HANNIGAN
ENGINEERING, INC.
8 MONUMENT SQUARE, LEOMINSTER, MA 01453 PHONE: (978) 534-1234 FAX (978) 534-6060 | CIVIL ENGINEERS & LAND SURVEYORS

Jason Grimshaw, Chair
Leicester Planning Board
3 Washburn Square
Leicester, Massachusetts 01524

October 19, 2021

RE: Site Plan Review-Peer Review
#1355 Main Street Energy Storage System (ESS)
ZP Battery Devco, LLC
Map 26/Parcel A1

Dear Ms. Buck,

Hannigan Engineering is in receipt of comments from Quinn Engineering, Inc. regarding the project submitted by this office for a Solar Energy Storage System (ESS) in Leicester, Massachusetts. We have reviewed the comments and offer our responses below. We have left the same format of their letter for ease of review. These responses have been incorporated into the updated plans for final review and approval by the Board.

General Comments:

Comment #1: *No landscaping or plantings are proposed. Hannigan Engineering, Inc. has indicated that they anticipate that the ESS will not be visible from the roadway or from residential properties due to the topography and due to the existing vegetation, that will remain. The Applicant should clarify to the Board how the landscaping requirements are met or should request a waiver with justification if the landscaping requirements are not met. (Zoning Bylaw 5.5.02.2, 5.14.6.4, SPRR II.F.6, SPRR II.K.1.c and Landscaping Regulations)*

Response: **As noted within the submittal package, the proposed Energy Storage Systems (ESS), are located on the property well below the abutting roadway elevation. The elevation relief from the roadway to concrete pads varies from approximately 12-feet to 18-feet along the length of the project, with an average height of approximately 8-feet per ESS, the top of the units are still approximately 4-feet to 6-feet below the existing grade of the roadway. This, along with the existing woodland and brush in this area is anticipated to shield these units from the abutting roadway and the residential properties located on the opposite side of Main Street. Waivers requests relative to the landscape requirements are included in this letter.**

Comment #2: *Driveway slopes in the HB-1 district are limited to 5% under the Zoning Bylaw 5.5.02.1.C.3. The proposed driveway slopes at approximately 7.5% from Main Street. It appears that the proposed 7.5% slope is reasonable given that the driveway is expected to see minimal use and is not open to the public. This office defers to the Board if the 5% slope requirement can be waived by the Board or if a variance is required.*

Response: **It is noted that the driveway from Main Street is approximately 7.5%, in excess of the maximum allowed of 5% per the Zoning By-Law. The project will not be open to the general public. Upon the completion of construction, Access is intended only for general maintenance purposes. It is anticipated that the steeper access way will not negatively impact access to the site. A waiver has been requested relative to the design criteria of the Access and Driveway requirements of the By-Law within this District.**

Comment #3: *It is recommended that the Board seek input from the Fire Department regarding the proposed gate access, driveway slope and configuration, dry sprinkler system, etc. (Zoning Bylaw 5.14.6.7)*

Response: **It is the understanding of this office that the Fire Department is reviewing the submittal documents at this time.**

Comment #4: *An estimate of the volume of material to be moved must be provided. (SPRR II.F.9)*

Response: **A cut-fill analysis has been performed and is included within this review. The estimated materials to be moved to the site is approximately 5,700 cubic-yards of material.**

Comment #5: *The locus plan provided does not meet some of the requirements specified in SPRR II.G.*

Response: **A Locus Plan has been incorporated into the revised Plan Set.**

Comment #6: *Post Construction View Representations are required under SPRR II.K.2. The conceptual renderings provided in the application generally depict the proposed ESS components but do not appear to represent the specific configuration at this site. This office defers to the Board if the conceptual renderings are sufficient or if the renderings must be updated.*

Response **Acknowledged. To aid in the review of the post construction sight lines for the project, a profile has been incorporated into the Site Plans to document the elevation relief and layout of the ESS Systems.**

Comment #7: *An operation and maintenance plan for the site must be submitted. The plan should include requirements for maintenance of the driveway, plowing, mowing outside of the basin, equipment maintenance, etc. (SPRR II.K.5)*

Response **An updated Operation and Maintenance plan has been provided with this review.**

Comment #8: *A specific form of decommissioning surety has not been identified. This office defers to the Board regarding the form of surety and mechanism for accounting for inflation that is to be provided. (SPRR II.K.7)*

Response **An estimated decommissioning cost associated with the project has been provided with this review. Typically, the specific form of surety will be determined prior to the issuance of the building permit.**

Comment #9: *The Drainage Analysis indicates that a very minor increase in runoff is expected at the existing catch basin in Main Street due to the driveway construction. The work in Main Street is subject to review by MA DOT and it is expected that MA DOT will review this minor increase. (Stormwater Regulations 5.0)*

Response: **It is noted that this project will require MassDOT Access Permit for the proposed work within the State Highway Layout. The aforementioned minor increase in runoff will be reviewed with the MassDOT at that time.**

Comment #10: *This office has not reviewed the proposed work in Main Street (Route 9) as it falls under the jurisdiction of MA DOT. A permit from MA DOT to access the state highway will be required for the proposed work.*

Response: **It is noted that this project will require MassDOT Access Permit for the proposed work within the State Highway Layout.**

Comment #11: *Based on the proposed grading, it appears that runoff from the easterly equipment pads may not flow to the basin as intended. The grading should be revised to ensure that the intended runoff reaches the basin.*

Response: **The proposed grading has been revised to direct additional runoff towards the detention basin.**

Comment #12: *A rip rap slope stabilizing detail is referred to on Sheet 3, however, the detail was not found in the plan set. The detail should be provided.*

Response: **A rip-rap slope detail has been added to the Plan.**

Comment #13: *The extent of the rip rap slope stabilization called out on Sheet 3 must be depicted on plan.*

Response: **The extent of the rip-rap stabilization has been depicted on the Site Plan.**

Comment #14: *Runoff from the driveway has potential to erode the slope between the driveway and basin. Additional stabilization is recommended on this slope.*

Response: **Additional Rip-rap has been provided for between the detention basin and driveway.**

Comment #15: *Check dams are recommended along the flow path of the existing discharge from the catch basin in Main Street to minimize erosion potential along the toe of the proposed slopes.*

Response: **Check dams and a stone swale have been provided downstream of the existing discharge and along the toe of the proposed slope to prevent erosion issues.**

Comment #16: The width identified Gravel Access Lane Section must be revised to reflect the proposed conditions in the plan view.

Response: Additional notations have been added to the Site Plan depicting the width of the access drive. As the width varies along the length of the access drive the Gravel Access Lane Section has been modified to depict the width as shown on the Site Plan.

Comment #17: The town of Southbridge is referenced in the decommissioning plan. The reference should be revised.

Response: The Decommissioning Plan has been corrected to refer to the Town of Leicester.

Comment #18: The deeds submitted with the application package are for property in Ashby. The deed for the subject property should be included in the application.

Response: The property deed of record as been included within this review submittal.

WAIVER REQUESTS - AMENDED

Per the Leicester Planning Board Site Plan Review Rules and Regulations, the Planning Board may waive any of the requirements upon submittal of information by the applicant that substantiates the waiver request. As required by the Zoning Bylaw several of the aspects of site plan review are not applicable to a project of this type specifically, traffic and water/sewer availability.

Due to the nature of this project, portions of this Site Plan Application are not applicable and waivers to these sections are requested as follows:

SPRR II.D: Traffic Study

– Due to the nature of the project, it is not anticipated that the project would have an adverse affect on traffic surrounding the site. Specifically, vehicular traffic for the project is not anticipated with the exception of the occasional maintenance and inspection. During construction, construction vehicles and equipment will be accessing the site by a proposed gravel drive off of Main Street. Additional signage will be placed along the roadway in this area to alert drivers of construction activity. Upon the completion of the project, the only traffic for the project would be for inspection and maintenance.

The applicant, therefore, requests a waiver to II.D: Traffic Study of the Bylaw.

SPRR II.I: Availability of Water and/or Sewer

-Due to the nature of the project, the project will not require any connections to the public water supply or any sewerage connections.

The applicant, therefore, requests a waiver to II.I: Availability of Water and/or Sewer of the Bylaw.

Zoning Bylaw 5.5.02.1.C.3: The Slope of Driveways shall be no greater than five percent (5%)

-It is the intent that the access drive from Main Street is approximately 7.5%, in excess of the maximum allowed of 5% per the Zoning By-Law. As the final project is not to be open to the general public and access upon the completion of construction is going to be intended only for general maintenance purposes, it is anticipated that the steeper access way will not negatively impact access to the site.

The applicant, therefore, requests a waiver to 5.5.02.1.C.3.

Zoning Bylaw 5.5.02.2.C: A landscaped buffer of at least 100 feet shall be provided where an HB-1 district boundary abuts a Residential District (R1, R2, SA)

-It is requested that the required landscaped buffer along the rear portion of the property be reduced to at minimum 20-feet abutting a Residential District (R1). The rear portion of the property abuts an existing residential property, where the existing dwelling is located immediately along Rawson Street, approximately 400-feet away, as shown on the Locus Plan. Due to the excessive distance and generally wooded characteristic and presence of jurisdictional areas of the Wetlands protection Act of the area abutting the locus property, it is anticipated that the view of the ESS system will not negatively impact the view from the dwelling.

The applicant, therefore, requests a waiver to 5.5.02.2.C.

SPRR II.F.6: Proposed landscaping, including size and type of plant material.

- The proposed Energy Storage Systems (ESS) are located on the property such that the units are located well below the abutting roadway elevation. The elevation relief from the roadway to concrete pads vary approximately 12-feet to 18-feet along the length of the project, with an average height of approximately 8-feet per ESS, the top of the units are still approximately 4-feet to 6-feet below the existing grade of the roadway. This in combination with the woodland and brush that is intended to remain it is anticipated to shield the ESS units from the abutting roadway as well as the residential properties located along the opposite side of Main Street. In addition, the abutting properties to the south of the locus property, is extensively wooded with the nearest residential dwelling be in excess of 400-feet from the property line. This in combination with jurisdictional areas of the Wetlands protection Act and woodland, to provide adequate vegetated buffer to the abutting properties.

As such it is proposed that there not be a requirement to include additional plantings within the projects limits as the project is anticipated to be adequately shielded from the road and the abutting properties by the topographical relief between the road and the site as well as the general Landscaping Requirements.

The applicant, therefore, requests a waiver to SPRR II.F.6

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SPRR II.K.1.c: Proposed screening/buffering in conformance with Zoning Bylaw requirements.

- The proposed Energy Storage Systems (ESS) are located on the property such that the units are located well below the abutting roadway elevation. The elevation relief from the roadway to concrete pads vary approximately 12-feet to 18-feet along the length of the project, with an average height of approximately 8-feet per ESS, the top of the units are still approximately 4-feet to 6-feet below the existing grade of the roadway. This in combination with the woodland and brush that is intended to remain it is anticipated to shield the ESS units from the abutting roadway as well as the residential properties located along the opposite side of Main Street. Reference is also made to the included sightline profile from the roadway to the ESS System to document the extent of the elevation relief.

The applicant, therefore, requests a waiver to SPRR II.K.1.c

This information is being provided as part of the review of the proposed Energy Storage Systems (ESS) submitted to the Town of Leicester. As discussed above, additional modifications and revisions to the plans were required based upon the Peer Review by the peer reviewer Quinn Engineering, Inc. The plans have been updated to reflect these modifications and revisions and are submitted herewith for final review. We look forward to the Board's anticipated approval of this project.

Hannigan Engineering, Inc. would like to thank the Town and its staff for its assistance and continued cooperation regarding this project.

Sincerely,
HANNIGAN ENGINEERING, INC.

Christopher Anderson, PE
Project Engineer

William D. Hannigan, PE
President

pc: Brendan Gove –ZP Battery DevCo, LLC
Pete Forte–ZP Battery DevCo, LLC
Tom Corbett–ZP Battery DevCo, LLC

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ZP Battery - Leicester

TOTAL AREA 31,331

Cut			Fill	
	1	4,137	A	27,194
	2		B	
	3		C	
	4		D	
	5		E	
	6		F	
	7		G	
	8		H	
		4,137 sf		27,194 sf
Total Area		31,331 sf		
Volume (T&S)		1,160 yd		
Depth of T&S		12 in		

CAD Volumes		
Cut	360	yd
Fill	4,359	yd
T&S-fill	1,007	yd
Net Total	5,726	yd

FACTORED BY:

CUT=1.25

FILL=1.15

Cut/Fill Report

Generated: 2021-10-18 09:25:07

By user: canderson

Drawing: J:\DWG\LEICESTER\Main Street\3010-Zero Point Battery Dev. Co\J:\DWG\LEICESTER\Main Street\3010-Zero Point Battery Dev. Co\3010-Base.dwg

Volume Summary

Name	Type	Cut Factor	Fill Factor	2d Area (Sq. Ft.)	Cut (Cu. Yd.)	Fill (Cu. Yd.)	Net (Cu. Yd.)
CutFill1	full	1.2500	1.1500	89690	359.04*	4359.79*	4000.75*

Totals

	2d Area (Sq. Ft.)	Cut (Cu. Yd.)	Fill (Cu. Yd.)	Net (Cu. Yd.)
Total	89690	359.04*	4359.79*	4000.75*

* Value adjusted by cut or fill factor other than 1.0

DEED

1355 Main Street Partners, LLC, a Massachusetts Limited Liability Company, having a usual place of business at 11 River Street, Wellesley, Norfolk County, Massachusetts 02481

for consideration paid in the amount of **LESS THAN ONE HUNDRED DOLLARS**

grant to WR Enterprises, LLC, a Massachusetts Limited Liability Company having a usual place of business at

1323 Main Street, Leicester, MA 01524

with quitclaim covenants

A certain parcel of land situated on Main Street in Leicester, Massachusetts shown as Parcel 1 on a plan entitled "Activity and Use Limitation Plan, No. 1355 Main Street, Leicester, Massachusetts dated December 7, 2001, by Henry R. Feldman, Inc., Land Surveyors" and recorded with the Worcester District Registry of Deeds in Plan Book 784, Plan 29.

Excepting therefrom , Parcel "A1", as shown on the plan entitled "Plan of Land Leicester, MA, Prepared for Owner RRM Corp. 1323 Main Street, Leicester, MA 01524 dated June 10, 2019 Thomas R. Fancy, Land Surveyor, 5 Hastings Rd., Spencer, MA 01562" recorded with the Worcester District Registry of Deed in Plan Book 945, Plan 4.

Said parcel contains an area of 5.44 acres, more or less, according to said plan at Plan Book 945, Plan 4.

Subject to and with the benefit of easements, reservations, restrictions and taking of record, if any, insofar as the same are now in force and applicable.

This sale is in the ordinary course of business and does not constitute the sale of all or substantially all of the assets of the grantor in the Commonwealth of Massachusetts. Said sale is pursuant to M.G.L Chapter 156C, Section 70, Paragraph (2) Subsection (c) and seller states this transfer is necessary to wind up and liquidate its affairs.

BEING a portion of the same premises as conveyed to the grantor by deed of Merrilee Sprague-Allen, formerly Merrilee Sprague, Executor under the Will of Walter H. Sprague dated April 8, 2006, and recorded with the Worcester District Registry of Deeds in Book 38785, Page 333.

NO TITLE EXAMINATION WAS PERFORMED AT THE REQUEST OF THE PARTIES.

Property Address: Main Street, Leicester, MA 01524

TT

Executed as a sealed instrument this 14 day of ~~December~~ April 2021, ~~2020~~.

1355 Main Street Partners, LLC

By: _____
William Roberts, Authorized Signor

By: _____
Robert A. Weiss, Authorized Signor

COMMONWEALTH OF MASSACHUSETTS

Worcester, ss.

On this 13 day of ~~December~~ MAY 2021, ~~2020~~ before me, the undersigned notary public, personally appeared William Roberts, proved to me through satisfactory evidence of identification, which was personal knowledge, to be the person whose name is signed above and acknowledged to me that he signed it voluntarily for its stated purpose as authorized signors for 1355 Main Street Partners, LLC., a Massachusetts Limited Liability Company.

NELSON J. EZEN
Notary Public, Commonwealth of Massachusetts
My Commission Expires January 31, 2025

_____ - Notary Public
My commission expires: 1/31/2025

COMMONWEALTH OF MASSACHUSETTS

Norfolk, ss.

On this 14 day of ~~December~~ April TT 2021 TT, ~~2020~~ before me, the undersigned notary public, personally appeared Robert A. Weiss, proved to me through satisfactory evidence of identification, which was MA Drivers license to be the person whose name is signed above and acknowledged to me that he signed it voluntarily for its stated purpose as authorized signors for 1355 Main Street Partners, LLC., a Massachusetts Limited Liability Company.

_____
Tyler Thomas Notary Public
My commission expires: March 20, 2026

TYLER THOMAS
Notary Public
Commonwealth of Massachusetts
My Commission Expires March 20, 2025

ZERO-POINT
DEVELOPMENT, INC.®

OPERATIONS & MAINTENANCE PLAN

Energy Storage System (ESS)

ZP Battery DevCo, LLC
10 E Worcester Street, Suite 3A, Worcester, Massachusetts 01604

1.0 PROTOCOL

1.1 Operations and Maintenance Dispatch Contact

The main point of contact for any operations and maintenance related issues will be:

Duk Lee
Technical Services Manager
(408) 638-0072
duk.lee@engie.com

2.0 SAFETY

2.1 Emergency

Incase of emergency, immediately call 9-1-1.

Please reference the site-specific Emergency Response Protocol (ERP). The ERP is an essential tool for safe and effective emergency response.

2.2 Safety Notice

Prior to opening, inspecting, using, or servicing an ESS system this manual must be read in its entirety. All instructions must be followed with diligent care. If there any questions regarding the operation or troubleshooting of the ESS system, please contact Engie Storage.

ENGIE STORAGE
engiestorage-remote@engie.com
1-800-426-5010

2.3 Safety Rules

All rules contained here within must be complied with in their entirety to reduce risk of injury to personnel.

1. The ESS contains high voltage AC and DC components and wiring and should not be opened or worked on except by trained personnel.
2. Before servicing any high voltage components, the system should be shut down and all safety disconnects and breakers should be opened to de-energize the system as completely as possible.
3. Adhere to all safety recommendations of the manufacture of all components contained within the ESS.
4. Do not short circuit terminals or components. This includes the battery modules.
5. Do not reverse the polarity of any connection. This includes the battery modules.

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6. Do not disassemble any component within the ESS. This includes the inverter, transformer, battery modules, and battery management modules.

7. Do not subject connections or components to excessive mechanical stresses.

8. Do not expose internal components to water.

9. Use high voltage safety equipment and procedures when working on the high voltage components. These include use of safety glasses, insulated tools and high voltage gloves.

2.4 Required Equipment and Guidelines

Equipment

- ESS enclosure door key
- Engie Storage (ES) controller lock key
- Safety glasses
- High voltage safety gloves (Class 00 or greater)
- Digital multi meter (DMM)
- Ohm meter
- Insulated tools (500V or greater)
- Torque wrench
- Label maker
- Tamper proof stickers
- CO2 fire extinguisher
- Body rescue hook

Spare Parts

- Misc. fuses i.e. for inverter and sub-components
- Door handle and keys
- Battery communication cables
- Warning labels/stickers

Safety Guidelines

- Remove conductive rings, jewelry, necklaces, belt buckles, etc.
- Always wear safety glasses
- Always work with a partner
- Always verify voltage potential with a DMM before making or breaking an electrical connection

3.0 ESS OVERVIEW

An Energy Storage System is comprised of many components to successfully store energy from a distribution line and discharge that energy back into the distribution line during times of high load. Interconnection to the distribution line is done by the local power company who owns the distribution line. The interconnection to a specific distribution line is done with intricate detail to assure the system charges and discharges at appropriate times and does not cause unwanted load on the grid. In addition, the Grid

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Synergy (GS) Controller is a hardware interface between ESS equipment on site and the Network Operations Center. The GS controller is typically mounted by the main electrical panel within the facility. The GS controller communicates to the ESS via an ethernet connection. The GS Controller is responsible for monitoring all components of the ESS and delivers charge and discharge commands to the ESS.

The ESS will charge from existing photovoltaic systems interconnected to the same distribution line as the ESS. PV arrays generate electricity during the day while the sun shines known as the charging window. While PV is a clean, renewable energy source it is only supplying energy to the grid during the day. This is when energy storage systems store the power produced by the PV arrays. ESS discharge the stored PV power to be utilized during times of peak demand thus creating an efficiency within the power structure.

4.0 MAINTENANCE OVERVIEW

General proper maintenance, both preventive and remedial, is the key to optimal operation of the energy storage system and will ensure a long and useful life of the equipment. Preventive maintenance includes regularly performed procedures designed to prevent system malfunction and obtain maximum operational efficiency. Remedial maintenance consists of troubleshooting the system in order to affect repairs. Troubleshooting the energy storage system involves following a logical sequence of steps which will determine the cause of an alarm and/or malfunction within the shortest time frame safely possible so as to expedite the repair and return of the equipment to normal service. It is recommended that the energy storage system be inspected annually to ensure that equipment is operating within normal tolerances. Any faults or alarms should be checked at time of discovery and not wait until annual maintenance. ES will monitor the system **24 hours a day, 7 days week, 365 days a year** to ensure that the system is delivering power as guaranteed.

5.0 SAFETY PRECAUTIONS

In order to safely and successfully perform maintenance on the system, certain basic safety precautions must be observed, necessary tools and test equipment must be available, and properly trained maintenance personnel must be involved. The following basic safety practices should always be observed:

1. Always be aware that hazardous voltages are present within the storage system even when the system is not operating.

2. Ensure that storage system operating, and maintenance personnel are thoroughly familiar with the equipment and with the contents of this manual.

3. Never wear metal jewelry such as rings or wrist watches when working on any equipment.

4. Keep cabinet doors closed and secured during normal operation.

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5. Never guess about safety procedures. If any doubt exists, ask someone who understands the equipment and safety protocols.

6. Always be aware of the presence of high voltage within the equipment. Check with a voltmeter to make sure power is off and conditions are safe before attempting to make repairs, adjustments, etc. within the unit.

7. Above all, always use common sense

6.0 PREVENTATIVE MAINTENANCE

The following describes the preventive maintenance procedures which, when followed, will increase the reliability and efficiency of the energy storage system operations.

6.1 Grid Synergy Controller System

1. Visually inspect exterior of Controller for signs of damage, discoloration, deterioration, disfiguration, and vandalism. Also inspect for possible failure points.

2. Inspect proper operation of door and seal is intact and not damaged.

3. Visually inspect interior for signs of damage, discoloration, deterioration, disfiguration and water and/or dust ingress.

4. Verify all current carrying conductor connections are tight and solidly connected.

5. Confirm all network cables are tight and solidly connected as well as indicate activity on both connection and data transfer lights.

6. Repeat steps 1-3 for all the Grid synergy controller equipment which can include Metering hub, Power hub, Lan hub, extended range metering boxes and 3rd party metering boxes.

7. Confirm mini master lock is placed on lock hole for all Grid synergy controller equipment hubs and boxes.

8. If applicable, verify voltage of battery backup.

9. Verify connectivity back to Network Operations Center (NOC) with Engie remote support team member.

6.2 ESS Enclosure

1. Visually inspect exterior of ESS enclosure for signs of damage, discoloration, deterioration, disfiguration and vandalism. Also inspect for possible failure points.

2. Visually inspect all louvers for any signs of damage, discoloration, deterioration, disfiguration and vandalism. Also inspect for possible failure points.

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3. Verify all ESS's are labeled with their designated number and that it matches the breaker inside the subpanel.

4. Verify all anchor bolts are securely fastened and check for any signs of damage, discoloration, deterioration, disfiguration and vandalism.

5. If applicable, verify combo of lockbox and verify appropriate keys are inside.

6. Verify door, hinges, seals and locking mechanisms are in good working order.

7. Verify all doors close securely and tightly when handle is locked.

8. Visually inspect DC disconnect knob for damage and ensure knob/handle functionality.

9. Visually inspect interior of cabinet for any signs of damage, discoloration, deterioration, disfiguration and water, dust and rodent ingress. Also inspect for possible failure points.

10. Visually inspect internal components for any signs of damage, discoloration, deterioration, disfiguration and water, dust and rodent ingress. Also inspect for possible failure points.

11. Verify all current carrying conductor connections are tight and solidly connected.

12. Confirm all network cables are tight and solidly connected.

6.3 ESS Batteries

1. Visually inspect batteries and battery management systems for signs of damage, discoloration, deterioration, disfiguration and water ingress. Also inspect for possible failure points

2. Visually inspect battery power and data termination points for signs of damage, discoloration, deterioration, disfiguration and water damage. Also inspect for possible failure points

3. Visually inspect battery racking system for signs of damage, discoloration, deterioration, disfiguration and water and dust ingress. Also inspect for possible failure points

4. Measure insulation resistance between battery (+) to ground and battery (-) to ground at 1000VDC for 30 seconds

6.4 Power Converter

1. Visually inspect power converter for signs of damage, discoloration, deterioration, disfiguration and water, dust and rodent ingress. Also inspect for possible failure points.

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2. Visually inspect converter power termination points for signs of damage, discoloration, deterioration, disfiguration and water damage. Also inspect for possible failure points.

6.5 Heat and Air Conditioning System

1. Visually inspect HVAC unit for signs of damage, discoloration, deterioration, disfiguration and water and dust ingress. Also inspect for possible failure points.
2. Visually inspect drip tray for signs of pooling or clogging.
3. Inspect bottom of HVAC unit for pooling.
4. Visually inspect exhaust hose for damage and proper operation.
5. Inspect outlet of exhaust hose for signs of pooling.
6. Inspect all filters and clean/change as necessary.
7. Once HVAC unit is on, inspect settings are set per OEM specifications.

6.6 Balance of System Equipment

1. Visually inspect exterior of AC disconnect(s) for signs of damage, discoloration, deterioration, disfiguration and vandalism. Also inspect for possible failure points.
2. Verify AC disconnect(s) has "ES Warning" sticker applied on the front of the box and that site ID is visible. Apply/re-apply as necessary.
3. Verify AC disconnect(s) has tamper proof sticker placed on handle. Apply/re-apply as necessary.
4. With all power de-energized, visually inspect interior of AC disconnect(s) for signs of damage, discoloration, deterioration, disfiguration and water ingress.
5. Visually inspect subpanel for any signs of damage, discoloration, deterioration, disfiguration and vandalism.
6. Verify if subpanel has proper labels defining location of feed, voltage, amperage and appropriate placards.
7. Verify key exists inside subpanel.
8. Verify subpanel panel schedule has breakers assigned to appropriate equipment.

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Worcester, Massachusetts 01604

9. Verify subpanel schedule has drawing of ESS cabinet layout w/ associated cabinet number for multiple systems.

10. Verify breakers inside subpanel are labeled. Label/re-label as necessary.

11. With all power turned off, visually inspect subpanel condition of breakers and check for operation by toggling off then on (perform only during servicing window).

12. Verify tamper proof sticker is placed on ESS and Controller breakers. Apply/re-apply as necessary.

13. Verify subpanel has "ES Warning" sticker applied visibly inside the panel and that the site ID visible. Apply/re-apply as necessary.

14. If applicable, visually inspect step-up and/or step-down transformer(s) for signs of damage, discoloration, deterioration, disfiguration and vandalism. Also inspect for possible failure points.

15. Visually inspect all conduit runs for signs of damage, discoloration, deterioration, disfiguration and vandalism. Also inspect for possible failure points.

16. Visually inspect all junction and gutter boxes for signs of damage, discoloration, deterioration, disfiguration and vandalism. Also inspect for possible failure points.

17. Open all junction and gutter boxes and inspect for signs of damage, discoloration, deterioration, disfiguration and water ingress.

6.7 Dry Pipes

1. Visually inspect dry pipes for signs of damage, discoloration, deterioration, disfiguration and water and dust ingress. Also inspect for possible failure points.

2. Visually inspect for signs of pooling or clogging.

3. Visually inspect pipe connection at ESS for damage and proper operation.

6.7 Fence

1. Confirm working area and surrounding area is clear of debris, plant overgrowth, water or any other inhibiting factors.
2. If applicable, inspect access locks for signs of damage, discoloration, deterioration, disfiguration and vandalism. Also inspect for possible failure points.
3. If applicable, inspect access gates for signs of damage, discoloration, deterioration, disfiguration and vandalism. Also inspect for possible failure points.
4. If applicable, inspect fence for signs of damage, discoloration, deterioration, disfiguration and vandalism. Also inspect for possible failure points.

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10 E Worcester Street, Suite 3A
Worcester, Massachusetts 01604

5. If applicable, inspect posts for any signs of damage, discoloration, deterioration, disfiguration and vandalism. Also inspect for possible failure points.

6.7 Access Drive

1. Confirm working area and surrounding area is clear of debris, plant overgrowth water or any other inhibiting factors.

2. Repair and/or replace gravel base material as needed in order to maintain integrity of drive.

3. Any evidence of significant erosion within driveway, area to be stabilized with crush stone and graveled. Area to be monitored to determine if further stabilization is required.

4. Snow shall be plowed and removed from public roadway to access gate upon the completion of a snow event (+4") to allow access to gate and fire suppression system.

5. Snow removal from internal access drive areas shall be done on periodic basis as need to perform basic equipment maintenance.

6.8 Stormwater Management and Landscape Maintenance

1. A visual inspection of all erosion control and stormwater management systems shall be conducted by the above identified person(s) a minimum of once per month and after every major storm during the first six months of operation (a portion of that time must be in the growing season). Thorough investigations shall be conducted twice a year. Monthly maintenance requirements may be adjusted based upon the results obtained from the first year of operation.

2. **Maintenance Schedule**

Structure Type	Inspection	Maintenance	Task
Rip/Rap Aprons	Twice a Year	Every 10 Years	Remove Debris & Add Stone
Subdrains	Twice a Year	Every 4 Years	Replace Peastone
Detention Basins	Monthly (May-Oct)	Monthly (May-Oct)	Mow Grass Areas & Remove Debris Remove Sediment if present
Outfall Structures	Twice a Year	Every 10 Years	Remove Debris & Add Stone

LONG TERM POLLUTION PREVENTION PLAN

1. Trash and other debris shall be removed from landscaped and planted areas periodically as needed. Full inspection of the site shall be made on a semi-annual basis to ensure clean and neat appearance to the site. This measure will help in the overall performance of the onsite systems.
2. Reseed any bare areas as soon as they occur. Erosion control measures shall be installed in these areas to prevent deposits of sediment from entering the drainage system
3. Grass shall be maintained at a minimum blade height of four to six inches and not allowed to exceed 18 inches in total height. Only 1/3 of the plant height shall be removed at a time.

ZP Battery DevCO, LLC
10 E Worcester Street, Suite 3A
Worcester, Massachusetts 01604

SEEDING OPERATION AND MAINTENANCE

1. Grass shall be maintained at a minimum blade height of four to six inches and not allowed to exceed 18 inches in total height. Only 1/3 of the plant height shall be removed at a time.
2. No Herbicides or pesticides will be used on this project.

ZP Battery DevCO, LLC
10 E Worcester Street, Suite 3A
Worcester, Massachusetts 01604

DECOMMISSIONING PLAN

ZPB-38 Energy Storage System
Map 26B, Lot A1
4.948 MWAC

1355 Main Street
Leicester, MA 01524

September 20, 2021

ZPBattery DevCo LLC
10 E Worcester St, Suite 3A, Worcester MA 01604

BACKGROUND

ZPBattery DevCo LLC ("ZPB") has prepared this Decommissioning Plan (the "Plan") for the Energy Storage System (the "System") located off 1355 Main Street, Leicester, MA 01524. The System will consist of a 4.948 MWac Energy Storage System located on approximately a third of acre of land owned by WR Enterprise.

The purpose of this Decommissioning Plan is to provide the general scope of decommissioning work as well as for a decommissioning assurance mechanism designed to satisfy the decommissioning assurance requirements under the Special Permit.

System Description:

The System will consist of a 4.948 MWac capacity energy storing operation secured within a chain-link fence surrounding the pad mounted equipment and accessed via Main Street. The System will include the following site features:

- Utility owned equipment:
  - One (1) Utility Pole
  - One (1) GOAB
  - One (1) Recloser
  - One (1) Transformer
  - Two (2) Meters
- ZPB Owned Equipment
  - One (1) GOAB
  - One (1) Recloser
  - One (1) Meter
  - One (1) Transformer
  - One (1) Neutral Ground Reactor
  - One (1) Controller
  - Four (2) Inverters
  - Five (8) Energy Storage Containers
- Seven (7)-foot chain-link security fence
- Underground conduit and wires

DECOMMISSIONING ACTIVITIES

The System will be decommissioned by completing the following major steps:

- Dismantlement and Demolition
- Disposal or Recycle
- Site Stabilization

Dismantlement, Demolition, and Disposal or Recycle:

A significant amount of the components of the System will include recyclable or re-saleable components, including copper, aluminum, galvanized steel, and batteries. Due to their resale monetary value, these components will be dismantled and disassembled rather than being demolished and disposed of.

Following coordination with the local utility company regarding timing and required procedures for disconnecting the System from the private utility, all electrical connections to the system will be disconnected and all connections will be tested locally to confirm that no electric current is running through them before proceeding. All electrical connections to the batteries will be cut at the panel and then removed from their framework by cutting or dismantling the connections to the supports. Batteries will be removed. Disposal of these materials at a recycling center will be permissible.

Finally, all associated structures will be demolished and removed from the site for recycling or disposal as required in the bylaws for Leicester. This will include the site fence and gates, which will likely be reclaimed or recycled. Grade slabs will be broken and removed to a depth of one foot below grade, and clean concrete will be crushed and disposed of off-site or recycled (reused either on- or off-site). Sanitary facilities will be provided on-site for the workers conducting the decommissioning of the System.

Pad mounted interconnection equipment owned by the System will be completely removed and disposed of off-site in accordance with utility best practices. Overhead wires will be removed from the and terminated at the utility-owned point of common coupling.

A final site walkthrough will be conducted to remove debris and/or trash generated within the site during the decommissioning process, and will include removal and proper disposal of any debris that may have been wind-blown to areas outside the immediate footprint of the System being removed.

Site Stabilization:

The areas of the System that are disturbed (during decommissioning) will be re-graded to establish a uniform slope, stabilized as needed, and approved by the Building Inspector/Planning Board during the decommissioning process. The gravel access driveway from Main Street, including the portion within the perimeter fence, will remain intact and shall not be removed until site is fully stabilized.

Current Permitting Requirements for Decommissioning

Given the size and location of the System, several approvals are required prior to initiation of ground-disturbing activity. ZPB has provided a summary of the expected approvals if the decommissioning were to take place in September 2021. Noting, however, that because the decommissioning is expected to occur at a later date, the permitting requirements listed below will be reviewed and updated based on current local, state, and federal regulations at the time.

National Pollutant Discharge Elimination System (NPDES) General Permit for Discharges from Construction Activity

- U.S. Environmental Protection Agency - Ground disturbance of greater than 1 acre with discharge to wetlands or water bodies. Requires preparation of a storm Water Pollution Prevention Plan, including erosion and sedimentation controls.

Site Plan Approval

- Town of Leicester Planning Board - Anticipated decommissioning requirements listed in the Site Plan Approval conditions of approval.

Building Permit

- A building permit is required to construct the System. A building permit must also be obtained for any construction, alteration, repair, demolition, or change to the use or occupancy of a building.

Permitting Requirement Assumptions:

1. The access driveway will remain in place throughout the System until site is fully stabilized.
2. No ground disturbance, including temporary laydown areas, is required within areas subject to the Massachusetts Wetlands Protection Act.

Schedule

The decommissioning process is estimated to take approximately 3-6 weeks and is intended to occur outside of the winter season.

Decommissioning Cost

ZPB has estimated the decommissioning and land remediation costs. **Exhibit A** attached hereto shows the detail of ZPB's estimates of the foregoing costs.

DECOMMISSIONING ASSURANCE

Form of Decommissioning Assurance

During each year from the period of commencement of construction of the System through completion of decommissioning activities at the System, ZPB shall provide a performance guarantee in a form reasonably accepted by the Town of Leicester.

Amount of Decommissioning Assurance

The initial amounts of the decommissioning assurance shall be **$86,653**. Please note that this amount is derived from estimates of the cost set forth in **Exhibit A**.

As of each five-year anniversary of the commercial operation date of the System, the decommission assurance shall be updated to reflect 110% of an updated reasonable estimate of decommissioning costs (net of salvage value). At least three (3) months prior to the five-year anniversary, ZPB shall provide an updated estimate of decommissioning costs to the Town of Leicester for its review and approval, not to be unreasonably withheld. (For avoidance of doubt, in disapproving an updated estimate of decommissioning costs, the Town of Leicester may reasonably require that an updated estimate be provided.) In connection with an update of the decommissioning assurance amount, ZPB shall provide the Town of Leicester with such supporting information as it reasonably requests.

USE OF DECOMMISSIONING ASSURANCE

In the event that ZPB fails to undertake decommissioning activities within one year of discontinued operations, the Town of Leicester shall have the right to undertake decommissioning activities and make a claim against the decommissioning assurance. ZPB agrees that in such circumstances that the Town of Leicester shall have such access to the site as may be necessary to allow its qualified contractors to conduct decommissioning activities. For purposes hereof, ZPB and the Town of Leicester agree that the "date of discontinued operations" shall be (i) the date of discontinued operations designed by ZPB in its notice to the Town of Leicester or (ii) in absence of such notice, the last day of a continuous period of nine (9) months in which the System has not operated and where such inactivity is not the result of a casualty, equipment problem, permitting matter, financial matter or other issue that ZPB or the owner/operator is in good faith attempting to remedy.

ZPB agrees to indemnify and hold the Town of Leicester harmless from and against all net loss, cost and expenses, including court costs and reasonable attorney's fees, related to and arising out of the Town of Leicester's decommissioning activities, except to the extent such loss, cost or expenses relate to or arise out of the negligence, willful misconduct or violation of the law by the Town of Leicester, its officials, employees, contractors or agents.

Submitted by:

ZPBattery DevCo LLC

By: _____

Name: Brendan Gove

Title: Authorized Person

ACKNOWLEDGEMENT AND APPROVAL

The Town of Leicester Planning Board hereby acknowledges receipt of this Decommissioning Plan and affirms that the Decommissioning Plan (assuming establishment of the escrow fund in the amount provided for above) satisfies the conditions of the Site Plan Approval relevant thereto.

Town of Leicester Planning Board

By: _____ **Date:** _____**, 2021**

Name:

_____

Name:

_____

Name:

_____

Name:

_____

Name:

_____

Name:

_____

Name:

EXHIBIT A – DECOMMISSIONING COST ESTIMATE

Decommissiong Estimate
ZP-38- Classsic Auto Leicester MA 4948 kW

	Unit	Est. Qty.	Material/ Labor Cost	Salvage Labor	Material Recycle Val.	Net Salvage	Net Cost	Notes
Contractor Fees								
Supervisory/Management	LS	1	10,625			-	10,625	85 man hours @ $125/hour
Electrical Disconnection	EA	1	1,600			-	1,600	20 hours @ $80/hour to de-energize
Erosion Controls	LF	565	763			-	763	$1.35/LF
Subtotal			12,988	-	-	-	12,988	
Sitework								
Access Roads & Gravel Area Removed	SF	1	1			-	1	
Restoration Seeding	AC	0.75	938			-	938	$1250 per acre
Fence Removal and Recycling	LF	560	300		-	-	300	100 LF/hr @ $53.5/hr
Site Cleanup	LS	1	1,000			-	1,000	Labor & Dumpster Rental
Subtotal			2,238	-	-	-	2,238	
AC & DC Wire Removal								
Interconnection pole removal	EA	1	240			-	240	Assume 3 hours per pole @ $80/hour
AC overhead wire removal	LF	50	80		(10)	(10)	70	100'/hour removed/crewmember @ $80/hr
MV direct burial wire removal	LF	560	80		(112)	(112)	(32)	600'/hour removed/crewmember @ $80/hr
DC wire removal	LF	3,000	160		(300)	(300)	(140)	1500'/hour removed @ $80/hour
Subtotal			560	-	(422)	(422)	138	
Equipment Removal								
IX Equipment removal	EA	5	4,267			-	4,267	Crew of 4 removes 3/day @ $80/hour
Inverter removal	EA	2	1,707			-	1,707	Crew of 4 removes 3/day @ $80/hour
Auxiliary Equip Removal	EA	2	1,707			-	1,707	Crew of 4 removes 3/day @ $80/hour
Transformer removal	EA	1	853			-	853	Crew of 4 removes 3/day @ $80/hour
Subtotal			8,533	-	-	-	8,533	
ESS Removal								
Disconnection	EA	8	20,480			-	20,480	Crew of 4 removes 1/day @ $80/hour
Container removal	EA	8	25,360			-	25,360	200 ton Crane & Trucking
Subtotal			45,840	-	-	-	45,840	
Equipment Pad Removal								
Remove equipment pads	EA	10	3,000			-	3,000	$6/sq ft
Remove ESS Footings	EA	8	6,000			-	6,000	$6/sq ft
Subtotal			9,000	-	-	-	9,000	
Decommissioning Subtotal			79,159	-	-	-	79,159	
Subcontractor Markup	10%		7,916					
Total Decommissioning			87,075	-	(422)	(422)	86,653	
	Cost/kW AC		$ (17.60)				$ (17.51)	

SITE DEVELOPMENT PLAN
SOLAR ENERGY STORAGE SYSTEM (ESS)
1355 MAIN STREET
IN
LEICESTER, MASSACHUSETTS
SEPTEMBER 21, 2021
REVISIONS THROUGH OCTOBER 19, 2021

VICINITY MAP SCALE: 1" = 1000'

APPLICANT:

ZP BATTERY DEVCO, LLC
BRENDON GOVE
10 E. WORCESTER STREET, SUITE 3A
WORCESTER, MASSACHUSETTS 01604

OWNER:

WR ENTERPRISES, LLC
1323 MAIN STREET
LEICESTER, MASSACHUSETTS 01420

CIVIL ENGINEER & LAND SURVEYOR:

HANNIGAN ENGINEERING, INC.
8 MONUMENT SQUARE
LEOMINSTER, MASSACHUSETTS 01453
TEL: (978) 534-1234

PLAN INDEX

PERMITTING SET - NOT FOR CONSTRUCTION

3010- ZP BATTERY DEVCO, LLC C-17-38 (OCTOBER 19, 2021)

NOTE: PROPERTY LINES AND STRUCTURE LOCATIONS ARE BASED ON MASSGIS AND ARE APPROXIMATE IN NATURE.

1000FT PROPERTY OFFSET

HIGHWAY BUSINESS–INDUSTRIAL DISTRICT (HB–1)

RESIDENTIAL 2 DISTRICT

1478 MAIN ST (SF RES)
1472 MAIN ST (SF RES)
1454 MAIN ST (SF RES)
1438 MAIN ST (MF RES)
VACANT
1475 MAIN ST (SF RES)
1 MOUNT PLEASANT AVE (SF RES)
1469 MAIN ST (SF RES)
1455 MAIN ST (SF RES)
1445 MAIN ST (COMMERICAL)
1430 MAIN STREET (COUNTRY CLUB)
1434 MAIN STREET (MULTI-FAMILY RES)
1342 MAIN STREET (SF RES)
1340 MAIN STREET (SF RES)
1326 MAIN STREET (SINGLE FAMILY RES)
1360 MAIN STREET (MUNICIPAL)
1350 MAIN STREET (SF RES)
1323 MAIN ST (COMMERICAL)
MAIN STREET (ROUTE 9)
2 MOUNT PLEASANT AVE (SF RES)
3 MOUNT PLEASANT AVE (SF RES)
4 MOUNT PLEASANT AVE (SF RES)
5 MOUNT PLEASANT AVE (SF RES)
6 MOUNT PLEASANT AVE (SF RES)
7 MOUNT PLEASANT AVE (SF RES)
8 MOUNT PLEASANT AVE (SF RES)
9 MOUNT PLEASANT AVE (SF RES)
10 MOUNT PLEASANT AVE (SF RES)
11 MOUNT PLEASANT AVE (SF RES)
MOUNT PLEASANT AVE
BUSINESS–RESIDENTIAL–1 DISTRICT (BR–1)
RESIDENTIAL–1 DISTRICT (R1)
LOCUS
HIGHWAY BUSINESS–INDUSTRIAL DISTRICT (HB–1)
RESIDENTIAL–1 DISTRICT (R1)
SHEET 2 & 3 : PROJECT AREA
1439 MAIN ST (VACANT)
142 RAWSON ST (SF RES)
WATER RESOURCE PROTECTION DISTRICT
1000FT PROPERTY OFFSET
RAWSON STREET
0 RAWSON ST (MUNICIPAL)
27 FELIX ST (MF RES)
25 FELIX ST (SF RES)
VACANT
59 LAKE AVE (SF RES)
49 LAKE AVE (SF RES)
2 FELIX ST (SF RES)
43 LAKE AVE (SF RES)
5 FELIX ST (SF RES)
25 LAKE AVE (SF RES)
LAKE AVENUE
32 LAKE AVE (SF RES)
17 LAKE AVE (SF RES)
15 LAKE AVE (SF RES)
1296 MAIN STREET (MULT–FAMILY RES)
312 MAIN ST (SF RES)
1286 MAIN ST (COMMERICAL)
1284 MAIN ST (MF RES)
278 MAIN ST (SF RES)
1274 MAIN ST (SF RES)
1248 MAIN ST (SF RES)
CENTRAL BUISNESS DISTRICT (CB)
1000FT PROPERTY OFFSET
1279 MAIN ST (MF RES)
271 MAIN ST (MF RES)
1263 MAIN ST (MF RES)
22 RAWSON ST (SF RES)
9 RAWSON ST (SF RES)
30 RAWSON ST (SF RES)
6 KING COURT (SF RES)
15 KING COURT (MF RES)
10 KING COURT (SF RES)
18 KING COURT (SF RES)
17 KING COURT (SF RES)
20 KING COURT (SF RES)
19 KING COURT (SF RES)
23 KING COURT (SF RES)
25 KING COURT (SF RES)
27 KING COURT (SF RES)
KING COURT
44 RAWSON ST (SF RES)
54 RAWSON ST (SF RES)
46 RAWSON ST (SF RES)
58 RAWSON ST (SF RES)
66 RAWSON ST (MF RES)
77 RAWSON ST (SF RES)
80 RAWSON ST (SF RES)
82 RAWSON ST (SF RES)
84 RAWSON ST (SF RES)
86 RAWSON ST (SF RES)
88 RAWSON ST (SF RES)
90 RAWSON ST (SF RES)
92 RAWSON ST (SF RES)
79 RAWSON ST (SF RES)
81 RAWSON ST (SF RES)
83 RAWSON ST (SF RES)

PROJECT INFORMATION

LAND INFORMATION

MAP/PARCEL:	26B/A1
DEED BOOK–PAGE:	65218/149
EXISTING FRONTAGE:	794.29'
EXISTING AREA:	5.44 ACRES

ZONING INFORMATION

ZONING DISTRICT: HIGHWAY BUSINESS–INDUSTRIAL 1 (HB–1)

DIMENSIONAL REQUIREMENTS:

MINIMUM AREA:	60,000 S.F.
MINIMUM FRONTAGE:	200'
MAXIMUM HEIGHT:	55'
MINIMUM SETBACKS:	
FRONT YARD:	50'
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REAR YARD:	50'

GENERAL NOTES:

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2. AREAS SUBJECT TO PROTECTION UNDER THE WETLANDS PROTECTION ACT HAVE BEEN DELINEATED BY CARON ENVIRONMENTAL CONSULTING ON MARCH 26, 2021. THESE AREAS ARE DEPICTED ON THE PLANS BASED ON FIELD SURVEY LOCATION DURING THE TOPOGRAPHIC SURVEY.
3. LOCATION OF ALL UTILITIES ARE APPROXIMATE AS SHOWN AND BASED UPON VISIBLE STRUCTURES AT THE TIME OF THE FIELD SURVEY. LOCATION OF EXISTING UTILITIES AND SUBSURFACE STRUCTURES, WHETHER OR NOT SHOWN ON THESE PLANS, SHALL BE DETERMINED BY THE CONTRACTOR, MARKED IN THE FIELD, AND REVIEWED BY THE ENGINEER PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. THE CONTRACTOR SHALL BE AWARE OF THE OBLIGATION TO ALL UTILITY COMPANIES AND AGENCY AS WELL AS DIG–SAFE PRIOR TO EXCAVATION. (SEE NOTE)
4. NOTIFICATION REQUIREMENTS SHOWN ON THIS PLAN SHALL NOT RELIEVE THE CONTRACTOR OF ANY OTHER REQUIREMENTS WHICH MAY EXIST UNDER LOCAL, STATE, OR FEDERAL JURISDICTION TO WHICH THE CONTRACTOR IS OBLIGATED.
5. RELOCATION OF AND/OR CONNECTION TO EXISTING UTILITIES SHALL BE PERFORMED IN ACCORDANCE WITH PROVISIONS OF THE APPROPRIATE UTILITY COMPANY AND/OR REGULATORY AGENCY.
6. UNLESS OTHERWISE SPECIFIED, ALL MATERIALS AND WORKMANSHIP SHALL CONFORM WITH THE REQUIREMENTS OF THE TOWN OF LEICESTER AND THE MASS DOT SPECIFICATIONS OF HIGHWAYS AND BRIDGES.
7. ALL SLOPES UNLESS OTHERWISE SPECIFIED, SHALL BE LOAMED AND SEEDED FOR STABILIZATION.
8. ANY DEVIATIONS IN DESIGN AS SHOWN SHALL REQUIRE A REVIEW AND APPROVAL OF THE DESIGN ENGINEER OR FIRM. CHANGES MADE IN THE FIELD MADE WITHOUT AUTHORIZATION SHALL BE SUBJECT TO REVIEW BY THE ENGINEER AND APPROPRIATE APPROVAL AUTHORITY. EXPENSES INCURRED TO BRING THE UNAUTHORIZED CHANGES TO ACCEPTABLE CONFORMANCE SHALL BE BORNE BY THE COMPANY OR CONTRACTOR MAKING THE UNAUTHORIZED CHANGE.
9. ANY MATERIALS DISCOVERED ON–SITE WHICH ARE NOT SUITABLE FOR USE IN THE PROJECT AS SHOWN ON THIS PLAN SHALL BE REMOVED AND HAULED OFF–SITE TO AN APPROPRIATELY LICENSED FACILITY.
10. PLANS TO BE REVIEWED BY APPLICABLE UTILITY AGENCIES FOR COMPLIANCE WITH REGULATIONS. FINAL LOCATION IS SUBJECT TO CHANGE.
11. APPLICANT SHOULD BE AWARE OF OBLIGATIONS TO COMPLY WITH CHAPTER 131, SECTION 40 OF THE MASSACHUSETTS GENERAL LAWS, OTHERWISE KNOWN AS THE WETLANDS PROTECTION ACT, AND THE ASSOCIATED REGULATIONS (310 CMR 10.00)
12. STOCKPILING OF MATERIAL SHALL NOT BE PERMITTED WITHIN ANY AREAS SUBJECT TO PROTECTION UNDER THE WETLANDS PROTECTION ACT WITHOUT PRIOR APPROVAL BY THE LOCAL CONSERVATION COMMISSION. STOCKPILES SHALL BE PLACED IN A SUITABLE LOCATION AND SURROUNDED BY A ROW OF STAKED HAY BALES FOR EROSION CONTROL.
13. AREAS OF FILL TO BE COMPACTED TO A MINIMUM 95% DRY DENSITY IN AREAS WITHIN ROADWAYS AND UTILITY EASEMENTS. OTHER AREAS OF FILL TO BE COMPACTED TO A MINIMUM 90% DRY DENSITY. ALL FILL MATERIALS ARE TO BE CLEAN FILL, FREE OF DELETERIOUS MATERIALS AND DEBRIS.
14. ALL SIDEWALKS AND RAMPS TO CONFORM TO REQUIREMENTS OF THE AMERICANS WITH DISABILITIES ACT (ADA), AS REQUIRED. SEE ARCHITECTURAL PLANS FOR CONFORMANCE REQUIREMENTS FOR PROPOSED BUILDINGS.
15. THE AREA PROPOSED FOR DEVELOPMENT IS NOT WITHIN A 100 YEAR FLOOD PLAIN PER F.E.M.A. FIRM PANEL #250313 0781 E, DATED: JULY 4, 2011. COMPLIANCE WITH APPLICABLE REGULATIONS IS REQUIRED.
16. ALL REINFORCED CONCRETE PIPE TO BE CLASS III UNLESS OTHERWISE NOTED.
17. PRE–CONSTRUCTION CONFERENCE SHALL BE HELD PRIOR TO THE COMMENCEMENT OF CONSTRUCTION.
18. ALL UTILITIES ARE TO BE INSTALLED BY A LICENSED UTILITY CONTRACTOR LICENSED BY THE TOWN OF LEICESTER.

NO.	DATE	REVISIONS	BY
1	10/19/21	PEER–REVIEW COMMENT	CMA

COMMONWEALTH OF MASSACHUSETTS
CHRISTOPHER M ANDERSON
CIVIL
No. 55372
REGISTERED PROFESSIONAL ENGINEER
10-19-21

APPLICANT:
ZP BATTERY DEVCO, LLC
BRENDON GOVE
10 E. WORCESTER STREET, SUIT 3A
WORCESTER, MASSACHUSETTS 01604

OWNER:
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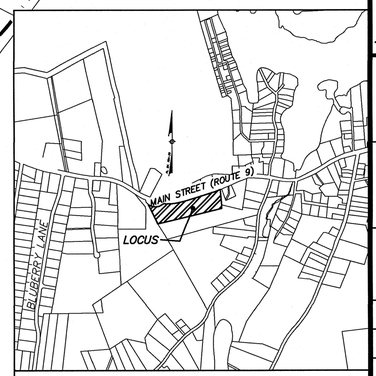
HANNIGAN ENGINEERING, INC.
CIVIL ENGINEERS & LAND SURVEYORS
8 MONUMENT SQUARE
LEOMINSTER, MASSACHUSETTS 01453
(978) 534-1234 (T)
(978) 534-6060 (F)
WWW.HANNIGANENGINEERING.COM

LOCUS PLAN IN LEICESTER, MASSACHUSETTS

PREPARED FOR:
ZP BATTERY DEVCO, LLC
BRENDAN GOVE
10 E WORCESTER STREET SUITE 3A
WORCESTER, MASSACHUSETTS 01604
TEL:

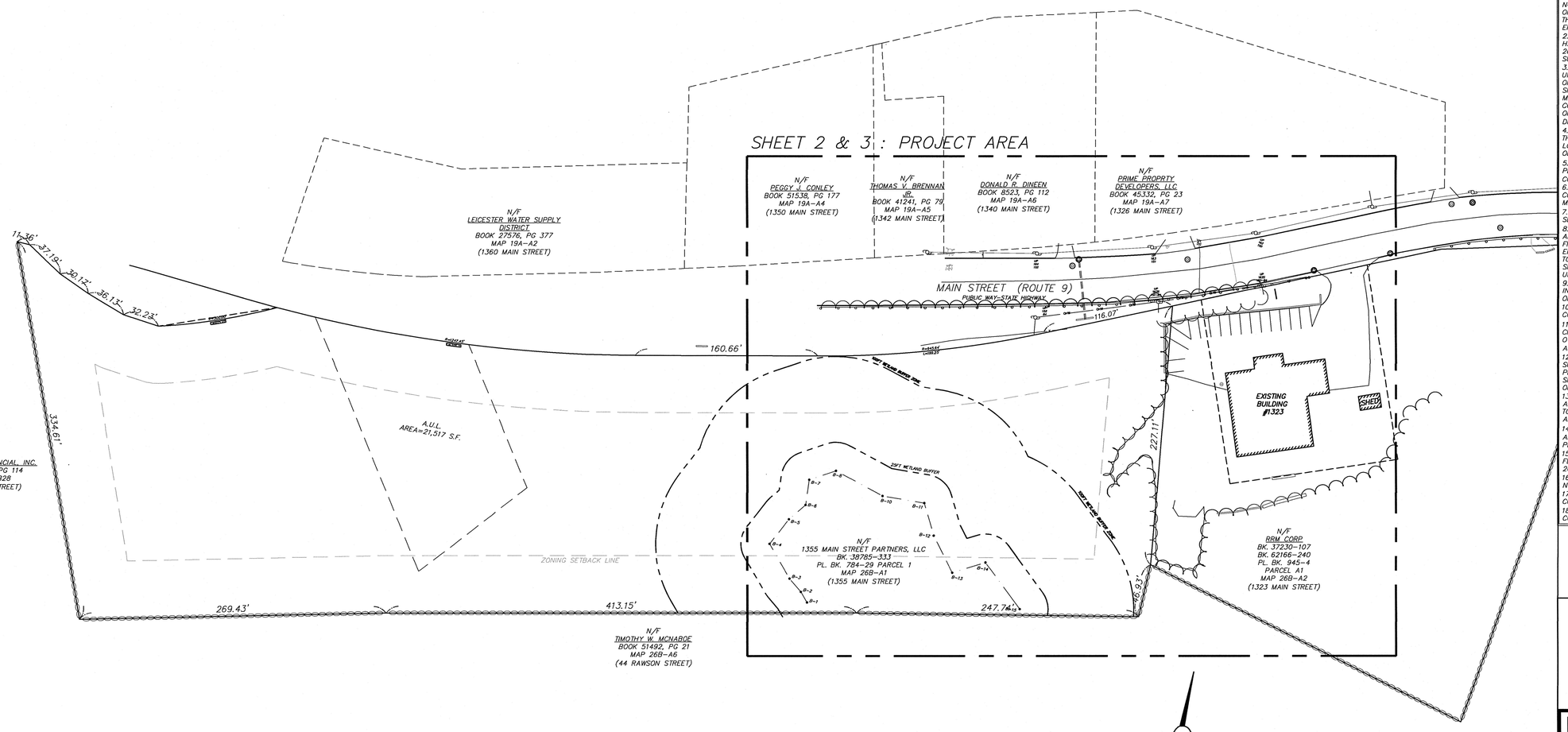
GRAPHIC SCALE: 1"=120'

0 100 150 200 300 400 500 FEET
0 10 20 30 40 60 80 100 120 140 METERS



LOCUS PLAN SCALE: 1":1000'

CALC: CMA	DRWN: CMA	SCALE: 1"=120'
CHKD: WDH	APPD: WDH	DATE: SEP 21, 2021
SRV: JEF	FB: 71–22	JOB NO: 3010
TAB: (1) LOCUS	SHEET 1 OF 6	PLAN NO:C–17–38



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COMMONWEALTH OF MASSACHUSETTS
CHRISTOPHER M ANDES
CIV.
No. 52...
REGISTERED PROFESSIONAL ENGINEER

10-19-21

HANNIGAN ENGINEERING, INC.
CIVIL ENGINEERS & LAND SURVEYORS

8 MONUMENT SQUARE
LEOMINSTER, MASSACHUSETTS 01453
(978) 534-1234 (T)
(978) 534-6060 (F)
WWW.HANNIGANENGINEERING.COM

INDEX PLAN
IN
LEICESTER, MASSACHUSETTS

PREPARED FOR:
ZP BATTERY DEVCO, LLC
BRENDAN GOVE
10 E WORCESTER STREET SUITE 3A
WORCESTER, MASSACHUSETTS 01604
TEL:

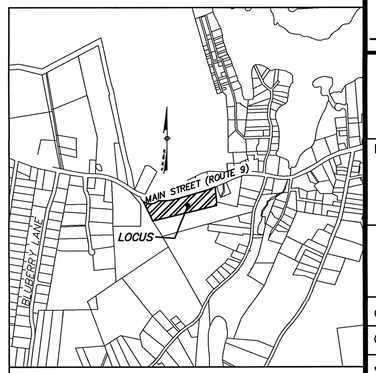
GRAPHIC SCALE: 1"=50'

0 10 20 30 40 50 75 100 150 200 FEET
0 5 10 15 20 30 40 50 60 METERS

CALC: CMA	DRWN: CMA	SCALE: 1"=50'
CHKD: WDH	APPD: WDH	DATE: SEP 21, 2021
SRV: JEF	FB: 71-22	JOB NO: 3010
TAB: (2) INDEX	SHEET 2 OF 6	PLAN NO:C-17-38

APPLICANT:
ZP BATTERY DEVCO, LLC
BRENDON GOVE
10 E. WORCESTER STREET, SUIT 3A
WORCESTER, MASSACHUSETTS 01604

OWNER:
WR ENTERPRISES, LLC
1323 MAIN STREET
LEICESTER, MASSACHUSETTS 01524



LOCUS PLAN SCALE: 1":1000'

N/F
PEGGY J. CONLEY
BOOK 51538, PG 177
MAP 19A–A4
(1350 MAIN STREET)

N/F
THOMAS V. BRENNAN JR.
BOOK 41241, PG 79
MAP 19A–A5
(1342 MAIN STREET)

N/F
DONALD R. DINEEN
BOOK 8523, PG 112
MAP 19A–A6
(1340 MAIN STREET)

N/F
PRIME PROPRTY DEVELOPERS, LLC
BOOK 45332, PG 23
MAP 19A–A7
(1326 MAIN STREET)

MAIN STREET (ROUTE 9)
PUBLIC WAY–STATE HIGHWAY

DCB–1
RIM=116.24
INV=112.04

12" HDPE

24" OUTLET
INV=108.0±

UP 164 152
UP 163 151
UP 162 150
UP 162S 150–84
UP 163S 151–84
UP 152 84

116.01'

R=945.64'
L=199.25'

100FT WETLAND BUFFER ZONE

25FT WETLAND BUFFER

109FT WETLAND BUFFER ZONE

EDGE OF PAVEMENT

EXISTING BUILDING #1323

SHED

GRAVEL AREA

227.11'

45.53'

247.74'

B–1
B–2
B–3
B–4
B–5
B–6
B–7
B–8
B–10
B–11
B–12
B–13
B–14
B–15

N/F
WR ENTERPRISES, LLC
BK 65218–149
PL BK. 784–29 PARCEL 1
MAP 26B–A1
(1355 MAIN STREET)

N/F
RRM CORP
BK. 37230–107
BK. 62166–240
PL. BK. 945–4
PARCEL A1
MAP 26B–A2
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MAP 26B–A6
(44 RAWSON STREET)

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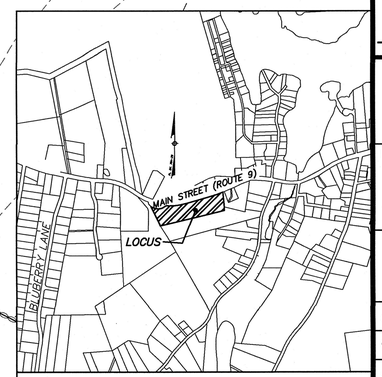

LOCUS PLAN SCALE: 1":1000'

PROJECT INFORMATION

LAND INFORMATION

MAP/PARCEL:	26B/A1
DEED BOOK–PAGE:	65218/149
EXISTING FRONTAGE:	794.29'
EXISTING AREA:	5.44 ACRES

ZONING INFORMATION

ZONING DISTRICT: HIGHWAY BUSINESS–INDUSTRIAL 1 (HB–1)
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1	10/19/21	PEER–REVIEW COMMENT	CMA

COMMONWEALTH OF MASSACHUSETTS
David J LeRoy
No. 47416
REGISTERED PROFESSIONAL LAND SURVEYOR

David J. LeRoy 10-22-21

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EXISTING CONDITIONS PLAN
IN
LEICESTER, MASSACHUSETTS

PREPARED FOR:
ZP BATTERY DEVCO, LLC
BRENDAN GOVE
10 E WORCESTER STREET SUITE 3A
WORCESTER, MASSACHUSETTS 01604
TEL:

GRAPHIC SCALE: 1"=20'
0 5 10 15 20 25 30 40 50 75 FEET
0 1 2 3 4 5 10 15 20 25 METERS

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CHKD: WDH	APPD: WDH	DATE: SEP 21, 2021
SRV: JEF	FB: 71–22	JOB NO: 3010
TAB: (3) EXCOND	SHEET 3 OF 6	PLAN NO:C–17–38

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MAP 19A-A4
(1350 MAIN STREET)

N/F
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PUBLIC WAY-STATE HIGHWAY

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INV=112.04

12" HDPE

24" OUTLET
INV=108.0±

UP 164 152
UP 163 151
UP 162 150
UP 162S 150-84
UP 163S 151-84

E114x5
H45x0
H6.0'

PROVIDE CRUSHED STONE APRON SWALE ALONG TOE OF SLOPE AND PROVIDE STONE CHECKDAMS - - - APPROXIMATELY 25-FOOT ON-CENTER (SEE DETAIL)

PROVIDE VERTICAL QUICK CONNECT STAND PIPE (SUBJECT TO FINAL DESIGN)

EXISTING FENCE (TO REMAIN)

R=945.64'
L=199.25'

15.4 FT

22.3 FT

NOTE: MAXIMUM HEIGHT OF SOLAR ENERGY SYSTEM NOT TO EXCEED 12-FEET

PROVIDE DRY PIPE MANIFOLD FOR FIRE SUPPRESSION SYSTEM (FINAL SIZE TO BE DETERMINED BY MANUFACTURER)

100FT WETLAND BUFFER ZONE

EROSION CONTROL:
STAKED STRAWWATTLE AND SILT FENCE (SEE DETAIL)

EROSION CONTROL:
PROVIDE STAKED STRAWBALES WITH SILTFENCE FENCE DOWNGRADIENT OF DRAINAGE WAY(SEE DETAIL)

PROPOSED SECURITY FENCE (SEE DETAIL)

PROVIDE CONCRETE PADS FOR CONTAINER STORAGE

PAD ELEV=102.6±
PAD ELEV=103.9±
PAD ELEV=105.4±
PAD ELEV=106.6±

ACCESS GATE

PROPOSED ELECTRICAL EQUIPMENT

UNDERGROUND ELECTRICAL CONDUIT (SEE NOTE)

ACCESS GATE

24.0 FT GRAVEL ACCESS DRIVE (SEE DETAIL)

20.0 FT

25FT WETLAND BUFFER

BASIN ACCESS

4" SUBDRAIN
INV=87.83
(HIGH POINT)

FB-BASIN#1
BOTTOM ELEV=88.0±

100FT WETLAND BUFFER ZONE

BERM ELEV=92.0±

FE#1
INV=87.0±

EMERGENCY SPILLWAY ELEV=91.0±

EROSION CONTROL:
PROVIDE STAKED STRAWBALES WITH SILTFENCE FENCE DOWNGRADIENT OF BASIN OUTLET (SEE DETAIL)

EROSION CONTROL:
STAKED STRAWWATTLE AND SILT FENCE (SEE DETAIL)

247.74'

B-1 B-2 B-3 B-4 B-5 B-6 B-7 B-8 B-10 B-11 B-12 B-13 B-14 B-15

N/F
WR ENTERPRISES, LLC
BK 65218-149
PL BK. 784-29 PARCEL 1
MAP 26B-A1
(1355 MAIN STREET)

HIGHWAY BUSINESS-INDUSTRIAL DISTRICT (HB-1)
RESIDENTIAL-1 DISTRICT (R1)

N/F
TIMOTHY W. MCNABOE
BOOK 51492, PG 21
MAP 26B-A6
(44 RAWSON STREET)

PROVIDE KNOX BOX AT ENTRANCE GATE FOR EMERGENCY SERVICES ACCESS

PROVIDE RIP-RAP SLOPE STABILIZATION (SEE DETAIL)

227.11'

EXISTING BUILDING #1323

SHED

N/F
RRM CORP
BK. 37230-107
BK. 62166-240
PL. BK. 945-4
PARCEL A1
MAP 26B-A2
(1323 MAIN STREET)

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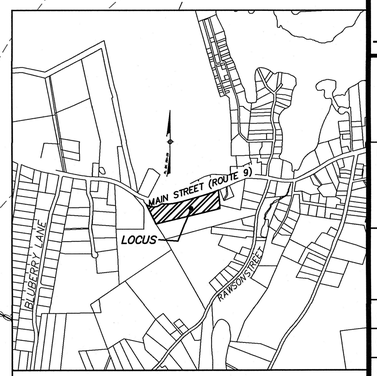

LOCUS PLAN SCALE: 1":1000'

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COMMONWEALTH OF MASSACHUSETTS
CHRISTOPHER M ANDERSON
CIVIL
No. 55372
REGISTERED PROFESSIONAL ENGINEER
10-19-21

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SITE DEVELOPMENT PLAN IN LEICESTER, MASSACHUSETTS

PREPARED FOR:
ZP BATTERY DEVCO, LLC
BRENDAN GOVE
10 E WORCESTER STREET SUITE 3A
WORCESTER, MASSACHUSETTS 01604
TEL:

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TAB: (4) SDP	SHEET 4 OF 6	PLAN NO: C-17-38

EROSION & SEDIMENTATION CONTROL PLAN

GENERAL:

1. THE PURPOSE OF THIS PLAN IS TO PRESENT A PREVENTIVE METHOD OF CONSTRUCTION TO MINIMIZE THE IMPACT OF THE CONSTRUCTION ACTIVITIES UPON WETLAND AND OTHER SENSITIVE AREAS. THE DATA CONTAINED ON THIS PLAN IS INTENDED TO SUPPLEMENT THE DEVELOPER OR CONTRACTORS' EXPERTISE AND IS NOT MEANT TO CIRCUMVENT LOGICAL DECISIONS REQUIRED BY A VARIETY OF FIELD CONDITIONS INCLUDING WEATHER AND THE TYPE OF EQUIPMENT AVAILABLE TO THE CONTRACTOR.

2. THE CONTRACTOR IS TO BE AWARE OF THE REQUIREMENTS AND OBLIGATIONS TO COMPLY WITH CHAPTER 131, SECTION 40 OF THE MASSACHUSETTS GENERAL LAWS, OTHERWISE KNOWN AS THE WETLANDS PROTECTION ACT, AND ITS ASSOCIATED REGULATIONS (310 CMR 10.00). CERTAIN PERMITS IN THE FORM OF AN ORDER OF CONDITIONS, OR OTHER FORMAT, MAY BE REQUIRED FOR THE CONSTRUCTION AS DEPICTED ON THIS PLAN. THESE PERMITS SHALL BE REVIEWED AND ADHERED TO BY THE CONTRACTOR THROUGHOUT THE CONSTRUCTION PROCESS. THE CONTRACTOR SHALL ALSO MAINTAIN COPIES OF ALL PERMITS ON SITE AT ALL TIMES.

3. IF CHANGES IN THE PROJECT ARE REQUIRED DUE TO FIELD CONDITIONS THE DEVELOPER/CONTRACTOR SHALL PROMPTLY NOTIFY THE ENGINEER FOR REVIEW OF THESE CONDITIONS. UPON REVIEW, AND PRIOR TO THE IMPLEMENTATION OF ANY CHANGE, THE CONTRACTOR AND THE ENGINEER SHALL MEET WITH THE APPROPRIATE LOCAL AND/OR STATE OFFICIAL, OR ITS AGENT, TO DETERMINE IF THE CHANGE REQUIRES MODIFICATION TO EXISTING APPROVED PERMITS.

4. ALTERATION AND/OR DESTRUCTION OF WETLAND AREAS WITHOUT PRIOR CONSENT OF THE CONSERVATION COMMISSION IS PROHIBITED. SILTATION PLUMES, ILLICIT DISCHARGES, OR INADVERTANT ALTERATION SHALL BE CONSIDERED AS ACTIVITIES NOT PERMITTED BY THE ORDER AND SHALL BE REPORTED TO THE CONSERVATION COMMISSION ALONG WITH THE PROPOSED MITIGATIVE MEASURES.

5. PRIOR TO THE COMMENCEMENT OF CONSTRUCTION, THE EROSION AND SEDIMENT CONTROL BARRIER SHALL BE INSTALLED AS SHOWN ON THE PLANS. THE CONTRACTOR SHALL MAINTAIN THE EROSION CONTROL BARRIER UNTIL ALL WORK IS COMPLETE AND ALL AREAS HAVE BEEN STABILIZED. THE REMOVAL OF SEDIMENT CONTROL DEVICES SHALL BE ONLY UPON THE APPROVAL OF THE CONSERVATION COMMISSION.

6. EROSION AND SEDIMENTATION CONTROL DEVICES, SUCH AS CHECK DAMS, SEDIMENT BASINS, ETC. ARE TO BE INSTALLED AS SHOWN ON THE SITE DEVELOPMENT PLANS WITH ASSOCIATED DETAILS, AS APPROPRIATE.

7. CONSTRUCTION OPERATIONS SHALL NOT CAUSE NOTICEABLE SEDIMENTATION PLUMES TO OCCUR ON OR SURROUNDING THE PROJECT. SHOULD SEDIMENT EXTEND BEYOND THE EROSION CONTROL BARRIERS, THE CONTRACTOR SHALL STOP WORK AND INSTALL ADDITIONAL MITIGATION MEASURES TO PREVENT FURTHER SEDIMENTATION.

8. NO MATERIAL SUBJECT TO EROSION SHALL BE STOCKPILED OVERNIGHT WITHIN 100 FEET OF ANY WETLAND AREAS WITHOUT PROPER EROSION AND SEDIMENTATION DEVICES IN PLACE.

9. EQUIPMENT SHALL NOT BE PARKED WITHIN WETLAND OR BUFFER AREAS EXCEPT DURING ACTUAL OPERATIONS REQUIRING SAID EQUIPMENT.

10. ACCUMULATED SEDIMENT ALONG EROSION CONTROL BARRIERS SHALL BE PERIODICALLY REMOVED AND DISPOSED OF BY THE CONTRACTOR AS REQUIRED BY THE CONSERVATION COMMISSION OR AS DIRECTED BY THE ENGINEER.

EROSION CONTROL METHODS:

1. IT IS OF GREAT IMPORTANCE THAT CONCENTRATION OF RUNOFF BE AVOIDED IN ORDER TO PREVENT THE TRANSPORT OF SEDIMENT.

2. THE PRIMARY EROSION CONTROL METHOD TO BE UTILIZED IS TO LIMIT THE AREA OF DISTURBANCE DURING CONSTRUCTION ACTIVITIES. THIS IS ACCOMPLISHED BY PROMPT STABILIZATION OF DISTURBED AREAS UPON COMPLETION OF SEQUENCES OF CONSTRUCTION.

3. EROSION AND SEDIMENT CONTROL DEVICES SUCH AS HAY BALES, SILT FENCES, DIVERSION BERMS, ETC. SHALL BE UTILIZED FOR THE PROTECTION OF THE AREAS BEYOND THE LIMIT OF CONSTRUCTION.

DEMARCATION OF SENSITIVE AREAS:

1. IT IS RECOMMEND THAT BARRIERS BE PLACED ON THE SITE TO CONTROL THE LIMITS OF THE DISTURBANCE. AS AN EXAMPLE, HAY BALE BARRIERS PROVIDE SUCH DEMARCATION AND OTHER METHODS SUCH AS LOG BARRIERS, ROPE WITH FLAGGING, ETC. MAY BE UTILIZED.

2. CARE SHOULD BE TAKEN IN THE OPERATION OF EQUIPMENT, SUCH THAT ONLY THE MINIMUM AREA NEEDED TO BE ALTERED IS DISTURBED.

1. ACCESS TO THE SITE SHALL BE MADE IN THE AREA OF A PERMANENT DRIVEWAY OR ROADWAY UNLESS DOING SO WOULD RESULT IN A TRAFFIC HAZARD.

2. AN AREA OF CRUSHED STONE SHALL BE PLACED AT THE DRIVEWAY ENTRANCE TO INSURE THAT MUD IS NOT TRACKED ONTO THE EXISTING ROAD (SEE CONSTRUCTION ENTRANCE DETAIL). IF MUD IS INADVERTENTLY TRACKED ONTO THE ROAD, IT SHOULD BE PROMPTLY REMOVED.

3. LABORERS VEHICLES SHALL BE PARKED IN A DESIGNATED AREA AS TO MINIMIZE DISTURBED SURFACES AND TO INSURE THAT RUTS ARE NOT CREATED AND WHICH COULD CARRY WATER TO A WETLAND OR OTHER SENSITIVE AREA.

4. SUITABLE MEASURES SHALL BE TAKEN TO INSURE THAT LARGE DELIVERY TRUCKS SERVICING THE SITE DO NOT DAMAGE TO AREAS OF EXISTING VEGETATION OR CAUSE DISTURBANCE TO STABILIZED AREAS.

ORDERLY CONSTRUCTION PROCEDURES:

1. THE CONTRACTOR SHALL PERFORM SITE CONSTRUCTION IN A MANNER WHICH WILL INSURE THE STABILIZATION OF AREAS IN PROXIMITY OF OR TRIBUTARY TO WETLAND AREAS AS SOON AS POSSIBLE.

2. EROSION CONTROL DEVICES SUCH AS HAY BALE BARRIERS, SILT FENCES AND MULCH SHALL BE BROUGHT TO THE SITE AND STOCKPILED PRIOR TO INITIATING CONSTRUCTION.

3. THE CONTRACTOR SHALL PROVIDE AREAS FOR THE TEMPORARY STORAGE OF CONSTRUCTION DEBRIS. CONSTRUCTION DEBRIS SHALL NOT BE ALLOWED TO ACCUMULATE FOR AN EXTENDED PERIOD OF TIME.

CLEARING:

1. LAND CLEARING SHALL BE PERFORMED IN PHASES CONSISTENT WITH ACTUAL CONSTRUCTION REQUIREMENTS. FINAL LAND CLEARING SHALL BE LIMITED TO RETURN TO GRADE SLOPES.

2. TREES SHALL BE CUT FOR ENTIRE SITE LEAVING SUMPS IN PLACE TO MAINTAIN SOIL STABILIZATION.

3. STUMPS SHALL BE PULLED AND STOCKPILED FOR GRINDING.

4. BRUSH AND BRANCHES SHOULD BE CHIPPED AND UTILIZED FOR WOOD MULCH IF PRACTICAL.

5. VEHICLES UTILIZED IN THE CLEARING OPERATION SHOULD NOT TRAVERSE WETLANDS OR FLOWING BROOKS OR STREAMS WITHOUT PRIOR APPROVAL FROM THE LOCAL CONSERVATION COMMISSION OR AGENT.

ROUGH GRADING:

1. THE ROUGH GRADING OF THE SITE SHALL FOLLOW THE FILL AND EXCAVATION SEQUENCES AS DESCRIBED ON THE CONSTRUCTION PHASING PLANS. SLOPES SHALL BE MAINTAINED AWAY FROM WETLANDS AND SENSITIVE AREAS AS MUCH IS PRACTICAL.

2. DURING THIS PROCESS THE EROSION POTENTIAL IS HIGH. SUFFICIENT EROSION CONTROL BARRIERS SHOULD BE KEPT IN PROXIMITY TO THE WORK AREA TO ALLOW QUICK ACTION SHOULD EROSION BECOME AN ISSUE AND TO INSURE THAT NO SEDIMENT REACHES WETLANDS OR OTHER SENSITIVE AREAS.

3. IN AREAS OF CUT AND/OR FILL WHERE SLOPES COULD DIVERT WATER TOWARD WETLAND AREAS, DIVERSION TRENCHES AND/OR SWALES SHOULD BE CONSIDERED AND IMPLEMENTED TO DIVERT WATER AWAY FROM THESE AREAS.

4. STEEP SIDE SLOPES IN EXCAVATION OR FILL SHOULD BE AVOIDED.

5. DISTURBED AREAS SHALL BE STABILIZED BY LOAMING AND SEEDING OR RIPRAPPED IMMEDIATELY AFTER THE FINISH GRADE HAS BEEN MET. IF FINAL GRADING DOES NOT OCCUR DURING THE GROWING SEASON, THESE AREAS SHALL BE MULCHED WITH HAY WITH A TACKIFIER, IF NECESSARY SLOPED AREAS MAY REQUIRE ADDITIONAL CONTROLS SUCH AS EROSION CONTROL SOCKS OR HAYBALES.

6. A GROUND COVER SUFFICIENT TO RETAIN SOILS IN A STABILIZED CONDITION MUST BE PROVIDED WITHIN 14 WORKING DAYS, SEASON PERMITTING, ON ANY PORTION OF THE TRACT UPON WHICH FURTHER ACTIVE CONSTRUCTION IS NOT BEING UNDERTAKEN.

DRAINAGE:

1. IF DRAINAGE PIPES OR SWALES ARE TO BE INSTALLED, THEY SHALL BE CONSTRUCTED FROM DOWNSTREAM UP AND CONSTRUCTION SHALL INCLUDE THE PLACEMENT OF OUTFALL RIPRAP AND OTHER MITIGATIVE MEASURES SHOWN ON THE PLAN.

2. PRIOR TO THE COMMENCEMENT OF CONSTRUCTION, HAY BALES OR OTHER SUITABLE METHODS TO ENTRAP SEDIMENT SHALL BE PLACED DOWNSTREAM.

3. THE TOE OF EMBANKMENTS SHALL BE STABILIZED IMMEDIATELY, MULCHED AND TACKED DOWN BY SUITABLE MEANS.

CREATION OF DETENTION BASIN:

1. THE DETENTION BASIN HAS BEEN PLACED AS A SEPARATE ITEM TO EMPHASIZE THE IMPORTANCE OF EROSION CONTROL DURING ITS CONSTRUCTION.

2. THE PRIMARY EROSION CONTROL METHOD FOR BASIN CONSTRUCTION, AS WELL AS FOR THE SITE IS THE RAPID STABILIZATION OF ALL SURFACES. SECONDARY IN IMPORTANCE IS THE CONCENTRATION OF RUNOFF BE AVOIDED IN ORDER TO PREVENT THE TRANSPORT OF SEDIMENT.

3. DURING CONSTRUCTION, THE FILL AND EXCAVATION SEQUENCES SHOWN ON THE CONSTRUCTION PHASING PLANS, ALONG WITH THE DETAILS PROVIDED IN THIS PLAN SET SHALL BE UTILIZED. THESE SEQUENCES REQUIRE THAT SLOPED AREAS LEFT FOR ANY PERIOD OF TIME NOT SLOPED TOWARDS THE WETLAND OR SENSITIVE AREA, BUT RATHER BACK INTO THE FILL MATERIAL.

4. THE BASIN BERM IS TO BE CONSTRUCTED BY EQUIPMENT WORKING ON STABLE MATERIAL ONLY. HAY BALES SHALL BE PLACED AT THE TOE OF SLOPE UNTIL SURFACES ARE STABILIZED.

5. NO EXCAVATION WITHIN THE BASIN SHALL COMMENCE UNTIL THE BERM IS IN PLACE.

6. CARE SHOULD BE TAKEN TO INSURE THAT ORGANIC MATERIAL REMOVED FROM THE BASIN AREA IS RESERVED FOR FINISH GRADING AND THE STABILIZATION OF DISTURBED AREAS.

7. IF DEWATERING IS NECESSARY, PUMPING TO A SETTLING BASIN SHALL BE PERMITTED IF SETTLING BASIN IS CONSTRUCTED, MAINTAINED AND OPERATED EFFECTIVELY.

8. AT NO TIME SHALL RUNOFF CARRYING SEDIMENT BE ALLOWED TO FLOW TO THE WETLANDS OR SENSITIVE AREAS.

9. THE WORK AREA SHALL REMAIN FREE OF LITTER AND DEBRIS AT ALL TIMES AND MONITORED ON A DAILY BASIS TO ENSURE COMPLIANCE.

10. ALL MATERIALS STOCKPILED SHALL BE LOCATED, MULCHED OR OTHERWISE TREATED TO INSURE THAT MATERIALS CONTAINED, THEREIN, AREA NOT CARRIED INTO THE WETLANDS.

11. ANY MATERIALS BLOWN OR CARRIED BY WATER AWAY FROM THE CONSTRUCTION SITE OR INTO THE WETLAND AREAS SHALL BE PROMPTLY REMOVED AS REQUIRED BY THE LOCAL CONSERVATION COMMISSION.

12. A GEOTECHNICAL FILTER FABRIC SHALL BE PLACED OVER THE BASIN SUBDRAIN DURING CONSTRUCTION TO PREVENT SEDIMENT FROM ENTERING AND CLOGGING THE DRAIN. THE FABRIC SHALL BE REMOVED FOR BASIN PREPARATION FOR FINAL STABILIZATION.

GRUBBING AND STRIPPING:

1. TOP SOIL SHALL BE RETAINED AND STOCKPILED FOR LANDSCAPING PURPOSES.

2. GRUBBING AND STRIPPING OF SLOPES LEADING TO WETLAND AREAS SHOULD NOT BE UNDERTAKEN DURING PERIODS OF INTENSE RAINFALL.

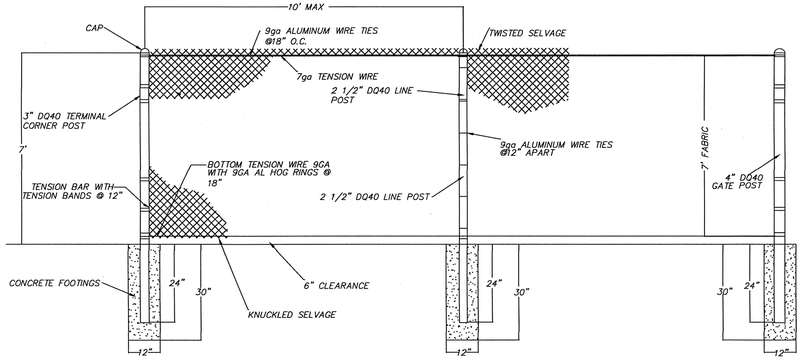
3. TOP SOIL STOCKPILE LOCATIONS ARE DEPICTED ON THE SITE DEVELOPMENT PLAN, THE EROSION CONTROL PLAN, AND/OR THE CONSTRUCTION PHASING PLAN AND SHALL BE ADHERED TO.

4. WHEN WORKING IN THE VICINITY OF WETLANDS, TOP SOIL SATURATED WITH WATER SHALL BE REMOVED, AND CONTAINED PRIOR TO BEING USED.

5. AREAS LEADING TO WETLANDS SHALL HAVE HAY BALE BARRIERS INSTALLED ACROSS THEM IN ARCS POINTING DOWN THE HILL AT INTERVALS SUFFICIENT TO MITIGATE RUNOFF CARRYING SEDIMENT.

6. DURING PERIODS OF INTENSE RAINFALL, OR IF THE PROJECT IS TO BE LEFT FOR A PERIOD OF TIME, CONSIDERATION SHOULD BE GIVEN TO SUPPLEMENT HAY BALE BARRIERS WITH EITHER CRUSHED STONE OR ARMORED BARRIERS. CONSIDERATION MAY ALSO BE GIVEN TO DIVERTING RUNOFF INTO TEMPORARY SEDIMENTATION CONTROL AREAS.

7. WHENEVER PRACTICAL, NATURAL VEGETATION SHALL BE RETAINED, PROTECTED AND SUPPLEMENTED.

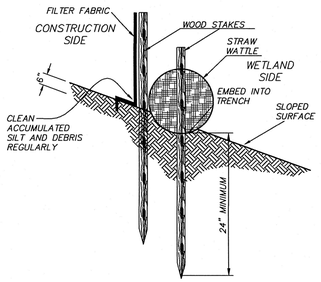


CHAIN LINK FENCE DETAIL

NO SCALE

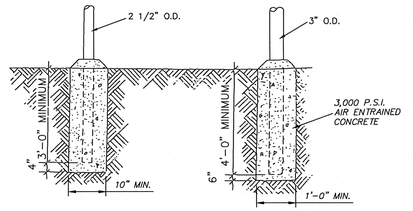
NOTES:
COLOR OF ALL MATERIALS ARE GALVANIZED
INCLUDES 1QTY 20' WIDE DOUBLE GATE
GATE POSTS 4"
TERMINAL POSTS 3"
LINE POSTS 2.5"
TOP TENSION WIRE 7ga HOG RING WITH STEEL CORE
TENSION BANDS @ 12"
WIRE 9ga TENSION WIRE TO MATCH FABRIC.
BOTTOM TENSION WIRE WITH 9ga AL HOG RINGS
DOME CAPS RAIL ENDS
9ga TIE WIRES WITH STEEL CORE
3" BRACE BANDS

STEEL CORE GALVANIZED with 9ga PVC EXTRUDED POLY VINYL CHLORIDE (PVC) COATED STEEL CHAIN LINK FABRIC AS PER ASTM F668 CLASS 1



STRAW WATTLE DETAIL

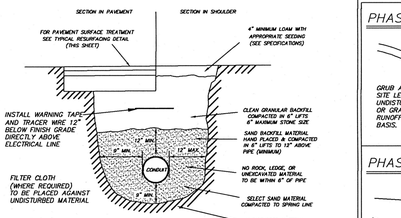
NO SCALE



LINE POST — CORNER AND GATEPOST

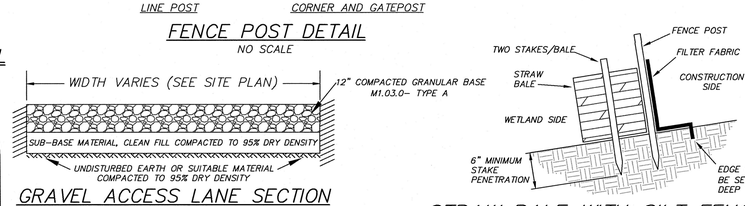
FENCE POST DETAIL

NO SCALE



CONDUIT TRENCH

NO SCALE

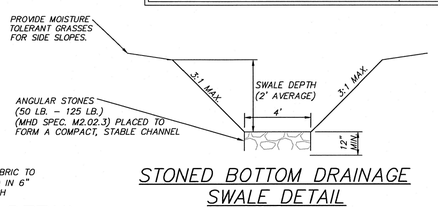


GRAVEL ACCESS LANE SECTION

(FOR ACCESS TO SITE AND DETENTION BASIN)
NO SCALE

STRAW BALE WITH SILT FENCE DETAIL

NO SCALE

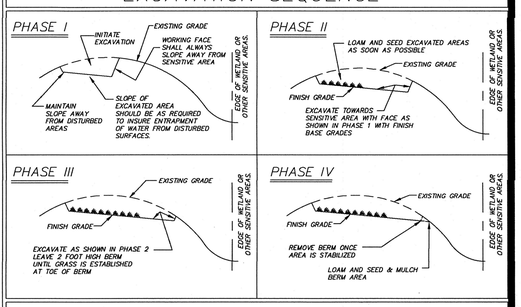


STONED BOTTOM DRAINAGE SWALE DETAIL

NO SCALE

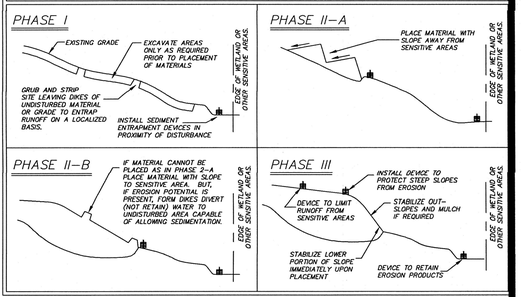
EXCAVATION SEQUENCE

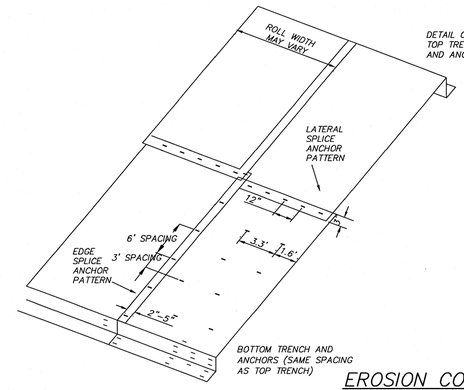
NO SCALE



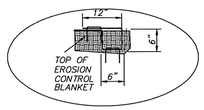
FILL SEQUENCE

NO SCALE





BOTTOM TRENCH AND ANCHORS (SAME SPACING AS TOP TRENCH)



DETAIL OF TOP TRENCH AND ANCHORS

PROCEDURES FOR INSTALLATION OF EROSION CONTROL BLANKET:

1) PREPARE SLOPES WITH FINAL GRADING AND LOAM PLACEMENT. RAKE AND SMOOTH FINAL SURFACE, APPLY APPLICABLE SEED MIX.

2) START AT THE TOP OF SLOPE BY ANCHORING BLANKETS IN A 6" DEEP x 6" WIDE ANCHOR TRENCH. PLACE BLANKETS, STAPLE (8" STAPLES), BACKFILL AND COMPACT WITH FABRIC OVERLAP OF 12".

3) ROLL BLANKETS DOWN THE SLOPE. STAPLE THE OPEN BLANKET EDGE USING ONE ROW OF STAPLES AT 2' INTERVALS. THE INTERIOR OF THE BLANKET SHOULD BE STAPLED USING A 2' WIDE x 3' HIGH STAPLE PATTERN. BE SURE TO LAY BLANKETS LOOSLY ON THE GROUND ALLOWING A GOOD CONTACT BETWEEN SOIL AND BLANKETS.

4) USE AN 6" OVERLAP BETWEEN BLANKET SPLICES. USE A SINGLE ROW OF STAPLES TO ANCHOR BLANKETS TOGETHER.

5) PROVIDE 6"x 6" ANCHOR TRENCH AT TOE OF SLOPE.

6) EROSION CONTROL BLANKET TYPE SHALL BE PROPERLY SELECTED FOR SOIL CONDITIONS AND MAXIMUM ALLOWABLE SLOPE.

7) ANY/ALL METALLIC ANCHORS SHALL BE PROMPTLY REMOVED ONCE THE VEGETATIVE COVER HAS BEEN ESTABLISHED.

8) GRASS SEED VARIETY SHALL BE PROPERLY CHOSEN FOR SPECIFIC SITE CONDITIONS (SHADE OR SUN, ETC.)

EROSION CONTROL BANKET PLACEMENT

NO SCALE

"FACILITY NAME"

OWNER CONTACT INFORMATION
(###) ### – ####

OPERATOR CONTACT INFORMATION
(###) ### – ####

EMERGENCY CONTACT INFORMATION
(###) ### – ####

TYPICAL PROJECT SIGN

NO SCALE
24" x 24"
SIGNS TO BE PLACED AT ENTRANCE OF PROJECT SITE

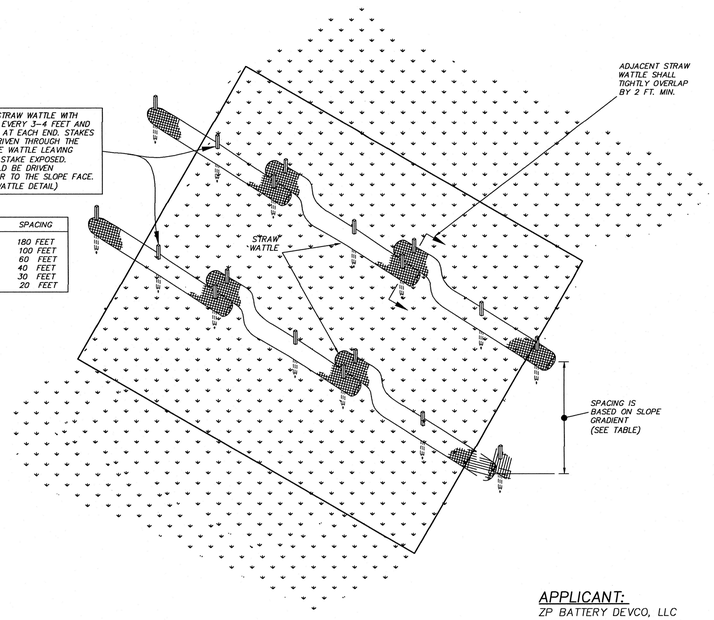
DANGER
NO TRESPASSING

PERIMETER SIGNAGE

NO SCALE
12" x 9"
SIGNS TO BE PLACED ALONG FENCELINE AT 50 FT INTERVALS

SECURE THE STRAW WATTLE WITH WOOD STAKES EVERY 3–4 FEET AND WITH A STAKE AT EACH END. STAKES SHOULD BE DRIVEN THROUGH THE MIDDLE OF THE WATTLE LEAVING 2–3" OF THE STAKE EXPOSED. STAKES SHOULD BE DRIVEN PERPENDICULAR TO THE SLOPE FACE. (SEE STRAW WATTLE DETAIL)

SLOPE	SPACING
1%	180 FEET
4%	100 FEET
9%	60 FEET
14%	40 FEET
18%	30 FEET
30%	20 FEET



EROSION CONTROL SLOPE DETAIL

APPLICANT:
ZP BATTERY DEVCO, LLC
BRENDON GOVE
10 E. WORCESTER STREET, SUIT 3A
WORCESTER, MASSACHUSETTS 01604
OWNER:
WR ENTERPRISES, LLC
1323 MAIN STREET
LEICESTER, MASSACHUSETTS 01524

NO.	DATE	REVISIONS	BY
1	10/19/21	PEER–REVIEW COMMENT	CMA

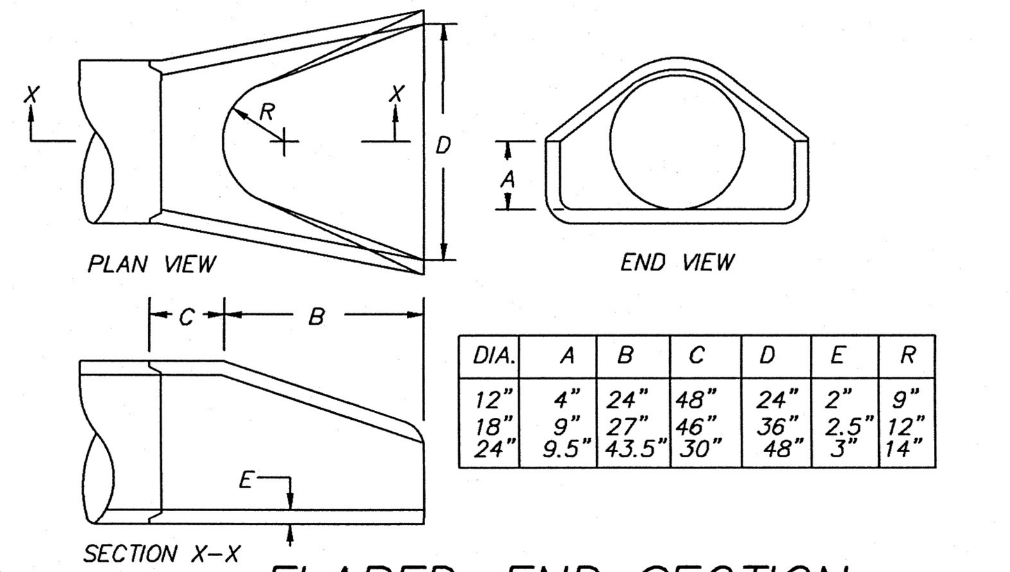
COMMONWEALTH OF MASSACHUSETTS — CHRISTOPHER M ANDERSON — CIVIL — No. 55773 — REGISTERED PROFESSIONAL ENGINEER

HANNIGAN ENGINEERING, INC.
CIVIL ENGINEERS & LAND SURVEYORS
8 MONUMENT SQUARE
LEOMINSTER, MASSACHUSETTS 01453
(978) 534-1234 (T)
(978) 534-6060 (F)
WWW.HANNIGANENGINEERING.COM

CONSTRUCTION DETAILS IN LEICESTER, MASSACHUSETTS

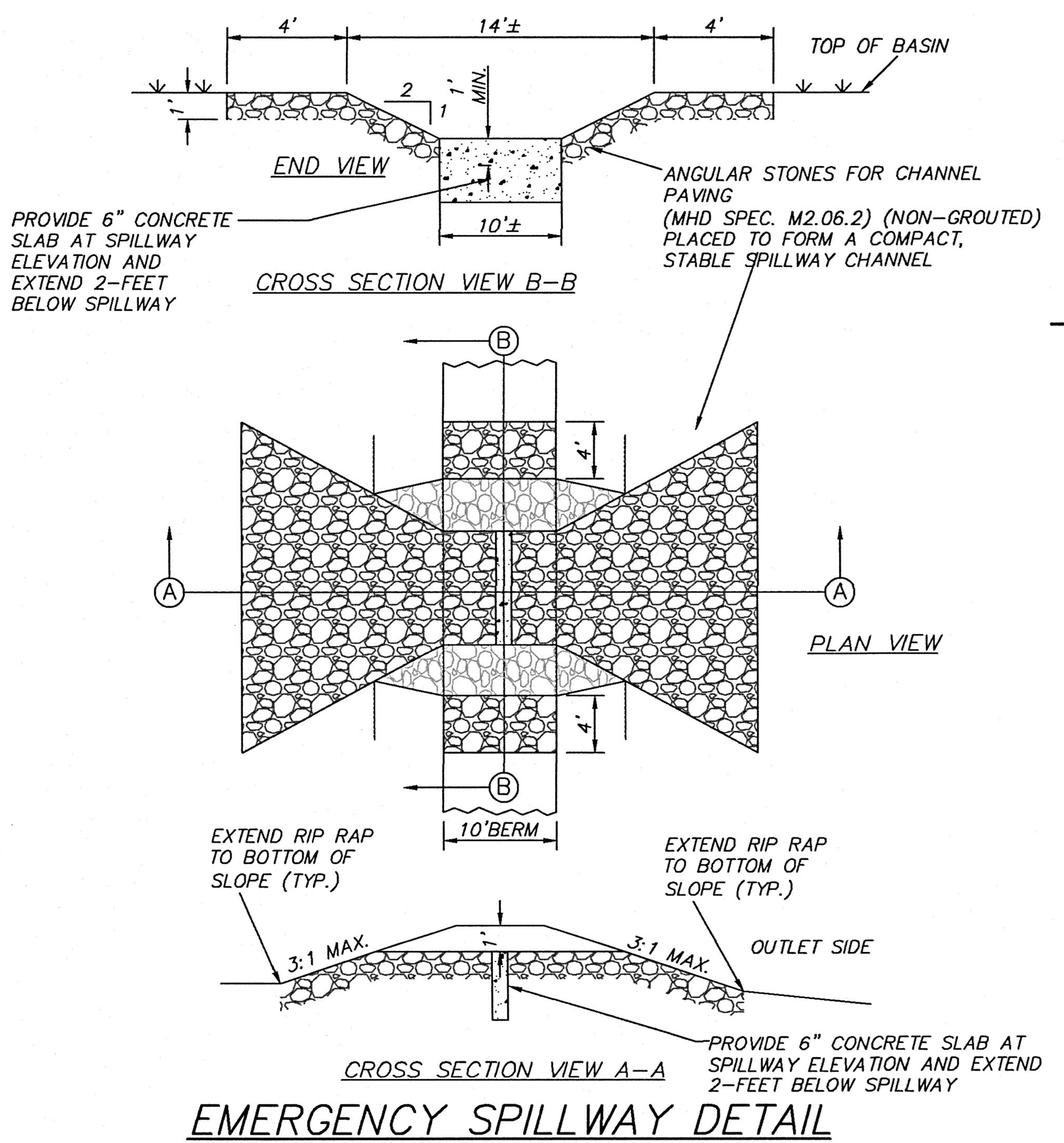
PREPARED FOR:
ZP BATTERY DEVCO, LLC
BRENDAN GOVE
10 E WORCESTER STREET SUITE 3A
WORCESTER, MASSACHUSETTS 01604
TEL:

CALC: CMA	DRWN: CMA	SCALE: NA
CHKD: WDH	APPD: WDH	DATE: SEP 21, 2021
SRV: JEF	FB: 71–22	JOB NO: 3010
TAB: (5–6)DET	SHEET 5 OF 6	PLAN NO:C–17–38

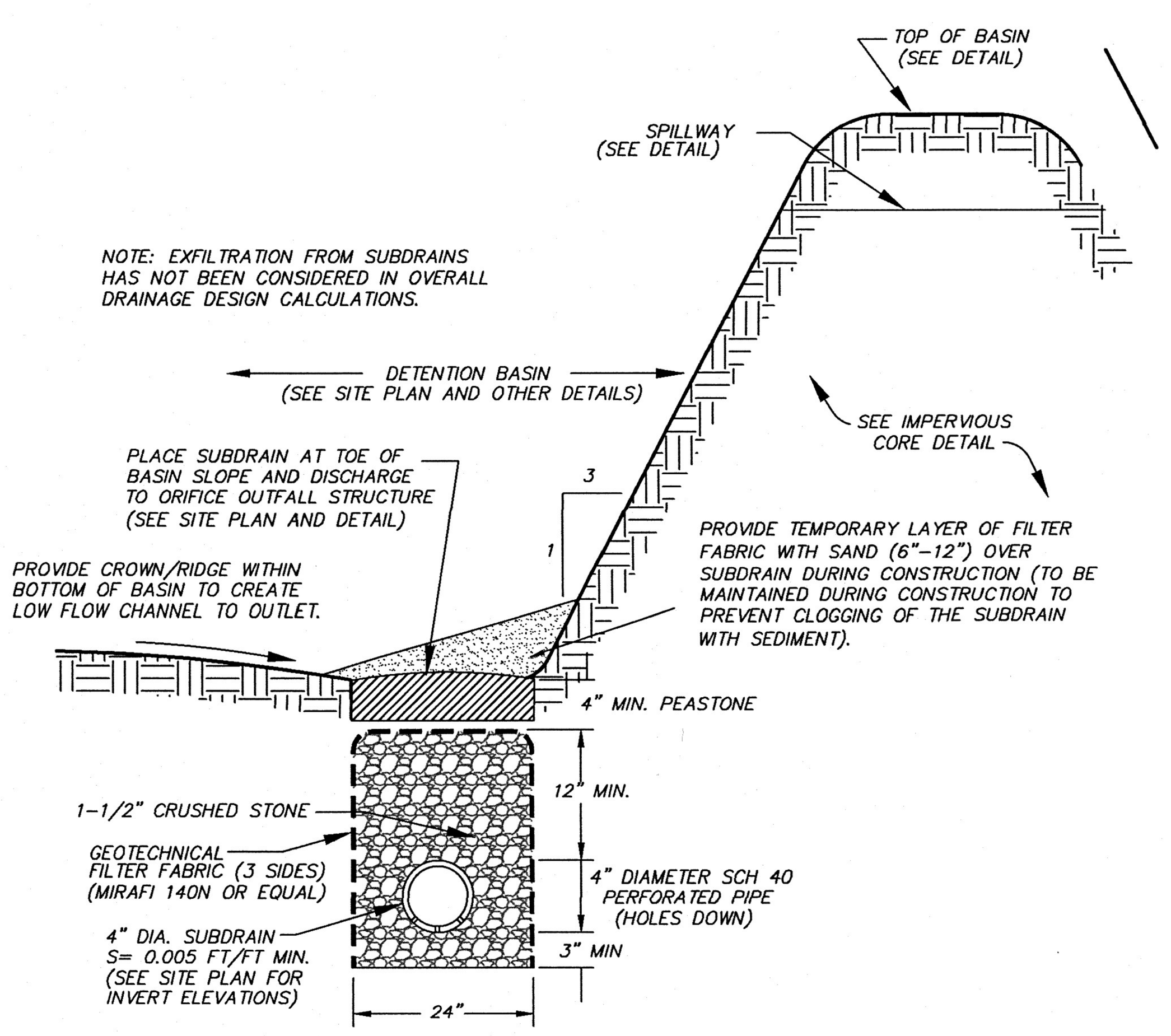


DIA.	A	B	C	D	E	R
12"	4"	24"	48"	24"	2"	9"
18"	9"	27"	46"	36"	2.5"	12"
24"	9.5"	43.5"	30"	48"	3"	14"

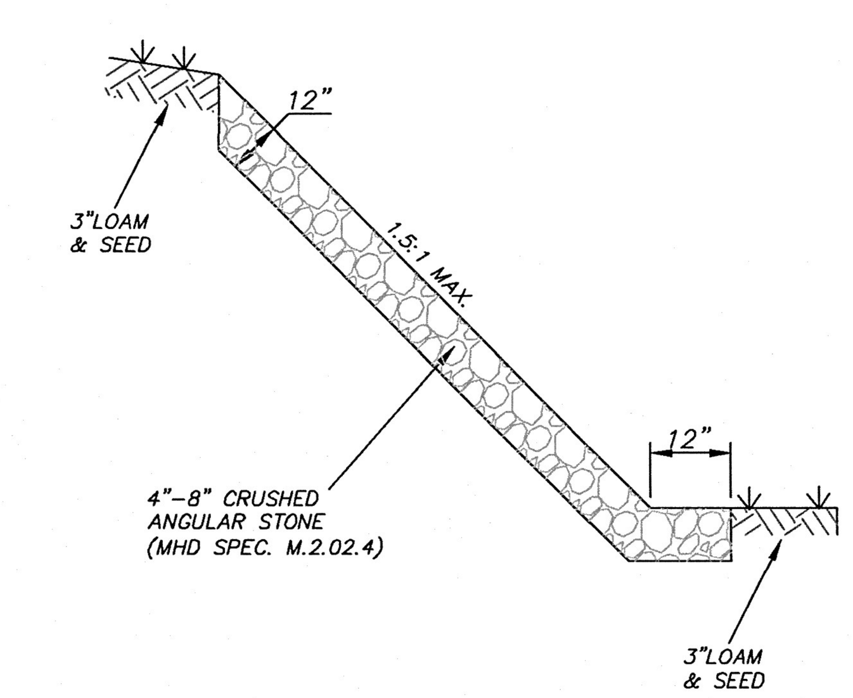
FLARED–END SECTION
NO SCALE



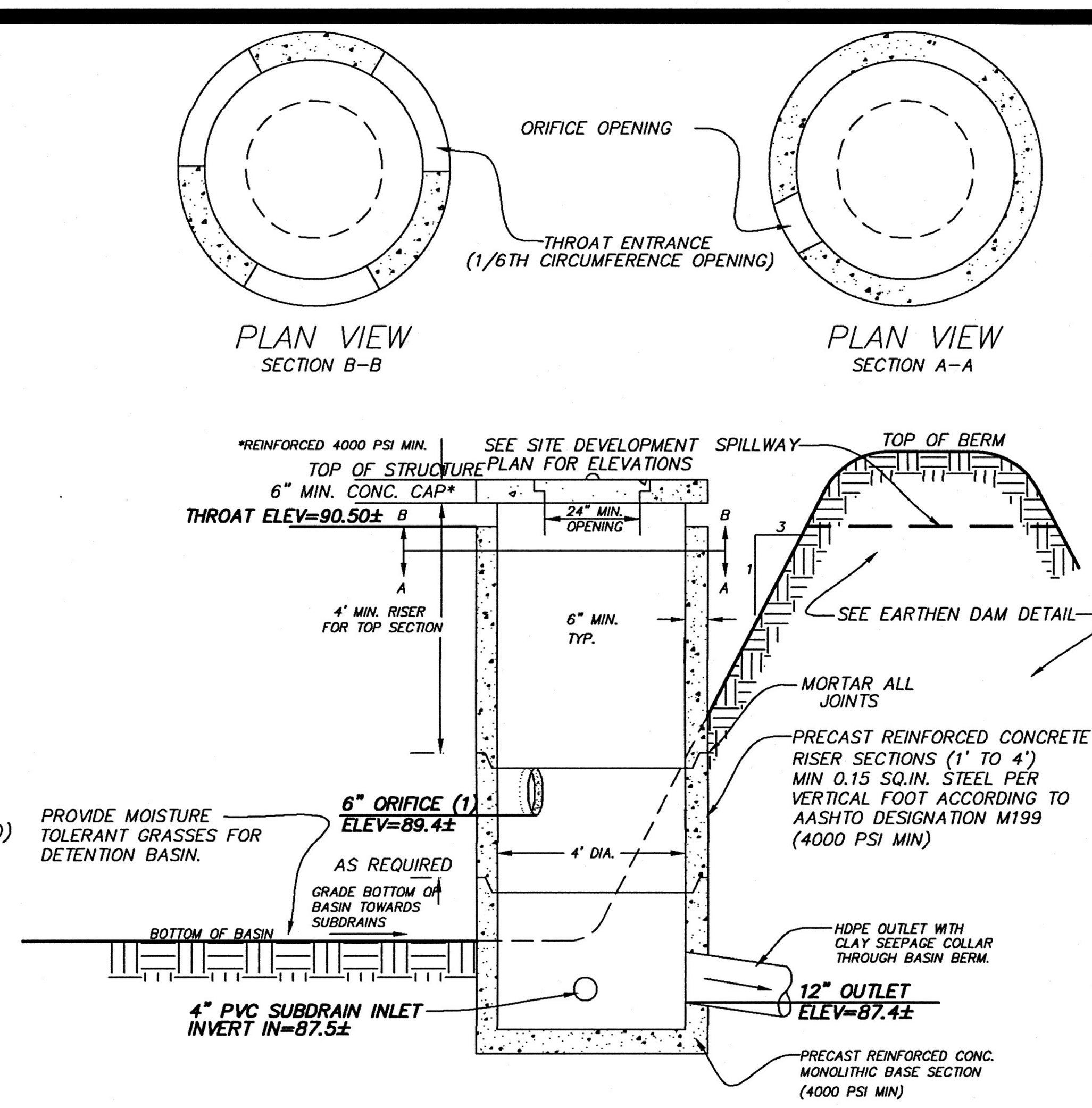
EMERGENCY SPILLWAY DETAIL
NO SCALE



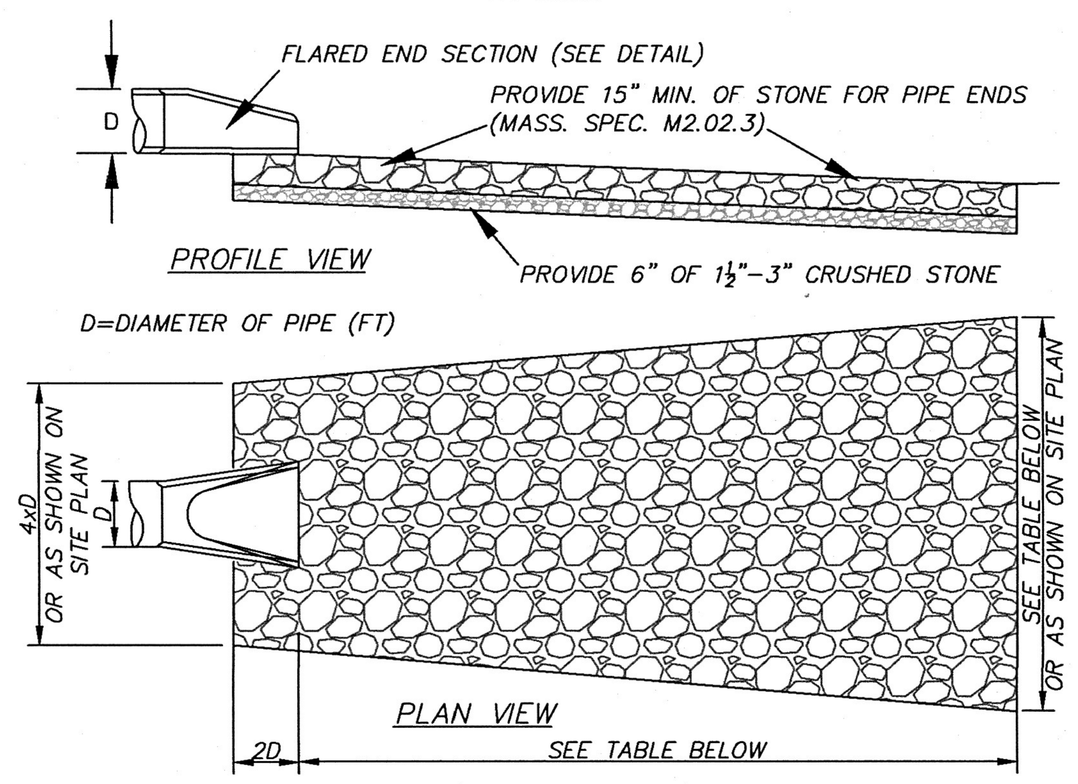
DETENTION BASIN 4"–SUBDRAIN DETAIL
NO SCALE



1.5:1 RIP RAP SLOPE DETAIL
NO SCALE

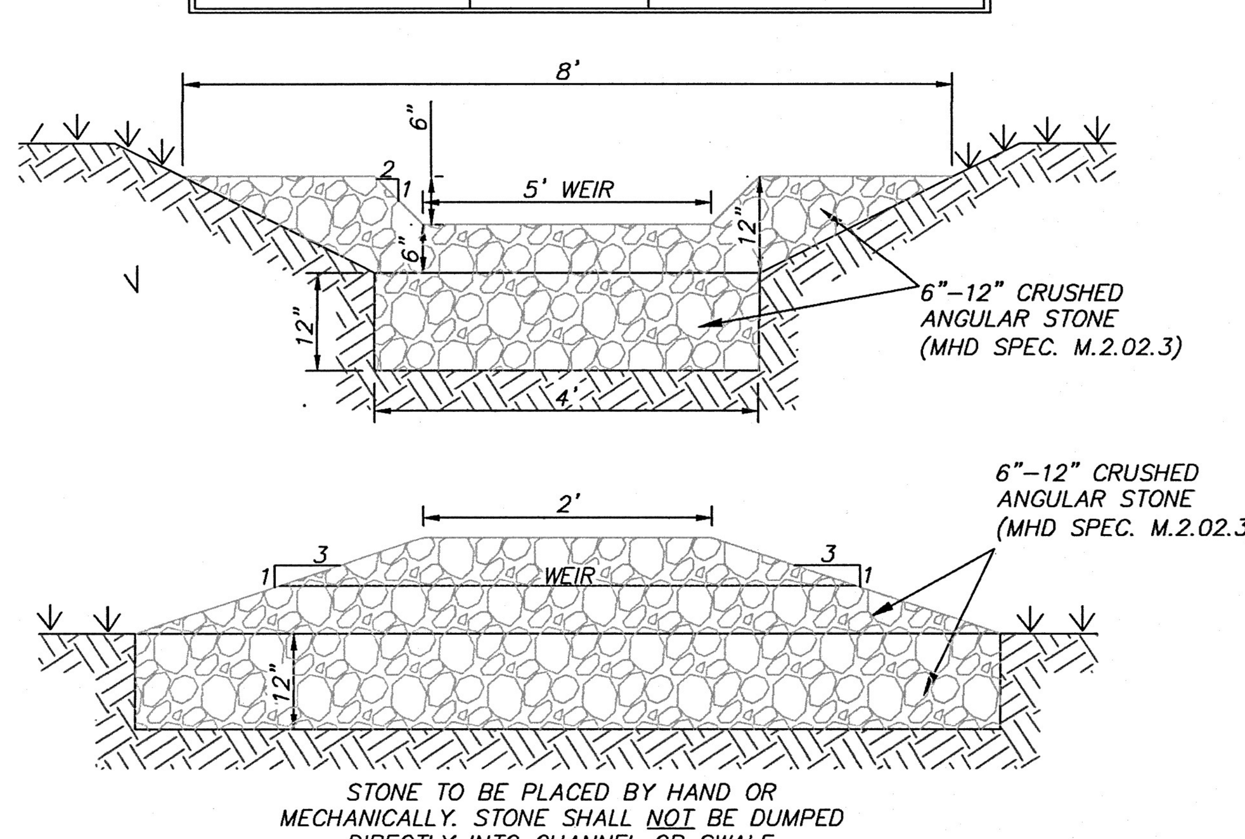


D–BASIN OUTLET STRUCTURE #11
WITH 1/6TH CIRCUMFERENCE THROAT OPENINGS
NO SCALE



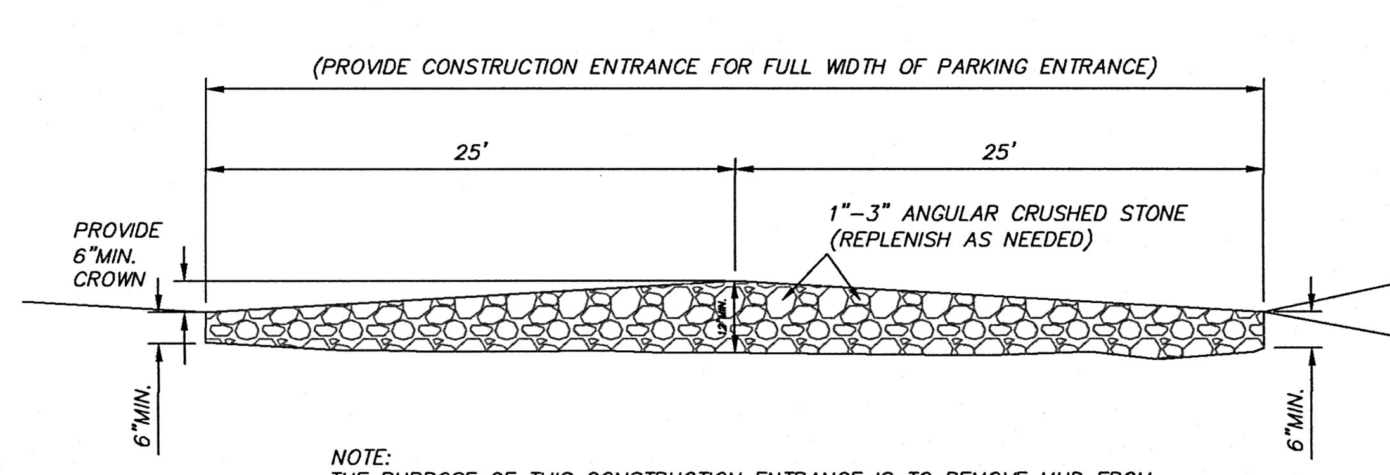
RIP RAP APRON DETAIL
NO SCALE

RIP–RAP APRON DIMENSIONING TABLE		
PIPE DIAMETER	LENGTH	TERMINUS WIDTH
12–INCH (FE#1)	10.0 FEET	10.0 FEET



STONE TO BE PLACED BY HAND OR MECHANICALLY. STONE SHALL NOT BE DUMPED DIRECTLY INTO CHANNEL OR SWALE.

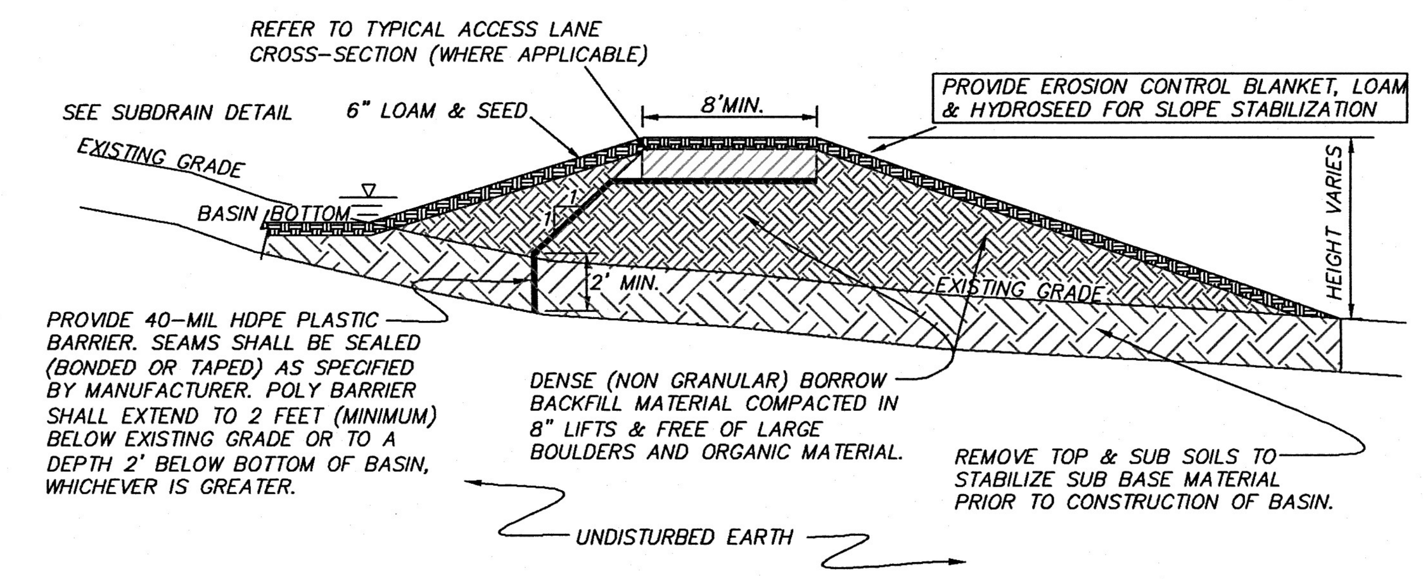
ROCK CHECK DAM
NO SCALE
(SEE PLAN FOR LOCATIONS AND ELEVATIONS)



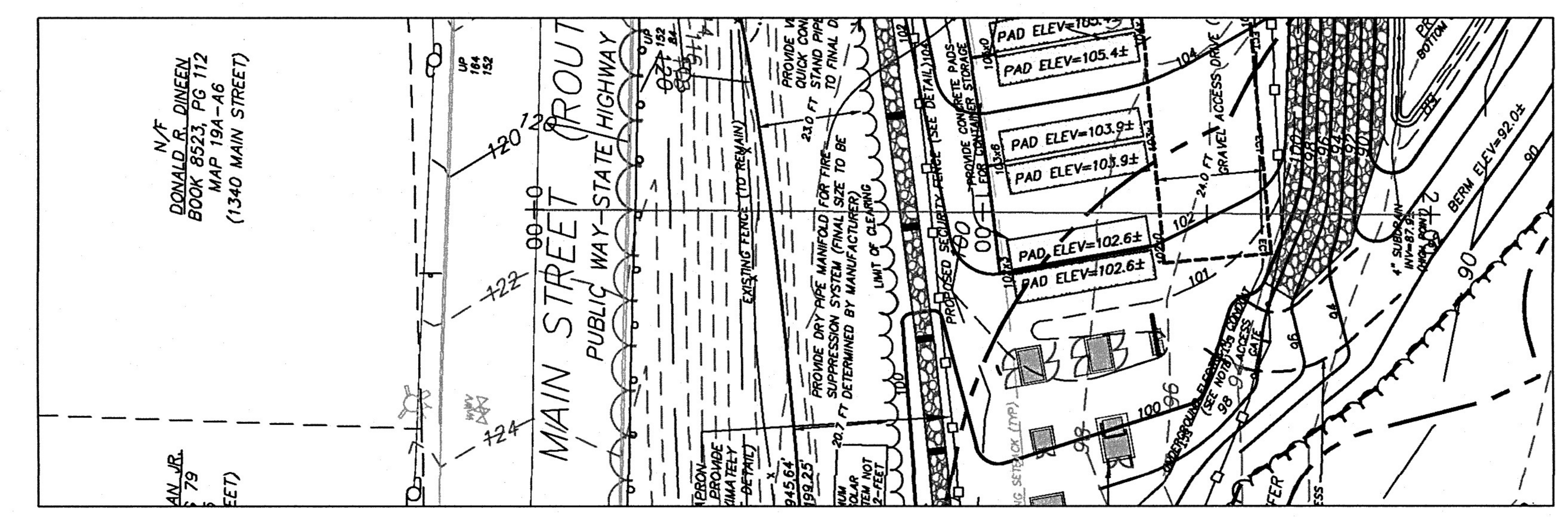
NOTE:
THE PURPOSE OF THIS CONSTRUCTION ENTRANCE IS TO REMOVE MUD FROM CONSTRUCTION VEHICLES. CONTRACTOR TO REPLENISH STONE AS NEEDED TO MAINTAIN EFFECTIVENESS.

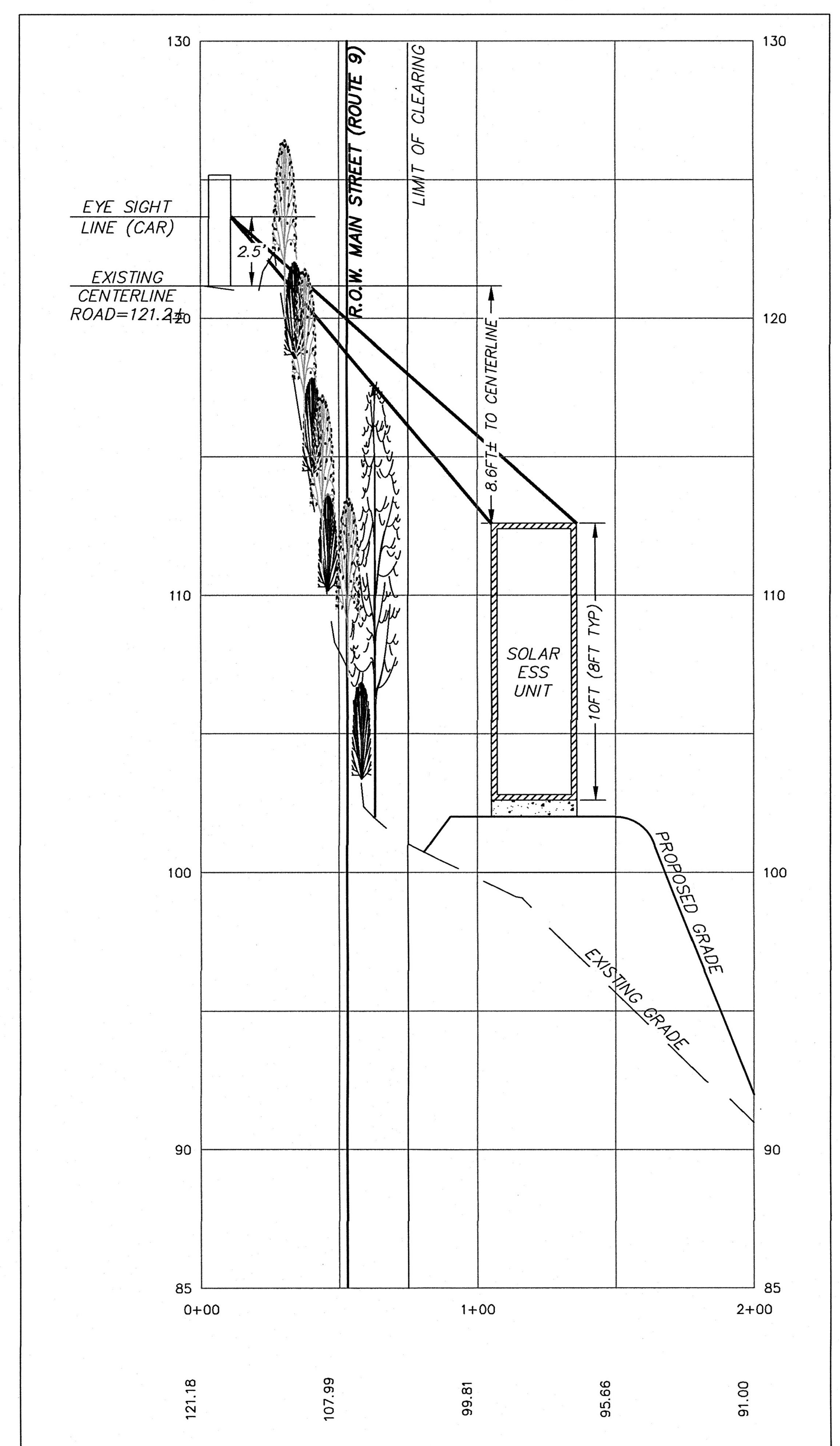
CONSTRUCTION ENTRANCE
NO SCALE

NOTE: FOUNDATION FOR BERM CONSTRUCTION SHALL BE CLEARED OF ALL TOP SOIL, ROCKS, DEBRIS, STUMPS, ETC. TO A FIRM SURFACE. IN NO CASE SHALL THIS EXCAVATION BE LESS THAN 12 INCHES SUBGRADE SHALL BE SCARIFIED AND MOISTENED TO A DEPTH OF 3 INCHES PRIOR TO PLACEMENT OF FILL.



DETENTION BASIN BERM
(REQUIRED FOR DETENTION BASIN CONSTRUCTION)
NO SCALE





PROJECT SIGHT LINE
HORIZONTAL SCALE=1":40' VERTICAL SCALE=1":4'

STORMWATER OPERATION AND MAINTENANCE PLAN

THE FOLLOWING SHALL BE CONSIDERED THE OPERATION & MAINTENANCE PLAN (OMP) FOR THE STORMWATER COLLECTION FACILITY FOR THIS DEVELOPMENT. THIS OMP HAS BEEN PREPARED IN ACCORDANCE WITH THE STORMWATER MANAGEMENT POLICY AS ISSUED BY THE DEPARTMENT OF ENVIRONMENTAL PROTECTION.

I. SYSTEM OWNERSHIP

THE SYSTEM SHALL INCLUDE THE DRAINAGE INFRASTRUCTURE AND ALL OF ITS COMPONENTS AS SHOWN ON THE SITE DEVELOPMENT PLANS, INCLUDING THE DETENTION FACILITIES AND OUTFALL AREAS OF THE DRAINAGE SYSTEM. THE STRUCTURES OF THE SYSTEM SHALL INCLUDE THE DRAINAGE SWALES AND THE OUTFALL & CONTROL STRUCTURES. THE SYSTEM SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE CONSTRUCTION DETAILS AND THE APPROVED PLANS.

UPON THE COMPLETION OF CONSTRUCTION THE DRAINAGE SYSTEM DESCRIBED ABOVE AND AS DEPICTED ON THE SITE PLANS SHALL BECOME PROPERTY OF THE LAND OWNER, WITH SPECIFIC EASEMENT RIGHTS TO THE OPERATOR OF THE SOLAR SYSTEM TO MAINTAIN THE DRAINAGE SYSTEM AS DEPICTED ON THE APPROVED PLANS. SAID EASEMENT RIGHTS SHALL BE SPECIFICALLY DESCRIBED IN LEASE DOCUMENTS FOR THE PROJECT.

II. RESPONSIBLE PARTIES

THE OPERATOR OF THE SOLAR SYSTEM SHALL BE CONSIDERED THE RESPONSIBLE PARTY FOR THE OPERATION AND MAINTENANCE OF THE STORMWATER MANAGEMENT SYSTEM. THE SYSTEM SHALL INCLUDE THE DRAINAGE INFRASTRUCTURE AND ALL OF ITS COMPONENTS AS SHOWN ON THE APPROVED PLANS. THE SYSTEM SHALL ALSO INCLUDE THE DETENTION FACILITIES AND THE OUTFALL AREAS OF THE DRAINAGE SYSTEM.

III. INSPECTION & MAINTENANCE SCHEDULE

THE FOLLOWING MAINTENANCE SCHEDULE SHALL BE FOLLOWED IN ORDER TO MAINTAIN THE EFFECTIVENESS OF THE STORMWATER MANAGEMENT SYSTEM.

STRUCTURE TYPE	INSPECTION	MAINTENANCE	TASK
RIP/RAP APRONS	TWICE A YEAR	EVERY 10 YEARS	REMOVE DEBRIS & ADD STONE
SUBDRAINS	TWICE A YEAR	EVERY 4 YEARS	REPLACE PEASTONE
DETENTION BASINS	MONTHLY (MAY–OCT)	MONTHLY (MAY–OCT)	MOW GRASS AREAS & REMOVE DEBRIS REMOVE SEDIMENT IF PRESENT
OUTFALL STRUCTURES: SPILLWAYS	TWICE A YEAR	EVERY 10 YEARS	REMOVE DEBRIS & ADD STONE

NOTE: THE DETENTION BASINS ON THIS PROJECT MAY GROW VEGETATION IN THE BOTTOM WHICH MAY INCLUDE SPECIES PART OF THE WETLAND PROTECTION ACT. THESE PLANTS SHALL NOT BE CONSTRUED AS HAVING PROTECTION UNDER THE ACT AND SHALL BE CONSIDERED OPPORTUNISTIC GROWTH PLANTS. ADDITIONALLY, THIS AREA SHALL NOT BE CONSIDERED A CONSTRUCTED WETLAND.

SEEDING OPERATION AND MAINTENANCE PLAN

I. RESPONSIBLE PARTIES

THE OPERATOR OF THE SOLAR SYSTEM SHALL BE CONSIDERED THE RESPONSIBLE PARTY FOR THE OPERATION AND MAINTENANCE OF THE GRASS & VEGETATION. THE VEGETATION SHALL INCLUDE ALL OF ITS AREAS AS SHOWN ON THE APPROVED PLANS. THE SYSTEM SHALL ALSO INCLUDE THE GRASSED AREAS AROUND THE PANELS AND DRAINAGE STRUCTURES.

II. INSPECTION & MAINTENANCE SCHEDULE

THE FOLLOWING MAINTENANCE SCHEDULE SHALL BE FOLLOWED IN ORDER TO MAINTAIN THE VEGETATED AREAS

ACTIVITY	MAINTENANCE	TASK
GRASS CUTTING	MONTHLY	GRASS HEIGHT TO BE ALLOWED TO GROW TO A HEIGHT OF NO MORE THAN 18 INCHES AND BE CUT TO A HEIGHT OF 4 TO 6 INCHES.

III. APPROPIATE SEED MIX AND APPLICATION RATES

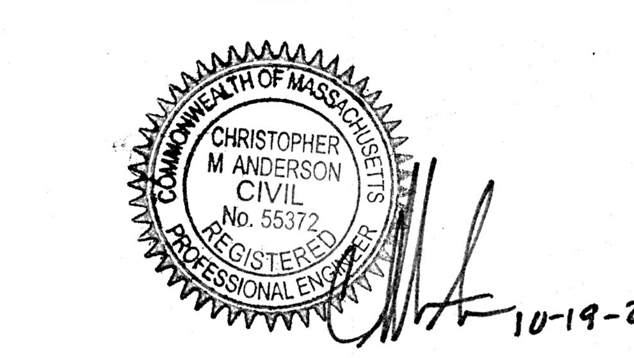
THE FOLLOWING SEED SCHEDULE SHALL BE FOLLOWED IN ORDER TO PROPERLY MAINTAIN VEGETATED AREAS

SEED TYPE (NATIVE SEED REQUIRED)	APPLICATION RATE	% OF MIX
WILDFLOWER SEED MIX	5 TO 10 POUNDS PER ACRE	50%
WHITE CLOVER SEED MIX	3 TO 5 POUNDS PER ACRE	10%
KENTUCKY BLUEGRASS	80 TO 100 POUNDS PER ACRE	40%

IV. HERBICIDES & PESTICIDES

THERE WILL NO HERBICIDES OR PESTICIDES USED ON THIS PROJECT.

NO.	DATE	REVISIONS	BY
1	10/19/21	PEER–REVIEW COMMENT	CMA



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CONSTRUCTION DETAILS
IN
LEICESTER, MASSACHUSETTS

PREPARED FOR:
ZP BATTERY DEVCO, LLC
BRENDAN GOVE
10 E WORCESTER STREET SUITE 3A
WORCESTER, MASSACHUSETTS 01604
TEL:

APPLICANT:
ZP BATTERY DEVCO, LLC
BRENDON GOVE
10 E. WORCESTER STREET, SUIT 3A
WORCESTER, MASSACHUSETTS 01604

OWNER:
WR ENTERPRISES, LLC
1323 MAIN STREET
LEICESTER, MASSACHUSETTS 01524

CALC: CMA	DRWN: CMA	SCALE: NA
CHKD: WDH	APPD: WDH	DATE: SEP 21, 2021
SRV: JEF	FB: 71–22	JOB NO: 3010
TAB: (5–6) DET	SHEET 6 OF 6	PLAN NO: C–17–38

DRAINAGE ANALYSIS

for

Solar Energy Storage System

ZP Battery Devco, LLC
1355 Main Street
Leicester, Massachusetts

September 21, 2021

Revised through October 19, 2021

Prepared for: ***ZP Battery Devco, LLC***
10 E. Worcester Street, Suite 3A
Worcester, MA 01604

Prepared by: ***Hannigan Engineering, Inc.***
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Leominster, Massachusetts 01453
(978) 534-1234

TABLE OF CONTENTS

1.0
DRAINAGE NARRATIVE

1.0 NARRATIVE
Revised Through October 19, 2021

1.1 INTRODUCTION

On behalf of our client, ZP Battery Devco, LLC, Hannigan Engineering, Inc. has prepared this Drainage Analysis and Report as part of the submittal package for Site Plan Review from the Town of Leicester for the construction of a new Energy Storage System (ESS). The Project will be situated on a portion of 1355 main street along the southerly side of Main Street (Route 9) in Leicester, Massachusetts.

The purpose of this analysis is to compare the pre-development and post-development peak flow rates to certain design points from the project. In particular, changes in peak rates of runoff generally associated with alterations of land use were studied. These alterations include land being transformed from areas of landscape (grass), woods, and brush to areas of grass, landscape, and impervious areas (rooftops, sidewalks and pavement). The effects of stormwater being re-directed to new areas as a result of the proposed construction and the associated drainage system were reviewed as well. For the purposes of this report, any developed areas which are not impervious will be considered to consist of lawn and landscape areas.

The U.S. Soil Conservation Sevice (SCS) methods were utilized for this analysis in order to establish land use and run-off characteristics in the determination of pre- and post-developement peak run-off rates. All proposed development areas and subsequent impacts on stormwater runoff relative to this development have been incorporated within this analysis and report.

The drainage from the site currently flows to several low points throughout the property. In the area of the proposed development, an increase in impervious areas due the construction of the concrete pads to store the ESS along with the general clearing of the land will occur, requiring additional provisions be made to provide compliance with the Massachusetts Stormwater Regulations and the Local Stormwater Bylaw. These measures include the implementation of a dry detention basin to capture and detain a portion of the anticpated runoff from the development.

1.2 METHOD OF ANALYSIS

The enclosed hydrologic calculations utilize the runoff estimating techniques developed by the USDA Soil Conservation Service (SCS). The following publications were used in the preparation of this report:

1. "Urban Hydrology for Small Watersheds"[1]
2. "National Engineering Handbook, Hydrology, Section 4" (NEH-4)[2]
3. "Handbook of Hydraulics" 6th ed. - E.F. Brater & H. Williams[3]
4. "Soil Survey Report for Northeastern Worcester County" 1985 ed. - USDA NRCS[4]

Using SCS publications and other texts on surface water hydrology, in conjunction with drainage software *HydroCAD* developed by Applied Microcomputer Systems[5], Hannigan Engineering, Inc. has calculated peak rates of runoff relative to the subject site for conditions prior to development as well as conditions upon the completion of construction. The drainage software program *HydroCAD* calculates peak rates of runoff similarly to the computer program known as *Computer Programs for Project Formulations-Hydrology, Technical Release Number 20 (TR-20),* developed by SCS. This program and series of programs are the technical standard utilized by engineers, Planning Boards, Conservation Commission, and Municipal Agencies throughout the region and across the country for the evaluation of storm water conditions.

The analysis reviews certain parameters of sub-watersheds surrounding the subject site and how these parameters are affected by various rainfall conditions. These parameters include land cover and use, soil strata and permeability, and variations in slope. These parameters are used to develop rainfall runoff characteristics, which are used to analyze both pre and post development conditions within and surrounding the proposed construction activity. Some of these characteristics include times of concentration (Tc), peak rates of runoff, runoff volume, and the time the peak rate of runoff occurs within the particular storm event.

Times of concentration were computed by using the SCS "Upland Method" as described in the aforementioned National Engineering Handbook and were utilized for the analysis of the individual watersheds. The Upland Method computes the time of travel of storm waters over segments of the watershed depending upon land conditions, such as surface roughness, channel configuration, slope of land, and flow patterns. The addition of these travel times determines the individual watershed Time of Concentration. This method translates to more accurate Tc's than other more general methods.

1.3 SITE DESCRIPTION

The Project will be situated on a portion of the #1355 Main Street property along the southerly side of Main Street (Route 9) in Leicester. The property is currently undeveloped and is comprised mostly of woodland and brush. It is noted that some areas of an existing gravel access way exist within the area of development that is associated with the previous use of the adjacent property at #1323 Main Street. Areas subject to protection under the Wetlands Protection Act and the Leicester Wetland Bylaws were reviewed and delineated by Caron Environmental. These areas are isolated to a Bordering Vegetated Wetland (BVW) along the southerly property line.

It is the intent of the Applicant to construct a new Energy Storage System (ESS) on a portion of #1355 Main Street. Access will be provided by a new gravel access drive which will extend in a southerly direction. This access drive will be terminated with a T-Turnaround configuration which will allow for service and emergency vehicles to enter and turnaround within the site. The proposes ESS system will be supported on the ground via a series of concrete pads along the access drive, with additional standalone electrical components. Additional provisions will be provided for the stormwater management system as well as electrical transmission infratructure.

For the purpose of the analysis, certain design points were reviewed. The design points are where the pre-development drainage for the subcatchment areas of the watershed over the property are directed. The same design points have been utilized and reviewed for both pre- and post-development runoff conditions. The drainage from the site currently overland flows to several low points located around the property. These Design Points are as follows. It is noted that Design Point #1 (DP#1) recieves the majority of the runoff from the proposed development.

Design Point #1 – Located at a low point within the onsite BVW along the southerly property line.
Design Point #2 – Located at a existing municipal catchbasin within Main Street to the east of the project.
Design Point #3 – Located at a low point located to the south east of the property on the abutting (#1323) property.

1.4 SOIL CHARACTERISTICS

Soil types for this analysis were based upon review of soils information contained in the SCS publication *Interim Soil Report for Worcester County, Massachusetts – Southern Part.* The original mapping has been reestablished via the Web Soil Survey as part of the National Cooperative Soil Survey under the Natural Resource Conservation Service and its website (http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx). This mapping is the basis for the soil type determinations for this analysis.

The soils are classified by number and name by SCS and, subsequently, the Hydrological Soil Group has been designated within the Urban Hydrology for Small Watersheds manual. Soils within the subject watersheds are also hydrologically classified into different soil groups as defined by the Soil Conservation Service. The following table provides the SCS Hydrological Soil Group classification for each soil type.

Soil Designation	Name	Hydrological Group
305D	Paxton fine Sandy Loam	C
310B	Woodbridge Fine Sandy Loam	C/D

1.5 RUNOFF CURVE NUMBERS

The SCS runoff curve numbers used in all watershed modeling contained in this report are based on the Hydrologic Soil Groups and land uses below:

Land Use	Hydrologic Soil Group	Curve #
Grass Cover (good)	C	74
Woods (Good)	C	70
Gravel Surface	C	89
Impervious Area	NA	98

1.6 DESIGN CRITERIA

This drainage analysis was developed utilizing a Type III, 24-hour tropical storm as developed by SCS and required for this region. The storm frequencies and the corresponding 24-hour rainfall amounts are as follows:

Storm Frequency (years)	Rainfall (inches)
2	3.0
10	4.5
25	5.3
100	6.5

1.7 THE PROPOSED DRAINAGE SYSTEM

The proposed drainage system captures stormwater runoff from the site via overland flow directed to as single detention basin prior to discharge. The majority of the proposed development will be captured and directed to this detention basin, with the remainder flowing overland, eventually make its way to one of the design points.

As with any development, changes in land use such as the transformation of woodland areas to lawn, landscape and impervious areas cause increased peak rates of runoff to the design points. These areas on this site consist of access drives and pad areas for ESS, as well as alterations in land use from woodland areas to open lawn and landscaped areas. In order to mitigate increases in peak rate of runoff, the site grading has been carefully designed to direct the majority of these land alterations to the storm drainage system. The majority of the runoff will be captured by a proposed dry detention basin located along the southerly limits of the project. This basin will provide the primary means of mitigating the peak rates of runoff from the development.

The detention basin will be equipped with a PVC sub-drain system and an outlet structure consisting of various orifices to control the discharge rate of the flow. During smaller storm events, the stormwater will back up in the detention basin controlled by the discharge flow allowed by the subdrain system and outlet control structure. Upon the completion of the storm event, these discharge control features will control the flow at or below pre-development rates until the stormwater has drained from the basin. It is noted that this subdrain system has a dual purpose of draining the basin between storm events and preventing groundwater from entering the basin from below. In addition to the subdrain and outlet structure of the detention basins, each basin will also be equipped with an emergency spillway. Based on the calculations, the emergency spillway will not experience flow in any storm event.

1.8 CONCLUSIONS

As stated above, three Design Points have been established throughout the project area. Changes in land use are the predominant cause of increases in peak rate of runoff to these design points. Under proposed conditions, the majority of stormwater runoff will be captured by a proposed detention basin before being directed towards DP#1. The results of the Drainage Analysis and resulting decreases in peak rates of runoff are shown below in *Table 1*.

Table #1: Peak Rates of Runoff

Design Point		2-yr Storm	10-yr Storm	25-yr Storm	100-yr Storm
#1	Pre-	1.37	3.35	4.54	6.41
	Post-	1.29	3.06	4.07	5.74
#2	***Pre-***	***0.90***	***1.41***	***1.67***	***2.07***
	Post-	***0.91***	***1.42***	***1.68***	***2.08***
#3	Pre-	2.30	4.89	6.38	8.67
	Post-	2.30	4.89	6.38	8.67

All flows are in cubic feet per second.

As outline above, the post-development peak rates are of runoff have been mitigated for all Storm Events, with the noted exception of Design Point #2 (DP#2),during all storm events. The increase within this Design point is due to the small increase in area caused by access to the gravel driveway. To maintain the gutter flow within Main Street, a ridge will be created along the shoulder of the. This results in an increase to the contributing

watershed of approximately 95 s.f. This increase by default is unavoidable to maintain the existing drainage pattern. The resulting increase in combination with the added convertion of grass to gravel surface are the cause behind the increase. Furthermore, the increase in the peak rate of flow during all stormevents is consistently 0.01 c.f.s. and is considered *de minimus* in nature.

The storm water management as outlined herein and as shown on the accompanying plans has the following positive values relative to storm water management:

A) Attenuation of the 2-, 10-, 25- and 100-year storm events has mitigated increases in peak rates of runoff, or has been justified herein.
B) The development adheres to the provisions of the Massachusetts Stormwater Management program with greater than 80% TSS removal.
C) The Stormwater Operation and Maintenance Plan (OMP) attached, has been prepared to ensure long-term function of the system, as designed.

---

[1]"Urban Hydrology for Small Watersheds (Technical Release Number 55); Engineering Division, United States Dept. of Agriculture ,Soil Conservation Service (Jan. 1975)

[2]"National Engineering Handbook Section 4- Hydrology" ; United States Dept. of Agriculture, Soil Conservation Service (March 1985)

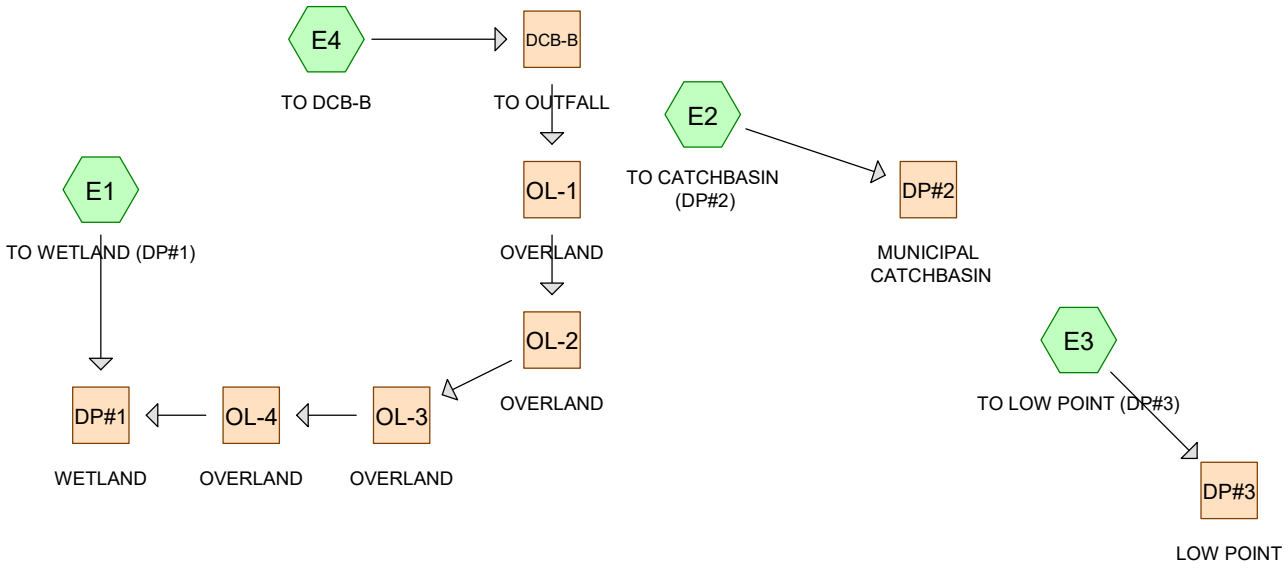
[3]"Handbook of Hydraulics" - 6th ed., E.F. Brater & H. Williams (1976)

[4]"Interim Soil Report for Southern Worcester County" 1995 ed., Published by the Southern Worcester County Conservation District, in cooperation with the United States Department of Agriculture, Natural Resources Conservation Service (1995)

[5] "HydroCAD" Drainage software developed by Applied Microcomputer, Page Hill Road, Chocorua, NH

2.0
HYDROLOGICAL CALCULATIONS

2.1
PRE-DEVELOPMENT CALCULATIONS



Subcat Reach Pond Link

Routing Diagram for 3010-Pre
Prepared by HANNIGAN ENGINEERING, INC., Printed 10/21/2021

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.284	74	>75% Grass cover, Good, HSG C (E1, E2, E3, E4)
0.355	89	Gravel roads, HSG C (E1, E3)
0.828	98	Paved parking, HSG C (E1, E2, E3, E4)
2.881	70	Woods, Good, HSG C (E1, E2, E3)
4.348	**77**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
4.348	HSG C	E1, E2, E3, E4
0.000	HSG D	
0.000	Other	
4.348		**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	0.284	0.000	0.000	0.284	>75% Grass cover, Good	E1, E2, E3, E4
0.000	0.000	0.355	0.000	0.000	0.355	Gravel roads	E1, E3
0.000	0.000	0.828	0.000	0.000	0.828	Paved parking	E1, E2, E3, E4
0.000	0.000	2.881	0.000	0.000	2.881	Woods, Good	E1, E2, E3
0.000	**0.000**	**4.348**	**0.000**	**0.000**	**4.348**	**TOTAL AREA**	

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Reach DCB-B: TO OUTFALL Inflow=0.51 cfs 0.037 af
Outflow=0.51 cfs 0.037 af

Reach DP#1: WETLAND Inflow=1.37 cfs 0.168 af
Outflow=1.37 cfs 0.168 af

Reach DP#2: MUNICIPAL CATCHBASIN Inflow=0.90 cfs 0.067 af
Outflow=0.90 cfs 0.067 af

Reach DP#3: LOW POINT Inflow=2.30 cfs 0.169 af
Outflow=2.30 cfs 0.169 af

Reach OL-1: OVERLAND Avg. Flow Depth=0.04' Max Vel=0.75 fps Inflow=0.51 cfs 0.037 af
n=0.080 L=46.0' S=0.1087 '/' Capacity=122.10 cfs Outflow=0.49 cfs 0.037 af

Reach OL-2: OVERLAND Avg. Flow Depth=0.04' Max Vel=0.65 fps Inflow=0.49 cfs 0.037 af
n=0.080 L=211.0' S=0.0867 '/' Capacity=109.07 cfs Outflow=0.42 cfs 0.037 af

Reach OL-3: OVERLAND Avg. Flow Depth=0.06' Max Vel=0.47 fps Inflow=0.42 cfs 0.037 af
n=0.080 L=23.0' S=0.0304 '/' Capacity=64.61 cfs Outflow=0.41 cfs 0.037 af

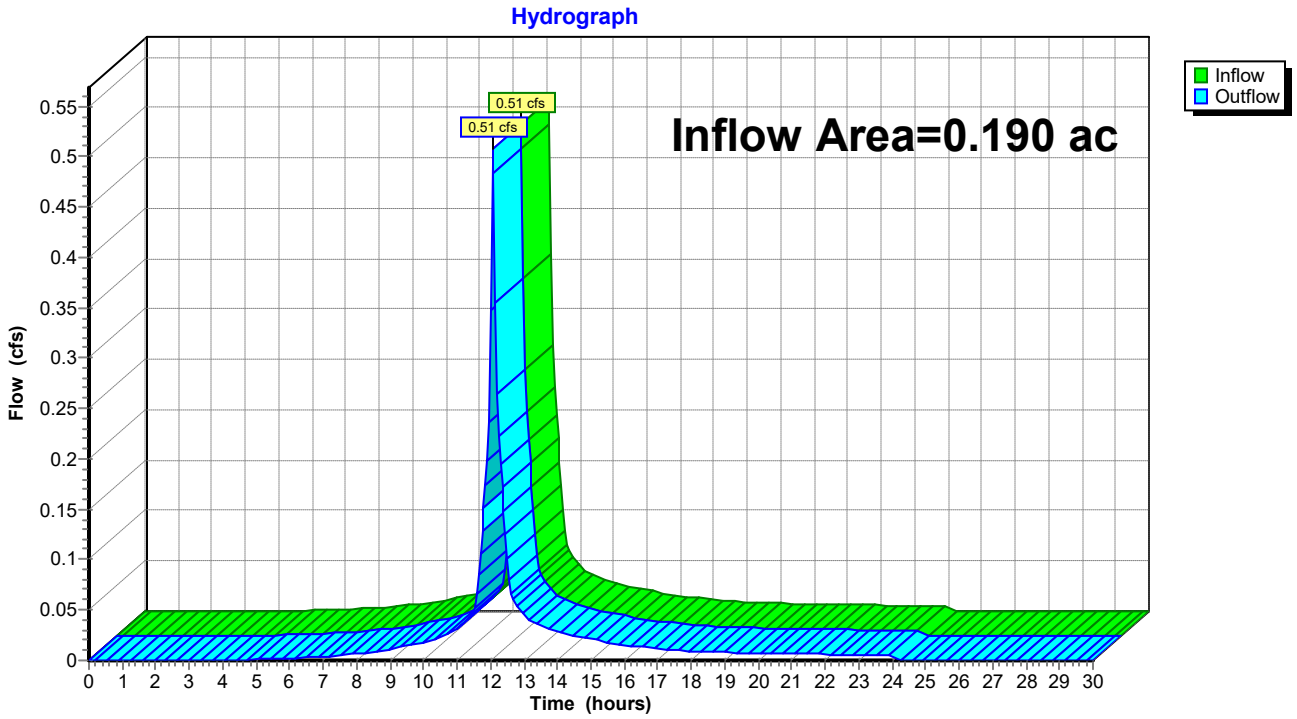
Reach OL-4: OVERLAND Avg. Flow Depth=0.06' Max Vel=0.19 fps Inflow=0.41 cfs 0.037 af
n=0.080 L=128.0' S=0.0050 '/' Capacity=45.22 cfs Outflow=0.33 cfs 0.037 af

Summary for Reach DCB-B: TO OUTFALL

Inflow Area = 0.190 ac, 83.72% Impervious, Inflow Depth = 2.35" for 2-Year event
Inflow = 0.51 cfs @ 12.07 hrs, Volume= 0.037 af
Outflow = 0.51 cfs @ 12.07 hrs, Volume= 0.037 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach DCB-B: TO OUTFALL

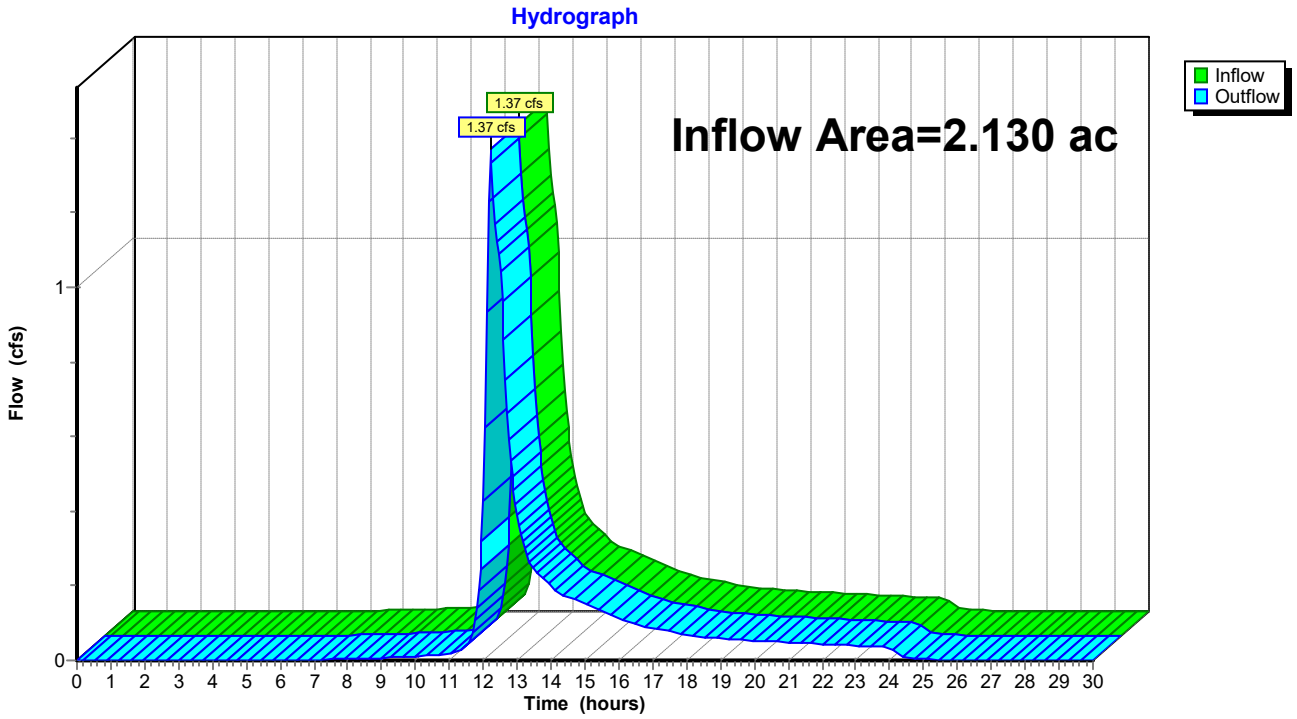


Summary for Reach DP#1: WETLAND

Inflow Area = 2.130 ac, 12.00% Impervious, Inflow Depth = 0.95" for 2-Year event
Inflow = 1.37 cfs @ 12.22 hrs, Volume= 0.168 af
Outflow = 1.37 cfs @ 12.22 hrs, Volume= 0.168 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach DP#1: WETLAND

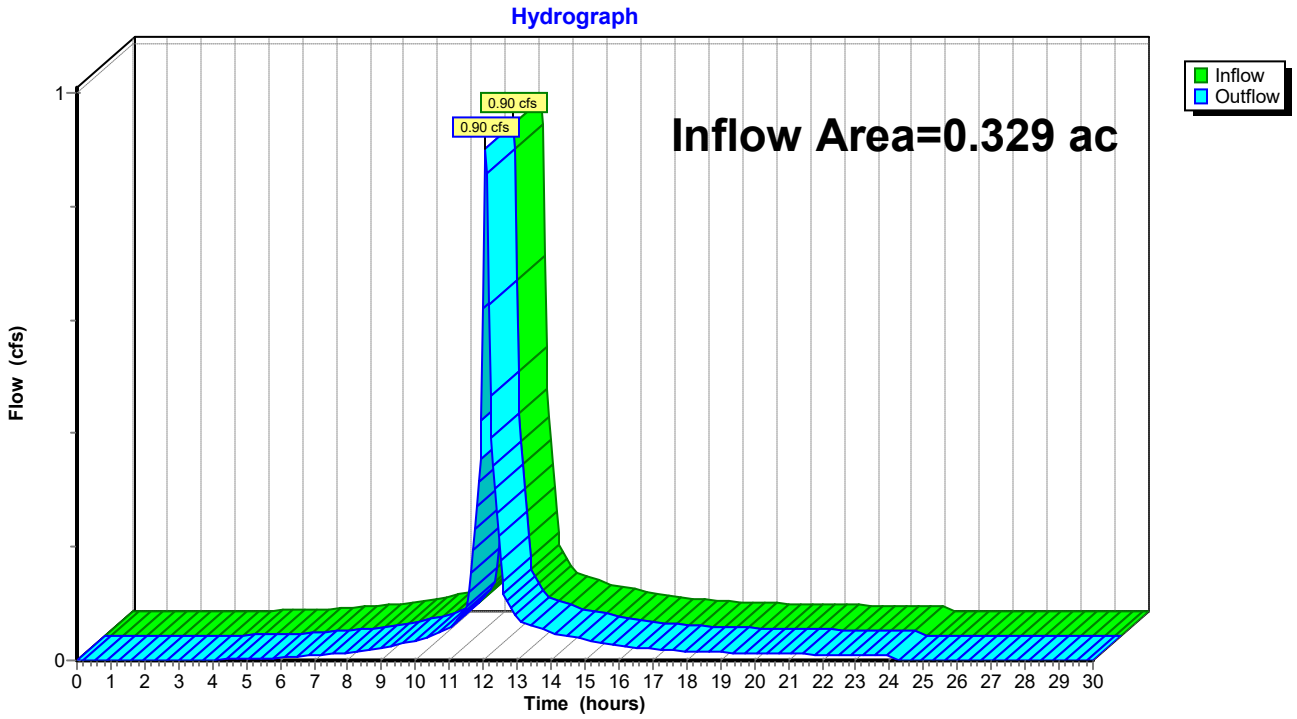


Summary for Reach DP#2: MUNICIPAL CATCHBASIN

Inflow Area = 0.329 ac, 87.38% Impervious, Inflow Depth = 2.45" for 2-Year event
Inflow = 0.90 cfs @ 12.07 hrs, Volume= 0.067 af
Outflow = 0.90 cfs @ 12.07 hrs, Volume= 0.067 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach DP#2: MUNICIPAL CATCHBASIN

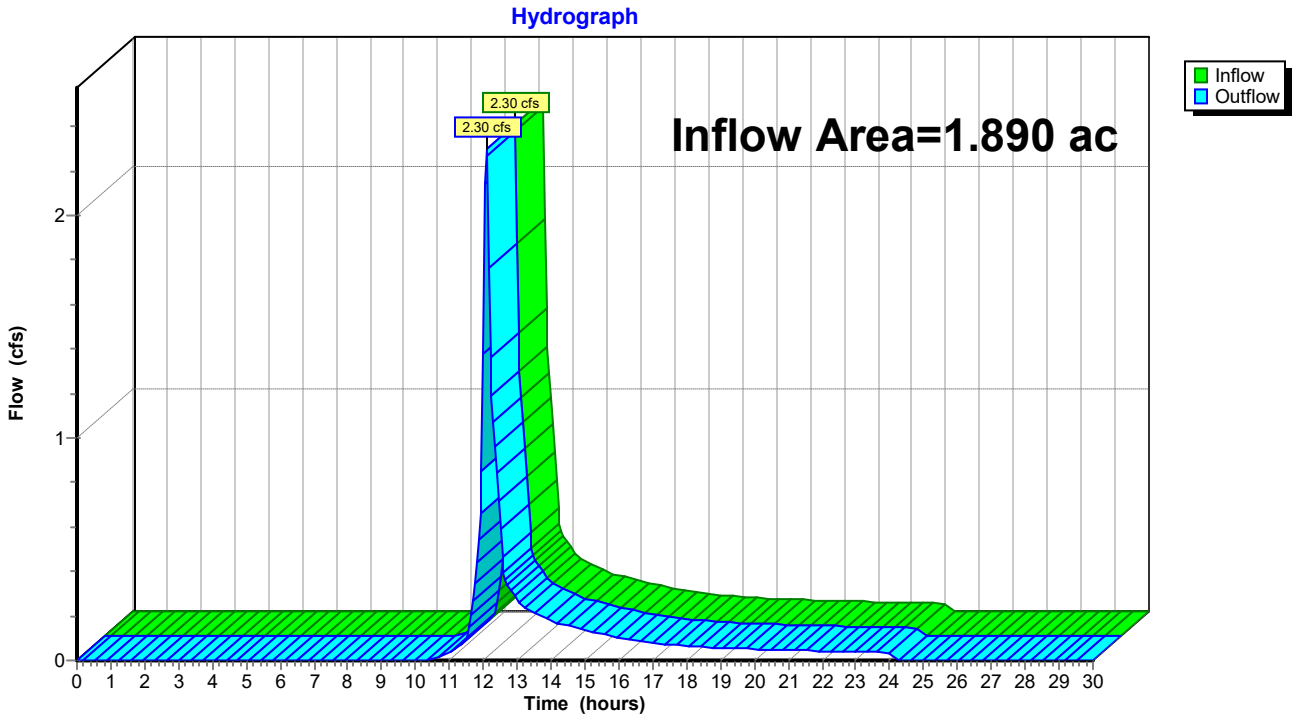


Summary for Reach DP#3: LOW POINT

Inflow Area = 1.890 ac, 15.10% Impervious, Inflow Depth = 1.07" for 2-Year event
Inflow = 2.30 cfs @ 12.09 hrs, Volume= 0.169 af
Outflow = 2.30 cfs @ 12.09 hrs, Volume= 0.169 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach DP#3: LOW POINT



Summary for Reach OL-1: OVERLAND

Inflow Area = 0.190 ac, 83.72% Impervious, Inflow Depth = 2.35" for 2-Year event
Inflow = 0.51 cfs @ 12.07 hrs, Volume= 0.037 af
Outflow = 0.49 cfs @ 12.10 hrs, Volume= 0.037 af, Atten= 4%, Lag= 1.9 min

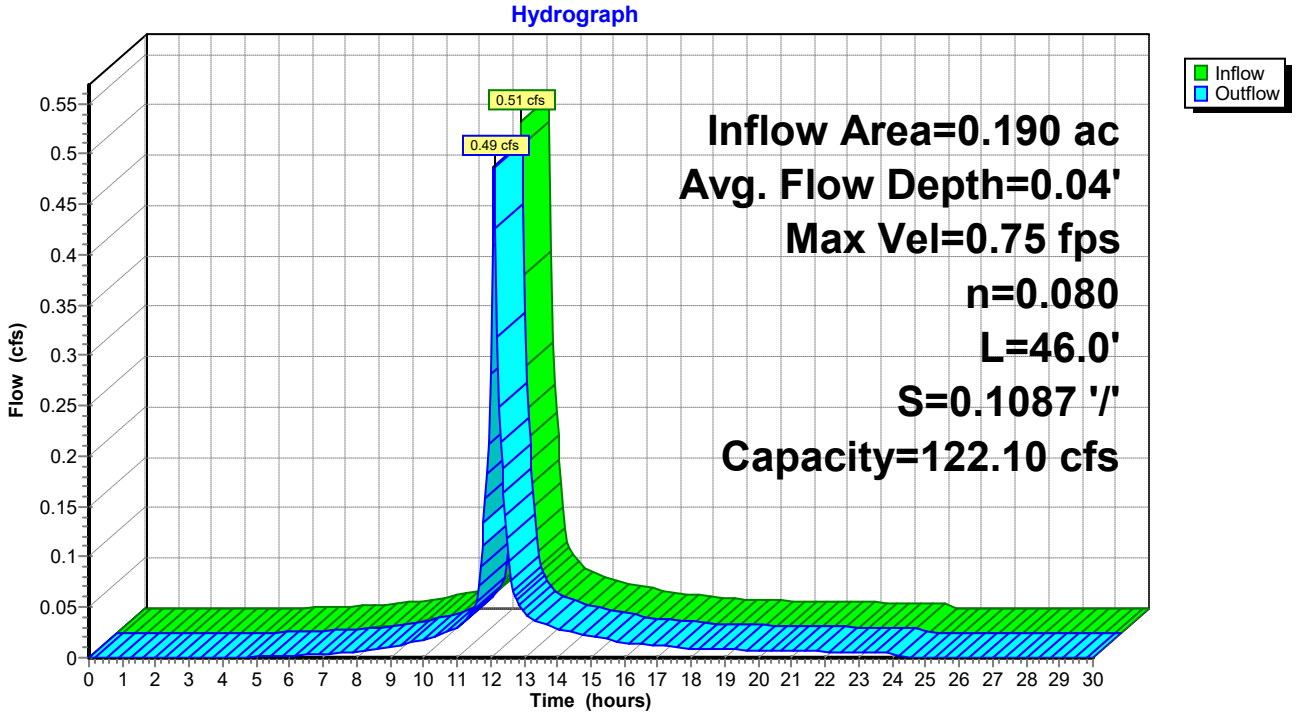
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.75 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 0.30 fps, Avg. Travel Time= 2.6 min

Peak Storage= 31 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.04'
Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 122.10 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 35.00'
Length= 46.0' Slope= 0.1087 '/'
Inlet Invert= 109.00', Outlet Invert= 104.00'

‡

Reach OL-1: OVERLAND



Summary for Reach OL-2: OVERLAND

Inflow Area = 0.190 ac, 83.72% Impervious, Inflow Depth = 2.35" for 2-Year event
Inflow = 0.49 cfs @ 12.10 hrs, Volume= 0.037 af
Outflow = 0.42 cfs @ 12.25 hrs, Volume= 0.037 af, Atten= 14%, Lag= 8.6 min

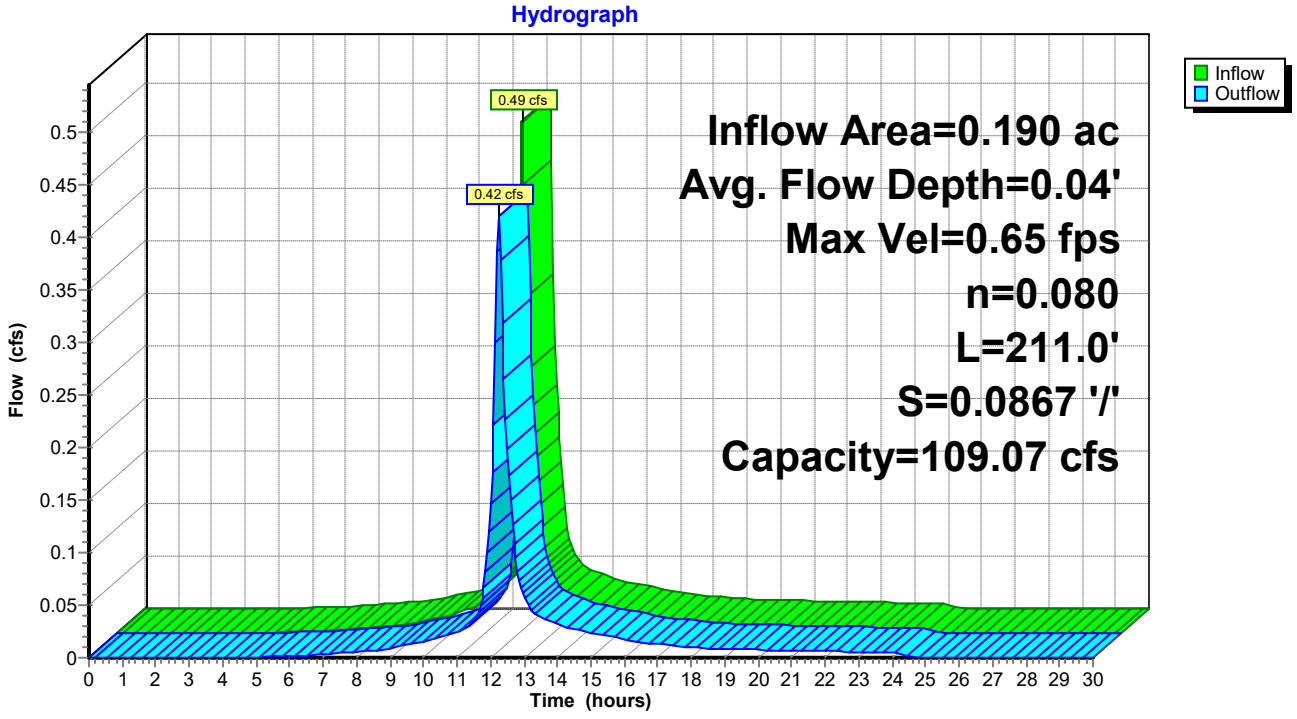
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.65 fps, Min. Travel Time= 5.4 min
Avg. Velocity = 0.27 fps, Avg. Travel Time= 13.3 min

Peak Storage= 138 cf @ 12.15 hrs
Average Depth at Peak Storage= 0.04'
Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 109.07 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 35.00'
Length= 211.0' Slope= 0.0867 '/'
Inlet Invert= 104.00', Outlet Invert= 85.70'

‡

Reach OL-2: OVERLAND



Summary for Reach OL-3: OVERLAND

Inflow Area = 0.190 ac, 83.72% Impervious, Inflow Depth = 2.35" for 2-Year event
Inflow = 0.42 cfs @ 12.25 hrs, Volume= 0.037 af
Outflow = 0.41 cfs @ 12.27 hrs, Volume= 0.037 af, Atten= 2%, Lag= 1.3 min

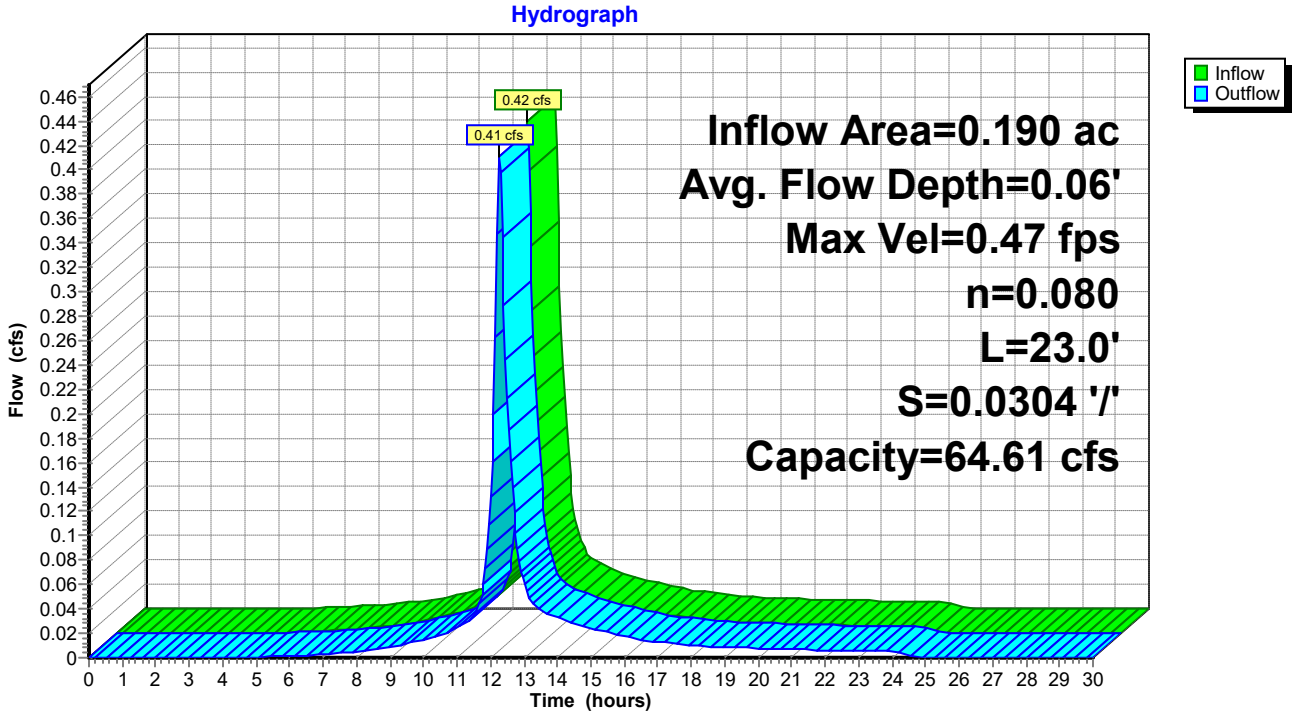
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.47 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 0.16 fps, Avg. Travel Time= 2.3 min

Peak Storage= 20 cf @ 12.26 hrs
Average Depth at Peak Storage= 0.06'
Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 64.61 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 35.00'
Length= 23.0' Slope= 0.0304 '/'
Inlet Invert= 85.70', Outlet Invert= 85.00'

‡

Reach OL-3: OVERLAND



Summary for Reach OL-4: OVERLAND

Inflow Area = 0.190 ac, 83.72% Impervious, Inflow Depth = 2.35" for 2-Year event
Inflow = 0.41 cfs @ 12.27 hrs, Volume= 0.037 af
Outflow = 0.33 cfs @ 12.56 hrs, Volume= 0.037 af, Atten= 21%, Lag= 17.4 min

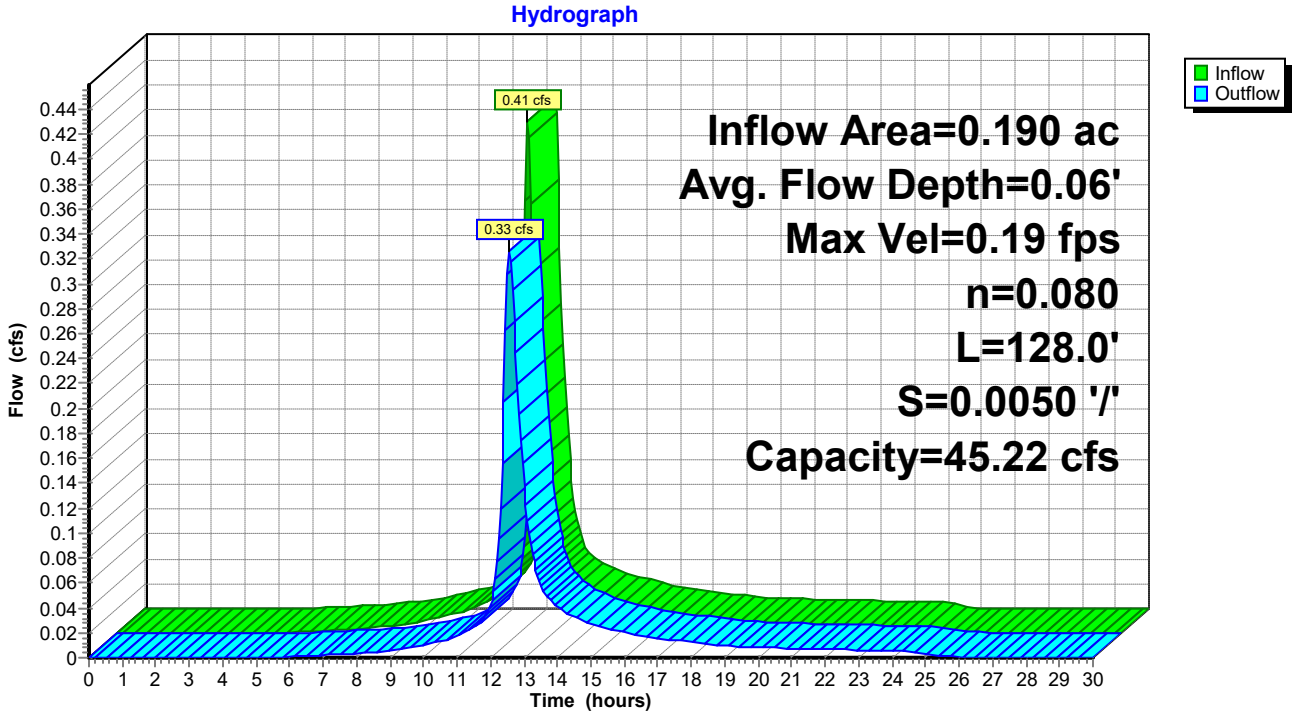
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.19 fps, Min. Travel Time= 11.2 min
Avg. Velocity = 0.07 fps, Avg. Travel Time= 31.5 min

Peak Storage= 220 cf @ 12.37 hrs
Average Depth at Peak Storage= 0.06'
Bank-Full Depth= 1.00' Flow Area= 40.0 sf, Capacity= 45.22 cfs

30.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 50.00'
Length= 128.0' Slope= 0.0050 '/'
Inlet Invert= 85.00', Outlet Invert= 84.36'

‡

Reach OL-4: OVERLAND



Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Reach DCB-B: TO OUTFALL Inflow=0.80 cfs 0.061 af
Outflow=0.80 cfs 0.061 af

Reach DP#1: WETLAND Inflow=3.35 cfs 0.355 af
Outflow=3.35 cfs 0.355 af

Reach DP#2: MUNICIPAL CATCHBASIN Inflow=1.41 cfs 0.107 af
Outflow=1.41 cfs 0.107 af

Reach DP#3: LOW POINT Inflow=4.89 cfs 0.348 af
Outflow=4.89 cfs 0.348 af

Reach OL-1: OVERLAND Avg. Flow Depth=0.06' Max Vel=0.89 fps Inflow=0.80 cfs 0.061 af
n=0.080 L=46.0' S=0.1087 '/' Capacity=122.10 cfs Outflow=0.77 cfs 0.061 af

Reach OL-2: OVERLAND Avg. Flow Depth=0.06' Max Vel=0.79 fps Inflow=0.77 cfs 0.061 af
n=0.080 L=211.0' S=0.0867 '/' Capacity=109.07 cfs Outflow=0.68 cfs 0.061 af

Reach OL-3: OVERLAND Avg. Flow Depth=0.08' Max Vel=0.56 fps Inflow=0.68 cfs 0.061 af
n=0.080 L=23.0' S=0.0304 '/' Capacity=64.61 cfs Outflow=0.66 cfs 0.061 af

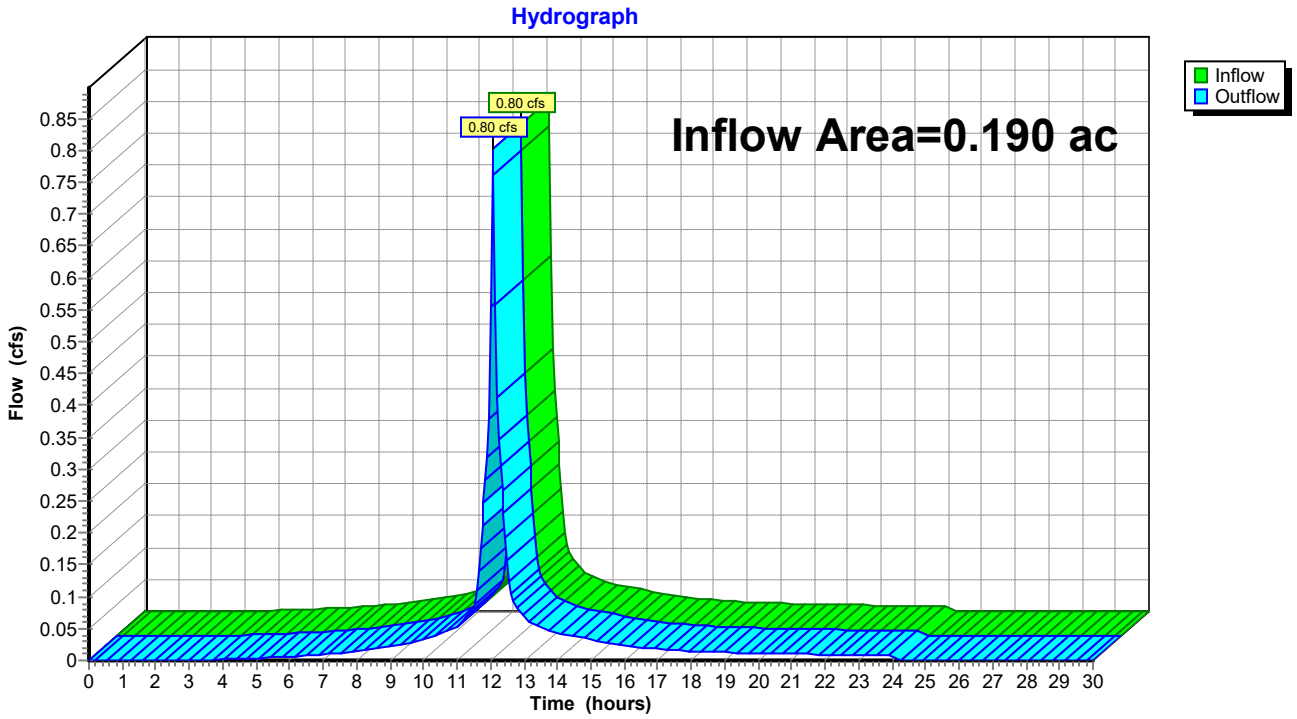
Reach OL-4: OVERLAND Avg. Flow Depth=0.08' Max Vel=0.23 fps Inflow=0.66 cfs 0.061 af
n=0.080 L=128.0' S=0.0050 '/' Capacity=45.22 cfs Outflow=0.56 cfs 0.061 af

Summary for Reach DCB-B: TO OUTFALL

Inflow Area = 0.190 ac, 83.72% Impervious, Inflow Depth = 3.82" for 10-Year event
Inflow = 0.80 cfs @ 12.07 hrs, Volume= 0.061 af
Outflow = 0.80 cfs @ 12.07 hrs, Volume= 0.061 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach DCB-B: TO OUTFALL

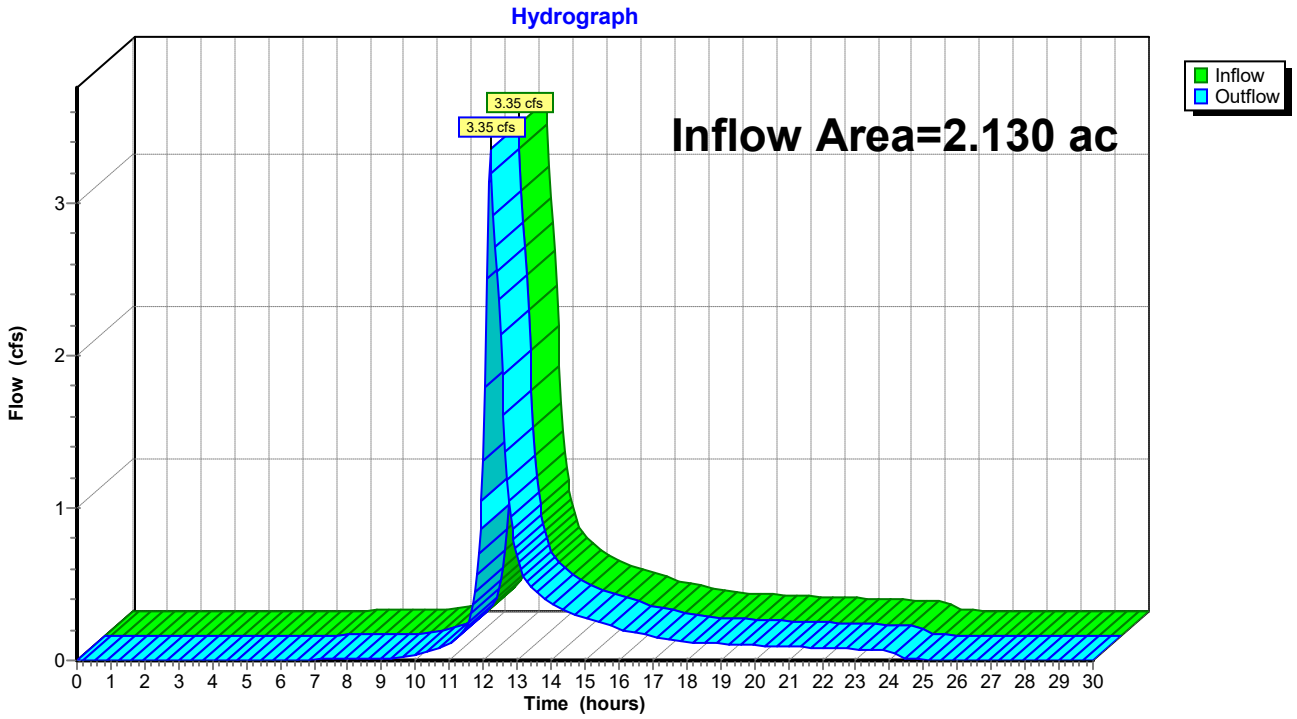


Summary for Reach DP#1: WETLAND

Inflow Area = 2.130 ac, 12.00% Impervious, Inflow Depth = 2.00" for 10-Year event
Inflow = 3.35 cfs @ 12.20 hrs, Volume= 0.355 af
Outflow = 3.35 cfs @ 12.20 hrs, Volume= 0.355 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach DP#1: WETLAND

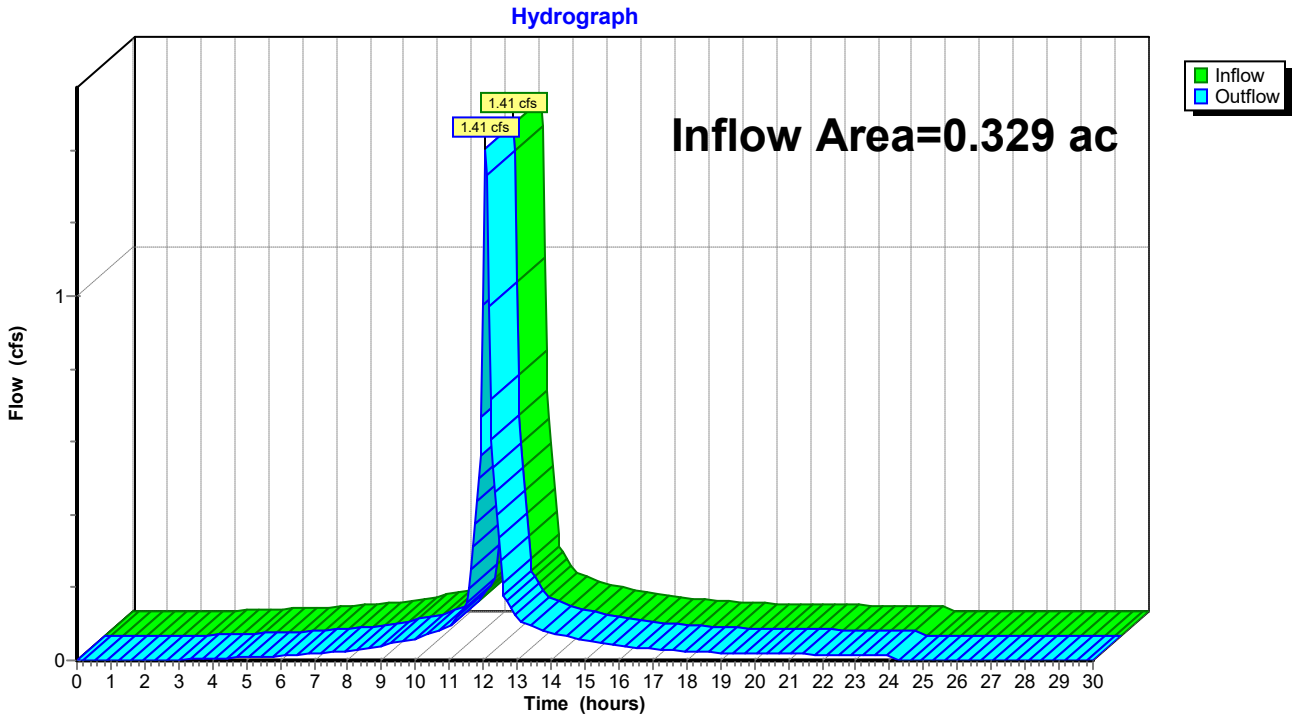


Summary for Reach DP#2: MUNICIPAL CATCHBASIN

Inflow Area = 0.329 ac, 87.38% Impervious, Inflow Depth = 3.92" for 10-Year event
Inflow = 1.41 cfs @ 12.07 hrs, Volume= 0.107 af
Outflow = 1.41 cfs @ 12.07 hrs, Volume= 0.107 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach DP#2: MUNICIPAL CATCHBASIN

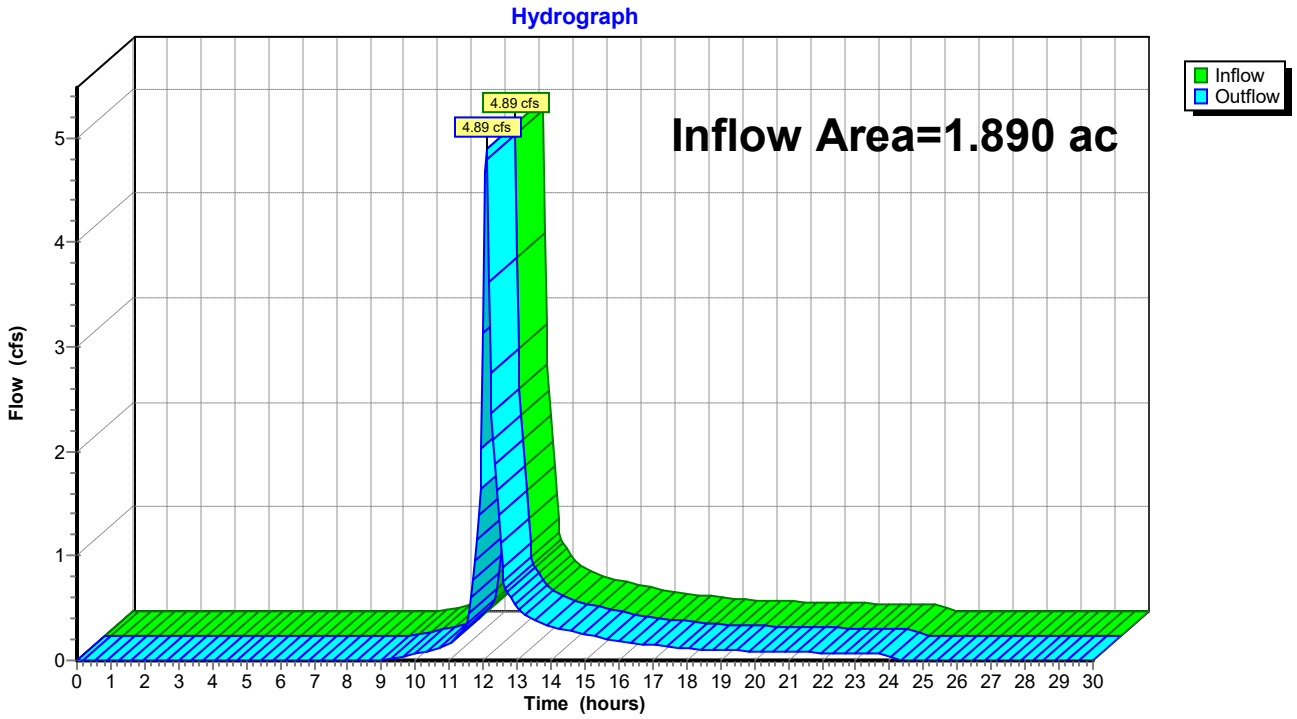


Summary for Reach DP#3: LOW POINT

Inflow Area = 1.890 ac, 15.10% Impervious, Inflow Depth = 2.21" for 10-Year event
Inflow = 4.89 cfs @ 12.08 hrs, Volume= 0.348 af
Outflow = 4.89 cfs @ 12.08 hrs, Volume= 0.348 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach DP#3: LOW POINT



Summary for Reach OL-1: OVERLAND

Inflow Area = 0.190 ac, 83.72% Impervious, Inflow Depth = 3.82" for 10-Year event
Inflow = 0.80 cfs @ 12.07 hrs, Volume= 0.061 af
Outflow = 0.77 cfs @ 12.10 hrs, Volume= 0.061 af, Atten= 4%, Lag= 1.6 min

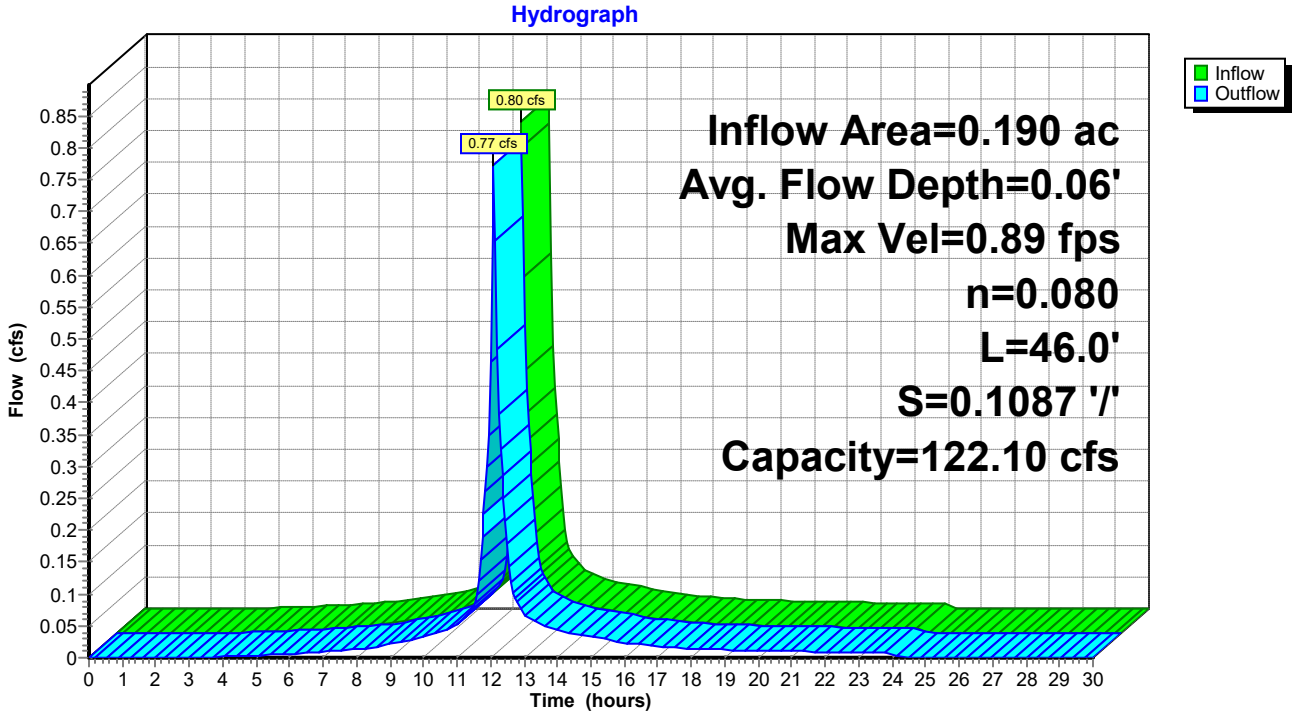
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.89 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 0.30 fps, Avg. Travel Time= 2.5 min

Peak Storage= 41 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.06'
Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 122.10 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 35.00'
Length= 46.0' Slope= 0.1087 '/'
Inlet Invert= 109.00', Outlet Invert= 104.00'

‡

Reach OL-1: OVERLAND



Summary for Reach OL-2: OVERLAND

Inflow Area = 0.190 ac, 83.72% Impervious, Inflow Depth = 3.82" for 10-Year event
Inflow = 0.77 cfs @ 12.10 hrs, Volume= 0.061 af
Outflow = 0.68 cfs @ 12.22 hrs, Volume= 0.061 af, Atten= 13%, Lag= 7.1 min

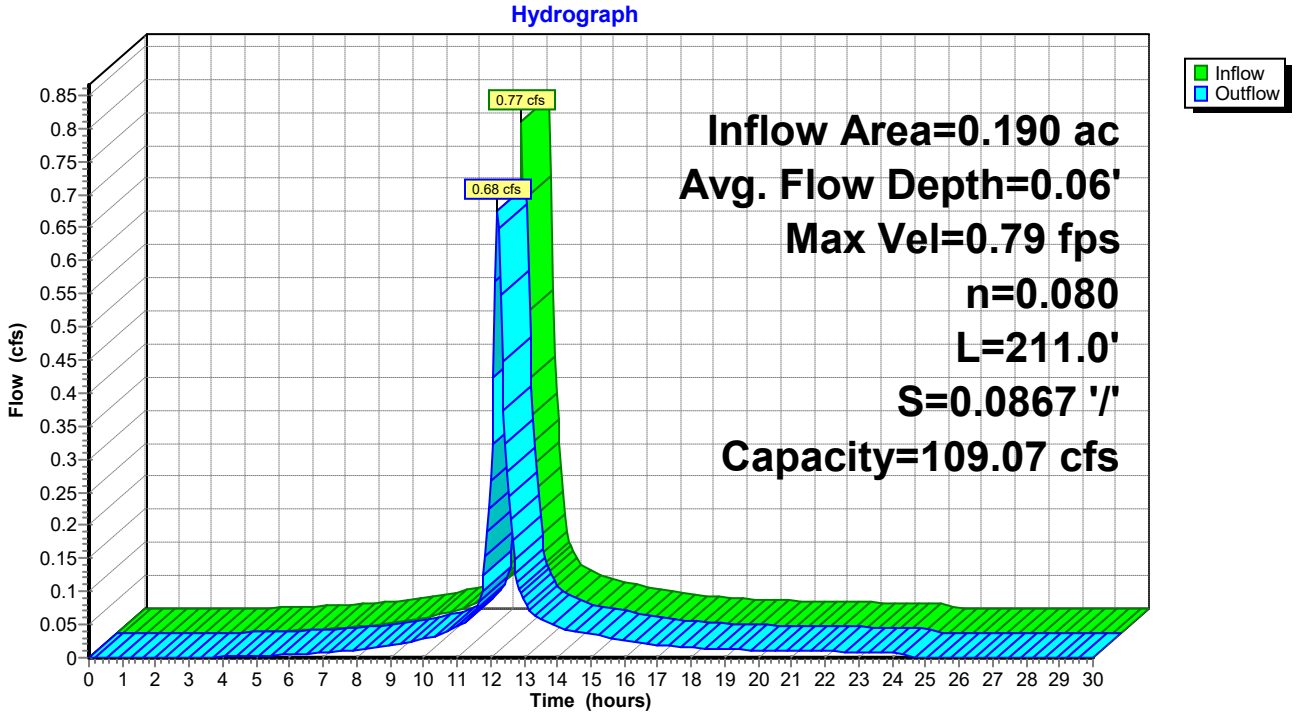
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.79 fps, Min. Travel Time= 4.5 min
Avg. Velocity = 0.27 fps, Avg. Travel Time= 12.8 min

Peak Storage= 186 cf @ 12.14 hrs
Average Depth at Peak Storage= 0.06'
Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 109.07 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 35.00'
Length= 211.0' Slope= 0.0867 '/'
Inlet Invert= 104.00', Outlet Invert= 85.70'

‡

Reach OL-2: OVERLAND



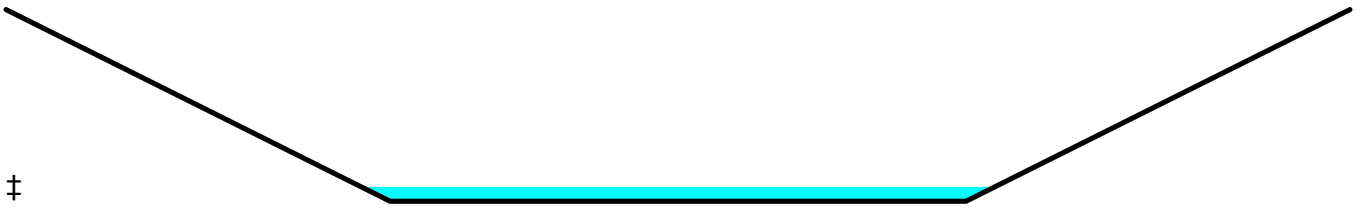
Summary for Reach OL-3: OVERLAND

Inflow Area = 0.190 ac, 83.72% Impervious, Inflow Depth = 3.82" for 10-Year event
Inflow = 0.68 cfs @ 12.22 hrs, Volume= 0.061 af
Outflow = 0.66 cfs @ 12.24 hrs, Volume= 0.061 af, Atten= 2%, Lag= 1.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.56 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 0.17 fps, Avg. Travel Time= 2.2 min

Peak Storage= 28 cf @ 12.22 hrs
Average Depth at Peak Storage= 0.08'
Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 64.61 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 35.00'
Length= 23.0' Slope= 0.0304 '/'
Inlet Invert= 85.70', Outlet Invert= 85.00'



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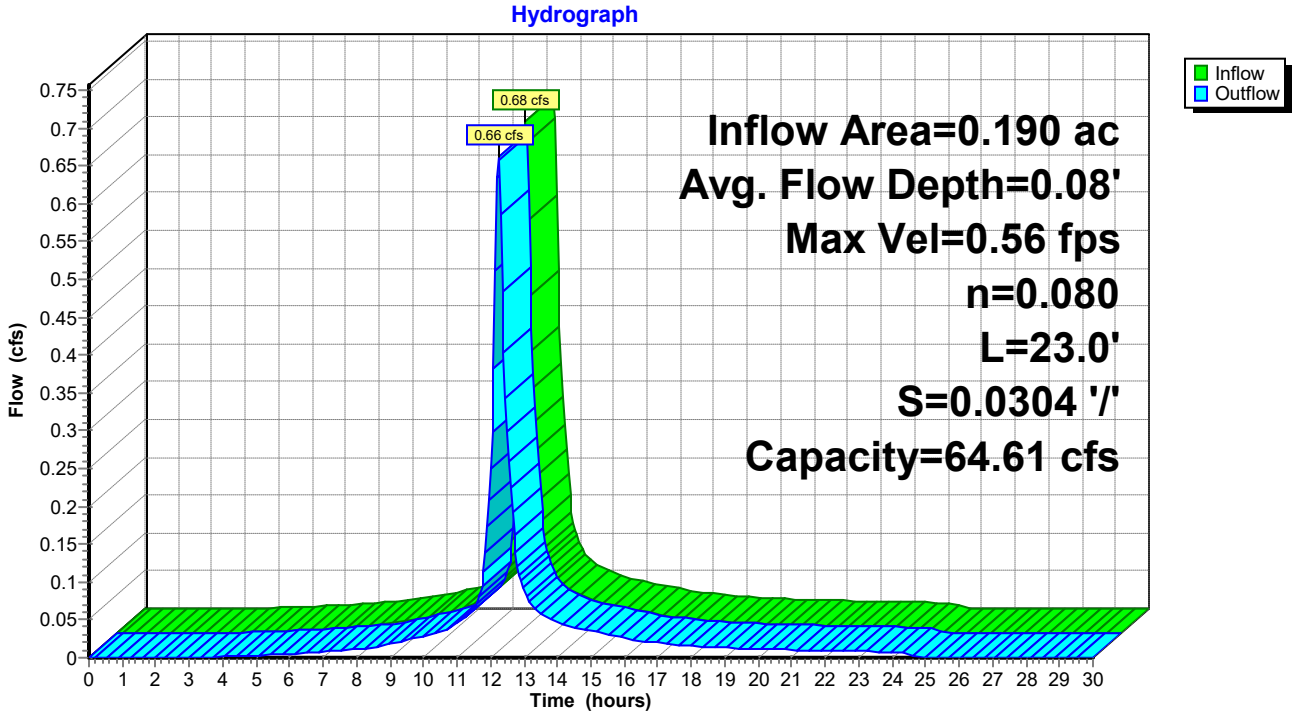
Reach OL-3: OVERLAND



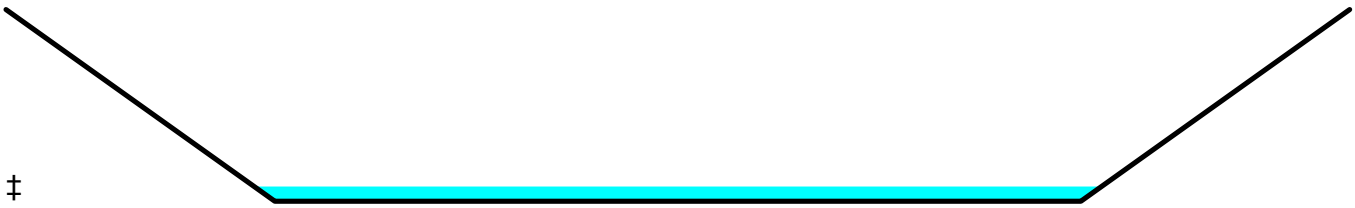
Summary for Reach OL-4: OVERLAND

Inflow Area = 0.190 ac, 83.72% Impervious, Inflow Depth = 3.82" for 10-Year event
Inflow = 0.66 cfs @ 12.24 hrs, Volume= 0.061 af
Outflow = 0.56 cfs @ 12.47 hrs, Volume= 0.061 af, Atten= 16%, Lag= 14.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.23 fps, Min. Travel Time= 9.1 min
Avg. Velocity = 0.07 fps, Avg. Travel Time= 29.6 min

Peak Storage= 304 cf @ 12.32 hrs
Average Depth at Peak Storage= 0.08'
Bank-Full Depth= 1.00' Flow Area= 40.0 sf, Capacity= 45.22 cfs

30.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 50.00'
Length= 128.0' Slope= 0.0050 '/'
Inlet Invert= 85.00', Outlet Invert= 84.36'



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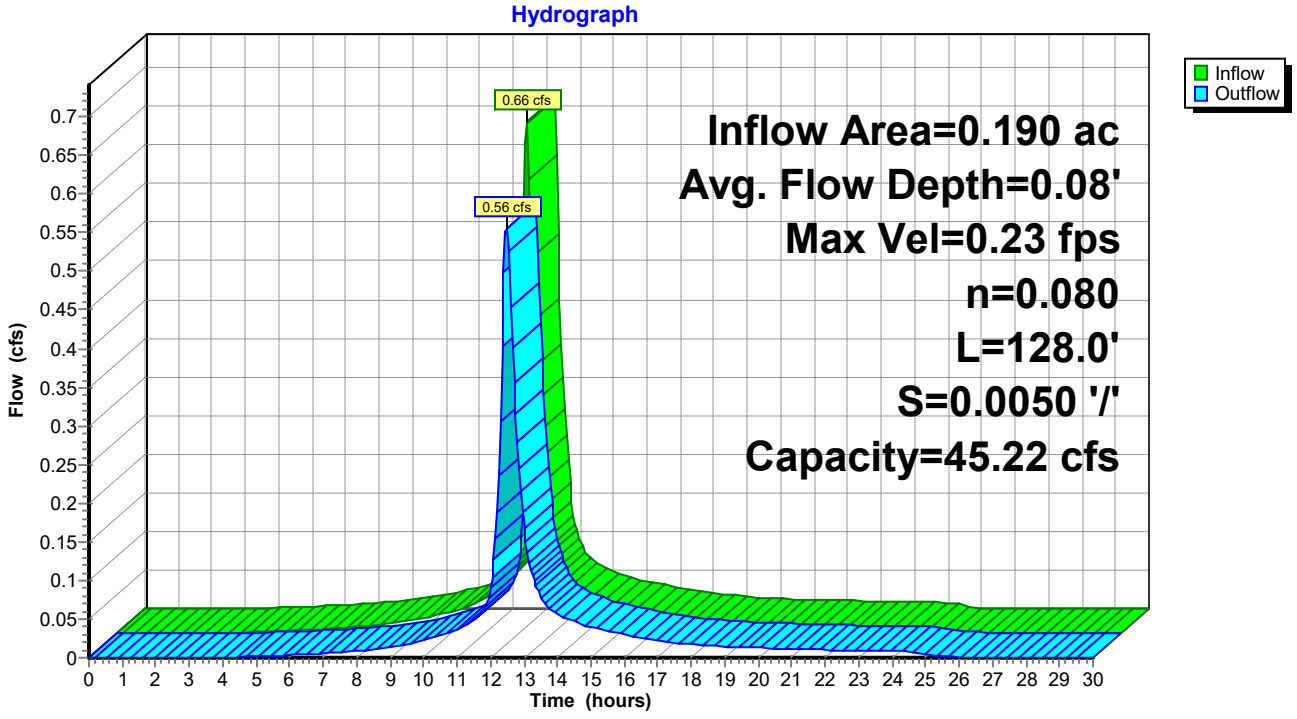
Reach OL-4: OVERLAND



Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Reach DCB-B: TO OUTFALL Inflow=0.96 cfs 0.073 af
Outflow=0.96 cfs 0.073 af

Reach DP#1: WETLAND Inflow=4.54 cfs 0.466 af
Outflow=4.54 cfs 0.466 af

Reach DP#2: MUNICIPAL CATCHBASIN Inflow=1.67 cfs 0.129 af
Outflow=1.67 cfs 0.129 af

Reach DP#3: LOW POINT Inflow=6.38 cfs 0.453 af
Outflow=6.38 cfs 0.453 af

Reach OL-1: OVERLAND Avg. Flow Depth=0.06' Max Vel=0.95 fps Inflow=0.96 cfs 0.073 af
n=0.080 L=46.0' S=0.1087 '/' Capacity=122.10 cfs Outflow=0.92 cfs 0.073 af

Reach OL-2: OVERLAND Avg. Flow Depth=0.06' Max Vel=0.85 fps Inflow=0.92 cfs 0.073 af
n=0.080 L=211.0' S=0.0867 '/' Capacity=109.07 cfs Outflow=0.82 cfs 0.073 af

Reach OL-3: OVERLAND Avg. Flow Depth=0.09' Max Vel=0.60 fps Inflow=0.82 cfs 0.073 af
n=0.080 L=23.0' S=0.0304 '/' Capacity=64.61 cfs Outflow=0.80 cfs 0.073 af

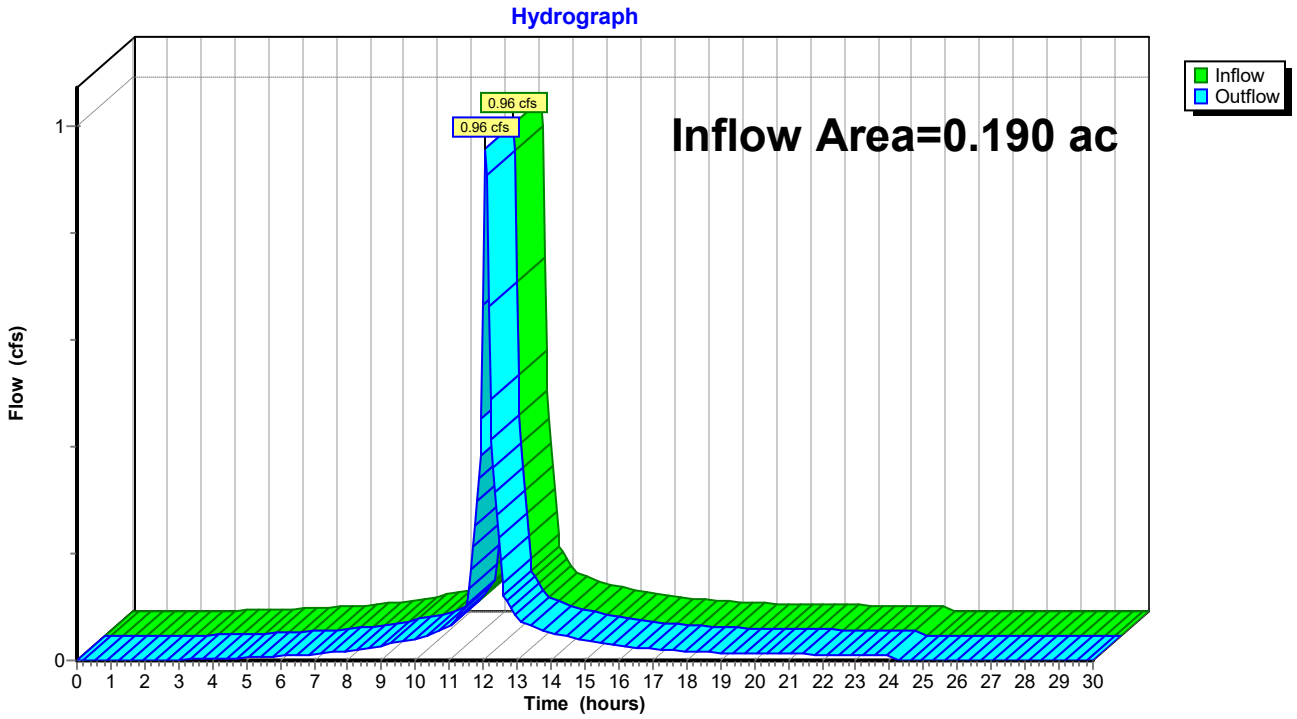
Reach OL-4: OVERLAND Avg. Flow Depth=0.09' Max Vel=0.25 fps Inflow=0.80 cfs 0.073 af
n=0.080 L=128.0' S=0.0050 '/' Capacity=45.22 cfs Outflow=0.67 cfs 0.073 af

Summary for Reach DCB-B: TO OUTFALL

Inflow Area = 0.190 ac, 83.72% Impervious, Inflow Depth = 4.60" for 25-Year event
Inflow = 0.96 cfs @ 12.07 hrs, Volume= 0.073 af
Outflow = 0.96 cfs @ 12.07 hrs, Volume= 0.073 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach DCB-B: TO OUTFALL

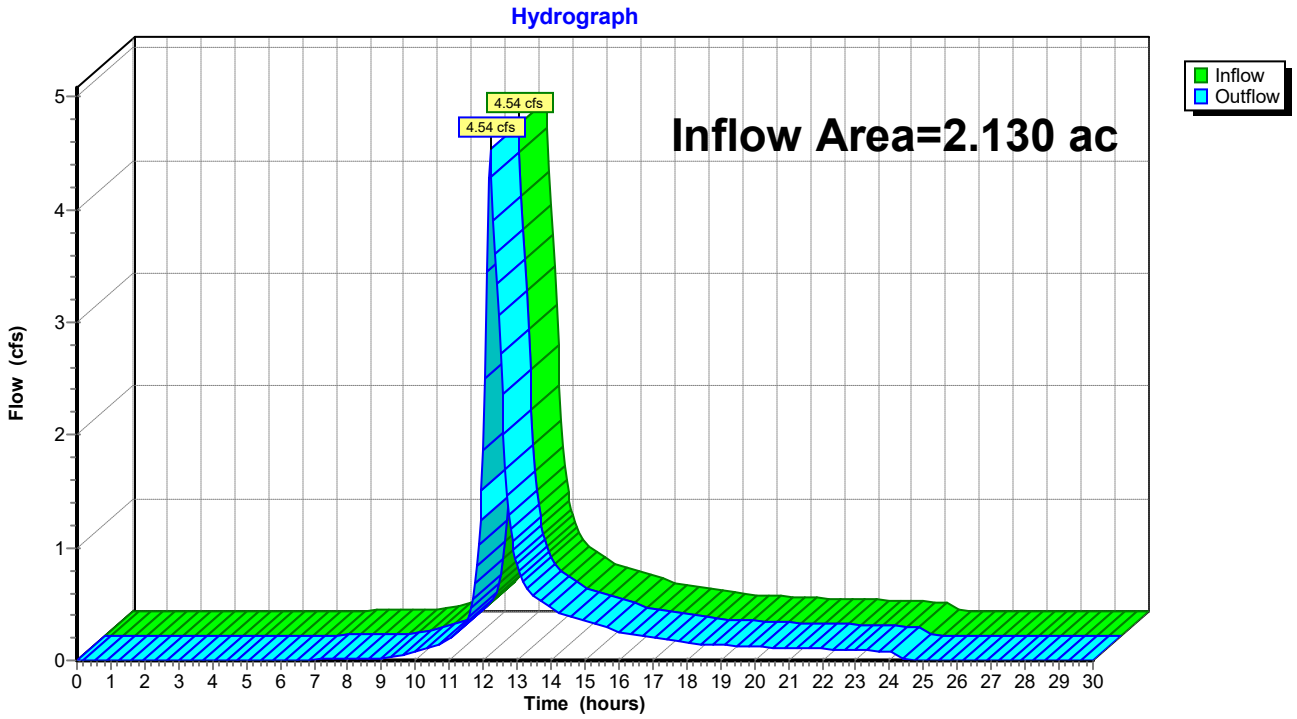


Summary for Reach DP#1: WETLAND

Inflow Area = 2.130 ac, 12.00% Impervious, Inflow Depth = 2.63" for 25-Year event
Inflow = 4.54 cfs @ 12.20 hrs, Volume= 0.466 af
Outflow = 4.54 cfs @ 12.20 hrs, Volume= 0.466 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach DP#1: WETLAND

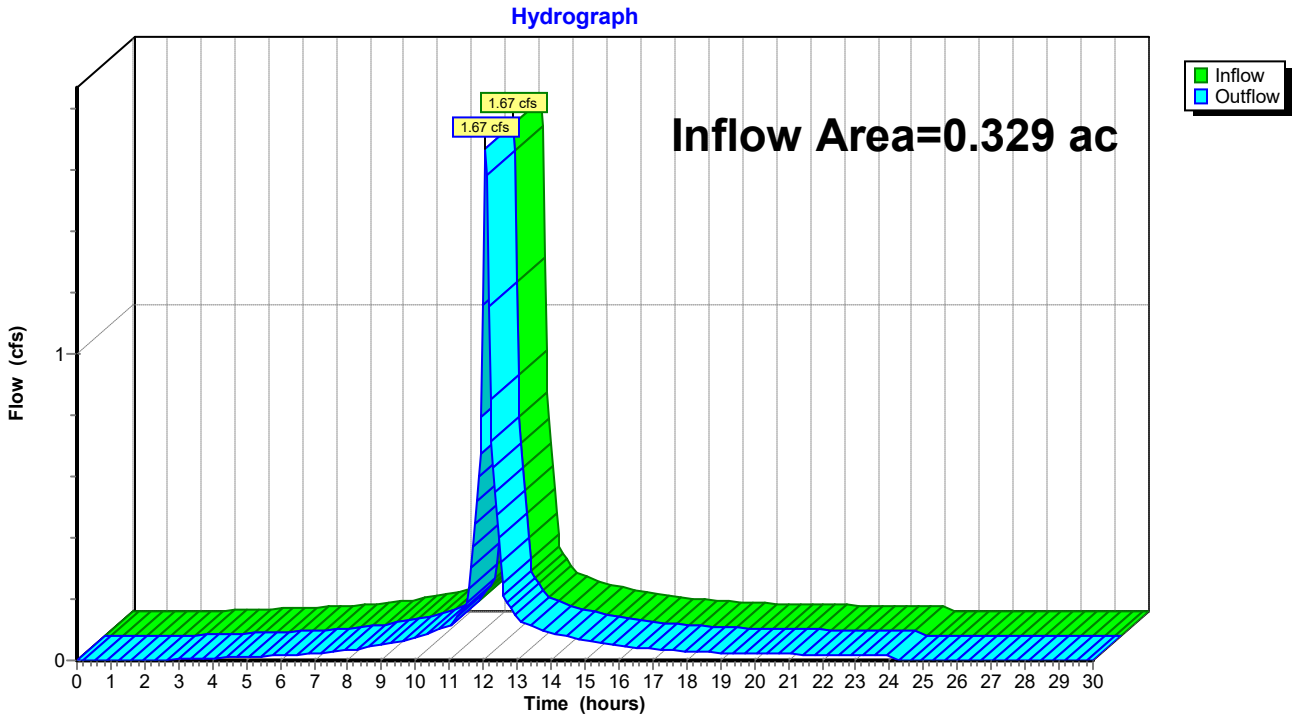


Summary for Reach DP#2: MUNICIPAL CATCHBASIN

Inflow Area = 0.329 ac, 87.38% Impervious, Inflow Depth = 4.72" for 25-Year event
Inflow = 1.67 cfs @ 12.07 hrs, Volume= 0.129 af
Outflow = 1.67 cfs @ 12.07 hrs, Volume= 0.129 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach DP#2: MUNICIPAL CATCHBASIN

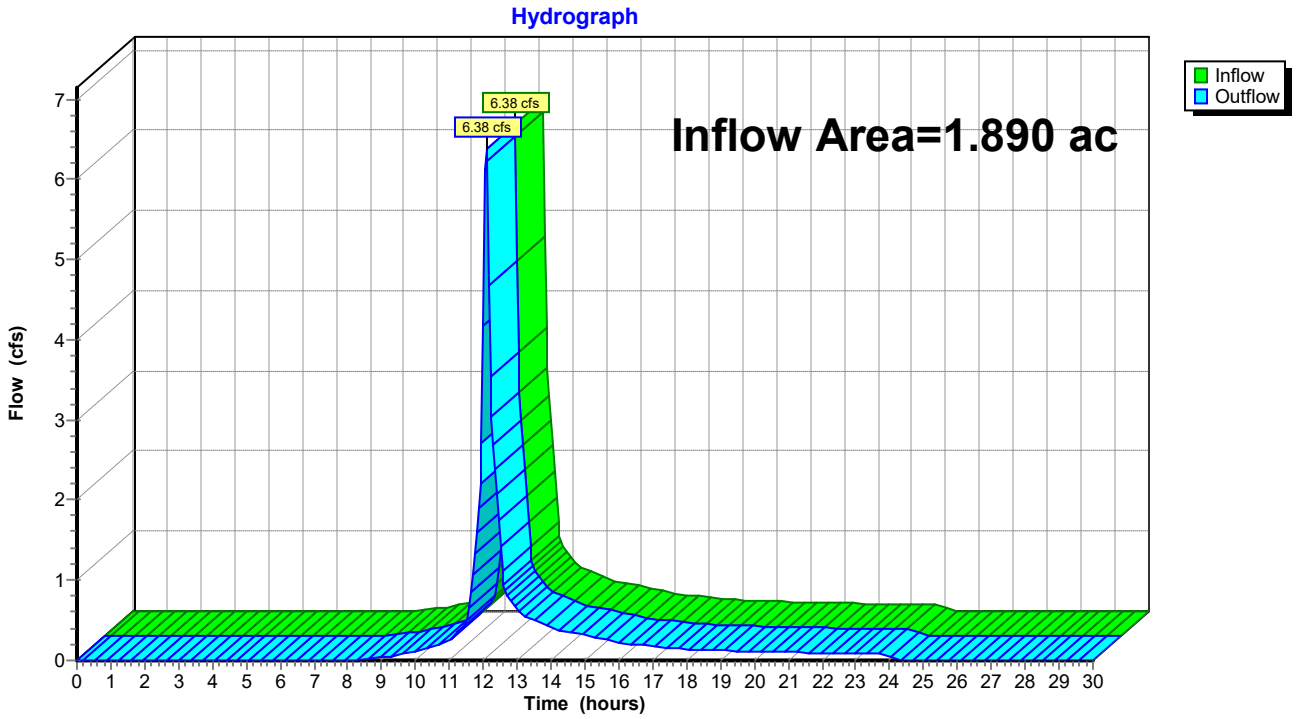


Summary for Reach DP#3: LOW POINT

Inflow Area = 1.890 ac, 15.10% Impervious, Inflow Depth = 2.88" for 25-Year event
Inflow = 6.38 cfs @ 12.08 hrs, Volume= 0.453 af
Outflow = 6.38 cfs @ 12.08 hrs, Volume= 0.453 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach DP#3: LOW POINT



Summary for Reach OL-1: OVERLAND

Inflow Area = 0.190 ac, 83.72% Impervious, Inflow Depth = 4.60" for 25-Year event
Inflow = 0.96 cfs @ 12.07 hrs, Volume= 0.073 af
Outflow = 0.92 cfs @ 12.10 hrs, Volume= 0.073 af, Atten= 3%, Lag= 1.5 min

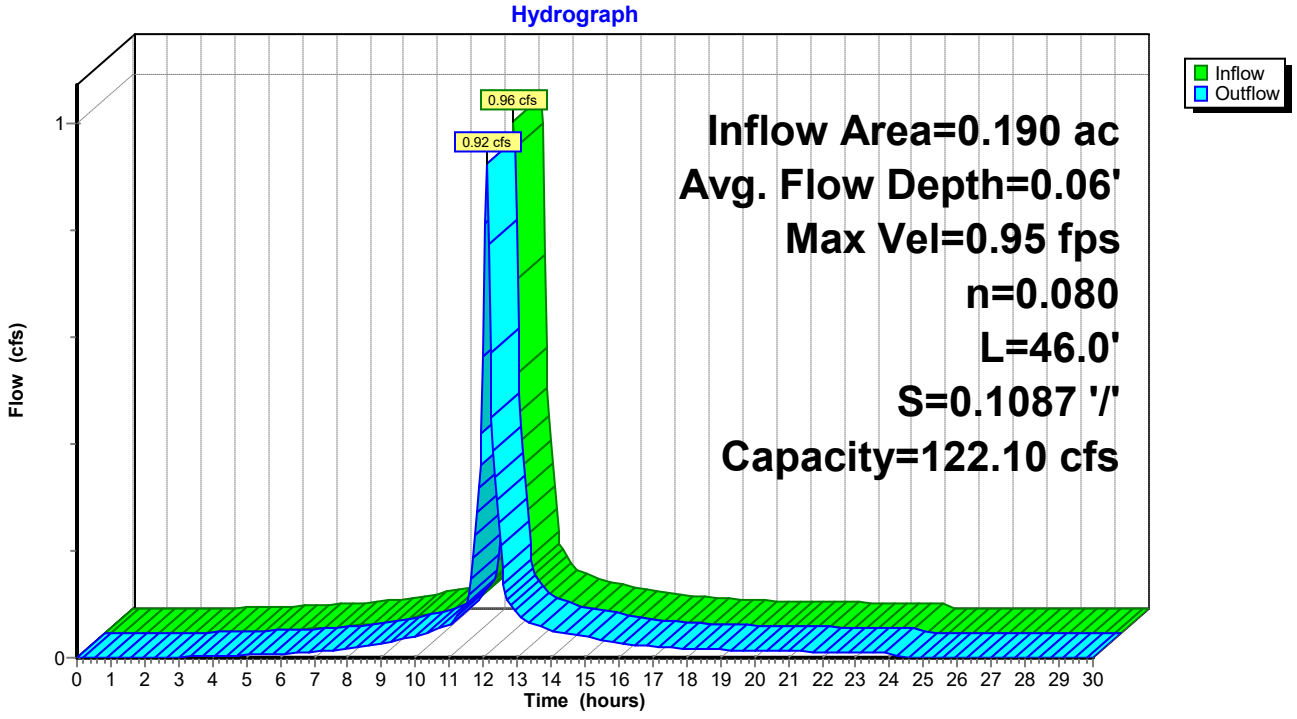
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.95 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 0.31 fps, Avg. Travel Time= 2.5 min

Peak Storage= 46 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.06'
Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 122.10 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 35.00'
Length= 46.0' Slope= 0.1087 '/'
Inlet Invert= 109.00', Outlet Invert= 104.00'

‡

Reach OL-1: OVERLAND



Summary for Reach OL-2: OVERLAND

Inflow Area = 0.190 ac, 83.72% Impervious, Inflow Depth = 4.60" for 25-Year event
Inflow = 0.92 cfs @ 12.10 hrs, Volume= 0.073 af
Outflow = 0.82 cfs @ 12.21 hrs, Volume= 0.073 af, Atten= 12%, Lag= 6.7 min

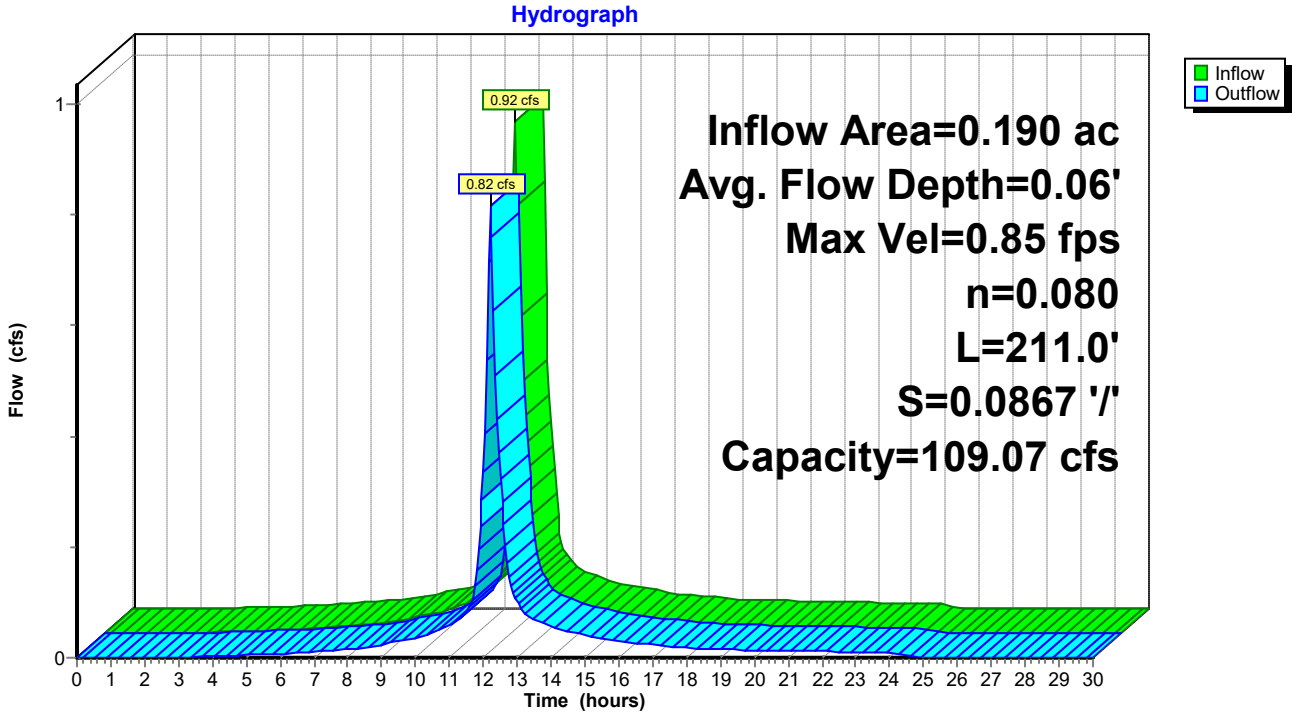
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.85 fps, Min. Travel Time= 4.2 min
Avg. Velocity = 0.28 fps, Avg. Travel Time= 12.6 min

Peak Storage= 209 cf @ 12.14 hrs
Average Depth at Peak Storage= 0.06'
Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 109.07 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 35.00'
Length= 211.0' Slope= 0.0867 '/'
Inlet Invert= 104.00', Outlet Invert= 85.70'

‡

Reach OL-2: OVERLAND



Summary for Reach OL-3: OVERLAND

Inflow Area = 0.190 ac, 83.72% Impervious, Inflow Depth = 4.60" for 25-Year event
Inflow = 0.82 cfs @ 12.21 hrs, Volume= 0.073 af
Outflow = 0.80 cfs @ 12.22 hrs, Volume= 0.073 af, Atten= 2%, Lag= 1.0 min

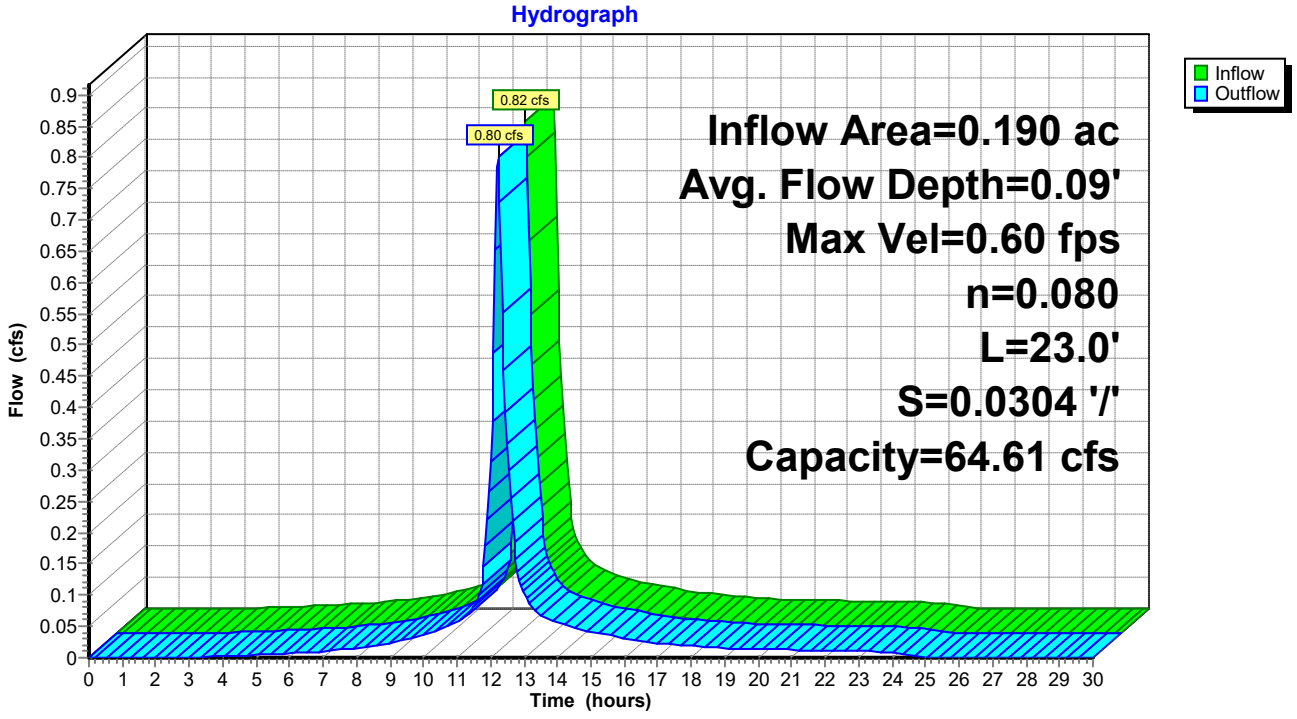
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.60 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 0.18 fps, Avg. Travel Time= 2.1 min

Peak Storage= 31 cf @ 12.21 hrs
Average Depth at Peak Storage= 0.09'
Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 64.61 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 35.00'
Length= 23.0' Slope= 0.0304 '/'
Inlet Invert= 85.70', Outlet Invert= 85.00'

‡

Reach OL-3: OVERLAND



Summary for Reach OL-4: OVERLAND

Inflow Area = 0.190 ac, 83.72% Impervious, Inflow Depth = 4.60" for 25-Year event
Inflow = 0.80 cfs @ 12.22 hrs, Volume= 0.073 af
Outflow = 0.67 cfs @ 12.45 hrs, Volume= 0.073 af, Atten= 16%, Lag= 13.3 min

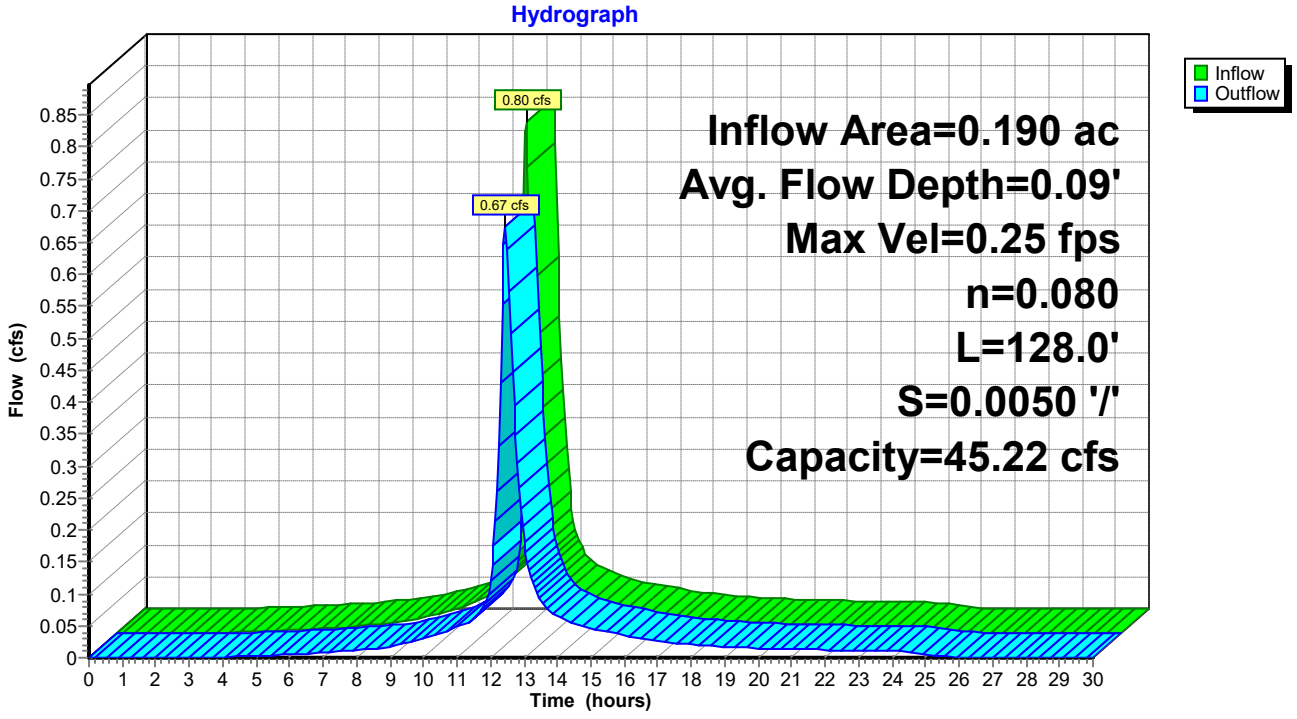
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.25 fps, Min. Travel Time= 8.4 min
Avg. Velocity = 0.07 fps, Avg. Travel Time= 28.7 min

Peak Storage= 344 cf @ 12.30 hrs
Average Depth at Peak Storage= 0.09'
Bank-Full Depth= 1.00' Flow Area= 40.0 sf, Capacity= 45.22 cfs

30.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 50.00'
Length= 128.0' Slope= 0.0050 '/'
Inlet Invert= 85.00', Outlet Invert= 84.36'

‡

Reach OL-4: OVERLAND



Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Reach DCB-B: TO OUTFALL Inflow=1.19 cfs 0.092 af
Outflow=1.19 cfs 0.092 af

Reach DP#1: WETLAND Inflow=6.41 cfs 0.643 af
Outflow=6.41 cfs 0.643 af

Reach DP#2: MUNICIPAL CATCHBASIN Inflow=2.07 cfs 0.162 af
Outflow=2.07 cfs 0.162 af

Reach DP#3: LOW POINT Inflow=8.67 cfs 0.617 af
Outflow=8.67 cfs 0.617 af

Reach OL-1: OVERLAND Avg. Flow Depth=0.07' Max Vel=1.03 fps Inflow=1.19 cfs 0.092 af
n=0.080 L=46.0' S=0.1087 '/' Capacity=122.10 cfs Outflow=1.15 cfs 0.092 af

Reach OL-2: OVERLAND Avg. Flow Depth=0.07' Max Vel=0.92 fps Inflow=1.15 cfs 0.092 af
n=0.080 L=211.0' S=0.0867 '/' Capacity=109.07 cfs Outflow=1.03 cfs 0.092 af

Reach OL-3: OVERLAND Avg. Flow Depth=0.10' Max Vel=0.66 fps Inflow=1.03 cfs 0.092 af
n=0.080 L=23.0' S=0.0304 '/' Capacity=64.61 cfs Outflow=1.01 cfs 0.092 af

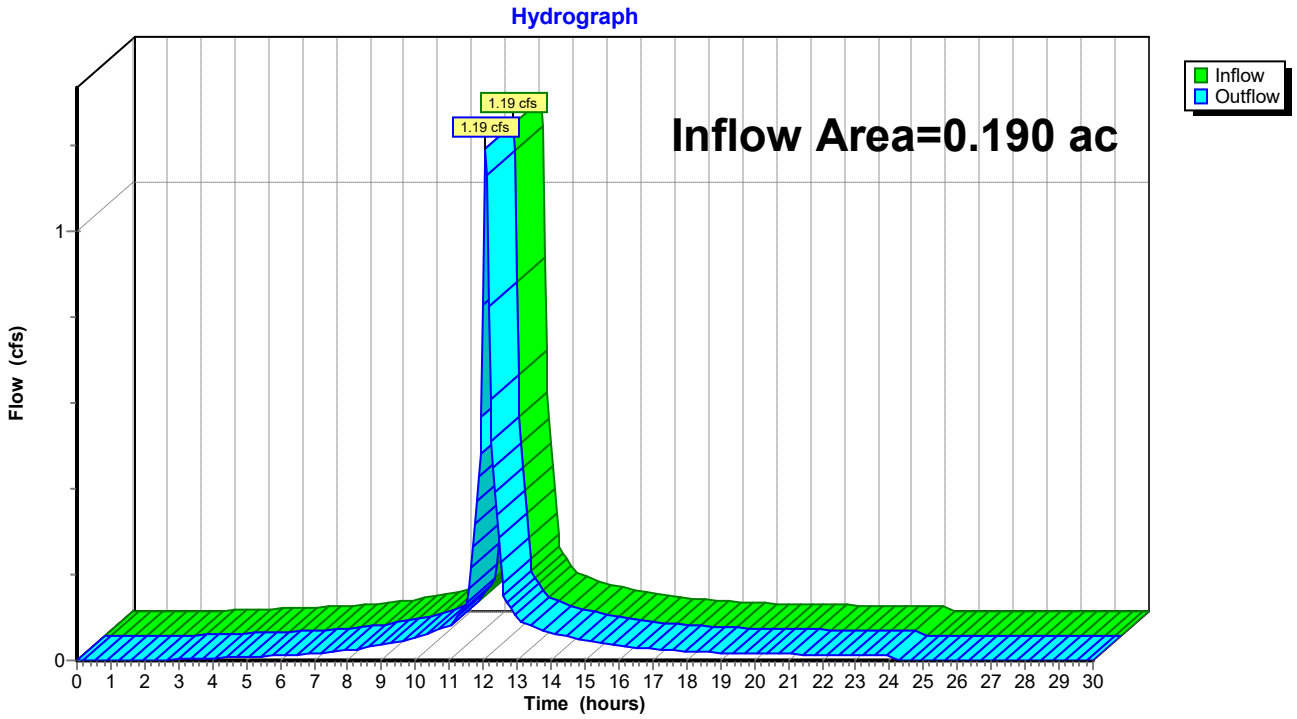
Reach OL-4: OVERLAND Avg. Flow Depth=0.10' Max Vel=0.28 fps Inflow=1.01 cfs 0.092 af
n=0.080 L=128.0' S=0.0050 '/' Capacity=45.22 cfs Outflow=0.86 cfs 0.092 af

Summary for Reach DCB-B: TO OUTFALL

Inflow Area = 0.190 ac, 83.72% Impervious, Inflow Depth = 5.79" for 100-Year event
Inflow = 1.19 cfs @ 12.07 hrs, Volume= 0.092 af
Outflow = 1.19 cfs @ 12.07 hrs, Volume= 0.092 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach DCB-B: TO OUTFALL

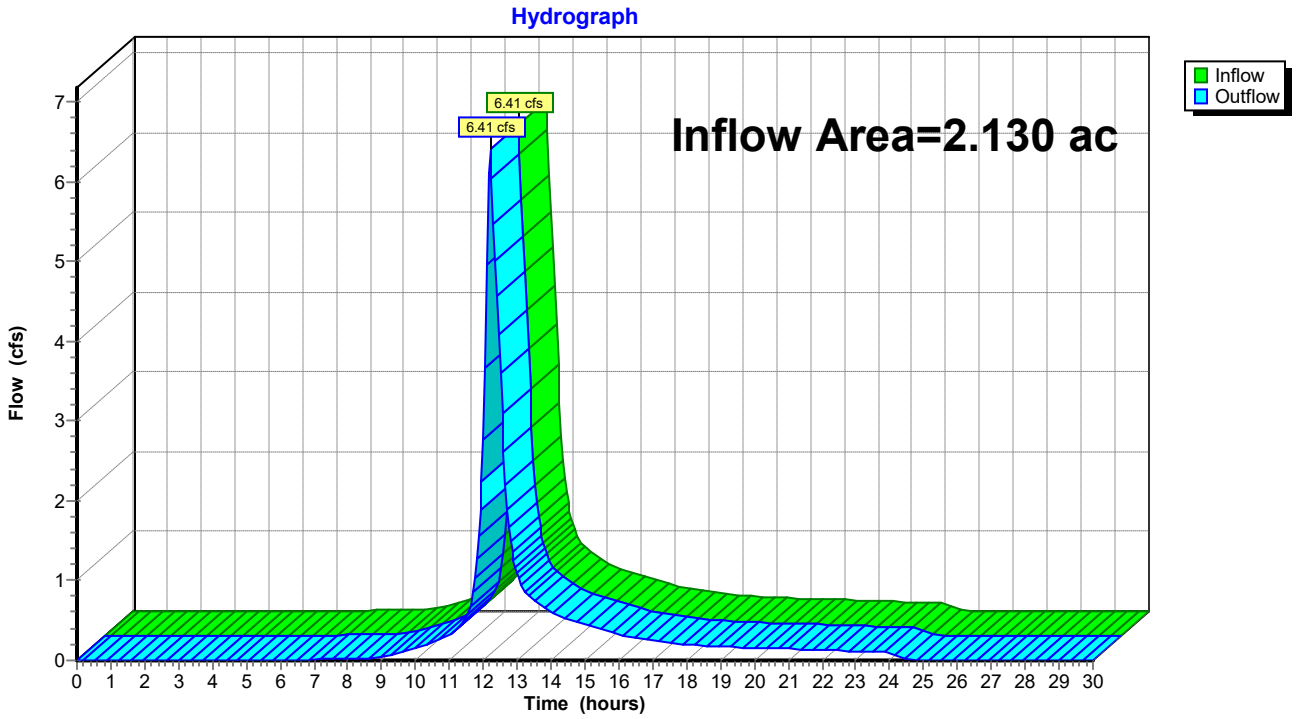


Summary for Reach DP#1: WETLAND

Inflow Area = 2.130 ac, 12.00% Impervious, Inflow Depth = 3.62" for 100-Year event
Inflow = 6.41 cfs @ 12.20 hrs, Volume= 0.643 af
Outflow = 6.41 cfs @ 12.20 hrs, Volume= 0.643 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach DP#1: WETLAND

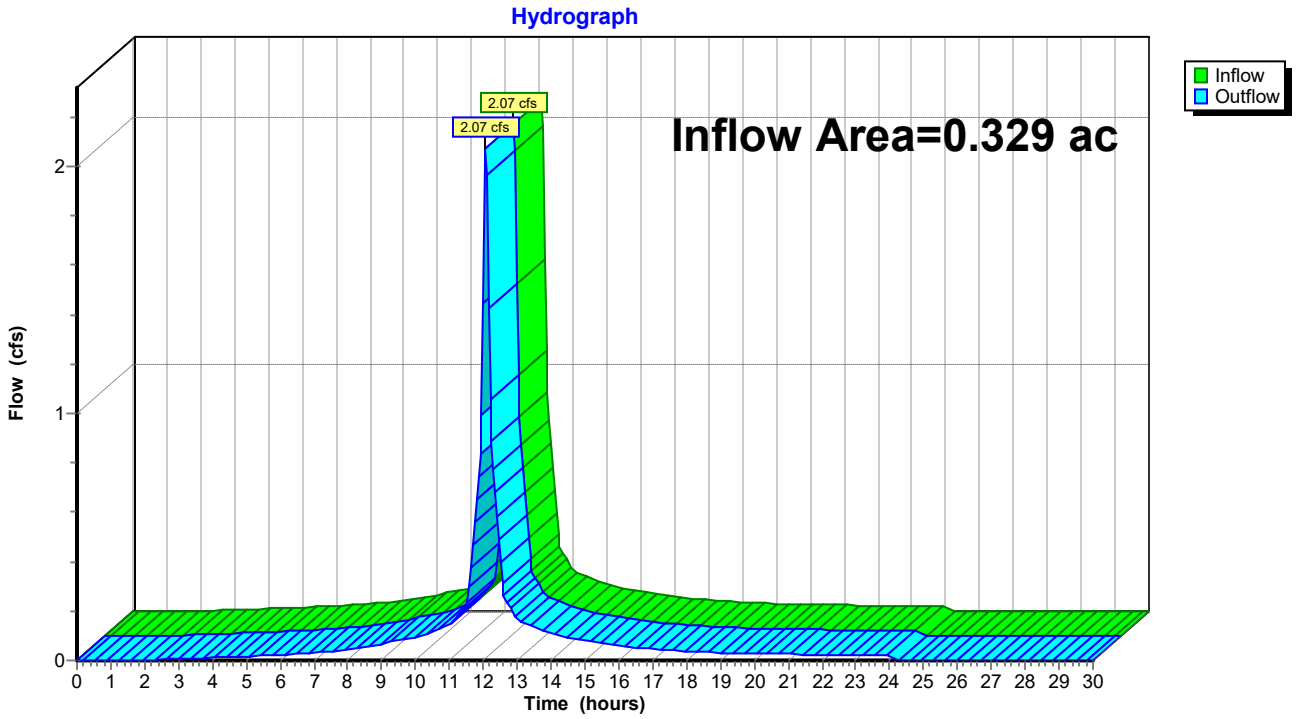


Summary for Reach DP#2: MUNICIPAL CATCHBASIN

Inflow Area = 0.329 ac, 87.38% Impervious, Inflow Depth = 5.91" for 100-Year event
Inflow = 2.07 cfs @ 12.07 hrs, Volume= 0.162 af
Outflow = 2.07 cfs @ 12.07 hrs, Volume= 0.162 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach DP#2: MUNICIPAL CATCHBASIN

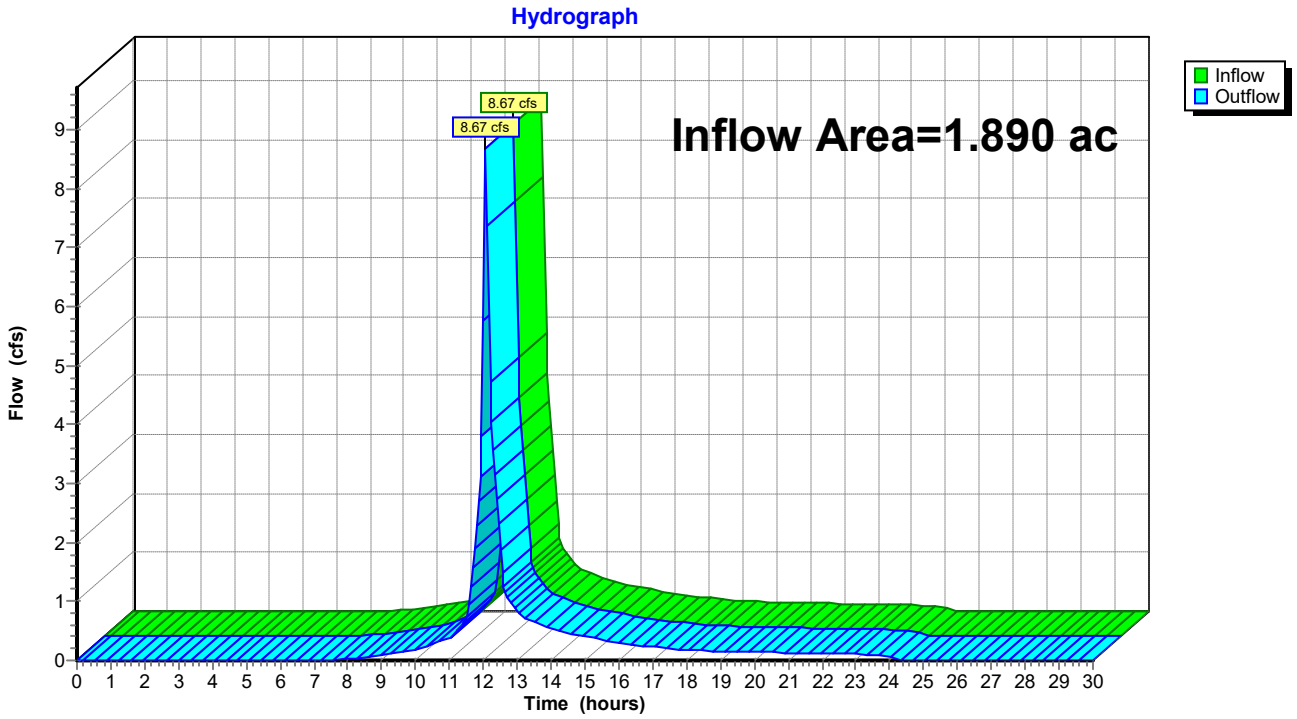


Summary for Reach DP#3: LOW POINT

Inflow Area = 1.890 ac, 15.10% Impervious, Inflow Depth = 3.92" for 100-Year event
Inflow = 8.67 cfs @ 12.08 hrs, Volume= 0.617 af
Outflow = 8.67 cfs @ 12.08 hrs, Volume= 0.617 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach DP#3: LOW POINT



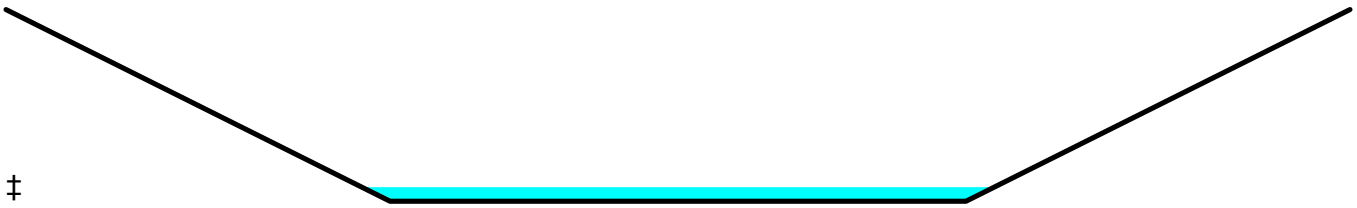
Summary for Reach OL-1: OVERLAND

Inflow Area = 0.190 ac, 83.72% Impervious, Inflow Depth = 5.79" for 100-Year event
Inflow = 1.19 cfs @ 12.07 hrs, Volume= 0.092 af
Outflow = 1.15 cfs @ 12.09 hrs, Volume= 0.092 af, Atten= 3%, Lag= 1.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.03 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 0.32 fps, Avg. Travel Time= 2.4 min

Peak Storage= 53 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.07'
Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 122.10 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 35.00'
Length= 46.0' Slope= 0.1087 '/'
Inlet Invert= 109.00', Outlet Invert= 104.00'



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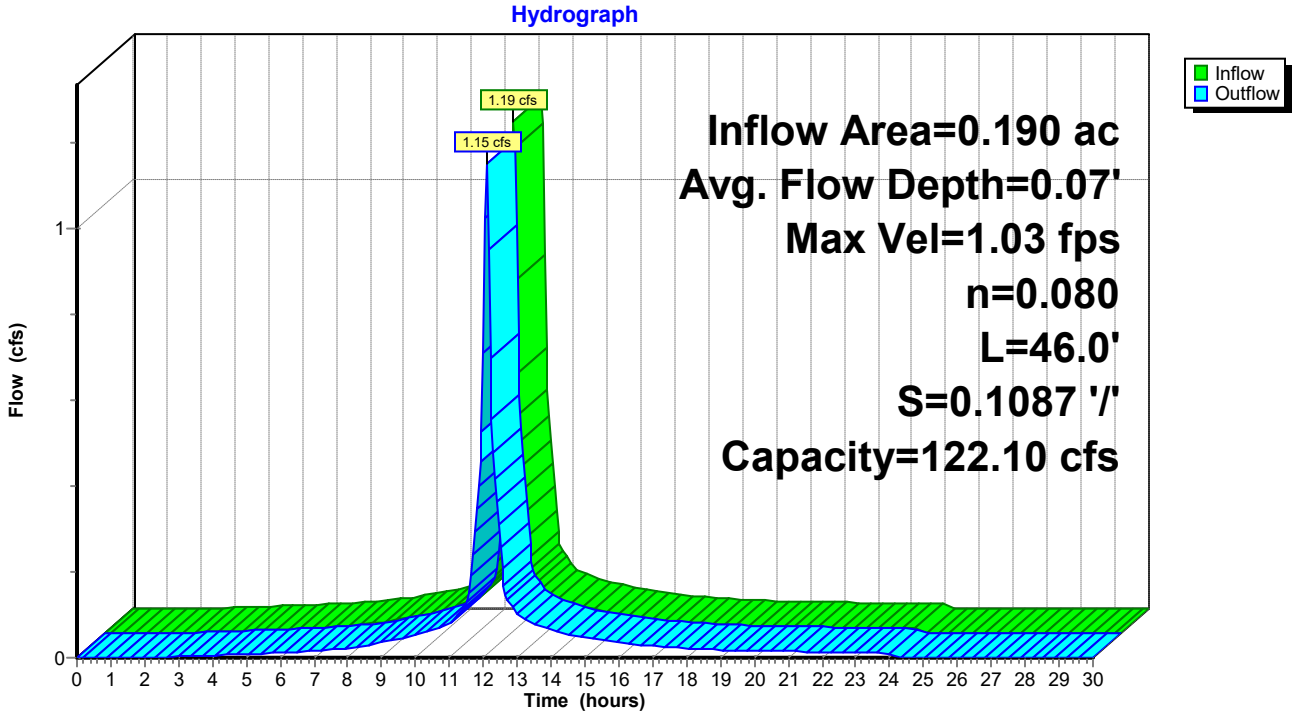
Reach OL-1: OVERLAND



Summary for Reach OL-2: OVERLAND

Inflow Area = 0.190 ac, 83.72% Impervious, Inflow Depth = 5.79" for 100-Year event
Inflow = 1.15 cfs @ 12.09 hrs, Volume= 0.092 af
Outflow = 1.03 cfs @ 12.20 hrs, Volume= 0.092 af, Atten= 10%, Lag= 6.2 min

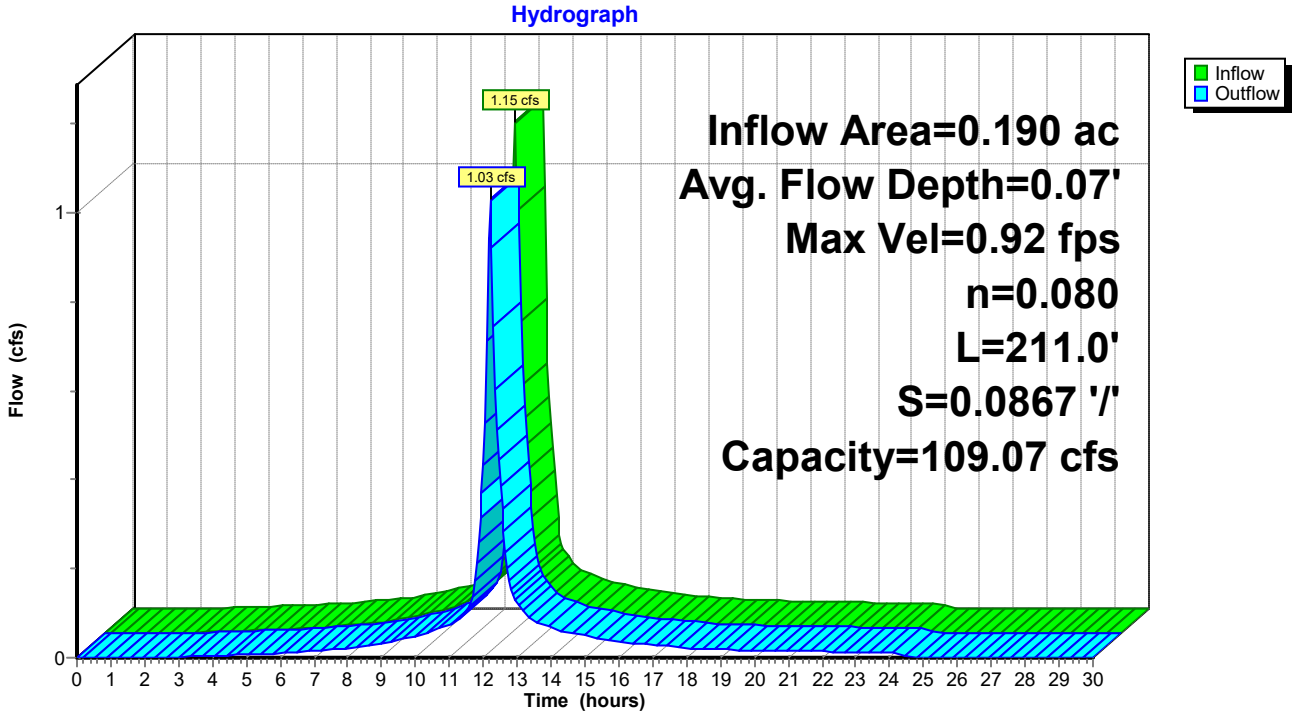
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.92 fps, Min. Travel Time= 3.8 min
Avg. Velocity = 0.29 fps, Avg. Travel Time= 12.3 min

Peak Storage= 240 cf @ 12.13 hrs
Average Depth at Peak Storage= 0.07'
Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 109.07 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 35.00'
Length= 211.0' Slope= 0.0867 '/'
Inlet Invert= 104.00', Outlet Invert= 85.70'

‡

Reach OL-2: OVERLAND



Summary for Reach OL-3: OVERLAND

Inflow Area = 0.190 ac, 83.72% Impervious, Inflow Depth = 5.79" for 100-Year event
Inflow = 1.03 cfs @ 12.20 hrs, Volume= 0.092 af
Outflow = 1.01 cfs @ 12.21 hrs, Volume= 0.092 af, Atten= 2%, Lag= 0.9 min

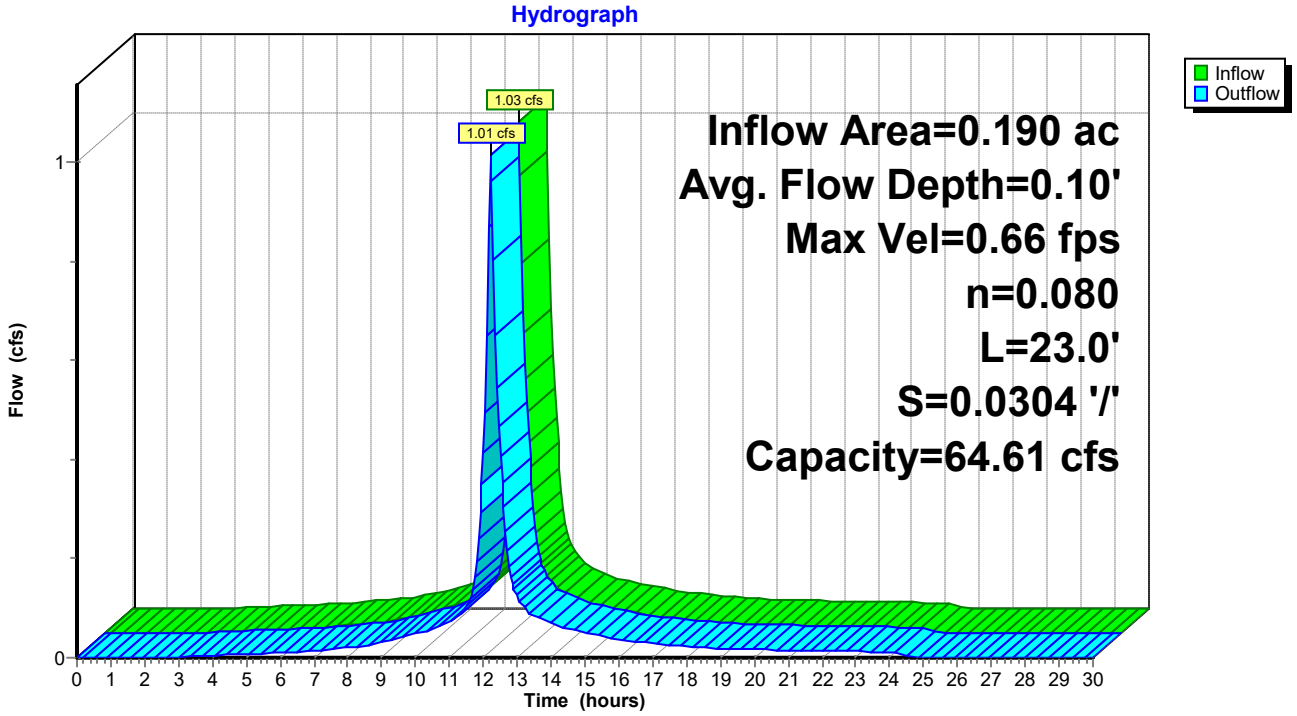
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.66 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 0.19 fps, Avg. Travel Time= 2.1 min

Peak Storage= 36 cf @ 12.20 hrs
Average Depth at Peak Storage= 0.10'
Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 64.61 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 35.00'
Length= 23.0' Slope= 0.0304 '/'
Inlet Invert= 85.70', Outlet Invert= 85.00'

‡

Reach OL-3: OVERLAND



Summary for Reach OL-4: OVERLAND

Inflow Area = 0.190 ac, 83.72% Impervious, Inflow Depth = 5.79" for 100-Year event
Inflow = 1.01 cfs @ 12.21 hrs, Volume= 0.092 af
Outflow = 0.86 cfs @ 12.41 hrs, Volume= 0.092 af, Atten= 15%, Lag= 12.1 min

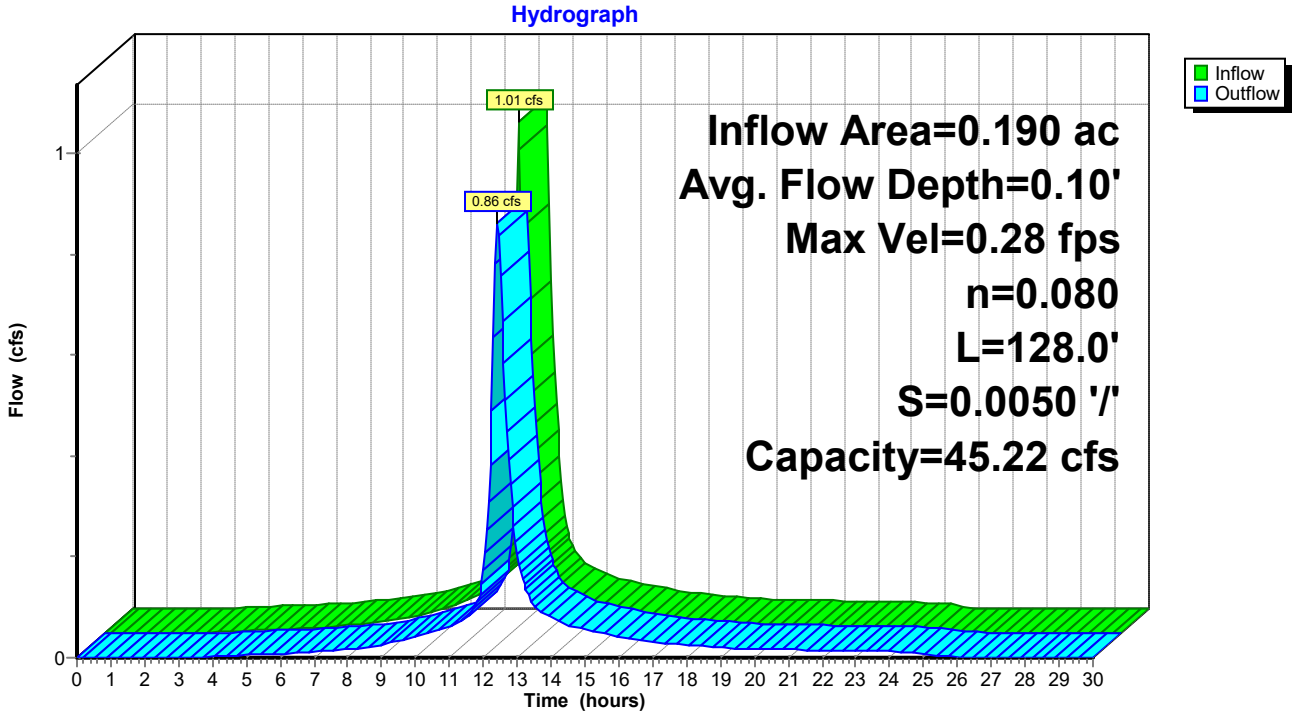
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.28 fps, Min. Travel Time= 7.7 min
Avg. Velocity = 0.08 fps, Avg. Travel Time= 27.5 min

Peak Storage= 399 cf @ 12.28 hrs
Average Depth at Peak Storage= 0.10'
Bank-Full Depth= 1.00' Flow Area= 40.0 sf, Capacity= 45.22 cfs

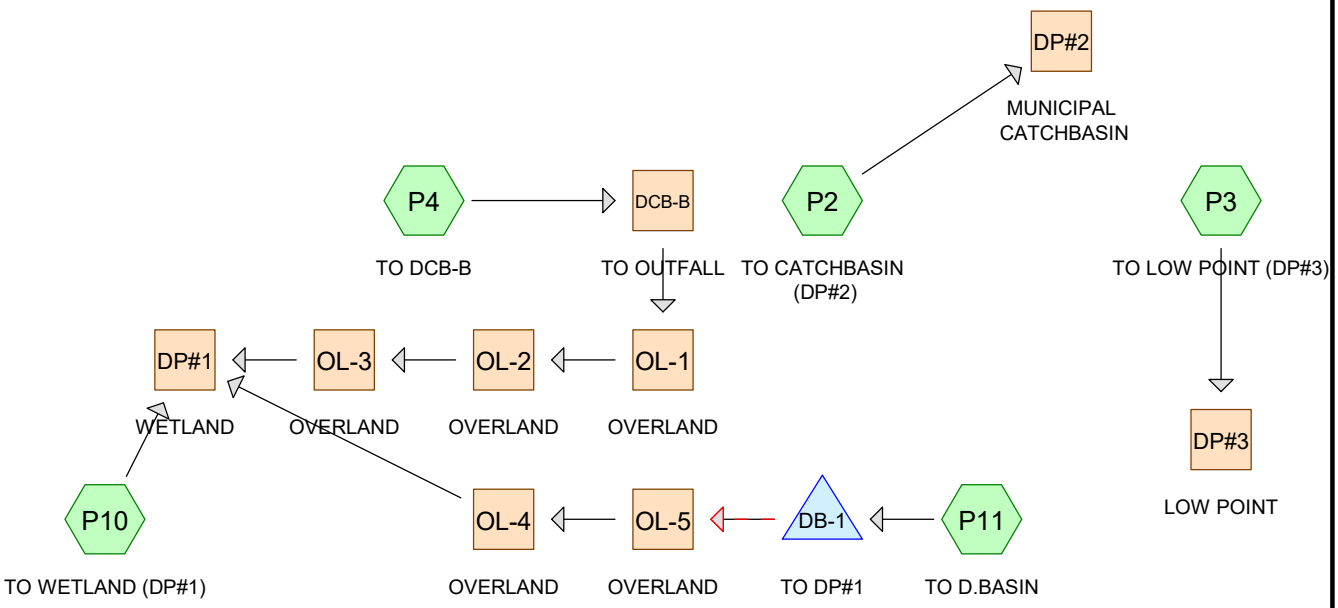
30.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 50.00'
Length= 128.0' Slope= 0.0050 '/'
Inlet Invert= 85.00', Outlet Invert= 84.36'

‡

Reach OL-4: OVERLAND



2.2
POST DEVELOPMENT CALCULATIONS



Subcat Reach Pond Link

Routing Diagram for 3010-POSTR1
Prepared by HANNIGAN ENGINEERING, INC., Printed 10/21/2021
HydroCAD® 10.00-25 s/n 00840 © 2019 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.910	74	>75% Grass cover, Good, HSG C (P10, P11, P2, P3, P4)
0.467	89	Gravel roads, HSG C (P10, P11, P2, P3)
0.828	98	Paved parking, HSG C (P10, P2, P3, P4)
0.038	98	Unconnected pavement, HSG C (P11)
2.105	70	Woods, Good, HSG C (P10, P2, P3)
4.348	**78**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
4.348	HSG C	P10, P11, P2, P3, P4
0.000	HSG D	
0.000	Other	
4.348		**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	0.910	0.000	0.000	0.910	>75% Grass cover, Good	P10, P11, P2, P3, P4
0.000	0.000	0.467	0.000	0.000	0.467	Gravel roads	P10, P11, P2, P3
0.000	0.000	0.828	0.000	0.000	0.828	Paved parking	P10, P2, P3, P4
0.000	0.000	0.038	0.000	0.000	0.038	Unconnected pavement	P11
0.000	0.000	2.105	0.000	0.000	2.105	Woods, Good	P10, P2, P3
0.000	**0.000**	**4.348**	**0.000**	**0.000**	**4.348**	**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	DB-1	87.40	87.00	30.0	0.0133	0.013	12.0	0.0	0.0

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Reach DCB-B: TO OUTFALL Inflow=0.51 cfs 0.037 af
Outflow=0.51 cfs 0.037 af

Reach DP#1: WETLAND Inflow=1.29 cfs 0.190 af
Outflow=1.29 cfs 0.190 af

Reach DP#2: MUNICIPAL CATCHBASIN Inflow=0.91 cfs 0.068 af
Outflow=0.91 cfs 0.068 af

Reach DP#3: LOW POINT Inflow=2.30 cfs 0.169 af
Outflow=2.30 cfs 0.169 af

Reach OL-1: OVERLAND Avg. Flow Depth=0.04' Max Vel=0.74 fps Inflow=0.51 cfs 0.037 af
n=0.080 L=66.0' S=0.1061 '/' Capacity=120.62 cfs Outflow=0.48 cfs 0.037 af

Reach OL-2: OVERLAND Avg. Flow Depth=0.06' Max Vel=0.43 fps Inflow=0.48 cfs 0.037 af
n=0.080 L=170.0' S=0.0235 '/' Capacity=56.81 cfs Outflow=0.40 cfs 0.037 af

Reach OL-3: OVERLAND Avg. Flow Depth=0.04' Max Vel=0.58 fps Inflow=0.40 cfs 0.037 af
n=0.080 L=189.0' S=0.0720 '/' Capacity=99.35 cfs Outflow=0.36 cfs 0.037 af

Reach OL-4: OVERLAND Avg. Flow Depth=0.04' Max Vel=0.15 fps Inflow=0.17 cfs 0.044 af
n=0.080 L=128.0' S=0.0050 '/' Capacity=45.22 cfs Outflow=0.17 cfs 0.044 af

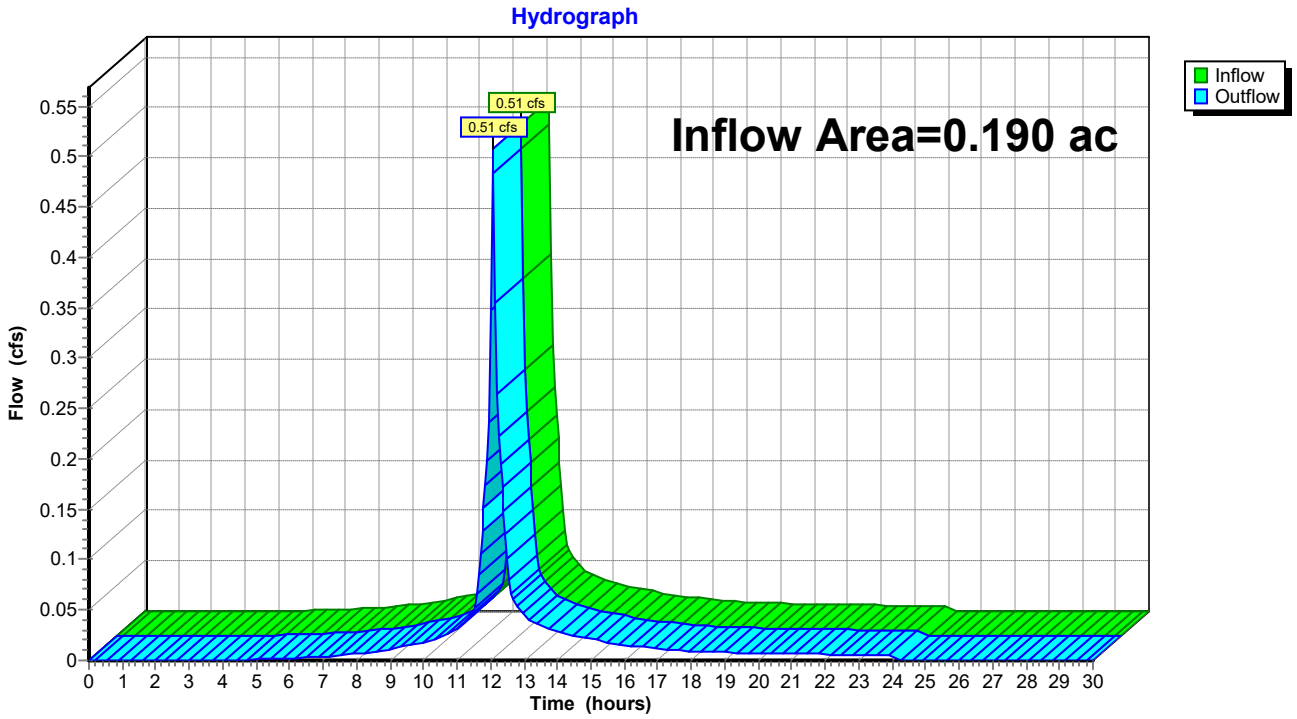
Reach OL-5: OVERLAND Avg. Flow Depth=0.03' Max Vel=0.34 fps Inflow=0.17 cfs 0.044 af
n=0.080 L=31.0' S=0.0323 '/' Capacity=66.52 cfs Outflow=0.17 cfs 0.044 af

Summary for Reach DCB-B: TO OUTFALL

Inflow Area = 0.190 ac, 83.72% Impervious, Inflow Depth = 2.35" for 2-Year event
Inflow = 0.51 cfs @ 12.07 hrs, Volume= 0.037 af
Outflow = 0.51 cfs @ 12.07 hrs, Volume= 0.037 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach DCB-B: TO OUTFALL

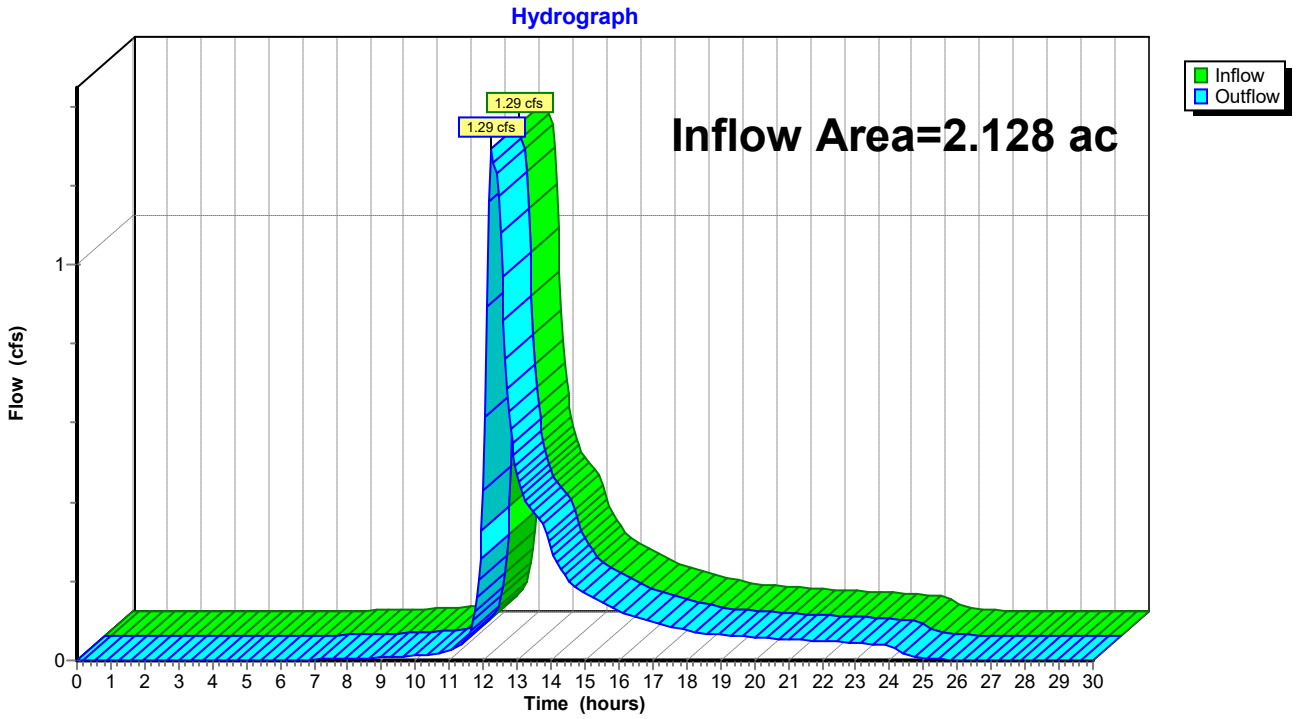


Summary for Reach DP#1: WETLAND

Inflow Area = 2.128 ac, 13.80% Impervious, Inflow Depth = 1.07" for 2-Year event
Inflow = 1.29 cfs @ 12.22 hrs, Volume= 0.190 af
Outflow = 1.29 cfs @ 12.22 hrs, Volume= 0.190 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach DP#1: WETLAND

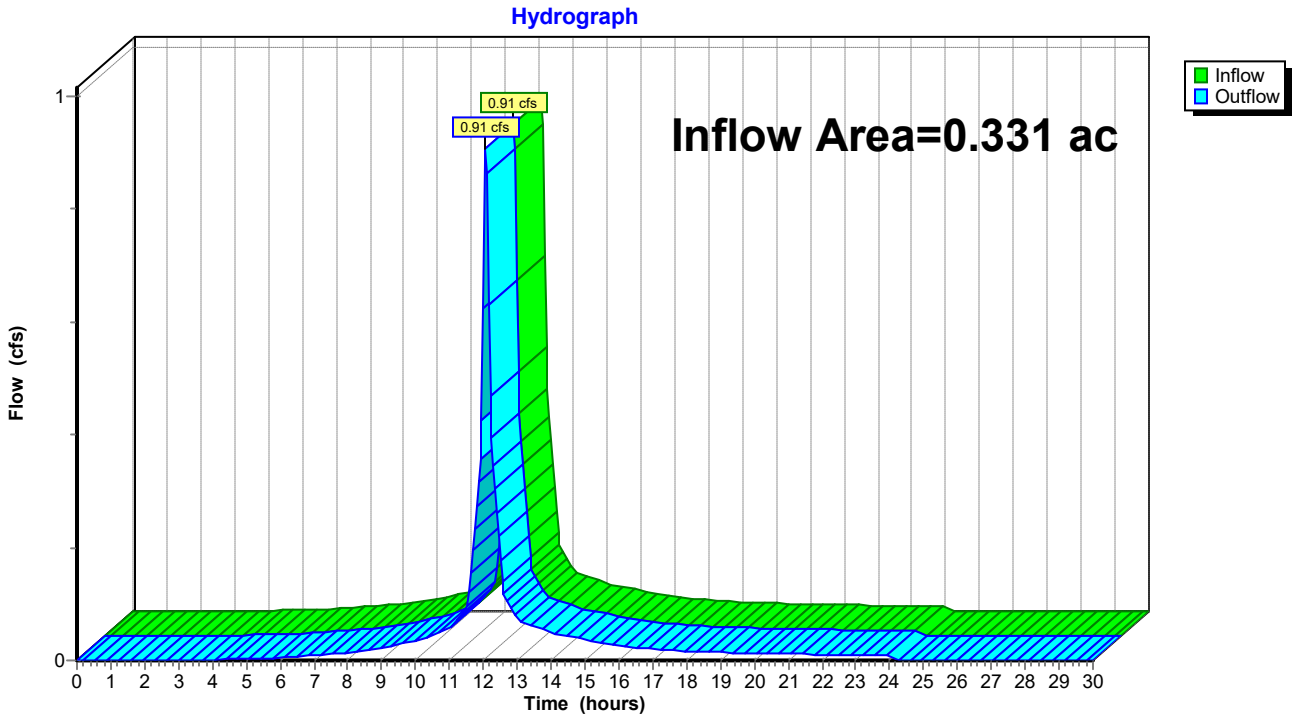


Summary for Reach DP#2: MUNICIPAL CATCHBASIN

Inflow Area = 0.331 ac, 86.79% Impervious, Inflow Depth = 2.45" for 2-Year event
Inflow = 0.91 cfs @ 12.07 hrs, Volume= 0.068 af
Outflow = 0.91 cfs @ 12.07 hrs, Volume= 0.068 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach DP#2: MUNICIPAL CATCHBASIN

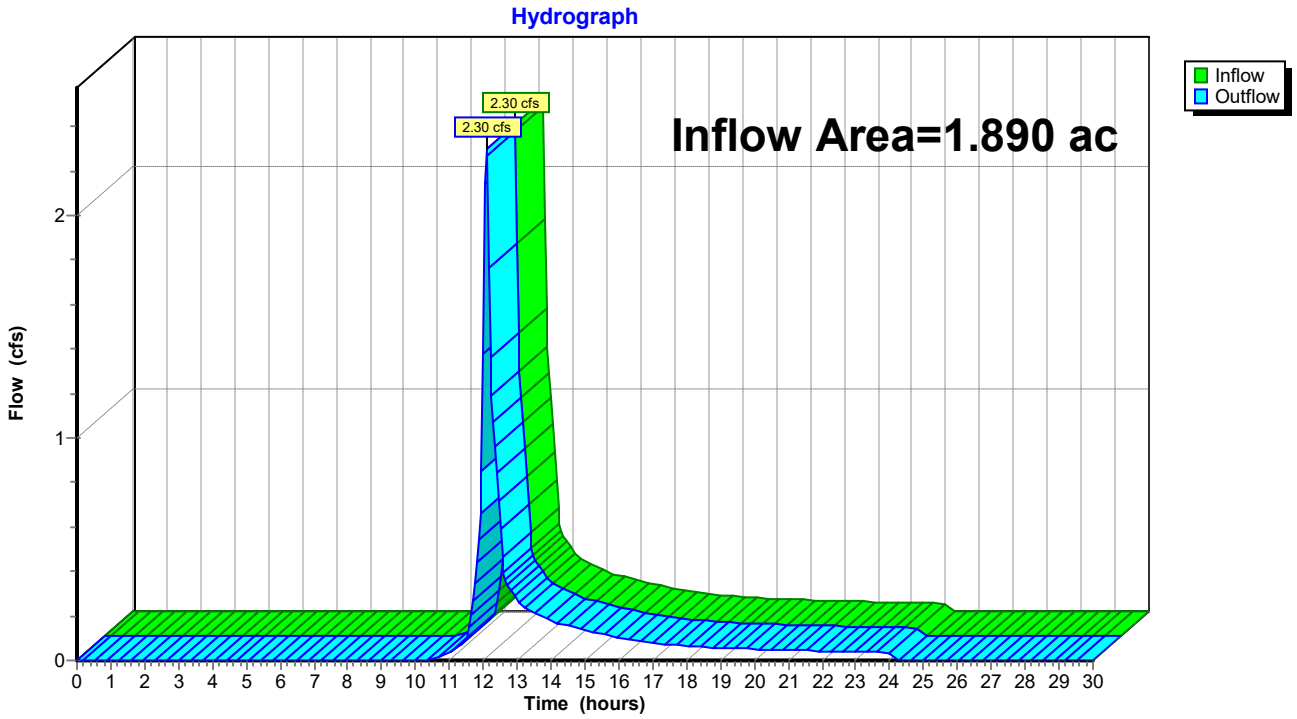


Summary for Reach DP#3: LOW POINT

Inflow Area = 1.890 ac, 15.10% Impervious, Inflow Depth = 1.07" for 2-Year event
Inflow = 2.30 cfs @ 12.09 hrs, Volume= 0.169 af
Outflow = 2.30 cfs @ 12.09 hrs, Volume= 0.169 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach DP#3: LOW POINT



Summary for Reach OL-1: OVERLAND

Inflow Area = 0.190 ac, 83.72% Impervious, Inflow Depth = 2.35" for 2-Year event
Inflow = 0.51 cfs @ 12.07 hrs, Volume= 0.037 af
Outflow = 0.48 cfs @ 12.12 hrs, Volume= 0.037 af, Atten= 6%, Lag= 2.6 min

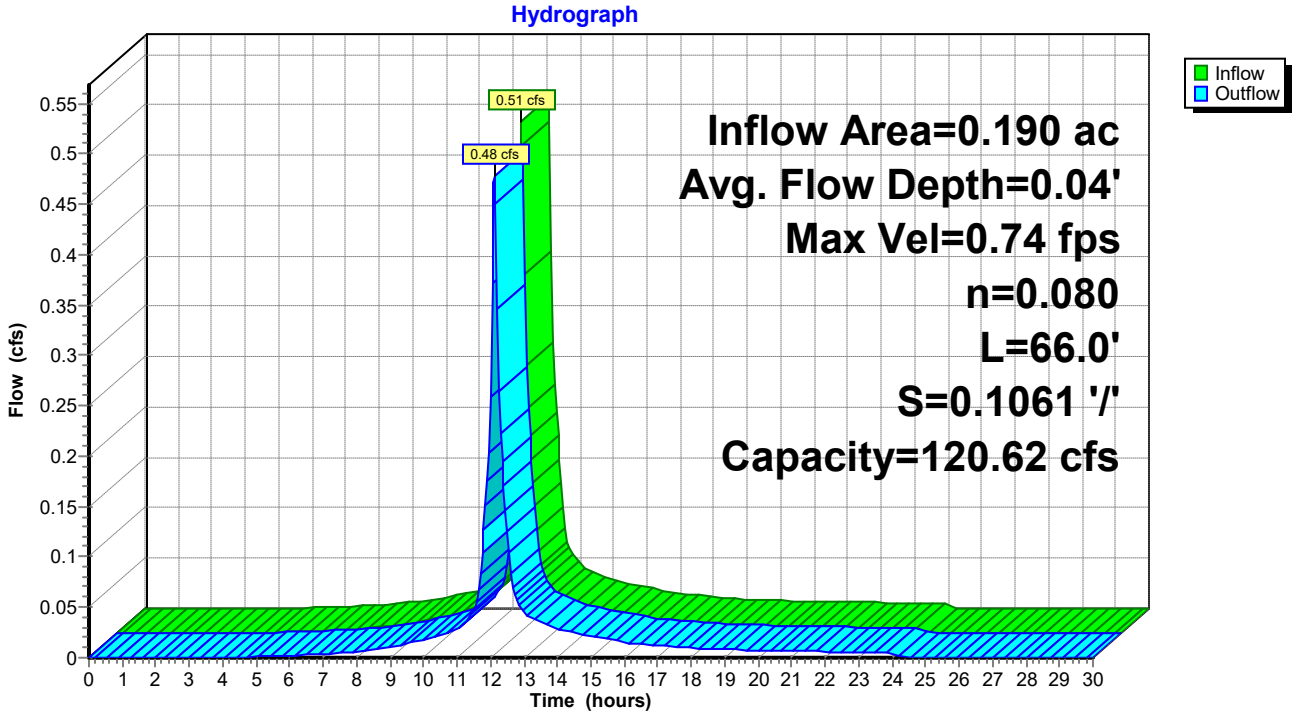
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.74 fps, Min. Travel Time= 1.5 min
Avg. Velocity = 0.29 fps, Avg. Travel Time= 3.8 min

Peak Storage= 45 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.04'
Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 120.62 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 35.00'
Length= 66.0' Slope= 0.1061 '/'
Inlet Invert= 109.00', Outlet Invert= 102.00'

‡

Reach OL-1: OVERLAND



Summary for Reach OL-2: OVERLAND

Inflow Area = 0.190 ac, 83.72% Impervious, Inflow Depth = 2.35" for 2-Year event
Inflow = 0.48 cfs @ 12.12 hrs, Volume= 0.037 af
Outflow = 0.40 cfs @ 12.29 hrs, Volume= 0.037 af, Atten= 17%, Lag= 10.4 min

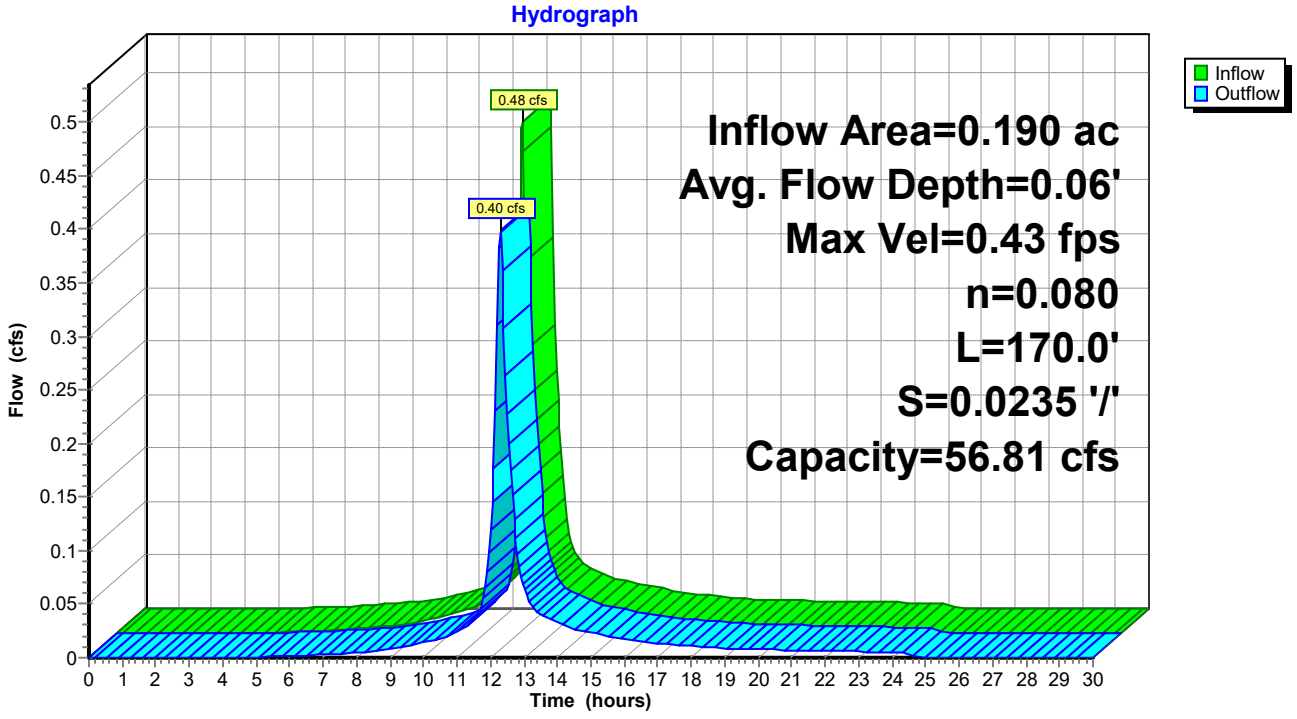
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.43 fps, Min. Travel Time= 6.7 min
Avg. Velocity = 0.15 fps, Avg. Travel Time= 19.4 min

Peak Storage= 160 cf @ 12.18 hrs
Average Depth at Peak Storage= 0.06'
Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 56.81 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 35.00'
Length= 170.0' Slope= 0.0235 '/'
Inlet Invert= 102.00', Outlet Invert= 98.00'

‡

Reach OL-2: OVERLAND



Summary for Reach OL-3: OVERLAND

Inflow Area = 0.190 ac, 83.72% Impervious, Inflow Depth = 2.35" for 2-Year event
Inflow = 0.40 cfs @ 12.29 hrs, Volume= 0.037 af
Outflow = 0.36 cfs @ 12.44 hrs, Volume= 0.037 af, Atten= 9%, Lag= 9.1 min

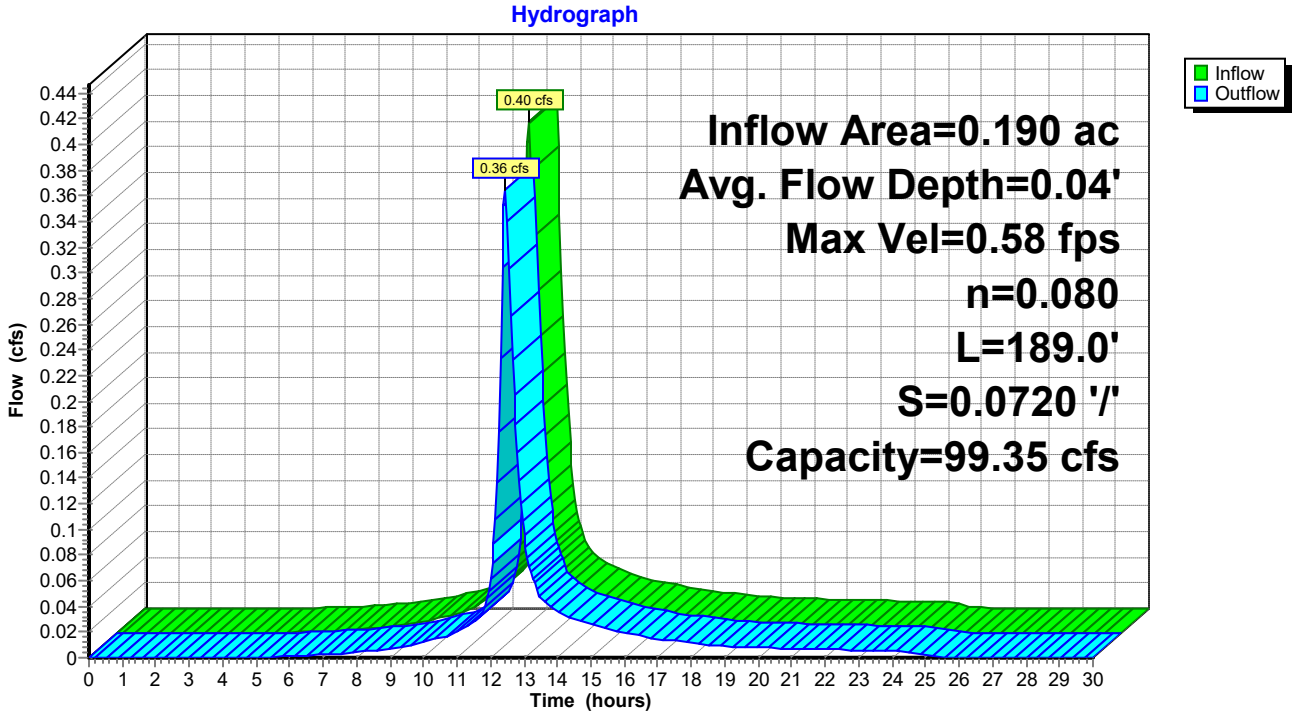
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.58 fps, Min. Travel Time= 5.4 min
Avg. Velocity = 0.24 fps, Avg. Travel Time= 13.0 min

Peak Storage= 119 cf @ 12.35 hrs
Average Depth at Peak Storage= 0.04'
Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 99.35 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 35.00'
Length= 189.0' Slope= 0.0720 '/'
Inlet Invert= 98.00', Outlet Invert= 84.40'

‡

Reach OL-3: OVERLAND



Summary for Reach OL-4: OVERLAND

Inflow Area = 0.426 ac, 8.93% Impervious, Inflow Depth = 1.25" for 2-Year event
Inflow = 0.17 cfs @ 12.15 hrs, Volume= 0.044 af
Outflow = 0.17 cfs @ 13.60 hrs, Volume= 0.044 af, Atten= 0%, Lag= 87.0 min

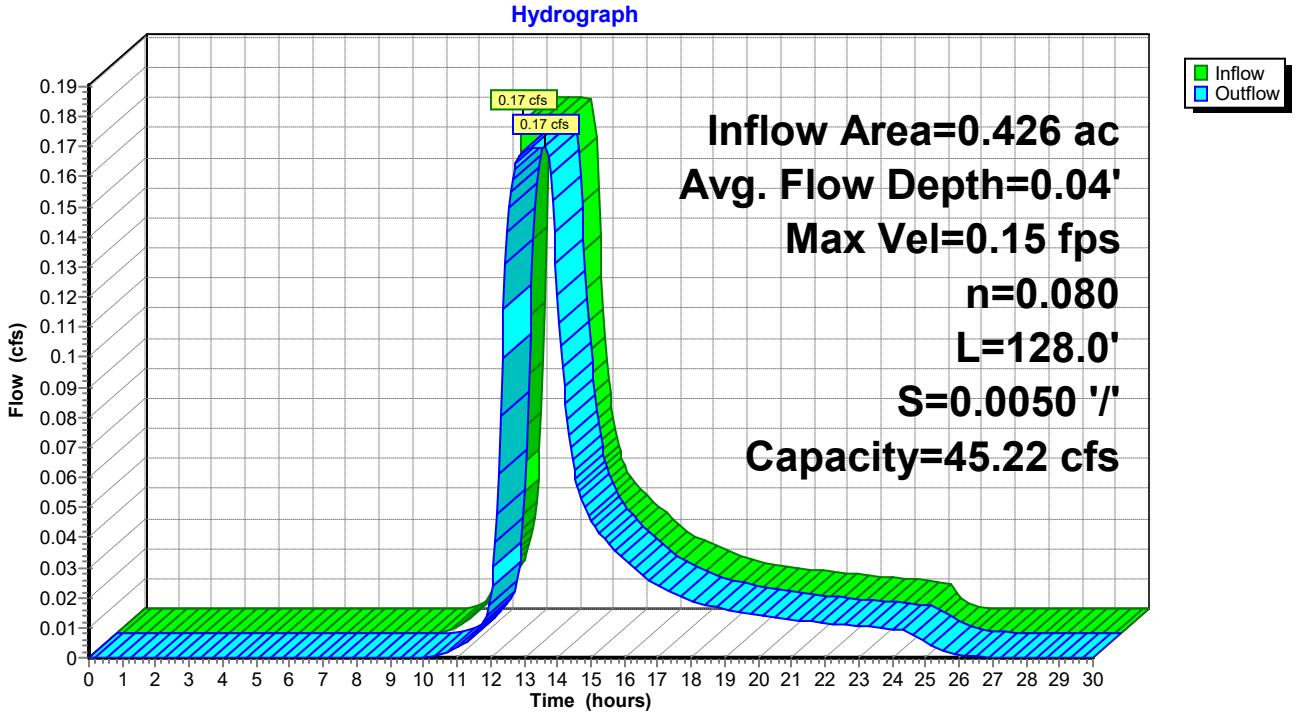
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.15 fps, Min. Travel Time= 14.4 min
Avg. Velocity = 0.07 fps, Avg. Travel Time= 29.2 min

Peak Storage= 147 cf @ 13.40 hrs
Average Depth at Peak Storage= 0.04'
Bank-Full Depth= 1.00' Flow Area= 40.0 sf, Capacity= 45.22 cfs

30.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 50.00'
Length= 128.0' Slope= 0.0050 '/'
Inlet Invert= 85.00', Outlet Invert= 84.36'

‡

Reach OL-4: OVERLAND



Summary for Reach OL-5: OVERLAND

Inflow Area = 0.426 ac, 8.93% Impervious, Inflow Depth = 1.25" for 2-Year event
Inflow = 0.17 cfs @ 12.05 hrs, Volume= 0.044 af
Outflow = 0.17 cfs @ 12.15 hrs, Volume= 0.044 af, Atten= 0%, Lag= 6.0 min

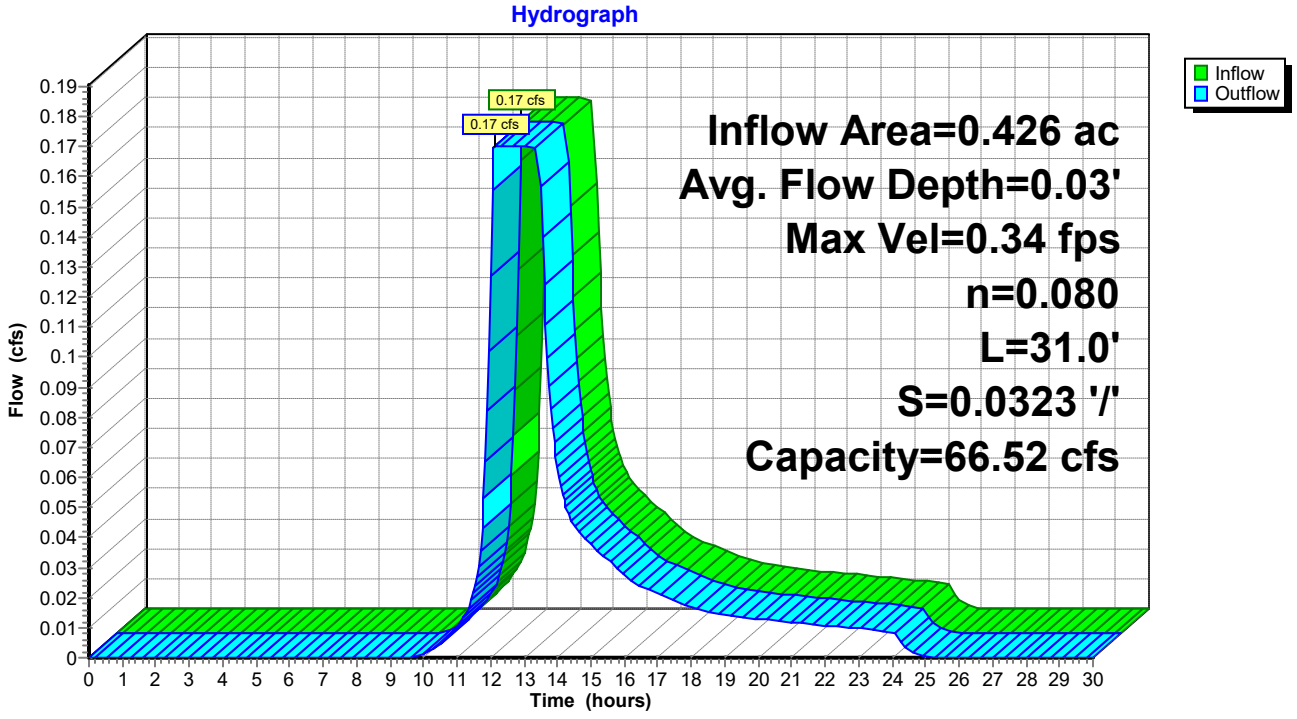
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.34 fps, Min. Travel Time= 1.5 min
Avg. Velocity = 0.18 fps, Avg. Travel Time= 2.8 min

Peak Storage= 16 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.03'
Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 66.52 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 35.00'
Length= 31.0' Slope= 0.0323 '/'
Inlet Invert= 86.00', Outlet Invert= 85.00'

‡

Reach OL-5: OVERLAND



Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Reach DCB-B: TO OUTFALL Inflow=0.80 cfs 0.061 af
Outflow=0.80 cfs 0.061 af

Reach DP#1: WETLAND Inflow=3.06 cfs 0.387 af
Outflow=3.06 cfs 0.387 af

Reach DP#2: MUNICIPAL CATCHBASIN Inflow=1.42 cfs 0.108 af
Outflow=1.42 cfs 0.108 af

Reach DP#3: LOW POINT Inflow=4.89 cfs 0.348 af
Outflow=4.89 cfs 0.348 af

Reach OL-1: OVERLAND Avg. Flow Depth=0.06' Max Vel=0.88 fps Inflow=0.80 cfs 0.061 af
n=0.080 L=66.0' S=0.1061 '/' Capacity=120.62 cfs Outflow=0.76 cfs 0.061 af

Reach OL-2: OVERLAND Avg. Flow Depth=0.08' Max Vel=0.52 fps Inflow=0.76 cfs 0.061 af
n=0.080 L=170.0' S=0.0235 '/' Capacity=56.81 cfs Outflow=0.66 cfs 0.061 af

Reach OL-3: OVERLAND Avg. Flow Depth=0.06' Max Vel=0.71 fps Inflow=0.66 cfs 0.061 af
n=0.080 L=189.0' S=0.0720 '/' Capacity=99.35 cfs Outflow=0.60 cfs 0.061 af

Reach OL-4: OVERLAND Avg. Flow Depth=0.07' Max Vel=0.21 fps Inflow=0.47 cfs 0.087 af
n=0.080 L=128.0' S=0.0050 '/' Capacity=45.22 cfs Outflow=0.44 cfs 0.087 af

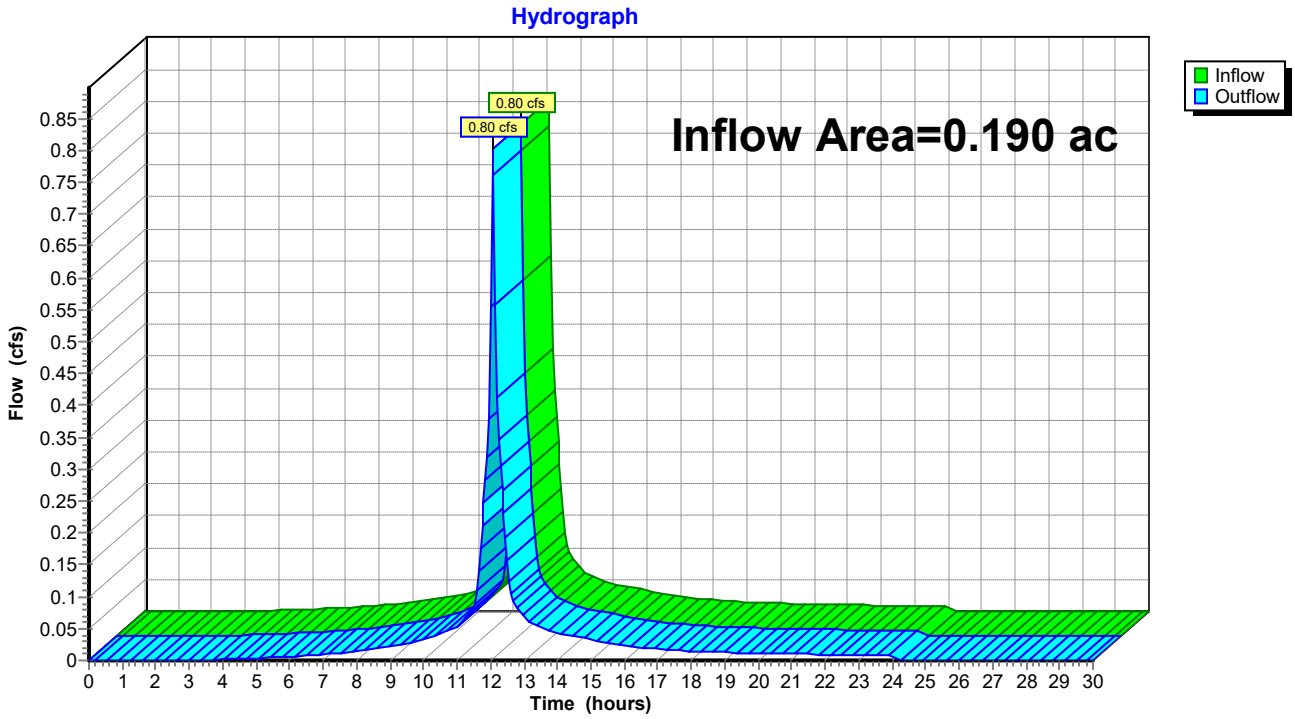
Reach OL-5: OVERLAND Avg. Flow Depth=0.06' Max Vel=0.50 fps Inflow=0.47 cfs 0.087 af
n=0.080 L=31.0' S=0.0323 '/' Capacity=66.52 cfs Outflow=0.47 cfs 0.087 af

Summary for Reach DCB-B: TO OUTFALL

Inflow Area = 0.190 ac, 83.72% Impervious, Inflow Depth = 3.82" for 10-Year event
Inflow = 0.80 cfs @ 12.07 hrs, Volume= 0.061 af
Outflow = 0.80 cfs @ 12.07 hrs, Volume= 0.061 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach DCB-B: TO OUTFALL

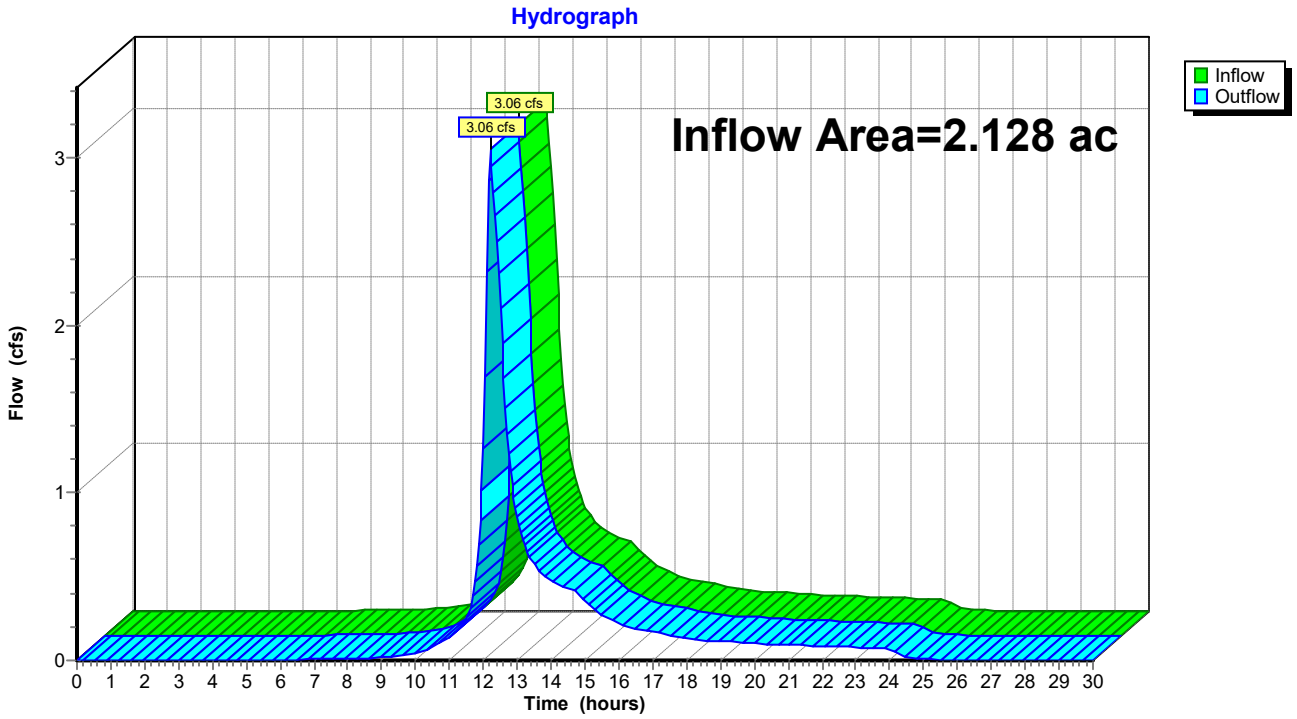


Summary for Reach DP#1: WETLAND

Inflow Area = 2.128 ac, 13.80% Impervious, Inflow Depth = 2.18" for 10-Year event
Inflow = 3.06 cfs @ 12.21 hrs, Volume= 0.387 af
Outflow = 3.06 cfs @ 12.21 hrs, Volume= 0.387 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach DP#1: WETLAND

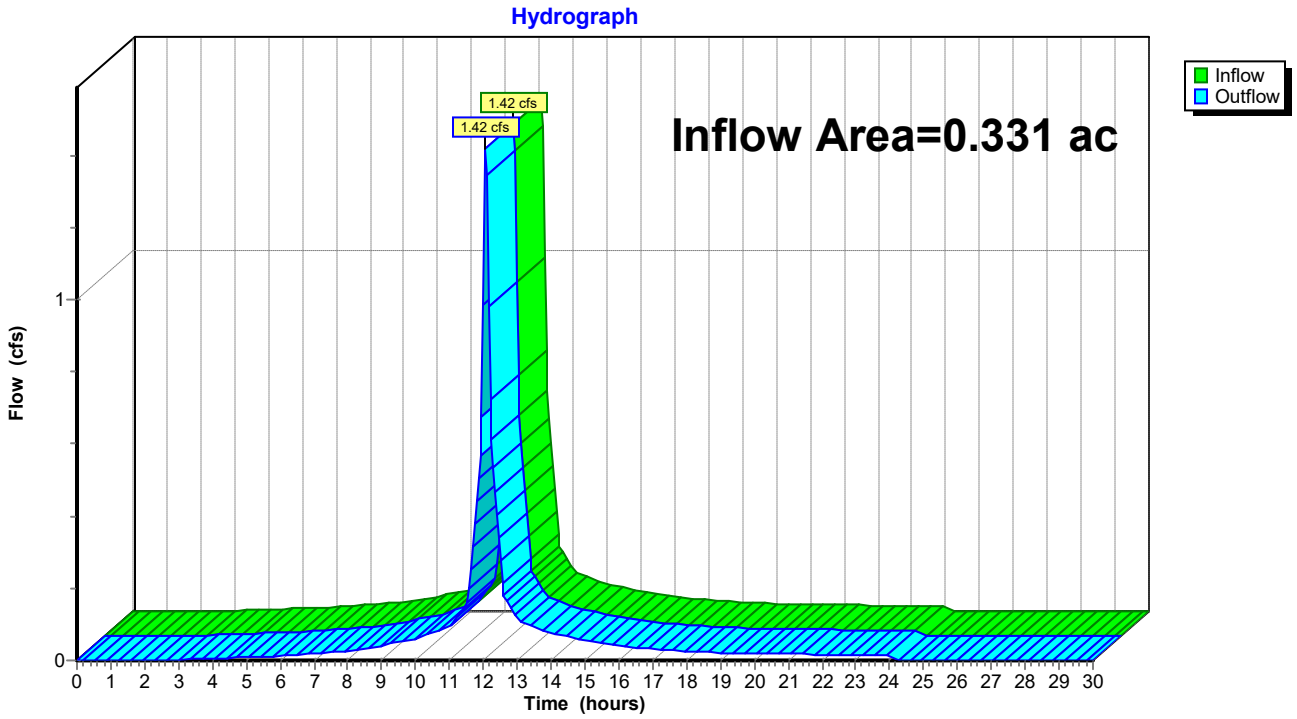


Summary for Reach DP#2: MUNICIPAL CATCHBASIN

Inflow Area = 0.331 ac, 86.79% Impervious, Inflow Depth = 3.92" for 10-Year event
Inflow = 1.42 cfs @ 12.07 hrs, Volume= 0.108 af
Outflow = 1.42 cfs @ 12.07 hrs, Volume= 0.108 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach DP#2: MUNICIPAL CATCHBASIN

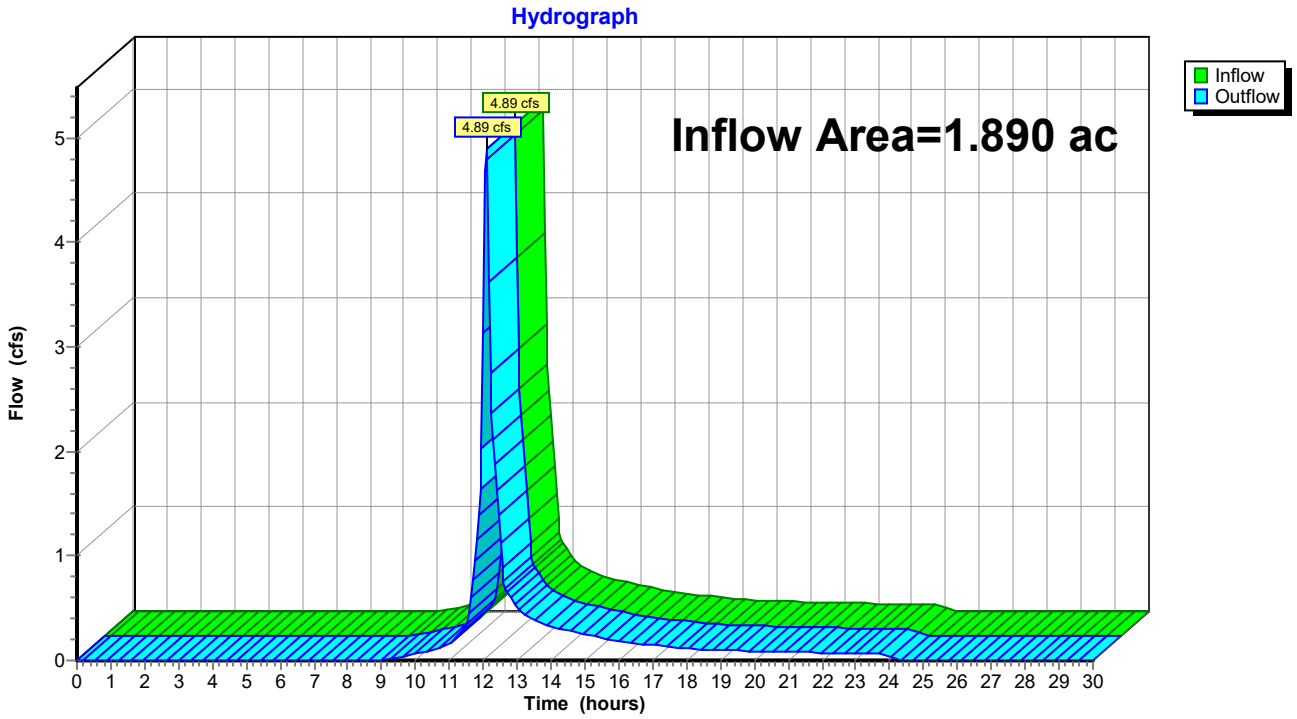


Summary for Reach DP#3: LOW POINT

Inflow Area = 1.890 ac, 15.10% Impervious, Inflow Depth = 2.21" for 10-Year event
Inflow = 4.89 cfs @ 12.08 hrs, Volume= 0.348 af
Outflow = 4.89 cfs @ 12.08 hrs, Volume= 0.348 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach DP#3: LOW POINT



Summary for Reach OL-1: OVERLAND

Inflow Area = 0.190 ac, 83.72% Impervious, Inflow Depth = 3.82" for 10-Year event
Inflow = 0.80 cfs @ 12.07 hrs, Volume= 0.061 af
Outflow = 0.76 cfs @ 12.11 hrs, Volume= 0.061 af, Atten= 5%, Lag= 2.2 min

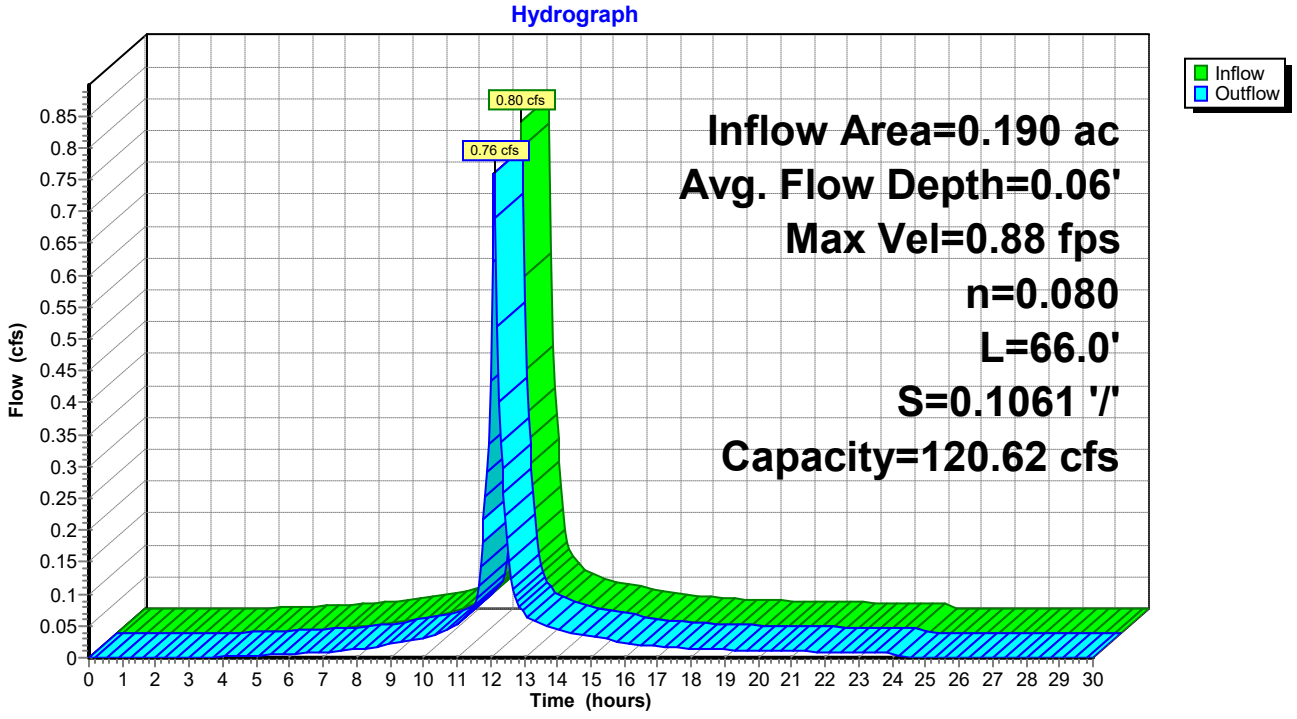
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.88 fps, Min. Travel Time= 1.2 min
Avg. Velocity = 0.30 fps, Avg. Travel Time= 3.7 min

Peak Storage= 59 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.06'
Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 120.62 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 35.00'
Length= 66.0' Slope= 0.1061 '/'
Inlet Invert= 109.00', Outlet Invert= 102.00'

‡

Reach OL-1: OVERLAND



Summary for Reach OL-2: OVERLAND

Inflow Area = 0.190 ac, 83.72% Impervious, Inflow Depth = 3.82" for 10-Year event
Inflow = 0.76 cfs @ 12.11 hrs, Volume= 0.061 af
Outflow = 0.66 cfs @ 12.25 hrs, Volume= 0.061 af, Atten= 13%, Lag= 8.7 min

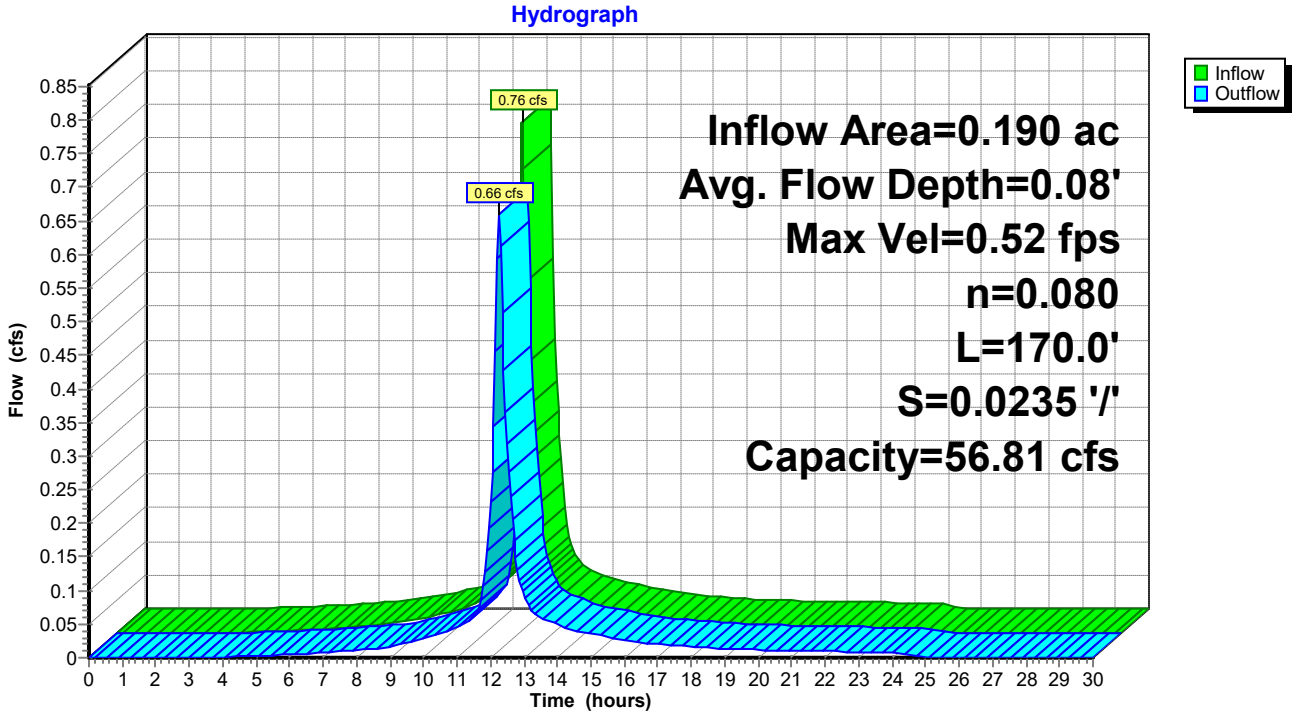
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.52 fps, Min. Travel Time= 5.5 min
Avg. Velocity = 0.16 fps, Avg. Travel Time= 18.2 min

Peak Storage= 219 cf @ 12.16 hrs
Average Depth at Peak Storage= 0.08'
Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 56.81 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 35.00'
Length= 170.0' Slope= 0.0235 '/'
Inlet Invert= 102.00', Outlet Invert= 98.00'

‡

Reach OL-2: OVERLAND



Summary for Reach OL-3: OVERLAND

Inflow Area = 0.190 ac, 83.72% Impervious, Inflow Depth = 3.82" for 10-Year event
Inflow = 0.66 cfs @ 12.25 hrs, Volume= 0.061 af
Outflow = 0.60 cfs @ 12.38 hrs, Volume= 0.061 af, Atten= 8%, Lag= 7.3 min

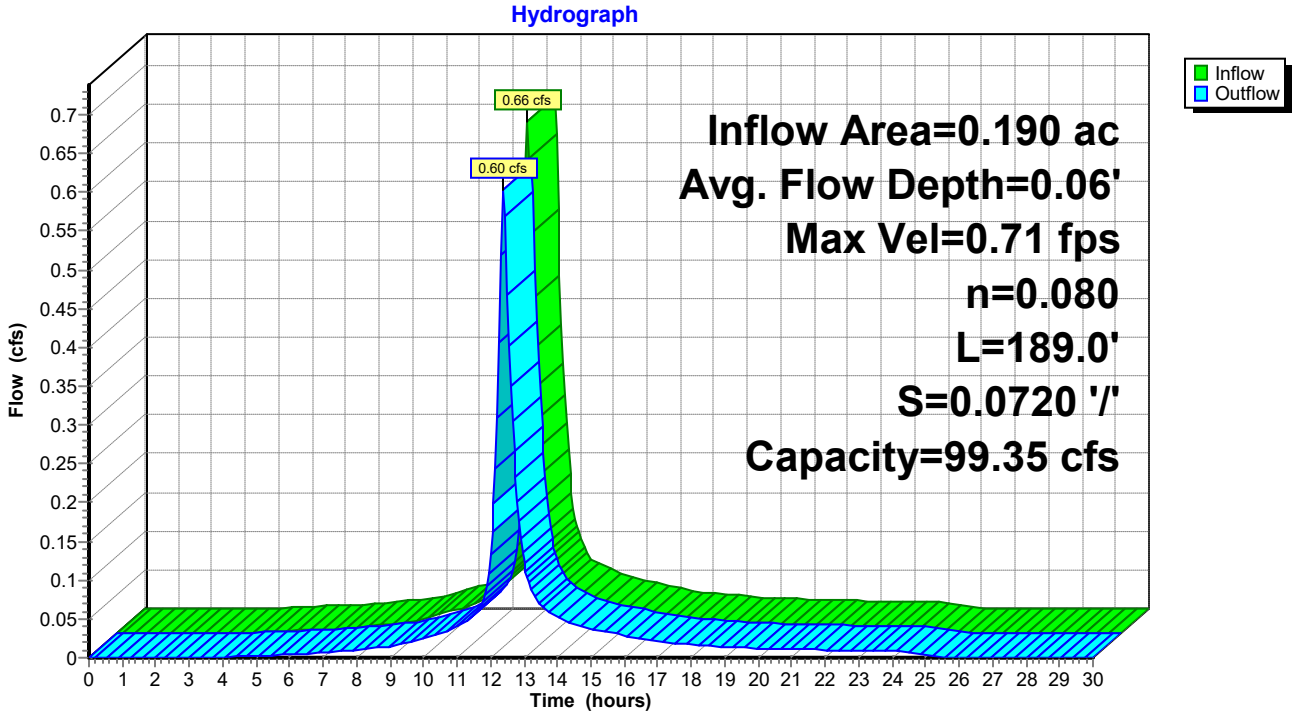
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.71 fps, Min. Travel Time= 4.4 min
Avg. Velocity = 0.25 fps, Avg. Travel Time= 12.5 min

Peak Storage= 164 cf @ 12.30 hrs
Average Depth at Peak Storage= 0.06'
Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 99.35 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 35.00'
Length= 189.0' Slope= 0.0720 '/'
Inlet Invert= 98.00', Outlet Invert= 84.40'

‡

Reach OL-3: OVERLAND



Summary for Reach OL-4: OVERLAND

Inflow Area = 0.426 ac, 8.93% Impervious, Inflow Depth = 2.46" for 10-Year event
Inflow = 0.47 cfs @ 12.37 hrs, Volume= 0.087 af
Outflow = 0.44 cfs @ 12.67 hrs, Volume= 0.087 af, Atten= 6%, Lag= 17.6 min

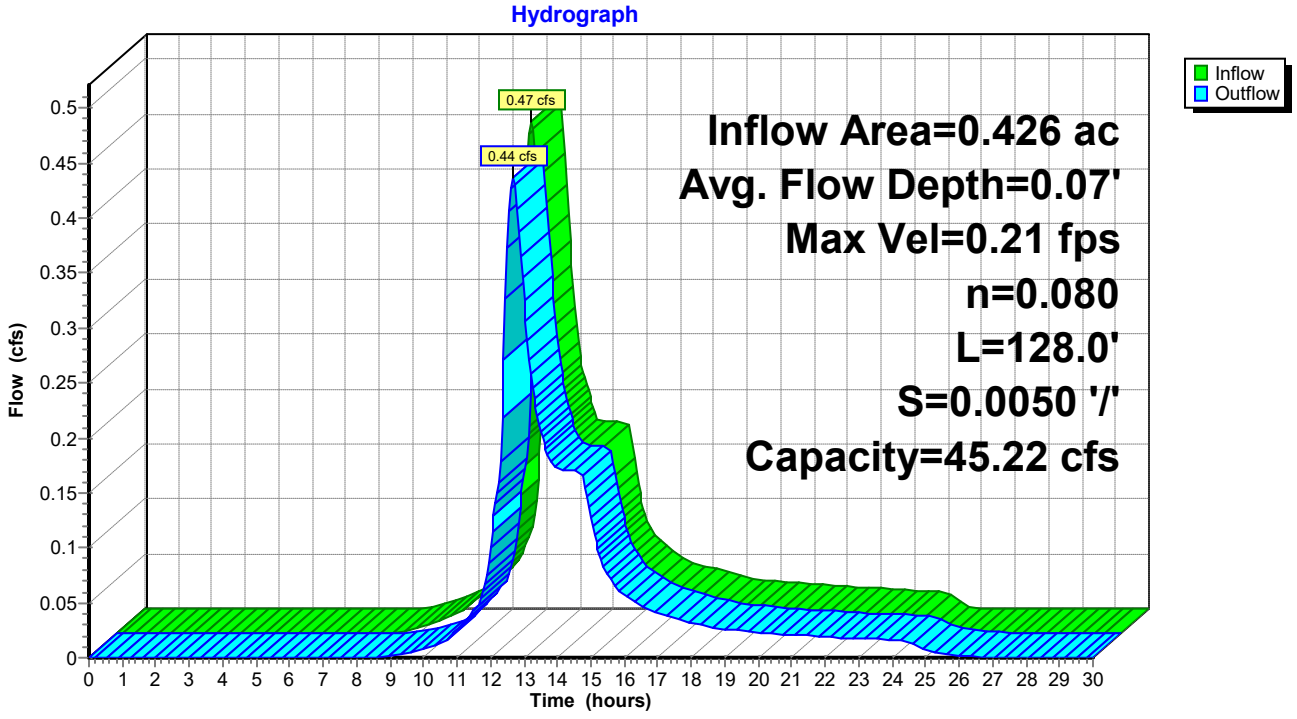
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.21 fps, Min. Travel Time= 10.0 min
Avg. Velocity = 0.08 fps, Avg. Travel Time= 25.6 min

Peak Storage= 262 cf @ 12.50 hrs
Average Depth at Peak Storage= 0.07'
Bank-Full Depth= 1.00' Flow Area= 40.0 sf, Capacity= 45.22 cfs

30.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 50.00'
Length= 128.0' Slope= 0.0050 '/'
Inlet Invert= 85.00', Outlet Invert= 84.36'

‡

Reach OL-4: OVERLAND



Summary for Reach OL-5: OVERLAND

Inflow Area = 0.426 ac, 8.93% Impervious, Inflow Depth = 2.46" for 10-Year event
Inflow = 0.47 cfs @ 12.34 hrs, Volume= 0.087 af
Outflow = 0.47 cfs @ 12.37 hrs, Volume= 0.087 af, Atten= 0%, Lag= 1.7 min

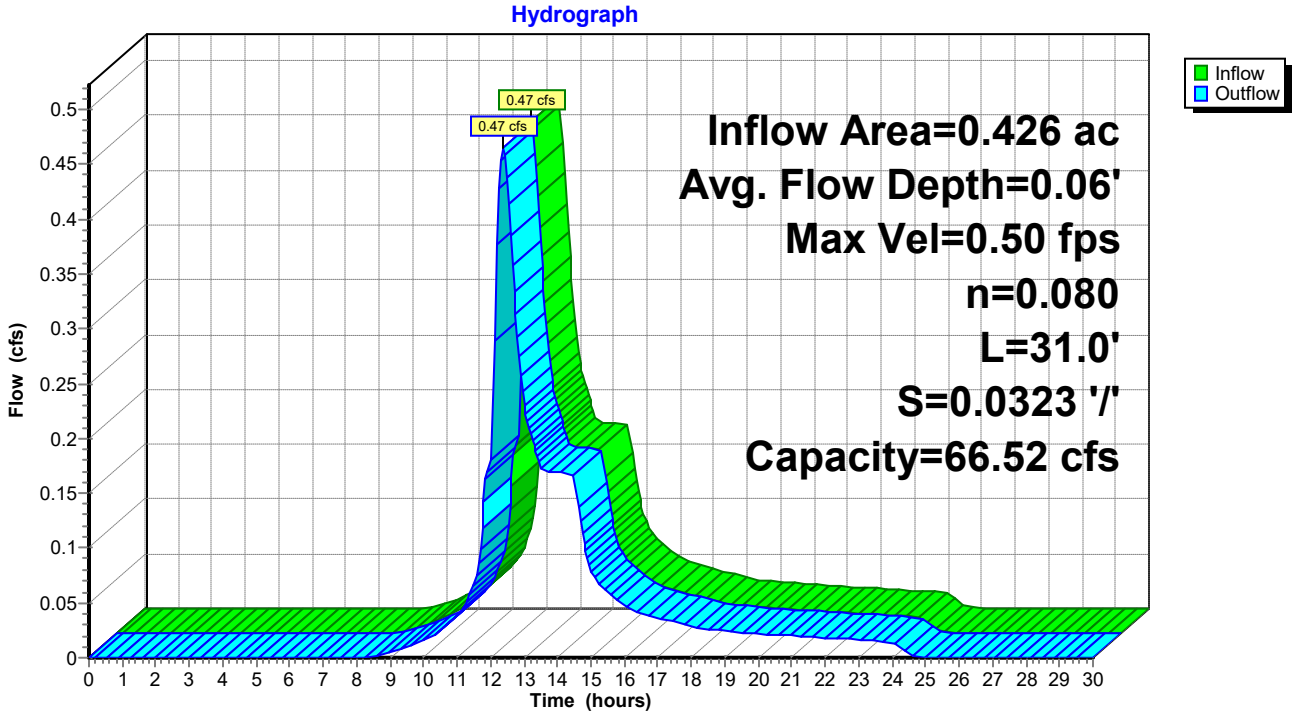
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.50 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 0.21 fps, Avg. Travel Time= 2.5 min

Peak Storage= 29 cf @ 12.36 hrs
Average Depth at Peak Storage= 0.06'
Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 66.52 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 35.00'
Length= 31.0' Slope= 0.0323 '/'
Inlet Invert= 86.00', Outlet Invert= 85.00'

‡

Reach OL-5: OVERLAND



Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Reach DCB-B: TO OUTFALL Inflow=0.96 cfs 0.073 af
Outflow=0.96 cfs 0.073 af

Reach DP#1: WETLAND Inflow=4.07 cfs 0.502 af
Outflow=4.07 cfs 0.502 af

Reach DP#2: MUNICIPAL CATCHBASIN Inflow=1.68 cfs 0.130 af
Outflow=1.68 cfs 0.130 af

Reach DP#3: LOW POINT Inflow=6.38 cfs 0.453 af
Outflow=6.38 cfs 0.453 af

Reach OL-1: OVERLAND Avg. Flow Depth=0.06' Max Vel=0.94 fps Inflow=0.96 cfs 0.073 af
n=0.080 L=66.0' S=0.1061 '/' Capacity=120.62 cfs Outflow=0.91 cfs 0.073 af

Reach OL-2: OVERLAND Avg. Flow Depth=0.09' Max Vel=0.56 fps Inflow=0.91 cfs 0.073 af
n=0.080 L=170.0' S=0.0235 '/' Capacity=56.81 cfs Outflow=0.79 cfs 0.073 af

Reach OL-3: OVERLAND Avg. Flow Depth=0.06' Max Vel=0.76 fps Inflow=0.79 cfs 0.073 af
n=0.080 L=189.0' S=0.0720 '/' Capacity=99.35 cfs Outflow=0.73 cfs 0.073 af

Reach OL-4: OVERLAND Avg. Flow Depth=0.08' Max Vel=0.24 fps Inflow=0.64 cfs 0.112 af
n=0.080 L=128.0' S=0.0050 '/' Capacity=45.22 cfs Outflow=0.61 cfs 0.112 af

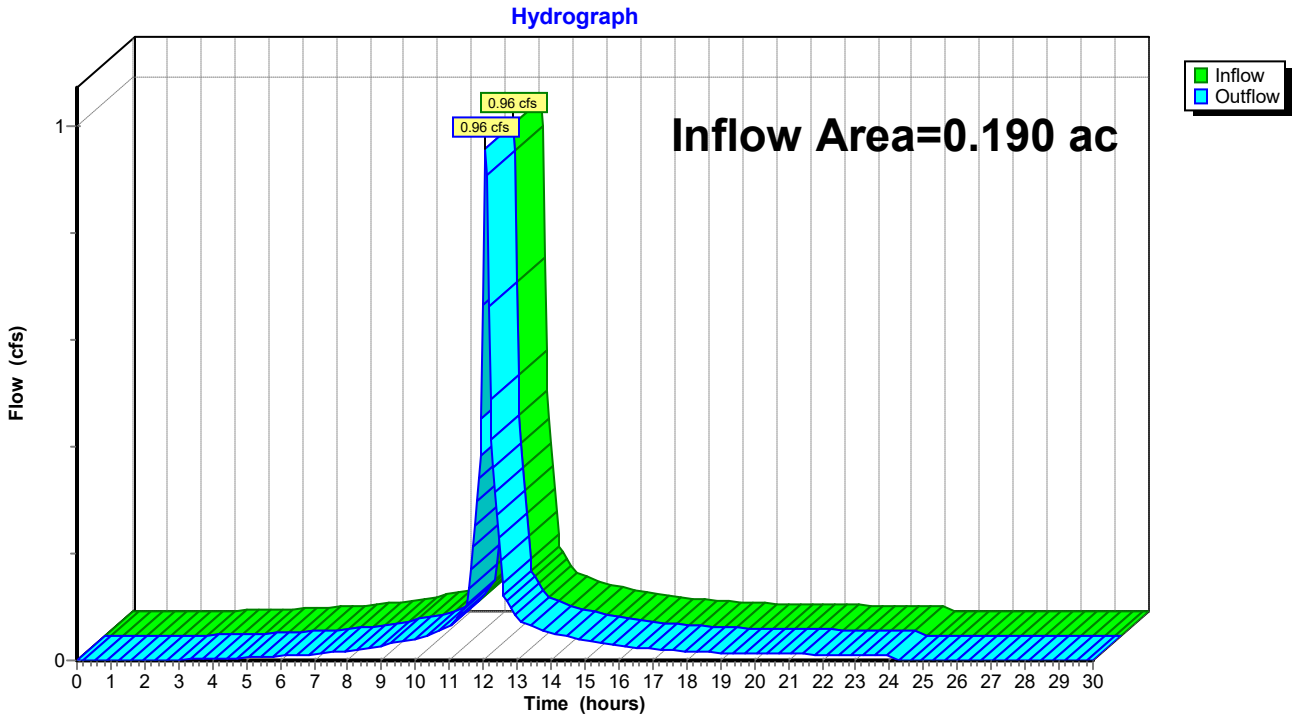
Reach OL-5: OVERLAND Avg. Flow Depth=0.07' Max Vel=0.56 fps Inflow=0.64 cfs 0.112 af
n=0.080 L=31.0' S=0.0323 '/' Capacity=66.52 cfs Outflow=0.64 cfs 0.112 af

Summary for Reach DCB-B: TO OUTFALL

Inflow Area = 0.190 ac, 83.72% Impervious, Inflow Depth = 4.60" for 25-Year event
Inflow = 0.96 cfs @ 12.07 hrs, Volume= 0.073 af
Outflow = 0.96 cfs @ 12.07 hrs, Volume= 0.073 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach DCB-B: TO OUTFALL

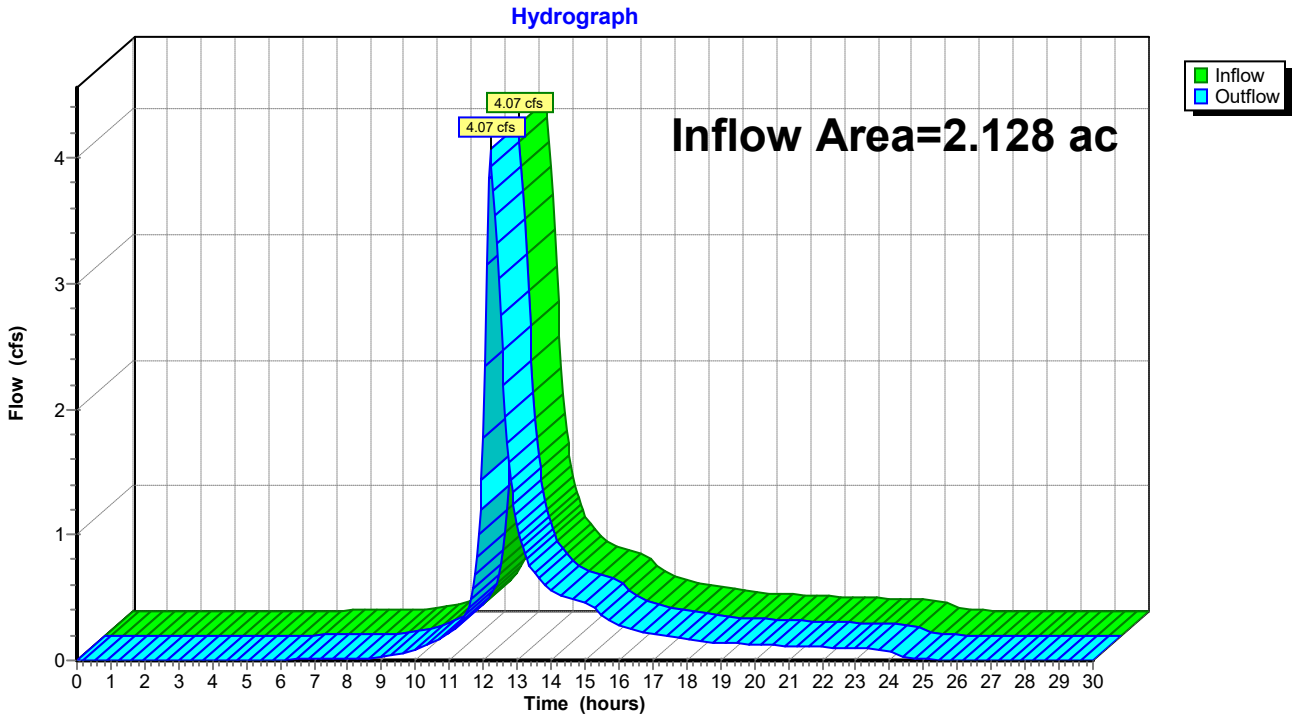


Summary for Reach DP#1: WETLAND

Inflow Area = 2.128 ac, 13.80% Impervious, Inflow Depth = 2.83" for 25-Year event
Inflow = 4.07 cfs @ 12.21 hrs, Volume= 0.502 af
Outflow = 4.07 cfs @ 12.21 hrs, Volume= 0.502 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach DP#1: WETLAND

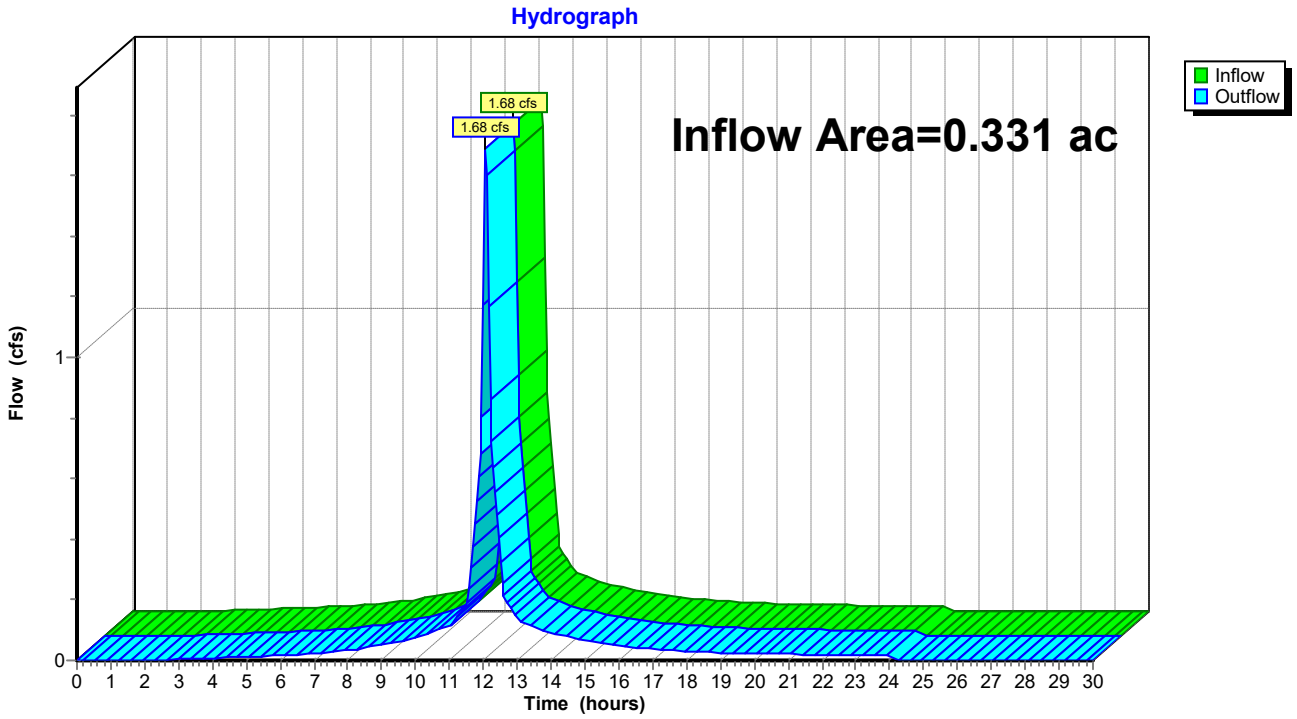


Summary for Reach DP#2: MUNICIPAL CATCHBASIN

Inflow Area = 0.331 ac, 86.79% Impervious, Inflow Depth = 4.72" for 25-Year event
Inflow = 1.68 cfs @ 12.07 hrs, Volume= 0.130 af
Outflow = 1.68 cfs @ 12.07 hrs, Volume= 0.130 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach DP#2: MUNICIPAL CATCHBASIN

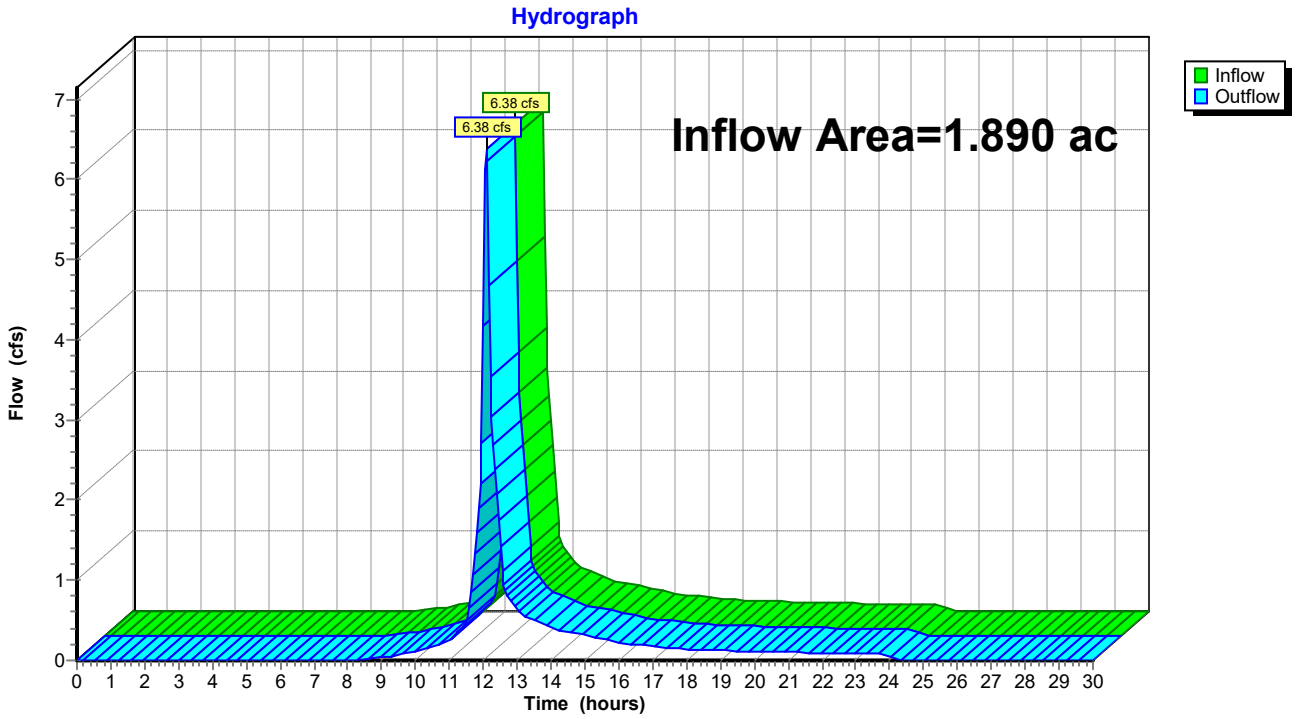


Summary for Reach DP#3: LOW POINT

Inflow Area = 1.890 ac, 15.10% Impervious, Inflow Depth = 2.88" for 25-Year event
Inflow = 6.38 cfs @ 12.08 hrs, Volume= 0.453 af
Outflow = 6.38 cfs @ 12.08 hrs, Volume= 0.453 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach DP#3: LOW POINT



Summary for Reach OL-1: OVERLAND

Inflow Area = 0.190 ac, 83.72% Impervious, Inflow Depth = 4.60" for 25-Year event
Inflow = 0.96 cfs @ 12.07 hrs, Volume= 0.073 af
Outflow = 0.91 cfs @ 12.11 hrs, Volume= 0.073 af, Atten= 5%, Lag= 2.1 min

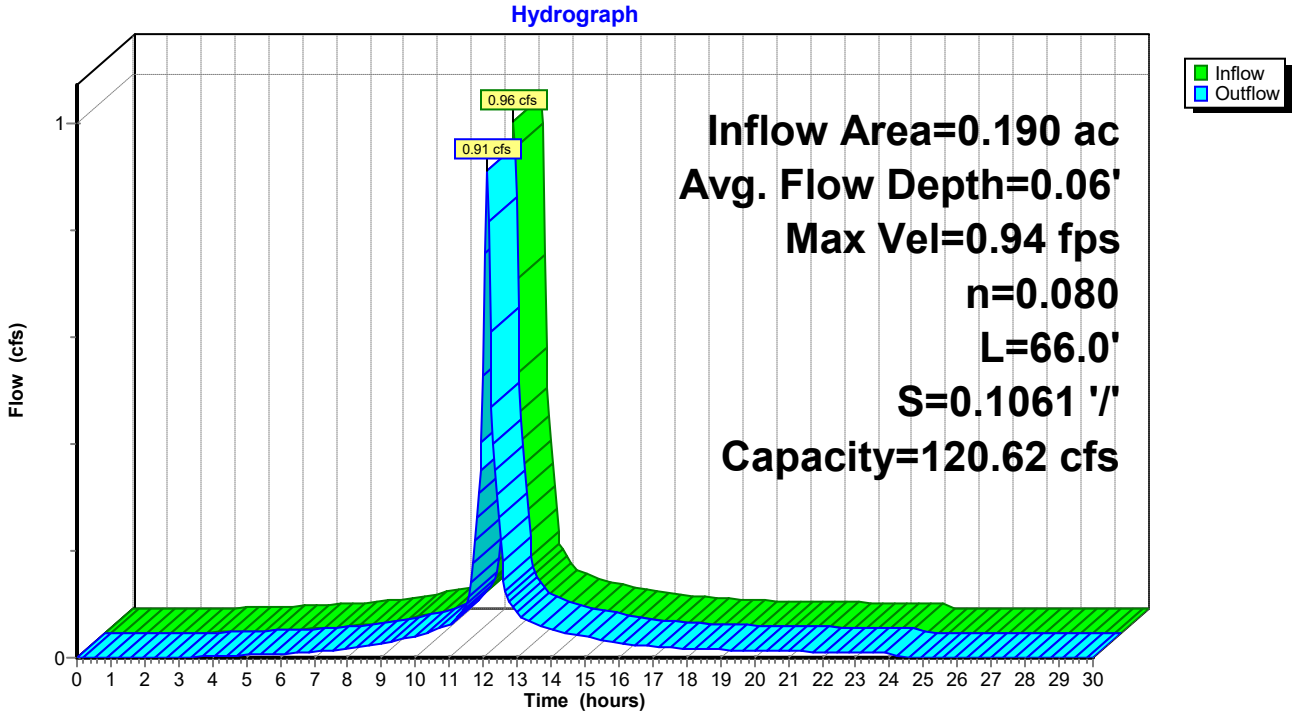
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.94 fps, Min. Travel Time= 1.2 min
Avg. Velocity = 0.31 fps, Avg. Travel Time= 3.6 min

Peak Storage= 66 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.06'
Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 120.62 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 35.00'
Length= 66.0' Slope= 0.1061 '/'
Inlet Invert= 109.00', Outlet Invert= 102.00'

‡

Reach OL-1: OVERLAND



Summary for Reach OL-2: OVERLAND

Inflow Area = 0.190 ac, 83.72% Impervious, Inflow Depth = 4.60" for 25-Year event
Inflow = 0.91 cfs @ 12.11 hrs, Volume= 0.073 af
Outflow = 0.79 cfs @ 12.24 hrs, Volume= 0.073 af, Atten= 13%, Lag= 8.3 min

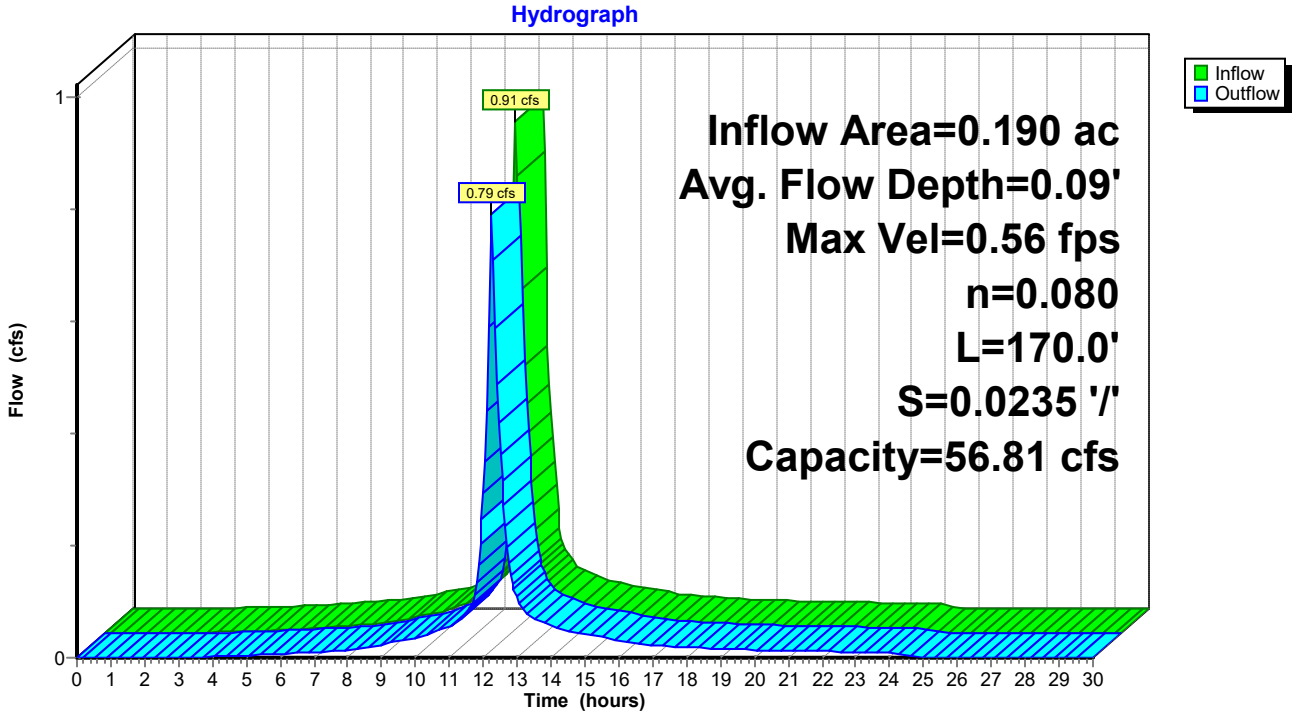
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.56 fps, Min. Travel Time= 5.1 min
Avg. Velocity = 0.16 fps, Avg. Travel Time= 17.7 min

Peak Storage= 247 cf @ 12.16 hrs
Average Depth at Peak Storage= 0.09'
Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 56.81 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 35.00'
Length= 170.0' Slope= 0.0235 '/'
Inlet Invert= 102.00', Outlet Invert= 98.00'

‡

Reach OL-2: OVERLAND



Summary for Reach OL-3: OVERLAND

Inflow Area = 0.190 ac, 83.72% Impervious, Inflow Depth = 4.60" for 25-Year event
Inflow = 0.79 cfs @ 12.24 hrs, Volume= 0.073 af
Outflow = 0.73 cfs @ 12.36 hrs, Volume= 0.073 af, Atten= 7%, Lag= 6.8 min

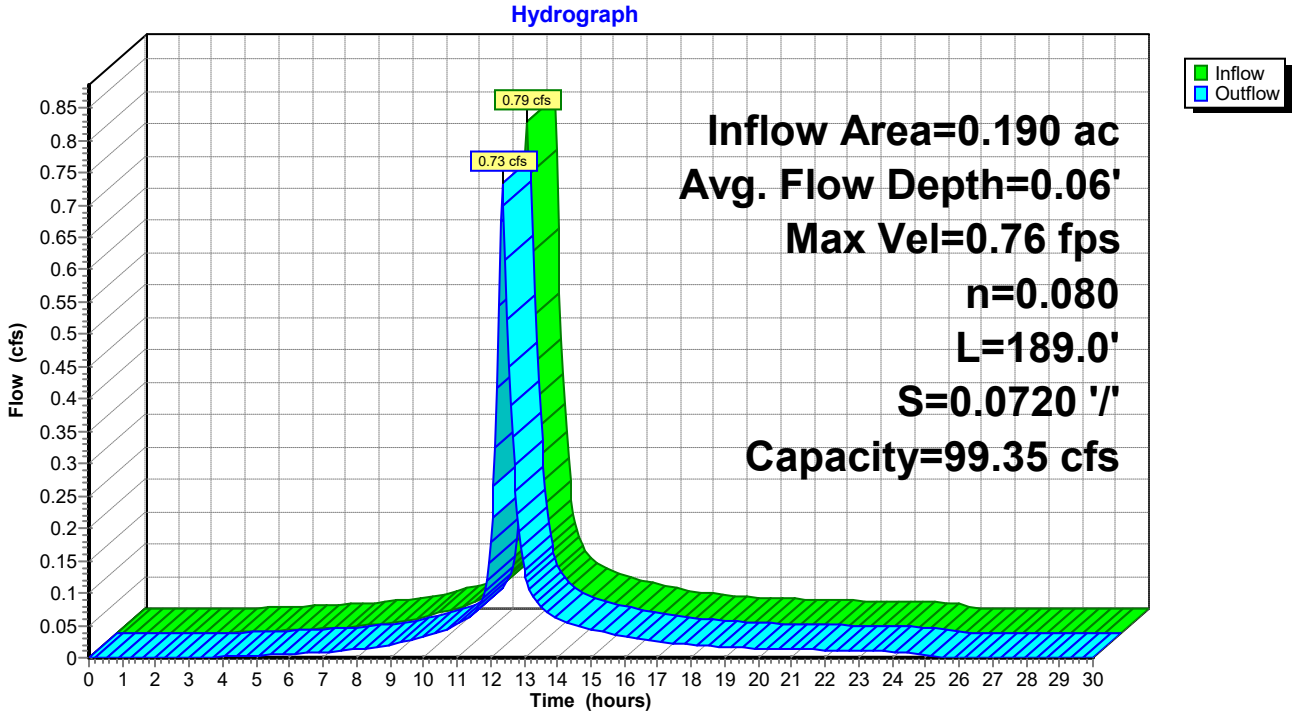
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.76 fps, Min. Travel Time= 4.1 min
Avg. Velocity = 0.26 fps, Avg. Travel Time= 12.3 min

Peak Storage= 184 cf @ 12.29 hrs
Average Depth at Peak Storage= 0.06'
Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 99.35 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 35.00'
Length= 189.0' Slope= 0.0720 '/'
Inlet Invert= 98.00', Outlet Invert= 84.40'

‡

Reach OL-3: OVERLAND



Summary for Reach OL-4: OVERLAND

Inflow Area = 0.426 ac, 8.93% Impervious, Inflow Depth = 3.16" for 25-Year event
Inflow = 0.64 cfs @ 12.33 hrs, Volume= 0.112 af
Outflow = 0.61 cfs @ 12.61 hrs, Volume= 0.112 af, Atten= 4%, Lag= 16.7 min

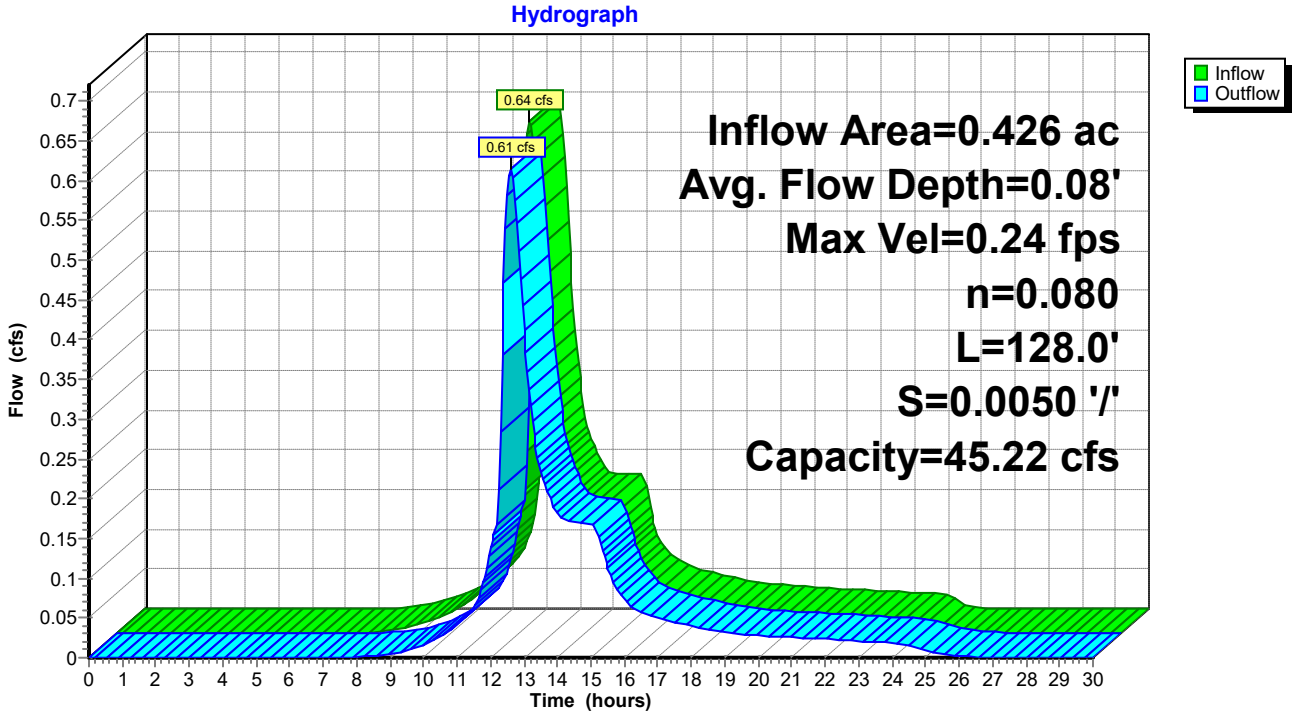
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.24 fps, Min. Travel Time= 8.8 min
Avg. Velocity = 0.09 fps, Avg. Travel Time= 24.2 min

Peak Storage= 323 cf @ 12.46 hrs
Average Depth at Peak Storage= 0.08'
Bank-Full Depth= 1.00' Flow Area= 40.0 sf, Capacity= 45.22 cfs

30.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 50.00'
Length= 128.0' Slope= 0.0050 '/'
Inlet Invert= 85.00', Outlet Invert= 84.36'

‡

Reach OL-4: OVERLAND



Summary for Reach OL-5: OVERLAND

Inflow Area = 0.426 ac, 8.93% Impervious, Inflow Depth = 3.16" for 25-Year event
Inflow = 0.64 cfs @ 12.31 hrs, Volume= 0.112 af
Outflow = 0.64 cfs @ 12.33 hrs, Volume= 0.112 af, Atten= 0%, Lag= 1.5 min

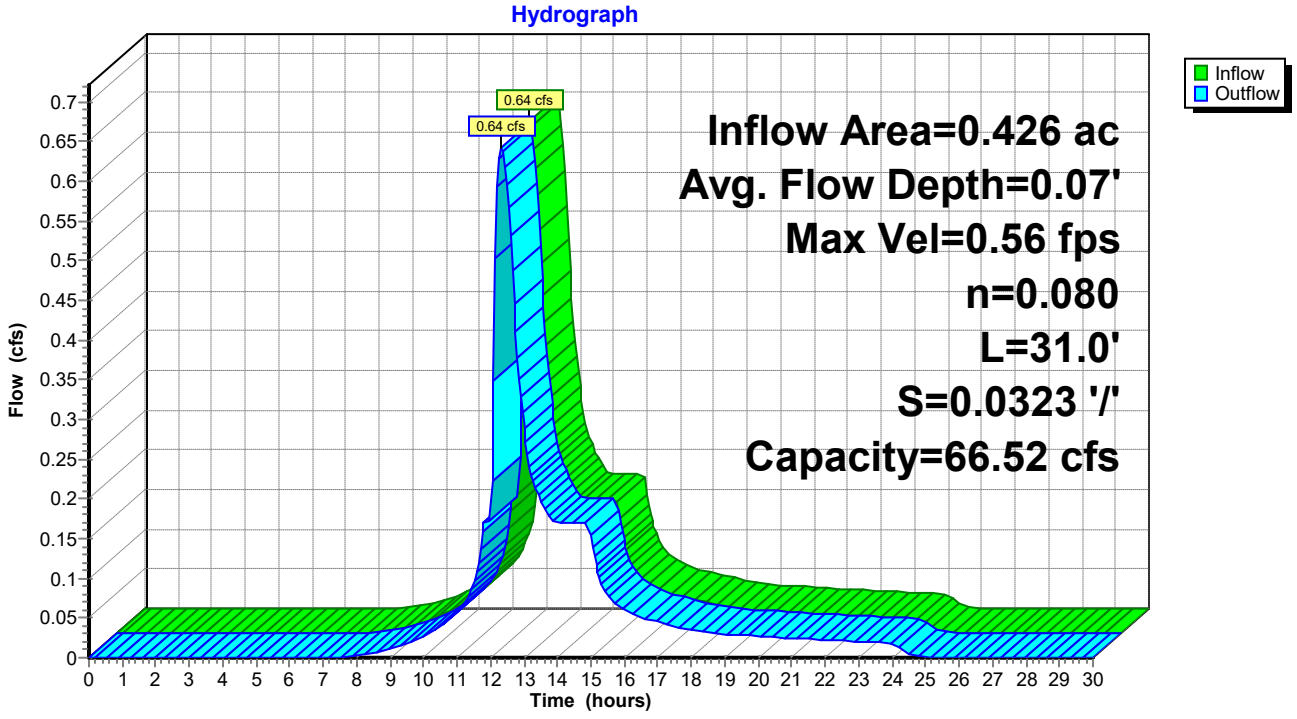
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.56 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 0.22 fps, Avg. Travel Time= 2.4 min

Peak Storage= 35 cf @ 12.31 hrs
Average Depth at Peak Storage= 0.07'
Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 66.52 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 35.00'
Length= 31.0' Slope= 0.0323 '/'
Inlet Invert= 86.00', Outlet Invert= 85.00'

‡

Reach OL-5: OVERLAND



Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Reach DCB-B: TO OUTFALL Inflow=1.19 cfs 0.092 af
Outflow=1.19 cfs 0.092 af

Reach DP#1: WETLAND Inflow=5.74 cfs 0.684 af
Outflow=5.74 cfs 0.684 af

Reach DP#2: MUNICIPAL CATCHBASIN Inflow=2.08 cfs 0.163 af
Outflow=2.08 cfs 0.163 af

Reach DP#3: LOW POINT Inflow=8.67 cfs 0.617 af
Outflow=8.67 cfs 0.617 af

Reach OL-1: OVERLAND Avg. Flow Depth=0.07' Max Vel=1.02 fps Inflow=1.19 cfs 0.092 af
n=0.080 L=66.0' S=0.1061 '/' Capacity=120.62 cfs Outflow=1.14 cfs 0.092 af

Reach OL-2: OVERLAND Avg. Flow Depth=0.10' Max Vel=0.61 fps Inflow=1.14 cfs 0.092 af
n=0.080 L=170.0' S=0.0235 '/' Capacity=56.81 cfs Outflow=0.99 cfs 0.092 af

Reach OL-3: OVERLAND Avg. Flow Depth=0.07' Max Vel=0.83 fps Inflow=0.99 cfs 0.092 af
n=0.080 L=189.0' S=0.0720 '/' Capacity=99.35 cfs Outflow=0.92 cfs 0.092 af

Reach OL-4: OVERLAND Avg. Flow Depth=0.10' Max Vel=0.27 fps Inflow=0.84 cfs 0.150 af
n=0.080 L=128.0' S=0.0050 '/' Capacity=45.22 cfs Outflow=0.82 cfs 0.150 af

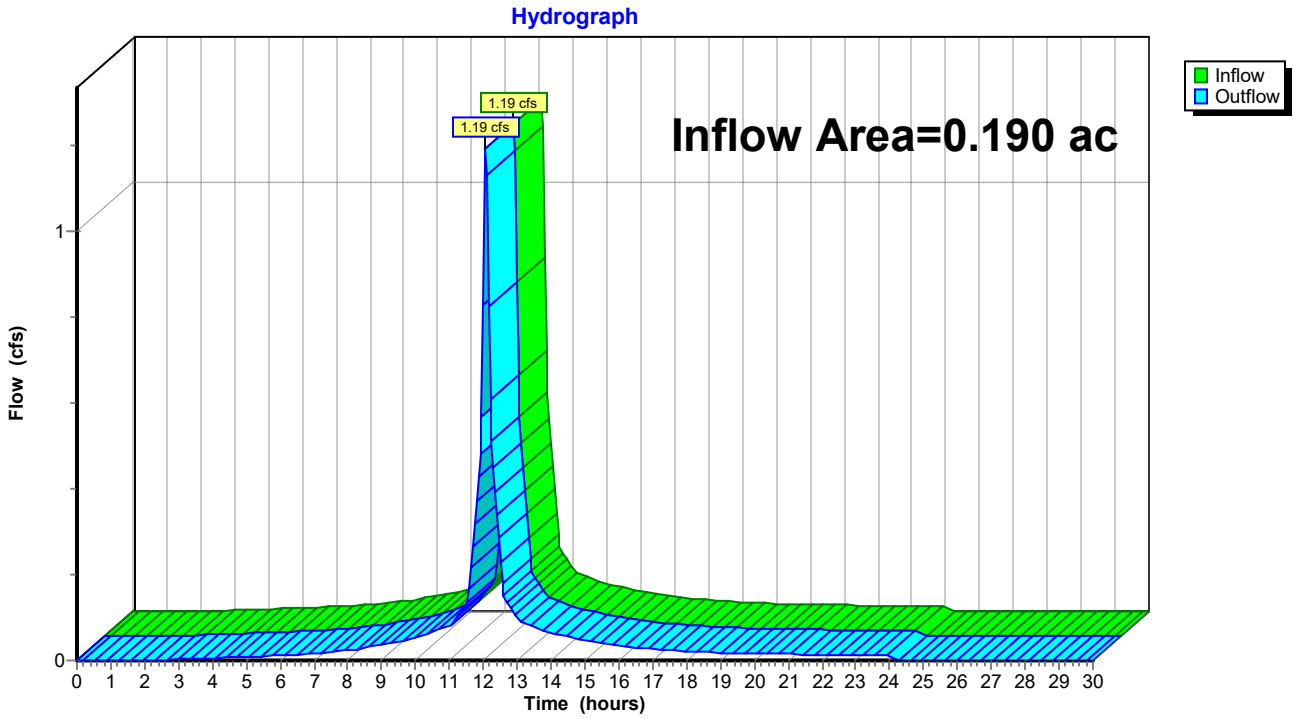
Reach OL-5: OVERLAND Avg. Flow Depth=0.09' Max Vel=0.62 fps Inflow=0.84 cfs 0.150 af
n=0.080 L=31.0' S=0.0323 '/' Capacity=66.52 cfs Outflow=0.84 cfs 0.150 af

Summary for Reach DCB-B: TO OUTFALL

Inflow Area = 0.190 ac, 83.72% Impervious, Inflow Depth = 5.79" for 100-Year event
Inflow = 1.19 cfs @ 12.07 hrs, Volume= 0.092 af
Outflow = 1.19 cfs @ 12.07 hrs, Volume= 0.092 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach DCB-B: TO OUTFALL

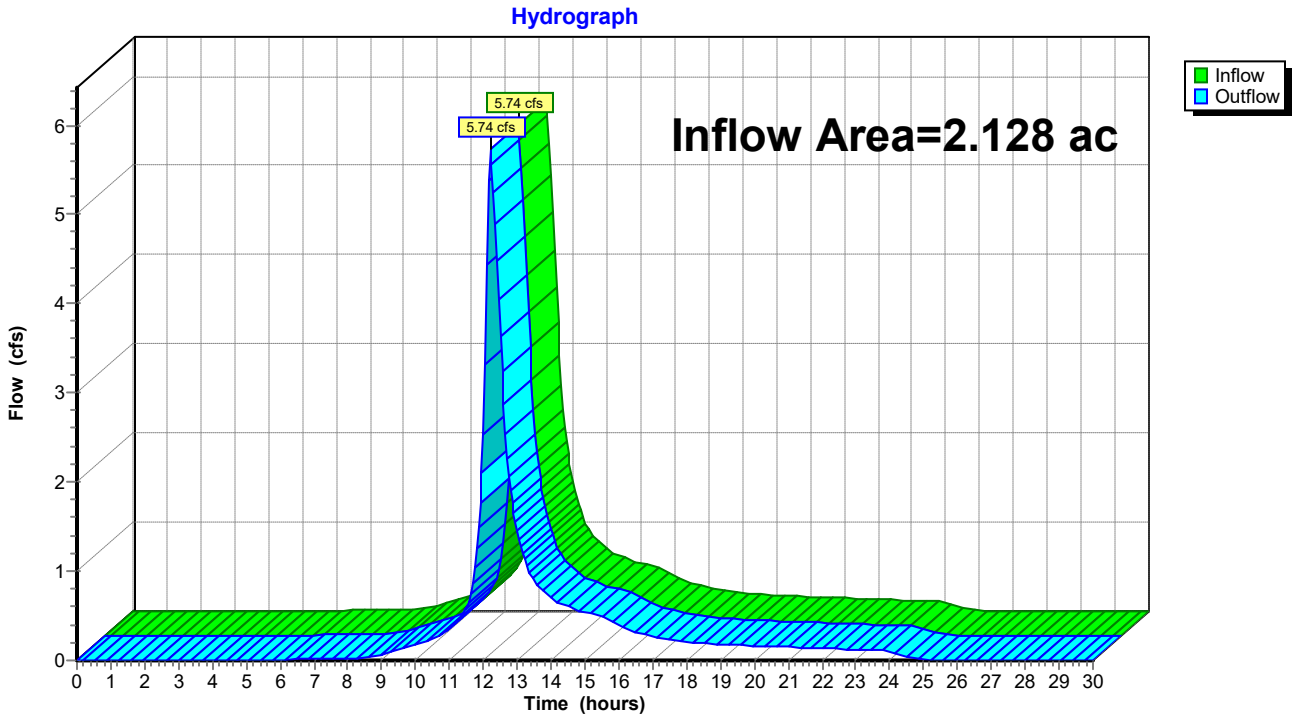


Summary for Reach DP#1: WETLAND

Inflow Area = 2.128 ac, 13.80% Impervious, Inflow Depth = 3.86" for 100-Year event
Inflow = 5.74 cfs @ 12.21 hrs, Volume= 0.684 af
Outflow = 5.74 cfs @ 12.21 hrs, Volume= 0.684 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach DP#1: WETLAND

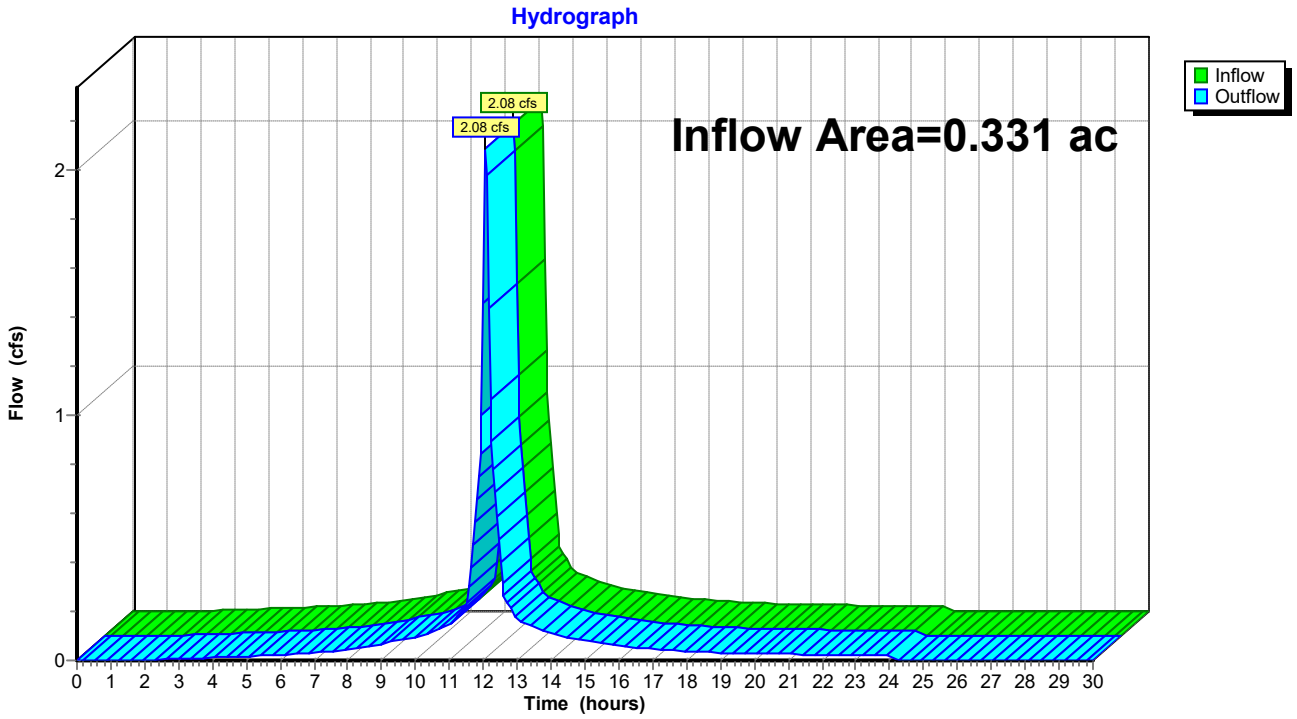


Summary for Reach DP#2: MUNICIPAL CATCHBASIN

Inflow Area = 0.331 ac, 86.79% Impervious, Inflow Depth = 5.91" for 100-Year event
Inflow = 2.08 cfs @ 12.07 hrs, Volume= 0.163 af
Outflow = 2.08 cfs @ 12.07 hrs, Volume= 0.163 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach DP#2: MUNICIPAL CATCHBASIN

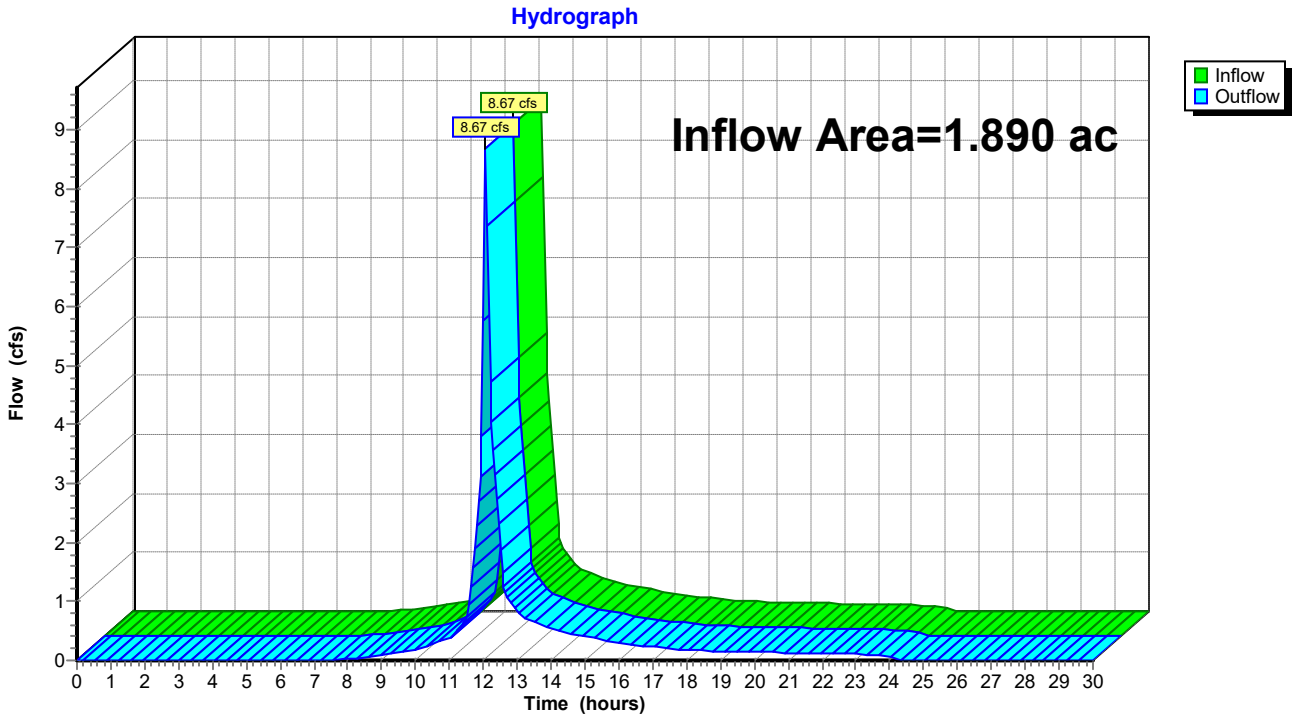


Summary for Reach DP#3: LOW POINT

Inflow Area = 1.890 ac, 15.10% Impervious, Inflow Depth = 3.92" for 100-Year event
Inflow = 8.67 cfs @ 12.08 hrs, Volume= 0.617 af
Outflow = 8.67 cfs @ 12.08 hrs, Volume= 0.617 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach DP#3: LOW POINT



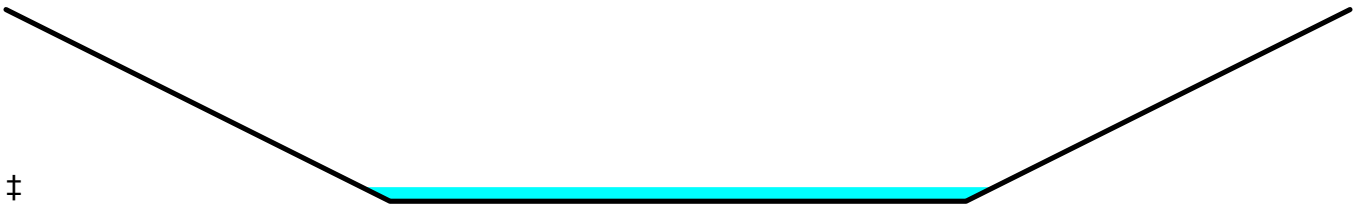
Summary for Reach OL-1: OVERLAND

Inflow Area = 0.190 ac, 83.72% Impervious, Inflow Depth = 5.79" for 100-Year event
Inflow = 1.19 cfs @ 12.07 hrs, Volume= 0.092 af
Outflow = 1.14 cfs @ 12.10 hrs, Volume= 0.092 af, Atten= 4%, Lag= 1.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.02 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 0.31 fps, Avg. Travel Time= 3.5 min

Peak Storage= 76 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.07'
Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 120.62 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 35.00'
Length= 66.0' Slope= 0.1061 '/'
Inlet Invert= 109.00', Outlet Invert= 102.00'



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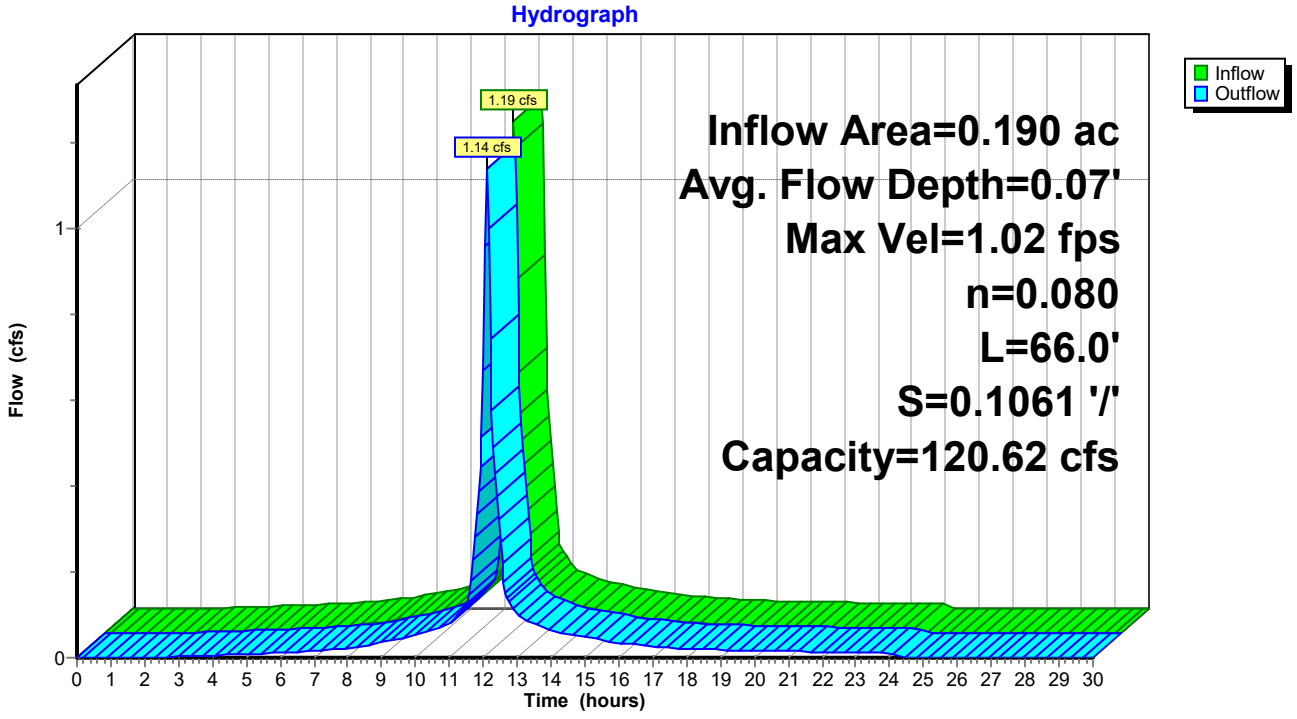
Reach OL-1: OVERLAND



Summary for Reach OL-2: OVERLAND

Inflow Area = 0.190 ac, 83.72% Impervious, Inflow Depth = 5.79" for 100-Year event
Inflow = 1.14 cfs @ 12.10 hrs, Volume= 0.092 af
Outflow = 0.99 cfs @ 12.23 hrs, Volume= 0.092 af, Atten= 13%, Lag= 7.5 min

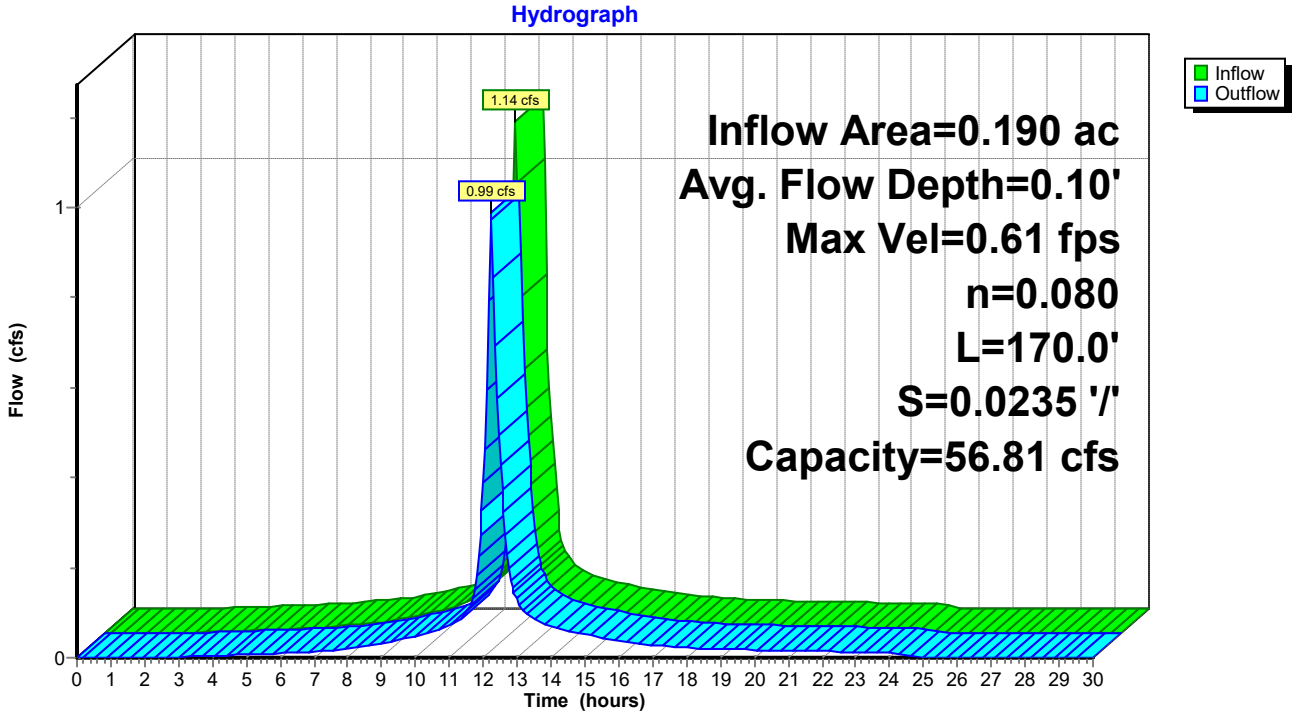
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.61 fps, Min. Travel Time= 4.7 min
Avg. Velocity = 0.17 fps, Avg. Travel Time= 17.0 min

Peak Storage= 285 cf @ 12.15 hrs
Average Depth at Peak Storage= 0.10'
Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 56.81 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 35.00'
Length= 170.0' Slope= 0.0235 '/'
Inlet Invert= 102.00', Outlet Invert= 98.00'

‡

Reach OL-2: OVERLAND



Summary for Reach OL-3: OVERLAND

Inflow Area = 0.190 ac, 83.72% Impervious, Inflow Depth = 5.79" for 100-Year event
Inflow = 0.99 cfs @ 12.23 hrs, Volume= 0.092 af
Outflow = 0.92 cfs @ 12.33 hrs, Volume= 0.092 af, Atten= 6%, Lag= 6.3 min

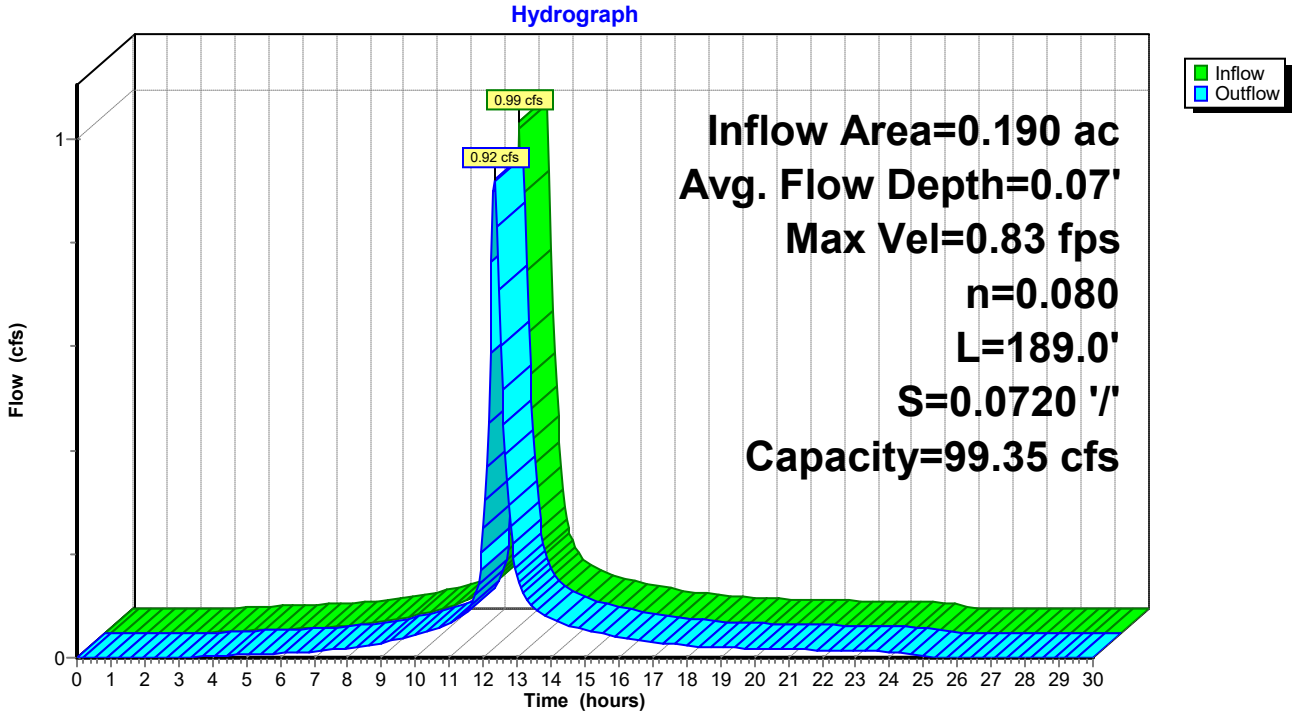
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.83 fps, Min. Travel Time= 3.8 min
Avg. Velocity = 0.26 fps, Avg. Travel Time= 11.9 min

Peak Storage= 213 cf @ 12.27 hrs
Average Depth at Peak Storage= 0.07'
Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 99.35 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 35.00'
Length= 189.0' Slope= 0.0720 '/'
Inlet Invert= 98.00', Outlet Invert= 84.40'

‡

Reach OL-3: OVERLAND



Summary for Reach OL-4: OVERLAND

Inflow Area = 0.426 ac, 8.93% Impervious, Inflow Depth = 4.24" for 100-Year event
Inflow = 0.84 cfs @ 12.33 hrs, Volume= 0.150 af
Outflow = 0.82 cfs @ 12.58 hrs, Volume= 0.150 af, Atten= 3%, Lag= 15.3 min

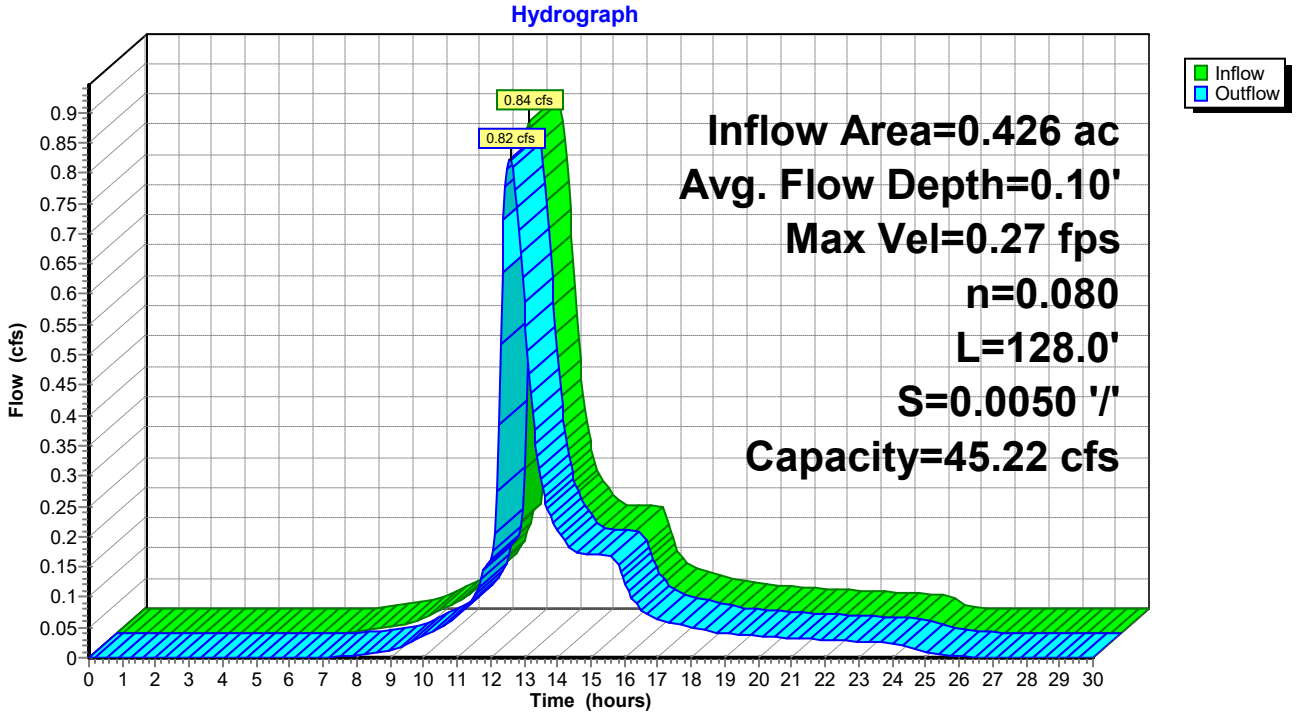
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.27 fps, Min. Travel Time= 7.8 min
Avg. Velocity = 0.10 fps, Avg. Travel Time= 22.4 min

Peak Storage= 387 cf @ 12.45 hrs
Average Depth at Peak Storage= 0.10'
Bank-Full Depth= 1.00' Flow Area= 40.0 sf, Capacity= 45.22 cfs

30.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 50.00'
Length= 128.0' Slope= 0.0050 '/'
Inlet Invert= 85.00', Outlet Invert= 84.36'

‡

Reach OL-4: OVERLAND



Summary for Reach OL-5: OVERLAND

Inflow Area = 0.426 ac, 8.93% Impervious, Inflow Depth = 4.24" for 100-Year event
Inflow = 0.84 cfs @ 12.30 hrs, Volume= 0.150 af
Outflow = 0.84 cfs @ 12.33 hrs, Volume= 0.150 af, Atten= 0%, Lag= 1.3 min

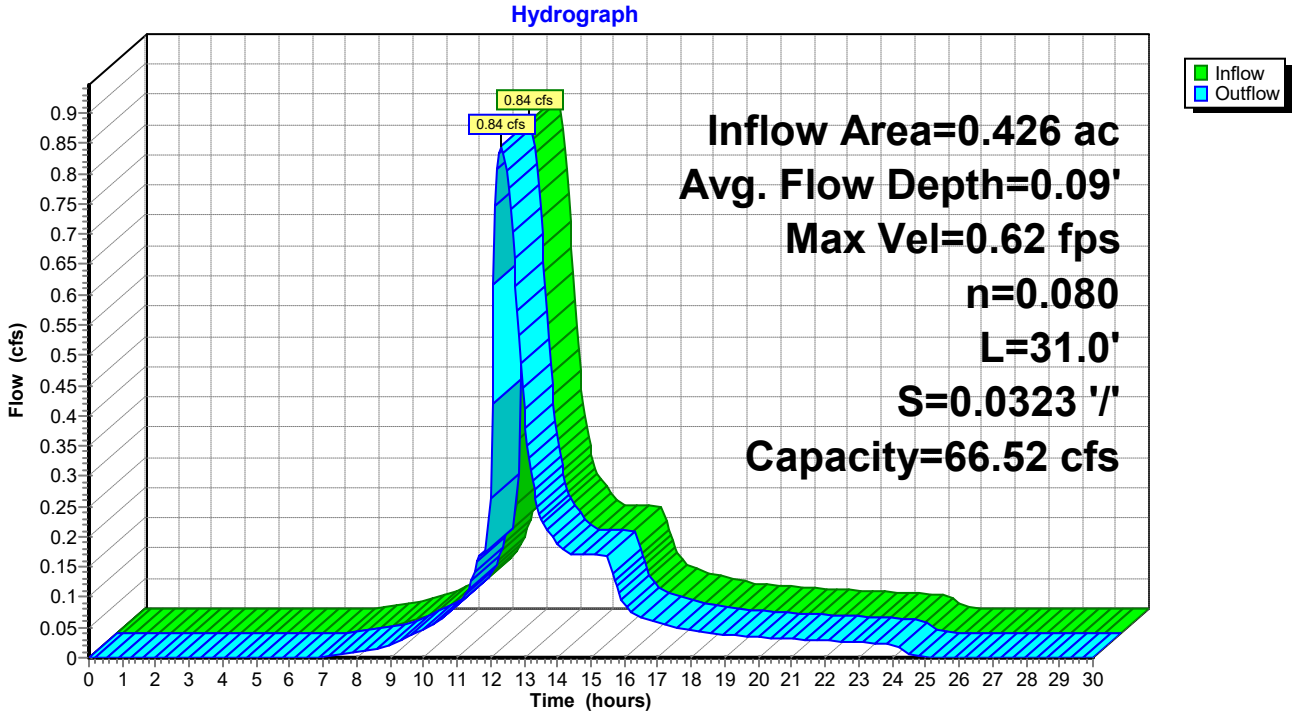
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.62 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 0.23 fps, Avg. Travel Time= 2.2 min

Peak Storage= 42 cf @ 12.31 hrs
Average Depth at Peak Storage= 0.09'
Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 66.52 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 35.00'
Length= 31.0' Slope= 0.0323 '/'
Inlet Invert= 86.00', Outlet Invert= 85.00'

‡

Reach OL-5: OVERLAND



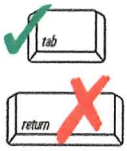
3.0
STORMWATER MANAGEMENT FORMS

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

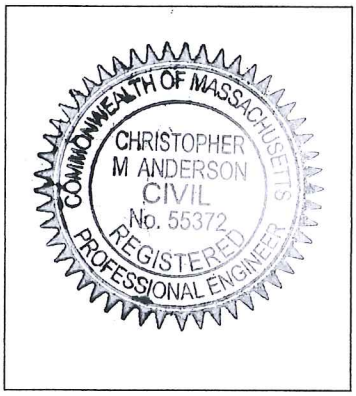
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature



10-19-21

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- ☒ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☐ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☐ Use of "country drainage" versus curb and gutter conveyance and pipe
- ☒ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☒ Other (describe): Dry Detention Basin

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☐ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☒ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do no exceed pre-development rates for the 100-year 24-hour storm. ***Peak rate mitigation has been achieved for all storm events with the exception of DP#2 during all storm events. This increase is due to the additional grading required in order to maintain the should of the existing road and the installation of a small portion of the gravel drive. These increases are considered de minimius as the increase is consistently at 0.01 c.f.s in all storm events.***

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☒ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge V olume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

☒ Site is comprised solely of C and D soils and/or bedrock at the land surface

☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000

☐ Solid Waste Landfill pursuant to 310 CMR 19.000

☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

Checklist for Stormwater Report

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☐ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☒ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☐ *Portions of the project are* subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☐ Description and delineation of public safety features;
- ☐ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☐ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☐ An Illicit Discharge Compliance Statement is attached;

☒ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

Stormwater Compliance Documentation

1355 Main Street, Leicester
September 21, 2021
Revised Through October 19, 2021

Standard 1: No Untreated Discharges or Erosion to Wetlands

The drainage from the site currently overland flows towards one of two points within the project area. The majority of the project area overland flows to a wetland area located along the southerly property line. It is noted that a portion of the existing roadway drainage infrastructure flows onto the locus property and sheet flows to this wetland area as well. The remaining runoff either is directed towards the municipal drainage system further to the east along Main Street or a low point located further to the southeasterly corner of the abutting property.

As part of the project the majority of the runoff will be directed towards a small dry-detention basin located along the southerly portion of the project. This will then discharge towards the aforementioned wetland. Provided are the computations showing the calculations per the Connecticut DOT Drainage Manual, Section 11.13 that the proposed rip-rap aprons will provide adequate protection from scouring.

Equation-11.31
L=1.80(Q-5)/Sp^(1.5) + 10

Equation-11.33
W2=3Sp +0.7La

For 12-inch HDPE pipe (FE#1)

Qmax=0.95 cfs (100-Year) Sp=12/12 → 1.0 ft

L=1.8(0.95-5)/(1^1.5) + 10 → -7.3 + 10 = 2.7 → 10 feet (min)

W2=3(1.0) +0.7(10) → 3.0+ 7.0 = 10 → 20.0 feet

Provide an apron 10-feet long with a terminus width of 10 feet wide.

Standard 2: Peak Rate Attenuation

Table #1: Peak Rate of Runoff

Design Point		2-yr Storm	10-yr Storm	25-yr Storm	100-yr Storm
#1	Pre-	1.37	3.35	4.54	6.41
	Post-	1.29	3.06	4.07	5.74
#2	***Pre-***	***0.90***	***1.41***	***1.67***	***2.07***
	Post-	***0.91***	***1.42***	***1.68***	***2.08***
#3	Pre-	2.30	4.89	6.38	8.67
	Post-	2.30	4.89	6.38	8.67

All flows are in cubic feet per second.

As outline above, the post-development peak rates are of runoff have been mitigated for all Storm Events, with the noted exception of Design Point #2 (DP#2),during all storm events. The increase within this Design point is due to the small increase in area caused by the gravel driveway. In order to maintain the gutter flow within Main Street ridge is to be created to maintain the street drainage within the street, this results in an increase in the contributing watershed of approximately 95 s.f. This increase by default is unavoidable in order to maintain this drainage pattern. Furthermore, the increase in the peak rate of flow during all stormevents is consistently 0.01 c.f.s. and is considered *de minimus*.

Standard 3: Stormwater Recharge

Project is located exclusively within an area of hydrological C (HSG-C) soils, as such compliance is provided to the maximum extent practicable.

Impervious Area Proposed: (This area includes all proposed buildings, driveways, etc.)

The soils within the reviewed project area classified as HSG C:
Existing Impervious HSG-C: 0.00 s.f.
Proposed Impervious HSG-C: 1,658 s.f.
Net New Impervious HSG-A: +1,658 s.f.

Total New Impervious area = +1,658 s.f.
Total Project Impervious = 1,658 s.f.

Required Recharge Volume:

Net Increase HSG Soil C

Net New Impervious HSG C= 1,658 s.f.
HSG C: 1,658 s.f. x (0.25 in/12) = 35 c.f.

Required Recharge Volume = 35 c.f.

Capture Rate:

Total Impervious to DB#1	1,658 sf
Net Captured Impervious	**1,658 sf**

Capture Rate = 1,658 s.f. / 1,658 s.f. = 100%

Compliance is provided, Capture rate in excess of 65%

Storage Volume Provided:

Volume below lowest outlet within detention facility.

DB-1: 465 c.f. of storage volume provided

Recharge Provided:

Total Volume Required: 35 c.f.

Volume below lowest outlet within detention facility.

DB-1: 465 c.f. of storage volume provided

Required Recharge Volume = 35 c.f.
Provided Recharge Volume = 465 c.f.

Compliance is provided to the maximum extent practicable

Drawdown Time: (72 Hours Max.)

Time = Storage Volume / (K x Bottom Area)

Where K = Saturated Hydraulic Conductivity (inches/hour) (From table 2.3.3 1982 Rawls Rates – Mass Stormwater Handbook)

D-Basin #1: 465 c.f. of storage volume provided.
Time = 465 c.f. / (0.27 in/hr x (1 ft/ 12 in) x 1,060 s.f.) = **19.5 hrs**

Compliance is provided

Standard 4: Water Quality

Water Quality Volume (WQV) = Water Quality Depth x Impervious Area

Water Quality Depth = 1/2 inch
WQV = [(1/2 inch) / 12 inches/foot] x (1,658 s.f.) = 69 cf

The total new impervious surfaces created by the project are associated with the concrete pads that are used for the transformers. Because these pads are not associated with activities that typically generate sediment, for the purposes of this analysis they are also considered similar to roofs. Therefore, Water Quality Volume is not warranted under Stormwater Management Regulations

Standard 5: Land Uses with Higher Potential Pollutant Loads

Not Applicable

Standard 6: Critical Areas

Not Applicable

Standard 7: Redevelopment

Not Applicable

Standard 8: Construction Period Controls

Proper erosion controls have been incorporated into the submitted plans and details to ensure compliance with the standard.

Standard 9: Operation and Maintenance Plan

Operation and Maintenance plans for the project have been incorporated into the submitted plans and details to ensure compliance with the standard.

Standard 10: Illicit Discharges to Drainage System

No Illicit discharges to the drainage system will occur as a result of this proposed project. A No Illicit discharge statement shall be provided prior to construction.

Summary for Pond DB-1: TO DP#1

[44] Hint: Outlet device #2 is below defined storage

Inflow Area = 0.426 ac, 8.93% Impervious, Inflow Depth = 2.39" for Custom event
Inflow = 1.20 cfs @ 12.08 hrs, Volume= 0.085 af
Outflow = 0.55 cfs @ 12.05 hrs, Volume= 0.085 af, Atten= 54%, Lag= 0.0 min
Primary = 0.55 cfs @ 12.05 hrs, Volume= 0.085 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 89.40' @ 12.27 hrs Surf.Area= 1,273 sf Storage= 465 cf <=Storage/Drawdown Volume

Plug-Flow detention time= 6.7 min calculated for 0.085 af (100% of inflow)
Center-of-Mass det. time= 6.7 min (833.0 - 826.3)

Volume	Invert	Avail.Storage	Storage Description
#1	89.00'	5,611 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
89.00	1,060	0	0
90.00	1,596	1,328	1,328
92.00	2,687	4,283	5,611

Device	Routing	Invert	Outlet Devices
#1	Secondary	91.00'	**10.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#2	Device 5	87.50'	**Special & User-Defined** Head (feet) 0.00 1.00 15.00 Disch. (cfs) 0.000 0.550 0.550
#3	Device 5	90.50'	**2.6' long Sharp-Crested Rectangular Weir X 3.00** 2 End Contraction(s) 0.5' Crest Height
#4	Device 5	89.40'	**6.0" Vert. Orifice/Grate** C= 0.600
#5	Primary	87.40'	**12.0" Round Culvert** L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 87.40' / 87.00' S= 0.0133 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.55 cfs @ 12.05 hrs HW=89.19' (Free Discharge)
└**5=Culvert** (Passes 0.55 cfs of 3.40 cfs potential flow)
  ├**2=Special & User-Defined** (Custom Controls 0.55 cfs)
  ├**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  └**4=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=89.00' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

3.1
OPERATION AND MAINTENANCE

STORMWATER OPERATION, MAINTENANCE AND POLLUTION PREVENTION PLAN

ZP Battery Devco, LLC
#1355 Main Street
Leicester, Massachusetts

RESPONSIBLE PARTY DURING CONSTRUCTION:
To Be Determined.

RESPONSIBLE PARTY POST CONSTRUCTION:
ZP Battery Devco, LLC
10 E. Worcester Street, Suite 3A
Worcester, Massachusetts 01604

BEST MANAGEMENT PRACTICES

To prevent the migration of soils, Best Management Practices (BMP's) shall be employed. During construction, hay bales and silt fence will be installed as shown on the plans and also at additional locations on an as needed basis to provide sufficient erosion controls on the site. These components shall be installed to catch and trap the migrating soil materials and pollutants.

All applicable BMP's listed below and in the Department of Environmental Protection's Stormwater Management Handbooks (Volume1: Overview of Massachusetts Stormwater Management Standards and Volume 2: Technical Guide for Compliance with Massachusetts Stormwater Management Standards) dated January 2008 (as amended), shall be incorporated in this project. This Plan shall be followed by the Homeowners Association and residents as required and amended by the Massachusetts Department of Environmental Protection's Stormwater Management Regulations

INSPECTION AND MAINTENANCE (DURING CONSTRUCTION)

1. At all times, hay bales, siltation fabric fencing and wooden stakes sufficient to construct sedimentation control barrier a minimum of 50 feet long will be stockpiled on the site in order to repair established barriers which may have been damaged or breached.

2. Necessary erosion controls shall be in place prior to any clearing or construction on the site. Construction sequence shall be phased in such a manner that the on-site detention basins are stabilized and functioning prior to the establishment of any new impervious areas on the site. The Contractor shall provide temporary stilling or settling basins as needed to catch and trap any migrating soil materials and pollutants from the construction areas.

3. An inspection of all erosion control and stormwater management systems shall be conducted at least once every fourteen (14) calendar days and following significant storm events. Where sites have been finally or temporarily stabilized, or runoff is unlikely due to winter conditions, such inspections shall be conducted at least once every month. (EPA SWPPP IS REQUIRED FOR THIS PROJECT)

In case of any noted breach or failure, the General Contractor shall immediately make appropriate repairs to any erosion control system and notify the engineer of any problems involving storm water management systems.

A significant storm event shall be defined as all or one of the following thresholds.

a. Any storm in which rain is predicted to last for twelve consecutive hours or more.
b. Any storm for which a flash flood watch or warning is issued.
c. Any single storm predicted to have a cumulative rainfall of greater than one inch.
d. Any storm not meeting the previous three thresholds but which would mark a third consecutive day of measurable rainfall.

4. If site inspections identify BMPs not operating effectively, maintenance must be performed as soon as possible and before the next storm event.

5. If BMPs need modification or additional BMPs need to be added, implementation must be completed before the next storm if practicable. If implementation before the next storm event is impracticable, the situation must be documented in the construction log and alternative BMPs must be implemented as soon as possible

6. The General Contractor shall also inspect the erosion control and stormwater management systems at times of significant increase in surface water runoff due to rapid thawing when the risk of failure of erosion control measures is significant.

7. In such instances as remedial action is necessary, the General Contractor shall repair any and all significant deficiencies in erosion control systems within two days.

8. The Department of Public Works and/or Conservation Commission shall be notified of any significant failure of storm water management systems and erosion and sediment control measures and shall be notified of any release of pollutants to a water body (stream, brook, pond, etc.).

9. The General Contractor shall remove the sediment from behind the fence of the sedimentation control barrier when the accumulated sediment has reached one-half of the original installed height of the barrier.

INSPECTION AND MAINTENANCE (POST-CONSTRUCTION)

It is the agreement of the responsible parties to finance, inspect, and perform (respectfully) the long-term maintenance of the erosion control devices and the stormwater management systems within the limits stated below.

1. A visual inspection of all erosion control and stormwater management systems shall be conducted by the above identified person(s) a minimum of once per month and after every major storm during the first six months of operation (a portion of that time must be in the growing season). Thorough investigations shall be conducted twice a year. Monthly maintenance requirements may be adjusted based upon the results obtained from the first year of operation.

2. **Maintenance Schedule**

Structure Type	Inspection	Maintenance	Task
Rip/Rap Aprons	Twice a Year	Every 10 Years	Remove Debris & Add Stone
Subdrains	Twice a Year	Every 4 Years	Replace Peastone
Detention Basins	Monthly (May-Oct)	Monthly (May-Oct)	Mow Grass Areas & Remove Debris Remove Sediment if present
Outfall Structures	Twice a Year	Every 10 Years	Remove Debris & Add Stone

LONG TERM POLLUTION PREVENTION PLAN

1. Trash and other debris shall be removed from landscaped and planted areas periodically as needed. Full inspection of the site shall be made on a semi-annual basis to ensure clean and neat appearance to the site. This measure will help in the overall performance of the onsite systems.

2. Reseed any bare areas as soon as they occur. Erosion control measures shall be installed in these areas to prevent deposits of sediment from entering the drainage system

3. Grass shall be maintained at a minimum blade height of four to six inches and not allowed to exceed 18 inches in total height. Only 1/3 of the plant height shall be removed at a time.

SEEDING OPERATION AND MAINTENANCE

1. Grass shall be maintained at a minimum blade height of four to six inches and not allowed to exceed 18 inches in total height. Only 1/3 of the plant height shall be removed at a time.

2. No Herbicides or pesticides will be used on this project.

Inspection Log

ZP Battery Devco, LLC
#1355 Main Street, Leicester, Massachusetts

DATE	ACTION	RESULT	PERFORMED BY

Maintenance Log

ZP Battery Devco, LLC
#1355 Main Street, Leicester, Massachusetts

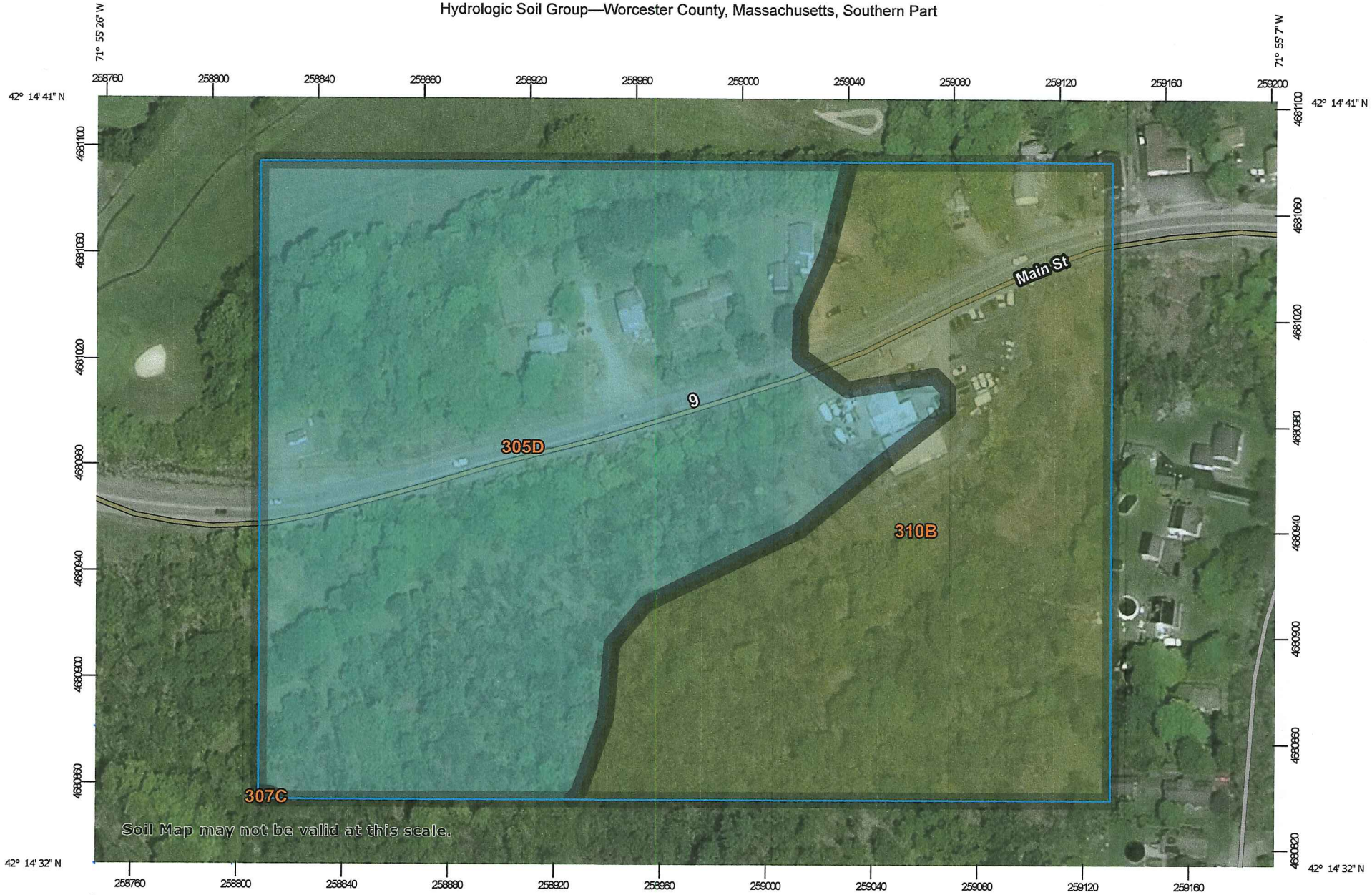
DATE	ACTION	PERFORMED BY

FIGURE 1
LOCUS MAP AND SOILS MAP

1355 Main Street, Leicester, MA

MN 16° TN

0 1/2 1 MILE
0 1000 FEET 0 500 m 1000 m



Map Scale: 1:2,040 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 30 60 120 180

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Worcester County, Massachusetts, Southern Part
Survey Area Data: Version 13, Jun 11, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 18, 2019—Jul 9, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
305D	Paxton fine sandy loam, 15 to 25 percent slopes	C	11.3	58.6%
307C	Paxton fine sandy loam, 8 to 15 percent slopes, extremely stony	C	0.0	0.0%
310B	Woodbridge fine sandy loam, 3 to 8 percent slopes	C/D	7.9	41.4%
Totals for Area of Interest			**19.2**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

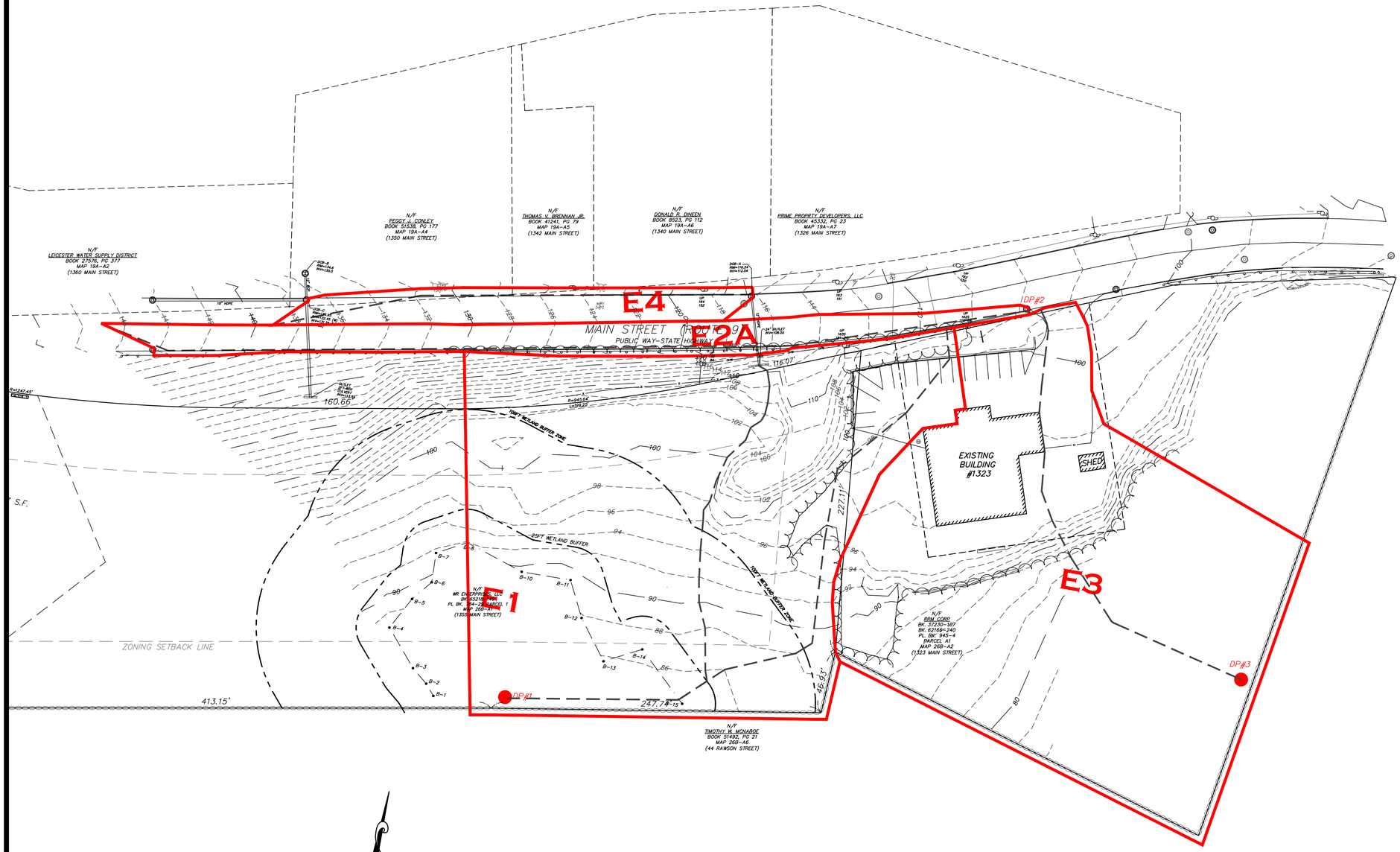
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

FIGURE 2
PRE-DEVELOMPENT WATERSHED MAP



PROJECT INFORMATION

LAND INFORMATION

MAP/PARCEL:	26B/A1
DEED BOOK-PAGE:	65218/149
EXISTING FRONTAGE:	794.29'
EXISTING AREA:	5.44 ACRES

ZONING INFORMATION

ZONING DISTRICT: HIGHWAY BUSINESS-INDUSTRIAL 1 (HB-1)

DIMENSIONAL REQUIREMENTS:

MINIMUM AREA:	60,000 S.F.
MINIMUM FRONTAGE:	200'
MAXIMUM HEIGHT:	55'
MINIMUM SETBACKS:	
FRONT YARD:	50'
SIDE YARD:	50'
REAR YARD:	50'

GENERAL NOTES:

1. PROPERTY LINE INFORMATION BASED DEEDS AND PLANS OF RECORD. NO CERTIFICATION OF PROPERTY LINES SHOWN ON THIS PLAN IS INTENDED OR IMPLIED BY HANNIGAN ENGINEERING, INC. TOPOGRAPHIC INFORMATION IS THE RESULT OF AN ON-THE-GROUND TOPOGRAPHIC SURVEY BY HANNIGAN ENGINEERING, INC. IN JULY OF 2021.
2. AREAS SUBJECT TO PROTECTION UNDER THE WETLANDS PROTECTION ACT HAVE BEEN DELINEATED BY CARON ENVIRONMENTAL CONSULTING ON MARCH 26, 2021. THESE AREAS ARE DEPICTED ON THE PLANS BASED ON FIELD SURVEY LOCATION DURING THE TOPOGRAPHIC SURVEY.
3. LOCATION OF ALL UTILITIES ARE APPROXIMATE AS SHOWN AND BASED UPON VISIBLE STRUCTURES AT THE TIME OF THE FIELD SURVEY. LOCATION OF EXISTING UTILITIES AND SUBSURFACE STRUCTURES, WHETHER OR NOT SHOWN ON THESE PLANS, SHALL BE DETERMINED BY THE CONTRACTOR, MARKED IN THE FIELD, AND REVIEWED BY THE ENGINEER PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. THE CONTRACTOR SHALL BE AWARE OF THE OBLIGATION TO ALL UTILITY COMPANIES AND AGENCY AS WELL AS DIG-SAFE PRIOR TO EXCAVATION. (SEE NOTE)
4. NOTIFICATION REQUIREMENTS SHOWN ON THIS PLAN SHALL NOT RELIEVE THE CONTRACTOR OF ANY OTHER REQUIREMENTS WHICH MAY EXIST UNDER LOCAL, STATE, OR FEDERAL JURISDICTION TO WHICH THE CONTRACTOR IS OBLIGATED.
5. RELOCATION OF AND/OR CONNECTION TO EXISTING UTILITIES SHALL BE PERFORMED IN ACCORDANCE WITH PROVISIONS OF THE APPROPRIATE UTILITY COMPANY AND/OR REGULATORY AGENCY.
6. UNLESS OTHERWISE SPECIFIED, ALL MATERIALS AND WORKMANSHIP SHALL CONFORM WITH THE REQUIREMENTS OF THE TOWN OF LEICESTER AND THE MASS DOT SPECIFICATIONS OF HIGHWAYS AND BRIDGES.
7. ALL SLOPES UNLESS OTHERWISE SPECIFIED, SHALL BE LOAMED AND SEEDED FOR STABILIZATION.
8. ANY DEVIATIONS IN DESIGN AS SHOWN SHALL REQUIRE A REVIEW AND APPROVAL OF THE DESIGN ENGINEER OR FIRM. CHANGES MADE IN THE FIELD MADE WITHOUT AUTHORIZATION SHALL BE SUBJECT TO REVIEW BY THE ENGINEER AND APPROPRIATE APPROVING AUTHORITY. EXPENSES INCURRED TO BRING THE UNAUTHORIZED CHANGES TO ACCEPTABLE CONFORMANCE SHALL BE BORNE BY THE COMPANY OR CONTRACTOR MAKING THE UNAUTHORIZED CHANGE.
9. ANY MATERIALS DISCOVERED ON-SITE WHICH ARE NOT SUITABLE FOR USE IN THE PROJECT AS SHOWN ON THIS PLAN SHALL BE REMOVED AND HAULED OFF-SITE TO AN APPROPRIATELY LICENSED FACILITY.
10. PLANS TO BE REVIEWED BY APPLICABLE UTILITY AGENCIES FOR COMPLIANCE WITH REGULATIONS. FINAL LOCATION IS SUBJECT TO CHANGE.
11. APPLICANT SHOULD BE AWARE OF OBLIGATIONS TO COMPLY WITH CHAPTER 131, SECTION 40 OF THE MASSACHUSETTS GENERAL LAWS, OTHERWISE KNOWN AS THE WETLANDS PROTECTION ACT, AND THE ASSOCIATED REGULATIONS (310 CMR 10.00)
12. STOCKPILING OF MATERIAL SHALL NOT BE PERMITTED WITHIN ANY AREAS SUBJECT TO PROTECTION UNDER THE WETLANDS PROTECTION ACT WITHOUT PRIOR APPROVAL BY THE LOCAL CONSERVATION COMMISSION. STOCKPILES SHALL BE PLACED IN A SUITABLE LOCATION AND SURROUNDED BY A ROW OF STAKED HAY BALES FOR EROSION CONTROL.
13. AREAS OF FILL TO BE COMPACTED TO A MINIMUM 95% DRY DENSITY IN AREAS WITHIN ROADWAYS AND UTILITY EASEMENTS. OTHER AREAS OF FILL TO BE COMPACTED TO A MINIMUM 90% DRY DENSITY. ALL FILL MATERIALS ARE TO BE CLEAN FILL, FREE OF DELETERIOUS MATERIALS AND DEBRIS.
14. ALL SIDEWALKS AND RAMPS TO CONFORM TO REQUIREMENTS OF THE AMERICANS WITH DISABILITIES ACT (ADA), AS REQUIRED. SEE ARCHITECTURAL PLANS FOR CONFORMANCE REQUIREMENTS FOR PROPOSED BUILDINGS.
15. THE AREA PROPOSED FOR DEVELOPMENT IS NOT WITHIN A 100 YEAR FLOOD PLAIN PER F.E.M.A. FIRM PANEL #250313 0781 E, DATED: JULY 4, 2011. COMPLIANCE WITH APPLICABLE REGULATIONS IS REQUIRED.
16. ALL REINFORCED CONCRETE PIPE TO BE CLASS III UNLESS OTHERWISE NOTED.
17. PRE-CONSTRUCTION CONFERENCE SHALL BE HELD PRIOR TO THE COMMENCEMENT OF CONSTRUCTION.
18. ALL UTILITIES ARE TO BE INSTALLED BY A LICENSED UTILITY CONTRACTOR LICENSED BY THE TOWN OF LEICESTER.

HANNIGAN ENGINEERING, INC.
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WWW.HANNIGANENGINEERING.COM

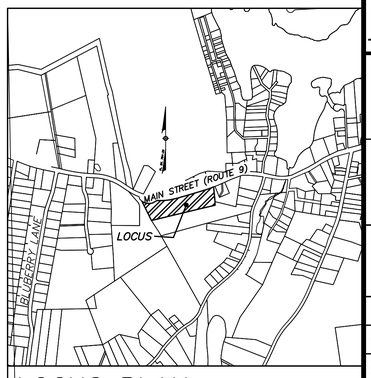
EXISTING WATERSHED IN LEICESTER, MASSACHUSETTS

PREPARED FOR:
ZP BATTERY DEVCO, LLC
BRENDAN GOVE
10 E WORCESTER STREET SUITE 3A
WORCESTER, MASSACHUSETTS 01604
TEL:

GRAPHIC SCALE: 1"=40'

0 10 20 30 40 50 75 100 150 FEET
0 5 10 15 20 30 40 50 METERS

CALC: CMA	DRWN: CMA	SCALE: 1"=40'
CHKD: WDH	APPD: WDH	DATE: SEP 21, 2021
SRV: JEF	FB: 71-22	JOB NO: 3010
TAB: WS	SHEET 1 OF 2	PLAN NO: C-17-38



LOCUS PLAN SCALE: 1":1000'

APPLICANT:
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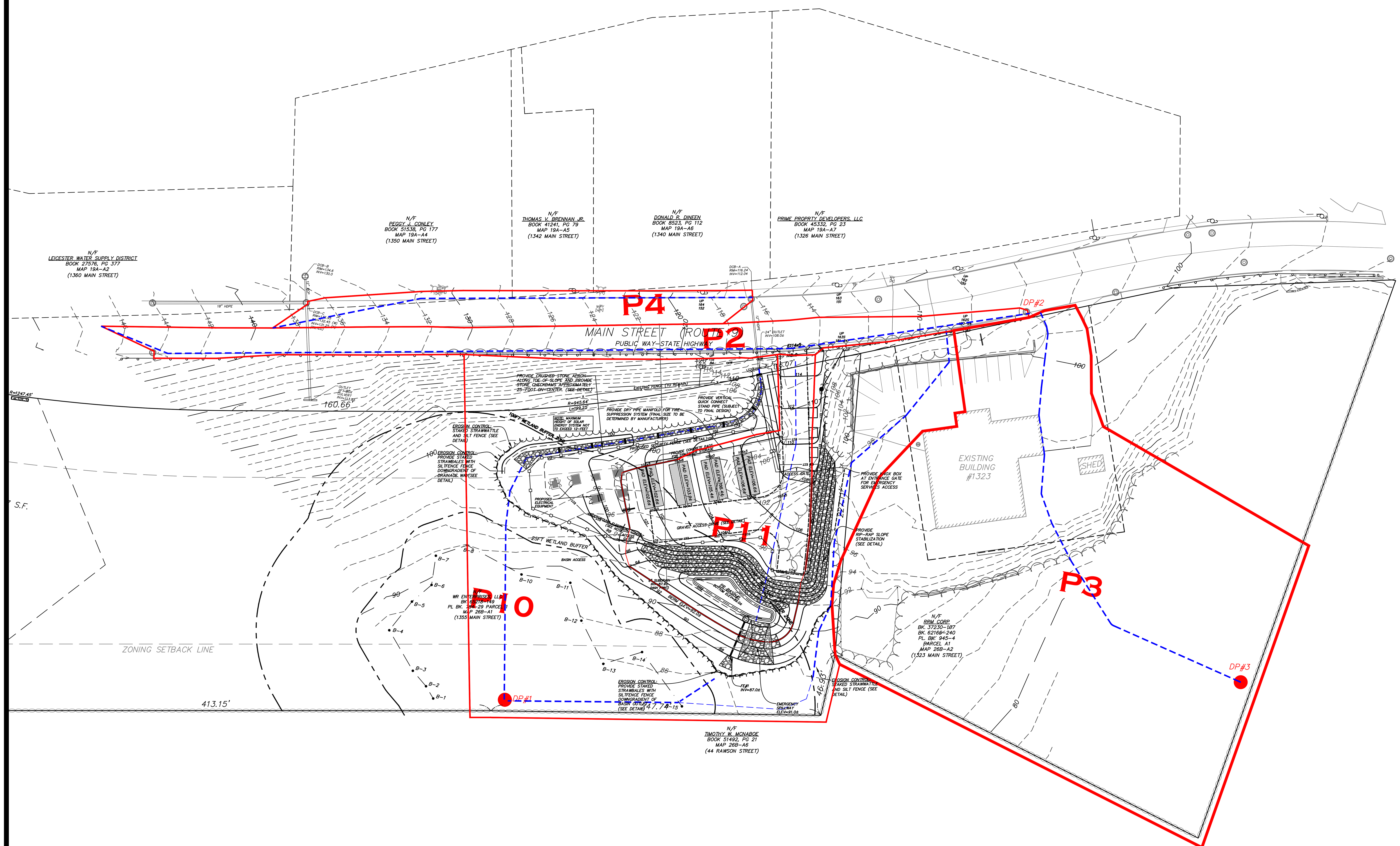
BRENDON GOVE
10 E. WORCESTER STREET, SUIT 3A
WORCESTER, MASSACHUSETTS 01604

OWNER:
WR ENTERPRISES, LLC
1323 MAIN STREET
LEICESTER, MASSACHUSETTS 01524

FIGURE 3
POST-DEVELOMPENT WATERSHED MAP



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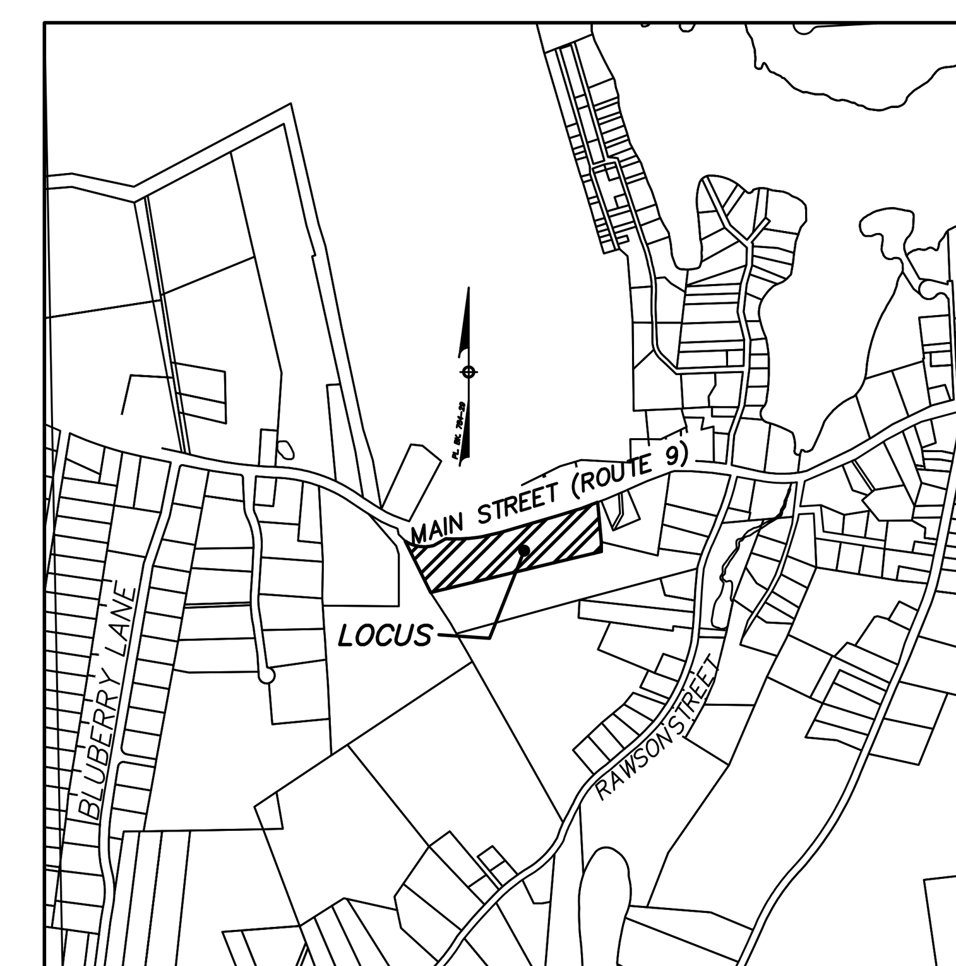

LOCUS PLAN SCALE: 1"=1000'

PROJECT INFORMATION

LAND INFORMATION

MAP/PARCEL:	26B/A1
DEED BOOK-PAGE:	65218/149
EXISTING FRONTAGE:	794.29'
EXISTING AREA:	5.44 ACRES

ZONING INFORMATION

ZONING DISTRICT: HIGHWAY BUSINESS-INDUSTRIAL 1 (HB-1)

DIMENSIONAL REQUIREMENTS:

MINIMUM AREA:	60,000 S.F.
MINIMUM FRONTAGE:	200'
MAXIMUM HEIGHT:	55'
MINIMUM SETBACKS:	
FRONT YARD:	50'
SIDE YARD:	50'
REAR YARD:	50'

GENERAL NOTES:

1. PROPERTY LINE INFORMATION BASED DEEDS AND PLANS OF RECORD. NO CERTIFICATION OF PROPERTY LINES SHOWN ON THIS PLAN IS INTENDED OR IMPLIED BY HANNIGAN ENGINEERING, INC. TOPOGRAPHIC INFORMATION IS THE RESULT OF AN ON-THE-GROUND TOPOGRAPHIC SURVEY BY HANNIGAN ENGINEERING, INC. IN JULY OF 2021.
2. AREAS SUBJECT TO PROTECTION UNDER THE WETLANDS PROTECTION ACT HAVE BEEN DELINEATED BY CARON ENVIRONMENTAL CONSULTING ON MARCH 26, 2021. THESE AREAS ARE DEPICTED ON THE PLANS BASED ON FIELD SURVEY LOCATION DURING THE TOPOGRAPHIC SURVEY.
3. LOCATION OF ALL UTILITIES ARE APPROXIMATE AS SHOWN AND BASED UPON VISIBLE STRUCTURES AT THE TIME OF THE FIELD SURVEY. LOCATION OF EXISTING UTILITIES AND SUBSURFACE STRUCTURES, WHETHER OR NOT SHOWN ON THESE PLANS, SHALL BE DETERMINED BY THE CONTRACTOR, MARKED IN THE FIELD, AND REVIEWED BY THE ENGINEER PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. THE CONTRACTOR SHALL BE AWARE OF THE OBLIGATION TO ALL UTILITY COMPANIES AND AGENCY AS WELL AS DIG-SAFE PRIOR TO EXCAVATION. (SEE NOTE)
4. NOTIFICATION REQUIREMENTS SHOWN ON THIS PLAN SHALL NOT RELIEVE THE CONTRACTOR OF ANY OTHER REQUIREMENTS WHICH MAY EXIST UNDER LOCAL, STATE, OR FEDERAL JURISDICTION TO WHICH THE CONTRACTOR IS OBLIGATED.
5. RELOCATION OF AND/OR CONNECTION TO EXISTING UTILITIES SHALL BE PERFORMED IN ACCORDANCE WITH PROVISIONS OF THE APPROPRIATE UTILITY COMPANY AND/OR REGULATORY AGENCY.
6. UNLESS OTHERWISE SPECIFIED, ALL MATERIALS AND WORKMANSHIP SHALL CONFORM WITH THE REQUIREMENTS OF THE TOWN OF LEICESTER AND THE MASS DOT SPECIFICATIONS OF HIGHWAYS AND BRIDGES.
7. ALL SLOPES UNLESS OTHERWISE SPECIFIED, SHALL BE LOAMED AND SEEDED FOR STABILIZATION.
8. ANY DEVIATIONS IN DESIGN AS SHOWN SHALL REQUIRE A REVIEW AND APPROVAL OF THE DESIGN ENGINEER OR FIRM. CHANGES MADE IN THE FIELD MADE WITHOUT AUTHORIZATION SHALL BE SUBJECT TO REVIEW BY THE ENGINEER AND APPROPRIATE APPROVING AUTHORITY. EXPENSES INCURRED TO BRING THE UNAUTHORIZED CHANGES TO ACCEPTABLE CONFORMANCE SHALL BE BORNE BY THE COMPANY OR CONTRACTOR MAKING THE UNAUTHORIZED CHANGE.
9. ANY MATERIALS DISCOVERED ON-SITE WHICH ARE NOT SUITABLE FOR USE IN THE PROJECT AS SHOWN ON THIS PLAN SHALL BE REMOVED AND HAULED OFF-SITE TO AN APPROPRIATELY LICENSED FACILITY.
10. PLANS TO BE REVIEWED BY APPLICABLE UTILITY AGENCIES FOR COMPLIANCE WITH REGULATIONS. FINAL LOCATION IS SUBJECT TO CHANGE.
11. APPLICANT SHOULD BE AWARE OF OBLIGATIONS TO COMPLY WITH CHAPTER 131, SECTION 40 OF THE MASSACHUSETTS GENERAL LAWS, OTHERWISE KNOWN AS THE WETLANDS PROTECTION ACT, AND THE ASSOCIATED REGULATIONS (310 CMR 10.00)
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