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CROSS GENERATING STATION

Run-on and Run-off Control System Plan for Existing Class 2 CCR Landfill and Existing Class 3 Landfill Area 1B

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CROSS GENERATING STATION

RUN-ON AND RUN-OFF CONTROL SYSTEM PLAN FOR EXISTING CLASS 2 CCR LANDFILL AND EXISTING CLASS 3 LANDFILL AREA 1B

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SOUTH CAROLINA
WORLEY PARSONS GROUP INC.
No. 1505
CERTIFICATE OF AUTHORIZATION

SOUTH CAROLINA
LICENSED PROFESSIONAL ENGINEER
No. 24767
FLETCHER M. WOOD

Fletcher Wood

14-OCT-2016

1. INTRODUCTION

The United States Environmental Protection Agency (EPA) promulgated new regulations regarding Coal Combustion Residuals (CCRs). These regulations (40 CFR Part 257) were published in the Federal Register on April 17, 2015. One of the requirements (§257.81(c)) of the new regulations is to prepare a written run-on and run-off control system plan for CCR landfills. This plan must be placed in the facility's operating record no later than October 17, 2016, as required by §257.81(c)(3).

This report presents the run-on and run-off control system plan for the existing CCR landfill areas at Cross Generating Station in Pineville, South Carolina. The runoff control system for the existing (operating) Class Three CCR landfill Area 1B is integrated with the runoff control system for the existing (closed) Class Two CCR landfill. This control system plan therefore addresses both existing landfill areas.

2. DISCUSSION

Title 40 CFR §257.81(c)(1) requires that the run-on and run-off control system plan *must document how the run-on and run-off control systems have been designed and constructed to meet the applicable requirements of this section. Each plan must be supported by appropriate engineering calculations.*

The applicable requirements for the run-on and run-off control system plan are listed below, with a description of how the systems are designed and constructed to satisfy each requirement. Appendix A and Appendix B include the appropriate supporting engineering calculations.

§257.81**(a)** states that *the owner or operator of an existing or new CCR landfill or any lateral expansion of a CCR landfill must design, construct, operate, and maintain:*

> (1) *A run-on control system to prevent flow onto the active portion of the CCR unit during the peak discharge from a 24-hour, 25-year storm*
>
> > The existing Class Two CCR Landfill has undergone final closure. It no longer has an active portion that is capable of receiving stormwater flow.
> >
> > The existing Class Three CCR Landfill Area 1B is an operating landfill located immediately east of the existing Class Two landfill. The Class Three landfill is surrounded on the north, east, and south sides by a perimeter berm that prevents run-on from flowing onto the active portion of the landfill. The western portion of the active landfill consists of the previously-closed east slope of the Class Two landfill. The east slope of the Class Two landfill is constructed with benches. These benches include drainage channels that intercept stormwater runoff from the upper regions of the Class 2 landfill, convey it around the Class 2 landfill and through a system of downdrains at the north and south ends of the landfill, and through the onsite ditch network to the stormwater pond, thereby preventing the stormwater from flowing onto the active surface of the Class Three landfill. Engineering calculation CROSS-0-DC-044-CE-0001, included in Appendix A, demonstrates the design of all system conveyances at each phase of operations, including benches, downdrains, culverts, riprap protection, ditches, and the permanent stormwater pond. All facilities are designed to handle the peak discharge from a 24-hour, 25-year storm event.

(2) *A run-off control system from the active portion of the CCR unit to collect and control at least the water volume resulting from a 24-hour, 25-year storm*

The existing Class Two CCR Landfill has undergone final closure. It no longer has an active portion that is capable of generating runoff. However, the stormwater runoff control system for the Class Two landfill is designed to collect and control at least the water volume (and peak flow rate) from the closed surfaces of the landfill resulting from a 24-hour, 25-year storm event.

The existing Class Three CCR Landfill Area 1B includes a leachate collection system as well as a decant structure (chimney drain) located within the active portion of the landfill. The decant structure is designed to intercept stormwater runoff from the active face of the landfill and convey it directly to the leachate collection pond via gravity piping. The purpose of the decant structure is to minimize leachate generation and to collect and control at least the water volume (and peak flow rate) resulting from a 24-hour, 25-year storm. Engineering calculation CR34-0-DC-LF-CE-007 included in Appendix B demonstrates the design of the decant structure.

§257.81(b) states that *run-off from the active portion of the CCR unit must be handled in accordance with the surface water requirements under (§257.57.3-3)*

The existing Class Two CCR Landfill has undergone final closure. It no longer has an active portion that is capable of generating runoff.

All run-off generated from the active portion of the existing Class Three CCR Landfill Area 1B is conveyed to the leachate collection pond. The leachate collection pond is designed to hold an average month's worth of run-off and leachate from the active portion of the landfill, in addition to the volume resulting from a 24-hour, 25-year storm. The effluent from the leachate collection pond is pumped to the Bottom Ash Pond / Wastewater Decant Pond and ultimately discharged from the site through permitted outfall NPDES 002. All run-off from the active portion of the Class Three landfill is handled in accordance with the surface water requirements under §257.57.3-3.

This report satisfies the requirements of §257.81(c) by providing a run-on and run-off control system plan that documents how the run-on and run-off control systems for the existing (closed) Class Two CCR landfill and the existing (operating) Class Three CCR landfill Area 1B at Cross Generating Station have been designed and constructed to meet the applicable requirments of this section, including supporting engineering calculations.

3. CONCLUSIONS

This report presents the run-on and runo-off control system plan for the existing (closed) Class Two CCR landfill and the existing (operating) Class Three CCR landfill Area 1B at Cross Generating Station in Pineville, SC. The run-on and run-off control system plan contained herein is in accordance with the requirements of Title 40 CFR §257.81.

4. CERTIFICATION

I, the undersigned Professional Engineer registered in good standing in the State of South Carolina, do hereby certify under penalty of law that I have personally examined and am familiar with the information submitted in this demonstration, and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. I certify, for the above-referenced CCR Units, that the run-on and run-off control system plan contained herein is in accordance with the requirements of Title 40 CFR §257.81.

SOUTH CAROLINA
WORLEY PARSONS GROUP INC.
No. 1505
CERTIFICATE OF AUTHORIZATION

SOUTH CAROLINA
PROFESSIONAL ENGINEER
LICENSED
No. 24767
FLETCHER M. WOOD

14-OCT-2016

Fletcher Wood
Printed Name of Professional Engineer

Signature of Professional Engineer

24767
South Carolina License #

Attachment A - Calculation CROSS-0-DC-044-CE-0001

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Calculation Cover Sheet

Customer	Santee Cooper	**Project No.**	108008-01330
Project Title	Cross Generating Station	**Calc No.**	CROSS-0-DC-044-CE-0001
Calculation Title	Stormwater Calculation for Areas 1B and 1D	**Phase/CTR**	N/A
Elec File Location	\\usreawpfil01\civileng\01 PROJECTS\Santee Cooper\Cross\CCR Rule Demonstrations\0005 Class 3 Run-on Run-off Control Plan\Rev 0\CROSS-0-DC-044-CE-0001\CROSS-0-DC-044-CE-0001.docm		
		Page	1 **of** 257

Calculation Objective

The objective of this calculation is to manage the stormwater from the existing Class 2 CCR Landfill, as well as Class 3 CCR landfill Areas 1B (operating) and 1D (future). The stormwater collection and conveyance system is designed for 25-year 24-hour storm event.

Calculation Method

The post developed stormwater runoff quantity will be calculated according to the SCS design methodology for a 25 yr-24 hour rainfall event, applying Type-III rainfall distribution for the rainfall depth within the project work limits. The drainage collection, conveyance and pond routing calculations are performed using Bentley PondPack software. TR-55 method is used for the time of concentration (TC) computation. The culverts are designed using Bentley CulvertMaster.

Assumptions

All assumptions are included in the calculation. None that require further verification.

Software Used

Title	Version	Validation (Y / N / N/A)
Bentley PondPack	10.1	Yes
Bentley CulvertMaster	3.1	Yes

References

- SCDHEC standards for the stormwater and sediment reduction regulation 72-300 thru 72-316.
- SCDHEC OCRM stormwater BMPs handbook.
- SCDHEC solid waste management industrial solid waste landfills regulation DHEC R61-107-19.
- Existing topographic survey drawing prepared by Parker Land Surveying, LLC, dated at 5/2016.
- SWPPP calculation report CR34-0-DC-024-CE-002 prepared earlier for the landfill expansion NPDES permit.
- WorleyParsons' Drawings CR34-0-DW-LF-735-0200 THRU 0549.

Conclusions

The proposed system of stormwater conveyance structures is designed to meet or exceed the regulations and/or standards of South Carolina Department of Health and Environmental Control (SCDHEC) and Ocean and Coastal Resource Management (OCRM). The channels, culverts, down drains, and the ponds all will work together to convey and control the 25-year, 24-hour design storm event. The pond is adequately designed to manage the 25-year, 24-hour storm event. The stormwater detention basin is adequate to hold the 25-year, 24-hour rainfall and release it over a period of 24 hours in accordance with the SCDHEC Water Quality Volume (WQV) criteria.

Related to a Safety Critical System?	**No**	Status of Supplier Data used	**N/A**

HOLDS

None.

0	14-10-16	Issued for Use	S. Velugubantla	L. LaVoie	F. Wood
Rev	**Date**	**Description**	**By**	**Checked**	**Approved**

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Calculation Checklist

Customer	Santee Cooper	**Project No.**	108008-01330
Project Title	Cross Generating Station	**Calc No.**	CROSS-0-DC-044-CE-0001
Calculation Title	Stormwater Calculation for Areas 1B and 1D	**Phase/CTR**	N/A
Elec File Location	\\usreawpfil01\civileng\01 PROJECTS\Santee Cooper\Cross\CCR Rule Demonstrations\0005 Class 3 Run-on Run-off Control Plan\Rev 0\CROSS-0-DC-044-CE-0001\CROSS-0-DC-044-CE-0001.docm		

Please check boxes for all applicable items checked or mark as "N/A" if not appropriate:

Calculations:

Originator	Checker	
☒	☒	Calculation number assigned and registered (refer to project numbering system or Document Number Standard (DPP-031-COR-EN for format).
☒	☒	All required information on Cover Sheet provided
☒	☒	Revision history box complete and signed. (Typed names (minimum of first initial and surname e.g. A. Wood) of Originator, Checker, Approver to be initialed beside at sign-off) (Dates in standard format (DD-MMM-YY))
☒	☒	Table of Contents.
☒	☒	Source of input data stated (with revision number and date if relevant).
☒	☒	Customer's requirements included/addressed.
☒	☒	Approach used is appropriate for problem being solved.
☒	☒	Method clear and easy to follow.
☒	☒	Input data correct.
☒	☒	Calculation is arithmetically correct OR software previously verified and reference to verification checked.
☒	☒	Calculation result within expected limits.
☒	☒	Calculation tolerances stated if significant.
☒	☒	Units used as required by customer. Unit conversions correctly performed.
☒	☒	Appropriate cross-references.
☒	☒	Sketches included and clearly labeled, where required.
☒	☒	Appendices included and referenced, as required.
☒	☒	Considered design reviews, Hazop actions, Customer input, safety and environmental issues, etc.
☒	☒	Safety in Design (SID) and Sustainable Design are addressed. Refer relevant SID Discipline Standard.
☒	☒	Conclusions and recommendations are appropriate.

Checking records:

☒	☒	Checked and annotated copy of calculation filed (use "Doc Check Print" stamp).
☒	☒	Corrections made as required and calculation dated and signed on cover sheet by checker.

Revisions:

☐	☐	Changes clouded, tracked or highlighted.
☐	☐	Revision history block updated.
☐	☐	Calculation re-checked if required.

0	14-10-16	Issued for Use	S. Velugubantla	L. LaVoie	F. Wood
Rev	**Date**	**Description**	**By**	**Checked**	**Approved**

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SOUTH CAROLINA CERTIFICATE OF AUTHORIZATION WORLEY PARSONS GROUP INC. No. 1505

SOUTH CAROLINA PROFESSIONAL ENGINEER LICENSED No. 24767 FLETCHER M. WOOD

14-OCT-2016

1 DESIGN CRITERIA

The following design criteria exceed or meet the criterion established in accordance with the requirements of South Carolina Department of Health and Environmental Control (SCDHEC) and Ocean and Coastal Resource Management (OCRM) regulations:

- The stormwater collection, conveyance and detention to be designed for 25-year, 24-hour storm event without flooding the plant roads.
- The two existing fish grow-out ponds have been modified and converted to wet detention basin for treating surface runoff collected from the existing Class 2 landfill and the proposed Class 3 expansion.
- The detention basin has been designed to provide at least 24 hours of detention time for the water quality volume before discharging to the existing diversion canal.
- The detention basin outlet structure was designed to manage the 25-year, 24-hour design storm event and maintain at least 0.5-foot of free board between the maximum water surface elevation from this storm and the crest elevation of the emergency spillway, which is located on the west side of the ditch immediately before entering into the pond.
- The peripheral stormwater channels will have 0.05% slope with 3:1 side slopes and bottom width of minimum 13.5 ft. Landfill terrace channels (V-ditch) will have 0.5% slope with 3:1 side slope on one side and 10.33:1 on the other side.

2 PRE-DEVELOPMENT CONDITION

- Site topographic conditions are primarily flat terrain with minimal vertical relief. The site near the landfill is predominantly covered with Goldsboro soil. This soil is classified under hydrologic soil group B. Therefore, it has a moderate infiltration rate when thoroughly wetted. Furthermore, it has moderately fine to moderately coarse textures.
- The existing Class 2 landfill occupies an approximate area of 96 acres surrounded by peripheral earthen channels. These channels collect stormwater from the landfill and convey it to the stormwater pond. The existing channels are relatively flat with an approximate slope of 0.0005 ft/ft, and are about 2.5 feet deep with a varying bottom width and 3:1 side slopes.
- The existing Class 2 landfill has been closed and capped with a composite liner cover system (HDPE geomembrane over a geosynthetic clay liner). Stormwater from the existing landfill drains to the north and south via 3 existing landfill terrace channels. The channels drain to the north and south peripheral stormwater channels via a series of 24" HDPE stormwater downdrain pipes. The peripheral stormwater channels drain to the stormwater pond at the south end of the site.
- The old fish grow-out ponds at the south end of the site have been converted to a permanent stormwater pond. The diversion canal runs on the south side of these ponds. Refer to the aerial image and existing contours in the Appendix –A.

3 POST-DEVELOPMENT CONDITION

- Class 3 landfill Areas 1B and 1D will be constructed adjacent to the closed Class 2 landfill. Area 1B, to the east of the existing landfill, will be constructed first, and will be constructed in 2 Phases: the north half (Cell 1) first, and the south half (Cell 2) second. Area 1D, to the west, will be constructed after Area 1B, and in a similar manner. The Class 3 landfills will piggyback over the top of the closed existing Class 2 landfill, as each cell is constructed. Refer to the Phasing sketches in Appendix E.
- New peripheral drainage ditches are provided around the perimeter of landfill Areas 1B and 1D. These ditches provide continuity for the stormwater runoff from the Class 2 landfill to the pond. Additionally, as the landfill Areas 1B and 1D are closed, these peripheral ditches will provide drainage for the stormwater from the closed surfaces of the new landfill areas as well.
- Culverts are designed to convey the required flow wherever the peripheral ditches crosses the roads. Adequate culvert end treatments will be provided to curtail the erosion and to protect the culvert headwalls.
- Water surface elevation at any channel confluence point is computed based on the combined total flow, obtained from PondPack output, for that particular node.
- Refer to Appendix B for the drainage plan and for the PondPack design output and Appendix C for culvert calculations.

4 RAINFALL DATA

The project rainfall data obtained from SCDHEC Storm Water Management BMP Handbook is summarized below in Table-1.

TABLE-1
Project Location: Berkley County (North), South Carolina

2-yr	10-yr	25-yr	50-yr	100-yr
3.8	5.9	7.2	8.2	9.4

5 STORMWATER CALCULATION

The stormwater calculations are performed according to the SCS methodology using PondPack software. The computer output and summary of results are enclosed in Appendix B. The proposed drainage system, which includes mainly open channels and culverts, is designed for the most conservative scenario of a fully developed site with the Class 2 landfill and Class 3 landfill Areas 1B and 1D fully constructed and closed, when all landfill areas are contributory to the stormwater runoff pond, as shown in the final phasing sketch in Appendix E.

The drainage contributory area to the existing outfall (Out-20) includes the existing and proposed landfill, approximately 2-acres of open area immediately south of the landfill, all adjacent roads and channels, and the proposed detention basin. The total drainage area is about 220 acres, of which about 190 acres are occupied by the existing and proposed landfill and its adjacent open areas. The peak flows are calculated by assuming a composite curve number of 79 for landfill areas, and 98 for the wet pond area. See Table-2 for summary of drainage contributory areas included in the full Class 3 expansion of the landfill.

TABLE-2
SUMMARY OF DRAINAGE AREAS

Area	Acreage	Discharge Q_{25}	Discharge Q_{100}	CN
EX-N6	3.89	15.1	21.4	79
EX-N7	2.56	10.8	15.3	79
EX-S6	1.82	7.5	10.7	79
EX-S7	4.04	15.6	22.1	79
NE	15.93	51.8	73.3	79
NE3	4.18	11.8	16.7	79
NE7	16.18	54.7	77.4	79
NW	20.96	52.3	74.1	79
NW3	4.19	11.0	15.6	79
NW4+EXN4+NE4	11.22	29.4	41.7	79
NW5+EXN5+NE5	12.08	29.7	42.1	79
NW7	15.36	44.2	62.6	79
SE	27.52	78.9	111.7	79
SE3	2.38	8.1	11.5	79
SE4+EXS4+SW4	7.06	24.7	34.9	79
SE7	5.84	19.2	27.2	79
SW	30.66	85.2	120.6	79
SW3	2.19	7.4	10.4	79
SW5+EXS5+SE5	6.40	18.1	25.7	79
SW7	6.52	21.0	29.7	79

5.1 Peripheral Channels and Culvert Design

New peripheral drainage channels are 13.5 to 15.0 ft wide with 3:1 side slopes and 0.05% longitudinal slope, runoff collected within these channels will flow to the proposed detention basin. All the peripheral grass lined channels around the landfill, as well as the channel running to the detention basin are designed to have a bottom width of 13.5 ft. and 15.0 ft. respectively with side slopes graded to 3 horizontal to 1 vertical with varying depths from 2.0

feet to 6.0 feet. The average channel slopes are kept relatively flat at about 0.0005 ft/ft. All channels are designed to handle the peak flow during the 25-year, 24-hour storm event. Culverts will be installed wherever these ditches cross the landfill roads or the detention basin embankment.

The overall system is designed to be adequate for a 25 yr-24 hr storm event without overflowing externally. The top of the road elevations adjacent to the channels varies between 83.0 and 89.0. Ditches are modeled in PondPack. Table-3 summarizes the ditch design. For detailed calculations, refer to PondPack output in Appendix B. See the WorleyParsons Drawing CR34-0-DW-LF-735-0280 for the ditch schedule. The Landfill terrace channels (V-ditch) capacity is calculated to be around 16 cfs (See Appendix F).

TABLE-3

SUMMARY OF PERIPHERAL CHANNELS

Ditch No.	Bottom. Width	Side Slope	Max WS Elev. (Q_{25})	T/Bank Elev.	Discharge Q_{25} (cfs)	Velocity Q_{25} (fps)	DWG label
CH-E1	13.5	3:1	82.2	82.5	74.10	1.3	D-1
CH-E2	13.5	3:1	81.	82.5	90.84	1.4	D-1
CH-NE1	13.5	3:1	82.9	83.0	82.47	1.3	D-1
CH-NE2	13.5	3:1	82.6	83.0	85.43	1.3	D-1
CH-NW1	13.5	3:1	82.95	83.0	88.31	1.4	D-6
CH-NW2	13.5	3:1	82.6	83.0	89.97	1.4	D-6
CH-S1	13.5	3:1	79.3	87.5	96.42*	1.4	D-7A
CH-S2	13.5	3:1	80.5	83.0	209.97	1.7	D-8
CH-S3	13.5	3:1	78.1	87.5	5.43	0.6	D-5A
CH-SE1	13.5	3:1	80.5	83.0	96.80	1.4	D-2
CH-SE2	13.5	3:1	80.8	83.0	269.42	1.8	D-5
CH-SW1	13.5	3:1	79.2	83.0	99.83	1.4	D-6
CH-SW2	13.5	3:1	79.7	83.0	185.92*	1.7	D-9
CH-SW3	15	3:1	80.5	83.0	340.97	1.9	D-10
CH-W1	13.5	3:1	82.1	82.5	80.16	1.3	D-6
CH-W2	13.5	3:1	80.9	82.5	94.44	1.4	D-6

*85cfs is added as it will be diverted to CH-S1 over the compacted random fill berm during the peak flow

The peak discharge from the downdrains (JCT SE-6) on the south slope of the landfill, during 25-year storm, is 215.6 cfs. During the peak discharge, about 85 cfs will over flow the top of the compacted random fill berm, to an adjacent stormwater channel. The top of berm will be at EL. 86.5 feet. The overflow will remain in the stormwater channels, and will not flood adjacent roads. The maximum water surface elevation over the berm will be EL. 87.6 feet. The maximum velocity of the flow on the top of berm will be 3.0 cfs. See Appendix C for weir flow calculations. The weir overflow is not modeled in Pondpack. Instead, this overflow was conservatively added as additional flow to culverts and channels as required. See Table-3 and Table-4.

Bentley CulvertMaster is utilized to size the culverts by inputting the peak flow data obtained from PondPack. See Appendix C for detailed culvert design calculations. The Table-4 below summarizes the culverts.

The latest survey shows that a 36 inch pipe is located at P-2. Since we are not adding significant changes to this drainage area, we assume the flow will not increase. Therefore, a pipe of 42 inch will be placed at P-2 Location as a conservative approach. For the pipe P-10, a flow of 10 cfs is assumed as the contributing drainage area is less than two acres.

TABLE-4
SUMMARY OF CULVERTS

PIPE	SIZE (IN)	INV IN	INV OUT	NO. OF PIPES	LENGTH (FT)	JUNC.	DISCHARGE Q25 (CFS)	VEL. (FPS)	DRAWING
P-1	42	78.78	78.73	3	100	E-1	100.2	6.8	LF-735-0221
P-3	42	77.99	77.87	3	100	SE-4	98.2	6.7	LF-735-0221
P-4	42	77.02	76.2	4	90	SE-2	99.1	8.2	LF-735-0221
P-5	42	76.13	75.78	4	70	SE-5	293.4	9.3	LF-735-0221
P-5A	24	80	78	1	56	SE-1	7.5	9.9	LF-735-0221
P-5B	30	84.5	84	4	70	SE-6	130.6*	8.0	LF-735-0301
P-6	42	77.84	77.8	3	90	W-1	101.8	6.8	LF-735-0223
P-7	42	77.65	77.37	3	100	SW-4	99.8	6.7	LF-735-0223
P-8	42	75.74	75.38	3	70	SW-2	187.8**	8.6	LF-735-0223
P-8A	30	76	75	2	54	SW-1	100.6**	12.1	LF-735-0223
P-9	42	74.2	74.1	4	88	SW-8	341.0	10.1	LF-735-0250
P-10	18	83	82.8	1	25	-	10.0	5.7	LF-735-0250

*85cfs is removed as it will be diverted to CH-S1 over the internal compacted random fill berm during the peak flow
**85cfs is added to account for the additional water to CH-S1

5.2 Riprap Design

Riprap aprons are designed at the culvert upstream and downstream ends to minimize erosion. The SCDHEC riprap design nomograph for minimum tail water condition is utilized to size the riprap. The summary of the riprap design is shown below. The dimension of the Rip-Rap aprons are listed on the WorleyParsons' drawing CR34-0-DW-LF-735-0281. Refer to Appendix D for SCDHEC riprap design nomographs.

TABLE-5

SUMMARY OF RIP RAP

LOCATION	DIAMTER (IN)	NO. OF PIPES	JUNCTION	Q (CFS)	DRAWING
RA-B-6	30	4	SE-6	215.6	LF-735-0301
RA-EX-N	24	10	NE-1+NW-1	179.9	LF-735-0222
RA-EX-S	24	10	SE-6	215.6	LF-735-0301
RA-P-1	42	3	E-1	100.2	LF-735-0221
RA-P-2	42	1	-	45.0	LF-735-0221
RA-P-3	42	3	SE-4	98.2	LF-735-0221
RA-P-4	42	4	SE-2	99.1	LF-735-0221
RA-P-5	42	4	SE-5	293.4	LF-735-0221
RA-P-5A	24	1	SE-1	7.5	LF-735-0221
RA-P-6	42	3	W-1	101.8	LF-735-0223
RA-P-7	42	3	SW-4	99.8	LF-735-0223
RA-P-8	42	3	SW-2	102.8	LF-735-0223
RA-P-8A	30	1	SW-1	15.6	LF-735-0223
RA-P-9	42	4	SW-8	341.0	LF-735-0250
RA-P-10	18	1	-	10.0	LF-735-0250

5.3 Landfill Down Drains Design

The down drains are designed to handle the required runoff from each bench of the existing Class 2 landfill, as well as from each bench of the proposed Class 3 landfill Areas after their subsequent phased enclosure with the final cover system. Down drains consists of 24" HDPE pipes with HDPE inlets installed at the low point of each landfill cell terrace. The inlets will be depressed at least 2.0 ft. below the adjacent ground to contain the accumulated runoff from overflowing the terrace/roof edges during peak discharges. These down drains collect the runoff from each cell terrace/roof and discharge into the peripheral ditch located at the toe of the lowest cell. This terrace and down drain system intercepts runoff from the surface of the closed Class 2 landfill such that run-on to the active surface of the individual Class Three landfill areas is minimized at all times.

Summary of down drains is shown below. Refer to Appendix B for down drain calculations included in the PondPack design output.

TABLE-6
SUMMARY OF DOWN DRAINS

Down Drain No.	location	Number of Pipes	Size	Full Flow Capacity	Actual Discharge Q_{25} (cfs)	VELOCITY (FPS)
DDNE	North-TOP	2	24”	155.00	51.8	22.2
DDNW	North -TOP	2	24”	155.00	52.3	22.3
DDNE3	North –L3	1	24”	77.50	11.8	17.1
DDNW3	North –L3	1	24”	77.50	11.0	17.0
DDN4	North-L4	2	24”	155.00	29.4	19.1
DDN5	North-L5	2	24”	155.00	29.7	19.1
DDSE	South-TOP	2	24”	155.00	78.9	24.8
DDSW	South-TOP	2	24”	155.00	85.2	25.2
DDSE3	South-L3	1	24”	77.50	8.1	15.6
DDSW3	South-L3	1	24”	77.50	7.4	15.4
DDS4	South-L4	2	24”	155.00	24.7	18.3
DDS5	South-L5	2	24”	155.00	18.1	16.5

5.4 Pond Design

The old fish grow-out ponds have been modified and converted to a wet detention basin by excavating the bottom and reshaping the sides to the required grade & elevation, and by removing a small segment of the dike at the north end of the existing pond. Refer to the SWPPP drainage calculation report (CR34-O-DC-024-CE-002) for detention basin plan and details.

The bottom of the basin is at elevation 71.50 and the top of the basin embankment is kept at elevation 86.00 to match the surrounding terrain. The lower elevation value of 83.00 for the basin embankment is chosen in the design to be consistent with the top of ditch elevations, which are basically a controlling factor throughout the proposed landfill drainage system design. The permanent pool elevation of the pond is 75.5.

The stormwater detention basin is designed to be adequate for a 25-year 24-hour storm event. The maximum capacity of the basin is approximately 130 ac-ft with more than 2.0 ft of freeboard and 4 feet of permanent pool below the basin outlet orifice elevation of 75.5. Effluent from the detention basin will be discharged through an outfall (Out-20) located at the existing diversion canal.

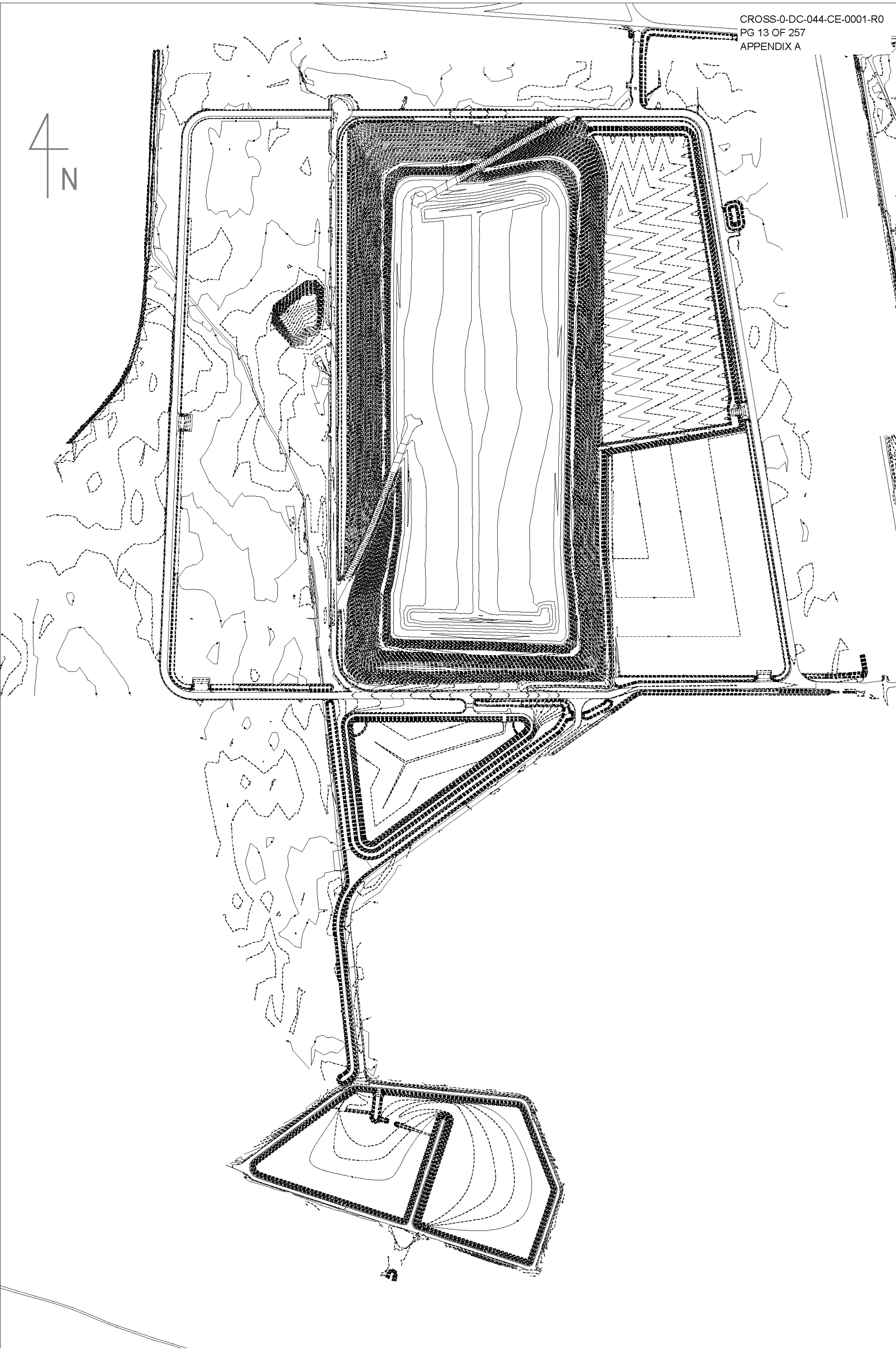
The basin outlet structure consists of a precast riser box (7’ x 7’) with a rectangular orifice opening and two 30-inch HDPE pipes connecting the riser box to the outfall structure (Out-20) at the diversion canal. The outlet structure is designed to regulate the discharge rate from the basin, and its location is chosen in the basin such that it provides the longest flow path through the basin to give maximum possible duration for the sediment to settle down. The primary weir opening of 2.0' x 0.5' is located at crest elevation of 75.5. The primary weir opening will handle the 25-year-24 hour and discharges and release it at a controlled rate varying between 0.0 cfs and 9.6 cfs.

The previous outfall located in the diversion canal has been demolished and a new outfall was constructed with two 30" dia pipes connected to the new detention basin outlet structure. The new pipes were installed at elevation 73.50. The high water elevation of 75.50 in the diversion canal will keep the new outfall pipes submerged underwater during peak flow in the diversion canal. (Refer to the document CR34-0-DC-024-CE-002 for anti-seep collar and outfall design information).

The pond routing calculations are performed using Bentley PondPack. The analysis shows that a 25-year, 24-hour storm results in a maximum water surface elevation of 79.5 and a peak outflow of 30.8 cfs. The maximum water surface elevation for a 100-year 24-hour storm is 80.3 with a peak flow of 87.8 cfs. See Appendix B for the full drainage report. The primary orifice opening can handle the 25-year, 24-hour storm and the 7' x 7' opening at the top of the box will take the 100-year 24-hour storm. The 7' x7' opening at the top of the box is will be maintained and protected with trash rack. In the worst case scenario, if the outfall pipes get clogged, the stormwater will naturally over flow to the wetlands, which are located at the west side of the pond, near the pond entrance.

Appendix A – Existing Topography

(2 total pages)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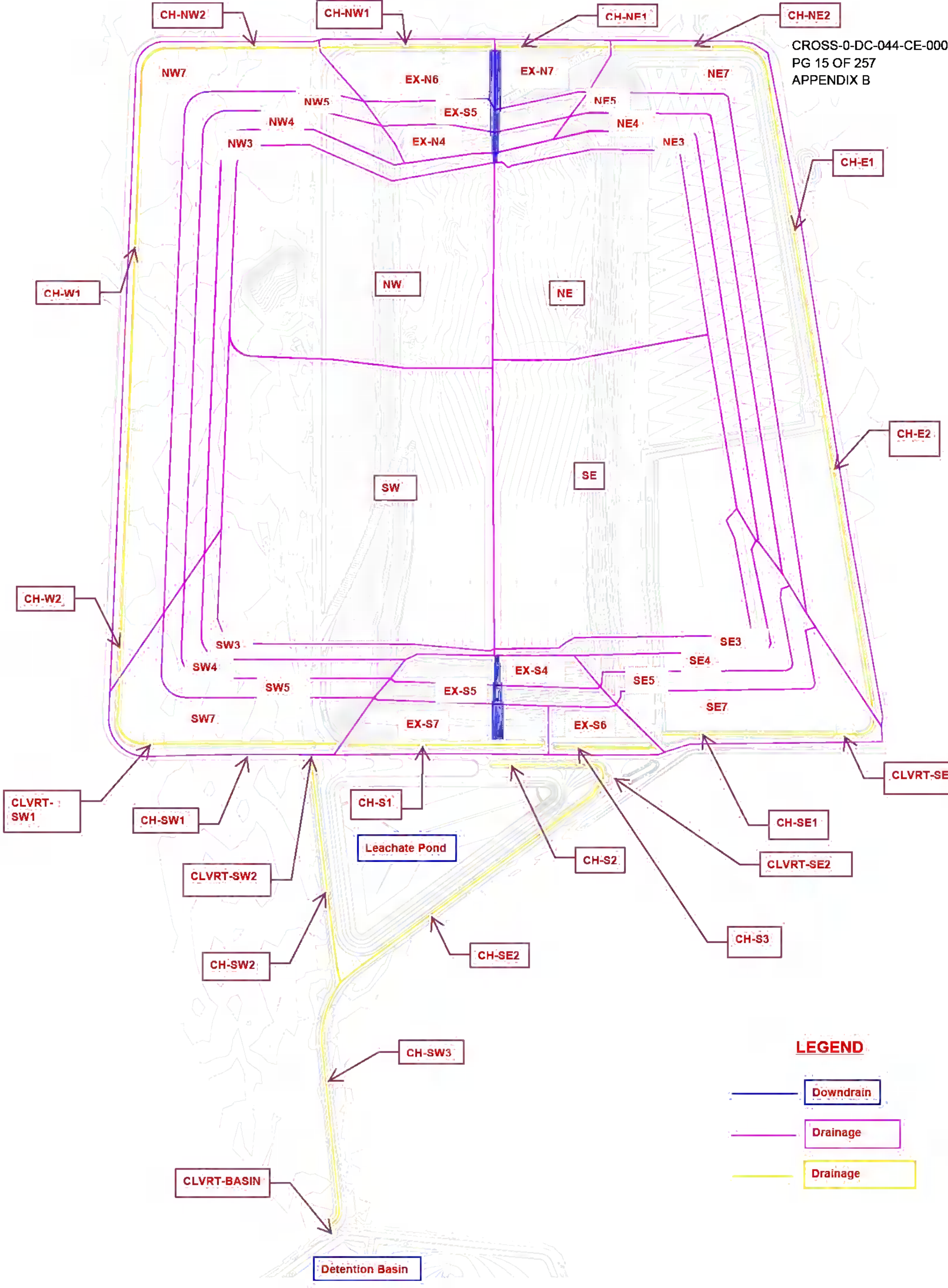
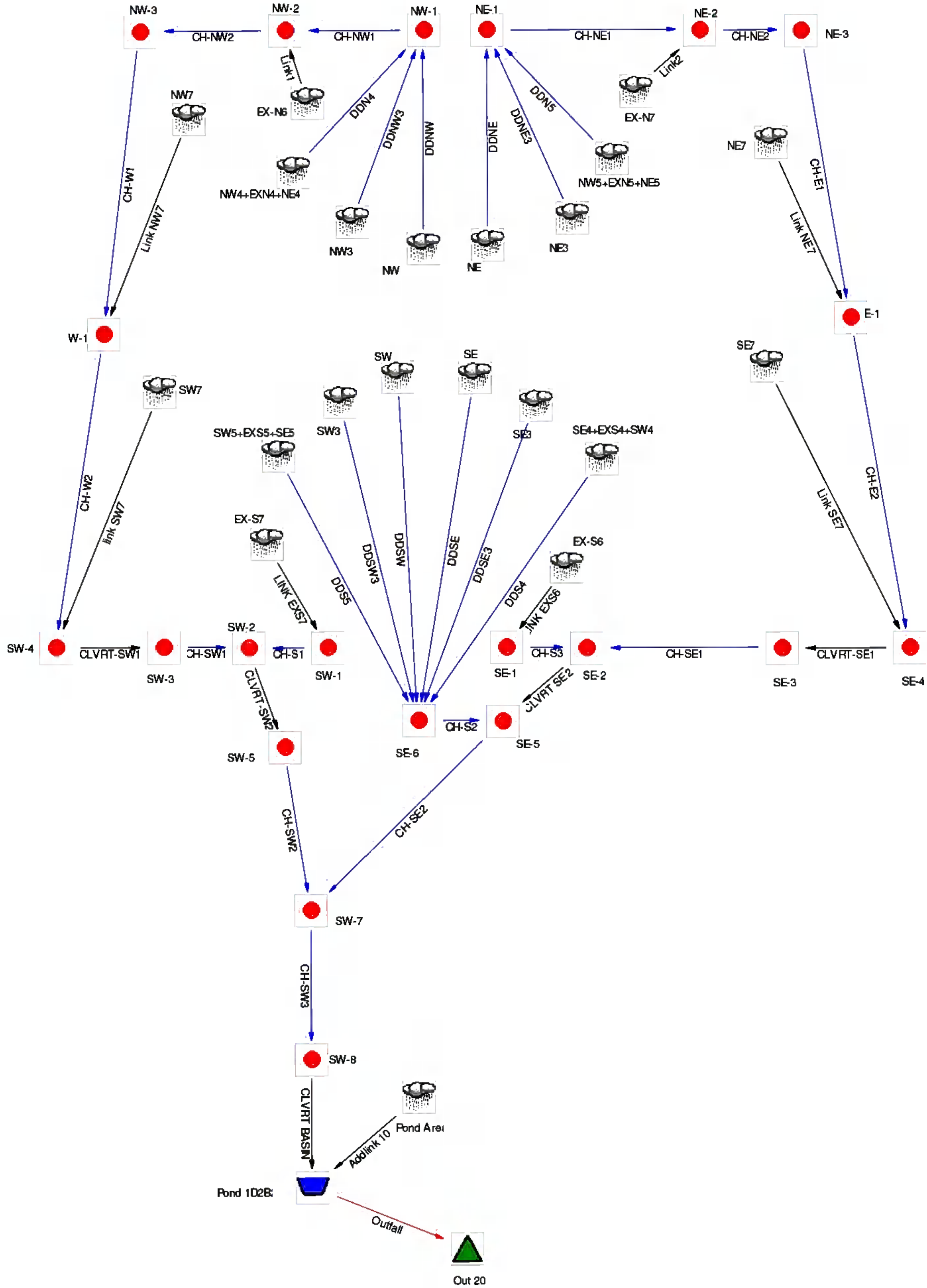
Appendix B – PondPack Results

(204 total pages)

CROSS-0-DC-044-CE-0001-R0
PG 15 OF 257
APPENDIX B

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NW-2
NW-1
NE-1
NE-2
NE-3
CH-NW2
CH-NW1
CH-NE1
CH-NE2
Link1
Link2
EX-N6
EX-N7
NW7
DDN4
DDNW3
DDNW
DDNE
DDNE3
DDN5
NW4+EXN4+NE4
NW5+EXN5+NE5
NW3
NW
NE
NE3
NE7
CH-W1
Link NW7
CH-E1
Link NE7
W-1
E-1
SW
SE
SE7
SW7
SW3
SE3
SW5+EXS5+SE5
SE4+EXS4+SW4
EX-S7
EX-S6
CH-W2
link SW7
DDSW3
DDSW
DDSE
DDSE3
DDS5
DDS4
LINK EXS7
LINK EXS6
Link SE7
CH-E2
SW-4
CLVRT-SW1
SW-3
CH-SW1
SW-2
CH-S1
SW-1
SE-1
CH-S3
SE-2
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SE-3
CLVRT-SE1
SE-4
CLVRT-SW2
CLVRT SE2
SE-6
CH-S2
SE-5
SW-5
CH-SW2
CH-SE2
SW-7
CH-SW3
SW-8
CLVRT BASIN
Pond Area
Addlink 10
Pond 1D2B
Outfall
Out 20

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Table of Contents (continued)

Table of Contents (continued)

Table of Contents (continued)

******************** OUTLET STRUCTURES *********************

MASTER DESIGN STORM SUMMARY

Network Storm Collection: Cross - Berkley

Return Event	Total Depth in	Rainfall Type	RNF ID
Dev 25	7.2000	Synthetic Curve	TypeIII 24hr
Dev100	9.4000	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
E-1	JCT	25	20.233		12.6100	100.15		
E-1	JCT	100	28.991		12.4450	139.74		
EX-N6	AREA	25	1.546		12.2150	15.13		
EX-N6	AREA	100	2.212		12.2100	21.40		
EX-N7	AREA	25	1.017		12.1700	10.84		
EX-N7	AREA	100	1.456		12.1650	15.31		
EX-S6	AREA	25	.723		12.1800	7.54		
EX-S6	AREA	100	1.035		12.1750	10.66		
EX-S7	AREA	25	1.605		12.2150	15.62		
EX-S7	AREA	100	2.297		12.2150	22.10		
NE	AREA	25	6.329		12.3400	51.78		
NE	AREA	100	9.058		12.3350	73.30		
NE-1	JCT	25	12.790		12.4100	87.41		
NE-1	JCT	100	18.303		12.4050	123.94		

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
NE-2	JCT	25	13.806		12.5100	86.64		
NE-2	JCT	100	19.793	R	12.3000	102.63		
NE-3	JCT	25	13.806		12.5750	85.43		
NE-3	JCT	100	19.793		12.4250	99.14		
NE3	AREA	25	1.661		12.4600	11.76		
NE3	AREA	100	2.377		12.4550	16.65		
NE7	AREA	25	6.429		12.3100	54.66		
NE7	AREA	100	9.200		12.3050	77.35		
NW	AREA	25	8.328		12.5850	52.27		
NW	AREA	100	11.918		12.5800	74.07		
NW-1	JCT	25	14.450		12.5650	92.50		
NW-1	JCT	100	20.680		12.5600	131.07		
NW-2	JCT	25	15.995		12.6550	93.15		
NW-2	JCT	100	22.923	R	12.3900	106.67		
NW-3	JCT	25	15.995		12.7650	89.96		
NW-3	JCT	100	22.923		12.5900	99.88		
NW3	AREA	25	1.665		12.5250	11.03		
NW3	AREA	100	2.382		12.5200	15.63		
NW4+EXN4+NE4	AREA	25	4.458		12.5300	29.42		
NW4+EXN4+NE4	AREA	100	6.380		12.5250	41.69		
NW5+EXN5+NE5	AREA	25	4.800		12.6000	29.71		
NW5+EXN5+NE5	AREA	100	6.869		12.5900	42.10		
NW7	AREA	25	6.103		12.4450	44.23		
NW7	AREA	100	8.734		12.4400	62.63		

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 20	JCT	25	65.301	R	18.6850	30.84		
*OUT 20	JCT	100	103.391	R	15.8850	87.82		
POND 1D2B2 IN	POND	25	92.305		12.9200	354.46		
POND 1D2B2 IN	POND	100	130.727		12.8450	522.33		
POND 1D2B2 OUT	POND	25	80.737	R	18.6850	30.84	79.53	133.987
POND 1D2B2 OUT	POND	100	119.049	R	15.8850	87.82	80.29	148.152
POND AREA	AREA	25	12.471		12.1000	130.44		
POND AREA	AREA	100	16.411		12.1000	170.47		
SE	AREA	25	10.934		12.4500	78.88		
SE	AREA	100	15.648		12.4450	111.69		
SE-1	JCT	25	.723		12.1800	7.54		
SE-1	JCT	100	1.035		12.1750	10.66		
SE-2	JCT	25	23.272		12.8800	99.09		
SE-2	JCT	100	33.345		12.7300	139.95		
SE-3	JCT	25	22.550		12.7850	98.18		
SE-3	JCT	100	32.311		12.6400	138.27		
SE-4	JCT	25	22.550		12.7850	98.18		
SE-4	JCT	100	32.311		12.6400	138.27		
SE-5	JCT	25	53.549		12.5600	293.36		
SE-5	JCT	100	76.673		12.5400	426.33		
SE-6	JCT	25	30.280		12.4350	215.61		
SE-6	JCT	100	43.333		12.4250	305.37		
SE3	AREA	25	.946		12.3000	8.12		
SE3	AREA	100	1.353		12.2950	11.49		

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
SE4+EXS4+SW4	AREA	25	2.805		12.2850	24.66		
SE4+EXS4+SW4	AREA	100	4.014		12.2800	34.90		
SE7	AREA	25	2.320		12.3300	19.24		
SE7	AREA	100	3.321		12.3250	27.24		
SW	AREA	25	12.182		12.4800	85.17		
SW	AREA	100	17.433		12.4700	120.62		
SW-1	JCT	25	1.605		12.2150	15.62		
SW-1	JCT	100	2.297		12.2150	22.10		
SW-2	JCT	25	26.289		13.1050	102.76		
SW-2	JCT	100	37.656		12.8700	139.91		
SW-3	JCT	25	24.684		13.0350	99.77		
SW-3	JCT	100	35.360		12.8200	133.63		
SW-4	JCT	25	24.684		13.0350	99.77		
SW-4	JCT	100	35.360		12.8200	133.63		
SW-5	JCT	25	26.289		13.1050	102.76		
SW-5	JCT	100	37.656		12.8700	139.91		
SW-7	JCT	25	79.838		12.7950	350.02		
SW-7	JCT	100	114.319		12.7400	517.05		
SW-8	JCT	25	79.834		12.9300	340.96		
SW-8	JCT	100	114.316		12.8550	503.44		
SW3	AREA	25	.870		12.3100	7.36		
SW3	AREA	100	1.245		12.3050	10.42		
SW5+EXS5+SE5	AREA	25	2.543		12.4600	18.13		
SW5+EXS5+SE5	AREA	100	3.639		12.4550	25.67		

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
SW7	AREA	25	2.590		12.3500	20.95		
SW7	AREA	100	3.707		12.3450	29.66		
W-1	JCT	25	22.096		12.8450	101.80		
W-1	JCT	100	31.654		12.6300	134.45		

Title... Project Date: 5/10/2011
Project Engineer: WORLEYPARSONS\SYED.AHMED
Project Title: Cross LandFill Area 1D & 1B
Project Comments:

DESIGN STORMS SUMMARY

Design Storm File,ID = Cross - Berkley

Storm Tag Name = Dev 25

Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 7.2000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = Dev100

Data Type, File, ID = Synthetic Storm TypeIII 24hr
Storm Frequency = 100 yr
Total Rainfall Depth= 9.4000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.1500	
Hydraulic Length	225.00	ft
2yr, 24hr P	3.8000	in
Slope	.330000	ft/ft
Avg.Velocity	.67	ft/sec

Segment #1 Time: .0934 hrs

Segment #2: Tc: TR-55 Channel

Flow Area	27.0000	sq.ft
Wetted Perimeter	22.98	ft
Hydraulic Radius	1.17	ft
Slope	.000500	ft/ft
Mannings n	.0400	
Hydraulic Length	725.00	ft
Avg.Velocity	.93	ft/sec

Segment #2 Time: .2171 hrs

=========================
Total Tc: .3106 hrs
=========================

```
-------------------------------------------------------------------------
Tc Equations used...
-------------------------------------------------------------------------


==== SCS TR-55 Sheet Flow ===============================================

     Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

     Where:  Tc = Time of concentration, hrs
             n  = Mannings n
             Lf = Flow length, ft
             P  = 2yr, 24hr Rain depth, inches
             Sf = Slope, %


==== SCS Channel Flow ===================================================

     R  = Aq / Wp
     V  = (1.49 * (R**(2/3)) * (Sf**-0.5)) / n

     Tc = (Lf / V) / (3600sec/hr)

     Where:  R  = Hydraulic radius
             Aq = Flow area, sq.ft.
             Wp = Wetted perimeter, ft
             V  = Velocity, ft/sec
             Sf = Slope, ft/ft
             n  = Mannings n
             Tc = Time of concentration, hrs
             Lf = Flow length, ft
```

```
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
TIME OF CONCENTRATION CALCULATOR
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

------------------------------------------------------------------------

Segment #1:  Tc: TR-55 Sheet

Mannings n           .1500
Hydraulic Length   215.00 ft
2yr, 24hr P        3.8000 in
Slope             .330000 ft/ft

Avg.Velocity          .66 ft/sec

                                        Segment #1 Time:     .0901 hrs
------------------------------------------------------------------------

Segment #2:  Tc: TR-55 Channel

Flow Area         27.0000 sq.ft
Wetted Perimeter    22.98 ft
Hydraulic Radius     1.17 ft
Slope             .000500 ft/ft
Mannings n          .0400
Hydraulic Length   475.00 ft

Avg.Velocity          .93 ft/sec

                                        Segment #2 Time:     .1423 hrs
------------------------------------------------------------------------

                                              =========================
                                               Total Tc:     .2323 hrs
                                              =========================
```

```
------------------------------------------------------------------------
Tc Equations used...
------------------------------------------------------------------------


==== SCS TR-55 Sheet Flow ==============================================

     Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

     Where:  Tc = Time of concentration, hrs
             n  = Mannings n
             Lf = Flow length, ft
             P  = 2yr, 24hr Rain depth, inches
             Sf = Slope, %


==== SCS Channel Flow ==================================================

     R  = Aq / Wp
     V  = (1.49 * (R**(2/3)) * (Sf**-0.5)) / n

     Tc = (Lf / V) / (3600sec/hr)

     Where:  R  = Hydraulic radius
             Aq = Flow area, sq.ft.
             Wp = Wetted perimeter, ft
             V  = Velocity, ft/sec
             Sf = Slope, ft/ft
             n  = Mannings n
             Tc = Time of concentration, hrs
             Lf = Flow length, ft
```

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

```
Mannings n            .1500
Hydraulic Length   150.00 ft
2yr, 24hr P        3.8000 in
Slope            .330000 ft/ft

Avg.Velocity          .62 ft/sec

                                        Segment #1 Time:     .0675 hrs
```

Segment #2: Tc: TR-55 Channel

```
Flow Area         27.0000 sq.ft
Wetted Perimeter    22.98 ft
Hydraulic Radius     1.17 ft
Slope            .000500 ft/ft
Mannings n          .0400
Hydraulic Length   615.00 ft

Avg.Velocity          .93 ft/sec

                                        Segment #2 Time:     .1842 hrs
```

```
=========================
 Total Tc:     .2517 hrs
=========================
```

```
-----------------------------------------------------------------------
Tc Equations used...
-----------------------------------------------------------------------


==== SCS TR-55 Sheet Flow =============================================

     Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

     Where:  Tc = Time of concentration, hrs
             n  = Mannings n
             Lf = Flow length, ft
             P  = 2yr, 24hr Rain depth, inches
             Sf = Slope, %


==== SCS Channel Flow =================================================

     R  = Aq / Wp
     V  = (1.49 * (R**(2/3)) * (Sf**-0.5)) / n

     Tc = (Lf / V) / (3600sec/hr)

     Where:  R  = Hydraulic radius
             Aq = Flow area, sq.ft.
             Wp = Wetted perimeter, ft
             V  = Velocity, ft/sec
             Sf = Slope, ft/ft
             n  = Mannings n
             Tc = Time of concentration, hrs
             Lf = Flow length, ft
```

::
TIME OF CONCENTRATION CALCULATOR
::

```
------------------------------------------------------------------------

Segment #1:  Tc: TR-55 Sheet

Mannings n           .1500
Hydraulic Length   150.00 ft
2yr, 24hr P        3.8000 in
Slope             .330000 ft/ft

Avg.Velocity          .62 ft/sec

                                         Segment #1 Time:     .0675 hrs
------------------------------------------------------------------------

Segment #2:  Tc: TR-55 Channel

Flow Area         27.0000 sq.ft
Wetted Perimeter    22.98 ft
Hydraulic Radius     1.17 ft
Slope             .000500 ft/ft
Mannings n          .0400
Hydraulic Length   830.00 ft

Avg.Velocity          .93 ft/sec

                                         Segment #2 Time:     .2486 hrs
------------------------------------------------------------------------

                                               =========================
                                                Total Tc:     .3161 hrs
                                               =========================
```

```
------------------------------------------------------------------------
Tc Equations used...
------------------------------------------------------------------------


==== SCS TR-55 Sheet Flow ==============================================

     Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

     Where:  Tc = Time of concentration, hrs
             n  = Mannings n
             Lf = Flow length, ft
             P  = 2yr, 24hr Rain depth, inches
             Sf = Slope, %


==== SCS Channel Flow ==================================================

     R  = Aq / Wp
     V  = (1.49 * (R**(2/3)) * (Sf**-0.5)) / n

     Tc = (Lf / V) / (3600sec/hr)

     Where:  R  = Hydraulic radius
             Aq = Flow area, sq.ft.
             Wp = Wetted perimeter, ft
             V  = Velocity, ft/sec
             Sf = Slope, ft/ft
             n  = Mannings n
             Tc = Time of concentration, hrs
             Lf = Flow length, ft
```

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.1500	
Hydraulic Length	100.00	ft
2yr, 24hr P	3.8000	in
Slope	.030000	ft/ft
Avg.Velocity	.22	ft/sec

Segment #1 Time: .1274 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	308.00	ft
Slope	.030000	ft/ft
Unpaved		
Avg.Velocity	2.79	ft/sec

Segment #2 Time: .0306 hrs

Segment #3: Tc: TR-55 Channel

Flow Area	10.0000	sq.ft
Wetted Perimeter	20.19	ft
Hydraulic Radius	.50	ft
Slope	.005000	ft/ft
Mannings n	.0650	
Hydraulic Length	1250.00	ft
Avg.Velocity	1.01	ft/sec

Segment #3 Time: .3422 hrs

Total Tc: .5002 hrs

```
------------------------------------------------------------------------
Tc Equations used...
------------------------------------------------------------------------


==== SCS TR-55 Sheet Flow ==============================================

     Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

     Where:  Tc = Time of concentration, hrs
             n  = Mannings n
             Lf = Flow length, ft
             P  = 2yr, 24hr Rain depth, inches
             Sf = Slope, %


==== SCS TR-55 Shallow Concentrated Flow ===============================

     Unpaved surface:
     V  = 16.1345 * (Sf**0.5)

     Paved surface:
     V  = 20.3282 * (Sf**0.5)

     Tc = (Lf / V) / (3600sec/hr)

     Where:  V  = Velocity, ft/sec
             Sf = Slope, ft/ft
             Tc = Time of concentration, hrs
             Lf = Flow length, ft
```

==== SCS Channel Flow ==

```
R  = Aq / Wp
V  = (1.49 * (R**(2/3)) * (Sf**-0.5)) / n

Tc = (Lf / V) / (3600sec/hr)

Where:  R  = Hydraulic radius
        Aq = Flow area, sq.ft.
        Wp = Wetted perimeter, ft
        V  = Velocity, ft/sec
        Sf = Slope, ft/ft
        n  = Mannings n
        Tc = Time of concentration, hrs
        Lf = Flow length, ft
```

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TIME OF CONCENTRATION CALCULATOR
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------------------------------------------------------------------------


Segment #1:  Tc: TR-55 Sheet

Mannings n            .1500
Hydraulic Length    50.00 ft
2yr, 24hr P        3.8000 in
Slope            .330000 ft/ft

Avg.Velocity          .50 ft/sec

                                         Segment #1 Time:     .0280 hrs
------------------------------------------------------------------------

Segment #2:  Tc: TR-55 Channel

Flow Area         10.0000 sq.ft
Wetted Perimeter    20.19 ft
Hydraulic Radius      .50 ft
Slope            .005000 ft/ft
Mannings n          .0650
Hydraulic Length  2420.00 ft

Avg.Velocity         1.01 ft/sec

                                         Segment #2 Time:     .6625 hrs
------------------------------------------------------------------------

                                               =========================
                                                Total Tc:     .6905 hrs
                                               =========================
```

```
------------------------------------------------------------------------
Tc Equations used...
------------------------------------------------------------------------


==== SCS TR-55 Sheet Flow ===============================================

     Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

     Where:  Tc = Time of concentration, hrs
             n  = Mannings n
             Lf = Flow length, ft
             P  = 2yr, 24hr Rain depth, inches
             Sf = Slope, %


==== SCS Channel Flow ===================================================

     R  = Aq / Wp
     V  = (1.49 * (R**(2/3)) * (Sf**-0.5)) / n

     Tc = (Lf / V) / (3600sec/hr)

     Where:  R  = Hydraulic radius
             Aq = Flow area, sq.ft.
             Wp = Wetted perimeter, ft
             V  = Velocity, ft/sec
             Sf = Slope, ft/ft
             n  = Mannings n
             Tc = Time of concentration, hrs
             Lf = Flow length, ft
```

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TIME OF CONCENTRATION CALCULATOR
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------------------------------------------------------------------------


Segment #1:  Tc: TR-55 Sheet

Mannings n           .1500
Hydraulic Length    80.00 ft
2yr, 24hr P        3.8000 in
Slope             .330000 ft/ft

Avg.Velocity          .54 ft/sec

                                        Segment #1 Time:     .0408 hrs
------------------------------------------------------------------------

Segment #2:  Tc: TR-55 Channel

Flow Area         27.0000 sq.ft
Wetted Perimeter    22.98 ft
Hydraulic Radius     1.17 ft
Slope             .000500 ft/ft
Mannings n          .0400
Hydraulic Length  1385.00 ft

Avg.Velocity          .93 ft/sec

                                        Segment #2 Time:     .4148 hrs
------------------------------------------------------------------------

                                              =========================
                                               Total Tc:     .4557 hrs
                                              =========================
```

Tc Equations used...

==== SCS TR-55 Sheet Flow ====

```
Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where:  Tc = Time of concentration, hrs
        n  = Mannings n
        Lf = Flow length, ft
        P  = 2yr, 24hr Rain depth, inches
        Sf = Slope, %
```

==== SCS Channel Flow ====

```
R  = Aq / Wp
V  = (1.49 * (R**(2/3)) * (Sf**-0.5)) / n

Tc = (Lf / V) / (3600sec/hr)

Where:  R  = Hydraulic radius
        Aq = Flow area, sq.ft.
        Wp = Wetted perimeter, ft
        V  = Velocity, ft/sec
        Sf = Slope, ft/ft
        n  = Mannings n
        Tc = Time of concentration, hrs
        Lf = Flow length, ft
```

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TIME OF CONCENTRATION CALCULATOR
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------------------------------------------------------------------------

Segment #1:  Tc: TR-55 Sheet

Mannings n           .1500
Hydraulic Length   100.00 ft
2yr, 24hr P        3.8000 in
Slope             .030000 ft/ft

Avg.Velocity          .22 ft/sec

                                        Segment #1 Time:     .1274 hrs
------------------------------------------------------------------------

Segment #2:  Tc: TR-55 Channel

Flow Area         10.0000 sq.ft
Wetted Perimeter    20.19 ft
Hydraulic Radius      .50 ft
Slope             .005000 ft/ft
Mannings n          .0650
Hydraulic Length  2620.00 ft

Avg.Velocity         1.01 ft/sec

                                        Segment #2 Time:     .7172 hrs
------------------------------------------------------------------------

Segment #3:  Tc: TR-55 Shallow

Hydraulic Length   330.00 ft
Slope             .030000 ft/ft
Unpaved

Avg.Velocity         2.79 ft/sec

                                        Segment #3 Time:     .0328 hrs
------------------------------------------------------------------------

                                              =========================
                                               Total Tc:     .8775 hrs
                                              =========================
```

```
------------------------------------------------------------------------
Tc Equations used...
------------------------------------------------------------------------


==== SCS TR-55 Sheet Flow ================================================

     Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

     Where:  Tc = Time of concentration, hrs
             n  = Mannings n
             Lf = Flow length, ft
             P  = 2yr, 24hr Rain depth, inches
             Sf = Slope, %


==== SCS TR-55 Shallow Concentrated Flow ===============================

     Unpaved surface:
     V  = 16.1345 * (Sf**0.5)

     Paved surface:
     V  = 20.3282 * (Sf**0.5)

     Tc = (Lf / V) / (3600sec/hr)

     Where:  V  = Velocity, ft/sec
             Sf = Slope, ft/ft
             Tc = Time of concentration, hrs
             Lf = Flow length, ft
```

==== SCS Channel Flow ==

```
R  = Aq / Wp
V  = (1.49 * (R**(2/3)) * (Sf**-0.5)) / n

Tc = (Lf / V) / (3600sec/hr)

Where:  R  = Hydraulic radius
        Aq = Flow area, sq.ft.
        Wp = Wetted perimeter, ft
        V  = Velocity, ft/sec
        Sf = Slope, ft/ft
        n  = Mannings n
        Tc = Time of concentration, hrs
        Lf = Flow length, ft
```

TIME OF CONCENTRATION CALCULATOR

Segment #1: Tc: TR-55 Sheet

Mannings n	.1500	
Hydraulic Length	50.00	ft
2yr, 24hr P	3.8000	in
Slope	.330000	ft/ft
Avg.Velocity	.50	ft/sec

Segment #1 Time: .0280 hrs

Segment #2: Tc: TR-55 Channel

Flow Area	10.0000	sq.ft
Wetted Perimeter	20.19	ft
Hydraulic Radius	.50	ft
Slope	.005000	ft/ft
Mannings n	.0650	
Hydraulic Length	2785.00	ft
Avg.Velocity	1.01	ft/sec

Segment #2 Time: .7624 hrs

Total Tc: .7905 hrs

Tc Equations used...

==== SCS TR-55 Sheet Flow ====

```
Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where:  Tc = Time of concentration, hrs
        n  = Mannings n
        Lf = Flow length, ft
        P  = 2yr, 24hr Rain depth, inches
        Sf = Slope, %
```

==== SCS Channel Flow ====

```
R  = Aq / Wp
V  = (1.49 * (R**(2/3)) * (Sf**-0.5)) / n

Tc = (Lf / V) / (3600sec/hr)

Where:  R  = Hydraulic radius
        Aq = Flow area, sq.ft.
        Wp = Wetted perimeter, ft
        V  = Velocity, ft/sec
        Sf = Slope, ft/ft
        n  = Mannings n
        Tc = Time of concentration, hrs
        Lf = Flow length, ft
```

```
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TIME OF CONCENTRATION CALCULATOR
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------------------------------------------------------------------------

Segment #1:  Tc: TR-55 Sheet

Mannings n           .1500
Hydraulic Length    80.00 ft
2yr, 24hr P        3.8000 in
Slope             .330000 ft/ft

Avg.Velocity          .54 ft/sec

                                         Segment #1 Time:     .0408 hrs
------------------------------------------------------------------------

Segment #2:  Tc: TR-55 Channel

Flow Area         10.0000 sq.ft
Wetted Perimeter    20.19 ft
Hydraulic Radius      .50 ft
Slope             .005000 ft/ft
Mannings n          .0650
Hydraulic Length  2760.00 ft

Avg.Velocity         1.01 ft/sec

                                         Segment #2 Time:     .7556 hrs
------------------------------------------------------------------------

                                               =========================
                                                Total Tc:     .7964 hrs
                                               =========================
```

```
------------------------------------------------------------------------
Tc Equations used...
------------------------------------------------------------------------


==== SCS TR-55 Sheet Flow ==============================================

     Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

     Where:  Tc = Time of concentration, hrs
             n  = Mannings n
             Lf = Flow length, ft
             P  = 2yr, 24hr Rain depth, inches
             Sf = Slope, %


==== SCS Channel Flow ==================================================

     R  = Aq / Wp
     V  = (1.49 * (R**(2/3)) * (Sf**-0.5)) / n

     Tc = (Lf / V) / (3600sec/hr)

     Where:  R  = Hydraulic radius
             Aq = Flow area, sq.ft.
             Wp = Wetted perimeter, ft
             V  = Velocity, ft/sec
             Sf = Slope, ft/ft
             n  = Mannings n
             Tc = Time of concentration, hrs
             Lf = Flow length, ft
```

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.1500	
Hydraulic Length	80.00	ft
2yr, 24hr P	3.8000	in
Slope	.330000	ft/ft
Avg.Velocity	.54	ft/sec

Segment #1 Time: .0408 hrs

Segment #2: Tc: TR-55 Channel

Flow Area	10.0000	sq.ft
Wetted Perimeter	20.10	ft
Hydraulic Radius	.50	ft
Slope	.005000	ft/ft
Mannings n	.0650	
Hydraulic Length	3150.00	ft
Avg.Velocity	1.02	ft/sec

Segment #2 Time: .8598 hrs

=========================
Total Tc: .9006 hrs
=========================

```
------------------------------------------------------------------------
Tc Equations used...
------------------------------------------------------------------------


==== SCS TR-55 Sheet Flow ==============================================

     Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

     Where:  Tc = Time of concentration, hrs
             n  = Mannings n
             Lf = Flow length, ft
             P  = 2yr, 24hr Rain depth, inches
             Sf = Slope, %


==== SCS Channel Flow ==================================================

     R  = Aq / Wp
     V  = (1.49 * (R**(2/3)) * (Sf**-0.5)) / n

     Tc = (Lf / V) / (3600sec/hr)

     Where:  R  = Hydraulic radius
             Aq = Flow area, sq.ft.
             Wp = Wetted perimeter, ft
             V  = Velocity, ft/sec
             Sf = Slope, ft/ft
             n  = Mannings n
             Tc = Time of concentration, hrs
             Lf = Flow length, ft
```

```
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TIME OF CONCENTRATION CALCULATOR
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------------------------------------------------------------------------

Segment #1:  Tc: TR-55 Sheet

Mannings n           .1500
Hydraulic Length    80.00 ft
2yr, 24hr P        3.8000 in
Slope             .310000 ft/ft

Avg.Velocity          .53 ft/sec

                                        Segment #1 Time:     .0419 hrs
------------------------------------------------------------------------

Segment #2:  Tc: TR-55 Channel

Flow Area          6.2900 sq.ft
Wetted Perimeter     9.95 ft
Hydraulic Radius      .63 ft
Slope             .000500 ft/ft
Mannings n          .0400
Hydraulic Length  1360.00 ft

Avg.Velocity          .61 ft/sec

                                        Segment #2 Time:     .6158 hrs
------------------------------------------------------------------------

                                              =========================
                                               Total Tc:     .6576 hrs
                                              =========================
```

```
-----------------------------------------------------------------------
Tc Equations used...
-----------------------------------------------------------------------


==== SCS TR-55 Sheet Flow ==============================================

     Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

     Where:  Tc = Time of concentration, hrs
             n  = Mannings n
             Lf = Flow length, ft
             P  = 2yr, 24hr Rain depth, inches
             Sf = Slope, %


==== SCS Channel Flow ==================================================

     R  = Aq / Wp
     V  = (1.49 * (R**(2/3)) * (Sf**-0.5)) / n

     Tc = (Lf / V) / (3600sec/hr)

     Where:  R  = Hydraulic radius
             Aq = Flow area, sq.ft.
             Wp = Wetted perimeter, ft
             V  = Velocity, ft/sec
             Sf = Slope, ft/ft
             n  = Mannings n
             Tc = Time of concentration, hrs
             Lf = Flow length, ft
```

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: User Defined

Segment #1 Time: .0830 hrs

=========================
Total Tc: .0830 hrs

Calculated Tc < Min.Tc:
Use Minimum Tc...
Use Tc = .0833 hrs
=========================

Tc Equations used...

==== User Defined ==

Tc = Value entered by user

Where: Tc = Time of concentration

```
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
TIME OF CONCENTRATION CALCULATOR
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------------------------------------------------------------------------

Segment #1:  Tc: TR-55 Sheet

Mannings n          .1500
Hydraulic Length   100.00 ft
2yr, 24hr P        3.8000 in
Slope             .030000 ft/ft

Avg.Velocity          .22 ft/sec

                                         Segment #1 Time:     .1274 hrs
------------------------------------------------------------------------

Segment #2:  Tc: TR-55 Channel

Flow Area         10.0000 sq.ft
Wetted Perimeter    20.19 ft
Hydraulic Radius      .50 ft
Slope             .005000 ft/ft
Mannings n          .0650
Hydraulic Length  1870.00 ft

Avg.Velocity         1.01 ft/sec

                                         Segment #2 Time:     .5119 hrs
------------------------------------------------------------------------

Segment #3:  Tc: TR-55 Shallow

Hydraulic Length   250.00 ft
Slope             .030000 ft/ft
Unpaved

Avg.Velocity         2.79 ft/sec

                                         Segment #3 Time:     .0248 hrs
------------------------------------------------------------------------

                                               =========================
                                                Total Tc:     .6642 hrs
                                               =========================
```

```
-----------------------------------------------------------------------
Tc Equations used...
-----------------------------------------------------------------------


==== SCS TR-55 Sheet Flow ==============================================

     Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

     Where:  Tc = Time of concentration, hrs
             n  = Mannings n
             Lf = Flow length, ft
             P  = 2yr, 24hr Rain depth, inches
             Sf = Slope, %


==== SCS TR-55 Shallow Concentrated Flow ===============================

     Unpaved surface:
     V  = 16.1345 * (Sf**0.5)

     Paved surface:
     V  = 20.3282 * (Sf**0.5)

     Tc = (Lf / V) / (3600sec/hr)

     Where:  V  = Velocity, ft/sec
             Sf = Slope, ft/ft
             Tc = Time of concentration, hrs
             Lf = Flow length, ft
```

```
==== SCS Channel Flow ==================================================

     R  = Aq / Wp
     V  = (1.49 * (R**(2/3)) * (Sf**-0.5)) / n

     Tc = (Lf / V) / (3600sec/hr)

     Where:  R  = Hydraulic radius
             Aq = Flow area, sq.ft.
             Wp = Wetted perimeter, ft
             V  = Velocity, ft/sec
             Sf = Slope, ft/ft
             n  = Mannings n
             Tc = Time of concentration, hrs
             Lf = Flow length, ft
```

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TIME OF CONCENTRATION CALCULATOR
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------------------------------------------------------------------------


Segment #1:  Tc: TR-55 Sheet

Mannings n           .1500
Hydraulic Length    50.00 ft
2yr, 24hr P        3.8000 in
Slope             .330000 ft/ft

Avg.Velocity          .50 ft/sec

                                        Segment #1 Time:     .0280 hrs
------------------------------------------------------------------------

Segment #2:  Tc: TR-55 Channel

Flow Area         10.0000 sq.ft
Wetted Perimeter    20.19 ft
Hydraulic Radius      .50 ft
Slope             .005000 ft/ft
Mannings n          .0650
Hydraulic Length  1520.00 ft

Avg.Velocity         1.01 ft/sec

                                        Segment #2 Time:     .4161 hrs
------------------------------------------------------------------------

                                              =========================
                                               Total Tc:     .4442 hrs
                                              =========================
```

```
------------------------------------------------------------------------
Tc Equations used...
------------------------------------------------------------------------


==== SCS TR-55 Sheet Flow ===============================================

     Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

     Where:  Tc = Time of concentration, hrs
             n  = Mannings n
             Lf = Flow length, ft
             P  = 2yr, 24hr Rain depth, inches
             Sf = Slope, %


==== SCS Channel Flow ===================================================

     R  = Aq / Wp
     V  = (1.49 * (R**(2/3)) * (Sf**-0.5)) / n

     Tc = (Lf / V) / (3600sec/hr)

     Where:  R  = Hydraulic radius
             Aq = Flow area, sq.ft.
             Wp = Wetted perimeter, ft
             V  = Velocity, ft/sec
             Sf = Slope, ft/ft
             n  = Mannings n
             Tc = Time of concentration, hrs
             Lf = Flow length, ft
```

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TIME OF CONCENTRATION CALCULATOR
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------------------------------------------------------------------------

Segment #1:  Tc: TR-55 Sheet

Mannings n           .1500
Hydraulic Length    80.00 ft
2yr, 24hr P        3.8000 in
Slope             .330000 ft/ft

Avg.Velocity          .54 ft/sec

                                        Segment #1 Time:      .0408 hrs
------------------------------------------------------------------------

Segment #2:  Tc: TR-55 Channel

Flow Area         10.0000 sq.ft
Wetted Perimeter    20.19 ft
Hydraulic Radius      .50 ft
Slope             .005000 ft/ft
Mannings n          .0650
Hydraulic Length  1380.00 ft

Avg.Velocity         1.01 ft/sec

                                        Segment #2 Time:      .3778 hrs
------------------------------------------------------------------------

                                              =========================
                                               Total Tc:      .4186 hrs
                                              =========================
```

```
------------------------------------------------------------------------
Tc Equations used...
------------------------------------------------------------------------


==== SCS TR-55 Sheet Flow ==============================================

     Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

     Where:  Tc = Time of concentration, hrs
             n  = Mannings n
             Lf = Flow length, ft
             P  = 2yr, 24hr Rain depth, inches
             Sf = Slope, %


==== SCS Channel Flow ==================================================

     R  = Aq / Wp
     V  = (1.49 * (R**(2/3)) * (Sf**-0.5)) / n

     Tc = (Lf / V) / (3600sec/hr)

     Where:  R  = Hydraulic radius
             Aq = Flow area, sq.ft.
             Wp = Wetted perimeter, ft
             V  = Velocity, ft/sec
             Sf = Slope, ft/ft
             n  = Mannings n
             Tc = Time of concentration, hrs
             Lf = Flow length, ft
```

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TIME OF CONCENTRATION CALCULATOR
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------------------------------------------------------------------------


Segment #1:  Tc: TR-55 Sheet

Mannings n           .1500
Hydraulic Length    80.00 ft
2yr, 24hr P        3.8000 in
Slope             .330000 ft/ft

Avg.Velocity          .54 ft/sec

                                         Segment #1 Time:     .0408 hrs
------------------------------------------------------------------------

Segment #2:  Tc: TR-55 Channel

Flow Area         27.0000 sq.ft
Wetted Perimeter    22.98 ft
Hydraulic Radius     1.17 ft
Slope             .000500 ft/ft
Mannings n          .0400
Hydraulic Length  1480.00 ft

Avg.Velocity          .93 ft/sec

                                         Segment #2 Time:     .4433 hrs
------------------------------------------------------------------------

                                               =========================
                                                Total Tc:     .4841 hrs
                                               =========================
```

```
------------------------------------------------------------------------
Tc Equations used...
------------------------------------------------------------------------


==== SCS TR-55 Sheet Flow ==============================================

     Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

     Where:  Tc = Time of concentration, hrs
             n  = Mannings n
             Lf = Flow length, ft
             P  = 2yr, 24hr Rain depth, inches
             Sf = Slope, %


==== SCS Channel Flow ==================================================

     R  = Aq / Wp
     V  = (1.49 * (R**(2/3)) * (Sf**-0.5)) / n

     Tc = (Lf / V) / (3600sec/hr)

     Where:  R  = Hydraulic radius
             Aq = Flow area, sq.ft.
             Wp = Wetted perimeter, ft
             V  = Velocity, ft/sec
             Sf = Slope, ft/ft
             n  = Mannings n
             Tc = Time of concentration, hrs
             Lf = Flow length, ft
```

```
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TIME OF CONCENTRATION CALCULATOR
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------------------------------------------------------------------------

Segment #1:  Tc: TR-55 Sheet

Mannings n           .1500
Hydraulic Length   100.00 ft
2yr, 24hr P        3.8000 in
Slope             .030000 ft/ft

Avg.Velocity          .22 ft/sec

                                        Segment #1 Time:      .1274 hrs
------------------------------------------------------------------------

Segment #2:  Tc: TR-55 Channel

Flow Area         10.0000 sq.ft
Wetted Perimeter    20.19 ft
Hydraulic Radius      .50 ft
Slope             .005000 ft/ft
Mannings n          .0650
Hydraulic Length  1900.00 ft

Avg.Velocity         1.01 ft/sec

                                        Segment #2 Time:      .5201 hrs
------------------------------------------------------------------------

Segment #3:  Tc: TR-55 Shallow

Hydraulic Length   620.00 ft
Slope             .030000 ft/ft
Unpaved

Avg.Velocity         2.79 ft/sec

                                        Segment #3 Time:      .0616 hrs
------------------------------------------------------------------------

                                              =========================
                                               Total Tc:      .7092 hrs
                                              =========================
```

```
------------------------------------------------------------------------
Tc Equations used...
------------------------------------------------------------------------


==== SCS TR-55 Sheet Flow ================================================

     Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

     Where:  Tc = Time of concentration, hrs
             n  = Mannings n
             Lf = Flow length, ft
             P  = 2yr, 24hr Rain depth, inches
             Sf = Slope, %


==== SCS TR-55 Shallow Concentrated Flow ================================

     Unpaved surface:
     V  = 16.1345 * (Sf**0.5)

     Paved surface:
     V  = 20.3282 * (Sf**0.5)

     Tc = (Lf / V) / (3600sec/hr)

     Where:  V  = Velocity, ft/sec
             Sf = Slope, ft/ft
             Tc = Time of concentration, hrs
             Lf = Flow length, ft
```

```
==== SCS Channel Flow ==================================================

     R  = Aq / Wp
     V  = (1.49 * (R**(2/3)) * (Sf**-0.5)) / n

     Tc = (Lf / V) / (3600sec/hr)

     Where:  R  = Hydraulic radius
             Aq = Flow area, sq.ft.
             Wp = Wetted perimeter, ft
             V  = Velocity, ft/sec
             Sf = Slope, ft/ft
             n  = Mannings n
             Tc = Time of concentration, hrs
             Lf = Flow length, ft
```

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TIME OF CONCENTRATION CALCULATOR
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----------------------------------------------------------------------

Segment #1:  Tc: TR-55 Sheet

Mannings n          .1500
Hydraulic Length    50.00 ft
2yr, 24hr P        3.8000 in
Slope            .330000 ft/ft

Avg.Velocity          .50 ft/sec

                                        Segment #1 Time:     .0280 hrs
----------------------------------------------------------------------

Segment #2:  Tc: TR-55 Channel

Flow Area         10.0000 sq.ft
Wetted Perimeter    20.19 ft
Hydraulic Radius      .50 ft
Slope            .005000 ft/ft
Mannings n          .0650
Hydraulic Length  1580.00 ft

Avg.Velocity         1.01 ft/sec

                                        Segment #2 Time:     .4325 hrs
----------------------------------------------------------------------

                                              =========================
                                               Total Tc:     .4606 hrs
                                              =========================
```

```
-----------------------------------------------------------------------
Tc Equations used...
-----------------------------------------------------------------------


==== SCS TR-55 Sheet Flow ==============================================

     Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

     Where:  Tc = Time of concentration, hrs
             n  = Mannings n
             Lf = Flow length, ft
             P  = 2yr, 24hr Rain depth, inches
             Sf = Slope, %


==== SCS Channel Flow ==================================================

     R  = Aq / Wp
     V  = (1.49 * (R**(2/3)) * (Sf**-0.5)) / n

     Tc = (Lf / V) / (3600sec/hr)

     Where:  R  = Hydraulic radius
             Aq = Flow area, sq.ft.
             Wp = Wetted perimeter, ft
             V  = Velocity, ft/sec
             Sf = Slope, ft/ft
             n  = Mannings n
             Tc = Time of concentration, hrs
             Lf = Flow length, ft
```

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TIME OF CONCENTRATION CALCULATOR
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------------------------------------------------------------------------

Segment #1:  Tc: TR-55 Sheet

Mannings n          .1500
Hydraulic Length    80.00 ft
2yr, 24hr P        3.8000 in
Slope             .005000 ft/ft

Avg.Velocity          .10 ft/sec

                                        Segment #1 Time:     .2183 hrs
------------------------------------------------------------------------

Segment #2:  Tc: TR-55 Channel

Flow Area         10.0000 sq.ft
Wetted Perimeter    20.19 ft
Hydraulic Radius      .50 ft
Slope             .005000 ft/ft
Mannings n          .0650
Hydraulic Length  1690.00 ft

Avg.Velocity         1.01 ft/sec

                                        Segment #2 Time:     .4626 hrs
------------------------------------------------------------------------

                                              =========================
                                               Total Tc:     .6809 hrs
                                              =========================
```

```
------------------------------------------------------------------------
Tc Equations used...
------------------------------------------------------------------------


==== SCS TR-55 Sheet Flow ===============================================

     Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

     Where:  Tc = Time of concentration, hrs
             n  = Mannings n
             Lf = Flow length, ft
             P  = 2yr, 24hr Rain depth, inches
             Sf = Slope, %


==== SCS Channel Flow ===================================================

     R  = Aq / Wp
     V  = (1.49 * (R**(2/3)) * (Sf**-0.5)) / n

     Tc = (Lf / V) / (3600sec/hr)

     Where:  R  = Hydraulic radius
             Aq = Flow area, sq.ft.
             Wp = Wetted perimeter, ft
             V  = Velocity, ft/sec
             Sf = Slope, ft/ft
             n  = Mannings n
             Tc = Time of concentration, hrs
             Lf = Flow length, ft
```

```
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
TIME OF CONCENTRATION CALCULATOR
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::


----------------------------------------------------------------------


Segment #1:  Tc: TR-55 Sheet

Mannings n            .1500
Hydraulic Length    80.00 ft
2yr, 24hr P        3.8000 in
Slope             .330000 ft/ft

Avg.Velocity          .54 ft/sec

                                        Segment #1 Time:     .0408 hrs
----------------------------------------------------------------------

Segment #2:  Tc: TR-55 Channel

Flow Area         27.0000 sq.ft
Wetted Perimeter    22.98 ft
Hydraulic Radius     1.17 ft
Slope             .000500 ft/ft
Mannings n          .0400
Hydraulic Length  1580.00 ft

Avg.Velocity          .93 ft/sec

                                        Segment #2 Time:     .4732 hrs
----------------------------------------------------------------------

                                              =========================
                                               Total Tc:     .5141 hrs
                                              =========================
```

```
------------------------------------------------------------------------
Tc Equations used...
------------------------------------------------------------------------


==== SCS TR-55 Sheet Flow ===============================================

     Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

     Where:  Tc = Time of concentration, hrs
             n  = Mannings n
             Lf = Flow length, ft
             P  = 2yr, 24hr Rain depth, inches
             Sf = Slope, %


==== SCS Channel Flow ===================================================

     R  = Aq / Wp
     V  = (1.49 * (R**(2/3)) * (Sf**-0.5)) / n

     Tc = (Lf / V) / (3600sec/hr)

     Where:  R  = Hydraulic radius
             Aq = Flow area, sq.ft.
             Wp = Wetted perimeter, ft
             V  = Velocity, ft/sec
             Sf = Slope, ft/ft
             n  = Mannings n
             Tc = Time of concentration, hrs
             Lf = Flow length, ft
```

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	Impervious Adjustment %UC	Adjusted CN
	79	3.890			79.00
COMPOSITE AREA & WEIGHTED CN --->		3.890			79.00 (79)

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RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	Impervious Adjustment %UC	Adjusted CN
	79	2.560			79.00
COMPOSITE AREA & WEIGHTED CN --->		2.560			79.00 (79)

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	Impervious Adjustment %UC	Adjusted CN
	79	1.820			79.00
COMPOSITE AREA & WEIGHTED CN --->		1.820			79.00 (79)

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	Impervious Adjustment %UC	Adjusted CN
	79	4.040			79.00
COMPOSITE AREA & WEIGHTED CN --->		4.040			79.00 (79)

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	Impervious Adjustment %UC	Adjusted CN
	79	15.930			79.00
COMPOSITE AREA & WEIGHTED CN --->		15.930			79.00 (79)

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	Impervious Adjustment %UC	Adjusted CN
	79	4.180			79.00
COMPOSITE AREA & WEIGHTED CN --->		4.180			79.00 (79)

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RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	Impervious Adjustment %UC	Adjusted CN
	79	16.180			79.00
COMPOSITE AREA & WEIGHTED CN --->		16.180			79.00 (79)

RUNOFF CURVE NUMBER DATA
::

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	Impervious Adjustment %UC	Adjusted CN
	79	20.960			79.00
COMPOSITE AREA & WEIGHTED CN --->		20.960			79.00 (79)

::

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	Impervious Adjustment %UC	Adjusted CN
	79	4.190			79.00
COMPOSITE AREA & WEIGHTED CN --->		4.190			79.00 (79)

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	Impervious Adjustment %UC	Adjusted CN
	79	11.220			79.00
COMPOSITE AREA & WEIGHTED CN --->		11.220			79.00 (79)

RUNOFF CURVE NUMBER DATA

::

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	Impervious Adjustment %UC	Adjusted CN
	79	12.080			79.00
COMPOSITE AREA & WEIGHTED CN --->		12.080			79.00 (79)

::

RUNOFF CURVE NUMBER DATA

::

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	Impervious Adjustment %UC	Adjusted CN
	79	15.360			79.00
COMPOSITE AREA & WEIGHTED CN --->		15.360			79.00 (79)

::

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	Impervious Adjustment %UC	Adjusted CN
	98	21.500			98.00
COMPOSITE AREA & WEIGHTED CN --->		21.500			98.00 (98)

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	Impervious Adjustment %UC	Adjusted CN
	79	27.520			79.00
COMPOSITE AREA & WEIGHTED CN --->		27.520			79.00 (79)

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	Impervious Adjustment %UC	Adjusted CN
	79	2.380			79.00
COMPOSITE AREA & WEIGHTED CN --->		2.380			79.00 (79)

Name.... SE4+EXS4+SW4

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RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	Impervious Adjustment %UC	Adjusted CN
	79	7.060			79.00
COMPOSITE AREA & WEIGHTED CN --->		7.060			79.00 (79)

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	Impervious Adjustment %UC	Adjusted CN
	79	5.840			79.00
COMPOSITE AREA & WEIGHTED CN --->		5.840			79.00 (79)

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	Impervious Adjustment %UC	Adjusted CN
	79	30.660			79.00
COMPOSITE AREA & WEIGHTED CN --->		30.660			79.00 (79)

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	Impervious Adjustment %UC	Adjusted CN
	79	2.190			79.00
COMPOSITE AREA & WEIGHTED CN --->		2.190			79.00 (79)

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	Impervious Adjustment %UC	Adjusted CN
	79	6.400			79.00
COMPOSITE AREA & WEIGHTED CN --->		6.400			79.00 (79)

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	Impervious Adjustment %UC	Adjusted CN
	79	6.520			79.00
COMPOSITE AREA & WEIGHTED CN --->		6.520			79.00 (79)

SCS UNIT HYDROGRAPH METHOD
(Computational Notes)

DEFINITION OF TERMS: ---

```
  At     = Total area (acres):  At = Ai+Ap
  Ai     = Impervious area (acres)
  Ap     = Pervious area (acres)
  CNi    = Runoff curve number for impervious area
  CNp    = Runoff curve number for pervious area
  fLoss  = f loss constant infiltration (depth/time)
  gKs    = Saturated Hydraulic Conductivity (depth/time)
  Md     = Volumetric Moisture Deficit
  Psi    = Capillary Suction (length)
  hK     = Horton Infiltration Decay Rate (time^-1)
  fo     = Initial Infiltration Rate (depth/time)
  fc     = Ultimate(capacity)Infiltration Rate (depth/time)
  Ia     = Initial Abstraction (length)
  dt     = Computational increment (duration of unit excess rainfall)
           Default dt is smallest value of 0.1333Tc, rtm, and th
           (Smallest dt is then adjusted to match up with Tp)
UDdt     = User specified override computational main time increment
           (only used if UDdt is => .1333Tc)
  D(t)   = Point on distribution curve (fraction of P) for time step t

  K      = 2 / (1 + (Tr/Tp)):  default K = 0.75: (for Tr/Tp = 1.67)
  Ks     = Hydrograph shape factor
         = Unit Conversions * K:
         = ((1hr/3600sec) * (1ft/12in) * ((5280ft)**2/sq.mi)) * K
           Default Ks = 645.333 * 0.75 = 484

  Lag    = Lag time from center of excess runoff (dt) to Tp:  Lag = 0.6Tc
  P      = Total precipitation depth, inches
  Pa(t)  = Accumulated rainfall at time step t
  Pi(t)  = Incremental rainfall at time step t
  qp     = Peak discharge (cfs) for 1in. runoff, for 1hr, for 1 sq.mi.
         = (Ks * A * Q) / Tp   (where Q = 1in. runoff, A=sq.mi.)
  Qu(t)  = Unit hydrograph ordinate (cfs) at time step t
  Q(t)   = Final hydrograph ordinate (cfs) at time step t
  Rai(t)= Accumulated runoff (inches) at time step t for impervious area
  Rap(t)= Accumulated runoff (inches) at time step t for pervious area
  Rii(t)= Incremental runoff (inches) at time step t for impervious area
  Rip(t)= Incremental runoff (inches) at time step t for pervious area
  R(t)   = Incremental weighted total runoff (inches)
  Rtm    = Time increment for rainfall table
  Si     = S for impervious area:  Si = (1000/CNi) - 10
  Sp     = S for pervious area:    Sp = (1000/CNp) - 10
  t      = Time step (row) number
  Tc     = Time of concentration
  Tb     = Time (hrs) of entire unit hydrograph:  Tb = Tp + Tr
  Tp     = Time (hrs) to peak of a unit hydrograph:  Tp = (dt/2) + Lag
  Tr     = Time (hrs) of receding limb of unit hydrograph:  Tr = ratio of Tp
```

```
                        SCS UNIT HYDROGRAPH METHOD
                          (Computational Notes)

PRECIPITATION: ------------------------------------------------------------
Column (1):  Time for time step t
Column (2):  D(t)  = Point on distribution curve for time step t
Column (3):  Pi(t) = Pa(t) - Pa(t-1): Col.(4) - Preceding Col.(4)
Column (4):  Pa(t) = D(t) x P:        Col.(2) x P


PERVIOUS AREA RUNOFF (using SCS Runoff CN Method) -------------------------
Column (5):  Rap(t) = Accumulated pervious runoff for time step t
             If (Pa(t) is <= 0.2Sp) then use: Rap(t) = 0.0
             If (Pa(t) is >  0.2Sp) then use:

             Rap(t) = (Col.(4)-0.2Sp)**2 / (Col.(4)+0.8Sp)

Column (6):  Rip(t) = Incremental pervious runoff for time step t
             Rip(t) =         Rap(t)          -         Rap(t-1)
             Rip(t) = Col.(5) for current row - Col.(5) for preceding row.

IMPERVIOUS AREA RUNOFF ----------------------------------------------------
Column (7 & 8)... Did not specify to use impervious areas.


INCREMENTAL WEIGHTED RUNOFF: ----------------------------------------------
Column (9):  R(t)  = (Ap/At) x Rip(t)   +  (Ai/At) x Rii(t)
             R(t)  = (Ap/At) x Col.(6)  +  (Ai/At) x Col.(8)


SCS UNIT HYDROGRAPH METHOD: -----------------------------------------------
Column (10): Q(t)   is computed with the SCS unit hydrograph method
                    using R() and Qu().
```

```
SCS UNIT HYDROGRAPH METHOD
Calc.Method Option =  1
STORM EVENT: 25 year storm
Duration      = 24.0000 hrs     Rain Depth = 7.2000 in
Rain Dir      = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Rain File -ID =  - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir       = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
HYG File - ID =  - EX-N6 Dev 25
Tc            = .3106 hrs
Drainage Area = 3.890 acres  Runoff CN= 79

============================================
Computational Time Increment   =   .00500 hrs
Computed Peak Time             =  12.2150 hrs
Computed Peak Flow             =    15.13 cfs

Time Increment for HYG File    =    .0050 hrs
Peak Time, Interpolated Output =  12.2152 hrs
Peak Flow, Interpolated Output =    15.13 cfs
============================================

                 DRAINAGE AREA
              -------------------
              ID:EX-N6
              CN   =   79
              Area =       3.890 acres
              S    =   2.6582 in
              0.2S =    .5316 in

               Cumulative Runoff
              -------------------
                      4.7678 in
                       1.546 ac-ft

HYG Volume...          1.546 ac-ft (area under HYG curve)

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

Time Concentration, Tc =   .31056 hrs (ID: EX-N6)
Computational Incr, Tm =   .00500 hrs = 0.02648 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 =    15.56 cfs
Unit peak time      Tp =   .18884 hrs
Unit receding limb, Tr =   .75534 hrs
Total unit time,    Tb =   .94418 hrs
```

```
SCS UNIT HYDROGRAPH METHOD
Calc.Method Option =  1
STORM EVENT: 25 year storm
Duration      = 24.0000 hrs     Rain Depth = 7.2000 in
Rain Dir      = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Rain File -ID =  - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir       = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
HYG File - ID =  - EX-N7 Dev 25
Tc            = .2323 hrs
Drainage Area = 2.560 acres  Runoff CN= 79

============================================
Computational Time Increment   =   .00500 hrs
Computed Peak Time             =  12.1700 hrs
Computed Peak Flow             =    10.84 cfs

Time Increment for HYG File    =    .0050 hrs
Peak Time, Interpolated Output =  12.1702 hrs
Peak Flow, Interpolated Output =    10.84 cfs
============================================

                DRAINAGE AREA
              -------------------
              ID:EX-N7
              CN   =   79
              Area =       2.560 acres
              S    =   2.6582 in
              0.2S =    .5316 in

               Cumulative Runoff
              -------------------
                      4.7678 in
                       1.017 ac-ft

HYG Volume...          1.017 ac-ft (area under HYG curve)

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

Time Concentration, Tc =   .23235 hrs (ID: EX-N7)
Computational Incr, Tm =   .00500 hrs = 0.03523 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 =    13.63 cfs
Unit peak time      Tp =   .14191 hrs
Unit receding limb, Tr =   .56763 hrs
Total unit time,    Tb =   .70954 hrs
```

```
SCS UNIT HYDROGRAPH METHOD
Calc.Method Option =  1
STORM EVENT: 25 year storm
Duration      = 24.0000 hrs     Rain Depth = 7.2000 in
Rain Dir      = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Rain File -ID =  - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir       = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
HYG File - ID =  - EX-S6 Dev 25
Tc            = .2517 hrs
Drainage Area = 1.820 acres  Runoff CN= 79

============================================
Computational Time Increment   =   .00500 hrs
Computed Peak Time             =  12.1800 hrs
Computed Peak Flow             =     7.54 cfs

Time Increment for HYG File    =    .0050 hrs
Peak Time, Interpolated Output =  12.1802 hrs
Peak Flow, Interpolated Output =     7.54 cfs
============================================

                 DRAINAGE AREA
              -------------------
              ID:EX-S6
              CN   =   79
              Area =       1.820 acres
              S    =   2.6582 in
              0.2S =    .5316 in

               Cumulative Runoff
              -------------------
                      4.7678 in
                        .723 ac-ft

HYG Volume...           .723 ac-ft (area under HYG curve)

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

Time Concentration, Tc =   .25174 hrs (ID: EX-S6)
Computational Incr, Tm =   .00500 hrs = 0.03256 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 =     8.95 cfs
Unit peak time      Tp =   .15354 hrs
Unit receding limb, Tr =   .61417 hrs
Total unit time,    Tb =   .76771 hrs
```

```
SCS UNIT HYDROGRAPH METHOD
Calc.Method Option =  1
STORM EVENT: 25 year storm
Duration      = 24.0000 hrs     Rain Depth = 7.2000 in
Rain Dir      = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Rain File -ID =  - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir       = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
HYG File - ID =  - EX-S7 Dev 25
Tc            = .3161 hrs
Drainage Area = 4.040 acres  Runoff CN= 79

============================================
Computational Time Increment   =   .00500 hrs
Computed Peak Time             =  12.2200 hrs
Computed Peak Flow             =    15.63 cfs

Time Increment for HYG File    =    .0050 hrs
Peak Time, Interpolated Output =  12.2202 hrs
Peak Flow, Interpolated Output =    15.62 cfs
============================================

                DRAINAGE AREA
              -------------------
              ID:EX-S7
              CN   =   79
              Area =       4.040 acres
              S    =   2.6582 in
              0.2S =    .5316 in

               Cumulative Runoff
              -------------------
                     4.7678 in
                      1.605 ac-ft

HYG Volume...           1.605 ac-ft (area under HYG curve)

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

Time Concentration, Tc =   .31613 hrs (ID: EX-S7)
Computational Incr, Tm =   .00500 hrs = 0.02602 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 =    15.88 cfs
Unit peak time      Tp =   .19218 hrs
Unit receding limb, Tr =   .76871 hrs
Total unit time,    Tb =   .96089 hrs
```

```
SCS UNIT HYDROGRAPH METHOD
Calc.Method Option =  1
STORM EVENT: 25 year storm
Duration      = 24.0000 hrs     Rain Depth = 7.2000 in
Rain Dir      = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Rain File -ID =  - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir       = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
HYG File - ID =  - NE Dev 25
Tc            = .5002 hrs
Drainage Area = 15.930 acres  Runoff CN= 79

============================================
Computational Time Increment   =   .00500 hrs
Computed Peak Time             =  12.3400 hrs
Computed Peak Flow             =    51.78 cfs

Time Increment for HYG File    =    .0050 hrs
Peak Time, Interpolated Output =  12.3402 hrs
Peak Flow, Interpolated Output =    51.78 cfs
============================================

                 DRAINAGE AREA
              -------------------
              ID:NE
              CN   =   79
              Area =      15.930 acres
              S    =   2.6582 in
              0.2S =    .5316 in

               Cumulative Runoff
              -------------------
                      4.7678 in
                       6.329 ac-ft

HYG Volume...          6.329 ac-ft (area under HYG curve)

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

Time Concentration, Tc =   .50023 hrs (ID: NE)
Computational Incr, Tm =   .00500 hrs = 0.01652 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 =    39.76 cfs
Unit peak time      Tp =   .30264 hrs
Unit receding limb, Tr =  1.21055 hrs
Total unit time,    Tb =  1.51318 hrs
```

```
SCS UNIT HYDROGRAPH METHOD
Calc.Method Option =  1
STORM EVENT: 25 year storm
Duration      = 24.0000 hrs     Rain Depth = 7.2000 in
Rain Dir      = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Rain File -ID =  - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir       = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
HYG File - ID =  - NE3 Dev 25
Tc            = .6905 hrs
Drainage Area = 4.180 acres  Runoff CN= 79

============================================
Computational Time Increment   =   .00500 hrs
Computed Peak Time             =  12.4650 hrs
Computed Peak Flow             =    11.76 cfs

Time Increment for HYG File    =    .0050 hrs
Peak Time, Interpolated Output =  12.4652 hrs
Peak Flow, Interpolated Output =    11.76 cfs
============================================

                 DRAINAGE AREA
              -------------------
              ID:NE3
              CN   =   79
              Area =       4.180 acres
              S    =   2.6582 in
              0.2S =    .5316 in

               Cumulative Runoff
              -------------------
                      4.7678 in
                       1.661 ac-ft

HYG Volume...          1.661 ac-ft (area under HYG curve)

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

Time Concentration, Tc =   .69053 hrs (ID: NE3)
Computational Incr, Tm =   .00500 hrs = 0.01200 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 =     7.57 cfs
Unit peak time      Tp =   .41682 hrs
Unit receding limb, Tr =  1.66728 hrs
Total unit time,    Tb =  2.08410 hrs
```

```
SCS UNIT HYDROGRAPH METHOD
Calc.Method Option =  1
STORM EVENT: 25 year storm
Duration      = 24.0000 hrs     Rain Depth = 7.2000 in
Rain Dir      = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Rain File -ID =  - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir       = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
HYG File - ID =  - NE7 Dev 25
Tc            = .4557 hrs
Drainage Area = 16.180 acres  Runoff CN= 79

============================================
Computational Time Increment   =   .00500 hrs
Computed Peak Time             =  12.3100 hrs
Computed Peak Flow             =    54.66 cfs

Time Increment for HYG File    =    .0050 hrs
Peak Time, Interpolated Output =  12.3102 hrs
Peak Flow, Interpolated Output =    54.66 cfs
============================================

                 DRAINAGE AREA
              -------------------
              ID:NE7
              CN   =   79
              Area =      16.180 acres
              S    =   2.6582 in
              0.2S =    .5316 in

               Cumulative Runoff
              -------------------
                      4.7678 in
                       6.429 ac-ft

HYG Volume...          6.429 ac-ft (area under HYG curve)

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

Time Concentration, Tc =   .45567 hrs (ID: NE7)
Computational Incr, Tm =   .00500 hrs = 0.01812 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 =    44.30 cfs
Unit peak time      Tp =   .27590 hrs
Unit receding limb, Tr =  1.10360 hrs
Total unit time,    Tb =  1.37950 hrs
```

```
SCS UNIT HYDROGRAPH METHOD
Calc.Method Option =  1
STORM EVENT: 25 year storm
Duration      = 24.0000 hrs     Rain Depth = 7.2000 in
Rain Dir      = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Rain File -ID =  - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir       = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
HYG File - ID =  - NW Dev 25
Tc            = .8775 hrs
Drainage Area = 20.960 acres  Runoff CN= 79

============================================
Computational Time Increment   =   .00500 hrs
Computed Peak Time             =  12.5850 hrs
Computed Peak Flow             =    52.27 cfs

Time Increment for HYG File    =    .0050 hrs
Peak Time, Interpolated Output =  12.5852 hrs
Peak Flow, Interpolated Output =    52.27 cfs
============================================

                 DRAINAGE AREA
              -------------------
              ID:NW
              CN   =   79
              Area =      20.960 acres
              S    =   2.6582 in
              0.2S =    .5316 in

               Cumulative Runoff
              -------------------
                      4.7678 in
                       8.328 ac-ft

HYG Volume...          8.328 ac-ft (area under HYG curve)

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

Time Concentration, Tc =   .87746 hrs (ID: NW)
Computational Incr, Tm =   .00500 hrs = 0.00945 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 =    29.93 cfs
Unit peak time      Tp =   .52898 hrs
Unit receding limb, Tr =  2.11591 hrs
Total unit time,    Tb =  2.64488 hrs
```

```
SCS UNIT HYDROGRAPH METHOD
Calc.Method Option =  1
STORM EVENT: 25 year storm
Duration      = 24.0000 hrs     Rain Depth = 7.2000 in
Rain Dir      = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Rain File -ID =  - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir       = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
HYG File - ID =  - NW3 Dev 25
Tc            = .7905 hrs
Drainage Area = 4.190 acres  Runoff CN= 79

============================================
Computational Time Increment   =   .00500 hrs
Computed Peak Time             =  12.5300 hrs
Computed Peak Flow             =    11.03 cfs

Time Increment for HYG File    =    .0050 hrs
Peak Time, Interpolated Output =  12.5302 hrs
Peak Flow, Interpolated Output =    11.03 cfs
============================================

                 DRAINAGE AREA
              -------------------
              ID:NW3
              CN   =   79
              Area =       4.190 acres
              S    =   2.6582 in
              0.2S =    .5316 in

               Cumulative Runoff
              -------------------
                      4.7678 in
                       1.665 ac-ft

HYG Volume...          1.665 ac-ft (area under HYG curve)

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

Time Concentration, Tc =   .79046 hrs (ID: NW3)
Computational Incr, Tm =   .00500 hrs = 0.01049 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 =     6.64 cfs
Unit peak time      Tp =   .47677 hrs
Unit receding limb, Tr =  1.90709 hrs
Total unit time,    Tb =  2.38387 hrs
```

```
SCS UNIT HYDROGRAPH METHOD
Calc.Method Option =  1
STORM EVENT: 25 year storm
Duration      = 24.0000 hrs     Rain Depth = 7.2000 in
Rain Dir      = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Rain File -ID =  - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir       = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
HYG File - ID =  - NW4+EXN4+NE4 Dev 25
Tc            = .7964 hrs
Drainage Area = 11.220 acres  Runoff CN= 79

============================================
Computational Time Increment   =   .00500 hrs
Computed Peak Time             =  12.5350 hrs
Computed Peak Flow             =    29.43 cfs

Time Increment for HYG File    =    .0050 hrs
Peak Time, Interpolated Output =  12.5352 hrs
Peak Flow, Interpolated Output =    29.43 cfs
============================================

                 DRAINAGE AREA
              -------------------
              ID:NW4+EXN4+NE4
              CN   =   79
              Area =      11.220 acres
              S    =   2.6582 in
              0.2S =    .5316 in

               Cumulative Runoff
              -------------------
                      4.7678 in
                       4.458 ac-ft

HYG Volume...          4.458 ac-ft (area under HYG curve)

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

Time Concentration, Tc =   .79641 hrs (ID: NW4+EXN4+NE4)
Computational Incr, Tm =   .00500 hrs = 0.01041 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 =    17.64 cfs
Unit peak time      Tp =   .48035 hrs
Unit receding limb, Tr =  1.92139 hrs
Total unit time,    Tb =  2.40174 hrs
```

```
SCS UNIT HYDROGRAPH METHOD
Calc.Method Option =  1
STORM EVENT: 25 year storm
Duration      = 24.0000 hrs     Rain Depth = 7.2000 in
Rain Dir      = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Rain File -ID =  - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir       = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
HYG File - ID =  - NW5+EXN5+NE5 Dev 25
Tc            = .9006 hrs
Drainage Area = 12.080 acres  Runoff CN= 79

============================================
Computational Time Increment   =   .00500 hrs
Computed Peak Time             =  12.6000 hrs
Computed Peak Flow             =    29.71 cfs

Time Increment for HYG File    =    .0050 hrs
Peak Time, Interpolated Output =  12.6002 hrs
Peak Flow, Interpolated Output =    29.71 cfs
============================================

                 DRAINAGE AREA
              -------------------
              ID:NW5+EXN5+NE5
              CN   =   79
              Area =      12.080 acres
              S    =   2.6582 in
              0.2S =    .5316 in

                Cumulative Runoff
              -------------------
                      4.7678 in
                       4.800 ac-ft

HYG Volume...          4.800 ac-ft (area under HYG curve)

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

Time Concentration, Tc =   .90061 hrs (ID: NW5+EXN5+NE5)
Computational Incr, Tm =   .00500 hrs = 0.00921 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 =    16.81 cfs
Unit peak time      Tp =   .54287 hrs
Unit receding limb, Tr =  2.17147 hrs
Total unit time,    Tb =  2.71434 hrs
```

```
SCS UNIT HYDROGRAPH METHOD
Calc.Method Option =  1
STORM EVENT: 25 year storm
Duration      = 24.0000 hrs     Rain Depth = 7.2000 in
Rain Dir      = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Rain File -ID =  - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir       = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
HYG File - ID =  - NW7 Dev 25
Tc            = .6576 hrs
Drainage Area = 15.360 acres  Runoff CN= 79

============================================
Computational Time Increment   =   .00500 hrs
Computed Peak Time             =  12.4450 hrs
Computed Peak Flow             =    44.23 cfs

Time Increment for HYG File    =    .0050 hrs
Peak Time, Interpolated Output =  12.4452 hrs
Peak Flow, Interpolated Output =    44.23 cfs
============================================

                DRAINAGE AREA
              -------------------
              ID:NW7
              CN   =   79
              Area =      15.360 acres
              S    =   2.6582 in
              0.2S =    .5316 in

               Cumulative Runoff
              -------------------
                      4.7678 in
                       6.103 ac-ft

HYG Volume...          6.103 ac-ft (area under HYG curve)

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

Time Concentration, Tc =   .65763 hrs (ID: NW7)
Computational Incr, Tm =   .00500 hrs = 0.01259 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 =    29.22 cfs
Unit peak time      Tp =   .39708 hrs
Unit receding limb, Tr =  1.58832 hrs
Total unit time,    Tb =  1.98540 hrs
```

```
SCS UNIT HYDROGRAPH METHOD
Calc.Method Option =  1
STORM EVENT: 25 year storm
Duration      = 24.0000 hrs     Rain Depth = 7.2000 in
Rain Dir      = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Rain File -ID =  - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir       = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
HYG File - ID =  - POND AREA Dev 25
Tc (Min. Tc)  = .0833 hrs
Drainage Area = 21.500 acres  Runoff CN= 98

============================================
Computational Time Increment   =   .00500 hrs
Computed Peak Time             =  12.1000 hrs
Computed Peak Flow             =   130.44 cfs

Time Increment for HYG File    =    .0050 hrs
Peak Time, Interpolated Output =  12.1002 hrs
Peak Flow, Interpolated Output =   130.44 cfs
============================================

                 DRAINAGE AREA
              -------------------
              ID:POND AREA
              CN   =   98
              Area =      21.500 acres
              S    =    .2041 in
              0.2S =    .0408 in

               Cumulative Runoff
              -------------------
                      6.9608 in
                      12.471 ac-ft

HYG Volume...         12.471 ac-ft (area under HYG curve)

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

Time Concentration, Tc =   .08330 hrs (ID: POND AREA)
Computational Incr, Tm =   .00500 hrs = 0.09527 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 =   309.46 cfs
Unit peak time      Tp =   .05248 hrs
Unit receding limb, Tr =   .20992 hrs
Total unit time,    Tb =   .26240 hrs
```

```
SCS UNIT HYDROGRAPH METHOD
Calc.Method Option =  1
STORM EVENT: 25 year storm
Duration      = 24.0000 hrs     Rain Depth = 7.2000 in
Rain Dir      = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Rain File -ID =  - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir       = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
HYG File - ID =  - SE Dev 25
Tc            = .6642 hrs
Drainage Area = 27.520 acres  Runoff CN= 79

============================================
Computational Time Increment   =   .00500 hrs
Computed Peak Time             =  12.4500 hrs
Computed Peak Flow             =    78.88 cfs

Time Increment for HYG File    =    .0050 hrs
Peak Time, Interpolated Output =  12.4502 hrs
Peak Flow, Interpolated Output =    78.88 cfs
============================================

                 DRAINAGE AREA
              -------------------
              ID:SE
              CN   =   79
              Area =      27.520 acres
              S    =   2.6582 in
              0.2S =    .5316 in

               Cumulative Runoff
              -------------------
                      4.7678 in
                      10.934 ac-ft

HYG Volume...         10.934 ac-ft (area under HYG curve)

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

Time Concentration, Tc =   .66419 hrs (ID: SE)
Computational Incr, Tm =   .00500 hrs = 0.01247 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 =    51.84 cfs
Unit peak time      Tp =   .40102 hrs
Unit receding limb, Tr =  1.60406 hrs
Total unit time,    Tb =  2.00508 hrs
```

```
SCS UNIT HYDROGRAPH METHOD
Calc.Method Option =  1
STORM EVENT: 25 year storm
Duration      = 24.0000 hrs     Rain Depth = 7.2000 in
Rain Dir      = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Rain File -ID =  - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir       = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
HYG File - ID =  - SE3 Dev 25
Tc            = .4442 hrs
Drainage Area = 2.380 acres  Runoff CN= 79

============================================
Computational Time Increment   =   .00500 hrs
Computed Peak Time             =  12.3050 hrs
Computed Peak Flow             =     8.12 cfs

Time Increment for HYG File    =    .0050 hrs
Peak Time, Interpolated Output =  12.3052 hrs
Peak Flow, Interpolated Output =     8.12 cfs
============================================

                 DRAINAGE AREA
              -------------------
              ID:SE3
              CN   =   79
              Area =       2.380 acres
              S    =   2.6582 in
              0.2S =    .5316 in

               Cumulative Runoff
              -------------------
                      4.7678 in
                        .946 ac-ft

HYG Volume...           .946 ac-ft (area under HYG curve)

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

Time Concentration, Tc =   .44415 hrs (ID: SE3)
Computational Incr, Tm =   .00500 hrs = 0.01859 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 =     6.68 cfs
Unit peak time      Tp =   .26899 hrs
Unit receding limb, Tr =  1.07597 hrs
Total unit time,    Tb =  1.34496 hrs
```

```
SCS UNIT HYDROGRAPH METHOD
Calc.Method Option =  1
STORM EVENT: 25 year storm
Duration      = 24.0000 hrs     Rain Depth = 7.2000 in
Rain Dir      = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Rain File -ID =  - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir       = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
HYG File - ID =  - SE4+EXS4+SW4 Dev 25
Tc            = .4186 hrs
Drainage Area = 7.060 acres  Runoff CN= 79

=============================================
Computational Time Increment   =   .00500 hrs
Computed Peak Time             =  12.2850 hrs
Computed Peak Flow             =    24.66 cfs

Time Increment for HYG File    =    .0050 hrs
Peak Time, Interpolated Output =  12.2852 hrs
Peak Flow, Interpolated Output =    24.66 cfs
=============================================

                    DRAINAGE AREA
              -------------------
              ID:SE4+EXS4+SW4
              CN   =   79
              Area =       7.060 acres
              S    =   2.6582 in
              0.2S =    .5316 in

               Cumulative Runoff
              -------------------
                      4.7678 in
                       2.805 ac-ft

HYG Volume...          2.805 ac-ft (area under HYG curve)

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

Time Concentration, Tc =   .41863 hrs (ID: SE4+EXS4+SW4)
Computational Incr, Tm =   .00500 hrs = 0.01971 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 =    21.02 cfs
Unit peak time      Tp =   .25368 hrs
Unit receding limb, Tr =  1.01471 hrs
Total unit time,    Tb =  1.26839 hrs
```

```
SCS UNIT HYDROGRAPH METHOD
Calc.Method Option =  1
STORM EVENT: 25 year storm
Duration      = 24.0000 hrs     Rain Depth = 7.2000 in
Rain Dir      = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Rain File -ID =  - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir       = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
HYG File - ID =  - SE7 Dev 25
Tc            = .4841 hrs
Drainage Area = 5.840 acres  Runoff CN= 79

============================================
Computational Time Increment   =   .00500 hrs
Computed Peak Time             =  12.3300 hrs
Computed Peak Flow             =    19.24 cfs

Time Increment for HYG File    =    .0050 hrs
Peak Time, Interpolated Output =  12.3302 hrs
Peak Flow, Interpolated Output =    19.24 cfs
============================================

                 DRAINAGE AREA
              -------------------
              ID:SE7
              CN   =   79
              Area =       5.840 acres
              S    =   2.6582 in
              0.2S =    .5316 in

               Cumulative Runoff
              -------------------
                      4.7678 in
                       2.320 ac-ft

HYG Volume...          2.320 ac-ft (area under HYG curve)

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

Time Concentration, Tc =   .48412 hrs (ID: SE7)
Computational Incr, Tm =   .00500 hrs = 0.01707 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 =    15.06 cfs
Unit peak time      Tp =   .29297 hrs
Unit receding limb, Tr =  1.17189 hrs
Total unit time,    Tb =  1.46486 hrs
```

```
SCS UNIT HYDROGRAPH METHOD
Calc.Method Option =  1
STORM EVENT: 25 year storm
Duration      = 24.0000 hrs     Rain Depth = 7.2000 in
Rain Dir      = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Rain File -ID =  - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir       = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
HYG File - ID =  - SW Dev 25
Tc            = .7092 hrs
Drainage Area = 30.660 acres  Runoff CN= 79

============================================
Computational Time Increment   =   .00500 hrs
Computed Peak Time             =  12.4800 hrs
Computed Peak Flow             =    85.18 cfs

Time Increment for HYG File    =    .0050 hrs
Peak Time, Interpolated Output =  12.4802 hrs
Peak Flow, Interpolated Output =    85.17 cfs
============================================

                 DRAINAGE AREA
              -------------------
              ID:SW
              CN   =   79
              Area =      30.660 acres
              S    =   2.6582 in
              0.2S =    .5316 in

               Cumulative Runoff
              -------------------
                      4.7678 in
                      12.182 ac-ft

HYG Volume...         12.182 ac-ft (area under HYG curve)

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

Time Concentration, Tc =   .70918 hrs (ID: SW)
Computational Incr, Tm =   .00500 hrs = 0.01168 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 =    54.11 cfs
Unit peak time      Tp =   .42801 hrs
Unit receding limb, Tr =  1.71204 hrs
Total unit time,    Tb =  2.14005 hrs
```

```
SCS UNIT HYDROGRAPH METHOD
Calc.Method Option =  1
STORM EVENT: 25 year storm
Duration       = 24.0000 hrs     Rain Depth = 7.2000 in
Rain Dir       = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Rain File -ID =  - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir        = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
HYG File - ID =  - SW3 Dev 25
Tc             = .4606 hrs
Drainage Area = 2.190 acres  Runoff CN= 79

============================================
Computational Time Increment   =   .00500 hrs
Computed Peak Time             =  12.3150 hrs
Computed Peak Flow             =     7.37 cfs

Time Increment for HYG File    =    .0050 hrs
Peak Time, Interpolated Output =  12.3152 hrs
Peak Flow, Interpolated Output =     7.37 cfs
============================================

                 DRAINAGE AREA
              -------------------
              ID:SW3
              CN   =   79
              Area =       2.190 acres
              S    =   2.6582 in
              0.2S =    .5316 in

               Cumulative Runoff
              -------------------
                      4.7678 in
                        .870 ac-ft

HYG Volume...           .870 ac-ft (area under HYG curve)

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

Time Concentration, Tc =   .46058 hrs (ID: SW3)
Computational Incr, Tm =   .00500 hrs = 0.01793 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 =     5.93 cfs
Unit peak time      Tp =   .27885 hrs
Unit receding limb, Tr =  1.11539 hrs
Total unit time,    Tb =  1.39424 hrs
```

```
SCS UNIT HYDROGRAPH METHOD
Calc.Method Option =  1
STORM EVENT: 25 year storm
Duration      = 24.0000 hrs     Rain Depth = 7.2000 in
Rain Dir      = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Rain File -ID =  - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir       = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
HYG File - ID =  - SW5+EXS5+SE5 Dev 25
Tc            = .6809 hrs
Drainage Area = 6.400 acres  Runoff CN= 79

============================================
Computational Time Increment   =   .00500 hrs
Computed Peak Time             =  12.4600 hrs
Computed Peak Flow             =    18.13 cfs

Time Increment for HYG File    =    .0050 hrs
Peak Time, Interpolated Output =  12.4602 hrs
Peak Flow, Interpolated Output =    18.13 cfs
============================================

                 DRAINAGE AREA
              -------------------
              ID:SW5+EXS5+SE5
              CN   =   79
              Area =       6.400 acres
              S    =   2.6582 in
              0.2S =    .5316 in

               Cumulative Runoff
              -------------------
                      4.7678 in
                       2.543 ac-ft

HYG Volume...          2.543 ac-ft (area under HYG curve)

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

Time Concentration, Tc =   .68090 hrs (ID: SW5+EXS5+SE5)
Computational Incr, Tm =   .00500 hrs = 0.01216 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 =    11.76 cfs
Unit peak time      Tp =   .41104 hrs
Unit receding limb, Tr =  1.64417 hrs
Total unit time,    Tb =  2.05521 hrs
```

```
SCS UNIT HYDROGRAPH METHOD
Calc.Method Option =  1
STORM EVENT: 25 year storm
Duration      = 24.0000 hrs     Rain Depth = 7.2000 in
Rain Dir      = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Rain File -ID =  - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir       = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
HYG File - ID =  - SW7 Dev 25
Tc            = .5141 hrs
Drainage Area = 6.520 acres  Runoff CN= 79

============================================
Computational Time Increment   =   .00500 hrs
Computed Peak Time             =  12.3500 hrs
Computed Peak Flow             =    20.95 cfs

Time Increment for HYG File    =    .0050 hrs
Peak Time, Interpolated Output =  12.3502 hrs
Peak Flow, Interpolated Output =    20.95 cfs
============================================

                 DRAINAGE AREA
              -------------------
              ID:SW7
              CN   =   79
              Area =       6.520 acres
              S    =   2.6582 in
              0.2S =    .5316 in

               Cumulative Runoff
              -------------------
                      4.7678 in
                       2.590 ac-ft

HYG Volume...          2.590 ac-ft (area under HYG curve)

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

Time Concentration, Tc =   .51407 hrs (ID: SW7)
Computational Incr, Tm =   .00500 hrs = 0.01608 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 =    15.84 cfs
Unit peak time      Tp =   .31094 hrs
Unit receding limb, Tr =  1.24377 hrs
Total unit time,    Tb =  1.55471 hrs
```

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .000500 ft/ft
Mannings n = 0.04000
Invert Elev. = 79.46 ft
Top of Channel = 82.50 ft
Base width = 13.50 ft
Rt Side slope = 3.000 horizontal :1 vert.
Lt Side slope = 3.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
79.460	.00	.00	.00	.0000	.00	.00	.00	0.00
79.470	.01	.01	.04	.1353	13.56	13.56	.01	0.07
79.520	.06	.10	.13	.8208	13.86	13.88	.06	0.09
79.580	.12	.33	.20	1.6632	14.22	14.26	.12	0.10
79.640	.18	.65	.26	2.5272	14.58	14.64	.17	0.11
79.700	.24	1.06	.31	3.4128	14.94	15.02	.23	0.11
79.760	.30	1.54	.36	4.3200	15.30	15.40	.28	0.12
79.820	.36	2.09	.40	5.2488	15.66	15.78	.34	0.12
79.880	.42	2.72	.44	6.1992	16.02	16.16	.39	0.12
79.940	.48	3.41	.48	7.1713	16.38	16.54	.44	0.13
80.000	.54	4.17	.51	8.1648	16.74	16.92	.49	0.13
80.060	.60	5.00	.54	9.1800	17.10	17.29	.54	0.13
80.120	.66	5.89	.58	10.2169	17.46	17.67	.59	0.13
80.180	.72	6.84	.61	11.2752	17.82	18.05	.63	0.13
80.240	.78	7.86	.64	12.3552	18.18	18.43	.68	0.14
80.300	.84	8.94	.66	13.4567	18.54	18.81	.73	0.14
80.360	.90	10.08	.69	14.5800	18.90	19.19	.77	0.14
80.420	.96	11.29	.72	15.7248	19.26	19.57	.82	0.14
80.480	1.02	12.56	.74	16.8911	19.62	19.95	.86	0.14
80.540	1.08	13.89	.77	18.0792	19.98	20.33	.90	0.14
80.600	1.14	15.28	.79	19.2888	20.34	20.71	.95	0.14
80.660	1.20	16.74	.82	20.5199	20.70	21.09	.99	0.14
80.720	1.26	18.26	.84	21.7728	21.06	21.47	1.03	0.15
80.780	1.32	19.84	.86	23.0472	21.42	21.85	1.08	0.15
80.840	1.38	21.48	.88	24.3431	21.78	22.23	1.12	0.15
80.900	1.44	23.19	.90	25.6609	22.14	22.61	1.16	0.15
80.960	1.50	24.97	.92	27.0000	22.50	22.99	1.20	0.15
81.020	1.56	26.81	.95	28.3607	22.86	23.37	1.24	0.15
81.080	1.62	28.71	.97	29.7433	23.22	23.75	1.28	0.15
81.140	1.68	30.68	.98	31.1472	23.58	24.13	1.32	0.15
81.200	1.74	32.71	1.00	32.5728	23.94	24.50	1.36	0.15
81.260	1.80	34.81	1.02	34.0201	24.30	24.88	1.40	0.15
81.320	1.86	36.98	1.04	35.4888	24.66	25.26	1.44	0.15
81.380	1.92	39.21	1.06	36.9792	25.02	25.64	1.48	0.15
81.440	1.98	41.51	1.08	38.4913	25.38	26.02	1.52	0.15

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .000500 ft/ft
Mannings n = 0.04000
Invert Elev. = 79.46 ft
Top of Channel = 82.50 ft
Base width = 13.50 ft
Rt Side slope = 3.000 horizontal :1 vert.
Lt Side slope = 3.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
81.500	2.04	43.87	1.10	40.0248	25.74	26.40	1.55	0.15
81.560	2.10	46.31	1.11	41.5800	26.10	26.78	1.59	0.16
81.620	2.16	48.81	1.13	43.1569	26.46	27.16	1.63	0.16
81.680	2.22	51.39	1.15	44.7552	26.82	27.54	1.67	0.16
81.740	2.28	54.03	1.17	46.3752	27.18	27.92	1.71	0.16
81.800	2.34	56.74	1.18	48.0167	27.54	28.30	1.74	0.16
81.860	2.40	59.52	1.20	49.6800	27.90	28.68	1.78	0.16
81.920	2.46	62.38	1.21	51.3648	28.26	29.06	1.82	0.16
81.980	2.52	65.30	1.23	53.0711	28.62	29.44	1.85	0.16
82.040	2.58	68.30	1.25	54.7993	28.98	29.82	1.89	0.16
82.100	2.64	71.36	1.26	56.5488	29.34	30.20	1.93	0.16
82.160	2.70	74.51	1.28	58.3199	29.70	30.58	1.96	0.16
82.220	2.76	77.72	1.29	60.1129	30.06	30.96	2.00	0.16
82.280	2.82	81.01	1.31	61.9272	30.42	31.34	2.04	0.16
82.340	2.88	84.37	1.32	63.7631	30.78	31.71	2.07	0.16
82.400	2.94	87.81	1.34	65.6209	31.14	32.09	2.11	0.16
82.460	3.00	91.32	1.35	67.5000	31.50	32.47	2.14	0.16
82.500	3.04	93.71	1.36	68.7648	31.74	32.73	2.17	0.16

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .000500 ft/ft
Mannings n = 0.04000
Invert Elev. = 78.77 ft
Top of Channel = 82.50 ft
Base width = 13.50 ft
Rt Side slope = 3.000 horizontal :1 vert.
Lt Side slope = 3.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
78.770	.00	.00	.00	.0000	.00	.00	.00	0.00
78.780	.01	.01	.04	.1353	13.56	13.56	.01	0.07
78.840	.07	.13	.14	.9597	13.92	13.94	.07	0.09
78.910	.14	.43	.22	1.9488	14.34	14.39	.14	0.10
78.980	.21	.84	.28	2.9673	14.76	14.83	.20	0.11
79.050	.28	1.37	.34	4.0152	15.18	15.27	.26	0.12
79.120	.35	2.00	.39	5.0925	15.60	15.71	.33	0.12
79.190	.42	2.72	.44	6.1992	16.02	16.16	.39	0.12
79.260	.49	3.54	.48	7.3353	16.44	16.60	.45	0.13
79.330	.56	4.44	.52	8.5008	16.86	17.04	.50	0.13
79.400	.63	5.44	.56	9.6957	17.28	17.48	.56	0.13
79.470	.70	6.52	.60	10.9200	17.70	17.93	.62	0.13
79.540	.77	7.69	.63	12.1736	18.12	18.37	.67	0.14
79.610	.84	8.94	.66	13.4567	18.54	18.81	.73	0.14
79.680	.91	10.28	.70	14.7694	18.96	19.26	.78	0.14
79.750	.98	11.70	.73	16.1113	19.38	19.70	.83	0.14
79.820	1.05	13.21	.76	17.4826	19.80	20.14	.88	0.14
79.890	1.12	14.81	.78	18.8833	20.22	20.58	.93	0.14
79.960	1.19	16.49	.81	20.3134	20.64	21.03	.98	0.14
80.030	1.26	18.26	.84	21.7728	21.06	21.47	1.03	0.15
80.100	1.33	20.11	.86	23.2617	21.48	21.91	1.08	0.15
80.170	1.40	22.05	.89	24.7800	21.90	22.35	1.13	0.15
80.240	1.47	24.07	.91	26.3277	22.32	22.80	1.18	0.15
80.310	1.54	26.19	.94	27.9048	22.74	23.24	1.23	0.15
80.380	1.61	28.39	.96	29.5113	23.16	23.68	1.27	0.15
80.450	1.68	30.68	.98	31.1472	23.58	24.13	1.32	0.15
80.520	1.75	33.06	1.01	32.8125	24.00	24.57	1.37	0.15
80.590	1.82	35.52	1.03	34.5072	24.42	25.01	1.41	0.15
80.660	1.89	38.08	1.05	36.2313	24.84	25.45	1.46	0.15
80.730	1.96	40.73	1.07	37.9848	25.26	25.90	1.50	0.15
80.800	2.03	43.47	1.09	39.7677	25.68	26.34	1.55	0.15
80.870	2.10	46.31	1.11	41.5800	26.10	26.78	1.59	0.16
80.940	2.17	49.24	1.13	43.4217	26.52	27.22	1.64	0.16
81.010	2.24	52.26	1.15	45.2927	26.94	27.67	1.68	0.16
81.080	2.31	55.38	1.17	47.1932	27.36	28.11	1.72	0.16

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Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .000500 ft/ft
Mannings n = 0.04000
Invert Elev. = 78.77 ft
Top of Channel = 82.50 ft
Base width = 13.50 ft
Rt Side slope = 3.000 horizontal :1 vert.
Lt Side slope = 3.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
81.150	2.38	58.59	1.19	49.1231	27.78	28.55	1.77	0.16
81.220	2.45	61.90	1.21	51.0824	28.20	29.00	1.81	0.16
81.290	2.52	65.30	1.23	53.0711	28.62	29.44	1.85	0.16
81.360	2.59	68.80	1.25	55.0892	29.04	29.88	1.90	0.16
81.430	2.66	72.40	1.27	57.1369	29.46	30.32	1.94	0.16
81.500	2.73	76.10	1.29	59.2138	29.88	30.77	1.98	0.16
81.570	2.80	79.90	1.30	61.3201	30.30	31.21	2.02	0.16
81.640	2.87	83.81	1.32	63.4558	30.72	31.65	2.07	0.16
81.710	2.94	87.81	1.34	65.6209	31.14	32.09	2.11	0.16
81.780	3.01	91.91	1.36	67.8154	31.56	32.54	2.15	0.16
81.850	3.08	96.12	1.37	70.0393	31.98	32.98	2.19	0.16
81.920	3.15	100.43	1.39	72.2926	32.40	33.42	2.23	0.16
81.990	3.22	104.85	1.41	74.5752	32.82	33.87	2.27	0.16
82.060	3.29	109.37	1.42	76.8873	33.24	34.31	2.31	0.16
82.130	3.36	114.00	1.44	79.2288	33.66	34.75	2.35	0.17
82.200	3.43	118.74	1.46	81.5997	34.08	35.19	2.39	0.17
82.270	3.50	123.58	1.47	84.0000	34.50	35.64	2.43	0.17
82.340	3.57	128.54	1.49	86.4297	34.92	36.08	2.48	0.17
82.410	3.64	133.60	1.50	88.8888	35.34	36.52	2.52	0.17
82.480	3.71	138.77	1.52	91.3773	35.76	36.96	2.56	0.17
82.500	3.73	140.27	1.52	92.0938	35.88	37.09	2.57	0.17

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Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .000500 ft/ft
Mannings n = 0.04000
Invert Elev. = 80.00 ft
Top of Channel = 83.00 ft
Base width = 13.50 ft
Rt Side slope = 3.000 horizontal :1 vert.
Lt Side slope = 3.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
80.000	.00	.00	.00	.0000	.00	.00	.00	0.00
80.010	.01	.01	.04	.1353	13.56	13.56	.01	0.07
80.060	.06	.10	.13	.8208	13.86	13.88	.06	0.09
80.120	.12	.33	.20	1.6632	14.22	14.26	.12	0.10
80.180	.18	.65	.26	2.5272	14.58	14.64	.17	0.11
80.240	.24	1.06	.31	3.4128	14.94	15.02	.23	0.11
80.300	.30	1.54	.36	4.3200	15.30	15.40	.28	0.12
80.360	.36	2.09	.40	5.2488	15.66	15.78	.34	0.12
80.420	.42	2.72	.44	6.1992	16.02	16.16	.39	0.12
80.480	.48	3.41	.48	7.1713	16.38	16.54	.44	0.13
80.540	.54	4.17	.51	8.1648	16.74	16.92	.49	0.13
80.600	.60	5.00	.54	9.1800	17.10	17.29	.54	0.13
80.660	.66	5.89	.58	10.2169	17.46	17.67	.59	0.13
80.720	.72	6.84	.61	11.2752	17.82	18.05	.63	0.13
80.780	.78	7.86	.64	12.3552	18.18	18.43	.68	0.14
80.840	.84	8.94	.66	13.4567	18.54	18.81	.73	0.14
80.900	.90	10.08	.69	14.5800	18.90	19.19	.77	0.14
80.960	.96	11.29	.72	15.7248	19.26	19.57	.82	0.14
81.020	1.02	12.56	.74	16.8911	19.62	19.95	.86	0.14
81.080	1.08	13.89	.77	18.0792	19.98	20.33	.90	0.14
81.140	1.14	15.28	.79	19.2888	20.34	20.71	.95	0.14
81.200	1.20	16.74	.82	20.5199	20.70	21.09	.99	0.14
81.260	1.26	18.26	.84	21.7728	21.06	21.47	1.03	0.15
81.320	1.32	19.84	.86	23.0472	21.42	21.85	1.08	0.15
81.380	1.38	21.48	.88	24.3431	21.78	22.23	1.12	0.15
81.440	1.44	23.19	.90	25.6609	22.14	22.61	1.16	0.15
81.500	1.50	24.97	.92	27.0000	22.50	22.99	1.20	0.15
81.560	1.56	26.81	.95	28.3607	22.86	23.37	1.24	0.15
81.620	1.62	28.71	.97	29.7433	23.22	23.75	1.28	0.15
81.680	1.68	30.68	.98	31.1472	23.58	24.13	1.32	0.15
81.740	1.74	32.71	1.00	32.5728	23.94	24.50	1.36	0.15
81.800	1.80	34.81	1.02	34.0201	24.30	24.88	1.40	0.15
81.860	1.86	36.98	1.04	35.4888	24.66	25.26	1.44	0.15
81.920	1.92	39.21	1.06	36.9792	25.02	25.64	1.48	0.15
81.980	1.98	41.51	1.08	38.4913	25.38	26.02	1.52	0.15

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .000500 ft/ft
Mannings n = 0.04000
Invert Elev. = 80.00 ft
Top of Channel = 83.00 ft
Base width = 13.50 ft
Rt Side slope = 3.000 horizontal :1 vert.
Lt Side slope = 3.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
82.040	2.04	43.87	1.10	40.0248	25.74	26.40	1.55	0.15
82.100	2.10	46.31	1.11	41.5800	26.10	26.78	1.59	0.16
82.160	2.16	48.81	1.13	43.1569	26.46	27.16	1.63	0.16
82.220	2.22	51.39	1.15	44.7552	26.82	27.54	1.67	0.16
82.280	2.28	54.03	1.17	46.3752	27.18	27.92	1.71	0.16
82.340	2.34	56.74	1.18	48.0167	27.54	28.30	1.74	0.16
82.400	2.40	59.52	1.20	49.6800	27.90	28.68	1.78	0.16
82.460	2.46	62.38	1.21	51.3648	28.26	29.06	1.82	0.16
82.520	2.52	65.30	1.23	53.0711	28.62	29.44	1.85	0.16
82.580	2.58	68.30	1.25	54.7993	28.98	29.82	1.89	0.16
82.640	2.64	71.36	1.26	56.5488	29.34	30.20	1.93	0.16
82.700	2.70	74.51	1.28	58.3199	29.70	30.58	1.96	0.16
82.760	2.76	77.72	1.29	60.1129	30.06	30.96	2.00	0.16
82.820	2.82	81.01	1.31	61.9272	30.42	31.34	2.04	0.16
82.880	2.88	84.37	1.32	63.7631	30.78	31.71	2.07	0.16
82.940	2.94	87.81	1.34	65.6209	31.14	32.09	2.11	0.16
83.000	3.00	91.32	1.35	67.5000	31.50	32.47	2.14	0.16

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .000500 ft/ft
Mannings n = 0.04000
Invert Elev. = 79.65 ft
Top of Channel = 83.00 ft
Base width = 13.50 ft
Rt Side slope = 3.000 horizontal :1 vert.
Lt Side slope = 3.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
79.650	.00	.00	.00	.0000	.00	.00	.00	0.00
79.660	.01	.01	.04	.1353	13.56	13.56	.01	0.07
79.720	.07	.13	.14	.9597	13.92	13.94	.07	0.09
79.790	.14	.43	.22	1.9488	14.34	14.39	.14	0.10
79.860	.21	.84	.28	2.9673	14.76	14.83	.20	0.11
79.930	.28	1.37	.34	4.0152	15.18	15.27	.26	0.12
80.000	.35	2.00	.39	5.0925	15.60	15.71	.33	0.12
80.070	.42	2.72	.44	6.1992	16.02	16.16	.39	0.12
80.140	.49	3.54	.48	7.3353	16.44	16.60	.45	0.13
80.210	.56	4.44	.52	8.5008	16.86	17.04	.50	0.13
80.280	.63	5.44	.56	9.6957	17.28	17.48	.56	0.13
80.350	.70	6.52	.60	10.9200	17.70	17.93	.62	0.13
80.420	.77	7.69	.63	12.1736	18.12	18.37	.67	0.14
80.490	.84	8.94	.66	13.4567	18.54	18.81	.73	0.14
80.560	.91	10.28	.70	14.7694	18.96	19.26	.78	0.14
80.630	.98	11.70	.73	16.1113	19.38	19.70	.83	0.14
80.700	1.05	13.21	.76	17.4826	19.80	20.14	.88	0.14
80.770	1.12	14.81	.78	18.8833	20.22	20.58	.93	0.14
80.840	1.19	16.49	.81	20.3134	20.64	21.03	.98	0.14
80.910	1.26	18.26	.84	21.7728	21.06	21.47	1.03	0.15
80.980	1.33	20.11	.86	23.2617	21.48	21.91	1.08	0.15
81.050	1.40	22.05	.89	24.7800	21.90	22.35	1.13	0.15
81.120	1.47	24.07	.91	26.3277	22.32	22.80	1.18	0.15
81.190	1.54	26.19	.94	27.9048	22.74	23.24	1.23	0.15
81.260	1.61	28.39	.96	29.5113	23.16	23.68	1.27	0.15
81.330	1.68	30.68	.98	31.1472	23.58	24.13	1.32	0.15
81.400	1.75	33.06	1.01	32.8125	24.00	24.57	1.37	0.15
81.470	1.82	35.52	1.03	34.5072	24.42	25.01	1.41	0.15
81.540	1.89	38.08	1.05	36.2313	24.84	25.45	1.46	0.15
81.610	1.96	40.73	1.07	37.9848	25.26	25.90	1.50	0.15
81.680	2.03	43.47	1.09	39.7677	25.68	26.34	1.55	0.15
81.750	2.10	46.31	1.11	41.5800	26.10	26.78	1.59	0.16
81.820	2.17	49.24	1.13	43.4217	26.52	27.22	1.64	0.16
81.890	2.24	52.26	1.15	45.2927	26.94	27.67	1.68	0.16
81.960	2.31	55.38	1.17	47.1932	27.36	28.11	1.72	0.16

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .000500 ft/ft
Mannings n = 0.04000
Invert Elev. = 79.65 ft
Top of Channel = 83.00 ft
Base width = 13.50 ft
Rt Side slope = 3.000 horizontal :1 vert.
Lt Side slope = 3.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
82.030	2.38	58.59	1.19	49.1231	27.78	28.55	1.77	0.16
82.100	2.45	61.90	1.21	51.0824	28.20	29.00	1.81	0.16
82.170	2.52	65.30	1.23	53.0711	28.62	29.44	1.85	0.16
82.240	2.59	68.80	1.25	55.0892	29.04	29.88	1.90	0.16
82.310	2.66	72.40	1.27	57.1369	29.46	30.32	1.94	0.16
82.380	2.73	76.10	1.29	59.2138	29.88	30.77	1.98	0.16
82.450	2.80	79.90	1.30	61.3201	30.30	31.21	2.02	0.16
82.520	2.87	83.81	1.32	63.4558	30.72	31.65	2.07	0.16
82.590	2.94	87.81	1.34	65.6209	31.14	32.09	2.11	0.16
82.660	3.01	91.91	1.36	67.8154	31.56	32.54	2.15	0.16
82.730	3.08	96.12	1.37	70.0393	31.98	32.98	2.19	0.16
82.800	3.15	100.43	1.39	72.2926	32.40	33.42	2.23	0.16
82.870	3.22	104.85	1.41	74.5752	32.82	33.87	2.27	0.16
82.940	3.29	109.37	1.42	76.8873	33.24	34.31	2.31	0.16
83.000	3.35	113.34	1.44	78.8925	33.60	34.69	2.35	0.17

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Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .000500 ft/ft
Mannings n = 0.04000
Invert Elev. = 80.00 ft
Top of Channel = 83.00 ft
Base width = 13.50 ft
Rt Side slope = 3.000 horizontal :1 vert.
Lt Side slope = 3.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
80.000	.00	.00	.00	.0000	.00	.00	.00	0.00
80.010	.01	.01	.04	.1353	13.56	13.56	.01	0.07
80.060	.06	.10	.13	.8208	13.86	13.88	.06	0.09
80.120	.12	.33	.20	1.6632	14.22	14.26	.12	0.10
80.180	.18	.65	.26	2.5272	14.58	14.64	.17	0.11
80.240	.24	1.06	.31	3.4128	14.94	15.02	.23	0.11
80.300	.30	1.54	.36	4.3200	15.30	15.40	.28	0.12
80.360	.36	2.09	.40	5.2488	15.66	15.78	.34	0.12
80.420	.42	2.72	.44	6.1992	16.02	16.16	.39	0.12
80.480	.48	3.41	.48	7.1713	16.38	16.54	.44	0.13
80.540	.54	4.17	.51	8.1648	16.74	16.92	.49	0.13
80.600	.60	5.00	.54	9.1800	17.10	17.29	.54	0.13
80.660	.66	5.89	.58	10.2169	17.46	17.67	.59	0.13
80.720	.72	6.84	.61	11.2752	17.82	18.05	.63	0.13
80.780	.78	7.86	.64	12.3552	18.18	18.43	.68	0.14
80.840	.84	8.94	.66	13.4567	18.54	18.81	.73	0.14
80.900	.90	10.08	.69	14.5800	18.90	19.19	.77	0.14
80.960	.96	11.29	.72	15.7248	19.26	19.57	.82	0.14
81.020	1.02	12.56	.74	16.8911	19.62	19.95	.86	0.14
81.080	1.08	13.89	.77	18.0792	19.98	20.33	.90	0.14
81.140	1.14	15.28	.79	19.2888	20.34	20.71	.95	0.14
81.200	1.20	16.74	.82	20.5199	20.70	21.09	.99	0.14
81.260	1.26	18.26	.84	21.7728	21.06	21.47	1.03	0.15
81.320	1.32	19.84	.86	23.0472	21.42	21.85	1.08	0.15
81.380	1.38	21.48	.88	24.3431	21.78	22.23	1.12	0.15
81.440	1.44	23.19	.90	25.6609	22.14	22.61	1.16	0.15
81.500	1.50	24.97	.92	27.0000	22.50	22.99	1.20	0.15
81.560	1.56	26.81	.95	28.3607	22.86	23.37	1.24	0.15
81.620	1.62	28.71	.97	29.7433	23.22	23.75	1.28	0.15
81.680	1.68	30.68	.98	31.1472	23.58	24.13	1.32	0.15
81.740	1.74	32.71	1.00	32.5728	23.94	24.50	1.36	0.15
81.800	1.80	34.81	1.02	34.0201	24.30	24.88	1.40	0.15
81.860	1.86	36.98	1.04	35.4888	24.66	25.26	1.44	0.15
81.920	1.92	39.21	1.06	36.9792	25.02	25.64	1.48	0.15
81.980	1.98	41.51	1.08	38.4913	25.38	26.02	1.52	0.15

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .000500 ft/ft
Mannings n = 0.04000
Invert Elev. = 80.00 ft
Top of Channel = 83.00 ft
Base width = 13.50 ft
Rt Side slope = 3.000 horizontal :1 vert.
Lt Side slope = 3.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
82.040	2.04	43.87	1.10	40.0248	25.74	26.40	1.55	0.15
82.100	2.10	46.31	1.11	41.5800	26.10	26.78	1.59	0.16
82.160	2.16	48.81	1.13	43.1569	26.46	27.16	1.63	0.16
82.220	2.22	51.39	1.15	44.7552	26.82	27.54	1.67	0.16
82.280	2.28	54.03	1.17	46.3752	27.18	27.92	1.71	0.16
82.340	2.34	56.74	1.18	48.0167	27.54	28.30	1.74	0.16
82.400	2.40	59.52	1.20	49.6800	27.90	28.68	1.78	0.16
82.460	2.46	62.38	1.21	51.3648	28.26	29.06	1.82	0.16
82.520	2.52	65.30	1.23	53.0711	28.62	29.44	1.85	0.16
82.580	2.58	68.30	1.25	54.7993	28.98	29.82	1.89	0.16
82.640	2.64	71.36	1.26	56.5488	29.34	30.20	1.93	0.16
82.700	2.70	74.51	1.28	58.3199	29.70	30.58	1.96	0.16
82.760	2.76	77.72	1.29	60.1129	30.06	30.96	2.00	0.16
82.820	2.82	81.01	1.31	61.9272	30.42	31.34	2.04	0.16
82.880	2.88	84.37	1.32	63.7631	30.78	31.71	2.07	0.16
82.940	2.94	87.81	1.34	65.6209	31.14	32.09	2.11	0.16
83.000	3.00	91.32	1.35	67.5000	31.50	32.47	2.14	0.16

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Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .000500 ft/ft
Mannings n = 0.04000
Invert Elev. = 79.63 ft
Top of Channel = 83.00 ft
Base width = 13.50 ft
Rt Side slope = 3.000 horizontal :1 vert.
Lt Side slope = 3.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
79.630	.00	.00	.00	.0000	.00	.00	.00	0.00
79.640	.01	.01	.04	.1353	13.56	13.56	.01	0.07
79.700	.07	.13	.14	.9597	13.92	13.94	.07	0.09
79.770	.14	.43	.22	1.9488	14.34	14.39	.14	0.10
79.840	.21	.84	.28	2.9673	14.76	14.83	.20	0.11
79.910	.28	1.37	.34	4.0152	15.18	15.27	.26	0.12
79.980	.35	2.00	.39	5.0925	15.60	15.71	.33	0.12
80.050	.42	2.72	.44	6.1992	16.02	16.16	.39	0.12
80.120	.49	3.54	.48	7.3353	16.44	16.60	.45	0.13
80.190	.56	4.44	.52	8.5008	16.86	17.04	.50	0.13
80.260	.63	5.44	.56	9.6957	17.28	17.48	.56	0.13
80.330	.70	6.52	.60	10.9200	17.70	17.93	.62	0.13
80.400	.77	7.69	.63	12.1736	18.12	18.37	.67	0.14
80.470	.84	8.94	.66	13.4567	18.54	18.81	.73	0.14
80.540	.91	10.28	.70	14.7694	18.96	19.26	.78	0.14
80.610	.98	11.70	.73	16.1113	19.38	19.70	.83	0.14
80.680	1.05	13.21	.76	17.4826	19.80	20.14	.88	0.14
80.750	1.12	14.81	.78	18.8833	20.22	20.58	.93	0.14
80.820	1.19	16.49	.81	20.3134	20.64	21.03	.98	0.14
80.890	1.26	18.26	.84	21.7728	21.06	21.47	1.03	0.15
80.960	1.33	20.11	.86	23.2617	21.48	21.91	1.08	0.15
81.030	1.40	22.05	.89	24.7800	21.90	22.35	1.13	0.15
81.100	1.47	24.07	.91	26.3277	22.32	22.80	1.18	0.15
81.170	1.54	26.19	.94	27.9048	22.74	23.24	1.23	0.15
81.240	1.61	28.39	.96	29.5113	23.16	23.68	1.27	0.15
81.310	1.68	30.68	.98	31.1472	23.58	24.13	1.32	0.15
81.380	1.75	33.06	1.01	32.8125	24.00	24.57	1.37	0.15
81.450	1.82	35.52	1.03	34.5072	24.42	25.01	1.41	0.15
81.520	1.89	38.08	1.05	36.2313	24.84	25.45	1.46	0.15
81.590	1.96	40.73	1.07	37.9848	25.26	25.90	1.50	0.15
81.660	2.03	43.47	1.09	39.7677	25.68	26.34	1.55	0.15
81.730	2.10	46.31	1.11	41.5800	26.10	26.78	1.59	0.16
81.800	2.17	49.24	1.13	43.4217	26.52	27.22	1.64	0.16
81.870	2.24	52.26	1.15	45.2927	26.94	27.67	1.68	0.16
81.940	2.31	55.38	1.17	47.1932	27.36	28.11	1.72	0.16

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Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .000500 ft/ft
Mannings n = 0.04000
Invert Elev. = 79.63 ft
Top of Channel = 83.00 ft
Base width = 13.50 ft
Rt Side slope = 3.000 horizontal :1 vert.
Lt Side slope = 3.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
82.010	2.38	58.59	1.19	49.1231	27.78	28.55	1.77	0.16
82.080	2.45	61.90	1.21	51.0824	28.20	29.00	1.81	0.16
82.150	2.52	65.30	1.23	53.0711	28.62	29.44	1.85	0.16
82.220	2.59	68.80	1.25	55.0892	29.04	29.88	1.90	0.16
82.290	2.66	72.40	1.27	57.1369	29.46	30.32	1.94	0.16
82.360	2.73	76.10	1.29	59.2138	29.88	30.77	1.98	0.16
82.430	2.80	79.90	1.30	61.3201	30.30	31.21	2.02	0.16
82.500	2.87	83.81	1.32	63.4558	30.72	31.65	2.07	0.16
82.570	2.94	87.81	1.34	65.6209	31.14	32.09	2.11	0.16
82.640	3.01	91.91	1.36	67.8154	31.56	32.54	2.15	0.16
82.710	3.08	96.12	1.37	70.0393	31.98	32.98	2.19	0.16
82.780	3.15	100.43	1.39	72.2926	32.40	33.42	2.23	0.16
82.850	3.22	104.85	1.41	74.5752	32.82	33.87	2.27	0.16
82.920	3.29	109.37	1.42	76.8873	33.24	34.31	2.31	0.16
82.990	3.36	114.00	1.44	79.2288	33.66	34.75	2.35	0.17
83.000	3.37	114.67	1.44	79.5658	33.72	34.81	2.36	0.17

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .000500 ft/ft
Mannings n = 0.04000
Invert Elev. = 76.20 ft
Top of Channel = 83.00 ft
Base width = 13.50 ft
Rt Side slope = 3.000 horizontal :1 vert.
Lt Side slope = 3.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
76.200	.00	.00	.00	.0000	.00	.00	.00	0.00
76.210	.01	.01	.04	.1353	13.56	13.56	.01	0.07
76.340	.14	.43	.22	1.9488	14.34	14.39	.14	0.10
76.480	.28	1.37	.34	4.0152	15.18	15.27	.26	0.12
76.620	.42	2.72	.44	6.1992	16.02	16.16	.39	0.12
76.760	.56	4.44	.52	8.5008	16.86	17.04	.50	0.13
76.900	.70	6.52	.60	10.9200	17.70	17.93	.62	0.13
77.040	.84	8.94	.66	13.4567	18.54	18.81	.73	0.14
77.180	.98	11.70	.73	16.1113	19.38	19.70	.83	0.14
77.320	1.12	14.81	.78	18.8833	20.22	20.58	.93	0.14
77.460	1.26	18.26	.84	21.7728	21.06	21.47	1.03	0.15
77.600	1.40	22.05	.89	24.7800	21.90	22.35	1.13	0.15
77.740	1.54	26.19	.94	27.9048	22.74	23.24	1.23	0.15
77.880	1.68	30.68	.98	31.1472	23.58	24.13	1.32	0.15
78.020	1.82	35.52	1.03	34.5072	24.42	25.01	1.41	0.15
78.160	1.96	40.73	1.07	37.9848	25.26	25.90	1.50	0.15
78.300	2.10	46.31	1.11	41.5800	26.10	26.78	1.59	0.16
78.440	2.24	52.26	1.15	45.2927	26.94	27.67	1.68	0.16
78.580	2.38	58.59	1.19	49.1231	27.78	28.55	1.77	0.16
78.720	2.52	65.30	1.23	53.0711	28.62	29.44	1.85	0.16
78.860	2.66	72.40	1.27	57.1369	29.46	30.32	1.94	0.16
79.000	2.80	79.90	1.30	61.3201	30.30	31.21	2.02	0.16
79.140	2.94	87.81	1.34	65.6209	31.14	32.09	2.11	0.16
79.280	3.08	96.12	1.37	70.0393	31.98	32.98	2.19	0.16
79.420	3.22	104.85	1.41	74.5752	32.82	33.87	2.27	0.16
79.560	3.36	114.00	1.44	79.2288	33.66	34.75	2.35	0.17
79.700	3.50	123.58	1.47	84.0000	34.50	35.64	2.43	0.17
79.840	3.64	133.60	1.50	88.8888	35.34	36.52	2.52	0.17
79.980	3.78	144.05	1.53	93.8952	36.18	37.41	2.60	0.17
80.120	3.92	154.96	1.56	99.0191	37.02	38.29	2.67	0.17
80.260	4.06	166.31	1.60	104.2607	37.86	39.18	2.75	0.17
80.400	4.20	178.13	1.62	109.6199	38.70	40.06	2.83	0.17
80.540	4.34	190.41	1.65	115.0967	39.54	40.95	2.91	0.17
80.680	4.48	203.17	1.68	120.6913	40.38	41.83	2.99	0.17
80.820	4.62	216.40	1.71	126.4033	41.22	42.72	3.07	0.17

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .000500 ft/ft
Mannings n = 0.04000
Invert Elev. = 76.20 ft
Top of Channel = 83.00 ft
Base width = 13.50 ft
Rt Side slope = 3.000 horizontal :1 vert.
Lt Side slope = 3.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
80.960	4.76	230.12	1.74	132.2329	42.06	43.60	3.14	0.17
81.100	4.90	244.33	1.77	138.1801	42.90	44.49	3.22	0.17
81.240	5.04	259.04	1.80	144.2448	43.74	45.38	3.30	0.17
81.380	5.18	274.25	1.82	150.4272	44.58	46.26	3.37	0.17
81.520	5.32	289.97	1.85	156.7272	45.42	47.15	3.45	0.18
81.660	5.46	306.21	1.88	163.1448	46.26	48.03	3.53	0.18
81.800	5.60	322.97	1.90	169.6799	47.10	48.92	3.60	0.18
81.940	5.74	340.26	1.93	176.3327	47.94	49.80	3.68	0.18
82.080	5.88	358.08	1.96	183.1031	48.78	50.69	3.75	0.18
82.220	6.02	376.43	1.98	189.9910	49.62	51.57	3.83	0.18
82.360	6.16	395.34	2.01	196.9970	50.46	52.46	3.90	0.18
82.500	6.30	414.80	2.03	204.1202	51.30	53.34	3.98	0.18
82.640	6.44	434.81	2.06	211.3609	52.14	54.23	4.05	0.18
82.780	6.58	455.39	2.08	218.7193	52.98	55.12	4.13	0.18
82.920	6.72	476.54	2.11	226.1953	53.82	56.00	4.20	0.18
83.000	6.80	488.88	2.12	230.5202	54.30	56.51	4.25	0.18

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .000500 ft/ft
Mannings n = 0.04000
Invert Elev. = 75.91 ft
Top of Channel = 83.00 ft
Base width = 13.00 ft
Rt Side slope = 3.000 horizontal :1 vert.
Lt Side slope = 3.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
75.910	.00	.00	.00	.0000	.00	.00	.00	0.00
75.920	.01	.01	.04	.1303	13.06	13.06	.01	0.07
76.050	.14	.41	.22	1.8788	13.84	13.89	.14	0.10
76.190	.28	1.32	.34	3.8752	14.68	14.77	.26	0.12
76.330	.42	2.62	.44	5.9892	15.52	15.66	.39	0.12
76.470	.56	4.28	.52	8.2208	16.36	16.54	.50	0.13
76.610	.70	6.29	.60	10.5700	17.20	17.43	.61	0.13
76.750	.84	8.63	.66	13.0367	18.04	18.31	.72	0.14
76.890	.98	11.31	.72	15.6213	18.88	19.20	.83	0.14
77.030	1.12	14.32	.78	18.3233	19.72	20.08	.93	0.14
77.170	1.26	17.66	.84	21.1428	20.56	20.97	1.03	0.15
77.310	1.40	21.34	.89	24.0800	21.40	21.85	1.13	0.15
77.450	1.54	25.36	.93	27.1348	22.24	22.74	1.22	0.15
77.590	1.68	29.72	.98	30.3072	23.08	23.63	1.31	0.15
77.730	1.82	34.44	1.02	33.5972	23.92	24.51	1.40	0.15
77.870	1.96	39.51	1.07	37.0048	24.76	25.40	1.49	0.15
78.010	2.10	44.94	1.11	40.5300	25.60	26.28	1.58	0.16
78.150	2.24	50.74	1.15	44.1727	26.44	27.17	1.67	0.16
78.290	2.38	56.91	1.19	47.9331	27.28	28.05	1.76	0.16
78.430	2.52	63.46	1.22	51.8111	28.12	28.94	1.84	0.16
78.570	2.66	70.39	1.26	55.8069	28.96	29.82	1.93	0.16
78.710	2.80	77.72	1.30	59.9201	29.80	30.71	2.01	0.16
78.850	2.94	85.44	1.33	64.1509	30.64	31.59	2.09	0.16
78.990	3.08	93.57	1.37	68.4993	31.48	32.48	2.18	0.16
79.130	3.22	102.11	1.40	72.9652	32.32	33.37	2.26	0.16
79.270	3.36	111.07	1.43	77.5488	33.16	34.25	2.34	0.17
79.410	3.50	120.45	1.46	82.2500	34.00	35.14	2.42	0.17
79.550	3.64	130.26	1.50	87.0688	34.84	36.02	2.50	0.17
79.690	3.78	140.51	1.53	92.0052	35.68	36.91	2.58	0.17
79.830	3.92	151.20	1.56	97.0591	36.52	37.79	2.66	0.17
79.970	4.06	162.34	1.59	102.2307	37.36	38.68	2.74	0.17
80.110	4.20	173.93	1.62	107.5199	38.20	39.56	2.81	0.17
80.250	4.34	185.99	1.65	112.9267	39.04	40.45	2.89	0.17
80.390	4.48	198.51	1.68	118.4513	39.88	41.33	2.97	0.17
80.530	4.62	211.51	1.70	124.0933	40.72	42.22	3.05	0.17

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .000500 ft/ft
Mannings n = 0.04000
Invert Elev. = 75.91 ft
Top of Channel = 83.00 ft
Base width = 13.00 ft
Rt Side slope = 3.000 horizontal :1 vert.
Lt Side slope = 3.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
80.670	4.76	224.99	1.73	129.8529	41.56	43.10	3.12	0.17
80.810	4.90	238.95	1.76	135.7301	42.40	43.99	3.20	0.17
80.950	5.04	253.41	1.79	141.7248	43.24	44.88	3.28	0.17
81.090	5.18	268.37	1.82	147.8372	44.08	45.76	3.35	0.17
81.230	5.32	283.83	1.84	154.0672	44.92	46.65	3.43	0.18
81.370	5.46	299.80	1.87	160.4148	45.76	47.53	3.51	0.18
81.510	5.60	316.29	1.90	166.8799	46.60	48.42	3.58	0.18
81.650	5.74	333.31	1.92	173.4627	47.44	49.30	3.66	0.18
81.790	5.88	350.86	1.95	180.1631	48.28	50.19	3.73	0.18
81.930	6.02	368.94	1.97	186.9810	49.12	51.07	3.81	0.18
82.070	6.16	387.56	2.00	193.9170	49.96	51.96	3.88	0.18
82.210	6.30	406.73	2.02	200.9702	50.80	52.84	3.96	0.18
82.350	6.44	426.45	2.05	208.1409	51.64	53.73	4.03	0.18
82.490	6.58	446.74	2.07	215.4293	52.48	54.62	4.10	0.18
82.630	6.72	467.58	2.10	222.8353	53.32	55.50	4.18	0.18
82.770	6.86	489.00	2.12	230.3588	54.16	56.39	4.25	0.18
82.910	7.00	511.00	2.15	238.0000	55.00	57.27	4.33	0.18
83.000	7.09	525.45	2.16	242.9741	55.54	57.84	4.37	0.18

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Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .000500 ft/ft
Mannings n = 0.04000
Invert Elev. = 77.42 ft
Top of Channel = 83.00 ft
Base width = 13.50 ft
Rt Side slope = 3.000 horizontal :1 vert.
Lt Side slope = 3.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
77.420	.00	.00	.00	.0000	.00	.00	.00	0.00
77.430	.01	.01	.04	.1353	13.56	13.56	.01	0.07
77.530	.11	.29	.19	1.5213	14.16	14.20	.11	0.10
77.640	.22	.91	.29	3.1152	14.82	14.89	.21	0.11
77.750	.33	1.81	.38	4.7817	15.48	15.59	.31	0.12
77.860	.44	2.94	.45	6.5208	16.14	16.28	.40	0.13
77.970	.55	4.31	.52	8.3326	16.80	16.98	.50	0.13
78.080	.66	5.89	.58	10.2169	17.46	17.67	.59	0.13
78.190	.77	7.69	.63	12.1736	18.12	18.37	.67	0.14
78.300	.88	9.70	.68	14.2032	18.78	19.07	.76	0.14
78.410	.99	11.91	.73	16.3053	19.44	19.76	.84	0.14
78.520	1.10	14.34	.78	18.4800	20.10	20.46	.92	0.14
78.630	1.21	16.99	.82	20.7273	20.76	21.15	1.00	0.14
78.740	1.32	19.84	.86	23.0472	21.42	21.85	1.08	0.15
78.850	1.43	22.90	.90	25.4397	22.08	22.54	1.15	0.15
78.960	1.54	26.19	.94	27.9048	22.74	23.24	1.23	0.15
79.070	1.65	29.68	.98	30.4425	23.40	23.94	1.30	0.15
79.180	1.76	33.40	1.01	33.0529	24.06	24.63	1.37	0.15
79.290	1.87	37.34	1.04	35.7358	24.72	25.33	1.45	0.15
79.400	1.98	41.51	1.08	38.4913	25.38	26.02	1.52	0.15
79.510	2.09	45.90	1.11	41.3192	26.04	26.72	1.59	0.16
79.620	2.20	50.52	1.14	44.2199	26.70	27.41	1.66	0.16
79.730	2.31	55.38	1.17	47.1932	27.36	28.11	1.72	0.16
79.840	2.42	60.47	1.20	50.2392	28.02	28.81	1.79	0.16
79.950	2.53	65.79	1.23	53.3577	28.68	29.50	1.86	0.16
80.060	2.64	71.36	1.26	56.5488	29.34	30.20	1.93	0.16
80.170	2.75	77.18	1.29	59.8125	30.00	30.89	1.99	0.16
80.280	2.86	83.24	1.32	63.1488	30.66	31.59	2.06	0.16
80.390	2.97	89.56	1.35	66.5577	31.32	32.28	2.13	0.16
80.500	3.08	96.12	1.37	70.0393	31.98	32.98	2.19	0.16
80.610	3.19	102.95	1.40	73.5934	32.64	33.68	2.25	0.16
80.720	3.30	110.03	1.42	77.2201	33.30	34.37	2.32	0.16
80.830	3.41	117.38	1.45	80.9194	33.96	35.07	2.38	0.17
80.940	3.52	124.99	1.48	84.6911	34.62	35.76	2.45	0.17
81.050	3.63	132.87	1.50	88.5356	35.28	36.46	2.51	0.17

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .000500 ft/ft
Mannings n = 0.04000
Invert Elev. = 77.42 ft
Top of Channel = 83.00 ft
Base width = 13.50 ft
Rt Side slope = 3.000 horizontal :1 vert.
Lt Side slope = 3.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
81.160	3.74	141.02	1.53	92.4527	35.94	37.15	2.57	0.17
81.270	3.85	149.45	1.55	96.4424	36.60	37.85	2.64	0.17
81.380	3.96	158.16	1.57	100.5048	37.26	38.55	2.70	0.17
81.490	4.07	167.14	1.60	104.6397	37.92	39.24	2.76	0.17
81.600	4.18	176.41	1.62	108.8472	38.58	39.94	2.82	0.17
81.710	4.29	185.97	1.64	113.1273	39.24	40.63	2.88	0.17
81.820	4.40	195.82	1.67	117.4801	39.90	41.33	2.94	0.17
81.930	4.51	205.97	1.69	121.9054	40.56	42.02	3.01	0.17
82.040	4.62	216.40	1.71	126.4033	41.22	42.72	3.07	0.17
82.150	4.73	227.14	1.73	130.9738	41.88	43.42	3.13	0.17
82.260	4.84	238.18	1.76	135.6166	42.54	44.11	3.19	0.17
82.370	4.95	249.53	1.78	140.3324	43.20	44.81	3.25	0.17
82.480	5.06	261.18	1.80	145.1207	43.86	45.50	3.31	0.17
82.590	5.17	273.15	1.82	149.9816	44.52	46.20	3.37	0.17
82.700	5.28	285.43	1.84	154.9151	45.18	46.89	3.43	0.18
82.810	5.39	298.03	1.86	159.9213	45.84	47.59	3.49	0.18
82.920	5.50	310.95	1.88	165.0000	46.50	48.29	3.55	0.18
83.000	5.58	320.54	1.90	168.7393	46.98	48.79	3.59	0.18

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .000500 ft/ft
Mannings n = 0.04000
Invert Elev. = 77.45 ft
Top of Channel = 83.00 ft
Base width = 13.50 ft
Rt Side slope = 3.000 horizontal :1 vert.
Lt Side slope = 3.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
77.450	.00	.00	.00	.0000	.00	.00	.00	0.00
77.460	.01	.01	.04	.1353	13.56	13.56	.01	0.07
77.560	.11	.29	.19	1.5213	14.16	14.20	.11	0.10
77.670	.22	.91	.29	3.1152	14.82	14.89	.21	0.11
77.780	.33	1.81	.38	4.7817	15.48	15.59	.31	0.12
77.890	.44	2.94	.45	6.5208	16.14	16.28	.40	0.13
78.000	.55	4.31	.52	8.3326	16.80	16.98	.50	0.13
78.110	.66	5.89	.58	10.2169	17.46	17.67	.59	0.13
78.220	.77	7.69	.63	12.1736	18.12	18.37	.67	0.14
78.330	.88	9.70	.68	14.2032	18.78	19.07	.76	0.14
78.440	.99	11.91	.73	16.3053	19.44	19.76	.84	0.14
78.550	1.10	14.34	.78	18.4800	20.10	20.46	.92	0.14
78.660	1.21	16.99	.82	20.7273	20.76	21.15	1.00	0.14
78.770	1.32	19.84	.86	23.0472	21.42	21.85	1.08	0.15
78.880	1.43	22.90	.90	25.4397	22.08	22.54	1.15	0.15
78.990	1.54	26.19	.94	27.9048	22.74	23.24	1.23	0.15
79.100	1.65	29.68	.98	30.4425	23.40	23.94	1.30	0.15
79.210	1.76	33.40	1.01	33.0529	24.06	24.63	1.37	0.15
79.320	1.87	37.34	1.04	35.7358	24.72	25.33	1.45	0.15
79.430	1.98	41.51	1.08	38.4913	25.38	26.02	1.52	0.15
79.540	2.09	45.90	1.11	41.3192	26.04	26.72	1.59	0.16
79.650	2.20	50.52	1.14	44.2199	26.70	27.41	1.66	0.16
79.760	2.31	55.38	1.17	47.1932	27.36	28.11	1.72	0.16
79.870	2.42	60.47	1.20	50.2392	28.02	28.81	1.79	0.16
79.980	2.53	65.79	1.23	53.3577	28.68	29.50	1.86	0.16
80.090	2.64	71.36	1.26	56.5488	29.34	30.20	1.93	0.16
80.200	2.75	77.18	1.29	59.8125	30.00	30.89	1.99	0.16
80.310	2.86	83.24	1.32	63.1488	30.66	31.59	2.06	0.16
80.420	2.97	89.56	1.35	66.5577	31.32	32.28	2.13	0.16
80.530	3.08	96.12	1.37	70.0393	31.98	32.98	2.19	0.16
80.640	3.19	102.95	1.40	73.5934	32.64	33.68	2.25	0.16
80.750	3.30	110.03	1.42	77.2201	33.30	34.37	2.32	0.16
80.860	3.41	117.38	1.45	80.9194	33.96	35.07	2.38	0.17
80.970	3.52	124.99	1.48	84.6911	34.62	35.76	2.45	0.17
81.080	3.63	132.87	1.50	88.5356	35.28	36.46	2.51	0.17

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .000500 ft/ft
Mannings n = 0.04000
Invert Elev. = 77.45 ft
Top of Channel = 83.00 ft
Base width = 13.50 ft
Rt Side slope = 3.000 horizontal :1 vert.
Lt Side slope = 3.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
81.190	3.74	141.02	1.53	92.4527	35.94	37.15	2.57	0.17
81.300	3.85	149.45	1.55	96.4424	36.60	37.85	2.64	0.17
81.410	3.96	158.16	1.57	100.5048	37.26	38.55	2.70	0.17
81.520	4.07	167.14	1.60	104.6397	37.92	39.24	2.76	0.17
81.630	4.18	176.41	1.62	108.8472	38.58	39.94	2.82	0.17
81.740	4.29	185.97	1.64	113.1273	39.24	40.63	2.88	0.17
81.850	4.40	195.82	1.67	117.4801	39.90	41.33	2.94	0.17
81.960	4.51	205.97	1.69	121.9054	40.56	42.02	3.01	0.17
82.070	4.62	216.40	1.71	126.4033	41.22	42.72	3.07	0.17
82.180	4.73	227.14	1.73	130.9738	41.88	43.42	3.13	0.17
82.290	4.84	238.18	1.76	135.6166	42.54	44.11	3.19	0.17
82.400	4.95	249.53	1.78	140.3324	43.20	44.81	3.25	0.17
82.510	5.06	261.18	1.80	145.1207	43.86	45.50	3.31	0.17
82.620	5.17	273.15	1.82	149.9816	44.52	46.20	3.37	0.17
82.730	5.28	285.43	1.84	154.9151	45.18	46.89	3.43	0.18
82.840	5.39	298.03	1.86	159.9213	45.84	47.59	3.49	0.18
82.950	5.50	310.95	1.88	165.0000	46.50	48.29	3.55	0.18
83.000	5.55	316.92	1.89	167.3326	46.80	48.60	3.58	0.18

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .000500 ft/ft
Mannings n = 0.04000
Invert Elev. = 75.61 ft
Top of Channel = 83.00 ft
Base width = 13.50 ft
Rt Side slope = 3.000 horizontal :1 vert.
Lt Side slope = 3.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
75.610	.00	.00	.00	.0000	.00	.00	.00	0.00
75.620	.01	.01	.04	.1353	13.56	13.56	.01	0.07
75.760	.15	.48	.23	2.0925	14.40	14.45	.15	0.11
75.910	.30	1.54	.36	4.3200	15.30	15.40	.28	0.12
76.060	.45	3.06	.46	6.6825	16.20	16.35	.41	0.13
76.210	.60	5.00	.54	9.1800	17.10	17.29	.54	0.13
76.360	.75	7.34	.62	11.8125	18.00	18.24	.66	0.14
76.510	.90	10.08	.69	14.5800	18.90	19.19	.77	0.14
76.660	1.05	13.21	.76	17.4826	19.80	20.14	.88	0.14
76.810	1.20	16.74	.82	20.5199	20.70	21.09	.99	0.14
76.960	1.35	20.65	.87	23.6925	21.60	22.04	1.10	0.15
77.110	1.50	24.97	.92	27.0000	22.50	22.99	1.20	0.15
77.260	1.65	29.68	.98	30.4425	23.40	23.94	1.30	0.15
77.410	1.80	34.81	1.02	34.0201	24.30	24.88	1.40	0.15
77.560	1.95	40.35	1.07	37.7324	25.20	25.83	1.50	0.15
77.710	2.10	46.31	1.11	41.5800	26.10	26.78	1.59	0.16
77.860	2.25	52.70	1.16	45.5625	27.00	27.73	1.69	0.16
78.010	2.40	59.52	1.20	49.6800	27.90	28.68	1.78	0.16
78.160	2.55	66.79	1.24	53.9326	28.80	29.63	1.87	0.16
78.310	2.70	74.51	1.28	58.3199	29.70	30.58	1.96	0.16
78.460	2.85	82.68	1.32	62.8425	30.60	31.52	2.05	0.16
78.610	3.00	91.32	1.35	67.5000	31.50	32.47	2.14	0.16
78.760	3.15	100.43	1.39	72.2926	32.40	33.42	2.23	0.16
78.910	3.30	110.03	1.42	77.2201	33.30	34.37	2.32	0.16
79.060	3.45	120.11	1.46	82.2824	34.20	35.32	2.41	0.17
79.210	3.60	130.69	1.49	87.4800	35.10	36.27	2.49	0.17
79.360	3.75	141.78	1.53	92.8125	36.00	37.22	2.58	0.17
79.510	3.90	153.37	1.56	98.2801	36.90	38.17	2.66	0.17
79.660	4.05	165.49	1.59	103.8826	37.80	39.11	2.75	0.17
79.810	4.20	178.13	1.62	109.6199	38.70	40.06	2.83	0.17
79.960	4.35	191.31	1.66	115.4924	39.60	41.01	2.92	0.17
80.110	4.50	205.03	1.69	121.5000	40.50	41.96	3.00	0.17
80.260	4.65	219.30	1.72	127.6426	41.40	42.91	3.08	0.17
80.410	4.80	234.13	1.75	133.9201	42.30	43.86	3.17	0.17
80.560	4.95	249.53	1.78	140.3324	43.20	44.81	3.25	0.17

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .000500 ft/ft
Mannings n = 0.04000
Invert Elev. = 75.61 ft
Top of Channel = 83.00 ft
Base width = 13.50 ft
Rt Side slope = 3.000 horizontal :1 vert.
Lt Side slope = 3.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
80.710	5.10	265.50	1.81	146.8799	44.10	45.76	3.33	0.17
80.860	5.25	282.05	1.84	153.5625	45.00	46.70	3.41	0.18
81.010	5.40	299.19	1.87	160.3801	45.90	47.65	3.49	0.18
81.160	5.55	316.92	1.89	167.3326	46.80	48.60	3.58	0.18
81.310	5.70	335.26	1.92	174.4199	47.70	49.55	3.66	0.18
81.460	5.85	354.21	1.95	181.6424	48.60	50.50	3.74	0.18
81.610	6.00	373.78	1.98	189.0000	49.50	51.45	3.82	0.18
81.760	6.15	393.97	2.01	196.4926	50.40	52.40	3.90	0.18
81.910	6.30	414.80	2.03	204.1202	51.30	53.34	3.98	0.18
82.060	6.45	436.26	2.06	211.8823	52.20	54.29	4.06	0.18
82.210	6.60	458.37	2.09	219.7799	53.10	55.24	4.14	0.18
82.360	6.75	481.14	2.11	227.8125	54.00	56.19	4.22	0.18
82.510	6.90	504.57	2.14	235.9801	54.90	57.14	4.30	0.18
82.660	7.05	528.67	2.16	244.2827	55.80	58.09	4.38	0.18
82.810	7.20	553.44	2.19	252.7198	56.70	59.04	4.46	0.18
82.960	7.35	578.90	2.22	261.2924	57.60	59.99	4.54	0.18
83.000	7.39	585.80	2.22	263.6013	57.84	60.24	4.56	0.18

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .000500 ft/ft
Mannings n = 0.04000
Invert Elev. = 76.06 ft
Top of Channel = 83.00 ft
Base width = 13.50 ft
Rt Side slope = 3.000 horizontal :1 vert.
Lt Side slope = 3.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
76.060	.00	.00	.00	.0000	.00	.00	.00	0.00
76.070	.01	.01	.04	.1353	13.56	13.56	.01	0.07
76.200	.14	.43	.22	1.9488	14.34	14.39	.14	0.10
76.340	.28	1.37	.34	4.0152	15.18	15.27	.26	0.12
76.480	.42	2.72	.44	6.1992	16.02	16.16	.39	0.12
76.620	.56	4.44	.52	8.5008	16.86	17.04	.50	0.13
76.760	.70	6.52	.60	10.9200	17.70	17.93	.62	0.13
76.900	.84	8.94	.66	13.4567	18.54	18.81	.73	0.14
77.040	.98	11.70	.73	16.1113	19.38	19.70	.83	0.14
77.180	1.12	14.81	.78	18.8833	20.22	20.58	.93	0.14
77.320	1.26	18.26	.84	21.7728	21.06	21.47	1.03	0.15
77.460	1.40	22.05	.89	24.7800	21.90	22.35	1.13	0.15
77.600	1.54	26.19	.94	27.9048	22.74	23.24	1.23	0.15
77.740	1.68	30.68	.98	31.1472	23.58	24.13	1.32	0.15
77.880	1.82	35.52	1.03	34.5072	24.42	25.01	1.41	0.15
78.020	1.96	40.73	1.07	37.9848	25.26	25.90	1.50	0.15
78.160	2.10	46.31	1.11	41.5800	26.10	26.78	1.59	0.16
78.300	2.24	52.26	1.15	45.2927	26.94	27.67	1.68	0.16
78.440	2.38	58.59	1.19	49.1231	27.78	28.55	1.77	0.16
78.580	2.52	65.30	1.23	53.0711	28.62	29.44	1.85	0.16
78.720	2.66	72.40	1.27	57.1369	29.46	30.32	1.94	0.16
78.860	2.80	79.90	1.30	61.3201	30.30	31.21	2.02	0.16
79.000	2.94	87.81	1.34	65.6209	31.14	32.09	2.11	0.16
79.140	3.08	96.12	1.37	70.0393	31.98	32.98	2.19	0.16
79.280	3.22	104.85	1.41	74.5752	32.82	33.87	2.27	0.16
79.420	3.36	114.00	1.44	79.2288	33.66	34.75	2.35	0.17
79.560	3.50	123.58	1.47	84.0000	34.50	35.64	2.43	0.17
79.700	3.64	133.60	1.50	88.8888	35.34	36.52	2.52	0.17
79.840	3.78	144.05	1.53	93.8952	36.18	37.41	2.60	0.17
79.980	3.92	154.96	1.56	99.0191	37.02	38.29	2.67	0.17
80.120	4.06	166.31	1.60	104.2607	37.86	39.18	2.75	0.17
80.260	4.20	178.13	1.62	109.6199	38.70	40.06	2.83	0.17
80.400	4.34	190.41	1.65	115.0967	39.54	40.95	2.91	0.17
80.540	4.48	203.17	1.68	120.6913	40.38	41.83	2.99	0.17
80.680	4.62	216.40	1.71	126.4033	41.22	42.72	3.07	0.17

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .000500 ft/ft
Mannings n = 0.04000
Invert Elev. = 76.06 ft
Top of Channel = 83.00 ft
Base width = 13.50 ft
Rt Side slope = 3.000 horizontal :1 vert.
Lt Side slope = 3.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
80.820	4.76	230.12	1.74	132.2329	42.06	43.60	3.14	0.17
80.960	4.90	244.33	1.77	138.1801	42.90	44.49	3.22	0.17
81.100	5.04	259.04	1.80	144.2448	43.74	45.38	3.30	0.17
81.240	5.18	274.25	1.82	150.4272	44.58	46.26	3.37	0.17
81.380	5.32	289.97	1.85	156.7272	45.42	47.15	3.45	0.18
81.520	5.46	306.21	1.88	163.1448	46.26	48.03	3.53	0.18
81.660	5.60	322.97	1.90	169.6799	47.10	48.92	3.60	0.18
81.800	5.74	340.26	1.93	176.3327	47.94	49.80	3.68	0.18
81.940	5.88	358.08	1.96	183.1031	48.78	50.69	3.75	0.18
82.080	6.02	376.43	1.98	189.9910	49.62	51.57	3.83	0.18
82.220	6.16	395.34	2.01	196.9970	50.46	52.46	3.90	0.18
82.360	6.30	414.80	2.03	204.1202	51.30	53.34	3.98	0.18
82.500	6.44	434.81	2.06	211.3609	52.14	54.23	4.05	0.18
82.640	6.58	455.39	2.08	218.7193	52.98	55.12	4.13	0.18
82.780	6.72	476.54	2.11	226.1953	53.82	56.00	4.20	0.18
82.920	6.86	498.26	2.13	233.7888	54.66	56.89	4.28	0.18
83.000	6.94	510.93	2.15	238.1809	55.14	57.39	4.32	0.18

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .000500 ft/ft
Mannings n = 0.04000
Invert Elev. = 75.35 ft
Top of Channel = 83.00 ft
Base width = 13.50 ft
Rt Side slope = 3.000 horizontal :1 vert.
Lt Side slope = 3.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
75.350	.00	.00	.00	.0000	.00	.00	.00	0.00
75.360	.01	.01	.04	.1353	13.56	13.56	.01	0.07
75.500	.15	.48	.23	2.0925	14.40	14.45	.15	0.11
75.650	.30	1.54	.36	4.3200	15.30	15.40	.28	0.12
75.800	.45	3.06	.46	6.6825	16.20	16.35	.41	0.13
75.950	.60	5.00	.54	9.1800	17.10	17.29	.54	0.13
76.100	.75	7.34	.62	11.8125	18.00	18.24	.66	0.14
76.250	.90	10.08	.69	14.5800	18.90	19.19	.77	0.14
76.400	1.05	13.21	.76	17.4826	19.80	20.14	.88	0.14
76.550	1.20	16.74	.82	20.5199	20.70	21.09	.99	0.14
76.700	1.35	20.65	.87	23.6925	21.60	22.04	1.10	0.15
76.850	1.50	24.97	.92	27.0000	22.50	22.99	1.20	0.15
77.000	1.65	29.68	.98	30.4425	23.40	23.94	1.30	0.15
77.150	1.80	34.81	1.02	34.0201	24.30	24.88	1.40	0.15
77.300	1.95	40.35	1.07	37.7324	25.20	25.83	1.50	0.15
77.450	2.10	46.31	1.11	41.5800	26.10	26.78	1.59	0.16
77.600	2.25	52.70	1.16	45.5625	27.00	27.73	1.69	0.16
77.750	2.40	59.52	1.20	49.6800	27.90	28.68	1.78	0.16
77.900	2.55	66.79	1.24	53.9326	28.80	29.63	1.87	0.16
78.050	2.70	74.51	1.28	58.3199	29.70	30.58	1.96	0.16
78.200	2.85	82.68	1.32	62.8425	30.60	31.52	2.05	0.16
78.350	3.00	91.32	1.35	67.5000	31.50	32.47	2.14	0.16
78.500	3.15	100.43	1.39	72.2926	32.40	33.42	2.23	0.16
78.650	3.30	110.03	1.42	77.2201	33.30	34.37	2.32	0.16
78.800	3.45	120.11	1.46	82.2824	34.20	35.32	2.41	0.17
78.950	3.60	130.69	1.49	87.4800	35.10	36.27	2.49	0.17
79.100	3.75	141.78	1.53	92.8125	36.00	37.22	2.58	0.17
79.250	3.90	153.37	1.56	98.2801	36.90	38.17	2.66	0.17
79.400	4.05	165.49	1.59	103.8826	37.80	39.11	2.75	0.17
79.550	4.20	178.13	1.62	109.6199	38.70	40.06	2.83	0.17
79.700	4.35	191.31	1.66	115.4924	39.60	41.01	2.92	0.17
79.850	4.50	205.03	1.69	121.5000	40.50	41.96	3.00	0.17
80.000	4.65	219.30	1.72	127.6426	41.40	42.91	3.08	0.17
80.150	4.80	234.13	1.75	133.9201	42.30	43.86	3.17	0.17
80.300	4.95	249.53	1.78	140.3324	43.20	44.81	3.25	0.17

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .000500 ft/ft
Mannings n = 0.04000
Invert Elev. = 75.35 ft
Top of Channel = 83.00 ft
Base width = 13.50 ft
Rt Side slope = 3.000 horizontal :1 vert.
Lt Side slope = 3.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
80.450	5.10	265.50	1.81	146.8799	44.10	45.76	3.33	0.17
80.600	5.25	282.05	1.84	153.5625	45.00	46.70	3.41	0.18
80.750	5.40	299.19	1.87	160.3801	45.90	47.65	3.49	0.18
80.900	5.55	316.92	1.89	167.3326	46.80	48.60	3.58	0.18
81.050	5.70	335.26	1.92	174.4199	47.70	49.55	3.66	0.18
81.200	5.85	354.21	1.95	181.6424	48.60	50.50	3.74	0.18
81.350	6.00	373.78	1.98	189.0000	49.50	51.45	3.82	0.18
81.500	6.15	393.97	2.01	196.4926	50.40	52.40	3.90	0.18
81.650	6.30	414.80	2.03	204.1202	51.30	53.34	3.98	0.18
81.800	6.45	436.26	2.06	211.8823	52.20	54.29	4.06	0.18
81.950	6.60	458.37	2.09	219.7799	53.10	55.24	4.14	0.18
82.100	6.75	481.14	2.11	227.8125	54.00	56.19	4.22	0.18
82.250	6.90	504.57	2.14	235.9801	54.90	57.14	4.30	0.18
82.400	7.05	528.67	2.16	244.2827	55.80	58.09	4.38	0.18
82.550	7.20	553.44	2.19	252.7198	56.70	59.04	4.46	0.18
82.700	7.35	578.90	2.22	261.2924	57.60	59.99	4.54	0.18
82.850	7.50	605.04	2.24	270.0000	58.50	60.93	4.62	0.18
83.000	7.65	631.89	2.27	278.8426	59.40	61.88	4.69	0.18

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .000500 ft/ft
Mannings n = 0.04000
Invert Elev. = 74.90 ft
Top of Channel = 83.00 ft
Base width = 15.00 ft
Rt Side slope = 3.000 horizontal :1 vert.
Lt Side slope = 3.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
74.900	.00	.00	.00	.0000	.00	.00	.00	0.00
74.910	.01	.01	.04	.1503	15.06	15.06	.01	0.07
75.060	.16	.59	.24	2.4769	15.96	16.01	.16	0.11
75.220	.32	1.90	.37	5.1072	16.92	17.02	.30	0.12
75.380	.48	3.78	.48	7.8913	17.88	18.04	.44	0.13
75.540	.64	6.17	.57	10.8288	18.84	19.05	.57	0.13
75.700	.80	9.06	.65	13.9201	19.80	20.06	.70	0.14
75.860	.96	12.44	.72	17.1648	20.76	21.07	.83	0.14
76.020	1.12	16.29	.79	20.5633	21.72	22.08	.95	0.14
76.180	1.28	20.62	.85	24.1152	22.68	23.10	1.06	0.15
76.340	1.44	25.43	.91	27.8209	23.64	24.11	1.18	0.15
76.500	1.60	30.72	.97	31.6800	24.60	25.12	1.29	0.15
76.660	1.76	36.50	1.02	35.6929	25.56	26.13	1.40	0.15
76.820	1.92	42.78	1.07	39.8592	26.52	27.14	1.50	0.15
76.980	2.08	49.55	1.12	44.1793	27.48	28.16	1.61	0.16
77.140	2.24	56.84	1.17	48.6527	28.44	29.17	1.71	0.16
77.300	2.40	64.65	1.21	53.2800	29.40	30.18	1.81	0.16
77.460	2.56	72.98	1.26	58.0607	30.36	31.19	1.91	0.16
77.620	2.72	81.85	1.30	62.9952	31.32	32.20	2.01	0.16
77.780	2.88	91.26	1.34	68.0831	32.28	33.21	2.11	0.16
77.940	3.04	101.22	1.38	73.3248	33.24	34.23	2.21	0.16
78.100	3.20	111.74	1.42	78.7199	34.20	35.24	2.30	0.16
78.260	3.36	122.84	1.46	84.2688	35.16	36.25	2.40	0.17
78.420	3.52	134.51	1.50	89.9711	36.12	37.26	2.49	0.17
78.580	3.68	146.77	1.53	95.8272	37.08	38.27	2.58	0.17
78.740	3.84	159.62	1.57	101.8367	38.04	39.29	2.68	0.17
78.900	4.00	173.09	1.60	108.0000	39.00	40.30	2.77	0.17
79.060	4.16	187.17	1.64	114.3169	39.96	41.31	2.86	0.17
79.220	4.32	201.87	1.67	120.7872	40.92	42.32	2.95	0.17
79.380	4.48	217.21	1.70	127.4113	41.88	43.33	3.04	0.17
79.540	4.64	233.19	1.74	134.1888	42.84	44.35	3.13	0.17
79.700	4.80	249.82	1.77	141.1201	43.80	45.36	3.22	0.17
79.860	4.96	267.12	1.80	148.2048	44.76	46.37	3.31	0.17
80.020	5.12	285.08	1.83	155.4433	45.72	47.38	3.40	0.18
80.180	5.28	303.72	1.87	162.8351	46.68	48.39	3.49	0.18

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .000500 ft/ft
Mannings n = 0.04000
Invert Elev. = 74.90 ft
Top of Channel = 83.00 ft
Base width = 15.00 ft
Rt Side slope = 3.000 horizontal :1 vert.
Lt Side slope = 3.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
80.340	5.44	323.05	1.90	170.3809	47.64	49.41	3.58	0.18
80.500	5.60	343.08	1.93	178.0799	48.60	50.42	3.66	0.18
80.660	5.76	363.81	1.96	185.9329	49.56	51.43	3.75	0.18
80.820	5.92	385.25	1.99	193.9391	50.52	52.44	3.84	0.18
80.980	6.08	407.42	2.02	202.0993	51.48	53.45	3.93	0.18
81.140	6.24	430.32	2.05	210.4127	52.44	54.47	4.01	0.18
81.300	6.40	453.96	2.07	218.8801	53.40	55.48	4.10	0.18
81.460	6.56	478.35	2.10	227.5007	54.36	56.49	4.19	0.18
81.620	6.72	503.50	2.13	236.2753	55.32	57.50	4.27	0.18
81.780	6.88	529.41	2.16	245.2030	56.28	58.51	4.36	0.18
81.940	7.04	556.10	2.19	254.2849	57.24	59.52	4.44	0.18
82.100	7.20	583.57	2.21	263.5198	58.20	60.54	4.53	0.18
82.260	7.36	611.84	2.24	272.9088	59.16	61.55	4.61	0.18
82.420	7.52	640.90	2.27	282.4510	60.12	62.56	4.70	0.18
82.580	7.68	670.77	2.30	292.1472	61.08	63.57	4.78	0.19
82.740	7.84	701.46	2.32	301.9966	62.04	64.58	4.87	0.19
82.900	8.00	732.98	2.35	312.0000	63.00	65.60	4.95	0.19
83.000	8.10	753.10	2.37	318.3299	63.60	66.23	5.01	0.19

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .000500 ft/ft
Mannings n = 0.04000
Invert Elev. = 79.27 ft
Top of Channel = 82.50 ft
Base width = 13.50 ft
Rt Side slope = 3.000 horizontal :1 vert.
Lt Side slope = 3.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
79.270	.00	.00	.00	.0000	.00	.00	.00	0.00
79.280	.01	.01	.04	.1353	13.56	13.56	.01	0.07
79.330	.06	.10	.13	.8208	13.86	13.88	.06	0.09
79.390	.12	.33	.20	1.6632	14.22	14.26	.12	0.10
79.450	.18	.65	.26	2.5272	14.58	14.64	.17	0.11
79.510	.24	1.06	.31	3.4128	14.94	15.02	.23	0.11
79.570	.30	1.54	.36	4.3200	15.30	15.40	.28	0.12
79.630	.36	2.09	.40	5.2488	15.66	15.78	.34	0.12
79.690	.42	2.72	.44	6.1992	16.02	16.16	.39	0.12
79.750	.48	3.41	.48	7.1713	16.38	16.54	.44	0.13
79.810	.54	4.17	.51	8.1648	16.74	16.92	.49	0.13
79.870	.60	5.00	.54	9.1800	17.10	17.29	.54	0.13
79.930	.66	5.89	.58	10.2169	17.46	17.67	.59	0.13
79.990	.72	6.84	.61	11.2752	17.82	18.05	.63	0.13
80.050	.78	7.86	.64	12.3552	18.18	18.43	.68	0.14
80.110	.84	8.94	.66	13.4567	18.54	18.81	.73	0.14
80.170	.90	10.08	.69	14.5800	18.90	19.19	.77	0.14
80.230	.96	11.29	.72	15.7248	19.26	19.57	.82	0.14
80.290	1.02	12.56	.74	16.8911	19.62	19.95	.86	0.14
80.350	1.08	13.89	.77	18.0792	19.98	20.33	.90	0.14
80.410	1.14	15.28	.79	19.2888	20.34	20.71	.95	0.14
80.470	1.20	16.74	.82	20.5199	20.70	21.09	.99	0.14
80.530	1.26	18.26	.84	21.7728	21.06	21.47	1.03	0.15
80.590	1.32	19.84	.86	23.0472	21.42	21.85	1.08	0.15
80.650	1.38	21.48	.88	24.3431	21.78	22.23	1.12	0.15
80.710	1.44	23.19	.90	25.6609	22.14	22.61	1.16	0.15
80.770	1.50	24.97	.92	27.0000	22.50	22.99	1.20	0.15
80.830	1.56	26.81	.95	28.3607	22.86	23.37	1.24	0.15
80.890	1.62	28.71	.97	29.7433	23.22	23.75	1.28	0.15
80.950	1.68	30.68	.98	31.1472	23.58	24.13	1.32	0.15
81.010	1.74	32.71	1.00	32.5728	23.94	24.50	1.36	0.15
81.070	1.80	34.81	1.02	34.0201	24.30	24.88	1.40	0.15
81.130	1.86	36.98	1.04	35.4888	24.66	25.26	1.44	0.15
81.190	1.92	39.21	1.06	36.9792	25.02	25.64	1.48	0.15
81.250	1.98	41.51	1.08	38.4913	25.38	26.02	1.52	0.15

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .000500 ft/ft
Mannings n = 0.04000
Invert Elev. = 79.27 ft
Top of Channel = 82.50 ft
Base width = 13.50 ft
Rt Side slope = 3.000 horizontal :1 vert.
Lt Side slope = 3.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
81.310	2.04	43.87	1.10	40.0248	25.74	26.40	1.55	0.15
81.370	2.10	46.31	1.11	41.5800	26.10	26.78	1.59	0.16
81.430	2.16	48.81	1.13	43.1569	26.46	27.16	1.63	0.16
81.490	2.22	51.39	1.15	44.7552	26.82	27.54	1.67	0.16
81.550	2.28	54.03	1.17	46.3752	27.18	27.92	1.71	0.16
81.610	2.34	56.74	1.18	48.0167	27.54	28.30	1.74	0.16
81.670	2.40	59.52	1.20	49.6800	27.90	28.68	1.78	0.16
81.730	2.46	62.38	1.21	51.3648	28.26	29.06	1.82	0.16
81.790	2.52	65.30	1.23	53.0711	28.62	29.44	1.85	0.16
81.850	2.58	68.30	1.25	54.7993	28.98	29.82	1.89	0.16
81.910	2.64	71.36	1.26	56.5488	29.34	30.20	1.93	0.16
81.970	2.70	74.51	1.28	58.3199	29.70	30.58	1.96	0.16
82.030	2.76	77.72	1.29	60.1129	30.06	30.96	2.00	0.16
82.090	2.82	81.01	1.31	61.9272	30.42	31.34	2.04	0.16
82.150	2.88	84.37	1.32	63.7631	30.78	31.71	2.07	0.16
82.210	2.94	87.81	1.34	65.6209	31.14	32.09	2.11	0.16
82.270	3.00	91.32	1.35	67.5000	31.50	32.47	2.14	0.16
82.330	3.06	94.91	1.37	69.4007	31.86	32.85	2.18	0.16
82.390	3.12	98.57	1.38	71.3233	32.22	33.23	2.21	0.16
82.450	3.18	102.32	1.40	73.2672	32.58	33.61	2.25	0.16
82.500	3.23	105.49	1.41	74.9038	32.88	33.93	2.28	0.16

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .000500 ft/ft
Mannings n = 0.04000
Invert Elev. = 77.83 ft
Top of Channel = 82.50 ft
Base width = 13.50 ft
Rt Side slope = 3.000 horizontal :1 vert.
Lt Side slope = 3.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
77.830	.00	.00	.00	.0000	.00	.00	.00	0.00
77.840	.01	.01	.04	.1353	13.56	13.56	.01	0.07
77.920	.09	.20	.16	1.2392	14.04	14.07	.09	0.10
78.010	.18	.65	.26	2.5272	14.58	14.64	.17	0.11
78.100	.27	1.29	.33	3.8636	15.12	15.21	.26	0.12
78.190	.36	2.09	.40	5.2488	15.66	15.78	.34	0.12
78.280	.45	3.06	.46	6.6825	16.20	16.35	.41	0.13
78.370	.54	4.17	.51	8.1648	16.74	16.92	.49	0.13
78.460	.63	5.44	.56	9.6957	17.28	17.48	.56	0.13
78.550	.72	6.84	.61	11.2752	17.82	18.05	.63	0.13
78.640	.81	8.39	.65	12.9033	18.36	18.62	.70	0.14
78.730	.90	10.08	.69	14.5800	18.90	19.19	.77	0.14
78.820	.99	11.91	.73	16.3053	19.44	19.76	.84	0.14
78.910	1.08	13.89	.77	18.0792	19.98	20.33	.90	0.14
79.000	1.17	16.00	.80	19.9017	20.52	20.90	.97	0.14
79.090	1.26	18.26	.84	21.7728	21.06	21.47	1.03	0.15
79.180	1.35	20.65	.87	23.6925	21.60	22.04	1.10	0.15
79.270	1.44	23.19	.90	25.6609	22.14	22.61	1.16	0.15
79.360	1.53	25.88	.93	27.6777	22.68	23.18	1.22	0.15
79.450	1.62	28.71	.97	29.7433	23.22	23.75	1.28	0.15
79.540	1.71	31.68	.99	31.8573	23.76	24.31	1.34	0.15
79.630	1.80	34.81	1.02	34.0201	24.30	24.88	1.40	0.15
79.720	1.89	38.08	1.05	36.2313	24.84	25.45	1.46	0.15
79.810	1.98	41.51	1.08	38.4913	25.38	26.02	1.52	0.15
79.900	2.07	45.08	1.10	40.7997	25.92	26.59	1.57	0.16
79.990	2.16	48.81	1.13	43.1569	26.46	27.16	1.63	0.16
80.080	2.25	52.70	1.16	45.5625	27.00	27.73	1.69	0.16
80.170	2.34	56.74	1.18	48.0167	27.54	28.30	1.74	0.16
80.260	2.43	60.94	1.21	50.5197	28.08	28.87	1.80	0.16
80.350	2.52	65.30	1.23	53.0711	28.62	29.44	1.85	0.16
80.440	2.61	69.82	1.25	55.6713	29.16	30.01	1.91	0.16
80.530	2.70	74.51	1.28	58.3199	29.70	30.58	1.96	0.16
80.620	2.79	79.36	1.30	61.0173	30.24	31.15	2.02	0.16
80.710	2.88	84.37	1.32	63.7631	30.78	31.71	2.07	0.16
80.800	2.97	89.56	1.35	66.5577	31.32	32.28	2.13	0.16

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

TRAPEZOIDAL CROSS SECTION

Slope = .000500 ft/ft
Mannings n = 0.04000
Invert Elev. = 77.83 ft
Top of Channel = 82.50 ft
Base width = 13.50 ft
Rt Side slope = 3.000 horizontal :1 vert.
Lt Side slope = 3.000 horizontal :1 vert.

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
80.890	3.06	94.91	1.37	69.4007	31.86	32.85	2.18	0.16
80.980	3.15	100.43	1.39	72.2926	32.40	33.42	2.23	0.16
81.070	3.24	106.13	1.41	75.2327	32.94	33.99	2.28	0.16
81.160	3.33	112.01	1.43	78.2218	33.48	34.56	2.34	0.17
81.250	3.42	118.06	1.45	81.2591	34.02	35.13	2.39	0.17
81.340	3.51	124.28	1.47	84.3454	34.56	35.70	2.44	0.17
81.430	3.60	130.69	1.49	87.4800	35.10	36.27	2.49	0.17
81.520	3.69	137.28	1.51	90.6634	35.64	36.84	2.54	0.17
81.610	3.78	144.05	1.53	93.8952	36.18	37.41	2.60	0.17
81.700	3.87	151.01	1.55	97.1758	36.72	37.98	2.65	0.17
81.790	3.96	158.16	1.57	100.5048	37.26	38.55	2.70	0.17
81.880	4.05	165.49	1.59	103.8826	37.80	39.11	2.75	0.17
81.970	4.14	173.01	1.61	107.3088	38.34	39.68	2.80	0.17
82.060	4.23	180.72	1.63	110.7838	38.88	40.25	2.85	0.17
82.150	4.32	188.63	1.65	114.3072	39.42	40.82	2.90	0.17
82.240	4.41	196.73	1.67	117.8794	39.96	41.39	2.95	0.17
82.330	4.50	205.03	1.69	121.5000	40.50	41.96	3.00	0.17
82.420	4.59	213.53	1.71	125.1695	41.04	42.53	3.05	0.17
82.500	4.67	221.25	1.72	128.4716	41.52	43.04	3.09	0.17

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .100000 ft/ft
Mannings n = 0.01200
Invert Elev. = 145.00 ft
Top of Channel = 147.00 ft
Diameter = 2.0000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
145.000	.00	.00	.00	.0000	.00	.00	.00	0.00
145.040	.04	.05	3.47	.0150	.56	.57	.03	3.74
145.080	.08	.23	5.48	.0422	.78	.81	.05	4.17
145.120	.12	.55	7.13	.0770	.95	.99	.08	4.42
145.160	.16	1.01	8.58	.1177	1.09	1.15	.11	4.59
145.200	.20	1.62	9.90	.1635	1.20	1.29	.14	4.73
145.240	.24	2.37	11.10	.2135	1.30	1.41	.16	4.83
145.280	.28	3.27	12.22	.2673	1.39	1.53	.19	4.91
145.320	.32	4.30	13.26	.3245	1.47	1.65	.22	4.97
145.360	.36	5.48	14.24	.3845	1.54	1.75	.25	5.02
145.400	.40	6.79	15.17	.4473	1.60	1.85	.28	5.06
145.440	.44	8.23	16.05	.5125	1.66	1.95	.31	5.09
145.480	.48	9.79	16.88	.5798	1.71	2.05	.34	5.11
145.520	.52	11.47	17.67	.6491	1.75	2.14	.37	5.12
145.560	.56	13.27	18.43	.7201	1.80	2.23	.40	5.13
145.600	.60	15.18	19.15	.7927	1.83	2.32	.43	5.13
145.640	.64	17.18	19.83	.8667	1.87	2.41	.46	5.13
145.680	.68	19.29	20.48	.9419	1.89	2.49	.50	5.12
145.720	.72	21.48	21.10	1.0182	1.92	2.57	.53	5.11
145.760	.76	23.76	21.69	1.0954	1.94	2.66	.56	5.09
145.800	.80	26.12	22.25	1.1735	1.96	2.74	.60	5.07
145.840	.84	28.54	22.79	1.2522	1.97	2.82	.63	5.04
145.880	.88	31.02	23.30	1.3314	1.99	2.90	.67	5.02
145.920	.92	33.55	23.78	1.4110	1.99	2.98	.71	4.98
145.960	.96	36.13	24.24	1.4908	2.00	3.06	.75	4.95
146.000	1.00	38.75	24.67	1.5708	2.00	3.14	.79	4.91
146.040	1.04	41.39	25.07	1.6508	2.00	3.22	.83	4.86
146.080	1.08	44.05	25.46	1.7306	1.99	3.30	.87	4.82
146.120	1.12	46.73	25.81	1.8102	1.99	3.38	.91	4.77
146.160	1.16	49.40	26.15	1.8894	1.97	3.46	.96	4.71
146.200	1.20	52.06	26.45	1.9681	1.96	3.54	1.00	4.65
146.240	1.24	54.71	26.74	2.0462	1.94	3.63	1.05	4.59
146.280	1.28	57.33	27.00	2.1234	1.92	3.71	1.11	4.53
146.320	1.32	59.90	27.23	2.1997	1.89	3.79	1.16	4.46
146.360	1.36	62.42	27.44	2.2749	1.87	3.88	1.22	4.38
146.400	1.40	64.88	27.62	2.3489	1.83	3.96	1.28	4.30
146.440	1.44	67.27	27.78	2.4215	1.80	4.05	1.35	4.22

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .100000 ft/ft
Mannings n = 0.01200
Invert Elev. = 145.00 ft
Top of Channel = 147.00 ft
Diameter = 2.0000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
146.480	1.48	69.56	27.91	2.4925	1.75	4.14	1.42	4.13
146.520	1.52	71.75	28.01	2.5618	1.71	4.24	1.50	4.03
146.560	1.56	73.82	28.08	2.6291	1.66	4.33	1.59	3.93
146.600	1.60	75.75	28.11	2.6943	1.60	4.43	1.68	3.82
146.640	1.64	77.53	28.12	2.7571	1.54	4.53	1.79	3.70
146.680	1.68	79.13	28.09	2.8171	1.47	4.64	1.92	3.57
146.720	1.72	80.53	28.02	2.8743	1.39	4.75	2.07	3.43
146.760	1.76	81.70	27.90	2.9280	1.30	4.87	2.25	3.28
146.800	1.80	82.59	27.73	2.9781	1.20	5.00	2.48	3.10
146.840	1.84	83.17	27.51	3.0238	1.09	5.14	2.79	2.91
146.876	1.88	83.36	27.23	3.0612	.96	5.28	3.18	2.69
146.880	1.88	83.36	27.20	3.0646	.95	5.29	3.23	2.67
146.920	1.92	83.03	26.79	3.0994	.78	5.48	3.95	2.37
146.960	1.96	81.89	26.19	3.1266	.56	5.72	5.58	1.95
147.000	2.00	77.50	24.67	3.1416	.00	6.28	****	****

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .100000 ft/ft
Mannings n = 0.01200
Invert Elev. = 145.00 ft
Top of Channel = 147.00 ft
Diameter = 2.0000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
145.000	.00	.00	.00	.0000	.00	.00	.00	0.00
145.040	.04	.05	3.47	.0150	.56	.57	.03	3.74
145.080	.08	.23	5.48	.0422	.78	.81	.05	4.17
145.120	.12	.55	7.13	.0770	.95	.99	.08	4.42
145.160	.16	1.01	8.58	.1177	1.09	1.15	.11	4.59
145.200	.20	1.62	9.90	.1635	1.20	1.29	.14	4.73
145.240	.24	2.37	11.10	.2135	1.30	1.41	.16	4.83
145.280	.28	3.27	12.22	.2673	1.39	1.53	.19	4.91
145.320	.32	4.30	13.26	.3245	1.47	1.65	.22	4.97
145.360	.36	5.48	14.24	.3845	1.54	1.75	.25	5.02
145.400	.40	6.79	15.17	.4473	1.60	1.85	.28	5.06
145.440	.44	8.23	16.05	.5125	1.66	1.95	.31	5.09
145.480	.48	9.79	16.88	.5798	1.71	2.05	.34	5.11
145.520	.52	11.47	17.67	.6491	1.75	2.14	.37	5.12
145.560	.56	13.27	18.43	.7201	1.80	2.23	.40	5.13
145.600	.60	15.18	19.15	.7927	1.83	2.32	.43	5.13
145.640	.64	17.18	19.83	.8667	1.87	2.41	.46	5.13
145.680	.68	19.29	20.48	.9419	1.89	2.49	.50	5.12
145.720	.72	21.48	21.10	1.0182	1.92	2.57	.53	5.11
145.760	.76	23.76	21.69	1.0954	1.94	2.66	.56	5.09
145.800	.80	26.12	22.25	1.1735	1.96	2.74	.60	5.07
145.840	.84	28.54	22.79	1.2522	1.97	2.82	.63	5.04
145.880	.88	31.02	23.30	1.3314	1.99	2.90	.67	5.02
145.920	.92	33.55	23.78	1.4110	1.99	2.98	.71	4.98
145.960	.96	36.13	24.24	1.4908	2.00	3.06	.75	4.95
146.000	1.00	38.75	24.67	1.5708	2.00	3.14	.79	4.91
146.040	1.04	41.39	25.07	1.6508	2.00	3.22	.83	4.86
146.080	1.08	44.05	25.46	1.7306	1.99	3.30	.87	4.82
146.120	1.12	46.73	25.81	1.8102	1.99	3.38	.91	4.77
146.160	1.16	49.40	26.15	1.8894	1.97	3.46	.96	4.71
146.200	1.20	52.06	26.45	1.9681	1.96	3.54	1.00	4.65
146.240	1.24	54.71	26.74	2.0462	1.94	3.63	1.05	4.59
146.280	1.28	57.33	27.00	2.1234	1.92	3.71	1.11	4.53
146.320	1.32	59.90	27.23	2.1997	1.89	3.79	1.16	4.46
146.360	1.36	62.42	27.44	2.2749	1.87	3.88	1.22	4.38
146.400	1.40	64.88	27.62	2.3489	1.83	3.96	1.28	4.30
146.440	1.44	67.27	27.78	2.4215	1.80	4.05	1.35	4.22

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .100000 ft/ft
Mannings n = 0.01200
Invert Elev. = 145.00 ft
Top of Channel = 147.00 ft
Diameter = 2.0000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
146.480	1.48	69.56	27.91	2.4925	1.75	4.14	1.42	4.13
146.520	1.52	71.75	28.01	2.5618	1.71	4.24	1.50	4.03
146.560	1.56	73.82	28.08	2.6291	1.66	4.33	1.59	3.93
146.600	1.60	75.75	28.11	2.6943	1.60	4.43	1.68	3.82
146.640	1.64	77.53	28.12	2.7571	1.54	4.53	1.79	3.70
146.680	1.68	79.13	28.09	2.8171	1.47	4.64	1.92	3.57
146.720	1.72	80.53	28.02	2.8743	1.39	4.75	2.07	3.43
146.760	1.76	81.70	27.90	2.9280	1.30	4.87	2.25	3.28
146.800	1.80	82.59	27.73	2.9781	1.20	5.00	2.48	3.10
146.840	1.84	83.17	27.51	3.0238	1.09	5.14	2.79	2.91
146.876	1.88	83.36	27.23	3.0612	.96	5.28	3.18	2.69
146.880	1.88	83.36	27.20	3.0646	.95	5.29	3.23	2.67
146.920	1.92	83.03	26.79	3.0994	.78	5.48	3.95	2.37
146.960	1.96	81.89	26.19	3.1266	.56	5.72	5.58	1.95
147.000	2.00	77.50	24.67	3.1416	.00	6.28	****	****

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .100000 ft/ft
Mannings n = 0.01200
Invert Elev. = 124.00 ft
Top of Channel = 126.00 ft
Diameter = 2.0000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
124.000	.00	.00	.00	.0000	.00	.00	.00	0.00
124.040	.04	.05	3.47	.0150	.56	.57	.03	3.74
124.080	.08	.23	5.48	.0422	.78	.81	.05	4.17
124.120	.12	.55	7.13	.0770	.95	.99	.08	4.42
124.160	.16	1.01	8.58	.1177	1.09	1.15	.11	4.59
124.200	.20	1.62	9.90	.1635	1.20	1.29	.14	4.73
124.240	.24	2.37	11.10	.2135	1.30	1.41	.16	4.83
124.280	.28	3.27	12.22	.2673	1.39	1.53	.19	4.91
124.320	.32	4.30	13.26	.3244	1.47	1.65	.22	4.97
124.360	.36	5.48	14.24	.3845	1.54	1.75	.25	5.02
124.400	.40	6.79	15.17	.4473	1.60	1.85	.28	5.06
124.440	.44	8.23	16.05	.5125	1.66	1.95	.31	5.09
124.480	.48	9.79	16.88	.5798	1.71	2.05	.34	5.11
124.520	.52	11.47	17.67	.6490	1.75	2.14	.37	5.12
124.560	.56	13.27	18.43	.7201	1.80	2.23	.40	5.13
124.600	.60	15.18	19.15	.7927	1.83	2.32	.43	5.13
124.640	.64	17.18	19.83	.8667	1.87	2.41	.46	5.13
124.680	.68	19.29	20.48	.9419	1.89	2.49	.50	5.12
124.720	.72	21.48	21.10	1.0182	1.92	2.57	.53	5.11
124.760	.76	23.76	21.69	1.0954	1.94	2.66	.56	5.09
124.800	.80	26.12	22.25	1.1735	1.96	2.74	.60	5.07
124.840	.84	28.54	22.79	1.2522	1.97	2.82	.63	5.04
124.880	.88	31.02	23.30	1.3314	1.99	2.90	.67	5.02
124.920	.92	33.55	23.78	1.4110	1.99	2.98	.71	4.98
124.960	.96	36.13	24.24	1.4908	2.00	3.06	.75	4.95
125.000	1.00	38.75	24.67	1.5708	2.00	3.14	.79	4.91
125.040	1.04	41.39	25.07	1.6508	2.00	3.22	.83	4.86
125.080	1.08	44.05	25.46	1.7306	1.99	3.30	.87	4.82
125.120	1.12	46.73	25.81	1.8102	1.99	3.38	.91	4.77
125.160	1.16	49.40	26.15	1.8894	1.97	3.46	.96	4.71
125.200	1.20	52.06	26.45	1.9681	1.96	3.54	1.00	4.65
125.240	1.24	54.71	26.74	2.0461	1.94	3.63	1.05	4.59
125.280	1.28	57.33	27.00	2.1234	1.92	3.71	1.11	4.53
125.320	1.32	59.90	27.23	2.1997	1.89	3.79	1.16	4.46
125.360	1.36	62.42	27.44	2.2749	1.87	3.88	1.22	4.38
125.400	1.40	64.88	27.62	2.3489	1.83	3.96	1.28	4.30
125.440	1.44	67.27	27.78	2.4215	1.80	4.05	1.35	4.22

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .100000 ft/ft
Mannings n = 0.01200
Invert Elev. = 124.00 ft
Top of Channel = 126.00 ft
Diameter = 2.0000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
125.480	1.48	69.56	27.91	2.4925	1.75	4.14	1.42	4.13
125.520	1.52	71.75	28.01	2.5618	1.71	4.24	1.50	4.03
125.560	1.56	73.82	28.08	2.6291	1.66	4.33	1.59	3.93
125.600	1.60	75.75	28.11	2.6943	1.60	4.43	1.68	3.82
125.640	1.64	77.53	28.12	2.7571	1.54	4.53	1.79	3.70
125.680	1.68	79.13	28.09	2.8171	1.47	4.64	1.92	3.57
125.720	1.72	80.53	28.02	2.8743	1.39	4.75	2.07	3.43
125.760	1.76	81.70	27.90	2.9281	1.30	4.87	2.25	3.28
125.800	1.80	82.59	27.73	2.9781	1.20	5.00	2.48	3.10
125.840	1.84	83.17	27.51	3.0238	1.09	5.14	2.79	2.91
125.876	1.88	83.36	27.23	3.0612	.96	5.28	3.18	2.69
125.880	1.88	83.36	27.20	3.0646	.95	5.29	3.23	2.67
125.920	1.92	83.03	26.79	3.0994	.78	5.48	3.95	2.37
125.960	1.96	81.89	26.19	3.1266	.56	5.72	5.58	1.95
126.000	2.00	77.50	24.67	3.1416	.00	6.28	****	****

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .100000 ft/ft
Mannings n = 0.01200
Invert Elev. = 160.00 ft
Top of Channel = 162.50 ft
Diameter = 2.5000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
160.000	.00	.00	.00	.0000	.00	.00	.00	0.00
160.050	.05	.09	4.03	.0234	.70	.71	.03	3.88
160.100	.10	.42	6.36	.0659	.98	1.01	.07	4.32
160.150	.15	1.00	8.28	.1202	1.19	1.24	.10	4.59
160.200	.20	1.83	9.96	.1840	1.36	1.43	.14	4.77
160.250	.25	2.93	11.48	.2555	1.50	1.61	.17	4.91
160.300	.30	4.30	12.88	.3337	1.62	1.77	.21	5.01
160.350	.35	5.92	14.18	.4177	1.73	1.92	.24	5.09
160.400	.40	7.80	15.39	.5069	1.83	2.06	.28	5.16
160.450	.45	9.93	16.53	.6008	1.92	2.19	.31	5.21
160.500	.50	12.30	17.61	.6989	2.00	2.32	.35	5.25
160.550	.55	14.91	18.62	.8007	2.07	2.44	.39	5.28
160.600	.60	17.75	19.59	.9059	2.14	2.56	.42	5.30
160.650	.65	20.80	20.51	1.0141	2.19	2.68	.46	5.32
160.700	.70	24.06	21.38	1.1251	2.24	2.79	.50	5.33
160.750	.75	27.52	22.22	1.2386	2.29	2.90	.54	5.33
160.800	.80	31.16	23.01	1.3542	2.33	3.01	.58	5.32
160.850	.85	34.98	23.77	1.4717	2.37	3.11	.62	5.32
160.900	.90	38.95	24.49	1.5909	2.40	3.22	.66	5.30
160.950	.95	43.08	25.17	1.7116	2.43	3.32	.71	5.28
161.000	1.00	47.35	25.82	1.8336	2.45	3.42	.75	5.26
161.050	1.05	51.74	26.44	1.9565	2.47	3.53	.79	5.24
161.100	1.10	56.24	27.03	2.0803	2.48	3.63	.84	5.21
161.150	1.15	60.83	27.59	2.2046	2.49	3.73	.88	5.17
161.200	1.20	65.51	28.12	2.3294	2.50	3.83	.93	5.13
161.250	1.25	70.25	28.62	2.4544	2.50	3.93	.98	5.09
161.300	1.30	75.05	29.10	2.5793	2.50	4.03	1.03	5.05
161.350	1.35	79.88	29.54	2.7041	2.49	4.13	1.09	5.00
161.400	1.40	84.72	29.95	2.8285	2.48	4.23	1.14	4.95
161.450	1.45	89.57	30.34	2.9522	2.47	4.33	1.20	4.89
161.500	1.50	94.40	30.70	3.0752	2.45	4.43	1.26	4.83
161.550	1.55	99.20	31.03	3.1971	2.43	4.53	1.32	4.77
161.600	1.60	103.94	31.33	3.3178	2.40	4.64	1.38	4.70
161.650	1.65	108.61	31.60	3.4370	2.37	4.74	1.45	4.62
161.700	1.70	113.18	31.84	3.5546	2.33	4.85	1.52	4.55
161.750	1.75	117.64	32.05	3.6702	2.29	4.96	1.60	4.46
161.800	1.80	121.96	32.23	3.7836	2.24	5.07	1.69	4.38

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .100000 ft/ft
Mannings n = 0.01200
Invert Elev. = 160.00 ft
Top of Channel = 162.50 ft
Diameter = 2.5000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
161.850	1.85	126.12	32.38	3.8946	2.19	5.18	1.78	4.28
161.900	1.90	130.09	32.50	4.0028	2.14	5.29	1.87	4.18
161.950	1.95	133.84	32.58	4.1080	2.07	5.41	1.98	4.08
162.000	2.00	137.34	32.62	4.2098	2.00	5.54	2.10	3.96
162.050	2.05	140.57	32.63	4.3079	1.92	5.66	2.24	3.84
162.100	2.10	143.47	32.59	4.4018	1.83	5.80	2.40	3.71
162.150	2.15	146.01	32.51	4.4910	1.73	5.94	2.59	3.56
162.200	2.20	148.12	32.38	4.5751	1.62	6.09	2.82	3.40
162.250	2.25	149.75	32.18	4.6533	1.50	6.25	3.10	3.22
162.300	2.30	150.81	31.92	4.7248	1.36	6.42	3.48	3.02
162.346	2.35	151.15	31.60	4.7831	1.20	6.60	3.97	2.79
162.350	2.35	151.14	31.56	4.7885	1.19	6.62	4.03	2.77
162.400	2.40	150.54	31.08	4.8429	.98	6.85	4.94	2.46
162.450	2.45	148.48	30.39	4.8853	.70	7.14	6.98	2.03
162.500	2.50	140.51	28.62	4.9087	.00	7.85	****	****

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .100000 ft/ft
Mannings n = 0.01200
Invert Elev. = 155.00 ft
Top of Channel = 157.00 ft
Diameter = 2.0000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
155.000	.00	.00	.00	.0000	.00	.00	.00	0.00
155.040	.04	.05	3.47	.0150	.56	.57	.03	3.74
155.080	.08	.23	5.48	.0422	.78	.81	.05	4.17
155.120	.12	.55	7.13	.0770	.95	.99	.08	4.42
155.160	.16	1.01	8.58	.1177	1.09	1.15	.11	4.59
155.200	.20	1.62	9.90	.1635	1.20	1.29	.14	4.73
155.240	.24	2.37	11.10	.2135	1.30	1.41	.16	4.83
155.280	.28	3.27	12.22	.2673	1.39	1.53	.19	4.91
155.320	.32	4.30	13.26	.3245	1.47	1.65	.22	4.97
155.360	.36	5.48	14.24	.3845	1.54	1.75	.25	5.02
155.400	.40	6.79	15.17	.4473	1.60	1.85	.28	5.06
155.440	.44	8.23	16.05	.5125	1.66	1.95	.31	5.09
155.480	.48	9.79	16.88	.5798	1.71	2.05	.34	5.11
155.520	.52	11.47	17.67	.6491	1.75	2.14	.37	5.12
155.560	.56	13.27	18.43	.7201	1.80	2.23	.40	5.13
155.600	.60	15.18	19.15	.7927	1.83	2.32	.43	5.13
155.640	.64	17.18	19.83	.8667	1.87	2.41	.46	5.13
155.680	.68	19.29	20.48	.9419	1.89	2.49	.50	5.12
155.720	.72	21.48	21.10	1.0182	1.92	2.57	.53	5.11
155.760	.76	23.76	21.69	1.0954	1.94	2.66	.56	5.09
155.800	.80	26.12	22.25	1.1735	1.96	2.74	.60	5.07
155.840	.84	28.54	22.79	1.2522	1.97	2.82	.63	5.04
155.880	.88	31.02	23.30	1.3314	1.99	2.90	.67	5.02
155.920	.92	33.55	23.78	1.4110	1.99	2.98	.71	4.98
155.960	.96	36.13	24.24	1.4908	2.00	3.06	.75	4.95
156.000	1.00	38.75	24.67	1.5708	2.00	3.14	.79	4.91
156.040	1.04	41.39	25.07	1.6508	2.00	3.22	.83	4.86
156.080	1.08	44.05	25.46	1.7306	1.99	3.30	.87	4.82
156.120	1.12	46.73	25.81	1.8102	1.99	3.38	.91	4.77
156.160	1.16	49.40	26.15	1.8894	1.97	3.46	.96	4.71
156.200	1.20	52.06	26.45	1.9681	1.96	3.54	1.00	4.65
156.240	1.24	54.71	26.74	2.0462	1.94	3.63	1.05	4.59
156.280	1.28	57.33	27.00	2.1234	1.92	3.71	1.11	4.53
156.320	1.32	59.90	27.23	2.1997	1.89	3.79	1.16	4.46
156.360	1.36	62.42	27.44	2.2749	1.87	3.88	1.22	4.38
156.400	1.40	64.88	27.62	2.3489	1.83	3.96	1.28	4.30
156.440	1.44	67.27	27.78	2.4215	1.80	4.05	1.35	4.22

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Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .100000 ft/ft
Mannings n = 0.01200
Invert Elev. = 155.00 ft
Top of Channel = 157.00 ft
Diameter = 2.0000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
156.480	1.48	69.56	27.91	2.4925	1.75	4.14	1.42	4.13
156.520	1.52	71.75	28.01	2.5618	1.71	4.24	1.50	4.03
156.560	1.56	73.82	28.08	2.6291	1.66	4.33	1.59	3.93
156.600	1.60	75.75	28.11	2.6943	1.60	4.43	1.68	3.82
156.640	1.64	77.53	28.12	2.7571	1.54	4.53	1.79	3.70
156.680	1.68	79.13	28.09	2.8171	1.47	4.64	1.92	3.57
156.720	1.72	80.53	28.02	2.8743	1.39	4.75	2.07	3.43
156.760	1.76	81.70	27.90	2.9280	1.30	4.87	2.25	3.28
156.800	1.80	82.59	27.73	2.9781	1.20	5.00	2.48	3.10
156.840	1.84	83.17	27.51	3.0238	1.09	5.14	2.79	2.91
156.876	1.88	83.36	27.23	3.0612	.96	5.28	3.18	2.69
156.880	1.88	83.36	27.20	3.0646	.95	5.29	3.23	2.67
156.920	1.92	83.03	26.79	3.0994	.78	5.48	3.95	2.37
156.960	1.96	81.89	26.19	3.1266	.56	5.72	5.58	1.95
157.000	2.00	77.50	24.67	3.1416	.00	6.28	****	****

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .100000 ft/ft
Mannings n = 0.01200
Invert Elev. = 160.00 ft
Top of Channel = 162.50 ft
Diameter = 2.5000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
160.000	.00	.00	.00	.0000	.00	.00	.00	0.00
160.050	.05	.09	4.03	.0234	.70	.71	.03	3.88
160.100	.10	.42	6.36	.0659	.98	1.01	.07	4.32
160.150	.15	1.00	8.28	.1202	1.19	1.24	.10	4.59
160.200	.20	1.83	9.96	.1840	1.36	1.43	.14	4.77
160.250	.25	2.93	11.48	.2555	1.50	1.61	.17	4.91
160.300	.30	4.30	12.88	.3337	1.62	1.77	.21	5.01
160.350	.35	5.92	14.18	.4177	1.73	1.92	.24	5.09
160.400	.40	7.80	15.39	.5069	1.83	2.06	.28	5.16
160.450	.45	9.93	16.53	.6008	1.92	2.19	.31	5.21
160.500	.50	12.30	17.61	.6989	2.00	2.32	.35	5.25
160.550	.55	14.91	18.62	.8007	2.07	2.44	.39	5.28
160.600	.60	17.75	19.59	.9059	2.14	2.56	.42	5.30
160.650	.65	20.80	20.51	1.0141	2.19	2.68	.46	5.32
160.700	.70	24.06	21.38	1.1251	2.24	2.79	.50	5.33
160.750	.75	27.52	22.22	1.2386	2.29	2.90	.54	5.33
160.800	.80	31.16	23.01	1.3542	2.33	3.01	.58	5.32
160.850	.85	34.98	23.77	1.4717	2.37	3.11	.62	5.32
160.900	.90	38.95	24.49	1.5909	2.40	3.22	.66	5.30
160.950	.95	43.08	25.17	1.7116	2.43	3.32	.71	5.28
161.000	1.00	47.35	25.82	1.8336	2.45	3.42	.75	5.26
161.050	1.05	51.74	26.44	1.9565	2.47	3.53	.79	5.24
161.100	1.10	56.24	27.03	2.0803	2.48	3.63	.84	5.21
161.150	1.15	60.83	27.59	2.2046	2.49	3.73	.88	5.17
161.200	1.20	65.51	28.12	2.3294	2.50	3.83	.93	5.13
161.250	1.25	70.25	28.62	2.4544	2.50	3.93	.98	5.09
161.300	1.30	75.05	29.10	2.5793	2.50	4.03	1.03	5.05
161.350	1.35	79.88	29.54	2.7041	2.49	4.13	1.09	5.00
161.400	1.40	84.72	29.95	2.8285	2.48	4.23	1.14	4.95
161.450	1.45	89.57	30.34	2.9522	2.47	4.33	1.20	4.89
161.500	1.50	94.40	30.70	3.0752	2.45	4.43	1.26	4.83
161.550	1.55	99.20	31.03	3.1971	2.43	4.53	1.32	4.77
161.600	1.60	103.94	31.33	3.3178	2.40	4.64	1.38	4.70
161.650	1.65	108.61	31.60	3.4370	2.37	4.74	1.45	4.62
161.700	1.70	113.18	31.84	3.5546	2.33	4.85	1.52	4.55
161.750	1.75	117.64	32.05	3.6702	2.29	4.96	1.60	4.46
161.800	1.80	121.96	32.23	3.7836	2.24	5.07	1.69	4.38

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Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .100000 ft/ft
Mannings n = 0.01200
Invert Elev. = 160.00 ft
Top of Channel = 162.50 ft
Diameter = 2.5000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
161.850	1.85	126.12	32.38	3.8946	2.19	5.18	1.78	4.28
161.900	1.90	130.09	32.50	4.0028	2.14	5.29	1.87	4.18
161.950	1.95	133.84	32.58	4.1080	2.07	5.41	1.98	4.08
162.000	2.00	137.34	32.62	4.2098	2.00	5.54	2.10	3.96
162.050	2.05	140.57	32.63	4.3079	1.92	5.66	2.24	3.84
162.100	2.10	143.47	32.59	4.4018	1.83	5.80	2.40	3.71
162.150	2.15	146.01	32.51	4.4910	1.73	5.94	2.59	3.56
162.200	2.20	148.12	32.38	4.5751	1.62	6.09	2.82	3.40
162.250	2.25	149.75	32.18	4.6533	1.50	6.25	3.10	3.22
162.300	2.30	150.81	31.92	4.7248	1.36	6.42	3.48	3.02
162.346	2.35	151.15	31.60	4.7831	1.20	6.60	3.97	2.79
162.350	2.35	151.14	31.56	4.7885	1.19	6.62	4.03	2.77
162.400	2.40	150.54	31.08	4.8429	.98	6.85	4.94	2.46
162.450	2.45	148.48	30.39	4.8853	.70	7.14	6.98	2.03
162.500	2.50	140.51	28.62	4.9087	.00	7.85	****	****

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .100000 ft/ft
Mannings n = 0.01200
Invert Elev. = 155.00 ft
Top of Channel = 157.00 ft
Diameter = 2.0000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
155.000	.00	.00	.00	.0000	.00	.00	.00	0.00
155.040	.04	.05	3.47	.0150	.56	.57	.03	3.74
155.080	.08	.23	5.48	.0422	.78	.81	.05	4.17
155.120	.12	.55	7.13	.0770	.95	.99	.08	4.42
155.160	.16	1.01	8.58	.1177	1.09	1.15	.11	4.59
155.200	.20	1.62	9.90	.1635	1.20	1.29	.14	4.73
155.240	.24	2.37	11.10	.2135	1.30	1.41	.16	4.83
155.280	.28	3.27	12.22	.2673	1.39	1.53	.19	4.91
155.320	.32	4.30	13.26	.3245	1.47	1.65	.22	4.97
155.360	.36	5.48	14.24	.3845	1.54	1.75	.25	5.02
155.400	.40	6.79	15.17	.4473	1.60	1.85	.28	5.06
155.440	.44	8.23	16.05	.5125	1.66	1.95	.31	5.09
155.480	.48	9.79	16.88	.5798	1.71	2.05	.34	5.11
155.520	.52	11.47	17.67	.6491	1.75	2.14	.37	5.12
155.560	.56	13.27	18.43	.7201	1.80	2.23	.40	5.13
155.600	.60	15.18	19.15	.7927	1.83	2.32	.43	5.13
155.640	.64	17.18	19.83	.8667	1.87	2.41	.46	5.13
155.680	.68	19.29	20.48	.9419	1.89	2.49	.50	5.12
155.720	.72	21.48	21.10	1.0182	1.92	2.57	.53	5.11
155.760	.76	23.76	21.69	1.0954	1.94	2.66	.56	5.09
155.800	.80	26.12	22.25	1.1735	1.96	2.74	.60	5.07
155.840	.84	28.54	22.79	1.2522	1.97	2.82	.63	5.04
155.880	.88	31.02	23.30	1.3314	1.99	2.90	.67	5.02
155.920	.92	33.55	23.78	1.4110	1.99	2.98	.71	4.98
155.960	.96	36.13	24.24	1.4908	2.00	3.06	.75	4.95
156.000	1.00	38.75	24.67	1.5708	2.00	3.14	.79	4.91
156.040	1.04	41.39	25.07	1.6508	2.00	3.22	.83	4.86
156.080	1.08	44.05	25.46	1.7306	1.99	3.30	.87	4.82
156.120	1.12	46.73	25.81	1.8102	1.99	3.38	.91	4.77
156.160	1.16	49.40	26.15	1.8894	1.97	3.46	.96	4.71
156.200	1.20	52.06	26.45	1.9681	1.96	3.54	1.00	4.65
156.240	1.24	54.71	26.74	2.0462	1.94	3.63	1.05	4.59
156.280	1.28	57.33	27.00	2.1234	1.92	3.71	1.11	4.53
156.320	1.32	59.90	27.23	2.1997	1.89	3.79	1.16	4.46
156.360	1.36	62.42	27.44	2.2749	1.87	3.88	1.22	4.38
156.400	1.40	64.88	27.62	2.3489	1.83	3.96	1.28	4.30
156.440	1.44	67.27	27.78	2.4215	1.80	4.05	1.35	4.22

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Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .100000 ft/ft
Mannings n = 0.01200
Invert Elev. = 155.00 ft
Top of Channel = 157.00 ft
Diameter = 2.0000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
156.480	1.48	69.56	27.91	2.4925	1.75	4.14	1.42	4.13
156.520	1.52	71.75	28.01	2.5618	1.71	4.24	1.50	4.03
156.560	1.56	73.82	28.08	2.6291	1.66	4.33	1.59	3.93
156.600	1.60	75.75	28.11	2.6943	1.60	4.43	1.68	3.82
156.640	1.64	77.53	28.12	2.7571	1.54	4.53	1.79	3.70
156.680	1.68	79.13	28.09	2.8171	1.47	4.64	1.92	3.57
156.720	1.72	80.53	28.02	2.8743	1.39	4.75	2.07	3.43
156.760	1.76	81.70	27.90	2.9280	1.30	4.87	2.25	3.28
156.800	1.80	82.59	27.73	2.9781	1.20	5.00	2.48	3.10
156.840	1.84	83.17	27.51	3.0238	1.09	5.14	2.79	2.91
156.876	1.88	83.36	27.23	3.0612	.96	5.28	3.18	2.69
156.880	1.88	83.36	27.20	3.0646	.95	5.29	3.23	2.67
156.920	1.92	83.03	26.79	3.0994	.78	5.48	3.95	2.37
156.960	1.96	81.89	26.19	3.1266	.56	5.72	5.58	1.95
157.000	2.00	77.50	24.67	3.1416	.00	6.28	****	****

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .100000 ft/ft
Mannings n = 0.01200
Invert Elev. = 124.00 ft
Top of Channel = 126.00 ft
Diameter = 2.0000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
124.000	.00	.00	.00	.0000	.00	.00	.00	0.00
124.040	.04	.05	3.47	.0150	.56	.57	.03	3.74
124.080	.08	.23	5.48	.0422	.78	.81	.05	4.17
124.120	.12	.55	7.13	.0770	.95	.99	.08	4.42
124.160	.16	1.01	8.58	.1177	1.09	1.15	.11	4.59
124.200	.20	1.62	9.90	.1635	1.20	1.29	.14	4.73
124.240	.24	2.37	11.10	.2135	1.30	1.41	.16	4.83
124.280	.28	3.27	12.22	.2673	1.39	1.53	.19	4.91
124.320	.32	4.30	13.26	.3244	1.47	1.65	.22	4.97
124.360	.36	5.48	14.24	.3845	1.54	1.75	.25	5.02
124.400	.40	6.79	15.17	.4473	1.60	1.85	.28	5.06
124.440	.44	8.23	16.05	.5125	1.66	1.95	.31	5.09
124.480	.48	9.79	16.88	.5798	1.71	2.05	.34	5.11
124.520	.52	11.47	17.67	.6490	1.75	2.14	.37	5.12
124.560	.56	13.27	18.43	.7201	1.80	2.23	.40	5.13
124.600	.60	15.18	19.15	.7927	1.83	2.32	.43	5.13
124.640	.64	17.18	19.83	.8667	1.87	2.41	.46	5.13
124.680	.68	19.29	20.48	.9419	1.89	2.49	.50	5.12
124.720	.72	21.48	21.10	1.0182	1.92	2.57	.53	5.11
124.760	.76	23.76	21.69	1.0954	1.94	2.66	.56	5.09
124.800	.80	26.12	22.25	1.1735	1.96	2.74	.60	5.07
124.840	.84	28.54	22.79	1.2522	1.97	2.82	.63	5.04
124.880	.88	31.02	23.30	1.3314	1.99	2.90	.67	5.02
124.920	.92	33.55	23.78	1.4110	1.99	2.98	.71	4.98
124.960	.96	36.13	24.24	1.4908	2.00	3.06	.75	4.95
125.000	1.00	38.75	24.67	1.5708	2.00	3.14	.79	4.91
125.040	1.04	41.39	25.07	1.6508	2.00	3.22	.83	4.86
125.080	1.08	44.05	25.46	1.7306	1.99	3.30	.87	4.82
125.120	1.12	46.73	25.81	1.8102	1.99	3.38	.91	4.77
125.160	1.16	49.40	26.15	1.8894	1.97	3.46	.96	4.71
125.200	1.20	52.06	26.45	1.9681	1.96	3.54	1.00	4.65
125.240	1.24	54.71	26.74	2.0461	1.94	3.63	1.05	4.59
125.280	1.28	57.33	27.00	2.1234	1.92	3.71	1.11	4.53
125.320	1.32	59.90	27.23	2.1997	1.89	3.79	1.16	4.46
125.360	1.36	62.42	27.44	2.2749	1.87	3.88	1.22	4.38
125.400	1.40	64.88	27.62	2.3489	1.83	3.96	1.28	4.30
125.440	1.44	67.27	27.78	2.4215	1.80	4.05	1.35	4.22

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .100000 ft/ft
Mannings n = 0.01200
Invert Elev. = 124.00 ft
Top of Channel = 126.00 ft
Diameter = 2.0000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
125.480	1.48	69.56	27.91	2.4925	1.75	4.14	1.42	4.13
125.520	1.52	71.75	28.01	2.5618	1.71	4.24	1.50	4.03
125.560	1.56	73.82	28.08	2.6291	1.66	4.33	1.59	3.93
125.600	1.60	75.75	28.11	2.6943	1.60	4.43	1.68	3.82
125.640	1.64	77.53	28.12	2.7571	1.54	4.53	1.79	3.70
125.680	1.68	79.13	28.09	2.8171	1.47	4.64	1.92	3.57
125.720	1.72	80.53	28.02	2.8743	1.39	4.75	2.07	3.43
125.760	1.76	81.70	27.90	2.9281	1.30	4.87	2.25	3.28
125.800	1.80	82.59	27.73	2.9781	1.20	5.00	2.48	3.10
125.840	1.84	83.17	27.51	3.0238	1.09	5.14	2.79	2.91
125.876	1.88	83.36	27.23	3.0612	.96	5.28	3.18	2.69
125.880	1.88	83.36	27.20	3.0646	.95	5.29	3.23	2.67
125.920	1.92	83.03	26.79	3.0994	.78	5.48	3.95	2.37
125.960	1.96	81.89	26.19	3.1266	.56	5.72	5.58	1.95
126.000	2.00	77.50	24.67	3.1416	.00	6.28	****	****

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .100000 ft/ft
Mannings n = 0.01200
Invert Elev. = 168.00 ft
Top of Channel = 170.50 ft
Diameter = 2.5000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
168.000	.00	.00	.00	.0000	.00	.00	.00	0.00
168.050	.05	.09	4.03	.0234	.70	.71	.03	3.88
168.100	.10	.42	6.36	.0659	.98	1.01	.07	4.32
168.150	.15	1.00	8.28	.1202	1.19	1.24	.10	4.59
168.200	.20	1.83	9.96	.1840	1.36	1.43	.14	4.77
168.250	.25	2.93	11.48	.2555	1.50	1.61	.17	4.91
168.300	.30	4.30	12.88	.3337	1.62	1.77	.21	5.01
168.350	.35	5.92	14.18	.4177	1.73	1.92	.24	5.09
168.400	.40	7.80	15.39	.5069	1.83	2.06	.28	5.16
168.450	.45	9.93	16.53	.6008	1.92	2.19	.31	5.21
168.500	.50	12.30	17.61	.6989	2.00	2.32	.35	5.25
168.550	.55	14.91	18.62	.8007	2.07	2.44	.39	5.28
168.600	.60	17.75	19.59	.9059	2.14	2.56	.42	5.30
168.650	.65	20.80	20.51	1.0141	2.19	2.68	.46	5.32
168.700	.70	24.06	21.38	1.1251	2.24	2.79	.50	5.33
168.750	.75	27.52	22.22	1.2386	2.29	2.90	.54	5.33
168.800	.80	31.16	23.01	1.3542	2.33	3.01	.58	5.32
168.850	.85	34.98	23.77	1.4717	2.37	3.11	.62	5.32
168.900	.90	38.95	24.49	1.5909	2.40	3.22	.66	5.30
168.950	.95	43.08	25.17	1.7116	2.43	3.32	.71	5.28
169.000	1.00	47.35	25.82	1.8336	2.45	3.42	.75	5.26
169.050	1.05	51.74	26.44	1.9565	2.47	3.53	.79	5.24
169.100	1.10	56.24	27.03	2.0803	2.48	3.63	.84	5.21
169.150	1.15	60.83	27.59	2.2046	2.49	3.73	.88	5.17
169.200	1.20	65.51	28.12	2.3294	2.50	3.83	.93	5.13
169.250	1.25	70.25	28.62	2.4544	2.50	3.93	.98	5.09
169.300	1.30	75.05	29.10	2.5793	2.50	4.03	1.03	5.05
169.350	1.35	79.88	29.54	2.7041	2.49	4.13	1.09	5.00
169.400	1.40	84.72	29.95	2.8285	2.48	4.23	1.14	4.95
169.450	1.45	89.57	30.34	2.9522	2.47	4.33	1.20	4.89
169.500	1.50	94.40	30.70	3.0752	2.45	4.43	1.26	4.83
169.550	1.55	99.20	31.03	3.1971	2.43	4.53	1.32	4.77
169.600	1.60	103.94	31.33	3.3178	2.40	4.64	1.38	4.70
169.650	1.65	108.61	31.60	3.4370	2.37	4.74	1.45	4.62
169.700	1.70	113.18	31.84	3.5546	2.33	4.85	1.52	4.55
169.750	1.75	117.64	32.05	3.6702	2.29	4.96	1.60	4.46
169.800	1.80	121.96	32.23	3.7836	2.24	5.07	1.69	4.38

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .100000 ft/ft
Mannings n = 0.01200
Invert Elev. = 168.00 ft
Top of Channel = 170.50 ft
Diameter = 2.5000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
169.850	1.85	126.12	32.38	3.8946	2.19	5.18	1.78	4.28
169.900	1.90	130.09	32.50	4.0028	2.14	5.29	1.87	4.18
169.950	1.95	133.84	32.58	4.1080	2.07	5.41	1.98	4.08
170.000	2.00	137.34	32.62	4.2098	2.00	5.54	2.10	3.96
170.050	2.05	140.57	32.63	4.3079	1.92	5.66	2.24	3.84
170.100	2.10	143.47	32.59	4.4018	1.83	5.80	2.40	3.71
170.150	2.15	146.01	32.51	4.4910	1.73	5.94	2.59	3.56
170.200	2.20	148.12	32.38	4.5751	1.62	6.09	2.82	3.40
170.250	2.25	149.75	32.18	4.6533	1.50	6.25	3.10	3.22
170.300	2.30	150.81	31.92	4.7248	1.36	6.42	3.48	3.02
170.346	2.35	151.15	31.60	4.7831	1.20	6.60	3.97	2.79
170.350	2.35	151.14	31.56	4.7885	1.19	6.62	4.03	2.77
170.400	2.40	150.54	31.08	4.8429	.98	6.85	4.94	2.46
170.450	2.45	148.48	30.39	4.8853	.70	7.14	6.98	2.03
170.500	2.50	140.51	28.62	4.9087	.00	7.85	****	****

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .100000 ft/ft
Mannings n = 0.01200
Invert Elev. = 155.00 ft
Top of Channel = 157.00 ft
Diameter = 2.0000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
155.000	.00	.00	.00	.0000	.00	.00	.00	0.00
155.040	.04	.05	3.47	.0150	.56	.57	.03	3.74
155.080	.08	.23	5.48	.0422	.78	.81	.05	4.17
155.120	.12	.55	7.13	.0770	.95	.99	.08	4.42
155.160	.16	1.01	8.58	.1177	1.09	1.15	.11	4.59
155.200	.20	1.62	9.90	.1635	1.20	1.29	.14	4.73
155.240	.24	2.37	11.10	.2135	1.30	1.41	.16	4.83
155.280	.28	3.27	12.22	.2673	1.39	1.53	.19	4.91
155.320	.32	4.30	13.26	.3245	1.47	1.65	.22	4.97
155.360	.36	5.48	14.24	.3845	1.54	1.75	.25	5.02
155.400	.40	6.79	15.17	.4473	1.60	1.85	.28	5.06
155.440	.44	8.23	16.05	.5125	1.66	1.95	.31	5.09
155.480	.48	9.79	16.88	.5798	1.71	2.05	.34	5.11
155.520	.52	11.47	17.67	.6491	1.75	2.14	.37	5.12
155.560	.56	13.27	18.43	.7201	1.80	2.23	.40	5.13
155.600	.60	15.18	19.15	.7927	1.83	2.32	.43	5.13
155.640	.64	17.18	19.83	.8667	1.87	2.41	.46	5.13
155.680	.68	19.29	20.48	.9419	1.89	2.49	.50	5.12
155.720	.72	21.48	21.10	1.0182	1.92	2.57	.53	5.11
155.760	.76	23.76	21.69	1.0954	1.94	2.66	.56	5.09
155.800	.80	26.12	22.25	1.1735	1.96	2.74	.60	5.07
155.840	.84	28.54	22.79	1.2522	1.97	2.82	.63	5.04
155.880	.88	31.02	23.30	1.3314	1.99	2.90	.67	5.02
155.920	.92	33.55	23.78	1.4110	1.99	2.98	.71	4.98
155.960	.96	36.13	24.24	1.4908	2.00	3.06	.75	4.95
156.000	1.00	38.75	24.67	1.5708	2.00	3.14	.79	4.91
156.040	1.04	41.39	25.07	1.6508	2.00	3.22	.83	4.86
156.080	1.08	44.05	25.46	1.7306	1.99	3.30	.87	4.82
156.120	1.12	46.73	25.81	1.8102	1.99	3.38	.91	4.77
156.160	1.16	49.40	26.15	1.8894	1.97	3.46	.96	4.71
156.200	1.20	52.06	26.45	1.9681	1.96	3.54	1.00	4.65
156.240	1.24	54.71	26.74	2.0462	1.94	3.63	1.05	4.59
156.280	1.28	57.33	27.00	2.1234	1.92	3.71	1.11	4.53
156.320	1.32	59.90	27.23	2.1997	1.89	3.79	1.16	4.46
156.360	1.36	62.42	27.44	2.2749	1.87	3.88	1.22	4.38
156.400	1.40	64.88	27.62	2.3489	1.83	3.96	1.28	4.30
156.440	1.44	67.27	27.78	2.4215	1.80	4.05	1.35	4.22

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .100000 ft/ft
Mannings n = 0.01200
Invert Elev. = 155.00 ft
Top of Channel = 157.00 ft
Diameter = 2.0000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
156.480	1.48	69.56	27.91	2.4925	1.75	4.14	1.42	4.13
156.520	1.52	71.75	28.01	2.5618	1.71	4.24	1.50	4.03
156.560	1.56	73.82	28.08	2.6291	1.66	4.33	1.59	3.93
156.600	1.60	75.75	28.11	2.6943	1.60	4.43	1.68	3.82
156.640	1.64	77.53	28.12	2.7571	1.54	4.53	1.79	3.70
156.680	1.68	79.13	28.09	2.8171	1.47	4.64	1.92	3.57
156.720	1.72	80.53	28.02	2.8743	1.39	4.75	2.07	3.43
156.760	1.76	81.70	27.90	2.9280	1.30	4.87	2.25	3.28
156.800	1.80	82.59	27.73	2.9781	1.20	5.00	2.48	3.10
156.840	1.84	83.17	27.51	3.0238	1.09	5.14	2.79	2.91
156.876	1.88	83.36	27.23	3.0612	.96	5.28	3.18	2.69
156.880	1.88	83.36	27.20	3.0646	.95	5.29	3.23	2.67
156.920	1.92	83.03	26.79	3.0994	.78	5.48	3.95	2.37
156.960	1.96	81.89	26.19	3.1266	.56	5.72	5.58	1.95
157.000	2.00	77.50	24.67	3.1416	.00	6.28	****	****

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .100000 ft/ft
Mannings n = 0.01200
Invert Elev. = 168.00 ft
Top of Channel = 170.50 ft
Diameter = 2.5000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
168.000	.00	.00	.00	.0000	.00	.00	.00	0.00
168.050	.05	.09	4.03	.0234	.70	.71	.03	3.88
168.100	.10	.42	6.36	.0659	.98	1.01	.07	4.32
168.150	.15	1.00	8.28	.1202	1.19	1.24	.10	4.59
168.200	.20	1.83	9.96	.1840	1.36	1.43	.14	4.77
168.250	.25	2.93	11.48	.2555	1.50	1.61	.17	4.91
168.300	.30	4.30	12.88	.3337	1.62	1.77	.21	5.01
168.350	.35	5.92	14.18	.4177	1.73	1.92	.24	5.09
168.400	.40	7.80	15.39	.5069	1.83	2.06	.28	5.16
168.450	.45	9.93	16.53	.6008	1.92	2.19	.31	5.21
168.500	.50	12.30	17.61	.6989	2.00	2.32	.35	5.25
168.550	.55	14.91	18.62	.8007	2.07	2.44	.39	5.28
168.600	.60	17.75	19.59	.9059	2.14	2.56	.42	5.30
168.650	.65	20.80	20.51	1.0141	2.19	2.68	.46	5.32
168.700	.70	24.06	21.38	1.1251	2.24	2.79	.50	5.33
168.750	.75	27.52	22.22	1.2386	2.29	2.90	.54	5.33
168.800	.80	31.16	23.01	1.3542	2.33	3.01	.58	5.32
168.850	.85	34.98	23.77	1.4717	2.37	3.11	.62	5.32
168.900	.90	38.95	24.49	1.5909	2.40	3.22	.66	5.30
168.950	.95	43.08	25.17	1.7116	2.43	3.32	.71	5.28
169.000	1.00	47.35	25.82	1.8336	2.45	3.42	.75	5.26
169.050	1.05	51.74	26.44	1.9565	2.47	3.53	.79	5.24
169.100	1.10	56.24	27.03	2.0803	2.48	3.63	.84	5.21
169.150	1.15	60.83	27.59	2.2046	2.49	3.73	.88	5.17
169.200	1.20	65.51	28.12	2.3294	2.50	3.83	.93	5.13
169.250	1.25	70.25	28.62	2.4544	2.50	3.93	.98	5.09
169.300	1.30	75.05	29.10	2.5793	2.50	4.03	1.03	5.05
169.350	1.35	79.88	29.54	2.7041	2.49	4.13	1.09	5.00
169.400	1.40	84.72	29.95	2.8285	2.48	4.23	1.14	4.95
169.450	1.45	89.57	30.34	2.9522	2.47	4.33	1.20	4.89
169.500	1.50	94.40	30.70	3.0752	2.45	4.43	1.26	4.83
169.550	1.55	99.20	31.03	3.1971	2.43	4.53	1.32	4.77
169.600	1.60	103.94	31.33	3.3178	2.40	4.64	1.38	4.70
169.650	1.65	108.61	31.60	3.4370	2.37	4.74	1.45	4.62
169.700	1.70	113.18	31.84	3.5546	2.33	4.85	1.52	4.55
169.750	1.75	117.64	32.05	3.6702	2.29	4.96	1.60	4.46
169.800	1.80	121.96	32.23	3.7836	2.24	5.07	1.69	4.38

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .100000 ft/ft
Mannings n = 0.01200
Invert Elev. = 168.00 ft
Top of Channel = 170.50 ft
Diameter = 2.5000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
169.850	1.85	126.12	32.38	3.8946	2.19	5.18	1.78	4.28
169.900	1.90	130.09	32.50	4.0028	2.14	5.29	1.87	4.18
169.950	1.95	133.84	32.58	4.1080	2.07	5.41	1.98	4.08
170.000	2.00	137.34	32.62	4.2098	2.00	5.54	2.10	3.96
170.050	2.05	140.57	32.63	4.3079	1.92	5.66	2.24	3.84
170.100	2.10	143.47	32.59	4.4018	1.83	5.80	2.40	3.71
170.150	2.15	146.01	32.51	4.4910	1.73	5.94	2.59	3.56
170.200	2.20	148.12	32.38	4.5751	1.62	6.09	2.82	3.40
170.250	2.25	149.75	32.18	4.6533	1.50	6.25	3.10	3.22
170.300	2.30	150.81	31.92	4.7248	1.36	6.42	3.48	3.02
170.346	2.35	151.15	31.60	4.7831	1.20	6.60	3.97	2.79
170.350	2.35	151.14	31.56	4.7885	1.19	6.62	4.03	2.77
170.400	2.40	150.54	31.08	4.8429	.98	6.85	4.94	2.46
170.450	2.45	148.48	30.39	4.8853	.70	7.14	6.98	2.03
170.500	2.50	140.51	28.62	4.9087	.00	7.85	****	****

Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .100000 ft/ft
Mannings n = 0.01200
Invert Elev. = 155.00 ft
Top of Channel = 157.00 ft
Diameter = 2.0000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
155.000	.00	.00	.00	.0000	.00	.00	.00	0.00
155.040	.04	.05	3.47	.0150	.56	.57	.03	3.74
155.080	.08	.23	5.48	.0422	.78	.81	.05	4.17
155.120	.12	.55	7.13	.0770	.95	.99	.08	4.42
155.160	.16	1.01	8.58	.1177	1.09	1.15	.11	4.59
155.200	.20	1.62	9.90	.1635	1.20	1.29	.14	4.73
155.240	.24	2.37	11.10	.2135	1.30	1.41	.16	4.83
155.280	.28	3.27	12.22	.2673	1.39	1.53	.19	4.91
155.320	.32	4.30	13.26	.3245	1.47	1.65	.22	4.97
155.360	.36	5.48	14.24	.3845	1.54	1.75	.25	5.02
155.400	.40	6.79	15.17	.4473	1.60	1.85	.28	5.06
155.440	.44	8.23	16.05	.5125	1.66	1.95	.31	5.09
155.480	.48	9.79	16.88	.5798	1.71	2.05	.34	5.11
155.520	.52	11.47	17.67	.6491	1.75	2.14	.37	5.12
155.560	.56	13.27	18.43	.7201	1.80	2.23	.40	5.13
155.600	.60	15.18	19.15	.7927	1.83	2.32	.43	5.13
155.640	.64	17.18	19.83	.8667	1.87	2.41	.46	5.13
155.680	.68	19.29	20.48	.9419	1.89	2.49	.50	5.12
155.720	.72	21.48	21.10	1.0182	1.92	2.57	.53	5.11
155.760	.76	23.76	21.69	1.0954	1.94	2.66	.56	5.09
155.800	.80	26.12	22.25	1.1735	1.96	2.74	.60	5.07
155.840	.84	28.54	22.79	1.2522	1.97	2.82	.63	5.04
155.880	.88	31.02	23.30	1.3314	1.99	2.90	.67	5.02
155.920	.92	33.55	23.78	1.4110	1.99	2.98	.71	4.98
155.960	.96	36.13	24.24	1.4908	2.00	3.06	.75	4.95
156.000	1.00	38.75	24.67	1.5708	2.00	3.14	.79	4.91
156.040	1.04	41.39	25.07	1.6508	2.00	3.22	.83	4.86
156.080	1.08	44.05	25.46	1.7306	1.99	3.30	.87	4.82
156.120	1.12	46.73	25.81	1.8102	1.99	3.38	.91	4.77
156.160	1.16	49.40	26.15	1.8894	1.97	3.46	.96	4.71
156.200	1.20	52.06	26.45	1.9681	1.96	3.54	1.00	4.65
156.240	1.24	54.71	26.74	2.0462	1.94	3.63	1.05	4.59
156.280	1.28	57.33	27.00	2.1234	1.92	3.71	1.11	4.53
156.320	1.32	59.90	27.23	2.1997	1.89	3.79	1.16	4.46
156.360	1.36	62.42	27.44	2.2749	1.87	3.88	1.22	4.38
156.400	1.40	64.88	27.62	2.3489	1.83	3.96	1.28	4.30
156.440	1.44	67.27	27.78	2.4215	1.80	4.05	1.35	4.22

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Solution to Mannings Open Channel Flow Equation
(Computed values are based on normal depth.)

CIRCULAR CROSS SECTION

Slope = .100000 ft/ft
Mannings n = 0.01200
Invert Elev. = 155.00 ft
Top of Channel = 157.00 ft
Diameter = 2.0000 ft

Elev. (ft)	Depth (ft)	Flow (cfs)	Vel. (ft/sec)	Area (sq.ft)	Top W. (ft)	Wet.P. (ft)	Hd (ft)	Froude No.
156.480	1.48	69.56	27.91	2.4925	1.75	4.14	1.42	4.13
156.520	1.52	71.75	28.01	2.5618	1.71	4.24	1.50	4.03
156.560	1.56	73.82	28.08	2.6291	1.66	4.33	1.59	3.93
156.600	1.60	75.75	28.11	2.6943	1.60	4.43	1.68	3.82
156.640	1.64	77.53	28.12	2.7571	1.54	4.53	1.79	3.70
156.680	1.68	79.13	28.09	2.8171	1.47	4.64	1.92	3.57
156.720	1.72	80.53	28.02	2.8743	1.39	4.75	2.07	3.43
156.760	1.76	81.70	27.90	2.9280	1.30	4.87	2.25	3.28
156.800	1.80	82.59	27.73	2.9781	1.20	5.00	2.48	3.10
156.840	1.84	83.17	27.51	3.0238	1.09	5.14	2.79	2.91
156.876	1.88	83.36	27.23	3.0612	.96	5.28	3.18	2.69
156.880	1.88	83.36	27.20	3.0646	.95	5.29	3.23	2.67
156.920	1.92	83.03	26.79	3.0994	.78	5.48	3.95	2.37
156.960	1.96	81.89	26.19	3.1266	.56	5.72	5.58	1.95
157.000	2.00	77.50	24.67	3.1416	.00	6.28	****	****

```
                 MODIFIED PULS REACH ROUTING SUMMARY

  HYG Dir           = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
  Inflow  HYG file = NONE STORED - NE-3             Dev 25
  Outflow HYG file = NONE STORED - CH-E1            Dev 25

  Reach Link Data  = CH-E1
  Reach Length     = 1385.00 ft
  Approx. Total Tt = .3721 hrs  (based on Wtd.Q = 36.02 cfs)
  Reach Channel    = CHE1  (Chn-Trapz.)
  Overflow Elev.   = 82.50 ft
  Overflow Channel = NONE

  No Infiltration

  INITIAL CONDITIONS
  ----------------------------------
  Starting WS Elev   =    79.46 ft
  Starting Volume    =     .000 ac-ft
  Starting Outflow   =      .00 cfs
  Starting Infiltr.  =      .00 cfs
  Starting Total Qout=      .00 cfs
  Time Increment     =    .0050 hrs


  INFLOW/OUTFLOW HYDROGRAPH SUMMARY
  =====================================================
  Peak Inflow       =     85.43 cfs    at   12.5750 hrs
  Peak Outflow      =     74.09 cfs    at   12.7950 hrs
  =====================================================


  MASS BALANCE (ac-ft)
  --------------------------
+ Initial Vol   =        .000
+ HYG Vol IN    =      13.806
- Infiltration =        .000
- HYG Vol OUT   =      13.805
- Retained Vol =        .002
                  ----------
  Unrouted Vol =        .000 ac-ft  (.002% of Inflow Volume)
```

MODIFIED PULS REACH ROUTING SUMMARY

```
HYG Dir          = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Inflow  HYG file = NONE STORED - E-1              Dev 25
Outflow HYG file = NONE STORED - CH-E2            Dev 25

Reach Link Data  = CH-E2
Reach Length     = 1610.00 ft
Approx. Total Tt = .4015 hrs  (based on Wtd.Q = 46.32 cfs)
Reach Channel    = CHE2  (Chn-Trapz.)
Overflow Elev.   = 82.50 ft
Overflow Channel = NONE

No Infiltration

INITIAL CONDITIONS
----------------------------------
Starting WS Elev   =    78.77 ft
Starting Volume    =     .000 ac-ft
Starting Outflow   =      .00 cfs
Starting Infiltr.  =      .00 cfs
Starting Total Qout=      .00 cfs
Time Increment     =    .0050 hrs


INFLOW/OUTFLOW HYDROGRAPH SUMMARY
=====================================================
Peak Inflow      =    100.15 cfs    at   12.6100 hrs
Peak Outflow     =     90.84 cfs    at   12.8550 hrs
=====================================================


 MASS BALANCE (ac-ft)
 --------------------------
+ Initial Vol  =        .000
+ HYG Vol IN   =      20.233
- Infiltration =        .000
- HYG Vol OUT  =      20.230
- Retained Vol =        .003
                  ----------
 Unrouted Vol =       -.001 ac-ft  (.003% of Inflow Volume)
```

MODIFIED PULS REACH ROUTING SUMMARY

```
HYG Dir           = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Inflow  HYG file = NONE STORED - NE-1              Dev 25
Outflow HYG file = NONE STORED - CH-NE1            Dev 25

Reach Link Data  = CH-NE1
Reach Length     = 708.00 ft
Approx. Total Tt = .1908 hrs  (based on Wtd.Q = 35.68 cfs)
Reach Channel    = CHNE1  (Chn-Trapz.)
Overflow Elev.   = 83.00 ft
Overflow Channel = NONE

No Infiltration

INITIAL CONDITIONS
----------------------------------
Starting WS Elev   =    80.00 ft
Starting Volume    =     .000 ac-ft
Starting Outflow   =      .00 cfs
Starting Infiltr.  =      .00 cfs
Starting Total Qout=      .00 cfs
Time Increment     =    .0050 hrs


INFLOW/OUTFLOW HYDROGRAPH SUMMARY
=====================================================
Peak Inflow      =     87.41 cfs    at   12.4100 hrs
Peak Outflow     =     82.47 cfs    at   12.5300 hrs
=====================================================


MASS BALANCE (ac-ft)
--------------------------
+ Initial Vol   =        .000
+ HYG Vol IN    =      12.790
- Infiltration =        .000
- HYG Vol OUT   =      12.789
- Retained Vol =        .000
                  ----------
Unrouted Vol =       -.001 ac-ft  (.004% of Inflow Volume)
```

MODIFIED PULS REACH ROUTING SUMMARY

```
HYG Dir           = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Inflow  HYG file = NONE STORED - NE-2               Dev 25
Outflow HYG file = NONE STORED - CH-NE2             Dev 25

Reach Link Data  = CH-NE2
Reach Length     = 378.00 ft
Approx. Total Tt = .1013 hrs  (based on Wtd.Q = 36.37 cfs)
Reach Channel    = CHNE2  (Chn-Trapz.)
Overflow Elev.   = 83.00 ft
Overflow Channel = NONE

No Infiltration

INITIAL CONDITIONS
----------------------------------
Starting WS Elev   =    79.65 ft
Starting Volume    =     .000 ac-ft
Starting Outflow   =      .00 cfs
Starting Infiltr.  =      .00 cfs
Starting Total Qout=      .00 cfs
Time Increment     =    .0050 hrs


INFLOW/OUTFLOW HYDROGRAPH SUMMARY
=====================================================
Peak Inflow       =     86.64 cfs    at   12.5100 hrs
Peak Outflow      =     85.43 cfs    at   12.5750 hrs
=====================================================


 MASS BALANCE (ac-ft)
 --------------------------
+ Initial Vol  =        .000
+ HYG Vol IN   =      13.806
- Infiltration =        .000
- HYG Vol OUT  =      13.806
- Retained Vol =        .000
                  ----------
 Unrouted Vol =       -.000 ac-ft  (.001% of Inflow Volume)
```

```
                   MODIFIED PULS REACH ROUTING SUMMARY

 HYG Dir          = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
 Inflow  HYG file = NONE STORED - NW-1             Dev 25
 Outflow HYG file = NONE STORED - CH-NW1           Dev 25

 Reach Link Data  = CH-NW1
 Reach Length     = 740.00 ft
 Approx. Total Tt = .1945 hrs  (based on Wtd.Q = 38.79 cfs)
 Reach Channel    = CHNW1  (Chn-Trapz.)
 Overflow Elev.   = 83.00 ft
 Overflow Channel = NONE

 No Infiltration

 INITIAL CONDITIONS
 ----------------------------------
 Starting WS Elev   =    80.00 ft
 Starting Volume    =     .000 ac-ft
 Starting Outflow   =      .00 cfs
 Starting Infiltr.  =      .00 cfs
 Starting Total Qout=      .00 cfs
 Time Increment     =    .0050 hrs


 INFLOW/OUTFLOW HYDROGRAPH SUMMARY
 =====================================================
 Peak Inflow      =     92.50 cfs    at   12.5650 hrs
 Peak Outflow     =     88.31 cfs    at   12.6800 hrs
 =====================================================


 MASS BALANCE (ac-ft)
 --------------------------
+ Initial Vol  =        .000
+ HYG Vol IN   =      14.450
- Infiltration =        .000
- HYG Vol OUT  =      14.450
- Retained Vol =        .000
                 ----------
 Unrouted Vol =       -.001 ac-ft  (.004% of Inflow Volume)
```

```
                    MODIFIED PULS REACH ROUTING SUMMARY

 HYG Dir           = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
 Inflow  HYG file = NONE STORED - NW-2             Dev 25
 Outflow HYG file = NONE STORED - CH-NW2           Dev 25

 Reach Link Data  = CH-NW2
 Reach Length     = 712.00 ft
 Approx. Total Tt = .1851 hrs  (based on Wtd.Q = 40.24 cfs)
 Reach Channel    = CHNW2  (Chn-Trapz.)
 Overflow Elev.   = 83.00 ft
 Overflow Channel = NONE

 No Infiltration

 INITIAL CONDITIONS
 ----------------------------------
 Starting WS Elev   =    79.63 ft
 Starting Volume    =     .000 ac-ft
 Starting Outflow   =      .00 cfs
 Starting Infiltr.  =      .00 cfs
 Starting Total Qout=      .00 cfs
 Time Increment     =    .0050 hrs


 INFLOW/OUTFLOW HYDROGRAPH SUMMARY
 =====================================================
 Peak Inflow       =     93.15 cfs    at   12.6550 hrs
 Peak Outflow      =     89.96 cfs    at   12.7650 hrs
 =====================================================


 MASS BALANCE (ac-ft)
 --------------------------
+ Initial Vol   =        .000
+ HYG Vol IN    =      15.995
- Infiltration =        .000
- HYG Vol OUT   =      15.995
- Retained Vol =        .000
                  ----------
 Unrouted Vol =       -.000 ac-ft  (.002% of Inflow Volume)
```

```
                    MODIFIED PULS REACH ROUTING SUMMARY

 HYG Dir           = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
 Inflow  HYG file = NONE STORED - SW-1             Dev 25
 Outflow HYG file = NONE STORED - CH-S1            Dev 25

 Reach Link Data  = CH-S1
 Reach Length     = 830.00 ft
 Approx. Total Tt = .4070 hrs  (based on Wtd.Q = 5.54 cfs)
 Reach Channel    = CHS1  (Chn-Trapz.)
 Overflow Elev.   = 83.00 ft
 Overflow Channel = NONE

 No Infiltration

 INITIAL CONDITIONS
 ----------------------------------
 Starting WS Elev   =    76.20 ft
 Starting Volume    =     .000 ac-ft
 Starting Outflow   =      .00 cfs
 Starting Infiltr.  =      .00 cfs
 Starting Total Qout=      .00 cfs
 Time Increment     =    .0050 hrs


 INFLOW/OUTFLOW HYDROGRAPH SUMMARY
 =====================================================
 Peak Inflow       =     15.62 cfs    at   12.2150 hrs
 Peak Outflow      =     11.42 cfs    at   12.3900 hrs
 =====================================================


 MASS BALANCE (ac-ft)
 --------------------------
+ Initial Vol  =        .000
+ HYG Vol IN   =       1.605
- Infiltration =        .000
- HYG Vol OUT  =       1.605
- Retained Vol =        .000
                  ----------
 Unrouted Vol =       -.000 ac-ft  (.001% of Inflow Volume)
```

```
                    MODIFIED PULS REACH ROUTING SUMMARY

 HYG Dir          = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
 Inflow  HYG file = NONE STORED - SE-6             Dev 25
 Outflow HYG file = NONE STORED - CH-S2            Dev 25

 Reach Link Data  = CH-S2
 Reach Length     = 595.00 ft
 Approx. Total Tt = .1233 hrs  (based on Wtd.Q = 87.37 cfs)
 Reach Channel    = CHS2  (Chn-Trapz.)
 Overflow Elev.   = 83.00 ft
 Overflow Channel = NONE

 No Infiltration

 INITIAL CONDITIONS
 ----------------------------------
 Starting WS Elev   =    75.91 ft
 Starting Volume    =     .000 ac-ft
 Starting Outflow   =      .00 cfs
 Starting Infiltr.  =      .00 cfs
 Starting Total Qout=      .00 cfs
 Time Increment     =    .0050 hrs


 INFLOW/OUTFLOW HYDROGRAPH SUMMARY
 =====================================================
 Peak Inflow       =    215.61 cfs    at   12.4350 hrs
 Peak Outflow      =    209.97 cfs    at   12.5100 hrs
 =====================================================


 MASS BALANCE (ac-ft)
 --------------------------
+ Initial Vol   =        .000
+ HYG Vol IN    =      30.280
- Infiltration =        .000
- HYG Vol OUT   =      30.279
- Retained Vol =        .000
                 ----------
 Unrouted Vol =       -.001 ac-ft  (.003% of Inflow Volume)
```

MODIFIED PULS REACH ROUTING SUMMARY

```
HYG Dir          = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Inflow  HYG file = NONE STORED - SE-1             Dev 25
Outflow HYG file = NONE STORED - CH-S3            Dev 25

Reach Link Data  = CH-S3
Reach Length     = 615.00 ft
Approx. Total Tt = .3949 hrs  (based on Wtd.Q = 2.58 cfs)
Reach Channel    = CHS3  (Chn-Trapz.)
Overflow Elev.   = 83.00 ft
Overflow Channel = NONE

No Infiltration

INITIAL CONDITIONS
----------------------------------
Starting WS Elev   =    77.42 ft
Starting Volume    =     .000 ac-ft
Starting Outflow   =      .00 cfs
Starting Infiltr.  =      .00 cfs
Starting Total Qout=      .00 cfs
Time Increment     =    .0050 hrs


INFLOW/OUTFLOW HYDROGRAPH SUMMARY
=====================================================
Peak Inflow       =      7.54 cfs    at   12.1800 hrs
Peak Outflow      =      5.43 cfs    at   12.3250 hrs
=====================================================


 MASS BALANCE (ac-ft)
 --------------------------
+ Initial Vol  =        .000
+ HYG Vol IN   =        .723
- Infiltration =        .000
- HYG Vol OUT  =        .723
- Retained Vol =        .000
                  ----------
  Unrouted Vol =       -.000 ac-ft  (.002% of Inflow Volume)
```

MODIFIED PULS REACH ROUTING SUMMARY

```
HYG Dir           = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Inflow  HYG file = NONE STORED - SE-3           Dev 25
Outflow HYG file = NONE STORED - CH-SE1         Dev 25

Reach Link Data  = CH-SE1
Reach Length     = 700.00 ft
Approx. Total Tt = .1737 hrs  (based on Wtd.Q = 47.08 cfs)
Reach Channel    = CHSE1  (Chn-Trapz.)
Overflow Elev.   = 83.00 ft
Overflow Channel = NONE

No Infiltration

INITIAL CONDITIONS
----------------------------------
Starting WS Elev   =    77.45 ft
Starting Volume    =     .000 ac-ft
Starting Outflow   =      .00 cfs
Starting Infiltr.  =      .00 cfs
Starting Total Qout=      .00 cfs
Time Increment     =    .0050 hrs


INFLOW/OUTFLOW HYDROGRAPH SUMMARY
=====================================================
Peak Inflow      =     98.18 cfs    at   12.7850 hrs
Peak Outflow     =     96.80 cfs    at   12.8950 hrs
=====================================================


MASS BALANCE (ac-ft)
--------------------------
+ Initial Vol  =       .000
+ HYG Vol IN   =     22.550
- Infiltration =       .000
- HYG Vol OUT  =     22.549
- Retained Vol =       .001
                 ----------
Unrouted Vol =       -.000 ac-ft  (.001% of Inflow Volume)
```

MODIFIED PULS REACH ROUTING SUMMARY

```
HYG Dir          = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Inflow  HYG file = NONE STORED - SE-5            Dev 25
Outflow HYG file = NONE STORED - CH-SE2          Dev 25

Reach Link Data  = CH-SE2
Reach Length     = 1415.00 ft
Approx. Total Tt = .2664 hrs  (based on Wtd.Q = 124.88 cfs)
Reach Channel    = CHSE2  (Chn-Trapz.)
Overflow Elev.   = 83.00 ft
Overflow Channel = NONE

No Infiltration

INITIAL CONDITIONS
----------------------------------
Starting WS Elev   =    75.61 ft
Starting Volume    =     .000 ac-ft
Starting Outflow   =      .00 cfs
Starting Infiltr.  =      .00 cfs
Starting Total Qout=      .00 cfs
Time Increment     =    .0050 hrs


INFLOW/OUTFLOW HYDROGRAPH SUMMARY
=====================================================
Peak Inflow      =    293.36 cfs    at   12.5600 hrs
Peak Outflow     =    269.42 cfs    at   12.7350 hrs
=====================================================


MASS BALANCE (ac-ft)
--------------------------
+ Initial Vol  =        .000
+ HYG Vol IN   =      53.549
- Infiltration =        .000
- HYG Vol OUT  =      53.545
- Retained Vol =        .003
                  ----------
Unrouted Vol =       -.001 ac-ft  (.002% of Inflow Volume)
```

MODIFIED PULS REACH ROUTING SUMMARY

```
HYG Dir           = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Inflow  HYG file = NONE STORED - SW-3             Dev 25
Outflow HYG file = NONE STORED - CH-SW1           Dev 25

Reach Link Data  = CH-SW1
Reach Length     = 640.00 ft
Approx. Total Tt = .1570 hrs  (based on Wtd.Q = 48.94 cfs)
Reach Channel    = CHSW1  (Chn-Trapz.)
Overflow Elev.   = 83.00 ft
Overflow Channel = NONE

No Infiltration

INITIAL CONDITIONS
----------------------------------
Starting WS Elev   =    76.06 ft
Starting Volume    =     .000 ac-ft
Starting Outflow   =      .00 cfs
Starting Infiltr.  =      .00 cfs
Starting Total Qout=      .00 cfs
Time Increment     =    .0050 hrs


INFLOW/OUTFLOW HYDROGRAPH SUMMARY
=====================================================
Peak Inflow      =     99.77 cfs    at   13.0350 hrs
Peak Outflow     =     98.82 cfs    at   13.1300 hrs
=====================================================


MASS BALANCE (ac-ft)
--------------------------
+ Initial Vol  =        .000
+ HYG Vol IN   =      24.684
- Infiltration =        .000
- HYG Vol OUT  =      24.684
- Retained Vol =        .001
                ----------
Unrouted Vol =        .000 ac-ft  (.002% of Inflow Volume)
```

```
                    MODIFIED PULS REACH ROUTING SUMMARY

 HYG Dir          = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
 Inflow  HYG file = NONE STORED - SW-5             Dev 25
 Outflow HYG file = NONE STORED - CH-SW2           Dev 25

 Reach Link Data  = CH-SW2
 Reach Length     = 950.00 ft
 Approx. Total Tt = .2300 hrs  (based on Wtd.Q = 51.18 cfs)
 Reach Channel    = CHSW2  (Chn-Trapz.)
 Overflow Elev.   = 83.00 ft
 Overflow Channel = NONE

 No Infiltration

 INITIAL CONDITIONS
 ----------------------------------
 Starting WS Elev   =    75.35 ft
 Starting Volume    =     .000 ac-ft
 Starting Outflow   =      .00 cfs
 Starting Infiltr.  =      .00 cfs
 Starting Total Qout=      .00 cfs
 Time Increment     =    .0050 hrs


 INFLOW/OUTFLOW HYDROGRAPH SUMMARY
 =====================================================
 Peak Inflow      =    102.76 cfs    at   13.1050 hrs
 Peak Outflow     =    100.92 cfs    at   13.2350 hrs
 =====================================================


 MASS BALANCE (ac-ft)
 --------------------------
+ Initial Vol  =        .000
+ HYG Vol IN   =      26.289
- Infiltration =        .000
- HYG Vol OUT  =      26.287
- Retained Vol =        .002
                ----------
 Unrouted Vol =        .000 ac-ft  (.000% of Inflow Volume)
```

MODIFIED PULS REACH ROUTING SUMMARY

```
HYG Dir           = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Inflow  HYG file = NONE STORED - SW-7            Dev 25
Outflow HYG file = NONE STORED - CH-SW3          Dev 25

Reach Link Data  = CH-SW3
Reach Length     = 1040.00 ft
Approx. Total Tt = .1829 hrs  (based on Wtd.Q = 164.01 cfs)
Reach Channel    = CHSW3  (Chn-Trapz.)
Overflow Elev.   = 83.00 ft
Overflow Channel = NONE

No Infiltration

INITIAL CONDITIONS
----------------------------------
Starting WS Elev   =    74.90 ft
Starting Volume    =     .000 ac-ft
Starting Outflow   =      .00 cfs
Starting Infiltr.  =      .00 cfs
Starting Total Qout=      .00 cfs
Time Increment     =    .0050 hrs


INFLOW/OUTFLOW HYDROGRAPH SUMMARY
=====================================================
Peak Inflow      =    350.02 cfs    at   12.7950 hrs
Peak Outflow     =    340.96 cfs    at   12.9300 hrs
=====================================================


MASS BALANCE (ac-ft)
--------------------------
+ Initial Vol   =        .000
+ HYG Vol IN    =      79.838
- Infiltration =        .000
- HYG Vol OUT   =      79.834
- Retained Vol =        .002
                  ----------
  Unrouted Vol =       -.002 ac-ft  (.002% of Inflow Volume)
```

MODIFIED PULS REACH ROUTING SUMMARY

```
HYG Dir           = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Inflow  HYG file = NONE STORED - NW-3            Dev 25
Outflow HYG file = NONE STORED - CH-W1           Dev 25

Reach Link Data  = CH-W1
Reach Length     = 1430.00 ft
Approx. Total Tt = .3745 hrs  (based on Wtd.Q = 39.25 cfs)
Reach Channel    = CHW1  (Chn-Trapz.)
Overflow Elev.   = 82.50 ft
Overflow Channel = NONE

No Infiltration

INITIAL CONDITIONS
----------------------------------
Starting WS Elev   =    79.27 ft
Starting Volume    =     .000 ac-ft
Starting Outflow   =      .00 cfs
Starting Infiltr.  =      .00 cfs
Starting Total Qout=      .00 cfs
Time Increment     =    .0050 hrs


INFLOW/OUTFLOW HYDROGRAPH SUMMARY
=====================================================
Peak Inflow       =     89.96 cfs    at   12.7650 hrs
Peak Outflow      =     80.16 cfs    at   12.9800 hrs
=====================================================


  MASS BALANCE (ac-ft)
  --------------------------
+ Initial Vol  =        .000
+ HYG Vol IN   =      15.995
- Infiltration =        .000
- HYG Vol OUT  =      15.993
- Retained Vol =        .002
                  ----------
  Unrouted Vol =        .000 ac-ft  (.000% of Inflow Volume)
```

```
                    MODIFIED PULS REACH ROUTING SUMMARY

 HYG Dir            = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
 Inflow  HYG file = NONE STORED - W-1                 Dev 25
 Outflow HYG file = NONE STORED - CH-W2               Dev 25

 Reach Link Data  = CH-W2
 Reach Length     = 1580.00 ft
 Approx. Total Tt = .3896 hrs  (based on Wtd.Q = 48.14 cfs)
 Reach Channel    = CHW2  (Chn-Trapz.)
 Overflow Elev.   = 82.50 ft
 Overflow Channel = NONE

 No Infiltration

 INITIAL CONDITIONS
 ----------------------------------
 Starting WS Elev   =    77.83 ft
 Starting Volume    =     .000 ac-ft
 Starting Outflow   =      .00 cfs
 Starting Infiltr.  =      .00 cfs
 Starting Total Qout=      .00 cfs
 Time Increment     =    .0050 hrs


 INFLOW/OUTFLOW HYDROGRAPH SUMMARY
 =====================================================
 Peak Inflow      =    101.80 cfs    at   12.8450 hrs
 Peak Outflow     =     94.44 cfs    at   13.0750 hrs
 =====================================================


 MASS BALANCE (ac-ft)
 --------------------------
+ Initial Vol   =        .000
+ HYG Vol IN    =      22.096
- Infiltration =        .000
- HYG Vol OUT   =      22.093
- Retained Vol =        .003
                 ----------
 Unrouted Vol =       -.000 ac-ft  (.001% of Inflow Volume)
```

MODIFIED PULS REACH ROUTING SUMMARY

```
HYG Dir          = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Inflow  HYG file = NONE STORED - NW4+EXN4+NE4     Dev 25
Outflow HYG file = NONE STORED - DDN4             Dev 25

Reach Link Data  = DDN4
Reach Length     = 370.00 ft
Approx. Total Tt = .0057 hrs  (based on Wtd.Q = 12.21 cfs)
Reach Channel    = DDN4  (Chn-Circular)
Overflow Elev.   = 146.84 ft
Overflow Channel = NONE

No Infiltration

INITIAL CONDITIONS
----------------------------------
Starting WS Elev   =   145.00 ft
Starting Volume    =     .000 ac-ft
Starting Outflow   =      .00 cfs
Starting Infiltr.  =      .00 cfs
Starting Total Qout=      .00 cfs
Time Increment     =    .0050 hrs


INFLOW/OUTFLOW HYDROGRAPH SUMMARY
=====================================================
Peak Inflow      =     29.42 cfs    at   12.5300 hrs
Peak Outflow     =     29.42 cfs    at   12.5350 hrs
=====================================================


MASS BALANCE (ac-ft)
--------------------------
+ Initial Vol   =        .000
+ HYG Vol IN    =       4.458
- Infiltration =        .000
- HYG Vol OUT   =       4.458
- Retained Vol =        .000
                  ----------
  Unrouted Vol =        .000 ac-ft  (.000% of Outflow Volume)
```

```
                    MODIFIED PULS REACH ROUTING SUMMARY

  HYG Dir          = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
  Inflow  HYG file = NONE STORED - NW5+EXN5+NE5     Dev 25
  Outflow HYG file = NONE STORED - DDN5             Dev 25

  Reach Link Data  = DDN5
  Reach Length     = 230.00 ft
  Approx. Total Tt = .0035 hrs  (based on Wtd.Q = 12.61 cfs)
  Reach Channel    = DDN5  (Chn-Circular)
  Overflow Elev.   = 125.84 ft
  Overflow Channel = NONE

  No Infiltration

  INITIAL CONDITIONS
  ----------------------------------
  Starting WS Elev   =   124.00 ft
  Starting Volume    =     .000 ac-ft
  Starting Outflow   =      .00 cfs
  Starting Infiltr.  =      .00 cfs
  Starting Total Qout=      .00 cfs
  Time Increment     =    .0050 hrs


  INFLOW/OUTFLOW HYDROGRAPH SUMMARY
  =====================================================
  Peak Inflow       =     29.71 cfs    at   12.6000 hrs
  Peak Outflow      =     29.71 cfs    at   12.6000 hrs
  =====================================================


  MASS BALANCE (ac-ft)
  --------------------------
+ Initial Vol  =        .000
+ HYG Vol IN   =       4.800
- Infiltration =        .000
- HYG Vol OUT  =       4.800
- Retained Vol =        .000
                  ----------
  Unrouted Vol =       -.000 ac-ft  (.000% of Inflow Volume)


  WARNING: For weighted average inflow, the approximate total
  travel time through entire reach is shorter than
  the inflow hydrograph time step. Consider reducing
  calculation time step.
  Wtd.Avg.Q = 12.61 cfs   Approx.Total Tt = .0035 hrs
```

```
                   MODIFIED PULS REACH ROUTING SUMMARY

HYG Dir           = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Inflow  HYG file = NONE STORED - NE               Dev 25
Outflow HYG file = NONE STORED - DDNE             Dev 25

Reach Link Data  = DDNE
Reach Length     = 505.00 ft
Approx. Total Tt = .0069 hrs  (based on Wtd.Q = 19.86 cfs)
Reach Channel    = DDNE  (Chn-Circular)
Overflow Elev.   = 162.30 ft
Overflow Channel = NONE

No Infiltration

INITIAL CONDITIONS
----------------------------------
Starting WS Elev   =   160.00 ft
Starting Volume    =     .000 ac-ft
Starting Outflow   =      .00 cfs
Starting Infiltr.  =      .00 cfs
Starting Total Qout=      .00 cfs
Time Increment     =    .0050 hrs


INFLOW/OUTFLOW HYDROGRAPH SUMMARY
=====================================================
Peak Inflow       =     51.78 cfs    at   12.3400 hrs
Peak Outflow      =     51.78 cfs    at   12.3450 hrs
=====================================================


MASS BALANCE (ac-ft)
--------------------------
+ Initial Vol  =        .000
+ HYG Vol IN   =       6.329
- Infiltration =        .000
- HYG Vol OUT  =       6.329
- Retained Vol =        .000
                 ----------
Unrouted Vol =        .000 ac-ft  (.000% of Outflow Volume)
```

MODIFIED PULS REACH ROUTING SUMMARY

```
HYG Dir           = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Inflow  HYG file = NONE STORED - NE3              Dev 25
Outflow HYG file = NONE STORED - DDNE3            Dev 25

Reach Link Data  = DDNE3
Reach Length     = 445.00 ft
Approx. Total Tt = .0090 hrs  (based on Wtd.Q = 4.76 cfs)
Reach Channel    = DDNE3  (Chn-Circular)
Overflow Elev.   = 156.84 ft
Overflow Channel = NONE

No Infiltration

INITIAL CONDITIONS
----------------------------------
Starting WS Elev   =   155.00 ft
Starting Volume    =     .000 ac-ft
Starting Outflow   =      .00 cfs
Starting Infiltr.  =      .00 cfs
Starting Total Qout=      .00 cfs
Time Increment     =    .0050 hrs


INFLOW/OUTFLOW HYDROGRAPH SUMMARY
=====================================================
Peak Inflow      =     11.76 cfs    at   12.4600 hrs
Peak Outflow     =     11.76 cfs    at   12.4650 hrs
=====================================================


 MASS BALANCE (ac-ft)
 --------------------------
+ Initial Vol  =        .000
+ HYG Vol IN   =       1.661
- Infiltration =        .000
- HYG Vol OUT  =       1.661
- Retained Vol =        .000
                  ----------
 Unrouted Vol =        .000 ac-ft  (.000% of Outflow Volume)
```

```
                    MODIFIED PULS REACH ROUTING SUMMARY

 HYG Dir          = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
 Inflow  HYG file = NONE STORED - NW              Dev 25
 Outflow HYG file = NONE STORED - DDNW            Dev 25

 Reach Link Data  = DDNW
 Reach Length     = 505.00 ft
 Approx. Total Tt = .0067 hrs  (based on Wtd.Q = 22.08 cfs)
 Reach Channel    = DDNW  (Chn-Circular)
 Overflow Elev.   = 162.30 ft
 Overflow Channel = NONE

 No Infiltration

 INITIAL CONDITIONS
 ----------------------------------
 Starting WS Elev   =   160.00 ft
 Starting Volume    =     .000 ac-ft
 Starting Outflow   =      .00 cfs
 Starting Infiltr.  =      .00 cfs
 Starting Total Qout=      .00 cfs
 Time Increment     =    .0050 hrs


 INFLOW/OUTFLOW HYDROGRAPH SUMMARY
 =====================================================
 Peak Inflow       =     52.27 cfs    at   12.5850 hrs
 Peak Outflow      =     52.27 cfs    at   12.5900 hrs
 =====================================================


 MASS BALANCE (ac-ft)
 --------------------------
+ Initial Vol  =        .000
+ HYG Vol IN   =       8.328
- Infiltration =        .000
- HYG Vol OUT  =       8.328
- Retained Vol =        .000
                  ----------
 Unrouted Vol =        .000 ac-ft  (.000% of Outflow Volume)
```

```
                    MODIFIED PULS REACH ROUTING SUMMARY

  HYG Dir          = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
  Inflow  HYG file = NONE STORED - NW3                 Dev 25
  Outflow HYG file = NONE STORED - DDNW3               Dev 25

  Reach Link Data  = DDNW3
  Reach Length     = 445.00 ft
  Approx. Total Tt = .0091 hrs  (based on Wtd.Q = 4.57 cfs)
  Reach Channel    = DDNW3  (Chn-Circular)
  Overflow Elev.   = 156.84 ft
  Overflow Channel = NONE

  No Infiltration

  INITIAL CONDITIONS
  ----------------------------------
  Starting WS Elev   =   155.00 ft
  Starting Volume    =     .000 ac-ft
  Starting Outflow   =      .00 cfs
  Starting Infiltr.  =      .00 cfs
  Starting Total Qout=      .00 cfs
  Time Increment     =    .0050 hrs


  INFLOW/OUTFLOW HYDROGRAPH SUMMARY
  =====================================================
  Peak Inflow       =     11.03 cfs    at   12.5250 hrs
  Peak Outflow      =     11.03 cfs    at   12.5300 hrs
  =====================================================


  MASS BALANCE (ac-ft)
  --------------------------
+ Initial Vol   =        .000
+ HYG Vol IN    =       1.665
- Infiltration =        .000
- HYG Vol OUT   =       1.665
- Retained Vol =        .000
                ----------
  Unrouted Vol =        .000 ac-ft  (.000% of Outflow Volume)
```

```
                    MODIFIED PULS REACH ROUTING SUMMARY

 HYG Dir          = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
 Inflow  HYG file = NONE STORED - SE4+EXS4+SW4     Dev 25
 Outflow HYG file = NONE STORED - DDS4             Dev 25

 Reach Link Data  = DDS4
 Reach Length     = 230.00 ft
 Approx. Total Tt = .0039 hrs  (based on Wtd.Q = 9.18 cfs)
 Reach Channel    = DDEXS4  (Chn-Circular)
 Overflow Elev.   = 146.84 ft
 Overflow Channel = NONE

 No Infiltration

 INITIAL CONDITIONS
 ----------------------------------
 Starting WS Elev   =   145.00 ft
 Starting Volume    =     .000 ac-ft
 Starting Outflow   =      .00 cfs
 Starting Infiltr.  =      .00 cfs
 Starting Total Qout=      .00 cfs
 Time Increment     =    .0050 hrs


 INFLOW/OUTFLOW HYDROGRAPH SUMMARY
 =====================================================
 Peak Inflow      =     24.66 cfs    at   12.2850 hrs
 Peak Outflow     =     24.66 cfs    at   12.2850 hrs
 =====================================================


 MASS BALANCE (ac-ft)
 --------------------------
+ Initial Vol  =        .000
+ HYG Vol IN   =       2.805
- Infiltration =        .000
- HYG Vol OUT  =       2.805
- Retained Vol =        .000
                 ----------
 Unrouted Vol =        .000 ac-ft  (.000% of Outflow Volume)


 WARNING: For weighted average inflow, the approximate total
 travel time through entire reach is shorter than
 the inflow hydrograph time step. Consider reducing
 calculation time step.
 Wtd.Avg.Q = 9.18 cfs   Approx.Total Tt = .0039 hrs
```

MODIFIED PULS REACH ROUTING SUMMARY

```
HYG Dir          = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Inflow  HYG file = NONE STORED - SW5+EXS5+SE5     Dev 25
Outflow HYG file = NONE STORED - DDS5             Dev 25

Reach Link Data  = DDS5
Reach Length     = 170.00 ft
Approx. Total Tt = .0030 hrs  (based on Wtd.Q = 7.33 cfs)
Reach Channel    = DDS5  (Chn-Circular)
Overflow Elev.   = 125.84 ft
Overflow Channel = NONE

No Infiltration

INITIAL CONDITIONS
----------------------------------
Starting WS Elev   =   124.00 ft
Starting Volume    =     .000 ac-ft
Starting Outflow   =      .00 cfs
Starting Infiltr.  =      .00 cfs
Starting Total Qout=      .00 cfs
Time Increment     =    .0050 hrs


INFLOW/OUTFLOW HYDROGRAPH SUMMARY
=====================================================
Peak Inflow       =     18.13 cfs    at   12.4600 hrs
Peak Outflow      =     18.13 cfs    at   12.4600 hrs
=====================================================


MASS BALANCE (ac-ft)
--------------------------
+ Initial Vol  =        .000
+ HYG Vol IN   =       2.543
- Infiltration =        .000
- HYG Vol OUT  =       2.543
- Retained Vol =        .000
                  ----------
Unrouted Vol =        .000 ac-ft  (.000% of Outflow Volume)


WARNING: For weighted average inflow, the approximate total
travel time through entire reach is shorter than
the inflow hydrograph time step. Consider reducing
calculation time step.
Wtd.Avg.Q = 7.33 cfs   Approx.Total Tt = .0030 hrs
```

MODIFIED PULS REACH ROUTING SUMMARY

```
HYG Dir          = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Inflow  HYG file = NONE STORED - SE                Dev100
Outflow HYG file = NONE STORED - DDSE              Dev100

Reach Link Data  = DDSE
Reach Length     = 380.00 ft
Approx. Total Tt = .0042 hrs  (based on Wtd.Q = 44.48 cfs)
Reach Channel    = DDSE  (Chn-Circular)
Overflow Elev.   = 170.30 ft
Overflow Channel = NONE

No Infiltration

INITIAL CONDITIONS
----------------------------------
Starting WS Elev   =   168.00 ft
Starting Volume    =     .000 ac-ft
Starting Outflow   =      .00 cfs
Starting Infiltr.  =      .00 cfs
Starting Total Qout=      .00 cfs
Time Increment     =    .0050 hrs


INFLOW/OUTFLOW HYDROGRAPH SUMMARY
=====================================================
Peak Inflow      =    111.69 cfs    at   12.4450 hrs
Peak Outflow     =    111.69 cfs    at   12.4450 hrs
=====================================================


MASS BALANCE (ac-ft)
--------------------------
+ Initial Vol  =        .000
+ HYG Vol IN   =      15.648
- Infiltration =        .000
- HYG Vol OUT  =      15.648
- Retained Vol =        .000
                  ----------
Unrouted Vol =        .000 ac-ft  (.000% of Outflow Volume)


WARNING: For weighted average inflow, the approximate total
travel time through entire reach is shorter than
the inflow hydrograph time step. Consider reducing
calculation time step.
Wtd.Avg.Q = 44.48 cfs   Approx.Total Tt = .0042 hrs
```

MODIFIED PULS REACH DATA

HYG Dir = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Inflow HYG file = NONE STORED - SW Dev 25
Outflow HYG file = NONE STORED - DDSW Dev 25

Reach Link Data = DDSW
Reach Length = 380.00 ft
Approx. Total Tt = .0045 hrs (based on Wtd.Q = 34.65 cfs)
Reach Channel = DDSW (Chn-Circular)
Overflow Elev. = 170.30 ft
Overflow Channel = NONE

No Infiltration

INITIAL CONDITIONS

Starting WS Elev = 168.00 ft
Starting Volume = .000 ac-ft
Starting Outflow = .00 cfs
Starting Infiltr. = .00 cfs
Starting Total Qout= .00 cfs
Time Increment = .0050 hrs

Elevation ft	Outflow cfs	Storage ac-ft	Area acres	Infilt. cfs	Q Total cfs	2S/t + O cfs
168.00	.00	.000	.0000	.00	.00	.00
168.05	.09	.000	.0061	.00	.09	1.08
168.10	.42	.001	.0085	.00	.42	3.20
168.15	1.00	.001	.0104	.00	1.00	6.07
168.20	1.83	.002	.0118	.00	1.83	9.60
168.25	2.93	.002	.0131	.00	2.93	13.72
168.30	4.30	.003	.0142	.00	4.30	18.39
168.35	5.92	.004	.0151	.00	5.92	23.56
168.40	7.80	.004	.0160	.00	7.80	29.21
168.45	9.93	.005	.0168	.00	9.93	35.30
168.50	12.30	.006	.0174	.00	12.30	41.81
168.55	14.91	.007	.0181	.00	14.91	48.72
168.60	17.75	.008	.0186	.00	17.75	56.00
168.65	20.80	.009	.0191	.00	20.80	63.62
168.70	24.06	.010	.0196	.00	24.06	71.56
168.75	27.52	.011	.0200	.00	27.52	79.81
168.80	31.16	.012	.0203	.00	31.16	88.33
168.85	34.98	.013	.0207	.00	34.98	97.12
168.90	38.95	.014	.0209	.00	38.95	106.13
168.95	43.08	.015	.0212	.00	43.08	115.35

MODIFIED PULS REACH DATA

HYG Dir = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Inflow HYG file = NONE STORED - SW Dev 25
Outflow HYG file = NONE STORED - DDSW Dev 25

Reach Link Data = DDSW
Reach Length = 380.00 ft
Approx. Total Tt = .0045 hrs (based on Wtd.Q = 34.65 cfs)
Reach Channel = DDSW (Chn-Circular)
Overflow Elev. = 170.30 ft
Overflow Channel = NONE

No Infiltration

INITIAL CONDITIONS

Starting WS Elev = 168.00 ft
Starting Volume = .000 ac-ft
Starting Outflow = .00 cfs
Starting Infiltr. = .00 cfs
Starting Total Qout= .00 cfs
Time Increment = .0050 hrs

Elevation ft	Outflow cfs	Storage ac-ft	Area acres	Infilt. cfs	Q Total cfs	2S/t + O cfs
169.00	47.35	.016	.0214	.00	47.35	124.77
169.05	51.74	.017	.0215	.00	51.74	134.35
169.10	56.24	.018	.0217	.00	56.24	144.07
169.15	60.83	.019	.0217	.00	60.83	153.92
169.20	65.51	.020	.0218	.00	65.51	163.86
169.25	70.25	.021	.0218	.00	70.25	173.88
169.30	75.05	.023	.0218	.00	75.05	183.95
169.35	79.88	.024	.0218	.00	79.88	194.05
169.40	84.72	.025	.0218	.00	84.72	204.14
169.45	89.57	.026	.0218	.00	89.57	214.22
169.50	94.40	.027	.0218	.00	94.40	224.24
169.55	99.20	.028	.0218	.00	99.20	234.18
169.60	103.94	.029	.0218	.00	103.94	244.02
169.65	108.61	.030	.0218	.00	108.61	253.72
169.70	113.18	.031	.0218	.00	113.18	263.26
169.75	117.64	.032	.0218	.00	117.64	272.60
169.80	121.96	.033	.0218	.00	121.96	281.71
169.85	126.12	.034	.0218	.00	126.12	290.56
169.90	130.09	.035	.0218	.00	130.09	299.09
169.95	133.84	.036	.0218	.00	133.84	307.29

MODIFIED PULS REACH DATA

HYG Dir = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Inflow HYG file = NONE STORED - SW Dev 25
Outflow HYG file = NONE STORED - DDSW Dev 25

Reach Link Data = DDSW
Reach Length = 380.00 ft
Approx. Total Tt = .0045 hrs (based on Wtd.Q = 34.65 cfs)
Reach Channel = DDSW (Chn-Circular)
Overflow Elev. = 170.30 ft
Overflow Channel = NONE

No Infiltration

INITIAL CONDITIONS

Starting WS Elev = 168.00 ft
Starting Volume = .000 ac-ft
Starting Outflow = .00 cfs
Starting Infiltr. = .00 cfs
Starting Total Qout= .00 cfs
Time Increment = .0050 hrs

Elevation ft	Outflow cfs	Storage ac-ft	Area acres	Infilt. cfs	Q Total cfs	2S/t + O cfs
170.00	137.34	.037	.0218	.00	137.34	315.09
170.05	140.57	.038	.0218	.00	140.57	322.46
170.10	143.47	.038	.0218	.00	143.47	329.32
170.15	146.01	.039	.0218	.00	146.01	335.63
170.20	148.12	.040	.0218	.00	148.12	341.29
170.25	149.75	.041	.0218	.00	149.75	346.23
170.30	150.81	.041	.0218	.00	150.81	350.30

MODIFIED PULS REACH ROUTING SUMMARY

```
HYG Dir           = C:\Users\s.velugubantla\Desktop\CR-Pondpack\
Inflow  HYG file = NONE STORED - SW3              Dev 25
Outflow HYG file = NONE STORED - DDSW3            Dev 25

Reach Link Data  = DDSW3
Reach Length     = 460.00 ft
Approx. Total Tt = .0109 hrs  (based on Wtd.Q = 2.79 cfs)
Reach Channel    = DDSW3  (Chn-Circular)
Overflow Elev.   = 156.84 ft
Overflow Channel = NONE

No Infiltration

INITIAL CONDITIONS
----------------------------------
Starting WS Elev   =   155.00 ft
Starting Volume    =     .000 ac-ft
Starting Outflow   =      .00 cfs
Starting Infiltr.  =      .00 cfs
Starting Total Qout=      .00 cfs
Time Increment     =    .0050 hrs


INFLOW/OUTFLOW HYDROGRAPH SUMMARY
=====================================================
Peak Inflow       =      7.36 cfs    at   12.3100 hrs
Peak Outflow      =      7.36 cfs    at   12.3150 hrs
=====================================================


MASS BALANCE (ac-ft)
-------------------------
+ Initial Vol  =        .000
+ HYG Vol IN   =        .870
- Infiltration =        .000
- HYG Vol OUT  =        .870
- Retained Vol =        .000
                  ----------
Unrouted Vol =       -.000 ac-ft  (.000% of Inflow Volume)
```

File.... C:\Users\s.velugubantla\Desktop\CR-Pondpack\Area 1D-1B Cross LF-Revised-201609.pp

Elevation (ft)	Planimeter (sq.in)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	Volume (ac-ft)	Volume Sum (ac-ft)
71.50	-----	4.0000	.0000	.000	.000
72.00	-----	15.9100	27.8875	4.648	4.648
83.00	-----	19.7000	53.3139	195.484	200.132

POND VOLUME EQUATIONS

* Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + sq.rt.(Area1*Area2))

where: EL1, EL2 = Lower and upper elevations of the increment
Area1,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

REQUESTED POND WS ELEVATIONS:

Min. Elev.= 71.50 ft
Increment = .10 ft
Max. Elev.= 83.00 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
Inlet Box	R1	--->	C0	79.150	83.000
Orifice-Circular	O0	<--->	C0	75.500	83.000
Culvert-Circular	C0	<--->	TW	73.500	83.000
TW SETUP, DS Channel					

OUTLET STRUCTURE INPUT DATA

```
Structure ID       = R1
Structure Type     = Inlet Box
------------------------------------
# of Openings      =         1
Invert Elev.       =     79.15 ft
Orifice Area       =   79.0000 sq.ft
Orifice Coeff.     =      .600
Weir Length        =     28.00 ft
Weir Coeff.        =     3.300
K, Reverse         =     1.000
Mannings n         =     .0000
Kev,Charged Riser  =      .000
Weir Submergence   = No
```

```
Structure ID       = O0
Structure Type     = Orifice-Circular
------------------------------------
# of Openings      =         1
Invert Elev.       =     75.50 ft
Diameter           =    1.1280 ft
Orifice Coeff.     =      .600
```

```
OUTLET STRUCTURE INPUT DATA


Structure ID       = C0
Structure Type     = Culvert-Circular
------------------------------------
No. Barrels        =         2
Barrel Diameter    =    2.5000 ft
Upstream Invert    =     73.50 ft
Dnstream Invert    =     72.50 ft
Horiz. Length      =    300.00 ft
Barrel Length      =    300.00 ft
Barrel Slope       =    .00333 ft/ft

OUTLET CONTROL DATA...
Mannings n         =     .0120
Ke                 =     .5000  (forward entrance loss)
Kb                 =   .007854  (per ft of full flow)
Kr                 =     .5000  (reverse entrance loss)
HW Convergence     =      .001  +/- ft

INLET CONTROL DATA...
Equation form      =         1
Inlet Control K    =     .0098
Inlet Control M    =    2.0000
Inlet Control c    =    .03980
Inlet Control Y    =     .6700
T1 ratio (HW/D)    =     1.159
T2 ratio (HW/D)    =     1.305
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 =     76.40 ft  --->  Flow =     27.16 cfs
At T2 Elev =     76.76 ft  --->  Flow =     31.05 cfs
```

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

CUMULATIVE HGL CONVERGENCE ERROR .000 (+/- ft)

* Max. convergence errors shown may also occur for
flow paths other than the ones listed above.

WS Elev, Total Q		Converge		Notes
Elev. ft	Q cfs	TW Elev ft	Error +/-ft	Contributing Structures
71.50	.00	75.50	.000	(no Q: R1,O0,C0)
71.60	.00	75.50	.000	(no Q: R1,O0,C0)
71.70	.00	75.50	.000	(no Q: R1,O0,C0)
71.80	.00	75.50	.000	(no Q: R1,O0,C0)
71.90	.00	75.50	.000	(no Q: R1,O0,C0)
72.00	.00	75.50	.000	(no Q: R1,O0,C0)
72.10	.00	75.50	.000	(no Q: R1,O0,C0)
72.20	.00	75.50	.000	(no Q: R1,O0,C0)
72.30	.00	75.50	.000	(no Q: R1,O0,C0)
72.40	.00	75.50	.000	(no Q: R1,O0,C0)
72.50	.00	75.50	.000	(no Q: R1,O0,C0)
72.60	.00	75.50	.000	(no Q: R1,O0,C0)
72.70	.00	75.50	.000	(no Q: R1,O0,C0)
72.80	.00	75.50	.000	(no Q: R1,O0,C0)
72.90	.00	75.50	.000	(no Q: R1,O0,C0)
73.00	.00	75.50	.000	(no Q: R1,O0,C0)
73.10	.00	75.50	.000	(no Q: R1,O0,C0)
73.20	.00	75.50	.000	(no Q: R1,O0,C0)
73.30	.00	75.50	.000	(no Q: R1,O0,C0)
73.40	.00	75.50	.000	(no Q: R1,O0,C0)
73.50	.00	75.50	.000	(no Q: R1,O0,C0)
73.60	.00	75.50	.000	(no Q: R1,O0,C0)
73.70	.00	75.50	.000	(no Q: R1,O0,C0)
73.80	.00	75.50	.000	(no Q: R1,O0,C0)
73.90	.00	75.50	.000	(no Q: R1,O0,C0)
74.00	.00	75.50	.000	(no Q: R1,O0,C0)
74.10	.00	75.50	.000	(no Q: R1,O0,C0)
74.20	.00	75.50	.000	(no Q: R1,O0,C0)
74.30	.00	75.50	.000	(no Q: R1,O0,C0)
74.40	.00	75.50	.000	(no Q: R1,O0,C0)
74.50	.00	75.50	.000	(no Q: R1,O0,C0)
74.60	.00	75.50	.000	(no Q: R1,O0,C0)
74.70	.00	75.50	.000	(no Q: R1,O0,C0)

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

CUMULATIVE HGL CONVERGENCE ERROR .000 (+/- ft)

* Max. convergence errors shown may also occur for flow paths other than the ones listed above.

WS Elev, Total Q		Converge		Notes
Elev. ft	Q cfs	TW Elev ft	Error +/-ft	Contributing Structures
74.80	.00	75.50	.000	(no Q: R1,O0,C0)
74.90	.00	75.50	.000	(no Q: R1,O0,C0)
75.00	.00	75.50	.000	(no Q: R1,O0,C0)
75.10	.00	75.50	.000	(no Q: R1,O0,C0)
75.20	.00	75.50	.000	(no Q: R1,O0,C0)
75.30	.00	75.50	.000	(no Q: R1,O0,C0)
75.40	.00	75.50	.000	(no Q: R1,O0,C0)
75.50	.00	75.50	.000	(no Q: R1,O0,C0)
75.60	.04	75.50	.000	O0,C0 (no Q: R1)
75.70	.14	75.50	.000	O0,C0 (no Q: R1)
75.80	.31	75.50	.000	O0,C0 (no Q: R1)
75.90	.54	75.50	.000	O0,C0 (no Q: R1)
76.00	.83	75.50	.000	O0,C0 (no Q: R1)
76.10	1.16	75.50	.000	O0,C0 (no Q: R1)
76.20	1.54	75.50	.000	O0,C0 (no Q: R1)
76.30	1.95	75.50	.000	O0,C0 (no Q: R1)
76.40	2.39	75.50	.000	O0,C0 (no Q: R1)
76.50	2.86	75.50	.000	O0,C0 (no Q: R1)
76.60	3.35	75.50	.000	O0,C0 (no Q: R1)
76.70	3.81	75.50	.000	O0,C0 (no Q: R1)
76.80	4.09	75.50	.000	O0,C0 (no Q: R1)
76.90	4.40	75.50	.000	O0,C0 (no Q: R1)
77.00	4.61	75.50	.000	O0,C0 (no Q: R1)
77.10	4.86	75.50	.000	O0,C0 (no Q: R1)
77.20	5.11	75.50	.000	O0,C0 (no Q: R1)
77.30	5.35	75.50	.000	O0,C0 (no Q: R1)
77.40	5.56	75.50	.000	O0,C0 (no Q: R1)
77.50	5.76	75.50	.000	O0,C0 (no Q: R1)
77.60	5.92	75.50	.000	O0,C0 (no Q: R1)
77.70	6.15	75.50	.000	O0,C0 (no Q: R1)
77.80	6.34	75.50	.000	O0,C0 (no Q: R1)
77.90	6.46	75.50	.000	O0,C0 (no Q: R1)
78.00	6.68	75.50	.000	O0,C0 (no Q: R1)

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

CUMULATIVE HGL CONVERGENCE ERROR .000 (+/- ft)

* Max. convergence errors shown may also occur for
flow paths other than the ones listed above.

WS Elev, Total Q		Converge		Notes
Elev. ft	Q cfs	TW Elev ft	Error +/-ft	Contributing Structures
78.10	6.86	75.50	.000	O0,C0 (no Q: R1)
78.20	6.98	75.50	.000	O0,C0 (no Q: R1)
78.30	7.19	75.50	.000	O0,C0 (no Q: R1)
78.40	7.35	75.50	.000	O0,C0 (no Q: R1)
78.50	7.50	75.50	.000	O0,C0 (no Q: R1)
78.60	7.66	75.50	.000	O0,C0 (no Q: R1)
78.70	7.78	75.50	.000	O0,C0 (no Q: R1)
78.80	7.96	75.50	.000	O0,C0 (no Q: R1)
78.90	8.07	75.50	.000	O0,C0 (no Q: R1)
79.00	8.24	75.50	.000	O0,C0 (no Q: R1)
79.10	8.34	75.50	.000	O0,C0 (no Q: R1)
79.15	8.45	75.50	.000	O0,C0 (no Q: R1)
79.20	9.55	75.50	.000	R1,O0,C0
79.30	14.02	75.50	.000	R1,O0,C0
79.40	20.32	75.50	.000	R1,O0,C0
79.50	28.05	75.50	.000	R1,O0,C0
79.60	36.57	75.50	.000	R1,O0,C0
79.70	45.85	75.50	.000	R1,O0,C0
79.80	55.79	75.50	.000	R1,O0,C0
79.90	66.20	75.50	.000	R1,O0,C0
80.00	76.74	75.50	.000	R1,O0,C0
80.10	85.94	75.50	.000	R1,O0,C0
80.20	86.95	75.50	.000	R1,C0 (no Q: O0)
80.30	87.87	75.50	.000	R1,C0 (no Q: O0)
80.40	88.77	75.50	.000	R1,C0 (no Q: O0)
80.50	89.67	75.50	.000	R1,C0 (no Q: O0)
80.60	90.57	75.50	.000	R1,C0 (no Q: O0)
80.70	91.45	75.50	.000	R1,C0 (no Q: O0)
80.80	92.33	75.50	.000	R1,C0 (no Q: O0)
80.90	93.19	75.50	.000	R1,C0 (no Q: O0)
81.00	94.05	75.50	.000	R1,C0 (no Q: O0)
81.10	94.90	75.50	.000	R1,C0 (no Q: O0)
81.20	95.76	75.50	.000	R1,C0 (no Q: O0)

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

CUMULATIVE HGL CONVERGENCE ERROR .000 (+/- ft)

* Max. convergence errors shown may also occur for
flow paths other than the ones listed above.

WS Elev, Total Q		Converge		Notes
Elev. ft	Q cfs	TW Elev ft	Error +/-ft	Contributing Structures
81.30	96.58	75.50	.000	R1,C0 (no Q: O0)
81.40	97.41	75.50	.000	R1,C0 (no Q: O0)
81.50	98.24	75.50	.000	R1,C0 (no Q: O0)
81.60	99.05	75.50	.000	R1,C0 (no Q: O0)
81.70	99.86	75.50	.000	R1,C0 (no Q: O0)
81.80	100.67	75.50	.000	R1,C0 (no Q: O0)
81.90	101.46	75.50	.000	R1,C0 (no Q: O0)
82.00	102.25	75.50	.000	R1,C0 (no Q: O0)
82.10	103.03	75.50	.000	R1,C0 (no Q: O0)
82.20	103.80	75.50	.000	R1,C0 (no Q: O0)
82.30	104.58	75.50	.000	R1,C0 (no Q: O0)
82.40	105.35	75.50	.000	R1,C0 (no Q: O0)
82.50	106.10	75.50	.000	R1,C0 (no Q: O0)
82.60	106.86	75.50	.000	R1,C0 (no Q: O0)
82.70	107.62	75.50	.000	R1,C0 (no Q: O0)
82.80	108.36	75.50	.000	R1,C0 (no Q: O0)
82.90	109.10	75.50	.000	R1,C0 (no Q: O0)
83.00	109.84	75.50	.000	R1,C0 (no Q: O0)

Index of Starting Page Numbers for ID Names

POND VOLUMES BY ELEVATION AND AREA

Volumes are calculated using the conic method.

Enter data sets from the top down. Leave extra rows blank.

	ELEVATION	AREA
Pond Bottom	75.5 FT	745747 FT^2
	76.1 FT	754633 FT^2
	77 FT	767963 FT^2
	83 FT	858132 FT^2
	FT	FT^2
	FT	FT^2
	FT	FT^2
	FT	FT^2
	FT	FT^2
	FT	FT^2
	FT	FT^2
	FT	FT^2
	FT	FT^2
	FT	FT^2
	FT	FT^2

ELEVATION	INCREMENTAL VOLUME	CUMMULATIVE VOLUME	CUMMULATIVE VOLUME
75.5 FT			0.00 AC-FT
76.1 FT	450112 CF	450112 CF	10.33 AC-FT
77 FT	685160 CF	1135271 CF	26.06 AC-FT
83 FT	4875782 CF	6011054 CF	137.99 AC-FT

BMP FIRST FLUSH CALCULATIONS

```
First Flush Depth  =     .5000 in
Drainage Area      =   200.000 acres

Volume = Flush Depth * Drainage Area

------------------------------------
First Flush volume =     8.333 ac-ft
------------------------------------
```

TIME vs. ELEVATION (ft)

Time hrs	Output Time increment = .2000 hrs Time on left represents time for first value in each row.				
.0000	76.10	76.10	76.10	76.10	76.10
1.0000	76.09	76.09	76.09	76.09	76.09
2.0000	76.09	76.09	76.09	76.09	76.08
3.0000	76.08	76.08	76.08	76.08	76.08
4.0000	76.08	76.08	76.08	76.08	76.07
5.0000	76.07	76.07	76.07	76.07	76.07
6.0000	76.07	76.07	76.07	76.07	76.06
7.0000	76.06	76.06	76.06	76.06	76.06
8.0000	76.06	76.06	76.06	76.06	76.05
9.0000	76.05	76.05	76.05	76.05	76.05
10.0000	76.05	76.05	76.05	76.05	76.04
11.0000	76.04	76.04	76.04	76.04	76.04
12.0000	76.04	76.04	76.04	76.04	76.04
13.0000	76.03	76.03	76.03	76.03	76.03
14.0000	76.03	76.03	76.03	76.03	76.03
15.0000	76.03	76.03	76.02	76.02	76.02
16.0000	76.02	76.02	76.02	76.02	76.02
17.0000	76.02	76.02	76.02	76.01	76.01
18.0000	76.01	76.01	76.01	76.01	76.01
19.0000	76.01	76.01	76.01	76.01	76.01
20.0000	76.00	76.00	76.00	76.00	76.00
21.0000	76.00	76.00	76.00	76.00	76.00
22.0000	76.00	76.00	76.00	75.99	75.99
23.0000	75.99	75.99	75.99	75.99	75.99
24.0000	75.99	75.99	75.99	75.99	75.99
25.0000	75.99	75.98	75.98	75.98	75.98
26.0000	75.98	75.98	75.98	75.98	75.98
27.0000	75.98	75.98	75.98	75.98	75.98
28.0000	75.97	75.97	75.97	75.97	75.97
29.0000	75.97	75.97	75.97	75.97	75.97
30.0000	75.97	75.97	75.97	75.97	75.96
31.0000	75.96	75.96	75.96	75.96	75.96
32.0000	75.96	75.96	75.96	75.96	75.96
33.0000	75.96	75.96	75.96	75.95	75.95
34.0000	75.95	75.95	75.95	75.95	75.95
35.0000	75.95	75.95	75.95	75.95	75.95
36.0000	75.95	75.95	75.95	75.95	75.94
37.0000	75.94	75.94	75.94	75.94	75.94
38.0000	75.94	75.94	75.94	75.94	75.94
39.0000	75.94	75.94	75.94	75.94	75.94
40.0000	75.93	75.93	75.93	75.93	75.93
41.0000	75.93	75.93	75.93	75.93	75.93
42.0000	75.93	75.93	75.93	75.93	75.93

Appendix C – Culvert Design

(15 total pages)

Culvert Calculator Report
P-1

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	82.50 ft	Headwater Depth/Height	0.79
Computed Headwater Eleva	81.55 ft	Discharge	100.20 cfs
Inlet Control HW Elev.	81.33 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	81.55 ft	Control Type	Outlet Control

Grades

Upstream Invert	78.78 ft	Downstream Invert	78.73 ft
Length	100.00 ft	Constructed Slope	0.000500 ft/ft

Hydraulic Profile

Profile	M2	Depth, Downstream	1.79 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	1.79 ft
Velocity Downstream	6.75 ft/s	Critical Slope	0.004084 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	3.50 ft
Section Size	42 inch	Rise	3.50 ft
Number Sections	3		

Outlet Control Properties

Outlet Control HW Elev.	81.55 ft	Upstream Velocity Head	0.38 ft
Ke	0.20	Entrance Loss	0.08 ft

Inlet Control Properties

Inlet Control HW Elev.	81.33 ft	Flow Control	Unsubmerged
Inlet Type	Groove end projecting	Area Full	28.9 ft^2
K	0.00450	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	3
C	0.03170	Equation Form	1
Y	0.69000		

Culvert Calculator Report
P-2

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	81.00	ft	Headwater Depth/Height	0.93	
Computed Headwater Eleva	79.99	ft	Discharge	47.52	cfs
Inlet Control HW Elev.	79.90	ft	Tailwater Elevation	0.00	ft
Outlet Control HW Elev.	79.99	ft	Control Type	Outlet Control	

Grades

Upstream Invert	76.73	ft	Downstream Invert	76.50	ft
Length	78.00	ft	Constructed Slope	0.002949	ft/ft

Hydraulic Profile

Profile	M2		Depth, Downstream	2.15	ft
Slope Type	Mild		Normal Depth	2.52	ft
Flow Regime	Subcritical		Critical Depth	2.15	ft
Velocity Downstream	7.66	ft/s	Critical Slope	0.004587	ft/ft

Section

Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	3.50	ft
Section Size	42 inch		Rise	3.50	ft
Number Sections	1				

Outlet Control Properties

Outlet Control HW Elev.	79.99	ft	Upstream Velocity Head	0.70	ft
Ke	0.20		Entrance Loss	0.14	ft

Inlet Control Properties

Inlet Control HW Elev.	79.90	ft	Flow Control	Unsubmerged	
Inlet Type	Groove end projecting		Area Full	9.6	ft^2
K	0.00450		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	3	
C	0.03170		Equation Form	1	
Y	0.69000				

Culvert Calculator Report
P-3

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	82.50 ft	Headwater Depth/Height	0.77
Computed Headwater Eleva	80.68 ft	Discharge	98.20 cfs
Inlet Control HW Elev.	80.49 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	80.68 ft	Control Type	Outlet Control

Grades

Upstream Invert	77.99 ft	Downstream Invert	77.87 ft
Length	100.00 ft	Constructed Slope	0.001200 ft/ft

Hydraulic Profile

Profile	M2	Depth, Downstream	1.77 ft
Slope Type	Mild	Normal Depth	2.69 ft
Flow Regime	Subcritical	Critical Depth	1.77 ft
Velocity Downstream	6.70 ft/s	Critical Slope	0.004065 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	3.50 ft
Section Size	42 inch	Rise	3.50 ft
Number Sections	3		

Outlet Control Properties

Outlet Control HW Elev.	80.68 ft	Upstream Velocity Head	0.41 ft
Ke	0.20	Entrance Loss	0.08 ft

Inlet Control Properties

Inlet Control HW Elev.	80.49 ft	Flow Control	Unsubmerged
Inlet Type	Beveled ring, 33.7° bevels	Area Full	28.9 ft²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

Culvert Calculator Report
P-4

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	82.50 ft	Headwater Depth/Height	0.64
Computed Headwater Eleva	79.25 ft	Discharge	99.10 cfs
Inlet Control HW Elev.	79.13 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	79.25 ft	Control Type	Entrance Control

Grades			
Upstream Invert	77.02 ft	Downstream Invert	76.20 ft
Length	90.00 ft	Constructed Slope	0.009111 ft/ft

Hydraulic Profile			
Profile	S2	Depth, Downstream	1.23 ft
Slope Type	Steep	Normal Depth	1.21 ft
Flow Regime	Supercritical	Critical Depth	1.53 ft
Velocity Downstream	8.20 ft/s	Critical Slope	0.003865 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	3.50 ft
Section Size	42 inch	Rise	3.50 ft
Number Sections	4		

Outlet Control Properties			
Outlet Control HW Elev.	79.25 ft	Upstream Velocity Head	0.58 ft
Ke	0.20	Entrance Loss	0.12 ft

Inlet Control Properties			
Inlet Control HW Elev.	79.13 ft	Flow Control	Unsubmerged
Inlet Type	Beveled ring, 33.7° bevels	Area Full	38.5 ft²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

Culvert Calculator Report
P-5

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	82.50	ft	Headwater Depth/Height	1.23	
Computed Headwater Eleva	80.44	ft	Discharge	293.40	cfs
Inlet Control HW Elev.	80.44	ft	Tailwater Elevation	0.00	ft
Outlet Control HW Elev.	80.41	ft	Control Type	Inlet Control	

Grades

Upstream Invert	76.13	ft	Downstream Invert	75.78	ft
Length	70.00	ft	Constructed Slope	0.005000	ft/ft

Hydraulic Profile

Profile	M2		Depth, Downstream	2.68	ft
Slope Type	Mild		Normal Depth	2.98	ft
Flow Regime	Subcritical		Critical Depth	2.68	ft
Velocity Downstream	9.27	ft/s	Critical Slope	0.006086	ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.013	
Section Material	Concrete	Span	3.50	ft
Section Size	42 inch	Rise	3.50	ft
Number Sections	4			

Outlet Control Properties

Outlet Control HW Elev.	80.41	ft	Upstream Velocity Head	1.16	ft
Ke	0.20		Entrance Loss	0.23	ft

Inlet Control Properties

Inlet Control HW Elev.	80.44	ft	Flow Control	Submerged	
Inlet Type	Beveled ring, 33.7° bevels		Area Full	38.5	ft²
K	0.00180		HDS 5 Chart	3	
M	2.50000		HDS 5 Scale	B	
C	0.02430		Equation Form	1	
Y	0.83000				

Culvert Calculator Report
P-5A

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	82.50	ft	Headwater Depth/Height	0.71	
Computed Headwater Eleva	81.43	ft	Discharge	7.50	cfs
Inlet Control HW Elev.	81.33	ft	Tailwater Elevation	0.00	ft
Outlet Control HW Elev.	81.43	ft	Control Type	Entrance Control	

Grades					
Upstream Invert	80.00	ft	Downstream Invert	78.00	ft
Length	56.00	ft	Constructed Slope	0.035714	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	0.58	ft
Slope Type	Steep		Normal Depth	0.57	ft
Flow Regime	Supercritical		Critical Depth	0.97	ft
Velocity Downstream	9.87	ft/s	Critical Slope	0.004821	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	2.00	ft
Section Size	24 inch		Rise	2.00	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	81.43	ft	Upstream Velocity Head	0.38	ft
Ke	0.20		Entrance Loss	0.08	ft

Inlet Control Properties					
Inlet Control HW Elev.	81.33	ft	Flow Control	Unsubmerged	
Inlet Type	Beveled ring, 33.7° bevels		Area Full	3.1	ft²
K	0.00180		HDS 5 Chart	3	
M	2.50000		HDS 5 Scale	B	
C	0.02430		Equation Form	1	
Y	0.83000				

Culvert Calculator Report
P-5B

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	88.00	ft	Headwater Depth/Height	1.26	
Computed Headwater Eleva	87.64	ft	Discharge	130.60	cfs
Inlet Control HW Elev.	87.64	ft	Tailwater Elevation	0.00	ft
Outlet Control HW Elev.	87.63	ft	Control Type	Inlet Control	

Grades					
Upstream Invert	84.50	ft	Downstream Invert	84.00	ft
Length	70.00	ft	Constructed Slope	0.007143	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	1.93	ft
Slope Type	Steep		Normal Depth	1.93	ft
Flow Regime	Supercritical		Critical Depth	1.95	ft
Velocity Downstream	8.03	ft/s	Critical Slope	0.007022	ft/ft

Section				
Section Shape	Circular	Mannings Coefficient	0.013	
Section Material	Concrete	Span	2.50	ft
Section Size	30 inch	Rise	2.50	ft
Number Sections	4			

Outlet Control Properties					
Outlet Control HW Elev.	87.63	ft	Upstream Velocity Head	0.99	ft
Ke	0.20		Entrance Loss	0.20	ft

Inlet Control Properties					
Inlet Control HW Elev.	87.64	ft	Flow Control	Submerged	
Inlet Type	Beveled ring, 33.7° bevels		Area Full	19.6	ft^2
K	0.00180		HDS 5 Chart	3	
M	2.50000		HDS 5 Scale	B	
C	0.02430		Equation Form	1	
Y	0.83000				

Culvert Calculator Report
P-6

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	81.00 ft	Headwater Depth/Height	0.80
Computed Headwater Eleva	80.63 ft	Discharge	101.80 cfs
Inlet Control HW Elev.	80.39 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	80.63 ft	Control Type	Outlet Control

Grades

Upstream Invert	77.84 ft	Downstream Invert	77.80 ft
Length	90.00 ft	Constructed Slope	0.000444 ft/ft

Hydraulic Profile

Profile	M2	Depth, Downstream	1.80 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	1.80 ft
Velocity Downstream	6.78 ft/s	Critical Slope	0.004100 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	3.50 ft
Section Size	42 inch	Rise	3.50 ft
Number Sections	3		

Outlet Control Properties

Outlet Control HW Elev.	80.63 ft	Upstream Velocity Head	0.39 ft
Ke	0.20	Entrance Loss	0.08 ft

Inlet Control Properties

Inlet Control HW Elev.	80.39 ft	Flow Control	N/A
Inlet Type	Beveled ring, 33.7° bevels	Area Full	28.9 ft²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

Culvert Calculator Report
P-7

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	81.00	ft	Headwater Depth/Height	0.75	
Computed Headwater Eleva	80.29	ft	Discharge	99.80	cfs
Inlet Control HW Elev.	80.17	ft	Tailwater Elevation	0.00	ft
Outlet Control HW Elev.	80.29	ft	Control Type	Outlet Control	

Grades

Upstream Invert	77.65	ft	Downstream Invert	77.37	ft
Length	100.00	ft	Constructed Slope	0.002800	ft/ft

Hydraulic Profile

Profile	M2		Depth, Downstream	1.79	ft
Slope Type	Mild		Normal Depth	2.00	ft
Flow Regime	Subcritical		Critical Depth	1.79	ft
Velocity Downstream	6.74	ft/s	Critical Slope	0.004080	ft/ft

Section

Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	3.50	ft
Section Size	42 inch		Rise	3.50	ft
Number Sections	3				

Outlet Control Properties

Outlet Control HW Elev.	80.29	ft	Upstream Velocity Head	0.55	ft
Ke	0.20		Entrance Loss	0.11	ft

Inlet Control Properties

Inlet Control HW Elev.	80.17	ft	Flow Control	N/A	
Inlet Type	Beveled ring, 33.7° bevels		Area Full	28.9	ft²
K	0.00180		HDS 5 Chart	3	
M	2.50000		HDS 5 Scale	B	
C	0.02430		Equation Form	1	
Y	0.83000				

Culvert Calculator Report
P-8

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	81.00	ft	Headwater Depth/Height	1.10	
Computed Headwater Eleva	79.59	ft	Discharge	187.80	cfs
Inlet Control HW Elev.	79.50	ft	Tailwater Elevation	0.00	ft
Outlet Control HW Elev.	79.59	ft	Control Type	Outlet Control	

Grades					
Upstream Invert	75.74	ft	Downstream Invert	75.38	ft
Length	70.00	ft	Constructed Slope	0.005143	ft/ft

Hydraulic Profile					
Profile	M2		Depth, Downstream	2.48	ft
Slope Type	Mild		Normal Depth	2.52	ft
Flow Regime	Subcritical		Critical Depth	2.48	ft
Velocity Downstream	8.59	ft/s	Critical Slope	0.005352	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	3.50	ft
Section Size	42 inch		Rise	3.50	ft
Number Sections	3				

Outlet Control Properties					
Outlet Control HW Elev.	79.59	ft	Upstream Velocity Head	1.11	ft
Ke	0.20		Entrance Loss	0.22	ft

Inlet Control Properties					
Inlet Control HW Elev.	79.50	ft	Flow Control	Unsubmerged	
Inlet Type	Beveled ring, 33.7° bevels		Area Full	28.9	ft²
K	0.00180		HDS 5 Chart	3	
M	2.50000		HDS 5 Scale	B	
C	0.02430		Equation Form	1	
Y	0.83000				

Culvert Calculator Report
P-8A

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	84.00 ft	Headwater Depth/Height	1.84
Computed Headwater Eleva	80.60 ft	Discharge	100.60 cfs
Inlet Control HW Elev.	80.60 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	80.41 ft	Control Type	Inlet Control

Grades			
Upstream Invert	76.00 ft	Downstream Invert	75.00 ft
Length	54.00 ft	Constructed Slope	0.018519 ft/ft

Hydraulic Profile			
Profile	S2	Depth, Downstream	1.97 ft
Slope Type	Steep	Normal Depth	1.86 ft
Flow Regime	Supercritical	Critical Depth	2.30 ft
Velocity Downstream	12.12 ft/s	Critical Slope	0.013048 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	2.50 ft
Section Size	30 inch	Rise	2.50 ft
Number Sections	2		

Outlet Control Properties			
Outlet Control HW Elev.	80.41 ft	Upstream Velocity Head	1.76 ft
Ke	0.20	Entrance Loss	0.35 ft

Inlet Control Properties			
Inlet Control HW Elev.	80.60 ft	Flow Control	Submerged
Inlet Type	Beveled ring, 33.7° bevels	Area Full	9.8 ft²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

Culvert Calculator Report
P-9

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	81.00	ft	Headwater Depth/Height	1.48	
Computed Headwater Eleva	79.40	ft	Discharge	341.00	cfs
Inlet Control HW Elev.	79.01	ft	Tailwater Elevation	75.50	ft
Outlet Control HW Elev.	79.40	ft	Control Type	Outlet Control	

Grades					
Upstream Invert	74.20	ft	Downstream Invert	74.10	ft
Length	88.00	ft	Constructed Slope	0.001136	ft/ft

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	2.88	ft
Slope Type	Mild		Normal Depth	N/A	ft
Flow Regime	Subcritical		Critical Depth	2.88	ft
Velocity Downstream	10.08	ft/s	Critical Slope	0.007149	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	3.50	ft
Section Size	42 inch		Rise	3.50	ft
Number Sections	4				

Outlet Control Properties					
Outlet Control HW Elev.	79.40	ft	Upstream Velocity Head	1.22	ft
Ke	0.20		Entrance Loss	0.24	ft

Inlet Control Properties					
Inlet Control HW Elev.	79.01	ft	Flow Control	Submerged	
Inlet Type	Beveled ring, 33.7° bevels		Area Full	38.5	ft²
K	0.00180		HDS 5 Chart	3	
M	2.50000		HDS 5 Scale	B	
C	0.02430		Equation Form	1	
Y	0.83000				

Culvert Calculator Report
P-10

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	85.50	ft	Headwater Depth/Height	1.88	
Computed Headwater Eleva	85.82	ft	Discharge	10.00	cfs
Inlet Control HW Elev.	85.02	ft	Tailwater Elevation	85.00	ft
Outlet Control HW Elev.	85.82	ft	Control Type	Outlet Control	

Grades

Upstream Invert	83.00	ft	Downstream Invert	82.80	ft
Length	25.00	ft	Constructed Slope	0.008000	ft/ft

Hydraulic Profile

Profile	PressureProfile		Depth, Downstream	2.20	ft
Slope Type	N/A		Normal Depth	1.35	ft
Flow Regime	N/A		Critical Depth	1.22	ft
Velocity Downstream	5.66	ft/s	Critical Slope	0.009206	ft/ft

Section

Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	1.50	ft
Section Size	18 inch		Rise	1.50	ft
Number Sections	1				

Outlet Control Properties

Outlet Control HW Elev.	85.82	ft	Upstream Velocity Head	0.50	ft
Ke	0.20		Entrance Loss	0.10	ft

Inlet Control Properties

Inlet Control HW Elev.	85.02	ft	Flow Control	N/A	
Inlet Type	Beveled ring, 33.7° bevels		Area Full	1.8	ft²
K	0.00180		HDS 5 Chart	3	
M	2.50000		HDS 5 Scale	B	
C	0.02430		Equation Form	1	
Y	0.83000				

Worksheet for Broad Crested Weir - 1

Project Description

Solve For	Discharge		

Input Data

Headwater Elevation		87.64	ft
Crest Elevation		86.50	ft
Tailwater Elevation		84.00	ft
Crest Surface Type	Gravel		
Crest Breadth		10.00	ft
Crest Length		25.00	ft

Results

Discharge	86.95	cfs
Headwater Height Above Crest	1.14	ft
Tailwater Height Above Crest	-2.50	ft
Weir Coefficient	2.86	US
Submergence Factor	1.00	
Adjusted Weir Coefficient	2.86	US
Flow Area	28.50	ft²
Velocity	3.05	ft/s
Wetted Perimeter	27.28	ft
Top Width	25.00	ft

Appendix D – Riprap Design

(10 total pages)

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Department of Health
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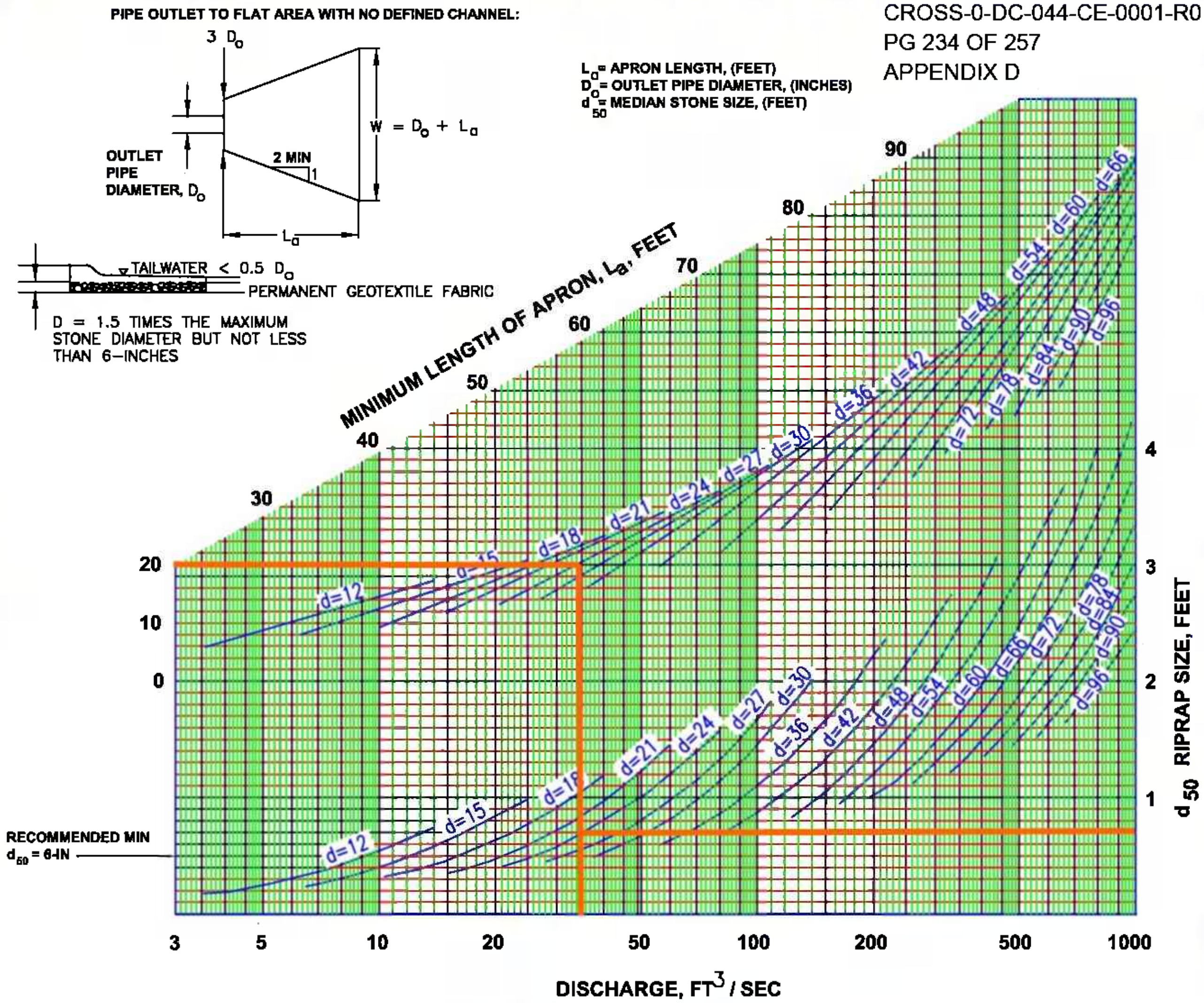
FIGURE RR-6

MINIMUM TAIL WATER CONDITION

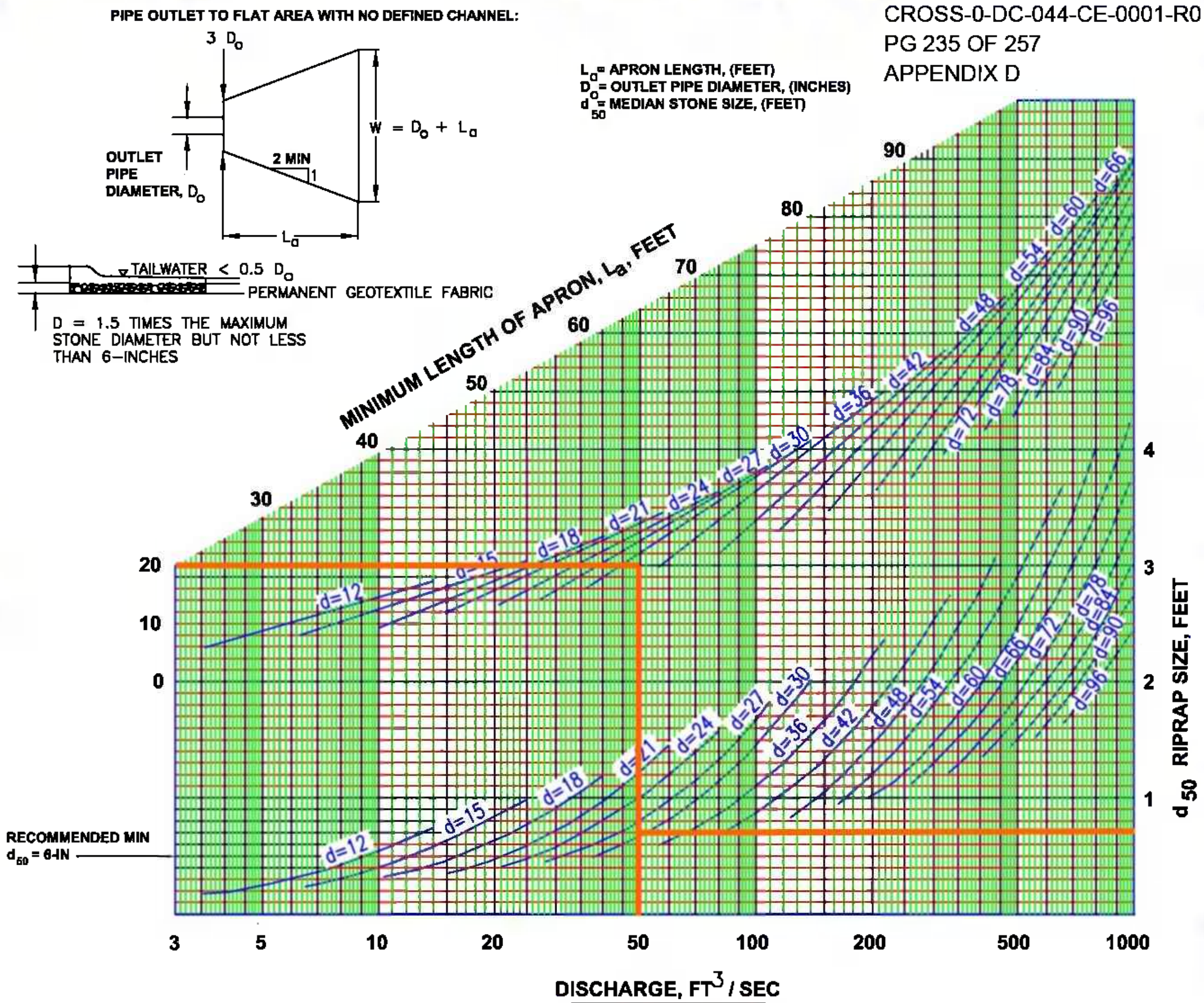
EFFECTIVE DATE: AUGUST, 2005

DESIGN OF OUTLET PROTECTION FROM A ROUND PIPE FLOWING FULL MINIMUM TAILWATER CONDITION (T_w < 0.5 DIAMETER)



RA-P1,P3,P4,P6,P7

DESIGN OF OUTLET PROTECTION FROM A ROUND PIPE FLOWING FULL
MINIMUM TAILWATER CONDITION (T_w< 0.5 DIAMETER)



RA- P2,P8

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Department of Health
and Environmental Control

FIGURE RR-6
MINIMUM TAIL WATER CONDITION

EFFECTIVE DATE: AUGUST, 2005

South Carolina
Department of Health
and Environmental Control

FIGURE RR-6

MINIMUM TAIL WATER CONDITION

EFFECTIVE DATE: AUGUST, 2005

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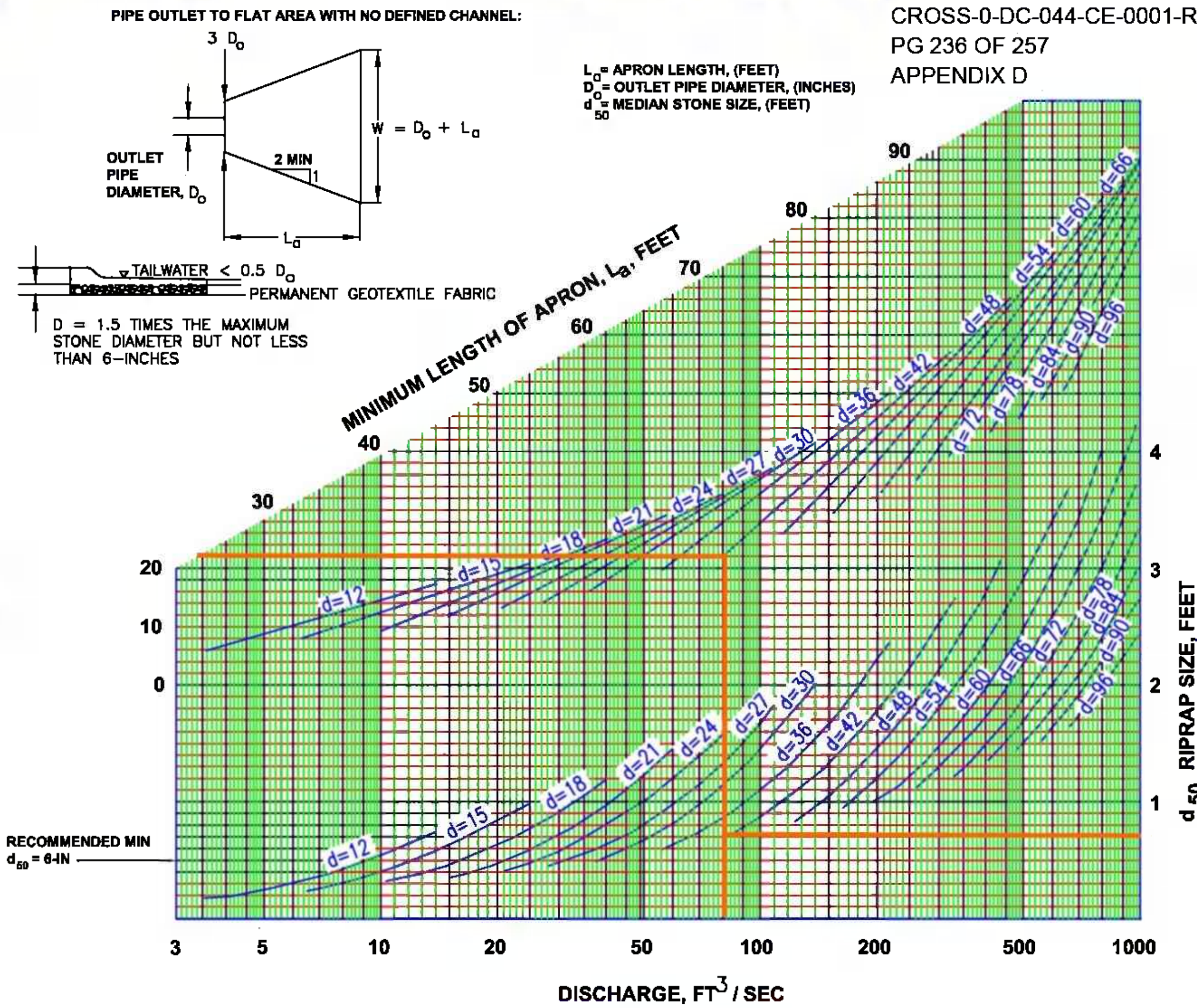
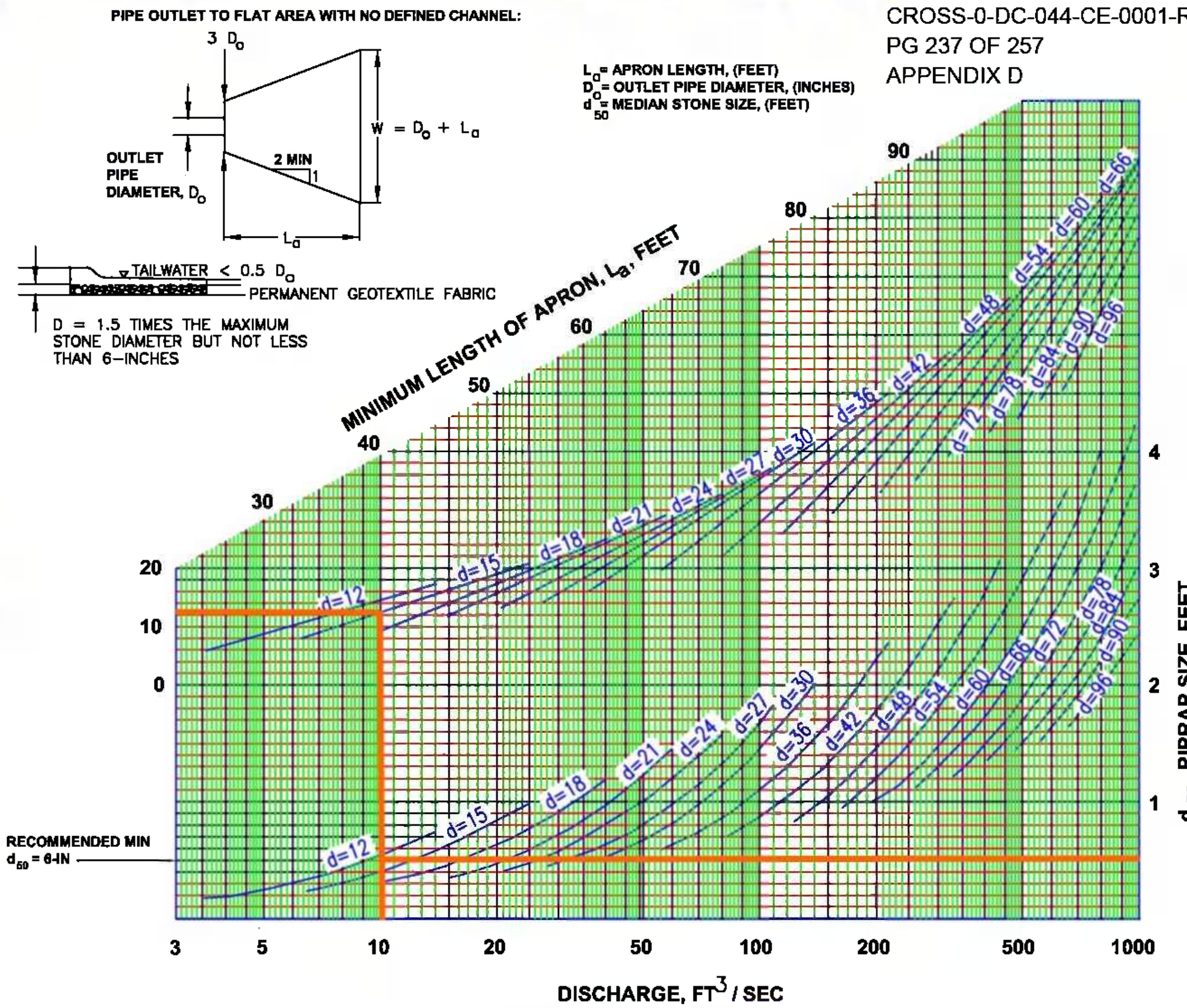


RA-P5

DESIGN OF OUTLET PROTECTION FROM A ROUND PIPE FLOWING FULL MINIMUM TAILWATER CONDITION (T_w< 0.5 DIAMETER)



RA-P-5A

South Carolina Department of Health and Environmental Control

FIGURE RR-6

MINIMUM TAIL WATER CONDITION

EFFECTIVE DATE: AUGUST, 2005

South Carolina Department of Health and Environmental Control

FIGURE RR-6

MINIMUM TAIL WATER CONDITION

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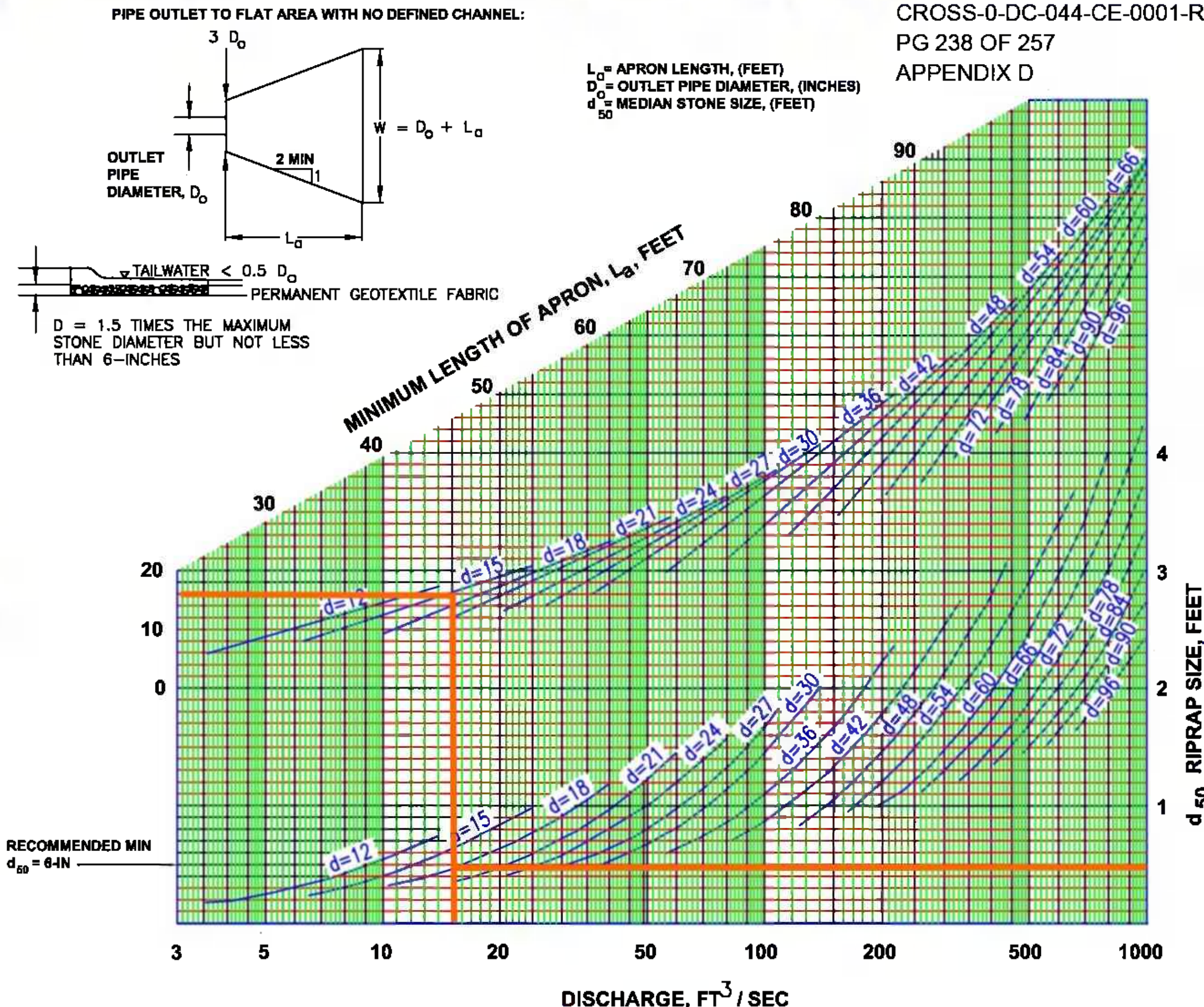

RA-P-8A

South Carolina
Department of Health
and Environmental Control

FIGURE RR-6

MINIMUM TAIL WATER CONDITION

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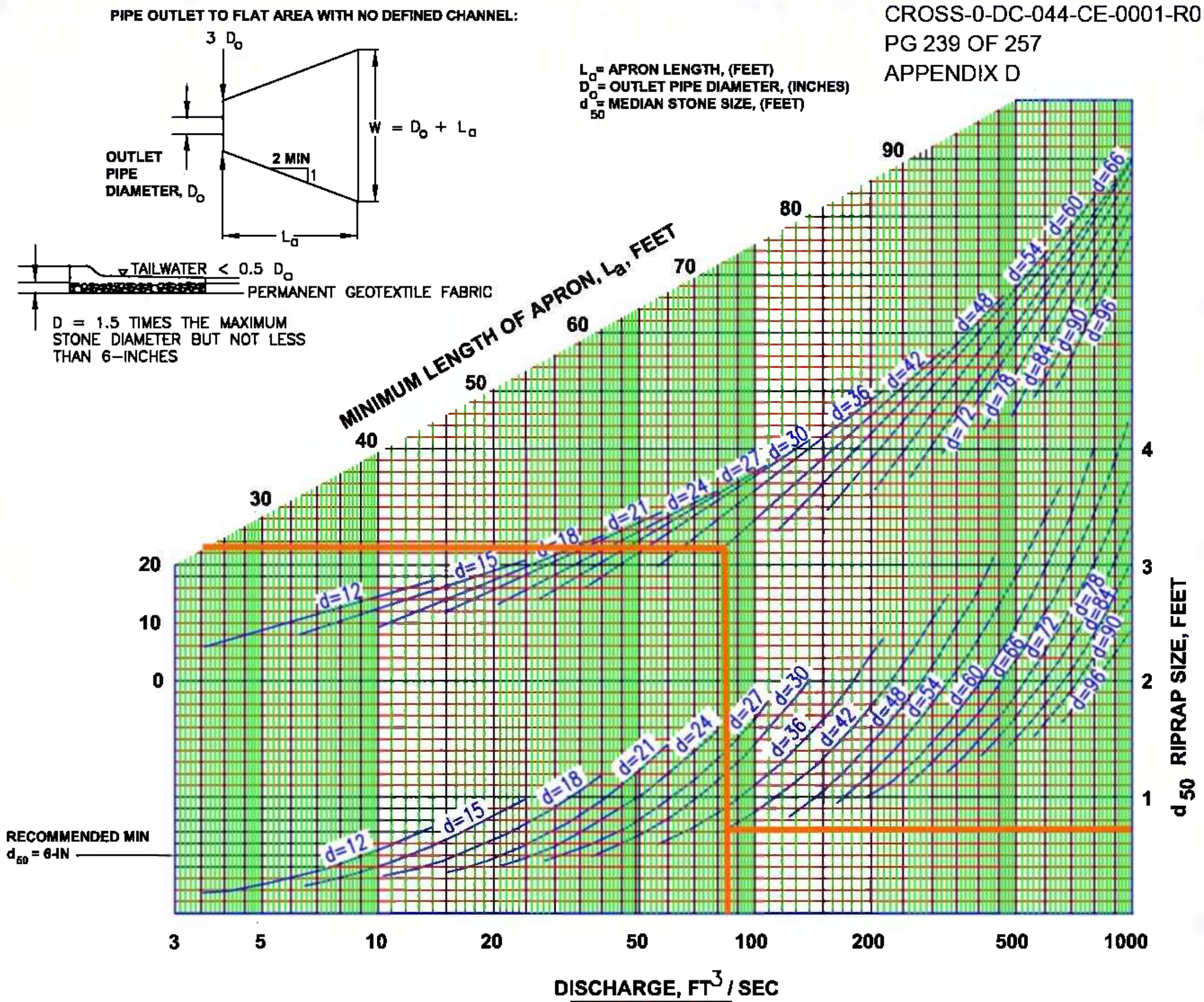

RA-P-9

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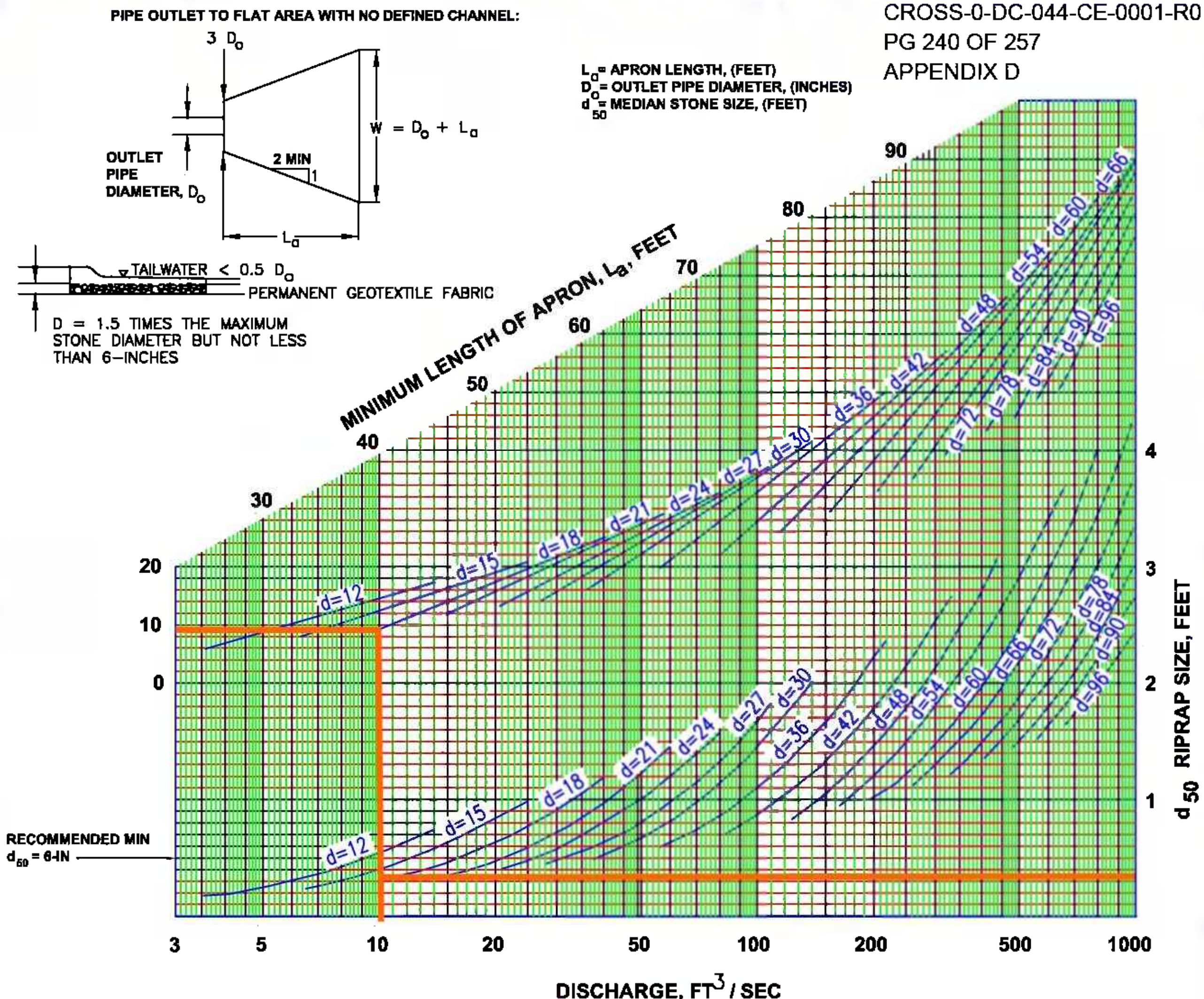
and Environmental Control

FIGURE RR-6

MINIMUM TAIL WATER CONDITION

EFFECTIVE DATE: AUGUST, 2005

DESIGN OF OUTLET PROTECTION FROM A ROUND PIPE FLOWING FULL
MINIMUM TAILWATER CONDITION (T_w< 0.5 DIAMETER)



RA-P-10

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FIGURE RR-6

MINIMUM TAIL WATER CONDITION

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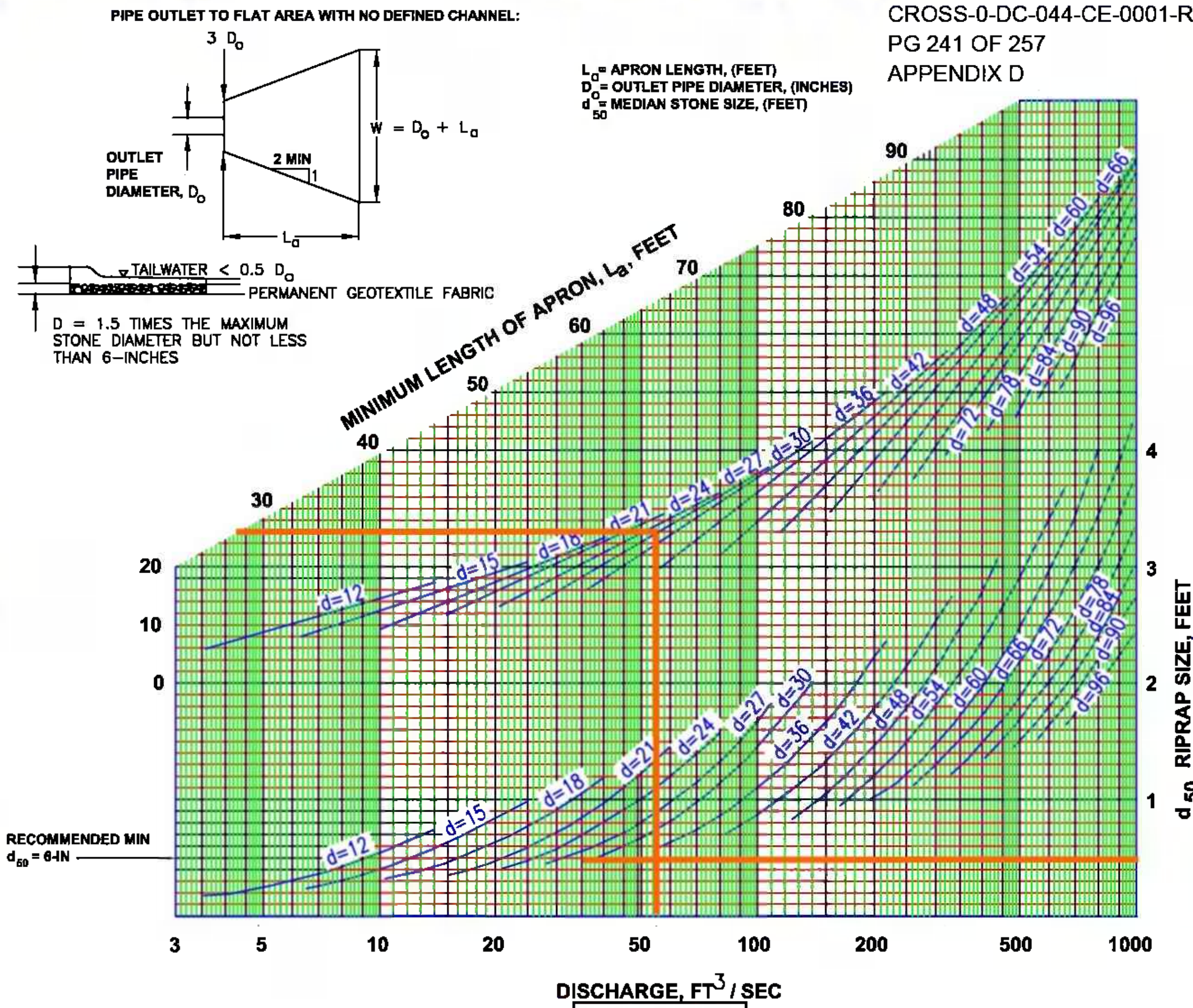
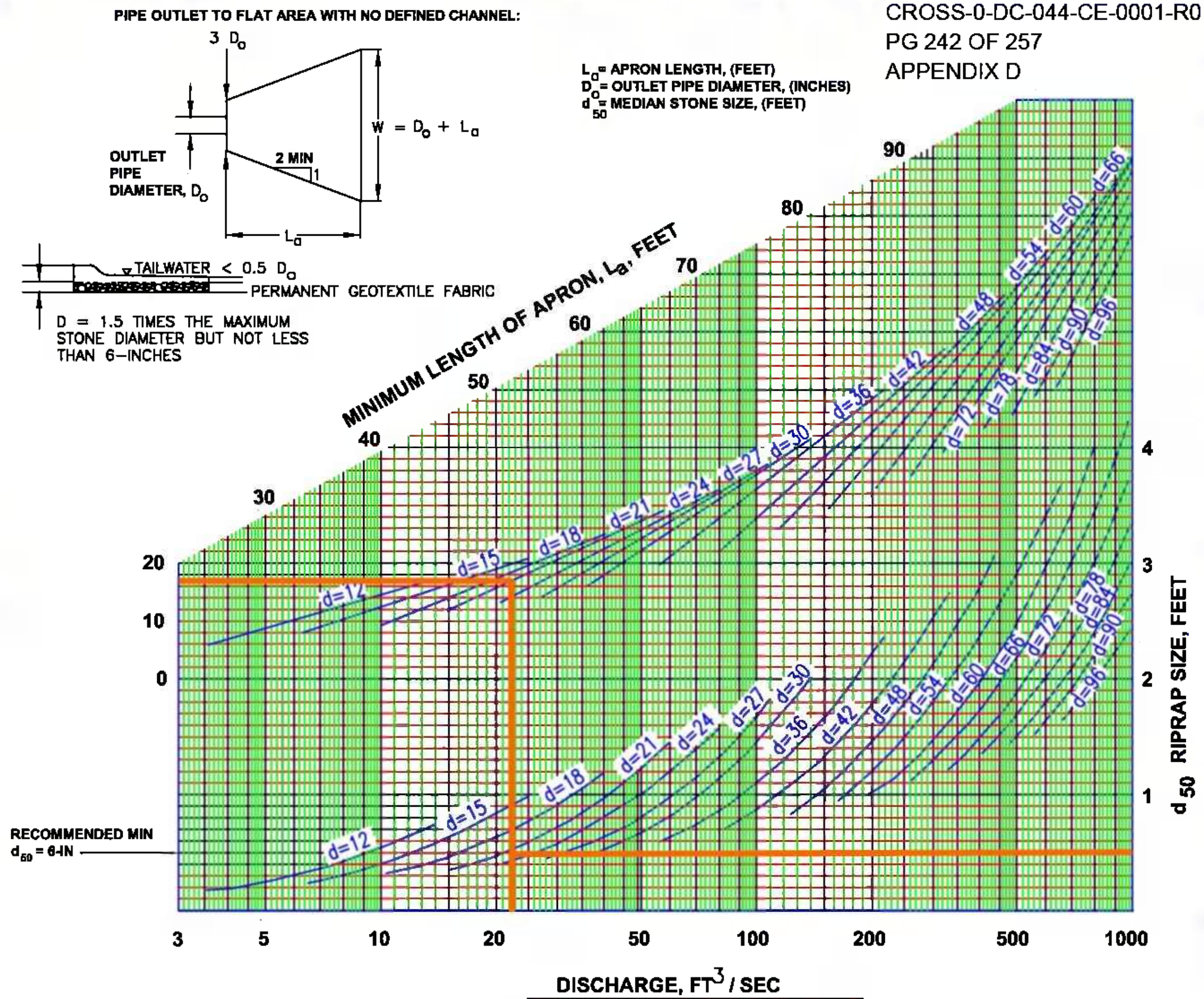


RA-B-6

DESIGN OF OUTLET PROTECTION FROM A ROUND PIPE FLOWING FULL
MINIMUM TAILWATER CONDITION (T_w < 0.5 DIAMETER)



RA-EX-N, RA-EX-S

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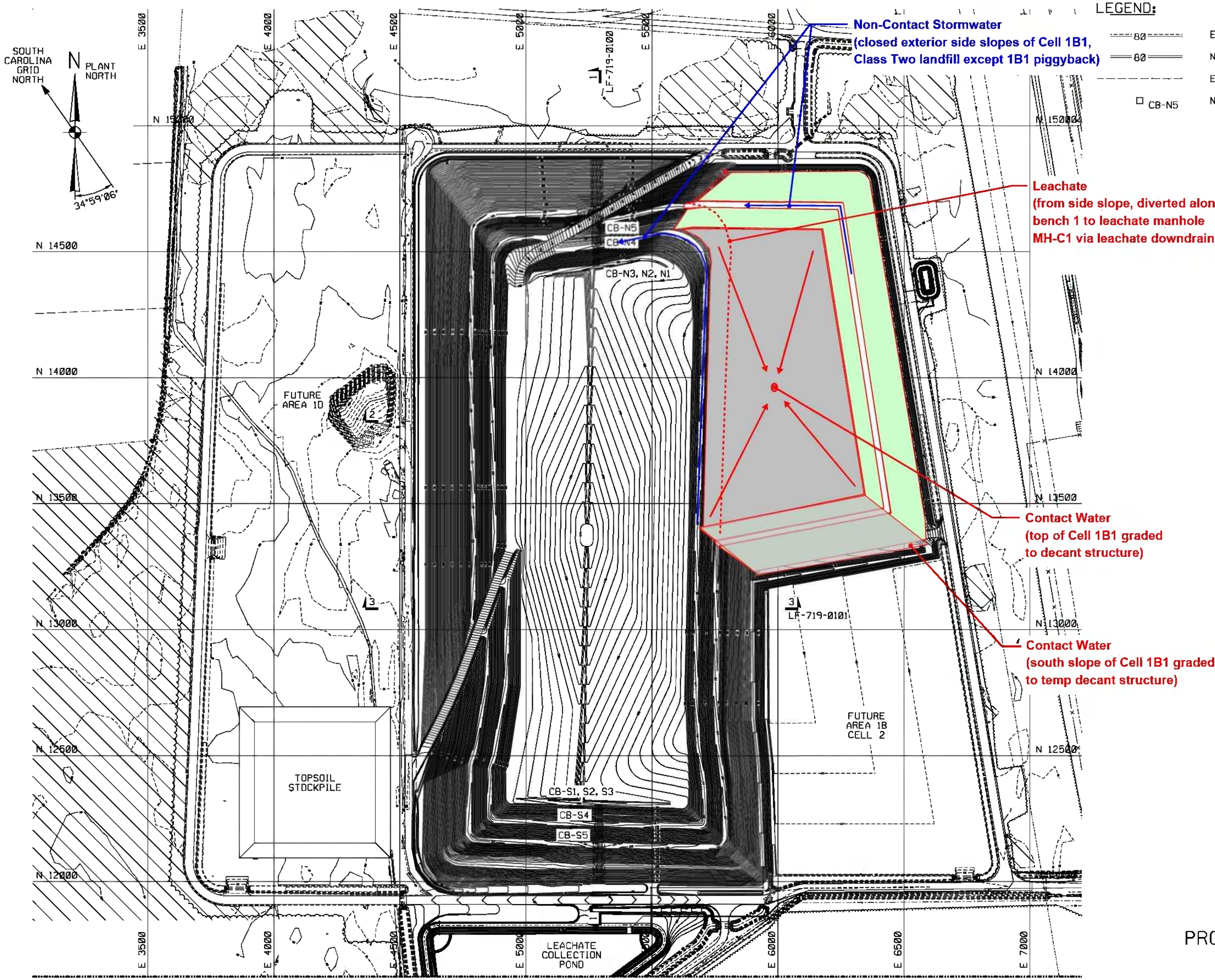
FIGURE RR-6
MINIMUM TAIL WATER CONDITION
EFFECTIVE DATE: AUGUST, 2005

Appendix E – Phasing Sketches

(10 total pages)



MATCH LINE LF-716-0119

PLAN
SCALE:1"=200'

LEGEND:

---60---	EXISTING CONTOURS
===60===	NEW CONTOURS
-----------	EXISTING DOWNDRAIN PIPE
□ CB-N5	NEW CATCH BASIN

NOTES:

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LF-719-0100	EXISTING, PHASING AND FINAL GRADE - CROSS SECTIONS
LF-719-0101	EXISTING, PHASING AND FINAL GRADE - CROSS SECTIONS

200 0 200 400 600
SCALE IN FEET

PROGRESS PLOT
11-20-14

DRAWN BY: KPF	ENGINEER: F.M. WOOD
CHECKED BY	PROJECT ENGINEERING MANAGER: R.E. SKIPTUNAS
LEAD DESIGNER: K.P. FEEG	PROJECT MANAGER: D.F. BECKER
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CLOSURE PLAN
FINAL GRADING PLAN

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A	01/11/13 ISSUED FOR REVIEW	KPF	RES	KPF	FMW	FMW
B	02/08/13 ISSUED FOR REVIEW	KPF	RES	KPF	FMW	FMW
C	ISSUED FOR REVIEW	KPF		KPF	FMW	FMW

SCALE: 1"=200'
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JOB NO. 188008-01330
WORLEYPARSONS DWG. NO. CR34-0-DW-LF-716-0118
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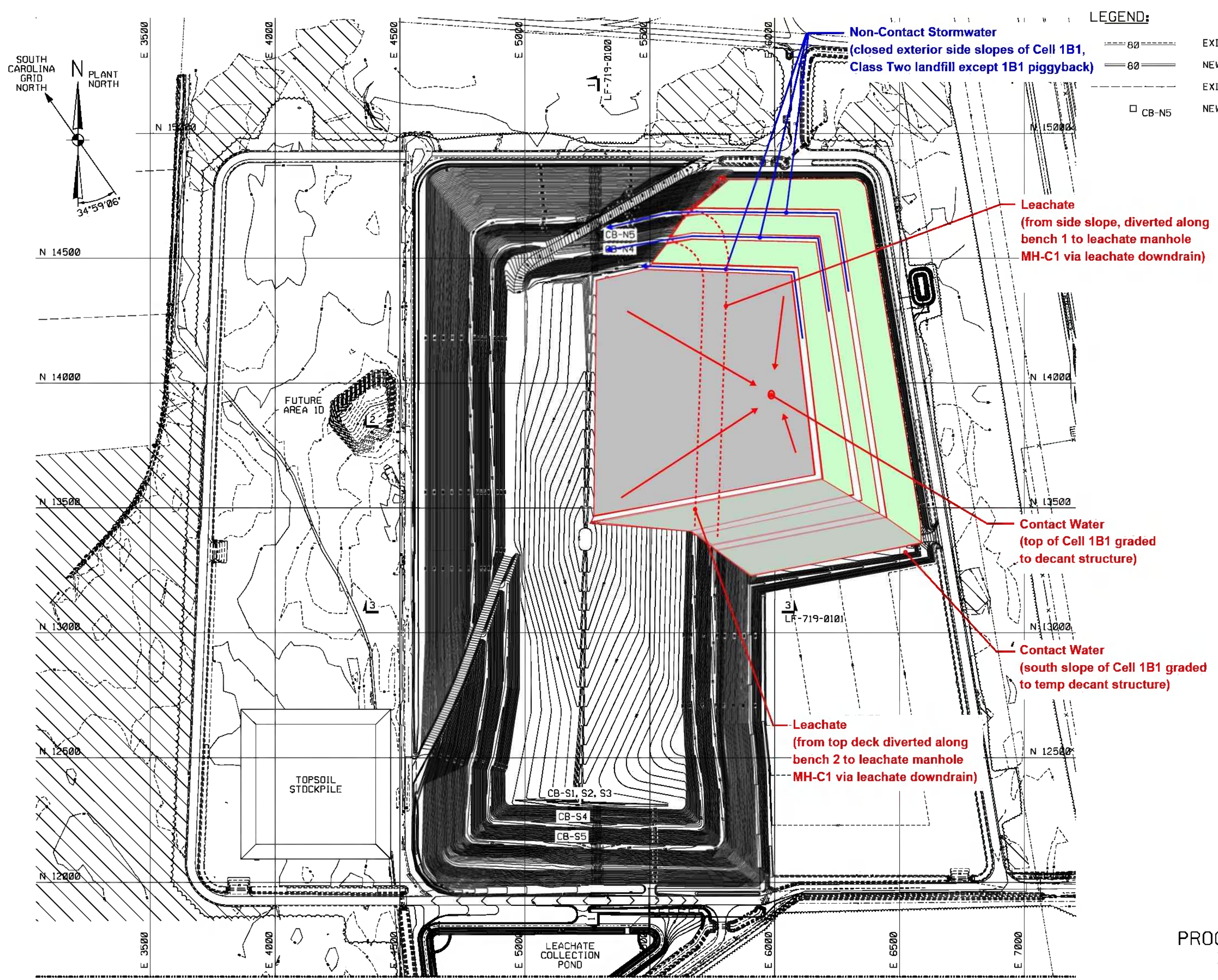

MATCH LINE LF-716-0119

PLAN
SCALE:1"=200'

LEGEND:

60	EXISTING CONTOURS
60	NEW CONTOURS
	EXISTING DOWNDRAIN PIPE
CB-N5	NEW CATCH BASIN

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200 0 200 400 600
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FINAL GRADING PLAN

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B	02/06/13	ISSUED FOR REVIEW	KPF	RES	KPF	FMW	FMW
A	01/11/13	ISSUED FOR REVIEW	KPF	RES	KPF	FMW	FMW
REV	DATE		DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/TECH. SPEC.	LEAD DISC ENGINEER

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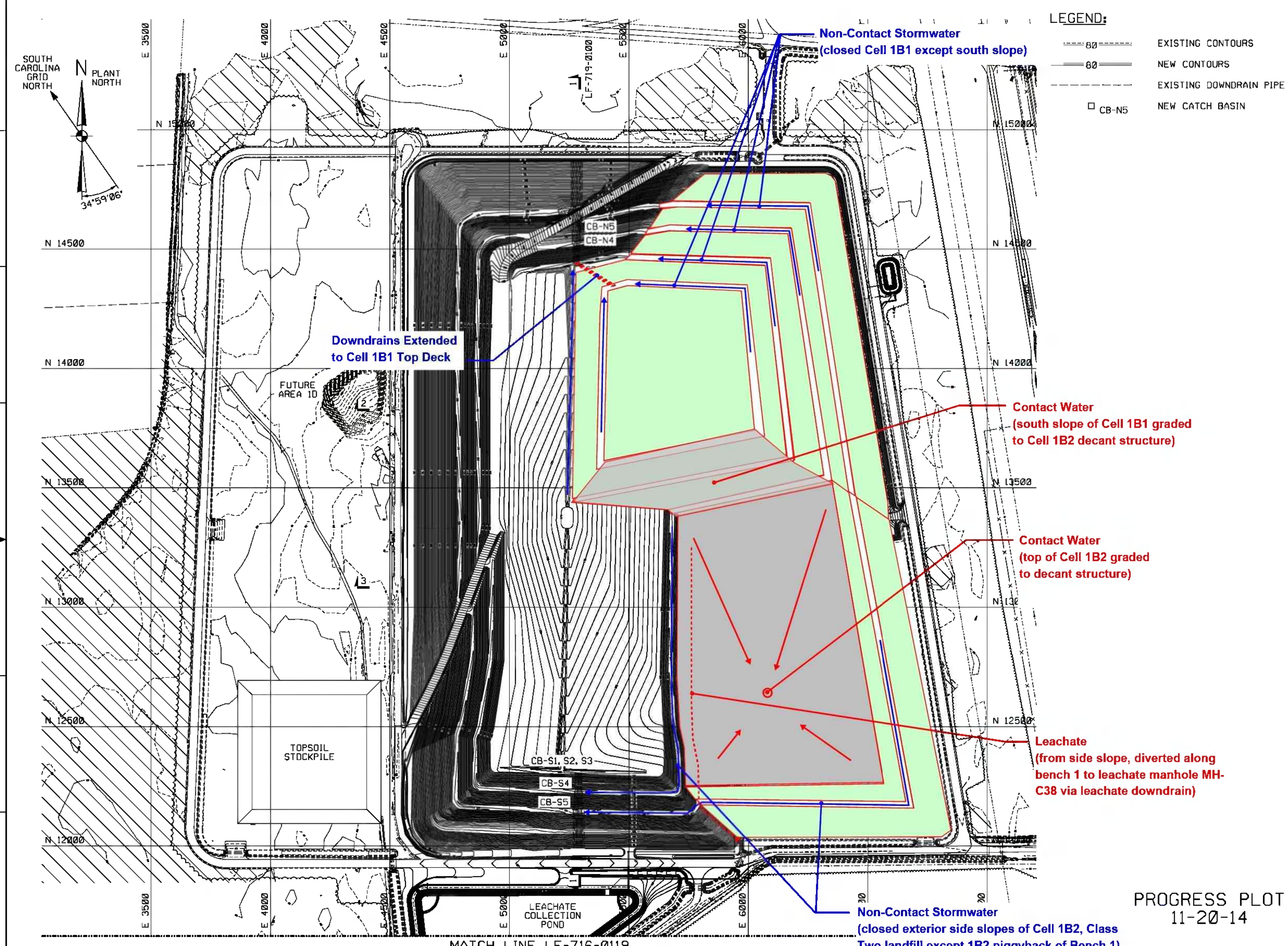

PLAN
SCALE:1"=200'

PROGRESS PLOT
11-20-14

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200 0 200 400 600
SCALE IN FEET

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CLOSURE PLAN
FINAL GRADING PLAN

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A	01/11/13	KPF	RES	KPF	FMW	FMW	ISSUED FOR REVIEW

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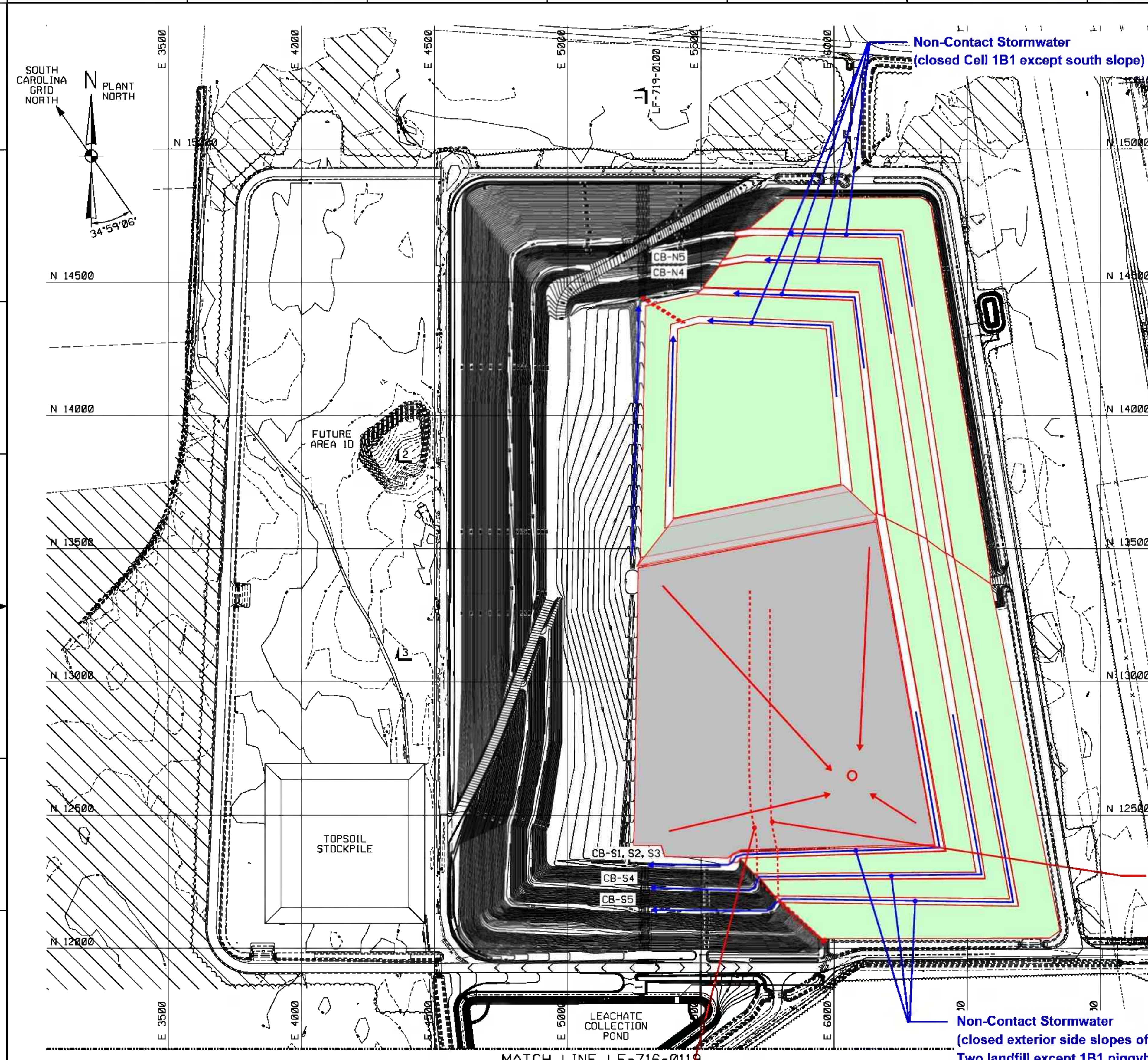

PLAN
SCALE:1"=200'

LEGEND:

60	EXISTING CONTOURS
60	NEW CONTOURS
	EXISTING DOWNDRAIN PIPE
CB-N5	NEW CATCH BASIN

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200 0 200 400 600
SCALE IN FEET

PROGRESS PLOT
11-20-14

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LEAD DESIGNER: K.P. FEEG	PROJECT MANAGER: D.F. BECKER
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FINAL GRADING PLAN

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B	02/06/13 ISSUED FOR REVIEW	KPF	RES	KPF	FMW	FMW
C	ISSUED FOR REVIEW	KPF		KPF	FMW	FMW

SCALE: 1"=200' — DRAWING SIZE: ARCH D (36" x 24") — JOB NO. 108000-01330
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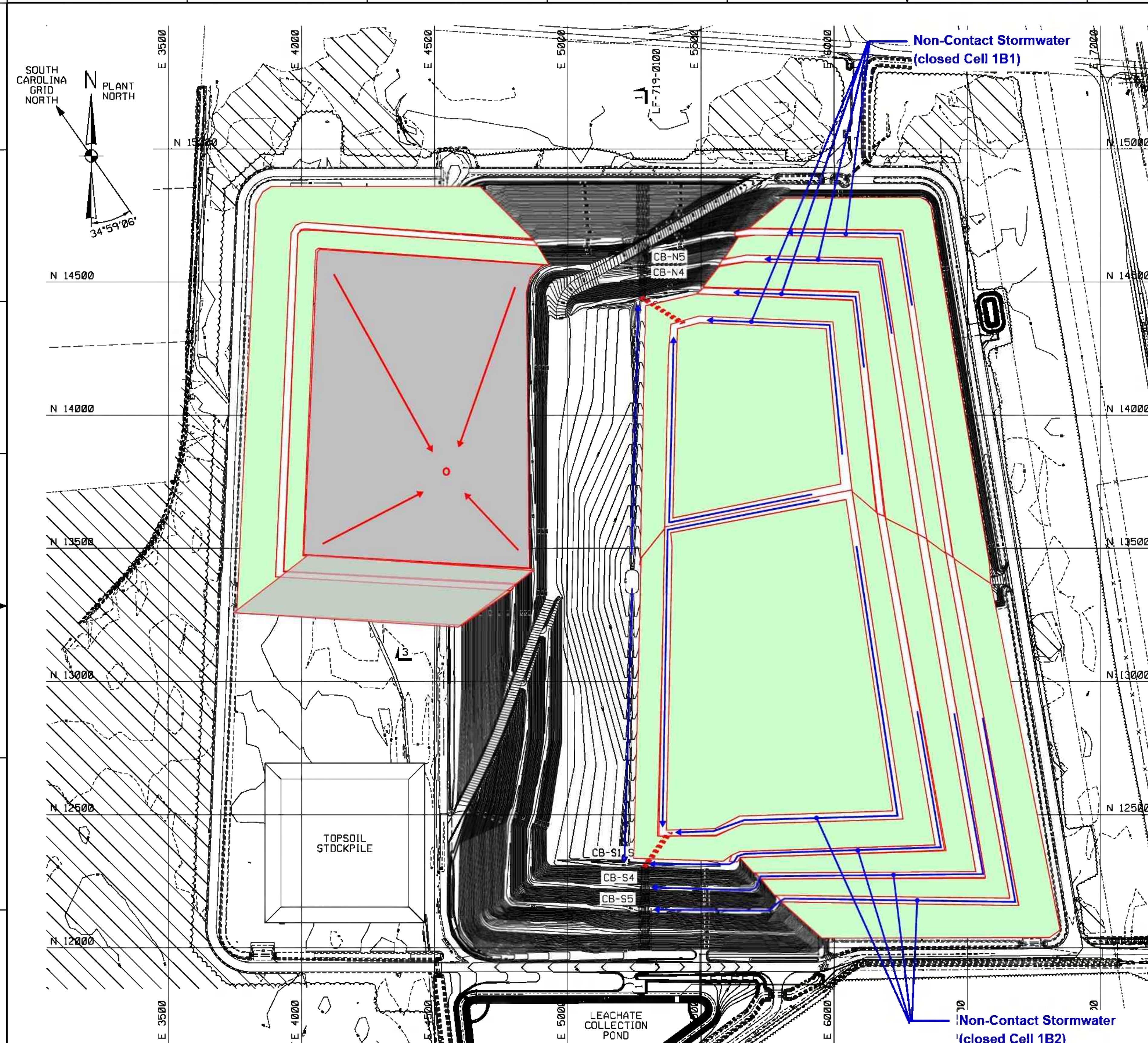

MATCH LINE LF-716-0119

PLAN
SCALE:1"=200'

LEGEND:

60	EXISTING CONTOURS
60	NEW CONTOURS
	EXISTING DOWNDRAIN PIPE
CB-N5	NEW CATCH BASIN

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200 0 200 400 600
SCALE IN FEET

PROGRESS PLOT
11-20-14

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CHECKED BY	PROJECT ENGINEERING MANAGER: R.E. SKIPTUNAS
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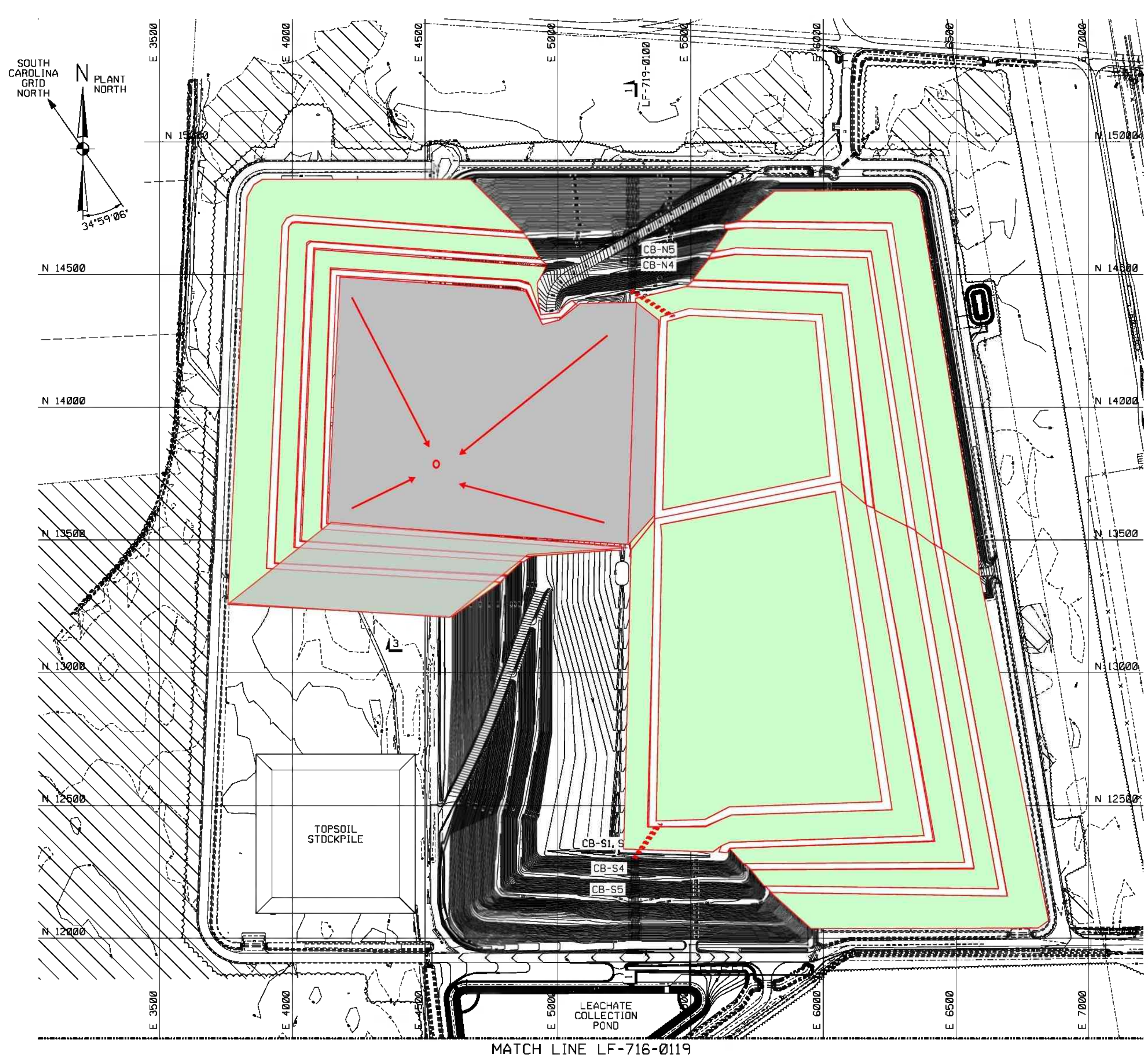
CLASS II SOLID WASTE LANDFILL
CLOSURE PLAN
FINAL GRADING PLAN

REV	DATE	DESCRIPTION	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/TECH. SPEC.	LEAD DISC. ENGINEER
C		ISSUED FOR REVIEW	KPF		KPF	FMW	FMW
B	02/06/13	ISSUED FOR REVIEW	KPF	RES	KPF	FMW	FMW
A	01/11/13	ISSUED FOR REVIEW	KPF	RES	KPF	FMW	FMW

SCALE: 1"=200' | DRAWING SIZE: ARCH D (36" x 24") | JOB NO. 108000-01330
WORLEYPARSONS DWG. NO. CR34-0-DW-LF-716-0118 | REV C



PLAN
SCALE:1"=200'

LEGEND:

60	EXISTING CONTOURS
60	NEW CONTOURS
	EXISTING DOWNDRAIN PIPE
CB-N5	NEW CATCH BASIN

NOTES:

1. GRID BASED ON THE PLANT COORDINATE SYSTEM.
2. BACKGROUND TOPOGRAPHY IS BASED ON A SURVEY PERFORMED BY STANTEC CONSULTING SERVICES INC., NORTH CHARLESTON, SC DATED 11/10/09.
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LF-716-0116	CLOSURE PLAN - PHASE 5
LF-716-0117	CLOSURE PLAN - PHASE 6
LF-716-0019	FINAL GRADING PLAN
LF-719-0100	EXISTING, PHASING AND FINAL GRADE - CROSS SECTIONS
LF-719-0101	EXISTING, PHASING AND FINAL GRADE - CROSS SECTIONS

200 0 200 400 600
SCALE IN FEET

PROGRESS PLOT
11-20-14

DRAWN BY KPF	ENGINEER F.M. WOOD
CHECKED BY	PROJECT ENGINEERING MANAGER R.E. SKIPTUNAS
LEAD DESIGNER K.P. FEEG	PROJECT MANAGER D.F. BECKER
PRELIMINARY STATUS DATE LDE F.M. WOOD	REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
APPROVED STATUS DATE LDE	REPRESENTS REVIEWED AND APPROVED DESIGN, ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.
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CLASS II SOLID WASTE LANDFILL
CLOSURE PLAN
FINAL GRADING PLAN

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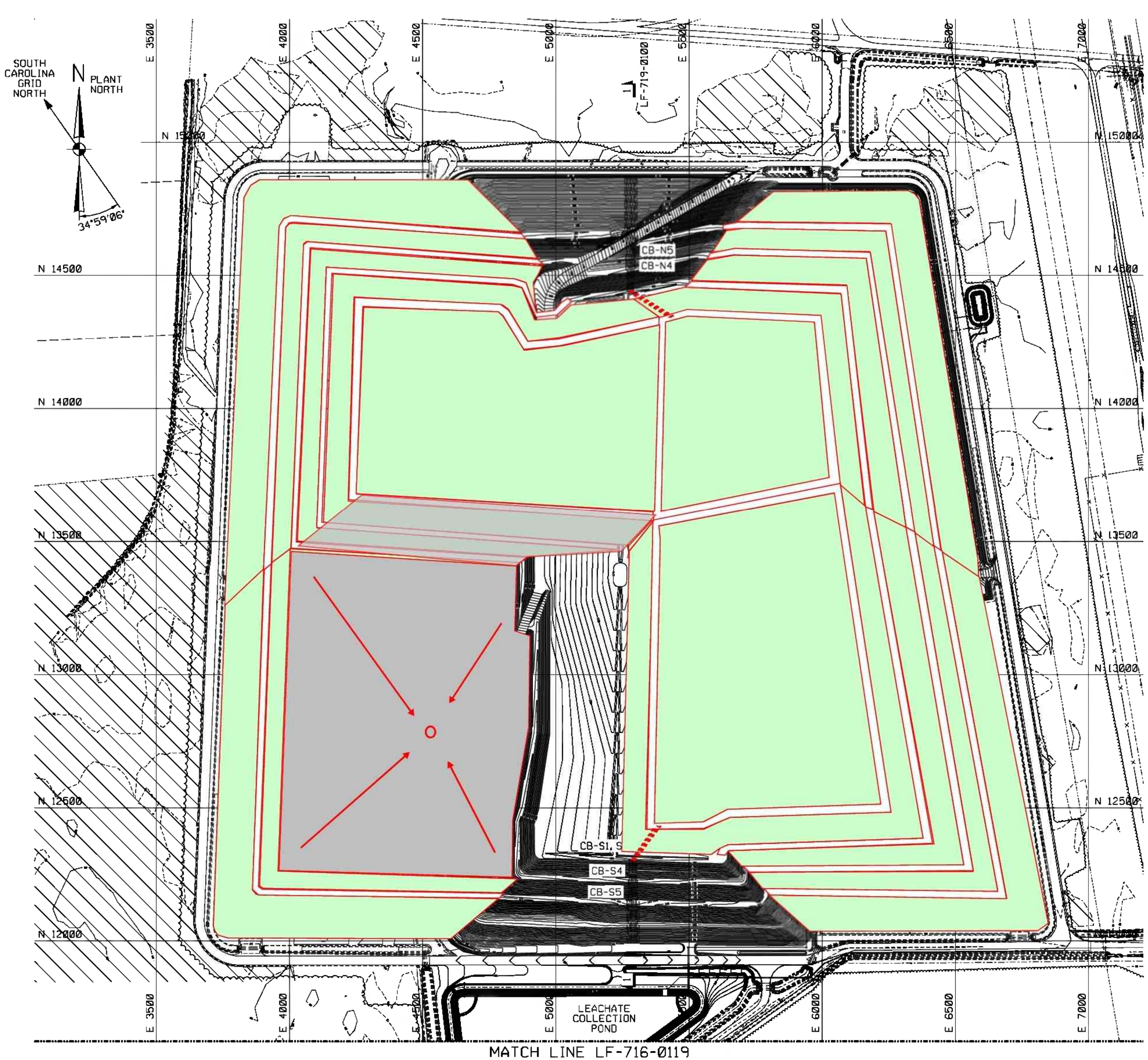
B	02/06/13	KPF	RES	KPF	FMW	FMW	ISSUED FOR REVIEW
C		KPF		KPF	FMW	FMW	ISSUED FOR REVIEW

SCALE 1"=200' | DRAWING SIZE ARCH D (36" x 24") | JOB NO. 100000-01330
WORLEYPARSONS DWG. NO. CR34-0-DW-LF-716-0118 | REV C



PLAN
SCALE:1"=200'

LEGEND:

60	EXISTING CONTOURS
60	NEW CONTOURS
	EXISTING DOWNDRAIN PIPE
CB-N5	NEW CATCH BASIN

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200 0 200 400 600
SCALE IN FEET

PROGRESS PLOT
11-20-14

DRAWN BY: KPF	ENGINEER: F.M. WOOD
CHECKED BY	PROJECT ENGINEERING MANAGER: R.E. SKIPTUNAS
LEAD DESIGNER: K.P. FEEG	PROJECT MANAGER: D.F. BECKER
PRELIMINARY STATUS DATE — LDE F.M. WOOD	REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
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CLASS II SOLID WASTE LANDFILL
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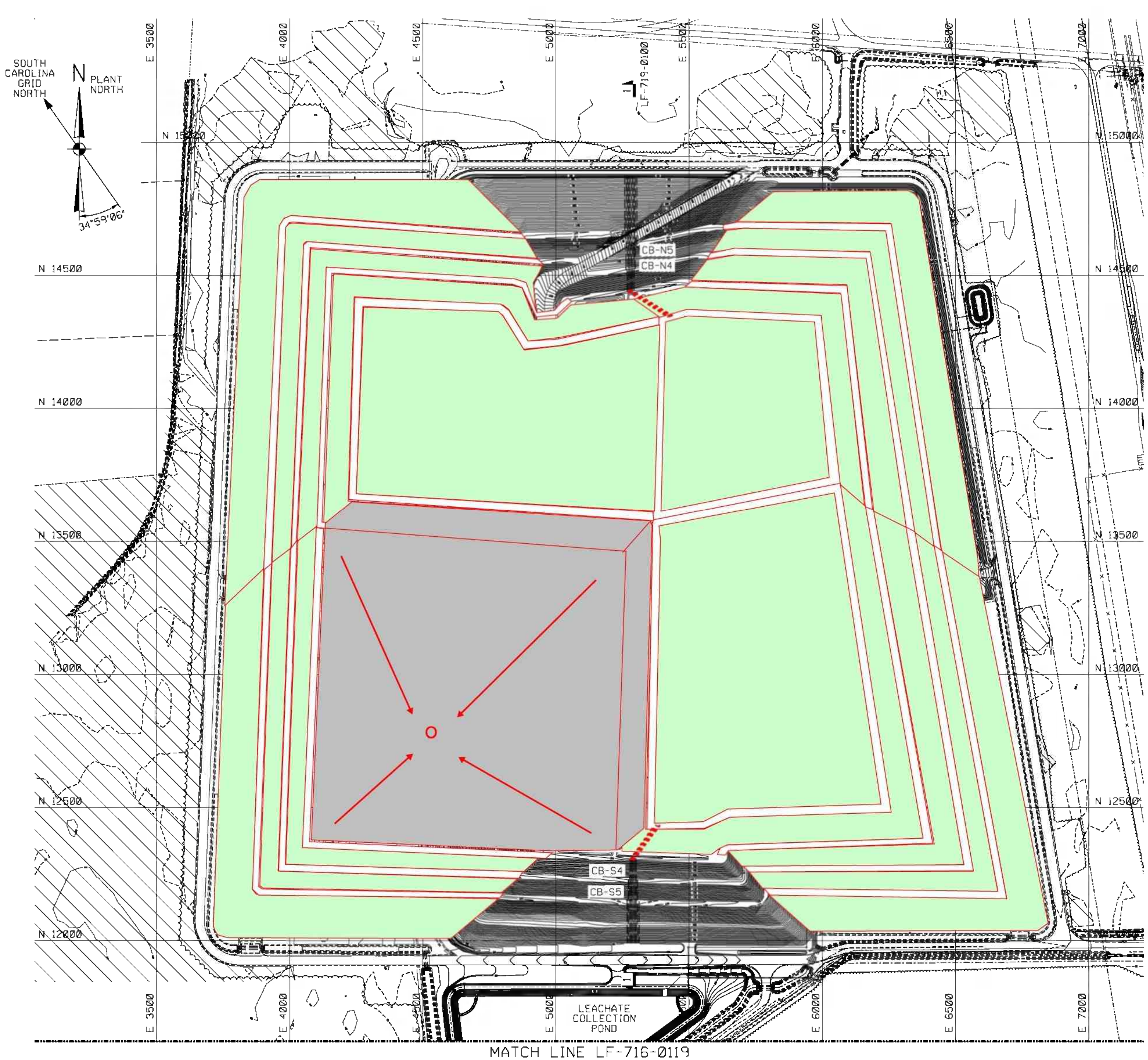
B	02/08/13	ISSUED FOR REVIEW	KPF	RES	KPF	FMW	FMW
C		ISSUED FOR REVIEW	KPF		KPF	FMW	FMW

SCALE: 1"=200' | DRAWING SIZE: ARCH D (36" x 24") | JOB NO. 108000-01330
WORLEYPARSONS DWG. NO. CR34-0-DW-LF-716-0118 | REV C



PLAN
SCALE:1"=200'

LEGEND:

----80----	EXISTING CONTOURS
====80====	NEW CONTOURS
— — — — —	EXISTING DOWNDRAIN PIPE
□ CB-N5	NEW CATCH BASIN

NOTES:

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200 0 200 400 600
SCALE IN FEET

PROGRESS PLOT
11-20-14

DRAWN BY: KPF	ENGINEER: F.M. WOOD
CHECKED BY:	PROJECT ENGINEERING MANAGER: R.E. SKIPTUNAS
LEAD DESIGNER: K.P. FEEG	PROJECT MANAGER: D.F. BECKER
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CLASS II SOLID WASTE LANDFILL
CLOSURE PLAN
FINAL GRADING PLAN

SCALE	DRAWING SIZE	JOB NO.
1"=200'	ARCH D (36" x 24")	109009-01330

WORLEYPARSONS DWG. NO.: CR34-0-DW-LF-716-0118 — REV: C

REV	DATE	DESCRIPTION	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/TECH SPEC.	LEAD DISC ENGINEER
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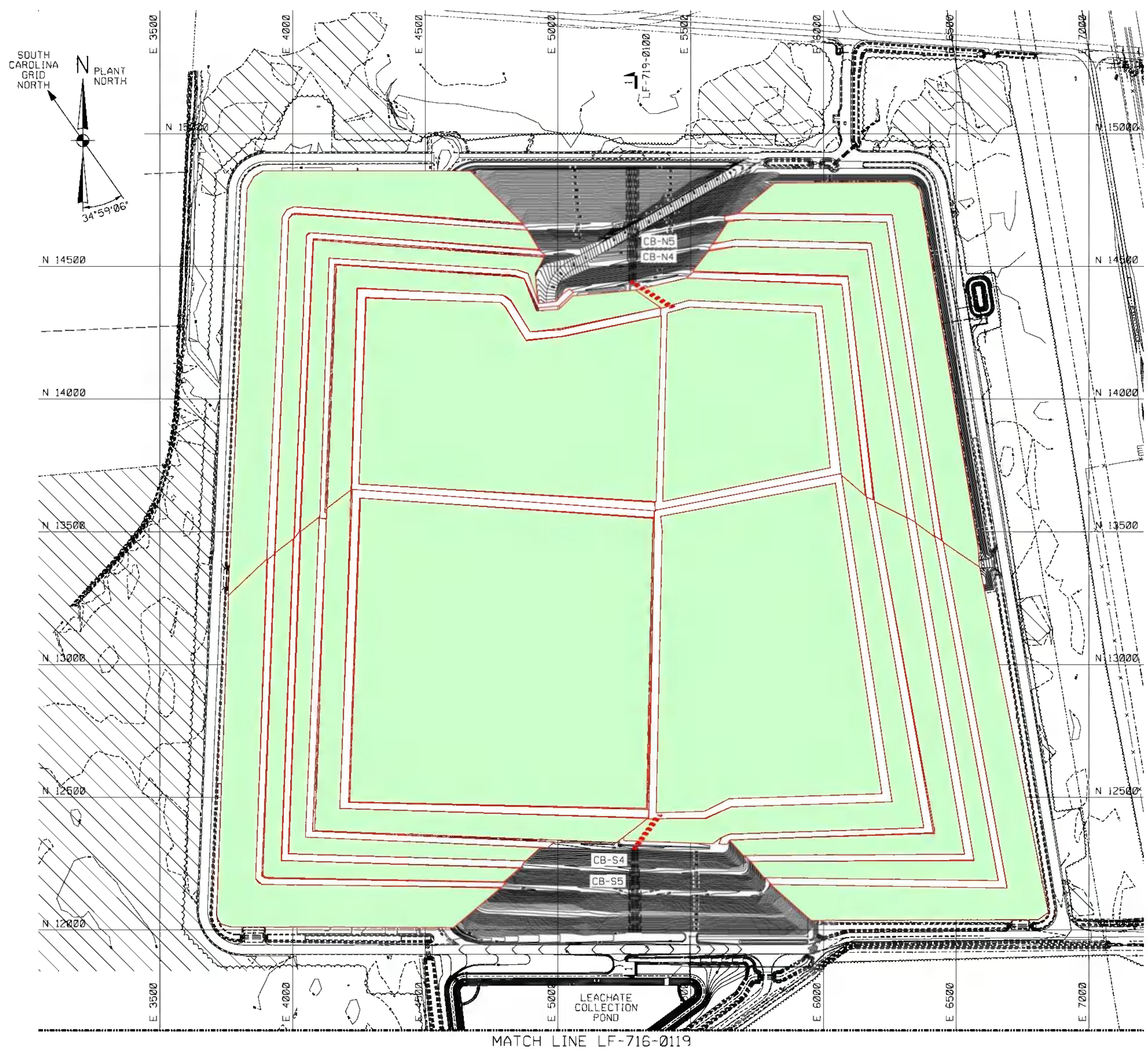
B	02/06/13	ISSUED FOR REVIEW	KPF	RES	KPF	FMW	FMW
C		ISSUED FOR REVIEW	KPF		KPF	FMW	FMW



PLAN
SCALE:1"=200'

LEGEND:

---80---	EXISTING CONTOURS
—80—	NEW CONTOURS
- - - - -	EXISTING DOWNDRAIN PIPE
□ CB-N5	NEW CATCH BASIN

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200 0 200 400 600
SCALE IN FEET

PROGRESS PLOT
11-20-14

DRAWN BY: KPF	ENGINEER: F.M. WOOD
CHECKED BY	PROJECT ENGINEERING MANAGER: R.E. SKIPTUNAS
LEAD DESIGNER: K.P. FEEG	PROJECT MANAGER: D.F. BECKER
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CLASS II SOLID WASTE LANDFILL
CLOSURE PLAN
FINAL GRADING PLAN

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B	02/06/13	KPF	RES	KPF	FMW	FMW	ISSUED FOR REVIEW
C		KPF		KPF	FMW	FMW	ISSUED FOR REVIEW

SCALE: 1"=200' | DRAWING SIZE: ARCH D (36" x 24") | JOB NO. 109008-01330
WORLEYPARSONS DWG. NO. CR34-0-DW-LF-716-0118 | REV C

Appendix F – Bench Capacity

(5 total pages)

SUMMARY OF PEAK FLOWS FOR BENCHES		
Area	Discharge Q_{25}	Description
NW2+EXN2+NE2	15.3	Area 1 - Bench 1 from top (NORTH)
NW3+EXN3+NE3	25.2	Area 1 - Bench 2 from top (NORTH)
NW4+EXN4+NE4	27.9	Area 1 - Bench 3 from top (NORTH)
NW5+EXN5+NE5	33.5	Area 1 - Bench 4 from top (NORTH)
SW2+EXS2+SE2	15.4	Area 1 - Bench 1 from top (SOUTH)
SW3+EXS3+SE3	28.0	Area 1 - Bench 2 from top (SOUTH)
SW4+EXS4+SE4	25.6	Area 1 - Bench 3 from top (SOUTH)
SW5+EXS5+SE5	20.3	Area 1 - Bench 4 from top (SOUTH)

From the table above, the maximum flow occurs in the drainage area, NW5+EXN5+NE5.
Since this flow is carried by the two landfill terrace channels, the flow will be divided into half.

The maximum flow from the sub areas = 33.5 cfs
The maximum flow per each channel = 16.7 cfs

The capacity of the channel = 16.5 cfs (see next page)

The estimated peak flow is slightly above the capacity of the channel. Since the peak flow calculations are based on conservative estimates, it is acceptable to tolerate 0.2 cfs. See Drawing CR34-0-DW-LF-735-0541 for the cross-section details

Worksheet for Bench Capacity

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.040	
Channel Slope	0.00500	ft/ft
Normal Depth	1.00	ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	17.00	ft/ft (H:V)

Results

Discharge	16.44	ft^3/s
Flow Area	10.00	ft^2
Wetted Perimeter	20.19	ft
Hydraulic Radius	0.50	ft
Top Width	20.00	ft
Critical Depth	0.70	ft
Critical Slope	0.03351	ft/ft
Velocity	1.64	ft/s
Velocity Head	0.04	ft
Specific Energy	1.04	ft
Froude Number	0.41	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.00	ft
Critical Depth	0.70	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.03351	ft/ft

6" Pipe Flow Capacity

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.012	
Channel Slope	0.00500	ft/ft
Normal Depth	0.50	ft
Diameter	0.50	ft
Discharge	37134.92	ft³/d

Results

Discharge	37134.92	ft³/d
Normal Depth	0.50	ft
Flow Area	0.20	ft²
Wetted Perimeter	1.57	ft
Hydraulic Radius	0.13	ft
Top Width	0.00	ft
Critical Depth	0.33	ft
Percent Full	100.0	%
Critical Slope	0.00809	ft/ft
Velocity	2.19	ft/s
Velocity Head	0.07	ft
Specific Energy	0.57	ft
Froude Number	0.00	
Maximum Discharge	0.46	ft³/s
Discharge Full	0.43	ft³/s
Slope Full	0.00500	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.50	ft

6" Pipe Flow Capacity

GVF Output Data

Critical Depth	0.33	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.00809	ft/ft

Attachment B - Calculation CR34-0-DC-LF-CE-007

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Calculation Template

Customer	Santee Cooper	**Project No.**	108008-01330
Project Title	Cross Generating Station - Class III Solid Waste Landfill	**Calc No.**	CR34-0-DC-LF-CE-007
Calculation Title	Decant Structure Design	**Phase/CTR**	N/A
Elec File Location	P:\SanteeCooper\CR34\Doc\Civil\Cross Generating Station\Class III SWLF Horizontal Expansion\Calculations\CE-007 Decant Structures\CR34-0-DC-LF-CE-007-R0.doc		
Project File Location	See Encompass	**Page**	1 of 62

Calculation Objective

Design the decant structures, which will be located on the Solid Waste Landfill Areas 1B, 1D, 2, and 5, to collect stormwater runoff and prevent the transport of sediment from the waste disposal area to the stormwater management facilities.

Calculation Method

Use Haestad Methods Pondpack program to generate runoff hydrographs for a 25-year, 24-hour storm event and to route the storm through the basin and the decant structure.

Software Used

Title	Version	Validated (Yes/No/NA)
Bentley Pondpack	10.1	Yes

Assumptions

All assumptions are included in the calculation. None that require further verification.

Professional Engineer Seal

See Page 3

References

1. SCDHEC Standards for Storm Water and Sediment Reduction Regulation 72-300 through 72-316.
2. SCDHEC Solid Waste Management Industrial Solid Waste Landfills –Regulation DHEC R61-107-19
3. SCDHEC OCRM Stormwater Best Management Practices. Handbook
4. WorleyParsons' Drawings CR34-0-DW-LF-735-0364 and 450 thru 0455

Conclusions

Use perforated 24" ADS N-12 pipe (or equal) for decant structure riser pipe. Use solid 18" and 24" ADS N-12 pipe (or equal) for discharge to the leachate pond. Keep the decant structure a minimum of 5 feet above the ash level. TYPAR 3601 will be used as filter geotextile. Keep the base of the depressed basin area around the decant structure at least 7 percent of the total contributing drainage area, with slopes of 5:1 or flatter upward to the surrounding active work area. Maintain the perimeter of the landfill at least 2 feet above the top of the decant riser pipe.

Rev	Date	Description	By	Checked	Approved
0	14-Feb-2012	Issued for Permitting	P.Velugubantla	E. Leiby	F. Wood

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Calculation Template

Customer	Santee Cooper	**Project No.**	108008-01330
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Project File Location	See Encompass	**Page**	2 of 62

Please check boxes for all applicable items checked or delete if not appropriate:

Calculations:

- ☒ Calculation number assigned and registered (refer to project numbering system or Document Numbering System EPP-0040 for format).
- ☒ Project title shown.
- ☒ Calculation title shown.
- ☒ Revision history box complete and signed.
- ☒ Index.
- ☐ Appropriate stamp for preliminary issues.
- ☒ Calculation objectives (aims) stated.
- ☒ Calculation method defined or described (including formulae if relevant).
- ☒ Reference made to text, standard or code. Check version/edition with that required for project.
- ☒ Source of input data stated (with revision number and date if relevant).
- ☒ Assumptions stated.
- ☒ Summary of results or conclusions.
- ☒ For software based calculations, reference to software validation if available.
- ☒ Approach used is appropriate for problem being solved.
- ☒ Method clear and easy to follow.
- ☒ Input data correct.
- ☒ Calculation is arithmetically correct OR software previously verified and reference to verification checked.
- ☒ Calculation result within expected limits.
- ☒ Calculation tolerances stated if significant.
- ☒ Units used as required by customer.
- ☒ Abbreviations correct.
- ☒ Appropriate cross-references.
- ☒ Sketches included and clearly labeled, where required.
- ☒ Attachments included and referenced, as required.
- ☒ Considered design reviews, Hazop actions, client input, safety and environmental issues, etc.

Checking records:

- ☒ Checked and annotated copy of calculation filed (use "Check Print" stamp).
- ☒ Corrections made as required and calculation dated and signed on cover sheet by checker.

Revisions:

- ☐ Changes clouded.
- ☐ Revision history block updated.
- ☐ Calculation re-checked if required.

Rev	Date	Description	By	Checked	Approved
0	14-Feb-2012	Issued for Permitting	P.Velugubantla	E. Leiby	F. Wood

Calculation Template

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Customer	Santee Cooper	**Project No.**	108008-01330
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Calculation Title	Decant Structure Design	**Phase/CTR**	N/A
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Project File Location	See Encompass	**Page**	3 of 62

Rev	Date	By	Checked	Rev	Date	By	Checked	Rev	Date	By	Checked
0	14-Feb-2012	P. Pedugubanda	E. Leiby								

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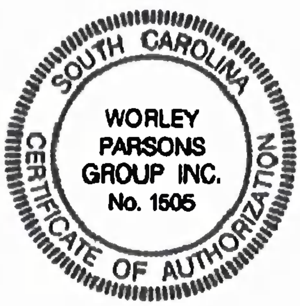

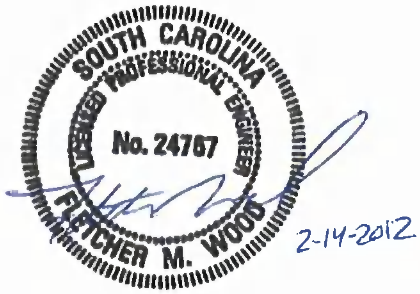

1. DESIGN CRITERIA

The following criteria are used to design the decant structures, which will be located on the Solid Waste Landfill Areas 1B, 1D, 2, and 5:

- Decant structure shall be sized to convey and control the runoff resulting from the 25-Year, 24-Hour storm event.
- Use a runoff curve number of 93 for the landfill (consistent with HELP model assumptions).

2. SITE CONDITIONS

The Class III solid waste landfills consist of gypsum, fly ash, and bottom ash. The decant structures will be placed in the footprint of landfills to collect the stormwater runoff and prevent the transport of sediment from the disposal area into the stormwater management facilities. The stormwater that falls on these landfill and runs off the surface of the waste and enters decant structures is considered a form of leachate (i.e. contact water surface runoff). Therefore, stormwater from the decant structures will be routed directly via gravity decant piping to the leachate collection pond.

3. METHODOLOGY

The decant structure riser pipe is designed to pass the 25-year, 24-hour storm through vertical perforations (after being filtered through the surrounding stone and filtration geotextile), without overtopping the riser pipe. The top of the riser has an open inlet grate so that larger storm events will be controlled without a free release elsewhere around the landfill.

Since all landfill cells are more or less similar in size, the decant structure with the largest drainage area (32 acres), is modeled using Bentley PondPack and the same design will be used for all cells as a conservative approach. The decant structure is modeled assuming that at least one extension has occurred (i.e. the height of solid waste is at least 10 feet within the landfill cell) to represent the majority of time during normal operations. The solid waste in the immediate vicinity of the decant structure must be kept lower than the rest of the active drainage area to assist the structure in attenuating large storm events (this lower area is still graded to drain to the structure). An important objective of this calculation is to determine the size of this lower area as a function of the size of the contributing drainage area for operational purposes.

As an extra check, another run is modeled for the decant structure assuming the surrounding solid waste level is equal to the base of the decant structure. This scenario is used to verify that the decant structure controls the peak stormwater event when it is first opened, the maximum possible area is draining to it, and the available perforations for drainage do not extend below the ground surface. The objective in this case is to ensure the 25-year, 24-hour storm event is still conveyed and controlled without free release, even if such a peak storm event may bypass the filtration mechanism of the structure. The maximum area draining to the structure in this case is 35 Acres. However, this scenario will be valid for the period of time until the first extension of the decant structure.

4. RAINFALL DATA

Rainfall data for Berkeley County (North), South Carolina is obtained from SCDHEC Storm Water Management BMP Handbook, Appendix F. Table 1 below summarizes the rainfall data, which is used in the calculation.

TABLE-1
BERKLEY (NORTH) COUNTY, SOUTH CAROLINA
RETURN PERIOD 24 HOUR STORM EVENT (INCHES)

2-yr	10-yr	25-yr	50-yr	100-yr
3.8	5.9	7.2	8.2	9.4

5. CALCULATIONS SUMMARY

The portion of the decant structure used to attenuate peak storm events consists of a vertical perforated riser pipe, (24-in ADS N-12 pipe), and a solid discharge pipe, (18-in ADS N-12 pipe). From Attachment-D, the perforated 24-inch N-12 Class II pipe has 0.313" holes spaced evenly around the pipe circumference. These perforations provide an open area of approximately 2.36 in^2/ft of pipe.

<u>Normal Operations Scenario</u>

In this scenario, the decant structure has been extended one or more times, which means that there are more available pipe perforations because the pipe and surrounding stone extends below grade. Therefore, a reference datum of EL 11 is used for the base of the decant structure so that perforations down to EL 0 can be modeled. In order to attenuate and pass water through the vertical perforations of the riser pipe, a low area 8 feet deep with side slopes of no more than 5:1 up to the surrounding active waste placement area are assumed. The maximum possible 32-acre drainage area will be contributing to the decant structure in this scenario. The following table shows the areas and elevations of this low area (referred to as a "basin" – though not a traditional basin as its base is graded to drain at 0.5 to 1.0 percent to the decant structure at all times and is not intended to retain water, merely attenuate it during very large storm events).

TABLE-2
BASIN SUMMARY

Elevation (ft)	Area (Ac.)
11 (base)	2.1
15 (4 ft deep)	2.6
19 (8 ft deep)	3.2

In this scenario, the bottom of the basin area will be approximately 7 percent of the total open area of the active cell. Since the outer edges of the basin slope up to the surrounding active waste placement area at 5:1 (max), the basin area is at least 10 percent of the total open area of the active cell when measured at a basin depth of 8 feet.

As the overall landfill elevation increases, the active open area decreases. In order to simplify decant operations during periodic upward expansion, the same proportion of area (7% of active cell) will be used to size the base of the depressed area at all times. Therefore, at any stage, the depressed basin area around the decant structure will always be at least 7 percent of the total open area contributing contact water runoff to the decant structure. The basin area will have slopes of 5:1 or flatter up towards the active waste placement area. In general, these slopes will be flatter initially after the decant is raised, then steepen up towards 5:1 as waste placement outside the basin area continues. As an additional precaution to help manage storms in excess of the design storm event, a continuous portion of the perimeter berm will always be maintained at least two feet above the top of the decant pipe. The exception would be when the decant structure is first installed and drainage is being established to the decant structure. Table-3 below shows the summary of the basin routing results.

TABLE-3
BASIN ROUTING RESULTS SUMMARY

	25-year Storm	100-year Storm
Peak Inflow	151.2 cfs	200.0 cfs
Peak Outflow	3.3 cfs	10.5 cfs
Max. Water Elevation*	16.9 ft	18.0 ft

* Bottom of basin is at reference EL 11.

The decant structure gabions will be maintained a minimum of five feet above the waste level (bottom of basin) and the riser pipe will be six inches above the gabions. This will manage the 25-year storm through the riser pipe perforations. However,the 100-year storm may overtop the riser pipe depending on the waste placement conditions at the time of such an event. For example, when multiple decant extensions have been made, more and more perforations will be available to convey water, and when the active waste placement area is relatively low within a given phase, more 'basin' area may be available to temporarily hold water.

The decant structure will have a block of concrete around the base to support the initial installation of the riser and gabions, to prevent differential movement of the gabion base components, and to direct excess water from within the decant stone column into the decant to the degree possible (rather than into the underlying leachate collection system). Standard 3ft x 3ft x 6ft gabions will be constructed around the riser. The space between the gabions and riser will be filled with stone. The gabions will be wrapped with a filter geotextile, TYPAR 3601. Additionally, filter stone will be placed around the gabions. The overall structure is considered flexible and will move with the overall mass of solid waste in the case of settlement or seismic motion.

Water surface elevations are plotted from the PondPack results in order to observe the dewatering time. Note that the water surface elevations assume a reference elevation of EL 11 for the bottom of the basin area. Elevations below this are within the stone column of the decant structure itself. Figure-1 below shows the plot of the results.

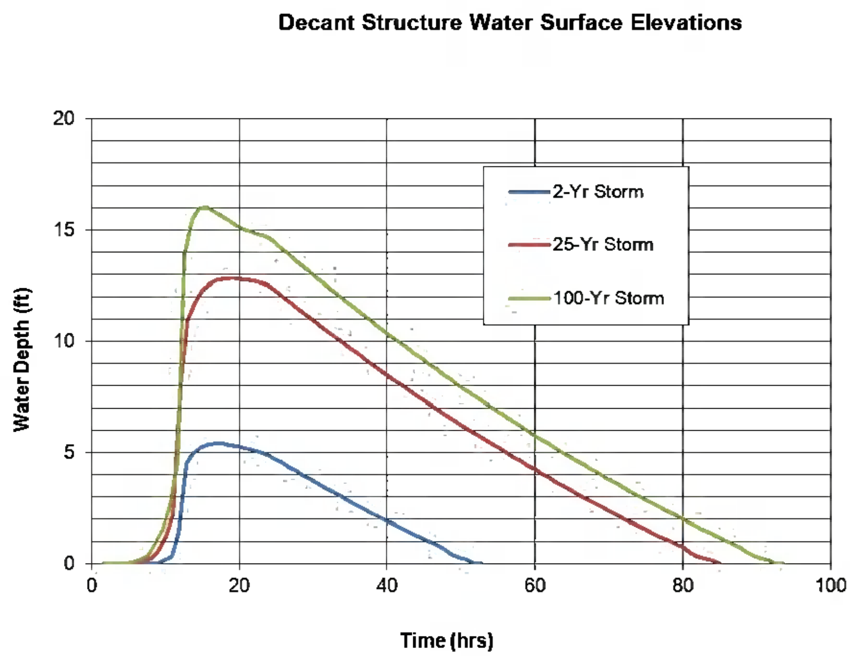

Figure -1: Decant Structure Water Surface Elevations

The dewatering results of this case are a more accurate worst-case representation during typical operations of the decant structure. Therefore, the decant structure will be relatively free draining and will not pond water during the normal operations. However, during the major events such as 25-year, 24-hour storm, it can take up to 3.5 days to dewater the basin area, although as the structure is extended vertically upward this time is expected to decrease significantly. Previous experience with these structures indicates that even for major storm events, drainage typically occurs within the same day.

Initial Scenario

This scenario simulates the decant performance during a short period of time when decant is initially installed to the time the first decant vertical extension is added. This scenario is modeled just to verify that decant still conveys and controls peak storm events when initially installed, even if some of the water passes through the inlet grate on top of the structure. A maximum drainage area of 35 acres will be contributing to decant in this case, which is a little more than the area used in the previous scenario. The following table shows the areas and elevations of the basin.

TABLE-4
BASIN SUMMARY

Elevation (ft)	Area (Ac.)
2 (base)	2.3
6 (4 ft deep)	2.8
10 (8 ft deep)	3.5

The results of the PondPack model show that the decant structure will still convey and control the runoff from the 25-year storm event. However, during initial condition, the 25-year, 24 hour storm may overtop the riser by 0.2 ft. If a 25-Year, 24-Hour storm event or larger were to occur during this time, and a confluence worste-case conditions existed, it's theoretically possible that some very fine particles with insufficient time to settle out within the basin may be carried to the downstream end of the decant piping. A sediment forebay area is included within the leachate collection pond at the decant pipe outlet (and includes concrete revetment over the membrane liner for protection). Manholes with line-of-sight acces along the decant piping also is included for cleanout access, should it ever be required. The following table shows the summary of the PondPack results. The PondPack output is shown in Appendix-A

TABLE-5
BASIN ROUTING RESULTS SUMMARY

	25-year Storm	100-year Storm
Peak Inflow	165.4 cfs	218.8 cfs
Peak Outflow	3.3 cfs	12.0 cfs
Max. Water Elevation	8.7 ft	9.3 ft

* Bottom of basin is at reference EL 2.

Calculation Template

Customer	Santee Cooper	**Project No.**	108008-01330
Project Title	Cross Generating Station - Class III Solid Waste Landfill	**Calc No.**	CR34-0-DC-LF-CE-007
Calculation Title	Decant Structure Design	**Phase/CTR**	N/A
Elec File Location	P:\SanteeCooper\CR34\Doc\Civil\Cross Generating Station\Class III SWLF Horizontal Expansion\Calculations\CE-007 Decant Structures\CR34-0-DC-LF-CE-007-R0.doc		
Project File Location	See Encompass	**Page**	9 of 62

Rev	Date	By	Checked	Rev	Date	By	Checked	Rev	Date	By	Checked
0	14-Feb-2012	P.Velugubantla	E. Leiby								

Geotextile permeability Check

The TYPAR 3601 geotextile specification in Appendix-K shows that the geotextile has a vertical water flow rate of 15 gpm/sf. The total square feet of geotextile around the filter stone is 9 ft x 5 ft x 4 sides = 180 sf/ft of height. Therefore, the geotextile can pass 15 gpm/sf x 180 sf = 2700 gpm ~ 6 cfs/ft of height.

From Table-3, the peak outflow from the 25-year, 24-hour storm is 3.3 cfs. Since TYPAR 3601 can pass nearly two times more flow than the calculated peak outflow per foot of height, the geotextile will not inhibit the ability of the discharge structure to freely drain the site.

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Calculation Template

Customer	Santee Cooper	**Project No.**	108008-01330
Project Title	Cross Generating Station - Class III Solid Waste Landfill	**Calc No.**	CR34-0-DC-LF-CE-007
Calculation Title	Decant Structure Design	**Phase/CTR**	N/A
Elec File Location	P:\SanteeCooper\CR34\Doc\Civil\Cross Generating Station\Class III SWLF Horizontal Expansion\Calculations\CE-007 Decant Structures\CR34-0-DC-LF-CE-007-R0.doc		
Project File Location	See Encompass	**Page**	1 of 36

Rev	Date	By	Checked	Rev	Date	By	Checked	Rev	Date	By	Checked
0	14-Feb-2012	P.Velugubantla	E. Leiby								

Appendix A – PondPack Output

(36 total pages)

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MASTER DESIGN STORM SUMMARY

Network Storm Collection: Cross - Berkley

Return Event	Total Depth in	Rainfall Type	RNF ID
2	3.8000	Synthetic Curve	TypeIII 24hr
25	7.2000	Synthetic Curve	TypeIII 24hr
100	9.4000	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 20		JCT	2	8.813		24.1000	.46		
*OUT 20		JCT	25	18.566		20.0000	3.29		
*OUT 20		JCT	100	24.936		15.2500	12.10		
POND 10	IN	POND	2	8.824		12.2000	81.76		
POND 10	IN	POND	25	18.577		12.2000	165.41		
POND 10	IN	POND	100	24.947		12.2000	218.78		
POND 10	OUT	POND	2	8.813		24.1000	.46	5.99	8.390
POND 10	OUT	POND	25	18.566		20.0000	3.29	8.66	16.488
POND 10	OUT	POND	100	24.936		15.2500	12.10	9.34	18.726
SUBAREA 10		AREA	2	8.824		12.2000	81.76		
SUBAREA 10		AREA	25	18.577		12.2000	165.41		
SUBAREA 10		AREA	100	24.947		12.2000	218.78		

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: User Defined

Segment #1 Time: .3000 hrs

=========================
Total Tc: .3000 hrs
=========================

Tc Equations used...

==== User Defined ==

Tc = Value entered by user

Where: Tc = Time of concentration

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	Impervious Adjustment %UC	Adjusted CN
Ash Pile	93	35.000			93.00
COMPOSITE AREA & WEIGHTED CN --->		35.000			93.00 (93)

Elevation (ft)	Planimeter (sq.in)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	Volume (ac-ft)	Volume Sum (ac-ft)
2.00	-----	.0023	.0000	.000	.000
3.00	-----	2.3000	2.3750	.792	.792
6.00	-----	2.8000	7.6377	7.638	8.429
10.00	-----	3.5000	9.4305	12.574	21.003

POND VOLUME EQUATIONS

* Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + sq.rt.(Area1*Area2))

where: EL1, EL2 = Lower and upper elevations of the increment
Area1,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

REQUESTED POND WS ELEVATIONS:

Min. Elev.= 2.00 ft
Increment = .50 ft
Max. Elev.= 10.00 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
Orifice-Circular	O2	--->	CV	2.530	10.000
Orifice-Circular	O3	--->	CV	3.050	10.000
Orifice-Circular	O4	--->	CV	3.580	10.000
Orifice-Circular	O5	--->	CV	4.100	10.000
Orifice-Circular	O6	--->	CV	4.630	10.000
Orifice-Circular	O7	--->	CV	5.150	10.000
Orifice-Circular	O8	--->	CV	5.680	10.000
Orifice-Circular	O9	--->	CV	6.200	10.000
Orifice-Circular	10	--->	CV	6.730	10.000
Stand Pipe	SP	--->	CV	8.500	10.000
Orifice-Circular	O1	--->	CV	2.000	10.000
Culvert-Circular	CV	--->	TW	-1.000	10.000
TW SETUP, DS Channel					

OUTLET STRUCTURE INPUT DATA

```
Structure ID       = O2
Structure Type     = Orifice-Circular
------------------------------------
# of Openings      =        16
Invert Elev.       =      2.53 ft
Diameter           =     .0261 ft
Orifice Coeff.     =      .600


Structure ID       = O3
Structure Type     = Orifice-Circular
------------------------------------
# of Openings      =        16
Invert Elev.       =      3.05 ft
Diameter           =     .0261 ft
Orifice Coeff.     =      .600


Structure ID       = O4
Structure Type     = Orifice-Circular
------------------------------------
# of Openings      =        16
Invert Elev.       =      3.58 ft
Diameter           =     .0261 ft
Orifice Coeff.     =      .600


Structure ID       = O5
Structure Type     = Orifice-Circular
------------------------------------
# of Openings      =        16
Invert Elev.       =      4.10 ft
Diameter           =     .0261 ft
Orifice Coeff.     =      .600
```

OUTLET STRUCTURE INPUT DATA

```
Structure ID      = O6
Structure Type    = Orifice-Circular
------------------------------------
# of Openings     =       16
Invert Elev.      =     4.63 ft
Diameter          =    .0261 ft
Orifice Coeff.    =     .600


Structure ID      = O7
Structure Type    = Orifice-Circular
------------------------------------
# of Openings     =       16
Invert Elev.      =     5.15 ft
Diameter          =    .0261 ft
Orifice Coeff.    =     .600


Structure ID      = O8
Structure Type    = Orifice-Circular
------------------------------------
# of Openings     =       16
Invert Elev.      =     5.68 ft
Diameter          =    .0261 ft
Orifice Coeff.    =     .600


Structure ID      = O9
Structure Type    = Orifice-Circular
------------------------------------
# of Openings     =       16
Invert Elev.      =     6.20 ft
Diameter          =    .0261 ft
Orifice Coeff.    =     .600
```

OUTLET STRUCTURE INPUT DATA

```
Structure ID       = 10
Structure Type     = Orifice-Circular
------------------------------------
# of Openings      =        32
Invert Elev.       =      6.73 ft
Diameter           =     .0261 ft
Orifice Coeff.     =      .600


Structure ID       = SP
Structure Type     = Stand Pipe
------------------------------------
# of Openings      =         1
Invert Elev.       =      8.50 ft
Diameter           =    2.0000 ft
Orifice Area       =    3.1416 sq.ft
Orifice Coeff.     =      .600
Weir Length        =      6.28 ft
Weir Coeff.        =     3.300
K, Reverse         =     1.000
Mannings n         =     .0000
Kev,Charged Riser  =      .000
Weir Submergence   = No


Structure ID       = O1
Structure Type     = Orifice-Circular
------------------------------------
# of Openings      =        16
Invert Elev.       =      2.00 ft
Diameter           =     .0261 ft
Orifice Coeff.     =      .600
```

```
               OUTLET STRUCTURE INPUT DATA



               Structure ID       = CV
               Structure Type     = Culvert-Circular
               ------------------------------------
               No. Barrels        =        1
               Barrel Diameter    =    1.5000 ft
               Upstream Invert    =     -1.00 ft
               Dnstream Invert    =     -8.00 ft
               Horiz. Length      =   1400.00 ft
               Barrel Length      =   1400.02 ft
               Barrel Slope       =    .00500 ft/ft

               OUTLET CONTROL DATA...
               Mannings n         =     .0100
               Ke                 =     .5000  (forward entrance loss)
               Kb                 =   .010777  (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 =       .70 ft  ---> Flow =      7.58 cfs
 At T2 Elev =       .94 ft  ---> Flow =      8.66 cfs



               Structure ID       = TW
               Structure Type     = TW SETUP, DS Channel
               ------------------------------------
               FREE OUTFALL CONDITIONS SPECIFIED

               CONVERGENCE TOLERANCES...
               Maximum Iterations=    40
               Min. TW tolerance =    .01 ft
               Max. TW tolerance =    .01 ft
               Min. HW tolerance =    .01 ft
               Max. HW tolerance =    .01 ft
               Min.  Q tolerance =    .00 cfs
               Max.  Q tolerance =    .00 cfs
```

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

WS Elev, Total Q		Converge		Notes
Elev. ft	Q cfs	TW Elev ft	Error +/-ft	Contributing Structures
2.00	.00	Free Outfall		(no Q: 02,03,04,05,06,07,08,09,10,SP,01,CV)
2.50	.03	Free Outfall		01,CV (no Q: 02,03,04,05,06,07,08,09,10,SP)
2.53	.03	Free Outfall		01,CV (no Q: 02,03,04,05,06,07,08,09,10,SP)
3.00	.07	Free Outfall		02,01,CV (no Q: 03,04,05,06,07,08,09,10,SP)
3.05	.07	Free Outfall		02,01,CV (no Q: 03,04,05,06,07,08,09,10,SP)
3.50	.12	Free Outfall		02,03,01,CV (no Q: 04,05,06,07,08,09,10,SP)
3.58	.12	Free Outfall		02,03,01,CV (no Q: 04,05,06,07,08,09,10,SP)
4.00	.17	Free Outfall		02,03,04,01,CV (no Q: 05,06,07,08,09,10,SP)
4.10	.18	Free Outfall		02,03,04,01,CV (no Q: 05,06,07,08,09,10,SP)
4.50	.24	Free Outfall		02,03,04,05,01,CV (no Q: 06,07,08,09,10,SP)
4.63	.25	Free Outfall		02,03,04,05,01,CV (no Q: 06,07,08,09,10,SP)
5.00	.30	Free Outfall		02,03,04,05,06,01,CV (no Q: 07,08,09,10,SP)
5.15	.32	Free Outfall		02,03,04,05,06,01,CV (no Q: 07,08,09,10,SP)
5.50	.38	Free Outfall		02,03,04,05,06,07,01,CV (no Q: 08,09,10,SP)
5.68	.40	Free Outfall		02,03,04,05,06,07,01,CV (no Q: 08,09,10,SP)
6.00	.46	Free Outfall		02,03,04,05,06,07,08,01,CV (no Q: 09,10,SP)
6.20	.48	Free Outfall		02,03,04,05,06,07,08,01,CV (no Q: 09,10,SP)
6.50	.54	Free Outfall		02,03,04,05,06,07,08,09,01,CV (no Q: 10,SP)
6.73	.57	Free Outfall		02,03,04,05,06,07,08,09,01,CV (no Q: 10,SP)
7.00	.65	Free Outfall		02,03,04,05,06,07,08,09,10,01,CV (no Q: SP)
7.50	.74	Free Outfall		02,03,04,05,06,07,08,09,10,01,CV (no Q: SP)
8.00	.81	Free Outfall		02,03,04,05,06,07,08,09,10,01,CV (no Q: SP)
8.50	.87	Free Outfall		02,03,04,05,06,07,08,09,10,01,CV (no Q: SP)
9.00	8.26	Free Outfall		02,03,04,05,06,07,08,09,10,SP,01,CV
9.50	13.94	Free Outfall		SP,CV (no Q: 02,03,04,05,06,07,08,09,10,01)
10.00	14.16	Free Outfall		SP,CV (no Q: 02,03,04,05,06,07,08,09,10,01)

SUMMARY FOR HYDROGRAPH ADDITION
at Node: POND 10 IN

HYG Directory: C:\Session\Decant\Pondpack\Combined\

Upstream Link ID	Upstream Node ID	HYG file	HYG ID	HYG tag
ADDLINK 10	SUBAREA 10		SUBAREA 10	25

INFLOWS TO: POND 10 IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
	SUBAREA 10	25	18.577	12.2000	165.41

TOTAL FLOW INTO: POND 10 IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
	POND 10 IN	25	18.577	12.2000	165.41

TOTAL NODE INFLOW...
HYG file =
HYG ID = POND 10 IN
HYG Tag = 25

Peak Discharge = 165.41 cfs
Time to Peak = 12.2000 hrs
HYG Volume = 18.577 ac-ft

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

Time hrs					
2.1500	.00	.00	.01	.02	.03
2.4000	.05	.07	.09	.12	.14
2.6500	.17	.19	.22	.24	.27
2.9000	.30	.32	.35	.38	.41
3.1500	.43	.46	.49	.52	.54
3.4000	.57	.60	.63	.66	.68
3.6500	.71	.74	.77	.80	.83
3.9000	.86	.89	.91	.94	.97
4.1500	1.00	1.03	1.06	1.09	1.12
4.4000	1.15	1.18	1.21	1.24	1.26
4.6500	1.29	1.32	1.35	1.38	1.41
4.9000	1.44	1.47	1.50	1.53	1.56
5.1500	1.59	1.62	1.65	1.68	1.71
5.4000	1.74	1.77	1.80	1.83	1.86
5.6500	1.88	1.91	1.94	1.97	2.00
5.9000	2.03	2.06	2.09	2.12	2.15
6.1500	2.19	2.23	2.27	2.32	2.37
6.4000	2.42	2.47	2.53	2.58	2.64
6.6500	2.70	2.75	2.81	2.87	2.93
6.9000	2.99	3.05	3.12	3.18	3.24
7.1500	3.30	3.37	3.43	3.49	3.56
7.4000	3.62	3.69	3.75	3.82	3.89
7.6500	3.95	4.02	4.09	4.16	4.22
7.9000	4.29	4.36	4.43	4.50	4.57
8.1500	4.65	4.75	4.85	4.96	5.08
8.4000	5.20	5.33	5.46	5.60	5.73
8.6500	5.87	6.00	6.14	6.29	6.43
8.9000	6.57	6.71	6.86	7.00	7.15
9.1500	7.29	7.44	7.59	7.74	7.89
9.4000	8.04	8.19	8.34	8.49	8.64
9.6500	8.79	8.95	9.10	9.25	9.41

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

Time hrs					
9.9000	9.56	9.72	9.88	10.03	10.20
10.1500	10.39	10.59	10.82	11.07	11.34
10.4000	11.62	11.90	12.19	12.49	12.79
10.6500	13.09	13.39	13.70	14.00	14.31
10.9000	14.62	14.93	15.24	15.57	15.96
11.1500	16.43	17.02	17.75	18.60	19.54
11.4000	20.53	21.58	22.68	24.04	25.89
11.6500	28.97	33.45	39.59	47.01	55.65
11.9000	65.31	77.40	94.09	116.53	139.55
12.1500	157.54	165.41	159.33	145.95	129.62
12.4000	113.56	99.43	86.46	74.26	63.13
12.6500	53.61	45.77	39.66	35.01	31.61
12.9000	28.93	26.73	24.87	23.31	21.97
13.1500	20.82	19.85	19.09	18.47	17.96
13.4000	17.53	17.15	16.79	16.46	16.14
13.6500	15.82	15.52	15.21	14.91	14.61
13.9000	14.31	14.01	13.71	13.41	13.13
14.1500	12.86	12.61	12.40	12.20	12.02
14.4000	11.86	11.70	11.55	11.40	11.25
14.6500	11.10	10.96	10.81	10.67	10.53
14.9000	10.38	10.24	10.09	9.95	9.81
15.1500	9.66	9.52	9.38	9.23	9.09
15.4000	8.94	8.80	8.66	8.51	8.37
15.6500	8.22	8.08	7.94	7.79	7.65
15.9000	7.51	7.36	7.22	7.07	6.94
16.1500	6.81	6.70	6.60	6.51	6.42
16.4000	6.35	6.28	6.21	6.15	6.08
16.6500	6.02	5.95	5.89	5.83	5.76
16.9000	5.70	5.64	5.58	5.51	5.45
17.1500	5.39	5.33	5.26	5.20	5.14
17.4000	5.07	5.01	4.95	4.89	4.82
17.6500	4.76	4.70	4.63	4.57	4.51
17.9000	4.45	4.38	4.32	4.26	4.20
18.1500	4.14	4.10	4.06	4.03	4.00
18.4000	3.97	3.95	3.93	3.91	3.89
18.6500	3.87	3.85	3.83	3.81	3.79
18.9000	3.77	3.75	3.74	3.72	3.70
19.1500	3.68	3.66	3.64	3.62	3.60
19.4000	3.59	3.57	3.55	3.53	3.51
19.6500	3.49	3.47	3.45	3.43	3.42
19.9000	3.40	3.38	3.36	3.34	3.32
20.1500	3.30	3.29	3.27	3.26	3.24
20.4000	3.23	3.21	3.20	3.18	3.17
20.6500	3.15	3.14	3.12	3.11	3.09
20.9000	3.08	3.07	3.05	3.04	3.03

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

Time hrs					
21.1500	3.02	3.00	2.99	2.97	2.96
21.4000	2.94	2.93	2.91	2.90	2.88
21.6500	2.87	2.86	2.84	2.83	2.82
21.9000	2.80	2.79	2.77	2.76	2.74
22.1500	2.73	2.72	2.70	2.69	2.67
22.4000	2.66	2.64	2.63	2.62	2.60
22.6500	2.59	2.58	2.56	2.55	2.53
22.9000	2.52	2.50	2.49	2.48	2.46
23.1500	2.45	2.43	2.42	2.40	2.39
23.4000	2.38	2.36	2.35	2.34	2.32
23.6500	2.31	2.29	2.28	2.26	2.25
23.9000	2.24	2.22	2.20	2.13	1.94
24.1500	1.60	1.20	.83	.55	.36
24.4000	.24	.16	.10	.07	.04
24.6500	.03	.02	.01	.01	.00
24.9000	.00	.00			

```
                   LEVEL POOL ROUTING SUMMARY

 HYG Dir          = C:\Session\Decant\Pondpack\Combined\
 Inflow  HYG file = NONE STORED - POND 10      IN  25
 Outflow HYG file = NONE STORED - POND 10      OUT 25

 Pond Node   Data = POND 10
 Pond Volume Data = POND 10
 Pond Outlet Data = Outfall 001

 No Infiltration

 INITIAL CONDITIONS
 ----------------------------------
 Starting WS Elev   =     2.00 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       =    165.41 cfs    at   12.2000 hrs
 Peak Outflow      =      3.29 cfs    at   20.0000 hrs
 -----------------------------------------------------
 Peak Elevation    =      8.66 ft
 Peak Storage =         16.488 ac-ft
 =====================================================


 MASS BALANCE (ac-ft)
 --------------------------
+ Initial Vol  =        .000
+ HYG Vol IN   =      18.577
- Infiltration =        .000
- HYG Vol OUT  =      18.566
- Retained Vol =        .000
                  ----------
 Unrouted Vol =       -.011 ac-ft  (.059% of Inflow Volume)
```

Index of Starting Page Numbers for ID Names

Table of Contents

MASTER DESIGN STORM SUMMARY

Network Storm Collection: Cross - Berkley

Return Event	Total Depth in	Rainfall Type	RNF ID
2	3.8000	Synthetic Curve	TypeIII 24hr
25	7.2000	Synthetic Curve	TypeIII 24hr
100	9.4000	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 20		JCT	2	8.068		16.8000	2.47		
*OUT 20		JCT	25	16.985		18.6000	3.30		
*OUT 20		JCT	100	22.809		15.4000	10.45		
POND 10	IN	POND	2	8.068		12.2000	74.75		
POND 10	IN	POND	25	16.985		12.2000	151.23		
POND 10	IN	POND	100	22.809		12.2000	200.03		
POND 10	OUT	POND	2	8.068		16.8000	2.47	14.09	5.394
POND 10	OUT	POND	25	16.985		18.6000	3.30	16.88	12.822
POND 10	OUT	POND	100	22.809		15.4000	10.45	17.96	16.047
SUBAREA 10		AREA	2	8.068		12.2000	74.75		
SUBAREA 10		AREA	25	16.985		12.2000	151.23		
SUBAREA 10		AREA	100	22.809		12.2000	200.03		

```
:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
TIME OF CONCENTRATION CALCULATOR
:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::


-----------------------------------------------------------------------


Segment #1:  Tc: User Defined

                                         Segment #1 Time:     .3000 hrs
-----------------------------------------------------------------------

                                                =========================
                                                 Total Tc:     .3000 hrs
                                                =========================
```

Tc Equations used...

==== User Defined ====

Tc = Value entered by user

Where: Tc = Time of concentration

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	Impervious Adjustment %UC	Adjusted CN
Ash Pile	93	32.000			93.00
COMPOSITE AREA & WEIGHTED CN --->		32.000			93.00 (93)

REQUESTED POND WS ELEVATIONS:

Min. Elev.= 2.00 ft
Increment = .50 ft
Max. Elev.= 19.00 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
Orifice-Circular	O2	--->	CV	4.100	19.000
Orifice-Circular	O3	--->	CV	6.200	19.000
Orifice-Circular	O4	--->	CV	8.300	19.000
Orifice-Circular	O5	--->	CV	10.400	19.000
Orifice-Circular	O6	--->	CV	12.500	19.000
Orifice-Circular	O7	--->	CV	14.600	19.000
Orifice-Circular	O8	--->	CV	16.700	19.000
Stand Pipe	SP	--->	CV	17.500	19.000
Orifice-Circular	O1	--->	CV	2.000	19.000
Culvert-Circular	CV	--->	TW	-1.000	19.000
TW SETUP, DS Channel					

OUTLET STRUCTURE INPUT DATA

```
Structure ID       = O2
Structure Type     = Orifice-Circular
------------------------------------
# of Openings      =        64
Invert Elev.       =      4.10 ft
Diameter           =     .0261 ft
Orifice Coeff.     =      .600


Structure ID       = O3
Structure Type     = Orifice-Circular
------------------------------------
# of Openings      =        64
Invert Elev.       =      6.20 ft
Diameter           =     .0261 ft
Orifice Coeff.     =      .600


Structure ID       = O4
Structure Type     = Orifice-Circular
------------------------------------
# of Openings      =        64
Invert Elev.       =      8.30 ft
Diameter           =     .0261 ft
Orifice Coeff.     =      .600


Structure ID       = O5
Structure Type     = Orifice-Circular
------------------------------------
# of Openings      =        64
Invert Elev.       =     10.40 ft
Diameter           =     .0261 ft
Orifice Coeff.     =      .600
```

OUTLET STRUCTURE INPUT DATA

```
Structure ID       = O6
Structure Type     = Orifice-Circular
------------------------------------
# of Openings      =        64
Invert Elev.       =     12.50 ft
Diameter           =     .0261 ft
Orifice Coeff.     =      .600


Structure ID       = O7
Structure Type     = Orifice-Circular
------------------------------------
# of Openings      =        64
Invert Elev.       =     14.60 ft
Diameter           =     .0261 ft
Orifice Coeff.     =      .600


Structure ID       = O8
Structure Type     = Orifice-Circular
------------------------------------
# of Openings      =        64
Invert Elev.       =     16.70 ft
Diameter           =     .0261 ft
Orifice Coeff.     =      .600


Structure ID       = SP
Structure Type     = Stand Pipe
------------------------------------
# of Openings      =         1
Invert Elev.       =     17.50 ft
Diameter           =    2.0000 ft
Orifice Area       =    3.1416 sq.ft
Orifice Coeff.     =      .600
Weir Length        =      6.28 ft
Weir Coeff.        =     3.300
K, Reverse         =     1.000
Mannings n         =     .0000
Kev,Charged Riser  =      .000
Weir Submergence   = No
```

```
OUTLET STRUCTURE INPUT DATA


Structure ID       = O1
Structure Type     = Orifice-Circular
------------------------------------
# of Openings      =        64
Invert Elev.       =      2.00 ft
Diameter           =     .0261 ft
Orifice Coeff.     =      .600



Structure ID       = CV
Structure Type     = Culvert-Circular
------------------------------------
No. Barrels        =         1
Barrel Diameter    =    1.5000 ft
Upstream Invert    =     -1.00 ft
Dnstream Invert    =     -8.00 ft
Horiz. Length      =   1400.00 ft
Barrel Length      =   1400.02 ft
Barrel Slope       =    .00500 ft/ft

OUTLET CONTROL DATA...
Mannings n         =     .0100
Ke                 =     .5000  (forward entrance loss)
Kb                 =   .010777  (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)    =      .000
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 =     -1.00 ft  --->  Flow =      7.58 cfs
At T2 Elev =       .94 ft  --->  Flow =      8.66 cfs
```

```
OUTLET STRUCTURE INPUT DATA


Structure ID       = TW
Structure Type     = TW SETUP, DS Channel
------------------------------------
FREE OUTFALL CONDITIONS SPECIFIED

CONVERGENCE TOLERANCES...
Maximum Iterations=    40
Min. TW tolerance =    .01 ft
Max. TW tolerance =    .01 ft
Min. HW tolerance =    .01 ft
Max. HW tolerance =    .01 ft
Min.  Q tolerance =    .00 cfs
Max.  Q tolerance =    .00 cfs
```

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

WS Elev, Total Q		Converge		Notes
Elev. ft	Q cfs	TW Elev ft	Error +/-ft	Contributing Structures
2.00	.00	Free Outfall		(no Q: O2,O3,O4,O5,O6,O7,O8,SP,O1,CV)
2.50	.12	Free Outfall		O1,CV (no Q: O2,O3,O4,O5,O6,O7,O8,SP)
3.00	.16	Free Outfall		O1,CV (no Q: O2,O3,O4,O5,O6,O7,O8,SP)
3.50	.20	Free Outfall		O1,CV (no Q: O2,O3,O4,O5,O6,O7,O8,SP)
4.00	.23	Free Outfall		O1,CV (no Q: O2,O3,O4,O5,O6,O7,O8,SP)
4.10	.24	Free Outfall		O1,CV (no Q: O2,O3,O4,O5,O6,O7,O8,SP)
4.50	.36	Free Outfall		O2,O1,CV (no Q: O3,O4,O5,O6,O7,O8,SP)
5.00	.44	Free Outfall		O2,O1,CV (no Q: O3,O4,O5,O6,O7,O8,SP)
5.50	.49	Free Outfall		O2,O1,CV (no Q: O3,O4,O5,O6,O7,O8,SP)
6.00	.54	Free Outfall		O2,O1,CV (no Q: O3,O4,O5,O6,O7,O8,SP)
6.20	.55	Free Outfall		O2,O1,CV (no Q: O3,O4,O5,O6,O7,O8,SP)
6.50	.66	Free Outfall		O2,O3,O1,CV (no Q: O4,O5,O6,O7,O8,SP)
7.00	.75	Free Outfall		O2,O3,O1,CV (no Q: O4,O5,O6,O7,O8,SP)
7.50	.83	Free Outfall		O2,O3,O1,CV (no Q: O4,O5,O6,O7,O8,SP)
8.00	.89	Free Outfall		O2,O3,O1,CV (no Q: O4,O5,O6,O7,O8,SP)
8.30	.93	Free Outfall		O2,O3,O1,CV (no Q: O4,O5,O6,O7,O8,SP)
8.50	1.08	Free Outfall		O2,O3,O4,O1,CV (no Q: O5,O6,O7,O8,SP)
9.00	1.21	Free Outfall		O2,O3,O4,O1,CV (no Q: O5,O6,O7,O8,SP)
9.50	1.31	Free Outfall		O2,O3,O4,O1,CV (no Q: O5,O6,O7,O8,SP)
10.00	1.40	Free Outfall		O2,O3,O4,O1,CV (no Q: O5,O6,O7,O8,SP)
10.40	1.46	Free Outfall		O2,O3,O4,O1,CV (no Q: O5,O6,O7,O8,SP)
10.50	1.53	Free Outfall		O2,O3,O4,O5,O1,CV (no Q: O6,O7,O8,SP)
11.00	1.68	Free Outfall		O2,O3,O4,O5,O1,CV (no Q: O6,O7,O8,SP)
11.50	1.78	Free Outfall		O2,O3,O4,O5,O1,CV (no Q: O6,O7,O8,SP)
12.00	1.89	Free Outfall		O2,O3,O4,O5,O1,CV (no Q: O6,O7,O8,SP)
12.50	1.98	Free Outfall		O2,O3,O4,O5,O1,CV (no Q: O6,O7,O8,SP)
13.00	2.20	Free Outfall		O2,O3,O4,O5,O6,O1,CV (no Q: O7,O8,SP)
13.50	2.33	Free Outfall		O2,O3,O4,O5,O6,O1,CV (no Q: O7,O8,SP)
14.00	2.45	Free Outfall		O2,O3,O4,O5,O6,O1,CV (no Q: O7,O8,SP)
14.50	2.56	Free Outfall		O2,O3,O4,O5,O6,O1,CV (no Q: O7,O8,SP)
14.60	2.58	Free Outfall		O2,O3,O4,O5,O6,O1,CV (no Q: O7,O8,SP)
15.00	2.76	Free Outfall		O2,O3,O4,O5,O6,O7,O1,CV (no Q: O8,SP)
15.50	2.92	Free Outfall		O2,O3,O4,O5,O6,O7,O1,CV (no Q: O8,SP)
16.00	3.04	Free Outfall		O2,O3,O4,O5,O6,O7,O1,CV (no Q: O8,SP)
16.50	3.17	Free Outfall		O2,O3,O4,O5,O6,O7,O1,CV (no Q: O8,SP)
16.70	3.21	Free Outfall		O2,O3,O4,O5,O6,O7,O1,CV (no Q: O8,SP)
17.00	3.37	Free Outfall		O2,O3,O4,O5,O6,O7,O8,O1,CV (no Q: SP)
17.50	3.53	Free Outfall		O2,O3,O4,O5,O6,O7,O8,O1,CV (no Q: SP)

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

WS Elev, Total Q		Converge		Notes
Elev. ft	Q cfs	TW Elev ft	Error +/-ft	Contributing Structures
18.00	10.98	Free Outfall		O2,O3,O4,O5,O6,O7,O8,SP,O1,CV
18.50	16.82	Free Outfall		O2,O3,O4,O5,O6,O7,O8,SP,O1,CV
19.00	17.58	Free Outfall		SP,CV (no Q: O2,O3,O4,O5,O6,O7,O8,O1)

SUMMARY FOR HYDROGRAPH ADDITION
at Node: POND 10 IN

HYG Directory: C:\Session\Decant\Pondpack\Combined\

Upstream Link ID	Upstream Node ID	HYG file	HYG ID	HYG tag
ADDLINK 10	SUBAREA 10		SUBAREA 10	25

INFLOWS TO: POND 10 IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
	SUBAREA 10	25	16.985	12.2000	151.23

TOTAL FLOW INTO: POND 10 IN

HYG file	HYG ID	HYG tag	Volume ac-ft	Peak Time hrs	Peak Flow cfs
	POND 10 IN	25	16.985	12.2000	151.23

TOTAL NODE INFLOW...
HYG file =
HYG ID = POND 10 IN
HYG Tag = 25

Peak Discharge =	151.23 cfs
Time to Peak =	12.2000 hrs
HYG Volume =	16.985 ac-ft

HYDROGRAPH ORDINATES (cfs)
Output Time increment = .2000 hrs
Time on left represents time for first value in each row.

Time hrs					
2.0000	.00	.00	.05	.13	.22
3.0000	.32	.42	.52	.63	.73
4.0000	.84	.94	1.05	1.16	1.26
5.0000	1.37	1.48	1.59	1.70	1.80
6.0000	1.91	2.04	2.21	2.41	2.63
7.0000	2.85	3.08	3.31	3.55	3.80
8.0000	4.05	4.34	4.76	5.24	5.75
9.0000	6.27	6.80	7.35	7.90	8.46
10.0000	9.03	9.68	10.62	11.69	12.80
11.0000	13.93	15.56	18.77	23.67	42.98
12.0000	86.01	151.23	103.84	57.73	32.01
13.0000	22.74	18.15	16.03	14.75	13.63
14.0000	12.53	11.53	10.84	10.29	9.76
15.0000	9.23	8.70	8.18	7.65	7.12
16.0000	6.60	6.12	5.81	5.56	5.33
17.0000	5.10	4.87	4.64	4.41	4.18
18.0000	3.95	3.74	3.63	3.55	3.48
19.0000	3.42	3.35	3.28	3.21	3.14
20.0000	3.07	3.01	2.95	2.90	2.84
21.0000	2.79	2.74	2.69	2.64	2.59
22.0000	2.54	2.48	2.43	2.38	2.33
23.0000	2.28	2.22	2.17	2.12	2.07
24.0000	2.02	1.10	.22	.04	.01
25.0000	.00				

LEVEL POOL ROUTING SUMMARY

```
HYG Dir           = C:\Session\Decant\Pondpack\Combined\
Inflow  HYG file = NONE STORED - POND 10      IN  25
Outflow HYG file = NONE STORED - POND 10      OUT 25

Pond Node   Data = POND 10
Pond Volume Data = POND 10
Pond Outlet Data = Outfall 001

No Infiltration

INITIAL CONDITIONS
---------------------------------
Starting WS Elev   =     2.00 ft
Starting Volume    =     .000 ac-ft
Starting Outflow   =      .00 cfs
Starting Infiltr.  =      .00 cfs
Starting Total Qout=      .00 cfs
Time Increment     =    .2000 hrs


INFLOW/OUTFLOW HYDROGRAPH SUMMARY
====================================================
Peak Inflow       =    151.23 cfs    at   12.2000 hrs
Peak Outflow      =      3.30 cfs    at   18.6000 hrs
----------------------------------------------------
Peak Elevation    =     16.88 ft
Peak Storage =          12.822 ac-ft
====================================================


MASS BALANCE (ac-ft)
-------------------------
+ Initial Vol  =        .000
+ HYG Vol IN   =      16.985
- Infiltration =        .000
- HYG Vol OUT  =      16.985
- Retained Vol =        .000
                  ----------
Unrouted Vol =          .000 ac-ft  (.000% of Inflow Volume)
```

Index of Starting Page Numbers for ID Names

Appendix B – TYPAR 3601 Geotextile Specification

(2 total pages)

TYPAR English Properties

AASHTO Class M288			-	-	-	-	3	2	2	1	1
			Typar 3151	Typar 3201	Typar 3301	Typar 3341	Typar 3401	Typar 3501	Typar 3601	Typar 3631	Typar 3801
MECHANICAL (MARV)[1]											
Grab tensile strength	ASTM D4632	lbs	35	60	120	120	130	160	240	250	300
Grab elongation	ASTM D4632	%	60	60	60	60	60	60	60	60	60
Trapezoidal tear strength	ASTM D4533	lbs	15	25	35	40	60	60	90	90	95
Puncture strength	ASTM D4833	lbs	10	18	25	34	41	56	67	81	93
CBR Puncture	ASTM D6241	lbs	-	-	-	-	225	310	370	435	510
ENDURANCE (MARV)[1]											
UV resistance @ 500 hrs	ASTM D4355	%	-	-	-	70	70	70	70	70	70
HYDRAULIC (MARV)[1]											
Apparent opening size[2]	ASTM D4751	US Sieve	20/30	30	50	60	70	70	140	140	170
Permittivity	ASTM D4491	sec^{-1}	1.5	1.0	0.8	0.7	0.7	0.5	0.1	0.2	0.1
Water flow rate	ASTM D4491	$gal/min/ft^2$	235	190	95	85	60	50	15	20	8
PHYSICAL (Typical)											
Unit weight		oz/yd^2	1.6	1.9	3.0	3.4	4.0	5.0	6.0	6.3	8.0
Roll diameter		in	7	7	8	8	9	10	10	10	12
Length		yd	100	100	100	100	100	100	100	100	100
Width		in	151	151	151	151	151	151	151	151	151
Roll area		yd^2	419	419	419	419	419	419	419	419	419
Roll weight gross		lbs	50	58	87	97	113	138	165	173	218
Width		In	-	-	-	-	187	187	187	187	187
Roll area		yd^2	-	-	-	-	519	519	519	519	519
Roll weight gross		lbs	-	-	-	-	142	175	209	219	275

NOTES:
1 Minimum average roll values (MARV) in the weaker principal direction
2 O_{95} Max. ARV

Product Selection Guide

	3151	3201	3301	3341	3401	3501	3601	3631	3801
Paved roads & parking lots				●	●	●	●	●	
Unpaved roads				●	●	●	●	●	
Industrial yards				●	●	●	●	●	
Subsurface drains		●	●	●	●	●	●	●	
Erosion control				●	●	●	●	●	●
Landfills				●	●	●	●	●	●
Recreational facilities		●	●	●	●	●	●	●	
Waste handling systems	●	●	●	●	●	●	●	●	●
Landscaping		●	●	●	●				

Typar also has many other unique related applications.

Customer	Santee Cooper	**Project No.**	108008-01330
Project Title	Cross Generating Station - Class III Solid Waste Landfill	**Calc No.**	CR34-0-DC-LF-CE-007
Calculation Title	Decant Structure Design	**Phase/CTR**	N/A
Elec File Location	P:\SanteeCooper\CR34\Doc\Civil\Cross Generating Station\Class III SWLF Horizontal Expansion\Calculations\CE-007 Decant Structures\CR34-0-DC-LF-CE-007-R0.doc		
Project File Location	See Encompass	**Page**	1 of 10

Rev	Date	By	Checked	Rev	Date	By	Checked	Rev	Date	By	Checked
0	14-Feb-2012	P.Velugubantla	E. Leiby								

Appendix C – Dewatering Time

(10 total pages)

Table of Contents

********************** TIME VS.ELEV **********************

TIME vs. ELEVATION (ft)

Output Time increment = .2000 hrs
Time on left represents time for first value in each row.

Time hrs					
3.8000	2.00	2.03	2.12	2.28	2.45
4.8000	2.69	3.02	3.44	3.97	4.38
5.8000	4.60	4.84	5.16	5.62	6.23
6.8000	6.71	7.09	7.62	8.28	8.67
7.8000	8.91	9.38	10.00	10.68	11.01
8.8000	11.04	11.08	11.15	11.23	11.34
9.8000	11.47	11.52	11.55	11.58	11.62
10.8000	11.67	11.72	11.79	11.87	11.97
11.8000	12.09	12.32	12.75	13.21	13.49
12.8000	13.63	13.71	13.77	13.81	13.85
13.8000	13.88	13.91	13.94	13.96	13.98
14.8000	14.00	14.02	14.03	14.04	14.05
15.8000	14.06	14.07	14.08	14.08	14.08
16.8000	14.09	14.09	14.09	14.09	14.09
17.8000	14.08	14.08	14.08	14.08	14.07
18.8000	14.07	14.06	14.06	14.05	14.05
19.8000	14.04	14.04	14.03	14.02	14.02
20.8000	14.01	14.00	14.00	13.99	13.98
21.8000	13.97	13.97	13.96	13.95	13.94
22.8000	13.93	13.92	13.92	13.91	13.90
23.8000	13.89	13.88	13.87	13.85	13.84
24.8000	13.82	13.80	13.79	13.77	13.75
25.8000	13.74	13.72	13.70	13.69	13.67
26.8000	13.65	13.64	13.62	13.60	13.59
27.8000	13.57	13.55	13.54	13.52	13.50
28.8000	13.49	13.47	13.45	13.44	13.42
29.8000	13.40	13.39	13.37	13.35	13.34
30.8000	13.32	13.30	13.29	13.27	13.25
31.8000	13.24	13.22	13.20	13.19	13.17
32.8000	13.15	13.14	13.12	13.11	13.09
33.8000	13.07	13.06	13.04	13.03	13.01
34.8000	12.99	12.98	12.96	12.94	12.93
35.8000	12.91	12.89	12.88	12.86	12.85
36.8000	12.83	12.81	12.80	12.78	12.77
37.8000	12.75	12.73	12.72	12.70	12.69
38.8000	12.67	12.66	12.64	12.62	12.61
39.8000	12.59	12.58	12.56	12.55	12.53
40.8000	12.52	12.50	12.49	12.47	12.46
41.8000	12.44	12.43	12.41	12.39	12.38
42.8000	12.36	12.35	12.33	12.32	12.30
43.8000	12.29	12.27	12.26	12.24	12.23
44.8000	12.21	12.20	12.18	12.17	12.15
45.8000	12.14	12.12	12.10	12.09	12.07

TIME vs. ELEVATION (ft)

Output Time increment = .2000 hrs
Time on left represents time for first value in each row.

Time hrs					
46.8000	12.06	12.04	12.03	12.01	12.00
47.8000	11.97	11.95	11.92	11.90	11.87
48.8000	11.85	11.82	11.80	11.77	11.75
49.8000	11.72	11.70	11.67	11.65	11.62
50.8000	11.60	11.58	11.55	11.53	11.50
51.8000	11.36	11.22	11.07	7.84	3.90
52.8000	2.63	2.09	2.01		

TIME vs. ELEVATION (ft)

Output Time increment = .2000 hrs
Time on left represents time for first value in each row.

Time hrs					
2.0000	2.00	2.00	2.10	2.35	2.81
3.0000	3.52	4.34	5.02	5.73	6.46
4.0000	7.04	7.65	8.33	8.73	8.98
5.0000	9.45	10.00	10.51	10.90	11.01
6.0000	11.02	11.04	11.08	11.13	11.20
7.0000	11.29	11.39	11.50	11.52	11.55
8.0000	11.58	11.61	11.65	11.69	11.74
9.0000	11.80	11.86	11.93	12.01	12.05
10.0000	12.11	12.17	12.23	12.31	12.39
11.0000	12.48	12.57	12.69	12.83	13.07
12.0000	13.52	14.32	15.13	15.62	15.87
13.0000	16.02	16.12	16.21	16.28	16.34
14.0000	16.40	16.46	16.50	16.55	16.59
15.0000	16.62	16.66	16.69	16.71	16.74
16.0000	16.76	16.78	16.79	16.81	16.82
17.0000	16.83	16.84	16.85	16.86	16.86
18.0000	16.87	16.87	16.87	16.87	16.87
19.0000	16.88	16.88	16.88	16.88	16.87
20.0000	16.87	16.87	16.87	16.87	16.87
21.0000	16.86	16.86	16.86	16.85	16.85
22.0000	16.84	16.84	16.84	16.83	16.83
23.0000	16.82	16.81	16.81	16.80	16.79
24.0000	16.79	16.78	16.76	16.74	16.73
25.0000	16.71	16.69	16.67	16.65	16.63
26.0000	16.61	16.60	16.58	16.56	16.54
27.0000	16.52	16.50	16.48	16.47	16.45
28.0000	16.43	16.41	16.39	16.37	16.35
29.0000	16.34	16.32	16.30	16.28	16.26
30.0000	16.24	16.22	16.21	16.19	16.17
31.0000	16.15	16.13	16.11	16.10	16.08
32.0000	16.06	16.04	16.02	16.01	15.99
33.0000	15.97	15.95	15.93	15.91	15.89
34.0000	15.88	15.86	15.84	15.82	15.80
35.0000	15.78	15.77	15.75	15.73	15.71
36.0000	15.69	15.68	15.66	15.64	15.62
37.0000	15.60	15.59	15.57	15.55	15.53
38.0000	15.51	15.50	15.48	15.46	15.44
39.0000	15.42	15.41	15.39	15.37	15.35
40.0000	15.33	15.32	15.30	15.28	15.26
41.0000	15.24	15.23	15.21	15.19	15.17
42.0000	15.16	15.14	15.12	15.10	15.09
43.0000	15.07	15.05	15.03	15.02	15.00
44.0000	14.98	14.96	14.94	14.93	14.91

TIME vs. ELEVATION (ft)

Time hrs	Output Time increment = .2000 hrs Time on left represents time for first value in each row.				
45.0000	14.89	14.87	14.86	14.84	14.82
46.0000	14.81	14.79	14.77	14.75	14.74
47.0000	14.72	14.70	14.69	14.67	14.65
48.0000	14.64	14.62	14.60	14.58	14.57
49.0000	14.55	14.53	14.52	14.50	14.48
50.0000	14.47	14.45	14.43	14.41	14.40
51.0000	14.38	14.36	14.35	14.33	14.31
52.0000	14.30	14.28	14.26	14.24	14.23
53.0000	14.21	14.19	14.18	14.16	14.14
54.0000	14.13	14.11	14.09	14.08	14.06
55.0000	14.04	14.03	14.01	13.99	13.98
56.0000	13.96	13.94	13.93	13.91	13.89
57.0000	13.88	13.86	13.84	13.82	13.81
58.0000	13.79	13.77	13.76	13.74	13.72
59.0000	13.71	13.69	13.67	13.66	13.64
60.0000	13.62	13.61	13.59	13.57	13.56
61.0000	13.54	13.53	13.51	13.49	13.48
62.0000	13.46	13.44	13.42	13.41	13.39
63.0000	13.37	13.36	13.34	13.32	13.31
64.0000	13.29	13.27	13.26	13.24	13.23
65.0000	13.21	13.19	13.18	13.16	13.14
66.0000	13.13	13.11	13.09	13.08	13.06
67.0000	13.05	13.03	13.01	13.00	12.98
68.0000	12.96	12.95	12.93	12.92	12.90
69.0000	12.88	12.87	12.85	12.83	12.82
70.0000	12.80	12.79	12.77	12.75	12.74
71.0000	12.72	12.71	12.69	12.68	12.66
72.0000	12.64	12.63	12.61	12.60	12.58
73.0000	12.57	12.55	12.54	12.52	12.51
74.0000	12.49	12.48	12.46	12.45	12.43
75.0000	12.41	12.40	12.38	12.37	12.35
76.0000	12.34	12.32	12.31	12.29	12.28
77.0000	12.26	12.25	12.23	12.22	12.20
78.0000	12.18	12.17	12.15	12.14	12.12
79.0000	12.11	12.09	12.08	12.06	12.05
80.0000	12.03	12.02	12.00	11.98	11.96
81.0000	11.93	11.91	11.88	11.85	11.83
82.0000	11.80	11.78	11.75	11.73	11.71
83.0000	11.68	11.66	11.63	11.61	11.58
84.0000	11.56	11.53	11.51	11.41	11.26
85.0000	11.11	9.65	4.01	2.70	2.12
86.0000	2.01				

TIME vs. ELEVATION (ft)

Time hrs	Output Time increment = .2000 hrs Time on left represents time for first value in each row.				
1.6000	2.00	2.04	2.30	2.88	3.87
2.6000	4.90	5.87	6.82	7.65	8.43
3.6000	8.98	9.54	10.30	10.91	11.01
4.6000	11.03	11.06	11.11	11.16	11.23
5.6000	11.31	11.39	11.49	11.52	11.54
6.6000	11.56	11.59	11.62	11.66	11.70
7.6000	11.74	11.79	11.84	11.90	11.96
8.6000	12.02	12.07	12.12	12.18	12.24
9.6000	12.31	12.38	12.46	12.55	12.64
10.6000	12.74	12.85	12.97	13.10	13.25
11.6000	13.45	13.74	14.32	15.31	16.32
12.6000	16.92	17.24	17.42	17.55	17.64
13.6000	17.72	17.78	17.83	17.87	17.90
14.6000	17.92	17.94	17.95	17.96	17.96
15.6000	17.96	17.96	17.95	17.94	17.93
16.6000	17.92	17.90	17.89	17.87	17.86
17.6000	17.84	17.83	17.81	17.80	17.78
18.6000	17.76	17.75	17.73	17.72	17.71
19.6000	17.69	17.68	17.67	17.66	17.65
20.6000	17.64	17.63	17.62	17.61	17.60
21.6000	17.59	17.59	17.58	17.57	17.56
22.6000	17.56	17.55	17.54	17.54	17.53
23.6000	17.52	17.52	17.51	17.50	17.49
24.6000	17.47	17.45	17.43	17.41	17.39
25.6000	17.37	17.35	17.33	17.31	17.29
26.6000	17.27	17.25	17.23	17.22	17.20
27.6000	17.18	17.16	17.14	17.12	17.10
28.6000	17.08	17.06	17.04	17.02	17.00
29.6000	16.99	16.97	16.95	16.93	16.91
30.6000	16.89	16.87	16.85	16.83	16.81
31.6000	16.80	16.78	16.76	16.74	16.72
32.6000	16.70	16.68	16.66	16.65	16.63
33.6000	16.61	16.59	16.57	16.55	16.53
34.6000	16.52	16.50	16.48	16.46	16.44
35.6000	16.42	16.40	16.39	16.37	16.35
36.6000	16.33	16.31	16.29	16.27	16.26
37.6000	16.24	16.22	16.20	16.18	16.16
38.6000	16.15	16.13	16.11	16.09	16.07
39.6000	16.05	16.04	16.02	16.00	15.98
40.6000	15.96	15.94	15.93	15.91	15.89
41.6000	15.87	15.85	15.83	15.82	15.80
42.6000	15.78	15.76	15.74	15.72	15.71
43.6000	15.69	15.67	15.65	15.63	15.62

TIME vs. ELEVATION (ft)

Output Time increment = .2000 hrs
Time on left represents time for first value in each row.

Time hrs					
44.6000	15.60	15.58	15.56	15.54	15.53
45.6000	15.51	15.49	15.47	15.45	15.44
46.6000	15.42	15.40	15.38	15.36	15.35
47.6000	15.33	15.31	15.29	15.27	15.26
48.6000	15.24	15.22	15.20	15.19	15.17
49.6000	15.15	15.13	15.11	15.10	15.08
50.6000	15.06	15.04	15.03	15.01	14.99
51.6000	14.97	14.96	14.94	14.92	14.90
52.6000	14.89	14.87	14.85	14.83	14.82
53.6000	14.80	14.78	14.77	14.75	14.73
54.6000	14.71	14.70	14.68	14.66	14.65
55.6000	14.63	14.61	14.60	14.58	14.56
56.6000	14.55	14.53	14.51	14.49	14.48
57.6000	14.46	14.44	14.43	14.41	14.39
58.6000	14.37	14.36	14.34	14.32	14.31
59.6000	14.29	14.27	14.26	14.24	14.22
60.6000	14.21	14.19	14.17	14.16	14.14
61.6000	14.12	14.11	14.09	14.07	14.06
62.6000	14.04	14.02	14.01	13.99	13.97
63.6000	13.95	13.94	13.92	13.90	13.89
64.6000	13.87	13.85	13.84	13.82	13.80
65.6000	13.79	13.77	13.75	13.74	13.72
66.6000	13.70	13.69	13.67	13.65	13.64
67.6000	13.62	13.60	13.59	13.57	13.55
68.6000	13.54	13.52	13.50	13.49	13.47
69.6000	13.45	13.44	13.42	13.40	13.39
70.6000	13.37	13.35	13.34	13.32	13.30
71.6000	13.29	13.27	13.25	13.24	13.22
72.6000	13.20	13.19	13.17	13.15	13.14
73.6000	13.12	13.11	13.09	13.07	13.06
74.6000	13.04	13.02	13.01	12.99	12.98
75.6000	12.96	12.94	12.93	12.91	12.89
76.6000	12.88	12.86	12.85	12.83	12.81
77.6000	12.80	12.78	12.77	12.75	12.73
78.6000	12.72	12.70	12.69	12.67	12.66
79.6000	12.64	12.62	12.61	12.59	12.58
80.6000	12.56	12.55	12.53	12.52	12.50
81.6000	12.49	12.47	12.46	12.44	12.43
82.6000	12.41	12.39	12.38	12.36	12.35
83.6000	12.33	12.32	12.30	12.29	12.27
84.6000	12.26	12.24	12.23	12.21	12.20
85.6000	12.18	12.16	12.15	12.13	12.12
86.6000	12.10	12.09	12.07	12.06	12.04
87.6000	12.03	12.01	12.00	11.97	11.95

TIME vs. ELEVATION (ft)

Time hrs	Output Time increment = .2000 hrs Time on left represents time for first value in each row.				
88.6000	11.92	11.90	11.87	11.85	11.82
89.6000	11.80	11.77	11.75	11.72	11.70
90.6000	11.67	11.65	11.62	11.60	11.57
91.6000	11.55	11.53	11.50	11.36	11.21
92.6000	11.07	7.56	3.77	2.56	2.07
93.6000	2.01				

Index of Starting Page Numbers for ID Names

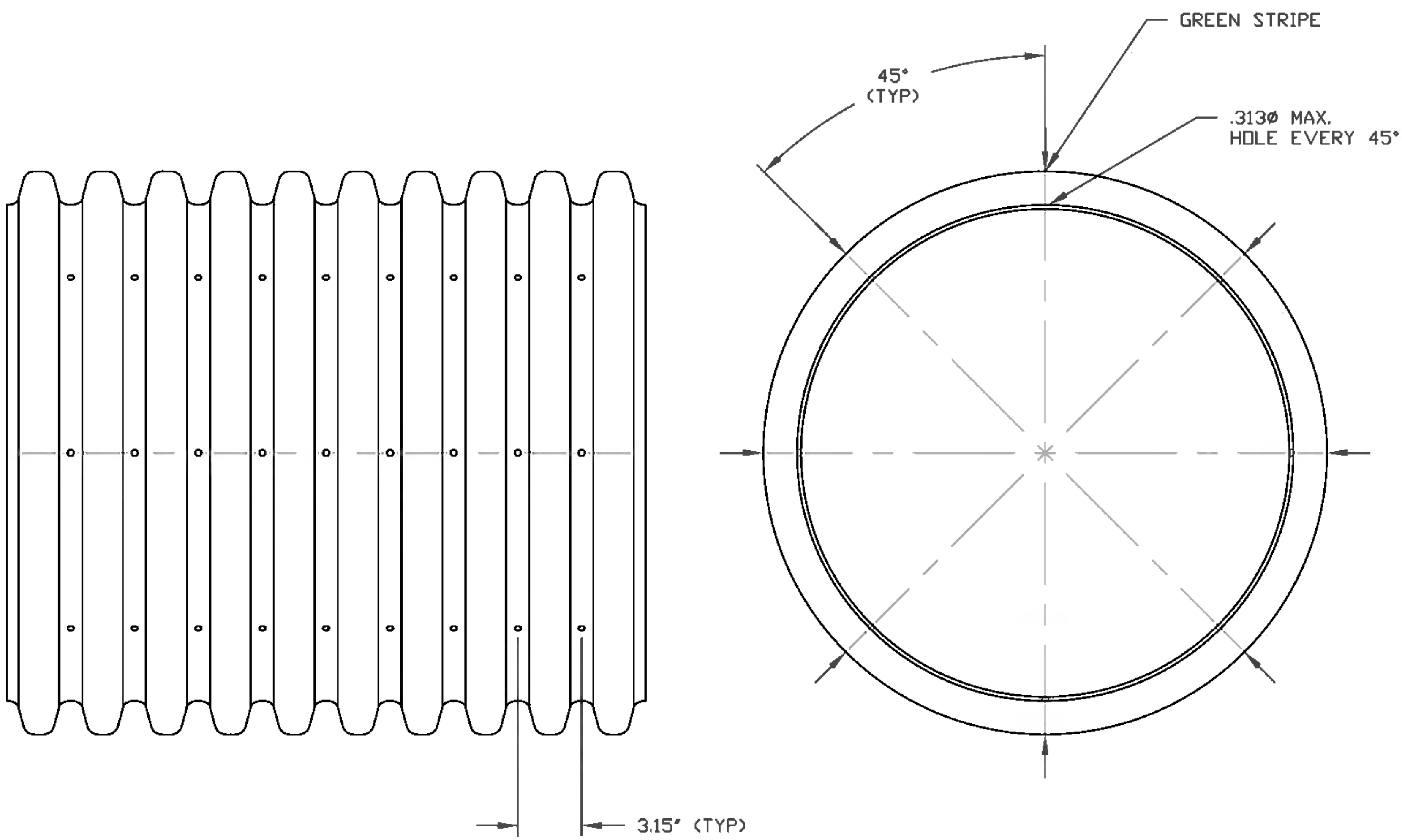
Customer	Santee Cooper	Project No.	108008-01330
Project Title	Cross Generating Station - Class III Solid Waste Landfill	Calc No.	CR34-0-DC-LF-CE-007
Calculation Title	Decant Structure Design	Phase/CTR	N/A
Elec File Location	P:\SanteeCooper\CR34\Doc\Civil\Cross Generating Station\Class III SWLF Horizontal Expansion\Calculations\CE-007 Decant Structures\CR34-0-DC-LF-CE-007-R0.doc		
Project File Location	See Encompass	Page	1 of 5

Rev	Date	By	Checked	Rev	Date	By	Checked	Rev	Date	By	Checked
0	14-Feb-2012	P.Velugubantla	E. Leiby								

Appendix D – ADS Pipe information

(5 total pages)

24" N-12 CLASS II PERF. PATTERN



TYPE DROSSBACH PLATFORM
AVERAGE INLET 2.63 IN^2/FT

ADS

24" CLASS II

DRAWN BY		APPROVED BY	DRAWING #
MGB	9/22/03		24 CLASS II_DROSS

REVISIONS	
BY	DATE
AMK	11/04/08

DWG. SCALE: 1:8

ADS N-12® PLAIN END PIPE (per AASHTO) SPECIFICATION

Scope
This specification describes 4- through 60-inch (100 to 1500 mm) ADS N-12 plain end pipe (per AASHTO) for use in gravity-flow drainage applications.

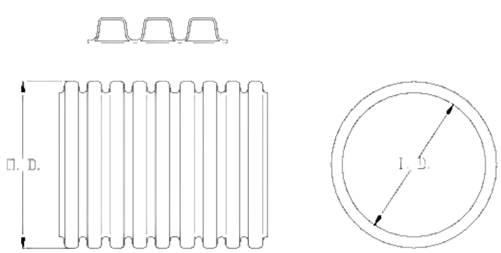
Pipe Requirements
ADS N-12 plain end pipe (per AASHTO) shall have a smooth interior and annular exterior corrugations.
- 4- through10-inch (100 to 250 mm) shall meet AASHTO M252, Type S or SP.
- 12- through 60-inch (300 to 1500 mm) shall meet AASHTO M294, Type S or SP or ASTM F2306.
- Manning's "n" value for use in design shall be 0.012.

Joint Performance
Pipe shall be joined with coupling bands covering at least two full corrugations on each end of the pipe. Standard connections shall meet or exceed the soil-tight requirements of AASHTO M252, AASHTO M294, or ASTM F2306. Gasketed connections shall incorporate a closed-cell synthetic expanded rubber gasket meeting the requirements of ASTM D1056 Grade 2A2. Gaskets, when applicable, shall be installed by the pipe manufacturer.

Fittings
Fittings shall conform to AASHTO M252, AASHTO M294 or ASTM F2306.

Material Properties
Virgin material for pipe and fitting production shall be high density polyethylene conforming with the minimum requirements of cell classification 424420C for 4- through 10-inch (100 to 250 mm) diameters, and 435400C for 12- through 60-inch (300 to 1500 mm) diameters, as defined and described in the latest version of ASTM D3350, except that carbon black content should not exceed 4%. The 12- through 60-inch (300 to 1500mm) virgin pipe material shall comply with the notched constant ligament-stress (NCLS) test as specified in Sections 9.5 and 5.1 of AASHTO M294 and ASTM F2306 respectively.

Installation
Installation shall be in accordance with ASTM D2321 and ADS recommended installation guidelines, with the exception that minimum cover in trafficked areas for 4- through 48-inch (100 to 1200 mm) diameters shall be one foot. (0.3 m) and for 54- and 60-inch (1350 and 1500 mm) diameters, the minimum cover shall be 2 ft. (0.6 m) in single run applications. Backfill for minimum cover situations shall consist of Class 1, Class 2 (minimum 90% SPD) or Class 3 (minimum 90%) material. Maximum fill heights depend on embedment material and compaction level; please refer to Technical Note 2.01. Contact your local ADS representative or visit our website at www.ads-pipe.com for a copy of the latest installation guidelines.



Pipe Dimensions

	Nominal Diameter, in (mm)													
Pipe I.D. in (mm)	4 (100)	6 (150)	8 (200)	10 (250)	12 (300)	15 (375)	18 (450)	24 (600)	30 (750)	36 (900)	42 (1050)	48 (1200)	54* (1350)	60 (1500)
Pipe O.D.** in (mm)	4.8 (122)	6.9 (175)	9.1 (231)	11.4 (290)	14.5 (368)	18 (457)	22 (559)	28 (711)	36 (914)	42 (1067)	48 (1219)	54 (1372)	61 (1549)	67 (1702)
Perforations	All diameters available with or without perforations													

**Pipe O.D. values are provided for reference purposes only, values stated for 12- through 60-inch are ± 1 inch. Contact a sales representative for exact values.

ONE COMPANY, ONE CULTURE

INTERNAL USE ONLY

PRODUCT NOTE

Dual Wall Perforation Patterns

IPN 1.01
Januarv 2009

The following Product Note provides the perforation pattern and the average actual inlet area for perforated pipe manufactured on A- and H-legacy equipment.

AASHTO M252, Class II Perforation Patterns

Pipe Diameter	Perforation Type	Perf Configuration	Average Perforation Size		Perf. / valley	Perf. / foot	Avg. Inlet Area / foot	
			in	mm			in^2/ft	cm^2/m
4”	Slotted	CD	0.81L x 0.08W	20.4L x 2.0W	3	54	3.48	74
6”	Slotted	CD	0.83L x 0.08W	21.2L x 2.0W	3	45	3.00	64
8”	Slotted	CD	1.00L x 0.08W	25.4L x 2.0W	3	36	3.24	69
10”	Slotted	CD	0.97L x 0.08W	24.6L x 2.0W	3	27	2.36	50

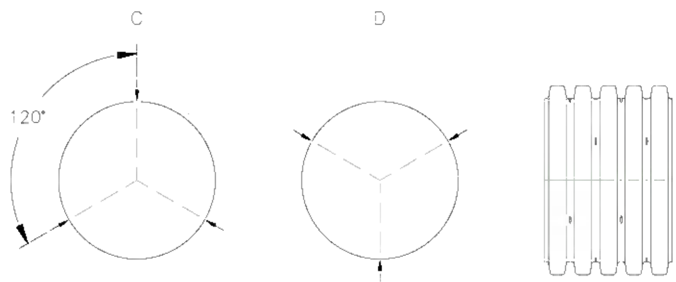
1) A-legacy equipment used in all plants

ASTM F2306 & AASHTO M294, Class II Perforation Patterns

Pipe Diameter	Perforation Type	Perf Configuration	Avg. Perforation Size		Perf. / Valley	Perf. / foot	Avg. Inlet Area / foot	
			in	mm			in^2/ft	cm^2/m
12"	Drilled	E	0.31	7.8	6	36	2.65	56
12" (3020)	Drilled	F	0.30	7.6	8	49	3.35	71
15"	Drilled	E	0.30	7.6	6	27	1.95	41
15” (3020)	Drilled	F	0.30	7.6	8	41	2.80	59
18"	Drilled	E	0.29	7.4	6	27	1.82	39
18” (3020)	Drilled	F	0.30	7.6	8	32	2.19	46
24"	Drilled	F	0.33	8.4	8	30	2.63	56
24" (3020)			0.30	7.6		24	1.64	35
30"	Drilled	H	0.31	7.8	16	46	3.36	71
30” (3020)	Drilled	F	0.30	7.6	8	24	1.64	35
36"	Drilled	H	0.32	8.1	16	36	2.88	61
36” (3660)						40	3.20	68
42"	Drilled	H	0.30	7.6	16	36	2.61	55
42” (3660)						32	2.32	49
48"	Drilled	H	0.32	8.1	16	36	2.81	59
48” (3660)						32	2.49	53
60”	Drilled	H	0.32	8.1	16	32	2.59	55
60” (3660)						24	1.93	41

1) Information obtained from plant samples sent in to New Miami Quality Control lab, October 2008
2) 36” – 60” pipe made on 3660 is hand drilled
3) 54” pipe has the same characteristics as 60” pipe (configuration, size, pitch, inlet area)

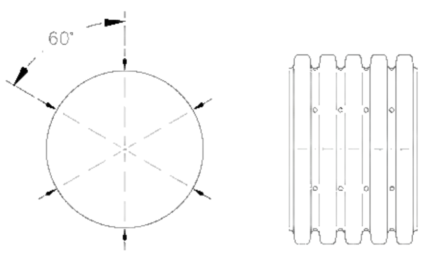
CD (SLOT)



3 AT 120°

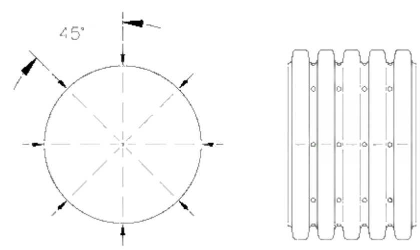
3 AT 120°
(60° FROM C)

E (CIRCULAR)



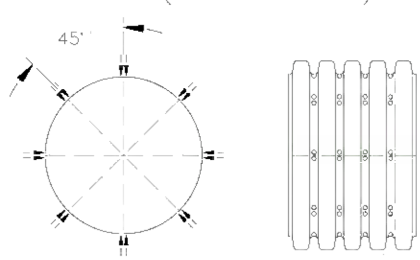
6 AT 60°

F (CIRCULAR)



8 AT 45°

H (CIRCULAR)



2 AT EVERY 45°