the Riverlands Recreation Area and to provide hydrology downstream to the Wetlands Nature Area. The entire site is located within the 100 year floodplain and will be inundated during a 100-year flood event.

2.4 Existing Land Use

The most significant historical land use around the Riverlands Mitigation Site is the construction and use of the canal. This segment of the canal system was known as the North Branch Canal (Columbia County Historical and Genealogical Society). Ground was first broken on July 4th, 1828 and was used until the entire 338 mile network of Pennsylvania canals were abandoned in 1901. At some point around the construction of Susquehanna Riverlands in the early 1980's, the canal was interrupted by constructing the configuration that is seen today (Figure 2).

The current watershed land use is predominantly forest, high density industrial and a lake. The land use around the proposed Riverlands Mitigation project is open water (canal), fallow fields and forest. The area is currently used for public recreation and education.

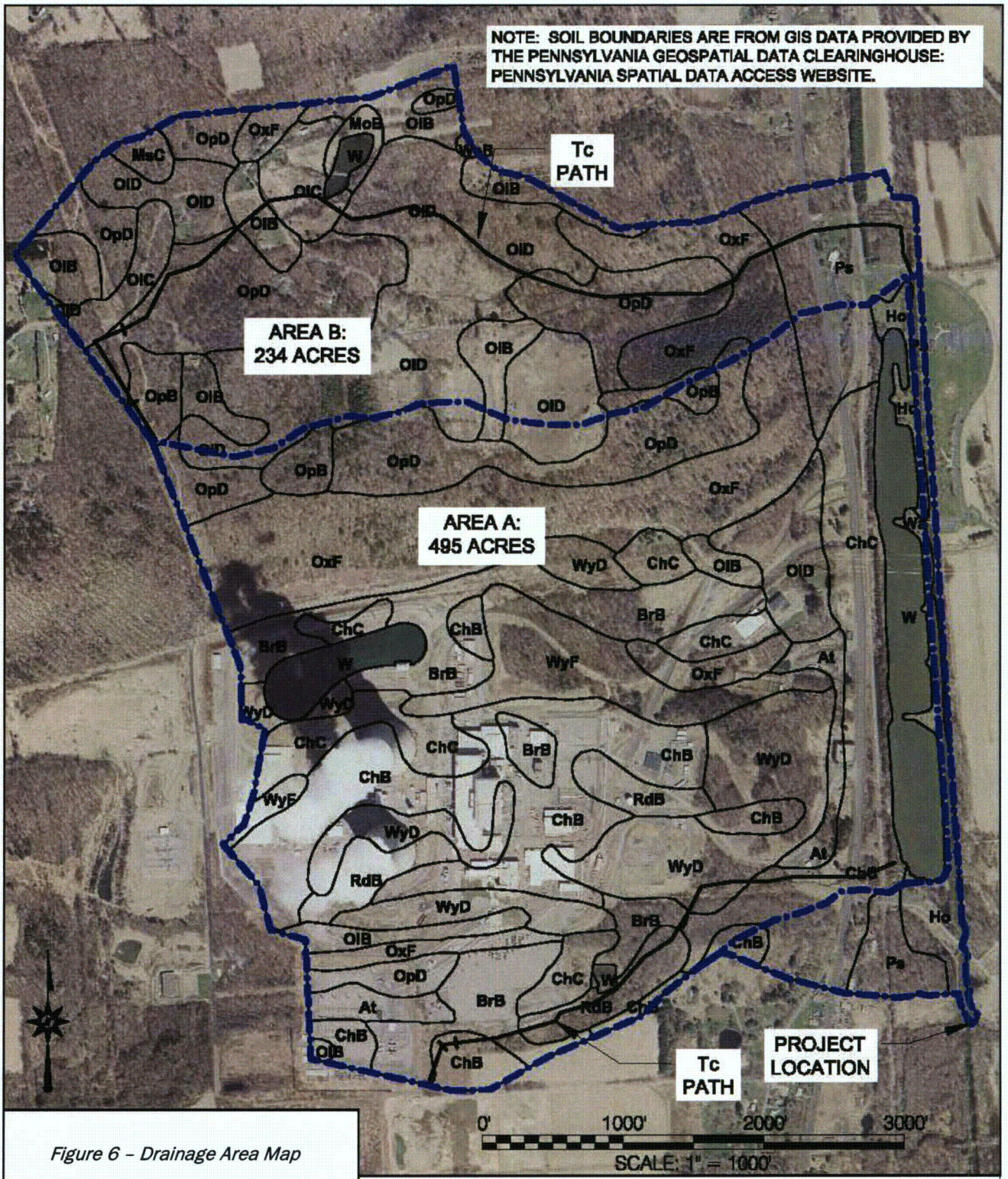

Figure 6 – Drainage Area Map

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3 Visual Assessment of Watershed and Project Site

The land use in the upper reaches of the watershed to the mitigation area is currently a mix dominated by forest and high density industrial development. The eastern, or lower portion of the watershed is primarily mixed open space consisting of forest, lawn, open water and some cultivated land.

The project site adjacent to the canal consists of emergent and forested wetlands. The quality of these wetlands is marginal, primarily due to historic disturbance and invasive vegetation. The reach of the canal downstream of the existing weir has a significant amount of accumulated sediment. The canal outfall channel is severely eroded through most of its length and secondary ditch extends from a partial breach of the canal berm to the outfall channel.

Substrate embeddedness and composition surveys in the canal outfall channel indicate fair to poor habitat conditions near the existing weir structure and good substrate conditions near the confluence with the Susquehanna River. The habitat quality was marginal throughout the system but the macroinvertebrate community surveys reflected a fair to poor score based on the macroinvertebrate biotic index(LandStudies, Inc., 2010).

4 Design

4.1 Design Objectives

The specific design objectives include:

1. Provide an ecologically and environmentally solution to direct flow into the canal and away from the proposed intake structure.
2. Maintain a stable tailwater surface elevation in the canal while providing the flexibility to make fine adjustments to that water level on an as needed basis.
3. Enhance and restore the historical value of the canal and tow path.
4. Enhance the quality of existing wetlands at the Riverlands Mitigation Site.

4.2 Design Methodology

The design objectives will be achieved through the following tasks:

1. Re-connect the original canal and tow path and creating a trail on the original tow path.
2. Install a stop log structure and canal crossing that will be used to maintain water surface elevations in upstream reach of the canal and maintain access across the canal in this location.
3. Maintain and repair the grade control structure in PPL Riverlands Wetlands Nature Area to allow for the effective management of water surface elevations in the constructed wetlands.

4. Fill eroded gulleys in the canal outfall channel with amended soil to provide suitable growing media for wetland vegetation.
5. Remove invasive species and plant native trees and shrubs in existing wetlands adjacent to the canal.
6. Install an overflow pipe to prevent excessive ponding behind the fill for the proposed intake structure.

4.3 Hydrology and Hydraulics

The Riverlands Mitigation Site watershed is 1.24 square miles, which includes the majority of the footprint of the existing Susquehanna Seam Electric Station, Lake Took-A-While, a large portion of the North Branch Canal, and Forested and Meadow Areas. The drainage area to the site is depicted over an aerial photograph in Figure 6. The watershed hydrology was modeled using SCS TR-20 methodology using the Hydraflow Hydrographs extension of AutoCAD. This allowed the drainage area to be broken into sub watersheds and allowed the significant storage volume in Lake Took-A-While and the Canal to be routed.

The watershed was divided into "Area A," which drains to Lake Took-A-While, and "Area B," which drains to the North Branch Canal. Land cover was evaluated for both drainage areas using aerial photography and site observations, and weighted Curve Numbers were calculated using standard CN values listed in TR-55. Time of concentration paths were mapped, as shown on Figure 6, and Tc values were developed using TR-55 methods for sheet flow, shallow concentrated, channel flow. Rainfall values were obtained from NOAA Atlas 14 data.

Runoff hydrographs for the 2, 5, 10, 25, 50, and 100-year storms were developed for Areas A and B, based on the inputs described above. The Hydrograph from Area A was routed through Lake Took-A-While using the storage indication method in the Hydrographs application. Pond data was based on existing topography and field measurements of the existing two-stage weir through which the lake discharges into the canal. The resultant routed hydrograph was then added to the Area B hydrograph. Finally, canal was routed through the proposed stoplog structure and pipe.

The proposed canal crossing was also modeled in HY-8 to more accurately reflect the overtopping conditions during large storm events. The routing of the structure using the Hydrographs software has the limitation of only allowing the input of a broad crested weir at a single elevation. HY-8 allows the input of an irregular overtopping cross section, but does not support a multi-stage weir structure at the inlet of a culvert. Based on these limitations, the Hydrographs model accurately predicts flow through the proposed stoplog structure and culvert up to the overtopping elevation. At that point and above, the pipe is in an outlet control condition, rendering the stoplog structure ineffective. Therefore, the HY-8 model more accurately predicts the performance of the system once overtopping begins, even though the stoplog structure is not included, due to the more accurate overtopping cross section.

Based on both hydraulic models, the proposed crossing will overtop during an event greater that the 10-year storm. All data inputs and routings, as well as model summary output is provided in Appendix A.

4.4 Design Summary

This design is intended to take flow that would currently go to the Susquehanna River and redirect it into the lower segment of the historical canal. This is necessary because the location and orientation of the proposed intake structure will prevent higher flows from going to the Susquehanna River and would otherwise flood the area around the intake structure. The installation of a stoplog structure will maintain the backwater elevation that is necessary to keep water in the canal upstream of this location, while conveying base flow and storm flow downstream in the canal into the PPL Riverlands Wetland and Nature Area. The gulleys that are currently present on the east side of the canal tow path will be repaired by placing amended topsoil in the deepest portions of the gulleys and promoting the establishment of wetland plant species. A headwall and 18" smooth lined corrugated polyethylene pipe will be installed at the toe of the proposed intake structure fill and will provide positive relief for local runoff that would otherwise be impounded behind the fill. This eliminates the potential for this wetland area to be permanently flooded, a maintaining the existing hydrology of the system.

A walking path will be established on the restored tow path of the historic North Branch Canal and a crossing will be created across the canal at the location of the stoplog structure. This stoplog structure will consist of a precast concrete drop structure with oak stop logs set to establish the desired elevation in the upstream reach of the canal. This the drop structure will connect to a 48" diameter smooth lined corrugated polyethylene pipe that outlets to the lower segment of the North Branch Canal and provided conveyance under the crossing. The crown of the crossing will be constructed such that overtopping will occur on the west side of the canal and proceed into the downstream segment of the existing canal rather than towards the proposed intake structure. This will promote channel and bank stability as well as keeping the majority of the flow away from the depression behind the proposed intake structure.

Invasive species will be removed from the adjacent wetland areas. Native tree, shrub, and herbaceous species will be planted in these adjacent wetlands, including the abandoned canal outfall channel. A plant list for the proposed wetland enhancement can be found in Appendix A.

See the Wetland Mitigation Plan for the Riverlands Site for Construction Drawings, Details, Specifications, and the Landscape Plan.

5 References

Columbia County Historical and Genealogical Society. (n.d.). *Gala Day in 1828 at Berwick as Ground Broken for Canal*. Retrieved November 4, 2010, from http://www.colcohist-gensoc.org/Essays/berwickcanal.htm

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United States Department of Agriculture Soil Conservation Service. *Soil Survey of Luzerne County, Pennsylvania.* The Pennsylvania State University College of Agriculture and the Pennsylvania Department of Environmental Resources State Conservation Commission.

Appendix A:
Hydrology and Hydraulics Data and Calculations

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Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

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			□□yr	2□yr	□□yr	□□yr	□□□yr	2□□yr	□□□yr	□□□□yr	
1	SCS Runoff	------	-------	185.07	-------	314.14	461.17	698.73	930.82	1220.87	Area A
2	Reservoir	1	-------	19.79	-------	40.00	69.20	127.48	195.85	293.33	Lake Took-a-While
3	SCS Runoff	------	-------	10.38	-------	33.35	70.09	143.65	225.78	337.54	Area B
4	Combine	2, 3	-------	23.66	-------	54.07	101.34	200.05	313.66	473.19	Combined Area A and B
5	Reservoir	4	-------	14.83	-------	34.23	56.74	121.76	202.09	323.52	Canal - Stop Log

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Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

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1	SCS Runoff	185.07	2	746	1,254,122	------	------	------	Area A
2	Reservoir	19.79	2	956	1,252,985	1	508.62	669,022	Lake Took-a-While
3	SCS Runoff	10.38	2	764	158,998	------	------	------	Area B
4	Combine	23.66	2	924	1,411,984	2, 3	------	------	Combined Area A and B
5	Reservoir	14.83	2	1454	1,380,214	4	509.27	621,088	Canal - Stop Log

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyds.	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	314.14	2	744	1,957,240	------	------	------	Area A
2	Reservoir	40.00	2	868	1,955,889	1	508.91	997,875	Lake Took-a-While
3	SCS Runoff	33.35	2	750	331,788	------	------	------	Area B
4	Combine	54.07	2	774	2,287,680	2, 3	------	------	Combined Area A and B
5	Reservoir	34.23	2	1148	2,251,672	4	509.53	724,971	Canal - Stop Log

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Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

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1	SCS Runoff	461.17	2	744	2,753,967	------	------	------	Area A
2	Reservoir	69.20	2	832	2,752,453	1	509.25	1,385,064	Lake Took-a-While
3	SCS Runoff	70.09	2	746	554,710	------	------	------	Area B
4	Combine	101.34	2	766	3,307,163	2, 3	------	------	Combined Area A and B
5	Reservoir	56.74	2	1052	3,267,716	4	509.99	905,762	Canal - Stop Log

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Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

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1	SCS Runoff	1220.87	2	744	6,933,142	------	------	------	Area A
2	Reservoir	293.33	2	790	6,931,184	1	511.04	3,428,562	Lake Took-a-While
3	SCS Runoff	337.54	2	742	1,955,443	------	------	------	Area B
4	Combine	473.19	2	758	8,886,613	2, 3	------	------	Combined Area A and B
5	Reservoir	323.52	2	826	8,838,069	4	511.26	1,494,673	Canal - Stop Log

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Forest (Good)*	C	55	197.60	10,868.00
Commercial (85% imperv)	C	94	49.40	4,643.60
Commercial (85% imperv)	A	89	173.60	15,450.40
Forest (Good)	A	30	49.60	1,488.00
Water	-	100	24.80	2,480.00
		Total CN*A =		34,930.00
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Forest (Good)*	C	55	187.00	10,285.00
Meadow (Good)*	C	58	47.00	2,726.00
		Total CN*A =		13,011.00
		□otal □rea □	2□□□□ a□□	
□eig□ted □□ □	□□			

* Adjusted to HSG B CN values based on site observations and calibration with other runoff models

Ma□ □y□ □ol	□oil □erie□	□lo□e	□ydrologi□ □oil □rou□
At	Atherton silt loam	- - -	B/D
BrB	Braceville gravelly loam	3% to 8%	C
ChB	Chenango gravelly loam	3% to 8%	A
ChC	Chenango gravelly loam	8% to 15%	A
Ho	Holly silt loam	- - -	B/D
MoB	Morris channery silt loam	0% to 8%	C
MsC	Morris very stony silt loam	8% to 15%	C
OlB	Oquaga and Lordstown channery silt loams	3% to 8%	C
OlC	Oquaga and Lordstown channery silt loams	8% to 15%	C
OlD	Oquaga and Lordstown channery silt loams	15% to 25%	C
OpB	Oquaga and Lordstown extremely stony silt loams	3% to 8%	C
OpD	Oquaga and Lordstown extremely stony silt loams	8% to 25%	C
OxF	Oquaga and Lordstown extremely stony silt loams	Steep	C
Ps	Pope soils	- - -	B
RdB	Rexford loam	3% to 8%	C
W	Water	- - -	- - -
Wa	Wayland silt loam	- - -	C/D
WeB	Weikert and Klinesville channery silt loams	3% to 8%	C/D
WyD	Wyoming gravelly loam	15% to 25%	A

Sources: Pennsylvania College of Agricultural Sciences Cooperative Extension and United States Department of Agriculture Soil Conservation Service

POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14

Pennsylvania 41.0868 N 76.1595 W 685 feet

from "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 2, Version 3
G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley
NOAA, National Weather Service, Silver Spring, Maryland, 2004

Extracted: Thu Mar 18 2010

Confidence Limits | Seasonality | Location Maps | Other Info. | GIS data | Maps | Docs | Return to State Map

Precipitation Frequency Estimates (inches)

ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.33	0.52	0.63	0.84	1.02	1.20	1.32	1.64	2.03	2.38	2.81	3.15	3.71	4.29	5.83	7.27	9.20	11.07
2	0.40	0.62	0.75	1.01	1.24	1.45	1.58	1.97	2.42	2.86	3.37	3.75	4.42	5.09	6.88	8.53	10.72	12.87
5	0.47	0.72	0.89	1.22	1.52	1.79	1.95	2.41	2.99	3.54	4.16	4.60	5.37	6.12	8.04	9.81	12.13	14.44
10	0.52	0.80	0.98	1.37	1.74	2.08	2.27	2.80	3.48	4.15	4.87	5.35	6.20	7.02	9.04	10.90	13.32	15.78
25	0.59	0.90	1.11	1.56	2.03	2.50	2.74	3.38	4.23	5.12	6.00	6.54	7.52	8.40	10.56	12.53	15.07	17.73
50	0.64	0.97	1.20	1.72	2.26	2.87	3.16	3.90	4.91	6.01	7.04	7.63	8.72	9.64	11.89	13.93	16.56	19.39
100	0.70	1.05	1.30	1.88	2.51	3.29	3.65	4.50	5.69	7.07	8.28	8.93	10.12	11.07	13.38	15.48	18.17	21.17
200	0.76	1.13	1.41	2.05	2.78	3.77	4.20	5.19	6.60	8.33	9.75	10.45	11.77	12.72	15.08	17.20	19.92	23.10
500	0.84	1.24	1.55	2.30	3.18	4.51	5.08	6.29	8.05	10.37	12.13	12.91	14.39	15.31	17.66	19.78	22.48	25.91
1000	0.92	1.33	1.67	2.50	3.51	5.17	5.86	7.26	9.37	12.26	14.35	15.18	16.78	17.63	19.91	21.98	24.62	28.23

* These precipitation frequency estimates are based on a partial duration series. **ARI** is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting forces estimates near zero to appear as zero.

*** Upper bound of the 90% confidence interval Precipitation Frequency Estimates (inches)**

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.37	0.57	0.70	0.93	1.14	1.34	1.48	1.86	2.29	2.66	3.17	3.50	4.12	4.72	6.32	7.84	9.86	11.79
2	0.44	0.69	0.84	1.12	1.38	1.62	1.77	2.22	2.73	3.19	3.80	4.18	4.92	5.61	7.45	9.19	11.50	13.71
5	0.52	0.80	0.99	1.35	1.70	2.01	2.19	2.72	3.36	3.95	4.69	5.11	5.97	6.74	8.69	10.56	13.00	15.38
10	0.58	0.89	1.09	1.52	1.93	2.32	2.54	3.15	3.91	4.61	5.47	5.93	6.88	7.71	9.75	11.72	14.27	16.80
25	0.65	0.99	1.23	1.74	2.25	2.79	3.07	3.80	4.74	5.65	6.70	7.20	8.30	9.19	11.36	13.44	16.13	18.88
50	0.71	1.08	1.34	1.91	2.52	3.21	3.54	4.38	5.50	6.60	7.83	8.39	9.59	10.53	12.77	14.93	17.71	20.62
100	0.78	1.17	1.45	2.09	2.80	3.69	4.09	5.05	6.38	7.73	9.18	9.77	11.11	12.06	14.36	16.57	19.42	22.50
200	0.84	1.26	1.57	2.29	3.10	4.23	4.72	5.84	7.42	9.06	10.76	11.41	12.87	13.82	16.15	18.40	21.27	24.55
500	0.95	1.39	1.74	2.58	3.56	5.08	5.73	7.12	9.11	11.22	13.33	14.02	15.67	16.61	18.88	21.13	23.98	27.54
1000	1.03	1.50	1.88	2.81	3.95	5.87	6.66	8.26	10.65	13.19	15.71	16.43	18.24	19.09	21.27	23.47	26.26	30.03

* The **upper** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **greater** than.
** These precipitation frequency estimates are based on a partial duration series. **ARI** is the Average Recurrence Interval.

Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

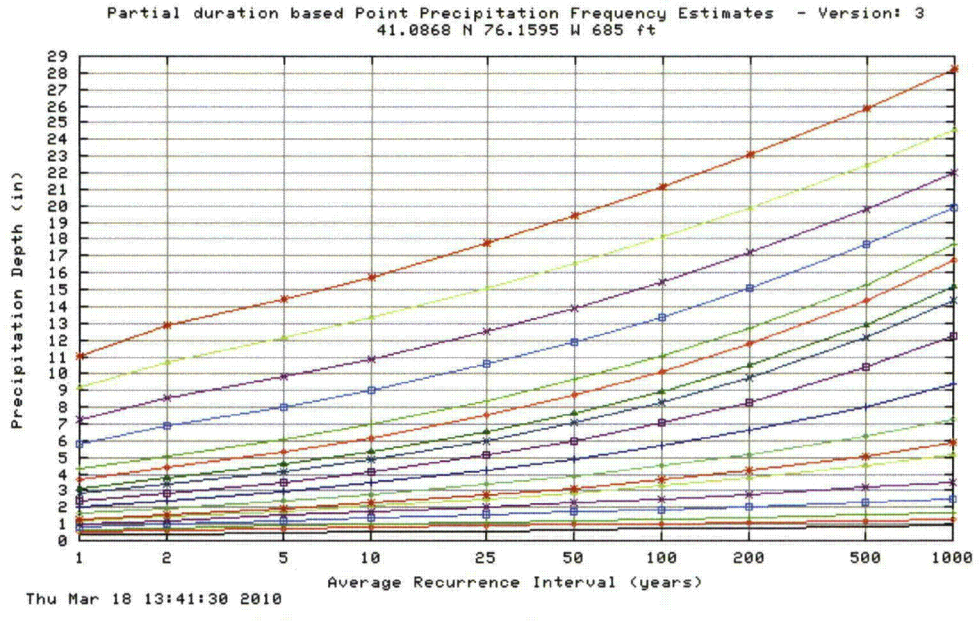
*** Lower bound of the 90% confidence interval Precipitation Frequency Estimates (inches)**

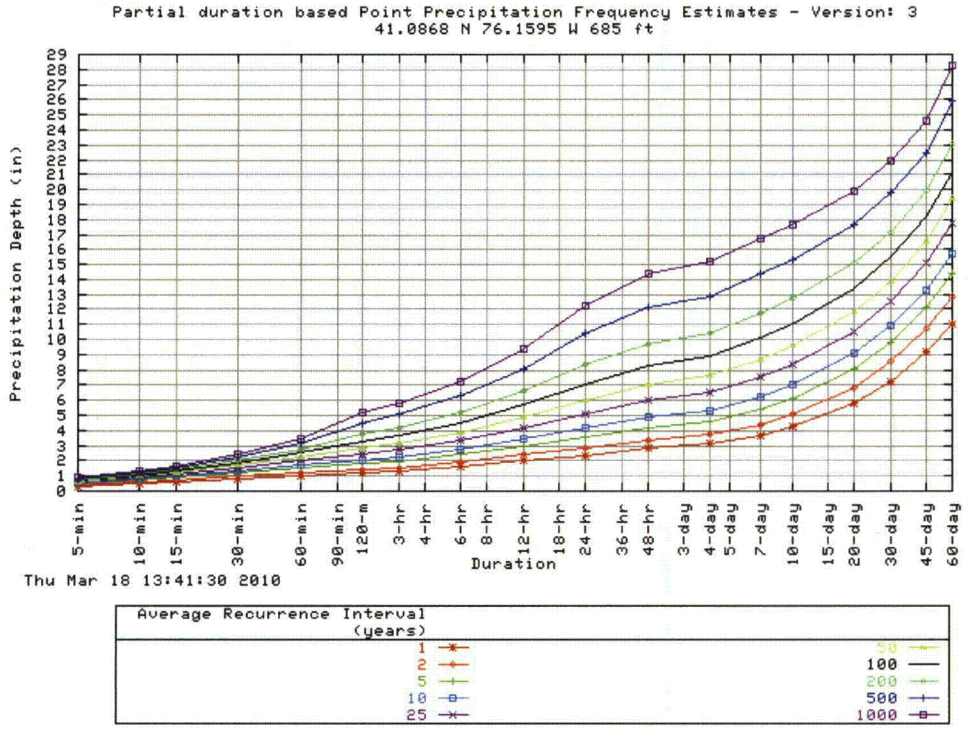
ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.30	0.47	0.57	0.75	0.92	1.08	1.18	1.47	1.82	2.16	2.53	2.87	3.38	3.93	5.43	6.80	8.64	10.45
2	0.35	0.55	0.68	0.91	1.11	1.30	1.42	1.76	2.17	2.59	3.04	3.42	4.03	4.67	6.39	7.96	10.07	12.15
5	0.42	0.65	0.80	1.09	1.37	1.61	1.75	2.16	2.68	3.21	3.75	4.19	4.89	5.61	7.46	9.15	11.38	13.63
10	0.47	0.72	0.88	1.23	1.56	1.86	2.03	2.49	3.10	3.74	4.37	4.86	5.63	6.40	8.37	10.14	12.49	14.88
25	0.52	0.80	0.99	1.39	1.81	2.22	2.44	2.99	3.74	4.57	5.34	5.89	6.79	7.62	9.73	11.63	14.10	16.70
50	0.57	0.86	1.07	1.52	2.01	2.54	2.79	3.43	4.31	5.33	6.23	6.84	7.83	8.71	10.92	12.90	15.46	18.22
100	0.61	0.93	1.15	1.66	2.22	2.89	3.19	3.91	4.95	6.21	7.26	7.94	9.02	9.94	12.24	14.28	16.92	19.85
200	0.66	0.99	1.23	1.80	2.44	3.28	3.64	4.47	5.67	7.25	8.46	9.21	10.40	11.33	13.72	15.79	18.49	21.60
500	0.73	1.08	1.34	1.99	2.75	3.87	4.32	5.32	6.80	8.90	10.39	11.24	12.55	13.49	15.93	18.03	20.75	24.11
1000	0.79	1.14	1.43	2.14	3.01	4.37	4.92	6.07	7.79	10.38	12.13	13.06	14.47	15.41	17.83	19.91	22.63	26.16

* The **lower** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **less** than.
** These precipitation frequency estimates are based on a partial duration maxima series. **ARI** is the Average Recurrence Interval.

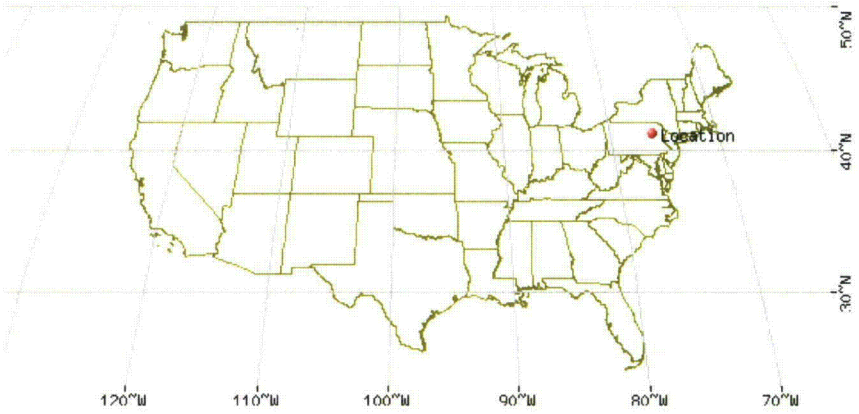
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

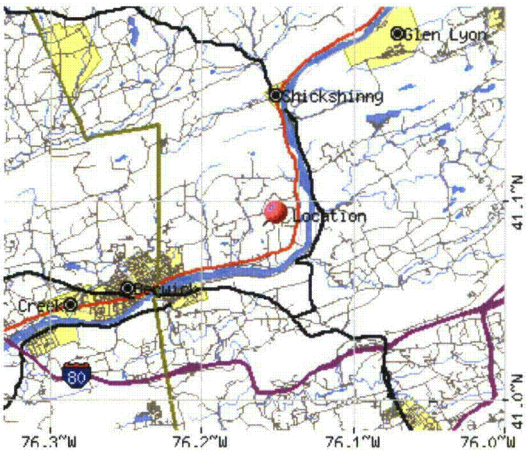
Text version of tables





Maps -





These maps were produced using a direct map request from the U.S. Census Bureau Mapping and Cartographic Resources Tiger Map Server.

Please read disclaimer for more information.

LEGEND

State
County
Indian Resv
Lake/Pond/Ocean
Street
Expressway
Highway
Connector
Stream
Military Area
National Park
Other Park
City
County

Scale 1:228583
0 2 4 6 8 mi
0 2 4 6 8 10 km
*average--true scale depends on monitor resolution

Other Maps/Photographs -

View USGS digital orthophoto quadrangle (DOQ) covering this location from TerraServer; **USGS Aerial Photograph** may also be available from this site. A DOQ is a computer-generated image of an aerial photograph in which image displacement caused by terrain relief and camera tilts has been removed. It combines the image characteristics of a photograph with the geometric qualities of a map. Visit the USGS for more information.

Watershed/Stream Flow Information -

Find the Watershed for this location using the U.S. Environmental Protection Agency's site.

Climate Data Sources -

Precipitation frequency results are based on data from a variety of sources, but largely NCDC. The following links provide general information about observing sites in the area, regardless of if their data was used in this study. For detailed information about the stations used in this study, please refer to NOAA Atlas 14 Document.

Using the **National Climatic Data Center's (NCDC)** station search engine, locate other climate stations within:

+/-30 minutes ...OR... +/-1 degree of this location (41.0868/-76.1595). Digital ASCII data can be obtained directly from **NCDC**.

Hydrometeorological Design Studies Center
DOC/NOAA/National Weather Service
1325 East-West Highway
Silver Spring, MD 20910

(301) 713-1669
Questions?: HDSC.Questions@noaa.gov

Disclaimer

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Area A

□e□□ri□tion	□	□	□	□otal□
□□eet Flo□				
Manning's n-value	= 0.170	0.011	0.011	
Flow length (ft)	= 300.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 2.89	0.00	0.00	
Land slope (%)	= 1.00	0.00	0.00	
□ra□el □i□ e □□ in□	□ □□2□	□ □□□□	□ □□□□	□ □□2□
□□allo□ □on□entrated Flo□				
Flow length (ft)	= 100.00	0.00	0.00	
Watercourse slope (%)	= 2.00	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	=2.28	0.00	0.00	
□ra□el □i□ e □□ in□	□ □□□□	□ □□□□	□ □□□□	□ □□□□
□□annel Flo□				
X sectional flow area (sqft)	= 3.00	0.00	0.00	
Wetted perimeter (ft)	= 5.00	0.00	0.00	
Channel slope (%)	= 2.20	0.00	0.00	
Manning's n-value	= 0.035	0.015	0.015	
Velocity (ft/s)	=4.48	0.00	0.00	
Flow length (ft)	({0})3600.0	0.0	0.0	
□ra□el □i□ e □□ in□	□ □□□□□	□ □□□□	□ □□□□	□ □□□□□
□otal □ra□el □i□ e□□□				**□□□2 □ in**

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Area A

Hydrograph type	= SCS Runoff	Peak discharge	= 461.17 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.40 hrs
Time interval	= 2 min	Hyd. volume	= 2,753,967 cuft
Drainage area	= 495.000 ac	Curve number	= 71
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 50.3 min
Total precip.	= 4.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

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(Printed values >= 10.00% of Qp. Print interval = 5)

□i□e □□□ut□o□ □□r□	□□□□	□i□e □□□ut□o□ □□r□	□□□□
11.83	54.79	14.83	47.47
12.00	171.73		
12.17	321.85	*...End*	
12.33	443.95		
12.50	440.20		
12.67	377.45		
12.83	299.15		
13.00	212.37		
13.17	133.89		
13.33	100.52		
13.50	87.05		
13.67	77.70		
13.83	70.86		
14.00	65.10		
14.17	60.14		
14.33	55.92		
14.50	52.39		
14.67	49.63		

Pond □e□ort

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8 Thursday, Nov 18, 2010

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Pond □ata

□ontour□ □User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 508.03 ft

□tage □□torage □a□le

□tage □t□	□le□ation □t□	□ontour area □□□t□	□n□r□□torage □□u□t□	□otal □torage □□u□t□
0.00	508.03	1,043,909	0	0
5.00	513.03	1,233,733	5,686,933	5,686,933

□ul□ert □□ri□i□e □tru□ture□

		□□□	□□□	□□□	□Pr□□□r□
□i□e □in□	=	0.00	0.00	0.00	0.00
□□an □in□	=	0.00	0.00	0.00	0.00
□o□□arrel□	=	0	0	0	0
□n□ert □□□t□	=	0.00	0.00	0.00	0.00
Lengt□ □t□	=	0.00	0.00	0.00	0.00
□lo□e □□ □	=	0.00	0.00	0.00	n/a
□□□alue	=	.013	.013	.013	n/a
□ri□i□e □oe□□□	=	0.60	0.60	0.60	0.60
Multi□□tage	=	n/a	No	No	No

□ eir □tru□ture□

		□□□	□□□	□□□	□□□
□re□t Len □t□	=	6.00	12.00	0.00	0.00
□re□t □l□□□t□	=	508.03	508.23	0.00	0.00
□ eir □oe□□□	=	3.33	3.33	3.33	3.33
□ eir □y□e	=	Rect	Rect	---	---
Multi□□tage	=	No	No	No	No
□□□il□in□□r□	=	0.000 (by Contour)			
□□ □le□□□□t□	=	0.00			

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

□tage □□torage □□i□□□arge □a□le

□tage ft	□torage □u□	□le□ation ft	□l□ □ □□□	□l□ □ □□□	□l□ □ □□□	Pr□□□r □□□	□ r □ □□□	□ r □ □□□	□ r □ □□□	□ r □ □□□	□□□il □□□	□□er □□□	□otal □□□
0.00	0	508.03	---	---	---	---	0.00	0.00	---	---	---	---	0.000
5.00	5,686,933	513.03	---	---	---	---	223.39	420.23	---	---	---	---	643.62

□ydrogra□□ □e□ort

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8 — Thursday, Nov 18, 2010

□yd□□o□2

Lake Took-a-While

Hydrograph type	= Reservoir	Peak discharge	= 69.20 cfs
Storm frequency	= 10 yrs	Time to peak	= 13.87 hrs
Time interval	= 2 min	Hyd. volume	= 2,752,453 cuft
Inflow hyd. No.	= 1 - Area A	Reservoir name	= Lake Took-a-While
Max. Elevation	= 509.25 ft	Max. Storage	= 1,385,064 cuft

Storage Indication method used.

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(Printed values >= 20.00% of Qp. Print interval = 5)

□i□e □r□□	□n□lo□ □□□	□le□ation □t	□l□□ □□□	□l□□ □□□	□l□□ □□□	P□□□r □□□	□ r □ □□□	□ r □ □□□	□ r □ □□□	□ r □ □□□	□□□il □□□	□ut□lo□ □□□
12.50	440.20	508.68	-----	-----	-----	-----	10.93	13.17	-----	-----	-----	24.10
12.67	377.45	508.88	-----	-----	-----	-----	16.10	21.97	-----	-----	-----	38.07
12.83	299.15	509.04	-----	-----	-----	-----	20.17	28.94	-----	-----	-----	49.11
13.00	212.37	509.14	-----	-----	-----	-----	23.72	35.45	-----	-----	-----	59.17
13.17	133.89	509.20	-----	-----	-----	-----	25.65	38.98	-----	-----	-----	64.62
13.33	100.52	509.22	-----	-----	-----	-----	26.48	40.50	-----	-----	-----	66.98
13.50	87.05	509.24	-----	-----	-----	-----	26.93	41.33	-----	-----	-----	68.26
13.67	77.70	509.24	-----	-----	-----	-----	27.17	41.76	-----	-----	-----	68.94
13.83	70.86	509.25	-----	-----	-----	-----	27.26	41.93	-----	-----	-----	69.19
14.00	65.10	509.25	-----	-----	-----	-----	27.24	41.89	-----	-----	-----	69.13
14.17	60.14	509.24	-----	-----	-----	-----	27.12	41.68	-----	-----	-----	68.80
14.33	55.92	509.24	-----	-----	-----	-----	26.94	41.34	-----	-----	-----	68.28
14.50	52.39	509.23	-----	-----	-----	-----	26.69	40.89	-----	-----	-----	67.58
14.67	49.63	509.22	-----	-----	-----	-----	26.41	40.37	-----	-----	-----	66.77
14.83	47.47	509.21	-----	-----	-----	-----	26.09	39.79	-----	-----	-----	65.88
15.00	45.70	509.20	-----	-----	-----	-----	25.76	39.18	-----	-----	-----	64.94
15.17	44.17	509.19	-----	-----	-----	-----	25.42	38.55	-----	-----	-----	63.96
15.33	42.75	509.18	-----	-----	-----	-----	25.06	37.90	-----	-----	-----	62.96
15.50	41.33	509.17	-----	-----	-----	-----	24.70	37.24	-----	-----	-----	61.94
15.67	39.90	509.16	-----	-----	-----	-----	24.33	36.57	-----	-----	-----	60.90

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15.83	38.44	509.15	-----	-----	-----	-----	23.96	35.89	-----	-----	-----	59.84
16.00	36.97	509.14	-----	-----	-----	-----	23.58	35.19	-----	-----	-----	58.77
16.17	35.51	509.13	-----	-----	-----	-----	23.19	34.48	-----	-----	-----	57.67
16.33	34.12	509.11	-----	-----	-----	-----	22.80	33.76	-----	-----	-----	56.55
16.50	32.90	509.10	-----	-----	-----	-----	22.40	33.03	-----	-----	-----	55.43
16.67	31.91	509.09	-----	-----	-----	-----	22.00	32.30	-----	-----	-----	54.31
16.83	31.11	509.08	-----	-----	-----	-----	21.61	31.58	-----	-----	-----	53.19
17.00	30.46	509.07	-----	-----	-----	-----	21.23	30.88	-----	-----	-----	52.10
17.17	29.90	509.06	-----	-----	-----	-----	20.85	30.18	-----	-----	-----	51.03
17.33	29.38	509.04	-----	-----	-----	-----	20.48	29.51	-----	-----	-----	49.99
17.50	28.86	509.03	-----	-----	-----	-----	20.12	28.85	-----	-----	-----	48.97
17.67	28.34	509.02	-----	-----	-----	-----	19.82	28.32	-----	-----	-----	48.13
17.83	27.81	509.01	-----	-----	-----	-----	19.55	27.86	-----	-----	-----	47.41
18.00	27.28	509.00	-----	-----	-----	-----	19.28	27.40	-----	-----	-----	46.69
18.17	26.75	508.99	-----	-----	-----	-----	19.02	26.95	-----	-----	-----	45.98
18.33	26.21	508.98	-----	-----	-----	-----	18.76	26.51	-----	-----	-----	45.27
18.50	25.67	508.97	-----	-----	-----	-----	18.50	26.07	-----	-----	-----	44.57
18.67	25.13	508.96	-----	-----	-----	-----	18.24	25.63	-----	-----	-----	43.88
18.83	24.58	508.95	-----	-----	-----	-----	17.99	25.20	-----	-----	-----	43.19
19.00	24.03	508.94	-----	-----	-----	-----	17.74	24.77	-----	-----	-----	42.50
19.17	23.48	508.93	-----	-----	-----	-----	17.49	24.34	-----	-----	-----	41.83
19.33	22.93	508.92	-----	-----	-----	-----	17.24	23.92	-----	-----	-----	41.15
19.50	22.37	508.91	-----	-----	-----	-----	16.99	23.49	-----	-----	-----	40.48
19.67	21.81	508.90	-----	-----	-----	-----	16.74	23.07	-----	-----	-----	39.82
19.83	21.24	508.90	-----	-----	-----	-----	16.50	22.66	-----	-----	-----	39.15
20.00	20.68	508.89	-----	-----	-----	-----	16.26	22.24	-----	-----	-----	38.50
20.17	20.12	508.88	-----	-----	-----	-----	16.01	21.83	-----	-----	-----	37.84
20.33	19.60	508.87	-----	-----	-----	-----	15.77	21.42	-----	-----	-----	37.19

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20.50	19.16	508.86	-----	-----	-----	-----	15.53	21.01	-----	-----	-----	36.54
20.67	18.83	508.85	-----	-----	-----	-----	15.30	20.61	-----	-----	-----	35.91
20.83	18.60	508.84	-----	-----	-----	-----	15.07	20.22	-----	-----	-----	35.29
21.00	18.43	508.83	-----	-----	-----	-----	14.84	19.83	-----	-----	-----	34.68
21.17	18.30	508.82	-----	-----	-----	-----	14.63	19.46	-----	-----	-----	34.09
21.33	18.20	508.81	-----	-----	-----	-----	14.41	19.10	-----	-----	-----	33.52
21.50	18.10	508.81	-----	-----	-----	-----	14.21	18.75	-----	-----	-----	32.96
21.67	18.00	508.80	-----	-----	-----	-----	14.01	18.41	-----	-----	-----	32.42
21.83	17.90	508.79	-----	-----	-----	-----	13.82	18.08	-----	-----	-----	31.90
22.00	17.80	508.78	-----	-----	-----	-----	13.63	17.76	-----	-----	-----	31.39
22.17	17.69	508.78	-----	-----	-----	-----	13.45	17.45	-----	-----	-----	30.89
22.33	17.59	508.77	-----	-----	-----	-----	13.27	17.15	-----	-----	-----	30.41
22.50	17.49	508.76	-----	-----	-----	-----	13.10	16.85	-----	-----	-----	29.95
22.67	17.39	508.76	-----	-----	-----	-----	12.93	16.57	-----	-----	-----	29.50
22.83	17.28	508.75	-----	-----	-----	-----	12.77	16.29	-----	-----	-----	29.05
23.00	17.18	508.74	-----	-----	-----	-----	12.61	16.02	-----	-----	-----	28.63
23.17	17.07	508.74	-----	-----	-----	-----	12.45	15.76	-----	-----	-----	28.21
23.33	16.97	508.73	-----	-----	-----	-----	12.30	15.50	-----	-----	-----	27.81
23.50	16.86	508.73	-----	-----	-----	-----	12.16	15.25	-----	-----	-----	27.41
23.67	16.76	508.72	-----	-----	-----	-----	12.02	15.01	-----	-----	-----	27.03
23.83	16.65	508.72	-----	-----	-----	-----	11.88	14.78	-----	-----	-----	26.65
24.00	16.54	508.71	-----	-----	-----	-----	11.74	14.55	-----	-----	-----	26.29
24.17	15.63	508.71	-----	-----	-----	-----	11.61	14.32	-----	-----	-----	25.92
24.33	13.38	508.70	-----	-----	-----	-----	11.46	14.06	-----	-----	-----	25.51
24.50	9.802	508.69	-----	-----	-----	-----	11.27	13.74	-----	-----	-----	25.01
24.67	6.194	508.68	-----	-----	-----	-----	11.04	13.35	-----	-----	-----	24.40
24.83	3.416	508.67	-----	-----	-----	-----	10.78	12.90	-----	-----	-----	23.68
25.00	1.461	508.66	-----	-----	-----	-----	10.49	12.42	-----	-----	-----	22.91

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25.17	0.324	508.65	-----	-----	-----	-----	10.20	11.91	-----	-----	-----	22.11
25.33	0.000	508.64	-----	-----	-----	-----	9.905	11.41	-----	-----	-----	21.32
25.50	0.000	508.63	-----	-----	-----	-----	9.620	10.92	-----	-----	-----	20.54
25.67	0.000	508.62	-----	-----	-----	-----	9.345	10.46	-----	-----	-----	19.80
25.83	0.000	508.61	-----	-----	-----	-----	9.080	10.00	-----	-----	-----	19.08
26.00	0.000	508.60	-----	-----	-----	-----	8.825	9.569	-----	-----	-----	18.39
26.17	0.000	508.59	-----	-----	-----	-----	8.578	9.148	-----	-----	-----	17.73
26.33	0.000	508.58	-----	-----	-----	-----	8.342	8.745	-----	-----	-----	17.09
26.50	0.000	508.57	-----	-----	-----	-----	8.113	8.355	-----	-----	-----	16.47
26.67	0.000	508.56	-----	-----	-----	-----	7.893	7.979	-----	-----	-----	15.87
26.83	0.000	508.55	-----	-----	-----	-----	7.680	7.617	-----	-----	-----	15.30
27.00	0.000	508.55	-----	-----	-----	-----	7.476	7.267	-----	-----	-----	14.74
27.17	0.000	508.54	-----	-----	-----	-----	7.278	6.931	-----	-----	-----	14.21

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Area B

□e□□ri□tion	□	□	□	□otal□
□□eet Flo□				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 300.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 2.89	0.00	0.00	
Land slope (%)	= 3.00	0.00	0.00	
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□□allo□ □on□entrated Flo□				
Flow length (ft)	= 730.00	0.00	0.00	
Watercourse slope (%)	= 9.50	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	=4.97	0.00	0.00	
□ra□el □i□e □□ in□	□ 2□□□	□ □□□□	□ □□□□	□ 2□□□
□□annel Flo□				
X sectional flow area (sqft)	= 3.00	0.00	0.00	
Wetted perimeter (ft)	= 5.00	0.00	0.00	
Channel slope (%)	= 7.00	0.00	0.00	
Manning's n-value	= 0.035	0.015	0.015	
Velocity (ft/s)	=8.00	0.00	0.00	
Flow length (ft)	({0})6453.0	0.0	0.0	
□ra□el □i□e □□ in□	□ □□□□□	□ □□□□	□ □□□□	□ □□□□□

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Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8 Thursday, Nov 18, 2010

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Area B

Hydrograph type	= SCS Runoff	Peak discharge	= 70.09 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.43 hrs
Time interval	= 2 min	Hyd. volume	= 554,710 cuft
Drainage area	= 234.000 ac	Curve number	= 56
Basin Slope	= 7.8 %	Hydraulic length	= 7140 ft
Tc method	= TR55	Time of conc. (Tc)	= 46.6 min
Total precip.	= 4.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

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(Printed values >= 10.00% of Qp. Print interval = 5)

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11.93	7.090	14.93	12.00	17.93	7.587
12.10	29.76	15.10	11.66	18.10	7.456
12.27	56.64	15.27	11.35	18.27	7.322
12.43	70.09	15.43	11.02	18.43	7.187
		15.60	10.68	18.60	7.049
12.60	65.45	15.77	10.33		
12.77	56.33			*...End*	
12.93	43.77	15.93	9.976		
13.10	30.02	16.10	9.612		
13.27	24.29	16.27	9.259		
13.43	21.37	16.43	8.945		
13.60	19.35	16.60	8.693		
13.77	17.84	16.77	8.497		
13.93	16.54	16.93	8.342		
14.10	15.40	17.10	8.212		
14.27	14.40	17.27	8.091		
14.43	13.56	17.43	7.968		
14.60	12.90	17.60	7.844		
14.77	12.40	17.77	7.717		

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Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8 Thursday, Nov 18, 2010

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Combined Area A and B

Hydrograph type	= Combine	Peak discharge	= 101.34 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.77 hrs
Time interval	= 2 min	Hyd. volume	= 3,307,163 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 234.000 ac

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(Printed values >= 20.00% of Qp. Print interval = 5)

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12.17	5.974	40.17	46.15
12.33	11.43	65.97	77.40
12.50	24.10	68.82	92.92
12.67	38.07	62.29	100.36
12.83	49.11	51.65	100.76
13.00	59.17	38.08	97.25
13.17	64.62	26.70	91.33
13.33	66.98	23.00	89.98
13.50	68.26	20.47	88.73
13.67	68.94	18.71	87.65
13.83	69.19	17.30	86.49
14.00	69.13	16.06	85.19
14.17	68.80	14.98	83.79
14.33	68.28	14.04	82.32
14.50	67.58	13.27	80.86
14.67	66.77	12.69	79.46
14.83	65.88	12.23	78.12
15.00	64.94	11.86	76.80
15.17	63.96	11.54	75.50
15.33	62.96	11.22	74.18
15.50	61.94	10.88	72.83

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15.67	60.90	10.54	71.45
15.83	59.84	10.19	70.04
16.00	58.77	9.831	68.60
16.17	57.67	9.468	67.14
16.33	56.55	9.128	65.68
16.50	55.43	8.837	64.27
16.67	54.31	8.609	62.91
16.83	53.19	8.431	61.62
17.00	52.10	8.288	60.39
17.17	51.03	8.163	59.20
17.33	49.99	8.042	58.03
17.50	48.97	7.919	56.89
17.67	48.13	7.793	55.93
17.83	47.41	7.665	55.07
18.00	46.69	7.535	54.22
18.17	45.98	7.403	53.38
18.33	45.27	7.268	52.54
18.50	44.57	7.132	51.70
18.67	43.88	6.994	50.87
18.83	43.19	6.854	50.04
19.00	42.50	6.712	49.22
19.17	41.83	6.568	48.39
19.33	41.15	6.423	47.57
19.50	40.48	6.276	46.76
19.67	39.82	6.127	45.94
19.83	39.15	5.977	45.13
20.00	38.50	5.825	44.32

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20.17	37.84	5.674	43.51
20.33	37.19	5.537	42.73
20.50	36.54	5.426	41.97
20.67	35.91	5.348	41.26
20.83	35.29	5.295	40.58
21.00	34.68	5.260	39.94
21.17	34.09	5.236	39.32
21.33	33.52	5.214	38.73
21.50	32.96	5.191	38.15
21.67	32.42	5.169	37.59
21.83	31.90	5.146	37.04
22.00	31.39	5.123	36.51
22.17	30.89	5.099	35.99
22.33	30.41	5.076	35.49
22.50	29.95	5.052	35.00
22.67	29.50	5.027	34.52
22.83	29.05	5.003	34.06
23.00	28.63	4.978	33.61
23.17	28.21	4.953	33.16
23.33	27.81	4.928	32.73
23.50	27.41	4.903	32.31
23.67	27.03	4.877	31.90
23.83	26.65	4.851	31.51
24.00	26.29	4.825	31.12
24.17	25.92	4.525	30.45
24.33	25.51	3.770	29.28
24.50	25.01	2.593	27.61

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Combined Area A and B

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24.67	24.40	1.524	25.92
24.83	23.68	0.738	24.42
25.00	22.91	0.234	23.15
25.17	22.11	0.011	22.12
25.33	21.32	0.000	21.32
25.50	20.54	0.000	20.54

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Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8 — Thursday, Nov 18, 2010

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□ontour□ □User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 507.20 ft

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0.00	507.20	231,459	0	0
1.00	508.20	298,434	264,212	264,212
2.00	509.20	365,409	331,324	595,536
2.80	510.00	418,990	313,484	909,020
4.30	511.50	512,775	697,571	1,606,591

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		□□□	□□□	□□□	□Pr□□r□
□i□e □in□	=	48.00	0.00	0.00	0.00
□□an □in□	=	48.00	0.00	0.00	0.00
□o□□arrel□	=	1	0	0	0
□n□ert □l□□t□	=	505.20	0.00	0.00	0.00
Lengt□ □t□	=	40.00	0.00	0.00	0.00
□lo□e □□ □	=	0.01	0.00	0.00	n/a
□□□alue	=	.012	.013	.013	n/a
□ri□i□e □oe□□□	=	0.60	0.60	0.60	0.60
Multi□□tage	=	n/a	No	No	No

□ eir □tru□ture□

		□□□	□□□	□□□	□□□
□re□t Len □t□	=	3.90	6.40	60.00	0.00
□re□t □l□□t□	=	507.20	508.20	510.00	0.00
□ eir □oe□□□	=	3.33	3.33	2.60	3.33
□ eir □y□e	=	Rect	Rect	Broad	---
Multi□□tage	=	Yes	Yes	No	No

□□il□in□□r□ = 0.000 (by Wet area)

□□ □le□□□t□ = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

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□tage □t	□torage □u□t	□le□ation □t	□l□□ □□□	□l□□ □□□	□l□□ □□□	Pr□□□r □□□	□ r □ □□□	□ r □ □□□	□ r □ □□□	□ r □ □□□	□□□il □□□	□□er □□□	□otal □□□
0.00	0	507.20	0.00	---	---	---	0.00	0.00	0.00	---	---	---	0.000
1.00	264,212	508.20	4.01 oc	---	---	---	4.00 s	0.00	0.00	---	---	---	4.005
2.00	595,536	509.20	4.94 oc	---	---	---	2.79 s	2.12 s	0.00	---	---	---	4.908
2.80	909,020	510.00	57.11 oc	---	---	---	28.59 s	28.51 s	0.00	---	---	---	57.11
4.30	1,606,591	511.50	109.94 oc	---	---	---	49.54 s	60.39 s	286.59	---	---	---	396.52

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Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8 — Thursday, Nov 18, 2010

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Canal - Stop Log

Hydrograph type	= Reservoir	Peak discharge	= 56.74 cfs
Storm frequency	= 10 yrs	Time to peak	= 17.53 hrs
Time interval	= 2 min	Hyd. volume	= 3,267,716 cuft
Inflow hyd. No.	= 4 - Combined Area A and B	Reservoir name	= Canal
Max. Elevation	= 509.99 ft	Max. Storage	= 905,762 cuft

Storage Indication method used.

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(Printed values >= 20.00% of Qp. Print interval = 5)

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14.17	83.79	509.29	18.22	-----	-----	-----	10.15	8.070	-----	-----	-----	18.22
14.33	82.32	509.39	25.44	-----	-----	-----	13.91	11.53	-----	-----	-----	25.44
14.50	80.86	509.47	30.66	-----	-----	-----	16.52	14.13	-----	-----	-----	30.66
14.67	79.46	509.54	34.85	-----	-----	-----	18.55	16.29	-----	-----	-----	34.84
14.83	78.12	509.61	38.36	-----	-----	-----	20.21	18.13	-----	-----	-----	38.35
15.00	76.80	509.66	41.33	-----	-----	-----	21.59	19.73	-----	-----	-----	41.32
15.17	75.50	509.71	43.89	-----	-----	-----	22.77	21.12	-----	-----	-----	43.89
15.33	74.18	509.76	46.14	-----	-----	-----	23.78	22.35	-----	-----	-----	46.13
15.50	72.83	509.80	48.05	-----	-----	-----	24.64	23.41	-----	-----	-----	48.04
15.67	71.45	509.84	49.74	-----	-----	-----	25.39	24.34	-----	-----	-----	49.73
15.83	70.04	509.87	51.16	-----	-----	-----	26.01	25.14	-----	-----	-----	51.16
16.00	68.60	509.89	52.39	-----	-----	-----	26.55	25.83	-----	-----	-----	52.39
16.17	67.14	509.92	53.44	-----	-----	-----	27.01	26.42	-----	-----	-----	53.43
16.33	65.68	509.94	54.30	-----	-----	-----	27.38	26.91	-----	-----	-----	54.29
16.50	64.27	509.95	55.00	-----	-----	-----	27.68	27.31	-----	-----	-----	54.99
16.67	62.91	509.96	55.56	-----	-----	-----	27.92	27.63	-----	-----	-----	55.55
16.83	61.62	509.97	56.00	-----	-----	-----	28.12	27.88	-----	-----	-----	56.00
17.00	60.39	509.98	56.33	-----	-----	-----	28.26	28.07	-----	-----	-----	56.32
17.17	59.20	509.99	56.56	-----	-----	-----	28.36	28.20	-----	-----	-----	56.55
17.33	58.03	509.99	56.69	-----	-----	-----	28.41	28.27	-----	-----	-----	56.69

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17.50	56.89	509.99	56.74	-----	-----	-----	28.44	28.30	-----	-----	-----	56.74
17.67	55.93	509.99	56.72	-----	-----	-----	28.42	28.29	-----	-----	-----	56.71
17.83	55.07	509.99	56.64	-----	-----	-----	28.39	28.24	-----	-----	-----	56.63
18.00	54.22	509.99	56.51	-----	-----	-----	28.33	28.17	-----	-----	-----	56.50
18.17	53.38	509.98	56.33	-----	-----	-----	28.26	28.07	-----	-----	-----	56.32
18.33	52.54	509.98	56.11	-----	-----	-----	28.16	27.94	-----	-----	-----	56.10
18.50	51.70	509.97	55.85	-----	-----	-----	28.05	27.79	-----	-----	-----	55.84
18.67	50.87	509.96	55.55	-----	-----	-----	27.92	27.62	-----	-----	-----	55.54
18.83	50.04	509.96	55.21	-----	-----	-----	27.77	27.43	-----	-----	-----	55.21
19.00	49.22	509.95	54.85	-----	-----	-----	27.62	27.22	-----	-----	-----	54.84
19.17	48.39	509.94	54.45	-----	-----	-----	27.45	27.00	-----	-----	-----	54.44
19.33	47.57	509.93	54.02	-----	-----	-----	27.26	26.75	-----	-----	-----	54.02
19.50	46.76	509.92	53.57	-----	-----	-----	27.07	26.50	-----	-----	-----	53.57
19.67	45.94	509.91	53.08	-----	-----	-----	26.85	26.22	-----	-----	-----	53.08
19.83	45.13	509.90	52.57	-----	-----	-----	26.63	25.94	-----	-----	-----	52.57
20.00	44.32	509.89	52.04	-----	-----	-----	26.40	25.64	-----	-----	-----	52.04
20.17	43.51	509.87	51.49	-----	-----	-----	26.16	25.33	-----	-----	-----	51.49
20.33	42.73	509.86	50.93	-----	-----	-----	25.91	25.01	-----	-----	-----	50.92
20.50	41.97	509.85	50.35	-----	-----	-----	25.66	24.68	-----	-----	-----	50.34
20.67	41.26	509.84	49.75	-----	-----	-----	25.39	24.35	-----	-----	-----	49.74
20.83	40.58	509.82	49.13	-----	-----	-----	25.12	24.01	-----	-----	-----	49.13
21.00	39.94	509.81	48.51	-----	-----	-----	24.84	23.66	-----	-----	-----	48.50
21.17	39.32	509.80	47.89	-----	-----	-----	24.56	23.32	-----	-----	-----	47.88
21.33	38.73	509.78	47.27	-----	-----	-----	24.29	22.97	-----	-----	-----	47.26
21.50	38.15	509.77	46.66	-----	-----	-----	24.01	22.63	-----	-----	-----	46.64
21.67	37.59	509.76	46.04	-----	-----	-----	23.74	22.29	-----	-----	-----	46.03
21.83	37.04	509.75	45.41	-----	-----	-----	23.45	21.94	-----	-----	-----	45.40
22.00	36.51	509.73	44.78	-----	-----	-----	23.17	21.60	-----	-----	-----	44.77

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22.17	35.99	509.72	44.16	-----	-----	-----	22.89	21.27	-----	-----	-----	44.15
22.33	35.49	509.71	43.55	-----	-----	-----	22.61	20.93	-----	-----	-----	43.54
22.50	35.00	509.70	42.94	-----	-----	-----	22.34	20.60	-----	-----	-----	42.94
22.67	34.52	509.68	42.35	-----	-----	-----	22.07	20.28	-----	-----	-----	42.35
22.83	34.06	509.67	41.75	-----	-----	-----	21.79	19.95	-----	-----	-----	41.74
23.00	33.61	509.66	41.14	-----	-----	-----	21.51	19.63	-----	-----	-----	41.14
23.17	33.16	509.65	40.56	-----	-----	-----	21.24	19.31	-----	-----	-----	40.55
23.33	32.73	509.64	39.98	-----	-----	-----	20.97	19.00	-----	-----	-----	39.97
23.50	32.31	509.63	39.41	-----	-----	-----	20.70	18.70	-----	-----	-----	39.41
23.67	31.90	509.62	38.86	-----	-----	-----	20.45	18.40	-----	-----	-----	38.85
23.83	31.51	509.61	38.32	-----	-----	-----	20.20	18.11	-----	-----	-----	38.31
24.00	31.12	509.59	37.77	-----	-----	-----	19.94	17.82	-----	-----	-----	37.76
24.17	30.45	509.58	37.22	-----	-----	-----	19.67	17.53	-----	-----	-----	37.20
24.33	29.28	509.57	36.63	-----	-----	-----	19.39	17.22	-----	-----	-----	36.62
24.50	27.61	509.56	35.98	-----	-----	-----	19.08	16.88	-----	-----	-----	35.96
24.67	25.92	509.55	35.24	-----	-----	-----	18.73	16.49	-----	-----	-----	35.22
24.83	24.42	509.53	34.43	-----	-----	-----	18.35	16.06	-----	-----	-----	34.41
25.00	23.15	509.52	33.56	-----	-----	-----	17.94	15.61	-----	-----	-----	33.55
25.17	22.12	509.50	32.62	-----	-----	-----	17.47	15.13	-----	-----	-----	32.60
25.33	21.32	509.49	31.67	-----	-----	-----	17.01	14.65	-----	-----	-----	31.66
25.50	20.54	509.47	30.74	-----	-----	-----	16.56	14.17	-----	-----	-----	30.73
25.67	19.80	509.45	29.83	-----	-----	-----	16.11	13.71	-----	-----	-----	29.82
25.83	19.08	509.44	28.92	-----	-----	-----	15.67	13.25	-----	-----	-----	28.92
26.00	18.39	509.42	27.94	-----	-----	-----	15.17	12.76	-----	-----	-----	27.94
26.17	17.73	509.41	26.98	-----	-----	-----	14.69	12.29	-----	-----	-----	26.98
26.33	17.09	509.40	26.06	-----	-----	-----	14.22	11.83	-----	-----	-----	26.05
26.50	16.47	509.38	25.16	-----	-----	-----	13.77	11.39	-----	-----	-----	25.16
26.67	15.87	509.37	24.29	-----	-----	-----	13.33	10.96	-----	-----	-----	24.29

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26.83	15.30	509.36	23.40	-----	-----	-----	12.88	10.52	-----	-----	-----	23.40
27.00	14.74	509.35	22.42	-----	-----	-----	12.36	10.06	-----	-----	-----	22.41
27.17	14.21	509.33	21.48	-----	-----	-----	11.86	9.615	-----	-----	-----	21.48
27.33	13.70	509.32	20.59	-----	-----	-----	11.40	9.195	-----	-----	-----	20.59
27.50	13.46	509.31	19.76	-----	-----	-----	10.96	8.803	-----	-----	-----	19.76
27.67	13.27	509.30	19.01	-----	-----	-----	10.56	8.446	-----	-----	-----	19.01
27.83	13.08	509.30	18.32	-----	-----	-----	10.20	8.120	-----	-----	-----	18.32
28.00	12.89	509.29	17.69	-----	-----	-----	9.870	7.823	-----	-----	-----	17.69
28.17	12.71	509.28	17.12	-----	-----	-----	9.566	7.549	-----	-----	-----	17.12
28.33	12.53	509.27	16.21	-----	-----	-----	9.062	7.143	-----	-----	-----	16.20
28.50	12.35	509.27	15.43	-----	-----	-----	8.626	6.794	-----	-----	-----	15.42
28.67	12.17	509.26	14.77	-----	-----	-----	8.260	6.500	-----	-----	-----	14.76
28.83	12.00	509.26	14.21	-----	-----	-----	7.951	6.252	-----	-----	-----	14.20
29.00	11.83	509.26	13.74	-----	-----	-----	7.688	6.041	-----	-----	-----	13.73
29.17	11.66	509.26	13.33	-----	-----	-----	7.459	5.857	-----	-----	-----	13.31
29.33	11.49	509.25	12.97	-----	-----	-----	7.257	5.696	-----	-----	-----	12.95
29.50	11.33	509.25	12.64	-----	-----	-----	7.077	5.551	-----	-----	-----	12.63
29.67	11.17	509.25	12.36	-----	-----	-----	6.917	5.423	-----	-----	-----	12.34
29.83	11.01	509.25	12.10	-----	-----	-----	6.773	5.307	-----	-----	-----	12.08
30.00	10.85	509.25	11.85	-----	-----	-----	6.639	5.200	-----	-----	-----	11.84
30.17	10.69	509.24	11.63	-----	-----	-----	6.515	5.101	-----	-----	-----	11.62
30.33	10.54	509.24	11.42	-----	-----	-----	6.399	5.008	-----	-----	-----	11.41

...End

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Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
506.20	0.00	0.00	0.00	1
508.44	47.32	47.32	0.00	1
510.20	94.64	93.72	0.90	7
510.82	141.96	108.15	33.71	7
511.08	189.28	113.06	76.02	6
511.27	236.60	116.45	119.86	5
511.43	283.92	119.20	164.61	5
511.55	323.52	121.19	202.13	4
511.70	378.56	123.69	254.77	4
511.82	425.88	125.63	299.86	3
511.94	473.20	125.68	347.24	3
510.00	88.56	88.56	0.00	Overtopping

□a□le 2 □□ul□ert □u□ □ ary □a□le: □ul□ert □

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	506.20	0.000	1.000	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
47.32	47.32	508.44	3.057	3.245	2-M2c	4.000	2.057	2.061	0.814	7.251	1.319
94.64	93.72	510.20	4.908	5.000	2-M2c	4.000	2.925	2.935	1.229	9.485	1.709
141.96	108.15	510.82	5.618	5.565	2-M2c	4.000	3.139	3.145	1.561	10.214	1.981
189.28	113.06	511.08	5.883	5.769	2-M2c	4.000	3.209	3.211	1.849	10.455	2.195
236.60	116.45	511.27	6.073	5.910	2-M2c	4.000	3.244	3.255	2.107	10.651	2.375
283.92	119.20	511.43	6.233	6.036	3-M2t	4.000	3.273	3.345	2.344	10.653	2.531
323.52	121.19	511.55	6.351	6.141	3-M2t	4.000	3.293	3.530	2.529	10.346	2.647
378.56	123.69	511.70	6.502	6.367	7-M2t	4.000	3.319	3.771	2.770	10.145	2.793
425.88	125.63	511.82	6.622	6.566	7-M2t	4.000	3.340	3.966	2.965	10.042	2.907
473.20	125.68	511.94	6.625	6.740	4-FFf	4.000	3.340	4.000	3.151	10.002	3.011

****

Inlet Elevation (invert): 505.20 ft, Outlet Elevation (invert): 505.20 ft

Culvert Length: 40.00 ft, Culvert Slope: 0.0000

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Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 505.20 ft

Outlet Station: 40.00 ft

Outlet Elevation: 505.20 ft

Number of Barrels: 1

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Barrel Shape: Circular

Barrel Diameter: 4.00 ft

Barrel Material: Smooth HDPE

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Inlet Type: Conventional

Inlet Edge Condition: Square Edge with Headwall

Inlet Depression: NONE

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Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	506.20	0.00	0.00	0.00	0.00
47.32	507.01	0.81	1.32	0.05	0.26
94.64	507.43	1.23	1.71	0.08	0.28
141.96	507.76	1.56	1.98	0.10	0.29
189.28	508.05	1.85	2.20	0.12	0.30
236.60	508.31	2.11	2.38	0.13	0.30
283.92	508.54	2.34	2.53	0.15	0.31
323.52	508.73	2.53	2.65	0.16	0.31
378.56	508.97	2.77	2.79	0.17	0.32
425.88	509.17	2.97	2.91	0.19	0.32
473.20	509.35	3.15	3.01	0.20	0.32

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Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 42.00 ft

Side Slope (H:V): 2.50 (_:1)

Channel Slope: 0.0010

Channel Manning's n: 0.0300

Channel Invert Elevation: 506.20 ft

□oad□ay □ata □or □ro□□ing: Pro□o□ed □anal □ro□□ing

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
1	0.00	511.50
2	5.00	511.00
3	35.00	510.70
4	67.00	510.00
5	80.00	511.30

Roadway Surface: Gravel

Roadway Top Width: 20.00 ft

Appendix B:
Plant List

Riverlands Mitigation Site Plant List

Common Name	Size	Qty.	Spacing	I.S.	Notes
Red Maple	#15	13		FAC	
Shagbark Hickory	#15	7		FACU	Upland areas only
Black Gum	#15	10		FACW	Do not plant in areas with frequent standing water
American Sycamore	#15	7		FACW	
Swamp White Oak	#15	10		FACW	
Pin Oak	#15	20		FACW	
		65			

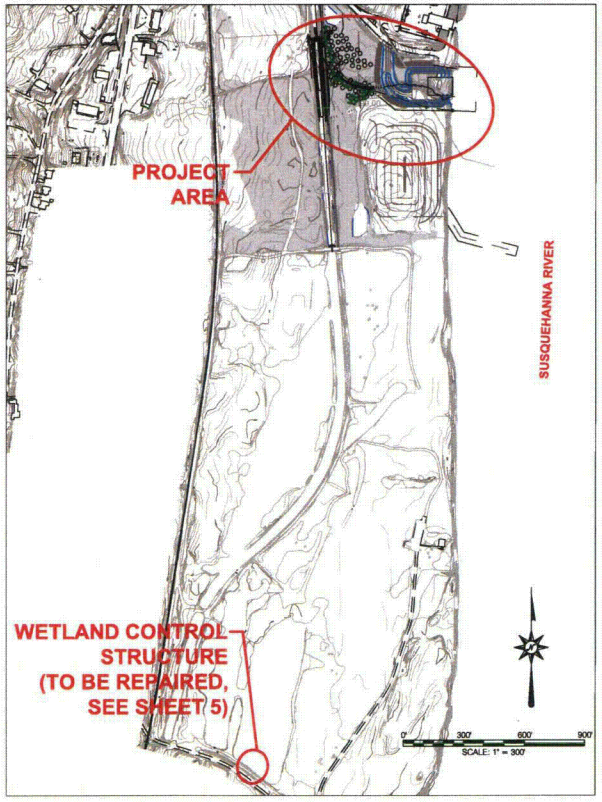
Common Name	Size	Qty.	Spacing	I.S.	Notes
Red Chockeberry	#5	21	4-6'	FACW	
Winterberry	#5	32	4-6'	FACW	1 male for every 8 females
Spicebush	#5	64	4-6'	FACW	
Highbush Blueberry	#5	54	4-6'	FACW	
Arrowwood	#5	21	4-6'	FAC	
Cranberry Bush	#5	21	4-6'	FACW	
		214			

Common Name	Size	Qty.	Spacing	I.S.	Notes
Thousand-flowered Aster	Quart	23	24"		
Soft Rush	Quart	55	24"	OBL	
Soft Stemmed Bullrush	Quart	37	24"	OBL	
Blue Flag	Quart	55	24"	OBL	
Swamp Milkweed	Quart	37	24"		
Fringed Sedge	Quart	46	24"	OBL	
Fox Sedge	Quart	46	24"	OBL	
New England Aster	Quart	37	24"		
White Turtlehead	Quart	46	24"		
New York Ironweed	Quart	37	24"		
Three-nerved Joe Pye	Quart	41	24"		
		458			

BELL BEND NUCLEAR POWER PLANT
WETLAND MITIGATION PLAN
RIVERLANDS SITE

SALEM TOWNSHIP, LUZERNE COUNTY, PENNSYLVANIA

PLAN DATE: OCTOBER 29, 2010
REVISION 1: AUGUST 12, 2011

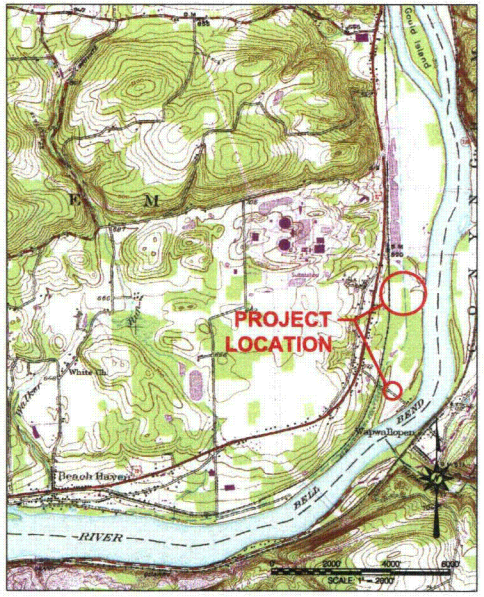


SITE MAP
1" = 300'

TABLE OF CONTENTS

SHEET 1 - COVER
SHEET 2 - GRADING PLAN
SHEET 3 - PROFILES & CROSS SECTIONS
SHEET 4 - CONSTRUCTION DETAILS
SHEET 5 - ORIGINAL CONSTRUCTION DETAILS
SHEET 6 - E&S PLAN
SHEET 7 - E&S NARRATIVE & DETAILS
SHEET 8 - LANDSCAPING PLAN
SHEET 9 - LANDSCAPING DETAILS

CLIENT ADDRESS:
PPL BELL BEND, LLC.
38 BOMBOY LANE, SUITE 2
BERWICK, PENNSYLVANIA 18603
PHONE: (570) 802-5636
FAX: (570) 802-5639

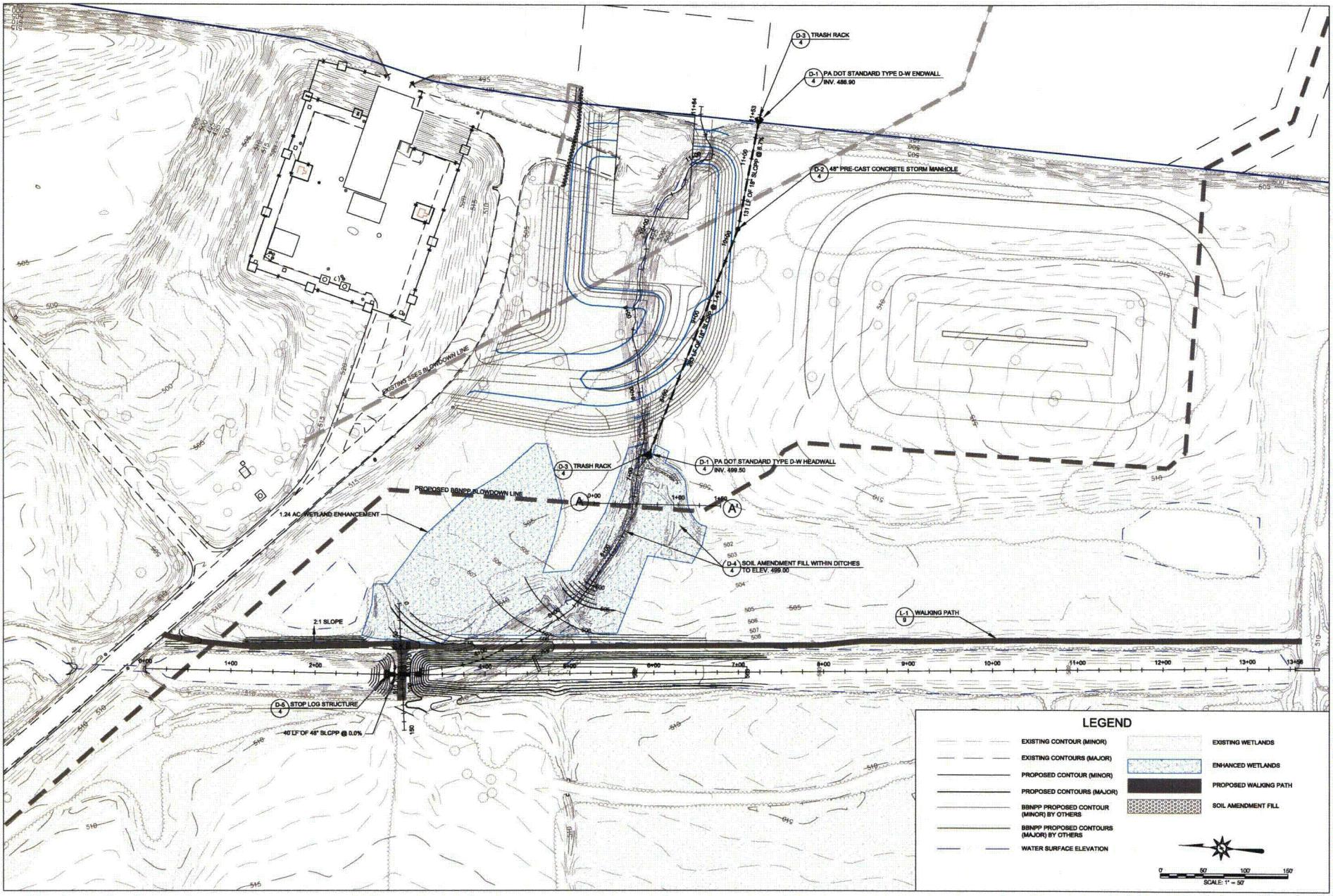


LOCATION MAP
1" = 2,000'

Land Studies
717-627-4440
fax: 717-627-4660
landstudies.com
land@landstudies.com
315 North Street | Lititz, PA 17543
PA 042324

NOTES:
1. BACKGROUND TOPOGRAPHIC MAPPING WAS PRODUCED BY PETERS CONSULTANTS, INC. IN NOV. 2007, JAN. 2008 AND APRIL 2010. THE HORIZONTAL COORDINATE SYSTEM SHOWN ON THIS DRAWING IS PENNSYLVANIA'S STATE PLAN COORDINATE SYSTEM, NORTH AMERICAN DATUM OF 1983 (NAD 83). THE VERTICAL CONTOURS ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
2. THE BBNPP PLOT PLAN IS FROM SARGENT & LUNDY, LLC., DRAWING SK-12198-400-001, REV. 4, REV. DATE 9-09-10.
3. THE WETLAND BOUNDARIES ARE FROM NORMANDEAU ASSOCIATES, INC. BELL BEND WETLANDS DELINEATION REPORT, REV. 3, JULY 2010.
4. EXISTING WEIR STRUCTURE DETAILS FROM KANDRA GREENLEAF HUTH, DRAWING E 187640, DATE AUGUST 1981.

PROJECT: MITIGATION PLAN - RIVERLANDS SITE | DATE: OCTOBER 29, 2010
PROJECT #: E-728-L8 | Drawing #: MIT-RL-001 | REVISION: 1 | DATE: 8/12/2011
COUNTY: LUZERNE COUNTY



PA 042324
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315 North Street | Lititz, PA 17543
Land Studies

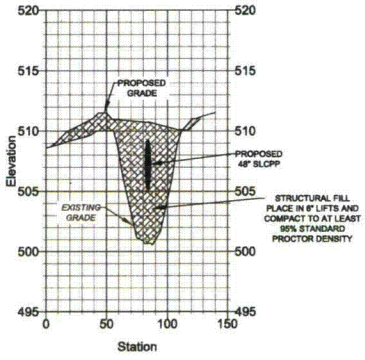
PROJECT:
BELL BEND NUCLEAR POWER PLANT
PPL BELL BEND, LLC.
38 BOMBOY LANE, SUITE 2
BERWICK, PENNSYLVANIA 18603

SHEET TITLE:
GRADING PLAN
WETLAND MITIGATION PLAN - RIVERLANDS SITE
SALEM TOWNSHIP
LUZERNE COUNTY, PENNSYLVANIA

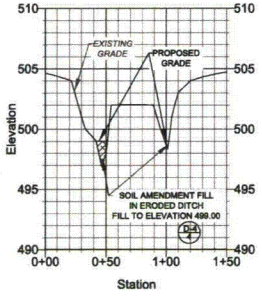
REVISIONS		
NO.	DATE	DESCRIPTION ADD DRAWING NUMBER
1	9/12/11	

PROJECT NUMBER:	E-729-L8
DRAWN BY:	JS
CHECKED BY:	BJE
DATE:	OCTOBER 29, 2010
SCALE:	1" = 50'
DRAWING NUMBER:	MIT-RL-002
SHEET NUMBER:	2 OF 9

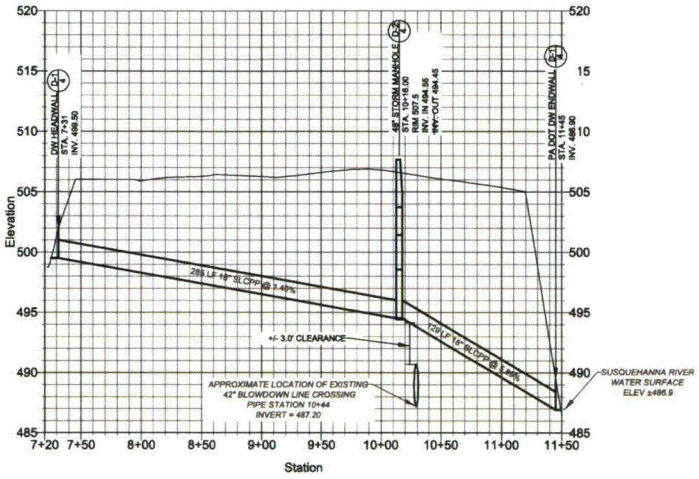
PROPOSED CANAL CROSSING CROSS SECTION



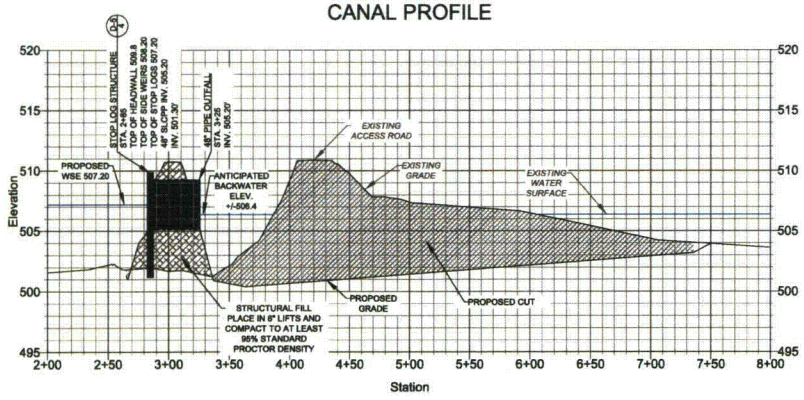
CROSS SECTION A - A'



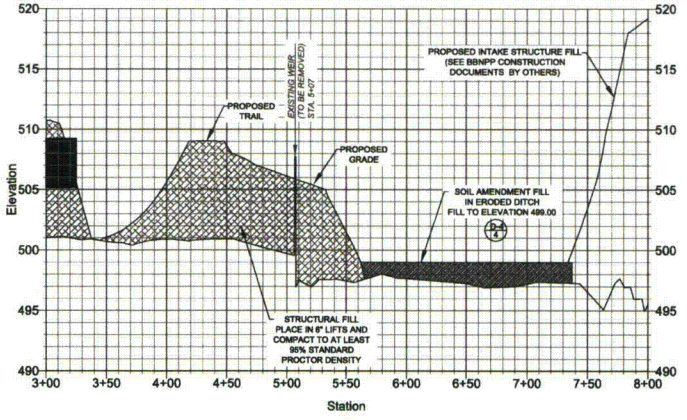
PIPE PROFILE



CANAL PROFILE



EXISTING CHANNEL PROFILE



HORIZONTAL SCALE: 1" = 50'

VERTICAL SCALE: 1" = 5'

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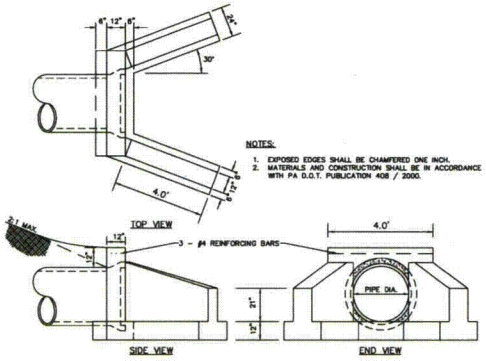
Land Studies

PROJECT:
BELL BEND NUCLEAR POWER PLANT
PPL BELL BEND, LLC.
38 BOMBOY LANE, SUITE 2
BERWICK, PENNSYLVANIA 18603

SHEET TITLE:
PROFILES AND CROSS SECTIONS
WETLAND MITIGATION PLAN - RIVERLANDS SITE
SALEM TOWNSHIP
LUZERNE COUNTY, PENNSYLVANIA

REVISIONS		
NO.	DATE	DESCRIPTION
1	8/12/11	ADD DRAWING NUMBER

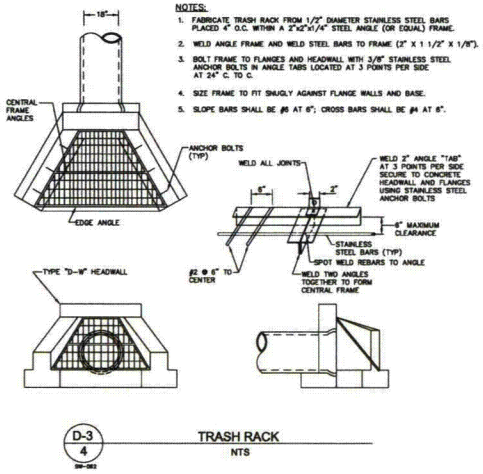
PROJECT NUMBER: E-726-L8
DRAWN BY: JS
CHECKED BY: BJE
DATE: OCTOBER 29, 2010
SCALE: 1" = 50'
DRAWING NUMBER: MIT-RL-003
SHEET NUMBER: 3
OF 9



(PA D.O.T. RC-31)

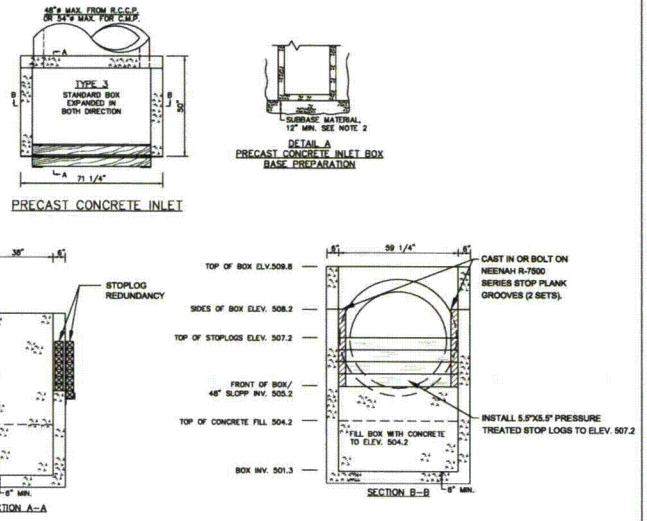
D-1 / 4 — STANDARD TYPE D-W ENDWALL

NTS



D-3 / 4 — TRASH RACK

NTS

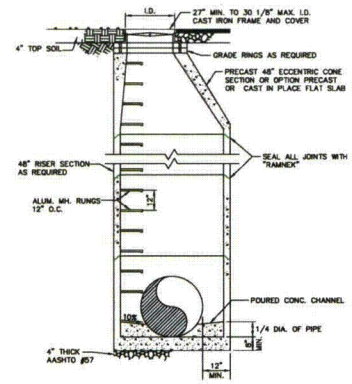


NOTES:
1. CONSTRUCT INLET BOXES IN ACCORDANCE WITH THE REQUIREMENTS OF PUBLICATION 408, SECTION 713.2(d), FOR PRECAST CEMENT CONCRETE UNITS.
2. PLACE SUBBASE MATERIAL MEETING THE REQUIREMENTS OF PUBLICATION 408, SECTION 350.2, IN 4 INCH LAYERS, COMPACTED TO A DENSITY SATISFACTORY TO THE ENGINEER AND INCIDENTAL TO THE INLET PAY ITEM.

D-5 / 4 — STOP LOG STRUCTURE

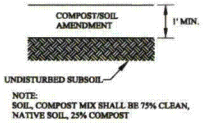
(MODIFIED PA DOT TYPE 3 BOX, RC-34)

NTS



D-2 / 4 — 48" PRE-CAST CONCRETE STORM MANHOLE

NTS



NOTE:
SOIL COMPOST MIX SHALL BE 75% CLEAN, NATIVE SOIL, 25% COMPOST

D-4 / 4 — SOIL AMENDMENT FILL

NTS

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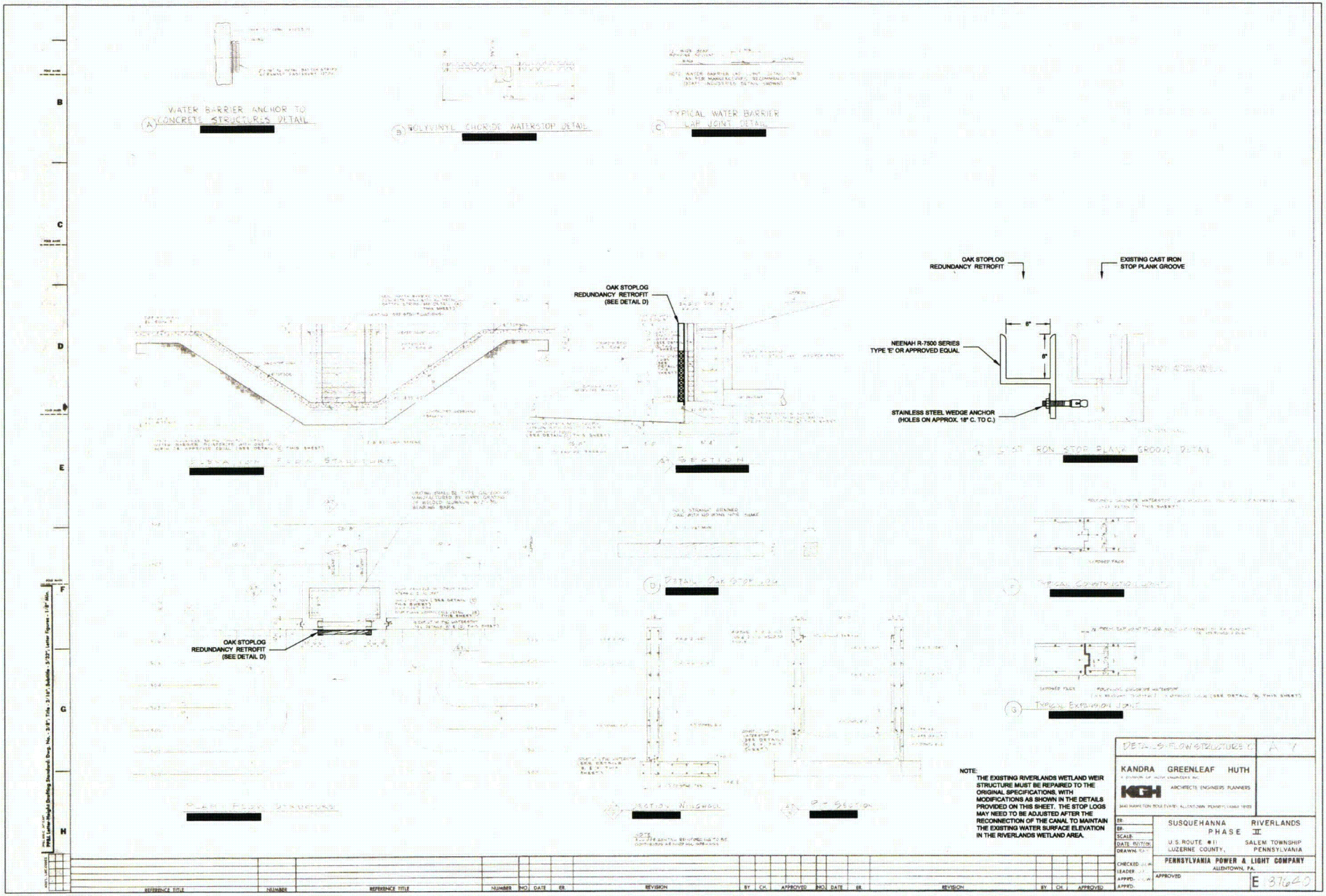
PROJECT:
BELL BEND NUCLEAR POWER PLANT
PPL BELL BEND, LLC.
38 ROMBOY LANE, SUITE 2
BERWICK, PENNSYLVANIA 18603

SHEET TITLE:
CONSTRUCTION DETAILS
WETLAND MITIGATION PLAN - RIVERLANDS SITE
SALEM TOWNSHIP
LUZERNE COUNTY, PENNSYLVANIA

REVISIONS		
NO.	DATE	DESCRIPTION AND DRAWING NUMBER
1	8/12/11	

PROJECT NUMBER: E-728-L8
DRAWN BY: JS
CHECKED BY: BJE
DATE: OCTOBER 29, 2010
SCALE: AS NOTED
DRAWING NUMBER: MIT-RL-004
SHEET NUMBER: 4
OF 9



NOTE:
THE EXISTING RIVERLANDS WETLAND WEIR STRUCTURE MUST BE REPAIRED TO THE ORIGINAL SPECIFICATIONS, WITH MODIFICATIONS AS SHOWN IN THE DETAILS PROVIDED ON THIS SHEET. THE STOP LOGS MAY NEED TO BE ADJUSTED AFTER THE RECONNECTION OF THE CANAL TO MAINTAIN THE EXISTING WATER SURFACE ELEVATION IN THE RIVERLANDS WETLAND AREA.

DETAILS FLOW STRUCTURE | A 7

KANDRA GREENLEAF HUTH
A DIVISION OF HUTH ENGINEERS INC.
KGH ARCHITECTS ENGINEERS PLANNERS
3440 HAMILTON BOULEVARD, ALLENTOWN, PENNSYLVANIA 18103

SUSQUEHANNA RIVERLANDS PHASE II
U.S. ROUTE #11 SALEM TOWNSHIP
LUZERNE COUNTY, PENNSYLVANIA

PENNSYLVANIA POWER & LIGHT COMPANY
ALLENTOWN, PA.

APPROVED

E 37643

BY:
BY:
SCALE:
DATE PLOTTED:
DRAWN:
CHECKED:
LEADER:
APPR'D:
APPR'D:

REFERENCE TITLE | NUMBER | REFERENCE TITLE | NUMBER | NO. | DATE | BY | REVISION | BY | CK | APPROVED | NO. | DATE | BY | REVISION | BY | CK | APPROVED

PROJECT NO. PP&L Luther Height Drafting Standard, Dwg. No., 3.5", Title - 3 1/4", Subtitle - 3.25", Letter Figures - 1.5" Min.

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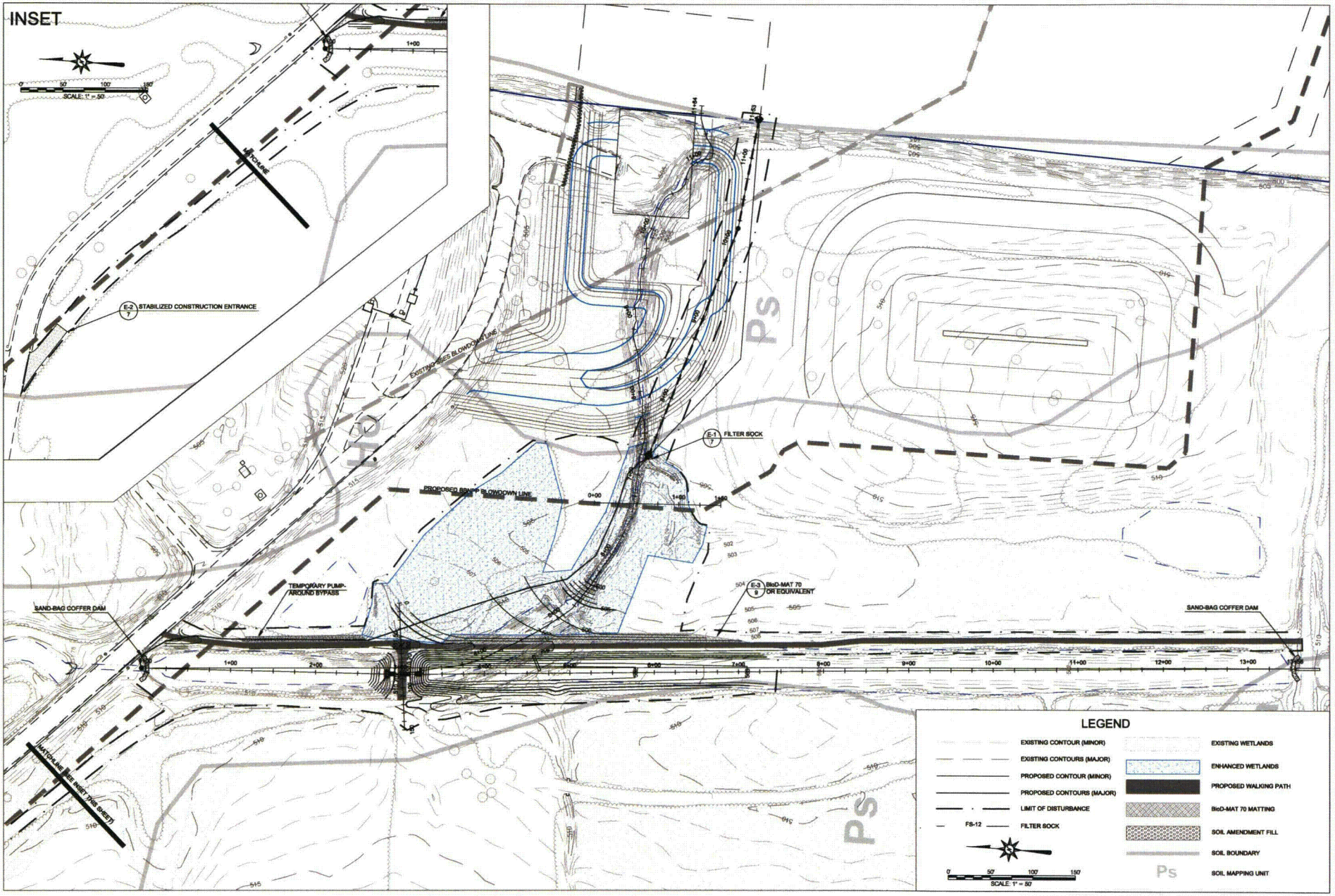
PROJECT:
BELL BEND NUCLEAR POWER PLANT
PPL BELL BEND, LLC.
38 BOMBOY LANE, SUITE 2
BERWICK, PENNSYLVANIA 18603

SHEET TITLE:
RIVERLANDS WETLAND WEIR STRUCTURE
ORIGINAL CONSTRUCTION DETAILS
WETLAND MITIGATION PLAN - RIVERLANDS SITE
SALEM TOWNSHIP
LUZERNE COUNTY, PENNSYLVANIA

REVISIONS		
NO.	DATE	DESCRIPTION
1	8/12/11	ADD DRAWING NUMBER

PROJECT NUMBER: E-728-L8
DRAWN BY: JS
CHECKED BY: SJE
DATE: OCTOBER 29, 2010
SCALE: AS NOTED
DRAWING NUMBER: MIT-RL-005
SHEET NUMBER: 5
OF 9



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PROJECT:
BELL BEND NUCLEAR POWER PLANT
PPL BELL BEND, LLC.
38 BOWDY LANE, SUITE 2
BERWICK, PENNSYLVANIA 18603

SHEET TITLE:
EROSION & SEDIMENT POLLUTION CONTROL PLAN
WETLAND MITIGATION PLAN - RIVERLANDS SITE
SALEM TOWNSHIP
LUZERNE COUNTY, PENNSYLVANIA

REVISIONS		
NO.	DATE	DESCRIPTION
1	8/12/11	ADD DRAWING NUMBER

PROJECT NUMBER:	E-729-L8
DRAWN BY:	JS
CHECKED BY:	BJE
DATE:	OCTOBER 29, 2010
SCALE:	1" = 50'
DRAWING NUMBER:	MIT-RL-006
SHEET NUMBER:	6 OF 9

EROSION AND SEDIMENTATION CONTROL NOTES

A. GENERAL EROSION AND SEDIMENTATION CONTROL GUIDELINES

CONTRACTORS RESPONSIBILITIES

1. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO CONTACT THE LUZERNE COUNTY CONSERVATION DISTRICT (LCCD) 72 HOURS PRIOR TO CONSTRUCTION AND 72 HOURS PRIOR TO LEAVING THE SITE. ALSO, AT LEAST 3 DAYS BEFORE STARTING ANY EARTH DISTURBANCE ACTIVITIES, ALL CONTRACTORS INVOLVED IN THOSE ACTIVITIES SHALL NOTIFY THE PENNSYLVANIA ONE CALL SYSTEM INCORPORATED AT 1-800-242-1776 FOR BURIED UTILITIES LOCATIONS.
   LUZERNE COUNTY CONSERVATION DISTRICT
   485 SMITHS POND ROAD
   SHAVERTOWN, PA 18708
   (570) 674-7991
2. A COPY OF THIS E&SC PLAN SHALL BE KEPT AVAILABLE FOR INSPECTION ON THE CONSTRUCTION SITE AT ALL TIMES DURING EARTH MOVING ACTIVITY AND UNTIL THE SITE IS STABILIZED.
3. THE CONTRACTOR SHALL MINIMIZE MUD OR SEDIMENT-LADEN WATER EXISTING THE CONSTRUCTION SITE TO THE GREATEST EXTENT POSSIBLE. THE CONTRACTOR IS RESPONSIBLE FOR ANY AND AL DAMAGES TO DOWNSTREAM PROPERTIES AS A RESULT OF HIS FAILURE TO PREVENT SUCH DAMAGES.
4. THE INTENT OF THIS PLAN/NARRATIVE IS TO INDICATE GENERAL MEANS OF COMPLIANCE WITH THE REQUIREMENTS OF THE RULES AND REGULATIONS OF CHAPTER 102 OF THE PENNSYLVANIA CLEA STREAMS LAW. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO IMPLEMENT THES METHODS PLUS ADDITIONAL METHODS AS MAY BE NECESSARY BECAUSE OF THE CONDITIONS, AND OR CONSTRUCTION PROCEDURES IN ORDER TO ASSURE COMPLIANCE WITH APPLICABLE LAW. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO MAINTAIN ALL SEDIMENT AND EROSION CONTRO FACILITIES SO THAT THEY PERFORM AS REQUIRED BY LAW.
5. THE CONTRACTOR IS ADVISED TO BECOME THOROUGHLY FAMILIAR WITH THE PROVISIONS OF THE APPENDIX 64, EROSION CONTROL RULES AND REGULATIONS, TITLE 25, PART 1, DEPARTMENT OF ENVIORNMENTAL PROTECTION, SUBPART C, PROTECTION OF NATURAL RESOURCES, ARTICLE III, WATER RESOURCES, CHAPTER 102, EROSION CONTROL.
6. BEFORE INITIATING ANY REVISIONS TO THE APPROVED EROSION AND SEDIMENT CONTROL PLAN OR REVISIONS TO OTHER PLANS WHICH MAY AFFECT THE EFFECTIVENESS OF THE APPROVED E&S CONTROL PLAN, THE OPERATOR MUST RECEIVE APPROVAL OF THE REVISIONS FROM THE LUZERNE COUNTY CONSERVATION DISTRICT.
7. THE CONTRACTOR WILL BE RESPONSIBLE FOR PROVIDING A PREPAREDNESS, PREVENTION, AND CONTIGENCY (PPC) PLAN DESCRIBING ANY POTENTIAL HAZARDOUS MATERIALS THAT MAY BE STORED OR USED ON SITE AND EMERGENCY CLEAN-UP OR SPILL REMEDIATION PROCEDURES. THE PPC PLAN SHALL BE KEPT ON THE CONSTRUCTION SITE AT ALL TIMES.

B. GENERAL SEDIMENT AND EROSION CONTROL METHODS/PROCEDURES

1. ALL RELATED SEDIMENT AND EROSION CONTROL FACILITIES SHALL BE IN PLACE AND CAPABLE OF FUNCTIONING AS INTENDED PRIOR TO EARTH MOVING ACTIVITY WITHIN THEIR CONTRIBUTING WATERSHED AREAS. ALL SEDIMENT AND EROSION CONTROL FACILITIES SHALL REMAIN SO UNTIL UNIFORM OF THE UPLAND DRAINAGE AREA IS STABILIZED WITH PERMANENT GROUND COVER.
2. VEHICLES AND EQUIPMENT MAY NEITHER ENTER DIRECTLY TO NOR EXIT DIRECTLY FROM THE PROJECT SITE ONTO PA ROUTE 11.
3. REDUCE BY THE GREATEST EXTENT PRACTICABLE THE AREA AND DURATION OF EXPOSURE OF READILY ERODIBLE SOILS.
4. HEAVY EQUIPMENT WILL WORK FROM THE SIDE OF THE STREAM TO MINIMIZE THE POSSIBILITY OF PULLING SOIL INTO THE STREAM.
5. EXCAVATED MATERIAL (SPOIL) SHALL BE PLACED UP SLOPE FROM THE EXCAVATION WHENEVER POSSIBLE. RUNOFF FROM SPOIL PILES SHALL BE DIRECTED THROUGH A SEDIMENT FILTER STRUCTURE AND DISCHARGED IN A NON-EROSIVE MANNER.
6. EXISTING RIPARIAN VEGETATION WILL BE PROTECTED TO THE GREATEST EXTENT POSSIBLE.
7. UPON COMPLETION OF EARTH MOVING, DISTURBED AREAS SHALL BE IMMEDIATELY SEEDED, MULCHED, OR OTHERWISE PROTECTED FROM ACCELERATED EROSION AND SEDIMENTATION.
8. THE CONTRACTOR SHALL PROVIDE PROTECTION AGAINST DISCHARGE OF POLLUTANTS SUCH AS CHEMICALS, FUEL, LUBRICANTS, SEWAGE, ETC. INTO STREAMS OR STORM WATER FACILITIES.
9. CONSTRUCTION ACCESS INTO UNPAVED AREAS FROM PAVED AREAS OR STREETS (PUBLIC OR PRIVATE) SHALL BE VIA A STABILIZED CONSTRUCTION ENTRANCE.
10. SEDIMENT SPILLED, DROPPED OR TRACKED ONTO PAVED SURFACES SHALL BE REMOVED IMMEDIATELY.
11. STOCKPILE HEIGHTS MUST NOT EXCEED 35 FEET. STOCKPILE SLOPES MUST BE 2:1 OR FLATTER.
12. ALL PUMPING OF SEDIMENT LADEN WATER OR POTENTIALLY SEDIMENT LADEN WATER SHALL BE THROUGH A SEDIMENT CONTROL BMP, SUCH AS A PUMPED WATER FILTER BAG DISCHARGING OVER UNDISTURBED AREAS.
13. IMMEDIATELY AFTER EARTH DISTURBANCE ACTIVITIES CEASE, THE OPERATOR SHALL STABILIZE ANY AREAS DISTURBED BY THE ACTIVITIES. DURING NON-GERMINATING PERIODS, MULCH MUST BE APPLIED AT THE SPECIFIED RATES. DISTURBED AREAS WHICH ARE NOT AT FINISHED GRADE AND WHICH WILL BE REDISTURBED WITHIN 1 YEAR MUST BE STABILIZED IN ACCORDANCE WITH THE TEMPORARY VEGETATIVE STABILIZATION SPECIFICATIONS. DISTURBED AREAS WHICH ARE AT FINISHED GRADE OR WHICH WILL NOT BE REDISTURBED WITHIN 1 YEAR MUST BE STABILIZED IN ACCORDANCE WITH THE PERMANENT VEGATATIVE STABILIZATION SPECIFICATIONS.
14. AN AREA SHALL BE CONSIDERED TO HAVE ACHIEVED FINAL STABILIZATION WHEN IT HAS A MINIMUM OF 70% UNIFORM PERENNIAL VEGETATIVE COVER WITH A DENSITY SUFFICIENT TO RESIST ACCELERATED SURFACE EROSION AND SUBSURFACE CHARACTERISTICS SUFFICIENT TO RESIST SLIDING AND OTHER MOVEMENTS.
15. AFTER FINAL SITE STABILIZATION HAS BEEN ACHIEVED, TEMPORARY EROSION AND SEDIMENT BMPS CONTROLS MUST BE REMOVED. AREAS DISTURBED DURING REMOVAL OF THE BMPS MUST BE STABILIZED IMMEDIATELY.

PA 1 SYSTEM, INC. 1-800-242-1776 SERIAL NUMBER: 9XXXXXXX — CALL BEFORE YOU DIG! (EXCEPT FLORIDA AND ALASKA) (2) WORKING DAYS NOTICE FOR CONSTRUCTION TEAMS ARE (10) WORKING DAYS IN DENVER STATE - DIG CALL

C. MAINTENANCE OF SEDIMENT AND EROSION CONTROL FACILITIES

1. UNTIL THE SITE ACHIEVES FINAL STABILIZATION, THE OPERATOR SHALL ASSURE THAT THE BEST MANAGEMENT PRACTICES ARE IMPLEMENTED, OPERATED, AND MAINTAINED PROPERLY AND COMPLETELY. MAINTENANCE SHALL INCLUDE INSPECTIONS OF ALL BEST MANAGEMENT PRACTICE FACILITIES. THE OPERATOR WILL MAINTAIN AND MAKE AVAILABLE TO LUZERNE COUNTY CONSERVATION DISTRICT COMPLETE, WRITTEN INSPECTION LOGS OF ALL THOSE INSPECTIONS. ALL MAINTENANCE WORK, INCLUDING CLEANING, REPAIR, REPLACEMENT, REGRADING AND RESTABILIZATION SHALL BE PERFORMED IMMEDIATELY.
2. UNTIL THE SITE IS STABILIZED, ALL EROSION AND SEDIMENT BMPS MUST BE MAITAINED PROPERLY. MAINTENANCE MUST INCLUDE INSPECTIONS OF ALL EROSION AND SEDIMENT CONTROL BMPS AFTER EACH RUNOFF EVENT AND ON A WEEKLY BASIS. ALL PREVENTATIVE AND REMEDIAL MAINTENANCE WORK, INCLUDING CLEAN OUT, REPAIR, REPLACEMENT, RE-GRADING, RE-SEEDING, RE-MULCHING, AND RE-NETTING, MUST BE PERFORMED IMMEDIATELY. IF EROSION AND SEDIMENT CONTROL BMPS FAIL TO PERFORM AS EXPECTED, REPLACEMENT BMPS, OR MODIFICATIONS OF THOSE INSTALLED WILL BE REQUIRED.
3. ALL SEDIMENT AND EROSION CONTROL FACILITIES MUST BE MAINTAINED IN OPERATING CONDITION UNTIL UPSTREAM AREAS ARE OF UNIFORM 70% STABILIZED WITH UNIFORM PERENNIAL VEGETATIVE COVER.
4. SEDIMENT REMOVED FROM BMPS SHALL BE DISPOSED OF IN LANDSCAPED AREAS OUTSIDE OF STEEP SLOPES, WETLANDS, FLOODPLAINS OR DRAINAGE SWALES AND IMMEDIATELY STABILIZED, OR PLACED IN TOPSOIL STOCKPILES.
5. ALL NON-USABLE MATERIAL AND DEBRIS SHALL BE REMOVED FROM THE SITE AND DISPOSED OF IN A LEGAL MANNER IN ACCORDANCE WITH STATE AND LOCAL REQUIREMENTS.
6. IMMEDIATELY UPON DISCOVERING UNFORESEEN CIRCUMSTANCES POSING THE POTENTIAL FOR ACCELERATED EROSION AND/OR SEDIMENT POLLUTION, THE OPERATOR SHALL IMPLEMENT APPROPRIATE BEST MANAGEMENT PRACTICES TO ELIMINATE POTENTIAL FOR ACCELERATED EROSION AND/OR SEDIMENT POLLUTION.

D. RECYCLING AND DISPOSAL OF WASTE MATERIALS

1. THE OPERATOR SHALL REMOVE FROM THE SITE, RECYCLE, OR DISPOSE OF ALL BUILDING MATERIALS AND WASTES IN ACCORDANCE WITH THE DEPARTMENT'S SOLID WASTE MANAGEMENT REGULATIONS AT 25 PA. CODE 260.1 ET SEQ., 271.1 ET SEQ., AND 287.1 ET SEQ. THE CONTRACTOR SHALL NOT ILLEGALLY BURY, DUMP, OR DISCHARGE ANY BUILDING MATERIAL OR WASTES AT THE SITE.
2. THE OPERATOR SHALL ASSURE THAT AN EROSION AND SEDIMENT CONTROL PLAN HAS BEEN PREPARED, APPROVED BY THE LUZERNE COUNTY CONSERVATION DISTRICT, AND IS BEING IMPLEMENTED AND MAINTAINED FOR ALL SOIL AND/OR ROCK SPOIL AND BORROW AREAS, REGARDLESS OF THEIR LOCATIONS.
3. DISPOSE OF EXCAVATED MATERIAL FROM STREAM AND FLOODPLAIN RESTORATION AT STOCKPILE AT THE PROPOSED LOCATION.
4. RE-USE OR RECYCLE SANDBAGS, CULVERTS, AND FLEXIBLE PIPE.
5. PROPERLY DISPOSE OF SEDIMENT FILTER BAGS, SILT FENCE, STAKES, AND FILTER SOCK MATERIAL.
6. DISPERSE COMPOST MATERIAL FROM FILTER SOCKS ON SITE, AS DIRECTED.

E. RESTORATION OF PLANTING AREAS

1. FINAL RESTORATION SHALL BE PERFORMED NO LATER THAN THE START OF THE NEXT PLANTING SEASON FOLLOWING CONSTRUCTION. THE PLANTING SEASON SHALL BE AS ESTABLISHED BY THE U.S. AGRICULTURAL SERVICE FOR THE AREA OF CONSTRUCTION.
2. TOPSOIL SHALL BE FREE FROM SUBSOIL, BRUSH, WEEDS, OR OTHER LITTER, CLAY LUMPS AND STONES, BUT MAY CONTAIN DECAYING VEGETABLE MATTER AS IS PRESENT IN GOOD TOPSOIL.
3. TOPSOIL SHALL BE IMPORTED FROM OFF-SITE IF NECESSARY AS DETERMINED BY PROJECT DESIGNER.
4. PRECAUTIONS SHALL BE EXERCISED AS NECESSARY TO CONFORM WITH LAWS RELATING TO EROSION AND SEDIMENT CONTROL.
5. SEED SHALL NOT HAVE LESS THAN 90% GERMINATION. GERMINATION TESTS OF SEEDS SHALL BE MADE NOT MORE THAN SIX (6) MONTHS PRIOR TO SEEDING. SEED WHICH HAS BECOME WET, MOLDY, OR OTHERWISE DAMAGED SHALL NOT BE USED.
6. THE CONTRACTOR SHALL BE RESPONSIBLE TO PRODUCE A STAND OF GRASS IN ALL SEEDED OR SODDED AREAS. EROSION, DROUGHT, OR ANY OTHER CONDITION ENCOUNTERED SHALL NOT RELIEVE THE CONTRACTOR OF THIS REQUIREMENT.

F. SITE STABILIZATION

1. ALL DISTURBED AREAS WITHIN THE ENHANCED WETLAND AREA WILL BE SEEDED WITH THE PROPOSED CONSERVATION SEED MIX (SEE SEEDING RESTORATION TABLE) WITHIN 48 HOURS OF COMPLETING EARTH MOVING ACTIVITIES OR BY THE END OF A WORK DAY IF A PRECIPITATION EVENT IS FORECASTED.
2. ALL DISTURBED UPLAND AREAS WILL BE SEEDED WITH THE PROPOSED STABILIZATION SEED MIX AND MULCHED UPON THE COMPLETION OF EARTH MOVING ACTIVITIES.
3. MULCH AND STRAW WILL BE SPREAD AT 3 TONS/ACRE. STRAW MULCH SHALL BE APPLIED IN LONG STRANDS, NOT CHOPPED OR FINELY BROKEN.
4. MULCH WITH MULCH CONTROL NETTING OR EROSION CONTROL BLANKETS MUST BE INSTALLED ON ALL SLOPES 3:1 AND STEEPER.

CONSTRUCTION SEQUENCE:

CONSTRUCTION NOTES:

- AT LEAST 7 DAYS BEFORE STARTING ANY EARTH DISTURBANCE ACTIVITIES THE OPERATOR SHALL INVITE ALL CONTRACTORS INVOLVED IN THOSE ACTIVITIES INCLUDING BUT NOT LIMITED TO: THE LANDOWNER, ALL APPROPRIATE MUNICIPAL OFFICIALS, THE EROSION AND SEDIMENT CONTROL PLAN PREPARER, AND A REPRESENTATIVE FROM THE LUZERNE COUNTY CONSERVATION DISTRICT FOR AN ON-SITE PRE-CONSTRUCTION MEETING. ALSO, AT LEAST 3 DAYS BEFORE STARTING ANY EARTH DISTURBANCE ACTIVITIES, ALL CONTRACTORS INVOLVED IN THOSE ACTIVITIES SHALL NOTIFY THE PENNSYLVANIA ONE CALL SYSTEM INCORPORATED AT 1-800-242-1776 FOR BURIED UTILITIES LOCATIONS.
- IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO CONTACT THE LUZERNE COUNTY CONSERVATION DISTRICT 72 HOURS PRIOR TO CONSTRUCTION AND 72 HOURS PRIOR TO LEAVING THE SITE.
- EXCESS CLEAN EXCAVATED MATERIAL SHALL BE HAULED FROM THE SITE IMMEDIATELY AND DISPOSED OF WITHIN THE BBNPP PROJECT AREA.
- IF WATER NEEDS TO BE PUMPED FROM THE EXCAVATED AREA, IT SHALL BE PUMPED THROUGH A PUMPED WATER FILTER BAG DISCHARGING OVER NON-DISTURBED AREAS
- 8" OF TOPSOIL SHALL BE SPREAD THROUGHOUT THE DISTURBED AREA TO ACHIEVE FINAL GRADE AND PROVIDE A SUITABLE PLANTING MEDIA.
- AN AREA SHALL BE CONSIDERED TO HAVE ACHIEVED FINAL STABILIZATION WHEN IT HAS A MINIMUM UNIFORM 70% PERENNIAL VEGETATIVE COVER OR OTHER PERMANENT NON-VEGETATIVE COVER WITH A DENSITY SUFFICIENT TO RESIST ACCELERATED SURFACE EROSION AND SUBSURFACE CHARACTERISTICS SUFFICIENT TO RESIST SLIDING AND OTHER MOVEMENT.
- ALL EARTH DISTURBANCE ACTIVITIES SHALL PROCEED IN ACCORDANCE WITH THE FOLLOWING SEQUENCE. EACH STAGE SHALL BE COMPLETED BEFORE ANY FOLLOWING STAGE IS INITIATED. CLEARING AND GRUBBING SHALL BE LIMITED ONLY TO THOSE AREAS DESCRIBED IN EACH STAGE.

CONSTRUCTION STAGES:

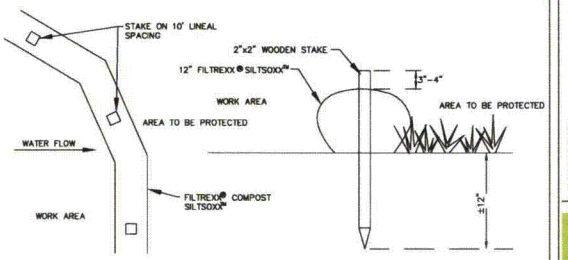
THE INSTALLATION OF THE PIPE, MANHOLE, INLET AND OUTFALL STRUCTURES MAY TAKE PLACE AT ANY TIME DURING THE CONSTRUCTION OF THE RIVERLANDS MITIGATION PROJECT, HOWEVER THE INSTALLATION OF THE PIPE AND DRAINAGE NETWORK MUST BE COMPLETE AND FUNCTIONING PRIOR TO THE FILLING OF THE TRIBUTARY FROM STATION 7+25 TO 11+50 FOR THE CONSTRUCTION OF THE PROPOSED INTAKE STRUCTURE. THE CONSTRUCTION OF THE DRAINAGE NETWORK MUST BEGIN WITH THE OUTFALL STRUCTURE AT THE RIVER, WORKING UPHILL TO THE MANHOLE AND THE INLET STRUCTURE AT PIPE STATION 7+25.

THE REPAIR AND MAINTAINENCE OF THE RIVERLANDS WETLAND CONTROL STRUCTURE MAY BE CONDUCTED AT ANY TIME AS THE PROCEDURE IS UNAFFECTED BY THE FOLLOWING SEQUENCE. SEE SHEET 5 FOR THE ORIGINAL CONSTRUCTION DETAILS.

1. LIMIT OF DISTURBANCE SHALL BE STAKED OUT IN THE FIELD.
2. INSTALL ORANGE CONSTRUCTION FENCE WHERE LOD IS ADJACENT TO EXISTING WETLANDS TO PREVENT ADDITIONAL DISTURBANCE TO THESE WETLANDS.
3. INSTALL STABILIZED CONSTRUCTION ENTRANCE
4. INSTALL FABRIC FILTER SOCK AS SHOWN ON THE PLAN
5. PERFORM NECESSARY CLEARING AND GRUBBING WITHIN PROPOSED LIMIT OF DISTURBANCE.
6. INSTALL SANDBAGS IN UPSTREAM AND DOWNSTREAM CULVERTS, AS SHOWN ON THE PLAN, AND SET UP PUMP AROUND. INSTALL PUMPS TO DE-WATER CANAL RECONNECTION AREA. CARE MUST BE EXERCISED TO PREVENT THE DISTURBANCE AND PUMPING OF SEDIMENT. FILTER BAGS MUST BE USED UNLESS PUMPING CLEAR WATER (SEE DETAIL E-4 ON SHEET 9 FOR FILTER BAG INSTALLATION).
7. BEGIN GRADING AT CANAL STATION 7+50 AND WORK UPSTREAM TO STATION 4+50.
8. REMOVE EXISTING WEIR (STATION 5+00) AND BACKFILL EXISTING CHANNEL WITH STRUCTURAL FILL. MATERIAL PLACED TO FILL THE EXISTING DIVERTED CANAL AND FORM THE RESTORED CANAL EMBANKMENT SHALL BE PLACED IN 8" LIFTS AND COMPACTED TO AT LEAST 95% STANDARD PROCTOR DENSITY. BLEND GRADING SURROUNDING EXISTING WEIR AND TIE INTO EXISTING CONTOURS. A MINIMUM OF 8" OF TOPSOIL MUST BE SPREAD ON ALL FILL LOCATIONS, WITH THE EXCEPTION OF THE PROPOSED PATHS, TO OBTAIN FINAL GRADE.
9. FILL TOW PATH (STATIONS 0+00 TO 2+50) AND CONSTRUCT WALKING PATH (SEE DETAIL L-1 ON SHEET 9).
10. FILL ENTRENCHED STREAM CHANNEL TO AN ELEVATION OF 499.00 WORKING FROM THE UPSTREAM FORKED REACH DOWNSTREAM TO THE PROPOSED INLET STRUCTURE AT PIPE STATION 7+25. USE SMALL TRACKED EQUIPMENT TO AVOID COMPACTING THE SOILS (BOTH NATIVE AND FILLED MATERIAL). ADD AMENDED TOPSOIL FROM THE PROPOSED INLET STRUCTURE PAD FILL (PIPE STATION 7+25) UPSTREAM TO THE LOCATION OF THE PROPOSED WEIR REMOVAL (STATION 5+00).
11. EXCAVATE CROSSING TO SOLID BASE MATERIAL AND FILL WITH STRUCTURAL FILL MATERIAL. INSTALL BASE FOR STOP LOG STRUCTURE ACCORDING TO DETAIL D-6 ON SHEET 4. INSTALL STOP LOG STRUCTURE AND PIPE.
12. REMOVE EXISTING CANAL DIVERSION EMBANKMENT (CANAL STATION 4+50 TO 3+50) AND RECONSTRUCT CANAL BERM AS SHOWN ON THE GRADING PLAN AND PROFILES. MATERIAL PLACED TO FILL THE EXISTING DIVERTED CANAL AND FORM THE RESTORED CANAL EMBANKMENT SHALL BE PLACED IN 8" LIFTS AND COMPACTED TO AT LEAST 95% STANDARD PROCTOR DENSITY.
13. SET GRADE CONTROL STRUCTURE STOP LOGS TO AN ELEVATION OF 507.20' AND REMOVE COFFER DAMS AND PUMPS.
14. SEED AND STABILIZE ALL DISTURBED AREAS WITH APPROPRIATE SEED MIX PER THE SEEDING RESTORATION TABLE AND THE LANDSCAPE PLAN. EROSION CONTROL MATTING (BioD-MAT 70 OR EQUIVALENT) MUST BE INSTALLED IN AREAS INDICATED ON THE E&S PLAN SHEET
15. REMOVE INVASIVE SPECIES PRIOR TO PLANTING.
16. INSTALL PROPOSED RIPARIAN VEGETATION AS INDICATED ON LANDSCAPING PLAN.
17. REMOVE STABILIZED CONSTRUCTION ENTRANCE.
18. REMOVE FABRIC FILTER SOCK AFTER ALL UPSLOPE DISTURBED AREAS HAVE ACHIEVED A MINIMUM OF 70% VEGETATIVE COVER. STABILIZE ANY AREAS DISTURBED WHILE REMOVING THESE BMPS WITH THE PROPOSED STABILIZATION SEED MIX AND MULCH.

SOIL DESCRIPTIONS

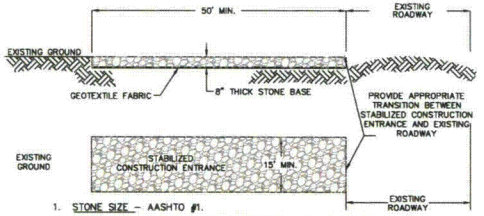
SYMBOL	NAME	DESCRIPTION	HYDRIC
Ho	HOLLY SILT LOAM	DEEP, VERY POORLY AND POORLY DRAINED SOILS FORMED IN THE LOAMY ALLUVIUM ON FLOODPLAINS. PERMEABILITY IS MODERATE OR MODERATELY SLOW. THE SEASONAL HIGH WATER TABLE IS WITHIN A DEPTH OF 6 INCHES OF THE SOIL SURFACE	YES
Pe	POPE SOILS	DEEP, WELL-DRAINED, NEARLY LEVEL TO GENTLY SLOPING SOILS ON HIGH BOTTOM FLOODPLAINS FORMED IN MIXED ALLUVIAL MATERIAL DEPOSITED BY RIVERS AND STREAMS. SURFACE LAYER IS TYPICALLY DARK GRAYISH BROWN SILT LOAM ABOUT 10 INCHES THICK. SUBSOIL IS BROWN AND DARK BROWN SILT LOAM ABOUT 32 INCHES THICK. MODERATE TO MODERATELY RAPID PERMEABILITY. HIGH TO MODERATE AVAILABLE WATER CAPACITY. SUBJECT TO OCCASIONAL FLOODING. SOIL IS SUITED TO MOST CROPS COMMONLY GROWN IN THE COUNTY.	INCLUSIONS OF HYDRIC COMPONENTS (HOLLY, WAYLAND)



FILTREXX® SILTSOXX™ PLAN VIEW — FILTREXX® SILTSOXX™ SECTION

NOTES:
1. ALL MATERIAL TO MEET FILTREXX® SPECIFICATIONS.
2. SILTSOXX™ COMPOST/JSOIL/ROCK/SEED FILL TO MEET APPLICATION REQUIREMENTS.
3. SILTSOXX™ DEPICTED IS FOR MINIMUM SLOPES. GREATER SLOPES MAY REQUIRE LARGER SOCKS PER THE ENGINEER.
4. COMPOST MATERIAL TO BE DISPERSED ON SITE, AS DETERMINED BY ENGINEER.
5. LOCAL FILTREXX CONTACT: KEYL GROFF AT GARDENIQUE (610-972-9018).

E-1 / 7 FILTER SOCK (FILTREXX) NTS



1. STONE SIZE – AASHTO #1.
2. LENGTH – AS REQUIRED TO BE EFFECTIVE, BUT NOT LESS THAN 50'.
3. THICKNESS – NOT LESS THAN 8".
4. WIDTH – FULL WIDTH OF ALL POINTS OF INGRESS OR EGRESS, BUT NOT LESS THAN 20'.
5. WASHING – WHEELS SHALL BE CLEAN PRIOR TO ENTRANCE ONTO EXISTING ROADWAY. WHEN WASHING IS REQUIRED IT SHALL BE DONE ON AN AREA STABILIZED WITH CRUSHED STONE WHICH DRAINS INTO AN APPROVED SEDIMENT TRAP OR SEDIMENT BASIN. ALL SEDIMENT SHALL BE PREVENTED FROM ENTERING ANY STORM DRAIN, DITCH, OR WATERCOURSE THROUGH USE OF SAND BAGS, GRAVEL, BOARDS, OR OTHER APPROVED METHODS.
6. MAINTENANCE – THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO EXISTING ROADWAY, THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR AND/OR CLEAN OUT OF ANY MEASURES USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO EXISTING ROADWAYS MUST BE REMOVED IMMEDIATELY. CONSTRUCTION ENTRANCE MUST BE INSPECTED DAILY.

E-2 / 7 STABILIZED CONSTRUCTION ENTRANCE NTS

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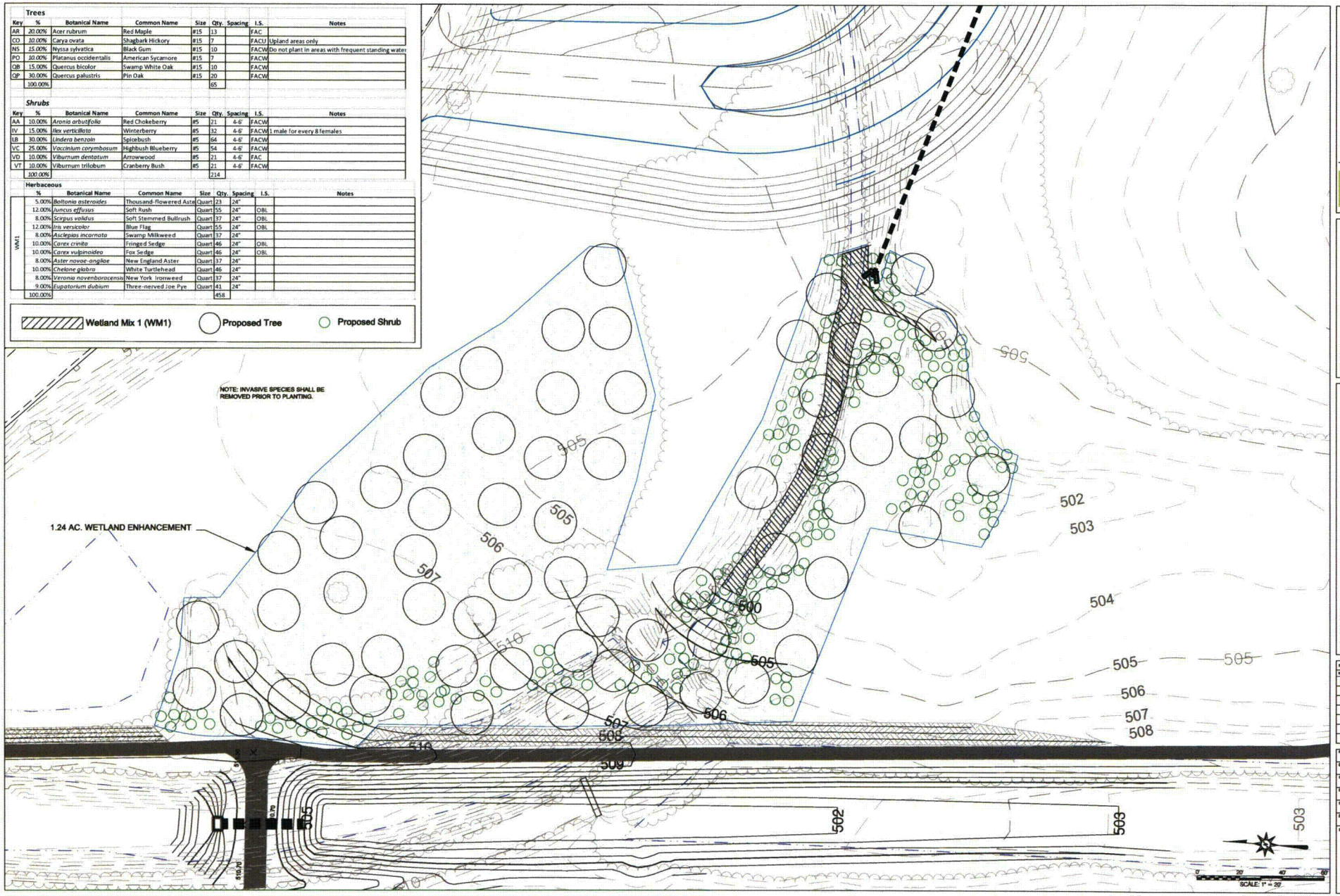
PROJECT: BELL BEND NUCLEAR POWER PLANT
PPL BELL BEND, LLC.
38 BOMBOY LANE, SUITE 2
BERWICK, PENNSYLVANIA 18603

SHEET TITLE: EROSION & SEDIMENT POLLUTION CONTROL NARRATIVE AND DETAILS
WETLAND MITIGATION PLAN - RIVERLANDS SITE
SALEM TOWNSHIP
LUZERNE COUNTY, PENNSYLVANIA

REVISIONS		
NO.	DATE	DESCRIPTION
1	9/12/11	ADD DRAWING NUMBER

PROJECT NUMBER: E-726-L8
DRAWN BY: JS
CHECKED BY: BJE
DATE: OCTOBER 29, 2010
SCALE: AS NOTED
DRAWING NUMBER: MIT-RL-007
SHEET NUMBER: 7 OF 9



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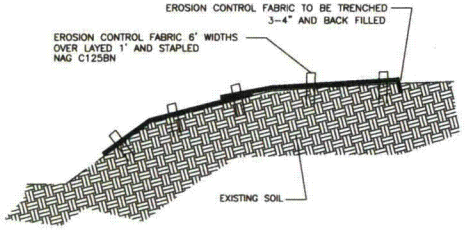
PROJECT:
BELL BEND NUCLEAR POWER PLANT
PPL BELL BEND, LLC.
38 BOWDOY LANE, SUITE 2
BERWICK, PENNSYLVANIA 18603

SHEET TITLE:
LANDSCAPING PLAN
WETLAND MITIGATION PLAN - RIVERLANDS SITE
SALEM TOWNSHIP
LUZERNE COUNTY, PENNSYLVANIA

REVISIONS		
NO.	DATE	DESCRIPTION
1	8/12/11	ADD DRAWING NUMBER

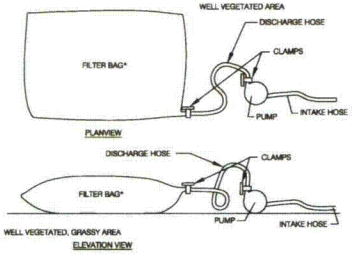
PROJECT NUMBER: E-726-L8
DRAWN BY: AK
CHECKED BY: BJE
DATE: OCTOBER 29, 2010
SCALE: 1" = 20'
DRAWING NUMBER: MIT-RL-008
SHEET NUMBER: 8
OF 9



BioD-MAT 70 SPECIFICATIONS:

ROLL SIZE	6.56' x 166'
AREA	120 SY
WEIGHT	23 OZ.
MATRIX	WOVEN BRISTLE COIR

E-3 / 9 — **BioD-MAT 70 MATTING** — NTS



Filter bags shall be made from non-woven geotextile material sewn with high strength, double stitched "J" type seams. They shall be capable of trapping particles larger than 150 microns.

A suitable means of accessing the bag with machinery required for disposal purposes must be provided. Filter bags shall be replaced when they become ½ full. Spare bags shall be kept available for replacement of those that have failed or are filled.

Bags shall be located in well-vegetated (grassy) area, and discharge onto stable, erosion resistant areas. Where this is not possible, a geotextile flow path shall be provided. Bags shall not be placed on slopes greater than 5%.

The pump discharge hose shall be inserted into the bags in a manner specified by the manufacturer and securely clamped.

The pumping rate shall be no greater than 750 gpm or ½ the maximum specified by the manufacturer, whichever is less. Pump intakes should be floating and screened.

Filter bags may be used to filter water pumped from disturbed areas prior to discharging to water of the Commonwealth. They may also be used to filter water pumped from the sediment storage areas of sediment basins.

The pumping rate should be specified on the plan drawings next to the typical detail. Pumping rates will vary depending on the size of the filter bag, and the type and amount of sediment discharged to the bag.

E-4 / 9 — **PUMPED WATER FILTER BAG** — NTS

SEEDING RESTORATION TABLE

LOCATION	TOPSOIL	STARTER FERTILIZER	LIME	SEED MIX
WETLAND	YES	N/A	N/A	FLOODPLAIN SEED MIX APPLICATION RATE: 15-20 LBS/ACRE
UPLAND	YES	N/A	N/A	CONSERVATION SEED MIX APPLICATION RATE: 15-20 LBS/ACRE
OTHER DISTURBED AREAS	NO	N/A	N/A	TEMPORARY STABILIZATION SEED MIX SEE SEED MIX FOR SEEDING

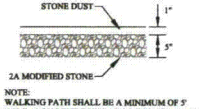
DUE TO SOIL LIMITATIONS NEITHER FERTILIZER NOR LIME WILL BE APPLIED TO THE GRADED WETLAND. IT IS ANTICIPATED THAT THE SPREADING OF TOPSOIL AND THE CLOSE PROXIMITY TO EXISTING WATER TABLE WILL PROMOTE RAPID GERMINATION OF PROPOSED SEED.

Temporary Stabilization Seed Mix

%	Botanical Name	Common Name	Seeding Window	Application Rate
100	*Secale cereale*	Cereal Rye	Sep. 1 - Oct. 16	30 lbs/acre
100	*Avena sativa*	Oats	May. 1 - Sept. 15	30 lbs/acre

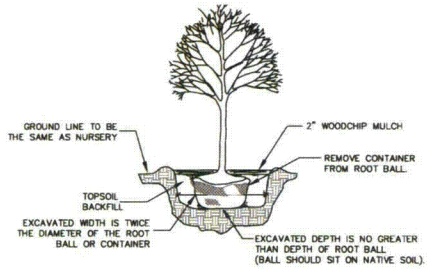
%	Botanical Name	Common Name	I.S.
10	*Elymus virginicus, PA*	Virginia Wild Rye, PA Ecotype	FACW
10	*Panicum ridgulum, PA*	Redtop Panic Grass, PA Ecotype	FACW+
8	*Elymus canadensis, PA*	Canada Wild Rye, PA Ecotype	FACU
5	*Carex vulpinoidea, PA Ecotype*	Fox Sedge, PA Ecotype	OBL
5	*Panicum clandestinum*	Deer Tongue 'Tioga', PA Ecotype	FAC+
5	*Elymus riparius, PA*	Riverbank Wild Rye, PA Ecotype	FACW
5	*Agrostis perennans, APB*	Autumn Bentgrass, APB	FACU
5	*Agrostis scabra, PA*	Ticklegrass, PA Ecotype (rough bentgrass	FAC
5	*Carex scoparia*	Blunt Broom Sedge	FACW
5	*Festuca rubra*	Creeping Red Fescue	FACU
4	*Carex comosa*	Bristly Sedge	OBL
4	*Chasmanthium latifolium, PA*	River Oats, PA Ecotype	FACU
3	*Carex stipata*	Awl Sedge	OBL
3	*Elymus hystrix, PA*	Bottlebrush Grass, PA Ecotype	NI
3	*Juncus effusus, PA*	Soft Rush, PA Ecotype	FACW+
2	*Asclepias incarnata*	Swamp Milkweed	OBL
2	*Bidens aristosa*	Bur Marigold, 'Suther' NC Ecotype	FACW-
2	*Carex lurida*	Lurid Sedge	OBL
2	*Juncus tenuis*	Path Rush	FAC-
2	*Poa palustris*	Fowl Bluegrass	FACW
1	*Aster prenanthoides*	Zigzag Aster	FAC
1	*Aster laevis*	Smooth Blue Aster	NI
1	*Aster novae-angliae*	New England Aster	FACW-
1	*Carex crinita*	Fringed Sedge	OBL
1	*Iris versicolor*	Blue Flag Iris	OBL
1	*Lobelia cardinalis*	Cardinal Flower	FACW+
1	*Lobelia siphilitica*	Great Blue Lobelia	FACW+
1	*Scirpus validus*	Soft-stem Bulrush	OBL
1	*Solidago riddellii*	Riddell's Goldenrod	OBL
1	*Solidago rugosa*	Wrinkle Leaf Goldenrod	FAC
100		*Application Rate: 15-20 lbs/acre*	

%	Botanical Name	Common Name	I.S.
15	*Schizachyrium scoparium, PA*	Little Bluestem, PA	FACU-
10	*Elymus virginicus, PA*	Virginia Wild Rye, PA Ecotype	FACW
8	*Panicum ridgulum, PA*	Redtop Panic Grass, PA Ecotype	FACW+
5	*Agrostis perennans, APB*	Autumn Bentgrass, APB	FACU
5	*Agrostis scabra, PA*	Ticklegrass, PA Ecotype (rough bentgrass	FAC
5	*Carex scoparia*	Blunt Broom Sedge	FACW
5	*Elymus canadensis, PA*	Canada Wild Rye, PA Ecotype	FACU
5	*Festuca rubra*	Creeping Red Fescue	FACU
5	*Panicum clandestinum*	Deer Tongue 'Tioga', PA Ecotype	FAC+
4	*Chasmanthium latifolium, PA*	River Oats, PA Ecotype	FACU
4	*Eupatorium perfoliatum*	Boneset	FACW+
3	*Carex vulpinoidea, PA Ecotype*	Fox Sedge, PA Ecotype	OBL
3	*Elymus hystrix, PA*	Bottlebrush Grass, PA Ecotype	NI
3	*Elymus riparius, PA*	Riverbank Wild Rye, PA Ecotype	FACW
3	*Juncus effusus, PA*	Soft Rush, PA Ecotype	FACW+
2	*Asclepias incarnata*	Swamp Milkweed	OBL
2	*Asclepias tuberosa*	Butterfly Milkweed	NI
2	*Helopsis helianthoides*	Ox Eye Sunflower	NI
2	*Juncus tenuis*	Path Rush	FAC-
2	*Poa palustris*	Fowl Bluegrass	FACW
2	*Vernonia noveboracensis*	New York Ironweed	FACW+
1	*Aster novae-angliae*	New England Aster	FACW-
1	*Aster prenanthoides*	Zigzag Aster	FAC
1	*Bidens aristosa*	Bur Marigold, 'Suther' NC Ecotype	FACW-
1	*Onoclea sensibilis*	Sensitive Fern	FACW
1	*Solidago rugosa*	Wrinkle Leaf Goldenrod	FAC
100		*Application Rate: 15-20 lbs/acre*	

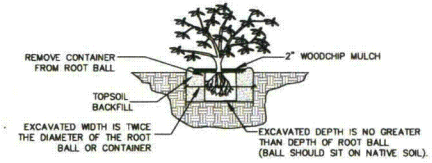


NOTE:
WALKING PATH SHALL BE A MINIMUM OF 5' WIDE ALONG THE TOW PATH, MINIMUM OF 10' WIDE OVER THE CANAL.

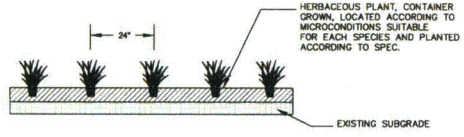
L-1 / 9 — **WALKING PATH** — NTS



L-3 / 9 — **TREE PLANTING DETAIL** — NTS



L-2 / 9 — **TYPICAL SHRUB PLANTING - CONTAINER** — NTS



L-4 / 9 — **HERBACEOUS QUART PLANTING DETAIL** — NTS

PLANT SPECIFICATIONS :

1. ALL PLANTS SHALL BE NURSERY GROWN IN A CLIMATE SIMILAR TO THAT OF THE LOCALITY OF THE PROJECT.
2. SET PLANTS AT SAME FINISHED GRADE AS GROWN IN THE NURSERY.
3. ALL PLANTS SHALL HAVE A NORMAL HABIT OF GROWTH AND SHALL BE SOUND, HEALTHY AND VIGOROUS, THEY SHALL BE FREE FROM DISEASE, INSECTS, INSECT EGGS, AND LARVAE.
4. ALL PLANTING SHALL BE PERFORMED IN CONFORMANCE WITH GOOD NURSERY AND LANDSCAPE PRACTICE.

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PROJECT:
BELL BEND NUCLEAR POWER PLANT
PPL BELL BEND, LLC.
38 BOWDOY LANE, SUITE 2
BERWICK, PENNSYLVANIA 18603

SHEET TITLE:
LANDSCAPING DETAILS
WETLAND MITIGATION PLAN - RIVERLANDS SITE
SALEM TOWNSHIP
LUZERNE COUNTY, PENNSYLVANIA

REVISIONS		
NO	DATE	DESCRIPTION
1	8/12/11	ADD DRAWING NUMBER

PROJECT NUMBER: E-728-L8
DRAWN BY: JS
CHECKED BY: BJE
DATE: OCTOBER 29, 2010
SCALE: AS NOTED
DRAWING NUMBER: MIT-RL-009
SHEET NUMBER:

9
OF 9