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Carmen Johnson 54-04 3/27/12 4/2/12 (9)

ASH LANDFILL
SOIL COVER – FINAL DESIGN REPORT

DuPont Kinston
Kinston, North Carolina

February 2003

Project No. 18983688.00012
504307

Prepared by

CORPORATE REMEDIATION GROUP
An Alliance between
DuPont and URS Diamond

Barley Mill Plaza, Building 27
Wilmington, Delaware 19805

ASH LANDFILL
SOIL COVER – FINAL DESIGN REPORT
DUPONT KINSTON FACILITY
KINSTON, NORTH CAROLINA

Date: February 2003

Project No.: 18983688.00012

Prepared for
DuPont Kinston Plant
Highway 11 N
Kinston, NC 28501

Prepared by

CORPORATE REMEDIATION GROUP
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APPENDICES

1.0 INTRODUCTION

This Design Report provides information to be used during closure of the DuPont Kinston Ash Landfill located at the DuPont Kinston Plant in Kinston, North Carolina. Closure is being performed according to the requirements as reviewed and mutually agreed between the North Carolina Department of Environment and Natural Resources (NCDENR) Division of Waste Management and the E.I. du Pont de Nemours and Company (DuPont) Kinston Plant (facility) located in Lenoir County.

Closure Design has been advanced in accordance with applicable NCDENR and Erosion and Sedimentation (E&S) Control requirements. Conformance with these requirements will serve to ensure the long-term performance of the constructed remedy.

1.1 Report Organization

This Design Report has been organized as follows:

- Section 1.0 presents the report organization and objectives;
- Section 2.0 summarizes the previous investigations and reports and provides site background;
- Section 3.0 details the soil cover design;
- Section 4.0 presents the closure schedule.

1.2 Design Report Supporting Information

The following support materials for the closure design are included in this report:

- *Design Calculations and Support Documentation*
  Calculations and technical information pertaining to design issues are presented in Appendix A.
- *Technical Specifications*
  Materials and construction procedures required to properly construct the design are documented in Technical Specifications, included in Appendix B.
- *Construction Drawings*
  Construction Drawings are presented in Appendix C.
- *Erosion and Sediment Control Plan*
  The Erosion and Sediment Control Plan describes measures for management of stormwater, mitigation of erosion and control of sediment migration. This Plan is being submitted separately to the North Carolina Department of Environment, Health and Natural Resources, Land Quality Section.

The proposed Kinston Ash Landfill design is based on currently accepted geotechnical and environmental engineering principles and practices.

2.0 BACKGROUND INFORMATION

This section provides a description of the site location and history. It also summarizes existing site information.

2.1 Site Location

The facility is located northeast of Kinston, North Carolina, on North Carolina Highway 11. It is located on approximately 650 acres and is bounded by the Neuse River on the south and southeast; North Carolina Highway 11 on the north and northwest; and farmland on the north, northeast, and southwest.

2.2 Site History

The DuPont Kinston Plant began operations in 1953 and continues to manufacture *Dacron*® polyester resin and fibers. The facility consists of several buildings that contribute to the manufacturing of *Dacron*® polyester fibers. *Dacron*® polyester production is accomplished using one of the following two chemical processes; dimethyl terephthalate (DMT) and ethylene glycol, or terephthalic acid (TPA) and ethylene glycol. Water is produced as a by-product from the TPA process, while methanol is a by-product of the DMT process.

2.3 Existing Site Information

The environmental setting of the facility is described in detail in the RCRA Facility Assessment (CH2M-Hill, 1993), the Confirmatory Sampling Work Plan (DERS 1996), the Confirmatory Sampling Report (DERS, 1997), and the RCRA Facility Investigation Phase I Report (CRG, 2000).

3.0 FINAL SITE REMEDIATION DESIGN

The proposed soil cover system consists of natural soil components and was designed to meet NCDENR requirements while serving to protect the environment. Design Calculations are presented in Appendix A.

3.1 Soil Cover Description

As detailed in Section 02200 of the Technical Specifications, cover soil and amended cover soil will be placed to achieve the required cover thickness of a 24-inch thick soil cover layer. Cover soils will be amended to meet required organic content and pH requirements, which will facilitate the establishment of a good vegetative stand. Seeding requirements for the vegetative layer are discussed in Section 02930 of the Technical Specifications. The Technical Specifications are presented in Appendix B.

3.2 Cap System – Grading Plan

The proposed final grading plan was developed to facilitate drainage of storm water from the cap system and achieve the required 24-inch thick soil cover layer. Existing slopes for the Ash landfill are steeper than 67% [1.5H:1V]. The proposed grading incorporates minimum slopes of 5%, or 20 Horizontal to 1 Vertical [20H:1V], and, predominantly, maximum slopes of 33% [3H:1V]. A portion of the western slope will be graded to 50% [2H:1V] to minimize impacts to the existing wooded area which borders the Ash Landfill on the western side. The Ash Landfill will be graded to conform to current conditions and direct storm water to perimeter drainage ditches and protected outlets. The Ash Landfill Grading Plan is presented with the Design Drawings in Appendix C.

3.3 Availability and Suitability of Final Cover Material

A borrow source investigation was conducted concurrently with the C&D Landfill cap investigation in October, 2002. This investigation determined that sufficient soil quantities are present in the proposed borrow area to support soil cover construction for the Ash Landfill. Development of the borrow area above the existing sediment basin will provide sufficient quantities of soil for the Ash Landfill closure. The sediment basin has been designed with sufficient capacity to support borrow area development for this project.

Soil types present at the borrow area included silty sands (SM) to clayey sands (SC) as encountered in the borrow area test pits. Fines content generally increased with depth. These soils are considered candidate materials for the soil cover system. Section 02200 of the Technical Specifications incorporates the use of on-site borrow materials in the soil cover. Borrow area soil geotechnical results were provided to NCDENR with the Construction and Demolition (C&D) Landfill Closure Final Design Report.

3.4 Stormwater Management / Erosion and Sediment Control

Management of stormwater is described in the Erosion and Sediment Control Plan, which has been prepared separately for submittal to the North Carolina Department of Environment, Health and Natural Resources, Land Quality Section.

3.5 Geotechnical Investigation

A geotechnical investigation was conducted within the Ash Landfill in February 2003 to better define the extent and thickness of the components of the landfill; namely, the ash, sludge, fill, and native soils.

Representative samples of the ash and ash/sludge materials from the investigation were shipped to a geotechnical laboratory for testing and analyses. These laboratory test results will be utilized to determine physical and engineering properties of materials present at the Landfill. Slope stability and bearing capacity analyses will be performed utilizing these properties to verify an acceptable factor of safety for constructed slopes and for bearing capacity for the construction and post-construction periods. These analyses will be performed prior to contractor procurement.

4.0 REMEDIATION SCHEDULE

DuPont anticipates the construction of the Ash Landfill soil cover during the second and third quarters of 2003 with potential additional work proceeding into the fourth quarter of 2003 and into 2004.

5.0 REFERENCES

CH2M-Hill, 1993. RCRA Facility Assessment. E.I. DuPont de Nemours and Company, Inc. Kinston Plant. Kinston North Carolina. EPA ID No. NCD003190386.

CRG, 2000. *RCRA Facility Investigation Phase I Report, Kinston Plant*. August 2000.

CRG, 2002. *Construction and Demolition Landfill Soil Cover – Final Design Report, Kinston Plant*. November 2002.

DERS, 1992. *Manufacturing Area Investigation for DuPont Fibers Kinston Plant*. March 1992.

DERS, 1996. *Confirmatory Sampling Work Plan, Kinston Plant*. October 1995, revised August 1996.

DERS, 1997. *Confirmatory Sampling Report, DuPont Kinston Plant*. June 1997.

Appendix A

APPENDIX A
DESIGN CALCULATIONS
ASH LANDFILL
SOIL COVER - FINAL DESIGN REPORT
DUPONT KINSTON
KINSTON, NORTH CAROLINA

February 25, 2003

Project No. 18983688.00012

CORPORATE REMEDIATION GROUP
An Alliance between
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Barley Mill Plaza, Building 27
Wilmington, Delaware 19880-0027

Kinston Ash Landfill
Soil Cover Construction
Final Design

List of Calculations

STORMWATER DRAINAGE DESIGN
CULVERT DESIGN
SEDIMENT TRAP DESIGN
SEDIMENT BASIN DESIGN

PURPOSE:

To assess the post-construction site runoff conditions for the 10-year/24-hour storm event for ditches and 25-year/24-hour storm events for culverts. Results of the analyses will be used to design a permanent stormwater conveyance and management system for the ash landfill cover.

DESIGN CRITERIA:

The design criteria is based on the *North Carolina Erosion and Sediment Control Planning and Design Manual* (Manual - Ref. 1). As required by the *Manual* permanent drainageways will be designed of sufficient capacity to convey the 10-year / 24-hour design storm. Channel protection will be designed based on the concept of maximum permissible tractive (shear) stress and to handle the shear stresses and velocities from the 10 year / 24 hour storm event. Culverts will be designed of sufficient capacity to convey the 25-year / 24-hour design storm. Peak flows to the culverts will be presented in this calculation, however, culvert design is presented in a separate calculation.

The grading plan was developed to direct cap runoff away from the long 2H:1V western slope. All embankment slopes will be lined with erosion control blanket for stabilization. The slope of the cap was set at 5% minimum to promote drainage as required in North Carolina Department of Environment and Natural Resources (NCDENR) Division of Waste Management regulations.

PROCEDURE:

The computer program SCS Technical Release 55 (*TR-55*, Ref. 2) will be used to estimate time of concentration (Tc) and runoff curve numbers (RCN) and peak flows will be determined using *PondPack* developed by Haestad Methods (Ref 3).

The following steps will be taken:

1) Using the existing site topographic map divide the site into watershed areas (and sub watershed areas as applicable) and estimate the size of each area in acres.
2) Estimate the appropriate runoff curve number for each drainage area based on existing conditions.
3) Estimate the time of concentration (T_c) of runoff for each drainage area.
4) Calculate peak flows at the outfall of each drainage area based on the 10-year/24-hour storm event and the appropriate rainfall distribution per Reference 2. Calculate peak flows to the culverts based on the 25-year/24-hour storm event and the appropriate rainfall distribution per Reference 1.
5) Determine channel geometry.
6) Determine required channel lining based on the maximum permissible tractive stress.

The computer program, *TR-55*, developed by the United States Department of Agriculture – SCS, will be used to perform the calculations for Steps 2 and 3. Haestad methods *PondPack* will then be used to compute the peak runoff hydrographs and determine peak flows for step 4. Haestad methods *Flowmaster* (Ref. 4) will be used to evaluate channel geometry for step 5.

1. Delineate and Estimate Size of Watershed Areas

The watershed areas were delineated on a drawing of the final grading plan. The areas were determined using the AutoCAD area command. The AutoCAD areas in acreage are displayed on the following table:

WATERSHED AREAS	
Watershed	Area (acres)
Ditch 1	1.6
Ditch 2	1.4
Ditch 3	0.44
Ditch 4	2.32
Ditch 5	7.5

2. Estimate Travel Times and Time of Concentration

Travel time (T_T) is the time it takes water to travel from one location to another within a watershed. T_T is a component of the time of concentration (T_c). T_c is defined as the time it takes for the entire watershed to contribute runoff and is quantified as the hydraulically most distant point within the watershed from its outfall point. It is calculated by summing the travel times of runoff within the watershed and includes sheet flow, overland flow, and/or channel flow.

A. Sheet Flow

Sheet flow is flow over uniform, planar surfaces. Generally, sheet flow will occur within the first 150 feet of the hydraulic path, or until the flow becomes concentrated. The following equation is used to calculate the travel time for sheet flow (Ref. 2):

$$T_T = \frac{0.007 \times (nL)^{0.8}}{P_2^{0.5} \times s^{0.4}}$$

where T_T = Travel time (hr),
n = Manning's roughness coefficient,
L = Flow length (ft),
P_2 = 2-year/24-hour rainfall (in), and
s = Slope (ft/ft).
For n, from Appendix 2, assume: grass-range, short for sheet flow (Ref. 2)
For P_2, from Appendix 2, use P_2 = 3.9 inches (Ref. 1)

B. Overland Flow

Due to topographic features or lengthy sheet flow, flow will begin to concentrate and become shallow concentrated flow, or overland flow. Water will travel as overland flow until it reaches defined channels. The following equation is used to calculate the travel time for overland flow (Ref. 2):

$$T_T = \frac{L}{3600\,{}^{\text{sec}}/_{\text{hr}} \times V}$$

where T_T = Travel time (hr),
L = Flow length (ft), and
V = Avg. velocity (ft/sec).

C. Channel Flow

For this calculation, Reference 2 recommends using Manning's equation to determine channel velocity, with subsequent travel times determined using the equation for Overland Flow above.

Based on design assumptions, reasonable assumptions can be made regarding conditions of the drainage channels, including slope, mannings coefficient and cross-section. The channel surfaces for proposed conditions were modeled as a rough channel with grass for upland portions (assume n = 0.030) [Ref. 4]. The geometries of the proposed ditches was obtained by modeling as ditches will be constructed (i.e. generally trapezoidal with 2' flat bottoms, or v-ditch in the case of ditch 3).

Using these assumptions, the computer program *Flowmaster* was used to solve Manning's equation for channel velocities. Computations for travel time and time of concentration were developed using *TR-55* and are provided in Appendix 1.

3. Determine Runoff Curve Number and Rainfall Distribution

The curve number (CN) rates the watershed areas for potential runoff according to soil type and the amount and type of vegetative cover. The proposed cover of the landfill was modeled as open space in fair condition. Fair condition assumes a grass cover of 50–75% which is a conservative value since the entire surface will be vegetated. The hydrologic soil group (HSG) designation was determined from *The Soil Survey of Lenoir County* (Ref. 5).

Site soils include:

Soil Classification	Symbol	Hydrologic Soil Groups (HSG's)
Kalmia	Ka	B
Norfolk	Na	B
Norfolk	Nc	B

Group B soils have moderate infiltration rates with moderately well to well drained soils containing moderately fine to moderately coarse textures. The watershed areas were then evaluated to determine the land use and soil type percentages existing throughout the drainage areas. A composite curve number was then calculated for each watershed area using the *TR-55* computer program (Ref. 2) for the specific cover and soil types. Computer output appears in Appendix 2. The following table displays a summary of the watershed information for proposed ditches:

SUMMARY			
Watershed	Area (ac)	RCN	Tc (hrs)
Ditch 1	1.6	69	0.18
Ditch 2	1.4	69	0.18
Ditch 3	0.44	69	0.20
Ditch 4	2.32	69	0.18
Ditch 5	7.5	64	0.18

The following table displays a summary of the watershed information for proposed culverts:

SUMMARY			
Watershed	Area (ac)	RCN	Tc (hrs)
Culvert 1	2.95	69	0.18
Culvert 2	2.76	69	0.20

4. Calculate Peak Discharges

The 10-year/24-hour rainfall event for Lenoir County is 6.3 inches (Reference 2). According to Reference 2, this region of the country is subject to a Type III rainfall distribution. *Pondpack* was used to estimate peak flows to the proposed ditches. The following table summarizes the peak runoff results for the 10-year storm to the proposed ditches.

Peak Flow Rate - Drainage Swales (modeled for 10-yr. storm)

Watershed	Peak Flow, Q (cfs)
Ditch 1	4.4
Ditch 2	3.7
Ditch 3	1.2
Ditch 4	6.4
Ditch 5	17.1

The 25-year/24-hour rainfall event for Lenoir County is 7.3 inches (Reference 2). *Pondpack* was used to estimate peak flows to the proposed culverts. The following table summarizes the peak runoff results for the 25-year storm to the proposed culverts:

Peak Flow Rate – Culverts (modeled for 25-yr. storm)

Culvert	Peak Flow, Q (cfs)
Culvert 1	10.4
Culvert 2	9.4

Detailed peak flow rate results for ditches and culverts are provided in Appendix 3.

5. Determine Channel Geometry

Using the computer program, *Flowmaster I* (Ref. 4), Manning's equation was used to calculate the normal flow depth based on various channel geometries for each ditch. The calculated normal depth was used to determine the required channel depth. The channel depth also includes a 0.5 foot of freeboard above the computed normal depth at peak flow. Computer output appears in Appendix 4. Displayed below is a summary of the channel geometry.

Channel Design Information for 10–year storm event

Ditch/Section	Channel Type	Channel Depth (ft)	Channel Side Slopes	Bottom Width (ft)	Flow Depth (ft)
Ditch 1	Trapezoidal	1	3H:1V	2	0.28
Ditch 2	Trapezoidal	1	3H:1V	2	0.47
Ditch 3	V-Ditch	1	3H:1V	-	0.41
Ditch 4	Trapezoidal	1.2	3H:1V	2	0.62
Ditch 5	Trapezoidal	1.3	Varies*	4	0.80

* = Consult the design drawings for the actual channel geometry.

6. Determine Channel Protection

Channel protection will be specified that is sufficient to handle the shear stresses and velocities from the 10-year / 24 hour storm event.

The shear stress on the channel is given by:

$$T_d = \gamma_w d S$$

Where;

T_d	=	the channel shear stress (psf)
γ_w	=	unit weight of water (62.4 pcf)
d	=	flow depth in center of channel (ft)
S	=	channel slope (ft/ft)

This evaluation is used to determine the shear stresses for drainage swales. The following table displays a summary of the channel shear stresses:

Channel Velocity and Shear Stress

Ditch/Section	Flow Depth (ft)	max Slope (%)	Flow Velocity (fps)	Calculated Shear Stress (psf)
Ditch 1	0.28	0.10	5.5	1.75
Ditch 2	0.47	0.01	2.3	0.29
Ditch 3	0.41	0.02	2.4	0.51
Ditch 4	0.62	0.01	2.7	0.39
Ditch 5	0.80	0.036	3.5	1.80

Ditch 1 will require a Turf Reinforcement Mat which provides a permanent protection period and with a maximum permissible shear stress of 2.5 psf as required in the erosion control measures section of the specifications. Ditches 2, 3, and 4 will require an erosion control blanket with a maximum permissible shear stress of 1.5 psf or higher as required in the erosion control measures section of the specifications.

Ditch 5 will require riprap with a D_{50} = 6-inches. Computer output appears in Appendix 4 for channel geometries and includes a HYCHL model run for Ditch 5 riprap protection.

REFERENCES:

1) *Erosion and Sediment Control Planning and Design Manual,,* North Carolina Sediment Control Commission, September 1, 1988

2) *"TR-55,"* Urban Hydrology for Small Watersheds, Version. 2.1, U.S. Dept. of Agriculture, Soil Conservation Service Technical Release 55, June 1986.

3) "*PondPack,*" Version 7.0, developed by Haestad Methods, Inc., 1999.

4) *"Flowmaster,"* Open Channel Flow Module, Version 6.1, developed by Haestad Methods, Inc., 2001.

5) *The Soil Survey of Lenoir Counties, NC,* U.S. Department of Agriculture, March, 1977.

6) *"HYCHL"* Version 2.0, developed by GKY & Assoicates Inc., Springfield, VA in cooperation with Federal Highway Administration

APPENDICES

APPENDIX 1 RUNOFF CURVE NUMBER OUTPUT

APPENDIX 2 TIME OF CONCENTRATION OUTPUT

APPENDIX 3 PEAK DISCHARGE OUTPUT

APPENDIX 4 CHANNEL GEOMETRY

APP'X 1

TIME OF CONCENTRATION COMPUTATIONS

TIME OF CONCENTRATION AND TRAVEL TIME Version 2.10

Project : Kinston User: amb Date: 02-07-2003

County : Lenoir State: NC Checked: ____ Date: _____

Subtitle: Post - Ditch 1

Subarea #1

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	3.9	150	.05	e					0.142
Shallow Concent'd		80	.056	u					0.006
Shallow Concent'd		40	.225	u					0.001
Open Channel		377						3.2	0.033
Open Channel		33						3.5	0.003
								Time of Concentration =	0.18*
									=====

--- Sheet Flow Surface Codes ---

A Smooth Surface
B Fallow (No Res.)
C Cultivated < 20 % Res.
D Cultivated > 20 % Res.
E Grass-Range, Short
F Grass, Dense
G Grass, Burmuda
H Woods, Light
I Woods, Dense
J Range, Natural

--- Shallow Concentrated --- --- Surface Codes ---

P Paved
U Unpaved

URS

Page ____ of ____

Job _____ Project No. _____ Sheet ____ of ____

Description _____ Computed by _____ Date _____

_____ Checked by _____ Date _____

Reference

Ditch # 1

Sheet Flow
Length = 150'
Slope = 93 − 85.5 / 150 = 5%
Surface = Short Grass

Shallow Conc ①
Length = 30'
Slope = 85.5 − 81 / 80 = 5.6%
Surface = Unpaved

Shallow Conc ②
Length = 40
Slope = 81 − 72 / 40 = 22.5%
Surface = Unpaved

Ditch Flow
Length = 377'
Slope = 72 − 64.3 / 377 = 1.2%

Culvert Flow
Length = 33'
Slope = 64.3 − 63.97 / 33 = 1%

TIME OF CONCENTRATION AND TRAVEL TIME Version 2.10

Project : Kinston User: amb Date: 02-07-2003

County : Lenoir State: NC Checked: ____ Date: _____

Subtitle: Post - Ditch 2

Subarea #1

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	3.9	150	.047	e					0.145
Shallow Concent'd		123	.053	u					0.009
Shallow Concent'd		40	.325	u					0.001
Open Channel		170						2.03	0.023
Open Channel		33						3.5	0.003

Time of Concentration = 0.18*

=====

--- Sheet Flow Surface Codes ---

A Smooth Surface
B Fallow (No Res.)
C Cultivated < 20 % Res.
D Cultivated > 20 % Res.
E Grass-Range, Short
F Grass, Dense
G Grass, Burmuda
H Woods, Light
I Woods, Dense
J Range, Natural

--- Shallow Concentrated --- Surface Codes ---

P Paved
U Unpaved

URS

Page ____ of ____

Job _____ Project No. _____ Sheet ____ of ____

Description _____ Computed by _____ Date _____

_____ Checked by _____ Date _____

Reference

Ditch 2

Sheet Flow
Length = 150'
Slope = 92.5 − 85.5 / 150 = 4.7%

Shallow Conc ① Unpaved
Length = 123
Slope = 85.5 − 79 / 123 = 5.3%

Shallow Conc ② Unpaved
Length = 40'
Slope = 79 − 66 / 40 = 32.5%

Ditch Flow
Length = 170
Slope = 66 − 64.3 / 170 = 1%

Culvert Flow
Length = 33'
Slope = 64.3 − 63.97 / 33 = 1%

TIME OF CONCENTRATION AND TRAVEL TIME Version 2.10

Project : Kinston User: amb Date: 02-07-2003

County : Lenoir State: NC Checked: ____ Date: _____

Subtitle: Post - Ditch 3

Subarea #1

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	3.9	150	.037	e					0.160
Shallow Concent'd		183	.044	u					0.015
Shallow Concent'd		42	.31	u					0.001
Open Channel		120						2.01	0.017
Open Channel		32						2.91	0.003

Time of Concentration = 0.20*

=====

--- Sheet Flow Surface Codes ---

A Smooth Surface
B Fallow (No Res.)
C Cultivated < 20 % Res.
D Cultivated > 20 % Res.
E Grass-Range, Short
F Grass, Dense
G Grass, Burmuda
H Woods, Light
I Woods, Dense
J Range, Natural

--- Shallow Concentrated Surface Codes ---

P Paved
U Unpaved

URS

Page ____ of ____

Job _____ Project No. _____ Sheet ____ of ____

Description _____ Computed by _____ Date _____

_____ Checked by _____ Date _____

Reference

Ditch 3

Sheet Flow
Length = 150'
Slope = 95.5 - 87/150 = 3.7%
Grass Fair

Shallow Conc Flow ①
Length = 183
Slope = 87 - 79 /183 = 4.4 %
Unpaved

Shallow Conc Flow ②
Length = 42'
Slope = 79 - 66/42 = 31.0%

Ditch Flow
Length = 120'
Slope = 66 - 64.45/120 = 1.3%

Culvert Flow
Length = 32'
Slope = 64.45 - 64.13 /32 = 1%

TIME OF CONCENTRATION AND TRAVEL TIME Version 2.10

Project : Kinston User: amb Date: 02-07-2003

County : Lenoir State: NC Checked: ____ Date: _____

Subtitle: Post - Ditch 4

Subarea #1

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	3.9	150	.05	e					0.142
Shallow Concent'd		125	.052	u					0.009
Shallow Concent'd		38	.32	u					0.001
Open Channel		255						2.42	0.029
Open Channel		32						4.15	0.002

Time of Concentration = 0.18*

=====

--- Sheet Flow Surface Codes ---

A Smooth Surface
B Fallow (No Res.)
C Cultivated < 20 % Res.
D Cultivated > 20 % Res.
E Grass-Range, Short
F Grass, Dense
G Grass, Burmuda
H Woods, Light
I Woods, Dense
J Range, Natural

--- Shallow Concentrated --- Surface Codes ---

P Paved
U Unpaved

URS

Page ____ of ____

Job _____ Project No. _____ Sheet ____ of ____

Description _____ Computed by _____ Date _____

_____ Checked by _____ Date _____

Reference

Ditch 4

Sheet Flow
Length = 150'
Slope = 93 - 85.5/150 = 5%

Shallow Conc Flow (1)
Length = 125'
Slope = 85.5 - 79/125 = 5.2 %

Shallow Conc Flow (2)
Length = 38'
Slope = 79 - 67 /38 = 32 %

Ditch Flow
Length = 255
Slope = 67 - 64.45/ 255 = 1.0 %

Culvert Flow
Length = 32'
Slope = 64.45 - 64.13 / 32 = 1%

TIME OF CONCENTRATION AND TRAVEL TIME Version 2.10

Project : Kinston User: amb Date: 02-07-2003

County : Lenoir State: NC Checked: ____ Date: _____

Subtitle: Post - Ditch 5

Subarea #1

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	3.9	150	.047	e					0.145
Open Channel		568						4.43	0.036
								Time of Concentration =	0.18*
									=====

--- Sheet Flow Surface Codes ---

A Smooth Surface
B Fallow (No Res.)
C Cultivated < 20 % Res.
D Cultivated > 20 % Res.
E Grass-Range, Short
F Grass, Dense
G Grass, Burmuda
H Woods, Light
I Woods, Dense
J Range, Natural

--- Shallow Concentrated --- Surface Codes ---

P Paved
U Unpaved

URS

Page ____ of ____

Job _____ Project No. _____ Sheet ____ of ____

Description _____ Computed by _____ Date _____

_____ Checked by _____ Date _____

Reference

Ditch 5

Sheet Flow
L = 150'
Slope = 70 − 63 / 150 = 4.7%

Ditch Flow
L = 568'
Slope = 63 − 52 / 568 = 1.9%

APPX 2

RUNOFF CURVE NUMBER COMPUTATIONS

RUNOFF CURVE NUMBER COMPUTATION Version 2.10

Project : Kinston User: amb Date: 02-07-2003

County : Lenoir State: NC Checked: ____ Date: _____

Subtitle: Post - Ditch 1

COVER DESCRIPTION	Hydrologic Soil Group A	B	C	D
		Acres (CN)		
FULLY DEVELOPED URBAN AREAS (Veg Estab.)				
Open space (Lawns,parks etc.)				
Fair condition; grass cover 50% to 75%	-	1.61(69)	-	-
Total Area (by Hydrologic Soil Group)		1.61		
		====		

TOTAL DRAINAGE AREA: 1.61 Acres WEIGHTED CURVE NUMBER: 69

RUNOFF CURVE NUMBER COMPUTATION Version 2.10

Project : Kinston User: amb Date: 02-07-2003

County : Lenoir State: NC Checked: ____ Date: _____

Subtitle: Post - Ditch 2

COVER DESCRIPTION	Hydrologic Soil Group A	B	C	D
		Acres (CN)		
FULLY DEVELOPED URBAN AREAS (Veg Estab.)				
Open space (Lawns,parks etc.)				
Fair condition; grass cover 50% to 75%	-	.83(69)	-	-
Total Area (by Hydrologic Soil Group)		.83		

TOTAL DRAINAGE AREA: .83 Acres WEIGHTED CURVE NUMBER: 69

RUNOFF CURVE NUMBER COMPUTATION Version 2.10

Project : Kinston User: amb Date: 02-07-2003

County : Lenoir State: NC Checked: ____ Date: _____

Subtitle: Post - Ditch 3

COVER DESCRIPTION	Hydrologic Soil Group A	B	C	D
		Acres (CN)		
FULLY DEVELOPED URBAN AREAS (Veg Estab.)				
Open space (Lawns,parks etc.)				
Fair condition; grass cover 50% to 75%	-	.44(69)	-	-
Total Area (by Hydrologic Soil Group)		.44		
		====		

TOTAL DRAINAGE AREA: .44 Acres WEIGHTED CURVE NUMBER: 69

RUNOFF CURVE NUMBER COMPUTATION Version 2.10

Project : Kinston User: amb Date: 02-07-2003

County : Lenoir State: NC Checked: ____ Date: _____

Subtitle: Post - Ditch 4

COVER DESCRIPTION	Hydrologic Soil Group A	B	C	D
		Acres (CN)		
FULLY DEVELOPED URBAN AREAS (Veg Estab.)				
Open space (Lawns,parks etc.)				
Fair condition; grass cover 50% to 75%	-	1.56(69)	-	-
Total Area (by Hydrologic Soil Group)		1.56		

TOTAL DRAINAGE AREA: 1.56 Acres WEIGHTED CURVE NUMBER: 69

RUNOFF CURVE NUMBER COMPUTATION Version 2.10

Project : Kinston User: amb Date: 02-07-2003

County : Lenoir State: NC Checked: ____ Date: _____

Subtitle: Post - Ditch 5

COVER DESCRIPTION		Hydrologic Soil Group A	B	C	D
			Acres (CN)		
FULLY DEVELOPED URBAN AREAS (Veg Estab.)					
Open space (Lawns,parks etc.)					
Fair condition; grass cover 50% to 75%		-	3.7(69)	-	-
Impervious Areas					
Paved parking lots, roofs, driveways		-	.3(98)	-	-
OTHER AGRICULTURAL LANDS					
Woods	good	-	3.5(55)	-	-
Total Area (by Hydrologic Soil Group)			7.5		

TOTAL DRAINAGE AREA: 7.5 Acres WEIGHTED CURVE NUMBER: 64

APPX 3

PEAK FLOW RATE

COMPUTATIONS

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 10 yr year storm
Duration = 24.0000 hrs Rain Depth = 6.3000 in
Rain Dir = D:\HAESTAD\PPKW\RAINFALL\
Rain File -ID = SCSTYPES.RNF - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = D:\HAESTAD\PPKW\KINSTON\
HYG File - ID = KI_POST_.HYG - POST DITCH 1 10 yr
Tc = .1800 hrs
Drainage Area = 1.610 acres Runoff CN= 69

==========
Computational Time Increment = .02400 hrs
Computed Peak Time = 12.1440 hrs
Computed Peak Flow = 4.42 cfs

Time Increment for HYG File = .0500 hrs
Peak Time, Interpolated Output = 12.1500 hrs
Peak Flow, Interpolated Output = 4.41 cfs
==========

DRAINAGE AREA

ID:None Selected
CN = 69
Area = 1.610 acres
S = 4.4928 in
0.2S = .8986 in

Cumulative Runoff

2.9488 in
.396 ac-ft

HYG Volume... .396 ac-ft (area under HYG curve)

***** UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .18000 hrs (ID: None Selected)
Computational Incr, Tm = .02400 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 10.13 cfs
Unit peak time Tp = .12000 hrs
Unit receding limb, Tr = .48000 hrs
Total unit time, Tb = .60000 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 10 yr year storm
Duration = 24.0000 hrs Rain Depth = 6.3000 in
Rain Dir = D:\HAESTAD\PPKW\RAINFALL\
Rain File -ID = SCSTYPES.RNF - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = D:\HAESTAD\PPKW\KINSTON\
HYG File - ID = KI_POST_.HYG - POST DITCH 2 10 yr
Tc = .1800 hrs
Drainage Area = 1.340 acres Runoff CN= 69

==========

Computational Time Increment	=	.02400 hrs
Computed Peak Time	=	12.1440 hrs
Computed Peak Flow	=	3.68 cfs
Time Increment for HYG File	=	.0500 hrs
Peak Time, Interpolated Output	=	12.1500 hrs
Peak Flow, Interpolated Output	=	3.67 cfs

==========

DRAINAGE AREA

ID:None Selected
CN = 69
Area = 1.340 acres
S = 4.4928 in
0.2S = .8986 in

Cumulative Runoff

2.9488 in
.329 ac-ft

HYG Volume... .329 ac-ft (area under HYG curve)

***** UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .18000 hrs (ID: None Selected)
Computational Incr, Tm = .02400 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak,	qp =	8.43 cfs
Unit peak time	Tp =	.12000 hrs
Unit receding limb,	Tr =	.48000 hrs
Total unit time,	Tb =	.60000 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 10 yr year storm
Duration = 24.0000 hrs Rain Depth = 6.3000 in
Rain Dir = D:\HAESTAD\PPKW\RAINFALL\
Rain File -ID = SCSTYPES.RNF - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = D:\HAESTAD\PPKW\KINSTON\
HYG File - ID = KI_POST_.HYG - POST DITCH 3 10 yr
Tc = .2000 hrs
Drainage Area = .440 acres Runoff CN= 69

==========

Computational Time Increment	=	.02667 hrs
Computed Peak Time	=	12.1600 hrs
Computed Peak Flow	=	1.18 cfs
Time Increment for HYG File	=	.0500 hrs
Peak Time, Interpolated Output	=	12.1500 hrs
Peak Flow, Interpolated Output	=	1.17 cfs

==========

DRAINAGE AREA

ID:None Selected
CN = 69
Area = .440 acres
S = 4.4928 in
0.2S = .8986 in

Cumulative Runoff

2.9488 in
.108 ac-ft

HYG Volume... .108 ac-ft (area under HYG curve)

***** UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .20000 hrs (ID: None Selected)
Computational Incr, Tm = .02667 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak,	qp =	2.49 cfs
Unit peak time	Tp =	.13333 hrs
Unit receding limb,	Tr =	.53333 hrs
Total unit time,	Tb =	.66667 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 10 yr year storm
Duration = 24.0000 hrs Rain Depth = 6.3000 in
Rain Dir = D:\HAESTAD\PPKW\RAINFALL\
Rain File -ID = SCSTYPES.RNF - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = D:\HAESTAD\PPKW\KINSTON\
HYG File - ID = KI_POST_.HYG - POST DITCH 4 10 yr
Tc = .1800 hrs
Drainage Area = 2.320 acres Runoff CN= 69

==========
Computational Time Increment = .02400 hrs
Computed Peak Time = 12.1440 hrs
Computed Peak Flow = 6.37 cfs

Time Increment for HYG File = .0500 hrs
Peak Time, Interpolated Output = 12.1500 hrs
Peak Flow, Interpolated Output = 6.35 cfs
==========

DRAINAGE AREA

ID:None Selected
CN = 69
Area = 2.320 acres
S = 4.4928 in
0.2S = .8986 in

Cumulative Runoff

2.9488 in
.570 ac-ft

HYG Volume... .570 ac-ft (area under HYG curve)

***** UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .18000 hrs (ID: None Selected)
Computational Incr, Tm = .02400 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 14.60 cfs
Unit peak time Tp = .12000 hrs
Unit receding limb, Tr = .48000 hrs
Total unit time, Tb = .60000 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 10 yr year storm
Duration = 24.0000 hrs Rain Depth = 6.3000 in
Rain Dir = D:\HAESTAD\PPKW\RAINFALL\
Rain File -ID = SCSTYPES.RNF - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = D:\HAESTAD\PPKW\KINSTON\
HYG File - ID = KI_POST_.HYG - POST DITCH 5 10 yr
Tc = .1800 hrs
Drainage Area = 7.500 acres Runoff CN= 64

==========
Computational Time Increment = .02400 hrs
Computed Peak Time = 12.1440 hrs
Computed Peak Flow = 17.06 cfs

Time Increment for HYG File = .0500 hrs
Peak Time, Interpolated Output = 12.1500 hrs
Peak Flow, Interpolated Output = 17.03 cfs
==========

DRAINAGE AREA

ID:None Selected
CN = 64
Area = 7.500 acres
S = 5.6250 in
0.2S = 1.1250 in

Cumulative Runoff

2.4797 in
1.550 ac-ft

HYG Volume... 1.550 ac-ft (area under HYG curve)

***** UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .18000 hrs (ID: None Selected)
Computational Incr, Tm = .02400 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 47.21 cfs
Unit peak time Tp = .12000 hrs
Unit receding limb, Tr = .48000 hrs
Total unit time, Tb = .60000 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 25 yr year storm
Duration = 24.0000 hrs Rain Depth = 7.3000 in
Rain Dir = D:\HAESTAD\PPKW\RAINFALL\
Rain File -ID = SCSTYPES.RNF - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = D:\HAESTAD\PPKW\KINSTON\
HYG File - ID = KI_POST_.HYG - CULVERT 1 25 yr
Tc = .1800 hrs
Drainage Area = 2.950 acres Runoff CN= 69

==========
Computational Time Increment = .02400 hrs
Computed Peak Time = 12.1440 hrs
Computed Peak Flow = 10.37 cfs

Time Increment for HYG File = .0500 hrs
Peak Time, Interpolated Output = 12.1500 hrs
Peak Flow, Interpolated Output = 10.33 cfs
==========

DRAINAGE AREA

ID:None Selected
CN = 69
Area = 2.950 acres
S = 4.4928 in
0.2S = .8986 in

Cumulative Runoff

3.7615 in
.925 ac-ft

HYG Volume... .925 ac-ft (area under HYG curve)

***** UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .18000 hrs (ID: None Selected)
Computational Incr, Tm = .02400 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 18.57 cfs
Unit peak time Tp = .12000 hrs
Unit receding limb, Tr = .48000 hrs
Total unit time, Tb = .60000 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 25 yr year storm
Duration = 24.0000 hrs Rain Depth = 7.3000 in
Rain Dir = D:\HAESTAD\PPKW\RAINFALL\
Rain File -ID = SCSTYPES.RNF - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = D:\HAESTAD\PPKW\KINSTON\
HYG File - ID = KI_POST_.HYG - CULVERT 2 25 yr
Tc = .2000 hrs
Drainage Area = 2.760 acres Runoff CN= 69

==========
Computational Time Increment = .02667 hrs
Computed Peak Time = 12.1600 hrs
Computed Peak Flow = 9.44 cfs

Time Increment for HYG File = .0500 hrs
Peak Time, Interpolated Output = 12.1500 hrs
Peak Flow, Interpolated Output = 9.39 cfs
==========

DRAINAGE AREA

ID:None Selected
CN = 69
Area = 2.760 acres
S = 4.4928 in
0.2S = .8986 in

Cumulative Runoff

3.7615 in
.865 ac-ft

HYG Volume... .865 ac-ft (area under HYG curve)

***** UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .20000 hrs (ID: None Selected)
Computational Incr, Tm = .02667 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 15.64 cfs
Unit peak time Tp = .13333 hrs
Unit receding limb, Tr = .53333 hrs
Total unit time, Tb = .66667 hrs

APPX 4

CHANNEL GEOMETRY

CALCULATIONS

Worksheet
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	ditch 1
Flow Element	Trapezoidal Cha
Method	Manning's Formı
Solve For	Channel Depth

Input Data		
Mannings Coeffic	0.030	
Slope	100000	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Bottom Width	2.00	ft
Discharge	4.40	cfs

Results		
Depth	0.28	ft
Flow Area	0.8	ft²
Wetted Perim	3.77	ft
Top Width	3.68	ft
Critical Depth	0.43	ft
Critical Slope	0.020232	ft/ft
Velocity	5.54	ft/s
Velocity Head	0.48	ft
Specific Ener	0.76	ft
Froude Numb	2.10	
Flow Type	Supercritical	

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Worksheet
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	ditch 2
Flow Element	Trapezoidal Cha
Method	Manning's Formı
Solve For	Channel Depth

Input Data		
Mannings Coeffic	0.030	
Slope	010000	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Bottom Width	2.00	ft
Discharge	3.70	cfs

Results		
Depth	0.47	ft
Flow Area	1.6	ft²
Wetted Perim	4.96	ft
Top Width	4.81	ft
Critical Depth	0.39	ft
Critical Slope	0.020745	ft/ft
Velocity	2.32	ft/s
Velocity Head	0.08	ft
Specific Ener	0.55	ft
Froude Numb	0.71	
Flow Type	Subcritical	

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Worksheet
Worksheet for Triangular Channel

Project Description	
Worksheet	ditch 3 v
Flow Element	Triangular Char
Method	Manning's Forr
Solve For	Channel Depth

Input Data		
Mannings Coeffic	0.030	
Slope	020000	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Discharge	1.21	cfs

Results		
Depth	0.41	ft
Flow Area	0.5	ft²
Wetted Perim	2.61	ft
Top Width	2.48	ft
Critical Depth	0.40	ft
Critical Slope	0.024078	ft/ft
Velocity	2.36	ft/s
Velocity Head	0.09	ft
Specific Energ	0.50	ft
Froude Numb	0.92	
Flow Type	Subcritical	

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Worksheet
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	ditch 4
Flow Element	Trapezoidal Cha
Method	Manning's Formı
Solve For	Channel Depth

Input Data		
Mannings Coeffic	0.030	
Slope	010000	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Bottom Width	2.00	ft
Discharge	6.40	cfs

Results		
Depth	0.62	ft
Flow Area	2.4	ft²
Wetted Perim	5.90	ft
Top Width	5.70	ft
Critical Depth	0.52	ft
Critical Slope	0.019186	ft/ft
Velocity	2.70	ft/s
Velocity Head	0.11	ft
Specific Ener	0.73	ft
Froude Numb	0.74	
Flow Type	Subcritical	

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```
        ******  HYCHL  ****** (Version 2.0) ******          Date 02-14-**
 Commands Read From File: D:\HYCHL\KIDITCH5.CHL

       JOB KINSTON DITCH5
       UNI 0
 ** UNITS PARAMETER = 0  (ENGLISH)
       CHL .036   17
       TRP 4 2 3
 ** LEFT SIDE SLOPE    2.0 AND RIGHT SIDE SLOPE    3.0
 ** THE BASE WIDTH OF THE TRAPEZOID (FT)    4.00
       LRR 0.50   2.41     2.65   0.047
 ** D50 (FT)      .50
 ** ANGLE OF REPOSE (DEGREES)   41.00
 ** SPECIFIC GRAVITY    2.65
 ** SHIELDS PARAMETER    .047
       END
***************END OF COMMAND FILE************

 KINSTON DITCH5
 ------------
 INPUT REVIEW
 ------------
   DESIGN PARAMETERS:
       DESIGN DISCHARGE (CFS):          17.00
       CHANNEL SHAPE:                TRAPEZOIDAL
       CHANNEL SLOPE (FT/FT):            .036
 -------------------------------------
 HYDRAULIC CALCULATIONS USING BATHURST
 -------------------------------------

 FLOW (CFS)                 17.00
 MAX DEPTH (FT)               .80
 AREA (FT^2)                 4.82
 WETTED PERIMETER (FT)       8.33
 HYDRAULIC RADIUS (FT)        .58
 AVG VELOCITY (FT/SEC)       3.53
 MANNINGS EQUIVALENT          .057
 Davg / D50                  1.20
 FROUDE NUMBER                .69
 REYNOLDS NUMBER (10^5)       .45
 ------------------
 STABILITY ANALYSIS
 ------------------

                      LINING     PERMIS SHR   CALC. SHR  STAB.
    CONDITION         TYPE       (LB/FT^2)    (LB/FT^2)  FACTOR   REMARKS
    ---------         ------     ----------   ---------  ------   -------
  BOTTOM; STRAIGHT   RIPRAP          2.42        1.80      1.34    STABLE
  SIDE; STRAIGHT     RIPRAP          1.77        1.58      1.12    STABLE

*** NORMAL END OF HYCHL ***
```

Use $D_{50} = 6''$ for Ditch 5 Ditch Lining

PURPOSE:

To design for the management of stormwater runoff to be conveyed via culverts for the ash landfill soil cover construction project.

PROJECT DESCRIPTION:

The project is located at the DuPont Kinston Plant in Kinston, North Carolina. Two culverts will be located under the proposed roadway: one along the east side and one at the south-east corner of the Ash Landfill.

DESIGN CRITERIA:

The design criteria is based on the *North Carolina Erosion and Sediment Control Planning and Design Manual* (Manual - Ref. 1). Culverts will be designed of sufficient capacity to convey the 25-year / 24-hour design storm. Culverts will be designed to allow for overtopping during the 25-year / 24-hour design storm.

Channel Protection: Permanent drainageways (i.e. channels to the proposed culvert inlets) will be designed of sufficient capacity to convey the 10-year / 24-hour design storm. Channel protection (to be installed upstream of the culvert inlet) will be designed and specified that is sufficient to handle the shear stresses and velocities from the 10-year / 24 hour storm event. Channel protection is presented in the stormwater drainage design.

Inlet / Outlet Protection: Outlet protection has been designed in accordance with the Manual, sections 6.40 and Appendix 8.06.

PROCEDURE:

The peak flow through the proposed culverts was determined in the stormwater drainage design calculation presented separately. The following table (also presented in the stormwater drainage design calculation) summarizes the peak runoff results for the 25-year storm to the proposed culverts:

Peak Flow Rate

Culvert	Peak Flow, Q (cfs)
Culvert 1	10.4
Culvert 2	9.4

The following steps will be taken:

1) Determine adequate culvert size and slope required to convey peak discharge.

2) Calculate inlet/outlet protection size and configuration.

The computer program *CulvertMaster* (Ref. 3) developed by Haestad Methods will be used for step 1. Outlet protection has been designed in accordance with the Manual, sections 6.40 and Appendix 8.06, for step 2.

Calculations

1. Determine Culvert Sizes and Slopes

Culverts were sized based on the site conditions and the peak flow for a 25-year/24-hour storm event. Appendix 1 contains computer output for the culvert. The following table summarizes the results of the analyses:

CULVERT INFORMATION FOR 25-YEAR/24-HOUR STORM EVENT

Culvert	Size/ Material	Computed Inlet Velocity (ft/s)	Computed Inlet H.W.E. (ft)	Computed Inlet Slope (ft/ft)	Upstream Invert Elevation (ft.)	Downstream Outlet Elevation (ft.)
Culvert 1	18" HDPE Barrel	9.13	64.86	0.02	62.5	61.5
Culvert 2	18" HDPE Barrel	18.35	62.61	0.15	60.5	53.0

2. Determine Inlet/Outlet Protection for the Culverts

Inlet protection Culverts 1 and 2: Inlet protection to culverts 1 and 2 will be provided for with riprap channel protection extended 5-feet upstream for each ditch contributing flows (i.e. ditches 1 and 2 for culvert 1 and ditches 3 and 4 for culvert 2).

Outlet protection Culverts 1 and 2: Outlet protection has been required utilizing the nomograph provided as Figure 8.06a in the Manual. Nomographs are included as Appendix 2. Outlet riprap protection will be provided as detailed on the following table and as presented on the drawings:

CULVERT	PIPE DIAMETER (in)	RIP-RAP SIZE (d50 - in.)	RIP-RAP Thickness (in.)	OUTLET La (ft)	OUTLET W (ft)
1	18	12	27	**	10
2	18	12	27	26	10

** = Outlet stone shall be extended to the elevation 55 contour to prevent erosion in this area.

REFERENCES:

1) *Erosion and Sediment Control Planning and Design Manual,,* North Carolina Sediment Control Commission, September 1, 1988

2) Stormwater Drainage Design – Peak Flow Rate Calculation for Kinston Ash Landfill Closure, performed by Mac Bonner, URS Corp., February, 2003.

3) "*Culvertmaster*," Version 2.0, developed by Haestad Methods, Inc., 2000.

APPENDICES

APPENDIX 1 CULVERT ANALYSIS OUTPUT

APPENDIX 2 OUTLET PROTECTION NOMOGRAPHS

APPENDIX 1

CULVERT ANALYSIS OUTPUT

Culvert Designer/Analyzer Report
culvert 1

Component:Culvert-1

Culvert Summary					
Computed Headwater Elev	64.86	ft	Discharge	10.37	cfs
Inlet Control HW Elev.	64.86	ft	Tailwater Elevation	N/A	ft
Outlet Control HW Elev.	64.77	ft	Control Type	Inlet Control	
Headwater Depth/Height	1.57				

Grades					
Upstream Invert	62.50	ft	Downstream Invert	61.50	ft
Length	50.00	ft	Constructed Slope	0.020000	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	0.92	ft
Slope Type	Steep		Normal Depth	0.88	ft
Flow Regime	Supercritical		Critical Depth	1.24	ft
Velocity Downstream	9.13	ft/s	Critical Slope	0.008195	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.012	
Section Material	HDPE (Smooth Interior)		Span	1.50	ft
Section Size	18 inch		Rise	1.50	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	64.77	ft	Upstream Velocity Head	0.69	ft
Ke	0.50		Entrance Loss	0.34	ft

Inlet Control Properties					
Inlet Control HW Elev.	64.86	ft	Flow Control	N/A	
Inlet Type	Square edge w/headwall		Area Full	1.8	ft²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Designer/Analyzer Report
culvert 2

Component:Culvert-1

Culvert Summary					
Computed Headwater Elev	62.61	ft	Discharge	9.44	cfs
Inlet Control HW Elev.	62.53	ft	Tailwater Elevation	N/A	ft
Outlet Control HW Elev.	62.61	ft	Control Type	Entrance Control	
Headwater Depth/Height	1.41				

Grades					
Upstream Invert	60.50	ft	Downstream Invert	53.00	ft
Length	50.00	ft	Constructed Slope	0.150000	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	0.50	ft
Slope Type	Steep		Normal Depth	0.47	ft
Flow Regime	Supercritical		Critical Depth	1.19	ft
Velocity Downstream	18.35	ft/s	Critical Slope	0.007358	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.012	
Section Material	HDPE (Smooth Interior)		Span	1.50	ft
Section Size	18 inch		Rise	1.50	ft
Number Sections	1				

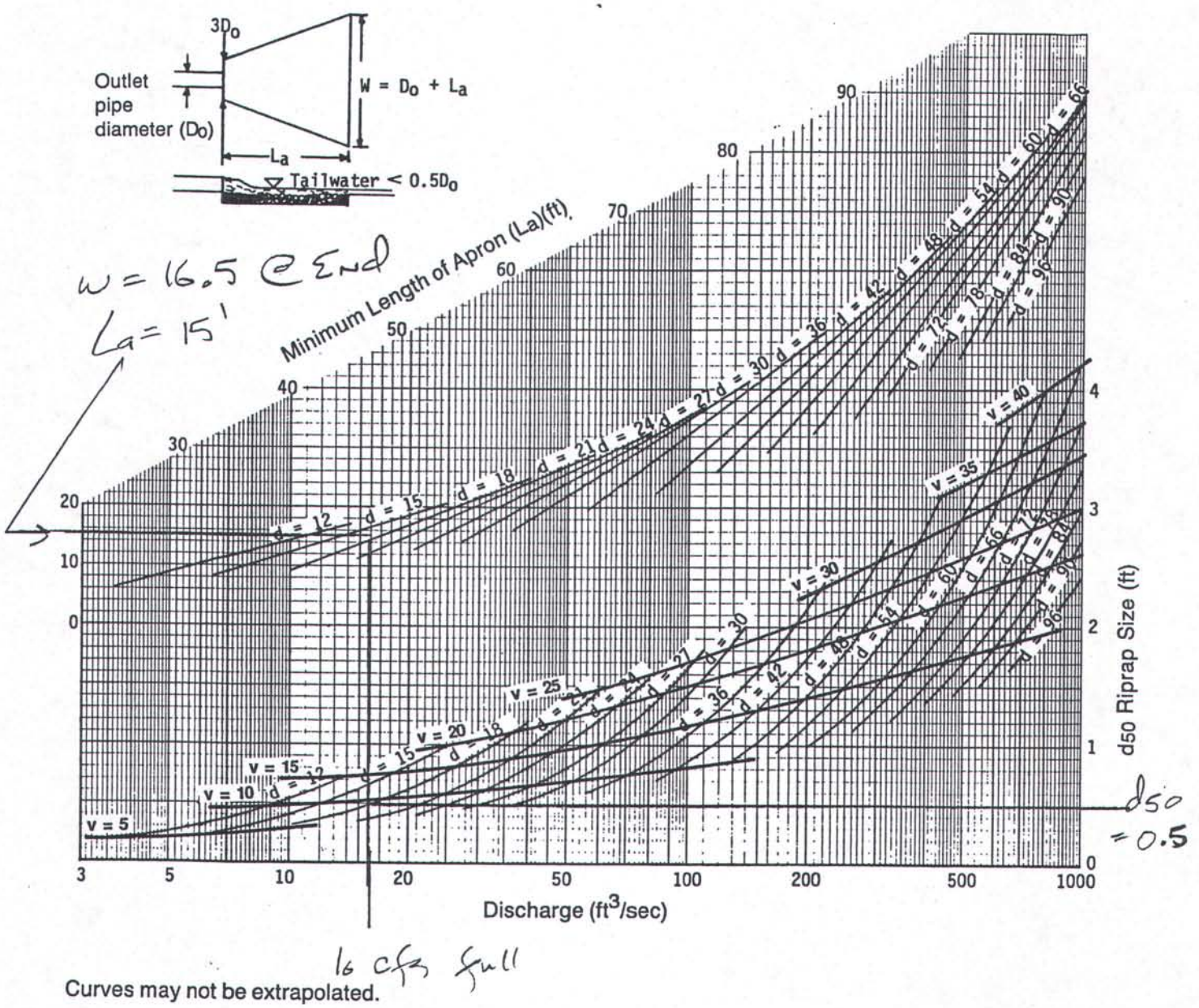
Outlet Control Properties					
Outlet Control HW Elev.	62.61	ft	Upstream Velocity Head	0.62	ft
Ke	0.50		Entrance Loss	0.31	ft

Inlet Control Properties					
Inlet Control HW Elev.	62.53	ft	Flow Control	N/A	
Inlet Type	Square edge w/headwall		Area Full	1.8	ft²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

APPENDIX 2

CULVERT OUTLET PROTECTION NOMOGRAPHS

Culvert 1



W = 16.5 @ End

La = 15'

d50 = 0.5'

16 cfs full

Curves may not be extrapolated.

Figure 8.06a Design of outlet protection protection from a round pipe flowing full, minimum tailwater condition (T_w < 0.5 diameter).

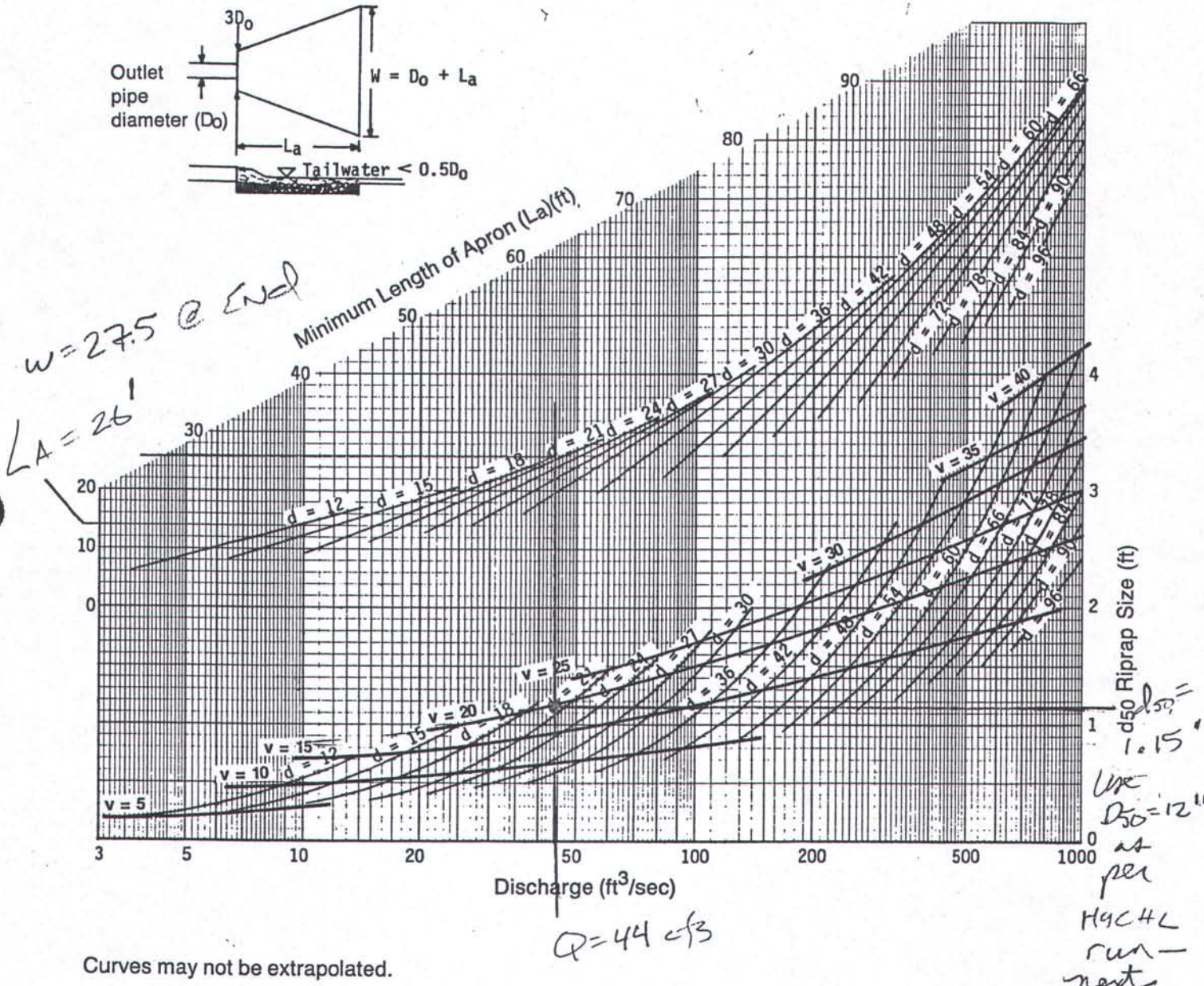
Culvert 1

Q = 10.37 cfs

V = 9.13 fps

Equivalent Q_{full} = 16 cfs

Culvert 2



W = 27.5 @ End

LA = 26'

Q = 44 cfs

d50 = 1.15'

Use D50 = 12" as per HYCHL run — next page

Curves may not be extrapolated.

Figure 8.06a Design of outlet protection protection from a round pipe flowing full, minimum tailwater condition (T_w < 0.5 diameter).

Culvert 2

Q = 9.5 cfs

V = 18.94 use 19

Equivalent Q_{FULL} = 44 cfs

```
      ******  HYCHL  ****** (Version 2.0) ******          Date 02-25-**
Commands Read From File: D:\HYCHL\KICULV02.CHL

      JOB KI-CULV2 OUTLET
      UNI 0
** UNITS PARAMETER = 0  (ENGLISH)
      CHL .06    9.5
      TRP 2 3 3
** LEFT SIDE SLOPE    3.0 AND RIGHT SIDE SLOPE    3.0
** THE BASE WIDTH OF THE TRAPEZOID (FT)    2.00
      LRR 1.00 2 41 2.65 0.047
** D50 (FT)    1.00
** ANGLE OF REPOSE (DEGREES)    41.00
** SPECIFIC GRAVITY    2.65
** SHIELDS PARAMETER    .047
      END
***************END OF COMMAND FILE************

KI-CULV2 OUTLET
------------
INPUT REVIEW
------------
  DESIGN PARAMETERS:
      DESIGN DISCHARGE (CFS):              9.50
      CHANNEL SHAPE:                   TRAPEZOIDAL
      CHANNEL SLOPE (FT/FT):               .060

*** WARNING *** DEPTH DID NOT CONVERGE. PROGRAM WILL CONTINUE
               WITH MOST RECENT VALUE
-------------------------------------
HYDRAULIC CALCULATIONS USING BATHURST
-------------------------------------

FLOW (CFS)                  9.50
MAX DEPTH (FT)               .79
AREA (FT^2)                 3.50
WETTED PERIMETER (FT)       7.04
HYDRAULIC RADIUS (FT)        .50
AVG VELOCITY (FT/SEC)       2.71
MANNINGS EQUIVALENT          .086
Davg / D50                   .52
FROUDE NUMBER                .54
REYNOLDS NUMBER (10^5)      1.28
*** WARNING *** REYNOLDS NUMBER IS LARGER THAN 10^5

------------------
STABILITY ANALYSIS
------------------

                    LINING     PERMIS SHR   CALC. SHR   STAB.
   CONDITION        TYPE       (LB/FT^2)    (LB/FT^2)   FACTOR   REMARKS
   ---------        ------     ----------   ---------   ------   -------
 BOTTOM; STRAIGHT   RIPRAP          4.84        2.97       1.63   STABLE
 SIDE; STRAIGHT     RIPRAP          4.24        2.52       1.69   STABLE

*** NORMAL END OF HYCHL ***
```

Culvert 2 Outlet

D_{50} = 12"

Stable for outlet

PURPOSE:

To reduce the discharge of sediment laden runoff to the existing water courses during construction of the Ash Landfill soil cap.

PROCEDURE:

The design criteria is based on the *North Carolina Erosion and Sediment Control Planning and Design Manual (Manual)* (Ref. 2).

Two sediment traps will be used during construction to prevent sediment loss from the site. The sediment traps will be located near the outlets for Culvert #1 and #2. A standard North Carolina stone outlet sediment trap will be used to control sediment runoff during construction. Each sediment trap is designed to provide 1,800 cubic feet per drainage acre and achieve a minimum trap efficiency of 75%.

1. Delineate and Estimate Size of Watershed Areas to the Sediment Traps

The watershed areas to the sediment traps were delineated on a 1" = 50' drawing of the Final Grading plan for the Ash Landfill. To be conservative, the worst case drainage areas were used for sizing the sediment traps. The drainage areas were calculated using the AutoCAD area command.

2. Determine Required Volume

Each sediment trap is designed to provide 1,800 cubic feet per drainage acre.

Displayed below is a summary of the required volume for the sediment traps.

SEDIMENT TRAP VOLUMES

Watershed	Area (ac)	Required Volume (cf)
Sediment Trap 1	4.1	7,450
Sediment Trap 2	2.6	4,765

3. Calculate Required Elevations and Spillway Configuration

The minimum width of the outlet spillway was sized per Table 6.60a of the *Manual*. In addition, a maximum flow depth of 1 foot, and a minimum freeboard of 0.5 feet has been provided for each sediment trap. See attached PondPack (Ref. 2) routing caculations. The peak flow was determined by inputing the CN value and tc path information for each drainage area into PondPack. These values were determined using the same methodology as shown in the Stormwater Management design calculations. Stone used in the outlet shall be small riprap. Sediment shall be removed and the trap restored to its original dimensions when the sediment has accumulated to ½ the design depth of the trap.

SEDIMENT TRAP DETAILS

Sediment Trap	Required Volume (cf)	Proposed Volume (cf)	Bottom Elevation	Top of Berm	Spillway Elevation	Spillway Width	Cleanout Elevation
Sed. Trap 1	7,450	8,735	60.5'	64.0'	62.5'	10'	61.5'
Sed. Trap 2	4,765	6,426	47.5'	51.0'	49.5'	8'	48.5'

A minimum trap efficiency of 75% is required in the Coast Plain regions. The following formula was used to ensure that the required efficiency has been provided:

Surface area at design flow (sf) = (0.01)(peak inflow rate)(43560 sf/ac) (cfs) - Page 6.60.2 in *Manual*

SEDIMENT TRAP EFFICIENCY

Sediment Trap	Peak Inflow Rate (cfs)	Required Surface Area (sf)	Proposed Surface Area (sf)
Sed. Trap 1	16.30	7,100	7,147
Sed. Trap 2	10.34	4,512	4,753

REFERENCES:

1) "Urban Hydrology for Small Watersheds," U.S. Dept. of Agriculture, Soil Conservation Service, Engineering Division, Technical Release 55, June 1986.

2) "North Carolina Erosion and Sediment Control Planning and Design Manual," prepared by North Carolina Sedimentation Control Commission, North Carolina Department of Natural Resources and Commuity Development and North Carolina Agricultural Extension Service, September 1, 1988.

3) *"TR-55,"* Urban Hydrology for Small Watersheds, Version. 2.1, U.S. Dept. of Agriculture, Soil Conservation Service.

4) "Soil Survey of Lenoir County, North Carolina." United States Department of Agriculture Soil Conservation Service in cooperation with North Carolina Agricultural Experiment Station and Lenoir County Board of Commissioners, March 1977.

5) "*PondPack*" Version 8.0, developed by Haestad Methods, Inc., 2002.

Sediment Trap #1

RUNOFF CURVE NUMBER COMPUTATION Version 2.10

Project : DuPont Kinston User: HCD Date: 02-25-2003
County : Lenoir State: NC Checked: ____ Date: _____
Subtitle: Sediment Trap #1

COVER DESCRIPTION	Hydrologic Soil Group A	B	C	D
		Acres (CN)		
DEVELOPING URBAN AREA (No Vegetation)				
Newly graded area (pervious only)	-	4.1(86)	-	-
Total Area (by Hydrologic Soil Group)		4.1		

TOTAL DRAINAGE AREA: 4.1 Acres WEIGHTED CURVE NUMBER: 86

TIME OF CONCENTRATION AND TRAVEL TIME — Version 2.10

Project : DuPont Kinston — User: HCD — Date: 02-25-2003
County : Lenoir — State: NC — Checked: ____ — Date: _____
Subtitle: Sediment Trap #1

Subarea #1

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	3.9	150	.05	a					0.018
Shallow Concent'd		115	.05	u					0.009
Shallow Concent'd		45	.33	u					0.001
Open Channel		420	.0175		.0355	.0	8.3		0.029
Open Channel		60	.005		.0131	.45	4.8		0.005
								Time of Concentration =	0.06*
									=====

--- Sheet Flow Surface Codes ---

A Smooth Surface	F Grass, Dense	--- Shallow Concentrated ---
B Fallow (No Res.)	G Grass, Burmuda	--- Surface Codes ---
C Cultivated < 20 % Res.	H Woods, Light	P Paved
D Cultivated > 20 % Res.	I Woods, Dense	U Unpaved
E Grass-Range, Short	J Range, Natural	

Table of Contents

MASTER DESIGN STORM SUMMARY

Network Storm Collection: Kinston

Return Event	Total Depth in	Rainfall Type	RNF ID
2yr	3.9000	Synthetic Curve	TypeIII 24hr
10yr	6.3000	Synthetic Curve	TypeIII 24hr
100yr	9.0000	Synthetic Curve	TypeIII 24hr

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
*OUT 10		JCT	2	.443		12.3000	4.24		
*OUT 10		JCT	10	1.149		12.1500	15.39		
*OUT 10		JCT	100	2.001		12.1000	24.90		
POND 10	IN	POND	2	.643		12.1000	7.87		
POND 10	IN	POND	10	1.349		12.1000	16.34		
POND 10	IN	POND	100	2.202		12.1000	26.12		
POND 10	OUT	POND	2	.443		12.3000	4.24	62.75	.235
POND 10	OUT	POND	10	1.149		12.1500	15.39	63.08	.281
POND 10	OUT	POND	100	2.001		12.1000	24.90	63.28	.312
SUBAREA 10		AREA	2	.643		12.1000	7.87		
SUBAREA 10		AREA	10	1.349		12.1000	16.34		
SUBAREA 10		AREA	100	2.202		12.1000	26.12		

File.... C:\Program Files\Haestad\PPKW\KINSTON_SEDTRAP1.PPW

USER DEFINED VOLUME RATING TABLE

Elevation (ft)	Volume (ac-ft)
60.50	.000
61.00	.027
62.00	.140
62.50	.201
63.00	.269
64.00	.422

File.... C:\Program Files\Haestad\PPKW\KINSTON_SEDTRAP1.PPW

REQUESTED POND WS ELEVATIONS:

Min. Elev.= 60.50 ft
Increment = .10 ft
Max. Elev.= 64.00 ft

****
OUTLET CONNECTIVITY
****

---> Forward Flow Only (UpStream to DnStream)
<--- Reverse Flow Only (DnStream to UpStream)
<---> Forward and Reverse Both Allowed

Structure	No.		Outfall	E1, ft	E2, ft
Weir-XY Points	ES	--->	TW	62.500	64.000
TW SETUP, DS Channel					

File.... C:\Program Files\Haestad\PPKW\KINSTON_SEDTRAP1.PPW

OUTLET STRUCTURE INPUT DATA

Structure ID = ES
Structure Type = Weir-XY Points

# of Openings = 1
WEIR X-Y GROUND POINTS

X, ft	Elev, ft
.00	64.00
4.50	62.50
14.50	62.50
19.00	64.00

Lowest Elev. = 62.50 ft

Weir Coeff. = 3.100000

Weir TW effects (Use adjustment equation)

Structure ID = TW
Structure Type = TW SETUP, DS Channel

FREE OUTFALL CONDITIONS SPECIFIED

CONVERGENCE TOLERANCES...
Maximum Iterations= 30
Min. TW tolerance = .01 ft
Max. TW tolerance = .01 ft
Min. HW tolerance = .01 ft
Max. HW tolerance = .01 ft
Min. Q tolerance = .10 cfs
Max. Q tolerance = .10 cfs

***** COMPOSITE OUTFLOW SUMMARY ****

WS Elev, Total Q		Notes		
		Converge		
Elev. ft	Q cfs	TW Elev ft	Error +/-ft	Contributing Structures
60.50	.00	Free Outfall		None contributing
60.60	.00	Free Outfall		None contributing
60.70	.00	Free Outfall		None contributing
60.80	.00	Free Outfall		None contributing
60.90	.00	Free Outfall		None contributing
61.00	.00	Free Outfall		None contributing
61.10	.00	Free Outfall		None contributing
61.20	.00	Free Outfall		None contributing
61.30	.00	Free Outfall		None contributing
61.40	.00	Free Outfall		None contributing
61.50	.00	Free Outfall		None contributing
61.60	.00	Free Outfall		None contributing
61.70	.00	Free Outfall		None contributing
61.80	.00	Free Outfall		None contributing
61.90	.00	Free Outfall		None contributing
62.00	.00	Free Outfall		None contributing
62.10	.00	Free Outfall		None contributing
62.20	.00	Free Outfall		None contributing
62.30	.00	Free Outfall		None contributing
62.40	.00	Free Outfall		None contributing
62.50	.00	Free Outfall		ES
62.60	1.00	Free Outfall		ES
62.70	2.89	Free Outfall		ES
62.80	5.42	Free Outfall		ES
62.90	8.51	Free Outfall		ES
63.00	12.12	Free Outfall		ES
63.10	16.24	Free Outfall		ES
63.20	20.85	Free Outfall		ES
63.30	25.95	Free Outfall		ES
63.40	31.52	Free Outfall		ES
63.50	37.58	Free Outfall		ES
63.60	44.11	Free Outfall		ES
63.70	51.12	Free Outfall		ES
63.80	58.62	Free Outfall		ES
63.90	66.60	Free Outfall		ES
64.00	75.07	Free Outfall		ES

SUMMARY FOR HYDROGRAPH ADDITION
at Node: POND 10 IN

HYG Directory: C:\Program Files\Haestad\PPKW\

Upstream Link ID	Upstream Node ID	HYG file	HYG ID	HYG tag
ADDLINK 10	SUBAREA 10		SUBAREA 10	10yr

INFLOWS TO: POND 10 IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
	SUBAREA 10	10yr	1.349	12.1000	16.34

TOTAL FLOW INTO: POND 10 IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
	POND 10 IN	10yr	1.349	12.1000	16.34

TOTAL NODE INFLOW...
HYG file =
HYG ID = POND 10 IN
HYG Tag = 10yr

Peak Discharge = 16.34 cfs
Time to Peak = 12.1000 hrs
HYG Volume = 1.349 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
6.7500	.00	.00	.00	.01	.01
7.0000	.01	.01	.02	.02	.02
7.2500	.03	.03	.03	.03	.04
7.5000	.04	.05	.05	.05	.06
7.7500	.06	.06	.07	.07	.08
8.0000	.08	.08	.09	.09	.10
8.2500	.11	.11	.12	.12	.13
8.5000	.14	.14	.15	.16	.17
8.7500	.18	.18	.19	.20	.21
9.0000	.22	.23	.24	.25	.26
9.2500	.27	.28	.29	.30	.31
9.5000	.32	.33	.34	.35	.36
9.7500	.37	.39	.40	.41	.42
10.0000	.44	.45	.47	.48	.50
10.2500	.52	.54	.56	.59	.61
10.5000	.63	.65	.68	.70	.73
10.7500	.75	.77	.80	.83	.85
11.0000	.88	.92	.97	1.02	1.10
11.2500	1.17	1.26	1.33	1.42	1.50
11.5000	1.60	1.83	2.22	2.75	3.51
11.7500	4.22	5.10	5.92	6.93	9.41
12.0000	13.52	15.43	16.34	14.68	10.90
12.2500	9.05	7.79	6.89	5.89	5.05
12.5000	4.04	3.40	2.80	2.53	2.37
12.7500	2.27	2.16	2.07	1.97	1.88
13.0000	1.77	1.70	1.63	1.59	1.56
13.2500	1.53	1.50	1.48	1.45	1.43
13.5000	1.40	1.38	1.35	1.33	1.30
13.7500	1.28	1.25	1.23	1.20	1.17
14.0000	1.14	1.12	1.10	1.09	1.07
14.2500	1.06	1.05	1.04	1.02	1.01
14.5000	1.00	.99	.97	.96	.95
14.7500	.94	.92	.91	.90	.89

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
15.0000	.87	.86	.85	.84	.82
15.2500	.81	.80	.79	.77	.76
15.5000	.75	.73	.72	.71	.69
15.7500	.68	.67	.66	.64	.63
16.0000	.62	.61	.60	.59	.58
16.2500	.58	.57	.57	.56	.56
16.5000	.55	.54	.54	.53	.53
16.7500	.52	.52	.51	.50	.50
17.0000	.49	.49	.48	.48	.47
17.2500	.46	.46	.45	.45	.44
17.5000	.44	.43	.42	.42	.41
17.7500	.41	.40	.40	.39	.39
18.0000	.38	.37	.37	.37	.37
18.2500	.36	.36	.36	.36	.36
18.5000	.36	.35	.35	.35	.35
18.7500	.35	.35	.34	.34	.34
19.0000	.34	.34	.34	.33	.33
19.2500	.33	.33	.33	.33	.32
19.5000	.32	.32	.32	.32	.32
19.7500	.31	.31	.31	.31	.31
20.0000	.31	.30	.30	.30	.30
20.2500	.30	.30	.30	.29	.29
20.5000	.29	.29	.29	.29	.29
20.7500	.28	.28	.28	.28	.28
21.0000	.28	.28	.28	.28	.27
21.2500	.27	.27	.27	.27	.27
21.5000	.27	.26	.26	.26	.26
21.7500	.26	.26	.26	.26	.25
22.0000	.25	.25	.25	.25	.25
22.2500	.25	.24	.24	.24	.24
22.5000	.24	.24	.24	.24	.24
22.7500	.23	.23	.23	.23	.23
23.0000	.23	.23	.22	.22	.22
23.2500	.22	.22	.22	.22	.22
23.5000	.21	.21	.21	.21	.21
23.7500	.21	.21	.21	.20	.20
24.0000	.20	.15	.05	.01	.00
24.2500	.00	.00			

LEVEL POOL ROUTING SUMMARY

HYG Dir = C:\Program Files\Haestad\PPKW\
Inflow HYG file = NONE STORED - POND 10 IN 10yr
Outflow HYG file = NONE STORED - POND 10 OUT 10yr

Pond Node Data = POND 10
Pond Volume Data = POND 10
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS

Starting WS Elev	=	60.50 ft
Starting Volume	=	.000 ac-ft
Starting Outflow	=	.00 cfs
Starting Infiltr.	=	.00 cfs
Starting Total Qout	=	.00 cfs
Time Increment	=	.0500 hrs

INFLOW/OUTFLOW HYDROGRAPH SUMMARY

Peak Inflow	=	16.34 cfs	at	12.1000 hrs
Peak Outflow	=	15.39 cfs	at	12.1500 hrs
Peak Elevation	=	63.08 ft		
Peak Storage	=	.281 ac-ft		

MASS BALANCE (ac-ft)

+ Initial Vol	=	.000
+ HYG Vol IN	=	1.349
- Infiltration	=	.000
- HYG Vol OUT	=	1.149
- Retained Vol	=	.201
Unrouted Vol	=	.000 ac-ft (.000% of Inflow Volume)

POND ROUTED TOTAL OUTFLOW HYG...
HYG file =
HYG ID = POND 10 OUT
HYG Tag = 10yr

Peak Discharge	15.39 cfs
Time to Peak	12.1500 hrs
HYG Volume	1.149 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
6.7500	.00	.00	.00	.00	.00
7.0000	.00	.00	.00	.00	.00
7.2500	.00	.00	.00	.00	.00
7.5000	.00	.00	.00	.00	.00
7.7500	.00	.00	.00	.00	.00
8.0000	.00	.00	.00	.00	.00
8.2500	.00	.00	.00	.00	.00
8.5000	.00	.00	.00	.00	.00
8.7500	.00	.00	.00	.00	.00
9.0000	.00	.00	.00	.00	.00
9.2500	.00	.00	.00	.00	.00
9.5000	.00	.00	.00	.00	.00
9.7500	.00	.00	.00	.00	.00
10.0000	.00	.00	.00	.00	.00
10.2500	.00	.00	.00	.00	.00
10.5000	.00	.00	.00	.00	.00
10.7500	.00	.00	.00	.00	.00
11.0000	.00	.00	.00	.00	.00
11.2500	.00	.00	.00	.00	.00
11.5000	.00	.00	.00	.00	.00
11.7500	.00	1.17	3.14	4.96	6.93
12.0000	9.96	13.16	15.11	15.39	13.53
12.2500	11.00	9.18	7.94	6.96	6.01
12.5000	5.12	4.35	3.66	3.11	2.77
12.7500	2.57	2.42	2.28	2.17	2.06
13.0000	1.95	1.86	1.77	1.70	1.64
13.2500	1.60	1.56	1.53	1.50	1.48
13.5000	1.45	1.42	1.40	1.37	1.35
13.7500	1.32	1.30	1.27	1.24	1.22
14.0000	1.19	1.17	1.14	1.12	1.10
14.2500	1.09	1.07	1.06	1.05	1.03
14.5000	1.02	1.01	1.00	.99	.98
14.7500	.97	.96	.95	.94	.93

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
15.0000	.91	.90	.89	.88	.87
15.2500	.85	.84	.83	.81	.80
15.5000	.79	.78	.76	.75	.74
15.7500	.72	.71	.70	.69	.67
16.0000	.66	.65	.64	.62	.61
16.2500	.61	.60	.59	.58	.58
16.5000	.57	.56	.56	.55	.55
16.7500	.54	.53	.53	.52	.52
17.0000	.51	.51	.50	.50	.49
17.2500	.48	.48	.47	.47	.46
17.5000	.46	.45	.44	.44	.43
17.7500	.43	.42	.42	.41	.40
18.0000	.40	.39	.39	.38	.38
18.2500	.38	.37	.37	.37	.37
18.5000	.36	.36	.36	.36	.36
18.7500	.35	.35	.35	.35	.35
19.0000	.34	.34	.34	.34	.34
19.2500	.34	.33	.33	.33	.33
19.5000	.33	.33	.32	.32	.32
19.7500	.32	.32	.32	.31	.31
20.0000	.31	.31	.31	.31	.30
20.2500	.30	.30	.30	.30	.30
20.5000	.30	.29	.29	.29	.29
20.7500	.29	.29	.29	.29	.28
21.0000	.28	.28	.28	.28	.28
21.2500	.28	.28	.27	.27	.27
21.5000	.27	.27	.27	.27	.27
21.7500	.26	.26	.26	.26	.26
22.0000	.26	.26	.26	.25	.25
22.2500	.25	.25	.25	.25	.25
22.5000	.24	.24	.24	.24	.24
22.7500	.24	.24	.24	.23	.23
23.0000	.23	.23	.23	.23	.23
23.2500	.23	.22	.22	.22	.22
23.5000	.22	.22	.22	.21	.21
23.7500	.21	.21	.21	.21	.21
24.0000	.21	.20	.17	.14	.10
24.2500	.08	.06	.04	.03	.02
24.5000	.02	.01	.01	.01	.00
24.7500	.00	.00			

Index of Starting Page Numbers for ID Names

Sediment Trap #2

RUNOFF CURVE NUMBER COMPUTATION Version 2.10

Project : DuPont Kinston User: HCD Date: 02-25-2003

County : Lenoir State: NC Checked: ____ Date: _____

Subtitle: Sediment Trap

COVER DESCRIPTION	Hydrologic Soil Group A	B	C	D
		Acres (CN)		
DEVELOPING URBAN AREA (No Vegetation)				
Newly graded area (pervious only)	-	2.6(86)	-	-
Total Area (by Hydrologic Soil Group)		2.6		

TOTAL DRAINAGE AREA: 2.6 Acres WEIGHTED CURVE NUMBER: 86

TIME OF CONCENTRATION AND TRAVEL TIME Version 2.10
Project : DuPont Kinston User: HCD Date: 02-25-2003
County : Lenoir State: NC Checked: ____ Date: _____
Subtitle: Sediment Trap #2

Subarea #1

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	3.9	150	.05	a					0.018
Shallow Concent'd		125	.05	u					0.010
Shallow Concent'd		50	.33	u					0.001
Open Channel		340	.005		.0355		8.4		0.044
Open Channel		50	.14		.0121.5		4.7		0.001
						Time of Concentration =			0.07*
									=====

--- Sheet Flow Surface Codes ---

A Smooth Surface
B Fallow (No Res.)
C Cultivated < 20 % Res.
D Cultivated > 20 % Res.
E Grass-Range, Short
F Grass, Dense
G Grass, Burmuda
H Woods, Light
I Woods, Dense
J Range, Natural

--- Shallow Concentrated --- Surface Codes ---

P Paved
U Unpaved

Table of Contents

MASTER DESIGN STORM SUMMARY

Network Storm Collection: Kinston

Return Event	Total Depth in	Rainfall Type	RNF ID
2yr	3.9000	Synthetic Curve	TypeIII 24hr
10yr	6.3000	Synthetic Curve	TypeIII 24hr
100yr	9.0000	Synthetic Curve	TypeIII 24hr

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
*OUT 10		JCT	2	.260		12.3500	2.20		
*OUT 10		JCT	10	.708		12.1500	9.80		
*OUT 10		JCT	100	1.249		12.1000	15.83		
POND 10	IN	POND	2	.408		12.1000	4.99		
POND 10	IN	POND	10	.855		12.1000	10.36		
POND 10	IN	POND	100	1.396		12.1000	16.56		
POND 10	OUT	POND	2	.260		12.3500	2.20	49.69	.166
POND 10	OUT	POND	10	.708		12.1500	9.80	50.00	.196
POND 10	OUT	POND	100	1.249		12.1000	15.83	50.16	.215
SUBAREA 10		AREA	2	.408		12.1000	4.99		
SUBAREA 10		AREA	10	.855		12.1000	10.36		
SUBAREA 10		AREA	100	1.396		12.1000	16.56		

File.... C:\Program Files\Haestad\PPKW\KINSTON_SEDTRAP2.PPW

USER DEFINED VOLUME RATING TABLE

Elevation (ft)	Volume (ac-ft)
47.50	.000
48.00	.030
49.00	.104
49.50	.148
50.00	.196
51.00	.309

File.... C:\Program Files\Haestad\PPKW\KINSTON_SEDTRAP2.PPW

REQUESTED POND WS ELEVATIONS:

Min. Elev.= 47.50 ft
Increment = .10 ft
Max. Elev.= 51.00 ft

****
OUTLET CONNECTIVITY
****

---> Forward Flow Only (UpStream to DnStream)
<--- Reverse Flow Only (DnStream to UpStream)
<---> Forward and Reverse Both Allowed

Structure	No.		Outfall	E1, ft	E2, ft
Weir-XY Points TW SETUP, DS Channel	ES	--->	TW	49.500	51.000

File.... C:\Program Files\Haestad\PPKW\KINSTON_SEDTRAP2.PPW

OUTLET STRUCTURE INPUT DATA

Structure ID = ES
Structure Type = Weir-XY Points

# of Openings = 1
WEIR X-Y GROUND POINTS

X, ft	Elev, ft
.00	51.00
4.50	49.50
12.50	49.50
17.00	51.00

Lowest Elev. = 49.50 ft

Weir Coeff. = 3.100000

Weir TW effects (Use adjustment equation)

Structure ID = TW
Structure Type = TW SETUP, DS Channel

FREE OUTFALL CONDITIONS SPECIFIED

CONVERGENCE TOLERANCES...
Maximum Iterations= 30
Min. TW tolerance = .01 ft
Max. TW tolerance = .01 ft
Min. HW tolerance = .01 ft
Max. HW tolerance = .01 ft
Min. Q tolerance = .10 cfs
Max. Q tolerance = .10 cfs

File.... C:\Program Files\Haestad\PPKW\KINSTON_SEDTRAP2.PPW

***** COMPOSITE OUTFLOW SUMMARY ****

WS Elev, Total Q		Notes		
		Converge		
Elev. ft	Q cfs	TW Elev ft	Error +/-ft	Contributing Structures
47.50	.00	Free Outfall		None contributing
47.60	.00	Free Outfall		None contributing
47.70	.00	Free Outfall		None contributing
47.80	.00	Free Outfall		None contributing
47.90	.00	Free Outfall		None contributing
48.00	.00	Free Outfall		None contributing
48.10	.00	Free Outfall		None contributing
48.20	.00	Free Outfall		None contributing
48.30	.00	Free Outfall		None contributing
48.40	.00	Free Outfall		None contributing
48.50	.00	Free Outfall		None contributing
48.60	.00	Free Outfall		None contributing
48.70	.00	Free Outfall		None contributing
48.80	.00	Free Outfall		None contributing
48.90	.00	Free Outfall		None contributing
49.00	.00	Free Outfall		None contributing
49.10	.00	Free Outfall		None contributing
49.20	.00	Free Outfall		None contributing
49.30	.00	Free Outfall		None contributing
49.40	.00	Free Outfall		None contributing
49.50	.00	Free Outfall		ES
49.60	.81	Free Outfall		ES
49.70	2.34	Free Outfall		ES
49.80	4.40	Free Outfall		ES
49.90	6.94	Free Outfall		ES
50.00	9.93	Free Outfall		ES
50.10	13.36	Free Outfall		ES
50.20	17.22	Free Outfall		ES
50.30	21.51	Free Outfall		ES
50.40	26.23	Free Outfall		ES
50.50	31.38	Free Outfall		ES
50.60	36.96	Free Outfall		ES
50.70	42.97	Free Outfall		ES
50.80	49.43	Free Outfall		ES
50.90	56.33	Free Outfall		ES
51.00	63.68	Free Outfall		ES

SUMMARY FOR HYDROGRAPH ADDITION
at Node: POND 10 IN

HYG Directory: C:\Program Files\Haestad\PPKW\

Upstream Link ID	Upstream Node ID	HYG file	HYG ID	HYG tag
ADDLINK 10	SUBAREA 10		SUBAREA 10	10yr

INFLOWS TO: POND 10 IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
	SUBAREA 10	10yr	.855	12.1000	10.36

TOTAL FLOW INTO: POND 10 IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
	POND 10 IN	10yr	.855	12.1000	10.36

TOTAL NODE INFLOW...
HYG file =
HYG ID = POND 10 IN
HYG Tag = 10yr

Peak Discharge = 10.36 cfs
Time to Peak = 12.1000 hrs
HYG Volume = .855 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
6.8000	.00	.00	.00	.01	.01
7.0500	.01	.01	.01	.01	.02
7.3000	.02	.02	.02	.02	.03
7.5500	.03	.03	.03	.04	.04
7.8000	.04	.04	.05	.05	.05
8.0500	.05	.06	.06	.06	.07
8.3000	.07	.07	.08	.08	.09
8.5500	.09	.10	.10	.11	.11
8.8000	.12	.12	.13	.13	.14
9.0500	.14	.15	.16	.16	.17
9.3000	.17	.18	.19	.19	.20
9.5500	.21	.22	.22	.23	.24
9.8000	.25	.25	.26	.27	.28
10.0500	.29	.30	.31	.32	.33
10.3000	.35	.36	.37	.39	.40
10.5500	.41	.43	.44	.46	.47
10.8000	.49	.51	.52	.54	.56
11.0500	.58	.61	.65	.70	.74
11.3000	.80	.84	.90	.95	1.01
11.5500	1.16	1.41	1.74	2.22	2.68
11.8000	3.23	3.75	4.40	5.97	8.57
12.0500	9.78	10.36	9.31	6.91	5.74
12.3000	4.94	4.37	3.74	3.20	2.56
12.5500	2.16	1.77	1.60	1.50	1.44
12.8000	1.37	1.31	1.25	1.19	1.12
13.0500	1.08	1.03	1.01	.99	.97
13.3000	.95	.94	.92	.91	.89
13.5500	.87	.86	.84	.82	.81
13.8000	.79	.78	.76	.74	.73
14.0500	.71	.70	.69	.68	.67
14.3000	.67	.66	.65	.64	.63
14.5500	.63	.62	.61	.60	.59
14.8000	.59	.58	.57	.56	.55

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
15.0500	.55	.54	.53	.52	.51
15.3000	.51	.50	.49	.48	.47
15.5500	.47	.46	.45	.44	.43
15.8000	.42	.42	.41	.40	.39
16.0500	.39	.38	.37	.37	.37
16.3000	.36	.36	.36	.35	.35
16.5500	.35	.34	.34	.33	.33
16.8000	.33	.32	.32	.32	.31
17.0500	.31	.31	.30	.30	.29
17.3000	.29	.29	.28	.28	.28
17.5500	.27	.27	.27	.26	.26
17.8000	.25	.25	.25	.24	.24
18.0500	.24	.23	.23	.23	.23
18.3000	.23	.23	.23	.23	.23
18.5500	.22	.22	.22	.22	.22
18.8000	.22	.22	.22	.22	.22
19.0500	.21	.21	.21	.21	.21
19.3000	.21	.21	.21	.21	.20
19.5500	.20	.20	.20	.20	.20
19.8000	.20	.20	.20	.19	.19
20.0500	.19	.19	.19	.19	.19
20.3000	.19	.19	.19	.19	.19
20.5500	.18	.18	.18	.18	.18
20.8000	.18	.18	.18	.18	.18
21.0500	.18	.18	.17	.17	.17
21.3000	.17	.17	.17	.17	.17
21.5500	.17	.17	.17	.17	.16
21.8000	.16	.16	.16	.16	.16
22.0500	.16	.16	.16	.16	.16
22.3000	.16	.15	.15	.15	.15
22.5500	.15	.15	.15	.15	.15
22.8000	.15	.15	.15	.15	.14
23.0500	.14	.14	.14	.14	.14
23.3000	.14	.14	.14	.14	.14
23.5500	.14	.13	.13	.13	.13
23.8000	.13	.13	.13	.13	.13
24.0500	.09	.03	.01	.00	.00

LEVEL POOL ROUTING SUMMARY

HYG Dir = C:\Program Files\Haestad\PPKW\
Inflow HYG file = NONE STORED - POND 10 IN 10yr
Outflow HYG file = NONE STORED - POND 10 OUT 10yr

Pond Node Data = POND 10
Pond Volume Data = POND 10
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS

Starting WS Elev	=	47.50 ft
Starting Volume	=	.000 ac-ft
Starting Outflow	=	.00 cfs
Starting Infiltr.	=	.00 cfs
Starting Total Qout	=	.00 cfs
Time Increment	=	.0500 hrs

INFLOW/OUTFLOW HYDROGRAPH SUMMARY

Peak Inflow	=	10.36 cfs	at	12.1000 hrs
Peak Outflow	=	9.80 cfs	at	12.1500 hrs
Peak Elevation	=	50.00 ft		
Peak Storage	=	.196 ac-ft		

MASS BALANCE (ac-ft)

+ Initial Vol	=	.000
+ HYG Vol IN	=	.855
- Infiltration	=	.000
- HYG Vol OUT	=	.708
- Retained Vol	=	.148
Unrouted Vol	=	.000 ac-ft (.000% of Inflow Volume)

POND ROUTED TOTAL OUTFLOW HYG...
HYG file =
HYG ID = POND 10 OUT
HYG Tag = 10yr

Peak Discharge =	9.80 cfs
Time to Peak =	12.1500 hrs
HYG Volume =	.708 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
6.8000	.00	.00	.00	.00	.00
7.0500	.00	.00	.00	.00	.00
7.3000	.00	.00	.00	.00	.00
7.5500	.00	.00	.00	.00	.00
7.8000	.00	.00	.00	.00	.00
8.0500	.00	.00	.00	.00	.00
8.3000	.00	.00	.00	.00	.00
8.5500	.00	.00	.00	.00	.00
8.8000	.00	.00	.00	.00	.00
9.0500	.00	.00	.00	.00	.00
9.3000	.00	.00	.00	.00	.00
9.5500	.00	.00	.00	.00	.00
9.8000	.00	.00	.00	.00	.00
10.0500	.00	.00	.00	.00	.00
10.3000	.00	.00	.00	.00	.00
10.5500	.00	.00	.00	.00	.00
10.8000	.00	.00	.00	.00	.00
11.0500	.00	.00	.00	.00	.00
11.3000	.00	.00	.00	.00	.00
11.5500	.00	.00	.00	.00	.00
11.8000	.00	.36	1.87	3.77	6.13
12.0500	8.40	9.70	9.80	8.49	6.82
12.3000	5.78	4.99	4.34	3.81	3.25
12.5500	2.71	2.27	1.99	1.78	1.63
12.8000	1.52	1.43	1.36	1.29	1.22
13.0500	1.16	1.11	1.07	1.03	1.01
13.3000	.98	.97	.95	.93	.92
13.5500	.90	.88	.87	.85	.83
13.8000	.82	.80	.79	.78	.77
14.0500	.75	.74	.73	.71	.70
14.3000	.69	.68	.68	.67	.66
14.5500	.65	.64	.63	.63	.62
14.8000	.61	.60	.59	.59	.58

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
15.0500	.57	.56	.55	.55	.54
15.3000	.53	.52	.51	.51	.50
15.5500	.49	.48	.47	.46	.46
15.8000	.45	.44	.43	.42	.42
16.0500	.41	.40	.39	.39	.38
16.3000	.38	.37	.37	.36	.36
16.5500	.36	.35	.35	.34	.34
16.8000	.34	.33	.33	.33	.32
17.0500	.32	.32	.31	.31	.31
17.3000	.30	.30	.29	.29	.29
17.5500	.28	.28	.28	.27	.27
17.8000	.27	.26	.26	.25	.25
18.0500	.25	.24	.24	.24	.24
18.3000	.24	.23	.23	.23	.23
18.5500	.23	.23	.23	.22	.22
18.8000	.22	.22	.22	.22	.22
19.0500	.22	.22	.22	.21	.21
19.3000	.21	.21	.21	.21	.21
19.5500	.21	.21	.20	.20	.20
19.8000	.20	.20	.20	.20	.20
20.0500	.20	.19	.19	.19	.19
20.3000	.19	.19	.19	.19	.19
20.5500	.19	.19	.19	.18	.18
20.8000	.18	.18	.18	.18	.18
21.0500	.18	.18	.18	.18	.18
21.3000	.17	.17	.17	.17	.17
21.5500	.17	.17	.17	.17	.17
21.8000	.17	.17	.16	.16	.16
22.0500	.16	.16	.16	.16	.16
22.3000	.16	.16	.16	.16	.15
22.5500	.15	.15	.15	.15	.15
22.8000	.15	.15	.15	.15	.15
23.0500	.15	.14	.14	.14	.14
23.3000	.14	.14	.14	.14	.14
23.5500	.14	.14	.14	.14	.13
23.8000	.13	.13	.13	.13	.13
24.0500	.12	.11	.08	.06	.04
24.3000	.03	.02	.02	.01	.01
24.5500	.01	.00	.00		

Index of Starting Page Numbers for ID Names

PURPOSE:

To reduce the discharge of sediment laden runoff to the existing water courses during construction.

PROCEDURE:

The SCS Technical Release 55 (Ref. 1) will be used to estimate peak flows. The design criteria is based on the requirements for the North Carolina Erosion and Sediment Control Planning and Design Manual (Ref 2). *PondPack* (Ref. 6) will be used to model the rating table for the sediment basin and calculate detention times.

A sediment basin is required for drainage areas of five acres or greater. Each sediment basin should be designed to provide 1,800 cubic feet per acre, as measured to the principal spillway. In addition, the spillway system must carry the peak runoff from the 10-year storm with a minimum 1 foot freeboard in the emergency spillway. A surface area calculation is also required to determine the trapping efficiency. A minimum of 10 hours detention time is required for the 10-year storm event.

One sediment basin will be used during construction to control sediment in the borrow area. The Ash landfill cap will be placed using soil from this borrow area. The sediment basin design is based on the disturbed area for the borrow area with all runoff directed to the basin.

1. Delineate and Estimate Size of Watershed Areas to the Sediment Basin

The watershed area to the sediment basin was delineated on a 1" = 50' drawing of existing conditions for the borrow area. To be conservative, the worst case drainage area was used for sizing the sediment basin. The drainage area was calculated using the AutoCAD area command.

2. Estimate Travel Times and Time of Concentration

Travel time (T_T) is the time it takes water to travel from one location to another within a watershed. T_T is a component of the time of concentration (T_C). T_C is defined as the time it takes for the entire watershed to contribute runoff and is quantified as the hydraulically most distant point within the watershed from its outfall point. It is calculated by summing the travel times of runoff within the watershed and includes sheet flow, overland flow, and/or channel flow.

Computations for travel time and time of concentration were developed using *TR-55* (Ref. 4) and are provided for the sediment basin.

3. Determine Runoff Curve Number and Rainfall Distribution

The curve number (CN) rates the watershed area for runoff according to soil type and land use.

The hydrologic soil group (HSG) designation was determined from a soil survey of Lenoir County, North Carolina (Ref. 5). The watershed area was then evaluated to determine the percentage of cover type (i.e., open space, woods, etc.) existing throughout the specific drainage area. Sediment basin calculations assume the construction area landuse is newly graded dirt. A composite curve number (RCN) was then calculated for the watershed area using the *TR-55* computer program for the specific cover types.

Displayed below is a summary of the drainage area information for the sediment basin calculations.

SEDIMENT BASIN CONDITIONS			
Watershed	Area (ac)	RCN	Tc
Sediment Basin – Borrow Area	7.06	83	0.15 hours

4. Determine Peak Inflow to Basin

PondPack was used to calculate the peak inflow into the basin. Rainfall distribution for Lenoir County, North Carolina follows a Type III distribution and the 10-year 24-hour rainfall event has 6.3 inches of rain. The peak inflow into the basin is 29.3 cfs.

5. Determine Required Surface Area to Achieve Adequate Trapping Efficiency

The required surface area for the basin was determined from the equation on page 6.61.3 of the North Carolina Erosion and Sediment Control Planning and Design Manual, A = 0.01q. The manual states that this provides a trapping efficiency greater than 75% for most sediment basins in the Coastal Plain region. The surface area of the sediment basin was determined by assuming that the entire borrow area would be disturbed. The surface area was determined using the flow from this area during the 10-year 24-hour storm event to ensure adequate trapping efficiency for the future phase.

A = 0.01q = 0.01 * 29.3 cfs = 0.293 Acres required → 0.403 surface area provided

6. Calculate the Storage Volume

An existing outfall structure is currently constructed in the sediment basin area and was modeled as follows: 2-3" diameter orifices at the invert (i.e. elevation 54.85), a 36" CMP riser with a principal spillway elevation of 55.85 and a 24" HDPE outlet pipe. The outlet barrel is sized to convey a minimum 0.2 cfs/acre.

Using the requirements listed in Section 6.61 Sediment Basin Practice Standards and Specifications, a storage volume of 1,800 cubic feet per acre is provided. The drainage area is 7.06 acres (including all disturbed and undistrubed areas) which requires a storage volume of 12,708 cubic feet. (A wet storage volume of 17,742 cubic feet is proposed.) A single orifice has been placed above the sediment cleanout level to allow the basin to dewater slowly and not interfere with the trap efficiency. The rating tables for the outlet structure were computed using *PondPack* software assuming the pool elevation was 54.85. *PondPack* computer output for the sediment basin appears in Appendix 1.

6. Determine Size of Outlet Protection

Since the outlet pipe will be used in the future, the outlet protection was sized and installed under separate contract assuming the maximum allowable flow through the pipe. Calculations have been included for the sizing of the outlet protection. The detention time during the 10-year storm event is 62.6 hours (68.35 hours – 5.75 hours).

Conclusions:

The sediment basin is designed to retain sediment carried by runoff during construction and to slowly release the runoff over a period of time. In addition, the sediment basin was designed to handle the 10-year storm event with one of freeboard.

SEDIMENT BASIN FREEBOARD			
Sediment Basin	**Top of Berm**	**10-year Max WSEL**	**Freeboard**
Borrow Area	59.00	56.61	2.39'

REFERENCES:

1) "Urban Hydrology for Small Watersheds," U.S. Dept. of Agriculture, Soil Conservation Service, Engineering Division, Technical Release 55, June 1986.

2) "North Carolina Erosion and Sediment Control Planning and Design Manual," prepared by North Carolina Sedimentation Control Commission, North Carolina Department of Natural Resources and Commuity Development and North Carolina Agricultural Extension Service, September 1, 1988.

3) *"TR-55,"* Urban Hydrology for Small Watersheds, Version. 2.1, U.S. Dept. of Agriculture, Soil Conservation Service.

4) "*FlowMaster*" Version 6.0, Open Channel Flow Module, developed by Haestad Methods, Inc., 2001.

5) "Soil Survey of Lenoir County, North Carolina." United States Department of Agriculture Soil Conservation Service in cooperation with North Carolina Agricultural Experiment Station and Lenoir County Board of Commissioners, March 1977.

6) "*PondPack*" Version 8.0, developed by Haestad Methods, Inc., 2002.

RUNOFF CURVE NUMBER COMPUTATION Version 2.10

Project : DuPont Kinston User: HCD Date: 02-15-2003
County : Lenoir State: NC Checked: ____ Date: _____
Subtitle: Borrow Area - Sediment Basin

COVER DESCRIPTION	Hydrologic Soil Group A	B	C	D
		Acres (CN)		
FULLY DEVELOPED URBAN AREAS (Veg Estab.)				
Open space (Lawns,parks etc.)				
Fair condition; grass cover 50% to 75%	-	1.2(69)	-	-
Streets and roads				
Gravel (w/ right-of-way)	-	0.85(85)	-	-
DEVELOPING URBAN AREA (No Vegetation)				
Newly graded area (pervious only)	-	5.01(86)	-	-
Total Area (by Hydrologic Soil Group)		7.06		

TOTAL DRAINAGE AREA: 7.06 Acres WEIGHTED CURVE NUMBER: 83*

* - Generated for use by GRAPHIC method

TIME OF CONCENTRATION AND TRAVEL TIME Version 2.10

Project : DuPont Kinston User: HCD Date: 02-15-2003

County : Lenoir State: NC Checked: ____ Date: _____

Subtitle: Borrow Area - Sediment Basin

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	3.9	150	.01	a					0.033
Shallow Concent'd		200	0.02	p					0.019
Shallow Concent'd		740	0.01	p					0.101
								Time of Concentration =	0.15*

--- Sheet Flow Surface Codes ---

A Smooth Surface
B Fallow (No Res.)
C Cultivated < 20 % Res.
D Cultivated > 20 % Res.
E Grass-Range, Short
F Grass, Dense
G Grass, Burmuda
H Woods, Light
I Woods, Dense
J Range, Natural

--- Shallow Concentrated --- --- Surface Codes ---

P Paved
U Unpaved

* - Generated for use by GRAPHIC method

GRAPHICAL PEAK DISCHARGE METHOD Version 2.10

Project : DuPont Kinston User: HCD Date: 02-15-2003
County : Lenoir State: NC Checked: ____ Date: _____
Subtitle: Borrow Area - Sediment Basin

Data: Drainage Area : 7.06 * Acres
Runoff Curve Number : 83 *
Time of Concentration: 0.15 * Hours
Rainfall Type : III
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	10
24-Hr Rainfall (in)	6.3
Ia/P Ratio	0.07
Used	0.10
Runoff (in)	4.37
Unit Peak Discharge (cfs/acre/in)	0.951
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	~~29~~ 29.3 cfs

* - Value(s) provided from TR-55 system routines

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MASTER DESIGN STORM SUMMARY

Network Storm Collection: Kinston

Return Event	Total Depth in	Rainfall Type	RNF ID
2yr	3.9000	Synthetic Curve	TypeIII 24hr
10yr	6.3000	Synthetic Curve	TypeIII 24hr
100yr	9.0000	Synthetic Curve	TypeIII 24hr

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
*OUT 10		JCT	2	1.288		12.5000	4.60		
*OUT 10		JCT	10	2.565		12.2500	19.87		
*OUT 10		JCT	100	4.074		12.3000	27.35		
POND 10	IN	POND	2	1.294		12.1500	14.81		
POND 10	IN	POND	10	2.571		12.1000	28.85		
POND 10	IN	POND	100	4.081		12.1000	44.94		
POND 10	OUT	POND	2	1.288		12.5000	4.60	56.12	1.015
POND 10	OUT	POND	10	2.565		12.2500	19.87	56.61	1.267
POND 10	OUT	POND	100	4.074		12.3000	27.35	57.13	1.539
SUBAREA 10		AREA	2	1.294		12.1500	14.81		
SUBAREA 10		AREA	10	2.571		12.1000	28.85		
SUBAREA 10		AREA	100	4.081		12.1000	44.94		

File.... C:\Program Files\Haestad\PPKW\KINSTON_ASH_BORROW.PPW

USER DEFINED VOLUME RATING TABLE

Elevation (ft)	Volume (ac-ft)
52.50	.000
53.00	.008
54.00	.141
55.00	.483
56.00	.954
57.00	1.468
58.00	2.025
59.00	2.617

File.... C:\Program Files\Haestad\PPKW\KINSTON_ASH_BORROW.PPW

REQUESTED POND WS ELEVATIONS:

Min. Elev.= 52.50 ft
Increment = .10 ft
Max. Elev.= 59.00 ft

****
OUTLET CONNECTIVITY
****

---> Forward Flow Only (UpStream to DnStream)
<--- Reverse Flow Only (DnStream to UpStream)
<---> Forward and Reverse Both Allowed

Structure	No.		Outfall	E1, ft	E2, ft
Stand Pipe	SP	--->	CV	55.850	59.000
Orifice-Circular	OR	--->	CV	54.850	59.000
Culvert-Circular	CV	--->	TW	52.500	59.000

TW SETUP, DS Channel

OUTLET STRUCTURE INPUT DATA

Structure ID	=	SP	
Structure Type	=	Stand Pipe	
# of Openings	=	1	
Invert Elev.	=	55.85	ft
Diameter	=	3.0000	ft
Orifice Area	=	7.0686	sq.ft
Orifice Coeff.	=	.600	
Weir Length	=	9.42	ft
Weir Coeff.	=	3.100	
K, Submerged	=	.000	
K, Reverse	=	1.000	
Kb,Barrel	=	.000000	(per ft of full flow)
Barrel Length	=	.00	ft
Mannings n	=	.0000	

Structure ID	=	OR	
Structure Type	=	Orifice-Circular	
# of Openings	=	2	
Invert Elev.	=	54.85	ft
Diameter	=	.2500	ft
Orifice Coeff.	=	.600	

File.... C:\Program Files\Haestad\PPKW\KINSTON_ASH_BORROW.PPW

OUTLET STRUCTURE INPUT DATA

Structure ID = CV
Structure Type = Culvert-Circular

No. Barrels	=	1	
Barrel Diameter	=	2.0000	ft
Upstream Invert	=	52.50	ft
Dnstream Invert	=	51.87	ft
Horiz. Length	=	126.00	ft
Barrel Length	=	126.00	ft
Barrel Slope	=	.00500	ft/ft

OUTLET CONTROL DATA...

Mannings n	=	.0120	
Ke	=	.5000	(forward entrance loss)
Kb	=	.010575	(per ft of full flow)
Kr	=	.5000	(reverse entrance loss)
HW Convergence	=	.001	+/- ft

INLET CONTROL DATA...

Equation form	=	1	
Inlet Control K	=	.0078	
Inlet Control M	=	2.0000	
Inlet Control c	=	.03790	
Inlet Control Y	=	.6900	
T1 ratio (HW/D)	=	1.133	
T2 ratio (HW/D)	=	1.294	
Slope Factor	=	-.500	

Use unsubmerged inlet control Form 1 equ. below T1 elev.
Use submerged inlet control Form 1 equ. above T2 elev.

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...
At T1 Elev = 54.77 ft ---> Flow = 15.55 cfs
At T2 Elev = 55.09 ft ---> Flow = 17.77 cfs

Structure ID = TW
Structure Type = TW SETUP, DS Channel

FREE OUTFALL CONDITIONS SPECIFIED

CONVERGENCE TOLERANCES...

Maximum Iterations	=	30
Min. TW tolerance	=	.01 ft
Max. TW tolerance	=	.01 ft
Min. HW tolerance	=	.01 ft
Max. HW tolerance	=	.01 ft
Min. Q tolerance	=	.10 cfs
Max. Q tolerance	=	.10 cfs

File.... C:\Program Files\Haestad\PPKW\KINSTON_ASH_BORROW.PPW

***** COMPOSITE OUTFLOW SUMMARY ****

WS Elev, Total Q		Notes		
		Converge		
Elev. ft	Q cfs	TW Elev ft	Error +/-ft	Contributing Structures
52.50	.00	Free Outfall		(no Q: SP,OR,CV)
52.60	.00	Free Outfall		(no Q: SP,OR,CV)
52.70	.00	Free Outfall		(no Q: SP,OR,CV)
52.80	.00	Free Outfall		(no Q: SP,OR,CV)
52.90	.00	Free Outfall		(no Q: SP,OR,CV)
53.00	.00	Free Outfall		(no Q: SP,OR,CV)
53.10	.00	Free Outfall		(no Q: SP,OR,CV)
53.20	.00	Free Outfall		(no Q: SP,OR,CV)
53.30	.00	Free Outfall		(no Q: SP,OR,CV)
53.40	.00	Free Outfall		(no Q: SP,OR,CV)
53.50	.00	Free Outfall		(no Q: SP,OR,CV)
53.60	.00	Free Outfall		(no Q: SP,OR,CV)
53.70	.00	Free Outfall		(no Q: SP,OR,CV)
53.80	.00	Free Outfall		(no Q: SP,OR,CV)
53.90	.00	Free Outfall		(no Q: SP,OR,CV)
54.00	.00	Free Outfall		(no Q: SP,OR,CV)
54.10	.00	Free Outfall		(no Q: SP,OR,CV)
54.20	.00	Free Outfall		(no Q: SP,OR,CV)
54.30	.00	Free Outfall		(no Q: SP,OR,CV)
54.40	.00	Free Outfall		(no Q: SP,OR,CV)
54.50	.00	Free Outfall		(no Q: SP,OR,CV)
54.60	.00	Free Outfall		(no Q: SP,OR,CV)
54.70	.00	Free Outfall		(no Q: SP,OR,CV)
54.80	.00	Free Outfall		(no Q: SP,OR,CV)
54.85	.00	Free Outfall		(no Q: SP,OR,CV)
54.90	.01	Free Outfall		OR,CV (no Q: SP)
55.00	.07	Free Outfall		OR,CV (no Q: SP)
55.10	.17	Free Outfall		OR,CV (no Q: SP)
55.20	.22	Free Outfall		OR,CV (no Q: SP)
55.30	.27	Free Outfall		OR,CV (no Q: SP)
55.40	.31	Free Outfall		OR,CV (no Q: SP)
55.50	.34	Free Outfall		OR,CV (no Q: SP)
55.60	.37	Free Outfall		OR,CV (no Q: SP)
55.70	.40	Free Outfall		OR,CV (no Q: SP)
55.80	.43	Free Outfall		OR,CV (no Q: SP)
55.85	.44	Free Outfall		OR,CV (no Q: SP)
55.90	.78	Free Outfall		SP,OR,CV
56.00	2.18	Free Outfall		SP,OR,CV

File.... C:\Program Files\Haestad\PPKW\KINSTON_ASH_BORROW.PPW

***** COMPOSITE OUTFLOW SUMMARY ****

WS Elev, Total Q		Notes		
		Converge		
Elev. ft	Q cfs	TW Elev ft	Error +/-ft	Contributing Structures
56.10	4.15	Free Outfall		SP,OR,CV
56.20	6.57	Free Outfall		SP,OR,CV
56.30	9.36	Free Outfall		SP,OR,CV
56.40	12.48	Free Outfall		SP,OR,CV
56.50	15.89	Free Outfall		SP,OR,CV
56.60	19.51	Free Outfall		SP,OR,CV
56.70	23.25	Free Outfall		SP,CV (no Q: OR)
56.80	26.05	Free Outfall		SP,CV (no Q: OR)
56.90	26.45	Free Outfall		SP,CV (no Q: OR)
57.00	26.85	Free Outfall		SP,CV (no Q: OR)
57.10	27.24	Free Outfall		SP,CV (no Q: OR)
57.20	27.65	Free Outfall		SP,CV (no Q: OR)
57.30	28.03	Free Outfall		SP,CV (no Q: OR)
57.40	28.41	Free Outfall		SP,CV (no Q: OR)
57.50	28.79	Free Outfall		SP,CV (no Q: OR)
57.60	29.16	Free Outfall		SP,CV (no Q: OR)
57.70	29.53	Free Outfall		SP,CV (no Q: OR)
57.80	29.90	Free Outfall		SP,CV (no Q: OR)
57.90	30.26	Free Outfall		SP,CV (no Q: OR)
58.00	30.62	Free Outfall		SP,CV (no Q: OR)
58.10	30.98	Free Outfall		SP,CV (no Q: OR)
58.20	31.33	Free Outfall		SP,CV (no Q: OR)
58.30	31.67	Free Outfall		SP,CV (no Q: OR)
58.40	32.02	Free Outfall		SP,CV (no Q: OR)
58.50	32.36	Free Outfall		SP,CV (no Q: OR)
58.60	32.71	Free Outfall		SP,CV (no Q: OR)
58.70	33.03	Free Outfall		SP,CV (no Q: OR)
58.80	33.36	Free Outfall		SP,CV (no Q: OR)
58.90	33.69	Free Outfall		SP,CV (no Q: OR)
59.00	34.02	Free Outfall		SP,CV (no Q: OR)

Name.... POND 10
File.... C:\Program Files\Haestad\PPKW\KINSTON_ASH_BORROW.PPW

LEVEL POOL ROUTING DATA

HYG Dir = C:\Program Files\Haestad\PPKW\
Inflow HYG file = NONE STORED - POND 10 IN 2yr
Outflow HYG file = NONE STORED - POND 10 OUT 2yr

Pond Node Data = POND 10
Pond Volume Data = POND 10
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS

Starting WS Elev	=	54.85 ft
Starting Volume	=	.432 ac-ft
Starting Outflow	=	.00 cfs
Starting Infiltr.	=	.00 cfs
Starting Total Qout	=	.00 cfs
Time Increment	=	.0500 hrs

Elevation ft	Outflow cfs	Storage ac-ft	Infilt. cfs	Q Total cfs	2S/t + O cfs
52.50	.00	.000	.00	.00	.00
52.60	.00	.002	.00	.00	.77
52.70	.00	.003	.00	.00	1.54
52.80	.00	.005	.00	.00	2.31
52.90	.00	.006	.00	.00	3.08
53.00	.00	.008	.00	.00	3.84
53.10	.00	.021	.00	.00	10.29
53.20	.00	.035	.00	.00	16.74
53.30	.00	.048	.00	.00	23.19
53.40	.00	.061	.00	.00	29.64
53.50	.00	.075	.00	.00	36.09
53.60	.00	.088	.00	.00	42.54
53.70	.00	.101	.00	.00	48.99
53.80	.00	.115	.00	.00	55.44
53.90	.00	.128	.00	.00	61.89
54.00	.00	.141	.00	.00	68.34
54.10	.00	.175	.00	.00	84.89
54.20	.00	.210	.00	.00	101.44
54.30	.00	.244	.00	.00	117.99
54.40	.00	.278	.00	.00	134.53
54.50	.00	.312	.00	.00	151.08
54.60	.00	.346	.00	.00	167.63
54.70	.00	.381	.00	.00	184.18

LEVEL POOL ROUTING DATA

HYG Dir = C:\Program Files\Haestad\PPKW\
Inflow HYG file = NONE STORED - POND 10 IN 2yr
Outflow HYG file = NONE STORED - POND 10 OUT 2yr

Pond Node Data = POND 10
Pond Volume Data = POND 10
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS

Starting WS Elev	=	54.85 ft
Starting Volume	=	.432 ac-ft
Starting Outflow	=	.00 cfs
Starting Infiltr.	=	.00 cfs
Starting Total Qout	=	.00 cfs
Time Increment	=	.0500 hrs

Elevation ft	Outflow cfs	Storage ac-ft	Infilt. cfs	Q Total cfs	2S/t + O cfs
54.80	.00	.415	.00	.00	200.73
54.85	.00	.432	.00	.00	209.00
54.90	.01	.449	.00	.01	217.29
55.00	.07	.483	.00	.07	233.89
55.10	.17	.530	.00	.17	256.77
55.20	.22	.577	.00	.22	279.60
55.30	.27	.624	.00	.27	302.41
55.40	.31	.671	.00	.31	325.23
55.50	.34	.718	.00	.34	348.03
55.60	.37	.765	.00	.37	370.83
55.70	.40	.812	.00	.40	393.64
55.80	.43	.860	.00	.43	416.43
55.85	.44	.883	.00	.44	427.83
55.90	.78	.907	.00	.78	439.56
56.00	2.18	.954	.00	2.18	463.73
56.10	4.15	1.005	.00	4.15	490.58
56.20	6.57	1.056	.00	6.57	517.88
56.30	9.36	1.108	.00	9.36	545.54
56.40	12.48	1.159	.00	12.48	573.54
56.50	15.89	1.211	.00	15.89	601.83
56.60	19.51	1.262	.00	19.51	630.31
56.70	23.25	1.313	.00	23.25	658.94
56.80	26.05	1.365	.00	26.05	686.61

LEVEL POOL ROUTING DATA

HYG Dir = C:\Program Files\Haestad\PPKW\
Inflow HYG file = NONE STORED - POND 10 IN 2yr
Outflow HYG file = NONE STORED - POND 10 OUT 2yr

Pond Node Data = POND 10
Pond Volume Data = POND 10
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS

Starting WS Elev	=	54.85 ft
Starting Volume	=	.432 ac-ft
Starting Outflow	=	.00 cfs
Starting Infiltr.	=	.00 cfs
Starting Total Qout	=	.00 cfs
Time Increment	=	.0500 hrs

Elevation ft	Outflow cfs	Storage ac-ft	Infilt. cfs	Q Total cfs	2S/t + O cfs
56.90	26.45	1.416	.00	26.45	711.89
57.00	26.85	1.468	.00	26.85	737.16
57.10	27.24	1.523	.00	27.24	764.51
57.20	27.65	1.579	.00	27.65	791.87
57.30	28.03	1.635	.00	28.03	819.21
57.40	28.41	1.690	.00	28.41	846.55
57.50	28.79	1.746	.00	28.79	873.89
57.60	29.16	1.802	.00	29.16	901.22
57.70	29.53	1.857	.00	29.53	928.55
57.80	29.90	1.913	.00	29.90	955.86
57.90	30.26	1.969	.00	30.26	983.19
58.00	30.62	2.025	.00	30.62	1010.50
58.10	30.98	2.084	.00	30.98	1039.55
58.20	31.33	2.143	.00	31.33	1068.59
58.30	31.67	2.202	.00	31.67	1097.62
58.40	32.02	2.262	.00	32.02	1126.66
58.50	32.36	2.321	.00	32.36	1155.69
58.60	32.71	2.380	.00	32.71	1184.72
58.70	33.03	2.439	.00	33.03	1213.73
58.80	33.36	2.499	.00	33.36	1242.75
58.90	33.69	2.558	.00	33.69	1271.77
59.00	34.02	2.617	.00	34.02	1300.78

SUMMARY FOR HYDROGRAPH ADDITION
at Node: POND 10 IN

HYG Directory: C:\Program Files\Haestad\PPKW\

Upstream Link ID	Upstream Node ID	HYG file	HYG ID	HYG tag
ADDLINK 10	SUBAREA 10		SUBAREA 10	2yr

INFLOWS TO: POND 10 IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
	SUBAREA 10	2yr	1.294	12.1500	14.81

TOTAL FLOW INTO: POND 10 IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
	POND 10 IN	2yr	1.294	12.1500	14.81

TOTAL NODE INFLOW...
HYG file =
HYG ID = POND 10 IN
HYG Tag = 2yr

Peak Discharge =	14.81 cfs
Time to Peak =	12.1500 hrs
HYG Volume =	1.294 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
7.7000	.00	.00	.00	.01	.01
7.9500	.01	.02	.02	.02	.03
8.2000	.03	.04	.04	.04	.05
8.4500	.05	.06	.07	.07	.08
8.7000	.08	.09	.10	.10	.11
8.9500	.12	.13	.13	.14	.15
9.2000	.16	.17	.18	.18	.19
9.4500	.20	.21	.22	.23	.24
9.7000	.25	.26	.28	.29	.30
9.9500	.31	.32	.33	.35	.36
10.2000	.38	.40	.41	.43	.45
10.4500	.47	.49	.51	.53	.55
10.7000	.58	.60	.62	.65	.67
10.9500	.70	.72	.75	.79	.84
11.2000	.90	.96	1.03	1.10	1.18
11.4500	1.25	1.34	1.48	1.74	2.12
11.7000	2.68	3.31	4.06	4.83	5.71
11.9500	7.23	10.22	12.98	14.67	14.81
12.2000	12.67	10.38	8.81	7.70	6.66
12.4500	5.75	4.78	3.97	3.30	2.83
12.7000	2.56	2.39	2.26	2.15	2.05
12.9500	1.95	1.85	1.76	1.69	1.63
13.2000	1.59	1.56	1.53	1.51	1.48
13.4500	1.46	1.43	1.41	1.38	1.36
13.7000	1.33	1.30	1.28	1.25	1.23
13.9500	1.20	1.17	1.15	1.13	1.11
14.2000	1.10	1.08	1.07	1.06	1.04
14.4500	1.03	1.02	1.01	.99	.98
14.7000	.97	.96	.94	.93	.92
14.9500	.91	.89	.88	.87	.86
15.2000	.84	.83	.82	.81	.79
15.4500	.78	.77	.75	.74	.73
15.7000	.71	.70	.69	.68	.66

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
15.9500	.65	.64	.62	.61	.61
16.2000	.60	.59	.59	.58	.57
16.4500	.57	.56	.56	.55	.55
16.7000	.54	.53	.53	.52	.52
16.9500	.51	.51	.50	.49	.49
17.2000	.48	.48	.47	.47	.46
17.4500	.45	.45	.44	.44	.43
17.7000	.43	.42	.41	.41	.40
17.9500	.40	.39	.38	.38	.38
18.2000	.37	.37	.37	.37	.37
18.4500	.37	.36	.36	.36	.36
18.7000	.36	.36	.35	.35	.35
18.9500	.35	.35	.35	.34	.34
19.2000	.34	.34	.34	.33	.33
19.4500	.33	.33	.33	.33	.32
19.7000	.32	.32	.32	.32	.32
19.9500	.31	.31	.31	.31	.31
20.2000	.31	.31	.30	.30	.30
20.4500	.30	.30	.30	.30	.29
20.7000	.29	.29	.29	.29	.29
20.9500	.29	.29	.29	.28	.28
21.2000	.28	.28	.28	.28	.28
21.4500	.27	.27	.27	.27	.27
21.7000	.27	.27	.27	.26	.26
21.9500	.26	.26	.26	.26	.26
22.2000	.25	.25	.25	.25	.25
22.4500	.25	.25	.24	.24	.24
22.7000	.24	.24	.24	.24	.24
22.9500	.23	.23	.23	.23	.23
23.2000	.23	.23	.23	.22	.22
23.4500	.22	.22	.22	.22	.22
23.7000	.21	.21	.21	.21	.21
23.9500	.21	.21	.18	.11	.05
24.2000	.02	.01	.00	.00	.00

SUMMARY FOR HYDROGRAPH ADDITION
at Node: POND 10 IN

HYG Directory: C:\Program Files\Haestad\PPKW\

Upstream Link ID	Upstream Node ID	HYG file	HYG ID	HYG tag
ADDLINK 10	SUBAREA 10		SUBAREA 10	10yr

INFLOWS TO: POND 10 IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
	SUBAREA 10	10yr	2.571	12.1000	28.85

TOTAL FLOW INTO: POND 10 IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
	POND 10 IN	10yr	2.571	12.1000	28.85

TOTAL NODE INFLOW...
HYG file =
HYG ID = POND 10 IN
HYG Tag = 10yr

Peak Discharge	28.85 cfs
Time to Peak	12.1000 hrs
HYG Volume	2.571 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
5.6500	.00	.00	.01	.01	.01
5.9000	.01	.02	.02	.03	.03
6.1500	.03	.04	.04	.04	.05
6.4000	.05	.06	.06	.07	.07
6.6500	.08	.08	.09	.09	.10
6.9000	.11	.11	.12	.12	.13
7.1500	.14	.14	.15	.16	.16
7.4000	.17	.18	.18	.19	.20
7.6500	.21	.22	.22	.23	.24
7.9000	.25	.26	.26	.27	.28
8.1500	.29	.31	.32	.33	.35
8.4000	.36	.38	.39	.41	.42
8.6500	.44	.45	.47	.49	.50
8.9000	.52	.54	.56	.58	.60
9.1500	.61	.63	.65	.67	.69
9.4000	.72	.74	.76	.78	.80
9.6500	.82	.85	.87	.89	.92
9.9000	.94	.96	.99	1.01	1.04
10.1500	1.07	1.11	1.15	1.19	1.23
10.4000	1.27	1.31	1.36	1.40	1.45
10.6500	1.49	1.54	1.58	1.63	1.68
10.9000	1.73	1.77	1.83	1.88	1.97
11.1500	2.07	2.20	2.33	2.49	2.64
11.4000	2.80	2.95	3.12	3.42	4.00
11.6500	4.81	6.02	7.34	8.86	10.40
11.9000	12.10	15.05	20.86	25.99	28.85
12.1500	28.69	24.28	19.70	16.59	14.39
12.4000	12.39	10.64	8.83	7.31	6.06
12.6500	5.19	4.68	4.37	4.12	3.93
12.9000	3.73	3.55	3.36	3.20	3.06
13.1500	2.96	2.88	2.82	2.77	2.72
13.4000	2.67	2.63	2.58	2.54	2.49
13.6500	2.44	2.39	2.35	2.30	2.25

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
13.9000	2.20	2.16	2.11	2.06	2.02
14.1500	1.99	1.96	1.94	1.91	1.89
14.4000	1.87	1.85	1.82	1.80	1.78
14.6500	1.75	1.73	1.71	1.69	1.66
14.9000	1.64	1.62	1.59	1.57	1.55
15.1500	1.52	1.50	1.48	1.45	1.43
15.4000	1.41	1.39	1.36	1.34	1.31
15.6500	1.29	1.27	1.25	1.22	1.20
15.9000	1.17	1.15	1.13	1.11	1.09
16.1500	1.07	1.06	1.05	1.04	1.03
16.4000	1.02	1.00	1.00	.99	.97
16.6500	.96	.95	.95	.93	.92
16.9000	.91	.90	.89	.88	.87
17.1500	.86	.85	.84	.83	.82
17.4000	.81	.80	.79	.78	.77
17.6500	.76	.75	.74	.73	.72
17.9000	.71	.70	.69	.68	.67
18.1500	.66	.66	.66	.65	.65
18.4000	.65	.64	.64	.64	.63
18.6500	.63	.63	.63	.62	.62
18.9000	.62	.61	.61	.61	.60
19.1500	.60	.60	.60	.59	.59
19.4000	.59	.58	.58	.58	.57
19.6500	.57	.57	.56	.56	.56
19.9000	.55	.55	.55	.55	.54
20.1500	.54	.54	.54	.53	.53
20.4000	.53	.53	.52	.52	.52
20.6500	.52	.51	.51	.51	.51
20.9000	.51	.50	.50	.50	.50
21.1500	.49	.49	.49	.49	.48
21.4000	.48	.48	.48	.47	.47
21.6500	.47	.47	.47	.46	.46
21.9000	.46	.46	.45	.45	.45
22.1500	.45	.45	.44	.44	.44
22.4000	.44	.43	.43	.43	.43
22.6500	.43	.42	.42	.42	.41
22.9000	.41	.41	.41	.41	.40
23.1500	.40	.40	.40	.39	.39
23.4000	.39	.39	.39	.38	.38
23.6500	.38	.38	.37	.37	.37
23.9000	.37	.36	.36	.32	.20
24.1500	.09	.04	.02	.01	.00
24.4000	.00	.00			

SUMMARY FOR HYDROGRAPH ADDITION
at Node: POND 10 IN

HYG Directory: C:\Program Files\Haestad\PPKW\

Upstream Link ID	Upstream Node ID	HYG file	HYG ID	HYG tag
ADDLINK 10	SUBAREA 10		SUBAREA 10	100yr

INFLOWS TO: POND 10 IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
	SUBAREA 10	100yr	4.081	12.1000	44.94

TOTAL FLOW INTO: POND 10 IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
	POND 10 IN	100yr	4.081	12.1000	44.94

TOTAL NODE INFLOW...
HYG file =
HYG ID = POND 10 IN
HYG Tag = 100yr

Peak Discharge =	44.94 cfs
Time to Peak =	12.1000 hrs
HYG Volume =	4.081 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
4.2500	.00	.00	.01	.01	.01
4.5000	.02	.02	.03	.03	.04
4.7500	.05	.05	.06	.06	.07
5.0000	.07	.08	.08	.09	.09
5.2500	.10	.11	.11	.12	.12
5.5000	.13	.13	.14	.15	.15
5.7500	.16	.16	.17	.18	.18
6.0000	.19	.19	.20	.21	.22
6.2500	.23	.23	.24	.25	.26
6.5000	.27	.28	.29	.30	.31
6.7500	.32	.33	.34	.36	.37
7.0000	.38	.39	.40	.42	.43
7.2500	.44	.45	.47	.48	.49
7.5000	.50	.52	.53	.54	.56
7.7500	.57	.59	.60	.62	.63
8.0000	.65	.66	.68	.70	.72
8.2500	.75	.77	.80	.82	.85
8.5000	.88	.90	.93	.96	.99
8.7500	1.02	1.05	1.08	1.11	1.14
9.0000	1.17	1.20	1.23	1.27	1.30
9.2500	1.33	1.36	1.40	1.43	1.47
9.5000	1.50	1.54	1.57	1.61	1.65
9.7500	1.68	1.72	1.75	1.79	1.83
10.0000	1.87	1.91	1.96	2.01	2.07
10.2500	2.13	2.20	2.26	2.33	2.40
10.5000	2.47	2.54	2.61	2.68	2.75
10.7500	2.82	2.90	2.97	3.05	3.12
11.0000	3.20	3.29	3.42	3.58	3.80
11.2500	4.02	4.26	4.51	4.76	5.02
11.5000	5.28	5.76	6.71	8.02	9.98
11.7500	12.10	14.52	16.91	19.54	24.10
12.0000	33.06	40.84	44.94	44.36	37.35
12.2500	30.17	25.30	21.87	18.79	16.10

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
12.5000	13.34	11.03	9.13	7.81	7.04
12.7500	6.57	6.20	5.90	5.60	5.33
13.0000	5.05	4.80	4.59	4.43	4.32
13.2500	4.23	4.15	4.08	4.00	3.93
13.5000	3.86	3.79	3.72	3.65	3.57
13.7500	3.51	3.43	3.36	3.29	3.22
14.0000	3.14	3.08	3.02	2.97	2.92
14.2500	2.89	2.85	2.82	2.78	2.75
14.5000	2.71	2.68	2.64	2.61	2.58
14.7500	2.54	2.51	2.47	2.44	2.40
15.0000	2.37	2.34	2.30	2.27	2.23
15.2500	2.20	2.16	2.13	2.09	2.06
15.5000	2.02	1.99	1.95	1.92	1.88
15.7500	1.85	1.81	1.78	1.74	1.71
16.0000	1.67	1.64	1.61	1.59	1.57
16.2500	1.55	1.54	1.52	1.50	1.49
16.5000	1.47	1.46	1.44	1.43	1.41
16.7500	1.40	1.38	1.37	1.35	1.34
17.0000	1.32	1.31	1.29	1.28	1.26
17.2500	1.25	1.23	1.22	1.20	1.19
17.5000	1.17	1.16	1.14	1.12	1.11
17.7500	1.10	1.08	1.06	1.05	1.03
18.0000	1.02	1.00	.99	.98	.98
18.2500	.97	.97	.96	.96	.95
18.5000	.95	.94	.94	.93	.93
18.7500	.92	.92	.92	.91	.91
19.0000	.90	.90	.89	.89	.88
19.2500	.88	.87	.87	.87	.86
19.5000	.86	.85	.85	.84	.84
19.7500	.83	.83	.82	.82	.81
20.0000	.81	.81	.80	.80	.80
20.2500	.79	.79	.78	.78	.78
20.5000	.77	.77	.77	.76	.76
20.7500	.75	.75	.75	.75	.74
21.0000	.74	.74	.73	.73	.73
21.2500	.72	.72	.72	.71	.71
21.5000	.70	.70	.70	.70	.69
21.7500	.69	.69	.68	.68	.67
22.0000	.67	.67	.66	.66	.66
22.2500	.65	.65	.64	.64	.64
22.5000	.64	.63	.63	.63	.62
22.7500	.62	.62	.61	.61	.61
23.0000	.60	.60	.59	.59	.59
23.2500	.59	.58	.58	.57	.57
23.5000	.57	.56	.56	.56	.55
23.7500	.55	.55	.54	.54	.53
24.0000	.53	.47	.29	.13	.06

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
24.2500	.03	.01	.00	.00	.00

LEVEL POOL ROUTING SUMMARY

HYG Dir = C:\Program Files\Haestad\PPKW\
Inflow HYG file = NONE STORED - POND 10 IN 2yr
Outflow HYG file = NONE STORED - POND 10 OUT 2yr

Pond Node Data = POND 10
Pond Volume Data = POND 10
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS

Starting WS Elev	=	54.85 ft
Starting Volume	=	.432 ac-ft
Starting Outflow	=	.00 cfs
Starting Infiltr.	=	.00 cfs
Starting Total Qout	=	.00 cfs
Time Increment	=	.0500 hrs

INFLOW/OUTFLOW HYDROGRAPH SUMMARY

Peak Inflow	=	14.81 cfs	at	12.1500 hrs
Peak Outflow	=	4.60 cfs	at	12.5000 hrs
Peak Elevation	=	56.12 ft		
Peak Storage	=	1.015 ac-ft		

MASS BALANCE (ac-ft)

+ Initial Vol	=	.432
+ HYG Vol IN	=	1.294
- Infiltration	=	.000
- HYG Vol OUT	=	1.288
- Retained Vol	=	.438
Unrouted Vol	=	.000 ac-ft (.000% of Inflow Volume)

POND ROUTED TOTAL OUTFLOW HYG...
HYG file =
HYG ID = POND 10 OUT
HYG Tag = 2yr

Peak Discharge	4.60 cfs
Time to Peak	12.5000 hrs
HYG Volume	1.288 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
7.7000	.00	.00	.00	.00	.00
7.9500	.00	.00	.00	.00	.00
8.2000	.00	.00	.00	.00	.00
8.4500	.00	.00	.00	.00	.00
8.7000	.00	.00	.00	.00	.00
8.9500	.00	.00	.00	.00	.00
9.2000	.00	.00	.00	.00	.00
9.4500	.01	.01	.01	.01	.01
9.7000	.01	.01	.01	.01	.01
9.9500	.02	.02	.02	.02	.02
10.2000	.03	.03	.03	.03	.04
10.4500	.04	.04	.05	.05	.05
10.7000	.06	.06	.07	.07	.07
10.9500	.08	.09	.09	.10	.10
11.2000	.11	.12	.13	.13	.14
11.4500	.15	.16	.17	.18	.19
11.7000	.20	.21	.23	.24	.26
11.9500	.29	.31	.35	.38	.42
12.2000	.62	1.72	2.76	3.57	4.10
12.4500	4.46	4.60	4.56	4.40	4.16
12.7000	3.95	3.73	3.52	3.33	3.15
12.9500	2.98	2.82	2.67	2.53	2.40
13.2000	2.29	2.18	2.11	2.04	1.98
13.4500	1.92	1.86	1.81	1.76	1.72
13.7000	1.67	1.63	1.59	1.56	1.52
13.9500	1.48	1.45	1.42	1.38	1.35
14.2000	1.33	1.30	1.27	1.25	1.23
14.4500	1.20	1.18	1.16	1.14	1.13
14.7000	1.11	1.09	1.08	1.06	1.04
14.9500	1.03	1.01	1.00	.99	.97
15.2000	.96	.94	.93	.92	.90
15.4500	.89	.88	.86	.85	.84
15.7000	.82	.81	.80	.78	.78

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
15.9500	.77	.76	.75	.75	.74
16.2000	.73	.72	.71	.71	.70
16.4500	.69	.68	.68	.67	.66
16.7000	.66	.65	.64	.64	.63
16.9500	.62	.62	.61	.60	.60
17.2000	.59	.58	.58	.57	.56
17.4500	.56	.55	.55	.54	.53
17.7000	.53	.52	.52	.51	.50
17.9500	.50	.49	.49	.48	.47
18.2000	.47	.46	.46	.45	.45
18.4500	.44	.44	.44	.44	.44
18.7000	.44	.44	.44	.44	.44
18.9500	.44	.44	.44	.44	.44
19.2000	.44	.44	.44	.44	.44
19.4500	.44	.44	.44	.44	.44
19.7000	.44	.44	.44	.44	.44
19.9500	.44	.44	.43	.43	.43
20.2000	.43	.43	.43	.43	.43
20.4500	.43	.43	.43	.43	.43
20.7000	.43	.43	.43	.43	.43
20.9500	.43	.43	.43	.43	.43
21.2000	.43	.43	.43	.43	.43
21.4500	.43	.43	.43	.42	.42
21.7000	.42	.42	.42	.42	.42
21.9500	.42	.42	.42	.42	.42
22.2000	.42	.42	.42	.42	.42
22.4500	.42	.42	.42	.42	.42
22.7000	.42	.42	.42	.42	.41
22.9500	.41	.41	.41	.41	.41
23.2000	.41	.41	.41	.41	.41
23.4500	.41	.41	.41	.41	.41
23.7000	.41	.41	.41	.41	.41
23.9500	.41	.40	.40	.40	.40
24.2000	.40	.40	.40	.40	.40
24.4500	.40	.40	.40	.39	.39
24.7000	.39	.39	.39	.39	.39
24.9500	.39	.39	.39	.38	.38
25.2000	.38	.38	.38	.38	.38
25.4500	.38	.38	.38	.37	.37
25.7000	.37	.37	.37	.37	.37
25.9500	.37	.37	.37	.36	.36
26.2000	.36	.36	.36	.36	.36
26.4500	.36	.36	.36	.35	.35
26.7000	.35	.35	.35	.35	.35
26.9500	.35	.35	.35	.35	.34
27.2000	.34	.34	.34	.34	.34
27.4500	.34	.34	.34	.34	.33

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
27.7000	.33	.33	.33	.33	.33
27.9500	.33	.33	.33	.33	.32
28.2000	.32	.32	.32	.32	.32
28.4500	.32	.32	.32	.32	.31
28.7000	.31	.31	.31	.31	.31
28.9500	.31	.31	.31	.31	.31
29.2000	.30	.30	.30	.30	.30
29.4500	.30	.30	.30	.30	.29
29.7000	.29	.29	.29	.29	.29
29.9500	.29	.29	.29	.29	.28
30.2000	.28	.28	.28	.28	.28
30.4500	.28	.28	.28	.28	.28
30.7000	.27	.27	.27	.27	.27
30.9500	.27	.27	.27	.27	.27
31.2000	.26	.26	.26	.26	.26
31.4500	.26	.26	.26	.26	.26
31.7000	.25	.25	.25	.25	.25
31.9500	.25	.25	.25	.25	.25
32.2000	.24	.24	.24	.24	.24
32.4500	.24	.24	.24	.24	.24
32.7000	.23	.23	.23	.23	.23
32.9500	.23	.23	.23	.23	.23
33.2000	.23	.22	.22	.22	.22
33.4500	.22	.22	.22	.22	.22
33.7000	.22	.21	.21	.21	.21
33.9500	.21	.21	.21	.21	.21
34.2000	.20	.20	.20	.20	.20
34.4500	.20	.20	.20	.20	.20
34.7000	.19	.19	.19	.19	.19
34.9500	.19	.19	.19	.19	.19
35.2000	.19	.18	.18	.18	.18
35.4500	.18	.18	.18	.18	.18
35.7000	.18	.18	.17	.17	.17
35.9500	.17	.17	.17	.17	.17
36.2000	.17	.17	.16	.16	.16
36.4500	.16	.16	.16	.16	.15
36.7000	.15	.15	.15	.15	.15
36.9500	.15	.15	.14	.14	.14
37.2000	.14	.14	.14	.14	.14
37.4500	.13	.13	.13	.13	.13
37.7000	.13	.13	.13	.13	.12
37.9500	.12	.12	.12	.12	.12
38.2000	.12	.12	.12	.11	.11
38.4500	.11	.11	.11	.11	.11
38.7000	.11	.11	.11	.11	.10
38.9500	.10	.10	.10	.10	.10
39.2000	.10	.10	.10	.10	.10

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
39.4500	.09	.09	.09	.09	.09
39.7000	.09	.09	.09	.09	.09
39.9500	.09	.09	.09	.08	.08
40.2000	.08	.08	.08	.08	.08
40.4500	.08	.08	.08	.08	.08
40.7000	.08	.08	.07	.07	.07
40.9500	.07	.07	.07	.07	.07
41.2000	.07	.07	.07	.07	.07
41.4500	.07	.07	.07	.07	.06
41.7000	.06	.06	.06	.06	.06
41.9500	.06	.06	.06	.06	.06
42.2000	.06	.06	.06	.06	.06
42.4500	.06	.06	.06	.06	.06
42.7000	.06	.06	.05	.05	.05
42.9500	.05	.05	.05	.05	.05
43.2000	.05	.05	.05	.05	.05
43.4500	.05	.05	.05	.05	.05
43.7000	.05	.05	.05	.05	.05
43.9500	.05	.05	.05	.05	.05
44.2000	.04	.04	.04	.04	.04
44.4500	.04	.04	.04	.04	.04
44.7000	.04	.04	.04	.04	.04
44.9500	.04	.04	.04	.04	.04
45.2000	.04	.04	.04	.04	.04
45.4500	.04	.04	.04	.04	.04
45.7000	.04	.04	.04	.04	.04
45.9500	.04	.03	.03	.03	.03
46.2000	.03	.03	.03	.03	.03
46.4500	.03	.03	.03	.03	.03
46.7000	.03	.03	.03	.03	.03
46.9500	.03	.03	.03	.03	.03
47.2000	.03	.03	.03	.03	.03
47.4500	.03	.03	.03	.03	.03
47.7000	.03	.03	.03	.03	.03
47.9500	.03	.03	.03	.03	.03
48.2000	.03	.03	.03	.02	.02
48.4500	.02	.02	.02	.02	.02
48.7000	.02	.02	.02	.02	.02
48.9500	.02	.02	.02	.02	.02
49.2000	.02	.02	.02	.02	.02
49.4500	.02	.02	.02	.02	.02
49.7000	.02	.02	.02	.02	.02
49.9500	.02	.02	.02	.02	.02
50.2000	.02	.02	.02	.02	.02
50.4500	.02	.02	.02	.02	.02
50.7000	.02	.02	.02	.02	.02
50.9500	.02	.02	.02	.02	.02

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
51.2000	.02	.02	.02	.02	.02
51.4500	.02	.02	.02	.02	.02
51.7000	.02	.02	.02	.02	.02
51.9500	.01	.01	.01	.01	.01
52.2000	.01	.01	.01	.01	.01
52.4500	.01	.01	.01	.01	.01
52.7000	.01	.01	.01	.01	.01
52.9500	.01	.01	.01	.01	.01
53.2000	.01	.01	.01	.01	.01
53.4500	.01	.01	.01	.01	.01
53.7000	.01	.01	.01	.01	.01
53.9500	.01	.01	.01	.01	.01
54.2000	.01	.01	.01	.01	.01
54.4500	.01	.01	.01	.01	.01
54.7000	.01	.01	.01	.01	.01
54.9500	.01	.01	.01	.01	.01
55.2000	.01	.01	.01	.01	.01
55.4500	.01	.01	.01	.01	.01
55.7000	.01	.01	.01	.01	.01
55.9500	.01	.01	.01	.01	.01
56.2000	.01	.01	.01	.01	.01
56.4500	.01	.01	.01	.01	.01
56.7000	.01	.01	.01	.01	.01
56.9500	.01	.01	.01	.01	.01
57.2000	.01	.01	.01	.01	.01
57.4500	.01	.01	.01	.01	.01
57.7000	.01	.01	.01	.01	.01
57.9500	.01	.01	.01	.01	.01
58.2000	.01	.01	.01	.01	.01
58.4500	.01	.01	.01	.01	.01
58.7000	.01	.01	.01	.01	.01
58.9500	.01	.01	.01	.01	.01
59.2000	.01	.01	.01	.01	.01
59.4500	.01	.01	.01	.01	.01
59.7000	.01	.01	.01	.01	.01
59.9500	.01	.01	.01	.01	.01
60.2000	.01	.01	.01	.01	.01
60.4500	.01	.01	.01	.01	.01
60.7000	.01	.01	.01	.01	.01
60.9500	.01	.01	.01	.01	.01
61.2000	.01	.01	.01	.01	.01
61.4500	.01	.01	.01	.01	.01
61.7000	.01	.01	.01	.01	.01
61.9500	.01	.01	.01	.01	.01
62.2000	.01	.01	.01	.01	.01
62.4500	.01	.01	.01	.01	.01
62.7000	.01	.01	.01	.01	.01

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
62.9500	.01	.01	.01	.01	.01
63.2000	.01	.01	.01	.01	.01
63.4500	.01	.01	.01	.01	.01
63.7000	.01	.01	.01	.01	.01
63.9500	.01	.01	.01	.01	.01
64.2000	.01	.01	.01	.01	.01
64.4500	.01	.01	.01	.01	.01
64.7000	.01	.01	.01	.01	.01
64.9500	.01	.01	.01	.01	.01
65.2000	.01	.01	.01	.01	.01
65.4500	.01	.01	.01	.01	.01
65.7000	.01	.01	.01	.01	.01
65.9500	.01	.01	.01	.01	.01
66.2000	.01	.01	.01	.01	.01
66.4500	.01	.01	.01	.01	.01
66.7000	.01	.01	.01	.01	.01
66.9500	.01	.01	.01	.01	.01
67.2000	.01	.01	.01	.01	.01
67.4500	.01	.01	.01	.01	.01
67.7000	.01	.01	.01	.01	.01
67.9500	.01	.01	.01	.01	.01
68.2000	.01	.01	.01	.01	.00
68.4500	.00	.00	.00	.00	.00
68.7000	.00	.00	.00	.00	.00
68.9500	.00	.00	.00	.00	.00
69.2000	.00	.00	.00	.00	.00
69.4500	.00	.00	.00	.00	.00
69.7000	.00	.00	.00	.00	.00
69.9500	.00	.00	.00	.00	.00
70.2000	.00	.00	.00	.00	.00
70.4500	.00	.00	.00	.00	.00
70.7000	.00	.00	.00	.00	.00
70.9500	.00	.00	.00	.00	.00
71.2000	.00	.00	.00	.00	.00
71.4500	.00	.00	.00	.00	.00
71.7000	.00	.00	.00	.00	.00
71.9500	.00	.00	.00	.00	.00
72.2000	.00	.00	.00	.00	.00
72.4500	.00	.00	.00	.00	.00
72.7000	.00	.00	.00	.00	.00
72.9500	.00	.00	.00	.00	.00
73.2000	.00	.00	.00	.00	.00
73.4500	.00	.00	.00	.00	.00
73.7000	.00	.00	.00	.00	.00
73.9500	.00	.00	.00	.00	.00
74.2000	.00	.00	.00	.00	.00
74.4500	.00	.00	.00	.00	.00

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
74.7000	.00	.00	.00	.00	.00
74.9500	.00	.00	.00	.00	.00
75.2000	.00	.00	.00	.00	.00
75.4500	.00	.00	.00	.00	.00
75.7000	.00	.00	.00	.00	.00
75.9500	.00	.00	.00	.00	.00
76.2000	.00	.00	.00	.00	.00
76.4500	.00	.00	.00	.00	.00
76.7000	.00	.00	.00	.00	.00
76.9500	.00	.00	.00	.00	.00
77.2000	.00	.00	.00	.00	.00
77.4500	.00	.00	.00	.00	.00
77.7000	.00	.00	.00	.00	.00
77.9500	.00	.00	.00	.00	.00
78.2000	.00	.00	.00	.00	.00
78.4500	.00	.00	.00	.00	.00
78.7000	.00	.00	.00	.00	.00
78.9500	.00	.00	.00	.00	.00
79.2000	.00	.00	.00	.00	.00
79.4500	.00	.00	.00	.00	.00
79.7000	.00	.00	.00	.00	.00
79.9500	.00	.00	.00	.00	.00
80.2000	.00	.00	.00	.00	.00
80.4500	.00	.00	.00	.00	.00
80.7000	.00	.00	.00	.00	.00
80.9500	.00	.00	.00	.00	.00
81.2000	.00	.00	.00	.00	.00
81.4500	.00	.00	.00	.00	.00
81.7000	.00	.00	.00	.00	.00

LEVEL POOL ROUTING SUMMARY

HYG Dir = C:\Program Files\Haestad\PPKW\
Inflow HYG file = NONE STORED - POND 10 IN 10yr
Outflow HYG file = NONE STORED - POND 10 OUT 10yr

Pond Node Data = POND 10
Pond Volume Data = POND 10
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS

Starting WS Elev	=	54.85 ft
Starting Volume	=	.432 ac-ft
Starting Outflow	=	.00 cfs
Starting Infiltr.	=	.00 cfs
Starting Total Qout	=	.00 cfs
Time Increment	=	.0500 hrs

INFLOW/OUTFLOW HYDROGRAPH SUMMARY

Peak Inflow	=	28.85 cfs	at	12.1000 hrs
Peak Outflow	=	19.87 cfs	at	12.2500 hrs
Peak Elevation	=	56.61 ft		
Peak Storage	=	1.267 ac-ft		

MASS BALANCE (ac-ft)

+ Initial Vol	=	.432
+ HYG Vol IN	=	2.571
- Infiltration	=	.000
- HYG Vol OUT	=	2.565
- Retained Vol	=	.438
Unrouted Vol	=	.000 ac-ft (.000% of Inflow Volume)

POND ROUTED TOTAL OUTFLOW HYG...
HYG file =
HYG ID = POND 10 OUT
HYG Tag = 10yr

Peak Discharge	19.87 cfs
Time to Peak	12.2500 hrs
HYG Volume	2.565 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
5.6500	.00	.00	.00	.00	.00
5.9000	.00	.00	.00	.00	.00
6.1500	.00	.00	.00	.00	.00
6.4000	.00	.00	.00	.00	.00
6.6500	.00	.00	.00	.00	.00
6.9000	.00	.00	.00	.00	.00
7.1500	.00	.00	.00	.00	.00
7.4000	.00	.00	.01	.01	.01
7.6500	.01	.01	.01	.01	.01
7.9000	.01	.01	.01	.02	.02
8.1500	.02	.02	.02	.03	.03
8.4000	.03	.03	.03	.04	.04
8.6500	.04	.05	.05	.05	.05
8.9000	.06	.06	.06	.07	.07
9.1500	.08	.08	.09	.09	.10
9.4000	.10	.11	.11	.12	.13
9.6500	.13	.14	.14	.15	.16
9.9000	.16	.17	.17	.18	.18
10.1500	.19	.19	.20	.20	.21
10.4000	.21	.22	.22	.23	.23
10.6500	.24	.24	.25	.25	.26
10.9000	.26	.27	.27	.28	.29
11.1500	.29	.30	.30	.31	.32
11.4000	.33	.33	.34	.35	.36
11.6500	.37	.38	.40	.42	.44
11.9000	1.14	2.69	5.10	8.59	12.72
12.1500	16.63	19.13	19.87	19.42	18.42
12.4000	17.14	15.73	14.28	12.78	11.40
12.6500	10.11	9.00	8.10	7.32	6.65
12.9000	6.14	5.70	5.30	4.94	4.62
13.1500	4.34	4.10	3.91	3.75	3.60
13.4000	3.47	3.35	3.24	3.14	3.05
13.6500	2.96	2.88	2.81	2.73	2.67

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
13.9000	2.60	2.54	2.48	2.42	2.37
14.1500	2.31	2.26	2.22	2.17	2.14
14.4000	2.11	2.08	2.05	2.03	2.00
14.6500	1.97	1.95	1.92	1.89	1.87
14.9000	1.84	1.82	1.79	1.77	1.75
15.1500	1.72	1.70	1.67	1.65	1.63
15.4000	1.60	1.58	1.55	1.53	1.51
15.6500	1.48	1.46	1.44	1.41	1.39
15.9000	1.37	1.34	1.32	1.30	1.27
16.1500	1.25	1.23	1.21	1.19	1.17
16.4000	1.15	1.14	1.12	1.11	1.09
16.6500	1.08	1.06	1.05	1.04	1.03
16.9000	1.01	1.00	.99	.98	.97
17.1500	.95	.94	.93	.92	.91
17.4000	.90	.89	.88	.87	.86
17.6500	.85	.84	.83	.81	.80
17.9000	.79	.78	.78	.77	.77
18.1500	.76	.75	.75	.74	.74
18.4000	.73	.73	.72	.72	.71
18.6500	.71	.70	.70	.70	.69
18.9000	.69	.68	.68	.67	.67
19.1500	.67	.66	.66	.66	.65
19.4000	.65	.64	.64	.64	.63
19.6500	.63	.63	.62	.62	.62
19.9000	.61	.61	.61	.60	.60
20.1500	.60	.59	.59	.59	.58
20.4000	.58	.58	.57	.57	.57
20.6500	.56	.56	.56	.56	.55
20.9000	.55	.55	.55	.54	.54
21.1500	.54	.54	.53	.53	.53
21.4000	.52	.52	.52	.52	.51
21.6500	.51	.51	.51	.50	.50
21.9000	.50	.50	.50	.49	.49
22.1500	.49	.49	.48	.48	.48
22.4000	.48	.47	.47	.47	.47
22.6500	.46	.46	.46	.46	.45
22.9000	.45	.45	.45	.45	.44
23.1500	.44	.44	.44	.44	.44
23.4000	.44	.44	.44	.44	.44
23.6500	.44	.44	.44	.44	.44
23.9000	.44	.44	.44	.44	.44
24.1500	.44	.44	.44	.44	.43
24.4000	.43	.43	.43	.43	.43
24.6500	.43	.43	.43	.43	.42
24.9000	.42	.42	.42	.42	.42
25.1500	.42	.42	.42	.42	.41
25.4000	.41	.41	.41	.41	.41

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
25.6500	.41	.41	.41	.41	.41
25.9000	.40	.40	.40	.40	.40
26.1500	.40	.40	.40	.40	.40
26.4000	.39	.39	.39	.39	.39
26.6500	.39	.39	.39	.39	.39
26.9000	.38	.38	.38	.38	.38
27.1500	.38	.38	.38	.38	.38
27.4000	.37	.37	.37	.37	.37
27.6500	.37	.37	.37	.37	.37
27.9000	.36	.36	.36	.36	.36
28.1500	.36	.36	.36	.36	.36
28.4000	.36	.35	.35	.35	.35
28.6500	.35	.35	.35	.35	.35
28.9000	.35	.34	.34	.34	.34
29.1500	.34	.34	.34	.34	.34
29.4000	.34	.33	.33	.33	.33
29.6500	.33	.33	.33	.33	.33
29.9000	.33	.32	.32	.32	.32
30.1500	.32	.32	.32	.32	.32
30.4000	.32	.31	.31	.31	.31
30.6500	.31	.31	.31	.31	.31
30.9000	.31	.31	.30	.30	.30
31.1500	.30	.30	.30	.30	.30
31.4000	.30	.30	.29	.29	.29
31.6500	.29	.29	.29	.29	.29
31.9000	.29	.29	.28	.28	.28
32.1500	.28	.28	.28	.28	.28
32.4000	.28	.28	.27	.27	.27
32.6500	.27	.27	.27	.27	.27
32.9000	.27	.27	.26	.26	.26
33.1500	.26	.26	.26	.26	.26
33.4000	.26	.26	.25	.25	.25
33.6500	.25	.25	.25	.25	.25
33.9000	.25	.25	.24	.24	.24
34.1500	.24	.24	.24	.24	.24
34.4000	.24	.24	.24	.23	.23
34.6500	.23	.23	.23	.23	.23
34.9000	.23	.23	.23	.23	.22
35.1500	.22	.22	.22	.22	.22
35.4000	.22	.22	.22	.21	.21
35.6500	.21	.21	.21	.21	.21
35.9000	.21	.21	.20	.20	.20
36.1500	.20	.20	.20	.20	.20
36.4000	.20	.20	.19	.19	.19
36.6500	.19	.19	.19	.19	.19
36.9000	.19	.19	.19	.18	.18
37.1500	.18	.18	.18	.18	.18

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
37.4000	.18	.18	.18	.18	.17
37.6500	.17	.17	.17	.17	.17
37.9000	.17	.17	.17	.17	.17
38.1500	.16	.16	.16	.16	.16
38.4000	.16	.16	.15	.15	.15
38.6500	.15	.15	.15	.15	.14
38.9000	.14	.14	.14	.14	.14
39.1500	.14	.14	.13	.13	.13
39.4000	.13	.13	.13	.13	.13
39.6500	.13	.12	.12	.12	.12
39.9000	.12	.12	.12	.12	.12
40.1500	.12	.11	.11	.11	.11
40.4000	.11	.11	.11	.11	.11
40.6500	.11	.10	.10	.10	.10
40.9000	.10	.10	.10	.10	.10
41.1500	.10	.10	.09	.09	.09
41.4000	.09	.09	.09	.09	.09
41.6500	.09	.09	.09	.09	.09
41.9000	.08	.08	.08	.08	.08
42.1500	.08	.08	.08	.08	.08
42.4000	.08	.08	.08	.08	.07
42.6500	.07	.07	.07	.07	.07
42.9000	.07	.07	.07	.07	.07
43.1500	.07	.07	.07	.07	.07
43.4000	.07	.06	.06	.06	.06
43.6500	.06	.06	.06	.06	.06
43.9000	.06	.06	.06	.06	.06
44.1500	.06	.06	.06	.06	.06
44.4000	.06	.06	.06	.06	.05
44.6500	.05	.05	.05	.05	.05
44.9000	.05	.05	.05	.05	.05
45.1500	.05	.05	.05	.05	.05
45.4000	.05	.05	.05	.05	.05
45.6500	.05	.05	.05	.05	.05
45.9000	.05	.05	.05	.04	.04
46.1500	.04	.04	.04	.04	.04
46.4000	.04	.04	.04	.04	.04
46.6500	.04	.04	.04	.04	.04
46.9000	.04	.04	.04	.04	.04
47.1500	.04	.04	.04	.04	.04
47.4000	.04	.04	.04	.04	.04
47.6500	.04	.04	.04	.03	.03
47.9000	.03	.03	.03	.03	.03
48.1500	.03	.03	.03	.03	.03
48.4000	.03	.03	.03	.03	.03
48.6500	.03	.03	.03	.03	.03
48.9000	.03	.03	.03	.03	.03

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
49.1500	.03	.03	.03	.03	.03
49.4000	.03	.03	.03	.03	.03
49.6500	.03	.03	.03	.03	.03
49.9000	.03	.03	.03	.03	.03
50.1500	.02	.02	.02	.02	.02
50.4000	.02	.02	.02	.02	.02
50.6500	.02	.02	.02	.02	.02
50.9000	.02	.02	.02	.02	.02
51.1500	.02	.02	.02	.02	.02
51.4000	.02	.02	.02	.02	.02
51.6500	.02	.02	.02	.02	.02
51.9000	.02	.02	.02	.02	.02
52.1500	.02	.02	.02	.02	.02
52.4000	.02	.02	.02	.02	.02
52.6500	.02	.02	.02	.02	.02
52.9000	.02	.02	.02	.02	.02
53.1500	.02	.02	.02	.02	.02
53.4000	.02	.02	.02	.02	.02
53.6500	.02	.02	.01	.01	.01
53.9000	.01	.01	.01	.01	.01
54.1500	.01	.01	.01	.01	.01
54.4000	.01	.01	.01	.01	.01
54.6500	.01	.01	.01	.01	.01
54.9000	.01	.01	.01	.01	.01
55.1500	.01	.01	.01	.01	.01
55.4000	.01	.01	.01	.01	.01
55.6500	.01	.01	.01	.01	.01
55.9000	.01	.01	.01	.01	.01
56.1500	.01	.01	.01	.01	.01
56.4000	.01	.01	.01	.01	.01
56.6500	.01	.01	.01	.01	.01
56.9000	.01	.01	.01	.01	.01
57.1500	.01	.01	.01	.01	.01
57.4000	.01	.01	.01	.01	.01
57.6500	.01	.01	.01	.01	.01
57.9000	.01	.01	.01	.01	.01
58.1500	.01	.01	.01	.01	.01
58.4000	.01	.01	.01	.01	.01
58.6500	.01	.01	.01	.01	.01
58.9000	.01	.01	.01	.01	.01
59.1500	.01	.01	.01	.01	.01
59.4000	.01	.01	.01	.01	.01
59.6500	.01	.01	.01	.01	.01
59.9000	.01	.01	.01	.01	.01
60.1500	.01	.01	.01	.01	.01
60.4000	.01	.01	.01	.01	.01
60.6500	.01	.01	.01	.01	.01

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
60.9000	.01	.01	.01	.01	.01
61.1500	.01	.01	.01	.01	.01
61.4000	.01	.01	.01	.01	.01
61.6500	.01	.01	.01	.01	.01
61.9000	.01	.01	.01	.01	.01
62.1500	.01	.01	.01	.01	.01
62.4000	.01	.01	.01	.01	.01
62.6500	.01	.01	.01	.01	.01
62.9000	.01	.01	.01	.01	.01
63.1500	.01	.01	.01	.01	.01
63.4000	.01	.01	.01	.01	.01
63.6500	.01	.01	.01	.01	.01
63.9000	.01	.01	.01	.01	.01
64.1500	.01	.01	.01	.01	.01
64.4000	.01	.01	.01	.01	.01
64.6500	.01	.01	.01	.01	.01
64.9000	.01	.01	.01	.01	.01
65.1500	.01	.01	.01	.01	.01
65.4000	.01	.01	.01	.01	.01
65.6500	.01	.01	.01	.01	.01
65.9000	.01	.01	.01	.01	.01
66.1500	.01	.01	.01	.01	.01
66.4000	.01	.01	.01	.01	.01
66.6500	.01	.01	.01	.01	.01
66.9000	.01	.01	.01	.01	.01
67.1500	.01	.01	.01	.01	.01
67.4000	.01	.01	.01	.01	.01
67.6500	.01	.01	.01	.01	.01
67.9000	.01	.01	.01	.01	.01
68.1500	.01	.01	.01	.01	.01
68.4000	.01	.01	.01	.01	.01
68.6500	.01	.01	.01	.01	.01
68.9000	.01	.01	.01	.01	.01
69.1500	.01	.01	.01	.01	.01
69.4000	.01	.01	.01	.01	.01
69.6500	.01	.01	.01	.01	.01
69.9000	.01	.01	.01	.01	.01
70.1500	.01	.00	.00	.00	.00
70.4000	.00	.00	.00	.00	.00
70.6500	.00	.00	.00	.00	.00
70.9000	.00	.00	.00	.00	.00
71.1500	.00	.00	.00	.00	.00
71.4000	.00	.00	.00	.00	.00
71.6500	.00	.00	.00	.00	.00
71.9000	.00	.00	.00	.00	.00
72.1500	.00	.00	.00	.00	.00
72.4000	.00	.00	.00	.00	.00

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
72.6500	.00	.00	.00	.00	.00
72.9000	.00	.00	.00	.00	.00
73.1500	.00	.00	.00	.00	.00
73.4000	.00	.00	.00	.00	.00
73.6500	.00	.00	.00	.00	.00
73.9000	.00	.00	.00	.00	.00
74.1500	.00	.00	.00	.00	.00
74.4000	.00	.00	.00	.00	.00
74.6500	.00	.00	.00	.00	.00
74.9000	.00	.00	.00	.00	.00
75.1500	.00	.00	.00	.00	.00
75.4000	.00	.00	.00	.00	.00
75.6500	.00	.00	.00	.00	.00
75.9000	.00	.00	.00	.00	.00
76.1500	.00	.00	.00	.00	.00
76.4000	.00	.00	.00	.00	.00
76.6500	.00	.00	.00	.00	.00
76.9000	.00	.00	.00	.00	.00
77.1500	.00	.00	.00	.00	.00
77.4000	.00	.00	.00	.00	.00
77.6500	.00	.00	.00	.00	.00
77.9000	.00	.00	.00	.00	.00
78.1500	.00	.00	.00	.00	.00
78.4000	.00	.00	.00	.00	.00
78.6500	.00	.00	.00	.00	.00
78.9000	.00	.00	.00	.00	.00
79.1500	.00	.00	.00	.00	.00
79.4000	.00	.00	.00	.00	.00
79.6500	.00	.00	.00	.00	.00
79.9000	.00	.00	.00	.00	.00
80.1500	.00	.00	.00	.00	.00
80.4000	.00	.00	.00	.00	.00
80.6500	.00	.00	.00	.00	.00
80.9000	.00	.00	.00	.00	.00
81.1500	.00	.00	.00	.00	.00
81.4000	.00	.00	.00	.00	.00
81.6500	.00	.00	.00	.00	.00
81.9000	.00	.00	.00	.00	.00
82.1500	.00	.00	.00	.00	.00
82.4000	.00	.00	.00	.00	.00
82.6500	.00	.00	.00	.00	.00
82.9000	.00	.00	.00	.00	.00
83.1500	.00	.00	.00	.00	.00
83.4000	.00	.00	.00	.00	.00
83.6500	.00	.00			

LEVEL POOL ROUTING SUMMARY

HYG Dir = C:\Program Files\Haestad\PPKW\
Inflow HYG file = NONE STORED - POND 10 IN 100yr
Outflow HYG file = NONE STORED - POND 10 OUT 100yr

Pond Node Data = POND 10
Pond Volume Data = POND 10
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS

Starting WS Elev	=	54.85 ft
Starting Volume	=	.432 ac-ft
Starting Outflow	=	.00 cfs
Starting Infiltr.	=	.00 cfs
Starting Total Qout	=	.00 cfs
Time Increment	=	.0500 hrs

INFLOW/OUTFLOW HYDROGRAPH SUMMARY

Peak Inflow	=	44.94 cfs	at	12.1000 hrs
Peak Outflow	=	27.35 cfs	at	12.3000 hrs
Peak Elevation	=	57.13 ft		
Peak Storage	=	1.539 ac-ft		

MASS BALANCE (ac-ft)

+ Initial Vol	=	.432
+ HYG Vol IN	=	4.081
- Infiltration	=	.000
- HYG Vol OUT	=	4.074
- Retained Vol	=	.438
Unrouted Vol	=	.000 ac-ft (.000% of Inflow Volume)

POND ROUTED TOTAL OUTFLOW HYG...
HYG file =
HYG ID = POND 10 OUT
HYG Tag = 100yr

Peak Discharge =	27.35 cfs
Time to Peak =	12.3000 hrs
HYG Volume =	4.074 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
4.2500	.00	.00	.00	.00	.00
4.5000	.00	.00	.00	.00	.00
4.7500	.00	.00	.00	.00	.00
5.0000	.00	.00	.00	.00	.00
5.2500	.00	.00	.00	.00	.00
5.5000	.00	.00	.00	.00	.00
5.7500	.00	.00	.00	.01	.01
6.0000	.01	.01	.01	.01	.01
6.2500	.01	.01	.01	.01	.01
6.5000	.02	.02	.02	.02	.02
6.7500	.03	.03	.03	.03	.03
7.0000	.04	.04	.04	.04	.05
7.2500	.05	.05	.06	.06	.06
7.5000	.06	.07	.07	.08	.08
7.7500	.08	.09	.09	.10	.10
8.0000	.11	.11	.12	.12	.13
8.2500	.13	.14	.14	.15	.16
8.5000	.16	.17	.17	.18	.18
8.7500	.18	.19	.19	.20	.20
9.0000	.21	.21	.22	.22	.23
9.2500	.23	.23	.24	.24	.25
9.5000	.25	.26	.26	.27	.27
9.7500	.28	.28	.29	.29	.30
10.0000	.30	.31	.31	.32	.32
10.2500	.33	.33	.34	.35	.35
10.5000	.36	.36	.37	.38	.38
10.7500	.39	.39	.40	.41	.41
11.0000	.42	.43	.43	.44	.56
11.2500	.75	1.11	1.49	1.85	2.21
11.5000	2.64	3.07	3.53	4.10	4.95
11.7500	6.03	7.43	9.10	11.10	13.58
12.0000	17.26	22.34	26.15	26.74	27.15
12.2500	27.34	27.35	27.24	27.05	26.76

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
12.5000	26.38	25.30	21.93	18.44	15.66
12.7500	13.52	11.85	10.56	9.49	8.66
13.0000	7.96	7.35	6.82	6.38	6.02
13.2500	5.71	5.44	5.21	5.00	4.82
13.5000	4.65	4.51	4.37	4.25	4.14
13.7500	4.05	3.97	3.88	3.80	3.72
14.0000	3.64	3.56	3.49	3.41	3.34
14.2500	3.28	3.22	3.16	3.11	3.06
14.5000	3.01	2.96	2.92	2.88	2.84
14.7500	2.79	2.75	2.72	2.68	2.64
15.0000	2.60	2.57	2.53	2.49	2.46
15.2500	2.42	2.39	2.35	2.31	2.28
15.5000	2.24	2.21	2.17	2.15	2.12
15.7500	2.09	2.06	2.03	2.00	1.97
16.0000	1.93	1.90	1.87	1.84	1.81
16.2500	1.78	1.75	1.73	1.70	1.68
16.5000	1.66	1.63	1.61	1.59	1.57
16.7500	1.55	1.54	1.52	1.50	1.48
17.0000	1.46	1.45	1.43	1.41	1.40
17.2500	1.38	1.36	1.35	1.33	1.32
17.5000	1.30	1.28	1.27	1.25	1.24
17.7500	1.22	1.21	1.19	1.18	1.16
18.0000	1.14	1.13	1.11	1.10	1.09
18.2500	1.07	1.06	1.05	1.04	1.03
18.5000	1.02	1.01	1.00	1.00	.99
18.7500	.98	.97	.97	.96	.96
19.0000	.95	.94	.94	.93	.93
19.2500	.92	.92	.91	.91	.90
19.5000	.90	.89	.89	.88	.88
19.7500	.87	.87	.86	.86	.85
20.0000	.85	.84	.84	.83	.83
20.2500	.83	.82	.82	.81	.81
20.5000	.81	.80	.80	.79	.79
20.7500	.79	.78	.78	.78	.78
21.0000	.77	.77	.77	.77	.77
21.2500	.76	.76	.76	.76	.75
21.5000	.75	.75	.74	.74	.74
21.7500	.74	.73	.73	.73	.72
22.0000	.72	.72	.72	.71	.71
22.2500	.71	.70	.70	.70	.69
22.5000	.69	.69	.68	.68	.68
22.7500	.67	.67	.67	.66	.66
23.0000	.66	.65	.65	.65	.64
23.2500	.64	.64	.63	.63	.63
23.5000	.62	.62	.62	.61	.61
23.7500	.61	.60	.60	.60	.59
24.0000	.59	.58	.57	.55	.53

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
24.2500	.50	.47	.44	.44	.44
24.5000	.44	.44	.44	.44	.44
24.7500	.43	.43	.43	.43	.43
25.0000	.43	.43	.43	.43	.43
25.2500	.42	.42	.42	.42	.42
25.5000	.42	.42	.42	.42	.42
25.7500	.41	.41	.41	.41	.41
26.0000	.41	.41	.41	.41	.41
26.2500	.40	.40	.40	.40	.40
26.5000	.40	.40	.40	.40	.40
26.7500	.39	.39	.39	.39	.39
27.0000	.39	.39	.39	.39	.39
27.2500	.38	.38	.38	.38	.38
27.5000	.38	.38	.38	.38	.38
27.7500	.38	.37	.37	.37	.37
28.0000	.37	.37	.37	.37	.37
28.2500	.37	.36	.36	.36	.36
28.5000	.36	.36	.36	.36	.36
28.7500	.36	.35	.35	.35	.35
29.0000	.35	.35	.35	.35	.35
29.2500	.35	.34	.34	.34	.34
29.5000	.34	.34	.34	.34	.34
29.7500	.34	.33	.33	.33	.33
30.0000	.33	.33	.33	.33	.33
30.2500	.33	.32	.32	.32	.32
30.5000	.32	.32	.32	.32	.32
30.7500	.32	.32	.31	.31	.31
31.0000	.31	.31	.31	.31	.31
31.2500	.31	.31	.30	.30	.30
31.5000	.30	.30	.30	.30	.30
31.7500	.30	.30	.29	.29	.29
32.0000	.29	.29	.29	.29	.29
32.2500	.29	.29	.28	.28	.28
32.5000	.28	.28	.28	.28	.28
32.7500	.28	.28	.28	.27	.27
33.0000	.27	.27	.27	.27	.27
33.2500	.27	.27	.27	.26	.26
33.5000	.26	.26	.26	.26	.26
33.7500	.26	.26	.26	.25	.25
34.0000	.25	.25	.25	.25	.25
34.2500	.25	.25	.25	.24	.24
34.5000	.24	.24	.24	.24	.24
34.7500	.24	.24	.24	.23	.23
35.0000	.23	.23	.23	.23	.23
35.2500	.23	.23	.23	.23	.22
35.5000	.22	.22	.22	.22	.22
35.7500	.22	.22	.22	.21	.21

HYDROGRAPH ORDINATES (cfs)

Output Time increment = .0500 hrs

Time hrs | Time on left represents time for first value in each row.

Time hrs					
36.0000	.21	.21	.21	.21	.21
36.2500	.21	.21	.21	.20	.20
36.5000	.20	.20	.20	.20	.20
36.7500	.20	.20	.20	.19	.19
37.0000	.19	.19	.19	.19	.19
37.2500	.19	.19	.19	.18	.18
37.5000	.18	.18	.18	.18	.18
37.7500	.18	.18	.18	.18	.17
38.0000	.17	.17	.17	.17	.17
38.2500	.17	.17	.17	.17	.17
38.5000	.16	.16	.16	.16	.16
38.7500	.16	.16	.15	.15	.15
39.0000	.15	.15	.15	.15	.15
39.2500	.14	.14	.14	.14	.14
39.5000	.14	.14	.14	.13	.13
39.7500	.13	.13	.13	.13	.13
40.0000	.13	.13	.12	.12	.12
40.2500	.12	.12	.12	.12	.12
40.5000	.12	.11	.11	.11	.11
40.7500	.11	.11	.11	.11	.11
41.0000	.11	.10	.10	.10	.10
41.2500	.10	.10	.10	.10	.10
41.5000	.10	.10	.10	.09	.09
41.7500	.09	.09	.09	.09	.09
42.0000	.09	.09	.09	.09	.09
42.2500	.08	.08	.08	.08	.08
42.5000	.08	.08	.08	.08	.08
42.7500	.08	.08	.08	.08	.07
43.0000	.07	.07	.07	.07	.07
43.2500	.07	.07	.07	.07	.07
43.5000	.07	.07	.07	.07	.07
43.7500	.07	.06	.06	.06	.06
44.0000	.06	.06	.06	.06	.06
44.2500	.06	.06	.06	.06	.06
44.5000	.06	.06	.06	.06	.06
44.7500	.06	.06	.06	.06	.06
45.0000	.05	.05	.05	.05	.05
45.2500	.05	.05	.05	.05	.05
45.5000	.05	.05	.05	.05	.05
45.7500	.05	.05	.05	.05	.05
46.0000	.05	.05	.05	.05	.05
46.2500	.05	.05	.05	.04	.04
46.5000	.04	.04	.04	.04	.04
46.7500	.04	.04	.04	.04	.04
47.0000	.04	.04	.04	.04	.04
47.2500	.04	.04	.04	.04	.04
47.5000	.04	.04	.04	.04	.04

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
47.7500	.04	.04	.04	.04	.04
48.0000	.04	.04	.04	.03	.03
48.2500	.03	.03	.03	.03	.03
48.5000	.03	.03	.03	.03	.03
48.7500	.03	.03	.03	.03	.03
49.0000	.03	.03	.03	.03	.03
49.2500	.03	.03	.03	.03	.03
49.5000	.03	.03	.03	.03	.03
49.7500	.03	.03	.03	.03	.03
50.0000	.03	.03	.03	.03	.03
50.2500	.03	.03	.03	.03	.03
50.5000	.03	.02	.02	.02	.02
50.7500	.02	.02	.02	.02	.02
51.0000	.02	.02	.02	.02	.02
51.2500	.02	.02	.02	.02	.02
51.5000	.02	.02	.02	.02	.02
51.7500	.02	.02	.02	.02	.02
52.0000	.02	.02	.02	.02	.02
52.2500	.02	.02	.02	.02	.02
52.5000	.02	.02	.02	.02	.02
52.7500	.02	.02	.02	.02	.02
53.0000	.02	.02	.02	.02	.02
53.2500	.02	.02	.02	.02	.02
53.5000	.02	.02	.02	.02	.02
53.7500	.02	.02	.02	.02	.02
54.0000	.02	.02	.02	.01	.01
54.2500	.01	.01	.01	.01	.01
54.5000	.01	.01	.01	.01	.01
54.7500	.01	.01	.01	.01	.01
55.0000	.01	.01	.01	.01	.01
55.2500	.01	.01	.01	.01	.01
55.5000	.01	.01	.01	.01	.01
55.7500	.01	.01	.01	.01	.01
56.0000	.01	.01	.01	.01	.01
56.2500	.01	.01	.01	.01	.01
56.5000	.01	.01	.01	.01	.01
56.7500	.01	.01	.01	.01	.01
57.0000	.01	.01	.01	.01	.01
57.2500	.01	.01	.01	.01	.01
57.5000	.01	.01	.01	.01	.01
57.7500	.01	.01	.01	.01	.01
58.0000	.01	.01	.01	.01	.01
58.2500	.01	.01	.01	.01	.01
58.5000	.01	.01	.01	.01	.01
58.7500	.01	.01	.01	.01	.01
59.0000	.01	.01	.01	.01	.01
59.2500	.01	.01	.01	.01	.01

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .0500 hrs
Time on left represents time for first value in each row.

Time hrs					
59.5000	.01	.01	.01	.01	.01
59.7500	.01	.01	.01	.01	.01
60.0000	.01	.01	.01	.01	.01
60.2500	.01	.01	.01	.01	.01
60.5000	.01	.01	.01	.01	.01
60.7500	.01	.01	.01	.01	.01
61.0000	.01	.01	.01	.01	.01
61.2500	.01	.01	.01	.01	.01
61.5000	.01	.01	.01	.01	.01
61.7500	.01	.01	.01	.01	.01
62.0000	.01	.01	.01	.01	.01
62.2500	.01	.01	.01	.01	.01
62.5000	.01	.01	.01	.01	.01
62.7500	.01	.01	.01	.01	.01
63.0000	.01	.01	.01	.01	.01
63.2500	.01	.01	.01	.01	.01
63.5000	.01	.01	.01	.01	.01
63.7500	.01	.01	.01	.01	.01
64.0000	.01	.01	.01	.01	.01
64.2500	.01	.01	.01	.01	.01
64.5000	.01	.01	.01	.01	.01
64.7500	.01	.01	.01	.01	.01
65.0000	.01	.01	.01	.01	.01
65.2500	.01	.01	.01	.01	.01
65.5000	.01	.01	.01	.01	.01
65.7500	.01	.01	.01	.01	.01
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66.5000	.01	.01	.01	.01	.01
66.7500	.01	.01	.01	.01	.01
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67.2500	.01	.01	.01	.01	.01
67.5000	.01	.01	.01	.01	.01
67.7500	.01	.01	.01	.01	.01
68.0000	.01	.01	.01	.01	.01
68.2500	.01	.01	.01	.01	.01
68.5000	.01	.01	.01	.01	.01
68.7500	.01	.01	.01	.01	.01
69.0000	.01	.01	.01	.01	.01
69.2500	.01	.01	.01	.01	.01
69.5000	.01	.01	.01	.01	.01
69.7500	.01	.01	.01	.01	.01
70.0000	.01	.01	.01	.01	.01
70.2500	.01	.01	.01	.01	.01
70.5000	.01	.00	.00	.00	.00
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Time on left represents time for first value in each row.

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72.7500	.00	.00	.00	.00	.00
73.0000	.00	.00	.00	.00	.00
73.2500	.00	.00	.00	.00	.00
73.5000	.00	.00	.00	.00	.00
73.7500	.00	.00	.00	.00	.00
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74.7500	.00	.00	.00	.00	.00
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75.2500	.00	.00	.00	.00	.00
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76.5000	.00	.00	.00	.00	.00
76.7500	.00	.00	.00	.00	.00
77.0000	.00	.00	.00	.00	.00
77.2500	.00	.00	.00	.00	.00
77.5000	.00	.00	.00	.00	.00
77.7500	.00	.00	.00	.00	.00
78.0000	.00	.00	.00	.00	.00
78.2500	.00	.00	.00	.00	.00
78.5000	.00	.00	.00	.00	.00
78.7500	.00	.00	.00	.00	.00
79.0000	.00	.00	.00	.00	.00
79.2500	.00	.00	.00	.00	.00
79.5000	.00	.00	.00	.00	.00
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81.5000	.00	.00	.00	.00	.00
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82.0000	.00	.00	.00	.00	.00
82.2500	.00	.00	.00	.00	.00
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83.5000	.00	.00	.00	.00	.00
83.7500	.00	.00	.00	.00	.00
84.0000	.00	.00			

Index of Starting Page Numbers for ID Names

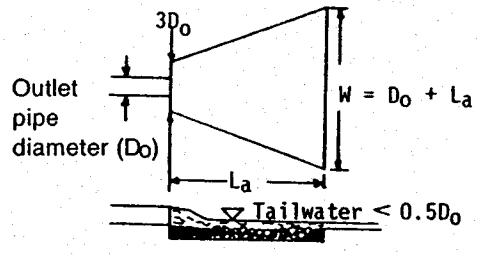
Worksheet
Worksheet for Circular Channel

Project Description	
Worksheet	Ex Outlet pipe
Flow Element	Circular Channe
Method	Manning's Forr
Solve For	Full Flow Capac

Input Data		
Mannings Coeffic	0.012	
Slope	.005000	ft/ft
Diameter	24	in

Results		
Depth	2.00	ft
Discharge	17.33	cfs
Flow Area	3.1	ft²
Wetted Perime	6.28	ft
Top Width	0.00	ft
Critical Depth	1.50	ft
Percent Full	100.0	%
Critical Slope	.006008	ft/ft
Velocity	5.52	ft/s
Velocity Head	0.47	ft
Specific Energ	2.47	ft
Froude Numbe	0.00	
Maximum Disc	18.64	cfs
Discharge Full	17.33	cfs
Slope Full	005000	ft/ft
Flow Type	N/A	

calculations for Existing
SED BASIN OUTLET



Curves may not be extrapolated.

Figure 8.06a Design of outlet protection protection from a round pipe flowing full, minimum tailwater condition (T_w < 0.5 diameter).

Appendix B

APPENDIX B
TECHNICAL SPECIFICATIONS
ASH LANDFILL
SOIL COVER - FINAL DESIGN REPORT
DUPONT KINSTON
KINSTON, NORTH CAROLINA

February 25, 2003

Project No. 18983688.00012

CORPORATE REMEDIATION GROUP
An Alliance between
DuPont and The W-C Diamond Group

Barley Mill Plaza, Building 27
Wilmington, Delaware 19880-0027

Kinston Ash Landfill
Soil Cover Construction
Final Design

List of Specifications

Division 1 – General Requirements

01010 – Summary of Work
01015 – Contractor's Use of Site
01025 – Measurement and Payment
(to be provided with bid package)
01040 – Coordination
01050 – Field Engineering
01110 – Safety, Health, and Emergency Response
01115 – Chemical Data Quality Management
01200 – Project Meetings
01300 – Submittals
01440 – Contractor Quality Control
01510 – Utilities and Controls
01590 – Field Offices
01700 – Project Closeout
01720 – Project Record Documents
01900 – Previous Subsurface Investigation Information

DIVISION 1 - GENERAL REQUIREMENTS
SECTION 01010
SUMMARY OF WORK

PART 1 - GENERAL

1.1 SCOPE

This section includes a brief description of the major construction activities included under this contract. Individual activities are more thoroughly described in subsequent sections of the Specifications. The Contractor shall be responsible for ensuring that sufficient equipment, labor, and materials, including health and safety and quality control provisions, are supplied to execute all work activities for final acceptance.

A. **Location of Work.** The Work of this Contract is located at the DuPont Kinston Plant located along Route 11 in Kinston, North Carolina. A location map is provided with the Drawings.

1.2 GENERAL REQUIREMENTS

As minimum requirements, the Contractor shall observe and follow all appropriate and relevant procedures identified in applicable federal, state, and local rules and regulations in conducting the work. Other applicable regulations not explicitly included in these Specifications shall be adhered to in conducting the work. The Contractor shall be responsible for contacting and informing the proper federal, state, and local agencies of the nature and timing of work on-site (including, if necessary, transportation of materials off the site for off-site disposal as needed and schedule for hauling of clean fill to the site) and for securing all necessary (and otherwise not obtained by DuPont) and applicable permits required to construct the work covered by this contract.

A. **Existing Features.** The Contractor shall protect and maintain survey and grid stakes and any other items as directed in the field by the Construction Manager against damage from equipment and vehicular traffic. Any damage shall be repaired by the Contractor at no expense to DuPont.

B. **Utilities.** The Contractor shall protect utility lines or appurtenances that are to remain. Utility locations have been shown on the Contract Drawings based on previously obtained information and have not been field verified. It is the Contractor's responsibility to locate or verify existing utilities on-site and to coordinate utility location with Kinston Plant Personnel. Any damage shall be repaired by the Contractor at no expense to DuPont. The State of North Carolina provides a construction alert system (One-Call) for utilities at 1-800-632-4949.

1.3 MATERIALS AND EQUIPMENT

Materials and equipment shall be provided in sufficient quantities for required construction activities. Materials and equipment shall not be stored or used in such a manner as to create unsafe conditions, and shall meet requirements of applicable codes and the approval of the Construction Manager and the Engineer.

1.4 DESCRIPTION OF WORK

The project generally includes construction of the following: an engineered soil cover to be constructed from on-site borrow for the Ash Landfill; Ash landfill sludge cover installation including woven geotextile to bridge over the sludge pond (located within the ash landfill); leachate collection and conveyance system; cap access roadways; drainage diversion ditches; sediment traps; culverts; and temporary erosion control measures during construction. In addition, the Contractor shall be responsible for soil excavation, hauling and placement (from the borrow area), borrow area grading and restoration, and C&D, borrow area, and Ash landfill area soil amendment and vegetation establishment.

The Contractor shall be responsible for providing all testing services, temporary facilities and related materials and equipment for the performance of the described work. The Contractor shall be responsible for the construction and installation of all temporary erosion and sediment control structures prior to full-scale earth disturbance or earth moving activities and maintenance of these controls throughout construction. The Contractor shall coordinate with Plant and local government transportation officials and be responsible for coordination of traffic flow resulting from site work and for road repairs as may be deemed necessary by these transportation officials.

The soil cover will be installed, tested, and ready for continuous service. Repairs, replacements, and restoration as a result of damages resulting from construction operations will be performed by the Contractor. All materials, equipment, and incidentals which are reasonably and properly inferable and necessary for the proper completion of the work, whether specifically indicated in the contract documents or not, will be furnished.

1.5 WORK TO BE PERFORMED

The major construction activities included are summarized below.

A. Temporary Site Facilities

Maintenance of temporary site facilities (as required by the Contractor) including, staging areas, Contractor offices, security and communication operations, personnel and equipment decontamination facilities, project signs during the performance period of the Contract, and removal of same at the completion of construction activities.

B. Temporary Site Utilities

This provision includes the operation and maintenance of all temporary site utilities (as required by the Contractor) including telephone, electricity, water, and sanitation.

C. Contractor Quality Control Plan

The Contractor shall develop and implement the Contractor Quality Control Plan, as identified in subsequent sections of the specifications. Four (4) copies of this plan shall be submitted to the Construction Manager within 10 days after Notice to Proceed. The Contractor shall also develop and implement all other plans required under this Contract and under applicable federal, state, and local laws.

D. Establishment of Temporary and Permanent Erosion and Sediment Control Measures

This activity includes the installation of sediment fence, rock check dams and rock filter outlets, sediment traps and associated structures, temporary diversions, erosion control blankets and turf reinforcement matting, culverts, riprap ditch and culvert inlet / outlet protection, stabilized construction entrance, etc.

E. Clearing and Grubbing

Activities associated with clearing and grubbing of the site, as required for project execution.

F. Soil Cover Construction – Ash Landfill Area

Construction of soil cover including geotextile deployment, grading, compaction, cover soil amendment, and vegetation establishment via seeding and mulching and erosion control blanket installation.

G. Leachate Collection and Conveyance System Intallation

Construction of the leachate collection and conveyance system including all ash landfill collection system perimeter infrastructure and conveyance infrastructure to the designated tie-in point.

H. Borrow Area Development

Development of the existing borrow area sediment basin including grading and vegetation establishment via seeding and mulching of the sediment basin embankments.

I. Soil amendment and vegetation establishment

Soil amendment and vegetation establishment of all disturbed areas including the C&D Landfill, Borrow Area, and Ash Landfill Area.

J. Quality Control
Maintain a quality control program to ensure that all operations performed by the Contractor and all subcontractors are completed in accordance with the provisions of this Contract.

K. Safety
Provide required safety for both personnel and equipment.

L. Project Documentation
Document all work, including work associated with health and safety, quality control, field engineering, and as-built documentation.

M. Project Closeout
Activities include, but are not limited to: decontamination and removal of all Contractor equipment, removal of all temporary construction facilities as directed by the Construction Manager, disconnection and restoration of all temporary utilities, and transfer of all records, drawings, and other project-related material to the Construction Manager.

All other activities to satisfactorily complete all work covered by the Technical Specifications, any drawings not specifically discussed but necessary for the project construction and final acceptance.

All other work required by DuPont under the terms of this Contract.

1.6 CONSTRUCTION SEQUENCE

The major construction sequence (as detailed in the Drawings) shall be adhered to by the Contractor during project execution.

1.7 LIMITATIONS TO CONSTRUCTION SEQUENCE

Construction under this contract must be coordinated with the Construction Manager and DuPont and accomplished in a logical order to allow construction to be completed within the schedule time allowed by the Contract Documents. The following limitations apply to the construction sequence for work under this contract:

A. Existing piping, trench spoils, and appurtenant materials to be disposed of from project execution will be disposed of underneath the Constructed cap or disposed of offsite if required by the Kinston Plant.

B. Access to and traffic flow through adjacent roadways shall be maintained throughout construction including Plant gravel and dirt roadways.

C. Site erosion and sediment control structures shall be constructed prior to initiation of full-scale site disturbance.

D. Construction activity shall be limited to 12 hours a day during daylight hours. Work shall not be conducted overnight, unless written approval is provided by the Construction Manager. Plant requirements may include daily work permits which shall be coordinated with Plant personnel.

1.8 WORK BY OTHERS

Health and Safety procedures to be adhered to during project execution have been prepared by DuPont and are including herein. The Contractor shall be responsible for compliance with these procedures.

PART 2 – MATERIALS

NOT APPLICABLE.

PART 3 – EXECUTION

NOT APPLICABLE.

[END OF SECTION]

DIVISION 1 - GENERAL REQUIREMENTS
SECTION 01015
CONTRACTOR'S USE OF SITE

PART 1 - GENERAL

1.1 SCOPE

This section covers the Contractor's rights and responsibilities with respect to the use of the Project Site, the extent of which is delineated in the Drawings.

1.2 GENERAL REQUIREMENTS

The Contractor must obtain written approval of the Contractor Quality Control Plan from the Construction Manager prior to executing any work on-site. The Contractor shall provide written acceptance of the Health and Safety Plan (HASP) to the Construction Manager. The HASP shall be provided by DuPont and implemented by the Contractor. The Contractor shall submit for approval a layout of the temporary site facilities, and a layout of staging and office facilities, prior to working on the project site. Only upon approval by the Construction Manager will the Contractor have access to the entire site, except for the areas occupied by the Construction Manager's office and work area.

No construction activity will be permitted until the Contractor's submittals for that activity have been approved by, as appropriate, the Construction Manager or the Engineer as required by the individual sections of these specifications.

PART 2 - MATERIALS

NOT APPLICABLE.

PART 3 - EXECUTION

3.1 EXECUTION

A. Scope

The Contractor will not have complete and exclusive use of the site for execution of the work. The Contractor shall share the site with DuPont and their authorized representatives including the Construction Manager, Engineer and regulatory authorities who have received prior approval for site entrance by DuPont. The Contractor is responsible for coordinating all activities with DuPont and their authorized representatives.

B. Contractor Responsibility

The Contractor shall assume full responsibility for the protection and safekeeping of equipment and materials located on-site. The Contractor shall assume full responsibility for the health and safety of all on-site personnel.

[END OF SECTION]

DIVISION 1 - GENERAL REQUIREMENTS
SECTION 01040
COORDINATION

PART 1 - GENERAL

1.1 DEFINITIONS

A. Construction Manager
The Construction Manager or his designee is DuPont's on-site representative responsible for daily on-site construction monitoring, coordination with DuPont or DuPont's representatives, and quality assurance.

B. Engineer
The Engineer developed the Contract Drawings and Specifications for DuPont and shall be responsible for review and approval of appropriate submittals for conformance with the Contract documents during construction.

C. Contractor
Contractor as used in the Specifications may refer to the general contractor or any other subcontractor at any tier. SECTION: SUMMARY OF WORK and the section in which it is used provide context for defining Contractor.

D. DuPont Corporate Remediation Group (CRG)
The DuPont CRG is undertaking the remedy through the Contractor, Engineer, and Construction Manager.

E. Contractor's Independent Quality Control Contractor
The Contractor's Independent Quality Control (QC) Contractor shall conduct sufficient inspections and tests of all items of work to ensure conformance to applicable Drawings and Specifications with respect to the quality of materials, workmanship, construction, function performance, and identification. QC shall be in accordance with SECTION: CONTRACTOR QUALITY CONTROL.

PART 2 - MATERIALS

NOT APPLICABLE.

PART 3 - EXECUTION

3.1 CONSTRUCTION

A. During construction, the Contractor shall serve as construction coordinator and is responsible for the performance of all work in accordance with the Contract Documents, including the Construction Drawings and Technical Specifications.

B. The Contractor is responsible for the coordination of the work and the work of all subcontractors including the delivery and staging of materials, access to work locations, and, if necessary, coordination with other DuPont Contractors performing work on-site not related to the subject project.

C. The Construction Manager's duties include but are not limited to:

1. Review of Contractor adherence to health and safety plans.
2. Verifying that the Contractor has obtained the necessary approvals from regulatory agencies, and the necessary permits from the Plant.
3. Monitoring compliance with Contract Documents, including Drawings and Specifications.
4. Quality assurance, assuring quality control is in compliance with these Specifications.
5. Tracking and verifying pay quantities, reviewing and approving applications for payment, and requests for change orders.
6. Scheduling and administering project meetings.
7. Any other duties as may be assigned by DuPont.

D. The Engineer's duties include but are not limited to:

1. Reviewing Contractor's submittals for compliance with the Contract Documents.
2. Reviewing proposed changes or substitutions in specified construction materials or procedures.
3. Reviewing or developing proposed field design changes.

[END OF SECTION]

DIVISION 1 - GENERAL REQUIREMENTS
SECTION 01050
FIELD ENGINEERING

PART 1 - GENERAL

1.1 SCOPE

A. The Contractor shall be responsible for providing certified survey work required to execute the project.

B. The Contractor shall provide civil, structural, or other professional engineering services specified or required to execute the Contractor's construction methods.

C. The Contractor shall provide record drawings to be used for determining work quantities and documenting construction. The Contractor shall provide such surveys and computations necessary to determine the quantities of their work performed or placed during each period for which a progress payment is to be made. Failure to do so will result in the stop of work until such surveys and computations are submitted.

1.2 RELATED WORK

A. Section 01010: Summary of Work.
B. Section 01025: Measurement and Payment.
C. Section 01720: Project Record Documents.

1.3 QUALIFICATIONS OF SURVEYOR

The Contractor shall retain the services a Surveyor who is Licensed in the State of North Carolina and who meets the Kinston Plant health and safety requirements.

1.4 SUBMITTALS

A. The Contractor shall submit documentation to verify the accuracy of field engineering work during project Progress Meetings, and at any time per the request of the Construction Manager or Engineer.

B. Topographic maps shall be provided in electronic format (i.e. AutoCAD Release 2000) and reproducible paper prints. All elevation and horizontal information in the AutoCAD file shall be in the same horizontal and vertical datums provided on

the Contract Drawings. All entries in the AutoCAD file shall be placed on layers named adequately to describe the entity being mapped.

C. Copies of all original field notes, computations, and other survey records developed for the purposes of layout, original, progress, and final surveys shall be recorded in duplicated field books, the original pages of which shall be furnished promptly in ring binders to the Construction Manager with Daily Work Activity Summary Reports and shall be used by the Construction Manager to the extent necessary in determining the proper amounts of progress and final payments. Copies of all original surveyor notes, records, and calculations used/developed by the licensed surveyor shall be submitted to the Engineer upon project completion. All data shall be submitted in a bound book organized chronologically and fully indexed.

D. Description and recovery sketches of all permanent control survey monuments established during the Contract.

PART 2 - MATERIALS

2.1 Permanent Bench Marks

Contractor is required to supply and maintain Permanent Bench Marks (PBMs) for the survey. The PBMs should be made of solid brass with machine-knurled stem and ribbed plastic expansion plug (1/2" diameter, 1-3/4" long) or equal.

PART 3 - EXECUTION

3.1 SURVEY REFERENCE POINTS

A. References shall be set and measurements taken using standard accepted surveying methods and equipment.

B. Existing basic horizontal and vertical control points for the project are those designated on the drawings.

C. The Contractor shall locate and protect control points prior to starting the work and preserve all permanent reference points during construction. The Contractor shall report to the Construction Manager and Engineer when any reference point is lost or destroyed, or requires relocation because of necessary changes in grades or interference from construction activities. The Contractor shall not make changes or relocations without prior written notice to the Engineer. The Contractor shall

immediately direct the surveyor to correctly replace project control points should they become lost or destroyed.

3.2 PROJECT SURVEY REQUIREMENTS

A. The Contractor shall lay out his work and shall make all measurements in connection with the project coordinate system (Plant Grid) indicated on the drawings. The accuracy of all survey layout data shall be ±0.1 foot horizontal and vertical. The Contractor shall furnish all stakes, templates, platforms, equipment, tools, and materials and labor as may be required in laying out any part of the work. The Contractor shall execute the work to the lines and grades established or indicated and shall maintain and preserve all stakes and other control points until authorized to remove them by the Construction Manager. If such marks are destroyed by or through negligence of the Contractor prior to their authorized removal, they may be replaced by the Construction Manager at his discretion and at no additional cost to the Owner.

B. The Contractor shall make such surveys and computations as are necessary to determine the quantities of their work performed or placed during each period for which a progress payment is to be made.

C. The cross-sectional average end area method shall be used to calculate the in-place volumes. The Contractor may use other methods utilizing computer software to calculate in-place volumes with prior written approval of the Construction Manager. All quantity calculations shall be provided to the Engineer in a form that will allow the quantities to be checked with field conditions. All data points, cross-sections or similar information associated with computer generated quantities shall be provided (hard copy and electronic format).

D. The Construction Manager or his designee will make such computations as are necessary to verify the quantities of work performed or in place. Quantity surveys made by the Contractor shall be made in the presence of a representative of the Construction Manager. The accuracy of quantity survey points shall be ±0.1 foot horizontal and vertical.

E. The Contractor shall make the following surveys of the site:

1. Construction areas prior to initiation of construction activities (including topography) unless existing or as-built survey information is provided by the Owner. Construction areas shall include (but not be limited to) the Ash Landfill, Borrow Area and Sediment Basin. The Contractor may utilize existing or as-built site survey information indicated in the Drawings provided that the information is verified by the Contractor prior to initiation of field activities. The Contractor

shall provide written acceptance to the Construction Manager of existing or as-built site survey information if he elects to use it.

2. Geotextile placement limits and elevation.
3. Ash Landfill intermediate grades.
4. Ash Landfill following placement of cover soil.
5. Ash Landfill following placement of amended cover soil.
6. Borrow area following borrow area development and amendment.
7. Subsurface drainage facilities, including leachate collection and conveyance system piping vertical and horizontal alignment.
8. Roadway (including alignment and center line).

F. The Contractor shall survey all surface and subsurface facilities installed as part of the project including, but not limited to, stormwater management features (including ditches, ditch outlet features, etc), and other site features that define the work performed.

G. The Contractor shall provide all measurements, reference marks, lines, and grades necessary to maintain and establish a grid system of maximum spacing of 50' x 50' for each required survey item. All breaks in grade shall be surveyed as well.

[END OF SECTION]

DIVISION 1 - GENERAL REQUIREMENTS
SECTION 01110
SAFETY, HEALTH, AND EMERGENCY RESPONSE

PART 1 - GENERAL

The Contractor will provide the required personnel and execute the project in accordance with the site Health and Safety Plan (HASP) which has been provided by DuPont. Execution of the contract will require compliance with all requirements detailed in the HASP including, but not limited to, personnel requirements, required meetings prior to and during construction activities, and personnel protective equipment levels specific to each work activity.

1.1 STAFF ORGANIZATION, QUALIFICATIONS, AND RESPONSIBILITIES

A. General

The Contractor shall develop an organizational structure that sets forth lines of authority, responsibility, and communication. The HASP shall include a description of this organization and the qualifications and responsibilities of each of the following individuals.

B. Certified Industrial Hygienist

1. Qualifications. The Contractor shall utilize the services of an industrial hygienist certified in comprehensive practice by the American Board of Industrial Hygiene. The CIH shall:
   a. Possess a minimum of 3 years experience in developing and implementing health and safety programs at hazardous waste sites,
   b. Have demonstrable experience in supervising professional and technician level personnel,
   c. Have demonstrable experience in developing worker exposure assessment programs and ambient air monitoring programs, and
   d. Have working knowledge of applicable state and federal occupational safety and health regulations.
2. Responsibilities. The CIH shall:
   a. Be responsible for the development, implementation, oversight, and enforcement of the HASP.
   b. Sign and date the HASP prior to submittal,
   c. Conduct initial site-specific training,
   d. Be present on site during the first 3 days of construction activities,
   e. Visit the site at least once per week for the duration of activities,

f. Be available for emergencies,
g. Provide on-site consultation as needed to ensure the HASP is fully implemented,
h. Coordinate any necessary modifications to the HASP with the Construction Manager, and
i. Serve as a member of the quality control staff.

C. Site Safety and Health Officer

1. Qualifications. The Contractor shall designate an individual to be the SSHO. The SSHO shall:
   a. Possess a minimum of one year experience in developing and implementing health and safety programs at hazardous waste sites,
   b. Possess demonstrable experience in construction safety techniques and procedures,
   c. Have working knowledge of applicable state and federal occupational safety and health regulations,
   d. Have specific training in personal and respiratory protective equipment program implementation and in the proper use of air monitoring instruments, and air sampling methods and procedures, and
   e. Be certified in first aid/CPR by the Red Cross, or equivalent agency.
2. Responsibilities. The SSHO shall:
   a. Assist and represent the CIH in the on-site implementation and enforcement of the HASP.
   b. Be assigned to the site on a full-time basis for the entire duration of field activities, and shall have no duties other than health and safety related duties.
   c. Ensure that all aspects of the HASP are complied with including preparation of records, air monitoring, use of personal protective equipment (PPE), decontamination, and site control. The SSHO shall have the authority to delegate these responsibilities to others but will be responsible for assuring the quality of work.
   d. Serve as a member of the quality control staff on matters relating to safety and health.
   e. Have authority to stop work if unacceptable health or safety conditions exist.
   f. Consult with and coordinate any necessary modifications to the HASP with the CIH and the Construction Manager.

D. Occupational Physician

The Contractor shall utilize the services of a licensed physician who is certified in occupational medicine by the American Board of Preventative

Medicine, or who, by necessary training and experience, is Board eligible. The physician shall be responsible for developing a medical monitoring program in compliance with 29 CFR 1910.120(f) [as required in the Site Health and Safety Plan prepared by the Owner].

PART 2 - MATERIALS

NOT APPLICABLE.

PART 3 - EXECUTION

NOT APPLICABLE.

[END OF SECTION]

DIVISION 1 - GENERAL REQUIREMENTS
SECTION 01200
PROJECT MEETINGS

PART 1 - GENERAL

1.1 SCOPE

A. The Construction Manager shall schedule and administer a pre-construction conference, periodic progress meetings, and specially called meetings throughout progress of the work. The Construction Manager shall:

1. Prepare agenda for meetings.
2. Make physical arrangements for meetings.
3. Preside at meetings.
4. Keep a record of the meeting, to include significant proceedings and decisions.
5. Reproduce and distribute copies of the record within five working days after each meeting to:
   a. Participants in the meeting.
   b. Parties affected by decisions made at the meeting.

B. The Contractor shall attend meetings to ascertain that work is implemented consistent with the Contract Documents and construction schedules. Representatives of contractors, subcontractors and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.

PART 2 - MATERIALS

NOT APPLICABLE.

PART 3 - EXECUTION

3.1 PRE-CONSTRUCTION MEETING

A. Minimum Requirements

1. The Contractor, including its' project manager, site supervisor, site health and safety officer, and tier subcontractors and their site supervisors, shall attend a meeting with DuPont representatives at a location convenient to all parties a minimum of 7 working days prior to commencement of the work to discuss work schedules, safety performance (including a Project Safety Analysis), and other relevant matters. A Project Safety Analysis (PSA) is a process to identify project safety and health hazards which may be known or anticipated

and the associated control measures which will be implemented while planning for the implementation of the project.

B. Attendance

1. DuPont's Representative.
2. Engineer.
3. Construction Manager.
4. Contractor's Superintendent.
5. Contractor's CIH and SSHO.
6. Contractor's QC Supervisor.
7. Major Subcontractors.
8. Major Suppliers.
9. Utilities.
10. NC DENR and other Regulatory Authorities
11. Others as appropriate.

C. Agenda

1. Project Safety Requirements/PSA.
2. Distribution and discussion of:
   a. List of major subcontractors and suppliers.
   b. Projected Construction Schedules.
3. Critical Work Sequencing.
4. Major equipment deliveries and priorities.
5. Project Coordination.
   a. Designation of responsible personnel.
6. Procedures and processing of:
   a. Field decisions.
   b. Proposal requests.
   c. Submittals.
   d. Change Orders.
   e. Applications for Payment (monthly date of Payment to be determined).
7. Adequacy of distribution of Contract Documents.
8. Procedures for maintaining Record Documents.
9. Use of premises.
   a. Office, work, and storage areas.
   b. DuPont's requirements.
10. Construction facilities.
11. Temporary utilities.
12. Housekeeping procedures.

3.2 PROGRESS MEETINGS

A. Minimum Requirements

1. Progress meetings are for the purposes of modifying work schedules, arriving at an orderly sequence of operations agreeable to the Contractors, resolving conflicts, adjusting work arrangements, preparing coordination drawings for the use of guidance of each Contractor, etc.

2. The Contractor shall schedule and administer at least one progress meeting per week and such additional meetings as required by the Construction Manager and necessary to meet project needs. In addition to the regularly scheduled meetings, the Construction Manager may schedule additional meetings at their discretion, at the request of government agency representatives, or at the request of the Contractor. The Contractor may initiate a meeting by addressing a request to the Construction Manager. The Construction Manager will give written notice of the time, place, and agenda of each such scheduled meeting to each Contractor impacted by the meeting agenda. These meetings shall be held at the Project Site.

B. Attendance

1. The Construction Manager and associated representatives.
2. Contractor's Superintendent and SSHO.
3. Contractor's Quality Control Supervisor.
4. Subcontractors appropriate to the agenda.
5. Suppliers appropriate to the agenda.
6. Others as appropriate. NC DENR (and other regulatory authorities) representatives may be present.

C. Agenda

1. Health and safety issues.
2. Review and approval of minutes of previous meeting.
3. Review of work progress since previous meeting.
4. Field observations, problems, conflicts.
5. Problems which impede construction schedule and proposed corrective actions.
6. Revisions to construction schedule.
7. Corrective measures and procedures to regain project schedule.
8. Projected progress during succeeding work period.
9. Review of off-site delivery schedules.
10. Review submittal schedules, expedite as required.
11. Quality control.
12. Review proposed changes for effect on construction schedule and on completion date, and effect on other contracts of the project.

13. Cost issues.
14. Other business as appropriate.

[END OF SECTION]

DIVISION 1 - GENERAL REQUIREMENTS
SECTION 01115
CHEMICAL DATA QUALITY MANAGEMENT

PART 1 - GENERAL

1.1 SCOPE

The Contractor shall provide and coordinate the services of a testing laboratory(s) to perform specified chemical analyses and associated services required to assess the acceptance of any commercial soil borrow sources used on the project. The Contractor is advised of the necessity for prompt analyses so as not to disrupt the project schedule. The Contractor shall provide letters of commitment from the laboratory agreeing to analyze samples for this project within the specified time constraints and in accordance with the specified quality control requirements.

1.2 LABORATORY AND EQUIPMENT

The Contractor must notify the Construction Manager in advance as to any laboratory to be used. The laboratories shall provide lists of laboratory analytical instrumentation (manufacturer, model, years of purchase) and complete chronological resumes for supervisors, quality control personnel, chemists, and analysts listing all appropriate education (minimum B.S. in Chemistry) and experience (minimum 1-5 years depending on techniques). The laboratory is subject to approval before receipt of any project samples.

1.3 ANALYTICAL PROGRAM

A. The Contractor shall collect and analyze representative samples of all imported soil from commercial borrow sources to be placed on-site for the parameters on the most recent Target Compound List/Target Analyte List. A minimum of one composite sample shall be collected and analyzed from each principal borrow source or each type of material encountered or utilized. Additional samples shall be collected and analyzed as directed by the Construction Manager. For each source proposed for use, an estimate of the number of cubic yards of borrow material available shall be made. Written results shall be submitted to the Construction Manager within 10 working days of sample collection and prior to transporting the soil to the site. Written clean fill certification documentation shall be substituted only if approved by the Construction Manager.

B. Material to be removed from the site for disposal shall be analyzed for compatibility and characterization, and as required by the potential receiver. The Construction Manager shall be notified of all analytical testing requirements. No

material shall be removed from the site without written permission from the Construction Manager.

C. Sample collection procedures and equipment and chain-of-custody requirements shall be detailed to the Construction Manager.

D. The Contractor shall uniquely identify and label each sample collected. At a minimum, the following information shall be recorded in a bound logbook on each sample:

1. Sample identification,
2. Sample location,
3. Field observations,
4. Sample type,
5. Analysis,
6. Date/time of collection,
7. Collector name(s), and
8. Number and volume of samples taken.

The Contractor's packing and shipping procedures shall meet federal DOT regulations. Chain-of-custody shall be maintained for all samples collected during this project. Chain-of-custody procedures shall be in accordance with USEPA procedures.

E. Standard analytical methods shall be utilized for the project. Analytical methods shall be the latest USEPA approved standard methods wherever practical. Where these methods are not practical, other properly validated and standardized analytical methods such as National Institute of Occupational Safety and Health (NIOSH) and American Society for Testing of Materials (ASTM) or state-of-the-art methods for which appropriate precision, accuracy and inter-laboratory comparison data have been generated shall be substituted with the approval of the Engineer.

F. A program of duplicate sampling and analysis shall be implemented to determine the precision of the sampling and analytical methods. Duplicate samples shall be collected by the Contractor for analyses. Quality control (QC) sample collection and analysis shall be performed for each parameter in accordance with this section. In addition, field blanks and trip blanks shall be collected and analyzed by the Contractor at the same frequency as duplicate samples. Trip blanks shall be analyzed for volatile organics only. The Contractor shall collect additional duplicate samples for independent quality assurance analysis as directed by the Construction Manager. A program of matrix spiking shall be implemented in accordance with the referenced methods. Spiking frequency shall be as specified in the referenced method, generally 1 of every 20 samples or, at a minimum, 1 per matrix.

G. The Contractor shall perform the QC procedures as described in the referenced methods. This includes reagent blanks, laboratory replicates, matrix spikes, calibration verification, surrogate standards, and desorption efficiency (air monitoring samples), as necessary. The Contractor Quality Control Plan (CQC Plan) shall describe in detail the laboratory QC procedures for the specific compounds and their appropriate performance criteria.

H. The Contractor shall evaluate and validate the data for each parameter analyzed. USEPA quality control guidelines shall be used in addition to surrogate percent recovery, matrix spikes, and USEPA or Contract Laboratory Program (CLP) referenced quality control limits.

1.4 CHEMICAL QUALITY CONTROL PROJECT SUMMARY REPORT

At the conclusion of the project, the Contractor shall submit a final Chemical Quality Control Project Summary Report. This report shall outline the practices employed and any problems encountered and corrective actions taken. A discussion of significant data as related to project scope shall be included. The Chemical Quality Control Project Summary Report shall be approved by the Construction Manager before issuance of final payment. The report shall include the following, at a minimum:

A. Data Collection
Sampling procedures, sample handling, sample custody, and equipment calibration and maintenance shall be described as detailed in the CQC Plan.

B. Analytical Procedures
The analyses and methods shall be listed.

C. Data Storage
A copy of all analytical results may, at the Construction Manager's option, be attached to the report.

D. Data Analysis and Validation
The Contractor shall describe statistical procedures used in the assessment of data, including the use of control limits, if applicable. The Contractor shall justify any results which seem to show bias or larger than expected deviations.

E. Data Summary
The report shall include a summary of analytical results listing what chemicals were found at what concentration levels.

1.5 PROCEDURES FOR ASSESSING DATA, PRECISION, ACCURACY, AND COMPLETENESS

The CDQM Plan shall describe procedures to assess the precision, accuracy, and completeness of all measurement parameters. Project specific precision and accuracy limits presented in the CDQM Plan will be reviewed and approved. The Contractor shall report precision based on analytical standards and known additions. Also, statistical procedures shall be used as required.

1.6 CORRECTIVE ACTION

The CDQM Plan shall include protocols describing corrective actions to be taken by the Contractor and specifically defined feedback systems. Limits of data acceptability shall be included with the corrective action to be taken when these limits are exceeded. Information justifying the poor recovery or precision shall be documented when limits are exceeded. The Construction Manager will then decide what further corrective action, if any, need be taken.

1.7 CALIBRATION PROCEDURES AND FREQUENCY

The CDQM Plan shall describe procedures to be used for calibration and frequency of checks for laboratory instrumentation (if appropriate, include details on manufacturer, models, accessories, etc. that are required). The calibrations and instrumentation should be consistent with applicable analytical method requirements. The Contractor shall provide calibration standards in the CDQM Plan.

1.8 PREVENTIVE MAINTENANCE

The CDQM Plan shall describe preventive maintenance systems for facilities and instrumentation. Preventive maintenance shall be performed by qualified personnel. Records shall be maintained by the laboratory and shall be available for inspection by the Construction Manager, on request. Subsequent repairs, adjustments, and calibrations shall be recorded.

PART 2 – MATERIALS

NOT APPLICABLE.

PART 3 – EXECUTION

NOT APPLICABLE.

[END OF SECTION]

DIVISION 1 - GENERAL REQUIREMENTS
SECTION 01300
SUBMITTALS

PART 1 - GENERAL

1.1 SUBMITTALS REQUIRED

Specification sections indicate the type of submittal required. The Contractor shall make submittals to the Construction Manager. The type of submittals are described below.

A. Data

Submittals which provide calculations, descriptions, or documentation regarding the work.

B. Drawings

Submittals which graphically show relationship of various components of the work, schematic diagrams of systems, details of fabrication, layouts of particular elements, connections, and other relational aspects of the work.

C. Instructions

Preprinted material describing installation of a product, system or material, including special notices and material safety data sheets, if any, concerning impedances, hazards, and safety precautions.

D. Schedules

Tabular lists showing location, features, or other pertinent information regarding products, materials, equipment, or components to be used in the work.

E. Statements

A document, required of the Contractor, or through its subcontractors, from a supplier, installer, manufacturer, or other lower tier subcontractor, the purpose of which is to confirm the quality or orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel, qualifications, or other verifications of quality.

F. Reports

Reports of inspections or tests, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used shall be identified and test results shall be recorded.

G. Certificates

Statement signed by responsible official of a manufacturer of a product, system or material, attesting that the product, system or material meets specified requirements. The statement must be dated after the award of this contract, must name the project, and must list the specific requirements which are being certified.

H. Samples

Samples, including both fabricated and unfabricated physical examples of materials, products, and units of work as complete units or as portions of units of work.

I. Records

Documentation to record compliance with technical or administrative requirements.

1.2 SUBMITTAL REGISTER

Within 10 working days after the award of contract, the Contractor shall submit a submittal register (attached to this specification) as part of his Construction Execution Plan to the Construction Manager for approval. The Contractor shall indicate in the submittal register the proposed dates of submittal and the number for the various types of work. The Contractor shall arrange submittal dates in the proper sequence of the importance of the work to the progress of construction and identify the Contractor's scheduled dates.

1.3 PROGRESS SCHEDULE

A. The Contractor, immediately after being awarded the contract, shall prepare and submit for the Construction Manager's approval an estimated progress schedule for the work. The progress schedule shall be related to the entire project and to the extent required by the Contract Documents. This schedule shall indicate the estimated dates for the starting of each stage of work and be revised accordingly by the conditions of the work, subject to the Construction Manager's approval, and submitted with each Application and Certificate for Payment.

B. If at any time, it appears to the Construction Manager that the rate of progress of work being made is insufficient to insure completion of the work by the scheduled completion date, the Construction Manager may require the Contractor to take such steps as are necessary to insure completion as scheduled. Any additional costs incurred shall be the sole obligation of the Contractor.

If the Contractor is delayed in the prosecution or completion of the work due solely to "acts of God" or fire, floods, insurrections, riots, epidemics, abnormally or unusually severe weather or other causes beyond the control and without the

fault or negligence of the Contractor, then the time for completion of the work shall be extended for a period consistent with the time by which completion is delayed. The Contractor shall use its best efforts to make up any time lost by such delays described herein, if any. The Contractor shall notify the Construction Manager of any such delay and the causes therefore within 24 hours after the delay commences, otherwise the Contractor will be deemed to have waived any extension of time. There shall be, however, no payment or compensation of any kind to the Contractor for damages arising from any such delay as provided in this section.

1.4 SUBMITTAL PROCEDURES

A. The Contractor's Independent Quality Control (QC) Contractor shall review each submittal for contract compliance. Submittals that comply will be forwarded to the Construction Manager. The Contractor shall submit three copies of each submittal unless otherwise indicated in these Specifications with such promptness as to avoid delay in the work. The Contractor must allow the Engineer a minimum of five working days to review submittals. The Contractor shall return submittals that do not conform with the Specifications to the originator to be corrected.

B. Each submittal must be accompanied by a letter of transmittal listing the items in the submittal. Each submittal must be marked with the name of the project, the name of the Contractor, and be numbered consecutively.

C. When making a submittal for approval, each Contractor shall do so with the understanding that the Contractor has checked the items in the submittal and the Contractor is satisfied that they not only meet the requirements of the Contract Documents, but will present no difficulties in executing and completing Contract Work. The Contractor shall clearly note approval on the submittals prior to issue to the Construction Manager. Failure of any Contractor or the Independent QC Contractor to note their approval will be reason for the Construction Manager to return such submittal to the Contractor unchecked. If it appears that submittals by any Contractor to the Construction Manager have not been properly checked by the Contractor and the Independent QC Contractor, even though the Contractor's approval has been noted thereon, the submittal will also be considered reason for the Construction Manager to return such submittal to the Contractor unchecked.

D. If submittals show variations from the contract requirements because of standard shop practice or other reasons, that Contractor shall make specific mention of such variations in the cover letter of the submittal in order that, if accepted, suitable action may be taken for proper adjustment in the contract. Otherwise, the

Contractor will not be relieved of the responsibility for executing the work in accordance with the contract even though the submittals have been approved.

E. The review and approval of submittals and samples by the Construction Manager or Engineer will be only for conformance with the design concept of the project and for compliance with the information given in the Contract Documents. The Construction Manager's or Engineer's review and approval shall not extend to means, methods, techniques, sequences or procedures of construction (except where a specific means, method, technique, sequence or procedure of construction is indicated in or required by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

F. The approval of submittals by the Construction Manager, Engineer, or any governmental agency shall not relieve any Contractor from the responsibility for proper fitting and construction of the work nor from furnishing materials and work required by the contract which may not be indicated on the submittals when approved.

G. After review by the Construction Manager, and as required, the Engineer, submittals will be returned marked as follows: Approved; Approved With Changes Noted; Returned for Correction; or Not Approved.

1. Approved: When submittals are returned "Approved," it is understood that the submittals have been found to be in conformance with the Contract. The Construction Manager or Engineer's approval of the submittals does not relieve the Contractor from responsibility for errors or discrepancies in them.
2. Approved with Changes Noted: When submittals are returned "Approved With Changes Noted" it is understood that the submittals have been found to be in conformance with the Contract Documents, provided the changes noted by the Construction Manager or Engineer are incorporated in the submittals. Submittals returned "Approved With Changes Noted" will not require resubmittal.
3. Returned For Correction: When submittals are returned noted "Returned For Correction" the Contractor shall make the required corrections and resubmit three copies of corrected submittals to the Construction Manager for review and approval.
4. Not Approved: When submittals are returned "Not Approved" it is understood that the Contractor shall make completely new submittals in accordance with procedure previously described.

H. Resubmittals will be handled in the same manner as original submittals. The Contractor shall direct specific attention, on resubmittals, to revisions other than the corrections requested by the Engineer by use of revision triangles or other

similar methods. Any revisions that are not clearly identified shall be made at the Contractor's risk and may be subject to corrections or rejection of the work.

I. The Engineer will not review incomplete submittals. The Engineer will be the sole judge of the completeness of the submittal. Incomplete submittals will be returned to the Contractor as "Not Approved".

J. Submittals will be reviewed no more than twice at DuPont's expense. All subsequent reviews will be performed at times convenient to the Engineer and at the Contractor's expense. Any need for more than one resubmission will not entitle the Contractor to an extension of the Contract Period.

K. If the Contractor considers any correction indicated within the submittal to constitute a change to the Contract Work, the Contractor shall give written notice thereof to the Engineer at least seven days prior to release for manufacture or construction.

L. When submittals have been completed to the satisfaction of the Engineer, the Contractor shall carry out the construction in accordance therewith and make no further changes therein except upon written instruction from the Engineer.

M. Where a shop drawing or sample is required by the Technical Specifications, and related work is performed prior to the Construction Manager's or Engineer's review and approval of the pertinent submittal, such work shall be the sole responsibility of the Contractor responsible for the work.

PART 2 – MATERIALS

NOT APPLICABLE.

PART 3 – EXECUTION

NOT APPLICABLE.

[END OF SECTION]

DIVISION 1 - GENERAL REQUIREMENTS
SECTION 01440
CONTRACTOR QUALITY CONTROL

PART 1 - GENERAL

1.1 CODES, RULES, PERMITS AND FEES

A. General

1. All construction shall conform to the current editions of the codes, regulations, specifications and standards in Paragraph: Standards, as well as applicable federal, state and local laws, regulations, codes, and ordinances.
2. The Contractor shall give all necessary notices, obtain all permits (except as otherwise noted herein) and pay all governmental taxes, fees, and other costs in connection with the work, file all necessary plans, prepare all documents and obtain all necessary approvals of all governmental departments having jurisdiction, obtain all required Certificates of Inspection and Approval for the work and deliver same to the Construction Manager, except as otherwise noted herein.
3. Contractor Quality Control (CQC). The Contractor shall establish and maintain an effective Quality Control Program. The Contractor shall develop a Contractor Quality Control (CQC) Plan in accordance with Paragraph - Contractor's Proposed CQC Plan. The Contractor shall submit the CQC Plan to the Construction Manager within 10 working days of Notice of Award.
4. Sufficient inspections and tests of all items of work, including that of subcontractors, to ensure conformance to applicable Drawings and Specifications and with respect to the quality of materials, workmanship, construction, functional performance, and identification shall be performed on a continuing basis. Contractors shall furnish qualified personnel, appropriate facilities, instruments, and testing devices necessary for the performance of the QC function. The controls shall be adequate to cover all construction operations both on and off site, shall be linked to the proposed construction sequence and shall be coordinated by the Contractor's QC personnel.

B. Included Items

The Contractors shall include in the work, without extra cost to the Owner, all labor, materials, services, apparatus, and drawings required to comply with all applicable laws, ordinances, rules and regulations, whether or not shown on the Drawings, and/or specified.

1.2 RELATED WORK

The following work specified herein is, or may be, related to the performance of quality control (QC) by the Contractor:

A. Section 01010: Summary of Work.
B. Section 01040: Coordination.
C. Section 01110: Safety, Health and Emergency Response.
D. Section 01115: Chemical Data Quality Management.
E. Section 01300: Submittals.
F. Section 02200: Earthwork.
G. Section 02700: Drainage Controls.
H. Section 02930: Seeding.

1.3 SUBMITTALS

Submittals shall be as specified in SECTION: SUBMITTALS. The CQC organization shall be responsible for certifying that all submittals are in compliance with the contract requirements.

1.4 STANDARDS

A. All references to standards in the Contract Documents shall always imply the latest issue in effect, including all amendments and errata at the time bids are taken, of said standards unless otherwise stated.

B. Abbreviations for various organizations which may be used in these Specifications are as follows:

Abbreviation	Organization
AAN	American Association of Nurseries
AASHTO	American Association of State Highway and Transportation Officials
ACGIH	American Conference of Governmental Industrial Hygienists
ACI	American Concrete Institute
ACS	American Chemical Society
AGA	American Gas Association
AHDGA	American Hot Dip Galvanizers Association
AIChE	American Institute of Chemical Engineers
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers

ASTM	American Society of Testing and Materials
AWS	American Welding Society
AWWA	American Water Works Association
BOCA	Building Officials Code Administration
CRSI	Concrete Reinforcing Steel Institute
DOT	Department of Transportation
FS	Federal Specification
IEEE	Institute of Electrical and Electronic Engineers
IPCEA	Insulated Power Cable Engineers Association
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry
NBFU	National Bureau of Fire Underwriters
NBS	National Bureau of Standards
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NICET	National Institute of Certification of Engineering Technicians
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Act of 1970
NCDENR	North Carolina Department of Environmental and Natural Resources
SSPC	Steel Structures Painting Council
UL	Underwriters' Laboratories
USEPA	U.S. Environmental Protection Agency
USGS	United States Geological Survey

1.5 VERIFICATION OF DIMENSIONS

Contractors shall be responsible for field verification of all dimensions of existing facilities and other items which are shown on the Drawings.

1.6 TESTING OF MATERIALS

A. The Construction Manager reserves the right to perform tests on materials and equipment.

B. Contractors shall submit materials for testing, taking into consideration when the materials will be incorporated in the work and the capabilities and capacities of the testing laboratory.

C. The Contractor shall furnish to the Construction Manager, at no additional cost to the Owner, duplicate certified copies of all routine tests made by the mill, shop, or

factory at which material or equipment has been fabricated or manufactured for the project.

PART 2 – MATERIALS

NOT APPLICABLE.

PART 3 – EXECUTION

3.1 GENERAL

The Contractor is responsible for QC and shall establish and maintain an effective QC system. The QC system shall consist of plans, procedures, and organization necessary to produce an end product that complies with the contract requirements. The system shall cover all construction operations, both on-site and off-site, and shall be keyed to the proposed construction sequence.

3.2 QUALITY CONTROL PLAN

A. General

The Contractor shall furnish for review by the Construction Manager, not later than 10 working days after Notice of Award, the CQC Plan. The plan shall identify personnel, procedures, control, instructions, tests, records, and forms to be used. Construction will be permitted to begin only after acceptance of the CQC Plan.

B. Contractor's Proposed CQC Plan

The CQC Plan shall include, as a minimum, the following to cover all construction operations, both on-site and off-site, including work by subcontractors, fabricators, suppliers and purchasing agents:

1. A description of the QC organization. The QC Contractor shall include a QC Supervisor who shall report directly to the Contractor's Project Manager, who in turn, shall report directly to the manager responsible for corporate QC in the Contractor's organization.
2. The name, qualifications, duties, responsibilities, and authorities of each person assigned a QC function.
3. The Contractor's manager of corporate QC shall document the responsibilities and authority of the QC Supervisor, including authority to stop work that is not in compliance with the contract. The QC Supervisor shall issue letters of direction to all other various QC representatives outlining duties, authorities and responsibilities. Copies of these letters will also be furnished to the Construction Manager.
4. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, off-site fabricators, suppliers and

purchasing agents. These procedures shall be in accordance with SECTION: SUBMITTALS.

5. Control, verification, acceptance, and submittal of testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person or qualified testing laboratory responsible for each test.
6. Location and availability of test facilities and equipment. Procedures for advance notice and coordination of special inspections and tests where required.
7. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation.
8. Procedures for tracking construction deficiencies from identification through acceptable corrective action. These procedures will establish verification that identified deficiencies have been corrected.
9. Reporting procedures, including proposed reporting formats and who will prepare, sign, and submit the reports.
10. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks and has separate control requirements. It could be identified by different trades or disciplines, or it could be work by the same trade in a different environment. Although each section of the Specifications may generally be considered as a definable feature of work, there are frequently more than one definable feature under a particular section. This list will be agreed upon during the coordination meeting.

C. Acceptance of Plan

Acceptance of the CQC Plan is required prior to the start of construction. Acceptance is conditional and will be based on satisfactory performance during the construction. The Construction Manager reserves the right to require the Contractor to make changes in his CQC plan and operations including removal or addition of personnel, as necessary, to obtain the quality specified at no additional costs to the Owner.

D. Notification of Changes

After acceptance of the CQC plan, the Contractor shall notify the Construction Manager in writing a minimum of 5 working days prior to any proposed change. Proposed changes are subject to acceptance by the Construction Manager.

3.3 COORDINATION MEETING

The Contractor together with the Contractor's Independent QC Contractor shall meet with the Construction Manager and discuss the QC system after the Preconstruction Conference, before the start of construction, and prior to acceptance of the CQC Plan by the Construction Manager. During the meeting, a mutual understanding of the system

details shall be developed, including the forms for recording the CQC operations, control activities, testing, administration of the system for both on-site and off-site work, and the interrelationship of the Contractor's management and QC Contractor with the Construction Manager's Quality Assurance. Minutes of the meeting shall be prepared by the Construction Manager and signed by the attending parties. The minutes shall become a part of the contract file. There may be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures which may require corrective action by the Contractor.

3.4 QUALITY CONTROL ORGANIZATION

A. QC Supervisor

The Independent QC Contractor shall identify an individual within their organization at the site of the work who shall be responsible for overall management of CQC and have the authority to act in all CQC matters for the Contractor. This QC Supervisor shall be on the site a minimum of 1 day per week and attend the pre-construction meeting and all construction progress meetings. The QC Supervisor shall be a graduate geotechnical engineer, or a graduate of construction management, and a registered professional engineer with a minimum of 5 years construction experience on earthwork projects similar to this contract.

B. QC Staff

Following are the minimum requirements for the QC staff. The QC staff will be at the site of work at all times during construction activities and will have complete authority to take any action necessary to ensure compliance with the contract. Any member of the QC staff shall be a graduate geotechnical engineer with a minimum of 2 years construction experience on earthwork projects similar to this contract. These minimum requirements will not necessarily assure an adequate staff to meet the QC requirements at all times during construction. The actual strength of the QC staff may vary during any specific work period to cover the needs of the work period. When necessary for a proper QC organization, the Contractor will add additional staff. This listing of minimum staff in no way relieves the Contractor of meeting the basic requirements of quality construction in accordance with contract requirements. All QC staff members shall be subject to acceptance by the Construction Manager.

A staff shall be maintained under the direction of the QC Supervisor to perform all QC activities. The staff must be of sufficient size to ensure adequate QC coverage of all work phases, work shifts, and work crews involved in the construction. During cap construction, the Independent QC Contractor shall provide adequate personnel to perform the QC functions required by these specifications. These personnel may perform other duties, but must be fully qualified by experience and technical training to perform their assigned QC

responsibilities and must be allowed sufficient time to carry out these responsibilities. The QC plan will clearly state the duties and responsibilities of each staff member.

C. Organizational Changes

The Contractor shall obtain Construction Manager's written acceptance before replacing any member of the QC staff. Requests shall include the names, qualifications, duties, and responsibilities of each proposed replacement.

3.5 CONTROL

The CQC is the means by which the Contractor assures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. The controls shall be adequate to cover all construction operations, including both on-site and off-site fabrication, and will be linked to the proposed construction sequence. The controls shall include at least 3 phases of control to be conducted by the QC Supervisor for all definable features of work, as follows:

A. Preparatory Phase

This phase shall be performed prior to beginning work on each definable feature of work and shall include:

1. A review of each paragraph of applicable specifications.
2. A review of the contract plans.
3. A check to assure that all materials and/or equipment have been tested, submitted, and approved.
4. A check to assure that provisions have been made to provide required control inspection and testing.
5. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the contract.
6. A physical examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawing or submitted data, and are properly stored.
7. A review of the appropriate activity hazard analysis to assure safety requirements are met.
8. Discussion of procedures for constructing the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that phase of work.
9. A check to ensure that the portion of the plan for the work to be performed has been accepted by the Construction Manager.
10. The Construction Manager shall be notified at least 48 hours in advance of beginning any of the required action of the preparatory phase. This phase shall include a meeting conducted by the QC Supervisor and attended by the superintendent, other QC personnel (as applicable), and the foreman responsible for the definable feature. The results of the preparatory phase

actions shall be documented by separate minutes prepared by the QC Supervisor and attached to the daily QC report. The Contractor shall instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

B. Initial Phase

This phase shall be accomplished at the beginning of a definable feature of work. The following shall be accomplished:

1. A check of preliminary work to ensure that it is in compliance with contract requirements. Review minutes of the preparatory meeting.
2. Verification of full contract compliance. Verify required control inspection and testing.
3. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with sample panels as appropriate.
4. Resolve all differences.
5. Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.
6. The Construction Manager shall be notified at least 48 hours in advance of beginning the initial phase. Separate minutes of this phase shall be prepared by the QC Supervisor and attached to the daily QC report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.
7. The initial phase should be repeated for each new crew to work on-site, or any time acceptable specified quality standards are not being met.

C. Follow-up Phase

Daily checks shall be performed to assure continuing compliance with contract requirements, including control testing, until completion of the particular feature of work. Each check performed shall be made a matter of record in the CQC documentation. Final follow-up checks shall be conducted and all deficiencies corrected prior to the start of additional features of work which may be affected by the deficient work. The Contractor shall not build upon or conceal non-conforming work.

D. Additional Preparatory and Initial Phases

Additional preparatory and initial phases may be conducted on the same definable features of work as determined by the Construction Manager if the quality of ongoing work is unacceptable; or if there are changes in the applicable QC staff or in the on-site production supervision or work crew; or if work on a definable feature is resumed after a substantial period of inactivity.

3.6 TESTS

A. Testing Procedure

The Contractor shall perform tests specified or required to verify that control measures are adequate to provide a product which conforms to contract requirements. Table 1 (to be provided with bid package) provides a summary of the minimum QC testing requirements. **Table 1 shall not supersede the requirements of each specification and is provided solely to assist the Contractor in preparing the CQC Plan and understanding the general scope of QC testing.** Testing includes operation and/or acceptance tests when specified. The Contractor shall procure the services of an offsite industry-recognized testing laboratory. A list of tests to be performed shall be furnished as a part of the CQC plan. The list shall give the test name, frequency, specification paragraph containing the test requirements, the personnel and laboratory responsible for each type of test, and an estimate of the number of tests required. The Contractor's Independent QC Contractor shall perform the following activities and record and provide the following data:

1. Verify that testing procedures comply with contract requirements.
2. Verify that facilities and testing equipment are available and comply with testing standards.
3. Check test instrument calibration data against certified standards.
4. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.
5. Results of all tests taken, both passing and failing tests, will be recorded on the QC report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test will be given. Actual test reports may be submitted later, if approved by the Construction Manager, with a reference to the test number and date taken. An information copy of tests performed by an off-site or commercial test facility will be provided directly to the Construction Manager. Failure to submit timely test reports, as stated, may result in nonpayment for related work performed and disapproval of the test facility for this contract.

B. Testing Laboratories

1. Capability Check. The Construction Manager reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques.
2. Capability Recheck. If the selected laboratory fails the capability check, the Contractor will be assessed the actual cost for the recheck to reimburse the Owner for each succeeding recheck of the laboratory or the checking of a subsequently selected laboratory. Such costs will be deducted from the contract amount due the Contractor.

3.7 COMPLETION INSPECTIONS

A. Contractor's Completion Inspection

Based upon the Construction Manager's concurrence that the Contractor's work is nearing substantial completion, and at least 15 working days prior to prefinal inspection, the Contractor's superintendent and Independent QC Contractor's QC Supervisor shall conduct a detailed inspection. The Construction Manager shall be notified of the inspection date in order that he may participate, if he so elects. The work shall be inspected for conformance to the Drawings and Specifications, quality, workmanship, and completeness. The Contractor shall prepare an itemized list of work not properly completed, inferior workmanship, or not conforming to Drawings and Specifications. The list shall also include outstanding administrative items such as as-built drawings. The list shall be included in the documentation and submitted to the Construction Manager within 5 working days after conducting this inspection with an estimated date for correction of each deficiency.

B. Pre-Final Inspection

The Contractor's superintendent and Independent QC Contractor's QC Supervisor, and other primary management person and the Construction Manager will be in attendance at this inspection. The pre-final inspection will be formally scheduled by the Construction Manager based upon written notice from the Contractor. This notice will be given to the Construction Manager at least 15 working days prior to the pre-final inspection and must include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining contract work, will be complete and acceptable by the date scheduled for the pre-final inspection. Failure of the Contractor to have all contract work completed and accepted prior to this inspection will be cause for the Construction Manager to bill the Contractor for the Owner' additional inspection costs. At this inspection the Construction Manager will develop a specific list of incomplete and/or unacceptable work performed under the contract and will furnish this list to the Contractor. Failure of the Construction Manager to detect and list all incomplete and/or unacceptable work during this inspection will not relieve the Contractor from performing all work required by and in accordance with the Contract Documents.

C. Final Acceptance Inspection

The Contractor's Independent QC Contractor personnel, his superintendent and other primary management person and the Construction Manager will be in attendance at this inspection. The final acceptance inspection will be formally scheduled by the Construction Manager based upon written notice from the Contractor. This notice will be given to the Construction Manager at least 15

working days prior to the final acceptance inspection and must include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the contract will be complete and acceptable by the date scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Construction Manager to bill the Contractor for the Owner' additional inspection costs.

3.8 DOCUMENTATION

The Contractor shall maintain current records of QC operations, activities, and tests performed, including the work of subcontractors and suppliers. These records shall be on an acceptable form and shall include factual evidence that required QC activities and/or tests have been performed, including but not limited to the following:

A. Contractor/subcontractors and their area of responsibility.

B. Operating plant/equipment with hours worked, idle, or down for repair.

C. Work performed today, giving location, description, and by whom.

D. Test and/or control activities performed with results and references to specifications/plan requirements. The control phase should be identified (Preparatory, Initial, Follow-up). List deficiencies noted along with corrective action.

E. Material received with statement as to its acceptability and storage.

F. Identify submittals reviewed, with contract reference, by whom, and action taken.

G. Off-site surveillance activities, including actions taken.

H. Job safety evaluations stating what was checked, results, and instructions or corrective actions.

I. List instructions given/received and conflicts in plans and/or specifications.

J. Contractor's verification statement.

K. These records shall indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in the work and workmanship comply with the contract. The original and 2 copies of

these records in report form shall be furnished to the Construction Manager on the first work day following the date covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, 2 reports shall be prepared and submitted for every 7 days of no work and on the last day of a no work period. All calendar days shall be accounted for throughout the life of the contract. The first report following a day of no work shall be for that day only. Reports shall be signed and dated by the QC Supervisor. The report from the QC Supervisor shall include copies of test reports and copies of reports prepared by all QC personnel.

3.9 ENFORCEMENT

The Contractor shall stop work on any item or feature, pending satisfactory correction of any deficiency noted by his QC staff or by the Construction Manager. Construction shall not proceed upon any feature of work containing incorrect work. Notations on QC reports will not be acceptable as a substitution for other written reports by the Contractor, if required.

3.10 NOTIFICATION OF NONCOMPLIANCE

The Construction Manager will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor shall, after receipt of such notice, immediately take corrective action. Such notice, when delivered to the Contractor at the site of the work, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Construction Manager may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

[END OF SECTION]

DIVISION 1 - GENERAL REQUIREMENTS
SECTION 01510
UTILITIES AND CONTROLS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

The Contractor shall provide all on-site temporary and permanent utilities including electricity, gas, telephone service, water, and sanitary service, as needed. Installation, connection fees, maintenance, and removal of utility services are the responsibility of the Contractor.

1.2 APPLICABLE PUBLICATIONS

A. National Electric Code (NFPA-70 1993).

B. National Electrical Safety Code: Latest edition.

1.3 REQUIREMENTS OF REGULATORY AGENCIES

The Contractor shall:

A. Comply with National Electric Code.

B. Comply with federal, state, and local codes and regulations, and utility company requirements.

C. Comply with related sections of the Specifications.

1.4 TEMPORARY UTILITIES

A. Materials

Except where noted otherwise, material may be new or used, but shall be adequate in capacity for the required usage, must not create unsafe conditions, and shall not violate requirements of applicable codes and standards.

B. Temporary Field Offices

The Contractor shall supply temporary field trailers for his workers and for the Construction Manager equipped with temperature control, lighting, and telephone service as specified in SECTION: FIELD OFFICES.

C. Temporary Electricity and Lighting

1. General. The Contractor shall arrange installation with the utility company; provide service required for power and lighting; pay all costs for installation, service, and for power uses; and arrange for sufficient transformer capacity.
2. Power Requirements. The Contractor is responsible for determining actual power requirements, associated with site work activities, and arranging with the local utilities for installation and service of a new transformer, and coordinating with plant personnel. The Contractor is responsible for coordinating with the power company to assure that the system is sufficient and adequate for all temporary power needs and that existing powerlines and poles are relocated to accommodate excavation and all other construction activities.
3. Installation. All work shall be by personnel familiar with code requirements and qualified for the work to be performed. The Contractor shall install circuit and branch wiring with area distribution boxes located so that power and lighting are available, if required, throughout the construction site by the use of construction-type power cords. Temporary wiring shall be guarded, buried, or isolated by elevation to prevent accidental contact by equipment.
4. Grounding System. All circuits throughout the construction site shall be protected by a ground fault interrupter.
5. Lighting. The Contractor shall provide adequate artificial lighting for all areas of work, as designated by the Construction Manager, when natural light is not adequate for work. Work areas shall be lighted to not less than the minimum illumination intensities listed in OSHA Standard 29 CFR 1910.120.
6. National Electrical Code Requirements. All electrical work shall be in accordance with latest issued National Electrical Code.
7. Project Completion. The Contractor shall be responsible for disconnecting and removing the temporary electrical and lighting systems at the completion of the site work as directed by the Construction Manager.

D. Temporary Telephone Service

1. General. The Contractor shall arrange with the local telephone service company to provide a minimum of 4 separate direct lines at the construction site. The service required includes:
   a. Three direct line instruments in the Construction Manager's field office.
   b. One direct line instrument in Contractor's field office.
   c. Other instruments at the option of the Contractor, or as required by regulations.
2. Removal. Contractor shall be responsible for arranging for removal of all telephone service at the completion of the site work.
3. Costs. The Contractor shall pay all costs of installation, maintenance, and removal, and service charges.

E. Temporary Water

1. Local Water Company. The Contractor shall provide his own water for the site.
2. Water Quantity. The quantity of water required for equipment and personnel decontamination, dust control, and other site activities shall be determined by the Contractor. If municipal water is intended for use, the Contractor shall obtain permits from the proper municipalities prior to use of the municipal water system for this project.
3. Removal. The Contractor shall be responsible for removal of all temporary water supply lines and equipment at the completion of the project.
4. Costs. The Contractor shall pay all costs of installation, maintenance, usage, and removal of all temporary water lines and equipment.

F. Temporary Sanitary Facilities

All sanitary facilities shall be of the chemical toilet type; supplied by the Contractor, unless otherwise approved by the Construction Manager. All sanitary wastes will be collected and removed from the site in an appropriate manner. Sanitary facilities shall comply with OSHA Standard 29 CFR 1910.120. Sanitary facilities shall be removed from the site after Final Acceptance unless otherwise directed by the Construction Manager.

PART 2 - MATERIALS

NOT APPLICABLE.

PART 3 - EXECUTION

NOT APPLICABLE.

[END OF SECTION]

DIVISION 1 - GENERAL REQUIREMENTS
SECTION 01590
FIELD OFFICES

PART 1 - GENERAL

1.1 SCOPE
The Contractor shall furnish, install, and maintain temporary field offices and furnishings for the Construction Manager/Engineer and the Contractor during the entire construction period and storage and work areas needed for construction. Upon completion of construction, the Contractor shall remove field offices and contents.

1.2 RELATED WORK
The following work specified herein is, or may be, related to field offices.

A. Section 01010: Summary of Work.
B. Section 01025: Measurement and Payment.
C. Section 01510: Utilities and Controls

1.3 SUBMITTALS
Prior to installation of field office, submit to Construction Manager/Engineer for review a complete description of proposed location, access, and related data.

1.4 FACILITY REQUIREMENTS

A. Construction:
1. Structurally sound, weathertight, with floors raised above ground.
2. Temperature transmission resistance: compatible with occupancy and storage requirements.
3. At Contractor's option, portable or mobile buildings may be used.
   a. Mobile trailers, when used, shall be modified for office use.
   b. Do not use mobile trailers for living quarters.

B. Office for the Construction Manager/Engineer:
1. Provide a separate field office with a minimum of 720 sq. ft. of floor space for the sole use of the Construction Manager, Engineer and/or Owner. The Contractor is responsible for maintenance, utilities and furnishings as hereinafter specified.
2. Provide the following furnishings:
   a. Two standard size desks, 3 ft x 5 ft with plastic laminate top and three drawers

b. One drafting table: 36 inches x 72 inches x 33 inches high with one equipment drawer, adjustable lamp and sliding parallel straight edge
c. Four standard four drawer legal-size metal filing cabinet with locks and keys
d. One drafting table stool
e. Four wastebaskets
f. One industrial first aid kit, Mr. First Aid Kit No. 8029, or equal
g. One outside thermometer (high/low recording type) and rain gauge
h. One telephone answering machine with the ability to listen to messages from any pushbutton phone
i. One refrigerator, minimum 4 cu. ft. capacity
j. Four 3' x 8' folding tables
k. 12 metal folding chairs
l. One photocopier
m. Two rolling desk chairs with arm rests

3. Services:
   a. Provide electrical service for receptacles and lighting.
   b. Provide potable water dispenser with dual temperature (warm/cool) spigots.
   c. Provide sanitary facilities for the private use of Construction Manager, Engineer and Owner.
   d. Provide telephone service as follows:
      1) Provide two pushbutton instruments with speaker phone and wireless hand set. Speaker phone application must be clear, audible, and able to perform conference calls.
      2) One line for Engineer.
      3) One line for Construction Manager
      4) One dedicated line for computer.
      5) One dedicated line for FAX machine.
   e. Telephone answering machine for receiving and recording calls.
   f. Provide heating and cooling system with indoor thermostatic controls.

C. Contractor's Office and Facilities:
1. Size: As required for general use and to provide space for project meetings.
2. Lighting and temperature control: As specified for Engineer's office.
3. Telephone: One direct line instrument.
4. Racks and files for Project Record Documents.
5. Other furnishings: Contractor's option.
6. One 10-inch (250 mm) outdoor-type thermometer.

D. Make all provisions and pay all installations and other costs for the Construction Manager/Engineer's construction office in order to provide telephone service, power service, exterior lights, and any local code and OSHA requirements. The

Contractor shall pay all monthly charges for the various services provided to the Construction Manager/Engineer's office for the duration of the project and for 30 days after final completion.

E. Provide fire insurance extended coverage and vandalism, malicious mischief, and burglary and theft insurance coverage for field office contents furnished by DuPont, Construction Manager or Engineer in the amount of $5,000 for DuPont, Construction Manager and Engineer. Provide proof of coverage. Items furnished by the Contractor will be covered by the Contractor's own insurance policies.

PART 2 - MATERIALS

2.1 EQUIPMENT AND FURNISHINGS

Materials may be new or used, but must be serviceable, adequate for required purpose, and must not violate applicable codes or regulations.

PART 3 - EXECUTION

3.1 PREPARATION

The Contractor shall fill and grade sites for temporary structures to provide surface drainage.

3.2 INSTALLATION

A. Field offices shall be equipped and ready for use within 10 working days after Notice to Proceed. Construct temporary field offices on proper foundations, provide connections for utility services.

1. Secure portable or mobile buildings when used.
2. Provide steps and landings complete with hand rails at all entrance doors.

Locate construction office facilities at the location approved by the Construction Manager within the areas designated on the Drawings.

B. Mount thermometer and rain gauge at convenient outside location, not in direct sunlight.

3.3 MAINTENANCE AND CLEANING

A. Provide weekly maintenance and cleaning for temporary field offices, structures, furnishings, equipment, and services.

B. Furnish, replace and replenish light bulbs, fluorescent tubes, toilet paper, paper towels, soap, bottled water, and other things required to maintain field offices in a clean condition.

C. Maintain offices in first class condition for the duration of the project. Wash floor and clean washroom at least once each week. Wash windows when needed or when requested by the Construction Manager. Sweep floor and dust furnishings daily.

D. Provide toner for photocopy machine and printer when requested by the Construction Manager.

3.4 REMOVAL

A. Remove temporary structures, field offices, contents and services at a time when no longer needed.

B. Remove foundations and debris, grade site to required elevations and clean the areas.

[END OF SECTION]

DIVISION 1 - GENERAL REQUIREMENTS
SECTION 01700
PROJECT CLOSEOUT

PART 1 - GENERAL

1.1 SCOPE

This section covers the activities that the Contractor must complete prior to final demobilization from the site.

1.2 RELATED WORK

A. Section 01025: Measurement and Payment.
B. Section 01300: Submittals.
C. Section 01440: Contractor Quality Control.
D. Section 01720: Project Record Documents.

1.3 GENERAL REQUIREMENTS

A. The Contractor shall conduct completion inspections, including prefinal and final acceptance inspections in accordance with SECTION: CONTRACTOR QUALITY CONTROL.

B. The Contractor shall submit as-built prints to the Construction Manager at the time of the final inspection for review and approval in accordance with SECTION: PROJECT RECORD DOCUMENTS.

C. The Contractor shall be responsible for the proper removal of the support area facilities and the collection and disposal of all Contractor-generated construction byproducts such as trash, waste, spare parts, etc.

D. The Contractor shall receive final acceptance and approval from the Construction Manager for each task identified in the Contract Drawings and in SECTION: MEASUREMENT AND PAYMENT.

E. Upon successful completion of all contracted activities as determined by the Construction Manager, the Contractor shall demobilize.

F. The Contractor shall complete and submit all documentation related to his/her contracted activities as required in part by SECTION: SUBMITTALS and SECTION: PROJECT RECORD DOCUMENTS.

G. The Contractor shall complete the project closeout.

1.4 UTILITIES

The Contractor shall disconnect and remove all temporary utilities from the site.

1.5 TEMPORARY FACILITIES

All remaining temporary facilities shall be dismantled and properly removed by the Contractor.

1.6 SECURITY

The Contractor shall maintain security during construction.

PART 2 - MATERIALS

NOT APPLICABLE.

PART 3 - EXECUTION

NOT APPLICABLE.

[END OF SECTION]

DIVISION 1 - GENERAL REQUIREMENTS
SECTION 01720
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

The Contractor shall prepare, maintain and submit project record documents as required by the Specifications. The Contractor shall keep current marked drawings of as-built conditions.

1.2 SUBMITTALS

The Contractor shall submit to the Construction Manager two copies of the Daily Work Activity Summary Reports as described in Paragraph 1.3, Document Requirements, on the first work day following the day covered by the report. At the completion of field operations, the Contractor shall submit to the Construction Manager project record documents not previously provided to the Construction Manager in accordance with SECTION: SUBMITTALS. Accompany submittal with transmittal letter in duplicate, containing:

A. Date.
B. Project title and number.
C. Contractor's name and address.
D. Title and number of each record document.
E. Signature of Contractor's authorized representative.

1.3 DOCUMENT REQUIREMENTS

A. Record Copies

The Contractor shall maintain at the site for the Construction Manager one record copy of:

1. Drawings.
2. Specifications.
3. Addenda.
4. Modifications to the contract.
5. Construction Manager's field orders or written instructions.
6. Daily Work Activity Summary Reports, including as applicable:
   a. Field test records.
   b. Photographs.
   c. Reports on any emergency response actions.
   d. Manifest documents and variance reports.

e. Records of all site work, including quantities of material handled.
f. Chain-of-custody documents.
g. Truck-load tickets.
h. All laboratory analytical results (as applicable).
i. Daily inspection reports.
j. Daily safety logs and inspection reports, including as necessary, any accident report incident reports.
k. Reports on all spill accidents.
l. Air monitoring reports and data.
m. Daily construction quality control reports.
n. Other items as may be required by the Construction Manager.

7. Approved site-specific health and safety plan.

8. As-built (red line) drawings.

1.4 AS-BUILT DRAWINGS

A. Progress Marked Up As-Built Prints

The Contractor shall mark up 2 sets of paper prints to show the as-built conditions. These as-built marked prints shall be kept current and available on the job site at all times. All changes from the contract plans which are made in the work or additional information which might be uncovered in the course of construction shall be accurately and neatly recorded as they occur by means of details and notes. The Contractor shall bring one copy of the current as-built (red line) drawings to every other weekly progress meeting for the Construction Manager to review. The drawings shall show (but not necessarily be limited to) the following information:

1. The location and description of any utility lines or other installations of any kind or description known to exist within the construction area. The location includes dimensions to permanent features.
2. Correct grade or alignment to constructed features if any changes were made from contract plans.
3. Correct elevations if changes were made in site grading.
4. Changes in details of design or additional information obtained from working drawings specified to be prepared and/or furnished by the Contractor.
5. All changes or modifications which result from the final inspection.
6. Where contract drawings or specifications allow options, only the option selected for construction shall be shown on the as-built drawings.

B. Preliminary Submittal

The Contractor shall prepare 2 copies of the progress as-built prints and these shall be delivered to the Construction Manager at the time of final inspection for his review and approval. These as-built marked prints shall be neat, legible, and accurate. The review by Construction Manager will be expedited to the maximum

extent possible. Upon approval, one copy of the as-built marked prints will be returned to the Contractor for use in preparation of final as-built drawings. If upon review, the drawings are found to contain errors and/or omissions, they shall be returned to the Contractor for corrections. The Contractor shall complete the corrections and return the as-built marked prints to the Construction Manager within 10 days.

1.5 MAINTENANCE OF DOCUMENTS

A. General

The Contractor shall store documents and material samples in the Contractor's field office apart from documents used for work. The Contractor shall:

1. Provide files and racks for storage of documents.
2. Provide locking cabinets or secure storage space.

B. Filing

Documents and material samples shall be filed to facilitate retrieval. Documents shall be maintained in a clean, dry, legible condition in good order. Record documents shall not be used for work purposes.

C. Actual Work

The Contractor shall legibly mark drawings to record actual work, including:

1. Field changes of dimension and detail.
2. Changes made by field order or by change order.
3. Details not on original contract drawings.

D. Changes

The Contractor shall legibly mark each section of the Specifications and addenda to record changes made by field order or by change order.

E. Availability

The Contractor shall make documents available at all times for inspection by the Construction Manager. The Contractor shall bring one copy of the current as-built (red line) drawings to every other weekly progress meeting for the Construction Manager to review.

PART 2 - MATERIALS

NOT APPLICABLE.

PART 3 - EXECUTION

NOT APPLICABLE.

[END OF SECTION]

DIVISION 1 - GENERAL REQUIREMENTS
SECTION 01900
PREVIOUS SUBSURFACE INVESTIGATION INFORMATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Limitations of Information Included in Contract Documents:

1. Information gathered during previous site investigations has been attached to the Contract Documents.
2. The Contractor hereby distinctly agrees that neither DuPont nor the Engineer is responsible for the correctness or sufficiency of the information given:
   a. That in no event is this information to be considered as a part of the Contract;
   b. That the Contractor shall have no claim for delay or extra compensation or damage against DuPont or the Engineer on account of incorrectness of information given; or on account of the insufficiency or absence of information regarding soil or groundwater conditions or obstructions either revealed or not revealed by the Documents or Drawings; and
   c. That the Contractor shall have no claim for relief from any obligation or responsibility under his Contract, in case the location, size or character of any pipe or other underground structure is not as indicated on the Documents or Drawings, or in case any pipe or other underground structure is encountered that is not indicated on the Documents or Drawings.

PART 2 - MATERIALS

NOT APPLICABLE.

PART 3 - EXECUTION

NOT APPLICABLE.

[END OF SECTION]

Kinston Ash Landfill
Soil Cover Construction
Final Design

List of Specifications (cont.)

Division 2 - Site Work

02100 – Site Preparation
02200 – Earthwork
02270 – Erosion Control Measures
02274 – Geotextile
02505 – Roadway Construction
02700 – Drainage Controls
02930 – Seeding

DIVISION 2 - SITE WORK
SECTION 02100
SITE PREPARATION

PART 1 - GENERAL

1.1 SCOPE
The work discussed in this section shall consist of all activities necessary to prepare the site for full-scale earthmoving operations including, but not limited to, clearing, grubbing, utility identification and location, and installation of erosion and sedimentation controls.

1.2 RELATED WORK
The following work specified herein is, or may be, related to site preparation:

- **A.** Section 01010: Summary of Work.
- **B.** Section 01025: Measurement and Payment.
- **C.** Section 01110. Safety, Health, and Emergency Response
- **D.** Section 02200: Earthwork.
- **E.** Section 02270: Erosion Control Measures.
- **F.** Section 02700: Drainage Controls.
- **G.** Section 02930: Seeding.

1.3 REFERENCES
The publication listed below forms a part of this specification to the extent referenced. The publication is referred to in the text by the basic designation only.

- **A.** State of North Carolina – Department of Transportation – *Standard Specifications*

1.4 DEFINITIONS

- **A. Clearing**
  Clearing and Grubbing shall conform to NC DOT Section 200. Clearing, where required to install all project features and where designated on the Drawings, shall consist of the felling, trimming, and cutting of trees into sections and the disposal of trees, vegetation, downed timber, snags, brush and debris occurring in the areas to be cleared. Clearing shall also include the removal and disposal of structures that obtrude, encroach upon, or otherwise obstruct the work. Grubbing shall be performed where required to implement Ash Landfill soil cover construction and for borrow area development.

B. Grubbing

Grubbing shall consist of the removal and disposal of stumps, roots larger than 3 inches in diameter and matted roots. Grubbing shall be performed where required to implement Ash Landfill soil cover construction and for borrow area development.

PART 2 - MATERIALS

NOT APPLICABLE.

PART 3 – EXECUTION

3.1 UTILITY IDENTIFICATION AND LOCATION

Construction areas shall be cleared of all utilities. The Contractor shall contact North Carolina One-Call (1-800-632-4949) prior to initiation of Construction activities [and coordinate one-call activities with the Construction Manager and plant personnel]. Existing utility (including overhead and underground) lines that are to be retained, the locations of which are made known to the Contractor prior to excavation, shall be protected from damage during excavation, backfilling and earthwork activities. If damaged during any construction activity, the Contractor shall repair existing utilities at no cost to DuPont. In the event that the Contractor damages any existing utility lines that are not shown, or the locations of which have not been made known, the Contractor shall immediately report the damage to the Construction Manager. If it is determined that repairs are to be made by the Contractor, such repairs shall be made and the contract modified. When utility lines (that are to be removed or relocated) are encountered within the area of operations, the Contractor shall coordinate removal or relocation with all affected parties and shall acquire all necessary permits.

3.2 CLEARING

Trees, shrubs, vegetation, downed timber, snags, brush, and debris in areas to be cleared shall be cut off flush with or below the original ground surface, except such trees and vegetation as may be indicated or directed to be left standing. Trees and vegetation to be left standing shall be protected from damage due to clearing, grubbing, and construction operations by the erection of barriers or by such other means as required. Existing utilities must be identified, located, and protected by the Contractor.

3.3 GRUBBING

Material to be grubbed together with logs and other organic debris not suitable for foundation purposes shall be removed to a depth of not less than 18 inches below the

original surface level of the ground in areas that are excavated. Depressions made by grubbing shall be filled with suitable structural fill and compacted as defined in SECTION: EARTHWORK to make the surface conform with the original adjacent surface of the ground.

3.4 DISPOSAL OF CLEARED AND GRUBBED MATERIAL

All felled trees (less than 8-inch diameter), shrubs, downed timber, snags, brush, stumps, roots, logs, rotten wood, and other vegetative refuse shall be chipped or shredded. Chipped and shredded, cleared and grubbed material shall be stockpiled on-site in a location designated by the Construction Manager. Chipped material may be used as mulch in areas approved by the Construction Manager. Under no circumstances shall the Contractor or his subcontractors remove from the site or sell grubbed material or material taken from the clearing areas.

3.5 DISPOSAL OF SURFACE/TRENCHING DEBRIS/ASH

Surface debris and debris/ash encountered during utility trenching (i.e. leachate collection trench and conveyance system) sediment trap and drainage ditch installation or other project excavation activities shall be collected and consolidated beneath the soil cover. Surface and trench debris shall be consolidated for disposal underneath the soil cover system. Material that cannot be disposed of underneath the cap system shall be decontaminated and properly disposed of off-site in accordance with applicable federal, state and local regulations and laws at an approved facility.

3.6 EROSION AND SEDIMENTATION CONTROLS

Prior to any earth disturbing activity, the Contractor shall install erosion and sedimentation control measures in accordance with SECTION: EROSION AND SEDIMENT CONTROL MEASURES and the Drawings. Erosion and sedimentation control measures shall include, but not be limited to, temporary diversion ditches, rock check dams, silt / sediment fence, and sediment traps, as indicated on the Drawings.

[END OF SECTION]

DIVISION 2 - SITE WORK
SECTION 02200
EARTHWORK

PART 1 - GENERAL

1.1 SCOPE

A. General

The work covered by this section consists of furnishing all labor and equipment, and performing all earthwork necessary to place, fill, and construct the soil cover in accordance with the lines, grades, and dimensions shown on the Drawings and in accordance with these Specifications. The Contractor shall be aware that any excavation into the existing ground surface at the Ash Landfill Area could potentially result in uncovering previously disposed of sludge, asbestos containing material (ACM), construction and demolition (C&D) debris or ash material.

B. Borrow Source

The Contractor shall utilize the designated on-site borrow area (indicated on the Drawings) to obtain specified soils for soil cover construction. The Contractor shall be responsible for obtaining all necessary permits (including plant required permits) required to obtain onsite borrow.

Off-site borrow sources shall only be utilized when on-site areas have been fully utilized. Off-site borrow sources must be a permitted commercial borrow pit, and the Contractor must submit written documentation certifying that it is an uncontaminated source. The use of any off-site borrow must meet the requirements of this specification and be approved by DuPont. The Contractor shall be required to identify any off-site borrow source well in advance of the need for off-site borrow, should the need exist, so as not to create a delay in the project schedule. DuPont reserves the right to perform chemical and/or geotechnical testing of any proposed off-site borrow source to assure the requirements of the project specifications are being met.

1.2 RELATED WORK

The following work specified herein is, or may be, related to earthwork:

A. Section 01010: Summary of Work.
B. Section 01025: Measurement and Payment.
C. Section 01050: Field Engineering.
D. Section 01050: Safety, Health, and Emergency Response
E. Section 01440: Contractor Quality Control.

F. Section 02100: Site Preparation.
G. Section 02270: Erosion Control Measures.
H. Section 02700: Drainage Controls.
I. Section 02930: Seeding.

1.3 REFERENCES

The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only.

A. State of North Carolina – Department of Transportation – *Standard Specifications*

B. American Society for Testing and Materials (ASTM)

ASTM D 422	Method for Particle-Size Analysis of Soils.
ASTM D 698	Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3).
ASTM D 1140	Test Method for Amount of Material in Soils Finer Than the No. 200 Sieve.
ASTM D 1556	Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
ASTM D 2167	Test Method for Density and Unit Weight for Soil in Place by the Rubber Balloon Method.
ASTM D 2216	Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil Aggregate Mixtures.
ASTM D 2487	Classification of Soils for Engineering Purposes.
ASTM D 2488	Practice for Description and Identification of Soils (Visual-Manual Procedure).
ASTM D 2922	Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
ASTM D 2974	Test Method for Moisture, Ash, and Organic Matter of Peat and Other Organic Materials.
ASTM D 3017	Test Method for Moisture Content of Soil and Soil-

	Aggregate in Place by Nuclear Methods (Shallow Depth).
ASTM D 4253	Test Method for Maximum Index Density and Unit Weight of Soils Using Vibratory Table.
ASTM D 4254	Test Method for Minimum Index Density and Unit Weight of Soils Using Vibratory Table.
ASTM D 4318	Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.4 SUBMITTALS

A. The Contractor shall submit the results of all testing performed in connection with quality control requirements of this Specification to the Construction Manager. Test results from advance testing shall be submitted at least 5 days in advance of delivery of the representative material to the site.

PART 2 - MATERIALS

2.1 COVER SOIL

Cover Soil shall be excavated from the designated on-site borrow source.

2.2 AMENDED COVER SOIL

Amended Cover Soil shall be excavated from the designated on-site borrow source and amended (from on-site or off-site sources) to meet the requirements detailed in paragraphs 3.2D, and 3.6 and in accordance with SECTION: SEEDING.

PART 3 - EXECUTION

3.1 GENERAL

The work to be performed under this Section shall be in accordance with the Drawings and as specified herein. The work under this Section shall include, but not be limited to, excavation for the leachate collection system and collection system conveyance piping, regrading of ash material and placement of cover soil to establish "intermediate grade" (or the bottom of the 2' thick soil cover), final grading, and excavation for erosion and sediment control and for drainage channels. The work under this Section shall also include excavation of borrow area and grading of the borrow area in accordance with the Drawings. The work under this section shall also include borrow area, C&D Landfill and Ash Landfill soil amendment.

A. Protection of Existing Utilities Structures

Existing utility lines that are to be retained, the locations of which are made known to the Contractor prior to excavation, shall be protected from damage during excavation and backfilling. If damaged during any construction activity, the existing utilities shall be repaired by the Contractor at no cost to DuPont. In the event that the Contractor damages any existing utility lines that are not shown, or the locations of which have not been made known, the Contractor shall immediately report the damage to the Construction Manager. If determined that repairs are to be made by the Contractor, such repairs will be made and the contract modified. When utility lines that are to be removed or relocated are encountered within the area of operations, the Contractor shall coordinate removal or relocation with all affected parties and shall acquire all necessary permits.

B. Landfill Structures

Landfill structures including, but not limited to, existing monitoring wells shall be carefully maintained and protected during placement of fill. If these structures are damaged during the placement of fill, the Contractor shall repair any damaged structure to the approval of the Construction Manager at no additional cost to DuPont.

C. A "Pass" Defined

A complete pass shall consist of the coverage of the entire lift to be compacted with the roller specified. The equipment shall be operated so that the strip being traversed by the roller shall overlap the rolled adjacent strip not less than 1 foot. Dumping, spreading, sprinkling, and compacting may be performed at the same time at different points along a section when there is sufficient area to permit these operations to proceed simultaneously.

D. Maintain Drainage

During construction, embankments and excavations shall be kept shaped and drained. Ditches along the cap shall be maintained in such a manner as to drain effectively at all times. Where ruts occur in the fill, the fill shall be brought to grade, reshaped if required, and recompacted prior to placing additional fill. The storage or stockpiling of materials on the cap will not be permitted.

E. Finished Surface

All areas covered by the project, including excavated and filled sections and adjacent transition areas, shall be uniformly smooth graded. The finished surfaces shall be reasonably smooth, compacted, and free from irregular surface changes, vegetation (except topsoil), and debris. The degree of finish shall be ordinarily obtainable from either blade-grader or scraper operations, except as otherwise specified. The finished surface shall be not more than 0.15 foot above or below

the established grade or approved cross section and shall be free of depressed areas where water would pond. All areas shall be finished so as to drain readily.

F. Haul Roads

Haul roads shall be located, designed and constructed by the Contractor to maintain the intended traffic, to be free draining, and shall be maintained in good condition throughout their use. Haul roads shall not be constructed by cutting into the existing ground surface.

G. Protection of Existing Monitoring Wells

Existing monitoring wells are present throughout the site. Any monitoring wells or other structures not shown on the Drawings which are located during construction activities should be reported to the Construction Manager for evaluation. The existing monitoring wells and any other monitoring wells encountered should not be disturbed in any manner.

3.2 BORROW AREA DEVELOPMENT

A. General

Borrow area development shall conform to NC DOT Section 230. Borrow area development shall be limited to the area designated on the Construction Drawings. The Contractor shall provide all equipment and labor necessary to develop the candidate borrow area. In addition, the Contractor shall identify and be responsible for obtaining all necessary (and Kinston Plant required) permits associated with borrow area development in advance of the work. No schedule extension will be granted for delays caused by the permit approval process.

B. Borrow Area Development

The Contractor shall develop the candidate borrow area in a planned, orderly fashion by stripping borrow topsoil and then implementing soil excavation and removal in order that the entire area is uniformly lowered in elevation to the grades shown in the Drawings. The Contractor shall be responsible for implementing and maintaining all necessary erosion and sediment controls and management of stormwater during borrow area development.

If during borrow area development, unsuitable soil (i.e. material with visible staining or apparent impact from historical plant operations) is encountered, the Contractor shall consolidate unsuitable materials as directed by the Construction Manager. Borrow area development shall either be discontinued or excavation activities shall be relocated to another portion of the borrow area as directed by the Construction Manager.

The Contractor should be aware that DuPont may require access to the borrow area to perform chemical sampling in the event that unexpected sources of

contamination are encountered during the course of borrow excavation. In the event such sampling is required, the Contractor shall move to another location within the borrow area to continue operations and shall not have cause to claim a delay to the project schedule.

C. Test Pits

The Contractor may conduct exploratory test pits within the candidate borrow area to establish the available thickness of suitable soils.

D. Borrow Area Soil Amendment, Final Grading, and Seeding

The Contractor shall excavate the candidate borrow area to meet the lines and grades presented in the final grading plan and as directed by the Construction Manager. The entire disturbed area shall be amended to meet pH and organic content requirements as required in Paragraph: Cover Soil Amendment. The entire disturbed area shall be seeded in accordance with SECTION: SEEDING. Final grading of the completed borrow area must be approved by the Construction Manager prior to seeding. The restored borrow area shall be surveyed during the final topographic survey of the site in accordance with SECTION: FIELD ENGINEERING.

3.3 BORROW AREA EXCAVATION

A. General

Excavation shall conform to current Local, State, and Federal regulations covering safety for excavation and as necessary for personal and property safety. The Contractor must provide any shoring or bracing as necessary to properly protect workers in excavations. Approval by the Engineer of the Contractor's procedures does not relieve the Contractor of responsibility for site safety.

B. Excavation

The Contractor shall excavate to the lines and grades shown on the Drawings. Over-excavation and/or fill not shown on the Drawings or specified herein shall be at the Contractor's expense, unless approved by the Construction Manager prior to commencing such work.

C. Excavation Instability/Slopes of Excavations

The Contractor shall immediately inform the Construction Manager of any signs of instability of any excavation during the course of the project. Work shall be halted until a plan of action for construction of the work is agreed to by the Construction Manager. Excavation of all materials shall be done with excavations at a safe slope. The cut slope shall not be steeper than 2H:1V unless so noted on the plans or agreed to by the Construction Manager.

3.4 ASH LANDFILL RE-GRADING PROCEDURES

A. Re-Grading

The Contractor shall excavate/regrade to the lines and grades shown on the Drawings. The Contractor shall perform all excavation/regrading of every description and of whatever substances encountered to the depths indicated on the Drawings. All excavation required under this contract is unclassified; no additional compensation will be considered for ACM excavation within the ash pile. Over-excavation and/or fill not shown on the Drawings or specified herein shall be at the Contractor's expense, unless approved by the Construction Manager prior to commencing such work.

B. Slopes of Excavation

Excavation of all materials shall be done with excavations at a safe slope. The cut slope shall not be steeper than 2H:1V unless so noted on the plans or agreed to by the Construction Manager. Approval of the Contractor's work plan by the Engineer does not relieve the Contractor of the sole responsibility for site safety.

C. Compaction

Excavated materials (i.e., ash material, off-pile trench spoils, etc) shall be compacted in 12-inch loose lifts using four passes of a Caterpillar CS-563D padded-foot or sheepsfoot drum vibrating soil compactor or an approved alternative.

D. Proof Rolling

After conclusion of re-grading of ash material, all site surfaces shall be proof rolled using a Caterpillar CS-563D padded-foot or sheepsfoot drum vibrating soil compactor or approved equal. After proof rolling, ash material shall be covered immediately with cover soil.

3.5 COVER SOIL PLACEMENT – ASH LANDFILL

A. General

All surface vegetation, such as brush, heavy growth of grass, and all decayed vegetative matter within the area upon which fill is to be placed shall be handled in accordance with SECTION: SITE PREPARATION, prior to fill placement.

B. Placement

The cover soil shall be placed at the location and to the lines and grades indicated on the Drawings. The Contractor shall place cover soil starting at the toe of the slope and working up the slope, perpendicular to the toe. Cover soil shall be placed in single lift in order to produce a maximum compacted lift thickness of 12

inches. Each lift shall be spread uniformly on the previously compacted surface; broken up; moistened or aerated as necessary.

C. Compaction

The cover soil shall be placed at the location and to the lines and grades indicated on the Drawings. Each lift of cover soil fill shall be tracked-in place by the compaction equipment to reach 90 percent compaction of γ_{Dmax} as determined by the standard Proctor compaction test (ASTM D698). Cover soil shall be placed in order to produce a compacted lift thickness of 12 inches. The Contractor shall place cover soil starting at the toe of the slope and working up the slope, perpendicular to the toe. Each lift shall be spread uniformly on the previously compacted and scarified (to a depth of at least 2 inches) surface, broken up, and moistened or aerated as necessary. If wheeled vehicles traversing the cap system cause rutting in excess of one inch, the Contractor shall cease to traverse the cap system in the affected area until the area has been repaired, recompacted and additional fill has been added.

The work shall be performed only during periods when beneficial results are likely to be obtained. When conditions are marginal, by reason of drought, excessive moisture, or other factors which prevent satisfactory results, the work will be stopped upon approval of the Construction Manager and shall be resumed only when directed. Cover soil shall not be placed when the subgrade is frozen, excessively wet, extremely dry or in a condition otherwise detrimental to proper grading or the proposed planting.

3.6 COVER SOIL AMENDMENT

A. General

All ground areas disturbed by construction under this contract, unless otherwise specified, shall be amended to promote vegetative growth. Previously constructed grades shall be repaired, if necessary, so that the areas to be amended shall conform to the section indicated upon completion of the required amendment. The work shall be performed only during periods when beneficial results are likely to be obtained. When conditions are marginal (by reason of drought, excessive moisture, or other factors which could impact satisfactory results) the work will be stopped and shall be resumed only upon approval of the Construction Manager.

B. Amendment Procedures – C&D Landfill

The upper six inches of all disturbed areas within the C&D Landfill construction area shall be amended to adjust for pH. Amended soil shall have a final pH value of between 6.0 to 7.5. If the pH is not within the 6.0 to 7.5 range, the Contractor shall add the material required to achieve that pH balance. Samples collected

during C&D construction indicated a pH in the range of 5.8 for the C&D landfill. The Contractor shall collect samples to determine pH in accordance with SECTION: SEEDING.

C. Amendment Procedures – Ash Landfill

The upper six inches of all disturbed areas within the Ash Landfill construction area shall be amended with an approved organic material (i.e. existing stripped borrow area topsoil, peat moss, compost, or other amendment) to provide a vegetative layer that can produce heavy growths of crops, grass or other vegetation. All areas to be amended shall be reasonably free from underlying subsoil, clay lumps, objectionable weeds, rocks, litter, brush, matted roots, toxic substances or any material that might be harmful to plant growth or be a hindrance to grading, planting or maintenance operations. Soils from ditch bottoms, drained ponds, or eroded areas (handled when too wet or soggy) are not acceptable.

Amended soil shall have a final pH value of between 6.0 to 7.5. If the pH is not within the 6.0 to 7.5 range the Contractor shall add the material required to achieve that pH balance. Amended soil shall contain from 3 to 10 percent organic matter as determined by loss on ignition in accordance with ASTM D 2974. If the organic matter is not within the 3 to 10 range, the Contractor shall add sufficient amendments to achieve the required organic content.

3.7 QUALITY CONTROL TESTING

A. General

1. Sampling and Testing: All quality control sampling and testing shall be performed by the Contractor at the Contractor's expense and as specified herein. Soil testing shall be provided by the Contractor's independent testing laboratory. The Construction Manager shall have the option to select test locations; otherwise, test locations must be approved by the Construction Manager. The Construction Manager will require additional tests beyond the minimum required to be performed whenever materials or construction are questionable. The Contractor should note that quality assurance tests for acceptance may be made by and at the expense of DuPont. The Contractor, however, shall not depend on quality assurance tests for his/her control of operations. Discrepancies between test results obtained by the Independent QC Contractor and the Construction Manager will be resolved to the Construction Manager's satisfaction prior to the Contractor performing any further work. Deficiencies in construction shall be corrected by the Contractor at no additional cost to DuPont.
2. As-Built Surveys: The Contractor shall submit as-built surveys of the completed intermediate grade (sub-grade), cover soil, and final cap system (amended cover soil) surface to the Construction Manager. The final as-built

submittal of the intermediate grade shall incorporate the entire intermediate grade and shall be approved prior to cover soil placement (unless otherwise approved by the Construction Manager). Similar to the previous layer, the as-built survey of the cover soil shall be supplied to the Construction Manager prior to the placement of the amended cover soil. The final as-built submittal of the cover soil (and the amended cover soil) shall incorporate the entire surface. The Contractor shall submit the as-built surveys in both reproducible paper prints and electronic formats as described in SECTION: PROJECT RECORD DOCUMENTS. The survey shall consist of vertical elevations of the cap on a 50-foot grid relative to the north and east project grid system shown on the Drawings and at all slope changes.

3. Advanced Testing: Advance testing shall be performed in advance of delivery from the borrow source and is required to establish borrow source properties and amendment requirements and to establish control parameters for compaction.
4. Construction Testing: Construction testing shall be performed during fill placement to verify that the representative fill material is meeting the requirements of this Specification.

B. Advanced and Construction Testing Protocols (Onsite Borrow)

The following testing shall be performed for onsite borrow soils:

1. **Advance Testing - Classification and Density-Moisture Determinations:** Tests for determination of maximum dry density and optimum moisture content shall be performed by the Contractor in accordance with the requirements of the standard Proctor compaction test in accordance with ASTM D 698 at a rate specified in Table 1 of SECTION: CONTRACTOR QUALITY CONTROL. A soil classification and moisture-density curve or maximum density determination shall be obtained for each principal type of material or combination of materials encountered or utilized. The above testing shall include soil classification, moisture content, Atterberg limits, and grain size determination (sieve and hydrometer analyses) and specific gravity. These tests are described in ASTM D 2487, ASTM D 2216, ASTM D 4318, and ASTM D 422, respectively. Classification testing shall be done at a rate specified in Table 1 of SECTION: CONTRACTOR QUALITY CONTROL. As necessary and applicable, the maximum and minimum density of cohesionless materials shall be determined by the Contractor using the vibrating table as described in ASTM D 4253 and ASTM D 4254, respectively. Samples shall be representative of the material placed. Copies of all advance test results for classification and control of density and moisture shall be furnished to the Construction Manager a minimum of 5 days in advance of the time the representative materials are to be placed.
2. **Insitu Density Control – Cover Soil:** The Contractor shall adequately control the specified in-place density and moisture content of the fill during

placement using ASTM D 2922 and ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job, on each different type of material encountered, and once every two weeks using ASTM D 1556 and ASTM D 2167. For each compacted lift, density and moisture content tests shall be performed at the rate specified in Table 1 of SECTION: CONTRACTOR QUALITY CONTROL for each type of material placed each day. Additional tests shall be made as necessary as directed by the Construction Manager. The testing performed on the completed lifts shall be the basis for approval and acceptance by the Construction Manager.

3. **Grade Verification – Cover Soil and Amended Cover Soil:** The Contractor shall monitor the depth of the compacted layers during placement and verify that the required grades are reached. Grade verification shall be performed by the Contractor as indicated and at the rate specified in Table 1 of SECTION: CONTRACTOR QUALITY CONTROL.
4. **Lift Thickness Verification– Cover Soil and Amended Cover Soil:** The Contractor shall monitor the depth of the compacted layers during placement and verify that the minimum layer thickness specified is reached. Layer thickness checks shall be performed by the Contractor as indicated and at the rate specified in Table 1 of SECTION: CONTRACTOR QUALITY CONTROL.

[END OF SECTION]

DIVISION 2 - SITE WORK
SECTION 02270
EROSION CONTROL MEASURES

PART 1 - GENERAL

1.1 SCOPE

A. The work shall include the furnishing and application of materials and labor required to construct erosion control measures in accordance with these Specifications and within the lines, grades, and dimensions shown on the Drawings, and the Erosion and Sediment Control Plan.

B. Construction of the following erosion controls is covered in this section: Reinforced Sediment Fence, Stone Outlets, Riprap Protection, Inlet/Outlet Protection, Temporary Gravel Construction Entrance/Exit, Erosion Control Blanket, and Sediment Traps.

C. The quantity of temporary erosion controls shown on the Drawings may be increased or decreased at the direction of the Engineer or Construction Manager based upon actual conditions which occur during the construction of the project. Such variations in quantity shall not be considered as alterations in the details of construction or a change in the character of work.

1.2 RELATED WORK

The following work specified herein is, or may be, related to the construction of erosion control measures:

A. Section 01025: Measurement and Payment.
B. Section 01440: Contractor Quality Control.
C. Section 02100: Site Preparation.
D. Section 02200: Earthwork.
E. Section 02700: Drainage Controls.
F. Section 02930: Seeding.

1.3 REFERENCES

The publications listed below form a part of this Technical Specification to the extent referenced. The publications are referenced in the text by basic designation only.

A. State of North Carolina – Sedimentation Control Commission – *Erosion and Sediment Control Planning and Design Manual (Manual)*, September 1, 1988.

B. American Society of Testing and Materials (ASTM)

ASTM C 136	Sieve Analysis of Fine and Coarse Aggregate.
ASTM D 123-93	Terminology Relating to Textile Materials.
ASTM D 488-98	Standard Classification for Sizes of Aggregate for Road and Bridge Construction.
ASTM D 3776-85	Test Methods for Mass Per Unit Area of Geotextile.
ASTM D 3786-87	Test Method for Hydraulic Bursting Strength of Knitted Goods and Non-woven Fabrics: Diaphragm Bursting Strength Tester Method.
ASTM D 4354-96	Practice for Sampling of Geotextiles for Testing.
ASTM D 4355-92	Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus).
ASTM D 4491-99	Test Method for Water Permeability of Geotextiles by Permittivity.
ASTM D 4632-91	Test Method for Grab Breaking Load and Elongation of Geotextiles.
ASTM D 4751-87	Test Method for Determining the Apparent Opening Size of a Geotextile.
ASTM D 4759-88	Test Method for Determining the Specification Conformance of Geosynthetics.

1.4 DEFINITIONS

A. Reinforced Sediment Fence

A temporary sediment barrier consisting of a sediment trapping geotextile fence that reduces the off-site transport of sediment via ponding of runoff allowing sediment to filter out on the upstream side of the fence.

B. Riprap
Specially selected and graded quarried stone placed in ditches and on slopes to prevent erosion.

C. Rock Inlet/Outlet Protection
Structurally lined aprons placed at the inlets and/or outlets of pipe culverts or ditches to dissipate the energy of runoff flow.

D. Temporary Gravel Construction Entrance/Exit
A stabilized pad of aggregate placed over a geotextile to significantly reduce the amount of soil and mud tracked off site by construction related traffic.

E. Erosion Control Blanket (ECB)
A temporary, degradable rolled erosion control product made of natural fibers attached to synthetic netting and used to protect newly seeded areas from environmental forces such as wind, rain and intense sunlight, and to enhance the growth of vegetation.

F. Turf Reinforcement Matrix (TRM)
A permanent erosion control product made of ultraviolet (UV) stable netting with a natural or synthetic matrix or a 3-D polypropylene matrix used provide long-term protection for newly seeded areas from environmental forces such as wind, rain and intense sunlight, and to enhance the growth of vegetation.

G. Sediment Trap
A temporary settling pond used to collect sediment-laden runoff and trap sediment while discharging clean water through a simple spillway outlet structure stabilized with geotextile and riprap.

H. Stone Outlets
A small rock dam constructed at low points along the reinforced sediment fence, installed to prevent damage to the sediment fence at drainage points along the barrier.

1.5 SUBMITTALS

In accordance with SECTION: SUBMITTALS, the Contractor shall submit the following items to DuPont for approval:

A. Geotextile
As required under SECTION: GEOTEXTILE of these Specifications.

B. Riprap

All data on the rock fill material including, but not limited to, proposed source of riprap and sieve analysis results, or DOT certification on each type of riprap material used.

C. Erosion Control Blanket (ECB)

1. Descriptive data on erosion control ditch lining material including manufacturer's specifications and material sample.
2. Certified material property data sheets for the ECB from the manufacturer indicating the material meets the specifications herein.
3. Manufacturer's installation procedures for the ECB for approval by DuPont.

D. Turf Reinforcement Matrix (TRM)

1. Descriptive data on TRM including manufacturer's specifications and material sample.
2. Certified material property data sheets for the TRM from the manufacturer indicating the material meets the specifications herein.
3. Manufacturer's installation procedures for the TRM for approval by DuPont.

E. Reinforced Sediment Fence

Certified material property data sheets for the reinforced sediment fence material indicating the material meets the specifications herein.

PART 2 - MATERIALS

2.1 REINFORCED SEDIMENT FENCE

Reinforced sediment fence shall conform to the requirements specified on the Drawings.

2.2 RIPRAP

A. Rock Ditch Protection

Riprap for ditch protection shall conform to the size requirements specified on the Drawings.

B. Temporary Gravel Construction Entrance/Exit

Riprap for the Temporary Gravel Construction Entrance/Exit shall conform to the size requirements specified on the Drawings.

C. Stone Outlets

Riprap for the stone outlets shall conform to the size requirements specified on the Drawings.

2.3 EROSION CONTROL BLANKET (ECB)

A. Grass-Lined Ditch and Slope Protection

ECB shall be a machine-produced mat of straw, wood fibers, coconut or other natural material. The ECB shall be of uniform thickness with matting material evenly distributed and woven into 2 continuous synthetic UV resistant netting on top of the natural materials. ECB must be capable of withstanding a limited shear stress of 1.5 lbs/sf in an un-vegetated state, and must be capable of providing a protection period of 24 months. The ECB shall also conform to the requirements specified on the Drawings.

ECB shall be installed for ditch protection and on all slopes within the disturbance area of 4H:1V or steeper (including the borrow area). ECB shall be installed in Ditches 2, 3, 4, and 6. Ditch 1 shall be protected with a TRM as detailed below and Ditch 5 shall be protected with Rip-Rap as presented on the Drawings.

B. Staples

ECB shall be anchored with "U"-shaped 11-gauge wire staples with a minimum top width of 1 inch and length as determined by the soil type and approved by the manufacturer and DuPont.

2.4 TURF REINFORCEMENT MATRIX (TRM)

A. Ditch Protection

TRM shall be installed in Ditch 1. TRM shall consist of a rolled turf reinforcement matrix of uniform thickness manufactured from a UV-stable netting with a UV-stable synthetic matrix. The TRM must be capable of withstanding a limited shear stress of 2.5 lbs/sf in an un-vegetated state, and must be capable of providing permanent protection.

B. Staples

TRM shall be anchored with "U"-shaped 11-gauge wire staples with a minimum top width of 1 inch and length as determined by the soil type and approved by the manufacturer and the Construction Manager.

2.5 GEOTEXTILE

As required under SECTION: GEOTEXTILE of these Specifications. Geotextile securing pins, or alternate securing method, shall be as recommended by the geotextile manufacturer.

2.6 COVER SOIL

Cover soil shall be as specified in SECTION: EARTHWORK.

PART 3 - EXECUTION

3.1 GENERAL

A. Delivery, Storage and Handling

Delivery, storage and handling of materials mentioned in this Technical Specification shall comply with the manufacturer's recommendations.

B. Erosion Control

The Contractor shall implement erosion control measures in accordance with the requirements of this section before and during performance of work within this section. Maintenance of erosion control measures shall be in accordance with Paragraph: Field Quality Control.

C. Dust Control

The Contractor shall implement dust control measures in accordance with the Drawing requirements. Sprinkling shall be considered an acceptable form of dust control. The Contractor shall be responsible for obtaining water, including all required DuPont Kinston Plant and NC DENR approvals and permitting requirements.

3.2 PERFORMANCE

A. Site Preparation

Surfaces of ditches and slopes shall conform to the lines, grades, and cross-sections shown on the Drawings and finished to a smooth and even condition with all debris, roots, stones, and clods greater than 3 inches in diameter raked out or removed prior to the placement of erosion control measures as applicable. Correct subgrade irregularities exceeding previously specified limit to DuPont's satisfaction either by removing or adding material as required, followed by rolling until satisfactorily compacted.

B. Reinforced Sediment Fence Installation

1. Reinforced sediment fence shall be constructed before upslope land disturbance begins.
2. All reinforced sediment fence shall be placed as close to the contour as possible so that water will not concentrate at low points in the fence and so that small swales or depressions which may carry small concentrated flows to the reinforced sediment fence are dissipated along its length.

3. To prevent water ponded by the reinforced sediment fence from flowing around the ends, each end shall be constructed upslope so that the ends are at a higher elevation.
4. Where possible, reinforced sediment fence shall be placed on the flattest area available, offset a minimum distance of five feet from the upstream slope.
5. Where possible, vegetation shall be preserved for 5 feet (or as much as possible) upslope from the sediment fence. If vegetation is removed, it shall be re-established within seven days from the installation of the reinforced sediment fence.
6. The height of the reinforced sediment fence stake shall not exceed 18 inches above the original ground surface.
7. The reinforced sediment fence shall be placed in a trench cut a minimum of eight inches deep. The trench shall be cut with a trencher, cable laying machine, or other suitable device which will ensure an adequately uniform trench depth.
8. The reinforced sediment fence shall be placed with the stakes on the downslope side of the geotextile. Excess material shall lay on the bottom of the trench. The trench shall be backfilled and compacted in accordance with SECTION: EARTHWORK.
9. Seams between sections of reinforced sediment fence shall be overlapped a minimum of 18 inches with the end stakes of each section wrapped together before driving into the ground.
10. Reinforced sediment fence shall allow runoff to pass only as diffuse flow through the geotextile. If runoff overtops the reinforced sediment fence, flows under or around the ends, or in any other way becomes a concentrated flow, the following shall be performed, as approved by the Construction Manager: i) accumulated sediment shall be removed, and/or ii) a stone outlet shall be installed.
11. Upslope areas shall be permanently stabilized prior to removing the reinforced sediment fence.
12. The wire support mesh shall be fastened securely behind the geotextile on the upslope side of the stake. The wire shall extend into the trench a minimum of 2 inches and extend a maximum of 30 inches above the original ground surface.

C. Riprap Installation – Ditch 5 and Pipe Inlet/Outlet Protection

1. Prior to placing riprap, geotextile shall be installed to the lines and grades indicated on the Drawings.
2. Stone for "riprap" shall be placed in such a manner as to produce a reasonably well-graded mass of rock with the minimum practicable percentage of voids, and shall be constructed within the specified

tolerance to the lines and grades shown on the Drawings or as staked in the field.

3. Riprap shall be placed to its full course thickness at one operation and in such a manner as to avoid damaging the geotextile and to minimize segregation of the riprap. The larger stones shall be well distributed and the entire mass of stones in their final position shall be roughly graded to conform to the gradation specified.
4. Should accidental damage occur to the geotextile during rock fill placement, carefully remove the rock fill and make repairs to the geotextile in accordance with the manufacturer's recommendations. All repairs will be made to the satisfaction of DuPont and at no additional expense.
5. Do not operate construction equipment directly on the geotextile during riprap placement.

D. Temporary Gravel Construction Entrance/Exit

1. The Temporary Gravel Construction Entrance/Exit shall be installed as soon as practicable once mobilization begins.
2. Dimensions of the entrance shall be as indicated on the Drawings.
3. A geotextile shall be placed over the entrance subgrade prior to placing aggregate.
4. Top dressing of additional stone shall be applied as conditions demand. Mud spilled, dropped, washed or tracked onto public roads, or any surface where runoff is not checked by sediment controls, shall be removed immediately. Removal shall be accomplished by scraping or sweeping.
5. Construction entrances shall not be relied upon to remove mud from vehicles and prevent off-site tracking. Vehicles that enter and leave the construction site shall be restricted from muddy areas.

E. Erosion Control Blanket (ECB) Installation

ECB shall be placed as indicated on the Drawings and as specified below:

1. Grass-lined Ditch Protection
   a. Prepare soil before installing blankets, including application of lime, fertilizer, seed, and mulch.
   b. Begin at the top of the ditch by anchoring the blanket in a 6-inch deep by 6-inch deep wide trench. Backfill and compact the trench after stapling.
   c. Roll center blanket in direction of water flow on bottom of ditch.
   d. Place blankets end over end (shingle style) with 6 inch overlap. Use a double row of staggered staples 4 inches apart to secure blankets.

e. Full-length edge of blankets at top of side slopes shall be anchored in a 6-inch deep by 6-inch wide trench. Backfill and compact the trench after stapling.
f. Blankets on side slopes shall be overlapped 4 inches over the center blanket and stapled.
g. In ditch applications, a staple check slot shall be used every 40 feet. Use a row of staples 4 inches apart over entire width of ditch. Place a second row 4 inches below the first row in a staggered pattern.
h. The terminal end of the blankets be anchored in a 6-inch deep by 6-inch wide trench. Backfill and compact the trench after stapling.
i. Staple pattern shall be per manufacturer's recommendations.

2. Grass-Lined Slope Protection
   a. Prepare soil before installing blankets, including application of lime, fertilizer, seed, and mulch.
   b. Begin at the top of the slope by anchoring the blanket in a 6-inch deep by 6-inch wide trench. Backfill and compact the trench after stapling.
   c. Roll the blankets down the slope.
   d. Staple pattern shall be per manufacturer's recommendations.
   e. The edges of parallel blankets shall be stapled with approximately 2 inches of overlap.
   f. When blankets must be spliced down the slope, place blankets end over end (shingle style) with approximately 4 inches of overlap. Staple through overlapped area, approximately 12 inches apart.
3. Adjustments
   If any staples become loosened or raised, or if any matting becomes loose, torn, or undermined, Contractor shall immediately make satisfactory repairs.

F. Turf Reinforcement Matrix (TRM) Installation

TRM shall be placed in ditches as indicated on the Drawings and as specified below:

1. Grass-lined Ditch Protection
   a. Prepare soil before installing blankets, including application of lime, fertilizer, seed, and mulch.
   b. Begin at the top of the ditch by anchoring the blanket in a 6-inch deep by 6-inch wide trench. Backfill and compact the trench after stapling.
   c. Roll center blanket in direction of water flow on bottom of ditch.
   d. Place blankets end over end (shingle style) with 6 inch overlap. Use a double row of staggered staples 4 inches apart to secure blankets.

e. Full-length edge of blankets at top of side slopes shall be anchored in a 6-inch deep by 6-inch wide trench. Backfill and compact the trench after stapling.
f. Blankets on side slopes shall be overlapped 4 inches over the center blanket and stapled.
g. A staple check slot shall be used every 40 feet. Use a row of staples 4 inches apart over entire width of ditch. Place a second row 4 inches below the first row in a staggered pattern.
h. The terminal end of the blankets shall be anchored in a 6-inch by 6-inch wide trench. Backfill and compact the trench after stapling.
i. Staple pattern shall be per manufacturer's recommendations and as indicated on the Drawings.

2. Adjustments
   a. If any staples become loosened or raised, or if any matting becomes loose, torn, or undermined, the Contractor shall immediately make repairs satisfactory to the Construction Manager.
   b. Contractor shall maintain installed TRM and mulched areas installed TRM at no additional cost to DuPont, until vegetation is adequately established, whichever is longer.

G. Geotextile Placement

1. Geotextile shall be placed on the prepared surface within the areas and to the limits shown on the Drawings or as directed by the Construction Manager.
2. Geotextile shall be installed in accordance with SECTION: GEOTEXTILE.

H. Construction of Sedimentation Traps

1. Sediment traps shall be constructed and operational before upslope land disturbance begins.
2. The area under the embankment shall be cleared, grubbed, and stripped of any vegetation and root mat. The pool area shall be cleared as needed to facilitate sediment cleanout.
3. Fill material used for the embankment shall be obtained from on-site borrow source material and shall be free of roots or other woody vegetation as well as oversized stones, rocks, organic material or other objectionable material. The embankment shall be compacted by traversing with equipment while it is being constructed in accordance with the requirements of SECTION: EARTHWORK.
4. Dikes directing water to the trap shall be higher than the height of the embankment.

5. Temporary seeding shall be established on all non-submerged areas of each sediment trap.
6. The outlet spillways shall be constructed to the dimensions shown in the Drawings.
7. ECB shall be placed over the bottom and slopes of the outlet spillway. ECB shall continue downstream of the embankment to form an apron on the surrounding ground. ECB shall overlap and be anchored as detailed in Paragraph: Erosion Control Blanket Installation.
8. Sediment shall be removed and the sediment trap restored to its original dimensions when the sediment has filled one-half the pond's original depth. Removed sediment shall be spread in a suitable area as directed by the Construction Manager and stabilized so it will not erode.
9. The structure and accumulated sediment shall be permanently stabilized when the drainage area has been stabilized.

3.3 FIELD QUALITY CONTROL

A. Inspection of Erosion Controls

The integrity of the erosion control devices shall be maintained as long as they are necessary to contain sediment runoff associated with the work to be performed. Erosion controls shall be inspected, at a minimum, once every 7 days and within 24 hours of a rainfall event of 0.5 inches or greater.

[END OF SECTION]

DIVISION 2 - SITE WORK
SECTION 02274
GEOTEXTILE

PART 1 – GENERAL

1.1 SCOPE

The work covered by this section consists of furnishing and installing the geotextile for roadway construction, for the stabilized construction entrance, for the leachate collection trench, over existing material and beneath the 6-inches of amended soil cover for "off-cap" areas, and to stabilize over the sludge material prior to cover soil installation above the sludge. Specification of the silt fence is covered in SECTION: EROSION CONTROL MEASURES.

1.2 RELATED WORK

The following work specified herein is, or may be, related to the geotextile installation:

A. Section 01025: Measurement and Payment.
B. Section 01110: Safety, Health and Emergency Response.
C. Section 01300: Submittals.
D. Section 01440: Contractor Quality Control.
E. Section 02200: Earthwork.
F. Section 02270: Erosion Control Measures.
G. Section 02700: Drainage Controls.

1.3 REFERENCES

The publications listed below form a part of the specification to the extent referenced. The publications are referenced to in the text by basic designation only.

A. American Society of Testing and Materials (ASTM)

ASTM D 123-93	Terminology Relating to Textiles Materials
ASTM D 3776-85	Test Methods for Mass Per Unit Area of Geotextile (1985)
ASTM D 3786-87	Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics: Diaphragm Bursting Strength Tester Method
ASTM D 3884-92	Test Method for Abrasion Resistance of Textile Fabrics

	(Rotary Platform, Double-Head Method)
ASTM D 4354-96	Test Method for Sampling of Geosynthetics for Testing
ASTM D 4355-92	Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus)
ASTM D 4491-92	Test Method for Water Permeability of Geotextiles by Permittivity
ASTM D 4533-91	Test Method for Trapezoidal Tearing Strength of Geotextiles
ASTM D 4595-86	Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method
ASTM D 4632-91	Test Method for Grab Breaking Load and Elongation of Geotextiles
ASTM D 4751-87	Test Method for Determining the Apparent Opening Size of a Geotextile
ASTM D 4833-88	Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products

B. American Association of State Highway and Transportation Officials (AASHTO)

AASHTO M 288-99	Geotextile Specification for Highway Applications

1.4 DEFINITIONS

A. Installer
The person or corporation hired by the Contractor who is responsible for field handling, deploying, seaming and anchoring of the geotextile.

B. Independent QC Contractor
The person or corporation hired by the Contractor, independent from the Contractor, manufacturer, fabricator, and installer, who is responsible for monitoring and documenting activities related to the quality control of the geotextile from manufacturing through installation. The QC Contractor shall review manufacturer's test data to verify that the delivered geotextile meets the material properties required by these specifications. In addition, the QC

Contractor shall be responsible for verifying that the geotextile has been installed in accordance with these specifications. The QC Contractor shall provide a QC Supervisor who is Level II NICET certified for geotextile installation on site, full-time to supervise the installation of the geotextile.

C. Independent Laboratory

An independent laboratory shall have provided QC and/or QA testing of the proposed geotextile material for at least five completed projects totaling a minimum of two million square feet and be accredited by the Geosynthetic Accreditation Institute (GAI). A name and telephone number of a project contact for each project shall be provided.

D. Contractor

The Contractor shall have demonstrated ability for successfully placing soil above a geotextile and sludge material as required by these specifications for a minimum of three completed projects of equal or larger size when compared to this project.

1.5 SUBMITTALS

In accordance with SECTION: SUBMITTALS, the Contractor shall submit the following items to DuPont for approval:

A. Manufacturer's certified material property data sheets indicating compliance with all specifications herein for the geotextile.

B. Manufacturer's installation procedures for the geotextile.

C. Manufacturer's quality control manual.

D. Manufacturer's certified quality control test results.

E. Contractor's certified field test results.

PART 2 - MATERIALS

2.1 GEOTEXTILE

The geotextile to be utilized for all functions, excluding the sludge reinforcement layer, shall be a needle-punched non-woven geotextile composed of either a polyester, polyethylene, or polypropylene fabric and have a minimum fabric weight of eight ounces per square yard as determined by ASTM D 3776. The geotextile shall be used in all areas designated for geotextile (i.e roadway construction, Leachate Collection trench, stabilized

construction entrance, beneath 6-inch amended cover soil for "off-cap" cover areas), excluding the woven geotextile to be installed to bridge over the sludge material.

Geotextile shall conform to AASHTO M288-99 – Separation Geotextile Property Requirements. Geotextile physical properties shall equal or exceed the minimum values listed in Table 1.

TABLE 1 - GEOTEXTILE PROPERTIES

PROPERTY	TEST METHOD	TEST VALUE
Apparent Opening Size, AOS	AASHTO M 288-99	0.002 ft (max avg. roll value)
Permittivity	ASTM D 4491	0.02 sec^{-1}
Geotextile Class	AASHTO M 288-99	Class 2
Grab Strength	ASTM D 4632	160 lbf
Tear Strength	ASTM D 4533	60 lbf
Puncture Strength	ASTM D 4833	60 lbf
Burst Strength	ASTM D 3786	300 lbf
Ultraviolet Degradation at 500 hours	ASTM D 4355	50 % strength retained

PART 3 – EXECUTION

3.1 DELIVERY, STORAGE AND HANDLING

The geotextile shall be packaged, shipped, stored and handled by appropriate means so that no damage is incurred. Materials shall be delivered only after the required submittals have been received and approved by DuPont. The Contractor shall be responsible for keeping the geotextile free of dirt, dust, mud, or any other foreign materials and protected from direct sunlight, ultraviolet rays and temperature greater than 140°F. No materials shall be dropped or dumped. The geotextile surface shall be raised off the floor or ground and protected from accumulated moisture. Any geotextile material found to be damaged shall be replaced with new material at the Contractor's expense.

3.2 INSTALLATION

A. Surface Preparation

Prior to placement of the geotextile, the surface shall be cleaned of all soil, rock, excessive dust, and other debris as determined by the QC Contractor and Construction Manager. The area to be covered shall be graded to a relatively smooth condition, with all depressions filled.

B. Placement

1. The geotextile shall be maintained free of dirt, mud, or any other foreign materials at all times. Geotextile, which is contaminated with these materials, shall be cleaned or replaced by the Contractor at no additional cost to DuPont.
2. The Contractor shall deploy the geotextile carefully such that the geotextile and underlying materials are not damaged. All faulty or damaged geotextile shall be replaced.
3. Geotextile shall be placed on the prepared surface in a fairly loose and unstretched condition to minimize shifting, puncture and/or tearing. All adjacent roll edges and roll ends shall be overlapped a minimum of 18-inches. The direction of the fabric laying operation shall be up and down the slope, and overlap direction at roll ends shall be upslope over downslope.
4. Precautions shall be taken to protect the integrity of the geotextile. If the geotextile is damaged, the damaged area shall be covered by an additional layer of geotextile, which extends a minimum of 12-inches beyond the damaged area in all directions and shall be placed over the damaged geotextile.
5. Prior to and during installation, the geotextile may be exposed to sunlight for a period not exceeding 2 days. When possible the geotextile should be covered on the same day it is installed.
6. All geotextile installations shall be subject to the approval of the Construction Manager before covering.

[END OF SECTION]

DIVISION 2 - SITE WORK
SECTION 02505
ROADWAY CONSTRUCTION

PART 1 - GENERAL

1.1 SCOPE

Work in this section consists of constructing a gravel access roadway up the north-west corner of the landfill and along the east side of the landfill to the lines, grades, and dimensions shown on the Drawings.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING ALL OFF-SITE VEHICULAR TRAFFIC, INCLUDING HAULING ASSOCIATED WITH THEIR ACTIVITIES, WITH STATE AND LOCAL GOVERNMENT. THE CONTRACTOR SHALL BE RESPONSIBLE FOR NEGOTIATING THE USE, MAINTENANCE, AND REPAIR OF THESE ROADS. PUBLIC ROADS SHALL BE MAINTAINED AND REPAIRED IN ACCORDANCE WITH THE GOVERING TRANSPORTATION AGENCY.

1.2 RELATED WORK

The following work specified herein is, or may be, related to the construction of the roadways:

- **A.** Section 01010: Summary of Work.
- **B.** Section 01025: Measurement and Payment.
- **C.** Section 01120: Environmental Protection.
- **D.** Section 01300: Submittals.
- **E.** Section 01440: Contractor Quality Control.
- **F.** Section 02274: Geotextile.
- **G.** Section 02700: Drainage Controls

1.3 REFERENCES

A. State of North Carolina, Department of Transportation, *Standard Specifications*

B. American Society for Testing and Materials (ASTM)

ASTM C 88-83	Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
ASTM C 136-84a	Sieve Analysis of Fine and Coarse Aggregates.

ASTM C 535-81	Resistance to Regradation of Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
ASTM D 75-82	Sampling Aggregates.
ASTM D 422-72	Particle Size Analysis of Soils.
ASTM E 11-87	Wire-Cloth Sieves for Testing Purposes.

1.4 DEFINITIONS

A. Roadway
Unless otherwise specified herein, the gravel road constructed as indicated herein and on the Drawings.

1.5 SUBMITTALS

The Contractor shall submit test results of the roadway aggregate as required in Paragraph 3.3: Sampling and Testing. This shall include copies of the initial test results for the aggregate and copies of final test results on the constructed roadway.

PART 2 - MATERIALS

2.1 ROADWAY AGGREGATE

Roadway aggregate shall meet the minimum requirements for aggregate base, as specified in NC DOT's "*Standard Specifications*," Section 1005, "General Requirements for Aggregate." Slag will not be included in the aggregate.

The gradation shall be as follows (typical of a NC DOT ABC material as presented in Table 1005-1):

Sieve Size	Total Percent Passing
1 ½"	100
1"	75-97
3/4"	55-80
No. 4	35-55
No. 10	25-45
No. 40	14-30
No. 200	4-12

2.2 GEOTEXTILE

Geotextile shall be as specified in SECTION: GEOTEXTILE.

PART 3 - EXECUTION

3.1 GENERAL

Following construction of the soil cover, a gravel access road shall be constructed up the north-west corner of the landfill and along the east side of the landfill to the grades and dimensions indicated on the Drawings.

3.2 ROADWAY CONSTRUCTION

A. Preparation of Subgrade

Prior to placing the geotextile and aggregate, the subgrade shall be cleaned of all foreign substances and vegetation. The aggregate roadway shall not be constructed on a wet, frozen, or unsuitable subgrade. Unsuitable subgrade material shall be removed at the direction of the Construction Manager. Unsuitable subgrade material is any material that is not capable of supporting a load. The subgrade shall be proof rolled thoroughly prior to the placement of geotextile with a 10-ton vibratory compactor approved by the Construction Manager. The rolling shall begin at the sides and progress to the center. The rolling shall be parallel with the center line of the roadway, uniformly lapping each preceding track, covering the entire surface with the rear wheels, and continuing until the material does not creep or wave ahead of the roller wheels.

B. Placement of Geotextile

The geotextile shall be unrolled as smoothly as possible with no wrinkles or folds (except in curved sections and corners) on the prepared subgrade in the direction of construction traffic, and to the full width of the base. Adjacent geotextile rolls shall be overlapped parallel to the center line of the road with a minimum, overlap of 24 inches. For curves, the geotextile shall be folded or cut and overlapped in the direction of the turn. Overlaps shall meet the minimum overlap requirements of 24 inches. Folds in geotextile shall be stapled or pinned 5 feet on center. Geotextile shall be covered with aggregate the same day it is placed.

C. Placement of Aggregate

The aggregate shall be spread uniformly over the geotextile and graded to achieve a final compacted minimum depth of 8 inches over the full width of the base.

D. Compacting Aggregate

The aggregate shall be rolled and thoroughly compacted with vibratory equipment approved by the Construction Manager. The rolling shall begin at the sides and progress to the center. The rolling shall be parallel with the center line of the roadway, uniformly lapping each preceding track, covering the entire surface with the rear wheels, and continuing until the material does not creep or wave ahead of

the roller wheels. Red flags shall be placed at the limits of satisfactorily compacted aggregate. The flags shall be moved ahead by the Contractor as additional material is compacted.

E. Repairs to Damaged Areas

Holes, tears, or otherwise damaged geotextiles, as determined by the Construction Manager, shall be repaired immediately at no additional expense to DuPont. The damaged area shall be cleared of all fill material, a suitable distance from the damaged area, to allow placement of a geotextile patch which extends 3 feet beyond the perimeter of the damaged area. Aggregate removed shall be replaced to the specified 8-inch thickness and compacted as specified above.

F. Inspection and Smoothness Test

After the aggregate has been spread and compacted, the final surface shall not show deviations in excess of 1-½ inches when tested with a 10-foot straightedge applied parallel with and at right angles to the centerline of the area under consideration. Deviations exceeding this amount shall be corrected by removing material, replacing with new material, or reworking existing material and compacting, as directed by the Construction Manager. The Contractor shall test the surface smoothness in the presence of a representative of the Construction Manager at intervals as directed by the Construction Manager.

G. Thickness Control

The Contractor shall control his operations by measurements to insure placement of materials to the thickness specified. Thickness shall be verified by test holes at least 3 inches in diameter through the base course. One depth measurement shall be made for each 1,000 square yards of roadway, or part thereof. Measurements may be made by the Construction Manager for verification of compliance, however, the Contractor shall not depend on such measurements for his control of operations. The completed thickness of the aggregate shall be within ½-inch (plus or minus) of the thickness indicated. Where the measured thickness of the aggregate is more than ½-inch deficient, the Contractor shall correct such areas at no additional expense to DuPont by scarifying, adding mixture of proper gradation, reblading, and recompacting as directed. Where the measured thickness of the aggregate is more than ½-inch thicker than that indicated on the Drawings, it shall be considered as conforming with the specified thickness requirements plus ½-inch. The average job thickness shall be the average of the job measurements determined as specified above but shall be within ¼-inch of the thickness indicated on the Drawings.

H. Weather Limitations

The roadway shall be constructed when the atmospheric temperature is above 35 degrees Fahrenheit. When the temperature falls below 35 degrees Fahrenheit, the Contractor shall protect all areas of completed roadway by approved methods against detrimental effects of freezing. Areas of completed roadway damaged by freezing, rainfall, or other weather conditions shall be corrected to meet specified requirements at no additional cost to DuPont.

3.3 SAMPLING AND TESTING

Sampling and testing of the roadway aggregate shall be the responsibility of the Contractor and shall be performed at no additional cost to DuPont. Sampling and testing shall be performed by an independent commercial testing laboratory. Tests shall be performed at the frequency specified hereinafter. Copies of the test results shall be submitted to the Construction Manager as soon as the tests are completed.

A. General

The Contractor shall select the source of materials and perform the initial sampling and testing sufficiently in advance to not delay the work. The Contractor shall control his operations during production and placement of material, so that the materials in the completed roadway will meet the specified requirements. The Construction Manager may perform verification tests for final approval of the materials in the completed roadway. All quality control sampling and testing shall be performed as specified herein.

B. Samples

All samples including those required and used by the Contractor for control of his operations shall be representative of the materials being placed. In addition, samples shall be taken from the completed and compacted roadway. All samples shall be taken in conformance with ASTM D 75 unless otherwise approved or directed by the Construction Manager.

C. Testing

The following tests shall be performed for the Contractor by an approved independent commercial testing laboratory. Testing shall be performed at no additional cost to DuPont.

1. Aggregate Gradation (Sieve analysis) shall be determined in accordance with ASTM C 136, and ASTM D 422. Sieves shall conform to ASTM E 11.
2. Wear (L.A. Abrasion) Test shall be performed in conformance with ASTM C 535.
3. Soundness shall be determined in accordance with ASTM C 88, using magnesium sulfate.

D. Testing Frequency

1. Initial Tests. Each type of test defined in Paragraph 3.3C: Testing of this Section shall be performed on the proposed material from each supplier or when visual variations occur in the material from one source. These tests shall be performed prior to commencing construction to demonstrate that the proposed material will meet all specified requirements when furnished.
2. In-Place Tests: Sieve analysis shall be performed on samples taken from the placed and compacted aggregate. Samples shall be taken for each 1,000 square yards of aggregate placed.

[END OF SECTION]

DIVISION 2 - SITE WORK
SECTION 02700
DRAINAGE CONTROLS

PART 1 - GENERAL

1.1 SCOPE

The work shall include the furnishing and application of materials and labor required to construct site surface water drainage controls and the leachate collection system in accordance with these Specifications and within the lines, grades, and dimensions shown on the Drawings. Construction of the following drainage controls is covered in this section: corrugated metal pipe, corrugated plastic pipe, polyvinyl chloride pipe, drainage ditches, and culverts as indicated on the Drawings and as specified herein. Surveying required for construction is detailed in SECTION: FIELD ENGINEERING.

1.2 RELATED WORK

The following work specified herein is, or may be, related to the construction of waterways:

A. Section 01025: Measurement and Payment.
B. Section 01440: Contractor Quality Control.
C. Section 02100: Site Preparation.
D. Section 02200: Earthwork.
E. Section 02270: Erosion Control Measures.
F. Section 02930: Seeding.

1.3 REFERENCES

The publications listed below form a part of this Specification to the extent referenced. The publications are referenced in the text by basic designation only.

A. State of North Carolina – Sedimentation Control Commission – *Erosion and Sediment Control Planning and Design Manual (Manual)*, September 1, 1988.

B. American Society of Testing and Materials (ASTM)

ASTM A 90	Standard Test Method for Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
F1417-92 (1998)	Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air

ASTM A 239	Standard Test Method for Locating the Thinnest Spot in a Zinc (Galvanized) Coating on Iron or Steel articles by the Preece Test (Copper Sulfate Dip).
ASTM D 751	Standard Test Methods for Coated Fabrics.
ASTM D 1505	Standard Test Method for Density of Plastics by the Density Gradient Technique.
ASTM D 3350	Standard Specification for Polyethylene Plastic Pipe and Fittings Materials.
ASTM D2774	Recommended Practice for Underground Installation of Thermoplastic Pressure Piping and PVC Pipe.
ASTM D3034	Specification for Sewer Pipe and Fittings.
ASTM D3212	Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM F477	Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM D2564	Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D2321	Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe

1.4 DEFINITIONS

A. Culverts / Corrugated Plastic Pipe / Corrugated Metal Pipe
Pipe constructed to convey stormwater underground in areas where drainage of surface water is undesirable or impracticable such as across roadways or embankments.

B. Drainage Ditch
Unless otherwise specifically qualified herein, a constructed channel which conveys or is designed to convey surface water.

C. Temporary Diversion
A temporary diversion is an earthen dike and/or swale used to direct sediment laden runoff to an appropriate erosion control structure.

D. Leachate Collection System
A subsurface drainage system or underdrain system installed to collect and outlet subsurface drainage.

1.5 SUBMITTALS

A. Backfill
As detailed on the drawings.

B. Geotextile
As required under SECTION: GEOTEXTILE of these specifications.

C. Culverts / Corrugated Plastic Pipe / Corrugated Metal Pipe
Contractor shall provide certification that culvert pipe provided meets the requirements as specified herein.

D. Leachate Collection System
Submit in accordance with SECTION: SUBMITTALS certification that underdrain materials provided meet the requirements as specified in the design drawings.

Submit manufacturer's technical Product Data, installation instructions, and directions for adjustment for all Products required to complete Work of this Section.

Submit Shop Drawings: Indicate pipe materials and fittings used, joining methods, all equipment of this Section, installation and piping connections for all piping systems to be installed under this Section.

1.6 QUALITY ASSURANCE

Valves shall bear AWWA or UL label or marking. Provide manufacturer's name and pressure rating marked on valve body.

1.7 DELIVERY, STORAGE AND HANDLING

Deliver, store, protect and handle products to site as required by manufacturer. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

PART 2 - MATERIALS

2.1 BACKFILL

Backfill shall meet the requirements as specified on the drawings and in SECTIONS: EARTHWORK and CONTRACTOR QUALITY CONTROL and as approved by DuPont.

2.2 GEOTEXTILE

Geotextile shall meet to the requirements as specified in SECTION: GEOTEXTILE.

2.3 CULVERTS / CORRUGATED PLASTIC PIPE / CORRUGATED METAL PIPE

Corrugated Plastic Pipe and Fittings: The pipe used shall be high density, high molecular weight, solid-wall polyethylene pipe (HDPE) Advanced Drainage System (ADS) N-12®, or equal, smooth interior pipe with pro-link soil tight (ST) fittings or equal, as indicated on the Drawings. All pipe and pipe fittings shall comply with the H20 DOT load rating.

Corrugated Metal Pipe and Fittings: Pipe shall be as indicated on the drawings.

2.4 PVC GRAVITY PIPE

PVC pipe compound shall conform to ASTM D1784.

PVC pipe four inches and larger shall conform to ASTM D3034, SDR 35, Type PSM, with integral bells meeting requirements of ASTM D3212. Rubber gaskets shall conform to ASTM F477.

Fittings for PVC pipe four inches and larger shall conform to ASTM D3034, SDR 35, Type PSM. Joints shall meet requirements of ASTM D3212 and gaskets shall conform to ASTM F477.

Pipe and fittings shall be manufactured by CertainTeed Corporation; J-M Manufacturing Company, Inc., Diamond or equal.

PART 3 - EXECUTION

3.1 GENERAL

A. Erosion Control

The Contractor shall implement erosion control measures before and during performance of work within this Section and in accordance with SECTION: EROSION CONTROL MEASURES.

3.2 PERFORMANCE

A. Earthwork

The Contractor shall conduct all earthwork required to construct drainage controls to the lines and grades indicated on the Drawings or as otherwise required by DuPont:

1. During construction of the drainage controls, the Contractor shall conduct excavation and filling in a manner and sequence that will provide proper drainage at all times.
2. The Contractor shall grade the drainage ditches and temporary diversions to the lines and grades shown on the Drawings and maintain a tolerance of not more than 0.1 foot above or below the indicated grade, less specified topsoil or riprap thickness.
3. Construction of the drainage ditches shall be smooth and free from irregularities.
4. The Contractor shall correct all surface irregularities that exceed specified tolerance limits either by removing or adding materials as required.
5. Backfill, as specified, shall be placed and compacted to give complete vertical and lateral support for the culverts as detailed in the Drawings. Culverts shall be installed in full accordance with the manufacturer's recommendations.
6. Check finished subgrade along the length of the drainage ditch for smoothness and elevation through survey or a method approved by the Construction Manager.

B. Geotextile Placement

Geotextile placement shall be performed as specified in SECTION: GEOTEXTILE.

C. Culvert Pipe Installation

1. Culvert pipe shall be installed at the locations, lines, and grades shown on the Drawings. All culvert pipe shall be installed plus or minus one tenth of a foot (± 0.1 ft.).
2. Handling and storage of the pipe and fittings shall be in accordance with the manufacturers recommendations.

3. Sections of pipe shall be connected as approved by the Construction Manager. Under no circumstances shall crowbars alone be used nor shall motor driven equipment be used for the purpose of drawing culvert sections together.
4. Backfill
   a. After the pipe has been placed, material as detailed in the Drawings, at a moisture content that will facilitate compaction, shall be placed along both sides of pipe in layers not exceeding six inches in compacted depth. The backfill shall be brought up evenly on both sides of pipe for the full length of the pipe. Consult the trench detail in the design drawings for more detail.
   b. Each layer shall be thoroughly compacted. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. This method of filling and compacting shall continue until the fill has reached an elevation of at least twelve inches above the top of the pipe.
   c. No equipment shall be operated over the pipe until 12-inches of compacted cover material has been installed over the pipe. Pipe damaged thereby shall be replaced by the Contractor at no additional cost to DuPont.

D. Leachate Collection and Conveyance System – Installation

1. No pipework is to be started until all materials, layout, schedules, stakeout, and cut sheets have been approved by the Engineer in writing. Samples of all materials to be incorporated in the Work shall be submitted for the approval of the Engineer sufficiently in advance of Work commencement to allow time for specified testing. Pipe alignment shall be maintained through the use of laser alignment equipment.
2. Examine all pipe, fittings, and other appurtenances for damage or defects immediately before installation. Mark and hold for inspection by the Construction Manager any defective Products. Verify dimensions of all pipes, fittings and appurtenances to ensure all Work of this Section will fit together properly and conform to Drawings.
3. Pipe, backfill stone, geotextile, fittings, etc. shall be installed at the locations, lines, and grades shown on the Drawings. All underdrain and conveyance piping shall be installed plus or minus one tenth of a foot (± 0.1 ft.). Any drainage system component not conforming with this tolerance shall be reworked by the Contractor to meet tolerance at no additional cost to DuPont.
4. Verify that trench excavations meet alignment, depth, width and elevation requirements shown on the Drawings. Verify that trench bottoms to receive Work of this Section are smooth and free of water, frozen materials, large stones or dirt clods. Beginning of Work of this Section means acceptance of existing conditions.
5. Sections of pipe shall be connected as specified by the manufacturer, or as approved by the Construction Manager. Proper and suitable tools and

equipment for the safe and convenient handling and laying of the pipe and fittings shall be used in accordance with manufacturer's standards. Pipe and fittings shall be carefully handled and lowered into the trench. Under no circumstances shall crowbars alone be used nor shall motor driven equipment be used for the purpose of drawing piping sections together.

6. Whenever a pipe requires cutting to fit in the line or to bring it to the required location, the Work shall be done without extra compensation, in a satisfactory manner so as to leave a smooth end perpendicular to the long axis of the pipe.
7. Before any joints are actually made in the trench, the Contractor shall demonstrate to the Engineer, by making a sample joint, that the methods he will employ conform with specifications and will secure a watertight joint, and that the workmen whom he intends to use in this Work are familiar with the requirements of this Specification Section.
8. All laying, jointing, testing for defects and for leakage shall be performed in the presence of the Engineer. All defects in workmanship rejected by the Engineer shall be promptly corrected by the Contractor and defective material removed from the Project site.
9. The excavation in which pipe is being laid shall be kept free from water, and no joint shall be made under water. Care shall be used to secure water-tightness and to prevent damage to, or the disturbing of, the joints during the backfilling process or at any other time. After joint materials, which require it, have received their set, backfilling of the trench may proceed.
10. Before joints are made, each pipe shall be well bedded on a solid foundation and no pipe shall be brought into position until the preceding length has been thoroughly embedded and secured in place. No pipe shall be laid in wet trench conditions that preclude proper bedding, or on a frozen trench bottom, or when in the opinion of the Engineer, the trench or weather conditions are unsuitable for proper installation. Any defects due to settlement shall be corrected by the Contractor at his own expense. Bell holes or coupling holes shall be dug sufficiently large to insure making of proper joints. In no case will pipe be closer than four (4) inches from bedrock.
11. In laying pipe, special care shall be taken to insure that each length shall abut against the next in such a manner that there shall be no shoulder or unevenness of any kind along the inside of the pipe line.
12. No wedging or blocking will be permitted in laying pipe unless by written order from the Engineer.
13. Pipes and fittings shall be thoroughly cleaned before they are laid and shall be kept clean until the acceptance of the completed Work. The open end shall be kept closed with a stopper until the next length is laid. At the close of work each day, the end of the pipe line shall be tightly closed with an expansion stopper so that no dirt or other foreign substances may enter the line, and this stopper shall be kept in place until pipe laying is again resumed.

14. Cold weather protection shall be provided, during freezing weather, for all masonry, mortar and concrete construction connected with the exterior piping by maintaining a temperature of not less than 50°F. for a period of three (3) days, or by backfilling immediately, or by covering with backfill material in a temporary manner, all as directed by the Engineer.
15. All open ends of pipelines to be abandoned, exposed during construction operations, shall have their openings plugged with a two (2) foot minimum thickness of concrete.
16. All dead-ends of pipelines, and fittings, shall be provided with standard plugs and caps either temporarily or permanently as directed by the Engineer. A concrete or other approved thrust blocking shall be provided at all dead ends. Where plugged or capped outlets are to be tied to fittings with clamps and tie rods, as indicated on the Contract Documents or as directed by the Engineer, the minimum number and size of rods and other pertinent details shall be as shown and/or specified.
17. Anchorages, buttresses, and thrust blocks shall be used to secure all caps, plugs, horizontal and vertical bends, branches, tees, and dead ends. They shall be constructed in accordance with the Drawing details, unless otherwise specified, and shall bear against solid, undisturbed earth.
18. Place underground warning tape in the trench above all underground pipeline installations.
19. PVC piping shall be installed in accordance with AWWA M23 and the manufacturer's recommendations.
20. Backfill: Leachate Collection pipe shall be installed on AASHTO #57 stone of minimum thickness of 3-inches beneath the pipe. The backfill shall be brought up evenly on both sides of pipe for the full length of pipe and cover the pipe a minimum of 17-inches. Soil cover above the stone shall be thoroughly compacted until the fill has reached an elevation of at least twelve inches above the top of the pipe. After pipes have been laid and the joints have been made, there shall be no walking on or working over them except as may be necessary in tamping until there is a covering at least two (2) feet in depth over their top. Pipe damaged thereby shall be replaced by the Contractor at no additional cost to DuPont.

3.3 TESTING

Testing PVC Leachate Conveyance Pipe

1. The Contractor shall furnish all labor, tools, materials including water and equipment including mirrors, flashlights or other artificial lighting, weirs, pump, compressors, stopwatch, gauges, and meters, subject to the approval of the Engineer for testing in accordance with these Specifications and ASTM 1417.
   a. All branch fittings and ends of lateral stubs shall be securely plugged to withstand the internal test pressures. The section of line being tested shall also be securely plugged at each manhole. All stoppers shall be adequately braced when received.
   b. Air shall be slowly supplied to the plugged pipeline until the internal air pressure reaches 5.0 pounds per square inch. At least two minutes shall be allowed for temperature stabilization before proceeding further with the test.
   c. The rate of air loss shall then be determined by measuring the time interval required for the internal pressure to decrease by 1.0 pound per square inch (psi).
   d. The line shall be considered acceptable if the time required for the 1.0 psi pressure drop is not less than 10 minutes.

3.4 PROTECTION OF INSTALLED WORK

A. Protect installed pipe, joints, fittings and appurtenances from damage or displacement during the backfilling process or other construction activities.
B. Keep pipe interior free from debris. Stopper open ends of pipe each day and until next length of pipe is laid.

3.5 ADJUSTING

A. Adjust Work as required by the Construction Manager and in accordance with manufacturer's instructions. Correct subgrade irregularities exceeding previously specified limit to the Construction Manager's satisfaction either by removing or adding material as required, followed by rolling until satisfactorily compacted.

[END OF SECTION]

DIVISION 2 - SITE WORK
SECTION 02930
SEEDING

PART 1 - GENERAL

1.1 SCOPE

The work covered by this section consists of furnishing all materials, labor and equipment, and performing all operations necessary to establish a satisfactory stand of grass over all disturbed areas in accordance with these Technical Specifications.

A. Permanent seeding shall include the seedbed preparation, seeding, and the establishment of perennial vegetation used to permanently stabilize soil, minimize sediment pollution, reduce runoff by promoting infiltration, and provide stormwater quality benefits offered by dense vegetation.

B. Temporary seeding grasses that are quick growing shall be seeded and mulched to provide prompt, temporary soil stabilization. Temporary seeding shall be applied on exposed soil where additional work (grading, etc.) is not scheduled for more than 20 days. Permanent seeding shall be applied if the areas will be idle for more than 120 days.

1.2 RELATED WORK

The following work specified herein is, or may be, related to seeding:

A. Section 01010: Summary of Work.
B. Section 01025: Measurement and Payment.
C. Section 02200: Earthwork.
D. Section 02270: Erosion Control Measures.

1.3 REFERENCES

The publication listed below forms a part of this specification to the extent referenced. The publication is referred to in the text by the basic designation only.

A. State of North Carolina – Sedimentation Control Commission – *Erosion and Sediment Control Planning and Design Manual (Manual)*, September 1, 1988.

B. American Society for Testing and Materials (ASTM)

ASTM D 2974-87	Test Method for Moisture, Ash and Organic Matter of Peat and other Organic Materials

1.4 SUBMITTALS

In accordance with SECTION: SUBMITTALS, the Contractor shall submit the following to the Construction Manager as indicated.

A. Test Reports

The Contractor shall submit laboratory test reports (i.e. soil analysis) of the borrow area cover soil to the Construction Manager for approval. Laboratory reports shall recommend both grade and application rates of fertilizer, lime and such other soil supplements as required. The laboratory tests shall include an organic content analysis (ASTM D 2974) on the proposed cover soil.

B. Soil Supplement Product Certification

The Contractor shall submit for review certificates which confirm or certify that the soil supplements have a guaranteed analysis in conformity with the DuPont-approved laboratory soil supplement recommendations report.

C. Seed Certification

The Contractor shall submit for review certificates or certifying tags indicating seed mixture, seed purity percentage, seed germination percentage and weed seed content percentage to certify conformity with the specifications.

PART 2 - MATERIALS

2.1 SEED MIXTURES

State certified seed of the latest season's crop shall be provided in the original sealed packages bearing the producers guaranteed analysis for percentages of germination, pure seed, inert matter, and weed seed. Labels shall be in accordance with the state's requirements. Bulk quantities of seed shall be labeled as described above. Weed seed shall not exceed 1 percent by weight of the total mixture. Wet, moldy or otherwise damaged seed shall be rejected.

The mixing of seed shall be performed by the seed supplier prior to delivery on site. All legume seed shall be inoculated with the required bacterial culture prior to delivery to the site.

A. Permanent Seed Mixture

The Contractor shall utilize seed mix in accordance with Table 6.11b (and the required seeding dates) of the *Manual.* Seeding mix No. 5CP shall be utilized in accordance with the following schedule:

Minimum Seed specification:

Species	Rate (lb/acre)
Penasacola Bahiagrass	50
Sericea Lespedeza	30
Common Bermudagrass	10
German millet	10

B. Temporary Seed Mixture

The Contractor shall utilize seed mix in accordance with Table 6.10a-6.10c of the *Manual* in accordance with the season of the year and as recommended in the Table.

Minimum Seed specification (late winter / early spring):

Species	Rate (lb/acre)
Rye (grain)	120
Annual Lespedeza (Kobe)	50

Minimum Seed specification (summer):

Species	Rate (lb/acre)
German millet	40

Minimum Seed specification (fall):

Species	Rate (lb/acre)
Rye (grain)	120

2.2 SOIL AMENDMENTS

Soil amendments shall consist of lime and fertilizer meeting the following requirements.

A. Limestone

Lime shall be pulverized agricultural limestone and shall have a minimum calcium carbonate equivalent of 90 percent and shall be ground to such a fineness that at least 95 percent will pass a 20-mesh sieve, at least 60 percent will pass a 60-mesh sieve, and, at least 50 percent will pass a 100-mesh screen. Lime shall be in accordance with soil test requirements and to correct the pH to 6.0 to 7.5.

B. Fertilizer

Fertilizer shall be in accordance with soil test requirements. Fertilizer shall be commercial grade, free flowing, low in salts, uniform in composition and conforming to applicable state fertilizer laws. The fertilizer shall be commercial fertilizer containing the plant nutrients of Nitrogen (N), available phosphoric acid (P_2O_5), and soluble potash (K_2O) at the rates determined by tests on the soil. Bagged fertilizer shall display the following information on the bag or on a sticker

or tag attached to the bag: net weight, brand and grade, guaranteed analysis, and name and address of manufacturer. Bulk fertilizer (dry or liquid) shall be accompanied by a statement from the manufacturer that contains the same information required for the bagged fertilizer.

2.3 MULCH / EROSION CONTROL BLANKET

The Contractor shall use native grass hay or straw on all surfaces with slopes less than 4 horizontal to 1 vertical (4H:1V). All slopes equal to or steeper than 4H:1V, and drainage ditches as shown on the Drawings, will require an erosion control blanket. Ditch 1 will require a Turf Reinforcement Mat in accordance with SECTION: EROSION CONTROL MEASURES.

A. Straw or Hay Mulch

Straw or hay mulch shall be unrotted small grain straw or hay applied. Mulch materials shall be relatively free of weeds, mold, decomposed material, brittle weed mat, and shall be free of noxious weeds such as: thistles, Johnsongrass, and quackgrass.

B. Erosion Control Blanket

Erosion control blanket shall be as specified in SECTION: EROSION CONTROL MEASURES.

PART 3 - EXECUTION

3.1 GENERAL

A. Cover Soil

The Contractor shall submit results of the soil test on the borrow area cover soils to the Construction Manager.

B. Soil Amendments

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis. In lieu of containers, soil amendments may be furnished in bulk. A chemical analysis shall be provided for each bulk delivery.

C. Inspection

The Contractor's Independent Quality Control (QC) Contractor shall inspect seed as it is delivered to the job site to verify conformity to type and quality of seed specified in accordance with Paragraph: Materials. The Contractor's QC Contractor shall inspect soil amendments to verify conformance to specified requirements. Unacceptable materials shall be removed from the job site.

D. Storage

Seed, lime, and fertilizer shall be stored in cool, dry locations away from contaminants. Chemical treatment materials shall not be stored with other landscape materials.

E. Material Handling

Except for bulk deliveries, materials shall not be dropped or dumped from vehicles.

3.2 PREPARATION OF SEEDBED

A. General

The Contractor shall place cover soil and establish finish grades in accordance with the SECTION: EARTHWORK.

B. Temporary Seeding

In accordance with a method approved by the Construction Manager, the Contractor shall roughen the ground surface to a depth of one inch prior to temporary seeding. Temporary seed shall be mulched as described in Paragraph 3.4.

C. Soil Supplements

The Contractor shall incorporate lime, fertilizer, and organic soil amendments into the soil in accordance with the recommendations of the soil test results. Amended soil shall contain from 5 to 10 percent organic matter as determined by loss on ignition in accordance with ASTM D 2974. During seedbed preparation, the lime and fertilizer shall be worked into the soil with a disk harrow, spring-tooth harrow or other approved field implements to a depth of 3 inches. On slopes steeper than 5% (i.e., 20H:1V) the soil shall be worked parallel to (across) the slope.

3.3 PLANTING SEED

A. General

Prior to seeding, any previously prepared seedbed areas compacted or damaged by interim rains, traffic, or other cause shall be reworked to restore the ground condition previously specified. Seed shall be planted at the rate specified in PART 2 - MATERIALS.

B. Seeding Dates – Permanent Seeding

1. The Contractor shall prepare the seedbed and perform permanent seeding between March 1 to May 31 or August 1 to October 15, and in compliance with seeding dates as specified in the *Manual.*

2. From October 15 to March 1, the Contractor shall prepare the seedbed, add the required quantities of lime and fertilizer as recommended by the soil test, then mulch and anchor. The Contractor shall broadcast the permanent seed mixture at a rate 50 percent greater than the rates specified in PART 2 – MATERIALS. The Contractor will be required to reseed (after March 1) as required in Paragraph 3.4D.

C. Seeding Dates – Temporary Seeding

1. Areas that will not be graded or reworked for 20 days or more will require temporary seeding. These idle areas shall be seeded as soon as possible after disturbance/grading but at maximum within 7 days of the last disturbance operation in the idle area. Temporary seeding shall be applied between March 1 to October 15. From October 15 through March 1, the Contractor shall use mulch only, or seed in accordance with Paragraph 3.3B(2) above.

D. Method

Seed planting shall be accomplished by:

1. *Hydroseeding*
   The Contractor shall accomplish seeding and fertilizing by hydroseed application. Seed and fertilizer with other soil conditions in the amount per acre designated, shall be combined with water to provide a slurry, and hydraulic application shall be performed in such manner that the liquid carrier will uniformly distribute the material over the entire area to be seeded at rates not less than indicated herein. No seeding following compaction shall be done. The seeded area shall be watered after seeding and the soil moistened to a depth of 2 to 4 inches.

2. *Manual Seeding*
   Small areas (approximately one-half acre or smaller) may be seeded and mulched manually or as directed by the Construction Manager.

3.4 MULCHING

Mulching shall be performed by the Contractor on the same day as planting seed.

A. Straw or Hay Mulch

1. Applying Mulch
   Straw or hay mulch shall be spread uniformly in a continuous blanket over the seeded areas, applied at the rate of 2 tons per acre. The mulch shall be spread in such a manner as to prevent bunching. Mulching shall be started on the windward side of relatively flat areas or on the upper part of a steep slope and continued uniformly until the area is covered.

2. Securing Mulch
   Immediately following the spreading of the mulch, paper fiber mulch overspray shall be sprayed over straw or hay mulch. When sprayed over the mulch the fibers form an absorbent cover, allowing percolation of water to the underlying soil. The recycled paper shall be applied at a minimum rate of 800 pounds per acre or more if recommended by the manufacturer. The mulch shall be mixed with water so as to produce a homogeneous slurry which shall be applied under pressure by hydraulic seeding equipment. The mix shall be constantly agitated during application to keep the ingredients thoroughly mixed. Alternatively, the material shall be anchored securely into the soil a minimum of 3 inches by means of a mulch anchoring machine equipped with large coulter-type discs spaced on approximate 8-inch centers. Edges of the discs shall be dull to prevent cutting of the mulching, and equipment operation shall be such as to embed the mulch to the required depth of 3 inches. In areas where equipment cannot be used, mulch shall be secured by shallow covering of each area or by embedding with approved hand methods, including straight-bladed spade with dulled edge.

B. Erosion Control Blanket

1. Straw or hay mulch shall be applied as indicated above.
2. Erosion control blankets (ECB) shall be installed on all slopes of 4H:1V or steeper and in grass lined drainage ditch bottoms and to the limits indicated on the drawings in accordance with the procedures specified in SECTION: EROSION CONTROL MEASURES for erosion control blanket.

C. Protection and Cleanup

After seeding and mulching operations have been completed, barricades and approved warning signs shall be erected by the Contractor as required to provide protection against traffic and trespass. Excess material from seeding and mulching operations, and all debris, shall be cleaned up and properly disposed off site.

D. Maintenance

1. Maintenance operations shall begin immediately after seeding a given area and shall continue through construction. The Contractor shall keep seed continually moist for proper germination and water thereafter as necessary to prevent drying out or burning. The Contractor shall re-seed areas not showing a prompt catch of grass, correct depressions and irregularities and re-seed; repeat until complete (100%) coverage is obtained.
2. DuPont herein retains the right to require that the Contractor re-seed any and all areas where a satisfactory stand of grass does not exist after the first full growing season (following the final permanent seeding). A satisfactory stand of grass shall be defined as 90 percent coverage of every 5 acre area having a 3

inch stand of grass as determined by the step transect method or as otherwise defined by the Construction Manager. The step transect method estimates the percentage of vegetative cover using at least 100 systematically located observation points within the seeded area.

[END OF SECTION]

Appendix C

APPENDIX C
DESIGN DRAWINGS
ASH LANDFILL
SOIL COVER - FINAL DESIGN REPORT
DUPONT KINSTON
KINSTON, NORTH CAROLINA

February 25, 2003

Project No. 18983688.00012

CORPORATE REMEDIATION GROUP
An Alliance between
DuPont and The W-C Diamond Group

Barley Mill Plaza, Building 27
Wilmington, Delaware 19880-0027

LIST OF DRAWINGS
ASH LANDFILL
SOIL COVER - FINAL DESIGN REPORT
DUPONT KINSTON
KINSTON, NORTH CAROLINA

DRAWING NO.	TITLE
1	Title Sheet
2	Legend and Notes
3	Existing Conditions
4	Erosion and Sediment Control Plan for Ash Landfill
5	Erosion and Sediment Control Details-1
6	Erosion and Sediment Control Details-2
7	Final Grading Plan for Ash Landfill
8	Borrow Area Grading and Erosion and Sediment Control Plan
9	Cap System Cross Section Plan
10	Cross Sections
11	Cap System Construction Details
12	Leachate Collection/Conveyance Details

DRAWINGS ATTACHED SEPARATELY

URS

LETTER OF TRANSMITTAL

1200 Philadelphia Pike
Wilmington, DE 19809
Phone: 302-791-0700
Fax: 302-791-0708

Date: 3/31/03
Project No: 18983688.00012
Reference: DuPont Kinston Site Ash Landfill

To:
Mr. Jim Barber
Division of Waste Management
Solid Waste Section
1646 Mail Service Center
Raleigh, NC 27699-1646

Attached are the following:

Copies	Date	No.	Description
~~1~~ 3		13 sheets	Kinston Ash Cap Drawing Set (As-Bid Submittal)

Remarks:

Sent From: Christopher Curran, P.E.

cc: File

trans 3.31.03(DNR)
3/31/03