Attachment 44 to PLA-6219
Erosion and Sediment Pollution Control Narrative for PPL Susquehanna Steam Electric Station Stormwater Upgrades and Gravel Parking Lot Expansion. December 5, 2006

(NRC Document Request 99)

EROSION AND SEDIMENT POLLUTION CONTROL NARRATIVE

FOR

PPL Susquehanna Steam Electric Station Stormwater Upgrades and Gravel Parking Lot Expansion

LUZERNE COUNTY, PENNSYLVANIA

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Revised December 5, 2006

TABLE OF CONTENTS

Introduction	3
Qualifications of Plan Preparer	3
Existing Site Topography	3
Soils in the Project Area	3
Earth Disturbance Activities	4
Amount of Runoff	5
Location of Water to Receive Runoff	5
Supporting Calculations	6
Description of BMP's	6
Sequence of BMP Construction	7
Plan Drawings	Attached
Maintenance of Temporary Control Devices	9
Disposal of Materials	9
Project Location Map	10
Project Soils Map	11
Appendix A – model summary and supporting calculations	12

INTRODUCTION

It is the responsibility of the person conducting, or proposing to conduct, earth disturbance activities to provide effective and practical erosion and sediment control measures by utilizing Best Management Practices (BMP's) to minimize the potential for accelerated erosion and sedimentation of surrounding watersheds. The purpose of this narrative is to address the design of these BMP's. The implementation and maintenance of the BMP's is the responsibility of the person conducting the earth disturbance activity. This plan has been designed and prepared in accordance with Chapter 102 of Title 25 of the Pennsylvania Code with the *Erosion and Sediment Control Program Manual* date March 2000, of the Commonwealth of Pennsylvania Department of Environmental Protection. This narrative shall be used in conjunction with the attached plans.

This project involves voluntary stormwater improvements to reduce existing erosion from an existing asphalt and gravel parking lot adjacent to the PPL Susquehanna Steam Electric Station (PPL SSES). *The proposed area of disturbance totals 4.85 acres.* The project also includes the construction of an occasional use, permeable gravel parking area to accommodate overflow parking during scheduled maintenance outages at the facility, which require additional workers to access the facility. This project will result in a number of stormwater and erosion control improvements on the site that will reduce sediment discharge from the facility. All disturbed area under this plan drains to an existing sediment basin on the property which is a permitted stormwater discharge – NPDES Permit number PA-0047325. The outlet from the existing S-2 Pond discharges to an unnamed, intermittent tributary to the N. Branch Susquehanna River.

Qualifications of Plan Preparer

[Section 102.4(b)(3)

Plan Prepared by: Jonathan R. Klotz, LandStudies, Inc.

Qualifications: Master of Science in Hydrology, University of Nevada, Reno 1997
Nine years of experience in water resource management, stream restoration, wetland restoration, and erosion and sediment control practices.

Recently approved E&SPC Plans:

Upper Muncy Creek Restoration E&SPC Plan – Sullivan County, PA - 2004.
Choconut Creek Restoration E&SPC Plan - Susquehanna County, PA - 2004
Lititz Run Restoration E&SPC Plan – Lancaster County, PA - 2005

EXISTING SITE TOPOGRAPHY

[Section 102.4(b)(5)(i)]

The topographic data is based on a survey performed by L. Robert Kimball and Associates, Inc. Additional information was collected on subsequent field visits by personnel from LandStudies, Inc. Existing contours, proposed contours, proposed BMP's, legend, etc are shown on the plan drawings.

SOILS IN THE PROJECT AREA

[Section 102.4(b)(5)(ii)]

The soils information was taken from the United States Department of Agriculture, Natural Resource Conservation Service's Web Soil Survey.

Note that in the existing parking area over 8 feet of fill was placed during the original construction phase of the SSES in the 1970's. The soils reported in this area are likely to be inaccurate. *Upon inspection of the areas with soils indicating the potential for hydric soils, no wetland areas were found within the project limits.*

The soils on the site are reported as the following types:

At – Atherton Variant

The Atherton Silt Loam, Gray Subsoil Variant is listed as a potentially hydric soil. All areas mapped as Atherton within the limits of disturbance have been filled over 8 feet and are located under an existing gravel parking lot. The Atherton series is listed as a moderate profile permeability. Bedrock depth is very deep. The hydrologic soil group is B/D.

BrB – Braceville Gravelly Loam, 3-8 percent slopes

The Braceville gravelly loam is not listed as a potentially hydric soil. The drainage class for BrB is moderately well drained with a hydrologic soil group of C. The Braceville series is listed as a slow profile permeability. BrB underlies a small portion of the proposed overflow parking area. The engineering limitations to this application Frost Action 0.5 and Depth to Saturated Zone 0.03 do not pose significant impacts to use as an overflow parking area. Bedrock depth is very deep.

ChB & ChC – Chenango Gravelly Loam 3-8 percent and 8-15 percent slopes

The Chenango gravelly loam is not listed as a potentially hydric soil. The drainage class for ChB and ChC is well drained with a hydrologic soil group of A. The Chenango series is listed as a moderate profile permeability. ChB underlies a majority of the proposed overflow parking area. The engineering limitation to this application (Frost Action 0.5) does not pose significant impacts to use as an overflow parking area. Bedrock depth is very deep.

RdB – Rexford Loam, 3-8 percent

The Rexford Loam is listed as a potentially hydric soil. All areas mapped as RdB within the limits of disturbance have been filled over 8 feet and are located under an existing gravel parking lot. The drainage class for RdB is poorly drained with a hydrologic soil group of C. The Rexford Loam is listed as a slow profile permeability. RdB underlies a very small portion of the existing gravel overflow parking area. Bedrock depth is very deep.

EARTH DISTURBANCE ACTIVITIES

[Section 102.4(b)(5)(iii)]

The existing land use consists of existing parking lot and brush area associated with PPL Susquehanna Steam Electric Station. This land use has been in place for over 25 years. The proposed gravel parking area is located in a periodically maintained brush/ agricultural field area. The area has been periodically mowed and maintained for over 25 years. The only change in land use under the proposed conditions will the addition of the gravel overflow parking area. The existing parking area will remain in use as a parking area. The existing parking lot is primarily an asphalt paved lot with several gravel overflow parking areas. The current parking lot has no stormwater management

at the parking lot elevation and relies on the existing sediment/detention pond (S-2) for stormwater management. Runoff from the parking lot currently sheet flows on the lot until it concentrates and flows over the adjacent embankment to the South and East. As the flow concentrates and flows over the embankment, it causes serious erosion which mobilizes sediment and deposits in the S-2 Pond. As a result, the capacity of the S-2 Pond has been significantly reduced. This project will significantly reduce erosion from the parking lot embankments and limit additional sedimentation in the S-2 Pond. All of these activities are voluntary actions by the owner to reduce sediment production from the property and improve stormwater management practices.

The proposed disturbed area encompasses 4.85 acres.

All of the proposed changes to the project site will be shown on the plan drawings, including the following:

- Existing site conditions including contours
- Proposed grading for additional overflow parking area including contours
- Proposed stormwater management structures and drainage ways
- Proposed Erosion and Sedimentation Control Measures

AMOUNT OF RUNOFF

The 3.2-acre overflow parking area will be constructed of permeable gravel material. There will be no additional impervious area constructed. The change in land use from brush to permeable gravel parking will result in a minor increase in runoff. This increase in runoff will be more than offset by implementing stormwater controls on the existing parking lot and existing gravel overflow lots. A net decrease in runoff will be realized upon completion of this project. See attached table "Existing and Proposed Stormwater Conditions – PPL SSES" for a complete listing of existing and proposed discharges.

LOCATION OF WATER RECEIVING RUNOFF

All runoff from areas disturbed for this project enters the existing S-2 Sediment/Stormwater Pond and does not discharge directly to Waters of the Commonwealth. This NPDES permitted facility has been on the site since construction began in the 1970's. The S-2 Pond discharges to and forms the source of an unnamed tributary to the N. Branch Susquehanna River. This project will result in a significant net decrease of runoff from the site under all design storms from 1-year to 100-year recurrence intervals. See attached table "Existing and Proposed Stormwater Conditions – PPL SSES" for a complete listing of existing and proposed discharges.

All areas downstream will benefit from decreased peak discharges as a result of this project. Downstream watercourses will be subject to lower peak flows and therefore decreased erosion potential.

The outlet from the existing S-2 Pond discharges to an unnamed, intermittent tributary to the N. Branch Susquehanna River. *Under Chapter 93, the water quality designation of unnamed tributaries to the N. Branch Susquehanna River is CWF.*

SUPPORTING CALCULATIONS

Supporting calculations are attached. Note that sizing for stilling basins for pipe outlets and emergency spillway channels is based on the 100-year storm routed through the new detention facilities.

The proposed 3.2-acre gravel overflow parking area was modeled using the NRCS Curve Number Method in WinTR-55 for both existing and proposed conditions. The model input summary and output data are attached.

The existing parking areas were modeled using the NRCS Curve Number Method in HEC-HMS to accommodate routing through the proposed stormwater facilities. A summary of data inputs and output tables area attached.

DESCRIPTION OF BMP's

[Section 102.4(b)(5)(vi)

Permanent and temporary BMP locations and details are shown on the plan drawings.

BMP's Before Disturbance:

- Significant erosion is present in the proposed disturbance area.
- An existing sediment basin (S-2 Pond) treats runoff from all areas proposed for disturbance.
- The S-2 Pond discharges is a permitted NPDES discharge – permit number PA-0047325.
- All discharge from the proposed earth disturbance area enters and is treated by the S-2 pond.
- Rip-Rap and construction rubble protection of overflow points from the existing parking area have failed to stop erosion on the embankment adjacent to the parking area. The rip-rap failure is primarily due to lack of a geotextile backing.

BMP's During Disturbance:

- Project phasing and timing
  - All earth disturbance activities will be complete in less than 5 weeks.
  - The project is phased such that most portions of the project can be completed and stabilized in 1-2 days.
  - During construction of the infiltration trench, only as much trench as can be excavated, backfilled, and stabilized in one working day will be opened. This will severely limit exposure to erosion during this phase of construction.
- A rock construction entrance will be built at project access point to the proposed gravel overflow parking area.
- A thick vegetative buffer bounds the limits of disturbance for the overflow parking area. This buffer will be maintained in good condition for the duration of the project.
- Grading of the overflow parking area will be completed in phases to maintain vegetation on the downslope portion of the overflow parking area until upslope portions are stabilized.
- The culvert crossing to the proposed gravel overflow parking area will be constructed on a day with no measurable precipitation in the previous 24 hours.

The side slopes of the crossing will be stabilized immediately with permanent geotextile and rip-rap protection.

- During excavation of trenches in the existing parking area, only the amount of trench that can be completed and stabilized in one working day will be excavated.
- Construction of stormwater detention basins will be completed in one day with seeding completed and erosion control fabric applied to all slopes.
- Stormwater detention basin outlets and emergency spillways will be protected with geotextile and rock as they are constructed limiting their exposure to erosion to less than 2 days. All outlet protection is sized for the 100-year discharge.
- Clean rock will be used for all rip-rap and rock structures.

Vegetative buffer at eastern edge of proposed overflow parking

BMP's After Disturbance:

- Permanent stabilization with vegetation, erosion control fabric, geotextile, rock structures, and stone.
- Existing peak discharges will be decreased significantly by new stormwater facilities.

SEQUENCE OF BMP CONSTRUCTION

[Section 102.4(b)(5)(vii)

The sequence of construction is as follows:

1. Install rock stilling basin for discharge from stormwater detention basin 1.
2.
   a. Install stormwater detention basin 1, outlet structure, and emergency spillway. Upon completion of excavation, immediately seed basin bottom with ERNMX-122 seed seed mix at 15 lbs/acre and side slopes with 65lbs/acre annual ryegrass and 70 lbs/acre birdsfoot trefoil and tall fescue mix. Apply lime and fertilizer according to soil test. Stabilize side slopes immediately after seeding with erosion control blanket.

b. Utilize excavated material from stormwater detention basin 1 to repair eroded embankment on southeast edge of existing gravel overflow parking area. Upon placement of fill, immediately seed with 65lbs/acre annual ryegrass and 70 lbs/acre birdsfoot trefoil and tall fescue mix and stabilize with erosion control blanket.

3. Install rock stilling basin for discharge from stormwater detention basin 2.
4.
   a. Install stormwater detention basin 2, outlet structure, and emergency spillway. Upon completion of excavation, immediately seed basin bottom with ERNMX-122 seed seed mix at 15 lbs/acre and side slopes with 65lbs/acre annual ryegrass and 70 lbs/acre birdsfoot trefoil and tall fescue mix. Apply lime and fertilizer as indicated by soil test. Stabilize side slopes immediately after seeding with erosion control blanket.
   b. Utilize excavated material from stormwater detention basin 2 to repair eroded embankment to the southwest of detention basin 2. Upon placement of fill, immediately seed with 65lbs/acre annual ryegrass and 70 lbs/acre birdsfoot trefoil and tall fescue mix, apply soil amendments as indicated by soil test, and stabilize with erosion control blanket.
   c. Install 2-30" HDPE Culvert pipes in existing onsite stormwater swale. Complete installation only when there has been no measurable rainfall for 24 hours and the swale carries no flow. Stabilize fill as it is placed using permanent geotextile and R-5 Rock Rip-Rap.
   d. Construct rock construction entrances at access point to proposed gravel overflow parking area for equipment or truck traffic to enter and portions of the construction site which require traversing disturbed soil. There will be no traffic on disturbed soils in the existing parking areas.
5. Install stormwater/infiltration trench. Excavate ONLY as much trench as can be completed and stabilized by the end of the work day. Begin work at the trench outlet to the detention basin and continue installation working away from the detention basin until all trench is complete.
6. Install Rock Filter according to E&S Detail.
7. Install Filter Fabric Silt Fence Protection for temporary stockpile area.
8. Grade and stabilize parking area according to the following phasing plan.
   a. Work parking area from West to East opening no more than 100 feet of slope before stabilizing with stone surface. Maintain vegetative buffer in good condition at all times. If vegetative buffer is damaged, install reinforced fabric 30" silt fence at Elevation 651 contour as shown on the E&S Plan Sheet.
   b. Upon completing grading at the top of swale on the west side of the parking area, immediately seed with 65lbs/acre annual ryegrass and 70 lbs/acre birdsfoot trefoil and tall fescue mix, apply soil amendments as indicated by soil test, and stabilize with erosion control blanket.
   c. Upon completion of fill on the Northeast corner of the parking area, immediately seed with 65lbs/acre annual ryegrass and 70 lbs/acre birdsfoot trefoil and tall fescue mix, apply soil amendments as indicated by soil test, and stabilize with erosion control blanket.
   d. Remove Rock Filter and immediately seed with 65lbs/acre annual ryegrass and 70 lbs/acre birdsfoot trefoil and tall fescue mix, apply soil amendments as indicated by soil test, and stabilize with erosion control blanket.

e. Remove Rock Construction entrance and permanently stabilize with stone.
f. Remove 30" reinforced fabric silt fence. Immediately seed with 65lbs/acre annual ryegrass and 70 lbs/acre birdsfoot trefoil and tall fescue mix, apply soil amendments as indicated by soil test, and stabilize with erosion control blanket.

PLAN DRAWINGS

[Section 102.4(b)(5)(ix)

Site plans that are complete and legible are attached.

MAINTENANCE OF TEMPORARY CONTROL DEVICES

[Section 102.4(b)(5)(x)

It shall be the responsibility of the owner's contractor to maintain erosion and sedimentation practices. The project duration will be less than 5 weeks. All temporary control devices shall be inspected each working day that the project is active. All temporary control devices shall be inspected within 24 hours of any measurable precipitation event while the project is active.

Should the vegetative buffer surrounding the proposed 3.2 acre gravel parking area be damaged or compromised by deposition of sediment equal to or greater than ½ the original width, immediately place reinforced filter fabric silt fence 30" high as indicated on the E&S Plan and Detail Sheets.

DISPOSAL OF MATERIALS

[Section 102.4(b)(5)(xi)

The recycling and disposal of materials shall be in accordance with local, state, and federal regulations. Comply with air quality, water quality, solid waste management policies, etc.

Construction wastes may include, but are not limited to:

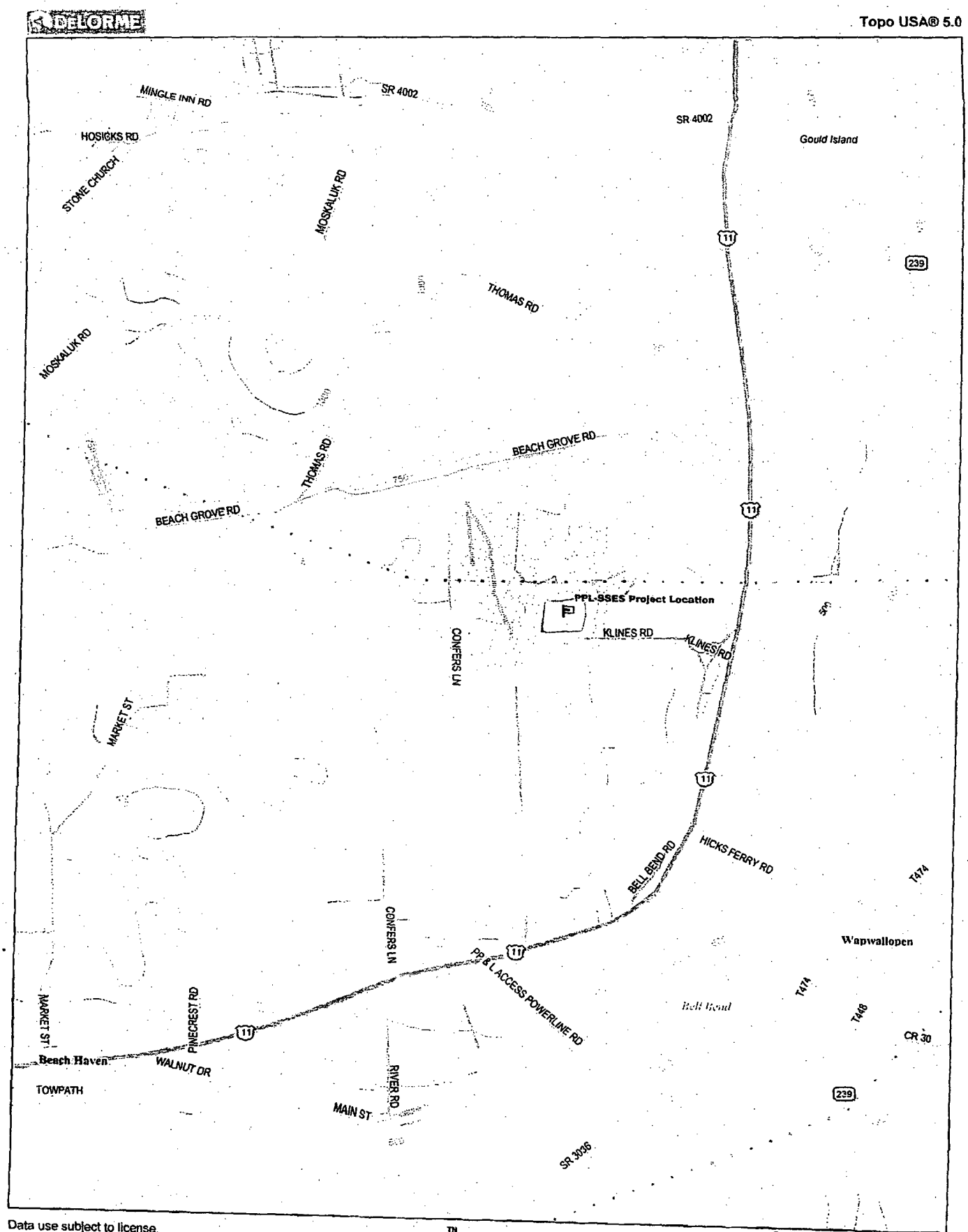
- Excess soil materials
- Shrubs and brush removed during clearing and grubbing
- Packaging materials (wood, paper, plastic, Styrofoam, etc.)
- Scrap or surplus building materials (concrete pipe, stone, etc.)

Unless otherwise directed, excess soil and excavated material may be used for fill material on site or off site. Coordinate with owner and agencies having jurisdiction.

Trees, shrubs and brush shall be chipped when possible and reused as mulch.
No burning is permitted.

Contractor shall practice good housekeeping, including by not limited to the following:

- Neat, orderly and centralized storage of materials and wastes
- Prompt cleanup of any spills in accordance with manufacturer's instructions or in accordance with regulatory requirements.
- Prompt cleanup of sediments within the site and onto adjacent roadways



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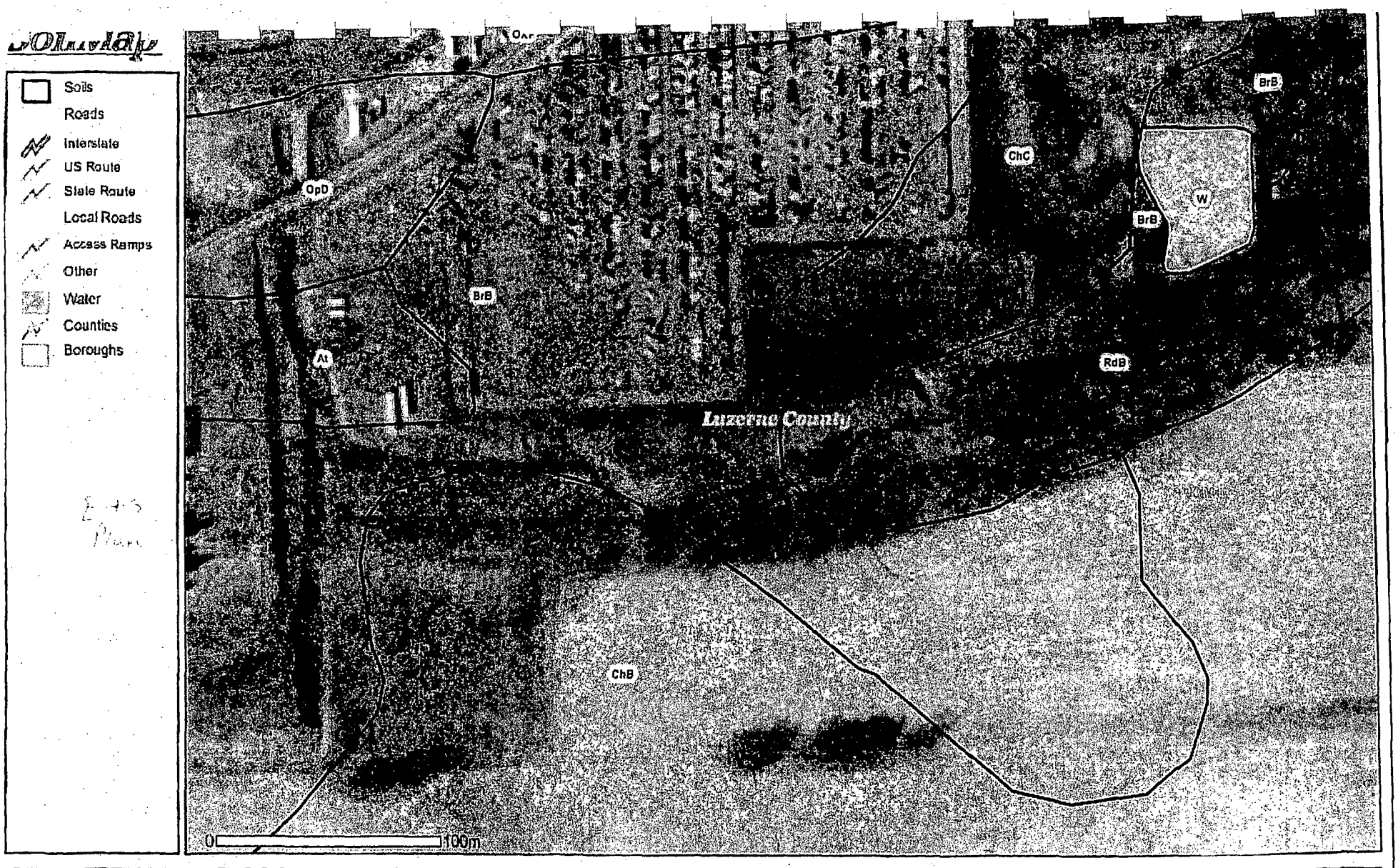
Scale 1 : 24,000
1" = 2,000.0 ft
Data Zoom 13-1



Map Scale 1:2635, 1 inch = 220 feet
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Soil maps are subject to change and may be copied without permission. Enlarging the maps may cause misunderstanding of the detail of mapping. Help in using soil surveys is available from the local office of the NRCS.

Cooperative Extension
Geospatial Technology Program

NRCS

Stormwater Upgrade Soils

Appendix A

Summary of NRCS Curve Number Method Model Inputs for Existing Parking Lot Drainages

Rainfall Runoff Modeling was completed using HEC-HMS and the NRCS Curve Number Method Option. Routing was by the Lag Method. Retention was computed based on Stage-Volume curves for each basin. Discharge from the basins was computed by stage-discharge relationships for the outlet structures.

Area A

Paved Area

6.27 Acres
98 Weighted CN
12 minutes Tc

Unpaved Area

1.6 Acres
72 Weighted CN
8 minutes Tc

Junction 1 - All flows were routed to Junction 1 to provide a value for comparison of existing condition discharge to post construction discharge. Output at Junction 1 is provided as existing conditions discharge.

Area B

Paved Area

3.0 Acres
98 Weighted CN
11 minutes Tc

Unpaved Area

1.86 Acres
72 Weighted CN
9 minutes Tc

Junction 1 - All flows were routed to Junction 1 to provide a value for comparison of existing condition discharge to post construction discharge. Output at Junction 1 is provided as existing conditions discharge.

Post-Construction Model Inputs

Area A

Paved Area

6.27 Acres
98 Weighted CN
12 minutes Tc

Infiltration/Stormwater Trench 1 – Routing for new trench – routed using the Lag Method

18 minute Lag

Unpaved Area

1.6 Acres
72 Weighted CN
8 minutes Tc

Infiltration/Stormwater Trench 2

8 minute Lag

Detention Basin 2 – Detention Basin Routing using Stage-Discharge Curve

Area B

Paved Area

3.0 Acres
98 Weighted CN
11 minutes Tc

Infiltration/Stormwater Trench 1 – Routing for new trench – routed using the Lag Method

10 minutes Lag

Unpaved Area

1.86 Acres
72 Weighted CN
9 minutes Tc

Infiltration/Stormwater Trench 2

10 minutes Lag

Detention Basin 1 – Detention Basin Routing using Stage-Discharge Curve

Existing Parking Area A
Existing Conditions HEC-HMS Output

Project : Existing Cond Simulation Run : 1-year Junction: Junction-1

Start of Run :	01Jan2006, 00:00	Basin Model :	Existing Parking A
End of Run :	02Jan2006, 23:00	Meteorologic Model :	1-year
Execution Time :	01Nov2006, 09:26:14	Control Specifications :	Control 1

Volume Units : IN

Computed Results

Peak Outflow : 15.96 (CFS) Date/Time of Peak Outflow : 01Jan2006, 12:04

Total Outflow : 2.05 (IN)

Project : Existing Cond Simulation Run : 2 year Junction: Junction-1

Start of Run :	01Jan2006, 00:00	Basin Model :	Existing Parking A
End of Run :	02Jan2006, 23:00	Meteorologic Model :	Met 2 yr
Execution Time :	01Nov2006, 09:13:16	Control Specifications :	Control 1

Volume Units : IN

Computed Results

Peak Outflow : 19.61 (CFS) Date/Time of Peak Outflow : 01Jan2006, 12:04
Total Outflow : 2.51 (IN)

Project : Existing Cond Simulation Run : 5 year Junction: Junction-1

Start of Run :	01Jan2006, 00:00	Basin Model :	Existing Parking A
End of Run :	02Jan2006, 23:00	Meteorologic Model :	5-year
Execution Time :	01Nov2006, 09:21:56	Control Specifications :	Control 1

Volume Units : IN

Computed Results

Peak Outflow : 27.05 (CFS) Date/Time of Peak Outflow : 01Jan2006, 12:04
Total Outflow : 3.45 (IN)

Project : Existing Cond Simulation Run : 10 year storm Junction: Junction-1

Start of Run :	01Jan2006, 00:00	Basin Model :	Existing Parking A
End of Run :	02Jan2006, 23:00	Meteorologic Model :	Met 10 yr
Execution Time :	01Nov2006, 09:22:35	Control Specifications :	Control 1

Volume Units : IN

Computed Results

Peak Outflow : 33.10 (CFS) Date/Time of Peak Outflow : 01Jan2006, 12:04

Total Outflow : 4.21 (IN)

Project : Existing Cond Simulation Run : 25 year storm Junction: Junction-1

Start of Run :	01Jan2006, 00:00	Basin Model :	Existing Parking A
End of Run :	02Jan2006, 23:00	Meteorologic Model :	Met 25 yr
Execution Time :	01Nov2006, 09:23:16	Control Specifications :	Control 1

Volume Units : IN

Computed Results

Peak Outflow : 36.92 (CFS) Date/Time of Peak Outflow : 01Jan2006, 12:04
Total Outflow : 4.69 (IN)

Project : Existing Cond Simulation Run : 50 year Junction: Junction-1

Start of Run :	01Jan2006, 00:00	Basin Model :	Existing Parking A
End of Run :	02Jan2006, 23:00	Meteorologic Model :	50-year
Execution Time :	01Nov2006, 09:23:41	Control Specifications :	Control 1

Volume Units : IN

Computed Results

Peak Outflow : 41.52 (CFS) Date/Time of Peak Outflow : 01Jan2006, 12:04
Total Outflow : 5.27 (IN)

Project : Existing Cond Simulation Run : 100-year Junction: Junction-1

Start of Run :	01Jan2006, 00:00	Basin Model :	Existing Parking A
End of Run :	02Jan2006, 23:00	Meteorologic Model :	100-year
Execution Time :	01Nov2006, 09:24:17	Control Specifications :	Control 1

Volume Units : IN

Computed Results

Peak Outflow : 46.13 (CFS) Date/Time of Peak Outflow : 01Jan2006, 12:04
Total Outflow : 5.85 (IN)

Existing Parking Area A
Post Construction Conditions HEC-HMS
Output

Project : Proposed Conditions - A Simulation Run : 1-year Reservoir: [redacted] detention basin 2

Start of Run :	01Jan2006, 00:00	Basin Model :	Existing Parking A
End of Run :	02Jan2006, 23:00	Meteorologic Model :	1-year
Execution Time :	01Nov2006, 09:42:35	Control Specifications :	Control 1

Volume Units : IN

Computed Results

Peak Inflow :	15.12 (CFS)	Date/Time of Peak Inflow :	01Jan2006, 12:22
Peak Outflow :	3.06 (CFS)	Date/Time of Peak Outflow :	01Jan2006, 12:48
Total Inflow :	2.05 (IN)	Peak Storage :	0.71 (AC-FT)
Total Outflow :	1.73 (IN)	Peak Elevation :	657.00 (FT)

Project : Proposed Conditions - A Simulation Run : 2 year Reservoir: detention Basin 2 [redacted]

Start of Run :	01Jan2006, 00:00	Basin Model :	Existing Parking A
End of Run :	02Jan2006, 23:00	Meteorologic Model :	Met 2 yr
Execution Time :	01Nov2006, 09:38:18	Control Specifications :	Control 1

Volume Units : IN

Computed Results

Peak Inflow :	18.37 (CFS)	Date/Time of Peak Inflow :	01Jan2006, 12:22
Peak Outflow :	3.55 (CFS)	Date/Time of Peak Outflow :	01Jan2006, 12:49
Total Inflow :	2.51 (IN)	Peak Storage :	0.84 (AC-FT)
Total Outflow :	2.19 (IN)	Peak Elevation :	657.43 (FT)

detention basin 2

Project : Proposed Conditions - A Simulation Run : 5-year Reservoir: [redacted]

Start of Run :	01Jan2006, 00:00	Basin Model :	Existing Parking A
End of Run :	02Jan2006, 23:00	Meteorologic Model :	5-year
Execution Time :	01Nov2006, 09:44:30	Control Specifications :	Control 1

Volume Units : IN

Computed Results

Peak Inflow :	24.93 (CFS)	Date/Time of Peak Inflow :	01Jan2006, 12:22
Peak Outflow :	5.12 (CFS)	Date/Time of Peak Outflow :	01Jan2006, 12:48
Total Inflow :	3.45 (IN)	Peak Storage :	1.09 (AC-FT)
Total Outflow :	3.12 (IN)	Peak Elevation :	658.24 (FT)

Project : Proposed Conditions - A Simulation Run : 10 year storm Reservoir: detention basin 2 [redacted]

Start of Run :	01Jan2006, 00:00	Basin Model :	Existing Parking A
End of Run :	02Jan2006, 23:00	Meteorologic Model :	Met 10 yr
Execution Time :	01Nov2006, 09:45:15	Control Specifications :	Control 1

Volume Units : IN

Computed Results

Peak Inflow :	30.21 (CFS)	Date/Time of Peak Inflow :	01Jan2006, 12:22
Peak Outflow :	5.93 (CFS)	Date/Time of Peak Outflow :	01Jan2006, 12:49
Total Inflow :	4.21 (IN)	Peak Storage :	1.31 (AC-FT)
Total Outflow :	3.88 (IN)	Peak Elevation :	658.88 (FT)

Project : Proposed Conditions - A Simulation Run : 25 year storm Reservoir: [redacted] detention basin 2

Start of Run :	01Jan2006, 00:00	Basin Model :	Existing Parking A
End of Run :	02Jan2006, 23:00	Meteorologic Model :	Met 25 yr
Execution Time :	01Nov2006, 09:45:42	Control Specifications :	Control 1

Volume Units : IN

Computed Results

Peak Inflow :	33.52 (CFS)	Date/Time of Peak Inflow :	01Jan2006, 12:22
Peak Outflow :	11.10 (CFS)	Date/Time of Peak Outflow :	01Jan2006, 12:40
Total Inflow :	4.69 (IN)	Peak Storage :	1.39 (AC-FT)
Total Outflow :	4.36 (IN)	Peak Elevation :	659.11 (FT)

Project : Proposed Conditions - A Simulation Run : 50 year Reservoir: [redacted] detention basin 2

Start of Run :	01Jan2006, 00:00	Basin Model :	Existing Parking A
End of Run :	02Jan2006, 23:00	Meteorologic Model :	50-year
Execution Time :	01Nov2006, 09:46:16	Control Specifications :	Control 1

Volume Units : IN

Computed Results

Peak Inflow :	37.49 (CFS)	Date/Time of Peak Inflow :	01Jan2006, 12:22
Peak Outflow :	15.25 (CFS)	Date/Time of Peak Outflow :	01Jan2006, 12:37
Total Inflow :	5.27 (IN)	Peak Storage :	1.47 (AC-FT)
Total Outflow :	4.94 (IN)	Peak Elevation :	659.34 (FT)

Project : Proposed Conditions - A Simulation Run : 100-year Reservoir: [redacted] detention basin 2

Start of Run :	01Jan2006, 00:00	Basin Model :	Existing Parking A
End of Run :	02Jan2006, 23:00	Meteorologic Model :	100-year
Execution Time :	01Nov2006, 09:46:42	Control Specifications :	Control 1

Volume Units : IN

Computed Results

Peak Inflow :	41.47 (CFS)	Date/Time of Peak Inflow :	01Jan2006, 12:22
Peak Outflow :	19.66 (CFS)	Date/Time of Peak Outflow :	01Jan2006, 12:35
Total Inflow :	5.85 (IN)	Peak Storage :	1.56 (AC-FT)
Total Outflow :	5.52 (IN)	Peak Elevation :	659.59 (FT)

Existing Parking Area B
Existing Conditions HEC-HMS Output

Project: Existing Lot B US Simulation Run: 1-year

Start of Run:	01Jan2006, 00:00	Basin Model:	Existing Parking B
End of Run:	02Jan2006, 12:00	Meteorologic Model:	1-year
Execution Time:	02Nov2006, 11:37:55	Control Specifications:	Control 1

Volume Units: IN

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Junction-1	0.0076	8.45	01Jan2006, 12:04	1.67
paved area	0.0047	7.18	01Jan2006, 12:04	2.35
unpaved area	0.0029	1.27	01Jan2006, 12:04	0.57

Project: Existing Lot B US Simulation Run: 5-year

Start of Run:	01Jan2006, 00:00	Basin Model:	Existing Parking B
End of Run:	02Jan2006, 12:00	Meteorologic Model:	5-year
Execution Time:	02Nov2006, 11:37:20	Control Specifications:	Control 1

Volume Units: IN

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Junction-1	0.0076	15.30	01Jan2006, 12:03	2.96
paved area	0.0047	11.72	01Jan2006, 12:04	3.85
unpaved area	0.0029	3.59	01Jan2006, 12:03	1.52

Project: Existing Lot B US Simulation Run: 10-year

Start of Run:	01Jan2006, 00:00	Basin Model:	Existing Parking B
End of Run:	02Jan2006, 12:00	Meteorologic Model:	10-year
Execution Time:	02Nov2006, 11:37:01	Control Specifications:	Control 1

Volume Units: IN

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Junction-1	0.0076	19.14	01Jan2006, 12:03	3.68
paved area	0.0047	14.13	01Jan2006, 12:04	4.65
unpaved area	0.0029	5.01	01Jan2006, 12:03	2.11

Project: Existing Lot B US Simulation Run: 25-year

Start of Run:	01Jan2006, 00:00	Basin Model:	Existing Parking B
End of Run:	02Jan2006, 12:00	Meteorologic Model:	25-year
Execution Time:	02Nov2006, 11:36:39	Control Specifications:	Control 1

Volume Units: IN

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Junction-1	0.0076	21.58	01Jan2006, 12:03	4.14
paved area	0.0047	15.64	01Jan2006, 12:04	5.15
unpaved area	0.0029	5.94	01Jan2006, 12:03	2.50

Project: Existing Lot B US Simulation Run: 50-year

Start of Run:	01Jan2006, 00:00	Basin Model:	Existing Parking B
End of Run:	02Jan2006, 12:00	Meteorologic Model:	50-year
Execution Time:	02Nov2006, 11:36:13	Control Specifications:	Control 1

Volume Units: IN

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Junction-1	0.0076	24.54	01Jan2006, 12:03	4.69
paved area	0.0047	17.46	01Jan2006, 12:04	5.75
unpaved area	0.0029	7.09	01Jan2006, 12:03	2.98

Project: Existing Lot B US Simulation Run: 100-year

Start of Run:	01Jan2006, 00:00	Basin Model:	Existing Parking B
End of Run:	02Jan2006, 12:00	Meteorologic Model:	100-year
Execution Time:	02Nov2006, 11:35:39	Control Specifications:	Control 1

Volume Units: IN

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Junction-1	0.0076	27.53	01Jan2006, 12:03	5.25
paved area	0.0047	19.27	01Jan2006, 12:04	6.35
unpaved area	0.0029	8.27	01Jan2006, 12:02	3.48

Existing Parking Area B
Post Construction Conditions HEC-HMS
Output

Project : Proposed Conditions Area B Simulation Run : 1-year Reservoir: [redacted] detention basin 1

Start of Run :	01Jan2006, 00:00	Basin Model :	Existing Parking B
End of Run :	02Jan2006, 12:00	Meteorologic Model :	1-year
Execution Time :	01Nov2006, 11:11:10	Control Specifications :	Control 1

Volume Units : IN

Computed Results

Peak Inflow :	8.49 (CFS)	Date/Time of Peak Inflow :	01Jan2006, 12:14
Peak Outflow :	2.26 (CFS)	Date/Time of Peak Outflow :	01Jan2006, 12:32
Total Inflow :	1.68 (IN)	Peak Storage :	0.28 (AC-FT)
Total Outflow :	1.49 (IN)	Peak Elevation :	650.30 (FT)

detention Basin 1

Project : Proposed Conditions Area B Simulation Run : 2-year Reservoir: [redacted]

Start of Run :	01Jan2006, 00:00	Basin Model :	Existing Parking B
End of Run :	02Jan2006, 12:00	Meteorologic Model :	2-year
Execution Time :	01Nov2006, 11:10:47	Control Specifications :	Control 1

Volume Units : IN

Computed Results

Peak Inflow :	10.70 (CFS)	Date/Time of Peak Inflow :	01Jan2006, 12:13
Peak Outflow :	2.55 (CFS)	Date/Time of Peak Outflow :	01Jan2006, 12:34
Total Inflow :	2.10 (IN)	Peak Storage :	0.34 (AC-FT)
Total Outflow :	1.90 (IN)	Peak Elevation :	650.80 (FT)

detention basin 1

Project : Proposed Conditions Area B Simulation Run : 5-year Reservoir: [redacted]

Start of Run :	01Jan2006, 00:00	Basin Model :	Existing Parking B
End of Run :	02Jan2006, 12:00	Meteorologic Model :	5-year
Execution Time :	01Nov2006, 11:09:05	Control Specifications :	Control 1

Volume Units : IN

Computed Results

Peak Inflow :	15.33 (CFS)	Date/Time of Peak Inflow :	01Jan2006, 12:13
Peak Outflow :	6.29 (CFS)	Date/Time of Peak Outflow :	01Jan2006, 12:26
Total Inflow :	2.97 (IN)	Peak Storage :	0.45 (AC-FT)
Total Outflow :	2.78 (IN)	Peak Elevation :	651.55 (FT)

Project : Proposed Conditions Area B Simulation Run : 10-year Reservoir: [redacted] detention basin 1

Start of Run :	01Jan2006, 00:00	Basin Model :	Existing Parking B
End of Run :	02Jan2006, 12:00	Meteorologic Model :	10-year
Execution Time :	01Nov2006, 11:08:35	Control Specifications :	Control 1

Volume Units : IN

Computed Results

Peak Inflow :	19.17 (CFS)	Date/Time of Peak Inflow :	01Jan2006, 12:13
Peak Outflow :	11.25 (CFS)	Date/Time of Peak Outflow :	01Jan2006, 12:22
Total Inflow :	3.69 (IN)	Peak Storage :	0.49 (AC-FT)
Total Outflow :	3.49 (IN)	Peak Elevation :	651.79 (FT)

Project : Proposed Conditions Area B Simulation Run : 25-year Reservoir: detention basin 1 [redacted]

Start of Run :	01Jan2006, 00:00	Basin Model :	Existing Parking B
End of Run :	02Jan2006, 12:00	Meteorologic Model :	25-year
Execution Time :	01Nov2006, 11:08:02	Control Specifications :	Control 1

Volume Units : IN

Computed Results

Peak Inflow :	21.61 (CFS)	Date/Time of Peak Inflow :	01Jan2006, 12:13
Peak Outflow :	13.51 (CFS)	Date/Time of Peak Outflow :	01Jan2006, 12:22
Total Inflow :	4.15 (IN)	Peak Storage :	0.52 (AC-FT)
Total Outflow :	3.95 (IN)	Peak Elevation :	651.97 (FT)

detention basin 1

Project : Proposed Conditions Area B Simulation Run : 50-year Reservoir: [redacted]

Start of Run :	01Jan2006, 00:00	Basin Model :	Existing Parking B
End of Run :	02Jan2006, 12:00	Meteorologic Model :	50-year
Execution Time :	01Nov2006, 11:07:19	Control Specifications :	Control 1

Volume Units : IN

Computed Results

Peak Inflow :	24.57 (CFS)	Date/Time of Peak Inflow :	01Jan2006, 12:13
Peak Outflow :	18.16 (CFS)	Date/Time of Peak Outflow :	01Jan2006, 12:20
Total Inflow :	4.71 (IN)	Peak Storage :	0.54 (AC-FT)
Total Outflow :	4.51 (IN)	Peak Elevation :	652.12 (FT)

detention basin 1

Project : Proposed Conditions Area B Simulation Run : 100-year Reservoir: [redacted]

Start of Run :	01Jan2006, 00:00	Basin Model :	Existing Parking B
End of Run :	02Jan2006, 12:00	Meteorologic Model :	100-year
Execution Time :	01Nov2006, 11:06:56	Control Specifications :	Control 1

Volume Units : IN

Computed Results

Peak Inflow :	27.55 (CFS)	Date/Time of Peak Inflow :	01Jan2006, 12:13
Peak Outflow :	23.07 (CFS)	Date/Time of Peak Outflow :	01Jan2006, 12:18
Total Inflow :	5.27 (IN)	Peak Storage :	0.56 (AC-FT)
Total Outflow :	5.07 (IN)	Peak Elevation :	652.21 (FT)

Channel Design Data

PROJECT NAME: PA 55-5 [illegible] Upgrades
LOCATION: Salem Twp Luzerne Co. PA
PREPARED BY: J. Kurtz DATE: [illegible]
CHECKED BY: DATE:

Emergency Spillways

CHANNEL OR CHANNEL SECTION	1	2			
PROTECTIVE LINING **	R-8	R-8			
CHANNEL TOP WIDTH (FT)@ D	[illegible]	[illegible]			
CHANNEL TOP WIDTH (FT)@ d	[illegible]	[illegible]			
CHANNEL SIDE SLOPES (H:V)	3	3			
CHANNEL BOTTOM WIDTH (FT)	5.5	5.75			
d (FLOW DEPTH IN FT)	0.45	0.47			
BOTTOM WIDTH:DEPTH RATIO (12:1 MAX)	[illegible]	12:1			
A (AREA IN SQ. FT.)	3.1	3.4			
R (HYDRAULIC RADIUS)	0.37	0.37			
S (BED SLOPE, FT/FT)*	0.25	0.27			
VEGETATIVE LINING RETARDANCE	N/A	N/A			
n (MANNING'S COEFFICIENT)**	0.06	0.06			
V (AT FLOW DEPTH d, CFS)	6.4	6.8			
Q (AT FLOW DEPTH d, CFS)	20	23			
Q_r (REQUIRED CAPACITY) CFS See note *	11	6			
S_c (CRITICAL SLOPE)	.01	.07			
$.7S_c$	[illegible]	.05			
$1.3S_c$	[illegible]	.09			
STABLE FLOW? (Y/N)	Y	Y			
FREEBOARD BASED ON UNSTABLE FLOW FT	N/A	N/A			
FREEBOARD BASED ON STABLE FLOW FT	[illegible]	[illegible]			
MINIMUM REQUIRED FREEBOARD FT	.5	.5			
D (TOTAL DEPTH) FT	2	2			
d_{50} STONE SIZE (IN	15	15			
DESIGN METHOD FOR PROTECTIVE LINING *** PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (S)	S	S			
V_a (ALLOWABLE VELOCITY) FPS					
τ_d (SHEAR STRESS AT FLOW DEPTH d) LB/FT^2	7.0	7.9			
τ_a (MAX ALLOWABLE SHEAR STRESS) LB/FT^2	8.0	8.0			

* Slopes may not be averaged.
** For vegetated channels, provide data for temporary linings and vegetated conditions in separate columns.
*** Minimum Freeboard,F, is 0.5 ft.
**** Permissible velocity lining design method is not acceptable for channels with a bed slope of 10% or greater. Shear stress lining design method is recommended for channels with a bed slope of 10% or greater. Shear stress lining design method may be used for any channel bed slope.

* channels are oversized to pass the discharge from the 100-year storm. Channel sizing assumes a worst case scenario of a clogged riser in the basin which would cause the 100 year discharge from the bioswale to flow through the emergency spillway. Required flow listed is the 10-year discharge per Chapter 102. Channel dimensions and flow related calculations reflect the 100-year discharge from the basins.

Proposed Overflow Parking Area
Existing Conditions TR-55 Runs

WinTR-55 Current Data Description

--- Identification Data ---

User: Jklotz
Project: Berwick Lot Expansion
SubTitle: E&S Runoff Calculations
State: Pennsylvania
County: Luzerne
Filename: C:\Landstudies\PPL Susquehanna Install\TR55 Files\Existing Expansion Lot.w55

Date: 11/1/2006
Units: English
Areal Units: Acres

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
ELot1	Expansion lot portion 1	Outlet	1.9	72	0.118
ELot2	Expansion lot portion 2	Outlet	1.3	68	0.100

Total area: 3.20 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
2.9	3.9	4.7	5.2	5.8	6.4	2.4

Storm Data Source: Luzerne County, PA (NRCS)
Rainfall Distribution Type: Type II
Dimensionless Unit Hydrograph: <standard>

Berwick Lot Expansion
E&S Runoff Calculations
Luzerne County, Pennsylvania

Storm Data

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
2.9	3.9	4.7	5.2	5.8	6.4	2.4

Storm Data Source: Luzerne County, PA (NRCS)
Rainfall Distribution Type: Type II
Dimensionless Unit Hydrograph: <standard>

Jklotz

Berwick Lot Expansion
E&S Runoff Calculations
Luzerne County, Pennsylvania

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period 2-Yr (cfs)	5-Yr (cfs)	10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)	1-Yr (cfs)
SUBAREAS							
ELot1	1.96	3.84	5.54	6.65	8.02	9.43	1.20
ELot2	1.00	2.16	3.26	3.99	4.90	5.85	0.56
REACHES							
OUTLET	2.96	6.00	8.78	10.62	12.90	15.25	1.76

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Berwick Lot Expansion
E&S Runoff Calculations
Luzerne County, Pennsylvania

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period 2-Yr (cfs) (hr)	5-Yr (cfs) (hr)	10-Yr (cfs) (hr)	25-Yr (cfs) (hr)	50-Yr (cfs) (hr)	100-Yr (cfs) (hr)	1-Yr (cfs) (hr)
SUBAREAS							
ELot1	1.96	3.84	5.54	6.65	8.02	9.43	1.20
	11.97	11.95	11.95	11.95	11.95	11.94	12.02
ELot2	1.00	2.16	3.26	3.99	4.90	5.85	0.56
	12.01	11.95	11.94	11.94	11.94	11.94	12.02
REACHES							
OUTLET	2.96	6.00	8.78	10.62	12.90	15.25	1.76

Proposed Overflow Parking Area
Post Construction Conditions TR-55 Runs

WinTR-55 Current Data Description

--- Identification Data ---

User: Jklotz
Project: Berwick Lot Expansion
SubTitle: E&S Runoff Calculations
State: Pennsylvania
County: Luzerne
Filename: C:\Landstudies\PPL Susquehanna Install\TR55 Files\Proposed expansion lot1.w55

Date: 11/1/2006
Units: English
Areal Units: Acres

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
ELot1	Expansion lot portion 1	Outlet	1.9	75	0.118
ELot2	Expansion lot portion 2	Outlet	1.3	72	0.100

Total area: 3.20 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
2.9	3.9	4.7	5.2	5.8	6.4	2.4

Storm Data Source: Luzerne County, PA (NRCS)
Rainfall Distribution Type: Type II
Dimensionless Unit Hydrograph: <standard>

Berwick Lot Expansion
E&S Runoff Calculations
Luzerne County, Pennsylvania

Storm Data

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
2.9	3.9	4.7	5.2	5.8	6.4	2.4

Storm Data Source: Luzerne County, PA (NRCS)
Rainfall Distribution Type: Type II
Dimensionless Unit Hydrograph: <standard>

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Berwick Lot Expansion
E&S Runoff Calculations
Luzerne County, Pennsylvania

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period 2-Yr (cfs)	5-Yr (cfs)	10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)	1-Yr (cfs)
SUBAREAS							
ELot1	2.43	4.46	6.25	7.41	8.83	10.28	1.54
ELot2	1.38	2.71	3.91	4.69	5.66	6.66	0.83
REACHES							
OUTLET	3.80	7.16	10.14	12.08	14.47	16.90	2.37

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Berwick Lot Expansion
E&S Runoff Calculations
Luzerne County, Pennsylvania

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period 2-Yr (cfs) (hr)	5-Yr (cfs) (hr)	10-Yr (cfs) (hr)	25-Yr (cfs) (hr)	50-Yr (cfs) (hr)	100-Yr (cfs) (hr)	1-Yr (cfs) (hr)
SUBAREAS							
ELot1	2.43	4.46	6.25	7.41	8.83	10.28	1.54
	11.96	11.95	11.95	11.94	11.95	11.94	12.00
ELot2	1.38	2.71	3.91	4.69	5.66	6.66	0.83
	11.95	11.94	11.94	11.94	11.93	11.93	12.02
REACHES							
OUTLET	3.80	7.16	10.14	12.08	14.47	16.90	2.37

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Berwick Lot Expansion
E&S Runoff Calculations
Luzerne County, Pennsylvania

Sub-Area Summary Table

Sub-Area Identifier	Drainage Area (ac)	Time of Concentration (hr)	Curve Number	Receiving Reach	Sub-Area Description
ELot1	1.90	0.118	75	Outlet	Expansion lot portion 1
ELot2	1.30	0.100	72	Outlet	Expansion lot portion 2

Total Area: 3.20 (ac)

Berwick Lot Expansion
E&S Runoff Calculations
Luzerne County, Pennsylvania

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
ELot1							
SHEET	100	0.0300	0.050				0.061
SHALLOW	170	0.0300	0.050				0.017
SHALLOW	400	0.0300	0.050				0.040
					Time of Concentration		0.118
ELot2							
SHEET	100	0.0300	0.050				0.061
SHALLOW	140	0.0300	0.050				0.014
SHALLOW	240	0.0300	0.050				0.024
					Time of Concentration		0.100

Berwick Lot Expansion
E&S Runoff Calculations
Luzerne County, Pennsylvania

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use	Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
ELot1	Dirt (w/ right-of-way)	A	1.5	72
	Dirt (w/ right-of-way)	C	.4	87
	Total Area / Weighted Curve Number		1.9	75
			===	==
ELot2	Dirt (w/ right-of-way)	A	1.3	72
	Total Area / Weighted Curve Number		1.3	72
			===	==