Environmental Overview in Support of Petition for Changed Conditions

CPV Towantic Energy Center

October 2014

Prepared for:

CPV Towantic, LLC
50 Braintree Hill Office Park, Suite 300
Braintree, MA 02184

Prepared by:

Tetra Tech, Inc.
238 Littleton Road, Suite 201B
Westford, MA 01886

TETRA TECH

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
1988 Guidelines	1988 Connecticut Guidelines for Erosion and Sedimentation Control
2004 Manual	2004 Connecticut Stormwater Quality Manual
°F	degrees Fahrenheit
%	percent
$\mu g/m^3$	micrograms per cubic meter
ACC	air-cooled condenser
Air Permit Application	Permit Application for Stationary Source of Air Pollution/New Source Review
AMSL	above mean sea level
Audubon CT	Audubon Connecticut, the Connecticut program of the National Audubon Society, Inc.
BACT	Best Available Control Technology
Btu/kW-hr	British thermal units per kilowatt-hour
Certificate	Certificate of Environmental Compatibility and Public Need
CFR	Code of Federal Regulations
CL&P	Connecticut Light and Power
CO	carbon monoxide
CO_2	carbon dioxide
CO_{2e}	carbon dioxide equivalent
Council	Connecticut Siting Council
CPV	CPV Towantic, LLC
CT ILF	Connecticut In-Lieu Fee
D&M Plan	Development and Management Plan
dB	decibels
dBA	broadband, or A-weighted decibels
DC Circuit Court of Appeals	United States Court of Appeals for the District of Columbia Circuit
DEEP	Connecticut Department of Energy and Environmental Protection
DOE	United States Department of Energy
FAA	Federal Aviation Administration
GE	General Electric
GHG	greenhouse gas

gpd	gallons per day
gpm	gallons per minute
H_2SO_4	sulfuric acid
Heritage	Heritage Village Water Company
HRSG	heat recovery steam generator
Hz	Hertz
ISO	International Organization for Standardization
ISO-NE	Independent System Operator-New England, Inc.
LAER	Lowest Achievable Emissions Rate
lb/MMBtu	pounds per million British thermal units
lb/MW-hr	pounds per megawatt-hour
mgd	million gallons per day
MW	megawatts
NAAQS	National Ambient Air Quality Standards
NPDES	National Pollutant Discharge Elimination System
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NSR	New Source Review
NSPS	New Source Performance Standards
PGP	Programmatic General Permit
PM_{10}	particulate matter with a diameter less than 10 microns
$PM_{2.5}$	particulate matter with a diameter less than 2.5 microns
ppb	parts per billion
ppm	parts per million
the Project	CPV Towantic Energy Center, a combined-cycle, dual-fuel-fired electric generating facility to be located off of Woodruff Hill Road in Oxford, Connecticut
PSD	Prevention of Significant Deterioration
RGGI	Regional Greenhouse Gas Initiative
ROW	right-of-way
SCR	selective catalytic reduction
SHPO	State Historic Preservation Office
SIL	Significant Impact Level
SO_2	sulfur dioxide

SWPPP	Stormwater Pollution Prevention Plan
Towantic	Towantic Energy L.L.C.
tpy	tons per year
ULSD	ultra-low sulfur distillate
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
VOC	volatile organic compounds

1.0 INTRODUCTION

CPV Towantic, LLC (CPV), formerly known as Towantic Energy L.L.C. (Towantic), is submitting a Petition to the Connecticut Siting Council (Council) for changed conditions necessitating a modification to its decision issuing a Certificate of Environmental Compatibility and Public Need (Certificate) for the proposed combined-cycle electric generating facility, the CPV Towantic Energy Center (Project). The Project is the subject of Council Docket No. 192, An Application by Towantic Energy L.L.C. for a Certificate of Environmental Compatibility and Public Need, which addressed the construction, maintenance, and operation of a proposed electric generating facility located north of the intersection of Prokop Road and Towantic Hill Road (now Woodruff Hill Road) in the Town of Oxford, Connecticut.

The Council issued the Certificate in 1999 authorizing the construction and operation of a net nameplate 512-megawatt (MW) combined-cycle dual-fuel electric generating facility. Since that time, development rights have passed through several entities, and permits have continued to be renewed and reissued accordingly. CPV Power Development, Inc., through its wholely owned subsidiary, took majority ownership of the Project entity in February 2012 and continued to move the Project towards construction and operation.

The Project, although designed with efficient, economical technology at the time, now has the opportunity to improve its efficiency and environmental performance by using updated General Electric (GE) turbine technology in order to obtain financing and compete effectively in the current Independent System Operator – New England, Inc. (ISO-NE) market. In addition, since 1999, the power market and regulatory framework have continued to evolve. CPV is proposing the following updates to the Project:

- Incorporation of GE Frame 7HA.01 turbine technology and associated equipment to produce more energy more efficiently (a net nameplate 785 MW[1]) while minimizing community and environmental impacts.
- Addition of approximately 6 acres located immediately to the south of the original Project site to allow for stormwater management consistent with current design standards and requirements.
- Incorporation of technological advances in air cooling technology to reduce the height, visual impacts and area requirements of the air-cooled condenser (ACC).
- Reorientation of the Project stacks to minimize influence on air traffic associated with the Waterbury-Oxford Airport.
- Replacement of one large building enclosure for the gas turbines and steam turbine with three smaller and shorter building enclosures to reduce visibility and facilitate emissions dispersion.
- Incorporation of other relatively minor site plan changes to accommodate facility layout.
- Demonstration of the Project's consistency with updated environmental regulations and policies.

The following sections of the report:

- Outline the Project description, focusing on the changed conditions that exist and can be associated with the proposed Project updates;
- Summarize the Project's consistency with relevant changed conditions in applicable regulations and policies; and

[1] At 100% operation, including duct firing, at 59 degrees Fahrenheit (°F).

- Discuss the effects of the proposed changes to the Project on the issues considered by the Council in granting the Certificate.

2.0 PROJECT DESCRIPTION

Towantic submitted the original application for the Certificate to the Council on December 7, 1998 for the construction, operation, and maintenance of a new net nameplate 512-MW dual-fuel electric generating facility to be located north of the intersection of Prokop Road and Towantic Hill Road (off of the planned Woodruff Hill Road, now in place) in Oxford, Connecticut. The Council issued a Decision and Order granting the Certificate and an Opinion and Findings of Fact on June 23, 1999. Several local approvals were received prior to the issuance of the Certificate by the Council. The Town of Oxford Conservation Commission, as well as the Planning and Zoning Commission, approved the proposal with conditions in early 1999; the Town of Oxford's First Selectman also supported the Project.

The approved Project footprint encompassed approximately 13 of the site's total 20 acres. The Project consisted of two dual-fuel combustion turbine generators and heat recovery steam generators (HRSG), each with a 160-foot exhaust stack coupled with a single steam turbine generator. The proposed facility also included an ACC, water and fuel storage tanks, electric switchyard, and administration and control building. The design utilized two GE Frame 7FA.03 turbines. Natural gas was the primary fuel and distillate fuel (0.05% sulfur content) was the backup fuel.[2] The initial schedule assumed a 26-month construction period with commercial operation by December 2001. The layout initially approved is shown in Figure 1. The proposed site footprint would have a final elevation of 834 feet above mean sea level (AMSL), and the substation, located on the north side of the site, would have a final elevation of 848 feet AMSL.

On October 19, 2000, Towantic submitted a Development and Management Plan (D&M Plan) to the Council and submitted revisions to that D&M Plan on December 15, 2000, including adjusted stack heights of 150 feet. In addition to the addressing requirements specified in the Decision and Order, the D&M Plan included several proposed Project refinements; the Council approved the D&M Plan on March 1, 2001. Updates for the Project incorporated in the D&M Plan included shifting of the facility layout 265 feet south, further from the Middlebury town line, and reorientation of the switchyard to preserve trees. In addition, details regarding the site elevation and building structures were adjusted, the construction schedule was updated, and updates were provided regarding agreements with the Town of Oxford for construction parking and with Northeast Utilities (parent company of Connecticut Light and Power [CL&P]) approving the interconnection plan.

Additional updates to the Project and surroundings have occurred over the intervening years. The most notable changes included: updated consideration of Best Available Control Technology (BACT) in the air permitting process resulted in incorporation of an oxidation catalyst for additional pollution control and a shift to the use of ULSD; construction by the Town of Oxford of Woodruff Hill Road and approval of the Woodruff Hill Industrial Park; and confirmation of the prohibition of natural gas use as a fuel pipeline or system cleaning medium and other related safety procedures.

In 2012, CPV Power Development, Inc., through its wholely owned subsidiary, acquired the majority interest in the Project entity and continued to evaluate market conditions to determine how best to proceed with the Project. Project construction is planned to commence in 2015 and changed conditions have caused CPV to consider further improvements to the Project. The Project, as presented in the Petition, reflects considerable efforts to continue to minimize environmental impacts and maintain

[2] Note that, in the most recent air permit issued on June 1, 2010, the backup fuel is specified as ultra-low sulfur distillate (ULSD) (0.0015% or lower sulfur content), as is currently proposed.

CPV Towantic Energy Center
Oxford, New Haven County, Connecticut

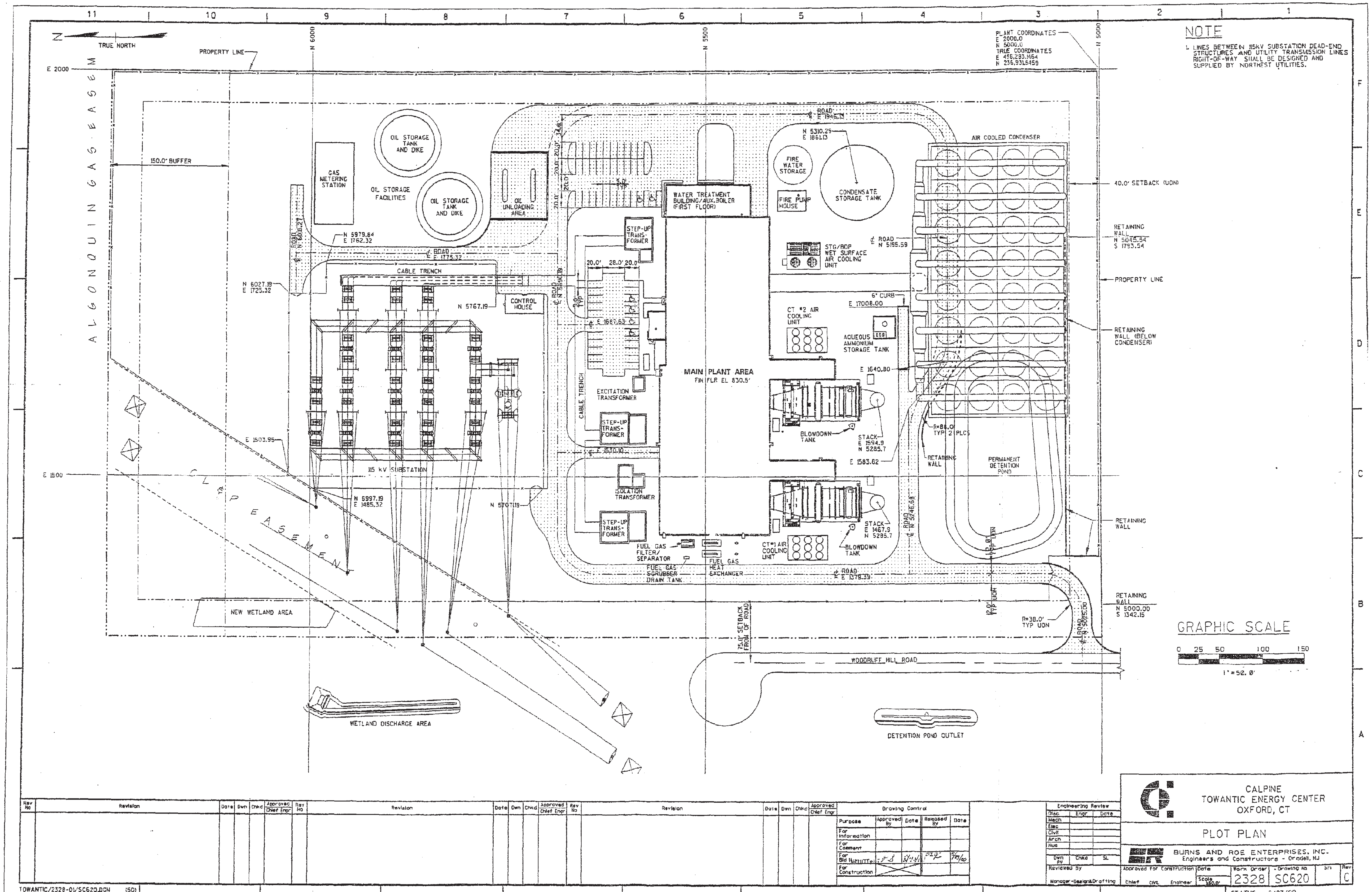


Figure 1.

Original Towantic Energy Center Layout

economic viability in the wholesale electricity markets. Although the fundamental Project design and characteristics remain the same, the following sections outline the updates that have been incorporated.

2.1 GE TECHNOLOGY UPDATE – FRAME 7HA.01 TURBINE

Existing Project approvals incorporate the use of the most efficient GE combustion turbine technology that was available at the time, the GE Frame 7FA.03. Given the changed market conditions within which the Project will operate, it was necessary to update the technology to allow for the greatest efficiency and flexibility now available, while providing the most needed power to the region.

Evaluation of the various equipment options led CPV to select the GE Frame 7HA.01 turbine based on several key benefits, including:

- More efficient energy output, saving fuel and reducing greenhouse gas (GHG) and criteria pollutant emissions per megawatt-hour (MW-hr) generated;
- Greater output with the same footprint and similar or improved environmental performance;
- Shorter start-up period and faster ramp rate; and
- Ability for rapid fuel switching between natural gas and ULSD, as well as increased reliability of the liquid fuel system.

2.1.1 Frame 7HA.01 Development

GE developed the Frame 7H-Series as part of the United States Department of Energy's (DOE’s) advanced turbine system program. GE was one of two turbine manufacturers partnering with DOE to extend the DOE's advanced turbine system program into the utility sector.

GE’s new Frame 7H technology reflects performance improvements for installed capacity, efficiency, emissions, and flexibility. GE commercially introduced its H-class technology around ten years ago, the lead project being a Frame 9H (the 50-Hertz [Hz] European version of the 60-Hz North American Frame 7H) at Baglan Bay in Wales, followed by three more Frame 9H units at Tepco's Futtsu plant in Japan, and two Frame 7H gas turbines at the Inland Empire Energy Center in Riverside County, California. These initial H-class turbines employed steam cooling of turbine components. GE indicates that the 7HA.01 has increased generating capacity and can achieve combined-cycle net efficiency of better than 60% (International Organization for Standardization [ISO] conditions) employing air cooling only.[3]

The ability to achieve such high efficiencies with air versus steam cooling derives from advances in technology on a number of fronts:

- Blade aerodynamics;
- Improved design of hot gas path components to reduce temperature and stress gradients;
- More effective deployment of air by using more intricate cooling flows (e.g., employing several thousand tear-drop shaped holes whereas 500 circular holes might have been used in the past);
- Improved thermal barrier coatings; and
- Improvements derived from significant operating experience amassed with GE’s existing gas turbine fleet.

---

[3] http://site.ge-energy.com/prod_serv/products/gas_turbines_cc/h_system/index.htm.

2.1.2 Efficiency Improvements

Turbine efficiency affects the economics, energy conservation, and environmental performance of a project. Turbine efficiency is measured in terms of heat rate, the amount of fuel necessary to generate a unit of electrical output. The lower the heat rate, the more efficient the use of our finite energy resources (natural gas). In addition, emissions of GHG are directly proportional to heat rate[4] in terms of pounds of GHG (measured as carbon dioxide equivalent [CO_{2e}]) per MW-hr (lb/MW-hr) of electrical generation. Efficiency improvements also translate into similar, or even more dramatic, reductions in emissions of other air pollutants on a lb/MW-hr basis.

The Project has opted to incorporate GE Frame 7HA.01 turbines to take advantage of that turbine's superior efficiency and GHG performance. Given the current marketplace, these improvements are particularly critical as Connecticut continues to implement its own GHG reduction program and prepares to address the United States Environmental Protection Agency's (USEPA's) new GHG Rule (addressed in Section 3.1), which will require the state to make fleet-wide reductions in CO_{2e} emissions on a lb/MW-hr basis.

A comparison of heat rate and GHG emissions performance is provided in Table 2-1. As shown in that table, the GE Frame 7HA.01 offers an approximately 6.5% improvement in efficiency and GHG performance over the GE Frame 7FA.03.

Table 2-1. GE Frame 7FA.03 and Frame 7HA.01 Turbines – Efficiency Comparison

Parameter	GE 7FA.03	GE 7HA.01
Heat Rate (Btu/kW-hr)[a]	6,770	6,402
CO_{2e} (lb/MW-hr)[b]	785.5	742.5

[a]British thermal units per kilowatt-hour, natural gas firing at 59°F without supplemental firing, net output basis, new and clean GE initial performance specification, higher heating value.
bNatural gas firing at 59°F without supplemental firing, gross output basis, new and clean, GE initial performance specification.

2.1.3 Increased Output

The GE Frame 7HA.01 offers greater energy output within approximately the same overall Project footprint. Given the announced retirements and "at risk" power plants in Connecticut and New England as a whole, additional energy output from the same site footprint is highly advantageous. In addition, greater Project output provides economies of scale that benefits Project economics and, as a result, ratepayers.

A comparison of output of the GE Frame 7HA.01 turbine-based Project with the Frame 7FA.03-based configuration is provided in Table 2-2.

[4] On a same-fuel basis.

Table 2-2. GE Frame 7FA.03 and Frame 7HA.01 Turbines – Energy Output Comparison

GE Frame 7FA.03[a]			
	0°F	**59°F**	**90°F**
Natural Gas			
Gas turbines (2 units)	367.37 MW	332.52 MW	294.52 MW
Steam turbine	189.95 MW	189.58 MW	164.70 MW
Facility load	(10.04 MW)	(10.04 MW)	(10.04 MW)
Total plant net output	547.28 MW	512.06 MW	449.18 MW
Distillate Fuel Oil			
Gas turbines (2 units)	371.51 MW	350.10 MW	312.43 MW
Steam turbine	186.90 MW	188.24 MW	165.67 MW
Facility load	(10.11 MW)	(10.11 MW)	(10.11 MW)
Total plant net output	548.30 MW	528.23 MW	467.99 MW
GE Frame 7HA.01[b]			
	0°F	**59°F**	**90°F**
Natural Gas			
Gas turbines (2 units)	556.00	524.34	487.63
Steam turbine (with duct firing)	280.46	280.47	271.48
Facility load	(20.91)	(20.12)	(18.98)
Total plant net output	815.55	784.69	740.13
ULSD			
Gas turbines (2 units)	531.12	494.51	453.75
Steam turbine	200.54	207.78	193.09
Facility load	(18.29)	(17.56)	(16.17)
Total plant net output	713.37	684.75	630.67

[a]Docket 192, Findings of Fact item number 19.
[b]Project performance estimates based on GE-provided heat balance data.

As shown in Table 2-2, the Frame 7HA.01 offers a more than 50% increase in Project output (natural gas firing at ISO conditions) while occupying the same footprint and with comparable or improved environmental performance.

2.1.4 Improved Start-Up, Operating Range and Ramp Rates

The Frame 7HA.01's rapid ramp rate and resulting shorter start-up times and wider operating range provides significant benefits to the electric grid for meeting energy needs. A shorter start-up time means not only power provided to the grid more quickly, but also means achieving compliance with more stringent steady-state emission rates faster. The ability to come online quickly and change loads (ramping) efficiently will become more and more important as intermittent renewable energy resources (wind and solar) become an increased component of New England's resource mix. A wider operating range means the Project will provide emissions-compliant power to the grid over a larger span of operating conditions and loads for better load-following and the avoidance of dispatch of more costly forms of power supply such as quick-start peaking resources. Combined-cycle projects are an important companion to wind and solar due to their ability to "balance" generation on a rapid basis, as the output of renewable energy sources greatly varies throughout the day. The GE Frame 7HA.01's superior ramping rate makes it a valuable addition to the regional power generation fleet.

A comparison of start-up time, operating range and ramp rate performance is provided in Table 2-3. As shown in Table 2-3, the Frame 7HA.01 offers significantly faster start times and a superior ramp rate providing significant benefits to the Project's performance as well as for grid reliability.

Table 2-3. GE Frame 7FA.03 and Frame 7HA.01 Turbines – Start-up and Ramp Rate Comparison[a]

Parameter	GE 7FA.03	GE 7HA.01
Cold start-up time (minutes)	60	35
Warm start-up time (minutes)	45	25
Hot start-up time (minutes)	30	17
Ramp Rate (MW/minute)	20	40
Minimum Emissions Compliance (% of full load)	41%	30%

[a]From initial firing to permit compliance. Data supplied by GE.

2.1.5 Rapid Fuel Switching

Like much of the Northeast, Connecticut has experienced periods of natural gas constraints, especially during the coldest days in the winter. Both the Frame 7FA.03 and Frame 7HA.01 are dual-fuel capable and the Project includes the ability to fire ULSD for up to 720 hours per year to ensure availability of the Project's output during critical winter conditions. GE reports that the GE Frame 7HA.01 can switch from natural gas to ULSD firing in 5 minutes, comparing favorably to the 7FA.03, which can switch fuels in 12 minutes. The ability to more rapidly switch fuels benefits the grid by providing greater flexibility and reliability.

2.1.6 Superior Environmental Performance

In addition to its superior efficiency, which results in lower emission rates on a lb/MW-hr basis, the GE Frame 7HA.01 represents the state-of-the-art emissions performance in terms of absolute emission rates (parts per million [ppm]). Table 2-4 provides a comparison between the Frame 7FA.03 and Frame 7HA.01 for key emission rates.

Table 2-4. GE Frame 7FA.03 and Frame 7HA.01 Turbines – Emission Rate Comparison[a]

Parameter	GE 7FA.03		GE 7HA.01	
Nitrogen Oxides (NO_x)	2.0 ppm	0.049 lb/MW-hr	2.0 ppm	0.046 lb/MW-hr
Volatile Organic Compounds (VOCs)	1.2 ppm	0.010 lb/MW-hr	1.0 ppm	0.008 lb/MW-hr
Carbon Monoxide (CO)	2.0 ppm	0.030 lb/MW-hr	0.9 ppm	0.013 lb/MW-hr
Particulate Matter (PM_{10}/$PM_{2.5}$)	0.008 lb/MMBtu[b]	0.053 lb/MW-hr	0.0038 lb/MMBtu	0.026 lb/MW-hr

[a]Natural gas firing, without supplemental firing, at full load.

[b]pounds per million British thermal units.

As shown in Table 2-4, the Frame 7HA.01 achieves lower emission rates for VOC, CO, and PM. Additional information regarding Project emissions is provided in Section 4.1.1.

2.1.7 Summary

On the basis of superior fuel efficiency and GHG performance, greater output within the same footprint, faster start-up and ramp times, rapid fuel switching capability, and superior emission rates, the GE Frame 7HA.01 provides significant advantages to the Project and to Connecticut. Therefore, CPV proposes to use the GE Frame 7HA.01 for the Project.

2.2 ADDITION OF DUCT FIRING

The current Project configuration incorporates the addition of duct firing. In addition to the efficiency improvements associated with technology selection, current market conditions reflect a need for additional efficient and flexible generation. By incorporating duct firing, the Project can rapidly increase output as market needs dictate within the same physical footprint and while maintaining compliance with the full range of environmental requirements. Duct firing provides incremental capacity in the steam cycle at a very low cost (on a dollars per kilowatt basis) and at a relatively good efficiency, making it one of the best forms of "peaking" capacity available. For example, duct firing at 90°F can add 53 MW in summer with an incremental heat rate of 8,224 Btu/kWh, and at 20°F can add 32 MW in the winter with an incremental heat rate of 8,234 Btu/kWh. Duct firing also has lower associated emission rates than other types of peaking power, such as simple-cycle turbines or diesel generators.

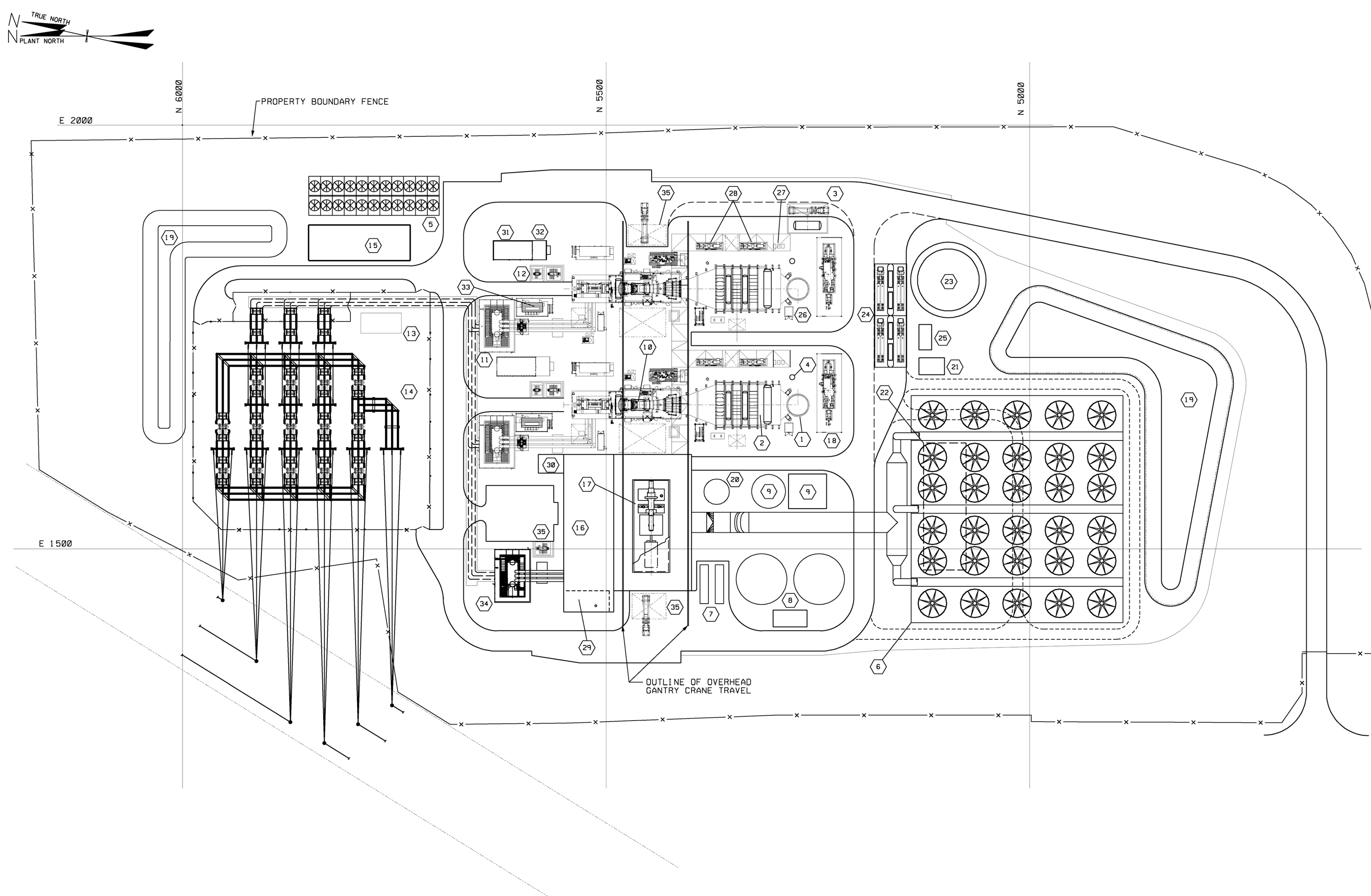
2.3 STACK LOCATION REPOSITIONING

Although first designated as "No Hazard to Air Navigation" in 1999, proximity to the Waterbury-Oxford Airport remains a factor in facility design. When assessing stack characteristics, it has been important to balance requirements associated with emission dispersion with other factors such as air traffic and visibility. The goal has been to identify the lowest stack practicable, and position it as far as possible from potential air traffic.

After detailed analysis, CPV determined the best approach would be to shift the stacks eastward, away from the nearby airport. The orientation and general layout of the Project remains the same, with repositioning accomplished by "flipping" the locations of the combustion turbines and the steam turbine (as shown in Figure 2). The movement of the stacks will avoid lateral navigation obstruction. The adjusted locations of the stacks has been submitted to the Federal Aviation Administration (FAA) for analysis and determination.

CPV Towantic Energy Center
Oxford, New Haven County, Connecticut

NOTES



LEGEND

1. STACK
2. HRSG
3. AQUEOUS AMMONIUM STORAGE TANK/UNLOADING AREA
4. BLOWDOWN TANK
5. AUXILIARY COOLING SYSTEM FIN FAN COOLER
6. AIR COOLED CONDENSER
7. DEMINERALIZED WATER TRAILERS
8. DEMINERALIZED WATER STORAGE TANKS/PUMP HOUSE (TWO (2) TANKS EACH 875,000 GAL.)
9. FIRE/SERVICE WATER STORAGE TANK & PUMP HOUSE
10. COMBUSTION TURBINE GENERATOR
11. CTG STEP-UP TRANSFORMER
12. ISOLATION TRANSFORMER/ EXCITATION TRANSFORMER
13. CONTROL HOUSE
14. SWITCHYARD
15. GAS METERING STATION
16. ELECTRICAL/BATTERY/ DIESEL GEN. ROOMS GND FLR OFFICE/CONTROL ROOMS SECOND FLR
17. STEAM TURBINE GENERATOR WITH ENCLOSURE
18. GAS HEATER, FILTER AND METERING
19. STORM WATER DETENTION POND
20. CONDENSATE STORAGE TANK
21. FIRE PROTECTION FOAM SYSTEM ENCLOSURE
22. ACC MECHANICAL/ELECTRICAL BUILDING
23. FUEL OIL STORAGE TANK WITH SECONDARY STEEL CONTAINMENT (1,500,000 GAL.)
24. FUEL OIL UNLOADING AREA
25. FUEL OIL FORWARDING PUMP/HEATER/FILTER SKID
26. CEMS ENCLOSURE
27. HRSG CHEM FEED
28. BOILER FEED WATER PUMPS
29. AUXILIARY BOILER ROOM (GROUND FLOOR)
30. EMERGENCY DIESEL GENERATOR ROOM
31. LOAD COMMUTATING INVERTER (LIC) COMPARTMENT
32. DC LINK REACTOR
33. GENERATOR EXCITATION COMPARTMENT
34. STG STEP-UP TRANSFORMER
35. EQUIPMENT REMOVAL AREA

GRAPHIC SCALE

0 30′ 60′ 120′ 180′

1" = 60.0′

Rev No	Revision	Date	Dwn	Chkd	Approved Chief Engr	Rev No	Revision	Date	Dwn	Chkd	Approved Chief Engr	Rev No	Revision	Date	Dwn	Chkd	Approved Chief Engr

Drawing Control				
Purpose	Approved By	Date	Released By	Date
For Information				
For Comment				
For Bid				
For Fabrication				
For Construction				

Engineering Review		
Disc	Engr	Date
Mech		
Elec		
Civil		
Arch		
Instr		
Drawn	Designed	Checked
JGF	JGF	

CPV TOWANTIC ENERGY CENTER
OXFORD, CONNECTICUT

GENERAL ARRANGEMENT
PLOT PLAN

BURNS AND ROE ENTERPRISES, INC.
Engineers and Constructors - Oradell, NJ
Connecticut License No. PEC 39

Lead Engineer	Date / Scale 1"=60′-0"	Approved for Construction: Chief MECHANICAL Engineer	Work Order	Drawing No	Sh	Rev
			3328	M300		C

$$DGNFILENAME$$
$$TIME$$
$$DATE$$

Figure 2.

Revised CPV Towantic Energy Center Layout

2.4 ADDITION OF PARCEL 9A

In May 2014, CPV entered into an Option Agreement for Purchase of Real Property associated with an additional 6-acre parcel, designated Lot 9A in the Woodruff Hill Industrial Park. This parcel is located adjacent to and south of the original property, bounded to the west by Woodruff Hill Road and to the south by the access drive associated with the nearby Algonquin Gas Transmission LLC's Oxford Compressor Station.

Similar to the original property, Lot 9A is characterized by gently rolling topography, ranging from 810 to 860 feet AMSL in elevation. Most of the land is open, agricultural fields with minimal wooded vegetation. Lot 9A has not been developed, aside from the infrastructure constructed during the improvement of the nearby roadways (e.g., drainage features).

Although integrating Lot 9A into the Project site provides only a small amount of additional acreage, benefits have resulted, most particularly allowing for appropriate area within which to accommodate current stormwater management requirements.

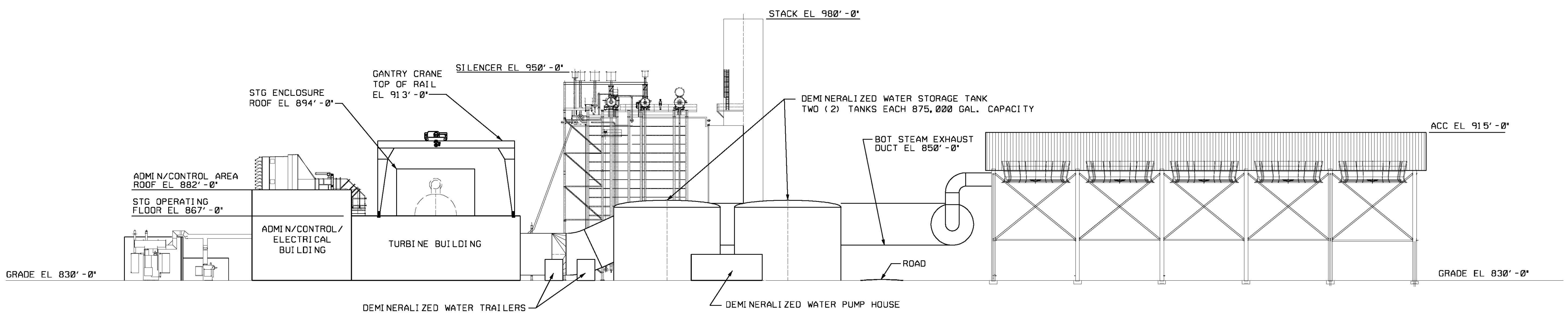
2.5 OTHER LAYOUT AND STRUCTURE ADJUSTMENTS

The updated GE technology and associated equipment results in certain structure height adjustments inherent in the technology. In addition, layout features were evaluated to determine if they reflected the most benefit for the updated Project, including several changes that could be made to result in more favorable visual and/or dispersion modeling effect. This resulted in certain minor structure height changes, as reflected in Figures 3 and 4:

- The building enclosure design inherent in GE's updated H technology allows for the elimination of a large 110-foot tall over-building for the combustion turbines. Much of that building enclosure consisted of open area for crane movement during outage periods. By eliminating the large structure, and incorporating three separate, smaller and shorter building enclosures (one for the steam turbine that is 64 feet tall and one for each of the combustion turbines that are 37 feet tall) and a crane rack, the Project visibility can be greatly reduced.
- Updated ACC technology is available that will result in the same performance with a slightly smaller footprint, and 31 feet shorter than the prior design.
- The HRSG height, previously 90 feet tall, is now 97 feet tall, with steel drums that are 110 feet tall and a silencer at 120 feet.
- The gas turbine inlet structure, previously 70 feet tall, is now 72 feet tall.
- The auxiliary boiler stack, previously 100 feet tall, is now 62 feet tall.
- ULSD storage, previously two 40-foot tall tanks, is now one tank that will be 48 feet tall.
- The single water storage tank will be replaced by two water storage tanks that are 42 feet tall.

As these layout adjustments were made, engineering consideration was given to additional features of the design that could be optimized. As noted above, one such change was adjustment of the stormwater management features, to shift detention areas from under the ACC (which was not recommended by the ACC vendor) to two locations to better reflect existing site drainage patterns. One area where a retaining wall was previously proposed will now be graded. The placement and sizing of the water and ULSD tanks have been revisited, with placement now adjusted to reflect a more efficient work arrangement and use of real estate. As previously noted, one larger oil tank is replacing the two oil tanks formerly proposed, and two water tanks where one was previously proposed. The revised site layout is shown in Figure 2.

CPV Towantic Energy Center
Oxford, New Haven County, Connecticut



ELEVATION LOOKING EAST
M202

GRAPHIC SCALE
0 15' 30' 60' 90'
1" = 30.0'

Engineering Review		
Disc	Engr	Date
Mech		
Elec		
Civil		
Arch		
Instr		
Drawn	Designed	Checked
JGF	JGF	

CPV TOWANTIC ENERGY CENTER
OXFORD, CONNECTICUT

GENERAL ARRANGEMENT
ELEVATION LOOKING EAST

BURNS AND ROE ENTERPRISES, INC.
Engineers and Constructors - Oradell, NJ
Connecticut License No. PEC 39

Lead Engineer	Date / Scale 1"=30'-0"	Approved for Construction: Chief MECHANICAL Engineer	Work Order	Drawing No	Sh	Rev
			3328	M301		B

Figure 3.

Revised CPV Towantic Energy Center Elevation Drawing

CPV Towantic Energy Center
Oxford, New Haven County, Connecticut

Figure 4.

Project Rendering

2.6 CONSTRUCTION AND OPERATION SCHEDULE

The construction and operational schedule has been updated to fit CPV's current plans. If approvals are received and a favorable outcome in the forward capacity market is achieved in February 2015, the Project would issue Notice to Proceed for construction in the second half of 2015 to support a commercial operation date of June 2018 . It is also possible, based on market conditions, that construction could be delayed for one year, initiating construction in the second half of 2016 and anticipating commercial operation by June 2019. No greater delay is anticipated.

2.7 CONCLUSION

The updated Project presents an opportunity to improve its efficiency and environmental performance, with impacts that continue to meet requirements protective of the community and the environment. In the following sections, changes that have occurred in environmental regulatory programs will be addressed, and the effect of the updated Project will be considered within the most recent context of requirements and policy.

3.0 CHANGES IN ENVIRONMENTAL REGULATION

This section discusses changes to regulations and standards that have occurred since the Project's current approvals and to which the Project is subject, including a discussion of environmental regulations and policies that have influenced the wholesale electric markets.

3.1 AIR QUALITY

The Connecticut Department of Energy and Environmental Protection (DEEP) has delegated authority to implement both USEPA and state environmental programs relating to air quality and emissions. Although the initial air permit was issued in 2004, an updated air permit was issued for the Project in 2010. In this filing and approval, all relevant regulatory updates to that point in time (e.g., updated National Ambient Air Quality Standards [NAAQS] for ozone, fine particulates, and lead; regional haze plans; and updated New Source Performance Standards [NSPS] applicable to the emergency generator and fire pump engine) were addressed, as well as an updated BACT analysis.

New NAAQS promulgated by the USEPA since the Project's most recent approvals are outlined below.

- New sulfur dioxide (SO_2) NAAQS – On June 2, 2010, USEPA strengthened the primary NAAQS for SO_2 by establishing a new 1-hour standard of 75 parts per billion (ppb), revoking the primary annual and 24-hour standards, but retaining the 3-hour standard. On March 14, 2013, DEEP recommended to USEPA a statewide designation of attainment with respect to the new 1-hour standard. Although USEPA has not yet made a formal attainment status designation, Connecticut is treated as "unclassifiable/attainment" with respect to the new standard.
- New nitrogen dioxide (NO_2) NAAQS – On January 22, 2010, the USEPA updated the NAAQS by adopting a new primary 1-hour standard of 100 ppb and retaining the existing primary and secondary annual standard of 53 ppb. Although USEPA utilizes an interim designation for all of Connecticut of "unclassifiable/attainment" for the 1-hour standard, a three-year near-road ambient monitoring program began in 2013 to determine whether peak traffic may cause adjustments of attainment status for some portions of the state.
- New $PM_{2.5}$ NAAQS – In addition to the more stringent 24-hour $PM_{2.5}$ standard that was incorporated in the Project's most recent air permit, on December 14, 2012, USEPA lowered the annual $PM_{2.5}$ standard to 12.0 micrograms per cubic meter (µg/m^3). All of Connecticut has been classified as "attainment" with respect to the annual and 24-hour $PM_{2.5}$ NAAQS, with redesignation of Connecticut's portion of the larger regional [5] $PM_{2.5}$ nonattainment area formalized by USEPA on October 24, 2013.

The Project has incorporated documentation of compliance with the new short-term standards for SO_2, NO_2, and $PM_{2.5}$ into the air permit application submitted to DEEP on September 8, 2014. The air permit application includes an air quality modeling demonstration that the Project will fully comply with the new NAAQS.

In addition to the above changes, since 1999, there have been major developments involving the regulation of GHG, including carbon dioxide (CO_2), in the State of Connecticut and on a regional basis that impact the Project. These developments include implementation of the Regional Greenhouse Gas Initiative (RGGI) program.

[5] Includes the states of New York and New Jersey, in addition to Connecticut.

As described in more detail by DEEP,[6] RGGI is a cooperative regional effort by Northeastern and Mid-Atlantic states to reduce CO_2 emissions. To help address climate change, the RGGI states operate the nation's first multi-state, CO_2 cap and trade program with a market-based emissions trading system applicable to the electricity generating sector. Under the program, fossil fuel-fired electricity generating facilities must hold one CO_2 allowance for each ton of CO_2 emitted at the end of each compliance period. Each state has a budget of allowances. The combined budgets comprise a regional cap on allowances available to generators within the region. The regional and state allowance caps are reviewed and periodically reduced to drive continued reductions in CO_2 emissions from the electricity generating sector.

In December 2013, Connecticut and the other RGGI states enacted substantive changes to strengthen RGGI and build on the more than 40% reduction in CO_2 emissions from the electricity generating sector in the RGGI states that occurred between 2005 and 2012. Each state committed to reducing its annual allowance budget to be consistent with recent emissions and to account for the surplus of banked allowances that accumulated over time due to the rapid decline in emissions. These changes were based on the outcome of a two-year program review conducted in accordance with the RGGI Memorandum of Understanding between Connecticut and the eight other RGGI states. The RGGI states agreed to reduce future regional CO_2 allowance budgets and the states' allocations under each budget to more closely align with current CO_2 emissions within the region and drive continued reductions in CO_2 emissions from the electricity generating sector. Proceeds from the auction of allowances will continue to be targeted for energy efficiency measures and the development of Class I renewable energy sources. The RGGI region's 2014 – 2020 Adjusted Base Budgets are outlined in Table 3-1.

Table 3-1. CO_2 Allowances for the RGGI Region

Year	RGGI Cap tons per year (tpy)	RGGI Adjusted Cap (to account for banked allowances) (tpy)
2014	91,000,000	82,792,336
2015	88,725,000	66,833,592
2016	86,506,875	64,615,467
2017	84,344,203	62,452,795
2018	82,235,598	60,344,190
2019	80,179,708	58,288,301
2020	78,175,215	56,283,807

Implementation of RGGI in Connecticut is an important part of the state's overall *Climate Change Action Plan*. On June 6, 2014, DEEP issued its report entitled *Taking Action on Climate Change – 2014 Progress Report*[7] assessing Connecticut's progress in meeting its CO_2 reduction and climate change goals. This report concludes that Connecticut has met its initial GHG emission reduction goal of returning to 1990 levels by 2010, is making good progress towards its further GHG reduction goals, and has made significant progress in implementing critical GHG reduction strategies identified by the 2005 Climate Change Action Plan and the 2013 Comprehensive Energy Strategy.

[6] http://www.ct.gov/deep/cwp/view.asp?a=2684&q=332278&deepNav_GID=1619.
[7] http://www.ct.gov/deep/lib/deep/climatechange/ct_progress_report_2014.pdf.

In addition to the RGGI program, effective January 2, 2011, new or modified major sources in Connecticut are required to consider GHG emissions in permits issued under both the New Source Review (NSR) and Prevention of Significant Deterioration (PSD) programs. Applicants for new or modified projects that exceed major source thresholds for criteria pollutants and the GHG thresholds identified in the June 29, 2012 GHG Tailoring Rule will be subject to the PSD program for GHG emissions, including the requirement to apply BACT. The Supreme Court's decision on June 23, 2014 in the Utility Air Regulatory Group versus USEPA regarding the GHG Tailoring Rule upheld the GHG BACT requirements that will apply to the Project.

On March 27, 2012 (published in the *Federal Register* on April 13, 2012), USEPA proposed the first NSPS for CO_2 from new power plants. The NSPS would establish an annual CO_2 emission limit based on project efficiency of 1,000 lb/MW-hr of CO_{2e} on a rolling 12-month basis. On September 20, 2013, after considering more than 2.5 million comments from the public about the 2012 proposal and recent trends in the power sector, USEPA issued a revised proposed NSPS, changing some aspects of its approach. The proposed NSPS is expected to be finalized by January 2015.

The Project's air permit application also includes a demonstration that the proposed combustion turbines' superior efficiency represents BACT for GHG emissions, which is well below the proposed NSPS. As was the case in the 2010 permit, the Project will be required to obtain RGGI allowances each year to match its annual CO_2 emissions.

3.2 STORMWATER

USEPA regulates all discharges to waters of the United States, including stormwater, under the National Pollutant Discharge Elimination System (NPDES) program. Stormwater NPDES permitting authority has been delegated to DEEP, who have established General Permits, under which applicants may apply for coverage. The Project, as most recently approved, incorporated compliance with General Permit standards in place at that time. Periodic updates occur to General Permits, with the following now reflecting current standards:

- General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities (Construction General Permit) – The Construction General Permit was reissued by DEEP on August 21, 2013, with an effective date of October 1, 2013. Coverage under the Construction General Permit is required for any construction project disturbing greater than 1 acre. The need for a Stormwater Management Plan developed consistent with Low Impact Development Principles, as well as other standards, is outlined in the reissued permit. Details for required standards are outlined in the 2004 Connecticut Stormwater Quality Manual, which was issued subsequent to the Project's original approval and substantially increased the consideration of water treatment and use of natural drainage features.

- General Permit for the Discharge of Stormwater Associated with Industrial Activity (Industrial General Permit) – A significant update to the Connecticut industrial activity stormwater program occurred in 2010 (effective October 1, 2011) with the release of the hybrid multi-sector permit process. Considerably more stringent control measures (as noted above), as well as specific requirements focused on certain industries (including steam electric generating facilities). The current Industrial General Permit became effective on October 1, 2011 and was modified on December 3, 2013. To seek coverage under this permit, applicants must submit a registration form, and implement a Stormwater Pollution Prevention Plan (SWPPP) addressing information about the site, an inventory of exposed materials, a summary of potential pollutants, and a description of and schedule for implementation of stormwater control methods, stormwater monitoring, and site inspection.

The additional acreage now incorporated into the Project has facilitated an improved stormwater management design that complies with currently applicable requirements, reflecting standards in the 2004 Connecticut Stormwater Quality Manual as well as other standards set forth in the Construction General Permit and Industrial General Permit. Low Impact Development Principles have been incorporated into the Project's design, resulting in a stormwater strategy that maintains pre-development hydrology through the use of site design principles and treatment practices distributed throughout the site to manage stormwater runoff volumes and quality. Prior to construction and operation, respectively, SWPPPs will be updated to reflect the current design and standards, and appropriate filings made. It is anticipated that a "no exposure" certification will be appropriate during operation, as no contact stormwater will be routed through the stormwater features.

3.3 WETLANDS

At the state level, wetland permitting is implemented by local Inland Wetland Commissions; however, in this case, the Council decision integrates state wetland permitting requirements that supersede local inland wetland jurisdiction. No regulatory changes are known to have occurred at the state level that would influence the Project.

In Connecticut, federal permitting for wetlands is overseen by the New England District of the United States Army Corps of Engineers (USACE). In the New England District, federal Nationwide Permits have been replaced with State General Permits. State General Permits take advantage of strong state coastal and inland wetland protection laws to reduce duplication in review between the USACE and the state and streamline the permitting process under federal regulation.

At the federal level, changes to 40 Code of Federal Regulations (CFR) 230, with an effective date of June 9, 2008, updated specific definitions, terms, conditions, and guidelines pertaining to compensatory mitigation. Although the adjustments did not alter the characteristics that prompt compensatory mitigation, additional details were added to regulate how mitigation is conducted and when mitigation activities can be deemed complete.

In 2011, the Connecticut Programmatic General Permit (PGP) that was issued in 2001 was replaced by the Connecticut General Permit. Generally, the 2011 Connecticut General Permit reorganized and expanded on the same conditions (previously called requirements) included in the 2001 Connecticut PGP. The 2011 Connecticut General Permit:

- Expands and provides more specificity regarding avoidance, minimization and compensatory mitigation;
- Defines more clearly the requirements for consideration of secondary and cumulative impacts;
- Expands the requirements for characterization of protected species habitat;
- Adds consideration of the introduction of invasive plant species; and
- Includes new requirements for vernal pool surveys and assessment of project impacts.

In March 2013, the USACE reissued the compensatory mitigation rule providing improved, consolidated regulations and guidance for mitigation banks, in-lieu fee programs, and permittee-responsible mitigation. In accordance with this ruling, the Connecticut In-Lieu Fee (CT ILF) Program was established on August 21, 2013 as a joint venture between the USACE and Audubon Connecticut (Audubon CT), the Connecticut program of the National Audubon Society, Inc.

Designed to provide an alternative to the permittee-responsible compensatory mitigation, the CT ILF Program requires an applicant for a USACE permit to pay a compensation fee in lieu of other forms of compensatory mitigation. This recognizes that targeting larger areas specifically identified for ecological value may provide greater benefit than smaller, on-site replication areas. A decision is made by the USACE on a case-by-case basis regarding applicability of mitigation strategy. If it is determined that payment into the CT ILF Program is appropriate, the USACE will calculate a per-acre fee (the Project's location in the Housatonic River Service Area had August 2013 fees noted of $7.56/square foot) that must be paid prior to commencement of Project construction. Although Audubon CT does not participate in the USACE permit decision, it oversees the execution of the mitigation projects funded through the CT ILF Program.

The Project, as will be discussed in Section 4.1.3, is in the process of obtaining USACE wetland authorization through the Connecticut General Permit, including consideration of appropriate mitigation.

3.4 WATER QUALITY

DEEP has been delegated authority to implement federal and state water quality standards under the Clean Water Act. The most recent update to Connecticut's water quality standards became effective on February 25, 2011, after approval by the USEPA. Revisions to the standards included:

- Modifications to anti-degradation provisions for consistency with federal requirements;
- Changes to dissolved oxygen criteria for marine waters;
- Inclusion of a nutrient control implementation strategy;
- Incorporation of new standards for aluminum, chloride and formaldehyde; and
- Revision of aquatic life criteria for cadmium, silver and acrolein.

None of these updates pose a concern for the Project, and the Project's wastewater discharge permit, conditionally approved on February 26, 2014 (Appendix A), reflects consistency with the most recent standards and guidelines.

3.5 FEDERAL AVIATION ADMINISTRATION

Pursuant to 49 CFR 77, the FAA requires a Notice of Proposed Construction or Alteration for any structure higher than 200 feet (or less if more proximate to an airport). Although the FAA issued a final ruling on amendments to the regulations on July 21, 2010, which became effective on January 18, 2011, the changes had no particular bearing on the Project. FAA review of the updated locations of the proposed stacks has been requested under the FAA's current regulatory framework.

3.6 ENVIRONMENTAL JUSTICE

Although updates to terminology and requirements for environmental justice review occurred in 2012, the Project is not located within an environmental justice community and these requirements do not apply.

3.7 ENVIRONMENTAL PROGRAMS INFLUENCING THE WHOLESALE ELECTRIC MARKETS

Although not requirements for the Project, other new and evolving environmental programs have influenced the Project by creating a strong need for this type of energy generation (i.e., efficient, fast-start, environmentally responsible dual fuel capable combined-cycle facilities). In particular, certain regulatory programs have put increasing pressure on older, less efficient generating facilities that have led to the retirement of certain coal, oil, and nuclear energy generation units. Even those generating facilities that will continue to operate will face increased environmental compliance costs that may have a direct bearing on their competitiveness in the energy marketplace. As environmental pressures increase, the addition of efficient facilities like the Project that are able to meet current standards, becomes increasingly important to system reliability and consumer cost. The following sections briefly outline key areas of regulatory change since the Project's current approvals that have the potential to affect existing units and further support the importance of this Project.

- Mercury and Air Toxics Standards – In 2012, USEPA updated emission limits for mercury and other air toxics for coal- and oil-fired steam electric boilers. Following a legal challenge (*White Stallion Energy Center, LLC versus USEPA and Utility Regulatory Group versus USEPA*), the United States Court of Appeals for the District of Columbia Circuit (DC Circuit Court of Appeals) fully upheld the rule on April 15, 2014. As a result, all new and existing coal- and oil-fired steam electric plants will be required to meet specific numeric emission limits for mercury, particulate matter, and acid gases beginning in April 2015. This will necessitate installation and operation of new emissions control technology on existing plants not so equipped, as well as increased operating costs for compliance with those standards, creating a need and providing a competitive advantage for new, lower emitting natural gas-fired facilities, like the Project.
- Proposed GHG Rule – USEPA has proposed "Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Generating Units," which was published in the *Federal Register* on June 18, 2014. The proposed rule would establish state-wide average GHG emission limits in units of lb/MW-hr for all electric generating units. The overall goal of the rule is to reduce nationwide GHG emissions from electric generation by 30% from a 2005 baseline by 2020. Economically or technically feasible control systems to reduce GHG emissions from existing electric generating units do not currently exist and are not expected to be available in the near-term. Therefore, in order to comply with the proposed emission limit, it is likely that there will be pressure to reduce the percentage of generation from coal- and oil-fired units. This would greatly increase the need for new, more efficient, lower GHG-emitting units in the state, like the Project. With its demonstration of BACT for GHGs and efficient use of GE's 7HA.01 technology, the Project will have the lowest GHG emissions per MW-hr of any fossil fuel-fired technology.
- Clean Water Act Section 316(b) – Recently implemented amendments to the Clean Water Act affect facilities, including electric generating units, that draw cooling water from waters of the United States. Affected facilities, especially those that employ "once-through" cooling systems, will need to make significant modifications to their water intake systems, to reduce impacts to aquatic organisms. This could, in some instances, necessitate retrofit of closed-cycle (cooling tower) systems that may be cost-prohibitive, resulting in additional plant retirements. Connecticut has significant once-through cooled electric generating capacity, including the Millstone nuclear plant.
- Effluent Limitation Guidelines – USEPA has proposed new effluent limitation guidelines for steam electric power plants, which are expected to be finalized by September 30, 2015. The new guidelines will result in the need for coal-fired power plants to replace wet ash handling systems with dry systems. In addition, significant wastewater treatment system upgrades will be needed at most coal plants for treating flue gas desulfurization system effluent, placing greater financial stress on those resources.
- Coal Combustion Residuals Rule – On June 21, 2010, USEPA proposed new rules for managing coal combustion residuals. Although various regulatory alternatives are still under consideration, discontinued use of ash ponds and their closure is a common element of all of the alternatives. This will have significant capital cost implications for many coal-fired generators, placing greater financial risk on those resources.

The implementation of the increasingly stringent environmental regulations discussed above places a significant amount of existing generation at risk of retirement. ISO-NE projects that 8,300 MW (a portion of which are older oil and coal units) of non-gas-fired generation are at risk of retirement due in part to environmental mandates; of these, approximately 2,400 MW reside in Connecticut.[8] In 2013 alone, nearly 2,700 MW of generation in New England announced their retirement.[9]

The addition of a new, highly efficient natural gas-fired facility in Connecticut will mitigate the risk of failing to meeting regional reliability requirements through the retirement of large existing generating resources by adding cost-effective and environmentally friendly generating units to the grid, helping to ensure the integrity and stability of the bulk power system.

[8] ISO-NE Infrastructure Needs: Electricity-Natural Gas Interdependencies, April 21, 2014, at 4.

[9] ISO-NE 2014 Regional Outlook.

4.0 ENVIRONMENTAL ANALYSIS

The following sections provide a discussion of:

- Environmental analyses that have changed relative to the updated Project; and
- Environmental and community conditions that have been reviewed and confirmed to remain fundamentally unchanged and, therefore, there is no associated Project change.

In all cases, the Project continues to reflect minimal environmental and community impact, and in some cases, reflects greater environmental benefit than the original configuration. The Project as proposed also complies with the latest updates to environmental regulations, policies, and standards.

4.1 ENVIRONMENTAL UPDATES

4.1.1 Air Quality

The Project, based on F-class GE technology and generating a nameplate net output of 512 MW, is proposed to be updated to H-class GE technology with a nameplate net output of 785 MW.[10] CPV has reduced emission rates where possible, and has completed a full analysis of the Project's potential effects on air quality as a part of its Permit Application for Stationary Source of Air Pollution/New Source Review (Air Permit Application), which was filed with DEEP on September 8, 2014.

The Project continues to incorporate BACT and, for NO_x emissions, Lowest Achievable Emission Rate (LAER) technology using the same stringent controls. Dry low-NO_X combustion in conjunction with selective catalytic reduction (SCR) will control NO_X emissions when firing natural gas. Water injection with SCR will control NO_X emissions when firing ULSD. An oxidation catalyst will control emissions of CO and VOC. Emissions of SO_2, $PM_{10}/PM_{2.5}$, and sulfuric acid (H_2SO_4) are controlled through good combustion practices and selection of the cleanest available fuels.

Table 4-1 provides a comparison of the GE 7FA.03 emission rates operating on natural gas (the Project's primary fuel) to the GE 7HA.01 emission rates currently proposed.

Table 4-1. Comparison of GE 7FA.03 and GE 7HA.01 Natural Gas Fired Emissions (Unfired)

	GE 7FA.03 (gas)	GE 7HA.01 (gas)
NO_x	2.0 ppm	2.0 ppm
VOC	1.2 ppm	1.0 ppm
CO	2.0 ppm	0.9 ppm
$PM_{10}/PM_{2.5}$	0.008 lb/MMBtu	0.0038 lb/MMBtu
SO_2	0.00081 lb/MMBtu	0.0015 lb/MMBtu
H_2SO_4	0.00072 lb/MMBtu	0.0011 lb/MMBtu

Note that, for the majority of pollutants, Project emission rates remain the same or have been decreased. The increases in emission rates for SO_2 and H_2SO_4 reflect a change in assumptions regarding the sulfur content of the natural gas that will be supplied through the regional system. Although the current permit

[10] Full load at 59°F, natural gas firing, with duct firing.

had a lower assumption for sulfur content, the Project update reflects an assumption of 0.5 grains per 100 cubic feet of natural gas, reflecting USEPA's definition of pipeline quality natural gas under the Acid Rain regulations.[11] The quality of natural gas supplied to the Project is an external factor outside of CPV's control; the emission rates reflected above still represent BACT levels for those pollutants.

The updated Project proposes to incorporate supplemental duct firing as a means to generate additional MW when needed; duct firing is not currently reflected in the existing permit. Under duct-fired conditions, all emission rates remain less than the currently permitted levels without duct firing except for VOC, which is 2.0 ppm for duct firing. For duct-fired operation, this emission rate reflects BACT. The Project's incremental output is more efficient than any existing facility in Connecticut for providing response to peak power needs.

Both the permitted and the proposed configurations include use of ULSD for no more than 720 hours per year in order to enhance Project reliability and flexibility. Table 4-2 provides a comparison of the GE 7FA.03 emissions rates operating on ULSD to the GE 7HA.01 emissions rates currently proposed.

Table 4-2. Comparison of GE 7FA.03 and GE 7HA.01 ULSD Fired Emissions

	GE 7FA.03 (ULSD)	GE 7HA.01 (ULSD)
NO_x	5.9 ppm	5.0 ppm
VOC	2.0 ppm	2.0 ppm
CO	2.0 ppm	2.0 ppm
$PM_{10}/PM_{2.5}$	0.019 lb/MMBtu	0.020 lb/MBtu
SO_2	0.0015 lb/MMBtu	0.0015 lb/MMBtu
H_2SO_4	0.00086 lb/MMBtu	0.0012 lb/MMBtu

As can be seen, a reduction in NO_x is reflected in the updated Project emissions when firing ULSD. The currently proposed emission rates reflect BACT/LAER for the Project.

In addition to improved performance on a lb/MMBtu basis, the Project has improved performance on a lb/MW-hr basis due to the increased efficiency of the selected turbine technology. Table 4-3 provides a comparison of the currently permitted configuration to the proposed Project on an electrical output basis. The emissions are improved over the current permit configuration due to the lower rates as noted above and the higher efficiency of the 7HA.01 combustion turbine.

Table 4-3. Comparison of GE 7FA.03 and GE 7HA.01 Emissions per Megawatt-Hour

	GE 7FA .03 (gas)	GE 7HA.01 (gas)
NO_x	0.049 lb/MW-hr	0.046 lb/MW-hr
VOC	0.010 lb/MW-hr	0.008 lb/MW-hr
CO	0.030 lb/MW-hr	0.013 lb/MW-hr
$PM_{10}/PM_{2.5}$	0.053 lb/MW-hr	0.026 lb/MW-hr

[11] Pipeline natural gas is defined under 40 CFR 72.2 as "Pipeline natural gas contains 0.5 grains or less of total sulfur per 100 standard cubic feet."

	GE 7FA .03 (gas)	GE 7HA.01 (gas)
SO_2	0.0053 lb/MW-hr	0.0094 lb/MW-hr
H_2SO_4	0.0048 lb/MW-hr	0.0069 lb/MW-hr
GHG (as CO_{2e})[a]	785.5 lb/MW-hr	742.55 lb/MW-hr

[a] At 59°F without supplemental firing, gross output basis, new and clean, GE initial performance specification.

The annual tpy emissions are developed to reflect a cap above which the Project will not be allowed to emit, and reflect all combustion turbine operating conditions including duct firing hours, ULSD firing hours, start-up and shutdown conditions, and ancillary equipment. With the increase in output, the annual values have changed. For some pollutants (CO and $PM_{10}/PM_{2.5}$/), the improved emissions result in a decrease in overall tpy, despite the increase in output. However, as would be expected with the higher generation output, in most cases the updated Project reflects an increase in the annual Potential to Emit[12]. Table 4-4 provides a comparison for the turbines only between the GE 7FA.03 and the GE 7HA.01.

Table 4-4. Comparison of GE 7FA.03 and GE 7HA.01 Combustion Turbine Potential to Emit

	GE 7FA.03 (tpy)	GE 7HA.01 (tpy)	Difference (tpy)
NO_x	133.6	189.3	+55.7
VOC	26.4	49.0	+22.6
CO	171.8	128.9	-42.9
$PM_{10}/PM_{2.5}$	196.6	153.3	-43.3
SO_2	14.2	39.4	+25.2
H_2SO_4	11.4	25.3	+13.9
GHG[a]	1,969,087	2,656,017	+686,930

[a]As CO_{2e}

The Air Permit Application reflects and assesses the above emission levels, including a detailed analysis of the range of potential operating conditions (at various loads and temperatures) through a dispersion modeling analysis. The dispersion modeling, in addition to normal combustion turbine and duct firing operation, incorporates start-up and shutdown conditions as well as ancillary equipment. Table 4-5 presents a comparison of the Project's modeled impact concentration to USEPA's Significant Impact Levels (SILs), NAAQS, and PSD Increments.

[12] The Potential to Emit establishes a theoretical maximum that cannot be exceeded by the Project.

Table 4-5. Maximum Predicted Impact Concentration for CPV Towantic Energy Center

Pollutant	Averaging Period	Impact Concentration ($\mu g/m^3$)	SIL ($\mu g/m^3$)	NAAQS Standards ($\mu g/m^3$)	PSD Class II Increment ($\mu g/m^3$)
NO_2	1-hour	12.9	7.5	188	NA
	Annual	1.4	1	100	25
CO	1-hour	301.9	2,000	40,000	NA
	8-hour	176.3	500	10,000	NA
PM_{10}	24-hour	4.2	5	150	30
	Annual	0.29	1	NA	17
$PM_{2.5}$	24-hour	4.2	1.2	35	9
	Annual	0.29	0.3	12	4
SO_2	1-hour	2.7	7.8	196	NA
	3-hour	1.4	25	1,300	512
	24-hour	0.5	5	365	91
	Annual	0.03	1	80	20

As can be seen from Table 4-5, Project impacts are below SILs for most pollutants and averaging periods. As was the case for the currently permitted configuration, NO_2 levels exceed both the annual SIL and 1-hour SIL. In addition, the 24-hour $PM_{2.5}$ SIL is exceeded. For pollutants with predicted modeled concentrations above a SIL, cumulative modeling with other existing regional sources was conducted for those pollutants, in accordance with DEEP guidance. Table 4-6 presents the results of the cumulative NAAQS compliance assessment for NO_2 and $PM_{2.5}$, which includes the predicted cumulative impacts of the Project and existing regional sources plus the representative ambient background concentrations for all receptors and time periods where the SIL is exceeded.

Table 4-6. CPV Towantic Energy Center Cumulative NAAQS Compliance Assessment

Pollutant	Averaging Period	Cumulative Impact Concentration[1] ($\mu g/m^3$)	Ambient Background ($\mu g/m^3$)	Total Impact Plus Background ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
NO_2	1-Hour	81.8	87	168.8	188
	Annual	1.9	21	22.9	100
$PM_{2.5}$	24-hour	3.5	24	27.5	35

[1] Total cumulative impact concentrations based on consideration of all receptors and time periods where the Project has a predicted significant impact concentration (based on 5-year average maximum H1H and lower ranked concentration).

As shown in Table 4-6, the resulting total concentrations for NO_2 and $PM_{2.5}$ are below the corresponding NAAQS concentrations, even conservatively assuming that all NO_X emitted is converted to NO_2 for 1-hour concentrations.

The PSD NSR program also requires a demonstration that the proposed Project, in combination with other PSD increment-consuming emission sources, will comply with the maximum allowable PSD "increment." This analysis is required because the Project is subject to PSD review for $PM_{2.5}$ and also has maximum predicted 24-hour $PM_{2.5}$ and annual NO_2 impacts greater than the corresponding SILs.

Table 4-7 presents the results of the PSD increment compliance assessment for 24-hour $PM_{2.5}$ and annual NO_2.

Table 4-7. CPV Towantic Energy Center Cumulative PSD Increment Compliance Assessment

Pollutant	Averaging Period	Total Increment Consumption[1] (µg/m^3)	Maximum Allowable PSD Increment (µg/m^3)
NO_2	Annual	2.4	25
$PM_{2.5}$	24-hour	4.2	9

[1] Impact concentrations are conservatively based on the maximum highest first highest (H1H) concentration predicted across the range of modeled years.

To comply with the requirements of Non-attainment New Source Review for NO_x, the proposed Project is required to obtain offsets at a minimum ratio of 1.2 to 1.0. The Project had previously acquired 177 offsets, and will acquire 57 additional offsets prior to initial operation from within the regional airshed to meet its adjusted emissions values. Once operational, the Project will also be required to obtain allowances to offset SO_2 emissions under the federal Acid Rain Program and NO_x allowances to offset ozone season NO_x emissions under the Clean Air Interstate Rule, as implemented by Connecticut.

As noted in Section 3.1, air quality regulation and policy has changed since the Project's current permit was issued. The above analysis and Project design reflects compliance with the more stringent SO_2, NO_2, and $PM_{2.5}$ NAAQS, as well as with the GHG rules establishing NSPS and BACT requirements. The Project continues to meet air quality standards that are protective of human health and the environment, even with the additional output that will benefit the wholesale electric markets.

4.1.2 Water Supply, Use and Discharge

4.1.2.1 Water Demand and Source

As is currently approved for the Project, water will be supplied to the Project by the Heritage Village Water Company (Heritage). As shown on the water balance provided as Figure 5, the quantity of water to be supplied by Heritage is expected to be in the range of 33.9 to 40.8 gallons per minute (gpm) average (48,816 to 58,752 gallons per day [gpd]) when the fuel is natural gas and the ambient temperature is not high enough to use the evaporative coolers (59°F or less). When the fuel is natural gas and the evaporative coolers are in operation, the quantity of water supplied by Heritage is expected to be in the range of 98.2 to 102.2 gpm (141,408 to 147,168 gpd). Prior water demand was approximately 41 gpm when firing natural gas. Instantaneous demands had previously been approximately 144 gpm, with water demand not exceeding 100,000 gpd.

If the supply of natural gas is interrupted and ULSD is used as the fuel, the quantity of water required will be in the range of 663 to 712 gpm (954,720 to 1,025,280 gpd); this higher range is a result of the water that will be injected into the gas turbines to control NO_x emissions. The increased water demand associated with oil firing was previously 749,000 gpd.

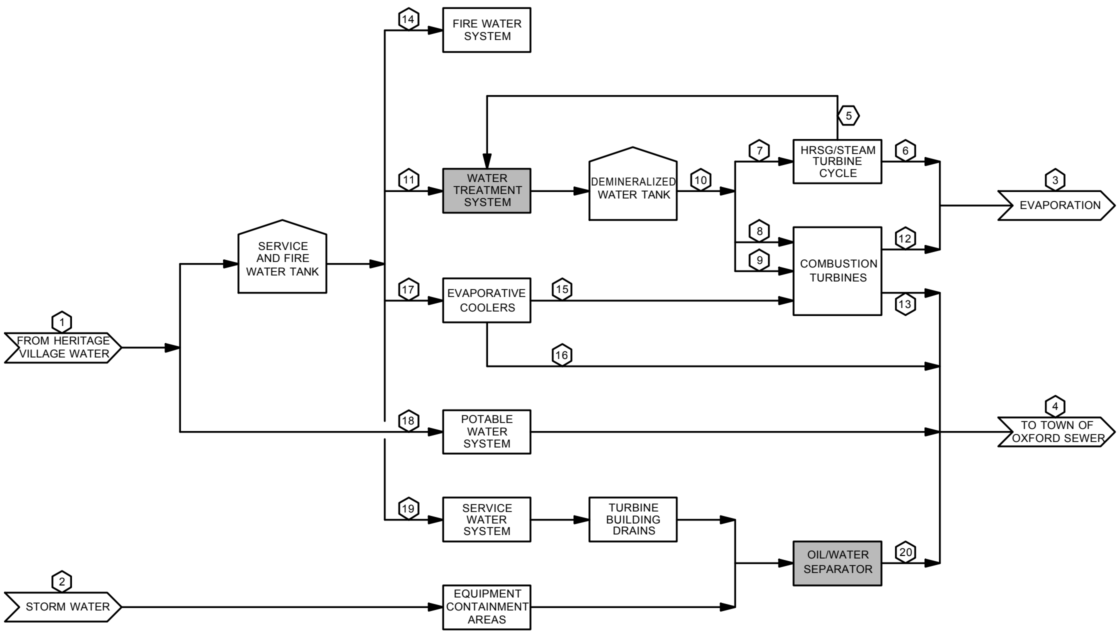
The Project previously proposed to limit its withdrawal from Heritage to 152 gpm or 218,000 gpd, and is expected to maintain that limitation pending the outcome of discussions with Heritage to determine whether additional supplies can be secured without stressing the permitted safe yield of 2.052 million gallons per day (mgd). The balance of the Project's requirements is expected to be met by on-site storage. CPV expects that it can limit any additional supplies to only the winter heating months (November – March) and to only 720 hours within that time period, consistent with the expected maximum limits for oil firing in the Project's air permit.

Burns and Roe

WATER BALANCE

CPV TOWANTIC ENERGY CENTER - OXFORD, CT

PREPARED BY: C. CROSMAN
JULY 16, 2014



CPV Towantic Energy Center
Oxford, New Haven County, Connecticut

Figure 5. (Page 1 of 2)

Water Balance

Burns and Roe

PREPARED BY: C. CROSMAN
JULY 16, 2014

WATER BALANCE
CPV TOWANTIC ENERGY CENTER - OXFORD, CT

CORRESPONDING HEAT BALANCE NUMBER	1	4	DO-1	6	DO-3	7	DO-4	10	DO-5	12	13	DO-6
FUEL	GAS	GAS	OIL	GAS	OIL	GAS	OIL	GAS	OIL	GAS	GAS	OIL
NET PLANT OUTPUT, MW	836.9	775.2	716.1	791.2	716.5	777.5	702.8	744.3	691.1	745.5	702.5	635.4
AMBIENT TEMPERATURE, °F	-14.2	-14.2	-14.2	20.0	20.0	50.0	50.0	59.0	59.0	90.0	90.0	90.0
RELATIVE HUMIDITY, %	20	20	20	60	60	60	60	60	60	60	60	60
NUMBER OF OPERATING GAS TURBINES/HRSGs	2	2	2	2	2	2	2	2	2	2	2	2
GAS TURBINE LOAD, %	100	100	100	100	100	100	100	97	100	100	100	100
EVAPORATIVE COOLERS	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON
DUCT BURNING, %	27	0	0	0	0	0	0	0	0	19	0	0

NUMBER	DESCRIPTION	FLOW RATE - AVERAGE GALLONS PER MINUTE											
1	WATER SUPPLIED BY HERITAGE VILLAGE WATER COMPANY	40.8	34.3	695	35.2	712	34.9	718	33.9	701	102.2	98.2	663
2	STORMWATER COLLECTED IN CONTAINED AREAS	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
3	TOTAL EVAPORATION LOSSES	37.1	30.6	692	31.5	709	31.2	714	30.2	698	77.2	73.2	639
4	DISCHARGE TO TOWN OF OXFORD SEWER	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	26.5	26.5	25.4
5	BLOWDOWN FROM TWO (2) HRSGs	74.2	61.3	46.8	63.0	47.6	62.4	47.9	60.4	47.5	69.2	61.1	46.6
6	EVAPORATIVE LOSSES FROM HRSG/STEAM TURBINE CYCLE	37.1	30.6	23.4	31.5	23.8	31.2	24.0	30.2	23.8	34.6	30.6	23.3
7	DEMINERALIZED WATER MAKEUP TO HRSG/STEAM TURBINE CYCLE	111.3	91.9	70.2	94.6	71.3	93.6	71.9	90.6	71.3	103.8	91.7	70.0
8	WATER INJECTED INTO COMBUSTION TURBINES DURING OIL FIRING	0	0	668	0	685	0	690	0	674	0	0	575
9	DEMINERALIZED WATER USED FOR OFF LINE WASH	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
10	TOTAL DEMINERALIZED WATER PRODUCED	111.9	92.6	739	95.2	757	94.3	763	91.2	746	105	92.4	646
11	SERVICE WATER USED IN WATER TREATMENT SYSTEM	37.8	31.3	692	32.2	709	31.9	715	30.9	698	35.3	31.3	599
12	TOTAL WATER EVAPORATED IN COMBUSTION TURBINES	0	0	668	0	685	0	690	0	674	42.6	42.6	616
13	COMBUSTION TURBINE OFF LINE WASH WASTE WATER	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
14	FIRE PROTECTION WATER	0	0	0	0	0	0	0	0	0	0	0	0
15	EVAPORATION FROM TWO (2) EVAPORATIVE COOLERS	0	0	0	0	0	0	0	0	0	42.6	42.6	40.3
16	BLOWDOWN FROM TWO (2) EVAPORATIVE COOLERS	0	0	0	0	0	0	0	0	0	21.3	21.3	20.2
17	MAKEUP TO TWO (2) EVAPORATIVE COOLERS	0	0	0	0	0	0	0	0	0	63.9	63.9	60.5
18	POTABLE WATER USES	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
19	MISCELLANEOUS SERVICE WATER USES	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
20	DISCHARGE FROM OIL/WATER SEPARATOR	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5

NOTES:
1. STORMWATER FLOW RATES SHOWN ABOVE ARE BASED ON YEARLY AVERAGE RAINFALL OF 51.1 INCHES.
2. THE ABOVE ASSUMES THAT HRSG BLOWDOWN WILL BE COOLED WITHOUT USING QUENCH WATER, TREATED IN THE MAKEUP DEMINERALIZER SYSTEM, AND REUSED IN THE HRSG/ STEAM TURBINE CYCLE.

COMPETITIVE POWER VENTURES CPV TOWANTIC ENERGY CENTER

CPV Towantic Energy Center
Oxford, New Haven County, Connecticut

Figure 5. (Page 2 of 2)

Water Balance

Most of the water will be stored in two 875,000-gallon service and fire water storage tanks and then supplied to the fire water, demineralized water treatment, evaporative cooler, and service water distribution systems. Demineralized water will be used for makeup to the HRSG/steam turbine cycle, injection into the combustion turbines for NO_x control during ULSD firing, and combustion turbine washing. A small portion of the water supplied by Heritage will bypass the service and fire water tank and be used in the potable water system.

Design features to minimize the quantity of water needed from Heritage that were not present in the currently permitted configuration, but have been incorporated into the current Project are, as follows:

- In the current Project, turbine lubrication oil and other auxiliary systems will be cooled by heat transfer to the atmosphere in a fin-fan type cooler. The currently permitted configuration included a wet surface air cooler which would have consumed water for evaporative cooling.
- In the current Project, HRSG blowdown will be cooled by a combination of either heat recovery or heat transfer to the atmosphere in a fin-fan cooler. HRSG blowdown will then be treated in the water treatment system and reused in the HRSG/steam turbine cycle. The currently permitted configuration would have used additional water to quench HRSG blowdown and for HRSG/steam turbine cycle makeup.
- In the current Project, the water treatment system will use ion exchange resins that are regenerated off-site, and regeneration water will not be needed. The currently permitted configuration included ion exchange resins that would have been regenerated on site and would have needed water for regeneration.

4.1.2.2 Sanitary and Process Wastewater

The Project will continue to discharge wastewater to the municipal sewer system, which in turn discharges to the Naugatuck Wastewater Treatment Plant. The Project has been conditionally issued a wastewater discharge permit by DEEP (see Appendix A); as a part of this review, the Naugatuck Wastewater Treatment Plant has confirmed it has adequate capacity to receive and treat Project flows.

The permit includes three permitted discharges:

- Discharge Serial Number 201-1 is for wastewater from the pH adjustment tank (demineralizer regeneration and chemical storage drains), boiler blowdown, cooling water from wet surface air cooler, and plant equipment and floor drains;
- Discharge Serial Number 201-a is for wastewater from equipment and plant drains; and
- Discharge Serial Number 201-b is for combustion turbine cleaning wastewater.

Wastewater quantities for the Project are shown on the water balance provided in Figure 5. Differences between the current configuration and the proposed Project are minimal but reduce overall wastewater flows:

- With an off-site (instead of on-site) regenerated ion exchange system to produce demineralized water, neutralized regeneration wastewater will not be discharged from a pH adjustment tank;
- Since HRSG blowdown will be recovered and reused, boiler blowdown will not be discharged;
- Without a wet surface air cooler, blowdown from this source will no longer require discharge; and
- A very small volume of blowdown from evaporative coolers in the present Project will now be discharged.

The current Project configuration will continue to meet all applicable wastewater discharge standards.

4.1.2.3 Stormwater

Figure 6 illustrates proposed grading and stormwater management features proposed for the Project. The addition of the 6-acre parcel to the south of the site allows for moving the stormwater detention pond from under the ACC, which was not recommended by the ACC vendor, while still maintaining performance guarantees and more importantly meeting state requirements as outlined in the 2004 Connecticut Stormwater Quality Manual (2004 Manual).

When, in accordance with Council conditions, the facility footprint shifted 265 feet south (as documented in the D&M Plan), this resulted in a reduction of the land available for development. In addition, the original sedimentation and erosion control plans prepared for the site and approved by the Council were designed in accordance with the 1988 Connecticut Guidelines for Soil Erosion and Sediment Control (1988 Guidelines), where stormwater quantity control was the primary consideration. The 1988 Guidelines did not contain the stormwater quality and groundwater recharge requirements set forth in the 2004 Manual.

The original arrangement included a dry detention pond at the southern site boundary that would meet the stormwater needs of the developed portion of the site. Due to spatial constraints, the pond was located below the elevated ACC unit, which is not optimal for its function. Drainage from undisturbed areas in the northeast portion of the property was to be directed to the original drainage paths east of the property. Drainage from undisturbed areas in the northwest and west portion of the property was to be directed to the planned compensating wetland area. Grass and crushed stone were used in the undeveloped portions of the property to facilitate infiltration and groundwater recharge. Under this design scenario, a number of elements of the 2004 Manual would not have been met, including groundwater recharge requirements for the pond and applicable setback distances from slopes and structures. Relief had been requested from the state, and best available design measures incorporated to meet the intent of the 2004 Manual to the greatest extent possible.

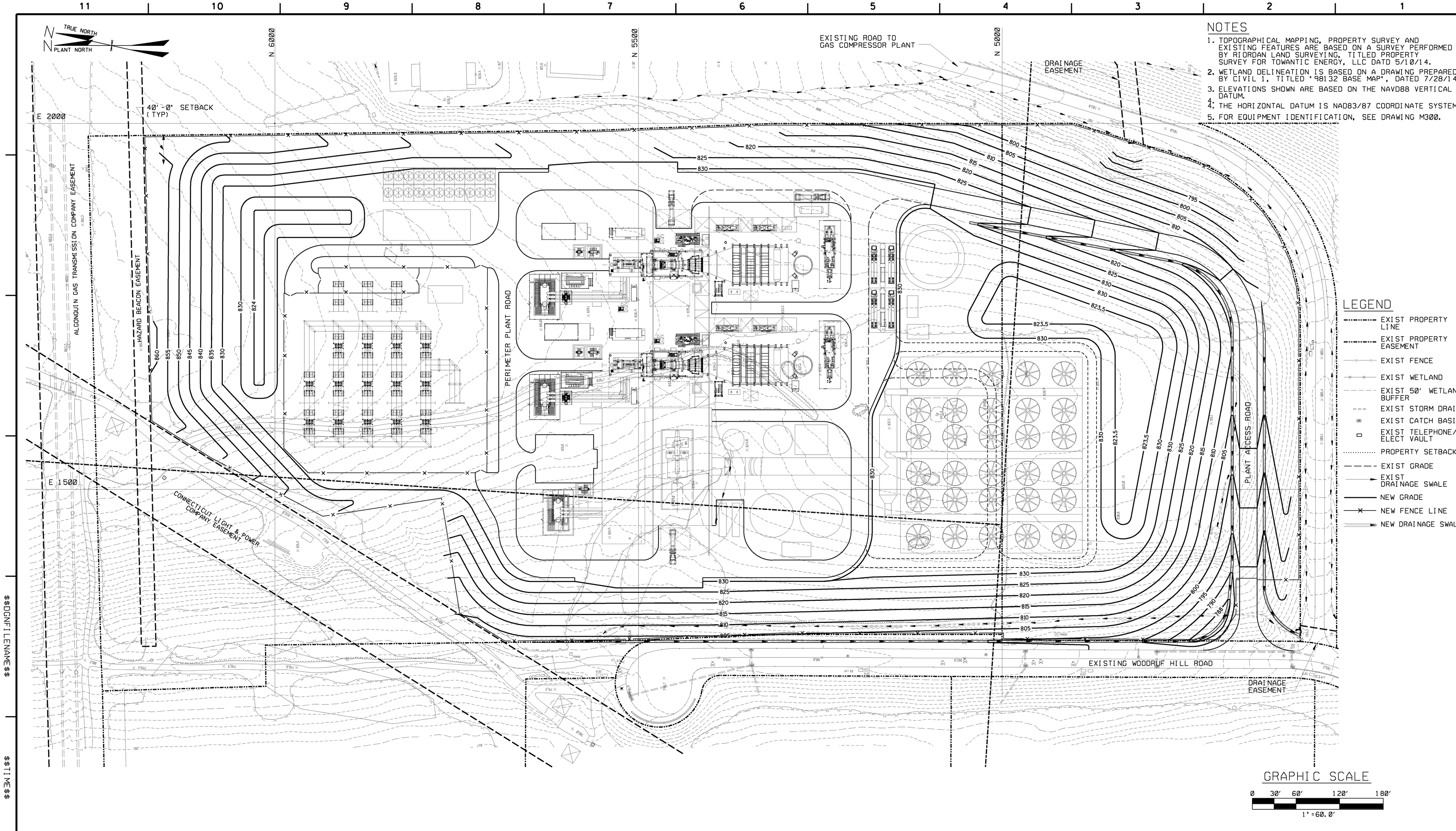
The larger area now available for the Project allows for two detention ponds, repositioned away from structures and reflecting the existing sub-watershed drainage, as well as incorporation of a design reflecting Low Impact Development Principles and the most recent Connecticut stormwater standards. Under the proposed Project configuration, all requirements of the 2004 Manual will be met. Additional stormwater design information is included as a component of the USACE application, discussed in the following section.

4.1.3 Wetlands

The Project as currently approved includes authorization to fill the one wetland resource located on the site, a 2,850 square foot intermittent watercourse, which was considered to be eligible under the USACE’s Connecticut PGP as a Category 1 project (minimal impact, non-reporting). A permit was granted by the Oxford Inland Wetland Agency (Application #673) on February 22, 1999 that included provisions for filling this entire wetland system. An attempt to fill this wetland occurred in February 2010. A February 10, 2010 inspection report by the engineering firm of Civil1 indicated that approximately 1 to 2 feet of common fill and topsoil were placed over the wetland, which was graded and leveled.

Due to the time that has passed since the original application, and the addition of the 6-acre parcel, wetland field investigations were conducted on June 26, July 3, and July 12, 2014 to evaluate current conditions at the expanded site. The delineation methodology followed was consistent with both the Connecticut Inland Wetlands and Watercourses Act and the *Corps of Engineers Wetland Delineation Manual* (1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region*, Version 2.0 (January 2012).

CPV Towantic Energy Center
Oxford, New Haven County, Connecticut



Rev No	Revision	Date	Dwn	Chkd	Approved Chief Engr	Rev No	Revision	Date	Dwn	Chkd	Approved Chief Engr	Rev No	Revision	Date	Dwn	Chkd	Approved Chief Engr
												B	REVISED SWITCHYARD LAYOUT		JH		
												C	REVISED WETLAND DELINEATION AND NOTES		JH		

Drawing Control				
Purpose	Approved By	Date	Released By	Date
For Information				
For Comment				
For Bid				
For Fabrication				
For Construction				

Engineering Review		
Disc	Engr	Date
Mech		
Elec		
Civil		
Arch		
Instr		

CPV TOWANTIC ENERGY CENTER
OXFORD, CONNECTICUT

GRADING PLAN

BURNS AND ROE ENTERPRISES, INC.
Engineers and Constructors - Oradell, NJ
Connecticut License No. PEC 39

Drawn	Designed	Checked	Approved for Construction	Work Order	Drawing No	Sh	Rev
JH			Chief CIVIL Engineer	3328	C310		C

Lead Engineer | Date | Scale 1"=60'-0"

$$DGNFILENAME$$
$$TIME$$
$$DATE$$

Figure 6.
Proposed Site Grading and Stormwater Management Features

The site is dominated by a complex of mature, even-aged, hardwood forest and open field with small areas of wetland inclusions located in the northern and western portions of the site. The surrounding land use consists primarily of undeveloped industrial parcels that currently include large tracts of mature forest, existing natural gas and electric transmission ROWs, and the adjacent Algonquin compressor station.

Four wetland areas were delineated as currently existing on the site, as shown on Figure 7, and generally described below (additional detail is provided in the wetland report in Appendix B).

- ***Wetland 1*** – This approximately 0.24-acre wetland, in the location of the previously identified intermittent channel, is currently a dense glacial till hillside seep wetland meadow system with scattered shrubs, characterized by a relatively narrow clearing surrounded to the north and south by mature upland forest. Water is conveyed west, originating at a stone wall cut at the edge of a large open field. This wetland feature terminates as it approaches the Woodruff Hill Road cul-de-sac. Evidence of mechanical compaction in the form of tire ruts is prevalent throughout this wetland seep system along with disturbed wetland soil profiles. The wetland area reveals some disturbance apparently associated with the work performed in 2010; however, most of the disturbance to the wetland soils is associated with the top 0.5 to1.0 feet characterized by topsoil fill high in organic matter, underlain by native wetland soil profiles. The hydrology of this wetland system does not appear to have been significantly altered by the previous disturbance, and vegetation is dominated by hydrophytes.

- ***Wetland 2*** – This wetland (approximately 0.24 acre of which occurs on-site) is a complex of forested, scrub/shrub, and emergent seep wetland habitats formed in dense glacial till located along the western edge in the northwest corner of the site. An overhead electrical distribution ROW running north/south along the site's western property boundary, north of the CL&P ROW, bisects the eastern upper reaches of this wetland system. Evidence of mechanical compaction in the form of tire ruts and gravel surfaces is prevalent throughout this utility ROW resulting in shallow ponding of water at the time of inspection. Wetland 2 generally drains east to west across a moderately west-facing slope, formed in dense glacial till. Numerous adult green and pickerel frogs were observed within the shallow pools artificially created by the tire ruts.

- ***Wetland 3*** – This is a small hillside seep wetland system that is located off-site but is connected to Wetland 2. It has experienced high levels of anthropogenic activity. Wetland 3 is generally located at the confluence of a CL&P ROW and the Woodruff Hill Road cul-de-sac. As such, the hydrology and nature of Wetland 3 has been highly altered from previous filling activities associated with CL&P maintenance and upgrading of this electrical transmission ROW, resulting in disturbed wetland soil profiles, surface compaction, and altered vegetation communities. This wetland system receives hydrology from the surrounding uplands to the north and east via seasonal overland flow and groundwater exfiltration, as well as a pipe conveying flows from a dug drainage swale located along the east side of Woodruff Hill Road on the site.

- ***Wetland 4*** – This approximately 0.004-acre area is a small depressional wetland feature located in a generally flat, forested upland area. This depression was artificially created in dense well-drained glacial till soils, apparently the result of a dug test pit that was improperly backfilled. This anthropogenic feature has formed a small depression that intercepts the seasonally high groundwater table as evident by a review of disturbed hydric soil profiles.

The identified wetlands have been assessed using *The Highway Methodology Workbook Supplement, Wetland Functions and Values: A Descriptive Approach*, issued by the USACE in September 1999 (see Appendix C for the detailed assessment). For Wetland 1, it was determined that biological, hydrologic, water quality, sediment/shoreline stabilization, and societal values are limited or non-existent. The quality

Legend

Wetland Flag	Delineated Wetland Boundary
CL&P 110' R.O.W.	Drainage Ditch
Wetland Area	Project Area
Approximate Parcel Boundary (CTDEEP)	Catch Basin
Electrical Box	ACOE Transet Plot A-Up
ACOE Transet Plot A-Wet	Transformer

100 50 0 100 Feet

N S E W

CPV Towantic Energy Center
Oxford, New Haven County, Connecticut

Figure 7.

Towantic Wetland Delineation Map

of Wetlands 2 and 3 are considered together due to their connectivity. These wetlands provide groundwater recharge as a principle function; secondary level function for biological, floodflow alteration, water quality and uniqueness/heritage value was identified. Considering the form of Wetland 4, its small size and general lack of wetland features, no significant wetland functions or values are supported by this wetland.

Although the higher-value wetlands 2 and 3 will be avoided by the Project, Wetland 1 (as was previously the case) and Wetland 4 are located in the area of the Project footprint and will be filled. Wetland 4 is quite small, but Wetland 1 has significantly increased in size since permits were originally issued for placement of fill in this area. A total of 0.24 acre of USACE jurisdictional wetland is now proposed to be filled for the Project. An application for approval as a Category 2 project under the USACE's Connecticut General Permit was submitted to the USACE on October 3, 2014 (Appendix C) and is under review.

Compensatory mitigation for the original 2,850 square feet of wetland fill was planned at a location in the general vicinity of Wetland 3, in the form of wetland replication. The upland area available for planned wetland creation is ill-suited due to steep topography consisting of mature upland forest. In addition, the USACE and DEEP have established a new program since the original approval that allows for an in-lieu payment towards creation and/or management of natural areas that are targeted to meet certain value objectives and are managed by Audubon CT. Although details of permit conditions, including mitigation, will be determined by the USACE during the course of its review process, it is anticipated that an in-lieu fee contribution could replace the originally planned wetland creation.

Although existing wetland resources have expanded, resulting in a greater area of impact, the wetlands to be impacted do not support functions and values in a significant capacity. The Project will obtain appropriate permits and implement an appropriate form of mitigation. Through this process, environmental benefit will result from the necessary impact.

4.1.4 Noise

Construction noise from the updated Project will not differ substantially from construction impacts approved for the original configuration. The Project has committed to scheduling louder construction activities during daytime hours to the greatest extent possible, and to coordinating with the local community during the construction process. Construction occurs in phases, and will not be expected to generate long-term noise levels, even during the 2½ year construction process.

The Project, as currently approved, meets Connecticut DEEP and Town of Oxford noise standards, regulated by land use category, with the more stringent of either outlined in Table 4-8.

Table 4-8. DEEP and Town of Oxford Noise Limits

Emitter	Receptor (dBA)[a]			
	Class C	Class B	Class A Daytime (7:00 am – 10:00 pm)	Class A Nighttime (10:00 pm – 7:00 am)
Class C – Industrial	70	62	61	51
Class B – Commercial and Retail Trade	62	62	55	45
Class A – Residential Areas and other sensitive areas	62	55	55	45

[a]A-weighted decibel.

As a Class C Industrial sound source, the Project incorporated mitigation to meet nighttime sound levels at the nearest residentially zoned area (523 feet to the north, in the town of Middlebury) of 51 dBA. No new standards have been developed that would apply to the Project. Current zoning classifications for the town of Oxford and the town of Middlebury have been considered for the updated Project.

The new configuration has been evaluated using the CadnaA® acoustic model (see Appendix D). An industry standard, Cadna-A® was developed by DataKustik GmbH to provide an estimate of sound levels at distances from sound sources of all types including complex facilities consisting of various equipment types like the Project. It incorporates consideration of the full range of sound sources in three dimensions, and provides a conservative evaluation assuming the most favorable weather conditions for sound propagation. Physical characteristics of the site and surroundings are also incorporated in the model.

Reference sound power levels (expressed in decibels, or dB) used as input to Cadna-A® were provided by equipment manufacturers and Project design engineers, based on information contained in reference documents, or developed using empirical methods.

Operational broadband (dBA) sound pressure levels were calculated during normal operation assuming that all identified components are operating continuously and concurrently at the representative manufacturer-rated sound levels. Sound contour plots displaying broadband (dBA) sound levels presented as color-coded isopleths are provided on Figure 8. The noise contours are graphical representations of the cumulative noise associated with full operation of the equipment and show how operational noise would be distributed over the surrounding area. The contour lines shown in the figure are analogous to elevation contours on a topographic map, i.e., the noise contours are continuous lines of equal noise level around some source, or sources, of noise.

As can be seen from Figure 8, sound levels at the nearest residentially zoned areas are projected to meet the 51 dBA nighttime limit. Additionally, the Project will conform with the 70 dBA limit set for the property boundaries between industrially zoned properties (see Table 4-8). Since sound levels decrease with distance, compliance with the applicable zoning limits at the closest borders ensures compliance at more distant receptors, i.e., structures found within a given zoning district.

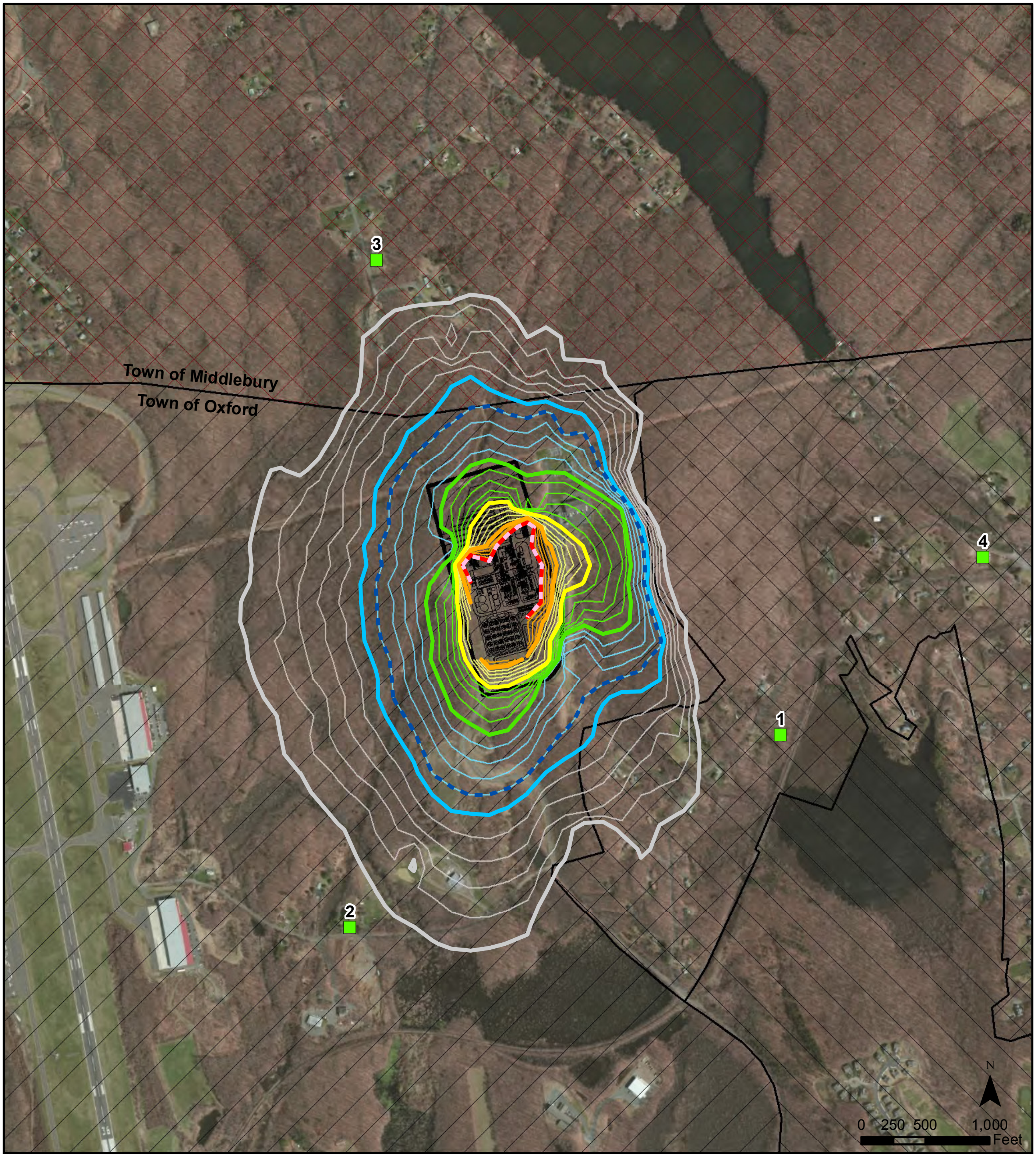
Detailed mitigation assumptions are incorporated in the modeling effort to demonstrate the feasibility of achieving compliance with state and local noise regulations. The details of the specific mitigation measures incorporated in the modeling effort may be refined in final Project design, while continuing to maintain compliance.

As demonstrated by the acoustic model, the updated Project design will continue to meet state and local noise standards.

4.1.5 Visibility

Visibility of the proposed Project was assessed in the original application. Tall Project components included the proposed 98-foot generation building, 116-foot ACC, and 160-foot exhaust stacks (later changed to 150 feet tall). These features were evaluated from five representative locations. At most of these locations, it was determined that the Project would not be visible or that visibility would be obscured by intervening vegetation. At two locations, the Waterbury-Oxford Airport to the west and Jacks Hill Road to the south, the Project was determined to be more directly visible.

With the updated Project, the stack locations have shifted approximately 250 feet to the northwest. This slight movement will not materially change stack visibility. In addition, on-going consideration for reducing visual impact has included selection of new ACC technology with a much lower profile. At 85 feet rather than 116 feet tall, this element of the Project is expected to be less visible. In addition, the Project previously incorporated a single, large 110-foot tall building that encompassed the combustion turbines and steam turbine. The updated Project plans to incorporate three smaller enclosures (one for the steam turbine and one for each combustion turbine). The combustion turbine enclosures are each 37 feet tall, and the steam turbine building is 64 feet tall. The use of these three smaller enclosures is also expected



CPV Towantic Energy Center
Oxford, New Haven County, Connecticut

Legend
Sound Monitoring Locations
Project Area
Oxford Zoning
I: Industrial District
R-A: Residential A
R-CGD: Residential Community Golf District

Middlebury Zoning
R: Residential District

Sound Level Contour (dBA)
45 dBA
50 dBA
55 dBA
60 dBA
65 dBA
70 dBA

DEEP and Oxford 70 dBA Industrial Noise Limit Isopleth
DEEP and Oxford 51 dBA Residential Nighttime Noise Limit Isopleth

Figure 8.

Mitigated Sound Contours

to reduce visibility of the Project from surrounding areas. Although some structures inherent in the 7HA.01 technology are somewhat taller, these increases only reflect a several-foot change in height for some layout elements. A rendering of the proposed Project confirmation is provided as Figure 4.

The updated Project continues to have minimal visual impact on the community and, in fact, will have a reduced visibility due to incorporation of design and technical features that reduce the heights of major structures.

4.1.6 Air Navigation

The Project proposed to install medium intensity flashing white lighting on the proposed stacks consistent with FAA criteria. As an alternative, medium intensity flashing white lighting by day and twilight, and red flashing lights at night could be used to minimize off-site impacts. Lighting will continue to be incorporated in the Project's stack design. With the repositioning of the stacks, potential impacts on air navigation from the Waterbury-Oxford Airport have been further reduced. Review of the current Project configuration is currently ongoing with the FAA.

4.2 CONFIRMATION OF NO MATERIAL ENVIRONMENTAL CHANGE

A full range of potential environmental conditions has been considered to determine whether changed conditions exist that warrant Project updates. As noted below, for the vast majority of environmental and community issues, no significant changed condition has occurred and the Project will continue to reflect the level of impact that was previously determined to be appropriately balanced by its benefits.

4.2.1 Physical Environment and Land Use

The Project location remains where it was originally proposed, with no change to the proposed access or basic footprint. Although an additional 6 acres has been added to the original parcel, it is very similar in character and does not reflect a material change in physical environment, geologic and soils characteristics, or land use.

The Project continues to be located within an area zoned and designated as an industrial park, with access planned off of the existing Woodruff Hill Road. Land use characteristics of the surrounding area have been relatively unchanged, with the exception of Algonquin's gas compressor station facility, which was constructed on the parcel directly east of the Project in 2008. Design standards for the Project are intended to be protective of the nearest residential zone, located 523 feet to the north in the town of Middlebury. Although additional development in the area has continued, no new residential development has occurred any closer than 523 feet.

4.2.2 Socioeconomics

No change in expected construction or operational impact to the community is anticipated as a result of Project refinements. The Project will continue to bring economic benefits to the town and to the region through taxes, employment, lower electric rates, secondary economic benefits from goods and services, and a source of reliable, efficient, and economical energy.

4.2.3 Groundwater

State mapping has been reviewed to confirm that the Project site, including the additional 6 acres, is not within an Aquifer Protection Area. The Project will continue to protect existing groundwater by providing secondary containment for all aboveground storage tanks and implementation of a Spill Control and Countermeasures Plan and a SWPPP outlining best management practices. The version of the plans previously submitted in the D&M Plan will be updated.

4.2.4 Cultural, Historic, and Archaeological Resources

Research regarding cultural, historic, and archaeological resources at the site when the Council application was filed in 1998 indicated that the site had never experienced development and that the natural gas pipelines and transmission lines were the only historic improvements made on or near the land. A Phase I Cultural Resource Survey was conducted in October 1998 by Historical Perspectives, Inc. on the 20-acre parcel. This assessment concluded that no further cultural resource investigation of the site was recommended. This survey was reviewed by the Connecticut State Historic Preservation Office (SHPO), which determined that there would be "no effect" on the state's historic, architectural, and archaeological resources.

In preparation for this submittal, the Connecticut SHPO was contacted on May 8, 2014 to request a review of the property, including the additional 6-acre parcel. In correspondence dated May 15, 2014, the SHPO noted that no historic properties will be affected by the expanded undertaking (see Appendix E). Appendix E also includes correspondence with the Tribal Historic Preservation Offices completed for the Project; a "no effect" response has been received from the Mashantucket Pequot Tribal Nation, while the response from the Mohegan Tribal Historic Preservation Office is still pending.

4.2.5 Transportation

During the proposed 26-month construction period, the average daily vehicular traffic was projected to be between 150 to 200 vehicles. Peak construction was anticipated to be about 12 months into the construction schedule, with as many as 740 vehicles per day during that period. The applicant proposed to transport as many as 600 construction workers from other locations within the town of Oxford to reduce traffic and parking congestion at the site. Other potential mitigation under consideration at the time included increased signage alerting the public to traffic changes, improvements to roadways susceptible to damage from heavy truck traffic and educating construction personnel and equipment transporters regarding primary access routes to the Project site. In that regard, the Project has committed to construct E-Commerce Drive for the town of Oxford. E-Commerce Drive will connect Woodruff Hill Road to Juliano Drive to the Waterbury-Oxford Airport access road off of Route 188. By constructing this road, truck traffic through residential neighborhoods will be minimized.

During operation, traffic would consist of approximately 21-25 employees working three eight-hour shifts per day. The State Traffic Commission concluded "that the site-generated traffic will not significantly impact the State highway system in the area."

As was previously the case, the potential for significant traffic impact is limited to the construction period. CPV will continue to coordinate closely with the town of Oxford to develop appropriate plans for minimizing impact during this temporary period. Once the Project is operational, impacts will continue to be negligible.

4.2.6 Wildlife and Protected Species

No change in the potential impact to wildlife is anticipated through the addition of the 6 acres to the Project site. The additional land is comprised of similar habitat to the balance of the site, with very limited tree clearing requirements added. Correspondence with both the United States Fish and Wildlife Service (USFWS) and DEEP is provided in Appendix F. The USWFS indicated that no federally listed species, critical habitat or National Wildlife Refuges were found within the vicinity of the Project. DEEP identified the potential for three bat species and one turtle to occur in the vicinity of the Project.

The red bat (*Lasiurus borealis*), the hoary bat (*Lasiurus cinereus*), and the silver-haired bat (*Lasionycteris noctivangans*) are tree-roosting, migratory bats that are state-listed species of concern that would need to be considered for the portion of the site that is currently in forest cover. DEEP recommends that clearing work should not be conducted between May 1 and August 15, and that large diameter trees be retained wherever possible, particularly close to brooks or streams. No brooks or streams are located on the Project site, and Project construction will incorporate seasonal clearing restrictions to avoid impact to these species.

The Eastern box turtle (*Terrapene Carolina Carolina*) is a state-listed species of concern with the potential to inhabit old fields and deciduous forests, and are often found near small streams and ponds. Although no small streams or ponds are located on the Project site, the field and forest habitat has the potential for turtle presence. Specific recommendations by DEEP include measures to prevent turtles that may pass through the area from accessing stockpiles for nesting, selection of silt fencing materials and placement so migration would not be impeded, and use of natural and native materials. The Project will incorporate awareness of this species in the selection and implementation of construction practices.

Field investigations did not reveal any flora or fauna listed as federal or state endangered, threatened, or special concern species at the site.

4.2.7 Solid Waste Disposal

No change in anticipated construction or operational solid waste generation or disposal is anticipated as a result of Project refinements.

4.2.8 Emergency Response

No change in emergency response is associated with the Project refinements. The Project will continue to incorporate alarms and control systems, and conduct employee training for emergency situations. Contingency plans, procedures, and equipment needs for emergency response will continue to be coordinated with the town of Oxford and adjoining communities, consistent with federal, state, and local regulations. Continued commitment to compliance with the most current Occupational Safety and Health Administration standards, including National Fire Protection Association 56 PS “Standard for Fire and Explosion Prevention During Cleaning and Purging of Flammable Gas Pipeline System,” which requires that only inert gases or compressed air be used for all cleaning of pipes, is incorporated into the Project.

4.2.9 Electrical Interconnection

The Project will continue to interconnect with the CL&P 115-kilovolt transmission lines located on-site, via an on-site switchyard. As was previously the case, electrical field levels would not change as a result of the Project, because no changes in line voltage are considered. Incremental increases in magnetic field levels were previously identified in the D&M Plan and will be updated for the increased output. The electric and magnetic field factors are not expected to result in substantially different impact to the community or environment.

5.0 SUMMARY AND CONCLUSIONS

The Project, although designed with efficient, economical technology at the time of the original issuance of the Council Certificate, now has the opportunity to improve its efficiency and environmental performance by using updated GE turbine technology. In addition, since 1999, the power market and regulatory framework have continued to evolve. The Petition to the Council reflects the following updates to the Project:

- Incorporation of the more efficient and state-of-the-art GE Frame 7HA.01 turbine technology and associated equipment to produce more energy (a net nameplate 785 MW) while minimizing community and environmental impacts.
- Addition of approximately 6 acres located immediately to the south of the original Project site to accommodate more stringent stormwater management requirements.
- Incorporation of technological advances in air cooling technology to reduce the height, visual impacts, and area requirements of the ACC.
- Reorientation of the Project stacks to minimize influence on air traffic associated with the Waterbury-Oxford Airport.
- Replacement of one large building enclosure for the gas turbines and steam turbine with three smaller and shorter building enclosures to reduce visibility and facilitate emissions dispersion.
- Incorporation of other relatively minor site plan changes to accommodate facility layout.
- Demonstration of the Project's consistency with updated environmental regulations and policies, as well as consideration of changed conditions over time.

As outlined in the preceding sections, the proposed updates to the Project can provide additional and highly efficient generating capacity to meet current and expected additional shortfalls in the ISO-NE markets, while complying with current regulations and policies and continuing to be consistent with the low levels of environmental and community impact that were the basis of the original Council approval for the Project.

APPENDIX A – DEEP WASTEWATER DISCHARGE INFORMATION

Connecticut Department of
ENERGY &
ENVIRONMENTAL
PROTECTION

79 Elm Street • Hartford, CT 06106-5127 www.ct.gov/deep Affirmative Action/Equal Opportunity Employer

APPROVAL

February 26, 2014

CPV Towantic, LLC
C/O Competitive Power Venutres, Inc.
50 Braintree Hill Park
Suite 300
Braintree, MA 02184-8724

Attention: Andrew J. Bazinet

Re: Permit Application No. 199902285
Town of Oxford

CPV Towantic, LLC is hereby authorized to install a 200 gallon per minute pH neutralization system and 3,000 gallon oil/water separator for the treatment of wastewater associated with steam electric generation prior to being discharged to the Naugatuck publicly owned treatment works ("POTW") via the sanitary sewer system in the town of Oxford, in accordance with plans and specifications filed with this Department on July 14, 1999.

This approval is granted subject to the following conditions:

1. CPV Towantic, LLC must confirm that the information contained in Permit Application No. 199902285 is still accurate. If any of the information contained in Permit Application No. 199902285 is no longer accurate, updated information must be submitted as appropriate.
2. CPV Towantic, LLC must submit documentation verifying that the Naugatuck POTW still has the ability to accept the propose discharge, including a letter from the POTW confirming this.

The documentation required pursuant to the conditions noted above must be submitted with forty-five (45) days of the date of this approval.

The applicant's attention is directed to the requirements of section 22a-430 of the Connecticut General Statutes as amended that a permit must be obtained before initiation of a discharge. This approval does not constitute that permit to discharge under section 22a-430. Upon verification that the actions hereby approved have been completed to the satisfaction of the Commissioner, said permit shall be issued.

This approval is issued in accordance with section 22a-430 of the Connecticut General Statutes as amended.

In accordance with section 22a-430-4(k)(5) of the Regulation of Connecticut State Agencies, construction of the system approved herein shall be completed within two years of the date of this approval. If construction is not completed within two years, the Commissioner may revoke this approval and require that a new application for a discharge permit be submitted.

This approval does not relieve CPV Towantic, LLC of the obligation to obtain any other authorizations as may be required by Federal, State or Local laws or regulations.

If you have any questions regarding this matter, please contact Stephen Edwards at (860) 424-3838.

Sincerely,

Oswald Inglese, Jr.
Director
Bureau of Materials Management and
Compliance Assurance
Water Permitting and Enforcement Division

OI/SCE

cc: Town of Naugatuck POTW

APPROVAL

April 22, 2014

CPV Towantic, LLC
C/O Competitive Power Venutres, Inc.
50 Braintree Hill Park
Suite 300
Braintree, MA 02184-8724

Attention: Andrew J. Bazinet

Re: Permit Application No. 199902285
Town of Oxford

This office is in receipt of the April 9, 2014 request from Brown Rudnick LLP, submitted on behalf of CPV Towantic, LLC, requesting additional time to respond to the Department's February 26, 2014 approval letter,. The request for an extension to July 30, 2014 is hereby granted.

This approval is issued in accordance with section 22a-430 of the Connecticut General Statutes as amended.

This approval does not relieve CPV Towantic, LLC of the obligation to obtain any other authorizations as may be required by Federal, State or Local laws or regulations.

If you have any questions regarding this matter, please contact Stephen Edwards at (860) 424-3838.

Sincerely,

Oswald Inglese, Jr.
Director
Water Permitting and Enforcement Division
Bureau of Materials Management and
Compliance Assurance

OI/SCE

cc: Town of Naugatuck POTW
Franca L. DeRosa, Esq., Brown Rudnick LLP

COMPETITIVE POWER VENTURES
CPV TOWANTIC
ENERGY CENTER

50 Braintree Hill Office Park, Suite 300
Braintree, MA 02184

July 29, 2014

By E-Mail and First Class Mail
Mr. Stephen Edwards
State of Connecticut Department of Energy and Environmental Protection
Bureau of Materials Management and Compliance Assurance
Water Permitting and Enforcement Division
79 Elm Street
Hartford, CT 06106-5127

Subject: Permit Application No. 199902285, CPV Towantic, LLC, Town of Oxford

Dear Mr. Edwards:

In a letter, dated February 26, 2014, the Department of Energy and Environmental Protection ("DEEP") issued approval for CPV Towantic, LLC (CPV) to install a 200 gallon per minute (gpm) pH neutralization system and a 3,000 gallon oil/water separator for the treatment of wastewater associated with steam electric generation prior to being discharged to the Naugatuck publicly owned treatment works (POTW) via the sanitary sewer system in the Town of Oxford. The DEEP approval letter contained two conditions that require responses from CPV, and DEEP provided CPV with an extension until July 30, 2014 to respond to the conditions.

Below are the two conditions from DEEP's February 26, 2014 letter with CPV's responses.

DEEP Condition #1: CPV Towantic, LLC must confirm that the information contained in Permit Application No. 19990285 is still accurate. If any of the information contained in Permit Application No. 199902285 is no longer accurate, updated information must be submitted as appropriate.

CPV Response: As previously noted, the Permit Application was submitted in 1999, and there have been changed conditions in technology and approach over the past 15 years requiring us to consider the potential effect on wastewater discharge.

These potential changes also include consideration of influent water quality and characteristics of the water source, given that the water company providing water to the facility, the Heritage Village Water Company (Heritage), has expanded its resources. CPV representatives have met with Heritage to review the current sources and quality of water associated with its system. Water quality information published by Heritage in a 2013 Annual Consumer Report and data from tests performed on April 21, 2014 by Environmental Consulting Laboratories, Inc. was utilized to evaluate the current project configuration's water needs, as recirculation and recycling of water is an inherent component of the project design.

COMPETITIVE POWER VENTURES
CPV TOWANTIC
ENERGY CENTER

50 Braintree Hill Office Park, Suite 300

Braintree, MA 02184

Burns & Roe, the project engineers, have provided an updated water balance for the facility (attached), reflecting both currently anticipated influent water quality and refinements of the project design. No significant change in design has occurred beyond updating the General Electric turbine technology, increasing the amount of recycling of water throughout the system, and using off-site instead of on-site regenerated ion exchange units to produce demineralized water.

Page 1 of the water balance diagram illustrates the water inputs, uses, and discharge for the project. As can be seen, the discharge of effluent will be to the Town of Oxford sewer system, as was previously proposed and approved. Page 2 of the water balance updates the required water use and discharge volumes under a range of cases for the facility operating on natural gas and on oil. As can be seen, the discharge volume to the sewer system ranges from 5.2 to 26.5 gpm (7,488 to 38,160 gallons per day) when the facility is firing natural gas, and from 5.2 to 25.4 gpm (7,488 to 36,576 gallons per day) when firing oil. This proposed discharge volume is consistent with information provided in the Permit Application, which was approved.

The date the discharge will begin was previously identified as late in 2001. The current projected start of discharge, pending permitting and approval schedules, is in the third or fourth quarter of 2017, when the plant begins its testing period. Full commercial operation and consistent discharge is expected in the second quarter of 2018.

The process and treatment substances identified in the Permit Application (sulfuric acid and sodium hydroxide) have been confirmed as the anticipated treatment substances for the updated project.

Based upon the quality of the influent water, the process and treatment plan, and other factors associated with water use and discharge in the Discharge Analysis completed for the range of constituents identified in the Permit Application, no change is anticipated in the projected quality of discharge.

In addition, the information and values listed in the previously issued Draft Pretreatment Permit (Permit ID: SP0002363) were reviewed. In Table A, the only recommended change is in the listing of Wastewater Description. The following outlines minor changes in facility equipment and can be described as follows:

- An off-site (instead of on-site) regenerated ion exchange system will be used to produce demineralized water, neutralized regeneration wastewater will not be discharged from a pH adjustment tank.
- Heat Recovery Steam Generator blowdown will be recovered and reused, therefore, boiler blowdown will not be discharged.
- Without a wet surface air cooler, no blowdown will be discharged from such equipment.

50 Braintree Hill Office Park, Suite 300

Braintree, MA 02184

- The facility plans to utilize evaporative coolers; therefore, evaporative cooler blowdown will be discharged to the sewer system.

Due to these changes, the description in Table A can be revised to read: "Wastewater from evaporative cooler blowdown, drains from potable water use, and plant equipment and floor drains." A hand marked version of Table A has been attached for reference.

DEEP Condition #2: CPV Towantic, LLC must submit documentation verifying that the Naugatuck POTW still has the ability to accept the proposed discharge, including a letter from the POTW confirming this.

CPV Response: CPV anticipates meeting with representatives of the Oxford Water Pollution Control Authority (WPCA) and the Naugatuck POTW to review the current water balance for the facility, including anticipated source and quality of discharge. Also, CPV has arranged to be on the Naugatuck POTW August 21, 2014 agenda. It is expected that these meetings will confirm that Naugatuck POTW has the ability and intends to accept the proposed discharge. A letter from the Naugatuck POTW confirming that it has the ability to accept the proposed discharge will be forwarded to DEEP as soon as practicable.

We understand that, with this verifying information, the permit for discharge will be issued. Should you require any additional information or clarification, please contact me at (781) 848-3611 or by email at abazinet@cpv.com.

Sincerely,

Andrew J. Bazinet

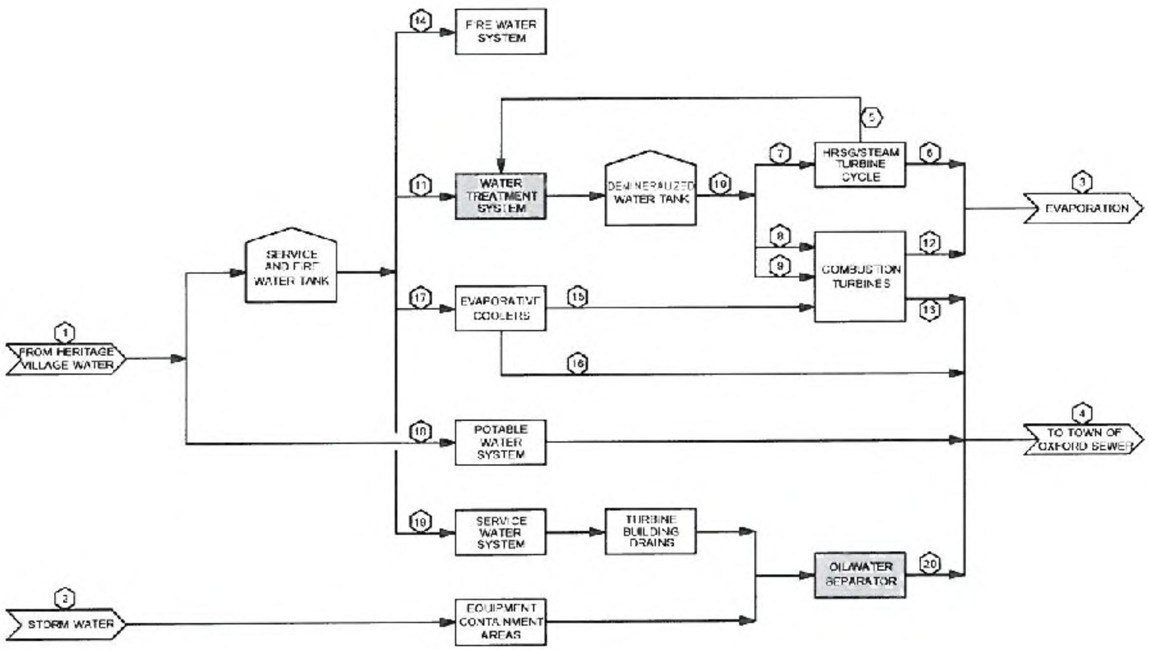
Enclosures

cc: D. Lynn Gresock, Tetra Tech
Joe Chiappinelli, Burns & Roe
Cliff Crosman, Burns & Roe
Franca DeRosa, Brown Rudnick LLP
Jim Stewart, Director of Public Works, Naugatuck
John Batorski, Manager, Naugatuck POTW

Burns and Roe

PREPARED BY: C. CROSMAN
JULY 18, 2014

WATER BALANCE
CPV TOWANTIC ENERGY CENTER - OXFORD, CT



Burns and Roe

PREPARED BY: C. CROSMAN
JULY 15, 2014

WATER BALANCE

CPV TOWANTIC ENERGY CENTER - OXFORD, CT

CORRESPONDING HEAT BALANCE NUMBER	1	4	DO-1	6	DO-3	7	DO-4	10	DO-5	12	13	DO-6
FUEL	GAS	GAS	OIL	GAS	OIL	GAS	OIL	GAS	OIL	GAS	GAS	OIL
NET PLANT OUTPUT, MW	839.9	775.2	716.1	791.2	716.5	777.5	702.5	744.3	691.1	745.5	702.5	835.4
AMBIENT TEMPERATURE, °F	-14.2	-14.2	-14.2	20.0	20.0	50.0	50.0	59.0	59.0	90.0	90.0	90.0
RELATIVE HUMIDITY, %	20	20	20	60	60	60	60	60	60	60	50	60
NUMBER OF OPERATING GAS TURBINES/HRSGs	2	2	2	2	2	2	2	2	2	2	2	2
GAS TURBINE LOAD, %	100	100	100	100	100	100	100	97	100	100	100	100
EVAPORATIVE COOLERS	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON
DUCT BURNING, %	27	0	0	0	0	0	0	0	0	19	0	0

NUMBER	DESCRIPTION	FLOW RATE - AVERAGE GALLONS PER MINUTE											
1	WATER SUPPLIED BY HERITAGE VILLAGE WATER COMPANY	40.8	34.3	695	36.2	712	34.9	718	33.9	701	102.2	98.2	663
2	STORMWATER COLLECTED IN CONTAINED AREAS	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
3	TOTAL EVAPORATION LOSSES	37.1	30.6	692	31.5	709	31.2	714	30.2	668	77.2	73.2	639
4	DISCHARGE TO TOWN OF OXFORD SEWER	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	26.5	26.5	25.4
5	BLOWDOWN FROM TWO (2) HRSGs	74.2	61.3	46.8	63.0	47.6	62.4	47.9	60.4	47.5	69.2	61.1	46.6
6	EVAPORATIVE LOSSES FROM HRSG/STEAM TURBINE CYCLE	37.1	30.6	23.4	31.5	23.8	31.2	24.0	30.2	23.8	34.5	30.6	23.3
7	DEMINERALIZED WATER MAKEUP TO HRSG/STEAM TURBINE CYCLE	111.3	91.9	70.2	94.6	71.3	93.6	71.9	90.6	71.3	103.8	91.7	70.0
8	WATER INJECTED INTO COMBUSTION TURBINES DURING OIL FIRING	0	0	668	0	685	0	690	0	674	0	0	575
9	DEMINERALIZED WATER USED FOR OFF LINE WASH	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
10	TOTAL DEMINERALIZED WATER PRODUCED	111.9	92.6	739	95.2	757	94.3	763	91.2	746	105	92.4	646
11	SERVICE WATER USED IN WATER TREATMENT SYSTEM	37.8	31.3	692	32.2	709	31.9	715	30.9	698	35.3	31.3	599
12	TOTAL WATER EVAPORATED IN COMBUSTION TURBINES	0	0	668	0	685	0	690	0	674	42.6	42.6	616
13	COMBUSTION TURBINE OFF LINE WASH WASTE WATER	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
14	FIRE PROTECTION WATER	0	0	0	0	0	0	0	0	0	0	0	0
15	EVAPORATION FROM TWO (2) EVAPORATIVE COOLERS	0	0	0	0	0	0	0	0	0	42.6	42.6	40.3
16	BLOWDOWN FROM TWO (2) EVAPORATIVE COOLERS	0	0	0	0	0	0	0	0	0	21.3	21.3	20.2
17	MAKEUP TO TWO (2) EVAPORATIVE COOLERS	0	0	0	0	0	0	0	0	0	63.9	63.9	60.5
18	POTABLE WATER USES	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
19	MISCELLANEOUS SERVICE WATER USES	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
20	DISCHARGE FROM OIL/WATER SEPARATOR	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5

NOTES: 1. STORMWATER FLOW RATES SHOWN ABOVE ARE BASED ON YEARLY AVERAGE RAINFALL OF 51.1 INCHES.

2. THE ABOVE ASSUMES THAT HRSG BLOWDOWN WILL BE COOLED WITHOUT USING QUENCH WATER, TREATED IN THE MAKEUP DEMINERALIZER SYSTEM, AND REUSED IN THE HRSG/STEAM TURBINE CYCLE.

Wastewater from evaporative cooler blowdown, drains from potable water uses, and plant equipment and floor drains

Table A								
Discharge Serial Number: 201-1						Monitoring Location: 1		
Wastewater Description: ~~Wastewater from the pH adjustment tank (demineralizer regeneration and chemical storage drains), boiler blowdown, cooling water from the wet surface air cooler and plant equipment and floor drains~~								
Monitoring Location Description: Samples taken to satisfy the monitoring requirements of this paragraph shall be taken at Test Manhole 1 (TMH-1).								
Discharge is to: The Borough of Naugatuck Water Pollution Control Facility								
PARAMETER	UNITS	FLOW/TIME BASED MONITORING				INSTANTANEOUS MONITORING		
		Average Monthly Limit	Maximum Daily Limit	Sample/Reporting Frequency 2	Sample Type or Measurement to be Reported	Instantaneous Limit or Required Range	Sample// Reporting Frequency 2	Sample Type or Measurement to be Reported
Arsenic, Total	mg/l	----	----	Twice per Month	Daily Composite	NA	NR	NA
Chromium, Total	mg/l	----	0.2	Twice per Month	Daily Composite	0.3	NR	NA
Copper, Total	mg/l	----	----	Twice per Month	Daily Composite	NA	NR	NA
Flow, Average and Maximum 1	gpd	37,440	104,000	Continuously// Monthly	Computed	NA	NR	NA
Flow, Total	gpd	----	104,000	Twice per Month	Daily Flow	NA	NR	NA
Magnesium, Total	mg/l	----	----	Twice per Month	Daily Composite	NA	NR	NA
Nickel, Total	mg/l	----	----	Twice per Month	Daily Composite	NA	NR	NA
Oil and Grease, Hydrocarbon Fraction	mg/l	----	----	Twice per Month	Grab Sample Average	NA	NR	NA
Oil and Grease, Total	mg/l	NA	----	Monthly	Grab Sample Average	NA	NR	NA
pH	S.U.	NA	NA	NR	NA	6.0 to 10.0	Twice per Month	RDS
pH, Continuous	S.U.	NA	NA	NR	NA	6.0 to 10.0	Continuously// Monthly	RDM
Silver, Total	mg/l	----	----	Twice per Month	Daily Composite	NA	NR	NA
Zinc, Total	mg/l	----	1.0	Twice per Month	Daily Composite	1.5	NR	NA

Table Footnotes and Remarks:

Footnotes:

1 For this parameter the permittee shall maintain at the facility a record of the total flow for each day of discharge and shall report the Average Daily Flow and the Maximum Daily Flow for each month.

2.The first entry in this column is the 'Sample Frequency'. If this entry is not followed by a 'Reporting Frequency' and the 'Sample Frequency' is more frequent than monthly then the 'Reporting Frequency' is monthly. If the 'Sample frequency' is specified as monthly, or less frequent, then the 'Reporting Frequency' is the same as the 'Sample Frequency'.

Remarks:

1. There shall be no discharge of polychlorinated biphenyl compounds.

BOROUGH OF NAUGATUCK
WATER POLLUTION CONTROL BOARD

229 CHURCH STREET
NAUGATUCK, CT 06770
203 / 720-7060
FAX 203 / 720-7099

September 19, 2014

Mr. Andrew Bazinet
Competitive Power Ventures, Inc.
50 Braintree Hill Office Park
Suite 300
Braintree, MA 02184

Re: Permit Application No. 199902285 Approval - Town of Oxford

Dear Mr. Bazinet:

Please note the following as recorded in the minutes of the Regular Meeting of the Water Pollution Control Authority held on August 21, 2014.

Chairman Ron Merancy commented that WPCA wants to make sure the discharge is metered and that WPCA receives copies of the monitoring reports.

VOTED: Unanimously on a motion by Rimas Balsys and seconded by Pat Mallane to **AUTHORIZE John Batorski to REVIEW and APPROVE their Discharge Permit Application.**

VOTE: **In Favor:** 5 **Opposed:** 0 **Abstained:** 0
Motion Carried: 5-0-0

APPENDIX B – WETLAND REPORT

WETLAND INVESTIGATION

August 22, 2014

CPV Towantic, LLC
50 Braintree Hill Office Park
Suite 300
Braintree, MA 02184

APT Project No.: CT444100

Re: CPV Towantic Energy Center Project
Woodruff Hill Road
Oxford, Connecticut

CPV Towantic, LLC plans to construct a new natural gas-fired electric generating facility on Woodruff Hill Road in Oxford, Connecticut. The proposed development (the "Project") encompasses two adjoining parcels located on the east side of Woodruff Hill Road along the cul-de-sac of the road; the original parcel encompasses 20± acres with a smaller 6± acre abutting parcel added to the south ("Site"). At your request, Dean Gustafson and Matthew Gustafson, Connecticut registered Soil Scientists with All-Points Technology Corporation, P.C. ("APT") conducted inspections of the Site on June 26, 2014, July 3, 2014, and July 12, 2014 to determine the presence or absence of wetlands and watercourses. The delineation methodology followed was consistent with both the Connecticut Inland Wetlands and Watercourses Act ("IWWA") and the *Corps of Engineers Wetland Delineation Manual* (1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region*, Version 2.0 (January 2012). The results of this wetland investigation are provided below.

Site and Project Description:

The approximately 26-acre Site is located in the Town of Oxford's Woodruff Hill Industrial Park and is generally bounded to the north by a Connecticut Light & Power ("CL&P") electrical transmission line right-of-way ("ROW") and Algonquin Gas transmission ROW, to the east and south by a Spectra Energy gas compression station and access road, and to the west by Woodruff Hill Road. The Site is dominated by a complex of mature, even-aged, hardwood forests and open fields with wetland inclusions isolated primarily isolated to the northern and western portions of the Site. The surrounding land-use consists primarily of undeveloped industrial parcels that currently include large tracts of mature forest.

Four wetland areas were delineated on the Site consisting of several scrub/shrub, wet meadow and seep systems and a small isolated forested man-made wetland depression. Please refer to the enclosed Wetland Delineation Map for the approximate locations of the identified wetland resource areas. Wetlands were marked with pink and blue plastic flagging tape numbered with the following sequence: WF 1-01 to 1-24, WF 2-01 to 2-16, WF 3-01 to 3-08, and WF 4-01 to 4-04. General weather conditions encountered during the above-referenced inspections ranged from low 70° F temperatures with partly cloudy skies on June 26th to mid 80° F temperatures with sunny skies on July 3rd and mid 80° F temperatures with partly cloudy skies on July 12th.

Regulation of Wetlands:

Wetlands and watercourses are regulated by local, state and federal regulations, with each regulatory agency differing slightly in their definition and regulatory authority of resource areas, as discussed below. The proposed Facility is under the jurisdiction of the State of Connecticut Siting Council and, therefore, is exempt from local regulation, although local wetland regulations are considered by the Siting Council. Wetlands identified on the Site are likely considered Waters of the United States and, therefore, any direct impact to jurisdictional wetlands are subject to regulation by the U.S. Army Corps of Engineers ("ACOE") New England District.

Town of Oxford: The Town of Oxford regulates activities within wetlands and watercourses and within 100 feet of wetlands and watercourses through administration of the IWWA. However, since the project is under the jurisdiction of the Connecticut Siting Council, the Oxford Inland Wetlands Agency's jurisdiction is superseded by the Council.

State of Connecticut: **Freshwater Wetlands:** The IWWA requires the regulation of activities affecting or having the potential to affect wetlands under Sec. 22a-36 through 22a-45 of the Connecticut General Statutes. The IWWA is administered through local municipalities. The IWWA defines wetlands as areas of poorly drained, very poorly drained, floodplain, and alluvial soils, as delineated by a soil scientist. Watercourses are defined as bogs, swamps, or marshes, as well as lakes, ponds, rivers, streams, etc., whether natural or man-made, permanent or intermittent. Intermittent watercourse determinations are based on the presence of a defined permanent channel and bank, and two of the following characteristics: (1) evidence of scour or deposits of recent alluvium or detritus; (2) the presence of standing or flowing water for a duration longer than a particular storm incident; and (3) the presence of hydrophytic vegetation.

ACOE: The ACOE regulates the discharge of dredged or fill material into waters of the United States under Section 404 of the Clean Water Act. Waters of the United States are navigable waters, tributaries to navigable waters, wetlands adjacent to those waters, and/or isolated wetlands that have a demonstrated interstate commerce connection. The ACOE Wetlands Delineation Manual defines wetlands as "[t]hose areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."

Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403) prohibits the unauthorized obstruction or alteration of any navigable water of the United States. This section provides that the construction of any structure in or over any navigable water of the United States, or the accomplishment of any other work affecting the course, location, condition, or physical capacity of such waters is unlawful unless the work has been approved by the ACOE.

Soil Description:

Soil types encountered throughout the Site were generally consistent with digitally available soil survey information obtained from the Natural Resources Conservation Service ("NRCS")[1]. The exception is the lack of NRCS-mapped wetland soils on the Site, which were identified in the field as Ridgebury, Leicester and Whitman soil complex. The non-wetland soils were examined along the wetland boundary and throughout the remainder of the Site. They are dominated by Woodbridge fine sandy loam and Paxton and Montauk fine sandy loams. Detailed descriptions of wetland and upland soil types are provided below.

Wetland Soils:

The **Leicester** series consists of very deep, poorly drained loamy soils formed in friable till. They are nearly level or gently sloping soils in drainageways and low-lying positions on hills. Depth to bedrock is commonly more than 6 feet. Rock fragments range from 5 to 35 percent by volume to a depth of 40 inches and up to 50 percent below 40 inches. Leicester soils have a water table at or near the surface much of the year.

The **Ridgebury** series consists of very deep, somewhat poorly and poorly drained soils formed in glacial till derived mainly from granite, gneiss and schist. They are nearly level to gently sloping soils in low areas in uplands. This series includes phases that are poorly drained and the wetter part of somewhat poorly drained. A perched, fluctuating water table above the dense till saturates the solum to or near the surface for 7 to 9 months of the year.

The **Whitman** series consists of very deep, very poorly drained soils formed in glacial till derived mainly from granite, gneiss, and schist. They are nearly level or gently sloping soils in depressions and drainageways on uplands. Depth to dense till is 12 to 30 inches. Some pedons have organic horizons overlying the A horizon. They are fibric hemic or sapric material, and are up to 5 inches thick. Whitman soils are found on nearly level and gently sloping soils in depressions and in drainage ways of glacial uplands. Slopes are typically 0 to 2 percent but range up to 8 percent where wetness is due to seepage water. This soil is very poorly drained. A perched water table, or excess seepage water, is at or near the surface for about 9 months of the year.

Upland Soils:

The **Paxton** and **Montauk** series consists very deep, well drained loamy soils formed in subglacial till derived primarily from granitic materials. The soils formed in thick moderately coarse or medium textured glacial till mantles underlain by firm to dense sandy till (known locally as hardpan). They are nearly level to steep soils on till plains, hills, and drumlins. The depth to the densic contact and material is commonly 20 to 40 inches but the range includes 18 to 40 inches. Depth to bedrock is commonly more than 6 feet. Permeability is moderate or moderately rapid in the solum and slow or moderately slow in the substratum.

The **Woodbridge** series consists of moderately well drained loamy soils formed in compact, subglacial till. They are very deep to bedrock. They are nearly level to moderately steep soils on till plains, hills, and drumlins. Depth to the compact layer (hardpan) is 18 to 40 inches. Depth to bedrock is commonly more than 6 feet. Woodbridge soils have a seasonal high water table on top of the compact layer (18-40") from fall through late spring.

[1] NRCS Web Soil Survey, http://websoilsurvey.nrcs.usda.gov/app/, accessed on June 25, 2014.

Wetlands Discussion:

Wetland 1 Classification Summary:

Wetland 1[2]	System	Subsystem	Class	Subclass	Water Regime	Special Modifier
(WF 1-01 to 1-24)	Palustrine		Emergent	Nonpersistent	Saturated	
Watercourse Type (None)	Perennial ☐	Intermittent ☐	Tidal ☐	**Special Aquatic Habitat** (None)	Vernal Pool ☐	Other ☐

Wetland 1 Description:

Wetland 1 is a dense glacial till hillside seep wetland meadow wetland system with scattered shrubs characterized by a relatively narrow clearing surrounded to the north and south by mature upland forest. Water is conveyed west, originating at a stone wall cut at the edge of a large open field. This wetland feature terminates as it approaches the Woodruff Hill cul-de-sac. Evidence of mechanical compaction in the form of tire ruts is prevalent throughout this wetland seep system along with disturbed wetland soil profiles.

A permit was granted by the Oxford Inland Wetland Agency (Application #673) on February 22, 1999 that included provisions for filling this entire wetland system, identifying it at the time as a 2,850 square foot intermittent watercourse/wetland area. An attempt to fill this wetland occurred in February 2010. A February 10, 2010 inspection report by Civil1 indicated that approximately one to two feet of common fill and topsoil was placed over the wetland, which was graded and leveled. An investigation of this wetland area reveals some disturbance apparently associated with the work performed in 2010; however, most of the disturbance to the wetland soils is associated with the top 0.5-1.0 feet characterized by topsoil fill high in organic matter, underlain by native wetland soil profiles. The hydrology of this wetland system does not appear to have been significantly altered by the previous disturbance, and vegetation is dominated by hydrophytes, as noted below.

Wetland 1 Dominant Vegetation:

Dominant Wetland Species Common Name (Latin Name)	**Dominant Adjacent Upland Species** Common Name (Latin Name)
Spicebush (Lindera benzoin)	Red Maple (Acer rubrum)
Multiflora Rose* (Rosa multiflora)	Japanese Barberry* (Berberis thunbergii)
Rice Cutgrass (Leersia oryzoides)	Virginia Creeper (Parthenosisus quinquefolia)
Jewelweed (Impatiens capensis)	Northern Arrow-wood (Viburnum recognitum)
Canada Goldenrod (Solidago canadensis)	Canada Mayflower (Maianthemum candense)
Grass-Leaved Goldenrod (Euthamia graminifolia)	Spicebush (Lindera benzoin)
Japanese Stiltgrass (Microstegium vimineum)	Black Cherry (Prunus serotina)
Soft Rush (Juncus effuses)	Sassafras (Sassafras albidum)
Greater Bladder Sedge (Carex intumesens)	Northern Red Oak (Quercus rubra)
Sallow sedge (Carex lurida)	White Ash (Fraxinus americana)
Common fox sedge (Carex vulpinoidea)	Cinnamon Fern (Osmunda cinnamomea)
Pointed broom sedge (Carex scoparia)	Hayscented Fern (Dennstaedtia punctilobula)
	Tulip Poplar (Liriodendron tulipifera)

* denotes Connecticut Invasive Plants Council invasive species

[2] Cowardin, L. M., V. Carter, F. C. Golet, E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. Jamestown, ND: Northern Prairie Wildlife Research Center Online. http://www.npwrc.usgs.gov/resource/wetlands/classwet/index.htm - contents.

Wetland 2 Classification Summary:

Wetland 2	System	Subsystem	Class	Subclass	Water Regime	Special Modifier
(WF 2-01 to 2-16)	Palustrine		Forested & Scrub-Shrub	Broad-leaved Deciduous	Seasonally Flooded	
Watercourse Type (None)	Perennial ☐	Intermittent ☐	Tidal ☐	**Special Aquatic Habitat** (None)	Vernal Pool ☐	Other ☐

Wetland 2 Description:

The majority of Wetland 2 is off-site, with only its western edge located in the northwest corner of the Site. Wetland 2 is a complex of forested, scrub/shrub, and emergent seep wetland habitats formed in dense glacial till. An overhead electrical distribution ROW running north/south along the Site's western property boundary, north of the CL&P ROW, bisects the eastern upper reaches of this wetland system. Evidence of mechanical compaction in the form of tire ruts and gravel surfaces is prevalent throughout this utility ROW resulting in shallow ponding water at the time of inspection. Wetland 2 generally drains east to west across a moderately west-facing slope, formed in dense glacial till. Numerous adult green and pickerel frogs were observed within the shallow pools artificially created by the tire ruts.

Wetland 2 Dominant Vegetation:

Dominant Wetland Species Common Name (Latin Name)	**Dominant Adjacent Upland Species** Common Name (Latin Name)
Jewelweed (Impatiens capensis)	Autumn Olive* (Elaeagnus umbellate)
Sensitive Fern (Onoclea sensibilis)	Multiflora Rose* (Rosa multiflora)
Northern Arrow-wood (Viburnum recognitum)	Timothy Grass (Phleum pratense)
Reed Canarygrass* (Phalaris arundinacea)	Raspberry (Rubus sp.)
Multiflora Rose* (Rosa multiflora)	Fox Grape (Vitis labrusca)
Fox Grape (Vitis labrusca)	Mugwort* (Artemisia vulgaris)
Red Maple (Acer rubrum)	
Silky Dogwood (Cornus amomum)	
Lurid Sedge (Carex lurida)	
Black Willow (Salix nigra)	
Pussywillow (Salix discolor)	
Green Bulrush (Scirpus atrovirens)	
Arrow-Leaved Tearthumb (Polyganum sagitarium)	

* denotes Connecticut Invasive Plants Council invasive species

Wetland 3 Classification Summary:

Wetland 3	System	Subsystem	Class	Subclass	Water Regime	Special Modifier
(WF 3-01 to 3-08)	Palustrine		Forested & Scrub-Shrub	Broad-leaved Deciduous	Seasonally Flooded	
Watercourse Type (**None**)	Perennial ☐	Intermittent ☐	Tidal ☐	**Special Aquatic Habitat** (None)	Vernal Pool ☐	Other ☐

Wetland 3 Description:

Wetland 3 is a small hillside seep wetland system that has experienced high levels of anthropogenic activity. Wetland 3 is generally located at the confluence of a CL&P ROW and Woodruff Hill Road cul-de-sac. As such, the hydrology and nature of Wetland 3 has been highly altered from previous filling activities associated with CL&P maintenance and upgrading of this electrical transmission ROW, resulting in disturbed wetland soil profiles, surface compaction and altered vegetation communities. This wetland system receives hydrology from the surrounding uplands to the north and east via seasonal overland flow and groundwater exfiltration, as well as a PVC pipe conveying flows from a dug drainage swale located along the east side of Woodruff Hill Road on the Site.

Wetland 3 Dominant Vegetation:

Dominant Wetland Species Common Name (Latin Name)	**Dominant Adjacent Upland Species** Common Name (Latin Name)
Spicebush (Lindera benzoin)	Red Maple (Acer rubrum)
Purple Loosestrife* (Lythrum salicaria)	Japanese Barberry* (Berberis thunbergii)
Bebb Willow (Salix bebbiana)	Virginia Creeper (Parthenosisus quinquefolia)
Soft Rush (Juncus effuses)	Northern Arrow-wood (Viburnum recognitum)
	Canada Mayflower (Maianthemum candense)
	Spicebush (Lindera benzoin)
	Black Cherry (Prunus serotina)
	Sassafras (Sassafras albidum)
	Northern Red Oak (Quercus rubra)
	White Ash (Fraxinus americana)
	Cinnamon Fern (Osmunda cinnamomea)
	Hayscented Fern (Dennstaedtia punctilobula)
	Tulip Poplar (Liriodendron tulipifera)

* denotes Connecticut Invasive Plants Council invasive species

Wetland 4 Classification Summary:

Wetland 4 (WF 4-01 to 4-04)	System Palustrine	Subsystem	Class Forested	Subclass Broad-leaved Deciduous	Water Regime Seasonally Flooded	Special Modifier
Watercourse Type (None)	Perennial ☐	Intermittent ☐	Tidal ☐	**Special Aquatic Habitat** (None)	Vernal Pool ☐	Other ☐

Wetland 4 Description:

Wetland 4 is a very small, isolated man-made depressional wetland feature located in a generally flat, forested upland area. This depression was artificially created in dense well drained glacial till soils, apparently the result of a dug test pit that was improperly backfilled. This anthropogenic feature has formed a small depression that intercepts the seasonally high groundwater table as evident by a review of disturbed hydric soil profiles.

Wetland 4 Dominant Vegetation:

Dominant Wetland Species Common Name (Latin Name)	**Dominant Adjacent Upland Species** Common Name (Latin Name)
Devoid of Vegetation (Barren)	Red Maple (Acer rubrum)
	Japanese Barberry* (Berberis thunbergii)
	Virginia Creeper (Parthenosisus quinquefolia)
	Northern Arrow-wood (Viburnum recognitum)
	Canada Mayflower (Maianthemum candense)
	Spicebush (Lindera benzoin)
	Black Cherry (Prunus serotina)
	Sassafras (Sassafras albidum)
	Northern Red Oak (Quercus rubra)
	White Ash (Fraxinus americana)
	Cinnamon Fern (Osmunda cinnamomea)
	Hayscented Fern (Dennstaedtia punctilobula)
	Tulip Poplar (Liriodendron tulipifera)

* denotes Connecticut Invasive Plants Council invasive species

Summary:

APT has determined that the proposed CPV Towantic Energy Center Project will result in direct impact to Wetlands 1 and 4 in order to satisfy the building program needs of this development. As a result, the proposed project is regulated by ACOE and appears eligible as a Category 2 project under the ACOE's Connecticut General Permit.

If you have any questions regarding the above-referenced information, please feel free to contact me by telephone at (860) 663-1697 ext. 201 or via email at dgustafson@allpointstech.com.

Sincerely,

All-Points Technology Corporation, P.C.

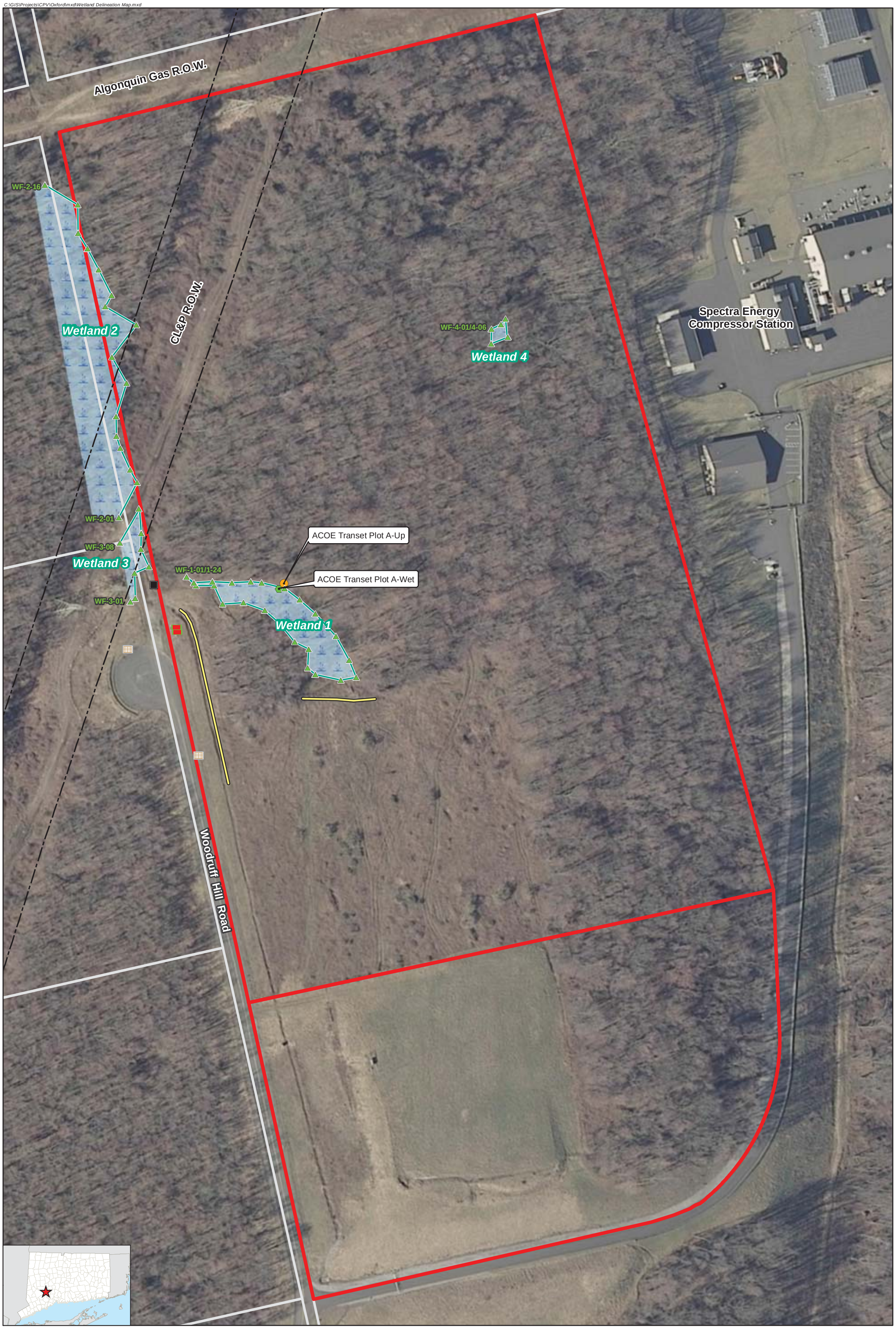
Dean Gustafson

Professional Soil Scientist

Enclosure

Wetland Delineation Map

C:\GIS\Projects\CPV\Oxford\mxd\Wetland Delineation Map.mxd



Legend

Wetland Flag	Wetland Area	Electrical Box
Delineated Wetland Boundary	Project Area	ACOE Transet Plot A-Up
CL&P 110' R.O.W.	Approximate Parcel Boundary (CTDEEP)	ACOE Transet Plot A-Wet
Drainage Ditch	Catch Basin	Transformer

Base Map Source: 2012 Aerial Photograph (CTECO)
Map Date: September 2014

100 50 0 100 Feet

N W E S

Wetland Delineation Map

Proposed CPV Towantic Energy Center
Woodruff Hill Road
Oxford, Connecticut

APPENDIX C – USACE'S CONNECTICUT GENERAL PERMIT APPLICATION

Category 2 Permit Application - Volume I

CPV Towantic Energy Center

Woodruff Hill Road
Oxford, Connecticut

Prepared for **CPV Towantic, LLC**
50 Braintree Hill Office Park, Suite 300
Braintree, Massachusetts 02184

Prepared by **All-Points Technology Corp., P.C.**
3 Saddlebrook Drive
Killingworth, Connecticut 06419

October 2014

Table of Contents

List of Figures

Project Site Plans
(attached separately – 11”x17” format)

Sheet Number	Title	Latest Revision
C001	TITLE SHEET AND DRAWING LIST	
C300	EXISTING CONDITIONS	9/26/14
C305	SITE PLAN	9/26/14
C310	STORMWATER MANAGEMENT & GRADING PLAN	9/26/14
C315	EROSION & SEDIMENT CONTROL PLAN	9/26/14
C320	DETAILS	9/26/14
C321	STORM DRAINAGE DETAILS	9/26/14
C330	EROSION CONTROL NARRATIVE	9/26/14
M301	GENERAL ARRANGEMENT ELEVATION LOOKING EAST	9/8/14

Category 2 Application Forms

- Application for Department of the Army Permit ENG Form 4345
- DEEP Connecticut Addendum form (DEP-ACGP-APP-001)

U.S. ARMY CORPS OF ENGINEERS **APPLICATION FOR DEPARTMENT OF THE ARMY PERMIT** 33 CFR 325. The proponent agency is CECW-CO-R.	***Form Approved -*** ***OMB No. 0710-0003*** ***Expires: 31-AUGUST-2013***

Public reporting for this collection of information is estimated to average 11 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of the collection of information, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters, Executive Services and Communications Directorate, Information Management Division and to the Office of Management and Budget, Paperwork Reduction Project (0710-0003). Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. Please DO NOT RETURN your form to either of those addresses. Completed applications must be submitted to the District Engineer having jurisdiction over the location of the proposed activity.

PRIVACY ACT STATEMENT

Authorities: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413; Regulatory Programs of the Corps of Engineers; Final Rule 33 CFR 320-332. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit. Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public and may be made available as part of a public notice as required by Federal law. Submission of requested information is voluntary, however, if information is not provided the permit application cannot be evaluated nor can a permit be issued. One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and/or instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned.

(ITEMS 1 THRU 4 TO BE FILLED BY THE CORPS)

1. APPLICATION NO.	2. FIELD OFFICE CODE	3. DATE RECEIVED	4. DATE APPLICATION COMPLETE

(ITEMS BELOW TO BE FILLED BY APPLICANT)

5. APPLICANT'S NAME	8. AUTHORIZED AGENT'S NAME AND TITLE (agent is not required)
First - Peter Middle - J. Last - Podurgiel	First - Dean Middle - E. Last - Gustafson
Company - CPV Towantic, LLC	Company - All-Points Technology Corp., P.C.
E-mail Address -	E-mail Address - dgustafson@allpointstech.com
6. APPLICANT'S ADDRESS:	9. AGENT'S ADDRESS:
Address- 50 Braintree Hill Office Park, Suite 300	Address- 3 Saddlebrook Drive
City - Braintree State - MA Zip - 02184 Country - USA	City - Killingworth State - CT Zip - 06419 Country - USA
7. APPLICANT'S PHONE NOs. w/AREA CODE	10. AGENTS PHONE NOs. w/AREA CODE
a. Residence b. Business (781) 848-3611 c. Fax (781) 848-5804	a. Residence b. Business (860) 663-1697 x201 c. Fax (860) 663-0935

STATEMENT OF AUTHORIZATION

11. I hereby authorize, Dean E. Gustafson, APT to act in my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this permit application.

[signature] 10/3/2014

SIGNATURE OF APPLICANT DATE

By: CPV Towantic Holding Company, LLC acting solely in its capacity as Managing Member of CPV Towantic, LLC

NAME, LOCATION, AND DESCRIPTION OF PROJECT OR ACTIVITY

12. PROJECT NAME OR TITLE (see instructions)

CPV Towantic Energy Center

13. NAME OF WATERBODY, IF KNOWN (if applicable)	14. PROJECT STREET ADDRESS (if applicable)
N/A	Address Woodruff Hill Road
15. LOCATION OF PROJECT Latitude: °N 41.483156 Longitude: °W -73.122417	City - Oxford State- CT Zip- 06478

16. OTHER LOCATION DESCRIPTIONS, IF KNOWN (see instructions)

State Tax Parcel ID Municipality

Section - Township - Range -

17. DIRECTIONS TO THE SITE

via I-84 W: take Exit 16/CT RT 188; turn left onto RT 188 and travel 1.1 miles and turn left onto Oxford Airport Road; travel 0.8 mile and take second right onto Christian Street; travel 1.1 miles and turn left onto Commerce Drive; travel 0.4 mile and Commerce Drive becomes Jack Hill Road; travel 0.8 mile and turn left onto Riggs Street; travel 0.8 mile and Riggs Street becomes Prokop Road; travel 0.25 mile and take right onto Woodruff Hill Road; travel 0.3 mile, going past access to Spectra Energy compressor station entrance on right, site is on right extending to the cul-de-sac end of Woodruff Hill Road.

18. Nature of Activity (Description of project, include all features)

The Applicant, CPV Towantic, LLC, seeks approval to construct a new natural gas-fired electric generating facility on Woodruff Hill Road in Oxford, Connecticut. The CPV Towantic Energy Center is a proposed dual-fueled (natural gas with ultra-low sulfur distillate back-up) combined cycle generating facility owned by CPV. The proposed development (the "Project") encompasses two adjoining parcels located on the east side of Woodruff Hill Road along the cul-de-sac of the road; the original parcel encompasses 20± acres with a smaller 6± acre abutting parcel added to the south.

Refer to attached Narrative - Attachment A for additional information.

19. Project Purpose (Describe the reason or purpose of the project, see instructions)

The CPV Towantic Energy Center would provide both grid reliability and local electrical reliability benefits by adding a new baseload resource to Southwest Connecticut. As of February 2014, the ISO-NE auction conducted for capacity resources for New England cleared at a deficit, signaling and confirming the need for new generation. Therefore, the Towantic facility would ensure the ability of the bulk power system to provide clean, reliable, efficient power and to meet customer and public policy needs for the State of Connecticut.

Refer to attached Narrative - Attachment A for additional information.

USE BLOCKS 20-23 IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED

20. Reason(s) for Discharge

Waters of the United States will be impacted by the Project due to their central location on the Site making avoidance impossible while satisfying the building program needs of the Towantic Energy Center. The proposed location of the Towantic facility satisfies important siting requirements with its close proximity to required interconnection facilities, avoiding and minimizing the need for acquiring rights-of-way. As a result, potential wetland impacts associated with siting a facility more distant from required interconnection facilities (requiring potentially long rights-of-way through wetland resources) has been avoided.

Refer to attached Narrative - Attachment A for additional information.

21. Type(s) of Material Being Discharged and the Amount of Each Type in Cubic Yards:

Type Amount in Cubic Yards	Type Amount in Cubic Yards	Type Amount in Cubic Yards

N/A (no discharge into navigable waters)

22. Surface Area in Acres of Wetlands or Other Waters Filled (see instructions)

Acres 0.24 acres

or

Linear Feet

23. Description of Avoidance, Minimization, and Compensation (see instructions)

The preferred alternative Site offers ease of electrical and gas interconnection; adequate separation to nearby residents; and, a location in a large industrial-zoned district which includes a state-owned airport. The preferred alternative will result in unavoidable impact to wetlands due to their central location on the Site making avoidance impossible while satisfying the building program needs of the Towantic Energy Center. CPV proposes to make payment into the Connecticut In-Lieu Fee Program. The Site provides limited opportunity to mitigate in kind for the project's impact to wetlands. Refer to attached Narrative - Attachment A for additional information.

24. Is Any Portion of the Work Already Complete? [X] Yes [ ] No IF YES, DESCRIBE THE COMPLETED WORK

A permit was granted by the Oxford Inland Wetland Agency (Application #673) on February 22, 1999 that included provisions for filling this entire wetland system, identifying it at the time as a 2,850 square foot intermittent watercourse/wetland area. An attempt to fill this wetland occurred in February 2010. A February 10, 2010 inspection report by Civil1 indicated that approximately one to two feet of common fill and topsoil was placed over the wetland, which was graded and leveled. An investigation of this wetland area reveals some disturbance apparently associated with the work performed in 2010; however, most of the disturbance to the wetland soils is associated with the top 0.5-1.0 feet characterized by topsoil fill high in organic matter, underlain by native wetland soil profiles. The hydrology of this wetland system does not appear to have been significantly altered by the previous disturbance, and vegetation is dominated by hydrophytes. Refer to attached Narrative - Attachment A for additional information.

25. Addresses of Adjoining Property Owners, Lessees, Etc., Whose Property Adjoins the Waterbody (if more than can be entered here, please attach a supplemental list).

a. Address- Refer to attached Narrative - Attachment C - Abutting Property Owners list.

City - State - Zip -

b. Address-

City - State - Zip -

c. Address-

City - State - Zip -

d. Address-

City - State - Zip -

e. Address-

City - State - Zip -

26. List of Other Certificates or Approvals/Denials received from other Federal, State, or Local Agencies for Work Described in This Application.

AGENCY	TYPE APPROVAL*	IDENTIFICATION NUMBER	DATE APPLIED	DATE APPROVED	DATE DENIED
CT Siting Council	Certificate	Docket No. 192		1999-06-23	
Oxford IWA	Inland Wtl. Permit	Appl. #673		1999-02-22	

* Would include but is not restricted to zoning, building, and flood plain permits

27. Application is hereby made for permit or permits to authorize the work described in this application. I certify that this information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent of the applicant.

[signature] 10/3/2014 [signature] APT 10/3/2014

SIGNATURE OF APPLICANT DATE SIGNATURE OF AGENT DATE

By: CPV Towantic Holding Company, LLC acting solely in its capacity as Managing Member of CPV Towantic, LLC

The Application must be signed by the person who desires to undertake the proposed activity (applicant) or it may be signed by a duly authorized agent if the statement in block 11 has been filled out and signed.

18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than $10,000 or imprisoned not more than five years or both.

Connecticut Department of
Energy & Environmental Protection
Bureau of Water Protection & Land Reuse
Inland Water Resources Division

DEEP/CPPU USE ONLY
App #: ______________________
Doc #: ______________________
Check #: ______________________
Program: Programmatic General Permit
NAE #: ______________________
DEEP #: ______________________
Determinations: ☐ Eligible Category 2 ☐ Eligible Category 1 ☐ Individual Permit

Connecticut Addendum Army Corps of Engineers General Permit State of Connecticut (CT GP)

Print or type unless otherwise noted.

Part I: Application Description

Town where site is located: **Oxford**

Brief Description of Project: The Applicant, CPV Towantic, LLC, seeks approval to construct a new natural gas-fired electric generating facility on Woodruff Hill Road in Oxford, Connecticut.

Part II: Fee Information

There is no fee required at this time. The Department of Energy and Environmental Protection (DEEP) may require an application fee to be submitted with this addendum at a later date.

Part III: Applicant Information

- ***If an applicant is a corporation, limited liability company, limited partnership, limited liability partnership, or a statutory trust, it must be registered with the Secretary of State. If applicable, registrant's name shall be stated** ***exactly*** *as it is registered with the Secretary of State. This information can be accessed at* CONCORD.
- *If an applicant is an individual, provide the legal name (include suffix) in the following format: First Name; Middle Initial; Last Name; Suffix (Jr, Sr., II, III, etc.).*

1. Applicant Name: **CPV Towantic, LLC**

   Mailing Address: **50 Braintree Hill Office Park, Suite 300**

   City/Town: **Braintree** State: **MA** Zip Code: **02184**

   Business Phone: **(781) 848-3611** ext. Fax: **(781) 848-5804**

   Contact Person: **Andrew Bazinet** Title: **Project Manager**

   *E-Mail: **abazinet@cpv.com**

   *By providing this e-mail address you are agreeing to receive official correspondence from the department, at this electronic address, concerning the subject application. Please remember to check your security settings to be sure you can receive e-mails from "ct.gov" addresses. Also, please notify the department if your e-mail address changes.

Part III: Applicant Information (continued)

a) Registrant Type (check one): ☐ individual ☒ ***business entity** ☐ federal agency

☐ state agency ☐ municipality ☐ tribal

***If a business entity:**

i) check type: ☐ corporation ☒ limited liability company ☐ limited partnership

☐ limited liability partnership ☐ statutory trust ☐ Other: ____________________

ii) provide Secretary of the State business ID #:0606312 __________This information can be accessed at [CONCORD]

iii) ☐ Check here if you are **NOT** registered with the SOTS.

☐ Check here if any co-applicants. If so, attach additional sheet(s) with the required information as requested above.

b) Applicant's interest in property at which the proposed activity is to be located:

☒ site owner ☒ option holder ☐ lessee ☐ developer

☐ easement holder ☐ operator ☐ other (specify):

☐ Check here if there are co-applicants. If so, label and attach additional sheet(s) to this sheet with the required information.

2. List primary contact for departmental correspondence and inquiries, if different than the applicant.

Name: **All-Points Technology Corporation, P.C.**

Mailing Address: **7 Saddlebrook Drive**

City/Town: **Killingworth** State: **CT** Zip Code: **06419**

Business Phone: **(860) 663-1697** ext. **201** Fax: **(860) 663-0935**

Contact Person: **Dean Gustafson** Title: **Professional Soil Scientist**

E-Mail: **dgustafson@allpointstech.com**

*By providing this e-mail address you are agreeing to receive official correspondence from the department, at this electronic address, concerning the subject application. Please remember to check your security settings to be sure you can receive e-mails from "ct.gov" addresses. Also, please notify the department if your e-mail address changes.

3. Property Owner, if different than the applicant:

Name: **For Lot 9A only: Woodruff Hill View, LLC**

Mailing Address: **600 George's Hill Road**

City/Town: **Southbury** State: **CT** Zip Code: **06488**

Business Phone: **(203) 262-0002** ext. Fax:

Contact Person: **Elizabeth M. Hanna** Title:

E-Mail:

Part III: Applicant Information (continued)

4. List any engineer(s) or other consultant(s) employed or retained to assist in preparing the application or in designing or constructing the activity.

   Name: **Civil 1**

   Mailing Address: **Cornerstone Professional Park, 43 Sherman Hill Road, Suite D-101**

   City/Town: **Woodbury** State: **CT** Zip Code: **06798**

   Business Phone: **(203) 266-0778** ext. Fax: **(860) 266-4759**

   Contact Person: **Curt Jones** Title: **P.E., LEED AP**

   E-Mail: **curt@civil1.com**

   Service Provided: **survey, civil design, sedimentation & erosion control plan, stormwater management plan**

   ☒ Check here if additional sheets are necessary, and label and attach them to this sheet.

Part IV: Site/Project Information

1. **SITE NAME AND LOCATION**

   Is the name of the site the same as the name of the applicant? ☐ Yes ☒ No

   Name of Site : **CPV Towantic Energy Center**

   Street Address or Description of Location: **Woodruff Hill Road (consists of two lots: 20.3 acres plus Lot 9A [6.2 acres])**

   City/Town: **Oxford** State: **CT** Zip Code: **06478**

   Latitude and longitude of the exact location of the proposed activity in degrees, minutes, and seconds or in decimal degrees: Latitude: **41.483156** Longitude: **73.122417**

   Method of determination (check one):

   ☒ GPS ☐ USGS Map ☐ Other (please specify):

   If a USGS Map was used, provide the quadrangle name:

2. **COASTAL BOUNDARY:** Is the activity which is the subject of this application located within the coastal boundary as delineated on DEEP approved coastal boundary maps? ☐ Yes ☒ No

   If yes, and this application is for a new authorization or a modification of an existing authorization where the physical footprint of the subject activity is modified, you must submit a *Coastal Consistency Review Form* (DEP-APP-004) with this completed application.

   Information on the coastal boundary is available at the local town hall or on the "Coastal Boundary Map" available at DEEP Maps and Publications (860-424-3555).

3. **ENDANGERED OR THREATENED SPECIES:** Is the project site located within an area identified as a habitat for endangered, threatened or special concern species as identified on the "State and Federal Listed Species and Natural Communities Map"? ☒ Yes ☐ No Date of Map: **June 2014**

   If yes, complete and submit a *Request for NDDB State Listed Species Review Form* (DEP-APP-007) to the address specified on the form. **Please note NDDB review generally takes 4 to 6 weeks and may require additional documentation from the applicant.**

   The CT NDDB response ***must*** be submitted with this completed application.

   For more information visit the DEEP website at www.ct.gov/dep/nddbrequests or call the NDDB at 860-424-3011.

Part III: Applicant Information (continued)

4. List any engineer(s) or other consultant(s) employed or retained to assist in preparing the application or in designing or constructing the activity.

Name: **Burns and Roe Enterprises, Inc. (a/k/a, Power Burns and Roe)**

Mailing Address: **800 Kinderkamack Road**

City/Town: **Oradell** State: **NJ** Zip Code: **07649**

Business Phone: **(201) 986-4303** ext. Fax: **(201) 986-4335**

Contact Person: **Joseph Chiappinelli** Title: **Sr. Project Manager**

E-Mail: **JChiappinelli@roe.com**

Service Provided: **energy center design, civil design, sedimentation & erosion control plan, stormwater management plan**

☐ Check here if additional sheets are necessary, and label and attach them to this sheet.

Part IV: Site/Project Information

1. SITE NAME AND LOCATION

Is the name of the site the same as the name of the applicant? ☐ Yes ☒ No

Name of Site : **CPV Towantic Energy Center**

Street Address or Description of Location: **Woodruff Hill Road (consists of two lots: 20.3 acres plus Lot 9A [6.2 acres])**

City/Town: **Oxford** State: **CT** Zip Code: **06478**

Latitude and longitude of the exact location of the proposed activity in degrees, minutes, and seconds or in decimal degrees: Latitude: **41.483156** Longitude: **73.122417**

Method of determination (check one):

☒ GPS ☐ USGS Map ☐ Other (please specify):

If a USGS Map was used, provide the quadrangle name:

2. COASTAL BOUNDARY: Is the activity which is the subject of this application located within the coastal boundary as delineated on DEEP approved coastal boundary maps? ☐ Yes ☒ No

If yes, and this application is for a new authorization or a modification of an existing authorization where the physical footprint of the subject activity is modified, you must submit a *Coastal Consistency Review Form* (DEP-APP-004) with this completed application.

Information on the coastal boundary is available at the local town hall or on the “Coastal Boundary Map” available at DEEP Maps and Publications (860-424-3555).

3. ENDANGERED OR THREATENED SPECIES: Is the project site located within an area identified as a habitat for endangered, threatened or special concern species as identified on the "State and Federal Listed Species and Natural Communities Map"? ☒ Yes ☐ No Date of Map: **June 2014**

If yes, complete and submit a *Request for NDDB State Listed Species Review Form* (DEP-APP-007) to the address specified on the form. **Please note NDDB review generally takes 4 to 6 weeks and may require additional documentation from the applicant.**

The CT NDDB response ***must*** be submitted with this completed application.

For more information visit the DEEP website at www.ct.gov/dep/nddbrequests or call the NDDB at 860-

Part IV: Project Information (continued)

4. AQUIFER PROTECTION AREAS: Is the site located within a town required to establish Aquifer Protection Areas, as defined in section 22a-354a through 354bb of the General Statutes (CGS)?

☒ Yes ☐ No To view the applicable list of towns and maps visit the DEEP website at www.ct.gov/deep/aquiferprotection

If yes, is the site within an area identified on a Level A map? ☐ Yes ☒ No

If yes, is the site within an area identified on a Level B map? ☐ Yes ☒ No

If your site is on a Level A map, check the DEEP website, Business and Industry Information to determine if your activity is required to be registered under the Aquifer Protection Area Program.

If your site is on a Level B map, no action is required at this time, however you may be required to register under the Aquifer Protection Area Program in the future when the area is delineated as Level A.

5. CONSERVATION OR PRESERVATION RESTRICTION: Is the property subject to a conservation or preservation restriction? ☐ Yes ☒ No

If Yes, proof of written notice of this registration to the holder of such restriction or a letter from the holder of such restriction verifying that this registration is in compliance with the terms of the restriction, must be submitted with this completed form.

6. Total area (in acres) within property boundaries: **26+/-**

7. Project Category: (please check all that apply)

☒ Industrial Site Developmet

☐ Commercial Site Development

☐ Pond/Lake Dredging

☐ Fish/Wildlife Management (Government Agency)

☐ Golf Course Development

☐ Individual Residential

☐ Condo/Apartment Complex

☐ Stream Restoration/Enhancement

☐ Multiple Lot Residential Development

☐ Public Water Supply

☐ Mine/Quarry

☐ Other (Describe below):

Part V: Environmental Information

1. Wetland Impact
   a. Direct Impact
      (Fill includes permanent & temporary): **10,500** sf **0.24** acres
   b. Secondary/Indirect Impact: **0** sf **0** acres
   c. **Total Impact**: **10,500** sf **0.24** acres
2. Waters/Waterways/Watercourses Impact
   a. Direct Impact
      (Fill includes permanent & temporary): **0** lf **0** sf
   b. Secondary/Indirect Impact: **0** lf **0** sf
   c. **Total Impact**: **0** lf **0** sf

Part V: Environmental Information (continued)

3. Do the following special wetland types occur on site?

Special Wetland	Yes	No	Total Area of Resource (SF)	Area of Resource Impacted (SF)
Vernal Pool	☐	☒		
Fen	☐	☒		
Bog	☐	☒		
Cedar Swamp	☐	☒		
Spruce Swamp	☐	☒		
Calcareous Seepage Swamp	☐	☒		

4. **Channel Relocation/Restoration/Stabilization**

Does the project include alterations to a perennial watercourse(s)? ☐ Yes ☒ No

If Yes, indicate all design features included in your project from the list below:

Design Features	Yes	No
Avoidance of barriers to fish movement	☐	☐
Formation of pools and riffles	☐	☐
Provisions for areas of sheltered flow (e.g., boulders, low check dams)	☐	☐
Preservation of stream bank vegetation and establishment of new vegetation	☐	☐
Use of clean natural bed materials of a suitable size	☐	☐

Indicate Design Flow for bank-full flow: **cfs**

Indicate Frequency Recurrence (year):

Indicate Design Velocity for bank-full flow: **fps**

Indicate Frequency Recurrence (year):

5. **Floodplains**	Yes	No
Is there a FEMA mapped floodplain for floodway on the site?	☐	☒
Are any excavations or permanent fill/structures proposed within the floodplain?	☐	☒
Are any excavations or permanent fill/structures proposed within the floodway?	☐	☒
Are any temporary stockpiles of fill or materials proposed within the floodplain?	☐	☒
Are any increases in the 100 year water surface elevation proposed? If Yes, indicate maximum increase in feet:	☐	☒
Are any flooding increases proposed that would extend off the subject property? If Yes, attach an explanation to this sheet.	☐	☒

If applicable, include with this form, hydraulic calculations including tabulated summary of results that demonstrate no adverse impacts of any fill in a floodplain and which are in accordance with the guidance document entitled, “Hydraulic Analysis Guidance Document” (www.ct.gov/dep/lib/dep/Permits_and_Licenses/Land_Use_Permits/Inland_Water_Permits/iwrdhydraulicguidance.pdf)

Part VI: Hydraulic and Drainage Structures *(You are required to complete a separate sheet for each structure)*

Sheet 1 of 23

1. Identify the type of structure: (Check one below that applies)

☐ Culvert ☐ Detention/Retention Basin ☐ Infiltration Basin/Structure ☐ Drainage Outfall ☐ Drainage Swale ☐ Bridge ☐ Dam
☐ Dike ☐ Weir ☐ Outlet Control Structure ☒ Pipe/Conduit/Aqueduct ☐ Other:

2. How is the structure labeled on the site plans and in reports? CB A7 to Basin A
3. Where is the structure located on the site plans? South of Perimeter Plant Road Station 28+75 offset 180'
4. For bridge/culvert structures, what is the **openness ratio**? **N/A** meters
(The openness ratio is the X-sectional area of structure opening/ length of the structure parallel to the stream.)
(www.nae.usace.army.mil/reg/Openness Ratio (OR) Spreadsheet.pdf)
5. What is the size of the contributing watershed to the structure? 1.33 Acres 0.0021 Square Miles
6. Is the structure located within a **FEMA flood zone**? ☒ No ☐ Yes If yes, indicate the type of zone: ☐ Floodway ☐ Flood Plain

7. **Provide the following information as appropriate for the structure identified above.**

Water Surface Elevation (feet) (Immediately upstream of structure)
Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Aerial Extent of Inundation (square feet) (Maximum)
Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Duration of Inundation (hours) Storm Event Frequency					**Discharge Velocity (feet/second)** Storm Event Frequency					**Flow Volume (cubic feet/second)** Storm Event Frequency				
2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr
N/A					6.88	8.21	8.41	8.97	9.22	2.54	4.60	5.33	6.22	7.21

Part VI: Hydraulic and Drainage Structures *(You are required to complete a separate sheet for each structure)*

Sheet 2 of 23

1. Identify the type of structure: (Check one below that applies)

☐ Culvert ☐ Detention/Retention Basin ☐ Infiltration Basin/Structure ☐ Drainage Outfall ☐ Drainage Swale ☐ Bridge ☐ Dam
☐ Dike ☐ Weir ☐ Outlet Control Structure ☒ Pipe/Conduit/Aqueduct ☐ Other:

2. How is the structure labeled on the site plans and in reports? CB A21 to Basin A

3. Where is the structure located on the site plans? South of Perimeter Plant Road Station 28+25 offset 180'

4. For bridge/culvert structures, what is the **openness ratio**? **N/A** meters
(The openness ratio is the X-sectional area of structure opening/ length of the structure parallel to the stream.)
(www.nae.usace.army.mil/reg/Openness Ratio (OR) Spreadsheet.pdf)

5. What is the size of the contributing watershed to the structure? 3.99 Acres 0.0062 Square Miles

6. Is the structure located within a **FEMA flood zone**? ☒ No ☐ Yes If yes, indicate the type of zone: ☐ Floodway ☐ Flood Plain

7. **Provide the following information as appropriate for the structure identified above.**

Water Surface Elevation (feet) (Immediately upstream of structure)

Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Aerial Extent of Inundation (square feet) (Maximum)

Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Duration of Inundation (hours) Storm Event Frequency					**Discharge Velocity (feet/second)** Storm Event Frequency					**Flow Volume (cubic feet/second)** Storm Event Frequency				
2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr
N/A					6.60	7.86	8.08	8.37	8.62	7.00	12.88	15.00	17.47	20.29

Part VI: Hydraulic and Drainage Structures *(You are required to complete a separate sheet for each structure)*

Sheet 3 of 23

1. Identify the type of structure: (Check one below that applies)

☐ Culvert ☒ Detention/Retention Basin ☐ Infiltration Basin/Structure ☐ Drainage Outfall ☐ Drainage Swale ☐ Bridge ☐ Dam
☐ Dike ☐ Weir ☐ Outlet Control Structure ☐ Pipe/Conduit/Aqueduct ☐ Other:

2. How is the structure labeled on the site plans and in reports? Stormwater Renovation Area "A"

3. Where is the structure located on the site plans? North of Proposed Access Drive Station 1+00 to 5+00

4. For bridge/culvert structures, what is the **openness ratio**? **N/A** meters
(The openness ratio is the X-sectional area of structure opening/ length of the structure parallel to the stream.)
(www.nae.usace.army.mil/reg/Openness Ratio (OR) Spreadsheet.pdf)

5. What is the size of the contributing watershed to the structure? 9.36 Acres 0.0146 Square Miles

6. Is the structure located within a **FEMA flood zone**? ☒ No ☐ Yes If yes, indicate the type of zone: ☐ Floodway ☐ Flood Plain

7. **Provide the following information as appropriate for the structure identified above.**

Water Surface Elevation (feet) (Immediately upstream of structure) Storm Event Frequency														
2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Aerial Extent of Inundation (square feet) (Maximum) Storm Event Frequency														
2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A	33,922	33,922	N/A	37,025	37,025	N/A	38,000	38,000	N/A	39,000	39,000	N/A	39,970	39,970

Duration of Inundation (hours) Storm Event Frequency					**Discharge Velocity (feet/second)** Storm Event Frequency					**Flow Volume (cubic feet/second)** Storm Event Frequency				
2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr
14	18	20	20.5	22	8.30	9.72	9.77	11.07	12.82	1.53	2.33	2.68	4.04	6.18

Part VI: Hydraulic and Drainage Structures *(You are required to complete a separate sheet for each structure)*

Sheet 4 of 23

1. Identify the type of structure: (Check one below that applies)

☐ Culvert ☐ Detention/Retention Basin ☐ Infiltration Basin/Structure ☐ Drainage Outfall ☐ Drainage Swale ☐ Bridge ☐ Dam

☐ Dike ☐ Weir ☒ Outlet Control Structure ☐ Pipe/Conduit/Aqueduct ☐ Other:

2. How is the structure labeled on the site plans and in reports? Outlet Structure A1

3. Where is the structure located on the site plans? West Edge of Basin A

4. For bridge/culvert structures, what is the **openness ratio**? **N/A** meters
(The openness ratio is the X-sectional area of structure opening/ length of the structure parallel to the stream.)
(www.nae.usace.army.mil/reg/Openness Ratio (OR) Spreadsheet.pdf)

5. What is the size of the contributing watershed to the structure? 9.36 Acres 0.0146 Square Miles

6. Is the structure located within a **FEMA flood zone**? ☒ No ☐ Yes If yes, indicate the type of zone: ☐ Floodway ☐ Flood Plain

7. Provide the following information as appropriate for the structure identified above.

Water Surface Elevation (feet) (Immediately upstream of structure)

Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Aerial Extent of Inundation (square feet) (Maximum)

Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Duration of Inundation (hours) Storm Event Frequency					**Discharge Velocity (feet/second)** Storm Event Frequency					**Flow Volume (cubic feet/second)** Storm Event Frequency				
2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr
N/A					8.30	9.72	9.77	11.07	12.82	0.77	1.16	1.33	1.85	2.91

Part VI: Hydraulic and Drainage Structures *(You are required to complete a separate sheet for each structure)* Sheet 5 of 23

1. Identify the type of structure: (Check one below that applies)

☐ Culvert ☐ Detention/Retention Basin ☐ Infiltration Basin/Structure ☒ Drainage Outfall ☐ Drainage Swale ☐ Bridge ☐ Dam
☐ Dike ☐ Weir ☐ Outlet Control Structure ☐ Pipe/Conduit/Aqueduct ☐ Other:

2. How is the structure labeled on the site plans and in reports? DP4

3. Where is the structure located on the site plans? Between Woodruff Hill Road Cul-de-sac and Main Access Entrance

4. For bridge/culvert structures, what is the **openness ratio**? **N/A** meters
(The openness ratio is the X-sectional area of structure opening/ length of the structure parallel to the stream.)
(www.nae.usace.army.mil/reg/Openness Ratio (OR) Spreadsheet.pdf)

5. What is the size of the contributing watershed to the structure? 10.19 Acres 0.0159 Square Miles

6. Is the structure located within a **FEMA flood zone**? ☒ No ☐ Yes If yes, indicate the type of zone: ☐ Floodway ☐ Flood Plain

7. **Provide the following information as appropriate for the structure identified above.**

Water Surface Elevation (feet) (Immediately upstream of structure)
Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Aerial Extent of Inundation (square feet) (Maximum)
Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Duration of Inundation (hours) Storm Event Frequency					**Discharge Velocity (feet/second)** Storm Event Frequency					**Flow Volume (cubic feet/second)** Storm Event Frequency				
2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr
N/A					6.67	8.40	8.63	9.15	9.54	1.67	3.36	3.96	4.65	5.44

Part VI: Hydraulic and Drainage Structures *(You are required to complete a separate sheet for each structure)*

1. Identify the type of structure: (Check one below that applies)

☐ Culvert ☐ Detention/Retention Basin ☐ Infiltration Basin/Structure ☐ Drainage Outfall ☐ Drainage Swale ☐ Bridge ☐ Dam
☐ Dike ☐ Weir ☒ Outlet Control Structure ☐ Pipe/Conduit/Aqueduct ☐ Other:

2. How is the structure labeled on the site plans and in reports? Outlet Structure A2

3. Where is the structure located on the site plans? West Edge of Basin A

4. For bridge/culvert structures, what is the **openness ratio**? **N/A** meters
(The openness ratio is the X-sectional area of structure opening/ length of the structure parallel to the stream.)
(www.nae.usace.army.mil/reg/Openness Ratio (OR) Spreadsheet.pdf)

5. What is the size of the contributing watershed to the structure? 9.36 Acres 0.0146 Square Miles

6. Is the structure located within a **FEMA flood zone**? ☒ No ☐ Yes If yes, indicate the type of zone: ☐ Floodway ☐ Flood Plain

7. **Provide the following information as appropriate for the structure identified above.**

Water Surface Elevation (feet) (Immediately upstream of structure)
Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Aerial Extent of Inundation (square feet) (Maximum)
Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Duration of Inundation (hours) Storm Event Frequency					**Discharge Velocity (feet/second)** Storm Event Frequency					**Flow Volume (cubic feet/second)** Storm Event Frequency				
2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr
N/A					4.92	5.59	5.95	6.81	7.69	0.77	1.16	1.35	2.09	3.27

Part VI: Hydraulic and Drainage Structures *(You are required to complete a separate sheet for each structure)*

Sheet 7 of 23

1. Identify the type of structure: (Check one below that applies)

☐ Culvert ☐ Detention/Retention Basin ☐ Infiltration Basin/Structure ☒ Drainage Outfall ☐ Drainage Swale ☐ Bridge ☐ Dam
☐ Dike ☐ Weir ☐ Outlet Control Structure ☐ Pipe/Conduit/Aqueduct ☐ Other:

2. How is the structure labeled on the site plans and in reports? DP3

3. Where is the structure located on the site plans? South of Woodruff Hill Road Cul-de-sac

4. For bridge/culvert structures, what is the **openness ratio**? **N/A** meters
(The openness ratio is the X-sectional area of structure opening/ length of the structure parallel to the stream.)
(www.nae.usace.army.mil/reg/Openness Ratio (OR) Spreadsheet.pdf)

5. What is the size of the contributing watershed to the structure? 10.17 Acres 0.0159 Square Miles

6. Is the structure located within a **FEMA flood zone**? ☒ No ☐ Yes If yes, indicate the type of zone: ☐ Floodway ☐ Flood Plain

7. **Provide the following information as appropriate for the structure identified above.**

Water Surface Elevation (feet) (Immediately upstream of structure)
Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Aerial Extent of Inundation (square feet) (Maximum)
Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Duration of Inundation (hours) Storm Event Frequency					**Discharge Velocity (feet/second)** Storm Event Frequency					**Flow Volume (cubic feet/second)** Storm Event Frequency				
2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr
N/A					6.79	8.40	8.59	9.09	9.44	1.70	3.36	3.94	4.62	5.38

Part VI: Hydraulic and Drainage Structures *(You are required to complete a separate sheet for each structure)*

Sheet 8 of 23

1. Identify the type of structure: (Check one below that applies)

☐ Culvert ☐ Detention/Retention Basin ☐ Infiltration Basin/Structure ☐ Drainage Outfall ☐ Drainage Swale ☐ Bridge ☐ Dam
☐ Dike ☐ Weir ☐ Outlet Control Structure ☒ Pipe/Conduit/Aqueduct ☐ Other:

2. How is the structure labeled on the site plans and in reports? CB B12 to Basin B

3. Where is the structure located on the site plans? North of Perimeter Plant Road Station 17+60 offset 340'

4. For bridge/culvert structures, what is the **openness ratio**? **N/A** meters
(The openness ratio is the X-sectional area of structure opening/ length of the structure parallel to the stream.)
(www.nae.usace.army.mil/reg/Openness Ratio (OR) Spreadsheet.pdf)

5. What is the size of the contributing watershed to the structure? 8.09 Acres 0.0126 Square Miles

6. Is the structure located within a **FEMA flood zone**? ☒ No ☐ Yes If yes, indicate the type of zone: ☐ Floodway ☐ Flood Plain

7. **Provide the following information as appropriate for the structure identified above.**

Water Surface Elevation (feet) (Immediately upstream of structure)

Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Aerial Extent of Inundation (square feet) (Maximum)

Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Duration of Inundation (hours) Storm Event Frequency					**Discharge Velocity (feet/second)** Storm Event Frequency					**Flow Volume (cubic feet/second)** Storm Event Frequency				
2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr
N/A					6.14	7.54	7.91	8.28	8.57	5.35	11.45	13.75	16.49	19.67

Part VI: Hydraulic and Drainage Structures *(You are required to complete a separate sheet for each structure)*

Sheet 9 of 23

1. Identify the type of structure: (Check one below that applies)

☐ Culvert ☒ Detention/Retention Basin ☐ Infiltration Basin/Structure ☐ Drainage Outfall ☐ Drainage Swale ☐ Bridge ☐ Dam
☐ Dike ☐ Weir ☐ Outlet Control Structure ☐ Pipe/Conduit/Aqueduct ☐ Other:

2. How is the structure labeled on the site plans and in reports? Stormwater Renovation Area "B"

3. Where is the structure located on the site plans? North of Perimeter Plant Road Station 15+00 to 18+00

4. For bridge/culvert structures, what is the **openness ratio**? **N/A** meters
(The openness ratio is the X-sectional area of structure opening/ length of the structure parallel to the stream.)
(www.nae.usace.army.mil/reg/Openness Ratio (OR) Spreadsheet.pdf)

5. What is the size of the contributing watershed to the structure? 8.52 Acres 0.0133 Square Miles

6. Is the structure located within a **FEMA flood zone**? ☒ No ☐ Yes If yes, indicate the type of zone: ☐ Floodway ☐ Flood Plain

7. **Provide the following information as appropriate for the structure identified above.**

Water Surface Elevation (feet) (Immediately upstream of structure)
Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Aerial Extent of Inundation (square feet) (Maximum)
Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A	12,982	12,982	N/A	15,789	15,789	N/A	16,550	16,550	N/A	17,325	17,325	N/A	18,283	18,283

Duration of Inundation (hours) Storm Event Frequency					**Discharge Velocity (feet/second)** Storm Event Frequency					**Flow Volume (cubic feet/second)** Storm Event Frequency				
2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr
14	17.5	19	19.5	21	3.78	5.58	6.04	6.50	6.84	1.10	3.87	5.43	7.39	9.24

Part VI: Hydraulic and Drainage Structures *(You are required to complete a separate sheet for each structure)*

Sheet 10 of 23

1. Identify the type of structure: (Check one below that applies)

☐ Culvert ☐ Detention/Retention Basin ☐ Infiltration Basin/Structure ☐ Drainage Outfall ☐ Drainage Swale ☐ Bridge ☐ Dam
☐ Dike ☐ Weir ☒ Outlet Control Structure ☐ Pipe/Conduit/Aqueduct ☐ Other:

2. How is the structure labeled on the site plans and in reports? Outlet Structure B1

3. Where is the structure located on the site plans? SE Corner of Basin B

4. For bridge/culvert structures, what is the **openness ratio**? **N/A** meters
(The openness ratio is the X-sectional area of structure opening/ length of the structure parallel to the stream.)
(www.nae.usace.army.mil/reg/Openness Ratio (OR) Spreadsheet.pdf)

5. What is the size of the contributing watershed to the structure? 8.52 Acres 0.0133 Square Miles

6. Is the structure located within a **FEMA flood zone**? ☒ No ☐ Yes If yes, indicate the type of zone: ☐ Floodway ☐ Flood Plain

7. Provide the following information as appropriate for the structure identified above.

Water Surface Elevation (feet) (Immediately upstream of structure)
Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Aerial Extent of Inundation (square feet) (Maximum)
Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Duration of Inundation (hours) Storm Event Frequency					**Discharge Velocity (feet/second)** Storm Event Frequency					**Flow Volume (cubic feet/second)** Storm Event Frequency				
2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr
N/A					3.78	5.58	6.04	6.50	6.84	1.10	3.87	5.43	7.39	9.24

Part VI: Hydraulic and Drainage Structures *(You are required to complete a separate sheet for each structure)*

Sheet 11 of 23

1. Identify the type of structure: (Check one below that applies)

☐ Culvert ☐ Detention/Retention Basin ☐ Infiltration Basin/Structure ☐ Drainage Outfall ☐ Drainage Swale ☐ Bridge ☐ Dam
☐ Dike ☐ Weir ☐ Outlet Control Structure ☒ Pipe/Conduit/Aqueduct ☐ Other:

2. How is the structure labeled on the site plans and in reports? DMH B9 to Existing Culvert

3. Where is the structure located on the site plans? East of Proposed Access Drive Station 7+00 offset 120'

4. For bridge/culvert structures, what is the **openness ratio**? **N/A** meters
(The openness ratio is the X-sectional area of structure opening/ length of the structure parallel to the stream.)
(www.nae.usace.army.mil/reg/Openness Ratio (OR) Spreadsheet.pdf)

5. What is the size of the contributing watershed to the structure? 8.52 Acres 0.0133 Square Miles

6. Is the structure located within a **FEMA flood zone**? ☒ No ☐ Yes If yes, indicate the type of zone: ☐ Floodway ☐ Flood Plain

7. **Provide the following information as appropriate for the structure identified above.**

Water Surface Elevation (feet) (Immediately upstream of structure)
Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Aerial Extent of Inundation (square feet) (Maximum)
Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Duration of Inundation (hours) Storm Event Frequency					**Discharge Velocity** (feet/second) Storm Event Frequency					**Flow Volume** (cubic feet/second) Storm Event Frequency				
2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr
N/A					5.76	8.35	9.00	4.93	10.61	1.10	3.87	5.43	7.39	9.24

Part VI: Hydraulic and Drainage Structures *(You are required to complete a separate sheet for each structure)* Sheet 12 of 23

1. Identify the type of structure: (Check one below that applies)

☐ Culvert ☐ Detention/Retention Basin ☐ Infiltration Basin/Structure ☐ Drainage Outfall ☒ Drainage Swale ☐ Bridge ☐ Dam
☐ Dike ☐ Weir ☐ Outlet Control Structure ☐ Pipe/Conduit/Aqueduct ☐ Other:

2. How is the structure labeled on the site plans and in reports? Water Quality Swale C

3. Where is the structure located on the site plans? West Side Along Proposed Access Drive Station 8+80 to 4+80

4. For bridge/culvert structures, what is the **openness ratio**? **N/A** meters
(The openness ratio is the X-sectional area of structure opening/ length of the structure parallel to the stream.)
(www.nae.usace.army.mil/reg/Openness Ratio (OR) Spreadsheet.pdf)

5. What is the size of the contributing watershed to the structure? 0.467 Acres 0.0007 Square Miles

6. Is the structure located within a **FEMA flood zone**? ☒ No ☐ Yes If yes, indicate the type of zone: ☐ Floodway ☐ Flood Plain

7. **Provide the following information as appropriate for the structure identified above.**

Water Surface Elevation (feet) (Immediately upstream of structure)
Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Aerial Extent of Inundation (square feet) (Maximum)
Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Duration of Inundation (hours) Storm Event Frequency					**Discharge Velocity (feet/second)** Storm Event Frequency					**Flow Volume (cubic feet/second)** Storm Event Frequency				
2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr
N/A					1.83	2.37	2.61	2.73	2.85	0.67	1.32	1.56	1.85	2.17

Part VI: Hydraulic and Drainage Structures *(You are required to complete a separate sheet for each structure)*

Sheet 13 of 23

1. Identify the type of structure: (Check one below that applies)

☐ Culvert ☐ Detention/Retention Basin ☐ Infiltration Basin/Structure ☐ Drainage Outfall ☐ Drainage Swale ☐ Bridge ☐ Dam
☐ Dike ☐ Weir ☐ Outlet Control Structure ☒ Pipe/Conduit/Aqueduct ☐ Other:

2. How is the structure labeled on the site plans and in reports? DMH C1 to Existing Culvert

3. Where is the structure located on the site plans? East of Proposed Access Drive Station 6+75 offset 120'

4. For bridge/culvert structures, what is the **openness ratio**? **N/A** meters
(The openness ratio is the X-sectional area of structure opening/ length of the structure parallel to the stream.)
(www.nae.usace.army.mil/reg/Openness Ratio (OR) Spreadsheet.pdf)

5. What is the size of the contributing watershed to the structure? 0.603 Acres 0.0009 Square Miles

6. Is the structure located within a **FEMA flood zone**? ☒ No ☐ Yes If yes, indicate the type of zone: ☐ Floodway ☐ Flood Plain

7. **Provide the following information as appropriate for the structure identified above.**

Water Surface Elevation (feet) (Immediately upstream of structure)

Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Aerial Extent of Inundation (square feet) (Maximum)

Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Duration of Inundation (hours) Storm Event Frequency					**Discharge Velocity (feet/second)** Storm Event Frequency					**Flow Volume (cubic feet/second)** Storm Event Frequency				
2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr
N/A					7.57	9.16	9.26	9.90	10.17	1.03	1.90	2.21	2.57	2.99

Part VI: Hydraulic and Drainage Structures ***(You are required to complete a separate sheet for each structure)*** Sheet 14 of 23

1. Identify the type of structure: (Check one below that applies)

☒ Culvert ☐ Detention/Retention Basin ☐ Infiltration Basin/Structure ☐ Drainage Outfall ☐ Drainage Swale ☐ Bridge ☐ Dam
☐ Dike ☐ Weir ☐ Outlet Control Structure ☐ Pipe/Conduit/Aqueduct ☐ Other:

2. How is the structure labeled on the site plans and in reports? Existing 24" Culvert

3. Where is the structure located on the site plans? Main Access Drive Station 6+90 R offset 130'

4. For bridge/culvert structures, what is the **openness ratio**? **N/A** meters
(The openness ratio is the X-sectional area of structure opening/ length of the structure parallel to the stream.)
(www.nae.usace.army.mil/reg/Openness Ratio (OR) Spreadsheet.pdf)

5. What is the size of the contributing watershed to the structure? 18.41 Acres 0.0288 Square Miles

6. Is the structure located within a **FEMA flood zone**? ☒ No ☐ Yes If yes, indicate the type of zone: ☐ Floodway ☐ Flood Plain

7. **Provide the following information as appropriate for the structure identified above.**

Water Surface Elevation (feet) (Immediately upstream of structure)
Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Aerial Extent of Inundation (square feet) (Maximum)
Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Duration of Inundation (hours) Storm Event Frequency					**Discharge Velocity (feet/second)** Storm Event Frequency					**Flow Volume (cubic feet/second)** Storm Event Frequency				
2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr
					18.03	22.44	23.73	25.18	26.98	7.23	15.08	18.44	23.26	29.13

Part VI: Hydraulic and Drainage Structures *(You are required to complete a separate sheet for each structure)*

Sheet 15 of 23

1. Identify the type of structure: (Check one below that applies)

☐ Culvert ☐ Detention/Retention Basin ☐ Infiltration Basin/Structure ☒ Drainage Outfall ☐ Drainage Swale ☐ Bridge ☐ Dam
☐ Dike ☐ Weir ☐ Outlet Control Structure ☐ Pipe/Conduit/Aqueduct ☐ Other:

2. How is the structure labeled on the site plans and in reports? DP1

3. Where is the structure located on the site plans? SE to the Property

4. For bridge/culvert structures, what is the **openness ratio**? **N/A** meters
(The openness ratio is the X-sectional area of structure opening/ length of the structure parallel to the stream.)
(www.nae.usace.army.mil/reg/Openness Ratio (OR) Spreadsheet.pdf)

5. What is the size of the contributing watershed to the structure? 18.41 Acres 0.0288 Square Miles

6. Is the structure located within a **FEMA flood zone**? ☒ No ☐ Yes If yes, indicate the type of zone: ☐ Floodway ☐ Flood Plain

7. **Provide the following information as appropriate for the structure identified above.**

Water Surface Elevation (feet) (Immediately upstream of structure)

Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Aerial Extent of Inundation (square feet) (Maximum)

Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Duration of Inundation (hours) Storm Event Frequency					Discharge Velocity (feet/second) Storm Event Frequency					Flow Volume (cubic feet/second) Storm Event Frequency				
2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr
N/A					18.03	22.44	23.73	25.18	26.98	7.23	15.08	18.44	23.26	29.13

Part VI: Hydraulic and Drainage Structures *(You are required to complete a separate sheet for each structure)*

Sheet 16 of 23

1. Identify the type of structure: (Check one below that applies)

☐ Culvert ☐ Detention/Retention Basin ☐ Infiltration Basin/Structure ☐ Drainage Outfall ☒ Drainage Swale ☐ Bridge ☐ Dam
☐ Dike ☐ Weir ☐ Outlet Control Structure ☐ Pipe/Conduit/Aqueduct ☐ Other:

2. How is the structure labeled on the site plans and in reports? Water Quality Swale E1
3. Where is the structure located on the site plans? North Side along Proposed Access Drive Station 2+70 to 0+00
4. For bridge/culvert structures, what is the **openness ratio**? **N/A** meters
(The openness ratio is the X-sectional area of structure opening/ length of the structure parallel to the stream.)
(www.nae.usace.army.mil/reg/Openness Ratio (OR) Spreadsheet.pdf)
5. What is the size of the contributing watershed to the structure? 0.597 Acres 0.009 Square Miles
6. Is the structure located within a **FEMA flood zone**? ☒ No ☐ Yes If yes, indicate the type of zone: ☐ Floodway ☐ Flood Plain
7. **Provide the following information as appropriate for the structure Identified above.**

Water Surface Elevation (feet) (Immediately upstream of structure)

Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Aerial Extent of Inundation (square feet) (Maximum)

Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Duration of Inundation (hours) Storm Event Frequency					**Discharge Velocity (feet/second)** Storm Event Frequency					**Flow Volume (cubic feet/second)** Storm Event Frequency				
2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr
N/A					1.91	2.55	2.65	2.95	3.11	0.63	1.32	1.58	1.88	2.24

Part VI: Hydraulic and Drainage Structures *(You are required to complete a separate sheet for each structure)*

1. Identify the type of structure: (Check one below that applies)

☐ Culvert ☐ Detention/Retention Basin ☐ Infiltration Basin/Structure ☐ Drainage Outfall ☒ Drainage Swale ☐ Bridge ☐ Dam
☐ Dike ☐ Weir ☐ Outlet Control Structure ☐ Pipe/Conduit/Aqueduct ☐ Other:

2. How is the structure labeled on the site plans and in reports? Water Quality Swale E2

3. Where is the structure located on the site plans? East Side along Woodruff Hill Road, North to Proposed Entrance

4. For bridge/culvert structures, what is the **openness ratio**? **N/A** meters
(The openness ratio is the X-sectional area of structure opening/ length of the structure parallel to the stream.)
(www.nae.usace.army.mil/reg/Openness Ratio (OR) Spreadsheet.pdf)

5. What is the size of the contributing watershed to the structure? 0.646 Acres 0.0010 Square Miles

6. Is the structure located within a **FEMA flood zone**? ☒ No ☐ Yes If yes, indicate the type of zone: ☐ Floodway ☐ Flood Plain

7. **Provide the following information as appropriate for the structure identified above.**

Water Surface Elevation (feet) (Immediately upstream of structure)
Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Aerial Extent of Inundation (square feet) (Maximum)
Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Duration of Inundation (hours) Storm Event Frequency					**Discharge Velocity (feet/second)** Storm Event Frequency					**Flow Volume (cubic feet/second)** Storm Event Frequency				
2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr
N/A					1.54	1.99	2.12	2.18	2.35	0.68	1.43	1.71	2.04	2.42

Part VI: Hydraulic and Drainage Structures *(You are required to complete a separate sheet for each structure)*

Sheet 18 of 23

1. Identify the type of structure: (Check one below that applies)

☐ Culvert ☐ Detention/Retention Basin ☐ Infiltration Basin/Structure ☒ Drainage Outfall ☐ Drainage Swale ☐ Bridge ☐ Dam
☐ Dike ☐ Weir ☐ Outlet Control Structure ☐ Pipe/Conduit/Aqueduct ☐ Other:

2. How is the structure labeled on the site plans and in reports? DP5

3. Where is the structure located on the site plans? Just North of Proposed Main Entrance

4. For bridge/culvert structures, what is the **openness ratio**? **N/A** meters
(The openness ratio is the X-sectional area of structure opening/ length of the structure parallel to the stream.)
(www.nae.usace.army.mil/reg/Openness Ratio (OR) Spreadsheet.pdf)

5. What is the size of the contributing watershed to the structure? 1.31 Acres 0.0020 Square Miles

6. Is the structure located within a **FEMA flood zone**? ☒ No ☐ Yes If yes, indicate the type of zone: ☐ Floodway ☐ Flood Plain

7. **Provide the following information as appropriate for the structure identified above.**

Water Surface Elevation (feet) (Immediately upstream of structure)
Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Aerial Extent of Inundation (square feet) (Maximum)
Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Duration of Inundation (hours) Storm Event Frequency					**Discharge Velocity (feet/second)** Storm Event Frequency					**Flow Volume (cubic feet/second)** Storm Event Frequency				
2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr
N/A					7.07	8.45	8.93	9.33	9.65	2.01	4.10	4.88	5.79	6.85

1. Identify the type of structure: (Check one below that applies)

☐ Culvert ☐ Detention/Retention Basin ☐ Infiltration Basin/Structure ☐ Drainage Outfall ☒ Drainage Swale ☐ Bridge ☐ Dam
☐ Dike ☐ Weir ☐ Outlet Control Structure ☐ Pipe/Conduit/Aqueduct ☐ Other:

2. How is the structure labeled on the site plans and in reports? Water Quality Swale D1

3. Where is the structure located on the site plans? North Side Along Proposed Access Drive Station 4+80 to 2+70

4. For bridge/culvert structures, what is the **openness ratio**? **N/A** meters
(The openness ratio is the X-sectional area of structure opening/ length of the structure parallel to the stream.)
(www.nae.usace.army.mil/reg/Openness Ratio (OR) Spreadsheet.pdf)

5. What is the size of the contributing watershed to the structure? 0.362 Acres 0.0006 Square Miles

6. Is the structure located within a **FEMA flood zone**? ☒ No ☐ Yes If yes, indicate the type of zone: ☐ Floodway ☐ Flood Plain

7. **Provide the following information as appropriate for the structure identified above.**

Water Surface Elevation (feet) (Immediately upstream of structure)
Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Aerial Extent of Inundation (square feet) (Maximum)
Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Duration of Inundation (hours) Storm Event Frequency					**Discharge Velocity (feet/second)** Storm Event Frequency					**Flow Volume (cubic feet/second)** Storm Event Frequency				
2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr
N/A					1.21	1.49	1.66	1.72	1.82	0.40	0.83	0.99	1.17	1.39

Part VI: Hydraulic and Drainage Structures *(You are required to complete a separate sheet for each structure)*

Sheet 20 of 23

1. Identify the type of structure: (Check one below that applies)

☐ Culvert ☐ Detention/Retention Basin ☐ Infiltration Basin/Structure ☐ Drainage Outfall ☐ Drainage Swale ☐ Bridge ☐ Dam
☐ Dike ☐ Weir ☐ Outlet Control Structure ☒ Pipe/Conduit/Aqueduct ☐ Other:

2. How is the structure labeled on the site plans and in reports? CB D1 to WQS D2

3. Where is the structure located on the site plans? Main Access Drive Station 2+70

4. For bridge/culvert structures, what is the **openness ratio**? **N/A** meters
(The openness ratio is the X-sectional area of structure opening/ length of the structure parallel to the stream.)
(www.nae.usace.army.mil/reg/Openness Ratio (OR) Spreadsheet.pdf)

5. What is the size of the contributing watershed to the structure? 0.362 Acres 0.0006 Square Miles

6. Is the structure located within a **FEMA flood zone**? ☒ No ☐ Yes If yes, indicate the type of zone: ☐ Floodway ☐ Flood Plain

7. **Provide the following information as appropriate for the structure identified above.**

Water Surface Elevation (feet) (Immediately upstream of structure)
Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A →														

Aerial Extent of Inundation (square feet) (Maximum)
Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A →														

Duration of Inundation (hours) Storm Event Frequency					**Discharge Velocity (feet/second)** Storm Event Frequency					**Flow Volume (cubic feet/second)** Storm Event Frequency				
2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr
N/A →					3.14	4.00	4.15	4.30	4.53	0.40	0.83	0.99	1.17	1.39

Part VI: Hydraulic and Drainage Structures *(You are required to complete a separate sheet for each structure)*

Sheet 21 of 23

1. Identify the type of structure: (Check one below that applies)

☐ Culvert ☐ Detention/Retention Basin ☐ Infiltration Basin/Structure ☐ Drainage Outfall ☒ Drainage Swale ☐ Bridge ☐ Dam
☐ Dike ☐ Weir ☐ Outlet Control Structure ☐ Pipe/Conduit/Aqueduct ☐ Other:

2. How is the structure labeled on the site plans and in reports? Water Quality Swale D2

3. Where is the structure located on the site plans? South Side along Proposed Access Drive Station. 4+80 to 0+00

4. For bridge/culvert structures, what is the **openness ratio**? **N/A** meters
(The openness ratio is the X-sectional area of structure opening/ length of the structure parallel to the stream.)
(www.nae.usace.army.mil/reg/Openness Ratio (OR) Spreadsheet.pdf)

5. What is the size of the contributing watershed to the structure? 1.15 Acres 0.0018 Square Miles

6. Is the structure located within a **FEMA flood zone**? ☒ No ☐ Yes If yes, indicate the type of zone: ☐ Floodway ☐ Flood Plain

7. **Provide the following information as appropriate for the structure Identified above.**

Water Surface Elevation (feet) (Immediately upstream of structure)

Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Aerial Extent of Inundation (square feet) (Maximum)

Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Duration of Inundation (hours) Storm Event Frequency					Discharge Velocity (feet/second) Storm Event Frequency					Flow Volume (cubic feet/second) Storm Event Frequency				
2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr
N/A					2.76	3.48	3.79	3.99	4.21	1.87	3.74	4.43	5.25	6.18

Part VI: Hydraulic and Drainage Structures *(You are required to complete a separate sheet for each structure)*

Sheet 22 of 23

1. Identify the type of structure: (Check one below that applies)

☐ Culvert ☐ Detention/Retention Basin ☐ Infiltration Basin/Structure ☒ Drainage Outfall ☐ Drainage Swale ☐ Bridge ☐ Dam
☐ Dike ☐ Weir ☐ Outlet Control Structure ☐ Pipe/Conduit/Aqueduct ☐ Other:

2. How is the structure labeled on the site plans and in reports? DP6

3. Where is the structure located on the site plans? Just South of Proposed Main Entrance

4. For bridge/culvert structures, what is the **openness ratio**? **N/A** meters
(The openness ratio is the X-sectional area of structure opening/ length of the structure parallel to the stream.)
(www.nae.usace.army.mil/reg/Openness Ratio (OR) Spreadsheet.pdf)

5. What is the size of the contributing watershed to the structure? 1.15 Acres 0.0018 Square Miles

6. Is the structure located within a **FEMA flood zone**? ☒ No ☐ Yes If yes, indicate the type of zone: ☐ Floodway ☐ Flood Plain

7. **Provide the following information as appropriate for the structure identified above.**

Water Surface Elevation (feet) (Immediately upstream of structure)
Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Aerial Extent of Inundation (square feet) (Maximum)
Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A														

Duration of Inundation (hours) Storm Event Frequency					**Discharge Velocity (feet/second)** Storm Event Frequency					**Flow Volume (cubic feet/second)** Storm Event Frequency				
2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr
N/A										1.87	3.74	4.43	5.25	6.18

Part VI: Hydraulic and Drainage Structures *(You are required to complete a separate sheet for each structure)*

Sheet 23 of 23

1. Identify the type of structure: (Check one below that applies)

☐ Culvert ☐ Detention/Retention Basin ☐ Infiltration Basin/Structure ☒ Drainage Outfall ☐ Drainage Swale ☐ Bridge ☐ Dam
☐ Dike ☐ Weir ☐ Outlet Control Structure ☐ Pipe/Conduit/Aqueduct ☐ Other:

2. How is the structure labeled on the site plans and in reports? DP2

3. Where is the structure located on the site plans? NW to the Property

4. For bridge/culvert structures, what is the **openness ratio**? **N/A** meters
(The openness ratio is the X-sectional area of structure opening/ length of the structure parallel to the stream.)
(www.nae.usace.army.mil/reg/Openness Ratio (OR) Spreadsheet.pdf)

5. What is the size of the contributing watershed to the structure? 3.53 Acres 0.0055 Square Miles

6. Is the structure located within a **FEMA flood zone**? ☒ No ☐ Yes If yes, indicate the type of zone: ☐ Floodway ☐ Flood Plain

7. **Provide the following information as appropriate for the structure identified above.**

Water Surface Elevation (feet) (Immediately upstream of structure)
Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A	→													

Aerial Extent of Inundation (square feet) (Maximum)
Storm Event Frequency

2-yr			10-yr			25-yr			50-yr			100-yr		
Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)	Existing	Proposed	Change (+/-)
N/A	→													

Duration of Inundation (hours) Storm Event Frequency					**Discharge Velocity (feet/second)** Storm Event Frequency					**Flow Volume (cubic feet/second)** Storm Event Frequency				
2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr	2-yr	10-yr	25-yr	50-yr	100-yr
N/A	→									2.55	6.01	7.35	8.96	10.85

Part VII: Supporting Documents

Please check the documents submitted as verification that *all* applicable attachments have been submitted with this application form. When submitting any supporting documents, please label the documents as indicated in this part and be sure to include the applicant's name.

Environmental Documentation	Report	Show on Plans
	√ If Included with this application	
Description of the proposed activities and the purpose.	☒	☐
Evaluation of the functions and values of all wetlands and waters on-site or affected off-site.	☒	☐
Evaluation of direct and secondary impacts to the functions and values of wetlands and waters affected.	☒	☐
Evaluation of mitigation/restoration and or creation of wetlands to replace the functions and values of impacted wetlands/watercourses.	☒	☐
Design details for reconstruction/modification of existing stream crossings	☐	☐
Biological field survey of the project area and any other information to identify the presence of endangered, threatened, or special concern species, including copies of any correspondence to and from the NDDB (including a completed CT NDDB Review Request Form, if applicable).	☒	☐
Culvert invert elevations for roadway crossings set at least 12 inches below the elevation of the natural stream bed for fish and aquatic passage?	☐	☐
Federal wetland delineation of the site shown on plans.	☐	☒
State wetland delineation of the site shown on plans.	☐	☒
Are there amphibian breeding pool(s) present on the project site or adjacent to the project site? If yes, project development plans incorporate recommendations presented in *"Best Development Practices, Conserving Pool-Breeding Amphibians in Residential and Commercial Developments in the Northeastern United States. MCA Technical Paper No. 5, Metropolitan Conservation Alliance, Wildlife Conservation Society, Bronx, NY*	☐	☐
Report documenting vegetation, soils, and hydrology of wetlands on site.	☒	☐
Incorporation of a permanently protected buffer zone adjacent to wetlands and waters.	☐	☐
Site plans drawn at a scale of 1":100' or larger showing the pre- and post- construction aerial extent of inundation of wetlands and waters for the 2-yr, 10-yr, 25-yr, 50-yr and 100-yr storm frequency events.	☐	☒

Part VI: Supporting Documents

Engineering Documentation	Report	Show on Plans
All plans and calculations must be signed and sealed by a professional engineer (PE) licensed in the state of Connecticut	**√ If Included with this application**	
Summary of all water handling proposed at the site, including plans and computations, as needed to show that temporary water handling will not cause erosion or flooding.	☒	☒
Erosion and Sediment control measures designed in accordance with the *2002 Connecticut Guidelines for Soil Erosion and Sediment Control*, including calculations as required for engineered measures. (www.ct.gov/dep/cwp/view.asp?a=2720&q=325660&depNav_GID1654)	☒	☒
Design details and calculations for each hydraulic and drainage structure demonstrating consistency with the standards contained within the Connecticut DOT Drainage Manual and 2004 Connecticut Storm Water Quality Manual.	☒	☒
FEMA floodway/floodplain boundaries within the project site plotted on the site plans and a copy of the FEMA map showing the site location.	☒	☐
Hydrologic calculations including pre- and post- drainage area maps and a tabulated summary of results that demonstrate no adverse increase in runoff rates or velocities as a result of the proposed activity at appropriate downstream points.	☒	☐

Part VII: Application Certification

The applicant *and* the individual(s) responsible for actually preparing the application must sign this part. An application will be considered incomplete unless all required signatures are provided. This includes consultants, professional engineers, surveyors, soil scientists, etc. If the applicant is the preparer, please mark N/A in the spaces provided for the preparer. By their signature, they certify that, to the best of their knowledge and belief, the information contained in this application, including all attachments, is true, accurate and complete.

The certification of this application package shall be signed as follows: 1) For an individual(s) or sole proprietorship: by the individual(s) or proprietor, respectively; 2) For a corporation: by a principal executive officer of at least the level of vice president, or his agent; 3) For a limited liability company (LLC): by a manager, if management of the LLC is vested in a manager(s) in accordance with the company's "Articles of Organization", or by a member of the LLC if no authority is vested in a manager(s); 4) For a partnership: by a general partner; 5) For a municipal, state, or federal agency or department: by either a principal executive officer, a ranking elected official, or by other representatives of such registrant authorized by law.

"I have personally examined and am familiar with the information submitted in this document and all attachments thereto, and I certify that based on reasonable investigation, including my inquiry of the individuals responsible for obtaining the information, the submitted information is true, accurate and complete to the best of my knowledge and belief.

I understand that a false statement in the submitted information may be punishable as a criminal offense, in accordance with section 22a-6 of the General Statutes, pursuant to section 53a-157b of the General Statutes, and in accordance with any other applicable statute.

I certify that this application is on complete and accurate forms as prescribed by the commissioner without alteration of the text."

10/3/2014	
Signature of Applicant	Date
Peter J. Podurgiel, CPV Towantic Holding Company, LLC acting solely in its capacity as Managing Member of CPV Towantic, LLC	**Senior Vice President**
Name of Applicant (print or type)	Title (if applicable)
APT	10/3/2014
Signature of Preparer (if different than above)	Date
Dean Gustafson, All-Points Technology Corp., P.C.	**Professional Soil Scientist**
Name of Preparer (print or type)	Title (if applicable)

☐ Check here if additional signatures are required. If so, please reproduce this sheet and attach signed copies to this sheet. You must include signatures of any person preparing any report or parts thereof required in this application (i.e., professional engineers, surveyors, soil scientists, consultants, etc.)

Note: Please submit ***three*** copies of this completed Addendum Form, a completed Army Corps Application Form (ENG Form 4345), and ***all*** Supporting Documents (including full scale plans, 1" = 40') to:

CENTRAL PERMIT PROCESSING UNIT
DEPARTMENT OF ENERGY AND ENVIRONMENTAL PROTECTION
79 ELM STREET
HARTFORD, CT 06106-5127

Attachment A

Joint Application Narrative

- Executive Summary
- Purpose and Need Statement
- Project Alternatives Analysis
- Existing Conditions
- Wetland Evaluation
- Work Description
- Stormwater Management
- Other Agency Coordination
- Mitigation Measures

Attachment A

Category 2 Application Narrative

This Narrative is submitted in support of an application for authorization under the Department of the Army General Permit State of Connecticut as a Category 2 project. It provides a summary of the purpose and need for a new natural gas-fired electric generating facility proposed by CPV Towantic, LLC in Oxford, Connecticut; an overview of investigated alternatives; descriptions and evaluations of wetlands; descriptions of the proposed activity and its impacts to waters of the United States; a summary of the stormwater management system; other agency coordination; and, a description of proposed mitigation measures.

Executive Summary

The Applicant, CPV Towantic, LLC ("CPV"), seeks approval to construct a new natural gas-fired electric generating facility on Woodruff Hill Road in Oxford, Connecticut. The CPV Towantic Energy Center ("Towantic") is a proposed dual-fueled (natural gas with ultra-low sulfur distillate back-up) combined cycle electrical generating facility. The proposed development (the "Project") encompasses two adjoining parcels located on the east side of Woodruff Hill Road along the cul-de-sac of the road; the original parcel encompasses 20± acres with a smaller 6± acre abutting parcel added to the south (collectively, the "Site").

The proposed Site lies in the northeast corner of a larger 2,500-acre industrially-zoned district. This industrial district surrounds but does not include the 427-acre state-owned Waterbury-Oxford Airport that is located 0.5± mile west of the proposed Site. Land uses adjacent to the proposed Site include a Connecticut Light and Power ("CL&P") transmission line right-of-way ("ROW") to the north and west, Woodruff Hill Road to the west, Algonquin Gas Transmission ROW and undeveloped woodland to the north, undeveloped woodland to the south, and a natural gas compressor station to the east.

The proposed Project was previously approved in 1999 by the Connecticut Siting Council ("CSC") which issued a Certificate of Environmental Compatibility and Public Need for the construction and operation of a (net nameplate) 512-megawatt ("MW") combined-cycle dual-fuel electric generating facility. The Project now incorporates new General Electric (GE) turbine technology for improved efficiency, environmental performance and increased output (net nameplate 785 MW), resulting in the Project's ability to obtain financing and compete effectively in the current Independent System Operators New England Inc. ("ISO-NE") market. As previously indicated by the CSC:

Reliability of electric supply is of great importance in Connecticut, a service-oriented state that has become increasingly dependent on high technology and a reliable electric supply. To improve the reliability of the electric supply system of the state, the proposed facility would operate on natural gas with a proven technology to augment and replace other existing generation facilities in the state. These existing facilities include older, more costly, nuclear facilities that have retired prematurely, and facilities that have higher levels of pollution emissions.[1]

Approximately 0.24 acres of Waters of the United States (Wetlands 1 and 4, as will be discussed in later sections) will be impacted by the Project due to their central location on the Site making avoidance impossible while satisfying the building program needs of Towantic. The proposed location of Towantic satisfies important siting requirements with its close proximity to required interconnection facilities, avoiding and minimizing the need for acquiring ROWs. As a result, potential wetland impacts associated with siting a facility more distant from required interconnection facilities (requiring potentially long ROW through wetland resources) has been avoided.

Wetland mitigation is proposed to properly compensate for unavoidable Project impacts to wetlands. CPV proposes to make payment into the Connecticut In-Lieu Fee ("ILF") Program. The Site provides limited opportunity to mitigate in kind for the Project's impact to wetlands. Therefore, entering into the Connecticut ILF Program is considered the most prudent and feasible option to mitigate for unavoidable wetland impacts. This will also result in greater ecological benefits than trying to create a relatively small hillside seep wetland, particularly considering that similar wetland habitats that support greater functions and values exist elsewhere on and proximate to the Site.

The following sections of this application provide: the Project purpose and need; Project alternatives considered by the Applicant; descriptions of existing Site conditions, including wetlands and functions and values supported by those wetlands; additional details regarding the proposed work activities; identification of specific wetland impacts; other agency coordination; and, mitigation measures to be implemented to ensure that short and long term adverse impacts to wetland resources are minimized by the Project.

CPV respectfully requests that the U.S. Army Corps of Engineers New England District ("Corps") and Connecticut Department of Energy and Environmental Protection ("DEEP") find these provisions consistent with the Federal Clean Water Act and the Connecticut Water Quality Standards and adequately protective of the waters of the United States and Authorize the Project as a Category 2 under the Connecticut General Permit, as described in this application and shown on the accompanying plans.

♦

[1] Opinion, Docket No. 192. June 23, 1999. Connecticut Siting Council.

Purpose and Need Statement

The Towantic facility is to be located at the intersection of two Algonquin interstate natural gas pipelines and a CL&P owned 115 kilovolt ("kV") transmission ROW. Careful siting of the Towantic facility in close proximity to required interconnection facilities has avoided and minimized the need for acquiring ROWs. As a result, potential wetland impacts associated with siting a facility more distant from required interconnection facilities (requiring potentially long ROWs through wetland resources) has been avoided. Towantic received its original Certificate of Environmental Compatibility and Public Need ("Certificate") permit from the CSC on June 23, 1999 in Docket No. 192.

The facility will utilize GE 7HA.01 model turbines with a net nameplate electric output of 785 megawatts. These turbines provide fast-start capabilities with flexibility to better meet grid reliability needs, as well as reduce emissions on a per megawatt basis. The Towantic facility would provide both grid reliability and local electrical reliability benefits by adding a new baseload resource to Southwest Connecticut. As of February 2014, the ISO-NE auction conducted for capacity resources for New England cleared at a deficit, signaling and confirming the need for new generation. Therefore, the Towantic facility would ensure the ability of the bulk power system to provide clean, reliable, efficient power and to meet customer and public policy needs for the State of Connecticut.

Project Alternatives Analysis

In order to determine compliance with the Federal Clean Water Act, the Application was evaluated by the environmental standards as set forth in 40 CFR Part 230 (a.k.a. "Guidelines"). The following section provides a discussion of alternatives along with the preferred alternative evaluated for the Project to comply with these Guidelines.

No-build Alternative

A "no-build" alternative would not fulfill the need for a new baseload resource to Southwest Connecticut that would result in improved grid and local electrical reliability. As a result, the "no-build" was not considered a practicable alternative that would satisfy the Project Need.

Siting Criteria

Screening criteria for siting the proposed Project included technical development and feasibility, environmental impacts, community acceptance and capital cost. These criteria include an enterprise zone or structured economic development area, proximity to both a natural gas transmission pipeline and high voltage electric transmission lines, site size of at least 20 acres of buildable land, site zoning designated to allow construction and operation of a generating facility, water and sewer availability, and minimal impacts to wetlands, air quality, and sensitive receptors (i.e., residential neighborhoods, hospitals, schools, and nursing homes). An important goal in the planning and development of the proposed Project was to ensure that the solutions selected would meet the Project objectives, while minimizing environmental impacts to the extent practicable, and promoting a feasible option in terms of providing both grid reliability and local electrical reliability benefits by adding a new baseload resource to Southwest Connecticut.

Off-Site Alternatives

Fourteen communities were evaluated, of which three were considered suitable for the proposed Project. Based on screening criteria, Oxford was chosen as the proposed site. Alternate sites in Middletown and Naugatuck were rejected for one or more of the following reasons: environmental contamination, extensive wetlands on the site, air quality concerns due to topography, lack of an electrical transmission line near the site, potential construction constraints due to topography, and no natural buffer vegetation around the site.

Within the Town of Oxford, the selected industrial-zoned district (Woodruff Hill Industrial Park) was found to satisfy the majority of the Project siting criteria. Within this district, the selected properties are in close proximity to required interconnection facilities, avoiding and minimizing the need for acquiring ROW. As a result, potential wetland impacts associated with siting a facility more distant from required interconnection facilities (requiring potentially long ROWs through wetland resources) has been avoided. Other parcels within the Woodruff Hill Industrial Park were evaluated but were rejected due to insufficient size, topographic constraints, wetlands and distance to interconnection facilities.

On-Site Alternatives

At the time the Site was selected, Wetland 1 was considerably smaller (±2,850 square feet) and Wetland 4 did not exist on the Site. Layout alternatives were considered to determine whether Wetland 1 could be avoided. Elements of an electric generating facility require the balancing of a number of design goals including wetland avoidance and minimization:

- Keeping equipment aligned to ensure safe, efficient operation and to facilitate maintenance;
- Positioning louder equipment such that appropriate sound reductions can be achieved;
- Allowing for appropriate access to accommodate operations and maintenance vehicles;
- Configuring to allow for shared service support; and
- Awareness of structure heights.

Positioning of the electrical equipment associated with the Project in the northern part of the Site was required based on the location of the 115 kV lines already in place. The shortest possible electrical interconnection, both between the generating facility and its switchyard and the switchyard and the existing transmission lines, provides the most efficient and reliable ability for the Project to supply its electricity to the regional grid.

Because the two combustion turbine generators share a single steam turbine, their positioning in a single “power block” is functionally necessary from an operational perspective. This results in a central feature of the Project that requires for safe and functional design a certain amount of minimum area.

Because Wetland 1 extended in a narrow band directly into the middle of where the power block was positioned, it could not be avoided. Now that Wetland 1 has expanded in size, it extends approximately 250 feet into the center of the power block. A small portion of western end of Wetland 1 is affected by grading that is necessary in order to provide adequately stabilized slopes from the Site to its surroundings in order to avoid erosion and sedimentation. Due to the position of Wetland 1, it cannot be avoided by the Project layout.

Wetland 4, created by human activity on the site, did not exist at the time of the original Project layout and currently falls in an area where access to the Project switchyard is proposed. Because the Site elevation is proposed to be graded to facilitate stormwater management, even if the roadway could avoid this wetland, the need to raise Site elevations would impact this small, isolated wetland. Additional information regarding the Site wetlands that will be impacted is provided in the Existing Conditions section.

Preferred Alternative

The preferred alternative Site offers ease of electrical and gas interconnection; adequate separation to nearby residents; and, a location in a large industrial-zoned district which includes a state-owned airport. The proposed Project has been strategically located based on market conditions and its ability to integrate with other electric suppliers to provide capacity to the region, providing benefits to both the local community and the region.

The preferred alternative will result in unavoidable impact to wetlands due to their central location on the Site making avoidance impossible while satisfying the building program needs of the Towantic Energy Center. However, the Project avoids impacts to larger nearby wetland resources that provide significantly higher functions and values. With the avoidance and minimization of wetland impacts as presented in subsequent sections of this Narrative, the preferred alternative incorporates various design elements that will minimize impact to the wetland habitat and properly mitigate for unavoidable impacts. Therefore, the preferred alternative is considered the least environmentally damaging practicable alternative that meets the Project Need.

Existing Conditions

The Project encompasses two adjoining parcels located on the east side of Woodruff Hill Road along the cul-de-sac of the road; the original parcel encompasses 20± acres with a smaller 6± acre abutting parcel added to the south ("Site"). The approximately 26-acre Site is located in the Town of Oxford's Woodruff Hill Industrial Park and is generally bounded to the north by a CL&P electrical transmission line ROW and Algonquin Gas transmission ROW, to the east and south by a Spectra Energy gas compressor station and access road, and to the west by Woodruff Hill Road. The Site is dominated by a complex of mature, even-aged, hardwood forests and open fields with small areas of wetland inclusions primarily in the northern and western portions of the Site. The surrounding land-use consists primarily of industrial parcels that currently include large tracts of mature forest and the adjacent compressor station.

A Site Location Map and Aerial Map are provided as Figures 1 and 2, respectively, in the Figures Attachment. Representative photographs of the Project area and wetlands are provided in Attachment B. Abutting property owners are provided in Attachment C.

Wetland Resource Area Delineation

Dean Gustafson and Matthew Gustafson, Connecticut registered Soil Scientists with APT, conducted field investigations on June 26, 2014, July 3, 2014, and July 12, 2014 to determine the presence or absence of wetlands and watercourses. The delineation methodology followed was consistent with both the Connecticut Inland Wetlands and Watercourses Act ("IWWA") and the *Corps of Engineers Wetland Delineation Manual* (1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region*, Version 2.0 (January 2012). The results of this wetland investigation are summarized in the discussion below. Additional details of APT's investigation are contained in the August 22, 2014 Wetland Investigation report, provided in Attachment D.

Federal and State Wetlands

The Corps Wetlands Delineation Manual defines wetlands as "[t]hose areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."

The Connecticut IWWA defines wetlands as areas of poorly drained, very poorly drained, floodplain, and alluvial soils, as delineated by a soil scientist. Watercourses are defined as bogs, swamps, or marshes, as well as lakes, ponds, rivers, streams, etc., whether natural or man-made, permanent or intermittent. Intermittent watercourse determinations are based on the presence of a defined permanent channel and bank, and two of the following characteristics: (1) evidence of scour or deposits of recent alluvium or detritus; (2) the presence of standing or flowing water for a duration longer than a particular storm incident; and (3) the presence of hydrophytic vegetation.

Four wetland areas were delineated on and adjacent to the Site consisting of scrub/shrub, wet meadow and seep systems and a small isolated forested man-made wetland depression. Please refer to the enclosed Wetland Delineation Map provided in Attachment D for the locations of the identified wetland resource areas. This information is also depicted on the Existing Conditions plan (Sheet C300) on the separately bound Project Site Plans. Soil types encountered throughout the Site were generally consistent with digitally available soil survey information obtained from the Natural Resources Conservation Service ("NRCS"), although no wetland soils were mapped on the Site. The field investigation revealed that wetland soils identified on Site are classified as Ridgebury, Leicester and Whitman soil complex. The non-wetland soils were examined along the wetland boundary and throughout the remainder of the Site. They are dominated by Woodbridge fine sandy loam and Paxton and Montauk fine sandy loams. Wetland hydrology is driven by a shallow restrictive layer in the dense till parent material, causing a seasonal perched water table. These wetlands primarily formed in areas on the hill side where seasonal groundwater exfiltrates at or near the soil surface and are commonly associated with concave slope depressions. Wetlands were marked with pink and blue plastic flagging tape numbered with the following sequence: WF 1-01 to 1-24, WF 2-01 to 2-16, WF 3-01 to 3-08, and WF 4-01 to 4-04. No significant differences were observed between Federal and Connecticut jurisdictional wetland boundaries. Please refer to Attachment D, Federal Wetland Determination Data Sheets for documentation of the Federal wetland boundaries.

Wetland 1 Description

Wetland 1 (±10,322 SF) is a dense glacial till hillside seep wetland meadow wetland system with scattered shrubs characterized by a relatively narrow clearing surrounded to the north and south by mature upland forest located in the central-west portion of the Site. Water is conveyed west, originating at a stone wall at the edge of a large open field. This wetland feature terminates as it approaches the Woodruff Hill cul-de-sac. Evidence of mechanical compaction in the form of tire ruts is prevalent throughout this wetland seep system along with disturbed wetland soil profiles.

A permit was granted by the Oxford Inland Wetland Agency (Application #673) on February 22, 1999 that included provisions for filling this entire wetland system, identifying it at the time as a ±2,850 square foot intermittent watercourse/wetland area. An attempt to fill this wetland occurred in February 2010. A February 10, 2010 inspection report by Civil1 indicated that approximately one to two feet of common fill and topsoil was placed over the wetland, which was graded and leveled. An investigation of this wetland area reveals some disturbance apparently associated with the work performed in 2010; however, most of the disturbance to the wetland soils is associated with the top 0.5-1.0 feet characterized by topsoil fill high in organic matter, underlain by native wetland soil profiles. The hydrology of this wetland system does not appear to have been significantly altered by the previous disturbance, and vegetation is dominated by hydrophytes, as further described in Attachment D.

Wetland 2 Description

The majority of Wetland 2 (±10,561 SF on site) is off-site, with only its western edge located in the northwest corner of the Site. Wetland 2 is a complex of forested, scrub/shrub, and emergent seep wetland habitats formed in dense glacial till. An overhead electrical distribution ROW running north/south along the Site's western property boundary, north of the CL&P ROW, bisects the eastern upper reaches of this wetland system. Evidence of mechanical compaction in the form of tire ruts and gravel surfaces is prevalent throughout this utility ROW resulting in shallow ponding water at the time of inspection. Wetland 2 generally drains east to west across a moderately west-facing slope, formed in dense glacial till. Numerous adult green and pickerel frogs were observed within the shallow pools artificially created by the tire ruts.

Wetland 3 Description

Wetland 3, located entirely off Site along the west property boundary and connected to Wetland 2 further off Site to the west, is a small hillside seep wetland system that has experienced high levels of anthropogenic activity. Wetland 3 is generally located at the confluence of a CL&P ROW and Woodruff Hill Road cul-de-sac. As such, the hydrology and nature of Wetland 3 has been highly altered from previous filling activities associated with CL&P maintenance and upgrading of this electrical transmission ROW, resulting in disturbed wetland soil profiles, surface compaction and altered vegetation communities. This wetland system receives hydrology from the surrounding uplands to the north and east via seasonal overland flow and groundwater exfiltration, as well as a PVC pipe conveying flows from a dug drainage swale located along the east side of Woodruff Hill Road on the Site.

Wetland 4 Description

Wetland 4 (±178 SF) is a very small, isolated man-made depressional wetland feature located in a generally flat, forested upland area located in the central-north portion of the Site. This depression was artificially created in dense well drained glacial till soils, apparently the result of a dug test pit that was improperly backfilled. This anthropogenic feature has formed a small depression that intercepts the seasonally high groundwater table as evident by a review of disturbed hydric soil profiles.

Floodplain

No flood hazard zones are located within or proximate to the proposed Site. The Site is classified as Zone X, areas of minimal flooding (no shading) outside of the 100-year and 500-year flood boundaries. This was determined through a review of the Federal Emergency Management Agency (FEMA)'s Flood Insurance Rate Map Panel 251 of 635, Map No. 09009C0251H, effective date December 17, 2010. A FEMA Flood Map is provided in the Figures Attachment as Figure 3.

Wetland Evaluation

There are many methods of evaluating wetlands, all incorporating different parameters to assess these resources. This study uses methodology recommended by the Corps, *The Highway Methodology Workbook Supplement, Wetland Functions and Values: A Descriptive Approach* issued by the Corps, dated September 1999. This evaluation provides a qualitative approach in which wetland functions can be considered Principal, Secondary, or unlikely to be provided at a significant level. Functions and values can be Principal if they are an important physical component of a wetland ecosystem (function only), and/or are considered of special value to society, from a local, regional, and/or national perspective. The Corps recommends that wetland values and functions be determined through "best professional judgment" based on a qualitative description of the physical attributes of wetlands and the functions and values exhibited.

These functions and values can be grouped into four basic categories as follows:

Biological Functions

Fish and Shellfish Habitat — This function considers the effectiveness of seasonal or permanent waterbodies associated with the wetland in question for fish and shellfish habitat.

Wildlife Habitat — This function considers the effectiveness of the wetland to provide habitat for various types and populations of animals typically associated with wetlands and the wetland edge. Both resident and/or migrating species must be considered. Species lists of observed and potential animals should be included in the wetland assessment report.

Production Export (Nutrient) — This function relates to the effectiveness of the wetland to produce food or usable products for humans or other living organisms

Hydrologic Functions

Floodflow Alteration (Storage & Desynchronization) — This function considers the effectiveness of the wetland in reducing flood damage by attenuation of floodwaters for prolonged periods following precipitation events.

Groundwater Recharge/Discharge — This function considers the potential for a wetland to serve as a groundwater recharge and/or discharge area. Recharge should relate to the potential for the wetland to contribute water to an aquifer. Discharge should relate to the potential for the wetland to serve as an area where groundwater can be discharged to the surface.

Water Quality Functions

Sediment/Toxicant/Pathogen Retention — This function reduces or prevents degradation of water quality. It relates to the effectiveness of the wetland as a trap for sediments, toxicants, or pathogens.

Nutrient Removal/Retention/Transformation — This function relates to the effectiveness of the wetland to prevent adverse effects of excess nutrients entering aquifers or surface waters such as ponds, lakes, streams, rivers, or estuaries.

Sediment/Shoreline Stabilization — This function relates to the effectiveness of a wetland to stabilize streambanks and shorelines against erosion.

Societal Values

Recreation (Consumptive and Non-Consumptive) — This value considers the effectiveness of the wetland and associated watercourses to provide recreational opportunities such as canoeing, boating, fishing, hunting, and other active or passive recreational activities. Consumptive activities consume or diminish the plants, animals, or other resources that are intrinsic to the wetland, whereas non-consumptive activities do not.

Educational/Scientific Value — This value considers the effectiveness of the wetland as a site for an “outdoor classroom” or as a location for scientific study or research.

Uniqueness/Heritage — This value relates to the effectiveness of the wetland or its associated waterbodies to produce certain special values. Special values may include such things as archaeological sites, unusual aesthetic quality, historical events, or unique plants, animals, or geologic features.

Visual Quality/Aesthetics — This value relates to the visual and aesthetic qualities of the wetland.

Threatened or Endangered Species Habitat — This value relates to the effectiveness of the wetland or associated waterbodies to support threatened or endangered species.

The degree to which a wetland provides each of these functions is determined by one or more of the following factors: landscape position, substrate, hydrology, vegetation, history of disturbance, and size. Each wetland may provide one or more of the listed functions at Principal levels.

The determining factors that affect the level of function provided by a wetland can often be broken into two categories. The effectiveness of a wetland to provide a specified function is generally dependent on factors within the wetland whereas the opportunity to provide a function is often influenced by the wetland's position in the landscape and adjacent land uses. For example, a depressed wetland with a restricted outlet may be considered highly effective in trapping sediment due to the long residence time of runoff water passing through the system. If this wetland is located in gently sloping woodland, however, there is no significant source of sediment in the runoff therefore the wetland is considered to have a small opportunity of providing this function.

Wetland 4 (±178 SF) is a very small, isolated man-made depressional wetland feature that was artificially created in dense well drained glacial till soils, apparently the result of a dug test pit that was improperly backfilled. This anthropogenic feature has formed a small depression that intercepts the seasonally high groundwater table as evident by a review of disturbed hydric soil profiles. Considering the form of this feature, its small size and general lack of wetland features, no significant wetland functions or values are supported by this wetland. Therefore, a detailed evaluation of wetland functions and values is not provided in this report for Wetland 4.

A detailed description of Wetlands 1, 2 and 3, including the Principal and Secondary functions and values associated with each wetland, is provided below.

Wetland 1 Evaluation

Wetland 1 (±10,322 SF) is a dense glacial till hillside seep wetland meadow wetland system with scattered shrubs characterized by a relatively narrow clearing surrounded to the north and south by mature upland forest. This wetland feature terminates as it approaches the Woodruff Hill cul-de-sac. APT's investigation of this wetland area revealed some disturbance apparently associated with authorized work performed in 2010 to fill this wetland; however, most of the disturbance to the wetland soils is associated with the top 0.5-1.0 feet characterized by topsoil fill high in organic matter, underlain by native wetland soil profiles. The hydrology of this wetland system does not appear to have been significantly altered by the previous disturbance, although any remnants of the previous intermittent watercourse feature (e.g., bank and channel) have been eliminated by the 2010 filling activity.

A summary of the functions and values of Wetland 1 is provided below. A Wetland Function-Value Evaluation Summary Table and accompanying Field/Office Wetland Function-Value Evaluation Form for this wetland are enclosed as Attachment E.

Biological Functions

Fish and amphibian breeding habitat are not supported due to the lack of inundation or ponding water.

This wetland system provides wildlife habitat function at a Secondary level due to the seasonal hydrology, previous disturbance, relatively small size and lack of structural diversity (primarily wet meadow habitat). The proximity to other wetland systems adjacent to the Site does enhance the wildlife habitat function of this isolated wetland system although Woodruff Hill Road results in habitat fragmentation that disrupts possible biological connectivity to other nearby wetland habitats.

Production export is not provided at a significant level from this wetland since it is relatively small and does not support a large diversity of vegetation, wildlife food sources or commercially used products.

Hydrologic Functions

This wetland does not provide floodflow alteration in a significant capacity due to its small size, small watershed that feeds surface and shallow subsurface water to this wetland system and moderate slope which limits flood storage capacity.

Considering this perched wetland has formed above a low-permeable densic contact, infiltration into the regional water table is not significant due to the unsaturated (vadose) zone present between the regional water table and the perched wetland. As a result, groundwater discharge/recharge is not supported at a Principal or Secondary level by this wetland. Shallow subsurface outflows may occur at the low point on the west perimeter of the wetland as primarily either overland flow or lateral interflow from the perched water table. No defined outlet channel was observed in Wetland 1 so interflow into the more permeable shallow surface soils on the west side of this wetland appears to occur.

Water Quality Functions

This wetland supports sediment, toxicant, and pathogen retention functions at a Secondary level, although it is limited in this capacity due to its small size, small watershed and undeveloped nature of the watershed which does not provide a source for these contaminants. This wetland does have some capacity to provide nutrient removal/nutrient retention/transformation function due to the dense herbaceous wetland vegetation.

Sediment/shoreline stabilization functions are not supported by this wetland since it is not associated with permanent open water or a stream system.

Societal Values

The wetland system does not provide recreational value as the wetland area is restricted from public access. Educational value is not supported in a significant capacity due to the lack of diversity of wetland habitats and restricted public access.

The Uniqueness/Heritage value considers the special value of a wetland in context with the overall landscape, cultural features, and rarity of wetland/habitat type in the local area. This wetland/habitat type is relatively common in the local area, including nearby Wetlands 2 and 3. Therefore, this value is not supported by this wetland in a significant capacity. According to Connecticut Department of Energy and Environmental Protection ("DEEP") Natural Diversity Data Base ("NDDB") records, eastern box turtle (*Terrapene carolina carolina*), a state species of special concern occur in the vicinity of the Project. Although the habitat of Eastern box turtle is more commonly associated with a variety of terrestrial habitats, particularly for adult turtles, their habitat preferences are seasonally influenced and include areas within and in close proximity to streams/groundwater seeps, which could include Wetland 1. Therefore, this wetland does provide endangered species habitat value in a Secondary capacity due to its possible association with a rare species although it is not considered to provide this value at a Principal level since the wetland/habitat type is relatively common in the local area (see descriptions of Wetlands 2 and 3) and no occurrences of box turtle have been documented on the Site. Previous disturbance to this wetland could further limit this value.

Wetlands 2 and 3 Evaluation

The majority of Wetland 2 is off Site (±10,561 SF on Site), with only its eastern edge located in the northwest corner of the Site. Wetland 2 is a complex of forested, scrub/shrub, and emergent seep wetland habitats formed in dense glacial till. Wetland 3, which is located off Site but in close proximity to Wetland 2 and the western Site boundary, is a small hillside seep wetland system that has experienced high levels of anthropogenic activity. Wetland 3 is generally located at the confluence of a CL&P ROW and Woodruff Hill Road cul-de-sac located off the subject property near the western property boundary.

Due to the similar form and characteristics that are shared between Wetlands 2 and 3 and the fact that these wetland systems merge off Site into a larger wetland system to the west, their functions and values have been evaluated together.

A summary of the functions and values of Wetland 2 and 3 is provided below. A Wetland Function-Value Evaluation Summary Table and accompanying Field/Office Wetland Function-Value Evaluation Form for these wetlands are enclosed as Attachment E. A discussion of the functions and values of these wetland areas focuses on the portion of these wetlands located either on or within approximately 200 feet of the Site. As these wetland systems converge further off Site to the west into a larger forested wetland complex, it is anticipated that functions and values are supported by the larger off-Site wetland system at a higher level than the wetland areas described herein.

Biological Functions

Fish habitat is not supported due to the ephemeral hydrology and lack of sustained hydrology within the confines of the seasonal intermittent watercourses associated with these two wetland systems.

These wetland systems provide wildlife habitat function at a Secondary level due to the structural diversity in the tree, shrub and herbaceous layers provided by these headwater wetland seeps. The proximity of both wetland systems, along with other wetland systems on the Site, further enhances the wildlife habitat function with intervening undeveloped forested terrestrial habitat likely providing wildlife corridors biologically linking these various wetland areas. Compromise of the wetlands' ecological integrity due to the presence of utility infrastructure, disturbance (e.g., tire ruts) and associated maintenance activities inhibits the ability to provide this function at a Principal level.

Production export is provided at a Secondary level from these wetlands since they support a moderate diversity of vegetation and wildlife food sources. No significant commercially used products are supported by these wetland systems.

Hydrologic Functions

These wetlands provide some floodflow alteration, at a Secondary level, due to the relatively narrow forms of these wetlands, the moderate gradient and unrestricted outlet.

A Secondary function of Wetlands 2 and 3 is groundwater discharge/recharge, which is likely cyclical depending upon time of year, level of precipitation and landscape position of the wetland system.

Water Quality Functions

These wetlands provide sediment, toxicant, and pathogen retention functions at a Secondary level. The wetlands do not have the capacity to settle and retain sediments, toxicants and pathogens at a Principal level due to the hillside seep forms of these wetlands. In addition, opportunities are limited due to the relatively undeveloped nature of the watershed that support these wetland systems. Wetlands 2 and 3 provide nutrient removal/nutrient retention/transformation at a Secondary level for similar reasons.

Sediment/shoreline stabilization functions are supported by these wetlands, although it is more of a function of the wetlands farther downstream off Site where zero order intermittent channels form and converge with other flows to become a first order intermittent watercourse.

Societal Values

The wetland system does not provide recreational or educational value as the wetland area is restricted from public access, there is a moderate diversity of wetland habitats and portions of the wetlands are encumbered by electrical ROWs.

The Uniqueness/Heritage value considers the special value of a wetland in context with the overall landscape, cultural features, and rarity of wetland/habitat type in the local area. These wetland/habitat types are relatively common in the local area; therefore, this value is not supported by these wetlands in a significant capacity.. As discussed previously for Wetland 1, eastern box turtle occurs in the vicinity of the Project. Although the habitat of eastern box turtle is more commonly associated with a variety of terrestrial habitats, particularly for adult turtles, their habitat preferences also include areas within and in close proximity to streams/groundwater seeps, which could include Wetlands 2 and 3. Therefore, these wetlands do provide endangered species habitat value in a Secondary capacity due to its possible association with a rare species although it is not considered to provide this value at a Principal level since the wetland/habitat type is relatively common in the local area (i.e., upland/wetland complexes along the ROWs) and no occurrences of box turtle have been documented on the Site.

Wetlands 2 and 3 do not support Visual Quality/Aesthetics value since they are relatively common wetland types, are encumbered by utility ROWs and do not support any unique visual qualities.

Work Description

The following section summarizes permanent wetland impacts associated with the proposed Project. All proposed wetland impacts are shown in detail on the Project Site Plans, attached separately.

CPV has considered alternative layouts and designs and determined that these impacts are unavoidable due to the building program needs of the energy center and central location of wetlands on the Site. An analysis of alternatives and measures to minimize impacts is contained in the Alternatives Analysis section of this narrative.

Construction Schedule

If approvals are received and a favorable outcome in the forward capacity market is achieved in February 2015, the Project would issue Notice to Proceed for construction in the second half of 2015, with construction mobilization occurring in the first quarter of 2016 to support a commercial operation date of June 2018. It is also possible, based on market conditions, that construction could be delayed for one year, initiating construction in the first quarter second half of 2016 and anticipating commercial operation for by June 2019.

Construction Sequence

General

The following construction sequence is considered preliminary and subject to change by a number of variables including actual field conditions, weather, contractor’s construction sequence, agency reviews, etc. A detailed construction phasing plan, including stormwater pollution controls and maintenance, and temporary and permanent erosion control measures are provided on Sheet C330 (Erosion Control Narrative) provided in the separately attached Project Site Plans.

All necessary grading, temporary diversion swales, piping and other temporary stormwater management measures will be constructed to ensure that, during construction, the Site runoff is directed to temporary sedimentation ponds and avoids impact to nearby wetland resources. Upon completion of construction, two of the temporary sedimentation ponds will be converted into permanent detention ponds.

Phase I

1. Clear areas sufficient to construct temporary stormwater diversion ditches, temporary sedimentation pond #1 and access road only.
2. Install temporary silt fence.
3. Construct temporary stabilized construction entrance.
4. Construct temporary sedimentation pond #1, pond outlet riser, control structure and discharge pipe.
5. Construct temporary stormwater diversion swales.
6. Construct rip rap check dams and level spreaders.

Phase II

1. Clear the Site as required to facilitate construction within the grading limits.
2. Grade switchyard area and storage tank area and use for temporary stockpile of topsoil. Excavated material in excess of what can be used on Site will be hauled to an approved off site location(s).
3. Construct temporary sedimentation pond #2, construct permanent access road and detention pond outlet.
4. Place compacted fill along west side of Site for perimeter road.
5. Construct stabilized construction entrance at permanent Site entrance and remove temporary entrance.
6. Construct perimeter road.
7. Construct ditches, catch basin and storm drains to convey runoff to the permanent detention ponds.
8. Cut and fill operations will generally progress from south to north and west to east.
9. Slopes steeper than 3:1 will receive erosion control blanket treatment and hydroseeding; all other areas will be seeded.
10. Following completion of major excavation and fill operations, excess cut stockpile shall be removed to the off-site location and temporary stockpile area shall receive final grading.

Phase III

1. As plant area facilities are constructed, the balance of storm drain facilities will be installed and connected to the earlier installed catch basins.
2. Convert temporary sedimentation pond #1 into the permanent detention pond by removing the temporary pond outlet riser and cleaning the pond of deposited materials.

3. Convert temporary sedimentation pond #2 into the permanent detention pond by removing the temporary pond outlet riser and cleaning the pond of deposited materials.
4. Remove and stabilize construction entrance upon completion of site paving.
5. Remove ditches, rip rap check dams, and level spreaders on east and south sides of Site at completion of construction.

Phase IV

1. Install 8-foot high chain link security fence and gates around the Site.
2. Install 8-foot high chain link security fence and gates around switchyard.
3. After slopes are stabilized and revegetated, remove all erosion control measures.

Wetland Impacts

The fundamental concept of wetland impact analysis is based on the precept that wetland impacts should first be avoided where possible. Secondly, if practicable alternatives do not exist to avoid wetland impacts, then impacts should be minimized. Thirdly, unavoidable wetland impacts should be mitigated.

Various mitigation measures have been incorporated into the Project to minimize impacts to wetland resource areas to the extent practicable. Mitigation measures primarily include the implementation of best management practices to minimize the area of wetland impact and the degree to which the ground surface will be disturbed. In addition, payment into the Connecticut ILF Program will be made to mitigate for unavoidable wetland impacts.

Approximately 21,062 square feet or 0.48 acre of wetlands were delineated within the Site. Of this total, approximately 10,500 square feet (0.24 acre) of permanent wetland impacts are unavoidable and required to satisfy the building needs of the Towantic Energy Center project. A tabular description of the wetlands impacted, including the square footage of impacts proposed, as well as the functions and values associated with each wetland impacted is provided within Table 1 below.

Table 1. Functions and Values of Wetlands Subject to Permanent Impacts														
Wetland I.D. Number	Square Feet of Permanent Wetland Impacts	Groundwater Recharge/ Discharge	Floodflow Alteration	Fish & Shellfish Habitat	Sediment/Toxicant/ Pathogen Retention	Nutrient Removal/Retention/ Transformation	Production Export	Sediment/Shoreline Stabilization	Wildlife Habitat	Recreation	Educational/Scientific Value	Uniqueness/Heritage	Visual Quality/Aesthetics	Endangered Species Habitat
1	10,322	-	-	-	S	S	-	-	S	-	-	-	-	S
2 & 3	None	S	S	-	S	S	S	-	S	-	-	-	-	S
4	178	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	10,500 sq. ft.													
	P = Principal Function/Value													
	S = Secondary Function/Value													
	- = Not a Significant Function/Value													

No impact will occur to the higher-value Wetlands 2 and 3. As noted in Table 1, impacts to Wetland 1 will result in limited loss of wetland functions and values, consisting of Sediment/Toxicant/Pathogen Retention, Nutrient Removal/Retention/Transformation, Wildlife Habitat and Endangered Species Habitat, all supported by this wetland in a Secondary capacity. The loss of Wetland 4 will not result in the loss of any wetland functions or values.

Stormwater Management

A Stormwater Management Plan has been designed in accordance with the *2004 Connecticut Stormwater Quality Manual* ("SQM") and incorporates green stormwater technologies to the extent practicable in accordance with the *Low Impact Development Appendix to the Connecticut Stormwater Quality Manual* (June 2011). Details of the stormwater management system are provided in a Stormwater Management and Erosion Control Report, dated September 29, 2014 and prepared by Civil1, is provided in Attachment F. In addition, please refer to the Stormwater Management & Grading Plan (Sheet C310) and Storm Drainage Details (Sheet C321) in the separately bound Project Site Plans. A summary of the stormwater management system is provided below.

The storm drainage system is designed so that post development stormwater flows will either remain the same or be decreased at all of the design points for the various storm intervals. Another goal of the storm drainage system design is to ensure that long-term post-development stormwater quality is protected and that there will be no erosion caused by the development. This was accomplished through the use of two vegetated stormwater renovation areas, grass-lined water quality swales and pervious surface treatments to promote stormwater infiltration, vegetative filtration and assimilation and treatment.

Where the topography of the Site allowed, grass lined water quality swales have been designed. These swales will provide for filtration and infiltration of stormwater coming off of the proposed access drive prior to discharge into the existing storm drainage system south of the property. It should also be noted that the storm drainage system south of the property contains existing stormwater facilities that will further treat and renovate the stormwater prior to the eventual discharge into the wetlands located west of Woodruff Hill Road.

In the interior of the proposed plant access drive where the equipment pad areas are set the surface treatment will be an 8-inch thick layer of pervious crushed stone to grade. The switchyard area to the north gets a similar treatment but is 12 inches thick and contains larger diameter stones. Stormwater that falls in these areas will be held and will not runoff immediately into the storm drainage system. The water will either infiltrate, particularly during smaller storm events, or will slowly work its way through the stone towards one of the proposed catch basin inlets for discharge into one of the vegetated stormwater renovation areas during larger precipitation events. This pervious surface treatment encompasses approximately 8.7 acres of the 11.7 acre energy center plant area, which accounts for 74.4% of the proposed development footprint.

Both of the storm water renovation areas are designed to hold and renovate the Water Quality Volume (“WQV”) while attenuating peak rates of stormwater runoff. The WQV is the initial flush of stormwater that contains most of the sediment and pollutants as defined in the SQM. The WQV will be retained in a “water quality cell” in each renovation area that will hold stormwater, allow it to cool and be exposed to native herbaceous vegetation for filtration and treatment, then slowly release it through a permeable water quality berm for discharge. This design allows for the maximum water quality treatment of post development stormwater runoff. As such, the stormwater management system as designed will provide for long-term protection of the down gradient wetlands and watercourses in the area.

Other Agency Coordination

Connecticut Siting Council

CPV, formerly known as Towantic Energy L.L.C., is submitting a Petition to the CSC for changed conditions necessitating a modification to its Certificate for the Project. The Project is the subject of Council Docket No. 192, an application by Towantic Energy L.L.C. for a Certificate of Environmental Compatibility and Public Need, which addressed the construction, maintenance, and operation of a proposed electric generating facility located north of the intersection of Prokop Road and Towantic Hill Road (now Woodruff Hill Road) in the Town of Oxford, Connecticut.

The Council issued the Certificate in 1999 authorizing the construction and operation of a net nameplate 512-MW combined cycle dual-fuel electric generating facility. Since that time, development rights have passed through several entities, and permits have continued to be renewed and reissued accordingly. CPV Power Development, Inc., through its wholly owned subsidiary, took majority ownership of the Project entity in February 2012 and continued to move the Project towards construction and operation.

Town of Oxford

As part of the CSC Petition application, the First Selectman of Oxford, CT has been notified of the proposed Project. In addition, a public open house was held to update the local community on the Project on August 5, 2014. The Project's permit application for Stationary Sources of Air Pollution – New Source Review that was submitted to DEEP on September 8, 2014 also included notification to the First Selectman of Oxford on September 5, 2014, as well as a legal notice that appeared in the New Haven Register on August 15, 2014.

Connecticut Department of Energy & Environmental Protection

The following state permits will be required for this project: Air - New Source Review, Air – Title V and Title IV, Air – Title IV Acid Rain, and NPDES Stormwater (construction and operation).

DEEP Natural Diversity Data Base Program

Consultation with the DEEP Natural Diversity Data Base ("NDDB") letter (NDDB #201405771) reveals that four (4) Special Concern Species are identified in the vicinity of the Site: red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), silver-haired bat (*Lasionycteris noctivagans*), and eastern box turtle (*Terrapene carolina Carolina*). A copy of the June 10, 2014 DEEP letter is provided in Attachment G. A NDDB Map is provided in the Figures Attachment as Figure 4.

Connecticut State Historic Preservation Officer

A Phase I Cultural Resource Survey conducted on the ±20-acre parcel by Historical Perspectives, Inc. in October 1998 concluded that no further cultural resource investigation of the proposed Project area was recommended. A portion of the ±6-acre parcel was included in a Reconnaissance Archaeological Survey of an alternative compressor station location by PAL in May 2006. This survey did not identify any cultural material. The Applicant has initiated contact with the State Historic Preservation Office ("SHPO") for review of the proposed Project for compliance with Section 106 of the National Historic Preservation Act and provided copies of the cultural resource reports. A May 15, 2014 letter from SHPO stated that "it is SHPO's opinion that no historic properties will be affected by the expanded undertaking." A copy of the SHPO letter is provided in Attachment G.

Tribal Historic Preservation Officers

The Applicant has initiated contact with the Tribal Historic Preservation Officers ("THPO") of the Mohegan Tribe and representatives from the Mashantucket Pequot Tribe for review of the proposed Project for compliance with Section 106 of the National Historic Preservation Act, which included submission of the previously referenced archeological survey reports. The Mashantucket Pequot Tribe THPO determined that "Based on the information provided to our office, the research design and testing strategy meets acceptable professional standards, and I agree with the recommendations & concur with the CT SHPO's opinion." A copy of the Mashantucket Pequot Tribe August 9, 2014 correspondence is provided in Attachment G. Correspondence from the Mohegan Tribe will be forwarded to the Corps for this application upon receipt.

U.S. Department of the Interior Fish and Wildlife Service New England Field Office

An evaluation was performed in accordance with Section 7 of the Endangered Species Act through the U.S. Fish and Wildlife Service's ("USFWS") Information, Planning, and Conservation System ("IPaC"). The evaluation concluded that no Federally-listed endangered or threatened species are known to occur in the vicinity of the project. A copy of the September 26, 2014 IPaC consultation is provided in Attachment G.

Mitigation Measures

A suite of mitigation measures is proposed to prevent short- and long-term impacts to wetland resource areas and compensate for direct disturbances associated with the Project. Proposed mitigation measures include payment into the Connecticut ILF Program and implementation of an invasive species control plan and erosion and sedimentation control program.

Wetland Mitigation – Connecticut In-Lieu Fee Program

Wetland mitigation is proposed to properly compensate for unavoidable project impacts to wetlands. In accordance with the Corps guidance, CPV plans to pay a fee into the National Audubon Society, Inc. - Connecticut ILF Program to compensate for unavoidable project impacts to wetlands. This ILF involves paying a fee "in lieu of" permittee-responsible mitigation; the amount of the fee is based on the area of wetlands impacted, type of wetland habitat impacted, watershed location and consultation with Corps and interagency review team. By aggregating funds from multiple permitted impacts, the ILF program can develop compensatory projects that offer greater ecological benefits than permittee-responsible mitigation and contribute to watershed level conservation goals.

Considering the Site provides limited opportunity to mitigate in kind for the Project's impact to wetlands, entering into the Connecticut ILF Program is considered the most prudent and feasible option to mitigate for unavoidable wetland impacts. It will also result in greater ecological benefits than proposing to create a relatively small hillside seep wetland with limited functions and values, particularly considering that similar wetland habitat supporting greater function and value exist elsewhere on or proximate to the Site.

Invasive Species Control Plan

The proliferation of invasive plant species in both wetland and upland areas of the northeastern United States is a concern for both biological reasons (e.g., the maintenance of endemic vegetation, the preservation of habitat for native wildlife species) and for cultural reasons (e.g., adverse aesthetic effects or nuisance impacts associated with the invasion of exotic species that out-compete native plants).

The Project will eliminate Wetlands 1 and 4; no temporary alteration of wetland areas are associated with the proposed construction activities. Therefore, the Project does not represent a significant risk for introduction of invasive species into wetland resource areas.

The Project will include construction of stormwater renovation areas and water quality swales. Stormwater management facilities will be seeded and planted with native plant species immediately following grading activities to minimize the establishment of invasive species. However, stormwater facilities can provide suitable growing conditions for invasive species that can be aggressive and persistent. Common invasive species found in stormwater facilities include, but are not limited to, purple loosestrife (*Lythrum salicaria*), common reed (*Phragmites australis*), reed canary grass (*Phalaris arundinacea*), European buckthorn (*Rhamnus frangula*), and Japanese knotweed (*Polygonum cuspidatum* or *Fallopia Japonica*). These species can be a significant problem if they become established within stormwater facilities. These species produce many seeds, grow quickly and can transport seeds into nearby habitats, excluding the growth of more desirable native species. The mitigation program for the Project includes measures to identify and address the growth of invasive species within the project limits.

The risk of invasive species colonization is present due to a variety of factors, including both natural and man-created. Natural colonization can occur through the soil's existing seed bank, windborne and wildlife dispersal, and changing regional climactic conditions. Man-created colonization may occur via the transport of invasive species' seeds or rhizome fragments onto the site by timber matting or other equipment. Due to stands of invasive species within and in the vicinity of the Project area, risk of colonization via windborne and wildlife dispersal is anticipated. CPV will monitor stormwater management facilities during construction to assess the presence of invasive species in these areas. As described below, CPV will implement measures to reduce the risk of colonization via man-created conditions.

The invasive species control measures described below are intended to limit the use of materials containing invasive species seeds and minimize establishment and/or spread of invasive species.

- Proper cleaning and inspection of all construction equipment prior entering the Site;
- Hay bales will not be used as an erosion and sedimentation control measure on the Site;
- The Contractor will certify and provide documentation that any imported material is free of invasive plant seeds;
- Planting/seeding of exposed soils will occur not more than 48 hours after the placement of organic soil or loam;
- Efforts will be made during construction to minimize equipment mobility in areas containing invasive species to avoid dragging invasive plant material back and forth from established stands;
- Soils excavated from areas containing invasive plants will be stockpiled separately and contained within erosion control measures to minimize the potential of spreading these soils elsewhere on the Project; and,

- Control of invasive plants may include focused herbicide application in accordance with all applicable standards and regulations. Due to the proximity of the Site to wetland resources, only glyphosate formulated herbicides for approved use in wetlands (e.g., Rodeo®, Accord®, etc.) will be used.

Erosion and Sedimentation Controls

An Erosion & Sediment Control Plan has been designed in accordance with the *2002 Connecticut Guidelines For Soil Erosion and Sediment Control*. A variety of erosion and sedimentation controls will be employed to minimize erosion and transport of sediment to wetland resource areas during the earthwork and construction phases of the Project. These controls were developed to avoid temporary impacts to wetland resource areas and represent an important element of the Project to avoid and minimize wetland impacts. Details of the erosion and sedimentation controls are provided in a Stormwater Management and Erosion Control Report, dated September 29, 2014 and prepared by Civil1, provided in Attachment F. In addition, please refer to the Erosion & Sediment Control Plan (Sheet C315), Details (Sheet C320) and Erosion Control Narrative (Sheet C330) in the separately bound Project Site Plans. A summary of the erosion and sedimentation control plan is provided below.

The erosion and sediment control plan calls for the use of the latest erosion and sediment control measures in order to minimize and control disturbance during construction and provide a stable site under finished conditions. These measures include:

- Stabilized construction entrance
- Temporary sediment traps
- Geotextile silt fence
- Staked straw wattles/compost filter socks
- Temporary soil stockpile areas
- Temporary water diversions
- Temporary seeding of exposed soils
- Stone check dams
- Water bars with straw wattles/compost filter sock traps
- Erosion control blankets

Additionally, proper outlet protection has been designed at all proposed drainage discharge points. The outlet protection structures were designed in accordance with the recommendations on the *2000 ConnDOT Drainage Manual* Chapter 8.7 (Appendix E). Velocities were also analyzed in all of the proposed water quality swales to ensure that a grass-lined surface treatment would be appropriate to prevent erosion of the underlying soils while treating and conveying stormwater.

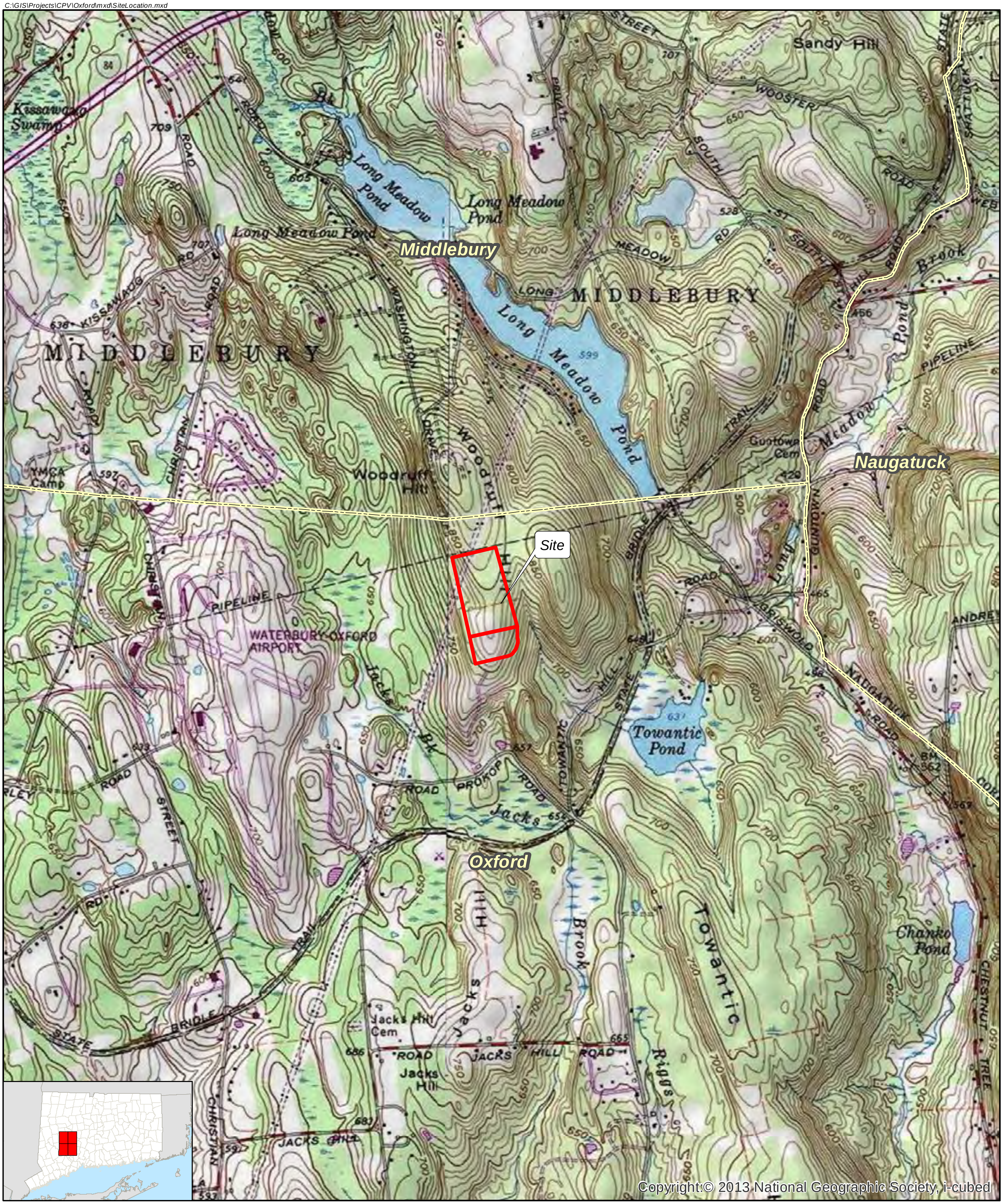
The BMPs identified in this plan and discussed below include, but are not limited to, providing measures to minimize exposed soil areas through sequencing and temporary stabilization; placement of sediment and erosion controls suitable for the type of work and environment and appropriate Site restoration and rehabilitation techniques as soon as practicable.

The following general measures will be employed to minimize impacts to the jurisdictional resource areas:

- The Contractor will be required to maintain a reserve supply of erosion control BMPs on-site for use as required;
- Protective measures will be inspected regularly and after significant precipitation events and repaired, as necessary;
- Erosion control measures shall remain in place until soils are clearly stabilized – either by erosion control blankets, or by robust, growing vegetation. Once soils are stable, erosion controls shall be removed and properly disposed; and
- Erosion controls shall be removed and properly disposed following plant colonization of disturbed soils.

Figures

C:\GIS\Projects\CPV\Oxford\mxd\SiteLocation.mxd



Legend

Project Area

Municipal Boundary

Figure 1
Site Location Map

Proposed CPV Towantic Energy Center
Woodruff Hill Road
Oxford, Connecticut

N W E S

1,000 500 0 1,000 Feet

Map Notes:
Base Map Source: USGS 7.5 Minute Topographic Quadrangle Maps, Naugatuck, Southbury, Waterbury, and Woodbury, CT (1984)
Site located on the Naugatuck Quadrangle
Map Date: September 2014

ALL-POINTS TECHNOLOGY CORPORATION

C:\GIS\Projects\CPV\Oxford\mxd\Aerial.mxd

Legend

CL&P R.O.W.

Project Area

Approximate Parcel Boundary (CTDEEP)

N W E S

200 100 0 200 Feet

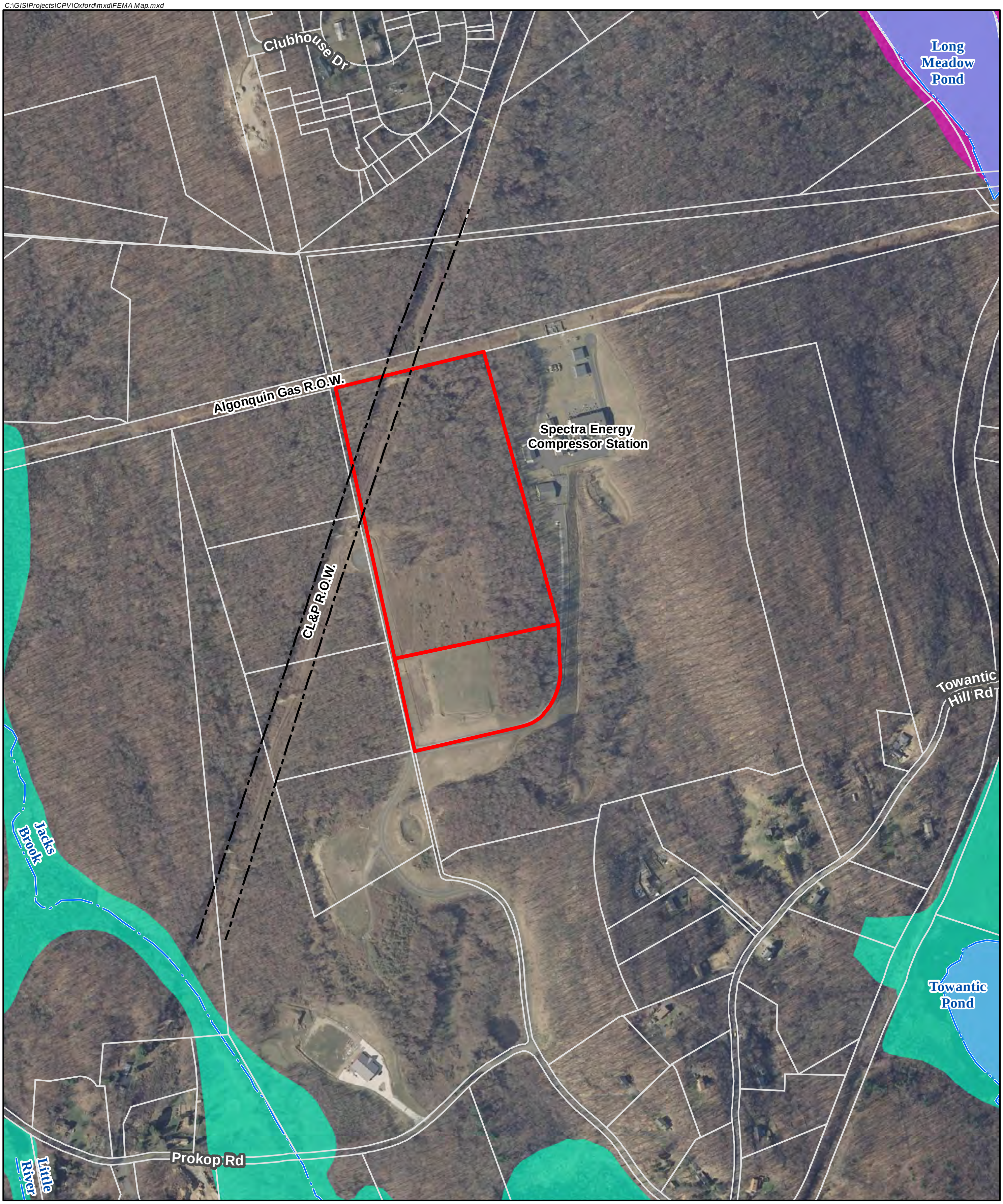
Base Map Source: 2012 Aerial Photograph (CTECO)
Map Date: September 2014

Figure 2
Aerial Photograph

Proposed CPV Towantic Energy Center
Woodruff Hill Road
Oxford, Connecticut

ALL-POINTS TECHNOLOGY CORPORATION

C:\GIS\Projects\CPV\Oxford\mxd\FEMA Map.mxd



Legend

CL&P R.O.W.

Project Area

Approximate Parcel Boundary (CTDEEP)

Watercourse

Open Water

FEMA NFHL Flood Hazard

100-Year Flood Zone

500-Year Flood Zone

Floodway

N
W E
S

250 125 0 250
Feet

Base Map Source: 2012 Aerial Photograph (CTECO)
Map Date: September 2014

Figure 3
FEMA Map

Proposed CPV Towantic Energy Center
Woodruff Hill Road
Oxford, Connecticut

ALL-POINTS TECHNOLOGY CORPORATION

C:\GIS\Projects\CPV\Oxford\mxd\NDDB Aerial Map.mxd

Legend

- CL&P R.O.W.
- Project Area
- Approximate Parcel Boundary (CTDEEP)
- CTDEEP Natural Diversity Database (NDDB) Area (June, 2014)

N
W E
S

200 100 0 200
Feet

Base Map Source: 2012 Aerial Photograph (CTECO)
Map Date: September 2014

Figure 4
NDDB Map

Proposed CPV Towantic Energy Center
Woodruff Hill Road
Oxford, Connecticut

ALL-POINTS
TECHNOLOGY CORPORATION

Attachment B

Photolog Documentation

Photo 1: Overview of Site looking north from Lot 9A at open field with forest in background. Photo date: July 3, 2014.

Photo 2: View of CL&P electrical transmission ROW, looking northwest near the cul-de-sac of Woodruff Hill Road. Photo date: July 12, 2014.

Photo 3: View of access road to compressor station looking northeast at the southeast corner of the Site. Photo date: July 3, 2014.

Photo 4: View of compressor station looking southeast from eastern property boundary of Site. Photo date: July 3, 2014.

Photo 5: View of natural gas line ROW, looking east with Site's north property boundary in right side of photo at edge of clearing. Photo date: July 3, 2014.

Photo 6: View of Wetland 1 (PEM) looking east (upland field in background). Photo date: June 26, 2014.

Photo 7: View of Wetland 1 looking west (CL&P ROW in background).
Photo date: June 26, 2014.

Photo 8: View of Wetland 1 Plot A-Wet. Photo date: June 26, 2014.

Photo 9: View of Wetland 1 Plot A-Up. Photo date: June 26, 2014.

Photo 10: View of south end of Wetland 2 looking north from CL&P ROW.
Photo date: July 12, 2014.

Photo 11: View of Wetland 3 looking north with CL&P ROW in background.
Photo date: July 12, 2014.

Photo 12: View of Wetland 4 (small depression to right of Trimble operator) looking north.
Photo date: July 3, 2014.

Attachment C

Abutting Property Owners

ABUTTERS TO PARCELS 24/21/8-1 & 24/21/8-9A

Parcel ID	Site Address	Owner Name	Mailing Address	Mailing City	Mailing State	Mailing Zip
24/21/8	PROKOP RD	OXFORD TOWN OF	486 OXFORD RD	OXFORD	CT	6478
24/21/8-1	16 WOODRUFF HILL RD	TOWANTIC ENERGY LLC	102 LONG RIDGE RD	STAMFORD	CT	6927
24/21/8-9	10 WOODRUFF HILL RD	ALGONQUIN GAS TRANSMISSION LLC	5400 WESTHEIMER COURT	HARRIS COUNTY	TX	77056
24/21/8-9A	WOODRUFF HILL RD	WOODRUFF HILL VIEW, LLC	600 GEORGES HILL RD	SOUTHBURY	CT	6488
24/21/8-9B	WOODRUFF HILL RD	ALGONQUIN GAS TRANSMISSION LLC	5400 WESTHEIMER COURT	HARRIS COUNTY	TX	77056
25/22/13	PROKOP RD	OXFORD TOWN OF	486 OXFORD RD	OXFORD	CT	6478
25/22/13-5	3 WOODRUFF HILL RD	OXFORD TOWN OF	486 OXFORD RD	OXFORD	CT	6478
25/22/13-6	7 WOODRUFF HILL RD	OXFORD TOWN OF	486 OXFORD RD	OXFORD	CT	6478
25/22/13-7	11 WOODRUFF HILL RD	OXFORD TOWN OF	486 OXFORD RD	OXFORD	CT	6478
25/22/13-8	15 WOODRUFF HILL RD	OXFORD TOWN OF	486 OXFORD RD	OXFORD	CT	6478

Note: highlighted parcels comprise the subject property

ABUTTERS MAPS ENCLOSED

Town of Oxford

Geographic Information System (GIS)

Date Printed: 9/29/2014

MAP DISCLAIMER - NOTICE OF LIABILITY

This map is for assessment purposes only. It is not for legal description or conveyances. All information is subject to verification by any user. The Town of Oxford and its mapping contractors assume no legal responsibility for the information contained herein.

Approximate Scale: 1 inch = 400 ft

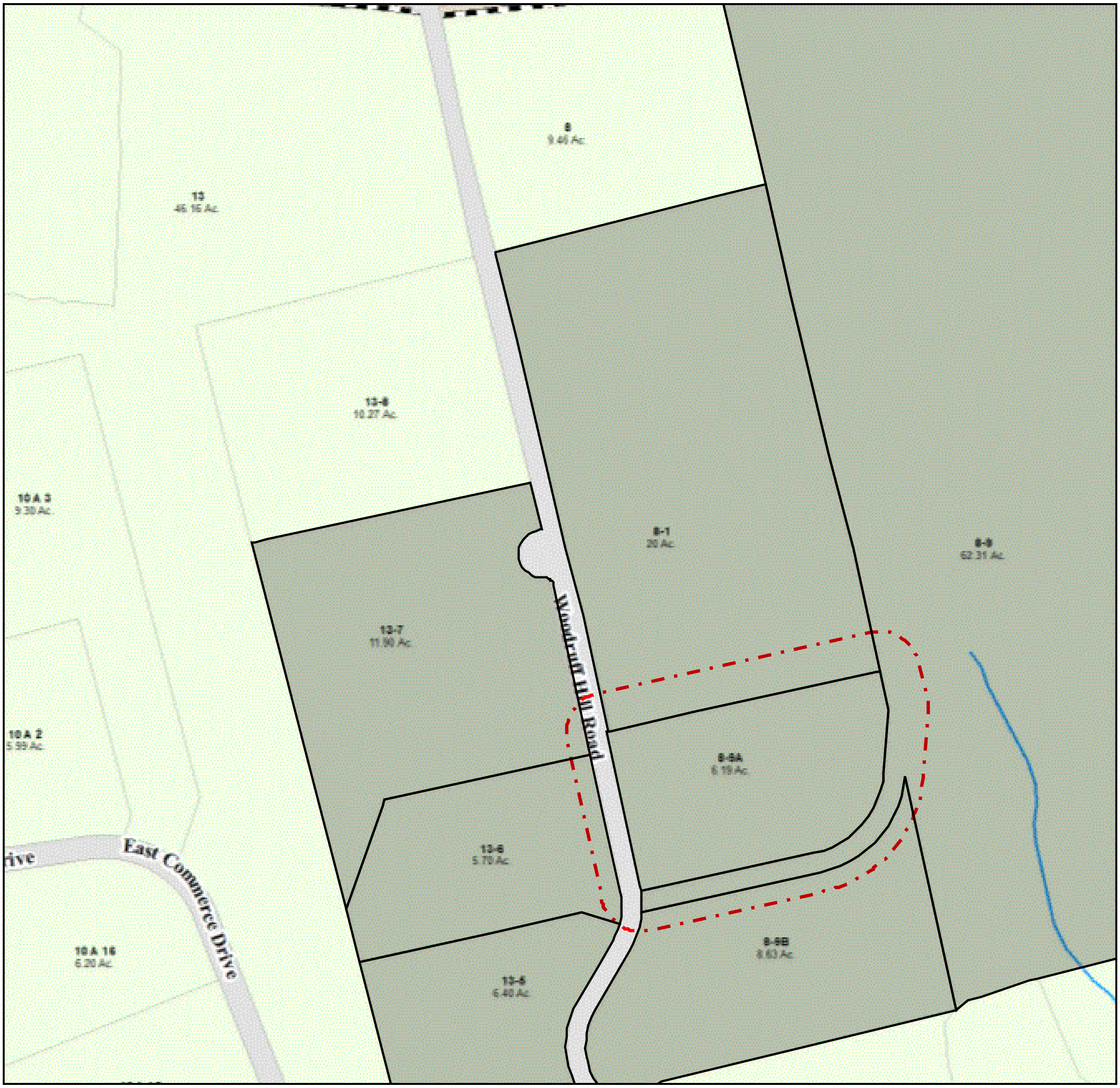
0 400 Feet

N W E S

Town of Oxford

Geographic Information System (GIS)

Date Printed: 9/29/2014



MAP DISCLAIMER - NOTICE OF LIABILITY

This map is for assessment purposes only. It is not for legal description or conveyances. All information is subject to verification by any user. The Town of Oxford and its mapping contractors assume no legal responsibility for the information contained herein.

Approximate Scale: 1 inch = 400 ft

0 400 Feet

N
W E
S

Attachment D

Wetland Investigation Report & Corps Wetland Determination Data Forms

WETLAND INVESTIGATION

August 22, 2014

CPV Towantic, LLC
50 Braintree Hill Office Park
Suite 300
Braintree, MA 02184

APT Project No.: CT444100

Re: CPV Towantic Energy Center Project
Woodruff Hill Road
Oxford, Connecticut

CPV Towantic, LLC plans to construct a new natural gas-fired electric generating facility on Woodruff Hill Road in Oxford, Connecticut. The proposed development (the "Project") encompasses two adjoining parcels located on the east side of Woodruff Hill Road along the cul-de-sac of the road; the original parcel encompasses 20± acres with a smaller 6± acre abutting parcel added to the south ("Site"). At your request, Dean Gustafson and Matthew Gustafson, Connecticut registered Soil Scientists with All-Points Technology Corporation, P.C. ("APT") conducted inspections of the Site on June 26, 2014, July 3, 2014, and July 12, 2014 to determine the presence or absence of wetlands and watercourses. The delineation methodology followed was consistent with both the Connecticut Inland Wetlands and Watercourses Act ("IWWA") and the *Corps of Engineers Wetland Delineation Manual* (1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region*, Version 2.0 (January 2012). The results of this wetland investigation are provided below.

Site and Project Description:

The approximately 26-acre Site is located in the Town of Oxford's Woodruff Hill Industrial Park and is generally bounded to the north by a Connecticut Light & Power ("CL&P") electrical transmission line right-of-way ("ROW") and Algonquin Gas transmission ROW, to the east and south by a Spectra Energy gas compression station and access road, and to the west by Woodruff Hill Road. The Site is dominated by a complex of mature, even-aged, hardwood forests and open fields with wetland inclusions isolated primarily isolated to the northern and western portions of the Site. The surrounding land-use consists primarily of undeveloped industrial parcels that currently include large tracts of mature forest.

Four wetland areas were delineated on the Site consisting of several scrub/shrub, wet meadow and seep systems and a small isolated forested man-made wetland depression. Please refer to the enclosed Wetland Delineation Map for the approximate locations of the identified wetland resource areas. Wetlands were marked with pink and blue plastic flagging tape numbered with the following sequence: WF 1-01 to 1-24, WF 2-01 to 2-16, WF 3-01 to 3-08, and WF 4-01 to 4-04. General weather conditions encountered during the above-referenced inspections ranged from low 70° F temperatures with partly cloudy skies on June 26th to mid 80° F temperatures with sunny skies on July 3rd and mid 80° F temperatures with partly cloudy skies on July 12th.

ALL-POINTS TECHNOLOGY CORPORATION, P.C.
☒ 3 SADDLEBROOK DRIVE · KILLINGWORTH, CT 06419 · PHONE 860-663-1697 · FAX 860-663-0935
☐ P.O. BOX 504 · 116 GRANDVIEW ROAD · CONWAY, NH 03818 · PHONE 603-496-5853 · FAX 603-447-2124

Regulation of Wetlands:

Wetlands and watercourses are regulated by local, state and federal regulations, with each regulatory agency differing slightly in their definition and regulatory authority of resource areas, as discussed below. The proposed Facility is under the jurisdiction of the State of Connecticut Siting Council and, therefore, is exempt from local regulation, although local wetland regulations are considered by the Siting Council. Wetlands identified on the Site are likely considered Waters of the United States and, therefore, any direct impact to jurisdictional wetlands are subject to regulation by the U.S. Army Corps of Engineers ("ACOE") New England District.

Town of Oxford: The Town of Oxford regulates activities within wetlands and watercourses and within 100 feet of wetlands and watercourses through administration of the IWWA. However, since the project is under the jurisdiction of the Connecticut Siting Council, the Oxford Inland Wetlands Agency's jurisdiction is superseded by the Council.

State of Connecticut: **Freshwater Wetlands:** The IWWA requires the regulation of activities affecting or having the potential to affect wetlands under Sec. 22a-36 through 22a-45 of the Connecticut General Statutes. The IWWA is administered through local municipalities. The IWWA defines wetlands as areas of poorly drained, very poorly drained, floodplain, and alluvial soils, as delineated by a soil scientist. Watercourses are defined as bogs, swamps, or marshes, as well as lakes, ponds, rivers, streams, etc., whether natural or man-made, permanent or intermittent. Intermittent watercourse determinations are based on the presence of a defined permanent channel and bank, and two of the following characteristics: (1) evidence of scour or deposits of recent alluvium or detritus; (2) the presence of standing or flowing water for a duration longer than a particular storm incident; and (3) the presence of hydrophytic vegetation.

ACOE: The ACOE regulates the discharge of dredged or fill material into waters of the United States under Section 404 of the Clean Water Act. Waters of the United States are navigable waters, tributaries to navigable waters, wetlands adjacent to those waters, and/or isolated wetlands that have a demonstrated interstate commerce connection. The ACOE Wetlands Delineation Manual defines wetlands as "[t]hose areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."

Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403) prohibits the unauthorized obstruction or alteration of any navigable water of the United States. This section provides that the construction of any structure in or over any navigable water of the United States, or the accomplishment of any other work affecting the course, location, condition, or physical capacity of such waters is unlawful unless the work has been approved by the ACOE.

Soil Description:

Soil types encountered throughout the Site were generally consistent with digitally available soil survey information obtained from the Natural Resources Conservation Service ("NRCS")[1]. The exception is the lack of NRCS-mapped wetland soils on the Site, which were identified in the field as Ridgebury, Leicester and Whitman soil complex. The non-wetland soils were examined along the wetland boundary and throughout the remainder of the Site. They are dominated by Woodbridge fine sandy loam and Paxton and Montauk fine sandy loams. Detailed descriptions of wetland and upland soil types are provided below.

Wetland Soils:

The **Leicester** series consists of very deep, poorly drained loamy soils formed in friable till. They are nearly level or gently sloping soils in drainageways and low-lying positions on hills. Depth to bedrock is commonly more than 6 feet. Rock fragments range from 5 to 35 percent by volume to a depth of 40 inches and up to 50 percent below 40 inches. Leicester soils have a water table at or near the surface much of the year.

The **Ridgebury** series consists of very deep, somewhat poorly and poorly drained soils formed in glacial till derived mainly from granite, gneiss and schist. They are nearly level to gently sloping soils in low areas in uplands. This series includes phases that are poorly drained and the wetter part of somewhat poorly drained. A perched, fluctuating water table above the dense till saturates the solum to or near the surface for 7 to 9 months of the year.

The **Whitman** series consists of very deep, very poorly drained soils formed in glacial till derived mainly from granite, gneiss, and schist. They are nearly level or gently sloping soils in depressions and drainageways on uplands. Depth to dense till is 12 to 30 inches. Some pedons have organic horizons overlying the A horizon. They are fibric hemic or sapric material, and are up to 5 inches thick. Whitman soils are found on nearly level and gently sloping soils in depressions and in drainage ways of glacial uplands. Slopes are typically 0 to 2 percent but range up to 8 percent where wetness is due to seepage water. This soil is very poorly drained. A perched water table, or excess seepage water, is at or near the surface for about 9 months of the year.

Upland Soils:

The **Paxton** and **Montauk** series consists very deep, well drained loamy soils formed in subglacial till derived primarily from granitic materials. The soils formed in thick moderately coarse or medium textured glacial till mantles underlain by firm to dense sandy till (known locally as hardpan). They are nearly level to steep soils on till plains, hills, and drumlins. The depth to the densic contact and material is commonly 20 to 40 inches but the range includes 18 to 40 inches. Depth to bedrock is commonly more than 6 feet. Permeability is moderate or moderately rapid in the solum and slow or moderately slow in the substratum.

The **Woodbridge** series consists of moderately well drained loamy soils formed in compact, subglacial till. They are very deep to bedrock. They are nearly level to moderately steep soils on till plains, hills, and drumlins. Depth to the compact layer (hardpan) is 18 to 40 inches. Depth to bedrock is commonly more than 6 feet. Woodbridge soils have a seasonal high water table on top of the compact layer (18-40") from fall through late spring.

[1] NRCS Web Soil Survey, http://websoilsurvey.nrcs.usda.gov/app/, accessed on June 25, 2014.

Wetlands Discussion:

Wetland 1 Classification Summary:

Wetland 1[2]	System	Subsystem	Class	Subclass	Water Regime	Special Modifier
(WF 1-01 to 1-24)	Palustrine		Emergent	Nonpersistent	Saturated	
Watercourse Type (None)	Perennial ☐	Intermittent ☐	Tidal ☐	**Special Aquatic Habitat** (None)	Vernal Pool ☐	Other ☐

Wetland 1 Description:

Wetland 1 is a dense glacial till hillside seep wetland meadow wetland system with scattered shrubs characterized by a relatively narrow clearing surrounded to the north and south by mature upland forest. Water is conveyed west, originating at a stone wall cut at the edge of a large open field. This wetland feature terminates as it approaches the Woodruff Hill cul-de-sac. Evidence of mechanical compaction in the form of tire ruts is prevalent throughout this wetland seep system along with disturbed wetland soil profiles.

A permit was granted by the Oxford Inland Wetland Agency (Application #673) on February 22, 1999 that included provisions for filling this entire wetland system, identifying it at the time as a 2,850 square foot intermittent watercourse/wetland area. An attempt to fill this wetland occurred in February 2010. A February 10, 2010 inspection report by Civil1 indicated that approximately one to two feet of common fill and topsoil was placed over the wetland, which was graded and leveled. An investigation of this wetland area reveals some disturbance apparently associated with the work performed in 2010; however, most of the disturbance to the wetland soils is associated with the top 0.5-1.0 feet characterized by topsoil fill high in organic matter, underlain by native wetland soil profiles. The hydrology of this wetland system does not appear to have been significantly altered by the previous disturbance, and vegetation is dominated by hydrophytes, as noted below.

Wetland 1 Dominant Vegetation:

Dominant Wetland Species Common Name (Latin Name)	**Dominant Adjacent Upland Species** Common Name (Latin Name)
Spicebush (Lindera benzoin)	Red Maple (Acer rubrum)
Multiflora Rose* (Rosa multiflora)	Japanese Barberry* (Berberis thunbergii)
Rice Cutgrass (Leersia oryzoides)	Virginia Creeper (Parthenosisus quinquefolia)
Jewelweed (Impatiens capensis)	Northern Arrow-wood (Viburnum recognitum)
Canada Goldenrod (Solidago canadensis)	Canada Mayflower (Maianthemum candense)
Grass-Leaved Goldenrod (Euthamia graminifolia)	Spicebush (Lindera benzoin)
Japanese Stiltgrass (Microstegium vimineum)	Black Cherry (Prunus serotina)
Soft Rush (Juncus effuses)	Sassafras (Sassafras albidum)
Greater Bladder Sedge (Carex intumesens)	Northern Red Oak (Quercus rubra)
Sallow sedge (Carex lurida)	White Ash (Fraxinus americana)
Common fox sedge (Carex vulpinoidea)	Cinnamon Fern (Osmunda cinnamomea)
Pointed broom sedge (Carex scoparia)	Hayscented Fern (Dennstaedtia punctilobula)
	Tulip Poplar (Liriodendron tulipifera)

* denotes Connecticut Invasive Plants Council invasive species

[2] Cowardin, L. M., V. Carter, F. C. Golet, E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. Jamestown, ND: Northern Prairie Wildlife Research Center Online. http://www.npwrc.usgs.gov/resource/wetlands/classwet/index.htm - contents.

Wetland 2 Classification Summary:

Wetland 2 (WF 2-01 to 2-16)	System Palustrine	Subsystem	Class Forested & Scrub-Shrub	Subclass Broad-leaved Deciduous	Water Regime Seasonally Flooded	Special Modifier
Watercourse Type (None)	Perennial ☐	Intermittent ☐	Tidal ☐	**Special Aquatic Habitat** (None)	Vernal Pool ☐	Other ☐

Wetland 2 Description:

The majority of Wetland 2 is off-site, with only its western edge located in the northwest corner of the Site. Wetland 2 is a complex of forested, scrub/shrub, and emergent seep wetland habitats formed in dense glacial till. An overhead electrical distribution ROW running north/south along the Site's western property boundary, north of the CL&P ROW, bisects the eastern upper reaches of this wetland system. Evidence of mechanical compaction in the form of tire ruts and gravel surfaces is prevalent throughout this utility ROW resulting in shallow ponding water at the time of inspection. Wetland 2 generally drains east to west across a moderately west-facing slope, formed in dense glacial till. Numerous adult green and pickerel frogs were observed within the shallow pools artificially created by the tire ruts.

Wetland 2 Dominant Vegetation:

Dominant Wetland Species Common Name (Latin Name)	**Dominant Adjacent Upland Species** Common Name (Latin Name)
Jewelweed (Impatiens capensis)	Autumn Olive* (Elaeagnus umbellate)
Sensitive Fern (Onoclea sensibilis)	Multiflora Rose* (Rosa multiflora)
Northern Arrow-wood (Viburnum recognitum)	Timothy Grass (Phleum pratense)
Reed Canarygrass* (Phalaris arundinacea)	Raspberry (Rubus sp.)
Multiflora Rose* (Rosa multiflora)	Fox Grape (Vitis labrusca)
Fox Grape (Vitis labrusca)	Mugwort* (Artemisia vulgaris)
Red Maple (Acer rubrum)	
Silky Dogwood (Cornus amomum)	
Lurid Sedge (Carex lurida)	
Black Willow (Salix nigra)	
Pussywillow (Salix discolor)	
Green Bulrush (Scirpus atrovirens)	
Arrow-Leaved Tearthumb (Polyganum sagitarium)	

* denotes Connecticut Invasive Plants Council invasive species

Wetland 3 Classification Summary:

Wetland 3 (WF 3-01 to 3-08)	System Palustrine	Subsystem	Class Forested & Scrub-Shrub	Subclass Broad-leaved Deciduous	Water Regime Seasonally Flooded	Special Modifier
Watercourse Type (**None**)	Perennial ☐	Intermittent ☐	Tidal ☐	**Special Aquatic Habitat** (None)	Vernal Pool ☐	Other ☐

Wetland 3 Description:

Wetland 3 is a small hillside seep wetland system that has experienced high levels of anthropogenic activity. Wetland 3 is generally located at the confluence of a CL&P ROW and Woodruff Hill Road cul-de-sac. As such, the hydrology and nature of Wetland 3 has been highly altered from previous filling activities associated with CL&P maintenance and upgrading of this electrical transmission ROW, resulting in disturbed wetland soil profiles, surface compaction and altered vegetation communities. This wetland system receives hydrology from the surrounding uplands to the north and east via seasonal overland flow and groundwater exfiltration, as well as a PVC pipe conveying flows from a dug drainage swale located along the east side of Woodruff Hill Road on the Site.

Wetland 3 Dominant Vegetation:

Dominant Wetland Species Common Name (Latin Name)	**Dominant Adjacent Upland Species** Common Name (Latin Name)
Spicebush (Lindera benzoin)	Red Maple (Acer rubrum)
Purple Loosestrife* (Lythrum salicaria)	Japanese Barberry* (Berberis thunbergii)
Bebb Willow (Salix bebbiana)	Virginia Creeper (Parthenosisus quinquefolia)
Soft Rush (Juncus effuses)	Northern Arrow-wood (Viburnum recognitum)
	Canada Mayflower (Maianthemum candense)
	Spicebush (Lindera benzoin)
	Black Cherry (Prunus serotina)
	Sassafras (Sassafras albidum)
	Northern Red Oak (Quercus rubra)
	White Ash (Fraxinus americana)
	Cinnamon Fern (Osmunda cinnamomea)
	Hayscented Fern (Dennstaedtia punctilobula)
	Tulip Poplar (Liriodendron tulipifera)

* denotes Connecticut Invasive Plants Council invasive species

Wetland 4 Classification Summary:

Wetland 4 (WF 4-01 to 4-04)	System	Subsystem	Class	Subclass	Water Regime	Special Modifier
	Palustrine		Forested	Broad-leaved Deciduous	Seasonally Flooded	
Watercourse Type (None)	Perennial ☐	Intermittent ☐	Tidal ☐	**Special Aquatic Habitat** (None)	Vernal Pool ☐	Other ☐

Wetland 4 Description:

Wetland 4 is a very small, isolated man-made depressional wetland feature located in a generally flat, forested upland area. This depression was artificially created in dense well drained glacial till soils, apparently the result of a dug test pit that was improperly backfilled. This anthropogenic feature has formed a small depression that intercepts the seasonally high groundwater table as evident by a review of disturbed hydric soil profiles.

Wetland 4 Dominant Vegetation:

Dominant Wetland Species Common Name (Latin Name)	**Dominant Adjacent Upland Species** Common Name (Latin Name)
Devoid of Vegetation (Barren)	Red Maple (Acer rubrum)
	Japanese Barberry* (Berberis thunbergii)
	Virginia Creeper (Parthenosisus quinquefolia)
	Northern Arrow-wood (Viburnum recognitum)
	Canada Mayflower (Maianthemum candense)
	Spicebush (Lindera benzoin)
	Black Cherry (Prunus serotina)
	Sassafras (Sassafras albidum)
	Northern Red Oak (Quercus rubra)
	White Ash (Fraxinus americana)
	Cinnamon Fern (Osmunda cinnamomea)
	Hayscented Fern (Dennstaedtia punctilobula)
	Tulip Poplar (Liriodendron tulipifera)

* denotes Connecticut Invasive Plants Council invasive species

Summary:

APT has determined that the proposed CPV Towantic Energy Center Project will result in direct impact to Wetlands 1 and 4 in order to satisfy the building program needs of this development. As a result, the proposed project is regulated by ACOE and appears eligible as a Category 2 project under the ACOE's Connecticut General Permit.

If you have any questions regarding the above-referenced information, please feel free to contact me by telephone at (860) 663-1697 ext. 201 or via email at dgustafson@allpointstech.com.

Sincerely,

All-Points Technology Corporation, P.C.

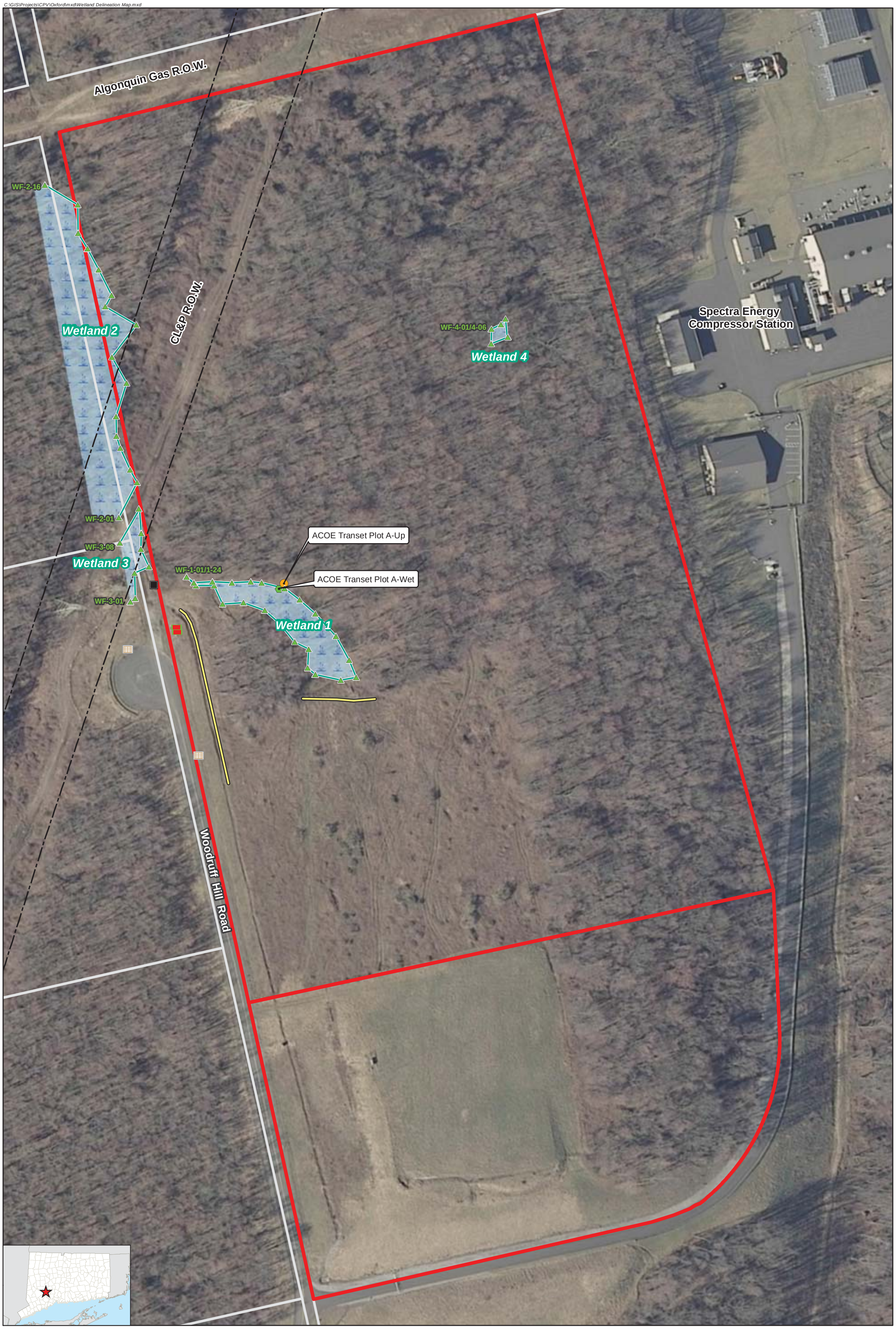
Dean Gustafson

Professional Soil Scientist

Enclosure

Wetland Delineation Map

C:\GIS\Projects\CPV\Oxford\mxd\Wetland Delineation Map.mxd



Legend

- Wetland Flag
- Delineated Wetland Boundary
- CL&P 110' R.O.W.
- Drainage Ditch
- Wetland Area
- Project Area
- Approximate Parcel Boundary (CTDEEP)
- Catch Basin
- Electrical Box
- ACOE Transet Plot A-Up
- ACOE Transet Plot A-Wet
- Transformer

Wetland Delineation Map

Proposed CPV Towantic Energy Center
Woodruff Hill Road
Oxford, Connecticut

Base Map Source: 2012 Aerial Photograph (CTECO)
Map Date: September 2014

100 50 0 100 Feet

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: CPV Towantic Energy Center/Woodruff Hill Road City/County: Oxford Sampling Date: 7/3/14

Applicant/Owner: CPV Towantic, LLC State: CT Sampling Point: A-Wet

Investigator(s): Matthew Gustafson & Dean Gustafson Section, Township, Range: ______

Landform (hillslope, terrace, etc.): hillslope - drumlin Local relief (concave, convex, none): ______ Slope (%): 5-10

Subregion (LRR or MLRA): NC & NE Lat: 41.484236° N Long: -73.123186° W Datum: NAD83

Soil Map Unit Name: Ridgebury fine sandy loam NWI classification: PEM

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☑ No ☐ (If no, explain in Remarks.)

Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☑ No ☐

Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☑	No ☐
Hydric Soil Present?	Yes ☑	No ☐
Wetland Hydrology Present?	Yes ☑	No ☐

Is the Sampled Area within a Wetland? **Yes** ☑ **No** ☐

If yes, optional Wetland Site ID: ______

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☑ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15)
- ☐ Hydrogen Sulfide Odor (C1)
- ☑ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ☑	No ☐	Depth (inches): 0-1
Water Table Present?	Yes ☑	No ☐	Depth (inches): 10
Saturation Present? (includes capillary fringe)	Yes ☑	No ☐	Depth (inches): 0

Wetland Hydrology Present? **Yes** ☑ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: A-Wet

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 5')			
1. Lindera benzoin	10	Yes	FACW
2. Rosa multiflora	5	Yes	FACU
3.			
4.			
5.			
6.			
7.			
	15 = Total Cover		
Herb Stratum (Plot size: 30')			
1. Leersia oryzoides	20	Yes	OBL
2. Impatiens capensis	30	Yes	FACW
3. Carex lurida	30	Yes	OBL
4. Euthamia graminifolia	5	No	FAC
5. Microstegium vimineum	15	No	FAC
6. Juncus effusus	10	No	OBL
7.			
8.			
9.			
10.			
11.			
12.			
	130 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 80% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	2	x 1 =	2
FACW species	2	x 2 =	4
FAC species	0	x 3 =	0
FACU species	1	x 4 =	4
UPL species	0	x 5 =	0
Column Totals:	5 (A)		10 (B)

Prevalence Index = B/A = 2.0

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: A-Wet

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-7	10 YR 3/1						FSL	
7-18	10 YR 5/2		10 YR 5/6	10	C		FSL	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☑ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ☐ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ☐ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ☐ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ☐ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ☐ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ☐ Dark Surface (S7) (**LRR K, L**)
- ☐ Polyvalue Below Surface (S8) (**LRR K, L**)
- ☐ Thin Dark Surface (S9) (**LRR K, L**)
- ☐ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ☐ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ☐ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ☐ Red Parent Material (F21)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____________

Depth (inches): ____________

Hydric Soil Present? **Yes** ☑ **No** ☐

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: CPV Towantic Energy Center/Woodruff Hill Road City/County: Oxford Sampling Date: 7/3/14

Applicant/Owner: CPV Towantic, LLC State: CT Sampling Point: A-Up

Investigator(s): Matthew Gustafson & Dean Gustafson Section, Township, Range: ______

Landform (hillslope, terrace, etc.): hillslope - drumlin Local relief (concave, convex, none): none Slope (%): 5-10

Subregion (LRR or MLRA): NC & NE Lat: 41.484282° N Long: -73.123137° W Datum: NAD83

Soil Map Unit Name: Woodbridge fine sandy loam NWI classification: Forested

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☑ No ☐ (If no, explain in Remarks.)

Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☑ No ☐

Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?	☑	☐
Hydric Soil Present?	☐	☑
Wetland Hydrology Present?	☐	☑

Is the Sampled Area within a Wetland? **Yes** ☐ **No** ☑

If yes, optional Wetland Site ID: ______

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

	Yes	No	Depth (inches)
Surface Water Present?	☐	☑	
Water Table Present?	☐	☑	
Saturation Present? (includes capillary fringe)	☐	☑	

Wetland Hydrology Present? **Yes** ☐ **No** ☑

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: A-Up

Tree Stratum (Plot size: 30')

	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubrum	75	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	75 = Total Cover		

Sapling/Shrub Stratum (Plot size: 15')

	Absolute % Cover	Dominant Species?	Indicator Status
1. Lindera benzoin	50	Yes	FACW
2. Berberis thunbergii	20	Yes	FACU
3. Ilex verticillata	5	No	FACW
4.			
5.			
6.			
7.			
	75 = Total Cover		

Herb Stratum (Plot size: 5')

	Absolute % Cover	Dominant Species?	Indicator Status
1. Maianthemum canadense	10	Yes	FACU
2. Streptopus sp.	10	Yes	FAC
3. Fragaria sp.	5	No	
4. Toxicodendron radicans	5	No	FAC
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	30 = Total Cover		

Woody Vine Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Indicator Status
1. Celastrus scandens	10	Yes	FACU
2.			
3.			
4.			
	10 = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 60% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	2	x 2 = 4
FAC species	3	x 3 = 9
FACU species	2	x 4 = 8
UPL species		x 5 =
Column Totals:	7 (A)	21 (B)

Prevalence Index = B/A = 3.0

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☑ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: A-Up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
1-0							fibric	
0-9	10 YR 3/2						FSL	
9-20	10 YR 4/4						FSL	
20-24	10 YR 6/3		10 YR 5/6&6/2				FSL	Fe/Mn soft masses

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ☐ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ☐ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ☐ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ☐ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ☐ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ☐ Dark Surface (S7) (**LRR K, L**)
- ☐ Polyvalue Below Surface (S8) (**LRR K, L**)
- ☐ Thin Dark Surface (S9) (**LRR K, L**)
- ☐ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ☐ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ☐ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ☐ Red Parent Material (F21)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** ☐ **No** ☑

Remarks:

Attachment E

Wetland Function-Value Evaluation Summary Table and Office/Field Forms

Wetland Function-Value Evaluation Summary Table

Total area of wetland	±10,322 SF	Human Made?	No	Is wetland part of a wildlife corridor?	No	or a "habitat Island"?	No	Wetland ID	Wetland 1 (WF 1-01 to 1-24)
Adjacent land use	Undeveloped forest, industrial park, ROWs	Distance to nearest roadway or other development	<100 ft.	Latitude/ Longitude	41.484122° N, -73.123075° W		
Dominant wetland systems present	Palustrine Emergent Marsh (wet meadow)	Contiguous undeveloped buffer zone present	Yes	Prepared by	D. Gustafson	Date	7/12/14
Is the wetland a separate hydraulic system?	Yes	If not, where does the wetland lie in the drainage basin?	Isolated wetland	Wetland Impact Type:	Permanent	Area	±10,322 SF
How many Tributaries contribute to the wetland?	none; isolated wetland system	Wildlife & vegetation diversity/abundance	No	Corps manual wetland delineation Completed?	Yes		

Function/Value	Suitability Y	Suitability N	Rationale (Reference #)*	Principal Function(s)/Values(s)	Comments
Groundwater Recharge/Discharge	☐	✓	1,2,6,8,12,15		perched wetland limits recharge to regional water table
Floodflow Alteration	☐	✓	2,3,5		wetland's flood storage capacity is not significant
Fish and Shellfish Habitat	☐	✓	1		fisheries habitat not supported
Sediment/Toxicant Retention	✓	☐	6-9	S	function not supported in a significant capacity
Nutrient Removal	✓	☐	3, 7-11		dense herbaceous wetland vegetation
Production Export	☐	✓	1,2,4,7,12		lack of vegetation structural diversity
Sediment/Shoreline Stabilization	☐	✓			does not border on stream or open water
Wildlife Habitat	✓	☐	5,7,8,11,13,16,17	S	seasonal hydrology, previous disturbance, relatively small size and lack of structural diversity limits function
Recreation	☐	✓	11		public access is restricted to the wetland
Educational/Scientific Value	☐	✓	13		lack of public access, small size and previous disturbance
Uniqueness/Heritage	☐	✓	5,10,18,19		value not supported in a significant capacity
Visual Quality/Aesthetics	☐	✓	9-11		lack of public access, small size and previous disturbance
Endangered Species Habitat	✓	☐		S	rare species identified by state agency in Site vicinity
Other	☐	✓			

* Refer to Field / Office Wetland Function-Value Evaluation Form for number considerations.

FLOODFLOW ALTERATION FUNCTION

CONSIDERATIONS/QUALIFIERS	Y	N	Principal
1. Area of this wetland is large relative to its watershed.	☐	✓	☐
2. Wetland occurs in the upper portions of its watershed.	✓	☐	☐
3. Effective flood storage is small or non-existent upslope of or above the wetland.	✓	☐	☐
4. Wetland watershed contains a high percent of impervious surfaces.	☐	✓	☐
5. Wetland contains hydric soils which are able to absorb and detain water.	✓	☐	☐
6. Wetland exists in a relatively flat area that has flood storage potential.	☐	✓	☐
7. Wetland has an intermittent outlet, ponded water, or signs are present of variable water level.	☐	✓	☐
8. During flooding wetland retains higher volumes of water than under normal/average rainfall conditions.	☐	✓	☐
9. Wetland receives and retains overland or sheet flow runoff from surrounding uplands.	☐	✓	☐
10. During a storm, this wetland may receive and detain excessive flood water from a nearby watercourse.	☐	✓	☐
11. Valuable properties, structures, or resources are located in/near floodplain downstream of the wetland.	☐	✓	☐
12. The watershed has a history of economic loss due to flooding.	☐	✓	☐
13. This wetland is associated with one or more watercourses.	☐	✓	☐
14. This wetland watercourse is sinuous or diffuse.	☐	✓	☐
15. This wetland outlet is constricted.	☐	✓	☐
16. Channel flow velocity is affected by this wetland.	☐	✓	☐
17. Land uses downstream are protected by this wetland.	☐	✓	☐
18. This wetland contains a high density of vegetation.	☐	✓	☐
Comments: Wetland’s flood storage capacity is not significant due to slope and small size which limit ability to attenuate flood flows.			

FISH AND SHELLFISH HABITAT (FRESHWATER) FUNCTION

CONSIDERATIONS/QUALIFIERS	Y	N	Principal
1. Forest land dominant in the watershed above this wetland.	✓	☐	☐
2. Abundance of cover objects present.	☐	✓	☐
STOP HERE IF THIS WETLAND IS NOT ASSOCIATED WITH A WATERCOURSE			
3. Size of this wetland is able to support large fish/shellfish populations.	☐	☐	☐
4. Wetland is part of a larger, contiguous watercourse.	☐	☐	☐
5. Sufficient open water size/depth so as not to freeze solid and retain some open water during winter.	☐	☐	☐
6. Stream width (bank to bank) is more than 50 feet.	☐	☐	☐
7. Quality of watercourse associated with wetland is able to support healthy fish/shellfish populations	☐	☐	☐
8. Streamside vegetation provides shade for the watercourse.	☐	☐	☐
9. Spawning areas are present (submerged vegetation or gravel beds).	☐	☐	☐
10. Food is available to fish/shellfish populations within this wetland.	☐	☐	☐
11. Anadromous fish barrier(s) absent from stream reach associated with this wetland.	☐	☐	☐
12. Evidence of fish is present.	☐	☐	☐
13. Wetland is stocked with fish.	☐	☐	☐
14. The watercourse is persistent.	☐	☐	☐
15. Man-made streams are absent.	☐	☐	☐
16. Water velocities are not too excessive for fish usage.	☐	☐	☐
17. Defined stream channel is present.	☐	☐	☐

Comments: Fish habitat is not supported due to the lack of inundation or ponding water.

FISH AND SHELLFISH HABITAT (MARINE) FUNCTION – N/A

CONSIDERATIONS/QUALIFIERS	Y	N	Principal
1. Special aquatic sites (tidal marsh, mud flats, eelgrass beds) are present.	☐	☐	☐
2. Suitable spawning habitat is present at the site or in the area.	☐	☐	☐
3. Commercially or recreationally important species are present or suitable habitat exists.	☐	☐	☐
4. The wetland/waterway supports prey for higher trophic level marine organisms.	☐	☐	☐
5. The waterway provides migratory habitat for anadromous fish.	☐	☐	☐
6. Essential fish habitat (1996 amendments to the Magnuson-Stevens) Fishery & Conservation Act present	☐	☐	☐
Comments: Marine fisheries habitat is not supported by this wetland.			

SEDIMENT/TOXICANT/PATHOGEN RETENTION FUNCTION

CONSIDERATIONS/QUALIFIERS	Y	N	Principal
1. Potential sources of excess sediment are in the watershed above the wetland.	☐	✓	☐
2. Potential or known sources of toxicants are in the watershed above the wetland.	☐	✓	☐
3. Opportunity for sediment trapping by slow moving water/deepwater habitat is present in wetland.	☐	✓	☐
4. Fine grained mineral or organic soils are present.	☐	✓	☐
5. Long duration water retention time is present in this wetland.	☐	✓	☐
6. Public or private water sources occur downstream.	✓	☐	☐
7. The wetland edge is broad and intermittently aerobic.	✓	☐	☐
8. The wetland is known to have existed for more than 50 years.	✓	☐	☐
9. Drainage ditches have not been constructed in the wetland.	✓	☐	☐
STOP HERE IF WETLAND IS NOT ASSOCIATED WITH A WATERCOURSE			
10. Wetland is associated with an intermittent or perennial stream or a lake.	☐	☐	☐
11. Channelized flows have visible velocity decreases in the wetland.	☐	☐	☐
12. Effective floodwater storage in wetland is occurring. Areas of impounded open water are present.	☐	☐	☐
13. No indicators of erosive forces are present. No high water velocities are present.	☐	☐	☐
14. Diffuse water flows are present in the wetland.	☐	☐	☐
15. Wetland has a high degree of water and vegetation interspersion.	☐	☐	☐
16. Dense vegetation provides sediment trapping/signs of sediment accumulation are present.	☐	☐	☐
Comments: Function supported in a limited in this capacity due to its small size, small watershed and undeveloped nature of the watershed which does not provide a source for these contaminants.			

NUTRIENT REMOVAL/RETENTION/TRANSFORMATION FUNCTION

CONSIDERATIONS/QUALIFIERS	Y	N	Principal
1. Wetland is large relative to the size of its watershed.	☐	✓	☐
2. Deep water or open water habitat exists.	☐	✓	☐
3. Overall potential for sediment trapping exists in the wetland.	✓	☐	☐
4. Potential sources of excess nutrients are present in the watershed above the wetland.	☐	✓	☐
5. Wetland saturated for most of the season. Ponded water is present in the wetland.	☐	✓	☐
6. Deep organic/sediment deposits are present.	☐	✓	☐
7. Slowly drained fine grained mineral or organic soils are present.	✓	☐	☐
8. Dense vegetation is present.	✓	☐	☐
9. Emergent vegetation and/or dense woody stems are dominant.	✓	☐	☐

10. Opportunity for nutrient attenuation exists.	✓	☐	☐
11. Vegetation diversity/abundance sufficient to utilize nutrients.	✓	☐	☐
STOP HERE IF WETLAND IS NOT ASSOCIATED WITH A WATERCOURSE			
12. Waterflow through this wetland is diffuse.	☐	☐	☐
13. Water retention/detention time in this wetland is increased by constricted outlet or thick vegetation.	☐	☐	☐
14. Water moves slowly through this wetland.	☐	☐	☐
Comments: This wetland does have some capacity to provide nutrient removal/nutrient retention/transformation function due to the dense herbaceous wetland vegetation.			

PRODUCTION EXPORT (Nutrient) FUNCTION

CONSIDERATIONS/QUALIFIERS	Y	N	Principal
1. Wildlife food sources grow within this wetland.	✓	☐	☐
2. Detritus development is present within this wetland	✓	☐	☐
3. Economically or commercially used products found in this wetland.	☐	✓	☐
4. Evidence of wildlife use found within this wetland.	✓	☐	☐
5. Higher trophic level consumers are utilizing this wetland.	☐	✓	☐
6. Fish or shellfish develop or occur in this wetland.	☐	✓	☐
7. High vegetation density is present.	✓	☐	☐
8. Wetland exhibits high degree of plant community structure/species diversity.	☐	✓	☐
9. High aquatic vegetative diversity/abundance is present.	☐	✓	☐
10. Nutrients exported in wetland watercourses (permanent outlet present).	☐	✓	☐
11. "Flushing" of relatively large amounts of organic plant material occurs from this wetland.	☐	✓	☐
12. Wetland contains flowering plants that are used by nectar-gathering insects.	✓	☐	☐
13. Indications of export are present.	☐	✓	☐
14. High production levels occurring with no visible signs of export (assumes export is attenuated).	☐	✓	☐
Comments: Function is limited due to general lack of vegetation structural diversity, lack of commercially used products and small size of wetland.			

SEDIMENT/SHORELINE STABILIZATION FUNCTION – N/A

CONSIDERATIONS/QUALIFIERS	Y	N	Principal
1. Indications of erosion or siltation are present.	☐	☐	☐
2. Topographical gradient is present in wetland.	☐	☐	☐
3. Potential sediment sources are present up-slope.	☐	☐	☐
4. Potential sediment sources are present upstream.	☐	☐	☐
5. No distinct shoreline or bank is evident between the waterbody and the wetland or upland.	☐	☐	☐
6. A distinct step between the open waterbody or stream and the adjacent land exists (i.e., sharp bank) with dense roots throughout.	☐	☐	☐
7. Wide wetland (>10') borders watercourse, lake, or pond.	☐	☐	☐
8. High flow velocities in the wetland.	☐	☐	☐
9. The watershed is of sufficient size to produce channelized flow.	☐	☐	☐
10. Open water fetch is present.	☐	☐	☐
11. Boating activity is present.	☐	☐	☐
12. Dense vegetation is bordering watercourse, lake, or pond.	☐	☐	☐
13. High percentage of energy-absorbing emergents and/or shrubs border a watercourse, lake, or pond.	☐	☐	☐
14. Vegetation is comprised of large trees and shrubs that withstand major flood events or erosive incidents and stabilize the shoreline on a large scale (feet).	☐	☐	☐
15. Vegetation is comprised of a dense resilient herbaceous layer that stabilizes sediments and the shoreline on a small scale (inches) during minor flood events or potentially erosive events.	☐	☐	☐

Comments: Wetland does not border on stream or permanent open water to provide stabilization function.

WILDLIFE HABITAT FUNCTION

CONSIDERATIONS/QUALIFIERS	Y	N	Principal
1. Wetland is not degraded by human activity.	☐	✓	☐
2. Water quality of watercourse/pond/lake associated w/ wetland meets/exceeds Class A or B standards.	☐	✓	☐
3. Wetland is not fragmented by development.	☐	✓	☐
4. Upland surrounding this wetland is undeveloped.	☐	✓	☐
5. > 40% of wetland edge bordered by upland wildlife habitat at least 500 ft in width.	✓	☐	☐
6. Wetland is contiguous with other wetland systems connected by a watercourse or lake.	☐	✓	☐
7. Wildlife overland access to other wetlands is present.	✓	☐	☐
8. Wildlife food sources are within this wetland or are nearby.	✓	☐	☐
9. Wetland exhibits a high degree of interspersion of vegetation classes and/or open water.	☐	✓	☐
10. Two or more islands or inclusions of upland within the wetland are present.	☐	✓	☐
11. Dominant wetland class includes deep or shallow marsh or wooded swamp.	✓	☐	☐
12. > 3 acres shallow permanent open water (< 6.6 feet deep), including in/adjacent streams present.	☐	✓	☐
13. Density of the wetland vegetation is high.	✓	☐	☐
14. Wetland exhibits a high degree of plant species diversity.	☐	✓	☐
15. Wetland exhibits high degree plant community structure diversity (tree/shrub/vine/grasses/mosses)	☐	✓	☐
16. Plant/animal indicator species are present. (List species for project)	✓	☐	☐
17. Animal signs observed (tracks, scats, nesting areas, etc.)	✓	☐	☐
18. Seasonal uses vary for wildlife and wetland appears to support varied population diversity/abundance during different seasons.	☐	✓	☐
19. Wetland contains or has potential to contain a high population of insects.	☐	✓	☐
20. Wetland contains or has potential to contain large amphibian populations.	☐	✓	☐
21 Wetland has a high avian utilization or its potential.	☐	✓	☐
22. Indications of less disturbance-tolerant species are present.	☐	✓	☐
23. Signs of wildlife habitat enhancement are present (birdhouses, nesting boxes, food sources, etc.).	☐	✓	☐
Comments: Wetland provides limited function due to the seasonal hydrology, previous disturbance, relatively small size and lack of structural diversity (primarily wet meadow habitat).			

RECREATION (Consumptive and Non-Consumptive) VALUE

CONSIDERATIONS/QUALIFIERS	Y	N	Principal
1. Wetland is part of a recreation area, park, forest, or refuge.	☐	✓	☐
2. Fishing is available within or from the wetland.	☐	✓	☐
3. Hunting is permitted in the wetland.	☐	✓	☐
4. Hiking occurs or has potential to occur within the wetland.	☐	✓	☐
5. Wetland is a valuable wildlife habitat.	☐	✓	☐
6. The watercourse, pond, or lake associated with the wetland is unpolluted.	☐	✓	☐
7. High visual/aesthetic quality of this potential recreation site.	☐	✓	☐
8. Access to water is available at this potential recreation site for boating, canoeing, or fishing.	☐	✓	☐
9. Watercourse associated w/ wetland is wide & deep enough to accommodate canoeing and/or non-powered boating.	☐	✓	☐
10. Off-road public parking available at the potential recreation site.	☐	✓	☐
11. Accessibility and travel ease is present at this site.	✓	☐	☐
12. The wetland is within a short drive or safe walk from highly populated public and private areas	☐	✓	☐

ALL-POINTS TECHNOLOGY CORPORATION
3 Saddlebrook Drive
Killingworth, Connecticut 06419
860 663-1697

Field / Office Wetland Function-Value Evaluation Form

Date(s):	July 12, 2014		Project Location:	Woodruff Hill Road, Oxford, CT	
Inspector(s):	Dean Gustafson, PSS		Wetland ID:	Wetland 1 (WF 1-01 to 1-24)	
Corps Delineation:	Yes ✓	No ☐	CT Delineation	Yes ✓	No ☐
Wetland Area:	±10,322 sq. ft.		Proposed Impact:	Type:None	Area:None
Created Wetland:	Yes ☐	No ✓	Adjacent Land Use:	Undeveloped Forest and Residential	
Dominate System:	PEM		Nearest Roadway:	Woodruff Hill Road	
Wildlife Corridor:	Yes ✓	No ☐	Habitat Island:	Yes ☐	No ✓
Tributaries:	none; isolated wetland		Buffer Condition:	Undeveloped - Forested	
Site Photo(s):	see photos 6 & 7 in photo doc		Species List(s):	Refer to Wetlands Delineation Report	

Wetland 1 (±10,322 SF) is a dense glacial till hillside seep wetland meadow wetland system with scattered shrubs characterized by a relatively narrow clearing surrounded to the north and south by mature upland forest located in the central-west portion of the Site. Water is conveyed west, originating at a stone wall cut at the edge of a large open field. This wetland feature terminates as it approaches the Woodruff Hill cul-de-sac, isolating it from other nearby wetland systems located further to the west. Evidence of mechanical compaction in the form of tire ruts is prevalent throughout this wetland seep system along with disturbed wetland soil profiles.

GROUNDWATER RECHARGE/DISCHARGE FUNCTION

CONSIDERATIONS/QUALIFIERS	Y	N	Principal
1. Public or private wells occur downstream of the wetland.	✓	☐	☐
2. Potential exists for public or private wells downstream of the wetland.	✓	☐	☐
3. Wetland is underlain by stratified drift.	☐	✓	☐
4. Gravel or sandy soils present in or adjacent to the wetland.	☐	✓	☐
5. Fragipan does not occur in the wetland.	☐	✓	☐
6. Fragipan, impervious soils, or bedrock does occur in the wetland.	✓	☐	☐
7. Wetland is associated with a perennial or intermittent watercourse.	☐	✓	☐
8. Signs of groundwater recharge are present or piezometer data demonstrates recharge.	✓	☐	☐
9. Wetland is associated w/ a watercourse but lacks a defined outlet/contains a constricted outlet.	☐	✓	☐
10. Wetland contains only an outlet, no inlet.	☐	✓	☐
11. Groundwater quality of stratified drift aquifer within or downstream of wetland meets drinking water standards.	☐	✓	☐
12. Quality of water associated with the wetland is high.	✓	☐	☐
13. Signs of groundwater discharge are present (e.g., springs).	☐	✓	☐
14. Water temperature suggests it is a discharge site.	☐	✓	☐
15. Wetland shows signs of variable water levels	✓	☐	☐
16. Piezometer data demonstrates discharge.	☐	✓	☐

Comments: Considering this perched wetland has formed above a low-permeable densic contact, infiltration into the regional water table is not significant due to the unsaturated (vadose) zone present between the regional water table and the perched wetland.

Comments: Public access is restricted to the wetland.

EDUCATIONAL/SCIENTIFIC VALUE

CONSIDERATIONS/QUALIFIERS	Y	N	Principal
1. Wetland contains or is known to contain threatened, rare, or endangered species.	☐	✓	☐
2. Little or no disturbance is occurring in this wetland.	☐	✓	☐
3. Potential educational site contains a diversity of wetland classes & are accessible/potentially accessible.	☐	✓	☐
4. Potential educational site is undisturbed and natural.	☐	✓	☐
5. Wetland is considered to be a valuable wildlife habitat.	☐	✓	☐
6. Wetland is located within a nature preserve or wildlife management area.	☐	✓	☐
7. Signs of wildlife habitat enhancement present (bird houses, nesting boxes, food sources, etc.).	☐	✓	☐
8. Off-road parking at potential educational site suitable for school bus access in or near wetland.	☐	✓	☐
9. Potential educational site is within safe walking distance or a short drive to schools.	☐	✓	☐
10. Potential educational site is within safe walking distance to other plant communities.	☐	✓	☐
11. Direct access to perennial stream at potential educational site is available.	☐	✓	☐
12. Direct access to pond or lake at potential educational site is available.	☐	✓	☐
13. No known safety hazards exist within the potential educational site.	✓	☐	☐
14. Public access to the potential educational site is controlled.	☐	✓	☐
15. Handicap accessibility is available.	☐	✓	☐
16. Site is currently used for educational or scientific purposes.	☐	✓	☐
Comments: Wetland has limited value due to lack of public access, small size and previous disturbance.			

UNIQUENESS/HERITAGE VALUE

CONSIDERATIONS/QUALIFIERS	Y	N	Principal
1. Upland surrounding wetland is primarily urban.	☐	✓	☐
2. Upland surrounding wetland is developing rapidly.	☐	✓	☐
3. > 3 acres of shallow permanent open water (< 6.6 feet deep), including streams, occur in wetlands.	☐	✓	☐
4. Three or more wetland classes are present.	☐	✓	☐
5. Deep and/or shallow marsh or wooded swamp dominate.	✓	☐	☐
6. High degree of interspersion of vegetation and/or open water occur in this wetland.	☐	✓	☐
7. Well-vegetated stream corridor (15 feet on each side of the stream) occurs in this wetland.	☐	✓	☐
8. Potential educational site is within a short drive or a safe walk from schools.	☐	✓	☐
9. Off-road parking at potential educational site is suitable for school buses.	☐	✓	☐
10. No known safety hazards exist within this potential educational site.	✓	☐	☐
11. Direct access to perennial stream or lake exists at potential educational site.	☐	✓	☐
12. Two or more wetland classes are visible from primary viewing locations.	☐	✓	☐
13. Low-growing wetlands (marshes, scrub-shrub, bogs, open water) visible from primary viewing locations.	☐	✓	☐
14. Half an acre of open water or 200 feet of stream is visible from the primary viewing locations.	☐	✓	☐
15. Large area of wetland dominated by flowering plants/plants that seasonally turn vibrant colors	☐	✓	☐
16. General appearance of the wetland visible from primary viewing locations is unpolluted and/or undisturbed.	☐	✓	☐
17. Overall view of the wetland is available from the surrounding upland.	☐	✓	☐
18. Quality of the water associated with the wetland is high.	✓	☐	☐
19. Opportunities for wildlife observations are available.	✓	☐	☐

20. Historical buildings are found within the wetland.	☐	✓	☐
21. Presence of pond or pond site and remains of a dam occur within the wetland.	☐	✓	☐
22. Wetland is within 50 yards of the nearest perennial watercourse.	☐	✓	☐
23. Visible stone or earthen foundations, berms, dams, standing structures, or associated features occur within the wetland.	☐	✓	☐
24. Wetland contains critical habitat for a state- or federally-listed threatened or endangered species.	☐	✓	☐
25. Wetland is known to be a study site for scientific research.	☐	✓	☐
26. Wetland is a natural landmark or recognized by the state natural heritage inventory authority as an exemplary natural community.	☐	✓	☐
27. Wetland has local significance because it serves several functional values.	☐	✓	☐
28. Wetland has local significance because it has biological, geological, or other features that are locally rare or unique.	☐	✓	☐
29. Wetland is known to contain an important archaeological site.	☐	✓	☐
30. Wetland is hydrologically connected to a state or federally designated scenic river.	☐	✓	☐
31. Wetland is located in an area experiencing a high wetland loss rate.	☐	✓	☐
Comments: Value not supported by wetland in a significant capacity.			

VISUAL QUALITY/AESTHETICS VALUE

CONSIDERATIONS/QUALIFIERS	Y	N	Principal
1. Multiple wetland classes are visible from primary viewing locations.	☐	✓	☐
2. Emergent marsh and/or open water are visible from primary viewing locations.	☐	✓	☐
3. A diversity of vegetative species is visible from primary viewing locations	☐	✓	☐
4. Wetland is dominated by flowering plants or plants that turn vibrant colors in different seasons.	☐	✓	☐
5. Land use surrounding the wetland is undeveloped as seen from primary viewing locations.	☐	✓	☐
6. Visible surrounding land use form contrasts with wetland.	☐	✓	☐
7. Wetland views absent of trash, debris, and signs of disturbance.	☐	✓	☐
8. Wetland is considered to be a valuable wildlife habitat.	☐	✓	☐
9. Wetland is easily accessed.	✓	☐	☐
10. Low noise level at primary viewing locations.	✓	☐	☐
11. Unpleasant odors absent at primary viewing locations.	✓	☐	☐
12. Relatively unobstructed sight line exists through wetland.	☐	✓	☐
Comments: Wetland has limited value due to lack of public access, small size and previous disturbance.			

ENDANGERED SPECIES HABITAT VALUE

CONSIDERATIONS/QUALIFIERS	Y	N	Principal
1. Wetland contains or is known to contain threatened or endangered species.	☐	✓	☐
2. Wetland contains critical habitat for a state or federally listed threatened or endangered species.	☐	✓	☐
Comments: DEEP indicates that eastern box turtle (*Terrapene carolina carolina*), a state species of special concern, occurs in the vicinity of the Site. Value is not supported by wetland at a Principal level since Eastern box turtle is more commonly associated with a variety of terrestrial habitats and no occurrences of box turtle have been documented on the Site. Value is assumed to be supported in a Secondary capacity due to potential for seasonal use by box turtle; previous disturbance to wetland could further limit this value.			

Wetland Function-Value Evaluation Summary Table

Total area of wetland	Wtl 2 - ±10,561 sq. ft. Wtl 3 – off Site	Human Made?	No	Is wetland part of a wildlife corridor?	Yes	or a “habitat Island”?	No	Wetland ID	Wetland 2 (WF 2-01 to 2-16) Wetland 3 (WF 3-01 to 3-08)
Adjacent land use	Undeveloped forest, industrial park, ROWs	Distance to nearest roadway or other development	<100 ft.	Latitude/ Longitude	41.484564° N, -73.123990° W				
Dominant wetland systems present	Palustrine Forested	Contiguous undeveloped buffer zone present	Yes	Prepared by	D. Gustafson	Date	7/12/14		
Is the wetland a separate hydraulic system?	No	If not, where does the wetland lie in the drainage basin?	headwater wetlands	Wetland Impact Type:	None	Area	None		
How many Tributaries contribute to the wetland?	zero order IWC	Wildlife & vegetation diversity/abundance	Yes	Corps manual wetland delineation Completed?	Yes				

Function/Value	Suitability Y	Suitability N	Rationale (Reference #)*	Principal Function(s)/Values(s)	Comments
Groundwater Recharge/Discharge	✓	☐	1,2,6,7,12,13,15	S	headwater wetlands provide groundwater discharge/recharge function
Floodflow Alteration	✓	☐	1-3,5,7,9,13,14,18	S	wetland’s flood storage capacity limited due to slope
Fish and Shellfish Habitat	☐	✓	1,8,15-17		fisheries habitat not supported due to ephemeral nature of intermittent watercourse
Sediment/Toxicant Retention	✓	☐	4,6-16	S	hillside seep form limits ability to support at a Principal level
Nutrient Removal	✓	☐	1,3,5,7-13	S	dense wetland vegetation
Production Export	✓	☐	1,2,4,5,7,8,10,12,13	S	moderate diversity of vegetation and wildlife food sources
Sediment/Shoreline Stabilization	✓	☐	2,5,7,9,12,14		more of a function of the wetlands farther downstream off Site
Wildlife Habitat	✓	☐	2,5-8,11,13-18	S	diversity of habitat provided by these headwater wetland seeps
Recreation	☐	✓	11		public access is restricted to the wetland
Educational/Scientific Value	☐	✓	13		public access is restricted to the wetland
Uniqueness/Heritage	☐	✓	5,10,18,19		value not supported in a significant capacity
Visual Quality/Aesthetics	☐	✓	9-11		lack of public access, located within CL&P ROW
Endangered Species Habitat	✓	☐		S	rare species identified by state agency in Site vicinity
Other	☐	✓			

* Refer to Field / Office Wetland Function-Value Evaluation Form for number considerations.

3 Saddlebrook Drive
Killingworth, Connecticut 06419
860 663-1697

Field / Office Wetland Function-Value Evaluation Form

Date(s):	July 12, 2014		Project Location:	Woodruff Hill Road, Oxford, CT	
Inspector(s):	Dean Gustafson, PSS		Wetland ID:	Wetland 2 (WF 2-01 to 2-16) Wetland 3 (WF 3-01 to 3-08)	
Corps Delineation:	Yes ✓	No ☐	CT Delineation	Yes ✓	No ☐
Wetland Area:	Wtl 2 - ±10,561 sq. ft. Wtl 3 – off Site		Proposed Impact:	Type:None	Area: None
Created Wetland:	Yes ☐	No ✓	Adjacent Land Use:	Utility Infrastructure and Forested Industrial Lots	
Dominate System:	PEM		Nearest Roadway:	Woodruff Hill Road	
Wildlife Corridor:	Yes ✓	No ☐	Habitat Island:	Yes ☐	No ✓
Tributaries:	zero order IWC		Buffer Condition:	Developed - Utility Infrastructure	
Site Photo(s):	see photos 6 & 7 in photo doc		Species List(s):	Refer to Wetlands Delineation Report	

The majority of Wetland 2 is off-site (±10,561 SF on site), with only its eastern edge located in the northwest corner of the Site. Wetland 2 is a complex of forested, scrub/shrub, and emergent seep wetland habitats formed in dense glacial till. Wetland 3, which is located off site but in close proximity to Wetland 2 and the western Site boundary, is a small hillside seep wetland system that has experienced high levels of anthropogenic activity. Wetland 3 is generally located at the confluence of a CL&P ROW and Woodruff Hill Road cul-de-sac located off the subject property near the western property boundary.

GROUNDWATER RECHARGE/DISCHARGE FUNCTION

CONSIDERATIONS/QUALIFIERS	Y	N	Principal
1. Public or private wells occur downstream of the wetland.	✓	☐	☐
2. Potential exists for public or private wells downstream of the wetland.	✓	☐	☐
3. Wetland is underlain by stratified drift.	☐	✓	☐
4. Gravel or sandy soils present in or adjacent to the wetland.	☐	✓	☐
5. Fragipan does not occur in the wetland.	☐	✓	☐
6. Fragipan, impervious soils, or bedrock does occur in the wetland.	✓	☐	☐
7. Wetland is associated with a perennial or intermittent watercourse.	✓	☐	☐
8. Signs of groundwater recharge are present or piezometer data demonstrates recharge.	☐	✓	☐
9. Wetland is associated w/ a watercourse but lacks a defined outlet/contains a constricted outlet.	☐	✓	☐
10. Wetland contains only an outlet, no inlet.	☐	✓	☐
11. Groundwater quality of stratified drift aquifer within or downstream of wetland meets drinking water standards.	☐	✓	☐
12. Quality of water associated with the wetland is high.	✓	☐	☐
13. Signs of groundwater discharge are present (e.g., springs).	✓	☐	✓
14. Water temperature suggests it is a discharge site.	☐	✓	☐
15. Wetland shows signs of variable water levels	✓	☐	☐
16. Piezometer data demonstrates discharge.	☐	✓	☐

Comments: A Secondary function of Wetlands 2 and 3 is groundwater discharge/recharge, which is likely cyclical depending upon time of year, level of precipitation and landscape position of the wetland system.

FLOODFLOW ALTERATION FUNCTION

CONSIDERATIONS/QUALIFIERS	Y	N	Principal
1. Area of this wetland is large relative to its watershed.	✓	☐	☐
2. Wetland occurs in the upper portions of its watershed.	✓	☐	✓
3. Effective flood storage is small or non-existent upslope of or above the wetland.	✓	☐	☐
4. Wetland watershed contains a high percent of impervious surfaces.	☐	✓	☐
5. Wetland contains hydric soils which are able to absorb and detain water.	✓	☐	☐
6. Wetland exists in a relatively flat area that has flood storage potential.	☐	✓	☐
7. Wetland has an intermittent outlet, ponded water, or signs are present of variable water level.	✓	☐	☐
8. During flooding wetland retains higher volumes of water than under normal/average rainfall conditions.	☐	✓	☐
9. Wetland receives and retains overland or sheet flow runoff from surrounding uplands.	✓	☐	☐
10. During a storm, this wetland may receive and detain excessive flood water from a nearby watercourse.	☐	✓	☐
11. Valuable properties, structures, or resources are located in/near floodplain downstream of the wetland.	☐	✓	☐
12. The watershed has a history of economic loss due to flooding.	☐	✓	☐
13. This wetland is associated with one or more watercourses.	✓	☐	☐
14. This wetland watercourse is sinuous or diffuse.	✓	☐	☐
15. This wetland outlet is constricted.	☐	✓	☐
16. Channel flow velocity is affected by this wetland.	☐	✓	☐
17. Land uses downstream are protected by this wetland.	☐	✓	☐
18. This wetland contains a high density of vegetation.	✓	☐	☐
Comments: Wetland’s flood storage capacity is limited due to slope.			

FISH AND SHELLFISH HABITAT (FRESHWATER) FUNCTION

CONSIDERATIONS/QUALIFIERS	Y	N	Principal
1. Forest land dominant in the watershed above this wetland.	✓	☐	☐
2. Abundance of cover objects present.	☐	✓	☐
STOP HERE IF THIS WETLAND IS NOT ASSOCIATED WITH A WATERCOURSE			
3. Size of this wetland is able to support large fish/shellfish populations.	☐	✓	☐
4. Wetland is part of a larger, contiguous watercourse.	☐	✓	☐
5. Sufficient open water size/depth so as not to freeze solid and retain some open water during winter.	☐	✓	☐
6. Stream width (bank to bank) is more than 50 feet.	☐	✓	☐
7. Quality of watercourse associated with wetland is able to support healthy fish/shellfish populations	☐	✓	☐
8. Streamside vegetation provides shade for the watercourse.	✓	☐	☐
9. Spawning areas are present (submerged vegetation or gravel beds).	☐	✓	☐
10. Food is available to fish/shellfish populations within this wetland.	☐	✓	☐
11. Anadromous fish barrier(s) absent from stream reach associated with this wetland.	☐	☐	☐
12. Evidence of fish is present.	☐	✓	☐
13. Wetland is stocked with fish.	☐	✓	☐
14. The watercourse is persistent.	☐	✓	☐
15. Man-made streams are absent.	✓	☐	☐
16. Water velocities are not too excessive for fish usage.	✓	☐	☐
17. Defined stream channel is present.	✓	☐	☐
Comments: Fish habitat is not supported due to ephemeral nature of intermittent watercourse.			

FISH AND SHELLFISH HABITAT (MARINE) FUNCTION – N/A

CONSIDERATIONS/QUALIFIERS	Y	N	Principal
1. Special aquatic sites (tidal marsh, mud flats, eelgrass beds) are present.	☐	☐	☐
2. Suitable spawning habitat is present at the site or in the area.	☐	☐	☐
3. Commercially or recreationally important species are present or suitable habitat exists.	☐	☐	☐
4. The wetland/waterway supports prey for higher trophic level marine organisms.	☐	☐	☐
5. The waterway provides migratory habitat for anadromous fish.	☐	☐	☐
6. Essential fish habitat (1996 amendments to the Magnuson-Stevens) Fishery & Conservation Act present	☐	☐	☐
Comments: Marine fisheries habitat is not supported by this wetland.			

SEDIMENT/TOXICANT/PATHOGEN RETENTION FUNCTION

CONSIDERATIONS/QUALIFIERS	Y	N	Principal
1. Potential sources of excess sediment are in the watershed above the wetland.	☐	✓	☐
2. Potential or known sources of toxicants are in the watershed above the wetland.	☐	✓	☐
3. Opportunity for sediment trapping by slow moving water/deepwater habitat is present in wetland.	☐	✓	☐
4. Fine grained mineral or organic soils are present.	✓	☐	☐
5. Long duration water retention time is present in this wetland.	☐	✓	☐
6. Public or private water sources occur downstream.	✓	☐	☐
7. The wetland edge is broad and intermittently aerobic.	✓	☐	☐
8. The wetland is known to have existed for more than 50 years.	✓	☐	☐
9. Drainage ditches have not been constructed in the wetland.	✓	☐	☐
STOP HERE IF WETLAND IS NOT ASSOCIATED WITH A WATERCOURSE			
10. Wetland is associated with an intermittent or perennial stream or a lake.	✓	☐	☐
11. Channelized flows have visible velocity decreases in the wetland.	✓	☐	☐
12. Effective floodwater storage in wetland is occurring. Areas of impounded open water are present.	✓	☐	☐
13. No indicators of erosive forces are present. No high water velocities are present.	✓	☐	☐
14. Diffuse water flows are present in the wetland.	✓	☐	☐
15. Wetland has a high degree of water and vegetation interspersion.	✓	☐	☐
16. Dense vegetation provides sediment trapping/signs of sediment accumulation are present.	✓	☐	☐
Comments: Function supported in a Secondary capacity; hillside seep form limits ability to support at a Principal level.			

NUTRIENT REMOVAL/RETENTION/TRANSFORMATION FUNCTION

CONSIDERATIONS/QUALIFIERS	Y	N	Principal
1. Wetland is large relative to the size of its watershed.	✓	☐	☐
2. Deep water or open water habitat exists.	☐	✓	☐
3. Overall potential for sediment trapping exists in the wetland.	✓	☐	☐
4. Potential sources of excess nutrients are present in the watershed above the wetland.	☐	✓	☐
5. Wetland saturated for most of the season. Ponded water is present in the wetland.	✓	☐	☐
6. Deep organic/sediment deposits are present.	☐	✓	☐
7. Slowly drained fine grained mineral or organic soils are present.	✓	☐	☐
8. Dense vegetation is present.	✓	☐	☐
9. Emergent vegetation and/or dense woody stems are dominant.	✓	☐	☐
10. Opportunity for nutrient attenuation exists.	✓	☐	☐
11. Vegetation diversity/abundance sufficient to utilize nutrients.	✓	☐	☐

STOP HERE IF WETLAND IS NOT ASSOCIATED WITH A WATERCOURSE			
12. Waterflow through this wetland is diffuse.	✓	☐	☐
13. Water retention/detention time in this wetland is increased by constricted outlet or thick vegetation.	✓	☐	☐
14. Water moves slowly through this wetland.	☐	✓	☐
Comments: Function supported in a Secondary capacity; hillside seep form limits ability to support at a Principal level			

PRODUCTION EXPORT (Nutrient) FUNCTION

CONSIDERATIONS/QUALIFIERS	Y	N	Principal
1. Wildlife food sources grow within this wetland.	✓	☐	☐
2. Detritus development is present within this wetland	✓	☐	☐
3. Economically or commercially used products found in this wetland.	☐	✓	☐
4. Evidence of wildlife use found within this wetland.	✓	☐	☐
5. Higher trophic level consumers are utilizing this wetland.	✓	☐	☐
6. Fish or shellfish develop or occur in this wetland.	☐	✓	☐
7. High vegetation density is present.	✓	☐	☐
8. Wetland exhibits high degree of plant community structure/species diversity.	✓	☐	☐
9. High aquatic vegetative diversity/abundance is present.	☐	✓	☐
10. Nutrients exported in wetland watercourses (permanent outlet present).	✓	☐	☐
11. "Flushing" of relatively large amounts of organic plant material occurs from this wetland.	☐	✓	☐
12. Wetland contains flowering plants that are used by nectar-gathering insects.	✓	☐	☐
13. Indications of export are present.	✓	☐	☐
14. High production levels occurring with no visible signs of export (assumes export is attenuated).	☐	✓	☐
Comments: Production export is provided at a Secondary level from these wetlands since they support a moderate diversity of vegetation and wildlife food sources.			

SEDIMENT/SHORELINE STABILIZATION FUNCTION

CONSIDERATIONS/QUALIFIERS	Y	N	Principal
1. Indications of erosion or siltation are present.	☐	✓	☐
2. Topographical gradient is present in wetland.	✓	☐	☐
3. Potential sediment sources are present up-slope.	☐	✓	☐
4. Potential sediment sources are present upstream.	☐	✓	☐
5. No distinct shoreline or bank is evident between the waterbody and the wetland or upland.	✓	☐	☐
6. A distinct step between the open waterbody or stream and the adjacent land exists (i.e., sharp bank) with dense roots throughout.	☐	✓	☐
7. Wide wetland (>10') borders watercourse, lake, or pond.	✓	☐	☐
8. High flow velocities in the wetland.	☐	✓	☐
9. The watershed is of sufficient size to produce channelized flow.	✓	☐	☐
10. Open water fetch is present.	☐	✓	☐
11. Boating activity is present.	☐	✓	☐
12. Dense vegetation is bordering watercourse, lake, or pond.	✓	☐	☐
13. High percentage of energy-absorbing emergents and/or shrubs border a watercourse, lake, or pond.	☐	✓	☐
14. Vegetation is comprised of large trees and shrubs that withstand major flood events or erosive incidents and stabilize the shoreline on a large scale (feet).	✓	☐	☐
15. Vegetation is comprised of a dense resilient herbaceous layer that stabilizes sediments and the shoreline on a small scale (inches) during minor flood events or potentially erosive events.	☐	✓	☐
Comments: More of a function of the wetlands farther downstream off Site where zero order intermittent channels form and converge with other flows to become a first order intermittent watercourse.			

WILDLIFE HABITAT FUNCTION

CONSIDERATIONS/QUALIFIERS	Y	N	Principal
1. Wetland is not degraded by human activity.	☐	✓	☐
2. Water quality of watercourse/pond/lake associated w/ wetland meets/exceeds Class A or B standards.	✓	☐	☐
3. Wetland is not fragmented by development.	☐	✓	☐
4. Upland surrounding this wetland is undeveloped.	☐	✓	☐
5. > 40% of wetland edge bordered by upland wildlife habitat at least 500 ft in width.	✓	☐	☐
6. Wetland is contiguous with other wetland systems connected by a watercourse or lake.	✓	☐	☐
7. Wildlife overland access to other wetlands is present.	✓	☐	☐
8. Wildlife food sources are within this wetland or are nearby.	✓	☐	☐
9. Wetland exhibits a high degree of interspersion of vegetation classes and/or open water.	☐	✓	☐
10. Two or more islands or inclusions of upland within the wetland are present.	☐	✓	☐
11. Dominant wetland class includes deep or shallow marsh or wooded swamp.	✓	☐	☐
12. > 3 acres shallow permanent open water (< 6.6 feet deep), including in/adjacent streams present.	☐	✓	☐
13. Density of the wetland vegetation is high.	✓	☐	☐
14. Wetland exhibits a high degree of plant species diversity.	✓	☐	☐
15. Wetland exhibits high degree plant community structure diversity (tree/shrub/vine/grasses/mosses)	✓	☐	☐
16. Plant/animal indicator species are present. (List species for project)	✓	☐	☐
17. Animal signs observed (tracks, scats, nesting areas, etc.)	✓	☐	☐
18. Seasonal uses vary for wildlife and wetland appears to support varied population diversity/abundance during different seasons.	✓	☐	☐
19. Wetland contains or has potential to contain a high population of insects.	☐	✓	☐
20. Wetland contains or has potential to contain large amphibian populations.	☐	✓	☐
21 Wetland has a high avian utilization or its potential.	☐	✓	☐
22. Indications of less disturbance-tolerant species are present.	☐	✓	☐
23. Signs of wildlife habitat enhancement are present (birdhouses, nesting boxes, food sources, etc.).	☐	✓	☐
Comments: These wetland systems provide wildlife habitat function at a Secondary level due to the diversity of habitat provided by these headwater wetland seeps.			

RECREATION (Consumptive and Non-Consumptive) VALUE

CONSIDERATIONS/QUALIFIERS	Y	N	Principal
1. Wetland is part of a recreation area, park, forest, or refuge.	☐	✓	☐
2. Fishing is available within or from the wetland.	☐	✓	☐
3. Hunting is permitted in the wetland.	☐	✓	☐
4. Hiking occurs or has potential to occur within the wetland.	☐	✓	☐
5. Wetland is a valuable wildlife habitat.	☐	✓	☐
6. The watercourse, pond, or lake associated with the wetland is unpolluted.	☐	✓	☐
7. High visual/aesthetic quality of this potential recreation site.	☐	✓	☐
8. Access to water is available at this potential recreation site for boating, canoeing, or fishing.	☐	✓	☐
9. Watercourse associated w/ wetland is wide & deep enough to accommodate canoeing and/or non-powered boating.	☐	✓	☐
10. Off-road public parking available at the potential recreation site.	☐	✓	☐
11. Accessibility and travel ease is present at this site.	✓	☐	☐
12. The wetland is within a short drive or safe walk from highly populated public and private areas	☐	✓	☐
Comments: Public access is restricted to the wetland.			

EDUCATIONAL/SCIENTIFIC VALUE

CONSIDERATIONS/QUALIFIERS	Y	N	Principal
1. Wetland contains or is known to contain threatened, rare, or endangered species.	☐	✓	☐
2. Little or no disturbance is occurring in this wetland.	☐	✓	☐
3. Potential educational site contains a diversity of wetland classes & are accessible/potentially accessible.	☐	✓	☐
4. Potential educational site is undisturbed and natural.	☐	✓	☐
5. Wetland is considered to be a valuable wildlife habitat.	☐	✓	☐
6. Wetland is located within a nature preserve or wildlife management area.	☐	✓	☐
7. Signs of wildlife habitat enhancement present (bird houses, nesting boxes, food sources, etc.).	☐	✓	☐
8. Off-road parking at potential educational site suitable for school bus access in or near wetland.	☐	✓	☐
9. Potential educational site is within safe walking distance or a short drive to schools.	☐	✓	☐
10. Potential educational site is within safe walking distance to other plant communities.	☐	✓	☐
11. Direct access to perennial stream at potential educational site is available.	☐	✓	☐
12. Direct access to pond or lake at potential educational site is available.	☐	✓	☐
13. No known safety hazards exist within the potential educational site.	✓	☐	☐
14. Public access to the potential educational site is controlled.	☐	✓	☐
15. Handicap accessibility is available.	☐	✓	☐
16. Site is currently used for educational or scientific purposes.	☐	✓	☐
Comments: Wetland has limited value due to lack of public access.			

UNIQUENESS/HERITAGE VALUE

CONSIDERATIONS/QUALIFIERS	Y	N	Principal
1. Upland surrounding wetland is primarily urban.	☐	✓	☐
2. Upland surrounding wetland is developing rapidly.	☐	✓	☐
3. > 3 acres of shallow permanent open water (< 6.6 feet deep), including streams, occur in wetlands.	☐	✓	☐
4. Three or more wetland classes are present.	☐	✓	☐
5. Deep and/or shallow marsh or wooded swamp dominate.	✓	☐	☐
6. High degree of interspersion of vegetation and/or open water occur in this wetland.	☐	✓	☐
7. Well-vegetated stream corridor (15 feet on each side of the stream) occurs in this wetland.	☐	✓	☐
8. Potential educational site is within a short drive or a safe walk from schools.	☐	✓	☐
9. Off-road parking at potential educational site is suitable for school buses.	☐	✓	☐
10. No known safety hazards exist within this potential educational site.	✓	☐	☐
11. Direct access to perennial stream or lake exists at potential educational site.	☐	✓	☐
12. Two or more wetland classes are visible from primary viewing locations.	☐	✓	☐
13. Low-growing wetlands (marshes, scrub-shrub, bogs, open water) visible from primary viewing locations.	☐	✓	☐
14. Half an acre of open water or 200 feet of stream is visible from the primary viewing locations.	☐	✓	☐
15. Large area of wetland dominated by flowering plants/plants that seasonally turn vibrant colors	☐	✓	☐
16. General appearance of the wetland visible from primary viewing locations is unpolluted and/or undisturbed.	☐	✓	☐
17. Overall view of the wetland is available from the surrounding upland.	☐	✓	☐
18. Quality of the water associated with the wetland is high.	✓	☐	☐
19. Opportunities for wildlife observations are available.	✓	☐	☐
20. Historical buildings are found within the wetland.	☐	✓	☐
21. Presence of pond or pond site and remains of a dam occur within the wetland.	☐	✓	☐

22. Wetland is within 50 yards of the nearest perennial watercourse.	☐	✓	☐
23. Visible stone or earthen foundations, berms, dams, standing structures, or associated features occur within the wetland.	☐	✓	☐
24. Wetland contains critical habitat for a state- or federally-listed threatened or endangered species.	☐	✓	☐
25. Wetland is known to be a study site for scientific research.	☐	✓	☐
26. Wetland is a natural landmark or recognized by the state natural heritage inventory authority as an exemplary natural community.	☐	✓	☐
27. Wetland has local significance because it serves several functional values.	☐	✓	☐
28. Wetland has local significance because it has biological, geological, or other features that are locally rare or unique.	☐	✓	☐
29. Wetland is known to contain an important archaeological site.	☐	✓	☐
30. Wetland is hydrologically connected to a state or federally designated scenic river.	☐	✓	☐
31. Wetland is located in an area experiencing a high wetland loss rate.	☐	✓	☐
Comments: Value not supported by wetland in a significant capacity.			

VISUAL QUALITY/AESTHETICS VALUE

CONSIDERATIONS/QUALIFIERS	Y	N	Principal
1. Multiple wetland classes are visible from primary viewing locations.	☐	✓	☐
2. Emergent marsh and/or open water are visible from primary viewing locations.	☐	✓	☐
3. A diversity of vegetative species is visible from primary viewing locations	☐	✓	☐
4. Wetland is dominated by flowering plants or plants that turn vibrant colors in different seasons.	☐	✓	☐
5. Land use surrounding the wetland is undeveloped as seen from primary viewing locations.	☐	✓	☐
6. Visible surrounding land use form contrasts with wetland.	☐	✓	☐
7. Wetland views absent of trash, debris, and signs of disturbance.	☐	✓	☐
8. Wetland is considered to be a valuable wildlife habitat.	☐	✓	☐
9. Wetland is easily accessed.	✓	☐	☐
10. Low noise level at primary viewing locations.	✓	☐	☐
11. Unpleasant odors absent at primary viewing locations.	✓	☐	☐
12. Relatively unobstructed sight line exists through wetland.	☐	✓	☐
Comments: Wetland has limited value due to lack of public access and is located within CL&P ROW.			

ENDANGERED SPECIES HABITAT VALUE

CONSIDERATIONS/QUALIFIERS	Y	N	Principal
1. Wetland contains or is known to contain threatened or endangered species.	☐	✓	☐
2. Wetland contains critical habitat for a state or federally listed threatened or endangered species.	☐	✓	☐
Comments: DEEP indicates that eastern box turtle (*Terrapene carolina carolina*), a state species of special concern, occurs in the vicinity of the Site. Value is not supported by wetland at a Principal level since Eastern box turtle is more commonly associated with a variety of terrestrial habitats and no occurrences of box turtle have been documented on the Site. Value is assumed to be supported in a Secondary capacity due to potential for seasonal use by box turtle.			

Attachment G

Other Agency Coordination Correspondence/Documentation

- June 10, 2014 NDDB letter
- May 15, 2014 SHPO letter
- August 9, 2014 Mashantucket Pequot Tribe THPO correspondence
- May 8, 2014 USFWS Section 7 consultation IPaC report

June 10, 2014

Ms. Lynn Gresock
Tetra Tech, Inc.
238 Little Road, Suite 201-B
Westford, MA 01886

Regarding: CPV Towantic Energy Center, Oxford, CT – Commercial/Industrial Development
Natural Diversity Data Base 201405771

Dear Ms. Gresock:

In response to your request for a Natural Diversity Data Base (NDDB) Review of State Listed Species for the CPV Towantic Energy Center in Oxford, CT, our records for this site indicate the following extant populations of species on or within the vicinity of the site:

Red bat (*Lasiurus borealis*) Protection Status: Species of Special Concern

Red bats are considered to be "tree-roosting" bats. They roost out in the foliage of deciduous and coniferous trees, camouflaged as dead leaves or cones. Red bats are primarily solitary roosters. They can be found roosting and feeding around forest edges and clearings. Typically, larger diameter trees (12-inch DBH and larger) are more valuable to these bats. Additionally, trees with loose, rough bark such as maples, hickories, and oaks are more desirable than other tree species due to the increased cover that the loose bark provides. Large trees with cavities are also utilized by this species. Retaining the above mentioned trees, wherever possible, may minimize the potential for negative impacts to this state-listed species.

Hoary bat (*Lasiurus cinereus*) Protection Status: Species of Special Concern

Hoary bats are found in Connecticut during the spring and summer seasons and migrate south to overwinter. Their diet primarily consists of moths and beetles. These bats will roost high in large coniferous and deciduous trees.

Silver-haired bat (*Lasionycteris noctivagans*) Protection Status: Species of Special Concern

Silver-haired bats typical roost sites include tree foliage, tree hollows, and crevices behind loose bark, but they are most likely to be found near water. They will typically give birth to their young in June or July, and the young will stay in roost until August.

Recommendations: Work should be conducted in the winter when the bats are not in the area, specifically work should not be conducted between May 1st through August 15th. Long-term impacts can be minimized by retaining large diameter coniferous and deciduous trees whenever possible, particularly close to brooks and streams. If these bats are found, please report the information to the Wildlife Division.

Eastern box turtle (*Terrapene carolina Carolina*) Protection Status: Species of Special Concern

Eastern box turtles inhabit old fields and deciduous forests, which can include power lines and logged woodlands. They are often found near small streams and ponds. The adults are completely terrestrial but the young may be semiaquatic, and hibernate on land by digging down in the soil from October to April. They have an extremely small home range and can usually be found in the same area year after year. Eastern box turtles have been negatively impacted by the loss of suitable habitat. Some turtles may be killed directly by construction activities, but many more are lost when important habitat areas for shelter, feeding, hibernation, or nesting are destroyed. As remaining habitat is fragmented into smaller pieces, turtle populations can become small and isolated.

Recommendations: The following guidelines should be implemented:

- ❖ Siltation and Erosion Control Measures:
    - Where possible, AVOID installing sediment and erosion control materials from 1) late August through September and 2) from March through mid-May. These two time periods are when amphibians and reptiles are most active, moving to and from wetlands to breed.
    - Most wildlife travels between different habitats throughout the year, the layout of how sediment and erosion control materials are placed is very important. If silt fencing needs to be installed and left up during peak times of amphibian migration, we recommend that it be installed in such a way to allow for animals to pass through. We would encourage a staggered layout for silt fence installation. We would be happy to provide additional guidance on placement of sediment and erosion control materials to limit impacts to wildlife.
    - The use of erosion control products with netting embedded in the product to maintain its shape and structure, has been shown to be fatal to wildlife in Connecticut, in particular snakes. Snakes can get tangled and trapped within the netting as they maneuver through the net openings. When reptiles are trapped, their ability to thermoregulate is compromised and in areas exposed to sun, trapped reptiles quickly overheat and die. To limit the potential for needless mortality to long-lived reptiles, we recommend the following considerations:
        - o Given the high variability of the composition of products with bio-degradable and degradable netting, we recommend that these products NOT be used.

- Use erosion control options that DO NOT contain netting such as net-less blankets or hay bales.

- Reconfigure/lower the grade of slopes so products without netting can be utilized.

- Siltation and erosion control measures should be removed as soon as soils are stable so as to not impede reptile and amphibian migrations between wetlands and uplands.

❖ Rip-rap: If rip-rap is going to be used, consider covering the rip-rap with local stream bank material.

❖ Stockpiles of Soil: Stockpiles of soil should be cordoned off with silt fencing so turtles do not attempt to try and nest in them.

❖ Native Plantings: Any plantings should be composed of species native to northeastern United States and appropriate for use in riparian habitat.

The Natural Diversity Data Base includes all information regarding critical biological resources available to us at the time of the request. This information is a compilation of data collected over the years by the Department of Energy and Environmental Protection's Natural History Survey and cooperating units of DEEP, private conservation groups and the scientific community. This information is not necessarily the result of comprehensive or site-specific field investigations. Consultations with the Data Base should not be substituted for on-site surveys required for environmental assessments. Current research projects and new contributors continue to identify additional populations of species and locations of habitats of concern, as well as, enhance existing data. Such new information is incorporated into the Data Base as it becomes available. If the project is not implemented within 12 months, then another Natural Diversity Data Base review should be requested for up-to-date information.

Please be advised a more detailed review may be conducted as part of any subsequent environmental permit applications submitted to the Department of Energy and Environmental Protection for the proposed site. Should state involvement occur in some other manner, specific restrictions or conditions relating to the species discussed above may apply.

Thank you for consulting the Natural Diversity Data Base. If you have further questions, I can be reached by email at Elaine.hinsch@ct.gov or by phone at (860) 424-3011.

Sincerely,
/s/
Elaine Hinsch
Program Specialist II
Wildlife Division

May 15, 2014

Ms. Lynn Gresock
Tetra Tech
238 Littleton Road, Suite 201B
Westford, MA 061886

Subject: CPV Towantic Energy Center Project at
16 Woodruff Hill Road in
Oxford, Connecticut.

Dear Ms. Gresock:

The State Historic Preservation Office (SHPO) is in receipt of your request for our comments on the potential effects of the referenced project on historic properties. In October of 1998, SHPO reviewed an Archaeological Assessment report completed by Historical Perspectives, Inc. for the then proposed Towantic Energy Project. At that time, project plans called for the construction of a power generator and associated infrastructural facilities. A 20 acre parcel on Woodruff Hill Road was examined as part of the cultural resources assessment survey (CHPC #845). Pedestrian survey and documentary research concluded that the project parcel was not historically improved and did not possess environmental features favorable to human occupation. As a result of that investigation, no archaeological investigations were recommended and SHPO concurred.

SHPO understands that although the project plans have not changed significantly, an additional 8 acres will be required to complete the project. The additional parcel is situated immediately to the south of the previously assessed property, and it was partially subjected to subsurface testing as an alternative compressor station location for Algonquin Gas Transmission. No cultural material was identified as part of that survey (CHPC #1488). The remainder of the 8 acre parcel was not subject to a cultural resources survey, but it consists of a rugged, steeply sloping, and rocky environment situated at a significant distance from any sources of fresh water. The additional 8 acre project area is unlikely to have provided suitable conditions for habitation and is unlikely to contain significant archeological deposits. Based on the information provided to our office, it is SHPO's opinion that no historic properties will be affected by this expanded undertaking.

The State Historic Preservation Office appreciates the opportunity to review and comment upon this project. These comments are provided in accordance with the Connecticut Environmental Policy Act. For additional information, please contact Catherine Labadia, Staff Archeologist, at (860) 256-2764 or catherine.labadia@ct.gov.

Sincerely,

Daniel T. Forrest

Daniel T. Forrest
State Historic Preservation Officer

From:	Knowles, Kathleen
To:	Lee, Susan K NAE (Susan.K.Lee@usace.army.mil); Dean Gustafson
Cc:	Forrest, Daniel; catherine.labadia@ct.gov; Stevens, Sue
Subject:	PHASE IA ARCHAELOGICAL ASSESSMENT & SUPPLEMENTAL TECHNICAL REPORT - RECONNAISSANCE ARCHAEOLOGICAL SURVEY- CPV TOWANTIC ENERGY CENTER PROJECT- 16 WOODRUFF HILL RD. - OXFORD, CT - ALL-POINTS TECHNOLOGY CORPORATION PROJECT NO.: CT444100
Date:	Saturday, August 09, 2014 2:33:32 PM

Re: CPV TOWANTIC ENERGY CENTER PROJECT
16 WOODRUFF HILL RD.
OXFORD, CT
ALL-POINTS TECHNOLOGY CORPORATION PROJECT NO.: CT444100

I have reviewed the Supplemental Technical Report – Reconnaissance Archaeological Survey – Algonquin Gas Transmission, LLC - Ramapo Expansion Project – Alternative Compressor Station "Site F" Oxford, CT, Submitted by PAL – and the Towantic Energy Project – Oxford, Ct – Phase IA Archaeological Assessment, submitted by Historical Perspectives, Inc. Based on the information provided to our office, the research design and testing strategy meets acceptable professional standards, and I agree with the recommendations & concur with the CT SHPO's opinion.
The Mashantucket Pequot Tribe appreciates the opportunity to review and comment on this proposed project.

Kathleen Knowles
Tribal Historic Preservation Officer
Natural Resources Protection & Regulatory Affairs

Mashantucket Pequot Tribal Nation
550 Trolley Line Blvd., P.O. Box 3202, Mashantucket, CT 06338-3202
TEL: 860-396-6887 FAX: 860-396-6914
kknowles@mptn-nsn.gov

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Ecological Services Field Office
70 COMMERCIAL STREET, SUITE 300
CONCORD, NH 3301
PHONE: (603)223-2541 FAX: (603)223-0104
URL: www.fws.gov/newengland

Consultation Tracking Number: 05E1NE00-2014-SLI-0580 September 26, 2014
Project Name: CPV Towantic Energy Center

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project.

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment

United States Department of Interior
Fish and Wildlife Service

Project name: CPV Towantic Energy Center

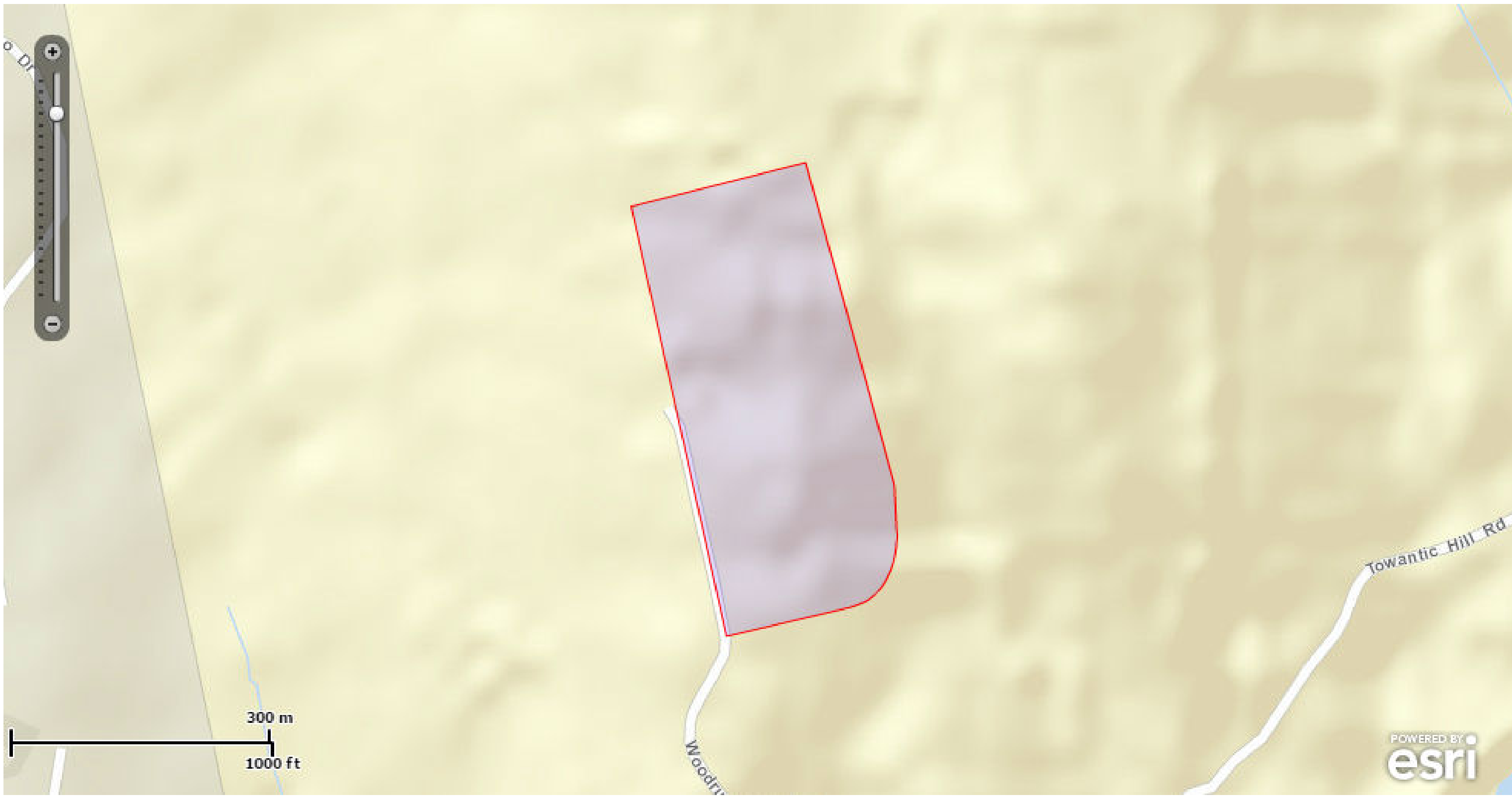
Official Species List

Provided by:

New England Ecological Services Field Office
70 COMMERCIAL STREET, SUITE 300
CONCORD, NH 3301
(603) 223-2541
http://www.fws.gov/newengland

Consultation Tracking Number: 05E1NE00-2014-SLI-0580
Project Type: Power Generation
Project Description: The ±26-acre Site is located in the Town of Oxfords Woodruff Hill Industrial Park along the east side of Woodruff Hill Road. Towantic Energy Center is a proposed dual-fueled (natural gas with ultra-low sulfur distillate back-up) combined cycle generating facility located at the intersection of a gas pipeline, a new compressor station and an electrical transmission line. The Site is a complex of hardwood forests and open fields with wetland inclusions.

Project Location Map:



Project Coordinates: MULTIPOLYGON (((-73.1212322 41.4818222, -73.1229604 41.481519, -73.1242876 41.4860066, -73.1218552 41.4864657, -73.1206152 41.483103, -73.120581 41.4825333, -73.1206628 41.4822089, -73.1208838 41.4819577, -73.1210327 41.4818749, -73.1212322 41.4818222)))

Project Counties: New Haven, CT

Endangered Species Act Species List

There are a total of 0 threatened or endangered species on your species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Critical habitats listed under the **Has Critical Habitat** column may or may not lie within your project area. See the **Critical habitats within your project area** section further below for critical habitat that lies within your project. Please contact the designated FWS office if you have questions.

There are no listed species identified for the vicinity of your project.

Critical habitats that lie within your project area

There are no critical habitats within your project area.

Category 2 Permit Application – Volume II

CPV Towantic Energy Center

Woodruff Hill Road
Oxford, Connecticut

Prepared for **CPV Towantic, LLC**
50 Braintree Hill Office Park, Suite 300
Braintree, Massachusetts 02184

Prepared by **All-Points Technology Corp., P.C.**
3 Saddlebrook Drive
Killingworth, Connecticut 06419

October 2014

Attachment F

Stormwater Management and Erosion Control Report

STORMWATER MANAGEMENT AND EROSION CONTROL REPORT

CPV TOWANTIC ENERGY CENTER
OXFORD, CONNECTICUT

Prepared by:

CIVIL 1
43 Sherman Hill Road
Suite D-101
Woodbury, CT 06798

September 29, 2014

TABLE OF CONTENTS

Introduction

The project site is located on the northeast side of Woodruff Hill Road near its northerly terminus. The property lies within the Industrial District and consists of 26.2 acres. The current proposal is to construct a gas-fired, electric power plant with associated driveways, parking areas, storm drainage, power plant equipment areas and switchyard.

A study of the site hydrology has been performed to evaluate and mitigate the potential impacts of the proposed power plant and to design a Stormwater Management Plan and an Erosion & Sediment Control Plan in accordance with the 2002 CT E&S Guidelines and the 2004 Stormwater Quality Manual. In order to evaluate the stormwater management requirement for the proposed development, the existing watershed area was delineated based on the current site conditions and analyzed at six key points down gradient of the property. The total combined watershed area delineated is approximately 35.7 acres which includes 9.2 acres of off-site watershed. This information was used to determine the peak flow rates under both existing and proposed conditions. Appendix A of this report includes a Drainage Area Map which delineates the six existing and proposed drainage areas.

Existing Site Conditions

Currently, the site consists mostly of woodlands while the western half is all fields. The property is bordered to the east and south by the Algonquin Gas Transmission Facility (Lot 9 of the Woodruff Hill Industrial Park Subdivision), to the west by Woodruff Hill Road and Lots 6, 7 and 8 of the Woodruff Hill Industrial Park Subdivision and to the north by Open Space of the Woodruff Hill Industrial Park Subdivision.

There are four wetlands areas located on or immediately adjacent to the property which were flagged by All-Points Technology Corporation in July of 2014. The wetlands areas are shown on Sheet C310 of the plan set entitled CPV Towantic Energy Center. There are no 100 year flood plains located on the site as defined by FEMA Flood Insurance Rate Mapping.

The project site is located within the Little River Watershed Drainage Basin Number 6920. This watershed is located within the Naugatuck Regional Basin within the Housatonic Major Basin, identified on the Connecticut Department of Environmental Protection Atlas of Public Water Supply Sources and Drainage Basins.

Proposed Site Conditions

The current proposal is to construct a gas-fired power plant with associated switchyard, power plant equipment areas, parking areas and related storage facilities. Approximately 3,000 linear feet access driveway will be constructed to access the facility along with the associated storm drainage system and stormwater quality measures. Of the 26.2 acre site, approximately 22.1 acres will be disturbed during construction, leaving 4.1 acres or 15.6% of the site undisturbed. The power plant will be served by municipal water and sewer.

Hydrology

The primary method of predicting the surface water runoff rates utilized in this report is the computer program HydroCAD V10 Stormwater Modeling System. HydroCAD combines the methodology of technical release No. 55 (TR-55) “Urban Hydrology for Small Watersheds” and technical release No. 20 (TR-20) “Project Formulation-Hydrology”. Both TR-55 & TR-20 were originally developed by the USDA Soil Conservation Service (SCS). The HydroCAD program forecasts the rate of surface water runoff based upon several factors, including information on land use, vegetation, watershed areas, soil types, time of concentration, rainfall data, storage volumes and hydraulic capacities of structures. The program predicts the amount of runoff as a function of time. Rainfall events with recurrence frequencies of 2, 10, 25, 50 and 100 years were utilized as input data. The National Weather Service developed 4 storm events to simulate rainfall around the country. The Type III rainfall pattern with 24-hour duration is appropriate for use in Connecticut and was utilized in this analysis.

Existing land use for the site was determined from aerial mapping, field survey and USGS Mapping. The types of land use utilized in the analysis include wood, grass, meadow and impervious cover. Soil types in the watershed were determined from the NRCS Web Soil Survey prepared by the United States Department of Agriculture. The existing watershed was found to contain only type C soils, along with impervious areas (Appendix B). The HydroCAD routing analysis was also completed under the proposed conditions in order to compare pre-development and post-development flows for all the proposed design storms (Appendix C).

The proposed storm drainage piping and swale system was designed using the rational method with adequate capacity to convey the 25-year storm event (Appendix D). The overall watershed was subdivided into sub-basins to determine the drainage area and stormwater runoff to each catch basin, pipe and swale. Inlet control capacity as well as velocity was also analyzed at each structure.

The pre and post development stormwater runoff was analyzed at six key points down gradient of the site (DP-1, DP-2, DP-3, DP-4, DP-5 and DP-6). The storm drainage system is designed so that post development stormwater flows will either remain the same or be decreased at all of the design points. Another goal of the storm drainage system design is to ensure that long-term post-development stormwater quality is protected and that there will be no erosion caused by the development. This was done by designing two Stormwater Renovation Areas using the recommendations found in the *2004 DEEP Stormwater Quality Manual (SQM)* and designing appropriate outlet protection at all points where the storm drainage system discharges.

Below is a summary of pre-development and post-development flows at the six design points:

			Storm Interval (DP-1)		
	2yr.	10yr.	25yr.	50yr.	100yr
Existing Flow (cfs)	8.1	19.2	23.5	28.7	34.8
Proposed Flow (cfs)	7.2	15.1	18.4	23.3	29.1
			Storm Interval (DP-2)		
	2yr.	10yr.	25yr.	50yr.	100yr
Existing Flow (cfs)	2.9	7.2	8.9	11.0	13.4
Proposed Flow (cfs)	2.6	6.0	7.4	9.0	10.9
			Storm Interval (DP-3)		
	2yr.	10yr.	25yr.	50yr.	100yr
Existing Flow (cfs)	2.5	6.1	7.5	9.1	11.1
Proposed Flow (cfs)	1.7	3.4	3.9	4.5	5.4
			Storm Interval (DP-4)		
	2yr.	10yr.	25yr.	50yr.	100yr
Existing Flow (cfs)	2.2	5.2	6.3	7.6	9.2
Proposed Flow (cfs)	1.7	3.4	4.0	4.7	5.4
			Storm Interval (DP-5)		
	2yr.	10yr.	25yr.	50yr.	100yr
Existing Flow (cfs)	1.9	4.1	4.9	5.9	7.0
Proposed Flow (cfs)	2.0	4.1	4.9	5.8	6.9
			Storm Interval (DP-6)		
	2yr.	10yr.	25yr.	50yr.	100yr
Existing Flow (cfs)	1.7	3.7	4.5	5.4	6.5
Proposed Flow (cfs)	1.9	3.7	4.4	5.3	6.2

Stormwater Management & LID Measures

In addition to mitigating post development stormwater flow rates another goal of the storm drainage system design was to ensure that long-term post-development stormwater quality was protected. This is being accomplished through the use of vegetated stormwater renovation areas, grass-lined water quality swales and pervious surface treatments.

Both of the storm water renovation areas are designed to hold and renovate the Water Quality Volume (WQV) while attenuating peak rates of stormwater runoff. The WQV is the initial flush of stormwater that contains most of the sediment and pollutants as defined in the CT DEP 2004 Stormwater Quality Manual. The WQV will be retained in a “water quality cell” in each renovation area that will hold stormwater, allow it to cool and be exposed to vegetation for filtration & treatment, then slowly release it through a permeable water quality berm for discharge. This design allows for the maximum water quality treatment of post development stormwater runoff.

Additionally a large sediment forebay area has been designed at the entrance to each of the stormwater renovation areas to slow down stormwater and trap fine-coarse sediments in a confined area where they can be periodically removed.

Where the topography of the site allowed, grass lined water quality swales have been designed. These swales will provide for filtration of stormwater coming off of the proposed access drive prior to discharge into the existing storm drainage system south of the property. It should also be noted that the storm drainage system south of the property contains existing stormwater facilities that will further treat and renovate the stormwater prior to the eventual discharge into the wetlands at the bottom of Woodruff Hill Road.

In the interior of the proposed plant access drive where the equipment pad areas are set the surface treatment will be an 8” layer of pervious crushed stone to grade. The switchyard area to the north gets a similar treatment but is 12” thick and contains larger diameter stones. Stormwater that falls in these areas will be held and will not runoff immediately into the storm drainage system. The water will either infiltrate in smaller storm events or will slowly work its’ way through the stone towards one of the proposed catch basin inlets for the storm drainage system in larger events. This pervious surface treatment encompasses approximately 8.7 acres of the 11.7 acre level power plant area (74.4%).

Erosion & Sedimentation Controls

The erosion and sediment control plan calls for the use of the latest erosion and sediment control measures in order to minimize and control disturbance during construction and provide a stable site under finished conditions. These measures include:

- Stabilized construction entrance
- Temporary sediment traps
- Geotextile silt fence
- Staked haybales
- Temporary soil stockpile areas
- Haybale filters
- Temporary water diversions
- Temporary seeding of exposed soils
- Stone check dams
- Water bars with haybale traps
- Erosion control blankets

The Erosion and Sediment Control Plan is contained on Sheet C315 of the plan set and all of the pertinent erosion control notes and construction sequencing is included on Sheet C330.

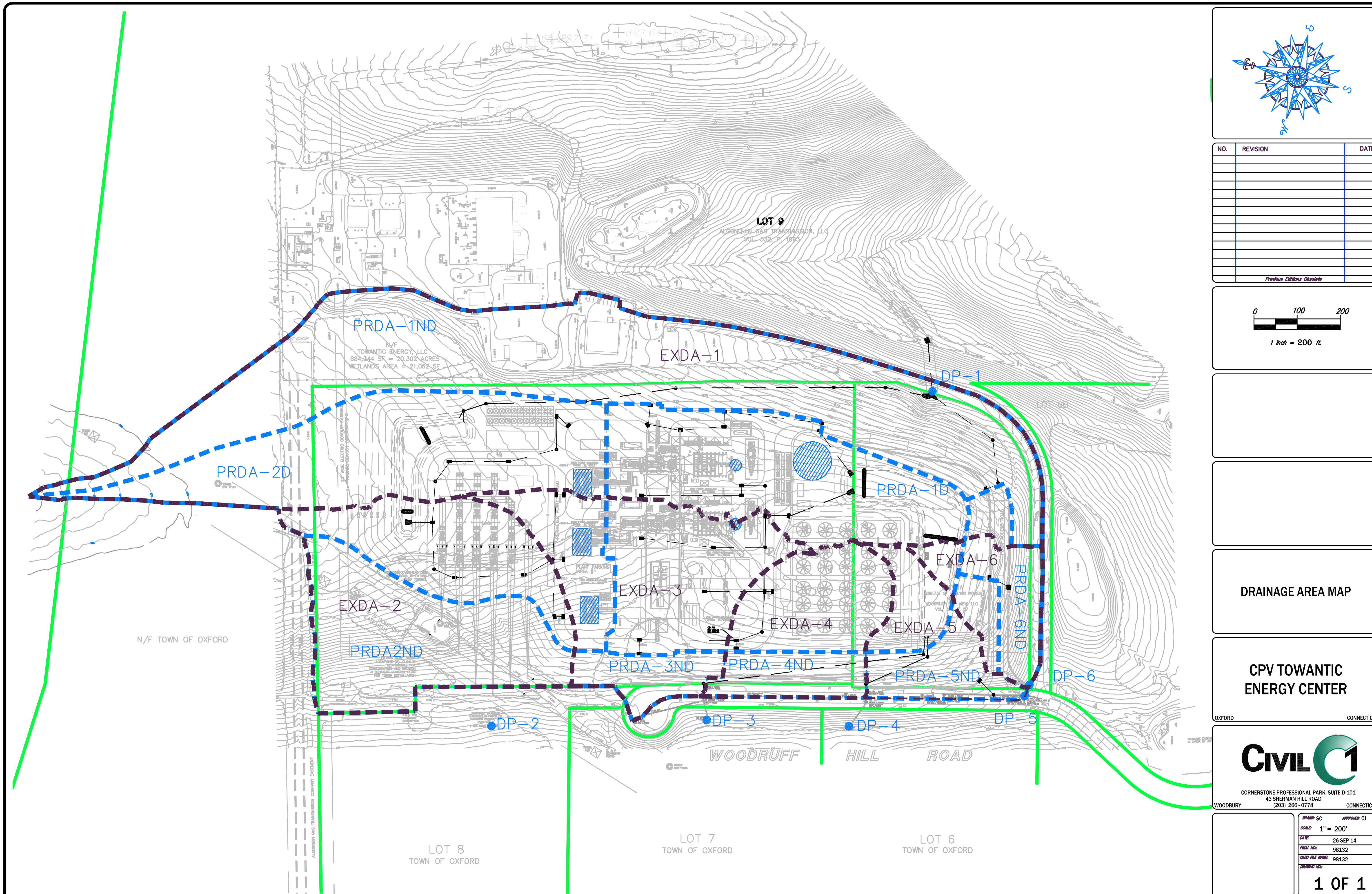
Additionally, proper outlet protection has been designed at all proposed drainage discharge points. The outlet protection structures were designed in accordance with the recommendations on the *2000 ConnDOT Drainage Manual* Chapter 8.7 (Appendix E). Velocities were also analyzed in all of the proposed water quality swales to ensure that a grass-lined surface treatment would be appropriate to prevent erosion of the underlying soils while treating and conveying stormwater.

Conclusion

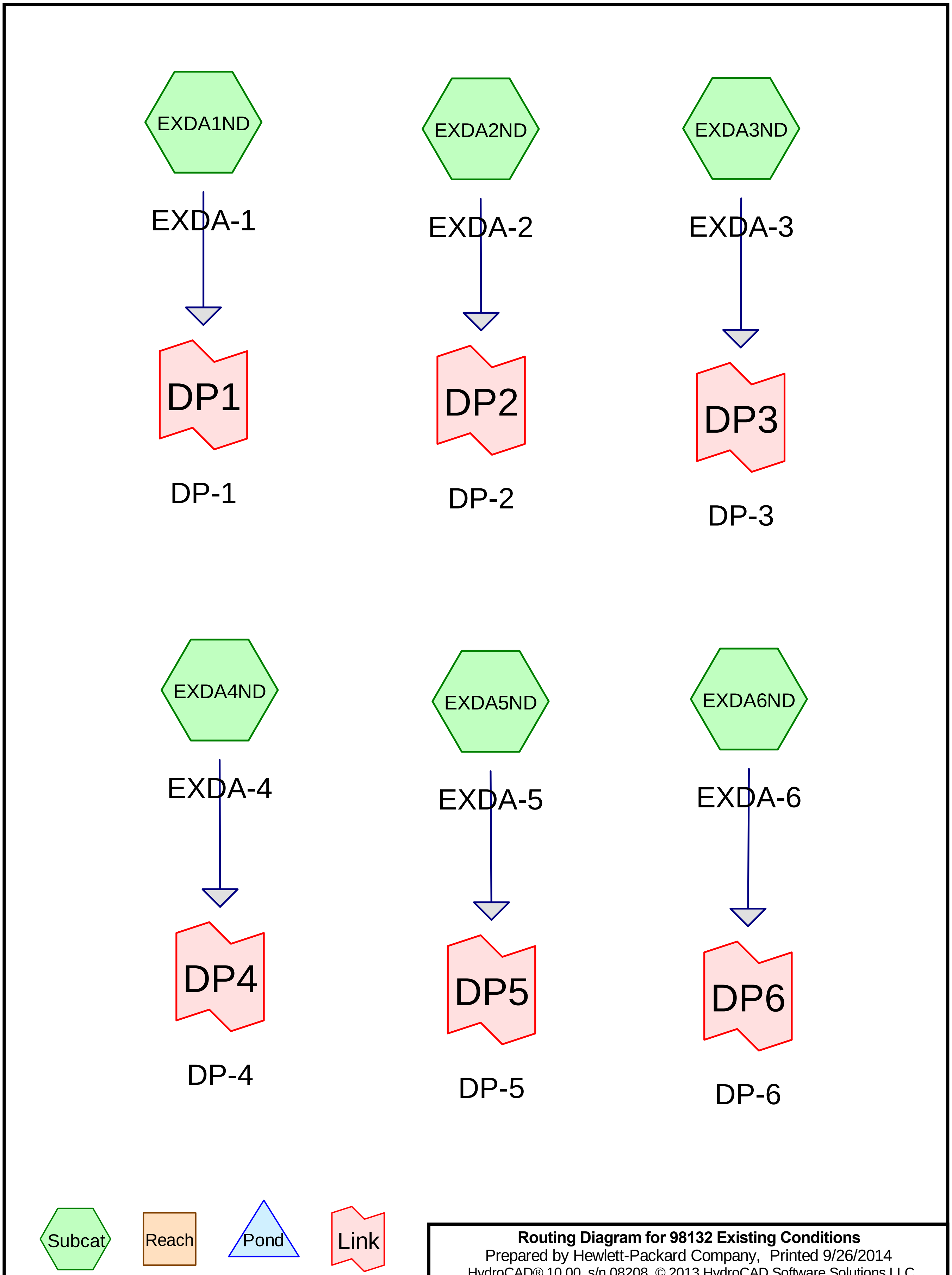
The goal of the proposed stormwater management system is to minimize the potential for impacts to down gradient properties due to the proposed development and to utilize Best Management Practices (BMPs) to improve post-development stormwater quality from the site. This is accomplished through the establishment of two stormwater renovation areas, grassed lined swales and outlet protection designed in accordance with the recommendations of the *CT DOT 2000 Drainage Manual*, the *2002 CT DEEP Erosion & Sediment Control Guidelines* and the *2004 CT DEEP Stormwater Quality Manual*.

As such, the stormwater management system as designed will provide for long-term protection of the down gradient wetlands and watercourses in the area.

Appendix A – Drainage Area Map


PRDA-1ND
EXDA-1
DP-1
PRDA-2D
PRDA-1D
EXDA-6
EXDA-2
EXDA-3
EXDA-4
EXDA-5
PRDA-6ND
PRDA2ND
PRDA-3ND
PRDA-4ND
PRDA-5ND
DP-6
DP-2
DP-3
DP-4
DP-5
LOT 9
N/F TOWN OF OXFORD
WOODRUFF HILL ROAD
LOT 8
TOWN OF OXFORD
LOT 7
TOWN OF OXFORD
LOT 6
TOWN OF OXFORD
NO.
REVISION
DATE
Previous Editions Obsolete
0
100
200
1 inch = 200 ft.
DRAINAGE AREA MAP
CPV TOWANTIC
ENERGY CENTER
OXFORD
CONNECTICUT
CIVIL 1
CORNERSTONE PROFESSIONAL PARK, SUITE D-101
43 SHERMAN HILL ROAD
WOODBURY
(203) 266-0778
CONNECTICUT
DRAWN: SC
APPROVED: CJ
SCALE: 1" = 200'
DATE: 26 SEP 14
PROJ. NO.: 98132
CADD FILE NAME: 98132
DRAWING NO.:
1 OF 1

Appendix B – Existing Conditions HydroCAD Routing



Routing Diagram for 98132 Existing Conditions
Prepared by Hewlett-Packard Company, Printed 9/26/2014

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.108	98	Impervious (EXDA4ND)
1.373	98	Impervious, HSG C (EXDA1ND, EXDA3ND, EXDA5ND, EXDA6ND)
3.681	71	Meadow, non-grazed, HSG C (EXDA1ND, EXDA3ND, EXDA4ND)
6.068	74	Pasture/grassland/range, Good, HSG C (EXDA1ND, EXDA3ND, EXDA4ND, EXDA5ND, EXDA6ND)
24.484	70	Woods, Good, HSG C (EXDA1ND, EXDA2ND, EXDA3ND)
35.713	**72**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
35.605	HSG C	EXDA1ND, EXDA2ND, EXDA3ND, EXDA4ND, EXDA5ND, EXDA6ND
0.000	HSG D	
0.108	Other	EXDA4ND
35.713		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	1.373	0.000	0.108	1.481	Impervious	EXDA1 ND, EXDA3 ND, EXDA4 ND, EXDA5 ND, EXDA6 ND
0.000	0.000	3.681	0.000	0.000	3.681	Meadow, non-grazed	EXDA1 ND, EXDA3 ND, EXDA4 ND
0.000	0.000	6.068	0.000	0.000	6.068	Pasture/grassland/range, Good	EXDA1 ND, EXDA3 ND, EXDA4 ND, EXDA5 ND, EXDA6 ND
0.000	0.000	24.484	0.000	0.000	24.484	Woods, Good	EXDA1 ND, EXDA2 ND, EXDA3 ND
0.000	**0.000**	**35.605**	**0.000**	**0.108**	**35.713**	**TOTAL AREA**	

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EXDA1ND: EXDA-1	Runoff Area=846,679 sf 5.80% Impervious Runoff Depth>0.88" Flow Length=2,225' Tc=61.0 min CN=72 Runoff=8.11 cfs 1.422 af
Subcatchment EXDA2ND: EXDA-2	Runoff Area=259,066 sf 0.00% Impervious Runoff Depth>0.79" Flow Length=620' Tc=36.0 min CN=70 Runoff=2.90 cfs 0.392 af
Subcatchment EXDA3ND: EXDA-3	Runoff Area=202,871 sf 2.14% Impervious Runoff Depth>0.84" Flow Length=575' Tc=33.8 min CN=71 Runoff=2.51 cfs 0.326 af
Subcatchment EXDA4ND: EXDA-4	Runoff Area=112,514 sf 4.18% Impervious Runoff Depth>0.95" Flow Length=430' Tc=15.0 min CN=73 Runoff=2.24 cfs 0.205 af
Subcatchment EXDA5ND: EXDA-5	Runoff Area=71,979 sf 6.27% Impervious Runoff Depth>1.12" Flow Length=500' Tc=11.3 min CN=76 Runoff=1.91 cfs 0.154 af
Subcatchment EXDA6ND: EXDA-6	Runoff Area=62,545 sf 2.95% Impervious Runoff Depth>1.06" Flow Length=350' Tc=8.3 min CN=75 Runoff=1.69 cfs 0.127 af
Link DP1: DP-1	Inflow=8.11 cfs 1.422 af Primary=8.11 cfs 1.422 af
Link DP2: DP-2	Inflow=2.90 cfs 0.392 af Primary=2.90 cfs 0.392 af
Link DP3: DP-3	Inflow=2.51 cfs 0.326 af Primary=2.51 cfs 0.326 af
Link DP4: DP-4	Inflow=2.24 cfs 0.205 af Primary=2.24 cfs 0.205 af
Link DP5: DP-5	Inflow=1.91 cfs 0.154 af Primary=1.91 cfs 0.154 af
Link DP6: DP-6	Inflow=1.69 cfs 0.127 af Primary=1.69 cfs 0.127 af

Total Runoff Area = 35.713 ac Runoff Volume = 2.626 af Average Runoff Depth = 0.88"
95.85% Pervious = 34.232 ac 4.15% Impervious = 1.481 ac

Summary for Subcatchment EXDA1ND: EXDA-1

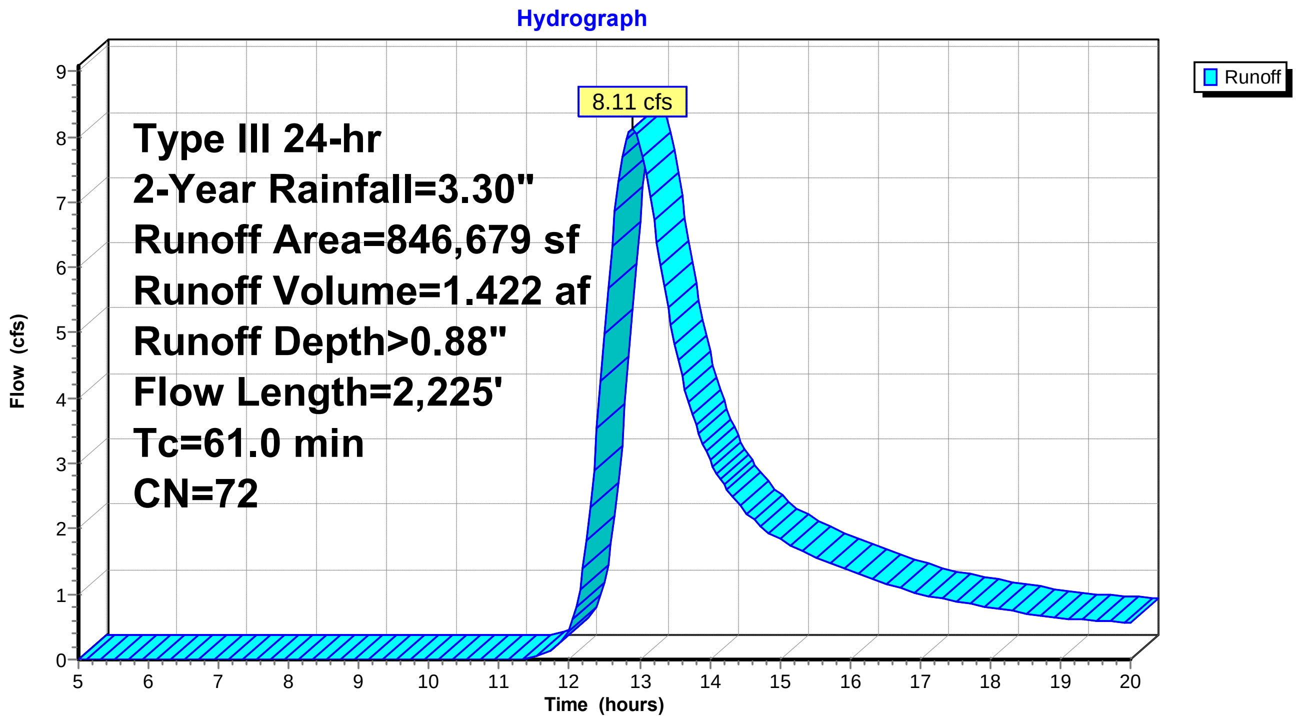
Runoff = 8.11 cfs @ 12.90 hrs, Volume= 1.422 af, Depth> 0.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.30"

Area (sf)	CN	Description
685,262	70	Woods, Good, HSG C
97,176	74	Pasture/grassland/range, Good, HSG C
15,129	71	Meadow, non-grazed, HSG C
49,112	98	Impervious, HSG C
846,679	72	Weighted Average
797,567		94.20% Pervious Area
49,112		5.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.0	250	0.0320	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
23.0	1,450	0.0440	1.05		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	525	0.0570	8.87	53.22	**Channel Flow,** Area= 6.0 sf Perim= 6.0' r= 1.00' n= 0.040 Earth, cobble bottom, clean sides
61.0	2,225	Total			

Subcatchment EXDA1ND: EXDA-1



Summary for Subcatchment EXDA2ND: EXDA-2

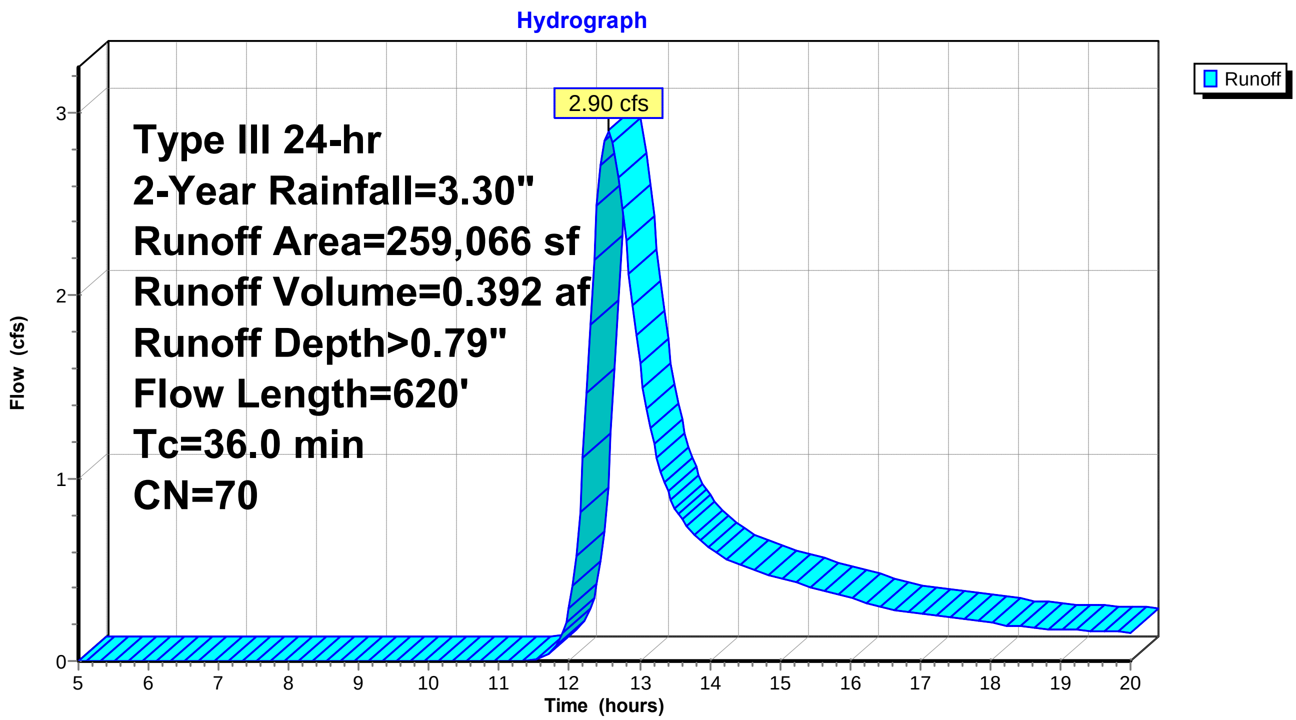
Runoff = 2.90 cfs @ 12.56 hrs, Volume= 0.392 af, Depth> 0.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.30"

Area (sf)	CN	Description
259,066	70	Woods, Good, HSG C
259,066		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.6	250	0.0440	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
3.4	370	0.1300	1.80		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
36.0	620	Total			

Subcatchment EXDA2ND: EXDA-2



Summary for Subcatchment EXDA3ND: EXDA-3

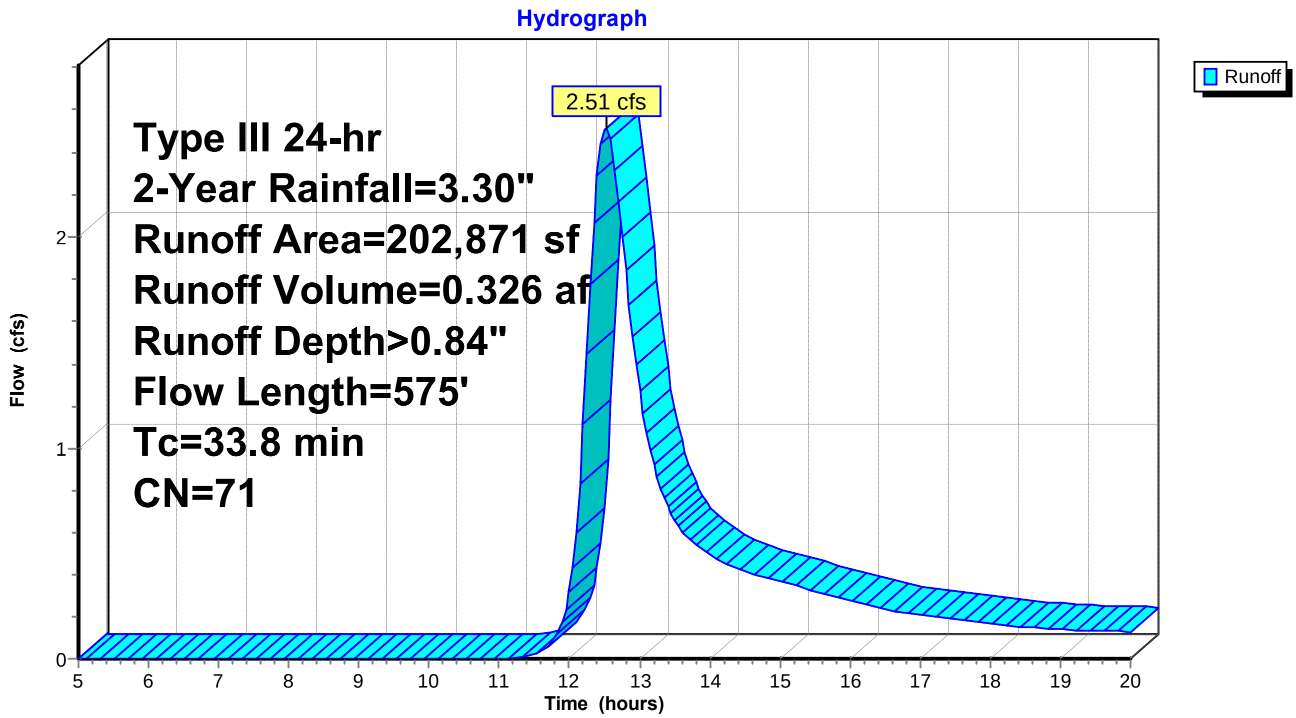
Runoff = 2.51 cfs @ 12.52 hrs, Volume= 0.326 af, Depth> 0.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.30"

Area (sf)	CN	Description
68,828	71	Meadow, non-grazed, HSG C
122,188	70	Woods, Good, HSG C
7,515	74	Pasture/grassland/range, Good, HSG C
4,340	98	Impervious, HSG C
202,871	71	Weighted Average
198,531		97.86% Pervious Area
4,340		2.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.5	250	0.0520	0.14		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
3.3	325	0.1110	1.67		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
33.8	575	Total			

Subcatchment EXDA3ND: EXDA-3



Summary for Subcatchment EXDA4ND: EXDA-4

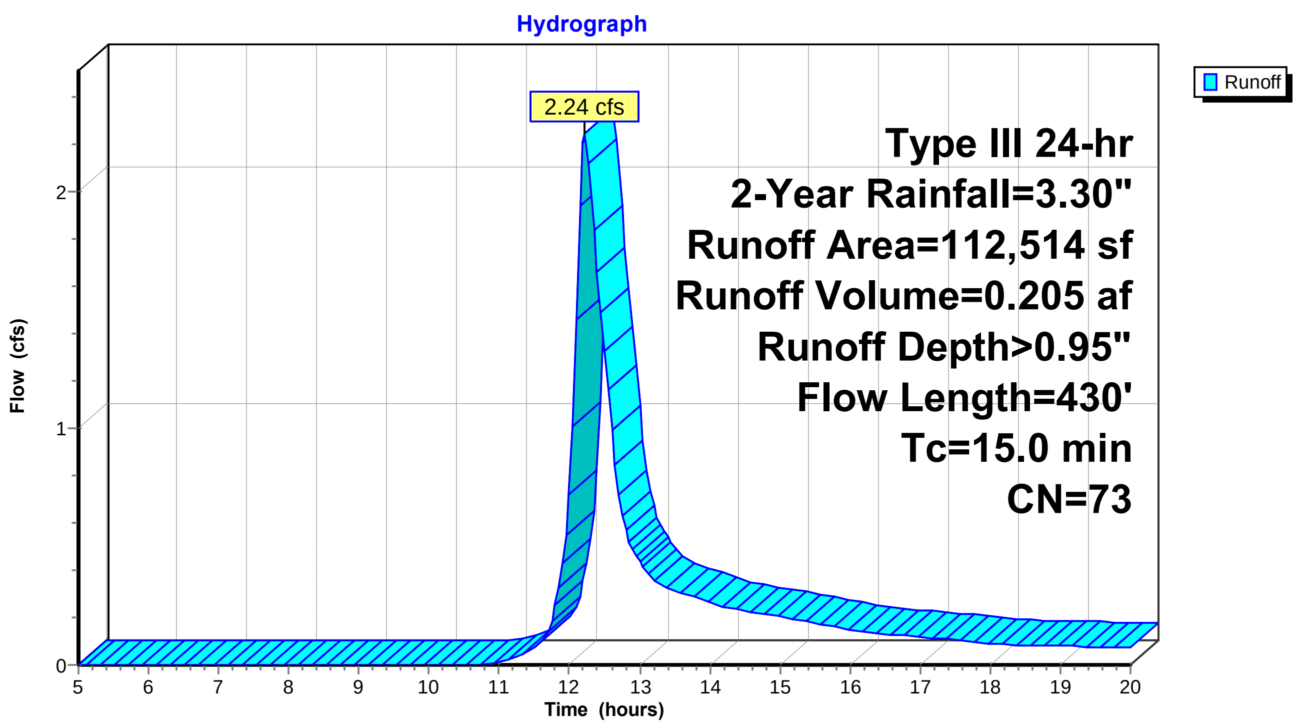
Runoff = 2.24 cfs @ 12.22 hrs, Volume= 0.205 af, Depth> 0.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.30"

	Area (sf)	CN	Description
	31,444	74	Pasture/grassland/range, Good, HSG C
	76,369	71	Meadow, non-grazed, HSG C
*	4,701	98	Impervious
	112,514	73	Weighted Average
	107,813		95.82% Pervious Area
	4,701		4.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.9	250	0.0520	0.30		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.1	180	0.1500	2.71		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
15.0	430	Total			

Subcatchment EXDA4ND: EXDA-4



Summary for Subcatchment EXDA5ND: EXDA-5

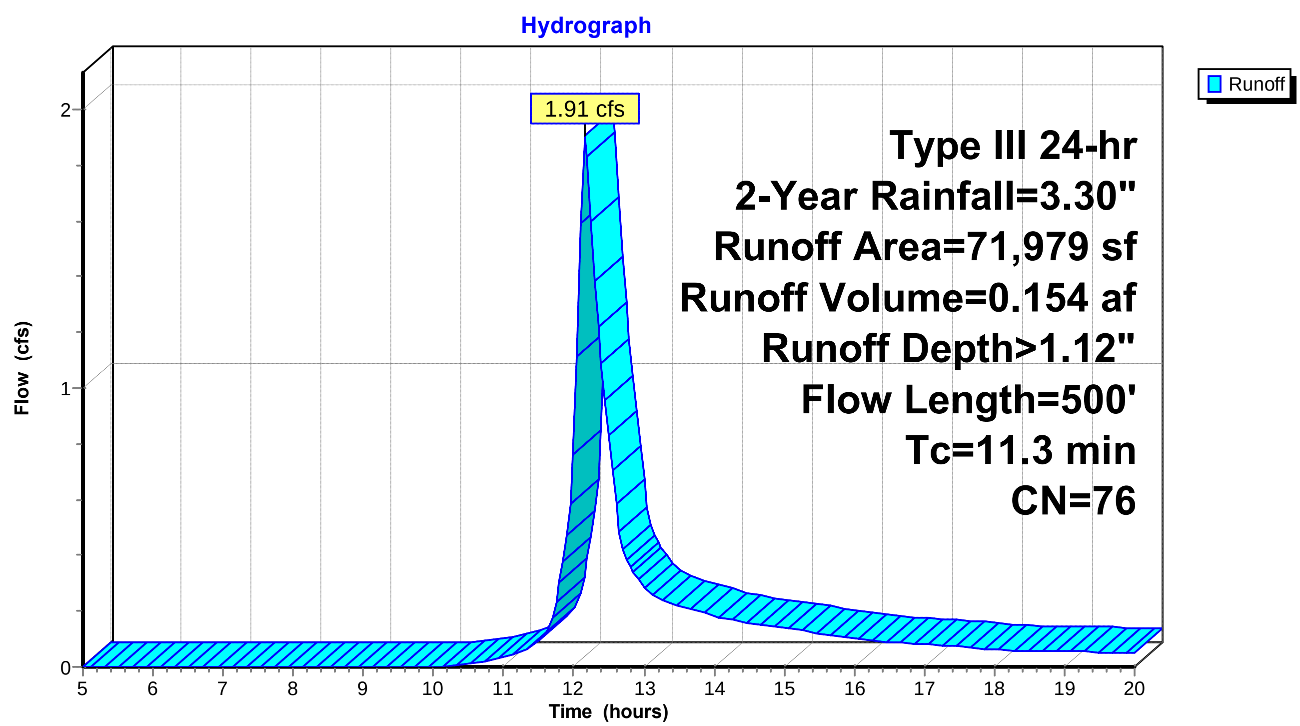
Runoff = 1.91 cfs @ 12.17 hrs, Volume= 0.154 af, Depth> 1.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.30"

Area (sf)	CN	Description
4,515	98	Impervious, HSG C
67,464	74	Pasture/grassland/range, Good, HSG C
71,979	76	Weighted Average
67,464		93.73% Pervious Area
4,515		6.27% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.3	150	0.0400	0.24		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.0	350	0.1350	5.92		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
11.3	500	Total			

Subcatchment EXDA5ND: EXDA-5



Summary for Subcatchment EXDA6ND: EXDA-6

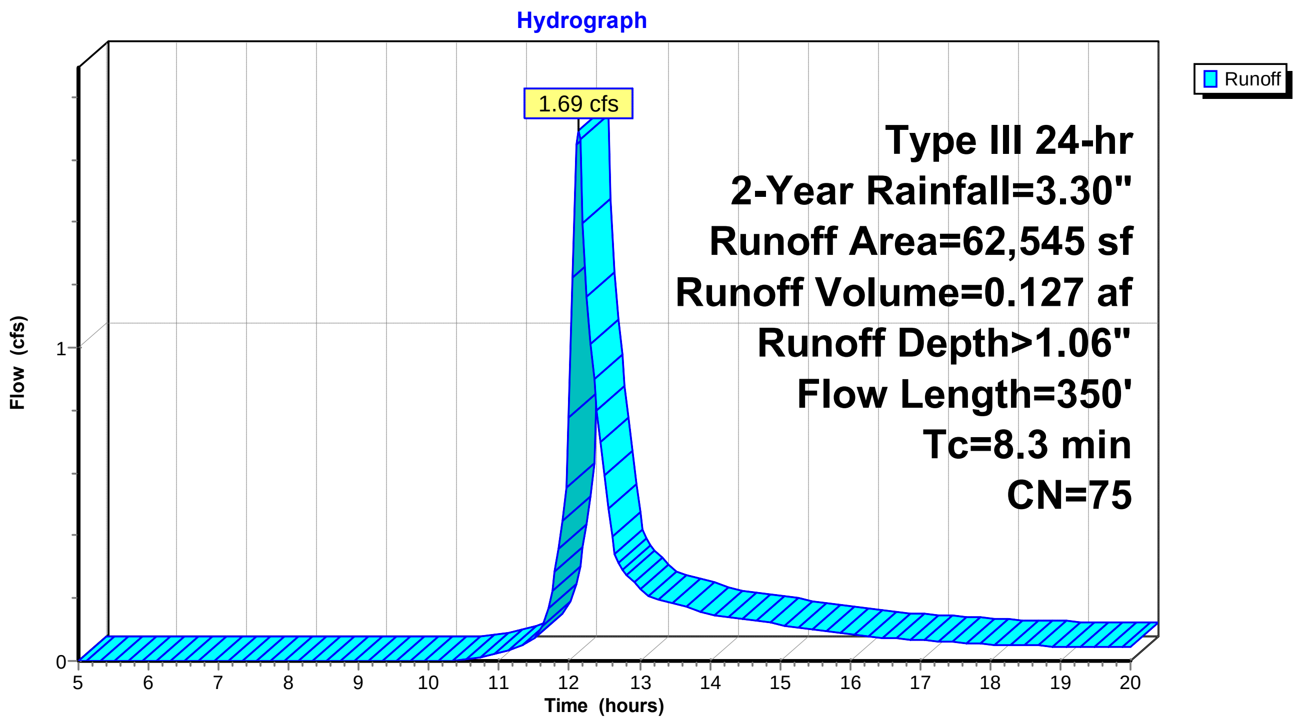
Runoff = 1.69 cfs @ 12.13 hrs, Volume= 0.127 af, Depth> 1.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.30"

Area (sf)	CN	Description
60,703	74	Pasture/grassland/range, Good, HSG C
1,842	98	Impervious, HSG C
62,545	75	Weighted Average
60,703		97.05% Pervious Area
1,842		2.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.7	100	0.0360	0.22		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.6	250	0.2050	7.29		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.3	350	Total			

Subcatchment EXDA6ND: EXDA-6

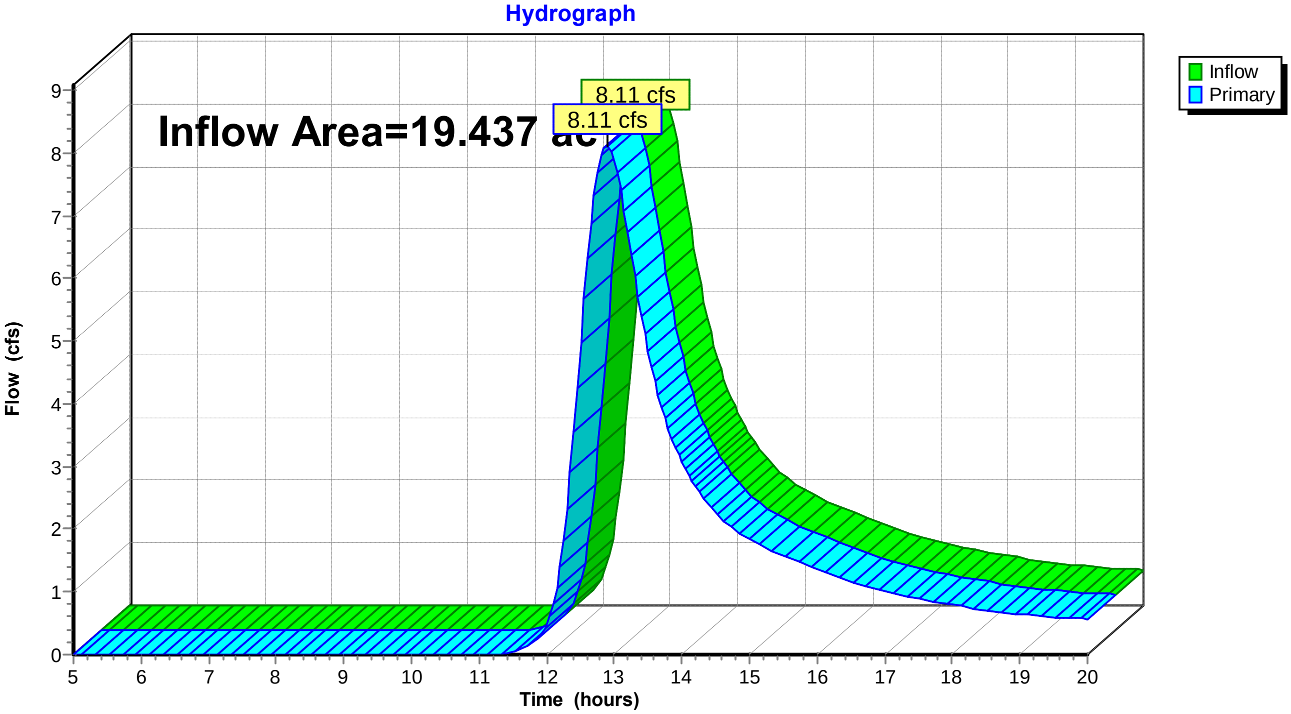


Summary for Link DP1: DP-1

Inflow Area =	19.437 ac,	5.80% Impervious,	Inflow Depth > 0.88"	for 2-Year event
Inflow =	8.11 cfs @	12.90 hrs, Volume=	1.422 af	
Primary =	8.11 cfs @	12.90 hrs, Volume=	1.422 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

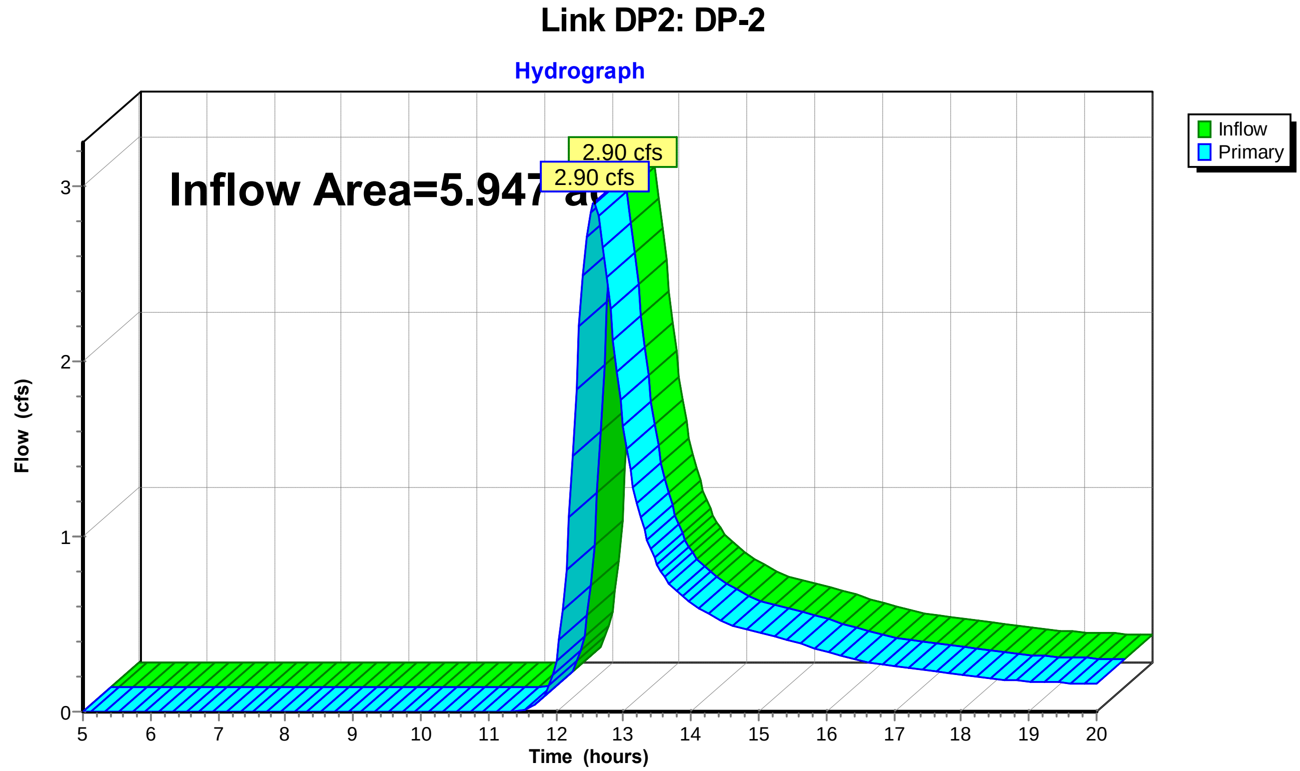
Link DP1: DP-1



Summary for Link DP2: DP-2

Inflow Area =	5.947 ac,	0.00% Impervious,	Inflow Depth > 0.79"	for 2-Year event
Inflow =	2.90 cfs @	12.56 hrs, Volume=	0.392 af	
Primary =	2.90 cfs @	12.56 hrs, Volume=	0.392 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

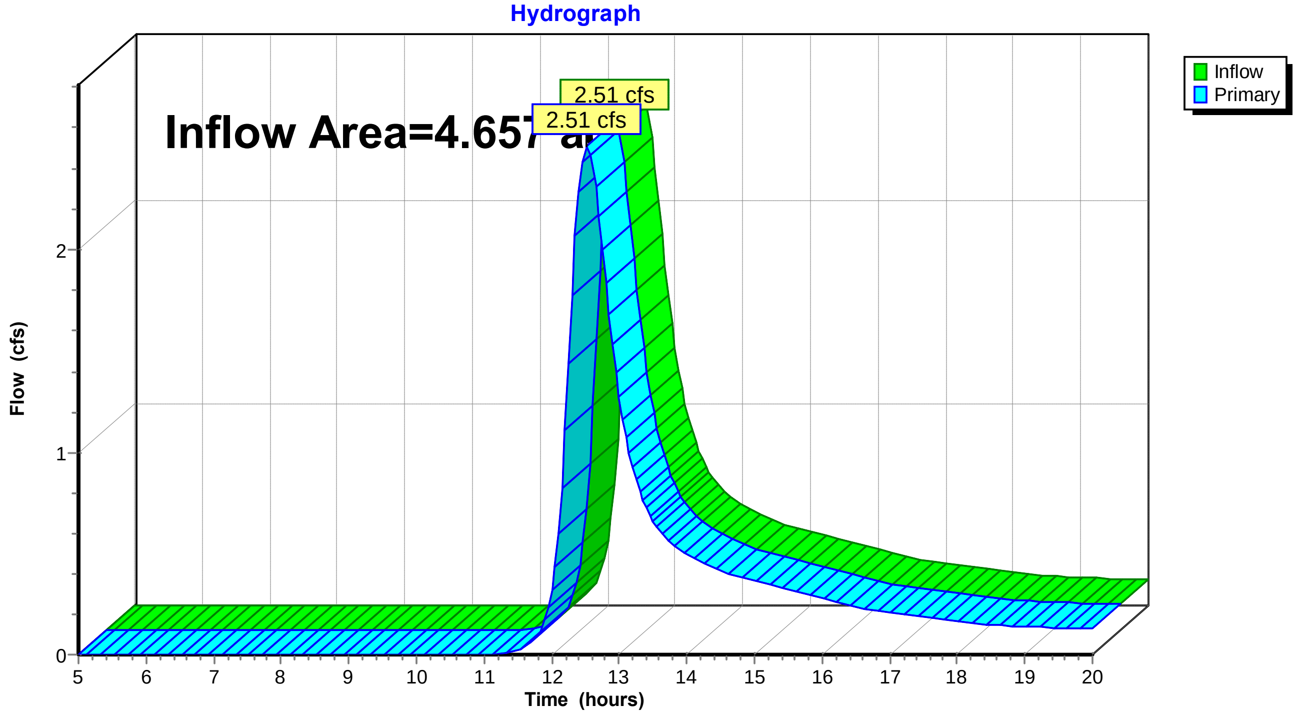


Summary for Link DP3: DP-3

Inflow Area = 4.657 ac, 2.14% Impervious, Inflow Depth > 0.84" for 2-Year event
Inflow = 2.51 cfs @ 12.52 hrs, Volume= 0.326 af
Primary = 2.51 cfs @ 12.52 hrs, Volume= 0.326 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP3: DP-3

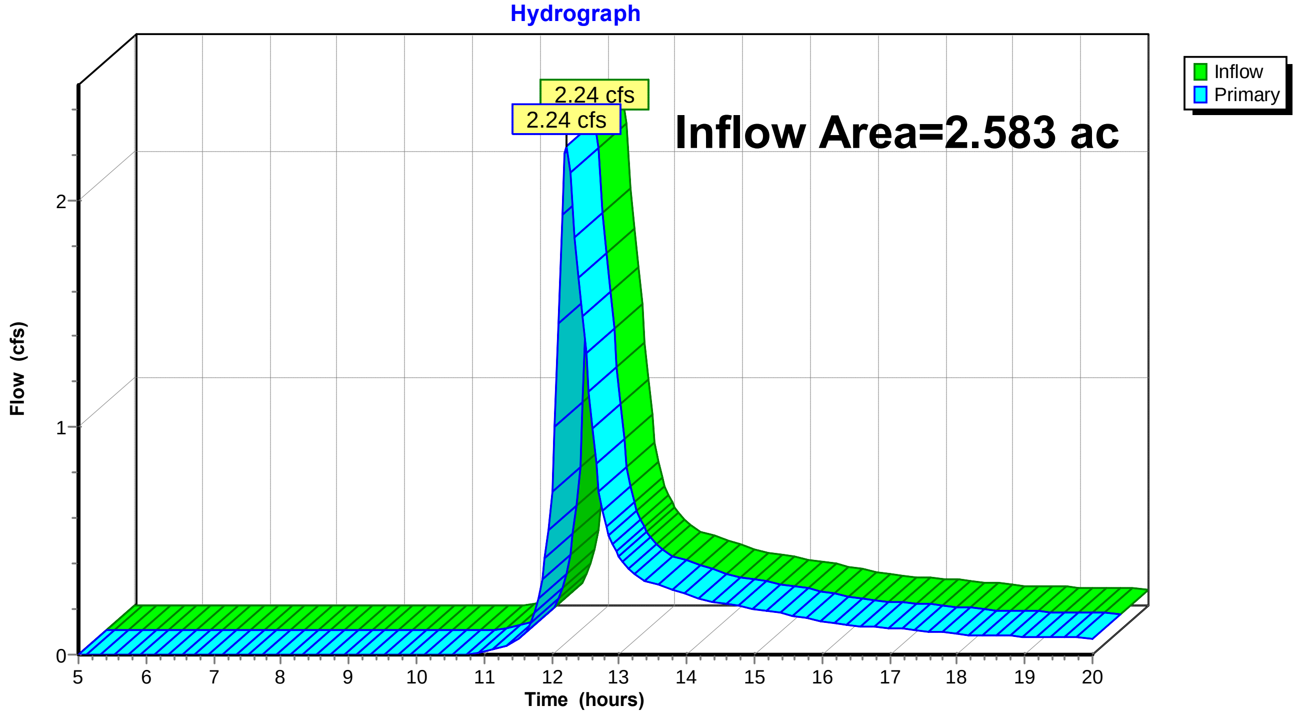


Summary for Link DP4: DP-4

Inflow Area =	2.583 ac,	4.18% Impervious,	Inflow Depth > 0.95"	for 2-Year event	
Inflow =	2.24 cfs @	12.22 hrs,	Volume=	0.205 af	
Primary =	2.24 cfs @	12.22 hrs,	Volume=	0.205 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP4: DP-4

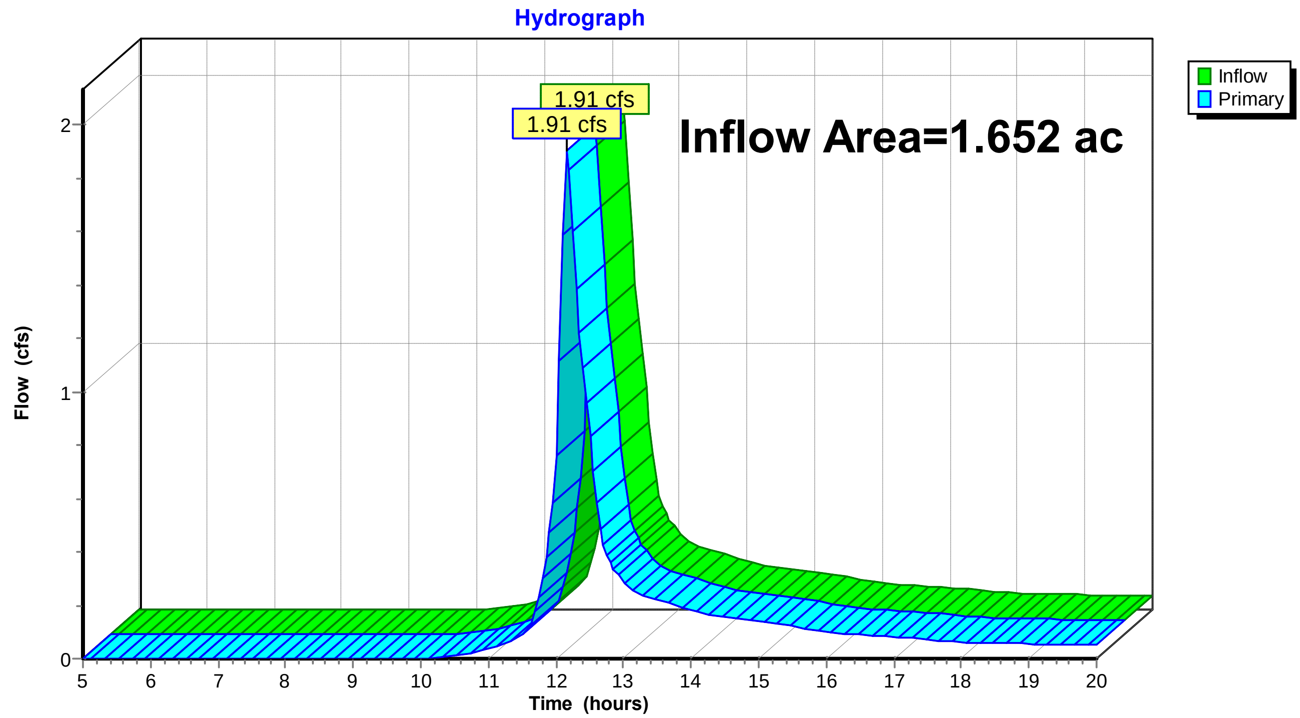


Summary for Link DP5: DP-5

Inflow Area =	1.652 ac,	6.27% Impervious, Inflow Depth > 1.12"	for 2-Year event	
Inflow =	1.91 cfs @	12.17 hrs, Volume=	0.154 af	
Primary =	1.91 cfs @	12.17 hrs, Volume=	0.154 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP5: DP-5

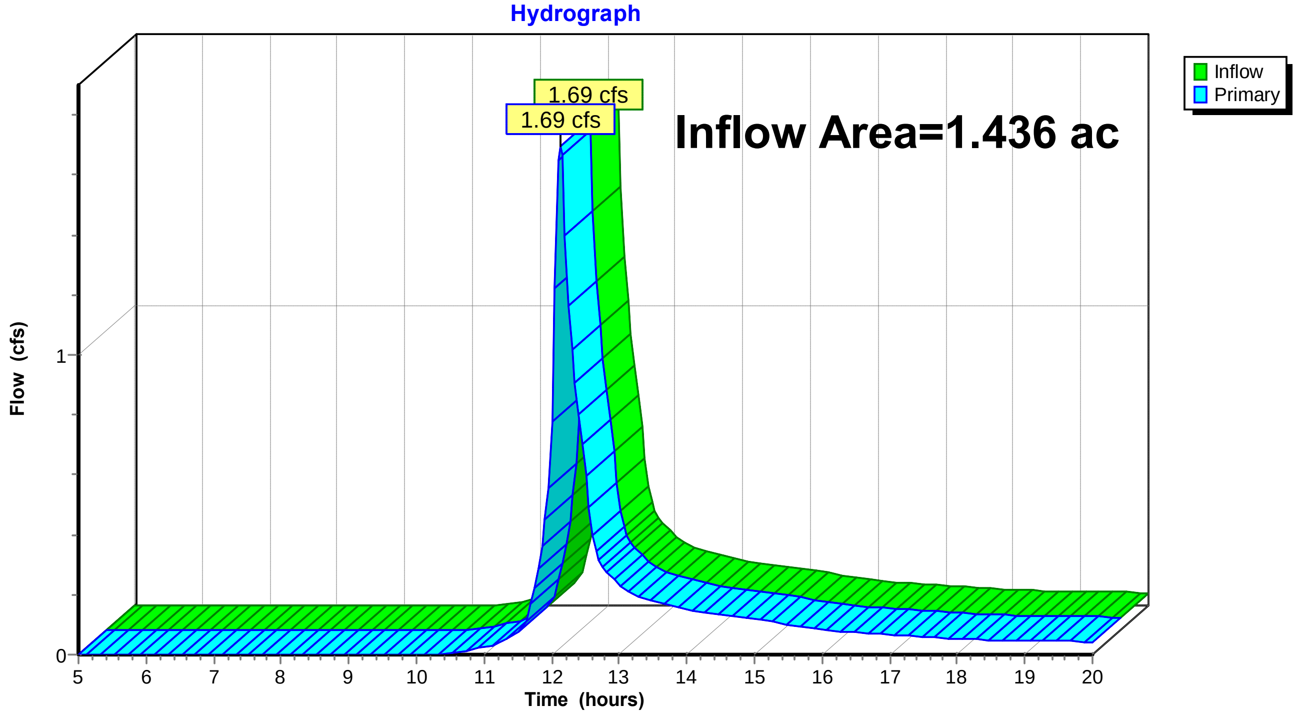


Summary for Link DP6: DP-6

Inflow Area = 1.436 ac, 2.95% Impervious, Inflow Depth > 1.06" for 2-Year event
Inflow = 1.69 cfs @ 12.13 hrs, Volume= 0.127 af
Primary = 1.69 cfs @ 12.13 hrs, Volume= 0.127 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP6: DP-6



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EXDA1ND: EXDA-1 Runoff Area=846,679 sf 5.80% Impervious Runoff Depth>1.99"
Flow Length=2,225' Tc=61.0 min CN=72 Runoff=19.19 cfs 3.216 af

Subcatchment EXDA2ND: EXDA-2 Runoff Area=259,066 sf 0.00% Impervious Runoff Depth>1.85"
Flow Length=620' Tc=36.0 min CN=70 Runoff=7.21 cfs 0.918 af

Subcatchment EXDA3ND: EXDA-3 Runoff Area=202,871 sf 2.14% Impervious Runoff Depth>1.93"
Flow Length=575' Tc=33.8 min CN=71 Runoff=6.07 cfs 0.749 af

Subcatchment EXDA4ND: EXDA-4 Runoff Area=112,514 sf 4.18% Impervious Runoff Depth>2.10"
Flow Length=430' Tc=15.0 min CN=73 Runoff=5.15 cfs 0.453 af

Subcatchment EXDA5ND: EXDA-5 Runoff Area=71,979 sf 6.27% Impervious Runoff Depth>2.35"
Flow Length=500' Tc=11.3 min CN=76 Runoff=4.08 cfs 0.324 af

Subcatchment EXDA6ND: EXDA-6 Runoff Area=62,545 sf 2.95% Impervious Runoff Depth>2.27"
Flow Length=350' Tc=8.3 min CN=75 Runoff=3.74 cfs 0.272 af

Link DP1: DP-1 Inflow=19.19 cfs 3.216 af
Primary=19.19 cfs 3.216 af

Link DP2: DP-2 Inflow=7.21 cfs 0.918 af
Primary=7.21 cfs 0.918 af

Link DP3: DP-3 Inflow=6.07 cfs 0.749 af
Primary=6.07 cfs 0.749 af

Link DP4: DP-4 Inflow=5.15 cfs 0.453 af
Primary=5.15 cfs 0.453 af

Link DP5: DP-5 Inflow=4.08 cfs 0.324 af
Primary=4.08 cfs 0.324 af

Link DP6: DP-6 Inflow=3.74 cfs 0.272 af
Primary=3.74 cfs 0.272 af

Total Runoff Area = 35.713 ac Runoff Volume = 5.932 af Average Runoff Depth = 1.99"
95.85% Pervious = 34.232 ac 4.15% Impervious = 1.481 ac

Summary for Subcatchment EXDA1ND: EXDA-1

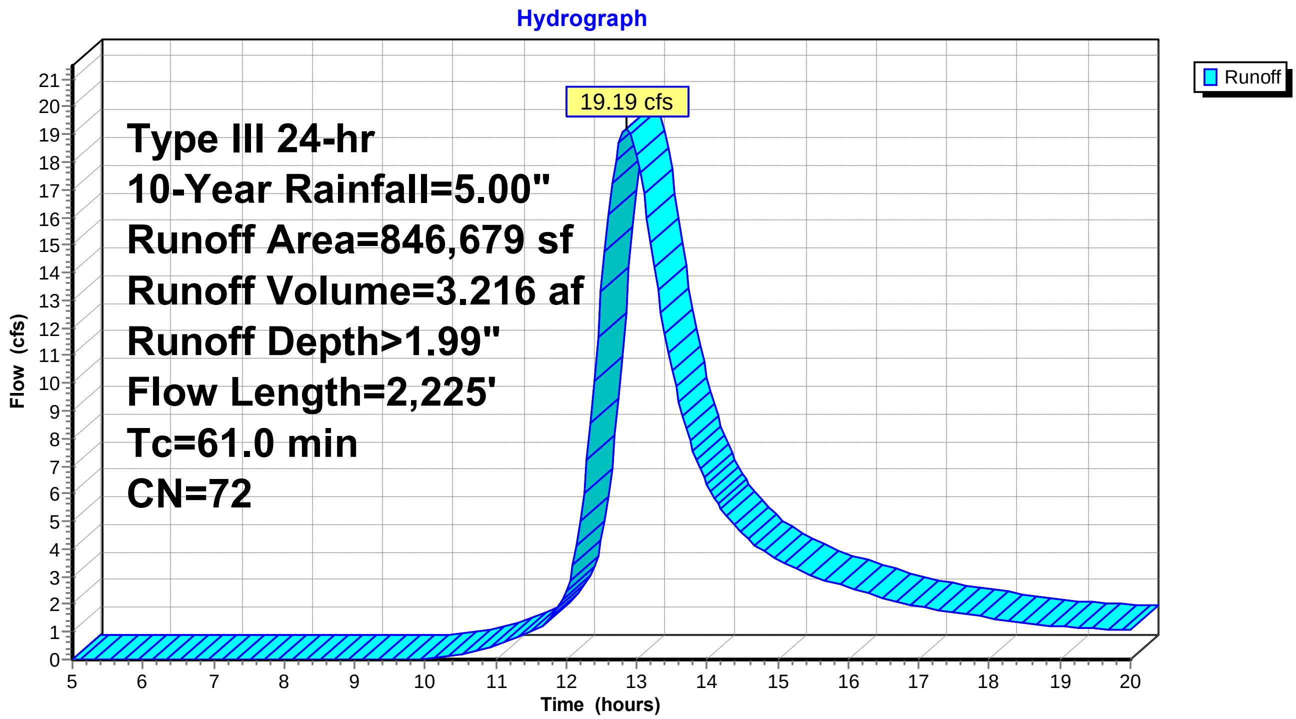
Runoff = 19.19 cfs @ 12.84 hrs, Volume= 3.216 af, Depth> 1.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.00"

Area (sf)	CN	Description
685,262	70	Woods, Good, HSG C
97,176	74	Pasture/grassland/range, Good, HSG C
15,129	71	Meadow, non-grazed, HSG C
49,112	98	Impervious, HSG C
846,679	72	Weighted Average
797,567		94.20% Pervious Area
49,112		5.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.0	250	0.0320	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
23.0	1,450	0.0440	1.05		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	525	0.0570	8.87	53.22	**Channel Flow,** Area= 6.0 sf Perim= 6.0' r= 1.00' n= 0.040 Earth, cobble bottom, clean sides
61.0	2,225	Total			

Subcatchment EXDA1ND: EXDA-1



Summary for Subcatchment EXDA2ND: EXDA-2

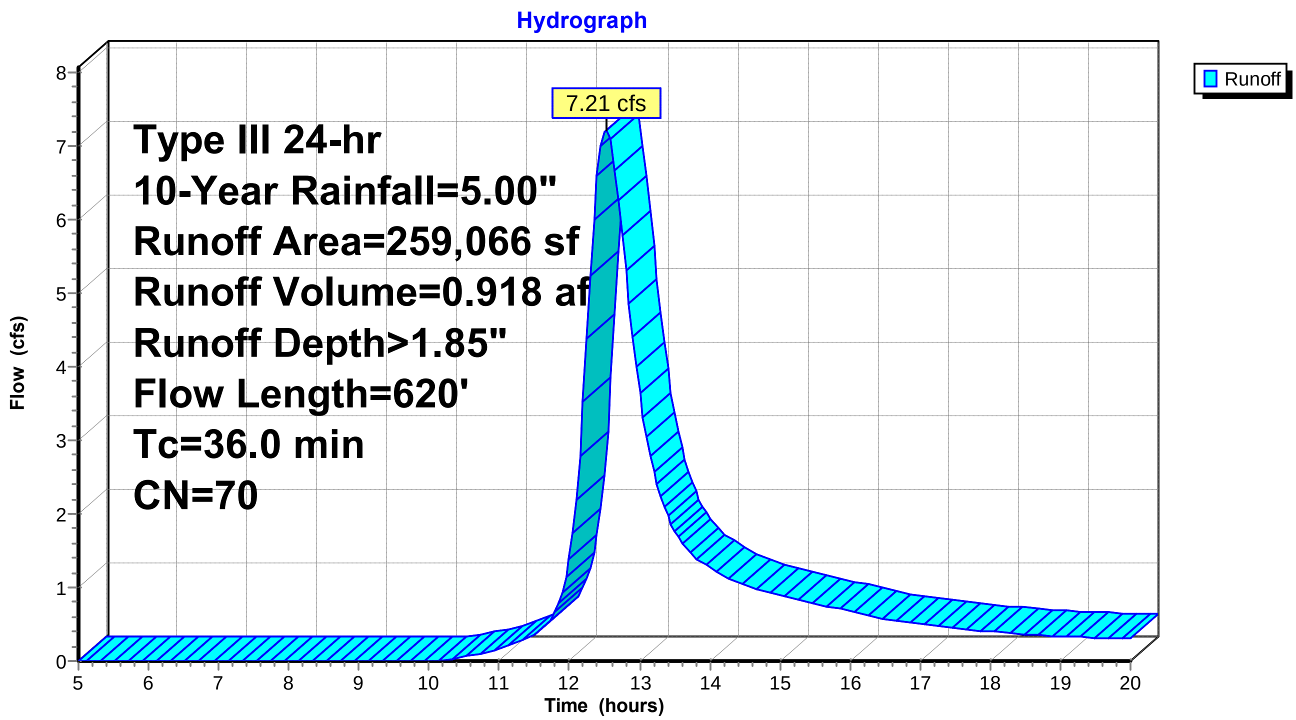
Runoff = 7.21 cfs @ 12.52 hrs, Volume= 0.918 af, Depth> 1.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.00"

Area (sf)	CN	Description
259,066	70	Woods, Good, HSG C
259,066		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.6	250	0.0440	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
3.4	370	0.1300	1.80		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
36.0	620	Total			

Subcatchment EXDA2ND: EXDA-2



Summary for Subcatchment EXDA3ND: EXDA-3

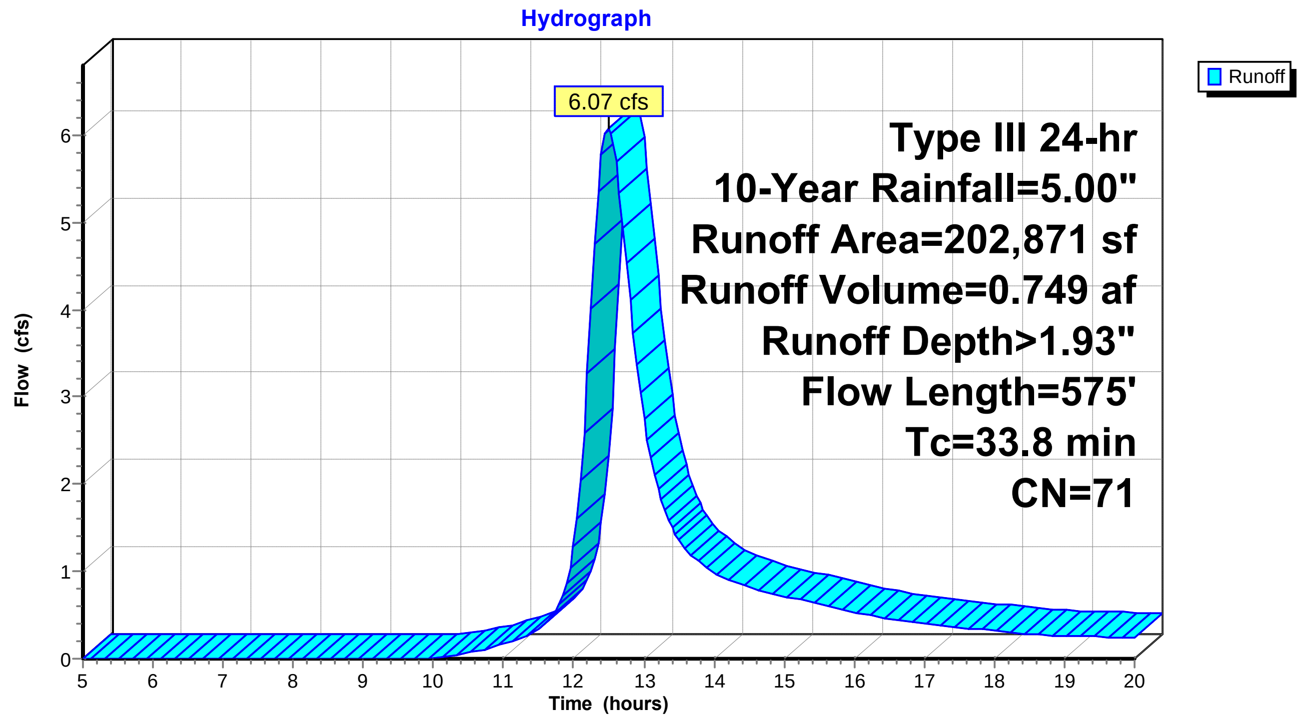
Runoff = 6.07 cfs @ 12.49 hrs, Volume= 0.749 af, Depth> 1.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.00"

Area (sf)	CN	Description
68,828	71	Meadow, non-grazed, HSG C
122,188	70	Woods, Good, HSG C
7,515	74	Pasture/grassland/range, Good, HSG C
4,340	98	Impervious, HSG C
202,871	71	Weighted Average
198,531		97.86% Pervious Area
4,340		2.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.5	250	0.0520	0.14		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
3.3	325	0.1110	1.67		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
33.8	575	Total			

Subcatchment EXDA3ND: EXDA-3



Summary for Subcatchment EXDA4ND: EXDA-4

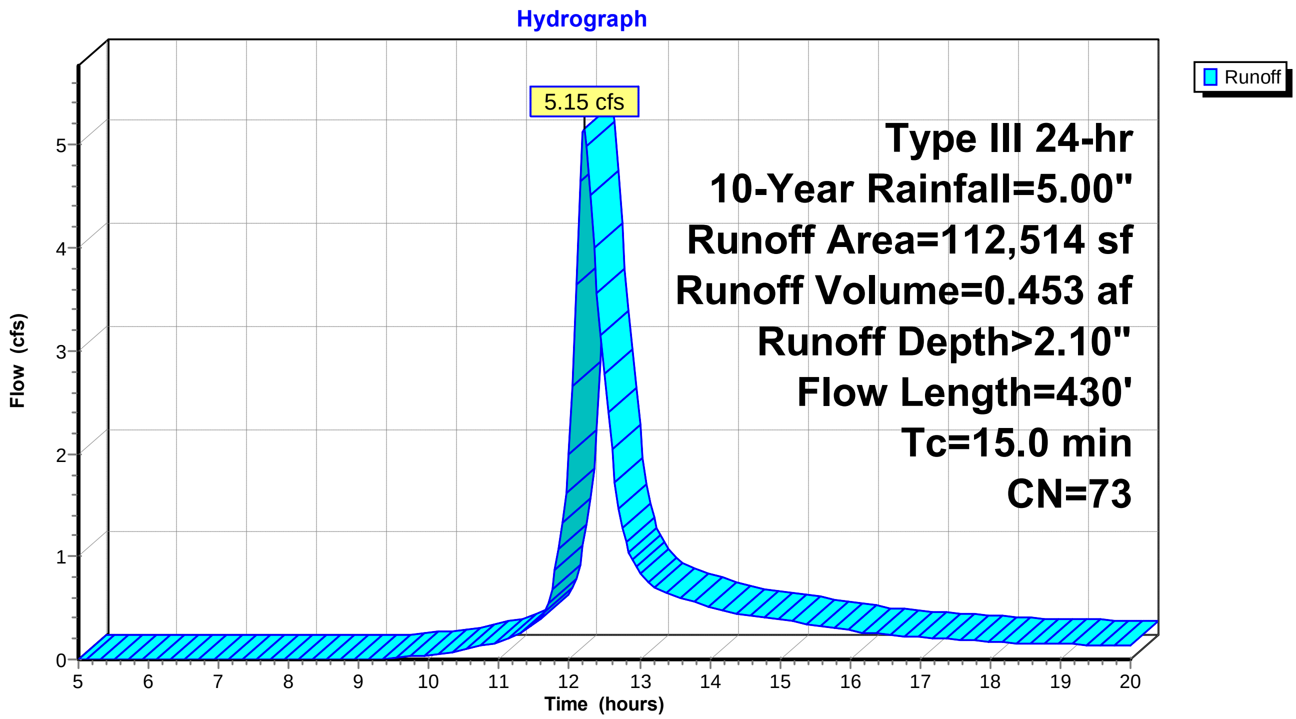
Runoff = 5.15 cfs @ 12.21 hrs, Volume= 0.453 af, Depth> 2.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.00"

	Area (sf)	CN	Description
	31,444	74	Pasture/grassland/range, Good, HSG C
	76,369	71	Meadow, non-grazed, HSG C
*	4,701	98	Impervious
	112,514	73	Weighted Average
	107,813		95.82% Pervious Area
	4,701		4.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.9	250	0.0520	0.30		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.1	180	0.1500	2.71		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
15.0	430	Total			

Subcatchment EXDA4ND: EXDA-4



Summary for Subcatchment EXDA5ND: EXDA-5

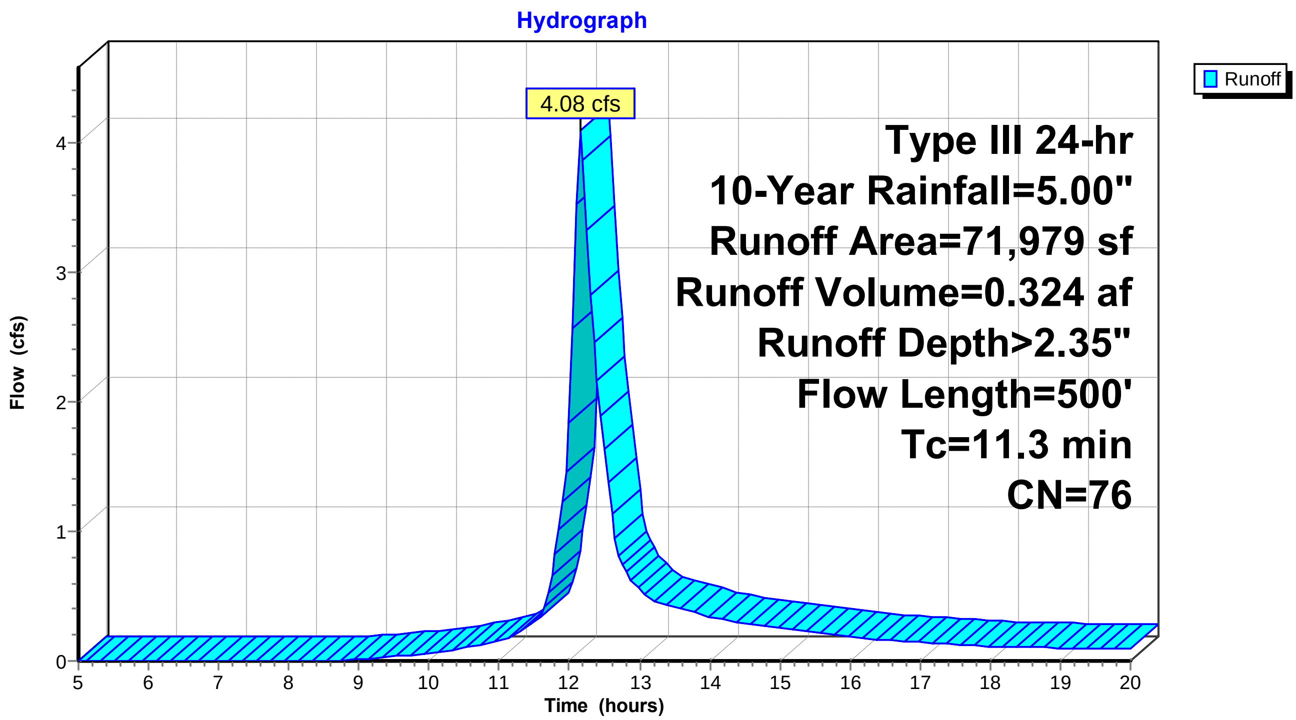
Runoff = 4.08 cfs @ 12.16 hrs, Volume= 0.324 af, Depth> 2.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.00"

Area (sf)	CN	Description
4,515	98	Impervious, HSG C
67,464	74	Pasture/grassland/range, Good, HSG C
71,979	76	Weighted Average
67,464		93.73% Pervious Area
4,515		6.27% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.3	150	0.0400	0.24		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.0	350	0.1350	5.92		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
11.3	500	Total			

Subcatchment EXDA5ND: EXDA-5



Summary for Subcatchment EXDA6ND: EXDA-6

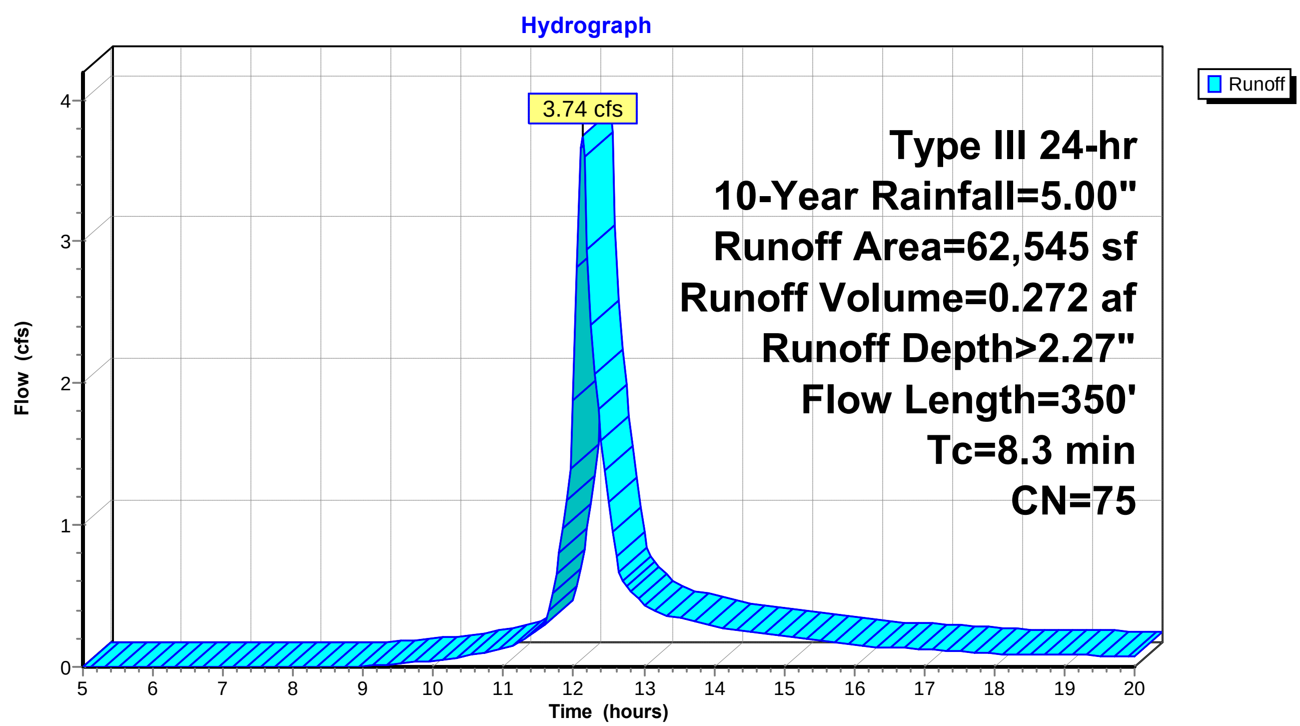
Runoff = 3.74 cfs @ 12.12 hrs, Volume= 0.272 af, Depth> 2.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.00"

Area (sf)	CN	Description
60,703	74	Pasture/grassland/range, Good, HSG C
1,842	98	Impervious, HSG C
62,545	75	Weighted Average
60,703		97.05% Pervious Area
1,842		2.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.7	100	0.0360	0.22		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.6	250	0.2050	7.29		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.3	350	Total			

Subcatchment EXDA6ND: EXDA-6

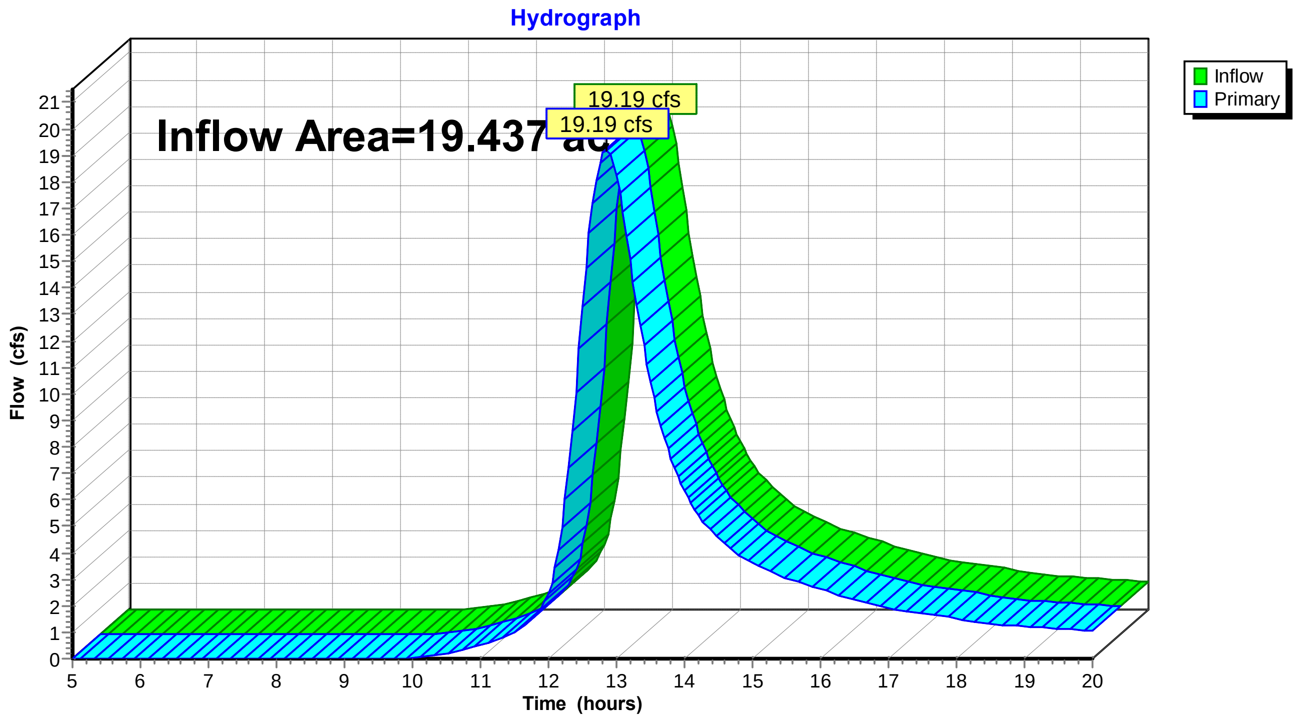


Summary for Link DP1: DP-1

Inflow Area =	19.437 ac,	5.80% Impervious, Inflow Depth > 1.99"	for 10-Year event
Inflow =	19.19 cfs @	12.84 hrs, Volume=	3.216 af
Primary =	19.19 cfs @	12.84 hrs, Volume=	3.216 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP1: DP-1

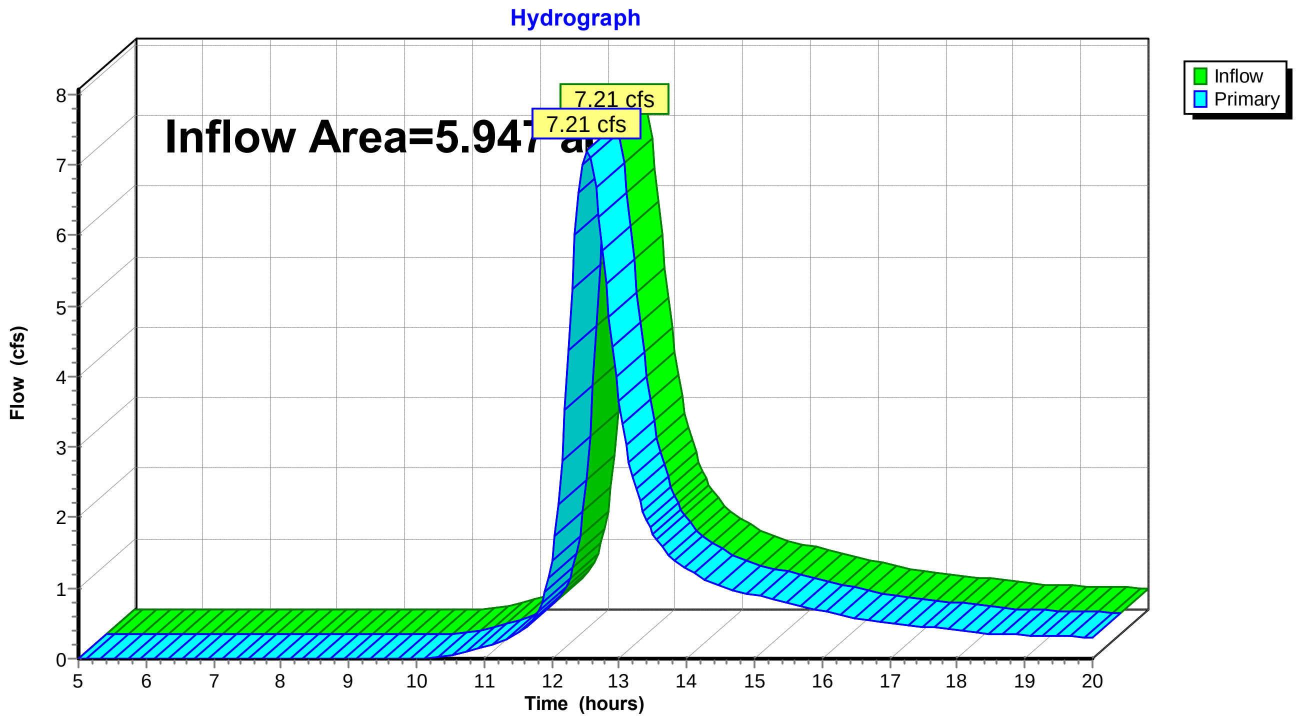


Summary for Link DP2: DP-2

Inflow Area =	5.947 ac,	0.00% Impervious,	Inflow Depth > 1.85"	for 10-Year event	
Inflow =	7.21 cfs @	12.52 hrs,	Volume=	0.918 af	
Primary =	7.21 cfs @	12.52 hrs,	Volume=	0.918 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP2: DP-2

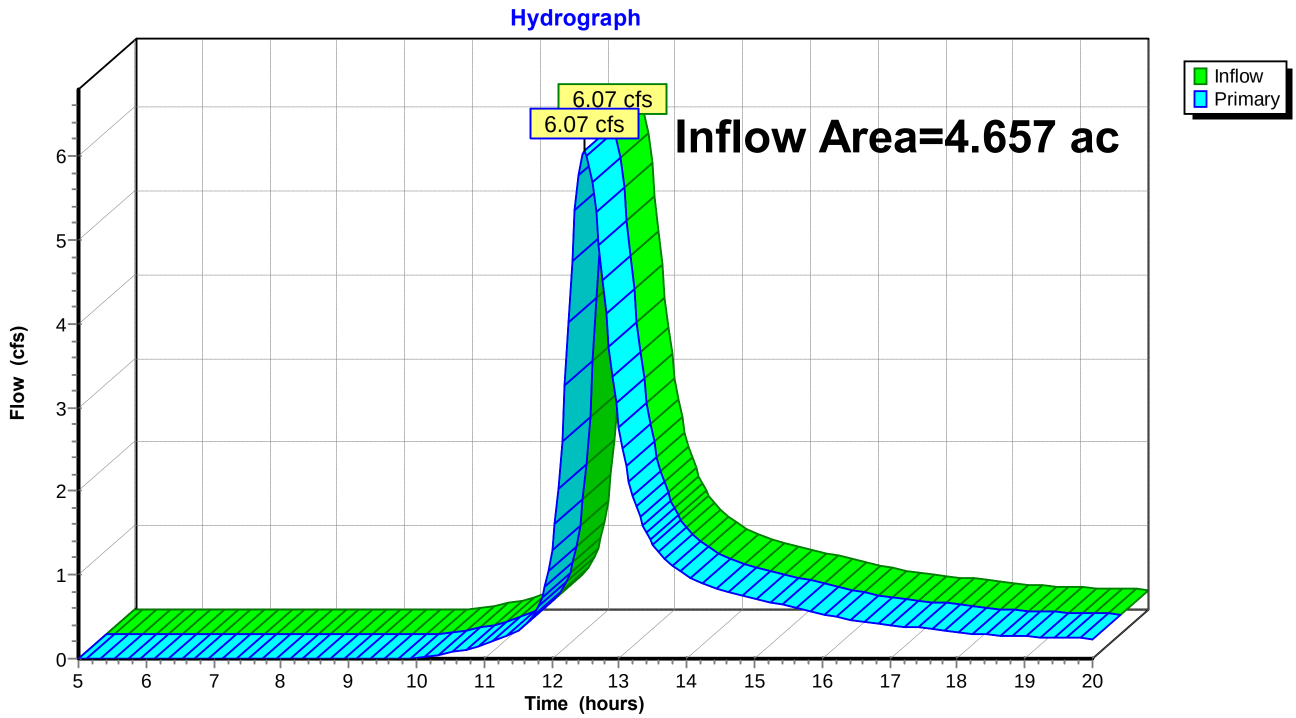


Summary for Link DP3: DP-3

Inflow Area =	4.657 ac,	2.14% Impervious,	Inflow Depth > 1.93"	for 10-Year event	
Inflow =	6.07 cfs @	12.49 hrs,	Volume=	0.749 af	
Primary =	6.07 cfs @	12.49 hrs,	Volume=	0.749 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP3: DP-3

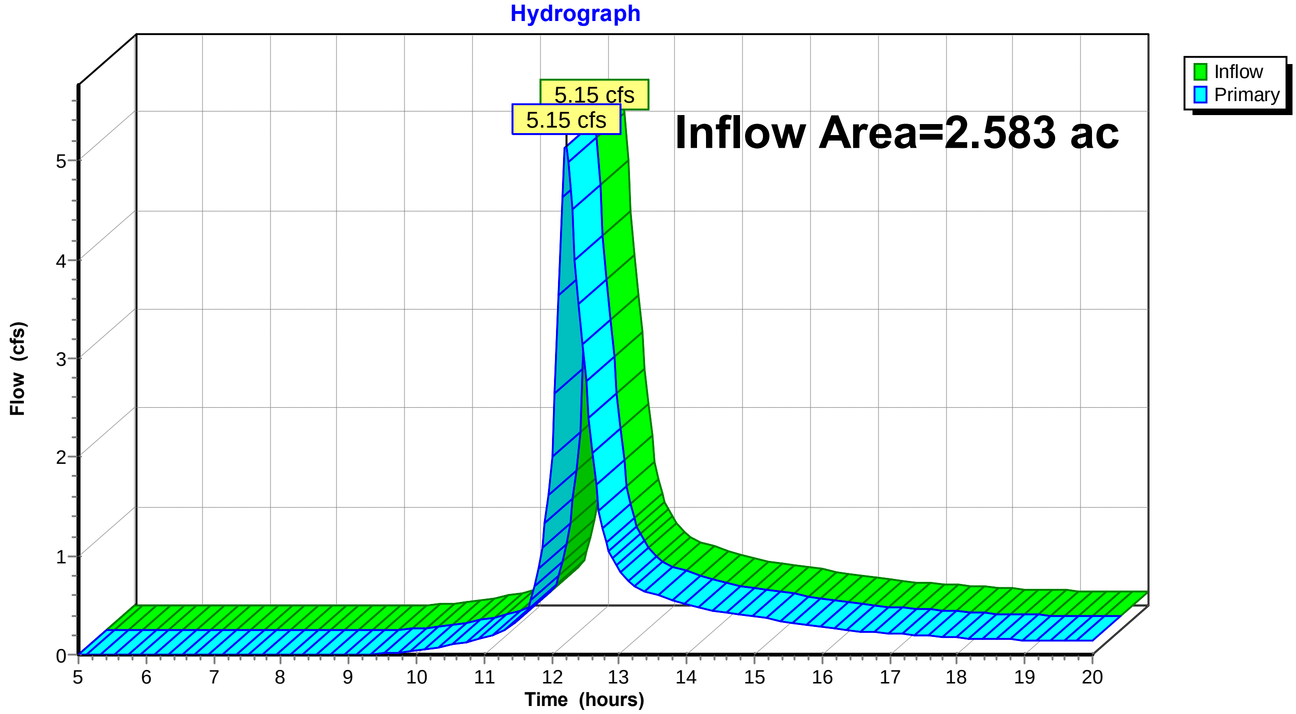


Summary for Link DP4: DP-4

Inflow Area =	2.583 ac,	4.18% Impervious,	Inflow Depth > 2.10"	for 10-Year event
Inflow =	5.15 cfs @	12.21 hrs, Volume=	0.453 af	
Primary =	5.15 cfs @	12.21 hrs, Volume=	0.453 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

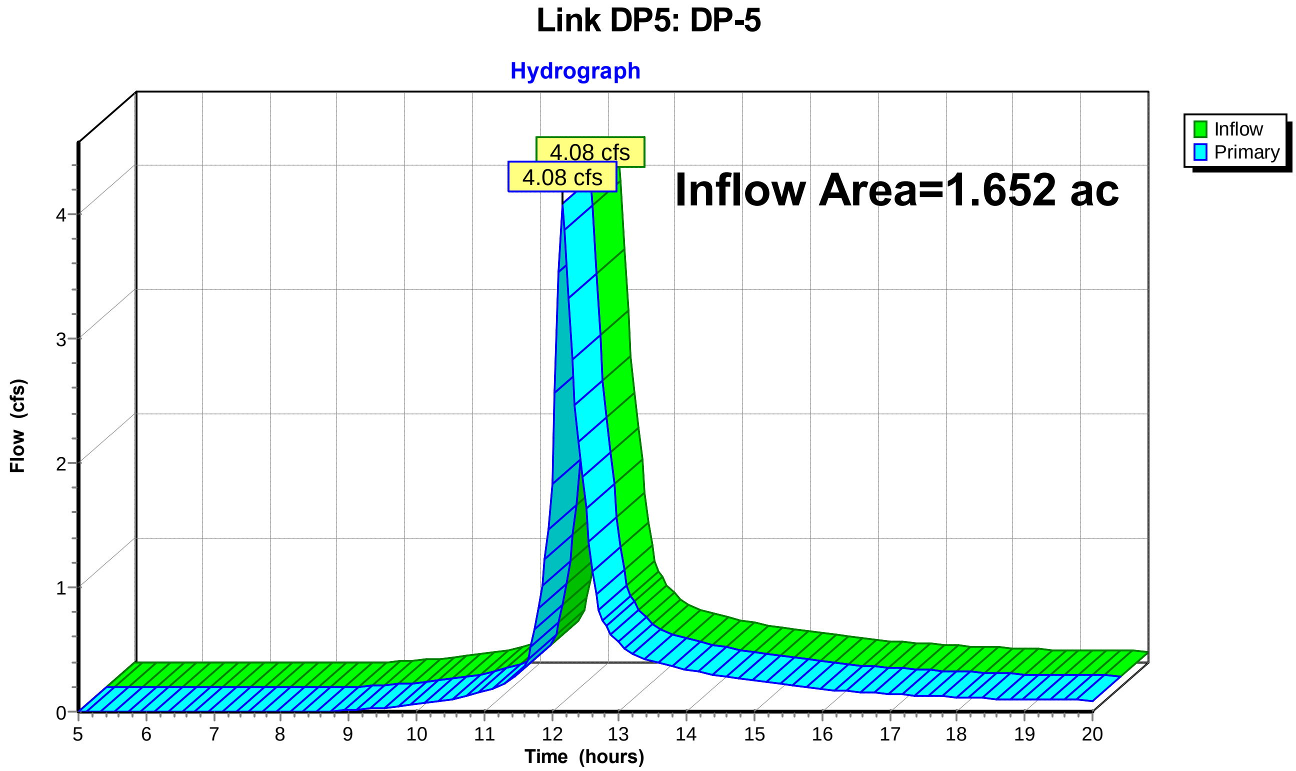
Link DP4: DP-4



Summary for Link DP5: DP-5

Inflow Area =	1.652 ac,	6.27% Impervious,	Inflow Depth > 2.35"	for 10-Year event	
Inflow =	4.08 cfs @	12.16 hrs,	Volume=	0.324 af	
Primary =	4.08 cfs @	12.16 hrs,	Volume=	0.324 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

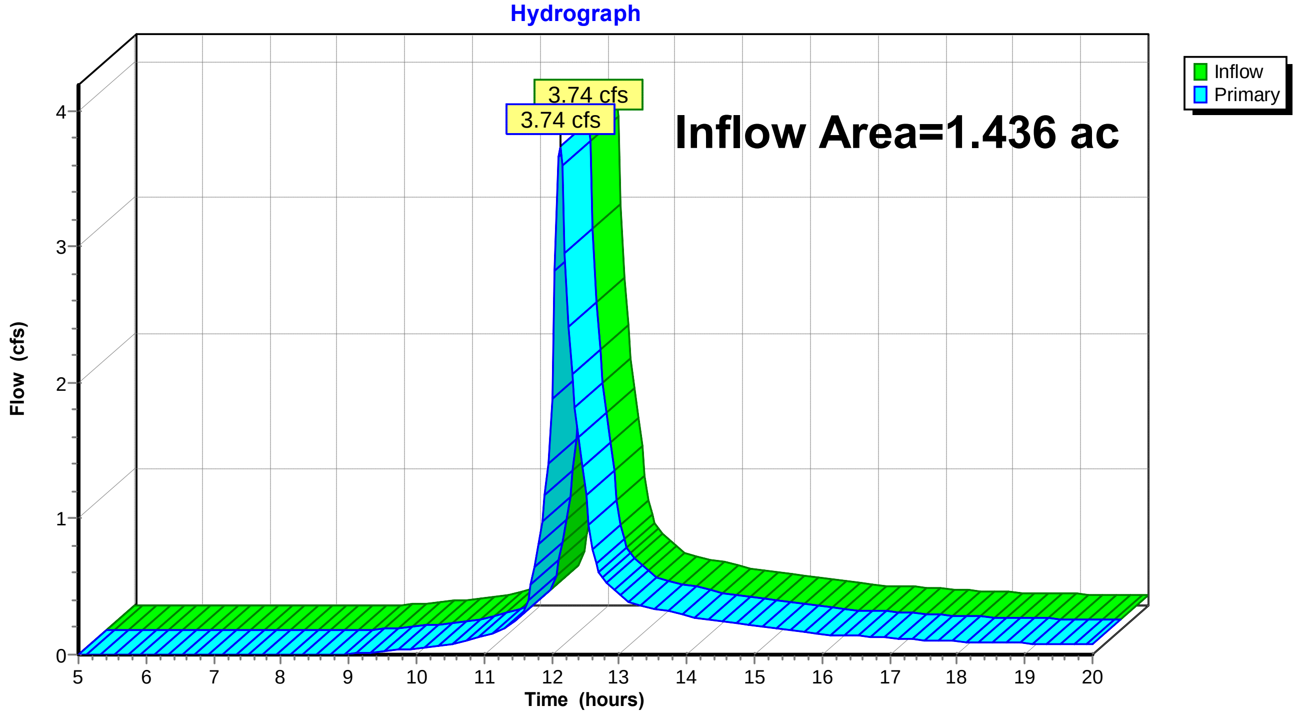


Summary for Link DP6: DP-6

Inflow Area =	1.436 ac,	2.95% Impervious,	Inflow Depth > 2.27"	for 10-Year event	
Inflow =	3.74 cfs @	12.12 hrs,	Volume=	0.272 af	
Primary =	3.74 cfs @	12.12 hrs,	Volume=	0.272 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP6: DP-6



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EXDA1ND: EXDA-1 Runoff Area=846,679 sf 5.80% Impervious Runoff Depth>2.42"
Flow Length=2,225' Tc=61.0 min CN=72 Runoff=23.49 cfs 3.923 af

Subcatchment EXDA2ND: EXDA-2 Runoff Area=259,066 sf 0.00% Impervious Runoff Depth>2.28"
Flow Length=620' Tc=36.0 min CN=70 Runoff=8.90 cfs 1.128 af

Subcatchment EXDA3ND: EXDA-3 Runoff Area=202,871 sf 2.14% Impervious Runoff Depth>2.36"
Flow Length=575' Tc=33.8 min CN=71 Runoff=7.46 cfs 0.917 af

Subcatchment EXDA4ND: EXDA-4 Runoff Area=112,514 sf 4.18% Impervious Runoff Depth>2.55"
Flow Length=430' Tc=15.0 min CN=73 Runoff=6.27 cfs 0.550 af

Subcatchment EXDA5ND: EXDA-5 Runoff Area=71,979 sf 6.27% Impervious Runoff Depth>2.83"
Flow Length=500' Tc=11.3 min CN=76 Runoff=4.90 cfs 0.389 af

Subcatchment EXDA6ND: EXDA-6 Runoff Area=62,545 sf 2.95% Impervious Runoff Depth>2.74"
Flow Length=350' Tc=8.3 min CN=75 Runoff=4.51 cfs 0.328 af

Link DP1: DP-1 Inflow=23.49 cfs 3.923 af
Primary=23.49 cfs 3.923 af

Link DP2: DP-2 Inflow=8.90 cfs 1.128 af
Primary=8.90 cfs 1.128 af

Link DP3: DP-3 Inflow=7.46 cfs 0.917 af
Primary=7.46 cfs 0.917 af

Link DP4: DP-4 Inflow=6.27 cfs 0.550 af
Primary=6.27 cfs 0.550 af

Link DP5: DP-5 Inflow=4.90 cfs 0.389 af
Primary=4.90 cfs 0.389 af

Link DP6: DP-6 Inflow=4.51 cfs 0.328 af
Primary=4.51 cfs 0.328 af

Total Runoff Area = 35.713 ac Runoff Volume = 7.234 af Average Runoff Depth = 2.43"
95.85% Pervious = 34.232 ac 4.15% Impervious = 1.481 ac

Summary for Subcatchment EXDA1ND: EXDA-1

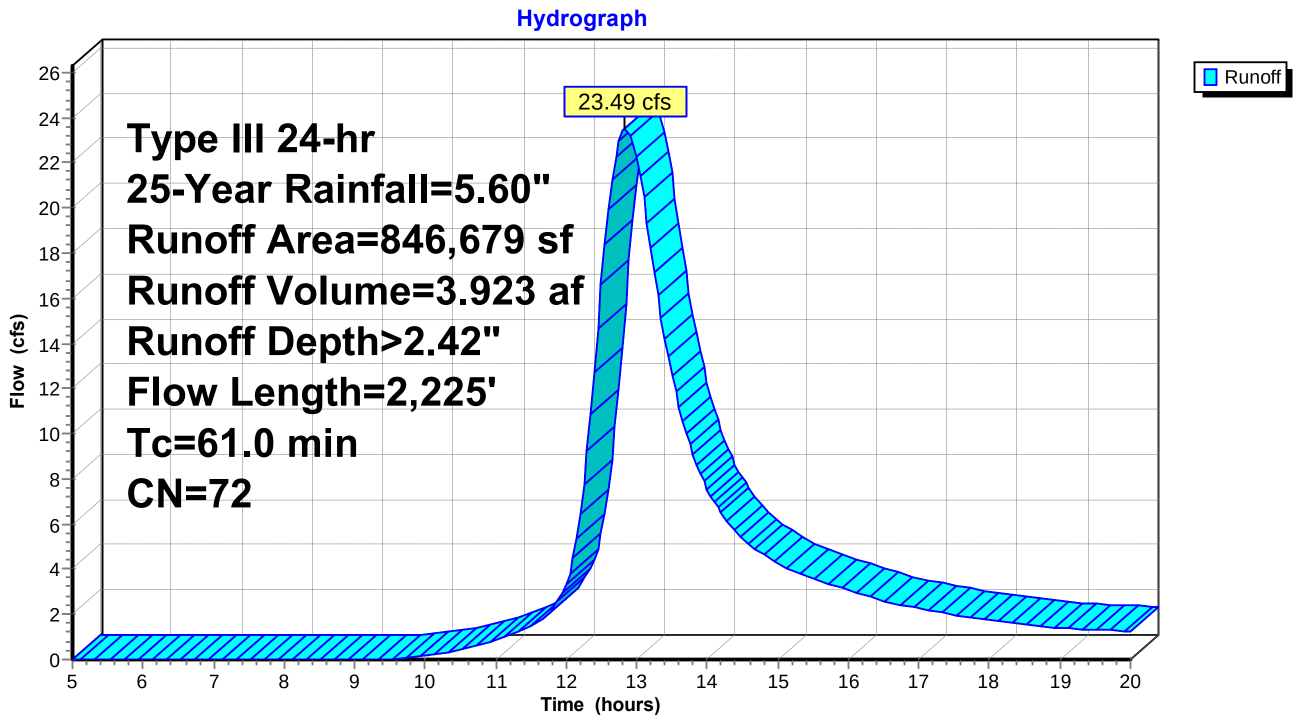
Runoff = 23.49 cfs @ 12.84 hrs, Volume= 3.923 af, Depth> 2.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.60"

Area (sf)	CN	Description
685,262	70	Woods, Good, HSG C
97,176	74	Pasture/grassland/range, Good, HSG C
15,129	71	Meadow, non-grazed, HSG C
49,112	98	Impervious, HSG C
846,679	72	Weighted Average
797,567		94.20% Pervious Area
49,112		5.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.0	250	0.0320	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
23.0	1,450	0.0440	1.05		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	525	0.0570	8.87	53.22	**Channel Flow,** Area= 6.0 sf Perim= 6.0' r= 1.00' n= 0.040 Earth, cobble bottom, clean sides
61.0	2,225	Total			

Subcatchment EXDA1ND: EXDA-1



Summary for Subcatchment EXDA2ND: EXDA-2

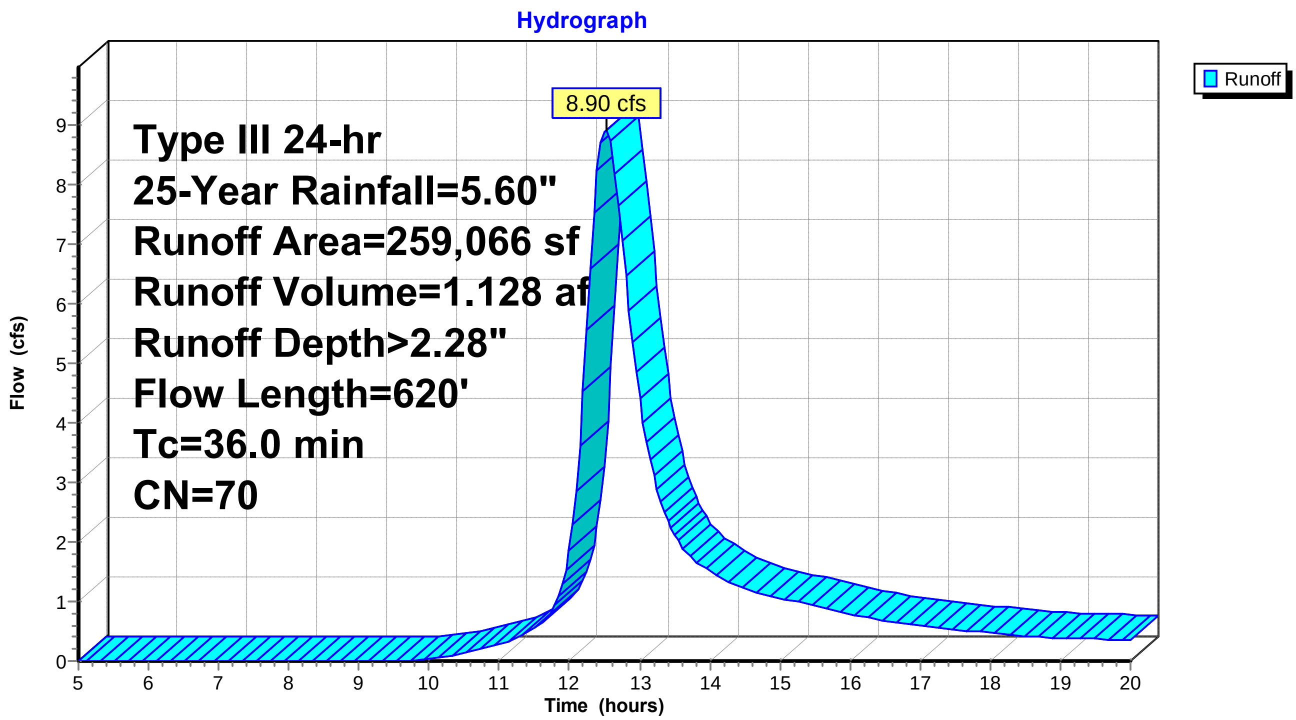
Runoff = 8.90 cfs @ 12.52 hrs, Volume= 1.128 af, Depth> 2.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.60"

Area (sf)	CN	Description
259,066	70	Woods, Good, HSG C
259,066		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.6	250	0.0440	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
3.4	370	0.1300	1.80		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
36.0	620	Total			

Subcatchment EXDA2ND: EXDA-2



Summary for Subcatchment EXDA3ND: EXDA-3

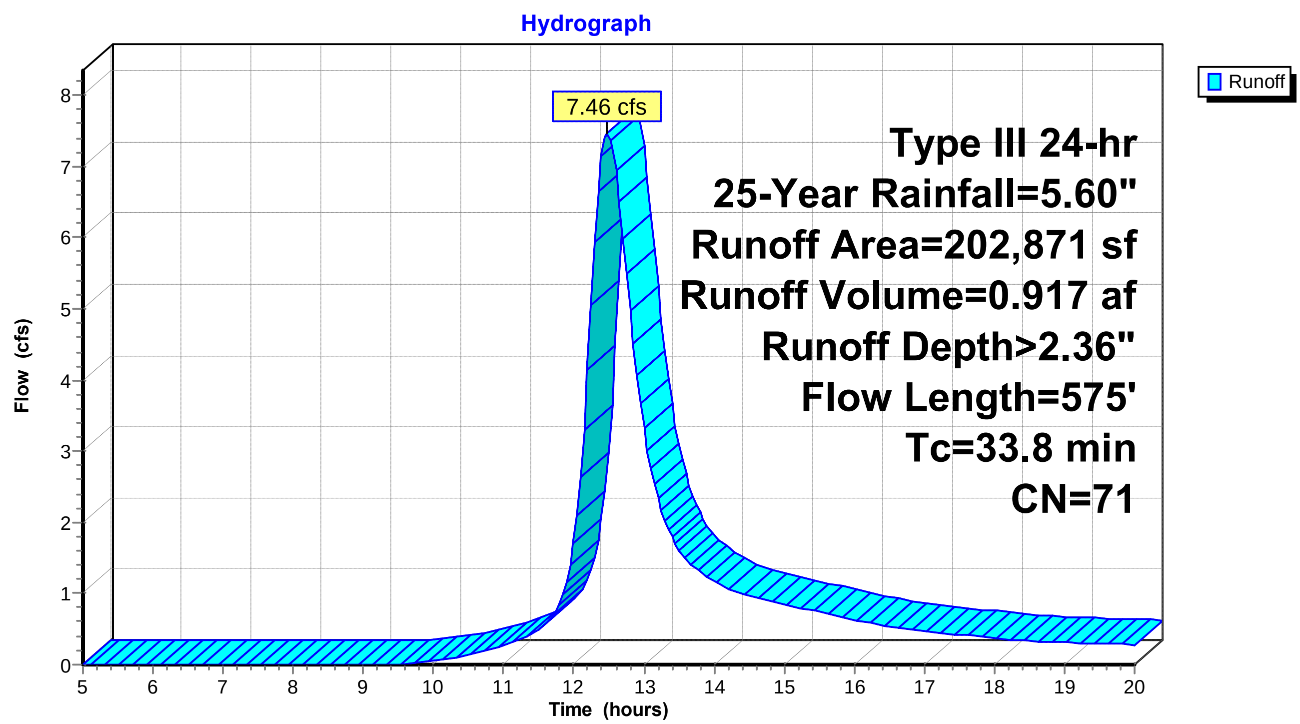
Runoff = 7.46 cfs @ 12.48 hrs, Volume= 0.917 af, Depth> 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.60"

Area (sf)	CN	Description
68,828	71	Meadow, non-grazed, HSG C
122,188	70	Woods, Good, HSG C
7,515	74	Pasture/grassland/range, Good, HSG C
4,340	98	Impervious, HSG C
202,871	71	Weighted Average
198,531		97.86% Pervious Area
4,340		2.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.5	250	0.0520	0.14		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
3.3	325	0.1110	1.67		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
33.8	575	Total			

Subcatchment EXDA3ND: EXDA-3



Summary for Subcatchment EXDA4ND: EXDA-4

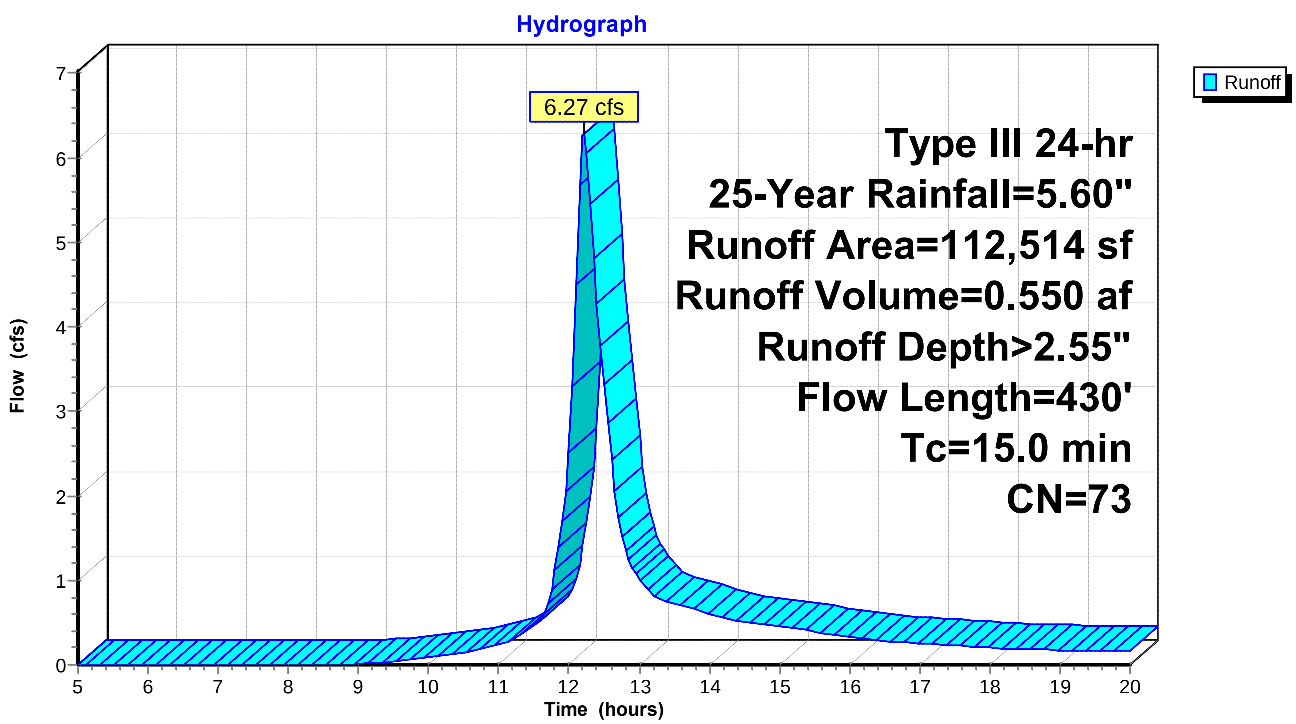
Runoff = 6.27 cfs @ 12.21 hrs, Volume= 0.550 af, Depth> 2.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.60"

	Area (sf)	CN	Description
	31,444	74	Pasture/grassland/range, Good, HSG C
	76,369	71	Meadow, non-grazed, HSG C
*	4,701	98	Impervious
	112,514	73	Weighted Average
	107,813		95.82% Pervious Area
	4,701		4.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.9	250	0.0520	0.30		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.1	180	0.1500	2.71		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
15.0	430	Total			

Subcatchment EXDA4ND: EXDA-4



Summary for Subcatchment EXDA5ND: EXDA-5

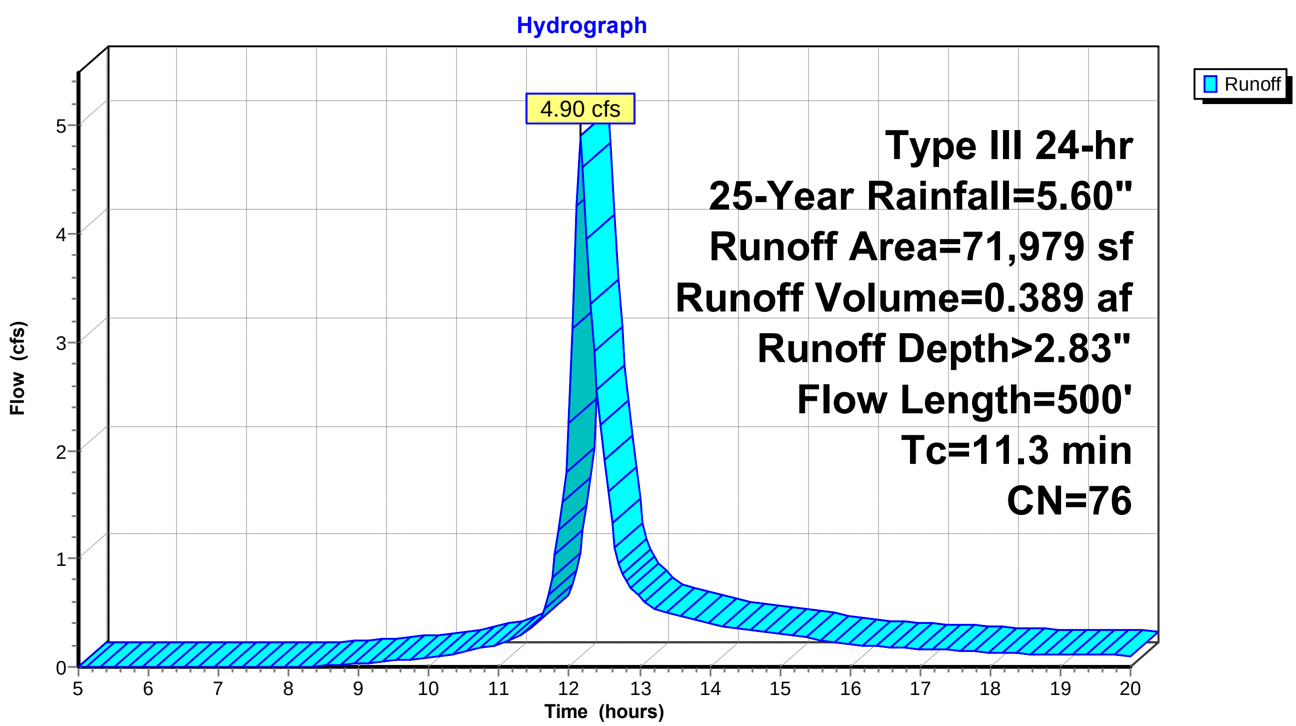
Runoff = 4.90 cfs @ 12.16 hrs, Volume= 0.389 af, Depth> 2.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.60"

Area (sf)	CN	Description
4,515	98	Impervious, HSG C
67,464	74	Pasture/grassland/range, Good, HSG C
71,979	76	Weighted Average
67,464		93.73% Pervious Area
4,515		6.27% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.3	150	0.0400	0.24		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.0	350	0.1350	5.92		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
11.3	500	Total			

Subcatchment EXDA5ND: EXDA-5



Summary for Subcatchment EXDA6ND: EXDA-6

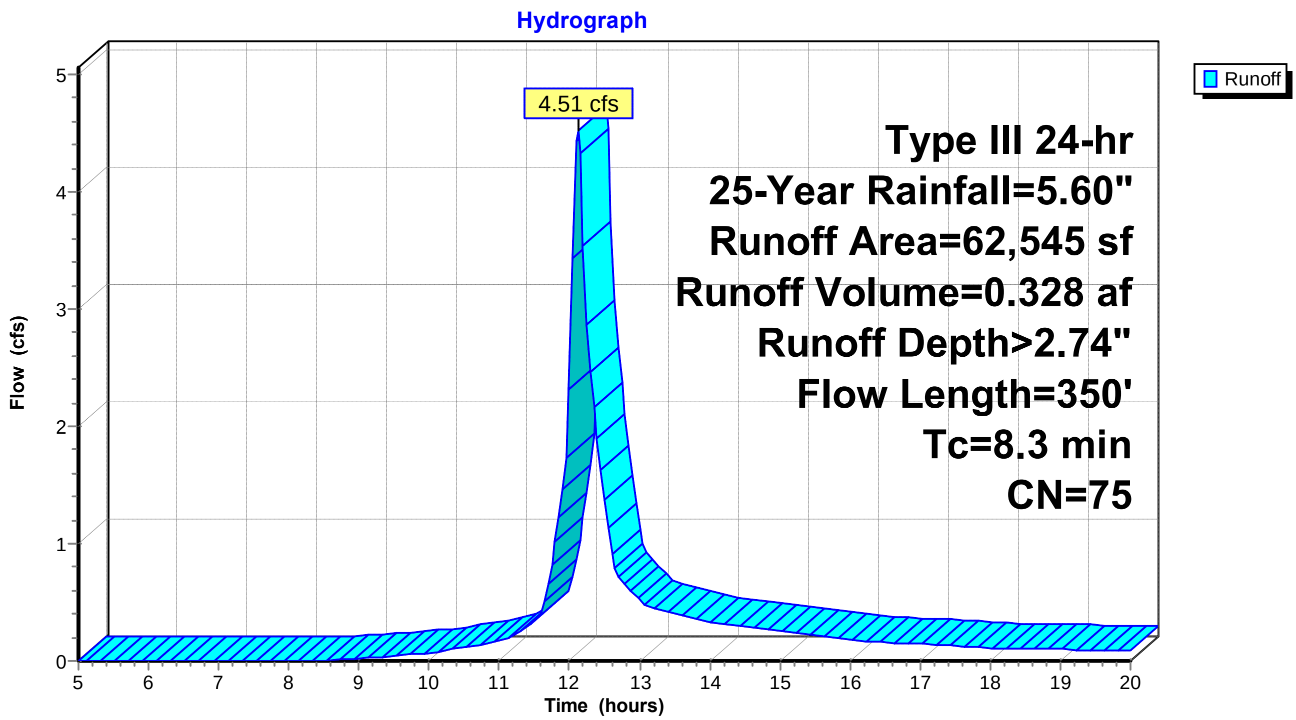
Runoff = 4.51 cfs @ 12.12 hrs, Volume= 0.328 af, Depth> 2.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.60"

Area (sf)	CN	Description
60,703	74	Pasture/grassland/range, Good, HSG C
1,842	98	Impervious, HSG C
62,545	75	Weighted Average
60,703		97.05% Pervious Area
1,842		2.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.7	100	0.0360	0.22		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.6	250	0.2050	7.29		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.3	350	Total			

Subcatchment EXDA6ND: EXDA-6

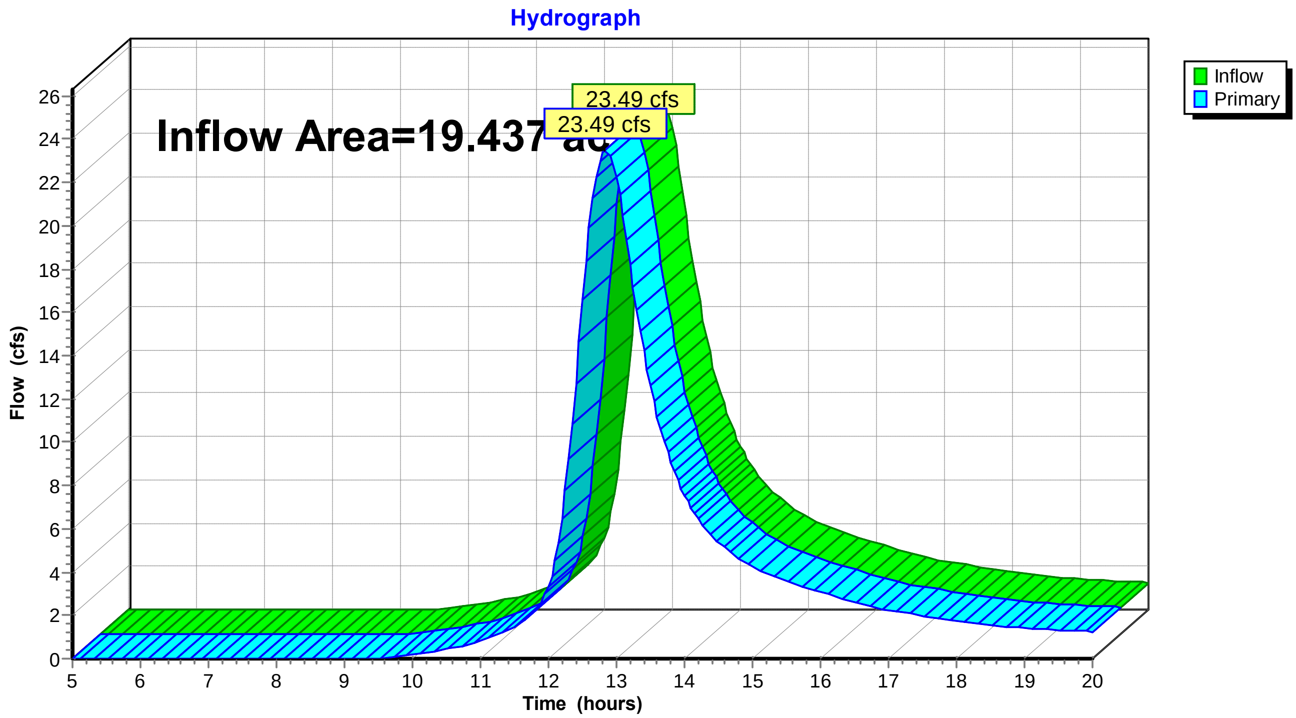


Summary for Link DP1: DP-1

Inflow Area =	19.437 ac,	5.80% Impervious,	Inflow Depth > 2.42"	for 25-Year event
Inflow =	23.49 cfs @	12.84 hrs, Volume=	3.923 af	
Primary =	23.49 cfs @	12.84 hrs, Volume=	3.923 af, Atten= 0%, Lag= 0.0 min	

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP1: DP-1

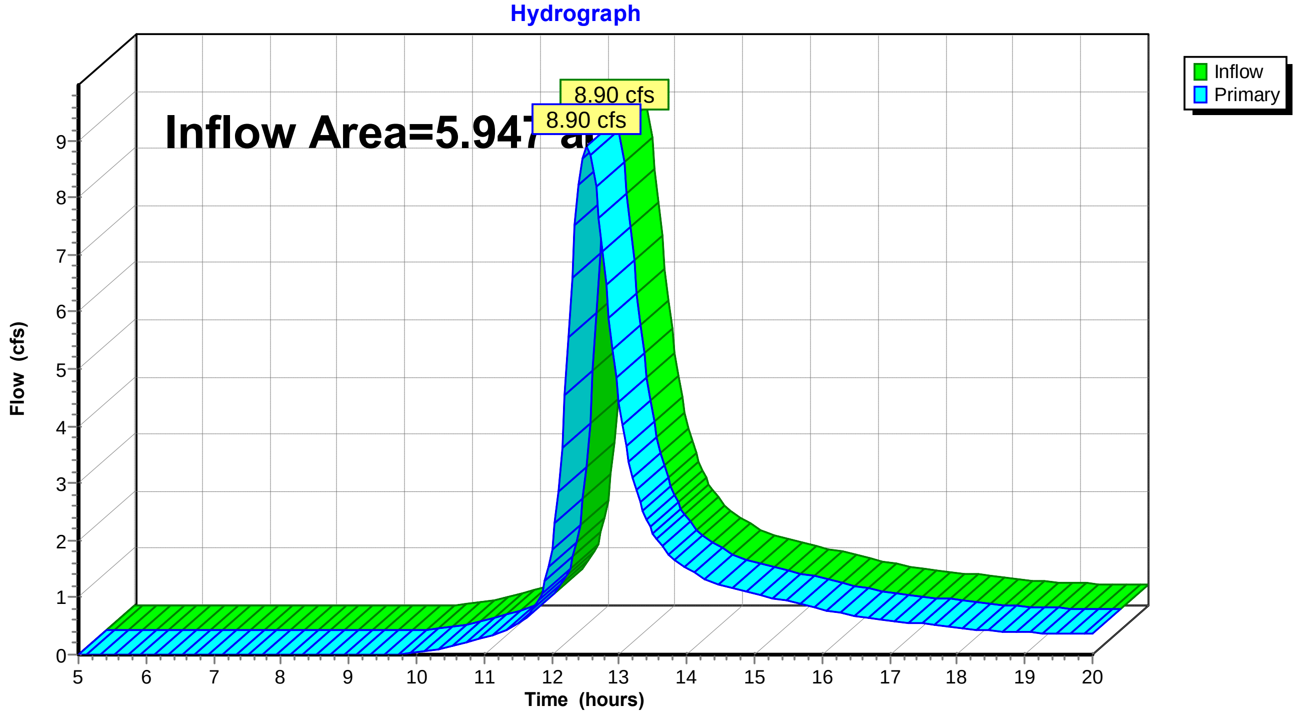


Summary for Link DP2: DP-2

Inflow Area =	5.947 ac,	0.00% Impervious,	Inflow Depth > 2.28"	for 25-Year event	
Inflow =	8.90 cfs @	12.52 hrs,	Volume=	1.128 af	
Primary =	8.90 cfs @	12.52 hrs,	Volume=	1.128 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP2: DP-2

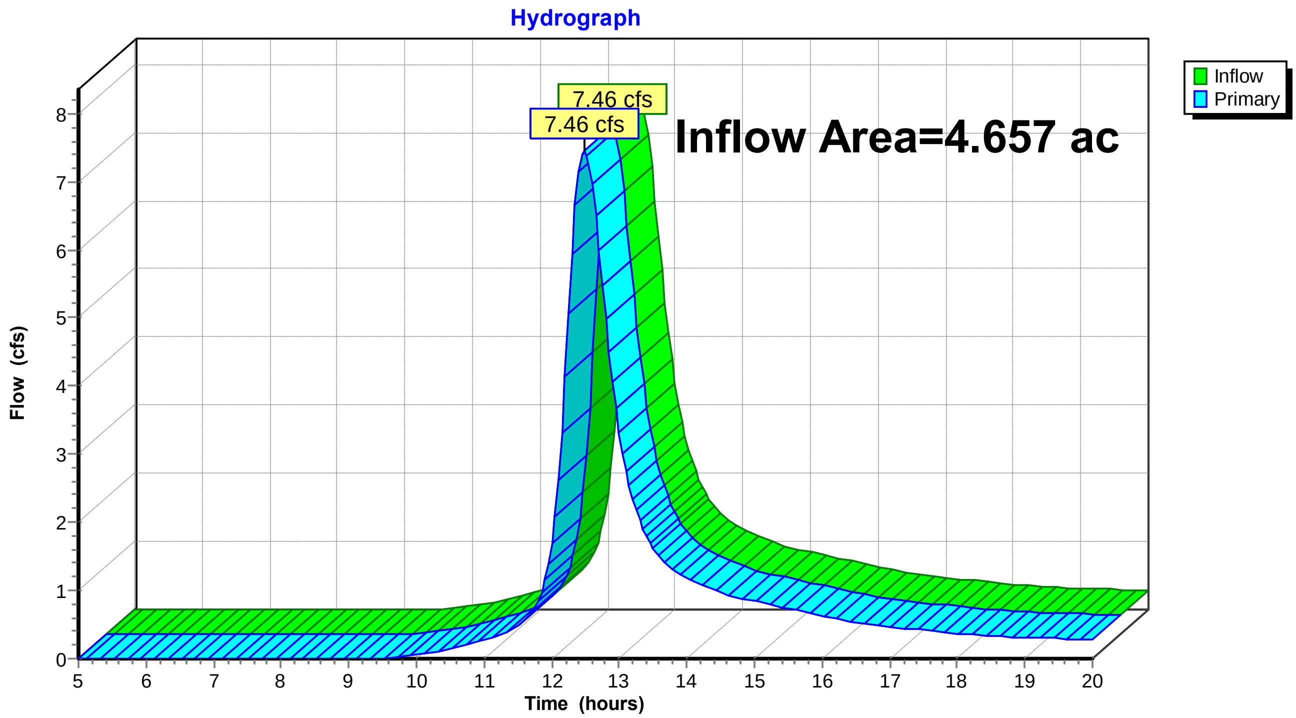


Summary for Link DP3: DP-3

Inflow Area = 4.657 ac, 2.14% Impervious, Inflow Depth > 2.36" for 25-Year event
Inflow = 7.46 cfs @ 12.48 hrs, Volume= 0.917 af
Primary = 7.46 cfs @ 12.48 hrs, Volume= 0.917 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP3: DP-3

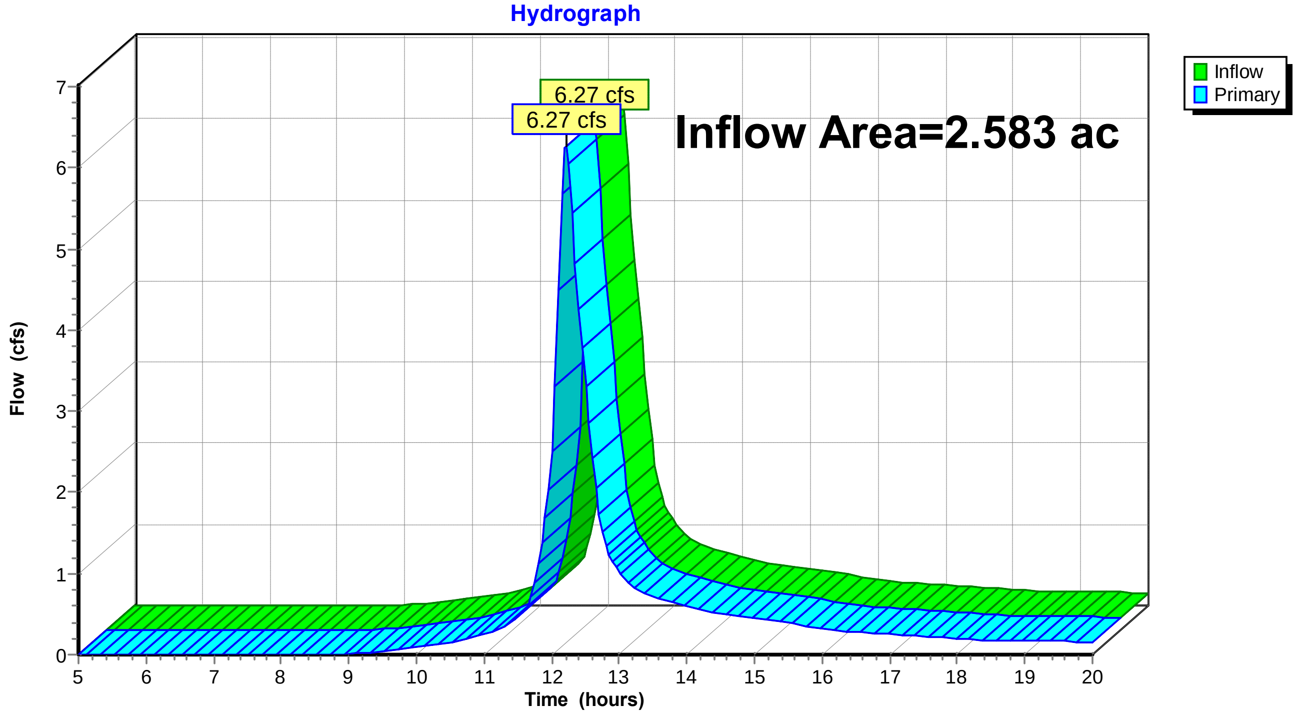


Summary for Link DP4: DP-4

Inflow Area = 2.583 ac, 4.18% Impervious, Inflow Depth > 2.55" for 25-Year event
Inflow = 6.27 cfs @ 12.21 hrs, Volume= 0.550 af
Primary = 6.27 cfs @ 12.21 hrs, Volume= 0.550 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

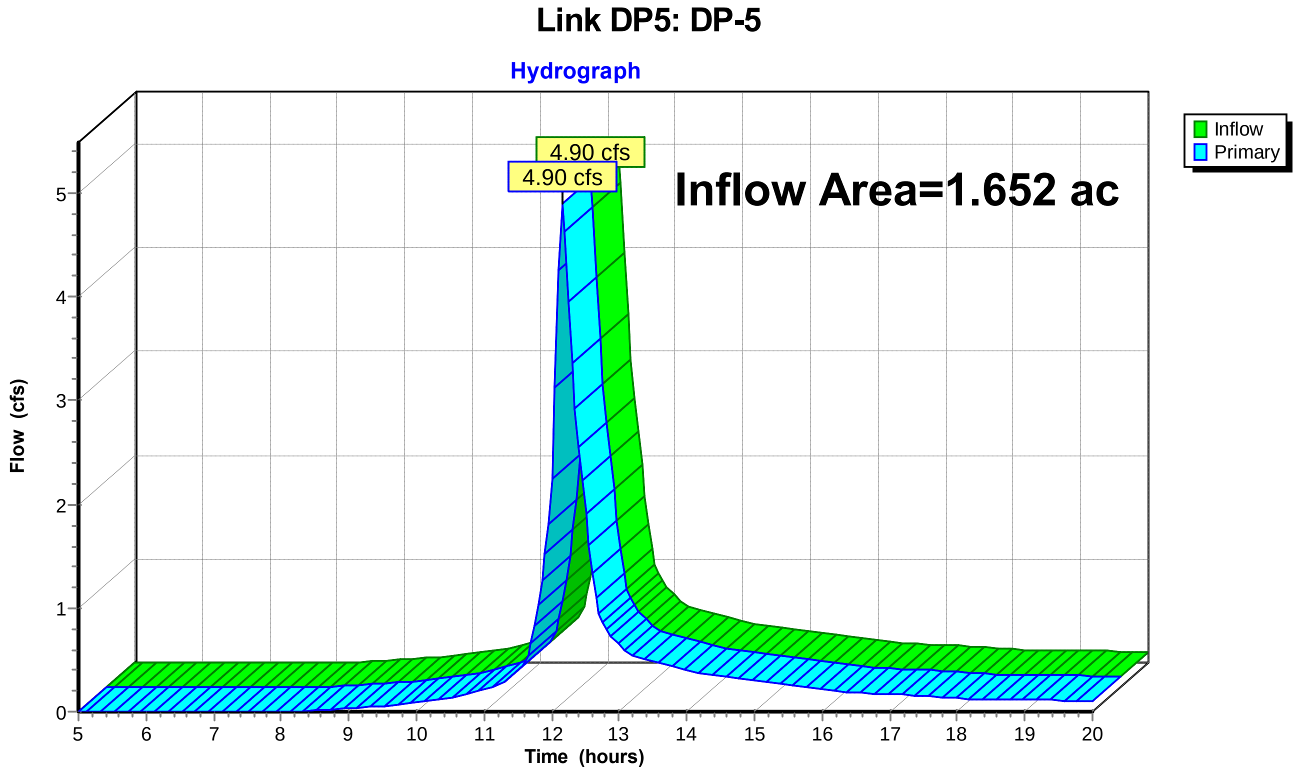
Link DP4: DP-4



Summary for Link DP5: DP-5

Inflow Area =	1.652 ac,	6.27% Impervious,	Inflow Depth > 2.83"	for 25-Year event
Inflow =	4.90 cfs @	12.16 hrs, Volume=	0.389 af	
Primary =	4.90 cfs @	12.16 hrs, Volume=	0.389 af, Atten= 0%, Lag= 0.0 min	

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

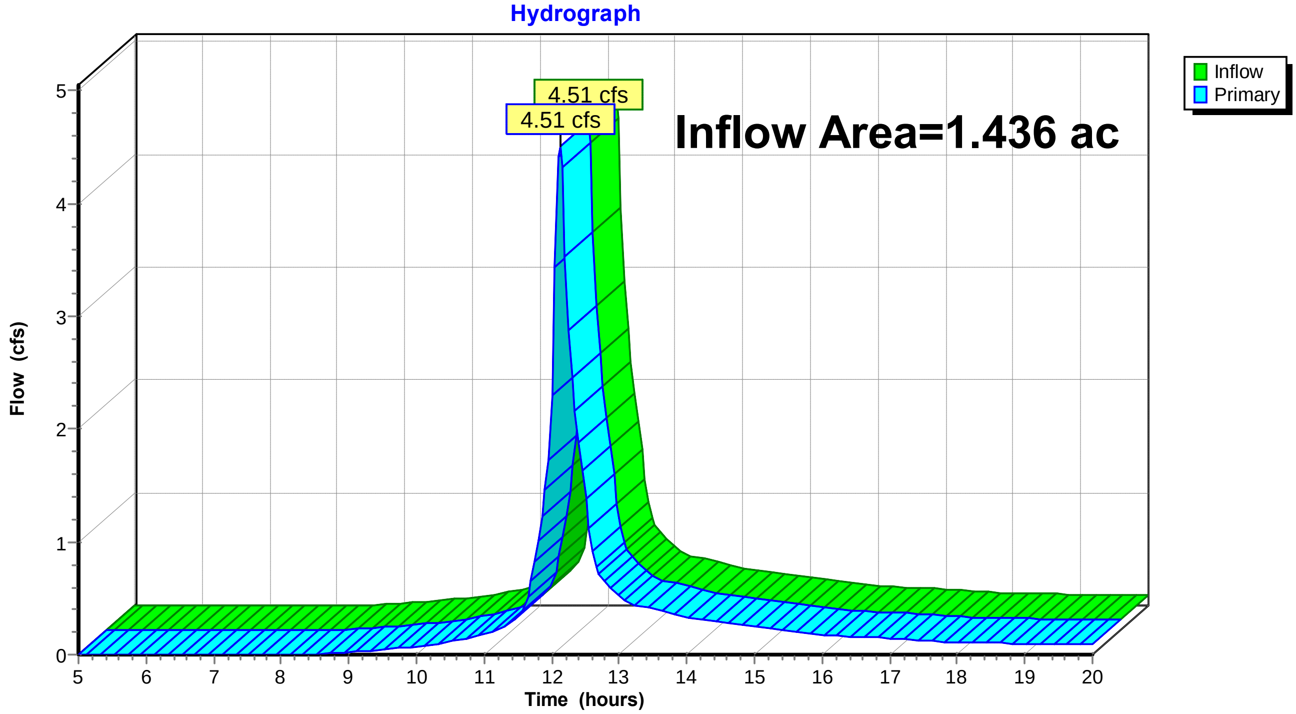


Summary for Link DP6: DP-6

Inflow Area =	1.436 ac,	2.95% Impervious, Inflow Depth > 2.74"		for 25-Year event
Inflow =	4.51 cfs @	12.12 hrs, Volume=	0.328 af	
Primary =	4.51 cfs @	12.12 hrs, Volume=	0.328 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP6: DP-6



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EXDA1ND: EXDA-1 Runoff Area=846,679 sf 5.80% Impervious Runoff Depth>2.95"
Flow Length=2,225' Tc=61.0 min CN=72 Runoff=28.66 cfs 4.781 af

Subcatchment EXDA2ND: EXDA-2 Runoff Area=259,066 sf 0.00% Impervious Runoff Depth>2.79"
Flow Length=620' Tc=36.0 min CN=70 Runoff=10.95 cfs 1.384 af

Subcatchment EXDA3ND: EXDA-3 Runoff Area=202,871 sf 2.14% Impervious Runoff Depth>2.89"
Flow Length=575' Tc=33.8 min CN=71 Runoff=9.13 cfs 1.121 af

Subcatchment EXDA4ND: EXDA-4 Runoff Area=112,514 sf 4.18% Impervious Runoff Depth>3.10"
Flow Length=430' Tc=15.0 min CN=73 Runoff=7.62 cfs 0.667 af

Subcatchment EXDA5ND: EXDA-5 Runoff Area=71,979 sf 6.27% Impervious Runoff Depth>3.39"
Flow Length=500' Tc=11.3 min CN=76 Runoff=5.88 cfs 0.467 af

Subcatchment EXDA6ND: EXDA-6 Runoff Area=62,545 sf 2.95% Impervious Runoff Depth>3.30"
Flow Length=350' Tc=8.3 min CN=75 Runoff=5.43 cfs 0.395 af

Link DP1: DP-1 Inflow=28.66 cfs 4.781 af
Primary=28.66 cfs 4.781 af

Link DP2: DP-2 Inflow=10.95 cfs 1.384 af
Primary=10.95 cfs 1.384 af

Link DP3: DP-3 Inflow=9.13 cfs 1.121 af
Primary=9.13 cfs 1.121 af

Link DP4: DP-4 Inflow=7.62 cfs 0.667 af
Primary=7.62 cfs 0.667 af

Link DP5: DP-5 Inflow=5.88 cfs 0.467 af
Primary=5.88 cfs 0.467 af

Link DP6: DP-6 Inflow=5.43 cfs 0.395 af
Primary=5.43 cfs 0.395 af

Total Runoff Area = 35.713 ac Runoff Volume = 8.815 af Average Runoff Depth = 2.96"
95.85% Pervious = 34.232 ac 4.15% Impervious = 1.481 ac

Summary for Subcatchment EXDA1ND: EXDA-1

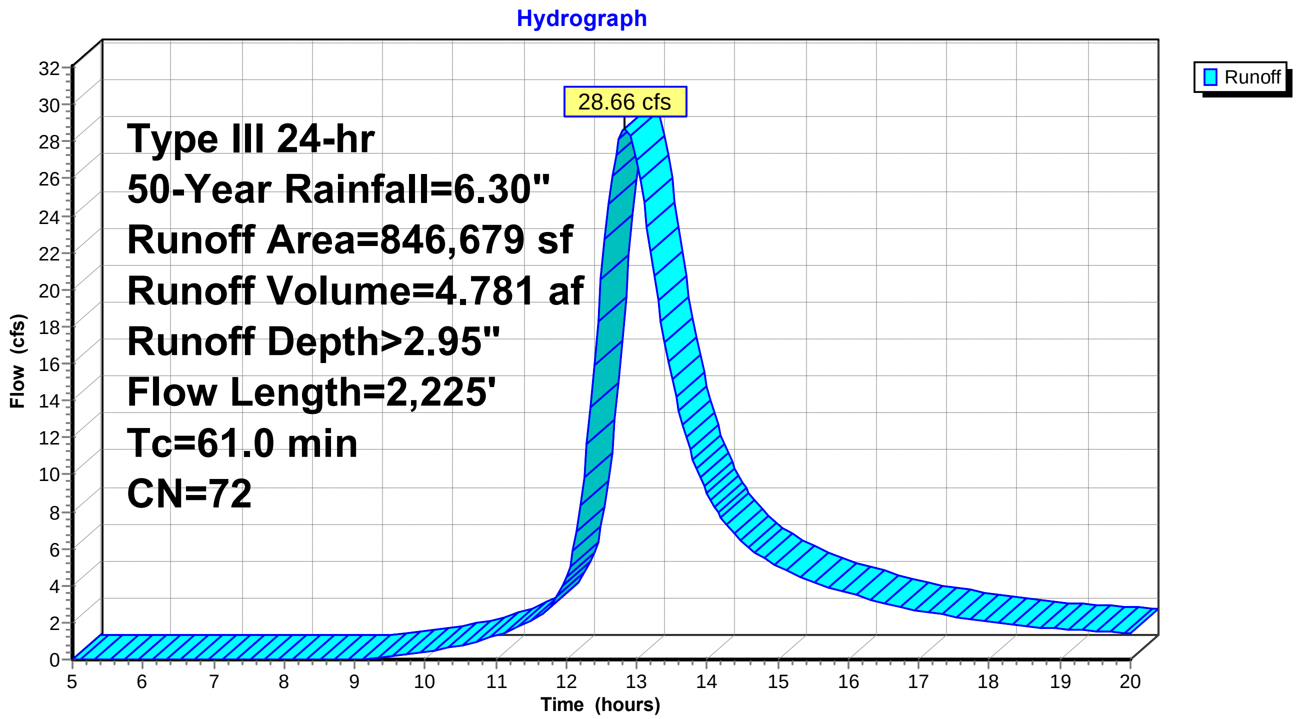
Runoff = 28.66 cfs @ 12.83 hrs, Volume= 4.781 af, Depth> 2.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.30"

Area (sf)	CN	Description
685,262	70	Woods, Good, HSG C
97,176	74	Pasture/grassland/range, Good, HSG C
15,129	71	Meadow, non-grazed, HSG C
49,112	98	Impervious, HSG C
846,679	72	Weighted Average
797,567		94.20% Pervious Area
49,112		5.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.0	250	0.0320	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
23.0	1,450	0.0440	1.05		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	525	0.0570	8.87	53.22	**Channel Flow,** Area= 6.0 sf Perim= 6.0' r= 1.00' n= 0.040 Earth, cobble bottom, clean sides
61.0	2,225	Total			

Subcatchment EXDA1ND: EXDA-1



Summary for Subcatchment EXDA2ND: EXDA-2

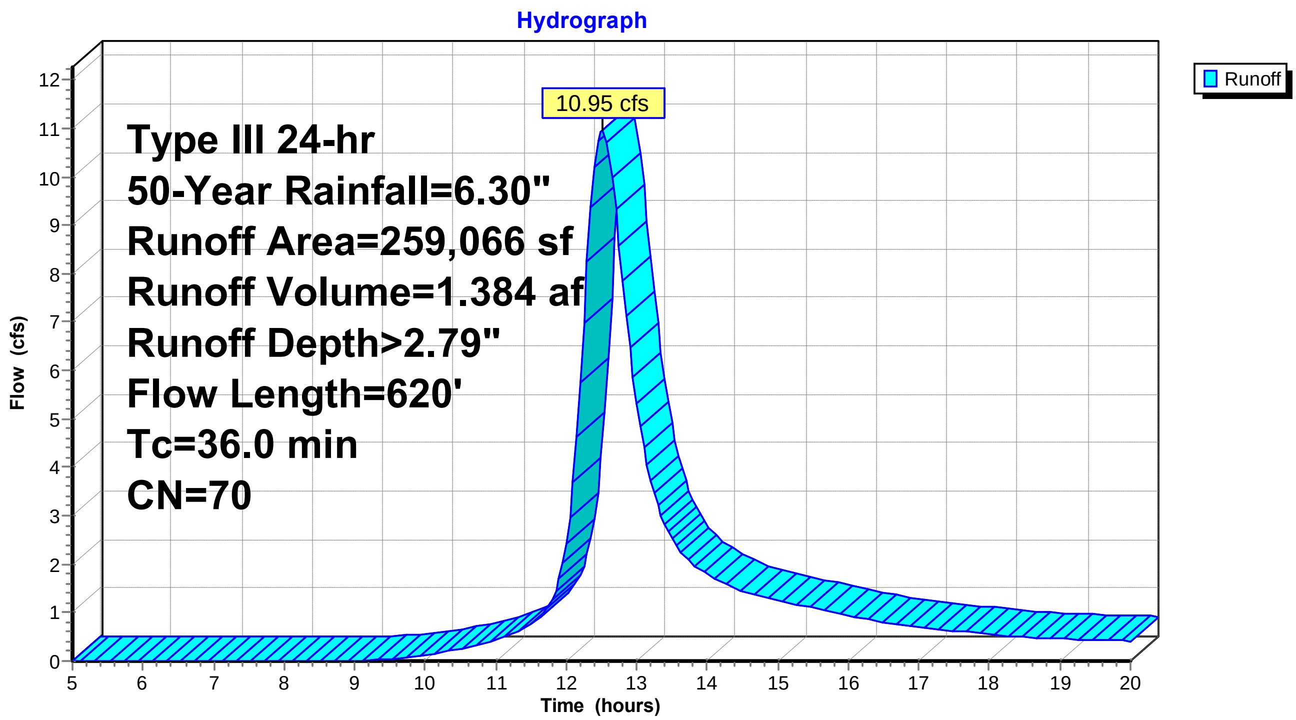
Runoff = 10.95 cfs @ 12.51 hrs, Volume= 1.384 af, Depth> 2.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.30"

Area (sf)	CN	Description
259,066	70	Woods, Good, HSG C
259,066		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.6	250	0.0440	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
3.4	370	0.1300	1.80		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
36.0	620	Total			

Subcatchment EXDA2ND: EXDA-2



Summary for Subcatchment EXDA3ND: EXDA-3

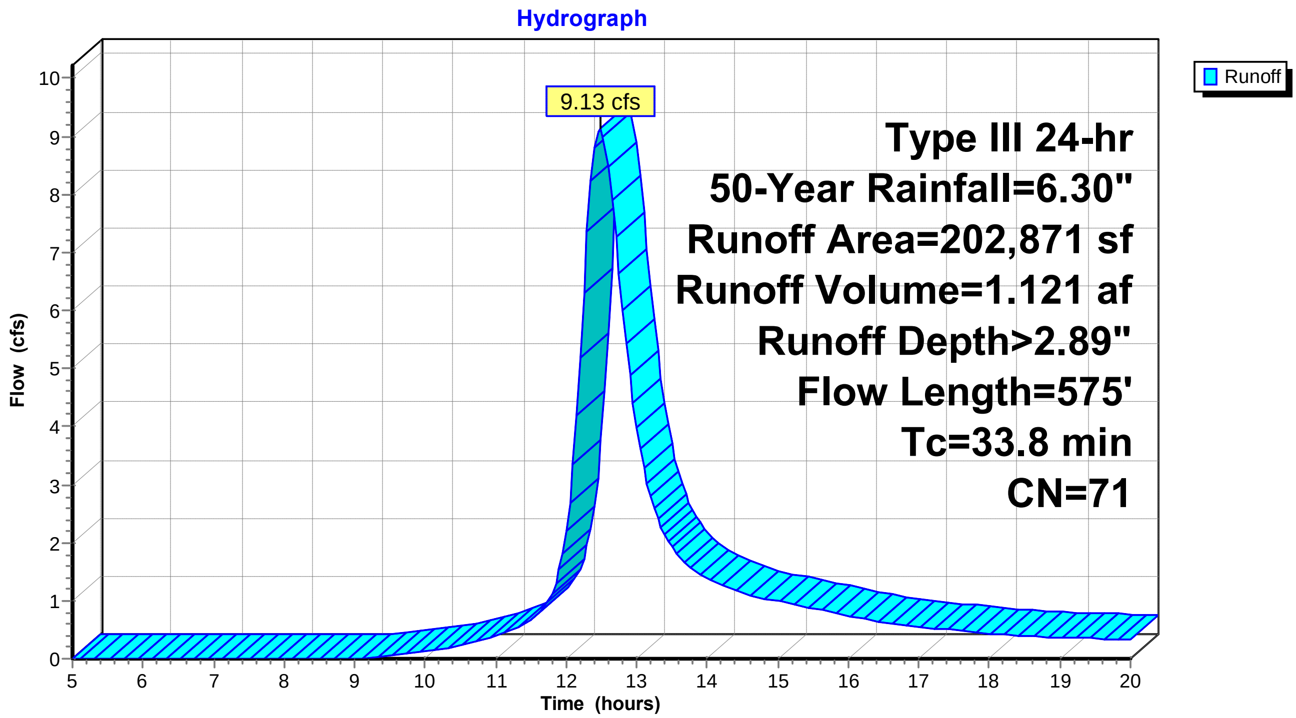
Runoff = 9.13 cfs @ 12.48 hrs, Volume= 1.121 af, Depth> 2.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.30"

Area (sf)	CN	Description
68,828	71	Meadow, non-grazed, HSG C
122,188	70	Woods, Good, HSG C
7,515	74	Pasture/grassland/range, Good, HSG C
4,340	98	Impervious, HSG C
202,871	71	Weighted Average
198,531		97.86% Pervious Area
4,340		2.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.5	250	0.0520	0.14		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
3.3	325	0.1110	1.67		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
33.8	575	Total			

Subcatchment EXDA3ND: EXDA-3



Summary for Subcatchment EXDA4ND: EXDA-4

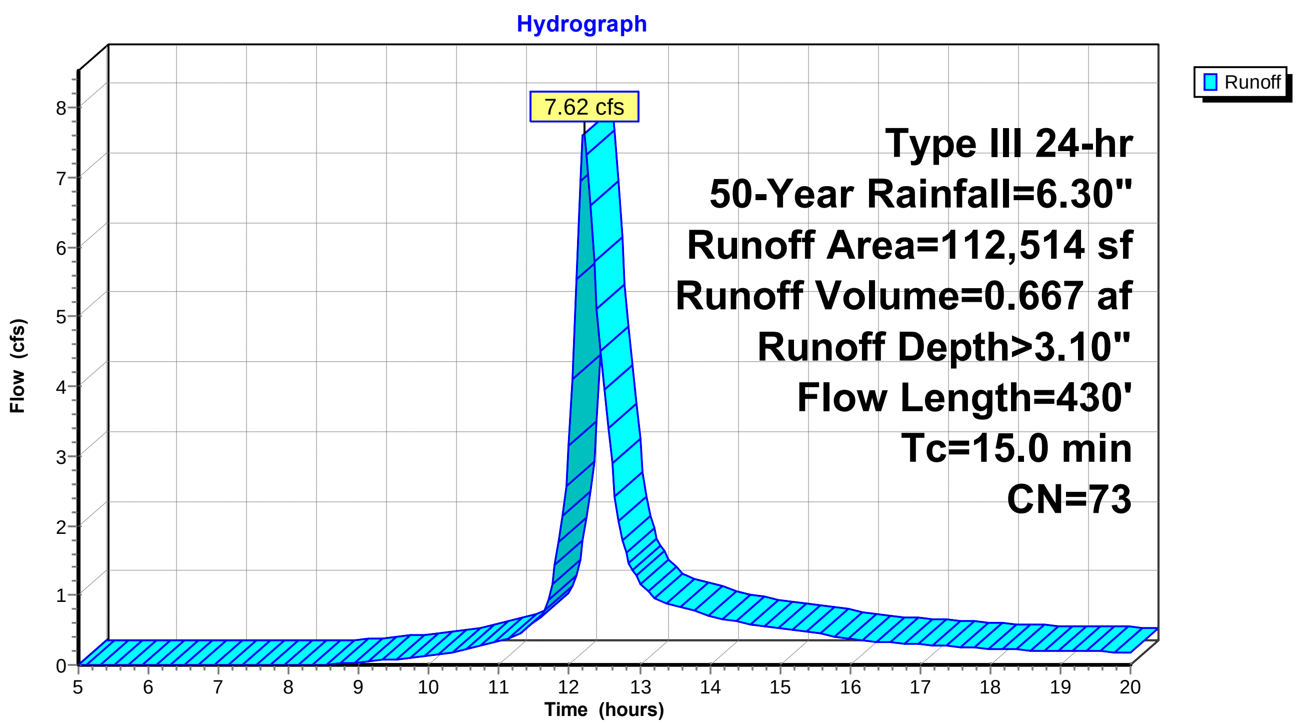
Runoff = 7.62 cfs @ 12.21 hrs, Volume= 0.667 af, Depth> 3.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.30"

	Area (sf)	CN	Description
	31,444	74	Pasture/grassland/range, Good, HSG C
	76,369	71	Meadow, non-grazed, HSG C
*	4,701	98	Impervious
	112,514	73	Weighted Average
	107,813		95.82% Pervious Area
	4,701		4.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.9	250	0.0520	0.30		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.1	180	0.1500	2.71		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
15.0	430	Total			

Subcatchment EXDA4ND: EXDA-4



Summary for Subcatchment EXDA5ND: EXDA-5

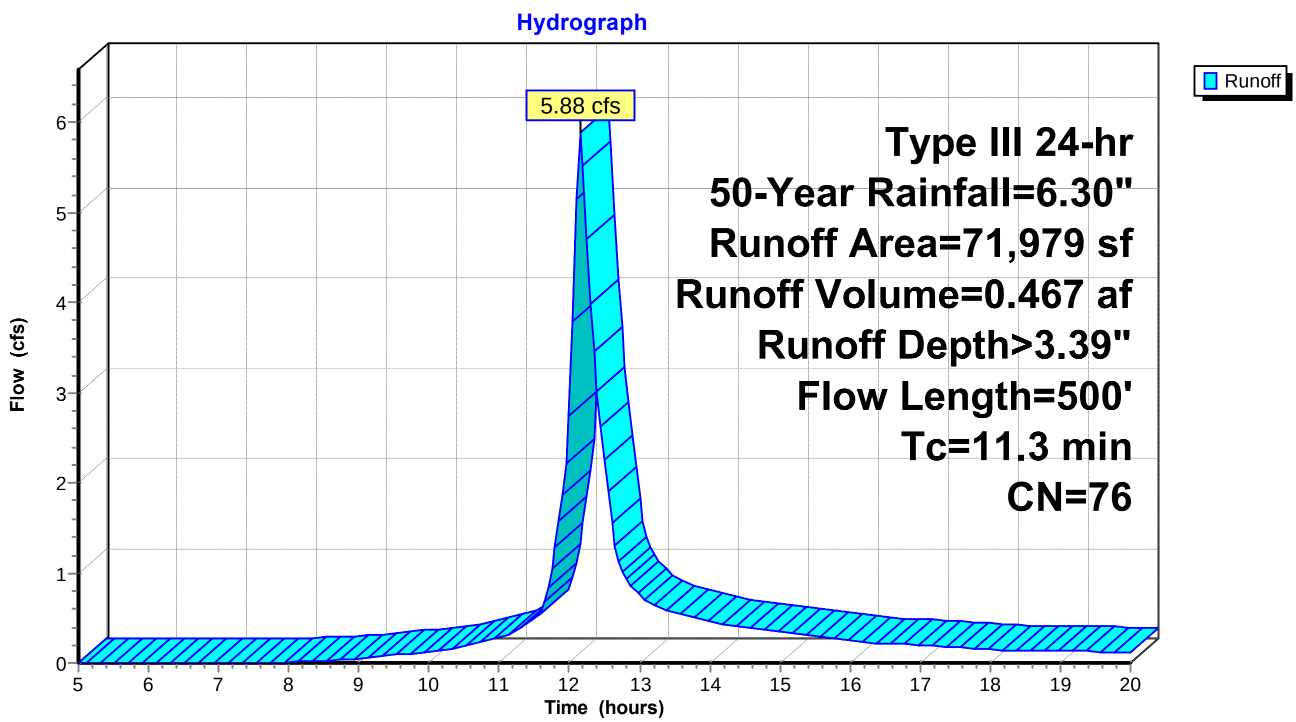
Runoff = 5.88 cfs @ 12.16 hrs, Volume= 0.467 af, Depth> 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.30"

Area (sf)	CN	Description
4,515	98	Impervious, HSG C
67,464	74	Pasture/grassland/range, Good, HSG C
71,979	76	Weighted Average
67,464		93.73% Pervious Area
4,515		6.27% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.3	150	0.0400	0.24		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.0	350	0.1350	5.92		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
11.3	500	Total			

Subcatchment EXDA5ND: EXDA-5



Summary for Subcatchment EXDA6ND: EXDA-6

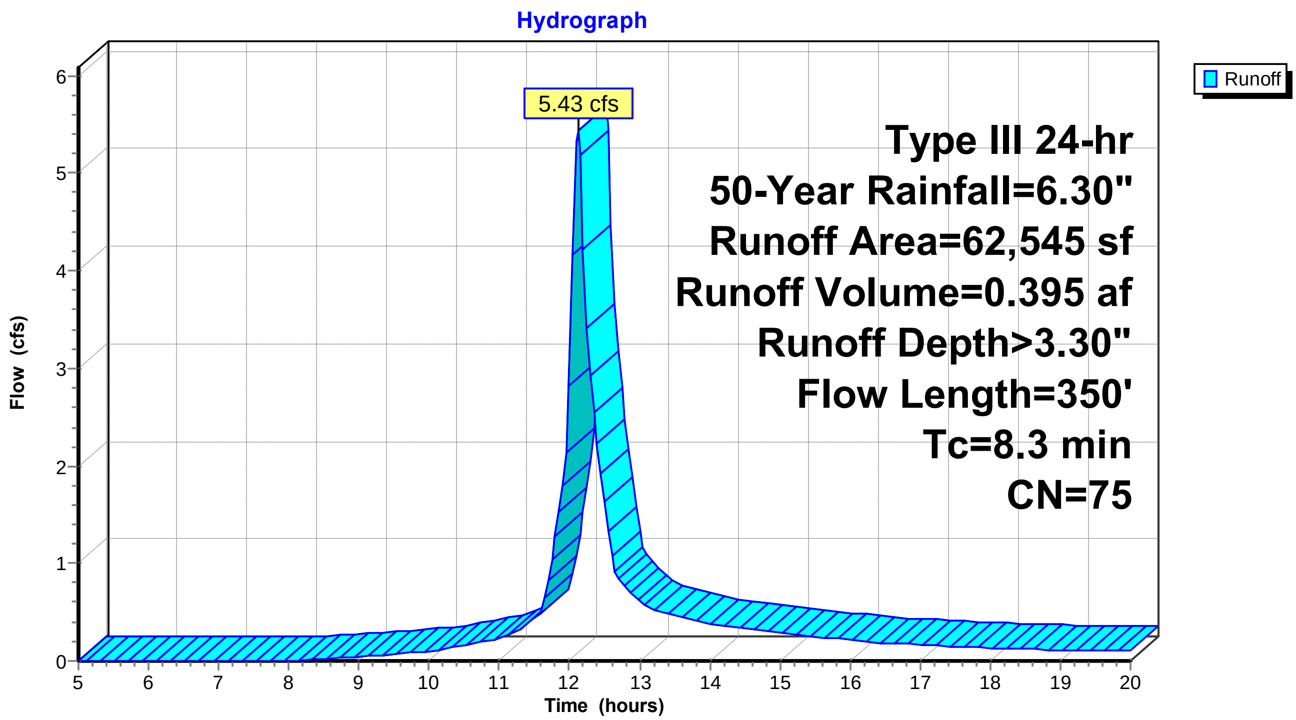
Runoff = 5.43 cfs @ 12.12 hrs, Volume= 0.395 af, Depth> 3.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.30"

Area (sf)	CN	Description
60,703	74	Pasture/grassland/range, Good, HSG C
1,842	98	Impervious, HSG C
62,545	75	Weighted Average
60,703		97.05% Pervious Area
1,842		2.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.7	100	0.0360	0.22		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.6	250	0.2050	7.29		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.3	350	Total			

Subcatchment EXDA6ND: EXDA-6

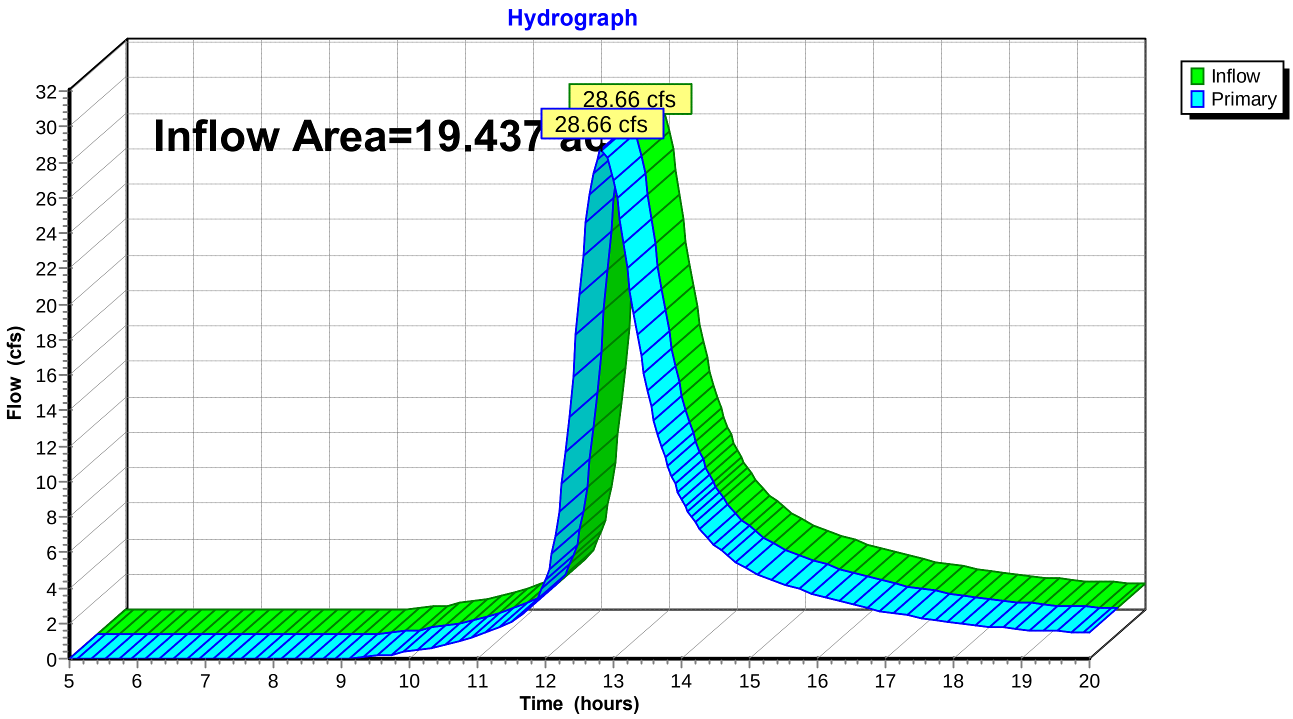


Summary for Link DP1: DP-1

Inflow Area = 19.437 ac, 5.80% Impervious, Inflow Depth > 2.95" for 50-Year event
Inflow = 28.66 cfs @ 12.83 hrs, Volume= 4.781 af
Primary = 28.66 cfs @ 12.83 hrs, Volume= 4.781 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP1: DP-1

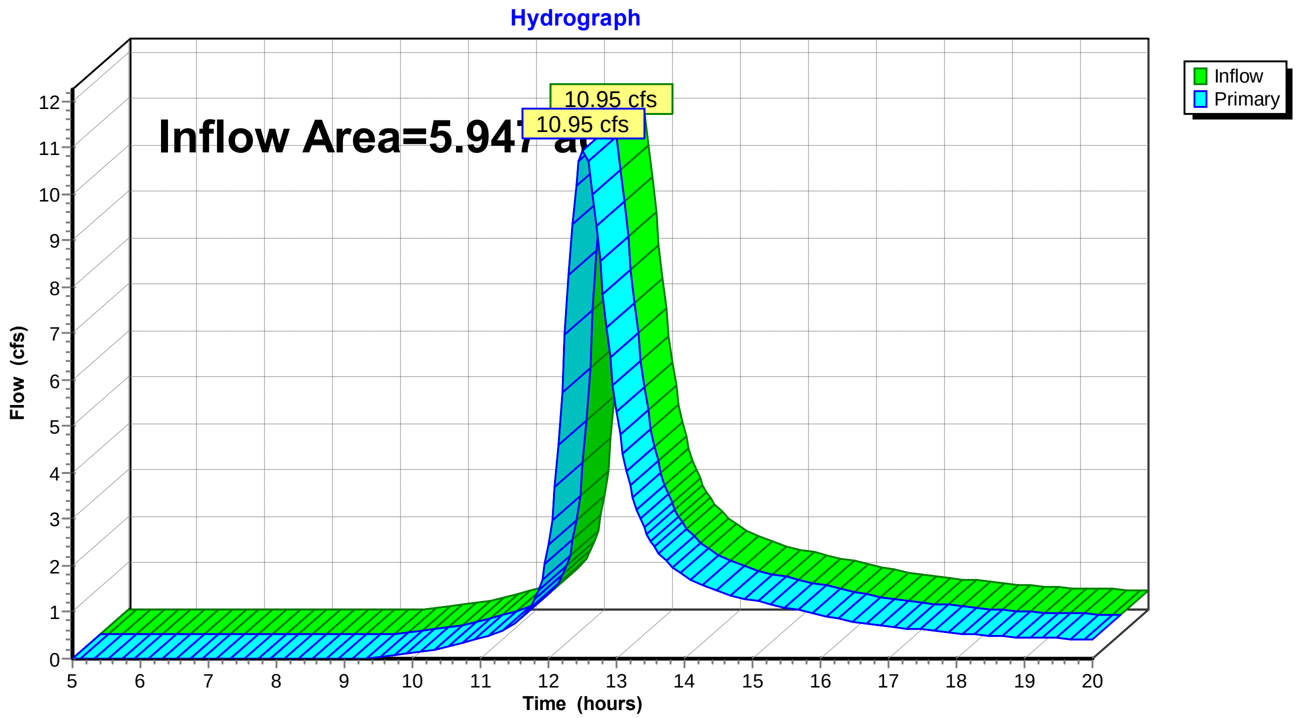


Summary for Link DP2: DP-2

Inflow Area =	5.947 ac,	0.00% Impervious,	Inflow Depth > 2.79"	for 50-Year event
Inflow =	10.95 cfs @	12.51 hrs, Volume=	1.384 af	
Primary =	10.95 cfs @	12.51 hrs, Volume=	1.384 af, Atten= 0%, Lag= 0.0 min	

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP2: DP-2

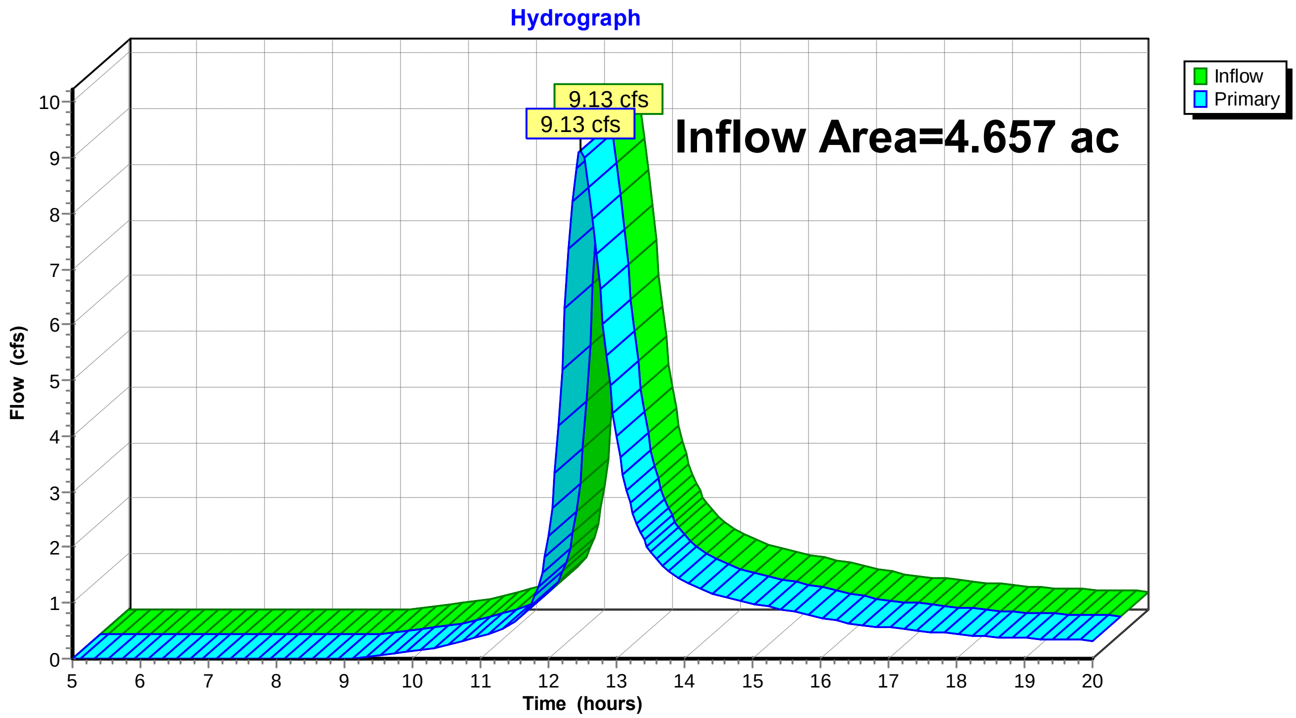


Summary for Link DP3: DP-3

Inflow Area =	4.657 ac,	2.14% Impervious,	Inflow Depth > 2.89"	for 50-Year event
Inflow =	9.13 cfs @	12.48 hrs, Volume=	1.121 af	
Primary =	9.13 cfs @	12.48 hrs, Volume=	1.121 af, Atten= 0%, Lag= 0.0 min	

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP3: DP-3

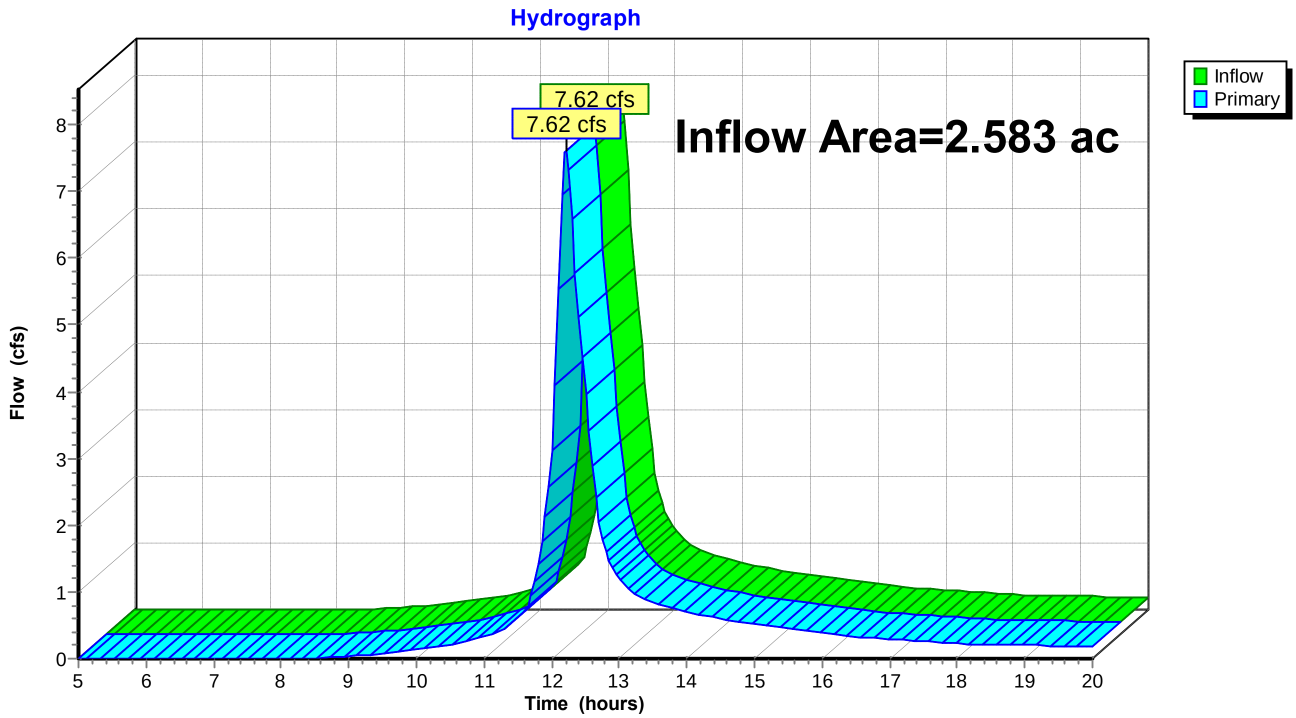


Summary for Link DP4: DP-4

Inflow Area =	2.583 ac,	4.18% Impervious,	Inflow Depth > 3.10"	for 50-Year event	
Inflow =	7.62 cfs @	12.21 hrs,	Volume=	0.667 af	
Primary =	7.62 cfs @	12.21 hrs,	Volume=	0.667 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP4: DP-4

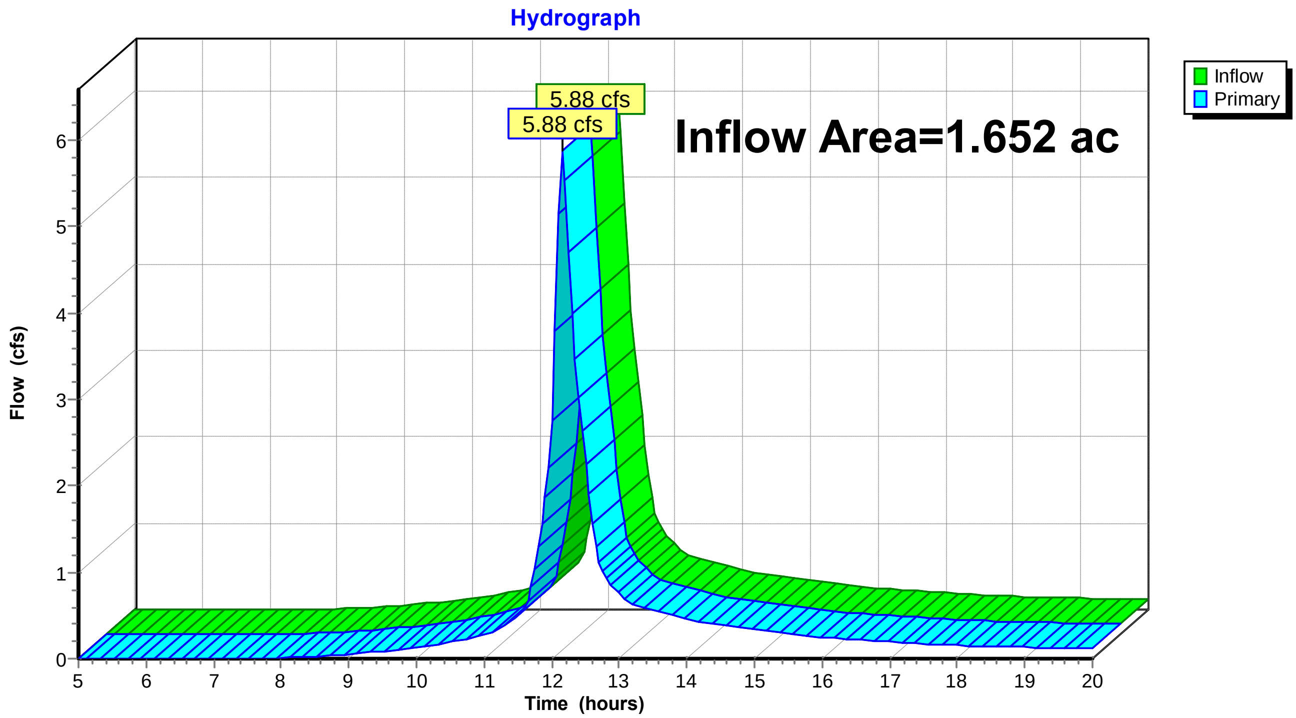


Summary for Link DP5: DP-5

Inflow Area = 1.652 ac, 6.27% Impervious, Inflow Depth > 3.39" for 50-Year event
Inflow = 5.88 cfs @ 12.16 hrs, Volume= 0.467 af
Primary = 5.88 cfs @ 12.16 hrs, Volume= 0.467 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP5: DP-5

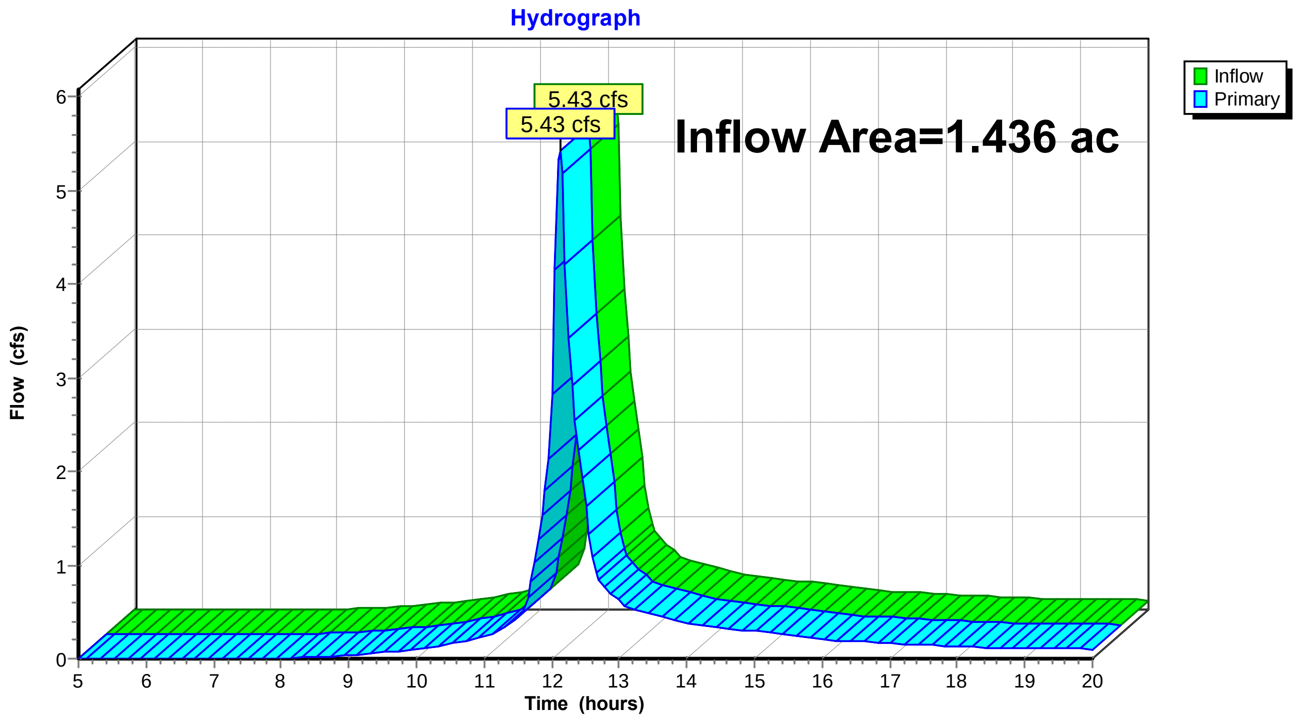


Summary for Link DP6: DP-6

Inflow Area =	1.436 ac,	2.95% Impervious,	Inflow Depth > 3.30"	for 50-Year event
Inflow =	5.43 cfs @	12.12 hrs, Volume=	0.395 af	
Primary =	5.43 cfs @	12.12 hrs, Volume=	0.395 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP6: DP-6



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EXDA1ND: EXDA-1	Runoff Area=846,679 sf 5.80% Impervious Runoff Depth>3.58" Flow Length=2,225' Tc=61.0 min CN=72 Runoff=34.77 cfs 5.796 af
Subcatchment EXDA2ND: EXDA-2	Runoff Area=259,066 sf 0.00% Impervious Runoff Depth>3.41" Flow Length=620' Tc=36.0 min CN=70 Runoff=13.36 cfs 1.688 af
Subcatchment EXDA3ND: EXDA-3	Runoff Area=202,871 sf 2.14% Impervious Runoff Depth>3.51" Flow Length=575' Tc=33.8 min CN=71 Runoff=11.10 cfs 1.363 af
Subcatchment EXDA4ND: EXDA-4	Runoff Area=112,514 sf 4.18% Impervious Runoff Depth>3.74" Flow Length=430' Tc=15.0 min CN=73 Runoff=9.18 cfs 0.806 af
Subcatchment EXDA5ND: EXDA-5	Runoff Area=71,979 sf 6.27% Impervious Runoff Depth>4.06" Flow Length=500' Tc=11.3 min CN=76 Runoff=7.01 cfs 0.559 af
Subcatchment EXDA6ND: EXDA-6	Runoff Area=62,545 sf 2.95% Impervious Runoff Depth>3.96" Flow Length=350' Tc=8.3 min CN=75 Runoff=6.50 cfs 0.474 af
Link DP1: DP-1	Inflow=34.77 cfs 5.796 af Primary=34.77 cfs 5.796 af
Link DP2: DP-2	Inflow=13.36 cfs 1.688 af Primary=13.36 cfs 1.688 af
Link DP3: DP-3	Inflow=11.10 cfs 1.363 af Primary=11.10 cfs 1.363 af
Link DP4: DP-4	Inflow=9.18 cfs 0.806 af Primary=9.18 cfs 0.806 af
Link DP5: DP-5	Inflow=7.01 cfs 0.559 af Primary=7.01 cfs 0.559 af
Link DP6: DP-6	Inflow=6.50 cfs 0.474 af Primary=6.50 cfs 0.474 af

Total Runoff Area = 35.713 ac Runoff Volume = 10.686 af Average Runoff Depth = 3.59"
95.85% Pervious = 34.232 ac 4.15% Impervious = 1.481 ac

Summary for Subcatchment EXDA1ND: EXDA-1

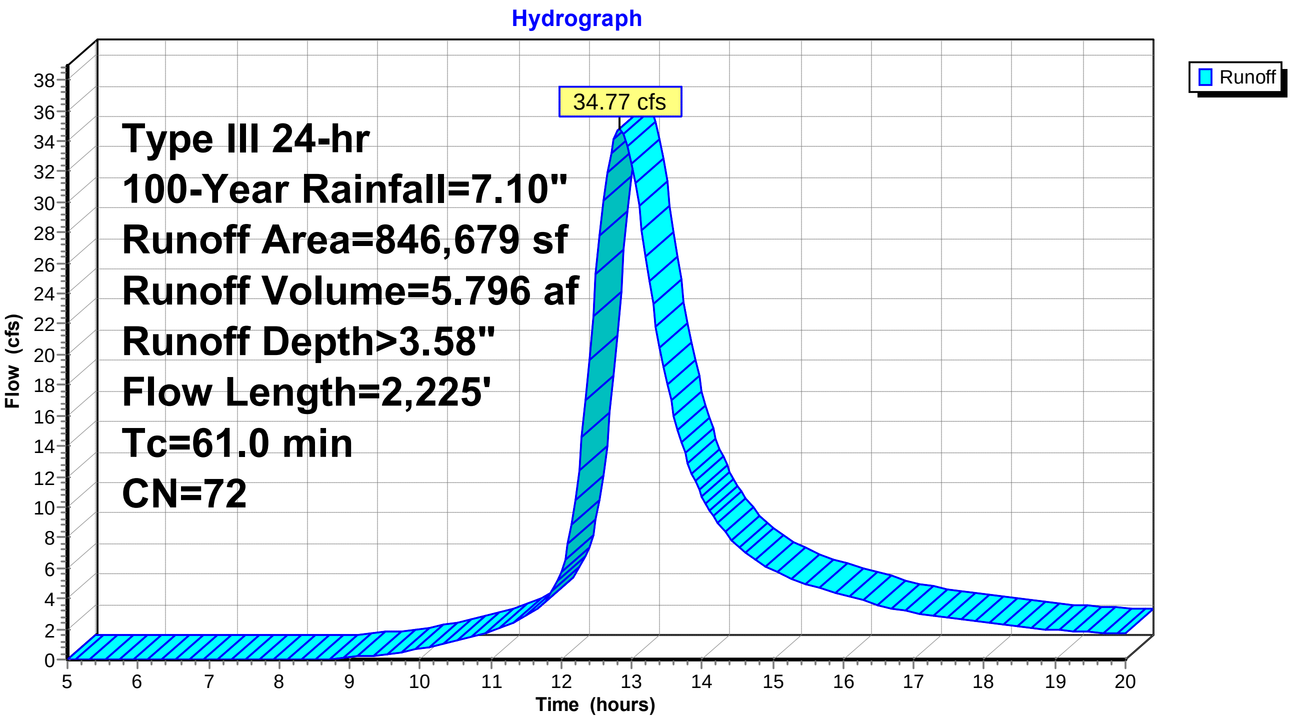
Runoff = 34.77 cfs @ 12.82 hrs, Volume= 5.796 af, Depth> 3.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.10"

Area (sf)	CN	Description
685,262	70	Woods, Good, HSG C
97,176	74	Pasture/grassland/range, Good, HSG C
15,129	71	Meadow, non-grazed, HSG C
49,112	98	Impervious, HSG C
846,679	72	Weighted Average
797,567		94.20% Pervious Area
49,112		5.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.0	250	0.0320	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
23.0	1,450	0.0440	1.05		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	525	0.0570	8.87	53.22	**Channel Flow,** Area= 6.0 sf Perim= 6.0' r= 1.00' n= 0.040 Earth, cobble bottom, clean sides
61.0	2,225	Total			

Subcatchment EXDA1ND: EXDA-1



Summary for Subcatchment EXDA2ND: EXDA-2

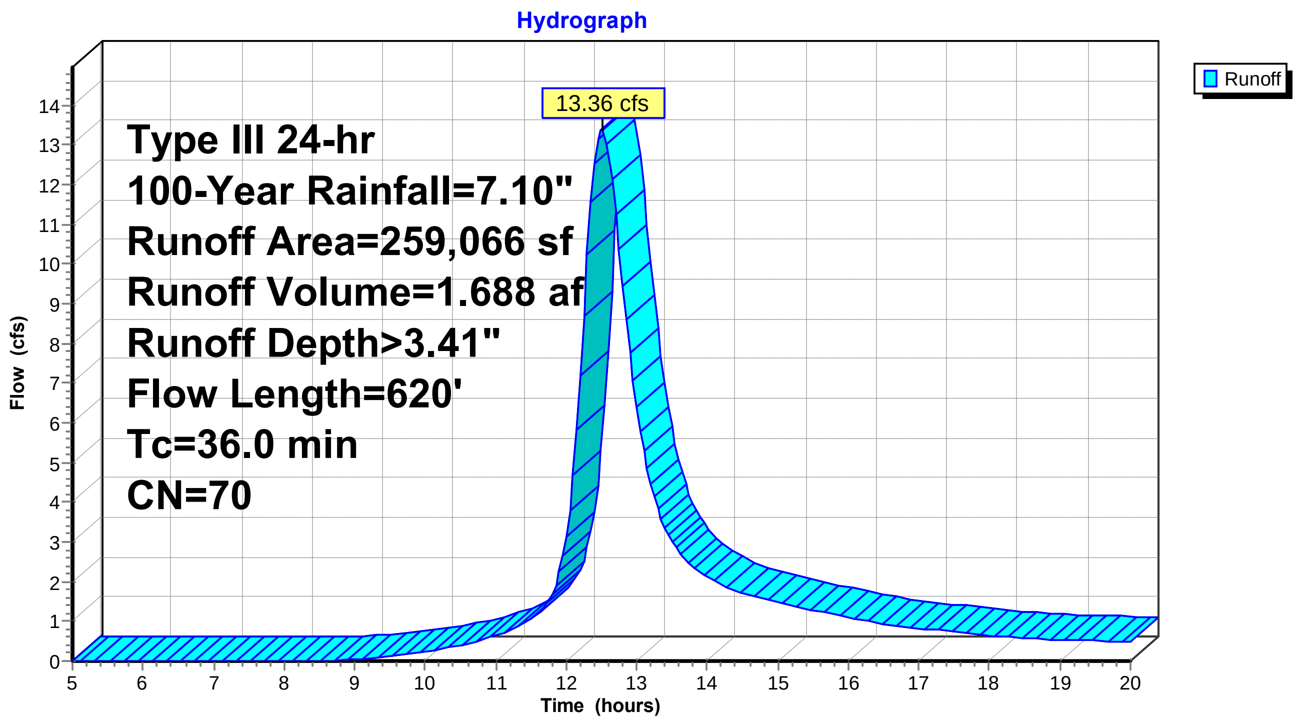
Runoff = 13.36 cfs @ 12.51 hrs, Volume= 1.688 af, Depth> 3.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.10"

Area (sf)	CN	Description
259,066	70	Woods, Good, HSG C
259,066		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.6	250	0.0440	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
3.4	370	0.1300	1.80		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
36.0	620	Total			

Subcatchment EXDA2ND: EXDA-2



Summary for Subcatchment EXDA3ND: EXDA-3

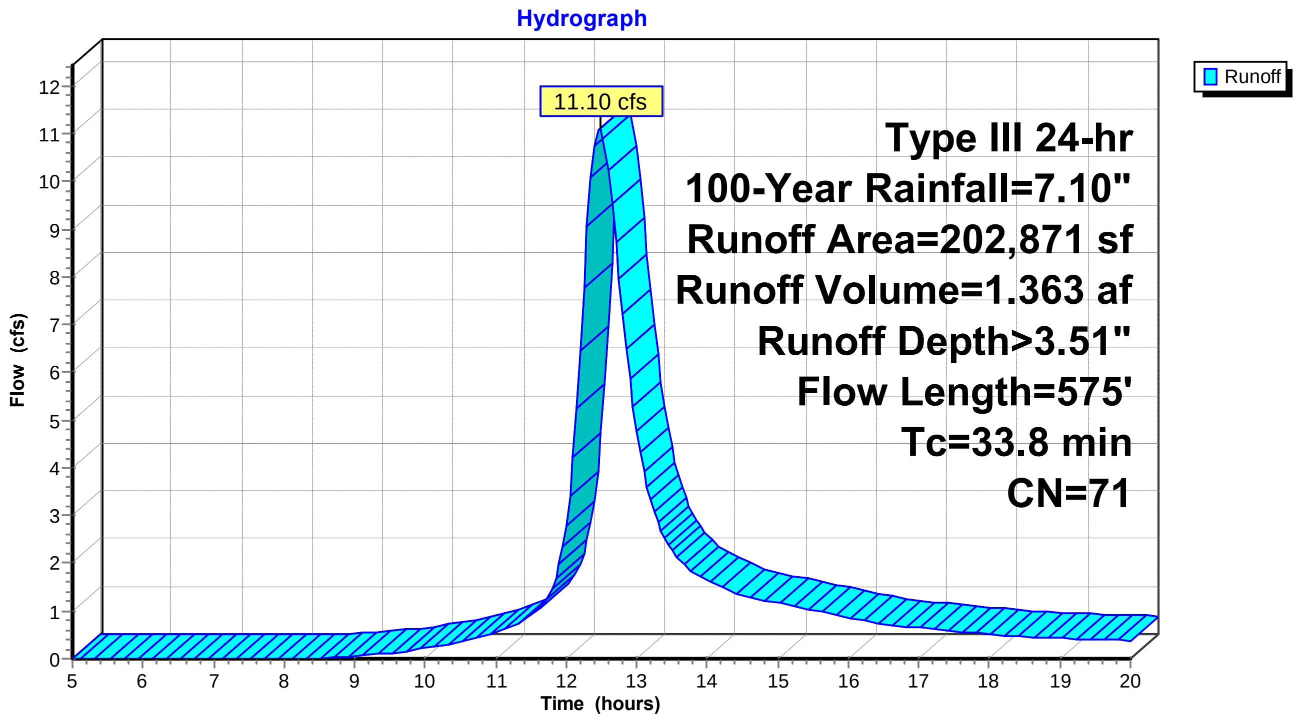
Runoff = 11.10 cfs @ 12.47 hrs, Volume= 1.363 af, Depth> 3.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.10"

Area (sf)	CN	Description
68,828	71	Meadow, non-grazed, HSG C
122,188	70	Woods, Good, HSG C
7,515	74	Pasture/grassland/range, Good, HSG C
4,340	98	Impervious, HSG C
202,871	71	Weighted Average
198,531		97.86% Pervious Area
4,340		2.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.5	250	0.0520	0.14		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
3.3	325	0.1110	1.67		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
33.8	575	Total			

Subcatchment EXDA3ND: EXDA-3



Summary for Subcatchment EXDA4ND: EXDA-4

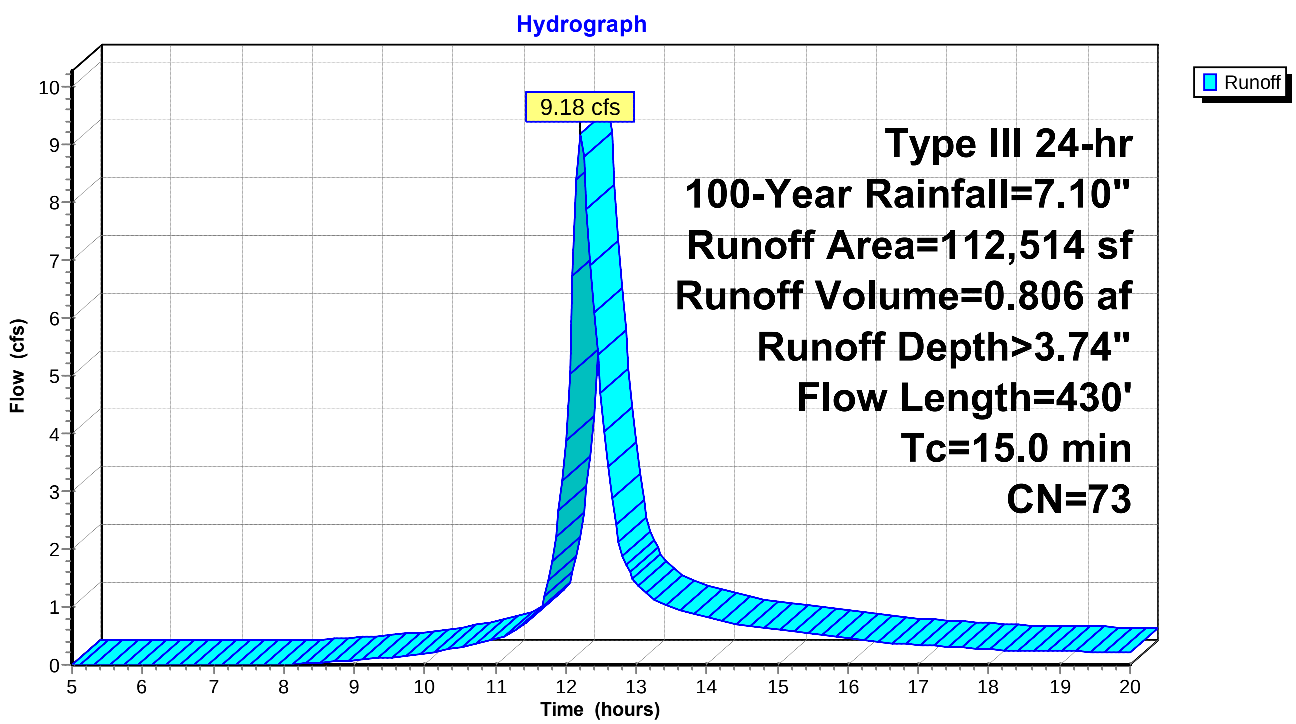
Runoff = 9.18 cfs @ 12.21 hrs, Volume= 0.806 af, Depth> 3.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.10"

	Area (sf)	CN	Description
	31,444	74	Pasture/grassland/range, Good, HSG C
	76,369	71	Meadow, non-grazed, HSG C
*	4,701	98	Impervious
	112,514	73	Weighted Average
	107,813		95.82% Pervious Area
	4,701		4.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.9	250	0.0520	0.30		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.1	180	0.1500	2.71		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
15.0	430	Total			

Subcatchment EXDA4ND: EXDA-4



Summary for Subcatchment EXDA5ND: EXDA-5

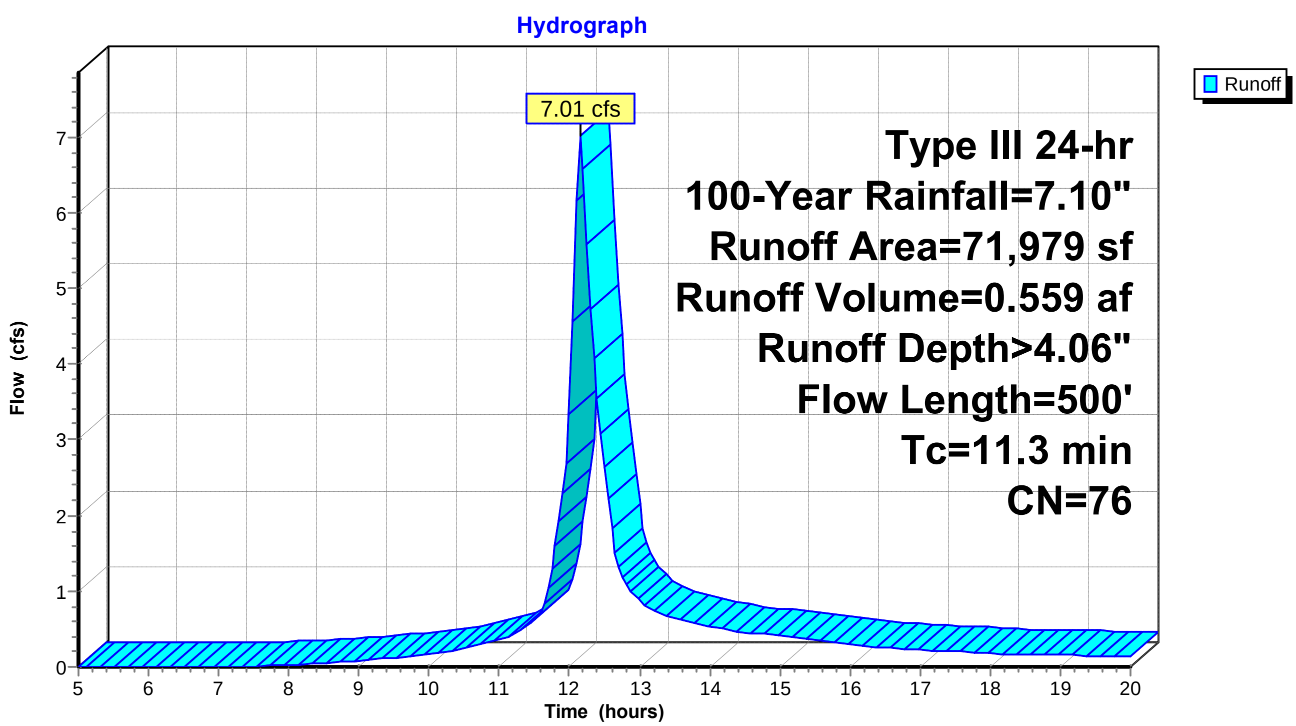
Runoff = 7.01 cfs @ 12.16 hrs, Volume= 0.559 af, Depth> 4.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.10"

Area (sf)	CN	Description
4,515	98	Impervious, HSG C
67,464	74	Pasture/grassland/range, Good, HSG C
71,979	76	Weighted Average
67,464		93.73% Pervious Area
4,515		6.27% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.3	150	0.0400	0.24		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.0	350	0.1350	5.92		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
11.3	500	Total			

Subcatchment EXDA5ND: EXDA-5



Summary for Subcatchment EXDA6ND: EXDA-6

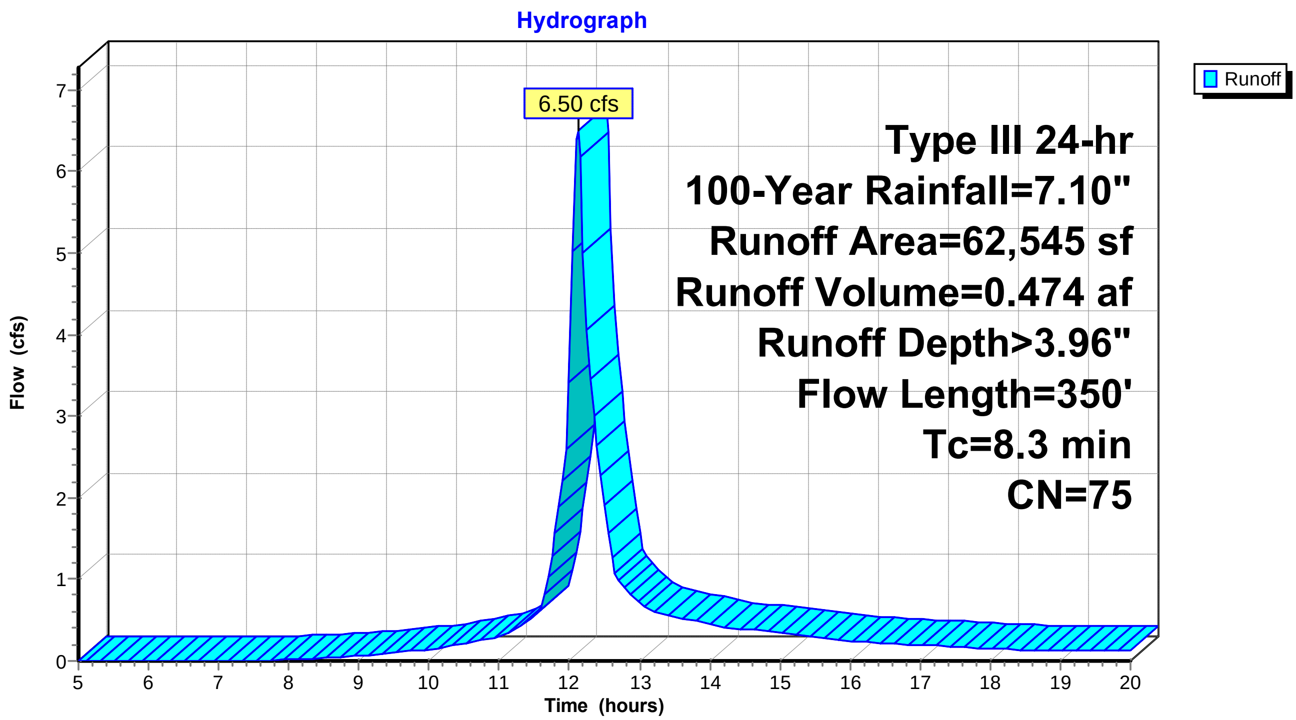
Runoff = 6.50 cfs @ 12.12 hrs, Volume= 0.474 af, Depth> 3.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.10"

Area (sf)	CN	Description
60,703	74	Pasture/grassland/range, Good, HSG C
1,842	98	Impervious, HSG C
62,545	75	Weighted Average
60,703		97.05% Pervious Area
1,842		2.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.7	100	0.0360	0.22		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.6	250	0.2050	7.29		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.3	350	Total			

Subcatchment EXDA6ND: EXDA-6

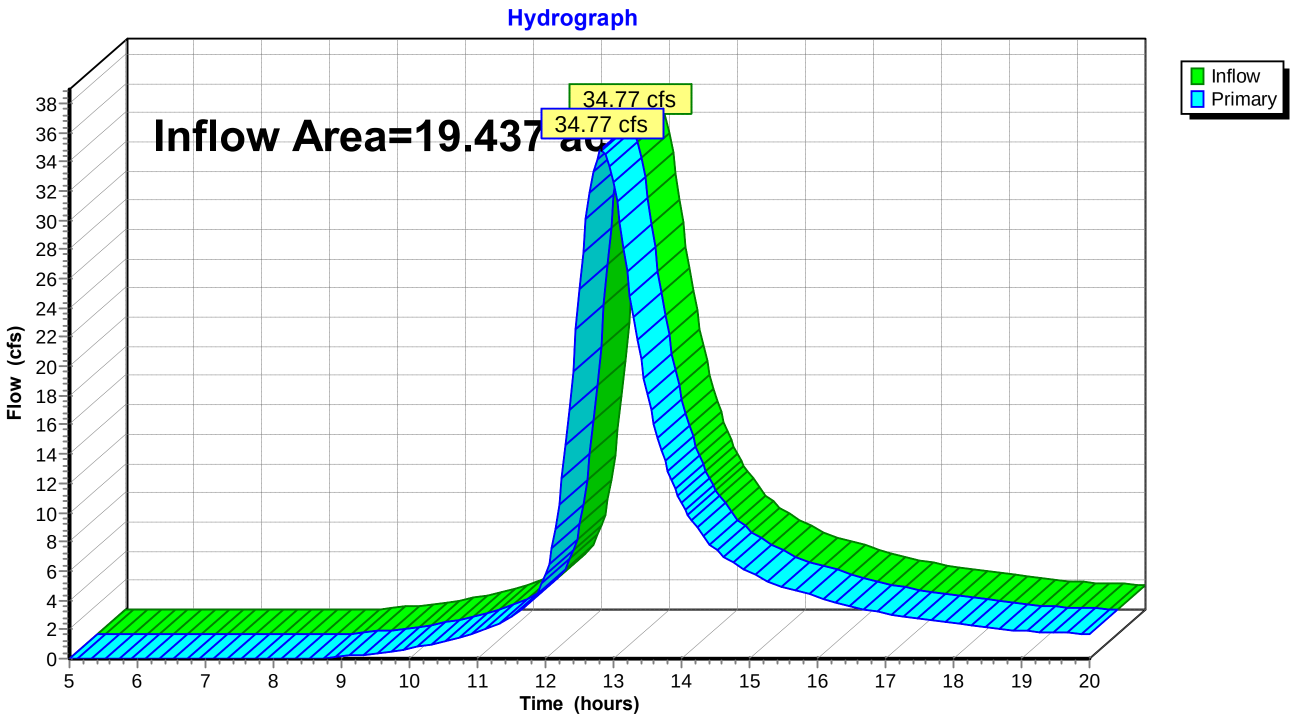


Summary for Link DP1: DP-1

Inflow Area = 19.437 ac, 5.80% Impervious, Inflow Depth > 3.58" for 100-Year event
Inflow = 34.77 cfs @ 12.82 hrs, Volume= 5.796 af
Primary = 34.77 cfs @ 12.82 hrs, Volume= 5.796 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP1: DP-1

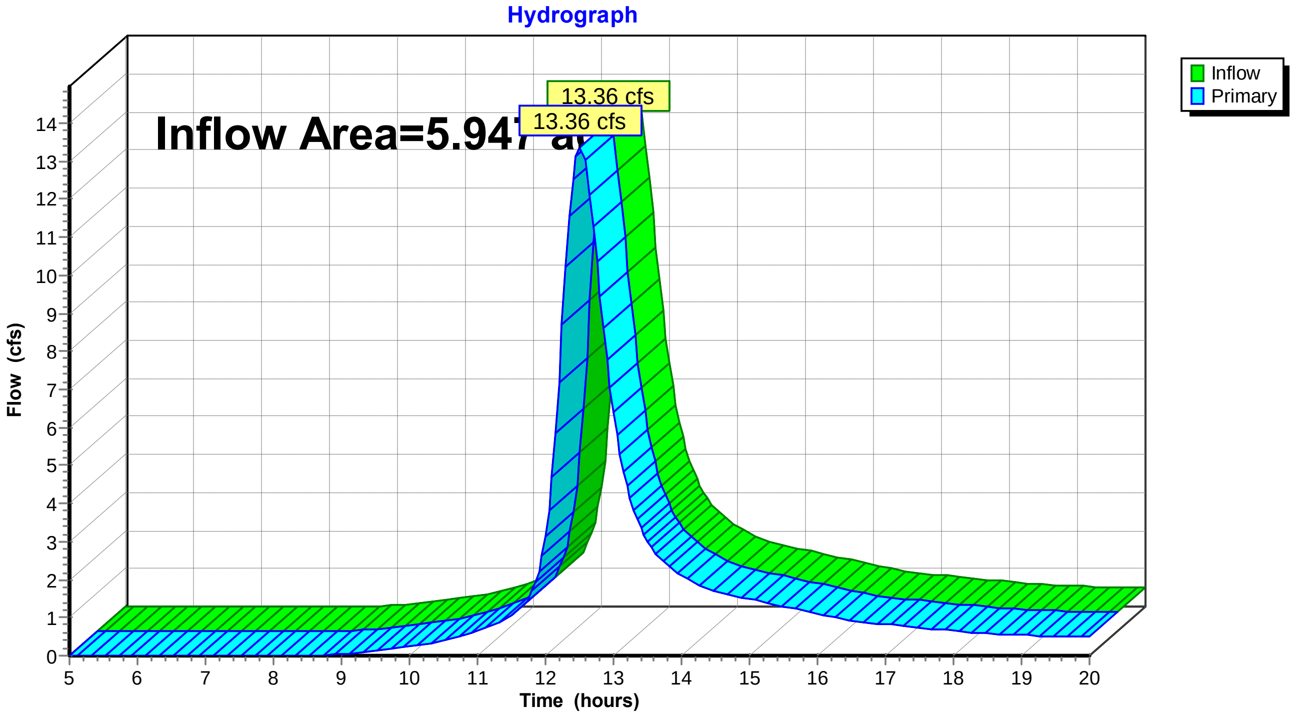


Summary for Link DP2: DP-2

Inflow Area =	5.947 ac,	0.00% Impervious,	Inflow Depth > 3.41"	for 100-Year event
Inflow =	13.36 cfs @	12.51 hrs, Volume=	1.688 af	
Primary =	13.36 cfs @	12.51 hrs, Volume=	1.688 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP2: DP-2

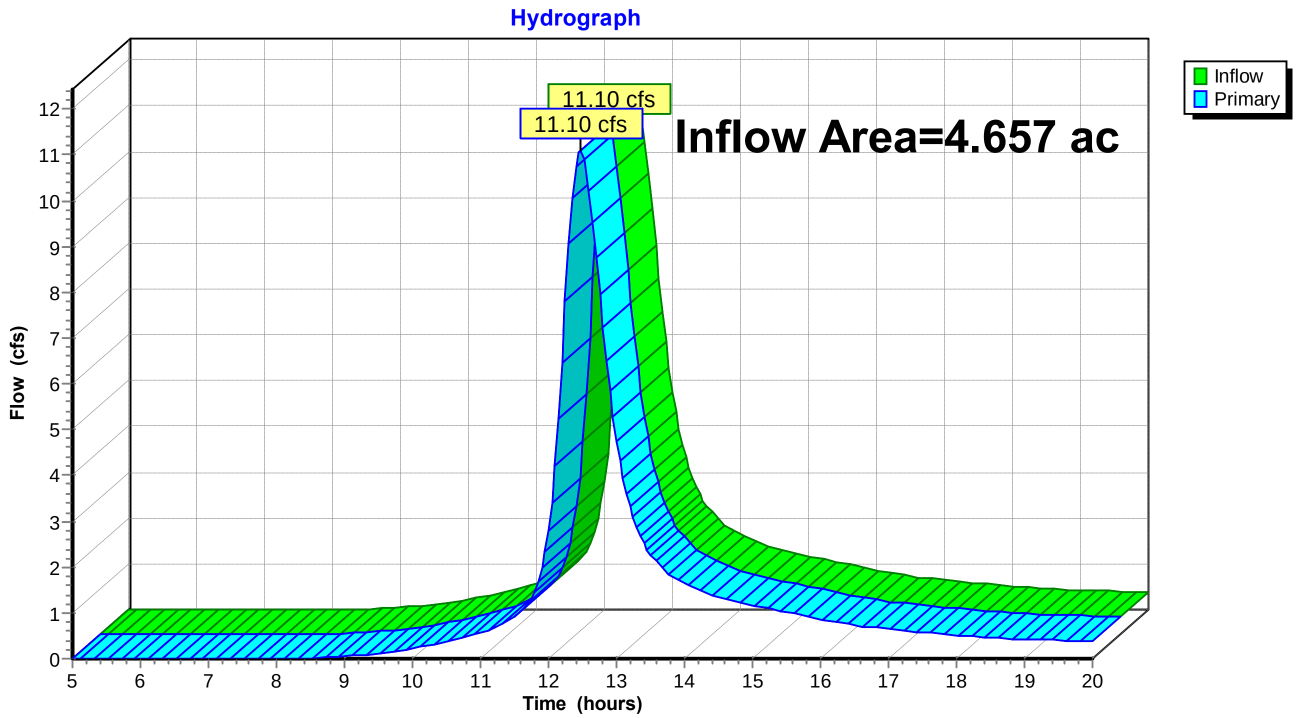


Summary for Link DP3: DP-3

Inflow Area =	4.657 ac,	2.14% Impervious,	Inflow Depth > 3.51"	for 100-Year event	
Inflow =	11.10 cfs @	12.47 hrs,	Volume=	1.363 af	
Primary =	11.10 cfs @	12.47 hrs,	Volume=	1.363 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP3: DP-3

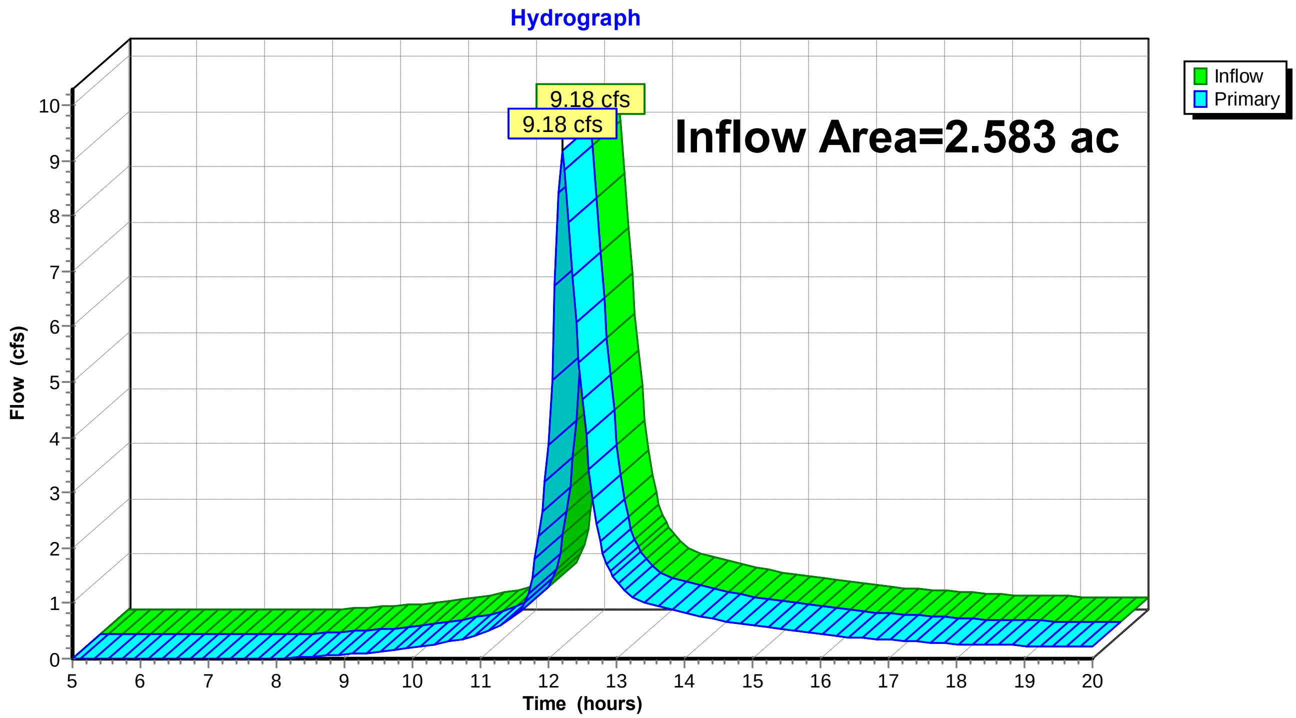


Summary for Link DP4: DP-4

Inflow Area =	2.583 ac,	4.18% Impervious,	Inflow Depth > 3.74"	for 100-Year event	
Inflow =	9.18 cfs @	12.21 hrs,	Volume=	0.806 af	
Primary =	9.18 cfs @	12.21 hrs,	Volume=	0.806 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP4: DP-4

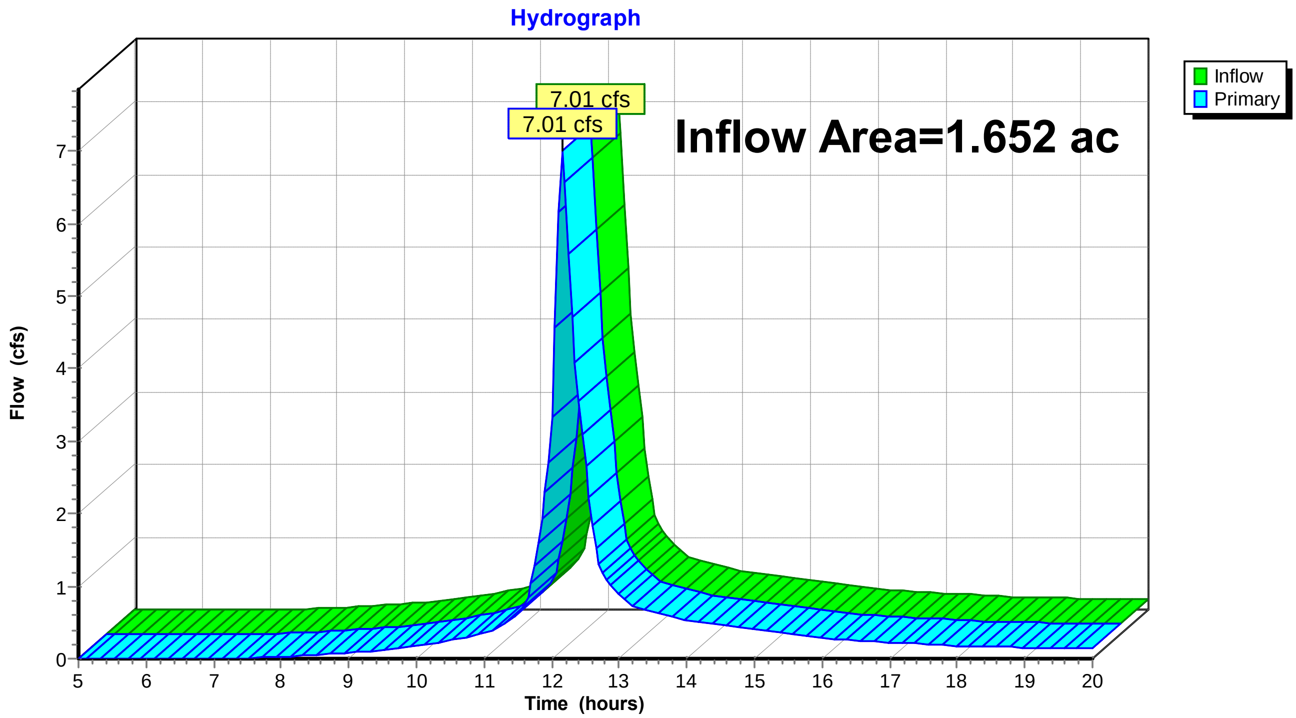


Summary for Link DP5: DP-5

Inflow Area =	1.652 ac,	6.27% Impervious,	Inflow Depth > 4.06"	for 100-Year event	
Inflow =	7.01 cfs @	12.16 hrs,	Volume=	0.559 af	
Primary =	7.01 cfs @	12.16 hrs,	Volume=	0.559 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP5: DP-5

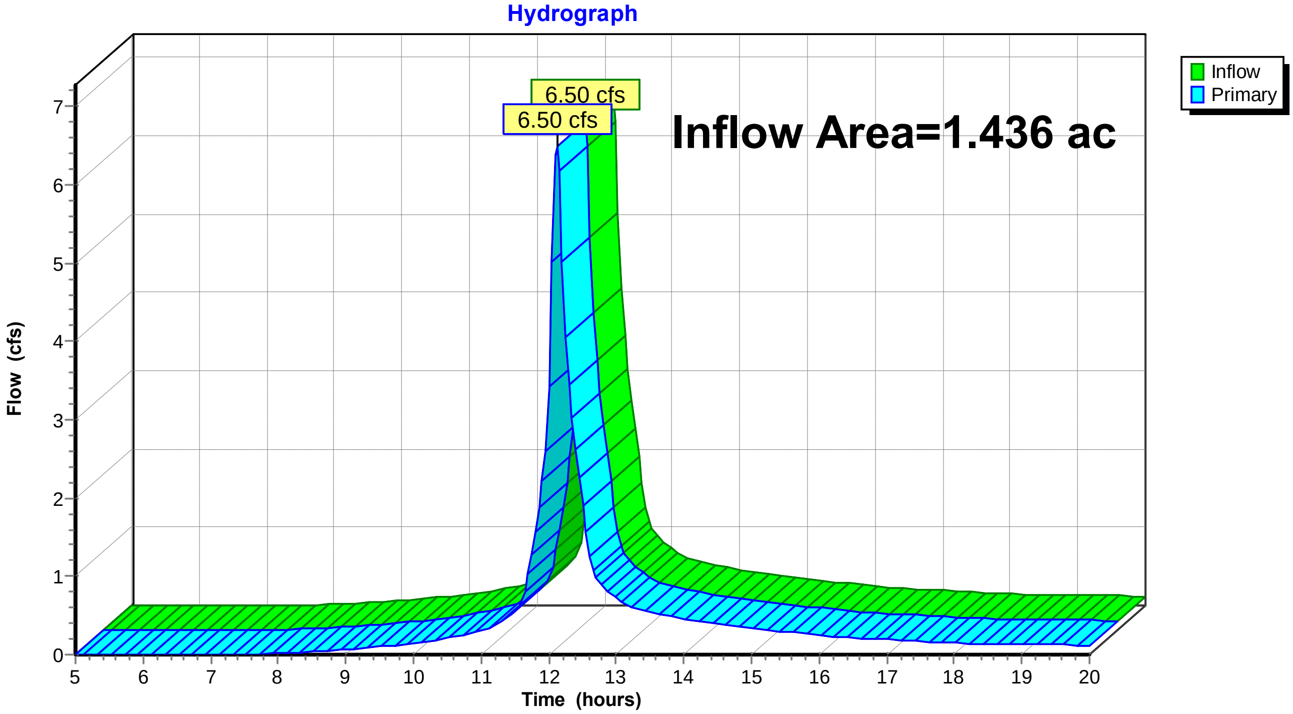


Summary for Link DP6: DP-6

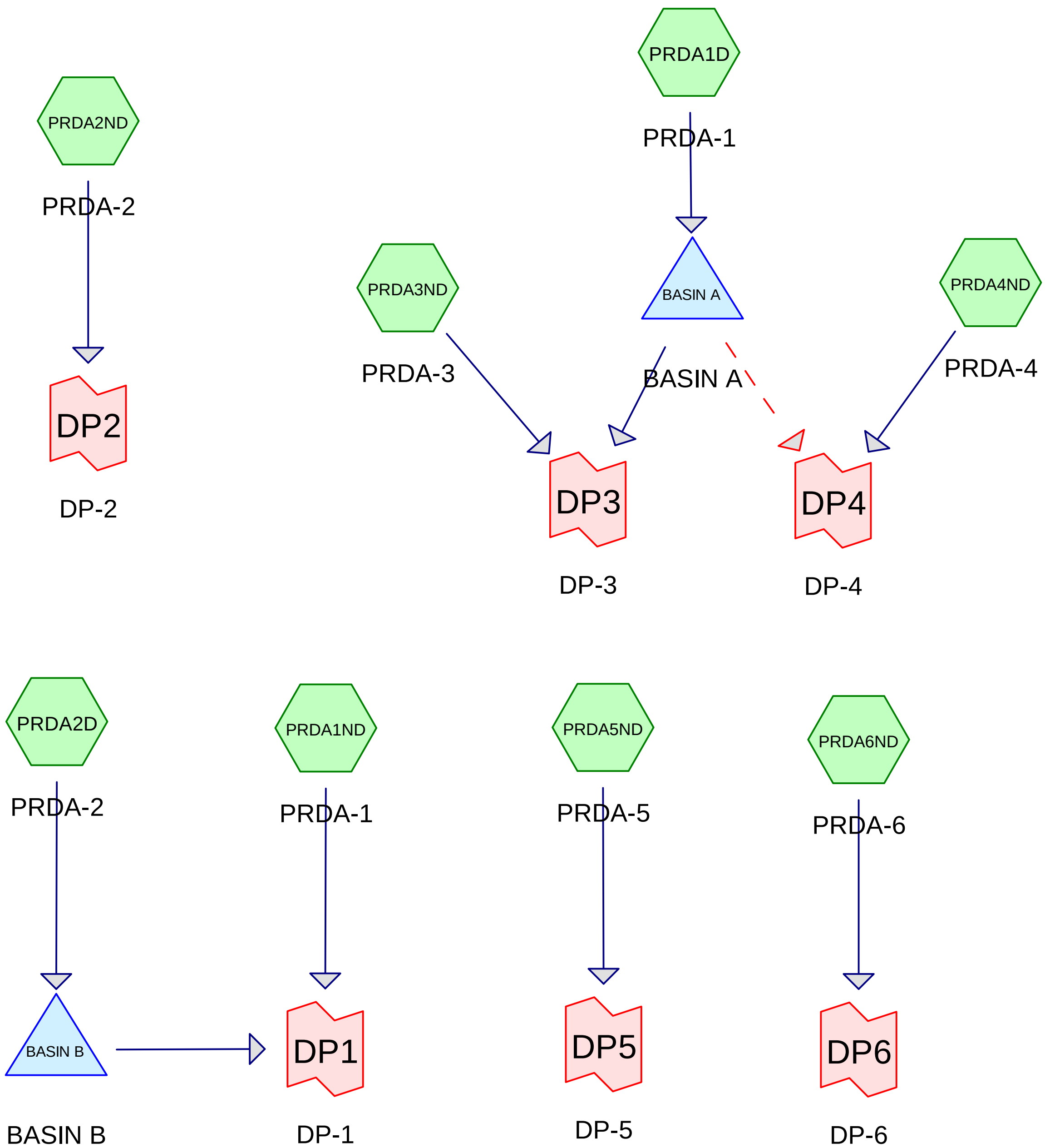
Inflow Area =	1.436 ac,	2.95% Impervious,	Inflow Depth > 3.96"	for 100-Year event	
Inflow =	6.50 cfs @	12.12 hrs,	Volume=	0.474 af	
Primary =	6.50 cfs @	12.12 hrs,	Volume=	0.474 af,	Atten= 0%, Lag= 0.0 min

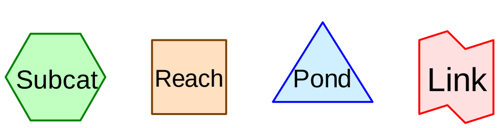
Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP6: DP-6



Appendix C – Proposed Conditions HydroCAD Routing





Routing Diagram for 98132 Proposed Conditions
Prepared by Hewlett-Packard Company, Printed 9/26/2014
HydroCAD® 10.00 s/n 08208 © 2013 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
8.638	75	Gravel, HSG C (PRDA1D, PRDA2D)
0.108	98	Impervious (PRDA4ND)
4.362	98	Impervious, HSG C (PRDA1D, PRDA1ND, PRDA2D, PRDA3ND, PRDA5ND, PRDA6ND)
14.311	74	Pasture/grassland/range, Good, HSG C (PRDA1ND, PRDA2D, PRDA2ND, PRDA3ND, PRDA4ND, PRDA5ND, PRDA6ND)
0.866	98	Roofs, HSG C (PRDA1D, PRDA2D)
1.380	98	Water Surface, HSG C (PRDA1D, PRDA2D)
5.733	70	Woods, Good, HSG C (PRDA1ND, PRDA2D, PRDA2ND)
35.398	**78**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
35.290	HSG C	PRDA1D, PRDA1ND, PRDA2D, PRDA2ND, PRDA3ND, PRDA4ND, PRDA5ND, PRDA6ND
0.000	HSG D	
0.108	Other	PRDA4ND
35.398		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	8.638	0.000	0.000	8.638	Gravel	PRDA1D, PRDA2D
0.000	0.000	4.362	0.000	0.108	4.470	Impervious	PRDA1D, PRDA1ND, PRDA2D, PRDA3ND, PRDA4ND, PRDA5ND, PRDA6ND
0.000	0.000	14.311	0.000	0.000	14.311	Pasture/grassland/range, Good	PRDA1ND, PRDA2D, PRDA2ND, PRDA3ND, PRDA4ND, PRDA5ND, PRDA6ND
0.000	0.000	0.866	0.000	0.000	0.866	Roofs	PRDA1D, PRDA2D
0.000	0.000	1.380	0.000	0.000	1.380	Water Surface	PRDA1D, PRDA2D
0.000	0.000	5.733	0.000	0.000	5.733	Woods, Good	PRDA1ND, PRDA2D, PRDA2ND

Ground Covers (all nodes) (continued)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	**0.000**	**35.290**	**0.000**	**0.108**	**35.398**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	PRDA1D	0.00	0.00	1,200.0	0.0075	0.010	15.0	0.0	0.0
2	PRDA5ND	0.00	0.00	100.0	0.0100	0.010	15.0	0.0	0.0
3	BASIN A	820.00	786.00	250.0	0.1360	0.010	15.0	0.0	0.0
4	BASIN A	820.00	786.00	250.0	0.1360	0.010	15.0	0.0	0.0
5	BASIN B	821.00	797.00	100.0	0.2400	0.010	15.0	0.0	0.0

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PRDA1D: PRDA-1 Runoff Area=407,573 sf 36.10% Impervious Runoff Depth>1.57"
Flow Length=1,450' Tc=6.7 min CN=83 Runoff=17.85 cfs 1.226 af

Subcatchment PRDA1ND: PRDA-1 Runoff Area=430,906 sf 13.85% Impervious Runoff Depth>1.10"
Flow Length=1,775' Tc=42.9 min CN=76 Runoff=6.50 cfs 0.909 af

Subcatchment PRDA2D: PRDA-2 Runoff Area=370,926 sf 15.24% Impervious Runoff Depth>1.16"
Flow Length=850' Tc=42.4 min CN=77 Runoff=5.96 cfs 0.825 af

Subcatchment PRDA2ND: PRDA-2 Runoff Area=153,744 sf 0.00% Impervious Runoff Depth>0.90"
Flow Length=500' Tc=20.1 min CN=72 Runoff=2.55 cfs 0.264 af

Subcatchment PRDA3ND: PRDA-3 Runoff Area=35,236 sf 15.90% Impervious Runoff Depth>1.24"
Flow Length=100' Slope=0.1100 '/' Tc=5.0 min CN=78 Runoff=1.26 cfs 0.084 af

Subcatchment PRDA4ND: PRDA-4 Runoff Area=36,465 sf 12.89% Impervious Runoff Depth>1.18"
Flow Length=100' Slope=0.1100 '/' Tc=5.0 min CN=77 Runoff=1.24 cfs 0.082 af

Subcatchment PRDA5ND: PRDA-5 Runoff Area=56,917 sf 16.34% Impervious Runoff Depth>1.24"
Flow Length=300' Tc=5.7 min CN=78 Runoff=2.01 cfs 0.135 af

Subcatchment PRDA6ND: PRDA-6 Runoff Area=50,169 sf 19.16% Impervious Runoff Depth>1.30"
Flow Length=650' Tc=5.6 min CN=79 Runoff=1.87 cfs 0.125 af

Pond BASIN A: BASIN A Peak Elev=820.91' Storage=29,448 cf Inflow=17.85 cfs 1.226 af
Primary=0.77 cfs 0.438 af Secondary=0.77 cfs 0.438 af Outflow=1.53 cfs 0.876 af

Pond BASIN B: BASIN B Peak Elev=822.61' Storage=18,063 cf Inflow=5.96 cfs 0.825 af
Outflow=1.10 cfs 0.615 af

Link DP1: DP-1 Inflow=7.23 cfs 1.525 af
Primary=7.23 cfs 1.525 af

Link DP2: DP-2 Inflow=2.55 cfs 0.264 af
Primary=2.55 cfs 0.264 af

Link DP3: DP-3 Inflow=1.70 cfs 0.522 af
Primary=1.70 cfs 0.522 af

Link DP4: DP-4 Inflow=1.67 cfs 0.520 af
Primary=1.67 cfs 0.520 af

Link DP5: DP-5 Inflow=2.01 cfs 0.135 af
Primary=2.01 cfs 0.135 af

Link DP6: DP-6 Inflow=1.87 cfs 0.125 af
Primary=1.87 cfs 0.125 af

Total Runoff Area = 35.398 ac Runoff Volume = 3.649 af Average Runoff Depth = 1.24"
81.03% Pervious = 28.682 ac 18.97% Impervious = 6.716 ac

Summary for Subcatchment PRDA1D: PRDA-1

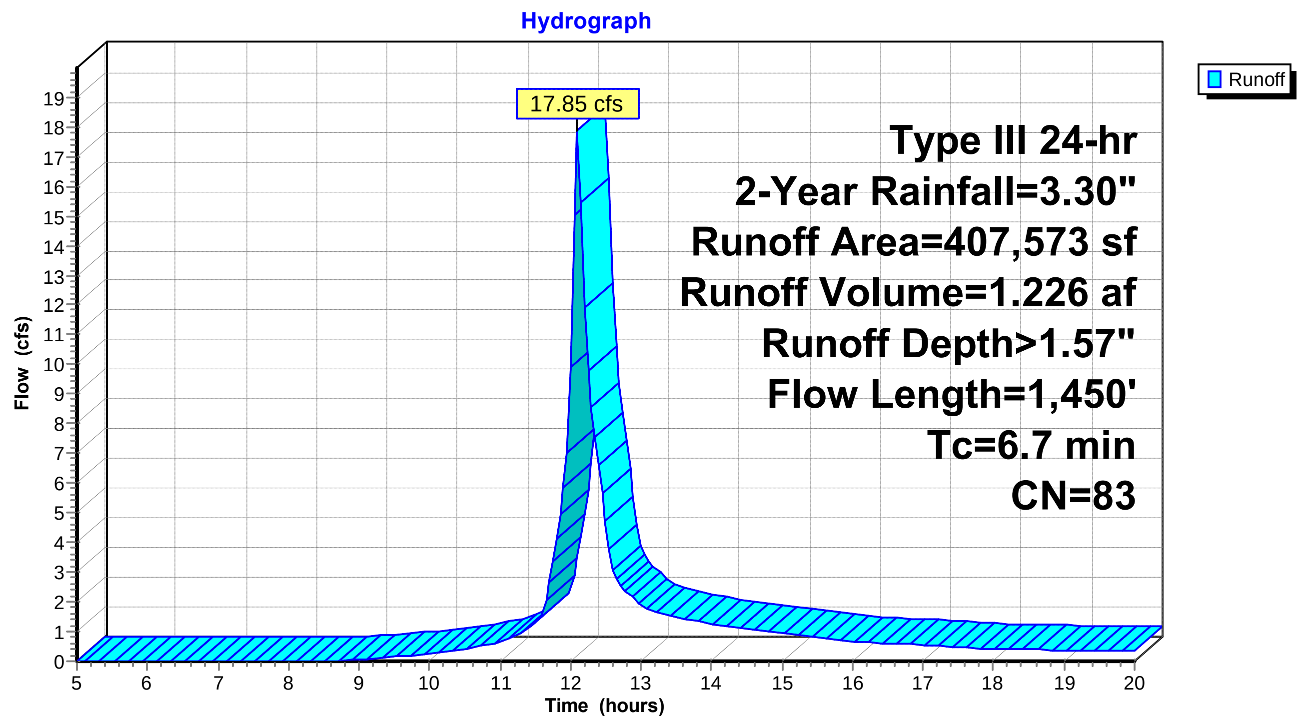
Runoff = 17.85 cfs @ 12.10 hrs, Volume= 1.226 af, Depth> 1.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.30"

	Area (sf)	CN	Description
	69,087	98	Impervious, HSG C
	36,569	98	Roofs, HSG C
	41,458	98	Water Surface, HSG C
*	260,459	75	Gravel, HSG C
	407,573	83	Weighted Average
	260,459		63.90% Pervious Area
	147,114		36.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	250	0.0100	1.25		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
3.4	1,200	0.0075	5.93	7.27	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.010 PVC, smooth interior
6.7	1,450	Total			

Subcatchment PRDA1D: PRDA-1



Summary for Subcatchment PRDA1ND: PRDA-1

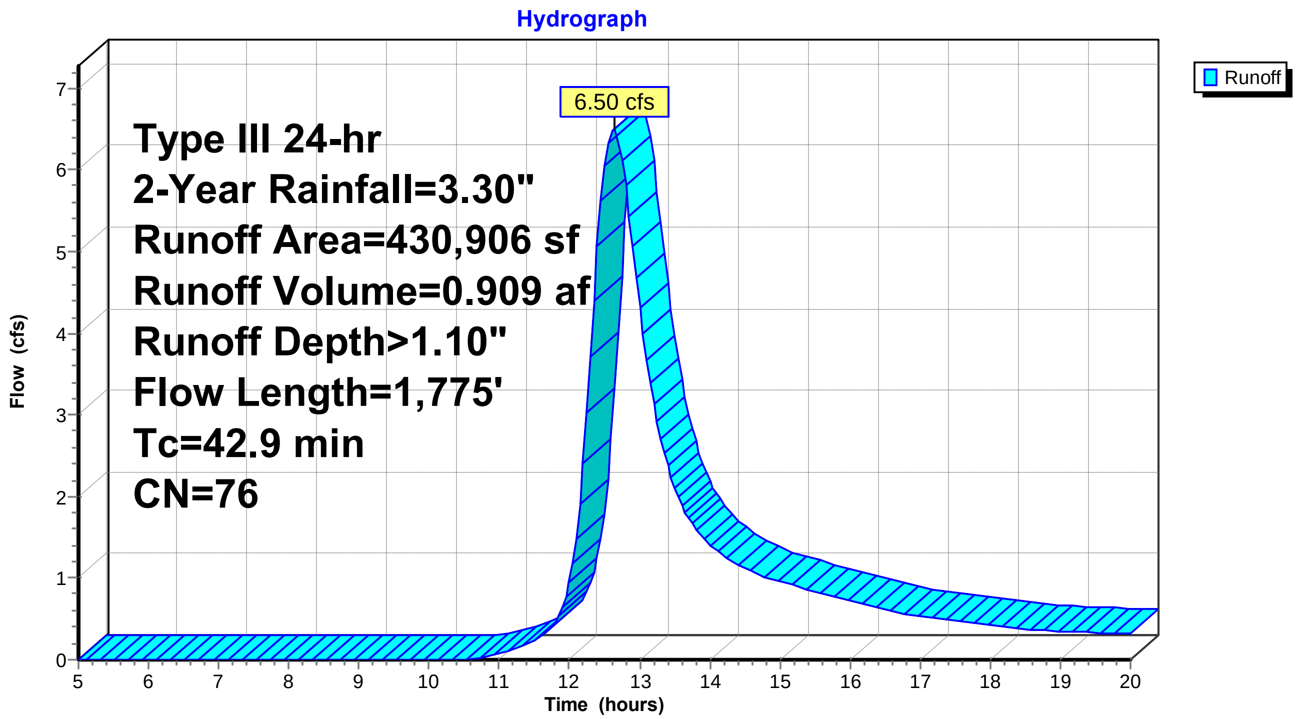
Runoff = 6.50 cfs @ 12.63 hrs, Volume= 0.909 af, Depth> 1.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.30"

Area (sf)	CN	Description
114,584	70	Woods, Good, HSG C
256,640	74	Pasture/grassland/range, Good, HSG C
59,682	98	Impervious, HSG C
430,906	76	Weighted Average
371,224		86.15% Pervious Area
59,682		13.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.0	250	0.0320	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
4.9	1,000	0.0440	3.38		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.0	525	0.0570	8.87	53.22	**Channel Flow,** Area= 6.0 sf Perim= 6.0' r= 1.00' n= 0.040 Earth, cobble bottom, clean sides
42.9	1,775	Total			

Subcatchment PRDA1ND: PRDA-1



Summary for Subcatchment PRDA2D: PRDA-2

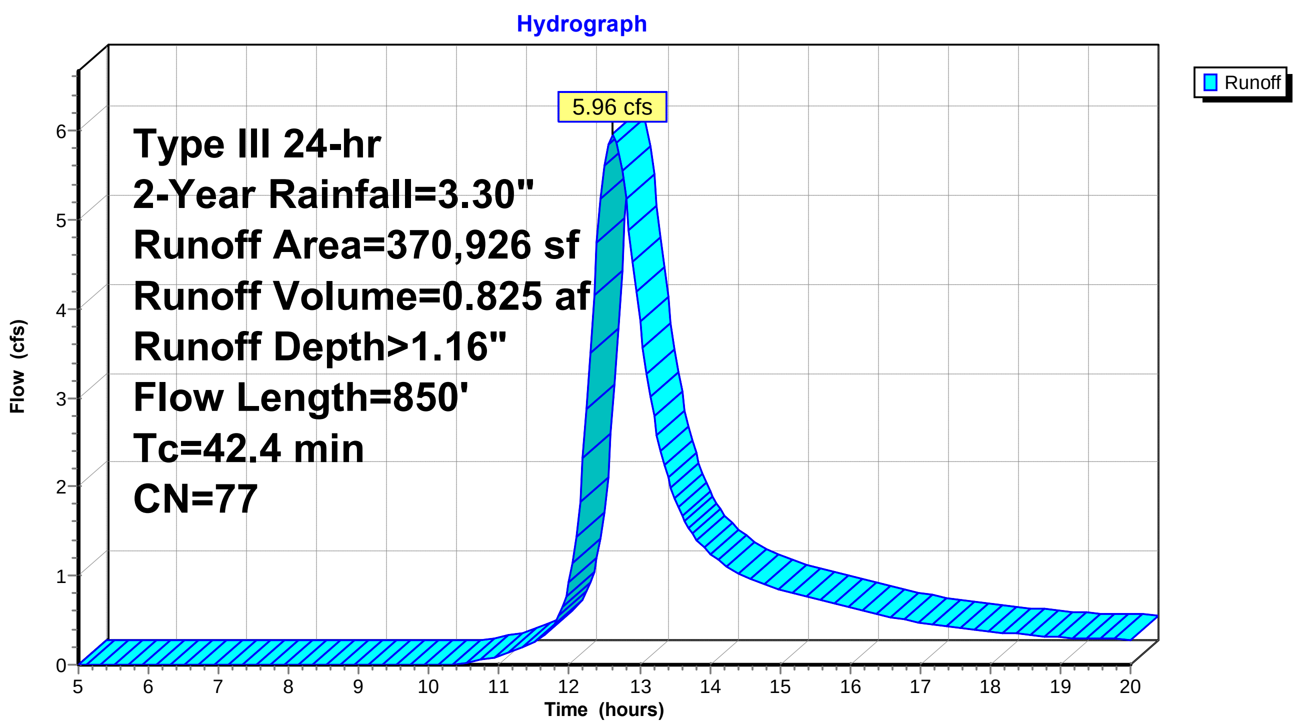
Runoff = 5.96 cfs @ 12.61 hrs, Volume= 0.825 af, Depth> 1.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.30"

	Area (sf)	CN	Description
	36,718	98	Impervious, HSG C
	1,151	98	Roofs, HSG C
	18,667	98	Water Surface, HSG C
	134,433	74	Pasture/grassland/range, Good, HSG C
*	115,820	75	Gravel, HSG C
	64,137	70	Woods, Good, HSG C
	370,926	77	Weighted Average
	314,390		84.76% Pervious Area
	56,536		15.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.0	250	0.0320	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
5.4	600	0.0700	1.85		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
42.4	850	Total			

Subcatchment PRDA2D: PRDA-2



Summary for Subcatchment PRDA2ND: PRDA-2

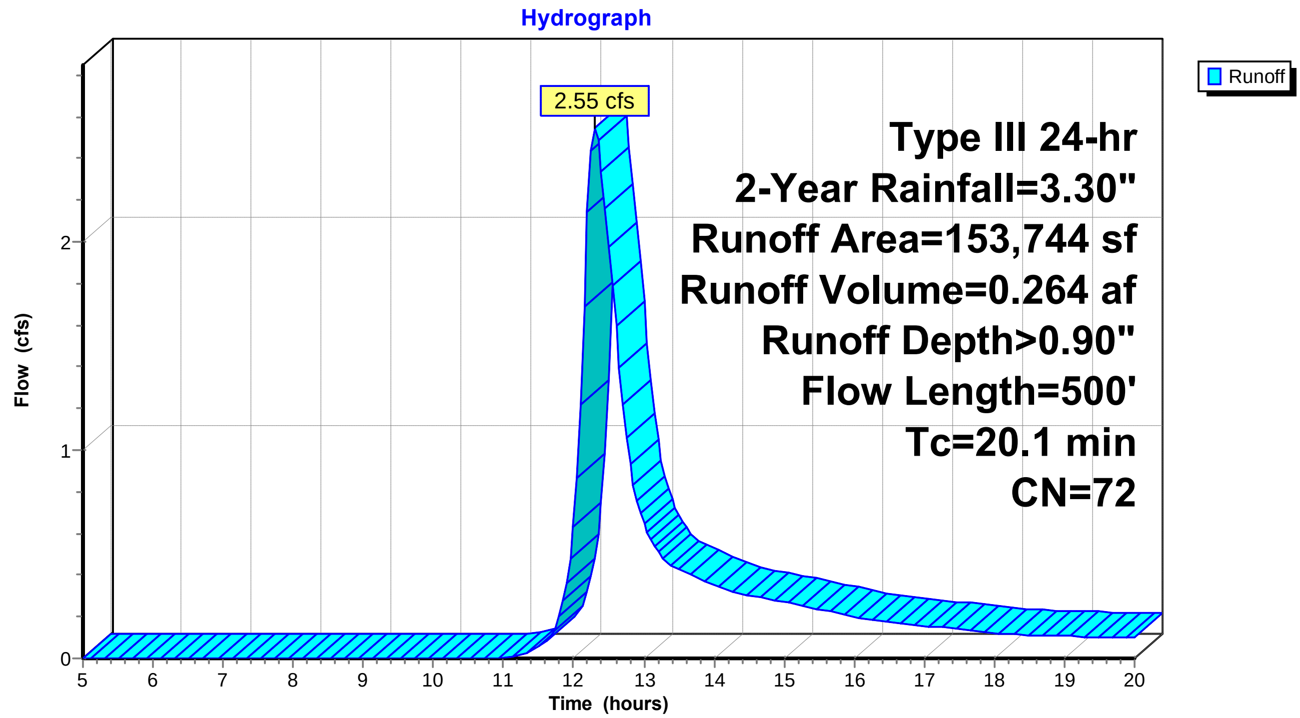
Runoff = 2.55 cfs @ 12.31 hrs, Volume= 0.264 af, Depth> 0.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.30"

Area (sf)	CN	Description
71,014	70	Woods, Good, HSG C
82,730	74	Pasture/grassland/range, Good, HSG C
153,744	72	Weighted Average
153,744		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.7	250	0.0560	0.21		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.20"
0.4	250	0.5000	11.38		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
20.1	500	Total			

Subcatchment PRDA2ND: PRDA-2



Summary for Subcatchment PRDA3ND: PRDA-3

[49] Hint: Tc<2dt may require smaller dt

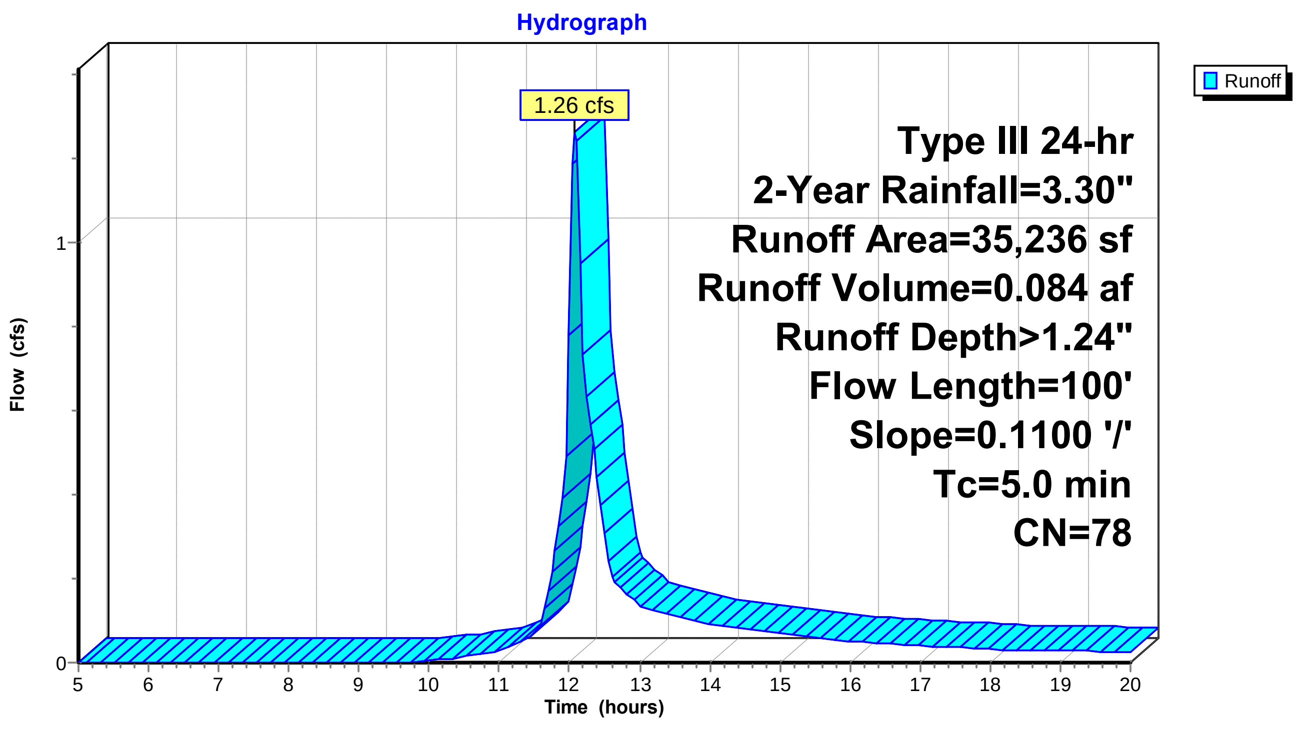
Runoff = 1.26 cfs @ 12.08 hrs, Volume= 0.084 af, Depth> 1.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.30"

Area (sf)	CN	Description
29,635	74	Pasture/grassland/range, Good, HSG C
5,601	98	Impervious, HSG C
35,236	78	Weighted Average
29,635		84.10% Pervious Area
5,601		15.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	100	0.1100	0.34		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"

Subcatchment PRDA3ND: PRDA-3



Summary for Subcatchment PRDA4ND: PRDA-4

[49] Hint: Tc<2dt may require smaller dt

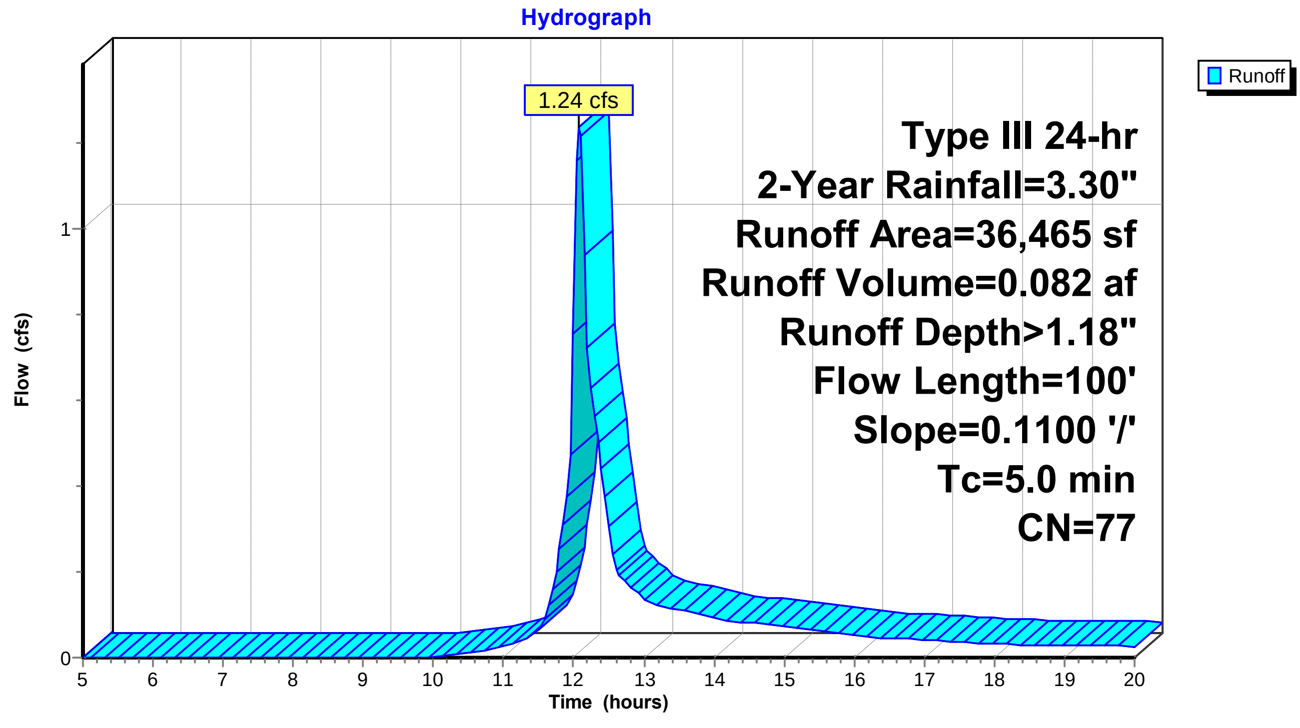
Runoff = 1.24 cfs @ 12.08 hrs, Volume= 0.082 af, Depth> 1.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.30"

	Area (sf)	CN	Description
	31,764	74	Pasture/grassland/range, Good, HSG C
*	4,701	98	Impervious
	36,465	77	Weighted Average
	31,764		87.11% Pervious Area
	4,701		12.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	100	0.1100	0.34		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"

Subcatchment PRDA4ND: PRDA-4



Summary for Subcatchment PRDA5ND: PRDA-5

[49] Hint: Tc<2dt may require smaller dt

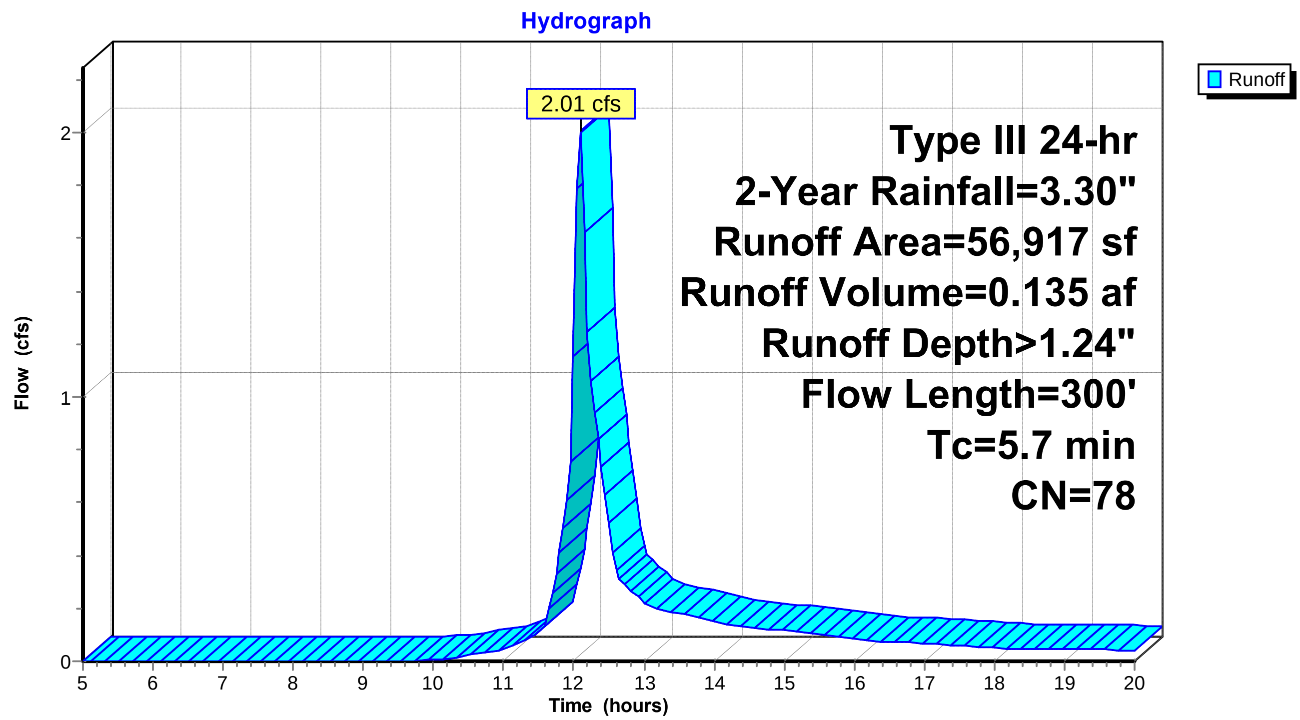
Runoff = 2.01 cfs @ 12.09 hrs, Volume= 0.135 af, Depth> 1.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.30"

Area (sf)	CN	Description
9,302	98	Impervious, HSG C
47,615	74	Pasture/grassland/range, Good, HSG C
56,917	78	Weighted Average
47,615		83.66% Pervious Area
9,302		16.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	200	0.3333	0.60		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.2	100	0.0100	6.84	8.40	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.010 PVC, smooth interior
5.7	300	Total			

Subcatchment PRDA5ND: PRDA-5



Summary for Subcatchment PRDA6ND: PRDA-6

[49] Hint: Tc<2dt may require smaller dt

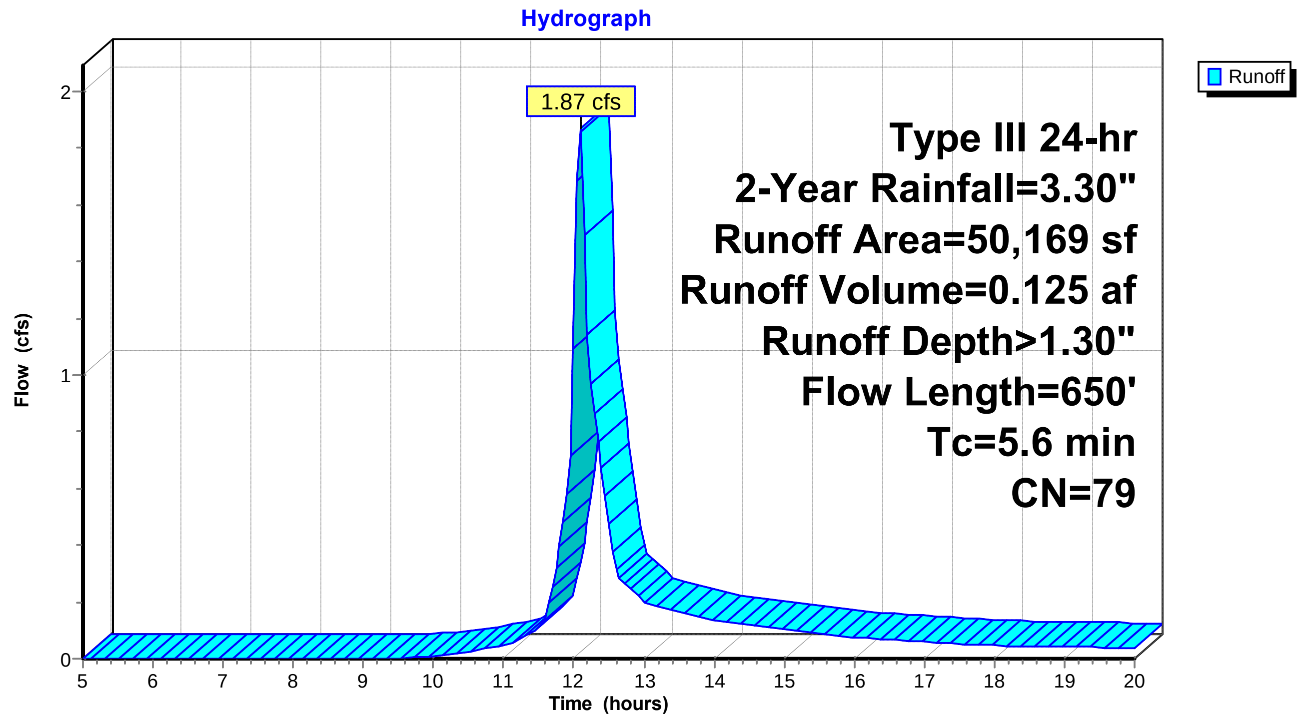
Runoff = 1.87 cfs @ 12.09 hrs, Volume= 0.125 af, Depth> 1.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.30"

Area (sf)	CN	Description
40,557	74	Pasture/grassland/range, Good, HSG C
9,612	98	Impervious, HSG C
50,169	79	Weighted Average
40,557		80.84% Pervious Area
9,612		19.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	150	0.3333	0.57		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.2	500	0.2050	6.79		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
5.6	650	Total			

Subcatchment PRDA6ND: PRDA-6



Summary for Pond BASIN A: BASIN A

Inflow Area = 9.357 ac, 36.10% Impervious, Inflow Depth > 1.57" for 2-Year event
Inflow = 17.85 cfs @ 12.10 hrs, Volume= 1.226 af
Outflow = 1.53 cfs @ 13.45 hrs, Volume= 0.876 af, Atten= 91%, Lag= 80.7 min
Primary = 0.77 cfs @ 13.45 hrs, Volume= 0.438 af
Secondary = 0.77 cfs @ 13.45 hrs, Volume= 0.438 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 820.91' @ 13.45 hrs Surf.Area= 33,954 sf Storage= 29,448 cf

Plug-Flow detention time= 211.1 min calculated for 0.873 af (71% of inflow)
Center-of-Mass det. time= 145.9 min (941.3 - 795.4)

Volume	Invert	Avail.Storage	Storage Description
#1	820.00'	151,470 cf	**Basin A (Irregular)** Listed below (Recalc)

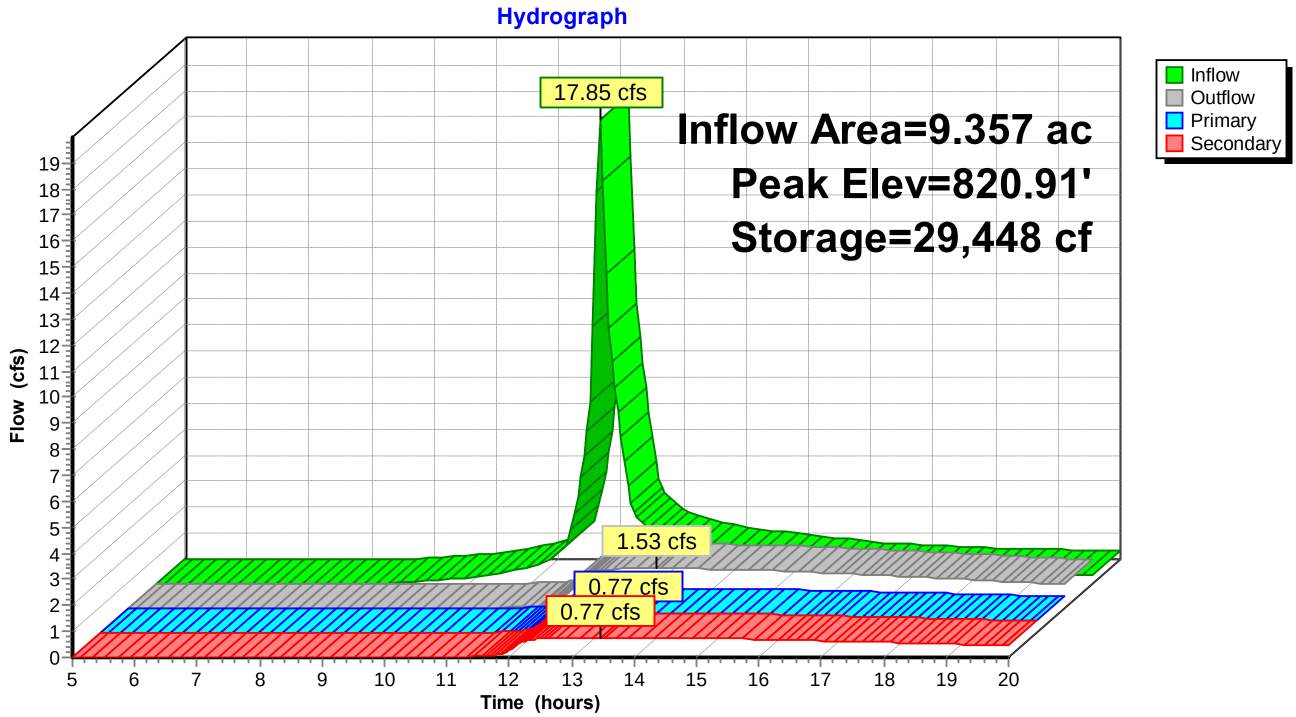
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
820.00	30,856	1,150.0	0	0	30,856
822.00	37,867	1,187.0	68,603	68,603	38,123
824.00	45,105	1,209.0	82,867	151,470	42,954

Device	Routing	Invert	Outlet Devices
#1	Primary	820.00'	**15.0" Round Culvert** L= 250.0' Ke= 0.500 Inlet / Outlet Invert= 820.00' / 786.00' S= 0.1360 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.23 sf
#2	Secondary	820.00'	**15.0" Round Culvert** L= 250.0' Ke= 0.500 Inlet / Outlet Invert= 820.00' / 786.00' S= 0.1360 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.23 sf
#3	Device 1	820.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Device 2	820.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#5	Device 1	822.00'	**15.0" W x 12.0" H Vert. Orifice/Grate** C= 0.600
#6	Device 2	822.00'	**12.0" W x 12.0" H Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.77 cfs @ 13.45 hrs HW=820.91' (Free Discharge)
└─**1=Culvert** (Passes 0.77 cfs of 3.10 cfs potential flow)
  ├─**3=Orifice/Grate** (Orifice Controls 0.77 cfs @ 3.91 fps)
  └─**5=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.77 cfs @ 13.45 hrs HW=820.91' (Free Discharge)
└─**2=Culvert** (Passes 0.77 cfs of 3.10 cfs potential flow)
  ├─**4=Orifice/Grate** (Orifice Controls 0.77 cfs @ 3.91 fps)
  └─**6=Orifice/Grate** (Controls 0.00 cfs)

Pond BASIN A: BASIN A



Summary for Pond BASIN B: BASIN B

Inflow Area = 8.515 ac, 15.24% Impervious, Inflow Depth > 1.16" for 2-Year event
Inflow = 5.96 cfs @ 12.61 hrs, Volume= 0.825 af
Outflow = 1.10 cfs @ 14.25 hrs, Volume= 0.615 af, Atten= 81%, Lag= 98.4 min
Primary = 1.10 cfs @ 14.25 hrs, Volume= 0.615 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 822.61' @ 14.25 hrs Surf.Area= 13,001 sf Storage= 18,063 cf

Plug-Flow detention time= 183.8 min calculated for 0.613 af (74% of inflow)
Center-of-Mass det. time= 124.9 min (962.5 - 837.6)

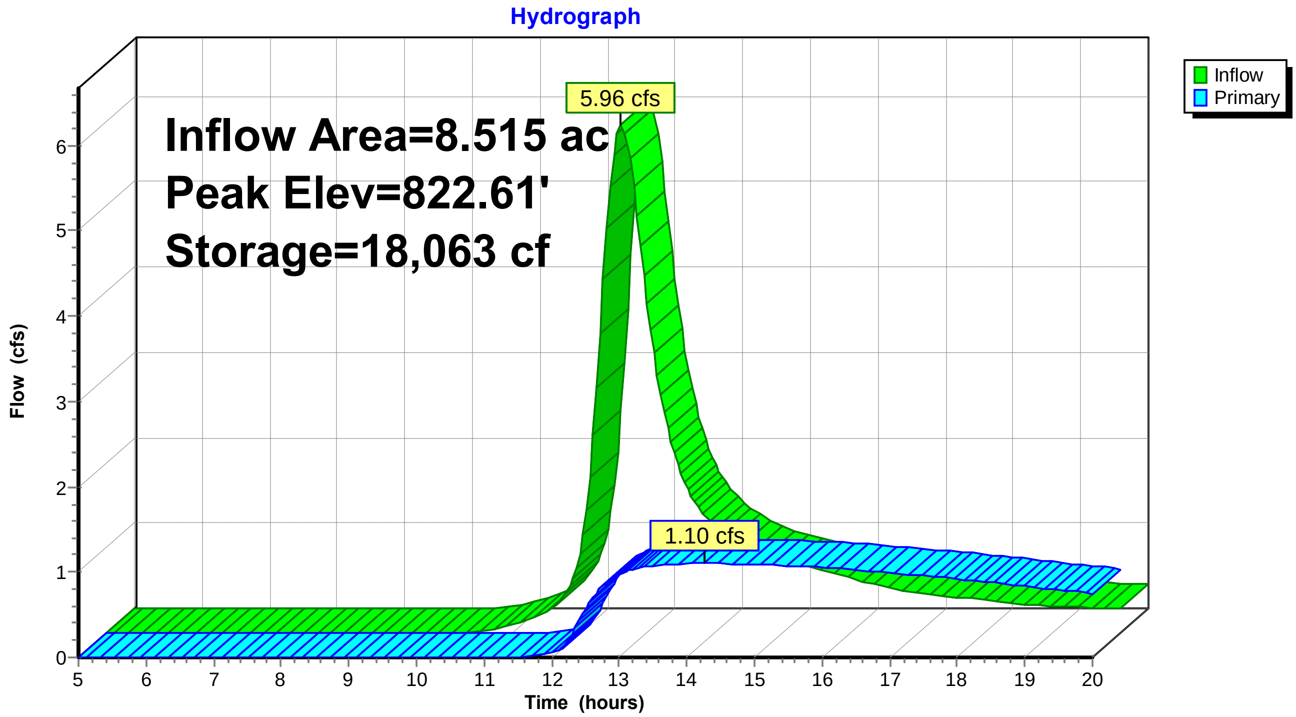
Volume	Invert	Avail.Storage	Storage Description
#1	821.00'	75,685 cf	**Basin B (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
821.00	9,468	729.0	0	0	9,468
822.00	11,682	748.0	10,556	10,556	11,820
824.00	16,283	786.0	27,838	38,394	16,706
826.00	21,113	824.1	37,292	75,685	21,846

Device	Routing	Invert	Outlet Devices
#1	Primary	821.00'	**15.0" Round Culvert** L= 100.0' Ke= 0.500 Inlet / Outlet Invert= 821.00' / 797.00' S= 0.2400 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.23 sf
#2	Device 1	821.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	823.00'	**12.0" W x 18.0" H Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=1.10 cfs @ 14.25 hrs HW=822.61' (Free Discharge)
└─**1=Culvert** (Passes 1.10 cfs of 5.86 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 1.10 cfs @ 5.61 fps)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Pond BASIN B: BASIN B

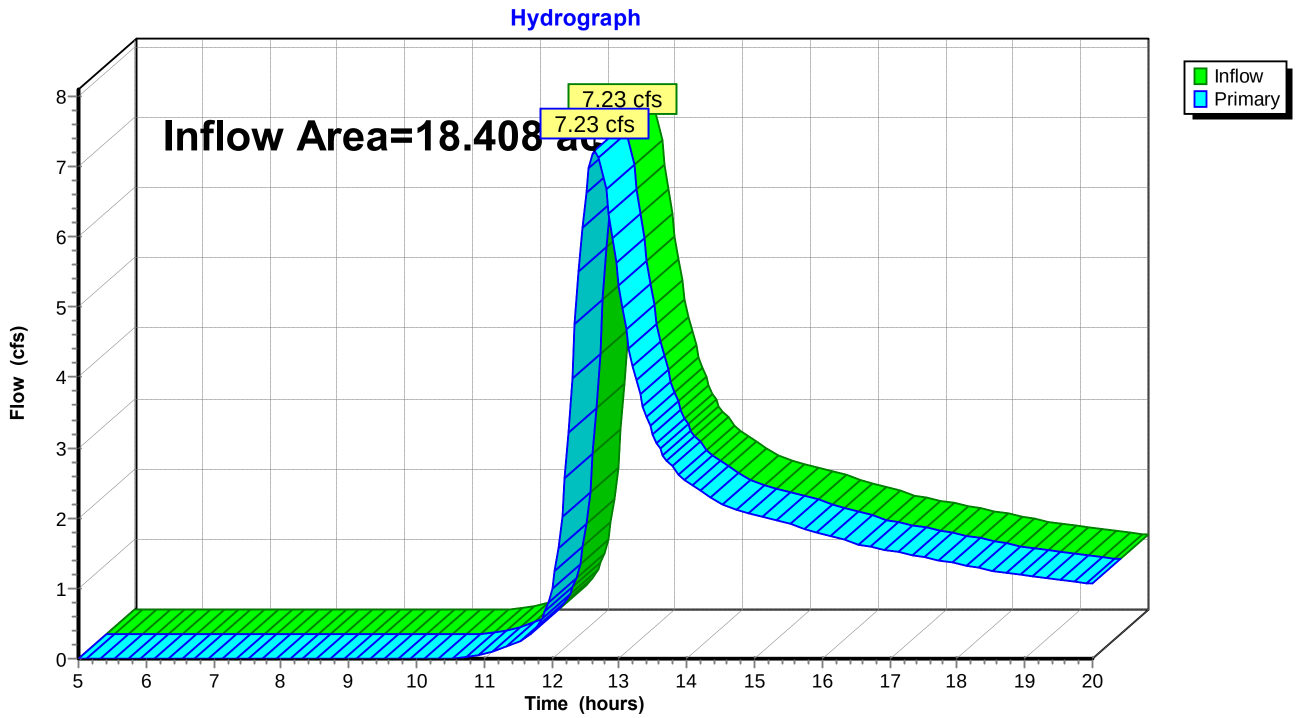


Summary for Link DP1: DP-1

Inflow Area = 18.408 ac, 14.49% Impervious, Inflow Depth > 0.99" for 2-Year event
Inflow = 7.23 cfs @ 12.65 hrs, Volume= 1.525 af
Primary = 7.23 cfs @ 12.65 hrs, Volume= 1.525 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP1: DP-1

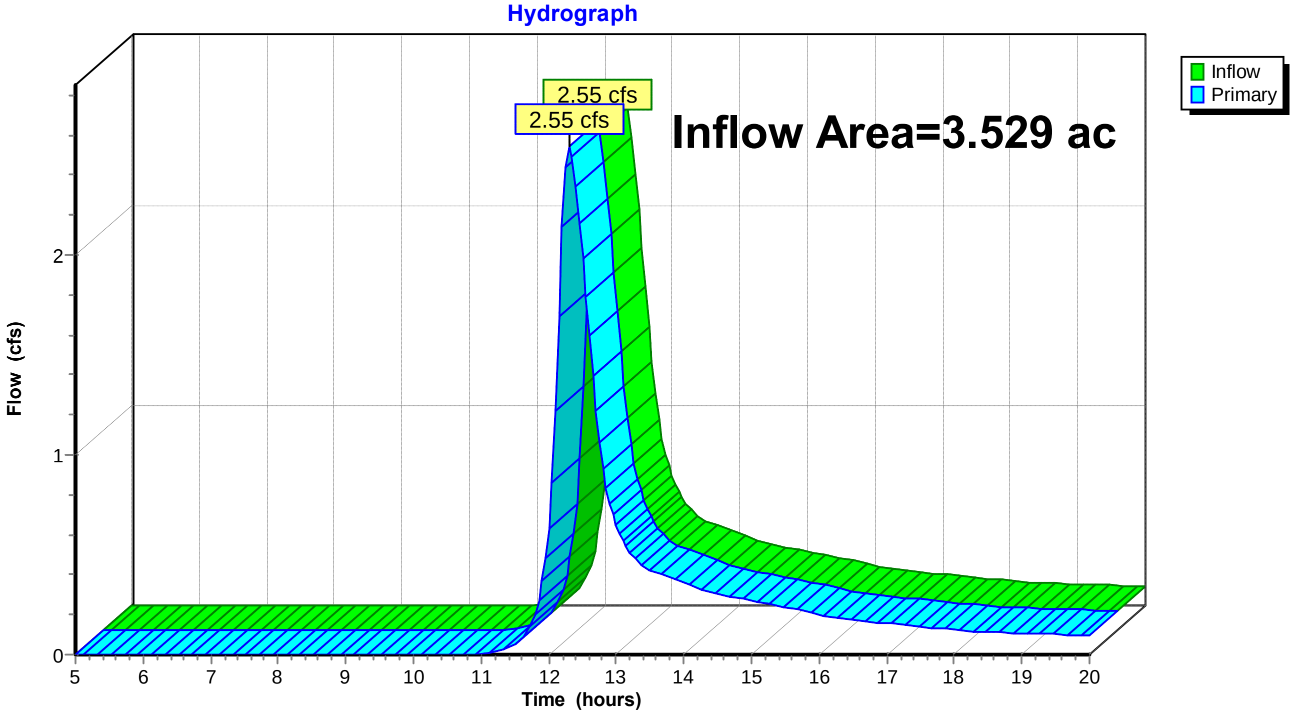


Summary for Link DP2: DP-2

Inflow Area =	3.529 ac,	0.00% Impervious, Inflow Depth >	0.90"	for 2-Year event
Inflow =	2.55 cfs @	12.31 hrs, Volume=	0.264 af	
Primary =	2.55 cfs @	12.31 hrs, Volume=	0.264 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP2: DP-2

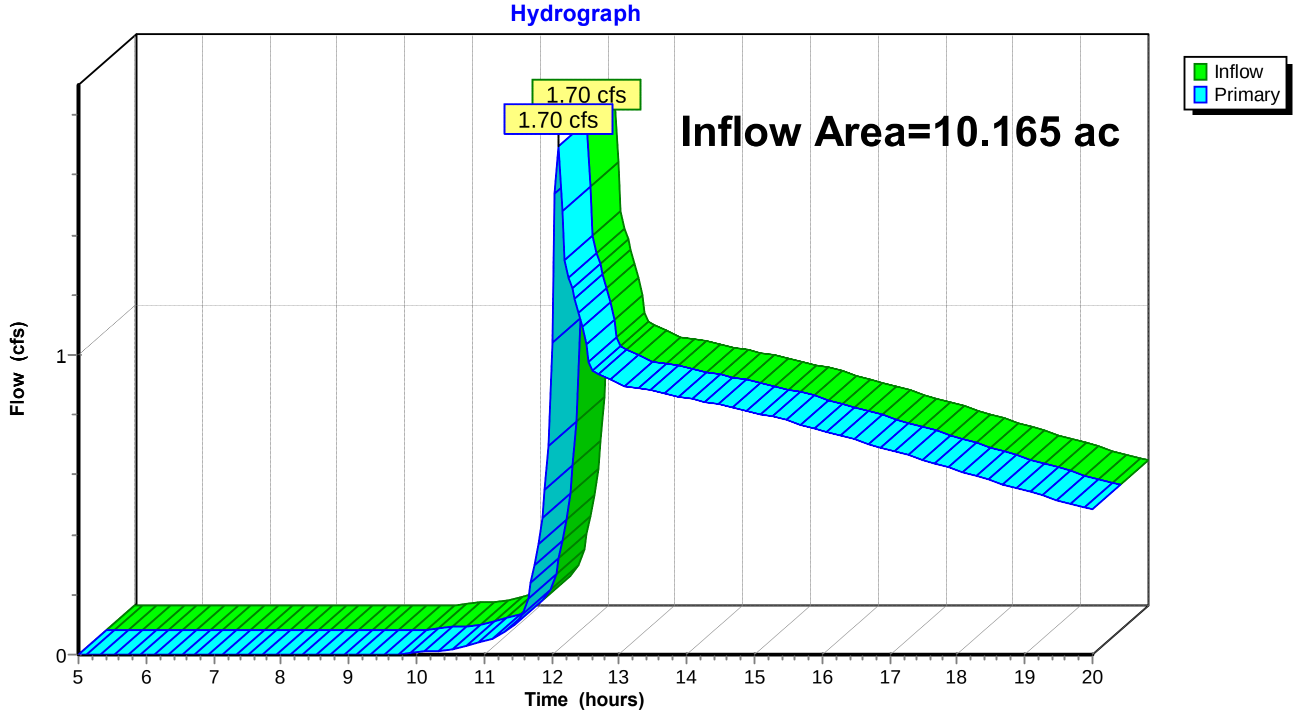


Summary for Link DP3: DP-3

Inflow Area =	10.165 ac, 34.49% Impervious, Inflow Depth > 0.62"	for 2-Year event
Inflow =	1.70 cfs @ 12.10 hrs, Volume=	0.522 af
Primary =	1.70 cfs @ 12.10 hrs, Volume=	0.522 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP3: DP-3

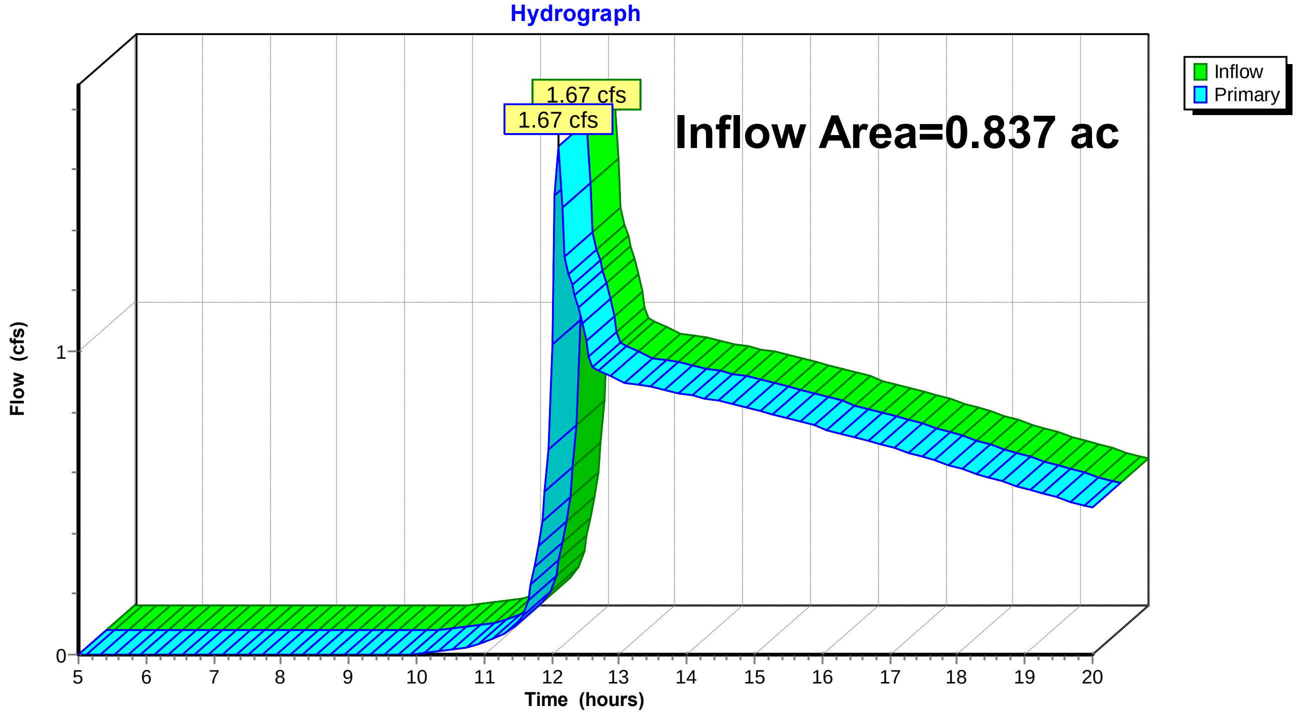


Summary for Link DP4: DP-4

Inflow Area =	0.837 ac,	12.89% Impervious,	Inflow Depth > 7.46"	for 2-Year event
Inflow =	1.67 cfs @	12.10 hrs, Volume=	0.520 af	
Primary =	1.67 cfs @	12.10 hrs, Volume=	0.520 af, Atten= 0%, Lag= 0.0 min	

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP4: DP-4

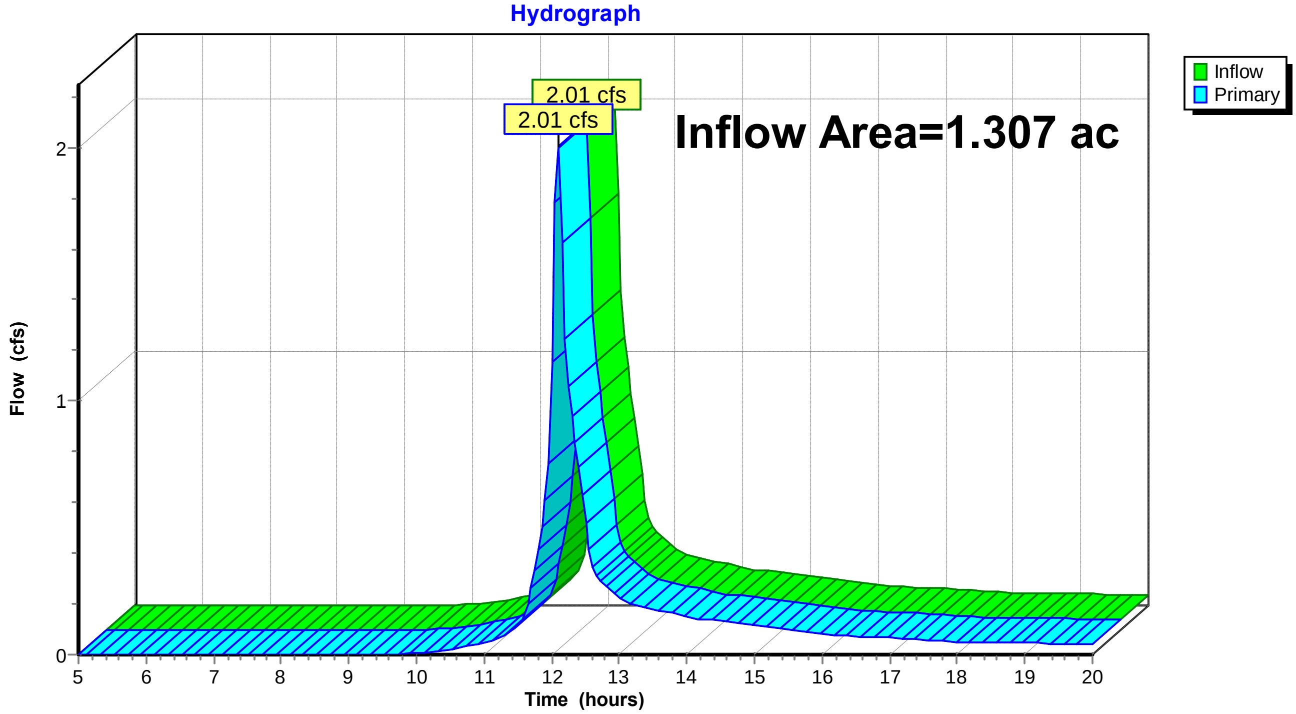


Summary for Link DP5: DP-5

Inflow Area =	1.307 ac, 16.34% Impervious, Inflow Depth > 1.24"		for 2-Year event
Inflow =	2.01 cfs @ 12.09 hrs, Volume=	0.135 af	
Primary =	2.01 cfs @ 12.09 hrs, Volume=	0.135 af, Atten= 0%, Lag= 0.0 min	

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP5: DP-5

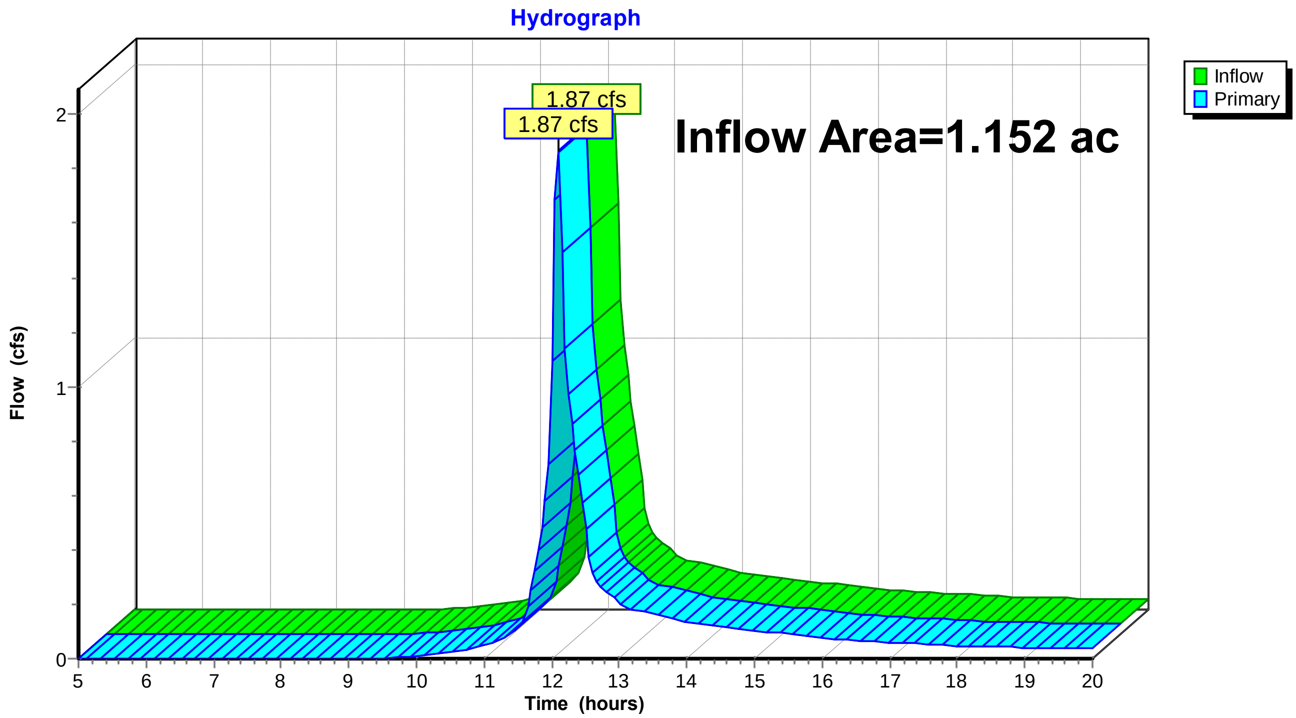


Summary for Link DP6: DP-6

Inflow Area = 1.152 ac, 19.16% Impervious, Inflow Depth > 1.30" for 2-Year event
Inflow = 1.87 cfs @ 12.09 hrs, Volume= 0.125 af
Primary = 1.87 cfs @ 12.09 hrs, Volume= 0.125 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP6: DP-6



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PRDA1D: PRDA-1 Runoff Area=407,573 sf 36.10% Impervious Runoff Depth>2.98"
Flow Length=1,450' Tc=6.7 min CN=83 Runoff=33.34 cfs 2.320 af

Subcatchment PRDA1ND: PRDA-1 Runoff Area=430,906 sf 13.85% Impervious Runoff Depth>2.32"
Flow Length=1,775' Tc=42.9 min CN=76 Runoff=13.90 cfs 1.916 af

Subcatchment PRDA2D: PRDA-2 Runoff Area=370,926 sf 15.24% Impervious Runoff Depth>2.41"
Flow Length=850' Tc=42.4 min CN=77 Runoff=12.49 cfs 1.709 af

Subcatchment PRDA2ND: PRDA-2 Runoff Area=153,744 sf 0.00% Impervious Runoff Depth>2.02"
Flow Length=500' Tc=20.1 min CN=72 Runoff=6.01 cfs 0.594 af

Subcatchment PRDA3ND: PRDA-3 Runoff Area=35,236 sf 15.90% Impervious Runoff Depth>2.53"
Flow Length=100' Slope=0.1100 '/' Tc=5.0 min CN=78 Runoff=2.57 cfs 0.170 af

Subcatchment PRDA4ND: PRDA-4 Runoff Area=36,465 sf 12.89% Impervious Runoff Depth>2.44"
Flow Length=100' Slope=0.1100 '/' Tc=5.0 min CN=77 Runoff=2.58 cfs 0.170 af

Subcatchment PRDA5ND: PRDA-5 Runoff Area=56,917 sf 16.34% Impervious Runoff Depth>2.53"
Flow Length=300' Tc=5.7 min CN=78 Runoff=4.10 cfs 0.275 af

Subcatchment PRDA6ND: PRDA-6 Runoff Area=50,169 sf 19.16% Impervious Runoff Depth>2.61"
Flow Length=650' Tc=5.6 min CN=79 Runoff=3.74 cfs 0.251 af

Pond BASIN A: BASIN A Peak Elev=821.77' Storage=59,825 cf Inflow=33.34 cfs 2.320 af
Primary=1.16 cfs 0.738 af Secondary=1.16 cfs 0.738 af Outflow=2.33 cfs 1.476 af

Pond BASIN B: BASIN B Peak Elev=823.81' Storage=35,393 cf Inflow=12.49 cfs 1.709 af
Outflow=3.87 cfs 1.284 af

Link DP1: DP-1 Inflow=15.08 cfs 3.200 af
Primary=15.08 cfs 3.200 af

Link DP2: DP-2 Inflow=6.01 cfs 0.594 af
Primary=6.01 cfs 0.594 af

Link DP3: DP-3 Inflow=3.36 cfs 0.908 af
Primary=3.36 cfs 0.908 af

Link DP4: DP-4 Inflow=3.36 cfs 0.908 af
Primary=3.36 cfs 0.908 af

Link DP5: DP-5 Inflow=4.10 cfs 0.275 af
Primary=4.10 cfs 0.275 af

Link DP6: DP-6 Inflow=3.74 cfs 0.251 af
Primary=3.74 cfs 0.251 af

Total Runoff Area = 35.398 ac Runoff Volume = 7.406 af Average Runoff Depth = 2.51"
81.03% Pervious = 28.682 ac 18.97% Impervious = 6.716 ac

Summary for Subcatchment PRDA1D: PRDA-1

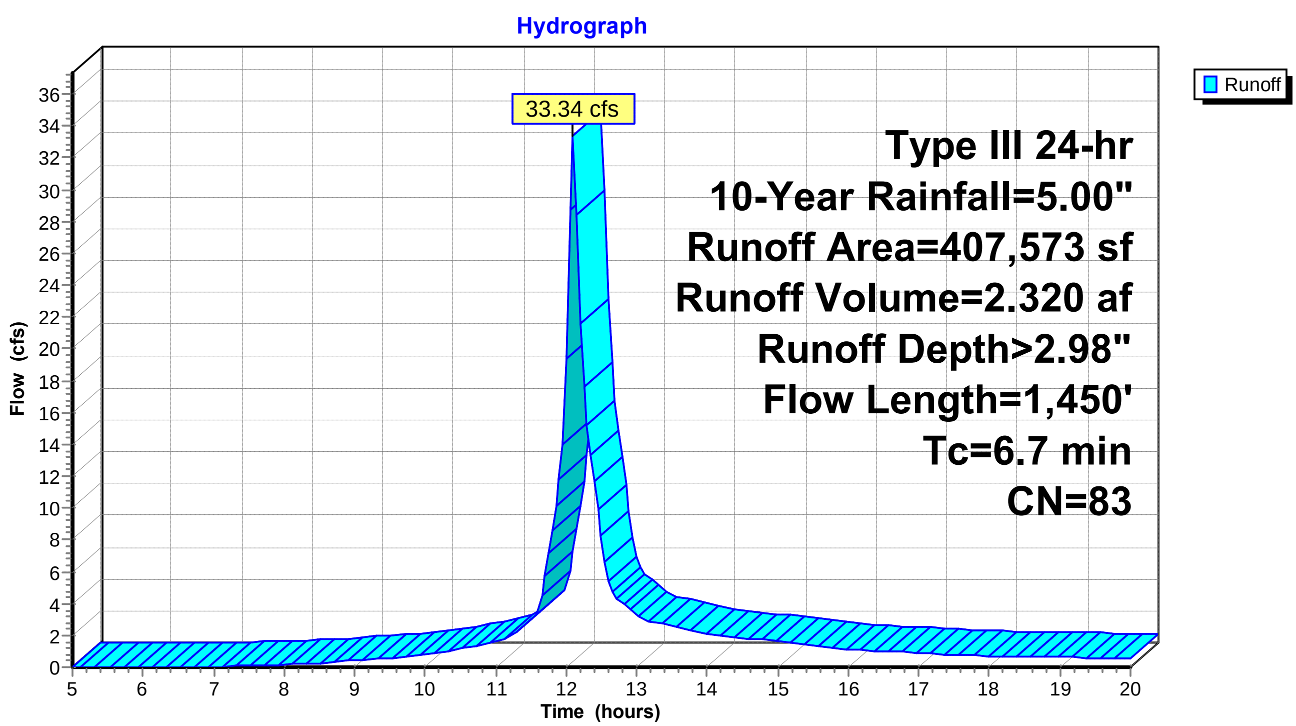
Runoff = 33.34 cfs @ 12.10 hrs, Volume= 2.320 af, Depth> 2.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.00"

	Area (sf)	CN	Description
	69,087	98	Impervious, HSG C
	36,569	98	Roofs, HSG C
	41,458	98	Water Surface, HSG C
*	260,459	75	Gravel, HSG C
	407,573	83	Weighted Average
	260,459		63.90% Pervious Area
	147,114		36.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	250	0.0100	1.25		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
3.4	1,200	0.0075	5.93	7.27	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.010 PVC, smooth interior
6.7	1,450	Total			

Subcatchment PRDA1D: PRDA-1



Summary for Subcatchment PRDA1ND: PRDA-1

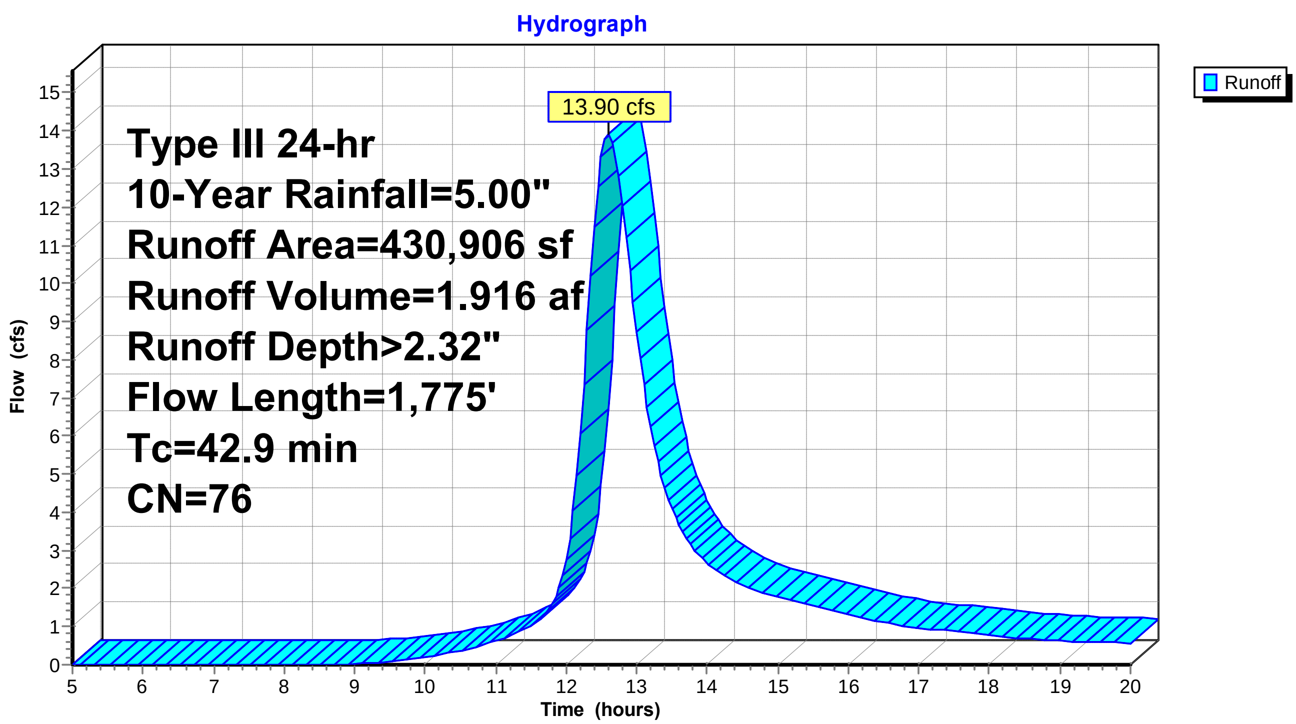
Runoff = 13.90 cfs @ 12.60 hrs, Volume= 1.916 af, Depth> 2.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.00"

Area (sf)	CN	Description
114,584	70	Woods, Good, HSG C
256,640	74	Pasture/grassland/range, Good, HSG C
59,682	98	Impervious, HSG C
430,906	76	Weighted Average
371,224		86.15% Pervious Area
59,682		13.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.0	250	0.0320	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
4.9	1,000	0.0440	3.38		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.0	525	0.0570	8.87	53.22	**Channel Flow,** Area= 6.0 sf Perim= 6.0' r= 1.00' n= 0.040 Earth, cobble bottom, clean sides
42.9	1,775	Total			

Subcatchment PRDA1ND: PRDA-1



Summary for Subcatchment PRDA2D: PRDA-2

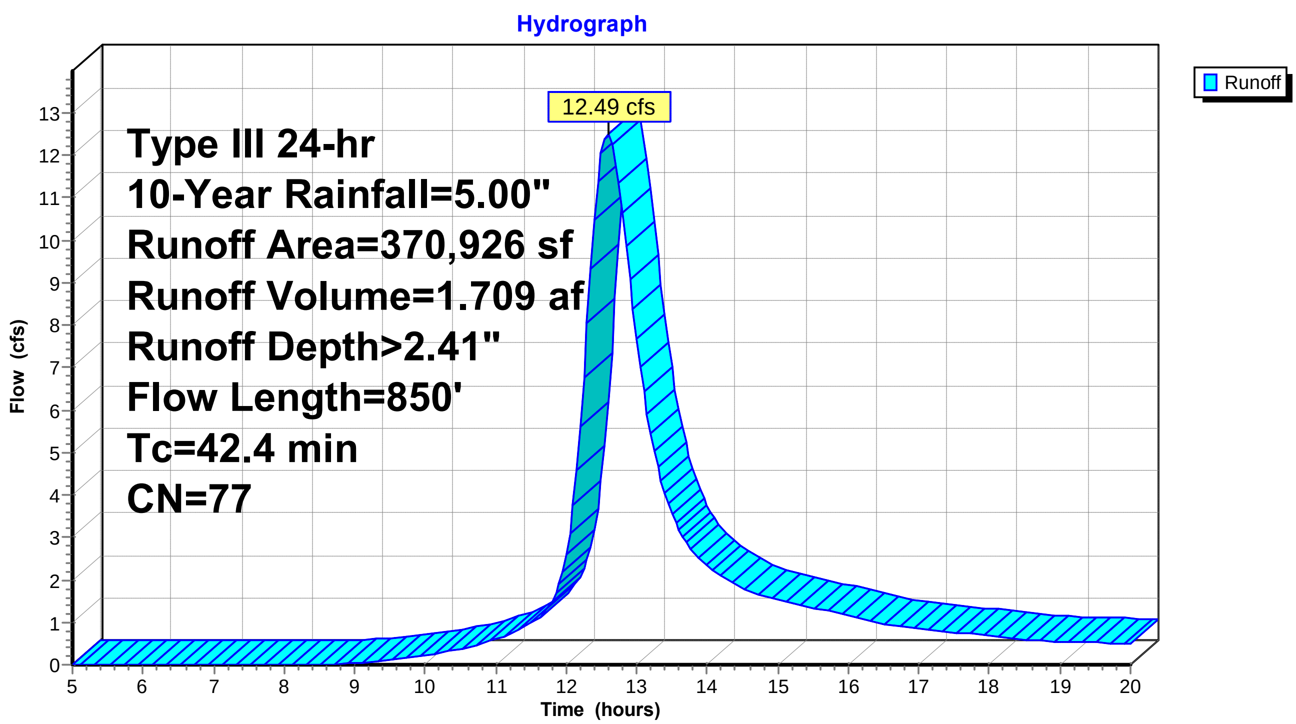
Runoff = 12.49 cfs @ 12.59 hrs, Volume= 1.709 af, Depth> 2.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.00"

	Area (sf)	CN	Description
	36,718	98	Impervious, HSG C
	1,151	98	Roofs, HSG C
	18,667	98	Water Surface, HSG C
	134,433	74	Pasture/grassland/range, Good, HSG C
*	115,820	75	Gravel, HSG C
	64,137	70	Woods, Good, HSG C
	370,926	77	Weighted Average
	314,390		84.76% Pervious Area
	56,536		15.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.0	250	0.0320	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
5.4	600	0.0700	1.85		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
42.4	850	Total			

Subcatchment PRDA2D: PRDA-2



Summary for Subcatchment PRDA2ND: PRDA-2

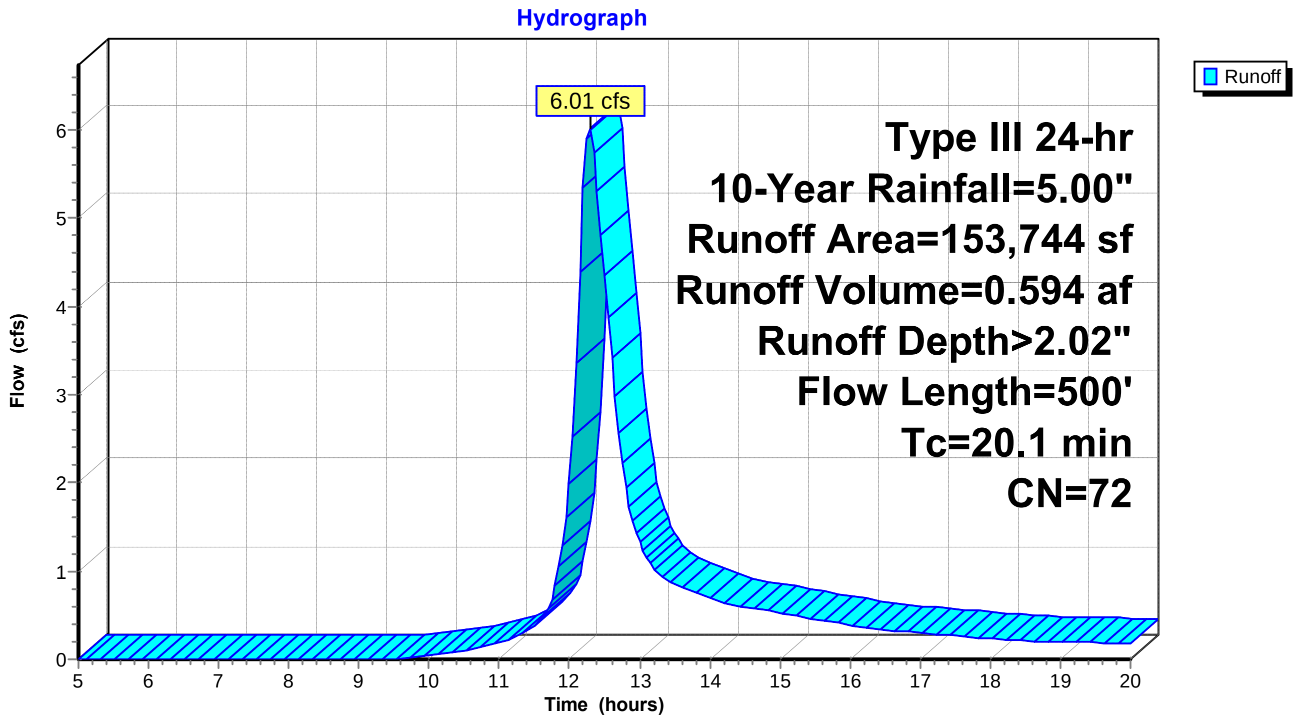
Runoff = 6.01 cfs @ 12.29 hrs, Volume= 0.594 af, Depth> 2.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.00"

Area (sf)	CN	Description
71,014	70	Woods, Good, HSG C
82,730	74	Pasture/grassland/range, Good, HSG C
153,744	72	Weighted Average
153,744		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.7	250	0.0560	0.21		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.20"
0.4	250	0.5000	11.38		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
20.1	500	Total			

Subcatchment PRDA2ND: PRDA-2



Summary for Subcatchment PRDA3ND: PRDA-3

[49] Hint: Tc<2dt may require smaller dt

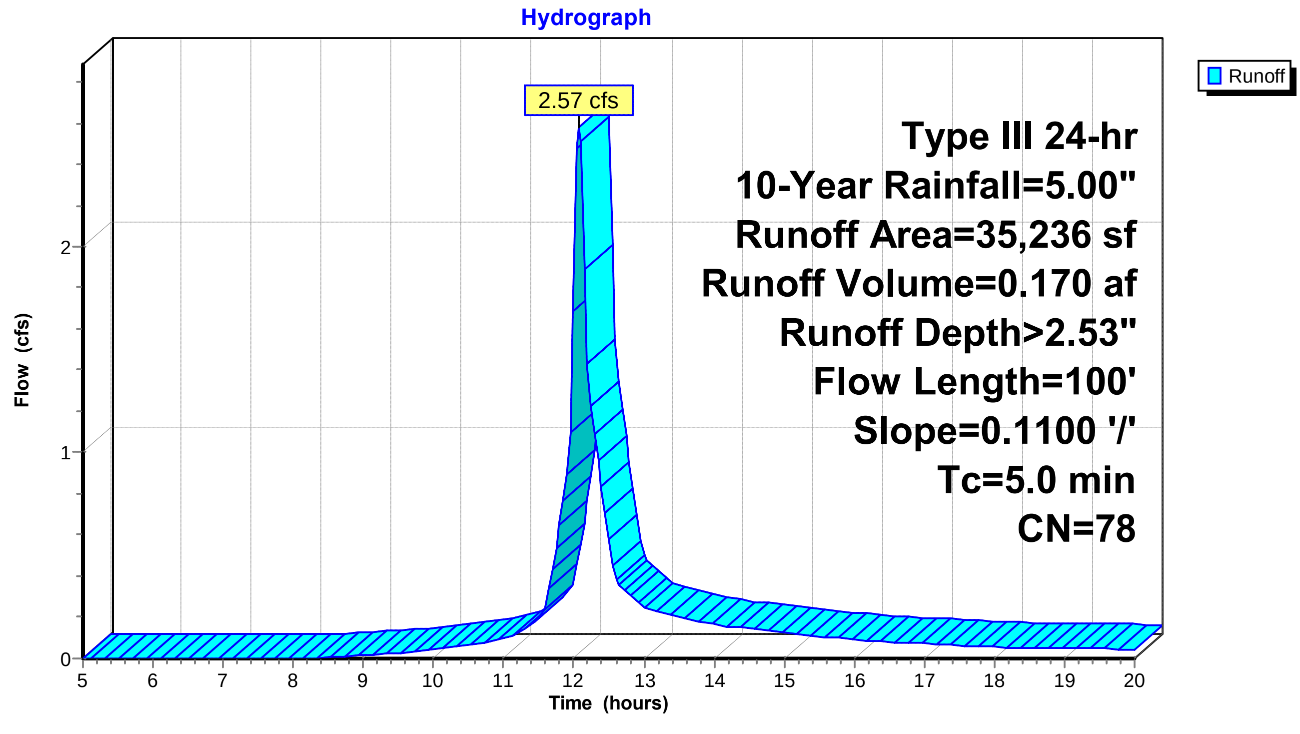
Runoff = 2.57 cfs @ 12.08 hrs, Volume= 0.170 af, Depth> 2.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.00"

Area (sf)	CN	Description
29,635	74	Pasture/grassland/range, Good, HSG C
5,601	98	Impervious, HSG C
35,236	78	Weighted Average
29,635		84.10% Pervious Area
5,601		15.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	100	0.1100	0.34		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"

Subcatchment PRDA3ND: PRDA-3



Summary for Subcatchment PRDA4ND: PRDA-4

[49] Hint: Tc<2dt may require smaller dt

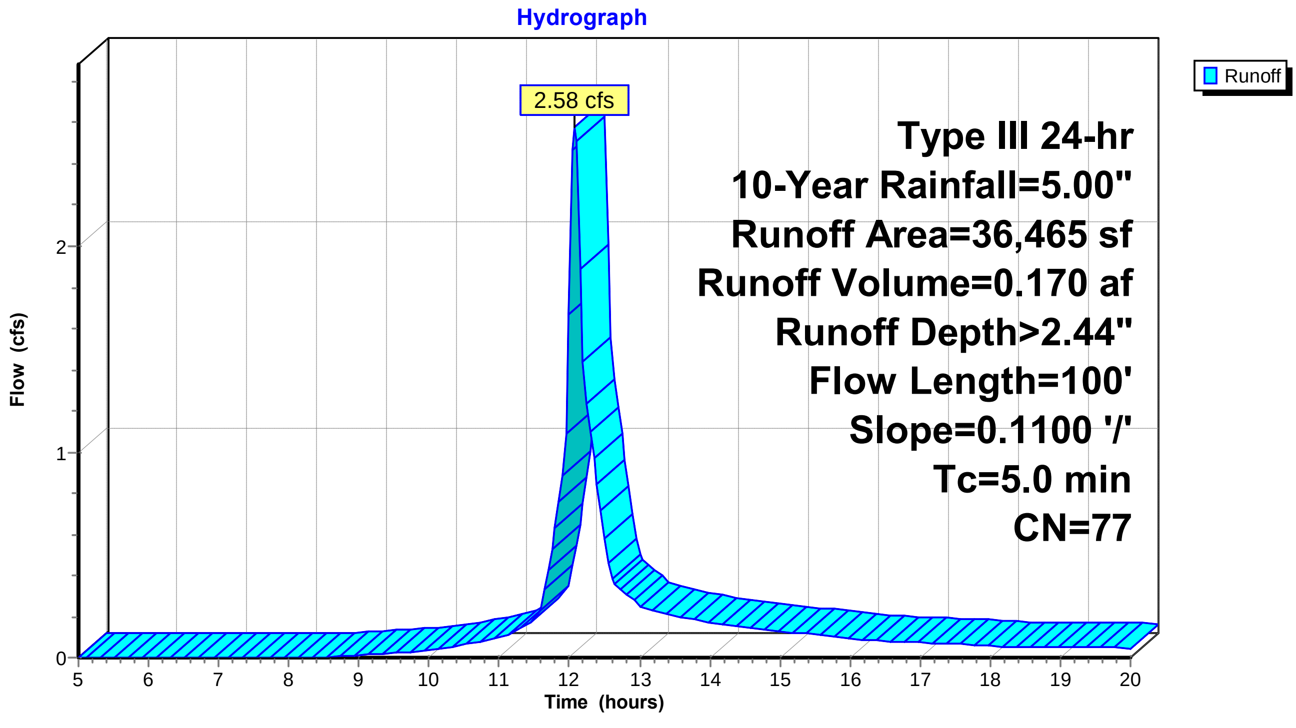
Runoff = 2.58 cfs @ 12.08 hrs, Volume= 0.170 af, Depth> 2.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.00"

	Area (sf)	CN	Description
	31,764	74	Pasture/grassland/range, Good, HSG C
*	4,701	98	Impervious
	36,465	77	Weighted Average
	31,764		87.11% Pervious Area
	4,701		12.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	100	0.1100	0.34		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"

Subcatchment PRDA4ND: PRDA-4



Summary for Subcatchment PRDA5ND: PRDA-5

[49] Hint: Tc<2dt may require smaller dt

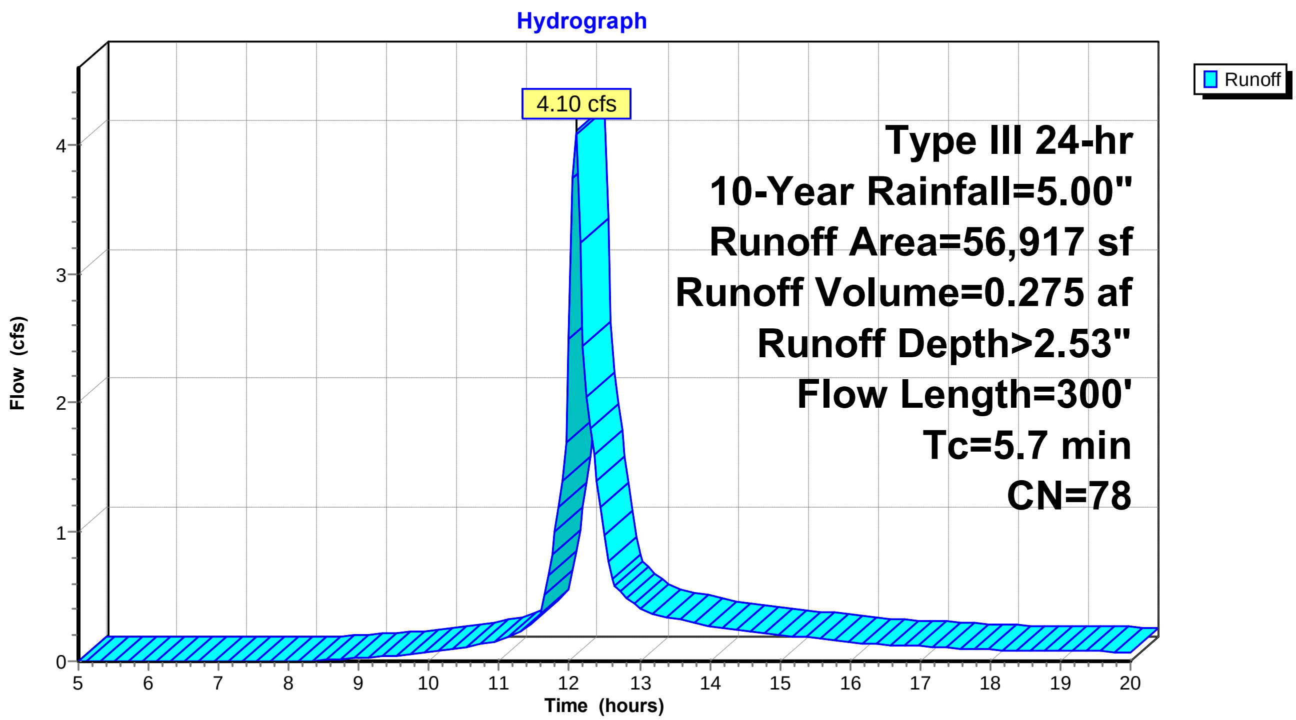
Runoff = 4.10 cfs @ 12.09 hrs, Volume= 0.275 af, Depth> 2.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.00"

Area (sf)	CN	Description
9,302	98	Impervious, HSG C
47,615	74	Pasture/grassland/range, Good, HSG C
56,917	78	Weighted Average
47,615		83.66% Pervious Area
9,302		16.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	200	0.3333	0.60		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.2	100	0.0100	6.84	8.40	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.010 PVC, smooth interior
5.7	300	Total			

Subcatchment PRDA5ND: PRDA-5



Summary for Subcatchment PRDA6ND: PRDA-6

[49] Hint: Tc<2dt may require smaller dt

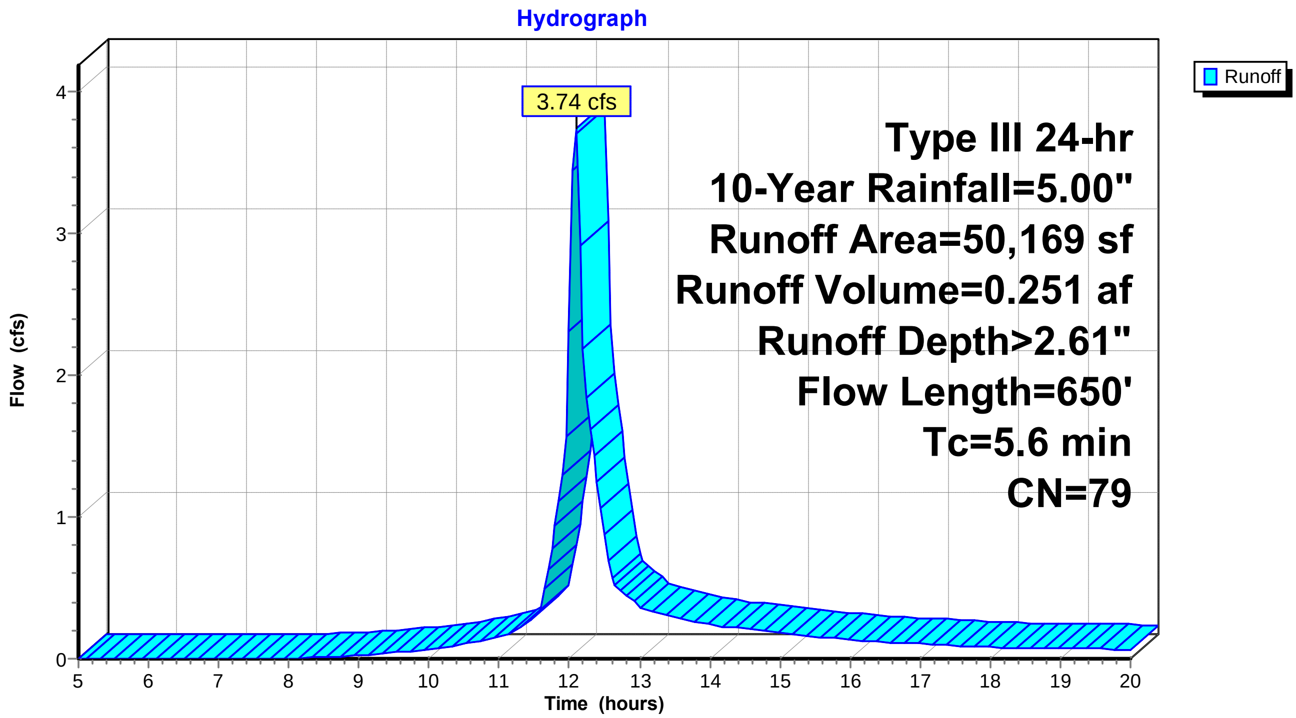
Runoff = 3.74 cfs @ 12.09 hrs, Volume= 0.251 af, Depth> 2.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.00"

Area (sf)	CN	Description
40,557	74	Pasture/grassland/range, Good, HSG C
9,612	98	Impervious, HSG C
50,169	79	Weighted Average
40,557		80.84% Pervious Area
9,612		19.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	150	0.3333	0.57		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.2	500	0.2050	6.79		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
5.6	650	Total			

Subcatchment PRDA6ND: PRDA-6



Summary for Pond BASIN A: BASIN A

Inflow Area = 9.357 ac, 36.10% Impervious, Inflow Depth > 2.98" for 10-Year event
Inflow = 33.34 cfs @ 12.10 hrs, Volume= 2.320 af
Outflow = 2.33 cfs @ 13.77 hrs, Volume= 1.476 af, Atten= 93%, Lag= 100.4 min
Primary = 1.16 cfs @ 13.77 hrs, Volume= 0.738 af
Secondary = 1.16 cfs @ 13.77 hrs, Volume= 0.738 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 821.77' @ 13.77 hrs Surf.Area= 37,008 sf Storage= 59,825 cf

Plug-Flow detention time= 231.5 min calculated for 1.471 af (63% of inflow)
Center-of-Mass det. time= 160.0 min (940.6 - 780.7)

Volume	Invert	Avail.Storage	Storage Description
#1	820.00'	151,470 cf	**Basin A (Irregular)** Listed below (Recalc)

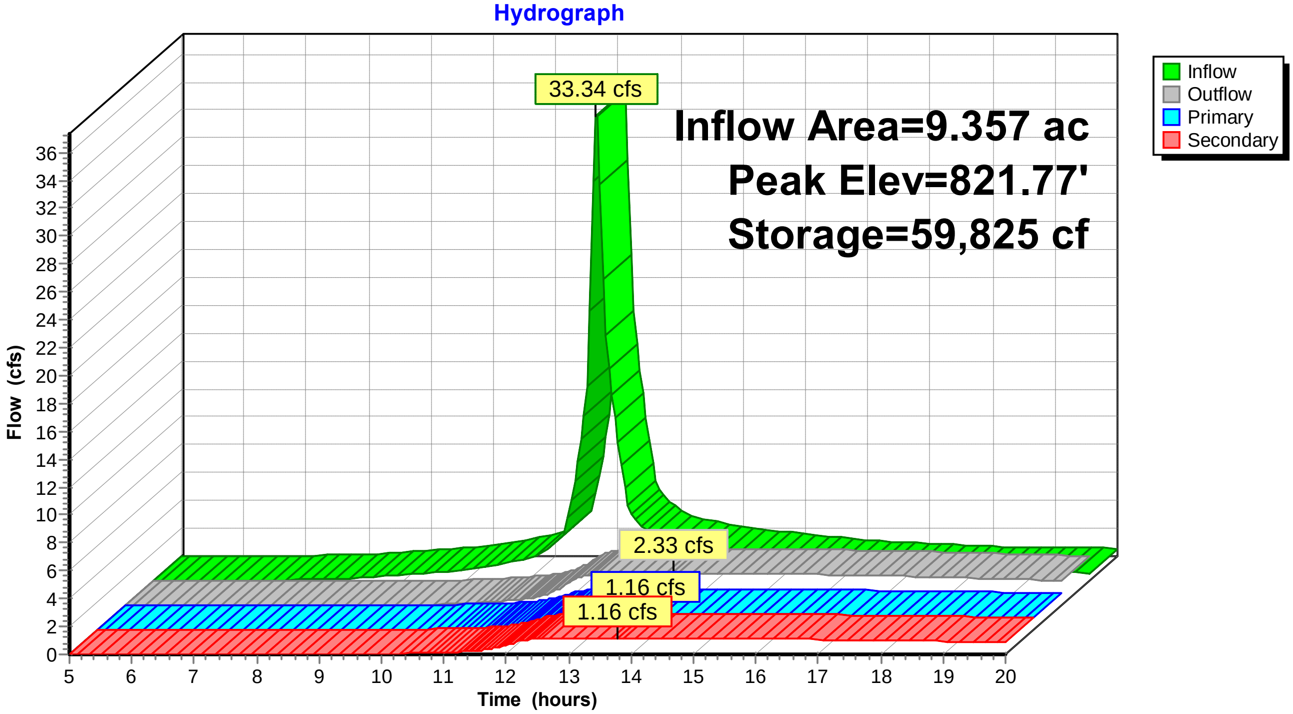
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
820.00	30,856	1,150.0	0	0	30,856
822.00	37,867	1,187.0	68,603	68,603	38,123
824.00	45,105	1,209.0	82,867	151,470	42,954

Device	Routing	Invert	Outlet Devices
#1	Primary	820.00'	**15.0" Round Culvert** L= 250.0' Ke= 0.500 Inlet / Outlet Invert= 820.00' / 786.00' S= 0.1360 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.23 sf
#2	Secondary	820.00'	**15.0" Round Culvert** L= 250.0' Ke= 0.500 Inlet / Outlet Invert= 820.00' / 786.00' S= 0.1360 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.23 sf
#3	Device 1	820.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Device 2	820.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#5	Device 1	822.00'	**15.0" W x 12.0" H Vert. Orifice/Grate** C= 0.600
#6	Device 2	822.00'	**12.0" W x 12.0" H Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=1.16 cfs @ 13.77 hrs HW=821.77' (Free Discharge)
└─**1=Culvert** (Passes 1.16 cfs of 6.31 cfs potential flow)
  ├─**3=Orifice/Grate** (Orifice Controls 1.16 cfs @ 5.93 fps)
  └─**5=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=1.16 cfs @ 13.77 hrs HW=821.77' (Free Discharge)
└─**2=Culvert** (Passes 1.16 cfs of 6.31 cfs potential flow)
  ├─**4=Orifice/Grate** (Orifice Controls 1.16 cfs @ 5.93 fps)
  └─**6=Orifice/Grate** (Controls 0.00 cfs)

Pond BASIN A: BASIN A



Summary for Pond BASIN B: BASIN B

Inflow Area =	8.515 ac, 15.24% Impervious, Inflow Depth > 2.41"		for 10-Year event
Inflow =	12.49 cfs @ 12.59 hrs, Volume=	1.709 af	
Outflow =	3.87 cfs @ 13.44 hrs, Volume=	1.284 af, Atten= 69%, Lag= 50.5 min	
Primary =	3.87 cfs @ 13.44 hrs, Volume=	1.284 af	

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 823.81' @ 13.44 hrs Surf.Area= 15,821 sf Storage= 35,393 cf

Plug-Flow detention time= 156.0 min calculated for 1.284 af (75% of inflow)
Center-of-Mass det. time= 98.5 min (920.5 - 822.0)

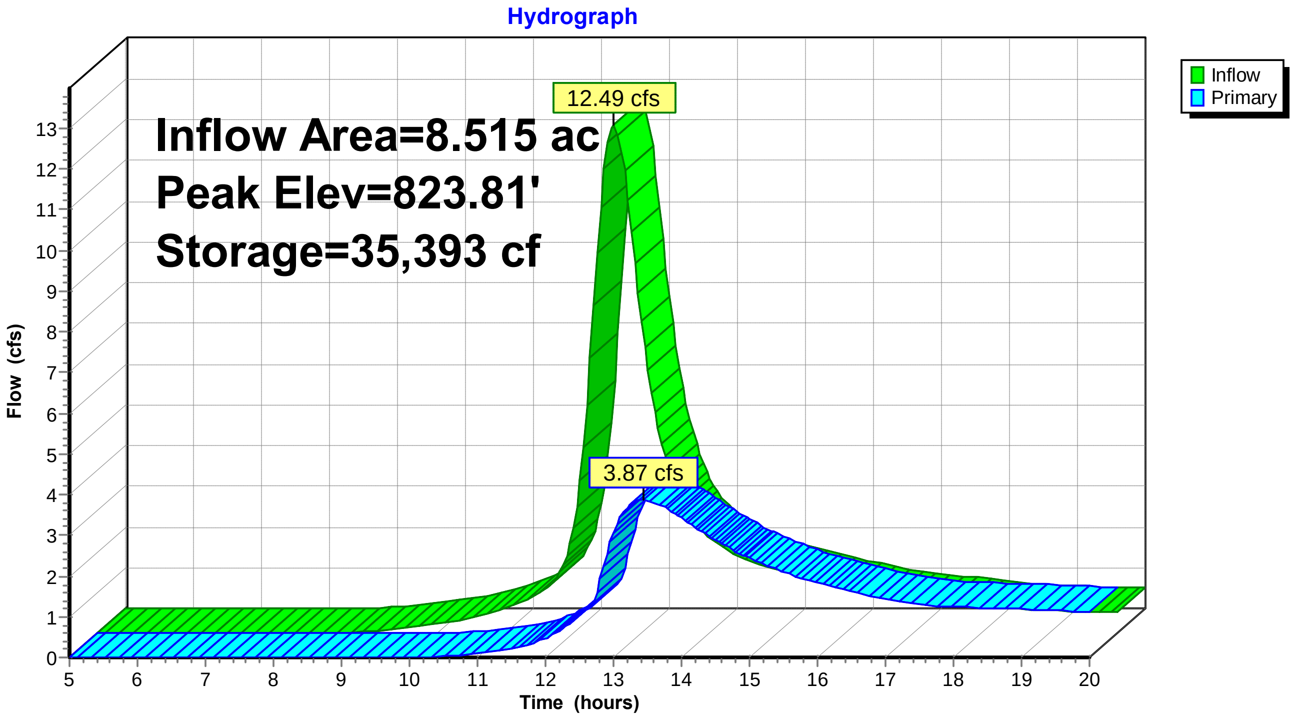
Volume	Invert	Avail.Storage	Storage Description
#1	821.00'	75,685 cf	**Basin B (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
821.00	9,468	729.0	0	0	9,468
822.00	11,682	748.0	10,556	10,556	11,820
824.00	16,283	786.0	27,838	38,394	16,706
826.00	21,113	824.1	37,292	75,685	21,846

Device	Routing	Invert	Outlet Devices
#1	Primary	821.00'	**15.0" Round Culvert** L= 100.0' Ke= 0.500 Inlet / Outlet Invert= 821.00' / 797.00' S= 0.2400 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.23 sf
#2	Device 1	821.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	823.00'	**12.0" W x 18.0" H Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=3.87 cfs @ 13.44 hrs HW=823.81' (Free Discharge)
└─**1=Culvert** (Passes 3.87 cfs of 8.74 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 1.51 cfs @ 7.71 fps)
  └─**3=Orifice/Grate** (Orifice Controls 2.35 cfs @ 2.89 fps)

Pond BASIN B: BASIN B

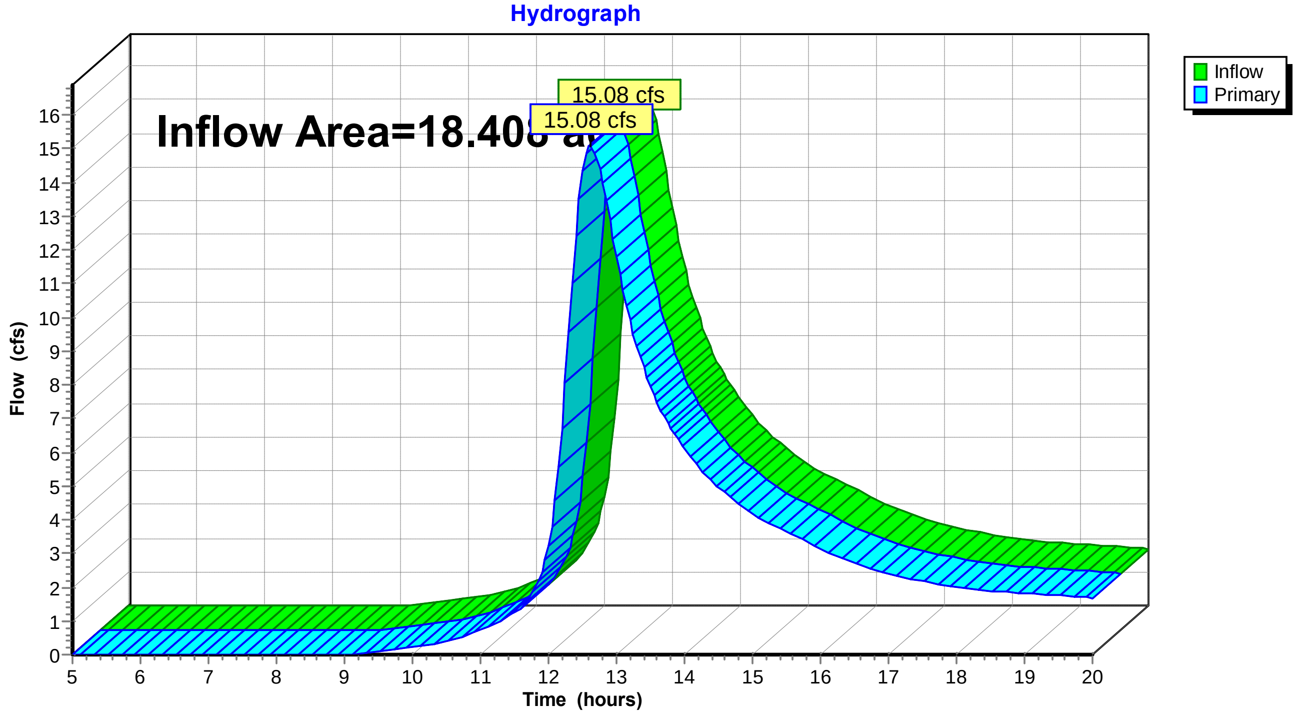


Summary for Link DP1: DP-1

Inflow Area = 18.408 ac, 14.49% Impervious, Inflow Depth > 2.09" for 10-Year event
Inflow = 15.08 cfs @ 12.61 hrs, Volume= 3.200 af
Primary = 15.08 cfs @ 12.61 hrs, Volume= 3.200 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP1: DP-1

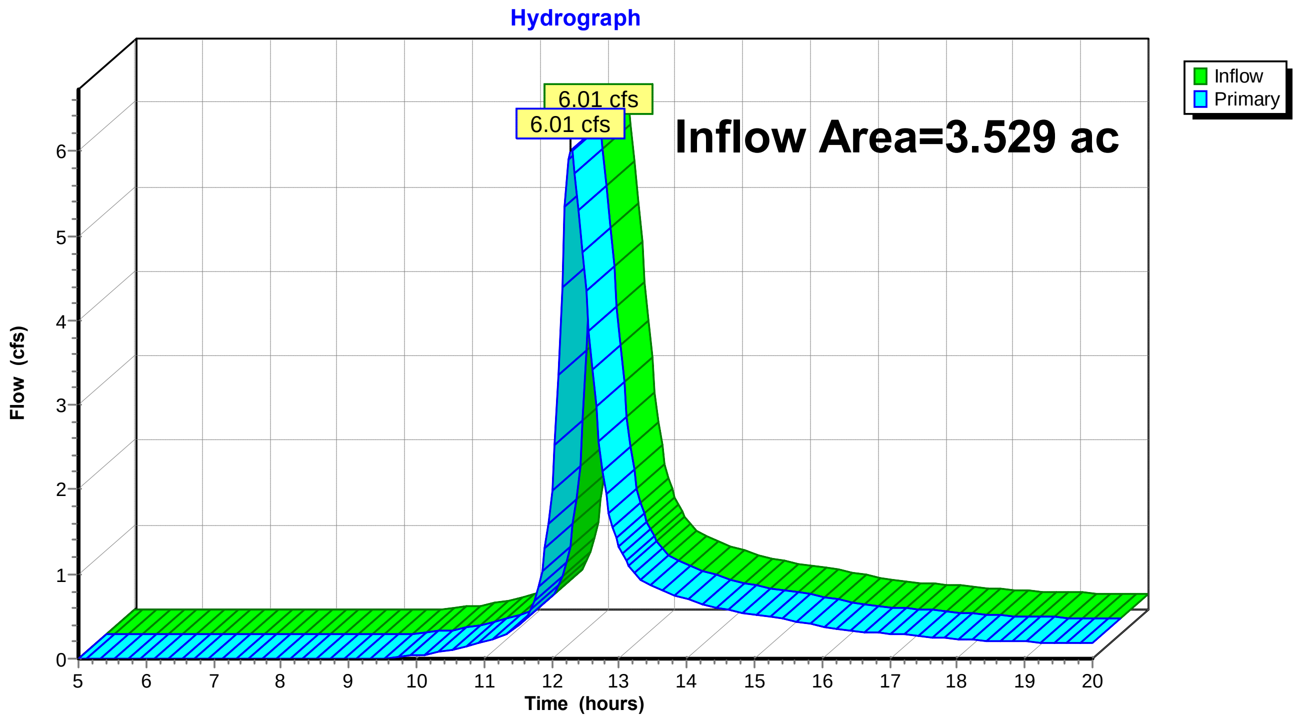


Summary for Link DP2: DP-2

Inflow Area = 3.529 ac, 0.00% Impervious, Inflow Depth > 2.02" for 10-Year event
Inflow = 6.01 cfs @ 12.29 hrs, Volume= 0.594 af
Primary = 6.01 cfs @ 12.29 hrs, Volume= 0.594 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP2: DP-2

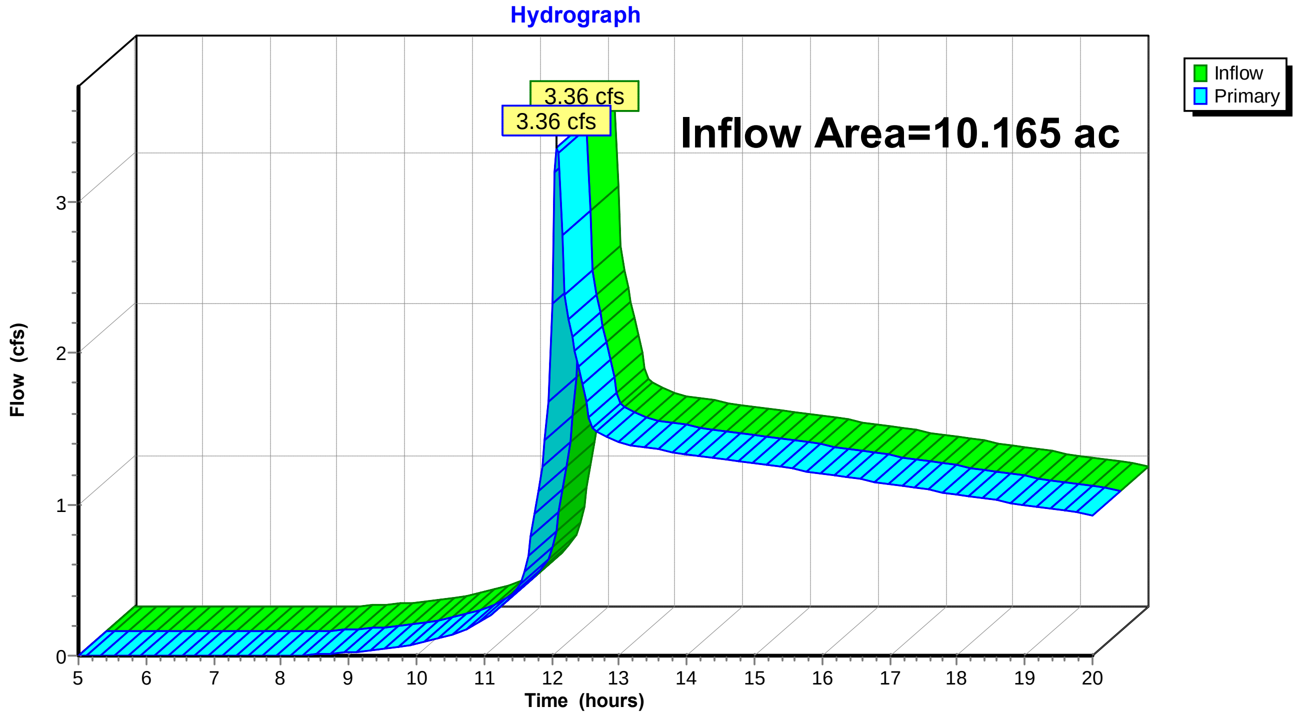


Summary for Link DP3: DP-3

Inflow Area =	10.165 ac,	34.49% Impervious, Inflow Depth >	1.07"	for 10-Year event
Inflow =	3.36 cfs @	12.08 hrs, Volume=	0.908 af	
Primary =	3.36 cfs @	12.08 hrs, Volume=	0.908 af, Atten= 0%, Lag= 0.0 min	

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

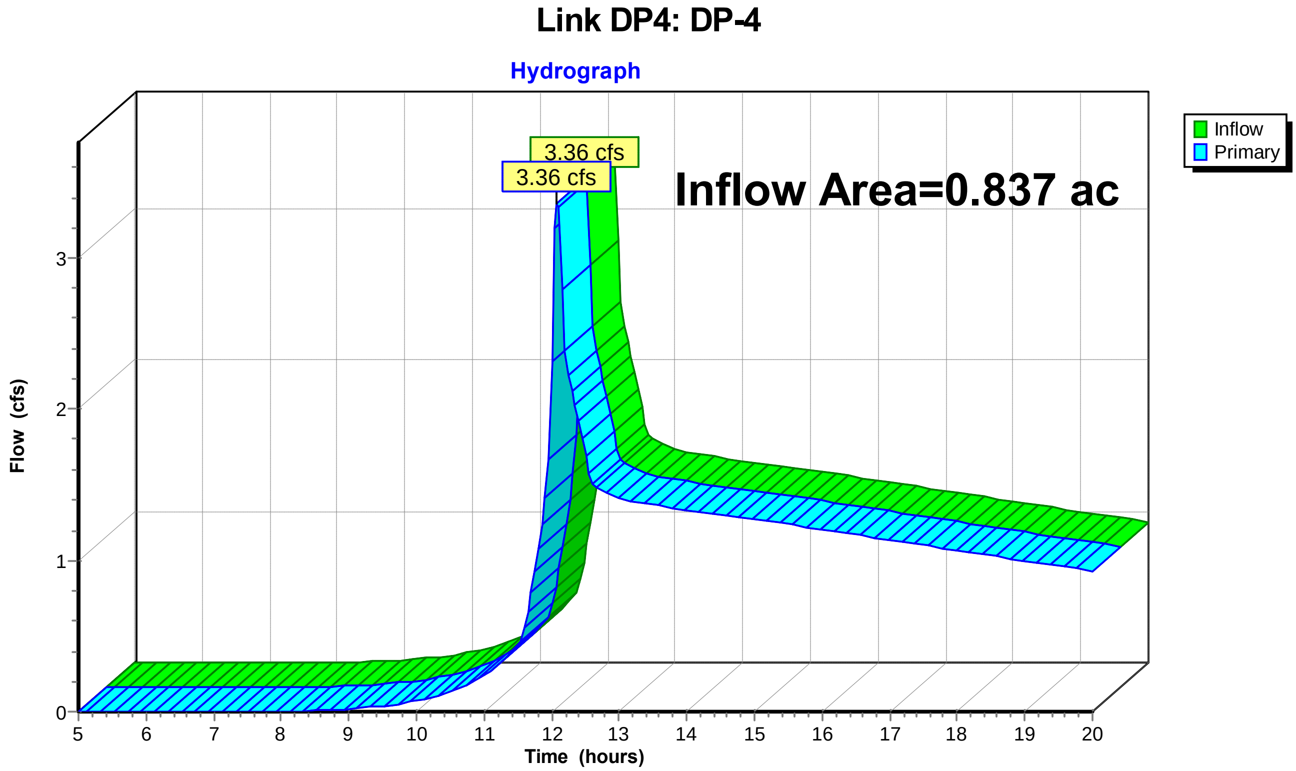
Link DP3: DP-3



Summary for Link DP4: DP-4

Inflow Area =	0.837 ac,	12.89% Impervious,	Inflow Depth > 13.02"	for 10-Year event
Inflow =	3.36 cfs @	12.09 hrs, Volume=	0.908 af	
Primary =	3.36 cfs @	12.09 hrs, Volume=	0.908 af, Atten= 0%, Lag= 0.0 min	

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

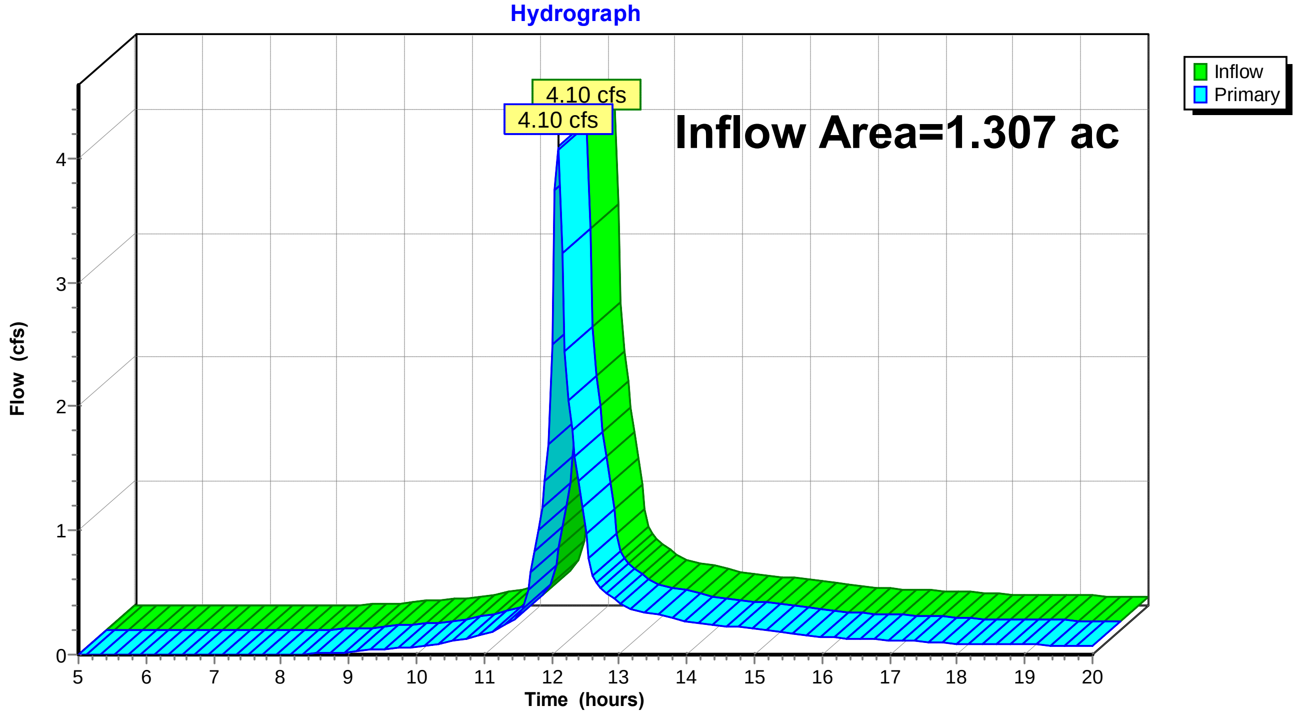


Summary for Link DP5: DP-5

Inflow Area =	1.307 ac, 16.34% Impervious,	Inflow Depth > 2.53"	for 10-Year event
Inflow =	4.10 cfs @ 12.09 hrs, Volume=	0.275 af	
Primary =	4.10 cfs @ 12.09 hrs, Volume=	0.275 af, Atten= 0%, Lag= 0.0 min	

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP5: DP-5

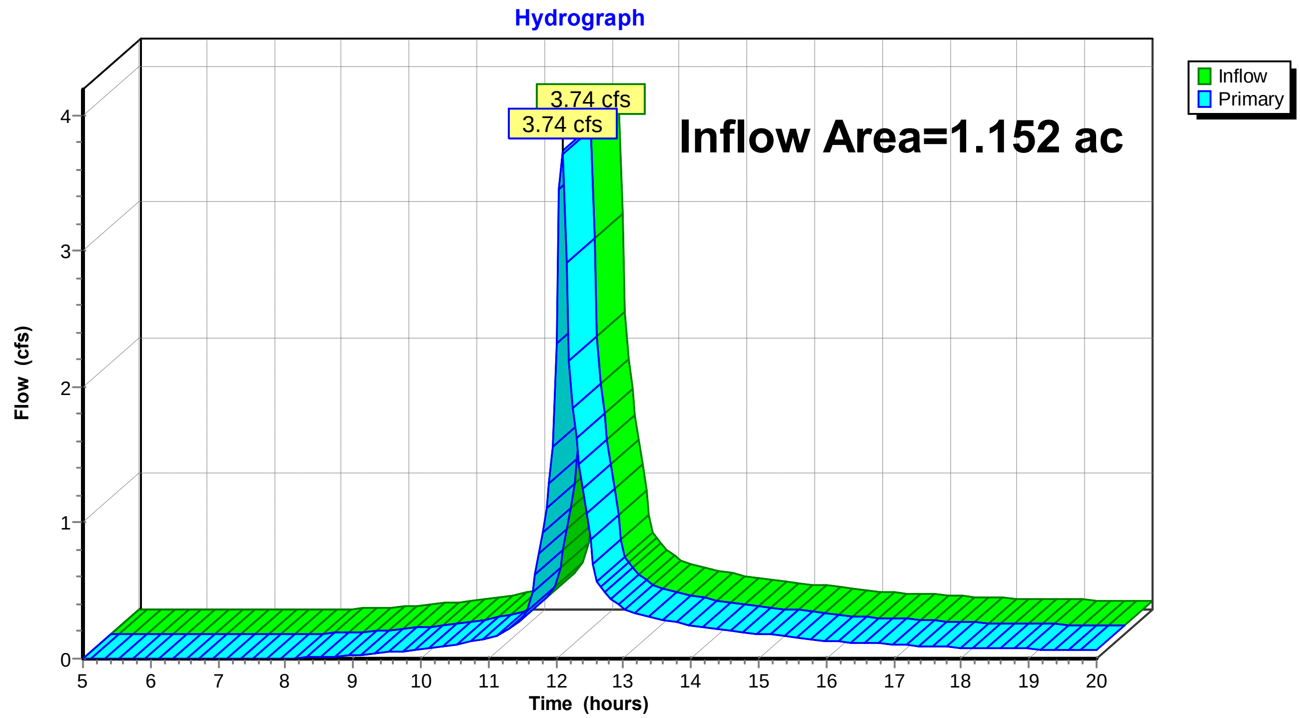


Summary for Link DP6: DP-6

Inflow Area =	1.152 ac,	19.16% Impervious,	Inflow Depth > 2.61"	for 10-Year event
Inflow =	3.74 cfs @	12.09 hrs, Volume=	0.251 af	
Primary =	3.74 cfs @	12.09 hrs, Volume=	0.251 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP6: DP-6



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PRDA1D: PRDA-1 Runoff Area=407,573 sf 36.10% Impervious Runoff Depth>3.50"
Flow Length=1,450' Tc=6.7 min CN=83 Runoff=38.92 cfs 2.726 af

Subcatchment PRDA1ND: PRDA-1 Runoff Area=430,906 sf 13.85% Impervious Runoff Depth>2.79"
Flow Length=1,775' Tc=42.9 min CN=76 Runoff=16.70 cfs 2.303 af

Subcatchment PRDA2D: PRDA-2 Runoff Area=370,926 sf 15.24% Impervious Runoff Depth>2.89"
Flow Length=850' Tc=42.4 min CN=77 Runoff=14.94 cfs 2.048 af

Subcatchment PRDA2ND: PRDA-2 Runoff Area=153,744 sf 0.00% Impervious Runoff Depth>2.46"
Flow Length=500' Tc=20.1 min CN=72 Runoff=7.35 cfs 0.724 af

Subcatchment PRDA3ND: PRDA-3 Runoff Area=35,236 sf 15.90% Impervious Runoff Depth>3.02"
Flow Length=100' Slope=0.1100 '/' Tc=5.0 min CN=78 Runoff=3.06 cfs 0.203 af

Subcatchment PRDA4ND: PRDA-4 Runoff Area=36,465 sf 12.89% Impervious Runoff Depth>2.92"
Flow Length=100' Slope=0.1100 '/' Tc=5.0 min CN=77 Runoff=3.08 cfs 0.204 af

Subcatchment PRDA5ND: PRDA-5 Runoff Area=56,917 sf 16.34% Impervious Runoff Depth>3.02"
Flow Length=300' Tc=5.7 min CN=78 Runoff=4.88 cfs 0.328 af

Subcatchment PRDA6ND: PRDA-6 Runoff Area=50,169 sf 19.16% Impervious Runoff Depth>3.11"
Flow Length=650' Tc=5.6 min CN=79 Runoff=4.43 cfs 0.298 af

Pond BASIN A: BASIN A Peak Elev=822.07' Storage=71,134 cf Inflow=38.92 cfs 2.726 af
Primary=1.35 cfs 0.836 af Secondary=1.33 cfs 0.835 af Outflow=2.68 cfs 1.671 af

Pond BASIN B: BASIN B Peak Elev=824.12' Storage=40,437 cf Inflow=14.94 cfs 2.048 af
Outflow=5.43 cfs 1.590 af

Link DP1: DP-1 Inflow=18.44 cfs 3.893 af
Primary=18.44 cfs 3.893 af

Link DP2: DP-2 Inflow=7.35 cfs 0.724 af
Primary=7.35 cfs 0.724 af

Link DP3: DP-3 Inflow=3.94 cfs 1.040 af
Primary=3.94 cfs 1.040 af

Link DP4: DP-4 Inflow=3.96 cfs 1.038 af
Primary=3.96 cfs 1.038 af

Link DP5: DP-5 Inflow=4.88 cfs 0.328 af
Primary=4.88 cfs 0.328 af

Link DP6: DP-6 Inflow=4.43 cfs 0.298 af
Primary=4.43 cfs 0.298 af

Total Runoff Area = 35.398 ac Runoff Volume = 8.834 af Average Runoff Depth = 2.99"
81.03% Pervious = 28.682 ac 18.97% Impervious = 6.716 ac

Summary for Subcatchment PRDA1D: PRDA-1

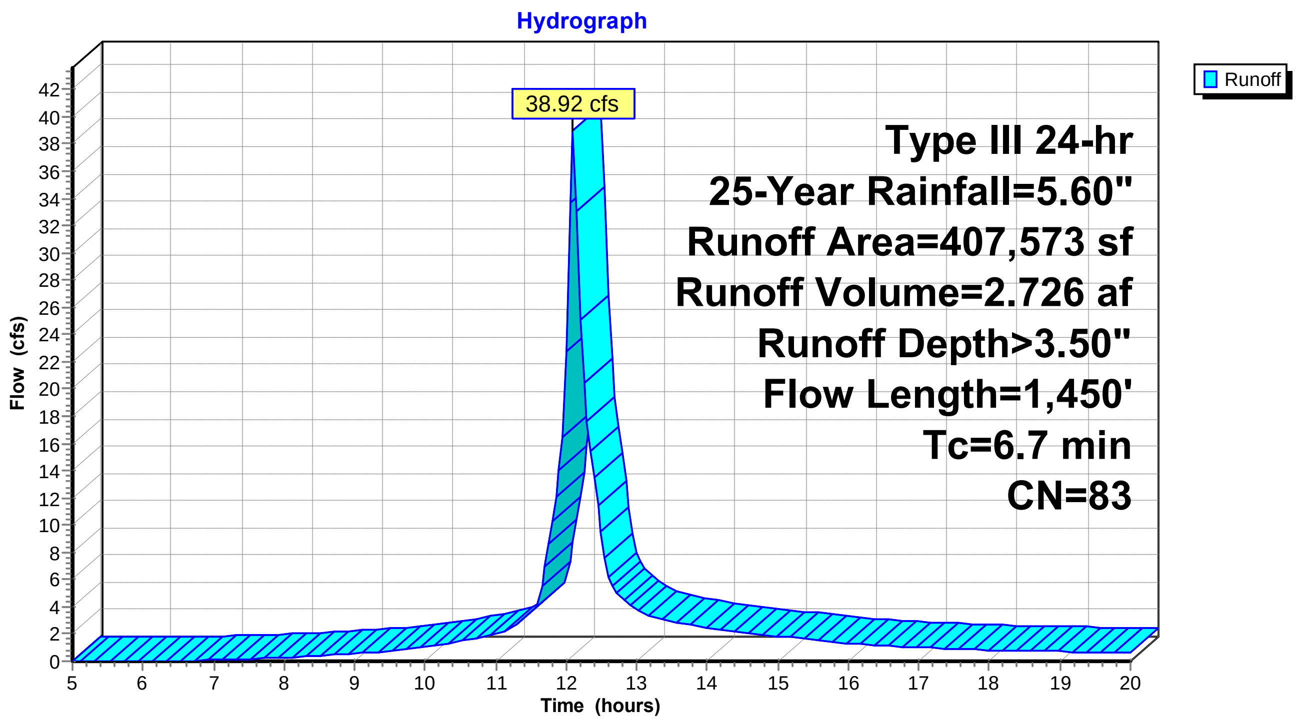
Runoff = 38.92 cfs @ 12.10 hrs, Volume= 2.726 af, Depth> 3.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.60"

	Area (sf)	CN	Description
	69,087	98	Impervious, HSG C
	36,569	98	Roofs, HSG C
	41,458	98	Water Surface, HSG C
*	260,459	75	Gravel, HSG C
	407,573	83	Weighted Average
	260,459		63.90% Pervious Area
	147,114		36.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	250	0.0100	1.25		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
3.4	1,200	0.0075	5.93	7.27	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.010 PVC, smooth interior
6.7	1,450	Total			

Subcatchment PRDA1D: PRDA-1



Summary for Subcatchment PRDA1ND: PRDA-1

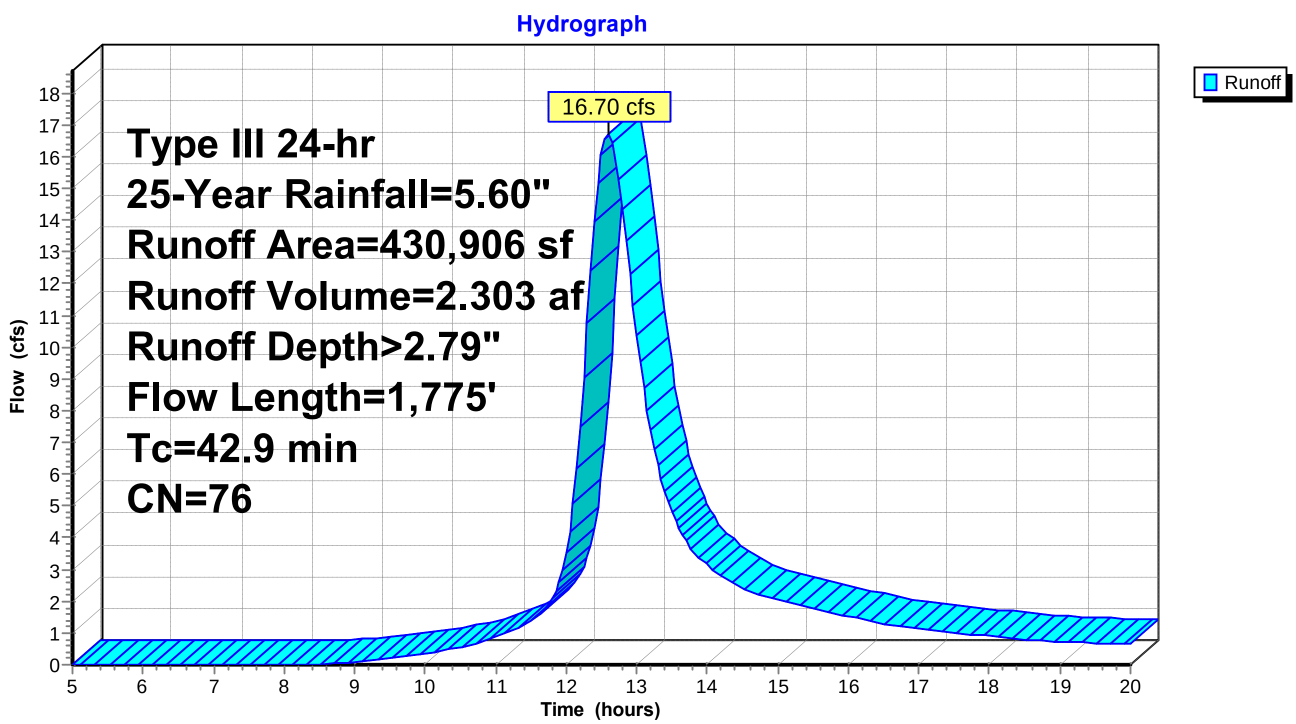
Runoff = 16.70 cfs @ 12.60 hrs, Volume= 2.303 af, Depth> 2.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.60"

Area (sf)	CN	Description
114,584	70	Woods, Good, HSG C
256,640	74	Pasture/grassland/range, Good, HSG C
59,682	98	Impervious, HSG C
430,906	76	Weighted Average
371,224		86.15% Pervious Area
59,682		13.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.0	250	0.0320	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
4.9	1,000	0.0440	3.38		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.0	525	0.0570	8.87	53.22	**Channel Flow,** Area= 6.0 sf Perim= 6.0' r= 1.00' n= 0.040 Earth, cobble bottom, clean sides
42.9	1,775	Total			

Subcatchment PRDA1ND: PRDA-1



Summary for Subcatchment PRDA2D: PRDA-2

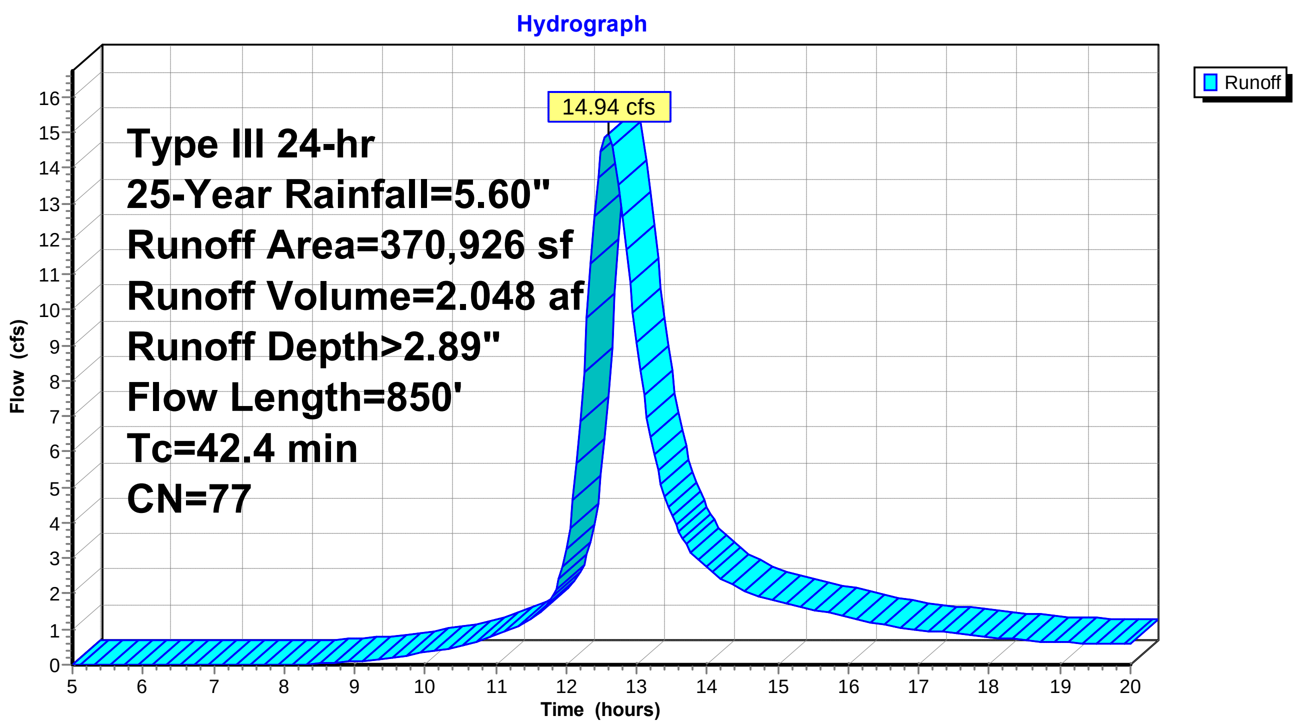
Runoff = 14.94 cfs @ 12.59 hrs, Volume= 2.048 af, Depth> 2.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.60"

	Area (sf)	CN	Description
	36,718	98	Impervious, HSG C
	1,151	98	Roofs, HSG C
	18,667	98	Water Surface, HSG C
	134,433	74	Pasture/grassland/range, Good, HSG C
*	115,820	75	Gravel, HSG C
	64,137	70	Woods, Good, HSG C
	370,926	77	Weighted Average
	314,390		84.76% Pervious Area
	56,536		15.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.0	250	0.0320	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
5.4	600	0.0700	1.85		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
42.4	850	Total			

Subcatchment PRDA2D: PRDA-2



Summary for Subcatchment PRDA2ND: PRDA-2

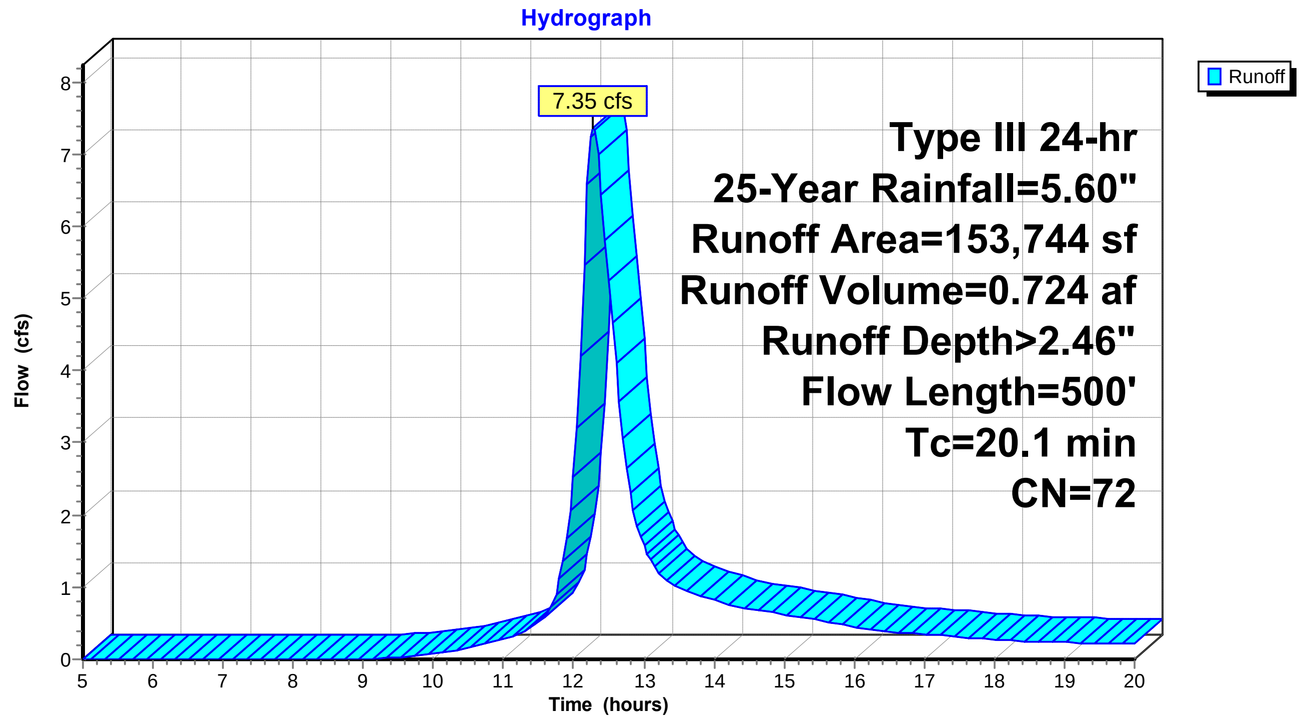
Runoff = 7.35 cfs @ 12.29 hrs, Volume= 0.724 af, Depth> 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.60"

Area (sf)	CN	Description
71,014	70	Woods, Good, HSG C
82,730	74	Pasture/grassland/range, Good, HSG C
153,744	72	Weighted Average
153,744		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.7	250	0.0560	0.21		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.20"
0.4	250	0.5000	11.38		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
20.1	500	Total			

Subcatchment PRDA2ND: PRDA-2



Summary for Subcatchment PRDA3ND: PRDA-3

[49] Hint: Tc<2dt may require smaller dt

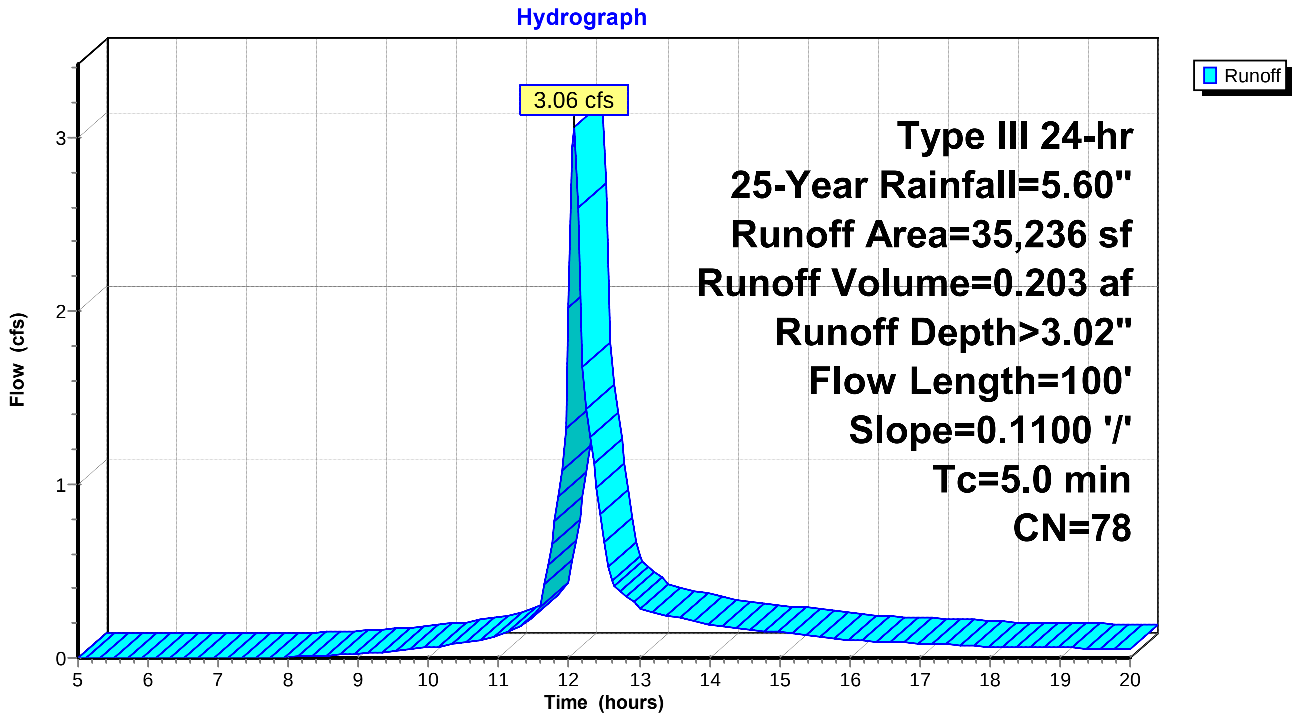
Runoff = 3.06 cfs @ 12.08 hrs, Volume= 0.203 af, Depth> 3.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.60"

Area (sf)	CN	Description
29,635	74	Pasture/grassland/range, Good, HSG C
5,601	98	Impervious, HSG C
35,236	78	Weighted Average
29,635		84.10% Pervious Area
5,601		15.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	100	0.1100	0.34		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"

Subcatchment PRDA3ND: PRDA-3



Summary for Subcatchment PRDA4ND: PRDA-4

[49] Hint: Tc<2dt may require smaller dt

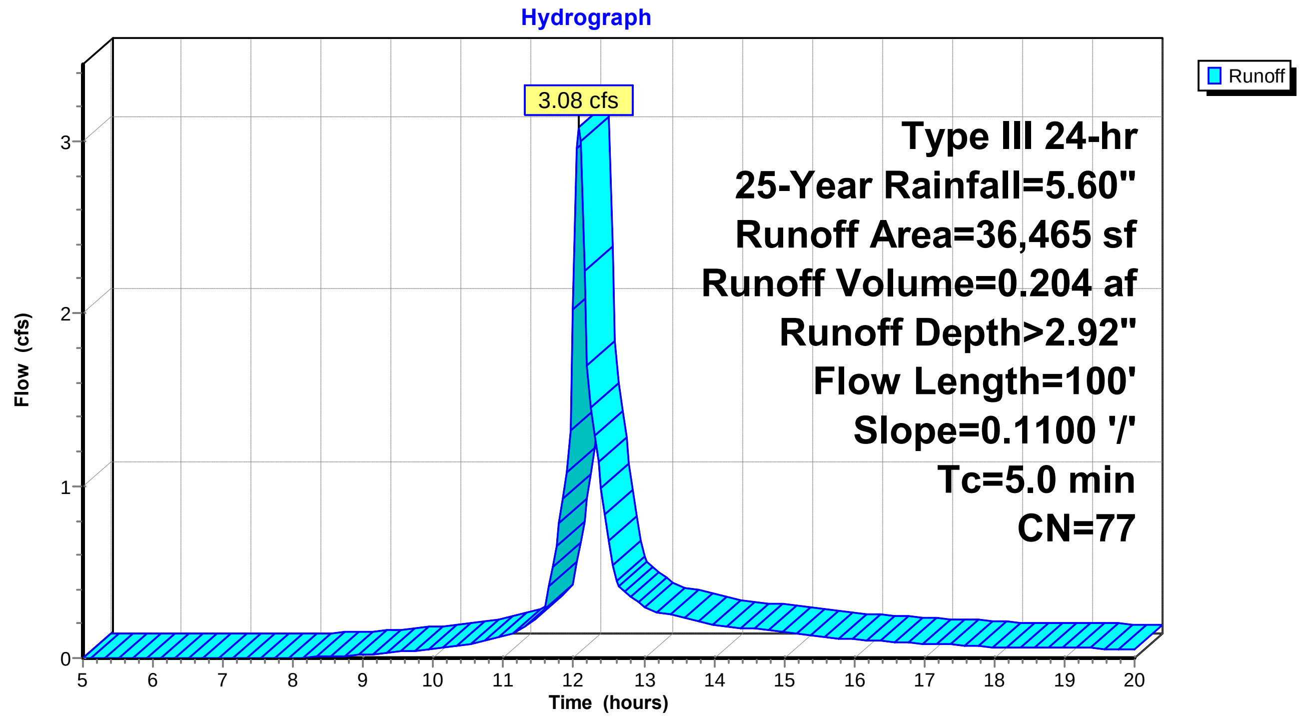
Runoff = 3.08 cfs @ 12.08 hrs, Volume= 0.204 af, Depth> 2.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.60"

	Area (sf)	CN	Description
	31,764	74	Pasture/grassland/range, Good, HSG C
*	4,701	98	Impervious
	36,465	77	Weighted Average
	31,764		87.11% Pervious Area
	4,701		12.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	100	0.1100	0.34		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"

Subcatchment PRDA4ND: PRDA-4



Summary for Subcatchment PRDA5ND: PRDA-5

[49] Hint: Tc<2dt may require smaller dt

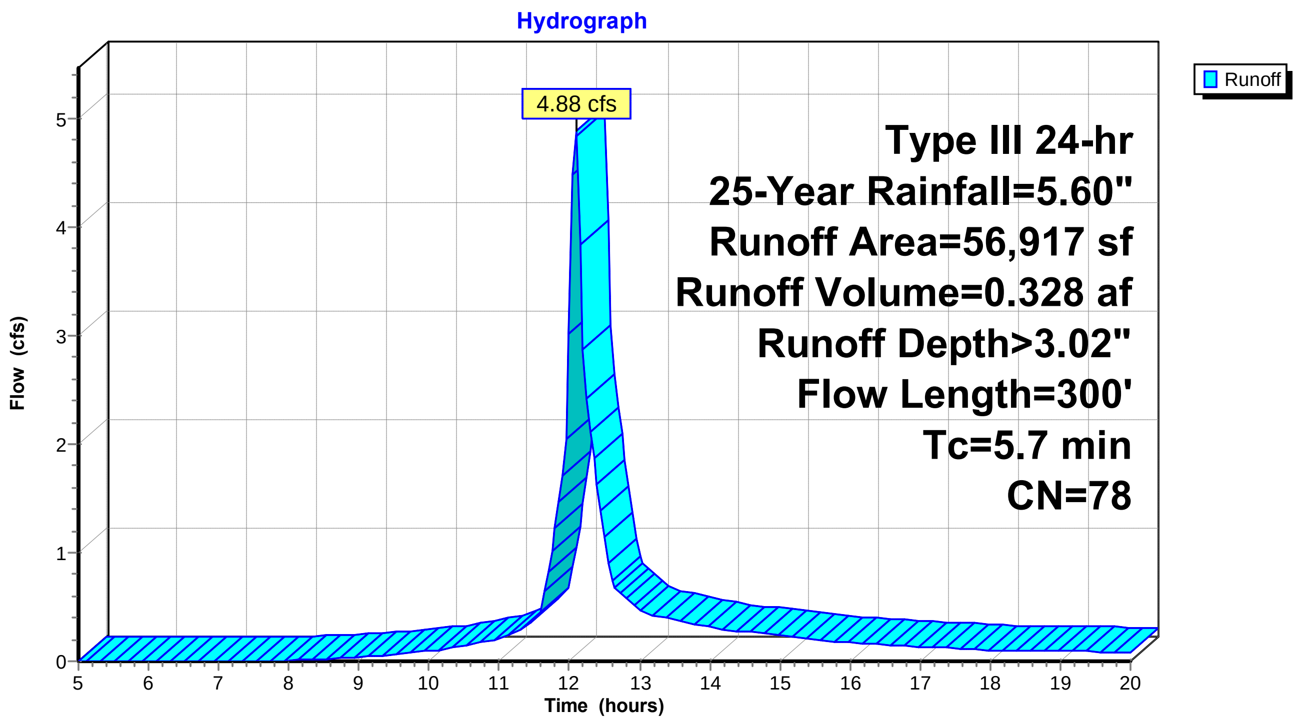
Runoff = 4.88 cfs @ 12.09 hrs, Volume= 0.328 af, Depth> 3.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.60"

Area (sf)	CN	Description
9,302	98	Impervious, HSG C
47,615	74	Pasture/grassland/range, Good, HSG C
56,917	78	Weighted Average
47,615		83.66% Pervious Area
9,302		16.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	200	0.3333	0.60		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.2	100	0.0100	6.84	8.40	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.010 PVC, smooth interior
5.7	300	Total			

Subcatchment PRDA5ND: PRDA-5



Summary for Subcatchment PRDA6ND: PRDA-6

[49] Hint: Tc<2dt may require smaller dt

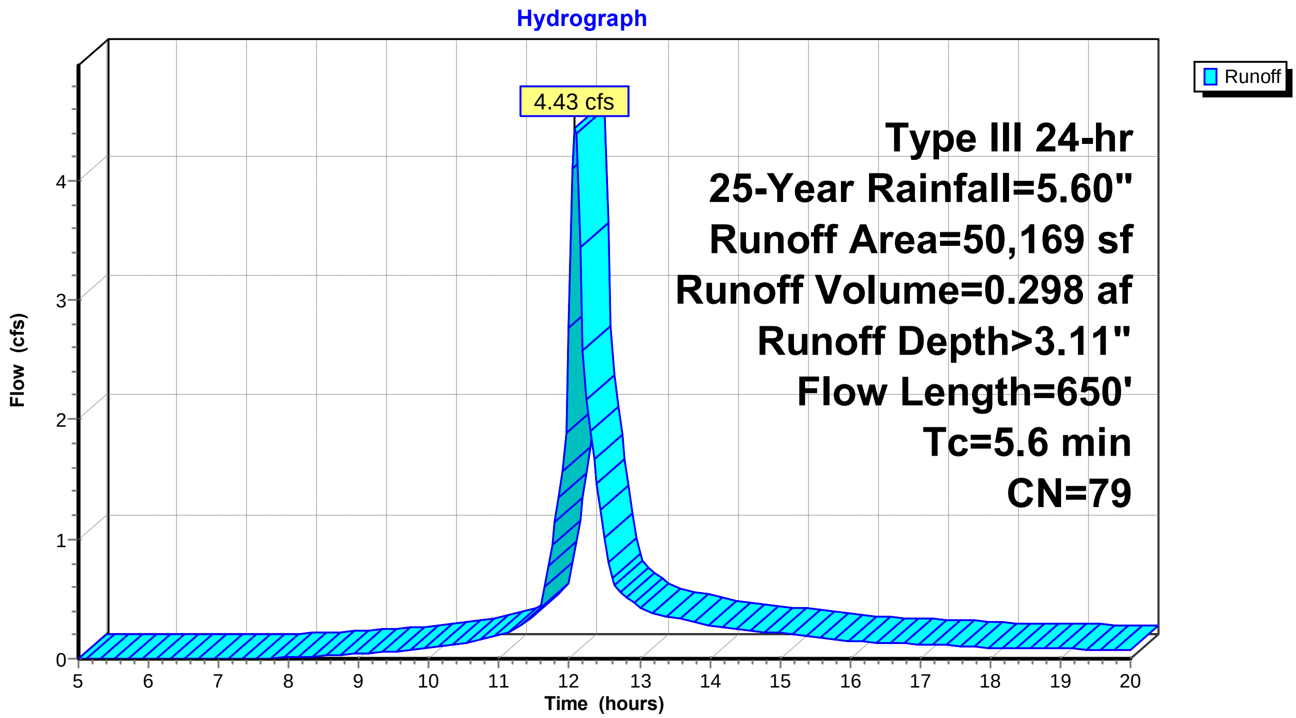
Runoff = 4.43 cfs @ 12.09 hrs, Volume= 0.298 af, Depth> 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.60"

Area (sf)	CN	Description
40,557	74	Pasture/grassland/range, Good, HSG C
9,612	98	Impervious, HSG C
50,169	79	Weighted Average
40,557		80.84% Pervious Area
9,612		19.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	150	0.3333	0.57		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.2	500	0.2050	6.79		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
5.6	650	Total			

Subcatchment PRDA6ND: PRDA-6



Summary for Pond BASIN A: BASIN A

Inflow Area = 9.357 ac, 36.10% Impervious, Inflow Depth > 3.50" for 25-Year event
Inflow = 38.92 cfs @ 12.10 hrs, Volume= 2.726 af
Outflow = 2.68 cfs @ 13.76 hrs, Volume= 1.671 af, Atten= 93%, Lag= 99.9 min
Primary = 1.35 cfs @ 13.76 hrs, Volume= 0.836 af
Secondary = 1.33 cfs @ 13.76 hrs, Volume= 0.835 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 822.07' @ 13.76 hrs Surf.Area= 38,098 sf Storage= 71,134 cf

Plug-Flow detention time= 234.4 min calculated for 1.671 af (61% of inflow)
Center-of-Mass det. time= 160.5 min (937.4 - 776.9)

Volume	Invert	Avail.Storage	Storage Description
#1	820.00'	151,470 cf	**Basin A (Irregular)** Listed below (Recalc)

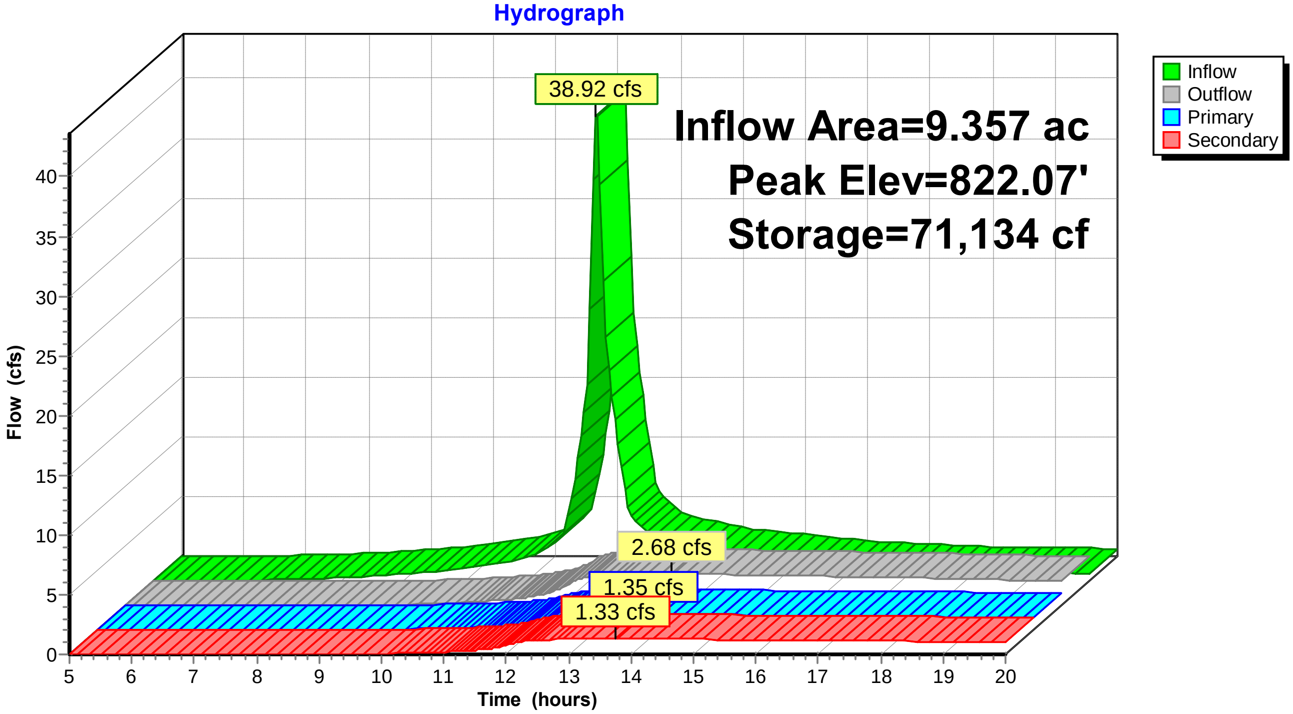
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
820.00	30,856	1,150.0	0	0	30,856
822.00	37,867	1,187.0	68,603	68,603	38,123
824.00	45,105	1,209.0	82,867	151,470	42,954

Device	Routing	Invert	Outlet Devices
#1	Primary	820.00'	**15.0" Round Culvert** L= 250.0' Ke= 0.500 Inlet / Outlet Invert= 820.00' / 786.00' S= 0.1360 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.23 sf
#2	Secondary	820.00'	**15.0" Round Culvert** L= 250.0' Ke= 0.500 Inlet / Outlet Invert= 820.00' / 786.00' S= 0.1360 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.23 sf
#3	Device 1	820.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Device 2	820.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#5	Device 1	822.00'	**15.0" W x 12.0" H Vert. Orifice/Grate** C= 0.600
#6	Device 2	822.00'	**12.0" W x 12.0" H Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=1.34 cfs @ 13.76 hrs HW=822.07' (Free Discharge)
└─**1=Culvert** (Passes 1.34 cfs of 7.09 cfs potential flow)
  ├─**3=Orifice/Grate** (Orifice Controls 1.27 cfs @ 6.49 fps)
  └─**5=Orifice/Grate** (Orifice Controls 0.07 cfs @ 0.83 fps)

Secondary OutFlow Max=1.33 cfs @ 13.76 hrs HW=822.07' (Free Discharge)
└─**2=Culvert** (Passes 1.33 cfs of 7.09 cfs potential flow)
  ├─**4=Orifice/Grate** (Orifice Controls 1.27 cfs @ 6.49 fps)
  └─**6=Orifice/Grate** (Orifice Controls 0.06 cfs @ 0.83 fps)

Pond BASIN A: BASIN A



Summary for Pond BASIN B: BASIN B

Inflow Area = 8.515 ac, 15.24% Impervious, Inflow Depth > 2.89" for 25-Year event
Inflow = 14.94 cfs @ 12.59 hrs, Volume= 2.048 af
Outflow = 5.43 cfs @ 13.31 hrs, Volume= 1.590 af, Atten= 64%, Lag= 43.2 min
Primary = 5.43 cfs @ 13.31 hrs, Volume= 1.590 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 824.12' @ 13.31 hrs Surf.Area= 16,565 sf Storage= 40,437 cf

Plug-Flow detention time= 141.4 min calculated for 1.590 af (78% of inflow)
Center-of-Mass det. time= 87.7 min (905.7 - 818.0)

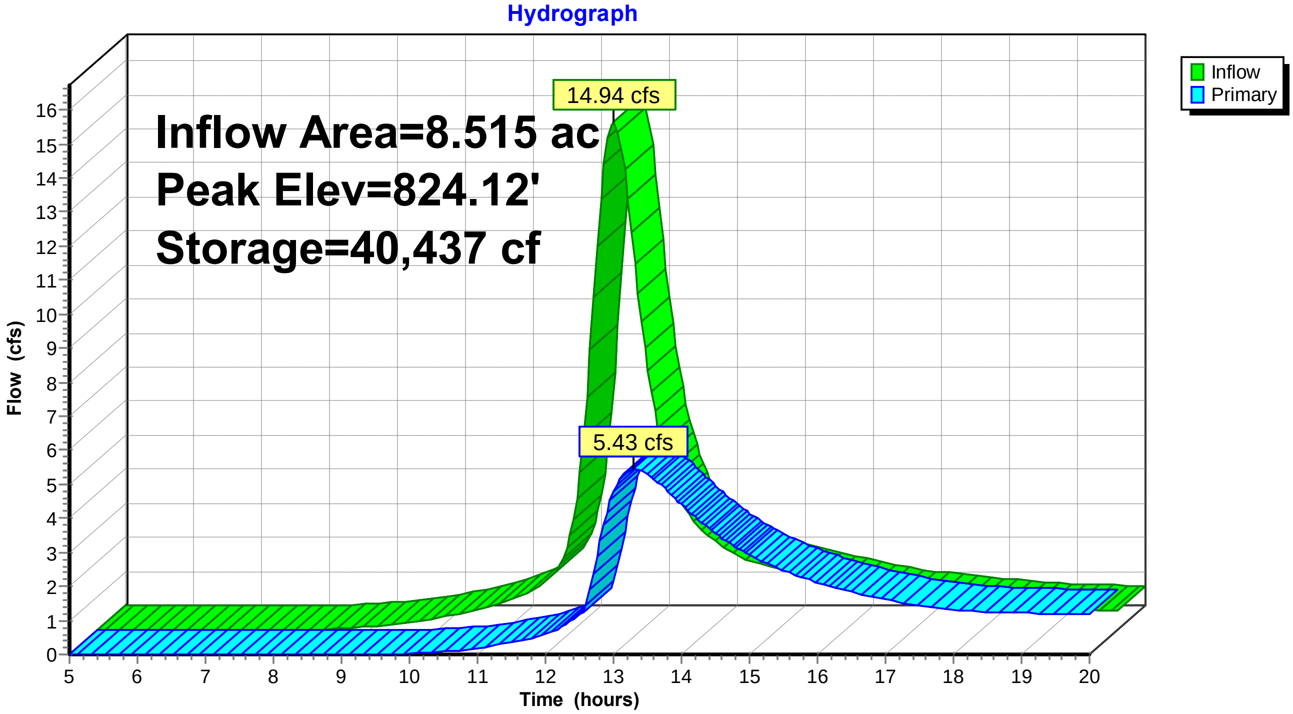
Volume	Invert	Avail.Storage	Storage Description
#1	821.00'	75,685 cf	**Basin B (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
821.00	9,468	729.0	0	0	9,468
822.00	11,682	748.0	10,556	10,556	11,820
824.00	16,283	786.0	27,838	38,394	16,706
826.00	21,113	824.1	37,292	75,685	21,846

Device	Routing	Invert	Outlet Devices
#1	Primary	821.00'	**15.0" Round Culvert** L= 100.0' Ke= 0.500 Inlet / Outlet Invert= 821.00' / 797.00' S= 0.2400 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.23 sf
#2	Device 1	821.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	823.00'	**12.0" W x 18.0" H Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=5.43 cfs @ 13.31 hrs HW=824.12' (Free Discharge)
└─**1=Culvert** (Passes 5.43 cfs of 9.34 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 1.60 cfs @ 8.16 fps)
  └─**3=Orifice/Grate** (Orifice Controls 3.83 cfs @ 3.40 fps)

Pond BASIN B: BASIN B

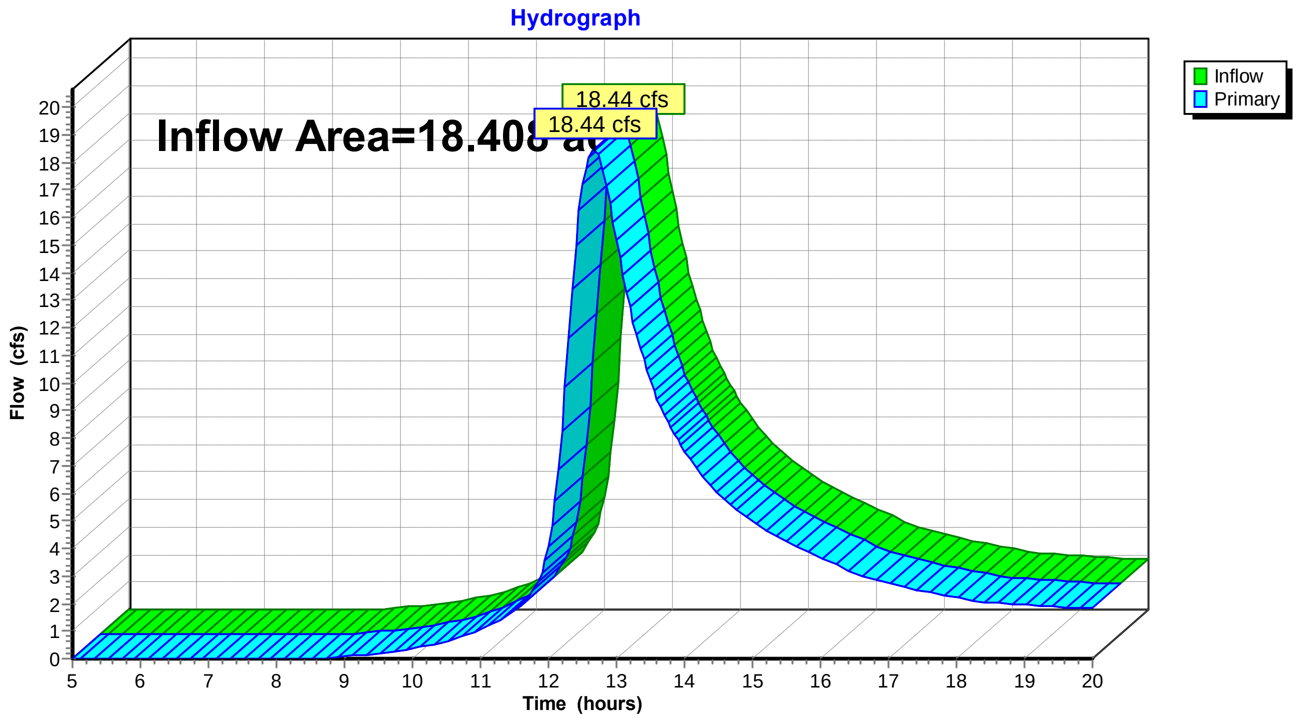


Summary for Link DP1: DP-1

Inflow Area = 18.408 ac, 14.49% Impervious, Inflow Depth > 2.54" for 25-Year event
Inflow = 18.44 cfs @ 12.67 hrs, Volume= 3.893 af
Primary = 18.44 cfs @ 12.67 hrs, Volume= 3.893 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP1: DP-1

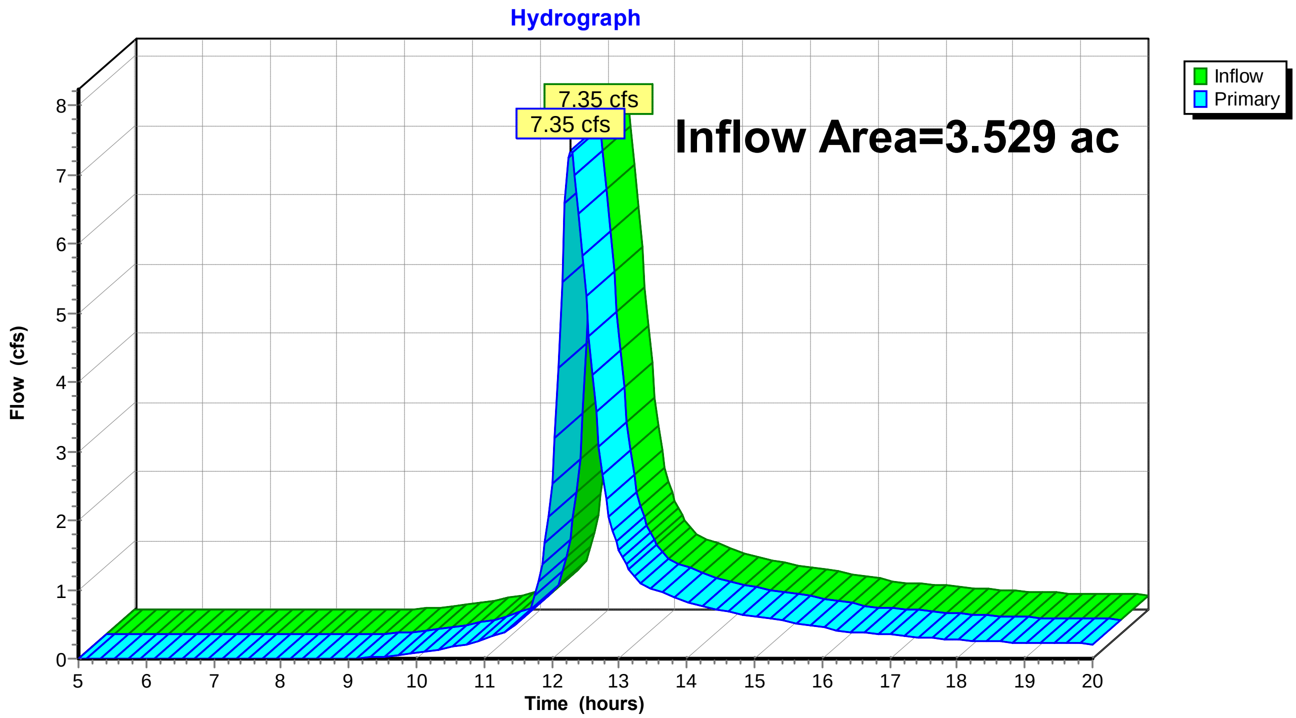


Summary for Link DP2: DP-2

Inflow Area =	3.529 ac,	0.00% Impervious,	Inflow Depth > 2.46"	for 25-Year event
Inflow =	7.35 cfs @	12.29 hrs, Volume=	0.724 af	
Primary =	7.35 cfs @	12.29 hrs, Volume=	0.724 af, Atten= 0%, Lag= 0.0 min	

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP2: DP-2

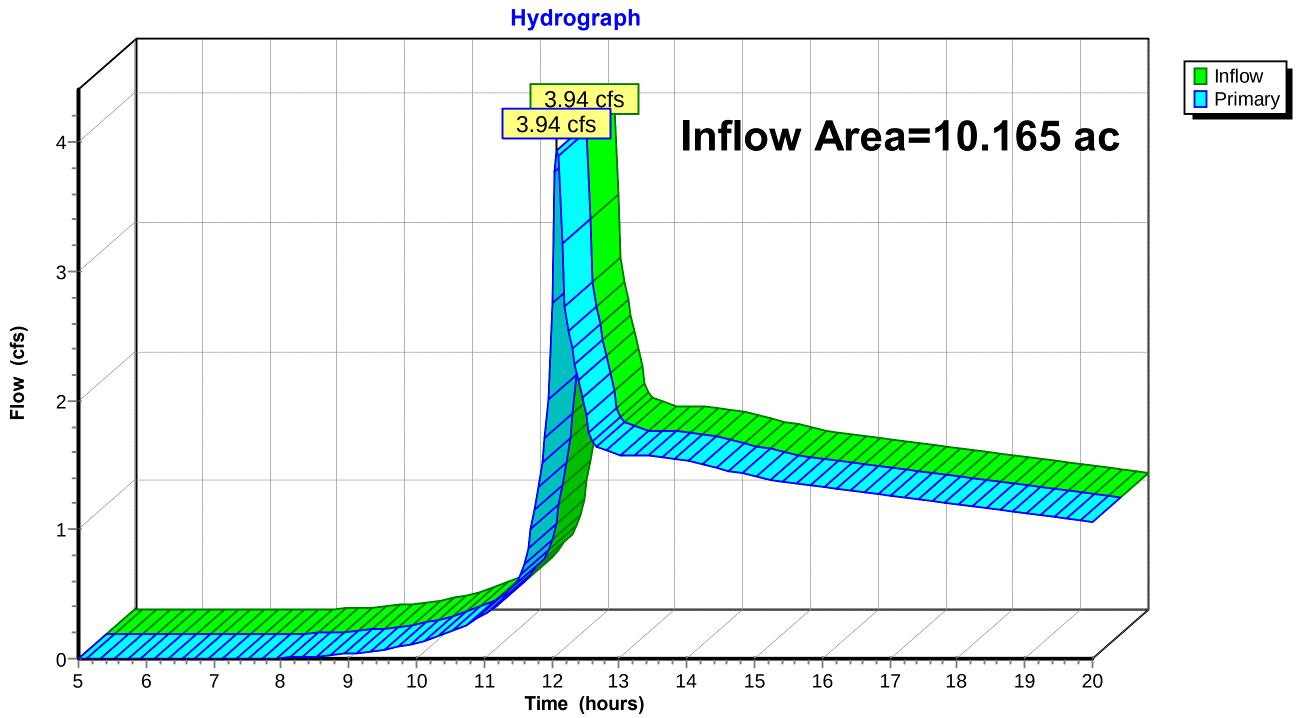


Summary for Link DP3: DP-3

Inflow Area =	10.165 ac,	34.49% Impervious,	Inflow Depth > 1.23"	for 25-Year event
Inflow =	3.94 cfs @	12.08 hrs,	Volume=	1.040 af
Primary =	3.94 cfs @	12.08 hrs,	Volume=	1.040 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP3: DP-3

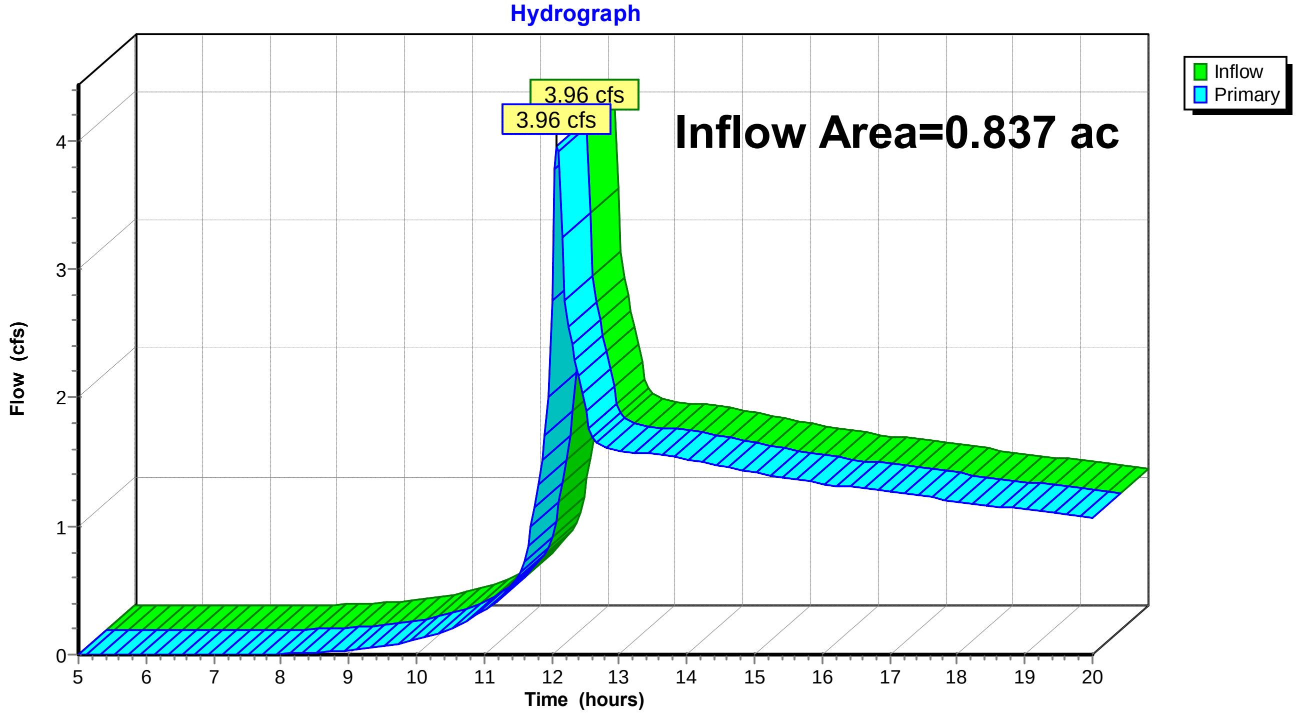


Summary for Link DP4: DP-4

Inflow Area =	0.837 ac,	12.89% Impervious,	Inflow Depth > 14.89"	for 25-Year event
Inflow =	3.96 cfs @	12.08 hrs, Volume=	1.038 af	
Primary =	3.96 cfs @	12.08 hrs, Volume=	1.038 af, Atten= 0%, Lag= 0.0 min	

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP4: DP-4

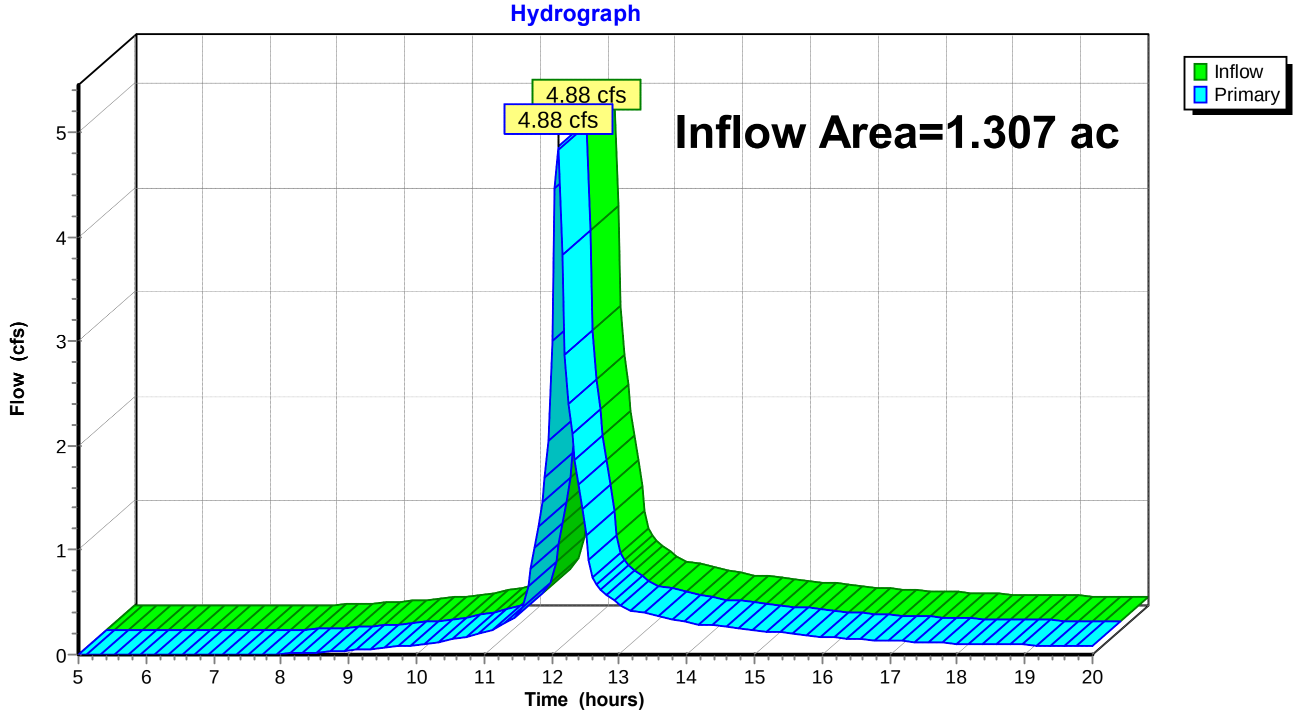


Summary for Link DP5: DP-5

Inflow Area = 1.307 ac, 16.34% Impervious, Inflow Depth > 3.02" for 25-Year event
Inflow = 4.88 cfs @ 12.09 hrs, Volume= 0.328 af
Primary = 4.88 cfs @ 12.09 hrs, Volume= 0.328 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP5: DP-5

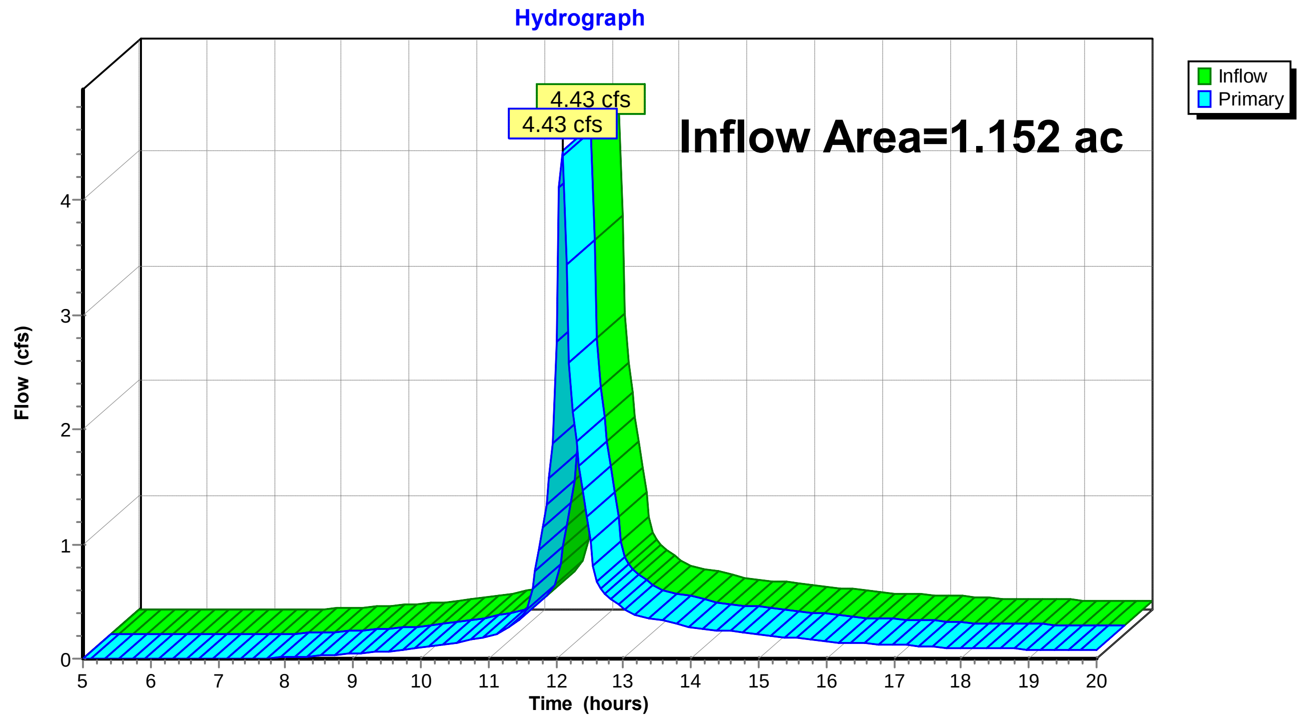


Summary for Link DP6: DP-6

Inflow Area = 1.152 ac, 19.16% Impervious, Inflow Depth > 3.11" for 25-Year event
Inflow = 4.43 cfs @ 12.09 hrs, Volume= 0.298 af
Primary = 4.43 cfs @ 12.09 hrs, Volume= 0.298 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP6: DP-6



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PRDA1D: PRDA-1 Runoff Area=407,573 sf 36.10% Impervious Runoff Depth>4.11"
Flow Length=1,450' Tc=6.7 min CN=83 Runoff=45.46 cfs 3.206 af

Subcatchment PRDA1ND: PRDA-1 Runoff Area=430,906 sf 13.85% Impervious Runoff Depth>3.36"
Flow Length=1,775' Tc=42.9 min CN=76 Runoff=20.02 cfs 2.768 af

Subcatchment PRDA2D: PRDA-2 Runoff Area=370,926 sf 15.24% Impervious Runoff Depth>3.46"
Flow Length=850' Tc=42.4 min CN=77 Runoff=17.84 cfs 2.453 af

Subcatchment PRDA2ND: PRDA-2 Runoff Area=153,744 sf 0.00% Impervious Runoff Depth>3.00"
Flow Length=500' Tc=20.1 min CN=72 Runoff=8.96 cfs 0.882 af

Subcatchment PRDA3ND: PRDA-3 Runoff Area=35,236 sf 15.90% Impervious Runoff Depth>3.60"
Flow Length=100' Slope=0.1100 '/' Tc=5.0 min CN=78 Runoff=3.64 cfs 0.243 af

Subcatchment PRDA4ND: PRDA-4 Runoff Area=36,465 sf 12.89% Impervious Runoff Depth>3.50"
Flow Length=100' Slope=0.1100 '/' Tc=5.0 min CN=77 Runoff=3.67 cfs 0.244 af

Subcatchment PRDA5ND: PRDA-5 Runoff Area=56,917 sf 16.34% Impervious Runoff Depth>3.60"
Flow Length=300' Tc=5.7 min CN=78 Runoff=5.79 cfs 0.392 af

Subcatchment PRDA6ND: PRDA-6 Runoff Area=50,169 sf 19.16% Impervious Runoff Depth>3.70"
Flow Length=650' Tc=5.6 min CN=79 Runoff=5.25 cfs 0.355 af

Pond BASIN A: BASIN A Peak Elev=822.32' Storage=80,956 cf Inflow=45.46 cfs 3.206 af
Primary=2.09 cfs 1.028 af Secondary=1.95 cfs 1.000 af Outflow=4.04 cfs 2.028 af

Pond BASIN B: BASIN B Peak Elev=824.47' Storage=46,228 cf Inflow=17.84 cfs 2.453 af
Outflow=7.39 cfs 1.965 af

Link DP1: DP-1 Inflow=23.26 cfs 4.733 af
Primary=23.26 cfs 4.733 af

Link DP2: DP-2 Inflow=8.96 cfs 0.882 af
Primary=8.96 cfs 0.882 af

Link DP3: DP-3 Inflow=4.62 cfs 1.270 af
Primary=4.62 cfs 1.270 af

Link DP4: DP-4 Inflow=4.65 cfs 1.244 af
Primary=4.65 cfs 1.244 af

Link DP5: DP-5 Inflow=5.79 cfs 0.392 af
Primary=5.79 cfs 0.392 af

Link DP6: DP-6 Inflow=5.25 cfs 0.355 af
Primary=5.25 cfs 0.355 af

Total Runoff Area = 35.398 ac Runoff Volume = 10.544 af Average Runoff Depth = 3.57"
81.03% Pervious = 28.682 ac 18.97% Impervious = 6.716 ac

Summary for Subcatchment PRDA1D: PRDA-1

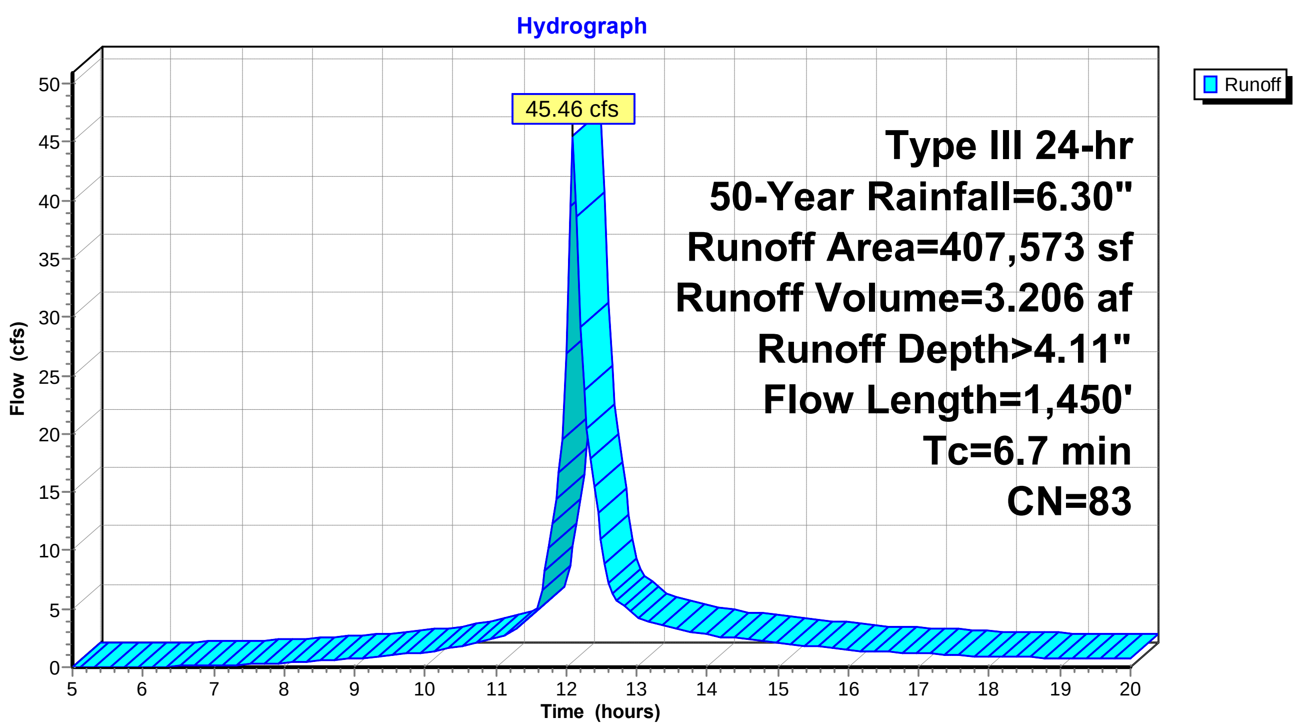
Runoff = 45.46 cfs @ 12.10 hrs, Volume= 3.206 af, Depth> 4.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.30"

	Area (sf)	CN	Description
	69,087	98	Impervious, HSG C
	36,569	98	Roofs, HSG C
	41,458	98	Water Surface, HSG C
*	260,459	75	Gravel, HSG C
	407,573	83	Weighted Average
	260,459		63.90% Pervious Area
	147,114		36.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	250	0.0100	1.25		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
3.4	1,200	0.0075	5.93	7.27	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.010 PVC, smooth interior
6.7	1,450	Total			

Subcatchment PRDA1D: PRDA-1



Summary for Subcatchment PRDA1ND: PRDA-1

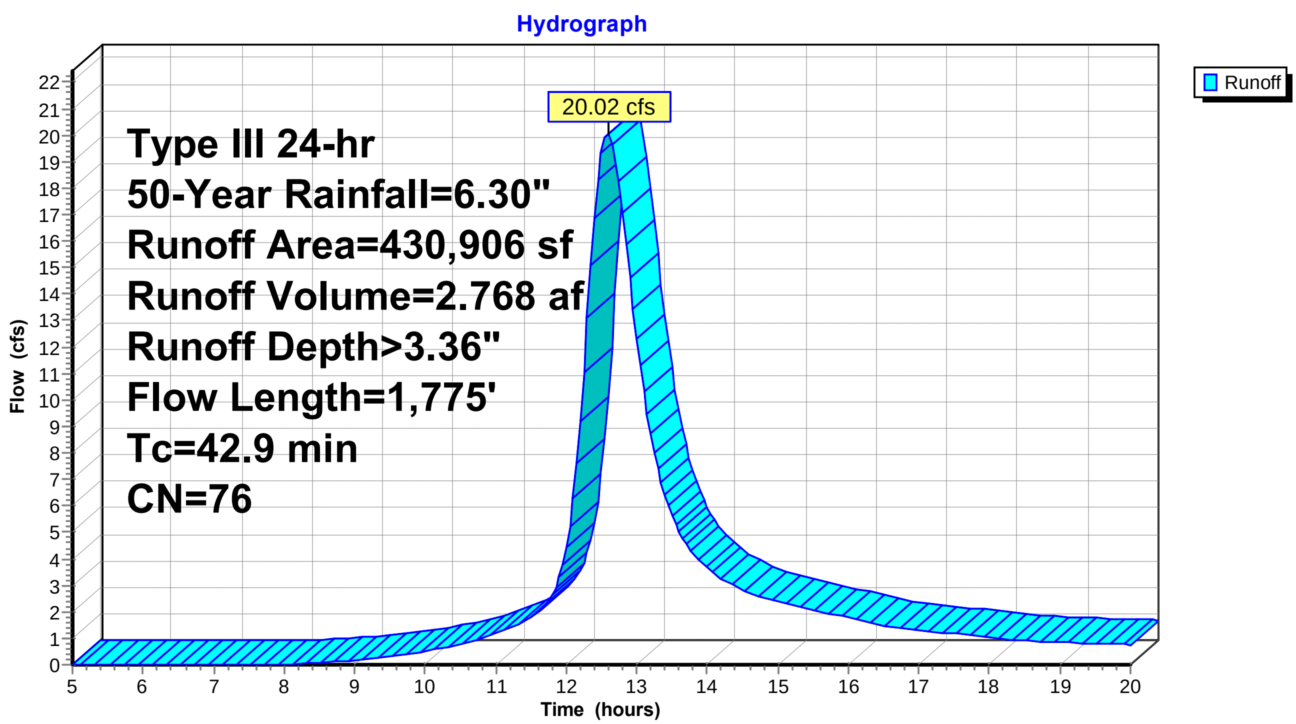
Runoff = 20.02 cfs @ 12.59 hrs, Volume= 2.768 af, Depth> 3.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.30"

Area (sf)	CN	Description
114,584	70	Woods, Good, HSG C
256,640	74	Pasture/grassland/range, Good, HSG C
59,682	98	Impervious, HSG C
430,906	76	Weighted Average
371,224		86.15% Pervious Area
59,682		13.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.0	250	0.0320	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
4.9	1,000	0.0440	3.38		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.0	525	0.0570	8.87	53.22	**Channel Flow,** Area= 6.0 sf Perim= 6.0' r= 1.00' n= 0.040 Earth, cobble bottom, clean sides
42.9	1,775	Total			

Subcatchment PRDA1ND: PRDA-1



Summary for Subcatchment PRDA2D: PRDA-2

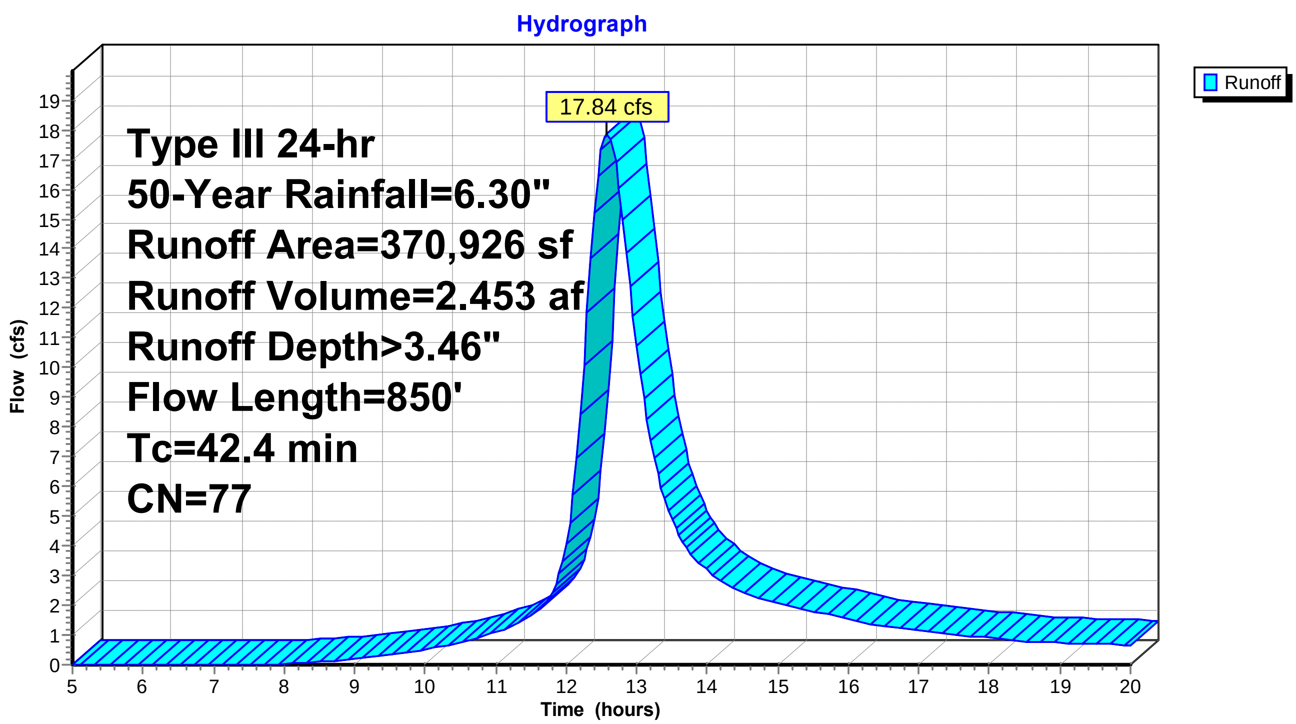
Runoff = 17.84 cfs @ 12.58 hrs, Volume= 2.453 af, Depth> 3.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.30"

	Area (sf)	CN	Description
	36,718	98	Impervious, HSG C
	1,151	98	Roofs, HSG C
	18,667	98	Water Surface, HSG C
	134,433	74	Pasture/grassland/range, Good, HSG C
*	115,820	75	Gravel, HSG C
	64,137	70	Woods, Good, HSG C
	370,926	77	Weighted Average
	314,390		84.76% Pervious Area
	56,536		15.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.0	250	0.0320	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
5.4	600	0.0700	1.85		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
42.4	850	Total			

Subcatchment PRDA2D: PRDA-2



Summary for Subcatchment PRDA2ND: PRDA-2

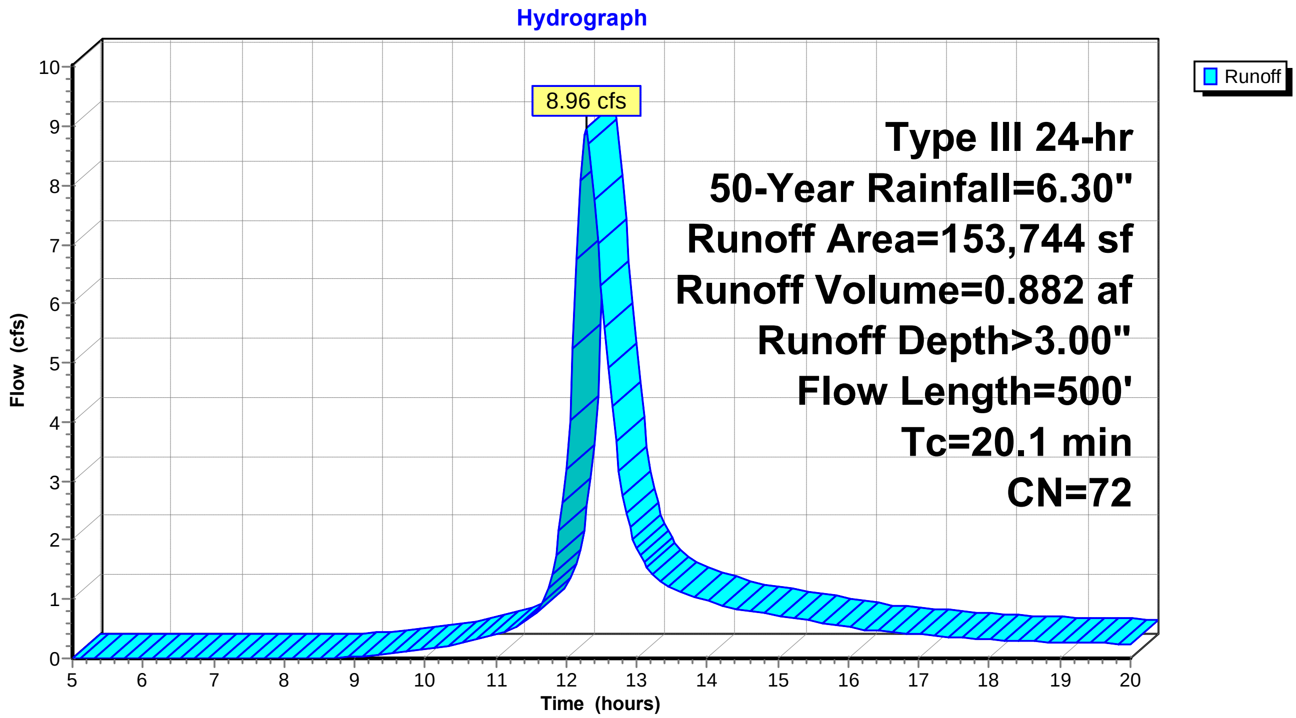
Runoff = 8.96 cfs @ 12.28 hrs, Volume= 0.882 af, Depth> 3.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.30"

Area (sf)	CN	Description
71,014	70	Woods, Good, HSG C
82,730	74	Pasture/grassland/range, Good, HSG C
153,744	72	Weighted Average
153,744		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.7	250	0.0560	0.21		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.20"
0.4	250	0.5000	11.38		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
20.1	500	Total			

Subcatchment PRDA2ND: PRDA-2



Summary for Subcatchment PRDA3ND: PRDA-3

[49] Hint: Tc<2dt may require smaller dt

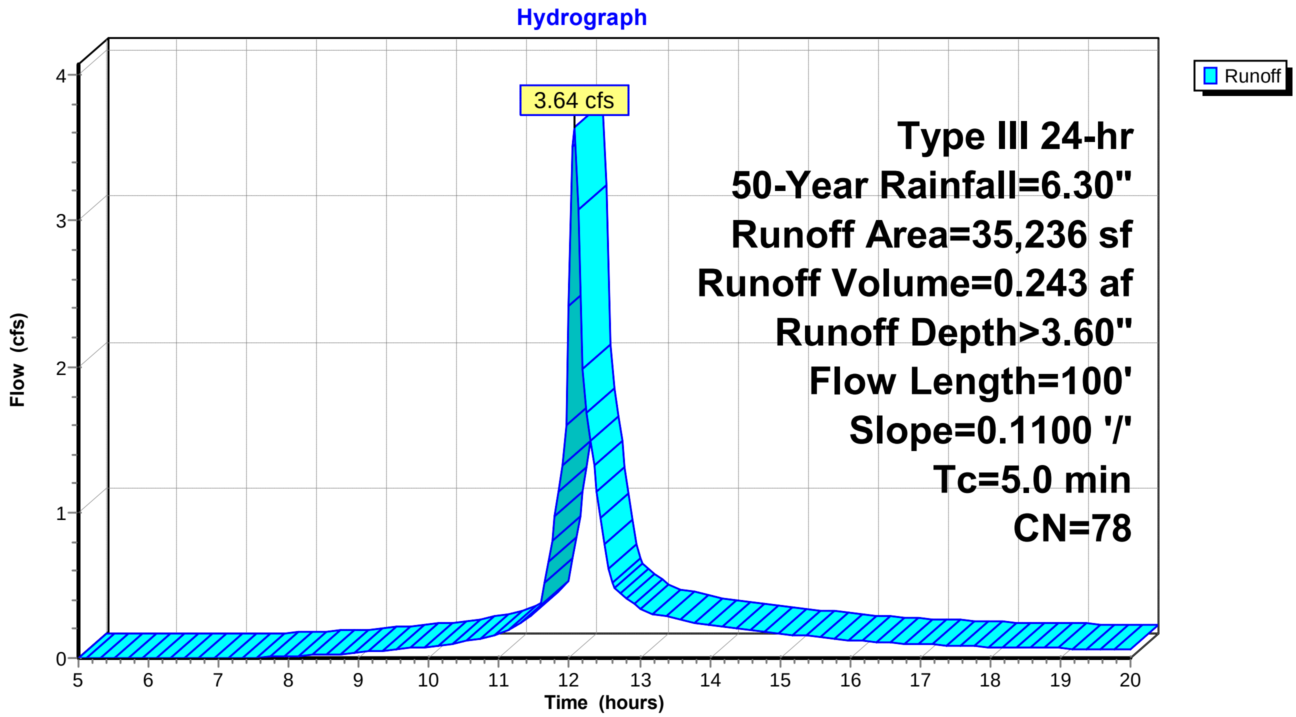
Runoff = 3.64 cfs @ 12.08 hrs, Volume= 0.243 af, Depth> 3.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.30"

Area (sf)	CN	Description
29,635	74	Pasture/grassland/range, Good, HSG C
5,601	98	Impervious, HSG C
35,236	78	Weighted Average
29,635		84.10% Pervious Area
5,601		15.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	100	0.1100	0.34		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"

Subcatchment PRDA3ND: PRDA-3



Summary for Subcatchment PRDA4ND: PRDA-4

[49] Hint: Tc<2dt may require smaller dt

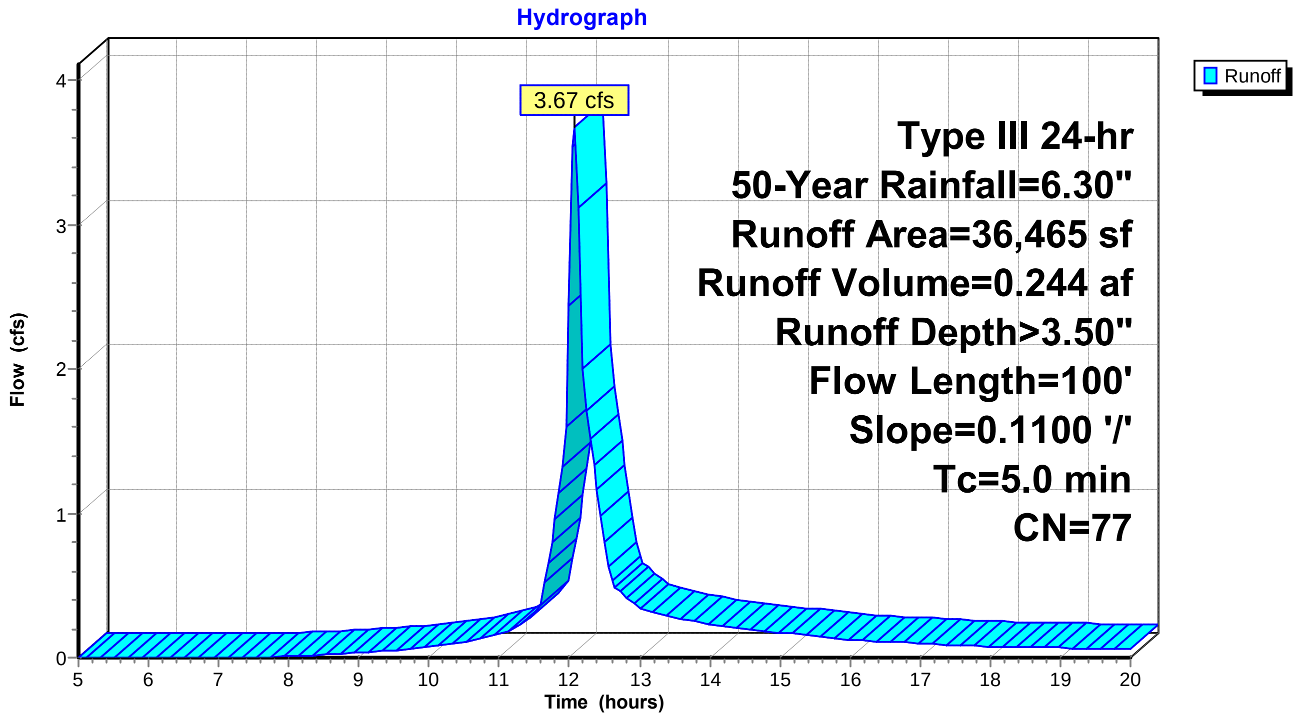
Runoff = 3.67 cfs @ 12.08 hrs, Volume= 0.244 af, Depth> 3.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.30"

	Area (sf)	CN	Description
	31,764	74	Pasture/grassland/range, Good, HSG C
*	4,701	98	Impervious
	36,465	77	Weighted Average
	31,764		87.11% Pervious Area
	4,701		12.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	100	0.1100	0.34		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"

Subcatchment PRDA4ND: PRDA-4



Summary for Subcatchment PRDA5ND: PRDA-5

[49] Hint: Tc<2dt may require smaller dt

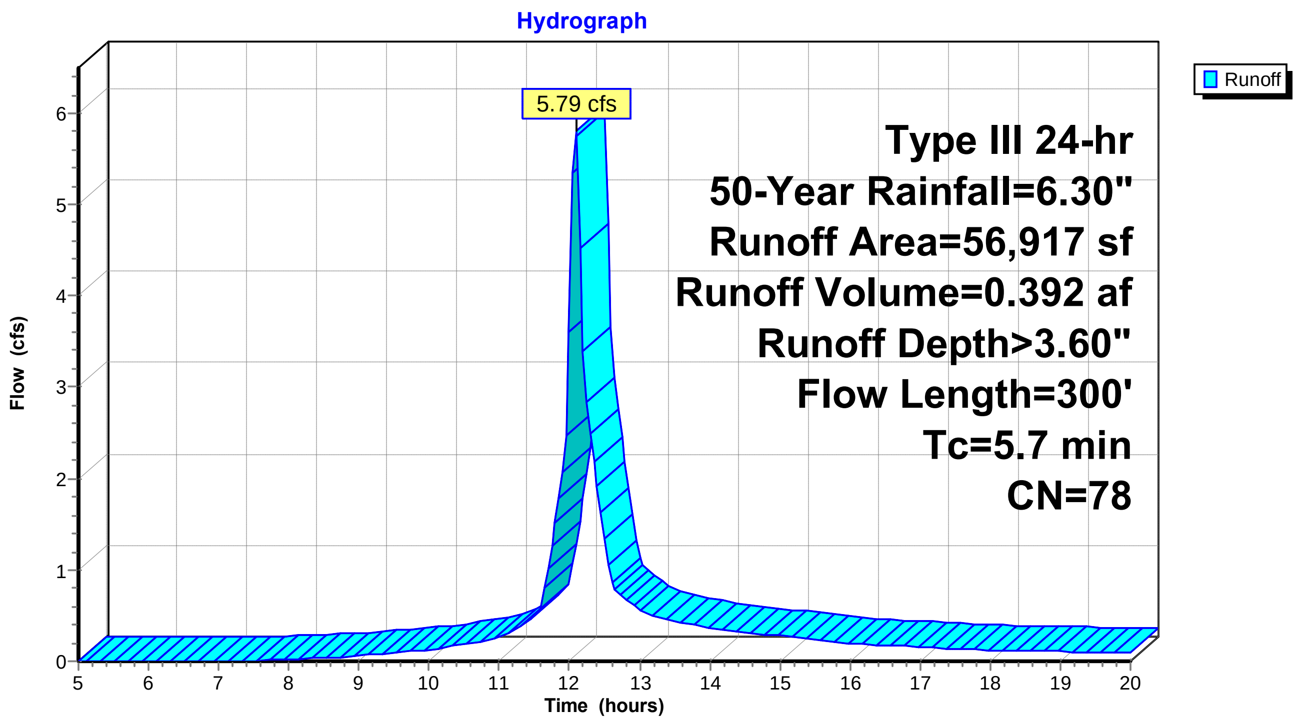
Runoff = 5.79 cfs @ 12.09 hrs, Volume= 0.392 af, Depth> 3.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.30"

Area (sf)	CN	Description
9,302	98	Impervious, HSG C
47,615	74	Pasture/grassland/range, Good, HSG C
56,917	78	Weighted Average
47,615		83.66% Pervious Area
9,302		16.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	200	0.3333	0.60		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.2	100	0.0100	6.84	8.40	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.010 PVC, smooth interior
5.7	300	Total			

Subcatchment PRDA5ND: PRDA-5



Summary for Subcatchment PRDA6ND: PRDA-6

[49] Hint: Tc<2dt may require smaller dt

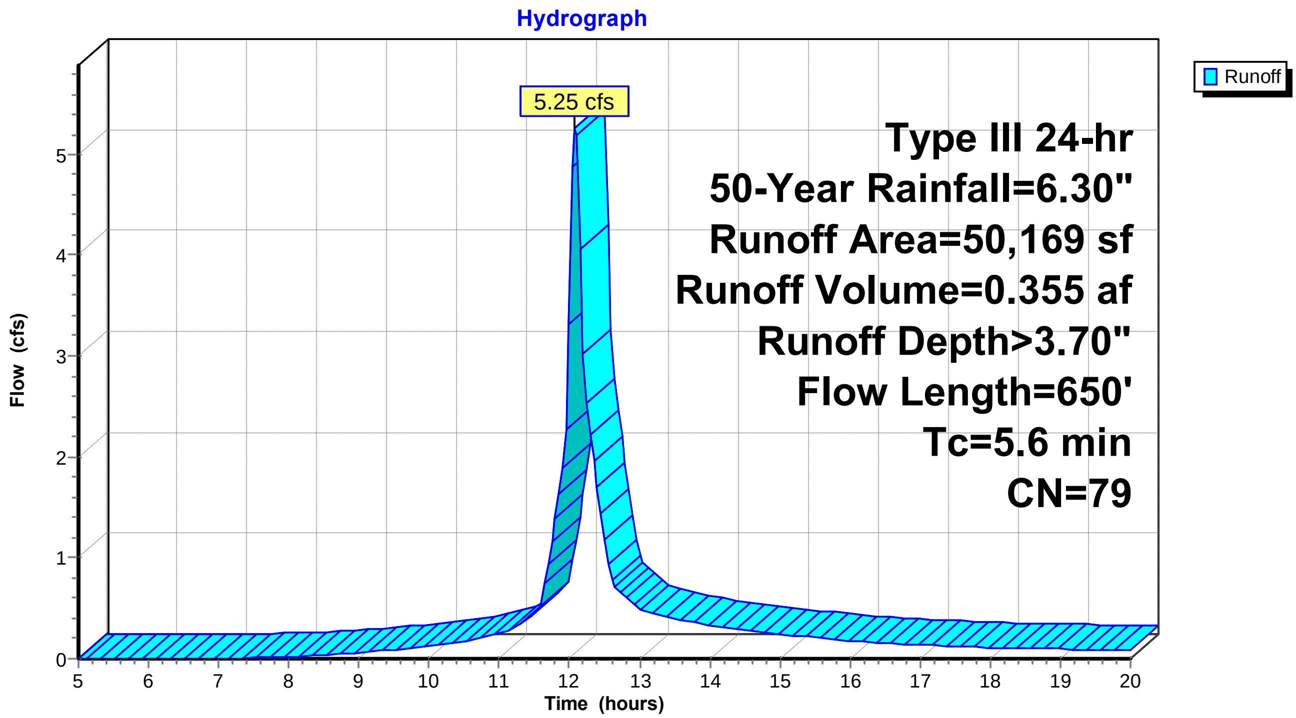
Runoff = 5.25 cfs @ 12.09 hrs, Volume= 0.355 af, Depth> 3.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.30"

Area (sf)	CN	Description
40,557	74	Pasture/grassland/range, Good, HSG C
9,612	98	Impervious, HSG C
50,169	79	Weighted Average
40,557		80.84% Pervious Area
9,612		19.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	150	0.3333	0.57		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.2	500	0.2050	6.79		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
5.6	650	Total			

Subcatchment PRDA6ND: PRDA-6



Summary for Pond BASIN A: BASIN A

Inflow Area = 9.357 ac, 36.10% Impervious, Inflow Depth > 4.11" for 50-Year event
Inflow = 45.46 cfs @ 12.10 hrs, Volume= 3.206 af
Outflow = 4.04 cfs @ 13.08 hrs, Volume= 2.028 af, Atten= 91%, Lag= 59.1 min
Primary = 2.09 cfs @ 13.08 hrs, Volume= 1.028 af
Secondary = 1.95 cfs @ 13.08 hrs, Volume= 1.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 822.32' @ 13.08 hrs Surf.Area= 38,988 sf Storage= 80,956 cf

Plug-Flow detention time= 219.1 min calculated for 2.028 af (63% of inflow)
Center-of-Mass det. time= 146.9 min (919.9 - 773.0)

Volume	Invert	Avail.Storage	Storage Description
#1	820.00'	151,470 cf	**Basin A (Irregular)** Listed below (Recalc)

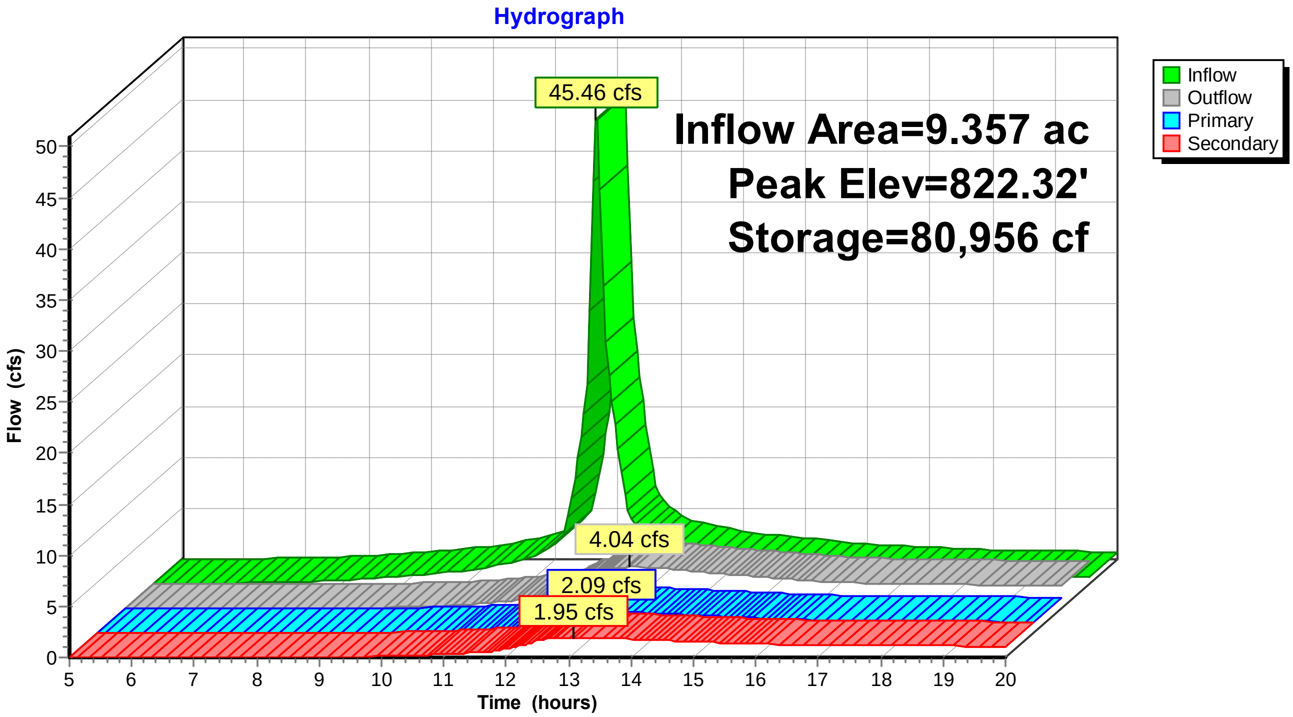
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
820.00	30,856	1,150.0	0	0	30,856
822.00	37,867	1,187.0	68,603	68,603	38,123
824.00	45,105	1,209.0	82,867	151,470	42,954

Device	Routing	Invert	Outlet Devices
#1	Primary	820.00'	**15.0" Round Culvert** L= 250.0' Ke= 0.500 Inlet / Outlet Invert= 820.00' / 786.00' S= 0.1360 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.23 sf
#2	Secondary	820.00'	**15.0" Round Culvert** L= 250.0' Ke= 0.500 Inlet / Outlet Invert= 820.00' / 786.00' S= 0.1360 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.23 sf
#3	Device 1	820.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Device 2	820.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#5	Device 1	822.00'	**15.0" W x 12.0" H Vert. Orifice/Grate** C= 0.600
#6	Device 2	822.00'	**12.0" W x 12.0" H Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=2.09 cfs @ 13.08 hrs HW=822.32' (Free Discharge)
└─**1=Culvert** (Passes 2.09 cfs of 7.70 cfs potential flow)
  ├─**3=Orifice/Grate** (Orifice Controls 1.36 cfs @ 6.93 fps)
  └─**5=Orifice/Grate** (Orifice Controls 0.73 cfs @ 1.82 fps)

Secondary OutFlow Max=1.95 cfs @ 13.08 hrs HW=822.32' (Free Discharge)
└─**2=Culvert** (Passes 1.95 cfs of 7.70 cfs potential flow)
  ├─**4=Orifice/Grate** (Orifice Controls 1.36 cfs @ 6.93 fps)
  └─**6=Orifice/Grate** (Orifice Controls 0.58 cfs @ 1.82 fps)

Pond BASIN A: BASIN A



Summary for Pond BASIN B: BASIN B

Inflow Area = 8.515 ac, 15.24% Impervious, Inflow Depth > 3.46" for 50-Year event
Inflow = 17.84 cfs @ 12.58 hrs, Volume= 2.453 af
Outflow = 7.39 cfs @ 13.21 hrs, Volume= 1.965 af, Atten= 59%, Lag= 37.9 min
Primary = 7.39 cfs @ 13.21 hrs, Volume= 1.965 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 824.47' @ 13.21 hrs Surf.Area= 17,352 sf Storage= 46,228 cf

Plug-Flow detention time= 128.1 min calculated for 1.958 af (80% of inflow)
Center-of-Mass det. time= 78.9 min (892.8 - 814.0)

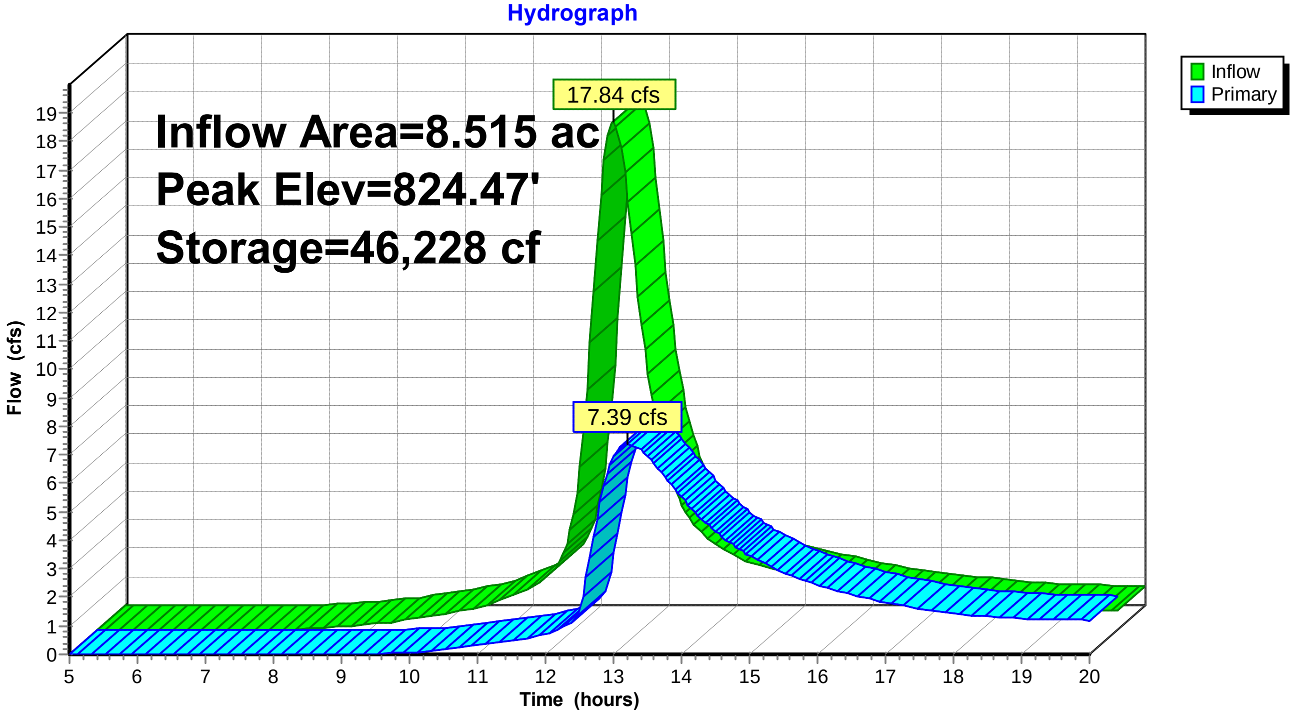
Volume	Invert	Avail.Storage	Storage Description
#1	821.00'	75,685 cf	**Basin B (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
821.00	9,468	729.0	0	0	9,468
822.00	11,682	748.0	10,556	10,556	11,820
824.00	16,283	786.0	27,838	38,394	16,706
826.00	21,113	824.1	37,292	75,685	21,846

Device	Routing	Invert	Outlet Devices
#1	Primary	821.00'	**15.0" Round Culvert** L= 100.0' Ke= 0.500 Inlet / Outlet Invert= 821.00' / 797.00' S= 0.2400 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.23 sf
#2	Device 1	821.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	823.00'	**12.0" W x 18.0" H Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=7.39 cfs @ 13.21 hrs HW=824.47' (Free Discharge)
└─**1=Culvert** (Passes 7.39 cfs of 9.96 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 1.70 cfs @ 8.63 fps)
  └─**3=Orifice/Grate** (Orifice Controls 5.69 cfs @ 3.89 fps)

Pond BASIN B: BASIN B

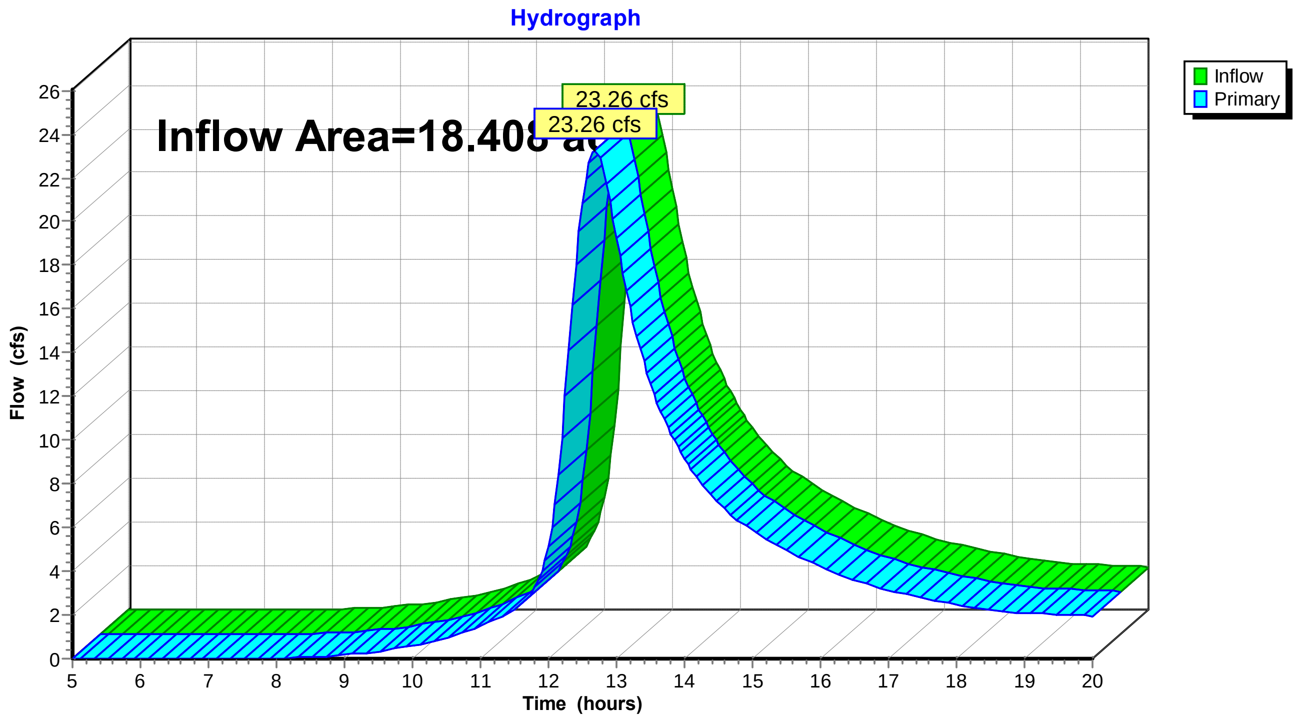


Summary for Link DP1: DP-1

Inflow Area = 18.408 ac, 14.49% Impervious, Inflow Depth > 3.09" for 50-Year event
Inflow = 23.26 cfs @ 12.69 hrs, Volume= 4.733 af
Primary = 23.26 cfs @ 12.69 hrs, Volume= 4.733 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP1: DP-1

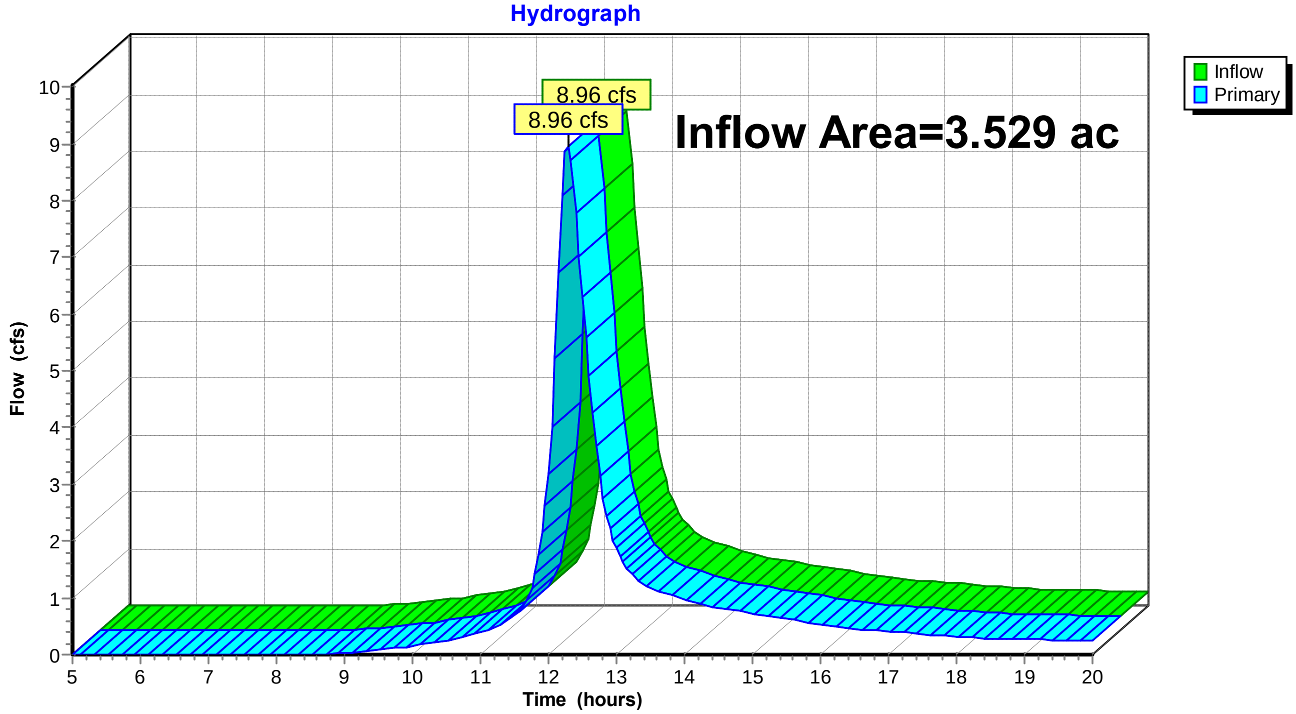


Summary for Link DP2: DP-2

Inflow Area = 3.529 ac, 0.00% Impervious, Inflow Depth > 3.00" for 50-Year event
Inflow = 8.96 cfs @ 12.28 hrs, Volume= 0.882 af
Primary = 8.96 cfs @ 12.28 hrs, Volume= 0.882 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP2: DP-2

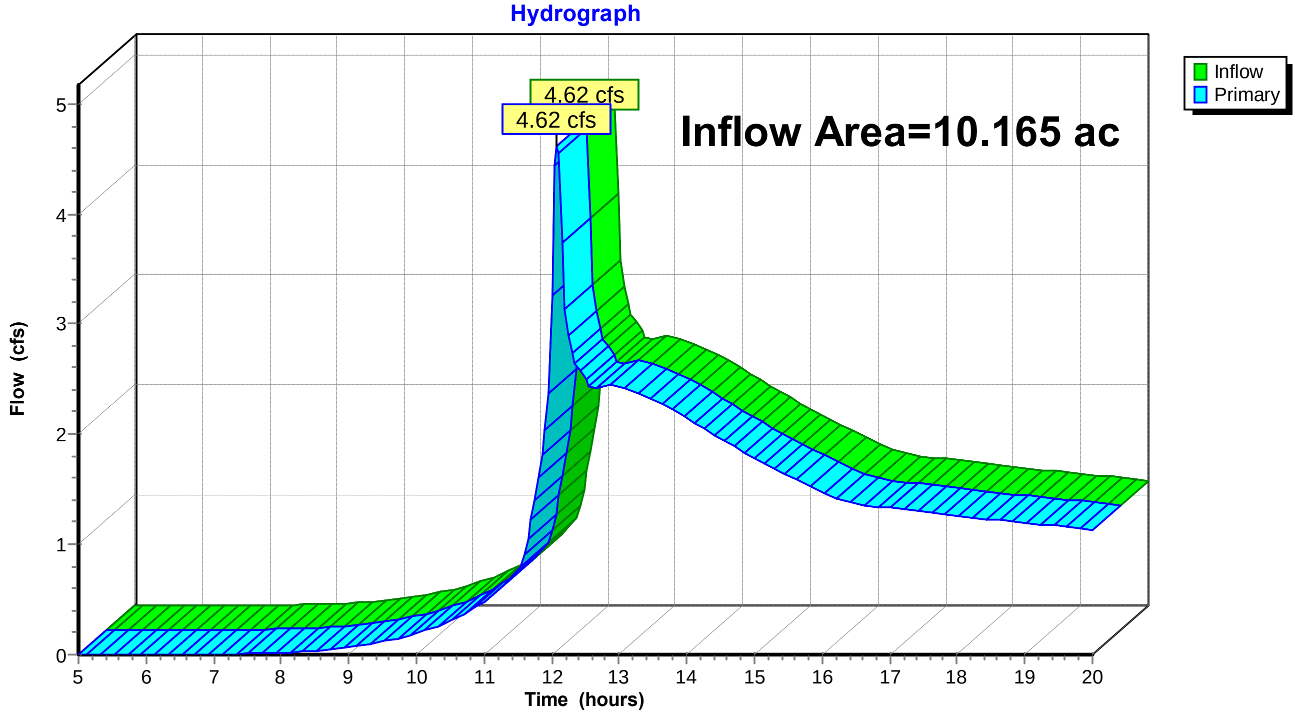


Summary for Link DP3: DP-3

Inflow Area = 10.165 ac, 34.49% Impervious, Inflow Depth > 1.50" for 50-Year event
Inflow = 4.62 cfs @ 12.08 hrs, Volume= 1.270 af
Primary = 4.62 cfs @ 12.08 hrs, Volume= 1.270 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP3: DP-3

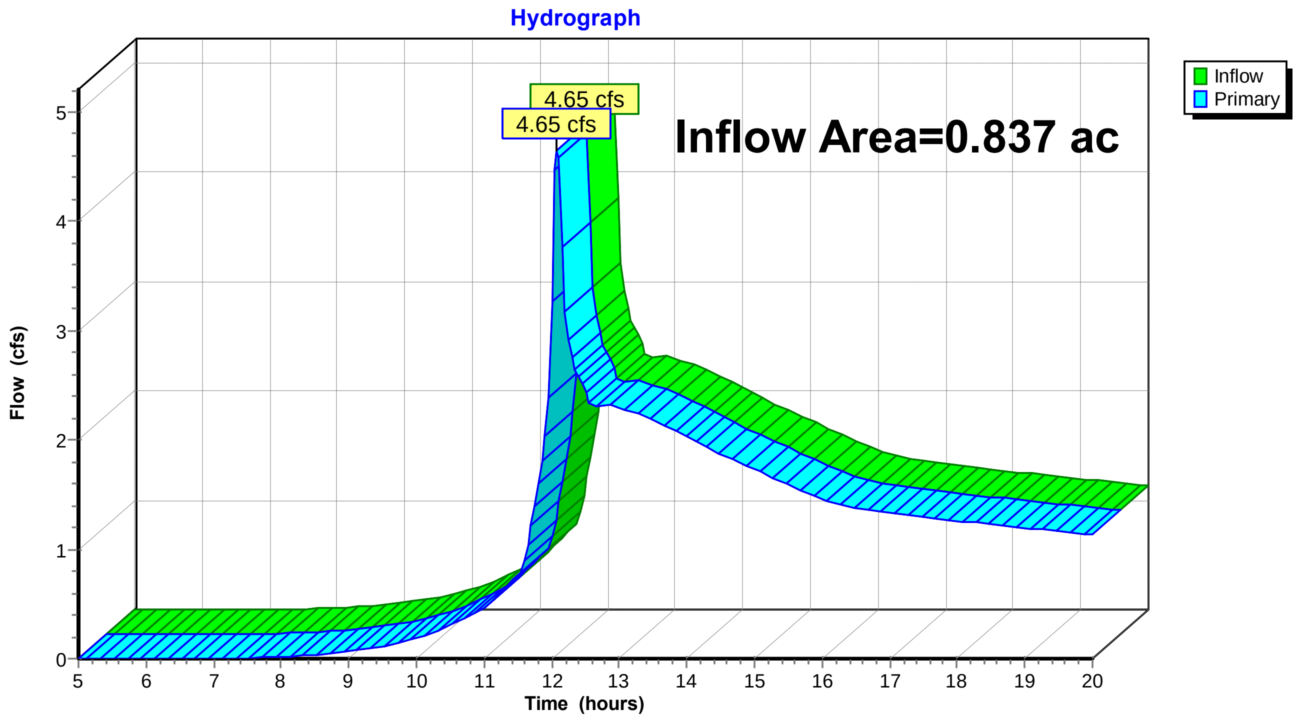


Summary for Link DP4: DP-4

Inflow Area = 0.837 ac, 12.89% Impervious, Inflow Depth > 17.84" for 50-Year event
Inflow = 4.65 cfs @ 12.08 hrs, Volume= 1.244 af
Primary = 4.65 cfs @ 12.08 hrs, Volume= 1.244 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP4: DP-4

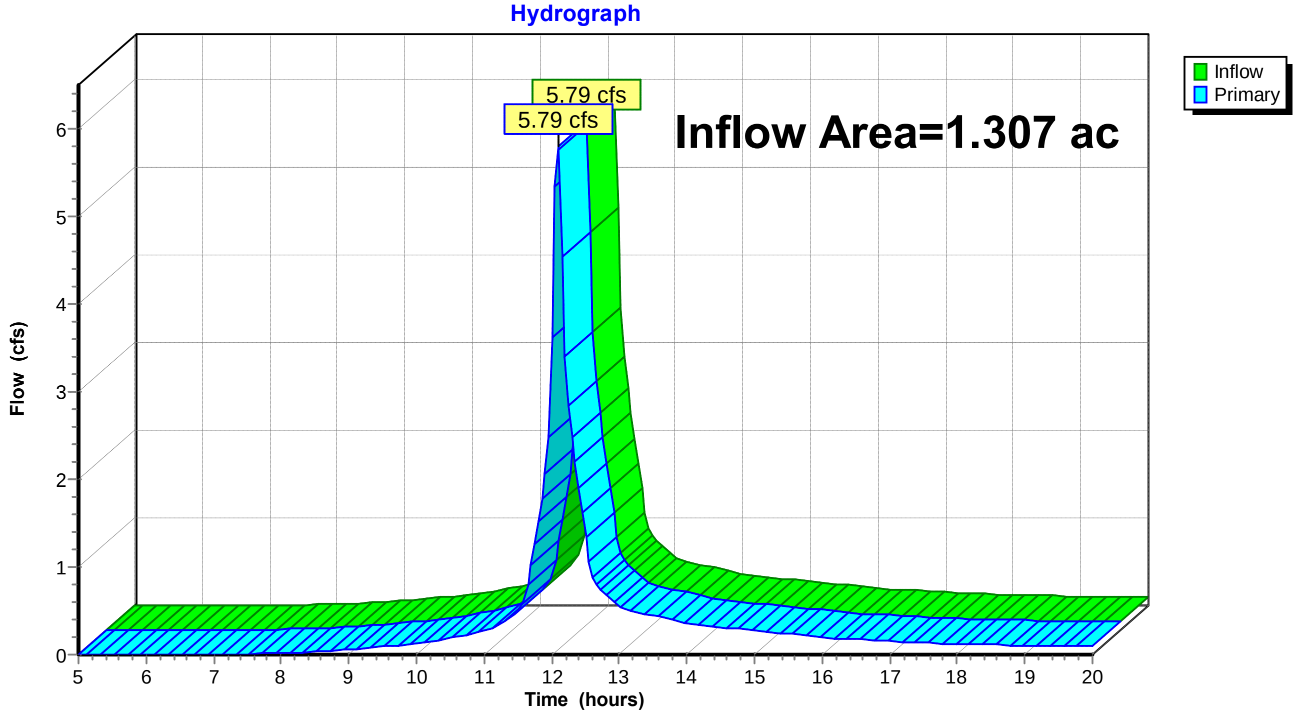


Summary for Link DP5: DP-5

Inflow Area =	1.307 ac,	16.34% Impervious,	Inflow Depth > 3.60"	for 50-Year event
Inflow =	5.79 cfs @	12.09 hrs, Volume=	0.392 af	
Primary =	5.79 cfs @	12.09 hrs, Volume=	0.392 af, Atten= 0%, Lag= 0.0 min	

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP5: DP-5

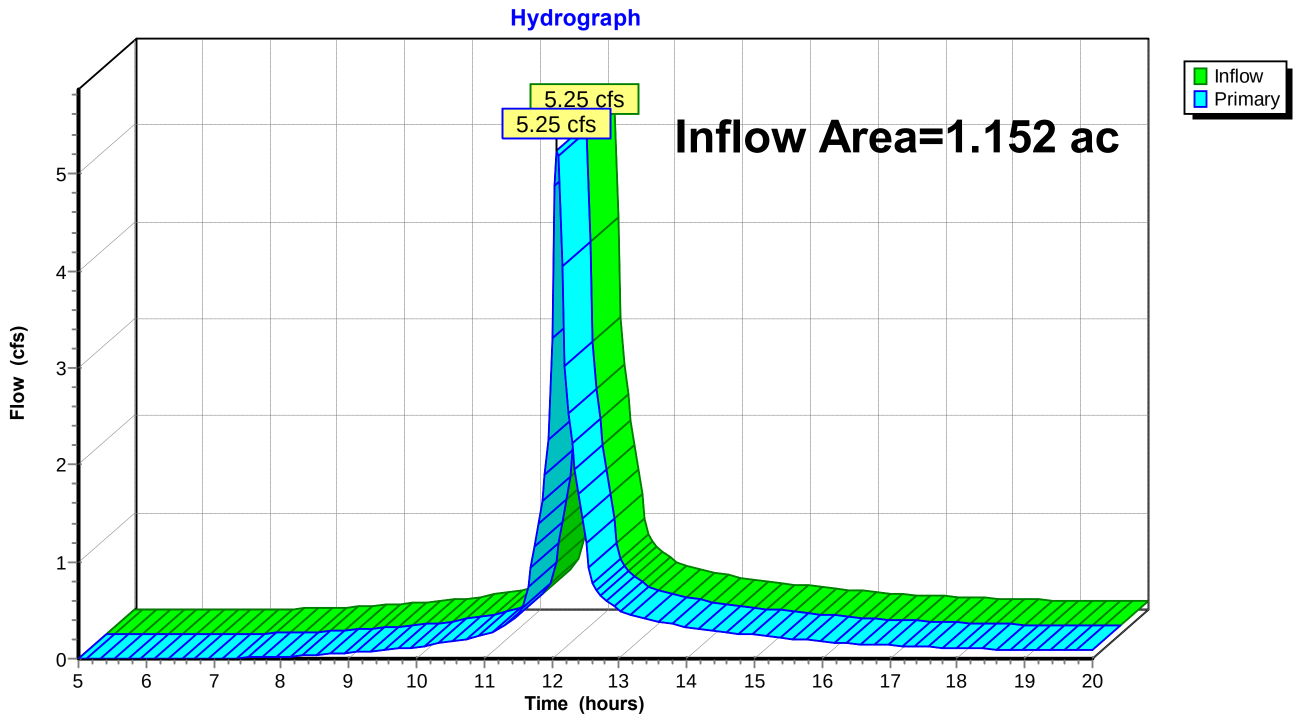


Summary for Link DP6: DP-6

Inflow Area =	1.152 ac,	19.16% Impervious,	Inflow Depth > 3.70"	for 50-Year event
Inflow =	5.25 cfs @	12.09 hrs, Volume=	0.355 af	
Primary =	5.25 cfs @	12.09 hrs, Volume=	0.355 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP6: DP-6



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PRDA1D: PRDA-1 Runoff Area=407,573 sf 36.10% Impervious Runoff Depth>4.83"
Flow Length=1,450' Tc=6.7 min CN=83 Runoff=52.94 cfs 3.764 af

Subcatchment PRDA1ND: PRDA-1 Runoff Area=430,906 sf 13.85% Impervious Runoff Depth>4.02"
Flow Length=1,775' Tc=42.9 min CN=76 Runoff=23.89 cfs 3.314 af

Subcatchment PRDA2D: PRDA-2 Runoff Area=370,926 sf 15.24% Impervious Runoff Depth>4.13"
Flow Length=850' Tc=42.4 min CN=77 Runoff=21.21 cfs 2.929 af

Subcatchment PRDA2ND: PRDA-2 Runoff Area=153,744 sf 0.00% Impervious Runoff Depth>3.63"
Flow Length=500' Tc=20.1 min CN=72 Runoff=10.85 cfs 1.068 af

Subcatchment PRDA3ND: PRDA-3 Runoff Area=35,236 sf 15.90% Impervious Runoff Depth>4.28"
Flow Length=100' Slope=0.1100 '/' Tc=5.0 min CN=78 Runoff=4.33 cfs 0.289 af

Subcatchment PRDA4ND: PRDA-4 Runoff Area=36,465 sf 12.89% Impervious Runoff Depth>4.18"
Flow Length=100' Slope=0.1100 '/' Tc=5.0 min CN=77 Runoff=4.35 cfs 0.291 af

Subcatchment PRDA5ND: PRDA-5 Runoff Area=56,917 sf 16.34% Impervious Runoff Depth>4.28"
Flow Length=300' Tc=5.7 min CN=78 Runoff=6.85 cfs 0.466 af

Subcatchment PRDA6ND: PRDA-6 Runoff Area=50,169 sf 19.16% Impervious Runoff Depth>4.39"
Flow Length=650' Tc=5.6 min CN=79 Runoff=6.18 cfs 0.421 af

Pond BASIN A: BASIN A Peak Elev=822.59' Storage=91,611 cf Inflow=52.94 cfs 3.764 af
Primary=3.27 cfs 1.283 af Secondary=2.91 cfs 1.215 af Outflow=6.18 cfs 2.499 af

Pond BASIN B: BASIN B Peak Elev=824.86' Storage=53,236 cf Inflow=21.21 cfs 2.929 af
Outflow=9.24 cfs 2.412 af

Link DP1: DP-1 Inflow=29.13 cfs 5.726 af
Primary=29.13 cfs 5.726 af

Link DP2: DP-2 Inflow=10.85 cfs 1.068 af
Primary=10.85 cfs 1.068 af

Link DP3: DP-3 Inflow=5.38 cfs 1.572 af
Primary=5.38 cfs 1.572 af

Link DP4: DP-4 Inflow=5.44 cfs 1.507 af
Primary=5.44 cfs 1.507 af

Link DP5: DP-5 Inflow=6.85 cfs 0.466 af
Primary=6.85 cfs 0.466 af

Link DP6: DP-6 Inflow=6.18 cfs 0.421 af
Primary=6.18 cfs 0.421 af

Total Runoff Area = 35.398 ac Runoff Volume = 12.544 af Average Runoff Depth = 4.25"
81.03% Pervious = 28.682 ac 18.97% Impervious = 6.716 ac

Summary for Subcatchment PRDA1D: PRDA-1

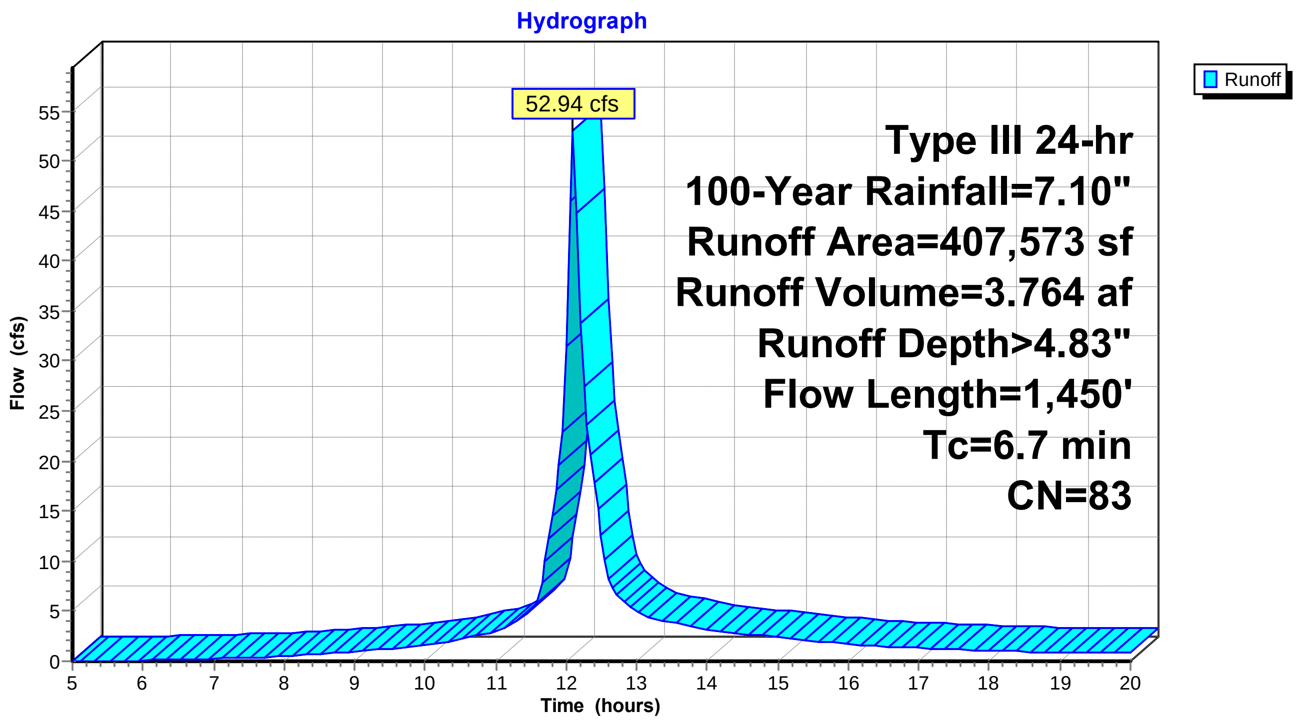
Runoff = 52.94 cfs @ 12.10 hrs, Volume= 3.764 af, Depth> 4.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.10"

	Area (sf)	CN	Description
	69,087	98	Impervious, HSG C
	36,569	98	Roofs, HSG C
	41,458	98	Water Surface, HSG C
*	260,459	75	Gravel, HSG C
	407,573	83	Weighted Average
	260,459		63.90% Pervious Area
	147,114		36.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	250	0.0100	1.25		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
3.4	1,200	0.0075	5.93	7.27	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.010 PVC, smooth interior
6.7	1,450	Total			

Subcatchment PRDA1D: PRDA-1



Summary for Subcatchment PRDA1ND: PRDA-1

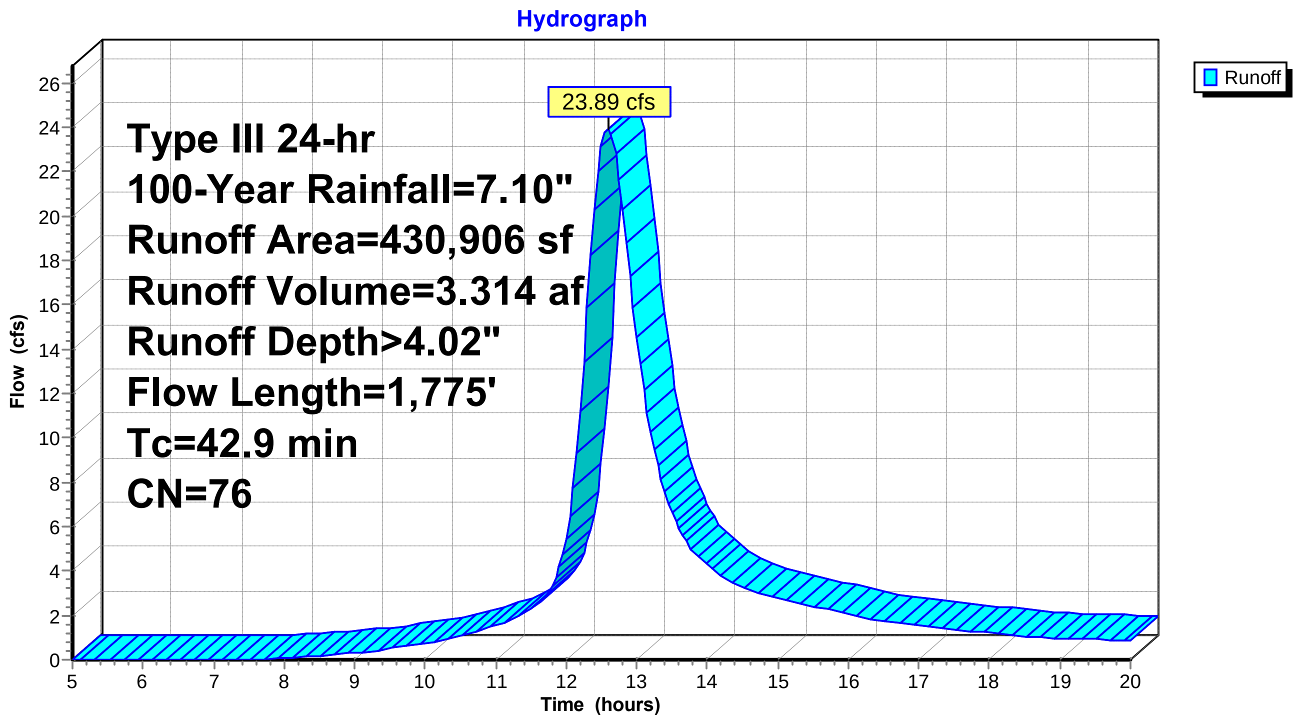
Runoff = 23.89 cfs @ 12.59 hrs, Volume= 3.314 af, Depth> 4.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.10"

Area (sf)	CN	Description
114,584	70	Woods, Good, HSG C
256,640	74	Pasture/grassland/range, Good, HSG C
59,682	98	Impervious, HSG C
430,906	76	Weighted Average
371,224		86.15% Pervious Area
59,682		13.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.0	250	0.0320	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
4.9	1,000	0.0440	3.38		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.0	525	0.0570	8.87	53.22	**Channel Flow,** Area= 6.0 sf Perim= 6.0' r= 1.00' n= 0.040 Earth, cobble bottom, clean sides
42.9	1,775	Total			

Subcatchment PRDA1ND: PRDA-1



Summary for Subcatchment PRDA2D: PRDA-2

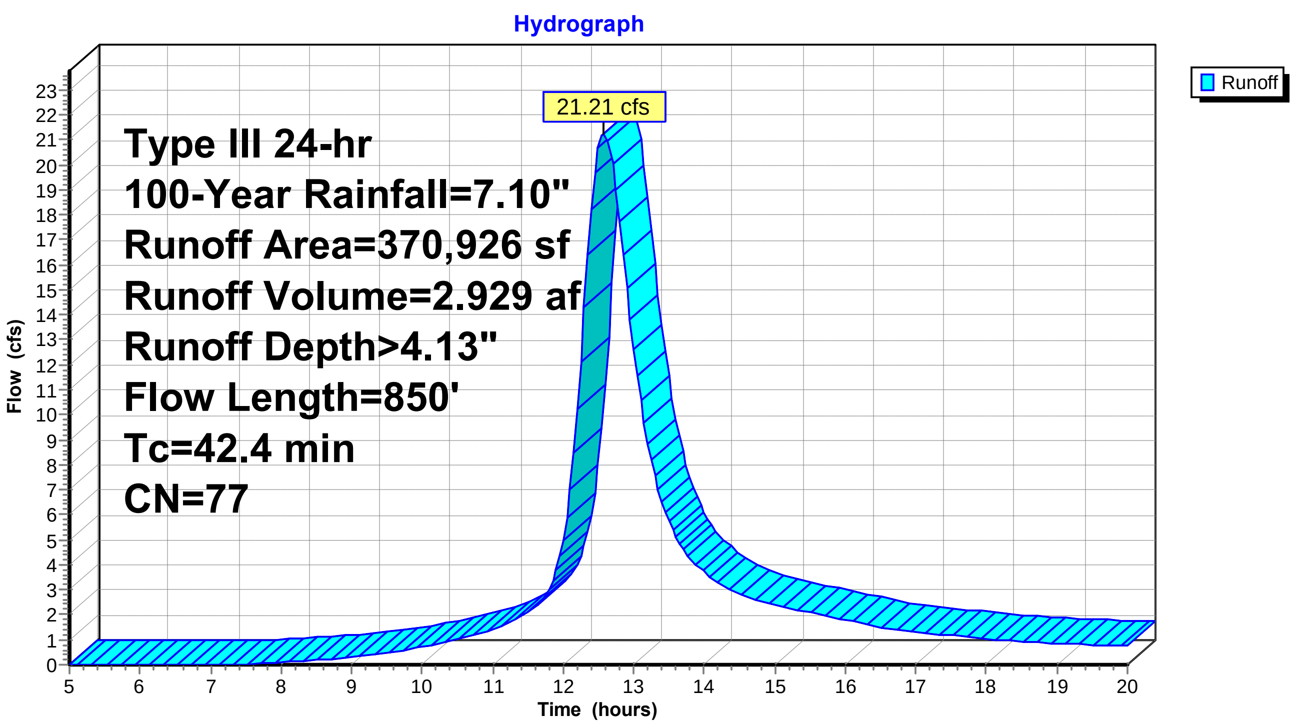
Runoff = 21.21 cfs @ 12.58 hrs, Volume= 2.929 af, Depth> 4.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.10"

	Area (sf)	CN	Description
	36,718	98	Impervious, HSG C
	1,151	98	Roofs, HSG C
	18,667	98	Water Surface, HSG C
	134,433	74	Pasture/grassland/range, Good, HSG C
*	115,820	75	Gravel, HSG C
	64,137	70	Woods, Good, HSG C
	370,926	77	Weighted Average
	314,390		84.76% Pervious Area
	56,536		15.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.0	250	0.0320	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
5.4	600	0.0700	1.85		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
42.4	850	Total			

Subcatchment PRDA2D: PRDA-2



Summary for Subcatchment PRDA2ND: PRDA-2

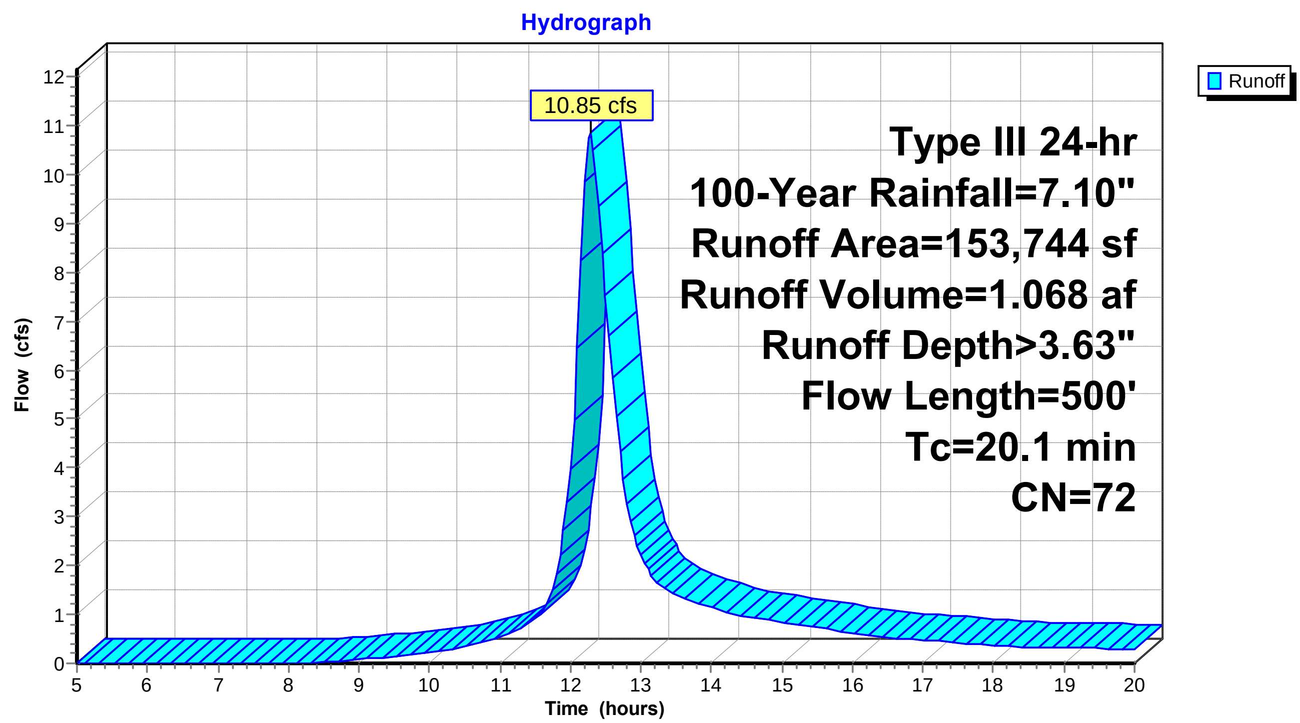
Runoff = 10.85 cfs @ 12.28 hrs, Volume= 1.068 af, Depth> 3.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.10"

Area (sf)	CN	Description
71,014	70	Woods, Good, HSG C
82,730	74	Pasture/grassland/range, Good, HSG C
153,744	72	Weighted Average
153,744		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.7	250	0.0560	0.21		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.20"
0.4	250	0.5000	11.38		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
20.1	500	Total			

Subcatchment PRDA2ND: PRDA-2



Summary for Subcatchment PRDA3ND: PRDA-3

[49] Hint: Tc<2dt may require smaller dt

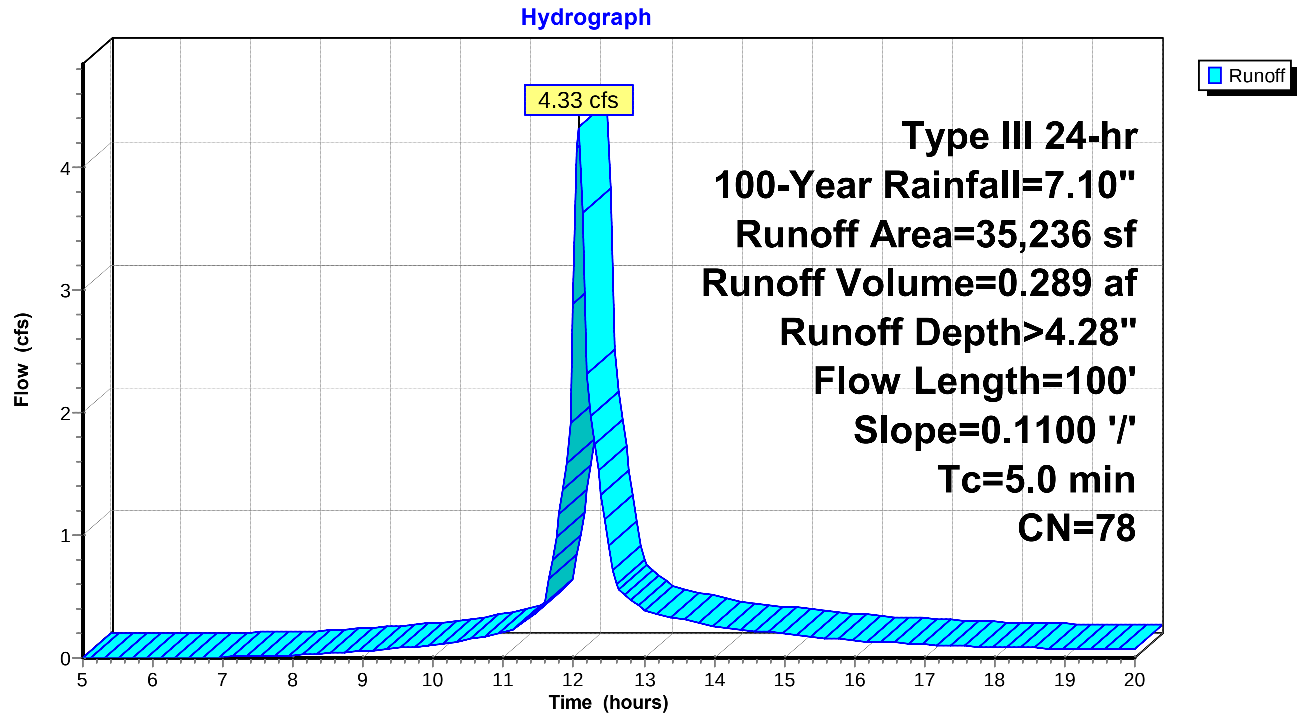
Runoff = 4.33 cfs @ 12.07 hrs, Volume= 0.289 af, Depth> 4.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.10"

Area (sf)	CN	Description
29,635	74	Pasture/grassland/range, Good, HSG C
5,601	98	Impervious, HSG C
35,236	78	Weighted Average
29,635		84.10% Pervious Area
5,601		15.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	100	0.1100	0.34		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"

Subcatchment PRDA3ND: PRDA-3



Summary for Subcatchment PRDA4ND: PRDA-4

[49] Hint: Tc<2dt may require smaller dt

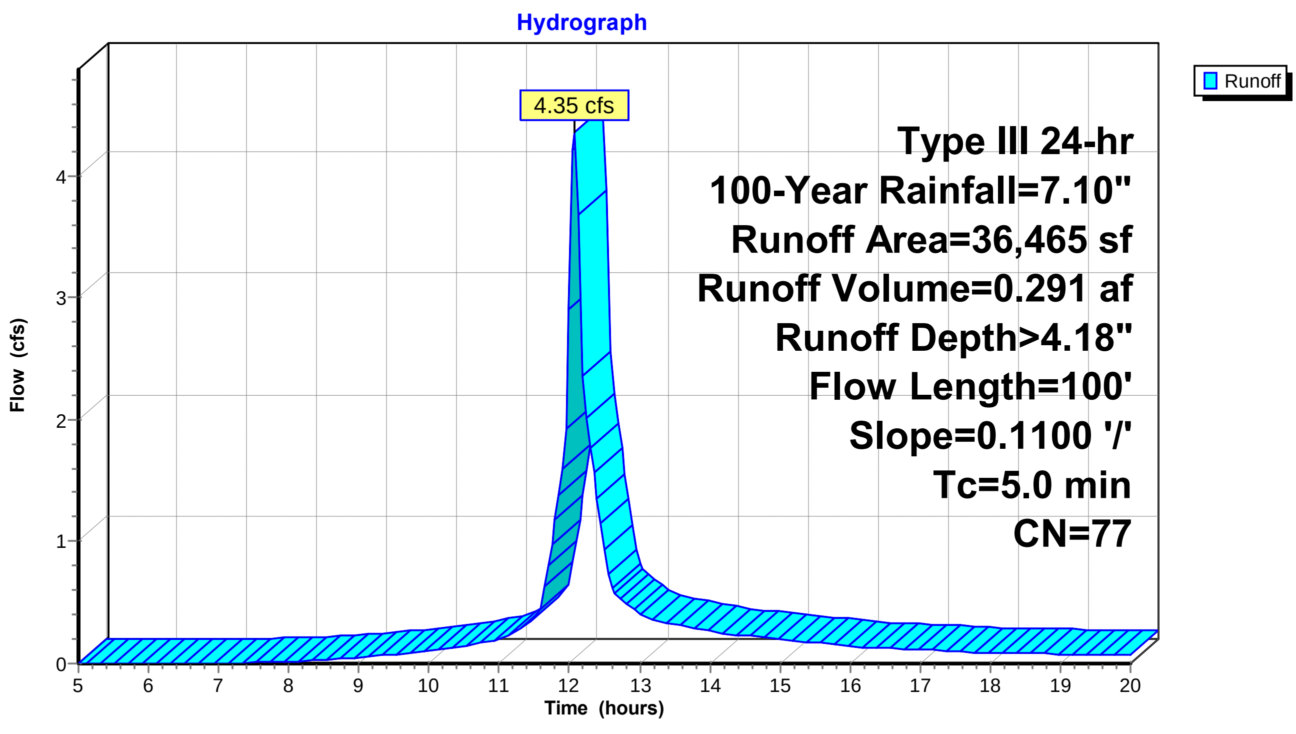
Runoff = 4.35 cfs @ 12.08 hrs, Volume= 0.291 af, Depth> 4.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.10"

	Area (sf)	CN	Description
	31,764	74	Pasture/grassland/range, Good, HSG C
*	4,701	98	Impervious
	36,465	77	Weighted Average
	31,764		87.11% Pervious Area
	4,701		12.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	100	0.1100	0.34		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"

Subcatchment PRDA4ND: PRDA-4



Summary for Subcatchment PRDA5ND: PRDA-5

[49] Hint: Tc<2dt may require smaller dt

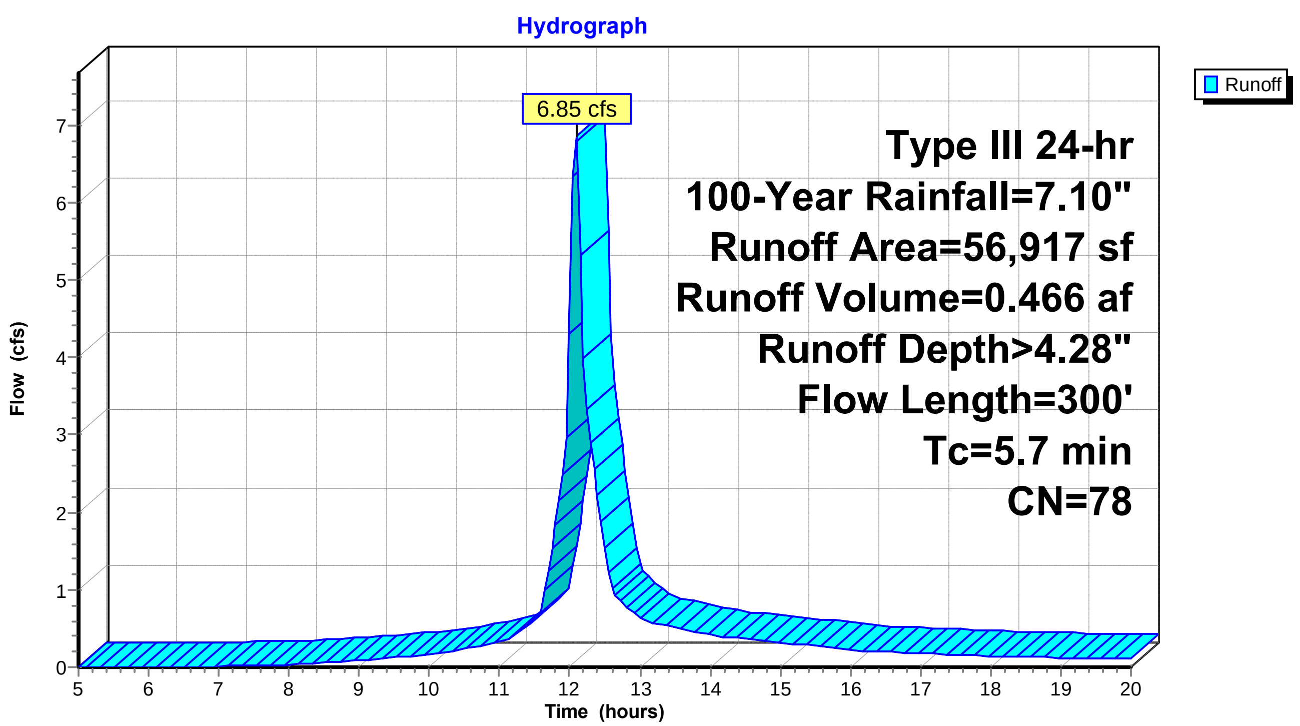
Runoff = 6.85 cfs @ 12.09 hrs, Volume= 0.466 af, Depth> 4.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.10"

Area (sf)	CN	Description
9,302	98	Impervious, HSG C
47,615	74	Pasture/grassland/range, Good, HSG C
56,917	78	Weighted Average
47,615		83.66% Pervious Area
9,302		16.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	200	0.3333	0.60		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.2	100	0.0100	6.84	8.40	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.010 PVC, smooth interior
5.7	300	Total			

Subcatchment PRDA5ND: PRDA-5



Summary for Subcatchment PRDA6ND: PRDA-6

[49] Hint: Tc<2dt may require smaller dt

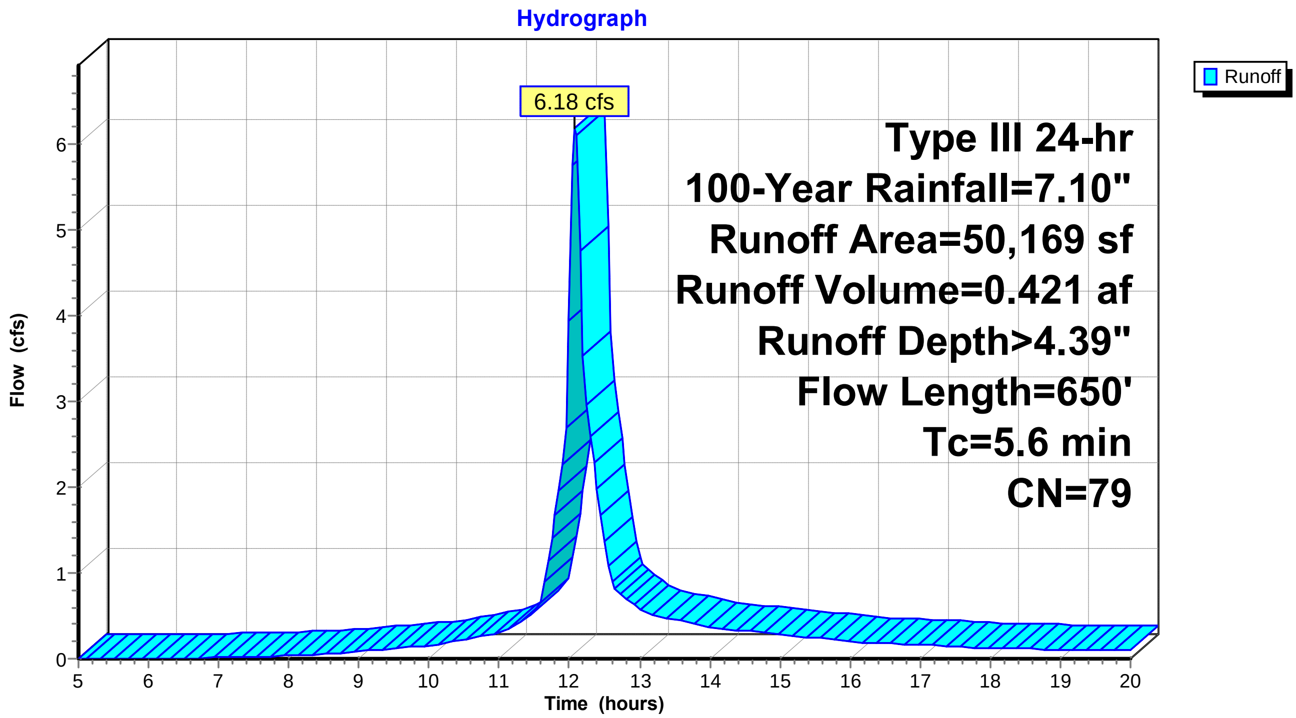
Runoff = 6.18 cfs @ 12.09 hrs, Volume= 0.421 af, Depth> 4.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.10"

Area (sf)	CN	Description
40,557	74	Pasture/grassland/range, Good, HSG C
9,612	98	Impervious, HSG C
50,169	79	Weighted Average
40,557		80.84% Pervious Area
9,612		19.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	150	0.3333	0.57		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.2	500	0.2050	6.79		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
5.6	650	Total			

Subcatchment PRDA6ND: PRDA-6



Summary for Pond BASIN A: BASIN A

Inflow Area =	9.357 ac,	36.10% Impervious,	Inflow Depth > 4.83"	for 100-Year event
Inflow =	52.94 cfs @	12.10 hrs, Volume=	3.764 af	
Outflow =	6.18 cfs @	12.80 hrs, Volume=	2.499 af,	Atten= 88%, Lag= 41.9 min
Primary =	3.27 cfs @	12.80 hrs, Volume=	1.283 af	
Secondary =	2.91 cfs @	12.80 hrs, Volume=	1.215 af	

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 822.59' @ 12.80 hrs Surf.Area= 39,942 sf Storage= 91,611 cf

Plug-Flow detention time= 200.2 min calculated for 2.490 af (66% of inflow)
Center-of-Mass det. time= 131.5 min (900.6 - 769.1)

Volume	Invert	Avail.Storage	Storage Description
#1	820.00'	151,470 cf	**Basin A (Irregular)** Listed below (Recalc)

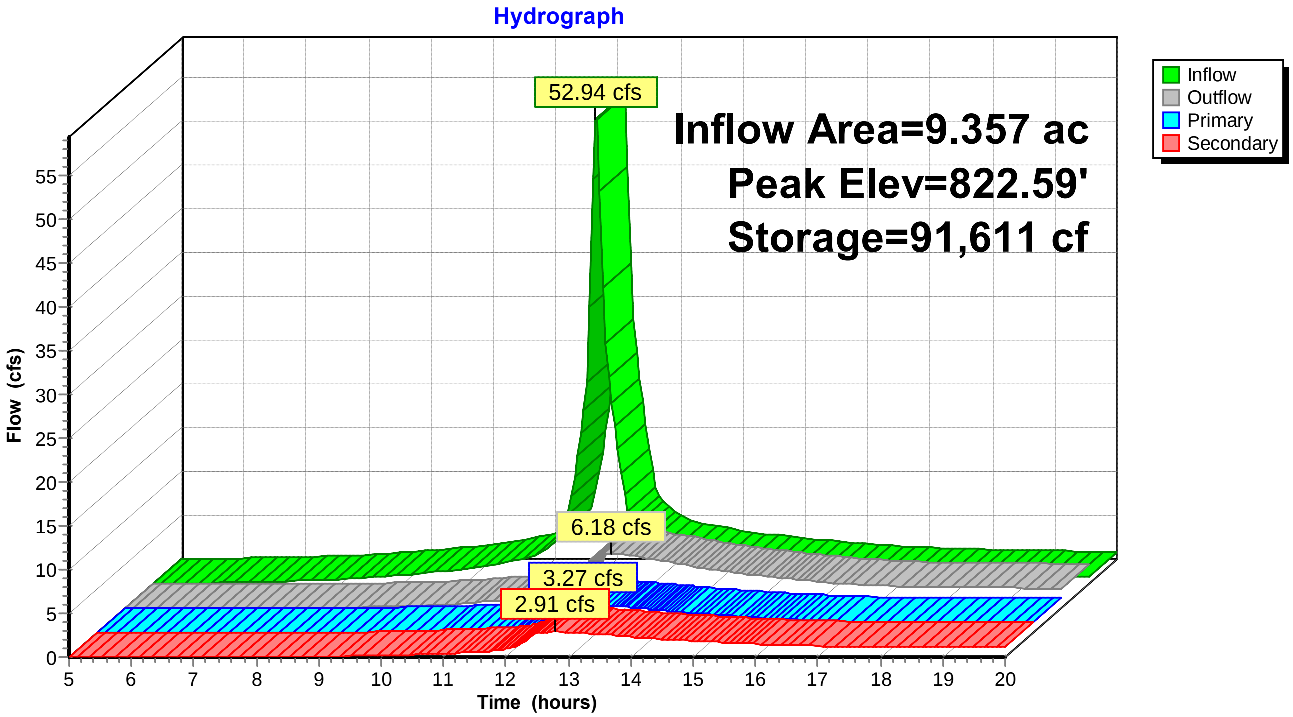
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
820.00	30,856	1,150.0	0	0	30,856
822.00	37,867	1,187.0	68,603	68,603	38,123
824.00	45,105	1,209.0	82,867	151,470	42,954

Device	Routing	Invert	Outlet Devices
#1	Primary	820.00'	**15.0" Round Culvert** L= 250.0' Ke= 0.500 Inlet / Outlet Invert= 820.00' / 786.00' S= 0.1360 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.23 sf
#2	Secondary	820.00'	**15.0" Round Culvert** L= 250.0' Ke= 0.500 Inlet / Outlet Invert= 820.00' / 786.00' S= 0.1360 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.23 sf
#3	Device 1	820.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Device 2	820.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#5	Device 1	822.00'	**15.0" W x 12.0" H Vert. Orifice/Grate** C= 0.600
#6	Device 2	822.00'	**12.0" W x 12.0" H Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=3.27 cfs @ 12.80 hrs HW=822.59' (Free Discharge)
└─**1=Culvert** (Passes 3.27 cfs of 8.29 cfs potential flow)
  ├─**3=Orifice/Grate** (Orifice Controls 1.45 cfs @ 7.37 fps)
  └─**5=Orifice/Grate** (Orifice Controls 1.82 cfs @ 2.47 fps)

Secondary OutFlow Max=2.91 cfs @ 12.80 hrs HW=822.59' (Free Discharge)
└─**2=Culvert** (Passes 2.91 cfs of 8.29 cfs potential flow)
  ├─**4=Orifice/Grate** (Orifice Controls 1.45 cfs @ 7.37 fps)
  └─**6=Orifice/Grate** (Orifice Controls 1.46 cfs @ 2.47 fps)

Pond BASIN A: BASIN A



Summary for Pond BASIN B: BASIN B

Inflow Area = 8.515 ac, 15.24% Impervious, Inflow Depth > 4.13" for 100-Year event
Inflow = 21.21 cfs @ 12.58 hrs, Volume= 2.929 af
Outflow = 9.24 cfs @ 13.18 hrs, Volume= 2.412 af, Atten= 56%, Lag= 35.8 min
Primary = 9.24 cfs @ 13.18 hrs, Volume= 2.412 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 824.86' @ 13.18 hrs Surf.Area= 18,281 sf Storage= 53,236 cf

Plug-Flow detention time= 118.4 min calculated for 2.404 af (82% of inflow)
Center-of-Mass det. time= 72.9 min (882.8 - 809.9)

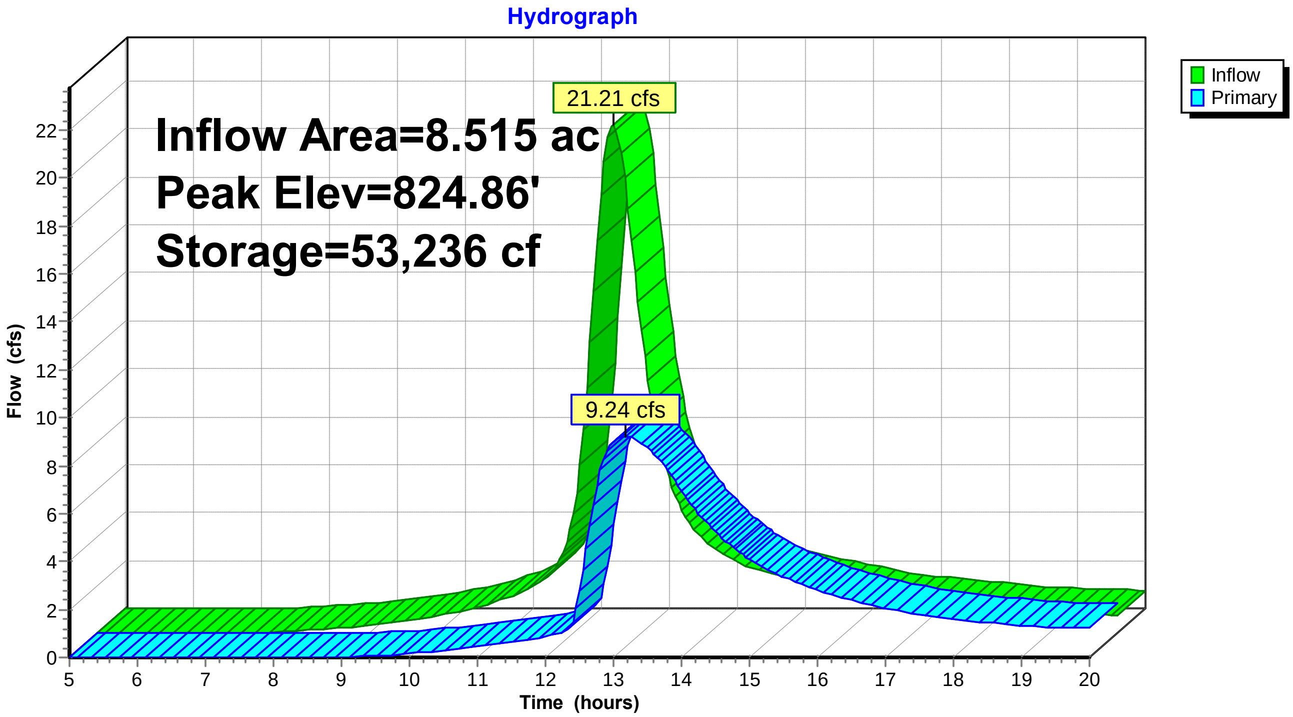
Volume	Invert	Avail.Storage	Storage Description
#1	821.00'	75,685 cf	**Basin B (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
821.00	9,468	729.0	0	0	9,468
822.00	11,682	748.0	10,556	10,556	11,820
824.00	16,283	786.0	27,838	38,394	16,706
826.00	21,113	824.1	37,292	75,685	21,846

Device	Routing	Invert	Outlet Devices
#1	Primary	821.00'	**15.0" Round Culvert** L= 100.0' Ke= 0.500 Inlet / Outlet Invert= 821.00' / 797.00' S= 0.2400 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.23 sf
#2	Device 1	821.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	823.00'	**12.0" W x 18.0" H Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=9.24 cfs @ 13.18 hrs HW=824.86' (Free Discharge)
└─**1=Culvert** (Passes 9.24 cfs of 10.63 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 1.80 cfs @ 9.15 fps)
  └─**3=Orifice/Grate** (Orifice Controls 7.44 cfs @ 4.96 fps)

Pond BASIN B: BASIN B

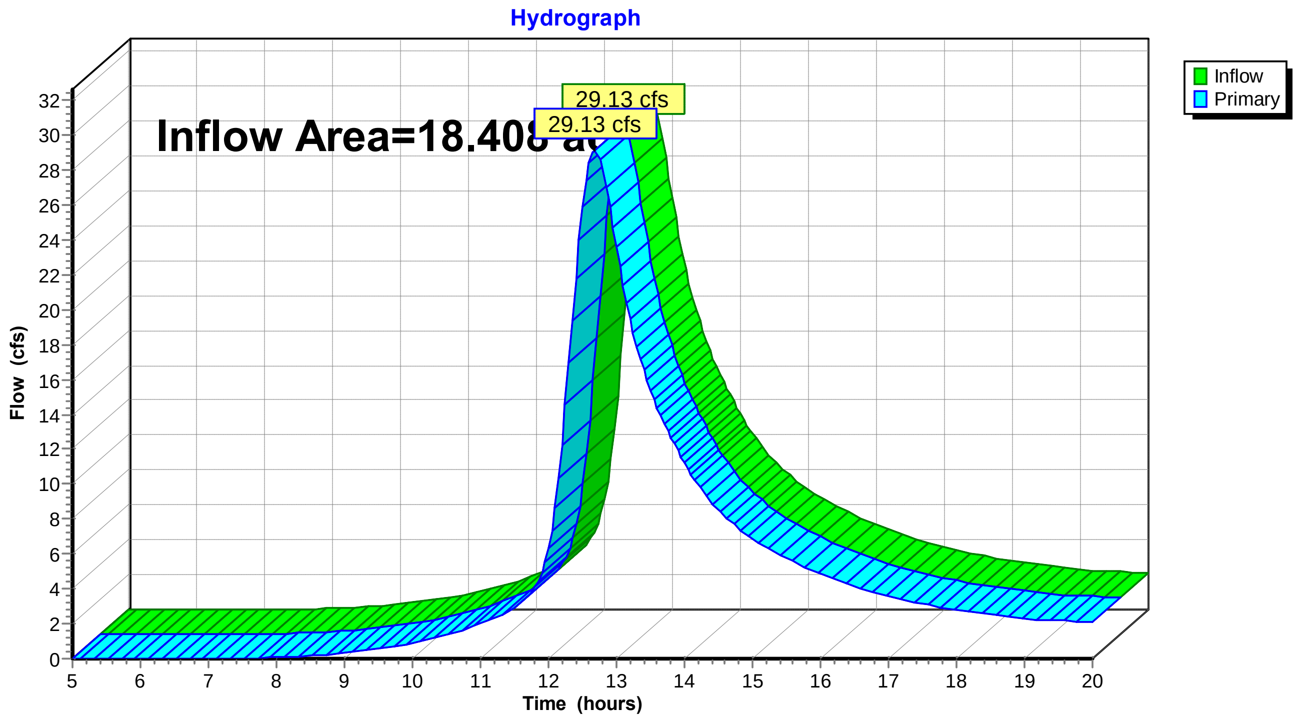


Summary for Link DP1: DP-1

Inflow Area =	18.408 ac,	14.49% Impervious,	Inflow Depth > 3.73"	for 100-Year event
Inflow =	29.13 cfs @	12.69 hrs, Volume=	5.726 af	
Primary =	29.13 cfs @	12.69 hrs, Volume=	5.726 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP1: DP-1

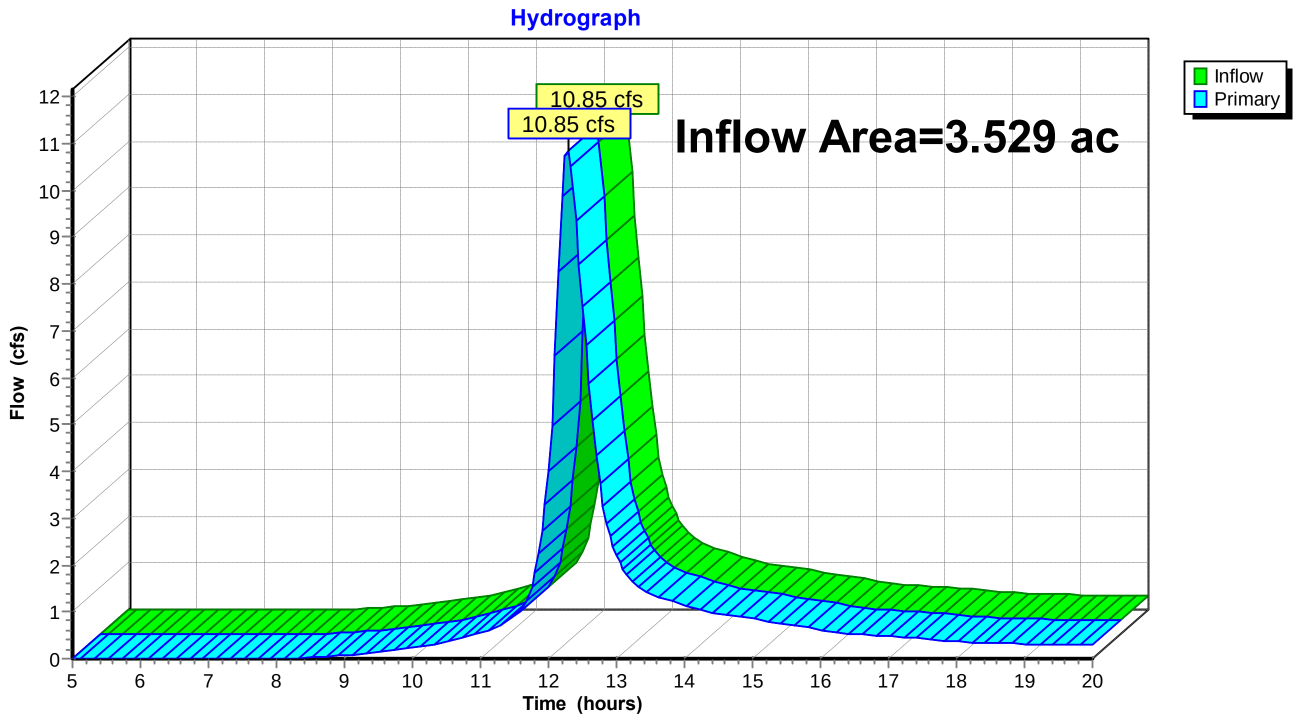


Summary for Link DP2: DP-2

Inflow Area =	3.529 ac,	0.00% Impervious, Inflow Depth >	3.63"	for 100-Year event
Inflow =	10.85 cfs @	12.28 hrs, Volume=	1.068 af	
Primary =	10.85 cfs @	12.28 hrs, Volume=	1.068 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP2: DP-2

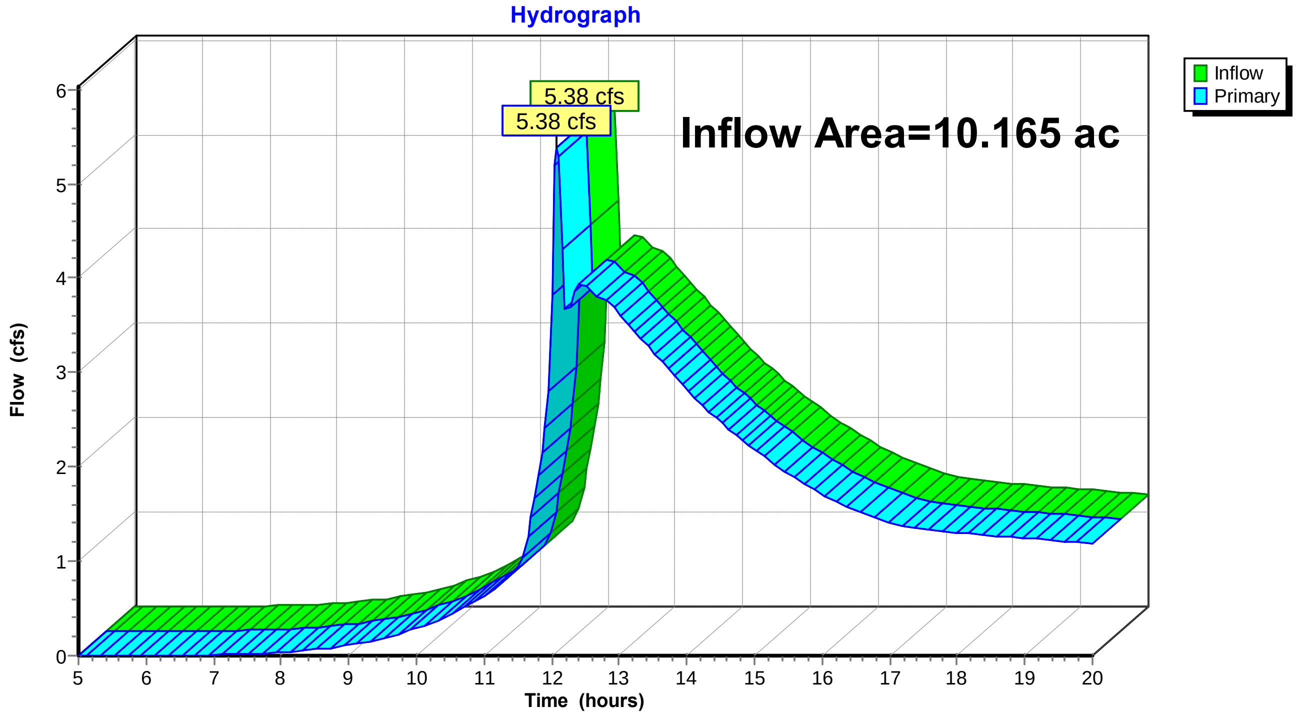


Summary for Link DP3: DP-3

Inflow Area =	10.165 ac,	34.49% Impervious,	Inflow Depth > 1.86"	for 100-Year event
Inflow =	5.38 cfs @	12.08 hrs, Volume=	1.572 af	
Primary =	5.38 cfs @	12.08 hrs, Volume=	1.572 af, Atten= 0%, Lag= 0.0 min	

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP3: DP-3

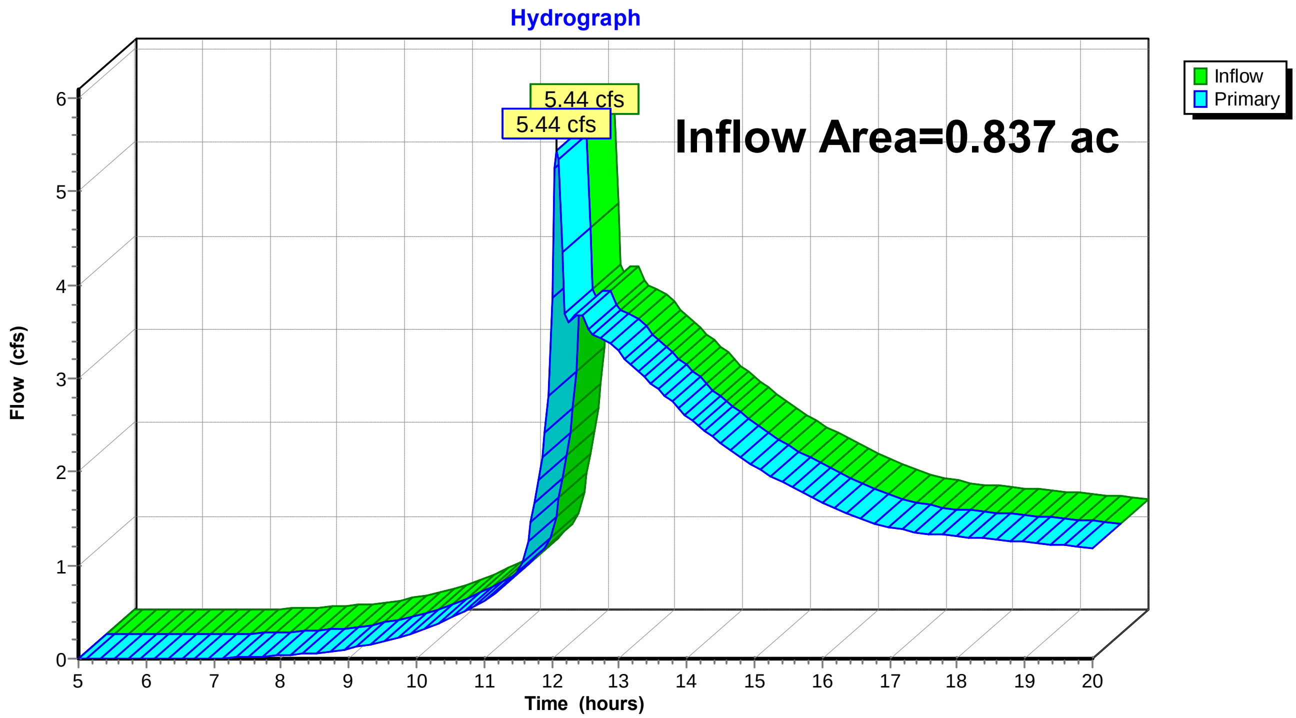


Summary for Link DP4: DP-4

Inflow Area =	0.837 ac, 12.89% Impervious, Inflow Depth > 21.60"	for 100-Year event	
Inflow =	5.44 cfs @ 12.08 hrs, Volume=	1.507 af	
Primary =	5.44 cfs @ 12.08 hrs, Volume=	1.507 af, Atten= 0%, Lag= 0.0 min	

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP4: DP-4

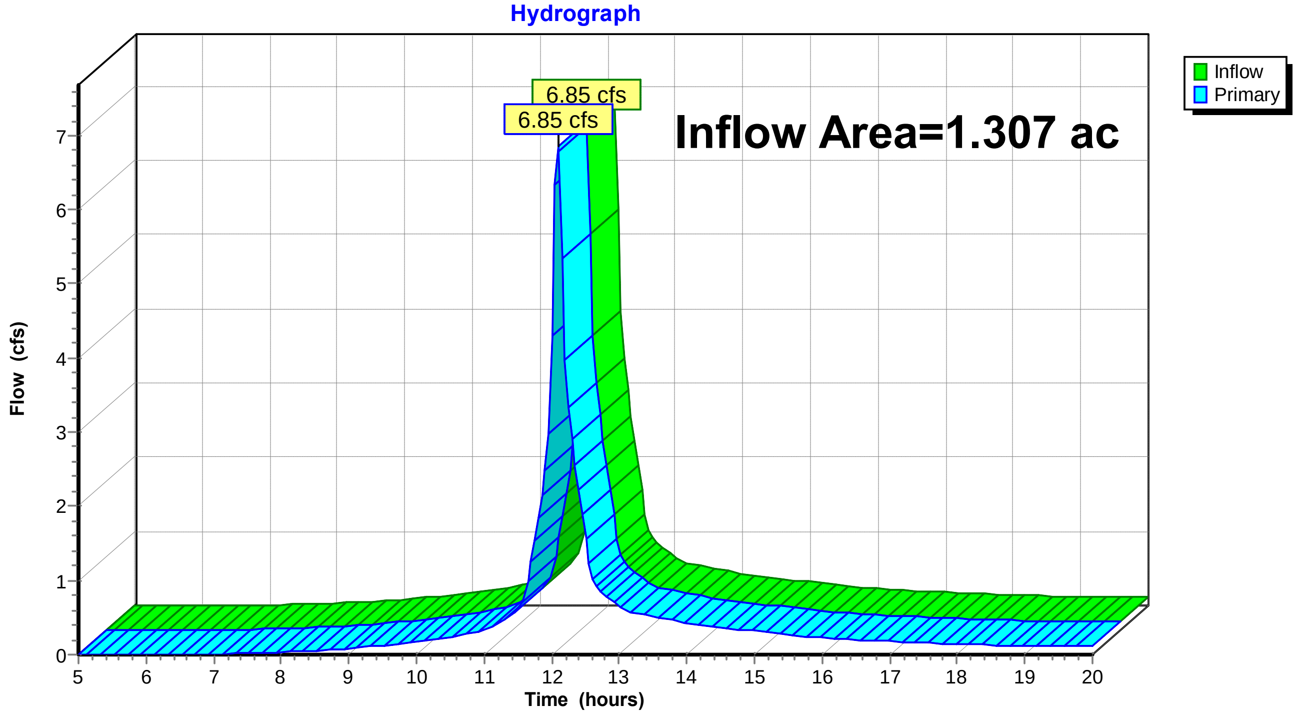


Summary for Link DP5: DP-5

Inflow Area =	1.307 ac, 16.34% Impervious, Inflow Depth > 4.28"	for 100-Year event	
Inflow =	6.85 cfs @ 12.09 hrs, Volume=	0.466 af	
Primary =	6.85 cfs @ 12.09 hrs, Volume=	0.466 af, Atten= 0%, Lag= 0.0 min	

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP5: DP-5

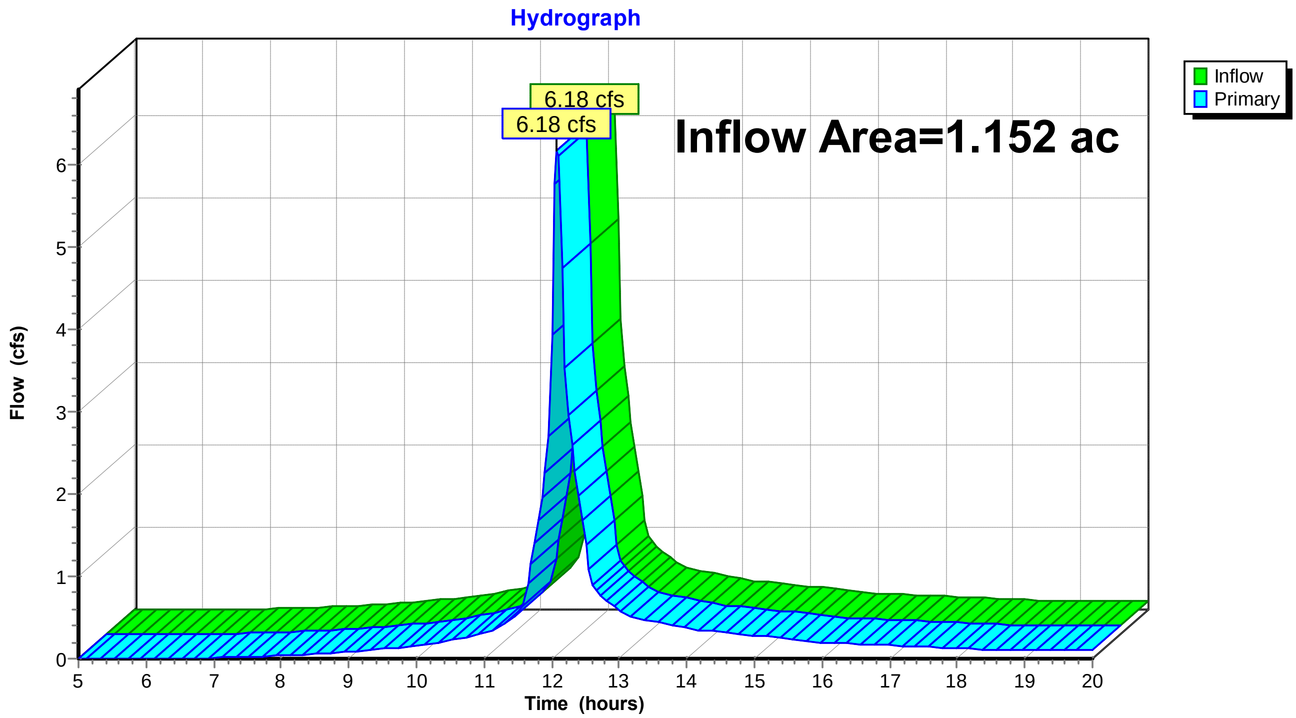


Summary for Link DP6: DP-6

Inflow Area =	1.152 ac,	19.16% Impervious,	Inflow Depth > 4.39"	for 100-Year event	
Inflow =	6.18 cfs @	12.09 hrs,	Volume=	0.421 af	
Primary =	6.18 cfs @	12.09 hrs,	Volume=	0.421 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP6: DP-6



Appendix D – Rational Method Pipe Sizing

STORM SEWER SYSTEM DESIGN
CPV Towantic Energy Center
Oxford, CT
25 Year Design Storm

Drainage Area	Impervious (0.9)	Grass or Crushed Stone (0.3)	Wooded (0.2)	Total Area (Ac.)	Average C	Sum of AxC	Tc
STDA A1	0.078	0.000	0.000	0.078	0.90	0.07	5.00
STDA A2	0.066	0.240	0.000	0.306	0.43	0.13	5.00
STDA A3	0.101	0.163	0.000	0.264	0.53	0.14	5.00
STDA A4	0.108	0.282	0.000	0.391	0.47	0.18	5.00
STDA A5	0.085	0.000	0.000	0.085	0.90	0.08	5.00
STDA A6	0.039	0.000	0.000	0.039	0.90	0.03	5.00
STDA A7	0.151	0.014	0.000	0.166	0.85	0.14	5.00
STDA A8	0.096	0.002	0.000	0.098	0.89	0.09	5.00
STDA A9	0.484	0.063	0.000	0.547	0.83	0.45	5.00
STDA A10	0.068	0.053	0.000	0.121	0.64	0.08	5.00
STDA A11	0.134	0.126	0.000	0.261	0.61	0.16	5.00
STDA A12	0.041	0.017	0.000	0.059	0.72	0.04	5.00
STDA A13	0.049	0.302	0.000	0.350	0.38	0.13	5.00
STDA A14	0.108	0.237	0.000	0.345	0.49	0.17	5.00
STDA A15	0.260	0.236	0.000	0.495	0.61	0.30	5.00
STDA A16	0.040	0.214	0.000	0.254	0.39	0.10	5.00
STDA A17	0.011	0.540	0.000	0.552	0.31	0.17	5.00
STDA A18	0.040	0.249	0.000	0.290	0.38	0.11	5.00
STDA A19	0.055	0.213	0.000	0.268	0.42	0.11	5.00
STDA A20	0.041	0.088	0.000	0.129	0.49	0.06	5.00
STDA A21	0.198	0.024	0.000	0.222	0.83	0.19	5.00
STDA B1	0.074	0.192	0.000	0.266	0.47	0.12	5.00
STDA B2	0.096	0.080	0.000	0.175	0.63	0.11	5.00
STDA B3	0.112	0.304	0.000	0.416	0.46	0.19	5.00
STDA B4	0.073	0.302	0.000	0.375	0.42	0.16	5.00
STDA B5	0.083	0.196	0.000	0.279	0.48	0.13	5.00
STDA B6	0.038	0.295	0.000	0.333	0.37	0.12	5.00
STDA B7	0.132	0.226	0.000	0.358	0.52	0.19	5.00
STDA B8	0.102	0.070	0.000	0.172	0.66	0.11	5.00
STDA B9	0.127	0.148	0.000	0.275	0.58	0.16	5.00
STDA B10	0.035	0.565	0.000	0.600	0.34	0.20	5.00
STDA B11	0.000	0.496	0.000	0.496	0.30	0.15	5.00
STDA B12	0.000	0.289	0.000	0.289	0.30	0.09	5.00
STDA C1	0.120	0.347	0.000	0.467	0.45	0.21	5.00
STDA C2	0.123	0.013	0.000	0.136	0.84	0.11	5.00
STDA D	0.059	0.303	0.000	0.362	0.40	0.14	5.00
STDA E1	0.081	0.516	0.000	0.597	0.38	0.23	5.00
STDA E2	0.091	0.555	0.000	0.646	0.38	0.25	5.00

STORM SEWER SYSTEM DESIGN
CPV Towantic Energy Center
Oxford, CT
25 Year Design Storm

LINE SEGMENT	DRAINAGE AREA	SEGMENT TYPE	TIME TO INLET	TIME IN PIPE	ACCUM. TIME	SUM OF AxC	ACCUM. AxC	RAINFALL I	SYSTEM Q (cfs)	PIPE SIZE (in)	PIPE (ft) LENGTH	SLOPE (ft/ft)	Vfull (fps)	Qfull (cfs)	N'	CAPACITY CHECK	HW/D
CB A1 - CB A2	STDA A1	I	5.00	0.14	5.00	0.07	0.07	6.70	0.47	15	46	0.0075	5.39	6.61	0.0110	WITHIN CAPACITY	<0.5
CB A2 - CB A3	STDA A2	C	5.00	0.24	5.14	0.13	0.20	6.70	1.35	15	77	0.0075	5.39	6.61	0.0110	WITHIN CAPACITY	0.5
CB A3 - CB A4	STDA A3	C	5.00	0.31	5.38	0.14	0.34	6.70	2.29	15	101	0.0075	5.39	6.61	0.0110	WITHIN CAPACITY	0.7
CB A4 - CB A5	STDA A4	C	5.00	0.11	5.69	0.18	0.52	6.70	3.51	15	34	0.0075	5.39	6.61	0.0110	WITHIN CAPACITY	0.9
CB A5 - CB A6	STDA A5	C	5.00	0.70	5.80	0.08	0.60	6.70	4.02	15	226	0.0075	5.39	6.61	0.0110	WITHIN CAPACITY	1
CB A6 - CB A7	STDA A6	C	5.00	0.05	6.50	0.03	0.63	6.70	4.25	15	17	0.0075	5.39	6.61	0.0110	WITHIN CAPACITY	1.05
CB A7 - BASIN A	STDA A7	C	5.00	0.22	6.55	0.14	0.78	6.70	5.19	15	115	0.0195	8.69	10.66	0.0110	WITHIN CAPACITY	1.1
CB A8 - CB A9	STDA A8	I	5.00	0.10	5.00	0.09	0.09	6.70	0.58	15	32	0.0075	5.39	6.61	0.0110	WITHIN CAPACITY	<0.5
CB A9 - CB A11	STDA A9	C	5.00	0.69	5.10	0.45	0.54	6.70	3.63	15	224	0.0075	5.39	6.61	0.0110	WITHIN CAPACITY	0.9
CB A10 - CB A11	STDA A10	I	5.00	0.02	5.00	0.08	0.08	6.70	0.52	15	17	0.0700	16.46	20.20	0.0110	WITHIN CAPACITY	<0.5
CB A11 - DMH A1	STDA A11	C	5.00	0.19	5.79	0.16	0.78	6.70	5.21	15	62	0.0075	5.39	6.61	0.0110	WITHIN CAPACITY	1.25
DMH A1 - CB A14	N/A	C	5.00	0.29	5.98	0.00	0.78	6.70	5.21	15	93	0.0075	5.39	6.61	0.0110	WITHIN CAPACITY	1.25
CB A12 - CB A14	STDA A12	I	5.00	0.05	5.00	0.04	0.04	6.70	0.28	15	17	0.0100	6.22	7.63	0.0110	WITHIN CAPACITY	<0.5
CB A13 - CB A14	STDA A13	I	5.00	0.25	5.00	0.13	0.13	6.70	0.90	15	140	0.0231	9.46	11.60	0.0110	WITHIN CAPACITY	<0.5
CB A14 - DMH A2	STDA A14	C	5.00	0.28	6.27	0.17	1.12	6.70	7.52	**18**	102	0.0075	6.08	10.75	0.0110	WITHIN CAPACITY	1.15
CB A15 - CB 16	STDA A15	I	5.00	0.39	5.00	0.30	0.30	6.70	2.04	15	167	0.0133	7.17	8.80	0.0110	WITHIN CAPACITY	0.65
CB A16 - DMH A2	STDA A16	C	5.00	0.28	5.39	0.10	0.40	6.70	2.71	15	120	0.0133	7.17	8.80	0.0110	WITHIN CAPACITY	0.75
DMH A2 - CB A20	N/A	C	5.00	0.16	6.55	0.00	1.53	6.70	10.23	**24**	72	0.0075	7.37	23.15	0.0110	WITHIN CAPACITY	0.85
CB A17 - CB A18	STDA A17	I	5.00	0.56	5.00	0.17	0.17	6.70	1.15	15	232	0.0125	6.96	8.54	0.0110	WITHIN CAPACITY	<0.5
CB A18 - CB A19	STDA A18	C	5.00	0.05	5.56	0.11	0.28	6.70	1.90	15	22	0.0125	6.96	8.54	0.0110	WITHIN CAPACITY	0.6
CB A19 - DMH A3	STDA A19	C	5.00	0.13	5.61	0.11	0.40	6.70	2.66	15	54	0.0125	6.96	8.54	0.0110	WITHIN CAPACITY	0.75
DMH A3 - CB A20	N/A	C	5.00	0.15	5.74	0.00	0.40	6.70	2.66	15	69	0.0148	7.57	9.29	0.0110	WITHIN CAPACITY	0.75
CB A20 - CB A21	STDA A20	C	5.00	0.12	6.71	0.06	1.99	6.70	13.31	**24**	54	0.0075	7.37	23.15	0.0110	WITHIN CAPACITY	1.05
CB A21 - BASIN A	STDA A21	C	5.00	0.31	6.84	0.19	2.17	6.70	14.55	**24**	145	0.0083	7.75	24.36	0.0110	WITHIN CAPACITY	1.1
CB B1 - CB B2	STDA B1	I	5.00	0.11	5.00	0.12	0.12	6.70	0.83	15	34	0.0075	5.39	6.61	0.0110	WITHIN CAPACITY	<0.5
CB B2 - DMH B1	STDA B2	C	5.00	0.24	5.11	0.11	0.23	6.70	1.57	15	76	0.0075	5.39	6.61	0.0110	WITHIN CAPACITY	0.55
DMH B1 - CB B3	N/A	C	5.00	0.35	5.34	0.00	0.23	6.70	1.57	15	114	0.0075	5.39	6.61	0.0110	WITHIN CAPACITY	0.55
CB B3 - CB B4	STDA B3	C	5.00	0.42	5.69	0.19	0.43	6.70	2.86	15	137	0.0075	5.39	6.61	0.0110	WITHIN CAPACITY	0.8
CB B4 - DMH B2	STDA B4	C	5.00	0.17	6.12	0.16	0.58	6.70	3.90	15	56	0.0075	5.39	6.61	0.0110	WITHIN CAPACITY	1
DMH B2 - CB B12	N/A	C	5.00	0.20	6.29	0.00	0.58	6.70	3.90	15	95	0.0155	7.75	9.50	0.0110	WITHIN CAPACITY	1
CB B5 - CB B6	STDA B5	I	5.00	0.05	5.00	0.13	0.13	6.70	0.89	15	17	0.0075	5.39	6.61	0.0110	WITHIN CAPACITY	<0.5
CB B6 - DMH B3	STDA B6	C	5.00	0.37	5.05	0.12	0.26	6.70	1.72	15	149	0.0115	6.67	8.19	0.0110	WITHIN CAPACITY	0.6
CB B7 - CB B8	STDA B7	I	5.00	0.06	5.00	0.19	0.19	6.70	1.25	15	20	0.0075	5.39	6.61	0.0110	WITHIN CAPACITY	<0.5
CB B8 - DMH B3	STDA B8	C	5.00	0.41	5.06	0.11	0.30	6.70	2.00	15	132	0.0075	5.39	6.61	0.0110	WITHIN CAPACITY	0.65
CB B9 - DMH B3	STDA B9	I	5.00	0.02	5.00	0.16	0.16	6.70	1.06	15	24	0.0683	16.26	19.95	0.0110	WITHIN CAPACITY	<0.5
DMH B3 - CB B10	N/A	C	5.00	0.24	5.42	0.00	0.71	6.70	4.78	15	76	0.0075	5.39	6.61	0.0110	WITHIN CAPACITY	1.15
CB B10 - CB B11	STDA B10	C	5.00	0.44	5.66	0.20	0.91	6.70	6.13	**18**	160	0.0075	6.08	10.75	0.0110	WITHIN CAPACITY	1
CB B11 - DMH B4	STDA B11	C	5.00	0.14	6.10	0.15	1.06	6.70	7.13	**18**	51	0.0075	6.08	10.75	0.0110	WITHIN CAPACITY	1.1
DMH B4 - CB B12	N/A	C	5.00	0.30	6.24	0.00	1.06	6.70	7.13	**18**	108	0.0075	6.08	10.75	0.0110	WITHIN CAPACITY	1.1
CB B12 - BASIN B	STDA B12	C	5.00	0.10	6.49	0.09	1.73	6.70	11.61	**24**	48	0.0083	7.75	24.36	0.0110	WITHIN CAPACITY	0.95
CB C1 - CB C2	STDA C1	I	5.00	0.08	5.00	0.21	0.21	6.70	1.42	15	31	0.0100	6.22	7.63	0.0110	WITHIN CAPACITY	0.5
CB C2 - DMH C1	STDA C2	C	5.00	0.07	5.08	0.11	0.33	6.70	2.19	15	102	0.1430	23.52	28.87	0.0110	WITHIN CAPACITY	0.65
DMH C1 - DP1	N/A	C	5.00	0.19	5.16	0.00	0.33	6.70	2.19	15	161	0.0500	13.91	17.07	0.0110	WITHIN CAPACITY	0.65
CB D1 - WQS D2	STDA D	I	5.00	0.11	5.00	0.14	0.14	6.70	0.97	15	40	0.0100	6.22	7.63	0.0110	WITHIN CAPACITY	<0.5
CB E1 - DP5	STDA E	I	5.00	0.11	5.00	0.48	0.48	6.70	3.19	15	36	0.0075	5.39	6.61	0.0110	WITHIN CAPACITY	0.85

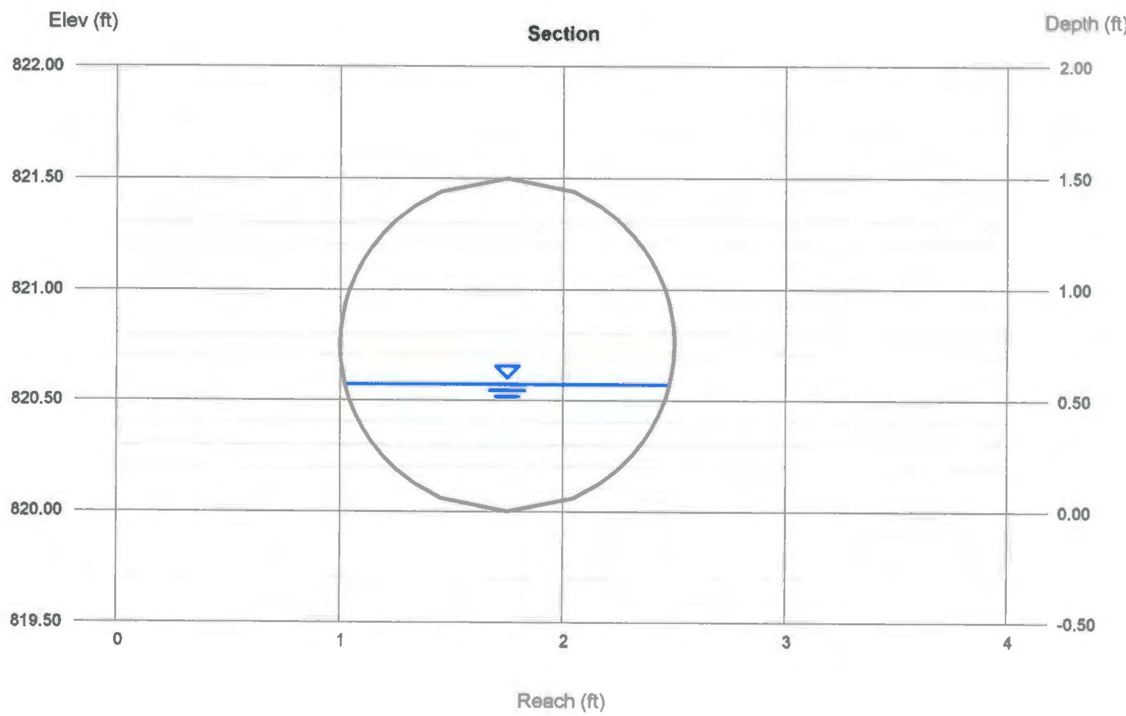
Appendix E – Outlet Protection Calculations

Channel Report

CB A7 to Basin A

Circular		**Highlighted**	
Diameter (ft)	= 1.50	Depth (ft)	= 0.57
		Q (cfs)	= 5.190
		Area (sqft)	= 0.62
Invert Elev (ft)	= 820.00	Velocity (ft/s)	= 8.40
Slope (%)	= 1.95	Wetted Perim (ft)	= 1.99
N-Value	= 0.011	Crit Depth, Yc (ft)	= 0.88
		Top Width (ft)	= 1.46
Calculations		EGL (ft)	= 1.67
Compute by:	Known Q		
Known Q (cfs)	= 5.19		

INTERMEDIATE RIPRAP



OUTLET PROTECTION - OUTLET VELOCITY ≤ 14 feet/sec

DISCHARGE (cfs)	OUTLET PIPE DIAMETER OR SPAN (in) 12	15	18	24	30	36	42	48	54	60
0-5	***10***	***10***		***USE***						
6	12	11								
7		13	***12***							
8		14	13	***12***		***MINIMUM***				
9			14	13						
10			15	13						
11			16	14				***LENGTH***		
12				14						
14				16	***14***					
16				17	15	***14***			***OUTLINED***	
18				18	16	15				
20					17	15	***14***			
22		USE			18	16	15			
24						17	15	***14***		
26						17	16	15		
28						18	16	15		
30						19	17	16		
35						20	18	17	***16***	
40			PREFORMED				20	18	17	***16***
45							21	19	18	16
50							22	20	18	17
55								21	19	18
60								22	20	19
65								24	21	20
70					SCOUR			25	22	20
75								26	23	21
80									24	22
90									26	24
100									28	25
110										27
125							HOLE			29
130										30

Table 8-6.1 - Length - L_a (feet)
Type A Riprap Apron

Notes: 1. Bold face outlined boxes indicate minimum L_a to be used for a given pipe diameter or span.
2. Rounding and interpolating are acceptable.

$W = 3S_p + 0.4L_a = 9.3'$

USE 9.5'W × 12'L Intermediate Riprap.

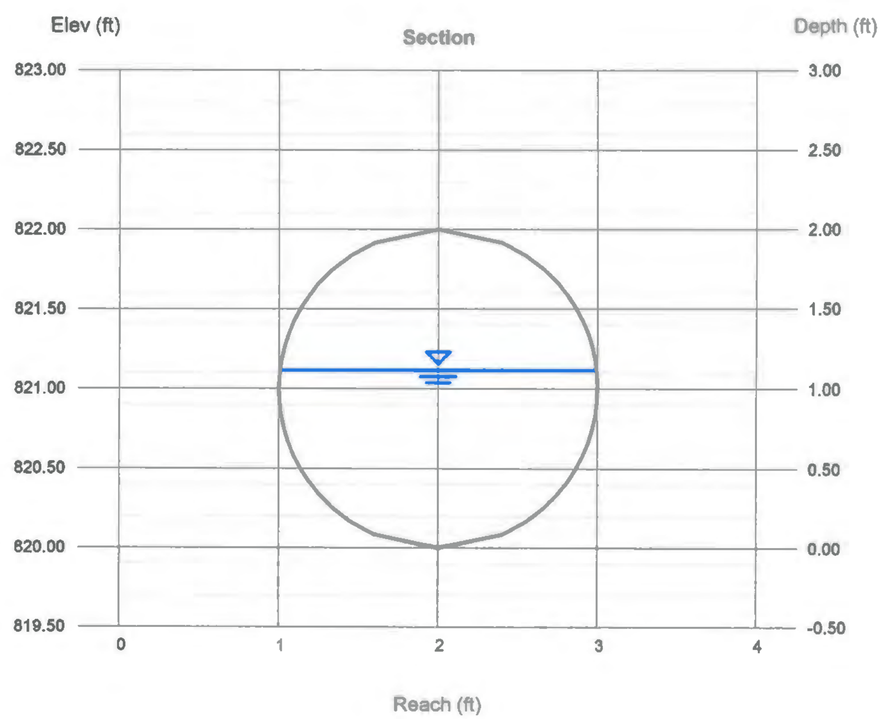
Channel Report

CB A21 to Basin A

Circular	
Diameter (ft)	= 2.00
Invert Elev (ft)	= 820.00
Slope (%)	= 0.83
N-Value	= 0.011
Calculations	
Compute by:	Known Q
Known Q (cfs)	= 14.55

Highlighted	
Depth (ft)	= 1.11
Q (cfs)	= 14.55
Area (sqft)	= 1.80
Velocity (ft/s)	= 8.09
Wetted Perim (ft)	= 3.37
Crit Depth, Yc (ft)	= 1.38
Top Width (ft)	= 1.99
EGL (ft)	= 2.13

INTERMEDIATE RIPRAP



OUTLET PROTECTION - OUTLET VELOCITY ≤ 14 feet/sec

DISCHARGE (cfs)	OUTLET PIPE DIAMETER OR SPAN (in)									
	12	15	18	24	30	36	42	48	54	60
0-5	***10***	***10***		***USE***						
6	12	11								
7		13	***12***							
8		14	13	***12***		***MINIMUM***				
9			14	13						
10			15	13						
11			16	14				***LENGTH***		
12				14						
14				16	***14***					
16				17	15	***14***			***OUTLINED***	
18				18	16	15				
20					17	15	***14***			
22		***USE***			18	16	15			
24						17	15	***14***		
26						17	16	15		
28						18	16	15		
30						19	17	16		
35						20	18	17	***16***	
40			***PREFORMED***				20	18	17	***16***
45							21	19	18	16
50							22	20	18	17
55								21	19	18
60								22	20	19
65								24	21	20
70					***SCOUR***			25	22	20
75								26	23	21
80									24	22
90									26	24
100									28	25
110										27
125							***HOLE***			29
130										30

Table 8-6.1 - Length - L_a (feet)
Type A Riprap Apron

Notes: 1. Bold face outlined boxes indicate minimum L_a to be used for a given pipe diameter or span.
2. Rounding and interpolating are acceptable.

$W = 3S_p + 0.4L_a = 12.4'$

USE 12.5'W × 16'L Intermediate Riprap.

Channel Report

CB B12 to Basin B

Circular

Diameter (ft)	= 2.00
Invert Elev (ft)	= 821.00
Slope (%)	= 0.83
N-Value	= 0.011

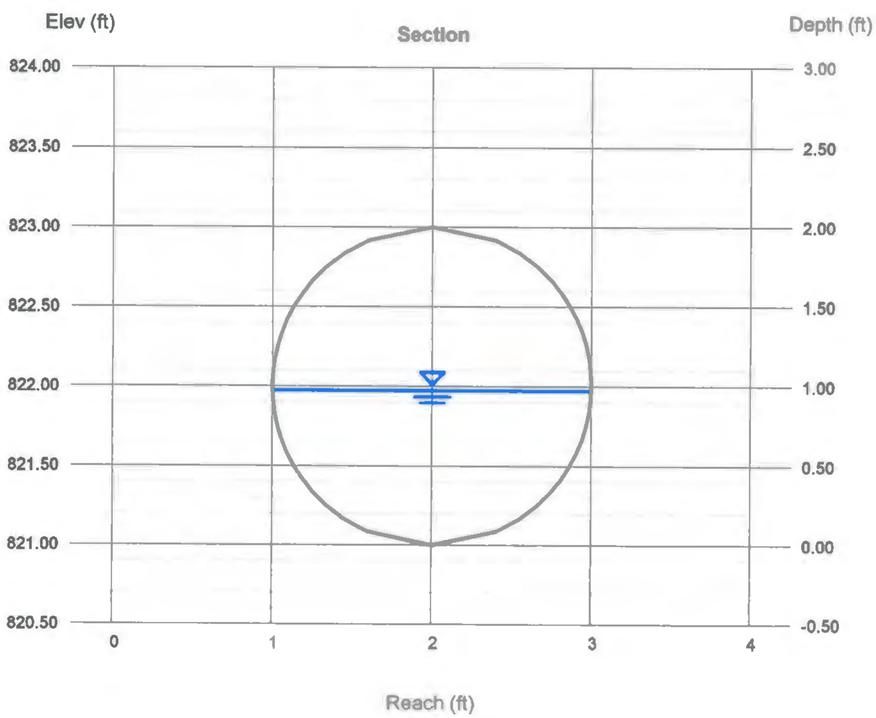
Calculations

Compute by:	Known Q
Known Q (cfs)	= 11.61

Highlighted

Depth (ft)	= 0.97
Q (cfs)	= 11.61
Area (sqft)	= 1.52
Velocity (ft/s)	= 7.64
Wetted Perim (ft)	= 3.09
Crit Depth, Yc (ft)	= 1.23
Top Width (ft)	= 2.00
EGL (ft)	= 1.88

MODIFIED RIPRAP



OUTLET PROTECTION - OUTLET VELOCITY ≤ 14 feet/sec

DISCHARGE (cfs)	12	15	18	24	30	36	42	48	54	60
	OUTLET PIPE DIAMETER OR SPAN (in)									
0-5	**10**	**10**		*USE*						
6	12	11								
7		13	**12**							
8		14	13	**12**		*MINIMUM*				
9			14	13						
10			15	13						
11			16	14				*LENGTH*		
12				14						
14				16	**14**					
16				17	15	**14**			*OUTLINED*	
18				18	16	15				
20					17	15	**14**			
22		*USE*			18	16	15			
24						17	15	**14**		
26						17	16	15		
28						18	16	15		
30						19	17	16		
35						20	18	17	**16**	
40			*PREFORMED*				20	18	17	**16**
45							21	19	18	16
50							22	20	18	17
55								21	19	18
60								22	20	19
65								24	21	20
70					*SCOUR*			25	22	20
75								26	23	21
80									24	22
90									26	24
100									28	25
110										27
125							*HOLE*			29
130										30

Table 8-6.1 - Length - L_a (feet)
Type A Riprap Apron

Notes: 1. Bold face outlined boxes indicate minimum L_a to be used for a given pipe diameter or span.
2. Rounding and interpolating are acceptable.

$W = 3S_p + 0.4L_a = 11.6'$

USE 12'W × 14'L Modified Riprap

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc.

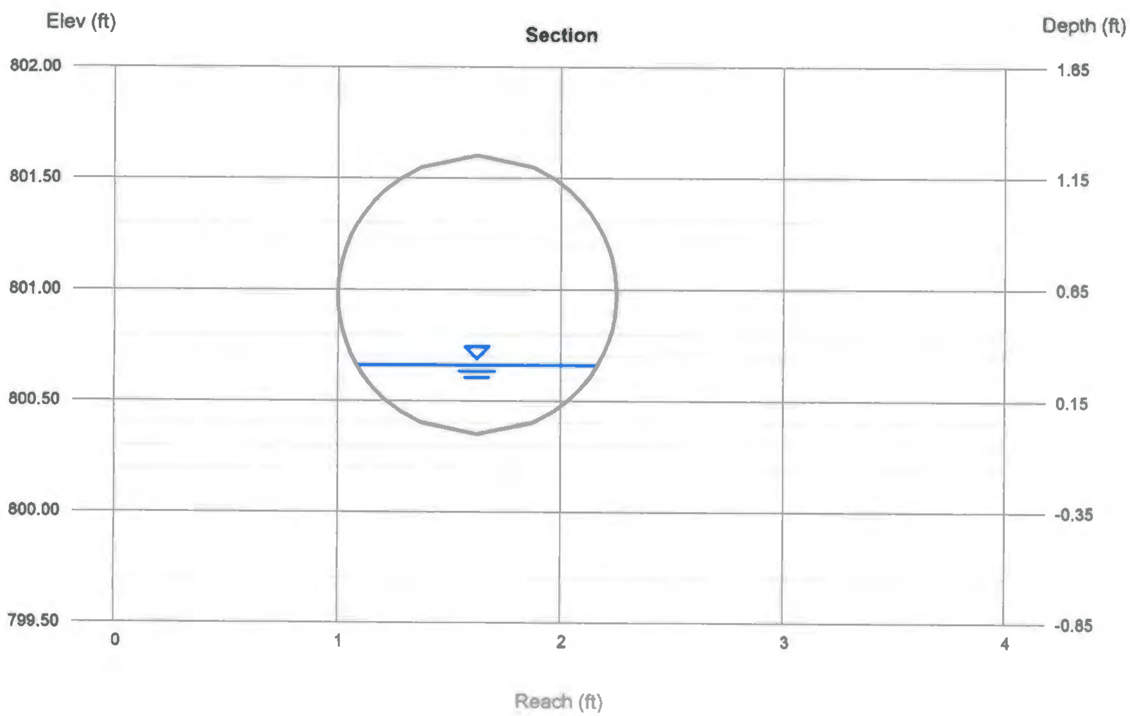
Thursday, Sep 25 2014

CB D1 to WQS D2

Circular	
Diameter (ft)	= 1.25
Invert Elev (ft)	= 800.35
Slope (%)	= 1.00
N-Value	= 0.011
Calculations	
Compute by:	Known Q
Known Q (cfs)	= 0.97

Highlighted	
Depth (ft)	= 0.31
Q (cfs)	= 0.970
Area (sqft)	= 0.24
Velocity (ft/s)	= 4.06
Wetted Perim (ft)	= 1.31
Crit Depth, Yc (ft)	= 0.39
Top Width (ft)	= 1.08
EGL (ft)	= 0.57

MODIFIED RIPRAP



OUTLET PROTECTION - OUTLET VELOCITY ≤ 14 feet/sec

DISCHARGE (cfs)	OUTLET PIPE DIAMETER OR SPAN (in)									
	12	15	18	24	30	36	42	48	54	60
0-5	***10***	***10***		USE						
6	12	11								
7		13	***12***							
8		14	13	***12***		MINIMUM				
9			14	13						
10			15	13						
11			16	14				LENGTH		
12				14						
14				16	***14***					
16				17	15	***14***			OUTLINED	
18				18	16	15				
20					17	15	***14***			
22		USE			18	16	15			
24						17	15	***14***		
26						17	16	15		
28						18	16	15		
30						19	17	16		
35						20	18	17	***16***	
40			PREFORMED				20	18	17	***16***
45							21	19	18	16
50							22	20	18	17
55								21	19	18
60								22	20	19
65								24	21	20
70					SCOUR			25	22	20
75								26	23	21
80									24	22
90									26	24
100									28	25
110										27
125							HOLE			29
130										30

Table 8-6.1 - Length - L_a (feet)
Type A Riprap Apron

Notes: 1. Bold face outlined boxes indicate minimum L_a to be used for a given pipe diameter or span.
2. Rounding and interpolating are acceptable.

$W = 3S_p + 0.4L_a = 7.75'$

USE 8' W x 10' L MODIFIED RIPRAP

Channel Report

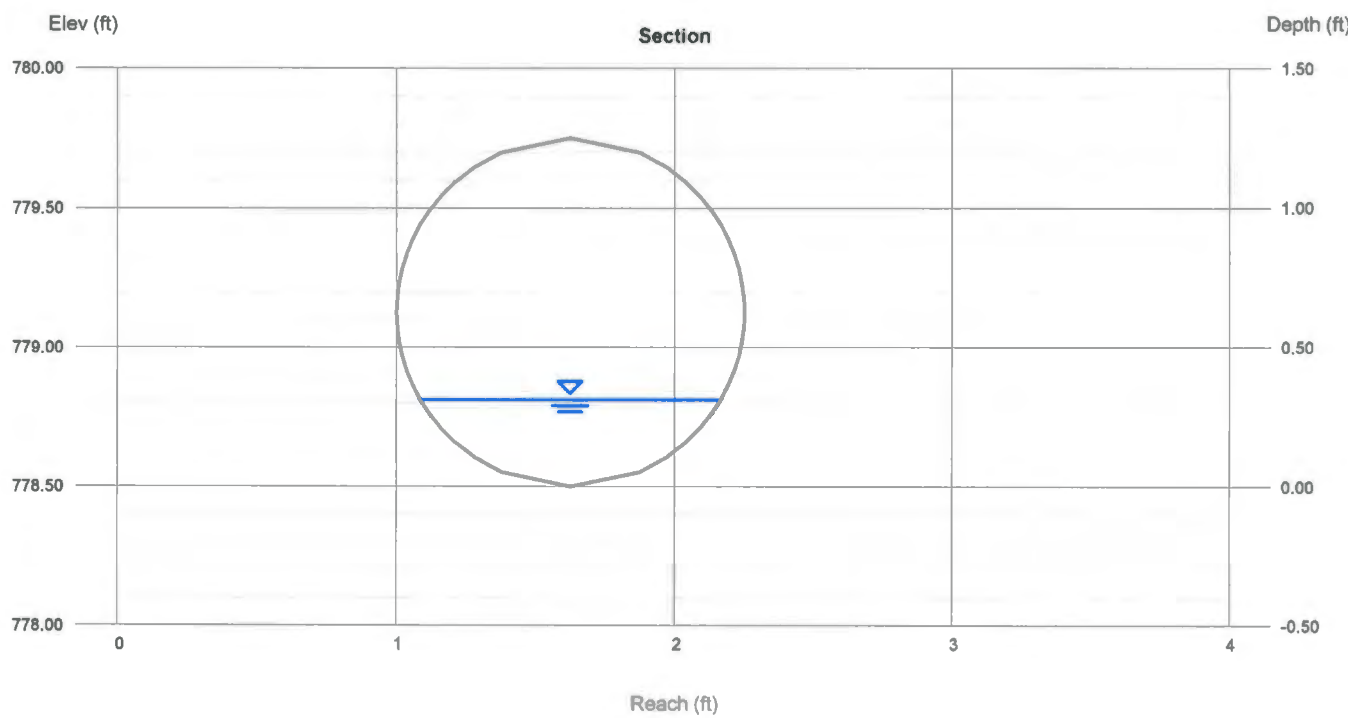
Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Thursday, Sep 25 2014

DMH C1 to DP1

Circular	
Diameter (ft)	= 1.25
Invert Elev (ft)	= 778.50
Slope (%)	= 5.00
N-Value	= 0.011
Calculations	
Compute by:	Known Q
Known Q (cfs)	= 2.19

Highlighted	
Depth (ft)	= 0.31
Q (cfs)	= 2.190
Area (sqft)	= 0.24
Velocity (ft/s)	= 9.18
Wetted Perim (ft)	= 1.31
Crit Depth, Yc (ft)	= 0.60
Top Width (ft)	= 1.08
EGL (ft)	= 1.62

INTERMEDIATE RIPRAP



OUTLET PROTECTION - OUTLET VELOCITY ≤ 14 feet/sec

DISCHARGE (cfs)	OUTLET PIPE DIAMETER OR SPAN (in) 12	15	18	24	30	36	42	48	54	60
0-5	**10**	**10**		USE						
6	12	11								
7		13	**12**							
8		14	13	**12**		MINIMUM				
9			14	13						
10			15	13						
11			16	14				LENGTH		
12				14						
14				16	**14**					
16				17	15	**14**			OUTLINED	
18				18	16	15				
20					17	15	**14**			
22		SE			18	16	15			
24						17	15	**14**		
26						17	16	15		
28						18	16	15		
30						19	17	16		
35						20	18	17	**16**	
40			PREFORMED				20	18	17	**16**
45							21	19	18	16
50							22	20	18	17
55								21	19	18
60								22	20	19
65								24	21	20
70					SCOUR			25	22	20
75								26	23	21
80									24	22
90									26	24
100									28	25
110										27
125							HOLE			29
130										30

Table 8-6.1 - Length - L_a (feet)
Type A Riprap Apron

Notes: 1. Bold face outlined boxes indicate minimum L_a to be used for a given pipe diameter or span.
2. Rounding and interpolating are acceptable.

$W = 3S_p + 0.4L_a = 7.75'$

USE 8'W × 10'L Intermediate Riprap

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc.

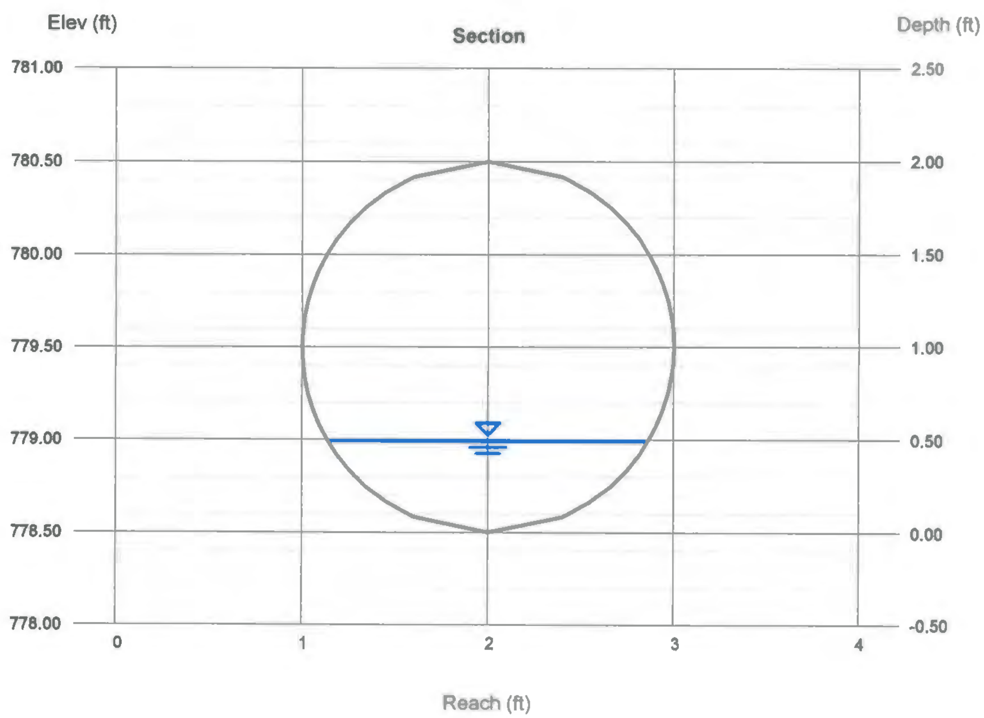
Thursday, Sep 25 2014

DMH B9 to DP1

Circular	
Diameter (ft)	= 2.00
Invert Elev (ft)	= 778.50
Slope (%)	= 2.50
N-Value	= 0.011
Calculations	
Compute by:	Known Q
Known Q (cfs)	= 5.43

Highlighted	
Depth (ft)	= 0.49
Q (cfs)	= 5.430
Area (sqft)	= 0.60
Velocity (ft/s)	= 9.00
Wetted Perim (ft)	= 2.08
Crit Depth, Yc (ft)	= 0.83
Top Width (ft)	= 1.72
EGL (ft)	= 1.75

INTERMEDIATE RIPRAP



OUTLET PROTECTION - OUTLET VELOCITY ≤ 14 feet/sec

DISCHARGE (cfs)	OUTLET PIPE DIAMETER OR SPAN (in) 12	15	18	24	30	36	42	48	54	60
0-5	**10**	**10**		**USE**						
6	12	11								
7		13	**12**							
8		14	13	**12**		**MINIMUM**				
9			14	13						
10			15	13						
11			16	14				**LENGTH**		
12				14						
14				16	**14**					
16				17	15	**14**			**OUTLINED**	
18				18	16	15				
20					17	15	**14**			
22		USE			18	16	15			
24						17	15	**14**		
26						17	16	15		
28						18	16	15		
30						19	17	16		
35						20	18	17	**16**	
40				PREFORMED			20	18	17	**16**
45							21	19	18	16
50							22	20	18	17
55								21	19	18
60								22	20	19
65								24	21	20
70						SCOUR		25	22	20
75								26	23	21
80									24	22
90									26	24
100									28	25
110										27
125							HOLE			29
130										30

Table 8-6.1 - Length - L_a (feet)
Type A Riprap Apron

Notes: 1. Bold face outlined boxes indicate minimum L_a to be used for a given pipe diameter or span.
2. Rounding and interpolating are acceptable.

$W = 3S_p + 0.4L_a = 10.8'$

USE 11'W × 12'L Intermediate Riprap

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc.

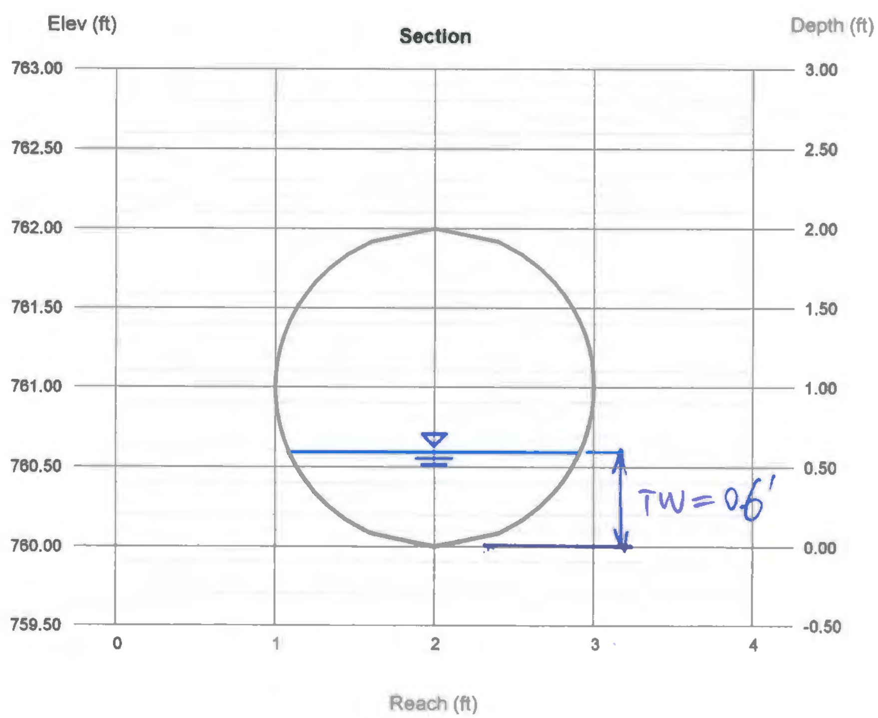
Thursday, Sep 25 2014

DP1 Outlet

Circular	
Diameter (ft)	= 2.00
Invert Elev (ft)	= 760.00
Slope (%)	= 13.50
N-Value	= 0.011
Calculations	
Compute by:	Known Q
Known Q (cfs)	= 18.44

Highlighted	
Depth (ft)	= 0.59
Q (cfs)	= 18.44
Area (sqft)	= 0.78
Velocity (ft/s)	= 23.73
Wetted Perim (ft)	= 2.30
Crit Depth, Yc (ft)	= 1.55
Top Width (ft)	= 1.83
EGL (ft)	= 9.34

TYPE 1
PREFORMED
SCOUR HOLE



OUTLET PROTECTION
OUTLET VELOCITY > 14 feet/sec or Length of Apron exceeds limits shown on Tables 8-6.1 and 8-7.1

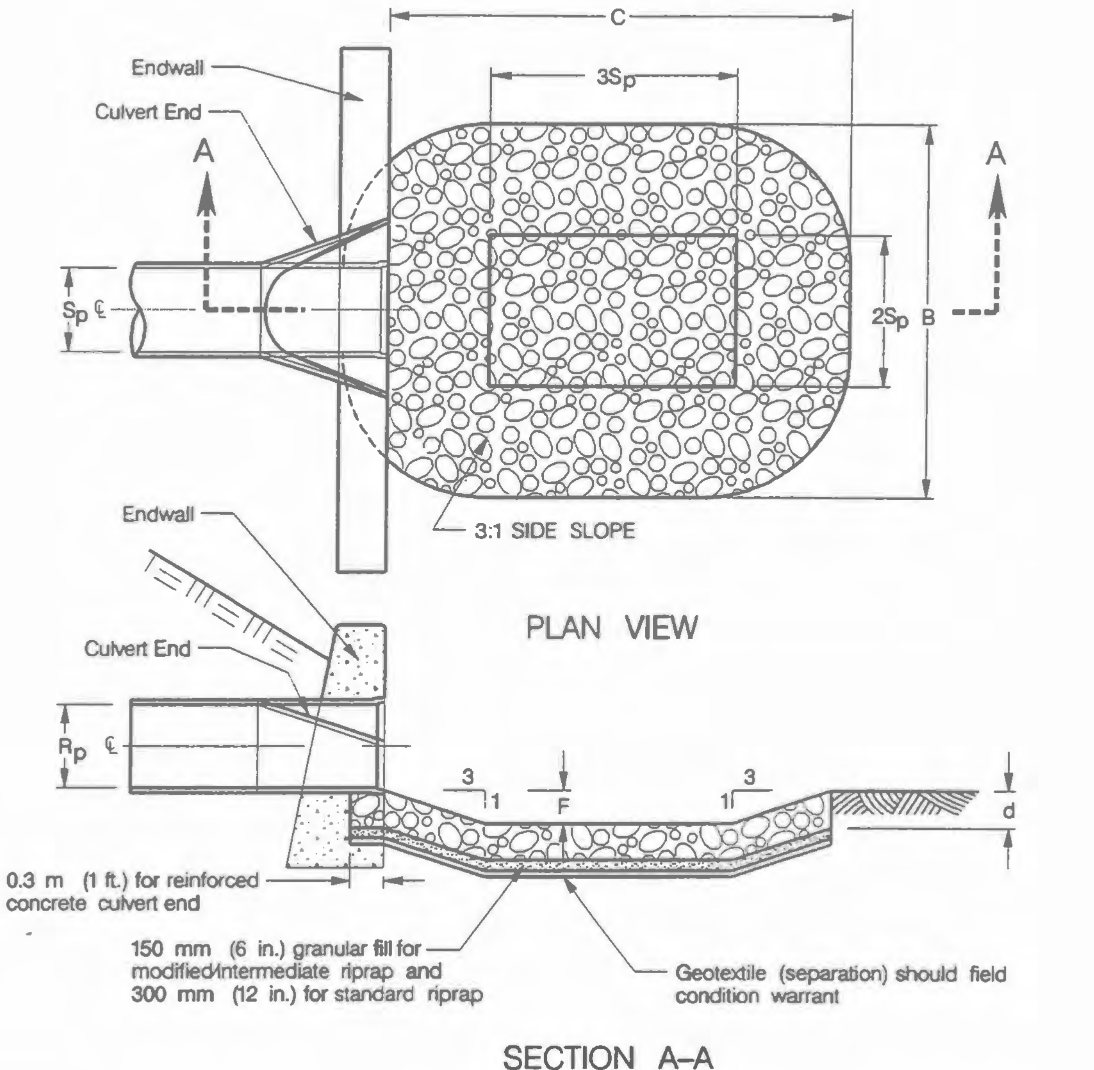
Preformed Scour Hole										
(See Figure 8-11)	PIPE DIAMETER (in)									
	12	15	18	24	30	36	42	48	54	60
Type 1										
B	5	6	8	10	13	15	18	20	23	25
C	6	8	9	12	15	18	21	24	27	30
d	Depends on riprap type(see Figure 8-11)									
$2S_p$	2.0	2.6	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
$3S_p$	3.0	3.9	4.5	6.0	7.5	9.0	10.5	12.0	13.5	15.0
$F = 0.5\ S_p$	0.5	0.625	0.75	1	1.25	1.5	1.75	2	2.25	2.5
Type 2										
B	8	10	12	16	20	24	28	32	36	40
C	9	11	14	18	23	27	32	36	41	45
d	Depends on riprap size (see Figure 8-11)									
$2S_p$	2.0	2.6	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
$3S_p$	3.0	3.9	4.5	6.0	7.5	9.0	10.5	12.0	13.5	15.0
$F = S_p$	1.0	1.3	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0

Table 8-8.1 - Dimensions of Preformed Scour Hole (Feet)

$d_{50} = (0.0125\, R_p^2/TW)(Q/R_p^{2.5})^{1.333} = 0.403'$

USE 10'W x 12'L x 1'D Type 1 Scour Hole

WITH Modified Riprap



LEGEND

$S_p = \begin{cases} \text{Max. inside pipe span (non-circular sections)} \\ \text{Inside pipe diameter (circular sections)} \end{cases}$

$R_p = \begin{cases} \text{Max. inside pipe rise (non-circular sections)} \\ \text{Inside pipe diameter (circular sections)} \end{cases}$

$d = \begin{cases} \text{300 mm (12 in.) Modified Riprap} \\ \text{450 mm (18 in.) Intermediate Riprap} \\ \text{900 mm (36 in.) Standard Riprap} \end{cases}$

Type 1 $F = 0.5\,R_p$

Type 2 $F = R_p$

$C = 3S_p + 6F$

$B = 2S_p + 6F$

Figure 8-11 Preformed Scour Hole Type 1 and Type 2

Appendix F – Water Quality Volume Calculations

WATER QUALITY VOLUME CALCULATIONS FOR
CPV Towantic Energy Center
(PER DEP 2004 STORMWATER QUALITY MANUAL)
9-23-14

Water Quality Volume (WQV) = 1òx R x A/ 12

Where R = Volumetric Runoff Coefficient = 0.05 + 0.009 x I
I = Percent impervious cover
A = Site area in acres

TO STORMWATER RENOVATION AREA "A"

A = 8.81 acres
I = 2.28 ac = 25.9%
R = 0.05 + 0.009 × 25.9 = 0.283
WQV (Drainage Area) = 1ò× 0.283 × 8.81 / 12 = .208 ac-ft = 9,050 CF
WQV Required = 9,050 CF

Total volume provided by Water Quality Cell in Renovation Area ñAò= 0.42 ac-ft = 18,300CF

TO STORMWATER RENOVATION AREA "B"

A = 8.72 acres
I = 0.92 ac = 10.6%
R = 0.05 + 0.009 × 10.6 = 0.145
WQV (Drainage Area) = 1ò× 0.145 × 8.72 / 12 = .105 ac-ft = 4,590 CF
WQV Required = 4,590 CF

Total volume provided by Water Quality Cell in Renovation Area ñBò= 0.18 ac-ft = 7,900 CF

Appendix G – Water Quality Swale Analysis

Channel Report

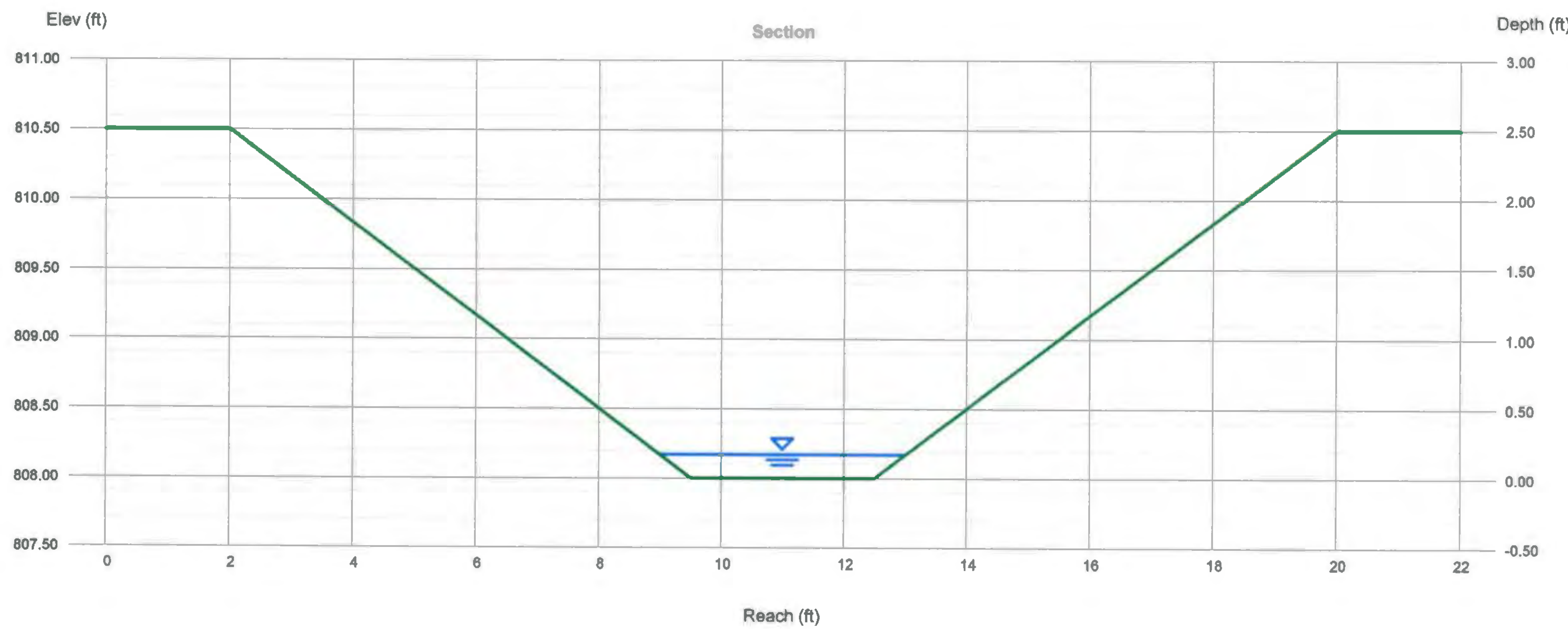
Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc.

Thursday, Sep 25 2014

WQS C

Trapezoidal	
Bottom Width (ft)	= 3.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 2.50
Invert Elev (ft)	= 808.00
Slope (%)	= 5.00
N-Value	= 0.035
Calculations	
Compute by:	Known Q
Known Q (cfs)	= 1.42

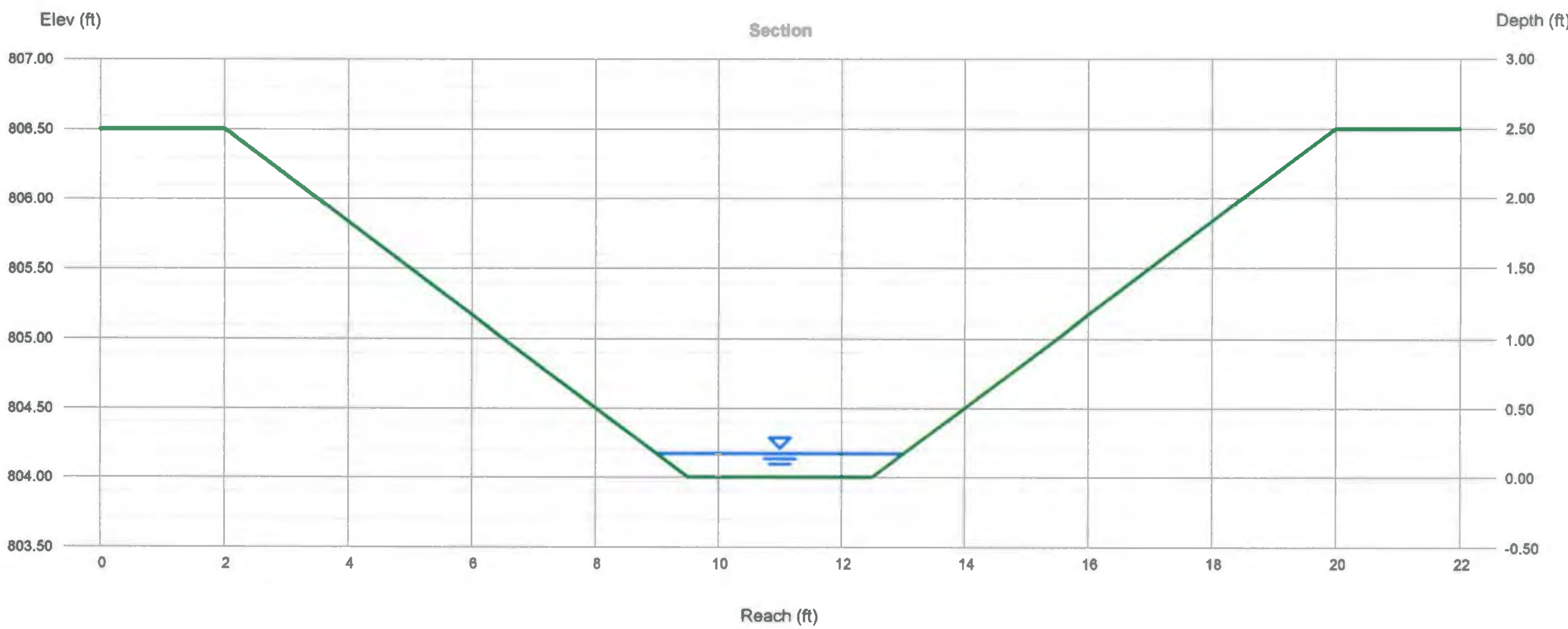
Highlighted	
Depth (ft)	= 0.17
Q (cfs)	= 1.420
Area (sqft)	= 0.60
Velocity (ft/s)	= 2.38
Wetted Perim (ft)	= 4.08
Crit Depth, Yc (ft)	= 0.18
Top Width (ft)	= 4.02
EGL (ft)	= 0.26



Channel Report

WQS D1

Trapezoidal		**Highlighted**	
Bottom Width (ft)	= 3.00	Depth (ft)	= 0.17
Side Slopes (z:1)	= 3.00, 3.00	Q (cfs)	= 0.970
Total Depth (ft)	= 2.50	Area (sqft)	= 0.60
Invert Elev (ft)	= 804.00	Velocity (ft/s)	= 1.63
Slope (%)	= 2.00	Wetted Perim (ft)	= 4.08
N-Value	= 0.035	Crit Depth, Yc (ft)	= 0.15
		Top Width (ft)	= 4.02
Calculations		EGL (ft)	= 0.21
Compute by:	Known Q		
Known Q (cfs)	= 0.97		



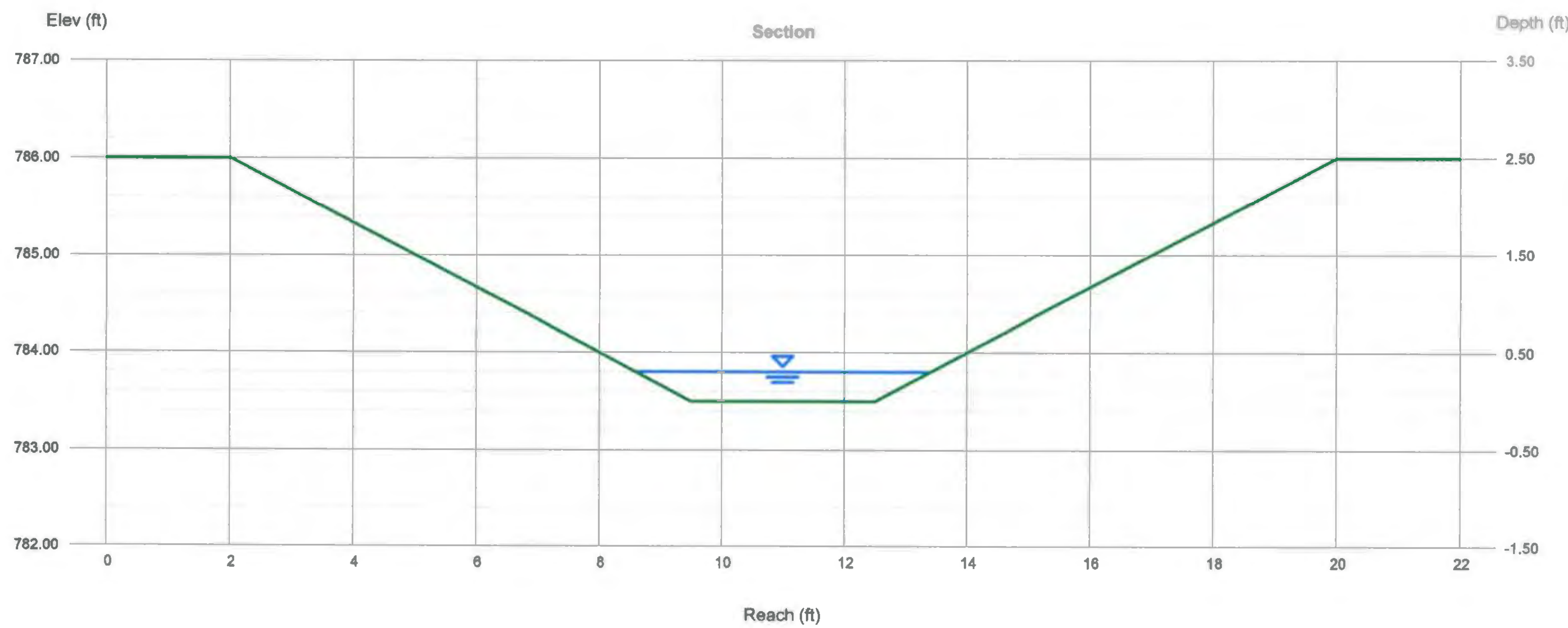
Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Thursday, Sep 25 2014

WQS D2

Trapezoidal	
Bottom Width (ft)	= 3.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 2.50
Invert Elev (ft)	= 783.50
Slope (%)	= 5.50
N-Value	= 0.035
Calculations	
Compute by:	Known Q
Known Q (cfs)	= 4.43

Highlighted	
Depth (ft)	= 0.30
Q (cfs)	= 4.430
Area (sqft)	= 1.17
Velocity (ft/s)	= 3.79
Wetted Perim (ft)	= 4.90
Crit Depth, Yc (ft)	= 0.36
Top Width (ft)	= 4.80
EGL (ft)	= 0.52



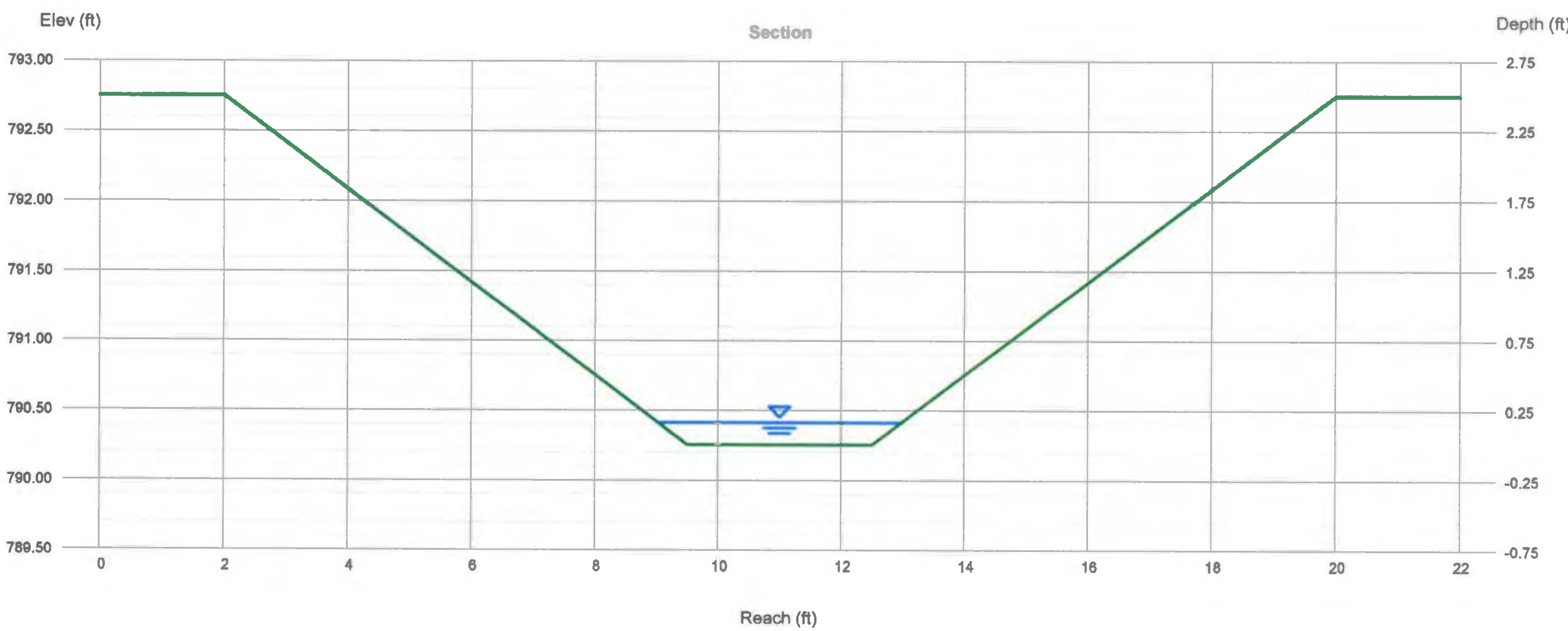
Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. — Thursday, Sep 25 2014

WQS E1

Trapezoidal	
Bottom Width (ft)	= 3.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 2.50
Invert Elev (ft)	= 790.25
Slope (%)	= 6.00
N-Value	= 0.035
Calculations	
Compute by:	Known Q
Known Q (cfs)	= 1.52

Highlighted	
Depth (ft)	= 0.16
Q (cfs)	= 1.520
Area (sqft)	= 0.56
Velocity (ft/s)	= 2.73
Wetted Perim (ft)	= 4.01
Crit Depth, Yc (ft)	= 0.19
Top Width (ft)	= 3.96
EGL (ft)	= 0.28



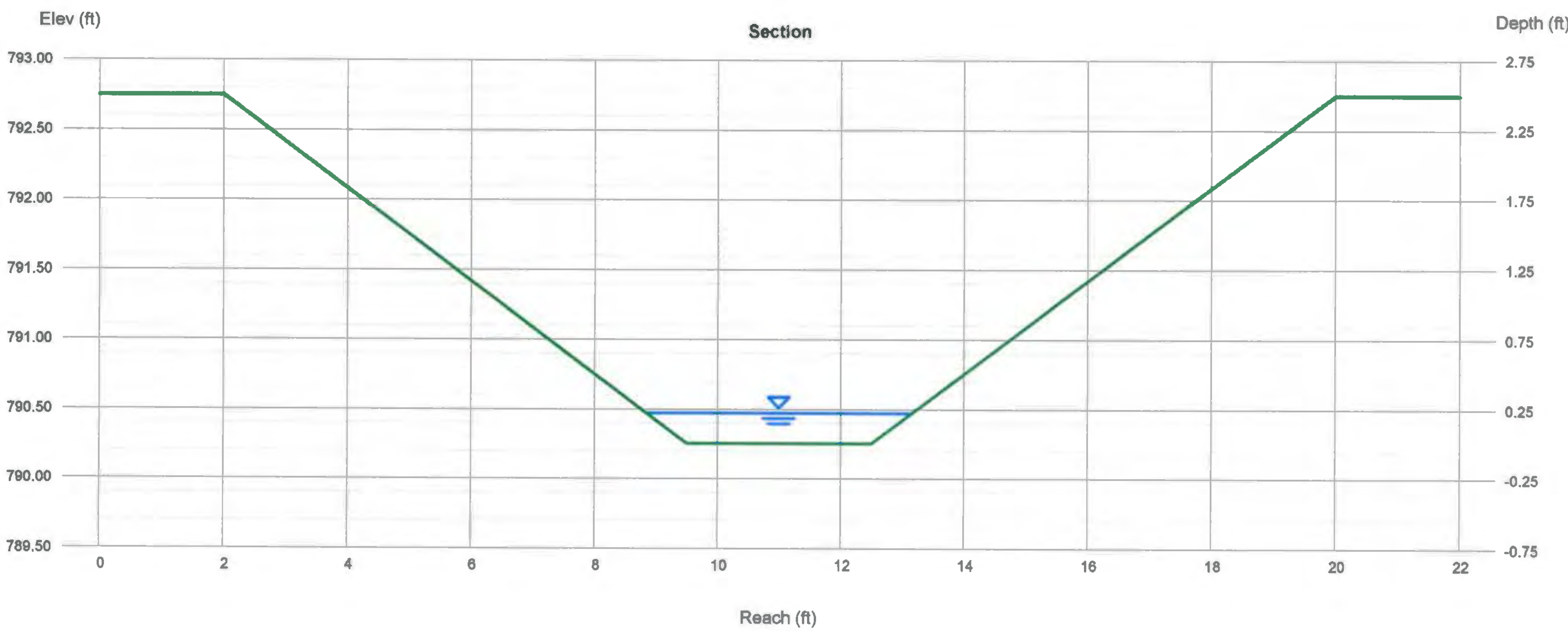
Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. — Thursday, Sep 25 2014

WQS E2

Trapezoidal	
Bottom Width (ft)	= 3.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 2.50
Invert Elev (ft)	= 790.25
Slope (%)	= 2.50
N-Value	= 0.035
Calculations	
Compute by:	Known Q
Known Q (cfs)	= 1.66

Highlighted	
Depth (ft)	= 0.22
Q (cfs)	= 1.660
Area (sqft)	= 0.81
Velocity (ft/s)	= 2.06
Wetted Perim (ft)	= 4.39
Crit Depth, Yc (ft)	= 0.20
Top Width (ft)	= 4.32
EGL (ft)	= 0.29



Appendix H – Temporary Sediment Trap Sizing

TEMPORARY SEDIMENT TRAP SIZING FOR
CPV Towantic Energy Center
(PER 2002 CT DEP E&S MANUAL)
9-26-14

TST A (STORMWATER RENOVATION AREA "A")

Initial Storage Volume = 134 cubic yards per acre of drainage area
V = 134 cubic yards x 10.87 acres = 1456.58 cubic yards
Half of Storage Volume will be wet and half dry = 728.29 cubic yards = 19,664 cubic feet

Vwet = provided in Pond below outlet elevation = 19,902 cubic feet

Vdry = provided in Pond above outlet elevation and below weir = 50,186 cubic feet

TST B (STORMWATER RENOVATION AREA "B")

Initial Storage Volume = 134 cubic yards per acre of drainage area
V = 134 cubic yards x 5.88 acres = 787.92 cubic yards
Half of Storage Volume will be wet and half dry = 393.96 cubic yards = 10,637 cubic feet

Vwet = provided in Pond below outlet elevation = 12,683 cubic feet

Vdry = provided in Pond above outlet elevation and below weir = 16,532 cubic feet

Project Site Plans

- C001: Title Sheet and Drawing List
- C300: Existing Conditions
- C305: Site Plan
- C310: Stormwater Management & Grading Plan
- C315: Erosion & Sediment Control Plan
- C320: Details
- C321: Storm Drainage Details
- C330: Erosion Control Narrative
- M301: General Arrangement Elevation Looking East

CPV TOWANTIC ENERGY CENTER
SITE DEVELOPMENT
OXFORD, CONNECTICUT
ACOE PERMIT SUBMISSION SET

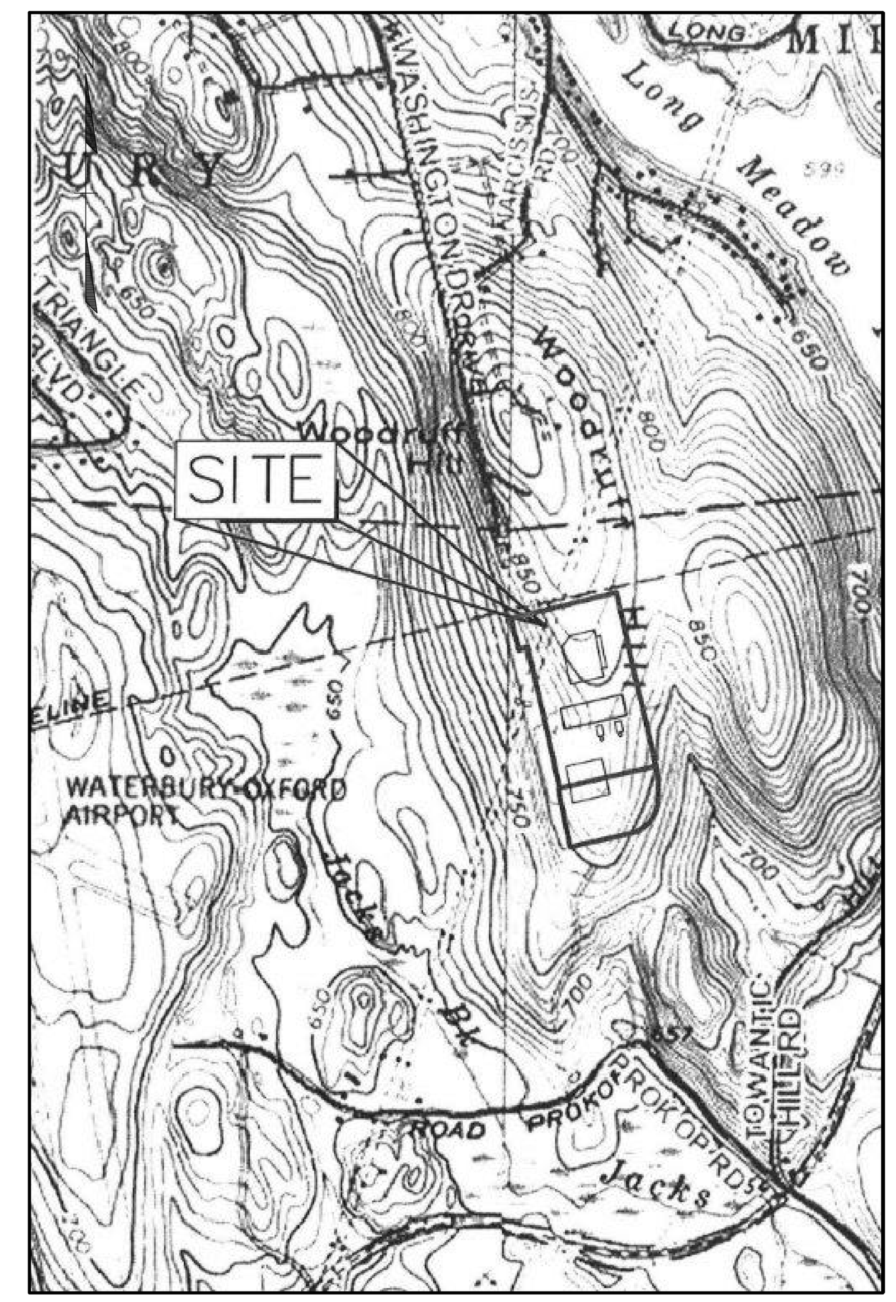
DRAWING INDEX

CIVIL DRAWINGS

DRAWING NO.	REVISION	TITLE
C001	–	COVER
C300	–	EXISTING CONDITIONS
C305	–	SITE PLAN
C310	–	STORMWATER MANAGEMENT & GRADING PLAN
C315	–	EROSION CONTROL PLAN
C320	–	DETAILS
C321	–	STORM DRAINAGE DETAILS
C330	–	EROSION CONTROL NARRATIVE

MECHANICAL DRAWINGS

DRAWING NO.	REVISION	TITLE
M301	B	GENERAL ARRANGEMENT ELEVATION LOOKING EAST



SITE MAP LOCATION
APPROXIMATE SCALE: 1"=1000'

CIVIL 1
CORNERSTONE PROFESSIONAL PARK, SUITE D-101
43 SHERMAN HILL ROAD
WOODBURY (203) 266-0778 CONNECTICUT

Rev No	Revision	Date	Dwn	Chkd	Approved Chief Engr	Rev No	Revision	Date	Dwn	Chkd	Approved Chief Engr	Rev No	Revision	Date	Dwn	Chkd	Approved Chief Engr

Drawing Control

Purpose	Approved By	Date	Released By	Date
For Information				
For Comment				
For Bid				
For Fabrication				
For Construction				

Engineering Review

Disc	Engr	Date
Mech		
Elec		
Civil		
Arch		
Instr		

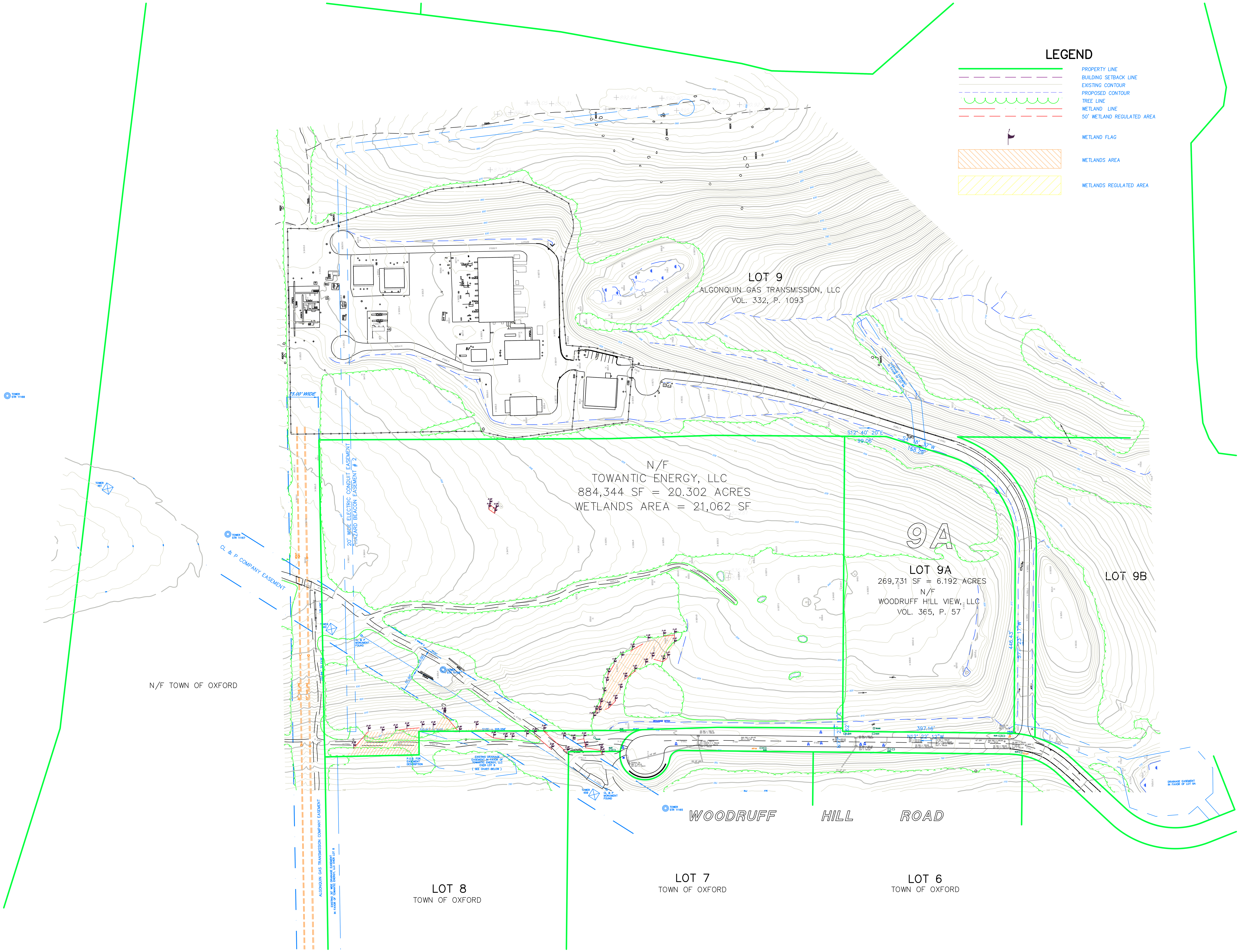
Drawn JH | Designed | Checked
Lead Engineer | Date | Scale NONE

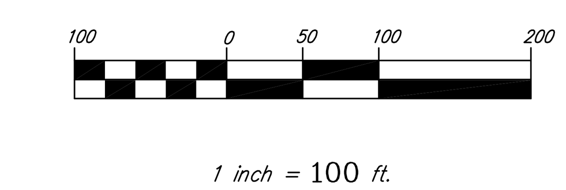
CPV TOWANTIC ENERGY CENTER
OXFORD, CONNECTICUT

TITLE SHEET AND DRAWING LIST

BURNS AND ROE ENTERPRISES, INC.
Engineers and Constructors - Oradell, NJ
Connecticut License No. PEC 39

Approved for Construction: Chief CIVIL Engineer
Work Order 3328 | Drawing No C001 | Sh | Rev F





NO.	REVISION	DATE

Previous Editions Obsolete

EXISTING CONDITIONS

CPV TOWANTIC ENERGY CENTER

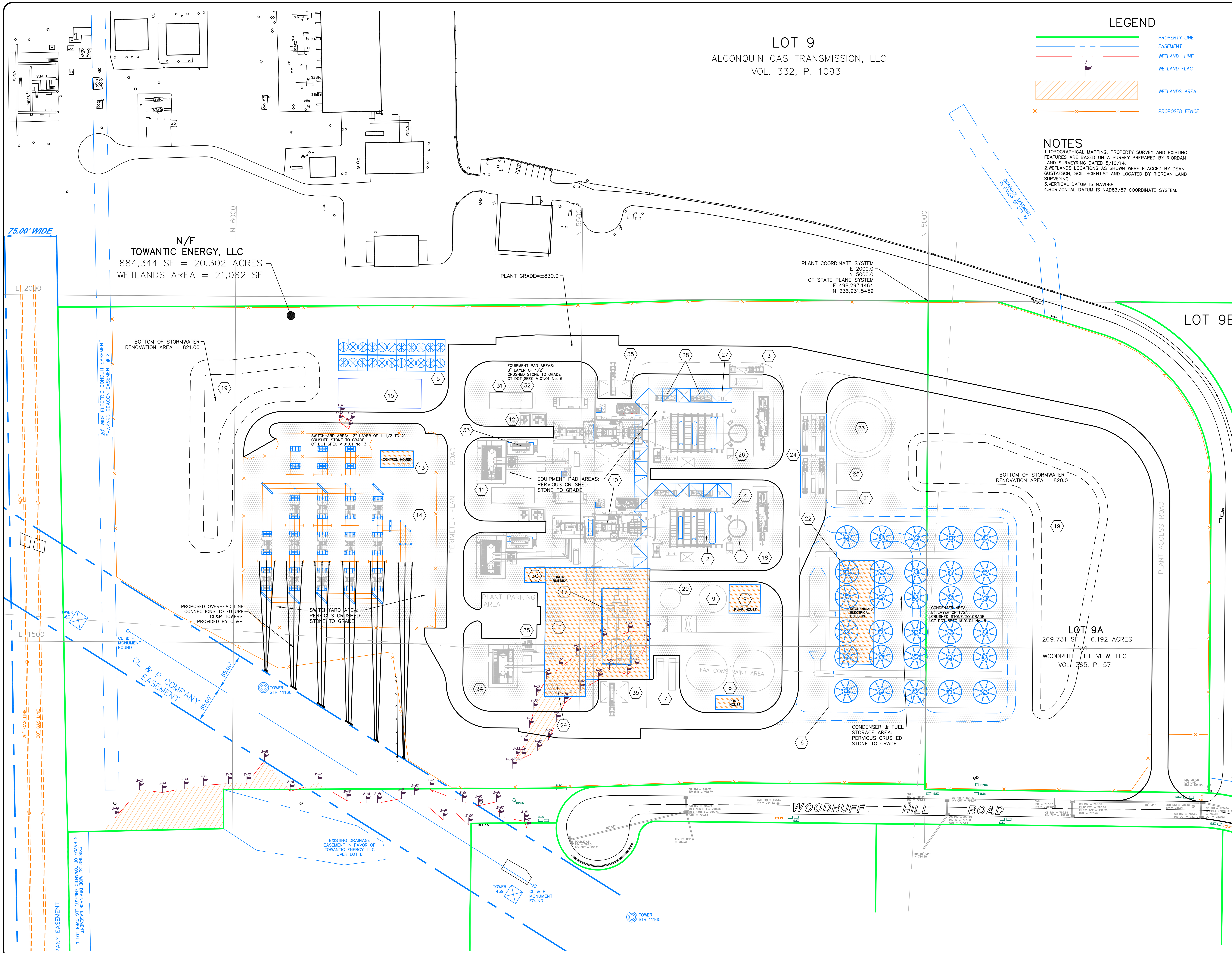
OXFORD CONNECTICUT

CIVIL 1

CORNERSTONE PROFESSIONAL PARK, SUITE D-101
43 SHERMAN HILL ROAD
WOODBURY (203) 266 - 0778 CONNECTICUT

STATE OF CONNECTICUT
CURTIS JONES
No. 17206
LICENSED PROFESSIONAL ENGINEER

DRAWN: SC	APPROVED: CJ
SCALE:	1" = 100'
DATE:	26 SEP 14
PROJ. NO.:	98132
CADD FILE NAME:	98132 Base Map
DRAWING NO.:	C 300



LEGEND

- PROPERTY LINE
- EASEMENT
- WETLAND LINE
- WETLAND FLAG
- WETLANDS AREA
- PROPOSED FENCE

NOTES

1. TOPOGRAPHICAL MAPPING, PROPERTY SURVEY AND EXISTING FEATURES ARE BASED ON A SURVEY PREPARED BY RIORDAN LAND SURVEYRING DATED 5/10/14.
2. WETLANDS LOCATIONS AS SHOWN WERE FLAGGED BY DEAN GUSTAFSON, SOIL SCIENTIST AND LOCATED BY RIORDAN LAND SURVEYING.
3. VERTICAL DATUM IS NAVD88.
4. HORIZONTAL DATUM IS NAD83/87 COORDINATE SYSTEM.

NO.	REVISION	DATE

Previous Editions Obsolete

LEGEND—POWER PLANT

1. STACK
2. HRSG
3. AQUEOUS AMMONIUM STORAGE TANK/UNLOADING AREA
4. BLOWDOWN TANK
5. AUXILIARY COOLING SYSTEM FIN FAN COOLER
6. AIR COOLED CONDENSER
7. DEMINERALIZED WATER TRAILERS
8. DEMINERALIZED WATER STORAGE TANKS/PUMP HOUSE (TWO (2) TANKS EACH 875,000 GAL.)
9. FIRE/SERVICE WATER STORAGE TANK & PUMP HOUSE
10. COMBUSTION TURBINE GENERATOR
11. CTG STEP-UP TRANSFORMER
12. ISOLATION TRANSFORMER/ EXCITATION TRANSFORMER
13. CONTROL HOUSE
14. SWITCHYARD
15. GAS METERING STATION
16. ELECTRICAL/BATTERY/ DIESEL GEN. ROOMS GND FLR OFFICE/CONTROL ROOMS SECOND FLR
17. STEAM TURBINE GENERATOR WITH ENCLOSURE
18. GAS HEATER,FILTER AND METERING
19. STORM WATER DETENTION POND
20. CONDENSATE STORAGE TANK
21. FIRE PROTECTION FOAM SYSTEM ENCLOSURE
22. ACC MECHANICAL/ELECTRICAL BUILDING
23. FUEL OIL STORAGE TANK WITH SECONDARY STEEL CONTAINMENT (1,500,000 GAL.)
24. FUEL OIL UNLOADING AREA
25. FUEL OIL FORWARDING PUMP/HEATER/FILTER SKID
26. CEMS ENCLOSURE
27. HRSG CHEM FEED
28. BOILER FEED WATER PUMPS
29. AUXILIARY BOILER ROOM (GROUND FLOOR)
30. EMERGENCY DIESEL GENERATOR ROOM
31. LOAD COMMUTATING INVERTER (LIC) COMPARTMENT
32. DC LINK REACTOR
33. GENERATOR EXCITATION COMPARTMENT
34. STG STEP-UP TRANSFORMER
35. EQUIPMENT REMOVAL AREA

60 0 30 60 120

1 inch = 60 ft.

SITE PLAN

CPV TOWANTIC ENERGY CENTER

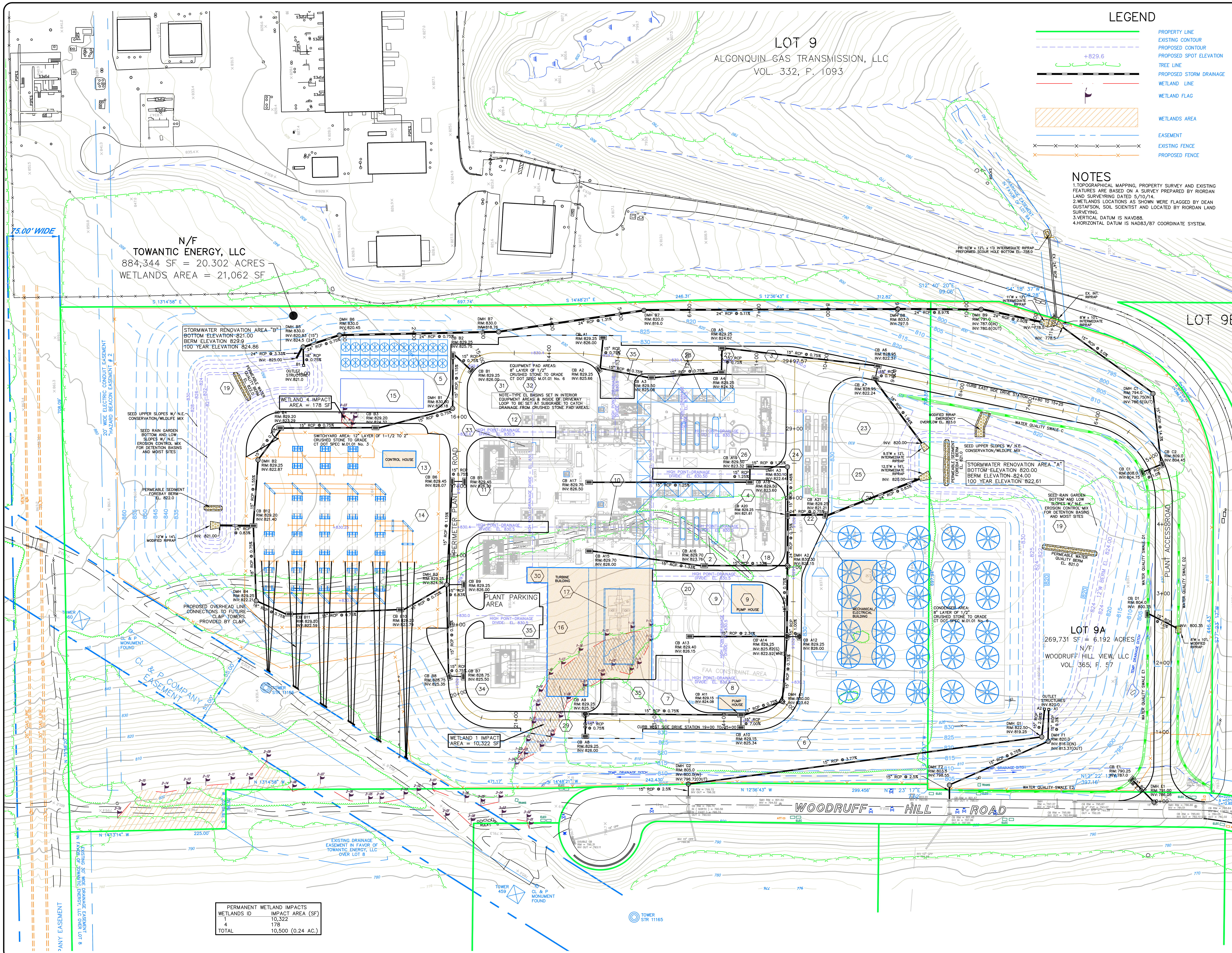
OXFORD CONNECTICUT

CIVIL 1

CORNERSTONE PROFESSIONAL PARK, SUITE D-101
43 SHERMAN HILL ROAD
WOODBURY (203) 266-0778 CONNECTICUT

STATE OF CONNECTICUT — CURTIS JONES — No. 17206 — LICENSED PROFESSIONAL ENGINEER

DRAWN: BB	APPROVED: CJ
SCALE: 1" = 60'	
DATE: 26 SEP 14	
PROJ. NO.: 98132	
CADD FILE NAME: 98132	
DRAWING NO.: C 305	



NOTES

1. TOPOGRAPHICAL MAPPING, PROPERTY SURVEY AND EXISTING FEATURES ARE BASED ON A SURVEY PREPARED BY RIORDAN LAND SURVEYRING DATED 5/10/14.
2. WETLANDS LOCATIONS AS SHOWN WERE FLAGGED BY DEAN GUSTAFSON, SOIL SCIENTIST AND LOCATED BY RIORDAN LAND SURVEYING.
3. VERTICAL DATUM IS NAVD88.
4. HORIZONTAL DATUM IS NAD83/87 COORDINATE SYSTEM.

PERMANENT WETLAND IMPACTS

WETLANDS ID	IMPACT AREA (SF)
1	10,322
4	178
TOTAL	10,500 (0.24 AC.)

NO.	REVISION	DATE

Previous Editions Obsolete

LEGEND–POWER PLANT

1. STACK
2. HRSG
3. AQUEOUS AMMONIUM STORAGE TANK/UNLOADING AREA
4. BLOWDOWN TANK
5. AUXILIARY COOLING SYSTEM FIN FAN COOLER
6. AIR COOLED CONDENSER
7. DEMINERALIZED WATER TRAILERS
8. DEMINERALIZED WATER STORAGE TANKS/PUMP HOUSE (TWO (2) TANKS EACH 875,000 GAL.)
9. FIRE/SERVICE WATER STORAGE TANK & PUMP HOUSE
10. COMBUSTION TURBINE GENERATOR
11. CTG STEP–UP TRANSFORMER
12. ISOLATION TRANSFORMER/ EXCITATION TRANSFORMER
13. CONTROL HOUSE
14. SWITCHYARD
15. GAS METERING STATION
16. ELECTRICAL/BATTERY/ DIESEL GEN. ROOMS GND FLR OFFICE/CONTROL ROOMS SECOND FLR
17. STEAM TURBINE GENERATOR WITH ENCLOSURE
18. GAS HEATER,FILTER AND METERING
19. STORM WATER DETENTION POND
20. CONDENSATE STORAGE TANK
21. FIRE PROTECTION FOAM SYSTEM ENCLOSURE
22. ACC MECHANICAL/ELECTRICAL BUILDING
23. FUEL OIL STORAGE TANK WITH SECONDARY STEEL CONTAINMENT (1,500,000 GAL.)
24. FUEL OIL UNLOADING AREA
25. FUEL OIL FORWARDING PUMP/HEATER/FILTER SKID
26. CEMS ENCLOSURE
27. HRSG CHEM FEED
28. BOILER FEED WATER PUMPS
29. AUXILIARY BOILER ROOM (GROUND FLOOR)
30. EMERGENCY DIESEL GENERATOR ROOM
31. LOAD COMMUTATING INVERTER (LIC) COMPARTMENT
32. DC LINK REACTOR
33. GENERATOR EXCITATION COMPARTMENT
34. STG STEP–UP TRANSFORMER
35. EQUIPMENT REMOVAL AREA

60 0 30 60 120

1 inch = 60 ft.

STORMWATER MANAGEMENT & GRADING PLAN

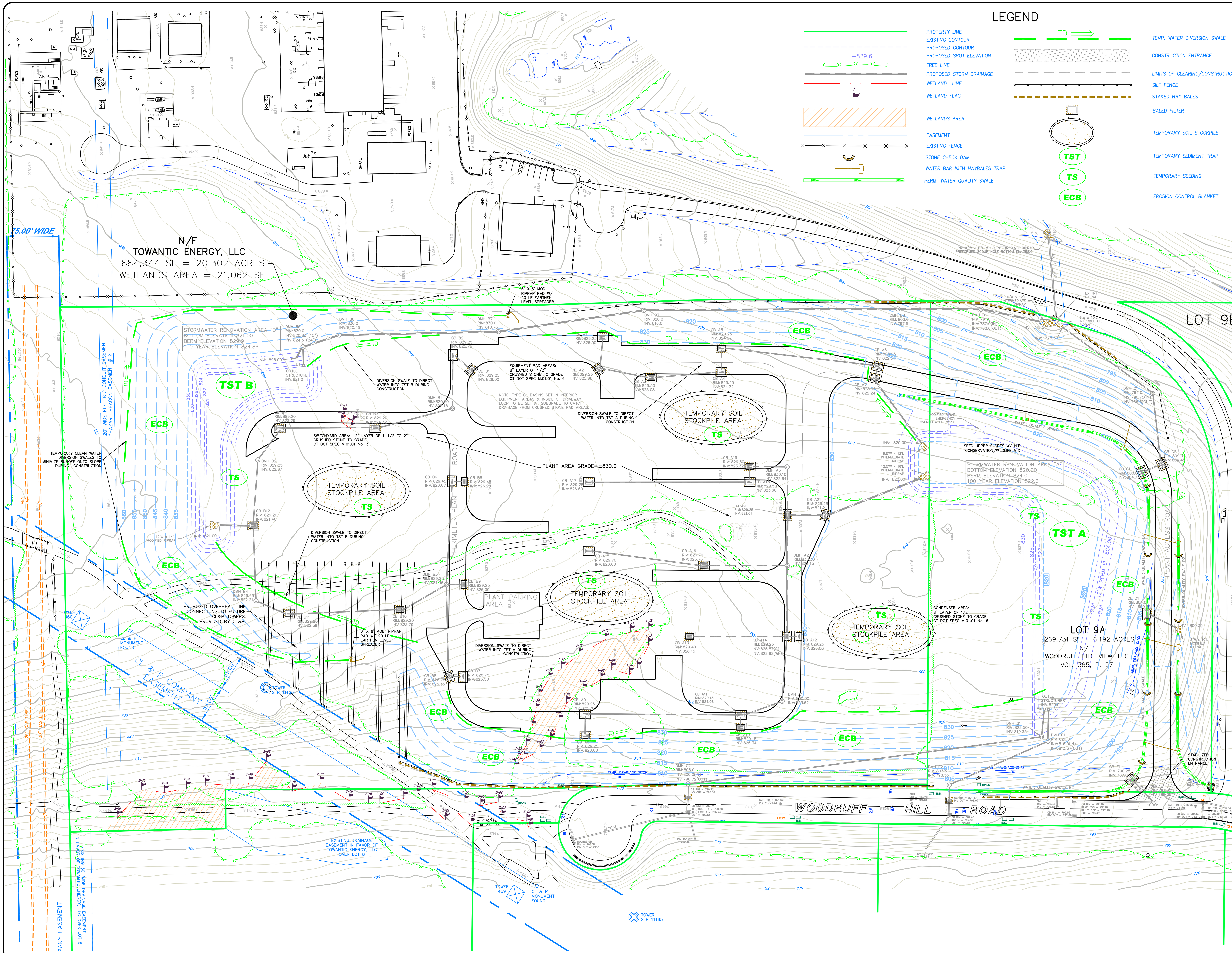
CPV TOWANTIC ENERGY CENTER

OXFORD CONNECTICUT

CIVIL 1
CORNERSTONE PROFESSIONAL PARK, SUITE D-101
43 SHERMAN HILL ROAD
WOODBURY (203) 266 - 0778 CONNECTICUT

STATE OF CONNECTICUT CURTIS JONES No. 17206 LICENSED PROFESSIONAL ENGINEER

DRAWN: BB	APPROVED: CJ
SCALE:	1" = 60'
DATE:	26 SEP 14
PROJ. NO.:	98132
CADD FILE NAME:	98132
DRAWING NO.:	C 310



NO.	REVISION	DATE

Previous Editions Obsolete

EROSION & SEDIMENT CONTROL PLAN

CPV TOWANTIC ENERGY CENTER

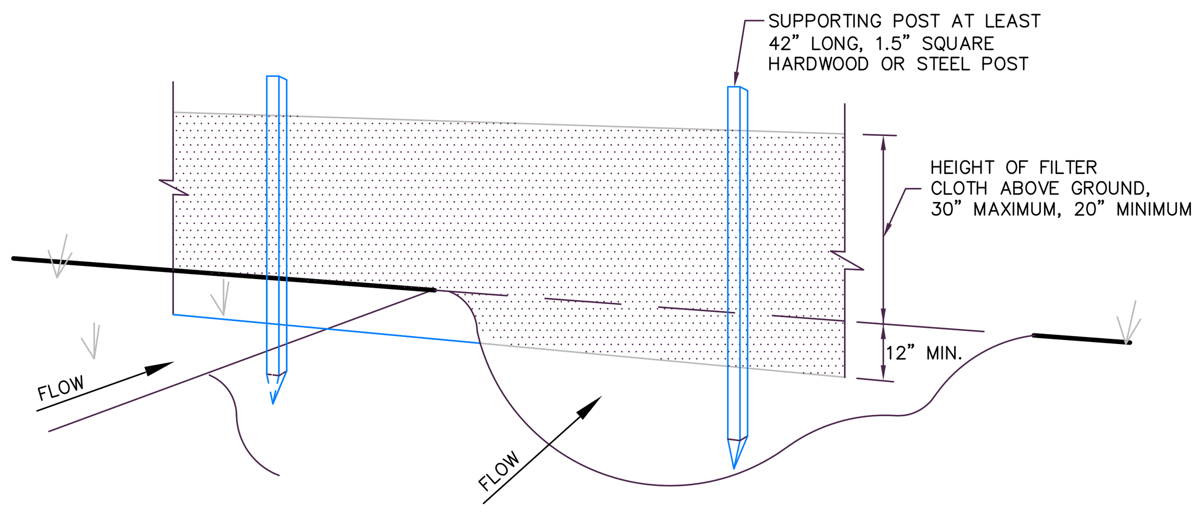
OXFORD CONNECTICUT

CIVIL 1

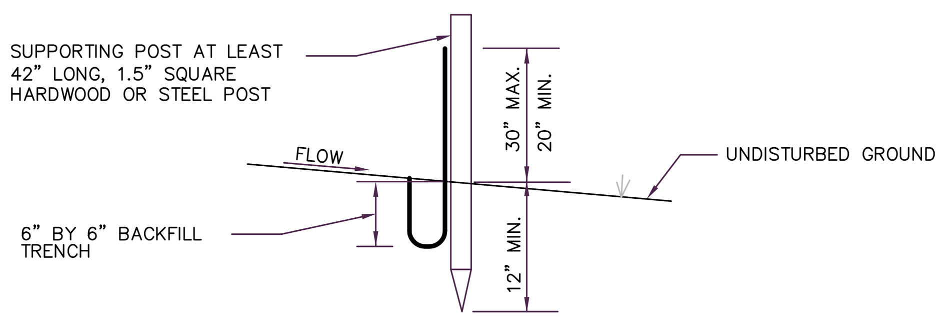
CORNERSTONE PROFESSIONAL PARK, SUITE D-101
43 SHERMAN HILL ROAD
WOODBURY (203) 266 - 0778 CONNECTICUT

STATE OF CONNECTICUT
CURTIS JONES
No. 17206
LICENSED PROFESSIONAL ENGINEER

DRAWN: BB	APPROVED: CJ
SCALE:	1" = 60'
DATE:	26 SEP 14
PROJ. NO.:	98132
CADD FILE NAME:	98132
DRAWING NO.:	C 315



PERSPECTIVE VIEW



SECTION

CONSTRUCTION NOTES FOR SILT FENCE

1. EXCAVATE A TRENCH A MINIMUM OF 6 INCHES DEEP AND 6 INCHES WIDE ON THE UP SIDE OF THE FENCE LOCATION.

2. DRIVE SUPPORT POSTS ON THE DOWN SLOPE SIDE OF THE TRENCH TO A DEPTH OF AT LEAST 12 INCHES INTO ORIGINAL GROUND.

3. STAPLE OR SECURE THE GEOTEXTILE TO THE SUPPORT POSTS PER MANUFACTURER'S INSTRUCTIONS SUCH THAT AT LEAST 6 INCHES OF GEOTEXTILE LIES WITHIN THE TRENCH.

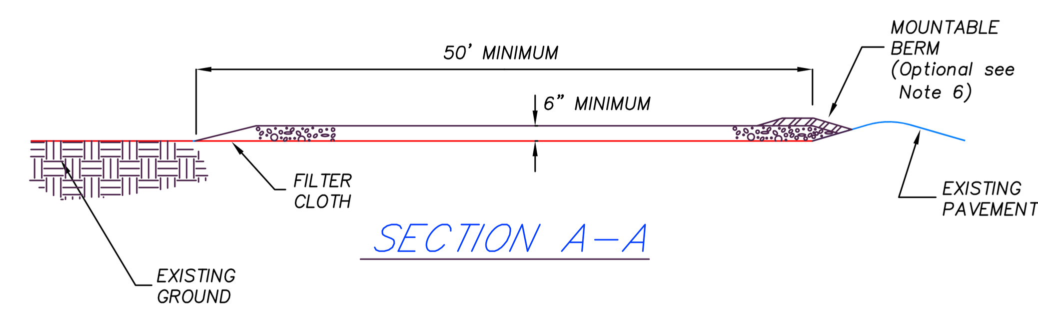
4. BACKFILL THE TRENCH WITH TAMPED SOIL OR AGGREGATE OVER THE GEOTEXTILE.

POSTS: 1.5" SQUARE HARDWOOD OR STEEL

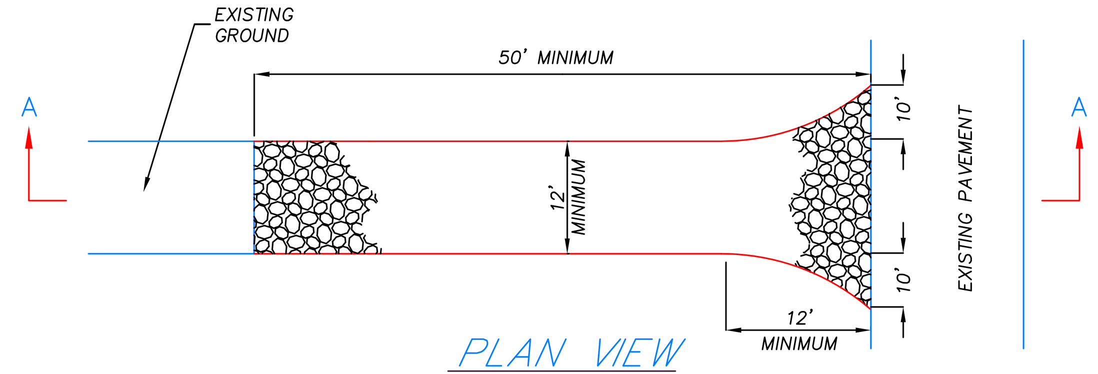
FILTER CLOTH: MIRAFI 100X, ENVIROFENCE OR APPROVED EQUAL

SILT FENCE DETAIL

N.T.S.



SECTION A–A



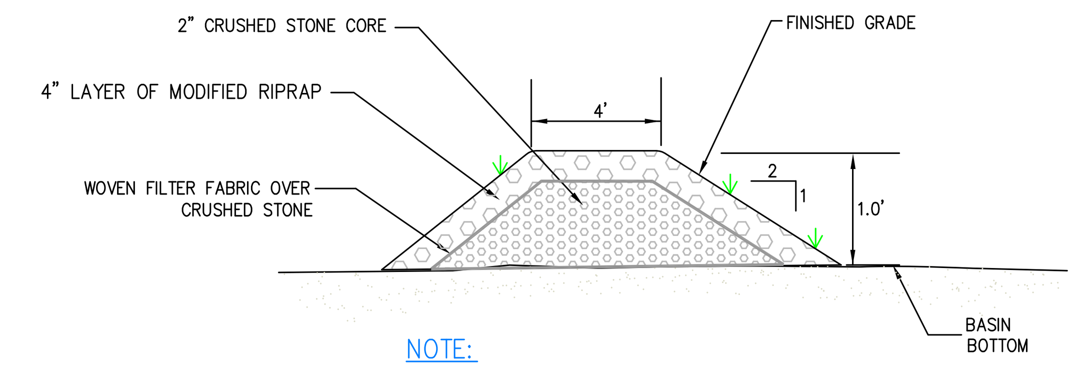
PLAN VIEW

NOTES:

1. STONE SIZE – USE 1" – 2" STONE, OR RECLAIMED OR RECYCLED CONCRETE EQUIVALENT.
2. LENGTH – AS REQUIRED, BUT NOT LESS THAN 50 FEET.
3. THICKNESS – NOT LESS THAN SIX (6) INCHES.
4. WIDTH – 12 FOOT MINIMUM, BUT NOT LESS THAN THE FULL WIDTH AT POINTS WHERE INGRESS OR EGRESS OCCURS. 24 FOOT MINIMUM IF SINGLE ENTRANCE TO SITE.
5. FILTER CLOTH – TO BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING OF STONE.
6. SURFACE WATER – ALL SURFACE WATER FLOWING OR DIVERTED TOWARD CONSTRUCTION ENTRANCES SHALL BE PIPED ACROSS THE ENTRANCE. IF PIPING IS IMPRACTICAL, A MOUNTABLE BERM WITH 5:1 SLOPES WILL BE PERMITTED.
7. MAINTENANCE – THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OF FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS–OF–WAY. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR AND/OR CLEANOUT OF ANY MEASURE USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, DRIPPED, WASHED OR TRACKED ONTO PUBLIC RIGHTS–OF–WAY MUST BE REMOVED IMMEDIATELY.
8. WASHING – WHEELS SHALL BE CLEANED TO REMOVE SEDIMENT PRIOR TO ENTRANCE ONTO PUBLIC RIGHTS–OF–WAY. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH STONE AND WHICH DRAINS INTO AN APPROVED SEDIMENT TRAPPING DEVICE.
9. PERIODIC INSPECTION AND NEEDED MAINTENANCE SHALL BE PROVIDED AFTER EACH RAIN.

STABILIZED CONSTRUCTION ENTRANCE

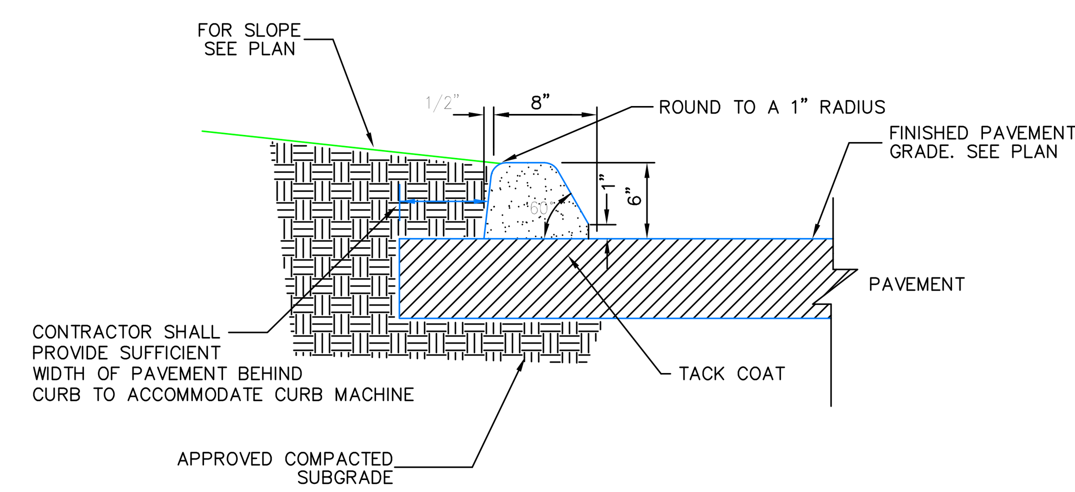
N.T.S.



NOTE:
AREA ADJACENT TO SWALE TO BE BROUGHT TO FINISHED GRADE IMMEDIATELY AS REQUIRED, TOPSOILED, SEEDED AND MAINTAINED FOR EROSION CONTROL.

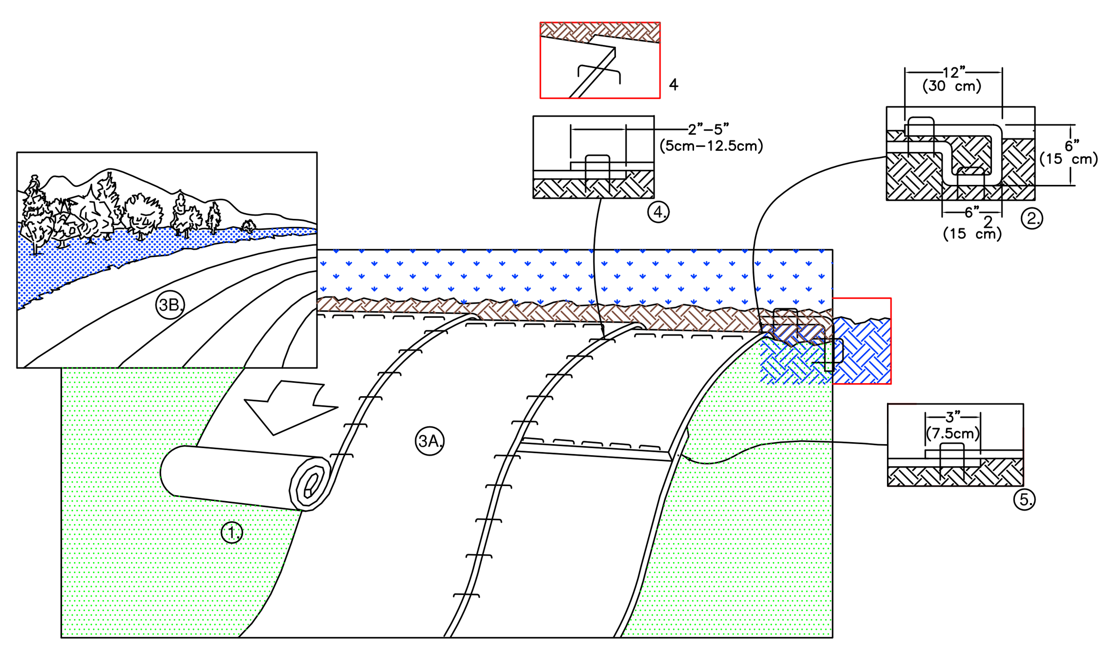
PERMEABLE BERM–SEDIMENT FOREBAYS & WATER QUALITY RENOVATION AREAS

N.T.S.



BITUMINOUS CONCRETE CURB DETAIL

N.T.S.



1. PREPARE SOIL BEFORE INSTALLING BLANKETS, INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED. NOTE: WHEN USING CELL–O–SEED DO NOT SEED PREPARED AREA. CELL–O–SEED MUST BE INSTALLED WITH PAPER SIDE DOWN.
2. BEGIN AT THE TOP OF THE SLOPE BY ANCHORING THE BLANKET IN A 6" (15cm) DEEP X 6" (15cm) WIDE TRENCH WITH APPROXIMATELY 12" (30cm) OF BLANKET EXTENDED BEYOND THE UP–SLOPE PORTION OF THE TRENCH. ANCHOR THE BLANKET WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" (30cm) APART IN THE BOTTOM OF THE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING. APPLY SEED TO COMPACTED SOIL AND FOLD REMAINING 12" (30cm) PORTION OF BLANKET BACK OVER SEED AND COMPACTED SOIL. SECURE BLANKET OVER COMPACTED SOIL WITH A ROW OF STAPLES/STAKES SPACED APPROXIMATELY 12" (30cm) APART ACROSS THE WIDTH OF THE BLANKET.
3. ROLL THE BLANKETS (A.) DOWN OR (B.) HORIZONTALLY ACROSS THE SLOPE. BLANKETS WILL UNROLL WITH APPROPRIATE SIDE AGAINST THE SOIL SURFACE. ALL BLANKETS MUST BE SECURELY FASTENED TO SOIL SURFACE BY PLACING STAPLES/STAKES IN APPROPRIATE LOCATIONS AS SHOWN IN THE STAPLE PATTERN GUIDE. WHEN USING OPTIONAL DOT SYSTEM™, STAPLES/STAKES SHOULD BE PLACED THROUGH EACH OF THE COLORED DOTS CORRESPONDING TO THE APPROPRIATE STAPLE PATTERN.
4. THE EDGES OF PARALLEL BLANKETS MUST BE STAPLED WITH APPROXIMATELY 2"–5" (5cm–12.5cm) OVERLAP DEPENDING ON BLANKET TYPE. TO ENSURE PROPER SEAM ALIGNMENT, PLACE THE EDGE OF THE OVERLAPPING BLANKET (BLANKET BEING INSTALLED ON TOP) EVEN WITH THE COLORED SEAM STITCH™ ON THE PREVIOUSLY INSTALLED BLANKET.
5. CONSECUTIVE BLANKETS SPLICED DOWN THE SLOPE MUST BE PLACED END OVER END (SHINGLE STYLE) WITH AN APPROXIMATE 3" (7.5cm) OVERLAP. STAPLE THROUGH OVERLAPPED AREA, APPROXIMATELY 12" (30cm) APART ACROSS ENTIRE BLANKET WIDTH.

NOTE:
*IN LOOSE SOIL CONDITIONS, THE USE OF STAPLE OR STAKE LENGTHS GREATER THAN 6" (15cm) MAY BE NECESSARY TO PROPERLY SECURE THE BLANKETS.

EROSION CONTROL BLANKETS

S75: Material:
100% straw matrix sewn into a photo–degradable net.
Straw: 5 lbs/sq. yd.
Net: Lightweight degradable (Top side only)

S150: Material:

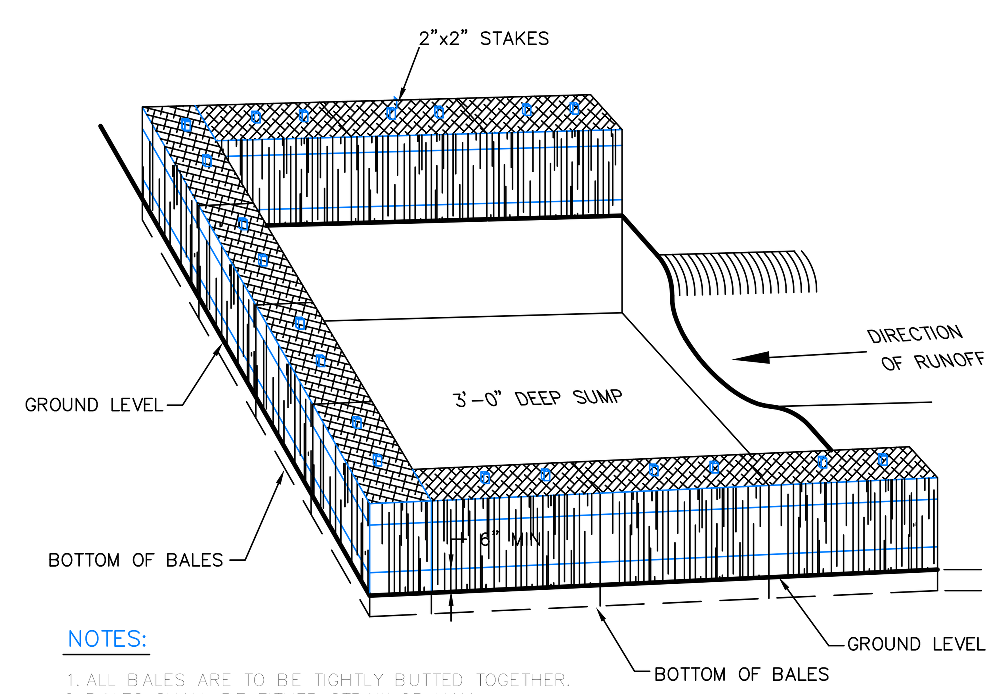
Straw fiber matrix sewn between two photo–degradable nets.
Straw: 5 lbs/sq. yd.
Net: Lightweight degradable (Both sides)

CRITICAL POINTS
A. OVERLAPS AND SEAMS
B. PROJECTED WATER LINE
C. CHANNEL BOTTOM/SIDE SLOPE VERTICES

NOTE
* HORIZONTAL STAPLE SPACING SHOULD BE ALTERED IF NECESSARY TO ALLOW STAPLES TO SECURE THE CRITICAL POINTS ALONG THE CHANNEL SURFACE.
** IN LOOSE SOIL CONDITIONS, THE USE OF STAPLE OR STAKE LENGTHS IN EXCESS OF 6" (15 CM) MAY BE NECESSARY TO PROPERLY ANCHOR THE BLANKETS.

EROSION CONTROL BLANKET

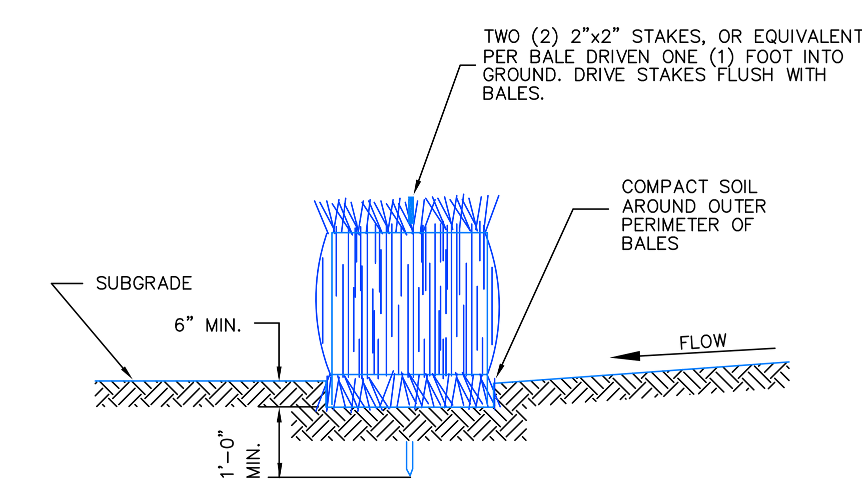
N.T.S.



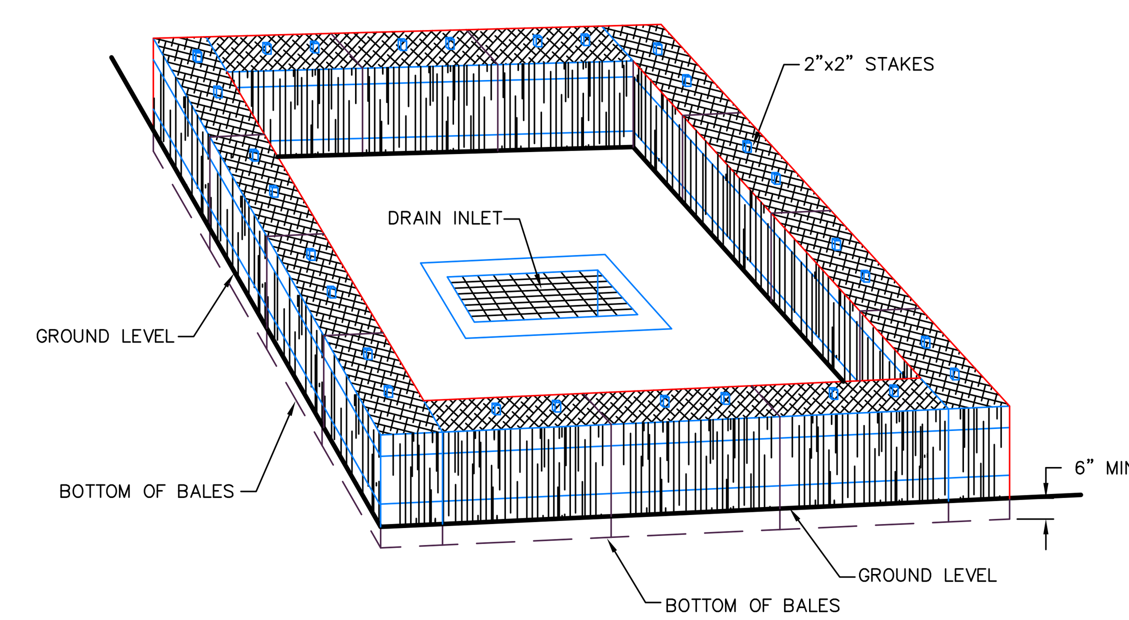
NOTES:
1. ALL BALES ARE TO BE TIGHTLY BUTTED TOGETHER.
2. BALES SHALL BE EITHER STRAW OR HAY.
3. PROVIDE FREQUENT INSPECTION AND MAINTENANCE. REMOVE ACCUMULATED SEDIMENT AND REPLACE CLOGGED BALES TO RESTORE EFFECTIVENESS OF INSTALLATION.

WATER BAR – TEMPORARY DIVERSION DITCH WITH HAYBALE TRAP

N.T.S.



SECTION



PERSPECTIVE VIEW

NOTES:
1. ALL BALES ARE TO BE TIGHTLY BUTTED TOGETHER.
2. BALES SHALL BE EITHER STRAW OR HAY.
3. PROVIDE FREQUENT INSPECTION AND MAINTENANCE. REMOVE ACCUMULATED SEDIMENT AND REPLACE CLOGGED BALES TO RESTORE EFFECTIVENESS OF INSTALLATION.

BALED FILTER

N.T.S.

NO.	REVISION	DATE

Previous Editions Obsolete

DETAILS

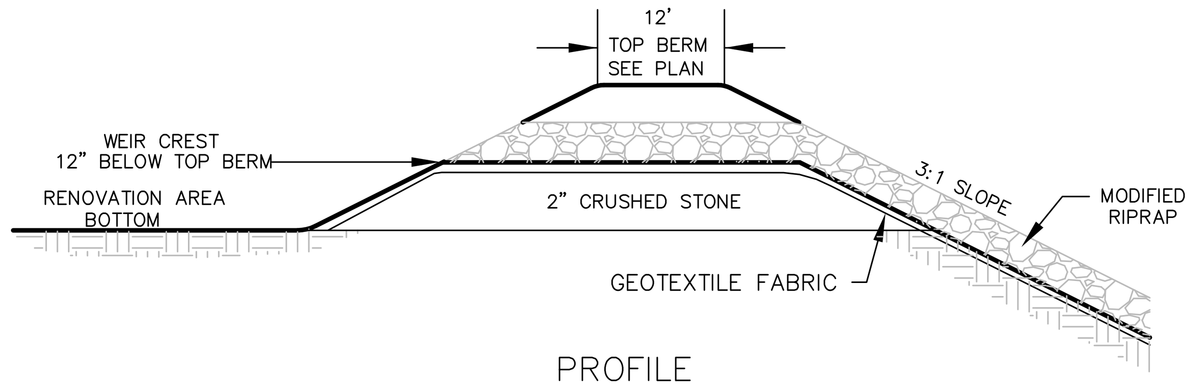
CPV TOWANTIC ENERGY CENTER

OXFORD CONNECTICUT

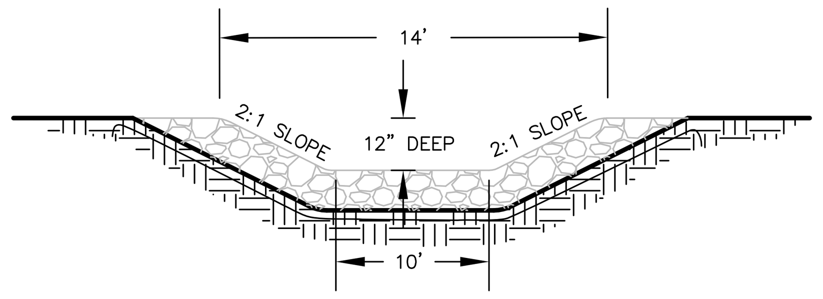
CIVIL 1
CORNERSTONE PROFESSIONAL PARK, SUITE D-101
43 SHERMAN HILL ROAD
WOODBURY (203) 266 - 0778 CONNECTICUT

STATE OF CONNECTICUT
CURTIS JONES
No. 17206
LICENSED
PROFESSIONAL ENGINEER

DRAWN: BB APPROVED: CJ
SCALE: N.T.S.
DATE: 26 SEP 14
PROJ. NO.: 98132
CADD FILE NAME: 98132
DRAWING NO.: C 320



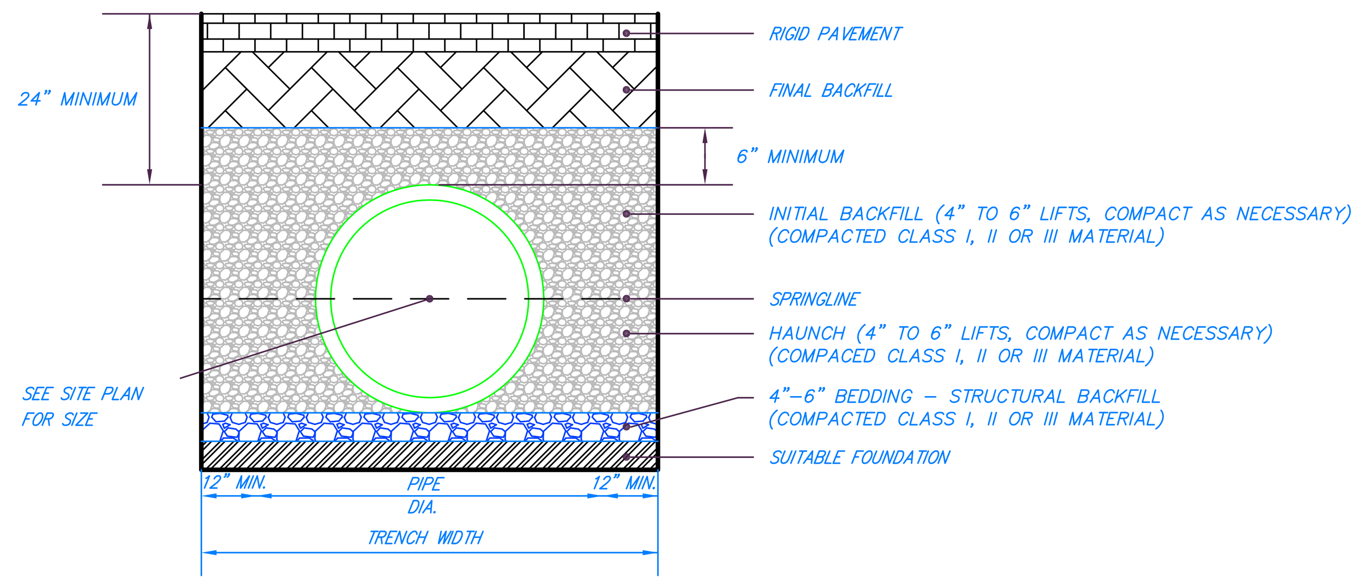
PROFILE



CROSS SECTION

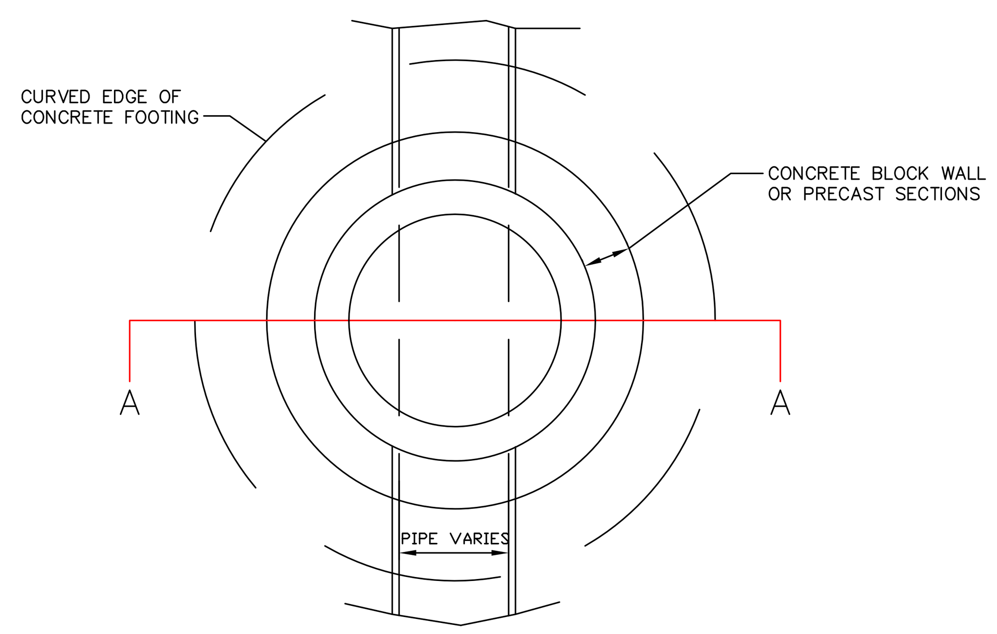
EMERGENCY SPILLWAY SWALE FOR STORMWATER RENOVATION AREA A

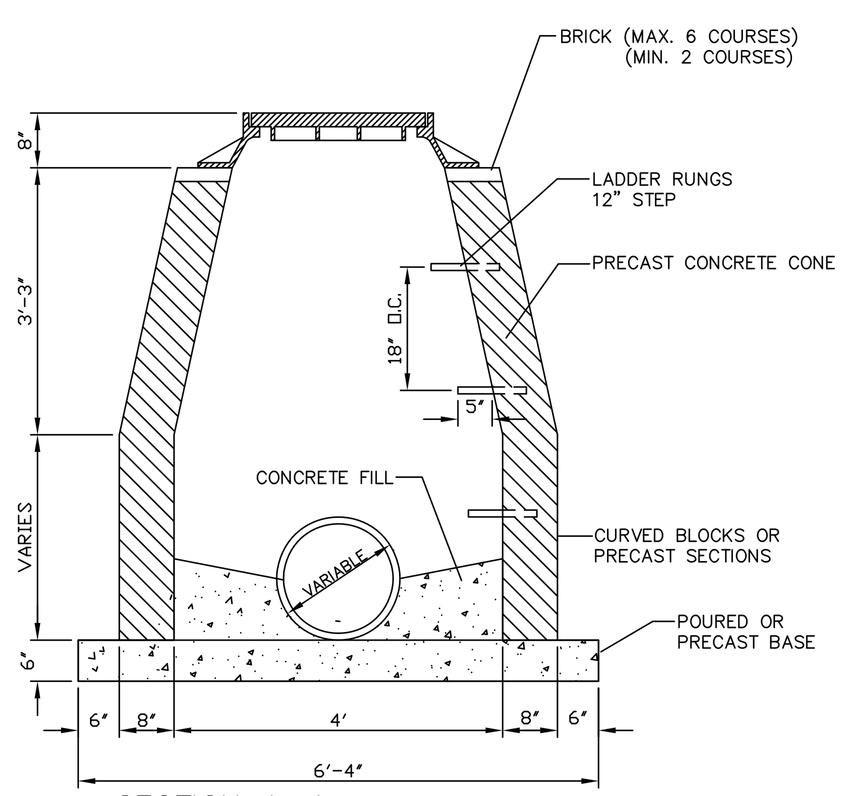
N.T.S



STORM DRAINAGE PIPE BEDDING DETAIL

N.T.S.

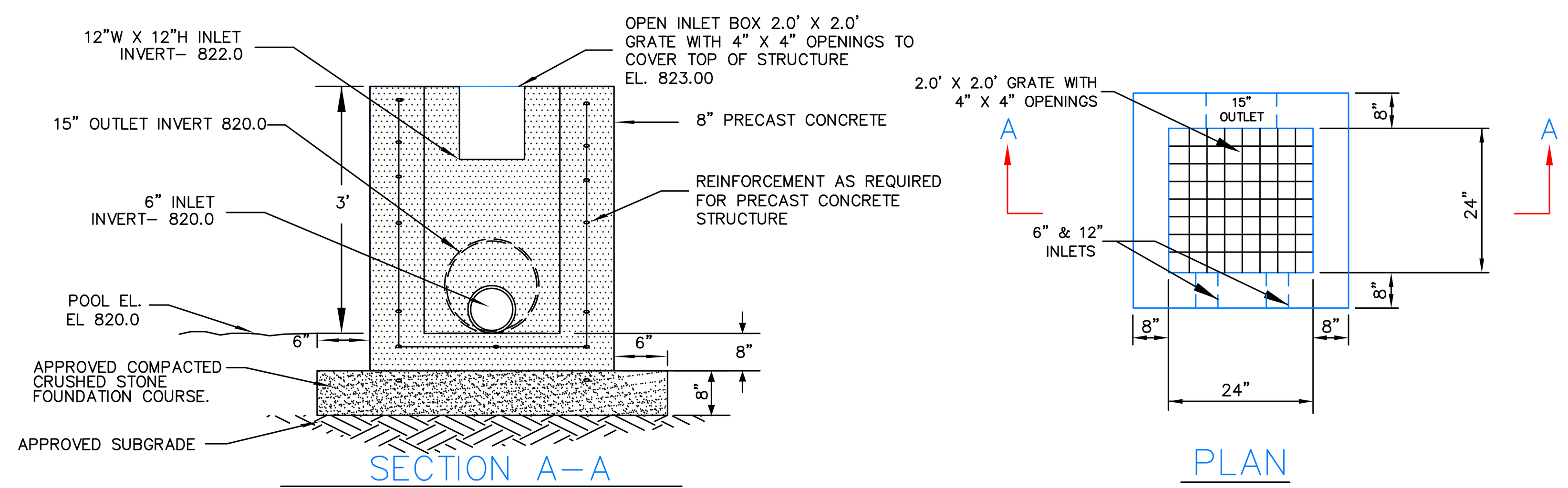




SECTION A-A

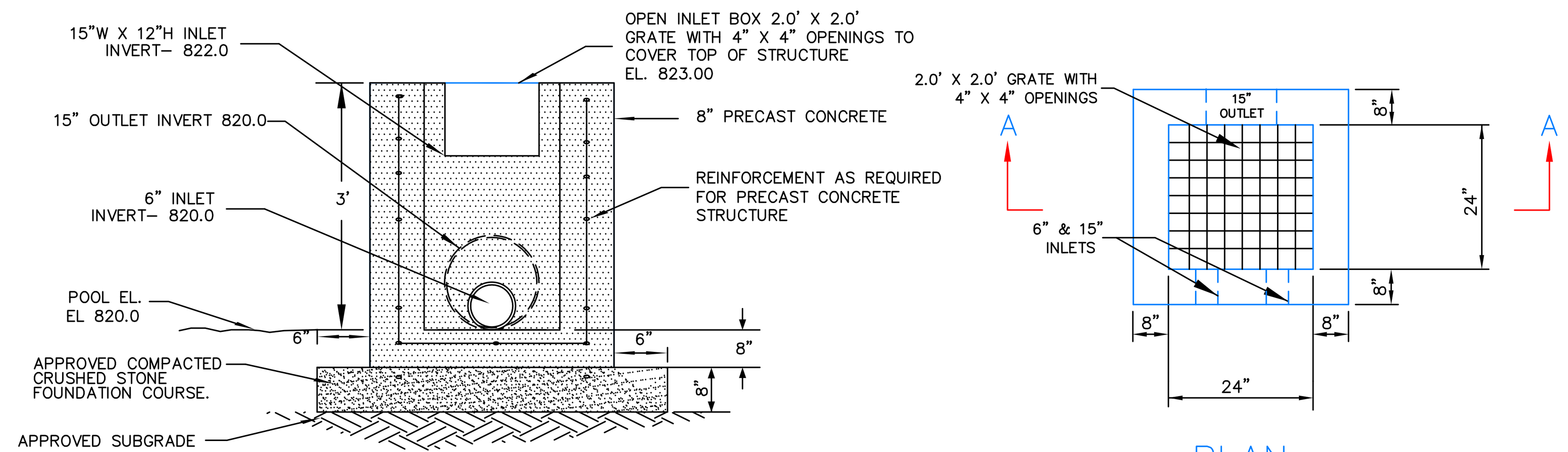
DRAINAGE MANHOLE

without sump



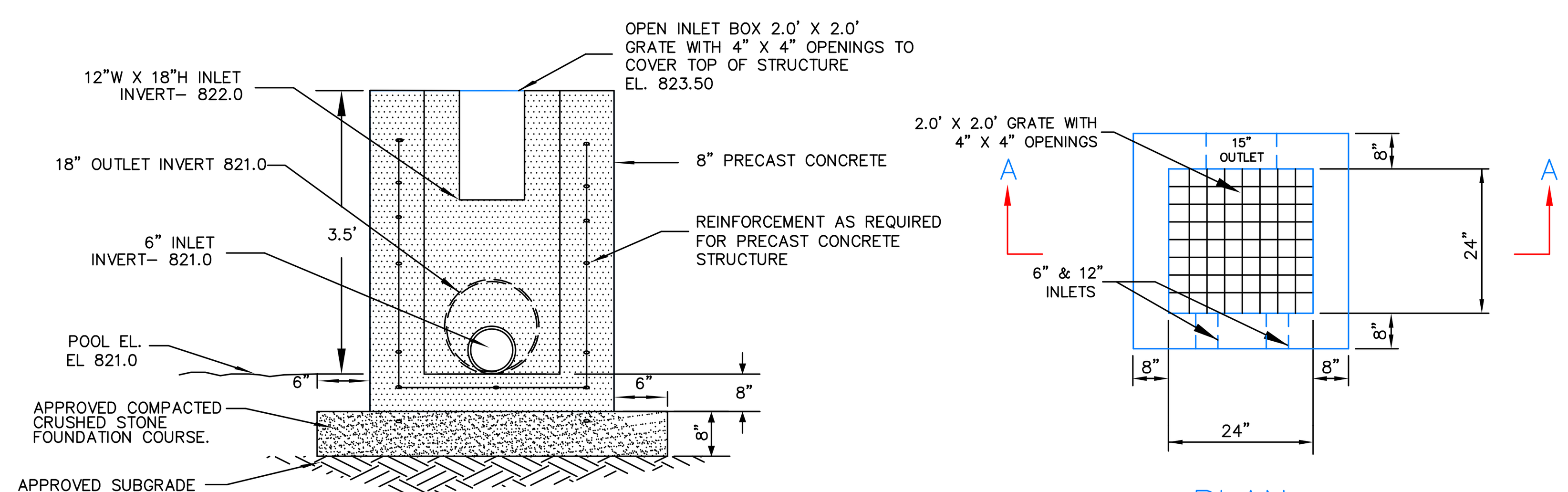
STORMWATER RENOVATION AREA A OUTLET CONTROL STRUCTURE A1

N.T.S.



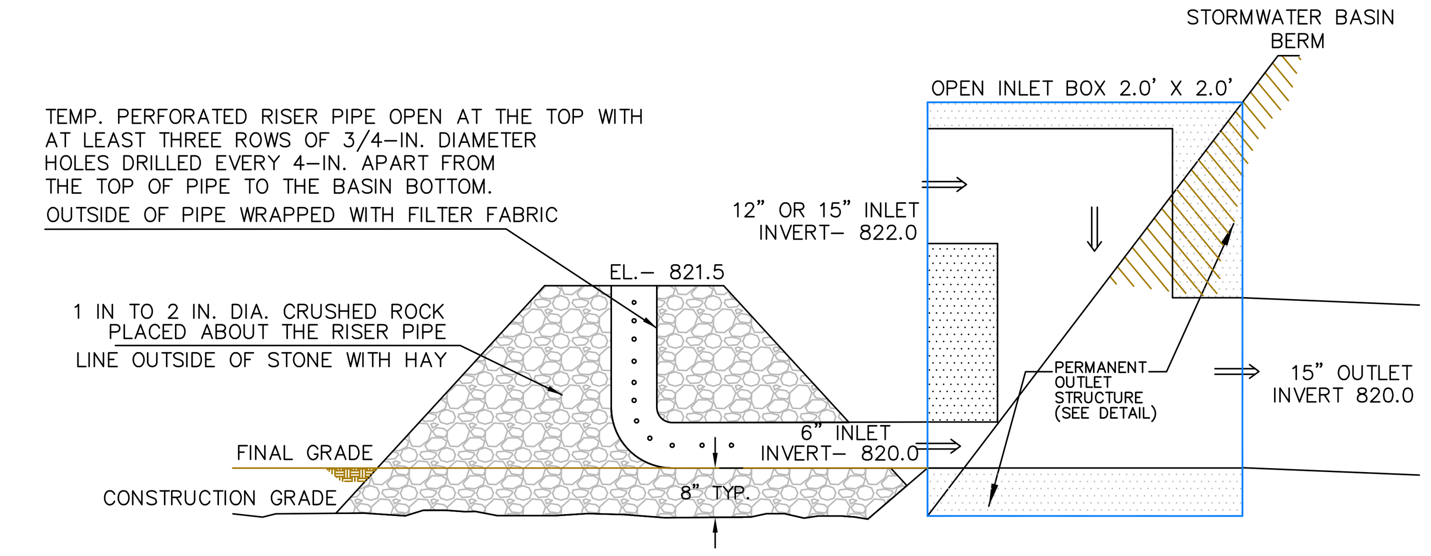
STORMWATER RENOVATION AREA A OUTLET CONTROL STRUCTURE A2

N.T.S.



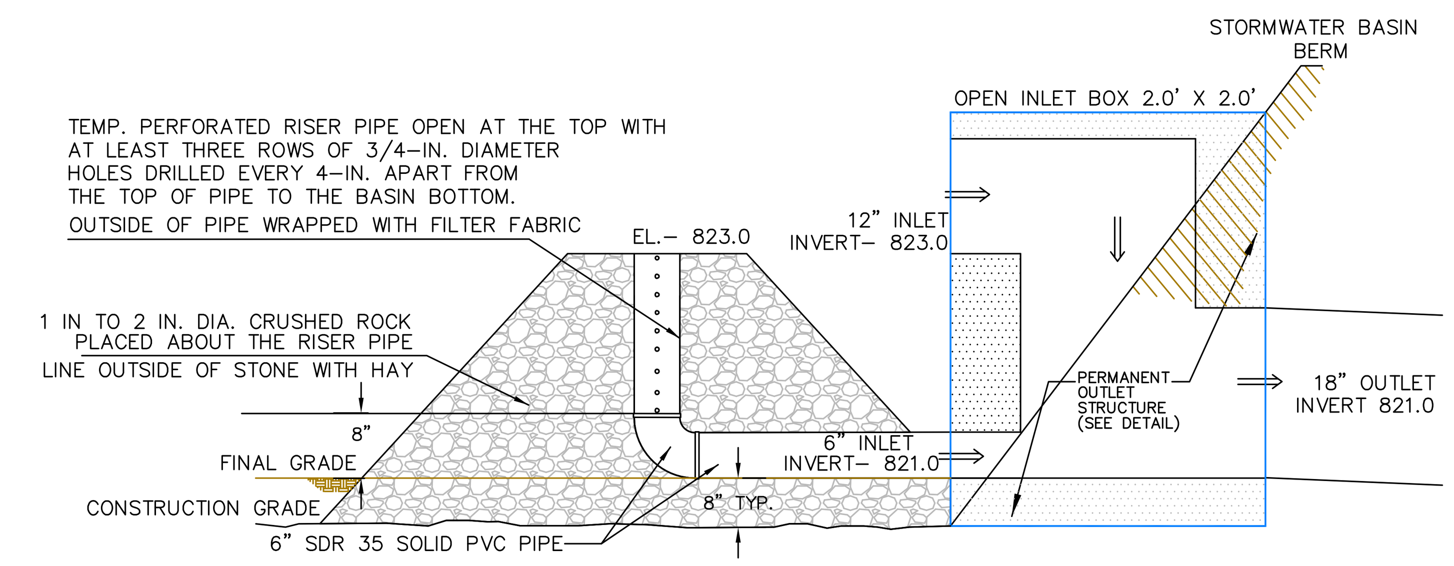
STORMWATER RENOVATION AREA B OUTLET CONTROL STRUCTURE B1

N.T.S.



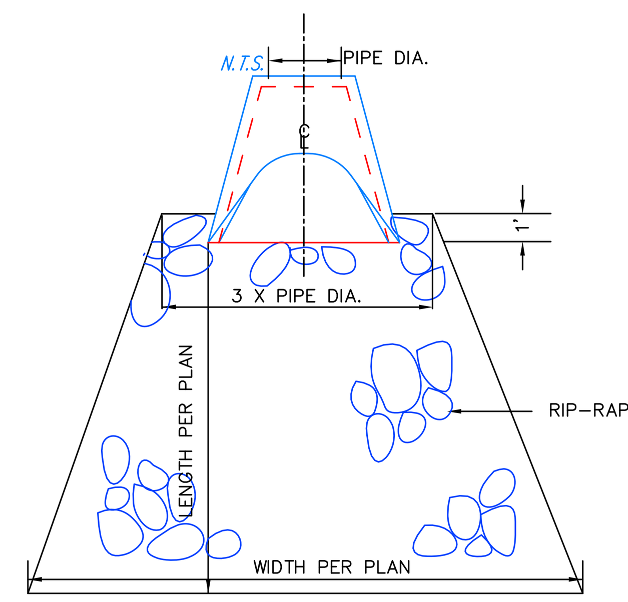
TEMPORARY OUTLET PIPE FOR SEDIMENT CONTAINMENT RENOVATION AREA A

N.T.S.

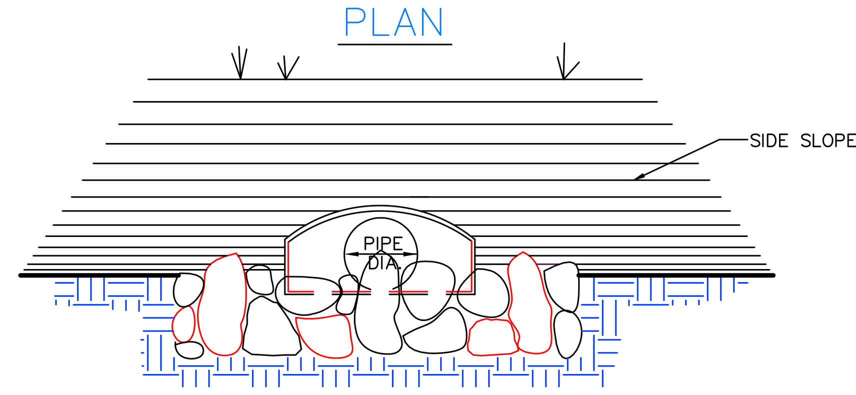


TEMPORARY OUTLET PIPE FOR SEDIMENT CONTAINMENT RENOVATION AREA B

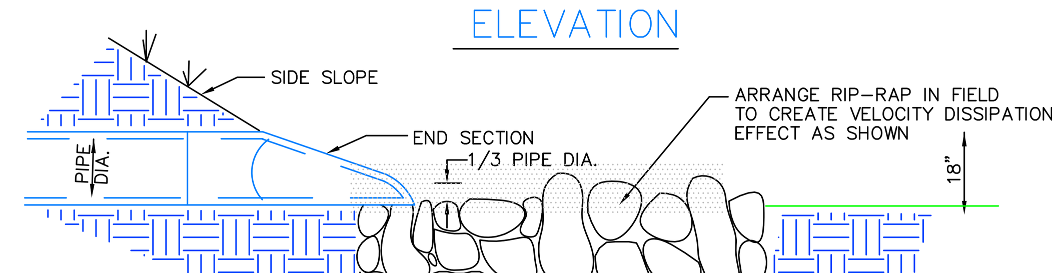
N.T.S.



PLAN



ELEVATION

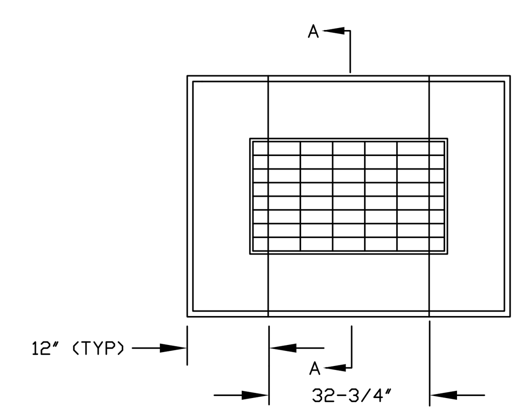


NOTE:
STONE OBTAINED FROM THE SITE EXCAVATION WHICH CONFORMS TO THE SPECIFICATIONS MAY BE USED AS RIP-RAP.

SECTION

RIP-RAP OUTLET PROTECTION

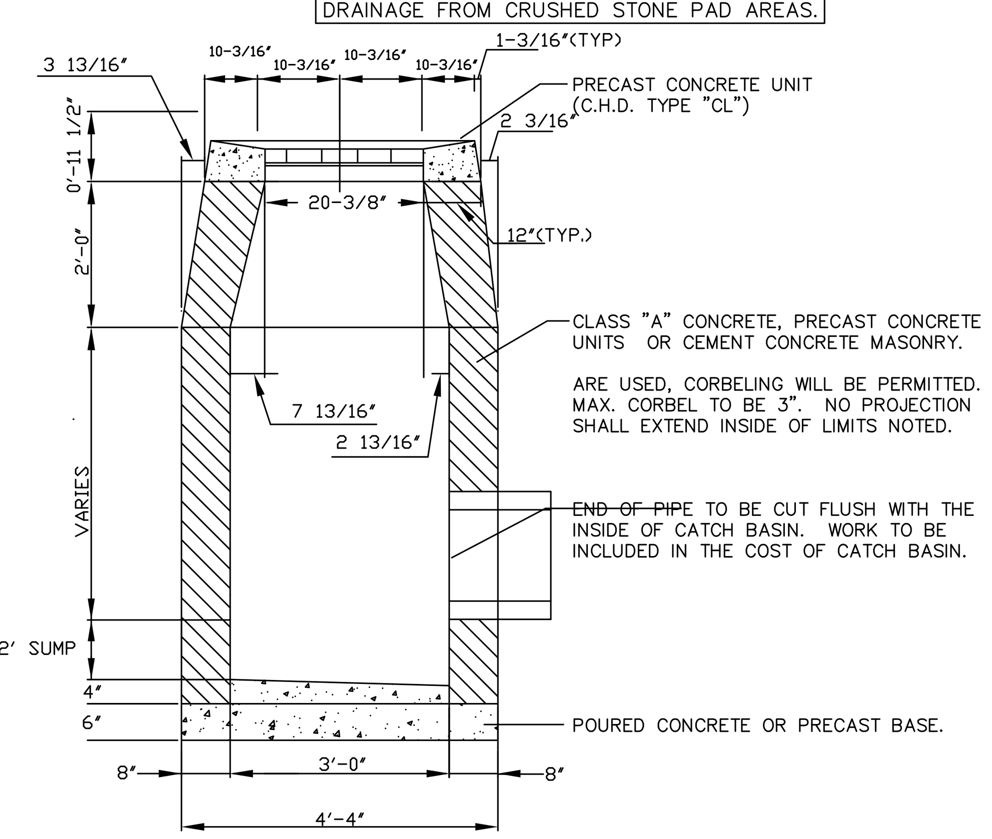
N.T.S.



NOTE:
OVER 10' DEEP SHALL BE INCREASED TO 12" THICKNESS.
2. SUMPS MAY BE REQUIRED AT LOCATIONS SPECIFIED BY THE TOWN ENGINEER.
3. BACKFILL BASINS WITH GRAVEL. LEAVE WEEP JOINTS AT LEVELS ABOVE TOP OF PIPE.

PLAN VIEW

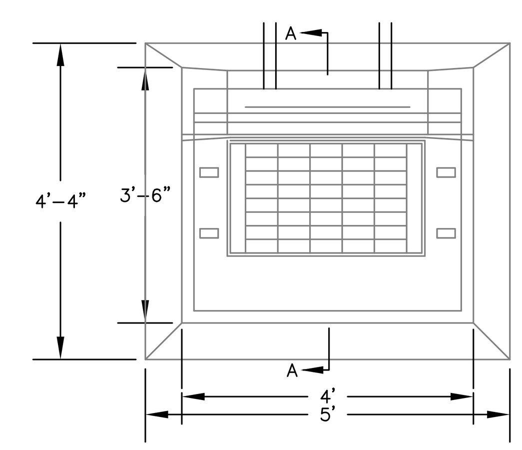
NOTE-TYPE CL BASINS SET IN INTERIOR EQUIPMENT AREAS & INSIDE OF DRIVEWAY LOOP TO BE SET AT SUBGRADE TO CATCH DRAINAGE FROM CRUSHED STONE PAD AREAS.



SECTION A-A

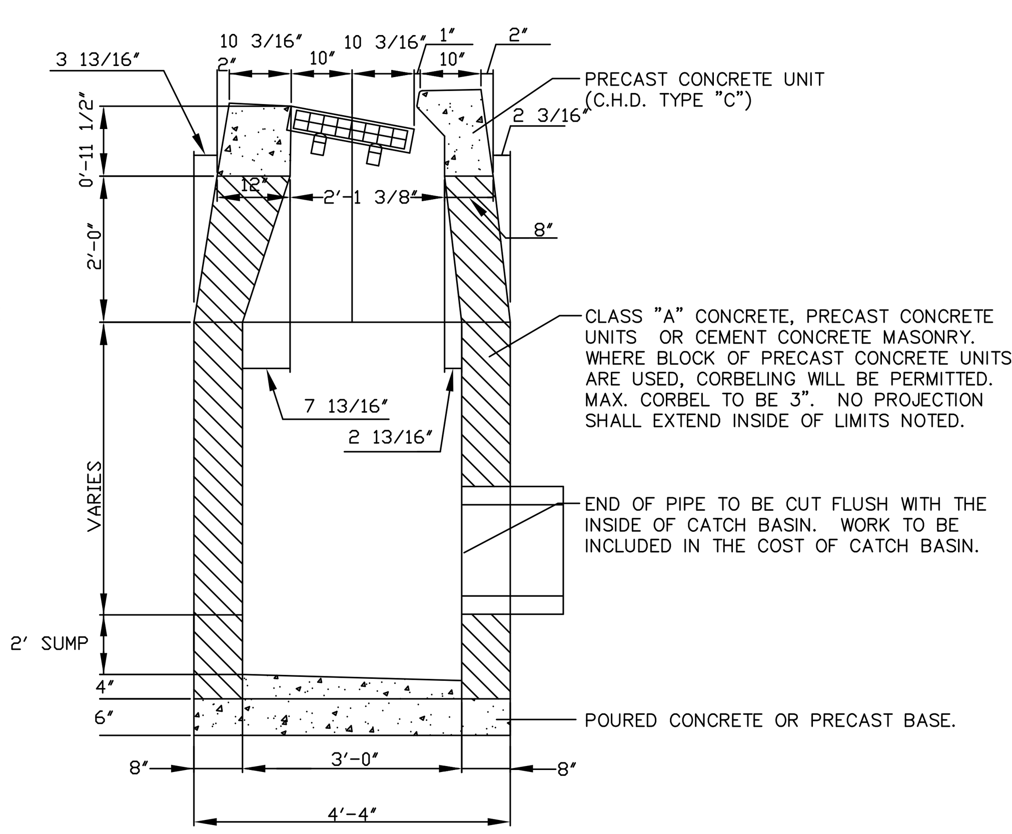
STANDARD TYPE "CL" CATCH BASIN

N.T.S.



NOTE:
1. WALLS OF ALL CATCH BASINS OVER 10' DEEP SHALL BE INCREASED TO 12" THICKNESS.
2. SUMPS MAY BE REQUIRED AT LOCATIONS SPECIFIED BY THE TOWN ENGINEER.
3. BACKFILL BASINS WITH GRAVEL. LEAVE WEEP JOINTS AT LEVELS ABOVE TOP OF PIPE.

PLAN VIEW



SECTION A-A

STANDARD TYPE "C" CATCH BASIN

N.T.S.

NO.	REVISION	DATE

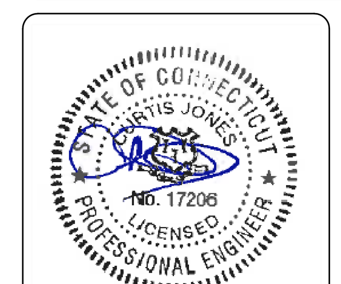
Previous Editions Obsolete

STORM DRAINAGE DETAILS

CPV TOWANTIC ENERGY CENTER

OXFORD CONNECTICUT

CIVIL 1
CORNERSTONE PROFESSIONAL PARK, SUITE D-101
43 SHERMAN HILL ROAD
WOODBURY (203) 266-0778 CONNECTICUT



DRAWN: BB	APPROVED: CJ
SCALE: N.T.S.	
DATE: 26 SEP 14	
PROJ. NO.: 98132	
CADD FILE NAME: 98132	
DRAWING NO.: C 321	

EROSION AND SEDIMENT CONTROL DEVICES

1. THE FOLLOWING EROSION AND SEDIMENT CONTROL DEVICES SHALL BE IMPLEMENTED AS PART OF THE SITE DEVELOPMENT. THESE DEVICES SHALL BE INSTALLED AS INDICATED ON THE DRAWINGS OR AS DESCRIBED BELOW. FOR FURTHER REFERENCE SEE THE STATE OF CONNECTICUT 2002 GUIDELINES FOR SOIL EROSION AND SEDIMENT CONTROL (THE GUIDELINES).

2. ORGANIC MULCHES (HAY OR STRAW), OR NETTING AND MATS ARE TO BE USED TO PREVENT EROSION BY PROTECTING THE EXPOSED SOIL, AND TO PROMOTE THE GROWTH OF VEGETATION. ORGANIC MULCH MATERIALS AND APPLICATION RATES SHALL BE IN ACCORDANCE WITH FIGURE 7-1 OF THE 2002 GUIDELINES FOR SOIL EROSION AND SEDIMENT CONTROL OF THE STATE OF CONNECTICUT ("GUIDE"). STRAW OR HAY MULCH MUST BE ANCHORED IMMEDIATELY AFTER SPREADING USING A TRACTOR-DRAWN MULCH ANCHORING TOOL, LIQUID MULCH BINDERS, NETTING OR OTHER MEANS OF ANCHORING ALLOWED BY THE "GUIDE". MULCHES MUST BE INSPECTED PERIODICALLY AND, IN PARTICULAR, AFTER RAINSTORMS, AND RE-APPLIED IMMEDIATELY IF EROSION IS OBSERVED.

3. TEMPORARY SEDIMENTATION BASINS A & B SHALL BE CONSTRUCTED TO PROVIDE SEDIMENTATION CONTROL AND WATER QUALITY ENHANCEMENT FOR THE STORMWATER RUNOFF FROM THE CONSTRUCTION AREA. REFER TO THE SEQUENCE OF CONSTRUCTION NOTES.

4. RIPRAP APRONS SHALL BE USED TO REDUCE RUNOFF VELOCITIES AND PROTECT EXPOSED SURFACES FROM CONCENTRATED FLOWS. INSTALLATION DETAILS ARE PROVIDED ON SHEET 7, TITLED "DETAILS" OF THIS PLAN SET.

5. VEGETATIVE COVERS (TEMPORARY AND PERMANENT) SHALL BE INSTALLED TO STABILIZE SOIL AND REDUCE DAMAGE FROM SEDIMENT DEPOSITS, WIND AND/OR RUNOFF EROSION. VEGETATIVE COVERS SHALL BE INSTALLED ON ALL DISTURBED AREAS NOT INTENDED FOR PRIMARY CONSTRUCTION AND NOT PROTECTED BY OTHER EROSION CONTROL MEASURES.

CONSTRUCTION SEQUENCE

IN ORDER TO ENSURE THAT THE EFFECTIVENESS OF THE EROSION AND SEDIMENTATION CONTROL MEASURES IS OPTIMIZED, THE FOLLOWING SEQUENCE OF CONSTRUCTION ACTIVITIES SHALL BE FOLLOWED:

A PRE-CONSTRUCTION MEETING WILL BE SET UP AND TAKE PLACE PRIOR TO THE START OF ANY CONSTRUCTION.

<u>PHASE I: FILL IN WETLANDS AREA 1 AND WETLANDS AREA 4</u> (30 - 60 DAYS)

1. FIELD STAKEOUT THE LIMITS OF ALL CONSTRUCTION ACTIVITIES.

2. INSTALL ANTI-TRACKING PAD AT CONSTRUCTION ENTRANCE AS SHOWN ON THE PLAN. INSTALL WATER BARS AND HAYBALE BARRIERS AS NECESSARY TO CONTROL DRAINAGE ALONG THE ENTRY DRIVE. AT THE END OF EACH WORKING DAY, ANY ACCUMULATED SILT SHALL BE SWEPT FROM THE EXISTING TOWN ROADS.

3. CLEAR ALL VEGETATION WITHIN THE CONSTRUCTION AREA. ALL TREES/SHRUBS LESS THAN 6" IN DIAMETER SHALL BE CHIPPED AND STORED ON THE SITE. DO NOT REMOVE STUMPS.

4. HAYBALES AND/OR SILTATION FENCE AND OTHER EROSION CONTROL FEATURES WILL BE PLACED AS SHOWN ON THE ENCLOSED PLAN PRIOR TO THE START OF ANY CONSTRUCTION.

5. REMOVE STUMPS ONLY FROM CONSTRUCTION AREA REQUIRED FOR FILLING OF THE WETLANDS AREA AFTER EROSION CONTROL MEASURES ARE IN PLACE.

6. FILL IN THE WETLANDS AREAS USING ON-SITE MATERIAL. ON-SITE MATERIAL TO BE TAKEN FROM ALREADY CLEARED AREAS THAT ARE PROPOSED AS FUTURE CUTS. FILL TO BE PLACED IN 12" LIFTS AND COMPACTED AS NECESSARY.

7. SEED ALL DISTURBED AREAS.

<u>PHASE II: CONSTRUCT SEDIMENT & EROSION CONTROL MEASURES</u> (30 - 60 DAYS)

1. FIELD STAKEOUT THE LIMITS OF ALL CONSTRUCTION ACTIVITIES

2. INSTALL HAYBABES AND/OR SILTATION FENCE AROUND BOUNDARY OF THE CONSTRUCTION AREA. CLEAR AREAS SUFFICIENT TO CONSTRUCT TEMPORARY DIVERSION SWALES TO TEMPORARY SEDIMENT TRAP "A".

3. GRUB AND CLEAR THE AREA FOR THE CONSTRUCTION OF TEMPORARY SEDIMENTATION TRAP "A" AND TEMPORARY DIVERSION SWALES DISCHARGING TO THE TEMPORARY SEDIMENT TRAP.

4. COMMENCE EARTHWORK AND GRADING FOR TEMPORARY SEDIMENTATION TRAP "A". CONSTRUCT BASIN BERM, OUTLET STRUCTURES, AND PERFORATED RISERS ON THE OUTLET STRUCTURES PER THE DETAIL ON SHEET C321. CONSTRUCT POND DISCHARGE OUTLET PIPING TO EXISTING CATCH BASINS ON WOODRUFF HILL ROAD.

5. MATERIAL EXCAVATION FROM AREA OF TEMPORARY SEDIMENT TRAP "A" SHALL BE USED AS FILL MATERIAL IN EASTERN AND WESTERN PORTIONS OF THE SITE, EXCESS MATERIAL MAY BE TRUCKED OFF SITE.

6. GRUB AND CLEAR AREAS SUFFICIENT FOR CONSTRUCTION OF TEMPORARY SEDIMENTATION TRAP "B" AND TEMPORARY DIVERSION SWALES DISCHARGING TO THE TEMPORARY SEDIMENT TRAP.

7. CONSTRUCT TEMPORARY DIVERSION SWALE AT TOP OF CUT SLOPE ABOVE TRAP "B" TO DIVERT CLEAN WATER FROM THE CONSTRUCTION AREA.

8. COMMENCE EARTHWORK AND GRADING FOR TEMPORARY SEDIMENTATION TRAP "B". CONSTRUCT BASIN BERM, OUTLET STRUCTURE, AND PERFORATED RISER ON THE OUTLET STRUCTURE PER THE DETAIL ON SHEET C321. CONSTRUCT POND DISCHARGE OUTLET PIPING TO PROPOSED DRAINAGE OUTLET ON EASTERN SIDE OF PROPERTY (TO EXISTING 24" PIPE UNDER LOT 9 DRIVEWAY).

9. MATERIAL EXCAVATION FROM AREA OF TEMPORARY SEDIMENT TRAP "B" SHALL BE USED AS FILL MATERIAL IN EASTERN AND WESTERN PORTIONS OF THE SITE, EXCESS MATERIAL MAY ALSO BE TRUCKED OFF SITE.

<u>PHASE III: CONSTRUCTION OF PERIMETER ROAD, MAIN PLANT AREA AND STORM DRAINAGE</u> (APPROX. 2 YEARS)

1. COMMENCE CLEARING AND GRUBBING NECESSARY TO CONSTRUCT PERMANENT PERIMETER ROAD AND REMINDER OF POWER PLANT PAD AREA.

2. CLEAR AND GRADE SWITCHYARD AND STORAGE TANK AREA TO ELEVATION 830.0 AND STABILIZE SLOPES BY SEEDING. SLOPES STEEPER THAN 3:1 SHALL RECEIVE SLOPE BLANKET PROTECTION AND HYDROSEEDING. USE AREAS DESIGNATED ON THE SITE PLANS FOR TEMPORARY STOCKPILE OF TOPSOIL.

4. COMMENCE INSTALLATION OF GAS, WATER, SEWER AND TELEPHONE LINES.

5. PLACE COMPACTED FILL ALONG WEST SITE BOUNDARY FOR THE CONSTRUCTION OF THE PERIMETER ROAD. STABILIZE THE SLOPE AS REQUIRED.

6. INSTALL ADDITIONAL SILT FENCING AND BERMS WITHIN PLANT AREA WHERE NECESSARY.

7. COMPLETE GRADING ALONG THE EASTERN BOUNDARY. STABILIZE SLOPES.

8. CONSTRUCT PERIMETER ROAD. PERFORM WORK IN INCREMENTS. COORDINATE WORK WITH THE INTERNAL FOUNDATION WORK FOR STRUCTURES AND FINAL GRADING OF THE SEDIMENTATION BASIN.

10. COMMENCE INSTALLATION OF DRAINAGE WITHIN THE POWER PLANT PAD AREA.

11. COMPLETE CONSTRUCTION OF ALL CATCH BASINS AND MANHOLES REQUIRED TO CONVEY SITE RUNOFF TO STORMWATER RENOVATION AREAS "A" & "B".

<u>PHASE IV: CONSTRUCT SWITCHYARD AND UNDERGROUND UTILITIES</u> (APPROX. 1 YEAR)

1. COMPLETE ALL REMAINING EARTHWORK OPERATIONS.

2. REMOVE EXCESS SOIL FROM THE SWITCHYARD AREA. INSTALL DRAINAGE, CONSTRUCT CABLE TRENCHES AND COMPLETE GRADING OF THE SWITCHYARD AREA.

3. INSTALL GRAVEL BASE COURSE FOR THE PERIMETER ROAD AND PARKING.

4. COMMENCE CONSTRUCTION OF FOUNDATIONS AND INSTALLATION OF UNDERGROUND UTILITIES IN THE POWER BLOCK AREA. REMOVE EXCESS SOIL FROM THE STORAGE TANK AREA AND CONSTRUCT TANK FOUNDATIONS.

5. INSTALL CRUSHED STONE IN THE AIR COOLED CONDENSER AND OTHER AREAS.

6. INSTALL ASPHALT CONCRETE SURFACE PAVING.

7. PROVIDE PAINT STRIPING FOR PARKING AS INDICATED ON THE DRAWINGS. INSTALL SIGNS.

8. LOAM, MULCH SEED AND FERTILIZE ALL REMAINING DISTURBED AREAS.

9. CONVERT TEMPORARY SEDIMENTATION TRAPS "A" & "B" INTO STORMWATER RENOVATION AREAS BY REMOVING THE BASIN OUTLET RISER AND CLEANING THE BASIN OF DEPOSITED MATERIALS.

10. REMOVE THE STABILIZED CONSTRUCTION ENTRANCE.

11. REMOVE ROCK CHECK DAMS, HAY BALES, AND LEVEL SPREADERS.

<u>PHASE V: CONSTRUCT PERIMETER FENCE & REMOVE TEMPORARY SEDIMENT & EROSION CONTROL MEASURES</u> (60 DAYS)

1. INSTALL CHAIN LINK SECURITY FENCE AND GATES AROUND THE SITE.

2. INSTALL CHAIN LINK SECURITY FENCE AND GATES AROUND SWITCHYARD.

3. COMPLETE SEEDING AND PLANTING.

4. REMOVE ALL SEDIMENT ACCUMULATED AHEAD OF ALL SEDIMENT BARRIERS.

5. REMOVE SILT FENCES AFTER ALL SLOPES ARE STABILIZED AND REVEGETATED.

GENERAL NOTES

1. A PROJECT MANAGER FROM COMPETITIVE POWER VENTURES, INC. IS THE RESPONSIBLE PARTY FOR IMPLEMENTING THE EROSION AND SEDIMENT CONTROL PLAN. THE RESPONSIBILITY INCLUDES THE INSTALLATION AND MAINTENANCE OF CONTROL MEASURES AND INFORMING ALL PARTIES ENGAGED ON THE CONSTRUCTION SITE OF THE REQUIREMENTS AND OBJECTIVES OF THE PLAN. THE ON-SITE CONSTRUCTION MANAGER SHALL BE RESPONSIBLE FOR HAVING THE EROSION CONTROL MEASURES CHECKED WEEKLY AND AFTER EVERY STORM. ALL ITEMS IDENTIFIED DURING INSPECTION AS THOSE REQUIRING MAINTENANCE/REPLACEMENT SHALL BE COMPLETED IMMEDIATELY.

2. PRIOR TO INITIATING CONSTRUCTION, A PRE-CONSTRUCTION MEETING SHALL BE SCHEDULED AND CONDUCTED INCLUDING THE FOLLOWING ATTENDEES: THE PROJECT MANAGER FROM COMPETITIVE POWER VENTURES, INC, ON-SITE CONSTRUCTION MANAGER, SITE CONTRACTOR, TOWN ENGINEER, AND OTHERS AS MAY BE REQUIRED BY THE CT SITING COUNCIL.

3. THE CUMULATIVE POST PEAK DEVELOPMENT RUN-OFF RATES WILL BE KEPT TO LESS THAN THE PRE-DEVELOPMENT RUN-OFF RATES FROM THE SITE THROUGH THE USE OF ON-SITE DETENTION BASINS.

4. EXISTING WETLANDS AND WATERCOURSES DOWN SLOPE FROM THE PROJECT SITE SHALL BE PROTECTED FROM SEDIMENT POLLUTION BY INSTALLING APPROPRIATE EROSION AND SEDIMENT CONTROL DEVICES, AS INDICATED ON THE VARIOUS EROSION CONTROL PLANS.

5. THE CONTRACTOR SHALL PRESERVE EXISTING VEGETATION. TEMPORARY MULCHING AND SEEDING SHALL BE USED TO PREVENT AND MINIMIZE EROSION.

6. TO REDUCE EROSION HAZARDS, CONSTRUCTION SHALL BE PHASED AS INDICATED ON THIS SHEET AND CONTRACT DRAWINGS TO MINIMIZE LAND DISTURBANCE AT ANY GIVEN TIME. WHERE CONSTRUCTION ACTIVITIES HAVE PERMANENTLY CEASED OR HAVE TEMPORARILY BEEN SUSPENDED FOR MORE THAN SEVEN DAYS, SOIL STABILIZATION MUST BE IMPLEMENTED WITHIN THREE DAYS. AREAS WHICH REMAIN INACTIVE FOR AT LEAST THIRTY DAYS SHALL RECEIVE TEMPORARY SEEDING IN ACCORDANCE WITH THE GUIDELINES.

7. THE CONTRACTOR MUST INSTALL ANY ADDITIONAL TEMPORARY AND/OR PERMANENT MEASURES WHICH MAY BE NECESSARY TO CONTROL EROSION/SEDIMENTATION ON- AND OFF-SITE DEPENDING ON WEATHER CONDITIONS AND WORK SEQUENCE.

8. THE PAVED AREAS SHALL BE KEPT TO A MINIMUM TO MINIMIZE IMPERVIOUS AREAS.

9. DEWATERING WASTEWATERS SHALL BE DISCHARGED BY INFILTRATION INTO THE GROUND.

10. THE CONTRACTOR MUST ENSURE THAT NO LITTER, DEBRIS, BUILDING MATERIALS OR SIMILAR MATERIALS ARE DISCHARGED IN THE WATERS OF THE STATE.

TEMPORARY SEDIMENT TRAPS

1. TWO TEMPORARY SEDIMENTATION TRAPS "A" & "B" WILL BE INSTALLED DURING CONSTRUCTION. THE AMOUNT OF SEDIMENT ENTERING THE BASINS WILL BE MINIMIZED BY THE USE OF SEDIMENT FOREBAYS AT THE INLETS TO THE PONDS. EACH SEDIMENTATION TRAP SHALL BE FITTED WITH A TEMPORARY OUTLET STRUCTURE ON THE DRAIN LINE OUTLET PIPE TO CONTROL OUTFLOW FROM THE BASIN.
2. SEDIMENT WHICH HAS ACCUMULATED IN THE TEMPORARY SEDIMENT TRAPS SHALL BE REMOVED AFTER REACHING A DEPTH OF 6" OR GREATER.
2. AFTER TRIBUTARY DRAINAGE AREAS HAVE BEEN STABILIZED, THE ACCUMULATED SEDIMENT WITHIN THE BASINS SHALL BE REMOVED. TEMPORARY SEDIMENTATION TRAPS "A" & "B" SHALL BE CONVERTED INTO PERMANENT STORMWATER RENOVATION BASINS.

PERMANENT EROSION CONTROL MEASURES

ALL PERMANENT EROSION CONTROL MEASURES SHALL BE INSTALLED IN STRICT ACCORDANCE WITH THE RECOMMENDATIONS OF THE "GUIDELINES". THE FOLLOWING PERMANENT EROSION CONTROL MEASURES HAVE BEEN DESIGNED AS PART OF THE EROSION AND SEDIMENT CONTROL PLAN:

1. PERMANENT VEGETATIVE COVER SHALL BE ESTABLISHED ON ALL EXPOSED/DISTURBED AREAS THAT ARE NOT SUBJECT TO OTHER RESTORATION (PAVING, RIPRAP, ETC). INSTALLATION AND MAINTENANCE REQUIREMENTS OF CHAPTER 6 OF THE "GUIDELINES" SHALL BE FOLLOWED. EXPOSED AREAS SHALL BE LOAMED, LIMED, FERTILIZED AND SEEDED. LIMESTONE AND FERTILIZER SHALL BE APPLIED IN ACCORDANCE WITH THE RESULTS OF SOIL TESTING OR AS RECOMMENDED BY THE "GUIDELINES". ALL PERMANENT SEEDING WILL BE DONE IN THE SPRING OR LATE SUMMER (BEFORE OCTOBER 31). ANY AREAS TO BE SEEDED OUTSIDE OF THIS TIME FRAME SHALL BE COVERED WITH AN EROSION CONTROL BLANKET TO STABILIZE THE SOIL UNTIL GROWTH CAN BE ESTABLISHED. SEEDING MIXTURES SHALL BE SELECTED IN ACCORDANCE WITH FIGURES 6-2 OR 6-3 OF THE "GUIDELINES" OR AS RECOMMENDED BY THE SOIL CONSERVATION SERVICE. HYDROSEEDING SHALL BE USED WHERE INDICATED ON THE PLANS AND IN CRITICAL AREAS. MULCH SHALL BE APPLIED AND ANCHORED AS RECOMMENDED UNDER "EROSION AND SEDIMENT CONTROL DEVICES" ABOVE. SLOPES STEEPER THAN 3:1 SHALL RECEIVE NORTH AMERICAN GREEN S75 OR S150 STRAW TURF REINFORCEMENT BLANKET OR APPROVED EQUAL.

2. THE RIPRAP APRONS AND PLUNGE POOLS SHALL BE CONSTRUCTED AND STABILIZED AT THE PIPE OUTLETS PRIOR TO DIRECTING RUNOFF TO EITHER STORMWATER RENOVATION AREA AND AT ALL STORM DRAINAGE OUTLETS.

TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES

THE FOLLOWING ARE PLANNED AS TEMPORARY EROSION/SEDIMENTATION CONTROL MEASURES DURING CONSTRUCTION:

1. A CRUSHED STONE STABILIZED CONSTRUCTION ENTRANCE SHALL BE PLACED AT THE SITE ACCESS ONTO WOODRUFF HILL ROAD.

2. FILTER FABRIC SILT FENCE SHALL BE INSTALLED ALONG THE DOWN GRADIENT SIDE OF ALL FILL SECTIONS. SILT FENCE WILL BE MAINTAINED IN PLACE UNTIL THE TRIBUTARY AREA PROTECTED BY THE FENCE IS REVEGETATED OR STABILIZED BY PERMANENT MEASURES. SYNTHETIC FILTER FABRIC, POST MATERIAL, SPACING AND EMBEDMENT, AND TRENCH DETAILS, SHALL BE AS SHOWN ON THE DRAWINGS. FILTER BARRIER SHALL BE INSPECTED IMMEDIATELY AFTER EACH RAINFALL GREATER THAN 0.1 INCH AND AT LEAST DAILY DURING PROLONGED RAINFALL. REFER TO THE CHAPTER 7 OF THE "GUIDELINES" FOR ADDITIONAL MAINTENANCE REQUIREMENTS.

3. DUST CONTROL SHALL BE USED TO PREVENT BLOWING AND MOVEMENT OF DUST FROM EXPOSED SOIL SURFACES AND REDUCE THE PRESENCE OF DUST WHICH MAY CAUSE OFF-SITE DAMAGE, BE A HEALTH HAZARD TO HUMANS, WILDLIFE AND PLANT LIFE. THE NEED FOR DUST CONTROL WILL BE MINIMIZED BY REDUCING AREA OF LAND DISTURBANCE AT ANY ONE TIME, MAINTAINING AS MUCH VEGETATION AS PRACTICABLE, USE OF MULCHING AND TEMPORARY VEGETATIVE COVER. THE CONTRACTOR SHALL USE MECHANICAL SWEEPERS ON PAVED AREAS AND UTILIZE FINE WATER SPRAYS NEAR SOURCES OF DUST. THE EXPOSED SOIL AREAS SHALL BE PERIODICALLY MOISTENED. SPRAY-ON ADHESIVES DILUTED IN WATER MAY BE USED.

4. TEMPORARY SOIL STOCKPILES SHALL BE PROTECTED BY A SEDIMENT BARRIER. SIDE SLOPES OF THE STOCKPILES SHALL NOT EXCEED 2 TO 1. THE STOCKPILES SHALL BE STABILIZED WITHIN THIRTY DAYS OF FORMATION OF THE STOCKPILE BY TEMPORARY SEEDING OR COVERING WITH MULCH.

5. TEMPORARY VEGETATIVE COVERS SHALL BE INSTALLED ON ALL DISTURBED AREAS NOT INTENDED FOR PRIMARY CONSTRUCTION AND HAVING THE POTENTIAL TO PRODUCE SEDIMENT AND CAUSE ON- AND OFF-SITE DAMAGES. SUCH AREAS BASED ON RECOMMENDATIONS SHALL BE COVERED WITH TOPSOIL AND SEEDED OF FIGURE 6-1 OF THE "GUIDELINES". FOR ADDITIONAL SEEDING REQUIREMENTS REFER TO CHAPTER 6 OF THE "GUIDELINES".

6. STONE CHECK DAMS SHALL BE INSTALLED AT ANY EVIDENT CONCENTRATED FLOW DISCHARGE POINTS.

7. STORM DRAIN CATCH BASIN INLET PROTECTION SHALL BE PROVIDED THROUGH THE USE OF FILTER FABRIC FENCE OR STONE BARRIERS AROUND THE CATCH BASINS AS INDICATED ON THE SEDIMENT AND EROSION CONTROL DRAWINGS. THE BARRIERS SHALL ONLY BE REMOVED WHEN THE TRIBUTARY DRAINAGE AREA HAS BEEN STABILIZED.

STORM DRAINAGE SYSTEM MAINTENANCE

STORMWATER RENOVATION AREAS:
Semiannual:
1. Cut or mow grass lined swales in Spring & Fall. Swales adjacent to the proposed roadway or units may be mowed more frequently.
2. Inspect for and remove invasive vegetation.
3. Clean and remove debris from inlet and outlet structures.

Annual:
1. Inspect sediment forebay area. Remove sediment once it has built up to a depth 12" or greater in the forebays for Basins A & B.
2. Remove excess leaves and debris. Plant matter shall be left in place over winter months to insulate the soil and add organic matter to the soil. Removal criteria shall include when plant matter is smothering or killing vegetation and aesthetics.
5. Prune trees and shrubs as needed.
6. Add supplemental plantings or seed as needed to maintain 80% area cover for turf areas and 50% area cover for tree/shrub/fern areas.

CATCH BASINS, PIPING, SWALES AND LEVEL SPREADERS:
Catch basins, storm drainage piping, swales and level spreaders will be inspected on an annual basis. Any floatables, trash, debris or sediment build up shall be removed by a licensed contractor. Grass-lined swales and level spreaders will be mowed.

The on-site catch basins, storm drainage manholes, swales, stormwater renovation basins and all aspects of the storm drainage system must be maintained in good working condition in accordance with the intent of these plans.

RESPONSIBILITY:
The owner of the property will be responsible for the long term maintenance of the storm drainage system as listed above. Maintenance reports indicating that the system has been maintained in accordance with the intent of the plan shall be submitted to the Town Land Use Offices & on a semiannual basis after the maintenance & inspections have occurred.

CONSTRUCTION OF STORMWATER RENOVATION AREA BERMS

A. MATERIALS

1. Fill material shall be free of frozen material, sod, brush, roots, stumps and other organic material. Earth embankments shall contain no stones over six inches in diameter. The material used in the core portion of the embankment shall be the most impervious material obtained from the borrow areas, as required. The more pervious materials shall be used in the outer fill portion of the embankment as shown on the plans.

2. The impervious core fill material shall be glacial till, to be provided in sufficient quantities to complete the work. Fill to be approved by the Engineer prior to placement. Glacial till to consist of hard and durable particles or fragments and shall be free from organic matter and other objectionable materials. Glacial till shall conform to the following gradation requirements.

U. S. Standard Sieve Size	Percentage Passing By Weight
3 inch	100
No. 4	60- 95
No. 10	50- 95
No. 40	30- 95
No. 100	20- 65
No. 200	10- 40

B. BERM FOUNDATION PREPARATION

1. All tree clearing shall be flagged prior to any cutting or clearing.

2. The area where the berm is to be constructed shall be cleared and grubbed of all topsoil and other organic materials to a depth of at least 24". Unless otherwise specified on the plans, berm foundation areas shall be scarified to a minimum depth of three inches prior to placement of fill material.

C. PLACEMENT OF FILL

1. All erosion control measures shall be erected prior to placement/excavation of material.

2. No fill shall be placed until the foundation preparation and excavations in the foundation have been completed and approved by the Engineer. No fill shall be placed on a frozen surface nor shall frozen material be incorporated.

3. Embankment material shall be placed in horizontal layers in 12 inch loose lifts. During construction, the surface of the fill shall be sloped to drain. Each layer or lift shall extend over the entire area of the fill.

4. The fill shall be free from lenses, pockets, streaks, or layers of material differing substantially in texture or gradation from the surrounding material. The more pervious material shall be placed in the outside portion of the berm or as indicated on the drawings. The finished fill shall be shaped and graded to the lines and grade shown on the drawings.

5. Pipe backfill shall be placed in horizontal layers not to exceed 6- 8 inch loose lifts and shall be brought up uniformly around the outlet pipe and flared end section.

D. MOISTURE CONTROL

1. The moisture content of materials in the berm shall be controlled to meet the requirements of Section E "Compaction of Berm". When necessary, moisture shall be added by the use of approved sprinkling equipment. Water shall be added uniformly and each layer shall be thoroughly disked or harrowed t provide proper mixing. Any layer found too wet for compaction shall be allowed to dry before rolling. Placing or rolling of materials on earth fills will not be permitted during or immediately after rainfalls which increase the moisture content beyond the limit of satisfactory compaction. The earth fill shall be brought up uniformly and its top shall be kept graded and sloped so that a minimum of rain water will be retained thereon. Compacted earth fill damaged by runoff shall be replaced immediately by the contractor.

E. COMPACTION
1. Berm material shall be compacted to 95% of the standard proctor density at or near optimum moisture content and by the compaction equipment specified herein. The compaction equipment shall traverse the entire surface of each layer of fill material.

2. Approved tamping rollers shall be used for compacting all parts of the berm. The contractor shall demonstrate the effectiveness of the roller by actual soil compaction test results of the soil to be used in the berm with laboratory work performed by an approved soil testing laboratory. Compaction tests shall include modified proctor and nuclear density tests made at the Engineer's discretion. A minimum of three proctor tests shall be performed and density tests shall be performed every 1500 square feet.

3. Pipe backfill shall be compacted by hand tamping with mechanical tampers. Heavy equipment shall not be operated within three feet of any structure. Equipment shall not be allowed to operate over the outlet culverts until there is at least two feet of cover over the pipes.

F. FINISHING EMBANKMENTS

1. The berm shall be constructed to the elevations, lines and grades and cross sections as shown on the plans. The berm shall be maintained in a manner satisfactory to the Engineer and the Town and surfaces shall be compact and and accurately graded before topsoil is placed on them.

2. The topsoil shall be placed at a depth of 5-6" over the disturbed area after completion of construction.

3. Disturbed areas shall be seeded with "New England Environmental Erosion Control Mix for Detention Basins and Moist Sites" or approved equal at a rate of 1 lb. per 5000 square feet or at a rate recommended by the manufacturer.

4. Seeded areas shall be stabilized with hay or mulch until vegetation is firmly established.

5. Seeded areas shall be monitored weekly for erosion and any areas that require reseeding shall be reseed completely and immediately.

EROSION CONTROL NARRATIVE

GENERAL PRINCIPLES

The following general principles shall be maintained as effective means of minimizing erosion and sedimentation during the development process.

Stripping away of vegetation, regrading or other development shall be done in such a way as to minimize erosion.

Grading and development plans shall preserve important natural features, keep cut and fill operations to a minimum, and insure conformity with topography so as to create the least erosion potential and adequately handle the volume and velocity of surface water runoff.

Whenever feasible, natural vegetation shall be retained, protected and supplemented wherever indicated on the site development plan.

The undisturbed area and the duration of exposure shall be kept to a practical minimum.

Disturbed soils shall be stabilized as quickly as possible.

Temporary vegetation and/or mulching shall be used to protect exposed critical areas during development when expected to be exposed in excess of 30 days.

The permanent (final) vegetation and mechanical erosion control measures shall be installed as soon as practical during construction.

Sediment in the runoff water shall be trapped until the disturbed areas is stabilized by the use of debris basins, sediment basins, silt traps or similar measures.

All tracts or developments shall be finally graded to provide proper drainage away from buildings and dispose of it without ponding; and all land within a development shall be graded to drain and dispose of surface water without ponding.

Where drainage swales are used to divert surface waters away from buildings, they shall be sodded or planted.

Concentration of surface runoff shall be only permitted by piping and/or through drainage swales or natural watercourses.

Excavation and Fills --

Slopes created by cuts or fills shall not be steeper than 2:1 and shall be restabilized by temporary or permanent measures, as required during the development process.

Adequate provisions shall be made to prevent surface water from damaging the cut face of excavations or the sloping surfaces of fills.

Cut and fills shall not endanger adjoining property.

All fills shall be compacted to provide stability of material and to prevent undesirable settlement. The fill shall be spread in a series of layers each not exceeding twelve (12) inches in thickness and shall be compacted by a sheep roller or other approved method after each layer is spread.

Fills shall not encroach on natural watercourses, constructed channels or regulated flood plain areas, unless permitted by license or permit from authority having jurisdiction.

Fills placed adjacent to natural watercourses, constructed channels or flood plains shall have suitable protection against erosion during periods of flooding.

Grading shall not be done in such a way as to divert water onto the property of another landowner without their express written consent.

During grading operations, necessary measures for dust control shall be exercised.

Sedimentation and erosion control shall be implemented in accordance with the Guidelines for Soil Erosion and Sediment Control (2002) - State of Connecticut DEP Bulletin 34 or most recent edition.

RESPONSIBILITY FOR THE PLAN

Whenever sedimentation is caused by stripping vegetation and/or grading, it shall be the responsibility of the person, corporation or other entity having responsibility to remove sedimentation from all lower properties, drainage systems and watercourses and to repair any damage at their expense as quickly as possible.

Maintenance of all drainage facilities and watercourses within any subdivision or land development shall be the responsibility of the Connecticut Power Ventures Project Manager until they are accepted by the Town. All control measures will be maintained in effective condition throughout the construction period. Surface inlets shall be kept open and free of sediment and debris. The system shall be checked after every major storm and sediment shall be disposed of at an approved location consistent with the plan.

It shall be the responsibility of any person, corporation or other entity engaging in any act on or near any stream, watercourse or swale or upon the flood plain or right-of-way thereof to maintain as nearly as possible in its present state that same stream, watercourse, swale, flood plain or right-of-way for the duration of the activity and to return it to its original or equal condition after such activity is completed.

Maintenance of drainage facilities or watercourses originating and completely on private property shall be the responsibility of the Connecticut Power Ventures, Inc. their point of open discharge at the property line or at a communal watercourse within property.

No person, corporation or other entity shall block, impede the flow of, alter, construct any structure or deposit any material or thing or commit any act which affects normal or flood flow in any communal stream or watercourse without having obtained prior approval from the Town.

An adequate right-of-way and/or easement shall be provided for all drainage facilities and watercourses which are proposed either for acceptance by the Town or provided by other property owners for the convenience of the OWNER.

Seedbed Preparation
Fine grade and rake surface to remove stones larger than 2" in diameter. Install needed erosion control devices such as surface water diversions. Grade stabilization structures, sediment basins or drainage channels to maintain grassed areas. Apply limestone at a rate of 2 tons/Ac. or 90 lbs/1000 SF unless otherwise required according to soil test results. Apply fertilizers with 10-10-10 at a rate of 300 lbs./Ac. or 7.5 lbs/1000 SF. At least 50% of the nitrogen shall be from organic sources. Work lime and fertilizer into soil uniformity to a depth of 4" with a whisk, springtooth harrow or other suitable equipment following the contour lines.

Seed Application
Apply grass mixtures at rates specified by hand, cyclone seeder or hydroseeder. Increase seed mixture by 10% if hydroseeder is used. Lightly drag or roll the seeded surface to cover seed. Seeding for selected fine grasses should be done between April 1 and June 1 or between August 15 and October 15. If seeding cannot be done during these times, repeat mulching procedure below until seeding can take place or seed with a quick germinating seed mixture to stabilize slopes. A quick germinating seed mixture (Domestic Rye) can be applied between June 15 through August 15 as approved by the Architect or Engineer.

Mulching
Immediately following seeding, mulch the seeded surface with straw, hay or wood fiber at a rate of 1.5 to 2 tons/Ac. except as otherwise specified elsewhere. Mulches should be free of weeds and coarse matter. Spread mulch by hand or mulch blower. Punch mulch into soil surface with track machine or disk harrow set straight up. Mulch material should be "tucked" approximately 2- 3" into the soil surface. Chemical mulch binders or netting, in combination with the straw, hay or wood fibers, will be used where difficult slopes do not allow harrowing by machines.

Grass Seed Mixtures

Temporary Covers		Permanent Covers	
Perennial ryegrass	20 lbs/Ac.	Creeping Red Fescue	40 lbs/Ac.
Annual ryegrass	20 lbs/Ac.	Canada Bluegrass	20 lbs/Ac.

NO.	REVISION	DATE

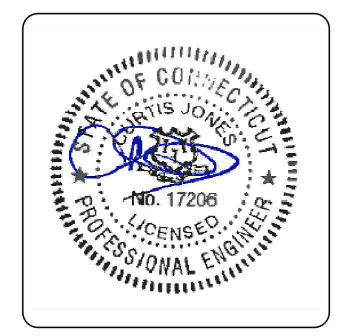
Previous Editions Obsolete

EROSION CONTROL NARRATIVE

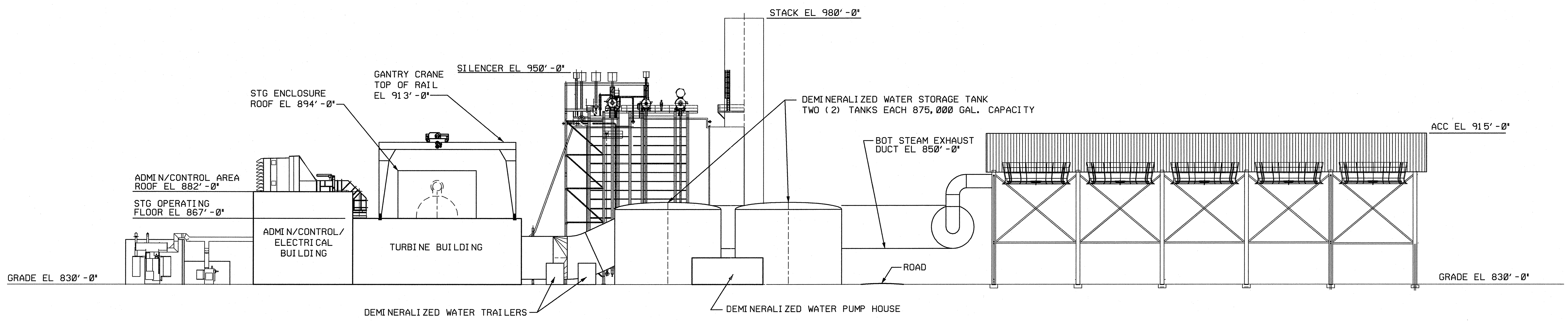
CPV TOWANTIC ENERGY CENTER

OXFORD CONNECTICUT

CORNERSTONE PROFESSIONAL PARK, SUITE D-101
43 SHERMAN HILL ROAD
WOODBURY (203) 266 - 0778 CONNECTICUT



DRAWN: BB APPROVED: CJ
SCALE: N.T.S.
DATE: 26 SEP 14
PROJ. NO.: 98132
CADD FILE NAME: 98132
DRAWING NO.: C 330



ELEVATION LOOKING EAST
M202

GRAPHIC SCALE
0 15' 30' 60' 90'
1"=30.0'

Rev No	Revision	Date	Dwn	Chkd	Approved Chief Engr	Rev No	Revision	Date	Dwn	Chkd	Approved Chief Engr	Rev No	Revision	Date	Dwn	Chkd	Approved Chief Engr

Drawing Control				
Purpose	Approved By	Date	Released By	Date
For Information	[signature]	9/8/14	[signature]	9/8/14
For Comment				
For Bid				
For Fabrication				
For Construction				

Engineering Review		
Disc	Engr	Date
Mech		
Elec		
Civil		
Arch		
Instr		
Drawn	Designed	Checked
JGF	JGF	
Lead Engineer	Date	
	Scale 1"=30'-0"	

CPV TOWANTIC ENERGY CENTER
OXFORD, CONNECTICUT

GENERAL ARRANGEMENT
ELEVATION LOOKING EAST

BURNS AND ROE ENTERPRISES, INC.
Engineers and Constructors - Oradell, NJ
Connecticut License No. PEC 39

Approved for Construction	Work Order	Drawing No	Sh	Rev
Chief MECHANICAL Engineer	3328	M301		B

M301.DGN 11:12 08-SEP-2014

APPENDIX D – SOUND SURVEY AND ANALYSIS

Sound Survey and Analysis Report

CPV Towantic Energy Center
Oxford, Connecticut

August 2014

Prepared for:

CPV Towantic, LLC
50 Braintree Hill Office Park, Suite 300
Braintree, MA 02184

Prepared by:

Tetra Tech, Inc.
238 Littleton Road, Suite 201-B
Westford, MA 01886

TETRA TECH

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
μPa	microPascal
ACC	air-cooled condenser
ANSI	American National Standards Institute
CSC	Connecticut Siting Council
dB	decibel
dBA	A-weighted decibel
dBL	linear decibel
DEEP	Connecticut Department of Energy and Environmental Protection
GE	General Electric
CT	combustion turbine
CTG	combustion turbine generator
HRSG	heat recovery steam generator
Hz	Hertz
ISO	International Organization for Standardization
kHz	kiloHertz
L_{eq}	equivalent sound level
L_{dn}	day-night noise level
L_{min}	minimum sound level
L_{max}	maximum sound level
L_w	sound power level
L_p	sound pressure level (measured in dB referenced to 20 μPa)
$L_{i(c)}$	interior sound pressure level
ML	Monitoring Location
mph	miles per hour
MW	megawatts
NEMA	National Electrical Manufacturers Association
NIST	National Institute of Standards and Technology
the Project	CPV Towantic Energy Center
STC	Sound Transmission Class
STG	steam turbine generator
Tetra Tech	Tetra Tech, Inc.
USEPA	United States Environmental Protection Agency
UTM	Universal Transverse Mercator

1.0 INTRODUCTION

Tetra Tech, Inc. (Tetra Tech) has prepared this report for the proposed CPV Towantic Energy Center (the Project) to support a Petition to the Connecticut Siting Council (CSC) to modify its Certificate of Environmental Compatibility and Public Need. The Project has a net nameplate capacity of 785 megawatts (MW) utilizing two highly efficient General Electric (GE) Frame 7HA.01 combustion turbine generators (CTG) operating in a combined-cycle mode. As a combined-cycle power plant, the exhaust heat of the CTG is used in the heat recovery steam generator (HRSG) to produce steam to generate additional energy in a steam turbine generator (STG). The two CTGs and the STG are located in separate acoustically-treated building enclosures. An air-cooled condenser (ACC) is located south of the CTG and STG building enclosures. Other external equipment on-site includes transformers, a fuel gas metering station, and switchyard.

This report provides background information on concepts related to environmental sound including: descriptions of the noise metrics used throughout the report; applicable noise standards and regulations; the results of the ambient sound measurement program; and predicted noise levels from full-load operation of Project equipment;.

The objectives of this report are to:

- Identify noise-sensitive land uses in the area that may be affected by the proposed Project;
- Describe the standards to which the Project is held;
- Document the existing ambient noise levels in the area;
- Identify the principal noise source levels associated with the Project;
- Propose practicable measures to minimize noise impacts associated with operation of the Project[1]. ; and
- Assess the potential impact of the Project on noise levels through the use of a predictive acoustic modeling analysis.

1.1 SITE DESCRIPTION

The Project site is located within the Town of Oxford in New Haven County, just south of the Middlebury, Connecticut town line. The Project footprint is situated along the eastern side of Woodruff Hill Road, adjacent to the south of an Algonquin Gas Transmission right-of-way. The Spectra Compressor Station and associated access road, built in 2008, form the southern and eastern boundaries of the Project site.

Located within an industrially-zoned district designated for the Woodruff Hill Industrial Park, the Project site encompasses approximately 26 acres. An electric transmission line right-of-way extends across the northwest corner of the Project site running southwest to northeast. The Waterbury-Oxford Airport is located approximately 0.8 kilometers (½ mile) west of the Project site, and the nearest residence is located approximately 274 meters (900 feet) to the south, along Towantic Hill Road.

The Project site consists of undeveloped woodland and open, agricultural fields, characterized by undulating topography with elevations that range between approximately 247 meters (810 feet) and 271 meters (890 feet) above mean sea level. Much of the Project lies at a higher elevation than the surrounding area, with a steep incline off Woodruff Hill Road.

[1] These mitigation measures are only to demonstrate the feasibility of the Project to meet the specific noise requirements; the final design may incorporate different mitigation measures in order to achieve the same objective as demonstrated in this assessment.

Most of the surrounding area to the west of the Project is zoned for industrial development, as part of the Woodruff Hill Industrial Park, with the Waterbury-Oxford Airport lying further west. To the north of the Project lies undeveloped wooded land, with the Middlebury town boundary located 163 meters (535 feet) north of the Project boundary marking the closest residentially-zoned area. Land use surrounding the site is predominately undeveloped, with residential neighborhoods to the north and northwest, in Middlebury, and southeast, along Towantic Hill Road. Figure 1 provides an overview of the Project area as well as the closest noise sensitive land uses.

1.2 SITE HISTORY AND DEVELOPMENT

Originally permitted in 1999, the 20-acre Project site was located within an industrially-zoned area proposed as the Woodruff Hill Industrial Park on the eastern side of the then-proposed Woodruff Hill Road. The net nameplate 512-MW combined-cycle electric generating facility was composed of two GE Frame 7FA.03 turbines and associated HRSGs, a single STG, and two 160-foot tall exhaust stacks. The proposed facility also included an ACC, water and fuel storage tanks, electric switchyard, and administration and control building.

A baseline noise study was conducted to characterize and quantify the existing sources of noise prior to development of the proposed facility. Measurements were taken at three locations identified within proximity to the Project site. Results from this survey found noise levels between 48.5 and 50.5 A-weighted decibels (dBA)[2] during daytime hours and between 42.6 and 45.1 dBA during nighttime hours. With appropriate noise mitigation, operational noise impacts were predicted to be in full compliance with State of Connecticut and Town of Oxford noise control regulations. Noise control measures to be employed included: high performance noise-attenuating enclosures for each combustion turbine; buildings using high-transmission loss wall construction enclosing the combustion turbines (CTs), steam-turbine, and STG; silencers within the HRSG or within the exhaust stacks; low-noise fans on the ACC; prudent placement of building ventilation openings (oriented away from nearby residences where possible); prudent siting of fixed structures, such as tank farms and buildings, so as to shield residences from noise sources; and air intake silencers on the inlet ducts of the combustion turbines. The nearest residence identified in 1998 was located approximately 372 meters (1,220 feet) north of the property boundary.

Since 1999, little has changed on the Project site. The Project site still remains undeveloped (except for the existing transmission line that traverses its northwest corner) with a mixture of forested area, shrub-covered land, and cleared fields previously used for agricultural production. The electric transmission right-of-way and natural gas transmission pipeline remain, with the addition of a compressor station located adjacent to the northeast of the site. Woodruff Hill Road was developed to support construction of the compressor station in 2008. Cast Global was constructed in 2010 off Prokop Road. These two facilities remain the only developments within the Woodruff Hill Industrial Park.

In addition to the original 20-acre parcel within the Woodruff Hill Industrial Park, the site has been expanded to include Lot 9A, a 6-acre parcel located south of the original 20-acre property. The additional property allows for additional and relocated stormwater management features to reflect current. Residential development has expanded to the north and southeast of the site, and although no new residentially-zoned areas exist in closer proximity, the addition of Lot 9A has reduced the distance to the nearest residence to approximately 274 meters (900 feet) south of the Project site boundary.

[2] See Table 2 for a description of noise metrics used in this report.

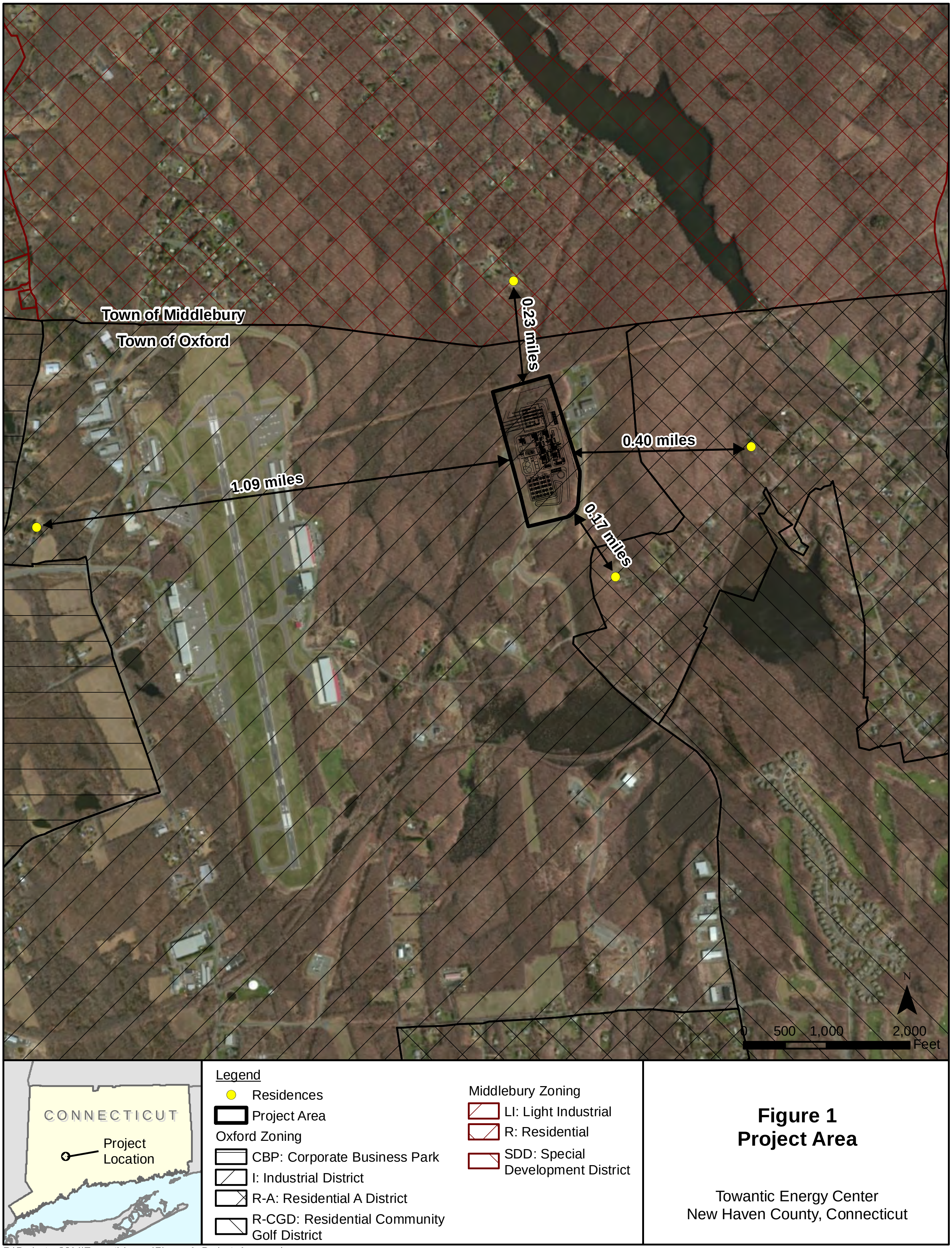


Figure 1
Project Area

Towantic Energy Center
New Haven County, Connecticut

R:\Projects_2014\Towantic\maps\Figure_1_Project_Area.mxd

1.3 ACOUSTIC METRICS AND TERMINOLOGY

All sounds originate with a source, whether it is a human voice, motor vehicles on a roadway, or a combustion turbine. Energy is required to produce sound and this sound energy is transmitted through the air in the form of sound waves – tiny, quick oscillations of pressure just above and just below atmospheric pressure. These oscillations, or sound pressures, impinge on the ear, creating the sound we hear. A sound source is defined by a sound power level (abbreviated "L_w"), which is independent of any external factors. By definition, sound power is the rate at which acoustical energy is radiated outward and is expressed in units of watts.

A source sound power level cannot be measured directly. It is calculated from measurements of sound intensity or sound pressure at a given distance from the source outside the acoustic and geometric near-field. A sound pressure level (abbreviated "L_p") is a measure of the sound wave fluctuation at a given receiver location, and can be obtained through the use of a microphone or calculated from information about the source sound power level and the surrounding environment. The sound pressure level in decibels (dB) is the logarithm of the ratio of the sound pressure of the source to the reference sound pressure of 20 microPascals (µPa), multiplied by 20.[3] The range of sound pressures that can be detected by a person with normal hearing is very wide, ranging from about 20 µPa for very faint sounds at the threshold of hearing to nearly 10 million µPa for extremely loud sounds, such as a jet during take-off at a distance of 300 feet.

Broadband sound includes sound energy summed across the entire audible frequency spectrum. In addition to broadband sound pressure levels, analysis of the various frequency components of the sound spectrum can be completed to determine tonal characteristics. The unit of frequency is Hertz (Hz), measuring the cycles per second of the sound pressure waves. Typically the frequency analysis examines 11 octave bands ranging from 16 Hz (low) to 16,000 Hz (high). Since the human ear does not perceive every frequency with equal loudness, spectrally-varying sounds are often adjusted with a weighting filter. The A-weighted filter is applied to compensate for the frequency response of the human auditory system, and is represented in dBA.

Sound can be measured, modeled, and presented in various formats, with the most common metric being the equivalent sound level (L_{eq}). The equivalent sound level has been shown to provide both an effective and uniform method for comparing time-varying sound levels and is widely used in acoustic assessments in the State of Connecticut. Estimates of noise sources and outdoor acoustic environments, and the comparison of relative loudness are presented in Table 1. Table 2 presents additional reference information on terminology used in the report.

Table 1. Sound Pressure Levels (L_p) and Relative Loudness of Typical Noise Sources and Acoustic Environments

Noise Source or Activity	Sound Level (dBA)	Subjective Impression
Vacuum cleaner (10 feet)	70	Moderate
Passenger car at 65 miles per hour (mph) (25 feet)	65	
Large store air-conditioning unit (20 feet)	60	
Light auto traffic (100 feet)	50	Quiet
Quiet rural residential area with no activity	45	
Bedroom or quiet living room; Bird calls	40	Faint

[3] The sound pressure level (L_p) in dB corresponding to a sound pressure (p) is given by the following equation:

$$L_p = 20 \log10 \, (p / pref);$$

Where:

p = the sound pressure in µPa; and
pref = the reference sound pressure of 20 µPa.

Noise Source or Activity	Sound Level (dBA)	Subjective Impression
Typical wilderness area	35	
Quiet library, soft whisper (15 feet)	30	Very quiet
Wilderness with no wind or animal activity	25	Extremely quiet
High-quality recording studio	20	
Acoustic test chamber	10	Just audible
	0	Threshold of hearing

Adapted from: Kurze and Beranek (1988) and United States Environmental Protection Agency (1971)

Table 2. Acoustic Terms and Definitions

Term	Definition
Noise	Typically defined as unwanted sound. This word adds the subjective response of humans to the physical phenomenon of sound. It is commonly used when negative effects on people are known to occur.
Sound Pressure Level (L_p)	Pressure fluctuations in a medium. Sound pressure is measured in dB referenced to 20 μPa, the approximate threshold of human perception to sound at 1,000 Hz.
Sound Power Level (L_w)	The total acoustic power of a noise source measured in dB referenced to picowatts (one trillionth of a watt). Noise specifications are provided by equipment manufacturers as sound power since it is independent of the environment in which it is located. A sound level meter does not directly measure sound power.
A-Weighted Decibel (dBA)	Environmental sound is typically composed of acoustic energy across all frequencies. To compensate for the auditory frequency response of the human ear, an A-weighting filter is commonly used for describing environmental sound levels. Sound levels that are A-weighted are presented as dBA in this report.
Unweighted Decibels (dBL)	Unweighted sound levels are referred to as linear. Linear decibels are used to determine a sound's tonality and to engineer solutions to reduce or control noise as techniques are different for low and high frequency noise. Sound levels that are linear are presented as dBL in this report.
Propagation and Attenuation	Propagation is the decrease in amplitude of an acoustic signal due to geometric spreading losses with increased distance from the source. Additional sound attenuation factors include air absorption, terrain effects, sound interaction with the ground, diffraction of sound around objects and topographical features, foliage, and meteorological conditions including wind velocity, temperature, humidity, and atmospheric conditions.
Octave Bands	The audible range of humans spans from 20 to 20,000 Hz and is typically divided into center frequencies ranging from 31 to 8,000 Hz.
Broadband Noise	Noise which covers a wide range of frequencies within the audible spectrum, i.e., 200 to 2,000 Hz.
Frequency (Hz)	The rate of oscillation of a sound, measured in units of Hz or kilohertz (kHz). One hundred Hz is a rate of one hundred times (or cycles) per second. The frequency of a sound is the property perceived as pitch: a low-frequency sound (such as a bass note) oscillates at a relatively slow rate, and a high-frequency sound (such as a treble note) oscillates at a relatively high rate. For comparative purposes, the lowest note on a full range piano is approximately 32 Hz and middle C is 261 Hz.

2.0 NOISE LEVEL REQUIREMENTS AND GUIDELINES

Potential noise impacts resulting from the operation of the Project were evaluated with respect to the Connecticut regulations for the Control of Noise established by the Connecticut Department of Energy and Environmental Protection (DEEP) at Section 22a-69. In addition, Chapter 95 of the Town of Oxford Code of Ordinances contains guidance pertaining to noise, which is generally consistent with the DEEP noise regulations, with some exceptions.

2.1 CONNECTICUT DEPARTMENT OF ENERGY AND ENVIRONMENTAL PROTECTION

The DEEP noise control regulations in Section 22a-69-3.1 which prescribe noise limits according to land use category, as reflected by zoning, are shown in Table 3.

Table 3. DEEP Noise Limits

Emitter	Receptor (dBA)			
	Class C	Class B	Class A Daytime (7:00 am – 10:00 pm)	Class A Nighttime (10:00 pm – 7:00 am)
Class C – Industrial	70	66	61	51
Class B – Commercial and Retail Trade	62	62	55	45
Class A – Residential Areas and other sensitive areas	62	55	55	45

The regulations also prescribe provisions for impulse noise, not allowing impulse noise in excess of 80 dB (peak) during nighttime hours in any Class A zone and not allowing impulse noise in excess 100 dB (peak) at any time to any zone. In addition, in the event that noise is generated that includes one or more audible discrete tones, it would be considered excessive noise if a level of 5 dBA below the levels specified in Table 3 is exceeded. A limit of 100 dB is also given pertaining to infrasonic and ultrasonic noise. Construction noise is exempt from the DEEP noise regulations.

2.2 TOWN OF OXFORD NOISE ORDINANCE

The Town of Oxford provides noise level standards applicable to the Project under Chapter 95 of the Code of Ordinances. Table 4 presents the Town noise-level standards, which are consistent with those prescribed by the DEEP for residential areas, but vary slightly for commercial and industrial land uses. Guidance pertaining to impulse sound and elevated background sound levels is consistent with what is provided by the DEEP. Construction during daytime hours is exempt from the noise level standards.

Table 4. Town of Oxford Noise Level Standards

Emitter	Receptor (dBA)			
	Industrial	Commercial	Residential Daytime (7:00 am – 10:00 pm)	Residential Nighttime (10:00 pm – 7:00 am)
Industrial	70	62	61	51
Commercial	66	62	55	45
Residential	62	55	55	45

3.0 EXISTING ENVIRONMENT

Tetra Tech conducted a series of ambient sound level measurements to characterize the existing acoustic environment in the vicinity of the proposed Project. This section summarizes the methodologies used by Tetra Tech to conduct the sound survey, describes the measurement locations, and presents the results of the ambient sound levels.

3.1 FIELD METHODOLOGY

Ambient sound measurements were performed on June 16 and 17, 2014. The measurements were conducted using a Larson Davis Model 831 precision integrating sound-level meter that meets the requirements of American National Standards Institute (ANSI) Standards for Type 1 instruments. This instrument has an operating range of 5 dB to 140 dB, and an overall frequency range of 8 to 20,000 Hz. During the measurements, the microphone was fitted with a windscreen, set upon a tripod at a height of approximately 1.5 meters (5 feet) above the ground, and located out of the influence of any vertical reflecting surfaces. The sound level meter was calibrated at the beginning and end of the measurement period using a Larson Davis Model CAL200 acoustic calibrator following procedures that are traceable to the National Institute of Standards and Technology (NIST). Table 5 lists the measurement equipment employed during the survey; the NIST laboratory calibration certifications are provided in Appendix A. The sound level meters were programmed to sample and store A-weighted and octave band sound level data, including L_{eq} and the percentile sound levels.

Table 5. Measurement Equipment

Description	Manufacturer	Type	Serial Number
Signal Analyzer	Larson Davis	831	3218
Preamplifier	Larson Davis	PRM902	23898
Microphone	PCB	377B02	140146
Windscreen	ACO Pacific	7-inch	NA
Calibrator	Larson Davis	CAL200	9540

During the survey there was no precipitation, and temperatures ranged from 78 (daytime) to 53 (nighttime) degrees Fahrenheit. Wind speeds were generally low, ranging from 4 to 5 mph, with occasional gusts up to 10 mph. Atmospheric conditions during the survey period were conducive for the collection of accurate sound measurements with clear skies and dry weather.

3.2 MEASUREMENT LOCATIONS

Short-term, attended sound measurements were performed at four locations in adjoining residentially-zoned areas, as shown on Figure 2. The measurement locations were selected to be reflect the positions previously monitored in the 1998 sound survey, designed as Monitoring Locations (ML) 1, 2, and 3. An additional monitoring location was also selected (ML 4), as additional residential development has occurred in the area since the 1998 survey. Measurements of 30 minutes in duration were made at each location for daytime (10:00 am to 4:00 pm) periods and nighttime periods (10:00 pm to 2:00 am) during a typical weekday. The measurement locations are mapped on Figure 2 and described below in Table 6. Additional descriptions of the monitoring locations and field observations are provided in Sections 3.2.1 through 3.2.4.

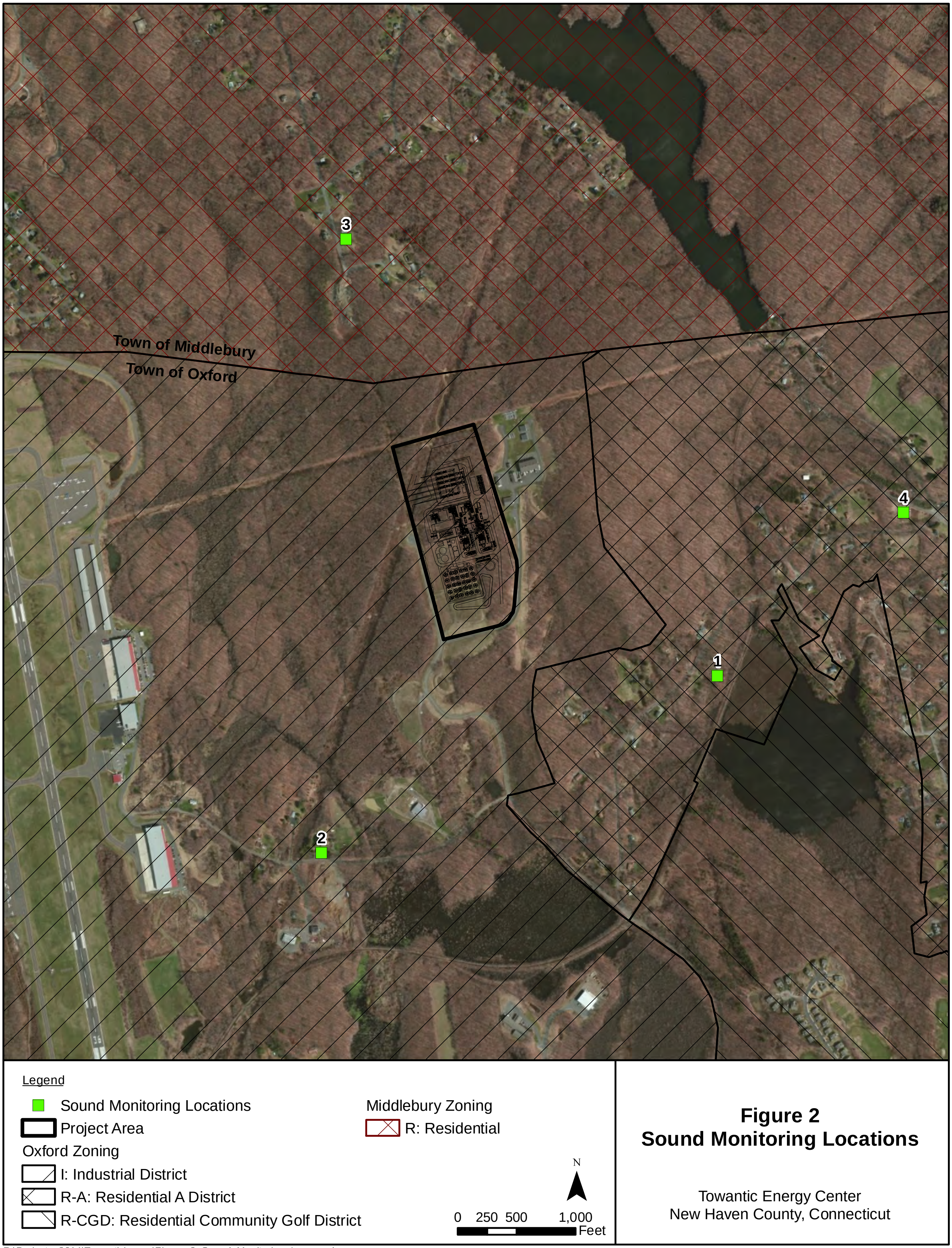


Figure 2
Sound Monitoring Locations

Towantic Energy Center
New Haven County, Connecticut

R:\Projects_2014\Towantic\maps\Figure_2_Sound_Monitoring_Locs.mxd

Table 6. Baseline Sound Monitoring Locations

Map ID	Nearest Residential Address	Coordinates (UTM[1] Zone 18N)		Distance and Direction from the Project
		Easting (meters)	Northing (meters)	
ML-1	54 Towantic Hill Rd, Oxford, CT	657354	4593850	530 m (1,739 ft) Southeast
ML-2	72 Prokop Rd, Oxford, CT	656437	4593338	660 m (2,165 ft) Southwest
ML-3	444 Washington Dr, Middlebury, CT	656466	4594881	475 m (1,558 ft) North
ML-4	14 Longmeadow Rd	657971	4594296	1,200 m (3,937 ft) East

[1] Universal Transverse Mercator

3.2.1 Monitoring Location 1: Towantic Hill Road

ML 1 is approximately 530 meters (1,739 feet) southeast of the Project site. The measurement was taken across from the residential address of 54 Towantic Hill Road, Oxford at the entrance to a gated private road. Daytime sound measurements were collected from 10:45 am to 11:15 am. Field observations identified a dominant acoustic source of motor vehicle traffic on Towantic Hill Road, aircraft flyovers from the Waterbury-Oxford Airport, birds chirping, and other natural sounds. All of these sources are considered typical for this residential environment near a busy narrow roadway. Nighttime sound measurements were collected from 11:25 pm to 11:55 pm. Field observations identified light motor vehicle traffic on Towantic Hill Road, aircraft flyovers from the Waterbury-Oxford Airport, tree leaves rustling, and other natural sounds. Nighttime levels were noticeably lower than daytime levels due to the lower contribution of nearby motor vehicle and aircraft traffic. Figure 3 presents a view of the measurement location to the northeast facing toward the Project. Figure 4 presents a view of the measurement location to the south facing toward Towantic Hill Road and the residence closest to the Project.

Figure 3: View from ML 1 looking Northeast

Figure 4: View from ML 1 looking South toward the residence

3.2.2 Monitoring Location 2: Prokop Road

ML 2 is approximately 660 meters (2,165 feet) southwest of the Project site. The measurement was taken across from the residential address of 72 Prokop Road, Oxford, at the entrance to a gated private construction road. Daytime sound measurements were collected from 2:17 pm to 2:47 pm. Field observations identified a dominant acoustic source of motor vehicle traffic on Prokop Road, aircraft flyovers from the Waterbury-Oxford Airport, a distant air conditioning unit running at the residence, wind rustling tree leaves, birds chirping, and other natural sounds. Nighttime sound measurements were collected from 12:02 am to 12:32 am. Field observations identified no motor vehicle traffic on Prokop Road; however, distant traffic noise was noted. Other sources included aircraft flyovers from the Waterbury-Oxford Airport, frogs, crickets, and other natural sounds. Nighttime levels were noticeably lower than daytime levels due to the lower contribution of nearby motor vehicle and aircraft traffic. Figure 5 presents a view of the measurement location to the northeast facing toward the Project. Figure 6 presents a view of the measurement location to the northwest facing toward the residence located on Prokop Road.

Figure 5: View from ML 2 looking Northeast toward the Project

Figure 6: View from ML 2 looking Northwest toward the residence

3.2.3 Monitoring Location 3: Washington Drive

ML 3 is approximately 475 meters (1,558 feet) north of the Project site. The measurement was taken across from the residential address of 444 Washington Drive, Middlebury, at the intersection of and adjacent to residences on Club House Drive near the entrance to a gated private road. Daytime sound measurements were collected from 3:12 pm to 3:42 pm. Field observations identified light traffic at the intersection, aircraft flyovers from the Waterbury-Oxford Airport, birds chirping, and other natural sounds. All of these sources are considered typical for this residential environment. Nighttime sound measurements were collected from 12:49 am to 1:19 am. Field observations identified no nearby motor vehicle traffic; however, distant traffic, presumed to be fromInterstate 84, was noted. Other sources included aircraft flyovers from the Waterbury-Oxford Airport, frogs, wind rustling tree leaves, and other natural sounds. Figure 7 presents a view of the measurement location to the south/southeast facing toward the Project and Club House Drive. Figure 8 presents a view of the measurement location to the north facing toward Washington Drive and the closest house, 444 Washington Drive.

Figure 7: View from ML 3 looking Southeast

Figure 8: View from ML 3 looking North toward the residence

3.2.4 Monitoring Location 4: Long Meadow Road

ML 4 is approximately 1,200 meters (3,937 feet) east of the Site. The measurement was taken adjacent to the residential address of 14 Long Meadow Road, Oxford. Long Meadow Road is a dead end road with a creek situated approximately 27 meters to the south toward the intersection of Towantic Hill Road. Daytime sound measurements were collected from 11:30 am to 12:00 pm. Field observations identified a dominant acoustic source of water flowing through the nearby creek, light traffic at the intersection, aircraft flyovers from the Waterbury-Oxford Airport, birds chirping, and other natural sounds. Nighttime sound measurements were collected from 10:50 pm to 11:19 pm. Field observations identified the dominant acoustic source of water flowing through the nearby creek, light motor vehicle traffic, aircraft flyovers from the Waterbury-Oxford Airport, dogs barking, wind rustling tree leaves, and other natural sounds. Nighttime levels were consistent with daytime levels due to the ongoing contribution of the daytime and nighttime sound source from the nearby creek. Figure 9 presents a view of the measurement location to the west/northwest facing toward the Project and Long Meadow Road. Figure 10 presents a view of the measurement location to the north facing toward 14 Long Meadow Road.

Figure 9: View from ML 4 looking North toward the residence

Figure 10: View from ML 4 looking Northwest

3.3 MEASUREMENT RESULTS

Tables 7 and 8 provide a summary of the measured ambient sound levels. For each monitoring location the average daytime and nighttime L_{eq}, L_{10}, L_{50}, and L_{90} values; L_{dn} values; and representative daytime and nighttime octave band sound pressure levels are provided.

Table 7. Sound Measurement Results

		Sound Level Metrics (dBA)			
Monitoring Location	**Time Period**	L_{eq}	L_{10}	L_{50}	L_{90}
ML-1	Day	52	52	37	30
	Night	41	32	28	27
ML-2	Day	49	51	38	35
	Night	37	39	35	33
ML-3	Day	50	51	41	35
	Night	41	44	40	38
ML-4	Day	50	51	48	48
	Night	49	49	48	48

Table 8. Sound Measurement Results – Composite L_{eq} Octave Band Center Frequencies

Monitoring Location	Time Period	1/1 L_{eq} Octave Band Sound Pressure Levels (dB)											
		8 Hz	16 Hz	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	16 kHz
ML-1	Day	49	53	54	57	53	48	48	49	43	35	27	14
	Night	46	49	46	49	41	36	34	38	32	23	15	13
ML-2	Day	60	57	65	59	54	50	47	46	35	29	21	12
	Night	43	46	45	44	43	34	28	26	26	33	14	11
ML-3	Day	63	55	51	55	56	50	48	45	41	35	26	16
	Night	67	60	54	45	40	38	37	35	34	33	26	16
ML-4	Day	48	48	48	53	54	50	46	46	43	38	29	17
	Night	48	47	50	48	45	41	42	44	43	39	31	17

Results of the ambient sound survey show that sound levels surrounding the Project area are at moderate levels reflective of sound sources within their area-specific environment (i.e., near an airport, roadway, or creek). Ambient sound levels also exhibited a typical diurnal pattern, with higher ambient sound levels during the day than at night. Daytime L_{eq} sound levels at the measurement locations ranged from low of 49 dBA at ML 2 to a high of 52 dBA at ML 1 (in line with the formerly identified range of 48.5 to 50.5 dBA). Nighttime sound levels ranged from a low of 37 dBA at ML 2 to 49 dBA at ML 4 (also similar to the formerly identified range of 42.6 to 45.1 dBA). Ambient characteristics of the Project surroundings do not appear to have materially changed over the intervening years. The highest sound levels presented for ML 4, situated east of the Project area, are expected, given the dominant source of the water running through the nearby creek during both the daytime and nighttime measurement periods. This is also shown in the relatively constant background sound levels with little variation between the L_{90} and L_{10} percentile values. The varied sound levels during the daytime versus nighttime at ML 1 and 2 situated southeast and southwest of the Project area, respectively, are expected given the dominant daytime sources of aircraft and roadway traffic which tend to fluctuate over time, and contribute considerably less during the nighttime measurements with lower human activity levels during the overnight period. The sound levels presented for ML 3, situated north of the Project area, were the lowest during the daytime measurement period due to lowest observed traffic within that area. The dominant source within this area during the nighttime measurement period was natural sounds such as wind in trees tree, insects, and frogs. During the daytime measurement periods, noise from aircraft overflights also contributed to the measured ambient sound levels.

4.0 OPERATIONAL NOISE IMPACT ANALYSIS

This section describes the methods and input assumptions used to calculate noise levels due to normal operation of the Project, and the results of the noise impact analysis.

4.1 NOISE PREDICTION MODEL

The Cadna-A® computer noise model was used to calculate sound pressure levels from the operation of the Project equipment in the vicinity of the site. An industry standard, Cadna-A® was developed by DataKustik GmbH to provide an estimate of sound levels at distances from sources of known sound emission. It is used by acousticians and acoustic engineers due to the capability to accurately describe noise emission and propagation from complex facilities consisting of various equipment types like the Project and in most cases yields conservative results of operational noise levels in the surrounding community.

The current International Organization for Standardization (ISO) standard for outdoor sound propagation, ISO 9613 Part 2 – "Attenuation of sound during propagation outdoors," was used within Cadna-A.® The method described in this standard calculates sound attenuation under weather conditions that are favorable for sound propagation, such as for downwind propagation or atmospheric inversion, conditions which are typically considered worst-case. The calculation of sound propagation from source to receiver locations consists of full octave band sound frequency algorithms, which incorporate the following physical effects:

- Geometric spreading wave divergence;
- Reflection from surfaces;
- Atmospheric absorption at 10 degrees Celsius and 70 percent relative humidity;
- Screening by topography and obstacles;
- The effects of terrain features including relative elevations of noise sources;
- Sound power levels from stationary and mobile sources;
- The locations of noise-sensitive land use types;
- Intervening objects including buildings and barrier walls;
- Ground effects due to areas of pavement and unpaved ground;
- Sound power at multiple frequencies;
- Source directivity factors;
- Multiple noise sources and source type (point, area, and/or line); and
- Averaging predicted sound levels over a given time period.

Cadna-A® allows for three basic types of sound sources to be introduced into the model: point, line, and area sources. Each noise-radiating element was modeled based on its noise emission pattern. Point sources were programmed for concentrated small dimension sources such as building ventilation fans that radiate sound hemispherically. Line sources are used for linear-shaped sources such as ducts and pipelines. Larger dimensional sources such as the HRSGs and building walls were modeled as area sources. Noise walls, equipment enclosures, stacks, and plant equipment were modeled as solid structures since diffracted paths around and over structures tend to reduce computed noise levels. The interaction between sound sources and structures was taken into account with reflection loss. The storage tanks were modeled as obstacles impeding noise propagation. The reflective characteristic of the structure is quantified by its reflection loss, which is typically defined as smooth façade from which the reflected sound energy is 2 dB less than the incident sound energy. Transformer fire walls and sound barriers were modeled as reflective or absorptive barriers.

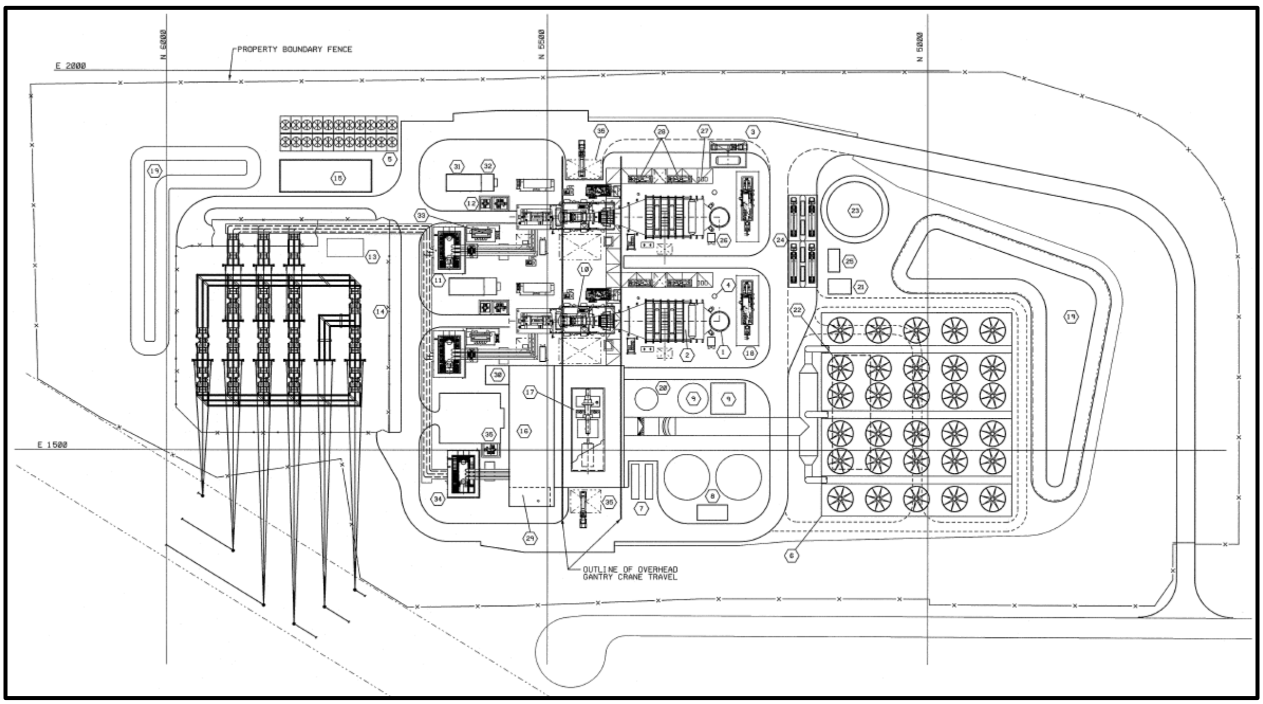
Off-site topography was obtained using the publically available United States Geological Survey digital elevation data. A default ground attenuation factor of 0.5 was assumed for off-site sound propagation over acoustically “mixed” ground. A ground attenuation factor of 0.0 for a reflective surface was assumed for paved on-site areas.

The output from Cadna-A® includes tabular sound level results at selected receiver locations and colored noise contour maps (isopleths) that show areas of equal and similar sound levels.

4.2 INPUT TO THE NOISE PREDICTION MODEL

The Project’s general arrangement was reviewed and directly imported into the acoustic model so that on-site equipment could be easily identified, buildings and structures could be added, and sound power data could be assigned to sources as appropriate. Figure 11 shows the Project equipment layout utilized based on Burns and Roe Enterprises Drawing No. M300.

Figure 11: Project Equipment Layout



The primary noise sources during base load operation are the ACC, STG, and CTG, main step-up transformers, combustion inlet face and filter house, the exhaust stack, and HRSG. Reference sound power levels used as input to Cadna-A® were provided by equipment manufacturers, based on information contained in reference documents, or developed using empirical methods. The source levels used in the predictive modeling are based on estimated sound power levels that are generally deemed to be conservative. The projected operational noise levels are based on vendor-supplied estimated sound power level data for the major sources of equipment including the power generation package. The sound power level (abbreviated “L_W”) is defined as ten times the logarithm (to the base 10) of the ratio of a given sound power to the reference sound power of 1 picowatt. Sound power is defined as the rate per unit time at which sound energy is radiated from a source and is expressed in terms of watts. Table 9 summarizes the equipment sound power level data used as inputs to the modeling analysis.

Table 9. Modeled Octave Band Sound Power Level (L_p) for Major Pieces of Project Equipment

Sound Source	Type[1]	Sound Power Level (L_p) by Octave Band Frequency dBL									Broadband Level
		31.5	63	125	250	500	1k	2k	4k	8k	dBA
CT Air Inlet Face w/ 8-foot Silencer	L_w	113	116	116	101	94	95	98	91	79	104
CT Air Inlet Plenum	L_w	102	96	93	90	92	97	97	94	83	102
Boiler Feedwater Pumps	L_w	101	106	108	99	104	103	102	97	93	108
CT[2]	L_w	108	106	103	99	100	101	104	107	95	111
CT Load Compartment[2]	L_w	96	101	99	91	94	99	98	93	83	103
CTG[2]	L_w	101	120	113	103	102	97	93	90	79	104
Steam Turbine[2]	L_w	112	112	108	107	106	101	96	94	93	107
STG[2]	L_w	106	106	105	102	104	103	102	97	88	108
Turbine Compartment Vent Fans	L_w	102	102	110	101	98	95	94	98	95	104
Fuel Gas Piping	L_w	104	100	89	81	80	86	88	91	89	96
HRSG Body and Inlet	L_w	115	119	118	108	94	92	85	68	51	105
HRSG Accessories Package	L_w	106	110	109	103	94	90	78	69	62	99
Stack Exit (90 degrees directivity)	L_w	111	118	117	108	93	90	75	66	59	104
ACC	L_p	68	70	64	57	55	54	47	39	20	58
Auxiliary Fin Fan Cooler	L_w	97	100	98	97	97	95	94	92	90	101
Condenser	L_w	100	101	100	98	99	93	88	83	79	107
Main Step-up Transformer	L_w	103	102	106	99	103	94	90	85	78	102
Auxiliary Transformer	L_w	90	96	98	93	93	87	82	77	70	93
Fuel Oil Pump	L_w	104	104	103	105	107	105	107	100	93	111
Fuel Gas Metering	L_w	96	85	82	75	82	83	93	90	88	97
Fuel Gas Heater	L_w	84	88	93	85	94	97	98	101	91	105
Auxiliary Steam Boiler	L_w	101	101	100	98	95	92	89	86	83	98
STG Building Enclosure (all interior sources)	$L_{i(c)}$	89	87	94	84	81	80	75	65	56	85
Control /Auxiliary Boiler Building (all interior sources)	$L_{i(c)}$	81	82	81	79	80	74	69	64	60	80
CT Lube Oil Module[2]	L_w	102	105	101	100	99	97	97	95	87	103

[1] "L_w" is the sound power level in dBL, and dBA broadband, (re: 1 picoWatt). "$L_{i(c)}$" is the calculated average interior sound pressure in dB, and dBA broadband, (re: 20 μPa), within a building or structure, based on the sound power levels of noise sources located within that building or structure. L_P is the sound pressure level from the ACC at a reference distance of 400 feet. Data presented may contain Project proprietary information and is not intended for use for any other purposes.

[2] Sound levels presented are equipment housed in acoustical package enclosures.

The Project has been designed such that several large components, including the combustion turbines and generators, are housed in acoustical package enclosures specifically designed for the attenuation of noise. Eight-foot silencers were applied to the combustion turbine air inlets and transmission loss ratings were incorporated into the wall and roof assemblies of the steam turbine and generator buildings based on the projected Sound Transmission Class (STC) ratings of the various wall components. These pre-packaged mitigation measures for which data were available from the equipment manufacturers are summarized in Table 10, which also includes the expected insertion loss associated with the installation of lagging and the net reduction resulting from the combined HRSG and silencer at the exhaust stack. Note that the selected mitigation reflected by these values is intended to reflect the feasibility of achieving the resulting level of impact; final design may incorporate different mitigation in order to achieve the same objective.

Table 10. Noise Level Reductions for Different Types of Construction and Acoustical Treatments

Type of Construction or Acoustical Treatment	Modeled Noise Level Reductions (dB re: 20 μPa) by Octave Band Center Frequency dBL								
	31.5	63	125	250	500	1k	2k	4k	8k
Wall Panel STC 32	5	9	14	19	29	38	46	52	58
Wall Panel STC 35	10	16	17	29	32	41	49	52	57
Wall Panel STC 44	13	19	25	35	39	45	52	58	59
Wall Panel STC 46	10	12	22	41	51	57	61	68	72
Building Acoustical Louver	1	1	2	3	3	4	5	5	3
Fan Attenuators	3	3	8	10	13	16	8	5	4
HRSG + Stack Silencer Attenuation	13	10	24	29	36	45	36	42	41
Acoustical Lagging Insertion Loss	-	3	8	14	18	23	25	27	28
ACC Acoustical Inlet Louvers	1	2	4	9	10	11	11	10	8

4.3 NOISE CONTROL MEASURES

In addition to using our acoustic modeling, potential noise control mitigation measures underwent two evaluations before they were incorporated in the final noise mitigation design. First, all major potential noise sources were entered into the software model, as noted in Section 4.2. Next, additional candidate mitigation strategies were tested and applied or discarded until the design was optimized. The following mitigation measures, in addition to assumptions reflected in Tables 9 and 10, were included in this analysis to demonstrate that compliant sound levels can be achieved by the Project:

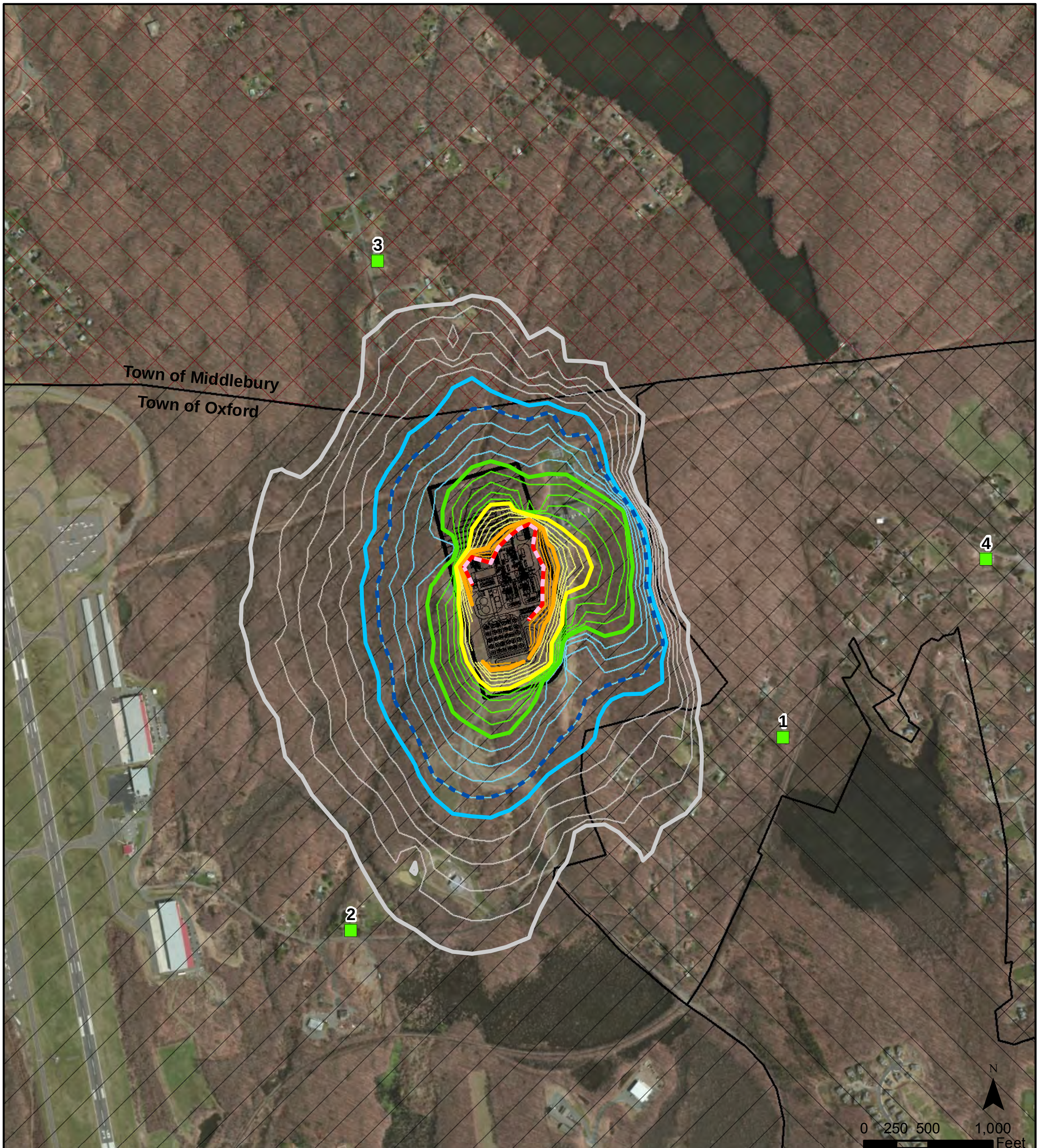
- All turbines and generators housed in acoustical enclosures equipped with acoustic silencers and attenuators as required to reduce noise emissions from ventilation openings, fans, and make-up air units;
- Use of low noise gas heaters or lube oil heater, or housing this equipment in acoustical enclosures;
- Steam system vents equipped with silencers;
- Safety and relief valves that release high pressure steam equipped with silencing, to the extent permitted by the American Society for Mechnical Engineers code;

- Large pumps associated with the HRSG and power train (i.e., boiler feed water pumps and fuel oil forwarding pumps) enclosed in acoustical structures;
- A low noise auxiliary fin fan cooler and the use of a acoustical barrier wall to reduce off-site sound levels and push noise from this equipment away from residential areas;
- A combustion turbine inlet silencing package designed to reduce air inlet sound power levels to 104 dBA immediately in front of the at the air inlet face;
- Acoustical lagging on the steam ducts from STG building to the ACC headers and the use of high efficiency control valves;
- Acoustical lagging of the CTG exhaust diffuser as it exits the turbine compartment and enters the HRSG;
- A stack silencing package inclusive of the HRSG will be designed to achieve a total 90-degree directional sound power level of 104 dBA to reduce sound pressure levels leaving the flue in the stack structure;
- National Electrical Manufacturers Association (NEMA) low-noise-rated step-up transformers associated with the CTG and the STG, combined with the use of fire walls and acoustical barriers will further serve to reduce off-site transformer noise levels; and
- A low-noise design ACC is specified in the design, with use of low noise fans or acoustical inlet louvers to be applied as necessary to achieve far-field acoustic design targets.

The treatments with the acoustic performance as outlined above relate to the dominant noise sources. These mitigation measures were incorporated into this screening level assessment to demonstrate the feasibility of our plant to meet the specific noise requirements, but the final design may incorporate different mitigation measures in order to achieve the same objective as demonstrated in this assessment.

4.4 NOISE PREDICTION MODEL RESULTS

Broadband (dBA) sound pressure levels were calculated at an elevation of 1.5 meters (5 feet) above the ground, the height of the ears of a standing person, for expected normal Project operation assuming that all components identified previously are operating continuously and concurrently at the representative manufacturer-rated sound levels. The sound energy was then summed to determine the equivalent continuous A-weighted downwind sound pressure level at a point of reception. Sound contour plots displaying broadband (dBA) sound levels presented as color-coded isopleths are provided in Figure 12. Figure 12 shows the mitigated anticipated noise levels due to the Project equipment as noise contours in 5-dB intervals, for normal operating conditions. In addition, isopleths are shown that correspond to the DEEP and Town of Oxford noise limits for Class C industrial land use emitter to Class C industrial land use receiver (70 dBA) and to Class A residential land use receiver during nighttime (51 dBA). The noise contours are graphical representations of the cumulative noise associated with full operation of the equipment and show how operational noise would be distributed over the surrounding area. The contour lines shown are analogous to elevation contours on a topographic map, i.e., the noise contours are continuous lines of equal noise level around some source, or sources, of noise. Figure 12 also shows the monitoring locations and identifies zoning districts that define the surrounding land use classifications.



Legend

Sound Monitoring Locations

Project Area

Oxford Zoning

I: Industrial District

R-A: Residential A

R-CGD: Residential Community Golf District

Middlebury Zoning

R: Residential District

Sound Level Contour (dBA)

45 dBA

50 dBA

55 dBA

60 dBA

65 dBA

70 dBA

DEEP and Oxford 70 dBA Industrial Noise Limit Isopleth

DEEP and Oxford 51 dBA Residential Nighttime Noise Limit Isopleth

Figure 12
Received Sound Levels: Normal Operation

Towantic Energy Center
New Haven County, Connecticut

Table 11 shows the projected exterior sound levels resulting from full, normal operation of the Project at the representative monitoring locations under the mitigated design.

Table 11. Acoustic Modeling Results Summary – Mitigated Design

Location	Project Sound Level, dBA
ML-1	40
ML-2	44
ML-3	42
ML-4	33

As shown in Table 11 and on Figure 12, the Project's predicted operational noise will be fully compliant with the state and local noise regulations which require a noise impact level of less than 70 dBA at the (industrial) property line and less than 51 dBA at the boundaries of residentially-zoned areas.

5.0 CONCLUSIONS

The operation of the Project equipment will fully comply with all of the applicable noise standards and limits pursuant to the state and local regulations. With the basic noise control features described in Section 4, operational noise levels are expected to meet the limits established by the Connecticut DEEP and Town of Oxford. Careful equipment specification will ensure that no pure tone violations will occur as a result of the Project. Figure 12 presents color-coded decibel contours for the maximum sound impacts from the Project during normal, full operation. Figure 12 confirms that the maximum Project sound in all nearby residentially-zoned areas in the Towns of Oxford and Middlebury will meet the 51 dB1 nighttime limit. Figure 12 also confirms that maximum Project sound will comply with the 70 dBA limit set for industrial areas off the premises of the Project, including the adjacent compressor station, and nearby Waterbury-Oxford Airport.

Since sound levels decrease with distance, compliance with the applicable zoning limits at the closest boarder ensures compliance at more distant receptors, i.e., structures found within a given zoning district. Although the specific mitigation assumptions incorporated in this modeling effort may be refined in final design, and are expected to change the level of impact reflected in the analysis can be readily achieved by the Project.

APPENDIX E – CULTURAL RESOURCES AGENCY CORRESPONDENCE

Department of Economic and
Community Development

Connecticut
still revolutionary

May 15, 2014

Ms. Lynn Gresock
Tetra Tech
238 Littleton Road, Suite 201B
Westford, MA 061886

Subject: CPV Towantic Energy Center Project at
16 Woodruff Hill Road in
Oxford, Connecticut.

Dear Ms. Gresock:

The State Historic Preservation Office (SHPO) is in receipt of your request for our comments on the potential effects of the referenced project on historic properties. In October of 1998, SHPO reviewed an Archaeological Assessment report completed by Historical Perspectives, Inc. for the then proposed Towantic Energy Project. At that time, project plans called for the construction of a power generator and associated infrastructural facilities. A 20 acre parcel on Woodruff Hill Road was examined as part of the cultural resources assessment survey (CHPC #845). Pedestrian survey and documentary research concluded that the project parcel was not historically improved and did not possess environmental features favorable to human occupation. As a result of that investigation, no archaeological investigations were recommended and SHPO concurred.

SHPO understands that although the project plans have not changed significantly, an additional 8 acres will be required to complete the project. The additional parcel is situated immediately to the south of the previously assessed property, and it was partially subjected to subsurface testing as an alternative compressor station location for Algonquin Gas Transmission. No cultural material was identified as part of that survey (CHPC #1488). The remainder of the 8 acre parcel was not subject to a cultural resources survey, but it consists of a rugged, steeply sloping, and rocky environment situated at a significant distance from any sources of fresh water. The additional 8 acre project area is unlikely to have provided suitable conditions for habitation and is unlikely to contain significant archeological deposits. Based on the information provided to our office, it is SHPO's opinion that no historic properties will be affected by this expanded undertaking.

The State Historic Preservation Office appreciates the opportunity to review and comment upon this project. These comments are provided in accordance with the Connecticut Environmental Policy Act. For additional information, please contact Catherine Labadia, Staff Archeologist, at (860) 256-2764 or catherine.labadia@ct.gov.

Sincerely,

Daniel T. Forrest
State Historic Preservation Officer

From:	Knowles, Kathleen
To:	Lee, Susan K NAE (Susan.K.Lee@usace.army.mil); Dean Gustafson
Cc:	Forrest, Daniel; catherine.labadia@ct.gov; Stevens, Sue
Subject:	PHASE IA ARCHAELOGICAL ASSESSMENT & SUPPLEMENTAL TECHNICAL REPORT - RECONNAISSANCE ARCHAEOLOGICAL SURVEY- CPV TOWANTIC ENERGY CENTER PROJECT- 16 WOODRUFF HILL RD. - OXFORD, CT - ALL-POINTS TECHNOLOGY CORPORATION PROJECT NO.: CT444100
Date:	Saturday, August 09, 2014 2:33:32 PM

Re: CPV TOWANTIC ENERGY CENTER PROJECT
16 WOODRUFF HILL RD.
OXFORD, CT
ALL-POINTS TECHNOLOGY CORPORATION PROJECT NO.: CT444100

I have reviewed the Supplemental Technical Report – Reconnaissance Archaeological Survey – Algonquin Gas Transmission, LLC - Ramapo Expansion Project – Alternative Compressor Station "Site F" Oxford, CT, Submitted by PAL – and the Towantic Energy Project – Oxford, Ct – Phase IA Archaeological Assessment, submitted by Historical Perspectives, Inc. Based on the information provided to our office, the research design and testing strategy meets acceptable professional standards, and I agree with the recommendations & concur with the CT SHPO's opinion.
The Mashantucket Pequot Tribe appreciates the opportunity to review and comment on this proposed project.

Kathleen Knowles
Tribal Historic Preservation Officer
Natural Resources Protection & Regulatory Affairs

Mashantucket Pequot Tribal Nation
550 Trolley Line Blvd., P.O. Box 3202, Mashantucket, CT 06338-3202
TEL: 860-396-6887 FAX: 860-396-6914
kknowles@mptn-nsn.gov

APPENDIX F – THREATENED AND ENDANGERED SPECIES AGENCY CORRESPONDENCE

Connecticut Department of
ENERGY & ENVIRONMENTAL PROTECTION

Bureau of Natural Resources
Wildlife Division
Natural History Survey – Natural Diversity Data Base

June 10, 2014

Ms. Lynn Gresock
Tetra Tech, Inc.
238 Little Road, Suite 201-B
Westford, MA 01886

Regarding: CPV Towantic Energy Center, Oxford, CT – Commercial/Industrial Development
Natural Diversity Data Base 201405771

Dear Ms. Gresock:

In response to your request for a Natural Diversity Data Base (NDDB) Review of State Listed Species for the CPV Towantic Energy Center in Oxford, CT, our records for this site indicate the following extant populations of species on or within the vicinity of the site:

Red bat (*Lasiurus borealis*) Protection Status: Species of Special Concern

Red bats are considered to be "tree-roosting" bats. They roost out in the foliage of deciduous and coniferous trees, camouflaged as dead leaves or cones. Red bats are primarily solitary roosters. They can be found roosting and feeding around forest edges and clearings. Typically, larger diameter trees (12-inch DBH and larger) are more valuable to these bats. Additionally, trees with loose, rough bark such as maples, hickories, and oaks are more desirable than other tree species due to the increased cover that the loose bark provides. Large trees with cavities are also utilized by this species. Retaining the above mentioned trees, wherever possible, may minimize the potential for negative impacts to this state-listed species.

Hoary bat (*Lasiurus cinereus*) Protection Status: Species of Special Concern

Hoary bats are found in Connecticut during the spring and summer seasons and migrate south to overwinter. Their diet primarily consists of moths and beetles. These bats will roost high in large coniferous and deciduous trees.

Silver-haired bat (*Lasionycteris noctivagans*) Protection Status: Species of Special Concern

Silver-haired bats typical roost sites include tree foliage, tree hollows, and crevices behind loose bark, but they are most likely to be found near water. They will typically give birth to their young in June or July, and the young will stay in roost until August.

Recommendations: Work should be conducted in the winter when the bats are not in the area, specifically work should not be conducted between May 1st through August 15th. Long-term impacts can be minimized by retaining large diameter coniferous and deciduous trees whenever possible, particularly close to brooks and streams. If these bats are found, please report the information to the Wildlife Division.

Eastern box turtle (*Terrapene carolina Carolina*) Protection Status: Species of Special Concern

Eastern box turtles inhabit old fields and deciduous forests, which can include power lines and logged woodlands. They are often found near small streams and ponds. The adults are completely terrestrial but the young may be semiaquatic, and hibernate on land by digging down in the soil from October to April. They have an extremely small home range and can usually be found in the same area year after year. Eastern box turtles have been negatively impacted by the loss of suitable habitat. Some turtles may be killed directly by construction activities, but many more are lost when important habitat areas for shelter, feeding, hibernation, or nesting are destroyed. As remaining habitat is fragmented into smaller pieces, turtle populations can become small and isolated.

Recommendations: The following guidelines should be implemented:

- ❖ Siltation and Erosion Control Measures:
    - Where possible, AVOID installing sediment and erosion control materials from 1) late August through September and 2) from March through mid-May. These two time periods are when amphibians and reptiles are most active, moving to and from wetlands to breed.
    - Most wildlife travels between different habitats throughout the year, the layout of how sediment and erosion control materials are placed is very important. If silt fencing needs to be installed and left up during peak times of amphibian migration, we recommend that it be installed in such a way to allow for animals to pass through. We would encourage a staggered layout for silt fence installation. We would be happy to provide additional guidance on placement of sediment and erosion control materials to limit impacts to wildlife.
    - The use of erosion control products with netting embedded in the product to maintain its shape and structure, has been shown to be fatal to wildlife in Connecticut, in particular snakes. Snakes can get tangled and trapped within the netting as they maneuver through the net openings. When reptiles are trapped, their ability to thermoregulate is compromised and in areas exposed to sun, trapped reptiles quickly overheat and die. To limit the potential for needless mortality to long-lived reptiles, we recommend the following considerations:
        - Given the high variability of the composition of products with bio-degradable and degradable netting, we recommend that these products NOT be used.

- Use erosion control options that DO NOT contain netting such as net-less blankets or hay bales.

- Reconfigure/lower the grade of slopes so products without netting can be utilized.

- Siltation and erosion control measures should be removed as soon as soils are stable so as to not impede reptile and amphibian migrations between wetlands and uplands.

❖ Rip-rap: If rip-rap is going to be used, consider covering the rip-rap with local stream bank material.

❖ Stockpiles of Soil: Stockpiles of soil should be cordoned off with silt fencing so turtles do not attempt to try and nest in them.

❖ Native Plantings: Any plantings should be composed of species native to northeastern United States and appropriate for use in riparian habitat.

The Natural Diversity Data Base includes all information regarding critical biological resources available to us at the time of the request. This information is a compilation of data collected over the years by the Department of Energy and Environmental Protection's Natural History Survey and cooperating units of DEEP, private conservation groups and the scientific community. This information is not necessarily the result of comprehensive or site-specific field investigations. Consultations with the Data Base should not be substituted for on-site surveys required for environmental assessments. Current research projects and new contributors continue to identify additional populations of species and locations of habitats of concern, as well as, enhance existing data. Such new information is incorporated into the Data Base as it becomes available. If the project is not implemented within 12 months, then another Natural Diversity Data Base review should be requested for up-to-date information.

Please be advised a more detailed review may be conducted as part of any subsequent environmental permit applications submitted to the Department of Energy and Environmental Protection for the proposed site. Should state involvement occur in some other manner, specific restrictions or conditions relating to the species discussed above may apply.

Thank you for consulting the Natural Diversity Data Base. If you have further questions, I can be reached by email at Elaine.hinsch@ct.gov or by phone at (860) 424-3011.

Sincerely,
/s/
Elaine Hinsch
Program Specialist II
Wildlife Division

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Ecological Services Field Office
70 COMMERCIAL STREET, SUITE 300
CONCORD, NH 3301
PHONE: (603)223-2541 FAX: (603)223-0104
URL: www.fws.gov/newengland

Consultation Tracking Number: 05E1NE00-2014-SLI-0580 September 26, 2014
Project Name: CPV Towantic Energy Center

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project.

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment

United States Department of Interior
Fish and Wildlife Service

Project name: CPV Towantic Energy Center

Official Species List

Provided by:

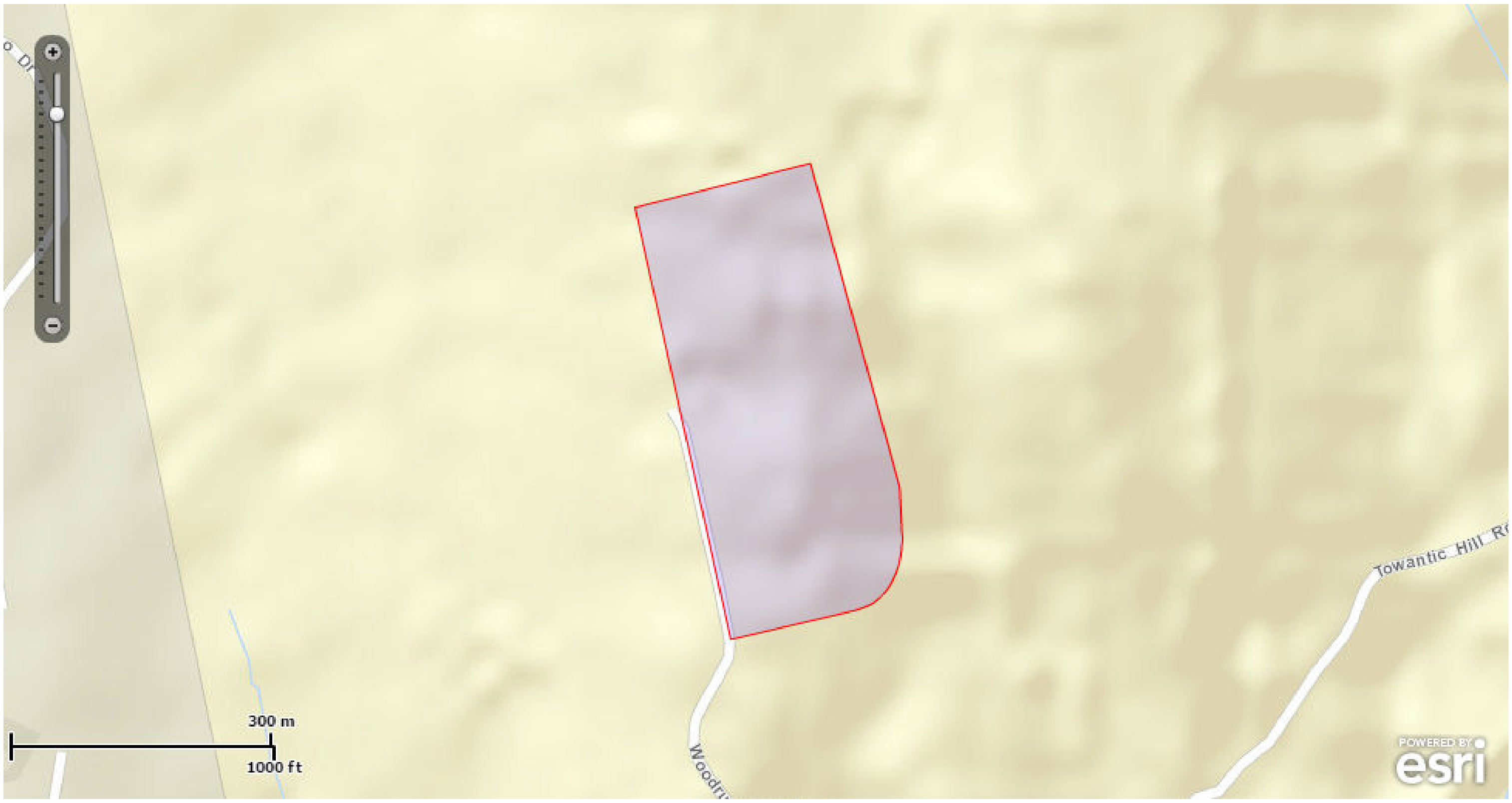
New England Ecological Services Field Office
70 COMMERCIAL STREET, SUITE 300
CONCORD, NH 3301
(603) 223-2541
http://www.fws.gov/newengland

Consultation Tracking Number: 05E1NE00-2014-SLI-0580
Project Type: Power Generation
Project Description: The ±26-acre Site is located in the Town of Oxfords Woodruff Hill Industrial Park along the east side of Woodruff Hill Road. Towantic Energy Center is a proposed dual-fueled (natural gas with ultra-low sulfur distillate back-up) combined cycle generating facility located at the intersection of a gas pipeline, a new compressor station and an electrical transmission line. The Site is a complex of hardwood forests and open fields with wetland inclusions.

United States Department of Interior
Fish and Wildlife Service

Project name: CPV Towantic Energy Center

Project Location Map:



Project Coordinates: MULTIPOLYGON (((-73.1212322 41.4818222, -73.1229604 41.481519, -73.1242876 41.4860066, -73.1218552 41.4864657, -73.1206152 41.483103, -73.120581 41.4825333, -73.1206628 41.4822089, -73.1208838 41.4819577, -73.1210327 41.4818749, -73.1212322 41.4818222)))

Project Counties: New Haven, CT

Endangered Species Act Species List

There are a total of 0 threatened or endangered species on your species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Critical habitats listed under the **Has Critical Habitat** column may or may not lie within your project area. See the **Critical habitats within your project area** section further below for critical habitat that lies within your project. Please contact the designated FWS office if you have questions.

There are no listed species identified for the vicinity of your project.

Critical habitats that lie within your project area

There are no critical habitats within your project area.

U.S. Fish and Wildlife Service

Natural Resources of Concern

This resource list is to be used for planning purposes only — it is not an official species list.

Endangered Species Act species list information for your project is available online and listed below for the following FWS Field Offices:

New England Ecological Services Field Office
70 COMMERCIAL STREET, SUITE 300
CONCORD, NH 3301
(603) 223-2541
http://www.fws.gov/newengland

Project Name:

CPV Towantic Energy Center

U.S. Fish and Wildlife Service

Natural Resources of Concern

Project Location Map:

Project Counties:

New Haven, CT

Geographic coordinates (Open Geospatial Consortium Well-Known Text, NAD83):

MULTIPOLYGON (((-73.1243608 41.4860559, -73.121853 41.4865305, -73.1205859 41.4830361, -73.1206842 41.4822985, -73.121058 41.4818787, -73.1227442 41.4815992, -73.1229556 41.4816522, -73.1243608 41.4860559)))

Project Type:

Power Generation

Natural Resources of Concern

Endangered Species Act Species List (USFWS Endangered Species Program).

There are no listed species found within the vicinity of your project.

Critical habitats within your project area:

There are no critical habitats within your project area.

FWS National Wildlife Refuges (USFWS National Wildlife Refuges Program).

There are no refuges found within the vicinity of your project.

FWS Migratory Birds (USFWS Migratory Bird Program).

Most species of birds, including eagles and other raptors, are protected under the Migratory Bird Treaty Act (16 U.S.C. 703). Bald eagles and golden eagles receive additional protection under the Bald and Golden Eagle Protection Act (16 U.S.C. 668). The Service's Birds of Conservation Concern (2008) report identifies species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become listed under the Endangered Species Act as amended (16 U.S.C 1531 et seq.).

Migratory bird information is not available for your project location.

NWI Wetlands (USFWS National Wetlands Inventory).

The U.S. Fish and Wildlife Service is the principal Federal agency that provides information on the extent and status of wetlands in the U.S., via the National Wetlands Inventory Program (NWI). In addition to impacts to wetlands within your immediate project area, wetlands outside of your project area may need to be considered in any evaluation of project impacts, due to the hydrologic nature of wetlands (for example, project activities may affect local hydrology within, and outside of, your immediate project area). It may be helpful to refer to the USFWS National Wetland Inventory website. The designated FWS office can also assist you. Impacts to wetlands and other aquatic habitats from your project may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal Statutes. Project Proponents should discuss the relationship of these requirements to their project with the Regulatory Program of the appropriate U.S. Army Corps of Engineers District.

Natural Resources of Concern

There are no wetlands found within the vicinity of your project.