Vanasse Hangen Brustlin, Inc.

R.S.A. 485-A:17

Alteration of Terrain Permit Application
Groton Wind Farm

Groton Wind, LLC
Groton, New Hampshire

Submitted to
NHDES - Water Division
29 Hazen Drive
PO Box 95
Concord, NH 03302-0095

Submitted by
Vanasse Hangen Brustlin, Inc.
Six Bedford Farms Drive, Ste. 607
Bedford, NH 03110

February 2010

VHB Project No.: 52036.00

Contents

Application Form

ALTERATION OF TERRAIN APPLICATION

R.S.A. 485-A:17
Department of Environmental Services - Water Division
29 Hazen Drive, PO Box 95
Concord, New Hampshire 03302-0095

Application Date: 2/2010

File Number (DES use): ____________

Groton Wind Farm	Map 9, Lots 1, 2, 8, & un-numbered lot Map 10, Lot 31
Name of Project	Map & Lot Number
Groton Hollow Road, Groton, NH	Grafton
Location of Project (town)	County

Check Project Type:

☐ Excavation ☐ Commercial ☐ School ☐ Agricultural ☐ Landfill
☐ Residential ☐ Golf Course ☐ Municipal ☐ Land Conversion ☒ Other *specify* (Renewable Energy Project)

1. Owner Information

Refer to attached owners list	
Name of Owner	Email address (optional)
Contact Name	Telephone Number
Mailing Address	Fax Number
City/Town	State / Zip Code

2. Permit Holder Information

Groton Wind, LLC	echerian@iberdrolausa.com
Desired Permit Holder Name (if different from owner)	Email address (optional)
Edward J. Cherian	603-440-3127
Contact Name	Telephone Number
P.O. Box 326	
Mailing Address	Fax Number
Concord	NH 03302
City/Town	State / Zip Code

3. Agent Information

Vanasse Hangen Brustlin, Inc.	pwalker@vhb.com
Agent Company	Email address
Peter Walker	603-644-0888
Contact Name	Telephone Number
Six Bedford Farms Drive, Ste. 607	603-644-2385
Mailing Address	Fax Number
Bedford	NH 03110
City/Town	State / Zip Code

4. Provide a *short* description of the project below (do not reply "see attached"):

The project proposes to construct a renewable energy facility utilizing 24 wind turbines at the end of Groton Hollow Road in Groton, New Hampshire. In addition to the turbines, approximately 12 miles of gravel access drives will be constructed along with associated maintenance facilities, pad areas, and transmission lines. The project site is located on approximately 4,179 acres of leased land on and/or between Tenney, Crosby, and Fletcher Mountains; and Route 25. The majority of the development is within the Clark Brook watershed which feeds into the Baker River.

5. If any work was done prior to receiving a permit, describe it below:

None associated with the proposed project. However, there is currently an active logging operation on the site that is independent of the proposed project.

6. Please answer the questions below:

A. What date was a copy of a complete application sent to the municipality[1]? per NHSEC process
DES recommends that you mail it by certified mail and retain a copy for yourself and for this application.

B. Total area of disturbance: 5,036,579+/- 116+/- ac square feet

C. Total impervious cover: 1,568,160+/- 36+/- ac square feet (note: total final impervious cover includes 58,400 sf for roof/parking/storage area O&M building and 1,509,760 sf for remainder of access drives/turbine pads)

D. Total Undisturbed cover: 177,000,661+/- 4,063+/- ac square feet

E. Number of lots proposed: 0

F. Total length of roadway: 62,000+/- feet (note: majority of road length is for access and maintenance of the proposed wind turbines and will have very limited vehicular traffic.)

G. Select plan type submitted:
☐ Land Conversion
☐ Excavation, grading, and reclamation
☒ Detailed Development Plan

H. Name of receiving waters: Clark Brook, Halls Brook, Wise Brook, & unnamed streams along 3A and 25
Are any of the receiving waters identified by the department as being impaired? YES ☒ NO ☐
If yes, for what pollutant(s)? Majority of site ultimately drains to the Baker River. The Baker River is impaired for E. Coli.
Guidance at: http://des.nh.gov/organization/divisions/water/wmb/tmdl/documents/onestop_gis_wgc_ref_guide.pdf

I. Any disturbance within a Designated River corridor? YES ☐ NO ☒
If yes what river[1]: n/a
If yes, what date was a copy of a complete application sent to the Local Advisory Committee (LAC)?: _____
DES recommends that you mail it by certified mail and retain a copy for yourself and for this application.

J. Threatened or Endangered species or critical habitat potentially impacted? YES ☐ NO ☒
If yes, what? n/a
Other natural resources potentially impacted? YES ☒ NO ☐
If yes, what? wetlands and ridgelines

K. Any disturbance within the 100-year floodplain? YES ☒ NO ☐
If yes, state the cut volume 27257 cubic feet and the fill volume 0 cubic feet

L. Is the project within a Water Supply Intake Protection Area (WSIPA)? YES ☐ NO ☒
Is the project within a Groundwater Protection Area (GPA)? YES ☐ NO ☒
Read Env-Wq 1508.02, visit the OneStop Web GIS website at www2.des.state.nh.us/gis/onestop/, and read Chapter 3.1 in Volume 2 of the NH Stormwater Manual (des.nh.gov/organization/divisions/water/stormwater/manual.htm), for more information and be sure to observe Water Supply Well Set-Backs requirements.

M. Is the project a High Load area, in accordance with Env-Wq 1502.26? YES ☐ NO ☒
If yes, specify type of high load land use or activity? n/a

N. Are there any drywells, infiltration trenches, or underground infiltration systems proposed? YES ☐ NO ☒
If yes, be sure to include a Registration and Notification Form for Storm Water Infiltration to Groundwater (download form at: des.nh.gov/organization/divisions/water/dwgb/dwspp/gw_discharge)

O. Other State Permits/Approvals	Note Status Below (NA, filed, not yet applied,
Wetlands permit required? YES ☒ NO ☐ If yes, total wetland impact: _____ square feet	Status: filed per NHSEC process
Shoreland permit required? YES ☐ NO ☒ If exempt, why?_____	Status: n/a
Large or small community well approval needed? YES ☐ NO ☒	Status: n/a
Large groundwater withdrawal permit required? YES ☐ NO ☒	Status: n/a

List other DES permits required and state their status?
Subsurface Systems Bureau- Individual Disposal System Approval

[1] - A copy of the application, including all items in #7, must be sent to the applicable municipality and, if applicable, to the local rivers management advisory committee at the same time (or before) filing this AoT permit application.

7. In the order listed, please include the following as part of your application, if applicable:

CHECK ALL THAT APPLY:

- [X] Application fee – des.nh.gov/organization/divisions/water/aot/fees.htm
- [X] This signed application form – des.nh.gov/organization/divisions/water/aot/index.htm

Bind in a report in the following order:

- [X] Copy of the signed application
- [X] Copy of the check
- [ ] If available, a copy of the certified mail receipts for mailings to the town and LAC (if applicable).
- [X] USGS map (1" = 2,000' scale with the site boundaries outlined) - color copy preferred but not required
- [X] Application Checklist – des.nh.gov/organization/divisions/water/aot/index.htm
- [X] Narrative of the project with a summary table of the peak discharge rate for the off-site discharge points
- [X] Web GIS printout – with the "Surface Water Impairments" layer turned on - www2.des.state.nh.us/gis/onestop/
- [X] Web GIS printouts – with the AoT screening layers turned on - www2.des.state.nh.us/gis/onestop/
- [X] NHB letter using DataCheck Tool – www.nhdfl.org/about-forests-and-lands/bureaus/natural-heritage-bureau/
- [X] The Web Soil Survey Map with project's watershed outlined – websoilsurvey.nrcs.usda.gov
- [X] Aerial photograph (1" = 2,000' scale with the site boundaries outlined)
- [X] Photographs representative of the site
- [X] Groundwater Recharge Volume calculations (one worksheet for each permit application) – des.nh.gov/organization/divisions/water/aot/documents/bmp_worksh.xls (Waiver requested)
- [X] BMP worksheets (one worksheet for each treatment system) – des.nh.gov/organization/divisions/water/aot/documents/bmp_worksh.xls
- [X] Drainage analysis (see Application Checklist for a list of printouts required)
- [X] Riprap apron or other energy dissipation or stability calculations
- [na] Site Evaluation Report & Infiltration calcs (see Vol.2, Ch.2-4, of the NH Stormwater Management Manual)
- [na] Registration and Notification Form for Storm Water Infiltration to Groundwater (for underground systems only, including drywells and trenches) – (http://des.nh.gov/organization/divisions/water/dwgb/dwspp/gw_discharge)
- [X] Inspection and maintenance manual with long term maintenance agreements
- [na] Source control plan

Plans:

- [X] One set of design plans (34 - 36" by 22 - 24" on white paper)
- [X] Color coded hydrologic soil group plan
- [X] Pre-development and post-development drainage area plans

100-year Floodplain Report – submitted as a separate report: (Waiver Requested)

- [ ] All information required in Env-Wq 1503.09

8. Signature Required:

[signature]	Peter Walker (VHB - Agent)
Signature (owner or agent) and Date	Name (owner or agent)

Note: In accordance with Env-Wq 1503.20(e), within one week after permit approval, the applicant shall submit a copy of all approved documents to the department in PDF format on a CD.

Owners List/Authorization Letters

Owners List

Alteration of Terrain Permit Application
Groton Wind Farm
Groton Wind, LLC
Groton Hollow Road, Groton, New Hampshire

OWNERS

1. **Map 9, Lot 1**
   Yankee Forest, LLC
   c/o Wagner Forest Management, Ltd.
   150 Orford Road
   Lyme, NH 03768
   603-795-2202 (phone)
   603-795-4631 (fax)

2. **Map 9, Lots 2, 8, & 9**
   Green Acre Woodlands, Inc. c/o Foreco, LLC
   PO Box 597
   Rumney, NH 03266-0597
   603-786-9544 (phone)
   603-786-9545 (fax)

3. **Map 10, Lot 31**
   Maurice Daniel Smith & Lois Ketterson Smith
   17 Orchard Drive
   Durham, NH 03824
   603-868-5013 (phone)

After Recording, Return to:

NOTICE OF LEASE

Notice is hereby given of a Wind Energy Facility Ground Lease with an execution date as of March 24, 2010 ("Lease") by and between **YANKEE FOREST LIMITED LIABILITY Company ("Property Owner")**, a New Hampshire limited liability company whose address is c/o Wagner Forest Management, Ltd., its Manager, 150 Orford Road, Lyme, NH 03768, and **GROTON WIND, LLC,** a Delaware limited liability company, with a mailing address at 1125 NW Couch, Suite 700, Portland, OR 97209 (**"Company"**).

Section 1: Description of Premises. Property Owner owns certain real estate in the Town of Groton, Grafton County, New Hampshire, which real estate is a portion of lands located in Groton conveyed by deed of Yorkshire Timber Company to Property Owner dated October 15, 1998 and recorded in Book 2348, Page 476 of the Grafton County Registry of Deeds, as more particularly described in **Exhibit A** hereto ("**Premises**"). The Town of Groton assesses real property taxes against the Premises as one tax lot, to wit, Tax Map 9, Lot 1.

Section 2: Purposes of Lease. Property Owner has leased to Company the Premises from the date hereof through "Start of Construction" (as defined in the Lease) for the initial purpose of conducting various studies to evaluate the potential for use of the Premises for "**Wind Energy Purposes**," as more fully defined in the Lease. If after completing its wind resource evaluation of the Premises, the Company determines to construct and operate a "**Wind Energy**

Facility" (as defined in the Lease) on a portion of the Premises, then the Property Owner shall continue to lease to the Company a portion of the Premises ("**Construction Leased Premises**") for the construction of a Wind Energy Facility; the portion of the Premises to be designated as the Construction Leased Premises is to be determined as provided in the Lease. After completion of construction of the Wind Energy Facility, the Property Owner shall continue to lease to the Company a portion of the Premises ("**Operating Leased Premises**") as specified in the Lease for the operation and maintenance of a Wind Energy Facility. The portion of the Premises to be designated as the Operating Leased Premises is to be determined as provided in the Lease, and a legal description of the Operating Leased Premises shall be attached to the Lease, and shall be recorded with and referenced in an amendment to this Notice of Lease.

Section 3: Term. The term of the Lease commences __________, 2010, for an initial Development Term concluding no later than December 31, 2012, with the Company having the right to extend the Development Term for up to two (2) successive renewal terms of one (1) year each upon meeting the requirements for extension of the Development Term as specified in the Lease, unless said term may be sooner terminated as provided in the Lease. The Development Term shall be automatically extended upon the Start of Construction (as defined in the Lease) and shall continue so long as requirements of the Lease are met until the Operations Term (as defined herein and in the Lease). When and if the Commercial Operations Date (as defined in the Lease) may be obtained by the Company, the term of the Lease shall continue for an operations term of thirty (30) years from the Commercial Operations Date (**"Operations Term"**), unless said term may be sooner terminated as provided in the Lease.

Section 4: Addresses of Parties. The parties' addresses as set forth in the Lease are as set forth in the first paragraph of this Notice.

[The remainder of this page is left blank intentionally. The next pages are the signature pages.]

IN WITNESS WHEREOF, the parties have executed this Notice of Lease as of ____________________________, 2010.

Witness:

COMPANY:

Groton Wind, LLC,

a Delaware limited liability company

____

By: ____________________________

Printed____________________

Name: Rany Raviv

Title: Authorized Representative

Scott Jacobson

Authorized Representative

STATE OF Oregon)

COUNTY OF Multnomah **)ss.:**

On the 17th day of March, 2010 before me, the undersigned, personally appeared Rany Raviv & Scott Jacobson personally known to me or proved to me on the basis of satisfactory evidence to be the individual whose name is subscribed to the within instrument and acknowledged to me that he/she executed the same in his/her capacity, that by his/her signature on the instrument, the individual, or the person upon behalf of which the individual acted, executed the instrument.

OFFICIAL SEAL
CHELSEA C MC FARLAND
NOTARY PUBLIC - OREGON
COMMISSION NO. 443054
MY COMMISSION EXPIRES OCTOBER 1, 2013

____
Notary Public

PROPERTY OWNER:

Witness:

Yankee Forest Limited Liability Company,
a New Hampshire limited liability company
By: Wagner Forest Management, LTD.,
a New Hampshire corporation

Printed Donald R. Frechette

Name: Thomas J. Colgan
Title: President

STATE OF NEW HAMPSHIRE

______________________________ **SS:**

COUNTY OF GRAFTON

On the 24th day of March 2010 before me, the undersigned, personally appeared Thomas J. Colgan personally known to me or proved to me on the basis of satisfactory evidence to be the individual whose name is subscribed to the within instrument and acknowledged to me that he executed the same in his capacity, that by his signature on the instrument, the entity upon behalf of which the individual acted, executed the instrument.

JOHN G. SOBETZER
Notary Public-New Hampshire
My Commission Expires: January 12, 2015

____
Notary Public

637374_1

EXHIBIT A – PROPERTY OF YANKEE FARM, LLC
Tax Map 9, Lot 1,
Groton, Grafton County, New Hampshire

Being parcels or tracts of land situated in the Town of Groton in the County of Grafton, State of New Hampshire. The premises herein described are a portion of those properties conveyed by Quitclaim Deed of Yorkshire Timber to Yankee Forest, LLC dated and recorded October 15, 1998 in the Grafton County Registry of Deeds, Book 2348, Page 476. Yorkshire Timber Company derived its title from the following deeds:

1. Section A: Deed of Rockwell International, dated November 7, 1977, recorded at Book 1324, Page 25 of the Grafton County Registry of Deeds.

2. Section E: Deed of Land/Vest Incorporated, General Partner of Forest Lands Associates, dated January 26, 1978, recorded at Book 1329, Page 608 of the Grafton County Registry of Deeds and deed of Land/Vest Incorporated, General Partner of Forest Lands Associates, dated January 26, 1978, recorded at Book 1329, Page 608 of the Grafton County Registry of Deeds.

3. Section F: Deed of Green Acre Woodlands, Inc., dated October 9, 1996, recorded at Book 2225, Page 998 of the Grafton County Registry of Deeds.

4. Section G: Deed of Alan E. Esty, dated July 11, 1989, recorded at Book 1821, Page 45 of the Grafton County Registry of Deeds.

The following are the remaining properties of Yankee Forest, LLC, believed to be Town of Groton Tax Map 9 Lot 1, approximately 954 acres, more or less, further described as follows:

SECTION A - ROCKWELL LANDS

Being the remaining certain parcels or tracts of land as deeded to Yorkshire Timber Company by deed of Rockwell International, dated November 7, 1977, recorded at Book 1324, Page 25 of the Grafton County Registry of Deeds. The designations in roman numerals (and subsections thereof) refer the deed of Rockwell to Yorkshire Timber; non-sequential listings indicate omitted sections:

- Property 3 –

V. Certain tracts or parcels of land located in the Town of Groton, being a portion of that land conveyed by Katherine B. Glover to Draper Corporation by Warranty Deed dated October 16, 1945, recorded in the Grafton County Registry of Deeds at Book 730, Page 462, described therein as follows:

3. Also any other real estate conveyed by George E. Colburn to Fred P. Weeks by deed dated December 27, 1910, recorded in Grafton County Records, Book 506, Page 10.

Excepting and reserving, however, all that part of the above mentioned premises which Fred P. Weeks conveyed to Mary L. Lamprey, May 22, 1912 by deed recorded in Grafton County Records, Book 580, Page 360, to wit: A certain tract of land in said Groton, it being all that part of the George C. Colburn Farm which is included within the following lines:

Beginning upon the line between said Colburn Farm and the Fairfield Place at the southeast corner of the said Colburn Farm and the northeast corner of land now or formerly owned by one Dodge; thence in a northwesterly direction on the Dodge and Colburn line along a stone wall about two hundred twenty (220) feet to a stake and stones at the end of the stone wall; thence in a northerly direction to a stake and stone standing in the corner of the stone wall at the upper edge of the south field of the said Colburn Farm; thence in a northeasterly direction following the stone wall along the outer edge of said field and through a small ravine to the middle field back of the house; thence northerly and easterly following the stone wall along the outer edge of said middle field to a white birch and wild cherry spotted and standing in the wall about one hundred eighty- five (185) feet westerly of the sugar house; thence in a northerly direction to a black cherry and silver birch standing in the stone wall on the southerly side of the west field near the intersection of two stone walls and about ninety-seven (97) feet westerly of the road leading to the said west field; thence westerly and northerly following the stone wall and fence along the edge of the said field to the northwest corner of the said west field; thence in an easterly direction along the stone wall on the northerly side of said west field to a silver birch tree spotted standing seventy (70) feet from the northerly line of said Colburn Farm; thence southeasterly in a line parallel with the said northerly line of the Colburn Farm and seventy (70) feet distant therefrom to the Fairfield Line; thence southwesterly on the Fairfield line to the point of beginning.

Excepting and reserving to Fred P. Weeks, his heirs and assigns, forever, the right to cross and recross the herein described premises at any and all times when necessary for the use and enjoyment of all that part of the Colburn Farm not to be sold, including the right temporarily to yard, cut up and pile up any timber, wood or lumber from any of said lands.

For my title to the above described tracts see deed of Blandin M. Glover, Inc. to me dated May 1, 1943 and recorded August 9, 1945 in Grafton County Records, Book 729, Page 74.

9. Certain tracts of lands situate in said Groton, being a portion of land known as the "Spitz" Valencia - lower Valencia, containing six hundred fifty (650) acres of land, more or less, bounded and described as follows:

A. Lot #4 in the Seventh Range in the Third Division of lots in the said Town of Groton, containing one hundred (100) acres, more or less. (For description see deed recorded in Grafton County Records, Book 257, Page 154).

B. Certain pieces or tracts of land situate in said Groton, one tract beginning at a stake and stones on the range line between lots #5 and #6 on the west side of the road; thence North sixty-one degrees (61°) West sixty-seven (67) rods to the northwest corner of Lot #5; thence South twenty-nine degrees (29°) West one-hundred twenty-three (123) rods to a stake and stones; thence South sixty-one degrees (61°) East one hundred (100) rods to the road; thence by the road to the bound begun at. Containing sixty-four (64) acres, more or less, being part of Lot #5 in the Sixth Range and Third Division of lots, in said Town of Groton.

Also, all that part of Lot #4 in the Sixth Range and Third Division, in the said Town of Groton, containing twenty seven (27) acres, more or less, bounded and described as follows: Bounded south by land now or formerly of Fletcher, on the west by land now or formerly of John Morrill; on the north by land now or formerly of Samuel Currier; on the east by land of said Currier and the highway, it being the southwest corner of Lot #4 in the Sixth Range, and Third Division of lots in said Town of Groton. (For description see Grafton County Records Book 162, Page 148).

C. A certain tract or parcel of land situate in Groton, lying in Lot #4 in the Sixth Range of hundred acre lots in said Groton on the same lot on which one, Samuel G. Fletcher, formerly lived, bounded on the north by land formerly of Folsom; on the east by, the Emerson lot; on the south by land now or formerly owned by the said Fletcher; on the west by the road leading by said Folsom's and Fletcher's dwelling houses, containing ten (10) acres, more or less.

D. Lot #5, in the Seventh Range, Third Division of lots in said Groton.

E. A certain tract or parcel of land bounded and described as follows: Commencing on the highway and land formerly of S.P. Fletcher and running nearly east on said Fletcher land to land formerly of Samuel G. Fletcher; thence northerly by said S. G. Fletcher land, thence following on the range line of said lots in a northerly direction to the highway; thence on said highway to the bound begun at, meaning the highway that leads from Norris's to Groton Meeting House.

Excepting and reserving, however, so much of the foregoing as was conveyed by deed recorded in Grafton County Records, Book 377, Page 142, said deed being in the following words and figures: A certain tract or parcel of land with the buildings thereon situate in Groton, bounded and described as follows:

Beginning at a stake and stones on the easterly side of the old highway leading from the Sabin G. Norris Place, so-called, to Groton Meeting House; thence South sixty- three and one-half degrees (63 ½°) East one hundred eleven (111) rods to a stake and stones; thence South twelve degrees (12°) West sixty-eight (68) rods to a spruce tree marked; thence North sixty-five degrees (65°) West one hundred twenty-three (123) rods to a stake and stones on the easterly side of the old highway; thence northerly on said old highway seventy (70) rods to the point begun at. Containing fifty (50) acres, more or less, being the southeasterly part of Lot #5 in the Sixth Range of lots in said Groton, the southwesterly part of Lot #45 in the Seventh Range in said Town and northwesterly part of Lot 43 in the Seventh Range of lots in said Town and the northeast part of lot #4 in the Sixth Range of lots in said Town. Being all that part of the land conveyed by Leo Spitz to Fred P. Weeks, February 25, 1921, lying above and easterly of the old and now abandoned highway leading from Sabin Norris Farm to North Groton. (See Grafton County Records, Book 560, Page 62) which said premises are set forth in the deed recorded in Book 560, Page 62 as follows: All that tract or parcel of land situated in Groton, bounded and described as follows: Beginning at the northeasterly corner at a marked beech tree standing near land now or formerly of Samuel G. Fletcher, thence westerly on the southerly line of said Fletcher land and following the brook to the "Parsley Farm," so-called; thence southerly twenty (20) rods, more or less; thence Westerly by the "Mill Brook," so-called; thence southerly on the westerly bank of said brook at high water mark as far as S. P. Fletcher bought of Elbridge Tilton; thence In the same direction following said brook to a stake and stones; thence easterly on the westerly line of the Spaulding land, so-called, to the old highway and stake and stones; thence northerly following the old highway to the bound begun at. Excepting and reserving about one-half (½) acre which William F. Simpson conveyed to the Valencia Mica Company whereon said Mica Company cleaning shop stands.

- Property 8 -

XIV. Certain tract or parcel of land located in the Town of Groton, County of Grafton, State of New Hampshire, conveyed by the Town of Groton to The Draper Corporation by Quitclaim Deed dated June 26, 1951 recorded in the Grafton County Registry of Deeds at Book 809, Page 215, described therein as being the 206 acre Welcome Smith Place.

- Property 9 -

XVI. [Three of the] [f]our certain tracts or parcels of land located in the Town of Groton, Grafton County, State of New Hampshire, conveyed by Edward F. McGee, Administrator, to Draper Corporation by Fiduciary Deed dated February 8, 1958, recorded in the Grafton County Registry of Deeds at Book 910, Page 515, and described therein as follows:

TRACT ONE

Four hundred twenty (420) acre Spaulding and Bacon Place, so-called, taxed in 1935 to Livona G. Smith (sometimes known as Lavona G. Smith) the same having been deeded to the Town of Groton by a tax collector's deed on October 10, 1938, said deed being recorded in the Grafton County Registry, Book 704, Page 114, and conveyed to J. Emery Dow by said Town of Groton by Selectmen's Deed dated November 10, 1952, and recorded in the Grafton County Registry, Book 830, Page 405, more fully described as follows:

Bounded northerly by the Rumney town line; easterly by land now or formerly of the New Hampshire Land Company and land of the Estate of the late George P. French; southerly by land now or formerly of the New Hampshire Land Company and land of the Estate of said French; westerly by land now or formerly of Harry Emmons, being the Bacon Farm, so-called, containing 75 acres, more or less, see Grafton County Records, Book 583, Page 127.

Also another certain lot or parcel of land in said Groton as shown on Plan 37 drawn by C. E. Varney, Surveyor, in 1907 (Recorded Vol. 530, Page 152). Containing 224 acres, more or less. See Grafton County Records, Book 583, Page 544.

Meaning and intending to convey the same premises conveyed to Livona G. Smith and Earle M. Barney by David W. Gibson et als. by said deeds dated November 26, 1924, and recorded in the Grafton County Registry, Book 583, Page 544, and in Book 583, Page 127, except that portion thereof conveyed to the Parker-Young Company by Livona G. Smith by deed dated June 7, 1928, and recorded in Book 607, Page 133. See also quitclaim deed from Earle M. Barney to Livona G. Smith dated July 30, 1926, and recorded in the Grafton County Records, Book 596, Page 214.

TRACT TWO

Thirty-two (32) acre French land taxed in 1946 to E.W. Clough and being the same premises described in a tax collector's deed to the Town of Groton issued September 27, 1949, and recorded in the Grafton County Registry, Book 786, Page 260, conveyed to J. Emery Dow by said Town of Groton by Selectmen's Deed dated November 10, 1952, and recorded in the Grafton County Registry, Book 830, Page 407.

TRACT THREE

Sixty (60) acres, Lot 14, 3rd. Division, 5th Range, taxed in 1947 to O.A. Patterson.

Being the same premises described in a tax collector's deed to the Town of Groton issued September 29, 1950, and recorded in the Grafton County Registry, Book 802, Page 399, and conveyed to J. Emery Dow by said Town of Groton by Selectmen's Deed dated November 10, 1952, and recorded in the Grafton County Registry, Book 830, Page 409.

SPECIAL EXCEPTIONS - GRAFTON COUNTY - SECTION A:

4. The premises conveyed by Catherine B. Glover to Draper Corporation by deed dated October 16, 1945, recorded at Book 730, Page 462, are subject to:

   a. Parcel 3, an exception and reservation to Fred P. Weeks of a right to cross and recross a portion of Parcel 3, being the reservation described in said deed.

   b. Parcels 4 through 12, an exception and reservation of all mineral and mining rights together with the right to enter for the purpose of mining and removing minerals, all as referred to in said deed.

5. The parcel of land described in a deed of the Town of Groton to Draper Corporation dated April 29, 1949, recorded at Book 775, Page 405, is subject to mineral rights to a mine conveyed to F. E. Balden as reserved in a deed of Anna M. Butterfield to Frank E. E. Butterfield dated January 18, 1927, recorded at Book 598, Page 28.

6. The premises conveyed by Tobey Lumber Company, Inc. to Draper Corporation by deed dated October 1, 1949, recorded at Book 789, Page 209, are subject to the effect, if any, of certain rights of way across a portion of the premises for access to mica mines as referred to in the deed of Harry D. Collins to Tobey Lumber Company, Inc. dated December 10, 19_5, recorded at Book 657, Page 239.

7. The premises conveyed by Town of Groton to Draper Corporation by deed dated June 26, 1951, recorded at Book 809, Page 215, known as the "Welcome Smith Place" is conveyed without warranty of title.

8. The premises described in a deed of Calley & Currier Company to Draper Corporation dated December 13, 1970, recorded at Book 937, Page 555, are subject to:

   a. An exception and reservation of mining rights in the premises.

   b. An easement and right of way conveyed by Calley & Currier Company to Grafton County Power Company by deed dated April 20, 1929, recorded at Book 612, Page 521.

9. The premises described in a deed of Anthony B. Chase to North American Rockwell Corporation dated March 7, 1968, recorded at Book 1068, Page 92, are subject to:

   a. The reservation to Sewell N. Kinne of mining and mineral rights located on a portion of the premises as described in the deed of Earl M. Barney and Elva Barney to Anthony B. Chase dated March 9, 1966, recorded at Book 1031, Page 11.

17. The effect, if any, of an easement deed of Draper Division, Rockwell International, to New Hampshire Electric Co-op, Inc. and New England Telephone Company over a strip of land 30' in width on the north side of North Groton Road in the Town of Groton dated May 18, 1973, recorded at Book 1197, Page 249.

19. The effect, if any, of an easement deed of Draper Corporation Division, Rockwell International, to New Hampshire Electric Co-op, Inc. and New England Telephone and Telegraph Company 15' in width along North Groton Road in the Town of Groton dated November 14, 1974, recorded at Book 1253, Page 372.

22. The following notices of Current Use Registration (to the extent they apply to the premises):

   a. Town of Groton – October 19, 1979 – Book 1376, Page 162.
   c. Town of Groton – November 20, 1980 – Book 1376, Page 818.
   d. Town of Groton – January 4, 1982 – Book 1420, Page 480.
   e. Town of Groton – December 15, 1982 – Book 1451, Page 106.
   f. Town of Groton – January 18, 1984 – Book 1451, Page 743.

26. Easement deed of Yorkshire Timber Company to New England Telephone and Telegraph Company, dated June 22, 1981, recorded at Book 1427, Page 313, Town of Groton, exclusive right to maintain anchors, bolts & braces within 15 ft. along Halls Brook State Road to support utility lines located in the road.

34. Easement Deed of Yorkshire Timber Company to New Hampshire Electric Cooperative, Inc. and New England Telephone and Telegraph Company, dated April 27, 1990, recorded in Book 1875, Page 547, Town of Groton, utility line easement 30 feet in width.

35. Easement Deed of Yorkshire Timber Company to New Hampshire Electric Cooperative, Inc. and New England Telephone and Telegraph Company, dated June 7, 1993, recorded in Book 2063, Page 893, Town of Groton, utility line easement 30 feet in width.

40. Deed out of Yorkshire Timber Company to Green Acre Woodlands, Inc., dated September 16, 1996, recorded at Book 2225, Page 996.

SECTION E - LAND/VEST LANDS

- Property 1 –

Being a portion of the lands conveyed to Yorkshire Timber Company by deed of Land/Vest Incorporated, General Partner of Forest Lands Associates, dated January 26, 1978, recorded at Book 1329, Page 608 of the Grafton County Registry of Deeds.

TRACT #3 – C.L. BLANCHARD LOT

A certain tract or parcel of land situated in said Groton and being the same premises described in deed recorded in said Registry at Book 834, Page 393. Intending to convey the "C.L. Blanchard Lot" described in the deed of Forest Lands, Inc. to Land/Vest Incorporated dated December 30, 1969 and recorded in said Registry at Book 1129, Page 4 and re-recorded in said Registry at Book 1135, Page 155.

- Property 2 -

One certain tract or parcel of land situated in the Town of Groton, Grafton County, State of New Hampshire, being a portion of that which was conveyed to Yorkshire Timber by deed of Land/Vest Incorporated, General Partner of Forest Lands Associates, dated January 26, 1978, recorded at Book 1329, Page 600 of the Grafton County Registry of Deeds, and bounded and described therein as follows:

TRACT #4 - VALENCIA MINE LOT

A certain tract or parcel of land situated on the easterly side of the Norris Road, so-called, in said Groton, bounded and described as follows:

Beginning at a point on the easterly limit of the Norris Road, said point being the northwesterly corner of the premises;

THENCE by the land now or formerly of Draper Corporation in three courses as follows for the distances indicated:

(1) S 52° E, 25 chains to a point;

(2) S 36° W 18 chains to a point; and

(3) N 52° W 23 chains to a point on the easterly limit of the Norris Road;

THENCE in a general northeasterly direction along the easterly limit of the Norris Road to the point of beginning.

All distances are more or less, all bearings are magnetic (1957).

Being the "Valencia Mine Lot" described in a Warranty Deed from Forest Lands, Inc. to Land/Vest, Incorporated, as General Partner of Forest Lands Associates, recorded in said Registry Book 1129, Page 4, and re-recorded in Book 1135, Page 155. See also Decree of the Grafton County Superior Court in the matter of Land/Vest, Incorporated, as General Partner, of Forest Lands Associates vs. Valencia Mica Company, et. als. Equity 77-541, dated February 9, 1978 and recorded in said Registry, Book 1329, Page 594.

See also: Plan titled "Wilson/Hackett/Forest Products/Valencia Lots, Groton, N.H. Scale 1" = 10 chains, August 1957" by W. McConnell, Traced by: E.E. Macomber and Revised June 11, 1971 by E.E. Macomber.

The above-described Valencia Mine Lot is conveyed subject to any outstanding mining and mineral rights, if any there be to the extent the same may still be in force.

SECTION F - GREEN ACRE WOODLANDS LAND

Land conveyed to Yorkshire Timber Company by deed of Green Acre Woodlands, Inc., dated October 9, 1996, recorded at Book 2225, Page 998 of the Grafton County Registry of Deeds:

Beginning at a stone pile being the northwest corner of Lot 5, Range 8, Division 3 in said Groton; thence

North 52° 33' West 396.4 feet along other land now or formerly of Yorkshire Timber Co. to a corner; thence

North 27° 21' East 1807.2 feet along said Yorkshire Timber Co. to a corner; thence South 52° 50' East 659.4 feet along said Yorkshire Timber Co. to a corner; thence

South 35° 43' West 1783.4 feet along said Yorkshire Timber Co. to the point of beginning; containing 21.6 acres, more or less.

Being a portion of the premises described in the deed of Marcalus Manufacturing Company, Inc. to Franconia Paper Corp., recorded in the Grafton County Registry of Deeds Book 800, Page 341 and as shown on the plan entitled "Boundary Line Adjustment Between Green Acre Woodlands, Inc. and Yorkshire Timber Co., Groton, N.H." dated October 10, 1995 recorded in said Registry as Plan #8291. A more particular description is found as Parcel #3 of Book 485, Page 79. Also reference the name change of Franconia Paper Corp. to Green Acre Woodlands, Inc. recorded in said Registry Book 1145, Page 174.

SECTION G - ESTY LAND

Being premises conveyed to Yorkshire Timber Company by deed of Alan E. Esty, dated July 11, 1989, recorded at Book 1821, Page 45 of the Grafton County Registry of Deeds.

All of the right, title and interest of the late Donald Esty in and to "mining rights on 100 Acre Valencia Land" in GROTON, Grafton County, State of New Hampshire, as described in and conveyed by Quitclaim deed from the Selectmen of the Town of Groton to Donald Esty and recorded in the Grafton County Registry of Deeds, Book 1016, Page 176.

The grantor intends hereby to convey the same rights conveyed to him by deed of George T. Ray, Administrator of the Estate of Donald E. Esty, dated June 7, 1976, recorded in Book 1285, Page 132 of the Grafton County Registry of Deeds.

636278_1.DOC

Note: An Amendment to this Notice will set forth the Legal Description of the Operating Leased Premises

(10)

Doc # 0020047 Nov 5, 2007 1:54 PM
Register of Deeds, Grafton County

BK3464PG0526

EXHIBIT C

NOTICE OF OPTION AGREEMENT

This Notice of Option Agreement is dated as of August 31, 2005, by and between **Green Acre Woodlands, Inc.**, a New Hampshire corporation (the "PROPERTY OWNER"), and **Wind Works LLC**, a Vermont limited liability company (the "COMPANY").

WHEREAS, the parties hereto have entered into an Option Agreement dated as of August 31, 2005 with respect to a lease burdening the Premises (described below); and

WHEREAS, the parties hereto desire to provide notice to third parties of said Option Agreement by recording this Notice in the Registry of Deeds for the county in which the Premises are located.

NOW THEREFORE, the parties agree as follows:

Section 1: Option, Description of Premises. PROPERTY OWNER does hereby grant to the COMPANY an option to obtain an exclusive lease on certain premises as described on **Exhibit A** attached hereto (the "Premises") for the purpose of wind analysis, wind energy facility construction, operation and maintenance, the construction, operation and maintenance of electric power lines and other related uses and a non-exclusive lease for ingress and egress to and from the wind energy facility. .

Section 2: Term of Option. The option may be exercised anytime during the period commencing August 31, 2005 and ending August 31, 2006. The initial exercise period may be extended for four (4) one (1) year periods upon payment to the PROPERTY OWNER of such amounts as are specified in the Option Agreement.

Section 3: Restriction. Until the expiration of the option, the PROPERTY OWNER shall not enter into any negotiation, agreements or discussion with third parties regarding any lease, easement, license or other agreement that would permit a third party to install any wind equipment on the Premises or otherwise utilize the Premises' wind for any purpose.

Section 4: Assignment. The COMPANY may assign the Option Agreement without the prior written consent of PROPERTY OWNER, as set forth in the Option Agreement.

Section 5: Successors and Assigns. All rights and liabilities herein given to, or imposed upon, the respective parties hereto shall extend to and bind the several respective heirs, executors, administrators, successors and permitted assigns of said parties.

Section 6: Addresses of Parties. The parties' addresses as set forth in the Option Agreement are as follows:

PROPERTY OWNER:	COMPANY:
Green Acre Woodlands, Inc. P.O. Box 444 Elmwood Park, NJ 07407	Wind Works LLC P.O. Box 245 823 Ferry Road Charlotte, VT 05445

Section7: Location of Option Agreement. The fully executed Option Agreement between the parties hereto is available by contacting the COMPANY.

(Remainder of page intentionally left blank; signature page to follow.)

WIND WORKS LLC-GREEN ACRE WOODLANDS, INC. WIND OPTION AGREEMENT; 2005-08-10

IN WITNESS WHEREOF, the parties have executed this Notice of Option Agreement as of the date first above written.

Witnesses:

____

Printed DERMOT McGUIGAN

COMPANY:

WIND WORKS LLC

By: Brian Killkelley

Name: Brian KillKelley

Title: LLC Member/Manager

PROPERTY OWNER:

GREEN ACRE WOODLANDS, INC.

Florence E. Noren

Printed FLORENCE E NOREN

By: R L Marcalus

Name: R.L. MARCALUS

Title: PRESIDENT

____

Printed______________________

By: ______________________

Name: ______________________

Title: ______________________

WIND WORKS LLC-GREEN ACRE WOODLANDS, INC. WIND OPTION AGREEMENT; 2005-08-10

Acknowledgements

STATE OF New Jersey)
COUNTY OF Bergen)ss.:

On the 31 day of August, 2005 before me, the undersigned, personally appeared R L Marcalus personally known to me or proved to me on the basis of satisfactory evidence to be the individual whose name is subscribed to the within instrument and acknowledged to me that he/she executed the same in his/her capacity, that by his/her signature on the instrument, the individual, or the person upon behalf of which the individual acted, executed the instrument.

Florence E. Noren

Notary Public

STATE OF Vermont)
COUNTY OF Chittenden)ss.:

FLORENCE E. NOREN
NOTARY PUBLIC OF NEW JERSEY
Commission Expires October 10, 2008

On the 10th day of August, 2005 before me, the undersigned, personally appeared Brian Killkelley personally known to me or proved to me on the basis of satisfactory evidence to be the individual whose name is subscribed to the within instrument and acknowledged to me that he/she executed the same in his/her capacity, that by his/her signature on the instrument, the individual, or the person upon behalf of which the individual acted, executed the instrument.

[signature]

Notary Public

My Commission Expires
February 10, 2007
Notary Public

EXHIBIT A

To Notice of Option Agreement

Description of Premises:

All real property owned by the PROPERTY OWNER as set forth in the warranty deed from Grantors to PROPERTY OWNER ("Grantee") as recorded in the Grafton County Registry of Deeds, being bounded and described as follows:

Deed Book and Page	Grantor	Grantee	Date
800-341[1]	Marcalus Mfg. Co., Inc.	Franconia Paper Corp.	4/26/1950
980-141	John R. French	Franconia Paper Corp	1/16/1963
1041-19	John R. French	Franconia Paper Corp	7/8/1966
1166-581	Lloyd E. French	G.A.W., Inc.	5/4/1972
2225-996	Yorkshire Timber Co.	G.A.W., Inc.	9/16/1996
2165-595	State of N.H. (Boundary Line Agreement)	G.A.W., Inc.	8/9/1995
1145-174	Franconia Paper Corp. (Name Change)	G.A.W., Inc.	7/9/1971
1435-121	Graham & Margaret Nelson	G.A.W., Inc.	11/13/1981
3009-88	P.K. Brown & Sons	G.A.W., Inc.	6/11/2004

[1] Kenrick, Wright, McCoy & Weeks Lots. Except GAW to Yorkshire Timber Co., 2225-998, 10/9/1996

(7)

BK3494PG0041

MEMORANDUM OF ASSIGNMENT

This **Memorandum of Assignment** (this "Memorandum") is dated as of November 15, 2007, and is by and between Wind Works LLC, a Vermont limited liability company ("Assignor"), and Groton Wind, LLC, a Delaware limited liability company ("Assignee").

RECITALS

WHEREAS, Assignor and Assignee have entered into that certain Assignment and Assumption Agreement (the "Assignment"), dated as of November 15, 2007 (the "Effective Date"), pursuant to which Assignor has assigned, transferred, sold and conveyed to Assignee, among other things, all of its right, title and interest in and to that certain Option Agreement, dated as of September 30, 2006, by and between Green Acre Woodlands, Inc. and Wind Works LLC (the "Land Contract"), a memorandum of which has been recorded in book 3464, page 526 of the Public Records of Grafton County, New Hampshire (the "County") relating to the real property described in Schedule 1 attached hereto (the "Property"); and

WHEREAS, Assignor and Assignee desire to provide notice to third parties of the Assignment by recording this Memorandum in the Public Records of the County.

AGREEMENT

NOW, THEREFORE, Assignor and Assignee agree as follows:

1. Pursuant to the Assignment, Assignor has assigned, transferred, sold and conveyed to Assignee all of Assignor's right, title and interest in and to the Land Contract effective as of the Effective Date.

2. A copy of the fully executed Assignment is available at the offices of Assignee, located at 201 King of Prussia Road, Suite 500, Radnor, PA 19087.

3. This Memorandum and the Assignment are governed by and construed in accordance with the laws of the State of New York without regard to applicable conflict of law principles (other than Section 5-1401 of the New York General Obligations Law).

4. This Memorandum may be executed in counterparts, each of which will be deemed to be an original and all of which together constitute one and the same instrument.

[SIGNATURE PAGE FOLLOWS]

Hogan + Hartson

Doc # 0003061 Feb 28, 2008 1:25 PM
Register of Deeds, Grafton County

STATE OF NEW HAMPSHIRE
DEPARTMENT OF REVENUE ADMINISTRATION
REAL ESTATE TRANSFER TAX
***** Thousand 1 Hundred 31 Dollars
DATE 02/28/2008 GR021487 AMOUNT $ *****131.00

IN WITNESS WHEREOF, Assignor and Assignee have caused this Memorandum of Assignment to be duly executed by their respective representatives thereunto duly authorized, all as of the day and year first above written.

ASSIGNOR

WIND WORKS LLC

By: ______________________________
Name: Dermot McGuigan
Title: Manager

ASSIGNEE

GROTON WIND, LLC

By: ______________________________
Name:
Title:

By: ______________________________
Name:
Title:

IN WITNESS WHEREOF, Assignor and Assignee have caused this Memorandum of Assignment to be duly executed by their respective representatives thereunto duly authorized, all as of the day and year first above written.

ASSIGNOR

WIND WORKS LLC

By: ______________________
Name: Dermot McGuigan
Title: Manager

ASSIGNEE

GROTON WIND, LLC

By: ______________________
Name: Martin Mugica
Title: Manager

By: ______________________
Name: Pablo Canalas
Title: Manager

IBERDROLA
NOV 12 2007
VISADO LEGAL

ASSIGNOR ACKNOWLEDGEMENT

STATE OF VERMONT)
COUNTY OF CHITTENDEN) ss.:

On the 13th day of November, 2007 before me, the undersigned, personally appeared Dermot McGuigan ~~personally known to me or~~ proved to me on the basis of satisfactory evidence to be the individual whose name is subscribed to the within instrument and acknowledged to me that he/she executed the same in his/her indicated capacity, that by his/her signature on the instrument, the individual, or the person upon behalf of which the individual acted, executed the instrument.

Christopher J Loff
Notary Public

ASSIGNEE ACKNOWLEDGEMENT

STATE OF PA)
COUNTY OF Delaware) ss.:

On the 12 day of November 2007 before me, the undersigned, personally appeared Martin Mugica and ——, each of whom are personally known to me or proved to me on the basis of satisfactory evidence to be the individuals whose names are subscribed to the within instrument and who each acknowledged to me that he/she executed the same in his/her indicated capacity, that by his/her signature on the instrument, the individual, or the person upon behalf of which the individual acted, executed the instrument.

Notary Public

COMMONWEALTH OF PENNSYLVANIA
NOTARIAL SEAL
JAMIE WHITE, Notary Public
Radnor Twp., Delaware County
My Commission Expires September 26, 2011

BK3494PG0046

ASSIGNEE ACKNOWLEDGEMENT

STATE OF PA)
COUNTY OF Delaware) ss.:

On the 16 day of November, 2007 before me, the undersigned, personally appeared Pablo Canales and ———, each of whom are personally known to me or proved to me on the basis of satisfactory evidence to be the individuals whose names are subscribed to the within instrument and who each acknowledged to me that he/she executed the same in his/her indicated capacity, that by his/her signature on the instrument, the individual, or the person upon behalf of which the individual acted, executed the instrument.

Jamie White
Notary Public

COMMONWEALTH OF PENNSYLVANIA
NOTARIAL SEAL
JAMIE WHITE, Notary Public
Radnor Twp., Delaware County
My Commission Expires September 26, 2011

IBERDROLA
NOV 12 2007
VISADO LEGAL

Schedule 1

Description of Property

All real property owned by Green Acre Woodlands, Inc. as set forth in the following warranty deeds:

Grafton County Registry of Deeds Deed Book and Page	Grantor	Grantee	Date
800-341	Marcalus Mfg. Co., Inc.	Franconia Paper Corp.	04/26/1950
980-141	John R. French	Franconia Paper Corp.	01/16/1963
1041-19	John R. French	Franconia Paper Corp.	07/08/1966
1166-581	Lloyd E. French	Green Acre Woodlands, Inc.	05/04/1972
2225-595	Yorkshire Timber Co.	Green Acre Woodlands, Inc.	09/16/1996
2165-595	State of New Hampshire (Boundary Line Agreement)	Green Acre Woodlands, Inc.	08/09/1995
1145-174	Franconia Paper Corp. (Name Change)	Green Acre Woodlands, Inc.	07/09/1971
1435-121	Graham & Margaret Nelson	Green Acre Woodlands, Inc.	11/13/1981
3009-88	P.K. Brown & Sons	Green Acre Woodlands, Inc.	06/11/2004

NOTICE OF LEASE

NOTICE IS HEREBY GIVEN of a certain lease by and between the parties identified in this Notice of property owned by M. Daniel Smith, Trustee of the M. Daniel Smith Revocable Trust u/t/a dated November 15, 1988, as amended, and located in Groton, Grafton County, New Hampshire, as follows:

LESSOR:	M. Daniel Smith, Trustee of the M. Daniel Smith Revocable Trust u/t/a dated November 15, 1988, as amended
LESSEE:	Groton Wind, LLC
PREMISES:	Certain property located on the easterly side of Hall Brook at the Rumney/Groton town line, a/k/a Tax Map 10, Lot 31, Groton, Grafton County, New Hampshire, further identified on SCHEDULE A attached hereto.
TERM:	The term of the Lease shall be twenty (25) years beginning on the 22nd day of January, 2010, ~~2009~~ (the "Effective Date"), with two (2) renewal terms of ten (10) years each.

(Signatures begin on follow page.)

LESSOR:

M. Daniel Smith, Trustee of the
M. Daniel Smith Revocable Trust u/t/a dated
November 15, 1988

STATE OF NEW HAMPSHIRE
COUNTY OF Strafford

On this 26th day of December, 2009, before me, the undersigned officer, personally appeared M. Daniel Smith, in his capacity as Trustee of M. Daniel Smith Revocable Trust u/t/a dated November 15, 1988, as amended, and that he, being authorized so to do, executed the foregoing instrument for the purposes therein contained on behalf of said Trust.

(Notarial Seal)

Notary Public/Justice of the Peace
My Commission Expires: ELI TILLINGHAST, Notary Public
My Commission Expires April 6, 2010

LESSEE:

Groton Wind, LLC

By: ______________________
Name: Rany Raviv
Title: Authorized Representative
Duly authorized

Scott Jacobson
Authorized Representative

STATE OF Oregon
COUNTY OF Multnomah

The foregoing instrument was acknowledged before me this 22nd day of January ~~2009~~ 2010, by Rany Raviv & Scott Jacobson, a duly authorized representatives of Groton Wind, LLC, a Delaware limited liability company, on behalf of the said limited liability company.

OFFICIAL SEAL
CHELSEA C MC FARLAND
NOTARY PUBLIC - OREGON
COMMISSION NO. 443054
MY COMMISSION EXPIRES OCTOBER 1, 2013

____
Notary Public/Justice of the Peace
Print Name: Chelsea McFarland
My Commission Expires: 10/1/2013

620722_1.DOC

SCHEDULE A

Legal Description

A certain tract of land in Groton, County of Grafton and State of New Hampshire, bounded and described as follows:

Beginning at a stone bound on the Town line of Rumney and Groton on the easterly side of Hall Brook;

Thence, South 55° East seventy-six and 84/100 (76.84) chains along the said Rumney-Groton Town Line, to a stone set with stones at land of Draper Corporation;

Thence, South 37° West, ten and 38/100 (10.38) chains along said Draper land to a stone corner at the top of the mountain;

Thence, westerly forty-five (45) chains along land of said Draper, this being the height of land, to a spruce tree, spotted;

Thence, South 38° West, sixteen and 29/100 (16.29) chains along said Draper land to a stake and stone;

Thence, South 53-1/2° East, forty-one and 90/100 (41.90) chains along said Draper land to a stake and stones;

Thence, South 37° West, seven and 70/100 (7.70) chains along said Draper land to the Old Stage Road leading from North Groton to Plymouth as shown on said map hereinafter referred to;

Thence, westerly thirty-three and 19/100 (33.19) chains along said Old Stage Road to a stake and stones at land of LaTulippe;

Thence, North 52° West, twenty-eight and 85/100 (28.85) chains along the land of said LaTulippe to the Old Woods Road leading from Blanchard Bridge to land of Mrs. Spaulding and the said Rumney-Groton Town Line as shown on aforesaid map;

Thence, northerly along said Old Woods Road three and 65/100 (3.65) chains to an ash tree on the northerly side of said Old Woods Road to land of Craddock;

Thence, North 8-3/4° West, four and 82/100 (4.82) chains along land of said Craddock to an iron pin beside a small brook;

Thence, westerly three and 80/100 (3.80) chains along said small brook to an iron pipe on the easterly side of Hall Brook Road at the corner known locally as "The Horn";

Thence, northerly along the easterly side of said Hall Brook Road thirty-five and 15/100 (35.15) chains to a point where the said Hall Brook and the said Hall Brook Road separate;

Thence, continuing northerly along the said Hall Brook thirty-eight and 80/100 (38.80) chains to the point of beginning on the said Rumney-Groton Town Line.

Aforesaid premises are set forth on a Map of Land dated August 1, 1968, made by John R. French, Surveyor, duly recorded in New Hampshire, Grafton County, Registry of Deeds.

ALSO conveying a right-of-way to the premises over Mrs. Spaulding's land across the Rumney Town Line as conveyed to the Grantor; also another right-of-way over the property of Rene Latulippe, Sr. over the old road from Blanchard Bridge to the "carriage road." This same right of way is also granted to the Draper Corporation.

Being the first described tract conveyed by Warranty Deed from Maurice Daniel Smith and Lois Ketterson Smith to Maurice Daniel Smith and Lois Ketterson Smith dated November 15, 1988 and recorded in Grafton County Registry of Deeds in Book 1774, Page 472. **See** also (1) Warranty Deed from Maurice Daniel Smith (a/k/a M. Daniel Smith) and Lois Ketterson Smith (a/k/a Emily K. Smith) dated November 15, 1988 and recorded November 18, 1988 in the Grafton County Registry of Deed, Book 1774, Page 0472; and (2) Warranty Deed from M. Daniel Smith, a/k/a Daniel Smith, a/k/a Maurice Daniel Smith and Lois Emily K. Smith, a/k/a Emily K. Smith, a/k/a Lois Ketterson Smith to M. Daniel Smith, Trustee of the M. Daniel Smith Revocable Trust U/T/A dated November 15, 1988, said deed dated May 1, 2002 and recorded July 5, 2002 in the Grafton County Registry of Deeds, Book 2685, Page 0779.

Application Fee Calculation

Project #:	52036.00		
Project:	Groton Wind Farm		
Location:	Groton, New Hampshire		
Calculated by:	B. Anderson	Date:	2/9/10
Checked by:		Date:	
Title:	NHDES Alteration of Terrain Fee		

NHDES - Alteration of Terrain Fee

Disturbance Area: 5,036,579 sf
115.6 ac

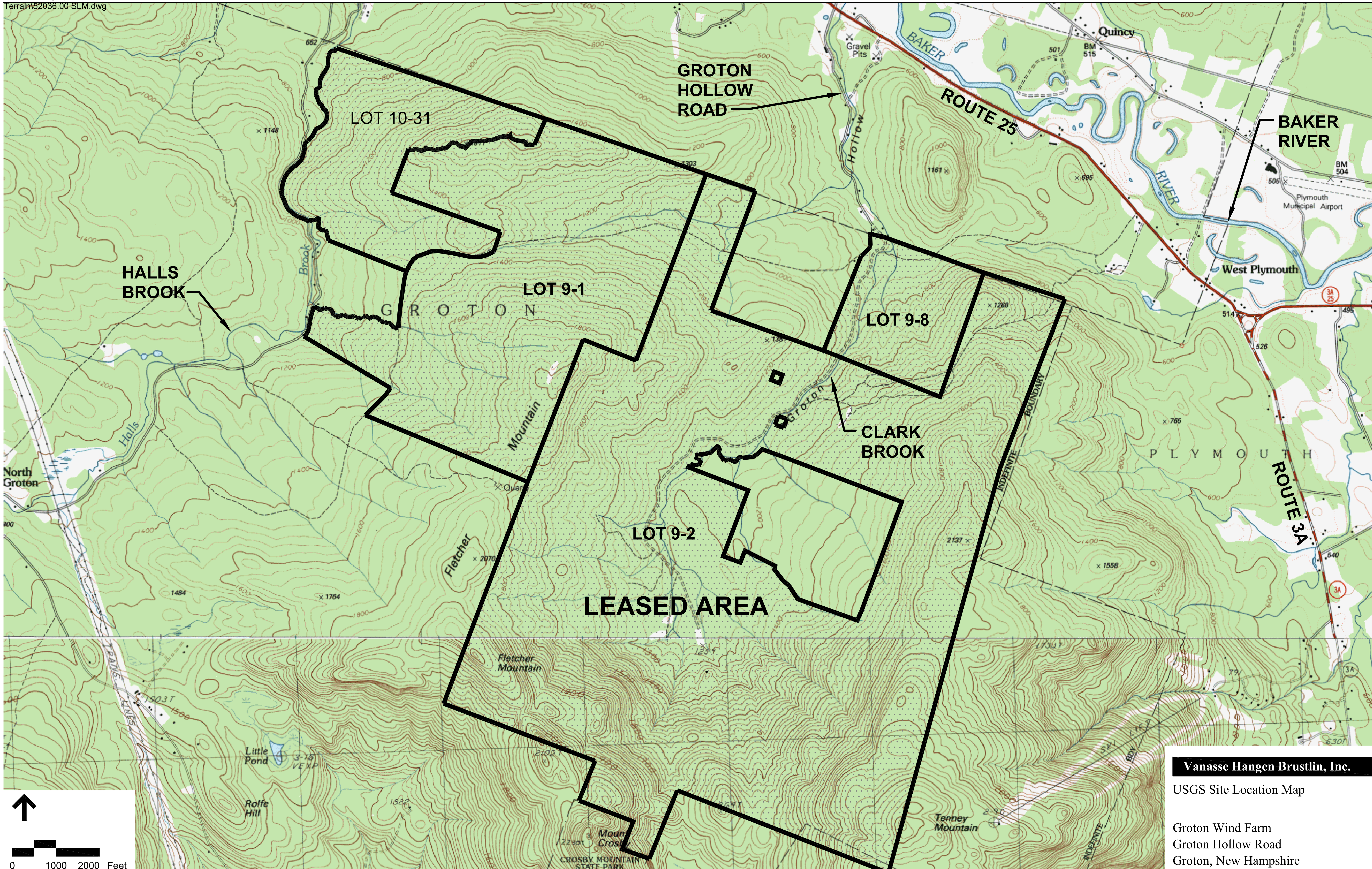
Unit Fee:	Disturbance (sf)		Fee
(eff. 7/1/07)	0	200,000	$ 1,250
	200,000	300,000	$ 1,750
	300,000	400,000	$ 2,250
	400,000	500,000	$ 2,750
	500,000	600,000	$ 3,250
	600,000	700,000	$ 3,750
	700,000	800,000	$ 4,250
	800,000	900,000	$ 4,750
	900,000	1,000,000	$ 5,250
	1,000,000	1,100,000	$ 5,750
	1,100,000	1,200,000	$ 6,250
	1,200,000	1,300,000	$ 6,750
	1,300,000	1,400,000	$ 7,250
	1,400,000	1,500,000	$ 7,750
	$500/add. 100,000 sf		

Total Fee: **$ 25,750**

Check (Payable to): *Treasurer - State of New Hampshire*

USGS Site Location Map

J:\52036.00\graphics\FIGURES\Alteration of Terrain\52036.00 SLM.dwg



Vanasse Hangen Brustlin, Inc.

USGS Site Location Map

Groton Wind Farm
Groton Hollow Road
Groton, New Hampshire

Application Checklist

REVIEW CHECK LIST FOR
COMPLETING AN ALTERATION OF TERRAIN APPLICATION

CHECK the box if the item has been provided and please be sure to review your application, prior to submitting. If an item does not apply, please state why. Don't forget to review the check list on the application form as well.

On plans provide:

[X] PE stamp
[X] Wetland delineation
[X] Temporary erosion control measures
* [X] Treatment for all stormwater runoff from impervious surfaces such as roadways (gravel roadways too), parking areas, and non-residential roof runoff. Guidance on treatment BMPs can be found in Volume 2, Chapter 4 of the NH Stormwater Management Manual. *(Note: Waiver requested for access roads and turbine pads)
[X] Pre-existing 2-foot contours
[X] Proposed 2-foot contours
[na] Drainage easements protecting the drainage/treatment structures
[X] Compliance with the Wetlands Bureau, RSA 482-A
http://des.nh.gov/organization/divisions/water/wetlands/index.htm
Note that artificial detention in wetlands is not allowed.
[na] Compliance with the Comprehensive Shoreland Protection Act, RSA 483-B
http://des.nh.gov/organization/divisions/water/wetlands/cspa
* [X] Benches. Benching is needed if you have more than 20 feet change in elevation on a 2:1 slope, 30 feet change in elevation on a 3:1 slope, 40 feet change in elevation on a 4:1 slope. *(Note: Waiver requested for certain slope conditions)

Provide the following details on the plans, as applicable:

[X] Typical roadway x-section
[X] Detention basin with inverts noted on the outlet structure
[X] Stone berm level spreader
[X] Outlet protection – riprap aprons
[X] A general installation detail for an erosion control blanket
[X] Silt fences or mulch berm
[X] Storm drain inlet protection – note that since hay bales must be embedded 4 inches into the ground, they are not to be used on hard surfaces such as pavement.
[ ] Hay bale barriers
[X] Stone check dams
[X] Gravel construction exit
[X] The treatment BMPs proposed
[X] Any innovative BMPs proposed

Construction Sequence/Erosion Control Notes

[X] Note that perimeter controls shall be installed prior to earth moving operations.
[X] Note that ponds and swales shall be installed early on in the construction sequence (before rough grading the site).
[X] Note that all ditches and swales shall be stabilized prior to directing runoff to them.
[X] Note that all roadways and parking lots shall be stabilized within 72 hours of achieving finished grade.
[X] Note that all cut and fill slopes shall be seeded/loamed within 72 hours of achieving finished grade.
[X] Note that all erosion controls shall be inspected weekly AND after every half-inch of rainfall.
[X] Note the limits on the open area allowed, see Env-Wq 1505.02 for detailed information.
Example note: *The smallest practical area shall be disturbed during construction, but in no case shall exceed 5 acres at any one time before disturbed areas are stabilized.*

☒ Note the definition of the word "stable." For example:

An area shall be considered stable if one of the following has occurred:

- *Base course gravels have been installed in areas to be paved.*
- *A minimum of 85 percent vegetated growth has been established.*
- *A minimum of 3 inches of non-erosive material such stone or riprap has been installed.*
- *Or, erosion control blankets have been properly installed.*

☒ Note the limit of time an area may be exposed. For example:
All areas shall be stabilized within 45 days of initial disturbance.

☒ Provide temporary and permanent seeding specifications.
(Reed canary grass is listed in the Green Book; however, this is a problematic species according to the Wetlands Bureau and therefore should not be specified).

☒ Provide winter construction notes that meet or exceed our standards.

Standard Winter Notes:

- *All proposed vegetated areas that do not exhibit a minimum of 85 percent vegetative growth by October 15, or which are disturbed after October 15, shall be stabilized by seeding and installing erosion control blankets on slopes greater than 3:1, and seeding and placing 3 to 4 tons of mulch per acre, secured with anchored netting, elsewhere. The installation of erosion control blankets or mulch and netting shall not occur over accumulated snow or on frozen ground and shall be completed in advance of thaw or spring melt events.*
- *All ditches or swales which do not exhibit a minimum of 85 percent vegetative growth by October 15, or which are disturbed after October 15, shall be stabilized temporarily with stone or erosion control blankets appropriate for the design flow conditions.*
- *After November 15, incomplete road or parking surfaces, where work has stopped for the winter season, shall be protected with a minimum of 3 inches of crushed gravel per NHDOT item 304.3.*

☒ Note at the end of the construction sequence that "Lot disturbance, other than that shown on the approved plans, shall not commence until after the roadway has the base course to design elevation and the associated drainage is complete and stable". – This note is applicable to single/duplex family subdivisions, when lot development is not part of the permit.

<u>Stormwater Management Report – preferably double sided, 1 page per side.</u>

☒ PE stamp

☒ Discussion of the discharge rates directed off-site. If there is an increase, provide a justification.

Drainage analyses, *preferably in the following order:*

- ☒ Pre-development analysis: Drainage diagram
- ☒ Pre-development analysis: Area Listing and Soil Listing
- ☒ Pre-development analysis: Node listing 1-year (if applicable), 2-year, 10-year and 50-year
- ☒ Pre-development analysis: Full summary of the 10-year storm
- ☒ Post-development analysis: Drainage diagram
- ☒ Post-development analysis: Area Listing and Soil Listing
- ☒ Post-development analysis: Node listing for the 2-year, 10-year and 50-year
- ☒ Post-development analysis: Full summary of the 10-year storm

Pre and post-development drainage area plans with the following – **submit this as a separate plan from the soil plans**:

- ☒ Labeled subcatchments, reaches and ponds
- ☒ Tc lines
- ☒ A clear delineation of the sub-catchment boundaries
- * ☐ Roadway station numbers *(Waiver requested do to scale of project)
- ☒ Culverts and other conveyance structures

☒ Color coded Site Specific Soil plan – **submit this as a separate plan from the drainage area plans**.
This can be an 11" x 17" if soil symbols and subcatchment boundaries are readable. It should be color coded: A = Green, B = yellow, C= orange, D=red, Water=blue, & Impervious = gray

Review the Area Listing and Soil Listing reports.

- [X] Hydrologic soil groups (HSG) match the HSGs on the soil maps provided.
- [X] There is the same or less HSG A soil area after development (check for each HSG).
- [X] There is the same or less "woods" cover in the post-development.
- [X] Undeveloped land was assumed to be in "good" condition.
- [X] The amount of impervious cover in the analyses is correct.
  Hint: A good check is to subtract the total impervious area used in the pre analysis from the total impervious area used in the post-analysis, does this number make sense? For residential projects without demolition occurring, a good check is to take this change in impervious area, subtract out the roadway and divide the remaining by the number of houses/units proposed. Does this number make sense?

- [X] Check the storage input used to model the ponds.
- [X] Check to see if the artificial berms pass the 50-year storm, i.e., make sure the constructed berms on ponds are not overtopped.
- [X] Check to see if the ponds need state Dam permits
  http://des.nh.gov/organization/divisions/water/dam/documents/damdef.pdf
- [X] Check the outlet structure proposed and make sure it matches that modeled
- [X] Check to see if the total areas in the pre and post analyses are same
- [X] Check to make sure the correct rainfall amount and SCS storm type was modeled.
  Hint: Coos, Carroll, and Grafton counties are Type II, all others Type III.
- [NA] Submit the Site Evaluation Report and infiltration calculations (Env-wq 1504.12 and 1504.13).

See Volume 2, Chapter 2-4, of the NH Stormwater Management Manual for guidance.

Please note that excavation projects, e.g., gravel pits, have similar requirements to that above, however the following are common exceptions/additions:

(not applicable)

- [ ] Drainage report is not needed if site does not have off-site flow.
- [ ] 5 foot contours allowed rather than 2 foot.
- [ ] No PE stamp needed.
- [ ] Add a note to the plans that the applicant must submit to the Department of Environmental Services a written update of the project and revised plans documenting the project status every five years from the date of the Alteration of Terrain permit.
- [ ] Reclamation notes.
  See NRCS publication titled: *Vegetating New Hampshire Sand and Gravel Pits* for a good resource.

[signature]	Peter Walker (VHB - Agent)	1/8/10
SIGNATURE OF PERMITTEE	PRINT NAME	DATE

**Please double-side your 8 ½" x 11" sheets where possible. However, please do not reduce the text such that more than one page fits on one side.*

Please visit http://des.nh.gov/organization/divisions/water/aot for more information about our program. Thank you.

Waiver Request(s)

ALTERATION OF TERRAIN WAIVER REQUEST FORM

R.S.A. 485-A:17

Department of Environmental Services - Water Division

29 Hazen Drive, PO Box 95

Concord, New Hampshire 03302-0095

Application Date: 02/2010

File Number (DES use): ______

Name of Project: Groton Wind Farm

Map & Lot Number: M9, L1, 2, 8, & un-numbered; M10, L31

Location of Project (town): Groton Hollow Road, Groton, NH

County: Grafton

Project Type: Other: Renewable Energy Project (Wind Farm)

1. Owner Information

Name: Refer to attached owners list

Email address (optional): ______

Contact Name: ______

Telephone Number: ______

Mailing Address: ______

Fax Number: ______

City/Town: ______

State: ______

Zip Code: ______

2. Person Requesting Waiver(s)

Name: Groton Wind, LLC

Email address (optional): echerian@iberdrolausa.com

Contact Name: Edward J. Cherian

Telephone Number: 603-369-3909

Mailing Address: 201 King of Prussia Road, Ste. 500

Fax Number: 603-369-3990

City/Town: Randor

State: PA

Zip Code: 19087

3. Waiver Request(s)

1) Env-Wq 1503.08 (m) — **100-yr Floodplain Supplementary Report**

Rule — Brief Description of Rule

Explanation of Request:	A waiver is requested to remove the requirement for a supplementary floodplain report because only a very small portion of the project site is located within the 100-yr floodplain of the Clark Brook as shown on the FEMA Flood Maps as Zone A (approximate methods). Additionally, the portions of the site that are within in the floodplain are at the uppermost portion of the floodplain. The proposed work within the floodplain is limited to a small section of reconstructed roadway that will result in a net cut in this area. Additionally, based on the project's hydrologic analysis, it is not anticipated that the project will have a significant impact on pre- versus post-development flow rates.
Permanent or Temporary:	Permanent.
Explanation of Alternative:	Not applicable.
Compliance with Env-Wq 1509.04:	Granting of the waiver will not result in an adverse impact on the environment because the project does not propose to reduce the flood storage capacity within the floodplain and is not anticipated to increase peak stormwater runoff rates. As such, the requirement for a supplementary report would only burden the applicant with additional project expenses and would not provide any appreciable benefit to the public or the environment.

2) Env-Wq 1504.08 (b) (2) b — **High Intensity and Site-Specific Soil Mapping**

Rule — Brief Description of Rule

Explanation of Request:	A waiver is requested to remove the requirement for High Intensity Soil Mapping and/or Site-Specific Soil Mapping for the proposed areas of disturbance. The disturbance areas account for approximately 116 acres of the 7,382 acre drainage study area or 1.6 percent.
Permanent or Temporary:	Permanent.
Explanation of Alternative:	Not applicable.
Compliance with Env-Wq 1509.04:	Granting of the waiver will not result in an adverse impact on the environment because the additional information that the required mapping would provide would have an insignificant effect on the results of the drainage analysis. It is anticipated to have an insignificant effect based on the relatively small size of the mapping area relative to the size of the overall drainage study area.

3) Env-Wq 1504.08 (e) | **Drainage Area Plan Requirements**

Rule | Brief Description of Rule

Explanation of Request: A waiver is requested to allow the following for the required drainage area plans: 1) the use of a drawing scale smaller than 1”=50’, 2) the use of different contour intervals from those on the site plans, and 3) not to show the roadway stationing.

Permanent or Temporary: Permanent.

Explanation of Alternative: The applicant proposed to use an appropriate scale and contour interval that will adequately convey the drainage information and will be appropriate for the overall size of the 7,382 acre drainage area.

Compliance with Env-Wq 1509.04: Granting of the waiver will not result in an adverse impact to the environment because the requested waiver deals only with graphical elements of the drainage plan. The intent of the request is to be able to convey the necessary information on the drainage plans while trying to minimize the number of sheets. This will result in plans that are easier to review and will more clearly show the intent of the project’s drainage analysis.

4) Env-Wq 1504.09 | **Calculation of Water Quality Volume (WQV)**

Rule | Brief Description of Rule

Explanation of Request: A waiver is requested to exclude the proposed gravel access drives, turbine pads, etc. from the calculation of the percent impervious area used in calculating the Water Quality Volume (WQV). These gravel areas will only be used on a limited basis to access the turbines for maintenance. Additionally, these areas do not fall under the definition of “Impervious Cover” stated under Env-Wq 1502.28 because they have a curve number of less than 98. It is the applicant’s understanding, based on a meeting with the NHDES on 10/6/09, that the major concern with stormwater would be sediment during construction.

Permanent or Temporary: Permanent.

Explanation of Alternative: Not. Applicable.

Compliance with Env-Wq 1509.04: Granting the waiver will not result in an adverse impact to the environment because the proposed access drives and other proposed gravel areas will only be used by maintenance vehicles on a limited basis. As such, these areas are not anticipated to result in a significant source of stormwater pollutants once the site is constructed. If the waiver were not granted a significant amount of additional undeveloped land area would be required to meet the stormwater treatment requirements associated with the higher WQV number even thought the runoff from these areas is not anticipated to be a significant source of pollutants. It should be noted that the gravel parking area for and the roof of the proposed Operation & Maintenance building has been included in the WQV calculation.

5) Env-Wq 1504.12 | **Site Evualation Report**

Rule | Brief Description of Rule

Explanation of Request: A waiver is requested to remove the requirement for a Site Evaluation Report. Due to the nature of the project and the project's site's shall depth to bedrock, stormwater infiltration systems are not being proposed.

Permanent or Temporary: Permanent.

Explanation of Alternative: Not applicable.

Compliance with Env-Wq 1509.04: Granting the waiver will not result in an adverse impact to the environment because the request is only asking for relief from the preparation of a report that is not needed because the project is not proposing stormwater infiltration practices.

6) Env-Wq 1507.04 | **Groundwater Recharge Requirements**

Rule | Brief Description of Rule

Explanation of Request: A waiver is requested to relieve the project of groundwater recharge requirements. The project site consists of mountainous terrain with a shallow depth to bedrock and mostly Hydrologic Group C soils. As such the site has minimum capacity for groundwater recharge.

Permanent or Temporary: Permanent.

Explanation of Alternative: Not Applicable.

Compliance with Env-Wq 1509.04: Granting the waiver will not result in an adverse impact to the environment because the existing site has a minimal capacity for groundwater recharge and the proposed development is not anticipated to significantly alter the amount of groundwater recharge that is currently occurring on the site.

7) Env-Wq 1508.19 | **Earthen Terraced Slope or Benching**

Rule | Brief Description of Rule

Explanation of Request: A waiver is requested to remove the requirement for slope benching for the project site. The existing site consists of large areas of slopes between 2:1 and 3:1 and has a very shallow depth to bedrock. In addition, it is anticipated that the proposed cut slopes that are over 10-15 ft high will be ledge cuts; and that all of the proposed earthen slopes will be stabilized with riprap, covered with loam and seeded. Due to the steep slopes of the existing terrain, providing benches would significantly increase the disturbance footprint of the project.

Permanent or Temporary: Permanent.

Explanation of Alternative: The applicant proposes to construct riprap slopes that will be top dressed with loam and seeded. This will help to provide stable slopes for the areas of the site where the height of the slopes exceed 20 feet. In addition, the proposed fill slopes will only have a minimal amount of runoff directed to them from only half of the gravel drives that are located at the top of the slopes.

Compliance with Env-Wq 1509.04: Granting the waiver will not result in an adverse impact to the environment because the proposed slopes will either be stabilized with riprap or will be ledge faces. The riprap cut slopes have been designed to have minimal stormwater runoff directed to them. If benches are required, the disturbance limits will increase significantly in order to tie into the relatively steep slopes of the existing ground.

4. Signature(s) Required

(1) The information provided is true, complete, and not misleading to the knowledge and belief or the signer; and

(2) The signer understands that any waiver granted based on false, incomplete, or misleading information shall be subject to revocation.

Refer to Owner Authorization Letters
Signature (owner) and Date

Name (owner)

Signature (person requesting waiver) and Date

Groton Wind, LLC (Edward Cherian)
Name (person requesting waiver)

Project Narrative

Project Narrative (Groton Wind Farm)

Groton Wind, LLC is proposing to construct a 48 megawatt renewable energy facility in Groton, New Hampshire. The facility will consist of twenty-four (24) four-hundred foot tall wind turbines to be located along the ridgelines of Tenney Mountain, Fletcher Mountain, and an un-named ridgeline in the northwest corner of the site. The proposed project is similar to the recent Wind Farm that was permitted through the NHDES and built on Lempster Mountain in Lempster, New Hampshire. In association with the turbines, the proposed project will require the construction of approximately 12 miles of gravel access drives, a meteorology station(s), and a 4,000 sf operation & maintenance building.

The 4,179–acre Site is located at the end of Groton Hollow Road in Groton, New Hampshire. The Site is bounded by the Town of Rumney to the north, the Town of Plymouth to the east, Mount Crosby and Tenney Mountain to the south, and Halls Brook to the west. The majority of the Site is located within the surface watershed of the Baker River with a small section of the Site located within the watershed of the Cockermouth River.

The Site is presently undeveloped and has an active logging operation occurring on it. Under existing conditions, storm water runoff flows down the mountain sides into several streams and drainage ways, with the majority of the site draining into the Clark Brook and ultimately the Baker River. The remaining portions of the site drain towards Halls Brook, Route 25, Route 3A, and Wise Brook.

The majority of the project will consist of the construction of the gravel access drives leading up to the wind turbines. These access drives will ultimately be 16 ft wide after the construction of the site and will be used on a very limited basis to provide access to the turbines for maintenance purposes. As such, the site is not anticipated to be a significant generator of stormwater pollutants. The pollutant of the most significant concern will be sediment associated with the construction of the facility.

Because this is an energy project, development of the site is governed by NH RSA 162-H and is subject to the requirements of the New Hampshire Site Evaluation Committee (NHSEC). Through the NHSEC process the project will require the following permits from the NH Department of Environmental Services:

- Alteration of Terrain Permit
- Wetlands Permit
- Individual wastewater Discharge Permit (for the O&M Building)

The proposed development will alter approximately 116 acres of land. In order to evaluate the project's effect on peak stormwater runoff rates a hydrologic model was developed to evaluate the existing and proposed drainage conditions on the Site.

The results of the analyses indicate that there is no significant change in peak discharge rates between the pre- and post-development conditions for the 2, 10, and 50 year storm events. The following Table provides a summary of the pre- and post-development peak discharge rates that are discussed further in the project's Drainage Report.

Peak Storm Water Runoff Rate Summary

			Peak Flow for Given Storm (cfs)		
Discharge Point		Condition	2-yr	10-yr	50-yr
D1	Clark Brook	Existing	105.7	761.7	1583.8
		Proposed	105.7	762.0	1584.4
			0.0	0.3	0.6
D2	Halls Brook/box culvert under Route 25	Existing	25.5	327.4	763.8
		Proposed	25.5	327.3	763.5
			0.0	-0.1	-0.3
D3	Pond/96" CMP under Route 25	Existing	6.6	128.7	336.2
		Proposed	6.6	128.5	335.7
			0.0	-0.2	-0.5
D4	Unnamed Stream/66" RCP Culvert under Route 25	Existing	3.6	88.3	245.5
		Proposed	3.6	88.3	245.5
			0.0	0.0	0.0
D5	Unnamed Stream/11' wide bridge under Route 3A	Existing	26.5	280.9	632.7
		Proposed	26.5	280.9	632.7
			0.0	0.0	0.3
D6	Unnamed Stream/15' wide bridge under route 3A	Existing	29.5	220.6	458.8
		Proposed	29.5	220.6	458.8
			0.0	0.0	0.0
D7	Wise Brook	Existing	18.8	102.2	194.5
		Proposed	18.8	102.1	194.3
			0.0	-0.1	-0.2

Drainage Report

Drainage Report

Proposed Groton Wind Farm

Groton Hollow Road
Groton, New Hampshire

Prepared for **Groton Wind, LLC**
Concord NH

Prepared by ***VHB*/Vanasse Hangen Brustlin, Inc.**
Bedford, New Hampshire

STATE OF NEW HAMPSHIRE
MICHAEL
C.
HANSEN
No. 12059
LICENSED
PROFESSIONAL ENGINEER

2/10/10

February 2010

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1

Introduction

Groton Wind, LLC is proposing to construct a 48 megawatt renewable energy facility in Groton, New Hampshire. The facility will consist of twenty-four (24) wind turbines to be located along the ridgelines of Tenney Mountain, Fletcher Mountain, and an un-named ridgeline in the northwest corner of the site. The Turbines are 256 feet at tower height and 399 feet with the blade at the 12:00 position. The proposed project is similar to the recent Wind Farm that was permitted through the NHDES and built on Lempster Mountain in Lempster, New Hampshire. In association with the turbines, the proposed project will require the construction of approximately 12 miles of gravel access drives (of which 2.3 miles is the upgrading of an existing logging road), a permanent meteorological tower and a 4,000 sf operations & maintenance building.

The Site is located on 4,179–acres of leased land at the end of Groton Hollow Road in Groton, New Hampshire. The Site is bounded by the Town of Rumney to the north, the Town of Plymouth to the east, Mount Crosby and Tenney Mountain to the south as well as the town of Hebron and portions of Groton, and Halls Brook to the west. The majority of the Site is located within the surface watershed of the Baker River with a small section of the Site located within the watershed of the Cockermouth River.

The Site is presently undeveloped and has an active logging operation occurring on it. Under existing conditions, storm water runoff flows down the mountain sides into several streams and drainage ways, with the majority of the site draining into the Clark Brook and ultimately the Baker River. The remaining portions of the site drain towards Halls Brook, Route 25, Route 3A, and Wise Brook.

The majority of the project will consist of the construction of the gravel access drives leading up to the wind turbines. These access drives will ultimately be 16 ft wide after the construction of the site and will be used on a very limited basis to provide access to the turbines for maintenance purposes. As such, the site is not anticipated to be a significant generator of stormwater pollutants. The pollutant of the most significant concern will be sediment associated with the construction of the facility.

The proposed development will alter approximately 116 acres of land. In order to evaluate the project's effect on peak stormwater runoff rates a hydrologic model was developed to evaluate the existing and proposed drainage conditions on the Site. The results of the analyses indicate that there will be an insignificant change in peak discharge rates between the pre- and post-development conditions for the 2, 10, and 50 year storm events. The pre- and post-development peak discharge rates are presented in the Storm Water Management Impacts Section of this report.

In order to mimic the existing drainage patterns as much as possible stone mattresses are being proposed approximately every 100 feet along access drive fill sections, where the mattress are not being used cross culverts are being placed. Each mattress can handle approximately 10 acres of overland flow. Culverts are being used in low points or were stream crossings occur. The minimum design storm being used is the 25 year event. For the stream crossings the culverts are being sized for either the 50 or 100 year event. This is based on the new guidelines by NHDES for stream crossings. There are approximately 65 culverts being installed for this project. Of those 65 pipes, 22 of them are replacements and upgrades along Groton Hollow Road.

2

Existing Conditions

The following report has been prepared by Vanasse Hangen Brustlin, Inc. (VHB) to provide a brief description of existing and proposed drainage areas, design methodology, soil characteristics, and a summary of peak discharge rates for the project area.

Description of Contributing Areas

The majority of the study area for the development is located within the Clark Brook and ultimately the Baker River watersheds. The existing drainage area is approximately 7,382-acres in size and is wooded and mountainous with elevations ranging from 650ft. up to 2,110 ft. The area is currently undeveloped and has an active logging operation occurring on it. Ground cover consists mainly of woodlands with gravel access roads, woods roads/logging roads and several clearing areas associated with the on-going logging operations.

The study area has been divided into eight (8) drainage areas that discharge into one of seven (7) discharge points. The discharge points include Clark Brook, Halls Brook, Wise Brook, a pond along Route 25, and several unnamed streams along Routes 3A and 25.

Table 1 summarizes the study area and its characteristics.

Table 1:
Existing Conditions: Drainage Area Characteristics Summary

Discharge Point		Sub Area(s)		Area (Acres)	Tc (Min.)	CN
D1	Clark Brook (just north of the Rumney Town line)	101	Main/central portion of the project site	2,672.8	112.5	67
		102	Northwest portion of site (drains to lower portion of Clark Brook)	758.7	53.9	68
D2	Halls Brook (22'w x 15'h box culvert under Route 25)	201	Western portion of the project site	1,196.5	63.7	65
D3	Pond w/weir and 96" CMP culvert outlet (under Route 25 west of Groton Hollow Rd.)	301	Northern portion of site	541.7	52.3	63
D4	Unnamed Stream (66" RCP culvert under Route 25)	401	Northeast corner of site	400.4	46.3	62
D5	Unnamed Stream (11' wide bridge under Route 3A)	501	Eastern edge of site	951.3	67.3	66
D6	Unnamed Stream (15' wide bridge under Route 3A)	601	Southeast edge of site	665.4	78.3	68
D7	Wise Brook	701	Southern end of site	195.0	62.0	71
Total				7,381.8	n/a	66*

* Weighted CN Value

Soil Conditions

The study area is comprised of several different soil types as defined by the NRCS Web Soil Survey. Table 2, Soil Types, lists the designations, names, and groups of the soils located within the study area. The Appendices contains a copy of the soil mapping and soil types found within the study area.

Table 2: Soil Types

Soil Designation	Soil Name	Soil Group
22	Colton Loamy Sand	A
28	Madawaska Fine Sandy Loam	B
36	Adams Loamy Sand	A
57	Becket Fine Sandy Loam	C
59	Waumbek Loamy Sand	C
61	Tunbridge-Lyman-Rock Outcrop Complex	C
72	Berkshire Loam	C
73	Berkshire Loam	B
77	Marlow Fine Sandy Loam	C
104	Podunk Fine Sandy Loam	B
105	Rumney Loam	C
255	Modadnock and Hermon Soils	B
295	Greenwood Mucky Peat	A
299	Udorthents, Smoothed	A
347	Lyme and Moosilauke Soils	C
355	Hermon Fine Sandy Loam	A
406	Medomak Silt Loam	D
559	Skerry Fine Sandy Loam	C
613	Croghan Loamy Fine Sand	B
614	Kinsman Sand	C
632	Nicholville Very Fine Sandy Loam	C
633	Pemi Silt Loam	C
701	Becket-Skerry Association	C
703	Becket-Monadnock Association	C
709	Becket-Tunbridge Association	C
710	Becket-Lyman-Rock Outcrop Complex	C
711	Monadnock-Hermon Association	B
713	Hermon-Waumbek Association	A
717	Lyme-Peacham Association	C
719	Marlow-Tunbridge Association	C
720	Marlow-Lyman-Rock Outcrop Complex	C
722	Marlow-Berkshire Association	C
723	Peru-Pillsbury Association	C
724	Skerry-Tunbridge Association	C
726	Rock Outcrop-Lyman Complex	D
729	Waumbek-Lyme Association	B
730	Skerry-Lyman-Rock Outcrop Complex	C
819	Peru-Tunbridge Association	C

Source: NCRS Web Soil Survey

Existing Hydrologic Flow Patterns

Storm water runoff from the existing study area generally flows down the mountain sides and is collected by many on-site streams and drainage ways. Runoff from the majority of the site flows into the Clark Brook which runs down the central portion of the site. Ultimately, runoff from the majority of the site is discharged into the Baker River with a relatively small portion of the study area being discharged in to the Wise Brook and ultimately into the Cockermouth River to the south.

The following describes the existing storm water flow patterns for each of the sub areas.

- Sub Area 101 consists of the majority of the site and flows overland into the Clark Brook.
- Sub Area 102 consists of the northwest portion of the project site and flows overland into the Clark Brook near the Groton/Rumney Town line.
- Sub Area 201 consists of the western portion of the project site and flows overland into Halls Brook to a box culvert under Route 25.
- Sub Area 301 consists of the northern most portion of the site and flows towards a pond located along Route 25 to the west of Groton Hollow Road. The pond discharges over a weir and into a culvert that runs under Route 25.
- Sub Area 401 consists of the northeast corner of the site and flows overland to an unnamed stream and a culvert that crosses under route 25 (just to the west of Route 3A).
- Sub Area 501 consists of the eastern edge of the site and flows overland to an unnamed stream and to a bridge crossing under Route 3A.
- Sub Area 601 consists of the southeast edge of the site and flows overland to an unnamed stream and to a bridge crossing under Route 3A.
- Sub Area 701 consists of a small portion of the site located at the southern end of the study area and flow overland to the Wise Brook. This sub area is located within the Cockermouth River water shed and is the only portion of the site that is not located within the Baker River watershed.

3

Proposed Conditions

Description of Contributing Areas

The proposed development for the study area includes the construction of 24 wind turbines, approximately 12 miles of associated gravel access drives, and a 4,000 sf Operation & Maintenance building.

The proposed conditions sub-areas are comprised of the same 7,382 acre study area represented in the existing conditions drainage analysis. The proposed development will disturb approximately 116 acres of land area including gravel access drives, vegetated slopes, temporary construction pads, and a small operation & maintenance facility.

Table 3 summarizes the proposed sub areas and their characteristics.

Table 3:
Proposed Conditions: Drainage Area Characteristics Summary

Discharge Point		Sub Area(s)		Area (Acres)	Tc (Min.)	CN
D1	Clark Brook (just north of the Rumney Town line)	P101	Main/central portion of the project site	2,673.4	112.5	67
		P102	Northwest portion of site (drains to lower portion of Clark Brook)	759.4	53.9	68
D2	Halls Brook (22'w x 15'h box culvert under Route 25)	P201	Western portion of the project site	1,196.1	63.7	65
D3	Pond w/weir and 96" CMP culvert outlet (under Route 25 west of Groton Hollow Rd.)	P301	Northern portion of site	540.9	52.3	63
D4	Unnamed Stream (66" RCP culvert under Route 25)	P401	Northeast corner of site	400.4	46.3	62
D5	Unnamed Stream (11' wide bridge under Route 3A)	P501	Eastern edge of site	951.3	67.3	66
D6	Unnamed Stream (15' wide bridge under Route 3A)	P601	Southeast edge of site	665.4	78.3	68
D7	Wise Brook	P701	Southern end of site	194.9	62.0	71
Total				7,381.8	n/a	66*

* Weighted CN Value

Proposed Hydrologic Flow Patterns

The proposed development has been designed to maintain the existing drainage paths to the maximum extent possible. In general the eight (8) drainage areas for the proposed conditions are essentially the same as the eight (8) areas from the existing conditions. Only minor adjustments were made to account for the proposed access drives that are located along the ridgelines and drainage divides.

The proposed development will disturb approximately 116 acres of land area within the studied watershed or 1.6 percent of the watershed. In addition, a significant portion of the proposed access drives are located along existing logging roads that have previously been disturbed and/or cleared. As a result, the proposed development will not significantly alter the weighted curve numbers for each of the drainage areas. Therefore, the Hydrologic Model indicates that there will be an insignificant change in peak storm water runoff rates from pre- to post-development conditions.

4

Methodology & Design Criteria

VHB analyzed both the proposed development's hydrologic impacts and hydraulic characteristics using the Soil Conservation Service (SCS) Technical Release 20 (TR-20) methodology. The following section summarizes the design parameters/constraints that were used during the drainage design for this development under the SCS Methodology. Additionally, this section summarizes the methodology used for the development's proposed erosion control and storm water treatment methods.

Hydrologic Model Description

VHB analyzed the proposed developments storm water runoff impacts using the SCS TR-20 methodology. The hydrologic program HydroCAD, as developed by Applied Microcomputer System, was utilized to compute and develop the storm water runoff model. HydroCAD's SCS TR-20 program is designed to model complex watersheds, such as the watershed analyzed in this report. The complexity of the watershed has been based on multiple land uses (surface conditions) with varying soil conditions and inter-connected sub-watersheds reflecting complex hydrologic flow patterns.

Design Storms

VHB analyzed the proposed storm water impacts for the 2, 10, and 50 year design storms. These rainfall events are based on a 24-hour storm duration using a Type II distribution curve. The appendices contain copies of the rainfall data charts used in the calculations.

Curve Number

VHB developed weighted curve numbers for each sub-area based on the different ground covers and hydrologic soil group types found within each area. The curve numbers were based on the SCS TR-55 methodology and are included in hydrologic calculations. For proposed areas of disturbance, including lot development, the following hydrologic conditions were used:

- Woods: CN values based on good conditions for woods.

- Existing logging clearings: CN values based on fair conditions for woods.
- Temporary pads that will be vegetated at the end of construction: CN values based on good conditions for open space.
- Vegetated riprap slopes: CN values based on good conditions for open spaces.
- Temporary road shoulders (to be seeded/vegetated at the end of construction): CN values based on poor conditions for open space.

Travel Times & Time of Concetration

VHB calculated the Travel Times (Tt) and the Time of Concentrations (Tc) for each of the individual sub-areas using the hydraulically most distant point within each area. Sheet flow was limited to 100 ft and a minimum time of 6 minutes was used in the calculations. The Tt's and Tc's were based on SCS TR-55 methodology and are included in hydrologic calculations.

Hydraulic Calculations (Culverts & Mattresses)

VHB used the same methodology that was used in the hydrologic model to develop the flows used in the design the development's culverts. The culverts were sized based on a 25, 50, or 100 year design storm depending on the type crossing and upstream drainage area. Perennial and intermittent stream crossing were designed for the 50 or 100 year design storm. The storms were determined by water shed size, for water sheds between 20 to 200 acres the 50 year event was used. Areas over 200 acres were designed for the 100 year event. Anything under 20 acres was designed for the 25 year event. The mattresses were designed based on the following assumptions of a void ratio of 30% and a CN of 67. Based on this the mattress can handle approximately 10 acres. VHB used the following design parameters and criteria to design the system:

Curve Numbers (CN):	Based on the weighted CN value for the overall drainage area that the culvert is located in.
Travel Times (Tt) and Time of Concentrations (Tc):	Based on same methodology used to develop the hydrologic model.

The culvert and mattress sizing calculations are included in the appendices.

Stormwater Treatment

Stormwater runoff from the roof and parking area associated with the operation & maintenance building will be treated by routing the runoff through a rain garden and an infiltration basin.

Riprap Outlet Protection

VHB sized the riprap outlet protection using Chapter 4, Section 4-6.6, pp. 172 to 174, of the New Hampshire Stormwater Manual, Volume 2, Post-Construction Best Management Practices Selection & Design, NHDES (December 2008). The following design parameters represent the minimum acceptable riprap apron dimensions used for design (refer to the appendices for design computations):

Apron Width:	≥10 feet
Apron Length:	≥10 feet
Median Stone Diameter:	0.5 feet
Depth of Stone:	12 inches (minimum)

When flows and discharges into existing stable stream beds and significant change in pre. / post discharge rates are not anticipated, the apron lengths are reduced to 6ft. minimum to avoid unnecessary disturbance to existing stream channels.

Base Calculations (GRV, WQV, & WQF)

Calculations for the Groundwater Recharge Volume (GRV), Water Quality Volume (WQV) and Water Quality Flow (WQF) were based on sections Env-Wq 1504.09, 1504.10, and 1504.11 of the Alteration of Terrain Administrative Rules. Calculation sheets are included in Appendix A. Waivers have been requested from the Alteration of Terrain Rules as part of the project to remove the requirement for groundwater recharge and to exclude the majority of the gravel areas of the site from the WQV calculation.

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5

Storm Water Management Impacts/Conclusion

Storm Water Quantity Mitigation

Under the proposed conditions, the peak flow rates were calculated for the 2, 10, and 50 year storm events. Based on the results of the hydrologic model the peak runoff rates for the proposed conditions are not anticipated to significantly change from the existing condition rates. Table 4 provides a summary of the peak storm water runoff rates from the proposed development.

Table 4:
Peak Storm Water Runoff Rate Summary

			Peak Flow for Given Storm (cfs)		
Discharge Point		Condition	2-yr	10-yr	50-yr
D1	Clark Brook	Existing	105.7	761.7	1583.8
		Proposed	105.7	762.0	1584.4
			0.0	0.3	0.6
D2	Halls Brook/box culvert under Route 25	Existing	25.5	327.4	763.8
		Proposed	25.5	327.3	763.5
			0.0	-0.1	-0.3
D3	Pond/96" CMP under Route 25	Existing	6.6	128.7	336.2
		Proposed	6.6	128.5	335.7
			0.0	-0.2	-0.5
D4	Unnamed Stream/66" RCP Culvert under Route 25	Existing	3.6	88.3	245.5
		Proposed	3.6	88.3	245.5
			0.0	0.0	0.0
D5	Unnamed Stream/11' wide bridge under Route 3A	Existing	26.5	280.9	632.7
		Proposed	26.5	280.9	632.7
			0.0	0.0	0.3
D6	Unnamed Stream/15' wide bridge under route 3A	Existing	29.5	220.6	458.8
		Proposed	29.5	220.6	458.8
			0.0	0.0	0.0
D7	Wise Brook	Existing	18.8	102.2	194.5
		Proposed	18.8	102.1	194.3
			0.0	-0.1	-0.2

Storm Water Quality Mitigation – Best Management Practices (BMP's)

The proposed Storm Water Management System contains the following Best Management Practices (BMP's) that will provide treatment of site generated storm water runoff from the proposed operation & maintenance building and associated parking lot. The proposed BMP's are described below:

■

Filtration Basin

The filtration basin is designed to filter the first 1-inch of runoff (Water Quality Volume) through an 18-inch thick sand filter located at the bottom of the basins. Runoff that has been treated by passing through the sand filter will be collected in a subsurface under drain prior to discharge.

■

Rain Garden

The rain garden manages and treats stormwater runoff using a conditioned planting soil bed and planting materials to filter runoff stored within a shallow depression. The vegetation serves to filter and transpire runoff — improving water quality and reducing runoff quantity — and the root systems can enhance filtration. The soil medium filters out pollutants and allows storage and infiltration of stormwater runoff; and the infiltration bed provides additional volume control.

■

Energy Dissipators

Energy dissipators (i.e. riprap stone protection) will be constructed below outlets of all pipes in the storm water management system. The energy dissipators will allow the concentrated runoff from the drainage system to be discharged at non-erosive velocities to protect the receiving water resources. The appendices contain design information and calculations for the energy dissipators.

Erosion Control Measures

■

Temporary Erosions Control

During construction of the proposed development, the contractor shall be responsible for installation and maintenance of temporary sedimentation and erosion control measures to prevent off-site tracking and waterborne loss of earth sediment and debris. The specific measures proposed as a part of the project plan are shown in the Site Plan Package on the Sedimentation and Erosion Control Plan and the Erosion Control Details.

Removal of temporary erosion control measures will be prohibited until site stabilization has been achieved and vegetation (grass) is well established.

Permanent Erosion Control

At the completion of construction, all soils will be permanently stabilized by one or more of the following measures:

- Access Drives: Driveways, parking areas and access roads will be stabilized with gravel and the outer portion of the access drives will be vegetated upon completion of construction so that, in general, 16 ft access drives are maintained.

- Landscaped Areas: All disturbed areas, not permanently stabilized by gravel or buildings, will be covered with a minimum of four (4) inches of topsoil and seeded.

- Cut/Fill Slopes: Slopes will be stabilized with stone (riprap) and covered with topsoil or humus and seeded. In certain areas ledge faces will be provided instead of riprap slopes depending on the location of bedrock in the vicinity of the proposed slopes.

- Pipe Outlets: Scour protection (riprap) shall be constructed at the headwall outlet to prevent scouring as necessary.

Conclusion

The results of the hydrologic model that was developed for the project indicate that there will be an insignificant change between the pre- and post-development peak runoff rates. Furthermore, storm water quality issues associated can be addressed through the proposed implementation of temporary erosion control measures during the construction period and a rain garden and filtration basin to provide treatment for runoff associated with the operation & maintenance building.

6

Figures

- Figure 1: Site Location Map (USGS)
- Figure 2: Hydrologic Soil Group Plan
- Figure 3: Drainage Area Map (Existing) – small scale
- Figure 4: Drainage Area Map (Proposed) – small scale
- Drainage Area Maps (full size, under separate cover)

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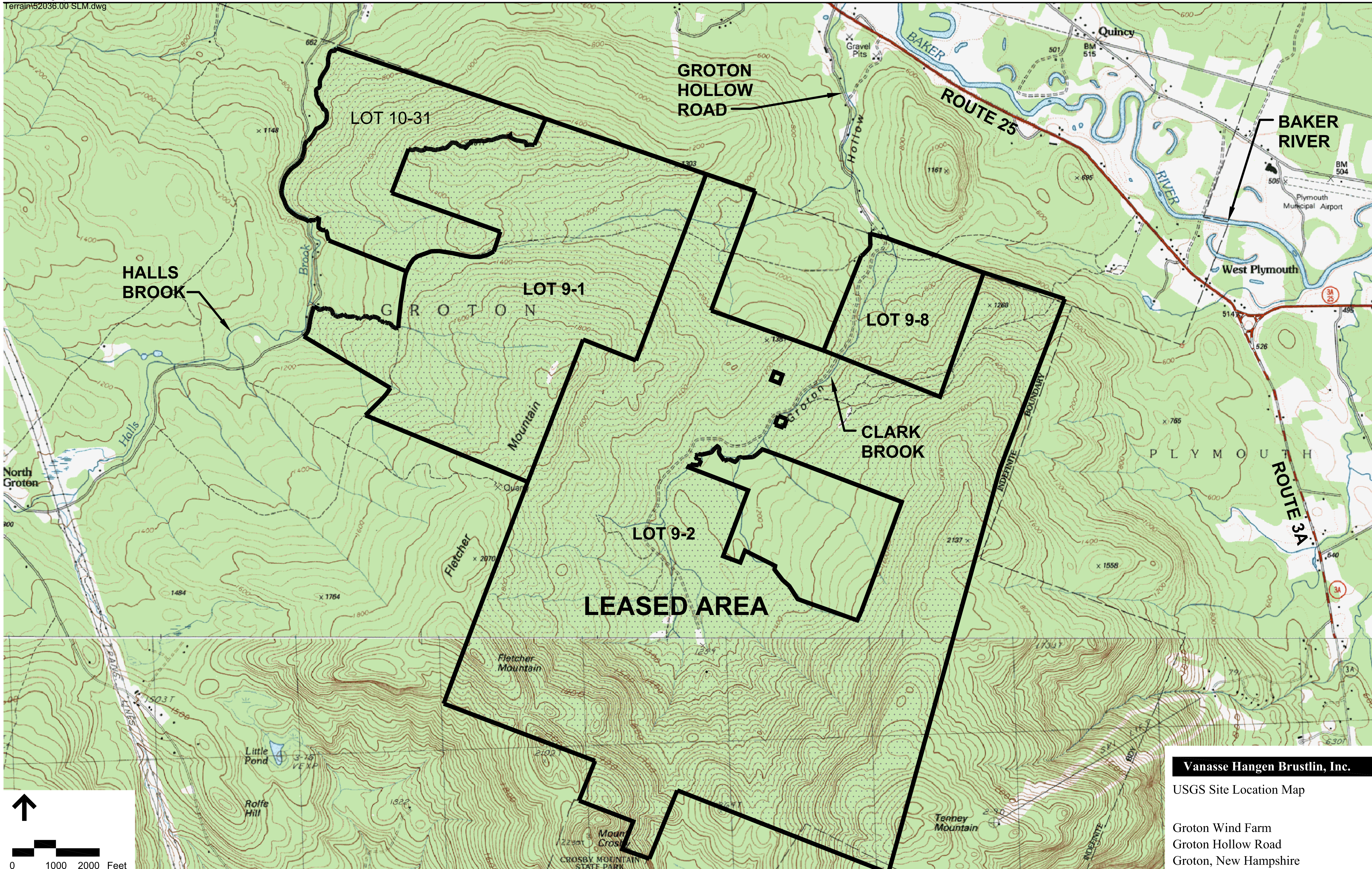
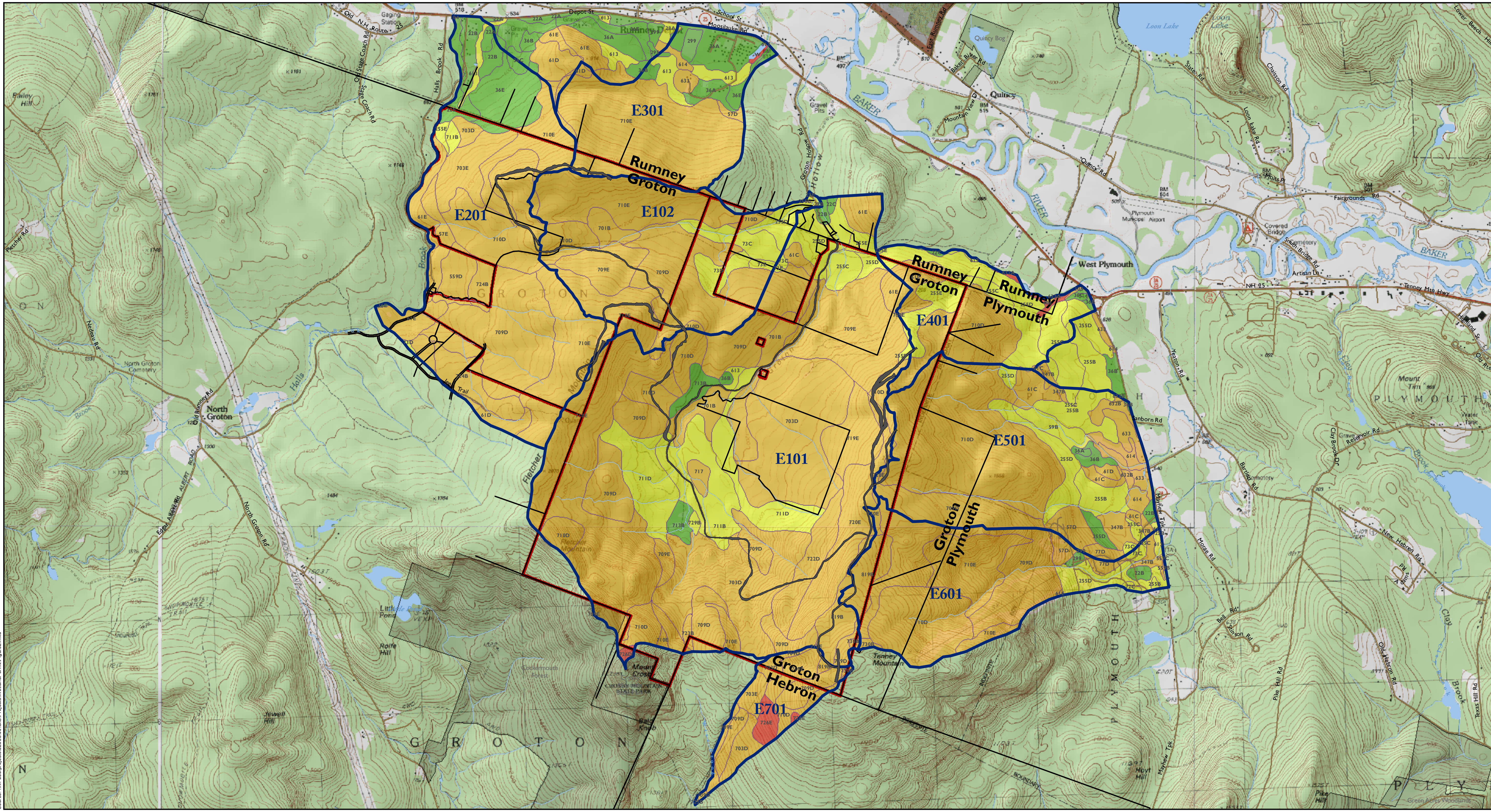


Vanasse Hangen Brustlin, Inc.

USGS Site Location Map

Groton Wind Farm
Groton Hollow Road
Groton, New Hampshire



Legend

- Property Lines
- Project Location
- Lake/Pond
- River/Stream
- Conservation/Public Land
- Roads (NHDOT)
- Existing Drainage Area

NRCS Soils by Hydrologic Group

- A
- B
- C
- D
- NRCS Soil Unit
- Impervious Surfaces

Source: USGS Quadrangle: Ashland, Mt. Cardigan, Newfound Lake, Plymouth, Rumney, Wentworth
Property Lines based on multiple sources of data including ground survey, and assessing tax maps.
Conservation Lands, Roads, and hydrography data taken from the archives on NHGRANIT.

0 2,500 5,000 Feet

Vanasse Hangen Brustlin, Inc.

Figure 2

Soil Hydrologic Group Plan

Iberdrola Renewables, Inc

Groton Windfarm
Groton, NH

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Vanasse Hangen Brustlin, Inc.

Figure 3

Drainage Area Map (Existing)
Groton Wind Farm
Groton Hollow Road
Groton, New Hampshire

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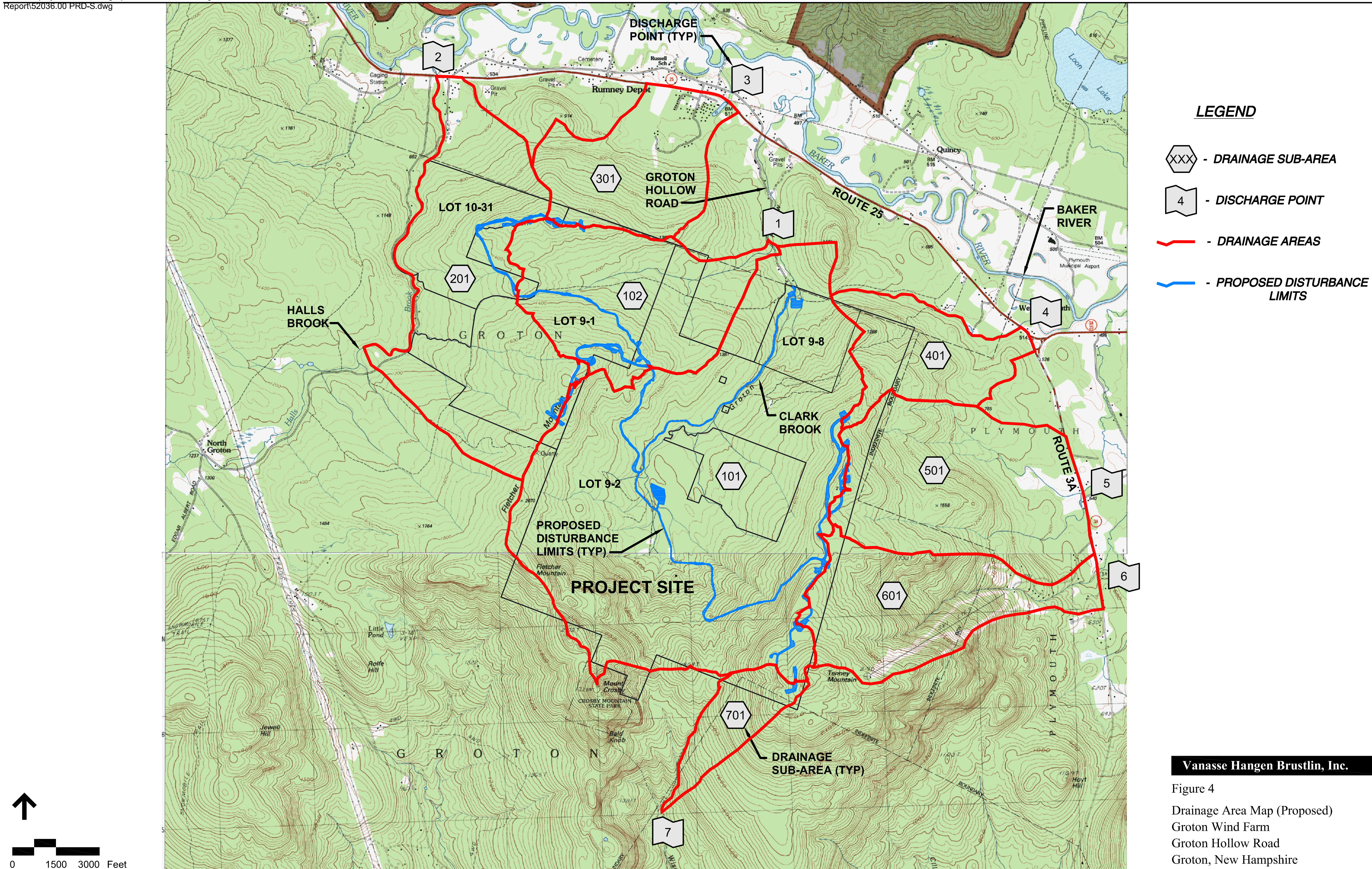

Vanasse Hangen Brustlin, Inc.

Figure 4

Drainage Area Map (Proposed)
Groton Wind Farm
Groton Hollow Road
Groton, New Hampshire

Appendix A: Support Data

- Web GIS Printouts
- NHB Letter
- Web Soil Survey Map(s)
- Aerial Photograph of the Site
- Site Photographs
- Base Calculations (GRV, WQV, & WQF)
- BMP Work Sheets
- Rainfall Data
- Floodplain Maps

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Web GIS Printouts

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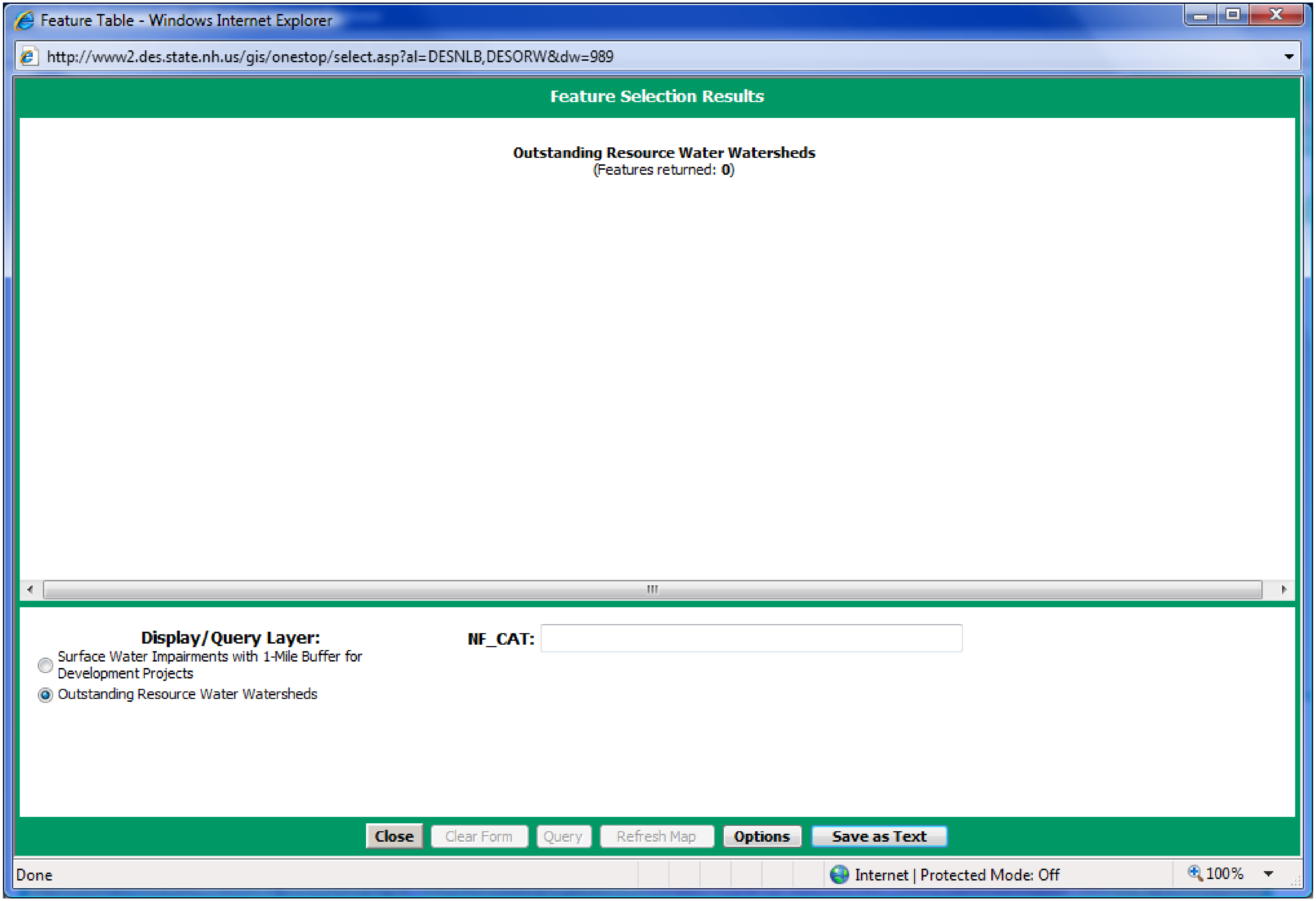
NHDES OneStop GIS Results (11/3/09)



NHDES OneStop GIS Results (11/3/09)

Feature Table - Windows Internet Explorer

http://www2.des.state.nh.us/gis/onestop/select.asp?al=DESNLB,DESORW&dw=989

Feature Selection Results

Surface Water Impairments with 1-Mile Buffer for Development Projects

Features returned: 2 of 729.

ASSESSMENT UNIT ID	BEACH?	ASSESSMENT UNIT NAME	IMPAIRMENTS
NHRIV700010307-11	N	BAKER RIVER, CWF	ESCHERICHIA COLI
NHRIV700010305-11	N	BAKER RIVER, CWF	ESCHERICHIA COLI

Display/Query Layer:

- (selected) Surface Water Impairments with 1-Mile Buffer for Development Projects
- Outstanding Resource Water Watersheds

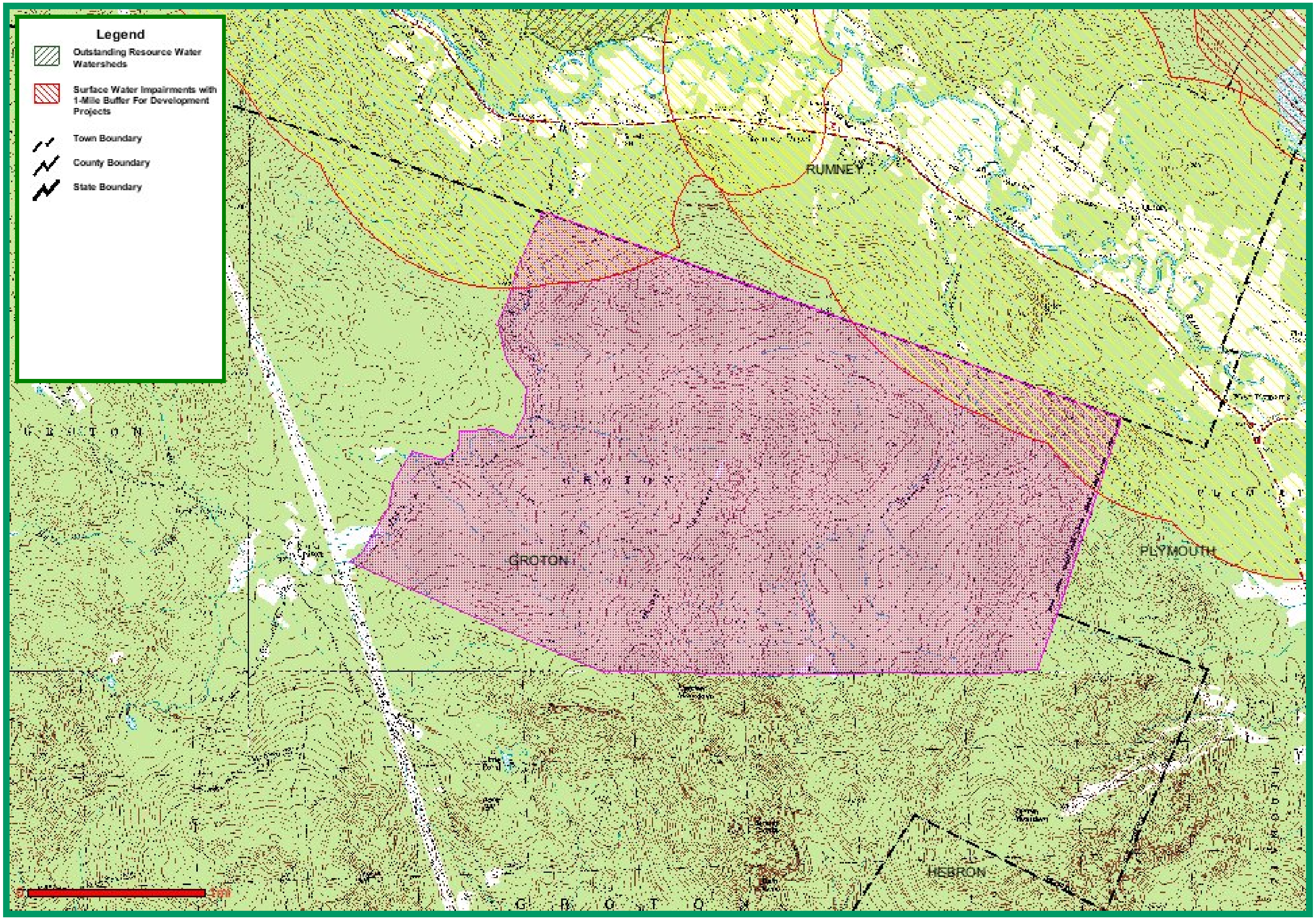
ASSESSMENT UNIT ID:

ASSESSMENT UNIT NAME:

Close | Clear Form | Query | Refresh Map | Options | Save as Text

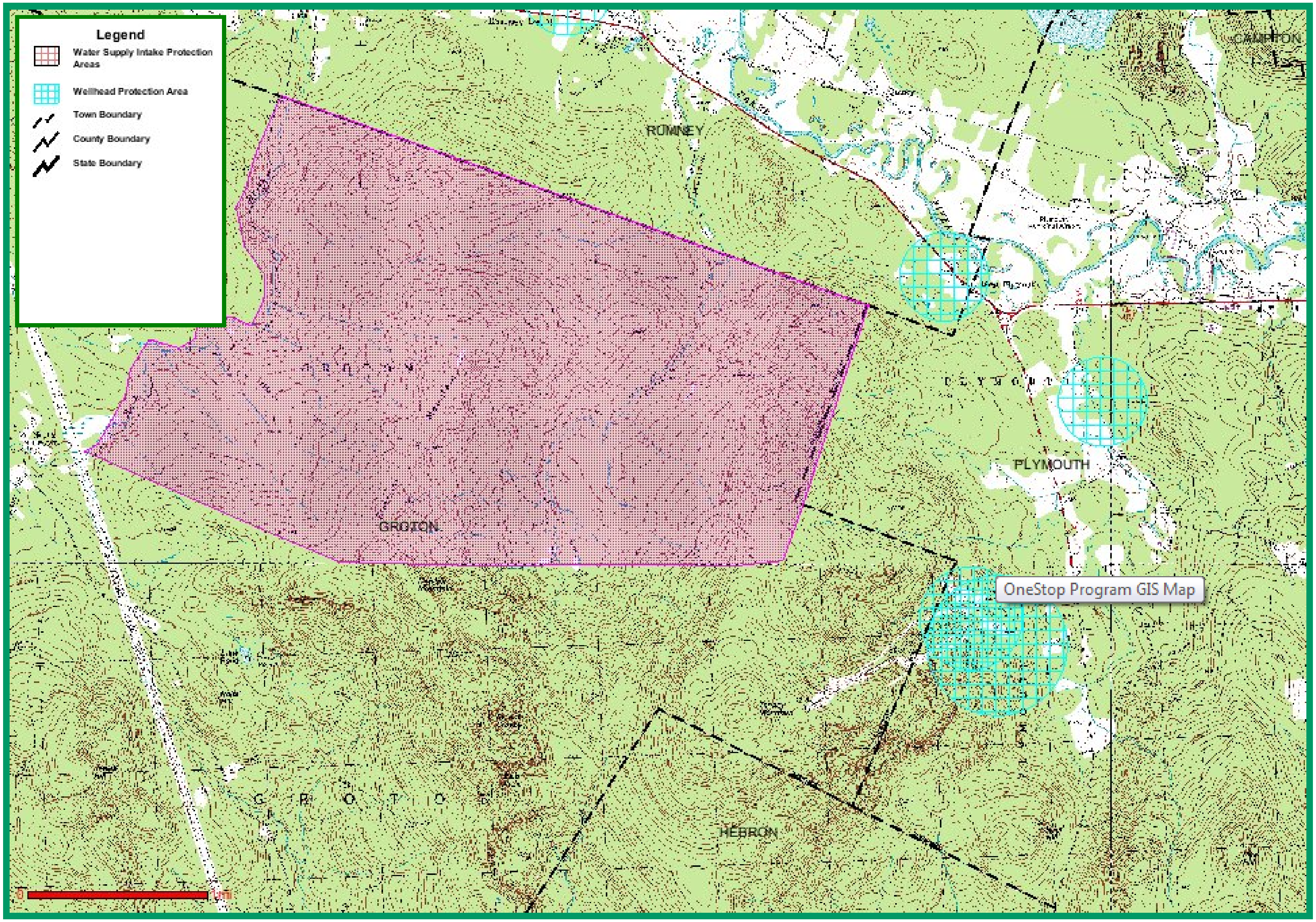
Done | Internet | Protected Mode: Off | 100%

NHDES OneStop GIS Results (11/3/09)



Map Scale = 1 : 46232 (1" = 0.7 miles or 3853 feet)
X = 961226.68, Y = 470812.59

NHDES OneStop GIS Results (11/3/09)



Map Scale = 1 : 45613 (1" = 0.7 miles or 3801 feet)
X = 958906.83, Y = 455785.52

NHB Letter

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Memo

NH NATURAL HERITAGE BUREAU

To: Dale Abbott
6 Bedford Farms Drive, Suite 607
Bedford, NH 03110-6532

From: Melissa Coppola, NH Natural Heritage Bureau
Date: 6/24/2009 (valid for one year from this date)
Re: Review by NH Natural Heritage Bureau

NHB File ID:	NHB09-1212	Town:	Groton
Project type:	Tower Construction: Wind power construction	Location:	Tax Maps: 9-1,9-2,9-8,9-18

cc: Kim Tuttle

As requested, I have searched our database for records of rare species and exemplary natural communities, with the following results.

Comments:

Vertebrate species	State[1]	Federal	Notes
Peregrine Falcon (*Falco peregrinus anatum*)*	T	M	Contact the NH Fish & Game Dept (see below).
Wood Turtle (*Glyptemys insculpta*)	SC	--	Contact the NH Fish & Game Dept (see below).

[1]Codes: "E" = Endangered, "T" = Threatened, "--" = an exemplary natural community, or a rare species tracked by NH Natural Heritage that has not yet been added to the official state list. An asterisk (*) indicates that the most recent report for that occurrence was more than 20 years ago.

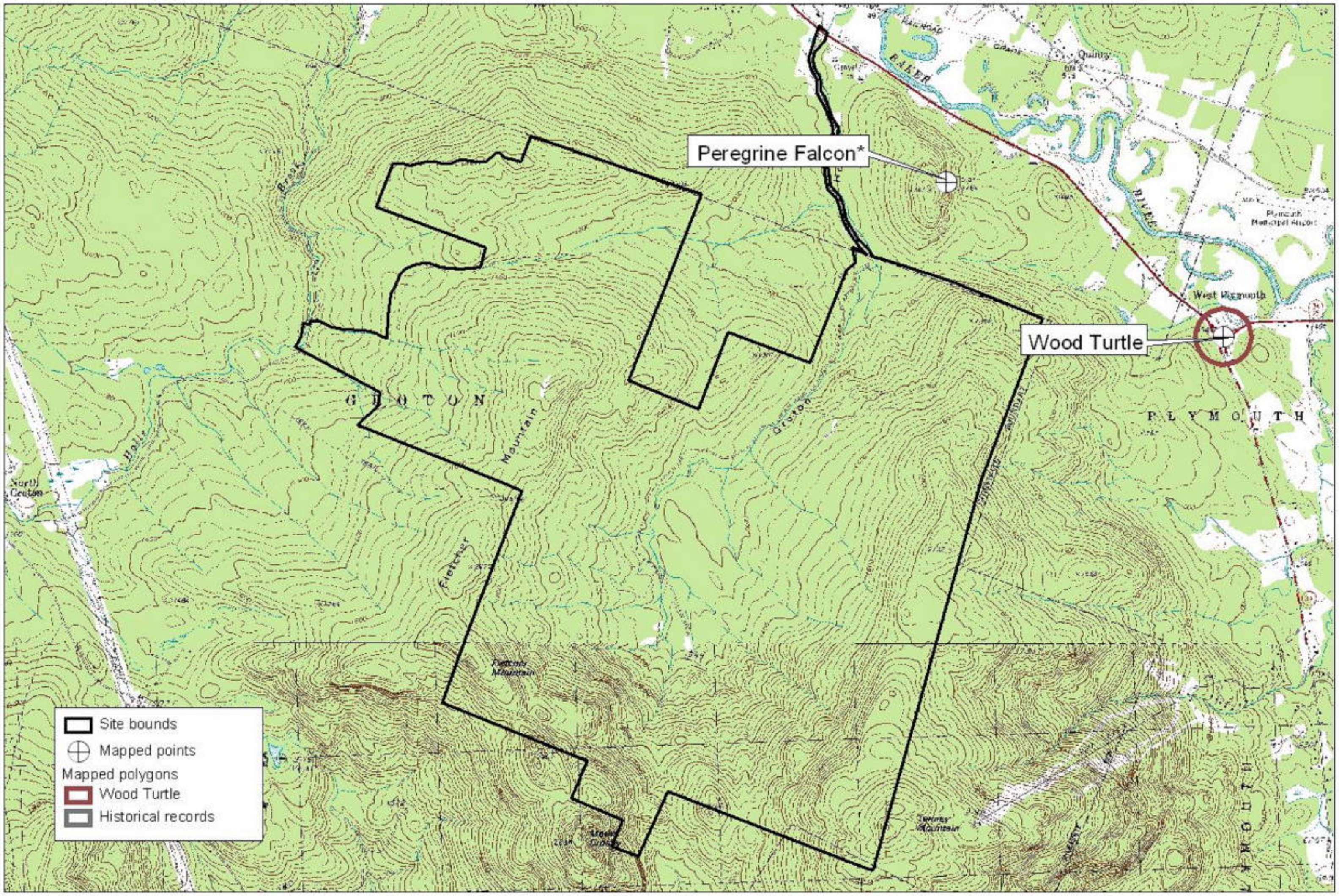
Contact for all animal reviews: Kim Tuttle, NH F&G, (603) 271-6544.

A negative result (no record in our database) does not mean that a sensitive species is not present. Our data can only tell you of known occurrences, based on information gathered by qualified biologists and reported to our office. However, many areas have never been surveyed, or have only been surveyed for certain species. For some purposes, including legal requirements for state wetland permits, the fact that no species of concern are known to be present is sufficient. However, an on-site survey would provide better information on what species and communities are indeed present.

NH NATURAL HERITAGE BUREAU

Known locations of rare species and exemplary natural communities

Note: Mapped locations are not always exact. Occurrences that are not in the vicinity of the project are not shown.



0.5 0 0.5 1 Miles

*Historical record

1:40000

Valid for one year from this date: 24 Jun 2009

New Hampshire Natural Heritage Bureau - Animal Record

Peregrine Falcon (*Falco peregrinus anatum*)

Legal Status

Federal: Monitored
State: Listed Threatened

Conservation Status

Global: Apparently secure but with cause for concern
State: Critically imperiled due to rarity or vulnerability

Description at this Location

Conservation Rank: Historical records only - current condition unknown.
Comments on Rank: Site not active since 1949.

Detailed Description: 1986: Not active1949 and 1939: Active. 1936: Bred. 1932 to 1939: Pair in residence. 1932: 1 adult seen (4/23).
General Area: East-facing cliff.
General Comments:
Management Comments:

Location

Survey Site Name: Polar Caves
Managed By:

County: Grafton
Town(s): Rumney
Size: 2.8 acres

USGS quad(s): Rumney (4307177)
Lat, Long: 434647N, 0714709W
Elevation: 900 feet

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: Cliff faces east. 2.5 miles east of Rumney Depot on Rte. 25.

Dates documented

First reported: 1932
Last reported: 1949-04-18

Hickey, J. J. No date. Natural History of the Peregrine Falcon East of the Rockies. Unpublished Manuscript. 178 pp.

New Hampshire Natural Heritage Bureau - Animal Record

Wood Turtle (*Glyptemys insculpta*)

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Apparently secure but with cause for concern
State:	SC	State:	Rare or uncommon

Description at this Location

Conservation Rank: Not ranked
Comments on Rank:

Detailed Description: 2002: 1 female seen, missing one leg. Laid 9 eggs in cage and 3 were crushed and 6 removed and are being incubated by Stacy Luke (Obs_id 2002.0085).
General Area: 2002: Near Baker River (Obs_id 2002.0085).
General Comments: 2002: Brought to Newfound Audubon society with a slight injury from a car collision. Kept until august 31st and released back in the same area. (Obs_id 2002.0085).
Management Comments:

Location

Survey Site Name: West Plymouth
Managed By:

County:	Grafton	USGS quad(s):	Rumney (4307177)
Town(s):	Plymouth	Lat, Long:	
Size:	30.8 acres	Elevation:	

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: 2002: Baker River, found by rotary at junction of rte 25 and rte 3a (Obs_id 2002.0085).

Dates documented

First reported: 2002-06-23 Last reported: 2002-06-23

The New Hampshire Fish & Game Department has jurisdiction over rare wildlife in New Hampshire. Please contact them at 11 Hazen Drive, Concord, NH 03301 or at (603) 271-2461.

New Hampshire Natural Heritage Bureau - Animal Record

Wood Turtle (*Glyptemys insculpta*)

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Apparently secure but with cause for concern
State:	SC	State:	Rare or uncommon

Description at this Location

Conservation Rank: Not ranked
Comments on Rank:

Detailed Description: 2003: 1 adult male. Data from 1996 to 2003 (Obs_id 2003.0183); 1 adult female. Data from 1996 to 2003 (Obs_id 2003.0184).
General Area: 2003: No details (Obs_id 2003.0183, 2003.0184).
General Comments:
Management Comments:

Location

Survey Site Name: Baker River, near Rumney
Managed By:

County:	Grafton	USGS quad(s):	Rumney (4307177)
Town(s):	Rumney	Lat, Long:	
Size:	61.7 acres	Elevation:	

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: 2003: Baker River half way between Quincey Rd. and Rumney (Obs_id 2003.0183); Baker River between Buffalo Rd. and Rte. 25 near Gaging Station. (Obs_id 2003.0184).

Dates documented

First reported:	1996	Last reported:	2003

The New Hampshire Fish & Game Department has jurisdiction over rare wildlife in New Hampshire. Please contact them at 11 Hazen Drive, Concord, NH 03301 or at (603) 271-2461.

New Hampshire Natural Heritage Bureau - Animal Record

Wood Turtle (*Glyptemys insculpta*)

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Apparently secure but with cause for concern
State:	SC	State:	Rare or uncommon

Description at this Location

Conservation Rank: Not ranked
Comments on Rank:

Detailed Description: 1998: 1 male seen. Adult. (Obs_id 1998.0312).
General Area:
General Comments:
Management Comments:

Location

Survey Site Name: Baker River, near Rumney
Managed By:

County:	Grafton	USGS quad(s):	Rumney (4307177)
Town(s):	Rumney	Lat, Long:	
Size:	11.4 acres	Elevation:	

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: 1998: Upland bank of Baker River. Southeast portion of Tax Map 12 Lot 5-4 between Stinson Brook and Baker River. [According to map, location of shell is on upper bank of Baker R., directly north of Russell School which is south of the river on School St.]

Dates documented

First reported:	1998-04-16	Last reported:	1998-04-16

Web Soil Survey Map(s)

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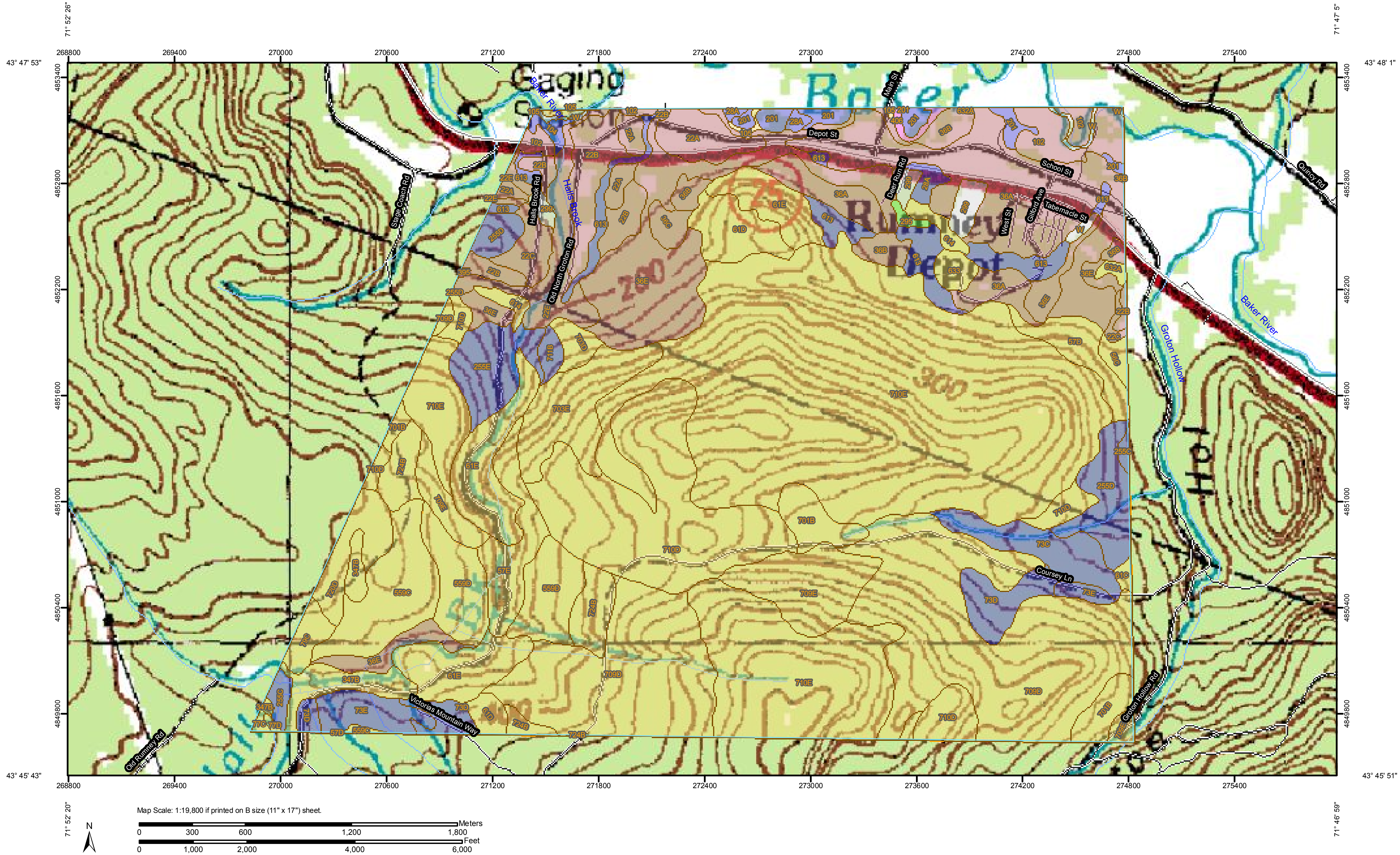
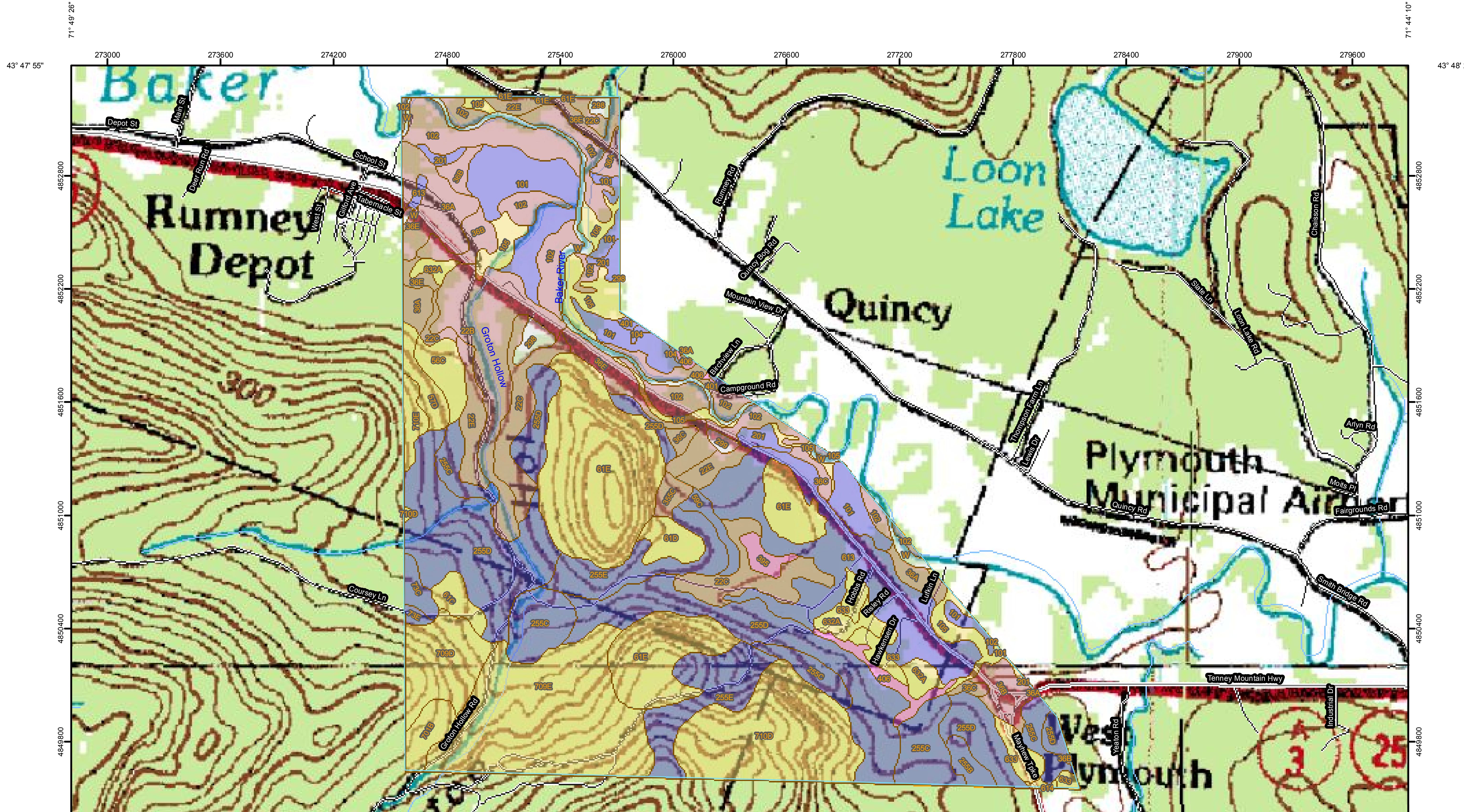
Hydrologic Soil Group—Grafton County, New Hampshire
(Groton Area 1)





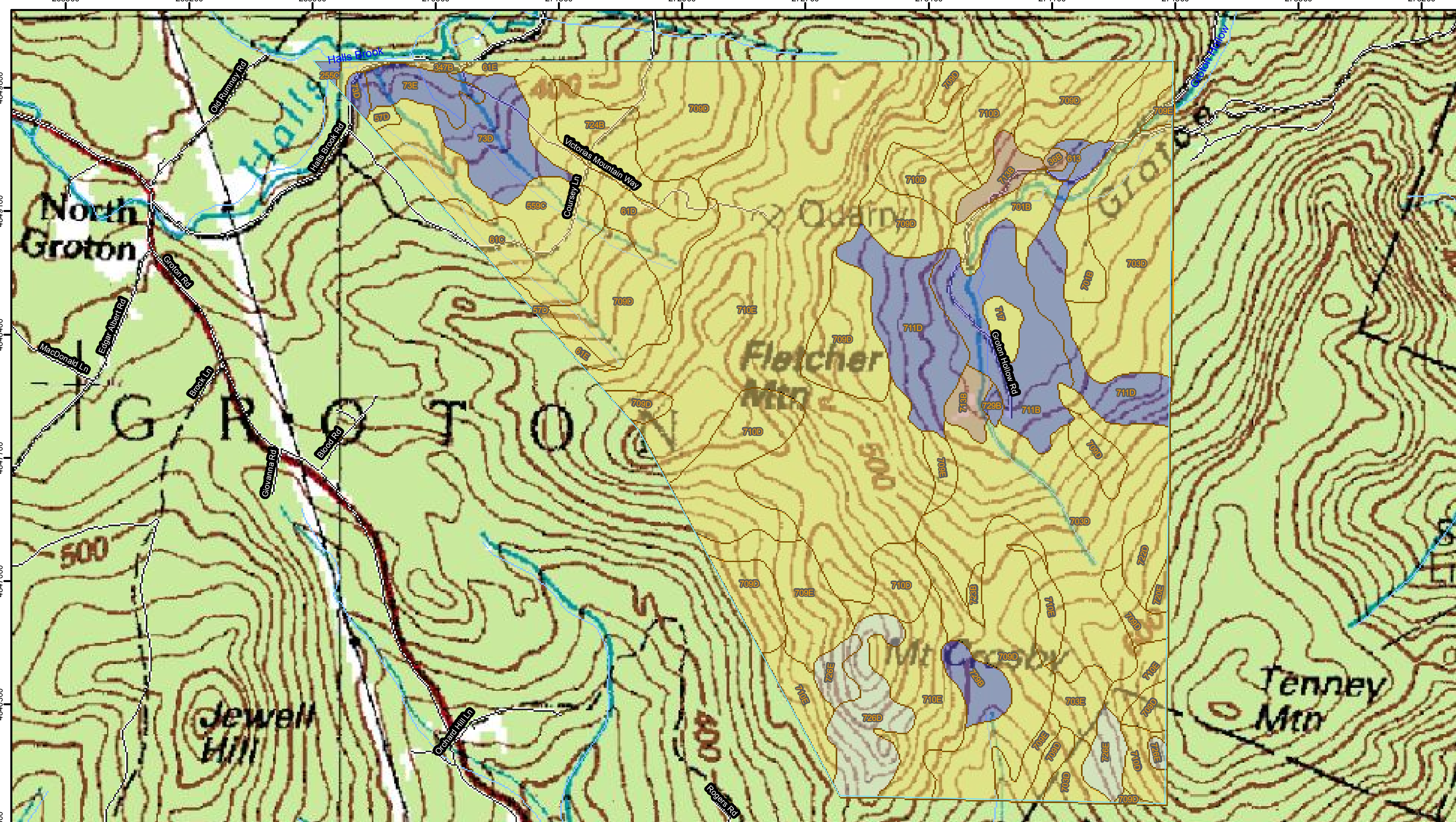
Map Scale: 1:19,600 if printed on B size (11" x 17") sheet.

N

Meters: 0, 300, 600, 1,200, 1,800

Feet: 0, 1,000, 2,000, 4,000, 6,000

Hydrologic Soil Group—Grafton County, New Hampshire
(Groton Area 3)



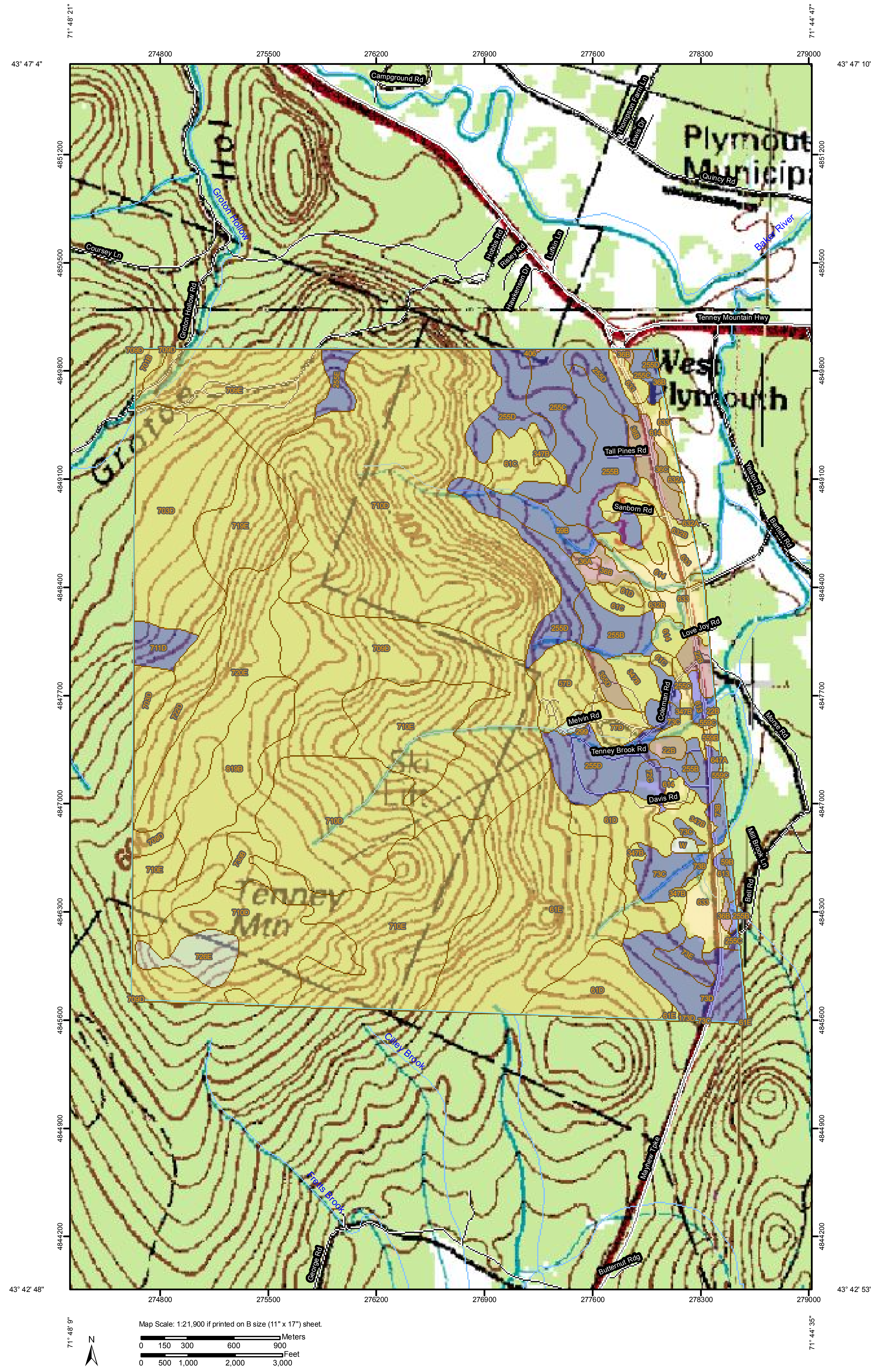
Map Scale: 1:22,800 if printed on B size (11" x 17") sheet.

N

Meters: 0, 350, 700, 1,400, 2,100

Feet: 0, 1,500, 3,000, 6,000, 9,000

Hydrologic Soil Group—Grafton County, New Hampshire
(Groton Area 4)



MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Units

Soil Ratings

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Political Features

Cities

Water Features

Oceans

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

MAP INFORMATION

Map Scale: 1:19,800 if printed on B size (11" × 17") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 19N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Grafton County, New Hampshire
Survey Area Data: Version 12, Aug 18, 2009

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Grafton County, New Hampshire				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
22A	Colton loamy sand, 0 to 3 percent slopes	A	47.9	1.3%
22B	Colton loamy sand, 3 to 8 percent slopes	A	70.9	1.9%
22C	Colton loamy sand, 8 to 15 percent slopes	A	23.3	0.6%
22E	Colton loamy sand, 15 to 60 percent slopes	A	56.8	1.5%
27B	Groveton fine sandy loam, 3 to 8 percent slopes	B	0.0	0.0%
28A	Madawaska fine sandy loam, 0 to 3 percent slopes	B	12.0	0.3%
36A	Adams loamy sand, 0 to 3 percent slopes	A	233.9	6.4%
36B	Adams loamy sand, 3 to 8 percent slopes	A	33.6	0.9%
36C	Adams loamy sand, 8 to 15 percent slopes	A	11.1	0.3%
36E	Adams loamy sand, 15 to 60 percent slopes	A	194.7	5.3%
56C	Becket fine sandy loam, 8 to 15 percent slopes	C	7.6	0.2%
57D	Becket fine sandy loam, 15 to 25 percent slopes, very stony	C	31.1	0.8%
57E	Becket fine sandy loam, 25 to 35 percent slopes, very stony	C	47.7	1.3%
61C	Tunbridge-Lyman-Rock outcrop complex, 8 to 15 percent slopes	C	3.3	0.1%
61D	Tunbridge-Lyman-Rock outcrop complex, 15 to 25 percent slopes	C	46.7	1.3%
61E	Tunbridge-Lyman-Rock outcrop complex, 25 to 60 percent slopes	C	137.6	3.8%
73C	Berkshire loam, 8 to 15 percent slopes, very stony	B	45.9	1.3%
73D	Berkshire loam, 15 to 25 percent slopes, very stony	B	50.4	1.4%
73E	Berkshire loam, 25 to 35 percent slopes, very stony	B	36.5	1.0%
77C	Marlow fine sandy loam, 8 to 15 percent slopes, very stony	C	1.9	0.1%
77D	Marlow fine sandy loam, 15 to 25 percent slopes, very stony	C	1.4	0.0%
79C	Peru fine sandy loam, 8 to 15 percent slopes, very stony	C	14.6	0.4%
102	Sunday loamy sand	A	45.5	1.2%
104	Podunk fine sandy loam	B	5.6	0.2%

Hydrologic Soil Group— Summary by Map Unit — Grafton County, New Hampshire				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
105	Rumney loam	C	4.2	0.1%
201	Ondawa fine sandy loam, occasionally flooded	B	25.4	0.7%
255C	Monadnock and Hermon soils, 8 to 15 percent, very stony	B	10.1	0.3%
255D	Monadnock and Hermon soils, 15 to 25 percent slopes, very stony	B	57.7	1.6%
255E	Monadnock and Hermon soils, 25 to 35 percent slopes, very stony	B	47.2	1.3%
295	Greenwood mucky peat	A/D	3.4	0.1%
299	Udorthents, smoothed		21.6	0.6%
347B	Lyme and Moosilauke soils, 3 to 8 percent slopes, very stony	C	37.5	1.0%
395	Chocorua mucky peat	D	0.6	0.0%
406	Medomak silt loam	D	4.5	0.1%
559C	Skerry fine sandy loam, 8 to 15 percent slopes, very stony	C	74.4	2.0%
559D	Skerry fine sandy loam, 15 to 25 percent slopes, very stony	C	84.6	2.3%
613	Croghan loamy fine sand	B	71.4	1.9%
614	Kinsman sand	C	15.0	0.4%
632A	Nicholville very fine sandy loam, 0 to 3 percent slopes	C	4.3	0.1%
633	Pemi silt loam	C	10.8	0.3%
701B	Becket-Skerry association, gently sloping, very stony	C	49.0	1.3%
703D	Becket-Monadnock association, moderately steep, very stony	C	12.3	0.3%
703E	Becket-Monadnock association, steep, very stony	C	69.8	1.9%
709D	Becket-Tunbridge association, hilly, very stony	C	482.2	13.2%
709E	Becket-Tunbridge association, steep, very stony	C	92.5	2.5%
710D	Becket-Lyman-Rock outcrop complex, hilly	C	257.3	7.0%
710E	Becket-Lyman-Rock outcrop complex, steep	C	970.3	26.5%
711B	Monadnock-Hermon association, undulating, very stony	B	7.7	0.2%
720D	Marlow-Lyman-Rock outcrop complex, hilly	C	34.1	0.9%
724B	Skerry-Tunbridge association, undulating, very stony	C	50.3	1.4%
W	Water		7.9	0.2%
Totals for Area of Interest			**3,665.9**	**100.0%**

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Grafton County, New Hampshire				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
22B	Colton loamy sand, 3 to 8 percent slopes	A	75.1	3.9%
22C	Colton loamy sand, 8 to 15 percent slopes	A	70.9	3.7%
22E	Colton loamy sand, 15 to 60 percent slopes	A	31.0	1.6%
36A	Adams loamy sand, 0 to 3 percent slopes	A	56.1	2.9%
36B	Adams loamy sand, 3 to 8 percent slopes	A	36.9	1.9%
36C	Adams loamy sand, 8 to 15 percent slopes	A	11.1	0.6%
36E	Adams loamy sand, 15 to 60 percent slopes	A	38.2	2.0%
56C	Becket fine sandy loam, 8 to 15 percent slopes	C	17.1	0.9%
57D	Becket fine sandy loam, 15 to 25 percent slopes, very stony	C	13.7	0.7%
59C	Waumbek loamy sand, 8 to 15 percent slopes, very stony	B	8.7	0.5%
61C	Tunbridge-Lyman-Rock outcrop complex, 8 to 15 percent slopes	C	11.4	0.6%
61D	Tunbridge-Lyman-Rock outcrop complex, 15 to 25 percent slopes	C	14.8	0.8%
61E	Tunbridge-Lyman-Rock outcrop complex, 25 to 60 percent slopes	C	208.0	10.8%
73C	Berkshire loam, 8 to 15 percent slopes, very stony	B	8.0	0.4%
73E	Berkshire loam, 25 to 35 percent slopes, very stony	B	2.7	0.1%
101	Ondawa fine sandy loam, frequently flooded	B	95.7	5.0%
102	Sunday loamy sand	A	126.7	6.6%
104	Podunk fine sandy loam	B	1.5	0.1%
105	Rumney loam	C	58.9	3.1%
201	Ondawa fine sandy loam, occasionally flooded	B	13.9	0.7%
255B	Monadnock and Hermon soils, 3 to 8 percent, very stony	B	9.0	0.5%
255C	Monadnock and Hermon soils, 8 to 15 percent, very stony	B	94.9	4.9%
255D	Monadnock and Hermon soils, 15 to 25 percent slopes, very stony	B	254.7	13.3%
255E	Monadnock and Hermon soils, 25 to 35 percent slopes, very stony	B	86.6	4.5%

Hydrologic Soil Group— Summary by Map Unit — Grafton County, New Hampshire				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
298	Pits, gravel		9.2	0.5%
299	Udorthents, smoothed		3.1	0.2%
355C	Hermon fine sandy loam, 8 to 15 percent slopes, extremely bouldery	A	7.3	0.4%
395	Chocorua mucky peat	D	7.6	0.4%
401	Occum fine sandy loam, occasionally flooded	B	2.5	0.1%
406	Medomak silt loam	D	13.1	0.7%
613	Croghan loamy fine sand	B	120.7	6.3%
614	Kinsman sand	C	1.4	0.1%
632A	Nicholville very fine sandy loam, 0 to 3 percent slopes	C	21.9	1.1%
633	Pemi silt loam	C	28.2	1.5%
701B	Becket-Skerry association, gently sloping, very stony	C	15.2	0.8%
709D	Becket-Tunbridge association, hilly, very stony	C	45.8	2.4%
709E	Becket-Tunbridge association, steep, very stony	C	155.0	8.1%
710D	Becket-Lyman-Rock outcrop complex, hilly	C	106.7	5.6%
710E	Becket-Lyman-Rock outcrop complex, steep	C	10.1	0.5%
W	Water		26.6	1.4%
Totals for Area of Interest			**1,919.6**	**100.0%**

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Grafton County, New Hampshire				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
36B	Adams loamy sand, 3 to 8 percent slopes	A	3.5	0.1%
57D	Becket fine sandy loam, 15 to 25 percent slopes, very stony	C	10.4	0.3%
61C	Tunbridge-Lyman-Rock outcrop complex, 8 to 15 percent slopes	C	25.1	0.8%
61D	Tunbridge-Lyman-Rock outcrop complex, 15 to 25 percent slopes	C	79.1	2.4%
61E	Tunbridge-Lyman-Rock outcrop complex, 25 to 60 percent slopes	C	12.7	0.4%
73D	Berkshire loam, 15 to 25 percent slopes, very stony	B	76.2	2.3%
73E	Berkshire loam, 25 to 35 percent slopes, very stony	B	32.2	1.0%
255C	Monadnock and Hermon soils, 8 to 15 percent, very stony	B	2.6	0.1%
347B	Lyme and Moosilauke soils, 3 to 8 percent slopes, very stony	C	9.0	0.3%
559C	Skerry fine sandy loam, 8 to 15 percent slopes, very stony	C	115.3	3.5%
613	Croghan loamy fine sand	B	5.8	0.2%
701B	Becket-Skerry association, gently sloping, very stony	C	95.2	2.9%
703D	Becket-Monadnock association, moderately steep, very stony	C	427.1	12.9%
703E	Becket-Monadnock association, steep, very stony	C	24.2	0.7%
709D	Becket-Tunbridge association, hilly, very stony	C	646.7	19.6%
709E	Becket-Tunbridge association, steep, very stony	C	102.0	3.1%
710D	Becket-Lyman-Rock outcrop complex, hilly	C	209.7	6.4%
710E	Becket-Lyman-Rock outcrop complex, steep	C	834.3	25.3%
711B	Monadnock-Hermon association, undulating, very stony	B	117.8	3.6%
711D	Monadnock-Hermon association, hilly, very stony	B	172.2	5.2%
713B	Hermon-Waumbek association, undulating, very stony	A	40.1	1.2%
717	Lyme-Peacham association, very stony	C	13.1	0.4%
720E	Marlow-Lyman-Rock outcrop complex, steep	C	6.1	0.2%

Hydrologic Soil Group— Summary by Map Unit — Grafton County, New Hampshire				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
722D	Marlow-Berkshire association, moderately steep, very stony	C	25.9	0.8%
723B	Peru-Pillsbury association, gently sloping, very stony	C	6.1	0.2%
724B	Skerry-Tunbridge association, undulating, very stony	C	62.5	1.9%
726D	Rock outcrop-Lyman complex, hilly		69.8	2.1%
726E	Rock outcrop-Lyman complex, steep		42.7	1.3%
729B	Waumbek-Lyme association, undulating, very stony	B	31.7	1.0%
Totals for Area of Interest			**3,299.3**	**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.

Hydrologic Soil Group

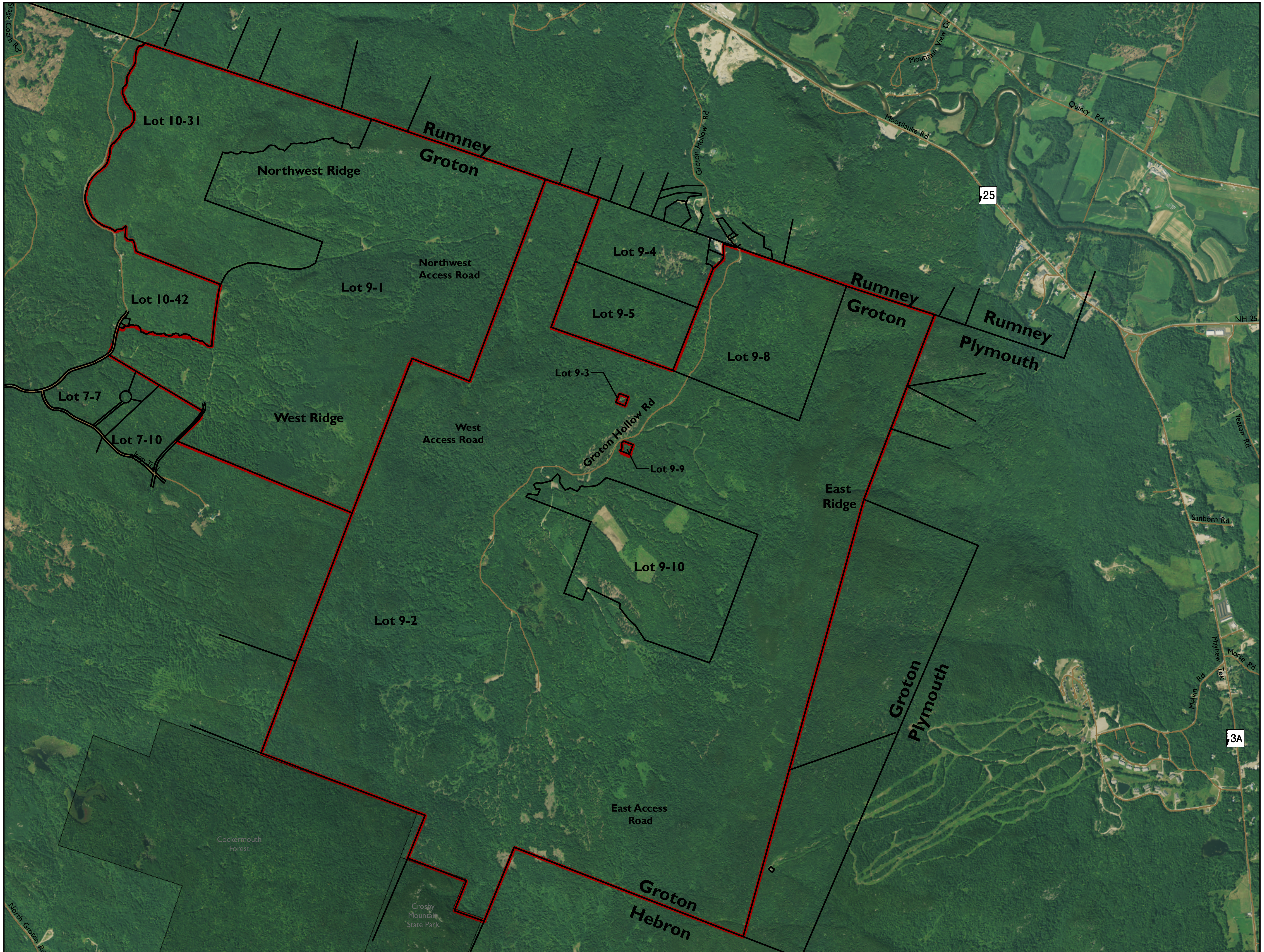
Hydrologic Soil Group— Summary by Map Unit — Grafton County, New Hampshire				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
22B	Colton loamy sand, 3 to 8 percent slopes	A	21.4	0.5%
36A	Adams loamy sand, 0 to 3 percent slopes	A	3.2	0.1%
36B	Adams loamy sand, 3 to 8 percent slopes	A	38.1	1.0%
36C	Adams loamy sand, 8 to 15 percent slopes	A	4.4	0.1%
57D	Becket fine sandy loam, 15 to 25 percent slopes, very stony	C	43.9	1.1%
59B	Waumbek loamy sand, 3 to 8 percent slopes, very stony	B	30.4	0.8%
61C	Tunbridge-Lyman-Rock outcrop complex, 8 to 15 percent slopes	C	43.7	1.1%
61D	Tunbridge-Lyman-Rock outcrop complex, 15 to 25 percent slopes	C	144.4	3.7%
61E	Tunbridge-Lyman-Rock outcrop complex, 25 to 60 percent slopes	C	275.4	7.0%
72C	Berkshire loam, 8 to 15 percent slopes	B	12.7	0.3%
73B	Berkshire loam, 3 to 8 percent slopes, very stony	B	12.1	0.3%
73C	Berkshire loam, 8 to 15 percent slopes, very stony	B	37.0	0.9%
73D	Berkshire loam, 15 to 25 percent slopes, very stony	B	66.8	1.7%
73E	Berkshire loam, 25 to 35 percent slopes, very stony	B	15.0	0.4%
77D	Marlow fine sandy loam, 15 to 25 percent slopes, very stony	C	21.1	0.5%
173D	Berkshire loam, 15 to 25 percent slopes, extremely stony	B	0.5	0.0%
255B	Monadnock and Hermon soils, 3 to 8 percent, very stony	B	121.0	3.1%
255C	Monadnock and Hermon soils, 8 to 15 percent, very stony	B	70.1	1.8%
255D	Monadnock and Hermon soils, 15 to 25 percent slopes, very stony	B	201.6	5.1%
255E	Monadnock and Hermon soils, 25 to 35 percent slopes, very stony	B	18.0	0.5%
299	Udorthents, smoothed		4.5	0.1%
347B	Lyme and Moosilauke soils, 3 to 8 percent slopes, very stony	C	66.5	1.7%
355D	Hermon fine sandy loam, 15 to 25 percent slopes, extremely bouldery	A	11.9	0.3%
406	Medomak silt loam	D	0.9	0.0%

Hydrologic Soil Group— Summary by Map Unit — Grafton County, New Hampshire				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
559B	Skerry fine sandy loam, 3 to 8 percent slopes, very stony	C	3.1	0.1%
559C	Skerry fine sandy loam, 8 to 15 percent slopes, very stony	C	2.6	0.1%
613	Croghan loamy fine sand	B	11.9	0.3%
614	Kinsman sand	C	43.7	1.1%
632A	Nicholville very fine sandy loam, 0 to 3 percent slopes	C	2.2	0.1%
632B	Nicholville very fine sandy loam, 3 to 8 percent slopes	C	25.3	0.6%
633	Pemi silt loam	C	97.8	2.5%
647A	Pillsbury fine sandy loam, 0 to 3 percent slopes, very stony	C	0.4	0.0%
701B	Becket-Skerry association, gently sloping, very stony	C	8.4	0.2%
703D	Becket-Monadnock association, moderately steep, very stony	C	216.8	5.5%
709D	Becket-Tunbridge association, hilly, very stony	C	378.3	9.6%
709E	Becket-Tunbridge association, steep, very stony	C	135.8	3.5%
710D	Becket-Lyman-Rock outcrop complex, hilly	C	901.9	22.9%
710E	Becket-Lyman-Rock outcrop complex, steep	C	379.3	9.6%
711D	Monadnock-Hermon association, hilly, very stony	B	22.8	0.6%
719E	Marlow-Tunbridge association, steep, very stony	C	76.4	1.9%
720E	Marlow-Lyman-Rock outcrop complex, steep	C	145.9	3.7%
722D	Marlow-Berkshire association, moderately steep, very stony	C	59.2	1.5%
726E	Rock outcrop-Lyman complex, steep		35.3	0.9%
730B	Skerry-Lyman-Rock outcrop complex, undulating	C	22.3	0.6%
819B	Peru-Tunbridge association, undulating, very stony	C	99.4	2.5%
W	Water		3.7	0.1%
Totals for Area of Interest			**3,936.8**	**100.0%**

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Grafton County, New Hampshire				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
59C	Waumbek loamy sand, 8 to 15 percent slopes, very stony	B	9.0	0.4%
61E	Tunbridge-Lyman-Rock outcrop complex, 25 to 60 percent slopes	C	4.0	0.2%
90D	Tunbridge-Lyman complex, 15 to 25 percent slopes	C	61.8	2.9%
254B	Monadnock and Hermon soils, 3 to 8 percent slopes	B	6.7	0.3%
255B	Monadnock and Hermon soils, 3 to 8 percent, very stony	B	15.5	0.7%
255C	Monadnock and Hermon soils, 8 to 15 percent, very stony	B	48.6	2.3%
255D	Monadnock and Hermon soils, 15 to 25 percent slopes, very stony	B	79.6	3.7%
255E	Monadnock and Hermon soils, 25 to 35 percent slopes, very stony	B	22.5	1.1%
347B	Lyme and Moosilauke soils, 3 to 8 percent slopes, very stony	C	0.2	0.0%
559B	Skerry fine sandy loam, 3 to 8 percent slopes, very stony	C	7.5	0.4%
559C	Skerry fine sandy loam, 8 to 15 percent slopes, very stony	C	12.6	0.6%
559D	Skerry fine sandy loam, 15 to 25 percent slopes, very stony	C	10.3	0.5%
701B	Becket-Skerry association, gently sloping, very stony	C	41.1	1.9%
703D	Becket-Monadnock association, moderately steep, very stony	C	446.9	21.0%
709D	Becket-Tunbridge association, hilly, very stony	C	170.8	8.0%
709E	Becket-Tunbridge association, steep, very stony	C	63.8	3.0%
710D	Becket-Lyman-Rock outcrop complex, hilly	C	140.9	6.6%
710E	Becket-Lyman-Rock outcrop complex, steep	C	475.2	22.3%
711D	Monadnock-Hermon association, hilly, very stony	B	20.2	0.9%
719D	Marlow-Tunbridge association, hilly, very stony	C	111.0	5.2%
722D	Marlow-Berkshire association, moderately steep, very stony	C	88.6	4.2%

Aerial Photograph of Site



Aerial Photo Map

Iberdrola Renewables, Inc

Groton Windfarm
Groton, NH

Legend

Project Location
Property Lines
Conservation/Public Land
Roads (NHDOT)

0 2,000 4,000 Feet

Source:
Property Lines based on multiple sources of data including ground survey, and assessing tax maps.
Conservation Lands, Roads, and hydrography data taken from the archives on NHGRANIT.
2008 aerial photography provided by the USDA Farm Bureau.

VHB

Vanasse Hangen Brustlin, Inc.

Site Photographs

Existing access/logging road.

Typical clearing and wooded area.

View of woods and a ridgeline.

View of woods and a ridgeline.

Typical wooded area.

View of woods and logging path.

View from on-site ridgeline.

View of Clark Brook

Base Calculations (GRV, WQV, & WQF)

General Calculations - WQV and WQF

Water Quality Volume (WQV)

1.6	ac	Area (A) draining to the system
0.2	ac	Impervious area draining to the system
0.11	decimal	Percent Impervious area (I) draining to the pond
0.15	unitless	Runoff coefficient (Rv) = 0.05 + (0.9 x I)
0.23	ac-in	WQV= 1" x Rv x A
846	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")

Water Quality Flow (WQF) - note you must first calculate the WQV using the above calculations

1	inches	P is the rainfall. For WQF in NH, P = 1".
0.15	inches	Q is the water quality depth. Q = WQV/A
84	unitless	CN is the unit peak discharge curve number. CN =1000/(10+5P+10Q–10*[Q2 + 1.25*Q*P] 0.5)
1.9	inches	S is the potential maximum retention. S = (1000/CN) - 10
0.390	inches	Ia is the initial abstraction. Ia = 0.2S
6.0	minutes	Time of Concentration
280.0	$cfs/mi^2/in$	qu is the unit peak discharge. Obtain this value from TR-55 exhibits 4-II and 4-III
0.102	cfs	WQF = qu x WQV. Conversion:to convert "cfs/mi2/in * ac-in" to "cfs" multiply by 1mi2/640 ac

Designer's Notes: For O&M Building site area

The rain garden and filtration basin have a total storage capacity of 14,084 cf

Rainfall Data

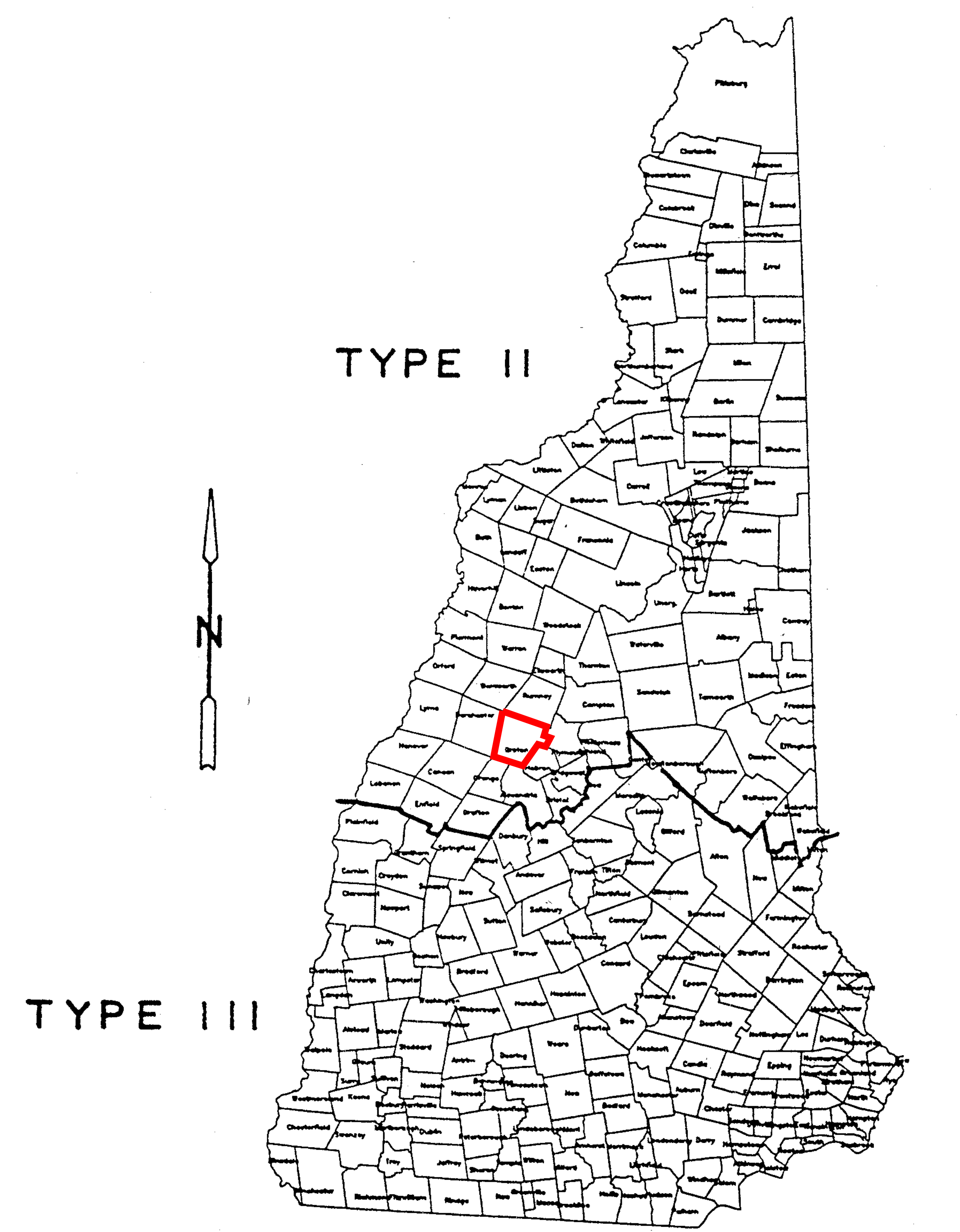


FIGURE 6-5 -- BOUNDARY FOR SCS RAINFALL DISTRIBUTION

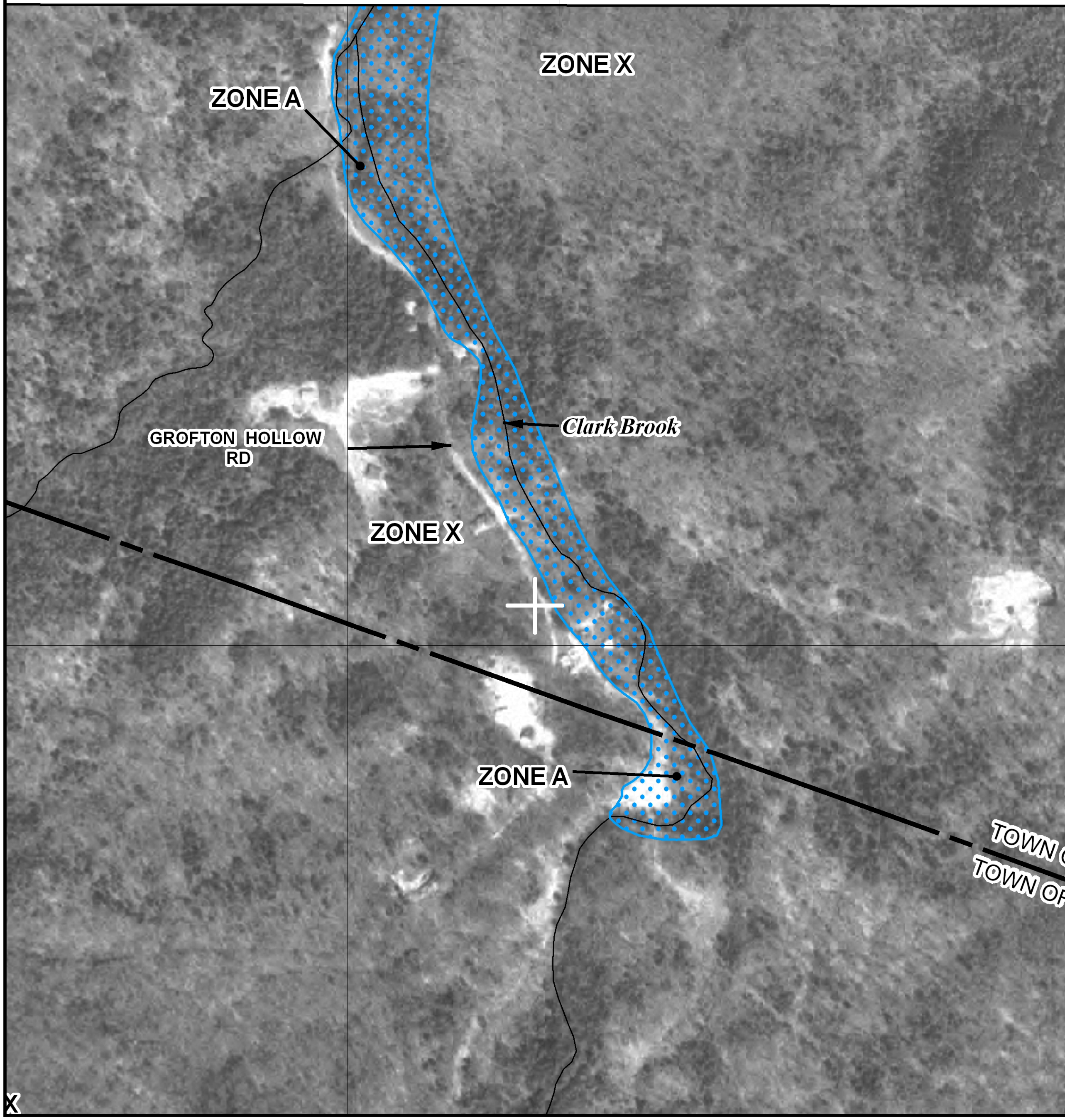
Source: USDA Soil Conservation Service

TOWN	24-hour SCS Rainfall*					
	1 yr	2 yr	10 yr	25 yr	50 yr	100 yr
FRANKLIN	2.4	2.8	4.1	5.0	5.4	6.1
FREEDOM	2.5	3.0	4.6	5.2	5.9	6.2
FREMONT	2.5	3.0	4.3	5.2	5.7	6.4
GILFORD	2.4	2.8	4.1	5.0	5.5	6.1
GILMANTON	2.4	2.9	4.2	5.0	5.5	6.2
GILSUM	2.3	2.8	4.1	4.9	5.5	6.2
GOFFSTOWN	2.5	2.9	4.2	5.1	5.7	6.3
GORHAM	2.7	3.4	4.9	5.4	6.2	6.7
GOSHEN	2.3	2.7	4.1	4.8	5.4	6.1
GRAFTON	2.3	2.7	4.0	4.8	5.3	5.9
GRANTHAM	2.3	2.6	4.0	4.8	5.3	5.9
GREENFIELD	2.4	2.9	4.2	5.0	5.6	6.3
GREENLAND	2.6	3.1	4.4	5.2	5.8	6.4
GREEN'S GRANT	3.0	3.7	5.2	6.1	6.6	7.2
GREENVILLE	2.5	2.9	4.3	5.1	5.7	6.4
GROTON	2.3	2.6	4.1	4.8	5.3	5.9
HADLEY'S PURCHASE	2.9	3.6	5.1	5.9	6.4	7.1
HALE'S LOCATION	3.0	3.4	5.0	5.8	6.3	6.7
HAMPSTEAD	2.5	3.0	4.3	5.2	5.8	6.4
HAMPTON	2.6	3.1	4.4	5.2	5.8	6.5
HAMPTON FALLS	2.6	3.1	4.4	5.2	5.8	6.5
HANCOCK	2.4	2.8	4.2	5.0	5.6	6.3
HANOVER	2.3	2.6	4.0	4.7	5.2	5.8
HARRISVILLE	2.4	2.8	4.2	5.0	5.6	6.3
HART'S LOCATION	2.9	3.6	5.0	5.8	6.3	7.1
HAVERHILL	2.3	2.5	3.9	4.7	5.1	5.7
HEBRON	2.4	2.7	4.1	4.9	5.3	5.9
HENNIKER	2.4	2.8	4.2	5.0	5.5	6.2
HILL	2.3	2.7	4.1	4.9	5.4	6.0
HILLSBOROUGH	2.4	2.8	4.2	4.9	5.5	6.2
HINSDALE	2.3	2.8	4.2	5.0	5.6	6.3
HOLDERNESS	2.4	2.8	4.2	5.0	5.4	6.0
HOLLIS	2.5	3.0	4.3	5.1	5.8	6.4
HOOKSETT	2.5	2.9	4.3	5.1	5.7	6.3
HOPKINTON	2.4	2.8	4.2	5.0	5.6	6.2
HUDSON	2.6	3.0	4.3	5.2	5.8	6.4
JACKSON	3.0	3.7	5.2	6.2	6.6	7.2
JAFFREY	2.4	2.9	4.2	5.0	5.6	6.3
JEFFERSON	2.5	3.1	4.3	5.0	5.6	6.1
KEENE	2.3	2.8	4.2	4.9	5.5	6.2
KENSINGTON	2.6	3.1	4.4	5.2	5.8	6.5
KILKENNY	2.4	2.8	4.1	4.9	5.3	6.1
KINGSTON	2.6	3.0	4.4	5.2	5.8	6.5
LACONIA	2.4	2.8	4.1	5.0	5.4	6.1

*Rainfall data is interpolated from *Technical Paper No. 40 (TP40) Rainfall Frequency Atlas of the Eastern United States* . Other data may be used (e.g., *Atlas of Precipitation Extremes for the Northeastern United States and Southeastern Canada* by Cornell University, Northeast Regional Climate Center, September, 1993.)

Floodplain Maps

JOINS PANEL 0816 950000 FT



od insurance is available in this community, contact your I
onal Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000

150 0 150 300

NFIP

PANEL 0818E

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

GRAFTON COUNTY, NEW HAMPSHIRE (ALL JURISDICTIONS)

PANEL 818 OF 1185

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
GROTON, TOWN OF	330055	0818	E
PLYMOUTH, TOWN OF	330072	0818	E
RUMNEY, TOWN OF	330073	0818	E

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER 33009C0818E

EFFECTIVE DATE FEBRUARY 20, 2008

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

Appendix B: Hydrologic Calculations

- Existing Conditions
- Proposed Conditions

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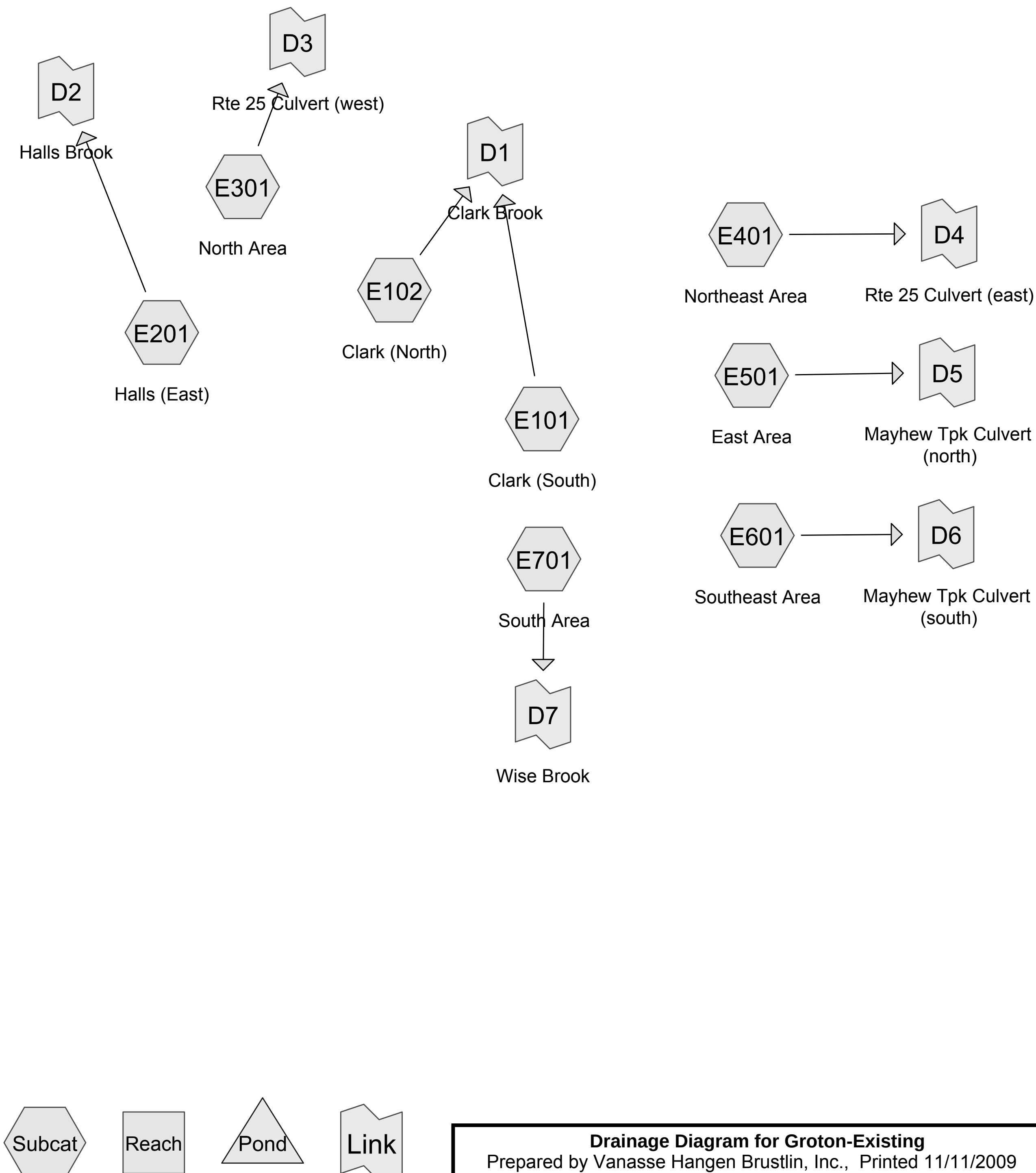
Existing Conditions

- Drainage Diagram (HydroCAD)
- Area and Soil Listings (HydroCAD)
- Node Listing: 2-yr, 10-yr, and 50 yr (HydroCAD)
- Full Summary: 10-yr (HydroCAD)



Drainage Diagram for Groton-Existing
Prepared by Vanasse Hangen Brustlin, Inc., Printed 11/11/2009
HydroCAD® 9.00 s/n 01038 © 2009 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
327.690	30	Woods, Good, HSG A (E101, E102, E201, E301, E401, E501, E601)
4.750	36	Clearing, HSG A (E101, E102)
33.680	51	1 acre lots, 20% imp, HSG A (E301)
992.910	55	Woods, Good, HSG B (E101, E102, E201, E301, E401, E501, E601, E701)
45.650	60	Clearing, HSG B (E101, E102)
5,825.470	70	Woods, Good, HSG C (E101, E102, E201, E301, E401, E501, E601, E701)
50.250	73	Clearing, HSG C (E101, E601)
1.450	76	Gravel roads, HSG A (E101, E102, E201)
36.980	77	Woods, Good, HSG D (E101, E301, E401, E701)
5.530	85	Gravel roads, HSG B (E101, E102, E201)
4.990	89	Gravel roads, HSG C (E101, E102, E201)
0.850	98	Buildings (E101, E102, E201)
6.170	98	Ledge Outcrop (E101, E102, E201, E301, E401, E501, E601)
35.360	98	Paved Roads (E201, E301, E401, E501, E601)
10.040	98	Water (E101, E102, E301)
7,381.770		**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Goup	Subcatchment Numbers
367.570	HSG A	E101, E102, E201, E301, E401, E501, E601
1,044.090	HSG B	E101, E102, E201, E301, E401, E501, E601, E701
5,880.710	HSG C	E101, E102, E201, E301, E401, E501, E601, E701
36.980	HSG D	E101, E301, E401, E701
52.420	Other	E101, E102, E201, E301, E401, E501, E601
7,381.770		**TOTAL AREA**

Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E101: Clark (South) Runoff Area=2,672.780 ac 0.35% Impervious Runoff Depth>0.21"
Flow Length=21,575' Tc=112.5 min CN=67 Runoff=80.14 cfs 46.395 af

Subcatchment E102: Clark (North) Runoff Area=758.680 ac 0.28% Impervious Runoff Depth=0.24"
Flow Length=10,573' Tc=53.9 min CN=68 Runoff=39.65 cfs 15.145 af

Subcatchment E201: Halls (East) Runoff Area=1,196.510 ac 1.11% Impervious Runoff Depth=0.15"
Flow Length=17,345' Tc=63.7 min CN=65 Runoff=25.48 cfs 15.177 af

Subcatchment E301: North Area Runoff Area=541.700 ac 2.69% Impervious Runoff Depth=0.10"
Flow Length=6,897' Tc=52.3 min CN=63 Runoff=6.58 cfs 4.725 af

Subcatchment E401: Northeast Area Runoff Area=400.410 ac 0.89% Impervious Runoff Depth=0.08"
Flow Length=9,068' Tc=46.3 min CN=62 Runoff=3.58 cfs 2.807 af

Subcatchment E501: East Area Runoff Area=951.260 ac 1.10% Impervious Runoff Depth=0.18"
Flow Length=10,511' Tc=67.3 min CN=66 Runoff=26.52 cfs 14.205 af

Subcatchment E601: Southeast Area Runoff Area=665.410 ac 0.86% Impervious Runoff Depth=0.24"
Flow Length=10,868' Tc=78.3 min CN=68 Runoff=29.46 cfs 13.283 af

Subcatchment E701: South Area Runoff Area=195.020 ac 0.00% Impervious Runoff Depth=0.35"
Flow Length=6,856' Tc=62.0 min CN=71 Runoff=18.80 cfs 5.625 af

Link D1: Clark Brook Inflow=105.66 cfs 61.540 af
Primary=105.66 cfs 61.540 af

Link D2: Halls Brook Inflow=25.48 cfs 15.177 af
Primary=25.48 cfs 15.177 af

Link D3: Rte 25 Culvert (west) Inflow=6.58 cfs 4.725 af
Primary=6.58 cfs 4.725 af

Link D4: Rte 25 Culvert (east) Inflow=3.58 cfs 2.807 af
Primary=3.58 cfs 2.807 af

Link D5: Mayhew Tpk Culvert (north) Inflow=26.52 cfs 14.205 af
Primary=26.52 cfs 14.205 af

Link D6: Mayhew Tpk Culvert (south) Inflow=29.46 cfs 13.283 af
Primary=29.46 cfs 13.283 af

Link D7: Wise Brook Inflow=18.80 cfs 5.625 af
Primary=18.80 cfs 5.625 af

Total Runoff Area = 7,381.770 ac Runoff Volume = 117.361 af Average Runoff Depth = 0.19"
99.20% Pervious = 7,322.614 ac 0.80% Impervious = 59.156 ac

Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E101: Clark (South) Runoff Area=2,672.780 ac 0.35% Impervious Runoff Depth=0.91"
Flow Length=21,575' Tc=112.5 min CN=67 Runoff=612.06 cfs 202.935 af

Subcatchment E102: Clark (North) Runoff Area=758.680 ac 0.28% Impervious Runoff Depth=0.98"
Flow Length=10,573' Tc=53.9 min CN=68 Runoff=329.64 cfs 61.791 af

Subcatchment E201: Halls (East) Runoff Area=1,196.510 ac 1.11% Impervious Runoff Depth=0.78"
Flow Length=17,345' Tc=63.7 min CN=65 Runoff=327.40 cfs 78.221 af

Subcatchment E301: North Area Runoff Area=541.700 ac 2.69% Impervious Runoff Depth=0.67"
Flow Length=6,897' Tc=52.3 min CN=63 Runoff=128.69 cfs 30.054 af

Subcatchment E401: Northeast Area Runoff Area=400.410 ac 0.89% Impervious Runoff Depth=0.61"
Flow Length=9,068' Tc=46.3 min CN=62 Runoff=88.31 cfs 20.336 af

Subcatchment E501: East Area Runoff Area=951.260 ac 1.10% Impervious Runoff Depth=0.85"
Flow Length=10,511' Tc=67.3 min CN=66 Runoff=280.90 cfs 67.129 af

Subcatchment E601: Southeast Area Runoff Area=665.410 ac 0.86% Impervious Runoff Depth=0.98"
Flow Length=10,868' Tc=78.3 min CN=68 Runoff=220.58 cfs 54.195 af

Subcatchment E701: South Area Runoff Area=195.020 ac 0.00% Impervious Runoff Depth=1.19"
Flow Length=6,856' Tc=62.0 min CN=71 Runoff=102.21 cfs 19.298 af

Link D1: Clark Brook Inflow=761.72 cfs 264.726 af
Primary=761.72 cfs 264.726 af

Link D2: Halls Brook Inflow=327.40 cfs 78.221 af
Primary=327.40 cfs 78.221 af

Link D3: Rte 25 Culvert (west) Inflow=128.69 cfs 30.054 af
Primary=128.69 cfs 30.054 af

Link D4: Rte 25 Culvert (east) Inflow=88.31 cfs 20.336 af
Primary=88.31 cfs 20.336 af

Link D5: Mayhew Tpk Culvert (north) Inflow=280.90 cfs 67.129 af
Primary=280.90 cfs 67.129 af

Link D6: Mayhew Tpk Culvert (south) Inflow=220.58 cfs 54.195 af
Primary=220.58 cfs 54.195 af

Link D7: Wise Brook Inflow=102.21 cfs 19.298 af
Primary=102.21 cfs 19.298 af

Total Runoff Area = 7,381.770 ac Runoff Volume = 533.958 af Average Runoff Depth = 0.87"
99.20% Pervious = 7,322.614 ac 0.80% Impervious = 59.156 ac

Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E101: Clark (South) Runoff Area=2,672.780 ac 0.35% Impervious Runoff Depth=1.67"
Flow Length=21,575' Tc=112.5 min CN=67 Runoff=1,298.55 cfs 372.010 af

Subcatchment E102: Clark (North) Runoff Area=758.680 ac 0.28% Impervious Runoff Depth=1.76"
Flow Length=10,573' Tc=53.9 min CN=68 Runoff=690.57 cfs 111.220 af

Subcatchment E201: Halls (East) Runoff Area=1,196.510 ac 1.11% Impervious Runoff Depth=1.50"
Flow Length=17,345' Tc=63.7 min CN=65 Runoff=763.78 cfs 149.262 af

Subcatchment E301: North Area Runoff Area=541.700 ac 2.69% Impervious Runoff Depth=1.33"
Flow Length=6,897' Tc=52.3 min CN=63 Runoff=336.19 cfs 60.045 af

Subcatchment E401: Northeast Area Runoff Area=400.410 ac 0.89% Impervious Runoff Depth=1.25"
Flow Length=9,068' Tc=46.3 min CN=62 Runoff=245.49 cfs 41.684 af

Subcatchment E501: East Area Runoff Area=951.260 ac 1.10% Impervious Runoff Depth=1.58"
Flow Length=10,511' Tc=67.3 min CN=66 Runoff=632.71 cfs 125.472 af

Subcatchment E601: Southeast Area Runoff Area=665.410 ac 0.86% Impervious Runoff Depth=1.76"
Flow Length=10,868' Tc=78.3 min CN=68 Runoff=458.84 cfs 97.547 af

Subcatchment E701: South Area Runoff Area=195.020 ac 0.00% Impervious Runoff Depth=2.03"
Flow Length=6,856' Tc=62.0 min CN=71 Runoff=194.46 cfs 33.070 af

Link D1: Clark Brook Inflow=1,583.81 cfs 483.229 af
Primary=1,583.81 cfs 483.229 af

Link D2: Halls Brook Inflow=763.78 cfs 149.262 af
Primary=763.78 cfs 149.262 af

Link D3: Rte 25 Culvert (west) Inflow=336.19 cfs 60.045 af
Primary=336.19 cfs 60.045 af

Link D4: Rte 25 Culvert (east) Inflow=245.49 cfs 41.684 af
Primary=245.49 cfs 41.684 af

Link D5: Mayhew Tpk Culvert (north) Inflow=632.71 cfs 125.472 af
Primary=632.71 cfs 125.472 af

Link D6: Mayhew Tpk Culvert (south) Inflow=458.84 cfs 97.547 af
Primary=458.84 cfs 97.547 af

Link D7: Wise Brook Inflow=194.46 cfs 33.070 af
Primary=194.46 cfs 33.070 af

Total Runoff Area = 7,381.770 ac Runoff Volume = 990.308 af Average Runoff Depth = 1.61"
99.20% Pervious = 7,322.614 ac 0.80% Impervious = 59.156 ac

Summary for Subcatchment E101: Clark (South)

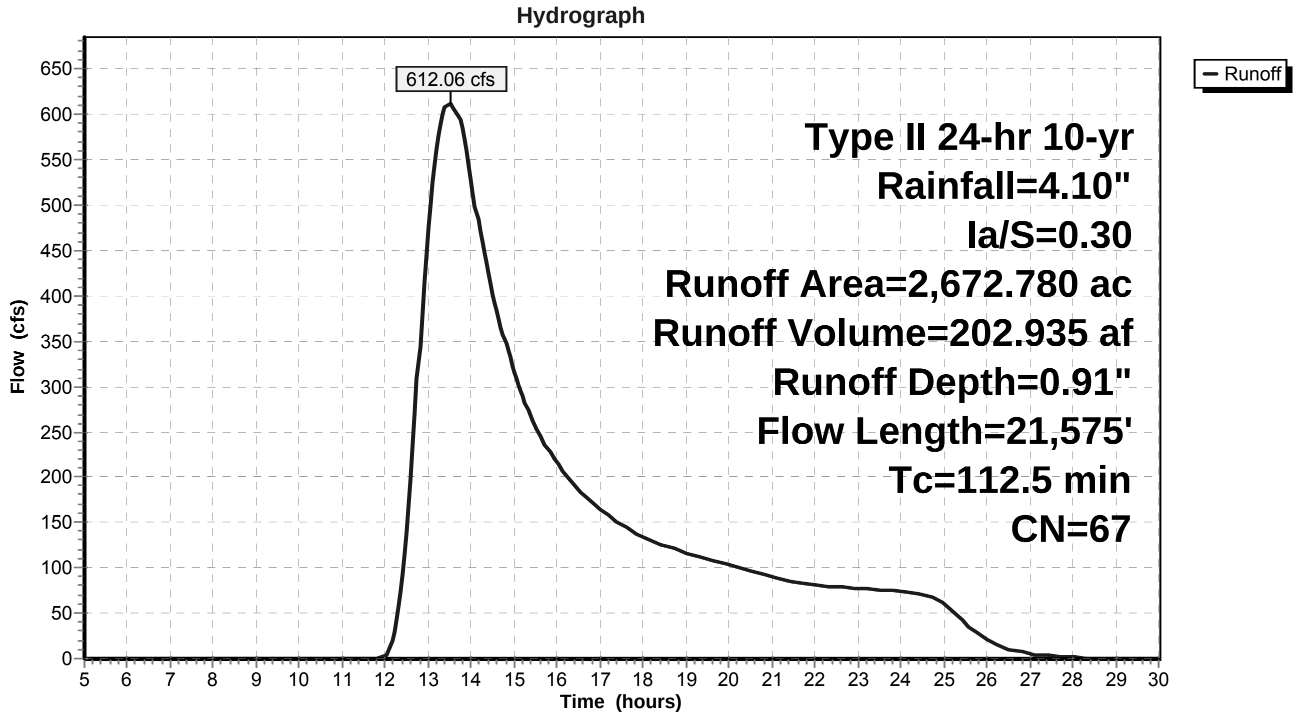
Runoff = 612.06 cfs @ 13.51 hrs, Volume= 202.935 af, Depth= 0.91"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.10", Ia/S=0.30

	Area (ac)	CN	Description
*	0.690	98	Buildings
*	4.510	36	Clearing, HSG A
*	44.900	60	Clearing, HSG B
*	48.390	73	Clearing, HSG C
	1.210	76	Gravel roads, HSG A
	5.340	85	Gravel roads, HSG B
	2.490	89	Gravel roads, HSG C
*	0.890	98	Ledge Outcrop
	0.000	51	1 acre lots, 20% imp, HSG A
*	0.000	98	Paved Roads
*	7.830	98	Water
	46.500	30	Woods, Good, HSG A
	378.580	55	Woods, Good, HSG B
	2,126.920	70	Woods, Good, HSG C
	4.530	77	Woods, Good, HSG D
	2,672.780	67	Weighted Average
	2,663.370		99.65% Pervious Area
	9.410		0.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
54.7	100	0.0100	0.03		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
5.7	540	0.1000	1.58		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
7.9	2,940	0.1200	6.22	24.90	**Trap/Vee/Rect Channel Flow, Drainage Channel** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.060
17.0	4,105	0.0500	4.02	16.07	**Trap/Vee/Rect Channel Flow, Channel/Brook** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.060
27.2	13,890	0.0400	8.50	492.74	**Trap/Vee/Rect Channel Flow, Clark Brook** Bot.W=25.00' D=2.00' Z= 2.0 '/' Top.W=33.00' n= 0.050
112.5	21,575	Total			

Subcatchment E101: Clark (South)



Summary for Subcatchment E102: Clark (North)

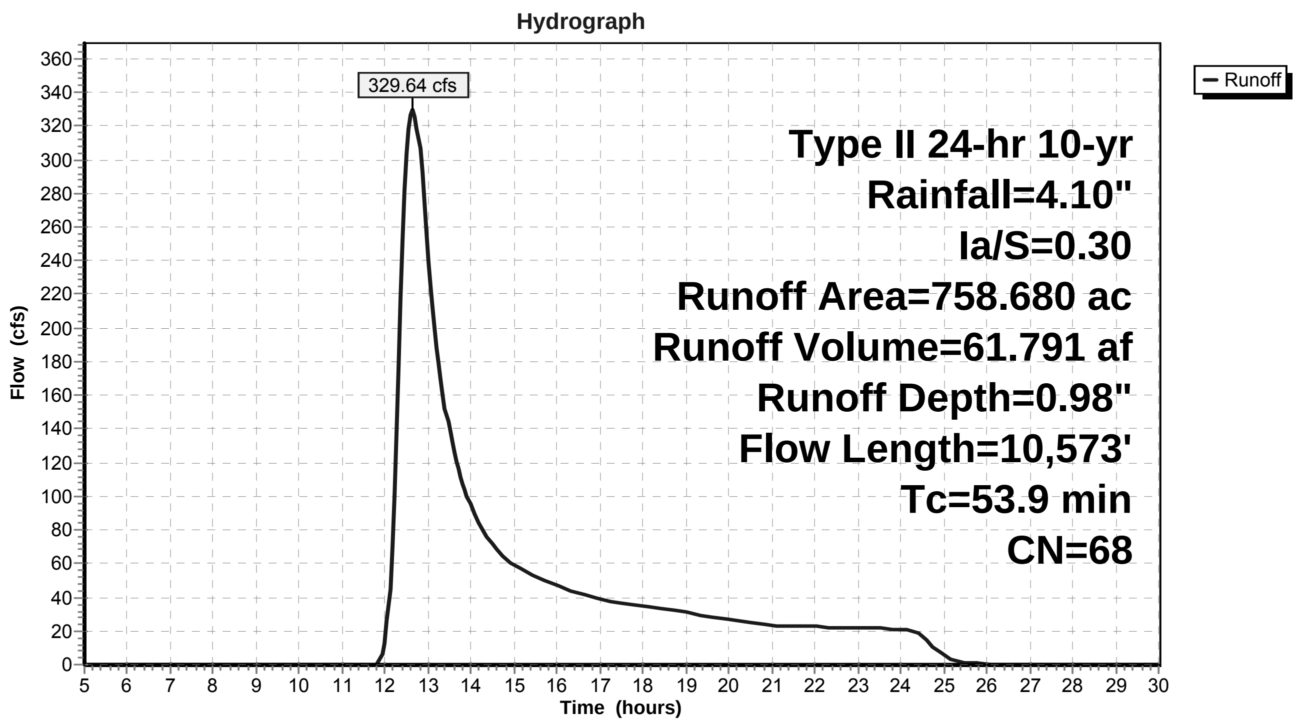
Runoff = 329.64 cfs @ 12.65 hrs, Volume= 61.791 af, Depth= 0.98"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.10", Ia/S=0.30

	Area (ac)	CN	Description
*	0.040	98	Buildings
*	0.240	36	Clearing, HSG A
*	0.750	60	Clearing, HSG B
*	0.000	73	Clearing, HSG C
*	0.060	76	Gravel roads, HSG A
*	0.180	85	Gravel roads, HSG B
*	0.990	89	Gravel roads, HSG C
*	1.860	98	Ledge Outcrop
*	0.000	51	1 acre lots, 20% imp, HSG A
*	0.000	98	Paved Roads
*	0.260	98	Water
*	0.540	30	Woods, Good, HSG A
*	110.260	55	Woods, Good, HSG B
*	643.500	70	Woods, Good, HSG C
*	0.000	77	Woods, Good, HSG D
	758.680	68	Weighted Average
	756.520		99.72% Pervious Area
	2.160		0.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.5	70	0.0570	0.06		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
3.7	458	0.1700	2.06		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.6	325	0.2500	8.98	35.94	**Trap/Vee/Rect Channel Flow, Drainage Channel** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.060
2.3	394	0.0250	2.84	11.37	**Trap/Vee/Rect Channel Flow, Drainage Channel** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.060
1.5	373	0.0540	4.18	16.70	**Trap/Vee/Rect Channel Flow, Drainage Channel** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.060
0.8	373	0.2100	8.23	32.94	**Trap/Vee/Rect Channel Flow, Drainage Channel** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.060
4.4	1,385	0.0850	5.24	20.96	**Trap/Vee/Rect Channel Flow, Drainage Channel** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.060
1.7	270	0.0220	2.67	10.66	**Trap/Vee/Rect Channel Flow, Drainage Channel** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.060
0.7	201	0.0800	5.08	20.33	**Trap/Vee/Rect Channel Flow, Drainage Channel** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.060
4.4	1,129	0.0350	4.25	21.27	**Trap/Vee/Rect Channel Flow, Stream** Bot.W=3.00' D=1.00' Z= 2.0 '/' Top.W=7.00' n= 0.050
13.3	5,595	0.0950	7.01	35.04	**Trap/Vee/Rect Channel Flow, Stream** Bot.W=3.00' D=1.00' Z= 2.0 '/' Top.W=7.00' n= 0.050
53.9	10,573	Total			

Subcatchment E102: Clark (North)



Summary for Subcatchment E201: Halls (East)

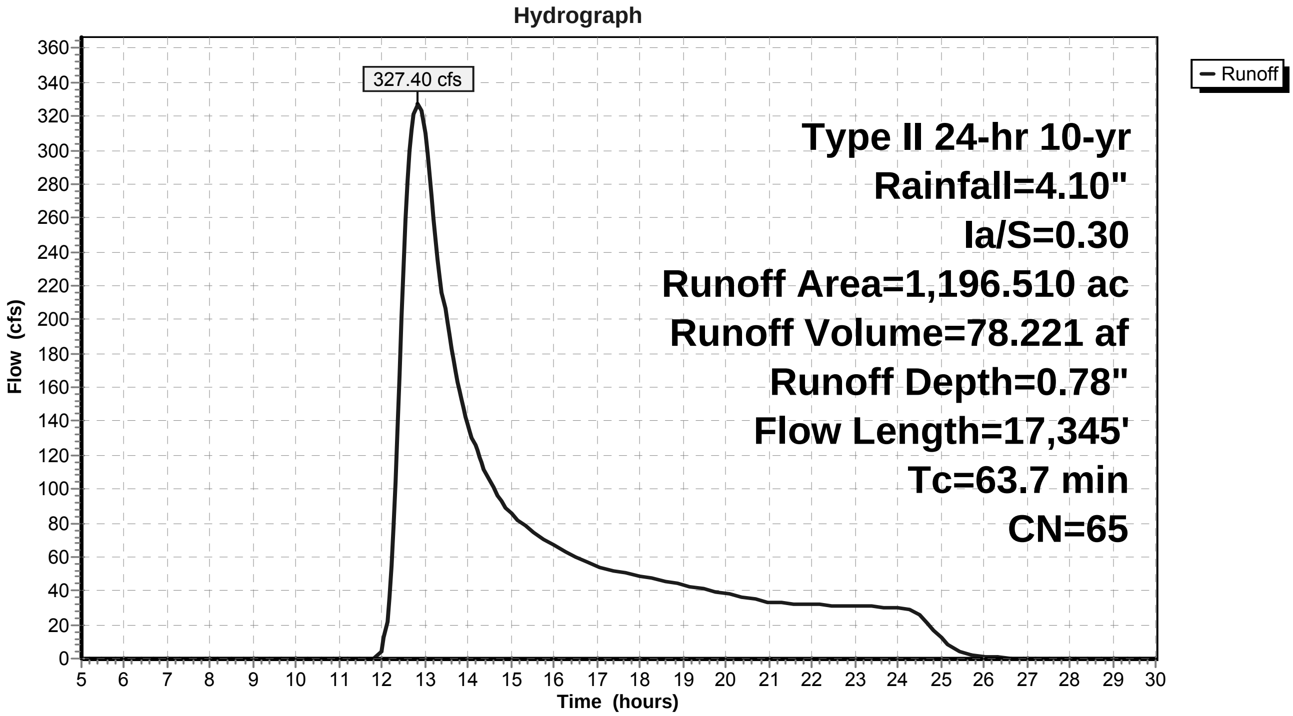
Runoff = 327.40 cfs @ 12.83 hrs, Volume= 78.221 af, Depth= 0.78"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.10", Ia/S=0.30

	Area (ac)	CN	Description
*	0.120	98	Buildings
*	0.000	36	Clearing, HSG A
*	0.000	60	Clearing, HSG B
*	0.000	73	Clearing, HSG C
	0.180	76	Gravel roads, HSG A
	0.010	85	Gravel roads, HSG B
	1.510	89	Gravel roads, HSG C
*	0.220	98	Ledge Outcrop
	0.000	51	1 acre lots, 20% imp, HSG A
*	12.940	98	Paved Roads
*	0.000	98	Water
	160.380	30	Woods, Good, HSG A
	26.210	55	Woods, Good, HSG B
	994.940	70	Woods, Good, HSG C
	0.000	77	Woods, Good, HSG D
	1,196.510	65	Weighted Average
	1,183.230		98.89% Pervious Area
	13.280		1.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.8	100	0.0800	0.07		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
6.3	950	0.2500	2.50		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
13.9	5,500	0.1350	6.60	26.41	**Trap/Vee/Rect Channel Flow, Stream** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.060
19.7	10,795	0.0450	9.14	621.64	**Trap/Vee/Rect Channel Flow, Halls Brook** Bot.W=30.00' D=2.00' Z= 2.0 '/' Top.W=38.00' n= 0.050
63.7	17,345	Total			

Subcatchment E201: Halls (East)



Summary for Subcatchment E301: North Area

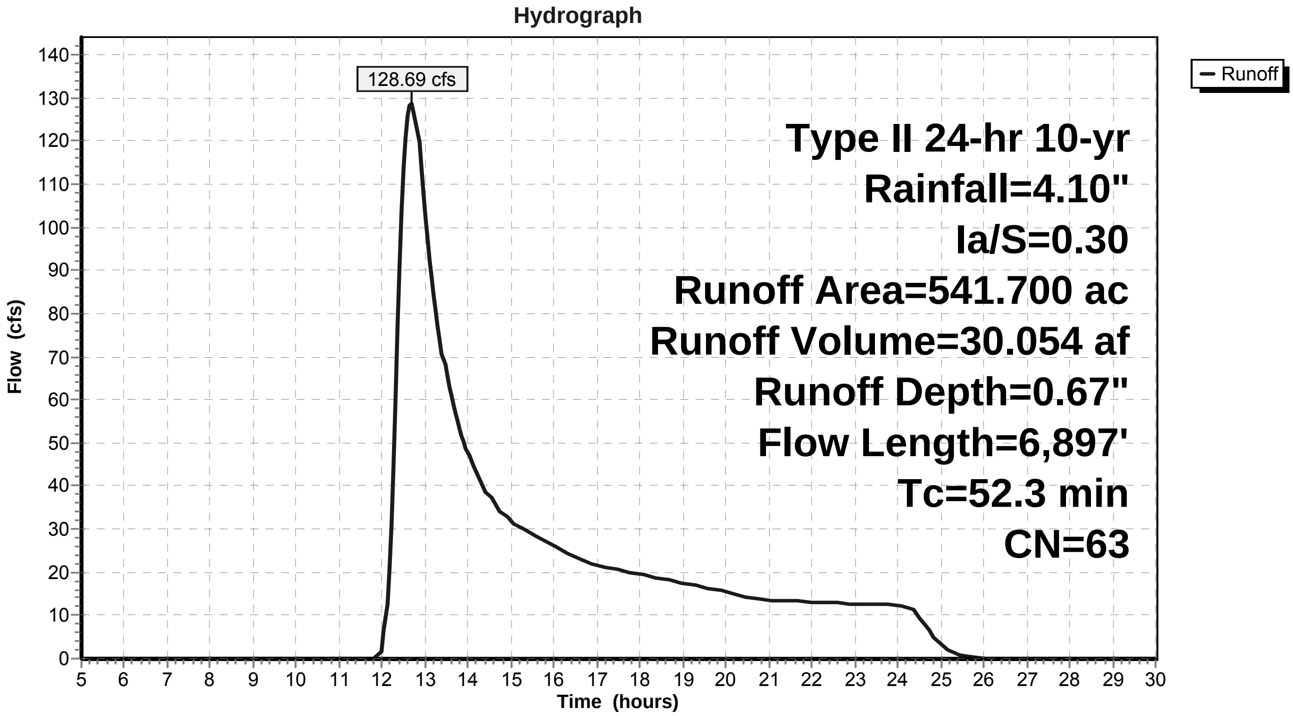
Runoff = 128.69 cfs @ 12.69 hrs, Volume= 30.054 af, Depth= 0.67"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.10", Ia/S=0.30

	Area (ac)	CN	Description
*	0.000	98	Buildings
*	0.000	36	Clearing, HSG A
*	0.000	60	Clearing, HSG B
*	0.000	73	Clearing, HSG C
	0.000	76	Gravel roads, HSG A
	0.000	85	Gravel roads, HSG B
	0.000	89	Gravel roads, HSG C
*	0.390	98	Ledge Outcrop
	33.680	51	1 acre lots, 20% imp, HSG A
*	5.510	98	Paved Roads
*	1.950	98	Water
	71.640	30	Woods, Good, HSG A
	36.050	55	Woods, Good, HSG B
	390.430	70	Woods, Good, HSG C
	2.050	77	Woods, Good, HSG D
	541.700	63	Weighted Average
	527.114		97.31% Pervious Area
	14.586		2.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.3	100	0.0940	0.07		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
5.0	707	0.2230	2.36		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
5.5	2,030	0.0790	6.14	73.73	**Trap/Vee/Rect Channel Flow, Drainage Channel** Bot.W=10.00' D=1.00' Z= 2.0 '/' Top.W=14.00' n= 0.060
18.7	3,400	0.0180	3.03	106.04	**Trap/Vee/Rect Channel Flow, Woods** Bot.W=30.00' D=1.00' Z= 5.0 '/' Top.W=40.00' n= 0.060
0.8	660		13.90		**Lake or Reservoir, Pond** Mean Depth= 6.00'
52.3	6,897	Total			

Subcatchment E301: North Area



Summary for Subcatchment E401: Northeast Area

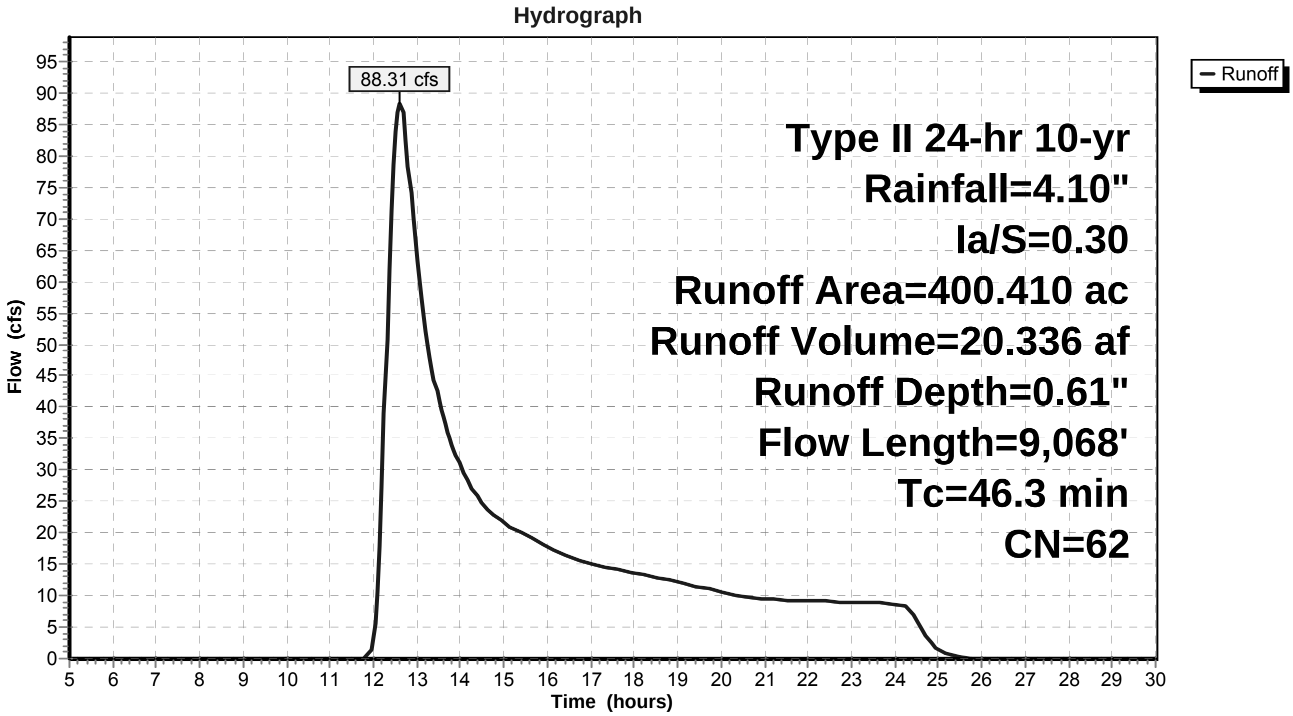
Runoff = 88.31 cfs @ 12.61 hrs, Volume= 20.336 af, Depth= 0.61"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.10", Ia/S=0.30

	Area (ac)	CN	Description
*	0.000	98	Buildings
*	0.000	36	Clearing, HSG A
*	0.000	60	Clearing, HSG B
*	0.000	73	Clearing, HSG C
	0.000	76	Gravel roads, HSG A
	0.000	85	Gravel roads, HSG B
	0.000	89	Gravel roads, HSG C
*	1.640	98	Ledge Outcrop
	0.000	51	1 acre lots, 20% imp, HSG A
*	1.940	98	Paved Roads
*	0.000	98	Water
	6.740	30	Woods, Good, HSG A
	200.500	55	Woods, Good, HSG B
	181.300	70	Woods, Good, HSG C
	8.290	77	Woods, Good, HSG D
	400.410	62	Weighted Average
	396.830		99.11% Pervious Area
	3.580		0.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.8	100	0.0800	0.07		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
2.0	270	0.2000	2.24		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
3.8	295	0.0680	1.30		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
8.8	4,525	0.2300	8.62	34.47	**Trap/Vee/Rect Channel Flow, Drainage Channel** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.060
7.9	3,878	0.0780	8.20	147.61	**Trap/Vee/Rect Channel Flow, Stream** Bot.W=5.00' D=2.00' Z= 2.0 '/' Top.W=13.00' n= 0.060
46.3	9,068	Total			

Subcatchment E401: Northeast Area



Summary for Subcatchment E501: East Area

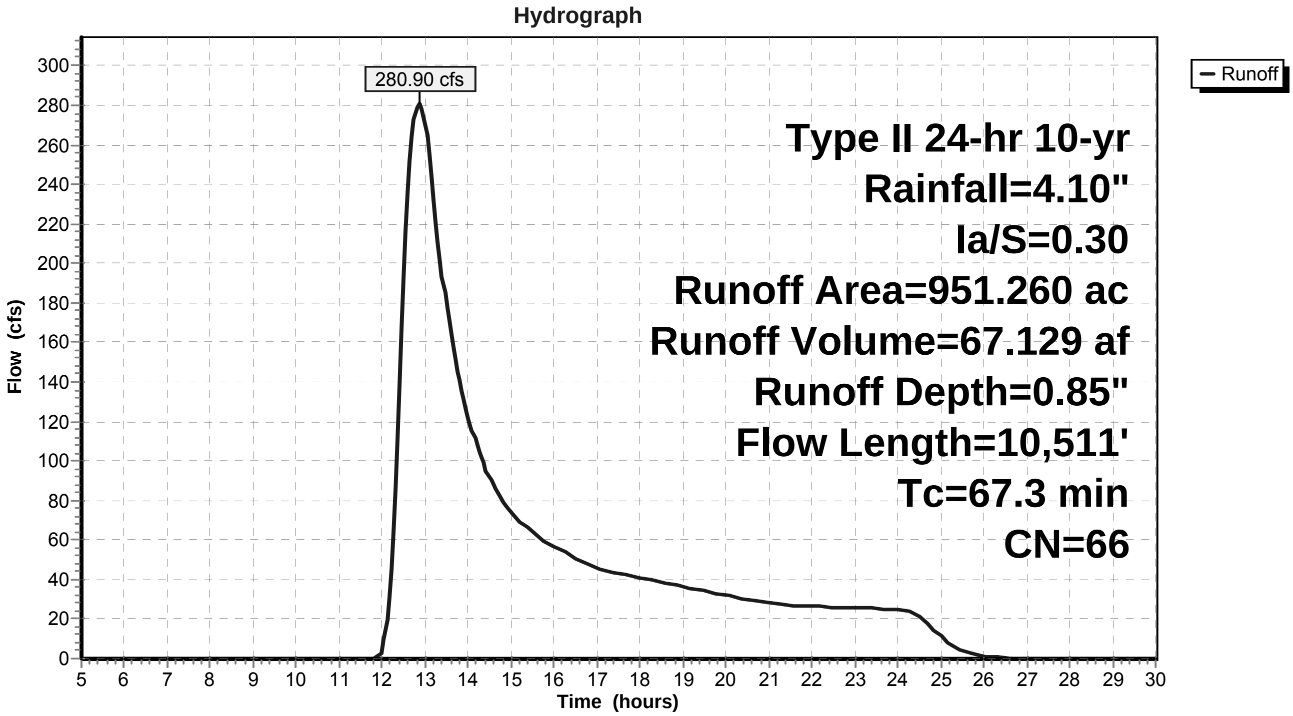
Runoff = 280.90 cfs @ 12.86 hrs, Volume= 67.129 af, Depth= 0.85"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.10", Ia/S=0.30

	Area (ac)	CN	Description
*	0.000	98	Buildings
*	0.000	36	Clearing, HSG A
*	0.000	60	Clearing, HSG B
*	0.000	73	Clearing, HSG C
*	0.000	76	Gravel roads, HSG A
*	0.000	85	Gravel roads, HSG B
*	0.000	89	Gravel roads, HSG C
*	0.940	98	Ledge Outcrop
*	0.000	51	1 acre lots, 20% imp, HSG A
*	9.480	98	Paved Roads
*	0.000	98	Water
*	30.250	30	Woods, Good, HSG A
*	182.780	55	Woods, Good, HSG B
*	727.810	70	Woods, Good, HSG C
*	0.000	77	Woods, Good, HSG D
	951.260	66	Weighted Average
	940.840		98.90% Pervious Area
	10.420		1.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.4	65	0.0170	0.03		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
5.5	353	0.0450	1.06		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
2.2	315	0.2300	2.40		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
11.8	6,380	0.1970	8.99	62.90	**Trap/Vee/Rect Channel Flow, Stream** Bot.W=5.00' D=1.00' Z= 2.0 '/' Top.W=9.00' n= 0.060
16.4	3,398	0.0290	3.45	24.13	**Trap/Vee/Rect Channel Flow, Stream** Bot.W=5.00' D=1.00' Z= 2.0 '/' Top.W=9.00' n= 0.060
67.3	10,511	Total			

Subcatchment E501: East Area



Summary for Subcatchment E601: Southeast Area

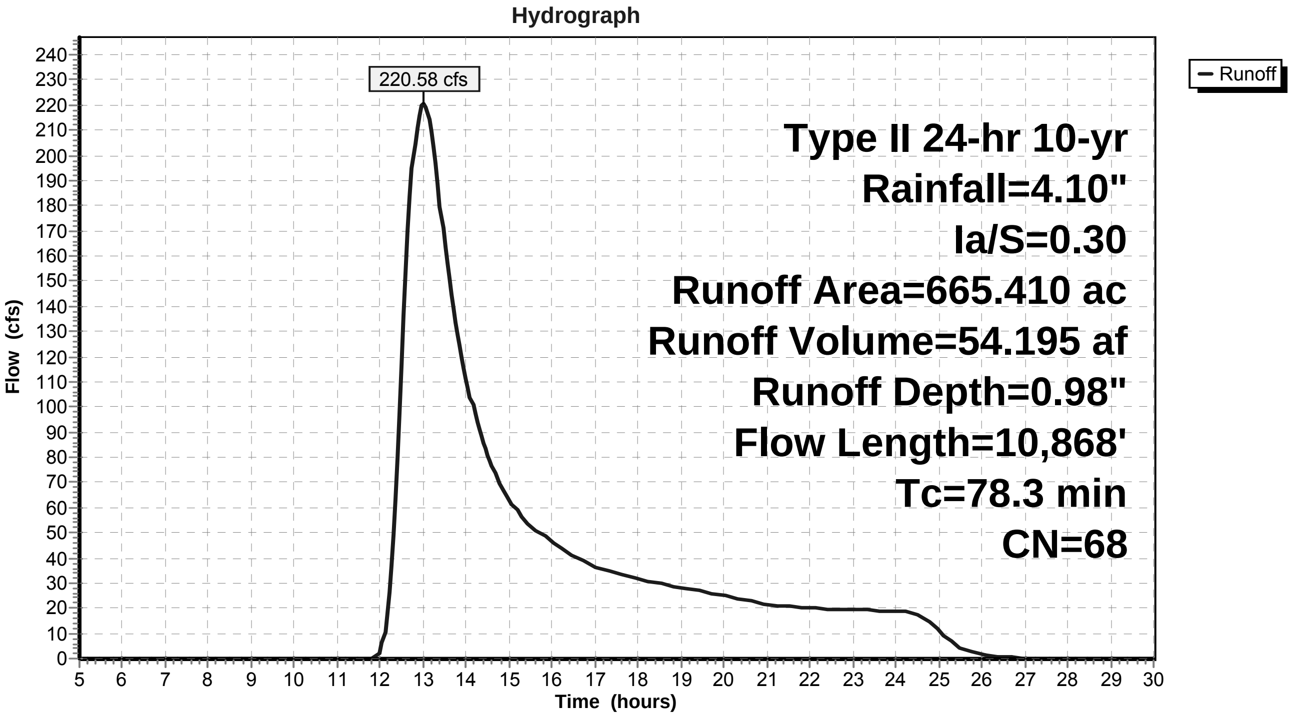
Runoff = 220.58 cfs @ 13.00 hrs, Volume= 54.195 af, Depth= 0.98"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.10", Ia/S=0.30

	Area (ac)	CN	Description
*	0.000	98	Buildings
*	0.000	36	Clearing, HSG A
*	0.000	60	Clearing, HSG B
*	1.860	73	Clearing, HSG C
	0.000	76	Gravel roads, HSG A
	0.000	85	Gravel roads, HSG B
	0.000	89	Gravel roads, HSG C
*	0.230	98	Ledge Outcrop
	0.000	51	1 acre lots, 20% imp, HSG A
*	5.490	98	Paved Roads
*	0.000	98	Water
	11.640	30	Woods, Good, HSG A
	58.420	55	Woods, Good, HSG B
	587.770	70	Woods, Good, HSG C
	0.000	77	Woods, Good, HSG D
	665.410	68	Weighted Average
	659.690		99.14% Pervious Area
	5.720		0.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
44.3	100	0.0170	0.04		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
11.4	1,053	0.0950	1.54		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
8.8	3,890	0.1690	7.39	29.55	**Trap/Vee/Rect Channel Flow, Drainage Channel** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.060
13.8	5,825	0.1200	7.01	49.09	**Trap/Vee/Rect Channel Flow, Stream** Bot.W=5.00' D=1.00' Z= 2.0 '/' Top.W=9.00' n= 0.060
78.3	10,868	Total			

Subcatchment E601: Southeast Area



Summary for Subcatchment E701: South Area

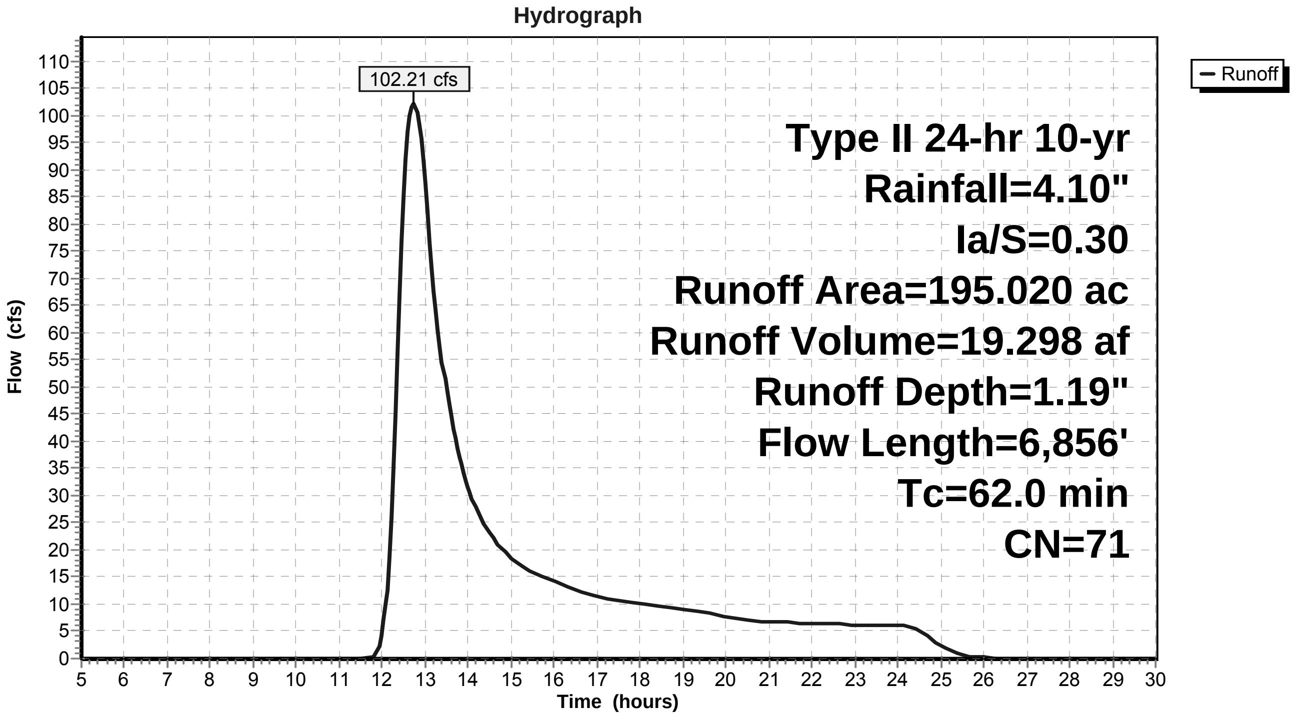
Runoff = 102.21 cfs @ 12.74 hrs, Volume= 19.298 af, Depth= 1.19"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.10", Ia/S=0.30

	Area (ac)	CN	Description
*	0.000	98	Buildings
*	0.000	36	Clearing, HSG A
*	0.000	60	Clearing, HSG B
*	0.000	73	Clearing, HSG C
	0.000	76	Gravel roads, HSG A
	0.000	85	Gravel roads, HSG B
	0.000	89	Gravel roads, HSG C
*	0.000	98	Ledge Outcrop
	0.000	51	1 acre lots, 20% imp, HSG A
*	0.000	98	Paved Roads
*	0.000	98	Water
	0.000	30	Woods, Good, HSG A
	0.110	55	Woods, Good, HSG B
	172.800	70	Woods, Good, HSG C
	22.110	77	Woods, Good, HSG D
	195.020	71	Weighted Average
	195.020		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
34.8	100	0.0310	0.05		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
17.1	2,339	0.2090	2.29		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
10.1	4,417	0.1300	7.30	51.09	**Trap/Vee/Rect Channel Flow, Stream** Bot.W=5.00' D=1.00' Z= 2.0 '/' Top.W=9.00' n= 0.060
62.0	6,856	Total			

Subcatchment E701: South Area

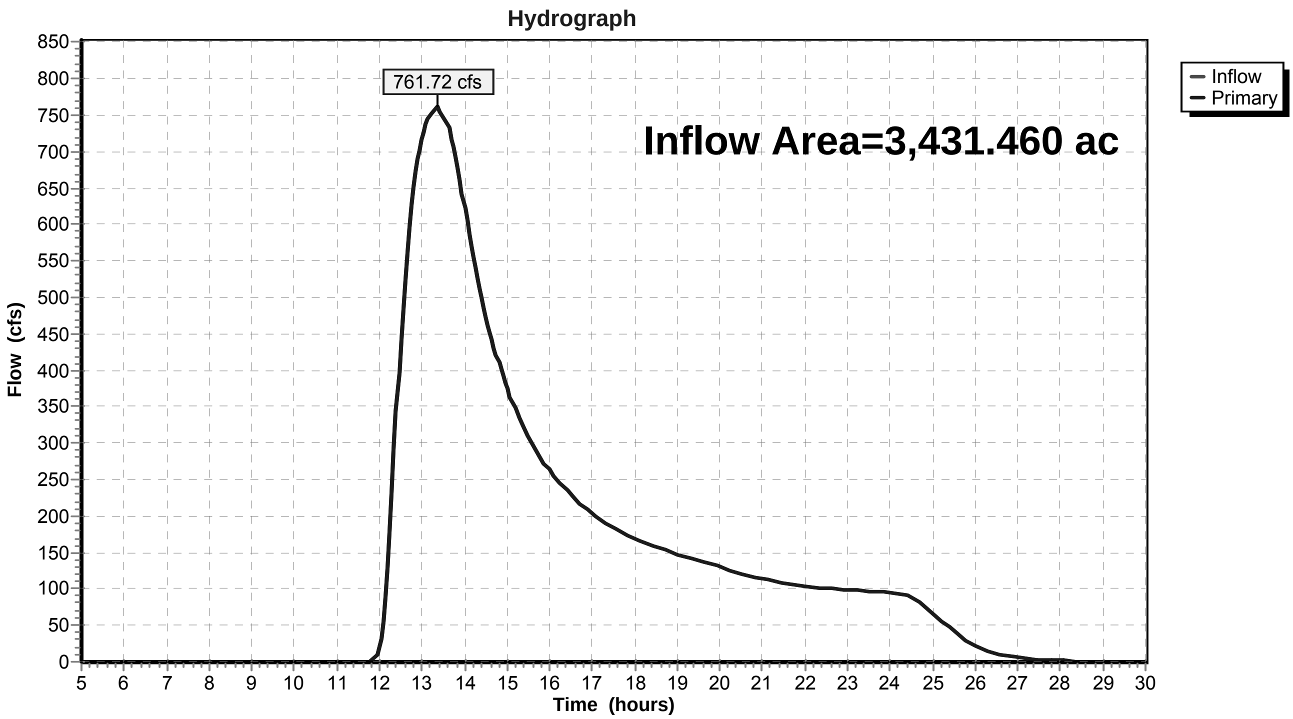


Summary for Link D1: Clark Brook

Inflow Area = 3,431.460 ac, 0.34% Impervious, Inflow Depth = 0.93" for 10-yr event
Inflow = 761.72 cfs @ 13.36 hrs, Volume= 264.726 af
Primary = 761.72 cfs @ 13.36 hrs, Volume= 264.726 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Link D1: Clark Brook

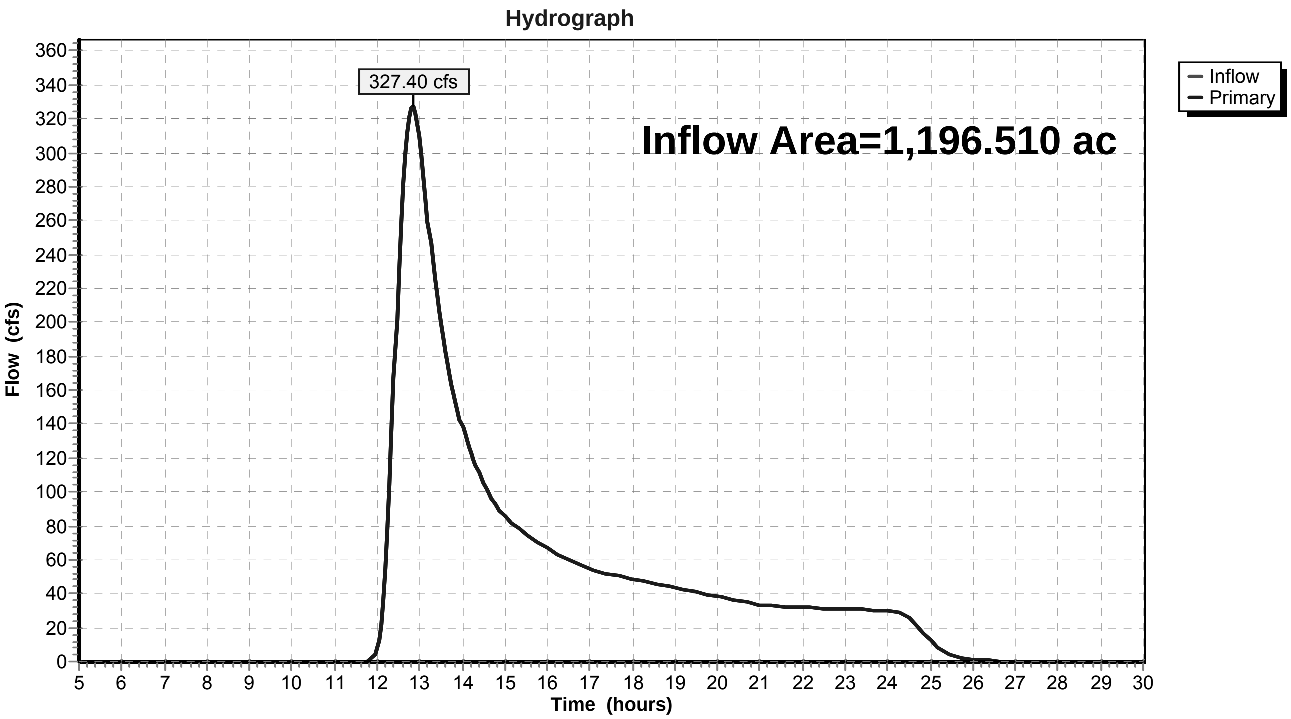


Summary for Link D2: Halls Brook

Inflow Area = 1,196.510 ac, 1.11% Impervious, Inflow Depth = 0.78" for 10-yr event
Inflow = 327.40 cfs @ 12.83 hrs, Volume= 78.221 af
Primary = 327.40 cfs @ 12.83 hrs, Volume= 78.221 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Link D2: Halls Brook

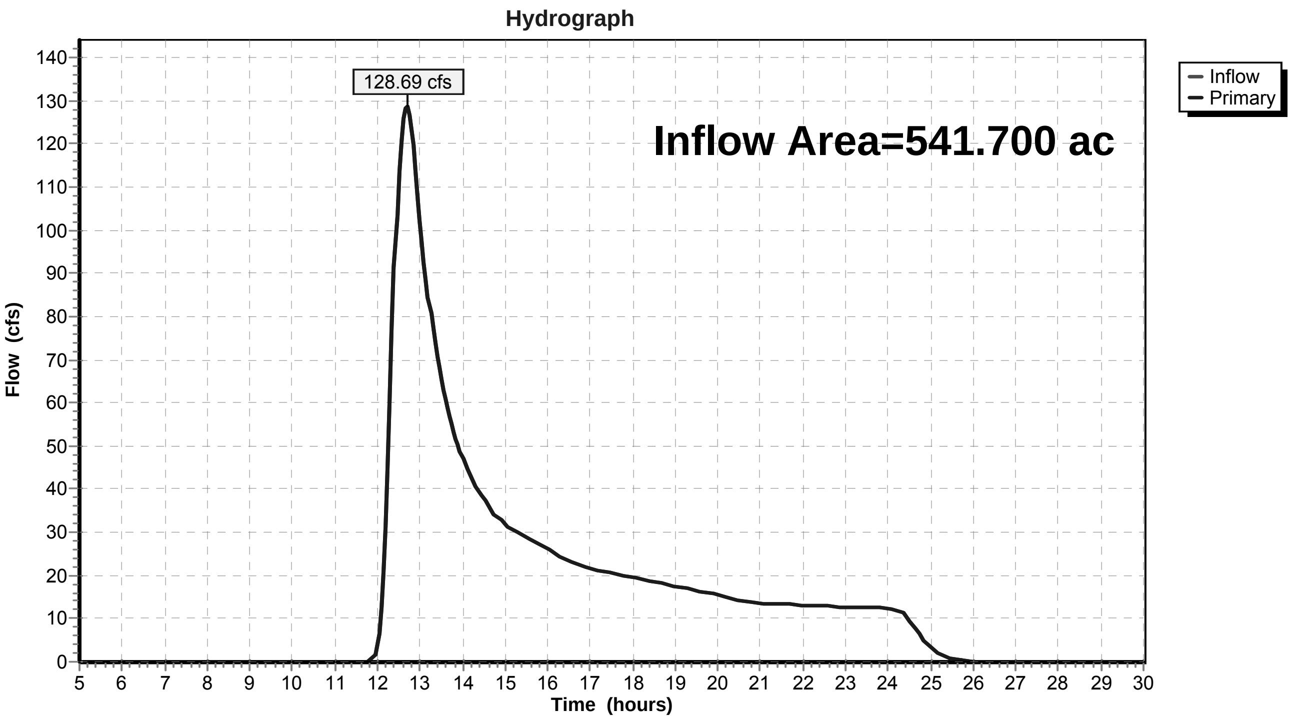


Summary for Link D3: Rte 25 Culvert (west)

Inflow Area = 541.700 ac, 2.69% Impervious, Inflow Depth = 0.67" for 10-yr event
Inflow = 128.69 cfs @ 12.69 hrs, Volume= 30.054 af
Primary = 128.69 cfs @ 12.69 hrs, Volume= 30.054 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Link D3: Rte 25 Culvert (west)

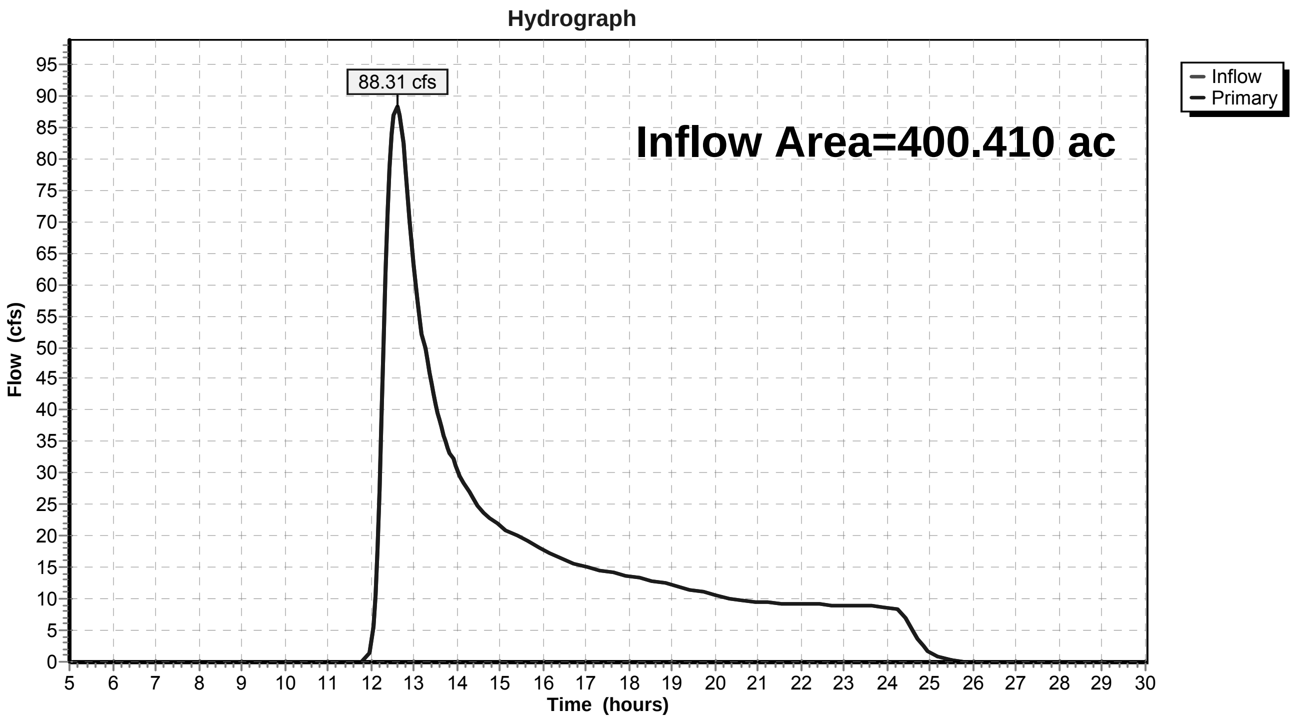


Summary for Link D4: Rte 25 Culvert (east)

Inflow Area =	400.410 ac,	0.89% Impervious, Inflow Depth = 0.61"	for 10-yr event
Inflow =	88.31 cfs @	12.61 hrs, Volume=	20.336 af
Primary =	88.31 cfs @	12.61 hrs, Volume=	20.336 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Link D4: Rte 25 Culvert (east)

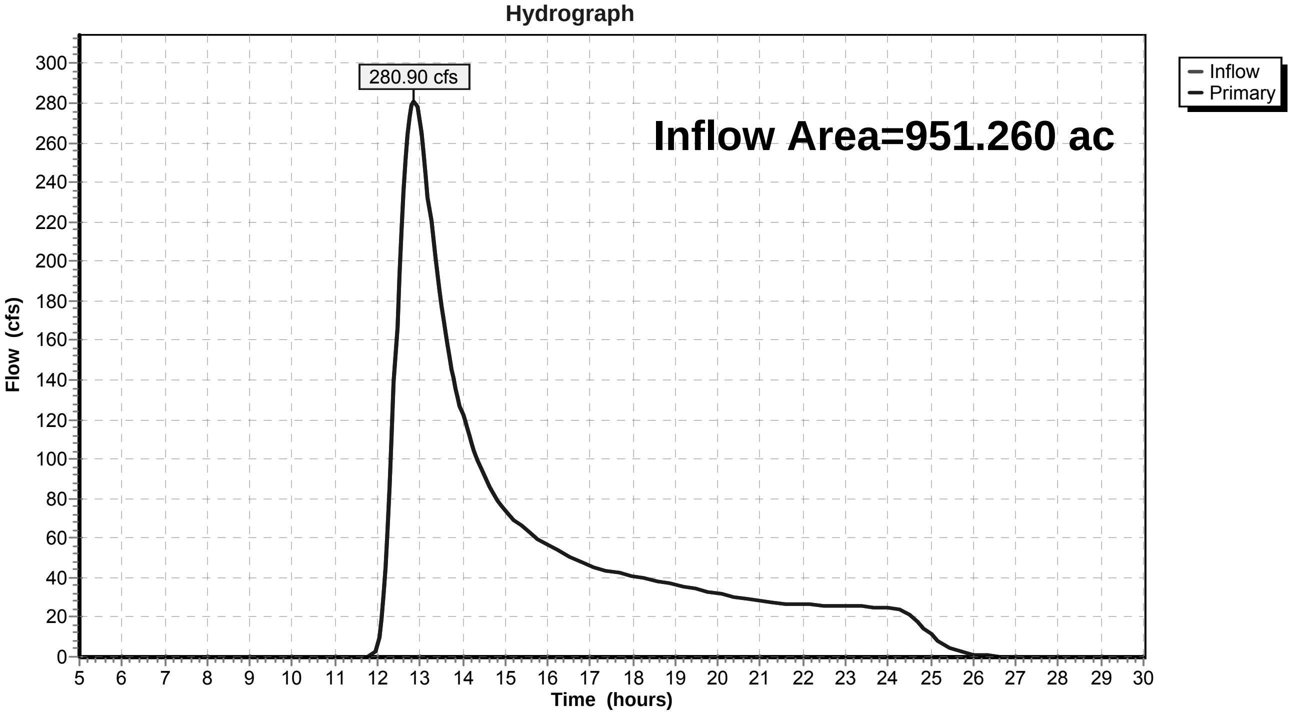


Summary for Link D5: Mayhew Tpk Culvert (north)

Inflow Area = 951.260 ac, 1.10% Impervious, Inflow Depth = 0.85" for 10-yr event
Inflow = 280.90 cfs @ 12.86 hrs, Volume= 67.129 af
Primary = 280.90 cfs @ 12.86 hrs, Volume= 67.129 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Link D5: Mayhew Tpk Culvert (north)

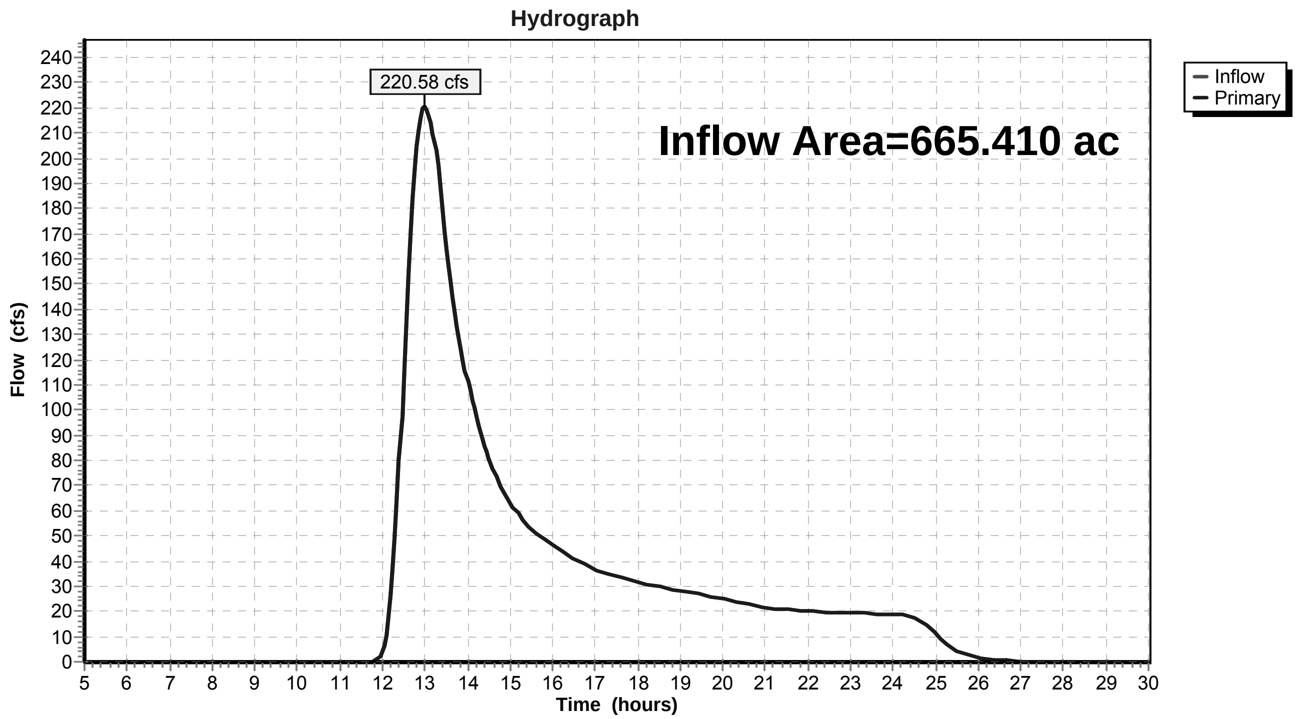


Summary for Link D6: Mayhew Tpk Culvert (south)

Inflow Area =	665.410 ac,	0.86% Impervious,	Inflow Depth = 0.98"	for 10-yr event	
Inflow =	220.58 cfs @	13.00 hrs,	Volume=	54.195 af	
Primary =	220.58 cfs @	13.00 hrs,	Volume=	54.195 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Link D6: Mayhew Tpk Culvert (south)

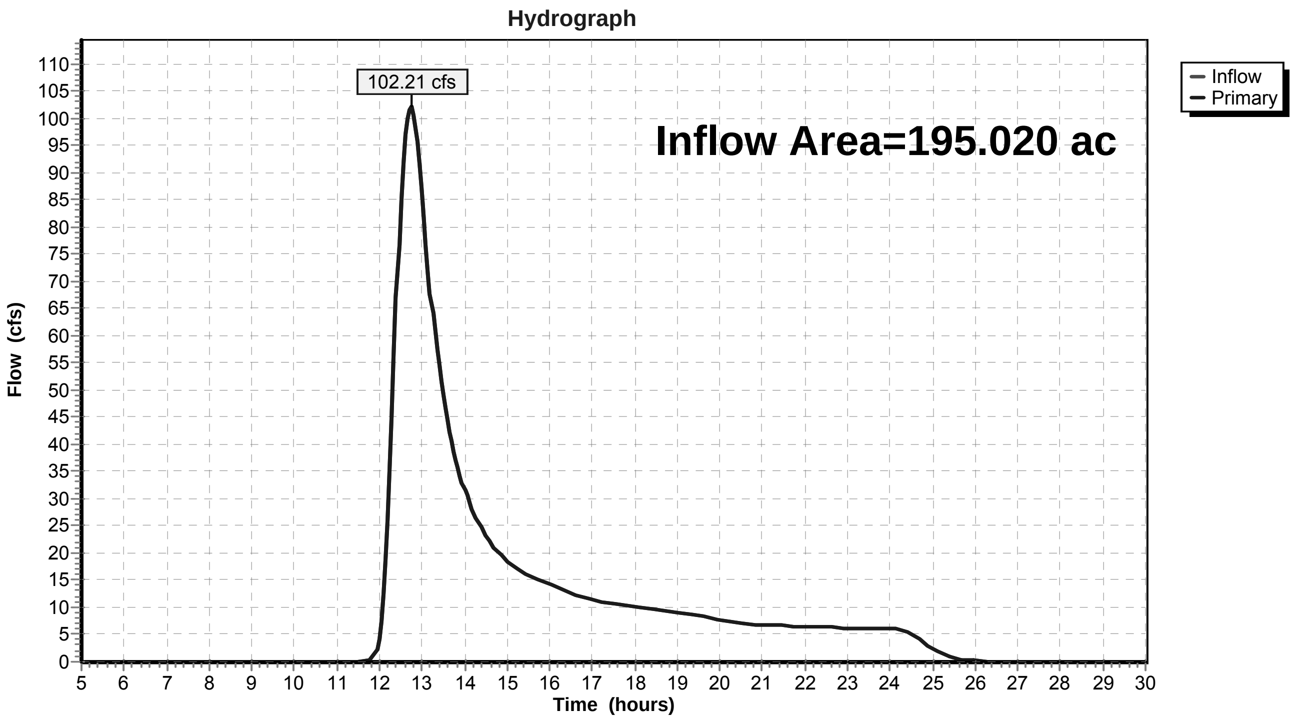


Summary for Link D7: Wise Brook

Inflow Area = 195.020 ac, 0.00% Impervious, Inflow Depth = 1.19" for 10-yr event
Inflow = 102.21 cfs @ 12.74 hrs, Volume= 19.298 af
Primary = 102.21 cfs @ 12.74 hrs, Volume= 19.298 af, Atten= 0%, Lag= 0.0 min

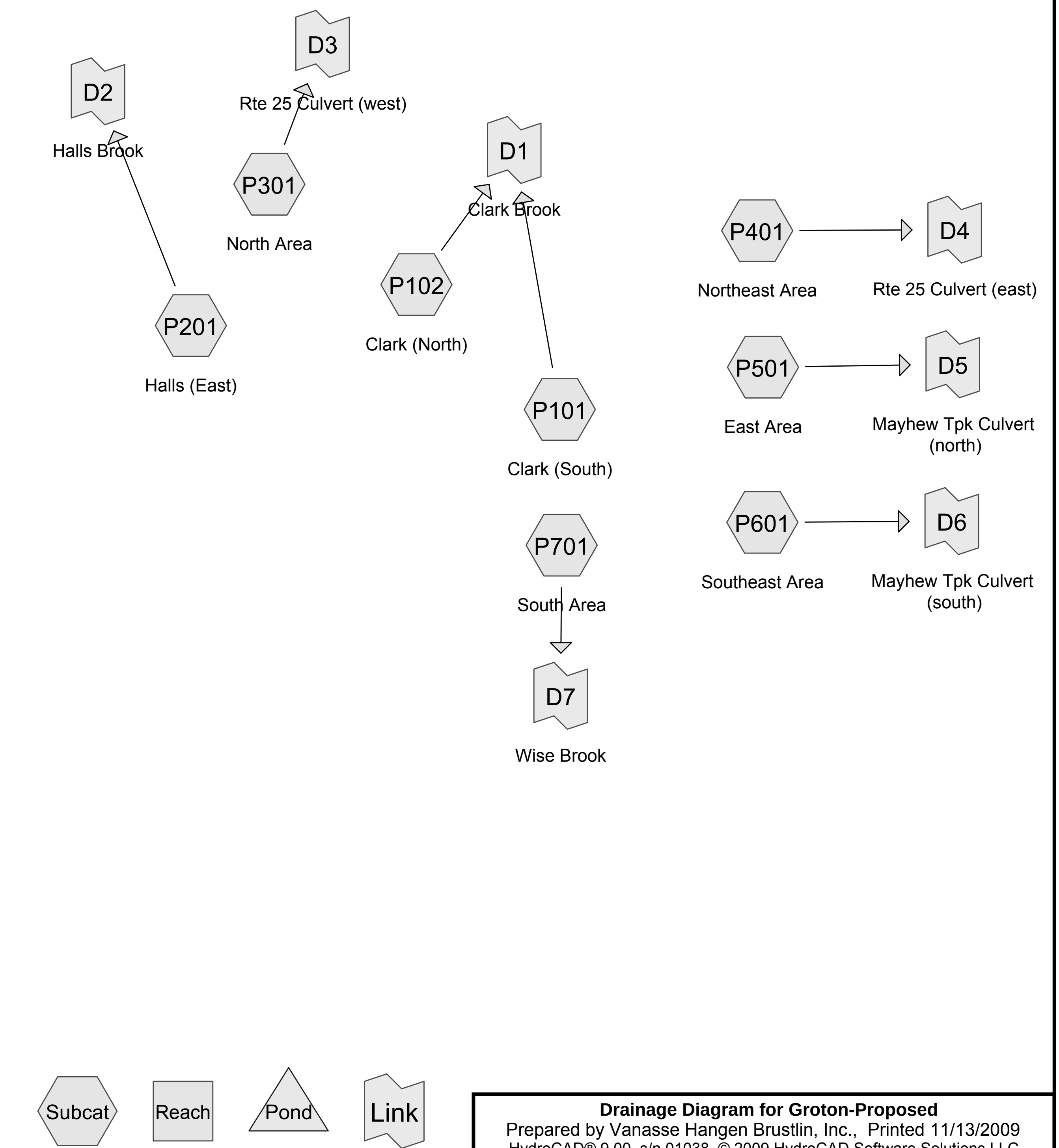
Primary outflow = Inflow, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Link D7: Wise Brook



Proposed Conditions

- Drainage Diagram (HydroCAD)
- Area and Soil Listings (HydroCAD)
- Node Listing: 2-yr, 10-yr, and 50 yr (HydroCAD)
- Full Summary: 10-yr (HydroCAD)



Drainage Diagram for Groton-Proposed
Prepared by Vanasse Hangen Brustlin, Inc., Printed 11/13/2009
HydroCAD® 9.00 s/n 01038 © 2009 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
327.590	30	Woods, Good, HSG A (P101, P102, P201, P301, P401, P501, P601)
4.260	36	Clearing, HSG A (P101, P102)
0.320	39	Side Slopes (vegetated), HSG A (P101)
33.680	51	1 acre lots, 20% imp, HSG A (P301)
985.370	55	Woods, Good, HSG B (P101, P102, P201, P301, P401, P501, P601, P701)
40.560	60	Clearing, HSG B (P101, P102)
6.540	61	Side Slopes (vegetated), HSG B (P101, P401)
1.850	61	Temp Pads (vegetated at end), HSG B (P101)
0.150	68	Shoulders/Temp Road (vegetated), HSG A (P101)
5,733.970	70	Woods, Good, HSG C (P101, P102, P201, P301, P401, P501, P601, P701)
44.900	73	Clearing, HSG C (P101, P601)
33.720	74	Side Slopes (vegetated), HSG C (P101, P102, P201, P301, P401, P501, P601, P701)
9.420	74	Temp Pads (vegetated at end), HSG C (P101, P102, P201, P501, P601)
0.410	76	Gravel roads (pr), HSG A (P101)
1.130	76	Gravel roads, HSG A (P101, P102, P201)
36.970	77	Woods, Good, HSG D (P101, P301, P401, P701)
1.310	79	Shoulders/Temp Road (vegetated), HSG B (P101, P401)
3.880	85	Gravel roads (pr), HSG B (P101, P401)
4.250	85	Gravel roads, HSG B (P101, P102, P201)
15.170	86	Shoulders/Temp Road (vegetated), HSG C (P101, P102, P301, P501, P601, P701)
31.250	89	Gravel roads (pr), HSG C (P101, P102, P201, P301, P501, P601, P701)
3.500	89	Gravel roads, HSG C (P101, P102, P201)
3.860	89	Shoulders/Temp Road (vegetated), HSG C (P201)
0.910	98	Buildings (P101, P102, P201)
4.730	98	Ledge Face (estimated) (P101, P102, P201, P301, P401, P501, P601, P701)
6.170	98	Ledge Outcrop (P101, P102, P201, P301, P401, P501, P601)
35.320	98	Paved Roads (P201, P301, P401, P501, P601)
0.560	98	Turbine/Foundation (P101, P102, P201, P301, P401, P501, P601, P701)
10.020	98	Water (P101, P102, P301)
7,381.770		**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Goup	Subcatchment Numbers
367.540	HSG A	P101, P102, P201, P301, P401, P501, P601
1,043.760	HSG B	P101, P102, P201, P301, P401, P501, P601, P701
5,875.790	HSG C	P101, P102, P201, P301, P401, P501, P601, P701
36.970	HSG D	P101, P301, P401, P701
57.710	Other	P101, P102, P201, P301, P401, P501, P601, P701
7,381.770		**TOTAL AREA**

Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P101: Clark (South) Runoff Area=2,673.440 ac 0.47% Impervious Runoff Depth>0.21"
Flow Length=21,575' Tc=112.5 min CN=67 Runoff=80.16 cfs 46.407 af

Subcatchment P102: Clark (North) Runoff Area=759.370 ac 0.40% Impervious Runoff Depth=0.24"
Flow Length=10,573' Tc=53.9 min CN=68 Runoff=39.69 cfs 15.159 af

Subcatchment P201: Halls (East) Runoff Area=1,196.100 ac 1.17% Impervious Runoff Depth=0.15"
Flow Length=17,345' Tc=63.7 min CN=65 Runoff=25.47 cfs 15.172 af

Subcatchment P301: North Area Runoff Area=540.870 ac 2.72% Impervious Runoff Depth=0.10"
Flow Length=6,897' Tc=52.3 min CN=63 Runoff=6.57 cfs 4.717 af

Subcatchment P401: Northeast Area Runoff Area=400.400 ac 0.90% Impervious Runoff Depth=0.08"
Flow Length=9,068' Tc=46.3 min CN=62 Runoff=3.58 cfs 2.807 af

Subcatchment P501: East Area Runoff Area=951.300 ac 1.11% Impervious Runoff Depth=0.18"
Flow Length=10,511' Tc=67.3 min CN=66 Runoff=26.52 cfs 14.205 af

Subcatchment P601: Southeast Area Runoff Area=665.400 ac 0.87% Impervious Runoff Depth=0.24"
Flow Length=10,868' Tc=78.3 min CN=68 Runoff=29.46 cfs 13.283 af

Subcatchment P701: South Area Runoff Area=194.890 ac 0.04% Impervious Runoff Depth=0.35"
Flow Length=6,856' Tc=62.0 min CN=71 Runoff=18.79 cfs 5.622 af

Link D1: Clark Brook Inflow=105.70 cfs 61.565 af
Primary=105.70 cfs 61.565 af

Link D2: Halls Brook Inflow=25.47 cfs 15.172 af
Primary=25.47 cfs 15.172 af

Link D3: Rte 25 Culvert (west) Inflow=6.57 cfs 4.717 af
Primary=6.57 cfs 4.717 af

Link D4: Rte 25 Culvert (east) Inflow=3.58 cfs 2.807 af
Primary=3.58 cfs 2.807 af

Link D5: Mayhew Tpk Culvert (north) Inflow=26.52 cfs 14.205 af
Primary=26.52 cfs 14.205 af

Link D6: Mayhew Tpk Culvert (south) Inflow=29.46 cfs 13.283 af
Primary=29.46 cfs 13.283 af

Link D7: Wise Brook Inflow=18.79 cfs 5.622 af
Primary=18.79 cfs 5.622 af

Total Runoff Area = 7,381.770 ac Runoff Volume = 117.371 af Average Runoff Depth = 0.19"
99.13% Pervious = 7,317.324 ac 0.87% Impervious = 64.446 ac

Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P101: Clark (South) Runoff Area=2,673.440 ac 0.47% Impervious Runoff Depth=0.91"
Flow Length=21,575' Tc=112.5 min CN=67 Runoff=612.21 cfs 202.985 af

Subcatchment P102: Clark (North) Runoff Area=759.370 ac 0.40% Impervious Runoff Depth=0.98"
Flow Length=10,573' Tc=53.9 min CN=68 Runoff=329.94 cfs 61.847 af

Subcatchment P201: Halls (East) Runoff Area=1,196.100 ac 1.17% Impervious Runoff Depth=0.78"
Flow Length=17,345' Tc=63.7 min CN=65 Runoff=327.29 cfs 78.194 af

Subcatchment P301: North Area Runoff Area=540.870 ac 2.72% Impervious Runoff Depth=0.67"
Flow Length=6,897' Tc=52.3 min CN=63 Runoff=128.50 cfs 30.008 af

Subcatchment P401: Northeast Area Runoff Area=400.400 ac 0.90% Impervious Runoff Depth=0.61"
Flow Length=9,068' Tc=46.3 min CN=62 Runoff=88.31 cfs 20.335 af

Subcatchment P501: East Area Runoff Area=951.300 ac 1.11% Impervious Runoff Depth=0.85"
Flow Length=10,511' Tc=67.3 min CN=66 Runoff=280.91 cfs 67.132 af

Subcatchment P601: Southeast Area Runoff Area=665.400 ac 0.87% Impervious Runoff Depth=0.98"
Flow Length=10,868' Tc=78.3 min CN=68 Runoff=220.57 cfs 54.194 af

Subcatchment P701: South Area Runoff Area=194.890 ac 0.04% Impervious Runoff Depth=1.19"
Flow Length=6,856' Tc=62.0 min CN=71 Runoff=102.14 cfs 19.285 af

Link D1: Clark Brook Inflow=762.01 cfs 264.833 af
Primary=762.01 cfs 264.833 af

Link D2: Halls Brook Inflow=327.29 cfs 78.194 af
Primary=327.29 cfs 78.194 af

Link D3: Rte 25 Culvert (west) Inflow=128.50 cfs 30.008 af
Primary=128.50 cfs 30.008 af

Link D4: Rte 25 Culvert (east) Inflow=88.31 cfs 20.335 af
Primary=88.31 cfs 20.335 af

Link D5: Mayhew Tpk Culvert (north) Inflow=280.91 cfs 67.132 af
Primary=280.91 cfs 67.132 af

Link D6: Mayhew Tpk Culvert (south) Inflow=220.57 cfs 54.194 af
Primary=220.57 cfs 54.194 af

Link D7: Wise Brook Inflow=102.14 cfs 19.285 af
Primary=102.14 cfs 19.285 af

Total Runoff Area = 7,381.770 ac Runoff Volume = 533.980 af Average Runoff Depth = 0.87"
99.13% Pervious = 7,317.324 ac 0.87% Impervious = 64.446 ac

Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P101: Clark (South) Runoff Area=2,673.440 ac 0.47% Impervious Runoff Depth=1.67"
Flow Length=21,575' Tc=112.5 min CN=67 Runoff=1,298.87 cfs 372.102 af

Subcatchment P102: Clark (North) Runoff Area=759.370 ac 0.40% Impervious Runoff Depth=1.76"
Flow Length=10,573' Tc=53.9 min CN=68 Runoff=691.20 cfs 111.321 af

Subcatchment P201: Halls (East) Runoff Area=1,196.100 ac 1.17% Impervious Runoff Depth=1.50"
Flow Length=17,345' Tc=63.7 min CN=65 Runoff=763.52 cfs 149.211 af

Subcatchment P301: North Area Runoff Area=540.870 ac 2.72% Impervious Runoff Depth=1.33"
Flow Length=6,897' Tc=52.3 min CN=63 Runoff=335.68 cfs 59.953 af

Subcatchment P401: Northeast Area Runoff Area=400.400 ac 0.90% Impervious Runoff Depth=1.25"
Flow Length=9,068' Tc=46.3 min CN=62 Runoff=245.48 cfs 41.683 af

Subcatchment P501: East Area Runoff Area=951.300 ac 1.11% Impervious Runoff Depth=1.58"
Flow Length=10,511' Tc=67.3 min CN=66 Runoff=632.74 cfs 125.477 af

Subcatchment P601: Southeast Area Runoff Area=665.400 ac 0.87% Impervious Runoff Depth=1.76"
Flow Length=10,868' Tc=78.3 min CN=68 Runoff=458.83 cfs 97.545 af

Subcatchment P701: South Area Runoff Area=194.890 ac 0.04% Impervious Runoff Depth=2.03"
Flow Length=6,856' Tc=62.0 min CN=71 Runoff=194.33 cfs 33.048 af

Link D1: Clark Brook Inflow=1,584.41 cfs 483.422 af
Primary=1,584.41 cfs 483.422 af

Link D2: Halls Brook Inflow=763.52 cfs 149.211 af
Primary=763.52 cfs 149.211 af

Link D3: Rte 25 Culvert (west) Inflow=335.68 cfs 59.953 af
Primary=335.68 cfs 59.953 af

Link D4: Rte 25 Culvert (east) Inflow=245.48 cfs 41.683 af
Primary=245.48 cfs 41.683 af

Link D5: Mayhew Tpk Culvert (north) Inflow=632.74 cfs 125.477 af
Primary=632.74 cfs 125.477 af

Link D6: Mayhew Tpk Culvert (south) Inflow=458.83 cfs 97.545 af
Primary=458.83 cfs 97.545 af

Link D7: Wise Brook Inflow=194.33 cfs 33.048 af
Primary=194.33 cfs 33.048 af

Total Runoff Area = 7,381.770 ac Runoff Volume = 990.339 af Average Runoff Depth = 1.61"
99.13% Pervious = 7,317.324 ac 0.87% Impervious = 64.446 ac

Summary for Subcatchment P101: Clark (South)

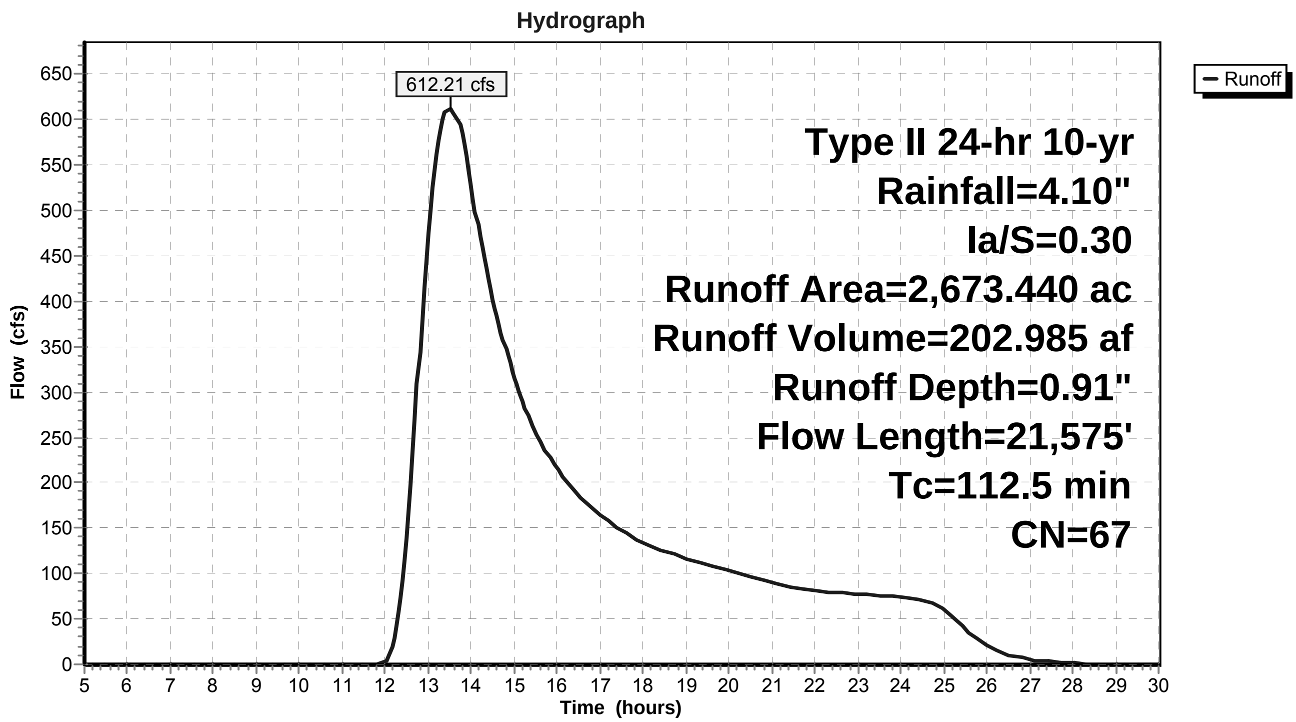
Runoff = 612.21 cfs @ 13.51 hrs, Volume= 202.985 af, Depth= 0.91"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.10", Ia/S=0.30

	Area (ac)	CN	Description
*	0.760	98	Buildings
*	4.020	36	Clearing, HSG A
*	39.810	60	Clearing, HSG B
*	43.040	73	Clearing, HSG C
*	0.200	98	Turbine/Foundation
*	0.890	76	Gravel roads, HSG A
*	4.060	85	Gravel roads, HSG B
*	1.010	89	Gravel roads, HSG C
*	0.410	76	Gravel roads (pr), HSG A
*	3.280	85	Gravel roads (pr), HSG B
*	13.740	89	Gravel roads (pr), HSG C
*	0.890	98	Ledge Outcrop
*	0.000	39	Temp Pads (vegetated at end), HSG A
*	1.850	61	Temp Pads (vegetated at end), HSG B
*	6.460	74	Temp Pads (vegetated at end), HSG C
*	0.320	39	Side Slopes (vegetated), HSG A
*	6.190	61	Side Slopes (vegetated), HSG B
*	17.620	74	Side Slopes (vegetated), HSG C
*	2.960	98	Ledge Face (estimated)
*	0.150	68	Shoulders/Temp Road (vegetated), HSG A
*	1.260	79	Shoulders/Temp Road (vegetated), HSG B
*	8.110	86	Shoulders/Temp Road (vegetated), HSG C
*	0.000	51	1 acre lots, 20% imp, HSG A
*	0.000	98	Paved Roads
*	7.820	98	Water
*	46.400	30	Woods, Good, HSG A
*	371.690	55	Woods, Good, HSG B
*	2,085.970	70	Woods, Good, HSG C
*	4.530	77	Woods, Good, HSG D
	2,673.440	67	Weighted Average
	2,660.810		99.53% Pervious Area
	12.630		0.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
54.7	100	0.0100	0.03		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
5.7	540	0.1000	1.58		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
7.9	2,940	0.1200	6.22	24.90	**Trap/Vee/Rect Channel Flow, Drainage Channel** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.060
17.0	4,105	0.0500	4.02	16.07	**Trap/Vee/Rect Channel Flow, Channel/Brook** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.060
27.2	13,890	0.0400	8.50	492.74	**Trap/Vee/Rect Channel Flow, Clark Brook** Bot.W=25.00' D=2.00' Z= 2.0 '/' Top.W=33.00' n= 0.050
112.5	21,575	Total			

Subcatchment P101: Clark (South)



Summary for Subcatchment P102: Clark (North)

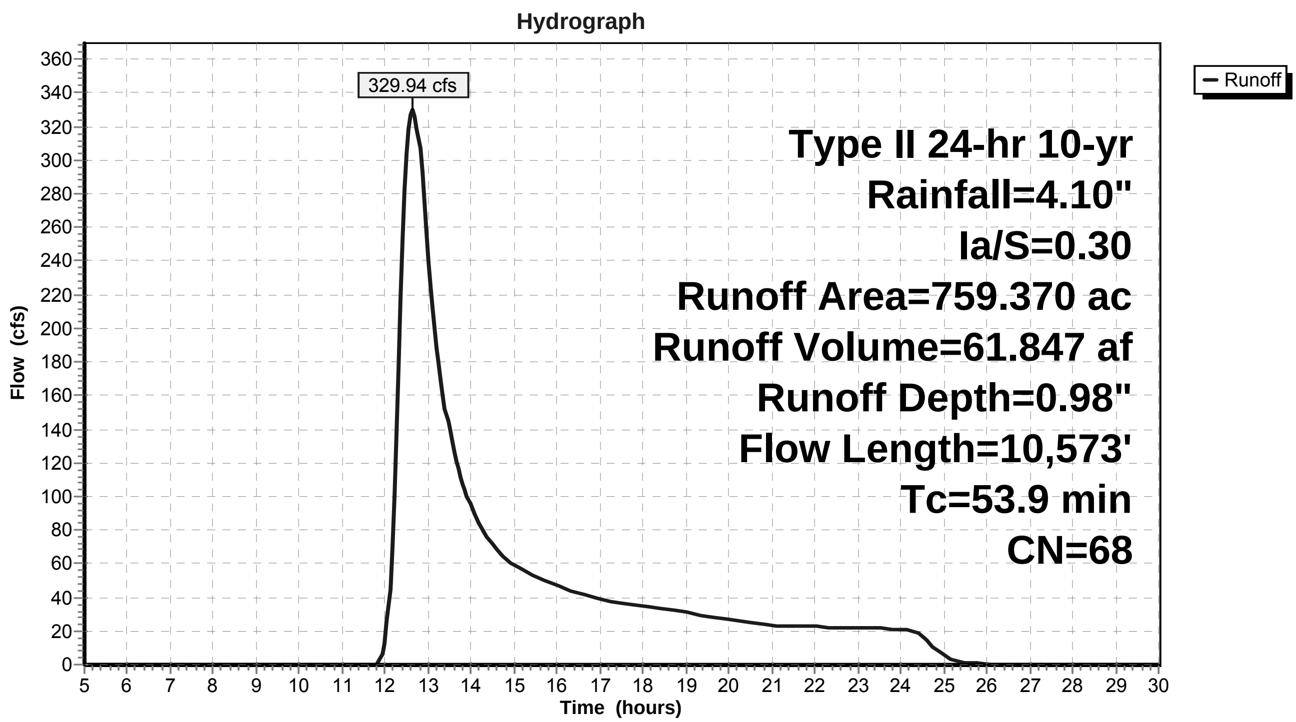
Runoff = 329.94 cfs @ 12.65 hrs, Volume= 61.847 af, Depth= 0.98"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.10", Ia/S=0.30

	Area (ac)	CN	Description
*	0.040	98	Buildings
*	0.240	36	Clearing, HSG A
*	0.750	60	Clearing, HSG B
*	0.000	73	Clearing, HSG C
*	0.120	98	Turbine/Foundation
*	0.060	76	Gravel roads, HSG A
*	0.180	85	Gravel roads, HSG B
*	0.980	89	Gravel roads, HSG C
*	0.000	76	Gravel roads (pr), HSG A
*	0.000	85	Gravel roads (pr), HSG B
*	6.020	89	Gravel roads (pr), HSG C
*	1.860	98	Ledge Outcrop
*	0.000	39	Temp Pads (vegetated at end), HSG A
*	0.000	61	Temp Pads (vegetated at end), HSG B
*	1.150	74	Temp Pads (vegetated at end), HSG C
*	0.000	39	Side Slopes (vegetated), HSG A
*	0.000	61	Side Slopes (vegetated), HSG B
*	7.020	74	Side Slopes (vegetated), HSG C
*	0.780	98	Ledge Face (estimated)
*	0.000	68	Shoulders/Temp Road (vegetated), HSG A
*	0.000	79	Shoulders/Temp Road (vegetated), HSG B
*	4.930	86	Shoulders/Temp Road (vegetated), HSG C
*	0.000	51	1 acre lots, 20% imp, HSG A
*	0.000	98	Paved Roads
*	0.250	98	Water
*	0.540	30	Woods, Good, HSG A
*	110.260	55	Woods, Good, HSG B
*	624.190	70	Woods, Good, HSG C
*	0.000	77	Woods, Good, HSG D
	759.370	68	Weighted Average
	756.320		99.60% Pervious Area
	3.050		0.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.5	70	0.0570	0.06		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
3.7	458	0.1700	2.06		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.6	325	0.2500	8.98	35.94	**Trap/Vee/Rect Channel Flow, Drainage Channel** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.060
2.3	394	0.0250	2.84	11.37	**Trap/Vee/Rect Channel Flow, Drainage Channel** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.060
1.5	373	0.0540	4.18	16.70	**Trap/Vee/Rect Channel Flow, Drainage Channel** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.060
0.8	373	0.2100	8.23	32.94	**Trap/Vee/Rect Channel Flow, Drainage Channel** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.060
4.4	1,385	0.0850	5.24	20.96	**Trap/Vee/Rect Channel Flow, Drainage Channel** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.060
1.7	270	0.0220	2.67	10.66	**Trap/Vee/Rect Channel Flow, Drainage Channel** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.060
0.7	201	0.0800	5.08	20.33	**Trap/Vee/Rect Channel Flow, Drainage Channel** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.060
4.4	1,129	0.0350	4.25	21.27	**Trap/Vee/Rect Channel Flow, Stream** Bot.W=3.00' D=1.00' Z= 2.0 '/' Top.W=7.00' n= 0.050
13.3	5,595	0.0950	7.01	35.04	**Trap/Vee/Rect Channel Flow, Stream** Bot.W=3.00' D=1.00' Z= 2.0 '/' Top.W=7.00' n= 0.050
53.9	10,573	Total			

Subcatchment P102: Clark (North)



Summary for Subcatchment P201: Halls (East)

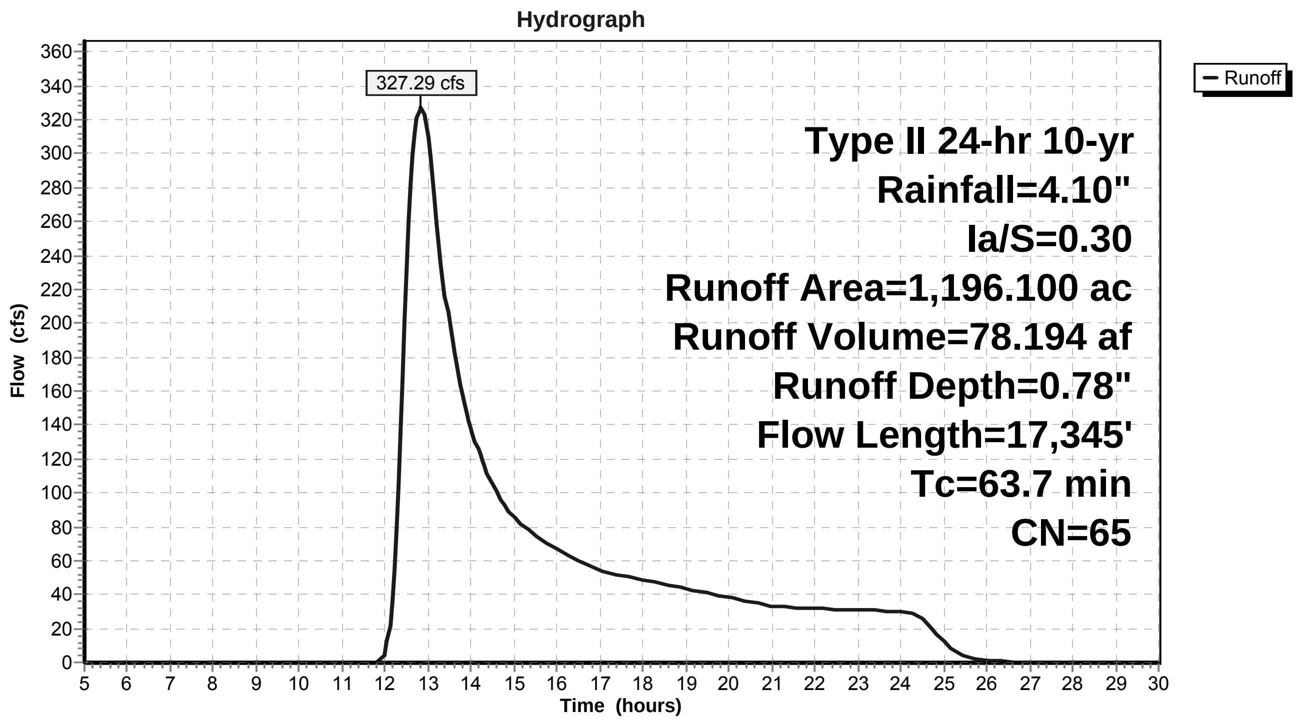
Runoff = 327.29 cfs @ 12.83 hrs, Volume= 78.194 af, Depth= 0.78"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.10", Ia/S=0.30

	Area (ac)	CN	Description
*	0.110	98	Buildings
*	0.000	36	Clearing, HSG A
*	0.000	60	Clearing, HSG B
*	0.000	73	Clearing, HSG C
*	0.130	98	Turbine/Foundation
*	0.180	76	Gravel roads, HSG A
*	0.010	85	Gravel roads, HSG B
*	1.510	89	Gravel roads, HSG C
*	0.000	76	Gravel roads (pr), HSG A
*	0.000	85	Gravel roads (pr), HSG B
*	7.530	89	Gravel roads (pr), HSG C
*	0.220	98	Ledge Outcrop
*	0.000	39	Temp Pads (vegetated at end), HSG A
*	0.000	61	Temp Pads (vegetated at end), HSG B
*	0.430	74	Temp Pads (vegetated at end), HSG C
*	0.000	39	Side Slopes (vegetated), HSG A
*	0.000	61	Side Slopes (vegetated), HSG B
*	5.770	74	Side Slopes (vegetated), HSG C
*	0.640	98	Ledge Face (estimated)
*	0.000	68	Shoulders/Temp Road (vegetated), HSG A
*	0.000	79	Shoulders/Temp Road (vegetated), HSG B
*	3.860	89	Shoulders/Temp Road (vegetated), HSG C
*	0.000	51	1 acre lots, 20% imp, HSG A
*	12.930	98	Paved Roads
*	0.000	98	Water
*	160.380	30	Woods, Good, HSG A
*	26.210	55	Woods, Good, HSG B
*	976.190	70	Woods, Good, HSG C
*	0.000	77	Woods, Good, HSG D
	1,196.100	65	Weighted Average
	1,182.070		98.83% Pervious Area
	14.030		1.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.8	100	0.0800	0.07		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
6.3	950	0.2500	2.50		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
13.9	5,500	0.1350	6.60	26.41	**Trap/Vee/Rect Channel Flow, Stream** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.060
19.7	10,795	0.0450	9.14	621.64	**Trap/Vee/Rect Channel Flow, Halls Brook** Bot.W=30.00' D=2.00' Z= 2.0 '/' Top.W=38.00' n= 0.050
63.7	17,345	Total			

Subcatchment P201: Halls (East)



Summary for Subcatchment P301: North Area

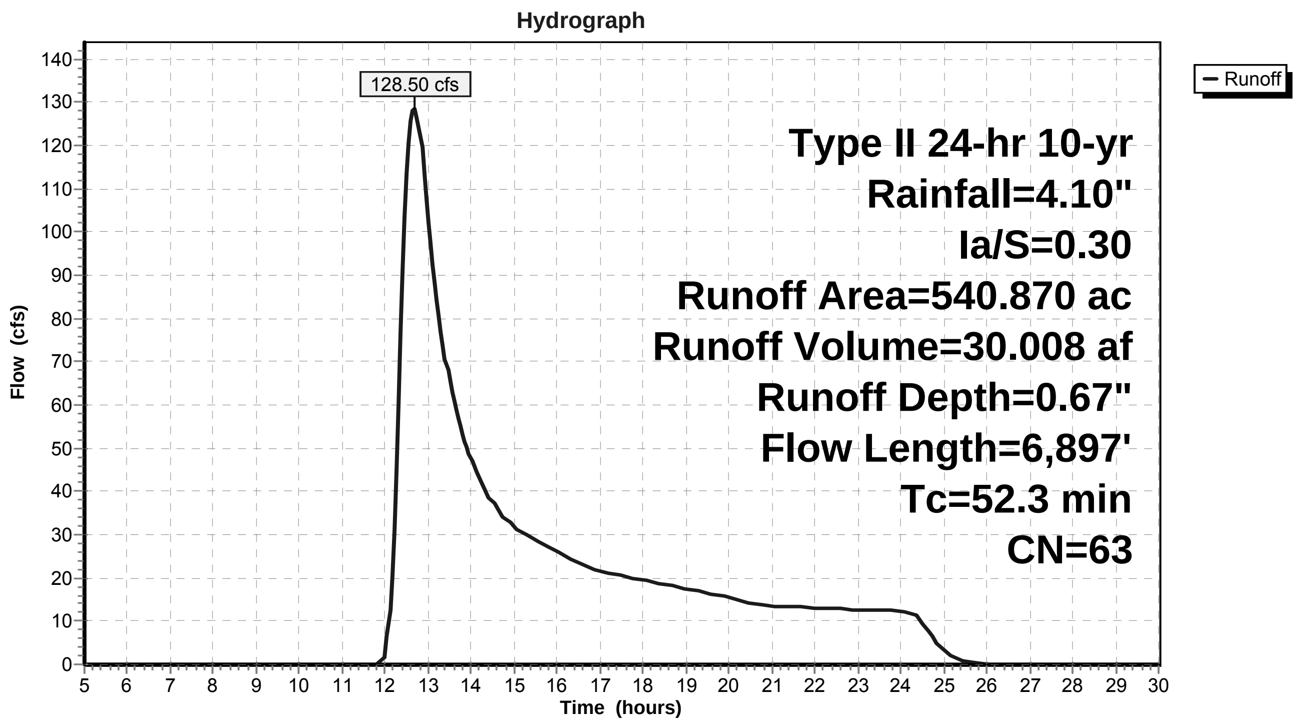
Runoff = 128.50 cfs @ 12.69 hrs, Volume= 30.008 af, Depth= 0.67"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.10", Ia/S=0.30

	Area (ac)	CN	Description
*	0.000	98	Buildings
*	0.000	36	Clearing, HSG A
*	0.000	60	Clearing, HSG B
*	0.000	73	Clearing, HSG C
*	0.020	98	Turbine/Foundation
*	0.000	76	Gravel roads, HSG A
*	0.000	85	Gravel roads, HSG B
*	0.000	89	Gravel roads, HSG C
*	0.000	76	Gravel roads (pr), HSG A
*	0.000	85	Gravel roads (pr), HSG B
*	1.250	89	Gravel roads (pr), HSG C
*	0.390	98	Ledge Outcrop
*	0.000	39	Temp Pads (vegetated at end), HSG A
*	0.000	61	Temp Pads (vegetated at end), HSG B
*	0.000	74	Temp Pads (vegetated at end), HSG C
*	0.000	39	Side Slopes (vegetated), HSG A
*	0.000	61	Side Slopes (vegetated), HSG B
*	0.890	74	Side Slopes (vegetated), HSG C
*	0.090	98	Ledge Face (estimated)
*	0.000	68	Shoulders/Temp Road (vegetated), HSG A
*	0.000	79	Shoulders/Temp Road (vegetated), HSG B
*	0.500	86	Shoulders/Temp Road (vegetated), HSG C
*	33.680	51	1 acre lots, 20% imp, HSG A
*	5.500	98	Paved Roads
*	1.950	98	Water
*	71.640	30	Woods, Good, HSG A
*	36.050	55	Woods, Good, HSG B
*	386.860	70	Woods, Good, HSG C
*	2.050	77	Woods, Good, HSG D
	540.870	63	Weighted Average
	526.184		97.28% Pervious Area
	14.686		2.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.3	100	0.0940	0.07		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
5.0	707	0.2230	2.36		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
5.5	2,030	0.0790	6.14	73.73	**Trap/Vee/Rect Channel Flow, Drainage Channel** Bot.W=10.00' D=1.00' Z= 2.0 '/' Top.W=14.00' n= 0.060
18.7	3,400	0.0180	3.03	106.04	**Trap/Vee/Rect Channel Flow, Woods** Bot.W=30.00' D=1.00' Z= 5.0 '/' Top.W=40.00' n= 0.060
0.8	660		13.90		**Lake or Reservoir, Pond** Mean Depth= 6.00'
52.3	6,897	Total			

Subcatchment P301: North Area



Summary for Subcatchment P401: Northeast Area

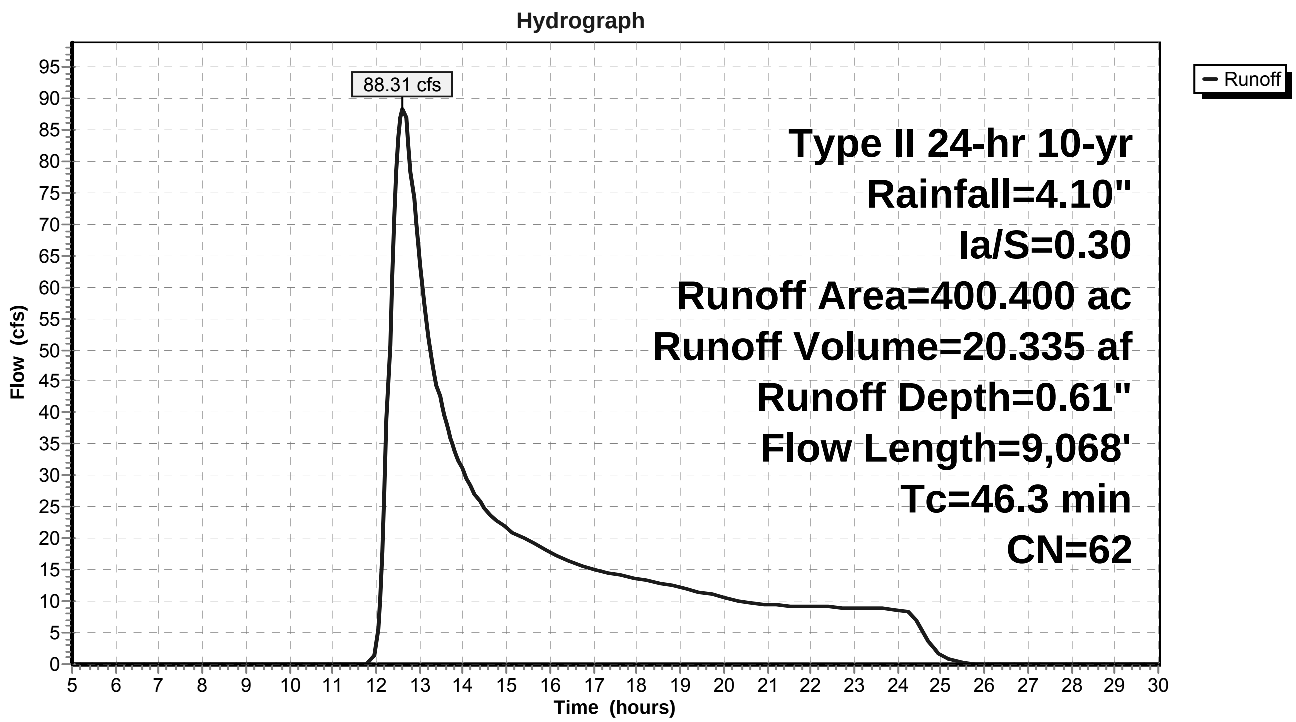
Runoff = 88.31 cfs @ 12.61 hrs, Volume= 20.335 af, Depth= 0.61"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.10", Ia/S=0.30

	Area (ac)	CN	Description
*	0.000	98	Buildings
*	0.000	36	Clearing, HSG A
*	0.000	60	Clearing, HSG B
*	0.000	73	Clearing, HSG C
*	0.010	98	Turbine/Foundation
*	0.000	76	Gravel roads, HSG A
*	0.000	85	Gravel roads, HSG B
*	0.000	89	Gravel roads, HSG C
*	0.000	76	Gravel roads (pr), HSG A
*	0.600	85	Gravel roads (pr), HSG B
*	0.000	89	Gravel roads (pr), HSG C
*	1.640	98	Ledge Outcrop
*	0.000	39	Temp Pads (vegetated at end), HSG A
*	0.000	61	Temp Pads (vegetated at end), HSG B
*	0.000	74	Temp Pads (vegetated at end), HSG C
*	0.000	39	Side Slopes (vegetated), HSG A
*	0.350	61	Side Slopes (vegetated), HSG B
*	0.120	74	Side Slopes (vegetated), HSG C
*	0.030	98	Ledge Face (estimated)
*	0.000	68	Shoulders/Temp Road (vegetated), HSG A
*	0.050	79	Shoulders/Temp Road (vegetated), HSG B
*	0.000	86	Shoulders/Temp Road (vegetated), HSG C
*	0.000	51	1 acre lots, 20% imp, HSG A
*	1.930	98	Paved Roads
*	0.000	98	Water
*	6.740	30	Woods, Good, HSG A
*	199.850	55	Woods, Good, HSG B
*	180.800	70	Woods, Good, HSG C
*	8.280	77	Woods, Good, HSG D
	400.400	62	Weighted Average
	396.790		99.10% Pervious Area
	3.610		0.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.8	100	0.0800	0.07		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
2.0	270	0.2000	2.24		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
3.8	295	0.0680	1.30		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
8.8	4,525	0.2300	8.62	34.47	**Trap/Vee/Rect Channel Flow, Drainage Channel** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.060
7.9	3,878	0.0780	8.20	147.61	**Trap/Vee/Rect Channel Flow, Stream** Bot.W=5.00' D=2.00' Z= 2.0 '/' Top.W=13.00' n= 0.060
46.3	9,068	Total			

Subcatchment P401: Northeast Area



Summary for Subcatchment P501: East Area

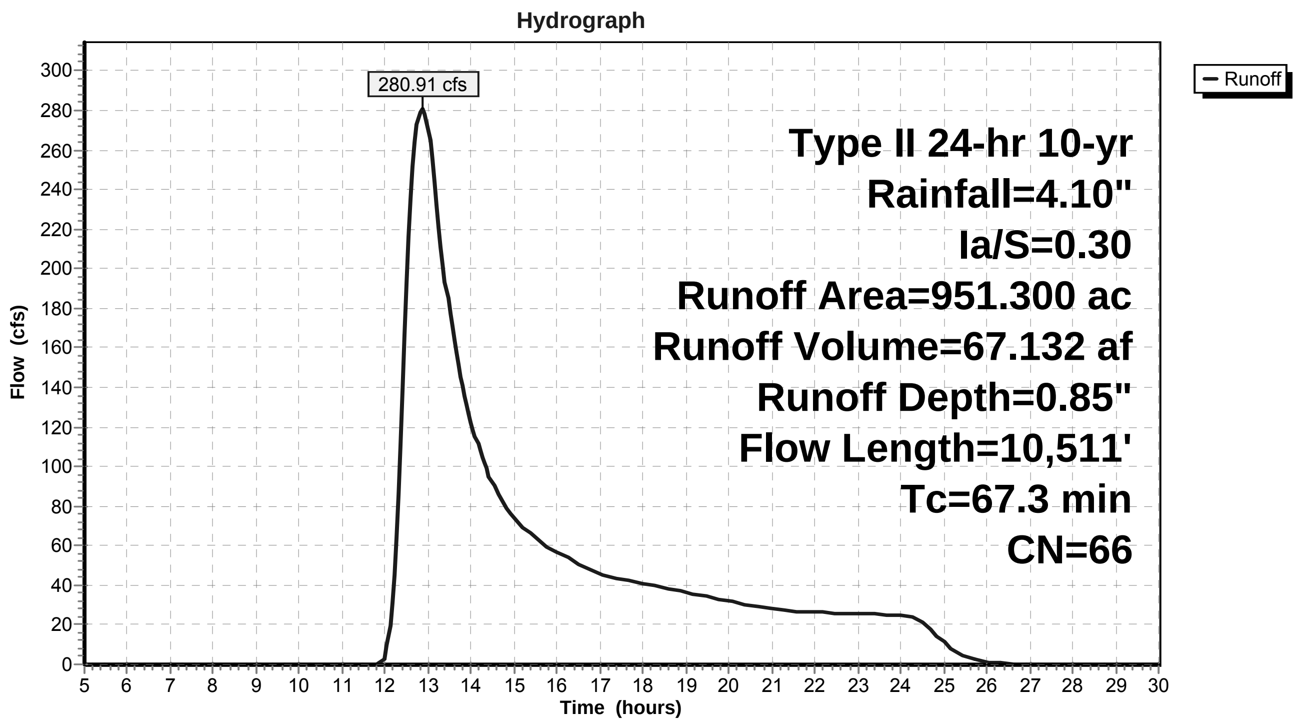
Runoff = 280.91 cfs @ 12.86 hrs, Volume= 67.132 af, Depth= 0.85"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.10", Ia/S=0.30

	Area (ac)	CN	Description
*	0.000	98	Buildings
*	0.000	36	Clearing, HSG A
*	0.000	60	Clearing, HSG B
*	0.000	73	Clearing, HSG C
*	0.040	98	Turbine/Foundation
*	0.000	76	Gravel roads, HSG A
*	0.000	85	Gravel roads, HSG B
*	0.000	89	Gravel roads, HSG C
*	0.000	76	Gravel roads (pr), HSG A
*	0.000	85	Gravel roads (pr), HSG B
*	1.350	89	Gravel roads (pr), HSG C
*	0.940	98	Ledge Outcrop
*	0.000	39	Temp Pads (vegetated at end), HSG A
*	0.000	61	Temp Pads (vegetated at end), HSG B
*	0.970	74	Temp Pads (vegetated at end), HSG C
*	0.000	39	Side Slopes (vegetated), HSG A
*	0.000	61	Side Slopes (vegetated), HSG B
*	0.970	74	Side Slopes (vegetated), HSG C
*	0.100	98	Ledge Face (estimated)
*	0.000	68	Shoulders/Temp Road (vegetated), HSG A
*	0.000	79	Shoulders/Temp Road (vegetated), HSG B
*	0.460	86	Shoulders/Temp Road (vegetated), HSG C
*	0.000	51	1 acre lots, 20% imp, HSG A
*	9.470	98	Paved Roads
*	0.000	98	Water
*	30.250	30	Woods, Good, HSG A
*	182.780	55	Woods, Good, HSG B
*	723.970	70	Woods, Good, HSG C
*	0.000	77	Woods, Good, HSG D
	951.300	66	Weighted Average
	940.750		98.89% Pervious Area
	10.550		1.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.4	65	0.0170	0.03		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
5.5	353	0.0450	1.06		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
2.2	315	0.2300	2.40		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
11.8	6,380	0.1970	8.99	62.90	**Trap/Vee/Rect Channel Flow, Stream** Bot.W=5.00' D=1.00' Z= 2.0 '/' Top.W=9.00' n= 0.060
16.4	3,398	0.0290	3.45	24.13	**Trap/Vee/Rect Channel Flow, Stream** Bot.W=5.00' D=1.00' Z= 2.0 '/' Top.W=9.00' n= 0.060
67.3	10,511	Total			

Subcatchment P501: East Area



Summary for Subcatchment P601: Southeast Area

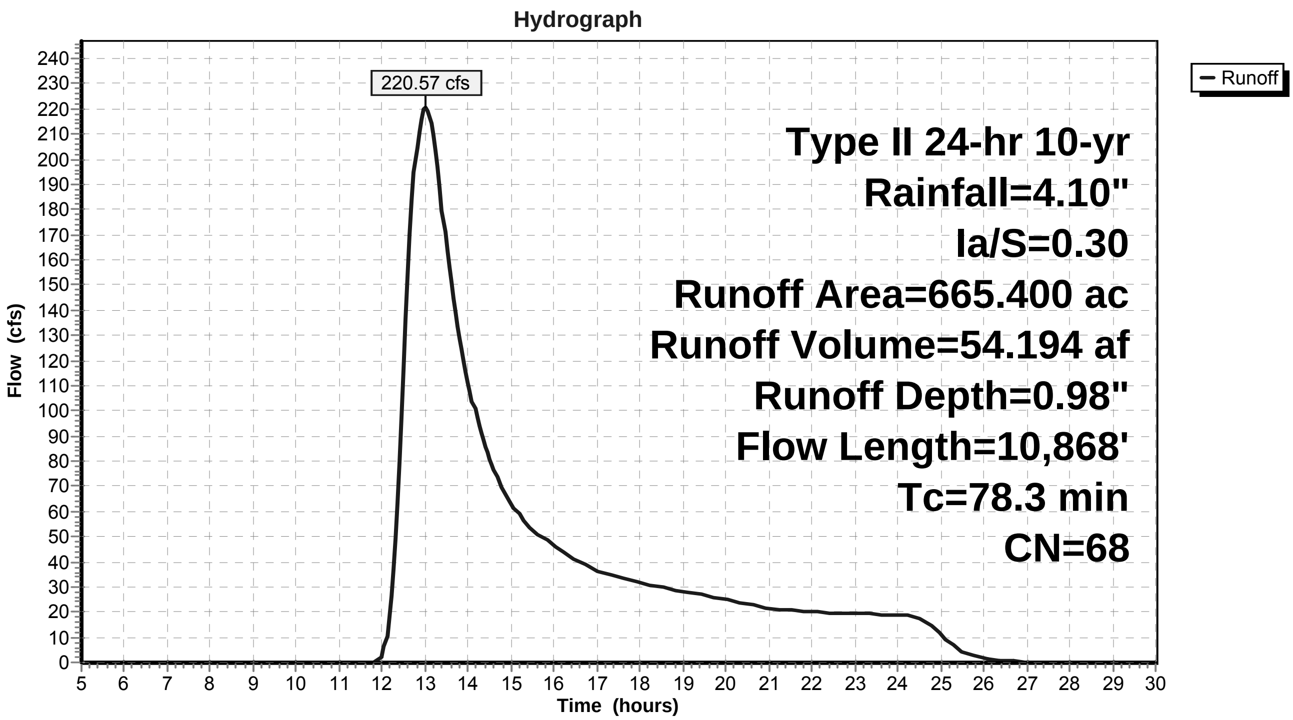
Runoff = 220.57 cfs @ 13.00 hrs, Volume= 54.194 af, Depth= 0.98"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.10", Ia/S=0.30

	Area (ac)	CN	Description
*	0.000	98	Buildings
*	0.000	36	Clearing, HSG A
*	0.000	60	Clearing, HSG B
*	1.860	73	Clearing, HSG C
*	0.020	98	Turbine/Foundation
*	0.000	76	Gravel roads, HSG A
*	0.000	85	Gravel roads, HSG B
*	0.000	89	Gravel roads, HSG C
*	0.000	76	Gravel roads (pr), HSG A
*	0.000	85	Gravel roads (pr), HSG B
*	0.640	89	Gravel roads (pr), HSG C
*	0.230	98	Ledge Outcrop
*	0.000	39	Temp Pads (vegetated at end), HSG A
*	0.000	61	Temp Pads (vegetated at end), HSG B
*	0.410	74	Temp Pads (vegetated at end), HSG C
*	0.000	39	Side Slopes (vegetated), HSG A
*	0.000	61	Side Slopes (vegetated), HSG B
*	0.720	74	Side Slopes (vegetated), HSG C
*	0.070	98	Ledge Face (estimated)
*	0.000	68	Shoulders/Temp Road (vegetated), HSG A
*	0.000	79	Shoulders/Temp Road (vegetated), HSG B
*	0.500	86	Shoulders/Temp Road (vegetated), HSG C
*	0.000	51	1 acre lots, 20% imp, HSG A
*	5.490	98	Paved Roads
*	0.000	98	Water
*	11.640	30	Woods, Good, HSG A
*	58.420	55	Woods, Good, HSG B
*	585.400	70	Woods, Good, HSG C
*	0.000	77	Woods, Good, HSG D
	665.400	68	Weighted Average
	659.590		99.13% Pervious Area
	5.810		0.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
44.3	100	0.0170	0.04		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
11.4	1,053	0.0950	1.54		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
8.8	3,890	0.1690	7.39	29.55	**Trap/Vee/Rect Channel Flow, Drainage Channel** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.060
13.8	5,825	0.1200	7.01	49.09	**Trap/Vee/Rect Channel Flow, Stream** Bot.W=5.00' D=1.00' Z= 2.0 '/' Top.W=9.00' n= 0.060
78.3	10,868	Total			

Subcatchment P601: Southeast Area



Summary for Subcatchment P701: South Area

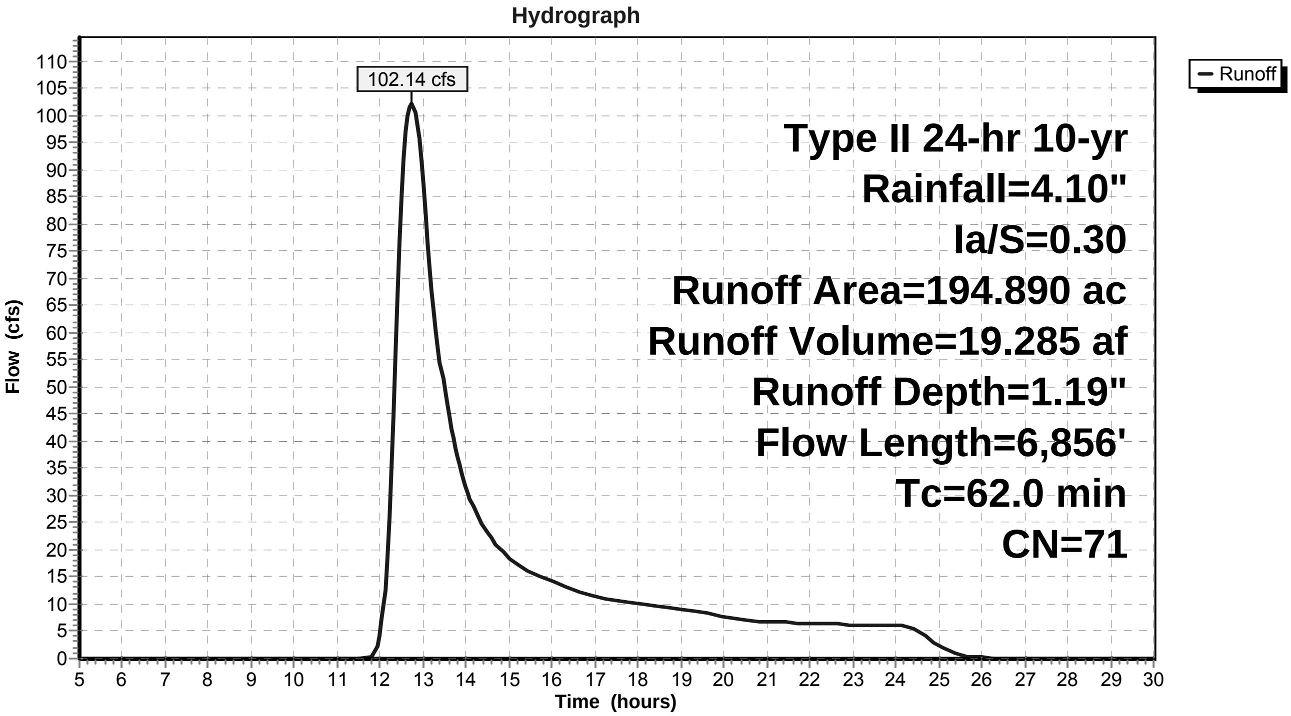
Runoff = 102.14 cfs @ 12.74 hrs, Volume= 19.285 af, Depth= 1.19"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.10", Ia/S=0.30

	Area (ac)	CN	Description
*	0.000	98	Buildings
*	0.000	36	Clearing, HSG A
*	0.000	60	Clearing, HSG B
*	0.000	73	Clearing, HSG C
*	0.020	98	Turbine/Foundation
*	0.000	76	Gravel roads, HSG A
*	0.000	85	Gravel roads, HSG B
*	0.000	89	Gravel roads, HSG C
*	0.000	76	Gravel roads (pr), HSG A
*	0.000	85	Gravel roads (pr), HSG B
*	0.720	89	Gravel roads (pr), HSG C
*	0.000	98	Ledge Outcrop
*	0.000	39	Temp Pads (vegetated at end), HSG A
*	0.000	61	Temp Pads (vegetated at end), HSG B
*	0.000	74	Temp Pads (vegetated at end), HSG C
*	0.000	39	Side Slopes (vegetated), HSG A
*	0.000	61	Side Slopes (vegetated), HSG B
*	0.610	74	Side Slopes (vegetated), HSG C
*	0.060	98	Ledge Face (estimated)
*	0.000	68	Shoulders/Temp Road (vegetated), HSG A
*	0.000	79	Shoulders/Temp Road (vegetated), HSG B
*	0.670	86	Shoulders/Temp Road (vegetated), HSG C
*	0.000	51	1 acre lots, 20% imp, HSG A
*	0.000	98	Paved Roads
*	0.000	98	Water
*	0.000	30	Woods, Good, HSG A
*	0.110	55	Woods, Good, HSG B
*	170.590	70	Woods, Good, HSG C
*	22.110	77	Woods, Good, HSG D
	194.890	71	Weighted Average
	194.810		99.96% Pervious Area
	0.080		0.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
34.8	100	0.0310	0.05		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
17.1	2,339	0.2090	2.29		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
10.1	4,417	0.1300	7.30	51.09	**Trap/Vee/Rect Channel Flow, Stream** Bot.W=5.00' D=1.00' Z= 2.0 '/' Top.W=9.00' n= 0.060
62.0	6,856	Total			

Subcatchment P701: South Area

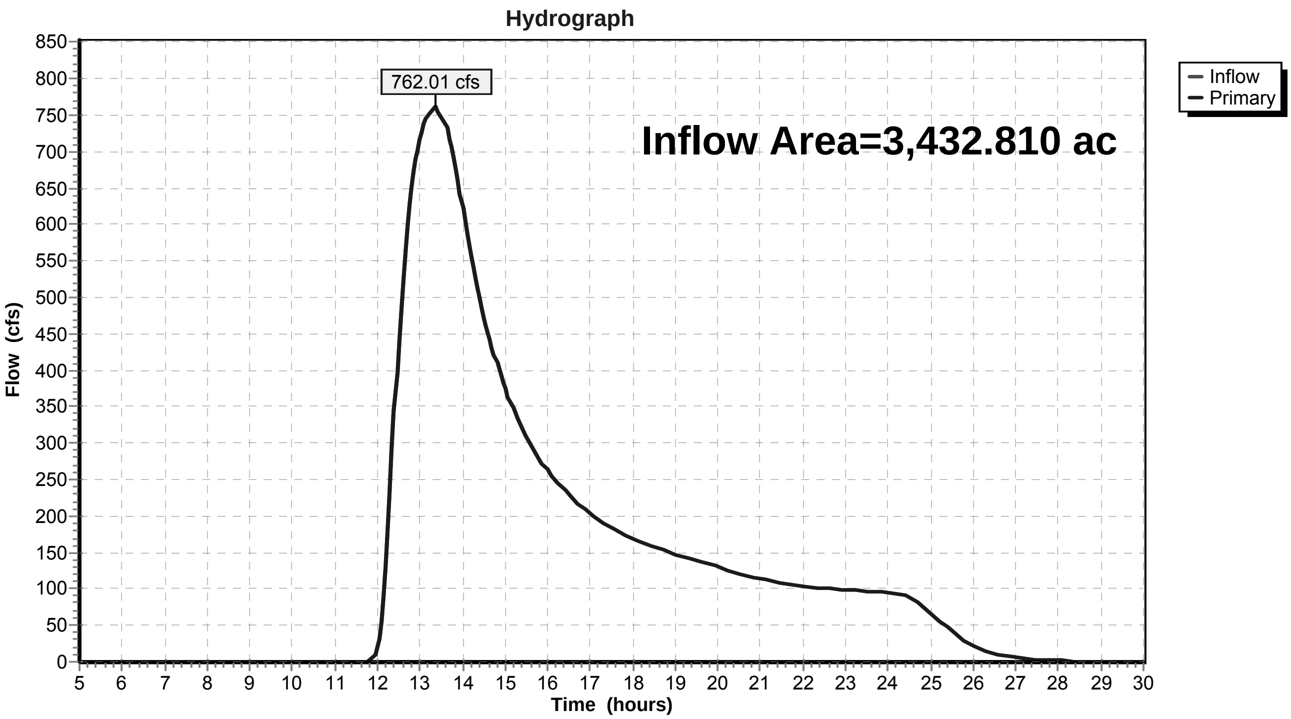


Summary for Link D1: Clark Brook

Inflow Area =	3,432.810 ac,	0.46% Impervious,	Inflow Depth = 0.93"	for 10-yr event	
Inflow =	762.01 cfs @	13.36 hrs,	Volume=	264.833 af	
Primary =	762.01 cfs @	13.36 hrs,	Volume=	264.833 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Link D1: Clark Brook

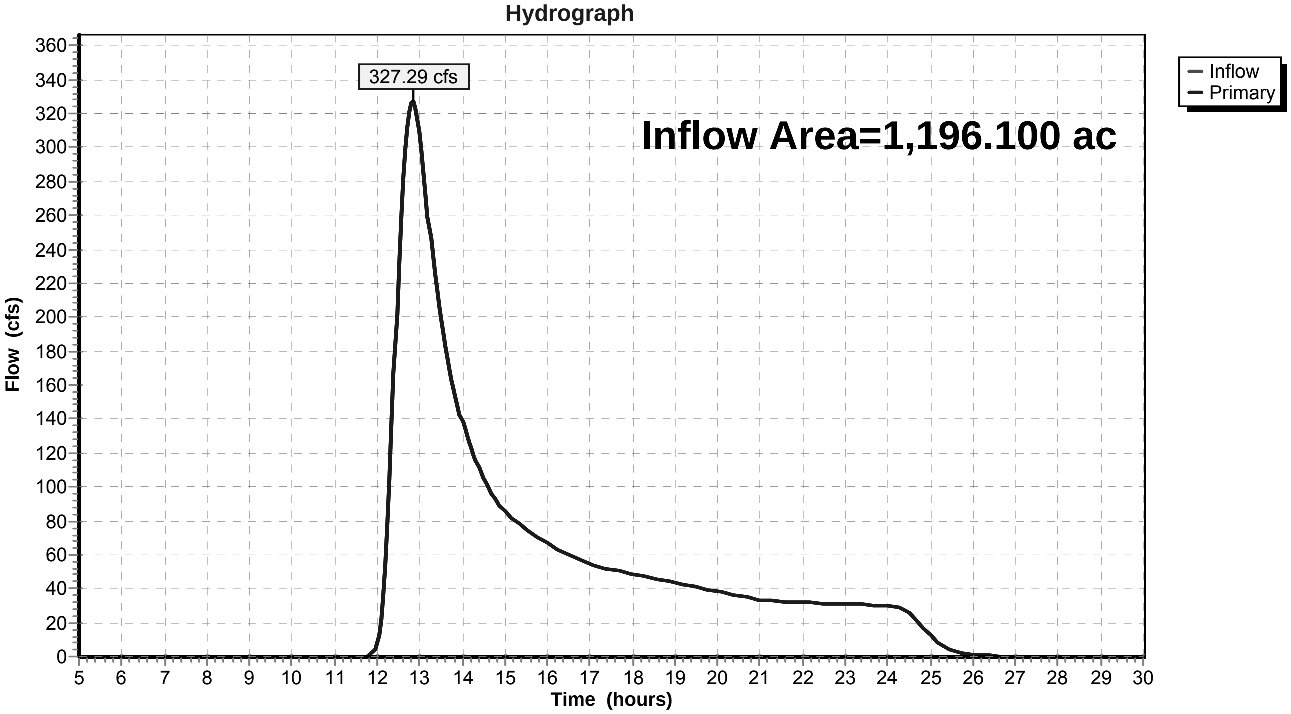


Summary for Link D2: Halls Brook

Inflow Area = 1,196.100 ac, 1.17% Impervious, Inflow Depth = 0.78" for 10-yr event
Inflow = 327.29 cfs @ 12.83 hrs, Volume= 78.194 af
Primary = 327.29 cfs @ 12.83 hrs, Volume= 78.194 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Link D2: Halls Brook

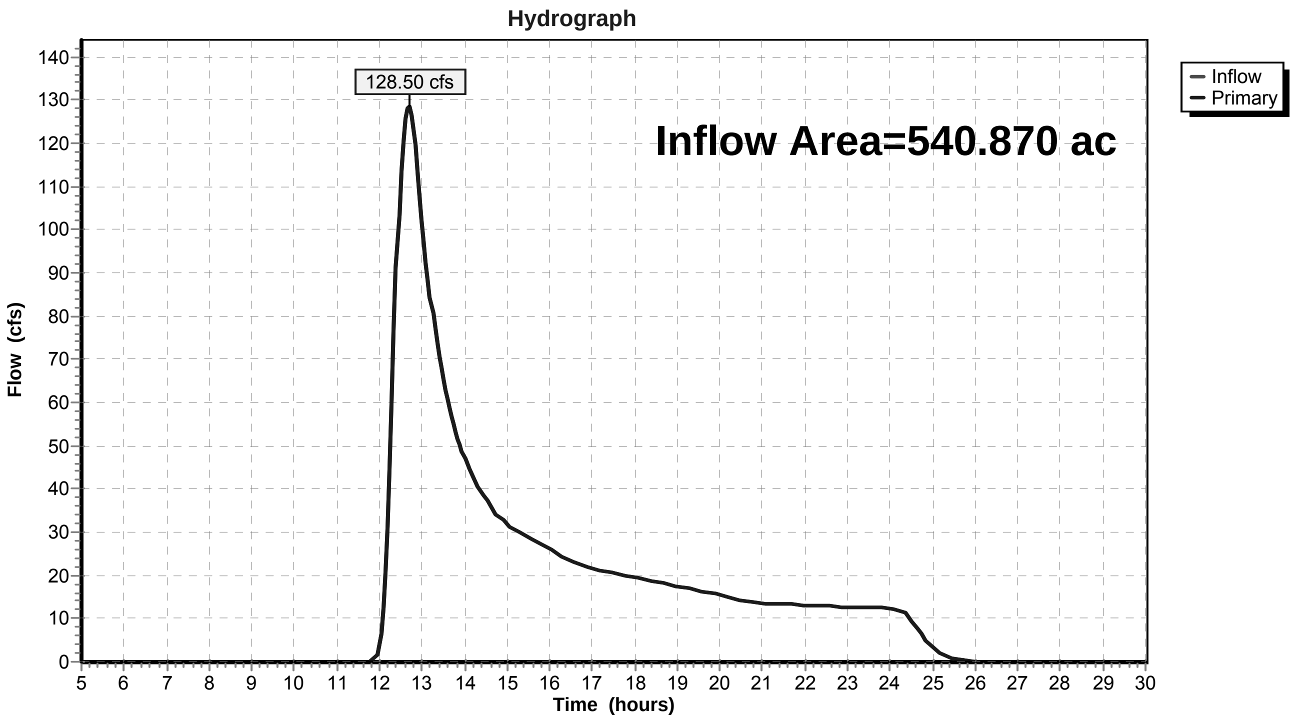


Summary for Link D3: Rte 25 Culvert (west)

Inflow Area =	540.870 ac,	2.72% Impervious, Inflow Depth = 0.67"	for 10-yr event	
Inflow =	128.50 cfs @	12.69 hrs, Volume=	30.008 af	
Primary =	128.50 cfs @	12.69 hrs, Volume=	30.008 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Link D3: Rte 25 Culvert (west)

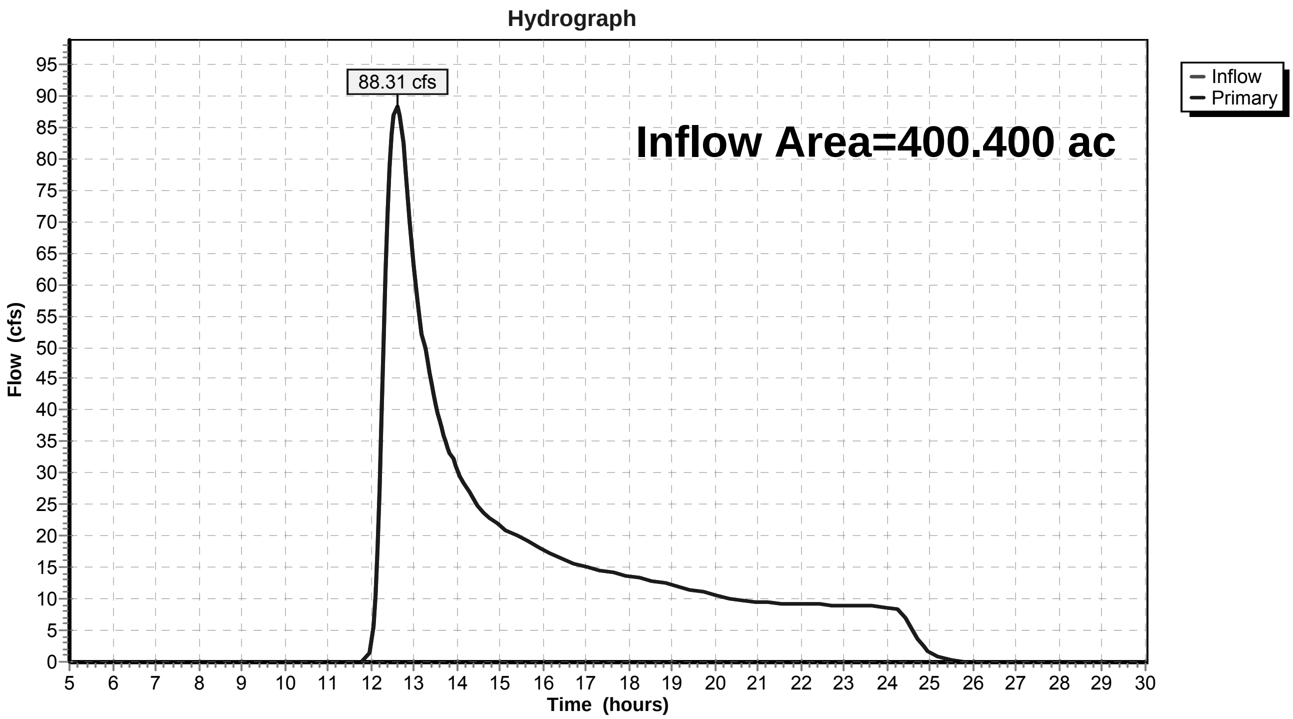


Summary for Link D4: Rte 25 Culvert (east)

Inflow Area =	400.400 ac,	0.90% Impervious, Inflow Depth = 0.61"	for 10-yr event	
Inflow =	88.31 cfs @	12.61 hrs, Volume=	20.335 af	
Primary =	88.31 cfs @	12.61 hrs, Volume=	20.335 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Link D4: Rte 25 Culvert (east)

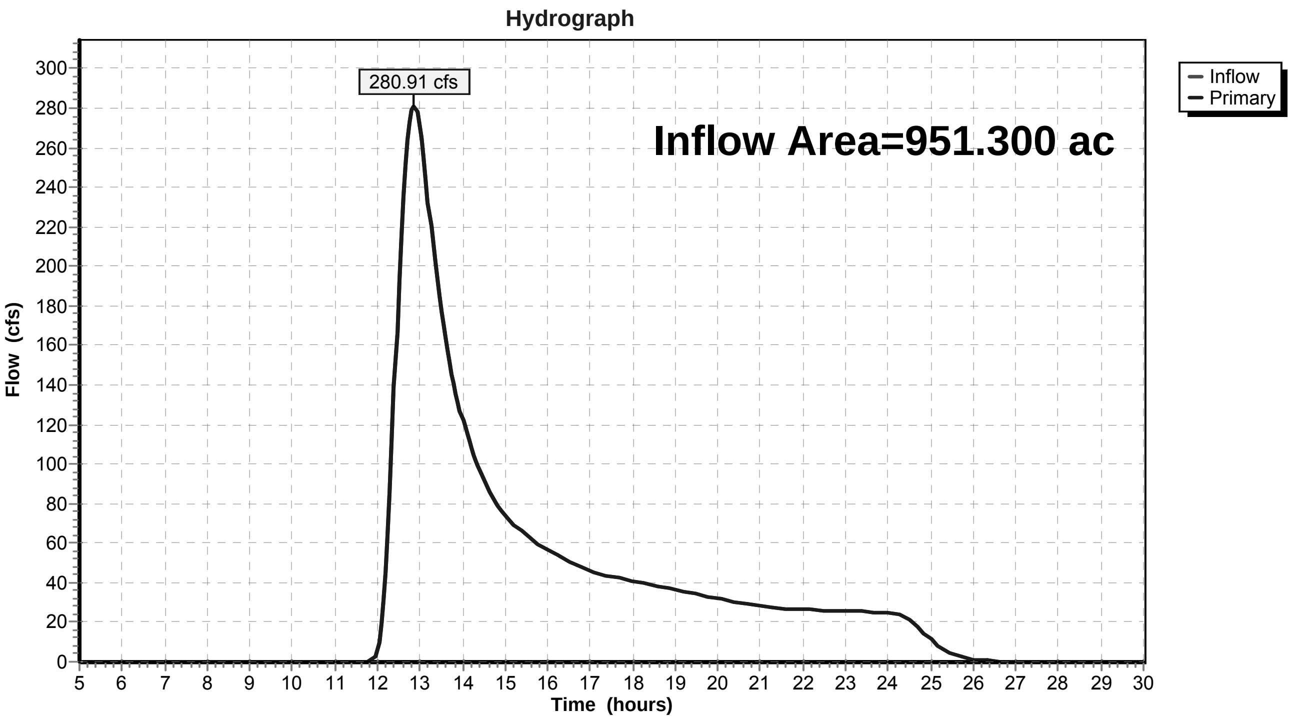


Summary for Link D5: Mayhew Tpk Culvert (north)

Inflow Area =	951.300 ac,	1.11% Impervious,	Inflow Depth = 0.85"	for 10-yr event
Inflow =	280.91 cfs @	12.86 hrs, Volume=	67.132 af	
Primary =	280.91 cfs @	12.86 hrs, Volume=	67.132 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Link D5: Mayhew Tpk Culvert (north)

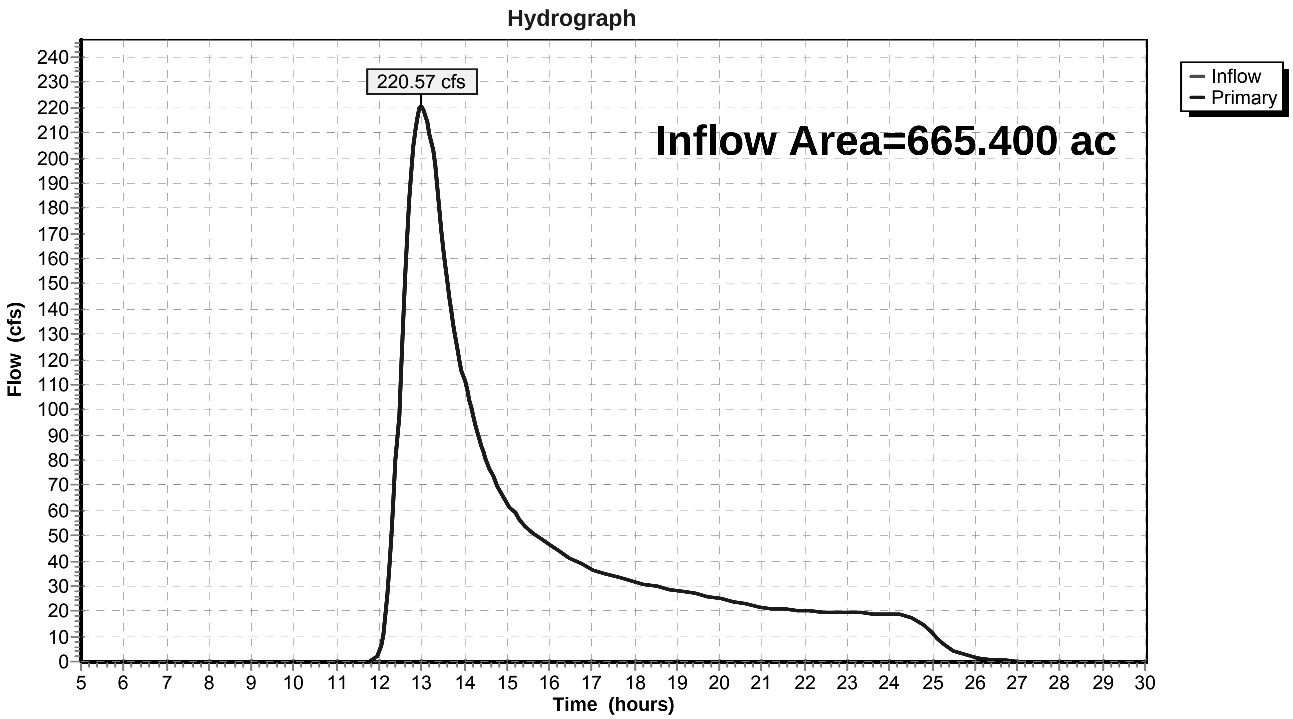


Summary for Link D6: Mayhew Tpk Culvert (south)

Inflow Area =	665.400 ac,	0.87% Impervious,	Inflow Depth = 0.98"	for 10-yr event
Inflow =	220.57 cfs @	13.00 hrs, Volume=	54.194 af	
Primary =	220.57 cfs @	13.00 hrs, Volume=	54.194 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Link D6: Mayhew Tpk Culvert (south)

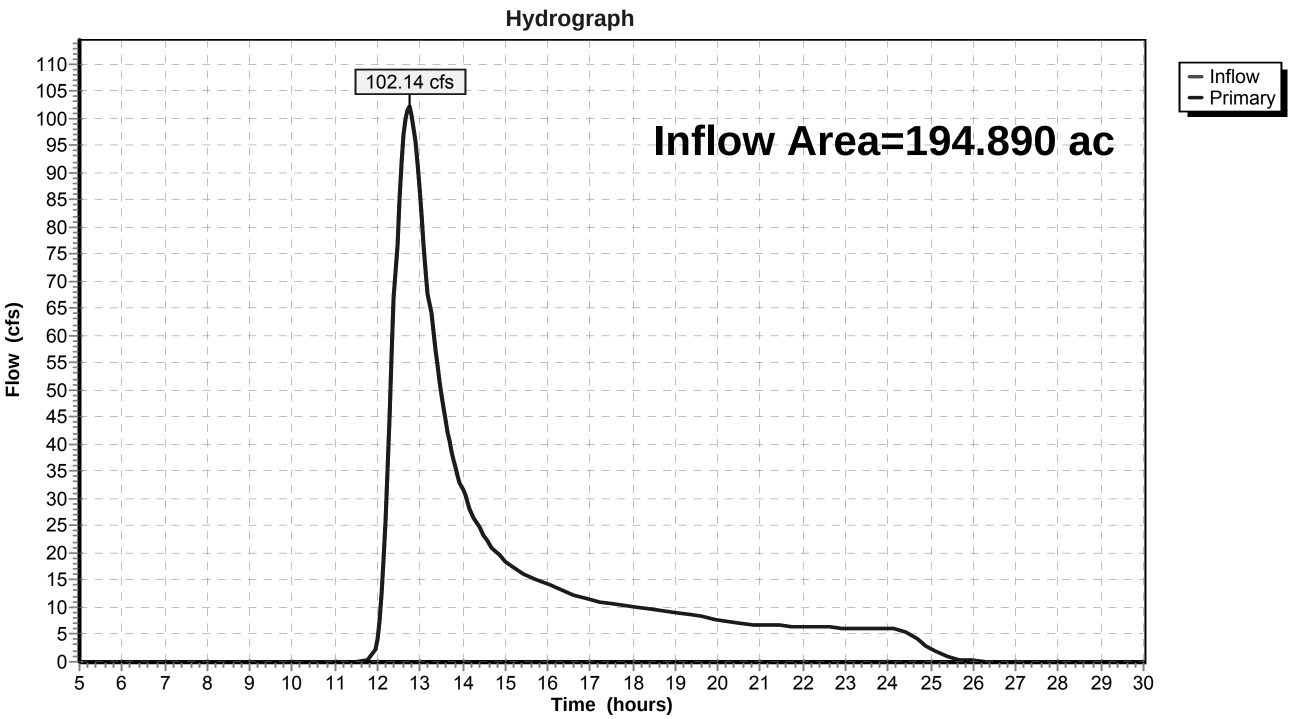


Summary for Link D7: Wise Brook

Inflow Area =	194.890 ac,	0.04% Impervious, Inflow Depth =	1.19"	for 10-yr event
Inflow =	102.14 cfs @	12.74 hrs, Volume=	19.285 af	
Primary =	102.14 cfs @	12.74 hrs, Volume=	19.285 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Link D7: Wise Brook



Appendix C: Hydraulic Calculations

- Culvert Sizing Calculations
- Riprap Apron/Energy Dissipation Calculations
- O & M Building Site
- Stone Mattresses

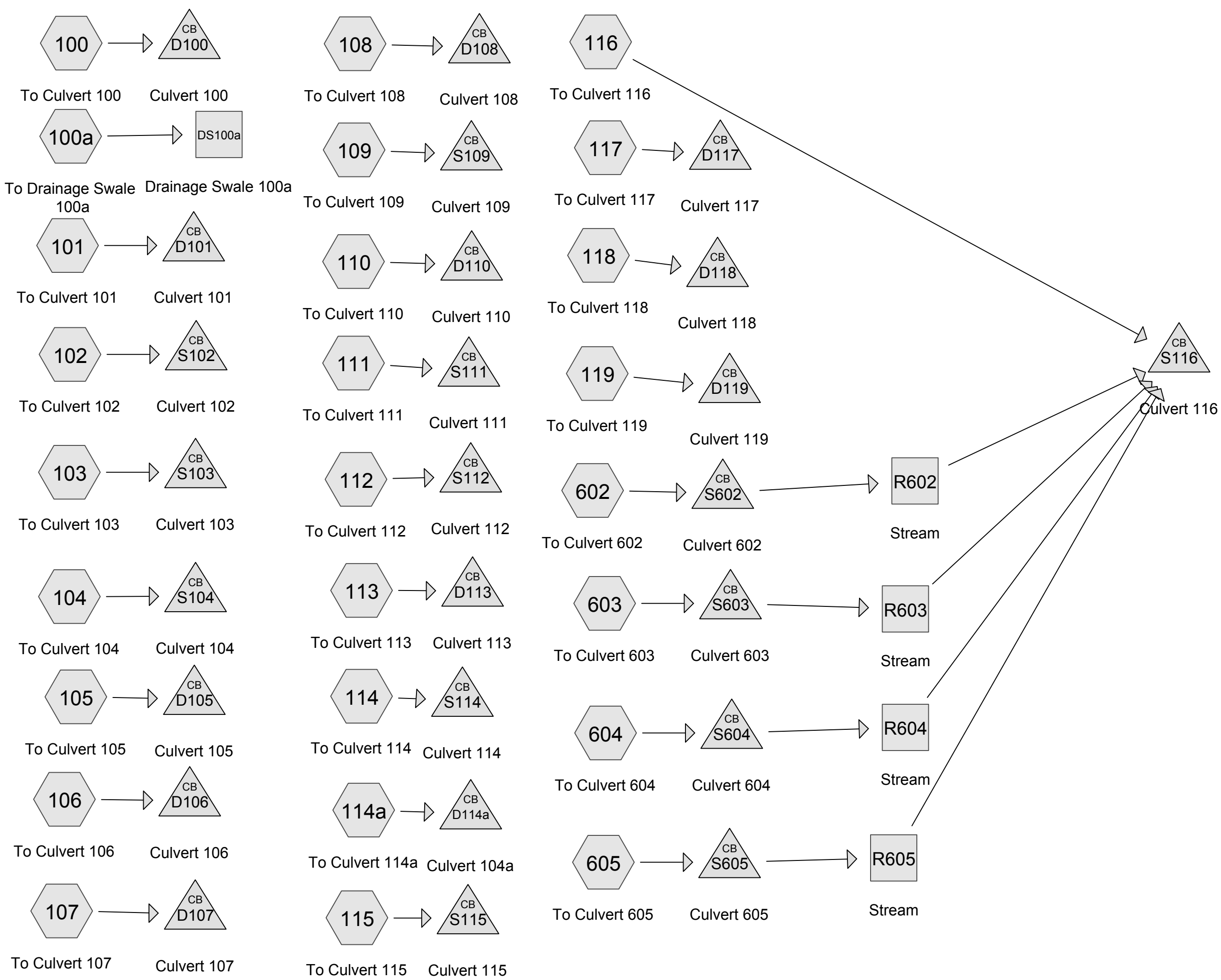
Culvert Sizing Calculations

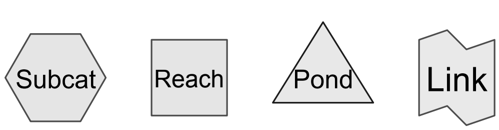
VHB *Computations*

Project #: 52036.00
Project: Wind Farm
Location: Groton, New Hampshire
Calculated by: Date: 11/30/09
Checked by: Date:
Title: Preliminary Culvert Sizing

Culvert	Location	Station	Size	Material	Design Storm	Flow (CFS)	Drainage Area (Acres)
100	Groton Hollow Road	58+98	12"	CPP	25-year	0.3	0.24
101	Groton Hollow Road	60+67	18"	CPP	25-year	10.5	10.3
102	Groton Hollow Road	67+31	49"x33"*	CMP Arch	50-year	38.5	30.0
103	Groton Hollow Road	68+56	35"x24"	CMP Arch	25-year	15.1	13.9
104	Groton Hollow Road	73+44	35"x24"	CMP Arch	25-year	13.9	13.6
105	Groton Hollow Road	78+42	18"	CPP	25-year	9.3	7.1
106	Groton Hollow Road	85+04	15"	CPP	25-year	4.1	2.9
107	Groton Hollow Road	87+85	18"	CPP	25-year	6.4	5.3
108	Groton Hollow Road	89+71	18"	CPP	25-year	5.7	5.5
109	Groton Hollow Road	95+38	42"x29"	CMP Arch	50-year	43.5	26.5
110	Groton Hollow Road	100+42	18"	CPP	25-year	6.9	6.5
111	Groton Hollow Road	107+02	28"x20"	CMP Arch	25-year	3.6	3.5
112	Groton Hollow Road	109+30	9'x3'	Steel Box	50-year	58.8	47.5
114	Groton Hollow Road	127+78	9'x3'	Steel Box	50-year	64.1	57.2
114a	Groton Hollow Road	135+08	15"	CPP	25-year	2.0	1.4
115	Groton Hollow Road	137+65	35"x24"	CMP Arch	50-year	27.4	22.2
116	Groton Hollow Road	142+31	83"x57"*	CMP Arch	50-year	161.4	110.6
117	Groton Hollow Road	143+11	18"	CPP	25-year	6.4	5.8
118	Groton Hollow Road	148+71	12"	CPP	25-year	1.6	1.0
119	Groton Hollow Road	150+65	12"	CPP	25-year	1.5	1.0
218	Groton Hollow Road	167+61	Ex. 6'x9'	Stone Box	NA	NA	562.4
219	Groton Hollow Road	163+23	9'x3'	Steel Box	50-year	105.1	81.9
220	Groton Hollow Road	157+87	21"x15"	CMP Arch	25-year	11.5	16.8
221	Groton Hollow Road	154+15	9'x3'	Steel Box	50-year	101.5	125.6
222	Groton Hollow Road	±169+00	17.3'x3.8'	Steel Box	100-year	394.2	282.2
201	East Access Road	82+91	17"x13"	CMP Arch	25-year	6.5	7.0
202	East Access Road	67+37	24"x18"	CMP Arch	25-year	6.1	5.8
203	East Access Road	60+50	57"x38"	CMP Arch	50-year	38.8	33.4
204	East Access Road	59+87	24"x18"	CMP Arch	25-year	3.9	3.2
205	East Access Road	53+96	42"x29"	CMP Arch	50-year	43.4	31.5
206	East Access Road	53+56	24"x18"	CMP Arch	25-year	22.2	16.0
207	East Access Road	47+23	24"x18"	CMP Arch	25-year	5.0	3.8
208	East Access Road	41+67	64"x43"*	CMP Arch	50-year	64.2	53.0
209	East Access Road	32+29	71"x47"*	CMP Arch	50-year	71.0	58.7
210	East Access Road	31+88	24"x18"	CMP Arch	25-year	0.9	0.6
211	East Access Road	30+64	24"x18"	CMP Arch	25-year	1.3	1.0
212	East Access Road	26+92	28"x20"*	CMP Arch	25-year	12.5	8.2
213	East Access Road	26+12	64"x43"*	CMP Arch	50-year	85.7	67.4
214	East Access Road	20+74	24"x18"	CMP Arch	25-year	3.2	2.4
215	East Access Road	13+22	24"	RCP	25-year	10.4	5.2
216	East Access Road	11+41	24"x18"	CMP Arch	25-year	2.8	2.2
217	East Access Road	6+24	17.3'x3.8'	Steel Box	100-year	333.9	235.1
501	Southeast Access Road	30+60	42"x29"	CMP Arch	50-year	33.4	23.4
502	Southeast Access Road	37+30	17"x13"	CMP Arch	25-year	3.2	2.6
503	Southeast Access Road	38+30	17"x13"	CMP Arch	25-year	4.3	3.4
504	Southeast Access Road	39+30	24"x18"	CMP Arch	25-year	9.7	6.4
505	Southeast Access Road	41+00	17"x13"	CMP Arch	25-year	5.5	2.6
602	West Access Road	19+29	21"x15"	CMP Arch	25-year	7.7	7.3
603	West Access Road	20+76	17"x13"	CMP Arch	25-year	2.4	1.7
604	West Access Road	21+35	57"x38"*	CMP Arch	50-year	97.2	61.1
605	West Access Road	23+77	35"x24"	CMP Arch	25-year	10.2	10.2
701	West Ridge Road	51+56	49"x33"*	CMP Arch	50-year	33.8	23.1
702	West Ridge Road	62+13	17"x13"	CMP Arch	25-year	2.2	2.0
703	West Ridge Road	5+16	17"x13"	CMP Arch	25-year	2.1	1.9
801	North Access Road	4+81	35"x24"*	CMP Arch	50-year	40.6	28.2
802	North Access Road	13+88	17"x13"	CMP Arch	25-year	8.9	6.7
803	North Access Road	21+42	17"x13"	CMP Arch	25-year	12.4	12.4
804	North Access Road	29+96	49"x33"*	CMP Arch	50-year	43.1	32.5
805	North Access Road	43+66	17"x13"	CMP Arch	25-year	7.2	5.1
806	North Access Road	45+54	12"	CPP	25-year	3.5	2.6
807	North Access Road	46+56	28"x20"	CMP Arch	50-year	28.1	20.5
808	North Access Road	47+04	17"x13"	CMP Arch	25-year	0.7	0.4
809	North Access Road	48+97	42"x29"*	CMP Arch	50-year	49.5	30.6
901	North Ridge Road	72+55	12"	CPP	25-year	7.0	8.0
903	North Ridge Road	83+50	24"x18"	CMP Arch	25-year	7.3	11.4

* Pipe calculation and sizing based on the next smaller nominal pipe size than currently shown. Perennial Stream crossings shall have pipe dimensions as shown on this chart with 8" of gravel placed within it to act as a natural bottom for the stream





Drainage Diagram for Groton-Culverts-100_600
Prepared by Vanasse Hangen Brustlin, Inc., Printed 12/2/2009
HydroCAD® 9.00 s/n 01038 © 2009 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
372.870	67	Based on CN for P101 (100, 100a, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 114a, 115, 116, 117, 118, 119, 602, 603, 604, 605)
372.870		**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Goup	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
372.870	Other	100, 100a, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 114a, 115, 116, 117, 118, 119, 602, 603, 604, 605
372.870		**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)
1	D100	659.00	658.30	121.5	0.0058	0.013	12.0	0.0
2	D101	674.50	674.00	50.0	0.0100	0.013	18.0	0.0
3	D105	841.50	841.00	40.0	0.0125	0.013	18.0	0.0
4	D106	900.50	900.00	40.0	0.0125	0.013	15.0	0.0
5	D107	928.50	928.00	40.0	0.0125	0.013	18.0	0.0
6	D108	945.50	945.00	30.0	0.0167	0.013	18.0	0.0
7	D110	1,026.50	1,026.00	40.0	0.0125	0.013	18.0	0.0
8	D113	1,113.00	1,112.50	35.0	0.0143	0.013	12.0	0.0
9	D114a	1,152.00	1,151.00	45.0	0.0222	0.013	15.0	0.0
10	D117	1,159.00	1,158.00	50.0	0.0200	0.013	18.0	0.0
11	D118	1,170.50	1,170.00	45.0	0.0111	0.013	12.0	0.0
12	D119	1,175.00	1,174.00	42.0	0.0238	0.013	12.0	0.0
13	S102	713.50	710.00	35.0	0.1000	0.025	42.0	29.0
14	S103	729.00	726.00	35.0	0.0857	0.025	35.0	24.0
15	S104	786.00	785.00	55.0	0.0182	0.025	35.0	24.0
16	S109	985.50	985.00	40.0	0.0125	0.025	42.0	29.0
17	S111	1,054.00	1,053.50	45.0	0.0111	0.025	28.0	20.0
18	S112	1,054.50	1,054.00	35.0	0.0143	0.025	108.0	24.0
19	S114	1,114.30	1,114.00	30.0	0.0100	0.025	108.0	24.0
20	S115	1,162.00	1,161.00	35.0	0.0286	0.025	35.0	24.0
21	S116	1,156.50	1,156.00	50.0	0.0100	0.025	77.0	52.0
22	S602	1,340.00	1,330.00	49.0	0.2041	0.025	21.0	15.0
23	S603	1,343.00	1,340.00	42.0	0.0714	0.013	17.0	13.0
24	S604	1,340.00	1,338.00	32.0	0.0625	0.013	49.0	33.0
25	S605	1,366.00	1,352.00	60.0	0.2333	0.013	35.0	24.0

Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment100: To Culvert 100 Runoff Area=0.240 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=149' Tc=17.7 min CN=67 Runoff=0.34 cfs 0.027 af

Subcatchment100a: To Drainage Swale 100a Runoff Area=0.230 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=366' Tc=1.4 min CN=67 Runoff=0.59 cfs 0.026 af

Subcatchment101: To Culvert 101 Runoff Area=10.300 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=1,690' Tc=28.5 min CN=67 Runoff=10.54 cfs 1.149 af

Subcatchment102: To Culvert 102 Runoff Area=30.000 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=2,965' Tc=30.5 min CN=67 Runoff=29.24 cfs 3.346 af

Subcatchment103: To Culvert 103 Runoff Area=13.900 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=2,230' Tc=26.0 min CN=67 Runoff=15.13 cfs 1.550 af

Subcatchment104: To Culvert 104 Runoff Area=13.600 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=1,840' Tc=28.7 min CN=67 Runoff=13.85 cfs 1.517 af

Subcatchment105: To Culvert 105 Runoff Area=7.100 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=1,600' Tc=19.9 min CN=67 Runoff=9.30 cfs 0.792 af

Subcatchment106: To Culvert 106 Runoff Area=2.900 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=764' Tc=17.9 min CN=67 Runoff=4.05 cfs 0.323 af

Subcatchment107: To Culvert 107 Runoff Area=5.300 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=1,200' Tc=22.4 min CN=67 Runoff=6.40 cfs 0.591 af

Subcatchment108: To Culvert 108 Runoff Area=5.500 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=1,180' Tc=28.3 min CN=67 Runoff=5.66 cfs 0.613 af

Subcatchment109: To Culvert 109 Runoff Area=26.500 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=1,260' Tc=21.4 min CN=67 Runoff=33.13 cfs 2.955 af

Subcatchment110: To Culvert 110 Runoff Area=6.500 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=785' Tc=27.3 min CN=67 Runoff=6.85 cfs 0.725 af

Subcatchment111: To Culvert 111 Runoff Area=3.500 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=715' Tc=28.6 min CN=67 Runoff=3.57 cfs 0.390 af

Subcatchment112: To Culvert 112 Runoff Area=47.500 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=905' Tc=32.0 min CN=67 Runoff=44.65 cfs 5.298 af

Subcatchment113: To Culvert 113 Runoff Area=0.590 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=310' Tc=20.6 min CN=67 Runoff=0.76 cfs 0.066 af

Subcatchment114: To Culvert 114 Runoff Area=57.200 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=2,622' Tc=36.8 min CN=67 Runoff=48.60 cfs 6.379 af

Subcatchment114a: To Culvert 114a Runoff Area=1.400 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=642' Tc=16.9 min CN=67 Runoff=2.04 cfs 0.156 af

Subcatchment115: To Culvert 115 Runoff Area=22.200 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=2,417' Tc=32.2 min CN=67 Runoff=20.78 cfs 2.476 af

Subcatchment116: To Culvert 116 Runoff Area=30.300 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=1,769' Tc=26.1 min CN=67 Runoff=32.93 cfs 3.379 af

Subcatchment117: To Culvert 117 Runoff Area=5.800 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=980' Tc=25.5 min CN=67 Runoff=6.42 cfs 0.647 af

Subcatchment118: To Culvert 118 Runoff Area=1.000 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=185' Tc=14.9 min CN=67 Runoff=1.56 cfs 0.112 af

Subcatchment119: To Culvert 119 Runoff Area=1.000 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=270' Tc=16.1 min CN=67 Runoff=1.50 cfs 0.112 af

Subcatchment602: To Culvert 602 Runoff Area=7.270 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=1,426' Tc=26.9 min CN=67 Runoff=7.73 cfs 0.811 af

Subcatchment603: To Culvert 603 Runoff Area=1.740 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=730' Tc=17.7 min CN=67 Runoff=2.46 cfs 0.194 af

Subcatchment604: To Culvert 604 Runoff Area=61.100 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=2,141' Tc=22.3 min CN=67 Runoff=74.05 cfs 6.814 af

Subcatchment605: To Culvert 605 Runoff Area=10.200 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=1,270' Tc=29.3 min CN=67 Runoff=10.21 cfs 1.138 af

Reach DS100a: Drainage Swale 100a Avg. Depth=0.16' Max Vel=2.73 fps Inflow=0.59 cfs 0.026 af
n=0.040 L=239.0' S=0.0879 '/' Capacity=22.13 cfs Outflow=0.54 cfs 0.026 af

Reach R602: Stream Avg. Depth=0.37' Max Vel=6.41 fps Inflow=7.73 cfs 0.811 af
n=0.040 L=1,095.0' S=0.1580 '/' Capacity=113.22 cfs Outflow=7.59 cfs 0.811 af

Reach R603: Stream Avg. Depth=0.18' Max Vel=4.23 fps Inflow=2.46 cfs 0.194 af
n=0.040 L=1,218.0' S=0.1502 '/' Capacity=110.41 cfs Outflow=2.21 cfs 0.194 af

Reach R604: Stream Avg. Depth=1.26' Max Vel=11.60 fps Inflow=74.05 cfs 6.814 af
n=0.040 L=1,316.0' S=0.1364 '/' Capacity=105.20 cfs Outflow=72.46 cfs 6.814 af

Reach R605: Stream Avg. Depth=0.43' Max Vel=6.87 fps Inflow=10.21 cfs 1.138 af
n=0.040 L=1,287.0' S=0.1507 '/' Capacity=110.59 cfs Outflow=10.05 cfs 1.138 af

Pond D100: Culvert 100 Peak Elev=659.32' Inflow=0.34 cfs 0.027 af
12.0" Round Culvert n=0.013 L=121.5' S=0.0058 '/' Outflow=0.34 cfs 0.027 af

Pond D101: Culvert 101 Peak Elev=676.83' Inflow=10.54 cfs 1.149 af
18.0" Round Culvert n=0.013 L=50.0' S=0.0100 '/' Outflow=10.54 cfs 1.149 af

Pond D105: Culvert 105 Peak Elev=843.45' Inflow=9.30 cfs 0.792 af
18.0" Round Culvert n=0.013 L=40.0' S=0.0125 '/' Outflow=9.30 cfs 0.792 af

Pond D106: Culvert 106 Peak Elev=901.60' Inflow=4.05 cfs 0.323 af
15.0" Round Culvert n=0.013 L=40.0' S=0.0125 '/' Outflow=4.05 cfs 0.323 af

Pond D107: Culvert 107 Peak Elev=929.84' Inflow=6.40 cfs 0.591 af
18.0" Round Culvert n=0.013 L=40.0' S=0.0125 '/' Outflow=6.40 cfs 0.591 af

Pond D108: Culvert 108 Peak Elev=946.70' Inflow=5.66 cfs 0.613 af
18.0" Round Culvert n=0.013 L=30.0' S=0.0167 '/' Outflow=5.66 cfs 0.613 af

Pond D110: Culvert 110 Peak Elev=1,027.91' Inflow=6.85 cfs 0.725 af
18.0" Round Culvert n=0.013 L=40.0' S=0.0125 '/' Outflow=6.85 cfs 0.725 af

Pond D113: Culvert 113 Peak Elev=1,113.44' Inflow=0.76 cfs 0.066 af
12.0" Round Culvert n=0.013 L=35.0' S=0.0143 '/' Outflow=0.76 cfs 0.066 af

Pond D114a: Culvert 104a Peak Elev=1,152.70' Inflow=2.04 cfs 0.156 af
15.0" Round Culvert n=0.013 L=45.0' S=0.0222 '/' Outflow=2.04 cfs 0.156 af

Pond D117: Culvert 117 Peak Elev=1,160.32' Inflow=6.42 cfs 0.647 af
18.0" Round Culvert n=0.013 L=50.0' S=0.0200 '/' Outflow=6.42 cfs 0.647 af

Pond D118: Culvert 118 Peak Elev=1,171.18' Inflow=1.56 cfs 0.112 af
12.0" Round Culvert n=0.013 L=45.0' S=0.0111 '/' Outflow=1.56 cfs 0.112 af

Pond D119: Culvert 119 Peak Elev=1,175.65' Inflow=1.50 cfs 0.112 af
12.0" Round Culvert n=0.013 L=42.0' S=0.0238 '/' Outflow=1.50 cfs 0.112 af

Pond S102: Culvert 102 Peak Elev=715.58' Inflow=29.24 cfs 3.346 af
42.0" x 29.0", R=21.5"/66.0" Arch Culvert n=0.025 L=35.0' S=0.1000 '/' Outflow=29.24 cfs 3.346 af

Pond S103: Culvert 103 Peak Elev=730.51' Inflow=15.13 cfs 1.550 af
35.0" x 24.0", R=17.9"/55.1" Arch Culvert n=0.025 L=35.0' S=0.0857 '/' Outflow=15.13 cfs 1.550 af

Pond S104: Culvert 104 Peak Elev=787.42' Inflow=13.85 cfs 1.517 af
35.0" x 24.0", R=17.9"/55.1" Arch Culvert n=0.025 L=55.0' S=0.0182 '/' Outflow=13.85 cfs 1.517 af

Pond S109: Culvert 109 Peak Elev=988.10' Inflow=33.13 cfs 2.955 af
42.0" x 29.0", R=21.5"/66.0" Arch Culvert n=0.025 L=40.0' S=0.0125 '/' Outflow=33.13 cfs 2.955 af

Pond S111: Culvert 111 Peak Elev=1,054.78' Inflow=3.57 cfs 0.390 af
28.0" x 20.0", R=14.4"/42.3" Arch Culvert n=0.025 L=45.0' S=0.0111 '/' Outflow=3.57 cfs 0.390 af

Pond S112: Culvert 112 Peak Elev=1,055.87' Inflow=44.65 cfs 5.298 af
108.0" x 24.0" Box Culvert n=0.025 L=35.0' S=0.0143 '/' Outflow=44.65 cfs 5.298 af

Pond S114: Culvert 114 Peak Elev=1,115.87' Inflow=48.60 cfs 6.379 af
108.0" x 24.0" Box Culvert n=0.025 L=30.0' S=0.0100 '/' Outflow=48.60 cfs 6.379 af

Pond S115: Culvert 115 Peak Elev=1,163.89' Inflow=20.78 cfs 2.476 af
35.0" x 24.0", R=17.9"/55.1" Arch Culvert n=0.025 L=35.0' S=0.0286 '/' Outflow=20.78 cfs 2.476 af

Pond S116: Culvert 116 Peak Elev=1,160.60' Inflow=122.48 cfs 12.336 af
77.0" x 52.0", R=39.4"/121.3" Arch Culvert n=0.025 L=50.0' S=0.0100 '/' Outflow=122.48 cfs 12.336 af

Pond S602: Culvert 602 Peak Elev=1,341.47' Inflow=7.73 cfs 0.811 af
21.0" x 15.0", R=10.8"/33.1" Arch Culvert n=0.025 L=49.0' S=0.2041 '/' Outflow=7.73 cfs 0.811 af

Pond S603: Culvert 603 Peak Elev=1,343.74' Inflow=2.46 cfs 0.194 af
17.0" x 13.0", R=9.0"/25.6" Arch Culvert n=0.013 L=42.0' S=0.0714 '/' Outflow=2.46 cfs 0.194 af

Pond S604: Culvert 604 Peak Elev=1,344.30' Inflow=74.05 cfs 6.814 af
49.0" x 33.0", R=25.1"/77.3" Arch Culvert n=0.013 L=32.0' S=0.0625 '/' Outflow=74.05 cfs 6.814 af

Pond S605: Culvert 605 Peak Elev=1,367.17' Inflow=10.21 cfs 1.138 af
35.0" x 24.0", R=17.9"/55.1" Arch Culvert n=0.013 L=60.0' S=0.2333 '/' Outflow=10.21 cfs 1.138 af

Total Runoff Area = 372.870 ac Runoff Volume = 41.585 af Average Runoff Depth = 1.34"
100.00% Pervious = 372.870 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 100: To Culvert 100

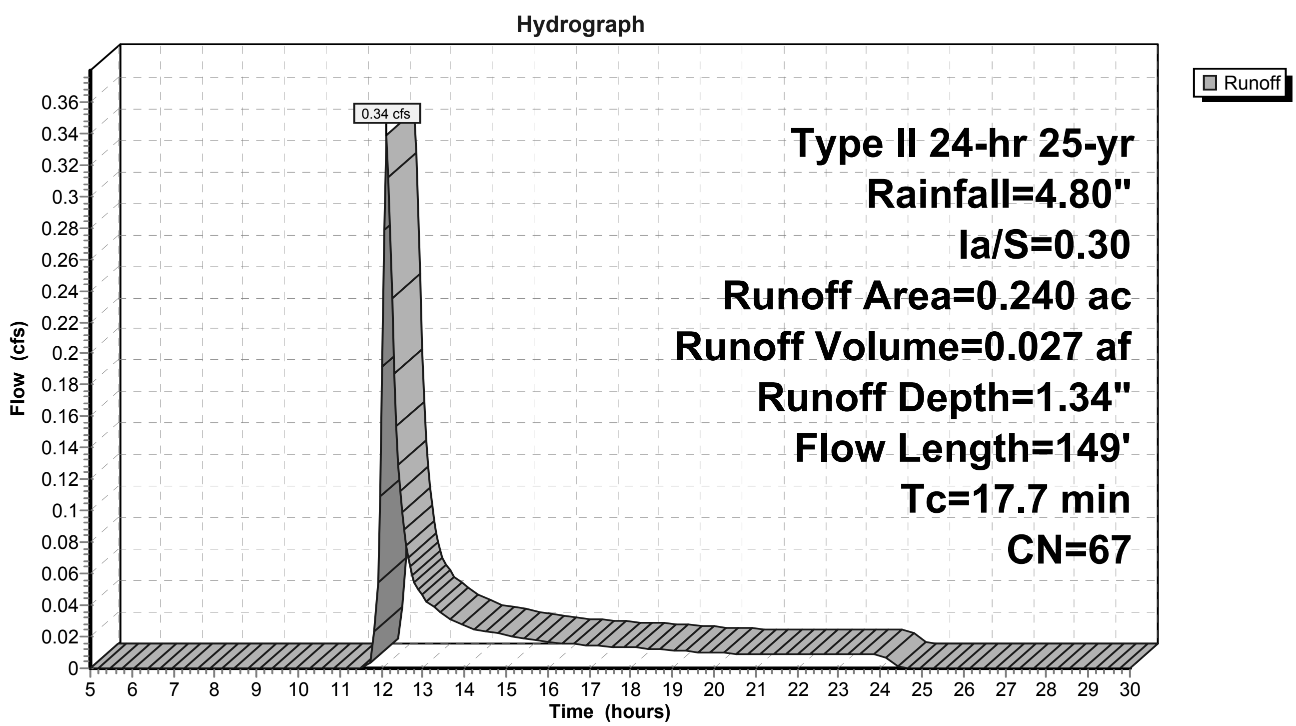
Runoff = 0.34 cfs @ 12.12 hrs, Volume= 0.027 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	0.240	67	Based on CN for P101
	0.240		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	64	0.3670	0.12		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
8.4	36	0.1390	0.07		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
0.1	22	0.5000	3.54		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.1	27	0.1110	4.13	6.19	**Trap/Vee/Rect Channel Flow, Drainage Way** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.060
17.7	149	Total			

Subcatchment 100: To Culvert 100



Summary for Subcatchment 100a: To Drainage Swale 100a

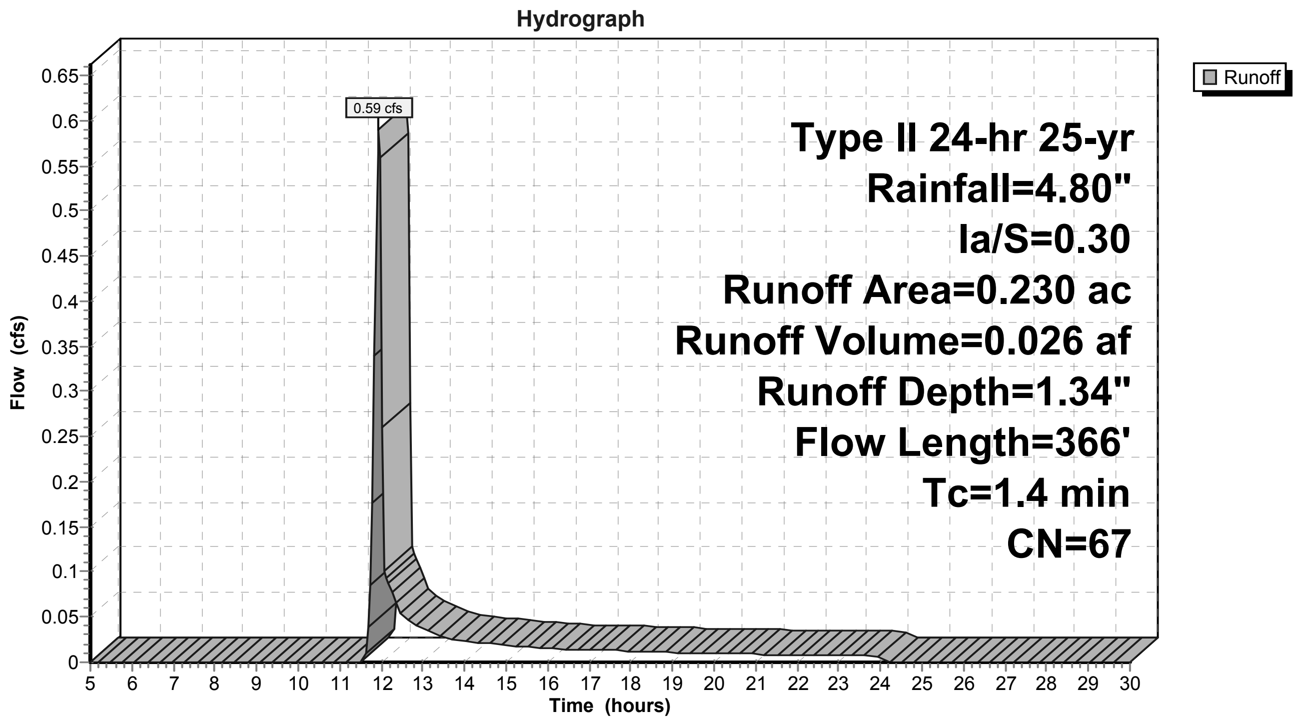
Runoff = 0.59 cfs @ 11.92 hrs, Volume= 0.026 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	0.230	67	Based on CN for P101
	0.230		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	100	0.0700	2.05		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.60"
0.1	27	0.1110	5.36		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.5	239	0.0880	7.38	22.15	**Trap/Vee/Rect Channel Flow,** Bot.W=1.00' D=1.00' Z= 2.0 '/' Top.W=5.00' n= 0.040
1.4	366	Total			

Subcatchment 100a: To Drainage Swale 100a



Summary for Subcatchment 101: To Culvert 101

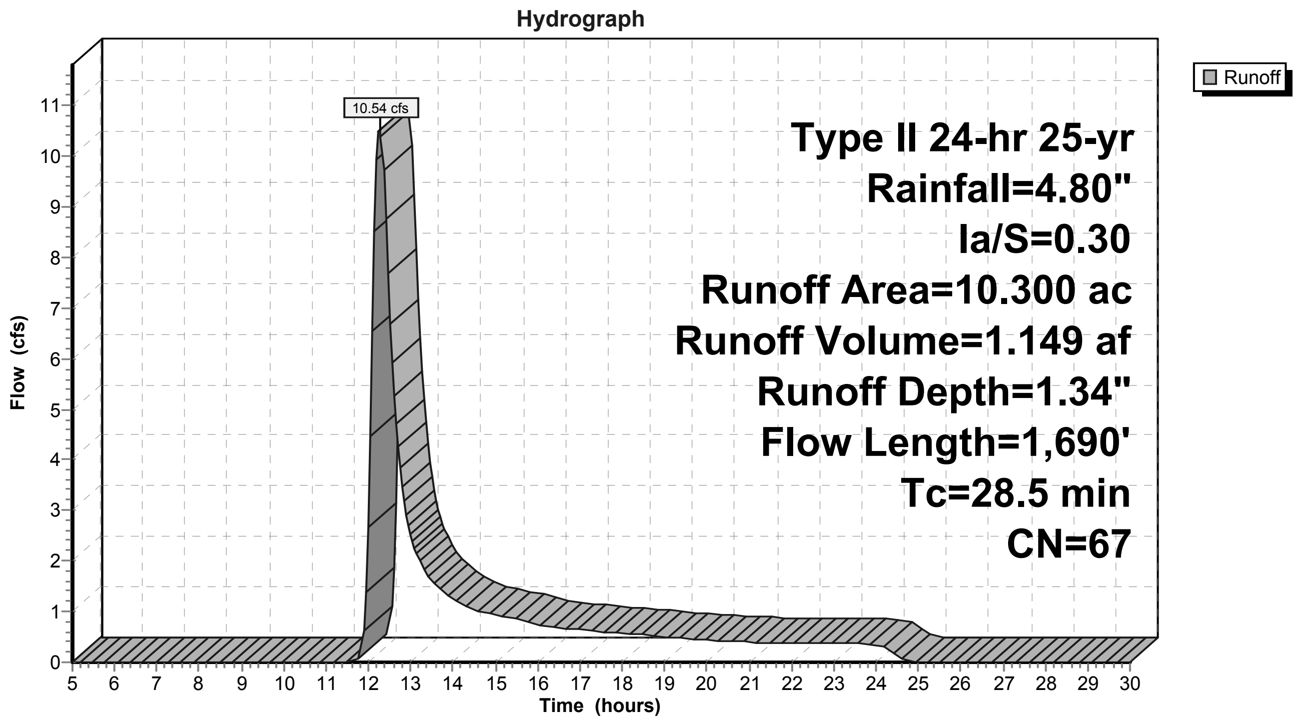
Runoff = 10.54 cfs @ 12.27 hrs, Volume= 1.149 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	10.300	67	Based on CN for P101
	10.300		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.5	100	0.1500	0.09		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
9.3	1,400	0.2500	2.50		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.7	190	0.1200	4.77	14.31	**Trap/Vee/Rect Channel Flow, Drainage Way** Bot.W=5.00' D=0.50' Z= 2.0 '/' Top.W=7.00' n= 0.060
28.5	1,690	Total			

Subcatchment 101: To Culvert 101



Summary for Subcatchment 102: To Culvert 102

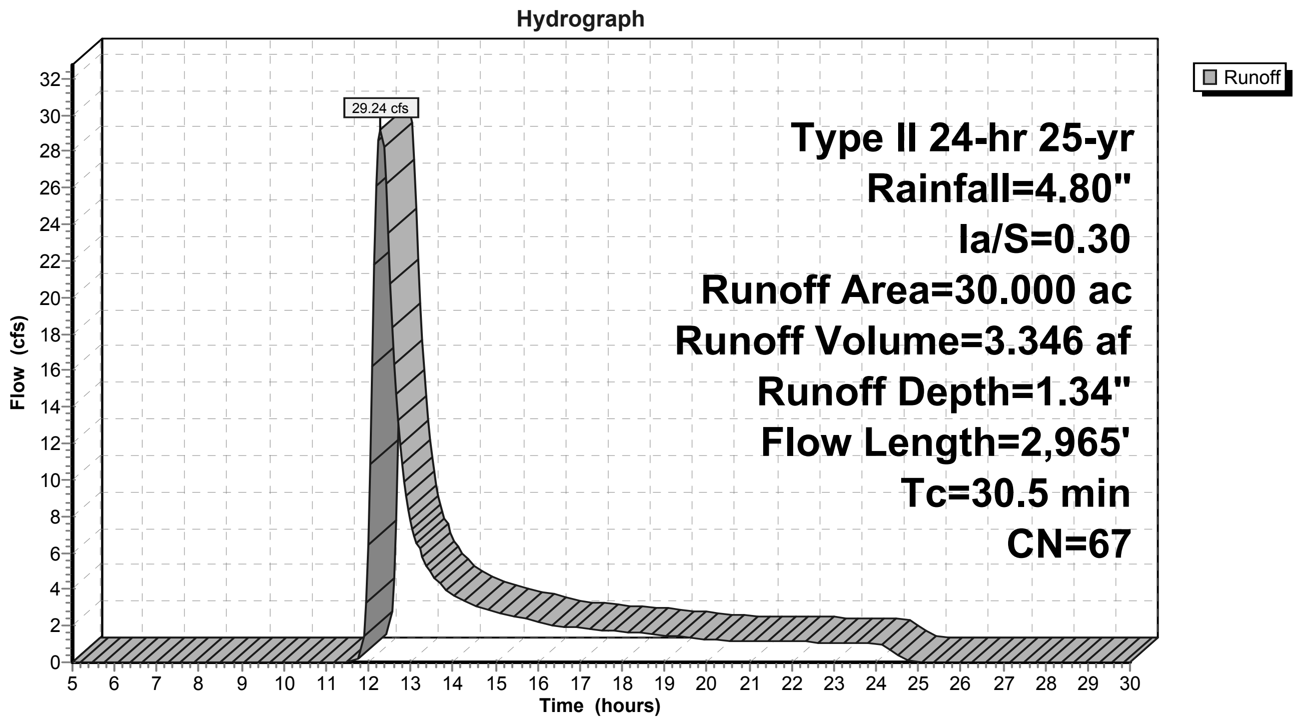
Runoff = 29.24 cfs @ 12.29 hrs, Volume= 3.346 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	30.000	67	Based on CN for P101
	30.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.1	100	0.2500	0.11		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
11.3	1,695	0.2500	2.50		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
4.1	1,170	0.1200	4.77	14.31	**Trap/Vee/Rect Channel Flow, Drainage Way** Bot.W=5.00' D=0.50' Z= 2.0 '/' Top.W=7.00' n= 0.060
30.5	2,965	Total			

Subcatchment 102: To Culvert 102



Summary for Subcatchment 103: To Culvert 103

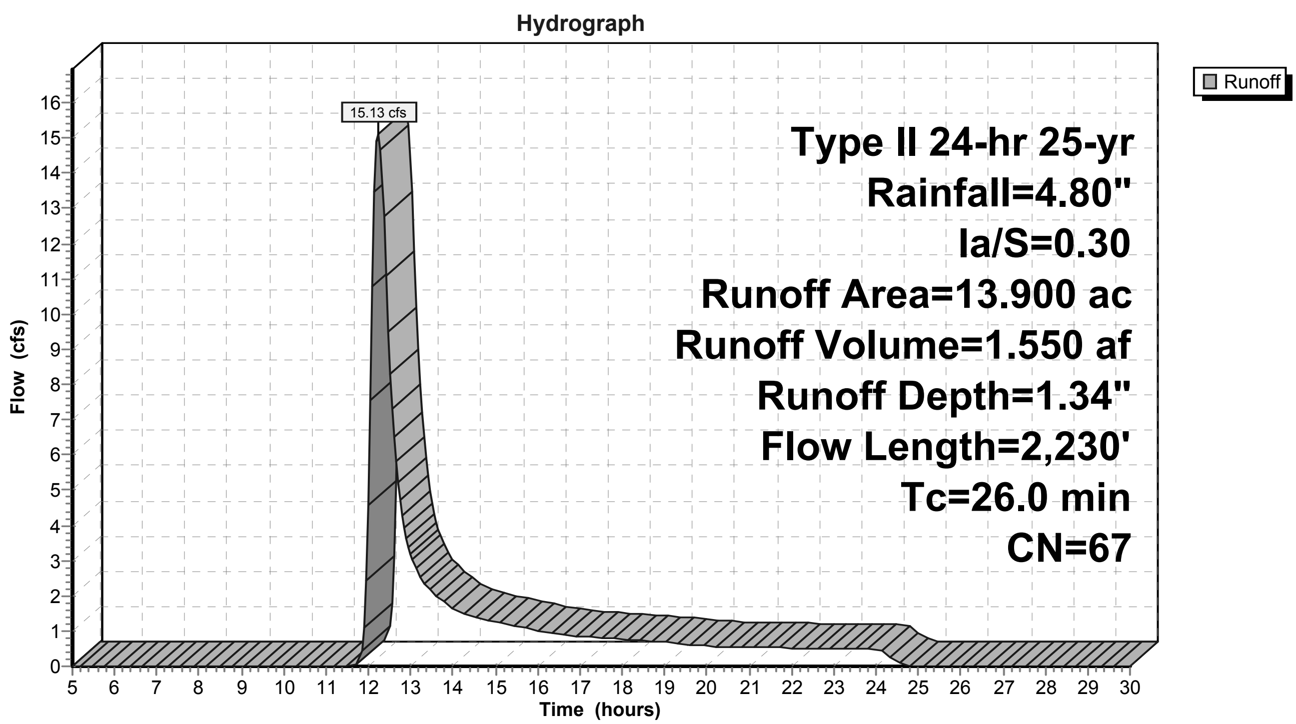
Runoff = 15.13 cfs @ 12.23 hrs, Volume= 1.550 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	13.900	67	Based on CN for P101
	13.900		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.1	100	0.2500	0.11		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
8.5	1,500	0.3500	2.96		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
2.4	630	0.1200	4.29	6.44	**Trap/Vee/Rect Channel Flow, Drainage Way** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.060
26.0	2,230	Total			

Subcatchment 103: To Culvert 103



Summary for Subcatchment 104: To Culvert 104

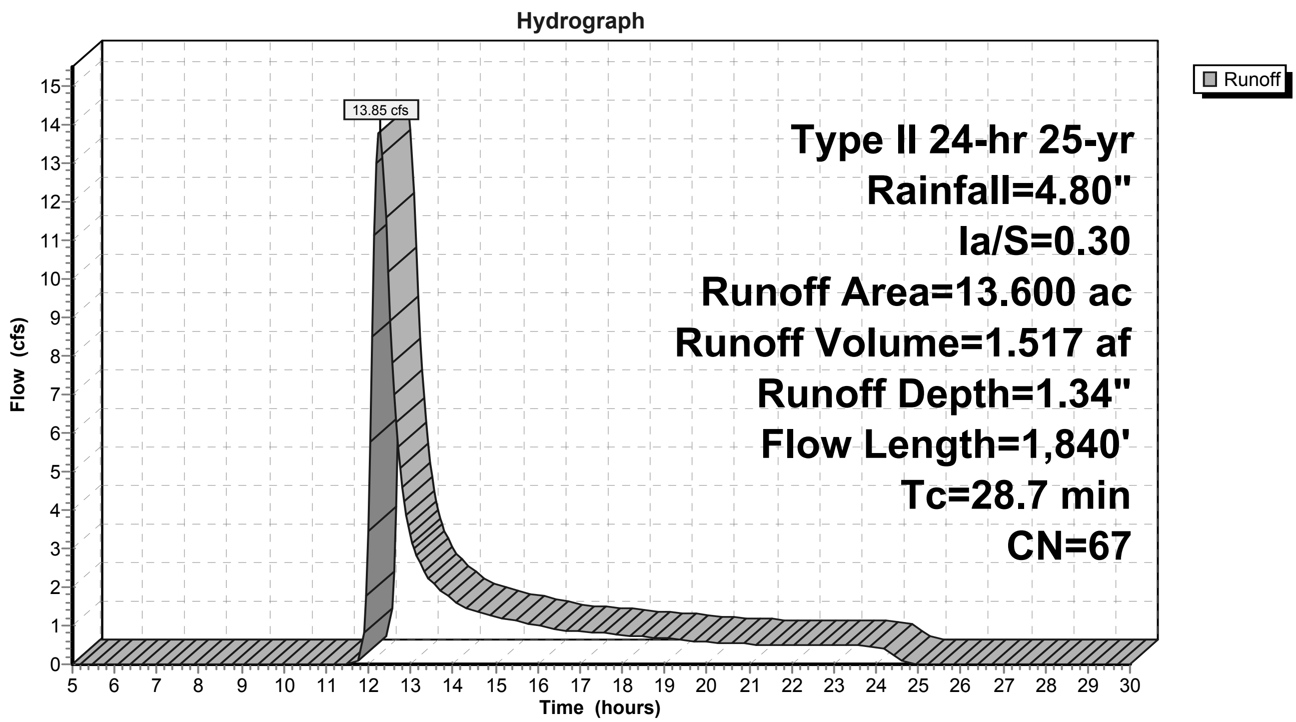
Runoff = 13.85 cfs @ 12.27 hrs, Volume= 1.517 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	13.600	67	Based on CN for P101
	13.600		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.5	100	0.1500	0.09		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
8.7	1,380	0.2800	2.65		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.5	360	0.1000	3.92	5.88	**Trap/Vee/Rect Channel Flow, Drainage Way** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.060
28.7	1,840	Total			

Subcatchment 104: To Culvert 104



Summary for Subcatchment 105: To Culvert 105

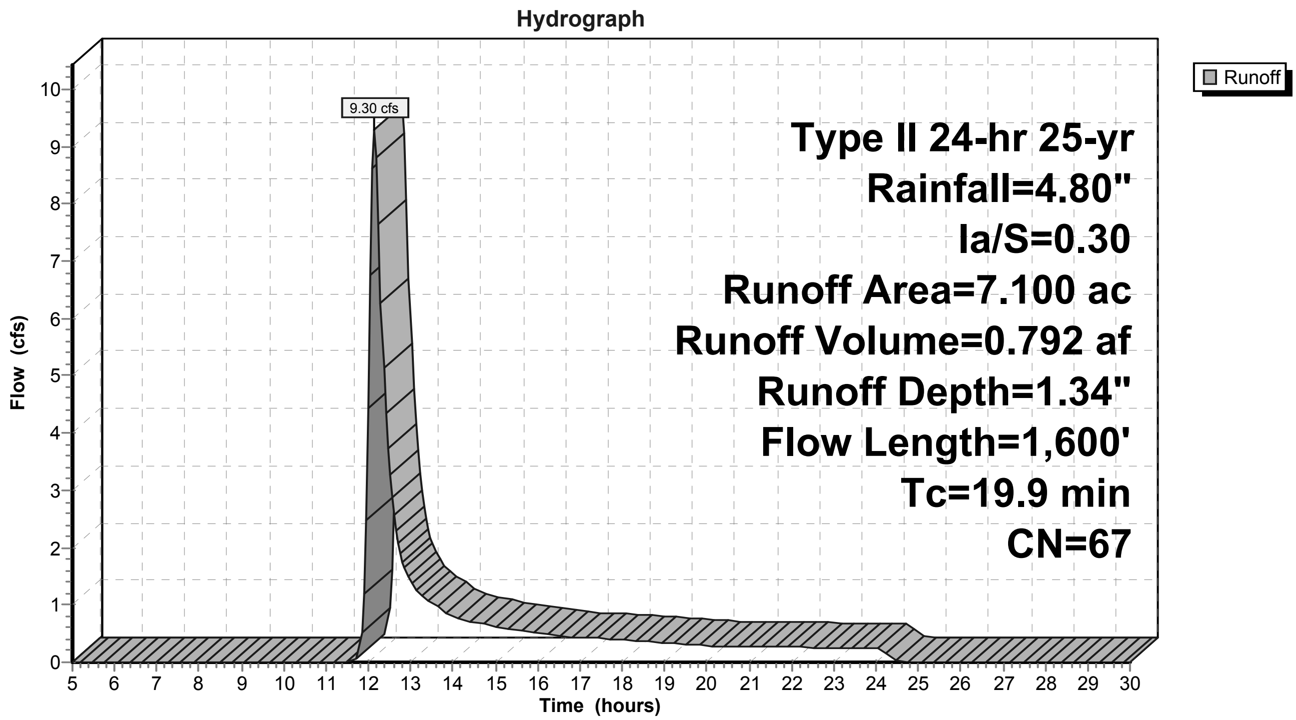
Runoff = 9.30 cfs @ 12.15 hrs, Volume= 0.792 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	7.100	67	Based on CN for P101
	7.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.4	100	0.5000	0.15		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
7.0	1,000	0.2300	2.40		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.5	500	0.1000	5.70	21.38	**Trap/Vee/Rect Channel Flow, Drainage Way** Bot.W=2.00' D=1.00' Z= 1.5 & 2.0 '/' Top.W=5.50' n= 0.060
19.9	1,600	Total			

Subcatchment 105: To Culvert 105



Summary for Subcatchment 106: To Culvert 106

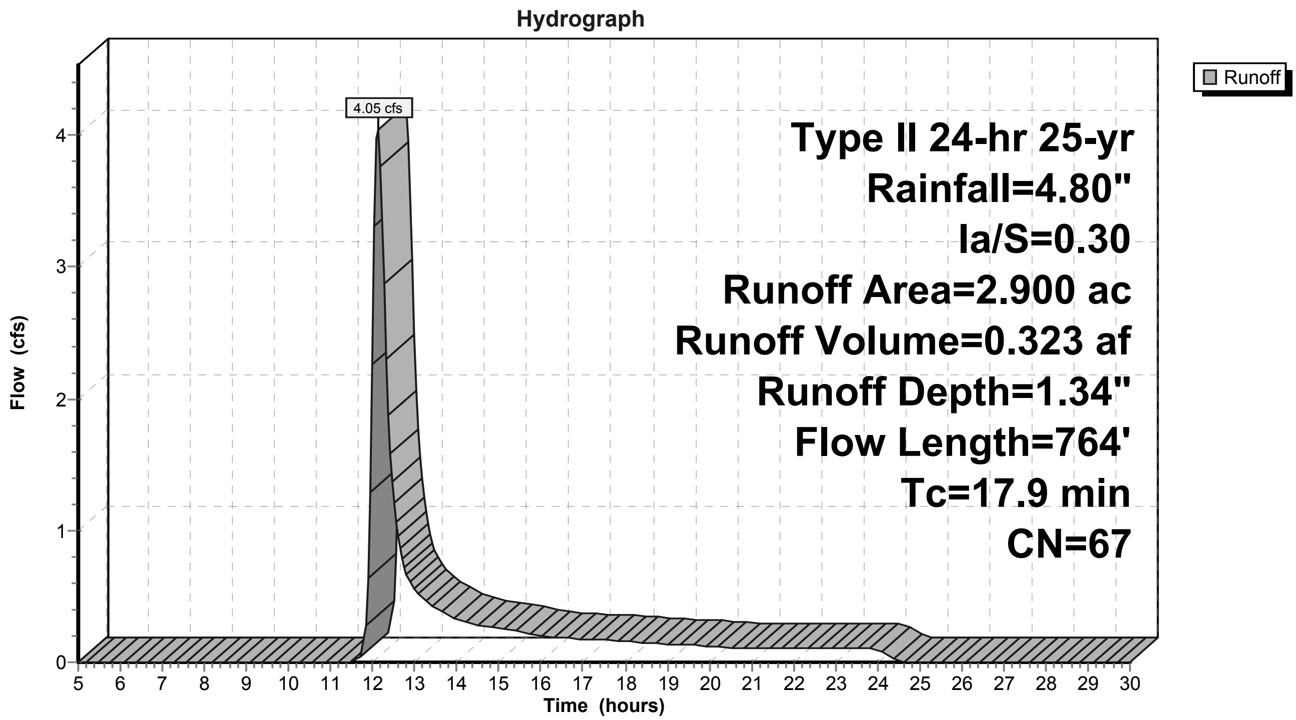
Runoff = 4.05 cfs @ 12.13 hrs, Volume= 0.323 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	2.900	67	Based on CN for P101
	2.900		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.6	100	0.2700	0.11		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
2.8	490	0.3500	2.96		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.5	174	0.1000	5.70	21.38	**Trap/Vee/Rect Channel Flow, Drainage Way** Bot.W=2.00' D=1.00' Z= 1.5 & 2.0 '/' Top.W=5.50' n= 0.060
17.9	764	Total			

Subcatchment 106: To Culvert 106



Summary for Subcatchment 107: To Culvert 107

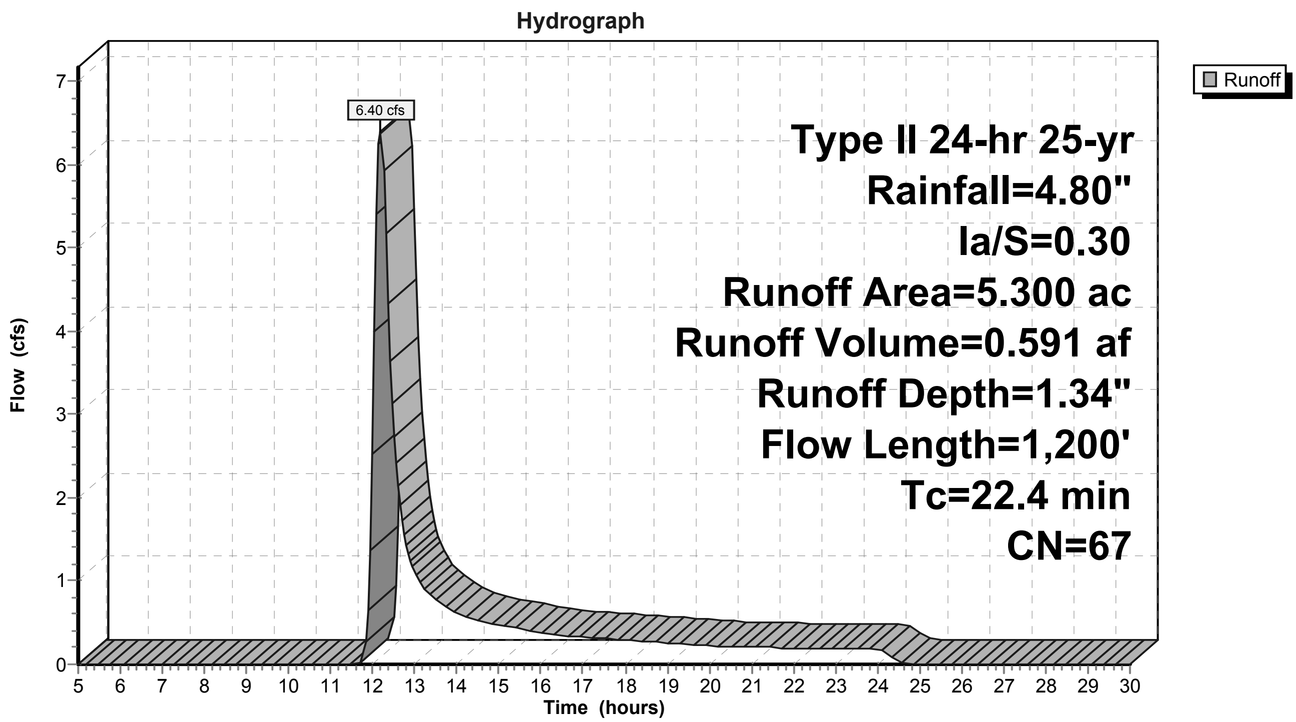
Runoff = 6.40 cfs @ 12.19 hrs, Volume= 0.591 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	5.300	67	Based on CN for P101
	5.300		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	100	0.3700	0.13		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
9.5	1,100	0.1500	1.94		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
22.4	1,200	Total			

Subcatchment 107: To Culvert 107



Summary for Subcatchment 108: To Culvert 108

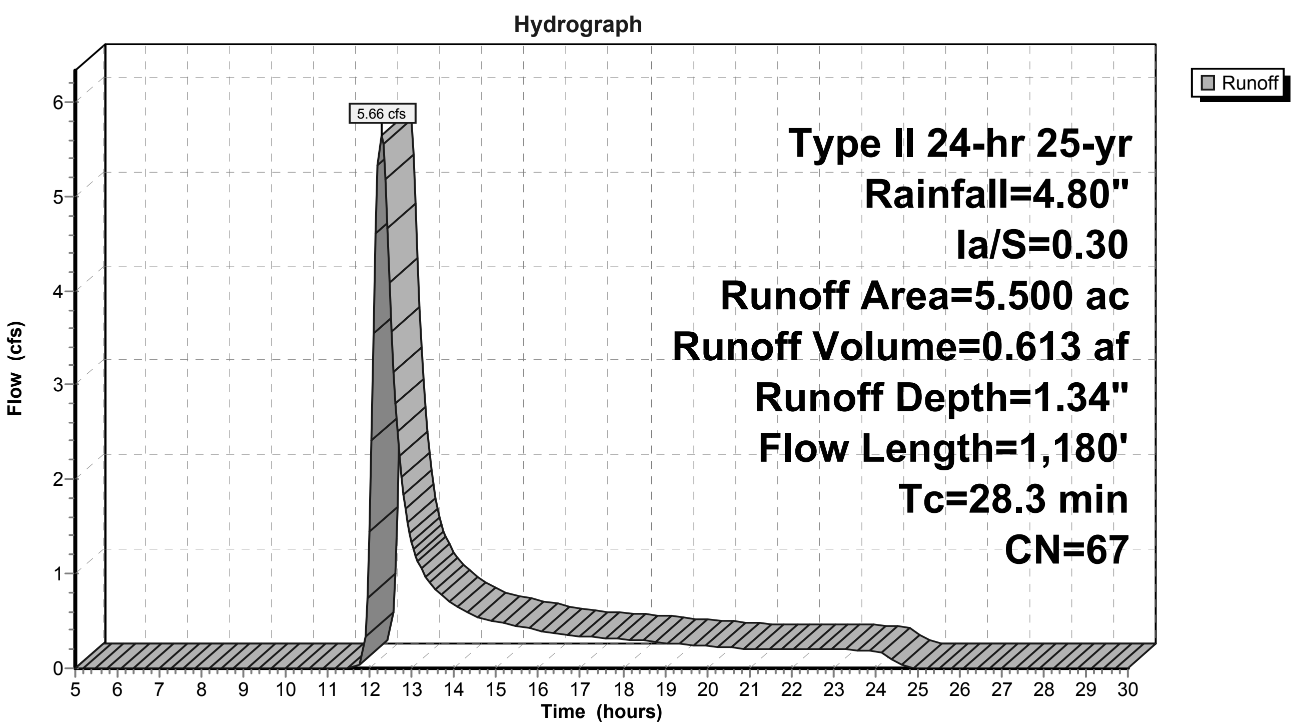
Runoff = 5.66 cfs @ 12.26 hrs, Volume= 0.613 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	5.500	67	Based on CN for P101
	5.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.0	100	0.1100	0.08		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
4.6	455	0.1100	1.66		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.6	300	0.4000	3.16		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.1	325	0.0800	5.10	19.12	**Trap/Vee/Rect Channel Flow, Ditch** Bot.W=2.00' D=1.00' Z= 1.5 & 2.0 '/' Top.W=5.50' n= 0.060
28.3	1,180	Total			

Subcatchment 108: To Culvert 108



Summary for Subcatchment 109: To Culvert 109

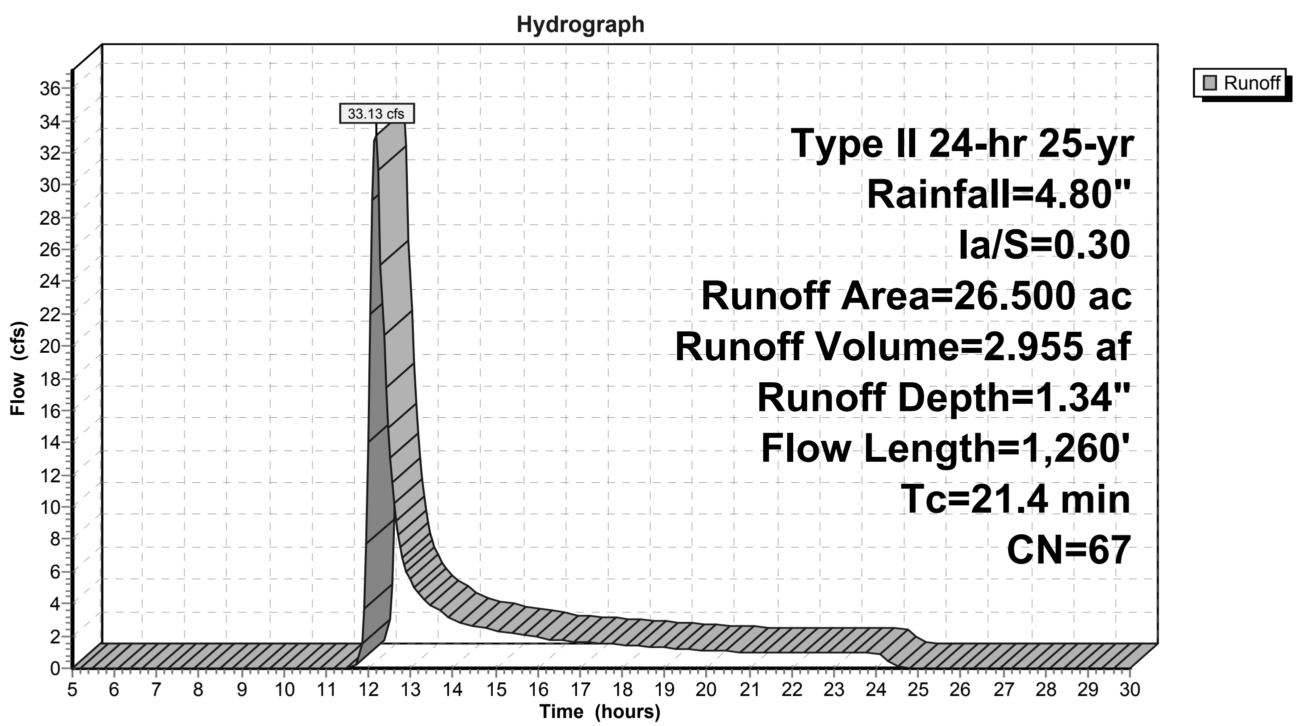
Runoff = 33.13 cfs @ 12.17 hrs, Volume= 2.955 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	26.500	67	Based on CN for P101
	26.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.1	100	0.2500	0.11		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
4.6	710	0.2700	2.60		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.9	75	0.0800	1.41		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.8	375	0.2000	8.04	32.15	**Trap/Vee/Rect Channel Flow, Stream** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.060
21.4	1,260	Total			

Subcatchment 109: To Culvert 109



Summary for Subcatchment 110: To Culvert 110

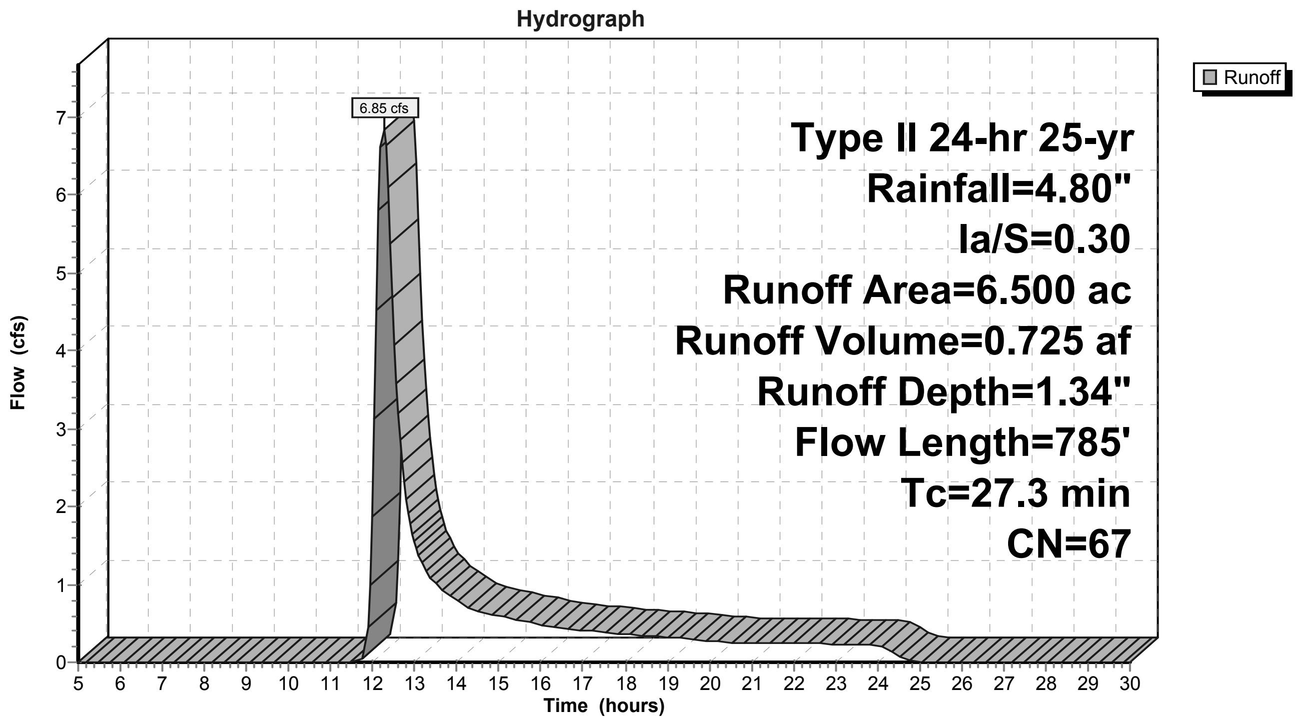
Runoff = 6.85 cfs @ 12.25 hrs, Volume= 0.725 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	6.500	67	Based on CN for P101
	6.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.8	100	0.1000	0.08		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
5.0	545	0.1300	1.80		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.5	140	0.0650	4.60	17.23	**Trap/Vee/Rect Channel Flow, Ditch** Bot.W=2.00' D=1.00' Z= 1.5 & 2.0 '/' Top.W=5.50' n= 0.060
27.3	785	Total			

Subcatchment 110: To Culvert 110



Summary for Subcatchment 111: To Culvert 111

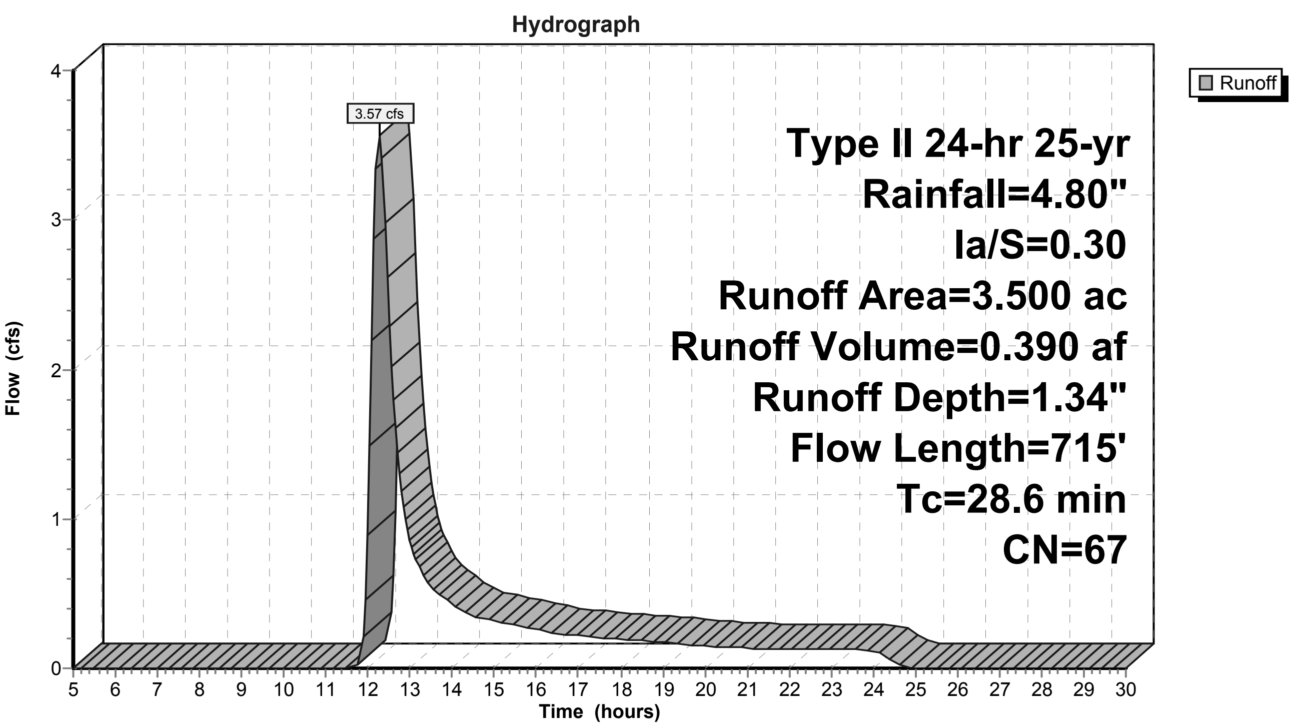
Runoff = 3.57 cfs @ 12.27 hrs, Volume= 0.390 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	3.500	67	Based on CN for P101
	3.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.8	100	0.0800	0.07		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
1.3	190	0.2400	2.45		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
3.0	255	0.0800	1.41		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.5	170	0.0600	5.28	21.13	**Trap/Vee/Rect Channel Flow, Drainage Channel** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.050
28.6	715	Total			

Subcatchment 111: To Culvert 111



Summary for Subcatchment 112: To Culvert 112

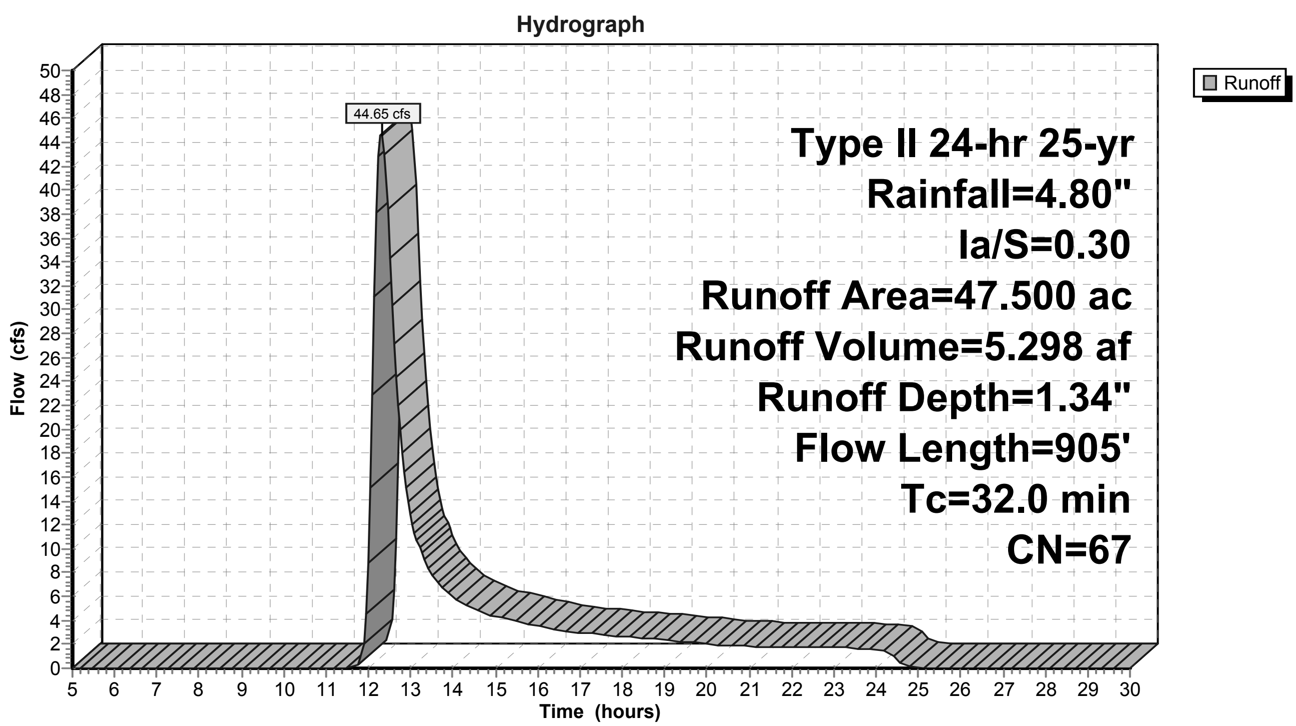
Runoff = 44.65 cfs @ 12.32 hrs, Volume= 5.298 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	47.500	67	Based on CN for P101
	47.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.8	100	0.0800	0.07		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
1.3	190	0.2400	2.45		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
3.0	255	0.0800	1.41		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
3.9	360	0.0050	1.52	6.10	**Trap/Vee/Rect Channel Flow, Stream** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.050
32.0	905	Total			

Subcatchment 112: To Culvert 112



Summary for Subcatchment 113: To Culvert 113

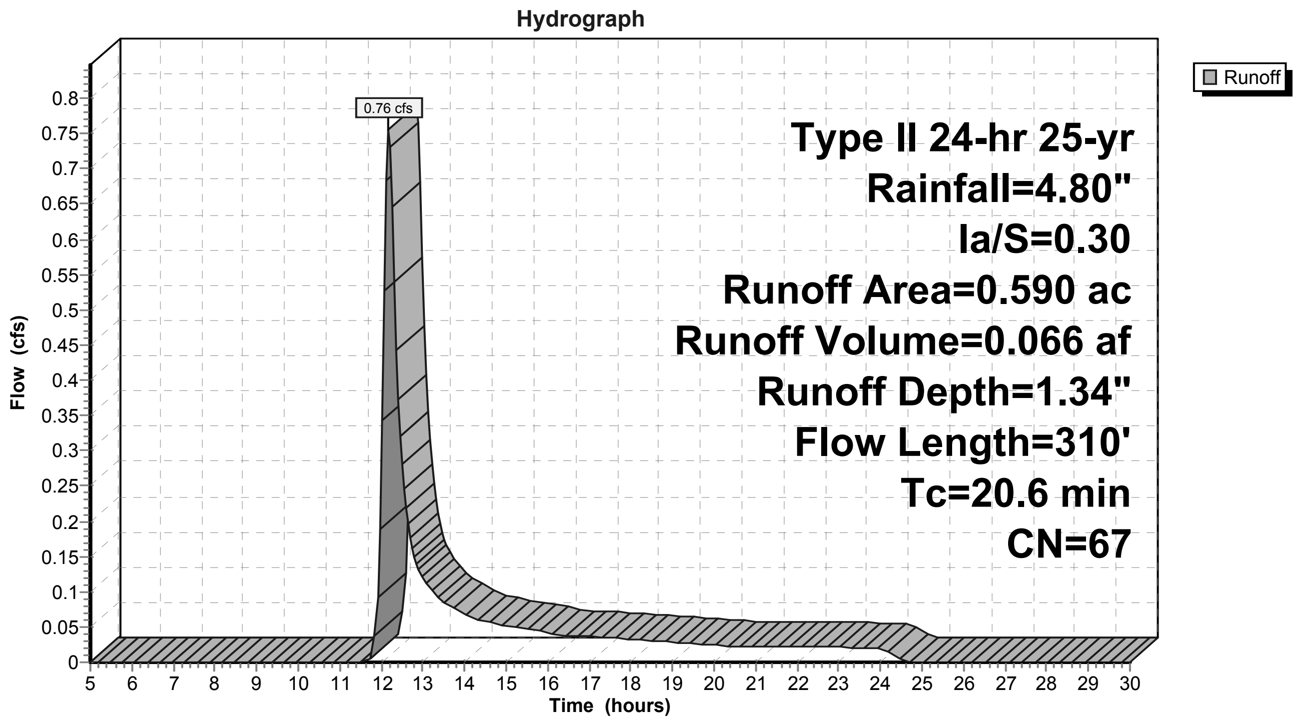
Runoff = 0.76 cfs @ 12.16 hrs, Volume= 0.066 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	0.590	67	Based on CN for P101
	0.590		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.0	100	0.1400	0.09		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
1.1	169	0.2720	2.61		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.5	41	0.0730	1.35		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
20.6	310	Total			

Subcatchment 113: To Culvert 113



Summary for Subcatchment 114: To Culvert 114

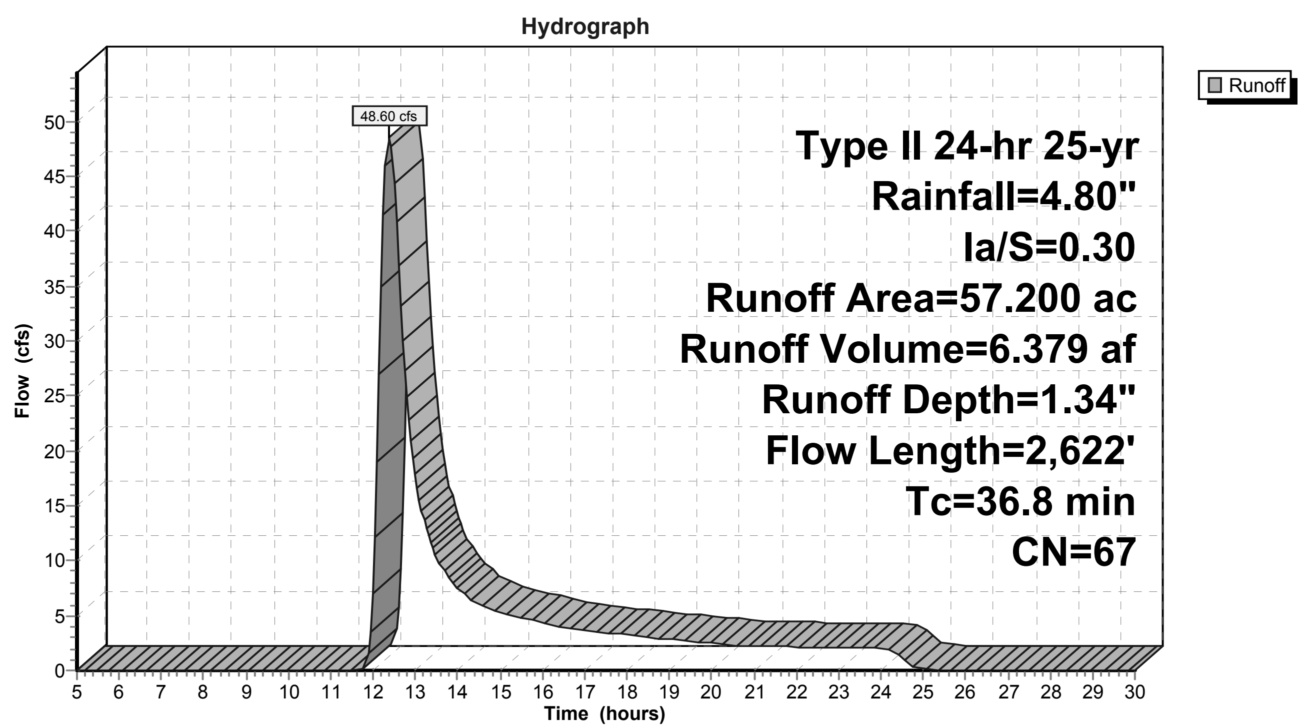
Runoff = 48.60 cfs @ 12.38 hrs, Volume= 6.379 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	57.200	67	Based on CN for P101
	57.200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.0	100	0.0980	0.08		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
7.3	1,190	0.2940	2.71		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
2.0	615	0.1190	5.13	7.70	**Trap/Vee/Rect Channel Flow, Drainage Channel/Stream** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.050
5.0	506	0.1130	1.68		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.5	211	0.0550	6.63	59.64	**Trap/Vee/Rect Channel Flow, Stream** Bot.W=3.00' D=1.50' Z= 2.0 '/' Top.W=9.00' n= 0.050
36.8	2,622	Total			

Subcatchment 114: To Culvert 114



Summary for Subcatchment 114a: To Culvert 114a

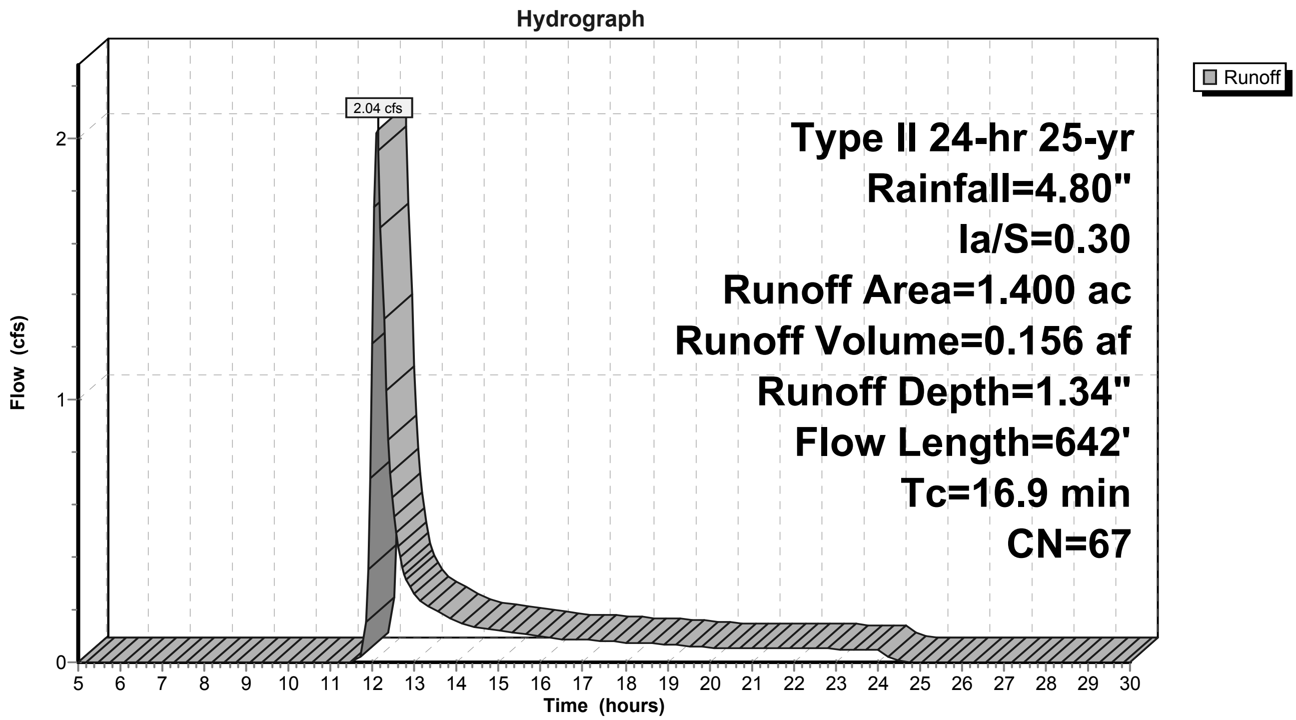
Runoff = 2.04 cfs @ 12.12 hrs, Volume= 0.156 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	1.400	67	Based on CN for P101
	1.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.1	100	0.3600	0.13		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
2.9	464	0.2930	2.71		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.9	78	0.0770	1.39		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
16.9	642	Total			

Subcatchment 114a: To Culvert 114a



Summary for Subcatchment 115: To Culvert 115

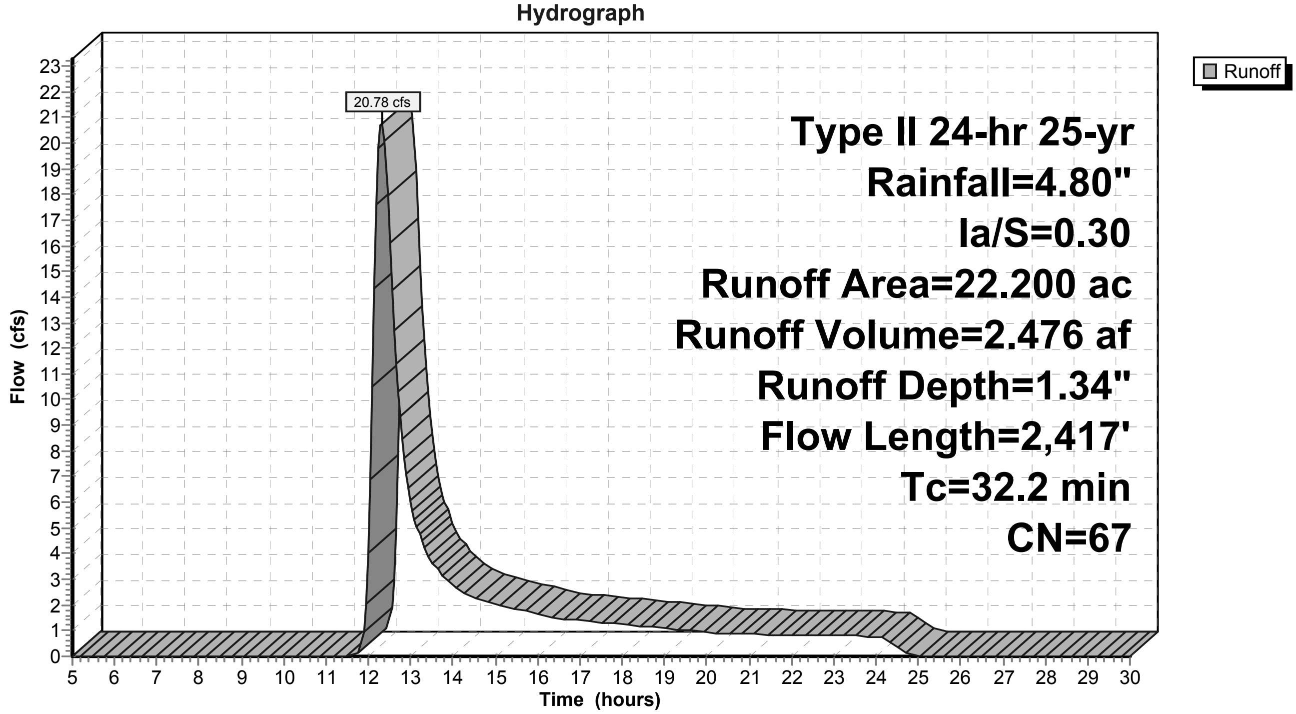
Runoff = 20.78 cfs @ 12.32 hrs, Volume= 2.476 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	22.200	67	Based on CN for P101
	22.200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.2	100	0.1560	0.09		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
1.4	71	0.0280	0.84		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.9	291	0.2500	2.50		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.6	426	0.1900	11.73	87.95	**Trap/Vee/Rect Channel Flow, Stream** Bot.W=2.00' D=1.50' Z= 2.0 '/' Top.W=8.00' n= 0.050
1.0	122	0.1560	1.97		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.9	85	0.0230	0.76		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.8	129	0.2790	2.64		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
2.0	198	0.1110	1.67		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
3.7	547	0.2410	2.45		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.7	448	0.1700	11.09	83.19	**Trap/Vee/Rect Channel Flow, Stream** Bot.W=2.00' D=1.50' Z= 2.0 '/' Top.W=8.00' n= 0.050
32.2	2,417	Total			

Subcatchment 115: To Culvert 115



Summary for Subcatchment 116: To Culvert 116

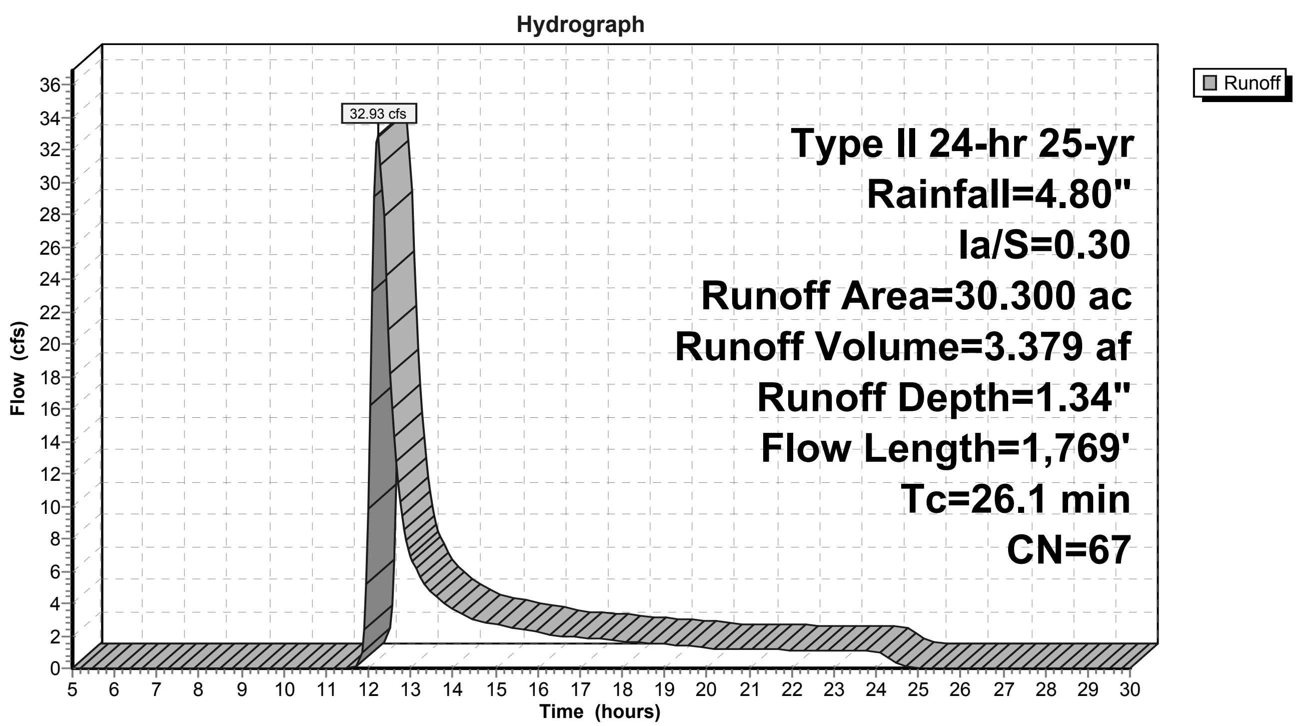
Runoff = 32.93 cfs @ 12.23 hrs, Volume= 3.379 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	30.300	67	Based on CN for P101
	30.300		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	19	0.0630	0.05		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
12.3	81	0.2720	0.11		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
5.4	819	0.2560	2.53		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.5	850	0.1240	9.73	80.24	**Trap/Vee/Rect Channel Flow, Stream** Bot.W=2.50' D=1.50' Z= 2.0 '/' Top.W=8.50' n= 0.050
26.1	1,769	Total			

Subcatchment 116: To Culvert 116



Summary for Subcatchment 117: To Culvert 117

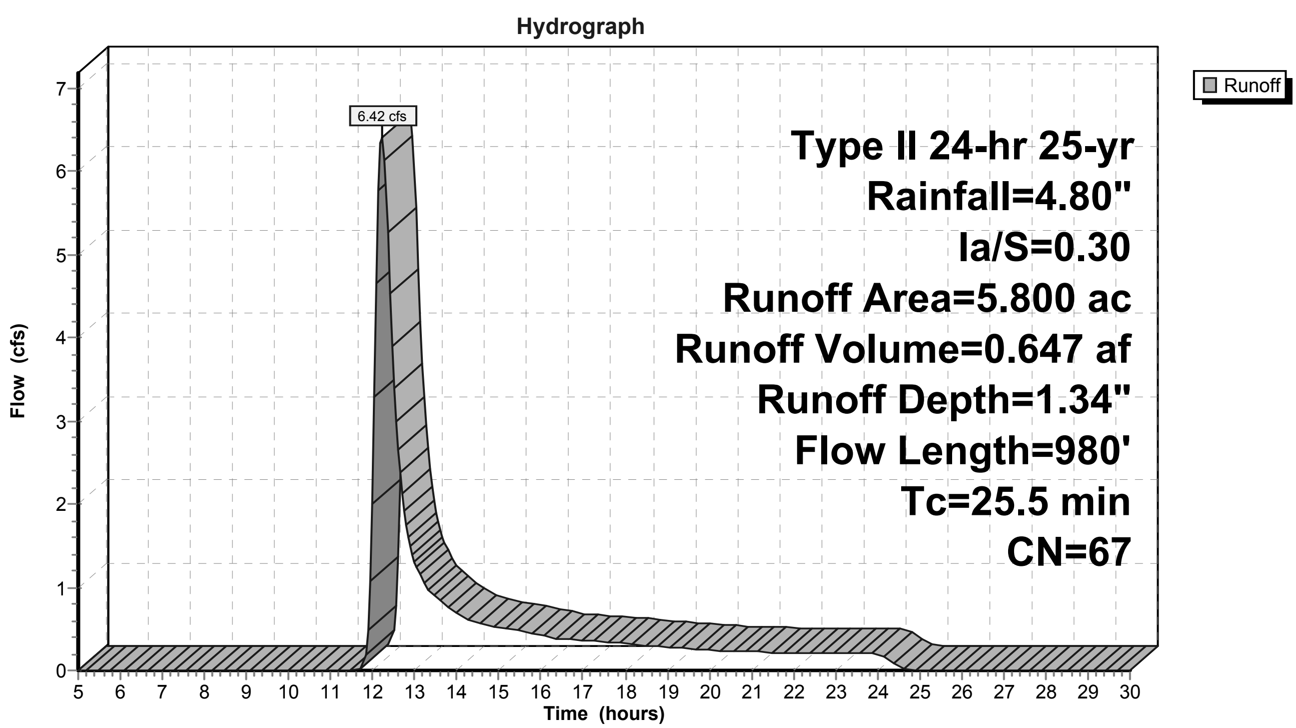
Runoff = 6.42 cfs @ 12.22 hrs, Volume= 0.647 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	5.800	67	Based on CN for P101
	5.800		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.3	100	0.1200	0.08		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
2.5	350	0.2200	2.35		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.2	80	0.1200	7.49	28.10	**Trap/Vee/Rect Channel Flow, Ditch** Bot.W=2.00' D=1.00' Z= 2.0 & 1.5 '/' Top.W=5.50' n= 0.050
0.9	150	0.3300	2.87		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.6	300	0.0200	3.06	11.47	**Trap/Vee/Rect Channel Flow, Ditch** Bot.W=2.00' D=1.00' Z= 1.5 & 2.0 '/' Top.W=5.50' n= 0.050
25.5	980	Total			

Subcatchment 117: To Culvert 117



Summary for Subcatchment 118: To Culvert 118

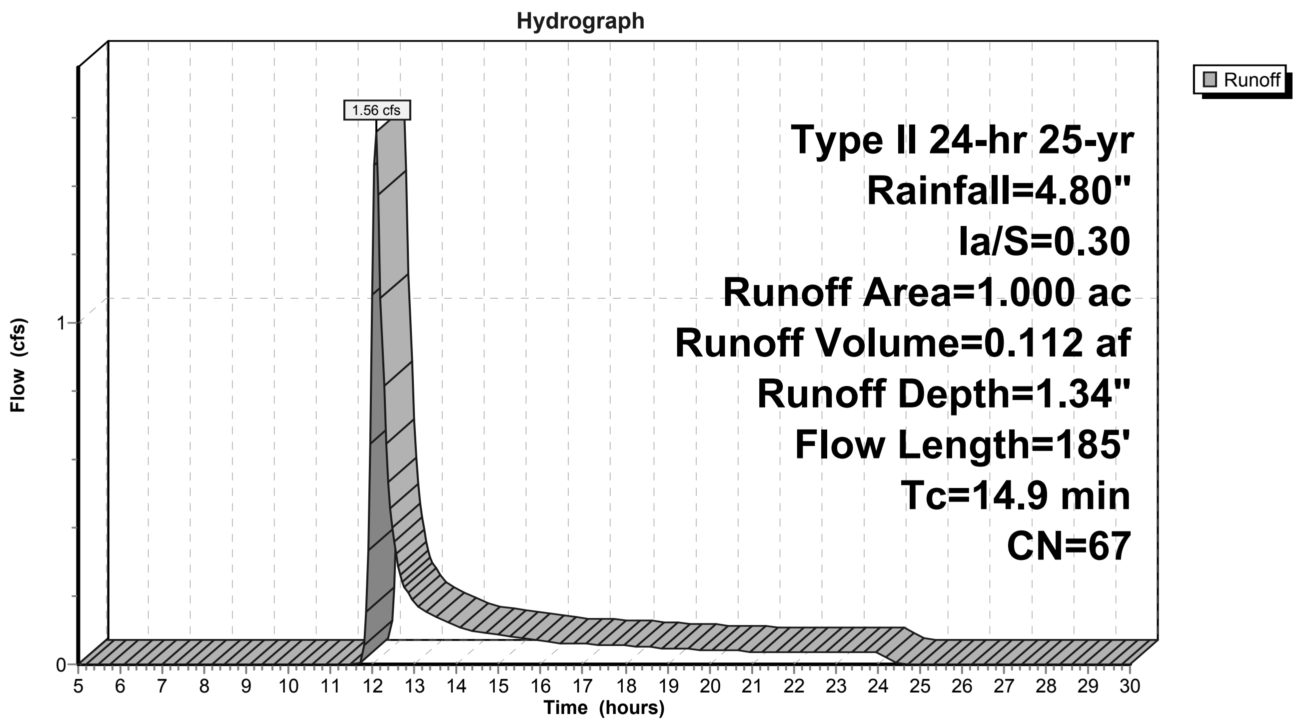
Runoff = 1.56 cfs @ 12.09 hrs, Volume= 0.112 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	1.000	67	Based on CN for P101
	1.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.2	100	0.2900	0.12		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
0.7	85	0.1800	2.12		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
14.9	185	Total			

Subcatchment 118: To Culvert 118



Summary for Subcatchment 119: To Culvert 119

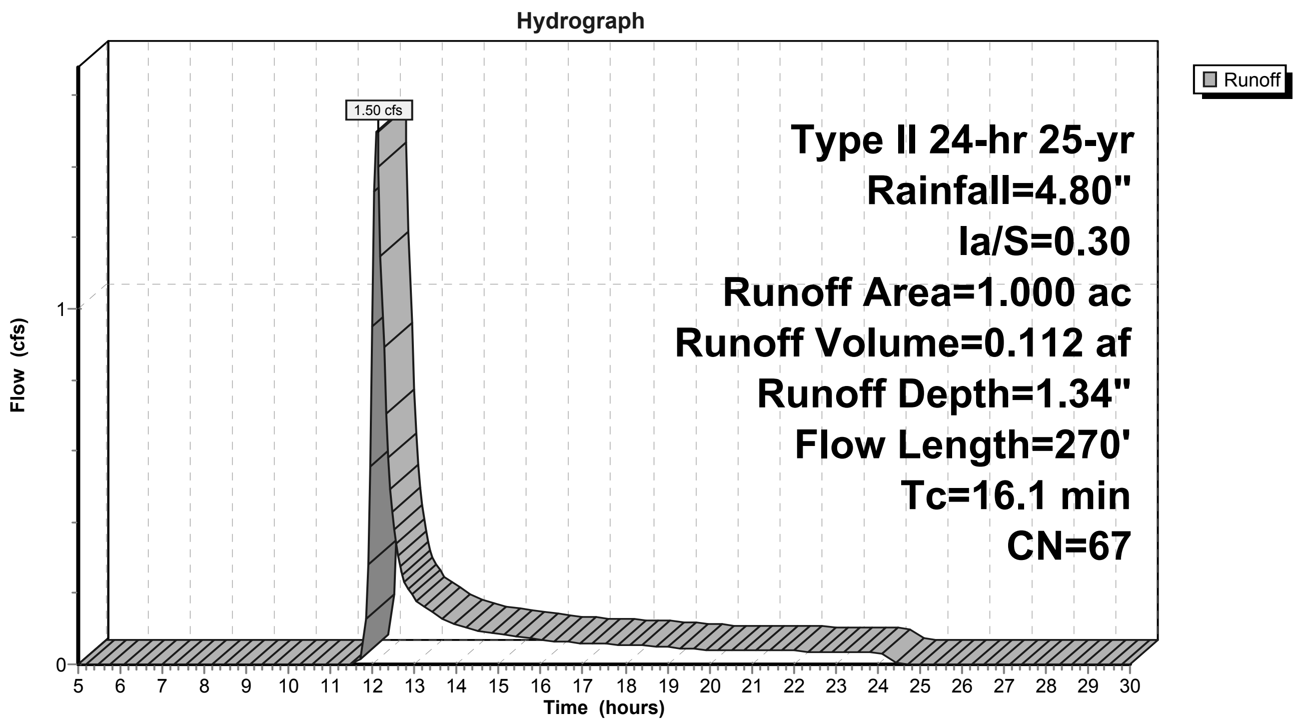
Runoff = 1.50 cfs @ 12.11 hrs, Volume= 0.112 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	1.000	67	Based on CN for P101
	1.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.6	100	0.2700	0.11		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
1.5	170	0.1400	1.87		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
16.1	270	Total			

Subcatchment 119: To Culvert 119



Summary for Subcatchment 602: To Culvert 602

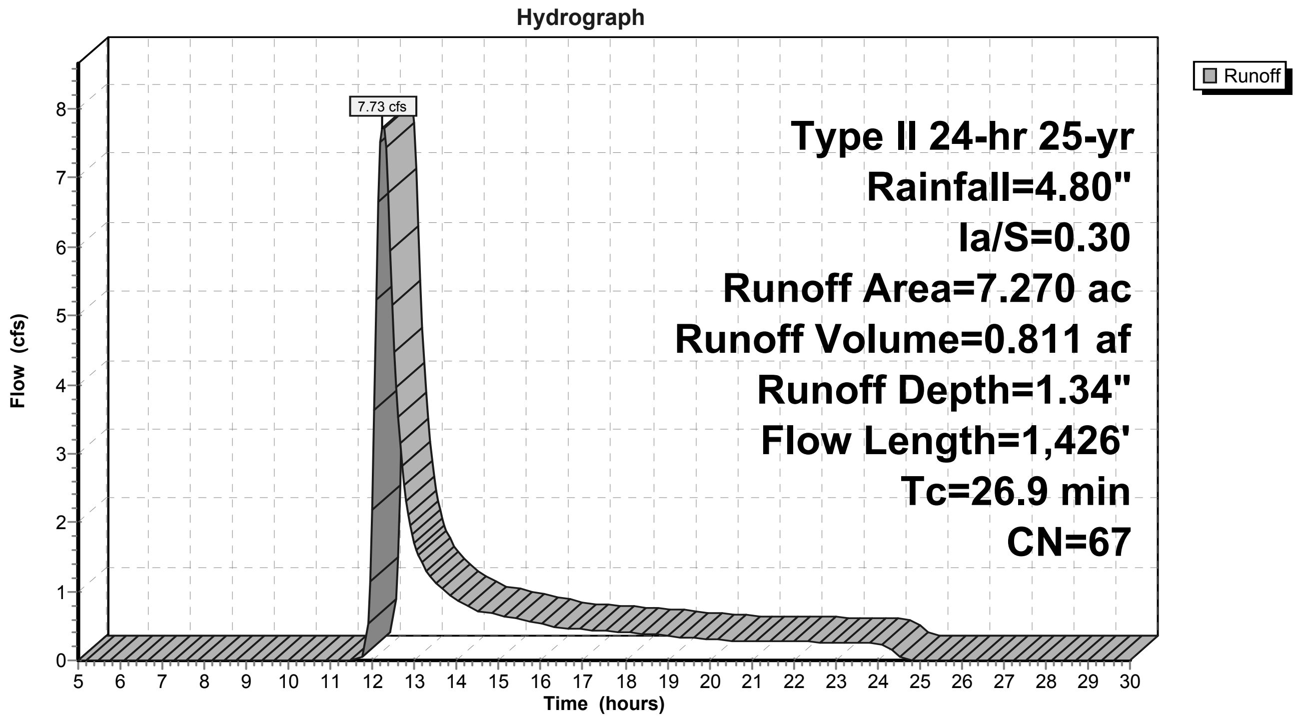
Runoff = 7.73 cfs @ 12.25 hrs, Volume= 0.811 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	7.270	67	Based on CN for P101
	7.270		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.2	100	0.2100	0.10		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
4.5	600	0.2000	2.24		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
3.0	204	0.0500	1.12		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.7	122	0.3400	2.92		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.9	81	0.0900	1.50		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.2	191	0.3000	2.74		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.4	128	0.1700	5.68	17.03	**Trap/Vee/Rect Channel Flow, Drainage Way** Bot.W=5.00' D=0.50' Z= 2.0 '/' Top.W=7.00' n= 0.060
26.9	1,426	Total			

Subcatchment 602: To Culvert 602



Summary for Subcatchment 603: To Culvert 603

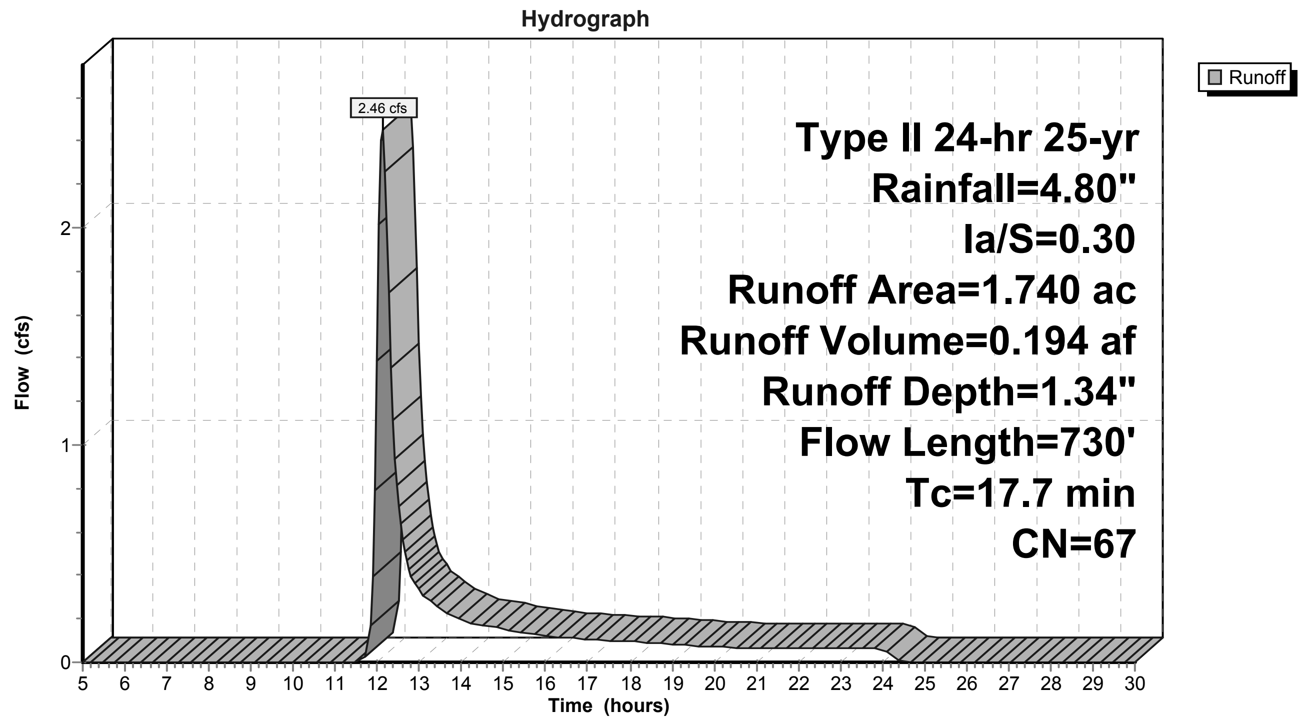
Runoff = 2.46 cfs @ 12.12 hrs, Volume= 0.194 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	1.740	67	Based on CN for P101
	1.740		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.2	100	0.2900	0.12		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
3.1	566	0.3800	3.08		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.4	64	0.0500	2.77	4.16	**Trap/Vee/Rect Channel Flow, Drainage Way** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.060
17.7	730	Total			

Subcatchment 603: To Culvert 603



Summary for Subcatchment 604: To Culvert 604

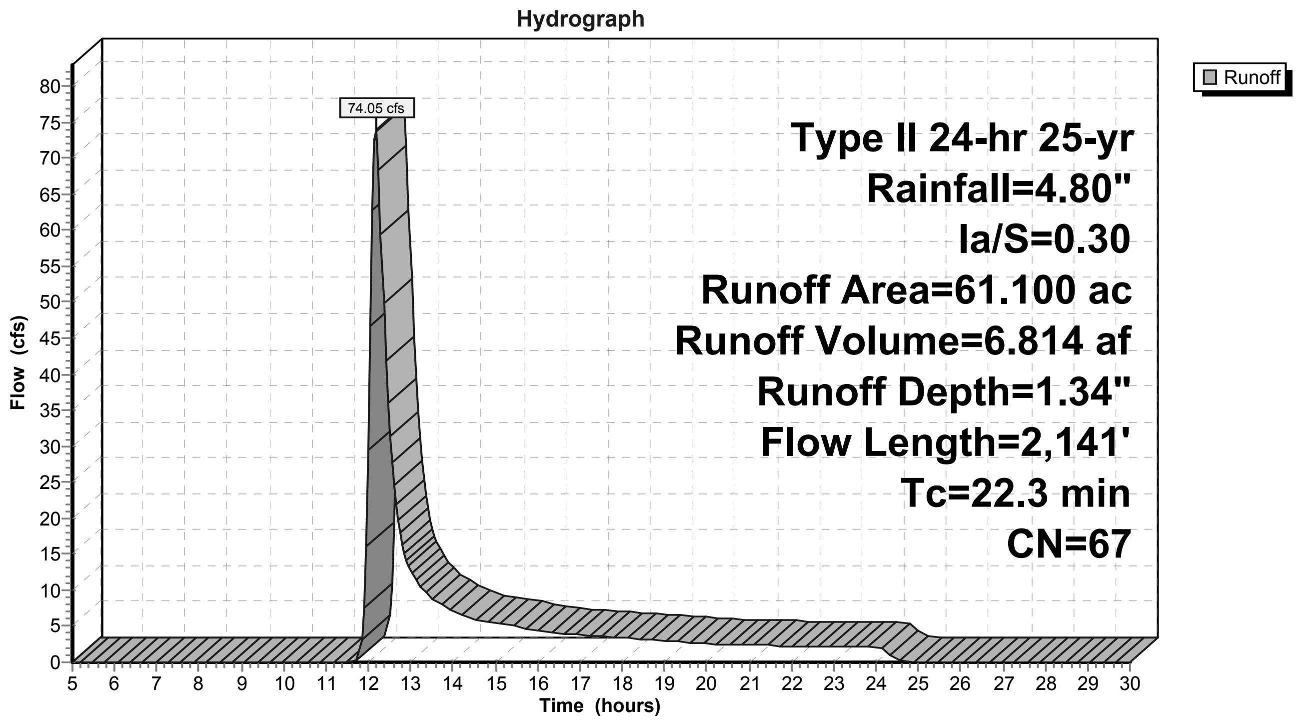
Runoff = 74.05 cfs @ 12.18 hrs, Volume= 6.814 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	61.100	67	Based on CN for P101
	61.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.8	100	0.3800	0.13		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
7.6	1,444	0.4000	3.16		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.9	597	0.1800	5.26	7.89	**Trap/Vee/Rect Channel Flow, Drainage Way** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.060
22.3	2,141	Total			

Subcatchment 604: To Culvert 604



Summary for Subcatchment 605: To Culvert 605

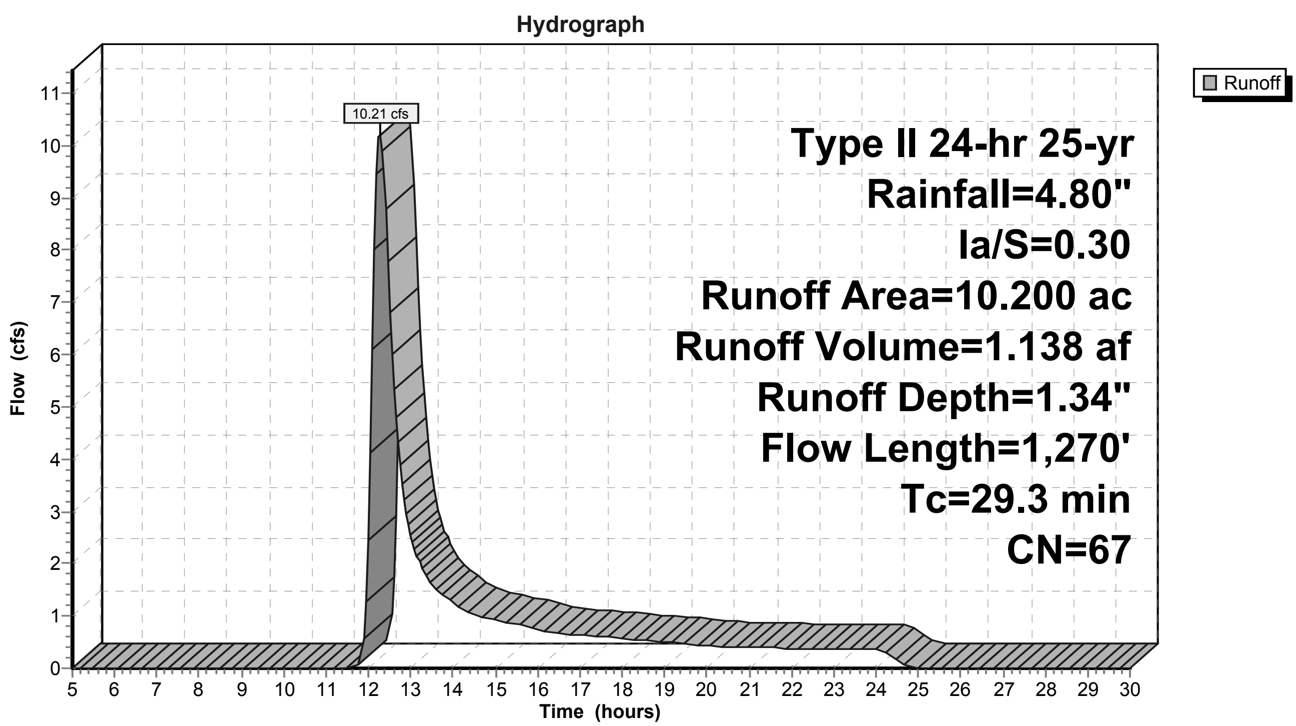
Runoff = 10.21 cfs @ 12.28 hrs, Volume= 1.138 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	10.200	67	Based on CN for P101
	10.200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.3	100	0.1200	0.08		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
3.4	256	0.0625	1.25		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
5.3	784	0.2400	2.45		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.3	130	0.2700	6.44	9.66	**Trap/Vee/Rect Channel Flow, Drainage Way** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.060
29.3	1,270	Total			

Subcatchment 605: To Culvert 605



Summary for Reach DS100a: Drainage Swale 100a

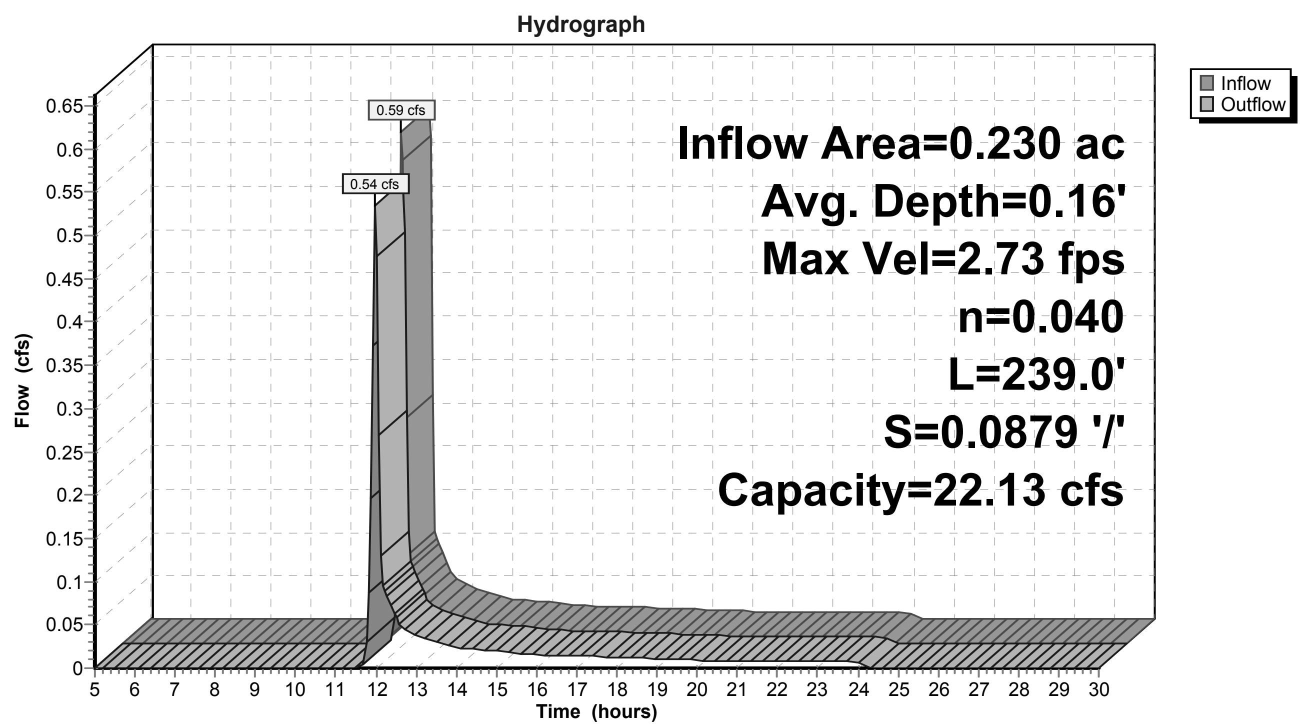
Inflow Area = 0.230 ac, 0.00% Impervious, Inflow Depth = 1.34" for 25-yr event
Inflow = 0.59 cfs @ 11.92 hrs, Volume= 0.026 af
Outflow = 0.54 cfs @ 11.96 hrs, Volume= 0.026 af, Atten= 9%, Lag= 2.3 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.73 fps, Min. Travel Time= 1.5 min
Avg. Velocity = 0.80 fps, Avg. Travel Time= 5.0 min

Peak Storage= 51 cf @ 11.94 hrs, Average Depth at Peak Storage= 0.16'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 22.13 cfs

1.00' x 1.00' deep channel, n= 0.040
Side Slope Z-value= 2.0 '/' Top Width= 5.00'
Length= 239.0' Slope= 0.0879 '/'
Inlet Invert= 680.00', Outlet Invert= 659.00'

Reach DS100a: Drainage Swale 100a



Summary for Reach R602: Stream

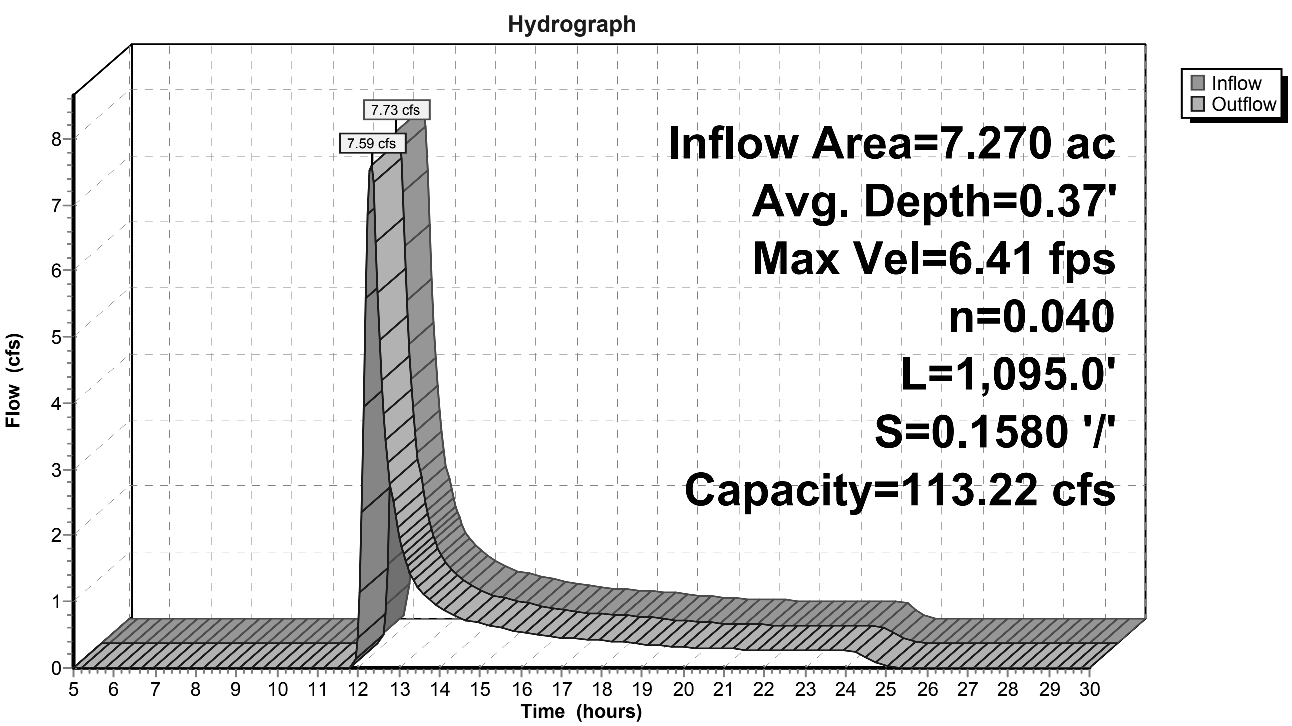
Inflow Area = 7.270 ac, 0.00% Impervious, Inflow Depth = 1.34" for 25-yr event
Inflow = 7.73 cfs @ 12.25 hrs, Volume= 0.811 af
Outflow = 7.59 cfs @ 12.33 hrs, Volume= 0.811 af, Atten= 2%, Lag= 5.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.41 fps, Min. Travel Time= 2.8 min
Avg. Velocity = 2.31 fps, Avg. Travel Time= 7.9 min

Peak Storage= 1,298 cf @ 12.28 hrs, Average Depth at Peak Storage= 0.37'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 113.22 cfs

2.50' x 1.50' deep channel, n= 0.040 Mountain streams
Side Slope Z-value= 2.0 '/' Top Width= 8.50'
Length= 1,095.0' Slope= 0.1580 '/'
Inlet Invert= 1,329.50', Outlet Invert= 1,156.50'

Reach R602: Stream



Summary for Reach R603: Stream

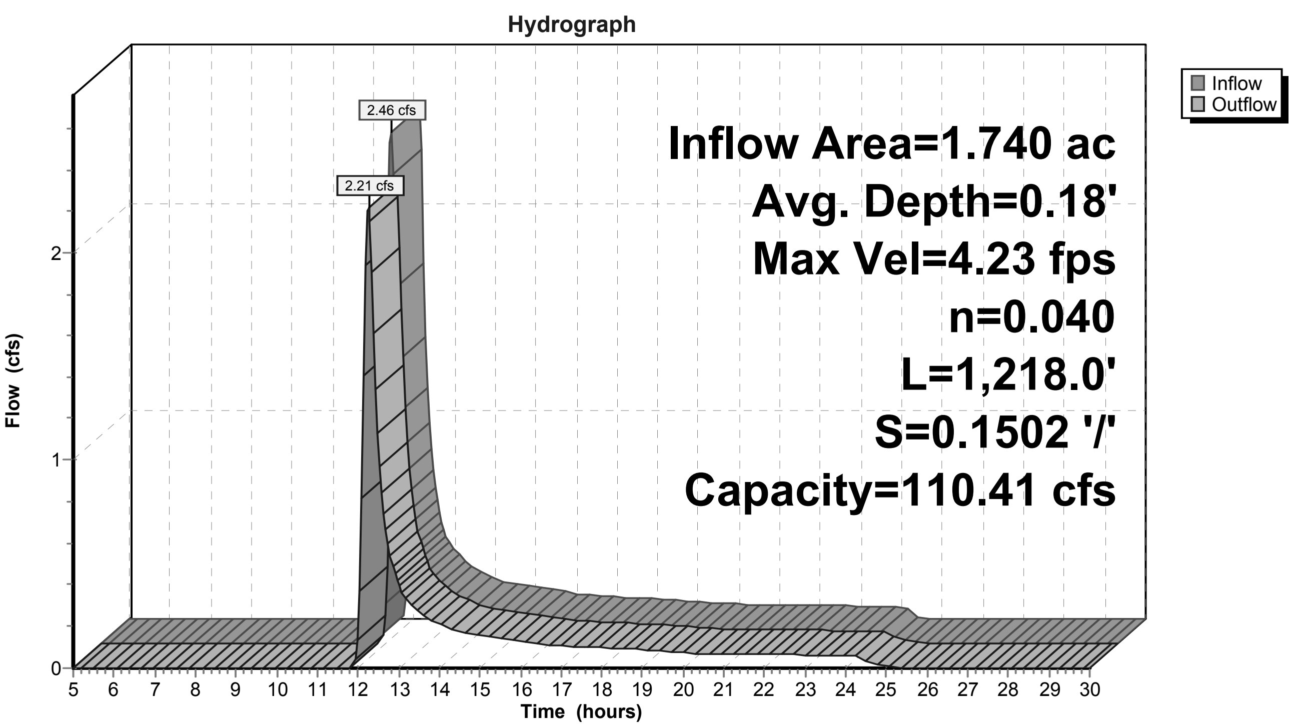
Inflow Area =	1.740 ac,	0.00% Impervious, Inflow Depth = 1.34"		for 25-yr event
Inflow =	2.46 cfs @	12.12 hrs, Volume=	0.194 af	
Outflow =	2.21 cfs @	12.27 hrs, Volume=	0.194 af, Atten= 10%, Lag= 8.5 min	

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.23 fps, Min. Travel Time= 4.8 min
Avg. Velocity = 1.41 fps, Avg. Travel Time= 14.4 min

Peak Storage= 645 cf @ 12.19 hrs, Average Depth at Peak Storage= 0.18'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 110.41 cfs

2.50' x 1.50' deep channel, n= 0.040 Mountain streams
Side Slope Z-value= 2.0 '/' Top Width= 8.50'
Length= 1,218.0' Slope= 0.1502 '/'
Inlet Invert= 1,339.50', Outlet Invert= 1,156.50'

Reach R603: Stream



Summary for Reach R604: Stream

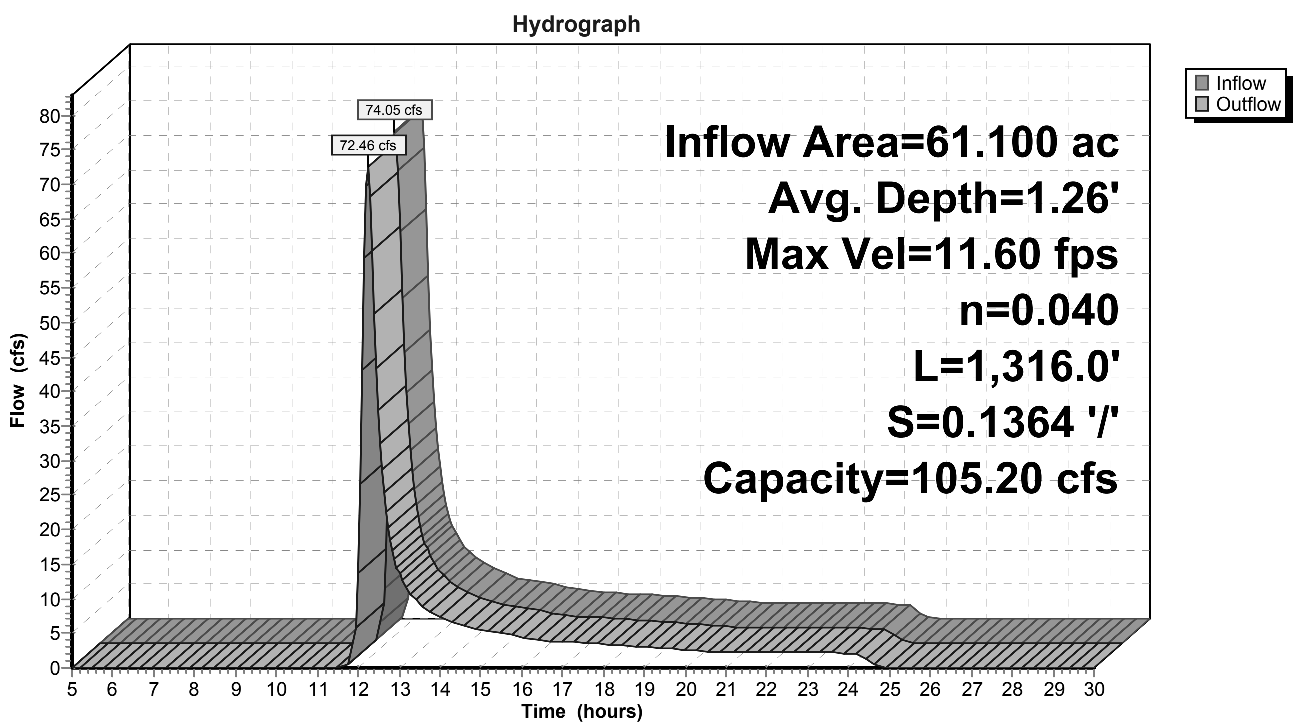
Inflow Area = 61.100 ac, 0.00% Impervious, Inflow Depth = 1.34" for 25-yr event
Inflow = 74.05 cfs @ 12.18 hrs, Volume= 6.814 af
Outflow = 72.46 cfs @ 12.24 hrs, Volume= 6.814 af, Atten= 2%, Lag= 3.6 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 11.60 fps, Min. Travel Time= 1.9 min
Avg. Velocity = 4.23 fps, Avg. Travel Time= 5.2 min

Peak Storage= 8,329 cf @ 12.21 hrs, Average Depth at Peak Storage= 1.26'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 105.20 cfs

2.50' x 1.50' deep channel, n= 0.040 Mountain streams
Side Slope Z-value= 2.0 '/' Top Width= 8.50'
Length= 1,316.0' Slope= 0.1364 '/'
Inlet Invert= 1,336.00', Outlet Invert= 1,156.50'

Reach R604: Stream



Summary for Reach R605: Stream

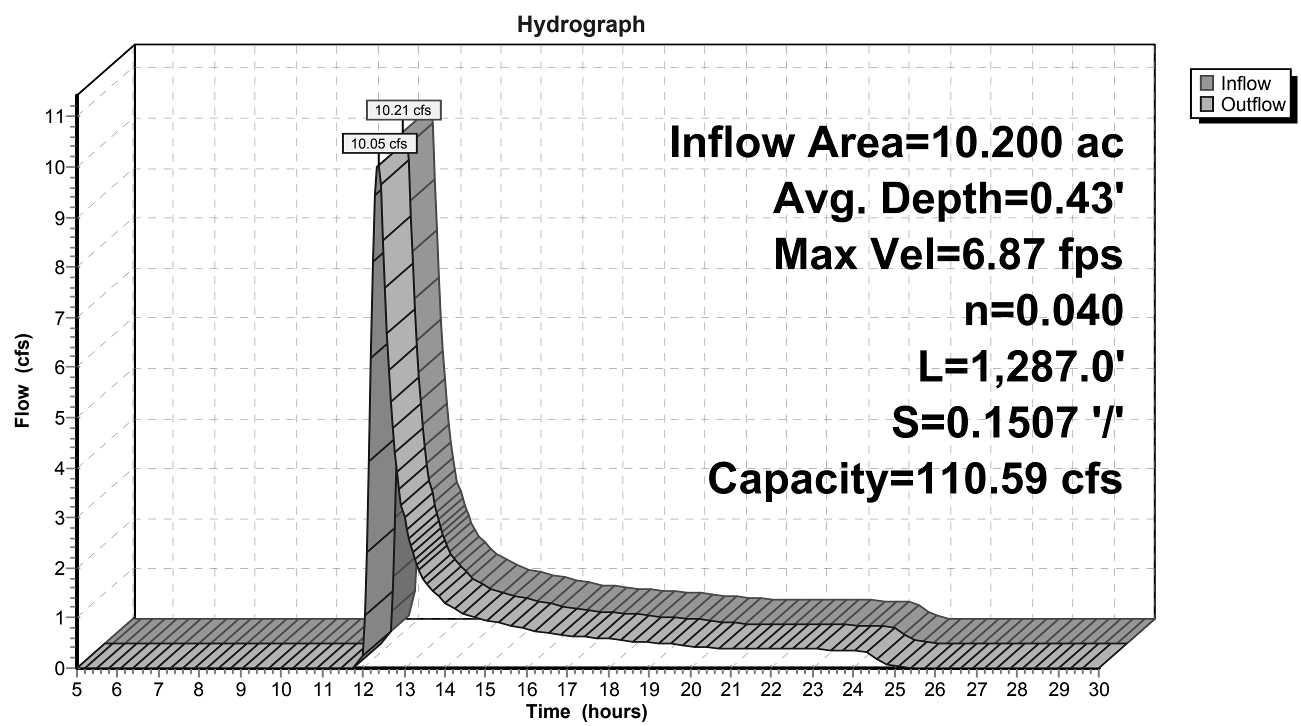
Inflow Area = 10.200 ac, 0.00% Impervious, Inflow Depth = 1.34" for 25-yr event
Inflow = 10.21 cfs @ 12.28 hrs, Volume= 1.138 af
Outflow = 10.05 cfs @ 12.37 hrs, Volume= 1.138 af, Atten= 2%, Lag= 5.6 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.87 fps, Min. Travel Time= 3.1 min
Avg. Velocity = 2.50 fps, Avg. Travel Time= 8.6 min

Peak Storage= 1,882 cf @ 12.32 hrs, Average Depth at Peak Storage= 0.43'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 110.59 cfs

2.50' x 1.50' deep channel, n= 0.040 Mountain streams
Side Slope Z-value= 2.0 '/' Top Width= 8.50'
Length= 1,287.0' Slope= 0.1507 '/'
Inlet Invert= 1,350.50', Outlet Invert= 1,156.50'

Reach R605: Stream



Summary for Pond D100: Culvert 100

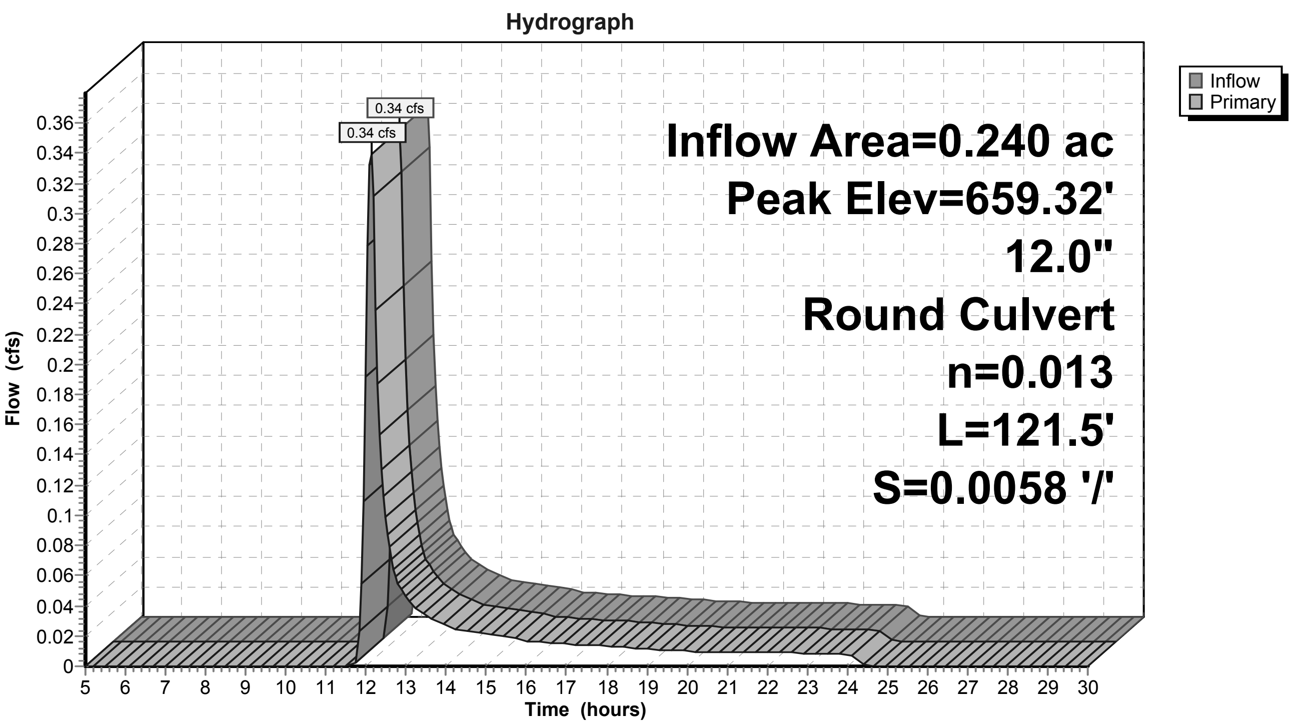
Inflow Area = 0.240 ac, 0.00% Impervious, Inflow Depth = 1.34" for 25-yr event
Inflow = 0.34 cfs @ 12.12 hrs, Volume= 0.027 af
Outflow = 0.34 cfs @ 12.12 hrs, Volume= 0.027 af, Atten= 0%, Lag= 0.0 min
Primary = 0.34 cfs @ 12.12 hrs, Volume= 0.027 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 659.32' @ 12.12 hrs
Flood Elev= 661.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	659.00'	**12.0" Round Culvert** L= 121.5' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 658.30' S= 0.0058 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.33 cfs @ 12.12 hrs HW=659.32' (Free Discharge)
1=Culvert (Barrel Controls 0.33 cfs @ 2.29 fps)

Pond D100: Culvert 100



Summary for Pond D101: Culvert 101

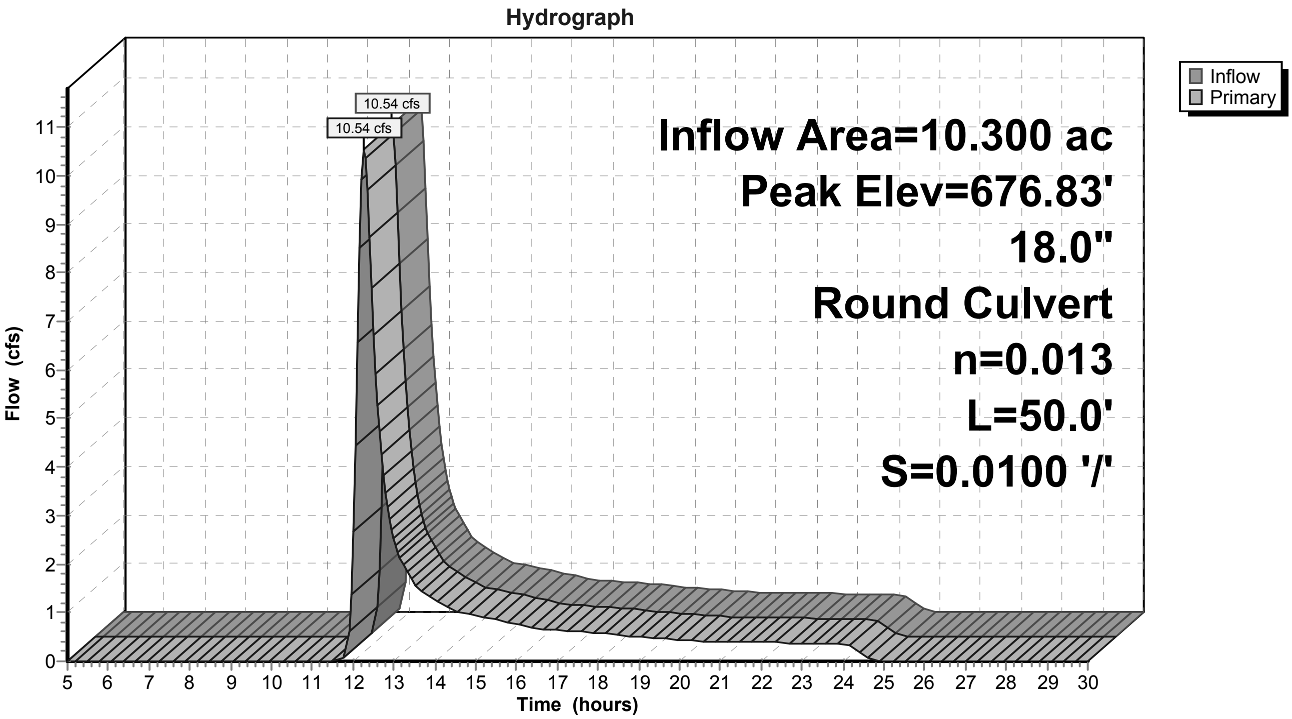
Inflow Area =	10.300 ac,	0.00% Impervious,	Inflow Depth = 1.34"	for 25-yr event	
Inflow =	10.54 cfs @	12.27 hrs,	Volume=	1.149 af	
Outflow =	10.54 cfs @	12.27 hrs,	Volume=	1.149 af,	Atten= 0%, Lag= 0.0 min
Primary =	10.54 cfs @	12.27 hrs,	Volume=	1.149 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 676.83' @ 12.27 hrs
Flood Elev= 677.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	674.50'	**18.0" Round Culvert** L= 50.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 674.00' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=10.46 cfs @ 12.27 hrs HW=676.81' (Free Discharge)
└─**1=Culvert** (Barrel Controls 10.46 cfs @ 5.92 fps)

Pond D101: Culvert 101



Summary for Pond D105: Culvert 105

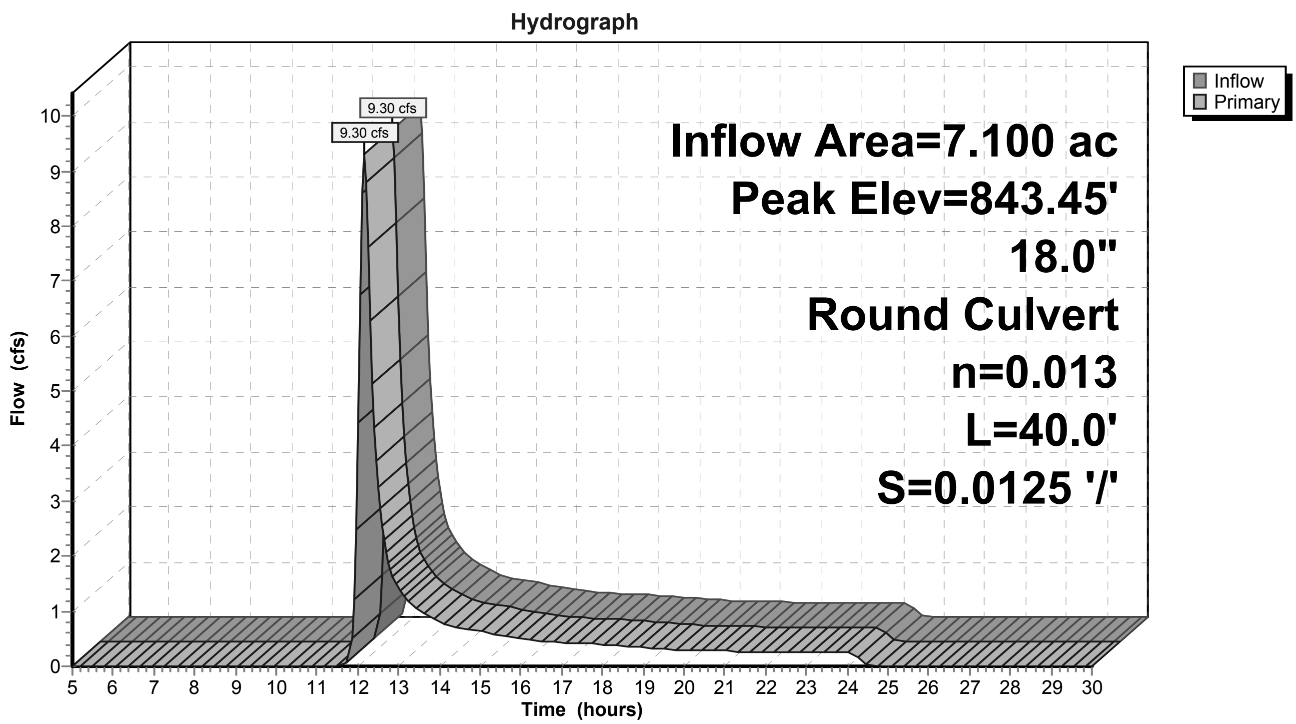
Inflow Area =	7.100 ac,	0.00% Impervious,	Inflow Depth = 1.34"	for 25-yr event	
Inflow =	9.30 cfs @	12.15 hrs,	Volume=	0.792 af	
Outflow =	9.30 cfs @	12.15 hrs,	Volume=	0.792 af,	Atten= 0%, Lag= 0.0 min
Primary =	9.30 cfs @	12.15 hrs,	Volume=	0.792 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 843.45' @ 12.15 hrs
Flood Elev= 844.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	841.50'	**18.0" Round Culvert** L= 40.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 841.00' S= 0.0125 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=9.26 cfs @ 12.15 hrs HW=843.43' (Free Discharge)
└─**1=Culvert** (Inlet Controls 9.26 cfs @ 5.24 fps)

Pond D105: Culvert 105



Summary for Pond D106: Culvert 106

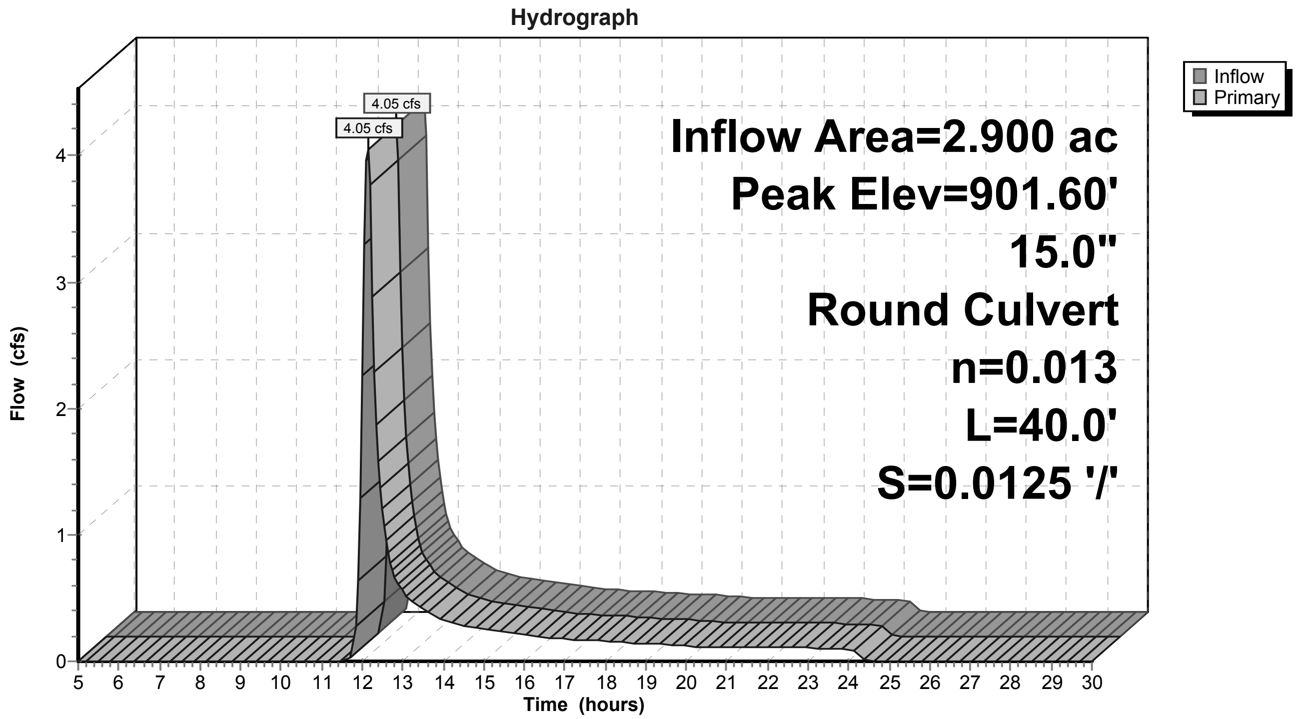
Inflow Area = 2.900 ac, 0.00% Impervious, Inflow Depth = 1.34" for 25-yr event
Inflow = 4.05 cfs @ 12.13 hrs, Volume= 0.323 af
Outflow = 4.05 cfs @ 12.13 hrs, Volume= 0.323 af, Atten= 0%, Lag= 0.0 min
Primary = 4.05 cfs @ 12.13 hrs, Volume= 0.323 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 901.60' @ 12.13 hrs
Flood Elev= 903.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	900.50'	**15.0" Round Culvert** L= 40.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 900.00' S= 0.0125 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=3.99 cfs @ 12.13 hrs HW=901.59' (Free Discharge)
└─**1=Culvert** (Barrel Controls 3.99 cfs @ 4.68 fps)

Pond D106: Culvert 106



Summary for Pond D107: Culvert 107

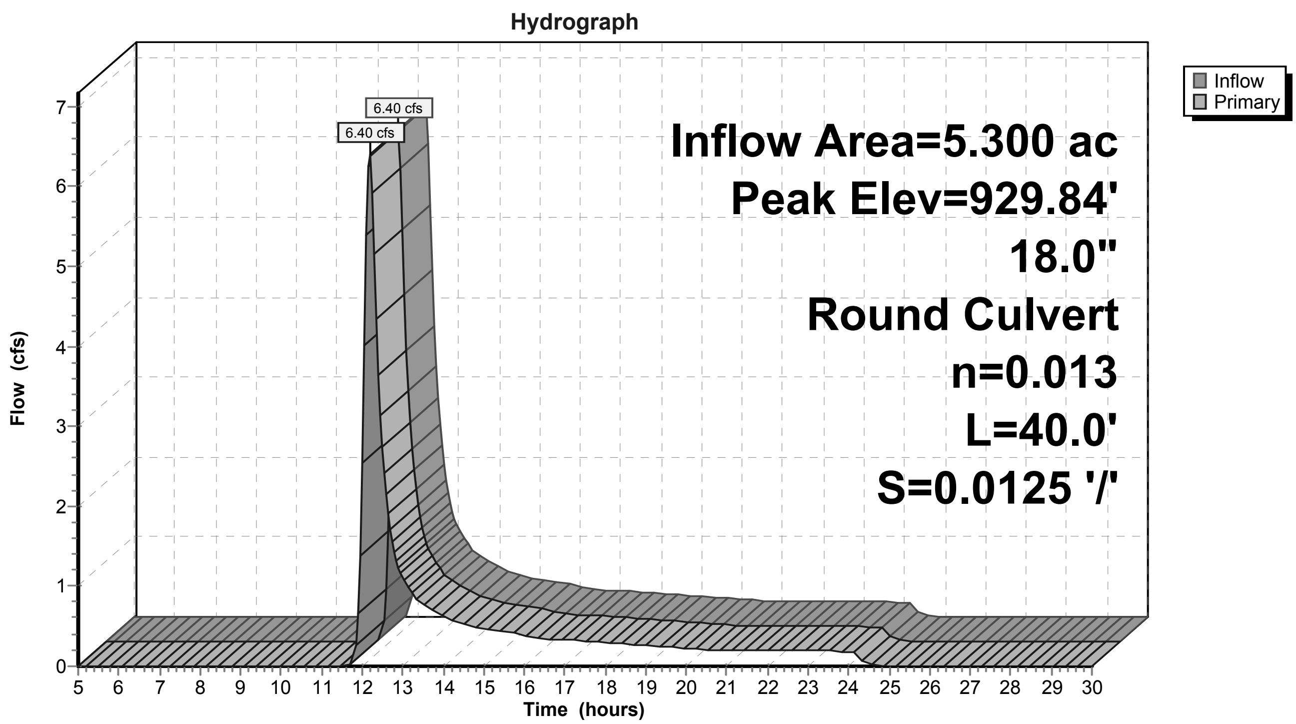
Inflow Area = 5.300 ac, 0.00% Impervious, Inflow Depth = 1.34" for 25-yr event
Inflow = 6.40 cfs @ 12.19 hrs, Volume= 0.591 af
Outflow = 6.40 cfs @ 12.19 hrs, Volume= 0.591 af, Atten= 0%, Lag= 0.0 min
Primary = 6.40 cfs @ 12.19 hrs, Volume= 0.591 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 929.84' @ 12.19 hrs
Flood Elev= 931.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	928.50'	**18.0" Round Culvert** L= 40.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 928.00' S= 0.0125 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=6.35 cfs @ 12.19 hrs HW=929.84' (Free Discharge)
└─**1=Culvert** (Barrel Controls 6.35 cfs @ 5.06 fps)

Pond D107: Culvert 107



Summary for Pond D108: Culvert 108

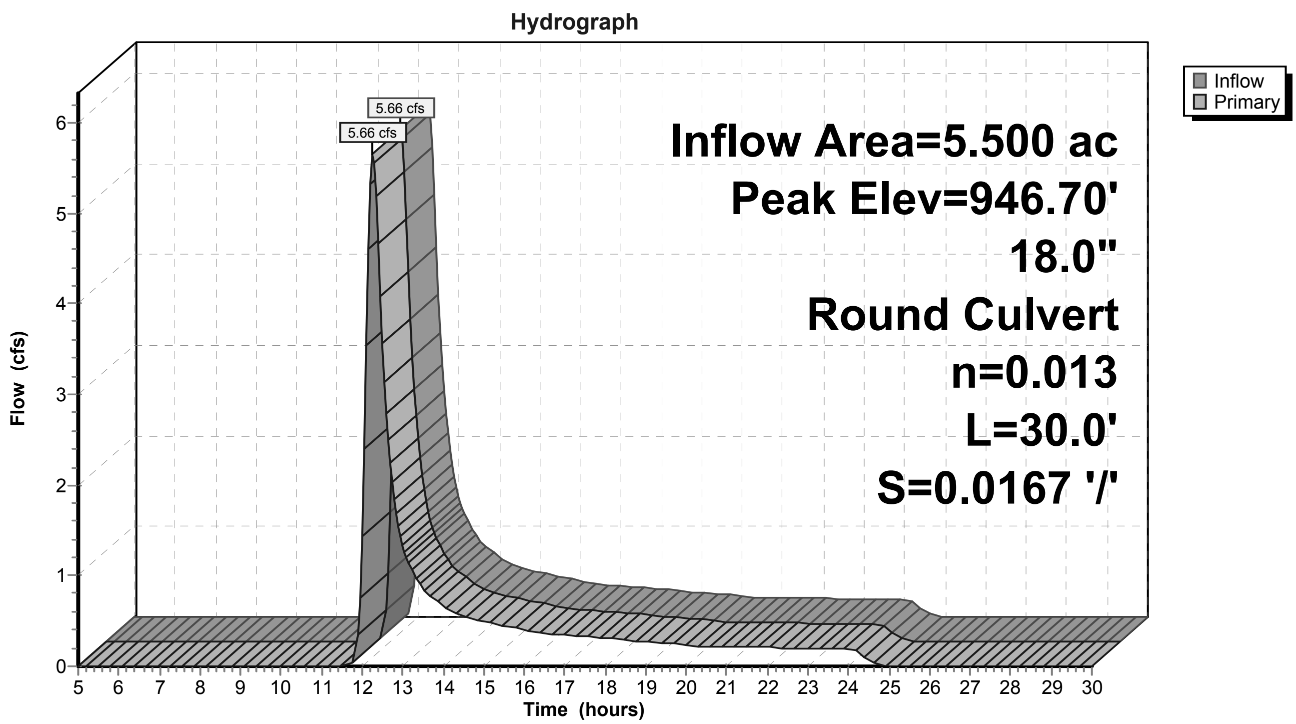
Inflow Area =	5.500 ac,	0.00% Impervious, Inflow Depth = 1.34" for 25-yr event		
Inflow =	5.66 cfs @	12.26 hrs, Volume=	0.613 af	
Outflow =	5.66 cfs @	12.26 hrs, Volume=	0.613 af,	Atten= 0%, Lag= 0.0 min
Primary =	5.66 cfs @	12.26 hrs, Volume=	0.613 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 946.70' @ 12.26 hrs
Flood Elev= 947.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	945.50'	**18.0" Round Culvert** L= 30.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 945.00' S= 0.0167 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=5.62 cfs @ 12.26 hrs HW=946.69' (Free Discharge)
└─**1=Culvert** (Barrel Controls 5.62 cfs @ 5.10 fps)

Pond D108: Culvert 108



Summary for Pond D110: Culvert 110

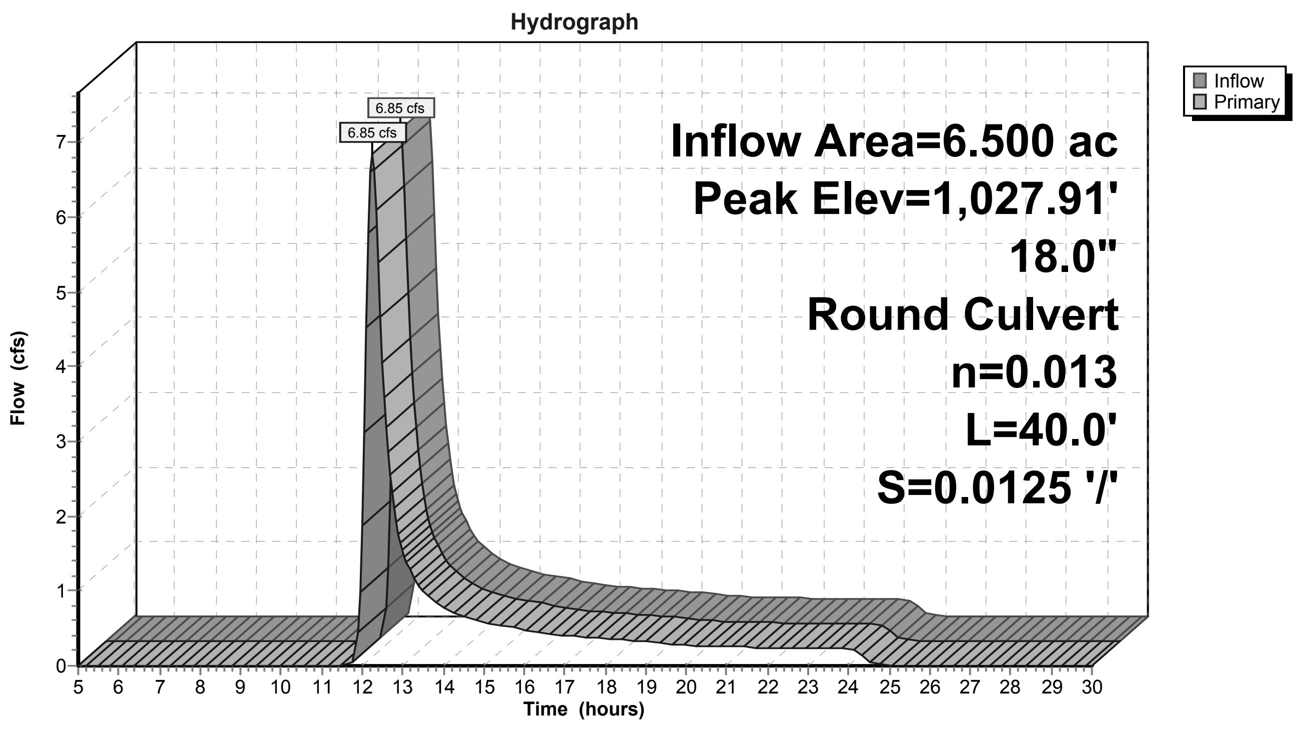
Inflow Area =	6.500 ac,	0.00% Impervious, Inflow Depth = 1.34" for 25-yr event		
Inflow =	6.85 cfs @	12.25 hrs, Volume=	0.725 af	
Outflow =	6.85 cfs @	12.25 hrs, Volume=	0.725 af,	Atten= 0%, Lag= 0.0 min
Primary =	6.85 cfs @	12.25 hrs, Volume=	0.725 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,027.91' @ 12.25 hrs
Flood Elev= 1,028.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,026.50'	**18.0" Round Culvert** L= 40.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,026.00' S= 0.0125 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=6.84 cfs @ 12.25 hrs HW=1,027.91' (Free Discharge)
└─**1=Culvert** (Barrel Controls 6.84 cfs @ 5.14 fps)

Pond D110: Culvert 110



Summary for Pond D113: Culvert 113

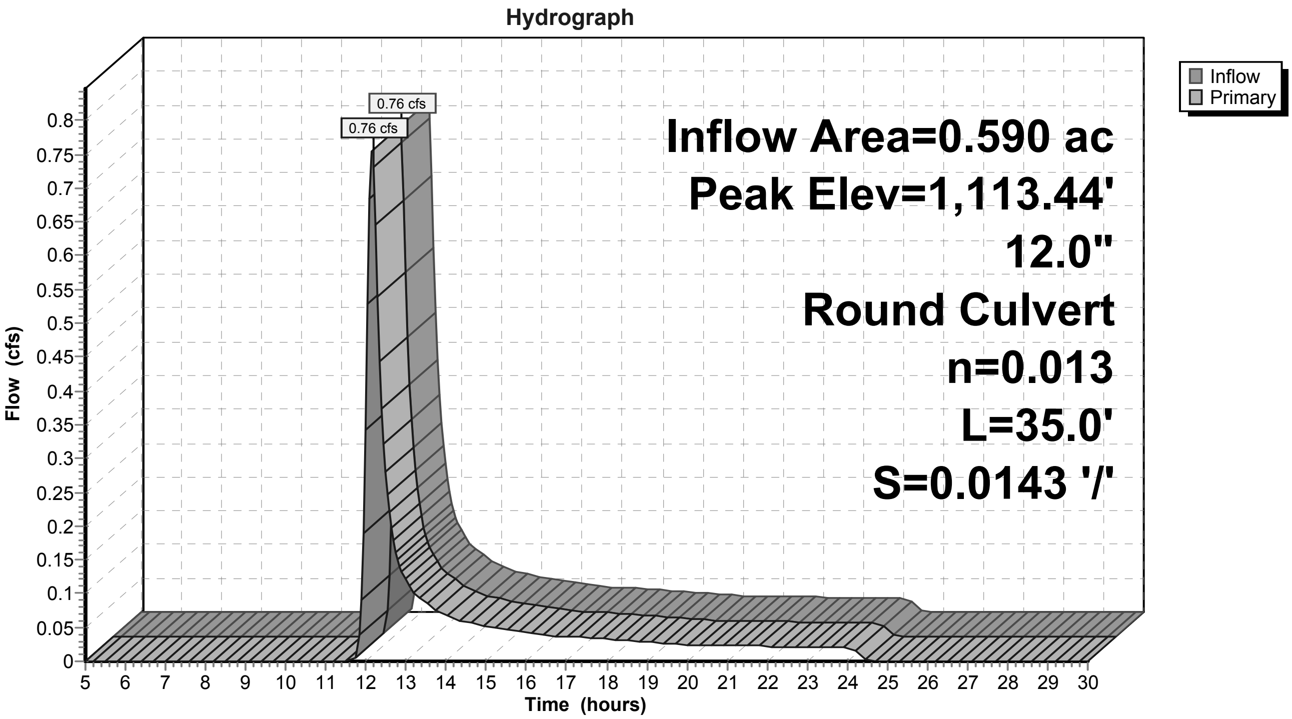
Inflow Area = 0.590 ac, 0.00% Impervious, Inflow Depth = 1.34" for 25-yr event
Inflow = 0.76 cfs @ 12.16 hrs, Volume= 0.066 af
Outflow = 0.76 cfs @ 12.16 hrs, Volume= 0.066 af, Atten= 0%, Lag= 0.0 min
Primary = 0.76 cfs @ 12.16 hrs, Volume= 0.066 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,113.44' @ 12.16 hrs
Flood Elev= 1,115.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,113.00'	**12.0" Round Culvert** L= 35.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,112.50' S= 0.0143 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=0.75 cfs @ 12.16 hrs HW=1,113.44' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 0.75 cfs @ 2.26 fps)

Pond D113: Culvert 113



Summary for Pond D114a: Culvert 104a

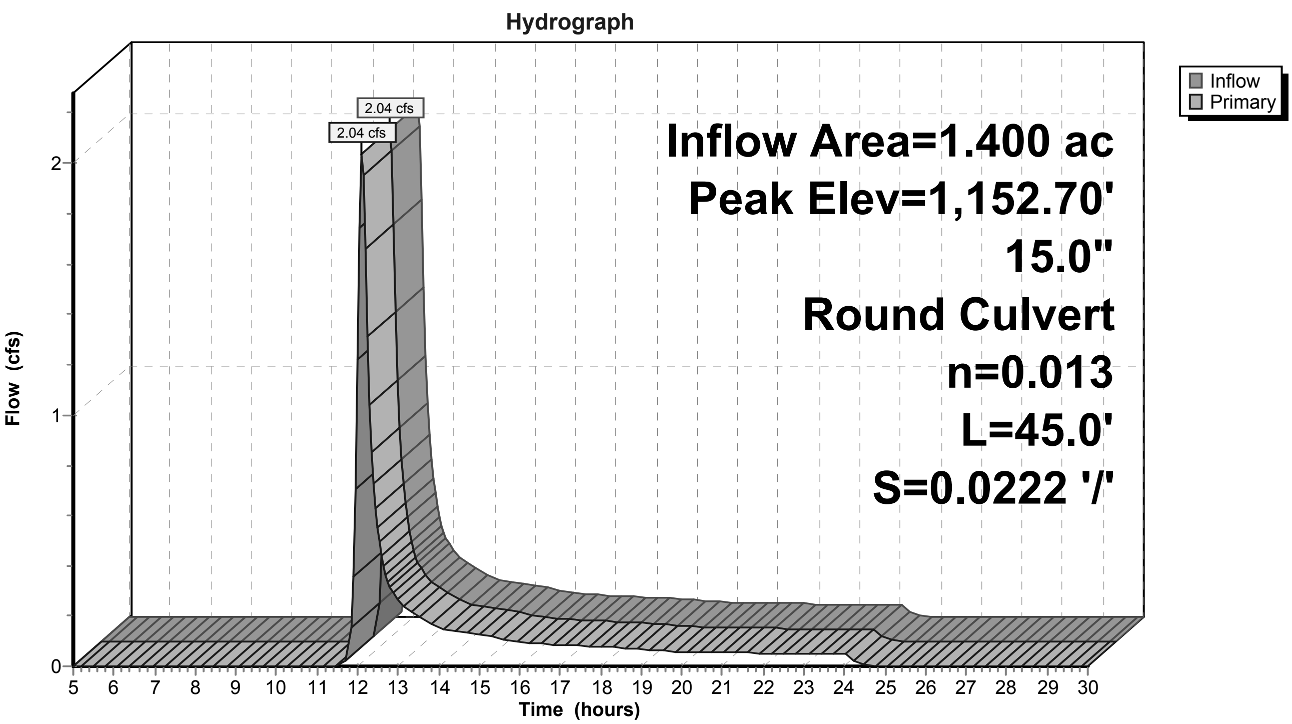
Inflow Area = 1.400 ac, 0.00% Impervious, Inflow Depth = 1.34" for 25-yr event
Inflow = 2.04 cfs @ 12.12 hrs, Volume= 0.156 af
Outflow = 2.04 cfs @ 12.12 hrs, Volume= 0.156 af, Atten= 0%, Lag= 0.0 min
Primary = 2.04 cfs @ 12.12 hrs, Volume= 0.156 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,152.70' @ 12.12 hrs
Flood Elev= 1,156.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,152.00'	**15.0" Round Culvert** L= 45.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,151.00' S= 0.0222 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=2.00 cfs @ 12.12 hrs HW=1,152.70' (Free Discharge)
└─**1=Culvert** (Inlet Controls 2.00 cfs @ 2.84 fps)

Pond D114a: Culvert 104a



Summary for Pond D117: Culvert 117

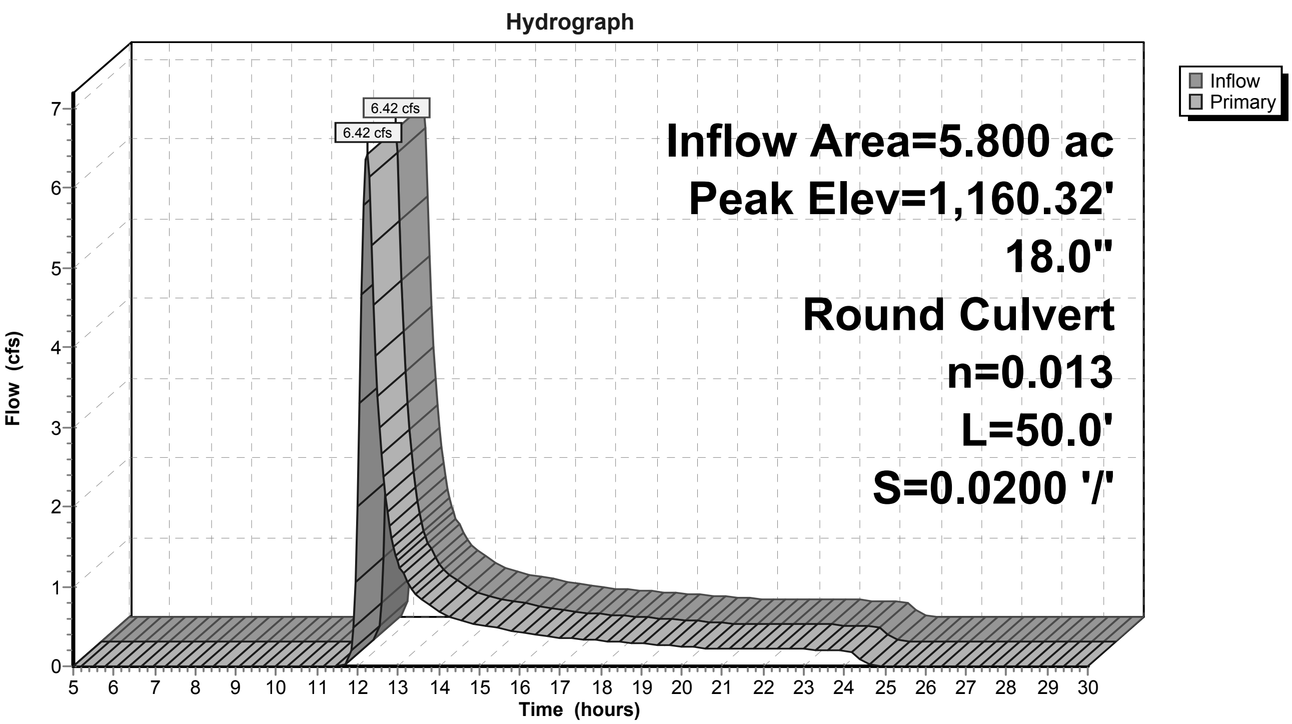
Inflow Area =	5.800 ac,	0.00% Impervious, Inflow Depth = 1.34" for 25-yr event		
Inflow =	6.42 cfs @	12.22 hrs, Volume=	0.647 af	
Outflow =	6.42 cfs @	12.22 hrs, Volume=	0.647 af,	Atten= 0%, Lag= 0.0 min
Primary =	6.42 cfs @	12.22 hrs, Volume=	0.647 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,160.32' @ 12.22 hrs
Flood Elev= 1,161.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,159.00'	**18.0" Round Culvert** L= 50.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,158.00' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=6.35 cfs @ 12.22 hrs HW=1,160.31' (Free Discharge)
└─**1=Culvert** (Inlet Controls 6.35 cfs @ 3.89 fps)

Pond D117: Culvert 117



Summary for Pond D118: Culvert 118

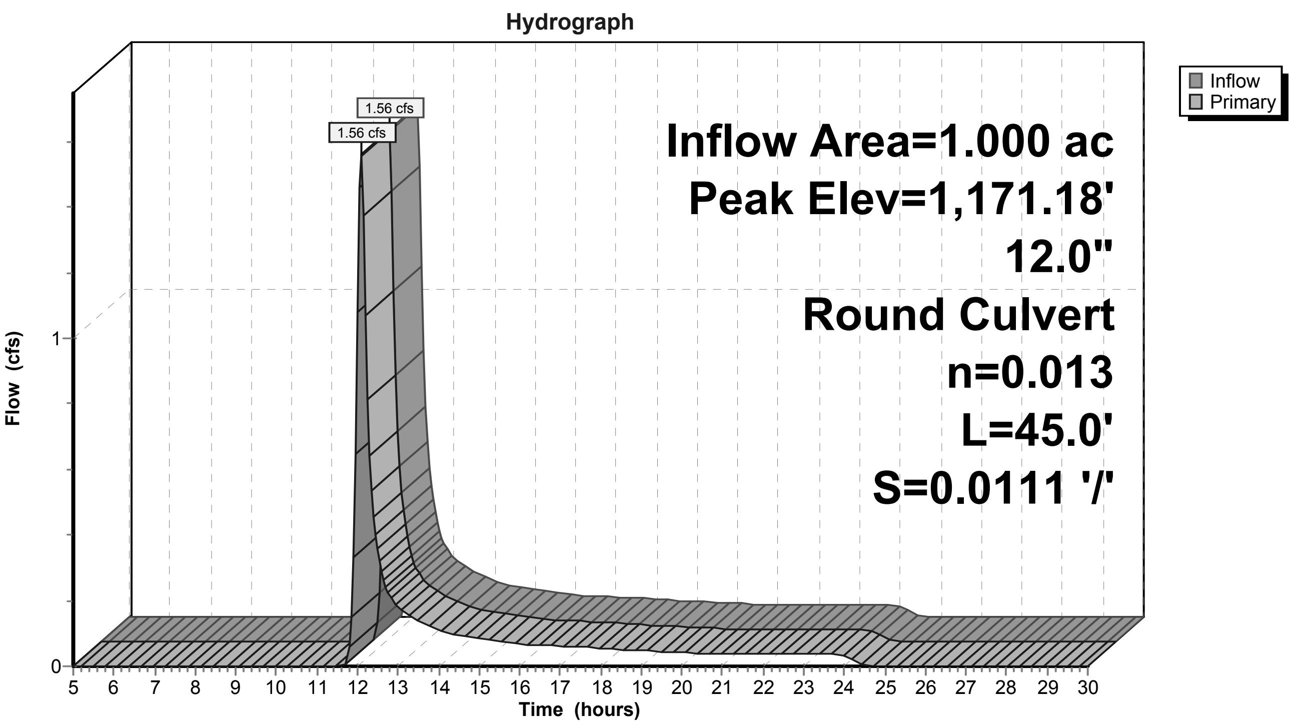
Inflow Area = 1.000 ac, 0.00% Impervious, Inflow Depth = 1.34" for 25-yr event
Inflow = 1.56 cfs @ 12.09 hrs, Volume= 0.112 af
Outflow = 1.56 cfs @ 12.09 hrs, Volume= 0.112 af, Atten= 0%, Lag= 0.0 min
Primary = 1.56 cfs @ 12.09 hrs, Volume= 0.112 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,171.18' @ 12.09 hrs
Flood Elev= 1,171.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,170.50'	**12.0" Round Culvert** L= 45.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,170.00' S= 0.0111 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=1.54 cfs @ 12.09 hrs HW=1,171.18' (Free Discharge)
└─**1=Culvert** (Barrel Controls 1.54 cfs @ 3.86 fps)

Pond D118: Culvert 118



Summary for Pond D119: Culvert 119

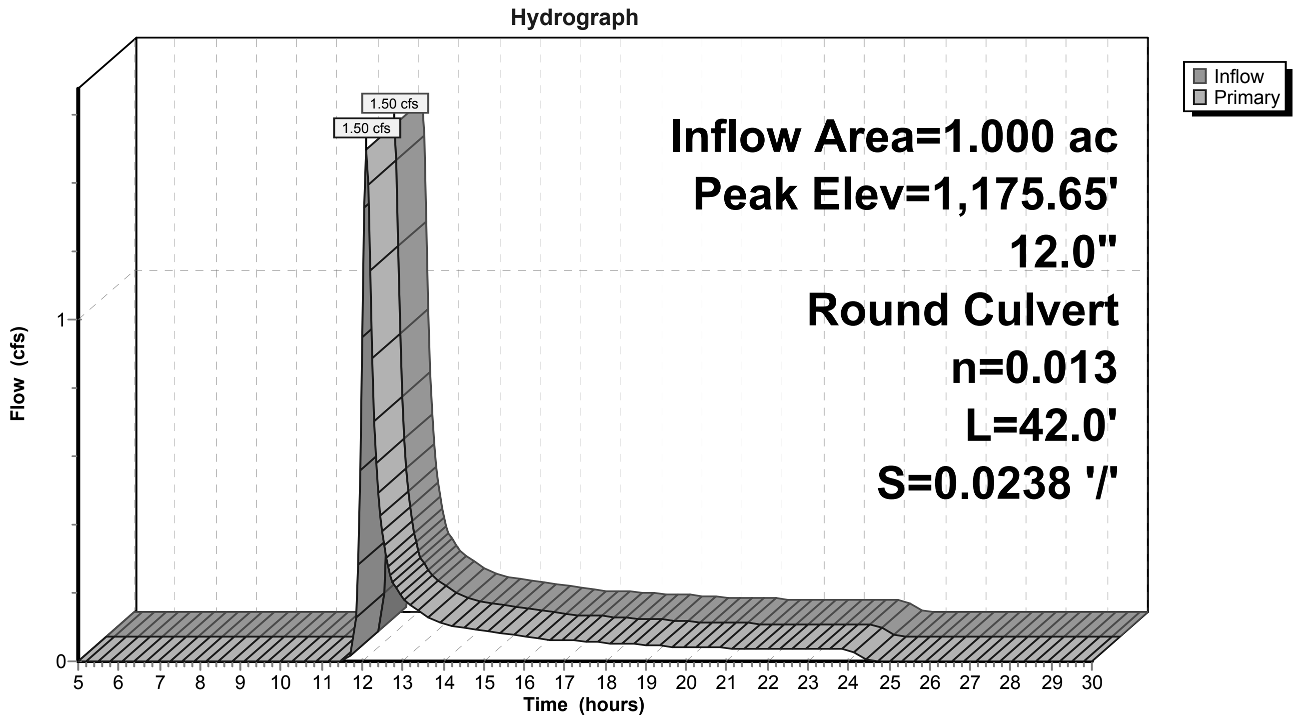
Inflow Area =	1.000 ac,	0.00% Impervious, Inflow Depth = 1.34"	for 25-yr event	
Inflow =	1.50 cfs @	12.11 hrs, Volume=	0.112 af	
Outflow =	1.50 cfs @	12.11 hrs, Volume=	0.112 af,	Atten= 0%, Lag= 0.0 min
Primary =	1.50 cfs @	12.11 hrs, Volume=	0.112 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,175.65' @ 12.11 hrs
Flood Elev= 1,178.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,175.00'	**12.0" Round Culvert** L= 42.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,174.00' S= 0.0238 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=1.48 cfs @ 12.11 hrs HW=1,175.65' (Free Discharge)
└─**1=Culvert** (Inlet Controls 1.48 cfs @ 2.74 fps)

Pond D119: Culvert 119



Summary for Pond S102: Culvert 102

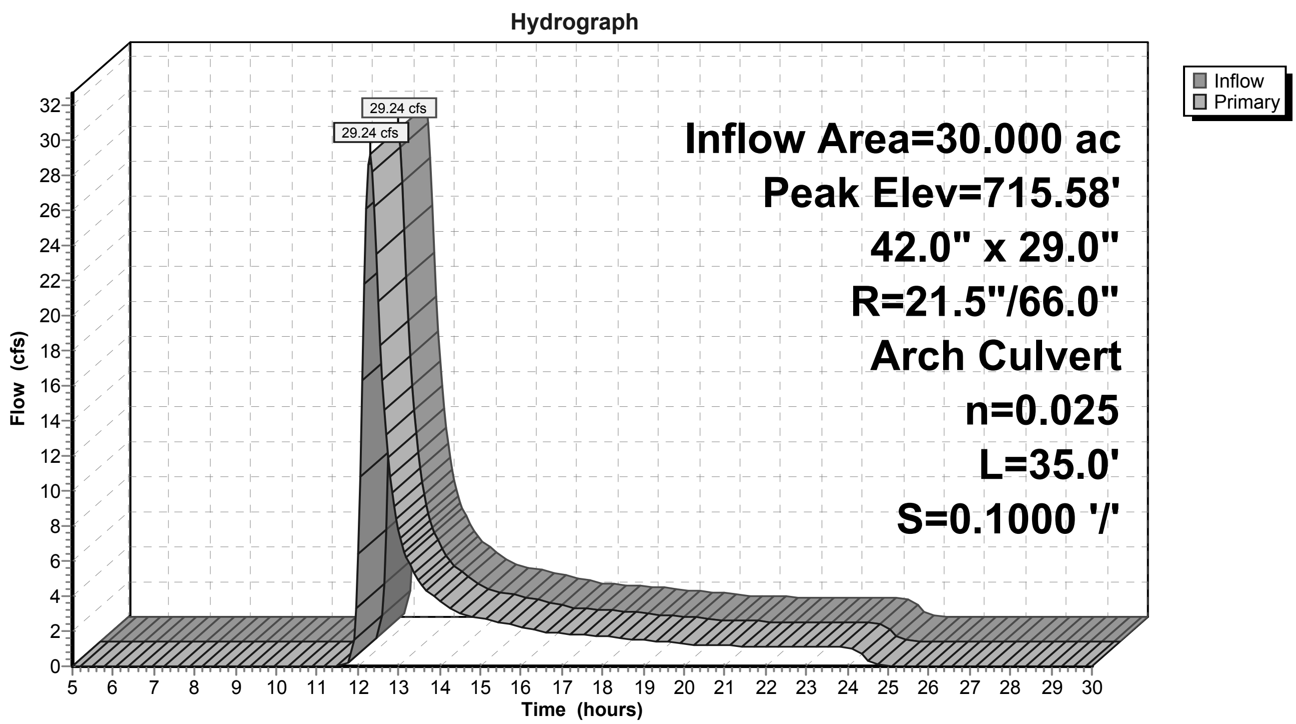
Inflow Area = 30.000 ac, 0.00% Impervious, Inflow Depth = 1.34" for 25-yr event
Inflow = 29.24 cfs @ 12.29 hrs, Volume= 3.346 af
Outflow = 29.24 cfs @ 12.29 hrs, Volume= 3.346 af, Atten= 0%, Lag= 0.0 min
Primary = 29.24 cfs @ 12.29 hrs, Volume= 3.346 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 715.58' @ 12.29 hrs
Flood Elev= 717.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	713.50'	**42.0" W x 29.0" H, R=21.5"/66.0" Arch Culvert** L= 35.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 710.00' S= 0.1000 '/' Cc= 0.900 n= 0.025 Corrugated metal

Primary OutFlow Max=29.15 cfs @ 12.29 hrs HW=715.58' (Free Discharge)
└─**1=Culvert** (Inlet Controls 29.15 cfs @ 4.67 fps)

Pond S102: Culvert 102



Summary for Pond S103: Culvert 103

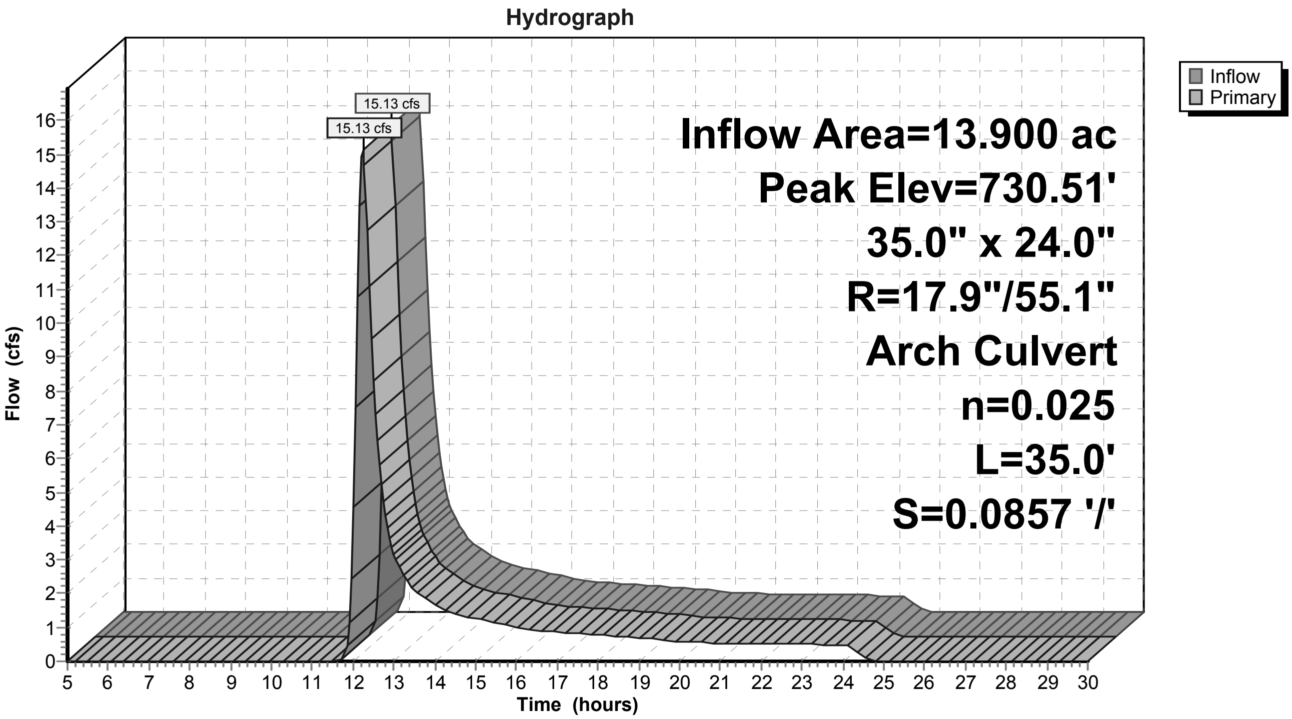
Inflow Area =	13.900 ac,	0.00% Impervious,	Inflow Depth = 1.34"	for 25-yr event
Inflow =	15.13 cfs @	12.23 hrs, Volume=	1.550 af	
Outflow =	15.13 cfs @	12.23 hrs, Volume=	1.550 af,	Atten= 0%, Lag= 0.0 min
Primary =	15.13 cfs @	12.23 hrs, Volume=	1.550 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 730.51' @ 12.23 hrs
Flood Elev= 732.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	729.00'	**35.0" W x 24.0" H, R=17.9"/55.1" Arch Culvert** L= 35.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 726.00' S= 0.0857 '/' Cc= 0.900 n= 0.025 Corrugated metal

Primary OutFlow Max=15.02 cfs @ 12.23 hrs HW=730.50' (Free Discharge)
└**1=Culvert** (Inlet Controls 15.02 cfs @ 3.89 fps)

Pond S103: Culvert 103



Summary for Pond S104: Culvert 104

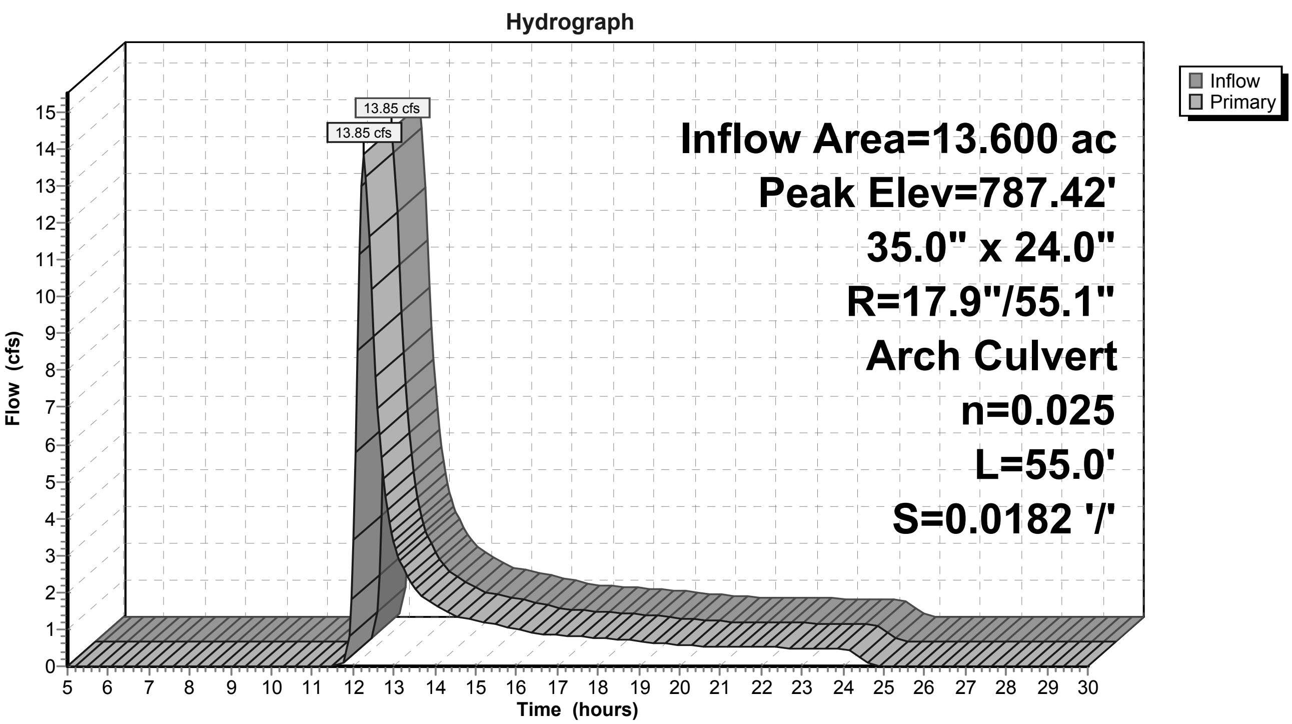
Inflow Area =	13.600 ac,	0.00% Impervious, Inflow Depth = 1.34"	for 25-yr event	
Inflow =	13.85 cfs @	12.27 hrs, Volume=	1.517 af	
Outflow =	13.85 cfs @	12.27 hrs, Volume=	1.517 af,	Atten= 0%, Lag= 0.0 min
Primary =	13.85 cfs @	12.27 hrs, Volume=	1.517 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 787.42' @ 12.27 hrs
Flood Elev= 792.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	786.00'	**35.0" W x 24.0" H, R=17.9"/55.1" Arch Culvert** L= 55.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 785.00' S= 0.0182 '/' Cc= 0.900 n= 0.025 Corrugated metal

Primary OutFlow Max=13.74 cfs @ 12.27 hrs HW=787.42' (Free Discharge)
1=Culvert (Inlet Controls 13.74 cfs @ 3.75 fps)

Pond S104: Culvert 104



Summary for Pond S109: Culvert 109

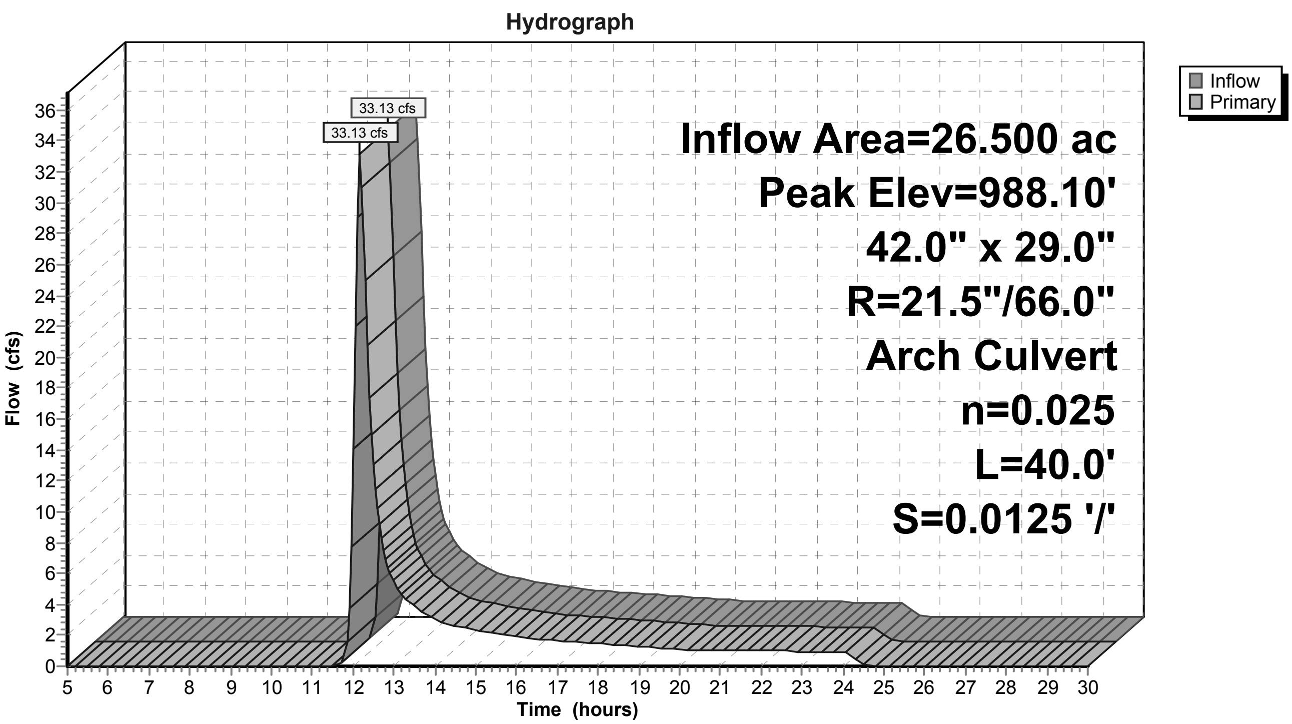
Inflow Area = 26.500 ac, 0.00% Impervious, Inflow Depth = 1.34" for 25-yr event
Inflow = 33.13 cfs @ 12.17 hrs, Volume= 2.955 af
Outflow = 33.13 cfs @ 12.17 hrs, Volume= 2.955 af, Atten= 0%, Lag= 0.0 min
Primary = 33.13 cfs @ 12.17 hrs, Volume= 2.955 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 988.10' @ 12.17 hrs
Flood Elev= 989.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	985.50'	**42.0" W x 29.0" H, R=21.5"/66.0" Arch Culvert** L= 40.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 985.00' S= 0.0125 '/' Cc= 0.900 n= 0.025 Corrugated metal

Primary OutFlow Max=32.64 cfs @ 12.17 hrs HW=988.06' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 32.64 cfs @ 5.55 fps)

Pond S109: Culvert 109



Summary for Pond S111: Culvert 111

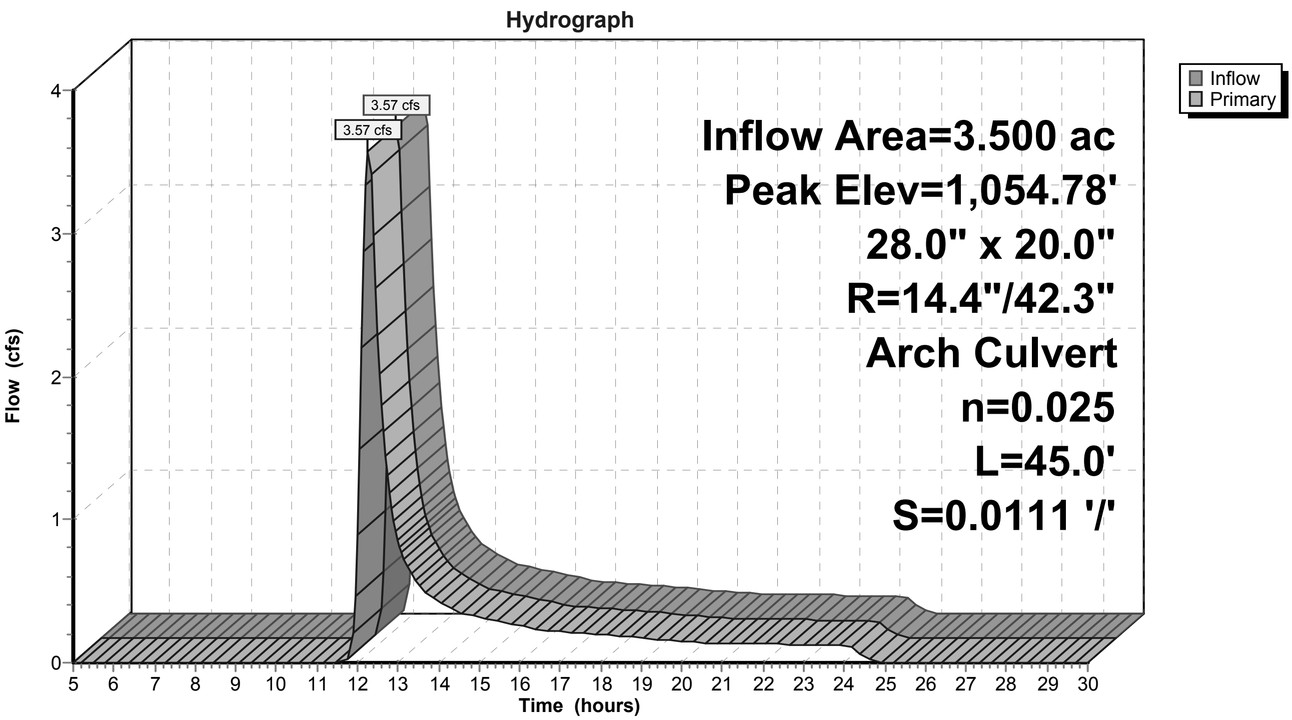
Inflow Area = 3.500 ac, 0.00% Impervious, Inflow Depth = 1.34" for 25-yr event
Inflow = 3.57 cfs @ 12.27 hrs, Volume= 0.390 af
Outflow = 3.57 cfs @ 12.27 hrs, Volume= 0.390 af, Atten= 0%, Lag= 0.0 min
Primary = 3.57 cfs @ 12.27 hrs, Volume= 0.390 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,054.78' @ 12.27 hrs
Flood Elev= 1,058.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,054.00'	**28.0" W x 20.0" H, R=14.4"/42.3" Arch Culvert** L= 45.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,053.50' S= 0.0111 '/' Cc= 0.900 n= 0.025

Primary OutFlow Max=3.54 cfs @ 12.27 hrs HW=1,054.77' (Free Discharge)
1=Culvert (Barrel Controls 3.54 cfs @ 3.18 fps)

Pond S111: Culvert 111



Summary for Pond S112: Culvert 112

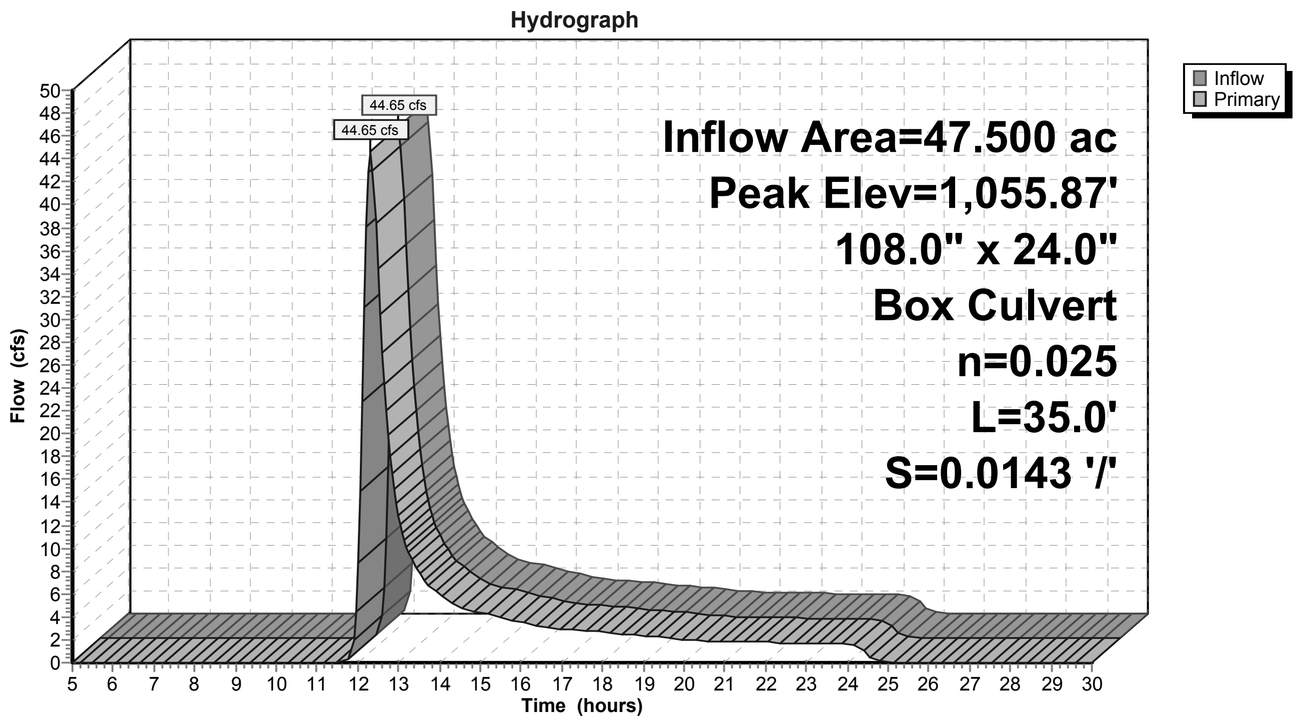
Inflow Area =	47.500 ac,	0.00% Impervious, Inflow Depth = 1.34"	for 25-yr event	
Inflow =	44.65 cfs @	12.32 hrs, Volume=	5.298 af	
Outflow =	44.65 cfs @	12.32 hrs, Volume=	5.298 af,	Atten= 0%, Lag= 0.0 min
Primary =	44.65 cfs @	12.32 hrs, Volume=	5.298 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,055.87' @ 12.32 hrs
Flood Elev= 1,059.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,054.50'	**108.0" W x 24.0" H Box Culvert** L= 35.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,054.00' S= 0.0143 '/' Cc= 0.900 n= 0.025

Primary OutFlow Max=44.41 cfs @ 12.32 hrs HW=1,055.86' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 44.41 cfs @ 4.83 fps)

Pond S112: Culvert 112



Summary for Pond S114: Culvert 114

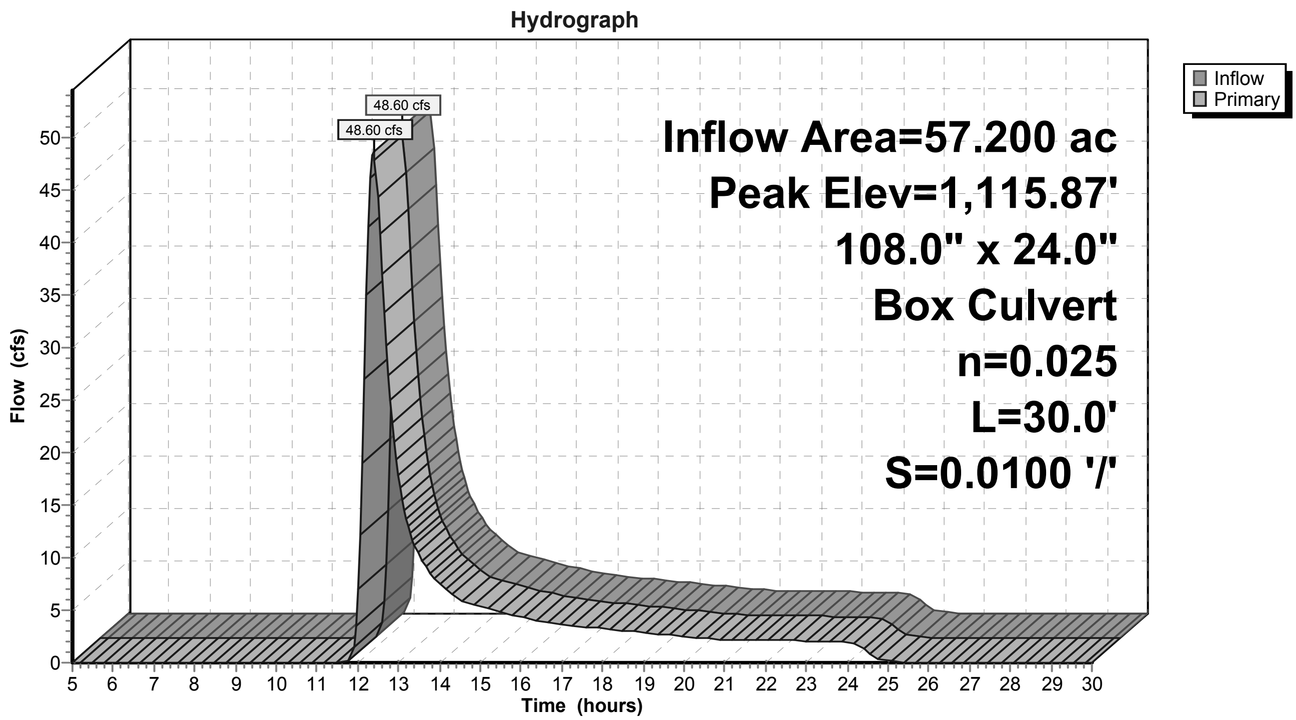
Inflow Area = 57.200 ac, 0.00% Impervious, Inflow Depth = 1.34" for 25-yr event
Inflow = 48.60 cfs @ 12.38 hrs, Volume= 6.379 af
Outflow = 48.60 cfs @ 12.38 hrs, Volume= 6.379 af, Atten= 0%, Lag= 0.0 min
Primary = 48.60 cfs @ 12.38 hrs, Volume= 6.379 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,115.87' @ 12.38 hrs
Flood Elev= 1,117.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,114.30'	**108.0" W x 24.0" H Box Culvert** L= 30.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,114.00' S= 0.0100 '/' Cc= 0.900 n= 0.025

Primary OutFlow Max=48.40 cfs @ 12.38 hrs HW=1,115.86' (Free Discharge)
└─**1=Culvert** (Barrel Controls 48.40 cfs @ 4.59 fps)

Pond S114: Culvert 114



Summary for Pond S115: Culvert 115

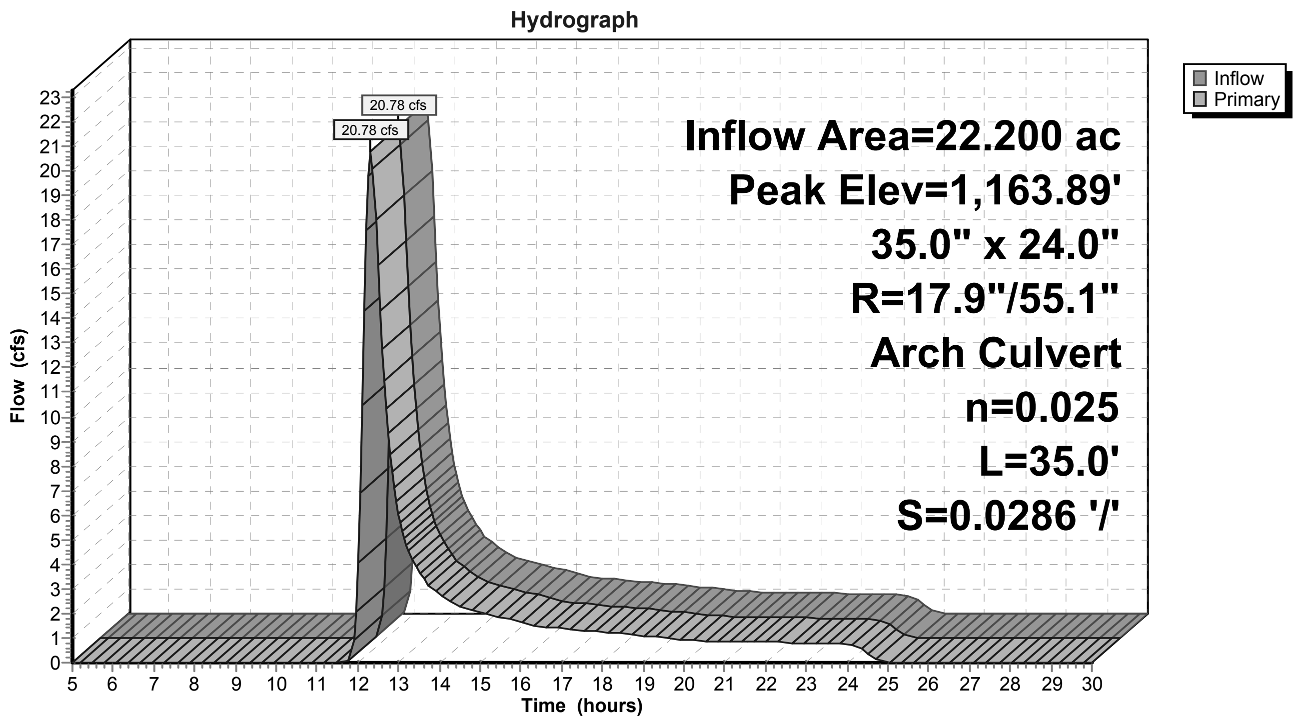
Inflow Area =	22.200 ac,	0.00% Impervious, Inflow Depth = 1.34"	for 25-yr event	
Inflow =	20.78 cfs @	12.32 hrs, Volume=	2.476 af	
Outflow =	20.78 cfs @	12.32 hrs, Volume=	2.476 af,	Atten= 0%, Lag= 0.0 min
Primary =	20.78 cfs @	12.32 hrs, Volume=	2.476 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,163.89' @ 12.32 hrs
Flood Elev= 1,165.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,162.00'	**35.0" W x 24.0" H, R=17.9"/55.1" Arch Culvert** L= 35.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,161.00' S= 0.0286 '/' Cc= 0.900 n= 0.025

Primary OutFlow Max=20.66 cfs @ 12.32 hrs HW=1,163.88' (Free Discharge)
└─**1=Culvert** (Inlet Controls 20.66 cfs @ 4.55 fps)

Pond S115: Culvert 115



Summary for Pond S116: Culvert 116

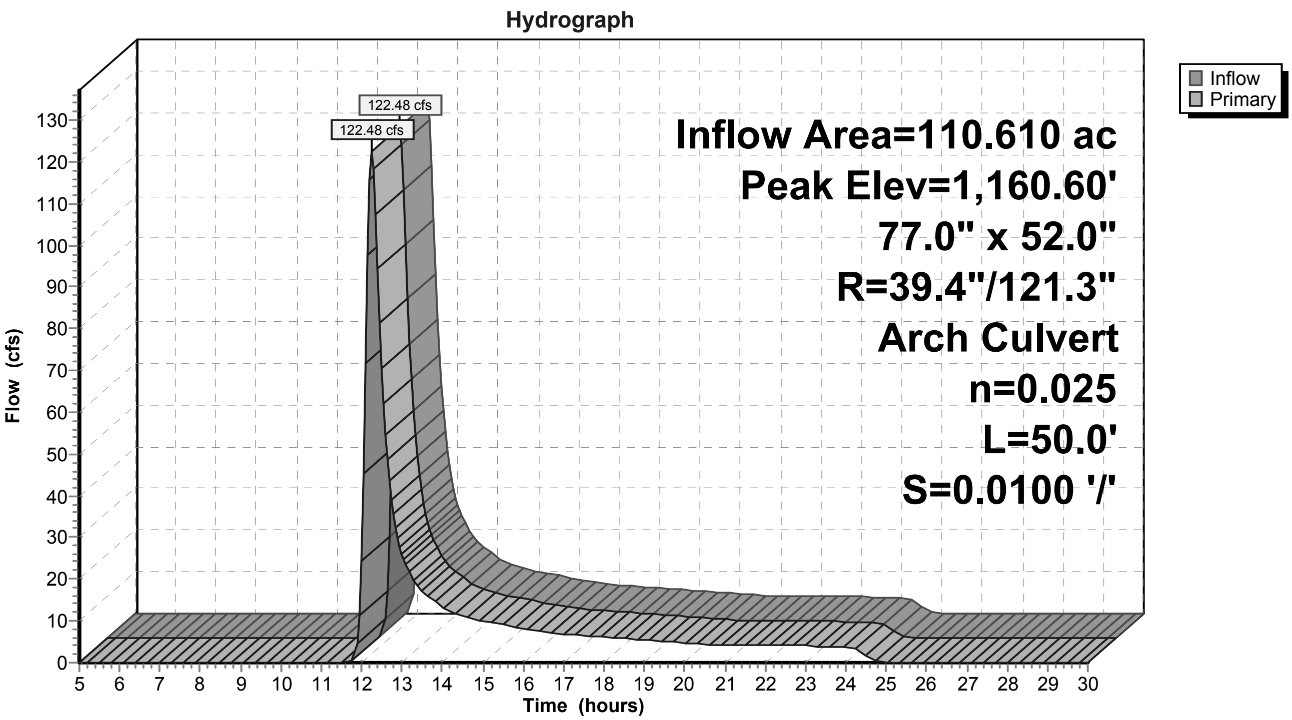
Inflow Area = 110.610 ac, 0.00% Impervious, Inflow Depth = 1.34" for 25-yr event
Inflow = 122.48 cfs @ 12.26 hrs, Volume= 12.336 af
Outflow = 122.48 cfs @ 12.26 hrs, Volume= 12.336 af, Atten= 0%, Lag= 0.0 min
Primary = 122.48 cfs @ 12.26 hrs, Volume= 12.336 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,160.60' @ 12.26 hrs
Flood Elev= 1,162.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,156.50'	**77.0" W x 52.0" H, R=39.4"/121.3" Arch Culvert** L= 50.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,156.00' S= 0.0100 '/' Cc= 0.900 n= 0.025

Primary OutFlow Max=121.96 cfs @ 12.26 hrs HW=1,160.59' (Free Discharge)
└─**1=Culvert** (Barrel Controls 121.96 cfs @ 6.98 fps)

Pond S116: Culvert 116



Summary for Pond S602: Culvert 602

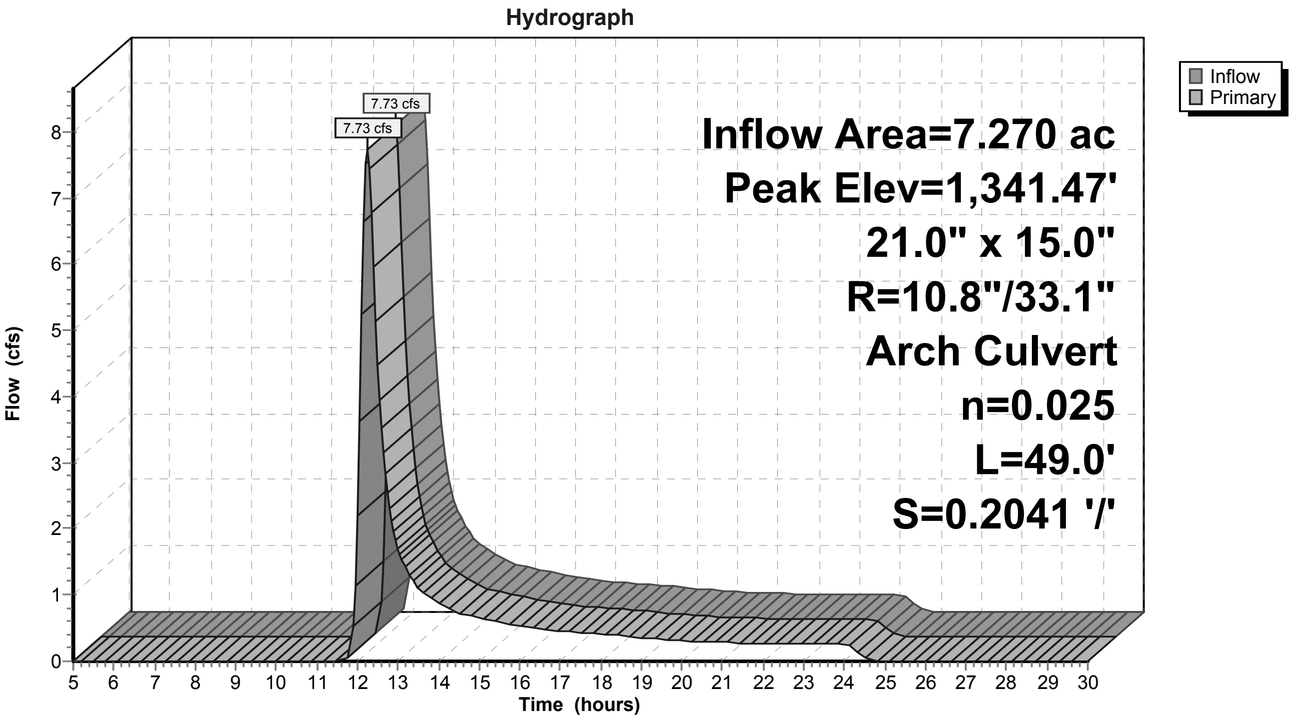
Inflow Area =	7.270 ac,	0.00% Impervious, Inflow Depth = 1.34"	for 25-yr event	
Inflow =	7.73 cfs @	12.25 hrs, Volume=	0.811 af	
Outflow =	7.73 cfs @	12.25 hrs, Volume=	0.811 af,	Atten= 0%, Lag= 0.0 min
Primary =	7.73 cfs @	12.25 hrs, Volume=	0.811 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,341.47' @ 12.25 hrs
Flood Elev= 1,343.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,340.00'	**21.0" W x 15.0" H, R=10.8"/33.1" Arch Culvert** L= 49.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,330.00' S= 0.2041 '/' Cc= 0.900 n= 0.025 Corrugated metal

Primary OutFlow Max=7.72 cfs @ 12.25 hrs HW=1,341.46' (Free Discharge)
└─**1=Culvert** (Inlet Controls 7.72 cfs @ 4.42 fps)

Pond S602: Culvert 602



Summary for Pond S603: Culvert 603

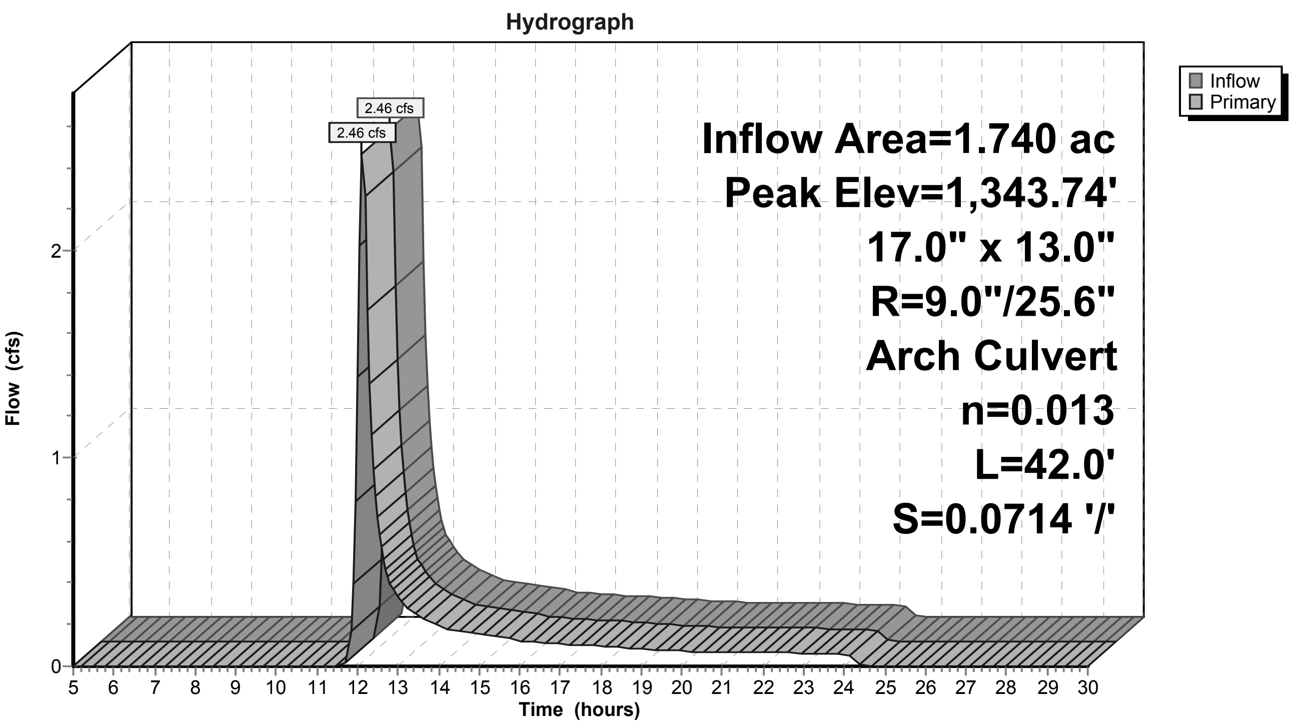
Inflow Area =	1.740 ac,	0.00% Impervious,	Inflow Depth = 1.34"	for 25-yr event	
Inflow =	2.46 cfs @	12.12 hrs,	Volume=	0.194 af	
Outflow =	2.46 cfs @	12.12 hrs,	Volume=	0.194 af,	Atten= 0%, Lag= 0.0 min
Primary =	2.46 cfs @	12.12 hrs,	Volume=	0.194 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,343.74' @ 12.12 hrs
Flood Elev= 1,349.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,343.00'	**17.0" W x 13.0" H, R=9.0"/25.6" Arch Culvert** L= 42.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,340.00' S= 0.0714 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=2.41 cfs @ 12.12 hrs HW=1,343.73' (Free Discharge)
└─**1=Culvert** (Inlet Controls 2.41 cfs @ 2.64 fps)

Pond S603: Culvert 603



Summary for Pond S604: Culvert 604

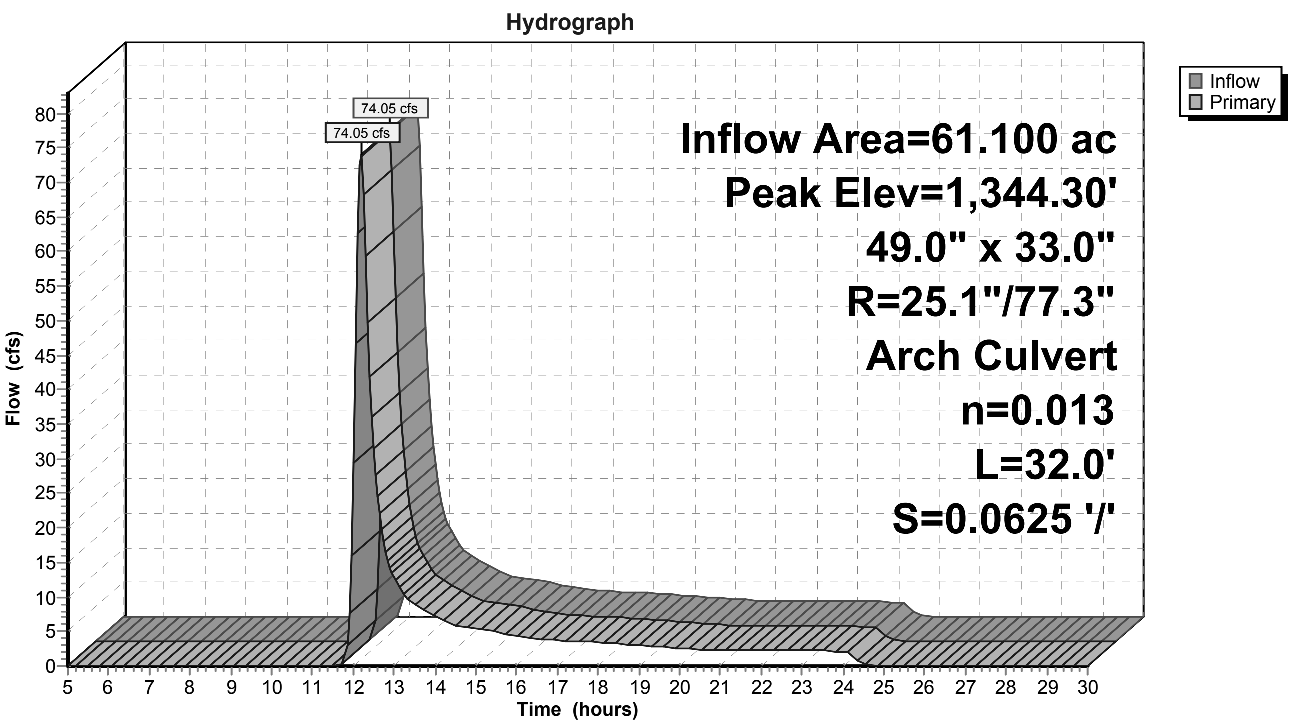
Inflow Area = 61.100 ac, 0.00% Impervious, Inflow Depth = 1.34" for 25-yr event
Inflow = 74.05 cfs @ 12.18 hrs, Volume= 6.814 af
Outflow = 74.05 cfs @ 12.18 hrs, Volume= 6.814 af, Atten= 0%, Lag= 0.0 min
Primary = 74.05 cfs @ 12.18 hrs, Volume= 6.814 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,344.30' @ 12.18 hrs
Flood Elev= 1,350.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,340.00'	**49.0" W x 33.0" H, R=25.1"/77.3" Arch Culvert** L= 32.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,338.00' S= 0.0625 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=73.34 cfs @ 12.18 hrs HW=1,344.25' (Free Discharge)
└─**1=Culvert** (Inlet Controls 73.34 cfs @ 8.24 fps)

Pond S604: Culvert 604



Summary for Pond S605: Culvert 605

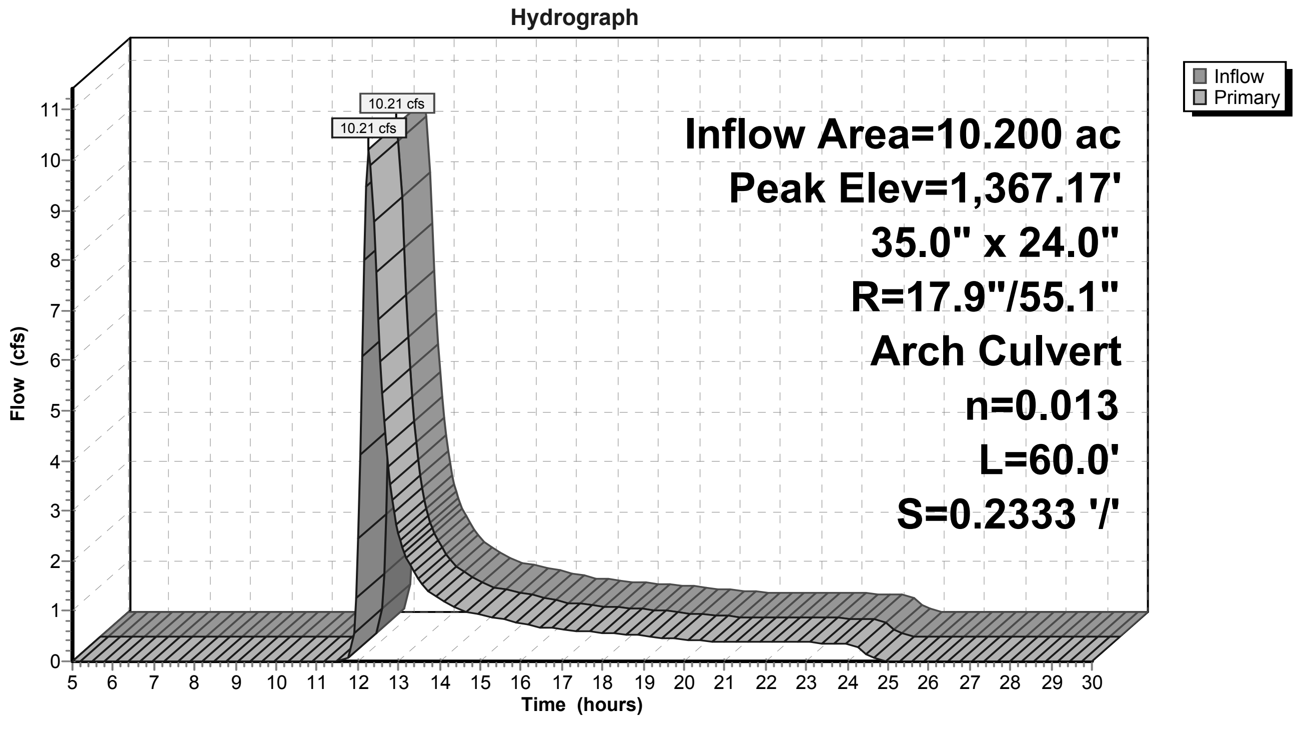
Inflow Area = 10.200 ac, 0.00% Impervious, Inflow Depth = 1.34" for 25-yr event
Inflow = 10.21 cfs @ 12.28 hrs, Volume= 1.138 af
Outflow = 10.21 cfs @ 12.28 hrs, Volume= 1.138 af, Atten= 0%, Lag= 0.0 min
Primary = 10.21 cfs @ 12.28 hrs, Volume= 1.138 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,367.17' @ 12.28 hrs
Flood Elev= 1,368.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,366.00'	**35.0" W x 24.0" H, R=17.9"/55.1" Arch Culvert** L= 60.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,352.00' S= 0.2333 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=10.15 cfs @ 12.28 hrs HW=1,367.17' (Free Discharge)
└─**1=Culvert** (Inlet Controls 10.15 cfs @ 3.34 fps)

Pond S605: Culvert 605



Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 102: To Culvert 102 Runoff Area=30.000 ac 0.00% Impervious Runoff Depth=1.67"
Flow Length=2,965' Tc=30.5 min CN=67 Runoff=38.51 cfs 4.176 af

Subcatchment 109: To Culvert 109 Runoff Area=26.500 ac 0.00% Impervious Runoff Depth=1.67"
Flow Length=1,260' Tc=21.4 min CN=67 Runoff=43.45 cfs 3.688 af

Subcatchment 112: To Culvert 112 Runoff Area=47.500 ac 0.00% Impervious Runoff Depth=1.67"
Flow Length=905' Tc=32.0 min CN=67 Runoff=58.83 cfs 6.611 af

Subcatchment 114: To Culvert 114 Runoff Area=57.200 ac 0.00% Impervious Runoff Depth=1.67"
Flow Length=2,622' Tc=36.8 min CN=67 Runoff=64.07 cfs 7.961 af

Subcatchment 115: To Culvert 115 Runoff Area=22.200 ac 0.00% Impervious Runoff Depth=1.67"
Flow Length=2,417' Tc=32.2 min CN=67 Runoff=27.38 cfs 3.090 af

Subcatchment 116: To Culvert 116 Runoff Area=30.300 ac 0.00% Impervious Runoff Depth=1.67"
Flow Length=1,769' Tc=26.1 min CN=67 Runoff=43.31 cfs 4.217 af

Subcatchment 604: To Culvert 604 Runoff Area=61.100 ac 0.00% Impervious Runoff Depth=1.67"
Flow Length=2,141' Tc=22.3 min CN=67 Runoff=97.16 cfs 8.504 af

Reach R602: Stream Avg. Depth=0.43' Max Vel=6.98 fps Inflow=10.17 cfs 1.012 af
n=0.040 L=1,095.0' S=0.1580 '/' Capacity=113.22 cfs Outflow=10.02 cfs 1.012 af

Reach R603: Stream Avg. Depth=0.22' Max Vel=4.64 fps Inflow=3.21 cfs 0.242 af
n=0.040 L=1,218.0' S=0.1502 '/' Capacity=110.41 cfs Outflow=2.94 cfs 0.242 af

Reach R604: Stream Avg. Depth=1.44' Max Vel=12.47 fps Inflow=97.16 cfs 8.504 af
n=0.040 L=1,316.0' S=0.1364 '/' Capacity=105.20 cfs Outflow=95.10 cfs 8.504 af

Reach R605: Stream Avg. Depth=0.51' Max Vel=7.47 fps Inflow=13.48 cfs 1.420 af
n=0.040 L=1,287.0' S=0.1507 '/' Capacity=110.59 cfs Outflow=13.26 cfs 1.420 af

Pond S102: Culvert 102 Peak Elev=716.12' Inflow=38.51 cfs 4.176 af
42.0" x 29.0", R=21.5"/66.0" Arch Culvert n=0.025 L=35.0' S=0.1000 '/' Outflow=38.51 cfs 4.176 af

Pond S109: Culvert 109 Peak Elev=989.14' Inflow=43.45 cfs 3.688 af
42.0" x 29.0", R=21.5"/66.0" Arch Culvert n=0.025 L=40.0' S=0.0125 '/' Outflow=43.45 cfs 3.688 af

Pond S112: Culvert 112 Peak Elev=1,056.17' Inflow=58.83 cfs 6.611 af
108.0" x 24.0" Box Culvert n=0.025 L=35.0' S=0.0143 '/' Outflow=58.83 cfs 6.611 af

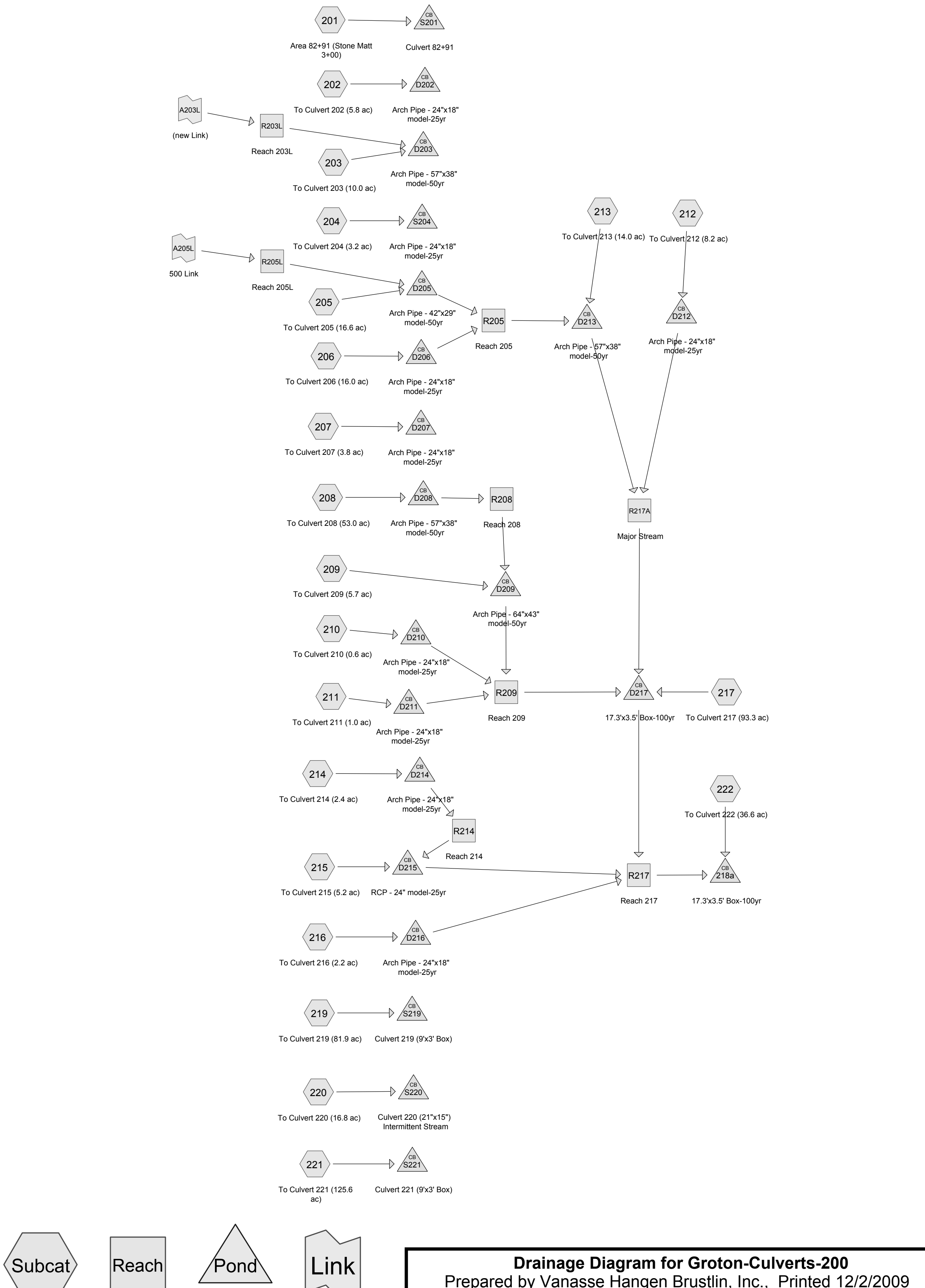
Pond S114: Culvert 114 Peak Elev=1,116.20' Inflow=64.07 cfs 7.961 af
108.0" x 24.0" Box Culvert n=0.025 L=30.0' S=0.0100 '/' Outflow=64.07 cfs 7.961 af

Pond S115: Culvert 115 Peak Elev=1,164.48' Inflow=27.38 cfs 3.090 af
35.0" x 24.0", R=17.9"/55.1" Arch Culvert n=0.025 L=35.0' S=0.0286 '/' Outflow=27.38 cfs 3.090 af

Pond S116: Culvert 116 Peak Elev=1,161.77' Inflow=161.38 cfs 15.395 af
77.0" x 52.0", R=39.4"/121.3" Arch Culvert n=0.025 L=50.0' S=0.0100 '/' Outflow=161.38 cfs 15.395 af

Pond S604: Culvert 604 Peak Elev=1,346.43' Inflow=97.16 cfs 8.504 af
49.0" x 33.0", R=25.1"/77.3" Arch Culvert n=0.013 L=32.0' S=0.0625 '/' Outflow=97.16 cfs 8.504 af

Total Runoff Area = 274.800 ac Runoff Volume = 38.248 af Average Runoff Depth = 1.67"
100.00% Pervious = 274.800 ac 0.00% Impervious = 0.000 ac



Drainage Diagram for Groton-Culverts-200
Prepared by Vanasse Hangen Brustlin, Inc., Printed 12/2/2009
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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
505.100	67	Based on CN for P101 (202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 219, 220, 221, 222)
1.900	67	From Mattress (209)
7.400	67	Mattress (213, 215, 217)
6.946	73	Woods, Fair, HSG C (201)
521.346		**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Goup	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
6.946	HSG C	201
0.000	HSG D	
514.400	Other	202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 219, 220, 221, 222
521.346		**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)
1	218a	1,190.00	1,188.00	73.0	0.0274	0.025	208.0	40.0
2	D202	1,848.00	1,846.00	29.0	0.0690	0.025	24.0	18.0
3	D203	1,784.00	1,776.00	41.0	0.1951	0.025	57.0	38.0
4	D205	1,716.00	1,704.00	55.0	0.2182	0.025	42.0	29.0
5	D206	1,710.00	1,702.00	60.0	0.1333	0.025	24.0	18.0
6	D207	1,656.00	1,654.00	33.0	0.0606	0.025	24.0	18.0
7	D208	1,594.00	1,591.00	52.0	0.0577	0.025	57.0	38.0
8	D209	1,510.00	1,503.00	46.0	0.1522	0.025	64.0	43.0
9	D210	1,512.00	1,504.00	55.0	0.1455	0.025	24.0	18.0
10	D211	1,503.00	1,496.00	48.0	0.1458	0.025	24.0	18.0
11	D212	1,452.00	1,442.00	35.0	0.2857	0.025	24.0	18.0
12	D213	1,448.00	1,440.00	38.0	0.2105	0.025	57.0	38.0
13	D214	1,397.00	1,382.00	71.0	0.2113	0.025	24.0	18.0
14	D215	1,308.00	1,298.00	122.0	0.0820	0.025	24.0	0.0
15	D216	1,300.00	1,292.00	52.0	0.1538	0.025	24.0	18.0
16	D217	1,268.00	1,264.00	32.0	0.1250	0.025	204.0	40.0
17	S201	1,972.00	1,964.00	69.0	0.1159	0.025	17.0	13.0
18	S204	1,782.00	1,767.00	69.0	0.2174	0.025	24.0	18.0
19	S219	1,201.00	1,200.50	35.0	0.0143	0.025	108.0	24.0
20	S220	1,201.00	1,200.00	35.0	0.0286	0.025	21.0	15.0
21	S221	1,186.50	1,186.00	35.0	0.0143	0.025	108.0	24.0

Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment201: Area 82+91 (Stone Runoff Area=302,570 sf 0.00% Impervious Runoff Depth=1.84"
Flow Length=1,591' Tc=62.9 min CN=73 Runoff=6.19 cfs 1.067 af

Subcatchment202: To Culvert 202 (5.8 ac) Runoff Area=5.800 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=1,295' Tc=27.5 min CN=67 Runoff=6.09 cfs 0.647 af

Subcatchment203: To Culvert 203 (10.0 ac) Runoff Area=10.000 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=1,438' Tc=20.4 min CN=67 Runoff=12.90 cfs 1.115 af

Subcatchment204: To Culvert 204 (3.2 ac) Runoff Area=3.200 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=1,396' Tc=22.5 min CN=67 Runoff=3.85 cfs 0.357 af

Subcatchment205: To Culvert 205 (16.6 ac) Runoff Area=16.600 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=2,216' Tc=29.0 min CN=67 Runoff=16.78 cfs 1.851 af

Subcatchment206: To Culvert 206 (16.0 ac) Runoff Area=16.000 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=1,964' Tc=18.1 min CN=67 Runoff=22.20 cfs 1.784 af

Subcatchment207: To Culvert 207 (3.8 ac) Runoff Area=3.800 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=867' Tc=19.5 min CN=67 Runoff=5.04 cfs 0.424 af

Subcatchment208: To Culvert 208 (53.0 ac) Runoff Area=53.000 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=2,839' Tc=33.1 min CN=67 Runoff=48.62 cfs 5.911 af

Subcatchment209: To Culvert 209 (5.7 ac) Runoff Area=7.600 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=1,417' Tc=20.1 min CN=67 Runoff=9.89 cfs 0.848 af

Subcatchment210: To Culvert 210 (0.6 ac) Runoff Area=0.600 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=318' Tc=16.3 min CN=67 Runoff=0.89 cfs 0.067 af

Subcatchment211: To Culvert 211 (1.0 ac) Runoff Area=1.000 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=462' Tc=19.7 min CN=67 Runoff=1.32 cfs 0.112 af

Subcatchment212: To Culvert 212 (8.2 ac) Runoff Area=11.400 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=1,805' Tc=25.9 min CN=67 Runoff=12.45 cfs 1.271 af

Subcatchment213: To Culvert 213 (14.0 ac) Runoff Area=19.900 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=3,233' Tc=29.7 min CN=67 Runoff=19.74 cfs 2.219 af

Subcatchment214: To Culvert 214 (2.4 ac) Runoff Area=2.400 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=724' Tc=19.5 min CN=67 Runoff=3.18 cfs 0.268 af

Subcatchment215: To Culvert 215 (5.2 ac) Runoff Area=5.900 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=1,115' Tc=18.3 min CN=67 Runoff=8.13 cfs 0.658 af

Subcatchment216: To Culvert 216 (2.2 ac) Runoff Area=2.200 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=578' Tc=20.8 min CN=67 Runoff=2.80 cfs 0.245 af

Subcatchment217: To Culvert 217 (93.3 ac) Runoff Area=94.100 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=578' Tc=20.8 min CN=67 Runoff=119.81 cfs 10.495 af

Subcatchment219: To Culvert 219 (81.9 ac) Runoff Area=81.900 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=5,195' Tc=30.5 min CN=67 Runoff=79.82 cfs 9.134 af

Subcatchment220: To Culvert 220 (16.8 ac) Runoff Area=16.800 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=2,592' Tc=49.1 min CN=67 Runoff=11.54 cfs 1.874 af

Subcatchment221: To Culvert 221 (125.6 Runoff Area=125.600 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=4,131' Tc=57.4 min CN=67 Runoff=77.17 cfs 14.008 af

Subcatchment222: To Culvert 222 (36.6 ac) Runoff Area=36.600 ac 0.00% Impervious Runoff Depth=1.34"
Flow Length=2,917' Tc=34.1 min CN=67 Runoff=32.83 cfs 4.082 af

Reach R203L: Reach 203L Avg. Depth=0.42' Max Vel=7.78 fps Inflow=26.97 cfs 3.596 af
n=0.040 L=1,354.0' S=0.2437 '/' Capacity=178.76 cfs Outflow=26.75 cfs 3.596 af

Reach R205: Reach 205 Avg. Depth=0.43' Max Vel=7.48 fps Inflow=46.22 cfs 5.921 af
n=0.040 L=1,400.0' S=0.1786 '/' Capacity=2,690.71 cfs Outflow=45.78 cfs 5.921 af

Reach R205L: Reach 205L Avg. Depth=0.35' Max Vel=6.44 fps Inflow=20.11 cfs 2.285 af
n=0.040 L=2,191.0' S=0.1926 '/' Capacity=4,824.43 cfs Outflow=19.22 cfs 2.285 af

Reach R208: Reach 208 Avg. Depth=0.64' Max Vel=7.81 fps Inflow=48.62 cfs 5.911 af
n=0.040 L=585.0' S=0.1385 '/' Capacity=601.39 cfs Outflow=48.33 cfs 5.911 af

Reach R209: Reach 209 Avg. Depth=0.66' Max Vel=6.96 fps Inflow=54.88 cfs 6.937 af
n=0.040 L=2,098.0' S=0.1125 '/' Capacity=10,342.61 cfs Outflow=52.80 cfs 6.937 af

Reach R214: Reach 214 Avg. Depth=0.10' Max Vel=2.80 fps Inflow=3.18 cfs 0.268 af
n=0.040 L=594.0' S=0.1246 '/' Capacity=629.85 cfs Outflow=3.03 cfs 0.268 af

Reach R217: Reach 217 Avg. Depth=1.11' Max Vel=7.94 fps Inflow=190.84 cfs 28.015 af
n=0.040 L=2,631.0' S=0.0699 '/' Capacity=3,336.17 cfs Outflow=186.67 cfs 28.015 af

Reach R217A: Major Stream Avg. Depth=0.79' Max Vel=7.26 fps Inflow=76.43 cfs 9.412 af
n=0.040 L=1,775.0' S=0.0992 '/' Capacity=9,710.33 cfs Outflow=73.82 cfs 9.412 af

Pond 218a: 17.3'x3.5' Box-100yr Peak Elev=1,192.67' Inflow=214.39 cfs 32.097 af
208.0" x 40.0" Box Culvert n=0.025 L=73.0' S=0.0274 '/' Outflow=214.39 cfs 32.097 af

Pond D202: Arch Pipe - 24"x18" model-25yr Peak Elev=1,849.07' Inflow=6.09 cfs 0.647 af
24.0" x 18.0", R=12.9"/34.6" Arch Culvert n=0.025 L=29.0' S=0.0690 '/' Outflow=6.09 cfs 0.647 af

Pond D203: Arch Pipe - 57"x38" model-50yr Peak Elev=1,785.78' Inflow=31.17 cfs 4.712 af
57.0" x 38.0", R=28.9"/88.3" Arch Culvert n=0.025 L=41.0' S=0.1951 '/' Outflow=31.17 cfs 4.712 af

Pond D205: Arch Pipe - 42"x29" model-50yr Peak Elev=1,718.33' Inflow=33.89 cfs 4.137 af
42.0" x 29.0", R=21.5"/66.0" Arch Culvert n=0.025 L=55.0' S=0.2182 '/' Outflow=33.89 cfs 4.137 af

Pond D206: Arch Pipe - 24"x18" model-25yr Peak Elev=1,714.40' Inflow=22.20 cfs 1.784 af
24.0" x 18.0", R=12.9"/34.6" Arch Culvert n=0.025 L=60.0' S=0.1333 '/' Outflow=22.20 cfs 1.784 af

Pond D207: Arch Pipe - 24"x18" model-25yr Peak Elev=1,656.96' Inflow=5.04 cfs 0.424 af
24.0" x 18.0", R=12.9"/34.6" Arch Culvert n=0.025 L=33.0' S=0.0606 '/' Outflow=5.04 cfs 0.424 af

Pond D208: Arch Pipe - 57"x38" model-50yr Peak Elev=1,596.37' Inflow=48.62 cfs 5.911 af
57.0" x 38.0", R=28.9"/88.3" Arch Culvert n=0.025 L=52.0' S=0.0577 '/' Outflow=48.62 cfs 5.911 af

Pond D209: Arch Pipe - 64"x43" model-50yr Peak Elev=1,512.35' Inflow=53.78 cfs 6.759 af
64.0" x 43.0", R=32.5"/99.3" Arch Culvert n=0.025 L=46.0' S=0.1522 '/' Outflow=53.78 cfs 6.759 af

Pond D210: Arch Pipe - 24"x18" model-25yr Peak Elev=1,512.35' Inflow=0.89 cfs 0.067 af
24.0" x 18.0", R=12.9"/34.6" Arch Culvert n=0.025 L=55.0' S=0.1455 '/' Outflow=0.89 cfs 0.067 af

Pond D211: Arch Pipe - 24"x18" model-25yr Peak Elev=1,503.44' Inflow=1.32 cfs 0.112 af
24.0" x 18.0", R=12.9"/34.6" Arch Culvert n=0.025 L=48.0' S=0.1458 '/' Outflow=1.32 cfs 0.112 af

Pond D212: Arch Pipe - 24"x18" model-25yr Peak Elev=1,453.91' Inflow=12.45 cfs 1.271 af
24.0" x 18.0", R=12.9"/34.6" Arch Culvert n=0.025 L=35.0' S=0.2857 '/' Outflow=12.45 cfs 1.271 af

Pond D213: Arch Pipe - 57"x38" model-50yr Peak Elev=1,450.92' Inflow=65.06 cfs 8.140 af
57.0" x 38.0", R=28.9"/88.3" Arch Culvert n=0.025 L=38.0' S=0.2105 '/' Outflow=65.06 cfs 8.140 af

Pond D214: Arch Pipe - 24"x18" model-25yr Peak Elev=1,397.73' Inflow=3.18 cfs 0.268 af
24.0" x 18.0", R=12.9"/34.6" Arch Culvert n=0.025 L=71.0' S=0.2113 '/' Outflow=3.18 cfs 0.268 af

Pond D215: RCP - 24" model-25yr Peak Elev=1,309.48' Inflow=10.36 cfs 0.926 af
24.0" Round Culvert n=0.025 L=122.0' S=0.0820 '/' Outflow=10.36 cfs 0.926 af

Pond D216: Arch Pipe - 24"x18" model-25yr Peak Elev=1,300.67' Inflow=2.80 cfs 0.245 af
24.0" x 18.0", R=12.9"/34.6" Arch Culvert n=0.025 L=52.0' S=0.1538 '/' Outflow=2.80 cfs 0.245 af

Pond D217: 17.3'x3.5' Box-100yr Peak Elev=1,270.43' Inflow=182.81 cfs 26.844 af
204.0" x 40.0" Box Culvert n=0.025 L=32.0' S=0.1250 '/' Outflow=182.81 cfs 26.844 af

Pond S201: Culvert 82+91 Peak Elev=1,973.63' Inflow=6.19 cfs 1.067 af
17.0" x 13.0", R=9.0"/25.6" Arch Culvert n=0.025 L=69.0' S=0.1159 '/' Outflow=6.19 cfs 1.067 af

Pond S204: Arch Pipe - 24"x18" model-25yr Peak Elev=1,782.81' Inflow=3.85 cfs 0.357 af
24.0" x 18.0", R=12.9"/34.6" Arch Culvert n=0.025 L=69.0' S=0.2174 '/' Outflow=3.85 cfs 0.357 af

Pond S219: Culvert 219 (9'x3' Box) Peak Elev=1,203.08' Inflow=79.82 cfs 9.134 af
108.0" x 24.0" Box Culvert n=0.025 L=35.0' S=0.0143 '/' Outflow=79.82 cfs 9.134 af

Pond S220: Culvert 220 (21"x15") Intermittent Stream Peak Elev=1,203.95' Inflow=11.54 cfs 1.874 af
21.0" x 15.0", R=10.8"/33.1" Arch Culvert n=0.025 L=35.0' S=0.0286 '/' Outflow=11.54 cfs 1.874 af

Pond S221: Culvert 221 (9'x3' Box) Peak Elev=1,188.53' Inflow=77.17 cfs 14.008 af
108.0" x 24.0" Box Culvert n=0.025 L=35.0' S=0.0143 '/' Outflow=77.17 cfs 14.008 af

Link 25-yr Primary Outflow Imported from Culverts-500-Southeast~Link A203.hce Inflow=26.97 cfs 3.596 af
Area= 23.415 ac Primary=26.97 cfs 3.596 af

Link 25-yr Primary Outflow Imported from Culverts-500-Southeast~Link A205.hce Inflow=20.11 cfs 2.285 af
Area= 14.878 ac Primary=20.11 cfs 2.285 af

Total Runoff Area = 521.346 ac Runoff Volume = 58.437 af Average Runoff Depth = 1.35"
100.00% Pervious = 521.346 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 201: Area 82+91 (Stone Matt 3+00)

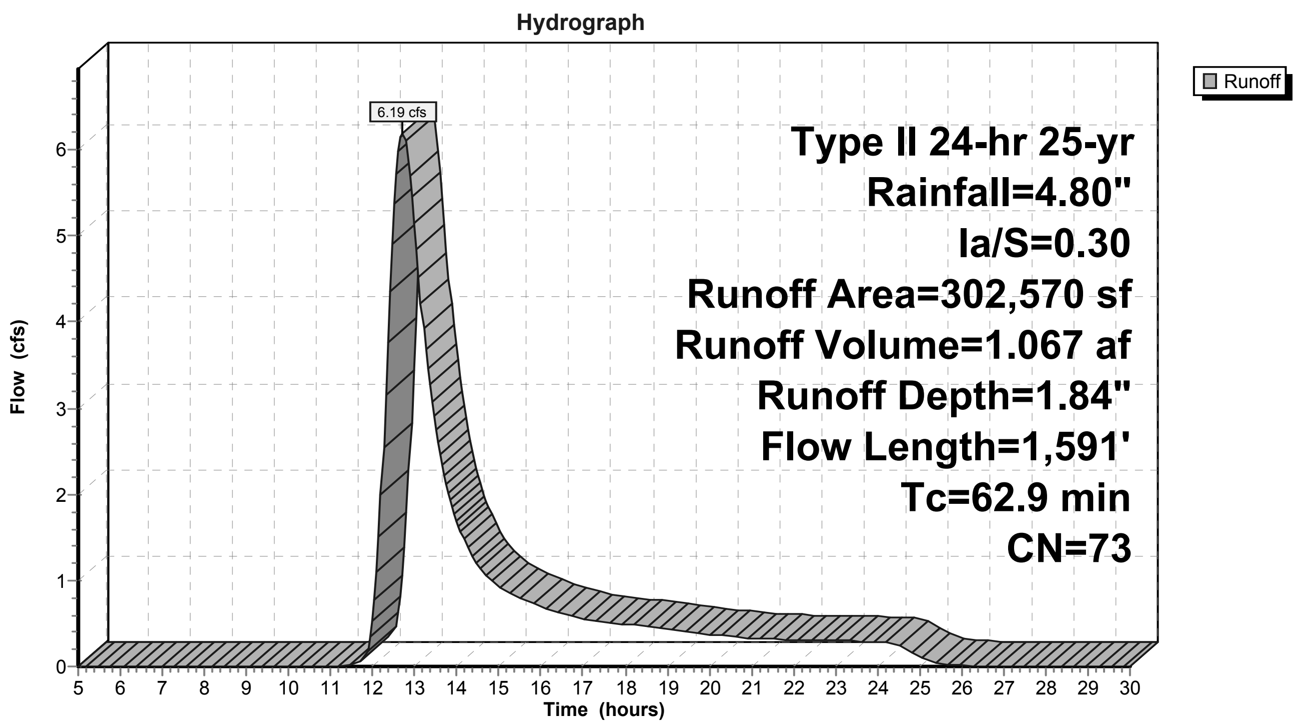
Runoff = 6.19 cfs @ 12.71 hrs, Volume= 1.067 af, Depth= 1.84"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

Area (sf)	CN	Description
302,570	73	Woods, Fair, HSG C
302,570		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	30	0.0200	0.08		**Sheet Flow, Gravel Road** Grass: Dense n= 0.240 P2= 2.60"
31.2	70	0.0200	0.04		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
1.9	468	0.1100	4.11	6.17	**Trap/Vee/Rect Channel Flow, Road Side Swale** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.060
12.3	523	0.0800	0.71		**Shallow Concentrated Flow, Woods** Forest w/Heavy Litter Kv= 2.5 fps
0.4	30	0.0200	1.24	12.42	**Channel Flow, Stone Mattress @ 3+00** Area= 10.0 sf Perim= 22.0' r= 0.45' n= 0.100
11.1	470	0.0800	0.71		**Shallow Concentrated Flow, Woods** Forest w/Heavy Litter Kv= 2.5 fps
62.9	1,591	Total			

Subcatchment 201: Area 82+91 (Stone Matt 3+00)



Summary for Subcatchment 202: To Culvert 202 (5.8 ac)

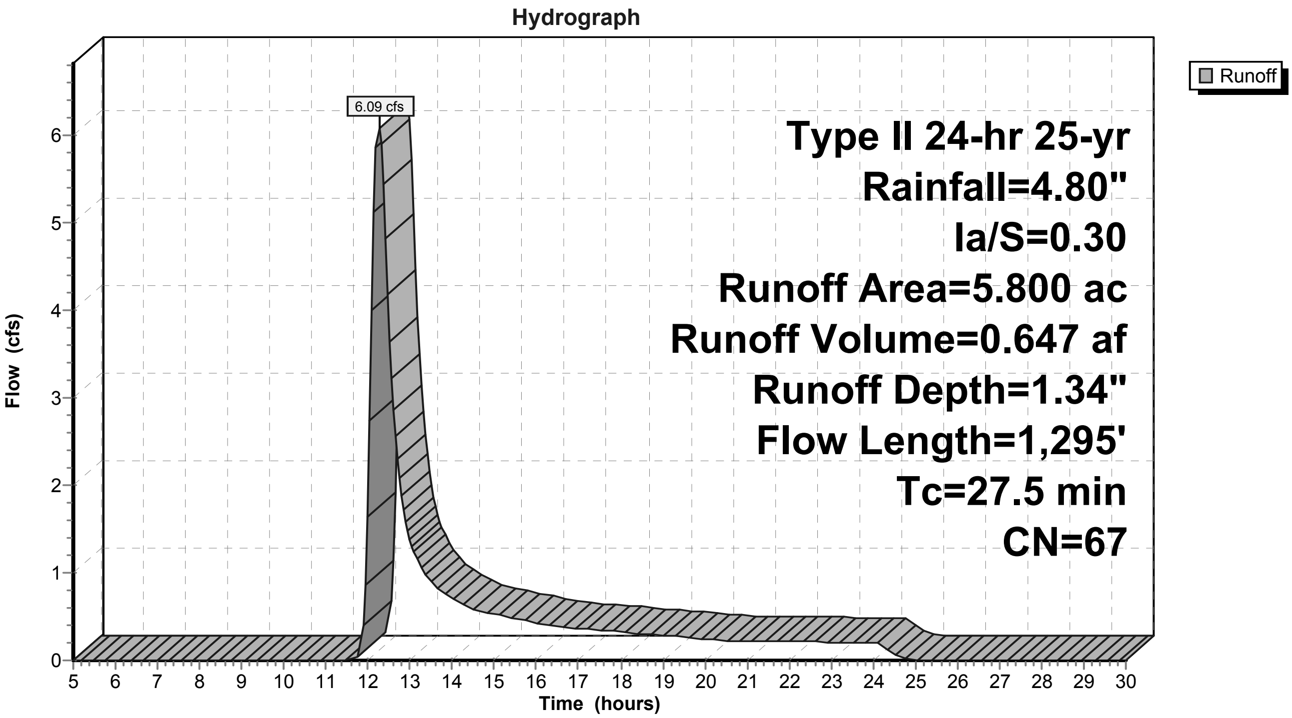
Runoff = 6.09 cfs @ 12.25 hrs, Volume= 0.647 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	5.800	67	Based on CN for P101
	5.800		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.6	100	0.1150	0.08		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
0.8	83	0.1150	1.70		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
2.3	288	0.0200	2.10	3.16	**Trap/Vee/Rect Channel Flow, Wetland** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.050 Mountain streams w/large boulders
0.4	132	0.1000	5.88	8.82	**Trap/Vee/Rect Channel Flow, Stream** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040 Mountain streams
3.1	493	0.2800	2.65		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.3	199	0.4400	12.33	18.50	**Trap/Vee/Rect Channel Flow, Stream** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040 Mountain streams
27.5	1,295	Total			

Subcatchment 202: To Culvert 202 (5.8 ac)



Summary for Subcatchment 203: To Culvert 203 (10.0 ac)

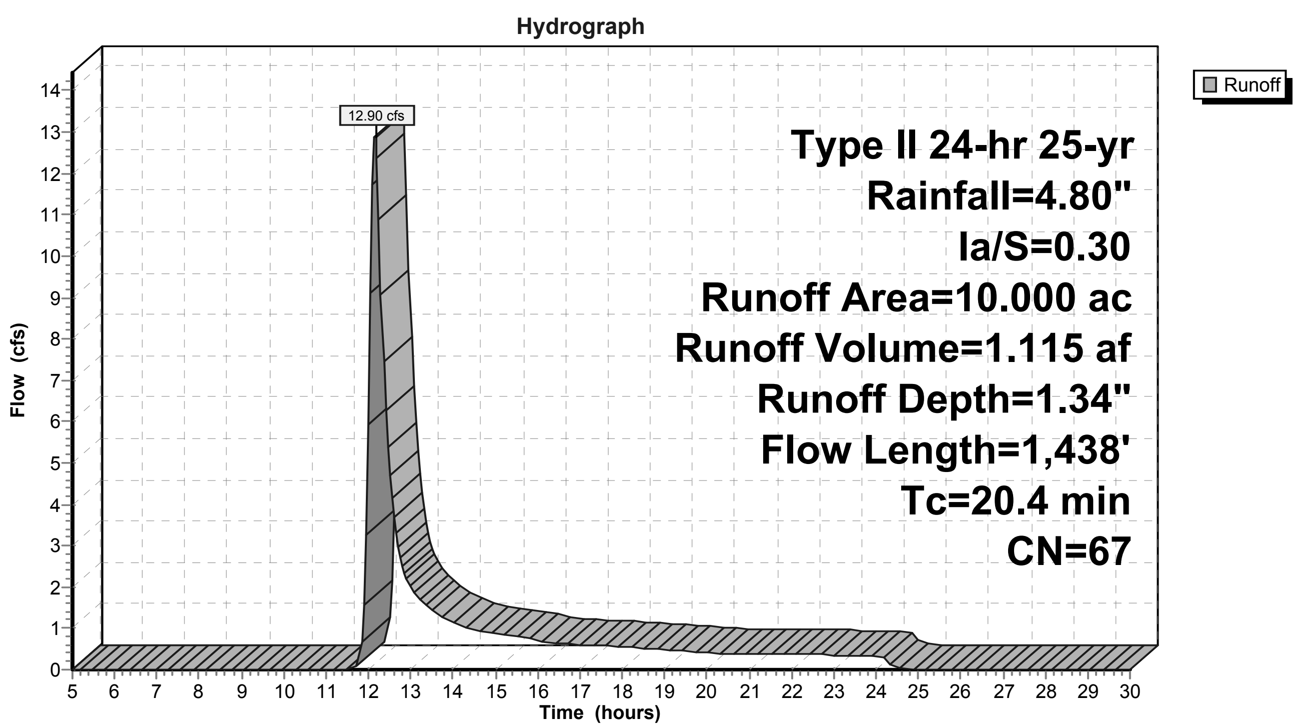
Runoff = 12.90 cfs @ 12.16 hrs, Volume= 1.115 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	10.000	67	Based on CN for P101
	10.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.2	100	0.1800	0.10		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
1.1	137	0.1800	2.12		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
2.1	1,201	0.2600	9.48	14.22	**Trap/Vee/Rect Channel Flow, Stream** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040 Mountain streams
20.4	1,438	Total			

Subcatchment 203: To Culvert 203 (10.0 ac)



Summary for Subcatchment 204: To Culvert 204 (3.2 ac)

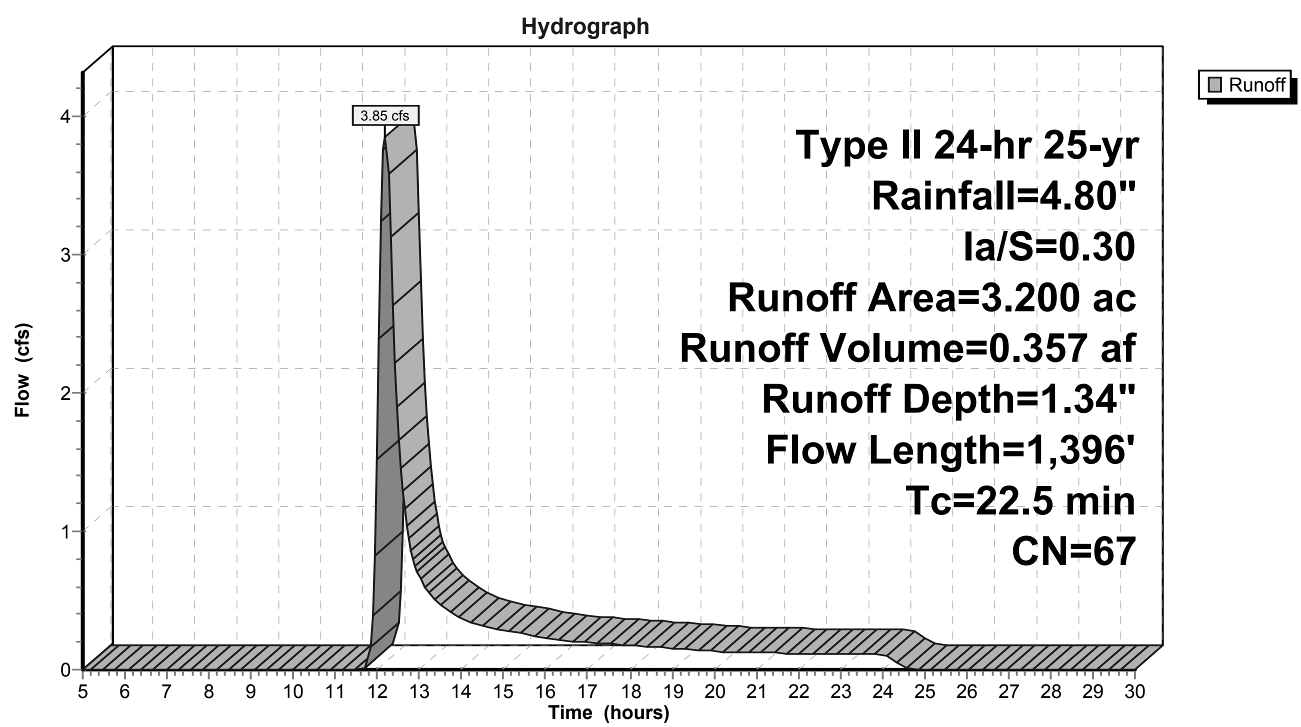
Runoff = 3.85 cfs @ 12.19 hrs, Volume= 0.357 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	3.200	67	Based on CN for P101
	3.200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.1	100	0.2500	0.11		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
6.9	1,041	0.2500	2.50		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.5	255	0.2100	8.52	12.78	**Trap/Vee/Rect Channel Flow, Stream** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040 Mountain streams
22.5	1,396	Total			

Subcatchment 204: To Culvert 204 (3.2 ac)



Summary for Subcatchment 205: To Culvert 205 (16.6 ac)

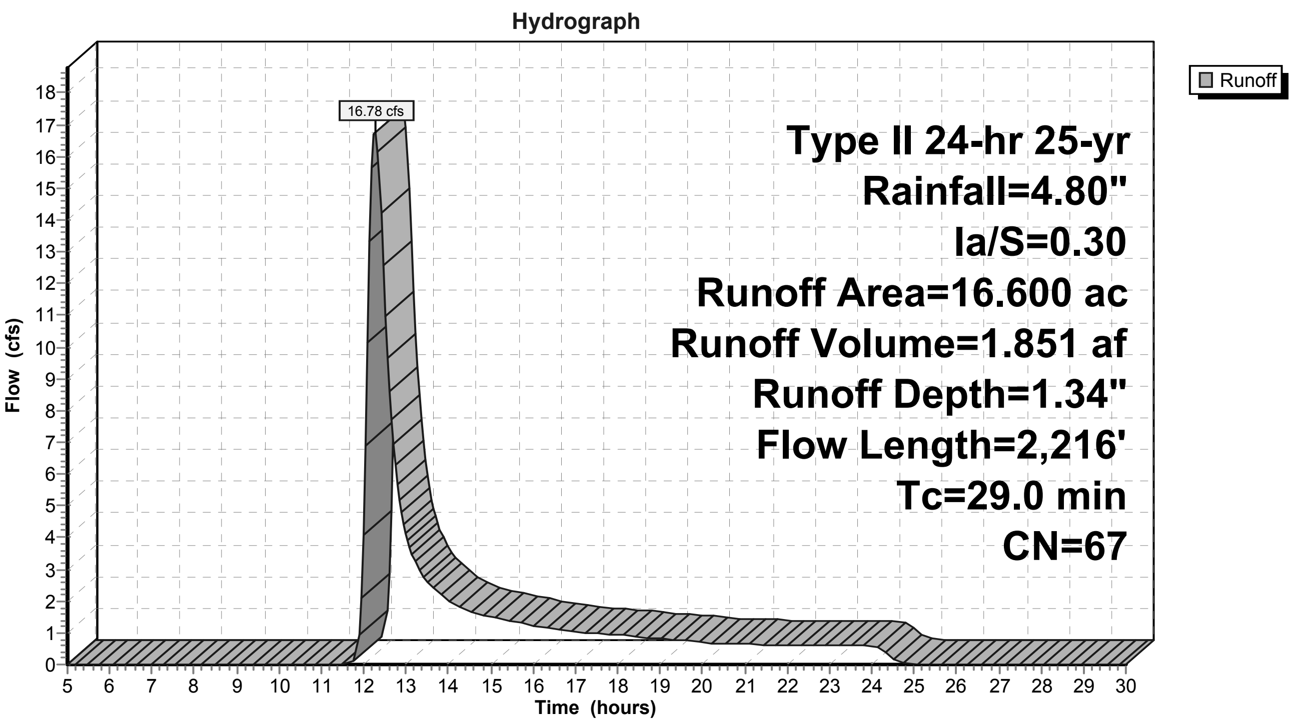
Runoff = 16.78 cfs @ 12.27 hrs, Volume= 1.851 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	16.600	67	Based on CN for P101
	16.600		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.8	100	0.0800	0.07		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
1.4	503	0.1000	5.88	8.82	**Trap/Vee/Rect Channel Flow, Int. Stream** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040 Mountain streams
1.1	183	0.3300	2.87		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
2.7	1,430	0.2200	8.72	13.08	**Trap/Vee/Rect Channel Flow, Stream** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040 Mountain streams
29.0	2,216	Total			

Subcatchment 205: To Culvert 205 (16.6 ac)



Summary for Subcatchment 206: To Culvert 206 (16.0 ac)

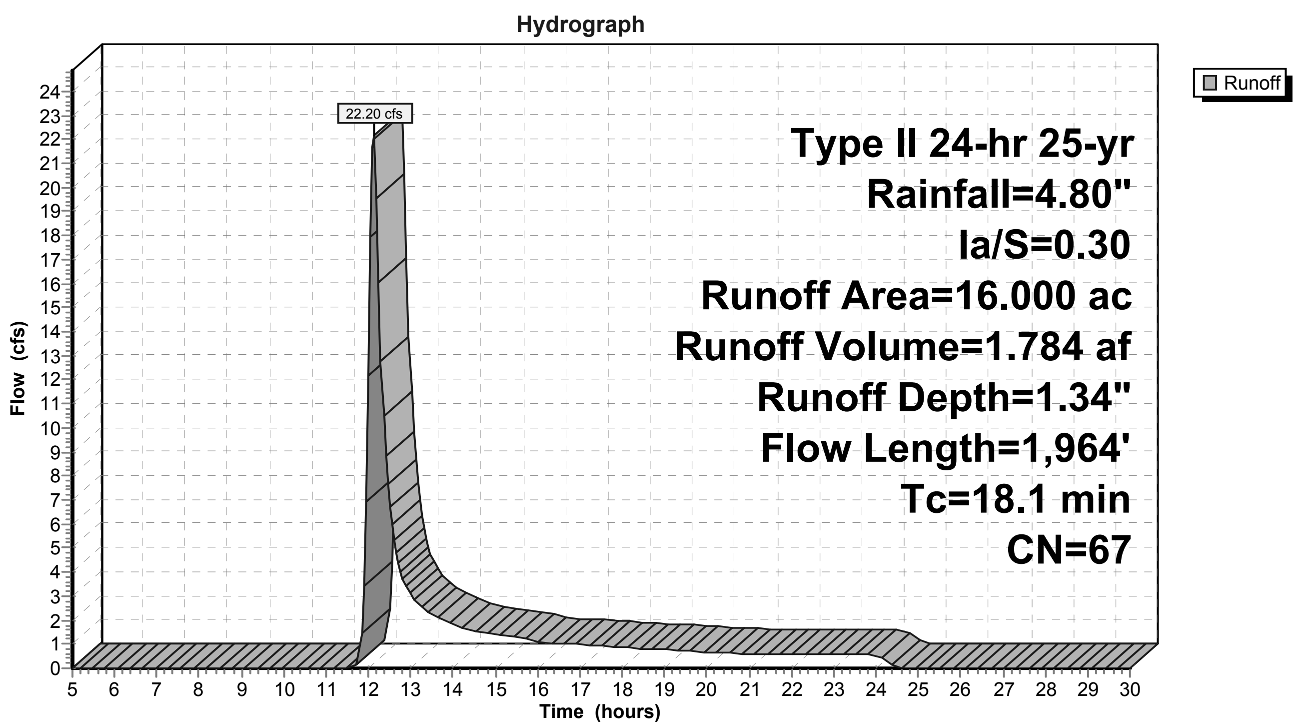
Runoff = 22.20 cfs @ 12.13 hrs, Volume= 1.784 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	16.000	67	Based on CN for P101
	16.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.6	100	0.2700	0.11		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
1.8	1,064	0.2700	9.66	14.49	**Trap/Vee/Rect Channel Flow, Int. Stream** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040 Mountain streams
1.7	800	0.1700	7.67	11.50	**Trap/Vee/Rect Channel Flow, Stream** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040 Mountain streams
18.1	1,964	Total			

Subcatchment 206: To Culvert 206 (16.0 ac)



Summary for Subcatchment 207: To Culvert 207 (3.8 ac)

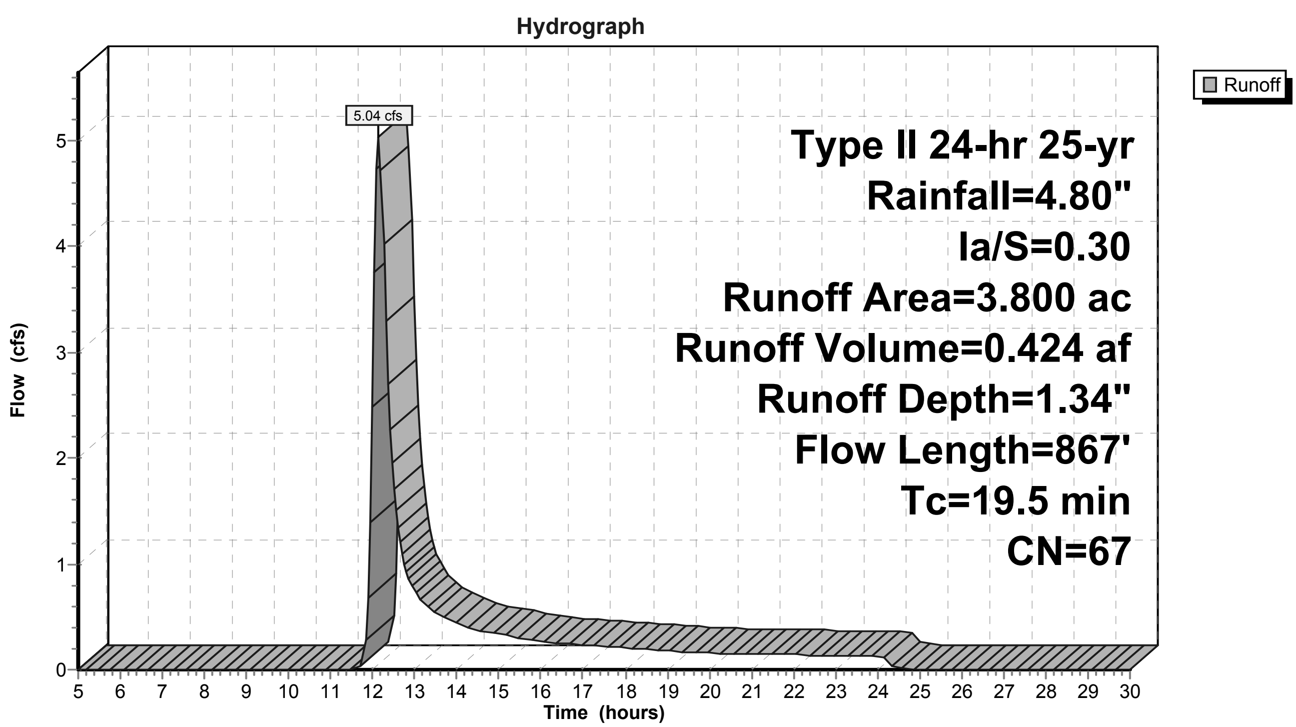
Runoff = 5.04 cfs @ 12.15 hrs, Volume= 0.424 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	3.800	67	Based on CN for P101
	3.800		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.1	100	0.2500	0.11		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
4.1	615	0.2500	2.50		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.3	152	0.2600	9.48	14.22	**Trap/Vee/Rect Channel Flow, Eph. Stream** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040 Mountain streams
19.5	867	Total			

Subcatchment 207: To Culvert 207 (3.8 ac)



Summary for Subcatchment 208: To Culvert 208 (53.0 ac)

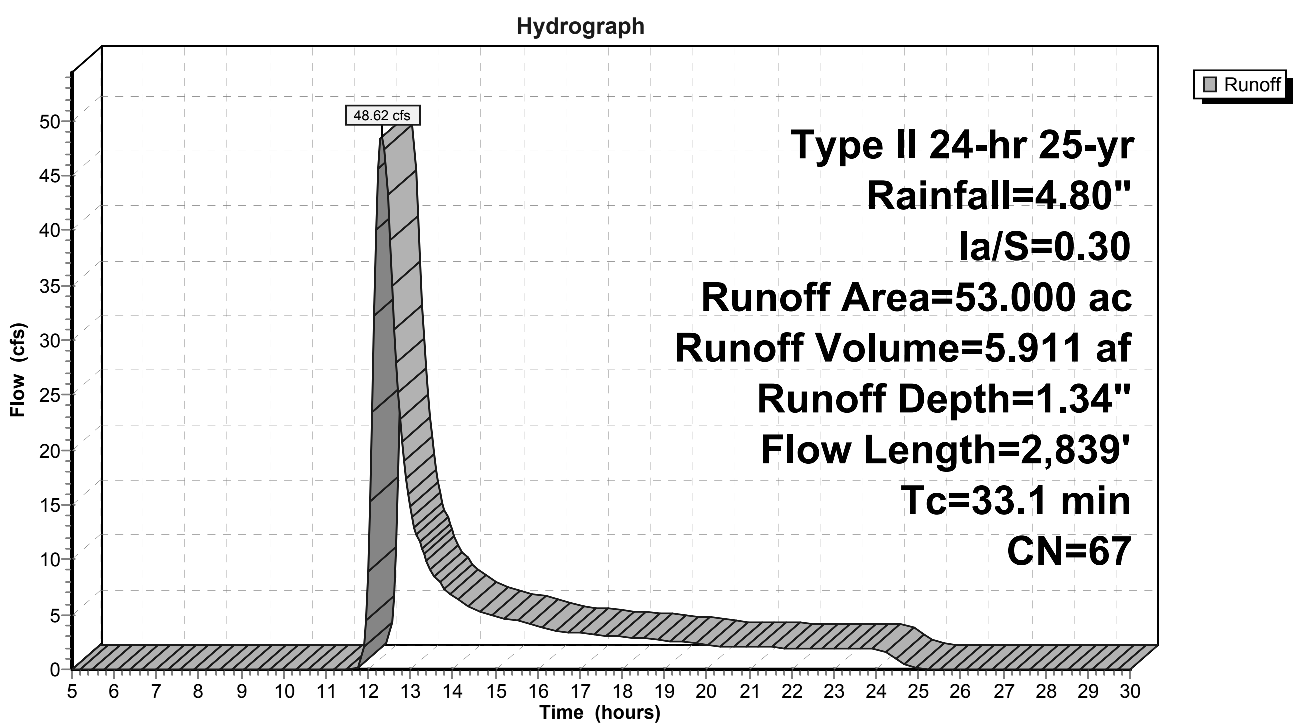
Runoff = 48.62 cfs @ 12.33 hrs, Volume= 5.911 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	53.000	67	Based on CN for P101
	53.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.8	100	0.1000	0.08		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
7.9	1,227	0.2700	2.60		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
3.4	1,512	0.1600	7.44	11.16	**Trap/Vee/Rect Channel Flow, Eph. Stream** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040 Mountain streams
33.1	2,839	Total			

Subcatchment 208: To Culvert 208 (53.0 ac)



Summary for Subcatchment 209: To Culvert 209 (5.7 ac)

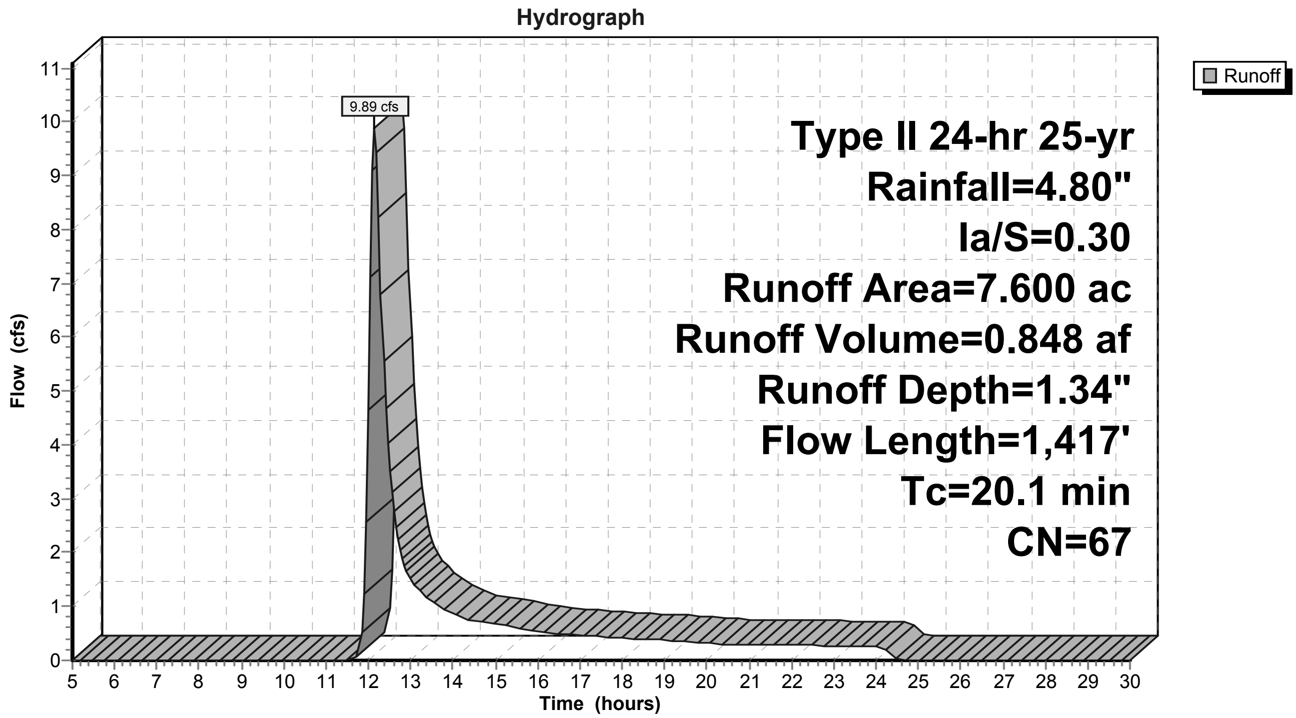
Runoff = 9.89 cfs @ 12.16 hrs, Volume= 0.848 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	5.700	67	Based on CN for P101
*	1.900	67	From Mattress
	7.600	67	Weighted Average
	7.600		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.2	100	0.2900	0.12		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
2.7	438	0.2900	2.69		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.0	230	0.0900	3.72	5.58	**Trap/Vee/Rect Channel Flow, Drainage Ditch** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.060
1.0	153	0.2600	2.55		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.2	496	0.1400	6.96	10.44	**Trap/Vee/Rect Channel Flow, Stream** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040 Mountain streams
20.1	1,417	Total			

Subcatchment 209: To Culvert 209 (5.7 ac)



Summary for Subcatchment 210: To Culvert 210 (0.6 ac)

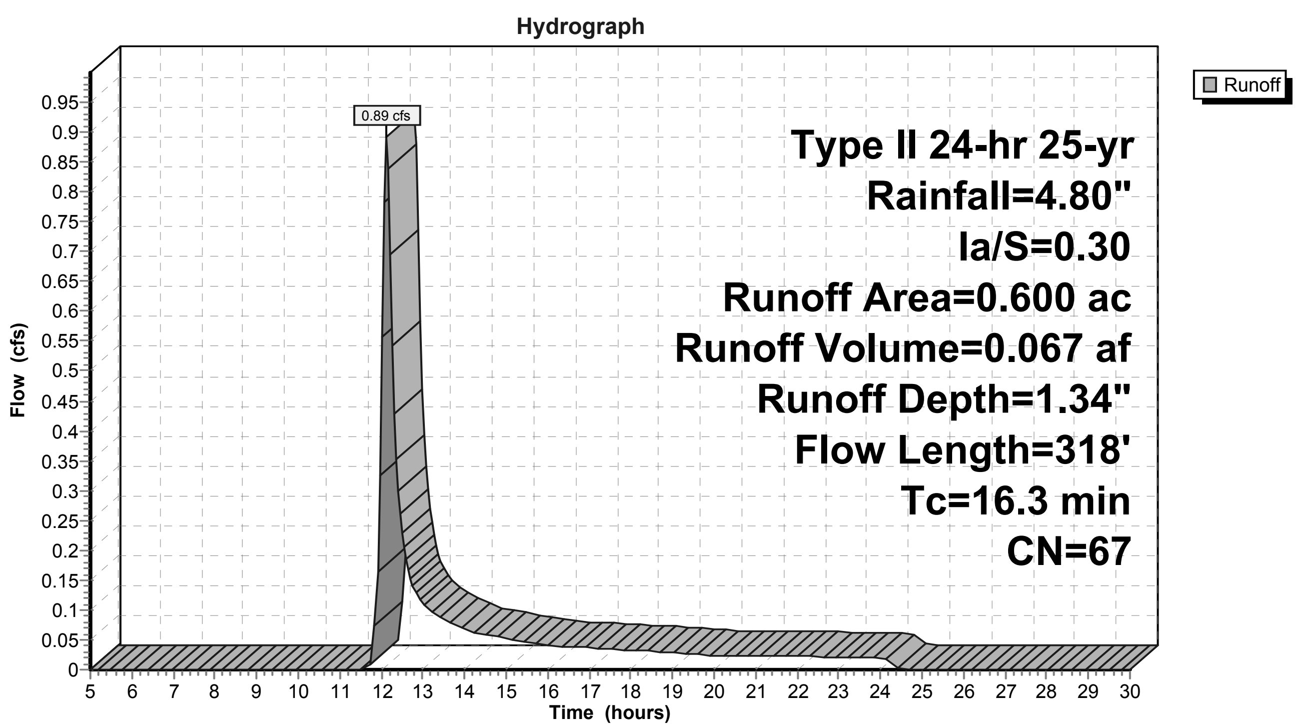
Runoff = 0.89 cfs @ 12.11 hrs, Volume= 0.067 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	0.600	67	Based on CN for P101
	0.600		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.1	100	0.2500	0.11		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
1.0	146	0.2500	2.50		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.2	72	0.1100	6.17	9.25	**Trap/Vee/Rect Channel Flow, Eph. Stream** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040 Mountain streams
16.3	318	Total			

Subcatchment 210: To Culvert 210 (0.6 ac)



Summary for Subcatchment 211: To Culvert 211 (1.0 ac)

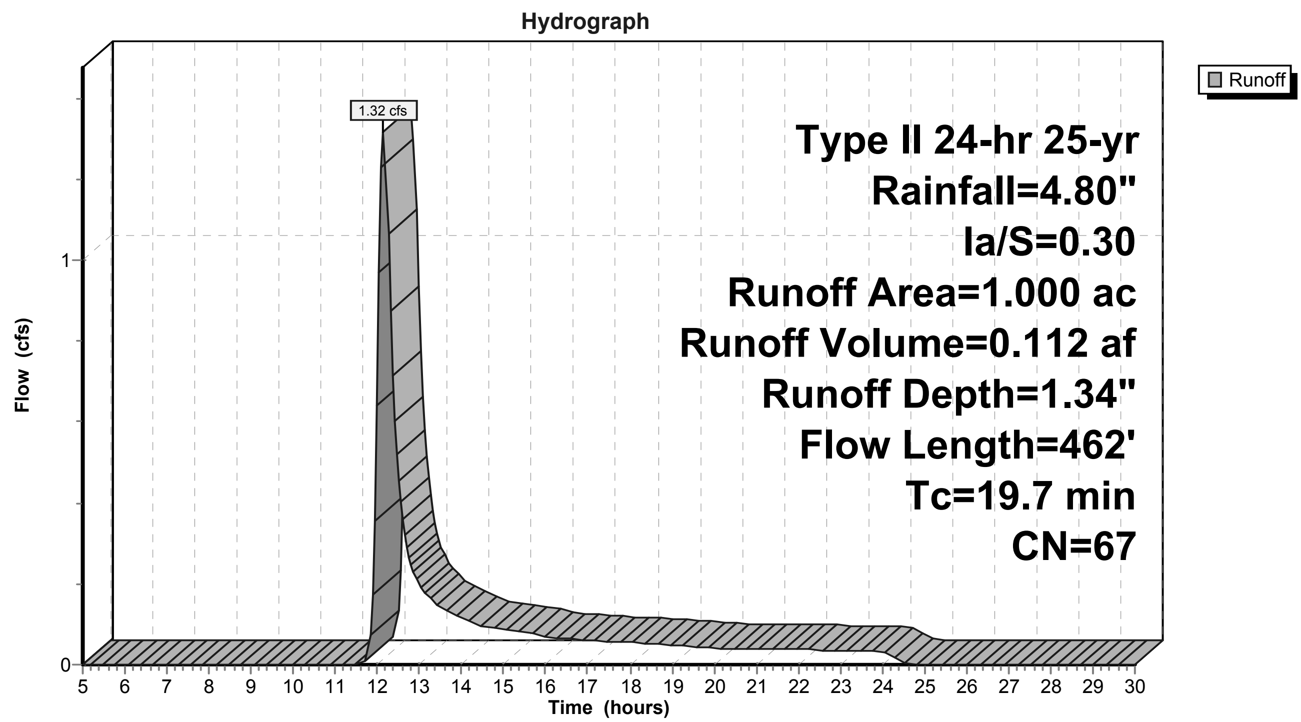
Runoff = 1.32 cfs @ 12.15 hrs, Volume= 0.112 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	1.000	67	Based on CN for P101
	1.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.2	100	0.1800	0.10		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
2.3	294	0.1800	2.12		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.2	68	0.1600	7.44	11.16	**Trap/Vee/Rect Channel Flow, Int. Stream** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040 Mountain streams
19.7	462	Total			

Subcatchment 211: To Culvert 211 (1.0 ac)



Summary for Subcatchment 212: To Culvert 212 (8.2 ac)

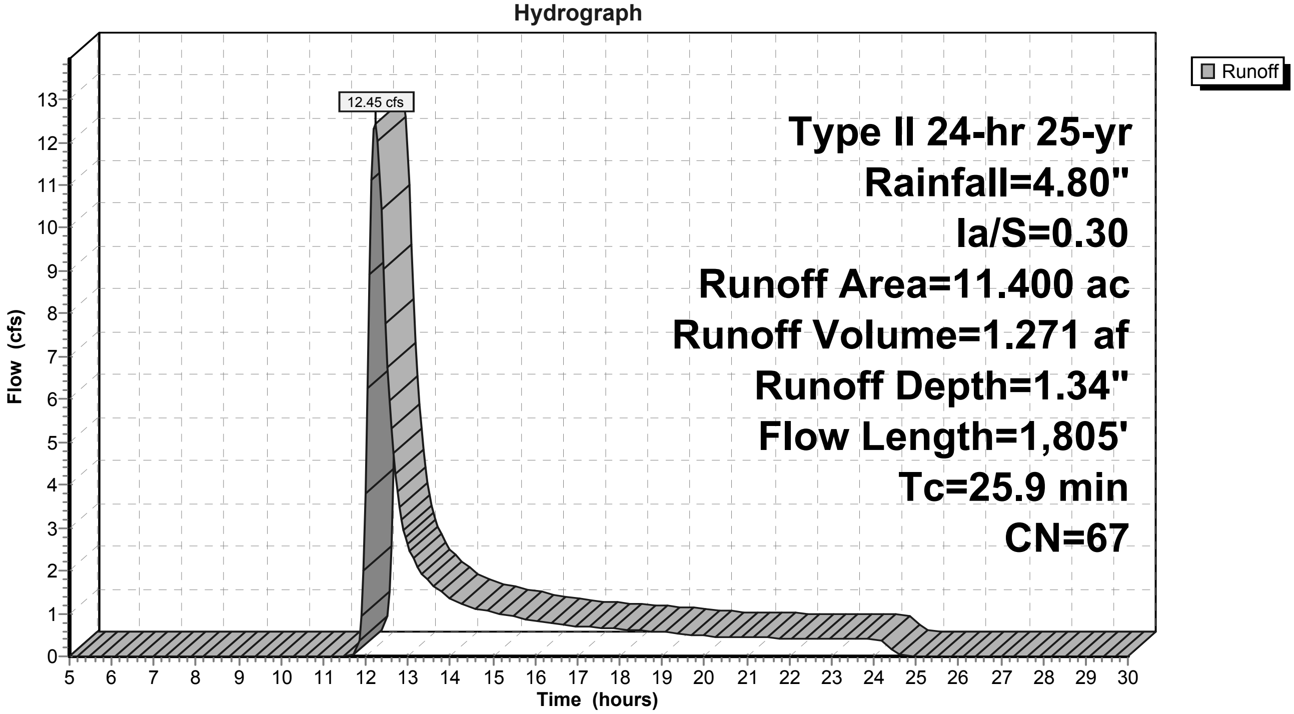
Runoff = 12.45 cfs @ 12.23 hrs, Volume= 1.271 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	8.200	67	Based on CN for P101
*	0.400	67	Based on CN for P101
*	1.100	67	Based on CN for P101
*	1.700	67	Based on CN for P101
	11.400	67	Weighted Average
	11.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	100	0.2600	0.11		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
4.0	615	0.2600	2.55		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
6.6	906	0.2100	2.29		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.4	184	0.1800	7.89	11.83	**Trap/Vee/Rect Channel Flow, Stream** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040 Mountain streams
25.9	1,805	Total			

Subcatchment 212: To Culvert 212 (8.2 ac)



Summary for Subcatchment 213: To Culvert 213 (14.0 ac)

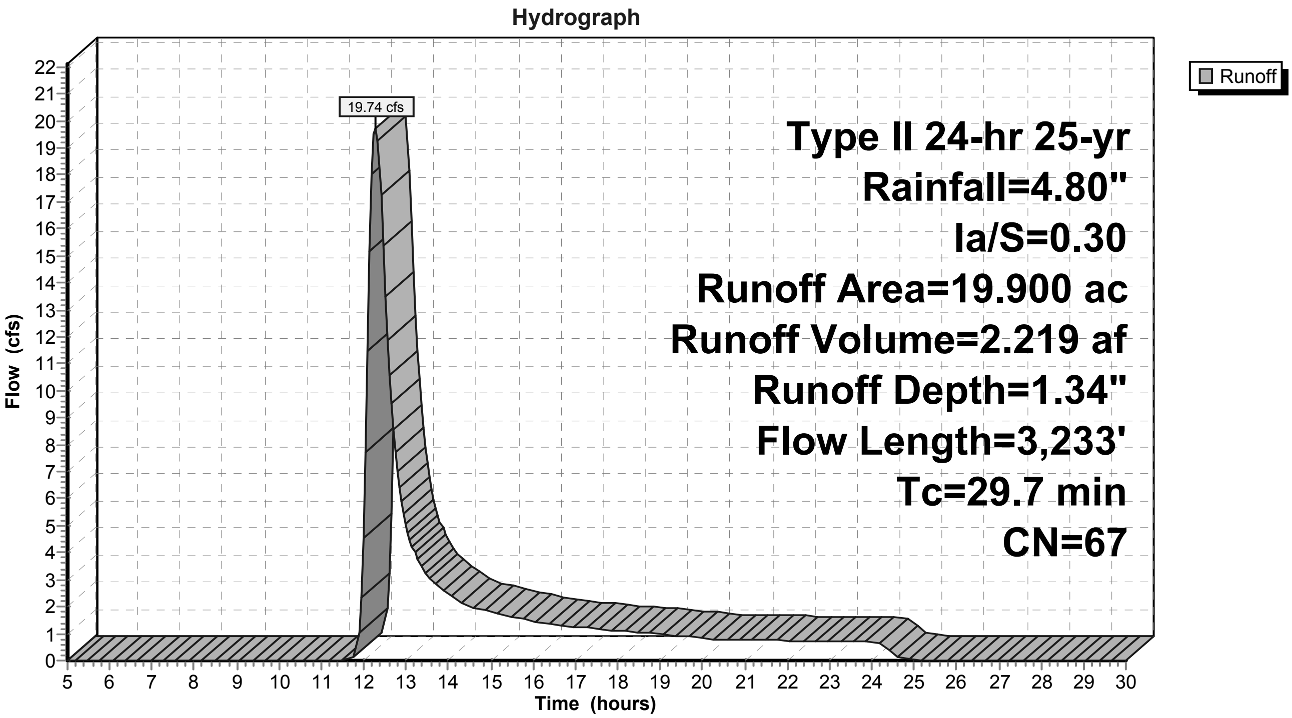
Runoff = 19.74 cfs @ 12.28 hrs, Volume= 2.219 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	14.000	67	Based on CN for P101
*	1.600	67	Mattress
*	4.300	67	Mattress
	19.900	67	Weighted Average
	19.900		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.4	100	0.2400	0.11		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
10.3	1,521	0.2400	2.45		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.0	212	0.0900	3.72	5.58	**Trap/Vee/Rect Channel Flow, Drainage Ditch** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.060
3.0	1,400	0.1800	7.89	11.83	**Trap/Vee/Rect Channel Flow, Stream** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040 Mountain streams
29.7	3,233	Total			

Subcatchment 213: To Culvert 213 (14.0 ac)



Summary for Subcatchment 214: To Culvert 214 (2.4 ac)

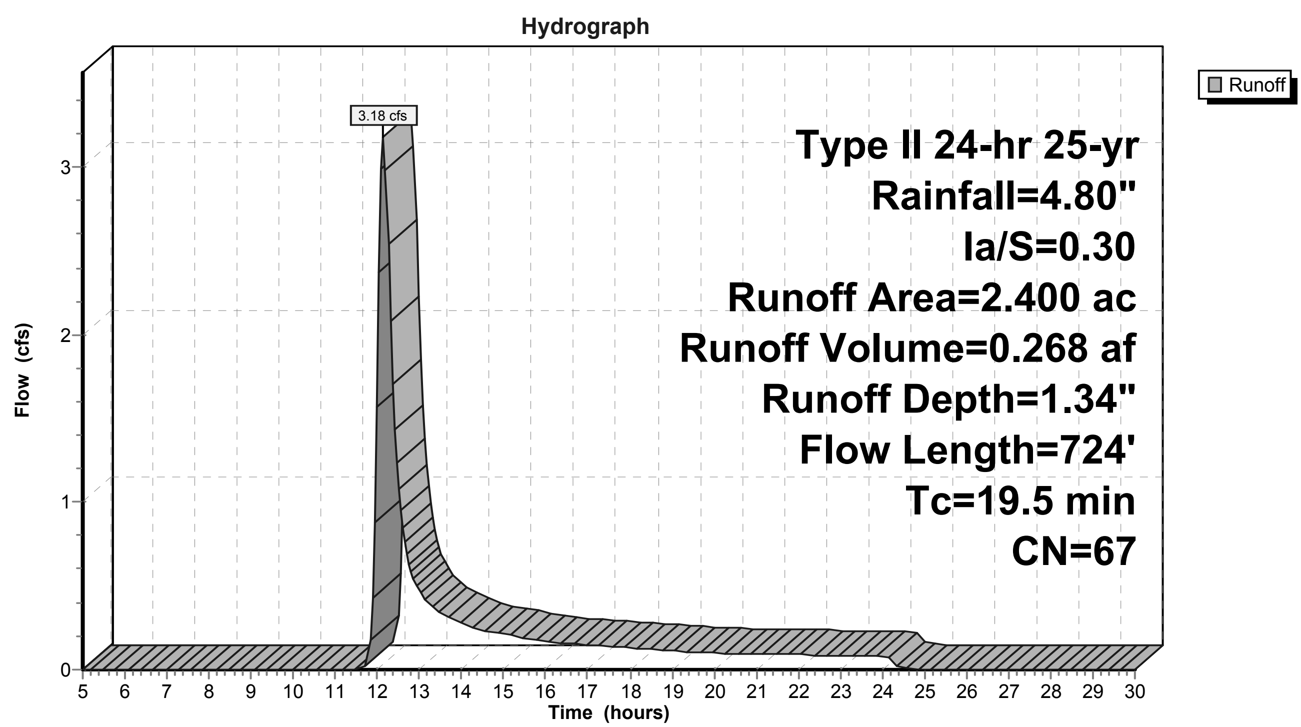
Runoff = 3.18 cfs @ 12.15 hrs, Volume= 0.268 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	2.400	67	Based on CN for P101
	2.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.9	100	0.2200	0.10		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
3.2	448	0.2200	2.35		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.4	176	0.1600	7.44	11.16	**Trap/Vee/Rect Channel Flow, Wetland/Stream** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040 Mountain streams
19.5	724	Total			

Subcatchment 214: To Culvert 214 (2.4 ac)



Summary for Subcatchment 215: To Culvert 215 (5.2 ac)

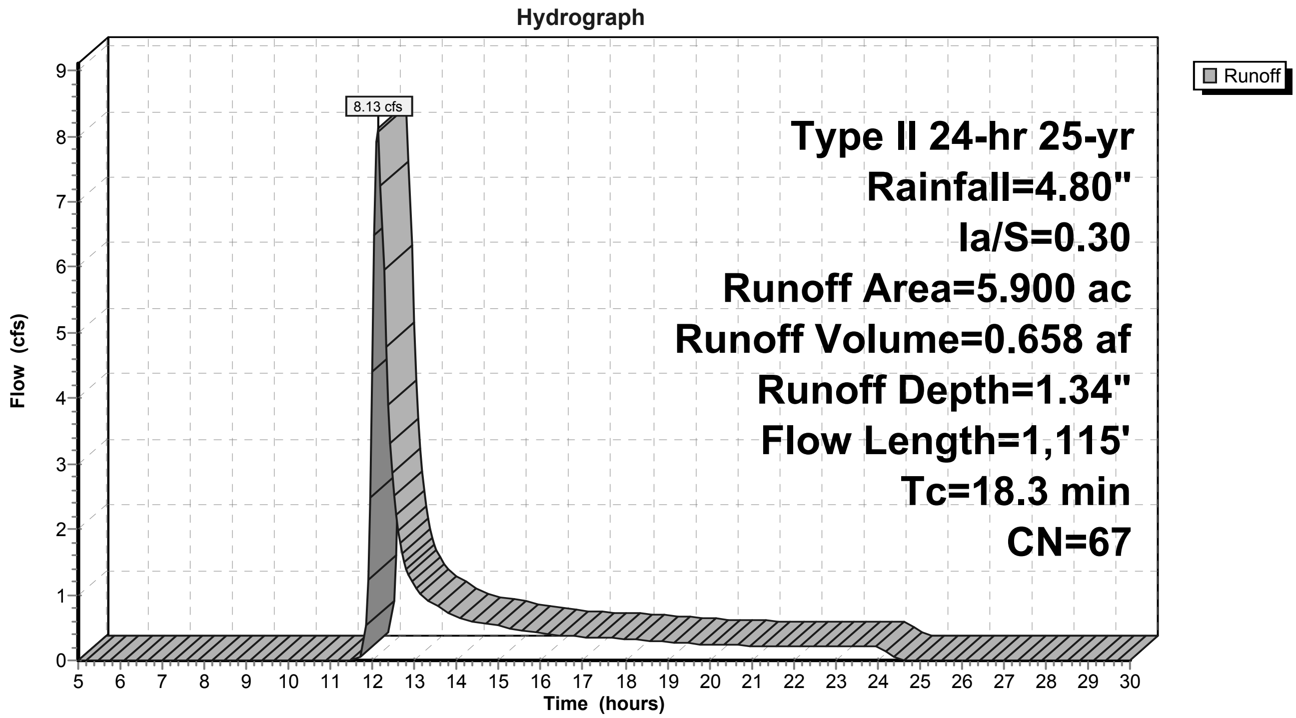
Runoff = 8.13 cfs @ 12.13 hrs, Volume= 0.658 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	5.200	67	Based on CN for P101
*	0.400	67	Mattress
*	0.200	67	Mattress
*	0.100	67	Mattress
	5.900	67	Weighted Average
	5.900		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	100	0.2600	0.11		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
1.1	172	0.2600	2.55		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.8	249	0.1600	4.96	7.44	**Trap/Vee/Rect Channel Flow, Drainage Ditch** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.060
1.5	594	0.1200	6.44	9.66	**Trap/Vee/Rect Channel Flow, Stream** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040 Mountain streams
18.3	1,115	Total			

Subcatchment 215: To Culvert 215 (5.2 ac)



Summary for Subcatchment 216: To Culvert 216 (2.2 ac)

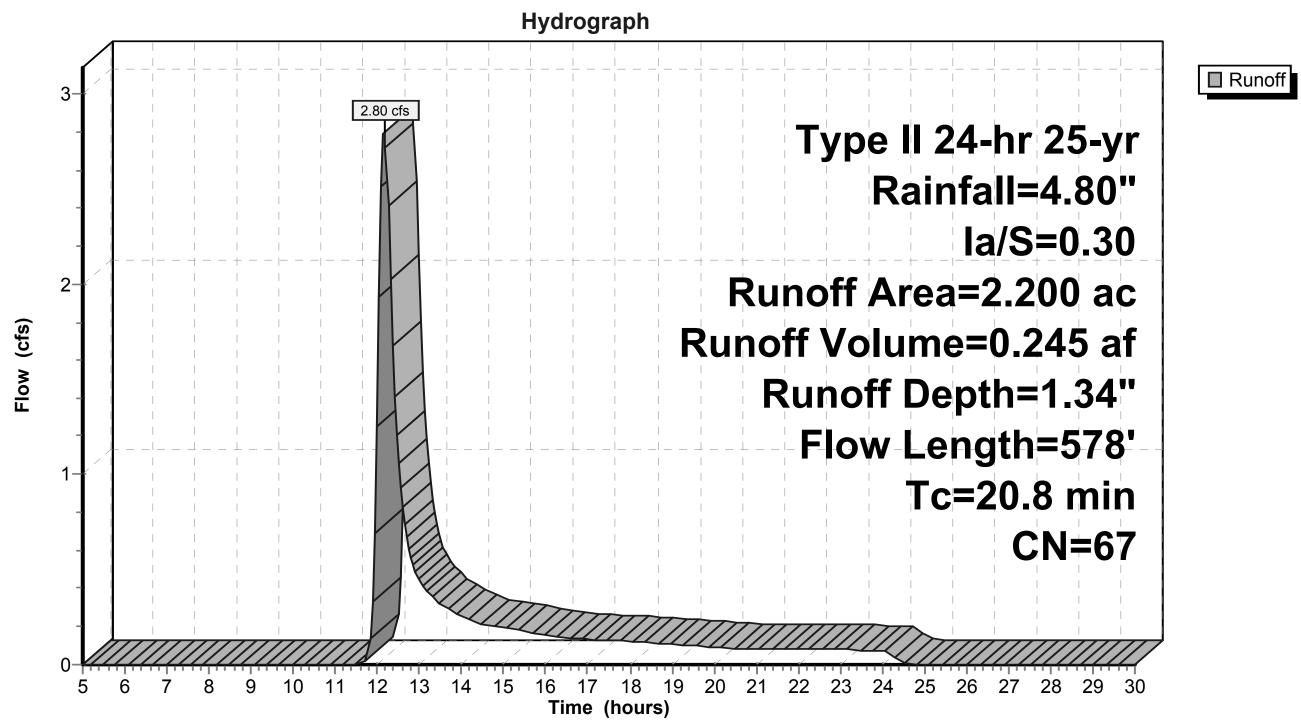
Runoff = 2.80 cfs @ 12.16 hrs, Volume= 0.245 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	2.200	67	Based on CN for P101
	2.200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.6	100	0.1700	0.09		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
2.8	352	0.1700	2.06		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.4	126	0.0900	5.58	8.37	**Trap/Vee/Rect Channel Flow, Stream** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040 Mountain streams
20.8	578	Total			

Subcatchment 216: To Culvert 216 (2.2 ac)



Summary for Subcatchment 217: To Culvert 217 (93.3 ac)

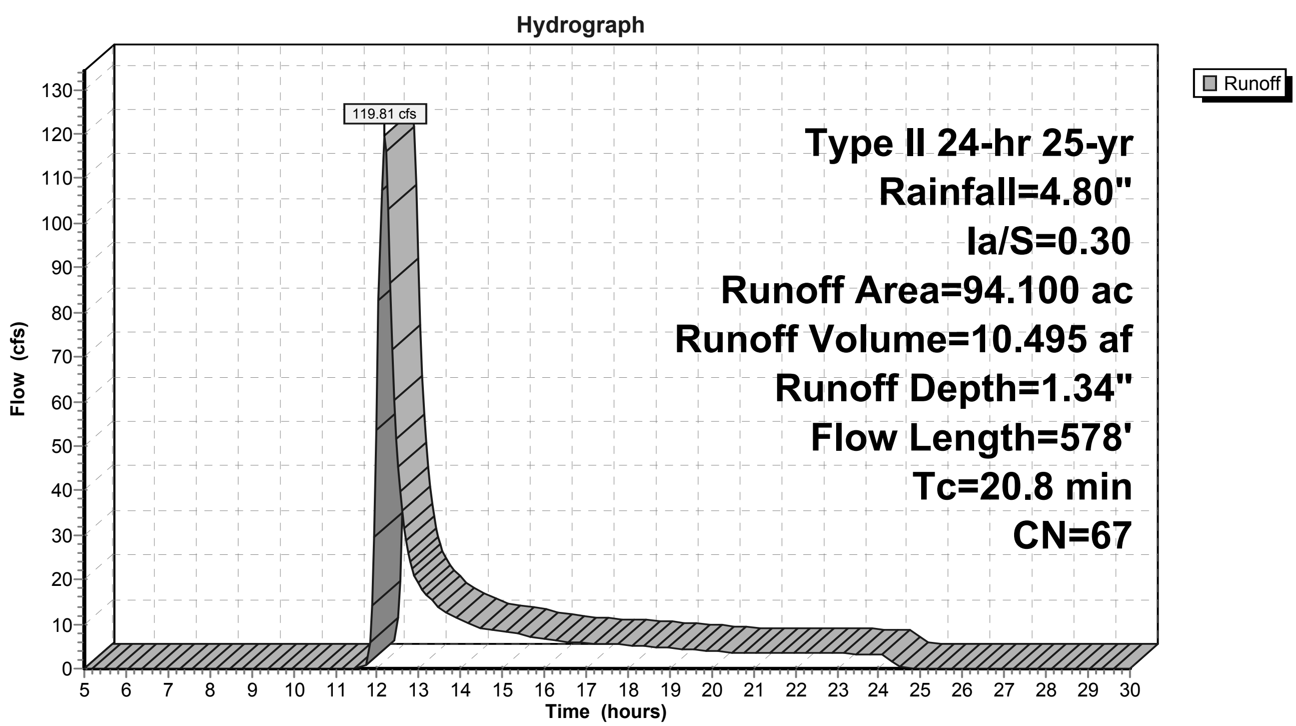
Runoff = 119.81 cfs @ 12.16 hrs, Volume= 10.495 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	93.300	67	Based on CN for P101
*	0.500	67	Mattress
*	0.100	67	Mattress
*	0.200	67	Mattress
	94.100	67	Weighted Average
	94.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.6	100	0.1700	0.09		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
2.8	352	0.1700	2.06		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.4	126	0.0900	5.58	8.37	**Trap/Vee/Rect Channel Flow, Stream** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040 Mountain streams
20.8	578	Total			

Subcatchment 217: To Culvert 217 (93.3 ac)



Summary for Subcatchment 219: To Culvert 219 (81.9 ac)

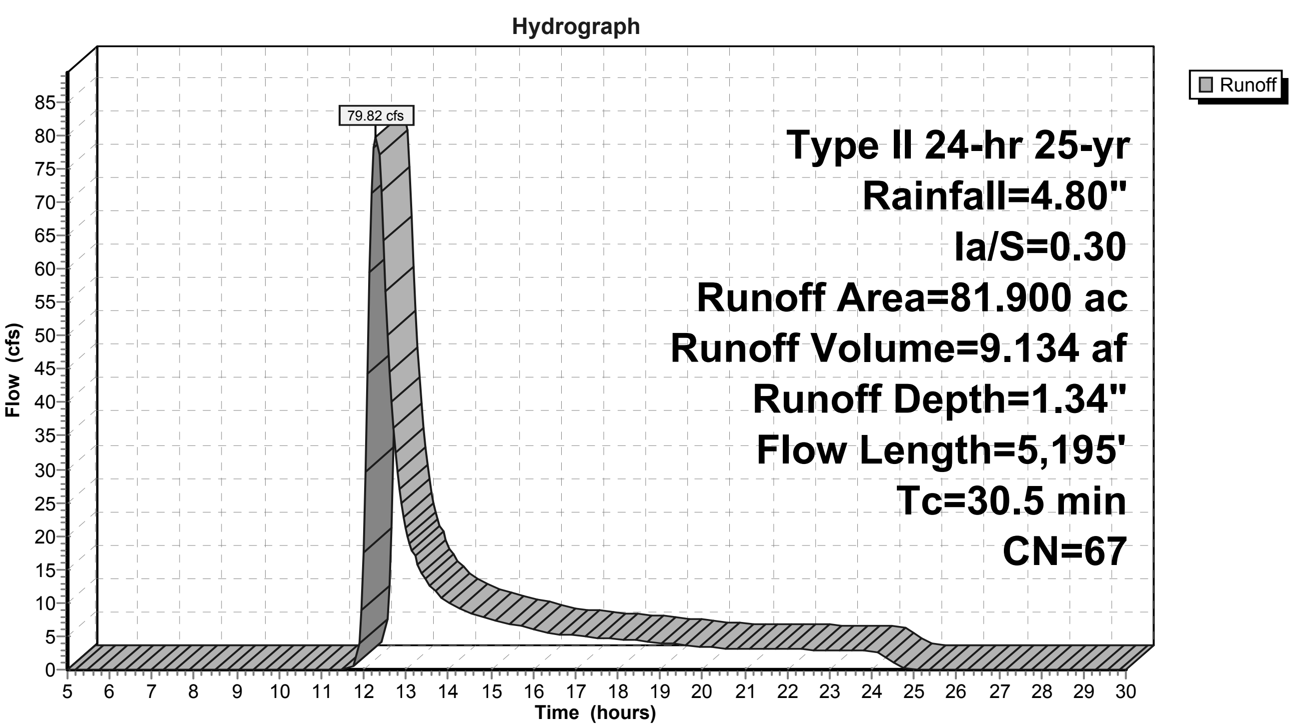
Runoff = 79.82 cfs @ 12.29 hrs, Volume= 9.134 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	81.900	67	Based on CN for P101
	81.900		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	100	0.2590	0.11		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
11.1	1,073	0.1030	1.60		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
4.5	4,022	0.1890	15.01	123.83	**Trap/Vee/Rect Channel Flow, Drainage Way** Bot.W=2.50' D=1.50' Z= 2.0 '/' Top.W=8.50' n= 0.040 Mountain streams
30.5	5,195	Total			

Subcatchment 219: To Culvert 219 (81.9 ac)



Summary for Subcatchment 220: To Culvert 220 (16.8 ac)

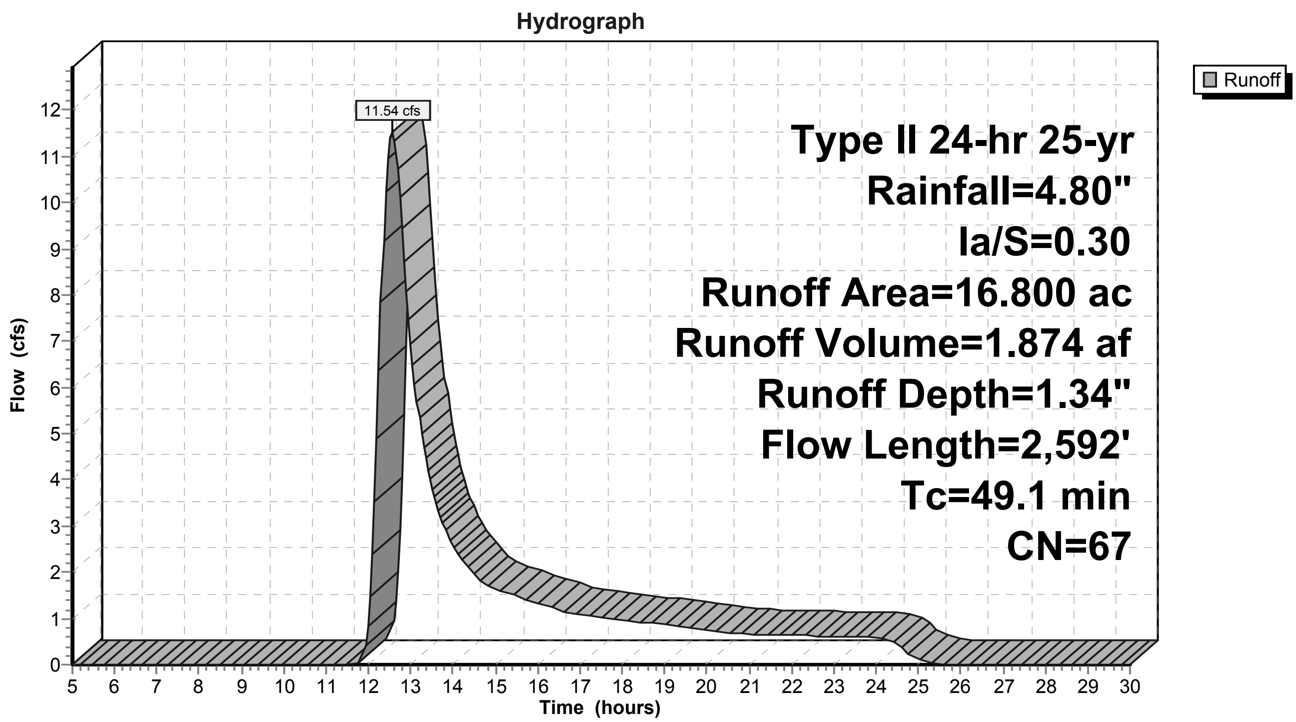
Runoff = 11.54 cfs @ 12.56 hrs, Volume= 1.874 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	16.800	67	Based on CN for P101
	16.800		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.4	100	0.0400	0.05		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
16.8	2,277	0.2040	2.26		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.9	215	0.0500	4.16	6.24	**Trap/Vee/Rect Channel Flow, Drainage Way** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040 Mountain streams
49.1	2,592	Total			

Subcatchment 220: To Culvert 220 (16.8 ac)



Summary for Subcatchment 221: To Culvert 221 (125.6 ac)

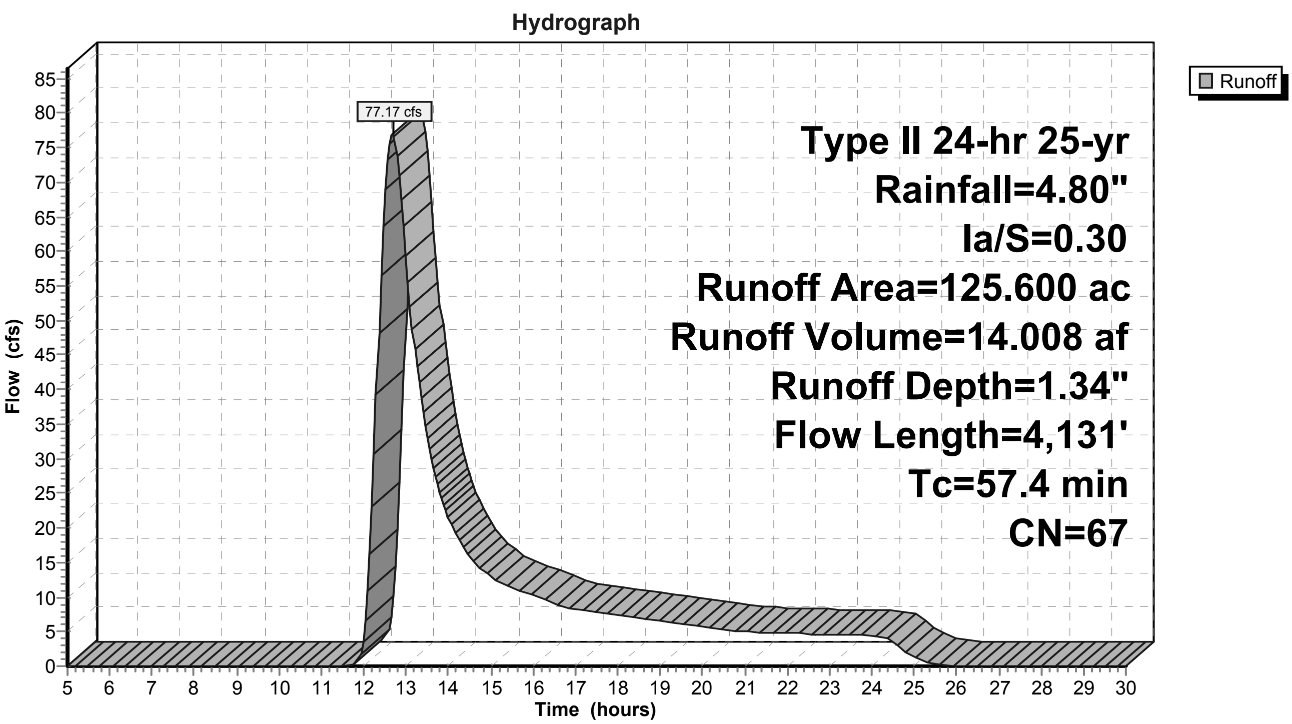
Runoff = 77.17 cfs @ 12.68 hrs, Volume= 14.008 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	125.600	67	Based on CN for P101
	125.600		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.4	83	0.0300	0.05		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
4.9	17	0.1180	0.06		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
20.3	2,539	0.1730	2.08		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.8	1,492	0.1520	13.46	111.05	**Trap/Vee/Rect Channel Flow, Drainage Way** Bot.W=2.50' D=1.50' Z= 2.0 '/' Top.W=8.50' n= 0.040 Mountain streams
57.4	4,131	Total			

Subcatchment 221: To Culvert 221 (125.6 ac)



Summary for Subcatchment 222: To Culvert 222 (36.6 ac)

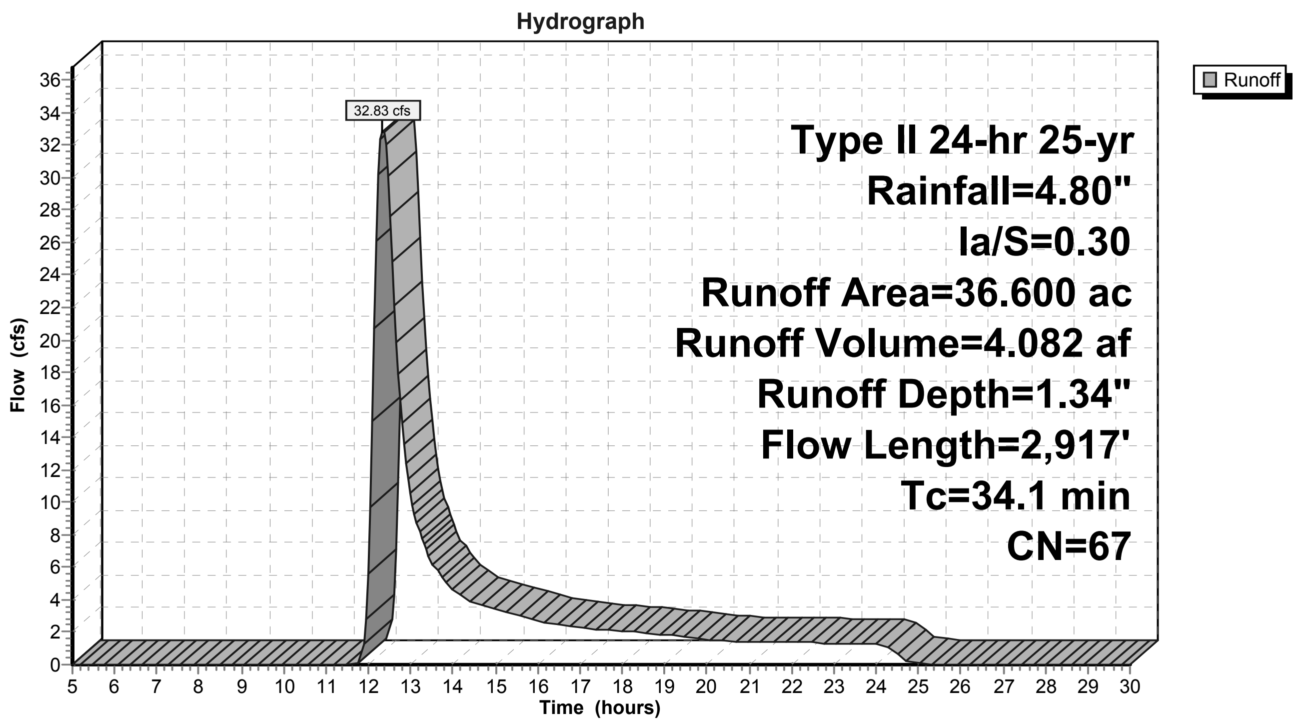
Runoff = 32.83 cfs @ 12.34 hrs, Volume= 4.082 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	36.600	67	Based on CN for P101
	36.600		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	48	0.0500	1.54		**Sheet Flow, Road** Smooth surfaces n= 0.011 P2= 2.60"
0.5	238	0.0700	8.32	49.90	**Trap/Vee/Rect Channel Flow, Road Ditch** Bot.W=1.00' D=1.50' Z= 2.0 '/' Top.W=7.00' n= 0.040 Earth, cobble bottom, clean sides
33.1	2,631	0.0700	1.32		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
34.1	2,917	Total			

Subcatchment 222: To Culvert 222 (36.6 ac)



Summary for Reach R203L: Reach 203L

Inflow Area = 23.415 ac, 0.00% Impervious, Inflow Depth = 1.84" for 25-yr event
Inflow = 26.97 cfs @ 12.46 hrs, Volume= 3.596 af
Outflow = 26.75 cfs @ 12.55 hrs, Volume= 3.596 af, Atten= 1%, Lag= 5.2 min

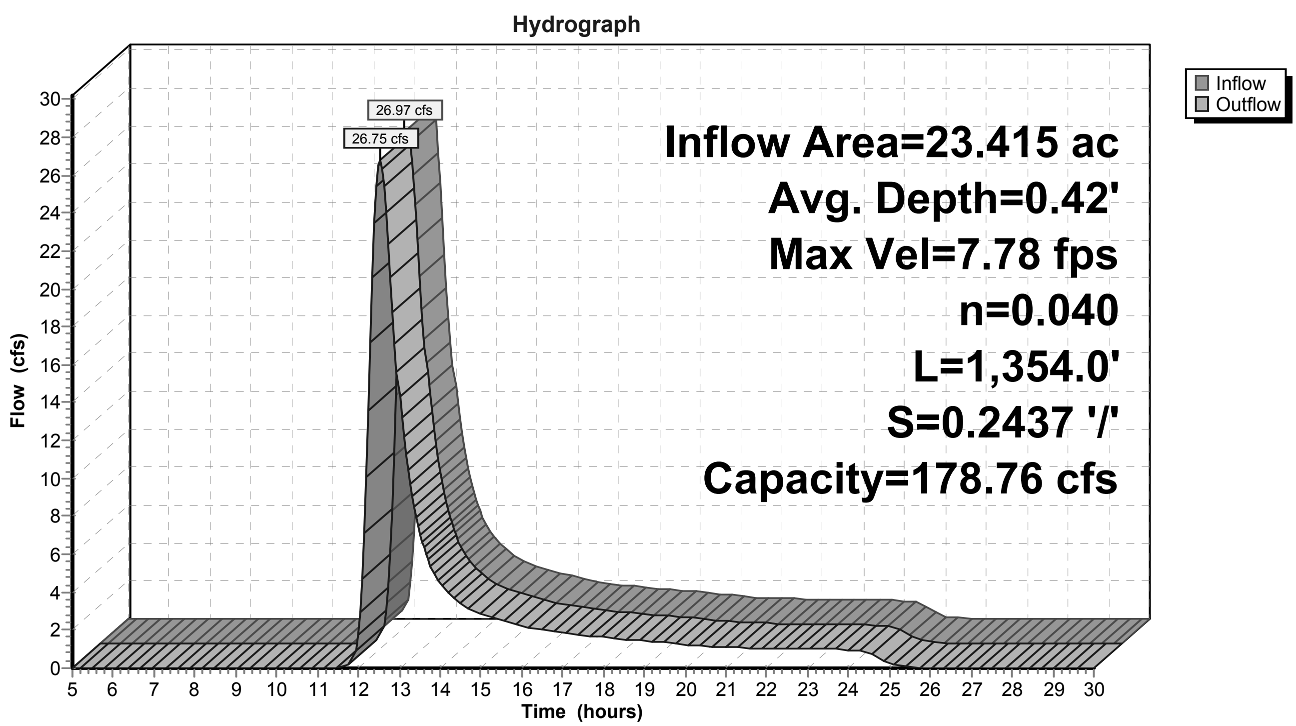
Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.78 fps, Min. Travel Time= 2.9 min
Avg. Velocity = 3.05 fps, Avg. Travel Time= 7.4 min

Peak Storage= 4,655 cf @ 12.50 hrs, Average Depth at Peak Storage= 0.42'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 178.76 cfs

4.00' x 1.00' deep channel, n= 0.040 Mountain streams
Side Slope Z-value= 10.0 '/' Top Width= 24.00'
Length= 1,354.0' Slope= 0.2437 '/'
Inlet Invert= 2,116.00', Outlet Invert= 1,786.00'

‡

Reach R203L: Reach 203L



Summary for Reach R205: Reach 205

Inflow Area = 47.478 ac, 0.00% Impervious, Inflow Depth = 1.50" for 25-yr event
Inflow = 46.22 cfs @ 12.25 hrs, Volume= 5.921 af
Outflow = 45.78 cfs @ 12.35 hrs, Volume= 5.921 af, Atten= 1%, Lag= 5.9 min

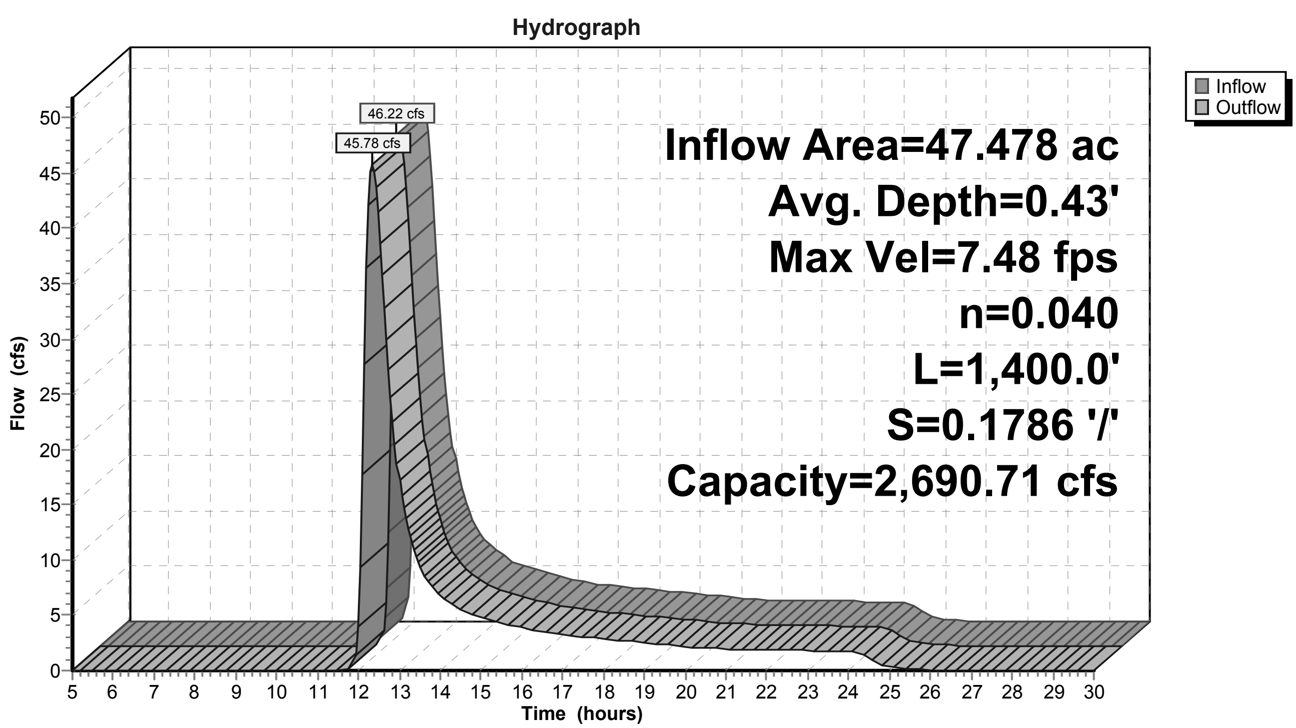
Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.48 fps, Min. Travel Time= 3.1 min
Avg. Velocity = 2.89 fps, Avg. Travel Time= 8.1 min

Peak Storage= 8,570 cf @ 12.30 hrs, Average Depth at Peak Storage= 0.43'
Defined Flood Depth= 3.00', Capacity at Flood Depth= 2,690.71 cfs
Bank-Full Depth= 3.00', Capacity at Bank-Full= 2,690.71 cfs

10.00' x 3.00' deep channel, n= 0.040 Mountain streams
Side Slope Z-value= 10.0 '/' Top Width= 70.00'
Length= 1,400.0' Slope= 0.1786 '/'
Inlet Invert= 1,700.00', Outlet Invert= 1,450.00'

‡

Reach R205: Reach 205



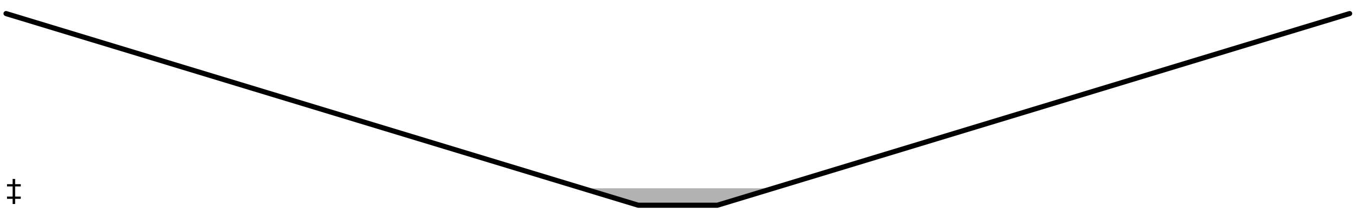
Summary for Reach R205L: Reach 205L

Inflow Area = 14.878 ac, 0.00% Impervious, Inflow Depth = 1.84" for 25-yr event
Inflow = 20.11 cfs @ 12.26 hrs, Volume= 2.285 af
Outflow = 19.22 cfs @ 12.43 hrs, Volume= 2.285 af, Atten= 4%, Lag= 10.5 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.44 fps, Min. Travel Time= 5.7 min
Avg. Velocity = 2.67 fps, Avg. Travel Time= 13.7 min

Peak Storage= 6,549 cf @ 12.34 hrs, Average Depth at Peak Storage= 0.35'
Bank-Full Depth= 4.00', Capacity at Bank-Full= 4,824.43 cfs

5.00' x 4.00' deep channel, n= 0.040 Mountain streams
Side Slope Z-value= 10.0 '/' Top Width= 85.00'
Length= 2,191.0' Slope= 0.1926 '/'
Inlet Invert= 2,138.00', Outlet Invert= 1,716.00'



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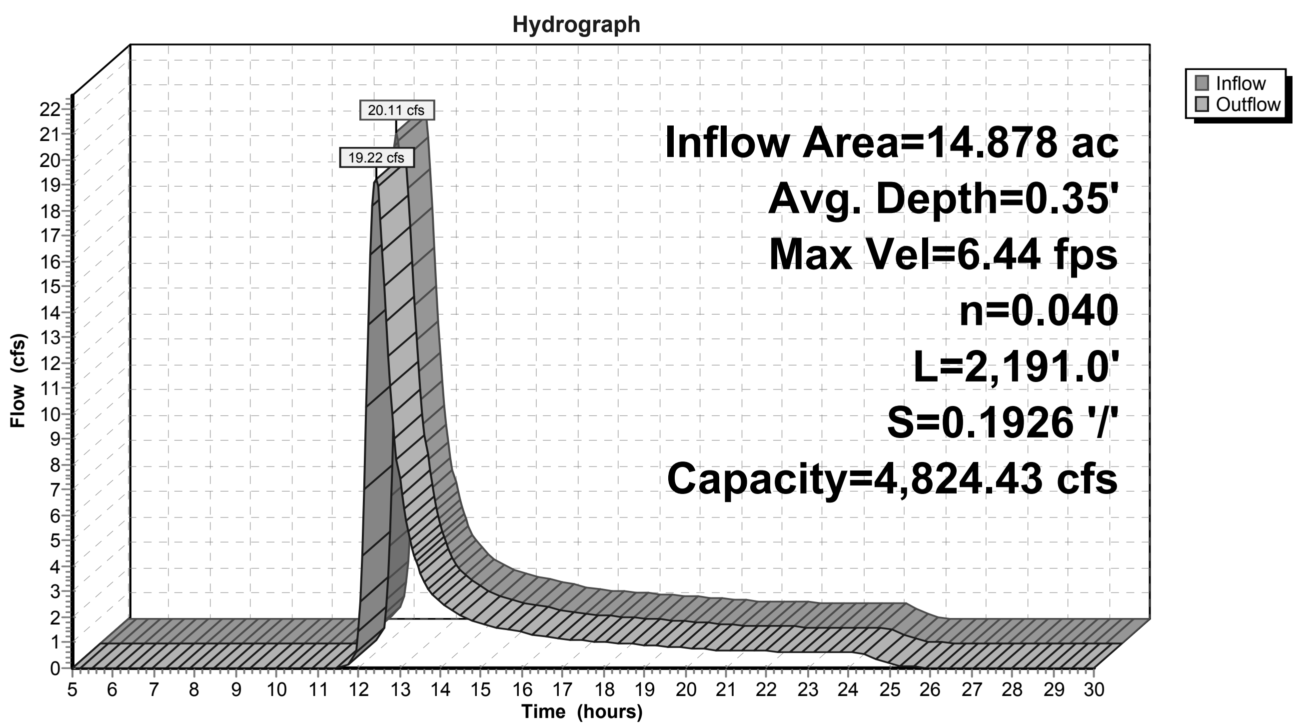
Reach R205L: Reach 205L



Summary for Reach R208: Reach 208

Inflow Area = 53.000 ac, 0.00% Impervious, Inflow Depth = 1.34" for 25-yr event
Inflow = 48.62 cfs @ 12.33 hrs, Volume= 5.911 af
Outflow = 48.33 cfs @ 12.37 hrs, Volume= 5.911 af, Atten= 1%, Lag= 2.4 min

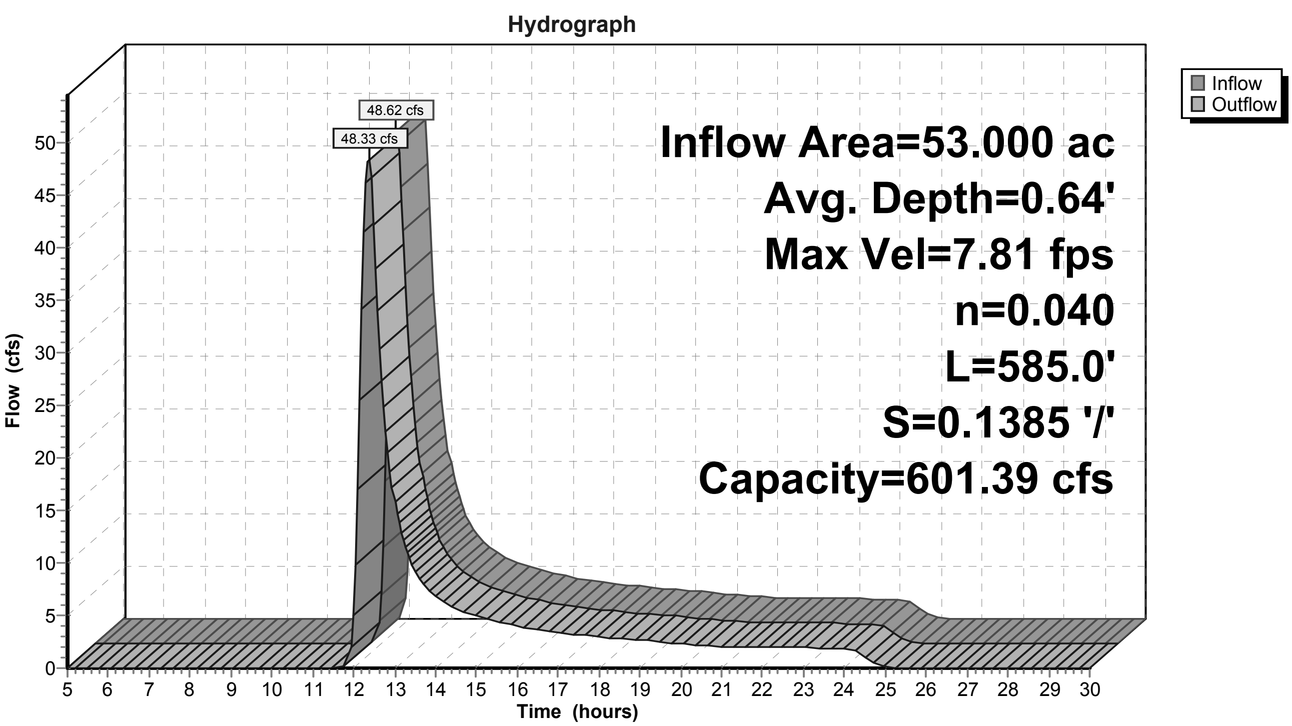
Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.81 fps, Min. Travel Time= 1.2 min
Avg. Velocity = 3.35 fps, Avg. Travel Time= 2.9 min

Peak Storage= 3,635 cf @ 12.34 hrs, Average Depth at Peak Storage= 0.64'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 601.39 cfs

5.00' x 2.00' deep channel, n= 0.040 Mountain streams
Side Slope Z-value= 7.5 '/' Top Width= 35.00'
Length= 585.0' Slope= 0.1385 '/'
Inlet Invert= 1,591.00', Outlet Invert= 1,510.00'

‡

Reach R208: Reach 208



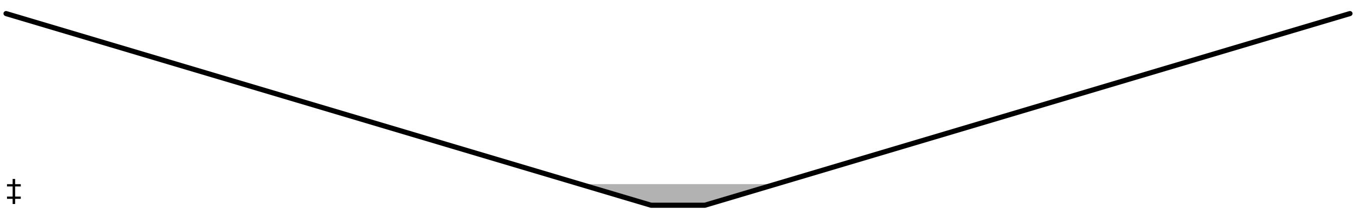
Summary for Reach R209: Reach 209

Inflow Area = 62.200 ac, 0.00% Impervious, Inflow Depth = 1.34" for 25-yr event
Inflow = 54.88 cfs @ 12.34 hrs, Volume= 6.937 af
Outflow = 52.80 cfs @ 12.49 hrs, Volume= 6.937 af, Atten= 4%, Lag= 9.4 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.96 fps, Min. Travel Time= 5.0 min
Avg. Velocity = 3.16 fps, Avg. Travel Time= 11.1 min

Peak Storage= 15,974 cf @ 12.41 hrs, Average Depth at Peak Storage= 0.66'
Bank-Full Depth= 6.00', Capacity at Bank-Full= 10,342.61 cfs

5.00' x 6.00' deep channel, n= 0.040 Mountain streams
Side Slope Z-value= 10.0 '/' Top Width= 125.00'
Length= 2,098.0' Slope= 0.1125 '/'
Inlet Invert= 1,504.00', Outlet Invert= 1,268.00'



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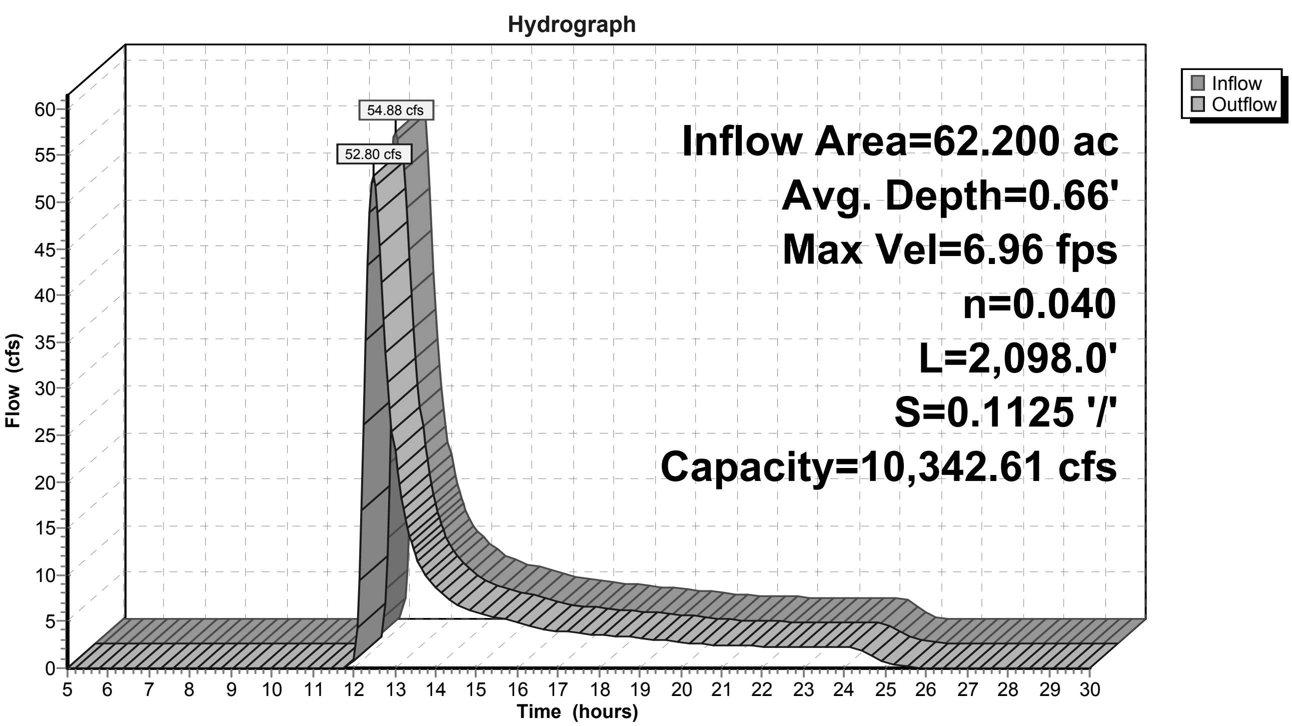
Reach R209: Reach 209



Summary for Reach R214: Reach 214

Inflow Area = 2.400 ac, 0.00% Impervious, Inflow Depth = 1.34" for 25-yr event
Inflow = 3.18 cfs @ 12.15 hrs, Volume= 0.268 af
Outflow = 3.03 cfs @ 12.25 hrs, Volume= 0.268 af, Atten= 5%, Lag= 6.2 min

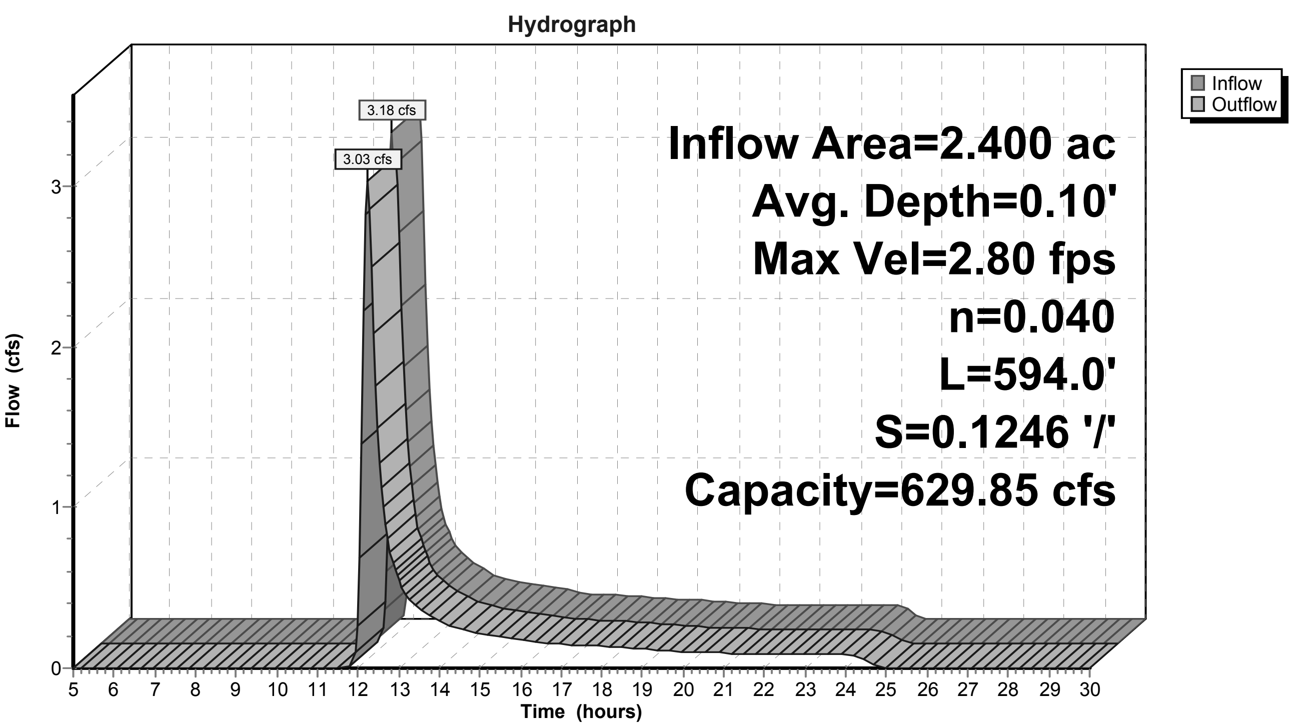
Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.80 fps, Min. Travel Time= 3.5 min
Avg. Velocity = 1.07 fps, Avg. Travel Time= 9.2 min

Peak Storage= 647 cf @ 12.19 hrs, Average Depth at Peak Storage= 0.10'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 629.85 cfs

10.00' x 2.00' deep channel, n= 0.040 Mountain streams
Side Slope Z-value= 5.0 '/' Top Width= 30.00'
Length= 594.0' Slope= 0.1246 '/'
Inlet Invert= 1,382.00', Outlet Invert= 1,308.00'

‡

Reach R214: Reach 214



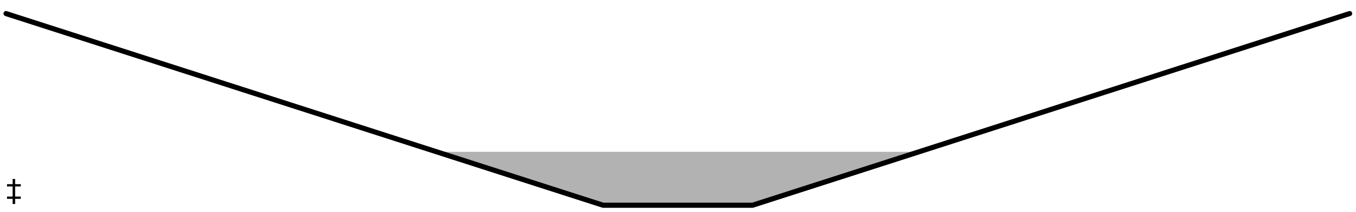
Summary for Reach R217: Reach 217

Inflow Area = 245.578 ac, 0.00% Impervious, Inflow Depth = 1.37" for 25-yr event
Inflow = 190.84 cfs @ 12.34 hrs, Volume= 28.015 af
Outflow = 186.67 cfs @ 12.51 hrs, Volume= 28.015 af, Atten= 2%, Lag= 10.4 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.94 fps, Min. Travel Time= 5.5 min
Avg. Velocity = 3.23 fps, Avg. Travel Time= 13.6 min

Peak Storage= 61,921 cf @ 12.42 hrs, Average Depth at Peak Storage= 1.11'
Bank-Full Depth= 4.00', Capacity at Bank-Full= 3,336.17 cfs

10.00' x 4.00' deep channel, n= 0.040 Mountain streams
Side Slope Z-value= 10.0 '/' Top Width= 90.00'
Length= 2,631.0' Slope= 0.0699 '/'
Inlet Invert= 1,374.00', Outlet Invert= 1,190.00'



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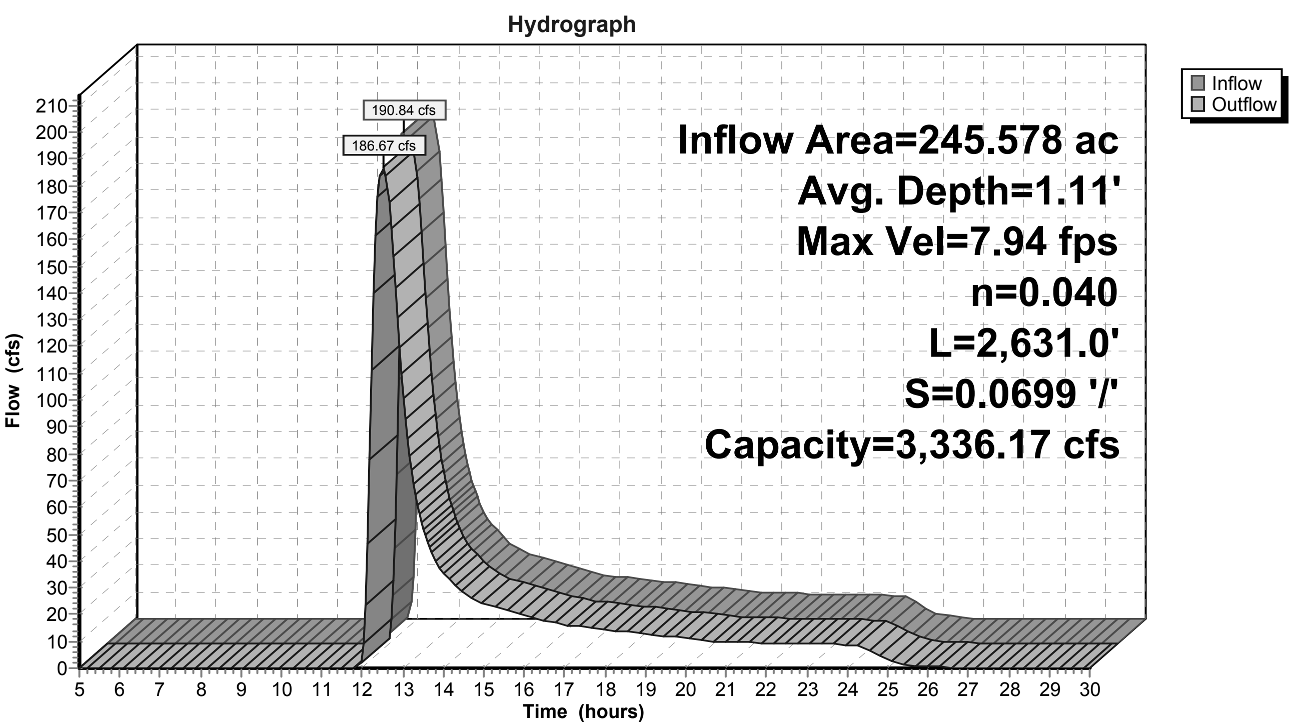
Reach R217: Reach 217



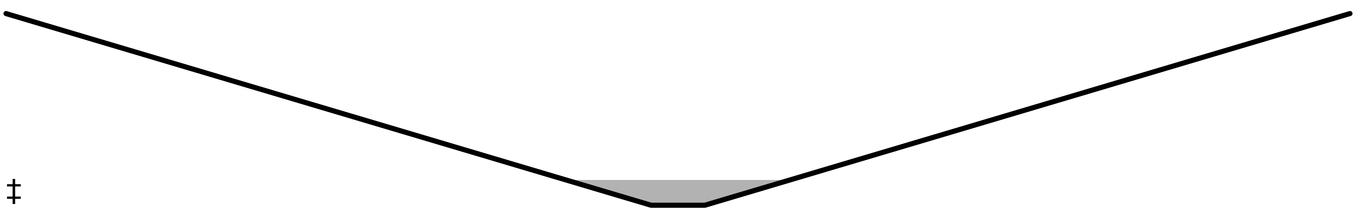
Summary for Reach R217A: Major Stream

Inflow Area = 78.778 ac, 0.00% Impervious, Inflow Depth = 1.43" for 25-yr event
Inflow = 76.43 cfs @ 12.31 hrs, Volume= 9.412 af
Outflow = 73.82 cfs @ 12.44 hrs, Volume= 9.412 af, Atten= 3%, Lag= 7.9 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.26 fps, Min. Travel Time= 4.1 min
Avg. Velocity = 3.15 fps, Avg. Travel Time= 9.4 min

Peak Storage= 18,162 cf @ 12.37 hrs, Average Depth at Peak Storage= 0.79'
Bank-Full Depth= 6.00', Capacity at Bank-Full= 9,710.33 cfs

5.00' x 6.00' deep channel, n= 0.040 Mountain streams
Side Slope Z-value= 10.0 '/' Top Width= 125.00'
Length= 1,775.0' Slope= 0.0992 '/'
Inlet Invert= 1,444.00', Outlet Invert= 1,268.00'



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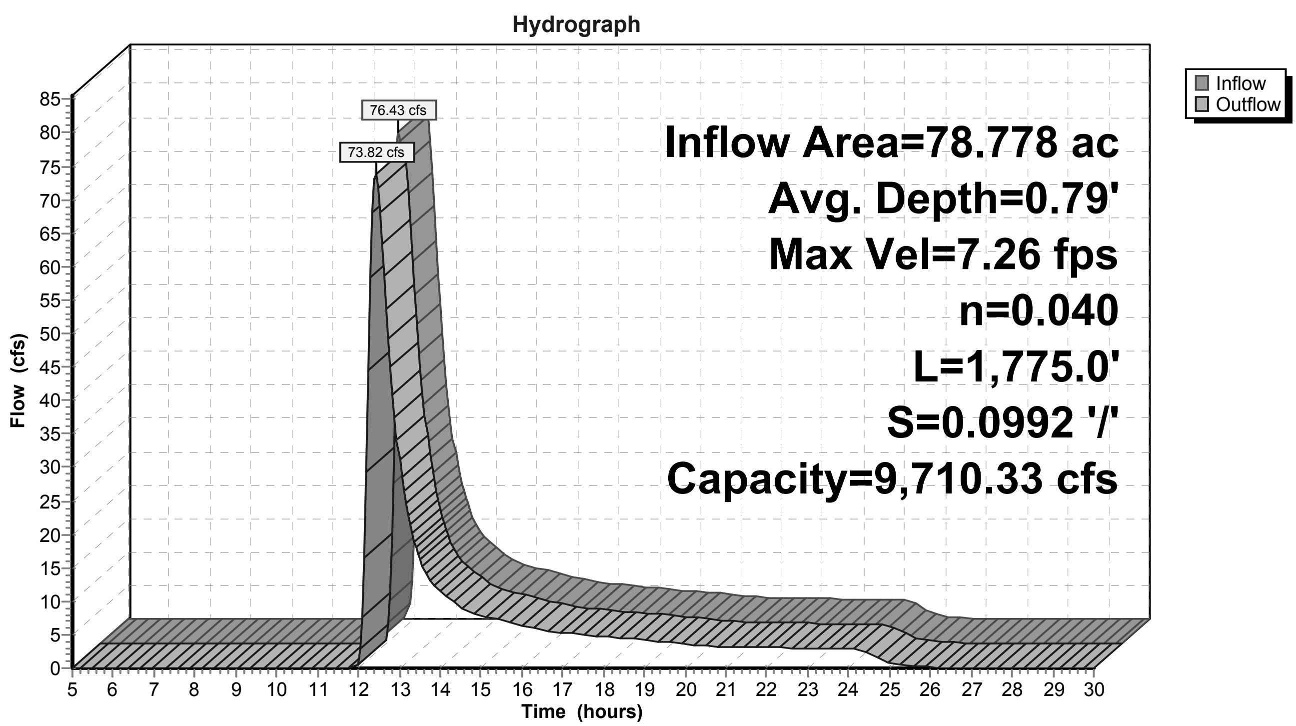
Reach R217A: Major Stream



Summary for Pond 218a: 17.3'x3.5' Box-100yr

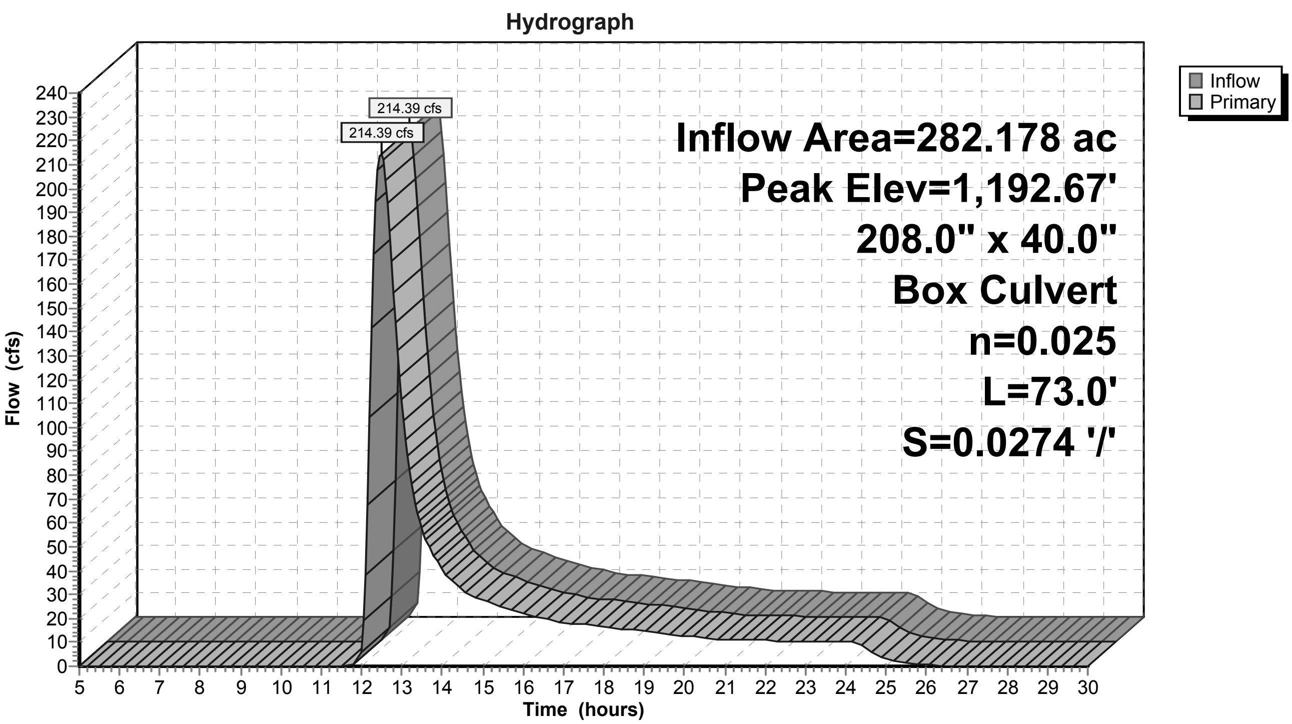
Inflow Area = 282.178 ac, 0.00% Impervious, Inflow Depth = 1.36" for 25-yr event
Inflow = 214.39 cfs @ 12.48 hrs, Volume= 32.097 af
Outflow = 214.39 cfs @ 12.48 hrs, Volume= 32.097 af, Atten= 0%, Lag= 0.0 min
Primary = 214.39 cfs @ 12.48 hrs, Volume= 32.097 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,192.67' @ 12.48 hrs
Flood Elev= 1,195.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,190.00'	**208.0" W x 40.0" H Box Culvert** L= 73.0' Box, 0° wingwalls, square crown edge, Ke= 0.700 Outlet Invert= 1,188.00' S= 0.0274 '/' Cc= 0.900 n= 0.025 Earth, clean & winding

Primary OutFlow Max=213.89 cfs @ 12.48 hrs HW=1,192.67' (Free Discharge)
└─**1=Culvert** (Inlet Controls 213.89 cfs @ 4.63 fps)

Pond 218a: 17.3'x3.5' Box-100yr



Summary for Pond D202: Arch Pipe - 24"x18" model-25yr

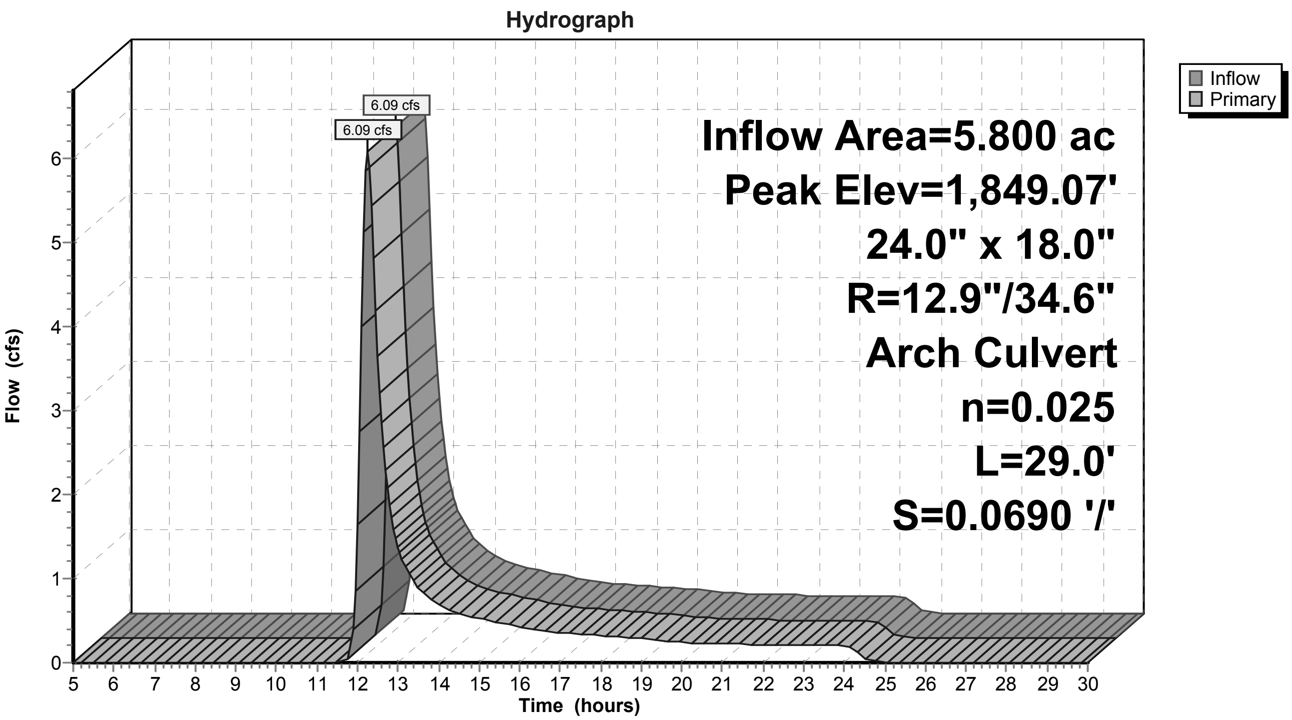
Inflow Area =	5.800 ac,	0.00% Impervious, Inflow Depth = 1.34"	for 25-yr event	
Inflow =	6.09 cfs @	12.25 hrs, Volume=	0.647 af	
Outflow =	6.09 cfs @	12.25 hrs, Volume=	0.647 af,	Atten= 0%, Lag= 0.0 min
Primary =	6.09 cfs @	12.25 hrs, Volume=	0.647 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,849.07' @ 12.25 hrs
Flood Elev= 1,850.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,848.00'	**24.0" W x 18.0" H, R=12.9"/34.6" Arch Culvert** L= 29.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,846.00' S= 0.0690 '/' Cc= 0.900 n= 0.025

Primary OutFlow Max=6.07 cfs @ 12.25 hrs HW=1,849.07' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 6.07 cfs @ 3.21 fps)

Pond D202: Arch Pipe - 24"x18" model-25yr



Summary for Pond D203: Arch Pipe - 57"x38" model-50yr

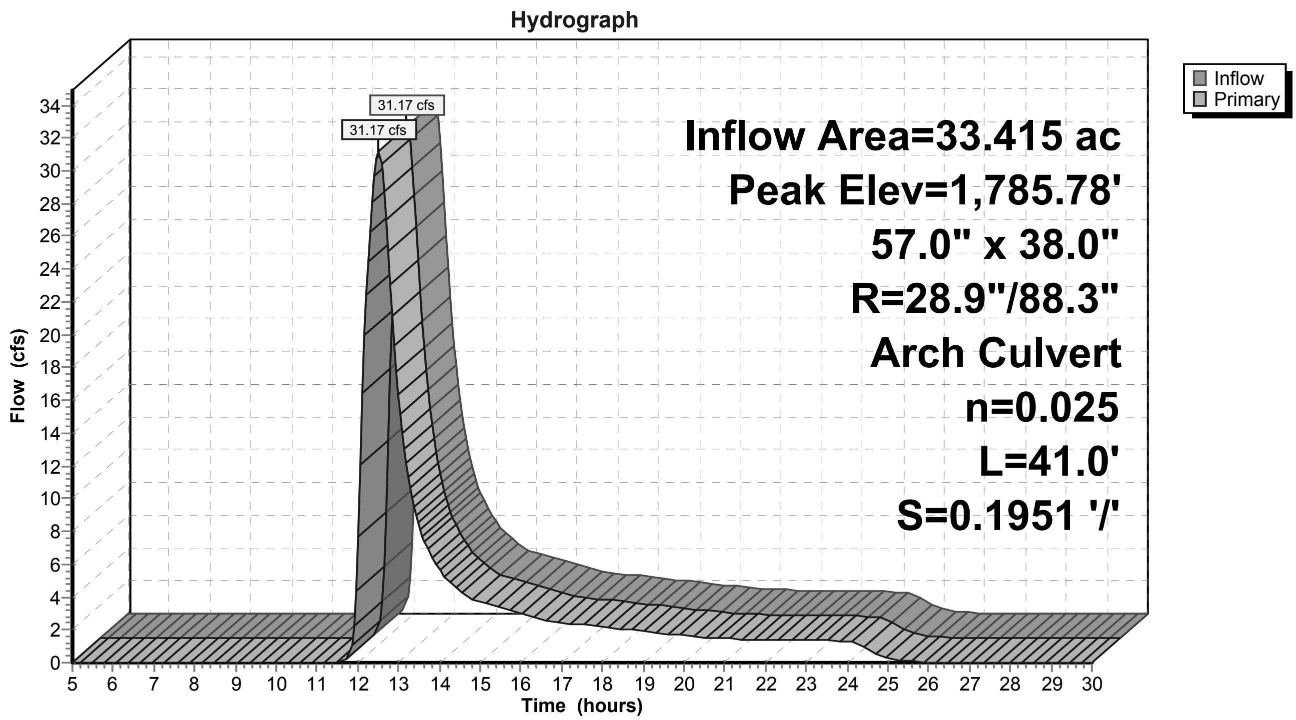
Inflow Area = 33.415 ac, 0.00% Impervious, Inflow Depth = 1.69" for 25-yr event
Inflow = 31.17 cfs @ 12.51 hrs, Volume= 4.712 af
Outflow = 31.17 cfs @ 12.51 hrs, Volume= 4.712 af, Atten= 0%, Lag= 0.0 min
Primary = 31.17 cfs @ 12.51 hrs, Volume= 4.712 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,785.78' @ 12.51 hrs
Flood Elev= 1,788.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,784.00'	**57.0" W x 38.0" H, R=28.9"/88.3" Arch Culvert** L= 41.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,776.00' S= 0.1951 '/' Cc= 0.900 n= 0.025

Primary OutFlow Max=31.14 cfs @ 12.51 hrs HW=1,785.78' (Free Discharge)
└─**1=Culvert** (Inlet Controls 31.14 cfs @ 4.13 fps)

Pond D203: Arch Pipe - 57"x38" model-50yr



Summary for Pond D205: Arch Pipe - 42"x29" model-50yr

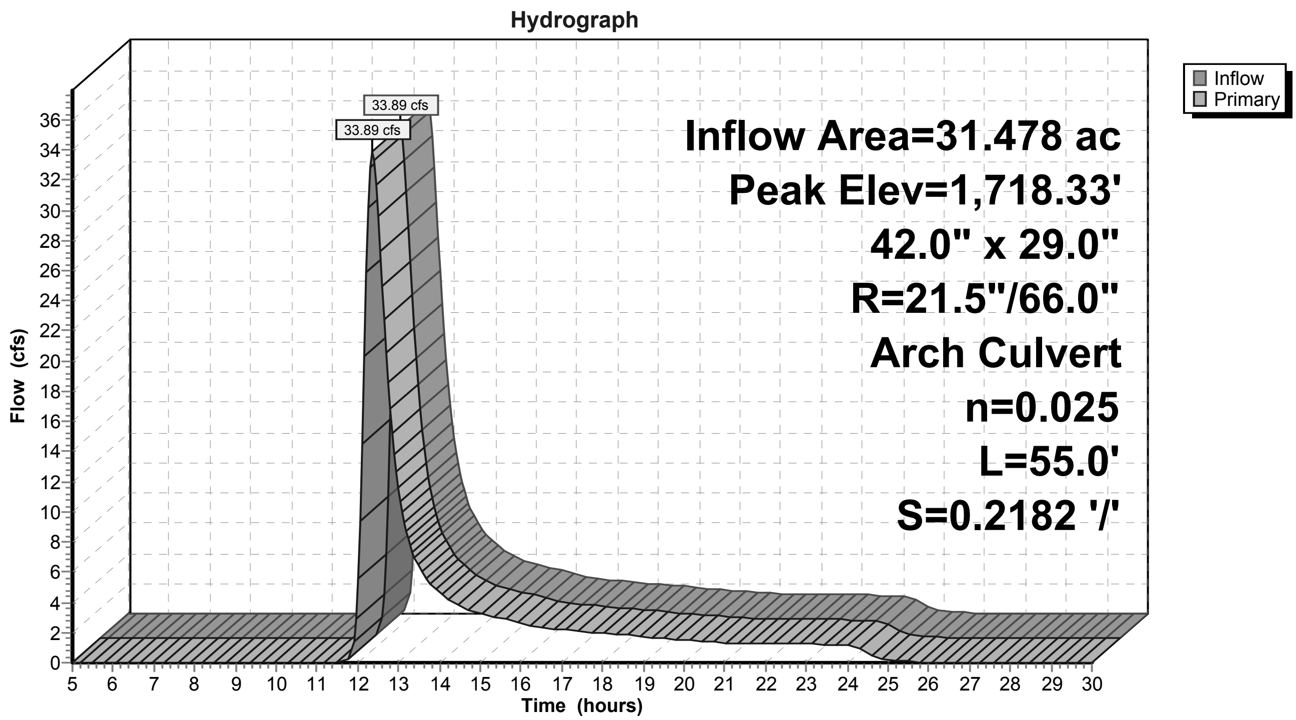
Inflow Area = 31.478 ac, 0.00% Impervious, Inflow Depth = 1.58" for 25-yr event
Inflow = 33.89 cfs @ 12.36 hrs, Volume= 4.137 af
Outflow = 33.89 cfs @ 12.36 hrs, Volume= 4.137 af, Atten= 0%, Lag= 0.0 min
Primary = 33.89 cfs @ 12.36 hrs, Volume= 4.137 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,718.33' @ 12.36 hrs
Flood Elev= 1,722.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,716.00'	**42.0" W x 29.0" H, R=21.5"/66.0" Arch Culvert** L= 55.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,704.00' S= 0.2182 '/' Cc= 0.900 n= 0.025

Primary OutFlow Max=33.80 cfs @ 12.36 hrs HW=1,718.32' (Free Discharge)
└─**1=Culvert** (Inlet Controls 33.80 cfs @ 5.08 fps)

Pond D205: Arch Pipe - 42"x29" model-50yr



Summary for Pond D206: Arch Pipe - 24"x18" model-25yr

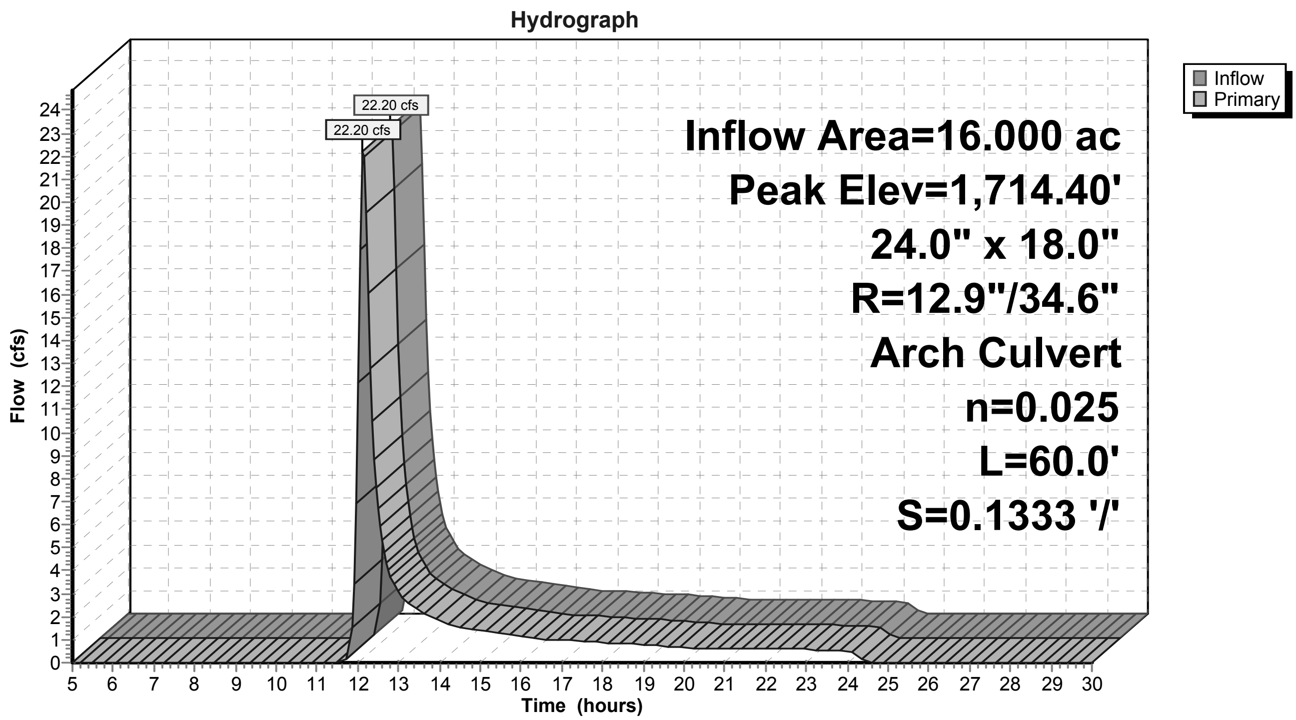
Inflow Area =	16.000 ac,	0.00% Impervious, Inflow Depth = 1.34"	for 25-yr event	
Inflow =	22.20 cfs @	12.13 hrs, Volume=	1.784 af	
Outflow =	22.20 cfs @	12.13 hrs, Volume=	1.784 af,	Atten= 0%, Lag= 0.0 min
Primary =	22.20 cfs @	12.13 hrs, Volume=	1.784 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,714.40' @ 12.13 hrs
Flood Elev= 1,718.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,710.00'	**24.0" W x 18.0" H, R=12.9"/34.6" Arch Culvert** L= 60.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,702.00' S= 0.1333 '/' Cc= 0.900 n= 0.025

Primary OutFlow Max=21.88 cfs @ 12.13 hrs HW=1,714.30' (Free Discharge)
└─**1=Culvert** (Inlet Controls 21.88 cfs @ 9.10 fps)

Pond D206: Arch Pipe - 24"x18" model-25yr



Summary for Pond D207: Arch Pipe - 24"x18" model-25yr

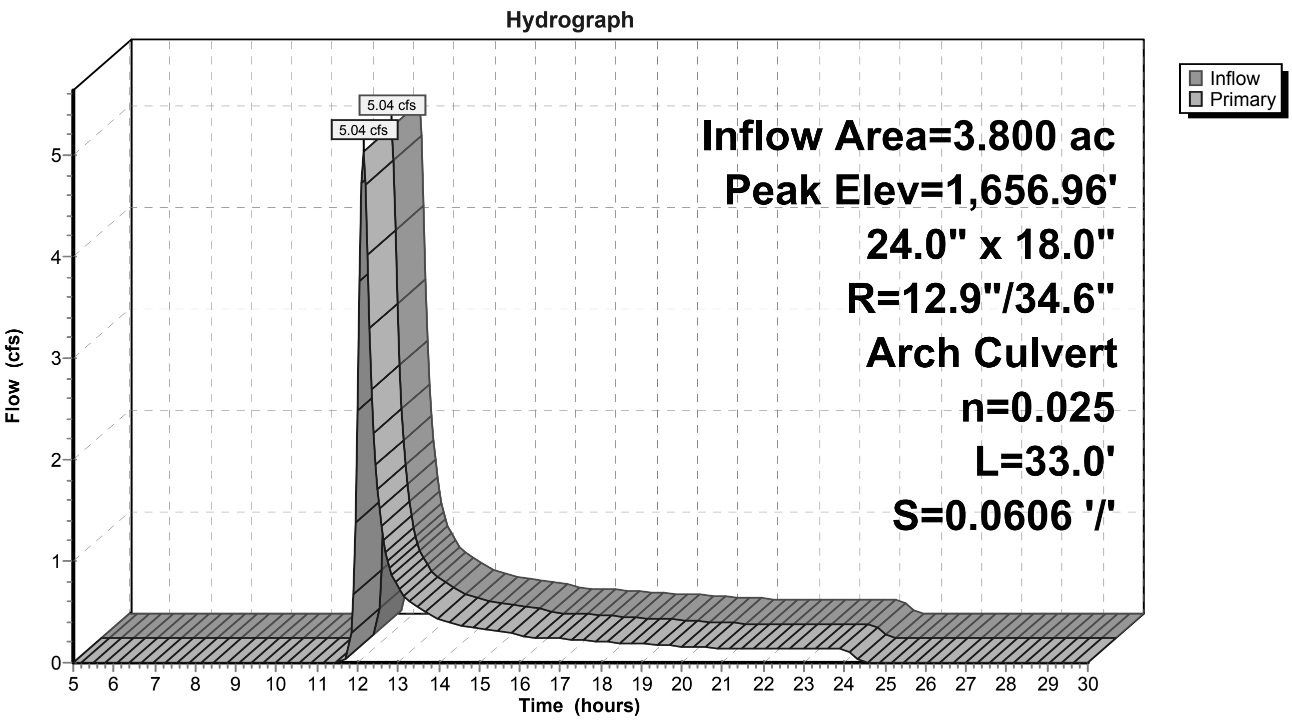
Inflow Area =	3.800 ac,	0.00% Impervious, Inflow Depth = 1.34" for 25-yr event		
Inflow =	5.04 cfs @	12.15 hrs, Volume=	0.424 af	
Outflow =	5.04 cfs @	12.15 hrs, Volume=	0.424 af,	Atten= 0%, Lag= 0.0 min
Primary =	5.04 cfs @	12.15 hrs, Volume=	0.424 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,656.96' @ 12.15 hrs
Flood Elev= 1,658.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,656.00'	**24.0" W x 18.0" H, R=12.9"/34.6" Arch Culvert** L= 33.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,654.00' S= 0.0606 '/' Cc= 0.900 n= 0.025

Primary OutFlow Max=5.04 cfs @ 12.15 hrs HW=1,656.96' (Free Discharge)
└─**1=Culvert** (Inlet Controls 5.04 cfs @ 3.00 fps)

Pond D207: Arch Pipe - 24"x18" model-25yr



Summary for Pond D208: Arch Pipe - 57"x38" model-50yr

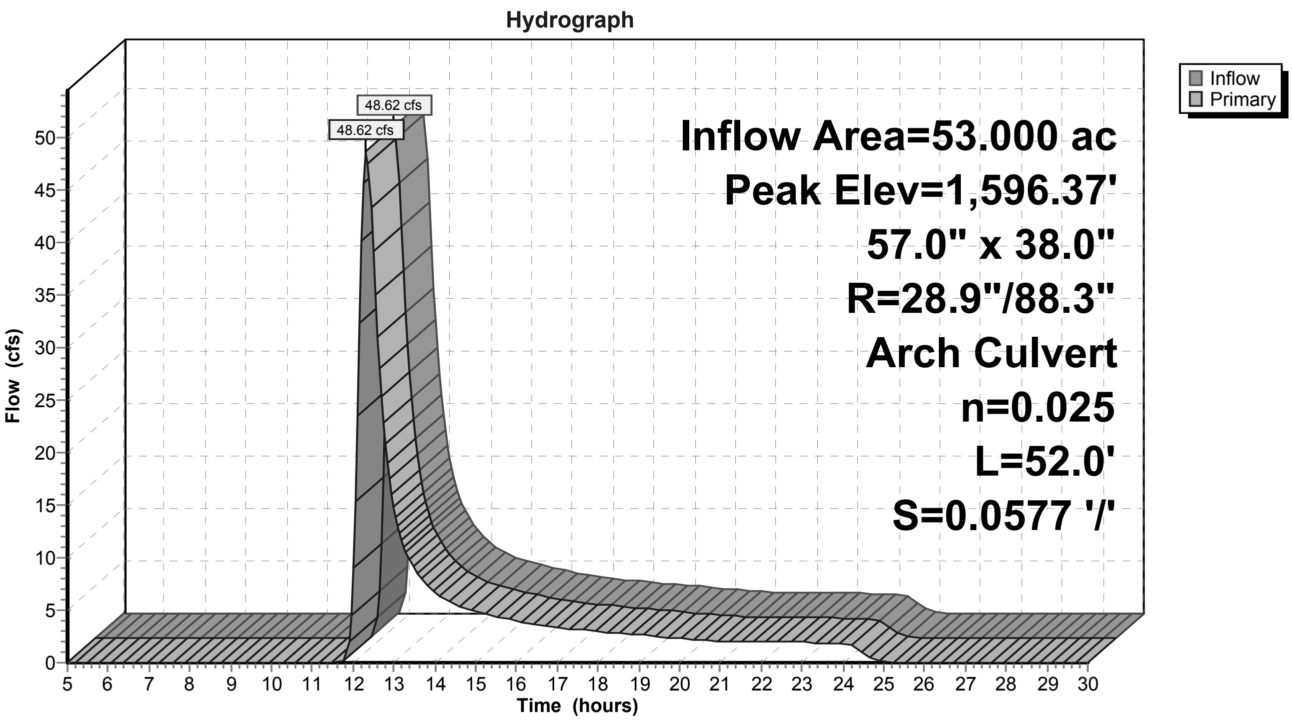
Inflow Area =	53.000 ac,	0.00% Impervious, Inflow Depth = 1.34"	for 25-yr event	
Inflow =	48.62 cfs @	12.33 hrs, Volume=	5.911 af	
Outflow =	48.62 cfs @	12.33 hrs, Volume=	5.911 af,	Atten= 0%, Lag= 0.0 min
Primary =	48.62 cfs @	12.33 hrs, Volume=	5.911 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,596.37' @ 12.33 hrs
Flood Elev= 1,598.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,594.00'	**57.0" W x 38.0" H, R=28.9"/88.3" Arch Culvert** L= 52.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,591.00' S= 0.0577 '/' Cc= 0.900 n= 0.025

Primary OutFlow Max=48.38 cfs @ 12.33 hrs HW=1,596.36' (Free Discharge)
1=Culvert (Inlet Controls 48.38 cfs @ 4.89 fps)

Pond D208: Arch Pipe - 57"x38" model-50yr



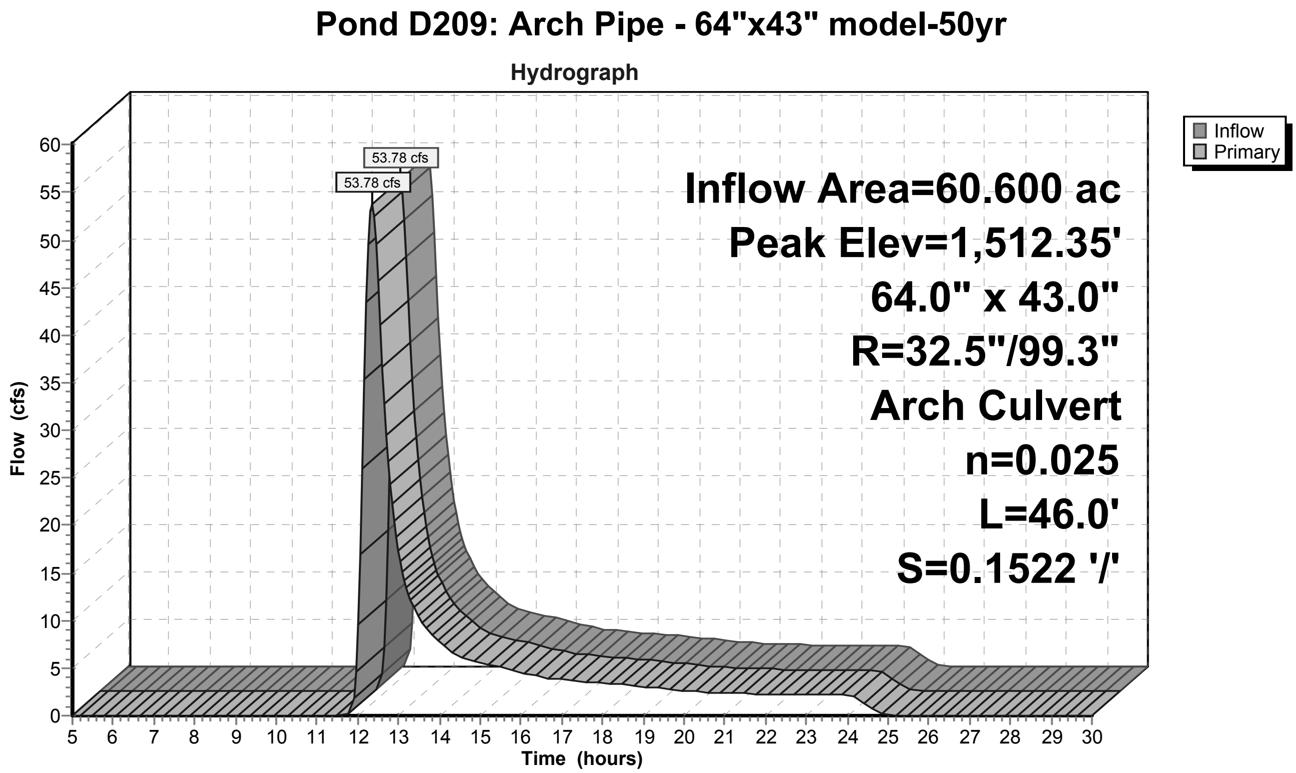
Summary for Pond D209: Arch Pipe - 64"x43" model-50yr

Inflow Area = 60.600 ac, 0.00% Impervious, Inflow Depth = 1.34" for 25-yr event
Inflow = 53.78 cfs @ 12.34 hrs, Volume= 6.759 af
Outflow = 53.78 cfs @ 12.34 hrs, Volume= 6.759 af, Atten= 0%, Lag= 0.0 min
Primary = 53.78 cfs @ 12.34 hrs, Volume= 6.759 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,512.35' @ 12.34 hrs
Flood Elev= 1,524.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,510.00'	**64.0" W x 43.0" H, R=32.5"/99.3" Arch Culvert** L= 46.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,503.00' S= 0.1522 '/' Cc= 0.900 n= 0.025

Primary OutFlow Max=53.66 cfs @ 12.34 hrs HW=1,512.35' (Free Discharge)
└─**1=Culvert** (Inlet Controls 53.66 cfs @ 4.80 fps)



Summary for Pond D210: Arch Pipe - 24"x18" model-25yr

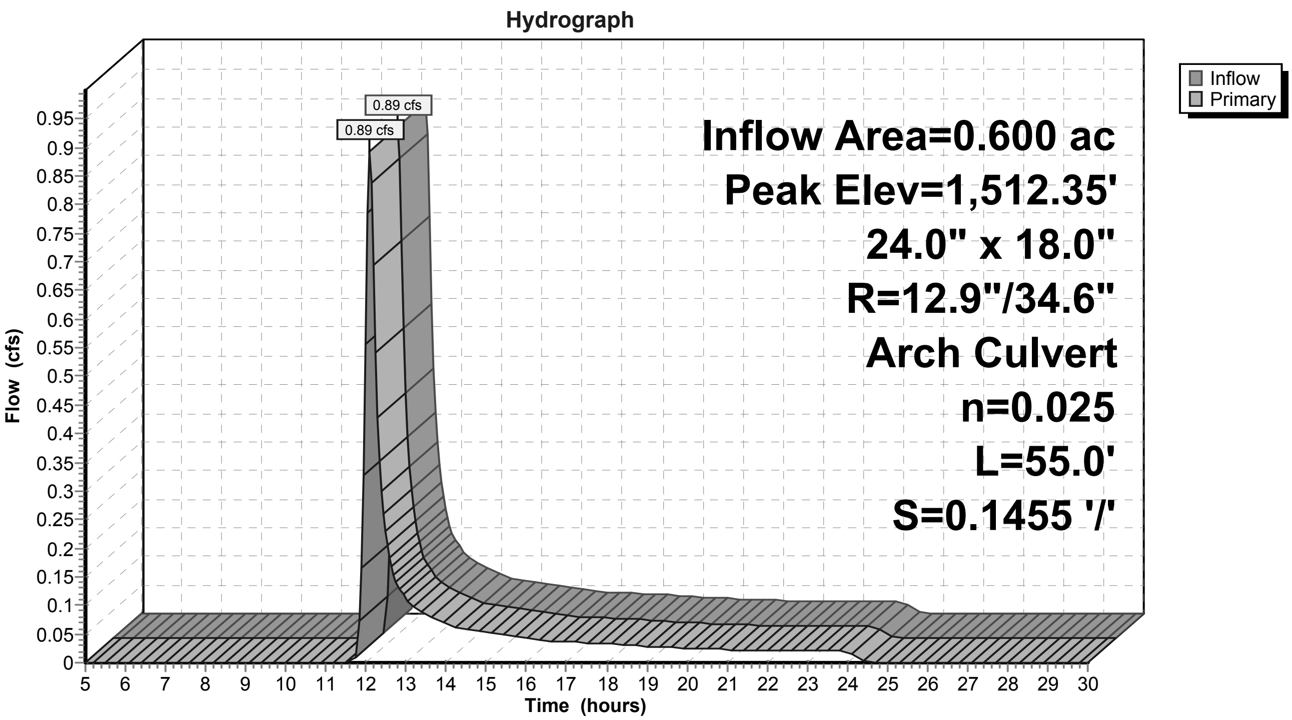
Inflow Area =	0.600 ac,	0.00% Impervious, Inflow Depth = 1.34"	for 25-yr event	
Inflow =	0.89 cfs @	12.11 hrs, Volume=	0.067 af	
Outflow =	0.89 cfs @	12.11 hrs, Volume=	0.067 af,	Atten= 0%, Lag= 0.0 min
Primary =	0.89 cfs @	12.11 hrs, Volume=	0.067 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,512.35' @ 12.11 hrs
Flood Elev= 1,518.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,512.00'	**24.0" W x 18.0" H, R=12.9"/34.6" Arch Culvert** L= 55.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,504.00' S= 0.1455 '/' Cc= 0.900 n= 0.025

Primary OutFlow Max=0.88 cfs @ 12.11 hrs HW=1,512.35' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 0.88 cfs @ 1.76 fps)

Pond D210: Arch Pipe - 24"x18" model-25yr



Summary for Pond D211: Arch Pipe - 24"x18" model-25yr

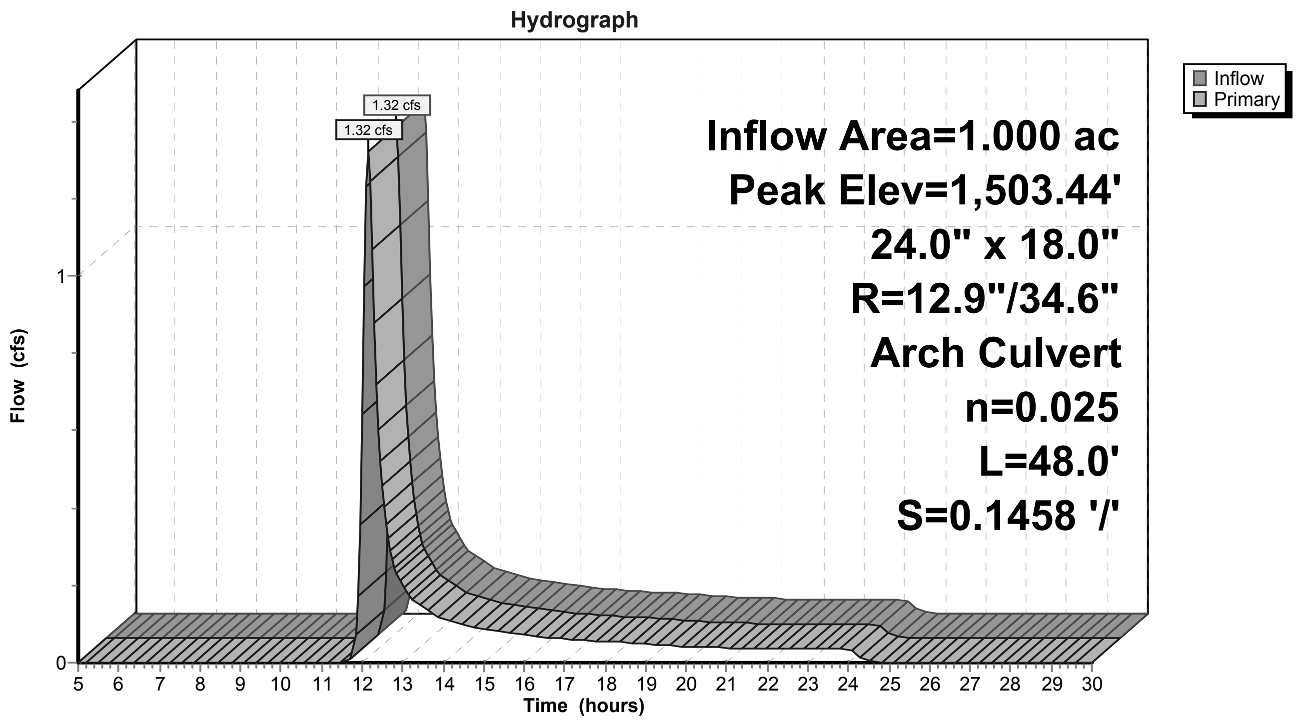
Inflow Area =	1.000 ac,	0.00% Impervious, Inflow Depth = 1.34"	for 25-yr event	
Inflow =	1.32 cfs @	12.15 hrs, Volume=	0.112 af	
Outflow =	1.32 cfs @	12.15 hrs, Volume=	0.112 af,	Atten= 0%, Lag= 0.0 min
Primary =	1.32 cfs @	12.15 hrs, Volume=	0.112 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,503.44' @ 12.15 hrs
Flood Elev= 1,504.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,503.00'	**24.0" W x 18.0" H, R=12.9"/34.6" Arch Culvert** L= 48.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,496.00' S= 0.1458 '/' Cc= 0.900 n= 0.025

Primary OutFlow Max=1.32 cfs @ 12.15 hrs HW=1,503.44' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 1.32 cfs @ 1.97 fps)

Pond D211: Arch Pipe - 24"x18" model-25yr



Summary for Pond D212: Arch Pipe - 24"x18" model-25yr

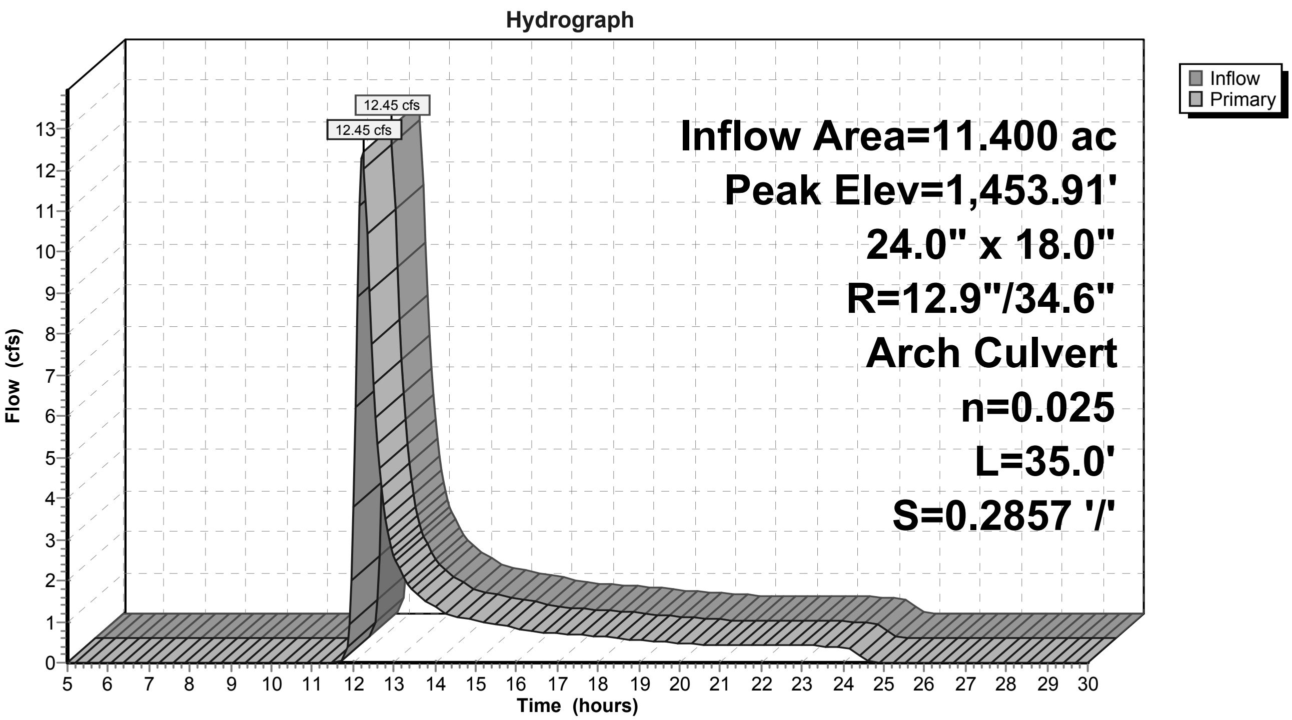
Inflow Area =	11.400 ac,	0.00% Impervious, Inflow Depth = 1.34"	for 25-yr event	
Inflow =	12.45 cfs @	12.23 hrs, Volume=	1.271 af	
Outflow =	12.45 cfs @	12.23 hrs, Volume=	1.271 af,	Atten= 0%, Lag= 0.0 min
Primary =	12.45 cfs @	12.23 hrs, Volume=	1.271 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,453.91' @ 12.23 hrs
Flood Elev= 1,464.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,452.00'	**24.0" W x 18.0" H, R=12.9"/34.6" Arch Culvert** L= 35.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,442.00' S= 0.2857 '/' Cc= 0.900 n= 0.025

Primary OutFlow Max=12.36 cfs @ 12.23 hrs HW=1,453.89' (Free Discharge)
└─**1=Culvert** (Inlet Controls 12.36 cfs @ 5.14 fps)

Pond D212: Arch Pipe - 24"x18" model-25yr



Summary for Pond D213: Arch Pipe - 57"x38" model-50yr

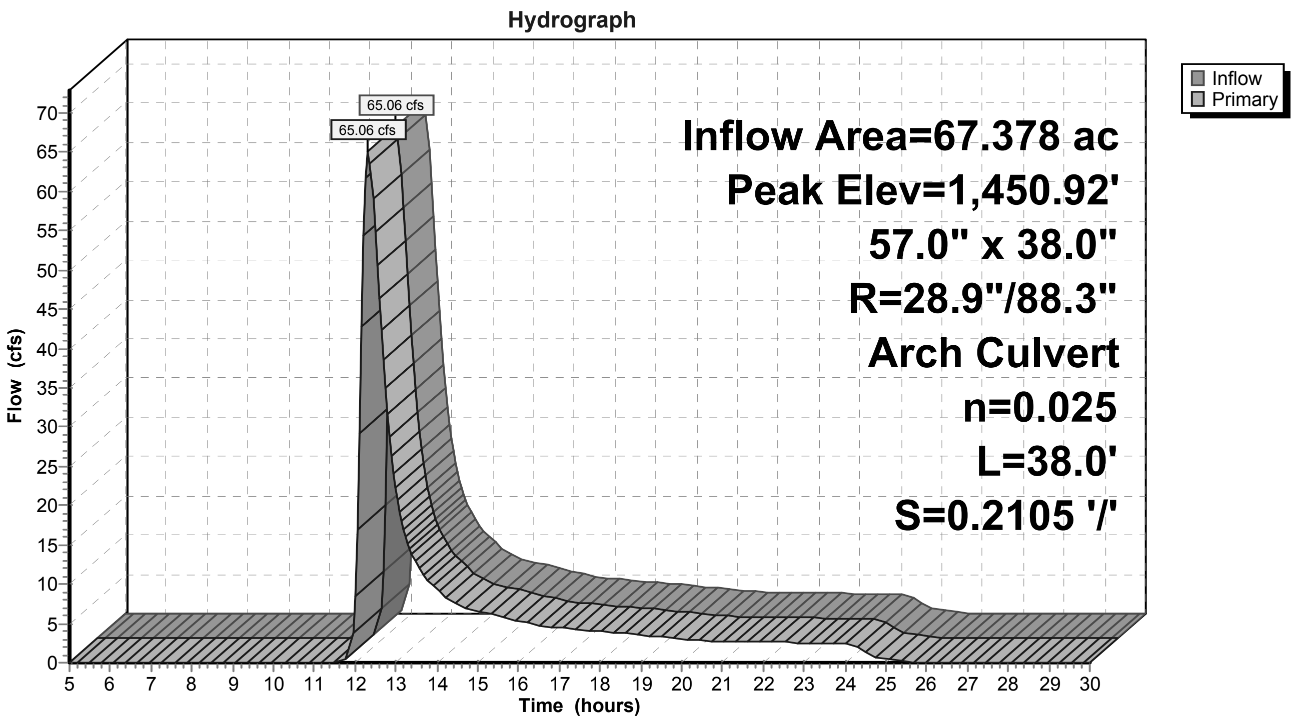
Inflow Area = 67.378 ac, 0.00% Impervious, Inflow Depth = 1.45" for 25-yr event
Inflow = 65.06 cfs @ 12.32 hrs, Volume= 8.140 af
Outflow = 65.06 cfs @ 12.32 hrs, Volume= 8.140 af, Atten= 0%, Lag= 0.0 min
Primary = 65.06 cfs @ 12.32 hrs, Volume= 8.140 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,450.92' @ 12.32 hrs
Flood Elev= 1,456.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,448.00'	**57.0" W x 38.0" H, R=28.9"/88.3" Arch Culvert** L= 38.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,440.00' S= 0.2105 '/' Cc= 0.900 n= 0.025

Primary OutFlow Max=64.67 cfs @ 12.32 hrs HW=1,450.90' (Free Discharge)
└─**1=Culvert** (Inlet Controls 64.67 cfs @ 5.62 fps)

Pond D213: Arch Pipe - 57"x38" model-50yr



Summary for Pond D214: Arch Pipe - 24"x18" model-25yr

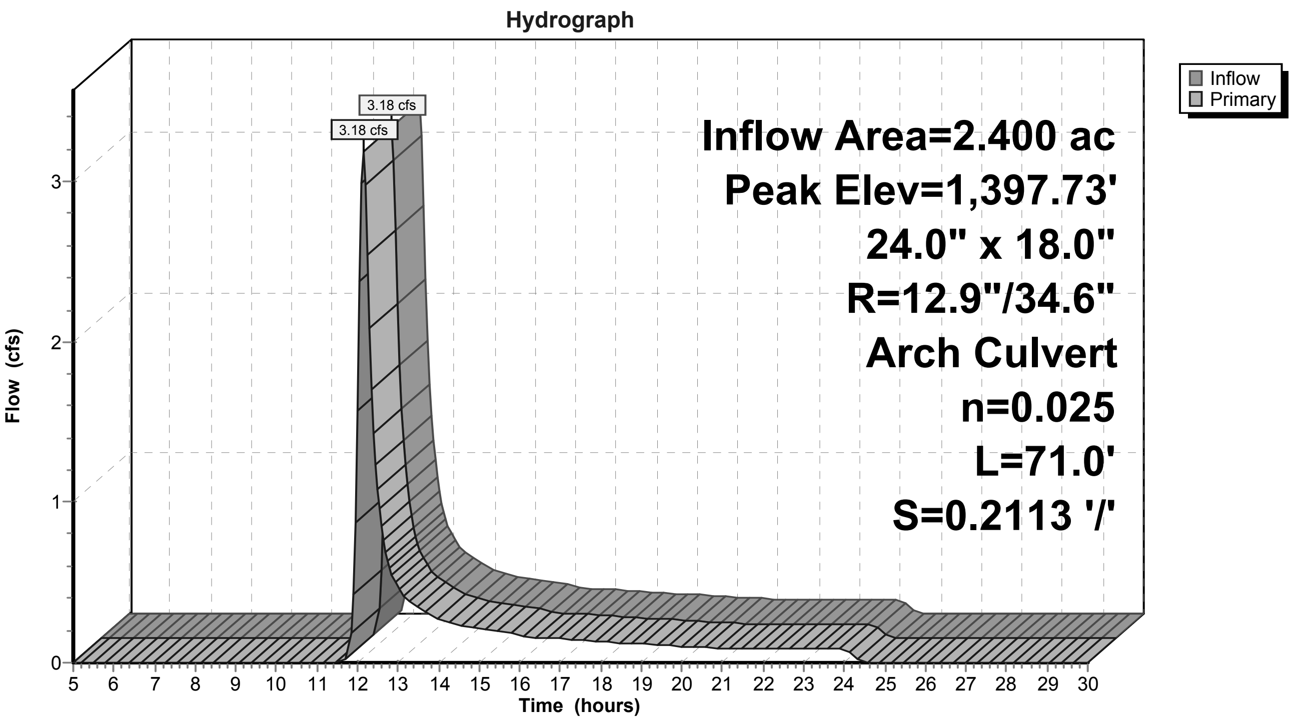
Inflow Area =	2.400 ac,	0.00% Impervious,	Inflow Depth = 1.34"	for 25-yr event	
Inflow =	3.18 cfs @	12.15 hrs,	Volume=	0.268 af	
Outflow =	3.18 cfs @	12.15 hrs,	Volume=	0.268 af,	Atten= 0%, Lag= 0.0 min
Primary =	3.18 cfs @	12.15 hrs,	Volume=	0.268 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,397.73' @ 12.15 hrs
Flood Elev= 1,401.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,397.00'	**24.0" W x 18.0" H, R=12.9"/34.6" Arch Culvert** L= 71.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,382.00' S= 0.2113 '/' Cc= 0.900 n= 0.025

Primary OutFlow Max=3.18 cfs @ 12.15 hrs HW=1,397.73' (Free Discharge)
└─**1=Culvert** (Inlet Controls 3.18 cfs @ 2.57 fps)

Pond D214: Arch Pipe - 24"x18" model-25yr



Summary for Pond D215: RCP - 24" model-25yr

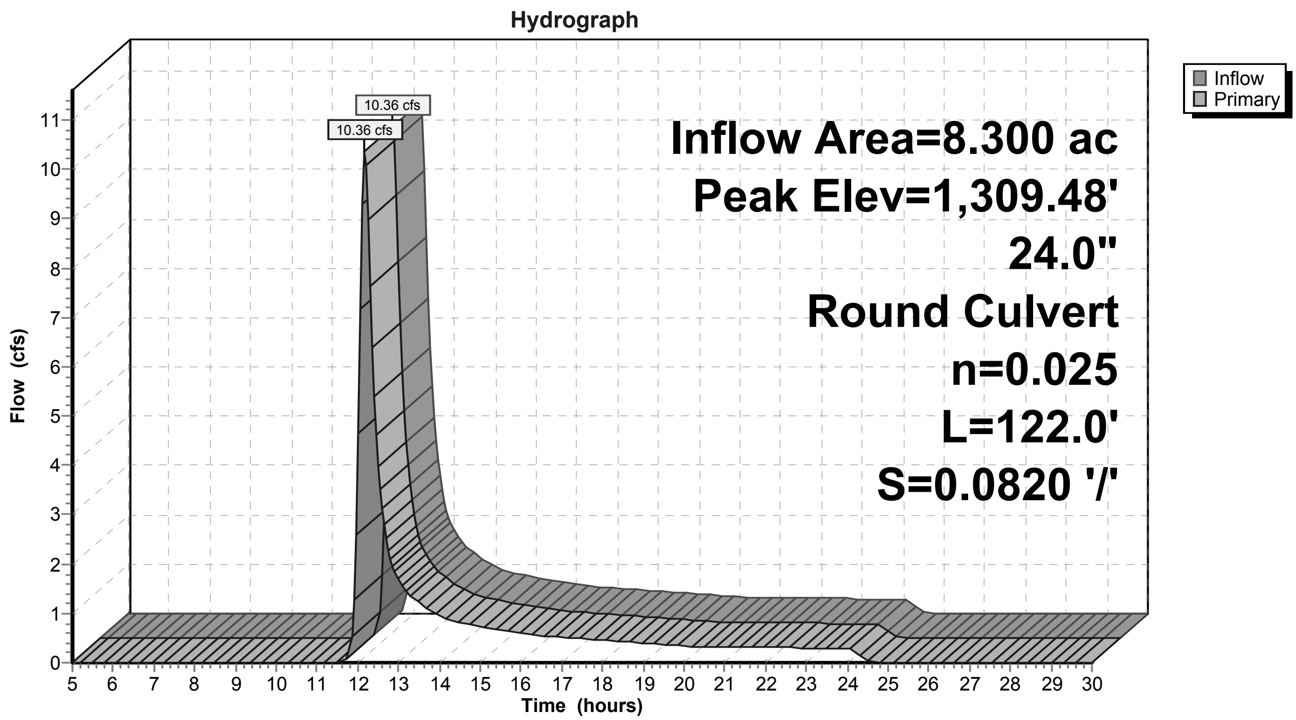
Inflow Area = 8.300 ac, 0.00% Impervious, Inflow Depth = 1.34" for 25-yr event
Inflow = 10.36 cfs @ 12.17 hrs, Volume= 0.926 af
Outflow = 10.36 cfs @ 12.17 hrs, Volume= 0.926 af, Atten= 0%, Lag= 0.0 min
Primary = 10.36 cfs @ 12.17 hrs, Volume= 0.926 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,309.48' @ 12.17 hrs
Flood Elev= 1,318.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,308.00'	**24.0" Round Culvert** L= 122.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,298.00' S= 0.0820 '/' Cc= 0.900 n= 0.025

Primary OutFlow Max=10.23 cfs @ 12.17 hrs HW=1,309.47' (Free Discharge)
1=Culvert (Inlet Controls 10.23 cfs @ 4.13 fps)

Pond D215: RCP - 24" model-25yr



Summary for Pond D216: Arch Pipe - 24"x18" model-25yr

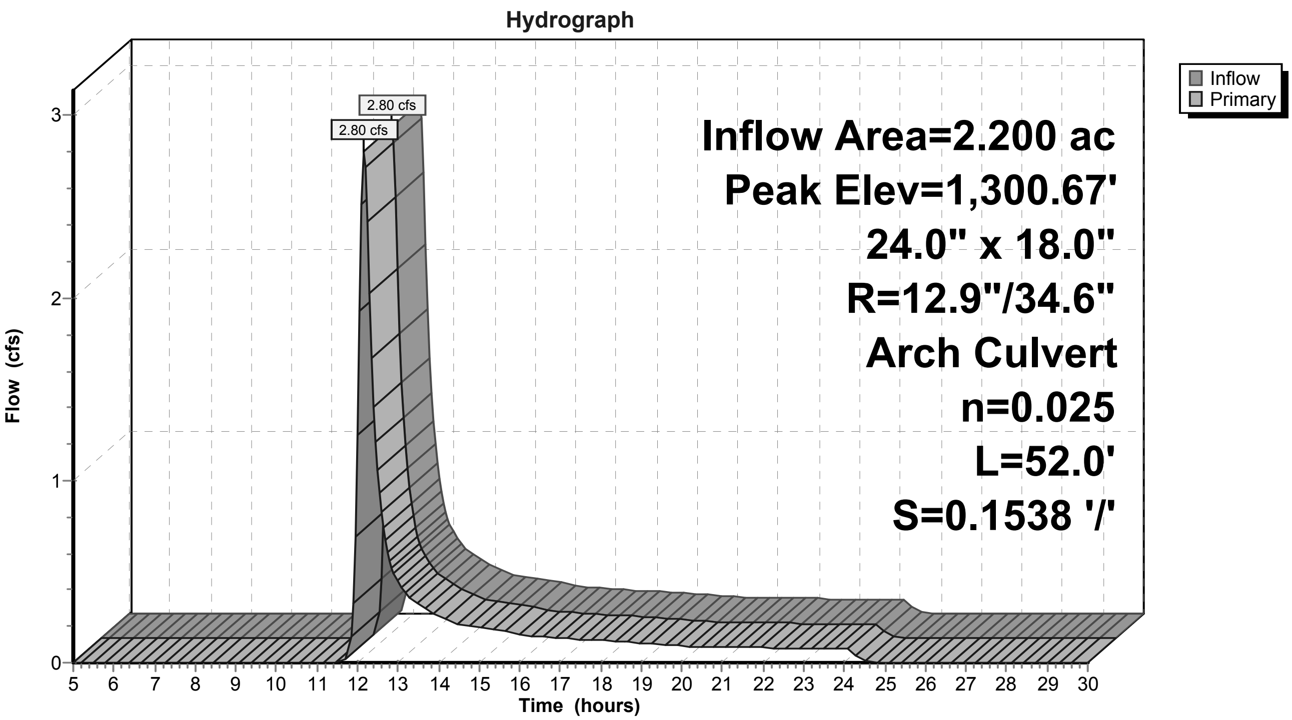
Inflow Area = 2.200 ac, 0.00% Impervious, Inflow Depth = 1.34" for 25-yr event
Inflow = 2.80 cfs @ 12.16 hrs, Volume= 0.245 af
Outflow = 2.80 cfs @ 12.16 hrs, Volume= 0.245 af, Atten= 0%, Lag= 0.0 min
Primary = 2.80 cfs @ 12.16 hrs, Volume= 0.245 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,300.67' @ 12.16 hrs
Flood Elev= 1,303.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,300.00'	**24.0" W x 18.0" H, R=12.9"/34.6" Arch Culvert** L= 52.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,292.00' S= 0.1538 '/' Cc= 0.900 n= 0.025

Primary OutFlow Max=2.76 cfs @ 12.16 hrs HW=1,300.67' (Free Discharge)
└─**1=Culvert** (Inlet Controls 2.76 cfs @ 2.46 fps)

Pond D216: Arch Pipe - 24"x18" model-25yr



Summary for Pond D217: 17.3'x3.5' Box-100yr

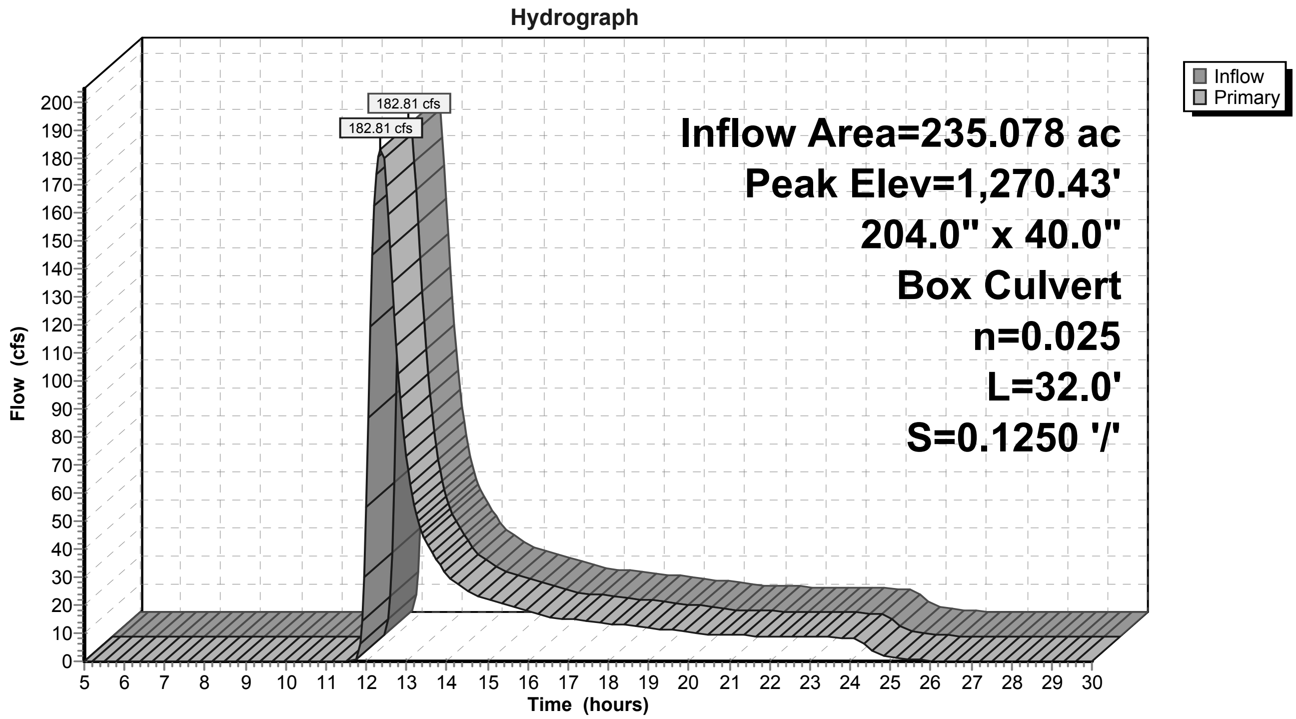
Inflow Area =	235.078 ac,	0.00% Impervious, Inflow Depth = 1.37"	for 25-yr event
Inflow =	182.81 cfs @	12.36 hrs, Volume=	26.844 af
Outflow =	182.81 cfs @	12.36 hrs, Volume=	26.844 af, Atten= 0%, Lag= 0.0 min
Primary =	182.81 cfs @	12.36 hrs, Volume=	26.844 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,270.43' @ 12.36 hrs
Flood Elev= 1,272.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,268.00'	**204.0" W x 40.0" H Box Culvert** L= 32.0' Box, 0° wingwalls, square crown edge, Ke= 0.700 Outlet Invert= 1,264.00' S= 0.1250 '/' Cc= 0.900 n= 0.025 Earth, clean & winding

Primary OutFlow Max=182.50 cfs @ 12.36 hrs HW=1,270.43' (Free Discharge)
└─**1=Culvert** (Inlet Controls 182.50 cfs @ 4.42 fps)

Pond D217: 17.3'x3.5' Box-100yr



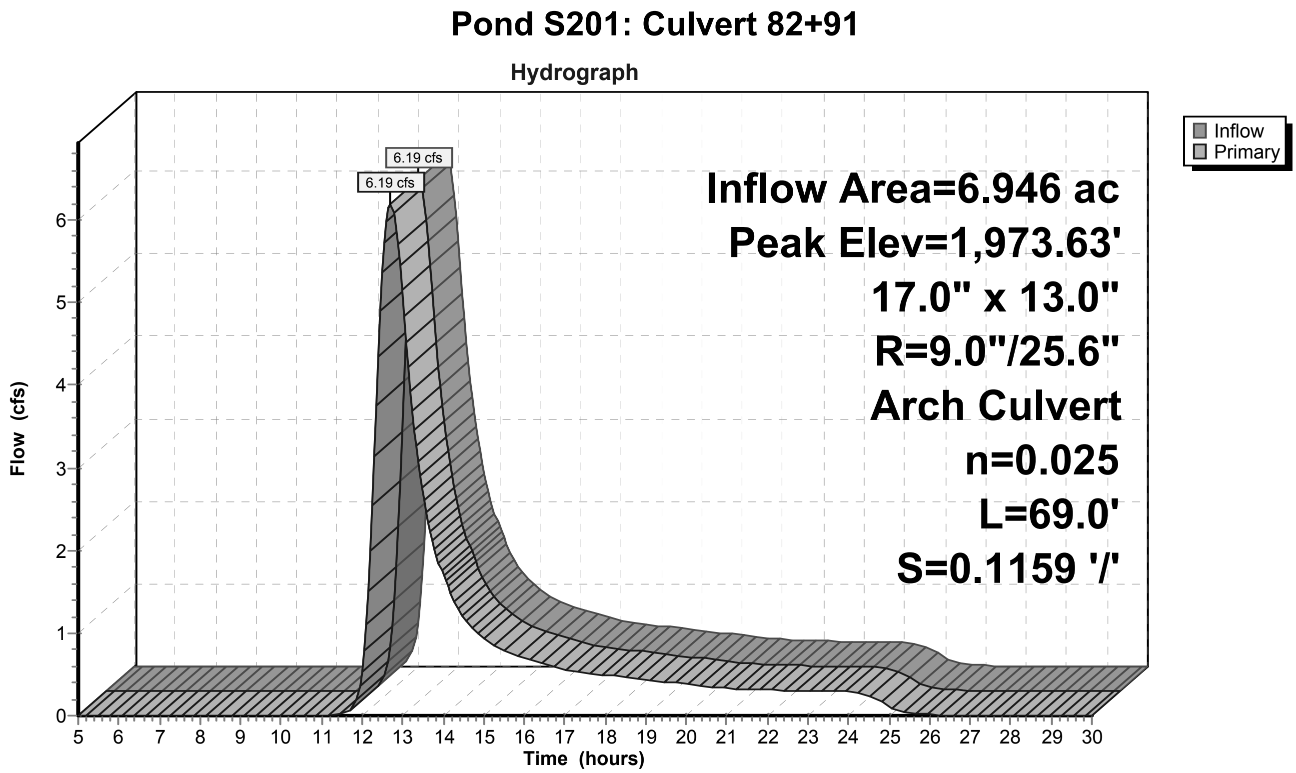
Summary for Pond S201: Culvert 82+91

Inflow Area =	6.946 ac,	0.00% Impervious, Inflow Depth = 1.84"	for 25-yr event
Inflow =	6.19 cfs @	12.71 hrs, Volume=	1.067 af
Outflow =	6.19 cfs @	12.71 hrs, Volume=	1.067 af, Atten= 0%, Lag= 0.0 min
Primary =	6.19 cfs @	12.71 hrs, Volume=	1.067 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,973.63' @ 12.71 hrs
Flood Elev= 1,976.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,972.00'	**17.0" W x 13.0" H, R=9.0"/25.6" Arch Culvert** L= 69.0' CMP, square edge headwall, Ke= 0.500 Outlet Invert= 1,964.00' S= 0.1159 '/' Cc= 0.900 n= 0.025

Primary OutFlow Max=6.19 cfs @ 12.71 hrs HW=1,973.63' (Free Discharge)
└─**1=Culvert** (Inlet Controls 6.19 cfs @ 5.04 fps)



Summary for Pond S204: Arch Pipe - 24"x18" model-25yr

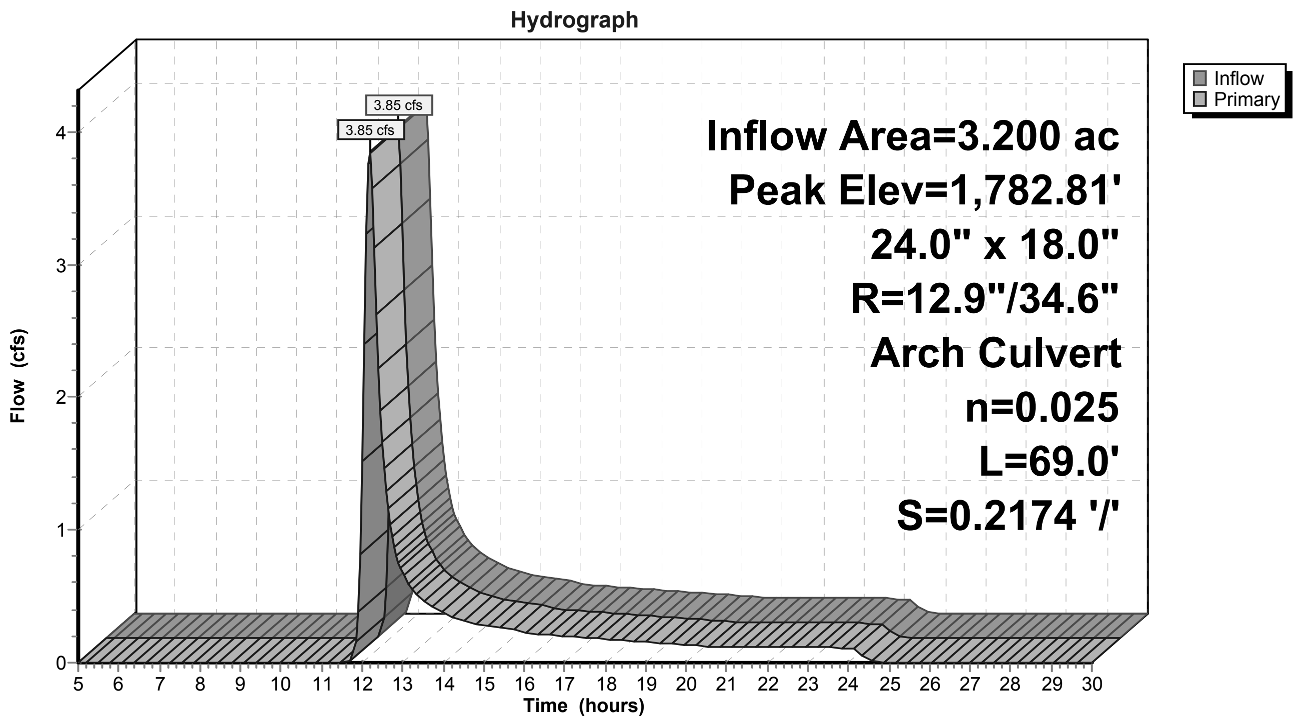
Inflow Area =	3.200 ac,	0.00% Impervious, Inflow Depth = 1.34"	for 25-yr event	
Inflow =	3.85 cfs @	12.19 hrs, Volume=	0.357 af	
Outflow =	3.85 cfs @	12.19 hrs, Volume=	0.357 af,	Atten= 0%, Lag= 0.0 min
Primary =	3.85 cfs @	12.19 hrs, Volume=	0.357 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,782.81' @ 12.19 hrs
Flood Elev= 1,784.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,782.00'	**24.0" W x 18.0" H, R=12.9"/34.6" Arch Culvert** L= 69.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,767.00' S= 0.2174 '/' Cc= 0.900 n= 0.025

Primary OutFlow Max=3.82 cfs @ 12.19 hrs HW=1,782.81' (Free Discharge)
└─**1=Culvert** (Inlet Controls 3.82 cfs @ 2.73 fps)

Pond S204: Arch Pipe - 24"x18" model-25yr



Summary for Pond S219: Culvert 219 (9'x3' Box)

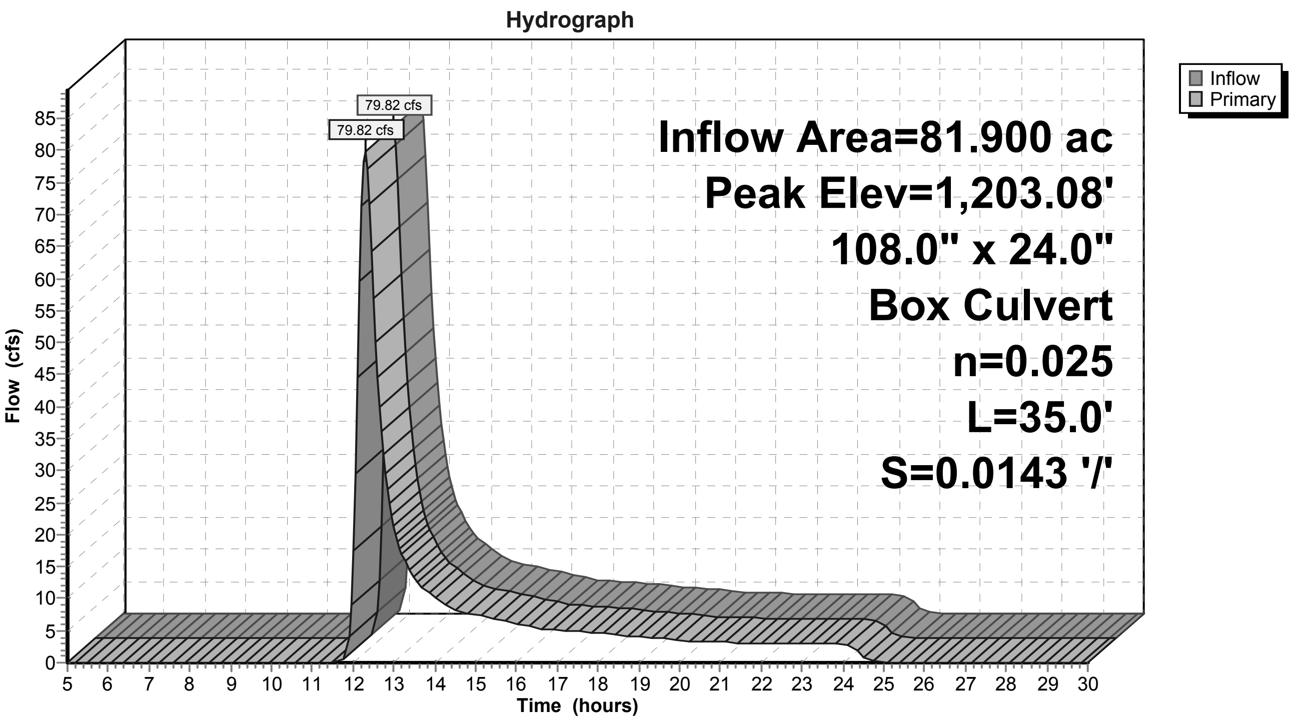
Inflow Area = 81.900 ac, 0.00% Impervious, Inflow Depth = 1.34" for 25-yr event
Inflow = 79.82 cfs @ 12.29 hrs, Volume= 9.134 af
Outflow = 79.82 cfs @ 12.29 hrs, Volume= 9.134 af, Atten= 0%, Lag= 0.0 min
Primary = 79.82 cfs @ 12.29 hrs, Volume= 9.134 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,203.08' @ 12.29 hrs
Flood Elev= 1,205.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,201.00'	**108.0" W x 24.0" H Box Culvert** L= 35.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,200.50' S= 0.0143 '/' Cc= 0.900 n= 0.025

Primary OutFlow Max=79.58 cfs @ 12.29 hrs HW=1,203.07' (Free Discharge)
└**1=Culvert** (Barrel Controls 79.58 cfs @ 5.69 fps)

Pond S219: Culvert 219 (9'x3' Box)



Summary for Pond S220: Culvert 220 (21"x15") Intermittent Stream

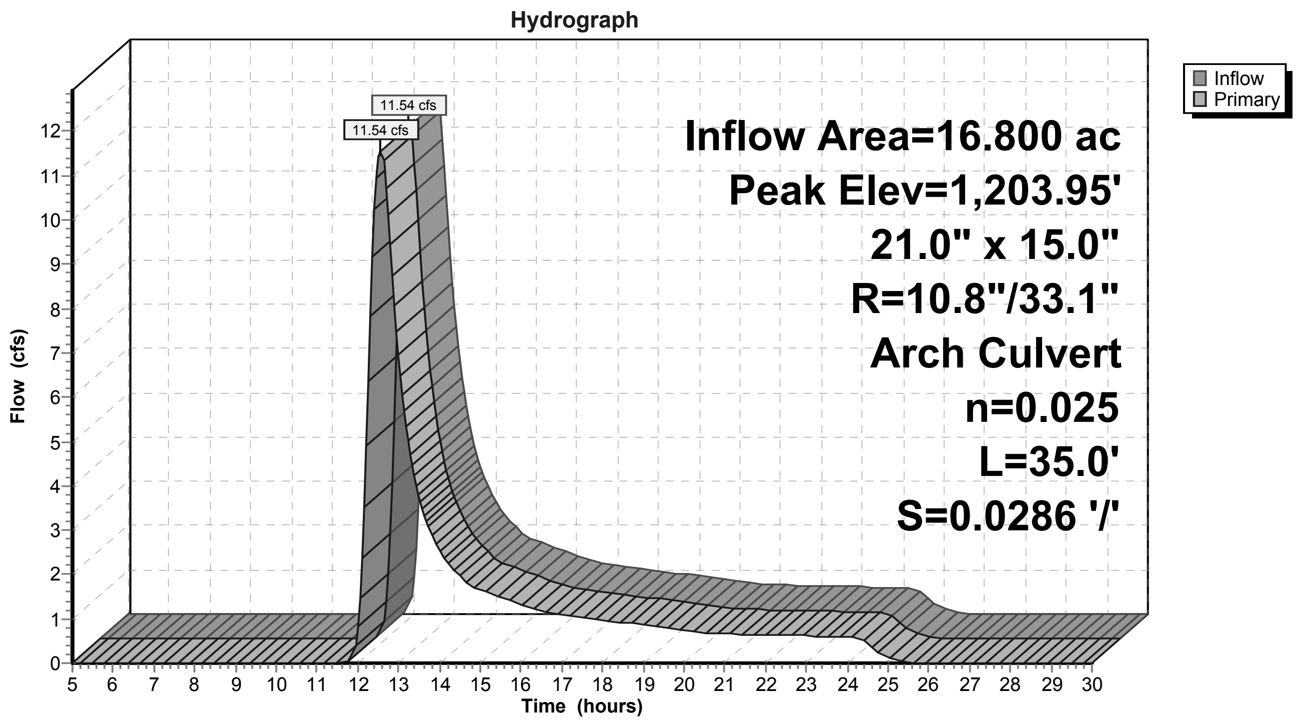
Inflow Area =	16.800 ac,	0.00% Impervious,	Inflow Depth = 1.34"	for 25-yr event	
Inflow =	11.54 cfs @	12.56 hrs,	Volume=	1.874 af	
Outflow =	11.54 cfs @	12.56 hrs,	Volume=	1.874 af,	Atten= 0%, Lag= 0.0 min
Primary =	11.54 cfs @	12.56 hrs,	Volume=	1.874 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,203.95' @ 12.56 hrs
Flood Elev= 1,204.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,201.00'	**21.0" W x 15.0" H, R=10.8"/33.1" Arch Culvert** L= 35.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,200.00' S= 0.0286 '/' Cc= 0.900 n= 0.025

Primary OutFlow Max=11.53 cfs @ 12.56 hrs HW=1,203.95' (Free Discharge)
└─**1=Culvert** (Barrel Controls 11.53 cfs @ 6.61 fps)

Pond S220: Culvert 220 (21"x15") Intermittent Stream



Summary for Pond S221: Culvert 221 (9'x3' Box)

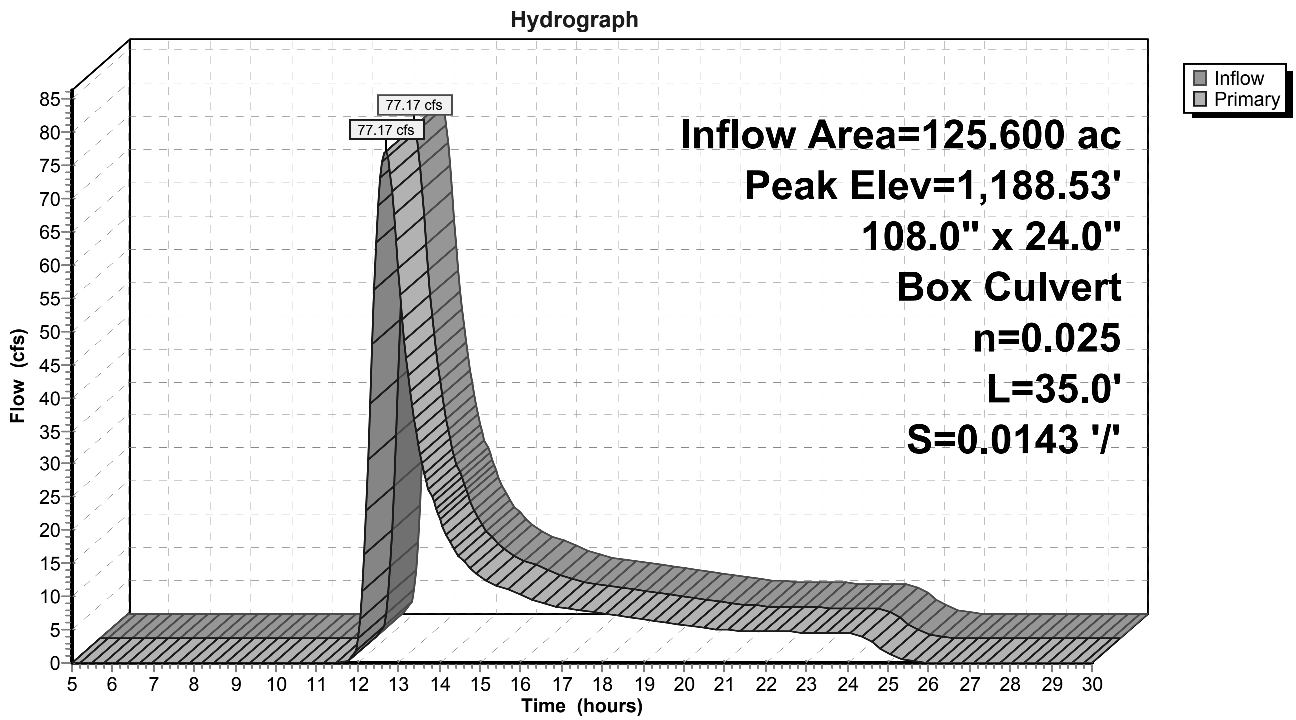
Inflow Area = 125.600 ac, 0.00% Impervious, Inflow Depth = 1.34" for 25-yr event
Inflow = 77.17 cfs @ 12.68 hrs, Volume= 14.008 af
Outflow = 77.17 cfs @ 12.68 hrs, Volume= 14.008 af, Atten= 0%, Lag= 0.0 min
Primary = 77.17 cfs @ 12.68 hrs, Volume= 14.008 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,188.53' @ 12.68 hrs
Flood Elev= 1,190.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,186.50'	**108.0" W x 24.0" H Box Culvert** L= 35.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,186.00' S= 0.0143 '/' Cc= 0.900 n= 0.025

Primary OutFlow Max=77.00 cfs @ 12.68 hrs HW=1,188.52' (Free Discharge)
└─**1=Culvert** (Barrel Controls 77.00 cfs @ 5.63 fps)

Pond S221: Culvert 221 (9'x3' Box)



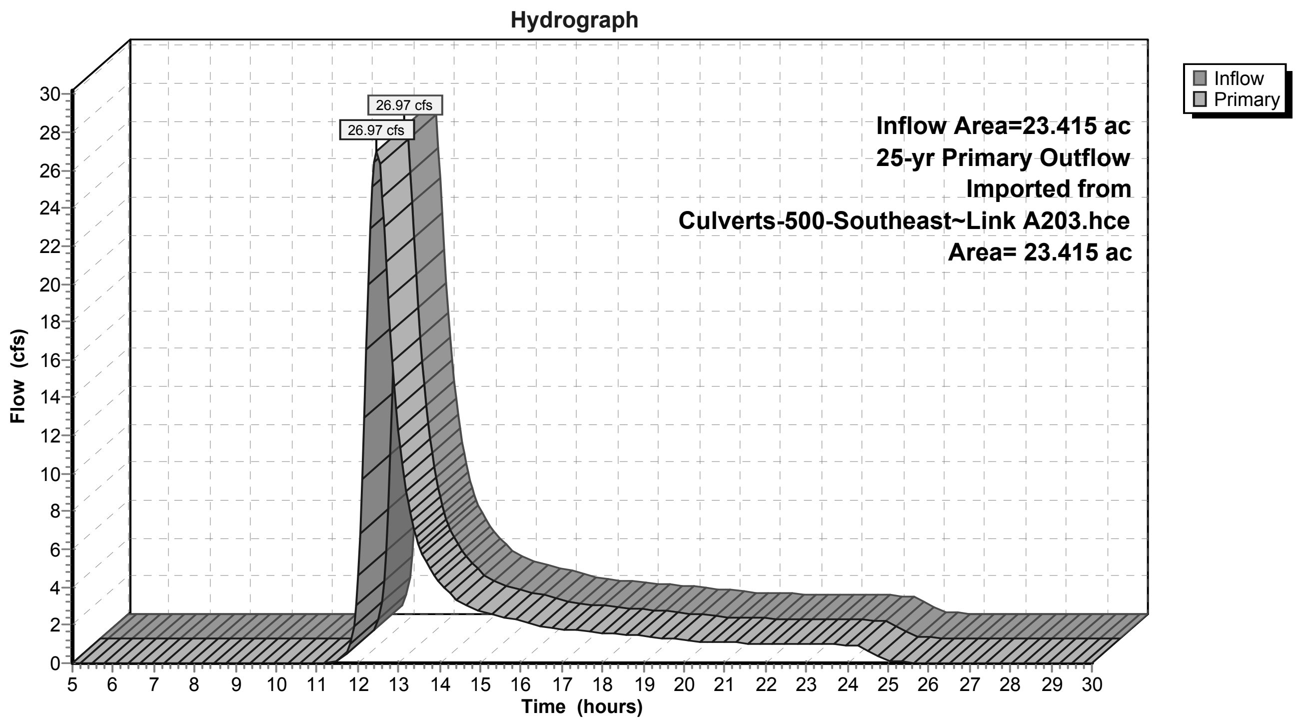
Summary for Link A203L: (new Link)

Inflow Area = 23.415 ac, 0.00% Impervious, Inflow Depth = 1.84" for 25-yr event
Inflow = 26.97 cfs @ 12.46 hrs, Volume= 3.596 af
Primary = 26.97 cfs @ 12.46 hrs, Volume= 3.596 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

25-yr Primary Outflow Imported from Culverts-500-Southeast~Link A203.hce

Link A203L: (new Link)



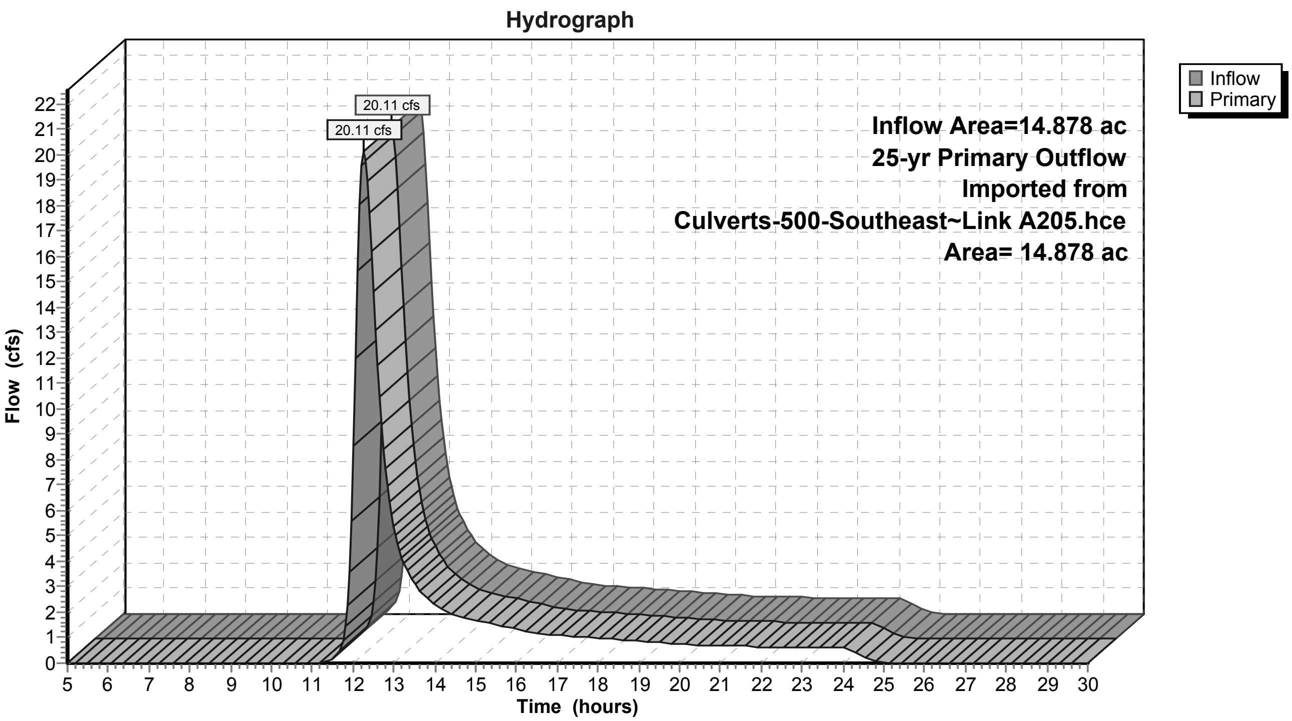
Summary for Link A205L: 500 Link

Inflow Area = 14.878 ac, 0.00% Impervious, Inflow Depth = 1.84" for 25-yr event
Inflow = 20.11 cfs @ 12.26 hrs, Volume= 2.285 af
Primary = 20.11 cfs @ 12.26 hrs, Volume= 2.285 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

25-yr Primary Outflow Imported from Culverts-500-Southeast~Link A205.hce

Link A205L: 500 Link



Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment203: To Culvert 203 (10.0 ac) Runoff Area=10.000 ac 0.00% Impervious Runoff Depth=1.67"
Flow Length=1,438' Tc=20.4 min CN=67 Runoff=16.89 cfs 1.392 af

Subcatchment208: To Culvert 208 (53.0 ac) Runoff Area=53.000 ac 0.00% Impervious Runoff Depth=1.67"
Flow Length=2,839' Tc=33.1 min CN=67 Runoff=64.23 cfs 7.377 af

Subcatchment209: To Culvert 209 (5.7 ac) Runoff Area=7.600 ac 0.00% Impervious Runoff Depth=1.67"
Flow Length=1,417' Tc=20.1 min CN=67 Runoff=12.96 cfs 1.058 af

Subcatchment213: To Culvert 213 (14.0 ac) Runoff Area=19.900 ac 0.00% Impervious Runoff Depth=1.67"
Flow Length=3,233' Tc=29.7 min CN=67 Runoff=26.05 cfs 2.770 af

Subcatchment217: To Culvert 217 (93.3 ac) Runoff Area=94.100 ac 0.00% Impervious Runoff Depth=1.67"
Flow Length=578' Tc=20.8 min CN=67 Runoff=157.01 cfs 13.097 af

Subcatchment219: To Culvert 219 (81.9 ac) Runoff Area=81.900 ac 0.00% Impervious Runoff Depth=1.67"
Flow Length=5,195' Tc=30.5 min CN=67 Runoff=105.14 cfs 11.399 af

Subcatchment221: To Culvert 221 (125.6 Runoff Area=125.600 ac 0.00% Impervious Runoff Depth=1.67"
Flow Length=4,131' Tc=57.4 min CN=67 Runoff=101.46 cfs 17.482 af

Subcatchment222: To Culvert 222 (36.6 ac) Runoff Area=36.600 ac 0.00% Impervious Runoff Depth=1.67"
Flow Length=2,917' Tc=34.1 min CN=67 Runoff=43.29 cfs 5.094 af

Reach R203L: Reach 203L Avg. Depth=0.46' Max Vel=8.24 fps Inflow=33.37 cfs 4.343 af
n=0.040 L=1,354.0' S=0.2437 '/' Capacity=178.76 cfs Outflow=33.10 cfs 4.343 af

Reach R205: Reach 205 Avg. Depth=0.50' Max Vel=8.10 fps Inflow=60.59 cfs 7.297 af
n=0.040 L=1,400.0' S=0.1786 '/' Capacity=2,690.71 cfs Outflow=60.15 cfs 7.297 af

Reach R208: Reach 208 Avg. Depth=0.73' Max Vel=8.41 fps Inflow=64.23 cfs 7.377 af
n=0.040 L=585.0' S=0.1385 '/' Capacity=601.39 cfs Outflow=63.72 cfs 7.377 af

Reach R209: Reach 209 Avg. Depth=0.75' Max Vel=7.51 fps Inflow=72.58 cfs 8.657 af
n=0.040 L=2,098.0' S=0.1125 '/' Capacity=10,342.61 cfs Outflow=70.10 cfs 8.657 af

Reach R217: Reach 217 Avg. Depth=1.29' Max Vel=8.61 fps Inflow=260.07 cfs 34.870 af
n=0.040 L=2,631.0' S=0.0699 '/' Capacity=3,336.17 cfs Outflow=253.23 cfs 34.870 af

Reach R217A: Major Stream Avg. Depth=0.90' Max Vel=7.81 fps Inflow=100.94 cfs 11.654 af
n=0.040 L=1,775.0' S=0.0992 '/' Capacity=9,710.33 cfs Outflow=98.01 cfs 11.654 af

Pond 218a: 17.3'x3.5' Box-100yr Peak Elev=1,193.28' Inflow=292.12 cfs 39.964 af
208.0" x 40.0" Box Culvert n=0.025 L=73.0' S=0.0274 '/' Outflow=292.12 cfs 39.964 af

Pond D203: Arch Pipe - 57"x38" model-50yr Peak Elev=1,786.04' Inflow=38.80 cfs 5.735 af
57.0" x 38.0", R=28.9"/88.3" Arch Culvert n=0.025 L=41.0' S=0.1951 '/' Outflow=38.80 cfs 5.735 af

Pond D208: Arch Pipe - 57"x38" model-50yr Peak Elev=1,596.89' Inflow=64.23 cfs 7.377 af
57.0" x 38.0", R=28.9"/88.3" Arch Culvert n=0.025 L=52.0' S=0.0577 '/' Outflow=64.23 cfs 7.377 af

Pond D209: Arch Pipe - 64"x43" model-50yr Peak Elev=1,512.83' Inflow=71.00 cfs 8.435 af
64.0" x 43.0", R=32.5"/99.3" Arch Culvert n=0.025 L=46.0' S=0.1522 '/' Outflow=71.00 cfs 8.435 af

Pond D213: Arch Pipe - 57"x38" model-50yr Peak Elev=1,451.78' Inflow=85.74 cfs 10.067 af
57.0" x 38.0", R=28.9"/88.3" Arch Culvert n=0.025 L=38.0' S=0.2105 '/' Outflow=85.74 cfs 10.067 af

Pond D217: 17.3'x3.5' Box-100yr Peak Elev=1,270.98' Inflow=248.07 cfs 33.408 af
204.0" x 40.0" Box Culvert n=0.025 L=32.0' S=0.1250 '/' Outflow=248.07 cfs 33.408 af

Pond S219: Culvert 219 (9'x3' Box) Peak Elev=1,203.54' Inflow=105.14 cfs 11.399 af
108.0" x 24.0" Box Culvert n=0.025 L=35.0' S=0.0143 '/' Outflow=105.14 cfs 11.399 af

Pond S221: Culvert 221 (9'x3' Box) Peak Elev=1,188.97' Inflow=101.46 cfs 17.482 af
108.0" x 24.0" Box Culvert n=0.025 L=35.0' S=0.0143 '/' Outflow=101.46 cfs 17.482 af

Total Runoff Area = 428.700 ac Runoff Volume = 59.668 af Average Runoff Depth = 1.67"
100.00% Pervious = 428.700 ac 0.00% Impervious = 0.000 ac

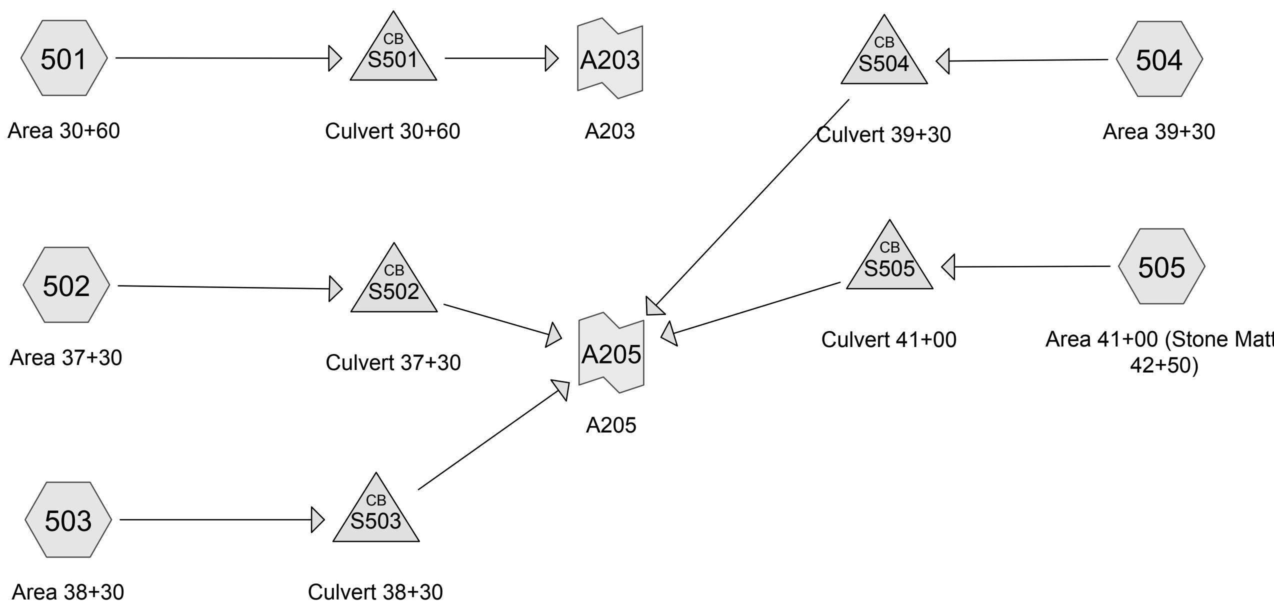
Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

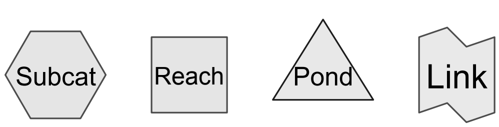
Reach R217: Reach 217 Avg. Depth=1.48' Max Vel=9.32 fps Inflow=351.43 cfs 43.575 af
n=0.040 L=2,631.0' S=0.0699 '/' Capacity=3,336.17 cfs Outflow=341.14 cfs 43.574 af

Reach R217A: Major Stream Avg. Depth=1.02' Max Vel=8.37 fps Inflow=132.41 cfs 14.493 af
n=0.040 L=1,775.0' S=0.0992 '/' Capacity=9,710.33 cfs Outflow=128.63 cfs 14.493 af

Pond 218a: 17.3'x3.5' Box-100yr Peak Elev=1,194.34' Inflow=394.22 cfs 49.956 af
208.0" x 40.0" Box Culvert n=0.025 L=73.0' S=0.0274 '/' Outflow=394.22 cfs 49.956 af

Pond D217: 17.3'x3.5' Box-100yr Peak Elev=1,271.72' Inflow=333.90 cfs 41.744 af
204.0" x 40.0" Box Culvert n=0.025 L=32.0' S=0.1250 '/' Outflow=333.90 cfs 41.744 af





Drainage Diagram for Groton-Culverts-500
Prepared by Vanasse Hangen Brustlin, Inc., Printed 12/2/2009

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
38.293	73	Woods, Fair, HSG C (501, 502, 503, 504, 505)
38.293		**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Goup	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
38.293	HSG C	501, 502, 503, 504, 505
0.000	HSG D	
0.000	Other	
38.293		**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)
1	S501	2,122.00	2,118.00	53.0	0.0755	0.025	42.0	29.0
2	S502	2,150.00	2,140.00	98.0	0.1020	0.025	17.0	13.0
3	S503	2,152.00	2,148.00	52.0	0.0769	0.025	17.0	13.0
4	S504	2,156.00	2,152.00	49.0	0.0816	0.025	24.0	18.0
5	S505	2,160.00	2,158.00	35.0	0.0571	0.025	17.0	13.0

Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment501: Area 30+60 Runoff Area=1,019,946 sf 0.00% Impervious Runoff Depth=1.84"
Flow Length=1,638' Tc=44.7 min CN=73 Runoff=26.97 cfs 3.596 af

Subcatchment502: Area 37+30 Runoff Area=111,495 sf 0.00% Impervious Runoff Depth=1.84"
Flow Length=985' Tc=39.8 min CN=73 Runoff=3.21 cfs 0.393 af

Subcatchment503: Area 38+30 Runoff Area=145,830 sf 0.00% Impervious Runoff Depth=1.84"
Flow Length=1,193' Tc=38.1 min CN=73 Runoff=4.33 cfs 0.514 af

Subcatchment504: Area 39+30 Runoff Area=276,813 sf 0.00% Impervious Runoff Depth=1.84"
Flow Length=1,241' Tc=30.0 min CN=73 Runoff=9.74 cfs 0.976 af

Subcatchment505: Area 41+00 (Stone Runoff Area=113,968 sf 0.00% Impervious Runoff Depth=1.84"
Flow Length=1,340' Tc=18.5 min CN=73 Runoff=5.47 cfs 0.402 af

Pond S501: Culvert 30+60 Peak Elev=2,123.97' Inflow=26.97 cfs 3.596 af
42.0" x 29.0", R=21.5"/66.1" Arch Culvert n=0.025 L=53.0' S=0.0755 '/' Outflow=26.97 cfs 3.596 af

Pond S502: Culvert 37+30 Peak Elev=2,150.88' Inflow=3.21 cfs 0.393 af
17.0" x 13.0", R=9.0"/25.6" Arch Culvert n=0.025 L=98.0' S=0.1020 '/' Outflow=3.21 cfs 0.393 af

Pond S503: Culvert 38+30 Peak Elev=2,153.09' Inflow=4.33 cfs 0.514 af
17.0" x 13.0", R=9.0"/25.6" Arch Culvert n=0.025 L=52.0' S=0.0769 '/' Outflow=4.33 cfs 0.514 af

Pond S504: Culvert 39+30 Peak Elev=2,157.49' Inflow=9.74 cfs 0.976 af
24.0" x 18.0", R=12.5"/34.6" Arch Culvert n=0.025 L=49.0' S=0.0816 '/' Outflow=9.74 cfs 0.976 af

Pond S505: Culvert 41+00 Peak Elev=2,161.39' Inflow=5.47 cfs 0.402 af
17.0" x 13.0", R=9.0"/25.6" Arch Culvert n=0.025 L=35.0' S=0.0571 '/' Outflow=5.47 cfs 0.402 af

Link A203: A203 Inflow=26.97 cfs 3.596 af
Primary=26.97 cfs 3.596 af

Link A205: A205 Inflow=20.11 cfs 2.285 af
Primary=20.11 cfs 2.285 af

Total Runoff Area = 38.293 ac Runoff Volume = 5.882 af Average Runoff Depth = 1.84"
100.00% Pervious = 38.293 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 501: Area 30+60

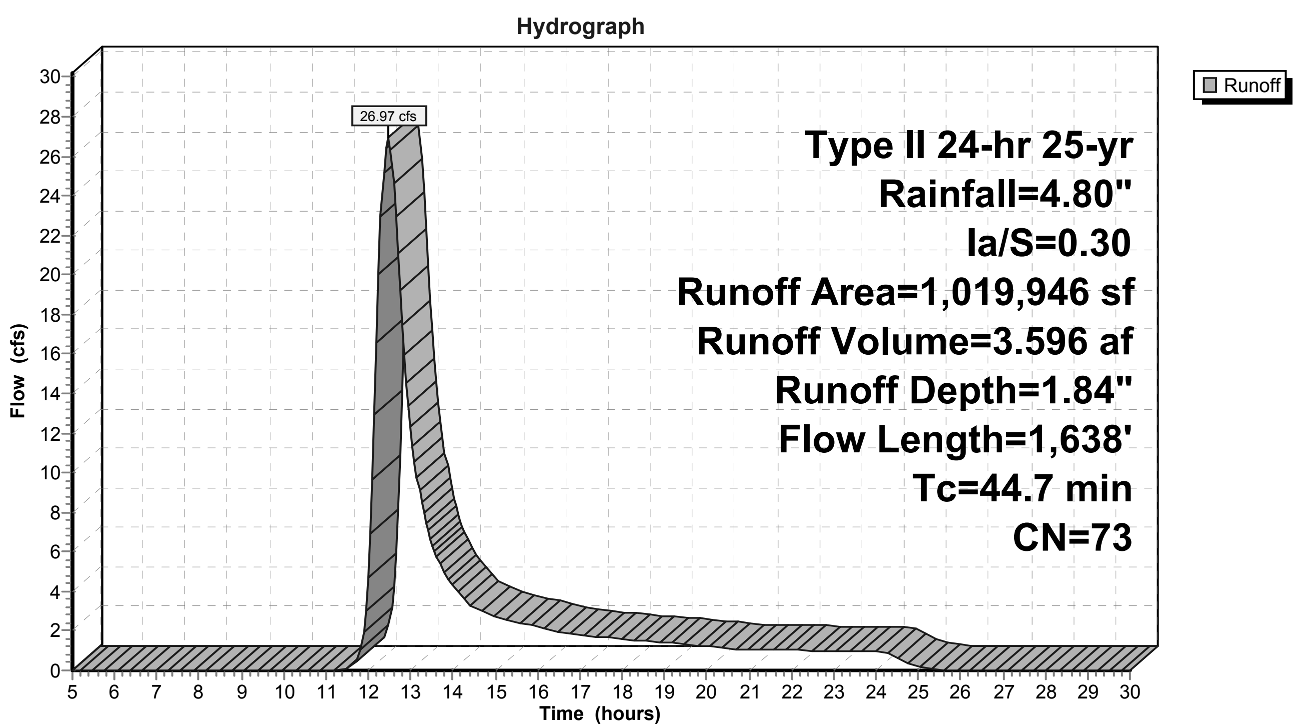
Runoff = 26.97 cfs @ 12.46 hrs, Volume= 3.596 af, Depth= 1.84"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

Area (sf)	CN	Description
1,019,946	73	Woods, Fair, HSG C
1,019,946		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.0	100	0.1100	0.08		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
17.3	900	0.1200	0.87		**Shallow Concentrated Flow, Woods** Forest w/Heavy Litter Kv= 2.5 fps
0.2	51	0.0700	4.26		**Shallow Concentrated Flow, Wetland** Unpaved Kv= 16.1 fps
5.6	382	0.0050	1.14		**Shallow Concentrated Flow, Wetland** Unpaved Kv= 16.1 fps
0.6	205	0.1100	5.34		**Shallow Concentrated Flow, Wetland** Unpaved Kv= 16.1 fps
44.7	1,638	Total			

Subcatchment 501: Area 30+60



Summary for Subcatchment 502: Area 37+30

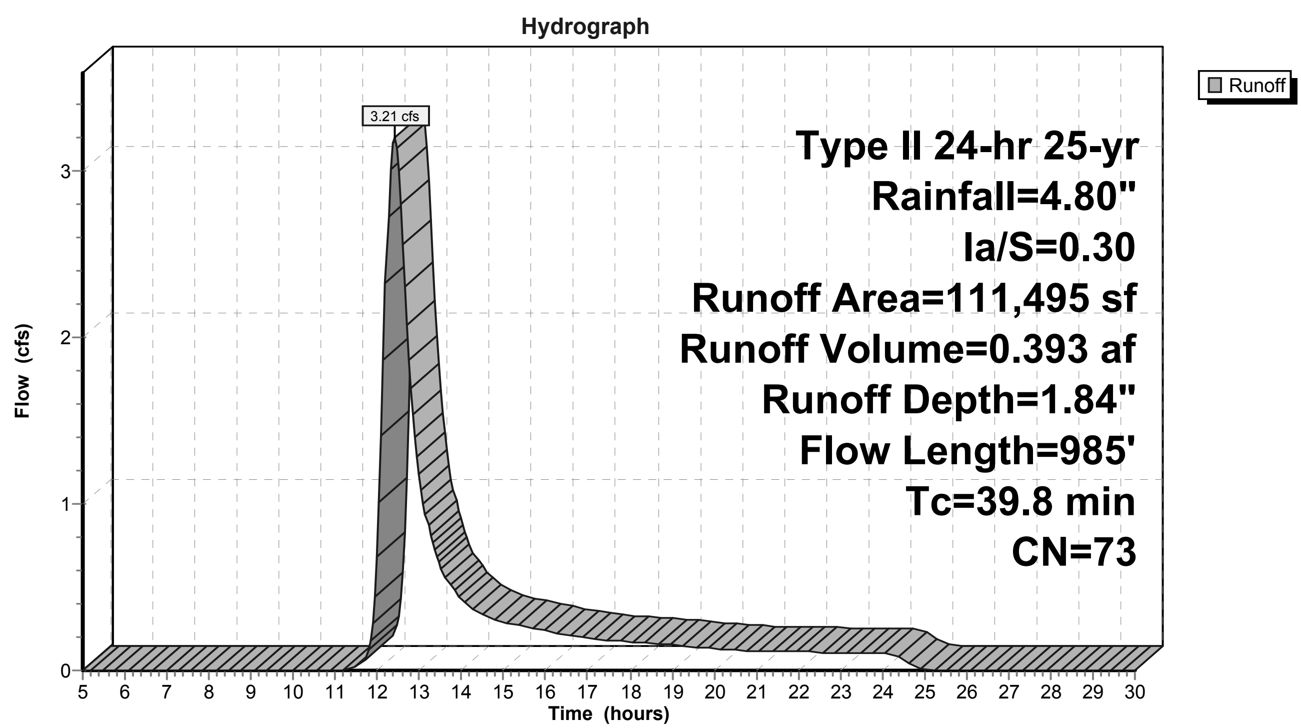
Runoff = 3.21 cfs @ 12.39 hrs, Volume= 0.393 af, Depth= 1.84"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

Area (sf)	CN	Description
111,495	73	Woods, Fair, HSG C
111,495		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.1	100	0.0700	0.07		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
2.1	134	0.1800	1.06		**Shallow Concentrated Flow, Woods** Forest w/Heavy Litter Kv= 2.5 fps
3.3	194	0.1500	0.97		**Shallow Concentrated Flow, Woods** Forest w/Heavy Litter Kv= 2.5 fps
5.1	359	0.2200	1.17		**Shallow Concentrated Flow, Woods** Forest w/Heavy Litter Kv= 2.5 fps
4.2	198	0.1000	0.79		**Shallow Concentrated Flow, Woods** Forest w/Heavy Litter Kv= 2.5 fps
39.8	985	Total			

Subcatchment 502: Area 37+30



Summary for Subcatchment 503: Area 38+30

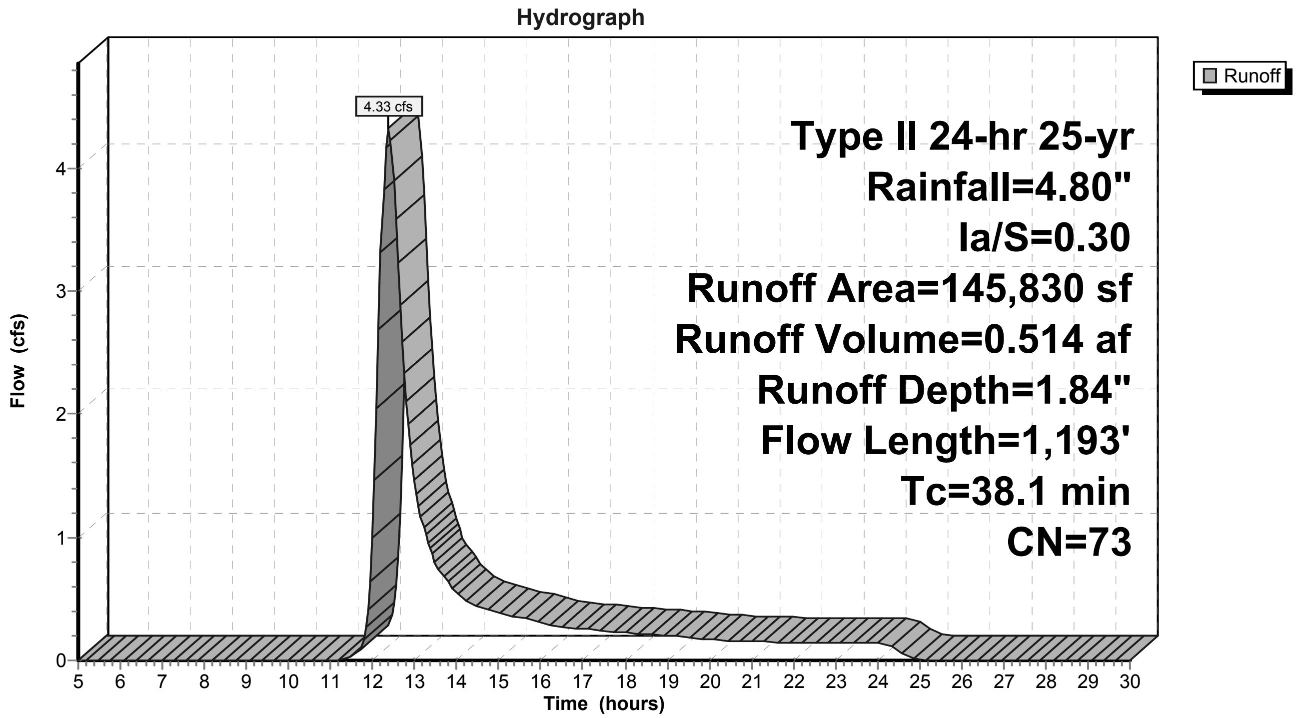
Runoff = 4.33 cfs @ 12.37 hrs, Volume= 0.514 af, Depth= 1.84"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

Area (sf)	CN	Description
145,830	73	Woods, Fair, HSG C
145,830		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.8	100	0.1000	0.08		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
0.9	56	0.1800	1.06		**Shallow Concentrated Flow, Woods** Forest w/Heavy Litter Kv= 2.5 fps
1.9	142	0.2600	1.27		**Shallow Concentrated Flow, Woods** Forest w/Heavy Litter Kv= 2.5 fps
1.1	74	0.2200	1.17		**Shallow Concentrated Flow, Woods** Forest w/Heavy Litter Kv= 2.5 fps
0.5	66	0.2200	2.35		**Shallow Concentrated Flow, Tree Clearing** Woodland Kv= 5.0 fps
0.0	12	1.0000	16.10		**Shallow Concentrated Flow, Road Side Slope** Unpaved Kv= 16.1 fps
0.8	100	0.0150	1.97		**Shallow Concentrated Flow, Flat Pad Area** Unpaved Kv= 16.1 fps
1.0	100	0.1100	1.66		**Shallow Concentrated Flow, Tree Clearing** Woodland Kv= 5.0 fps
4.6	282	0.1700	1.03		**Shallow Concentrated Flow, Woods** Forest w/Heavy Litter Kv= 2.5 fps
5.5	261	0.1000	0.79		**Shallow Concentrated Flow, Woods** Forest w/Heavy Litter Kv= 2.5 fps
38.1	1,193	Total			

Subcatchment 503: Area 38+30



Summary for Subcatchment 504: Area 39+30

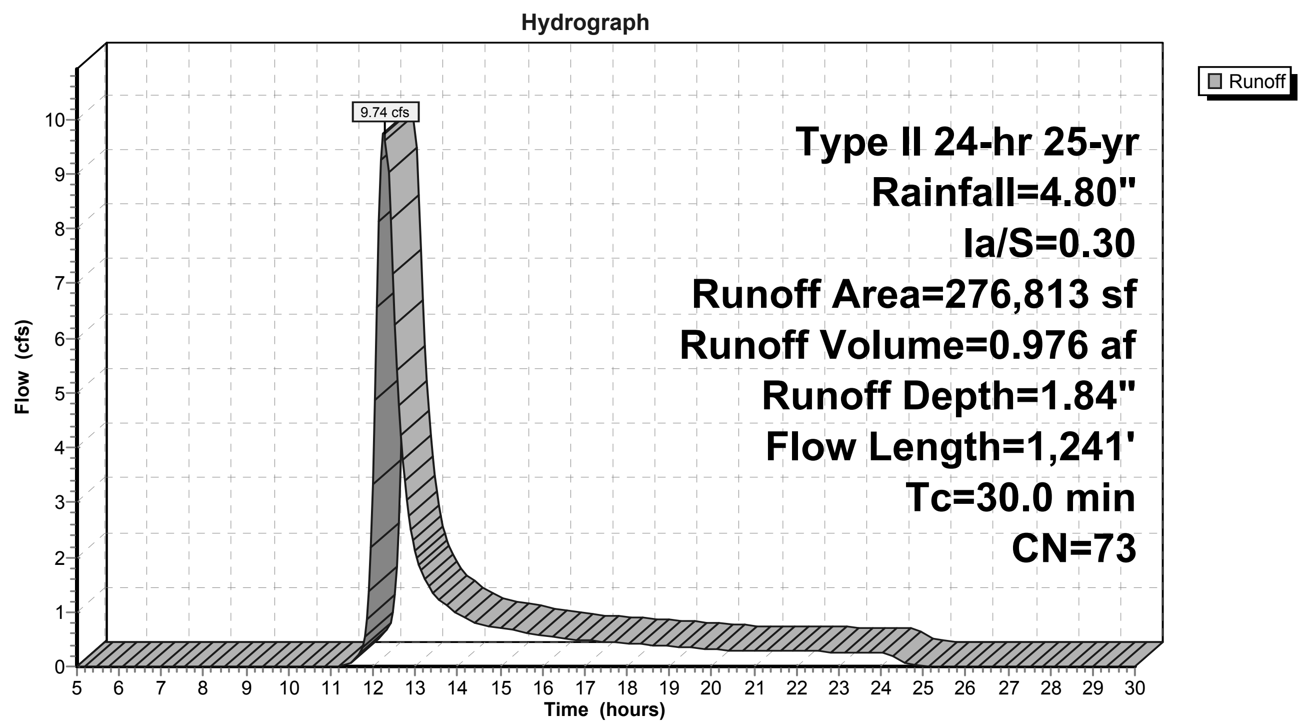
Runoff = 9.74 cfs @ 12.26 hrs, Volume= 0.976 af, Depth= 1.84"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

Area (sf)	CN	Description
276,813	73	Woods, Fair, HSG C
276,813		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.5	100	0.0300	0.12		**Sheet Flow, Gravel Road** Grass: Dense n= 0.240 P2= 2.60"
0.5	35	0.0300	1.21		**Shallow Concentrated Flow, Gravel Road** Short Grass Pasture Kv= 7.0 fps
1.9	173	0.0090	1.53		**Shallow Concentrated Flow, Wetland** Unpaved Kv= 16.1 fps
4.3	438	0.0600	1.71		**Shallow Concentrated Flow, Wetland** Short Grass Pasture Kv= 7.0 fps
4.1	240	0.1500	0.97		**Shallow Concentrated Flow, Woods** Forest w/Heavy Litter Kv= 2.5 fps
5.7	255	0.0900	0.75		**Shallow Concentrated Flow, Woods** Forest w/Heavy Litter Kv= 2.5 fps
30.0	1,241	Total			

Subcatchment 504: Area 39+30



Summary for Subcatchment 505: Area 41+00 (Stone Matt 42+50)

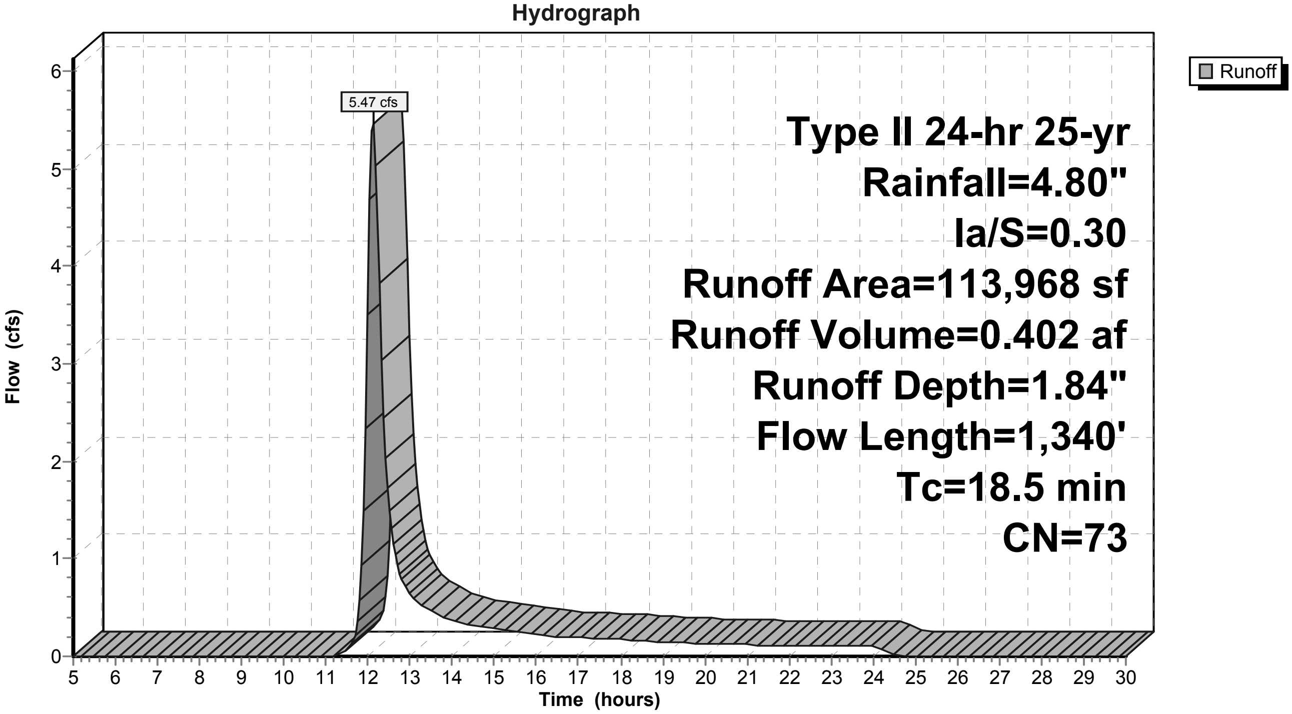
Runoff = 5.47 cfs @ 12.12 hrs, Volume= 0.402 af, Depth= 1.84"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

Area (sf)	CN	Description
113,968	73	Woods, Fair, HSG C
113,968		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.9	60	0.0300	0.11		**Sheet Flow, Gravel Road** Grass: Dense n= 0.240 P2= 2.60"
4.0	513	0.0300	2.15	3.22	**Trap/Vee/Rect Channel Flow, Road Side Swale** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.060
1.9	506	0.1300	4.47	6.70	**Trap/Vee/Rect Channel Flow, Road Side Swale** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.060
0.4	30	0.0200	1.24	12.42	**Channel Flow, Stone Mattress @ 42+50** Area= 10.0 sf Perim= 22.0' r= 0.45' n= 0.100
0.0	16	0.6700	13.18		**Shallow Concentrated Flow, Road Side Slope** Unpaved Kv= 16.1 fps
1.3	42	0.0500	0.56		**Shallow Concentrated Flow, Woods** Forest w/Heavy Litter Kv= 2.5 fps
1.1	127	0.0150	1.97		**Shallow Concentrated Flow, Wetland** Unpaved Kv= 16.1 fps
0.9	46	0.1100	0.83		**Shallow Concentrated Flow, Woods** Forest w/Heavy Litter Kv= 2.5 fps
18.5	1,340	Total			

Subcatchment 505: Area 41+00 (Stone Matt 42+50)



Summary for Pond S501: Culvert 30+60

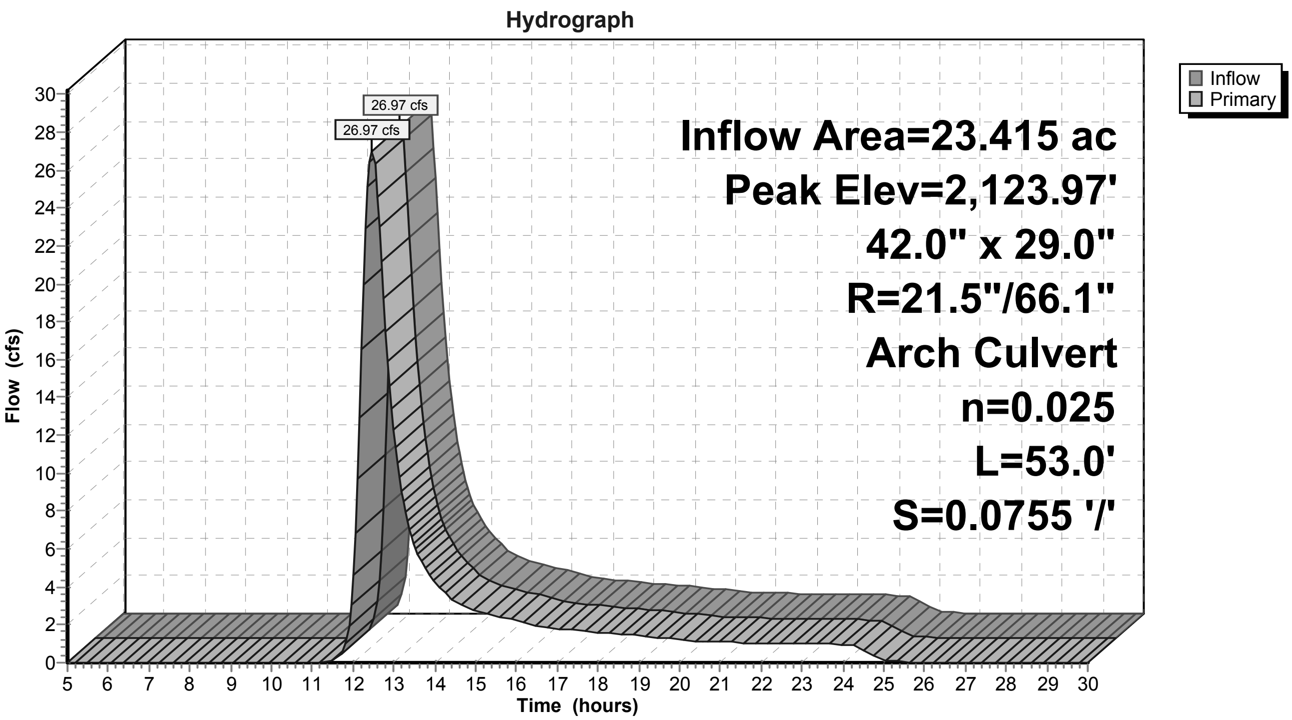
Inflow Area =	23.415 ac,	0.00% Impervious,	Inflow Depth = 1.84"	for 25-yr event	
Inflow =	26.97 cfs @	12.46 hrs, Volume=	3.596 af		
Outflow =	26.97 cfs @	12.46 hrs, Volume=	3.596 af,	Atten= 0%,	Lag= 0.0 min
Primary =	26.97 cfs @	12.46 hrs, Volume=	3.596 af		

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 2,123.97' @ 12.46 hrs
Flood Elev= 2,125.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	2,122.00'	**42.0" W x 29.0" H, R=21.5"/66.1" Arch Culvert** L= 53.0' CMP, square edge headwall, Ke= 0.500 Outlet Invert= 2,118.00' S= 0.0755 '/' Cc= 0.900 n= 0.025

Primary OutFlow Max=26.92 cfs @ 12.46 hrs HW=2,123.97' (Free Discharge)
└─**1=Culvert** (Inlet Controls 26.92 cfs @ 4.49 fps)

Pond S501: Culvert 30+60



Summary for Pond S502: Culvert 37+30

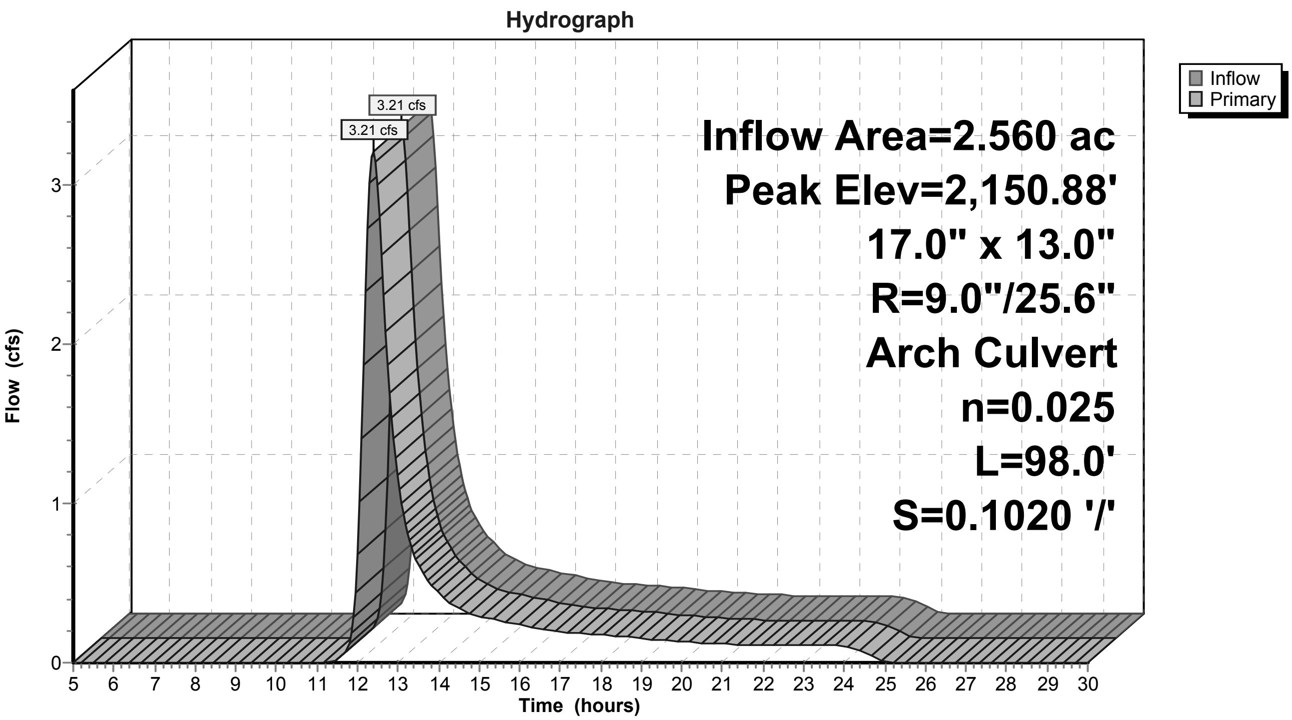
Inflow Area = 2.560 ac, 0.00% Impervious, Inflow Depth = 1.84" for 25-yr event
Inflow = 3.21 cfs @ 12.39 hrs, Volume= 0.393 af
Outflow = 3.21 cfs @ 12.39 hrs, Volume= 0.393 af, Atten= 0%, Lag= 0.0 min
Primary = 3.21 cfs @ 12.39 hrs, Volume= 0.393 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 2,150.88' @ 12.39 hrs
Flood Elev= 2,151.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	2,150.00'	**17.0" W x 13.0" H, R=9.0"/25.6" Arch Culvert** L= 98.0' CMP, square edge headwall, Ke= 0.500 Outlet Invert= 2,140.00' S= 0.1020 '/' Cc= 0.900 n= 0.025

Primary OutFlow Max=3.20 cfs @ 12.39 hrs HW=2,150.88' (Free Discharge)
└**1=Culvert** (Inlet Controls 3.20 cfs @ 2.96 fps)

Pond S502: Culvert 37+30



Summary for Pond S503: Culvert 38+30

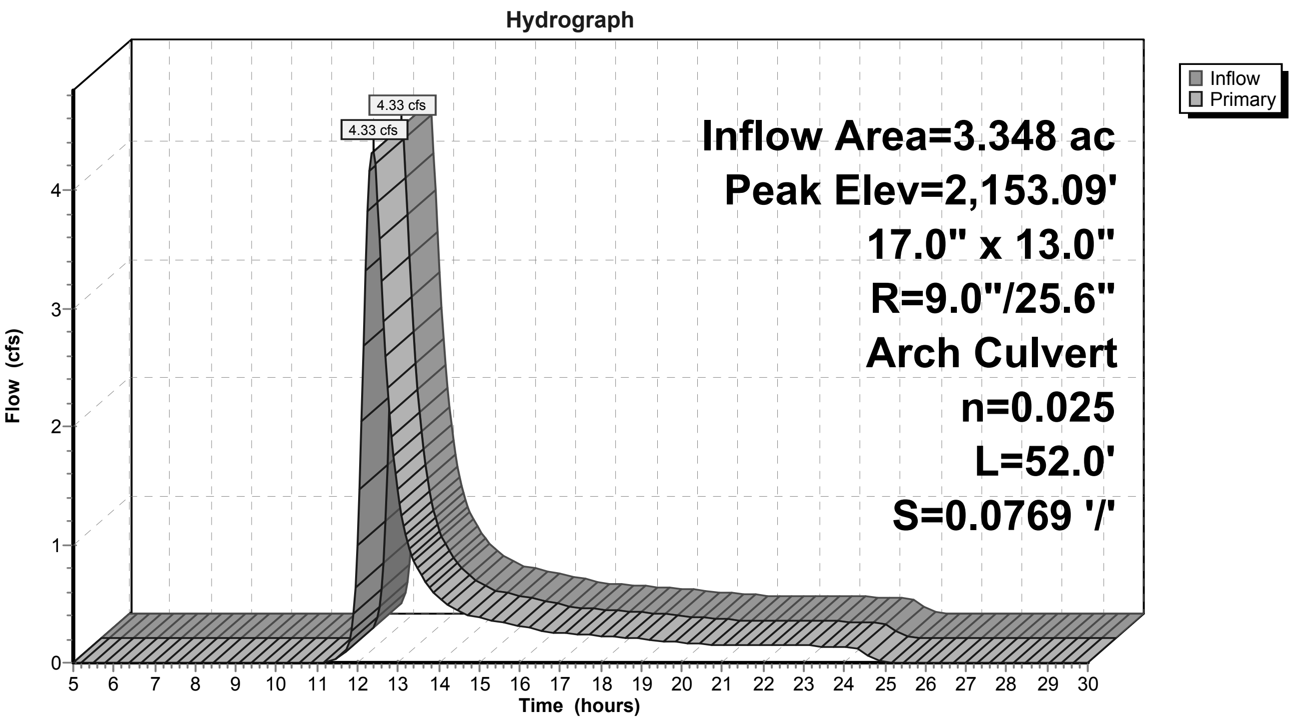
Inflow Area =	3.348 ac,	0.00% Impervious, Inflow Depth = 1.84"		for 25-yr event
Inflow =	4.33 cfs @	12.37 hrs, Volume=	0.514 af	
Outflow =	4.33 cfs @	12.37 hrs, Volume=	0.514 af,	Atten= 0%, Lag= 0.0 min
Primary =	4.33 cfs @	12.37 hrs, Volume=	0.514 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 2,153.09' @ 12.37 hrs
Flood Elev= 2,154.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	2,152.00'	**17.0" W x 13.0" H, R=9.0"/25.6" Arch Culvert** L= 52.0' CMP, square edge headwall, Ke= 0.500 Outlet Invert= 2,148.00' S= 0.0769 '/' Cc= 0.900 n= 0.025

Primary OutFlow Max=4.31 cfs @ 12.37 hrs HW=2,153.09' (Free Discharge)
└─**1=Culvert** (Inlet Controls 4.31 cfs @ 3.51 fps)

Pond S503: Culvert 38+30



Summary for Pond S504: Culvert 39+30

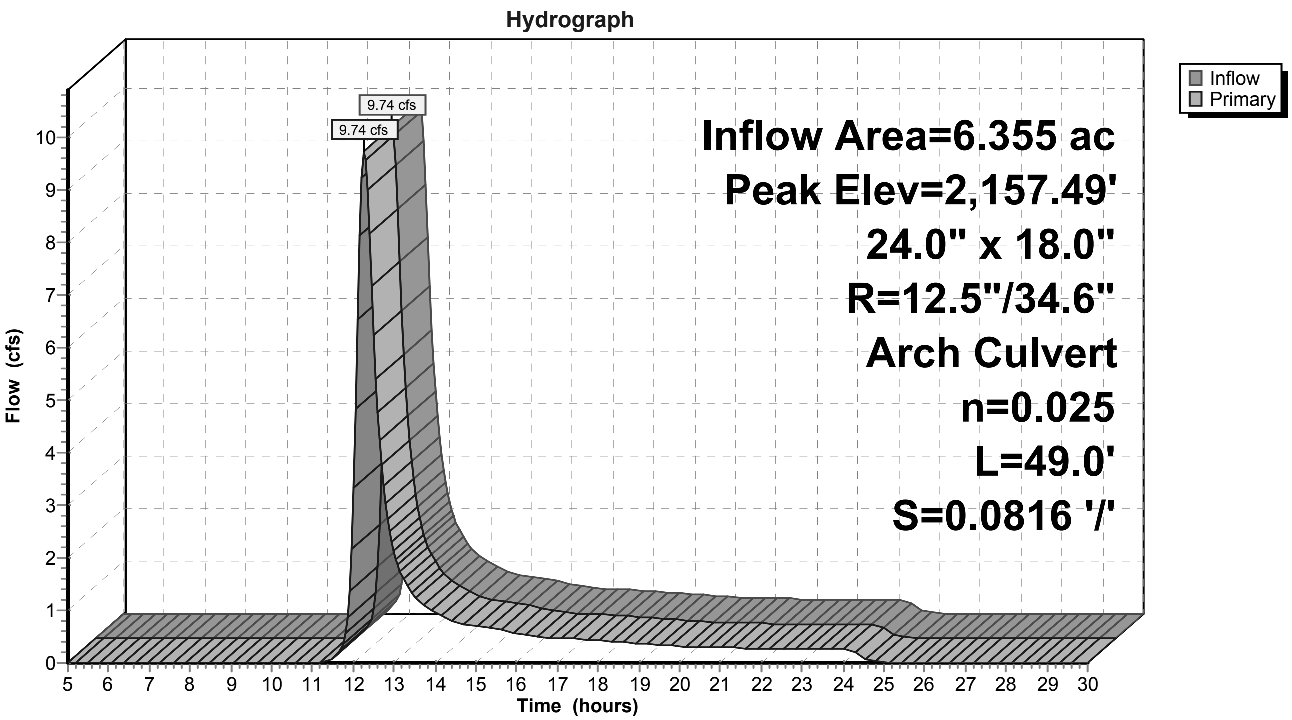
Inflow Area = 6.355 ac, 0.00% Impervious, Inflow Depth = 1.84" for 25-yr event
Inflow = 9.74 cfs @ 12.26 hrs, Volume= 0.976 af
Outflow = 9.74 cfs @ 12.26 hrs, Volume= 0.976 af, Atten= 0%, Lag= 0.0 min
Primary = 9.74 cfs @ 12.26 hrs, Volume= 0.976 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 2,157.49' @ 12.26 hrs
Flood Elev= 2,157.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	2,156.00'	**24.0" W x 18.0" H, R=12.5"/34.6" Arch Culvert** L= 49.0' CMP, square edge headwall, Ke= 0.500 Outlet Invert= 2,152.00' S= 0.0816 '/' Cc= 0.900 n= 0.025

Primary OutFlow Max=9.68 cfs @ 12.26 hrs HW=2,157.48' (Free Discharge)
1=Culvert (Inlet Controls 9.68 cfs @ 4.05 fps)

Pond S504: Culvert 39+30



Summary for Pond S505: Culvert 41+00

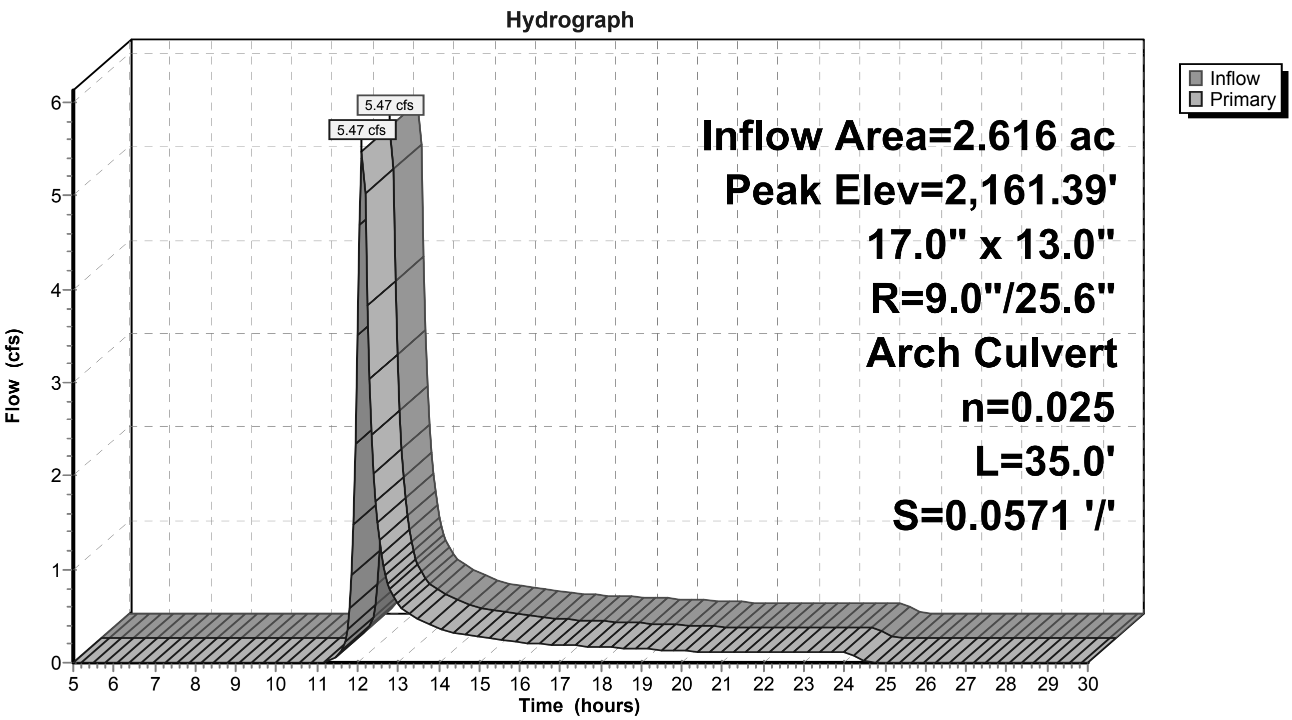
Inflow Area =	2.616 ac,	0.00% Impervious, Inflow Depth = 1.84"		for 25-yr event
Inflow =	5.47 cfs @	12.12 hrs, Volume=	0.402 af	
Outflow =	5.47 cfs @	12.12 hrs, Volume=	0.402 af,	Atten= 0%, Lag= 0.0 min
Primary =	5.47 cfs @	12.12 hrs, Volume=	0.402 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 2,161.39' @ 12.12 hrs
Flood Elev= 2,162.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	2,160.00'	**17.0" W x 13.0" H, R=9.0"/25.6" Arch Culvert** L= 35.0' CMP, square edge headwall, Ke= 0.500 Outlet Invert= 2,158.00' S= 0.0571 '/' Cc= 0.900 n= 0.025

Primary OutFlow Max=5.38 cfs @ 12.12 hrs HW=2,161.37' (Free Discharge)
└─**1=Culvert** (Inlet Controls 5.38 cfs @ 4.38 fps)

Pond S505: Culvert 41+00

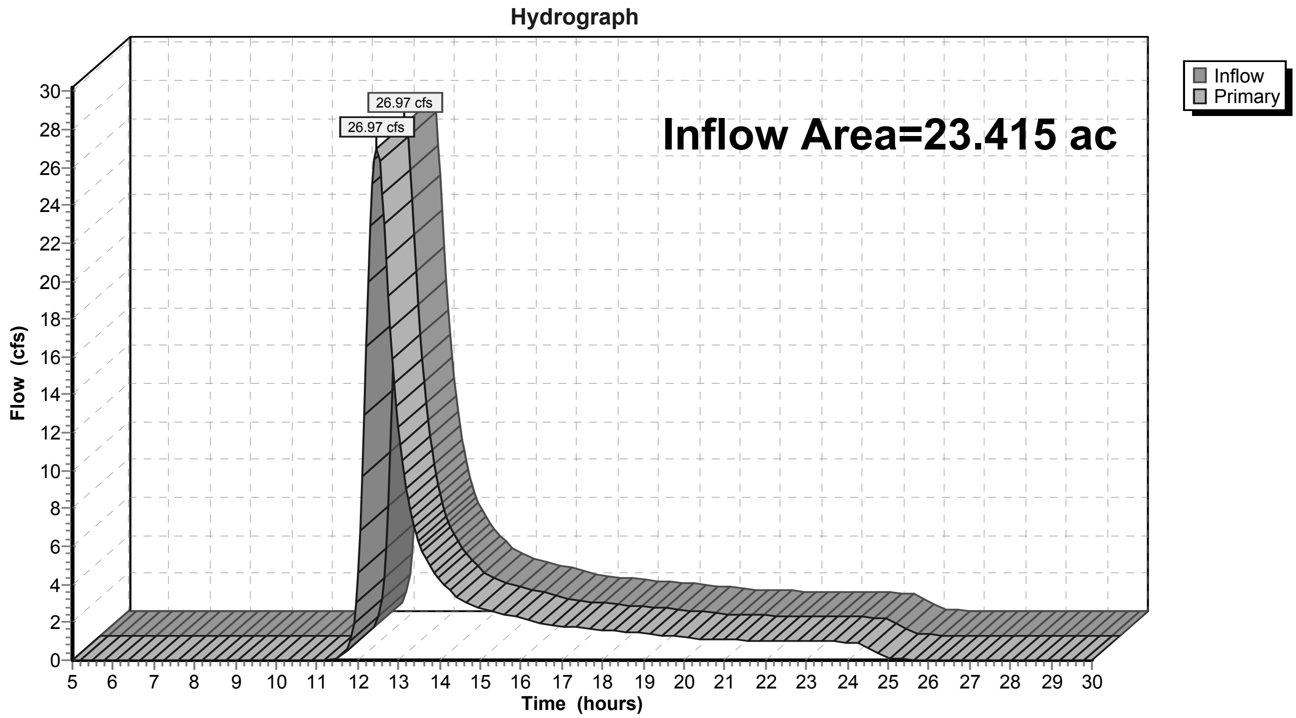


Summary for Link A203: A203

Inflow Area =	23.415 ac,	0.00% Impervious,	Inflow Depth = 1.84"	for 25-yr event	
Inflow =	26.97 cfs @	12.46 hrs,	Volume=	3.596 af	
Primary =	26.97 cfs @	12.46 hrs,	Volume=	3.596 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Link A203: A203

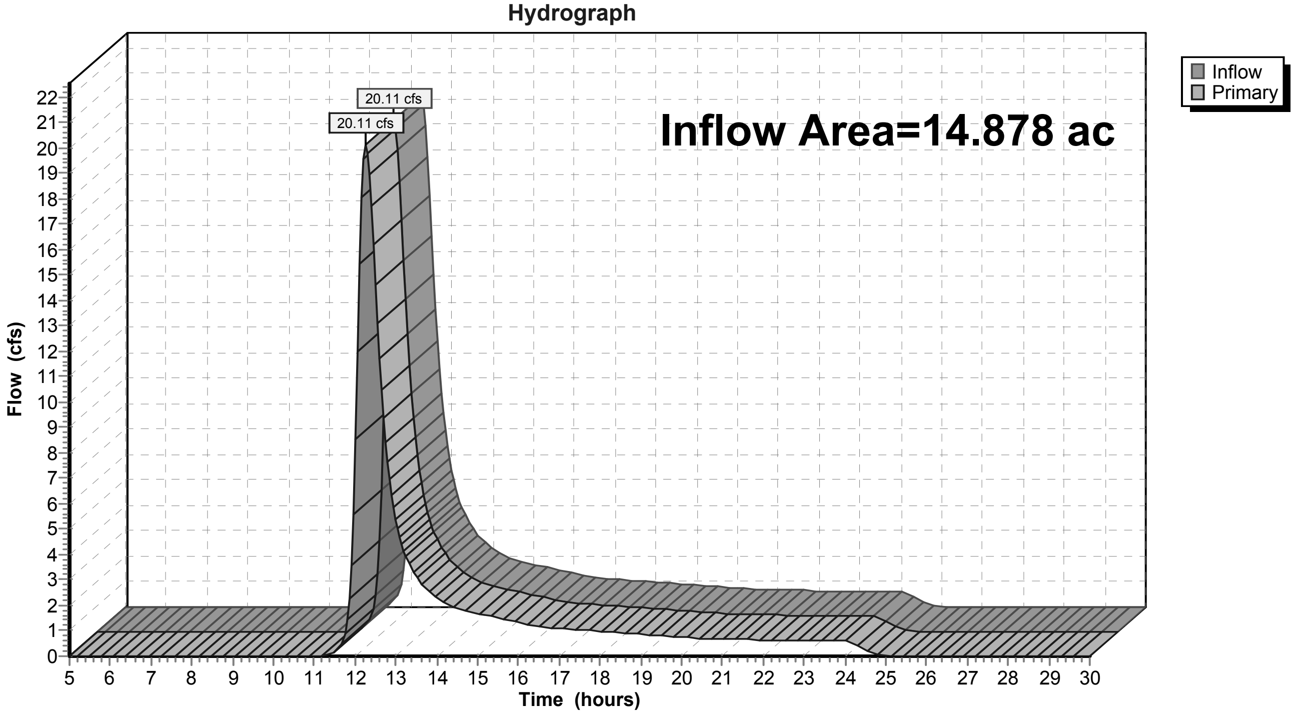


Summary for Link A205: A205

Inflow Area =	14.878 ac,	0.00% Impervious,	Inflow Depth = 1.84"	for 25-yr event	
Inflow =	20.11 cfs @	12.26 hrs,	Volume=	2.285 af	
Primary =	20.11 cfs @	12.26 hrs,	Volume=	2.285 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Link A205: A205



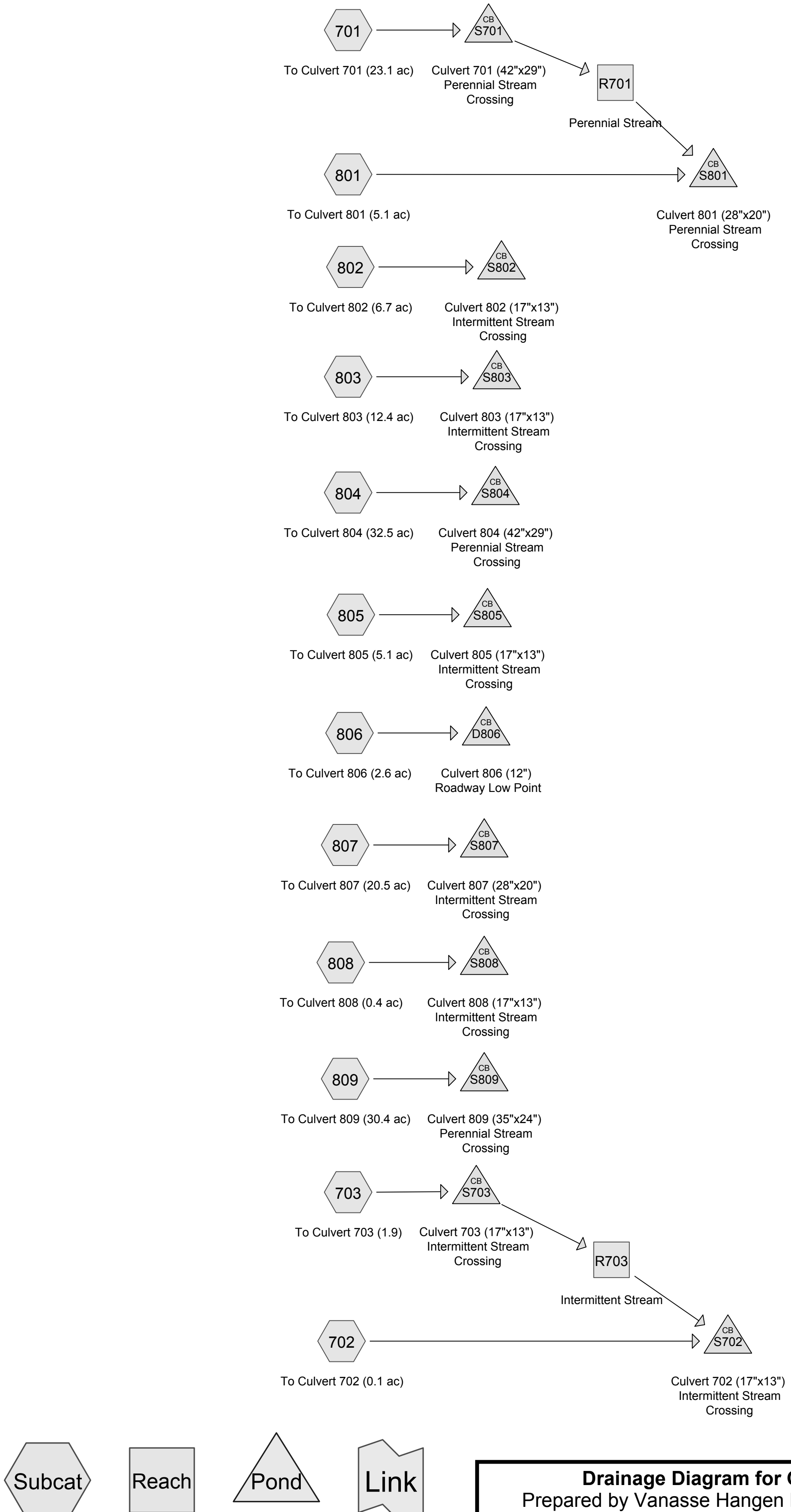
Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 501: Area 30+60 Runoff Area=1,019,946 sf 0.00% Impervious Runoff Depth=2.23"
Flow Length=1,638' Tc=44.7 min CN=73 Runoff=33.37 cfs 4.343 af

Pond S501: Culvert 30+60 Peak Elev=2,124.30' Inflow=33.37 cfs 4.343 af
42.0" x 29.0", R=21.5"/66.1" Arch Culvert n=0.025 L=53.0' S=0.0755 '/' Outflow=33.37 cfs 4.343 af

Link A203: A203 Inflow=33.37 cfs 4.343 af
Primary=33.37 cfs 4.343 af

Total Runoff Area = 23.415 ac Runoff Volume = 4.343 af Average Runoff Depth = 2.23"
100.00% Pervious = 23.415 ac 0.00% Impervious = 0.000 ac



Drainage Diagram for Groton-Culverts-700_800
Prepared by Vanasse Hangen Brustlin, Inc., Printed 12/3/2009
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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
140.800	68	Based on CN for P102 (701, 702, 703, 801, 802, 803, 804, 805, 806, 807, 808, 809)
140.800		**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)
1	D806	1,268.00	1,260.00	37.0	0.2162	0.013	12.0	0.0
2	S701	1,584.00	1,576.00	116.0	0.0690	0.013	42.0	29.0
3	S702	1,714.00	1,690.00	90.0	0.2667	0.025	17.0	13.0
4	S703	1,755.00	1,754.00	80.0	0.0125	0.025	17.0	13.0
5	S801	1,534.00	1,526.00	85.0	0.0941	0.025	28.0	20.0
6	S802	1,548.00	1,532.00	68.0	0.2353	0.025	17.0	13.0
7	S803	1,490.00	1,480.00	56.0	0.1786	0.025	17.0	13.0
8	S804	1,400.50	1,384.00	60.0	0.2750	0.013	42.0	29.0
9	S805	1,275.00	1,265.00	38.0	0.2632	0.025	17.0	13.0
10	S807	1,267.00	1,263.50	35.0	0.1000	0.025	28.0	20.0
11	S808	1,271.00	1,265.00	36.0	0.1667	0.025	17.0	13.0
12	S809	1,272.00	1,261.00	107.0	0.1028	0.025	35.0	24.0

Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 701: To Culvert 701 (23.1 ac) Runoff Area=23.100 ac 0.00% Impervious Runoff Depth=1.76"
Flow Length=1,860' Tc=28.1 min CN=68 Runoff=33.77 cfs 3.386 af

Subcatchment 702: To Culvert 702 (0.1 ac) Runoff Area=0.100 ac 0.00% Impervious Runoff Depth=1.76"
Flow Length=126' Tc=13.6 min CN=68 Runoff=0.23 cfs 0.015 af

Subcatchment 703: To Culvert 703 (1.9) Runoff Area=1.900 ac 0.00% Impervious Runoff Depth=1.76"
Flow Length=812' Tc=29.0 min CN=68 Runoff=2.72 cfs 0.279 af

Subcatchment 801: To Culvert 801 (5.1 ac) Runoff Area=5.100 ac 0.00% Impervious Runoff Depth=1.76"
Flow Length=641' Tc=30.3 min CN=68 Runoff=7.06 cfs 0.748 af

Subcatchment 802: To Culvert 802 (6.7 ac) Runoff Area=6.700 ac 0.00% Impervious Runoff Depth=1.76"
Flow Length=674' Tc=22.2 min CN=68 Runoff=11.50 cfs 0.982 af

Subcatchment 803: To Culvert 803 (12.4 ac) Runoff Area=12.400 ac 0.00% Impervious Runoff Depth=1.76"
Flow Length=1,773' Tc=33.0 min CN=68 Runoff=16.17 cfs 1.818 af

Subcatchment 804: To Culvert 804 (32.5 ac) Runoff Area=32.500 ac 0.00% Impervious Runoff Depth=1.76"
Flow Length=2,806' Tc=32.3 min CN=68 Runoff=43.09 cfs 4.764 af

Subcatchment 805: To Culvert 805 (5.1 ac) Runoff Area=5.100 ac 0.00% Impervious Runoff Depth=1.76"
Flow Length=1,329' Tc=20.0 min CN=68 Runoff=9.34 cfs 0.748 af

Subcatchment 806: To Culvert 806 (2.6 ac) Runoff Area=2.600 ac 0.00% Impervious Runoff Depth=1.76"
Flow Length=1,384' Tc=21.6 min CN=68 Runoff=4.54 cfs 0.381 af

Subcatchment 807: To Culvert 807 (20.5 ac) Runoff Area=20.500 ac 0.00% Impervious Runoff Depth=1.76"
Flow Length=2,383' Tc=30.8 min CN=68 Runoff=28.07 cfs 3.005 af

Subcatchment 808: To Culvert 808 (0.4 ac) Runoff Area=0.400 ac 0.00% Impervious Runoff Depth=1.76"
Flow Length=399' Tc=14.1 min CN=68 Runoff=0.90 cfs 0.059 af

Subcatchment 809: To Culvert 809 (30.4 ac) Runoff Area=30.400 ac 0.00% Impervious Runoff Depth=1.76"
Flow Length=1,781' Tc=24.0 min CN=68 Runoff=49.46 cfs 4.457 af

Reach R701: Perennial Stream Avg. Depth=0.48' Max Vel=7.01 fps Inflow=33.77 cfs 3.386 af
n=0.040 L=345.0' S=0.1203 '/' Capacity=126.34 cfs Outflow=33.54 cfs 3.386 af

Reach R703: Intermittent Stream Avg. Depth=0.18' Max Vel=5.99 fps Inflow=2.72 cfs 0.279 af
n=0.040 L=117.0' S=0.3419 '/' Capacity=18.48 cfs Outflow=2.71 cfs 0.279 af

Pond D806: Culvert 806 (12") Roadway Low Point Peak Elev=1,269.94' Inflow=4.54 cfs 0.381 af
12.0" Round Culvert n=0.013 L=37.0' S=0.2162 '/' Outflow=4.54 cfs 0.381 af

Pond S701: Culvert 701 (42"x29") Perennial Stream Peak Elev=1,586.32' Inflow=33.77 cfs 3.386 af
42.0" x 29.0", R=21.5"/66.1" Arch Culvert n=0.013 L=116.0' S=0.0690 '/' Outflow=33.77 cfs 3.386 af

Pond S702: Culvert 702 (17"x13") Intermittent Stream Peak Elev=1,714.80' Inflow=2.80 cfs 0.293 af
17.0" x 13.0", R=9.0"/25.6" Arch Culvert n=0.025 L=90.0' S=0.2667 '/' Outflow=2.80 cfs 0.293 af

Pond S703: Culvert 703 (17"x13") Intermittent Stream Peak Elev=1,755.89' Inflow=2.72 cfs 0.279 af
17.0" x 13.0", R=9.0"/25.6" Arch Culvert n=0.025 L=80.0' S=0.0125 '/' Outflow=2.72 cfs 0.279 af

Pond S801: Culvert 801 (28"x20") Perennial Stream Peak Elev=1,542.52' Inflow=40.62 cfs 4.134 af
28.0" x 20.0", R=14.4"/42.3" Arch Culvert n=0.025 L=85.0' S=0.0941 '/' Outflow=40.62 cfs 4.134 af

Pond S802: Culvert 802 (17"x13") Intermittent Stream Peak Elev=1,552.29' Inflow=11.50 cfs 0.982 af
17.0" x 13.0", R=9.0"/25.6" Arch Culvert n=0.025 L=68.0' S=0.2353 '/' Outflow=11.50 cfs 0.982 af

Pond S803: Culvert 803 (17"x13") Intermittent Stream Peak Elev=1,498.32' Inflow=16.17 cfs 1.818 af
17.0" x 13.0", R=9.0"/25.6" Arch Culvert n=0.025 L=56.0' S=0.1786 '/' Outflow=16.17 cfs 1.818 af

Pond S804: Culvert 804 (42"x29") Perennial Stream Peak Elev=1,403.46' Inflow=43.09 cfs 4.764 af
42.0" x 29.0", R=21.5"/66.1" Arch Culvert n=0.013 L=60.0' S=0.2750 '/' Outflow=43.09 cfs 4.764 af

Pond S805: Culvert 805 (17"x13") Intermittent Stream Peak Elev=1,278.02' Inflow=9.34 cfs 0.748 af
17.0" x 13.0", R=9.0"/25.6" Arch Culvert n=0.025 L=38.0' S=0.2632 '/' Outflow=9.34 cfs 0.748 af

Pond S807: Culvert 807 (28"x20") Intermittent Stream Peak Elev=1,271.34' Inflow=28.07 cfs 3.005 af
28.0" x 20.0", R=14.4"/42.3" Arch Culvert n=0.025 L=35.0' S=0.1000 '/' Outflow=28.07 cfs 3.005 af

Pond S808: Culvert 808 (17"x13") Intermittent Stream Peak Elev=1,271.41' Inflow=0.90 cfs 0.059 af
17.0" x 13.0", R=9.0"/25.6" Arch Culvert n=0.025 L=36.0' S=0.1667 '/' Outflow=0.90 cfs 0.059 af

Pond S809: Culvert 809 (35"x24") Perennial Stream Peak Elev=1,277.86' Inflow=49.46 cfs 4.457 af
35.0" x 24.0", R=17.9"/55.1" Arch Culvert n=0.025 L=107.0' S=0.1028 '/' Outflow=49.46 cfs 4.457 af

Total Runoff Area = 140.800 ac Runoff Volume = 20.641 af Average Runoff Depth = 1.76"
100.00% Pervious = 140.800 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 701: To Culvert 701 (23.1 ac)

Runoff = 33.77 cfs @ 12.25 hrs, Volume= 3.386 af, Depth= 1.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.30", Ia/S=0.30

	Area (ac)	CN	Description
*	23.100	68	Based on CN for P102
	23.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.2	100	0.2100	0.10		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
2.6	390	0.2460	2.48		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.9	232	0.1640	2.02		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
4.4	776	0.3480	2.95		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
2.5	196	0.0710	1.33		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.5	166	0.0800	5.26	7.89	**Trap/Vee/Rect Channel Flow, Stream** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040 Mountain streams
28.1	1,860	Total			

Summary for Subcatchment 702: To Culvert 702 (0.1 ac)

Runoff = 0.23 cfs @ 12.07 hrs, Volume= 0.015 af, Depth= 1.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.30", Ia/S=0.30

	Area (ac)	CN	Description
*	0.100	68	Based on CN for P102
	0.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.5	100	0.3300	0.12		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
0.1	26	0.6200	3.94		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
13.6	126	Total			

Summary for Subcatchment 703: To Culvert 703 (1.9)

Runoff = 2.72 cfs @ 12.26 hrs, Volume= 0.279 af, Depth= 1.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.30", Ia/S=0.30

	Area (ac)	CN	Description
*	1.900	68	Based on CN for P102
	1.900		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.8	100	0.0800	0.07		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
2.0	252	0.1850	2.15		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.1	93	0.0860	1.47		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.9	316	0.3230	2.84		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.2	51	0.1180	4.26	6.39	**Trap/Vee/Rect Channel Flow, Drainage Ditch** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.060
29.0	812	Total			

Summary for Subcatchment 801: To Culvert 801 (5.1 ac)

Runoff = 7.06 cfs @ 12.28 hrs, Volume= 0.748 af, Depth= 1.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.30", Ia/S=0.30

	Area (ac)	CN	Description
*	5.100	68	Based on CN for P102
	5.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.7	100	0.0600	0.06		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
3.0	350	0.1490	1.93		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.6	191	0.0940	5.70	8.55	**Trap/Vee/Rect Channel Flow, Stream** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040 Mountain streams
30.3	641	Total			

Summary for Subcatchment 802: To Culvert 802 (6.7 ac)

Runoff = 11.50 cfs @ 12.17 hrs, Volume= 0.982 af, Depth= 1.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.30", Ia/S=0.30

	Area (ac)	CN	Description
*	6.700	68	Based on CN for P102
	6.700		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.6	100	0.1300	0.08		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
1.0	146	0.2300	2.40		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.5	149	0.1500	5.33	16.00	**Trap/Vee/Rect Channel Flow, Drainage Way** Bot.W=5.00' D=0.50' Z= 2.0 '/' Top.W=7.00' n= 0.060
0.6	83	0.0200	2.28		**Shallow Concentrated Flow, Wetland** Unpaved Kv= 16.1 fps
0.5	196	0.2000	6.16	18.47	**Trap/Vee/Rect Channel Flow, Drainage Way** Bot.W=5.00' D=0.50' Z= 2.0 '/' Top.W=7.00' n= 0.060
22.2	674	Total			

Summary for Subcatchment 803: To Culvert 803 (12.4 ac)

Runoff = 16.17 cfs @ 12.31 hrs, Volume= 1.818 af, Depth= 1.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.30", Ia/S=0.30

	Area (ac)	CN	Description
*	12.400	68	Based on CN for P102
	12.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.1	100	0.0970	0.08		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
3.2	508	0.2810	2.65		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.1	45	0.1370	6.88	10.32	**Trap/Vee/Rect Channel Flow, Drainage** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040
0.5	43	0.0230	1.33	13.32	**Pipe Channel, Mattress** 120.0" x 12.0" Box Area= 10.0 sf Perim= 22.0' r= 0.45' n= 0.100
7.1	1,077	0.2550	2.52		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
33.0	1,773	Total			

Summary for Subcatchment 804: To Culvert 804 (32.5 ac)

Runoff = 43.09 cfs @ 12.30 hrs, Volume= 4.764 af, Depth= 1.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.30", Ia/S=0.30

	Area (ac)	CN	Description
*	32.500	68	Based on CN for P102
	32.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.1	100	0.1600	0.09		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
1.9	266	0.2260	2.38		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.7	104	0.0770	2.45	3.67	**Trap/Vee/Rect Channel Flow, wetland area** Bot.W=5.00' D=0.25' Z= 4.0 '/' Top.W=7.00' n= 0.060
1.9	272	0.2280	2.39		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.9	150	0.0530	2.85	4.28	**Trap/Vee/Rect Channel Flow, Drainage Way** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.060
0.6	44	0.0230	1.33	13.32	**Pipe Channel, Mattress** 120.0" x 12.0" Box Area= 10.0 sf Perim= 22.0' r= 0.45' n= 0.100
2.7	349	0.1920	2.19		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.3	87	0.1490	4.78	7.18	**Trap/Vee/Rect Channel Flow, Drainage Way** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.060
0.6	44	0.0230	1.33	13.32	**Pipe Channel, Mattress** 120.0" x 12.0" Box Area= 10.0 sf Perim= 22.0' r= 0.45' n= 0.100
3.2	564	0.3550	2.98		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.4	826	0.2620	9.52	14.28	**Trap/Vee/Rect Channel Flow, Mountain Stream** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040 Mountain streams
32.3	2,806	Total			

Summary for Subcatchment 805: To Culvert 805 (5.1 ac)

Runoff = 9.34 cfs @ 12.15 hrs, Volume= 0.748 af, Depth= 1.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.30", Ia/S=0.30

	Area (ac)	CN	Description
*	5.100	68	Based on CN for P102
	5.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.2	100	0.3530	0.13		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
6.8	1,229	0.3600	3.00		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
20.0	1,329	Total			

Summary for Subcatchment 806: To Culvert 806 (2.6 ac)

Runoff = 4.54 cfs @ 12.17 hrs, Volume= 0.381 af, Depth= 1.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.30", Ia/S=0.30

	Area (ac)	CN	Description
*	2.600	68	Based on CN for P102
	2.600		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.2	100	0.3530	0.13		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
8.4	1,284	0.2620	2.56		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
21.6	1,384	Total			

Summary for Subcatchment 807: To Culvert 807 (20.5 ac)

Runoff = 28.07 cfs @ 12.28 hrs, Volume= 3.005 af, Depth= 1.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.30", Ia/S=0.30

	Area (ac)	CN	Description
*	20.500	68	Based on CN for P102
	20.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.9	22	0.0450	0.04		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
15.0	78	0.1540	0.09		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
1.6	187	0.1600	2.00		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
1.2	196	0.0310	2.83		**Shallow Concentrated Flow, Upland Wetland** Unpaved Kv= 16.1 fps
0.3	155	0.2580	9.44	14.17	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040 Mountain streams
1.4	238	0.3020	2.75		**Shallow Concentrated Flow, Woodland** Woodland Kv= 5.0 fps
2.4	1,507	0.3110	10.37	15.55	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040 Mountain streams
30.8	2,383	Total			

Summary for Subcatchment 808: To Culvert 808 (0.4 ac)

Runoff = 0.90 cfs @ 12.07 hrs, Volume= 0.059 af, Depth= 1.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.30", Ia/S=0.30

	Area (ac)	CN	Description
*	0.400	68	Based on CN for P102
	0.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.6	100	0.3900	0.13		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
1.5	283	0.4100	3.20		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.0	16	0.1250	6.00	6.00	**Trap/Vee/Rect Channel Flow, Existing Stream** Bot.W=1.00' D=0.50' Z= 2.0 '/' Top.W=3.00' n= 0.040 Mountain streams
14.1	399	Total			

Summary for Subcatchment 809: To Culvert 809 (30.4 ac)

Runoff = 49.46 cfs @ 12.20 hrs, Volume= 4.457 af, Depth= 1.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.30", Ia/S=0.30

	Area (ac)	CN	Description
*	30.400	68	Based on CN for P102
	30.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.4	100	0.2800	0.12		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
8.8	1,481	0.3180	2.82		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.8	200	0.0600	4.16	4.16	**Trap/Vee/Rect Channel Flow, Existing Stream** Bot.W=1.00' D=0.50' Z= 2.0 '/' Top.W=3.00' n= 0.040 Mountain streams
24.0	1,781	Total			

Summary for Reach R701: Perennial Stream

Inflow Area = 23.100 ac, 0.00% Impervious, Inflow Depth = 1.76" for 50-yr event
Inflow = 33.77 cfs @ 12.25 hrs, Volume= 3.386 af
Outflow = 33.54 cfs @ 12.27 hrs, Volume= 3.386 af, Atten= 1%, Lag= 1.4 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.01 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 2.38 fps, Avg. Travel Time= 2.4 min

Peak Storage= 1,661 cf @ 12.26 hrs, Average Depth at Peak Storage= 0.48'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 126.34 cfs

8.00' x 1.00' deep channel, n= 0.040 Mountain streams
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 345.0' Slope= 0.1203 '/'
Inlet Invert= 1,575.50', Outlet Invert= 1,534.00'

‡

Summary for Reach R703: Intermittent Stream

Inflow Area = 1.900 ac, 0.00% Impervious, Inflow Depth = 1.76" for 50-yr event
Inflow = 2.72 cfs @ 12.26 hrs, Volume= 0.279 af
Outflow = 2.71 cfs @ 12.27 hrs, Volume= 0.279 af, Atten= 0%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.99 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.16 fps, Avg. Travel Time= 0.9 min

Peak Storage= 53 cf @ 12.26 hrs, Average Depth at Peak Storage= 0.18'
Bank-Full Depth= 0.50', Capacity at Bank-Full= 18.48 cfs

2.00' x 0.50' deep channel, n= 0.040 Mountain streams
Side Slope Z-value= 3.0 '/' Top Width= 5.00'
Length= 117.0' Slope= 0.3419 '/'
Inlet Invert= 1,754.00', Outlet Invert= 1,714.00'

‡

Summary for Pond D806: Culvert 806 (12") Roadway Low Point

Inflow Area = 2.600 ac, 0.00% Impervious, Inflow Depth = 1.76" for 50-yr event
Inflow = 4.54 cfs @ 12.17 hrs, Volume= 0.381 af
Outflow = 4.54 cfs @ 12.17 hrs, Volume= 0.381 af, Atten= 0%, Lag= 0.0 min
Primary = 4.54 cfs @ 12.17 hrs, Volume= 0.381 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,269.94' @ 12.17 hrs
Flood Elev= 1,271.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,268.00'	**12.0" Round Culvert** L= 37.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,260.00' S= 0.2162 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=4.49 cfs @ 12.17 hrs HW=1,269.91' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 4.49 cfs @ 5.71 fps)

Summary for Pond S701: Culvert 701 (42"x29") Perennial Stream Crossing

Inflow Area = 23.100 ac, 0.00% Impervious, Inflow Depth = 1.76" for 50-yr event
Inflow = 33.77 cfs @ 12.25 hrs, Volume= 3.386 af
Outflow = 33.77 cfs @ 12.25 hrs, Volume= 3.386 af, Atten= 0%, Lag= 0.0 min
Primary = 33.77 cfs @ 12.25 hrs, Volume= 3.386 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,586.32' @ 12.25 hrs
Flood Elev= 1,586.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,584.00'	**42.0" W x 29.0" H, R=21.5"/66.1" Arch Culvert** L= 116.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,576.00' S= 0.0690 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=33.74 cfs @ 12.25 hrs HW=1,586.32' (Free Discharge)
└─**1=Culvert** (Inlet Controls 33.74 cfs @ 5.08 fps)

Summary for Pond S702: Culvert 702 (17"x13") Intermittent Stream Crossing

Inflow Area =	2.000 ac,	0.00% Impervious,	Inflow Depth = 1.76"	for 50-yr event	
Inflow =	2.80 cfs @	12.26 hrs,	Volume=	0.293 af	
Outflow =	2.80 cfs @	12.26 hrs,	Volume=	0.293 af,	Atten= 0%, Lag= 0.0 min
Primary =	2.80 cfs @	12.26 hrs,	Volume=	0.293 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,714.80' @ 12.26 hrs
Flood Elev= 1,717.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,714.00'	**17.0" W x 13.0" H, R=9.0"/25.6" Arch Culvert** L= 90.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,690.00' S= 0.2667 '/' Cc= 0.900 n= 0.025

Primary OutFlow Max=2.78 cfs @ 12.26 hrs HW=1,714.80' (Free Discharge)
└─**1=Culvert** (Inlet Controls 2.78 cfs @ 2.79 fps)

Summary for Pond S703: Culvert 703 (17"x13") Intermittent Stream Crossing

Inflow Area =	1.900 ac,	0.00% Impervious,	Inflow Depth = 1.76"	for 50-yr event	
Inflow =	2.72 cfs @	12.26 hrs,	Volume=	0.279 af	
Outflow =	2.72 cfs @	12.26 hrs,	Volume=	0.279 af,	Atten= 0%, Lag= 0.0 min
Primary =	2.72 cfs @	12.26 hrs,	Volume=	0.279 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,755.89' @ 12.26 hrs
Flood Elev= 1,758.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,755.00'	**17.0" W x 13.0" H, R=9.0"/25.6" Arch Culvert** L= 80.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,754.00' S= 0.0125 '/' Cc= 0.900 n= 0.025

Primary OutFlow Max=2.70 cfs @ 12.26 hrs HW=1,755.88' (Free Discharge)
└─**1=Culvert** (Barrel Controls 2.70 cfs @ 3.28 fps)

Summary for Pond S801: Culvert 801 (28"x20") Perennial Stream Crossing

Inflow Area =	28.200 ac,	0.00% Impervious,	Inflow Depth = 1.76"	for 50-yr event	
Inflow =	40.62 cfs @	12.27 hrs,	Volume=	4.134 af	
Outflow =	40.62 cfs @	12.27 hrs,	Volume=	4.134 af,	Atten= 0%, Lag= 0.0 min
Primary =	40.62 cfs @	12.27 hrs,	Volume=	4.134 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Peak Elev= 1,542.52' @ 12.27 hrs
Flood Elev= 1,548.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,534.00'	**28.0" W x 20.0" H, R=14.4"/42.3" Arch Culvert** L= 85.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,526.00' S= 0.0941 '/' Cc= 0.900 n= 0.025

Primary OutFlow Max=40.26 cfs @ 12.27 hrs HW=1,542.35' (Free Discharge)
└─**1=Culvert** (Barrel Controls 40.26 cfs @ 13.00 fps)

Summary for Pond S802: Culvert 802 (17"x13") Intermittent Stream Crossing

Inflow Area = 6.700 ac, 0.00% Impervious, Inflow Depth = 1.76" for 50-yr event
Inflow = 11.50 cfs @ 12.17 hrs, Volume= 0.982 af
Outflow = 11.50 cfs @ 12.17 hrs, Volume= 0.982 af, Atten= 0%, Lag= 0.0 min
Primary = 11.50 cfs @ 12.17 hrs, Volume= 0.982 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,552.29' @ 12.17 hrs
Flood Elev= 1,560.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,548.00'	**17.0" W x 13.0" H, R=9.0"/25.6" Arch Culvert** L= 68.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,532.00' S= 0.2353 '/' Cc= 0.900 n= 0.025 Corrugated metal

Primary OutFlow Max=11.34 cfs @ 12.17 hrs HW=1,552.20' (Free Discharge)
└─**1=Culvert** (Inlet Controls 11.34 cfs @ 9.23 fps)

Summary for Pond S803: Culvert 803 (17"x13") Intermittent Stream Crossing

Inflow Area = 12.400 ac, 0.00% Impervious, Inflow Depth = 1.76" for 50-yr event
Inflow = 16.17 cfs @ 12.31 hrs, Volume= 1.818 af
Outflow = 16.17 cfs @ 12.31 hrs, Volume= 1.818 af, Atten= 0%, Lag= 0.0 min
Primary = 16.17 cfs @ 12.31 hrs, Volume= 1.818 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,498.32' @ 12.31 hrs
Flood Elev= 1,496.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,490.00'	**17.0" W x 13.0" H, R=9.0"/25.6" Arch Culvert** L= 56.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,480.00' S= 0.1786 '/' Cc= 0.900 n= 0.025 Corrugated metal

Primary OutFlow Max=16.09 cfs @ 12.31 hrs HW=1,498.18' (Free Discharge)
└─**1=Culvert** (Barrel Controls 16.09 cfs @ 13.09 fps)

Summary for Pond S804: Culvert 804 (42"x29") Perennial Stream Crossing

Inflow Area = 32.500 ac, 0.00% Impervious, Inflow Depth = 1.76" for 50-yr event
Inflow = 43.09 cfs @ 12.30 hrs, Volume= 4.764 af
Outflow = 43.09 cfs @ 12.30 hrs, Volume= 4.764 af, Atten= 0%, Lag= 0.0 min
Primary = 43.09 cfs @ 12.30 hrs, Volume= 4.764 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,403.46' @ 12.30 hrs
Flood Elev= 1,413.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,400.50'	**42.0" W x 29.0" H, R=21.5"/66.1" Arch Culvert** L= 60.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,384.00' S= 0.2750 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=43.03 cfs @ 12.30 hrs HW=1,403.45' (Free Discharge)
└—**1=Culvert** (Inlet Controls 43.03 cfs @ 6.40 fps)

Summary for Pond S805: Culvert 805 (17"x13") Intermittent Stream Crossing

Inflow Area = 5.100 ac, 0.00% Impervious, Inflow Depth = 1.76" for 50-yr event
Inflow = 9.34 cfs @ 12.15 hrs, Volume= 0.748 af
Outflow = 9.34 cfs @ 12.15 hrs, Volume= 0.748 af, Atten= 0%, Lag= 0.0 min
Primary = 9.34 cfs @ 12.15 hrs, Volume= 0.748 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,278.02' @ 12.15 hrs
Flood Elev= 1,279.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,275.00'	**17.0" W x 13.0" H, R=9.0"/25.6" Arch Culvert** L= 38.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,265.00' S= 0.2632 '/' Cc= 0.900 n= 0.025

Primary OutFlow Max=9.31 cfs @ 12.15 hrs HW=1,278.00' (Free Discharge)
└—**1=Culvert** (Inlet Controls 9.31 cfs @ 7.58 fps)

Summary for Pond S807: Culvert 807 (28"x20") Intermittent Stream Crossing

Inflow Area = 20.500 ac, 0.00% Impervious, Inflow Depth = 1.76" for 50-yr event
Inflow = 28.07 cfs @ 12.28 hrs, Volume= 3.005 af
Outflow = 28.07 cfs @ 12.28 hrs, Volume= 3.005 af, Atten= 0%, Lag= 0.0 min
Primary = 28.07 cfs @ 12.28 hrs, Volume= 3.005 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,271.34' @ 12.28 hrs
Flood Elev= 1,272.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,267.00'	**28.0" W x 20.0" H, R=14.4"/42.3" Arch Culvert** L= 35.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,263.50' S= 0.1000 '/' Cc= 0.900 n= 0.025

Primary OutFlow Max=27.92 cfs @ 12.28 hrs HW=1,271.30' (Free Discharge)
└─**1=Culvert** (Inlet Controls 27.92 cfs @ 9.01 fps)

Summary for Pond S808: Culvert 808 (17"x13") Intermittent Stream Crossing

Inflow Area = 0.400 ac, 0.00% Impervious, Inflow Depth = 1.76" for 50-yr event
Inflow = 0.90 cfs @ 12.07 hrs, Volume= 0.059 af
Outflow = 0.90 cfs @ 12.07 hrs, Volume= 0.059 af, Atten= 0%, Lag= 0.0 min
Primary = 0.90 cfs @ 12.07 hrs, Volume= 0.059 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,271.41' @ 12.07 hrs
Flood Elev= 1,274.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,271.00'	**17.0" W x 13.0" H, R=9.0"/25.6" Arch Culvert** L= 36.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,265.00' S= 0.1667 '/' Cc= 0.900 n= 0.025

Primary OutFlow Max=0.87 cfs @ 12.07 hrs HW=1,271.40' (Free Discharge)
└─**1=Culvert** (Inlet Controls 0.87 cfs @ 1.90 fps)

Summary for Pond S809: Culvert 809 (35"x24") Perennial Stream Crossing

Inflow Area = 30.400 ac, 0.00% Impervious, Inflow Depth = 1.76" for 50-yr event
Inflow = 49.46 cfs @ 12.20 hrs, Volume= 4.457 af
Outflow = 49.46 cfs @ 12.20 hrs, Volume= 4.457 af, Atten= 0%, Lag= 0.0 min
Primary = 49.46 cfs @ 12.20 hrs, Volume= 4.457 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,277.86' @ 12.20 hrs
Flood Elev= 1,278.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,272.00'	**35.0" W x 24.0" H, R=17.9"/55.1" Arch Culvert** L= 107.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,261.00' S= 0.1028 '/' Cc= 0.900 n= 0.025 Corrugated metal

Primary OutFlow Max=49.36 cfs @ 12.20 hrs HW=1,277.84' (Free Discharge)
└─**1=Culvert** (Inlet Controls 49.36 cfs @ 10.66 fps)

Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 701: To Culvert 701 (23.1 ac) Runoff Area=23.100 ac 0.00% Impervious Runoff Depth=1.76"
Flow Length=1,860' Tc=28.1 min CN=68 Runoff=33.77 cfs 3.386 af

Subcatchment 801: To Culvert 801 (5.1 ac) Runoff Area=5.100 ac 0.00% Impervious Runoff Depth=1.76"
Flow Length=641' Tc=30.3 min CN=68 Runoff=7.06 cfs 0.748 af

Subcatchment 804: To Culvert 804 (32.5 ac) Runoff Area=32.500 ac 0.00% Impervious Runoff Depth=1.76"
Flow Length=2,806' Tc=32.3 min CN=68 Runoff=43.09 cfs 4.764 af

Subcatchment 807: To Culvert 807 (20.5 ac) Runoff Area=20.500 ac 0.00% Impervious Runoff Depth=1.76"
Flow Length=2,383' Tc=30.8 min CN=68 Runoff=28.07 cfs 3.005 af

Subcatchment 809: To Culvert 809 (30.4 ac) Runoff Area=30.400 ac 0.00% Impervious Runoff Depth=1.76"
Flow Length=1,781' Tc=24.0 min CN=68 Runoff=49.46 cfs 4.457 af

Reach R701: Perennial Stream Avg. Depth=0.48' Max Vel=7.01 fps Inflow=33.77 cfs 3.386 af
n=0.040 L=345.0' S=0.1203 '/' Capacity=126.34 cfs Outflow=33.54 cfs 3.386 af

Pond S701: Culvert 701 (42"x29") Perennial Stream Peak Elev=1,586.32' Inflow=33.77 cfs 3.386 af
42.0" x 29.0", R=21.5"/66.1" Arch Culvert n=0.013 L=116.0' S=0.0690 '/' Outflow=33.77 cfs 3.386 af

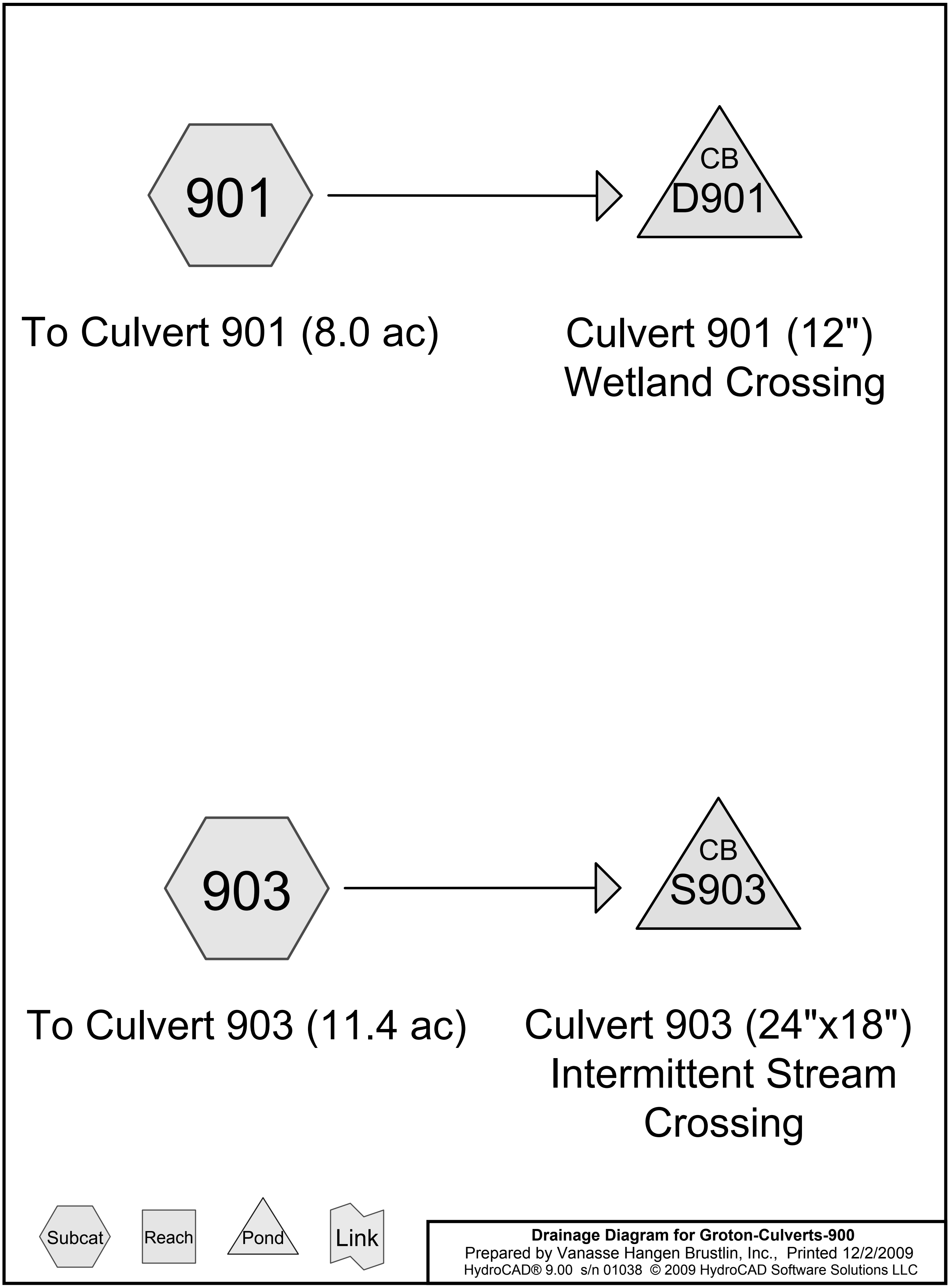
Pond S801: Culvert 801 (28"x20") Perennial Stream Peak Elev=1,542.52' Inflow=40.62 cfs 4.134 af
28.0" x 20.0", R=14.4"/42.3" Arch Culvert n=0.025 L=85.0' S=0.0941 '/' Outflow=40.62 cfs 4.134 af

Pond S804: Culvert 804 (42"x29") Perennial Stream Peak Elev=1,403.46' Inflow=43.09 cfs 4.764 af
42.0" x 29.0", R=21.5"/66.1" Arch Culvert n=0.013 L=60.0' S=0.2750 '/' Outflow=43.09 cfs 4.764 af

Pond S807: Culvert 807 (28"x20") Intermittent Stream Peak Elev=1,271.34' Inflow=28.07 cfs 3.005 af
28.0" x 20.0", R=14.4"/42.3" Arch Culvert n=0.025 L=35.0' S=0.1000 '/' Outflow=28.07 cfs 3.005 af

Pond S809: Culvert 809 (35"x24") Perennial Stream Peak Elev=1,277.86' Inflow=49.46 cfs 4.457 af
35.0" x 24.0", R=17.9"/55.1" Arch Culvert n=0.025 L=107.0' S=0.1028 '/' Outflow=49.46 cfs 4.457 af

Total Runoff Area = 111.600 ac Runoff Volume = 16.360 af Average Runoff Depth = 1.76"
100.00% Pervious = 111.600 ac 0.00% Impervious = 0.000 ac



Drainage Diagram for Groton-Culverts-900
Prepared by Vanasse Hangen Brustlin, Inc., Printed 12/2/2009
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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
19.400	65	Based on CN for P201 (901, 903)
19.400		**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Goup	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
19.400	Other	901, 903
19.400		**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)
1	D901	1,357.00	1,344.00	146.0	0.0890	0.013	12.0	0.0
2	S903	1,366.00	1,365.50	55.0	0.0091	0.025	24.0	18.0

Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment901: To Culvert 901 (8.0 ac) Runoff Area=8.000 ac 0.00% Impervious Runoff Depth=1.18"
Flow Length=787' Tc=27.3 min CN=65 Runoff=7.00 cfs 0.789 af

Subcatchment903: To Culvert 903 (11.4 ac) Runoff Area=11.400 ac 0.00% Impervious Runoff Depth=1.18"
Flow Length=1,278' Tc=41.9 min CN=65 Runoff=7.31 cfs 1.124 af

Pond D901: Culvert 901 (12") Wetland Crossing Peak Elev=1,360.92' Inflow=7.00 cfs 0.789 af
12.0" Round Culvert n=0.013 L=146.0' S=0.0890 '/' Outflow=7.00 cfs 0.789 af

Pond S903: Culvert 903 (24"x18") Intermittent Stream Peak Elev=1,367.46' Inflow=7.31 cfs 1.124 af
24.0" x 18.0", R=12.9"/34.6" Arch Culvert n=0.025 L=55.0' S=0.0091 '/' Outflow=7.31 cfs 1.124 af

Total Runoff Area = 19.400 ac Runoff Volume = 1.913 af Average Runoff Depth = 1.18"
100.00% Pervious = 19.400 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 901: To Culvert 901 (8.0 ac)

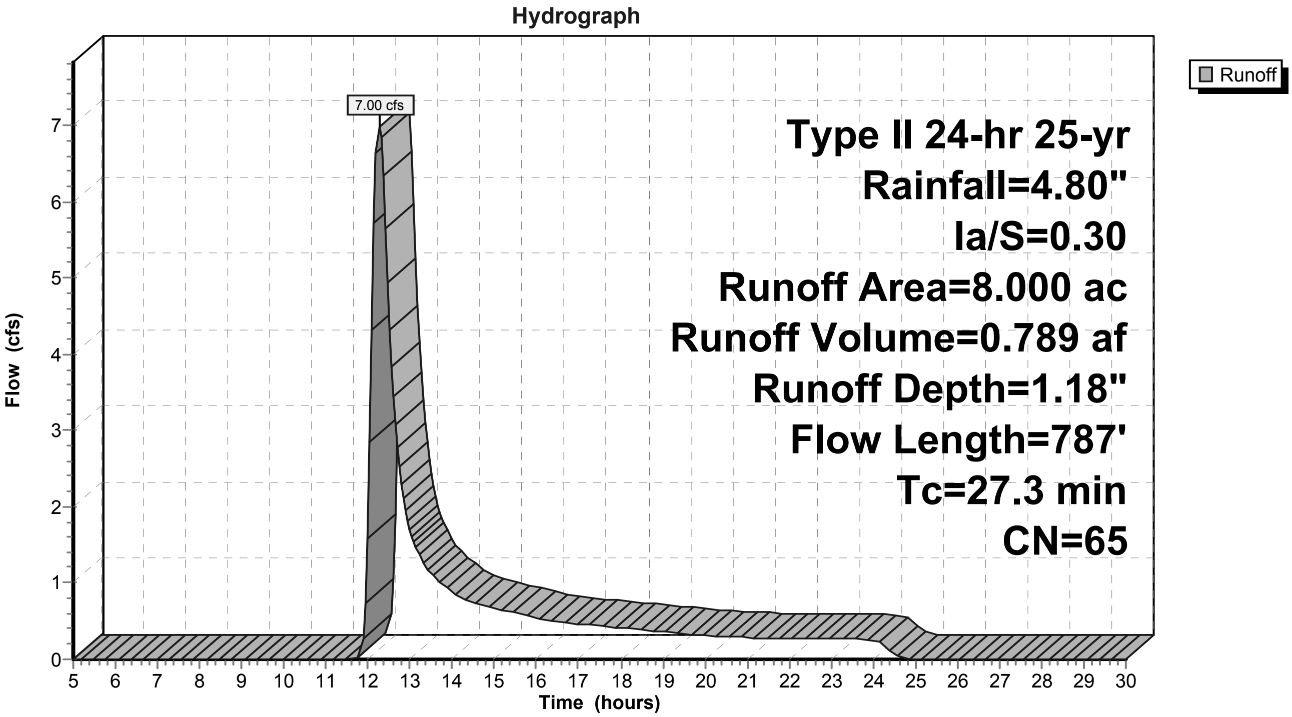
Runoff = 7.00 cfs @ 12.26 hrs, Volume= 0.789 af, Depth= 1.18"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	8.000	65	Based on CN for P201
	8.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.2	100	0.1380	0.09		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
8.1	687	0.0800	1.41		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
27.3	787	Total			

Subcatchment 901: To Culvert 901 (8.0 ac)



Summary for Subcatchment 903: To Culvert 903 (11.4 ac)

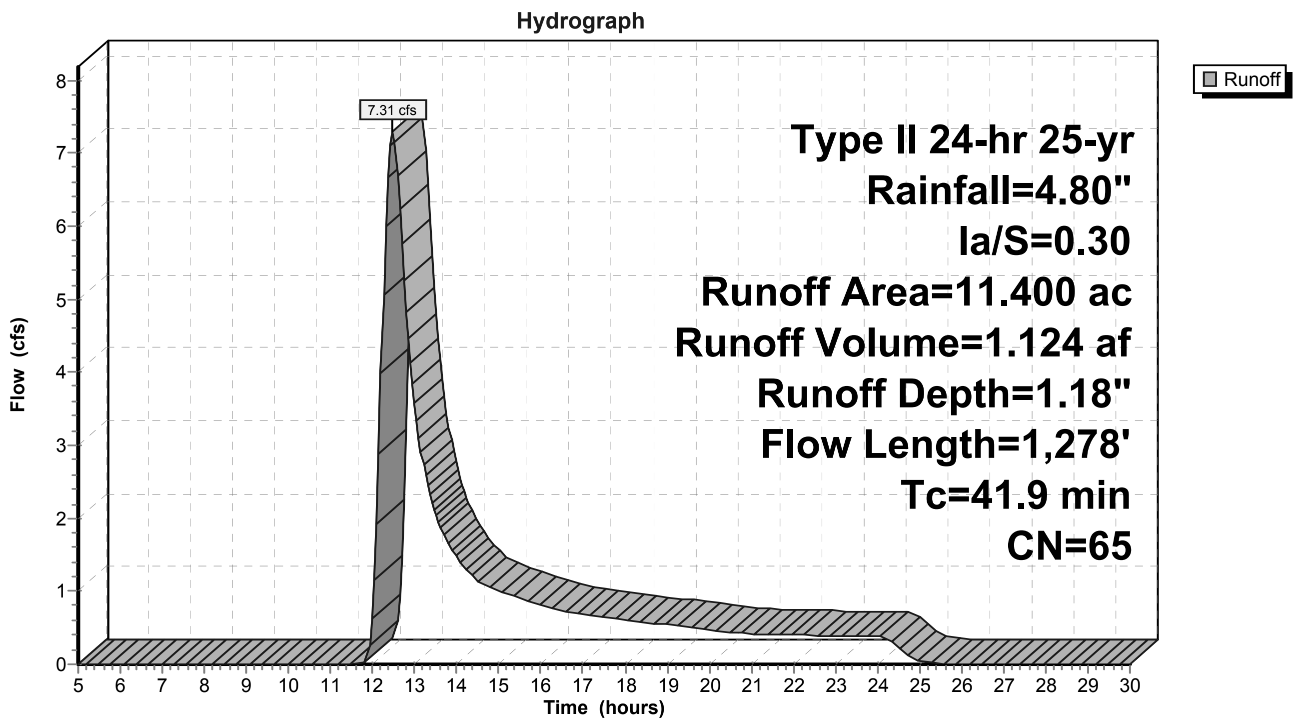
Runoff = 7.31 cfs @ 12.47 hrs, Volume= 1.124 af, Depth= 1.18"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	11.400	65	Based on CN for P201
	11.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.7	35	0.0110	0.03		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
9.8	65	0.3080	0.11		**Sheet Flow, Woods** Woods: Dense underbrush n= 0.800 P2= 2.60"
9.4	1,178	0.1730	2.08		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
41.9	1,278	Total			

Subcatchment 903: To Culvert 903 (11.4 ac)



Summary for Pond D901: Culvert 901 (12") Wetland Crossing

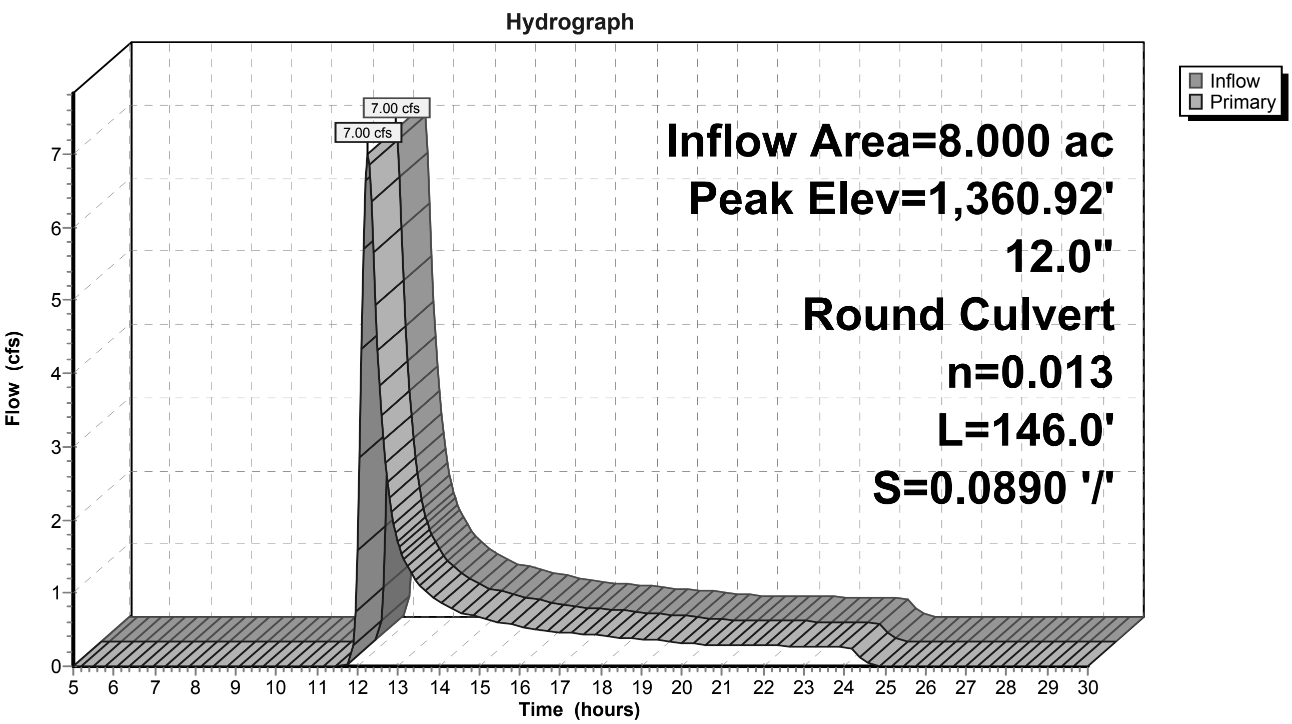
Inflow Area =	8.000 ac,	0.00% Impervious, Inflow Depth =	1.18"	for 25-yr event
Inflow =	7.00 cfs @	12.26 hrs, Volume=	0.789 af	
Outflow =	7.00 cfs @	12.26 hrs, Volume=	0.789 af,	Atten= 0%, Lag= 0.0 min
Primary =	7.00 cfs @	12.26 hrs, Volume=	0.789 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,360.92' @ 12.26 hrs
Flood Elev= 1,361.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,357.00'	**12.0" Round Culvert** L= 146.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,344.00' S= 0.0890 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior

Primary OutFlow Max=6.96 cfs @ 12.26 hrs HW=1,360.89' (Free Discharge)
└─**1=Culvert** (Inlet Controls 6.96 cfs @ 8.86 fps)

Pond D901: Culvert 901 (12") Wetland Crossing



Summary for Pond S903: Culvert 903 (24"x18") Intermittent Stream Crossing

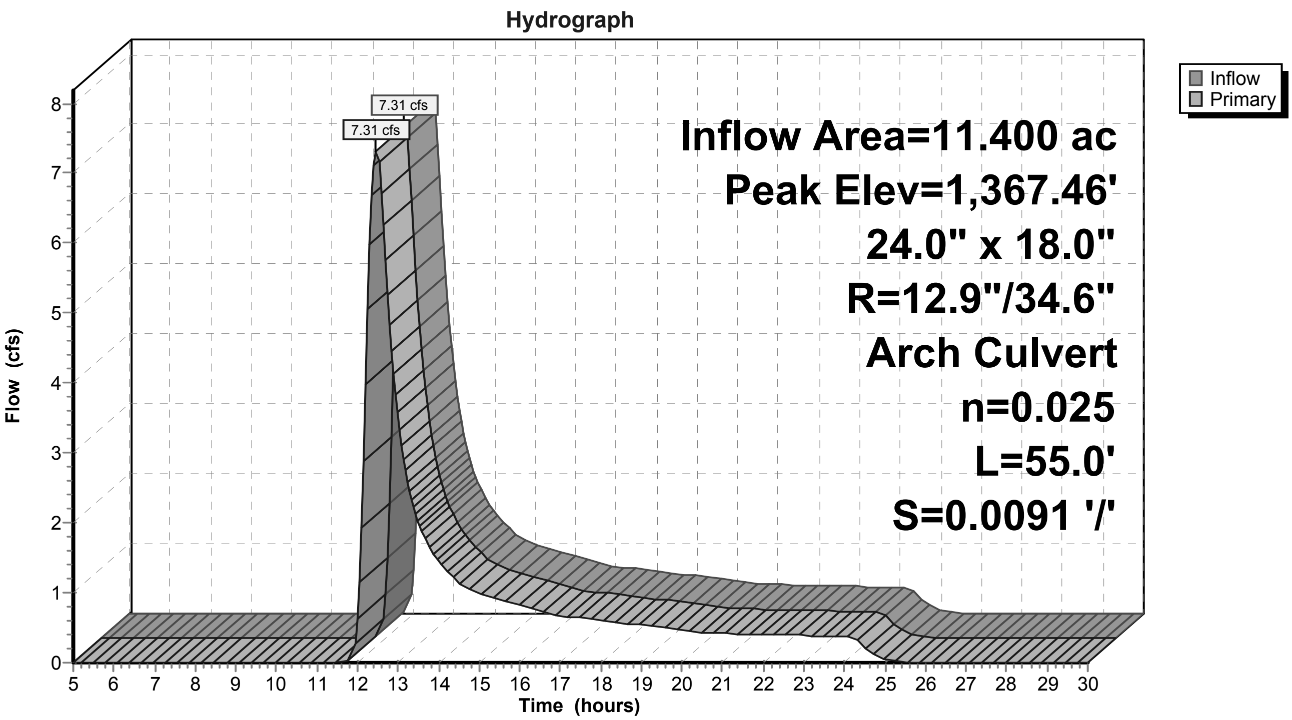
Inflow Area =	11.400 ac,	0.00% Impervious, Inflow Depth =	1.18"	for 25-yr event	
Inflow =	7.31 cfs @	12.47 hrs, Volume=	1.124 af		
Outflow =	7.31 cfs @	12.47 hrs, Volume=	1.124 af,	Atten= 0%,	Lag= 0.0 min
Primary =	7.31 cfs @	12.47 hrs, Volume=	1.124 af		

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1,367.46' @ 12.47 hrs
Flood Elev= 1,368.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	1,366.00'	**24.0" W x 18.0" H, R=12.9"/34.6" Arch Culvert** L= 55.0' CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1,365.50' S= 0.0091 '/' Cc= 0.900 n= 0.025

Primary OutFlow Max=7.29 cfs @ 12.47 hrs HW=1,367.45' (Free Discharge)
└─**1=Culvert** (Barrel Controls 7.29 cfs @ 3.79 fps)

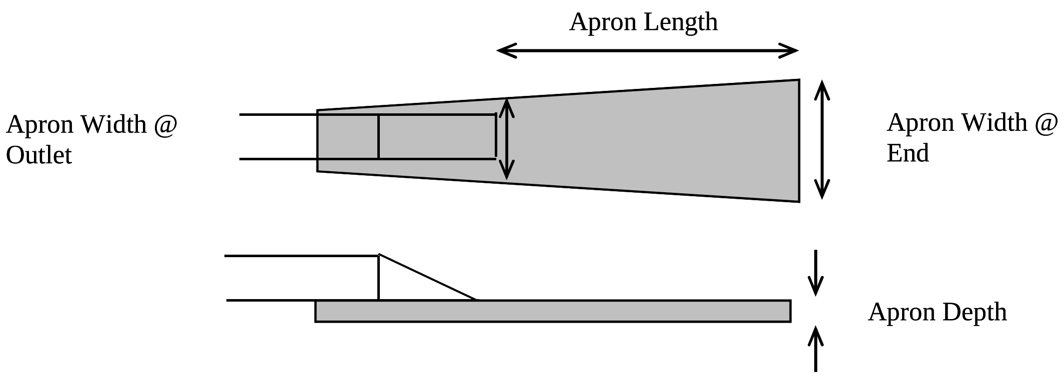
Pond S903: Culvert 903 (24"x18") Intermittent Stream Crossing



Riprap Apron/Energy Dissipation Calculations

Project #:	52036		
Project:	Groton Wind Farm		
Location:	Groton, New Hampshire		
Calculated by:	EKG	Date:	12/2/2009
Checked by:		Date:	
Title:	Riprap Outlet Protection Sizing		

Source: New Hampshire Stormwater Manual, Volume 2,
Post-Construction Best Management Practices Selection & Design
NHDES, December 2008, Section 4-6.6. p. 172.

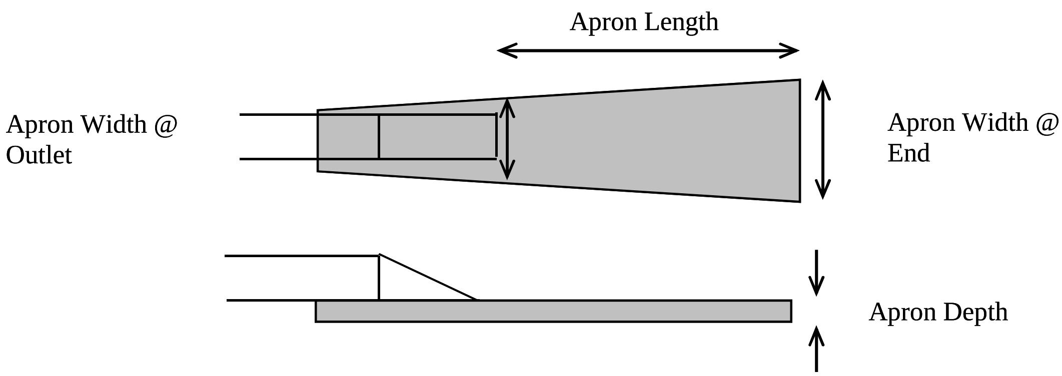


Apron Width at Outlet:	Width = 3*pipe dia. (or width of channel)	
Apron Length:	Length = (1.8*Q) / (dia.^3/2) + 7*dia.	if Tw depth is < 1/2 dia.
	Length = (3.0*Q) / (dia^3/2) + 7*dia.	if Tw dwpth is >= 1/2 dia.
Apron Width at End:	Width = 3*dia. + apron length	if Tw depth is < 1/2 dia.
	Width = 3*dia. + 0.4*apron length	if Tw dwpth is >= 1/2 dia.
	or apron width = channel width if a well defined channel exists	
Rock Riprap:	Median Diameter = (0.02 * Q^4/3) / (Tw * dia)	
	Depth = 6" or 1.5 * largest stone dia	(largest stone dia = 1.5 * d50)

	Outlet Description						
Design Element	100	100a	101	102	103	104	105
Design Storm (yr):	25	25	25	25	25	25	25
Defined Channel (yes/no)	no	Yes	no	no	no	no	no
Channel Width, ft	n/a	5	n/a	n/a	n/a	n/a	n/a
Pipe Dia (D), in	12	12	18	42	30	30	18
Tail Water (Tw), ft	0.5	0.5	0.8	1.8	1.3	1.3	0.8
	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D
Flow (Q), cfs	0.3	0.5	10.5	29.2	15.1	13.9	9.3
Apron Width (outlet), ft	3.0	5.0	4.5	10.5	7.5	7.5	4.5
Apron Length, ft	7.9	8.6	27.6	37.9	29.0	28.0	25.7
Apron Width (end), ft	6	n/a	16	26	19	19	15
Apron Width (channel), ft	n/a	5	n/a	n/a	n/a	n/a	n/a
Median Stone Dia., ft	0.01	0.02	0.41	0.29	0.24	0.21	0.35
Median Stone Dia., in	0.10	0.21	4.91	3.53	2.87	2.57	4.17
Largest Stone Dia., ft	0.01	0.03	0.61	0.44	0.36	0.32	0.52
Largest Stone Dia., in	0.14	0.32	7.36	5.29	4.30	3.85	6.26
Apron Depth, ft	0.5	0.5	0.9	0.7	0.5	0.5	0.8
Apron Depth, in	6.0	6.0	11.0	7.9	6.4	6.0	9.4

Project #:	52036
Project:	Groton Wind Farm
Location:	Groton, New Hampshire
Calculated by:	EKG — Date: 12/2/2009
Checked by:	Date:
Title:	Riprap Outlet Protection Sizing

Source: New Hampshire Stormwater Manual, Volume 2,
Post-Construction Best Management Practices Selection & Design
NHDES, December 2008, Section 4-6.6. p. 172.



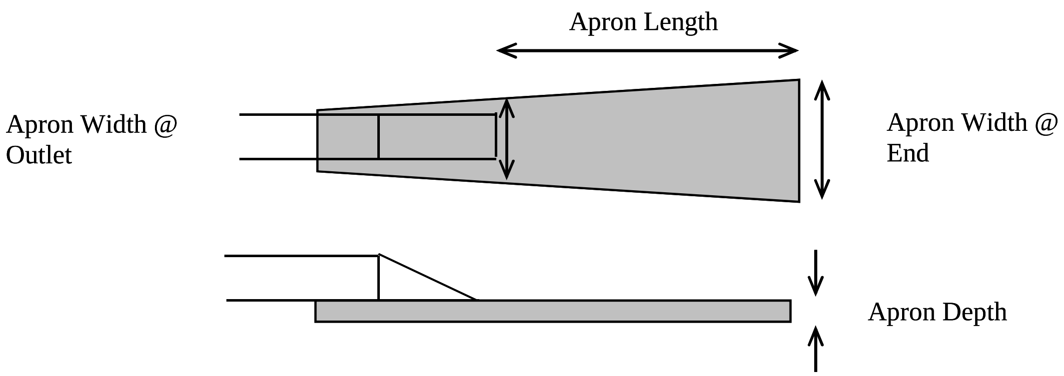
Apron Width at Outlet:	Width = 3*pipe dia. (or width of channel)	
Apron Length:	Length = (1.8*Q) / (dia.^3/2) + 7*dia.	if Tw depth is < 1/2 dia.
	Length = (3.0*Q) / (dia^3/2) + 7*dia.	if Tw dwpth is >= 1/2 dia.
Apron Width at End:	Width = 3*dia. + apron length	if Tw depth is < 1/2 dia.
	Width = 3*dia. + 0.4*apron length	if Tw dwpth is >= 1/2 dia.
	or apron width = channel width if a well defined channel exists	
Rock Riprap:	Median Diameter = (0.02 * Q^4/3) / (Tw * dia)	
	Depth = 6" or 1.5 * largest stone dia	(largest stone dia = 1.5 * d50)

	Outlet Description						
Design Element	106	107	108	109	110	111	112
Design Storm (yr):	25	25	25	25	25	25	25
Defined Channel (yes/no)	no	no	no	no	no	no	no
Channel Width, ft	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Pipe Dia (D), in	15	18	18	36	18	24	70
Tail Water (Tw), ft	0.6	0.8	0.8	1.5	0.8	1.0	2.9
	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D
Flow (Q), cfs	4.1	6.4	5.7	33.1	6.9	3.6	44.7
Apron Width (outlet), ft	3.8	4.5	4.5	9.0	4.5	6.0	17.5
Apron Length, ft	17.6	21.0	19.8	40.1	21.8	17.8	50.4
Apron Width (end), ft	11	13	12	25	13	13	38
Apron Width (channel), ft	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Median Stone Dia., ft	0.17	0.21	0.18	0.47	0.23	0.06	0.19
Median Stone Dia., in	2.02	2.53	2.17	5.67	2.80	0.66	2.24
Largest Stone Dia., ft	0.25	0.32	0.27	0.71	0.35	0.08	0.28
Largest Stone Dia., in	3.02	3.80	3.26	8.50	4.20	0.99	3.35
Apron Depth, ft	0.5	0.5	0.5	1.1	0.5	0.5	0.5
Apron Depth, in	6.0	6.0	6.0	12.8	6.3	6.0	6.0

Computations

Project #:	52036		
Project:	Groton Wind Farm		
Location:	Groton, New Hampshire		
Calculated by:	EKG	Date:	12/2/2009
Checked by:		Date:	
Title:	Riprap Outlet Protection Sizing		

Source: New Hampshire Stormwater Manual, Volume 2,
Post-Construction Best Management Practices Selection & Design
NHDES, December 2008, Section 4-6.6. p. 172.



Apron Width at Outlet:	Width = 3*pipe dia. (or width of channel)	
Apron Length:	Length = (1.8*Q) / (dia.^3/2) + 7*dia.	if Tw depth is < 1/2 dia.
	Length = (3.0*Q) / (dia^3/2) + 7*dia.	if Tw dwpth is >= 1/2 dia.
Apron Width at End:	Width = 3*dia. + apron length	if Tw depth is < 1/2 dia.
	Width = 3*dia. + 0.4*apron length	if Tw dwpth is >= 1/2 dia.
	or apron width = channel width if a well defined channel exists	
Rock Riprap:	Median Diameter = (0.02 * Q^4/3) / (Tw * dia)	
	Depth = 6" or 1.5 * largest stone dia	(largest stone dia = 1.5 * d50)

	Outlet Description						
Design Element	113	114	114a	115	116	117	118
Design Storm (yr):	25	25	25	25	25	25	25
Defined Channel (yes/no)	no	no	no	no	no	no	no
Channel Width, ft	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Pipe Dia (D), in	12	70	15	30	72	18	12
Tail Water (Tw), ft	0.5	2.9	0.6	1.3	3.0	0.8	0.5
	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D
Flow (Q), cfs	0.8	48.6	2.0	20.8	122.5	6.4	1.6
Apron Width (outlet), ft	3.0	17.5	3.8	7.5	18.0	4.5	3.0
Apron Length, ft	9.4	51.2	13.0	33.3	67.0	21.0	11.8
Apron Width (end), ft	7	38	9	21	45	13	8
Apron Width (channel), ft	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Median Stone Dia., ft	0.03	0.21	0.06	0.37	0.68	0.21	0.07
Median Stone Dia., in	0.36	2.50	0.77	4.39	8.11	2.53	0.90
Largest Stone Dia., ft	0.04	0.31	0.10	0.55	1.01	0.32	0.11
Largest Stone Dia., in	0.53	3.75	1.16	6.59	12.17	3.80	1.35
Apron Depth, ft	0.5	0.5	0.5	0.8	1.5	0.5	0.5
Apron Depth, in	6.0	6.0	6.0	9.9	18.3	6.0	6.0

Project #:	52036		
Project:	Groton Wind Farm		
Location:	Groton, New Hampshire		
Calculated by:	EKG	Date:	12/2/2009
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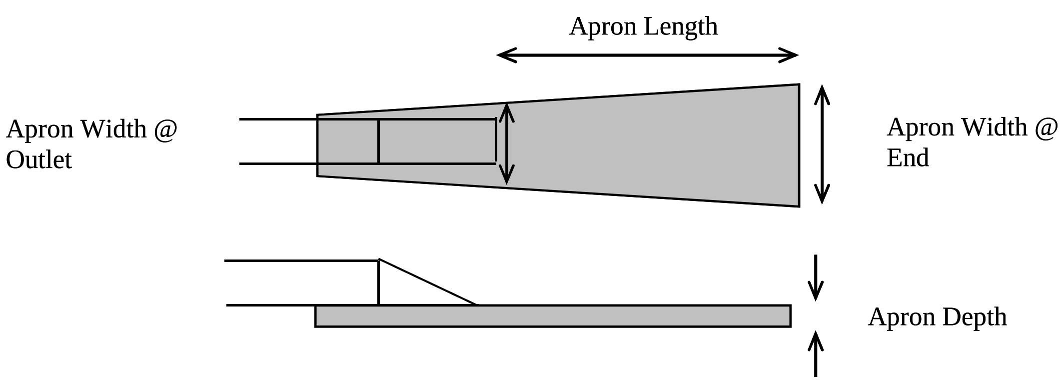
Source: New Hampshire Stormwater Manual, Volume 2,
Post-Construction Best Management Practices Selection & Design
NHDES, December 2008, Section 4-6.6. p. 172.



Apron Width at Outlet:	Width = 3*pipe dia. (or width of channel)	
Apron Length:	Length = (1.8*Q) / (dia.^3/2) + 7*dia.	if Tw depth is < 1/2 dia.
	Length = (3.0*Q) / (dia^3/2) + 7*dia.	if Tw dwpth is >= 1/2 dia.
Apron Width at End:	Width = 3*dia. + apron length	if Tw depth is < 1/2 dia.
	Width = 3*dia. + 0.4*apron length	if Tw dwpth is >= 1/2 dia.
	or apron width = channel width if a well defined channel exists	
Rock Riprap:	Median Diameter = (0.02 * Q^4/3) / (Tw * dia)	
	Depth = 6" or 1.5 * largest stone dia	(largest stone dia = 1.5 * d50)

	Outlet Description
Design Element	119
Design Storm (yr):	25
Defined Channel (yes/no)	no
Channel Width, ft	n/a
Pipe Dia (D), in	12
Tail Water (Tw), ft	0.5
	Tw>=0.5D
Flow (Q), cfs	1.5
Apron Width (outlet), ft	3.0
Apron Length, ft	11.5
Apron Width (end), ft	8
Apron Width (channel), ft	n/a
Median Stone Dia., ft	0.07
Median Stone Dia., in	0.82
Largest Stone Dia., ft	0.10
Largest Stone Dia., in	1.24
Apron Depth, ft	0.5
Apron Depth, in	6.0

Project #:	52036		
Project:	Groton Wind Farm		
Location:	Groton, New Hampshire		
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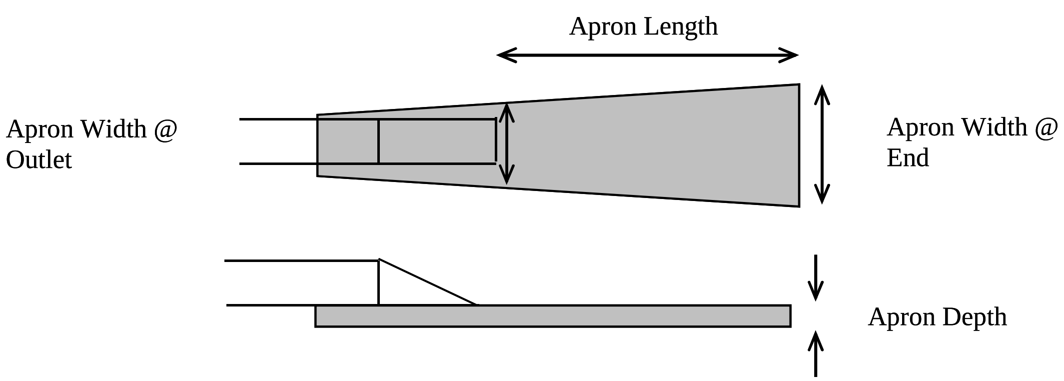

Apron Width at Outlet:	Width = 3*pipe dia. (or width of channel)	
Apron Length:	Length = (1.8*Q) / (dia.^3/2) + 7*dia.	if Tw depth is < 1/2 dia.
	Length = (3.0*Q) / (dia^3/2) + 7*dia.	if Tw dwpth is >= 1/2 dia.
Apron Width at End:	Width = 3*dia. + apron length	if Tw depth is < 1/2 dia.
	Width = 3*dia. + 0.4*apron length	if Tw dwpth is >= 1/2 dia.
	or apron width = channel width if a well defined channel exists	
Rock Riprap:	Median Diameter = (0.02 * Q^4/3) / (Tw * dia)	
	Depth = 6" or 1.5 * largest stone dia	(largest stone dia = 1.5 * d50)

	Outlet Description						
Design Element	201	202	203	204	205	206	207
Design Storm (yr):	25	25	25	25	25	25	25
Defined Channel (yes/no)	no	no	no	no	no	no	no
Channel Width, ft	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Pipe Dia (D), in	15	21	48	21	36	21	21
Tail Water (Tw), ft	0.6	0.9	2.0	0.9	1.5	0.9	0.9
	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D
Flow (Q), cfs	6.5	6.1	31.7	3.9	33.9	22.2	5.0
Apron Width (outlet), ft	3.8	5.3	12.0	5.3	9.0	5.3	5.3
Apron Length, ft	22.7	20.2	39.9	17.3	40.6	41.0	18.7
Apron Width (end), ft	13	13	28	12	25	22	13
Apron Width (channel), ft	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Median Stone Dia., ft	0.31	0.14	0.25	0.08	0.49	0.81	0.11
Median Stone Dia., in	3.73	1.70	3.01	0.96	5.85	9.78	1.30
Largest Stone Dia., ft	0.47	0.21	0.38	0.12	0.73	1.22	0.16
Largest Stone Dia., in	5.59	2.55	4.51	1.44	8.78	14.67	1.95
Apron Depth, ft	0.7	0.5	0.6	0.5	1.1	1.8	0.5
Apron Depth, in	8.4	6.0	6.8	6.0	13.2	22.0	6.0

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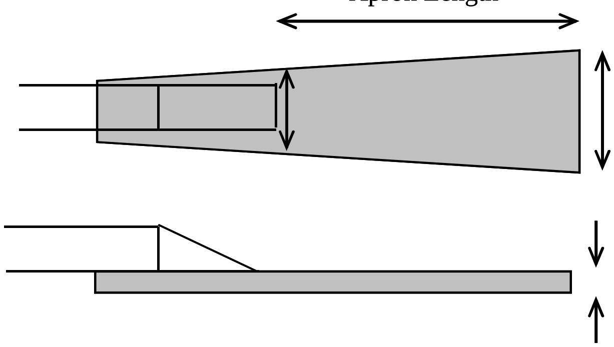

Apron Width at Outlet:	Width = 3*pipe dia. (or width of channel)	
Apron Length:	Length = (1.8*Q) / (dia.^3/2) + 7*dia.	if Tw depth is < 1/2 dia.
	Length = (3.0*Q) / (dia^3/2) + 7*dia.	if Tw dwpth is >= 1/2 dia.
Apron Width at End:	Width = 3*dia. + apron length	if Tw depth is < 1/2 dia.
	Width = 3*dia. + 0.4*apron length	if Tw dwpth is >= 1/2 dia.
	or apron width = channel width if a well defined channel exists	
Rock Riprap:	Median Diameter = (0.02 * Q^4/3) / (Tw * dia)	
	Depth = 6" or 1.5 * largest stone dia	(largest stone dia = 1.5 * d50)

	Outlet Description						
Design Element	208	209	210	211	212	213	214
Design Storm (yr):	25	25	25	25	25	25	25
Defined Channel (yes/no)	no	no	no	no	no	no	no
Channel Width, ft	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Pipe Dia (D), in	54	60	21	21	24	54	21
Tail Water (Tw), ft	2.3	2.5	0.9	0.9	1.0	2.3	0.9
	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D
Flow (Q), cfs	48.6	53.8	0.9	1.3	12.5	65.1	3.2
Apron Width (outlet), ft	13.5	15.0	5.3	5.3	6.0	13.5	5.3
Apron Length, ft	46.8	49.4	13.4	13.9	27.3	52.0	16.4
Apron Width (end), ft	32	35	11	11	17	34	12
Apron Width (channel), ft	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Median Stone Dia., ft	0.35	0.32	0.01	0.02	0.29	0.52	0.06
Median Stone Dia., in	4.20	3.90	0.14	0.22	3.48	6.21	0.72
Largest Stone Dia., ft	0.53	0.49	0.02	0.03	0.44	0.78	0.09
Largest Stone Dia., in	6.31	5.85	0.20	0.33	5.22	9.31	1.08
Apron Depth, ft	0.8	0.7	0.5	0.5	0.7	1.2	0.5
Apron Depth, in	9.5	8.8	6.0	6.0	7.8	14.0	6.0

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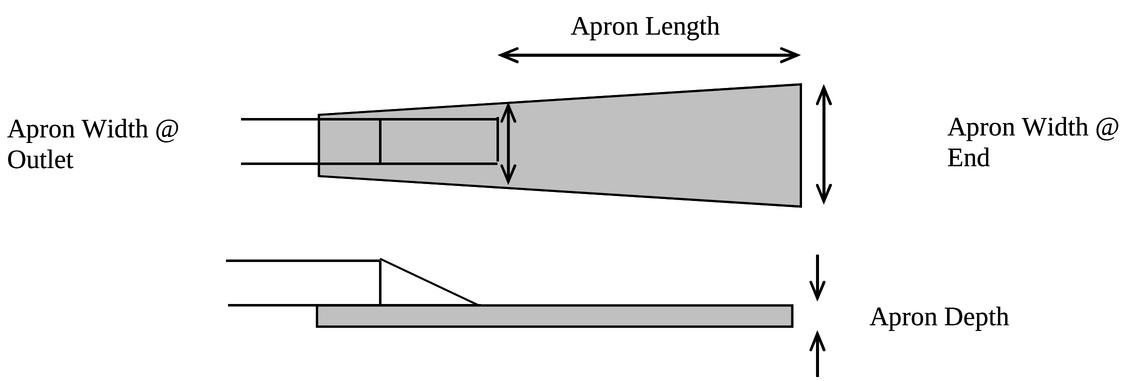

Apron Width at Outlet:	Width = 3*pipe dia. (or width of channel)	
Apron Length:	Length = (1.8*Q) / (dia.^3/2) + 7*dia.	if Tw depth is < 1/2 dia.
	Length = (3.0*Q) / (dia^3/2) + 7*dia.	if Tw dwpth is >= 1/2 d
Apron Width at End:	Width = 3*dia. + apron length	if Tw depth is < 1/2 dia.
	Width = 3*dia. + 0.4*apron length	if Tw dwpth is >= 1/2 d
	or apron width = channel width if a well defined channel exists	
Rock Riprap:	Median Diameter = (0.02 * Q^4/3) / (Tw * dia)	
	Depth = 6" or 1.5 * largest stone dia	(largest stone dia = 1.5 *

	Outlet Description						
Design Element	215	216	217	219	220	221	222
Design Storm (yr):	25	25	25	25	25	25	25
Defined Channel (yes/no)	no	no	no	no	no	no	no
Channel Width, ft	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Pipe Dia (D), in	24	21	110	70	18	70	110
Tail Water (Tw), ft	1.0	0.9	4.6	2.9	0.8	2.9	4.6
	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D
Flow (Q), cfs	10.4	2.8	182.8	79.8	11.5	77.2	214.4
Apron Width (outlet), ft	6.0	5.3	27.5	17.5	4.5	17.5	27.5
Apron Length, ft	25.0	15.9	83.9	57.8	29.3	57.3	87.3
Apron Width (end), ft	16	12	61	41	16	40	62
Apron Width (channel), ft	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Median Stone Dia., ft	0.23	0.05	0.49	0.40	0.46	0.39	0.61
Median Stone Dia., in	2.72	0.60	5.90	4.84	5.54	4.63	7.30
Largest Stone Dia., ft	0.34	0.08	0.74	0.61	0.69	0.58	0.91
Largest Stone Dia., in	4.09	0.90	8.86	7.26	8.31	6.95	10.96
Apron Depth, ft	0.5	0.5	1.1	0.9	1.0	0.9	1.4
Apron Depth, in	6.1	6.0	13.3	10.9	12.5	10.4	16.4

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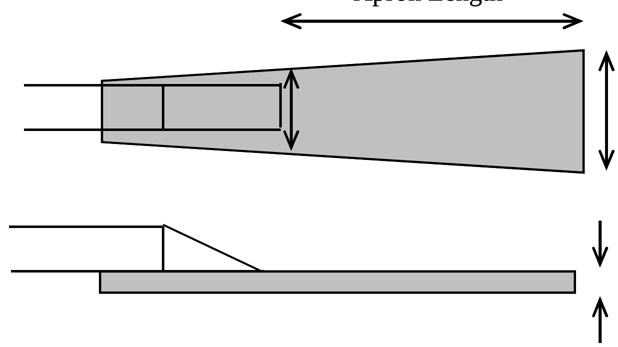

Apron Width at Outlet:	Width = 3*pipe dia. (or width of channel)	
Apron Length:	Length = (1.8*Q) / (dia.^3/2) + 7*dia.	if Tw depth is < 1/2 dia.
	Length = (3.0*Q) / (dia^3/2) + 7*dia.	if Tw dwpth is >= 1/2 dia.
Apron Width at End:	Width = 3*dia. + apron length	if Tw depth is < 1/2 dia.
	Width = 3*dia. + 0.4*apron length	if Tw dwpth is >= 1/2 dia.
	or apron width = channel width if a well defined channel exists	
Rock Riprap:	Median Diameter = (0.02 * Q^4/3) / (Tw * dia)	
	Depth = 6" or 1.5 * largest stone dia	(largest stone dia = 1.5 * d50)

Design Element	Outlet Description 501	502	503	504	505
Design Storm (yr):	25	25	25	25	25
Defined Channel (yes/no)	no	no	no	no	no
Channel Width, ft	n/a	n/a	n/a	n/a	n/a
Pipe Dia (D), in	36	15	15	21	15
Tail Water (Tw), ft	1.5	0.6	0.6	0.9	0.6
	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D
Flow (Q), cfs	27.0	3.2	4.3	9.7	5.5
Apron Width (outlet), ft	9.0	3.8	3.8	5.3	3.8
Apron Length, ft	36.6	15.6	18.0	24.8	20.6
Apron Width (end), ft	24	10	11	15	12
Apron Width (channel), ft	n/a	n/a	n/a	n/a	n/a
Median Stone Dia., ft	0.36	0.12	0.18	0.27	0.25
Median Stone Dia., in	4.32	1.45	2.15	3.24	2.98
Largest Stone Dia., ft	0.54	0.18	0.27	0.41	0.37
Largest Stone Dia., in	6.48	2.17	3.22	4.86	4.47
Apron Depth, ft	0.8	0.5	0.5	0.6	0.6
Apron Depth, in	9.7	6.0	6.0	7.3	6.7

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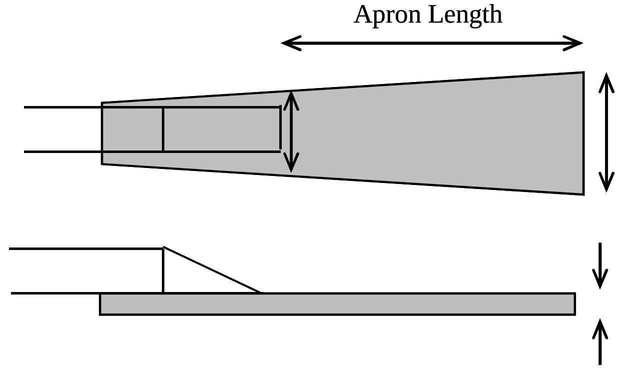
Project:	Groton Wind Farm
Location:	Groton, New Hampshire
Calculated by:	EKG — Date: 12/2/2009
Checked by:	Date:
Title:	Riprap Outlet Protection Sizing

Source: New Hampshire Stormwater Manual, Volume 2,
Post-Construction Best Management Practices Selection & Design
NHDES, December 2008, Section 4-6.6. p. 172.



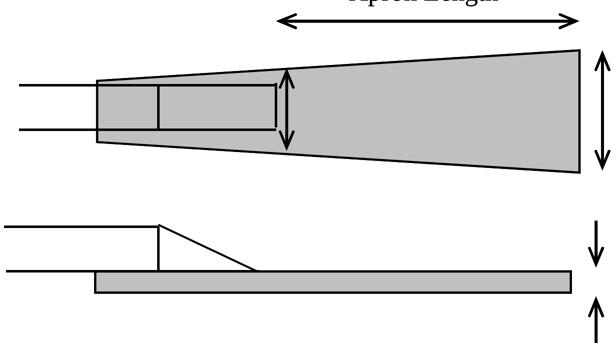
Apron Width at Outlet:	Width = 3*pipe dia. (or width of channel)	
Apron Length:	Length = (1.8*Q) / (dia.^3/2) + 7*dia.	if Tw depth is < 1/2 dia.
	Length = (3.0*Q) / (dia^3/2) + 7*dia.	if Tw dwpth is >= 1/2 dia.
Apron Width at End:	Width = 3*dia. + apron length	if Tw depth is < 1/2 dia.
	Width = 3*dia. + 0.4*apron length	if Tw dwpth is >= 1/2 dia.
	or apron width = channel width if a well defined channel exists	
Rock Riprap:	Median Diameter = (0.02 * Q^4/3) / (Tw * dia)	
	Depth = 6" or 1.5 * largest stone dia	(largest stone dia = 1.5 * d50)

Design Element	Outlet Description 602	603	604	605
Design Storm (yr):	25	25	25	25
Defined Channel (yes/no)	no	no	no	no
Channel Width, ft	n/a	n/a	n/a	n/a
Pipe Dia (D), in	18	15	48	30
Tail Water (Tw), ft	0.8	0.6	2.0	1.3
	Tw>=0.5D	Tw<0.5D	Tw>=0.5D	Tw>=0.5D
Flow (Q), cfs	7.7	2.4	74.1	10.2
Apron Width (outlet), ft	4.5	3.8	12.0	7.5
Apron Length, ft	23.1	11.8	55.8	25.2
Apron Width (end), ft	14	16	34	18
Apron Width (channel), ft	n/a	n/a	n/a	n/a
Median Stone Dia., ft	0.27	0.09	0.78	0.14
Median Stone Dia., in	3.24	1.03	9.34	1.70
Largest Stone Dia., ft	0.41	0.13	1.17	0.21
Largest Stone Dia., in	4.87	1.54	14.01	2.55
Apron Depth, ft	0.6	0.5	1.8	0.5
Apron Depth, in	7.3	6.0	21.0	6.0

Computations

Project #:	52036		
Project:	Groton Wind Farm		
Location:	Groton, New Hampshire		
Calculated by:	EKG	Date:	12/2/2009
Checked by:		Date:	
Title:	Riprap Outlet Protection Sizing		

Source: New Hampshire Stormwater Manual, Volume 2,
Post-Construction Best Management Practices Selection & Design
NHDES, December 2008, Section 4-6.6. p. 172.

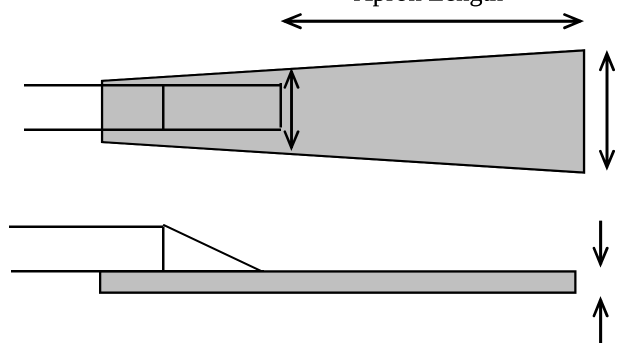


Apron Width at Outlet:	Width = 3*pipe dia. (or width of channel)	
Apron Length:	Length = (1.8*Q) / (dia.^3/2) + 7*dia.	if Tw depth is < 1/2 dia.
	Length = (3.0*Q) / (dia^3/2) + 7*dia.	if Tw dwpth is >= 1/2 dia.
Apron Width at End:	Width = 3*dia. + apron length	if Tw depth is < 1/2 dia.
	Width = 3*dia. + 0.4*apron length	if Tw dwpth is >= 1/2 dia.
	or apron width = channel width if a well defined channel exists	
Rock Riprap:	Median Diameter = (0.02 * Q^4/3) / (Tw * dia)	
	Depth = 6" or 1.5 * largest stone dia	(largest stone dia = 1.5 * d50)

	Outlet Description		
Design Element	701	702	703
Design Storm (yr):	25	25	25
Defined Channel (yes/no)	no	no	no
Channel Width, ft	n/a	n/a	n/a
Pipe Dia (D), in	42	15	15
Tail Water (Tw), ft	1.8	0.6	0.6
	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D
Flow (Q), cfs	26.0	2.2	2.1
Apron Width (outlet), ft	10.5	3.8	3.8
Apron Length, ft	36.4	13.5	13.3
Apron Width (end), ft	25	9	9
Apron Width (channel), ft	n/a	n/a	n/a
Median Stone Dia., ft	0.25	0.07	0.07
Median Stone Dia., in	3.02	0.88	0.83
Largest Stone Dia., ft	0.38	0.11	0.10
Largest Stone Dia., in	4.53	1.32	1.24
Apron Depth, ft	0.6	0.5	0.5
Apron Depth, in	6.8	6.0	6.0

Project #:	52036		
Project:	Groton Wind Farm		
Location:	Groton, New Hampshire		
Calculated by:	EKG	Date:	12/2/2009
Checked by:		Date:	
Title:	Riprap Outlet Protection Sizing		

Source: New Hampshire Stormwater Manual, Volume 2,
Post-Construction Best Management Practices Selection & Design
NHDES, December 2008, Section 4-6.6. p. 172.

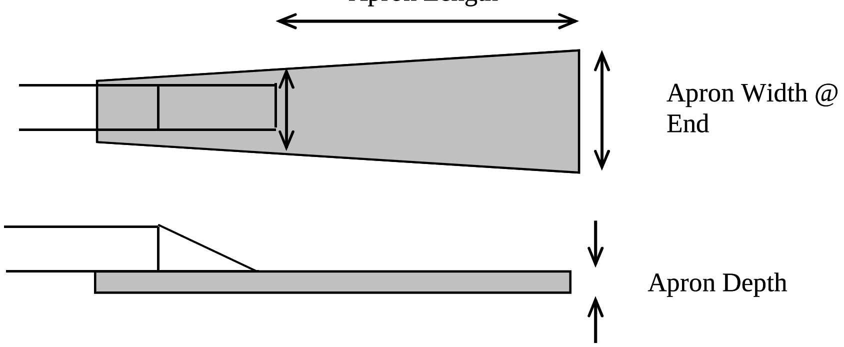


Apron Width at Outlet:	Width = 3*pipe dia. (or width of channel)	
Apron Length:	Length = (1.8*Q) / (dia.^3/2) + 7*dia.	if Tw depth is < 1/2 dia.
	Length = (3.0*Q) / (dia^3/2) + 7*dia.	if Tw dwpth is >= 1/2 dia.
Apron Width at End:	Width = 3*dia. + apron length	if Tw depth is < 1/2 dia.
	Width = 3*dia. + 0.4*apron length	if Tw dwpth is >= 1/2 dia.
	or apron width = channel width if a well defined channel exists	
Rock Riprap:	Median Diameter = (0.02 * Q^4/3) / (Tw * dia)	
	Depth = 6" or 1.5 * largest stone dia	(largest stone dia = 1.5 * d50)

	Outlet Description						
Design Element	801	802	803	804	805	806	807
Design Storm (yr):	25	25	25	25	25	25	25
Defined Channel (yes/no)	no	no	no	no	no	no	no
Channel Width, ft	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Pipe Dia (D), in	30	15	15	42	15	12	24
Tail Water (Tw), ft	1.3	0.6	0.6	1.8	0.6	0.5	1.0
	Tw>=0.5D	Tw<0.5D	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D	Tw>=0.5D
Flow (Q), cfs	31.2	8.9	12.4	33.1	7.2	3.5	21.6
Apron Width (outlet), ft	7.5	3.8	3.8	10.5	3.8	3.0	6.0
Apron Length, ft	41.2	20.2	35.4	39.7	24.2	17.5	36.9
Apron Width (end), ft	24	24	18	26	13	10	21
Apron Width (channel), ft	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Median Stone Dia., ft	0.63	0.49	0.73	0.35	0.36	0.21	0.60
Median Stone Dia., in	7.54	5.90	8.82	4.16	4.27	2.55	7.22
Largest Stone Dia., ft	0.94	0.74	1.10	0.52	0.53	0.32	0.90
Largest Stone Dia., in	11.32	8.85	13.23	6.25	6.41	3.83	10.83
Apron Depth, ft	1.4	1.1	1.7	0.8	0.8	0.5	1.4
Apron Depth, in	17.0	13.3	19.8	9.4	9.6	6.0	16.2

Project #:	52036		
Project:	Groton Wind Farm		
Location:	Groton, New Hampshire		
Calculated by:	EKG	Date:	12/2/2009
Checked by:		Date:	
Title:	Riprap Outlet Protection Sizing		

Source: New Hampshire Stormwater Manual, Volume 2,
Post-Construction Best Management Practices Selection & Design
NHDES, December 2008, Section 4-6.6. p. 172.



Apron Width at Outlet:	Width = 3*pipe dia. (or width of channel)	
Apron Length:	Length = (1.8*Q) / (dia.^3/2) + 7*dia.	if Tw depth is < 1/2 dia.
	Length = (3.0*Q) / (dia^3/2) + 7*dia.	if Tw dwpth is >= 1/2 dia.
Apron Width at End:	Width = 3*dia. + apron length	if Tw depth is < 1/2 dia.
	Width = 3*dia. + 0.4*apron length	if Tw dwpth is >= 1/2 dia.
	or apron width = channel width if a well defined channel exists	
Rock Riprap:	Median Diameter = (0.02 * Q^4/3) / (Tw * dia)	
	Depth = 6" or 1.5 * largest stone dia	(largest stone dia = 1.5 * d50)

Design Element	Outlet Description 808	809
Design Storm (yr):	25	25
Defined Channel (yes/no)	no	no
Channel Width, ft	n/a	n/a
Pipe Dia (D), in	15	36
Tail Water (Tw), ft	0.6	1.5
	Tw>=0.5D	Tw>=0.5D
Flow (Q), cfs	0.7	38.2
Apron Width (outlet), ft	3.8	9.0
Apron Length, ft	10.3	43.1
Apron Width (end), ft	8	26
Apron Width (channel), ft	n/a	n/a
Median Stone Dia., ft	0.02	0.57
Median Stone Dia., in	0.19	6.86
Largest Stone Dia., ft	0.02	0.86
Largest Stone Dia., in	0.29	10.29
Apron Depth, ft	0.5	1.3
Apron Depth, in	6.0	15.4

Project #:	52036
Project:	Groton Wind Farm
Location:	Groton, New Hampshire
Calculated by:	EKG Date: 12/2/2009
Checked by:	Date:
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Source: New Hampshire Stormwater Manual, Volume 2,
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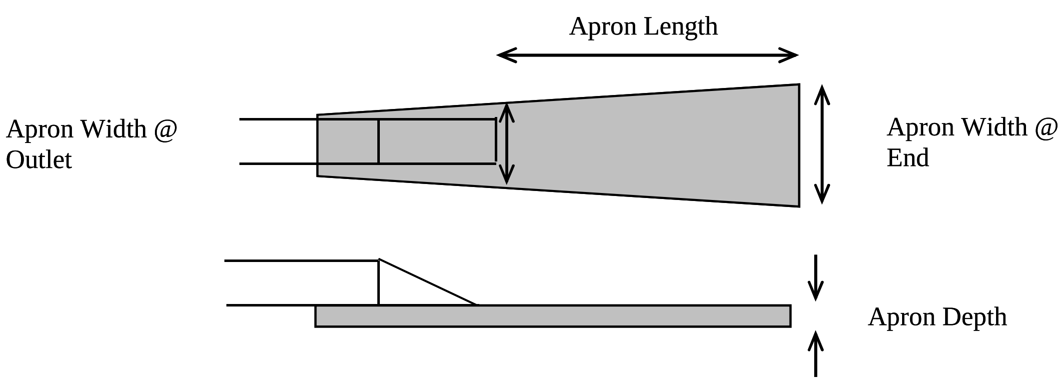
NHDES, December 2008, Section 4-6.6. p. 172.



Apron Width at Outlet:	Width = 3*pipe dia. (or width of channel)	
Apron Length:	Length = (1.8*Q) / (dia.^3/2) + 7*dia.	if Tw depth is < 1/2 dia.
	Length = (3.0*Q) / (dia^3/2) + 7*dia.	if Tw dwpth is >= 1/2 dia.
Apron Width at End:	Width = 3*dia. + apron length	if Tw depth is < 1/2 dia.
	Width = 3*dia. + 0.4*apron length	if Tw dwpth is >= 1/2 dia.
	or apron width = channel width if a well defined channel exists	
Rock Riprap:	Median Diameter = (0.02 * Q^4/3) / (Tw * dia)	
	Depth = 6" or 1.5 * largest stone dia	(largest stone dia = 1.5 * d50)

Design Element	Outlet Description: 901	903
Design Storm (yr):	25	25
Defined Channel (yes/no)	no	no
Channel Width, ft	n/a	n/a
Pipe Dia (D), in	12	21
Tail Water (Tw), ft	0.5	0.9
	Tw>=0.5D	Tw>=0.5D
Flow (Q), cfs	7.0	7.3
Apron Width (outlet), ft	3.0	5.3
Apron Length, ft	28.0	21.7
Apron Width (end), ft	14	14
Apron Width (channel), ft	n/a	n/a
Median Stone Dia., ft	0.54	0.18
Median Stone Dia., in	6.43	2.22
Largest Stone Dia., ft	0.80	0.28
Largest Stone Dia., in	9.64	3.33
Apron Depth, ft	1.2	0.5
Apron Depth, in	14.5	6.0

O & M Building Site

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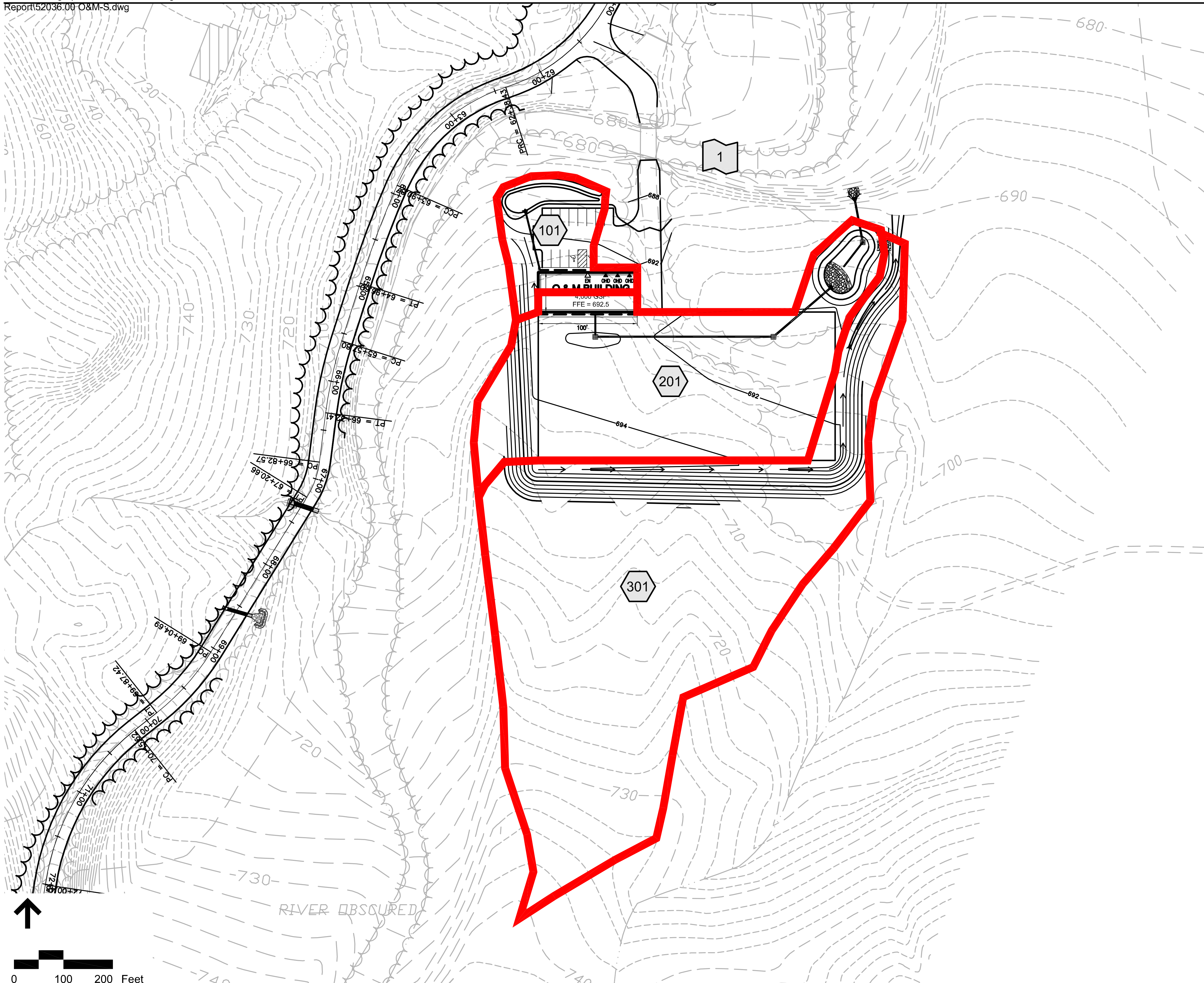
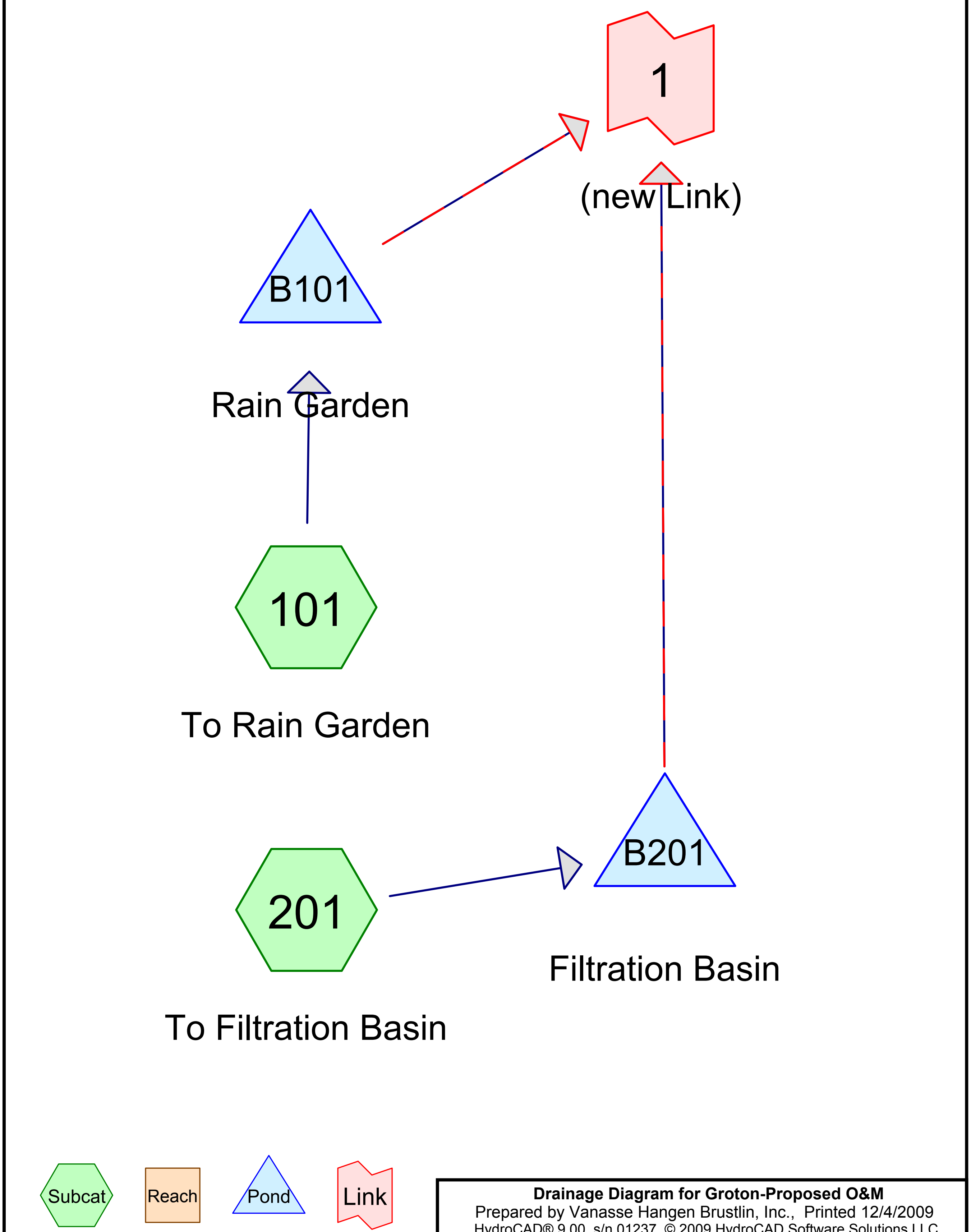


LEGEND

- XXX - DRAINAGE SUB-AREA
- X - DISCHARGE POINT
- DRAINAGE AREAS

Vanasse Hangen Brustlin, Inc.

Drainage Area Map
Operations & Maintenance Building
Groton Hollow Road
Groton, New Hampshire



Drainage Diagram for Groton-Proposed O&M
Prepared by Vanasse Hangen Brustlin, Inc., Printed 12/4/2009
HydroCAD® 9.00 s/n 01237 © 2009 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.057	55	Woods, Good, HSG B (201)
0.385	61	>75% Grass cover, Good, HSG B (101, 201)
1.016	85	Gravel roads, HSG B (101, 201)
0.174	98	Impervious (101, 201)
1.632		**TOTAL AREA**

Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 101: To Rain Garden Runoff Area=12,347 sf 45.03% Impervious Runoff Depth=0.54"
Tc=6.0 min CN=79 Runoff=0.25 cfs 0.013 af

Subcatchment 201: To Filtration Basin Runoff Area=58,726 sf 3.41% Impervious Runoff Depth=0.59"
Tc=6.0 min CN=80 Runoff=1.33 cfs 0.067 af

Pond B101: Rain Garden Peak Elev=688.53' Storage=31 cf Inflow=0.25 cfs 0.013 af
Primary=0.00 cfs 0.000 af Secondary=0.17 cfs 0.013 af Outflow=0.17 cfs 0.013 af

Pond B201: Filtration Basin Peak Elev=686.94' Storage=559 cf Inflow=1.33 cfs 0.067 af
Primary=0.00 cfs 0.000 af Secondary=0.35 cfs 0.067 af Outflow=0.35 cfs 0.067 af

Link 1: (new Link) Inflow=0.52 cfs 0.079 af
Primary=0.52 cfs 0.079 af

Total Runoff Area = 1.632 ac Runoff Volume = 0.079 af Average Runoff Depth = 0.58"
89.36% Pervious = 1.458 ac 10.64% Impervious = 0.174 ac

Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 101: To Rain Garden Runoff Area=12,347 sf 45.03% Impervious Runoff Depth=0.73"
Tc=6.0 min CN=79 Runoff=0.35 cfs 0.017 af

Subcatchment 201: To Filtration Basin Runoff Area=58,726 sf 3.41% Impervious Runoff Depth=0.79"
Tc=6.0 min CN=80 Runoff=1.83 cfs 0.088 af

Pond B101: Rain Garden Peak Elev=688.59' Storage=80 cf Inflow=0.35 cfs 0.017 af
Primary=0.00 cfs 0.000 af Secondary=0.17 cfs 0.017 af Outflow=0.17 cfs 0.017 af

Pond B201: Filtration Basin Peak Elev=687.19' Storage=825 cf Inflow=1.83 cfs 0.088 af
Primary=0.44 cfs 0.004 af Secondary=0.36 cfs 0.084 af Outflow=0.80 cfs 0.088 af

Link 1: (new Link) Inflow=0.97 cfs 0.106 af
Primary=0.97 cfs 0.106 af

Total Runoff Area = 1.632 ac Runoff Volume = 0.106 af Average Runoff Depth = 0.78"
89.36% Pervious = 1.458 ac 10.64% Impervious = 0.174 ac

Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment101: To Rain Garden Runoff Area=12,347 sf 45.03% Impervious Runoff Depth=1.83"
Tc=6.0 min CN=79 Runoff=0.92 cfs 0.043 af

Subcatchment201: To Filtration Basin Runoff Area=58,726 sf 3.41% Impervious Runoff Depth=1.92"
Tc=6.0 min CN=80 Runoff=4.57 cfs 0.216 af

Pond B101: Rain Garden Peak Elev=689.00' Storage=507 cf Inflow=0.92 cfs 0.043 af
Primary=0.00 cfs 0.000 af Secondary=0.18 cfs 0.043 af Outflow=0.18 cfs 0.043 af

Pond B201: Filtration Basin Peak Elev=687.49' Storage=1,188 cf Inflow=4.57 cfs 0.216 af
Primary=4.06 cfs 0.069 af Secondary=0.38 cfs 0.147 af Outflow=4.45 cfs 0.216 af

Link 1: (new Link) Inflow=4.62 cfs 0.259 af
Primary=4.62 cfs 0.259 af

Total Runoff Area = 1.632 ac Runoff Volume = 0.259 af Average Runoff Depth = 1.90"
89.36% Pervious = 1.458 ac 10.64% Impervious = 0.174 ac

Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment101: To Rain Garden Runoff Area=12,347 sf 45.03% Impervious Runoff Depth=2.83"
Tc=6.0 min CN=79 Runoff=1.41 cfs 0.067 af

Subcatchment201: To Filtration Basin Runoff Area=58,726 sf 3.41% Impervious Runoff Depth=2.94"
Tc=6.0 min CN=80 Runoff=6.93 cfs 0.330 af

Pond B101: Rain Garden Peak Elev=689.04' Storage=555 cf Inflow=1.41 cfs 0.067 af
Primary=1.34 cfs 0.011 af Secondary=0.18 cfs 0.056 af Outflow=1.53 cfs 0.067 af

Pond B201: Filtration Basin Peak Elev=687.71' Storage=1,460 cf Inflow=6.93 cfs 0.330 af
Primary=5.85 cfs 0.135 af Secondary=0.39 cfs 0.195 af Outflow=6.25 cfs 0.330 af

Link 1: (new Link) Inflow=7.76 cfs 0.397 af
Primary=7.76 cfs 0.397 af

Total Runoff Area = 1.632 ac Runoff Volume = 0.397 af Average Runoff Depth = 2.92"
89.36% Pervious = 1.458 ac 10.64% Impervious = 0.174 ac

Summary for Subcatchment 101: To Rain Garden

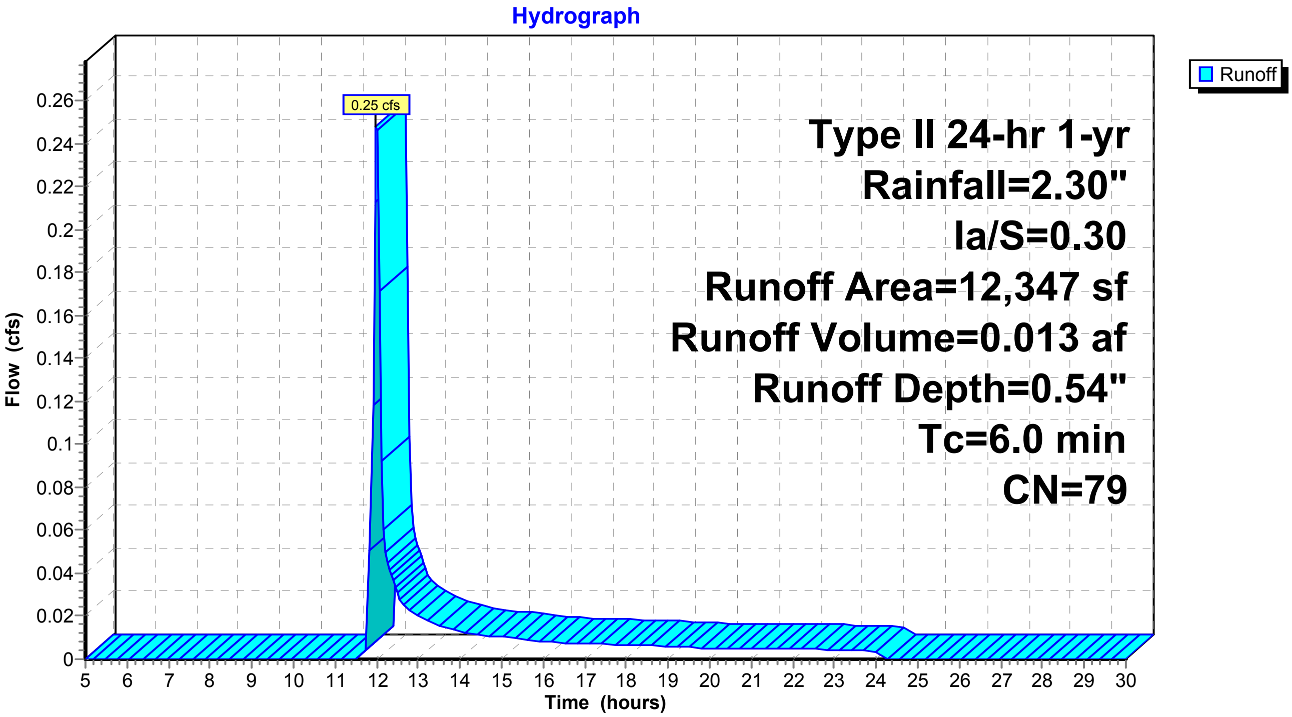
Runoff = 0.25 cfs @ 11.99 hrs, Volume= 0.013 af, Depth= 0.54"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-yr Rainfall=2.30", Ia/S=0.30

	Area (sf)	CN	Description
*	5,560	98	Impervious
	500	85	Gravel roads, HSG B
	6,287	61	>75% Grass cover, Good, HSG B
	12,347	79	Weighted Average
	6,787		54.97% Pervious Area
	5,560		45.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 101: To Rain Garden



Summary for Subcatchment 201: To Filtration Basin

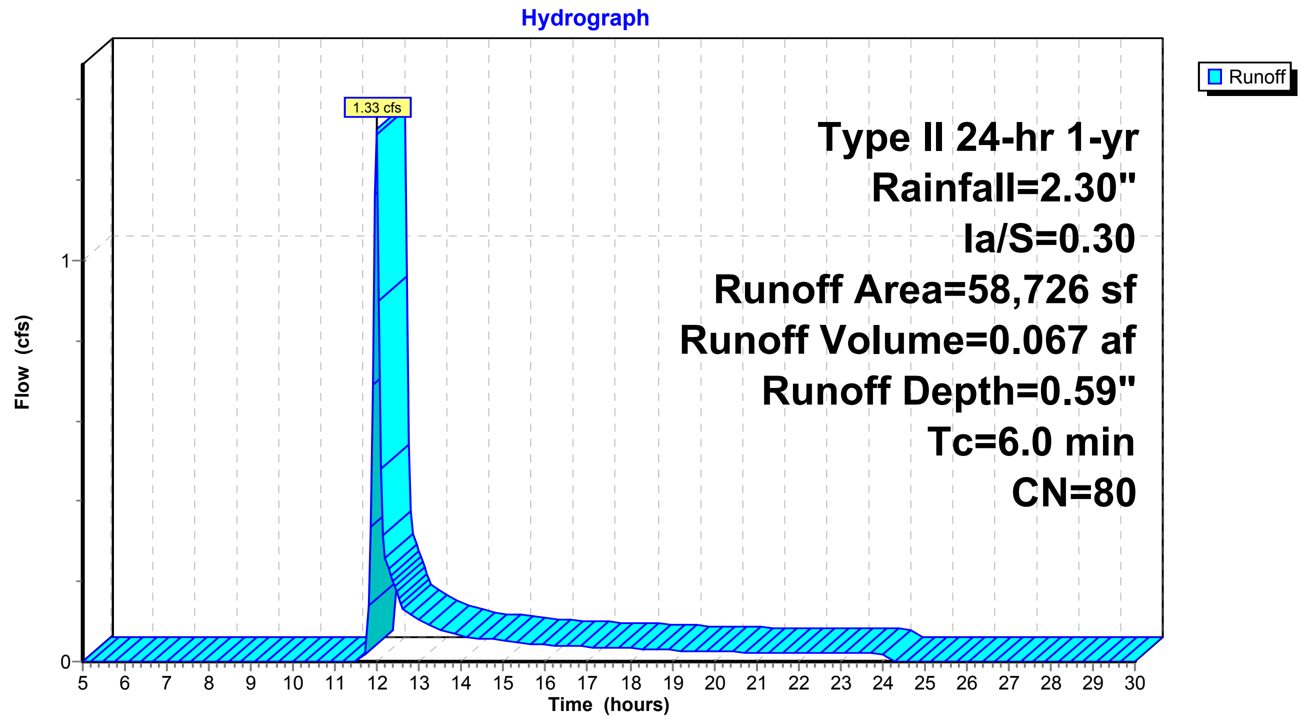
Runoff = 1.33 cfs @ 11.99 hrs, Volume= 0.067 af, Depth= 0.59"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-yr Rainfall=2.30", Ia/S=0.30

	Area (sf)	CN	Description
*	2,000	98	Impervious
	43,761	85	Gravel roads, HSG B
	10,485	61	>75% Grass cover, Good, HSG B
	2,480	55	Woods, Good, HSG B
	58,726	80	Weighted Average
	56,726		96.59% Pervious Area
	2,000		3.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 201: To Filtration Basin



Summary for Pond B101: Rain Garden

Inflow Area = 0.283 ac, 45.03% Impervious, Inflow Depth = 0.54" for 1-yr event
Inflow = 0.25 cfs @ 11.99 hrs, Volume= 0.013 af
Outflow = 0.17 cfs @ 12.05 hrs, Volume= 0.013 af, Atten= 31%, Lag= 3.6 min
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Secondary = 0.17 cfs @ 12.05 hrs, Volume= 0.013 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 688.53' @ 12.05 hrs Surf.Area= 915 sf Storage= 31 cf
Flood Elev= 689.50' Surf.Area= 1,387 sf Storage= 1,139 cf

Plug-Flow detention time= 1.4 min calculated for 0.013 af (100% of inflow)
Center-of-Mass det. time= 1.5 min (891.1 - 889.6)

Volume	Invert	Avail.Storage	Storage Description
#1	688.50'	1,899 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

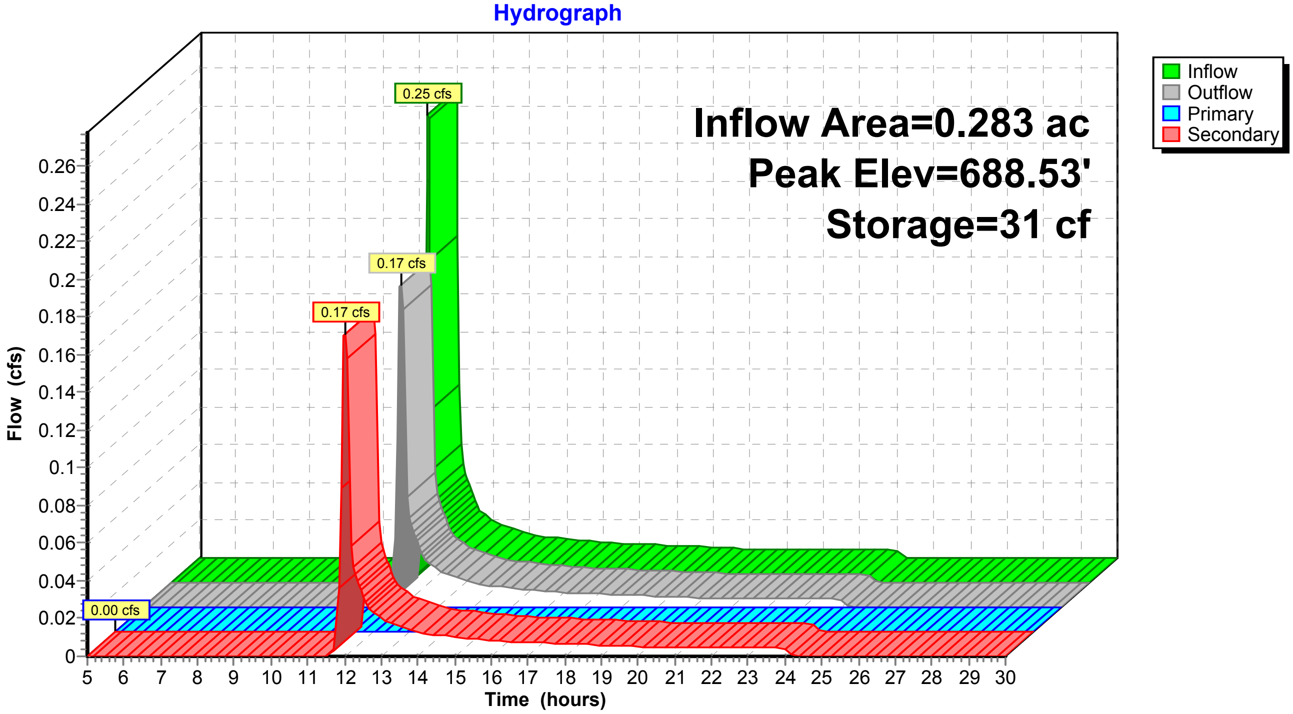
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
688.50	899	154.8	0	0	899
689.00	1,139	164.2	508	508	1,151
690.00	1,659	183.0	1,391	1,899	1,698

Device	Routing	Invert	Outlet Devices
#1	Primary	689.00'	**60.0' long Overflow** 2 End Contraction(s) 1.0' Crest Height
#2	Secondary	685.40'	**4.0" Round Culvert X 0.50** L= 85.0' CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 685.00' S= 0.0047 '/' Cc= 0.900 n= 0.013

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=688.50' (Free Discharge)
↑—**1=Overflow** (Controls 0.00 cfs)

Secondary OutFlow Max=0.17 cfs @ 12.05 hrs HW=688.53' (Free Discharge)
↑—**2=Culvert** (Barrel Controls 0.17 cfs @ 1.96 fps)

Pond B101: Rain Garden



Summary for Pond B201: Filtration Basin

Inflow Area = 1.348 ac, 3.41% Impervious, Inflow Depth = 0.59" for 1-yr event
Inflow = 1.33 cfs @ 11.99 hrs, Volume= 0.067 af
Outflow = 0.35 cfs @ 12.15 hrs, Volume= 0.067 af, Atten= 74%, Lag= 9.6 min
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Secondary = 0.35 cfs @ 12.15 hrs, Volume= 0.067 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 686.94' @ 12.15 hrs Surf.Area= 1,008 sf Storage= 559 cf
Flood Elev= 692.50' Surf.Area= 3,828 sf Storage= 12,185 cf

Plug-Flow detention time= 9.2 min calculated for 0.067 af (100% of inflow)
Center-of-Mass det. time= 9.2 min (892.2 - 883.1)

Volume	Invert	Avail.Storage	Storage Description
#1	686.30'	12,185 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

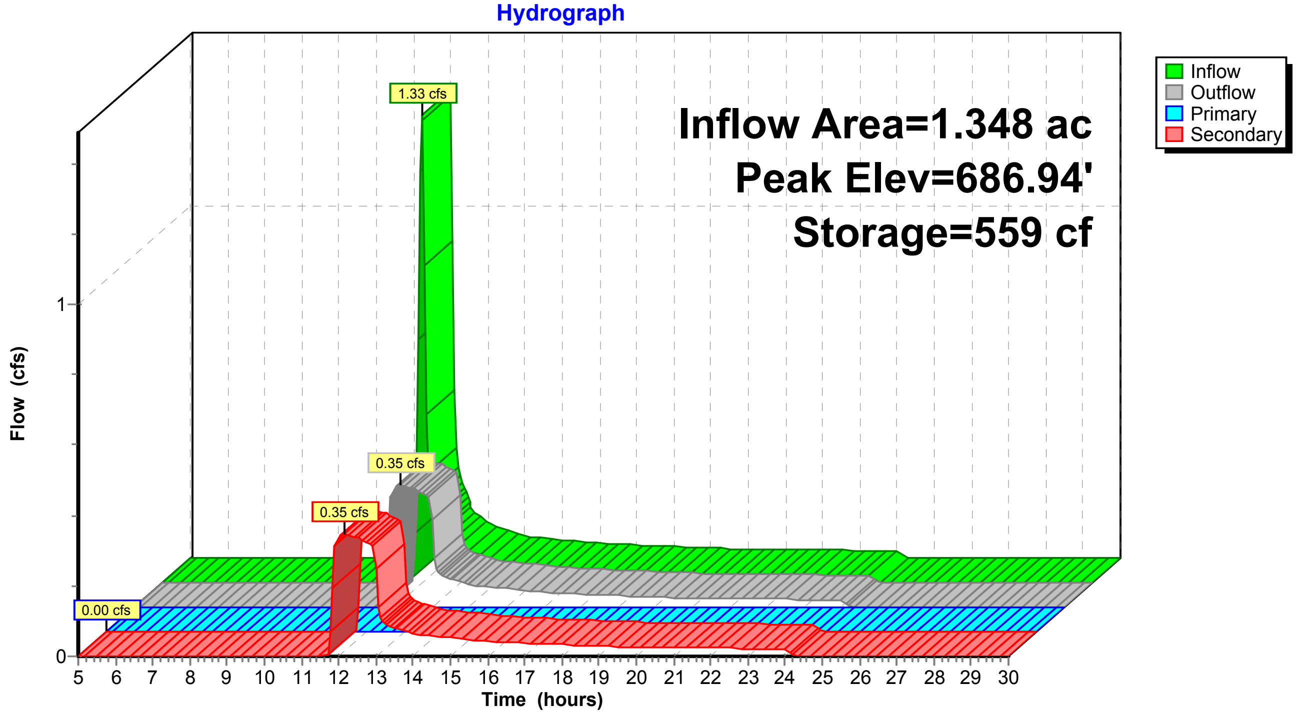
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
686.30	756	126.0	0	0	756
687.00	1,035	139.1	624	624	1,048
688.00	1,480	157.9	1,251	1,875	1,516
689.00	1,982	176.7	1,725	3,600	2,044
690.00	2,541	195.6	2,256	5,856	2,634
691.00	3,156	214.5	2,843	8,699	3,284
692.00	3,828	233.3	3,487	12,185	3,990

Device	Routing	Invert	Outlet Devices
#1	Primary	687.10'	**15.0" x 15.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	684.20'	**4.0" Horiz. Underdrain X 0.50** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=686.30' (Free Discharge)
└─**1=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.35 cfs @ 12.15 hrs HW=686.94' (Free Discharge)
└─**2=Underdrain** (Orifice Controls 0.35 cfs @ 3.98 fps)

Pond B201: Filtration Basin

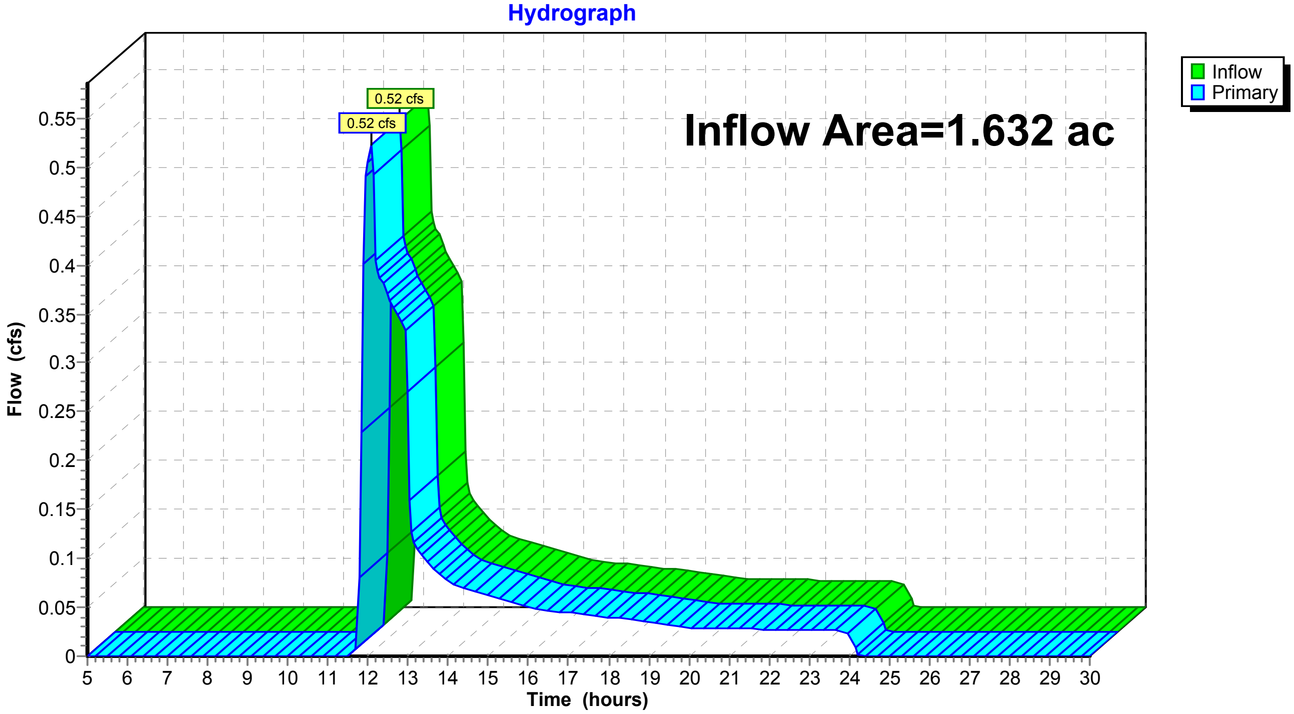


Summary for Link 1: (new Link)

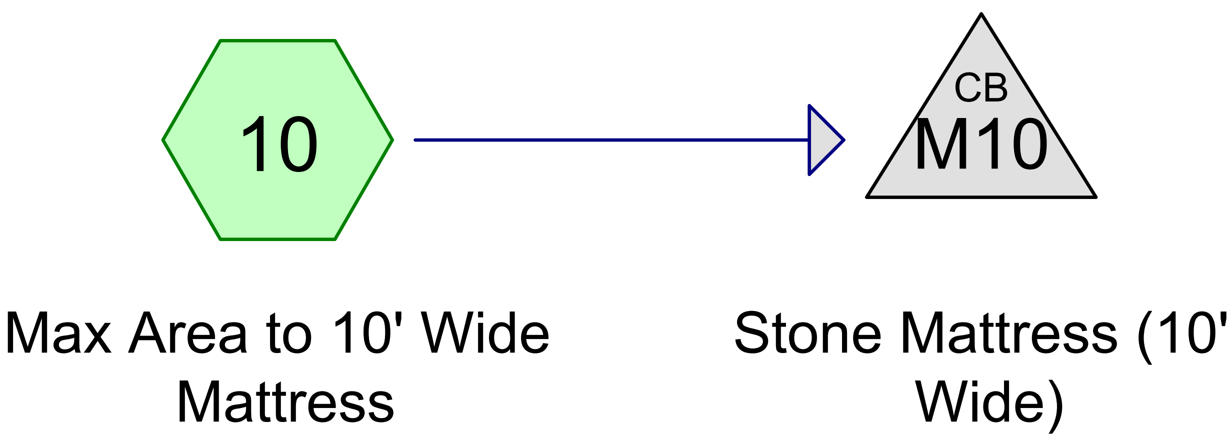
Inflow Area = 1.632 ac, 10.64% Impervious, Inflow Depth = 0.58" for 1-yr event
Inflow = 0.52 cfs @ 12.08 hrs, Volume= 0.079 af
Primary = 0.52 cfs @ 12.08 hrs, Volume= 0.079 af, Atten= 0%, Lag= 0.0 min

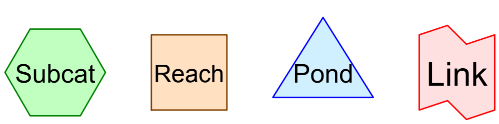
Primary outflow = Inflow, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Link 1: (new Link)



Stone Mattresses





Drainage Diagram for Groton-Stone Mattress Design
Prepared by {enter your company name here}, Printed 12/2/2009
HydroCAD® 9.00 s/n 01038 © 2009 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
11.250	67	Based on CN for P101 (10)
11.250		**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Goup	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
11.250	Other	10
11.250		**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)
1	M10	0.00	-0.60	30.0	0.0200	0.100	120.0	18.0

Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 10: Max Area to 10' Wide Runoff Area=11.250 ac 0.00% Impervious Runoff Depth=0.91"
Tc=25.0 min CN=67 Runoff=7.58 cfs 0.854 af

Pond M10: Stone Mattress (10' Wide) Peak Elev=1.47' Inflow=7.58 cfs 0.854 af
120.0" x 18.0" Box Culvert x 0.30 n=0.100 L=30.0' S=0.0200 '/' Outflow=7.58 cfs 0.854 af

Total Runoff Area = 11.250 ac Runoff Volume = 0.854 af Average Runoff Depth = 0.91"
100.00% Pervious = 11.250 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 10: Max Area to 10' Wide Mattress

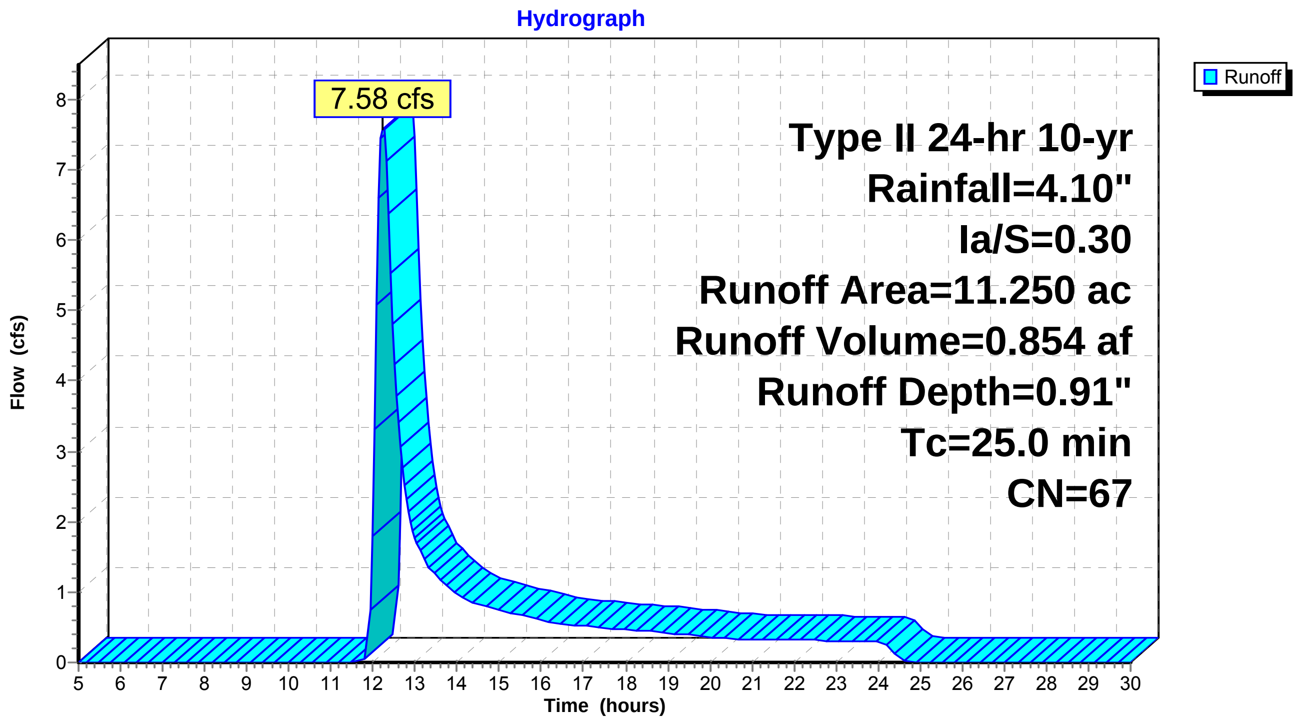
Runoff = 7.58 cfs @ 12.24 hrs, Volume= 0.854 af, Depth= 0.91"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.10", Ia/S=0.30

	Area (ac)	CN	Description
*	11.250	67	Based on CN for P101
	11.250		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.0					**Direct Entry, Typical Tc**

Subcatchment 10: Max Area to 10' Wide Mattress



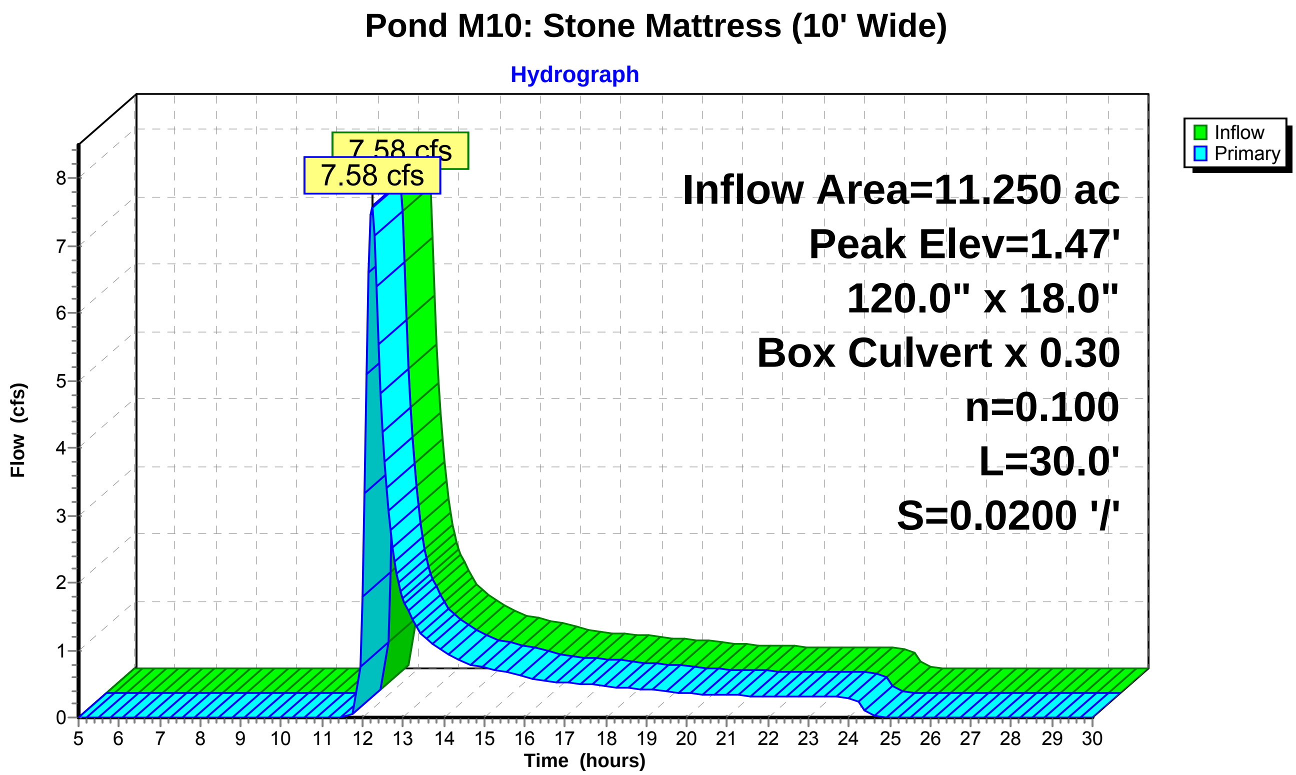
Summary for Pond M10: Stone Mattress (10' Wide)

Inflow Area =	11.250 ac,	0.00% Impervious,	Inflow Depth = 0.91"	for 10-yr event	
Inflow =	7.58 cfs @	12.24 hrs,	Volume=	0.854 af	
Outflow =	7.58 cfs @	12.24 hrs,	Volume=	0.854 af,	Atten= 0%, Lag= 0.0 min
Primary =	7.58 cfs @	12.24 hrs,	Volume=	0.854 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 1.47' @ 12.24 hrs
Flood Elev= 3.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**120.0" W x 18.0" H Box Stone Mattress X 0.30** L= 30.0' Ke= 0.700 Outlet Invert= -0.60' S= 0.0200 '/' Cc= 0.900 n= 0.100

Primary OutFlow Max=7.53 cfs @ 12.24 hrs HW=1.46' (Free Discharge)
└─**1=Stone Mattress** (Barrel Controls 7.53 cfs @ 0.69 fps)



Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 10: Max Area to 10' Wide Runoff Area=11.250 ac 0.00% Impervious Runoff Depth=1.34"
Tc=25.0 min CN=67 Runoff=12.64 cfs 1.255 af

Pond M10: Stone Mattress (10' Wide) Peak Elev=2.98' Inflow=12.64 cfs 1.255 af
120.0" x 18.0" Box Culvert x 0.30 n=0.100 L=30.0' S=0.0200 '/' Outflow=12.64 cfs 1.255 af

Total Runoff Area = 11.250 ac Runoff Volume = 1.255 af Average Runoff Depth = 1.34"
100.00% Pervious = 11.250 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 10: Max Area to 10' Wide Mattress

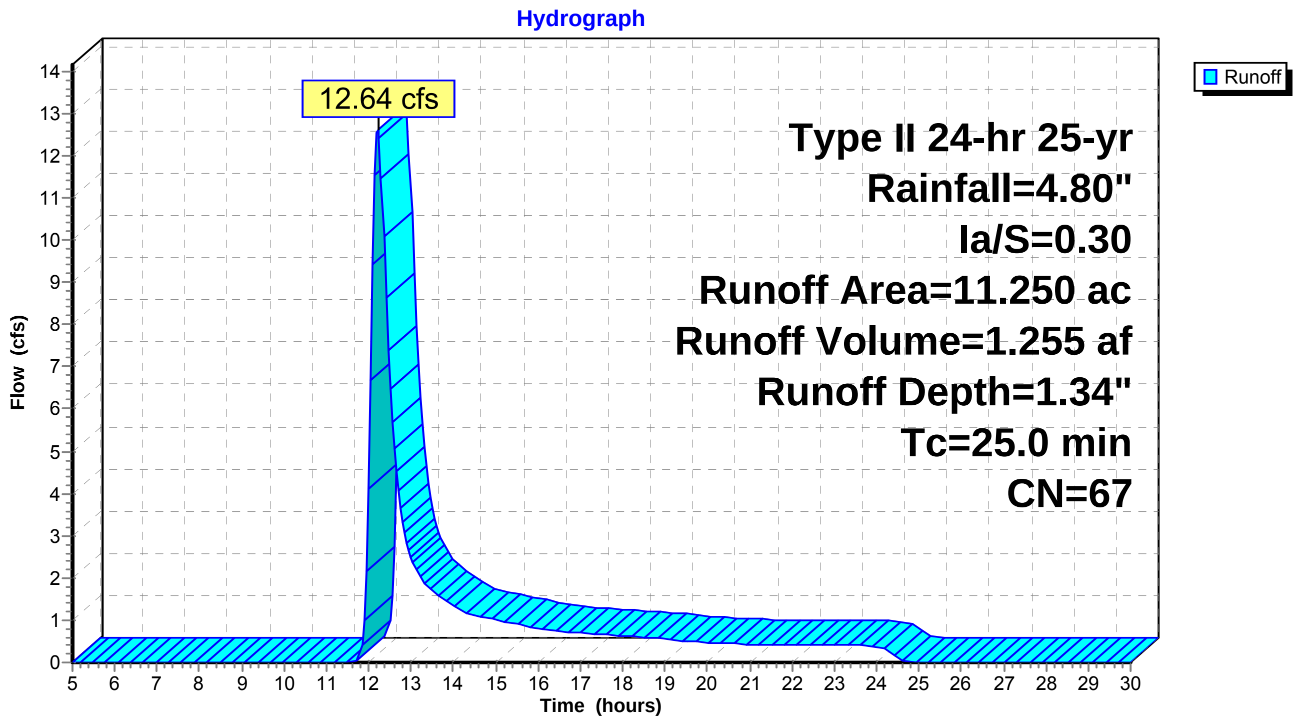
Runoff = 12.64 cfs @ 12.22 hrs, Volume= 1.255 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.80", Ia/S=0.30

	Area (ac)	CN	Description
*	11.250	67	Based on CN for P101
	11.250		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.0					**Direct Entry, Typical Tc**

Subcatchment 10: Max Area to 10' Wide Mattress



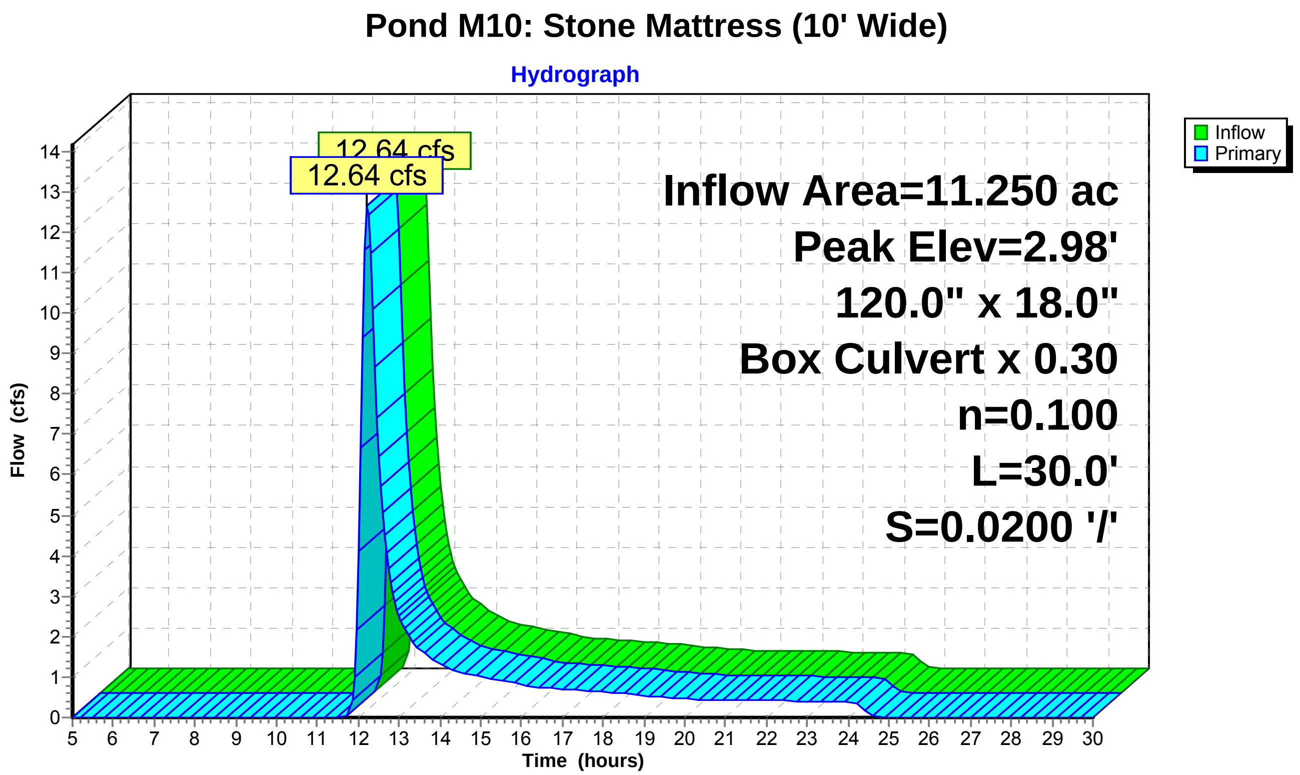
Summary for Pond M10: Stone Mattress (10' Wide)

Inflow Area = 11.250 ac, 0.00% Impervious, Inflow Depth = 1.34" for 25-yr event
Inflow = 12.64 cfs @ 12.22 hrs, Volume= 1.255 af
Outflow = 12.64 cfs @ 12.22 hrs, Volume= 1.255 af, Atten= 0%, Lag= 0.0 min
Primary = 12.64 cfs @ 12.22 hrs, Volume= 1.255 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 2.98' @ 12.20 hrs
Flood Elev= 3.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**120.0" W x 18.0" H Box Stone Mattress X 0.30** L= 30.0' Ke= 0.700 Outlet Invert= -0.60' S= 0.0200 '/' Cc= 0.900 n= 0.100

Primary OutFlow Max=11.34 cfs @ 12.22 hrs HW=2.60' (Free Discharge)
└─**1=Stone Mattress** (Barrel Controls 11.34 cfs @ 0.76 fps)

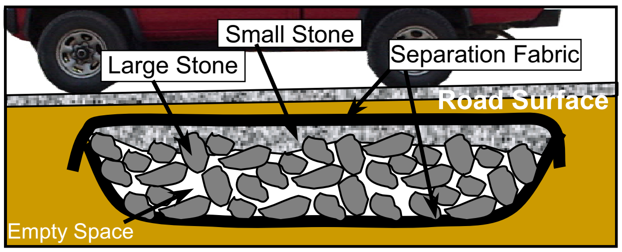


Technical Bulletin

French Mattress

Version 2.0 2/21/04

FRENCH MATTRESS –A structure under a road consisting of coarse rock wrapped in fabric through which water can freely pass. A *French mattress* is basically a French drain that is used similar to a culvert to allow water passage through the roadbed.



Side view cut-away diagram of a French mattress.

Side view of an actual French mattress.

PURPOSES: The primary function of a *French mattress* is to provide load support and to establish, maintain, or equalize the subsurface water on both sides of the road. The use of *French mattresses* in road maintenance is a relatively new concept. Please contact the Center for Dirt & Gravel Road Studies with any questions or concerns.

HOW THEY WORK:

Support strength is provided by large rocks in the lower portions and by spreading the weight load with layers of progressively smaller rock near the top. Water moves into the *French mattress* from any direction through the protective geo-textile fabric, which functions to prevent migration of fine material. The water collects in the voids provided by the larger rock and moves by gravity either into the soil or subsurface drainpipes, if provided, or exits as a gentle seep on the downhill end of the structure.

BENEFITS OF A *FRENCH MATTRESS*:

- Corrects road support problems in areas where the road base has been weakened by water saturation caused when the road acts as a dam to natural water flow.
- Allows for natural equalization of subsurface water on both sides of a road.
- Requires little, if any, maintenance compared to cross-drainage culverts.
- Eliminates the need for additional cross pipes in some instances.
- Allows a gentle, non-erosive water discharge rather than concentrated flow.
- Provides an indefinite service life if not compromised by heavy flows of sediment.

WHERE TO USE A *FRENCH MATTRESS*:

- Areas where concentrated outlet flow through a pipe may be undesirable, impractical, or regulated.
- Low-lying areas near streams or wetlands where installing cross drains would be difficult.
- Areas where a road is acting as an impoundment or dam to the natural water flow by isolating subsurface water on one side of the road from the other.
- Areas where placement of a pipe at the depth necessary to provide structural cover would lower the natural water table of the area and require long term maintenance.

The publishers of this publication gratefully acknowledge the financial support of the Pennsylvania State Conservation Commission. For additional information or assistance, contact: Center for Dirt & Gravel Roads Studies, Penn State University, 207 Research Unit D, University Park, PA 16802 (Toll-Free Phone: 1-866-668-6683, Fax: 814-863-6787, Email: dirtandgravel@psu.edu). Additional copies available on our website at: www.dirtandgravelroads.org

IMPORTANT CONSIDERATIONS

- Materials: The core material for the mattress should be large clean stone, typically referred to as R4[1]. A general rule is that the depth of the mattress needs to be at least three times the diameter of the largest stone used. Smaller stone, such as #3's[1] should be placed on top of the large stone. Progressively smaller stone should be place on top to prevent tearing of the fabric. The structure should be wrapped in heavy-duty, non-woven separation fabric.
- Dimensions: The length of the mattress must, at a minimum, equal the width of the road, but can extend out of the road area to equalize drainage. Mattress width and stone size depend on the amount of water that needs to pass through. In wetland settings, the mattress should be as wide as possible to allow slow lateral flow and avoid concentrating the outlet drainage. Mattress depth depends on stone size, depth available, and desired drainage patterns.
- Equipment: Most mattresses can be installed easily with a backhoe and a truck to haul stone.

CONSTRUCTION: *Refer to numbered pictures on right.*

1. Excavate the section of the road where the mattress will be located to desired depth. Lay heavy-duty separation fabric in the bottom of the area after excavation and leveling. Use bedding material if necessary to protect fabric. Leave enough fabric on the ends to wrap around and overlap with top fabric later.

2. Place large stone, typically R4[1], on top of the fabric and spread out into a uniform bed.

3. Place a layer of smaller stone such as #3's[1] on top of the R4[1]. Be careful not to intermix the two stone sizes. The empty space between the large stones, and therefore flow capacity, will be reduced if the small stone is intermixed. Spread increasingly smaller stone on top to create layer that will not puncture fabric.

4. Wrap ends of lower fabric up on top of structure. Place a piece of fabric on the top if existing fabric does not completely cover mattress. All fabric "joints" should overlap by at least 18".

5. Place bedding material and fill over the mattress if necessary. Place driving surface aggregate (DSA) over the structure according to normal program specifications and procedures.

TYPICAL REQUIREMENTS:

While these figures will vary with the size of structure and individual site conditions, here is what was required for the 20´ x 12´ x 1.5´ mattress illustrated on the right:

- 3 Hours of work with a Case 580 Backhoe
- 20 tons of clean R4[1] rock (large rock)
- 8 tons of clean #3[1] rock (small rock on top)
- 85 Square yards of heavy-duty geo-textile (fabric)
- Sufficient fill and driving surface aggregate over fabric (minimum of 6 inches recommended after compaction)

[1] R4 and #3 size rock refer to PA Department of Transportation Section 408 Specifications. #3 rock ranges from 1" to 2 ½". R4 rock ranges from 3" to 18".

Appendix D:
Inspection & Maintenance Manual

■

Stormwater Management System
Inspection & Maintenance Plan

Proposed Groton Wind Farm

Groton Hollow Road
Groton, New Hampshire

Prepared for **Groton Wind, LLC**
Concord, NH

Prepared by ***VHB*/Vanasse Hangen Brustlin, Inc.**
Six Bedford Farms
Kilton Road
Bedford, NH 03110

December 2009

Table of Contents

Introduction

Vanasse Hangen Brustlin, Inc. has prepared the following Stormwater Management System Inspection & Maintenance Plan for the Proposed Groton Wind Farm located in Groton, New Hampshire. The intent of this plan is to provide the owner with a list of procedures that document the inspection and maintenance requirements of the Stormwater Management System for this development.

The following inspection and maintenance program is necessary in order to keep the Stormwater Management System functioning properly. By following the enclosed procedures, the owner will be able to maintain the functional design of the Stormwater Management System and maximize its ability to remove sediment and other contaminants from site generated stormwater runoff.

Stormwater Management System Components

The Stormwater Management System is designed to mitigate both the quantity and quality of site-generated stormwater runoff. As a result, its design includes the following elements:

Non-Structural BMP's

Non-structural best management practices (BMP's) are designed to minimize and/or remove contaminants before they enter the stormwater collection system. Several of these BMP's have been incorporated into the Stormwater Management System including, reduced use of road salt, and litter/trash removal. These types of BMP's are a highly effective initial treatment measure for reducing stormwater pollutant loading.

Closed Drainage Collection and Piping System

Stormwater runoff from the operations and maintenance facility (O&M) will be collected in deep sump (4' deep) catch basins. Catch basin sump systems are effective pollution control devices for removal of large particulate and adsorbed pollutants. Catch basins with sumps are designed to collect sediment particles that are the largest constituents of the pollutant load in urban runoff. Stormwater runoff from catch basins will discharge through a closed drainage system consisting of interconnected catch basins and drain manholes, which will outlet to filtration basin. Stormwater runoff from the roof will also discharge through a closed drainage system and outlet into a rain garden.

Roadside Ditches, Stone Mattresses & Culverts

Road side ditches will convey runoff away from the access roads and direct the flow to either culverts or stone mattresses. The stone mattress are designed to handel up to 10 acres of surface runoff area and are being placed evey 100 feet along access roadsin order to mimic the existing drainage patterns. Culvets are being placed were there are low points or crossings of existing streams.

Filtration Basin

The filtration basin was designed to handle the first flush storm event. The first flush will infiltrate through filter media to underdrains which will collect the runoff and discharge to Clark Brook. Higher flows will be discharged throught the outlet control structure.

Rain Garden

The rain garden will receive runoff from the roof of the O&M building. The rain garden will allow the runoff to pond and infiltrate. This allows for the pollutant to settle out and be absorbed by the soil and plants with in the garden. Higher flows will build up with in the rain garden and overflow to Clark Brook.

Inspection & Maintenance Plan

By implementing the following procedures, the owner will be able to maintain the functional design of the Stormwater Management System and maximize the system's ability to remove sediment and other contaminants from site generated stormwater runoff.

Litter/Trash Removal: Routinely inspect the site for litter and trash and clean as necessary.

Deicing Agents: Use sand as the primary agent for parking lot and road safety during ice and snow conditions.

Minimize the use of road salt (sodium chloride) during the winter.

Use de-icing or anti-caking agents, added to enhance performance and application characteristics of sand mixtures, only as necessary and at minimum application rates.

Filtration Basin & Rain Garden

Inspect the outlet control structures once every year and remove accumulated sediment/debris around and within the structures.

Inspect sediment forbay once evey year and remove accumulated sediment/debris.

Inspect the underdrain inspections manhole for sediment buildup and clean manhole and underdrain system as required.

Inspect underdrain outfall for erosion and repair as necessary, if significant or repeated erosion is occurring contact the design engineer for remedial action.

Closed Drainage System:

Inspect all culverts and catch basins sumps once annually and remove accumulated sand, sediment, and floatable products. (Note certain culverts have been designed to allow for deposition of natural materials (gravel, sand,etc.) in the bottom 8" to 12" of the culvert. This material should not be removed unless sediment depth is significantly restricting culvert flow capacity.)

Inspect all drain manholes and drainage pipes once every two years and remove accumulated sediment.

Roadside Ditches & Stone Mattreses

Inspect ditches and surrounding area once in the spring every year for failure or erosion of side slopes. Repair and revegetate all damaged areas. If severe or repeated erosion is occurring contact design engineer for remedial action.

Annually inspect all inlets and outlets to each mattress and ensure they are free from debris and not clogged, repair as necessary.

Annually inspect and remove accumulated floatables and sediment inside and around inlet and outlet structures.

Annually inspect riprap stone aprons and stone checkdam for erosion and stone displacement. Repair erosion as necessary. Remove sediment accumulated behind stone check dams.

Inspect the discharge headwalls, pipes, and stone aprons once every year for erosion, sediment, debris, and stone displacement. Repair and/or clean as necessary.

General: Annually, inspect all onsite slopes for erosion, repair and revegetate as necessary. If severe or repeated erosion is occurring contact the design engineer for remedial action.

Annually, inspect all pipe outlets, flared end sections, and headwalls, ensure that riprap aprons are not eroding, outlets are not becoming undermined, and that erosion downstream of the riprap apron is not occurring. Repair as necessary, and contact design engineer if problem persists and/or is severe.

Inspection & Maintenance Checklist/Log

The following pages contain an Inspection & Maintenance Checklist and a blank copy of the Stormwater Management System's Inspection & Maintenance Log. These forms are provided to assist the owner's Site Manager with the inspection and maintenance of Stormwater Management System.

Site logs shall be filled out after and during each inspection and copies of the logs shall be maintained onsite with a copy of the inspection and maintenance plan and approved site plan.

Stormwater Management System

Inspection & Maintenance Checklist

BMP/System Component	Minimum Inspection Frequency	Minimum Inspection Requirements	Maintenance/Cleanout Threshold
Litter/Trash Removal	Routinely	Inspect grounds for spillage and litter.	Clean as required.
Deicing Agents	N/A	N/A	Use sand as primary agent for parking lot safety during winter.
Closed Drainage System			
Catch Basins	1 time per year	Check for sediment accumulation. Check for floatable contaminants.	≥ 2 ft. sediment depth. ≥ 3 in. floatable depth.
Drainage Pipes	1 time per 2 years	Check for sediment accumulation/clogging.	≥ 2 in. sediment depth.
Rain Garden			
Side Slopes/Vegetation	1 time per year	Inspect for failure, erosion, and bare soil areas.	Repair and reseed any damaged areas.
Filtration Basin			
Basin	1 time per year	Check for sediment accumulation.	≥ 2 in. sediment depth.
Outlet Control Structure	1 time per year	Check for sediment accumulation/clogging	Clean/repair as needed.
Underdrain Outlet Pipes	1 time per year	Check for sediment accumulation/clogging	Clean/repair as needed.
Road side ditches & StoneMattresses	1 time per year	Check for sediment and floatables accumulation.	Clean as required
Culverts	1 time per year	Check for sediment, floatables accumulation and debris build up. *	Clean as required

*(Note certain culverts have been designed to allow for deposition of natural materials (gravel, sand,etc.) in the bottom 8" to 12" of the culvert. This material should not be removed unless sediment depth is significantly restricting culvert flow capacity.)

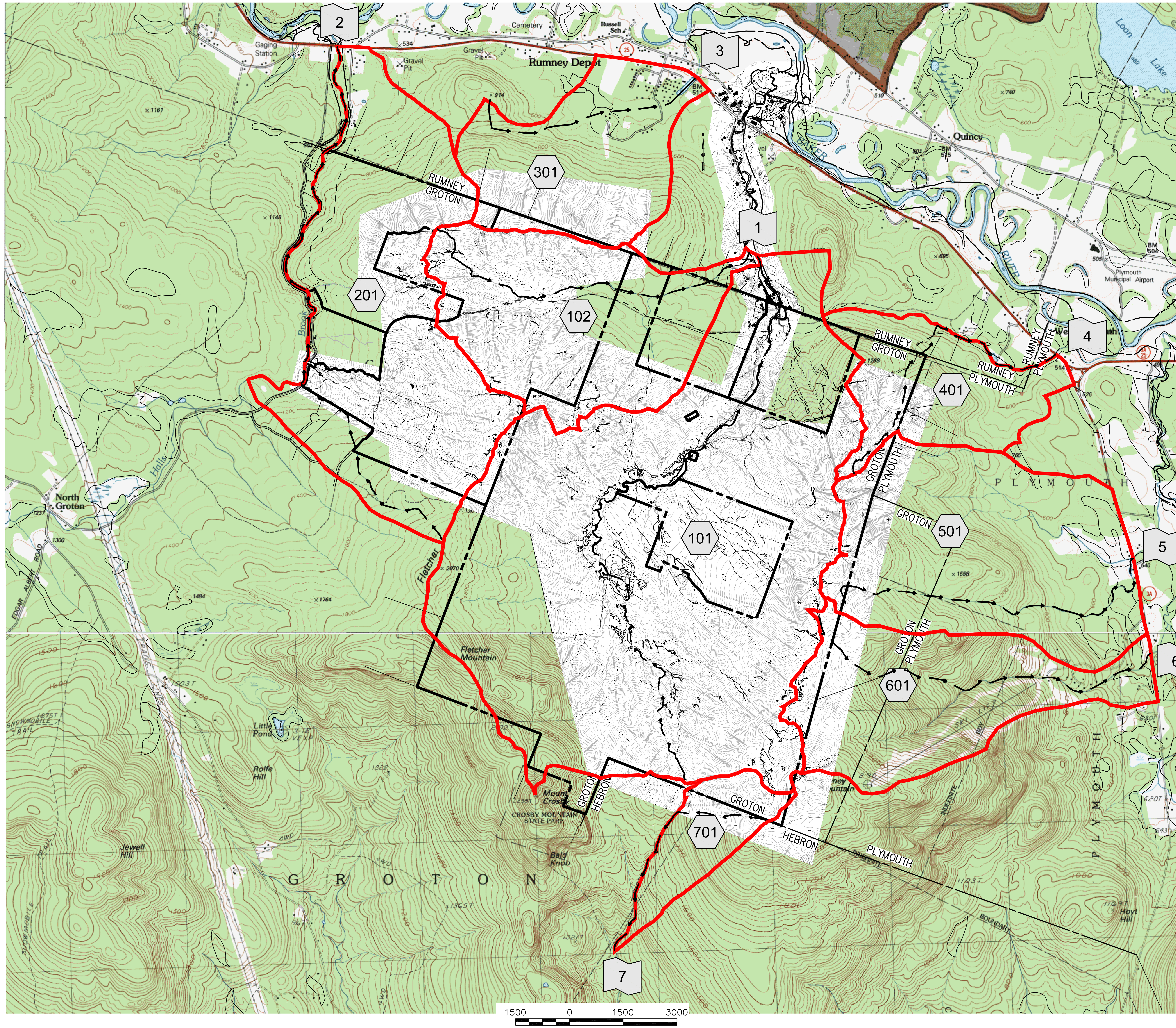
Stormwater Management System

Inspection & Maintenance Log

BMP/System Component	Date Inspected	Inspector	Cleaning/Repair Needed *(List Items/Comments)*	Date of Cleaning/Repair	Performed By

Drainage Plans

N



VHB

Vanasse Hangen Brustlin, Inc.

Transportation
Land Development
Environmental Services

Six Bedford Farms Drive, Suite 607
Bedford, New Hampshire 03110
603.644.0888 • FAX 603.644.2385

Prepared For:

IBERDROLA RENEWABLES

Symbol	Description
#	Drainage Area
#	Discharge Point
	Drainage Area Boundary
	Tc Path

No.	Revision	Date	Appvd.

Designed by | Drawn by | Checked by

CAD checked by | Approved by

Scale 1"=1500' | Date February 12, 2010

Project Title

Groton Wind Farm

Groton Hollow Road
Groton, New Hampshire

Issued for

Permitting

Not Approved for Construction

Drawing Title

Existing Conditions
Drainage Map
Overall Site

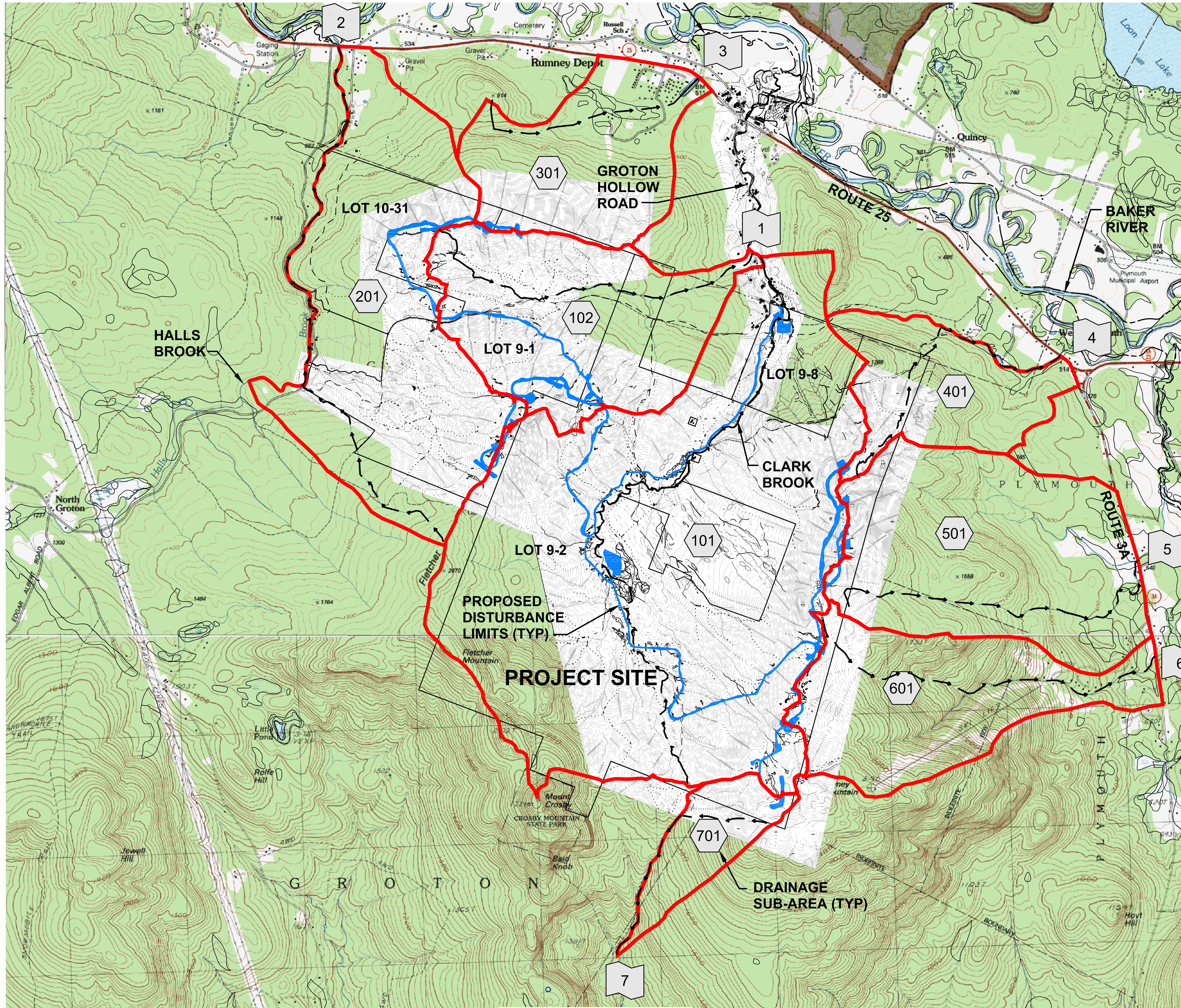
Drawing Number

Sheet 1 of 1

Project Number
52036.00

52036-EXD.DWG

N



1500 0 1500 3000
SCALE IN FEET

VHB

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Land Development
Environmental Services

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Bedford, New Hampshire 03110
603.644.0888 • FAX 603.644.2385

Prepared For:

IBERDROLA RENEWABLES

Symbol	Description
#	Drainage Area
#	Discharge Point
	Drainage Area Boundary
	Proposed Disturbance Limits
	Tc Path

No.	Revision	Date	Appvd.

Designed by | Drawn by | Checked by

CAD checked by | Approved by

Scale 1"=1500' | Date February 12, 2010

Project Title

Groton Wind Farm

Groton Hollow Road
Groton, New Hampshire

Issued for

Permitting

Not Approved for Construction

Drawing Title

Proposed Conditions
Drainage Map
Overall Site

Drawing Number

Sheet 1 of 1

Project Number
52036.00

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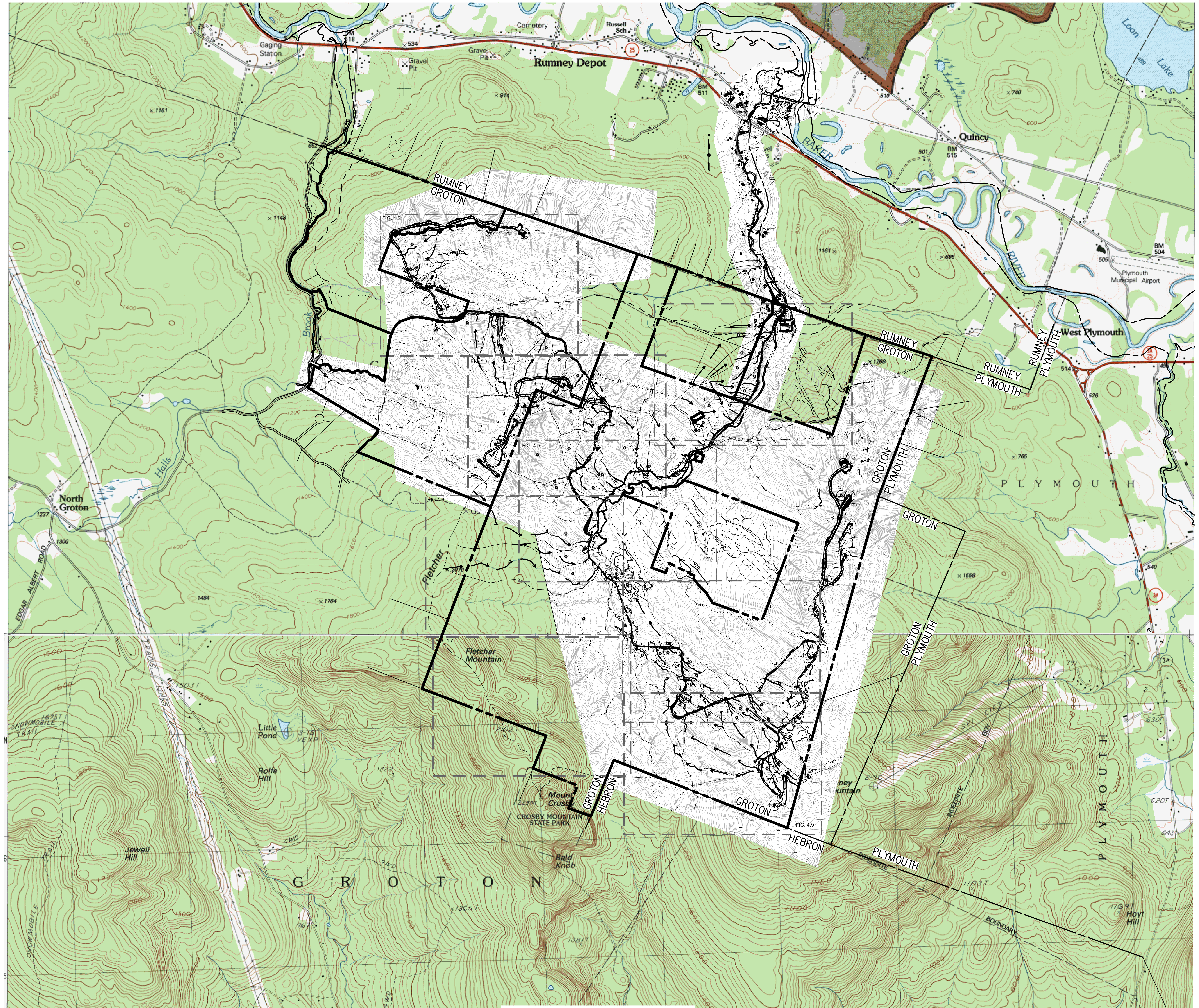

1500 0 1500 3000
SCALE IN FEET

VHB
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603.644.0888 • FAX 603.644.2385

Prepared For:

IBERDROLA RENEWABLES

Symbol	Description
#	Drainage Area
	Drainage Area Boundary
	Tc Path

No.	Revision	Date	Appvd.

Designed by | Drawn by | Checked by

CAD checked by | Approved by

Scale 1"=1500' | Date February 12, 2010

Project Title

Groton Wind Farm

Groton Hollow Road
Groton, New Hampshire

Issued for

Permitting

Not Approved for Construction

Drawing Title

Proposed Conditions
Drainage Map
Overall Site

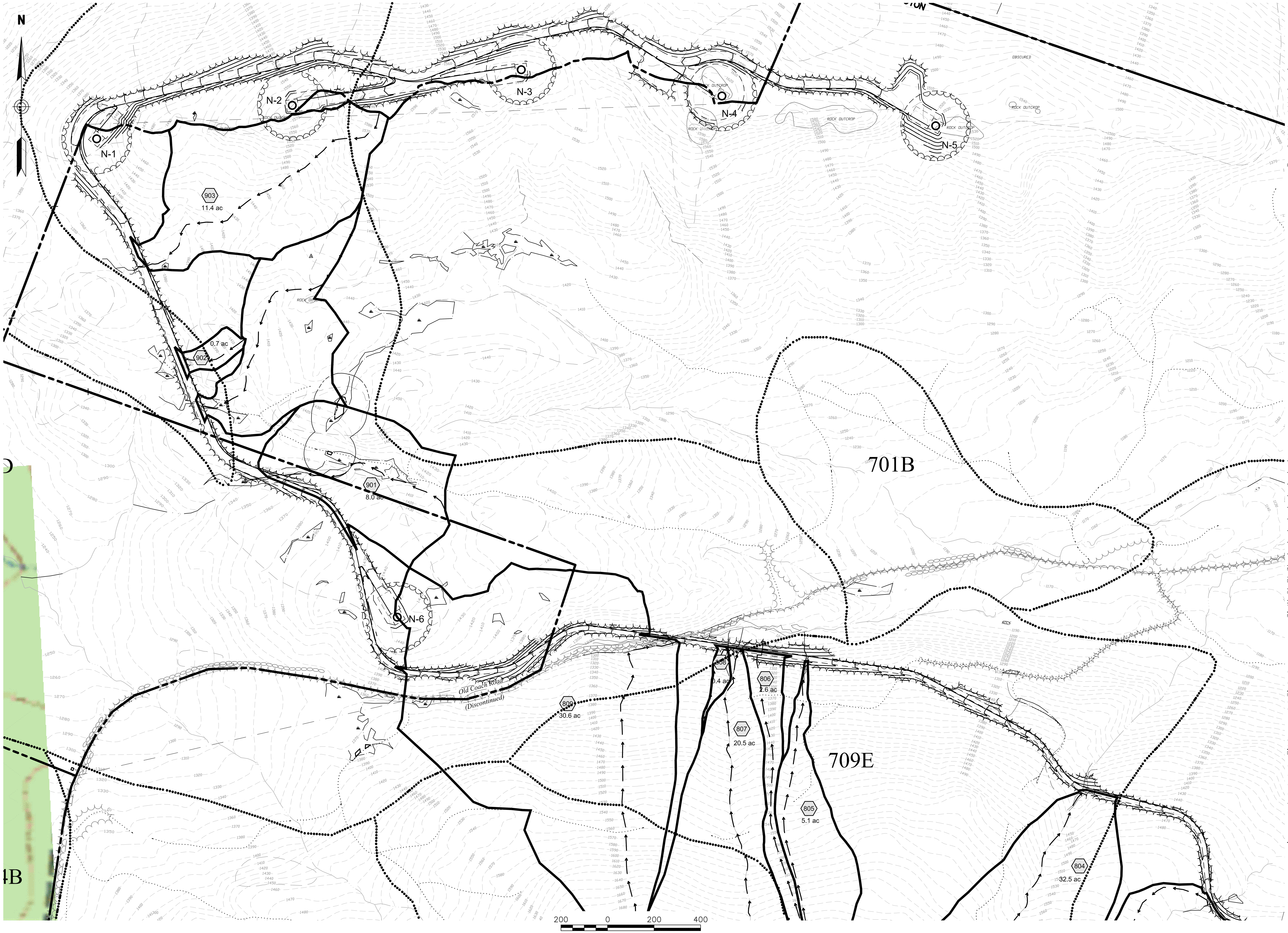
Drawing Number

Fig. 4.1

Sheet 1 of 9

Project Number
52036.00

52036-PRD.DWG



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603.644.0888 • FAX 603.644.2385

Prepared For:

IBERDROLA RENEWABLES

Symbol	Description
#	Drainage Area
	Drainage Area Boundary
	Tc Path
	Soil Boundary

No.	Revision	Date	Appvd.

Designed by | Drawn by | Checked by

CAD checked by | Approved by

Scale 1"=200' | Date February 12, 2010

Project Title
Groton Wind Farm

Groton Hollow Road
Groton, New Hampshire

Issued for
Permitting

Not Approved for Construction

Drawing Title
Proposed Conditions
Drainage Map
North Turbines

Drawing Number
Fig.4.2

Sheet 2 of 9

Project Number
52036.00

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Land Development
Environmental Services

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Bedford, New Hampshire 03110
603.644.0888 • FAX 603.644.2385

Prepared For:

IBERDROLA RENEWABLES

Symbol	Description
#	Drainage Area
	Drainage Area Boundary
	Tc Path
	Soil Boundary

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Groton Wind Farm

Groton Hollow Road
Groton, New Hampshire

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Drawing Title

Proposed Conditions Drainage Map West Turbines

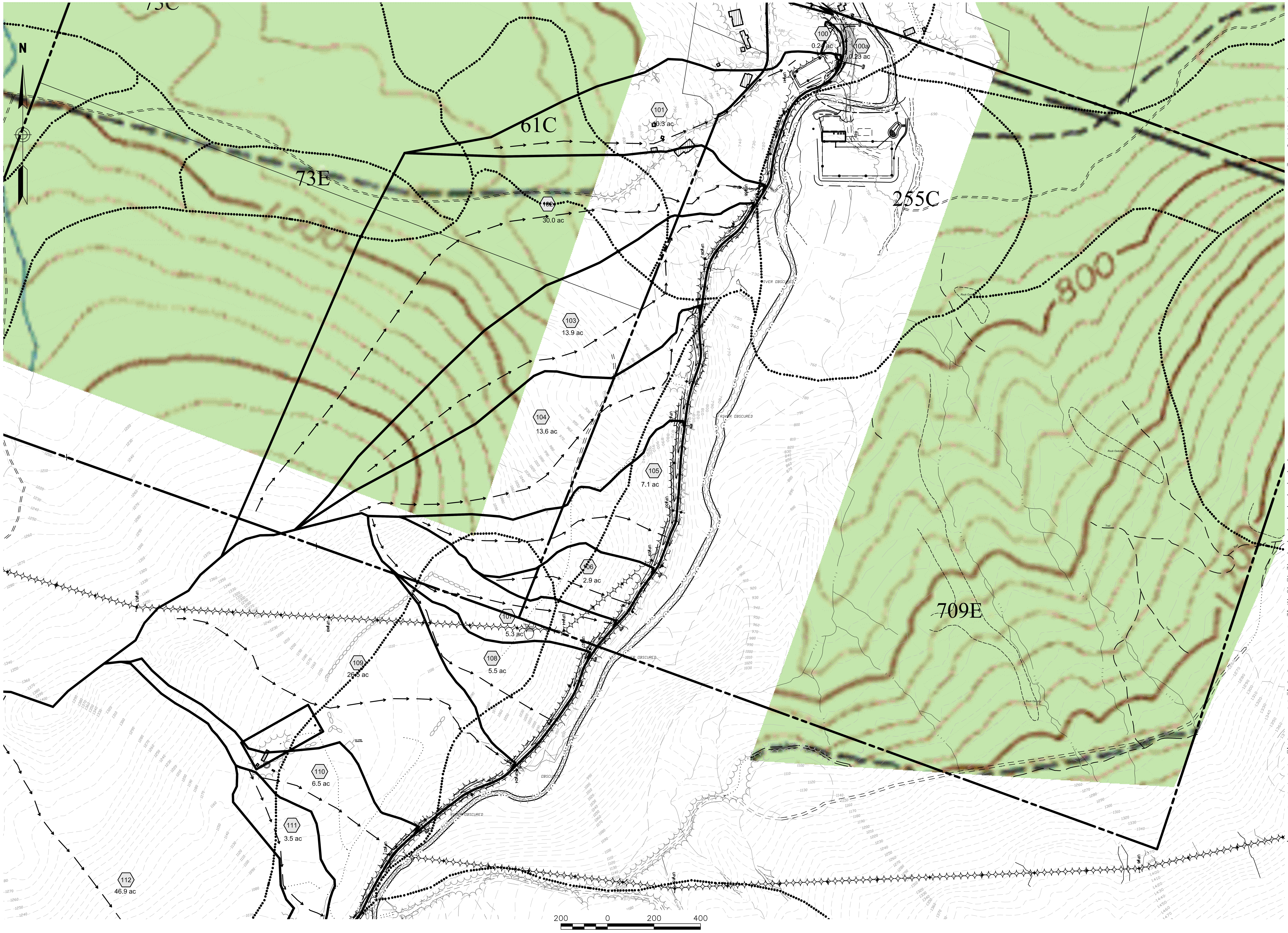
Drawing Number

Fig. 4.3

Sheet 3 of 9

Project Number
52036.00

52036-PRD.DWG



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	Tc Path
	Soil Boundary

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Groton Hollow Road
Groton, New Hampshire

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Drawing Title
Proposed Conditions
Drainage Map
Groton Hollow Road

Drawing Number
Fig. 4.4

Sheet 4 of 9

Project Number
52036.00

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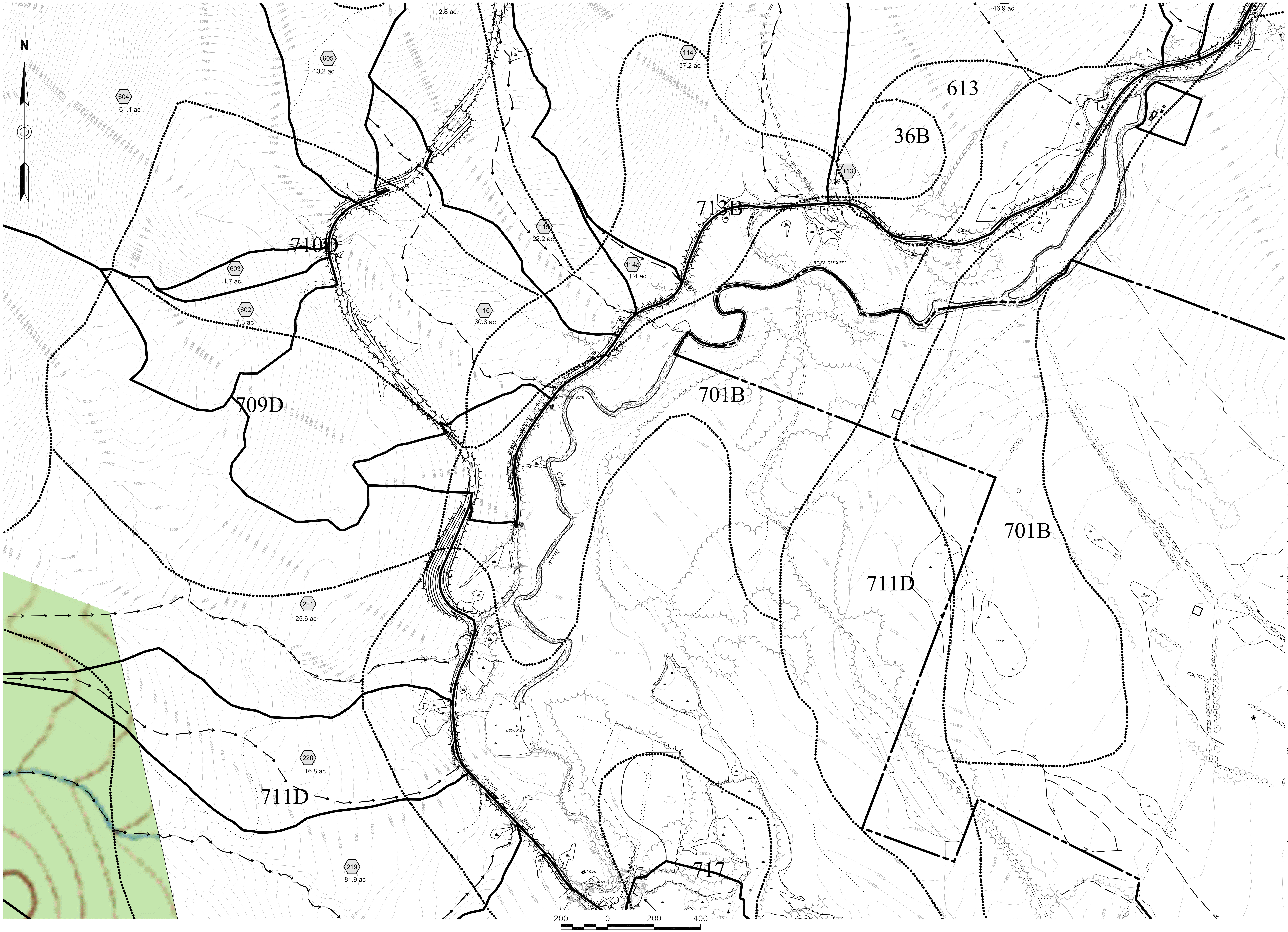

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	Drainage Area Boundary
	Tc Path
	Soil Boundary

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Groton Hollow Road
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Drawing Title
Proposed Conditions
Drainage Map
Groton Hollow Road

Drawing Number
Fig.4.5

Sheet 5 of 9

Project Number
52036.00

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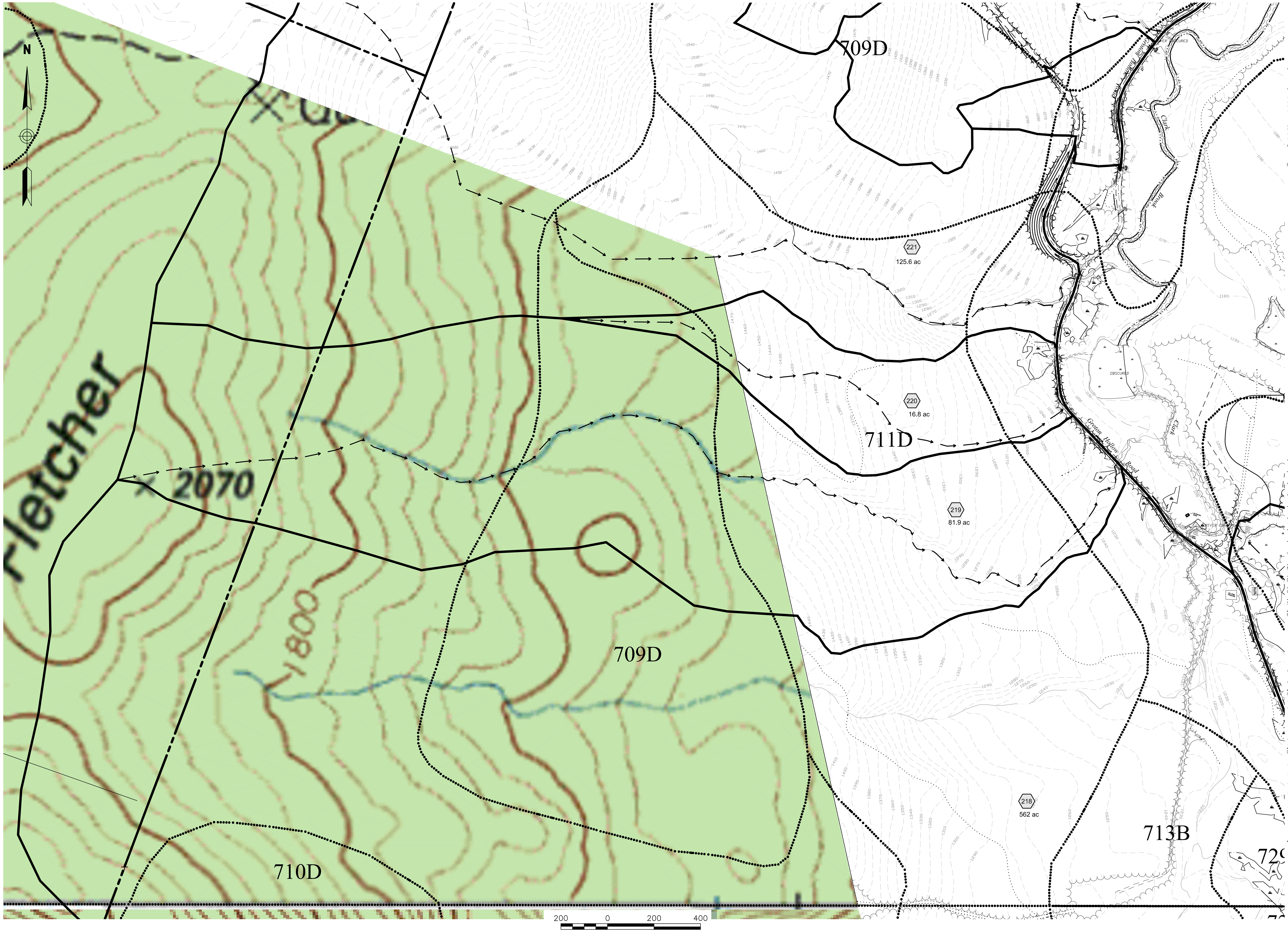

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Symbol	Description
#	Drainage Area
	Drainage Area Boundary
	Tc Path
	Soil Boundary

No.	Revision	Date	Appvd.

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Groton Hollow Road
Groton, New Hampshire

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Drawing Title
Proposed Conditions
Drainage Map
Groton Hollow Road

Drawing Number
Fig. 4.6

Sheet 6 of 9

Project Number
52036.00

52036-PRD.DWG

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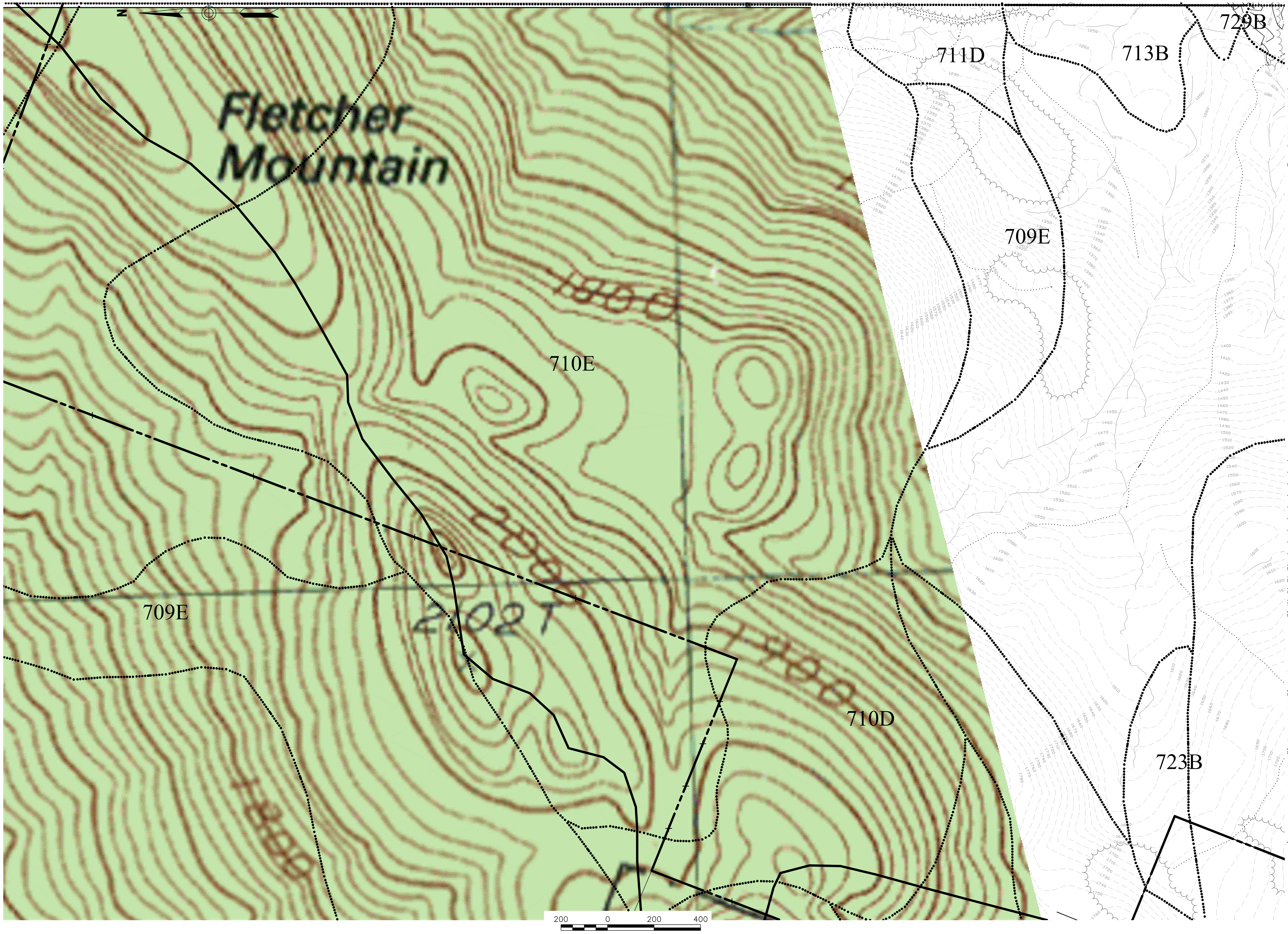

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Symbol	Description
#	Drainage Area
	Drainage Area Boundary
	Tc Path
	Soil Boundary

No.	Revision	Date	Appvd.

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Project Title

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Groton Hollow Road
Groton, New Hampshire

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Drawing Title

Proposed Conditions Drainage Map

Drawing Number

Fig. 4.7

Sheet 7 of 9

Project Number 52036.00

52036-PRD.DWG

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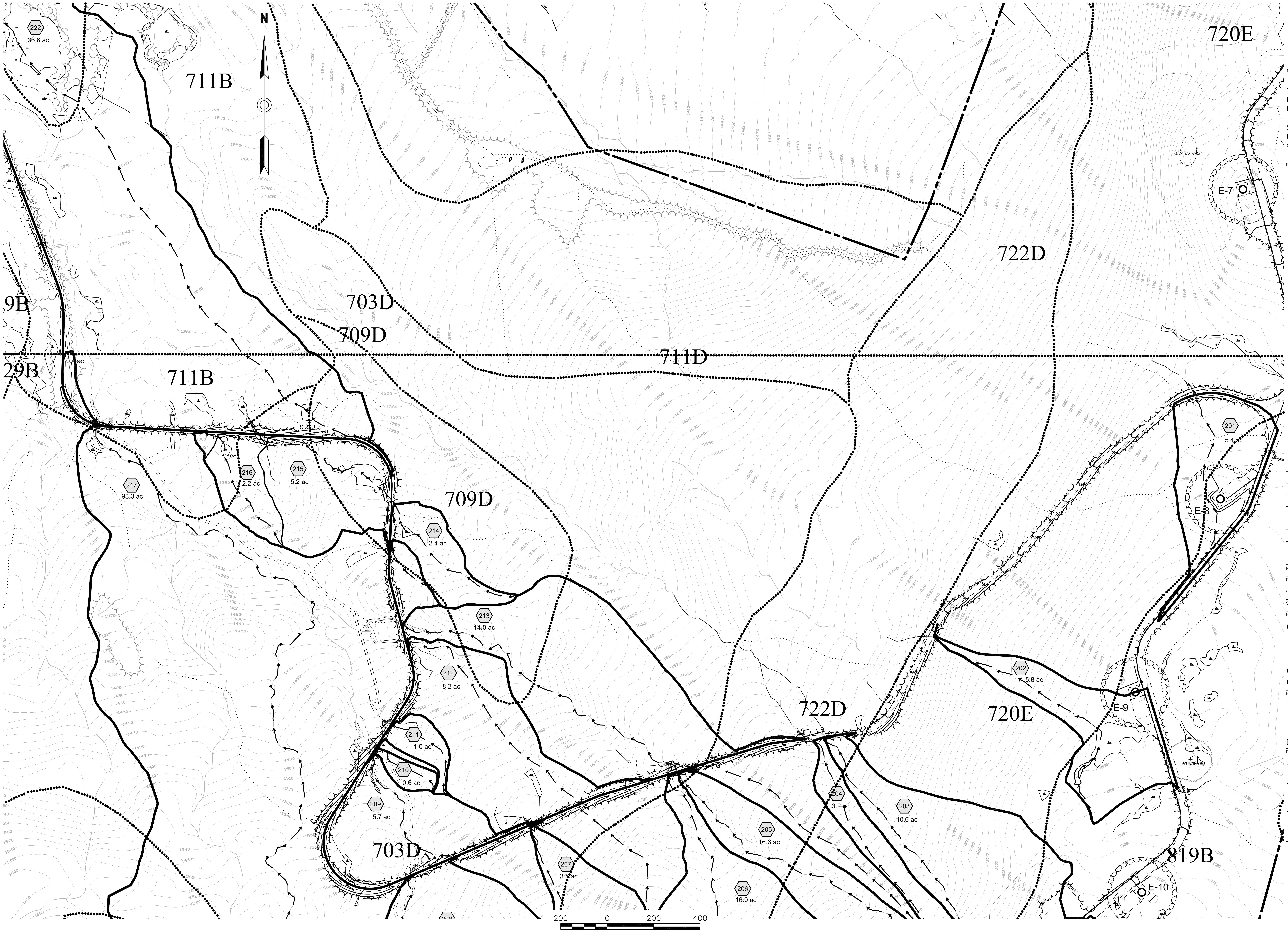

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Symbol	Description
#	Drainage Area
	Drainage Area Boundary
	Tc Path
	Soil Boundary

No.	Revision	Date	Appvd.

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Scale 1"=200' | Date February 12, 2010

Project Title

Groton Wind Farm

Groton Hollow Road
Groton, New Hampshire

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Drawing Title

Proposed Conditions
Drainage Map
East Access Road

Drawing Number

Fig. 4.8

Sheet 8 of 9

Project Number
52036.00

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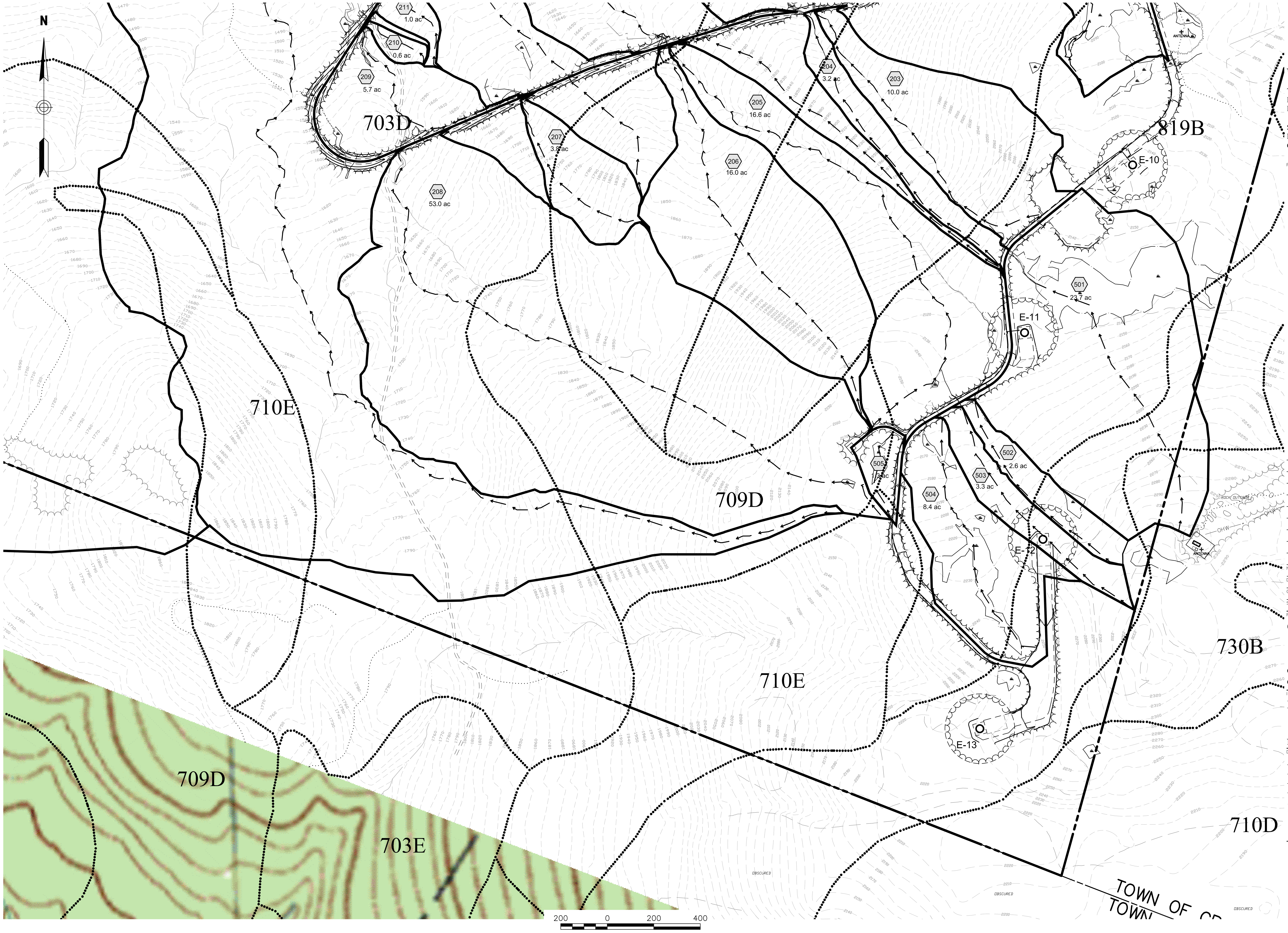

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Symbol	Description
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	Drainage Area Boundary
	Tc Path
	Soil Boundary

No.	Revision	Date	Appvd.

Designed by	Drawn by	Checked by
CAD checked by		Approved by
Scale 1"=200'		Date February 12, 2010

Project Title

Groton Wind Farm

Groton Hollow Road
Groton, New Hampshire

Issued for

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Not Approved for Construction

Drawing Title

Proposed Conditions
Drainage Map
Southeast Turbines

Drawing Number

Fig. 4.9

Sheet 9 of 9

Project Number
52036.00

52036-PRD.DWG

Site Plan (11x17 copy)

Site Plans

Issued for: **Permitting**

Date Issued: February 12, 2010

Latest Issue: February 12, 2010

Groton Wind Farm

Groton Hollow Road
Groton, New Hampshire

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C-3.1 thru C-3.9	Site Plans - Groton Hollow Road	02/12/10
C-4.1 thru C-4.7	Site Plans - East Access Road	02/12/10
C-5.1 thru C-5..5	Site Plans - Northeast Turbines	02/12/10
C-6.1 thru C-6.4	Site Plans - Southeast Turbines	02/12/10
C-7.1 thru C-7.7	Site Plans - West Access Road & Turbines	02/12/10
C-8.1 thru C-8.4	Site Plans - North Access Road	02/12/10
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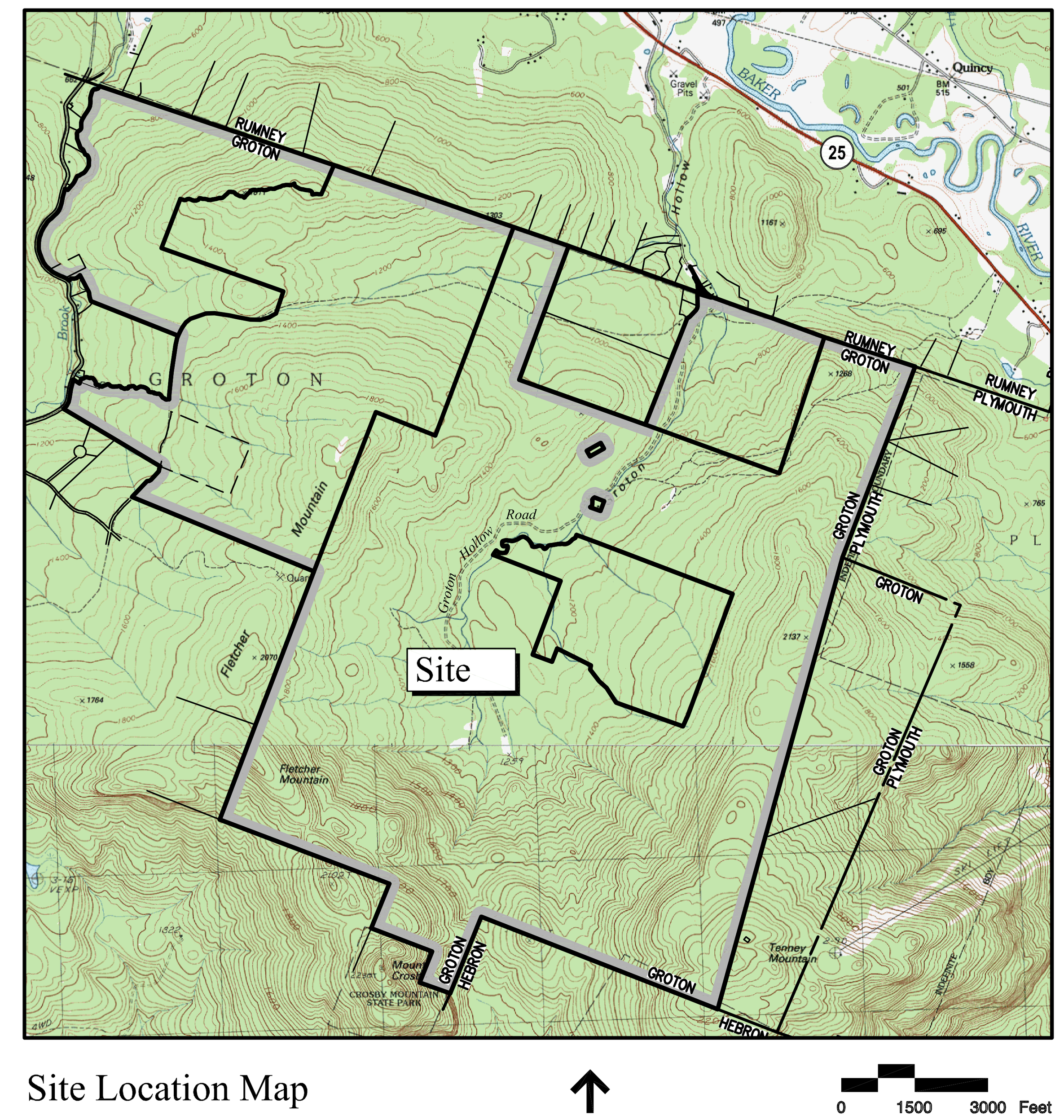
C-10.4	Site Details and Erosion Control Notes	02/12/10
PF-3.1 thru PF-8.2	Roadway Profiles	02/12/10



Site Location Map

Property Owners

Owners:

Green Acre Woodlands, Inc.
P.O. Box 334
Rumney, NH 03266

Yankee Forest, LLC
150 Orford Lane
P.O. Box 160
Lyme, NH 03768

Daniel Smith Revocable Trust
17 Orchard Drive
Durham, NH 03824

Applicant:

Groton Wind, LLC
P.O. Box 326
Concord, NH 03302

Assessor's Plat: 9 & 10
Lots: 1, 2, 8, 10 & 31

Vanasse Hangen Brustlin, Inc.
Transportation
Land Development
Environmental Services

Six Bedford Farms Drive, Suite 607
Bedford, New Hampshire 03110
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STATE OF NEW HAMPSHIRE MICHAEL J. LEO No. 7146 LICENSED PROFESSIONAL ENGINEER

STATE OF NEW HAMPSHIRE NANCY B. RENDALL No. 073 CERTIFIED WETLAND SCIENTIST

VHB Project No. 52036-Groton Wind Farm
Groton, NH
Issued for: Permitting - February 12, 2010

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Legend

Exist.	Prop.	
		PROPERTY LINE
		PROJECT LIMIT LINE
		RIGHT-OF-WAY/PROPERTY LINE
		EASEMENT
		BUILDING SETBACK
		PARKING SETBACK
10+00	10+00	BASELINE
		CONSTRUCTION LAYOUT
		ZONING LINE
		TOWN LINE
		LIMIT OF DISTURBANCE
		WETLAND LINE WITH FLAG
		FLOODPLAIN
		SURVEYED PERENNIAL STREAM TOP OF BANK
		SURVEYED DRAINAGE CHANNEL
		SURVEYED INTERMITTENT STREAM
		AERIAL SURVEYED STREAM/DRAINAGE CHANNEL
GH8 (PFO1E)		WETLAND IDENTIFICATION
35		WETLAND IMPACT SYMBOL
		GRAVEL ROAD
EOP		EDGE OF PAVEMENT
BB	BB	BITUMINOUS BERM
BC	BC	BITUMINOUS CURB
CC	CC	CONCRETE CURB
	CG	CURB AND GUTTER
CC	ECC	EXTRUDED CONCRETE CURB
CC	MCC	MONOLITHIC CONCRETE CURB
CC	PCC	PRECAST CONC. CURB
SGE	SGE	SLOPED GRAN. EDGING
VGC	VGC	VERT. GRAN. CURB
		LIMIT OF CURB TYPE
		SAWCUT
		BUILDING
	EN	BUILDING ENTRANCE
	LD	LOADING DOCK
		BOLLARD
D	D	DUMPSTER PAD
		SIGN
		DOUBLE SIGN
		STEEL GUARDRAIL
		WOOD GUARDRAIL
		PATH
		TREE LINE
		WIRE FENCE
		FENCE
		STOCKADE FENCE
		STONE WALL
		RETAINING WALL
		STREAM / POND / WATER COURSE
		DETENTION BASIN
		HAY BALES
		SILT FENCE
		EROSION CONTROL BARRIER
4	4	MINOR CONTOUR
20	20	MAJOR CONTOUR
10	10	PARKING COUNT
	C10	COMPACT PARKING STALLS
DYL	DYL	DOUBLE YELLOW LINE
SL	SL	STOP LINE
		CROSSWALK
		ACCESSIBLE CURB RAMP
		ACCESSIBLE PARKING
VAN	VAN	VAN-ACCESSIBLE PARKING

Exist.	Prop.	
		CONCRETE
		HEAVY DUTY PAVEMENT
		RIPRAP
		CONSTRUCTION ENTRANCE
27.35 TC×	27.35 TC×	TOP OF CURB ELEVATION
26.85 BC×	26.85 BC×	BOTTOM OF CURB ELEVATION
132.75 ×	132.75 ×	SPOT ELEVATION
45.0 TW× 38.5 BW	45.0 TW× 38.5 BW	TOP & BOTTOM OF WALL ELEVATION
		BORING LOCATION
		TEST PIT LOCATION
MW	MW	MONITORING WELL
UD	UD	UNDERDRAIN
12"D	12"D	DRAIN
6"RD	6"RD	ROOF DRAIN
12"S	12"S	SEWER
FM	FM	FORCE MAIN
OHW	OHW	OVERHEAD WIRE
6"W	6"W	WATER
4"FP	4"FP	FIRE PROTECTION
	2"DW	DOMESTIC WATER
3"G	G	GAS
E	E	ELECTRIC
STM	STM	STEAM
T	T	TELEPHONE
FA	FA	FIRE ALARM
CATV	CATV	CABLE TV
		CATCH BASIN
		DOUBLE CATCH BASIN
		GUTTER INLET
D		DRAIN MANHOLE
TD		TRENCH DRAIN
		PLUG OR CAP
CO	CO	CLEANOUT
		FLARED END SECTION
		HEADWALL
S		SEWER MANHOLE
CS	CS	CURB STOP & BOX
WV	WV	WATER VALVE & BOX
TSV	TSV	TAPPING SLEEVE, VALVE & BOX
		SIAMESE CONNECTION
HYD	HYD	FIRE HYDRANT
WM	WM	WATER METER
PIV	PIV	POST INDICATOR VALVE
W	W	WATER WELL
GG	GG	GAS GATE
GM	GM	GAS METER
E	EMH	ELECTRIC MANHOLE
EM	EM	ELECTRIC METER
		LIGHT POLE
T	TMH	TELEPHONE MANHOLE
T	T	TRANSFORMER PAD
		UTILITY POLE
		GUY POLE
		GUY WIRE & ANCHOR
HH	HH	HAND HOLE
PB	PB	PULL BOX
Matchline		MATCHLINE

Abbreviations

General

ABAN	ABANDON
ACR	ACCESSIBLE CURB RAMP
ADJ	ADJUST
APPROX	APPROXIMATE
BIT	BITUMINOUS
BS	BOTTOM OF SLOPE
BWLL	BROKEN WHITE LANE LINE
CONC	CONCRETE
DYCL	DOUBLE YELLOW CENTER LINE
EL	ELEVATION
ELEV	ELEVATION
EXIST	EXISTING
FDN	FOUNDATION
FFE	FIRST FLOOR ELEVATION
GRAN	GRANITE
GTD	GRADE TO DRAIN
LA	LANDSCAPE AREA
LOD	LIMIT OF DISTURBANCE
MAX	MAXIMUM
MIN	MINIMUM
NIC	NOT IN CONTRACT
NTS	NOT TO SCALE
PERF	PERFORATED
PROP	PROPOSED
REM	REMOVE
RET	RETAIN
R&D	REMOVE AND DISPOSE
R&R	REMOVE AND RESET
SWEL	SOLID WHITE EDGE LINE
SWLL	SOLID WHITE LANE LINE
TS	TOP OF SLOPE
TYP	TYPICAL

Utility

CB	CATCH BASIN
CMP	CORRUGATED METAL PIPE
CO	CLEANOUT
DCB	DOUBLE CATCH BASIN
DMH	DRAIN MANHOLE
CIP	CAST IRON PIPE
COND	CONDUIT
DIP	DUCTILE IRON PIPE
FES	FLARED END SECTION
FM	FORCE MAIN
F&G	FRAME AND GRATE
F&C	FRAME AND COVER
GI	GUTTER INLET
GT	GREASE TRAP
HDPE	HIGH DENSITY POLYETHYLENE PIPE
HH	HANDHOLE
HW	HEADWALL
HYD	HYDRANT
INV	INVERT ELEVATION
I=	INVERT ELEVATION
LP	LIGHT POLE
MES	METAL END SECTION
PWW	PAVED WATER WAY
PVC	POLYVINYLCHLORIDE PIPE
RCP	REINFORCED CONCRETE PIPE
R=	RIM ELEVATION
SMH	SEWER MANHOLE
TSV	TAPPING SLEEVE, VALVE AND BOX
UG	UNDERGROUND
UP	UTILITY POLE

Notes:

General

1. THE INTENT OF THIS PLAN SET IS DEPICT SITE ACCESS AND THE LAYOUT OF THE PROPOSED WIND TURBINE LOCATIONS, CRANE PADS, CRANE ROADS, DELIVERY ROADS, STAGING AREAS, AND OPERATIONS & MAINTENANCE BUILDING.
2. CONTRACTOR SHALL NOTIFY "DIG-SAFE" (1-888-344-7233) AT LEAST 72 HOURS BEFORE EXCAVATING.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR SITE SECURITY AND JOB SAFETY. CONSTRUCTION ACTIVITIES SHALL BE IN ACCORDANCE WITH OSHA STANDARDS AND LOCAL REQUIREMENTS.
4. AREAS DISTURBED DURING CONSTRUCTION AND NOT RESTORED WITH GRAVEL, ROCK, LEDGE FACE, ROOFS OR PAVEMENT SHALL RECEIVE 4 INCHES LOAM AND SEED.
5. WORK WITHIN THE LOCAL RIGHTS-OF-WAY SHALL CONFORM TO LOCAL MUNICIPAL STANDARDS. WORK WITHIN STATE RIGHTS-OF-WAY SHALL CONFORM TO THE LATEST EDITION OF THE STATE HIGHWAY DEPARTMENTS STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES.
6. UPON AWARD OF CONTRACT, CONTRACTOR SHALL MAKE NECESSARY CONSTRUCTION NOTIFICATIONS AND APPLY FOR AND OBTAIN NECESSARY PERMITS, PAY FEES, AND POST BONDS ASSOCIATED WITH THE WORK INDICATED ON THE DRAWINGS, IN THE SPECIFICATIONS, AND IN THE CONTRACT DOCUMENTS. DO NOT CLOSE OR OBSTRUCT ROADWAYS, SIDEWALKS, AND FIRE HYDRANTS, WITHOUT APPROPRIATE PERMITS.
7. TRAFFIC SIGNAGE AND PAVEMENT MARKINGS WITHIN THE PUBLIC RIGHT OF WAYS SHALL CONFORM TO THE MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES.
8. AREAS OUTSIDE THE LIMITS OF PROPOSED WORK DISTURBED BY THE CONTRACTOR'S OPERATIONS SHALL BE RESTORED BY THE CONTRACTOR TO THEIR ORIGINAL CONDITION AT THE CONTRACTOR'S EXPENSE.
9. IN THE EVENT THAT SUSPECTED CONTAMINATED SOIL, GROUNDWATER, AND OTHER MEDIA ARE ENCOUNTERED DURING EXCAVATION AND CONSTRUCTION ACTIVITIES BASED ON VISUAL, OLFACTORY, OR OTHER EVIDENCE, THE CONTRACTOR SHALL STOP WORK IN THE VICINITY OF THE SUSPECT MATERIAL TO AVOID FURTHER SPREADING OF THE MATERIAL, AND SHALL NOTIFY THE OWNER IMMEDIATELY SO THAT THE APPROPRIATE TESTING AND SUBSEQUENT ACTION CAN BE TAKEN.
10. CONTRACTOR SHALL PREVENT DUST, SEDIMENT, AND DEBRIS FROM EXITING THE SITE AND SHALL BE RESPONSIBLE FOR CLEANUP, REPAIRS AND CORRECTIVE ACTION IF SUCH OCCURS.
11. DAMAGE RESULTING FROM CONSTRUCTION LOADS SHALL BE REPAIRED BY THE CONTRACTOR AT NO ADDITIONAL COST TO OWNER.
12. CONTRACTOR SHALL CONTROL STORMWATER RUNOFF DURING CONSTRUCTION TO PREVENT ADVERSE IMPACTS TO OFF SITE AREAS, AND SHALL BE RESPONSIBLE TO REPAIR RESULTING DAMAGES, IF ANY, AT NO COST TO OWNER.
13. THIS PROJECT DISTURBS MORE THAN ONE ACRE OF LAND AND FALLS WITHIN THE NPDES CONSTRUCTION GENERAL PERMIT (CGP) PROGRAM AND EPA JURISDICTION. PRIOR TO THE START OF CONSTRUCTION CONTRACTOR IS TO FILE A CGP NOTICE OF INTENT WITH THE EPA AND PREPARE A STORMWATER POLLUTION PREVENTION PLAN IN ACCORDANCE WITH THE NPDES REGULATIONS. CONTRACTOR SHALL CONFIRM THE OWNER HAS ALSO FILED A NOTICE OF INTENT WITH THE EPA.

Utilities

1. THE UTILITY COMPANIES SERVICING THE PROJECT AREA ARE:

   A. WATER: THE TOWN OF GROTON DOES NOT HAVE A PUBLIC WATER SUPPLY SYSTEM.
   B. SEWER: THE TOWN OF GROTON DOES NOT HAVE A PUBLIC SEWER SYSTEM.
   C. ELECTRIC: NEW HAMPSHIRE ELECTRIC CO-OP (800) 698-2007.
   D. TELEPHONE: FAIRPOINT COMMUNICATIONS (888) 730-0066.
   E. CABLE TV: TIME WARNER CABLE (603) 726-2927.
   F. GAS: NATURAL GAS IS NOT AVAILABLE IN THE TOWN OF GROTON.

2. THE LOCATIONS, SIZES, AND TYPES OF EXISTING UTILITIES ARE SHOWN AS AN APPROXIMATE REPRESENTATION ONLY. THE OWNER OR IT'S REPRESENTATIVE(S) HAVE NOT INDEPENDENTLY VERIFIED THIS INFORMATION AS SHOWN ON THE PLANS. THE UTILITY INFORMATION SHOWN DOES NOT GUARANTEE THE ACTUAL EXISTENCE, SERVICEABILITY, OR OTHER DATA CONCERNING THE UTILITIES, NOR DOES IT GUARANTEE AGAINST THE POSSIBILITY THAT ADDITIONAL UTILITIES MAY BE PRESENT THAT ARE NOT SHOWN ON THE PLANS. PRIOR TO ORDERING MATERIALS AND BEGINNING CONSTRUCTION, THE CONTRACTOR SHALL VERIFY AND DETERMINE THE EXACT LOCATIONS, SIZES, AND ELEVATIONS OF THE POINTS OF CONNECTIONS TO EXISTING UTILITIES AND, SHALL CONFIRM THAT THERE ARE NO INTERFERENCES WITH EXISTING UTILITIES AND THE PROPOSED UTILITY ROUTES, INCLUDING ROUTES WITHIN THE PUBLIC RIGHTS OF WAY.
3. WHERE AN EXISTING UTILITY IS FOUND TO CONFLICT WITH THE PROPOSED WORK, OR EXISTING CONDITIONS DIFFER FROM THOSE SHOWN SUCH THAT THE WORK CANNOT BE COMPLETED AS INTENDED, THE LOCATION, ELEVATION, AND SIZE OF THE UTILITY SHALL BE ACCURATELY DETERMINED WITHOUT DELAY BY THE CONTRACTOR, AND THE INFORMATION FURNISHED IN WRITING TO THE OWNER'S REPRESENTATIVE FOR THE RESOLUTION OF THE CONFLICT AND CONTRACTOR'S FAILURE TO NOTIFY PRIOR TO PERFORMING ADDITIONAL WORK RELEASES OWNER FROM OBLIGATIONS FOR ADDITIONAL PAYMENTS WHICH OTHERWISE MAY BE WARRANTED TO RESOLVE THE CONFLICT.
4. SET CATCH BASIN RIMS, AND INVERTS OF SEWERS, DRAINS, AND DITCHES IN ACCORDANCE WITH ELEVATIONS ON THE SITE PLANS.
5. RIM ELEVATIONS FOR DRAIN AND SEWER MANHOLES, WATER VALVE COVERS, ELECTRIC AND TELEPHONE PULL BOXES, AND MANHOLES, AND OTHER SUCH ITEMS, ARE APPROXIMATE AND SHALL BE SET/RESET AS FOLLOWS:

   A. PAVEMENTS, CONCRETE AND GRAVEL SURFACES: FLUSH

   B. LANDSCAPE, LOAM AND SEED, AND OTHER EARTH SURFACE AREAS:
   ONE INCH ABOVE SURROUNDING AREA AND TAPER EARTH TO THE RIM ELEVATION.

6. MINOR ADJUSTMENTS TO DRAIN PIPE AND CULVERT LOCATIONS MAY BE REQUIRED TO ADEQUATELY INTERCEPT, CONVEY AND DISCHARGE SURFACE WATER FLOWS. GIVEN THE STEEP TERRAIN OF THE SITE, FIELD ADJUSTMENTS OF PIPE MAY BE NECESSARY TO INSURE PIPE LOCATIONS COINCIDE WITH EXISTING NATURAL FLOW PATHS AND PIPE INVERTS ARE LOCATED TO COLLECT AND DISCHARGE FLOWS NEAR EXISTING SURFACE GRADES AND/OR LOW POINTS. THE CONTRACTOR SHALL NOTIFY THE ENGINEER IF FIELD CONDITIONS VARY SIGNIFICANTLY FROM THAT INDICATED ON PLANS OR IF SIGNIFICANT MODIFICATION OF PIPE/CULVERT LOCATION IS REQUIRED TO MEET DESIGN INTENT AS INDICATED ON PLANS OR IN DETAILS.
7. THE LOCATION, SIZE, DEPTH, AND SPECIFICATIONS FOR CONSTRUCTION OF PROPOSED PRIVATE UTILITY SERVICES SHALL BE INSTALLED ACCORDING TO THE REQUIREMENTS PROVIDED BY, AND APPROVED BY, THE RESPECTIVE UTILITY COMPANY (TELEPHONE, ELECTRIC, FIRE ALARM, ETC.). FINAL DESIGN LOADS AND LOCATIONS TO BE COORDINATED WITH OWNER AND ARCHITECT.
8. CONTRACTOR SHALL MAKE ARRANGEMENTS FOR AND SHALL BE RESPONSIBLE FOR PAYING FEES FOR POLE RELOCATION AND FOR THE ALTERATION AND ADJUSTMENT OF GAS, ELECTRIC, TELEPHONE, FIRE ALARM, AND ANY OTHER PRIVATE UTILITIES, WHETHER WORK IS PERFORMED BY CONTRACTOR OR BY THE UTILITIES COMPANY.
9. DRAINAGE MATERIALS SHALL BE AS FOLLOWS, UNLESS OTHERWISE NOTED ON THE PLAN:

   A. STORM DRAINAGE PIPES SHALL BE HIGH DENSITY POLYETHYLENE (HDPE) WITH SMOOTH INTERIOR.
   B. CORRUGATED METAL PIPE (CMP) WHERE SPECIFIED ON PLANS SHALL BE GALVANIZED STEEL PIPE.
   C. RECTANGULAR BOX CULVERTS TO HAVE OPEN ("NATURAL") BOTTOMS. REFER TO DETAILS.
   D. DRAINAGE FABRIC OR FILTER FABRIC TO BE MIRAFI 140N NON-WOVEN FABRIC UNLESS OTHERWISE NOTED.

9. CONTRACTOR SHALL COORDINATE WITH ELECTRICAL CONTRACTOR AND SHALL FURNISH EXCAVATION, INSTALLATION, AND BACKFILL OF ELECTRICAL FURNISHED SITEWORK RELATED ITEMS SUCH AS PULL BOXES, CONDUITS, DUCT BANKS, LIGHT POLE BASES, AND CONCRETE PADS. SITE CONTRACTOR SHALL FURNISH CONCRETE ENCASEMENT OF DUCT BANKS IF REQUIRED BY THE UTILITY COMPANY AND AS INDICATED ON THE DRAWINGS.
10. ALL DRAINAGE AND SANITARY STRUCTURE INTERIOR DIAMETERS (4' MIN.) SHALL BE DETERMINED BY THE MANUFACTURER BASED ON THE PIPE CONFIGURATIONS SHOWN ON THESE PLANS.
11. LOCATIONS SHOWN FOR PROPOSED UNDERGROUND AND OVERHEAD ELECTRIC/TELECOMMUNICATION LINES ARE SCHEMATIC AND SUBJECT TO ADJUSTMENT, LOCATIONS SHOWN ARE FOR GENERAL ROUTING CONFIGURATION ONLY. LIMITS OF CLEARING FOR OVERHEAD UTILITY LINES TO BE 15 FEET EITHER SIDE OF CENTERLINE BETWEEN POLES.

Layout and Materials

1. DIMENSIONS ARE FROM THE FACE OF CURB, FACE OF WALL, AND CENTER LINE OF PAVEMENT MARKINGS, UNLESS OTHERWISE NOTED.
2. PROPOSED BOUNDS AND ANY EXISTING PROPERTY LINE MONUMENTATION DISTURBED DURING CONSTRUCTION SHALL BE SET OR RESET BY A LICENSED LAND SURVEYOR (LLS).
3. PRIOR TO START OF CONSTRUCTION, CONTRACTOR SHALL VERIFY EXISTING PAVEMENT AND GRAVEL ROAD ELEVATIONS AT INTERFACE WITH PROPOSED PAVEMENTS, PROPOSED GRAVEL ROADS, AND EXISTING GROUND ELEVATIONS ADJACENT TO DRAINAGE OUTLETS TO ASSURE PROPER TRANSITIONS BETWEEN EXISTING AND PROPOSED FACILITIES.
4. SYMBOLS AND LEGENDS OF PROJECT FEATURES ARE GRAPHIC REPRESENTATIONS AND ARE NOT NECESSARILY SCALED TO THEIR ACTUAL DIMENSIONS OR LOCATIONS ON THE DRAWINGS. THE CONTRACTOR SHALL REFER TO THE DETAIL SHEET DIMENSIONS, MANUFACTURERS' LITERATURE, SHOP DRAWINGS AND FIELD MEASUREMENTS OF SUPPLIED PRODUCTS FOR LAYOUT OF THE PROJECT FEATURES.
5. CONTRACTOR SHALL NOT RELY SOLELY ON ELECTRONIC VERSIONS OF PLANS, SPECIFICATIONS, AND DATA FILES THAT ARE OBTAINED FROM THE DESIGNERS, BUT SHALL VERIFY LOCATION OF PROJECT FEATURES IN ACCORDANCE WITH THE PAPER COPIES OF THE PLANS AND SPECIFICATIONS THAT ARE SUPPLIED AS PART OF THE CONTRACT DOCUMENTS.

Demolition

1. CONTRACTOR SHALL REMOVE AND DISPOSE OF EXISTING MANMADE SURFACE FEATURES WITHIN THE LIMIT OF WORK INCLUDING BUILDINGS, STRUCTURES, PAVEMENTS, SLABS, CURBING, FENCES, UTILITY POLES, SIGNS, ETC. UNLESS INDICATED OTHERWISE ON THE DRAWINGS. REMOVE AND DISPOSE OF EXISTING UTILITIES, FOUNDATIONS AND UNSUITABLE MATERIAL BENEATH AND FOR A DISTANCE OF 10 FEET BEYOND THE PROPOSED BUILDING FOOTPRINT INCLUDING EXTERIOR COLUMNS.
2. EXISTING UTILITIES SHALL BE TERMINATED, UNLESS OTHERWISE NOTED, IN CONFORMANCE WITH LOCAL, STATE AND INDIVIDUAL UTILITY COMPANY STANDARD SPECIFICATIONS AND DETAILS. THE CONTRACTOR SHALL COORDINATE UTILITY SERVICE DISCONNECTS WITH THE UTILITY REPRESENTATIVES.
3. CONTRACTOR SHALL DISPOSE OF DEMOLITION DEBRIS IN ACCORDANCE WITH APPLICABLE FEDERAL, STATE AND LOCAL REGULATIONS, ORDINANCES AND STATUTES.

Existing Conditions Information

1. BASE PLAN: THE PROPERTY LINES SHOWN WERE DETERMINED BY AN ACTUAL FIELD SURVEY CONDUCTED BY VANASSE HANGEN BRUSTLIN INC., DURING THE SPRING AND SUMMER DURING THE YEAR 2009. THE TOPOGRAPHY AND PHYSICAL FEATURES ARE BASED ON AERIAL TOPOGRAPHY PROVIDED BY MINUTEMEN MAPPING. THE SITE WAS FLOWN IN APRIL 2009.
2. TOPOGRAPHIC ELEVATIONS ARE BASED ON THE NGVD 1988 DATUM.

Wetland Mapping Notes

1. WETLANDS WERE FIELD DELINEATED BY VHB WETLAND SCIENTISTS DURING THE SUMMER AND FALL OF 2009 WITHIN THE PROJECT STUDY CORRIDOR.
2. WETLAND DELINEATION WAS PERFORMED TO THE STANDARDS OF US ARMY CORPS OF ENGINEERS WETLAND DELINEATION MANUAL. TECHNICAL REPORT Y-87-1 (JANUARY, 1987)
3. HYDRIC SOIL CONDITIONS WERE DETERMINED USING FIELD INDICATORS FOR IDENTIFYING HYDRIC SOILS IN NEW ENGLAND - SSSNNE, VERSION 3.
4. DOMINANCE OF WETLAND VEGETATION WAS ASSESSSED USING THE NATIONAL LIST OF WETLAND PLANT SPECIES THAT OCCUR IN WETLANDS - NORTHEAST; REGION 1 (PORTER B. REED, JR., 1988).
5. WETLANDS WERE CLASSIFIED USING THE USFWS METHODOLOGY, CLASSIFICATION OF WETLANDS AND DEEPWATERS HABITATS, (COWARDIN ET AL, 1979).
6. WETLANDS WERE LOCATED DURING THE SUMMER AND FALL OF 2009 PRIMARILY BY GPS METHODS USING TRIMBLE GPS RECEIVERS AND BY GROUND FIELD SURVEY AT SELECTED LOCATIONS.

Wetland Classification Codes

CODE	CODE DESCRIPTION
PEM1B	PALUSTRINE, EMERGENT, PERSISTENT, SATURATED
PEM1C	PALUSTRINE, EMERGENT, PERSISTENT, SEASONALLY FLOODED
PEM1E	PALUSTRINE, EMERGENT, PERSISTENT, SEASONALLY FLOODED/SATURATED
PEM2C	PALUSTRINE, EMERGENT, NON-PERSISTENT, SEASONALLY FLOODED
PEM2E	PALUSTRINE, EMERGENT, NON-PERSISTENT, SEASONALLY FLOODED/SATURATED
PFO1B	PALUSTRINE, FORESTED, BROAD-LEAVED DECIDUOUS, SATURATED
PFO1C	PALUSTRINE, FORESTED, BROAD-LEAVED DECIDUOUS, SEASONALLY FLOODED
PFO1E	PALUSTRINE, FORESTED, BROAD-LEAVED DECIDUOUS, SEASONALLY FLOODED/SATURATED
PFO1F	PALUSTRINE, FORESTED, BROAD-LEAVED DECIDUOUS, SEMI-PERMANENTLY FLOODED
PFO4C	PALUSTRINE, FORESTED, NEEDLE-LEAVED EVERGREEN, SEASONALLY FLOODED
PFO4E	PALUSTRINE, FORESTED, NEEDLE-LEAVED EVERGREEN, SEASONALLY FLOODED/SATURATED
PSS1A	PALUSTRINE, SCRUB-SHRUB, BROAD-LEAVED DECIDUOUS, TEMPORARILY FLOODED
PSS1B	PALUSTRINE, SCRUB-SHRUB, BROAD-LEAVED DECIDUOUS, SATURATED
PSS1C	PALUSTRINE, SCRUB-SHRUB, BROAD-LEAVED DECIDUOUS, SEASONALLY FLOODED
PSS1E	PALUSTRINE, SCRUB-SHRUB, BROAD-LEAVED DECIDUOUS, SEASONALLY FLOODED/SATURATED
PSS1F	PALUSTRINE, SCRUB-SHRUB, BROAD-LEAVED DECIDUOUS, SEMI-PERMANENTLY FLOODED
PUBE	PALUSTRINE, UNCONSOLIDATED BOTTOM, SEASONALLY FLOODED/SATURATED
R2RB2H	RIVERINE, LOWER PERENNIAL, ROCK BOTTOM, RUBBLE, PERMANENTLY FLOODED
R2UB1H	RIVERINE, LOWER PERENNIAL, UNCONSOLIDATED BOTTOM, COBBLE-GRAVEL, PERMANENTLY FLOODED
R2UB3H	RIVERINE, LOWER PERENNIAL, UNCONSOLIDATED BOTTOM, MUD, PERMANENTLY FLOODED
R3RB1H	RIVERINE, UPPER PERENNIAL, ROCK BOTTOM, BEDROCK, PERMANENTLY FLOODED
R3RB2H	RIVERINE, UPPER PERENNIAL, ROCK BOTTOM, RUBBLE, PERMANENTLY FLOODED
R3UB1H	RIVERINE, UPPER PERENNIAL, UNCONSOLIDATED BOTTOM, COBBLE-GRAVEL, PERMANENTLY FLOODED
R4SB1E	RIVERINE, INTERMITTENT, STREAMBED, BEDROCK, SEASONALLY FLOODED/SATURATED
R4SB1F	RIVERINE, INTERMITTENT, STREAMBED, BEDROCK, SEMI-PERMANENTLY FLOODED
R4SB2C	RIVERINE, INTERMITTENT, STREAMBED, RUBBLE, SEASONALLY FLOODED
R4SB2E	RIVERINE, INTERMITTENT, STREAMBED, RUBBLE, SEASONALLY FLOODED/SATURATED
R4SB2F	RIVERINE, INTERMITTENT, STREAMBED, RUBBLE, SEMI-PERMANENTLY FLOODED
R4SB2G	RIVERINE, INTERMITTENT, STREAMBED, RUBBLE, INTERMITTENTLY EXPOSED
R4SB3C	RIVERINE, INTERMITTENT, STREAMBED, COBBLE-GRAVEL, SEASONALLY FLOODED
R4SB3E	RIVERINE, INTERMITTENT, STREAMBED, COBBLE-GRAVEL, SEASONALLY FLOODED/SATURATED
R4SB5C	RIVERINE, INTERMITTENT, STREAMBED, MUD, SEASONALLY FLOODED
R4SB5E	RIVERINE, INTERMITTENT, STREAMBED, MUD, SEASONALLY FLOODED/SATURATED
R4SB5F	RIVERINE, INTERMITTENT, STREAMBED, MUD, SEMI-PERMANENTLY FLOODED
R4SB5G	RIVERINE, INTERMITTENT, STREAMBED, MUD, INTERMITTENTLY EXPOSED
R4SB7E	RIVERINE, INTERMITTENT, STREAMBED, VEGETATED, SEASONALLY FLOODED/SATURATED
R4SB7F	RIVERINE, INTERMITTENT, STREAMBED, VEGETATED, SEMI-PERMANENTLY FLOODED

State Permits

1. NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES 'ALTERATION OF TERRAIN PERMIT'.
2. NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES 'WETLANDS PERMIT'.

VHB

Vanasse Hangen Brustlin, Inc.

Transportation
Land Development
Environmental Services

Six Bedford Farms Drive, Suite 607
Bedford, New Hampshire 03110
603.644.0888 • FAX 603.644.2385

Prepared For:

IBERDROLA RENEWABLES

STATE OF NEW HAMPSHIRE
NANCY B. RENDALL
Nancy B. Rendall
No. 073
CERTIFIED WETLAND SCIENTIST

No.	Revision	Date	Appvd.

Designed by	Drawn by
Checked by	CAD checked by
Approved by	
Scale None	Date February 12, 2010

Project Title
Groton Wind Farm

Groton Hollow Road
Groton, New Hampshire

Issued for
Permitting

Not Approved for Construction

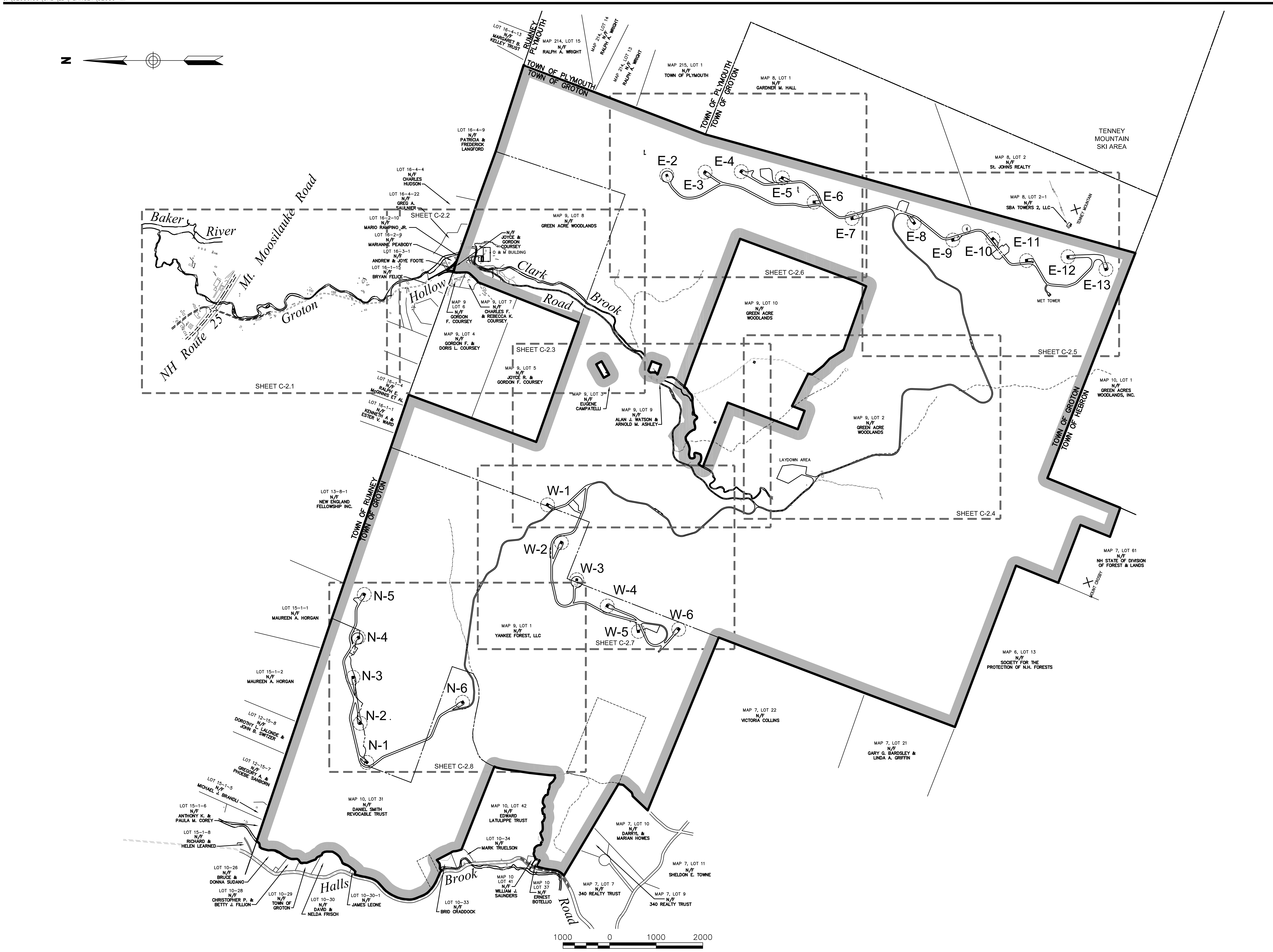
Drawing Title
Legend and General Notes

STATE OF NEW HAMPSHIRE
MICHAEL J. LEO
No. 7146
LICENSED
PROFESSIONAL ENGINEER

Drawing Number
C-1

Sheet 1 of 68

Project Number
52036.00



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Project Title

Groton Wind Farm

Groton Hollow Road
Groton, New Hampshire

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Drawing Title

Overall Site Plan

STATE OF NEW HAMPSHIRE MICHAEL J. LEO No. 7146 LICENSED PROFESSIONAL

Drawing Number

C-2.0

Sheet 2 of 68

Project Number
52036.00

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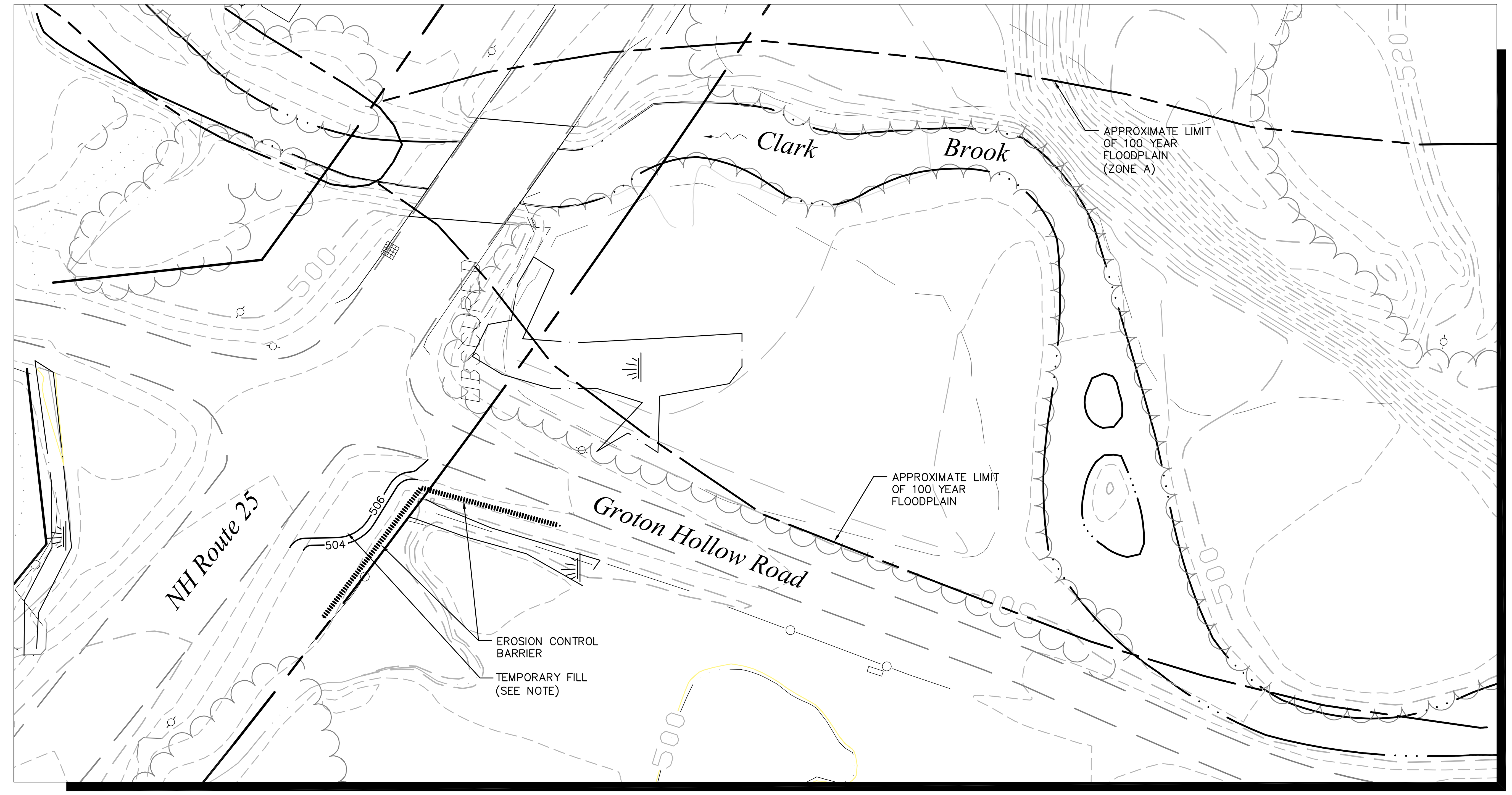

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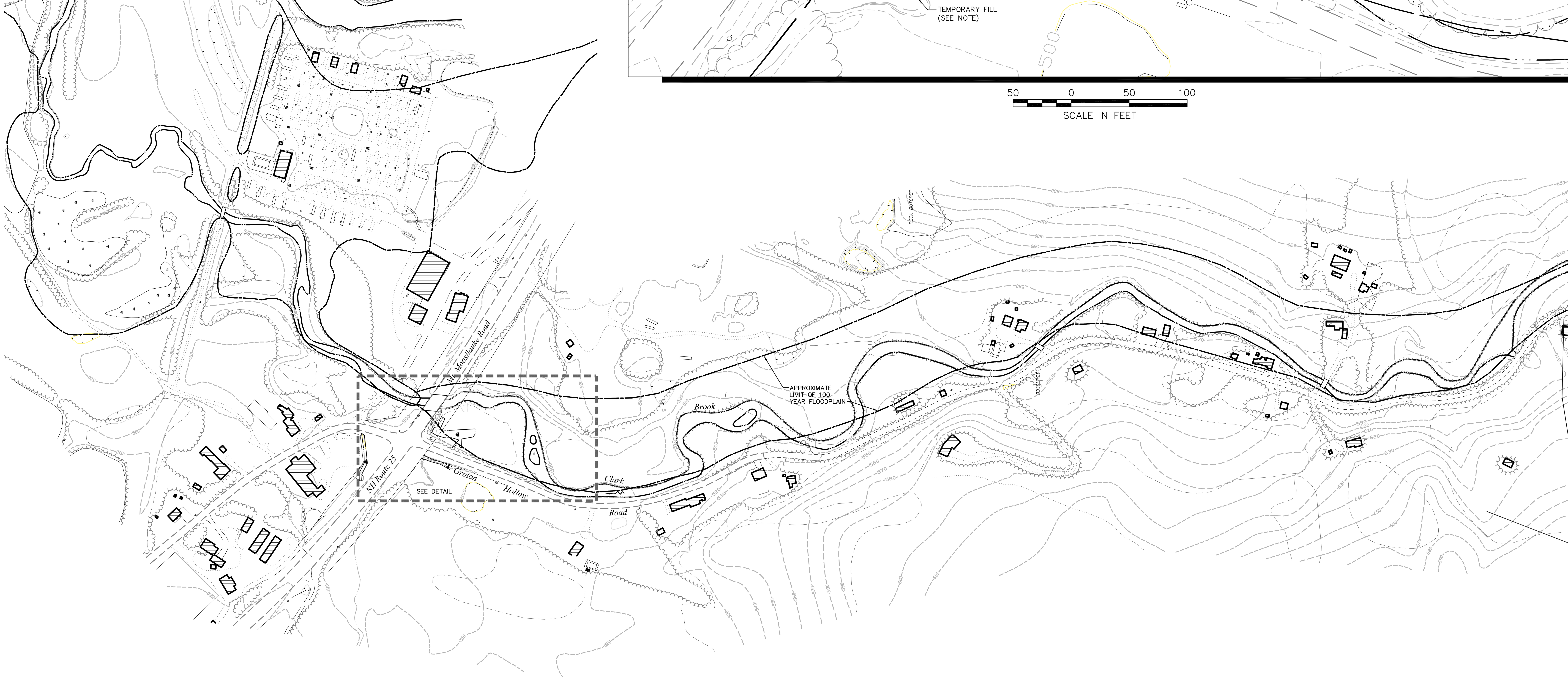

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IBERDROLA RENEWABLES

Note

TEMPORARY FILL ALONG NH ROUTE 25 IS TO ALLOW FOR TRACTOR TRAILER ACCESS TO GROTON HOLLOW ROAD. AREA TO BE RESTORED TO ORIGINAL GRADE, AND BE LOAMED AND SEEDED, WHEN CONSTRUCTION IS COMPLETED.

STATE OF NEW HAMPSHIRE
NANCY B. RENDALL
No. 073
CERTIFIED WETLAND SCIENTIST

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Scale 1"=200' | Date February 12, 2010

Project Title

Groton Wind Farm

Groton Hollow Road
Groton, New Hampshire

Issued for
Permitting

Not Approved for Construction

Drawing Title

Master Site Plan
Groton Hollow Road

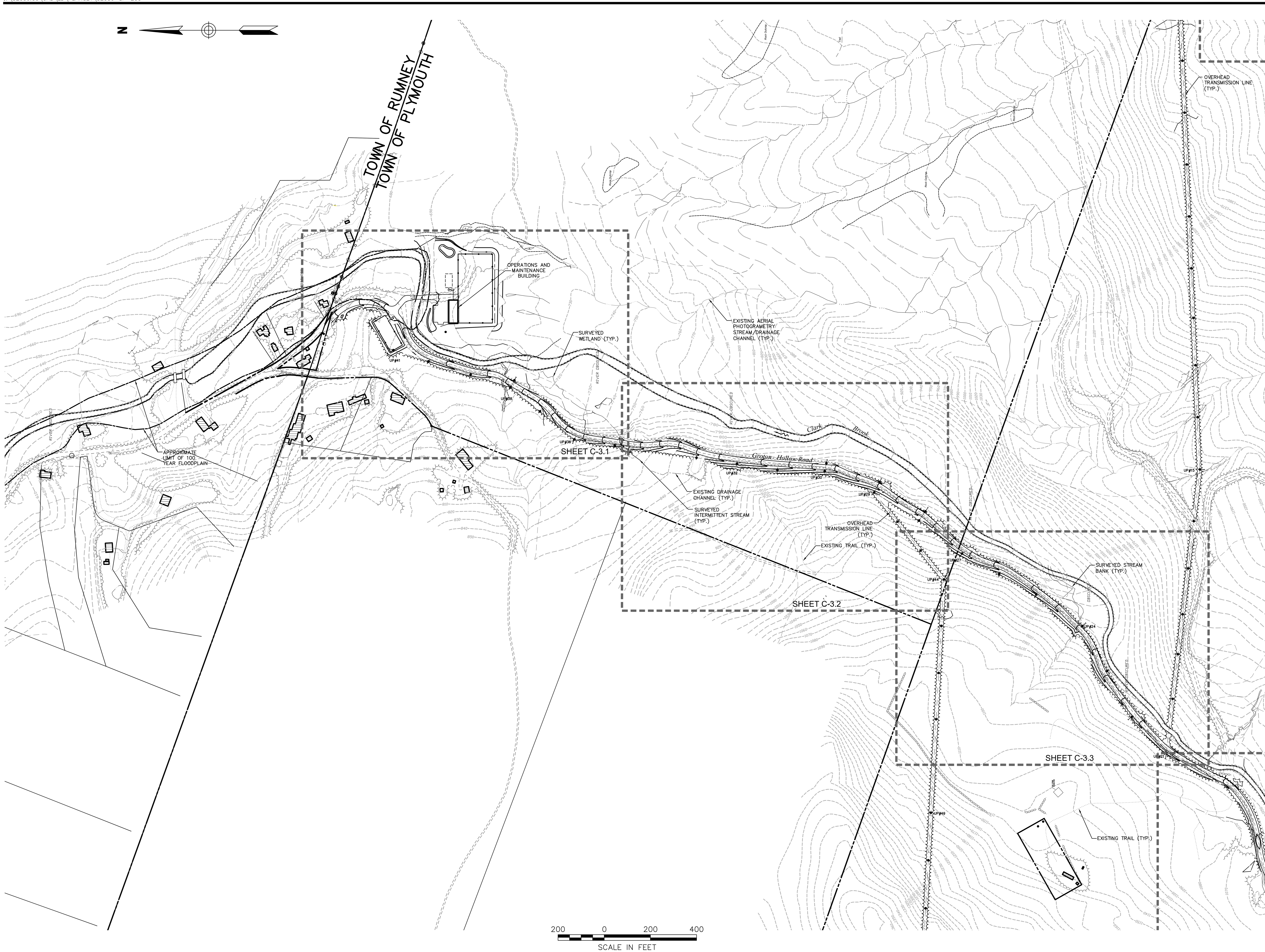
STATE OF NEW HAMPSHIRE
MICHAEL J. LEO
No. 7146
LICENSED PROFESSIONAL

Drawing Number
C-2.1

Sheet 3 of 68

Project Number
52036.00

52036-SP-200.DWG



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STATE OF NEW HAMPSHIRE
NANCY B. RENDALL
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Project Title

Groton Wind Farm

Groton Hollow Road
Groton, New Hampshire

Issued for

Permitting

Not Approved for Construction

Drawing Title

Master Site Plan
Groton Hollow Road

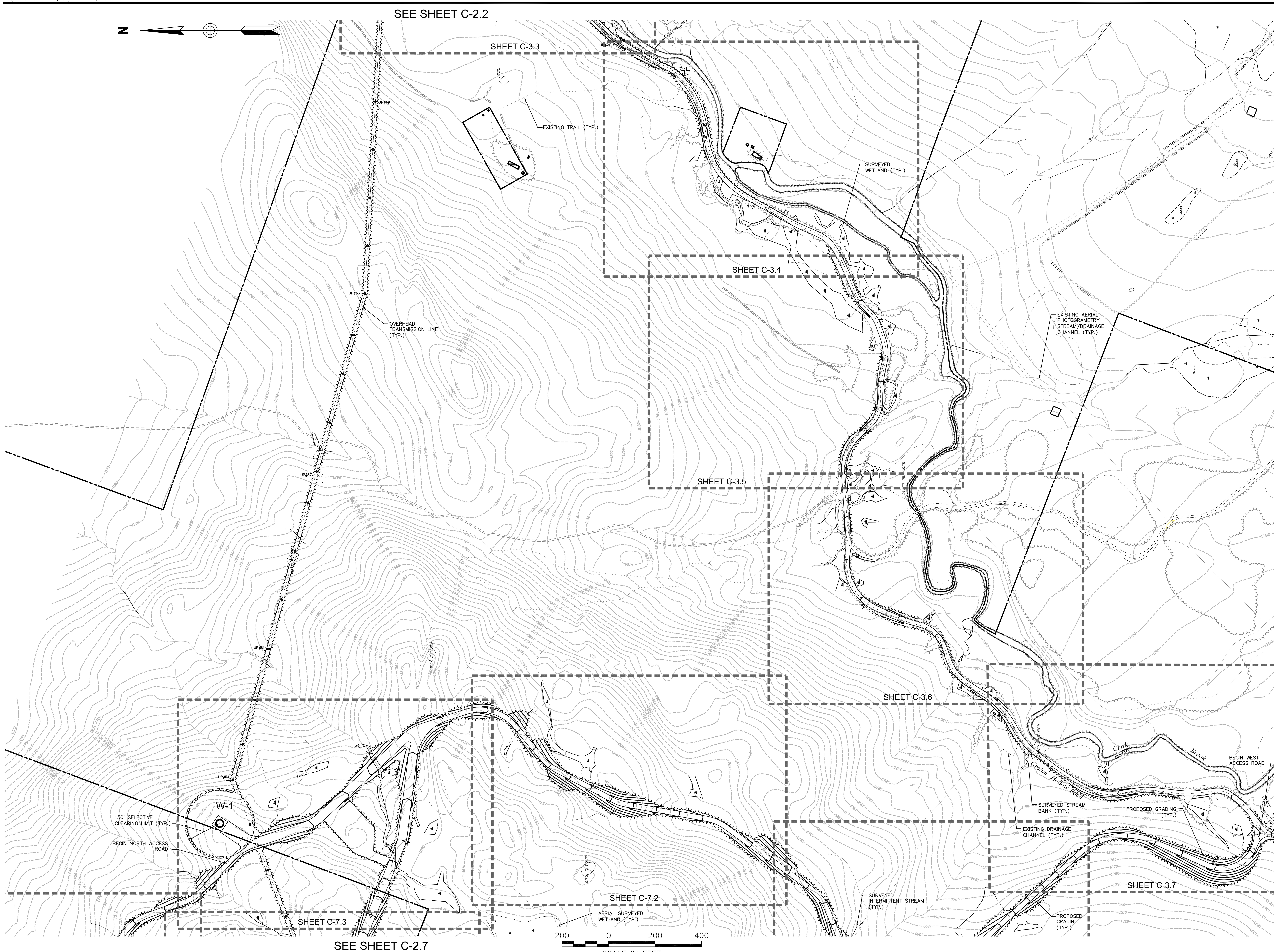
STATE OF NEW HAMPSHIRE
MICHAEL J. LEO
No. 7146
LICENSED
PROFESSIONAL ENGINEER

Drawing Number

C-2.2

Sheet 4 of 68

Project Number
52036.00



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Prepared For:

IBERDROLA RENEWABLES

State of New Hampshire — Nancy B. Rendall — No. 073 — Certified Wetland Scientist

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Checked by	CAD checked by
Approved by	
Scale 1"=200'	Date February 12, 2010

Project Title
Groton Wind Farm

Groton Hollow Road
Groton, New Hampshire

Issued for
Permitting

Not Approved for Construction

Drawing Title
Master Site Plan
Groton Hollow Road

State of New Hampshire — Michael J. Leo — No. 7146 — Licensed Professional Engineer

Drawing Number
C-2.3

Sheet 5 of 68

Project Number
52036.00

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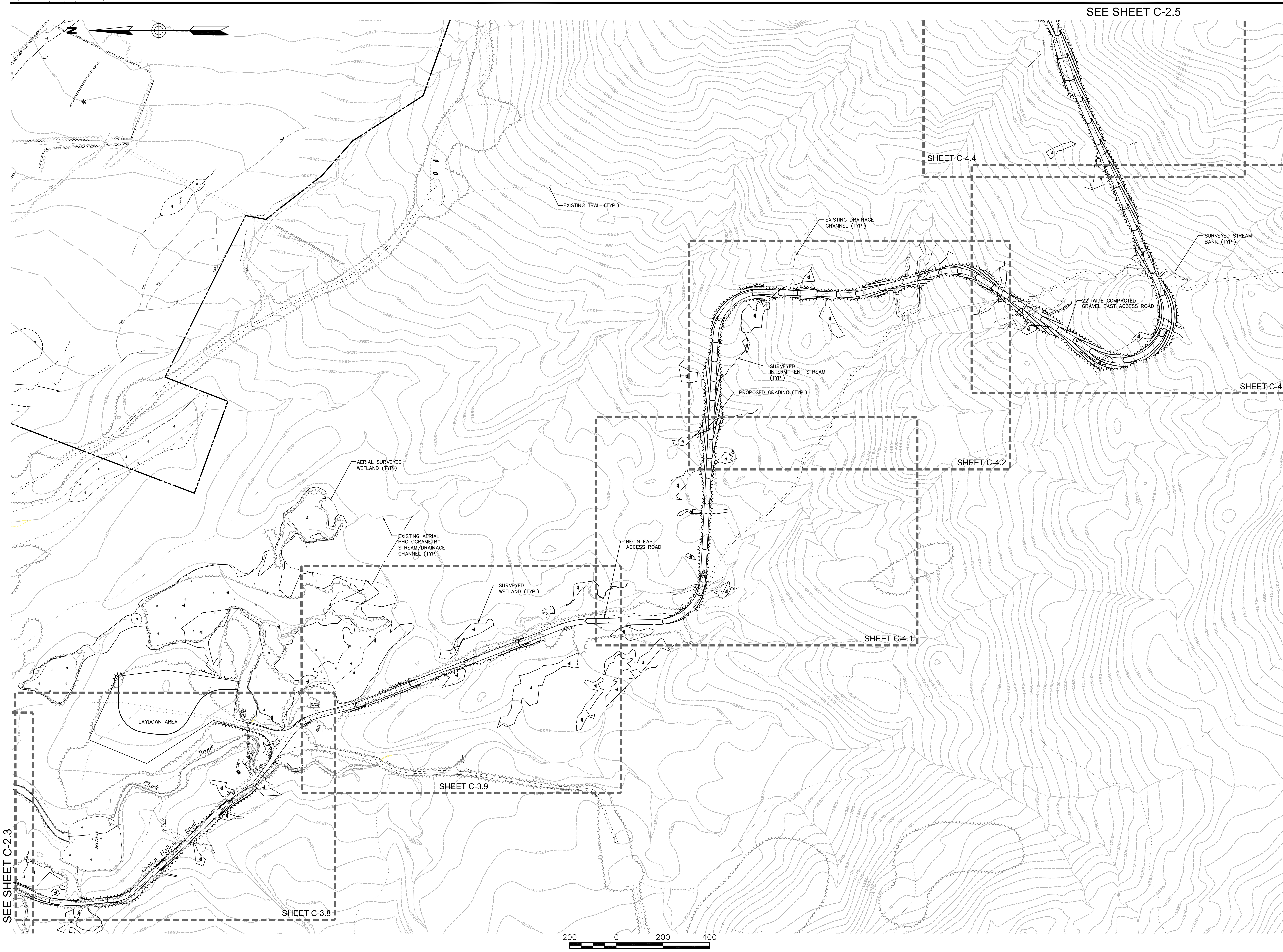

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Project Title

Groton Wind Farm

Groton Hollow Road
Groton, New Hampshire

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Drawing Title

Master Site Plan
East Access Road

STATE OF NEW HAMPSHIRE
MICHAEL J. LEO
No. 7146
LICENSED PROFESSIONAL ENGINEER

Drawing Number

C-2.4

Sheet 6 of 68

Project Number
52036.00

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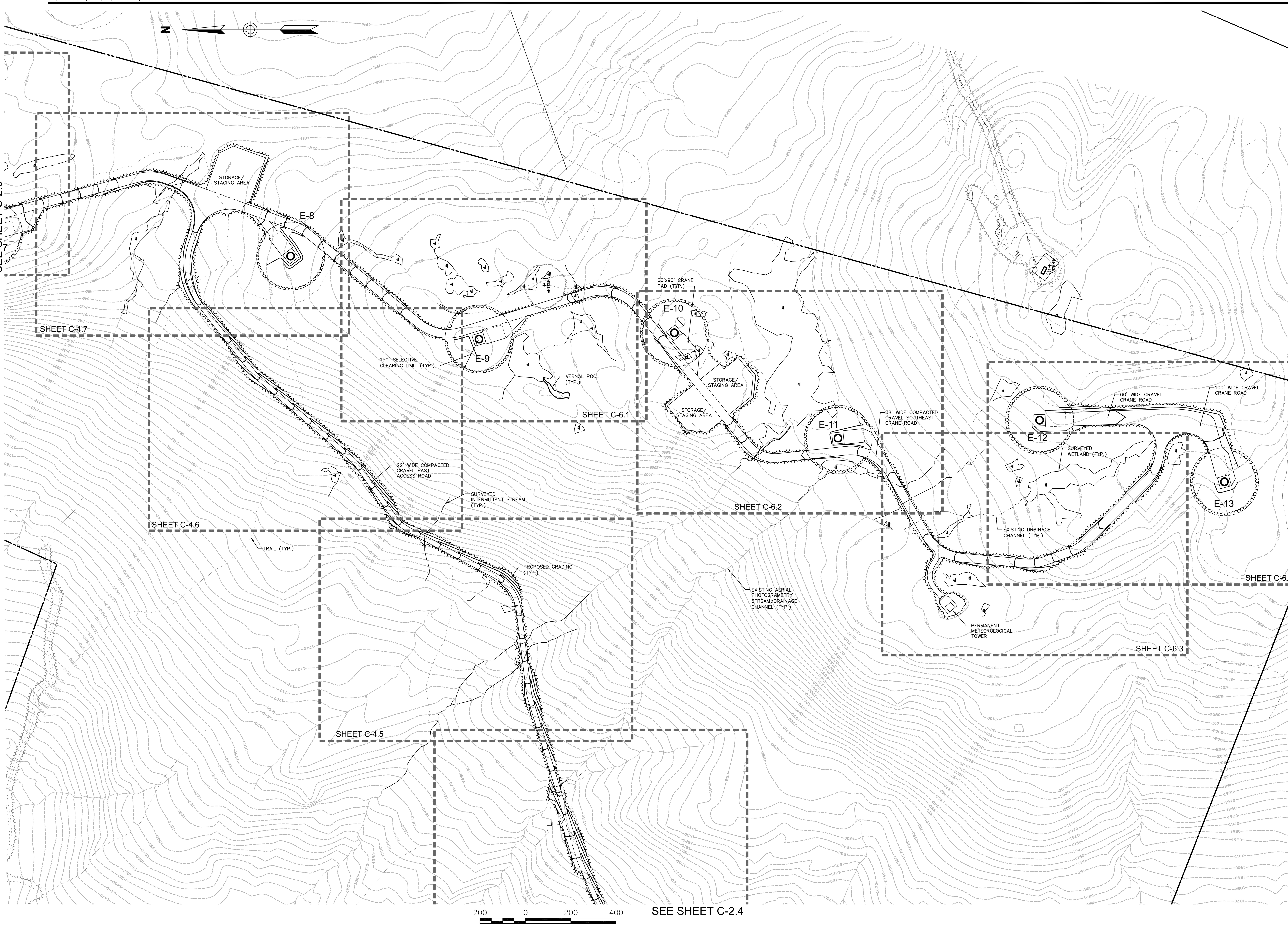

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NANCY B. RENDALL
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CERTIFIED WETLAND SCIENTIST

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Project Title

Groton Wind Farm

Groton Hollow Road
Groton, New Hampshire

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Not Approved for Construction

Drawing Title

Master Site Plan
Southeast Turbines

STATE OF NEW HAMPSHIRE
MICHAEL J. LEO
No. 7146
LICENSED
PROFESSIONAL ENGINEER

Drawing Number

C-2.5

Sheet 7 of 68

Project Number
52036.00

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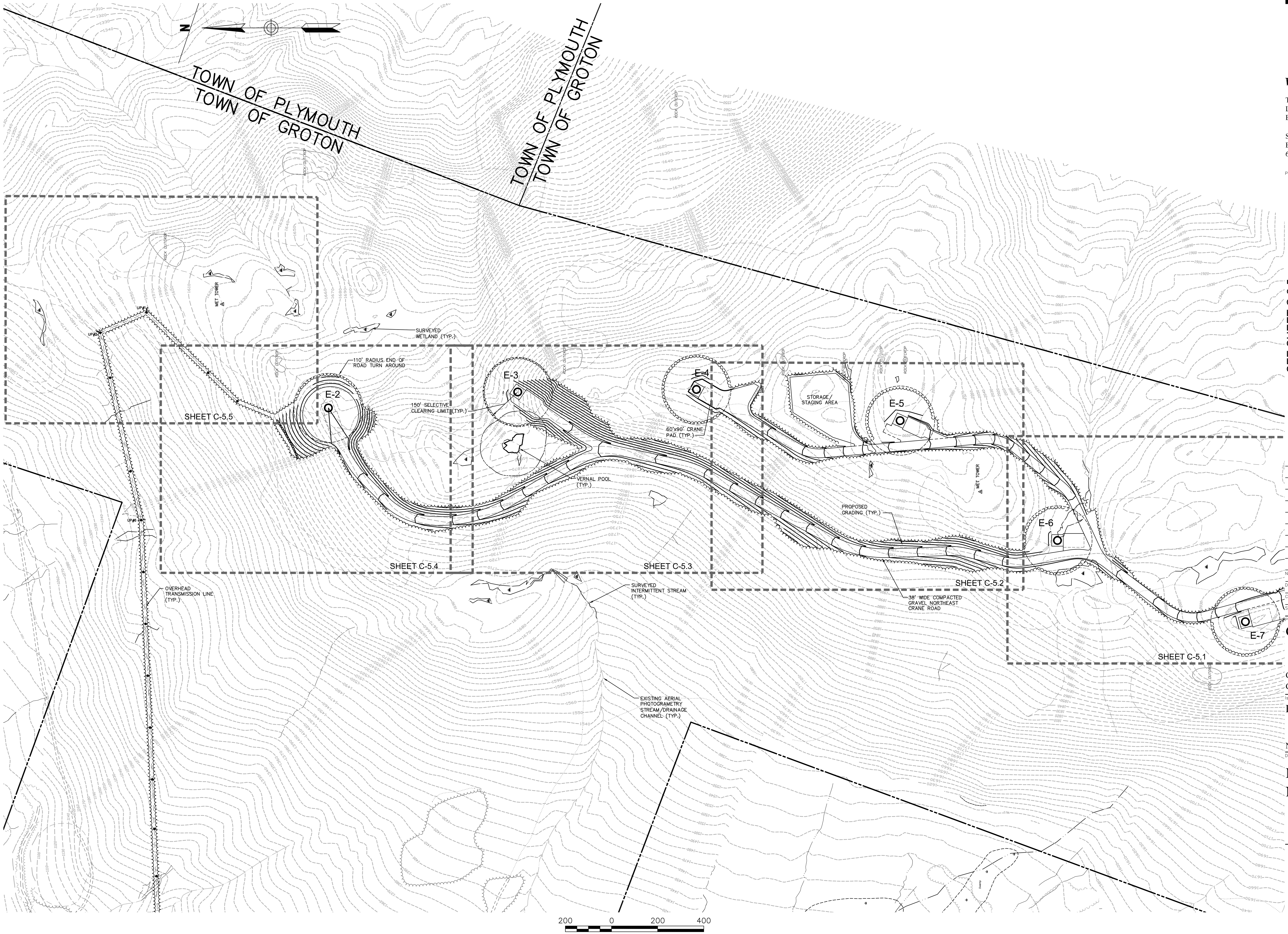

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No. 073
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Project Title

Groton Wind Farm

Groton Hollow Road
Groton, New Hampshire

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Drawing Title

Master Site Plan
Northeast Turbines

STATE OF NEW HAMPSHIRE
MICHAEL J. LEO
No. 7146
LICENSED
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Drawing Number

C-2.6

Sheet 8 of 68

Project Number
52036.00

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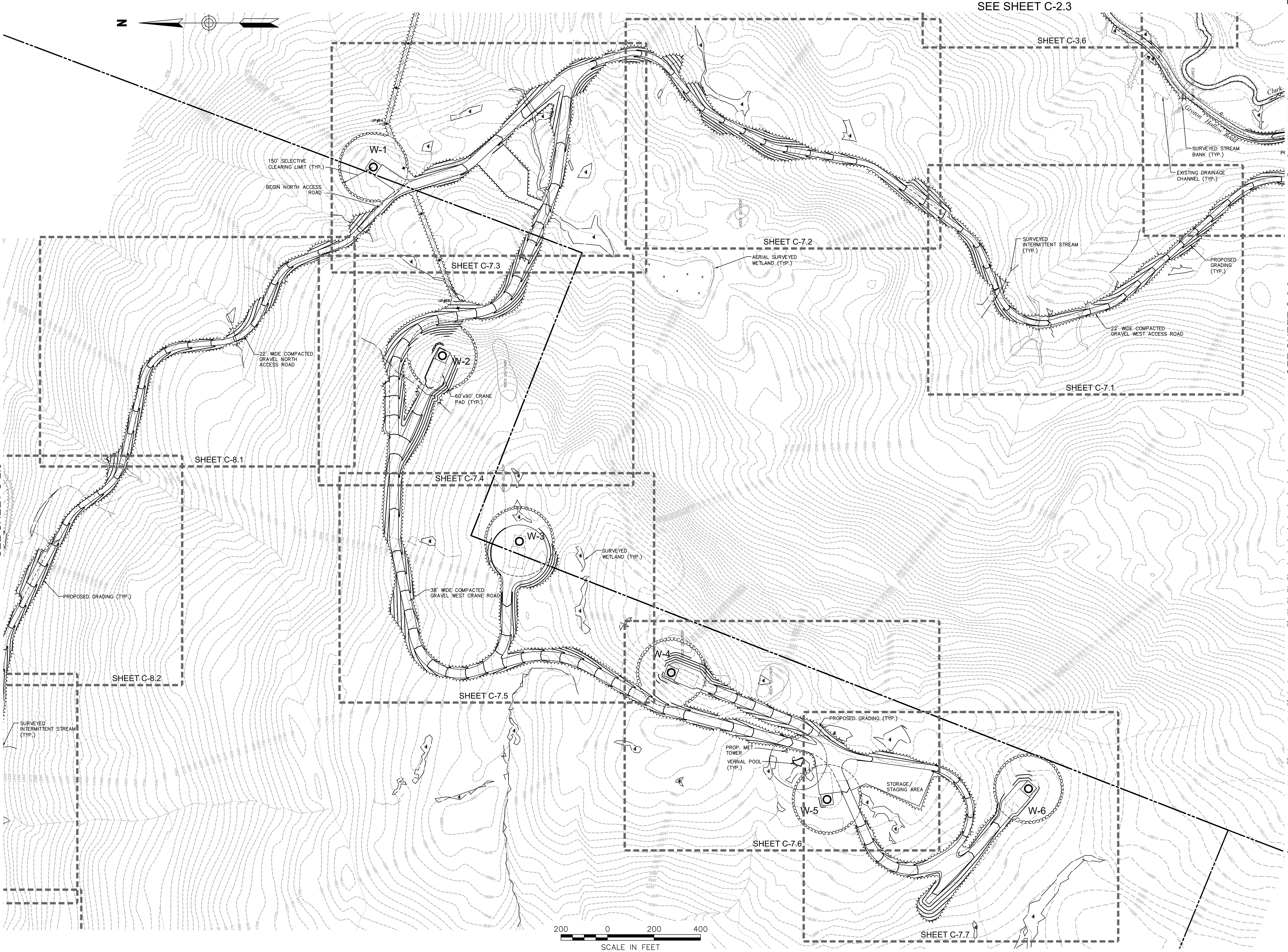

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Project Title

Groton Wind Farm

Groton Hollow Road
Groton, New Hampshire

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Drawing Title

Master Site Plans West Turbines

STATE OF NEW HAMPSHIRE
MICHAEL J. LEO
No. 7146
LICENSED PROFESSIONAL ENGINEER

Drawing Number

C-2.7

Sheet 9 of 68

Project Number 52036.00

52036-SP-200.DWG

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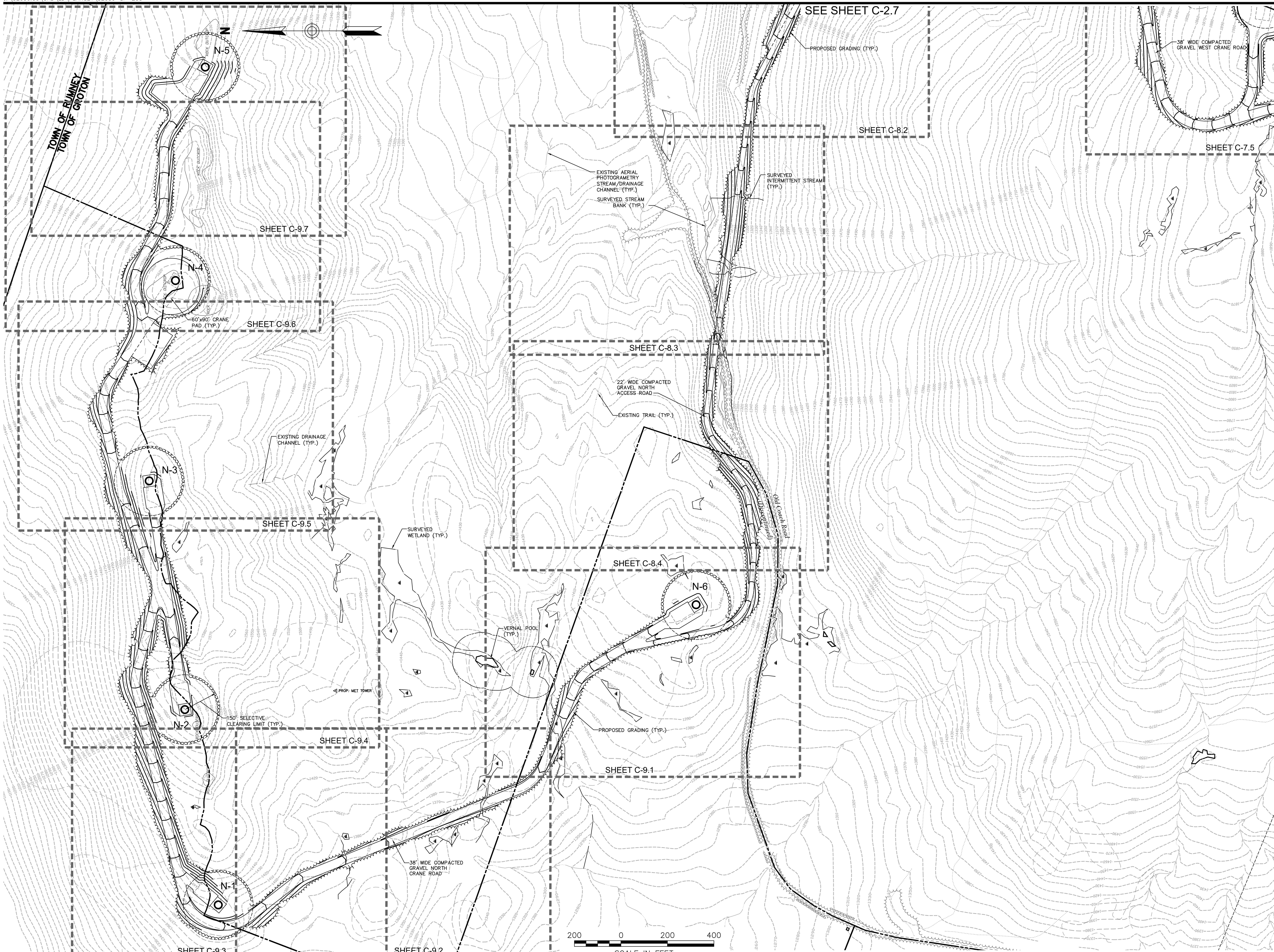

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Groton Wind Farm

Groton Hollow Road
Groton, New Hampshire

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Drawing Title

Master Site Plan North Turbines

STATE OF NEW HAMPSHIRE
MICHAEL J. LEO
No. 7146
LICENSED
PROFESSIONAL ENGINEER

Drawing Number
C-2.8

Sheet 10 of 68

Project Number
52036.00

52036-SP-200.DWG

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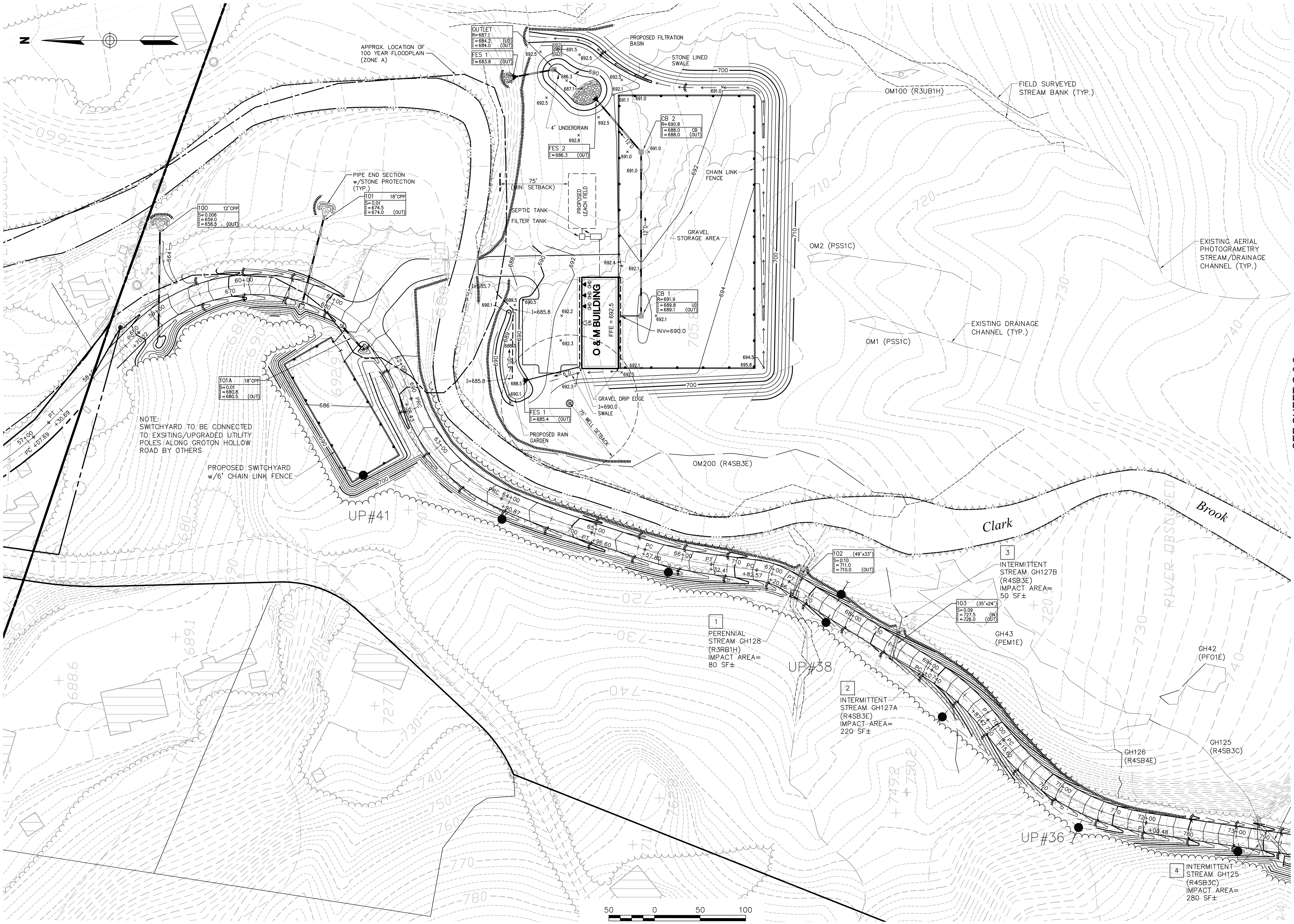

SEE SHEET C-3.2

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Bedford, New Hampshire 03110
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Prepared For:

IBERDROLA RENEWABLES

STATE OF NEW HAMPSHIRE NANCY B. RENDALL No. 073 CERTIFIED WETLAND SCIENTIST

No.	Revision	Date	Appvd.

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Scale 1"=50'		Date February 12, 2010

Project Title

Groton Wind Farm

Groton Hollow Road
Groton, New Hampshire

Issued for
Permitting

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Drawing Title

Site Plan
Groton Hollow Road

STATE OF NEW HAMPSHIRE MICHAEL J. LEO No. 7146 LICENSED PROFESSIONAL ENGINEER

Drawing Number
C-3.1

Sheet 11 of 68

Project Number
52036.00

52036-SP-GHR.DWG

Vanasse Hangen Brustlin, Inc.

Transportation
Land Development
Environmental Services

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Prepared For:

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STATE OF NEW HAMPSHIRE
NANCY B. RENDALL
No. 073
CERTIFIED WETLAND SCIENTIST

No.	Revision	Date	Appvd.

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Project Title

Groton Wind Farm

Groton Hollow Road
Groton, New Hampshire

Issued for

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Drawing Title

Site Plan
Groton Hollow Road

STATE OF NEW HAMPSHIRE
MICHAEL J. LEO
No. 7146
LICENSED
PROFESSIONAL ENGINEER

Drawing Number

C-3.2

Sheet 12 of 68

Project Number
52036.00

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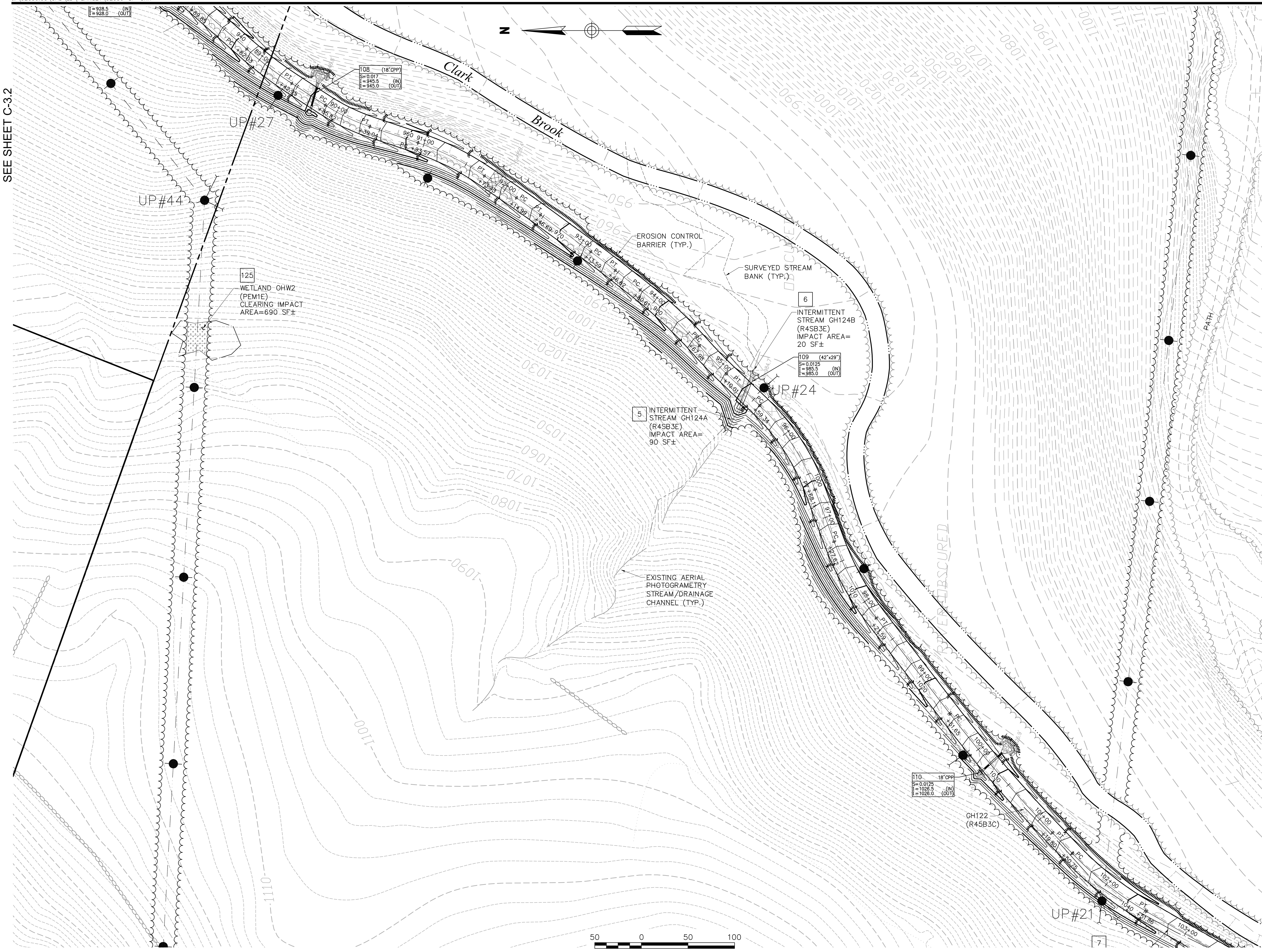

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Prepared For:

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No. 073
CERTIFIED WETLAND SCIENTIST

No.	Revision	Date	Appvd.

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CAD checked by | Approved by

Scale 1"=50' | Date February 12, 2010

Project Title

Groton Wind Farm

Groton Hollow Road
Groton, New Hampshire

Issued for

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Not Approved for Construction

Drawing Title

Site Plan
Groton Hollow Road

STATE OF NEW HAMPSHIRE
MICHAEL J. LEO
No. 7146
LICENSED
PROFESSIONAL ENGINEER

Drawing Number

C-3.3

Sheet 13 of 68

Project Number
52036.00

52036-SP-GHR.DWG

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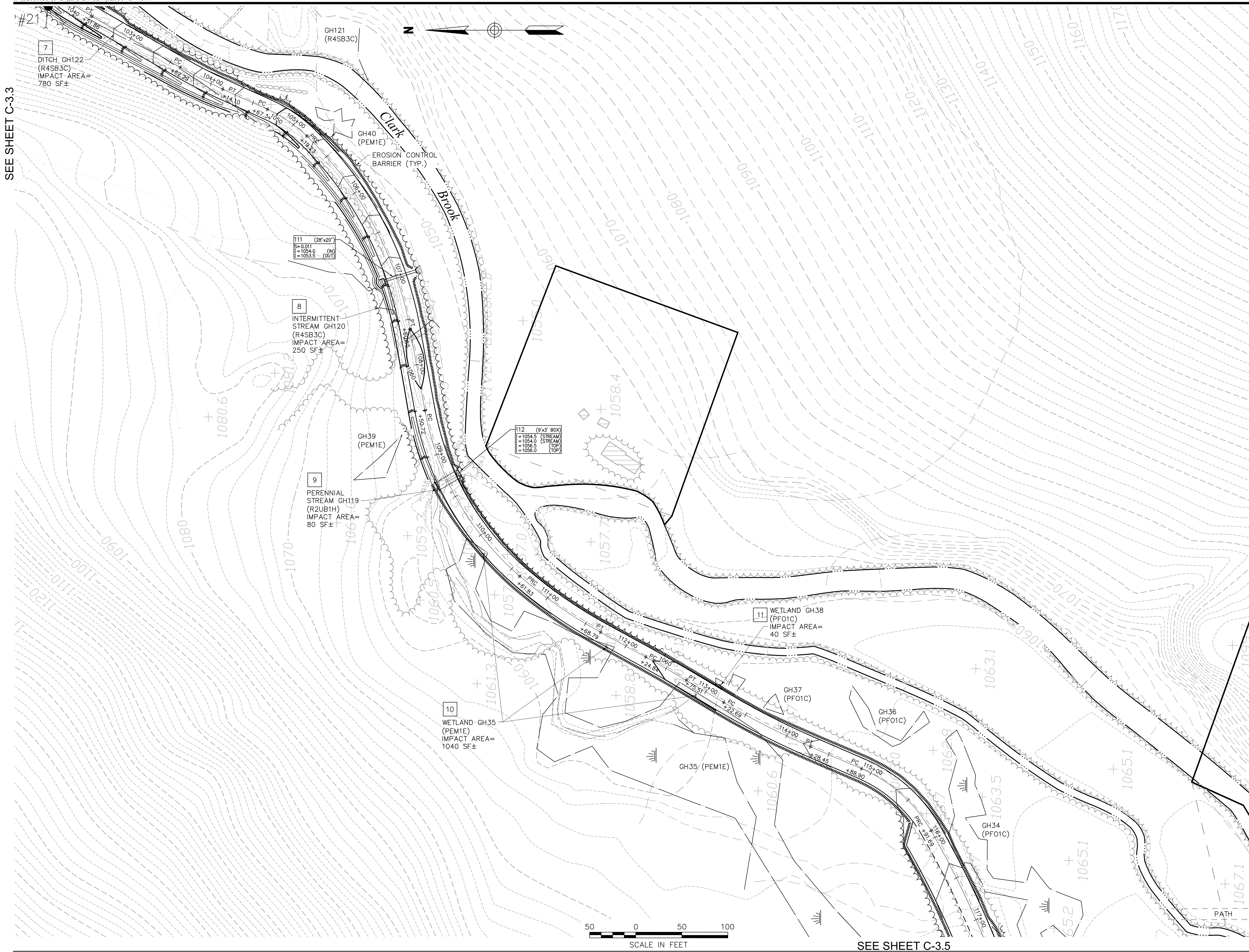

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Project Title

Groton Wind Farm

Groton Hollow Road
Groton, New Hampshire

Issued for

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Drawing Title

Site Plan
Groton Hollow Road

STATE OF NEW HAMPSHIRE
MICHAEL J. LEO
No. 7146
LICENSED
PROFESSIONAL ENGINEER

Drawing Number

C-3.4

Sheet 14 of 68

Project Number
52036.00

52036-SP-GHR.DWG

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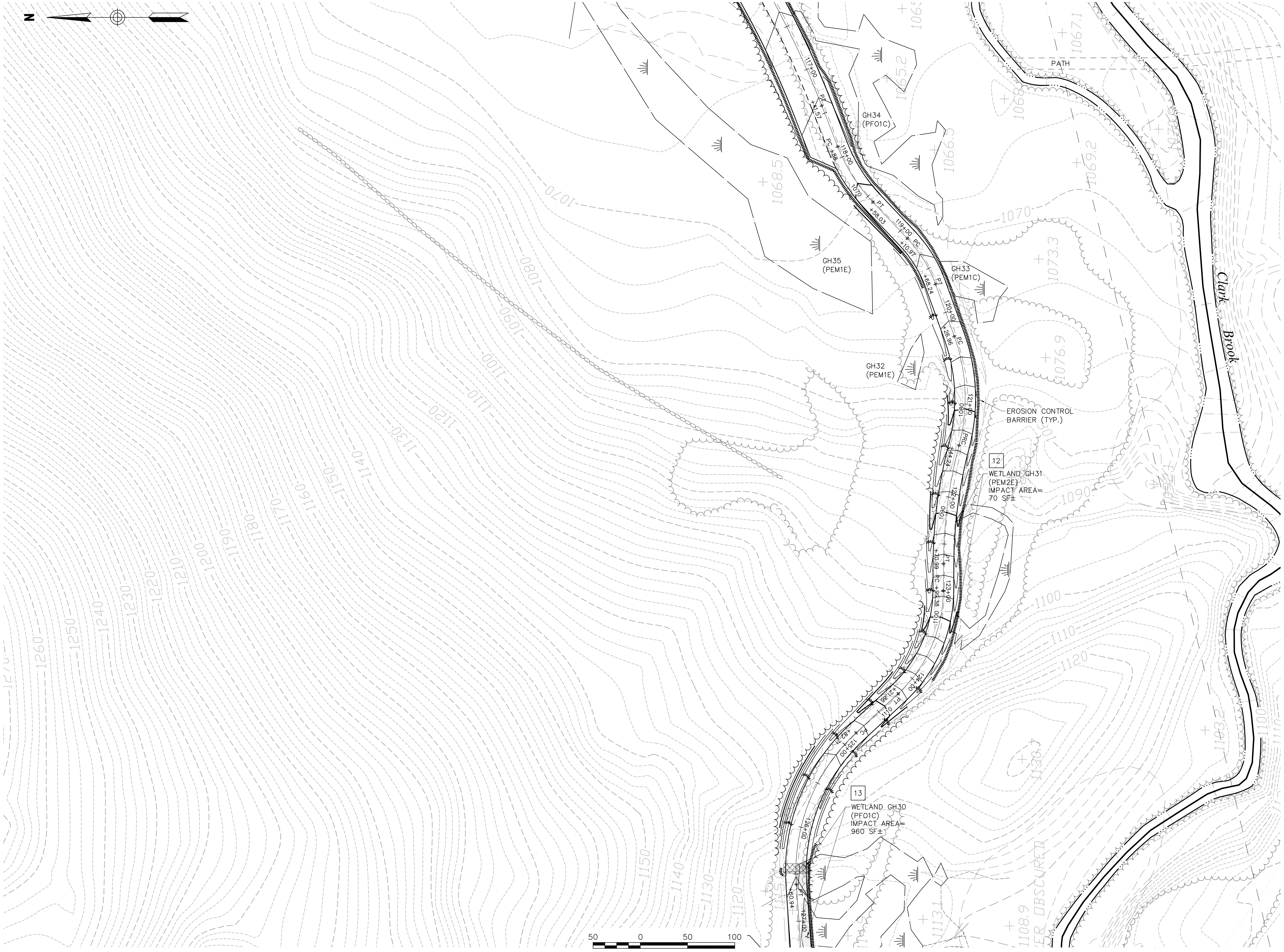
SEE SHEET C-3.4



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Groton Wind Farm

Groton Hollow Road
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Drawing Title
Site Plan
Groton Hollow Road

STATE OF NEW HAMPSHIRE
MICHAEL J. LEO
No. 7146
LICENSED
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Drawing Number
C-3.5

Sheet 15 of 68

Project Number
52036.00

52036-SP-GHR.DWG

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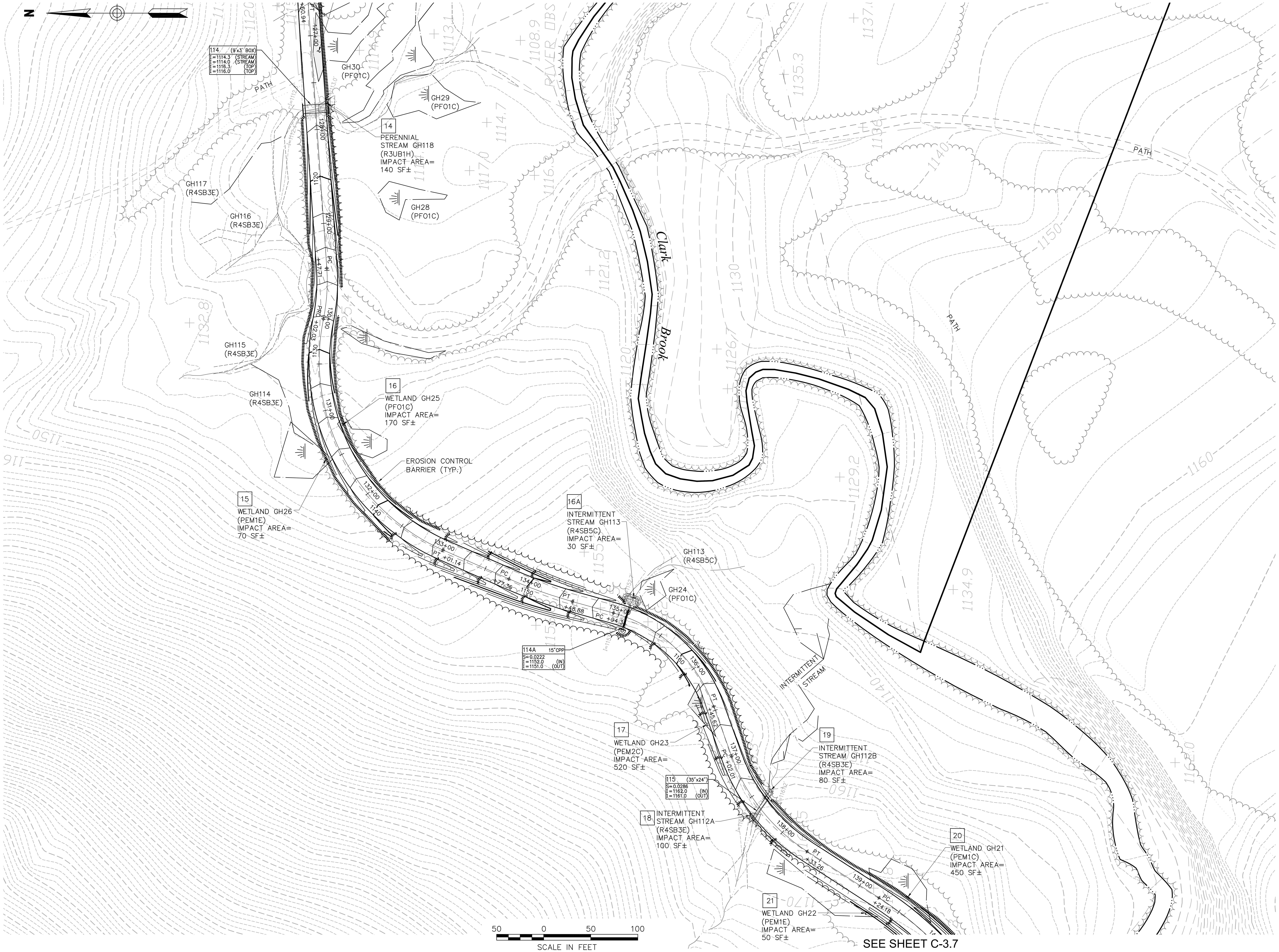
SEE SHEET C-3.5



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Groton Wind Farm

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Site Plan
Groton Hollow Road

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No. 7146
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Drawing Number
C-3.6

Sheet 16 of 68

Project Number
52036.00

52036-SP-GHR.DWG

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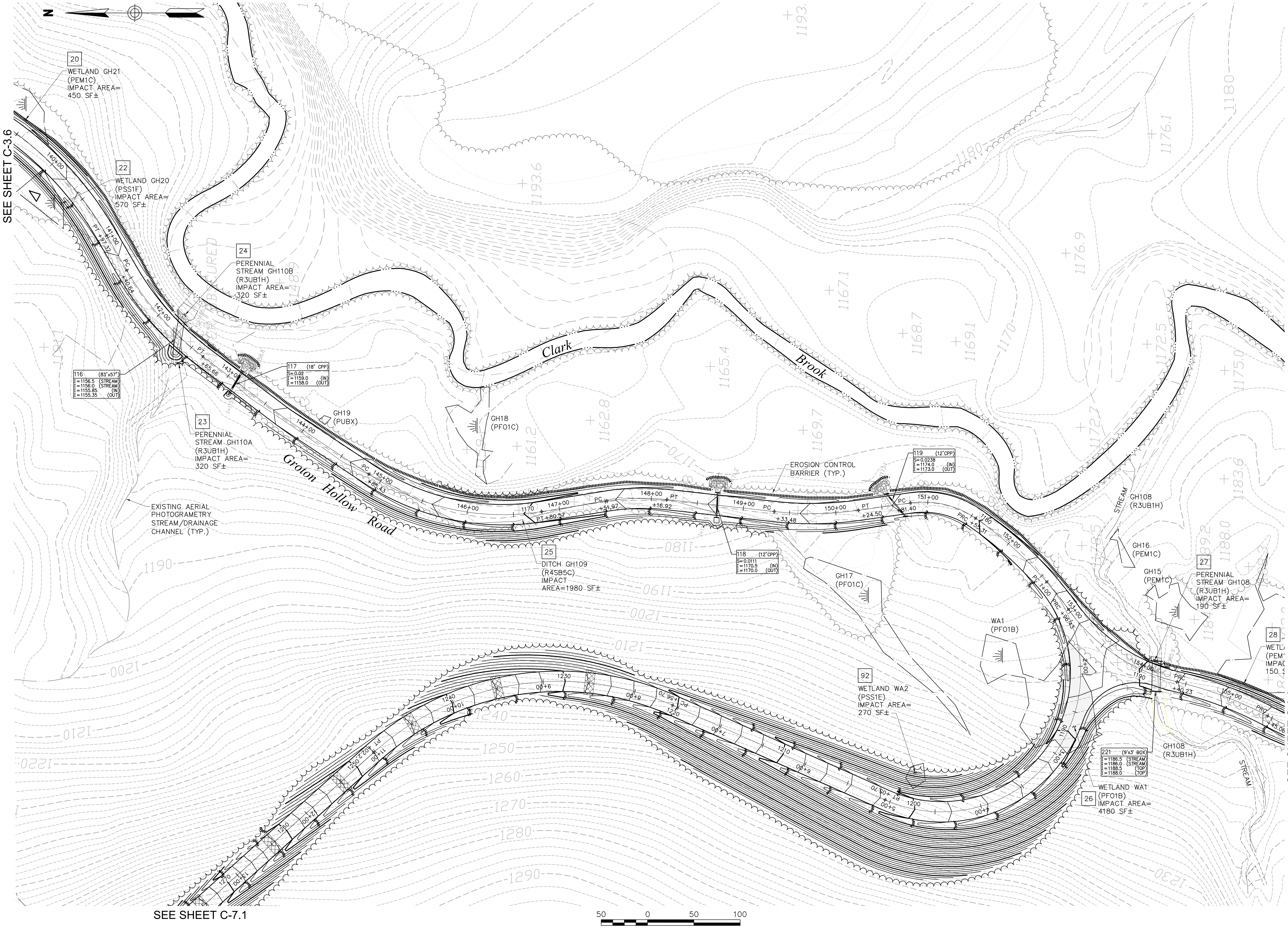

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Drawing Title

Site Plan
Groton Hollow Road

STATE OF NEW HAMPSHIRE
MICHAEL J. LEO
No. 7146
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Drawing Number

C-3.7

Sheet 17 of 68

Project Number
52036.00

52036-SP-GHR.DWG

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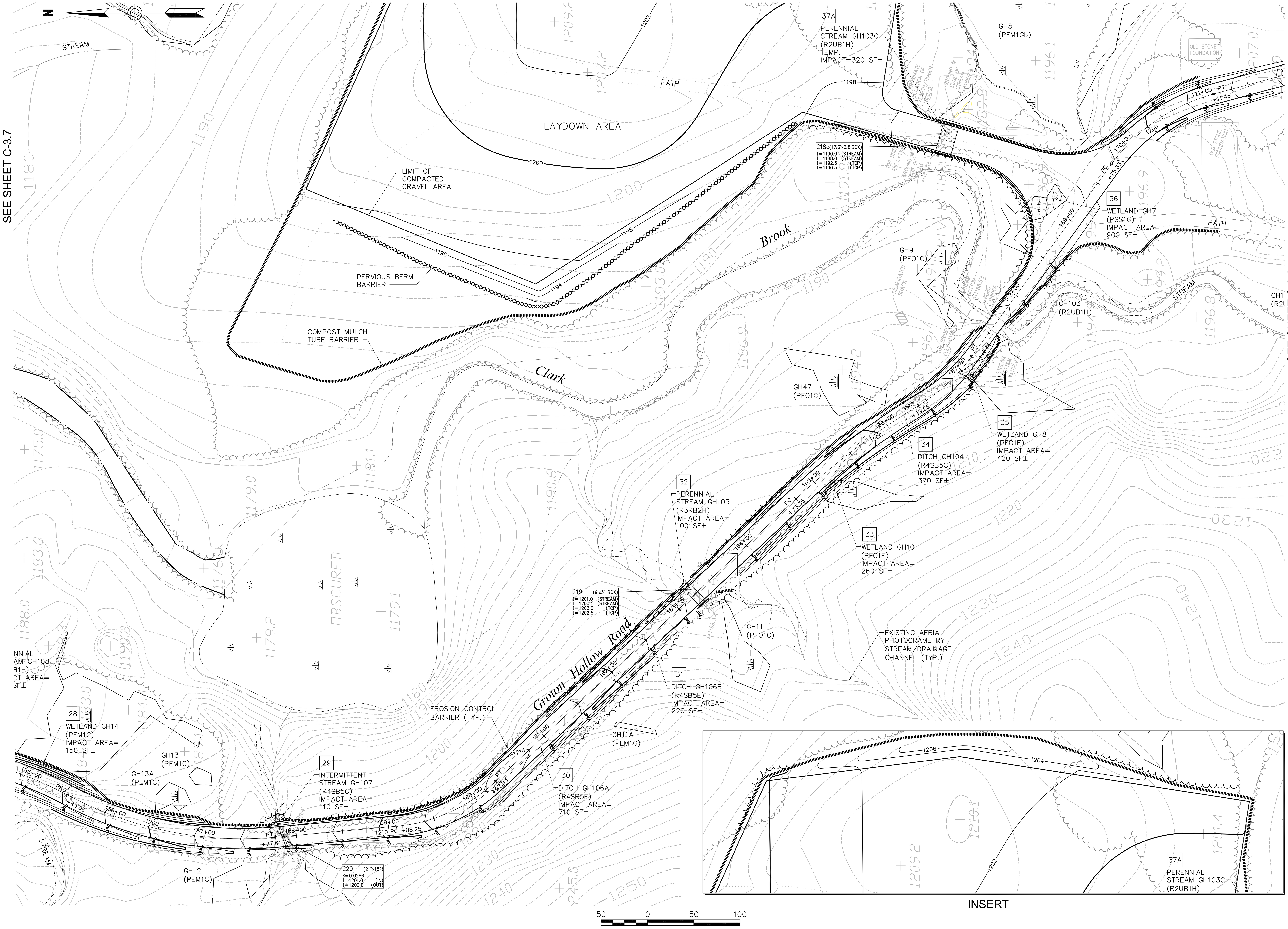

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Site Plan
Groton Hollow Road

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Drawing Number

C-3.8

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Groton Hollow Road

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Drawing Number

C-3.9

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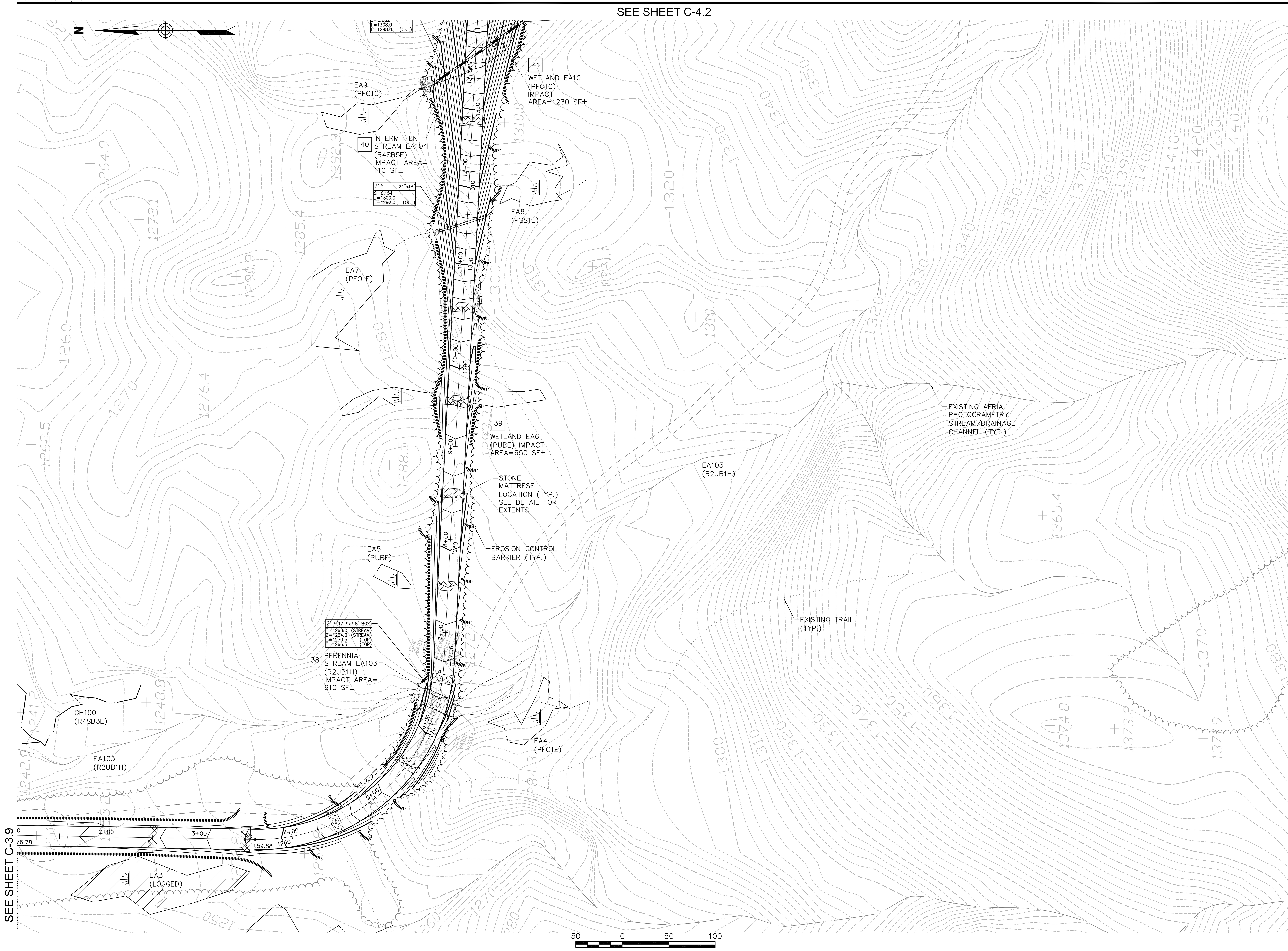

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Site Plan
East Access Road

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MICHAEL J. LEO
No. 7146
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PROFESSIONAL ENGINEER

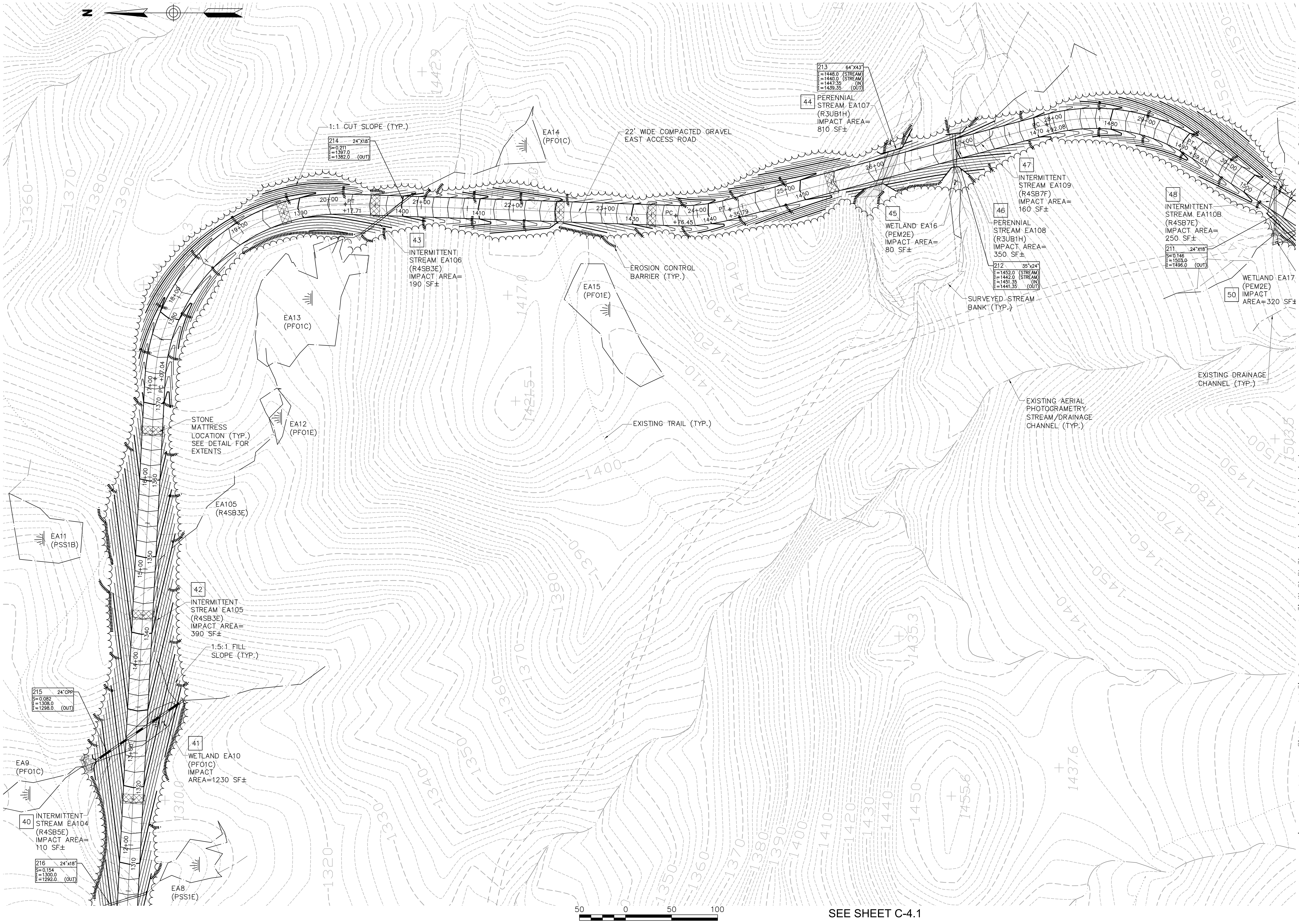
Drawing Number

C-4.1

Sheet 20 of 68

Project Number
52036.00

SEE SHEET C-4.3



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Drawing Title

Site Plan
East Access Road

STATE OF NEW HAMPSHIRE
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No. 7146
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Drawing Number

C-4.2

Sheet 21 of 68

Project Number
52036.00

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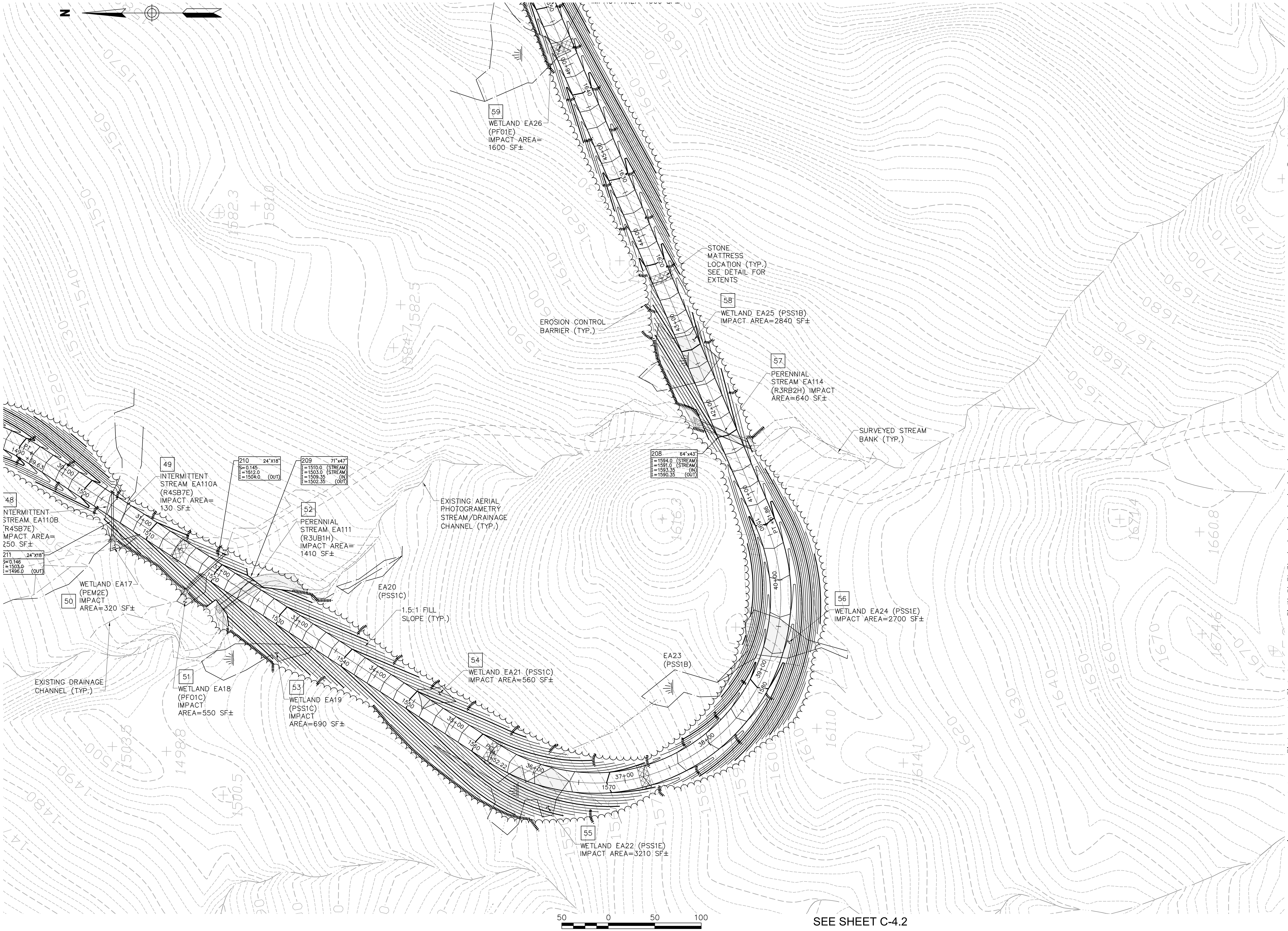
SEE SHEET C-4.4



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Drawing Number

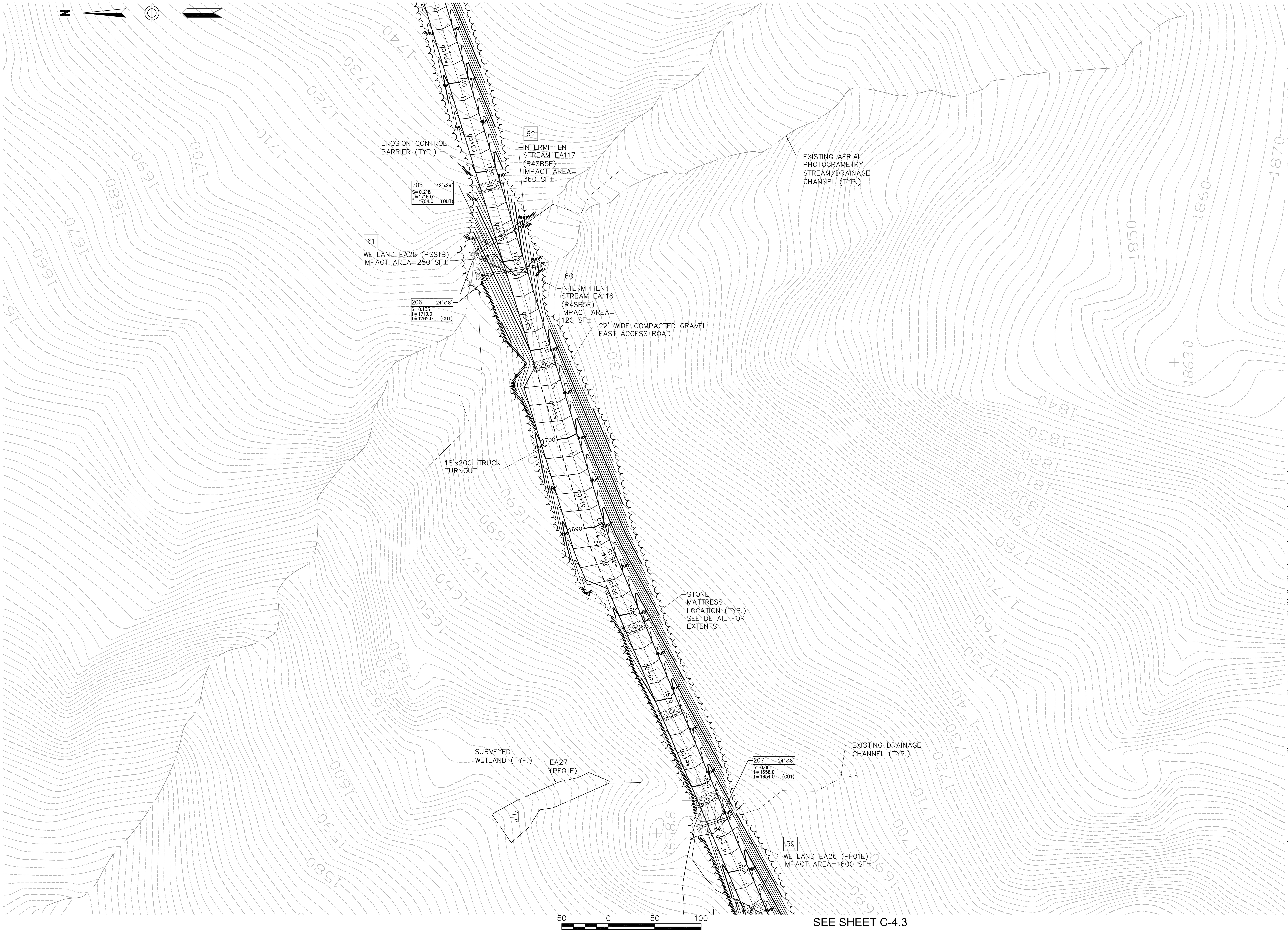
C-4.3

Sheet 22 of 68

Project Number
52036.00

52036-SP-EAST.DWG

SEE SHEET C-4.5



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Site Plan
East Access Road

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No. 7146
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Drawing Number

C-4.4

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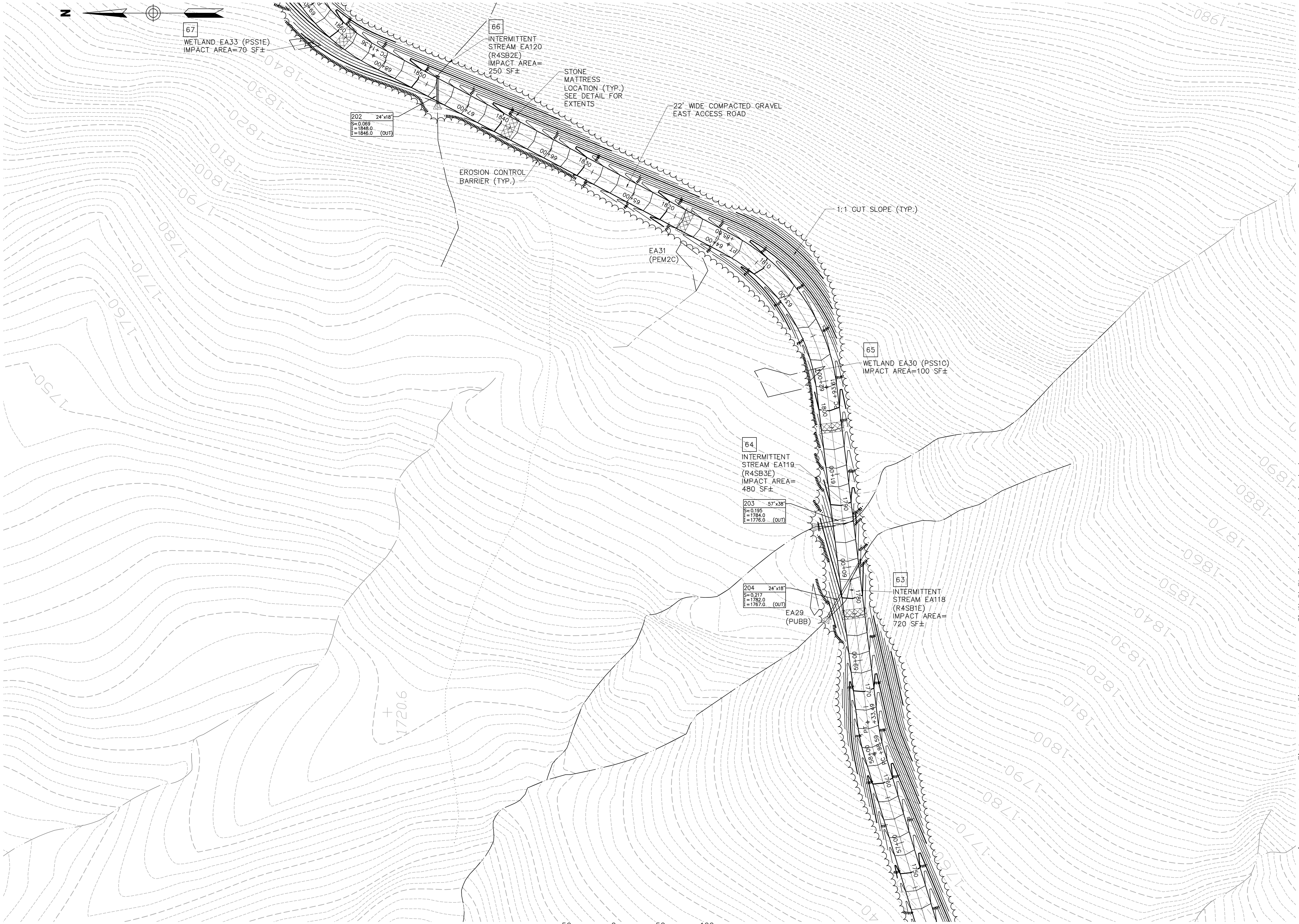
Project Number
52036.00

SEE SHEET C-4.6



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Site Plan
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Drawing Number
C-4.5

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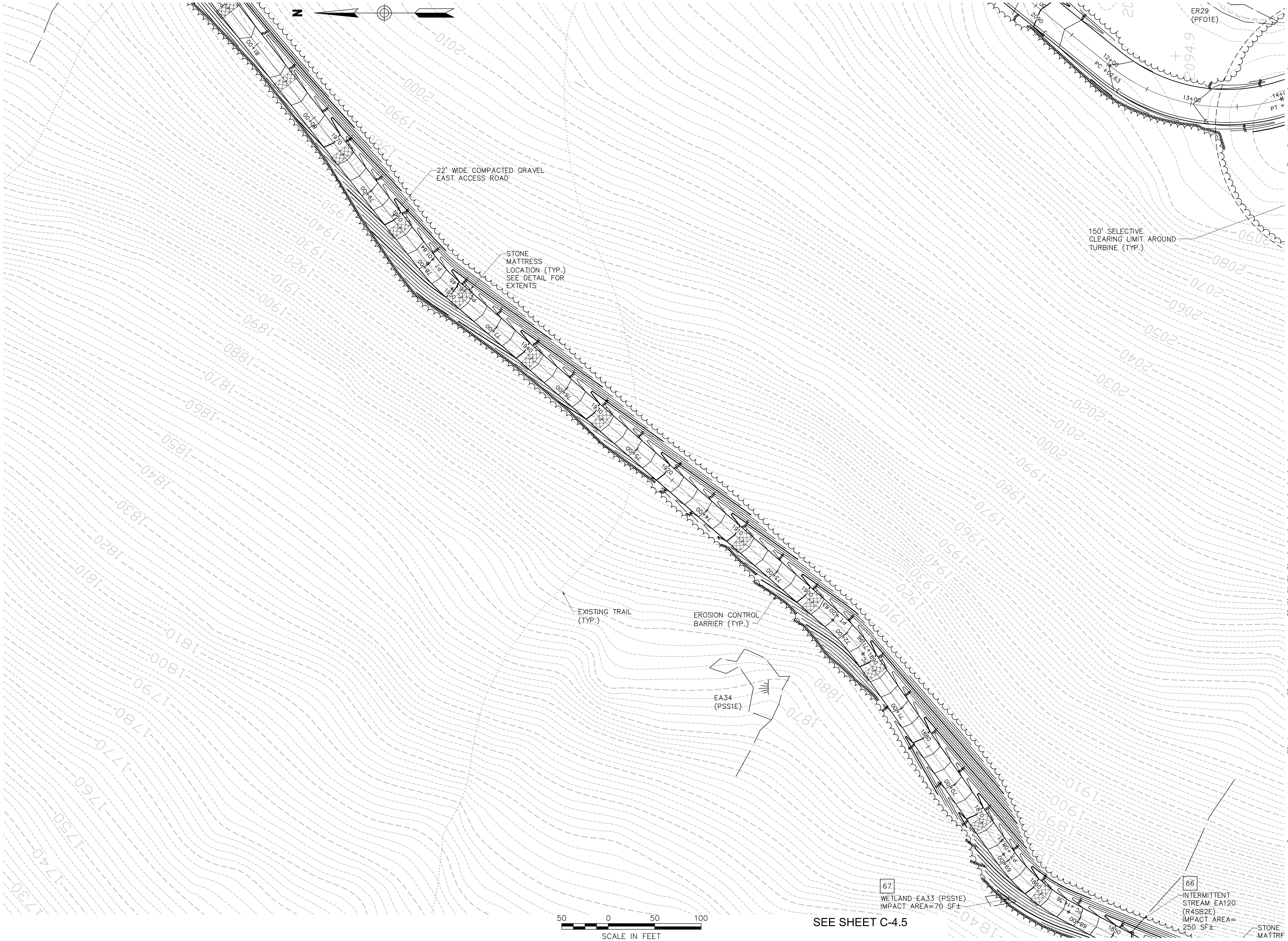
SEE SHEET C-4.7



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Site Plan
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Drawing Number

C-4.6

Sheet 25 of 68

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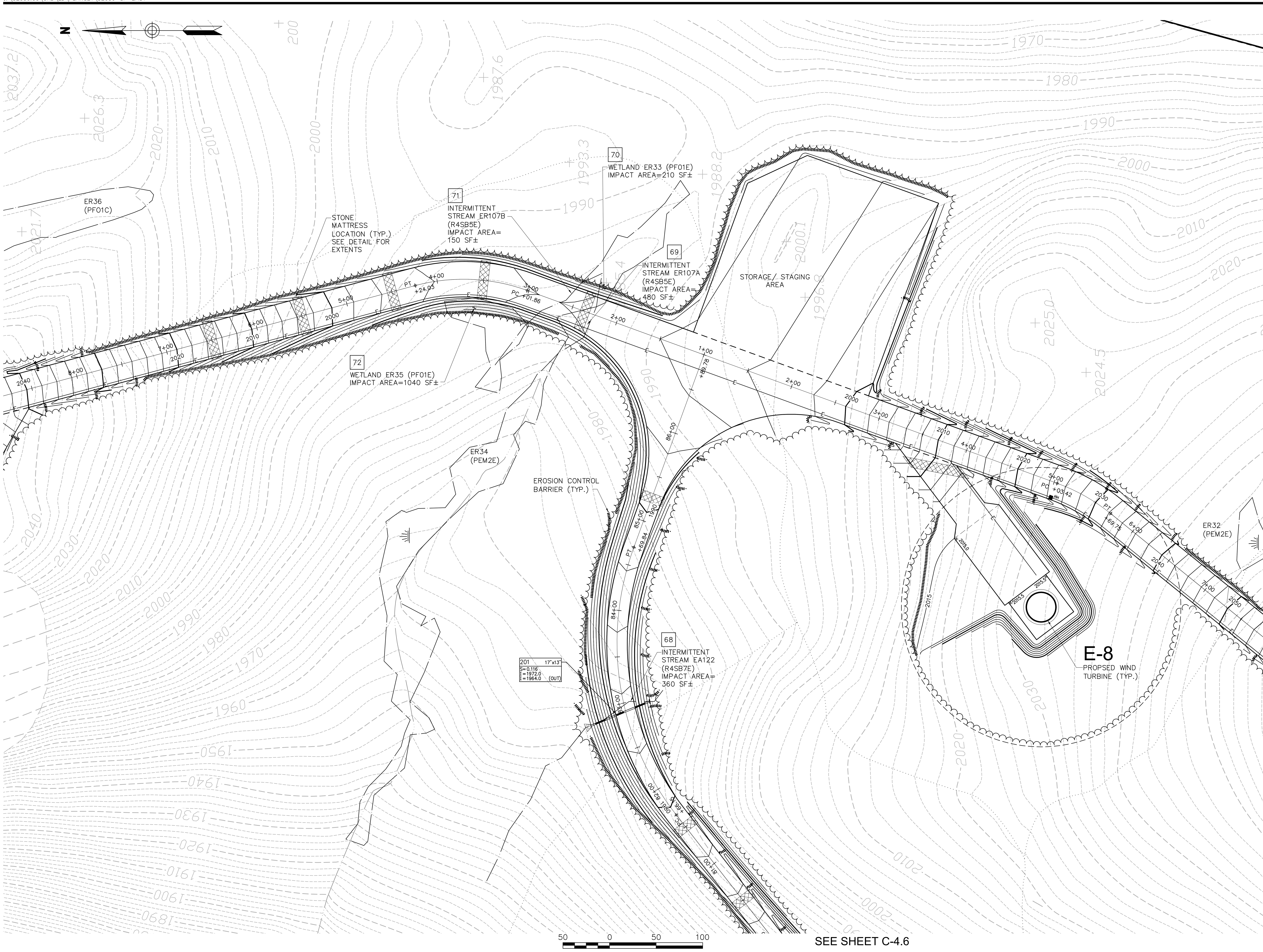

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Drawing Title

Site Plan
East Access Road

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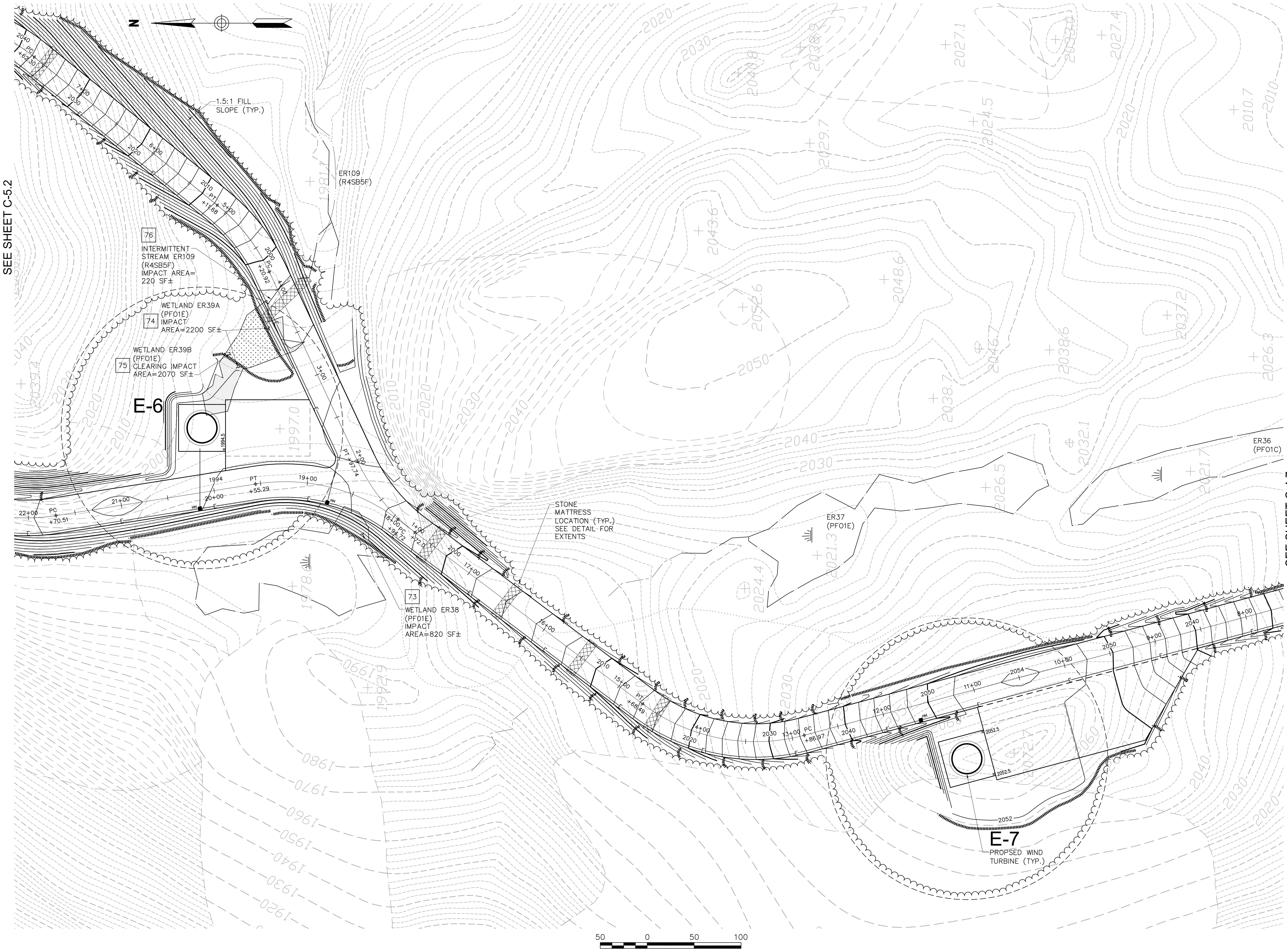
Drawing Number

C-4.7

Sheet 26 of 68

Project Number 52036.00



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Groton Wind Farm

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Drawing Title

Site Plan
Northeast Turbines

STATE OF NEW HAMPSHIRE MICHAEL J. LEO No. 7146 LICENSED PROFESSIONAL ENGINEER

Drawing Number

C-5.1

Sheet 27 of 68

Project Number
52036.00

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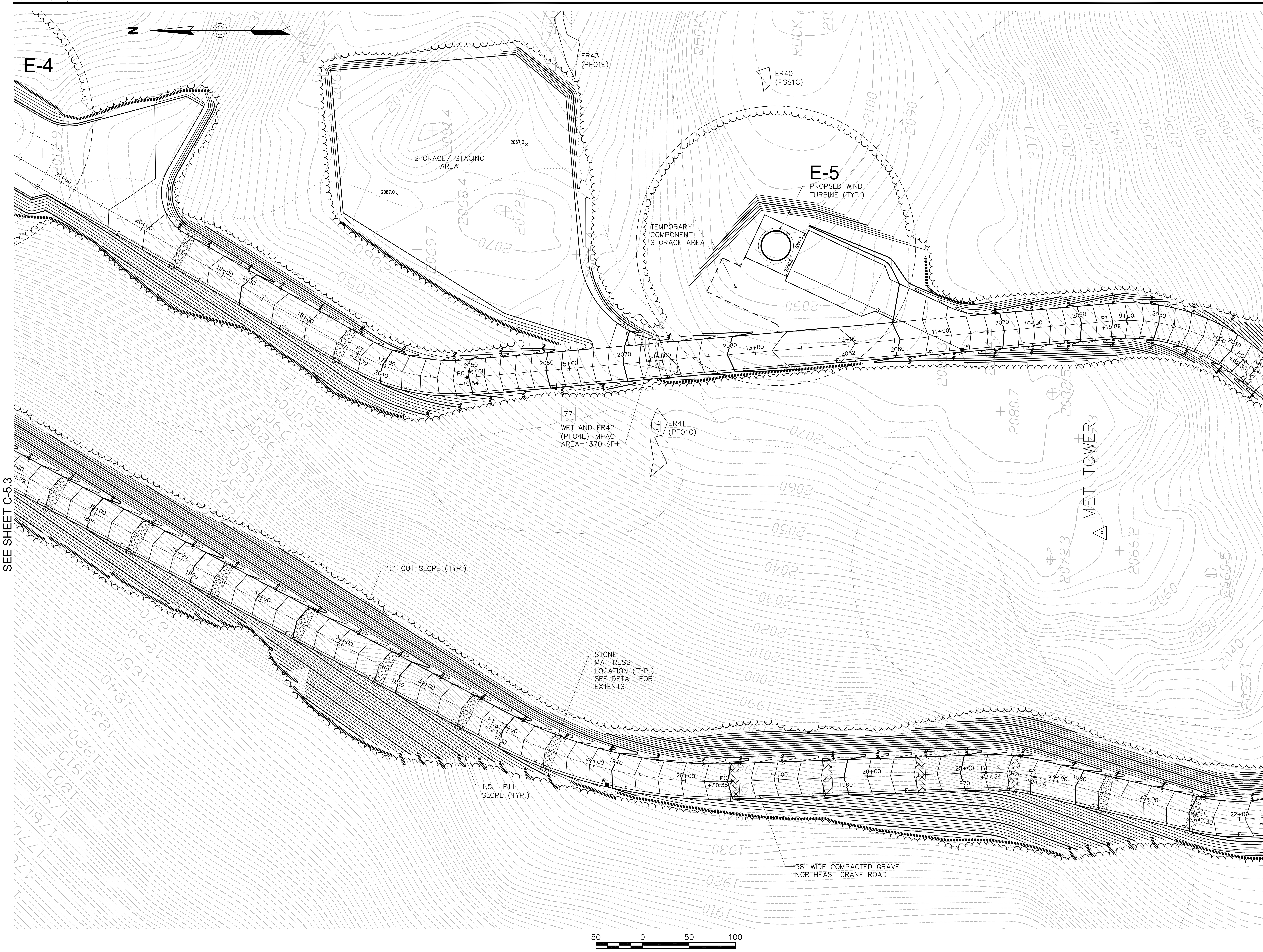

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Drawing Title
Preliminary Site Plan Northeast Turbines

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Drawing Number
C-5.2

Sheet 28 of 68

Project Number
52036.00

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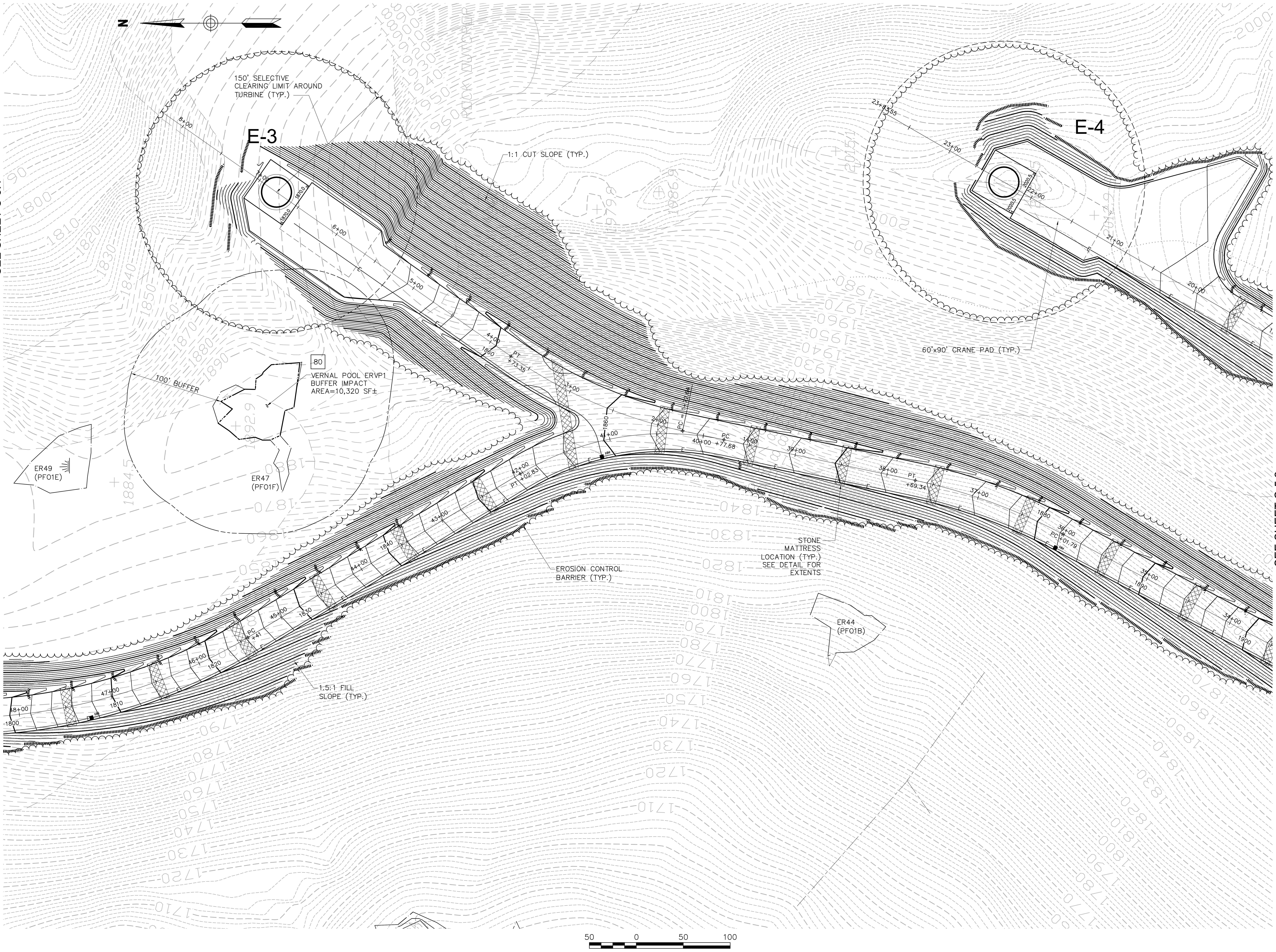

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Site Plan Southeast Turbines

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C-5.3

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Site Plan
Northeast Turbines

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Sheet 30 of 68

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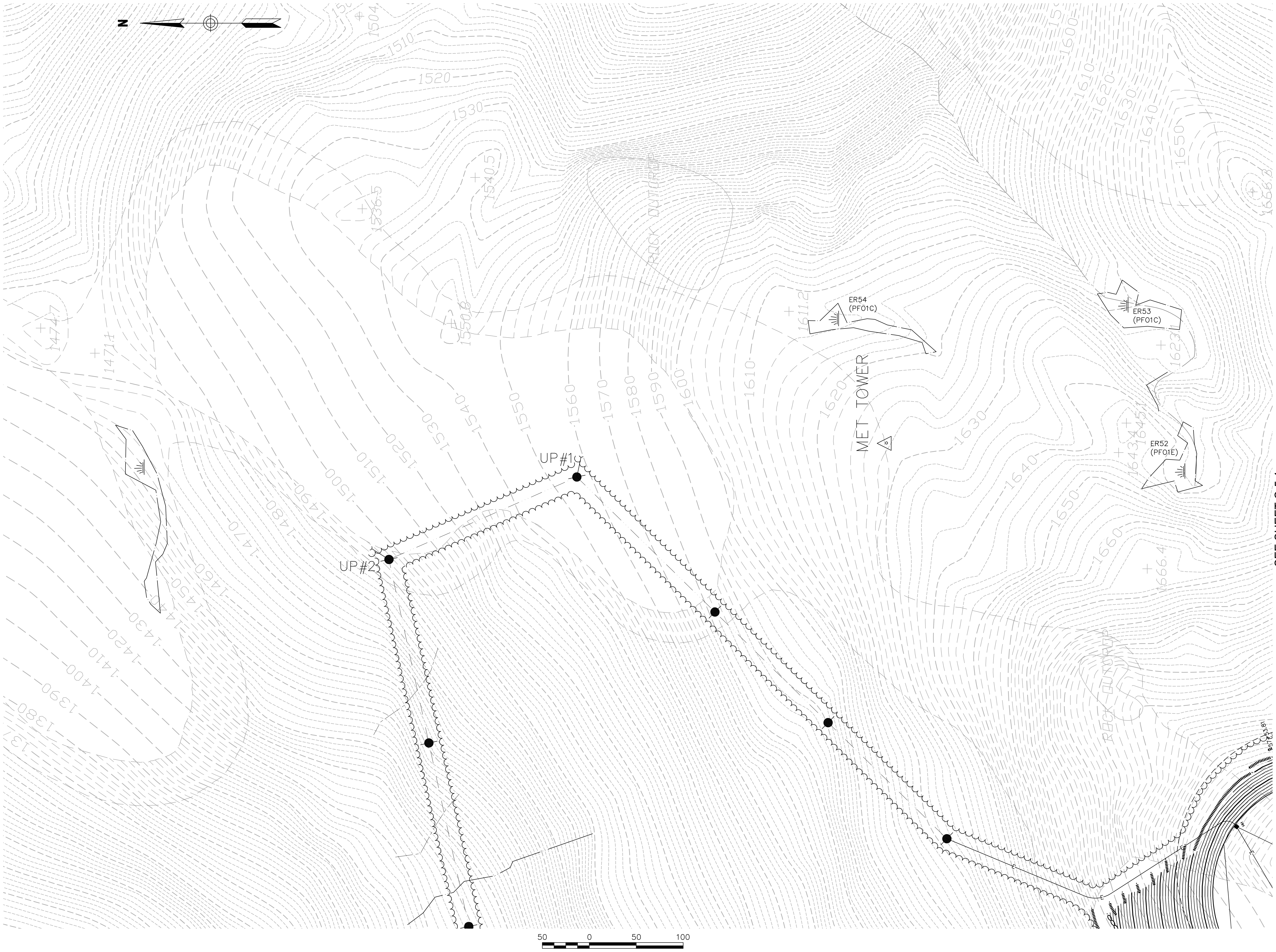

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Site Plan
Northeast Turbines

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C-5.5

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Project Number
52036.00

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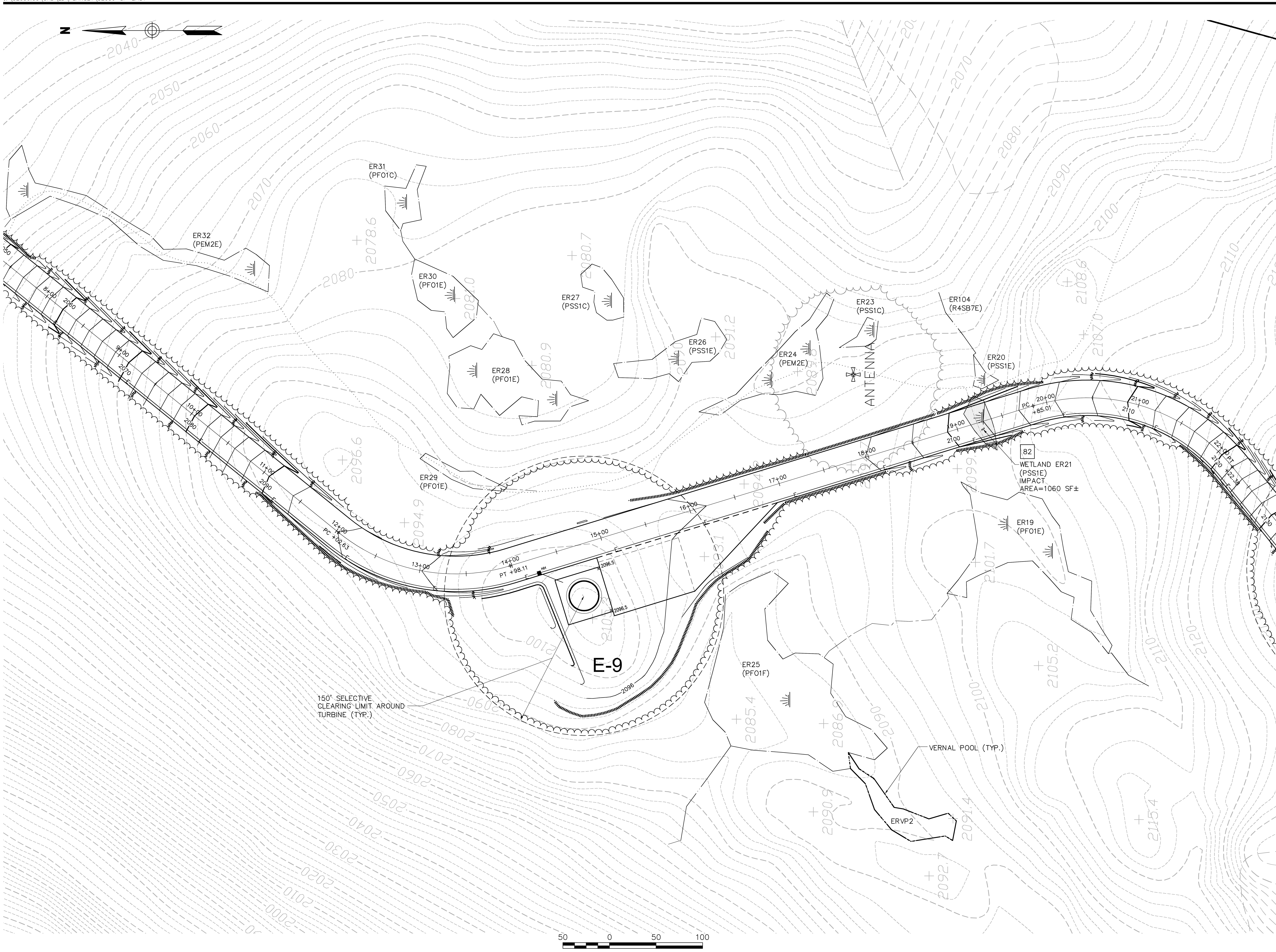

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Site Plan
Southeast Turbines

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Drawing Number

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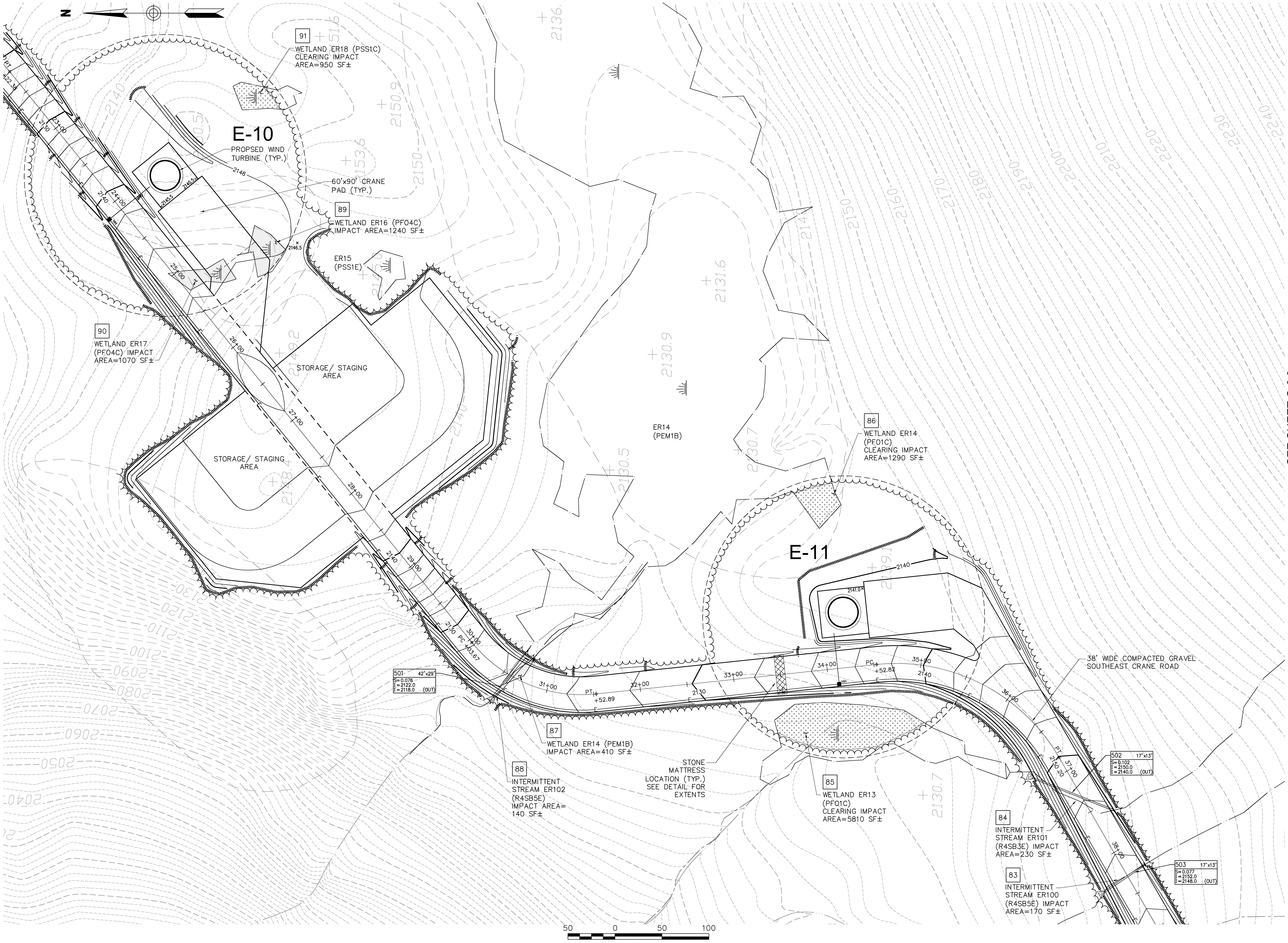

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Site Plan
Southeast Turbines

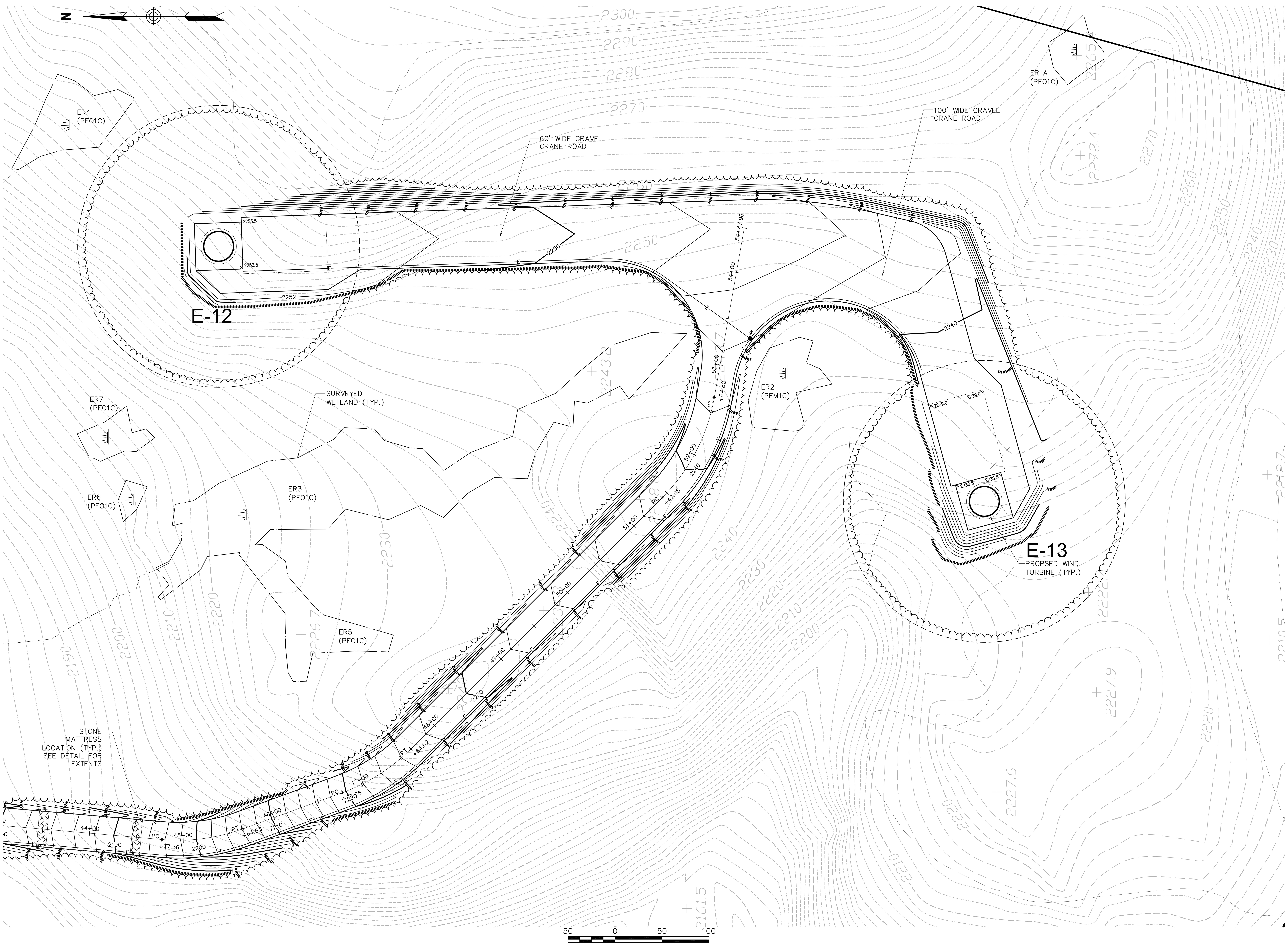
STATE OF NEW HAMPSHIRE
MICHAEL J. LEO
No. 7146
LICENSED
PROFESSIONAL

Drawing Number

C-6.3

Sheet 34 of 68

Project Number
52036.00



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IBERDROLA RENEWABLES

STATE OF NEW HAMPSHIRE
NANCY B. RENDALL
No. 073
CERTIFIED WETLAND SCIENTIST

No.	Revision	Date	Appvd.

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Scale 1"=50'		Date February 12, 2010

Project Title
Groton Wind Farm

Groton Hollow Road
Groton, New Hampshire

Issued for
Permitting

Not Approved for Construction

Drawing Title
Site Plan
Southeast Turbines

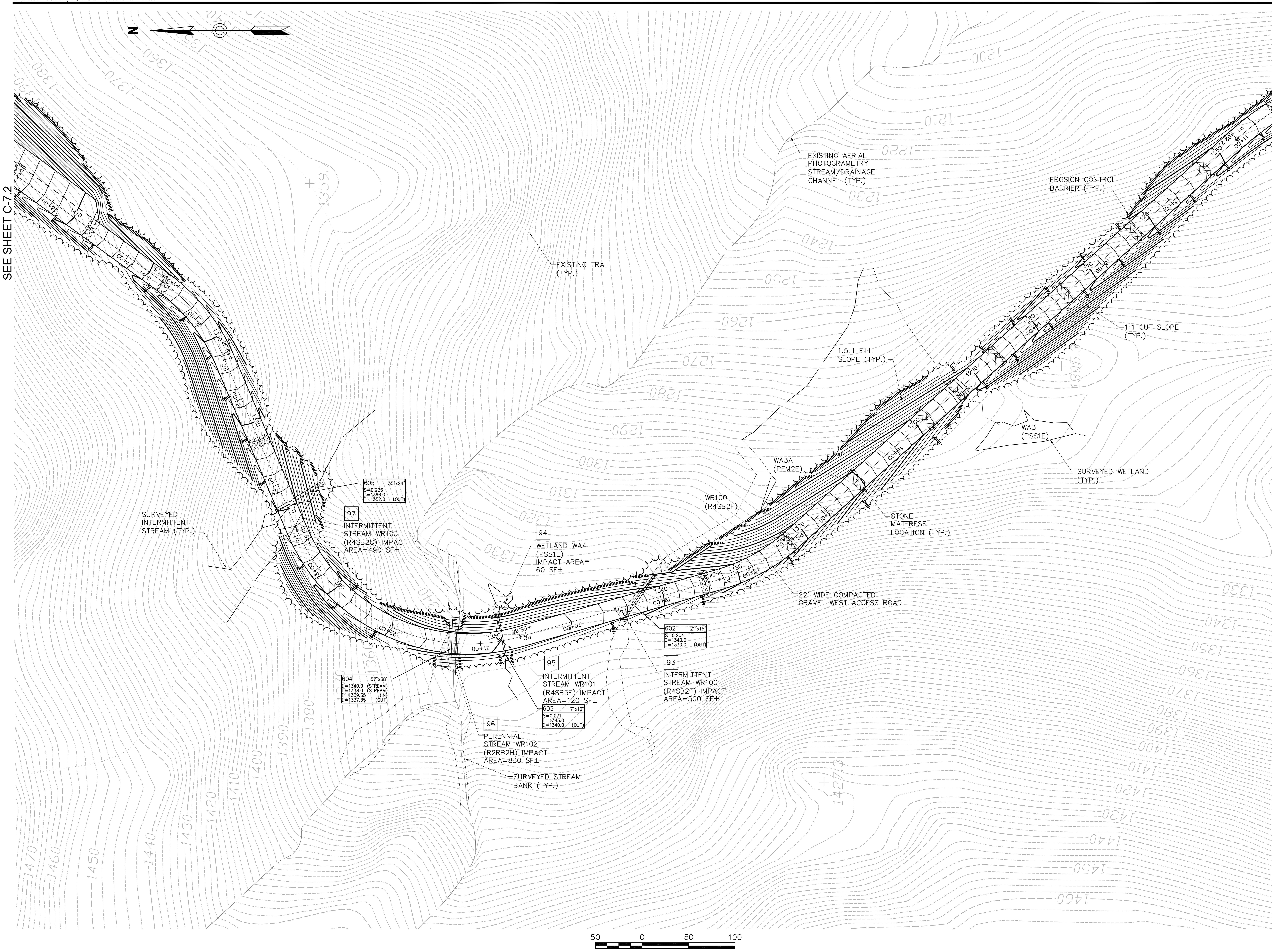
STATE OF NEW HAMPSHIRE
MICHAEL J. LEO
No. 7146
LICENSED
PROFESSIONAL ENGINEER

Drawing Number
C-6.4

Sheet 35 of 68

Project Number
52036.00

52036-SP-EAST.DWG



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Site Plan
West Access Road

STATE OF NEW HAMPSHIRE MICHAEL J. LEO No. 7146 LICENSED PROFESSIONAL

Drawing Number

C-7.1

Sheet 36 of 68

Project Number
52036.00

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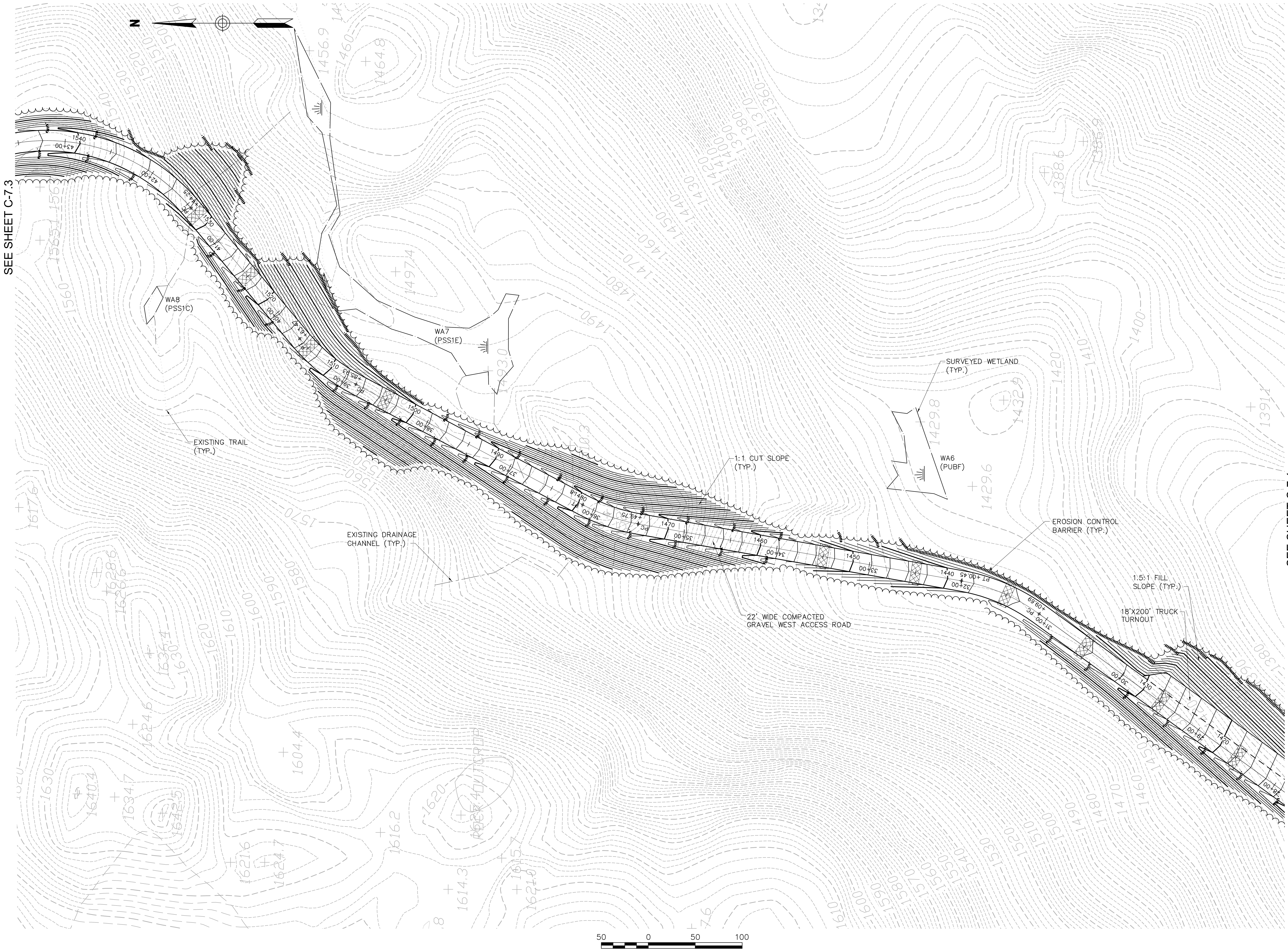

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Site Plan
West Access Road

STATE OF NEW HAMPSHIRE
MICHAEL J. LEO
No. 7146
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Drawing Number

C-7.2

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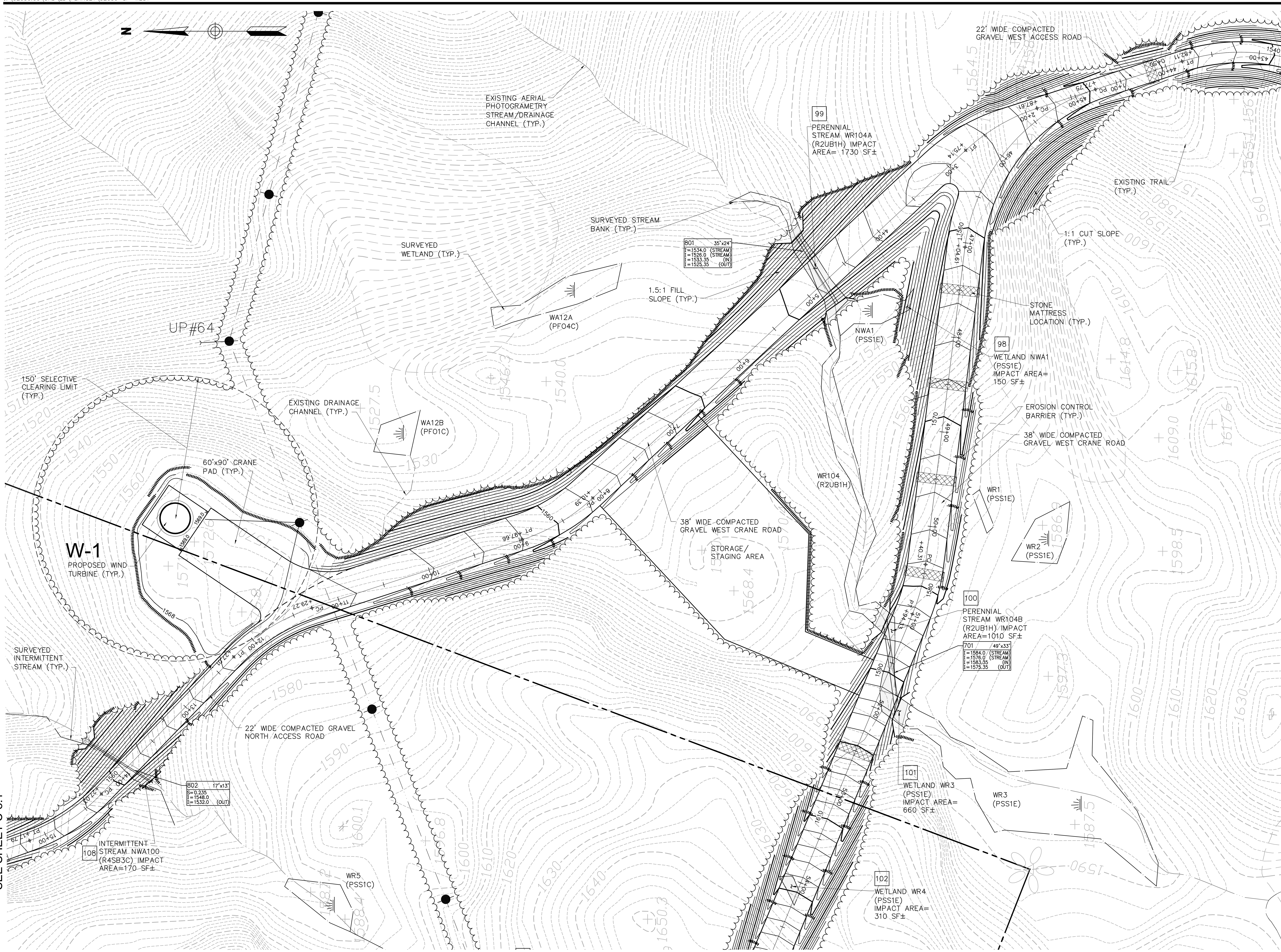

SEE SHEET C-7.2

SEE SHEET C-8.1

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SEE SHEET C-7.4

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Site Plan
West Access Road

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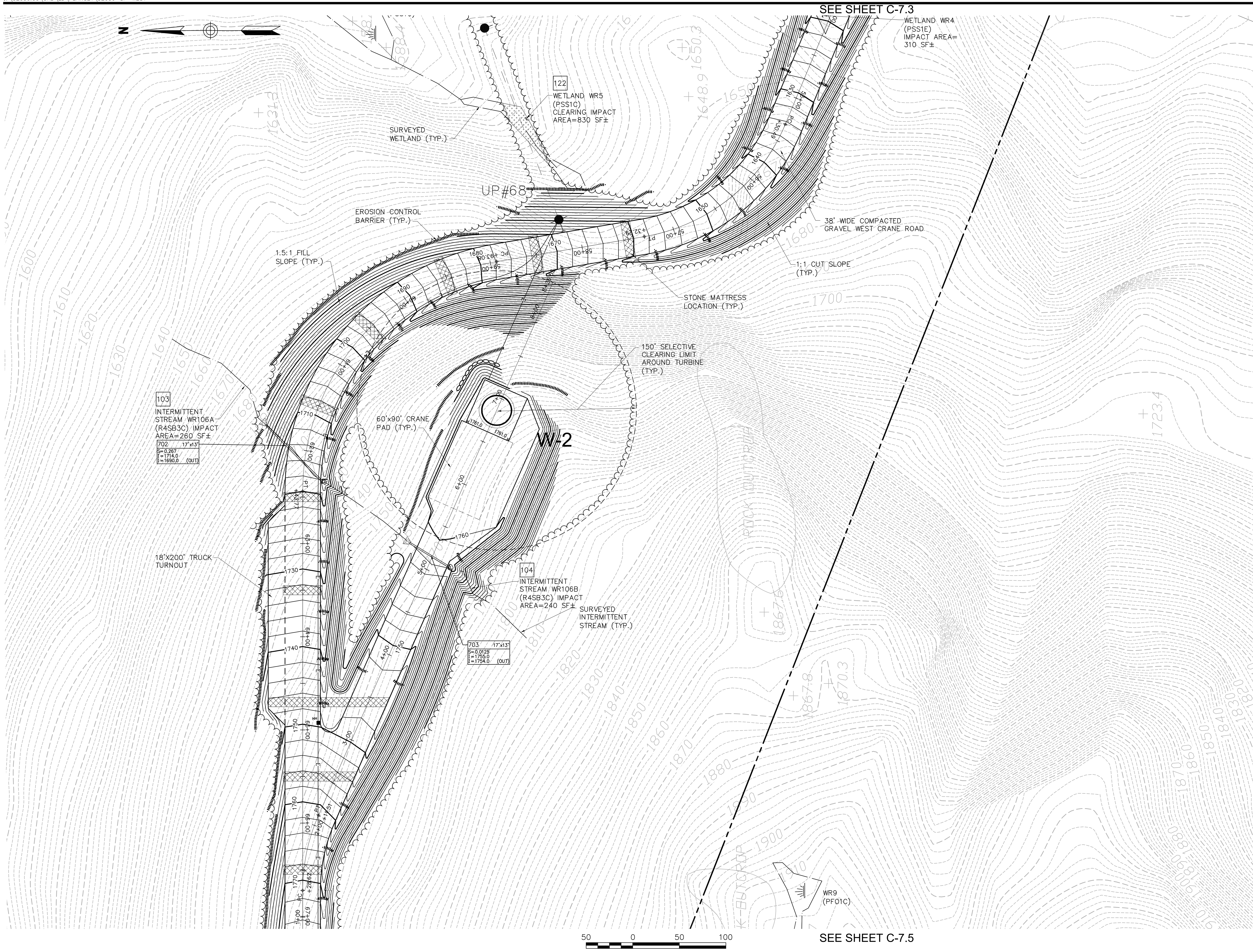

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Site Plan West Turbines

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Drawing Number

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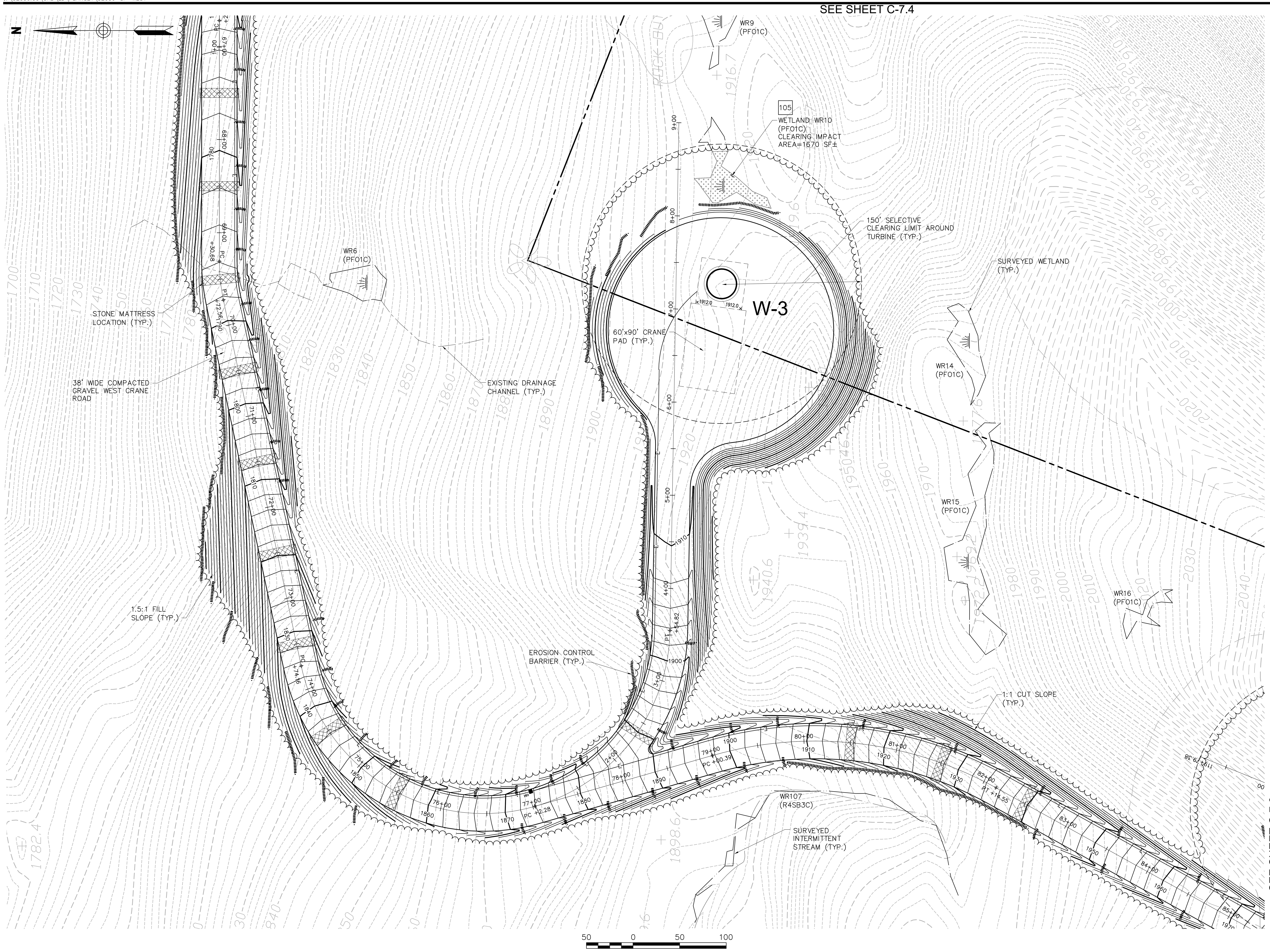

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Site Plan
West Turbines

STATE OF NEW HAMPSHIRE
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Sheet 40 of 68

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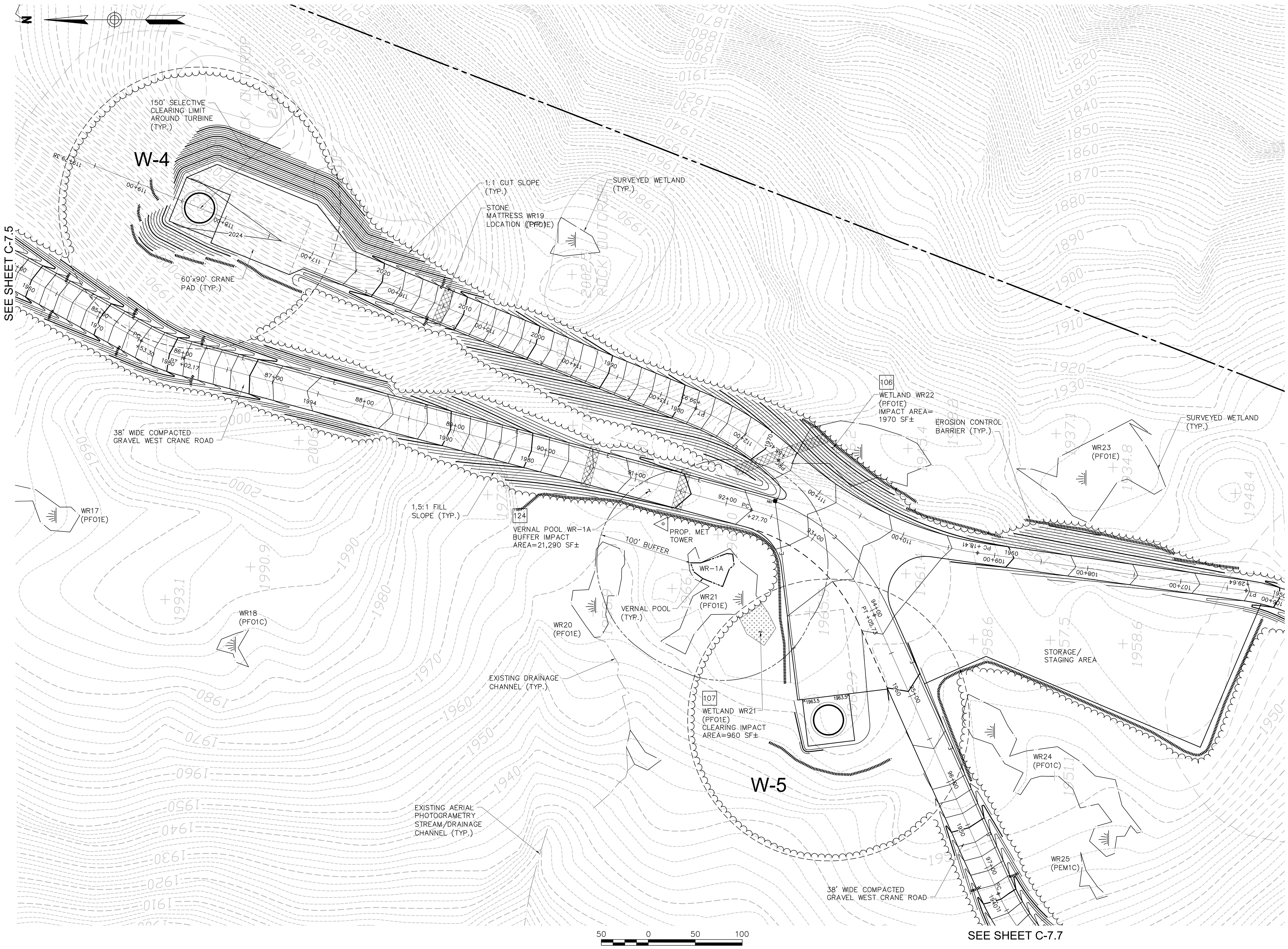

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Site Plan West Turbines

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Drawing Number
C-7.6

Sheet 41 of 68

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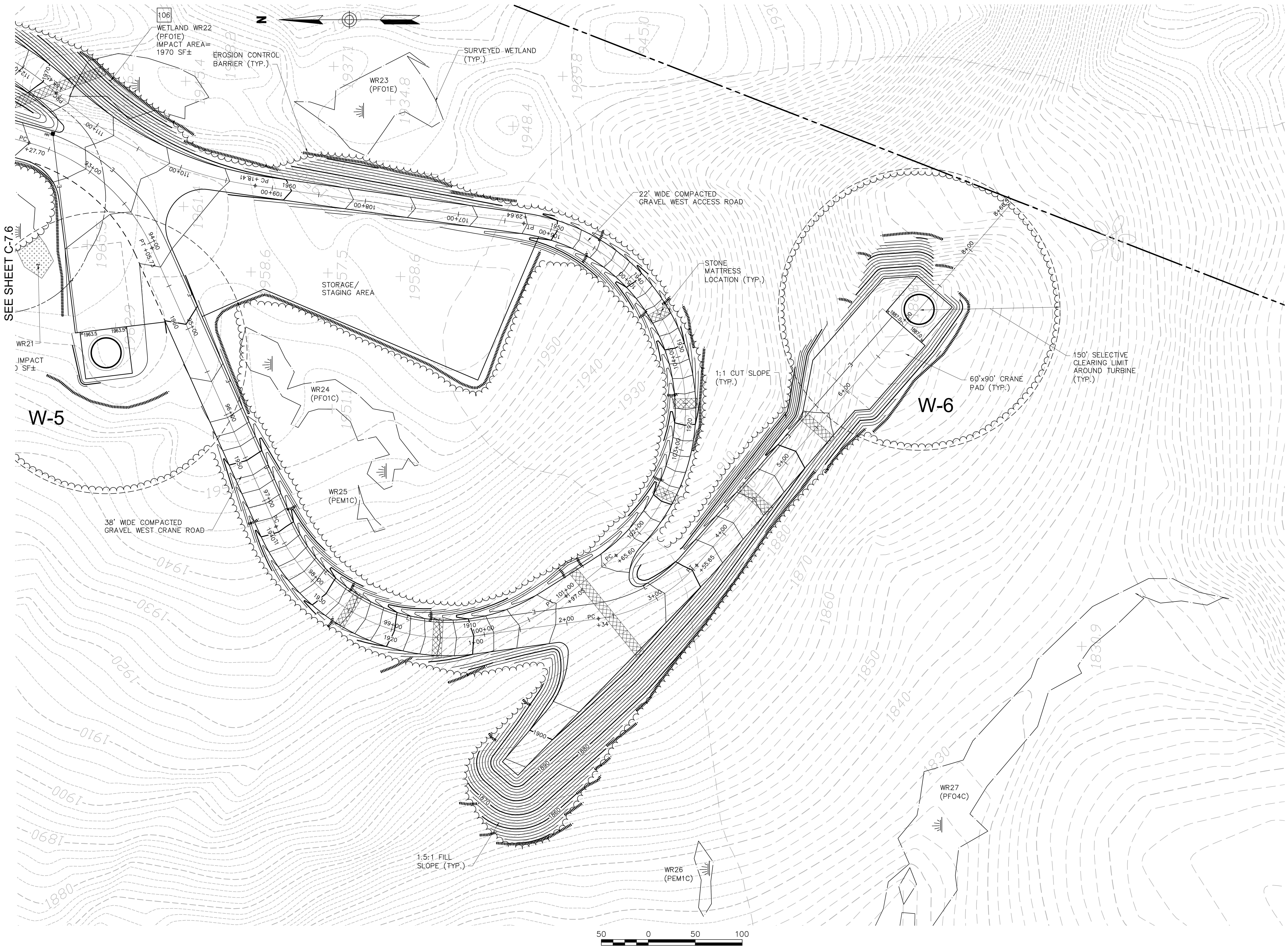

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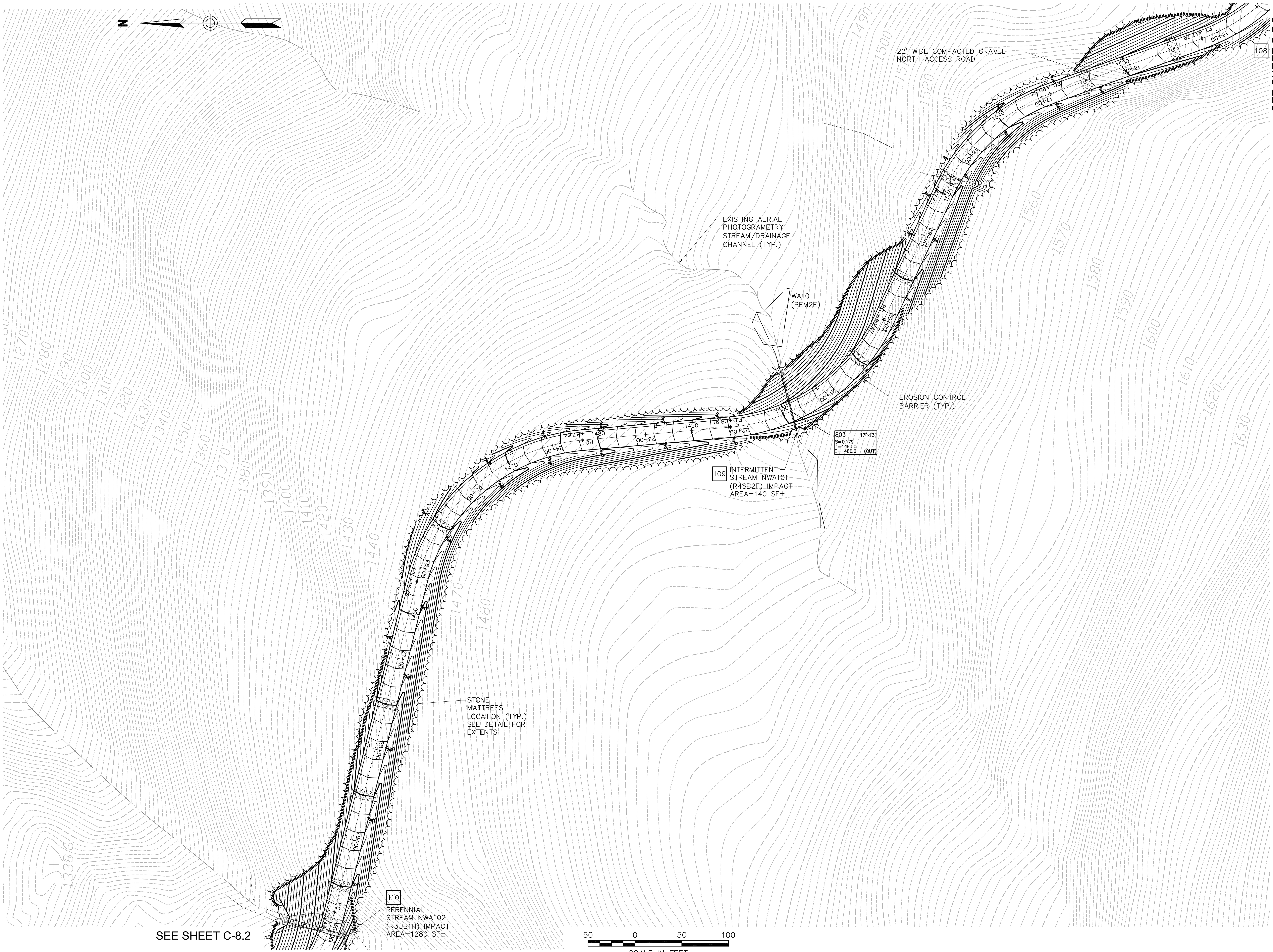

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Site Plan
North Access Road

STATE OF NEW HAMPSHIRE
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No. 7146
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Drawing Number

C-8.1

Sheet 43 of 68

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52036.00

SEE SHEET C-8.1

SEE SHEET C-8.3

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Site Plan
North Access Road

STATE OF NEW HAMPSHIRE
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Drawing Number

C-8.2

Sheet 44 of 68

Project Number
52036.00

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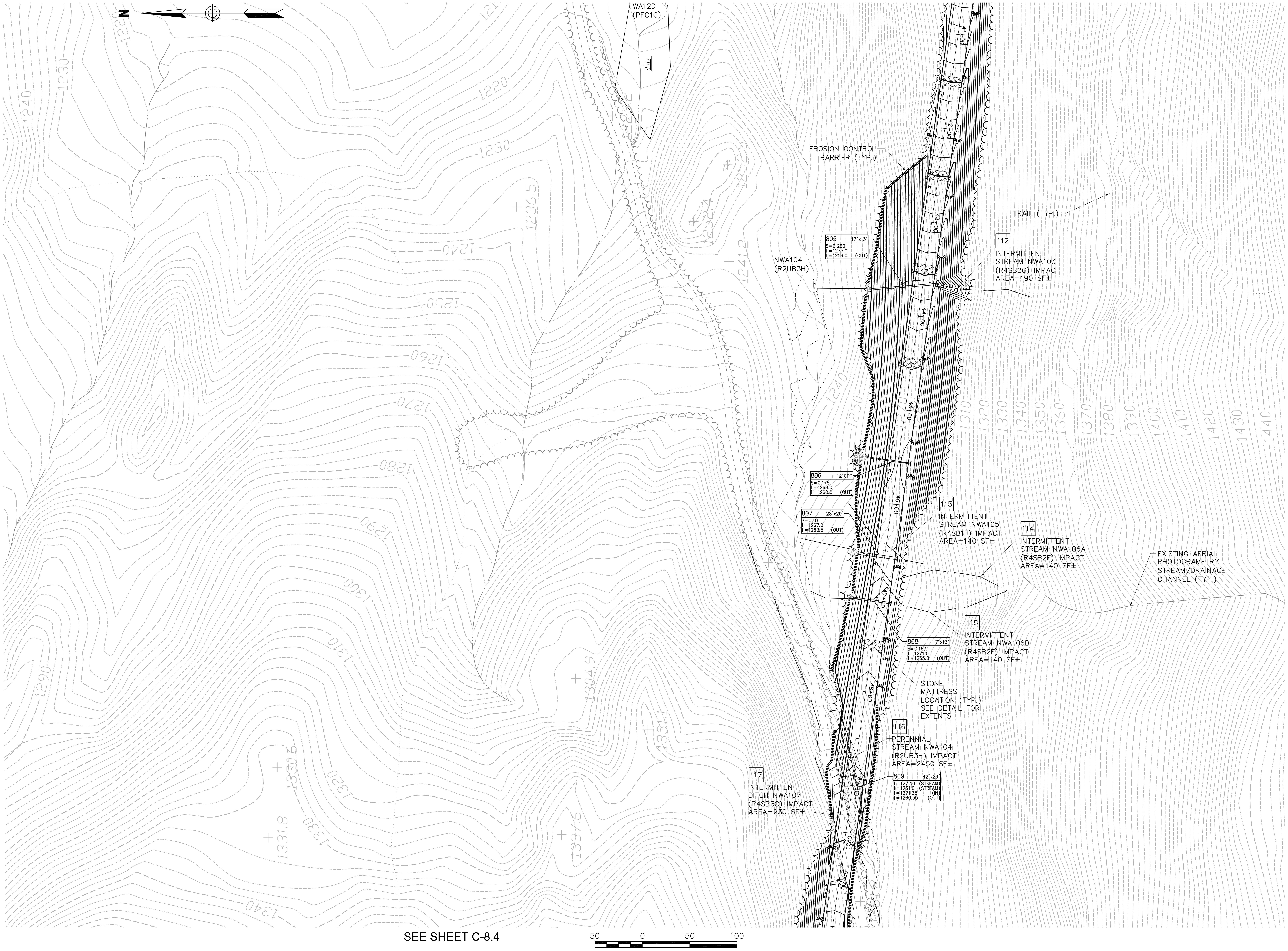

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Drawing Number

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Sheet 45 of 68

Project Number
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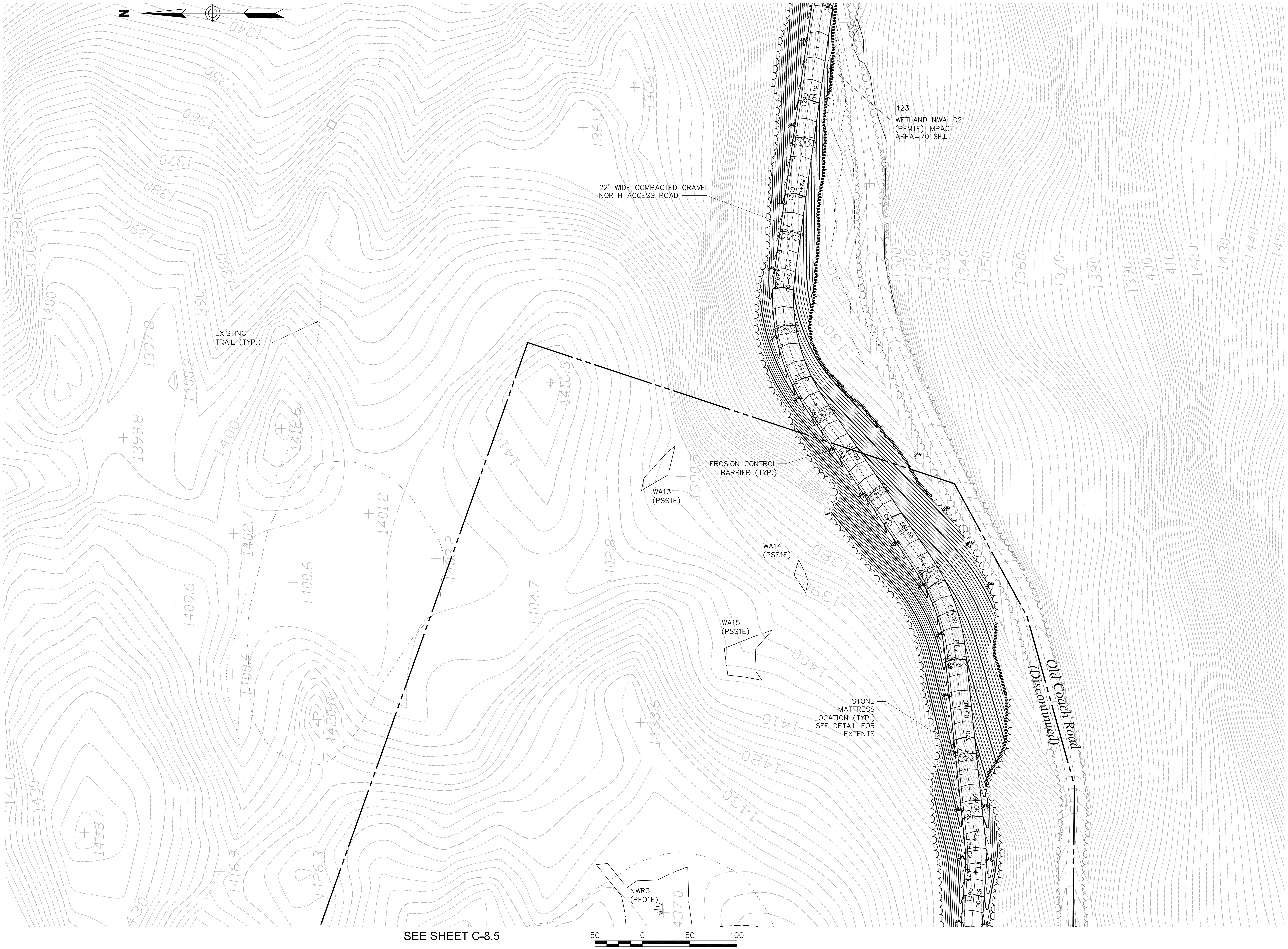

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Groton Wind Farm

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Site Plan
North Access Road

STATE OF NEW HAMPSHIRE
MICHAEL J. LEO
No. 7146
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PROFESSIONAL

Drawing Number

C-8.4

Sheet 46 of 68

Project Number
52036.00

SEE SHEET C-8.4

SEE SHEET C-9.2

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Site Plan
North Turbines

STATE OF NEW HAMPSHIRE
MICHAEL J. LEO
No. 7146
LICENSED PROFESSIONAL

Drawing Number

C-9.1

Sheet 47 of 68

Project Number
52036.00

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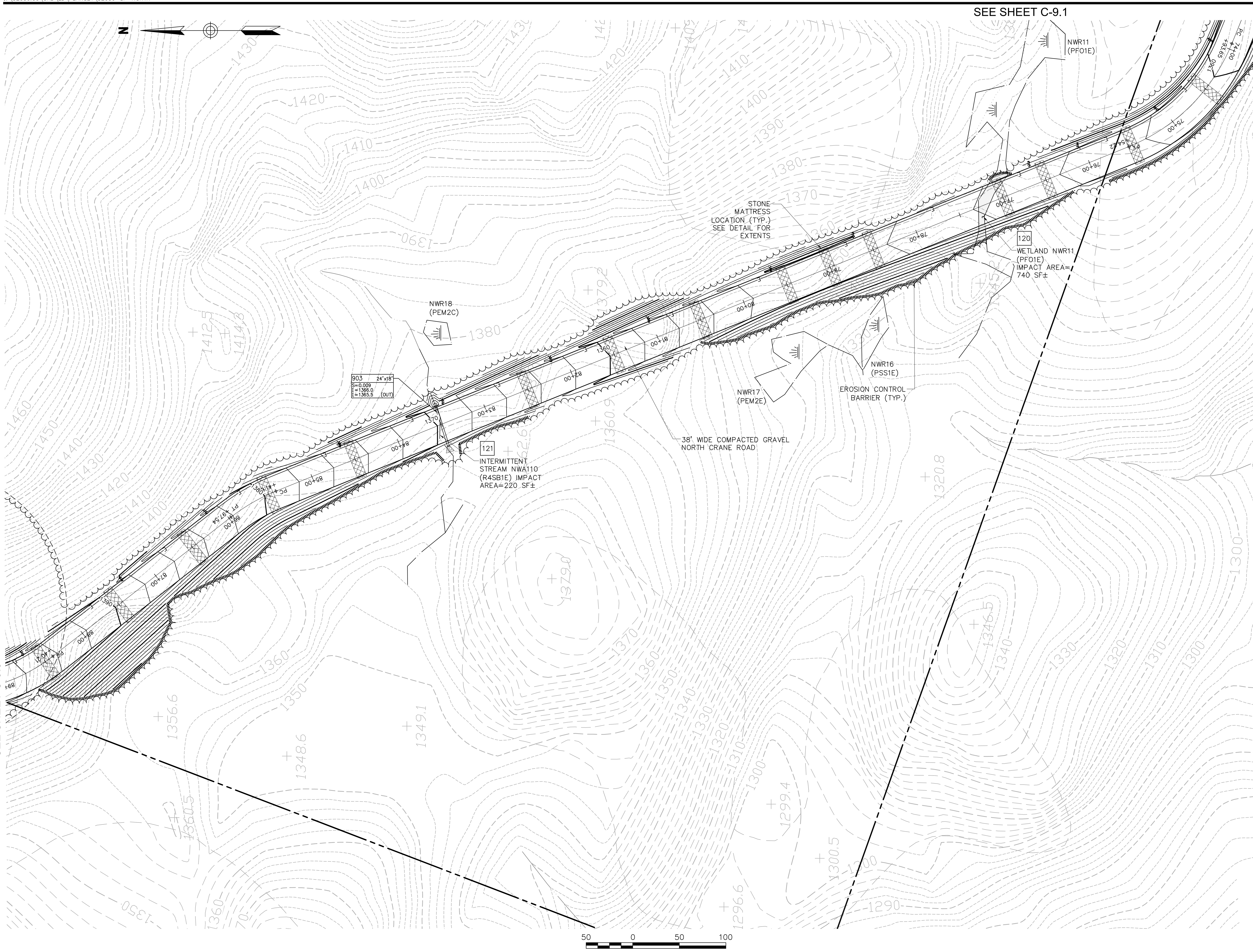

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North Turbines

STATE OF NEW HAMPSHIRE
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Drawing Number

C-9.2

Sheet 48 of 68

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52036.00

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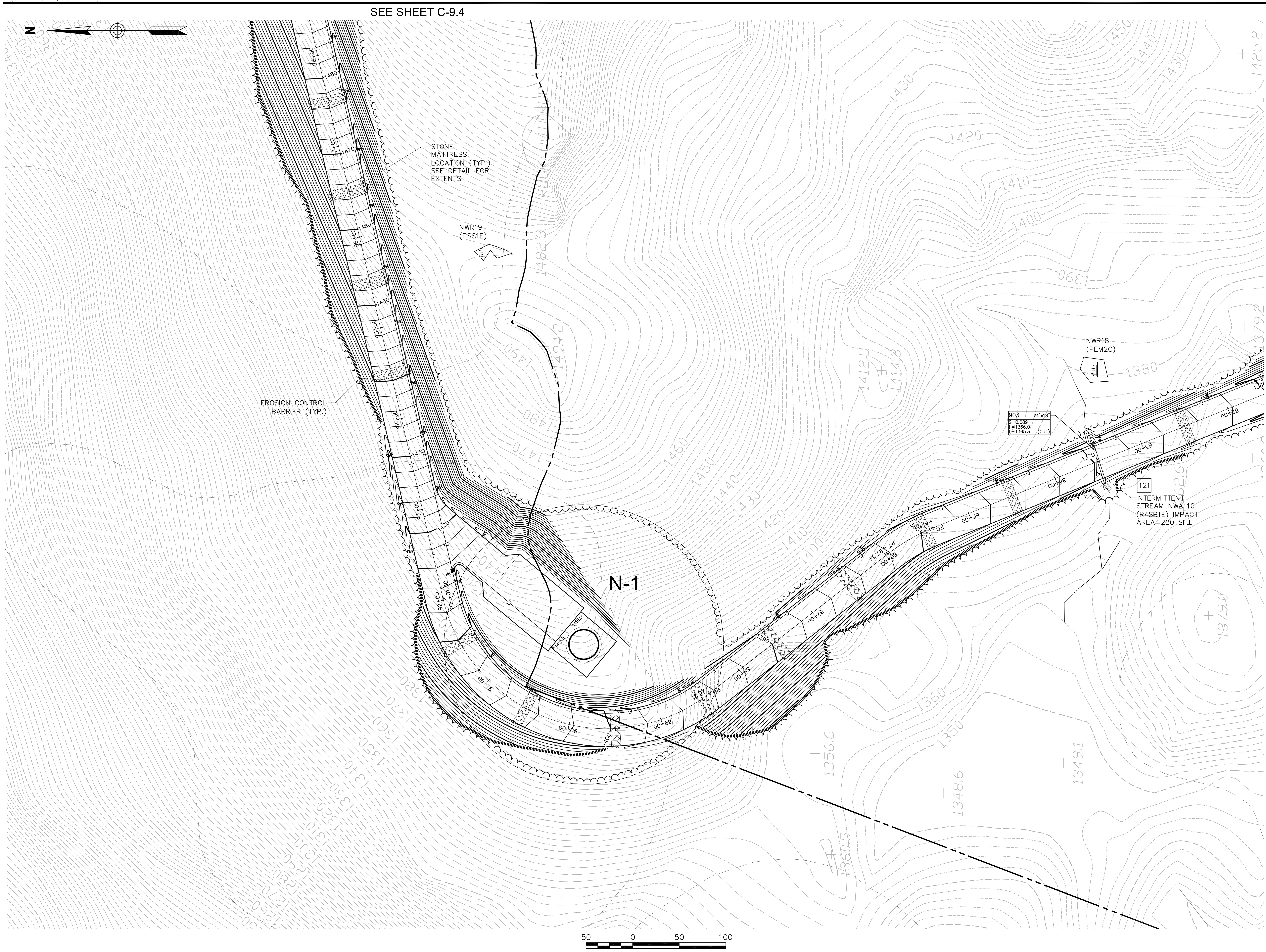

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Site Plan
North Turbines

STATE OF NEW HAMPSHIRE MICHAEL J. LEO No. 7146 LICENSED PROFESSIONAL

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C-9.3

Sheet 49 of 68

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SEE SHEET C-9.5

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North Turbines

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No. 7146
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Drawing Number
C-9.4

Sheet 50 of 68

Project Number
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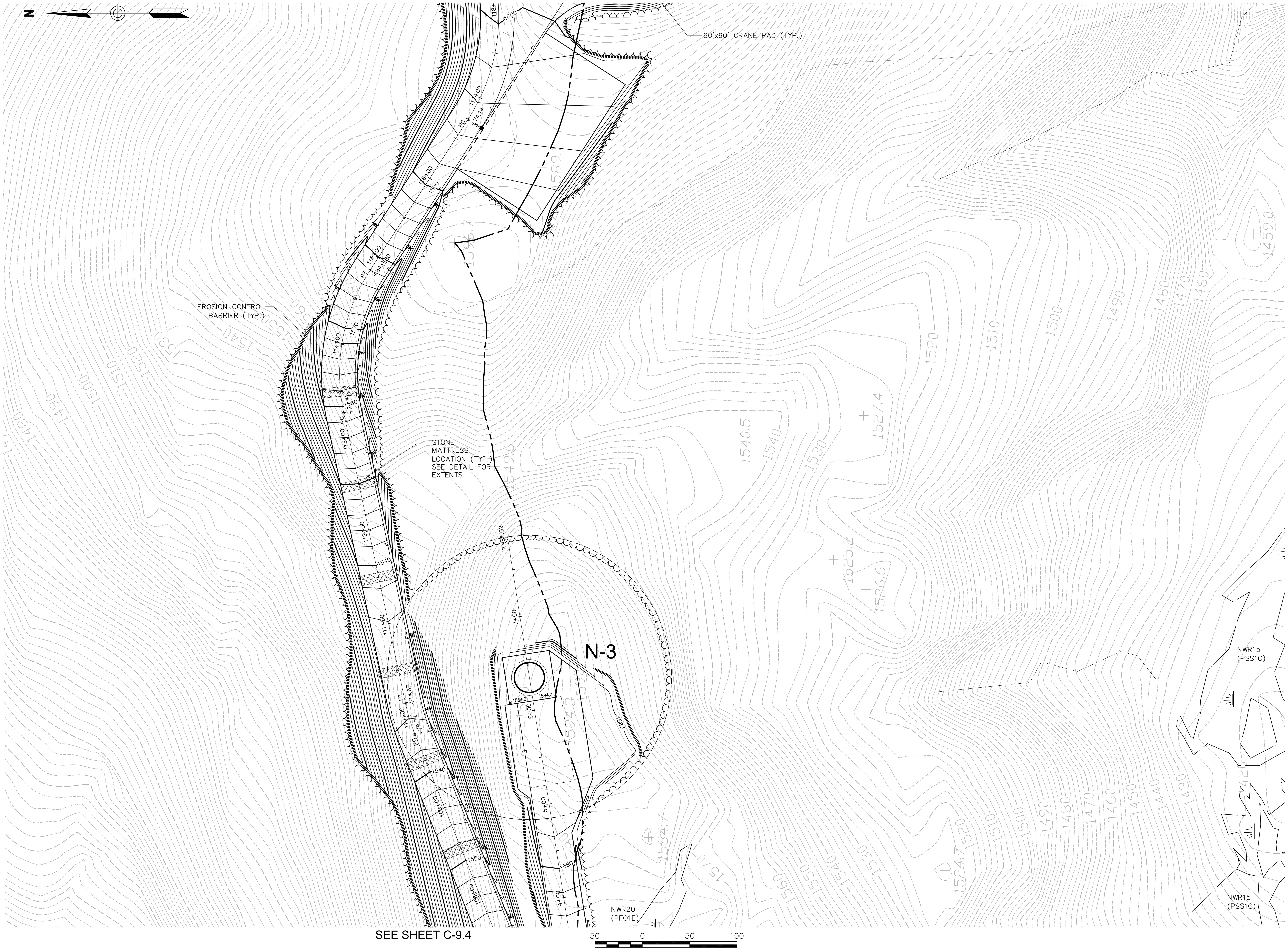

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52036.00

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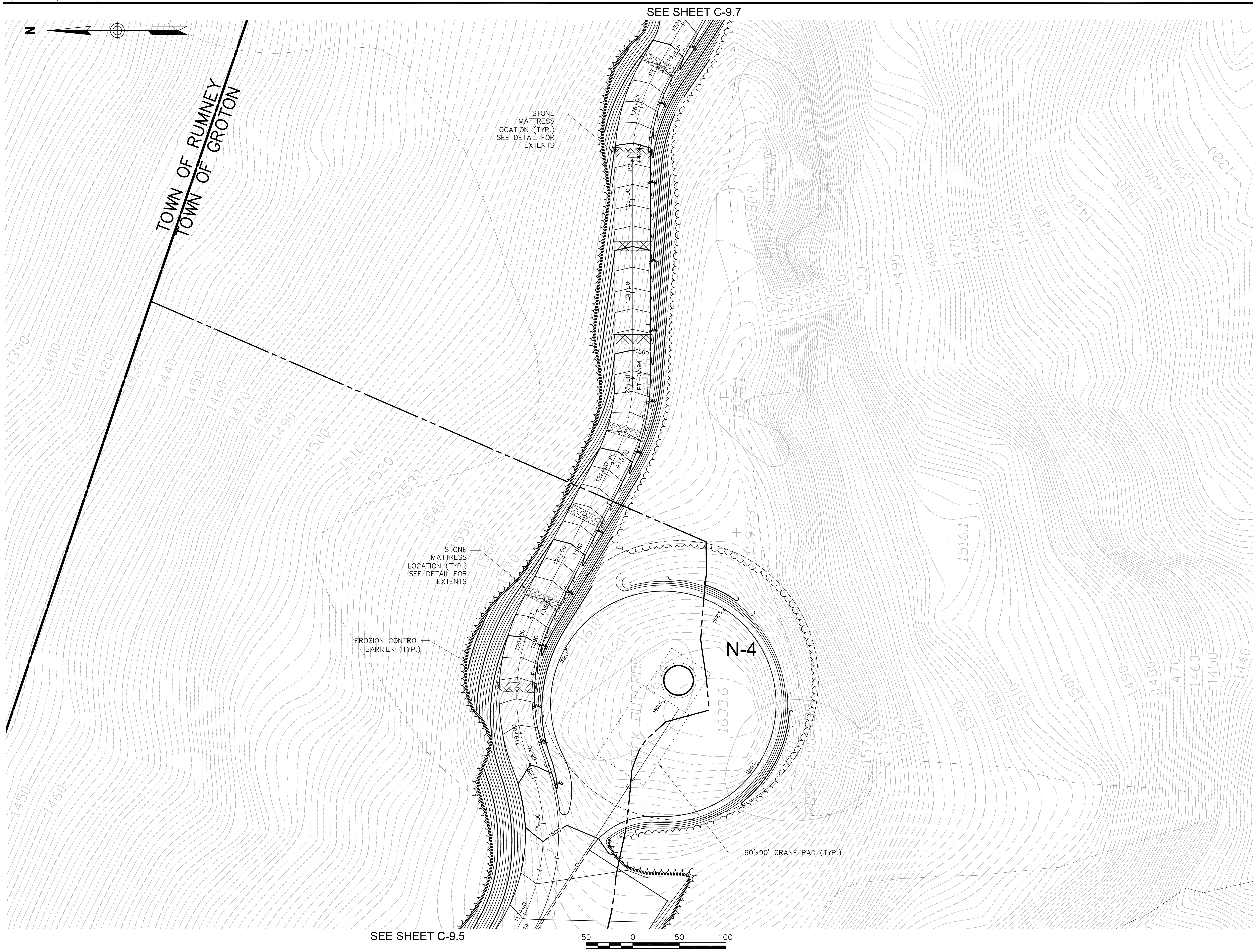

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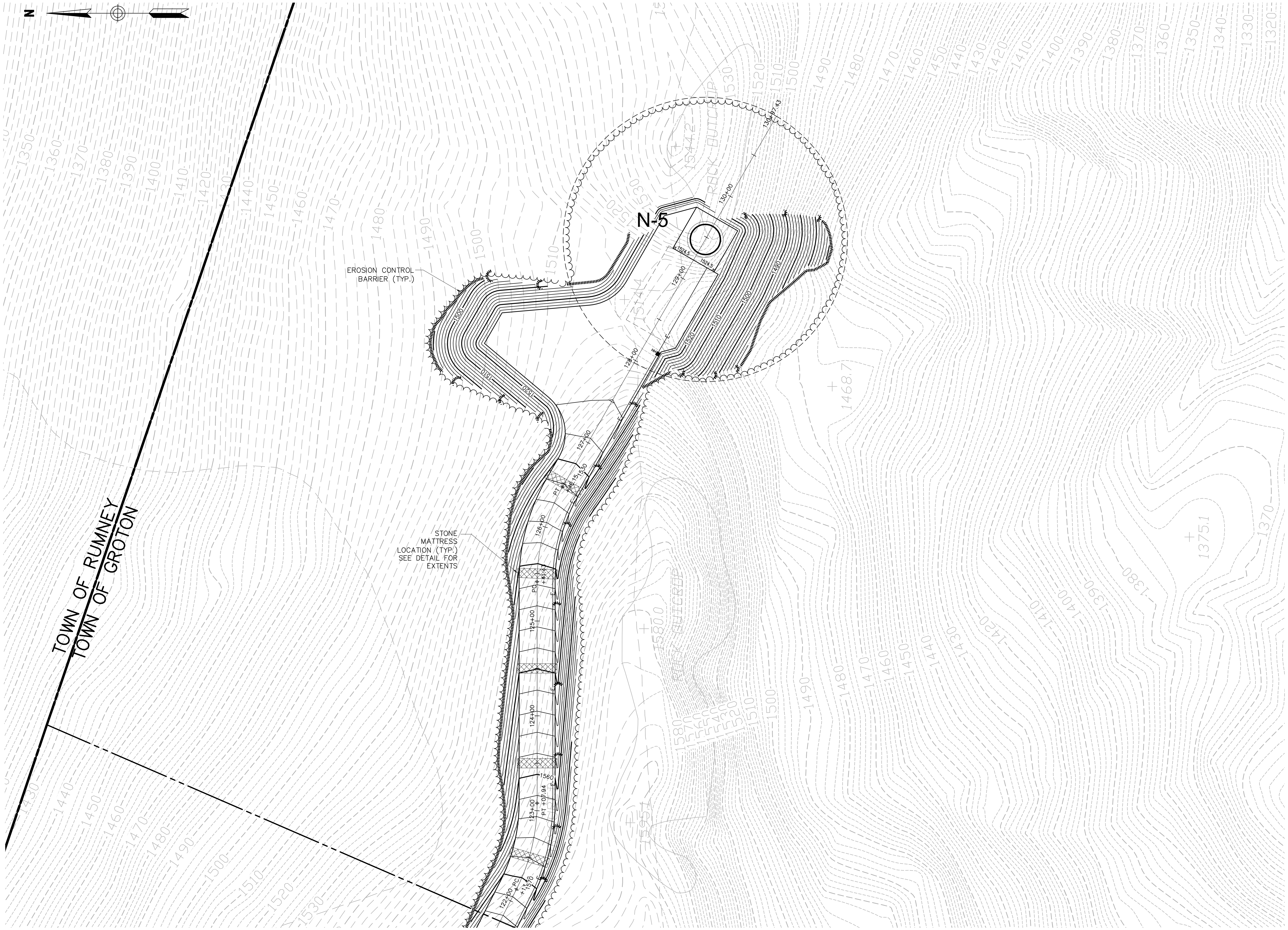

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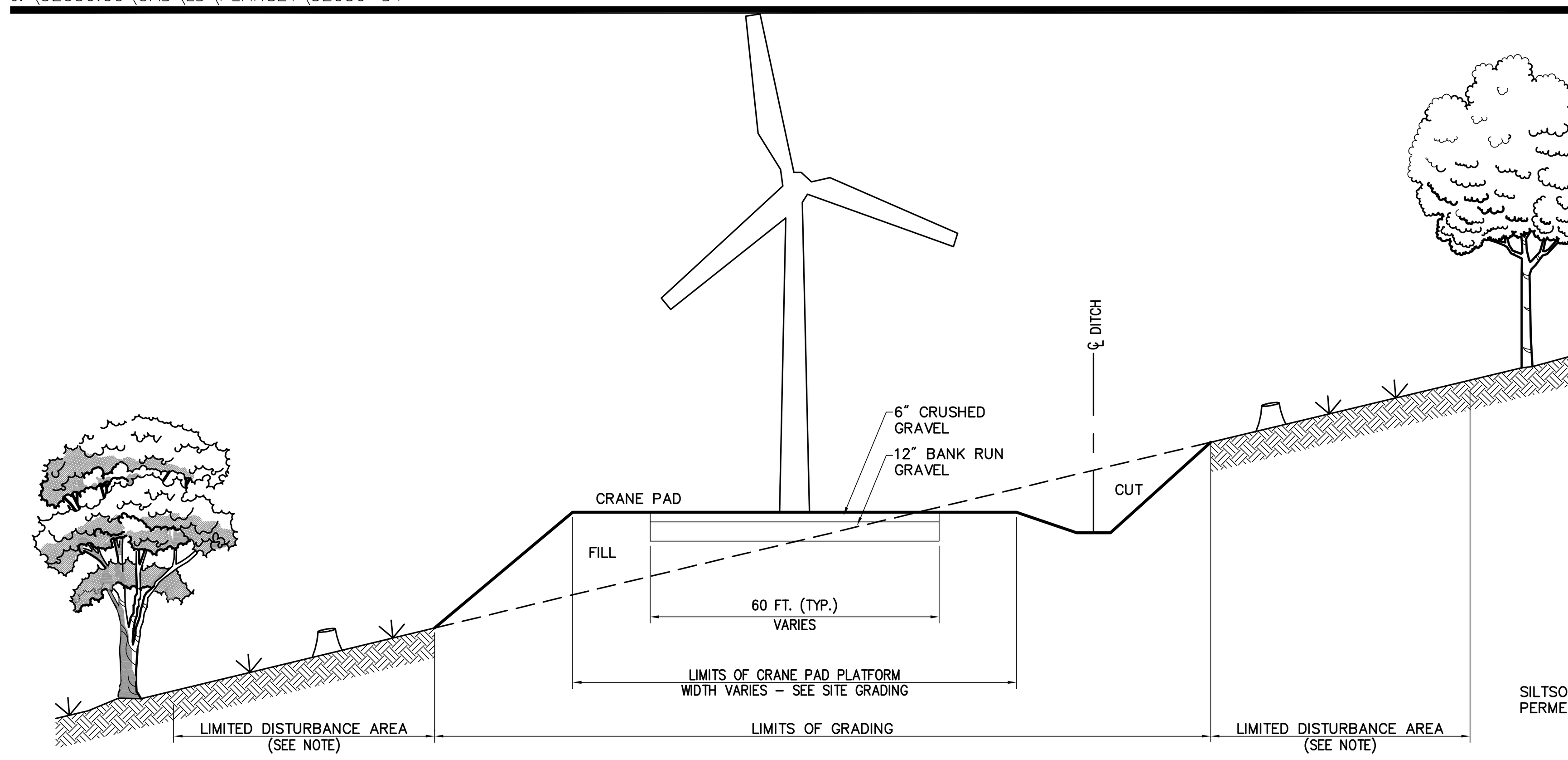
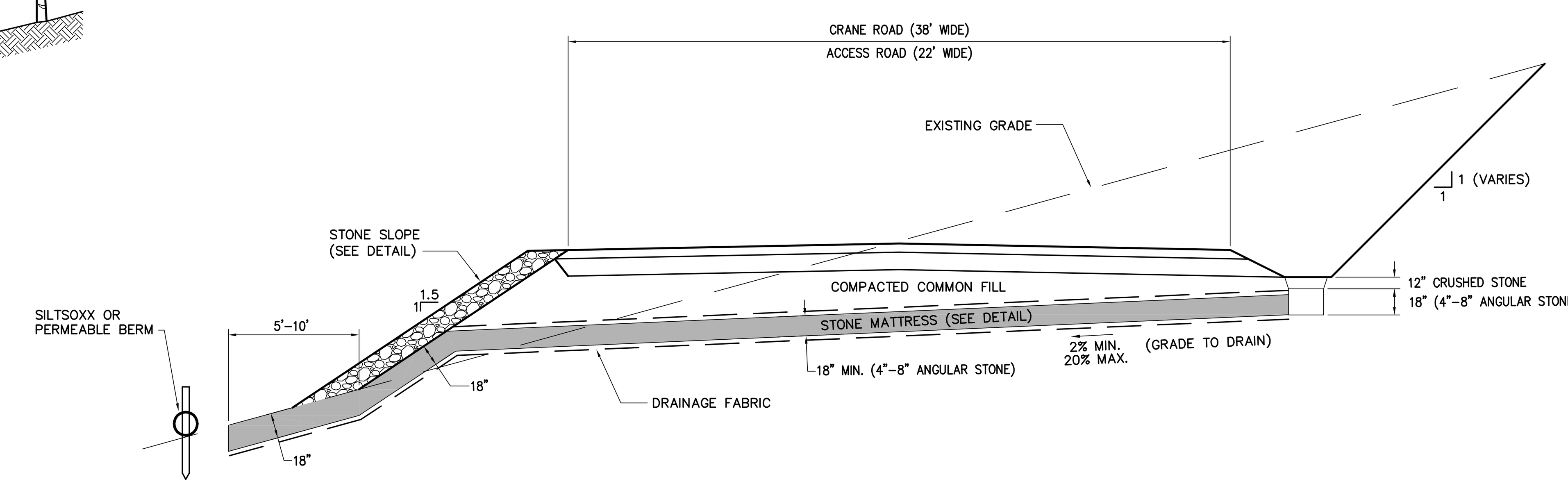


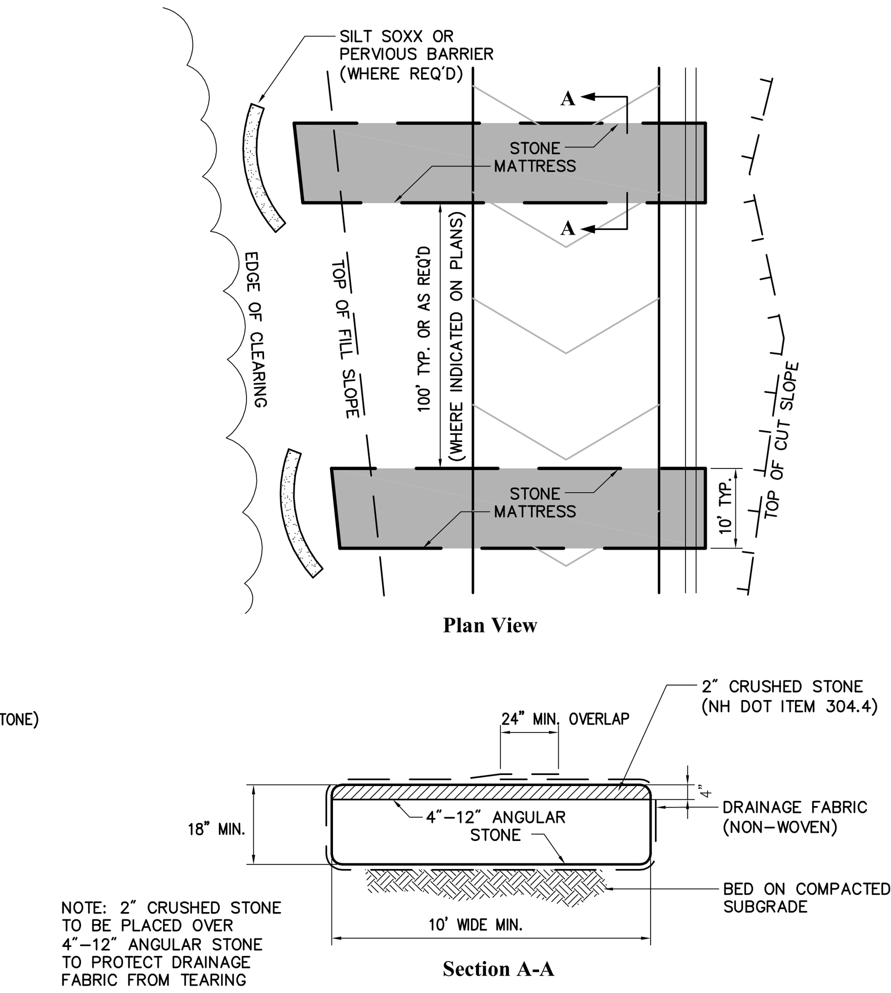
Notes:

1. WITHIN LIMITED DISTURBANCE AREA EXISTING TREES ARE TO BE LOGGED (REMOVED) AND TREES STUMPS ARE TO REMAIN. MINIMAL DISTURBANCES TO AREA SHALL BE ALLOWED ONLY AS REQUIRED FOR REMOVAL OF TREES AND ERECTION OF WIND TURBINE BLADES. IN GENERAL, THE EXISTING GROUND VEGETATION SHALL REMAIN AND NO GRUBBING SHALL OCCUR. POST-CONSTRUCTION THE AREA SHALL BE MANAGED TO PRECLUDE GROWTH OF LARGE TREES FROM INTERFERING WITH WIND TURBINE OPERATIONS AND CARE SHALL BE TAKEN TO PRESERVE AND MINIMIZE DISTURBANCES TO EXISTING GROUND VEGETATION

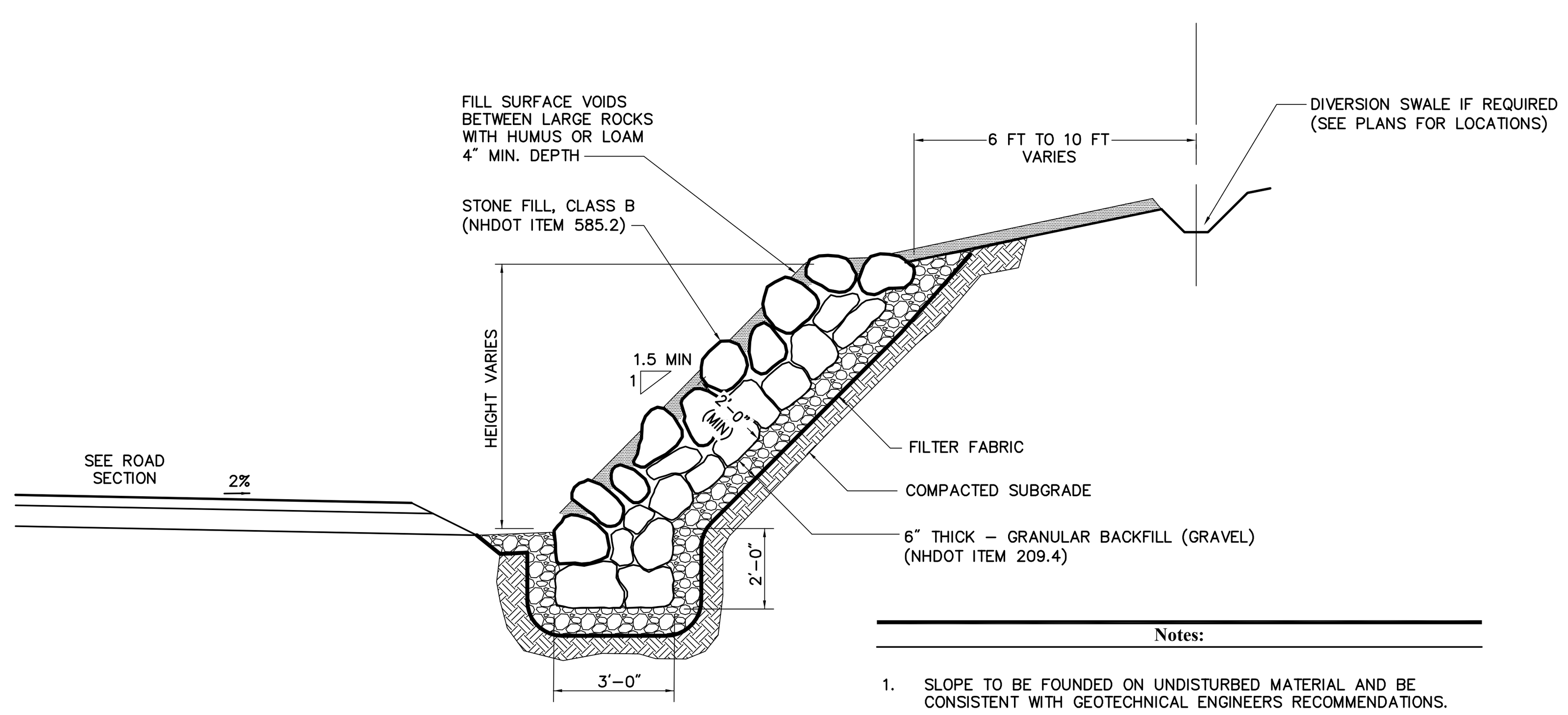
Crane Pad - Typical Section 11/09
N.T.S. Source: VHB



Typical Road Section - w/Stone Mattress 11/09
N.T.S. Source: VHB



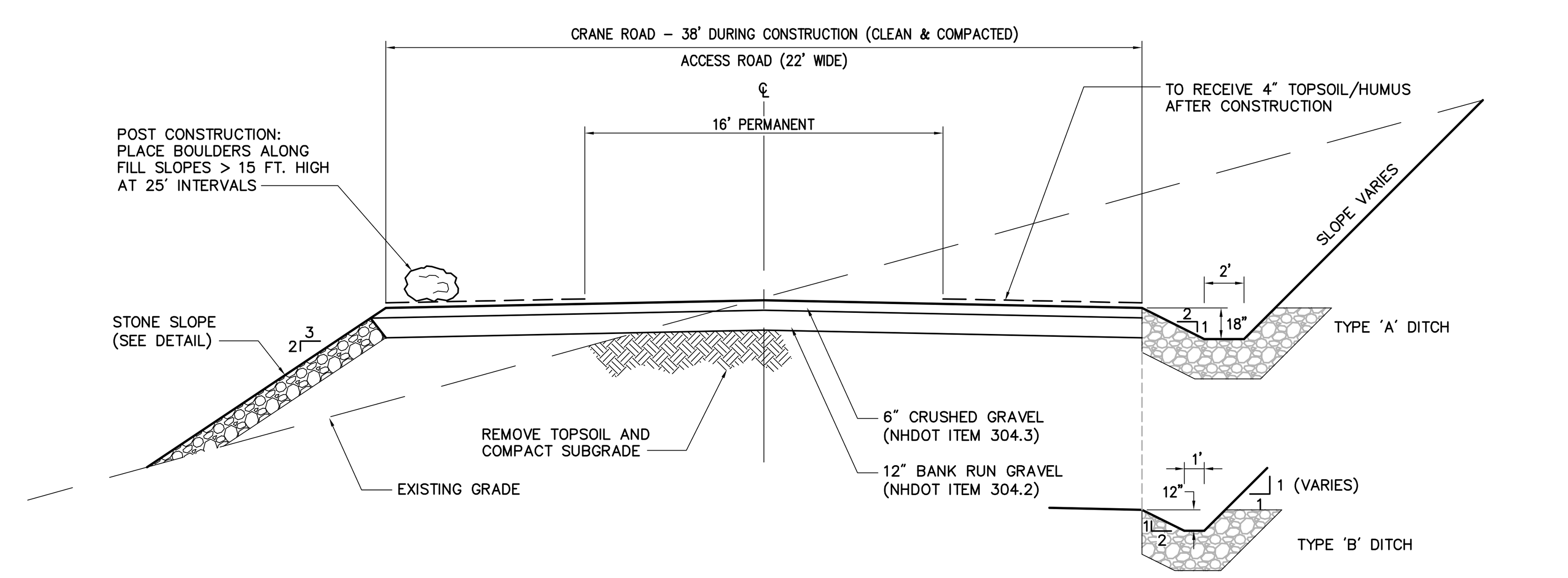
Stone Mattress Detail 11/09
N.T.S. Source: VHB



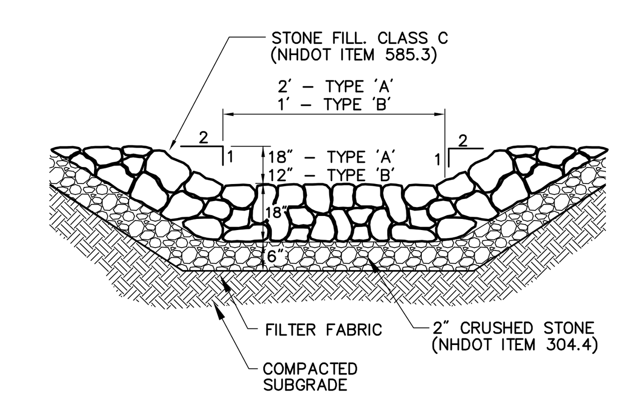
Notes:

1. SLOPE TO BE FOUNDED ON UNDISTURBED MATERIAL AND BE CONSISTENT WITH GEOTECHNICAL ENGINEERS RECOMMENDATIONS.
2. HUMUS OR LOAM TO BE PLACED IN SURFACE VOIDS ON STONE SLOPES WHERE PRACTICAL UNLESS OTHERWISE NOTED, AND TO BE THOROUGHLY "CHINKED" INTO STONE VOIDS USING GRAD-ALL OR OTHER APPROVED METHOD. SURFACE TO BE SEEDED AND MULCHED (APRIL-NOVEMBER ONLY), OR HYDROSEEDED WITH BONDED FIBER EMULSION (DIRT-GLUE OR EQUAL) AS TACKIFIER.
3. SEED MIX SHALL BE NHDOT SLOPE SEED MIX No. 44 (NHDOT ITEM 644.44).
4. LOAM AND SEED MAY BE OMITTED ON STONE SLOPES WHERE ACCESS IS DIFFICULT OR IN AREAS OF RE-OCCURING EROSION WHERE VEGETATION IS DIFFICULT TO ESTABLISH.
5. STONE SLOPES MAY BE ADJUSTED WHERE APPROVED BY GEOTECHNICAL ENGINEER.

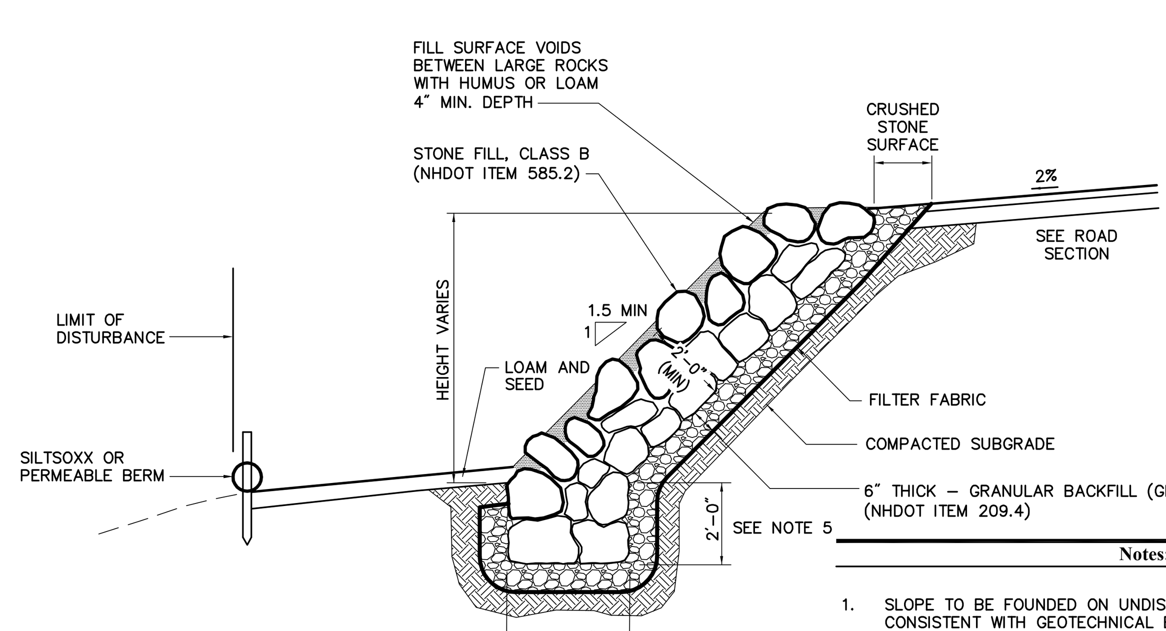
Placed Stone Slope - Cut Section REV 11/09
N.T.S. Source: VHB LD_760



Typical Road Section 11/09
N.T.S. Source: VHB



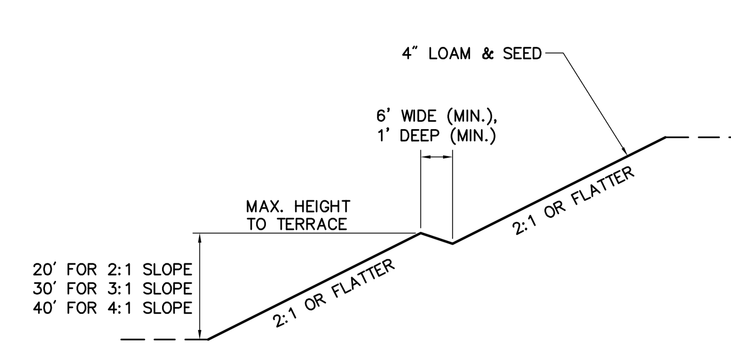
Roadside Ditch 6/08
N.T.S. Source: VHB REV LD_170



Notes:

1. SLOPE TO BE FOUNDED ON UNDISTURBED MATERIAL AND BE CONSISTENT WITH GEOTECHNICAL ENGINEERS RECOMMENDATIONS.
2. HUMUS OR LOAM TO BE PLACED IN SURFACE VOIDS ON STONE SLOPES WHERE PRACTICAL UNLESS OTHERWISE NOTED, AND TO BE THOROUGHLY "CHINKED" INTO STONE VOIDS USING GRAD-ALL OR OTHER APPROVED METHOD. SURFACE TO BE SEEDED AND MULCHED (APRIL-NOVEMBER ONLY), OR HYDROSEEDED WITH BONDED FIBER EMULSION (DIRT-GLUE OR EQUAL) AS TACKIFIER.
3. SEED MIX SHALL BE NHDOT SLOPE SEED MIX No. 44 (NHDOT ITEM 644.44).
4. LOAM AND SEED MAY BE OMITTED ON STONE SLOPES WHERE ACCESS IS DIFFICULT OR IN AREAS OF RE-OCCURING EROSION WHERE VEGETATION IS DIFFICULT TO ESTABLISH.
5. STONE SLOPES MAY BE ADJUSTED WHERE APPROVED BY GEOTECHNICAL ENGINEER.
6. STOP STONE SLOPE AT STONE MATTRESS WHERE ENCOUNTERED.

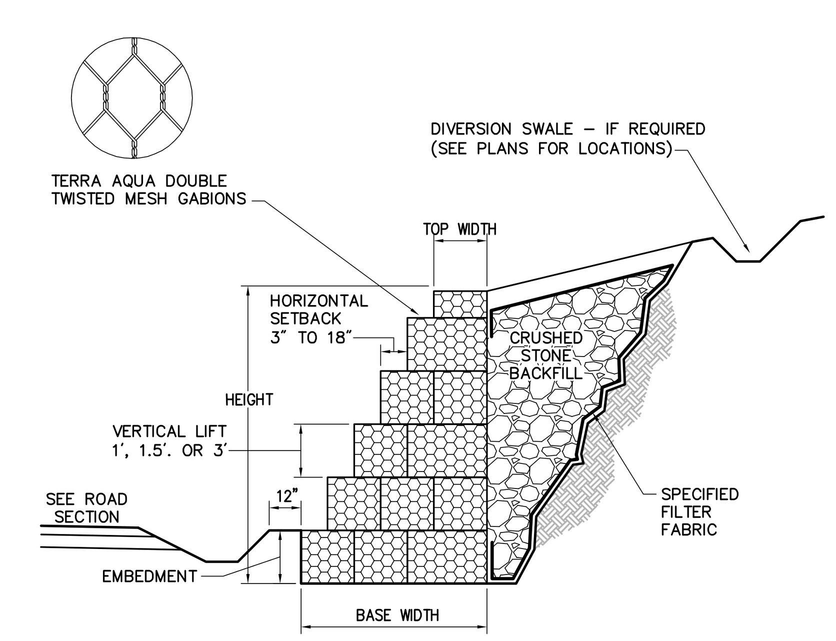
Placed Stone Slope - Fill Section REV 11/09
N.T.S. Source: VHB LD_760



Notes:

1. SEE EROSION CONTROL BLANKET DETAIL FOR SLOPES STEEPER THAN 3 HORIZONTAL: 1 VERTICAL
2. LONGITUDINAL BENCH GRADE ALONG TERRACE TO BE 2% TO 3%, AND MAXIMUM FLOW LENGTH ALONG BENCH SHALL NOT EXCEED 800 FT.
3. VEGETATED SLOPES MAY BE USED IN PLACE OF STONE SLOPES WHERE FLATTER SLOPES WOULD NOT SIGNIFICANTLY ALTER LIMITS OF CLEARING, AND WHERE APPROVED BY ENGINEER.

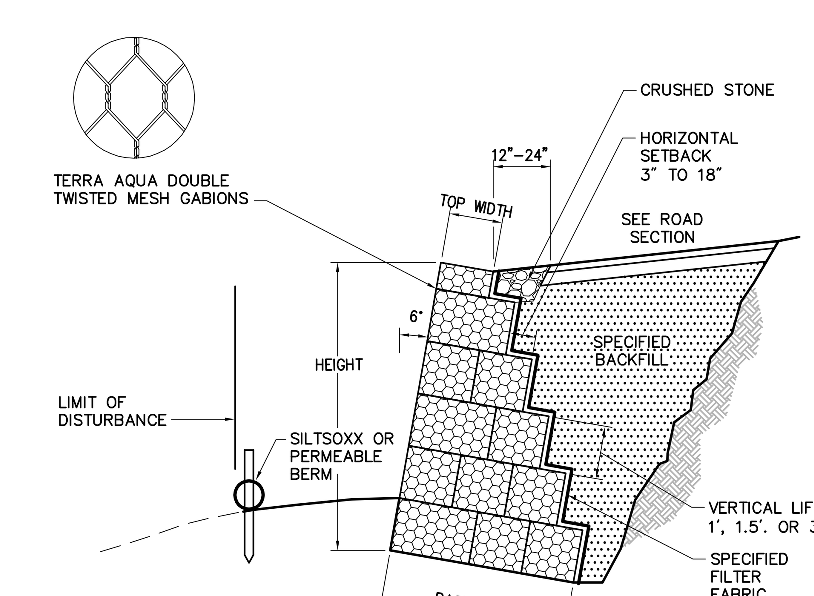
Vegetated Slopes (2:1 or Flatter)
N.T.S. Source: VHB



Notes:

1. USE WHERE NOTED ON PLANS OR AS APPROVED BY ENGINEER.
2. WALLS SHALL BE DESIGNED TO MEET AASHTO HS 20-44 LOADING.
3. GABIONS TO BE MANUFACTURED BY MacCAFERRI, INC (www.maccaferri-northamerica.com) OR APPROVED EQUAL, AND TO BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.

Gravity Gabion Wall (Vertical Cut Section) 6/09
N.T.S. Source: Gabion TAGGW1



Notes:

1. USE WHERE NOTED ON PLANS OR AS APPROVED BY ENGINEER.
2. WALLS SHALL BE DESIGNED TO MEET AASHTO HS 20-44 LOADING.
3. GABIONS TO BE MANUFACTURED BY MacCAFERRI, INC (www.maccaferri-northamerica.com) OR APPROVED EQUAL, AND TO BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.

Gravity Gabion Wall (Stepped Back - Fill Section) 6/09
N.T.S. Source: Gabion TAGGW5

VHB

Vanasse Hangen Brustlin, Inc.

Transportation
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Prepared For:

IBERDROLA RENEWABLES

No.	Revision	Date	Appvd.

Designed by | Drawn by | Checked by

CAD checked by | Approved by

Scale: As Noted | Date: February 12, 2010

Project Title

Groton Wind Farm

Groton Hollow Road
Groton, New Hampshire

Issued for

Permitting

Not Approved for Construction

Drawing Title

Site Details

STATE OF NEW HAMPSHIRE
MICHAEL J. LEO
No. 7146
LICENSED
PROFESSIONAL ENGINEER

Drawing Number

C-10.1

Sheet 54 of 68

Project Number
52036.00

52036-DT.DWG

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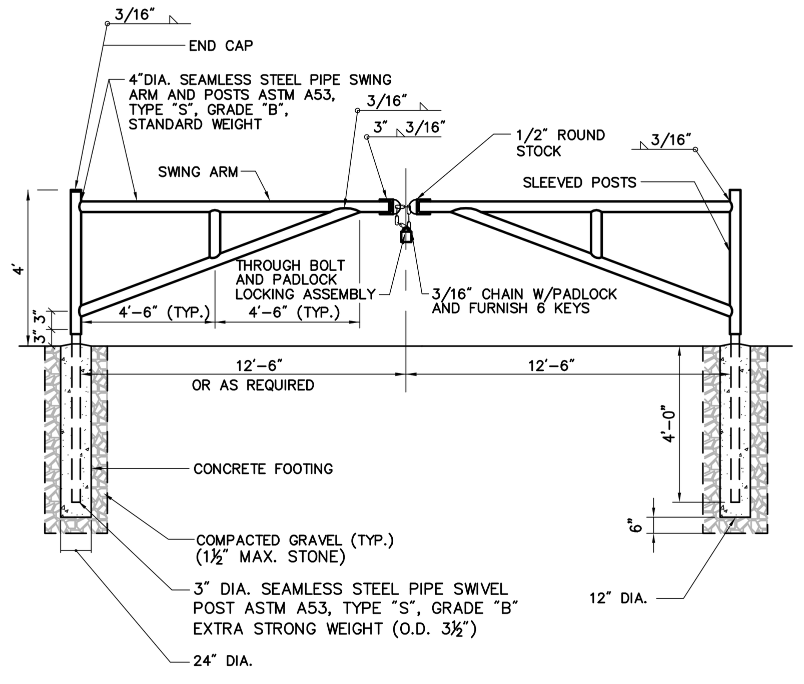
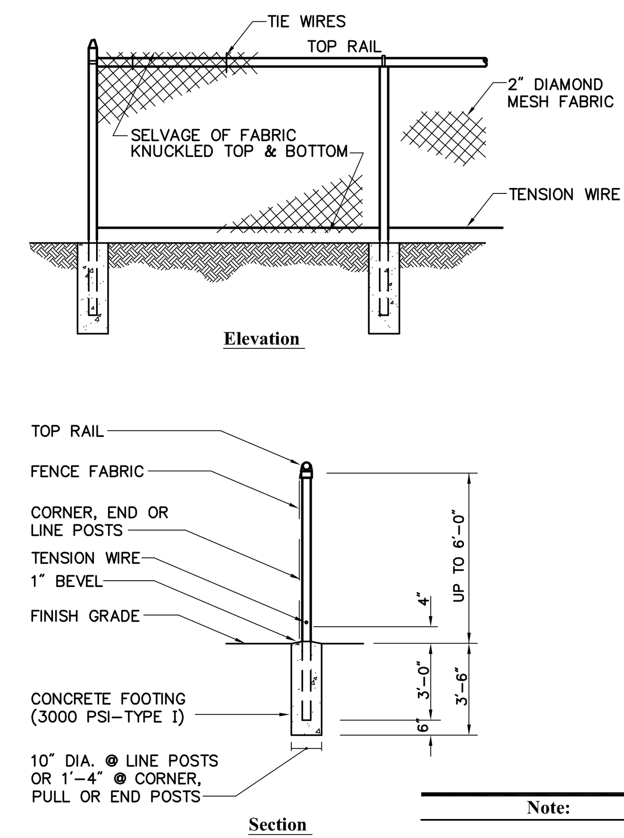


Notes:

1. SHOP PRIME PAINT EXPOSED SURFACES FIELD PAINT EPOXY ENAMEL–YELLOW.
2. PROVIDE "MASTER" PADLOCK WITH 6 WORKING KEYS.
3. 3,000 PSI CONCRETE FOOTING

Double Gate

2/09
N.T.S. Source: VHB REV LD_486

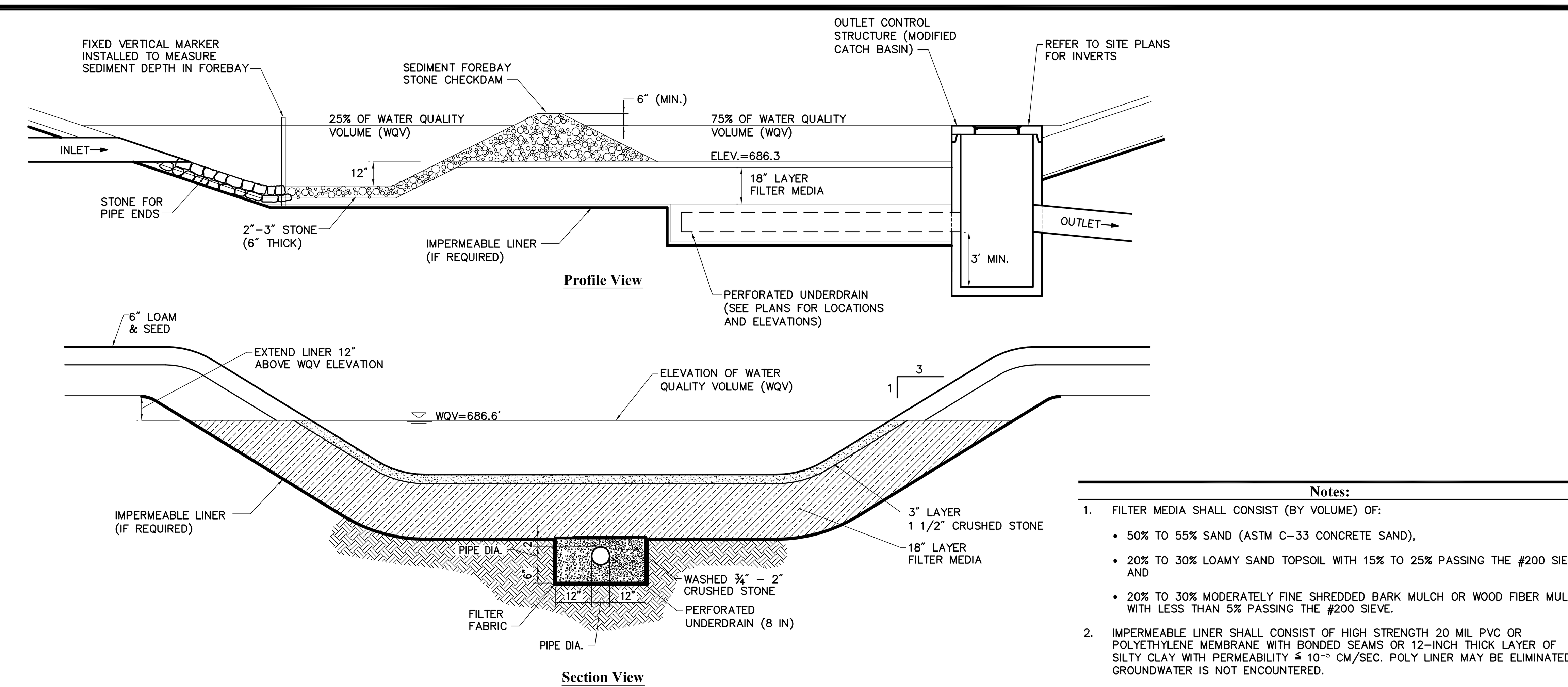


Note:

1. MATERIALS TO BE SUPPLIED AND INSTALLED IN CONFORMANCE WITH "CHAIN LINK MANUFACTURER'S INSTITUTE" PRODUCT MANUAL.

Chain Link Fence up to 6'

6/08
N.T.S. Source: VHB LD_481

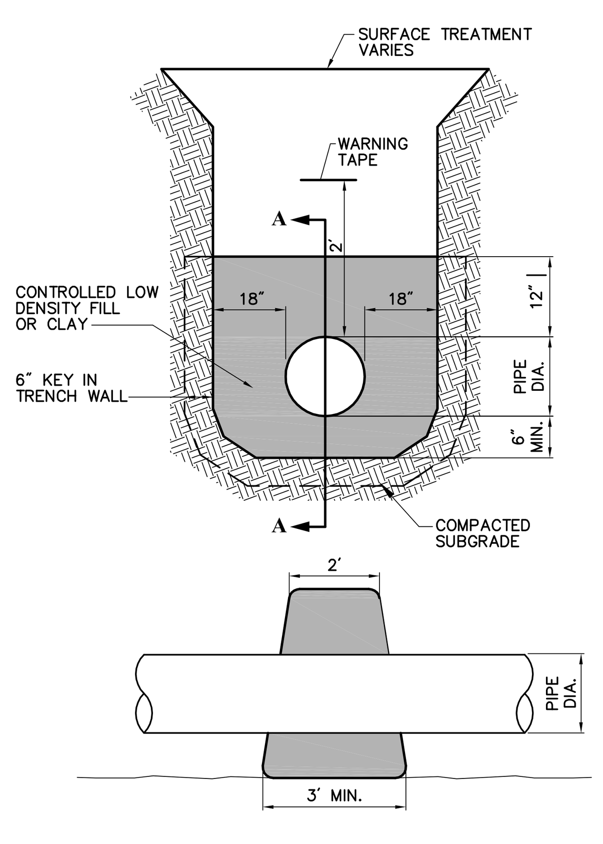


Notes:

1. FILTER MEDIA SHALL CONSIST (BY VOLUME) OF:
   - 50% TO 55% SAND (ASTM C-33 CONCRETE SAND),
   - 20% TO 30% LOAMY SAND TOPSOIL WITH 15% TO 25% PASSING THE #200 SIEVE; AND
   - 20% TO 30% MODERATELY FINE SHREDDED BARK MULCH OR WOOD FIBER MULCH WITH LESS THAN 5% PASSING THE #200 SIEVE.
2. IMPERMEABLE LINER SHALL CONSIST OF HIGH STRENGTH 20 MIL PVC OR POLYETHYLENE MEMBRANE WITH BONDED SEAMS OR 12-INCH THICK LAYER OF SILTY CLAY WITH PERMEABILITY ≦ 10^{-5} CM/SEC. POLY LINER MAY BE ELIMINATED IF GROUNDWATER IS NOT ENCOUNTERED.

Filtration Basin Detail

N.T.S. Source: VHB REV



Notes:

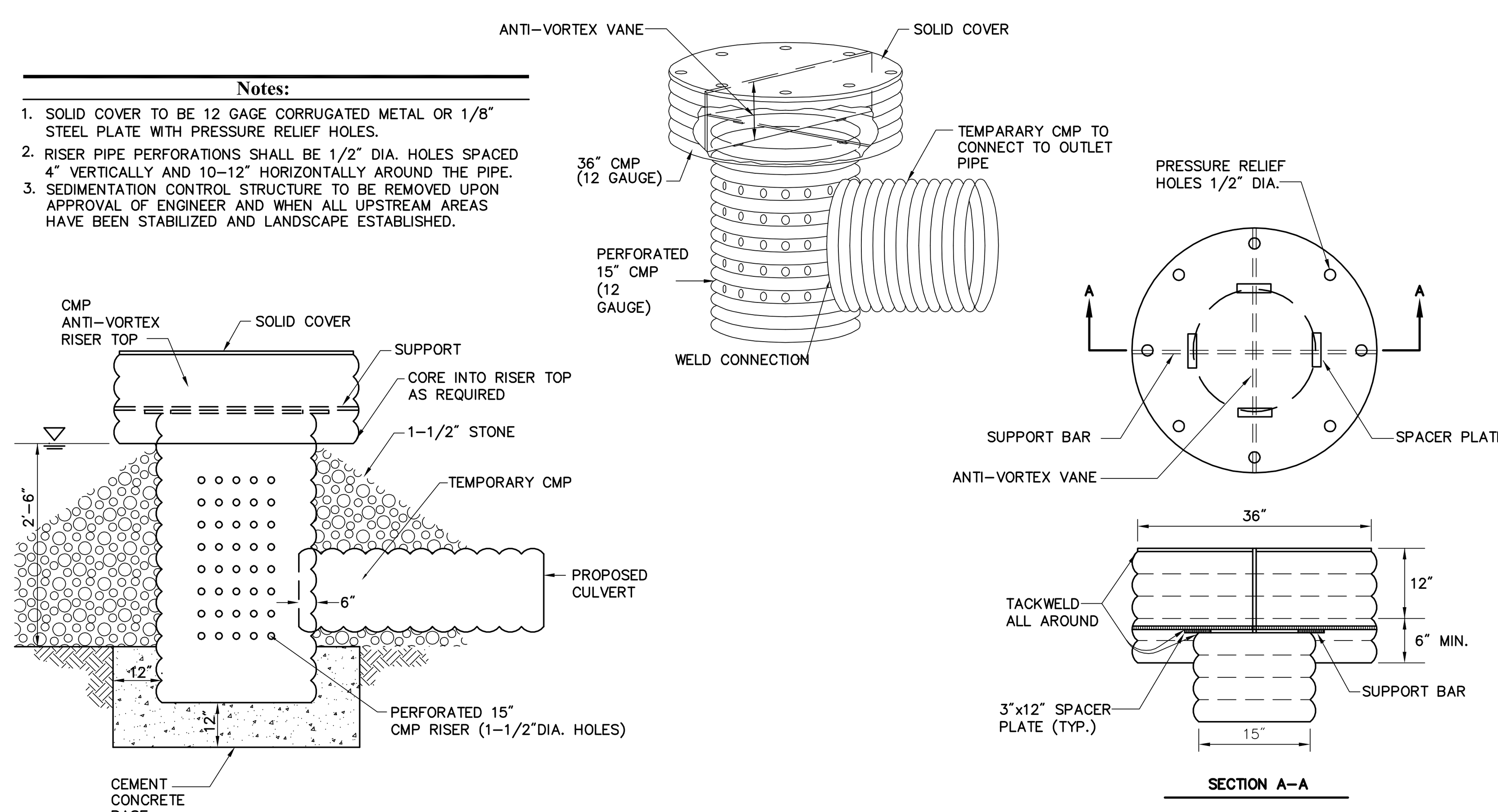
ANTI-SEEPAGE COLLAR TO BE INSTALLED AT 100' MAX. SPACING ALONG ALL PIPING SYSTEMS.

Anti-Seepage Collar

6/08
N.T.S. Source: VHB LD_301

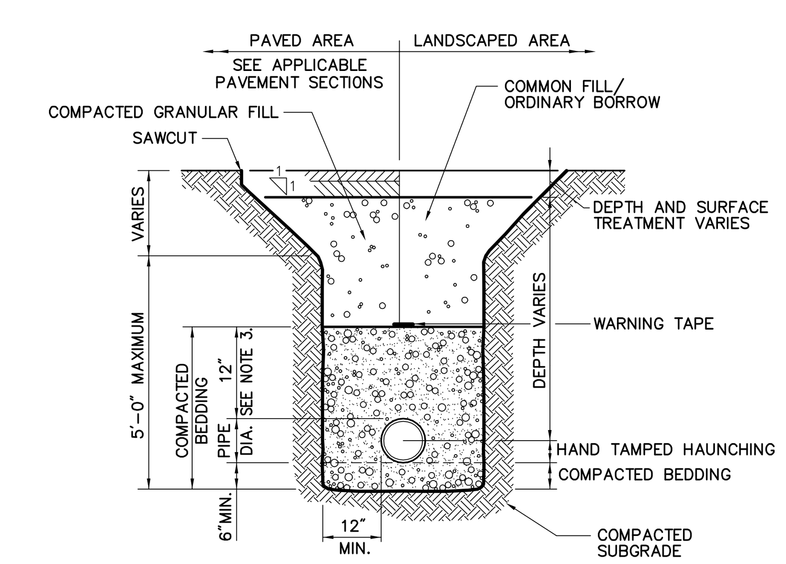
Notes:

1. SOLID COVER TO BE 12 GAGE CORRUGATED METAL OR 1/8" STEEL PLATE WITH PRESSURE RELIEF HOLES.
2. RISER PIPE PERFORATIONS SHALL BE 1/2" DIA. HOLES SPACED 4" VERTICALLY AND 10-12" HORIZONTALLY AROUND THE PIPE.
3. SEDIMENTATION CONTROL STRUCTURE TO BE REMOVED UPON APPROVAL OF ENGINEER AND WHEN ALL UPSTREAM AREAS HAVE BEEN STABILIZED AND LANDSCAPE ESTABLISHED.



Temporary Sedimentation Control Structure

6/08
N.T.S. Source: VHB LD_692



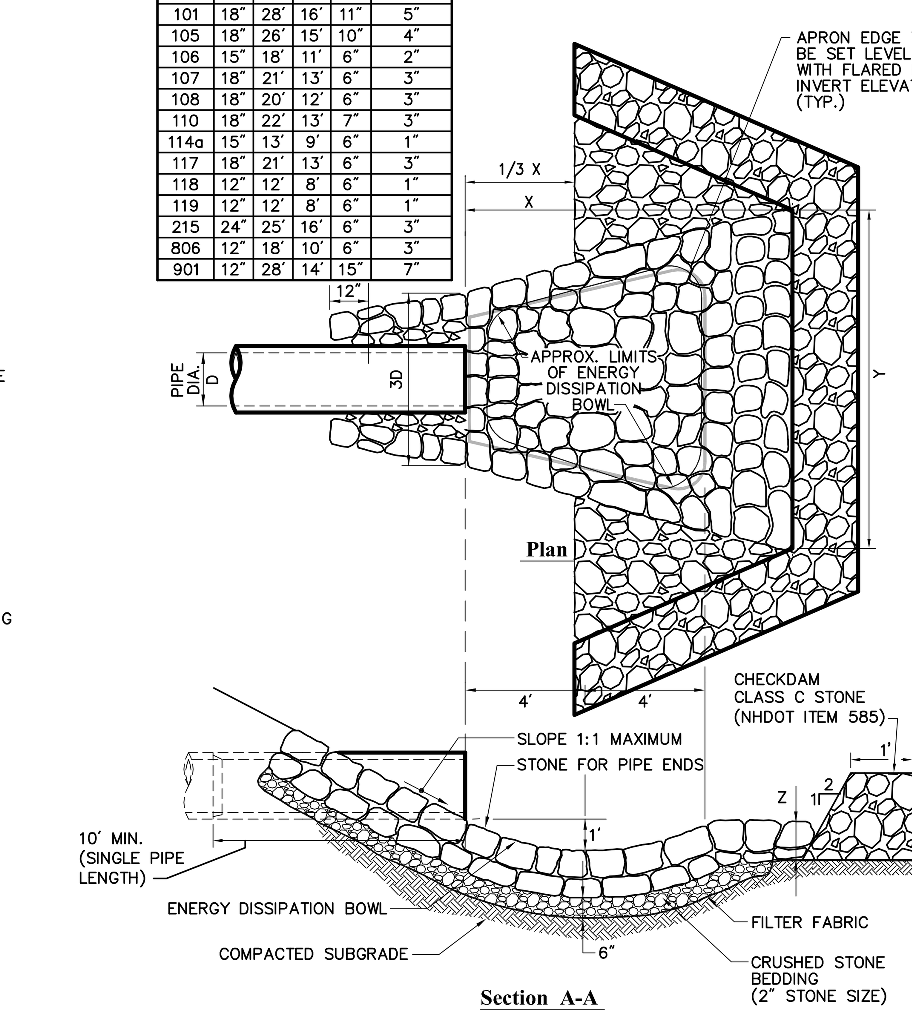
Notes:

1. WHERE UTILITY TRENCHES ARE CONSTRUCTED THROUGH DETENTION BASIN BERMS OR OTHER SUCH SPECIAL SECTIONS, PLACE TRENCH BACKFILL WITH MATERIALS SIMILAR TO THE SPECIAL SECTION REQUIREMENTS.
2. USE METALLIC TRACING/WARNING TAPE OVER ALL PIPES.
3. FOR HDPE PIPE, DIMENSION IS 24 INCHES.

Utility Trench

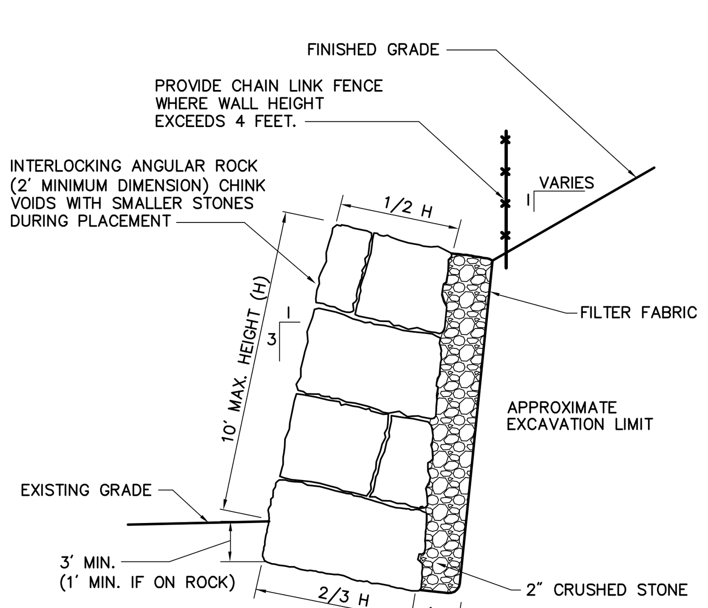
6/08
N.T.S. Source: VHB LD_300

FES NO.	D	X	Y	Z	STONE DIA. (D_{50})
100	12"	8'	6'	6"	1"
101	18"	28'	16'	11"	5"
105	18"	26'	15'	10"	4"
106	15"	18'	11'	6"	2"
107	18"	21'	13'	6"	3"
108	18"	20'	12'	6"	3"
110	18"	22'	13'	7"	3"
114a	15"	13'	9'	6"	1"
117	18"	21'	13'	6"	3"
118	12"	12'	8'	6"	1"
119	12"	12'	8'	6"	1"
215	24"	25'	16'	6"	3"
806	12"	18'	10'	6"	3"
901	12"	28'	14'	15"	7"



Pipe End Section with Stone Protection

REV 12/09
N.T.S. Source: VHB LD_134

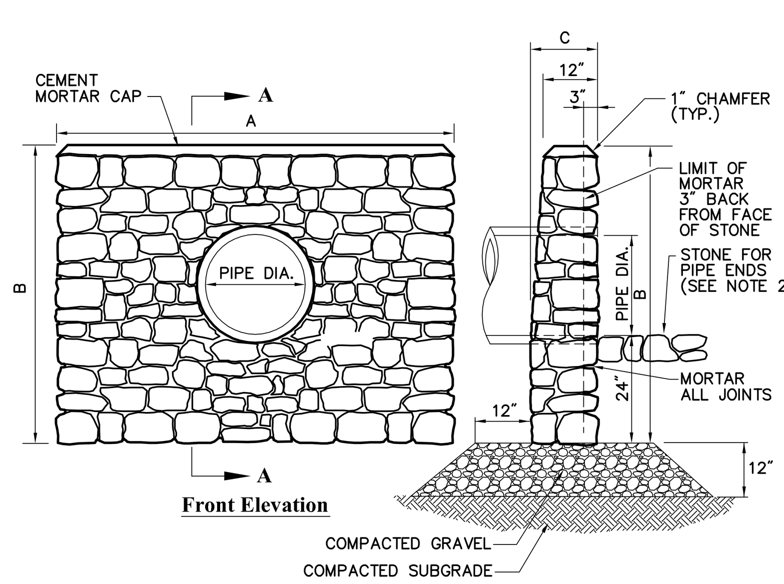


Notes:

1. STONE WALL TO BE FOUNDED ON UNDISTURBED MATERIAL AND CONSISTENT WITH GEOTECHNICAL ENGINEERS RECOMMENDATIONS.
2. PITCH BASE OF WALL DOWNWARD 1 VERT. TO 3 HOR. INTO SLOPE
3. CONSTRUCT BOULDER WALL BY INTERLOCKING ANGULAR ROCK SO THAT ROCK MASS ACTS AS GRAVITY RETAINING WALL.
4. WHERE NOTED ON PLANS OR AS APPROVED BY ENGINEER.

Stone Wall Detail

6/08
N.T.S. Source: VHB REV LD_751



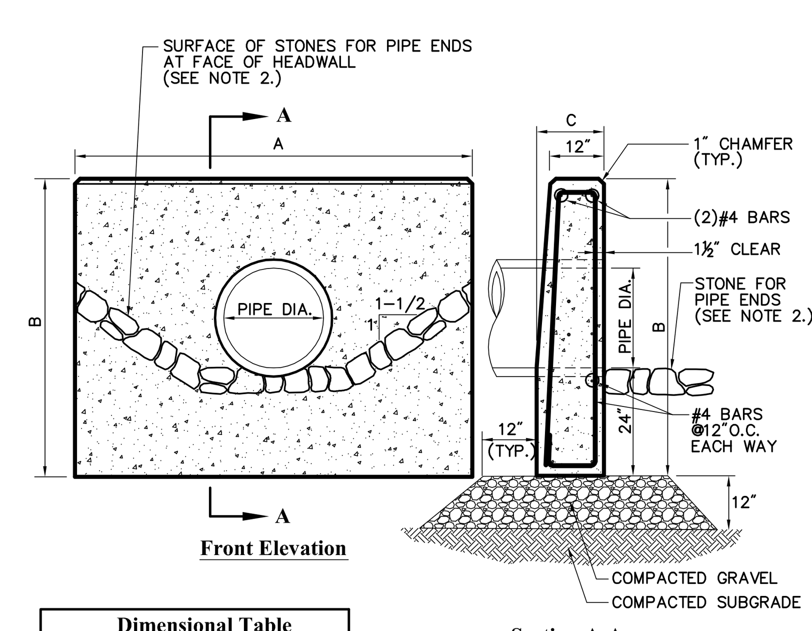
Dimensional Table			
PIPE DIA.	A	B	C
12"	5'-6"	4'-2"	1'-6"
15"	6'-6"	4'-5"	1'-6"
18"	7'-6"	4'-9"	1'-6"
24"	9'-0"	5'-3"	1'-6"
30"	11'-0"	5'-10"	1'-6"
36"	13'-0"	6'-4"	1'-9"
42"	15'-9"	6'-11"	1'-9"
48"	17'-9"	7'-5"	2'-0"
60"	21'-9"	8'-6"	2'-6"
72"	25'-9"	9'-7"	3'-0"

Notes:

1. CONCRETE SHALL BE COMPRESSIVE STRENGTH 4000 PSI, TYPE II CEMENT.
2. SEE PIPE END SECTION WITH STONE PROTECTION DETAIL.

Field Stone Masonry Headwall (HW)

REV 12/09
N.T.S. Source: VHB LD_131



Dimensional Table			
PIPE DIA.	A	B	C
12"	5'-6"	4'-2"	1'-6"
15"	6'-6"	4'-5"	1'-6"
18"	7'-6"	4'-9"	1'-6"
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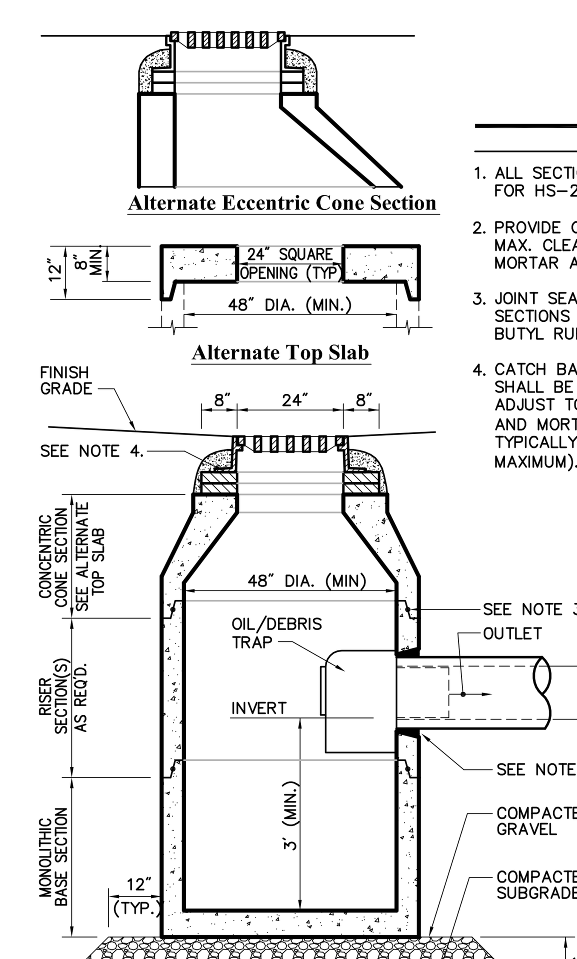
60"	21'-9"	8'-6"	2'-6"
72"	25'-9"	9'-7"	3'-0"

Notes:

1. CONCRETE SHALL BE COMPRESSIVE STRENGTH 4000 PSI, TYPE II CEMENT.
2. SEE PIPE END SECTION WITH STONE PROTECTION DETAIL.

Concrete Headwall (HW)

REV 12/09
N.T.S. Source: VHB LD_130

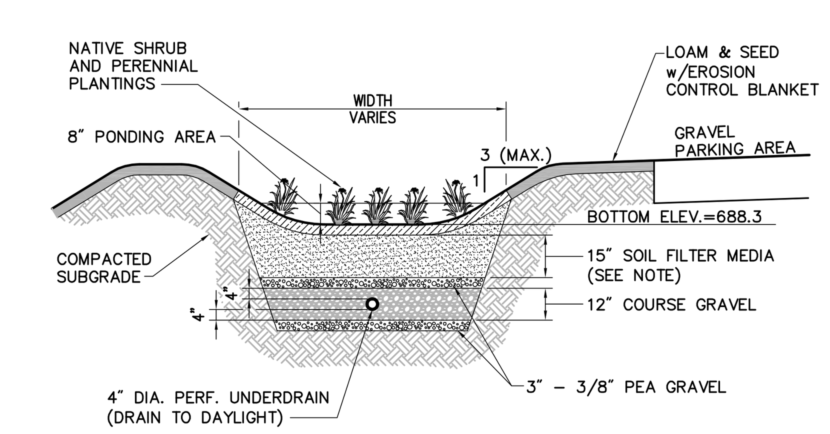


Notes:

1. ALL SECTIONS SHALL BE DESIGNED FOR HS-20 LOADING.
2. PROVIDE OPENINGS FOR PIPES WITH 2" MAX. CLEARANCE TO OUTSIDE OF PIPE. MORTAR ALL PIPE CONNECTIONS.
3. JOINT SEALANT BETWEEN PRECAST SECTIONS SHALL BE PREFORMED BUTYL RUBBER.
4. CATCH BASIN FRAME AND GRATE SHALL BE SET IN FULL MORTAR BED. ADJUST TO GRADE WITH CLAY BRICK AND MORTAR (2 BRICK COURSES TYPICALLY, 5 BRICK COURSES MAXIMUM).

Catch Basin (CB) With Oil/Debris Trap

REV 12/09
N.T.S. Source: VHB LD_101



Note:

FILTER MEDIA SHALL CONSIST (BY VOLUME) OF:

- 50% TO 55% SAND (ASTM C-33 CONCRETE SAND),
- 20% TO 30% LOAMY SAND TOPSOIL WITH 15% TO 25% PASSING THE #200 SIEVE; AND
- 20% TO 30% MODERATELY FINE SHREDDED BARK MULCH OR WOOD FIBER MULCH WITH LESS THAN 5% PASSING THE #200 SIEVE.

Rain Garden

12/06
N.T.S. Source: VHB REV

VHB

Vanasse Hangen Brustlin, Inc.

Transportation
Land Development
Environmental Services

Six Bedford Farms Drive, Suite 607
Bedford, New Hampshire 03110
603.644.0888 • FAX 603.644.2385

Prepared For:

IBERDROLA RENEWABLES

No.	Revision	Date	Appvd.
Designed by	Drawn by	Checked by	
CAD checked by		Approved by	

Scale As Noted
Date February 12, 2010

Project Title

Groton Wind Farm

Groton Hollow Road
Groton, New Hampshire

Issued for
Permitting

Not Approved for Construction

Drawing Title

Site Details

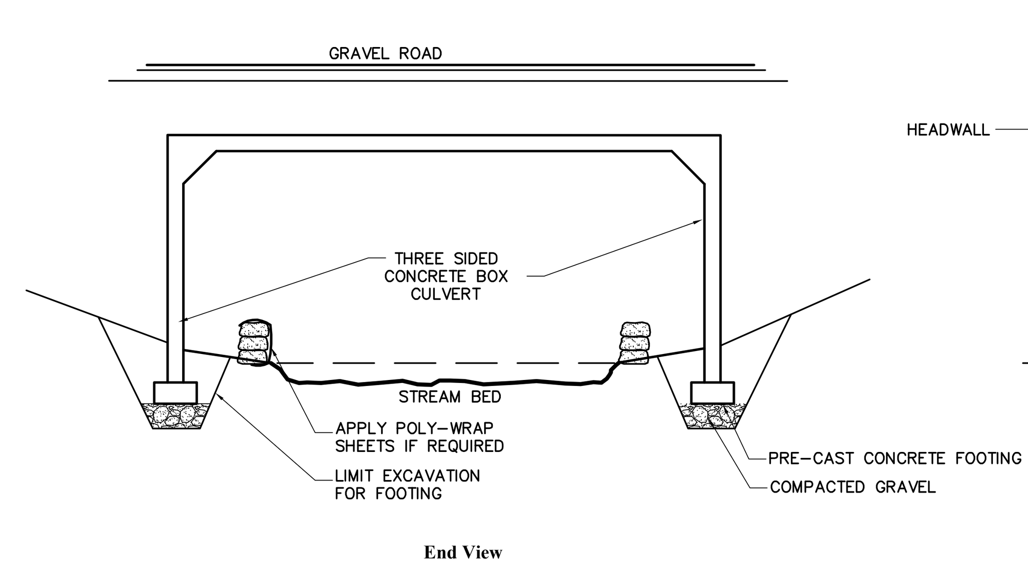
STATE OF NEW HAMPSHIRE
MICHAEL J. LEO
No. 7146
LICENSED
PROFESSIONAL ENGINEER

Drawing Number
C-10.2

Sheet 55 of 68

Project Number
52036.00

52036-DT.DWG

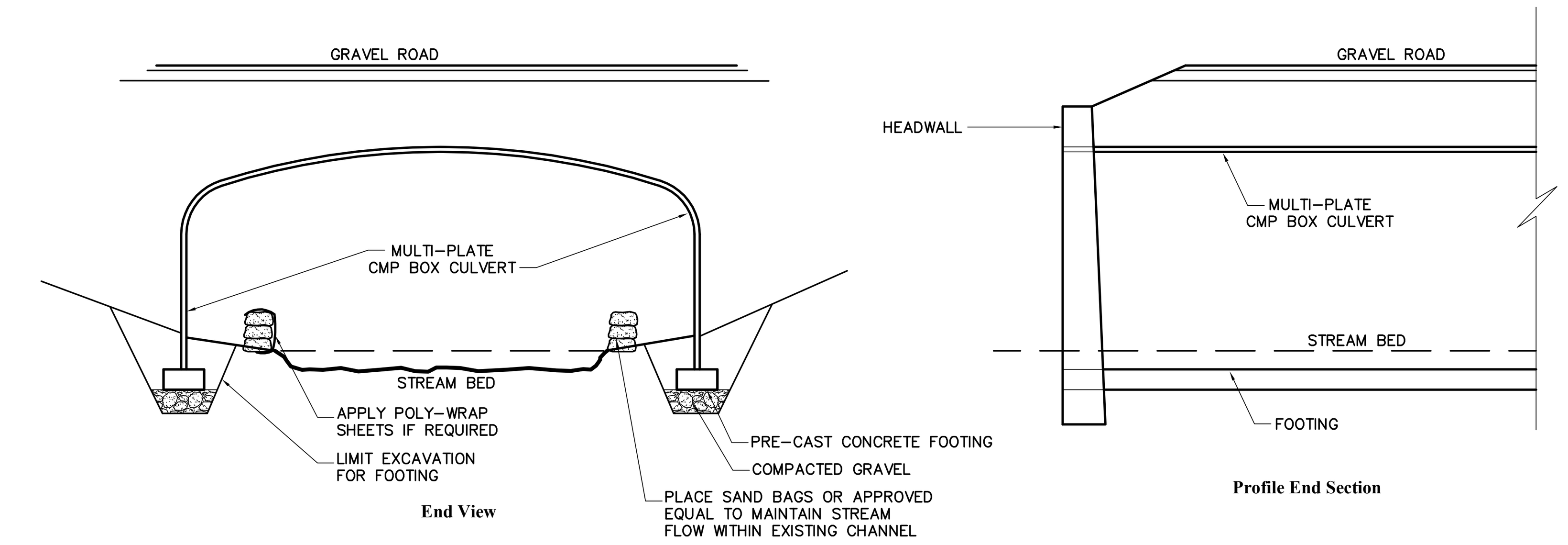


Notes:

1. CULVERT TO BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.

Concrete Box Culvert 12/09

N.T.S. Source: VHB

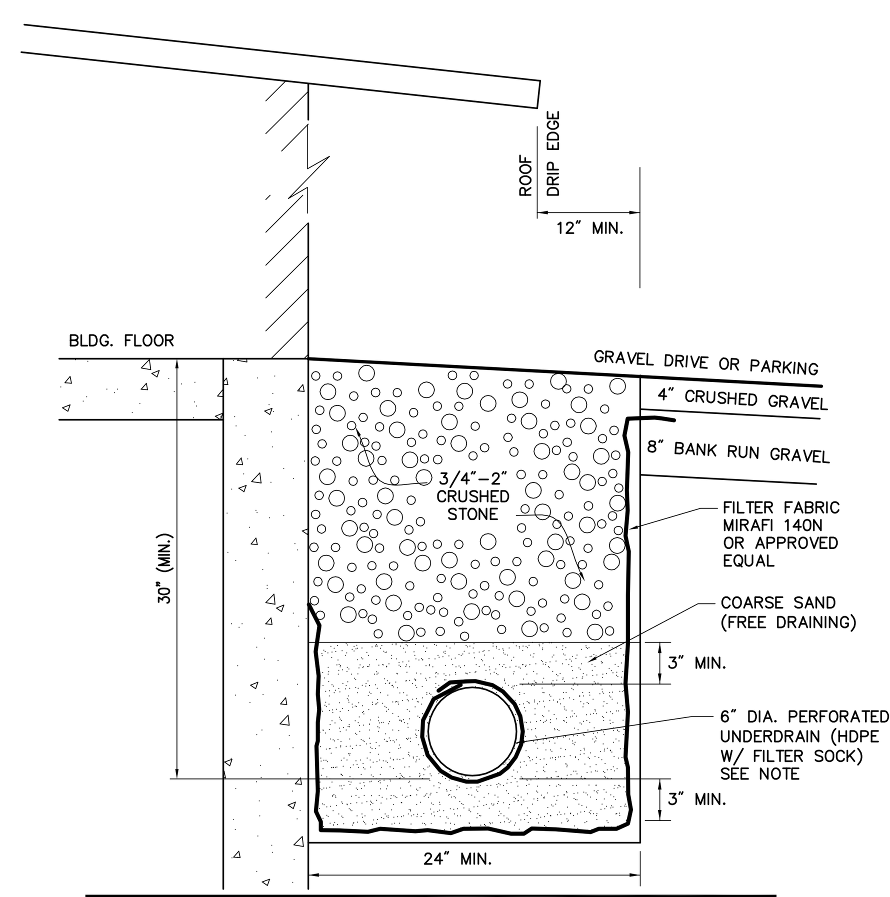


Notes:

1. CULVERT TO BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.

Multi-Plate CMP Box Culvert 11/09

N.T.S. Source: VHB

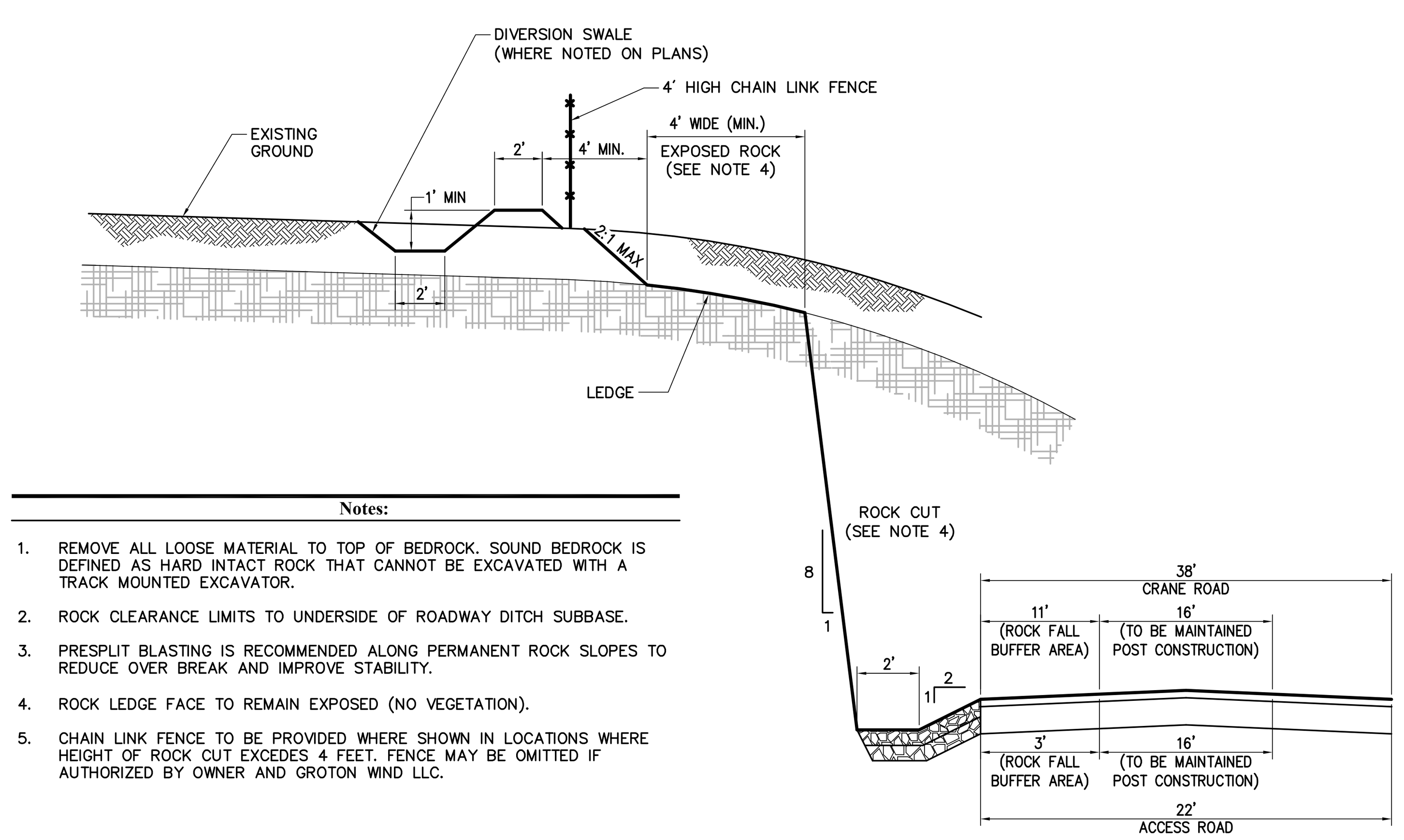


Notes:

1. PERFORATED UNDERDRAIN TO BE LAID FLAT ALONG BUILDING EDGE AND SLOPED TO DRAIN AS SHOWN ON PLANS.
2. INTERCONNECT PIPE FROM UNDERDRAIN AT BUILDING TO OUTFALL TO BE 6-INCH SOLID (NO PERFORATIONS) HDPE PIPE.

Drip Edge (DE) 12/09

N.T.S. Source: VHB

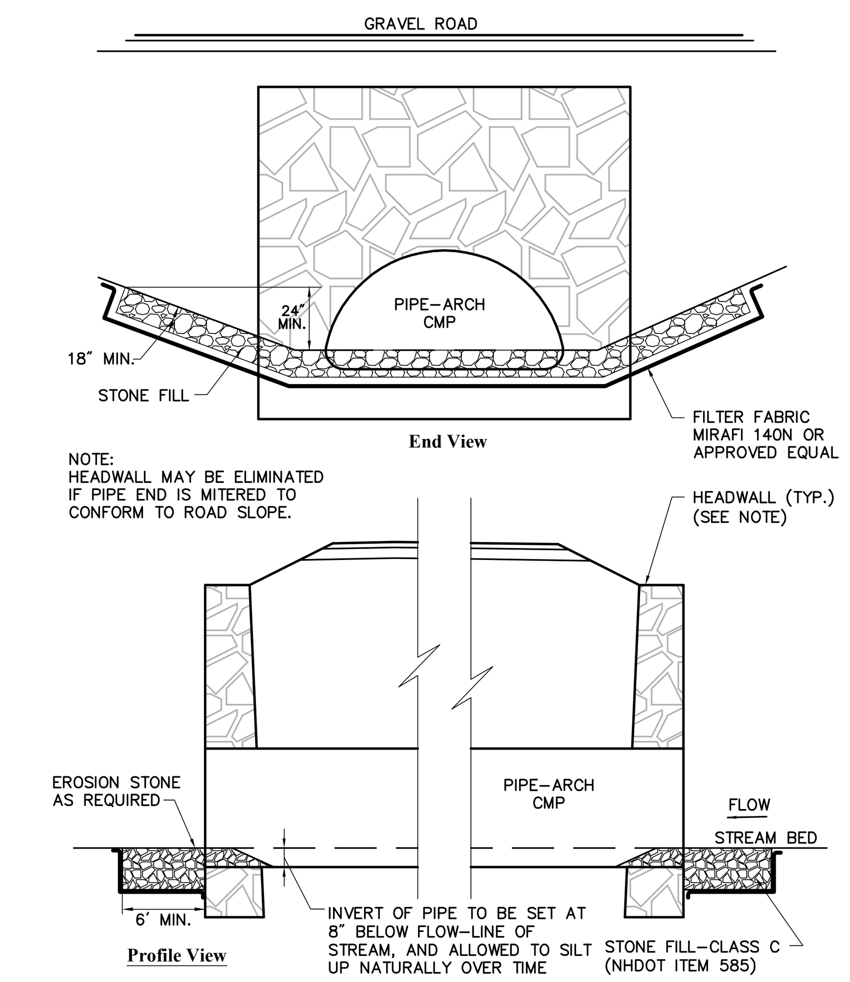


Notes:

1. REMOVE ALL LOOSE MATERIAL TO TOP OF BEDROCK. SOUND BEDROCK IS DEFINED AS HARD INTACT ROCK THAT CANNOT BE EXCAVATED WITH A TRACK MOUNTED EXCAVATOR.
2. ROCK CLEARANCE LIMITS TO UNDERSIDE OF ROADWAY DITCH SUBBASE.
3. PRESPLIT BLASTING IS RECOMMENDED ALONG PERMANENT ROCK SLOPES TO REDUCE OVER BREAK AND IMPROVE STABILITY.
4. ROCK LEDGE FACE TO REMAIN EXPOSED (NO VEGETATION).
5. CHAIN LINK FENCE TO BE PROVIDED WHERE SHOWN IN LOCATIONS WHERE HEIGHT OF ROCK CUT EXCEDES 4 FEET. FENCE MAY BE OMITTED IF AUTHORIZED BY OWNER AND GROTON WIND LLC.

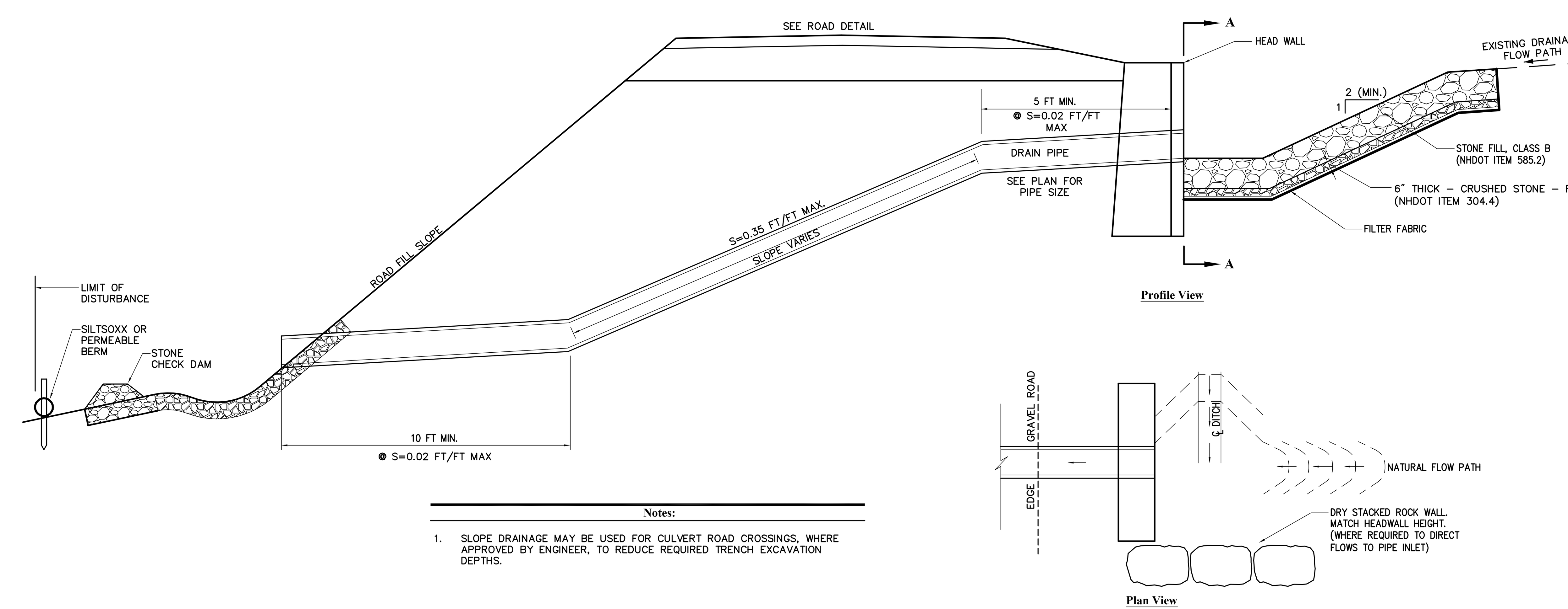
Ledge Cut Section 11/09

N.T.S. Source: VHB



Pipe-Arch Culvert 11/09

N.T.S. Source: VHB



Notes:

1. SLOPE DRAINAGE MAY BE USED FOR CULVERT ROAD CROSSINGS, WHERE APPROVED BY ENGINEER, TO REDUCE REQUIRED TRENCH EXCAVATION DEPTHS.

Slope Drainage 11/09

N.T.S. Source: VHB N.T.S.

VHB
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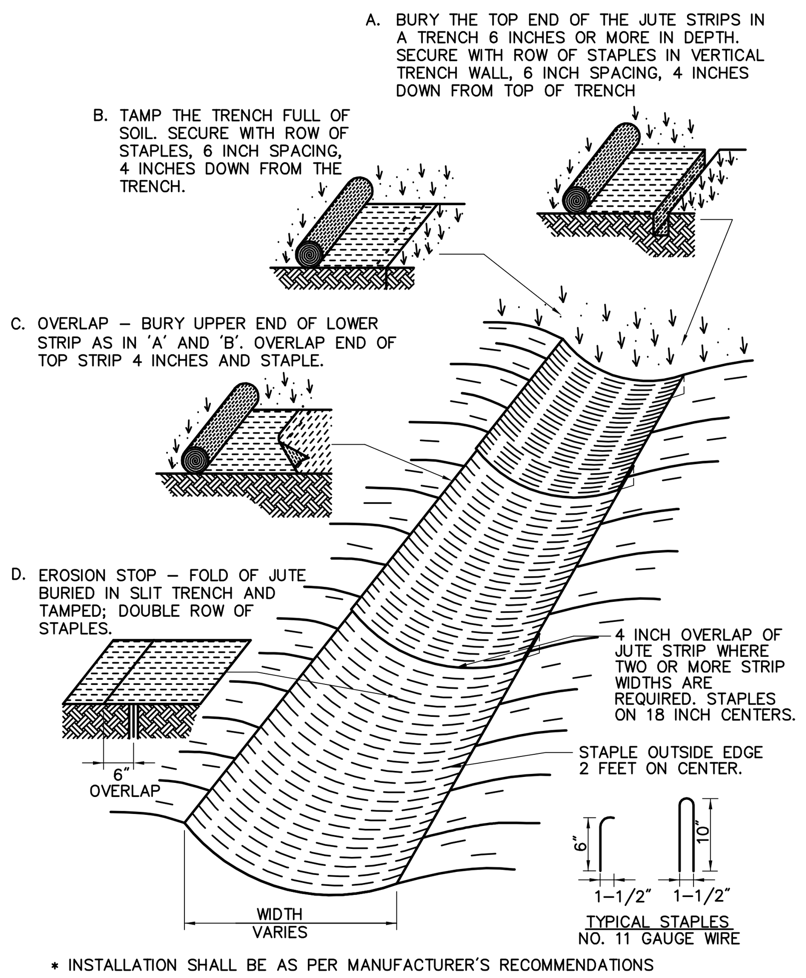
MICHAEL J. LEO
No. 7146
LICENSED
PROFESSIONAL ENGINEER

Drawing Number

C-10.3

Sheet 56 of 68

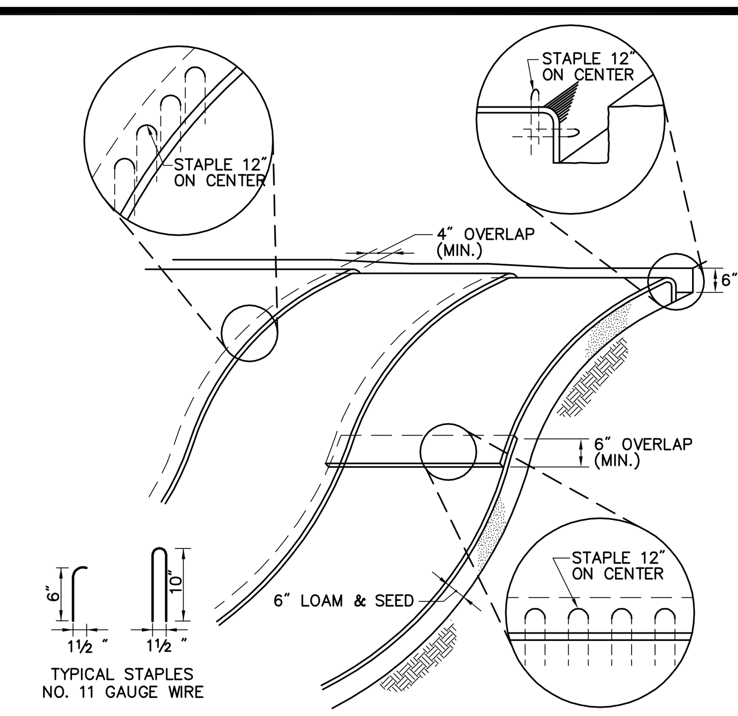
Project Number 52036.00



Erosion Control Blanket Swale Installation

6/08

N.T.S. Source: VHB LD_681



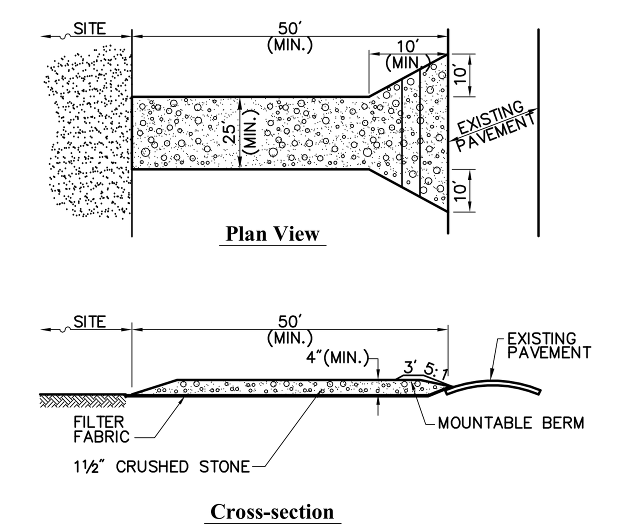
Notes:

1. BEGIN AT THE TOP OF BLANKET INSTALLATION AREA BY ANCHORING BLANKET IN A 6" DEEP TRENCH BACKFILL AND COMPACT TRENCH AFTER STAPLING.
2. ROLL THE BLANKET DOWN THE SWALE IN THE DIRECTION OF THE WATER FLOW.
3. THE EDGES OF BLANKETS MUST BE STAPLED WITH APPROX. 4 INCH OVERLAP WHERE 2 OR MORE STRIP WIDTHS ARE REQUIRED.
4. WHEN BLANKETS MUST BE SPLICED DOWN THE SWALE, PLACE UPPER BLANKET END OVER LOWER END WITH 6 INCH (MIN.) OVERLAP AND STAPLE BOTH TOGETHER.
5. METHOD OF INSTALLATION SHALL BE AS PER MANUFACTURER'S RECOMMENDATIONS.
6. FOR ALL VEGETATED SLOPES STEEPER THAN 3 HORIZONTAL TO 1 VERTICAL, UNLESS OTHERWISE NOTED ON PLANS.

Erosion Control Blanket Slope Installation

6/08

N.T.S. Source: VHB REV LD_680



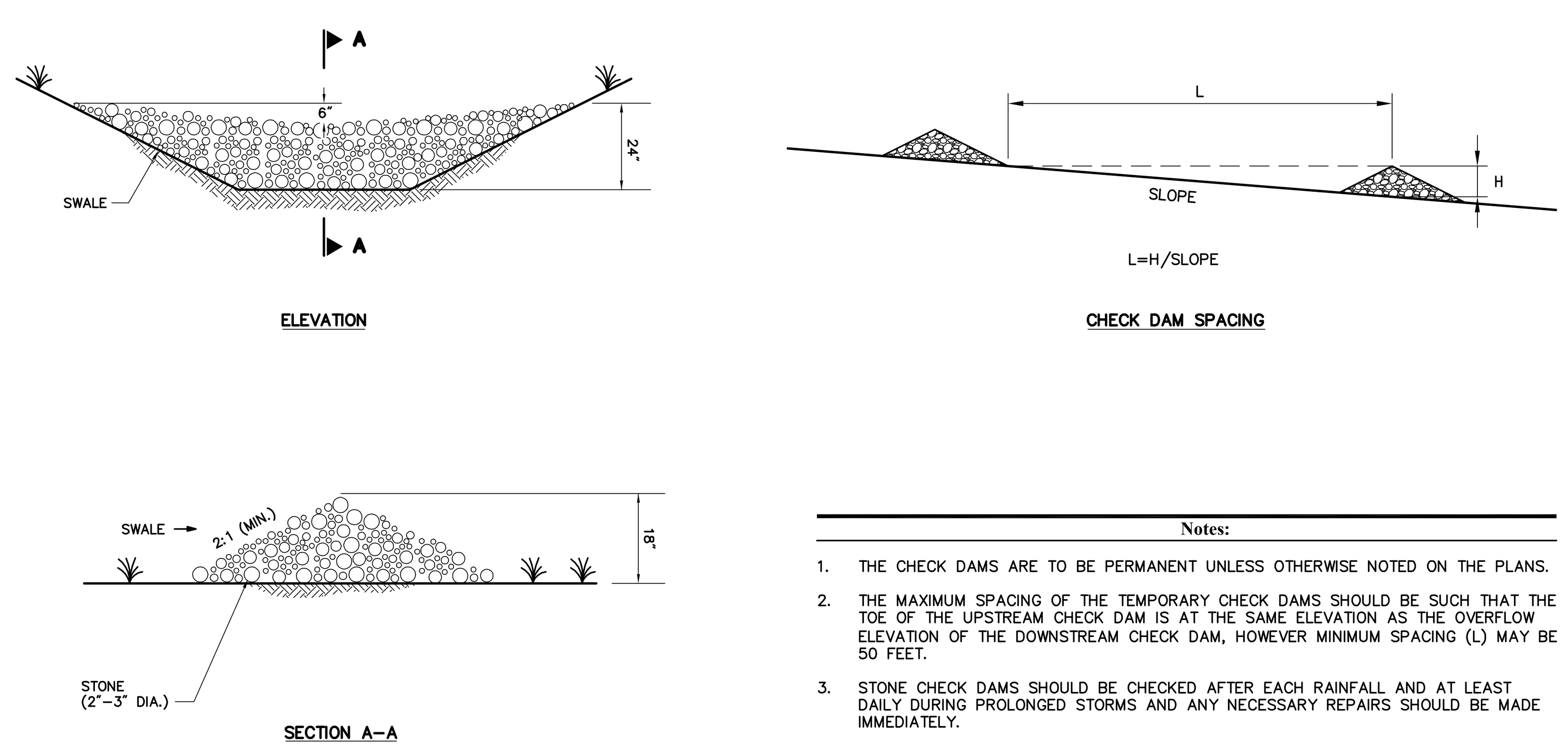
Notes:

1. ENTRANCE WIDTH SHALL BE A TWENTY-FIVE (25) FOOT MINIMUM, BUT NOT LESS THAN THE FULL WIDTH AT POINTS WHERE INGRESS OR EGRESS OCCURS.
2. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH SHALL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS-OF-WAY. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHTS-OF-WAY MUST BE REMOVED IMMEDIATELY. BERM SHALL BE PERMITTED. PERIODIC INSPECTION AND MAINTENANCE SHALL BE PROVIDED AS NEEDED.
3. STABILIZED CONSTRUCTION EXIT SHALL BE REMOVED PRIOR TO FINAL FINISH MATERIALS BEING INSTALLED.

Stabilized Construction Exit

6/08

N.T.S. Source: VHB LD_682

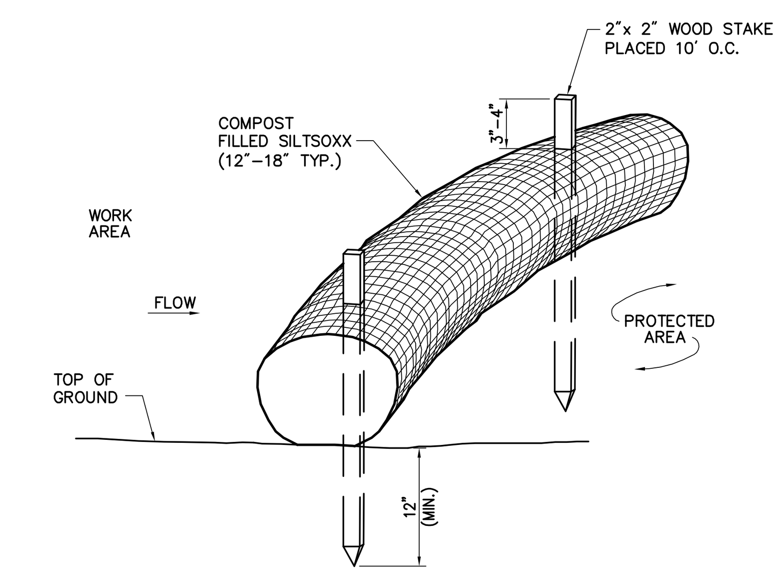


Notes:

1. THE CHECK DAMS ARE TO BE PERMANENT UNLESS OTHERWISE NOTED ON THE PLANS.
2. THE MAXIMUM SPACING OF THE TEMPORARY CHECK DAMS SHOULD BE SUCH THAT THE TOE OF THE UPSTREAM CHECK DAM IS AT THE SAME ELEVATION AS THE OVERFLOW ELEVATION OF THE DOWNSTREAM CHECK DAM, HOWEVER MINIMUM SPACING (L) MAY BE 50 FEET.
3. STONE CHECK DAMS SHOULD BE CHECKED AFTER EACH RAINFALL AND AT LEAST DAILY DURING PROLONGED STORMS AND ANY NECESSARY REPAIRS SHOULD BE MADE IMMEDIATELY.
4. SEDIMENT SHOULD BE REMOVED FROM BEHIND THE CHECK DAMS WHEN IT HAS ACCUMULATED TO ONE HALF OF THE ORIGINAL HEIGHT OF THE CHECK DAM.
5. TEMPORARY CHECK DAMS SHOULD BE REMOVED AFTER VEGETATION HAS BEEN ESTABLISHED.
6. WHEN CHECK DAMS ARE REMOVED, THE DISTURBED AREA SHOULD BE BROUGHT TO THE EXISTING CHANNEL GRADE, SEEDED AND MULCHED WITH STRAW.

Stone Check Dam - For Vegetative Swales

N.T.S. Source: VHB REV LD_616NH



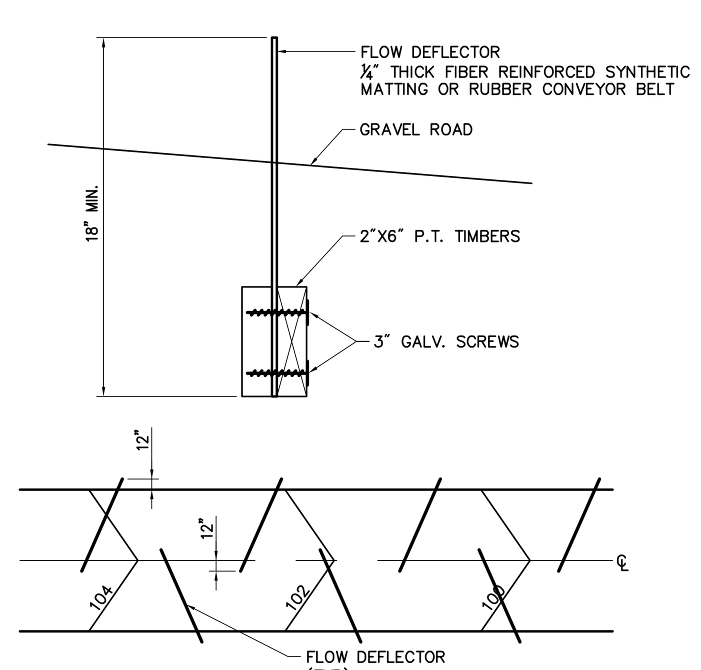
Notes:

1. SILTSOXX SHALL BE SILTSOXX, OR DITCH CHEXX AS MANUFACTURED BY "FILTREXX" OR APPROVED EQUAL.
2. COMPOST MATERIAL SHALL BE DISPERSED ON SITE, AS DETERMINED BY THE ENGINEER.
3. SILTSOXX SHALL BE INSPECTED PERIODICALLY AND AFTER ALL STORM EVENTS, AND REPAIR OR REPLACEMENT SHALL BE PERFORMED PROMPTLY AS NEEDED.
4. SEE MANUFACTURERS RECOMMENDATIONS FOR SOCK SIZE AND COMPOST FILL REQUIREMENTS.

Silt Soxx - Erosion Control Barrier

1/07

N.T.S. Source: VHB



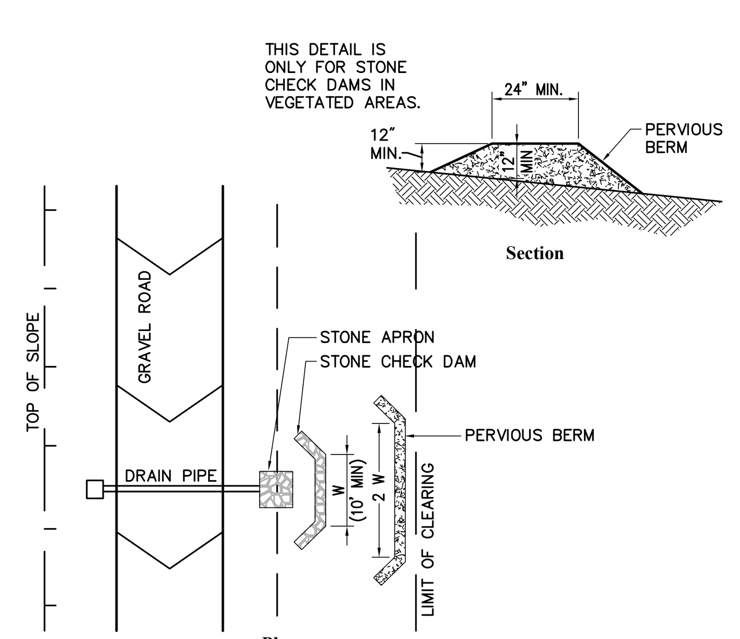
Notes:

1. FLOW DEFLECTOR SHALL BE ± ¼ INCH THICK FLEXIBLE MATERIAL CONSISTING OF FIBER REINFORCED SYNTHETIC MATTING OR RECYCLED RUBBER CONVEYOR BELTS OR OTHER APPROVED MATERIAL.
2. NARROW TRENCHES SHALL BE EXCAVATED FOR PLACEMENT OF FLOW DEFLECTORS AND BE BACKFILLED WITH GRANULAR MATERIAL (ROAD GRAVEL) AND BE THOROUGHLY TAMPED AND COMPACTED.
3. FLOW DEFLECTORS SHALL BE PLACED WHERE INDICATED ON PLANS OR AS DIRECTED BY THE ENGINEER.

Road Flow Deflector

4/09

N.T.S. Source: VHB LD_760



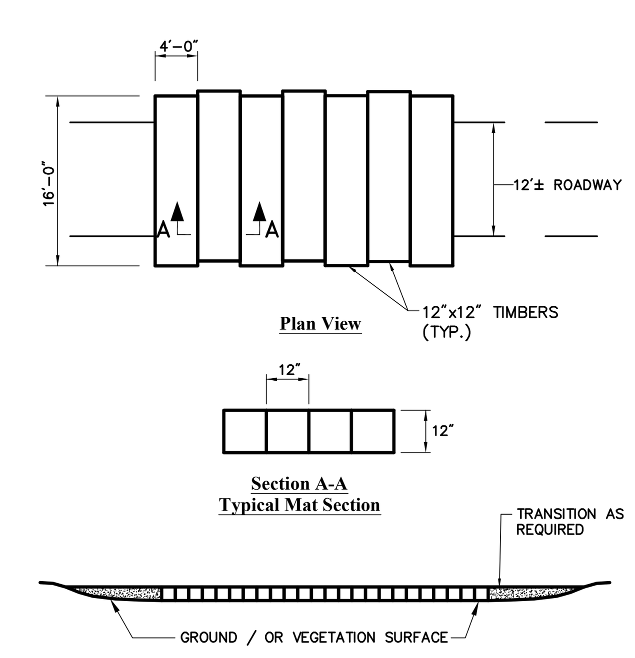
Notes:

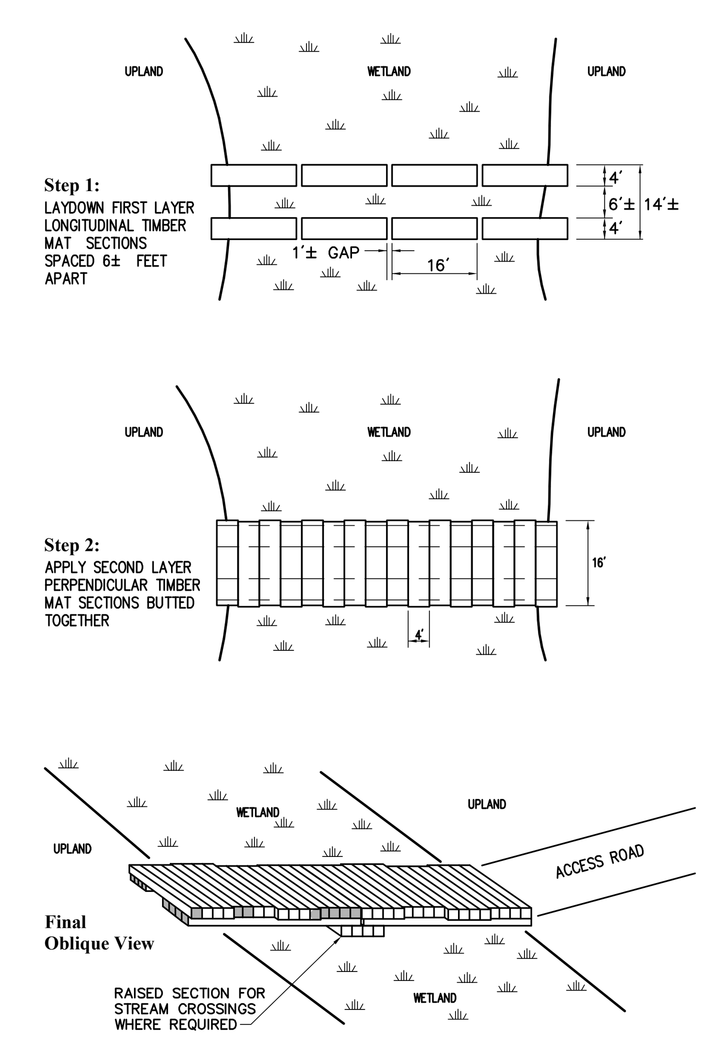
1. BERM SHALL CONSIST OF STUMP GRINDINGS, SHREDDED BARK, OR COMPOST BARK FROM PROJECT SITE AND SHALL HAVE BETWEEN 80% AND 100% ORGANIC MATERIAL. GRINDINGS SHALL BE FIBEROUS AND ELONGATED AND BE PRODUCT OF SHREDDED BARK, STUMP GRINDINGS OR COMPOSTED BARK.
2. GROUND CONSTRUCTION DEBRIS OR REPROCESSED WOOD PRODUCTS SHALL NOT BE USED AS REQUIRED ORGANIC MATERIAL.
3. THE BERM SHALL NOT CONTAIN SILTS, CLAYS OR FINE SANDS, REFUSE, PHYSICAL CONTAMINANTS OR MATERIAL TOXIC TO PLANT GROWTH.
4. PARTICLE SIZE BY WEIGHT SHOULD BE 100% PASSING 3" SCREEN, 90% TO 100% PASSING A 1" SCREEN, 70% TO 100% PASSING A 0.75" SCREEN, AND A MAXIMUM OF 30% TO 70% PASSING A 0.25" SCREEN.
5. THE GRINDINGS SHALL HAVE A pH BETWEEN 5.0 AND 8.0.

Pervious Berm - Erosion Control Barrier

11/09

N.T.S. Source: VHB





Notes:

1. TO BE INSTALLED WHERE NECESSARY FOR ACCESS FOR OVERHEAD UTILITY LINE CONSTRUCTION.
2. PREPARATION FOR INSTALLATION OF TIMBER MATS WILL CONSIST OF CUTTING TALL WOODY SPECIES AND TRIMMING SHRUBS IF CONDITIONS REQUIRE. VEGETATION ROOT MASS IS TO REMAIN UNDISTURBED.
3. TIMBER SECTIONS TO BE SECURED TOGETHER BY BOLTS, NAILS, STRAPS OR OTHER APPROPRIATE METHODS.
4. AS AN ALTERNATIVE FOR TEMPORARY SHALLOW WETLAND CROSSINGS, CROSSINGS MAY CONSIST OF TWO LAYERS OF GEOTEXTILE FABRIC COVERED WITH A MINIMUM OF 12 INCHES OF CLEAN CRUSHED STONE. FABRIC TO BE PLACED DIRECTLY OVER TRIMMED VEGETATION, AND GRAVEL/FABRIC TO BE REMOVED WHEN CONSTRUCTION ACTIVITIES ARE COMPLETED. VEGETATION ROOT MASS IS TO REMAIN UNDISTURBED.

Wetland Crossing - Timber Mat Detail

11/09

N.T.S. Source: VHB

Erosion Control

1. PRIOR TO STARTING ANY OTHER WORK ON THE SITE, THE CONTRACTOR SHALL NOTIFY APPROPRIATE AGENCIES AND SHALL INSTALL EROSION CONTROL MEASURES AS SHOWN ON THE PLANS AND AS IDENTIFIED IN FEDERAL, STATE, AND LOCAL APPROVAL DOCUMENTS PERTAINING TO THIS PROJECT.
2. CONTRACTOR SHALL INSPECT AND MAINTAIN EROSION CONTROL MEASURES, AND REMOVE SEDIMENT THEREFROM ON A WEEKLY BASIS AND WITHIN TWENTY-FOUR HOURS AFTER EACH STORM EVENT (0.5" OF RAINFALL OR GREATER) AND DISPOSE OF SEDIMENTS IN AN UPLAND AREA SUCH THAT THEY DO NOT ENCUMBER OTHER DRAINAGE STRUCTURES AND PROTECTED AREAS.
3. CONTRACTOR SHALL BE FULLY RESPONSIBLE TO CONTROL CONSTRUCTION SUCH THAT SEDIMENTATION SHALL NOT AFFECT REGULATORY PROTECTED AREAS, WHETHER SUCH SEDIMENTATION IS CAUSED BY WATER, WIND, OR DIRECT DEPOSIT.
4. CONTRACTOR SHALL PERFORM CONSTRUCTION SEQUENCING SUCH THAT EARTH MATERIALS ARE EXPOSED FOR A MINIMUM OF TIME BEFORE THEY ARE COVERED, SEEDED, OR OTHERWISE STABILIZED TO PREVENT EROSION.
5. UPON COMPLETION OF CONSTRUCTION AND ESTABLISHMENT OF PERMANENT GROUND COVER, CONTRACTOR SHALL REMOVE AND DISPOSE OF EROSION CONTROL MEASURES AND CLEAN SEDIMENT AND DEBRIS FROM ENTIRE DRAINAGE SYSTEMS.
6. AREAS REMAINING UNSTABILIZED FOR A PERIOD OF MORE THAN 30 DAYS SHALL BE TEMPORARILY SEEDED AND MULCHED. HAY MULCH SHALL BE APPLIED AT A MINIMUM RATE OF 1-1/2 TONS/ACRE. AS AN ALTERNATIVE, OR AS DIRECTED BY ENGINEER, A BONDED FIBER POLYMER EMULSION ("DIRT-GLUE" OR APPROVED EQUAL) MAY BE USED FOR TEMPORARY STABILIZATION.
7. PERMANENT SEEDING SHALL OCCUR BETWEEN APRIL 1 AND JUNE 1, AND/OR BETWEEN AUGUST 15 AND OCTOBER 15. ALL SEEDING FROM SEPTEMBER 15 SHALL BE HAY MULCHED.
8. DUST SHALL BE CONTROLLED THROUGH THE USE OF WATER.
9. SOILS TO BE STOCKPILED FOR A PERIOD OF MORE THAN 30 DAYS SHALL BE TEMPORARILY SEEDED AND MULCHED, OR STABILIZED WITH BONDED FIBER POLYMER EMULSION. CONTRACTOR SHALL INSTALL SILT SOX ALONG DOWNHILL SIDE OF STOCKPILES.
10. CONTRACTOR SHALL PROVIDE TEMPORARY SEDIMENTATION BASINS TO CONTROL SEDIMENTATION AND STORMWATER RUNOFF DURING THE CONSTRUCTION PERIOD. THE CONTRACTOR SHALL SUBMIT PROPOSED BASIN LOCATIONS, DESIGNS, ETC. TO THE ENGINEER FOR REVIEW PRIOR TO CONSTRUCTION. TEMPORARY SEDIMENTATION BASINS SHALL MEET NHDES REQUIREMENTS.
11. CONTRACTOR SHALL PROVIDE NECESSARY EROSION CONTROL MEASURES TO INSURE THAT SURFACE WATER RUN-OFF FROM UNSTABILIZED AREAS DOES NOT CARRY SILT, SEDIMENT, AND OTHER DEBRIS OUTSIDE OF THE LIMITS OF WORK.
12. AN AREA SHALL BE CONSIDERED STABLE IF ONE OF THE FOLLOWING HAS OCCURRED:

A. BASE COURSE GRAVELS HAVE BEEN INSTALLED ALONG ROADWAYS;
B. A MINIMUM OF 85% VEGETATED GROWTH HAS BEEN ESTABLISHED;
C. A MINIMUM OF 3-IN OF NON-EROSIVE MATERIAL, SUCH AS STONE OR RIPRAP, HAS BEEN INSTALLED;
D. EROSION CONTROL BLANKETS HAVE BEEN PROPERLY INSTALLED.
E. AREA IS PROTECTED WITH A BONDED FIBER POLYMER EMULSION ("DIRT-GLUE" OR APPROVED EQUAL) INSTALL IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS.

13. AT NO TIME SHALL THE TOTAL UNSTABILIZED DISTURBED AREA ON-SITE BE GREATER THAN (5) FIVE ACRES.
14. ALL DITCHES, SWALES, AND DRAINAGE BASINS SHALL BE STABILIZED PRIOR TO DIRECTING RUNOFF TO THEM.
15. ALL ROADWAYS AND PARKING AREAS SHALL BE STABILIZED WITHIN 72 HOURS OF ACHIEVING FINISHED GRADE.
16. ALL CUT AND FILL SLOPES SHALL BE STABILIZED WITHIN 72 HOURS OF ACHIEVING FINISH GRADE. SLOPES SHALL BE CONSIDERED STABILIZED IF LOAMED AND SEEDED, COVERED WITH STONE FILL (SEE STONE SLOPE DETAIL) OR EXPOSED LEDGE FACE. LOAMED AND SEEDED AREAS SHALL BE MULCHED, COVERED WITH EROSION CONTROL BLANKET OR STABILIZED WITH OTHER APPROVED METHOD.
17. ALL PERMANENT AND TEMPORARY SEEDING SHALL BE AS FOLLOWS (UNLESS OTHERWISE NOTED):

PERMANENT SEEDING	PROPORTION	GERMINATION MINIMUM	PURITY MINIMUM
LAWNS:			
CREEPING RED FESCUE	50%	85%	95%
KENTUCKY BLUEGRASS	40%	85%	90%
MANHATTAN PERENNIAL RYE	10%	90%	95%

TEMPORARY SEEDING*	% WEIGHT	GERMINATION MINIMUM
WINTER RYE	80% MIN.	85%
RED FESCUE (CREEPING)	4% MIN.	80%
PERENNIAL RYE GRASS	3% MIN.	90%
RED CLOVER	3% MIN.	90%
OTHER CROP GRASS	0.5% MAX.	
NOXIOUS WEED SEED	0.5% MAX.	
INERT MATTER	1.0% MAX.	

* TEMPORARY SEED FOR LAWNS SHALL ONLY BE PLANTED WHEN PERMANENT GRASSES CANNOT BE PLANTED DUE TO THE GROWING SEASON.

18. EROSION CONTROL BLANKETS SHALL BE INSTALLED ON ALL SLOPES THAT ARE STEEPER THAN 3-FT HORIZONTAL AND 1-FT VERTICAL (3:1). EROSION CONTROL BLANKETS SHALL BE NORTH AMERICAN GREEN SC150BN, OR APPROVED EQUAL.
19. BONDED FIBER POLYMER EMULSION (BFPE) SHALL BE AS MANUFACTURED BY DIRTGLUE ENTERPRISES (www.dirtglue.com) OR APPROVED EQUAL, AND BE APPLIED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS. WHEN HYDROSEEDING BFPE MAY BE USED IN PLACE OF TACKIFIER, WHEN USED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS AND APPROVED BY ENGINEER.
20. SITE AREAS TO BE VEGETATED SHALL RECEIVE MINIMUM OF 4 INCHES OF LOAM AND SEED, UNLESS OTHERWISE NOTED. LOAM MAY CONSIST OF TOPSOIL AND/OR HUMUS TAKEN FROM PROJECT SITE. USE OF LOAM, TOPSOIL AND/OR HUMUS FROM OFFSITE LOCATIONS MAY ONLY BE OCCUR WHERE SOURCE LOCATION IS PRE-APPROVED BY VHB ENVIRONMENTAL SCIENTIST.

Winter Construction

1. ALL PROPOSED VEGETATED AREAS WHICH DO NOT EXHIBIT A MINIMUM OF 85% VEGETATIVE GROWTH BY OCTOBER 15TH, OR WHICH ARE DISTURBED AFTER OCTOBER 15TH, SHALL BE STABILIZED. STABILIZATION METHODS SHALL INCLUDE SEEDING AND INSTALLING EROSION CONTROL BLANKETS ON SLOPES GREATER THAN 3:1, AND SEEDING AND PLACING 3 TO 4 TONS OF MULCH PER ACRE, SECURED WITH ANCHORED NETTING, ELSEWHERE. THE INSTALLATION OF EROSION CONTROL BLANKETS OR MULCH AND NETTING SHALL NOT OCCUR OVER ACCUMULATED SNOW OR FROZEN GROUND AND SHALL BE COMPLETED IN ADVANCE OF THAW OR SPRING MELT EVENTS. ALTERNATIVELY, WHERE APPROVED BY ENGINEER, STABILIZATION MAY BE ACCOMPLISHED BY USE OF BONDED FIBER POLYMER EMULSION APPLIED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS.
2. ALL DITCHES OR SWALES WHICH DO NOT EXHIBIT A MINIMUM OF 85% VEGETATIVE GROWTH BY OCTOBER 15TH, OR WHICH ARE DISTURBED AFTER OCTOBER 15TH, SHALL BE TEMPORARILY STABILIZED WITH STONE OR EROSION CONTROL BLANKETS APPROPRIATE FOR THE DESIGN FLOW CONDITIONS.
3. AFTER NOVEMBER 30TH, INCOMPLETE ROAD OR PARKING SURFACES, WHERE WORK HAS STOPPED FOR THE WINTER SEASON, SHALL BE PROTECTED WITH A MINIMUM OF 3 INCHES OF CRUSHED GRAVEL (NHDOT 304.3).

Inspections

1. A CERTIFIED PROFESSIONAL IN EROSION AND SEDIMENT CONTROL OR A PROFESSIONAL ENGINEER LICENSED IN THE STATE OF NEW HAMPSHIRE ("MONITOR") SHALL INSPECT THE SITE FROM THE START OF ALTERATION OF TERRAIN ACTIVITIES UNTIL THE SITE IS IN FULL COMPLIANCE WITH THE SITE SPECIFIC/ALTERATION OF TERRAIN PERMIT (PERMIT).
2. THE MONITOR SHALL INSPECT THE SUBJECT SITE AT LEAST ONCE A WEEK, AND IF POSSIBLE, DURING ANY 0.5 INCH OR GREATER RAIN EVENT (I.E. 0.5 INCHES OF PRECIPITATION OR MORE WITHIN A 24 HOUR PERIOD). IF UNABLE TO BE PRESENT DURING SUCH A STORM, THE MONITOR SHALL INSPECT THE SITE WITHIN 24 HOURS OF THIS EVENT.
3. THE MONITOR SHALL PROVIDE TECHNICAL ASSISTANCE AND RECOMMENDATIONS TO THE CONSTRUCTION PROJECT MANAGER (IBERDROLA) ON THE APPROPRIATE BEST MANAGEMENT PRACTICES FOR EROSION AND SEDIMENT CONTROLS REQUIRED TO MEET THE REQUIREMENTS OF RSA 485-A:17 AND ALL APPLICABLE DES PERMIT CONDITIONS.
4. THE PROJECT MONITOR SHALL BE UNDER DIRECT SUPERVISION OF THE PROJECT DESIGN ENGINEER (VHB) THAT WAS RESPONSIBLE FOR PREPARATION OF EROSION CONTROL PLANS.

Construction Sequencing

1. PRIOR TO START OF CONSTRUCTION, THE CONTRACTOR SHALL SUBMIT TO THE ENGINEER, A DETAILED PHASING AND CONSTRUCTION SEQUENCING PLAN THAT SHOWS THE PHASED AREAS OF CONSTRUCTION AND TEMPORARY EROSION CONTROL MEASURES TO BE IMPLEMENTED.
2. INSTALL PERIMETER EROSION CONTROLS AND EROSION CONTROL BARRIERS AT TOES (BOTTOM) OF PROPSED FILL AREAS PRIOR TO EARTH MOVING OPERATIONS.
3. INSTALL OTHER EROSION CONTROLS INCLUDING EROSION CONTROL BARRIERS ALONG DITCH LINES/FLOW LINES, CHECK DAMS, SEDIMENT PONDS, ETC. AS SOON AS POSSIBLE AS EARTH MOVING OPERATIONS PROGRESS.
4. WATER QUALITY PONDS AND SWALES SHALL BE INSTALLED EARLY ON IN THE CONSTRUCTION SEQUENCE.
5. ALL DITCHES AND SWALES SHALL BE STABILIZED PRIOR TO DIRECTING RUNOFF TO THEM.
6. ALL ROADWAYS AND PARKING AREAS SHALL BE STABILIZED WITHIN 72 HOURS OF ACHIEVING FINISHED GRADE.
7. ALL CUT AND FILL SLOPES SHALL BE STABILIZED WITHIN 72 HOURS OF ACHIEVING FINISHED GRADE.

Phasing

GROTON HOLLOW ROAD

A) GROTON HOLLOW ROAD

- MARK LIMITS OF DISTURBANCES AND INSTALL PERIMETER EROSION CONTROL ALONG GROTON HOLLOW ROAD;
- CLEAR AND GRUB ROAD TO LIMITS OF DISTURBANCE;
- CONSTRUCT GROTON HOLLOW ROAD IMPROVEMENTS AND UPGRADES;
- STABILIZE GROTON HOLLOW ROAD AND ADJACENT AREAS.

EAST RIDGE

B) EAST ACCESS ROAD

- MARK LIMITS OF DISTURBANCES AND INSTALL PERIMETER EROSION CONTROL ALONG EAST ACCESS ROAD;
- CLEAR AND GRUB ROAD TO LIMITS OF DISTURBANCE;
- CONSTRUCT EAST ACCESS ROAD IMPROVEMENTS;
- STABILIZE EAST ACCESS ROAD AND ADJACENT AREAS.

C) EAST RIDGE ROAD & EAST RIDGE TURBINE PADS

- MARK LIMITS OF DISTURBANCES AND INSTALL PERIMETER EROSION CONTROL ALONG EAST RIDGE ROAD AND TURBINE AREAS;
- CLEAR AND GRUB ROAD AND TURBINE AREAS TO LIMITS OF DISTURBANCE;
- CONSTRUCT EAST RIDGE ROAD AND TURBINE PADS;
- STABILIZE EAST RIDGE ROAD, TURBINE PADS AND ADJACENT AREAS.
- ERECT WIND TURBINES ON EAST RIDGE AND INSTALL UNDERGROUND AND ABOVE GROUND UTILITIES.

OPERATION & MAINTENANCE AREA

D) OPERATION & MAINTENANCE AREA

- MARK LIMITS OF DISTURBANCES AND INSTALL PERIMETER EROSION CONTROL AROUND O&M AREA;
- CLEAR AND GRUB O&M AREA TO LIMITS OF DISTURBANCE;
- GRADE O&M AREA, CONSTRUCT BUILDING AND INSTALL PERMANENT EROSION CONTROL MEASURES;

WEST RIDGE

E) WEST ACCESS ROAD

- MARK LIMITS OF DISTURBANCES AND INSTALL PERIMETER EROSION CONTROL ALONG WEST ACCESS ROAD;
- CLEAR AND GRUB ROAD TO LIMITS OF DISTURBANCE;
- CONSTRUCT WEST ACCESS ROAD IMPROVEMENTS;
- STABILIZE WEST ACCESS ROAD AND ADJACENT AREAS.

F) WEST RIDGE ROAD & WEST RIDGE TURBINE PADS

- MARK LIMITS OF DISTURBANCES AND INSTALL PERIMETER EROSION CONTROL ALONG WEST RIDGE ROAD AND TURBINE AREAS;
- CLEAR AND GRUB ROAD AND TURBINE AREAS TO LIMITS OF DISTURBANCE;
- CONSTRUCT WEST RIDGE ROAD AND TURBINE PADS;
- STABILIZE WEST RIDGE ROAD, TURBINE PADS AND ADJACENT AREAS.
- ERECT WIND TURBINES ON WEST RIDGE AND INSTALL UNDERGROUND AND ABOVE GROUND UTILITIES.

NORTH RIDGE

G) NORTH ACCESS ROAD

- MARK LIMITS OF DISTURBANCES AND INSTALL PERIMETER EROSION CONTROL ALONG NORTH ACCESS ROAD;
- CLEAR AND GRUB ROAD TO LIMITS OF DISTURBANCE;
- CONSTRUCT NORTH ACCESS ROAD IMPROVEMENTS;
- STABILIZE NORTH ACCESS ROAD AND ADJACENT AREAS.

H) NORTH RIDGE ROAD & NORTH RIDGE TURBINE PADS

- MARK LIMITS OF DISTURBANCES AND INSTALL PERIMETER EROSION CONTROL ALONG NORTH RIDGE ROAD AND TURBINE AREAS;
- CLEAR AND GRUB ROAD AND TURBINE AREAS TO LIMITS OF DISTURBANCE;
- CONSTRUCT NORTH RIDGE ROAD AND TURBINE PADS;
- STABILIZE NORTH RIDGE ROAD, TURBINE PADS AND ADJACENT AREAS.
- ERECT WIND TURBINES ON NORTH RIDGE AND INSTALL UNDERGROUND AND ABOVE GROUND UTILITIES.

VHB

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Environmental Services

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Prepared For:

IBERDROLA RENEWABLES

No.	Revision	Date	Appvd.

Designed by	Drawn by	Checked by
CAD checked by	Approved by	
Scale As Noted	Date February 12, 2010	

Project Title

Groton Wind Farm

Groton Hollow Road
Groton, New Hampshire

Issued for

Permitting

Not Approved for Construction

Drawing Title

Site Details and Erosion Control Notes

STATE OF NEW HAMPSHIRE
MICHAEL J. LEO
No. 7146
LICENSED
PROFESSIONAL ENGINEER

Drawing Number

C-10.4

Sheet 57 of 68

Project Number
52036.00

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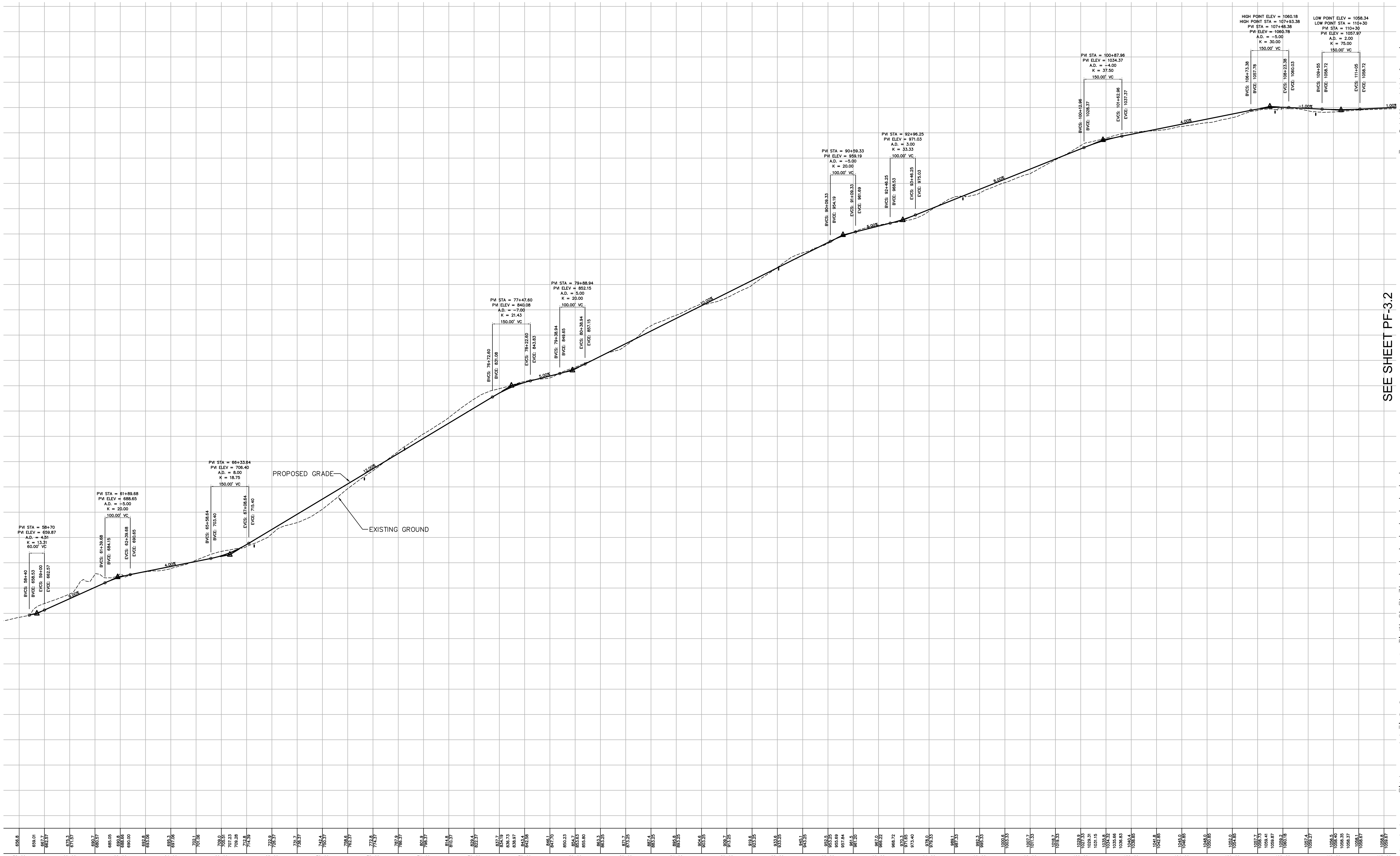

Groton Hollow Road

HORIZONTAL
200 0 200 400
40 0 40 80
VERTICAL
SCALE IN FEET

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Prepared For:
IBERDROLA RENEWABLES

No.	Revision	Date	Appvd.

Designed by | Drawn by | Checked by
CAD checked by | Approved by
Scale 1"=200'h/1"=40'v | Date February 12, 2010

Project Title
Groton Wind Farm

Groton Hollow Road
Groton, New Hampshire

Issued for
Permitting

Not Approved for Construction

Drawing Title
Roadway Profile
Groton Hollow Road

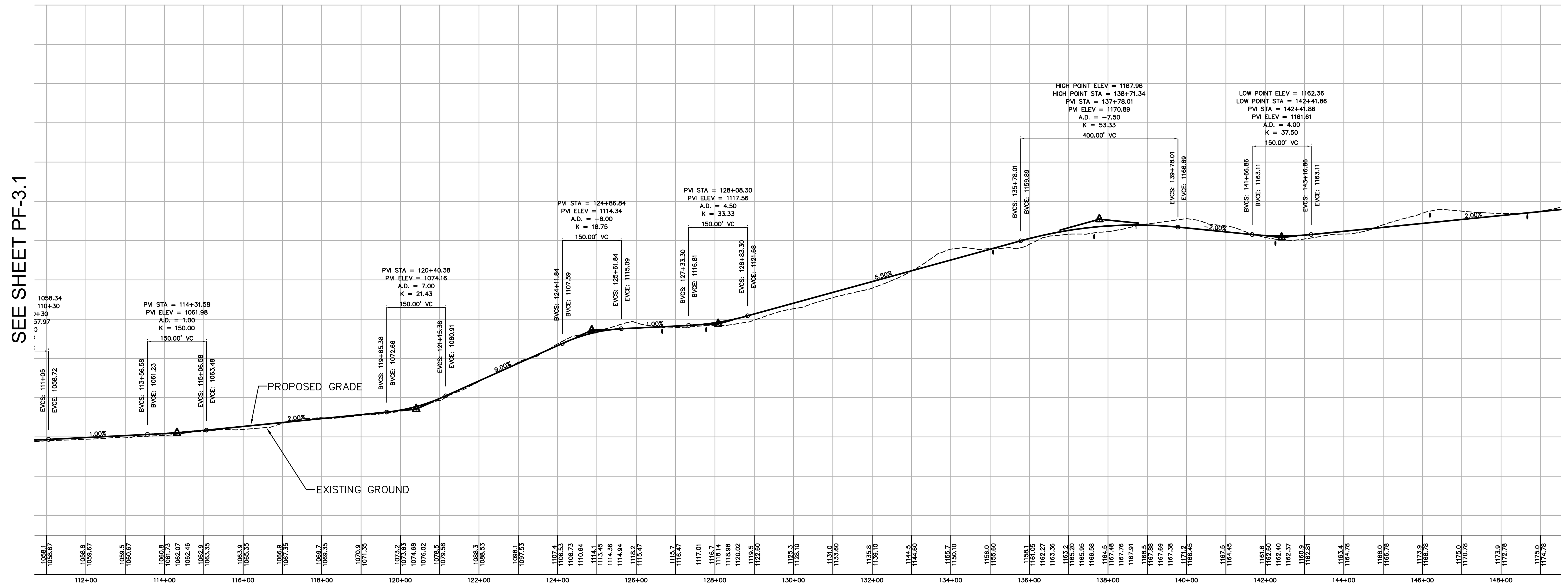
STATE OF NEW HAMPSHIRE
MICHAEL J. LEO
No. 7146
LICENSED
PROFESSIONAL ENGINEER

Drawing Number
PF-3.1

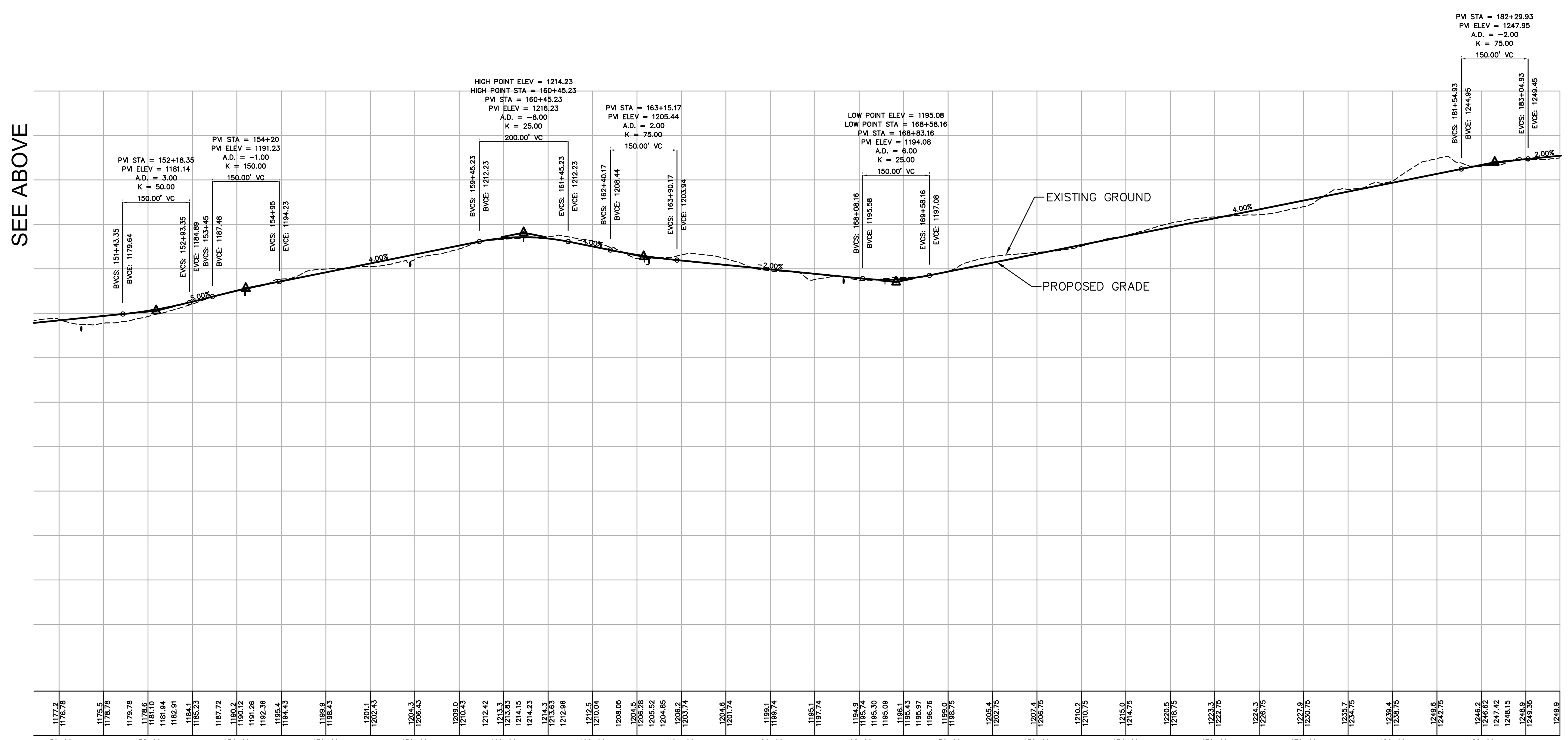
Sheet 58 of 68

Project Number
52036.00

52036-PF.DWG



Groton Hollow Road



Groton Hollow Road

HORIZONTAL
200 0 200 400
40 0 40 80
VERTICAL
SCALE IN FEET

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Prepared For:

IBERDROLA RENEWABLES

No.	Revision	Date	Appvd.

Designed by | Drawn by | Checked by

CAD checked by | Approved by

Scale 1"=200'h/1"=40'v | Date February 12, 2010

Project Title

Groton Wind Farm

Groton Hollow Road
Groton, New Hampshire

Issued for

Permitting

Not Approved for Construction

Drawing Title

Roadway Profile
Groton Hollow Road

STATE OF NEW HAMPSHIRE
MICHAEL J. LEO No. 7146
LICENSED PROFESSIONAL ENGINEER

Drawing Number

PF-3.2

Sheet 59 of 68

Project Number
52036.00

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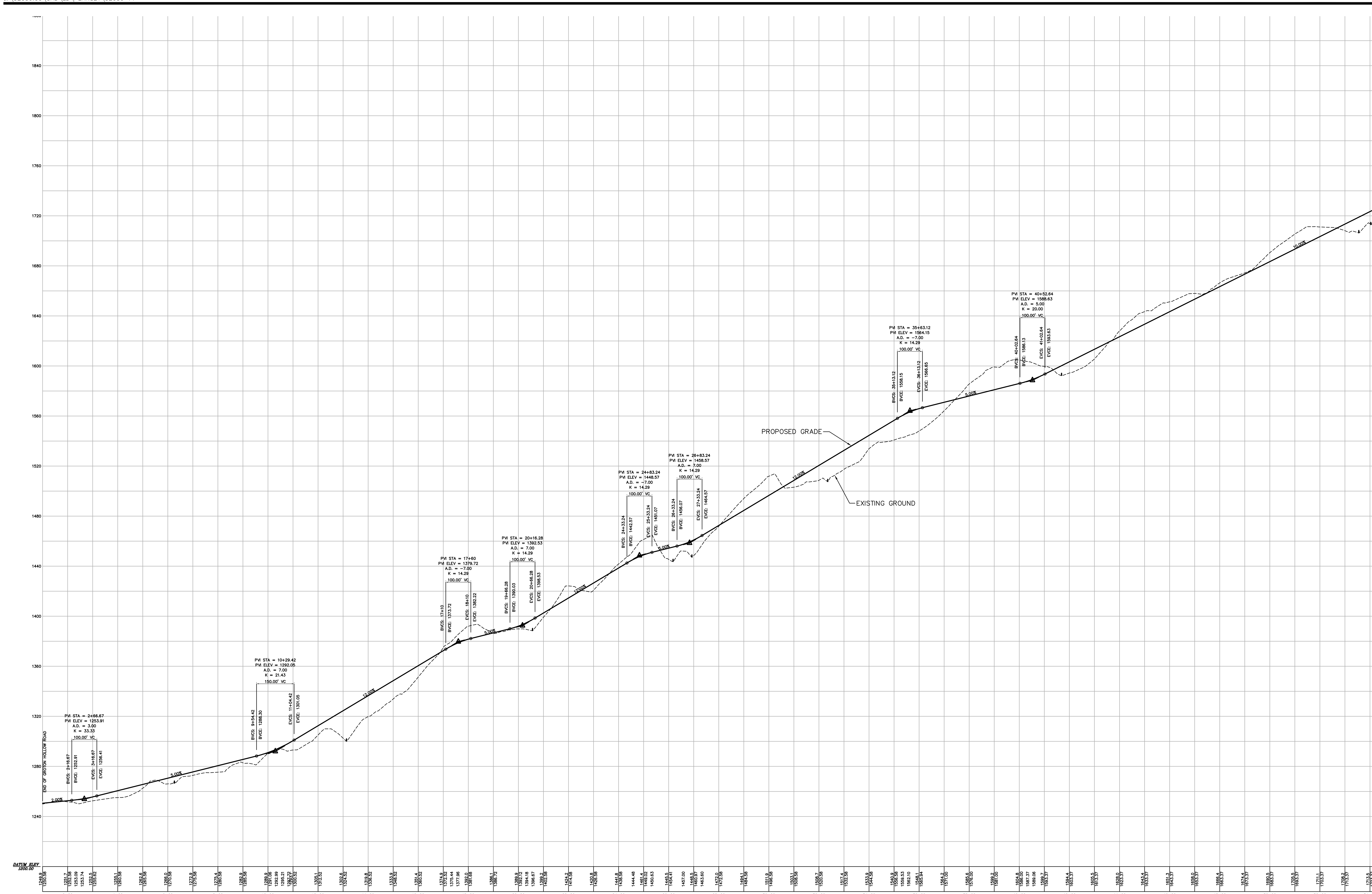

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Prepared For:

IBERDROLA RENEWABLES

No.	Revision	Date	Appvd.

Designed by	Drawn by	Checked by
CAD checked by	Approved by	
Scale 1"=200'h/1"=40'v	Date February 12, 2010	

Project Title

Groton Wind Farm

Groton Hollow Road
Groton, New Hampshire

Issued for

Permitting

Not Approved for Construction

Drawing Title

Roadway Profile
East Access Road

East Access Road

HORIZONTAL
200 0 200 400

40 0 40 80
VERTICAL
SCALE IN FEET

STATE OF NEW HAMPSHIRE
MICHAEL J. LEO
No. 7146
LICENSED
PROFESSIONAL ENGINEER

Drawing Number

PF-4.1

Sheet 60 of 68

Project Number
52036.00

52036-PF.DWG

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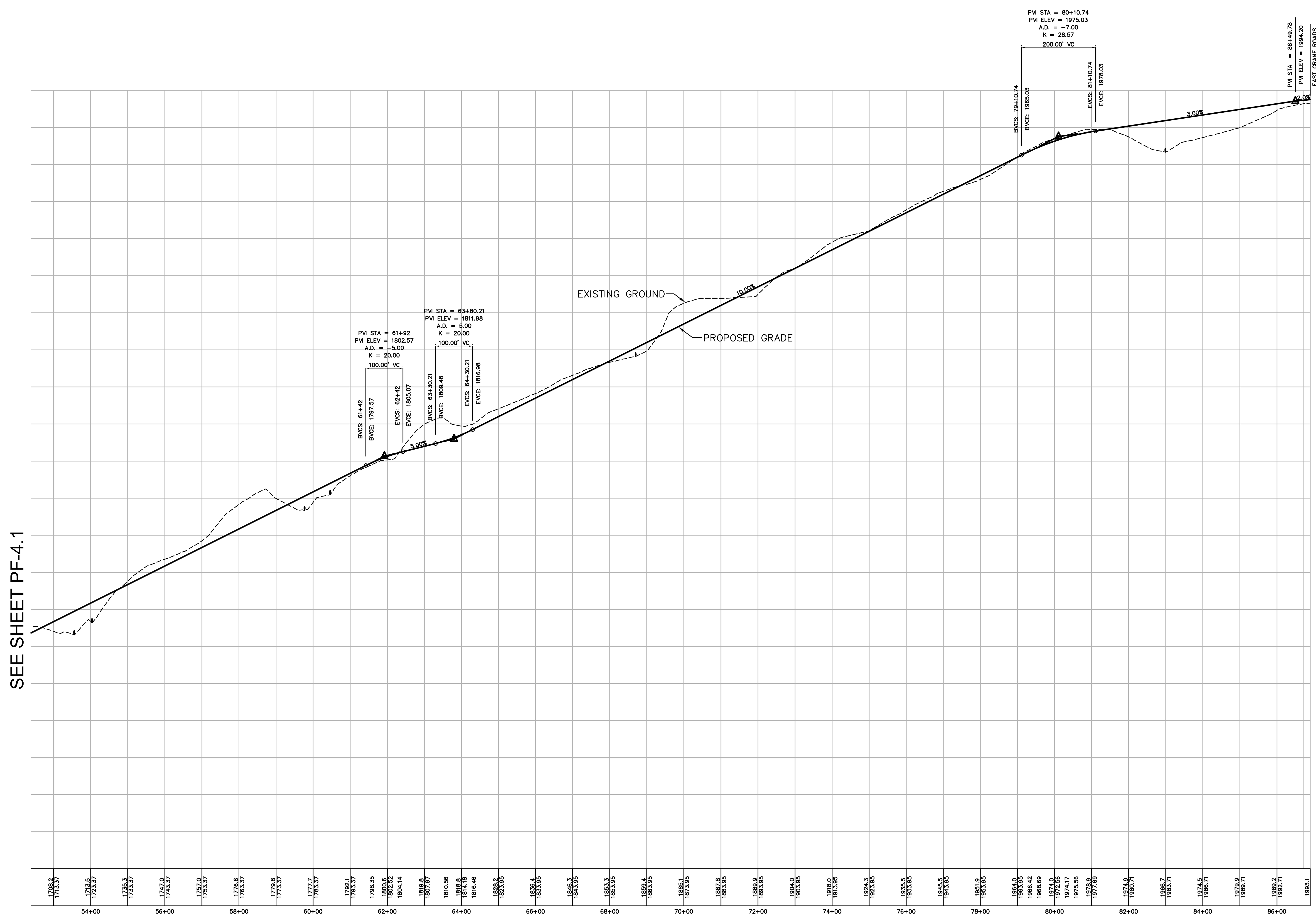

East Access Road

HORIZONTAL
200 0 200 400
40 0 40 80
VERTICAL
SCALE IN FEET

VHB

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Land Development
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IBERDROLA RENEWABLES

No.	Revision	Date	Appvd.

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CAD checked by | Approved by

Scale 1"=200'h/1"=40'v | Date February 12, 2010

Project Title

Groton Wind Farm

Groton Hollow Road
Groton, New Hampshire

Issued for

Permitting

Not Approved for Construction

Drawing Title

Roadway Profile
East Access Road

STATE OF NEW HAMPSHIRE
MICHAEL J. LEO
No. 7146
LICENSED
PROFESSIONAL

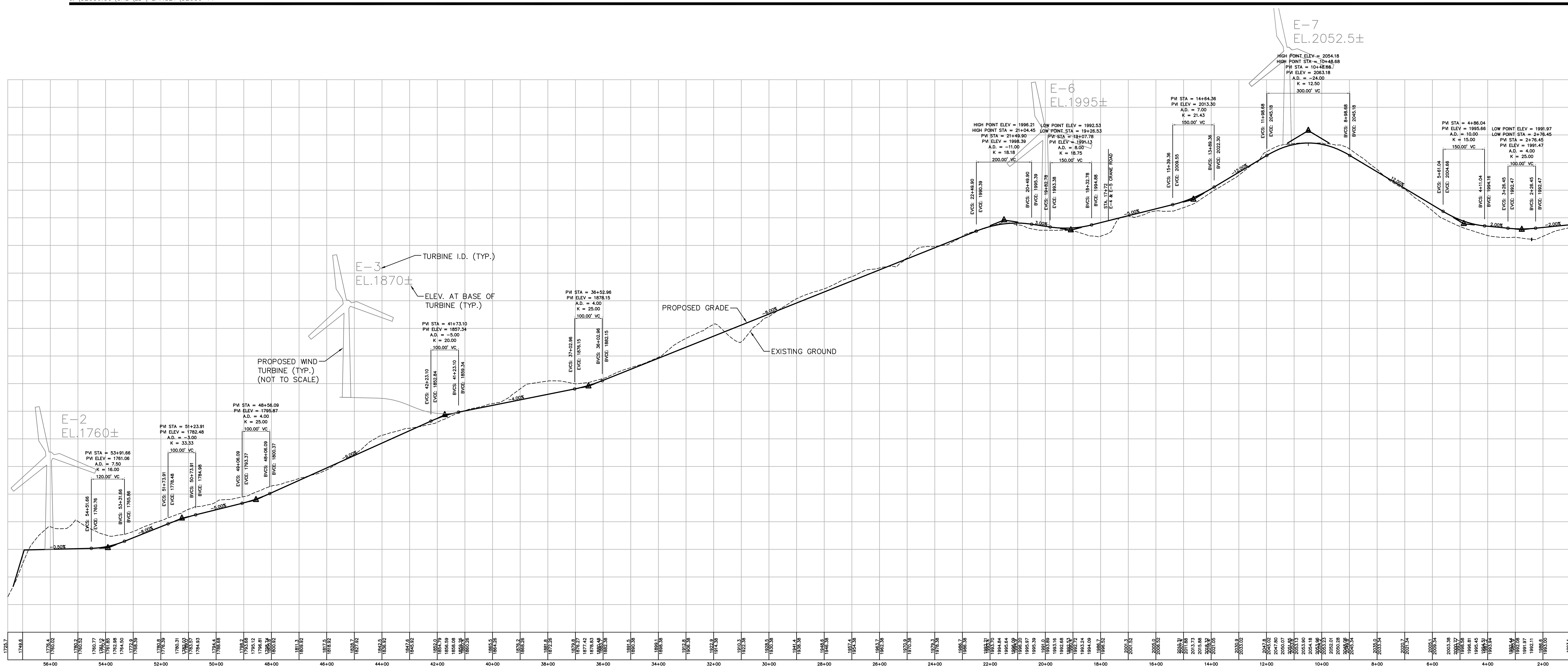
Drawing Number

PF-4.2

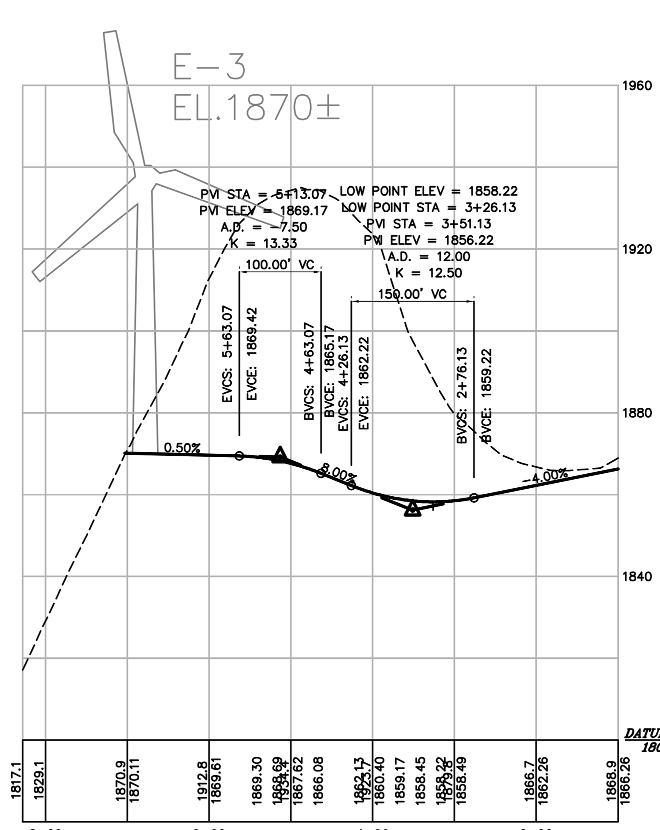
Sheet 61 of 68

Project Number
52036.00

52036-PF.DWG



Northeast Crane Road



E-3 Crane Road

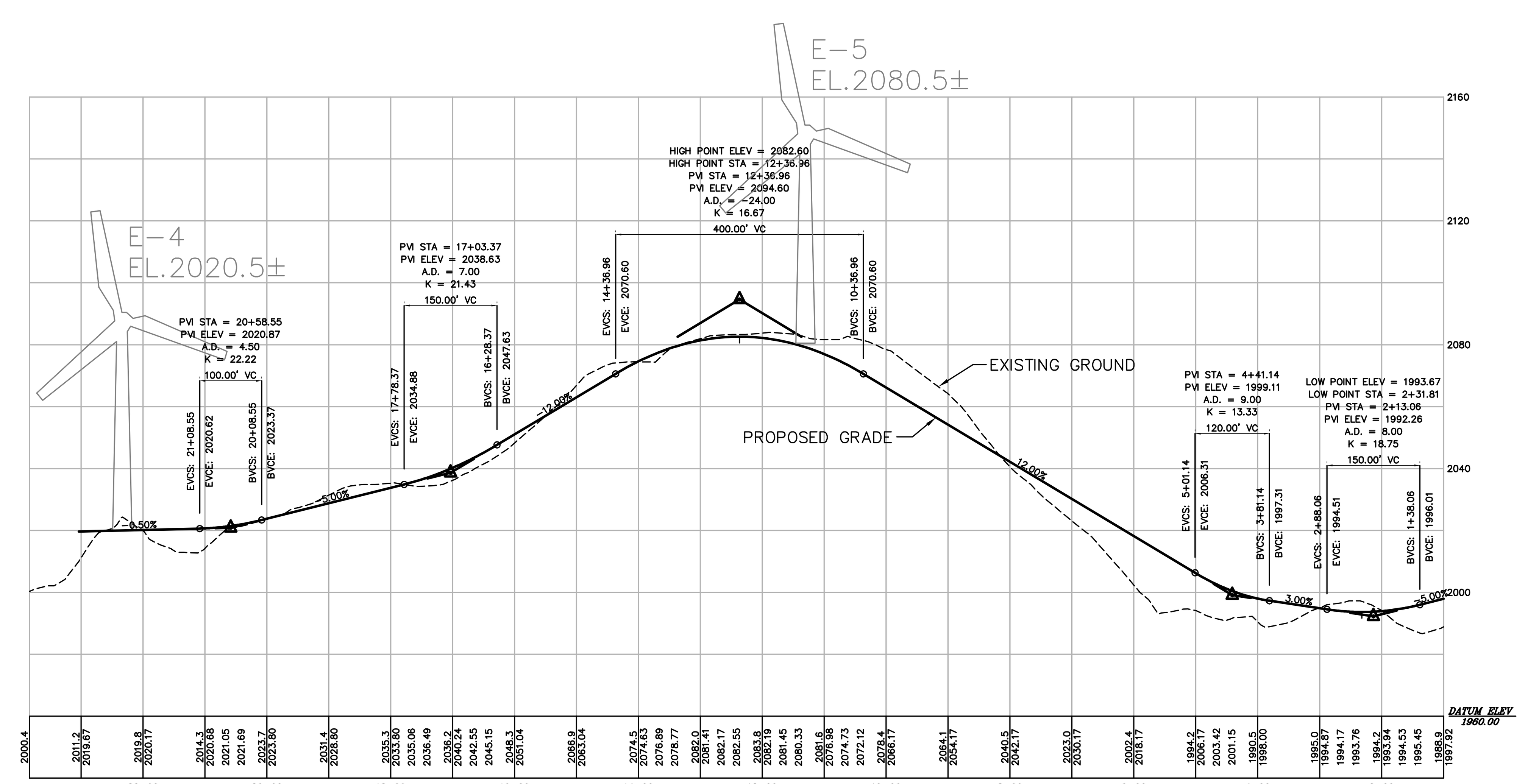
HORIZONTAL

200 0 200 400

40 0 40 80

VERTICAL

SCALE IN FEET



E-4 & E-5 Crane Road

VHB

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Project Title

Groton Wind Farm

Groton Hollow Road
Groton, New Hampshire

Issued for

Permitting

Not Approved for Construction

Drawing Title

Roadway Profile
Northeast Crane Road

Drawing Number

PF-5

STATE OF NEW HAMPSHIRE
MICHAEL J. LEO
No. 7146
LICENSED
PROFESSIONAL ENGINEER

Sheet 62 of 68

Project Number
52036.00

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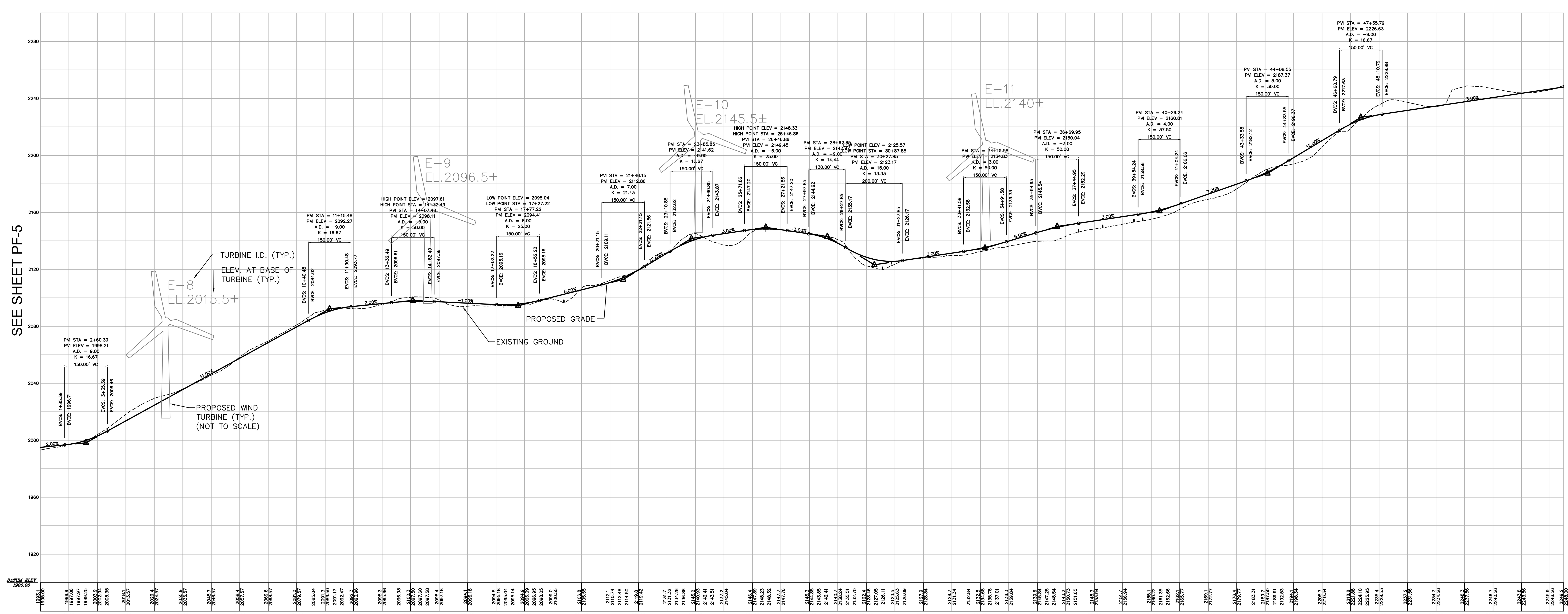
SEE SHEET PF-5



Southeast Crane Road

HORIZONTAL
200 0 200 400
40 0 40 80
VERTICAL
SCALE IN FEET

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Project Title
Groton Wind Farm

Groton Hollow Road
Groton, New Hampshire

Issued for
Permitting

Not Approved for Construction

Drawing Title

Roadway Profile
Southeast Crane Road

STATE OF NEW HAMPSHIRE MICHAEL J. LEO No. 7146 LICENSED PROFESSIONAL ENGINEER

Drawing Number
PF-6

Sheet 63 of 68

Project Number
52036.00

52036-PF.DWG

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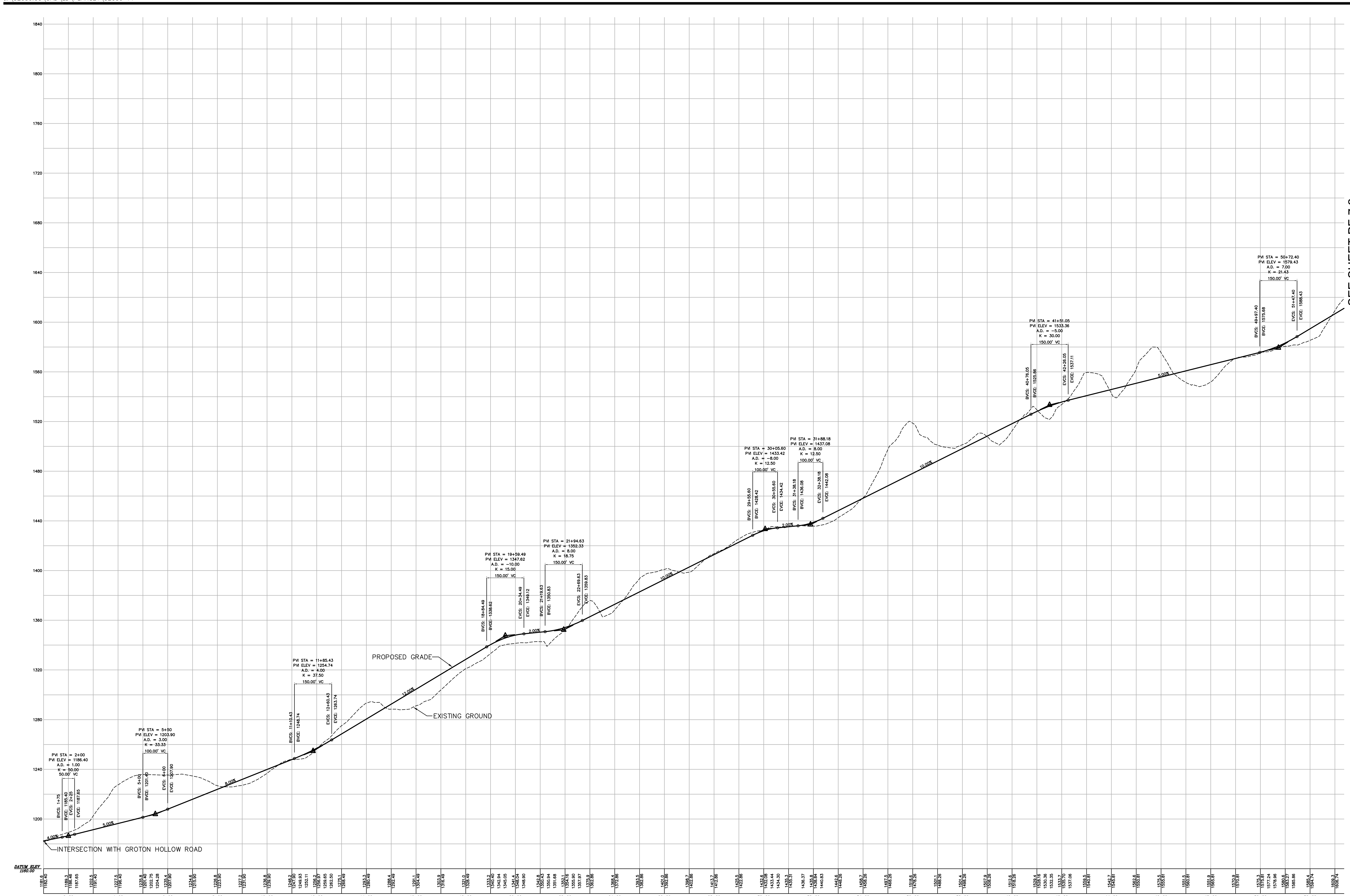

West Access Road

HORIZONTAL
200 0 200 400
40 0 40 80
VERTICAL
SCALE IN FEET

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Project Title

Groton Wind Farm

Groton Hollow Road
Groton, New Hampshire

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Drawing Title

Roadway Profile
West Access Road

Drawing Number

PF-7.1

Sheet 64 of 68

Project Number
52036.00

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MICHAEL J. LEO
No. 7146
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52036-PF.DWG

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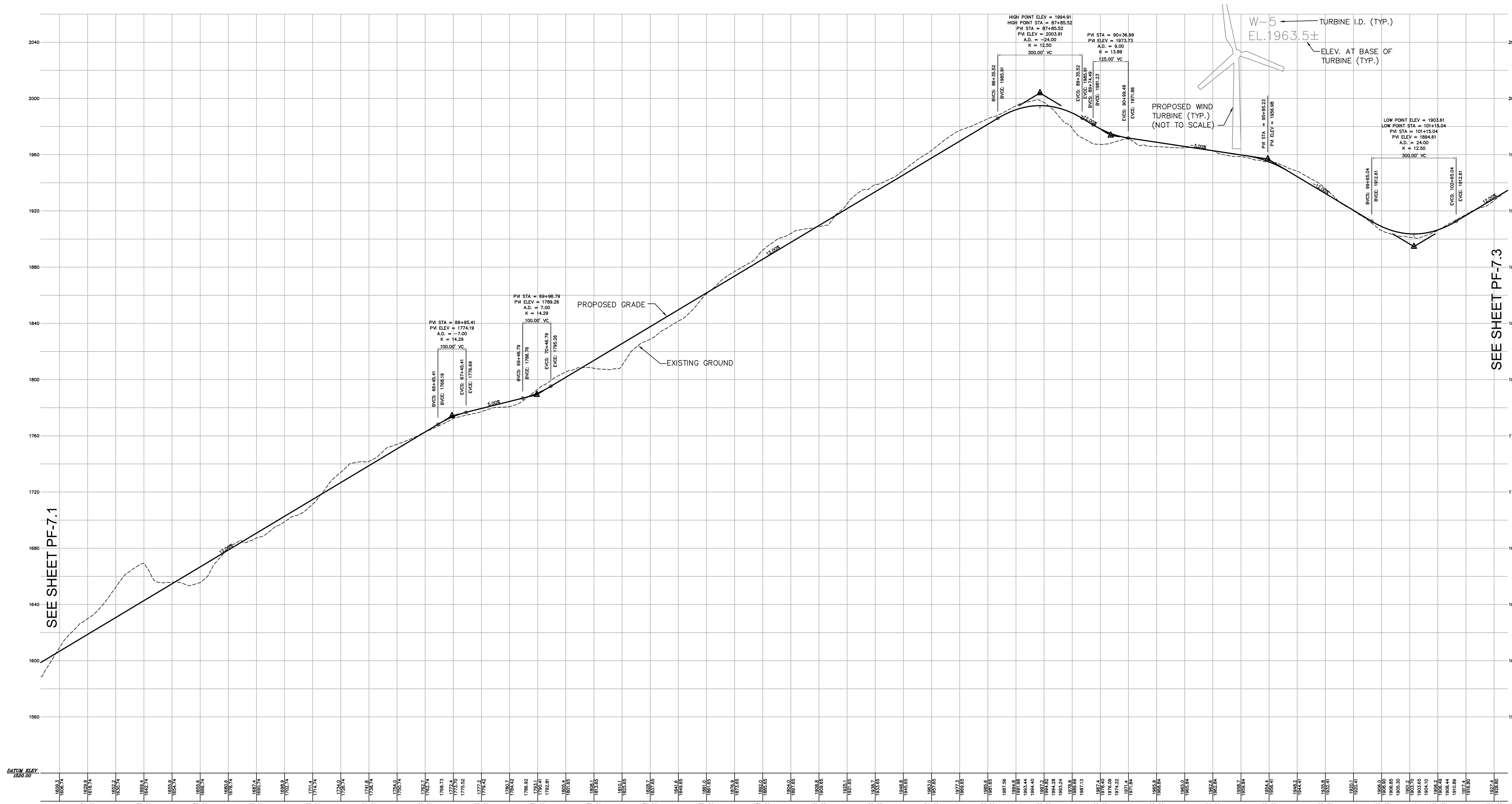

West Access Road

HORIZONTAL
200 0 200 400
40 0 40 80
VERTICAL
SCALE IN FEET

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Drawing Title

Roadway Profile
West Access Road

STATE OF NEW HAMPSHIRE
MICHAEL J. LEO
No. 7146
LICENSED
PROFESSIONAL ENGINEER

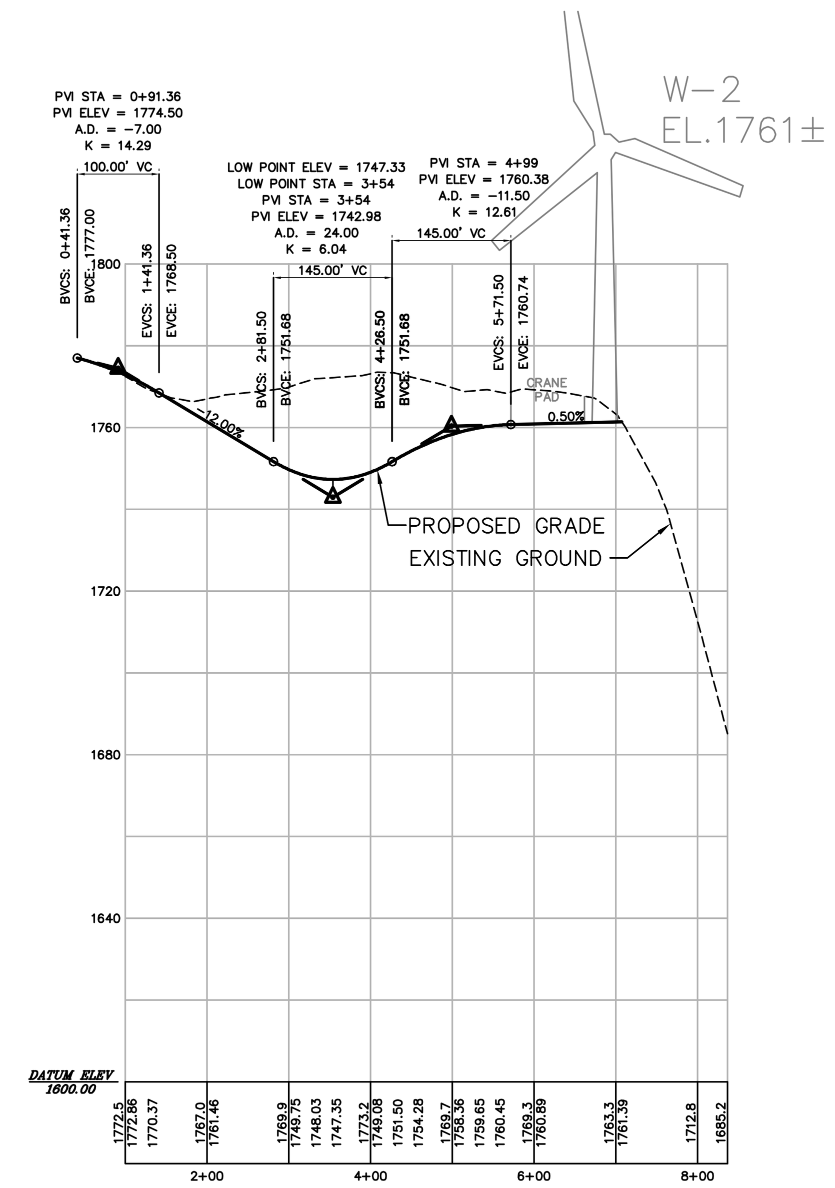
Drawing Number

PF-7.2

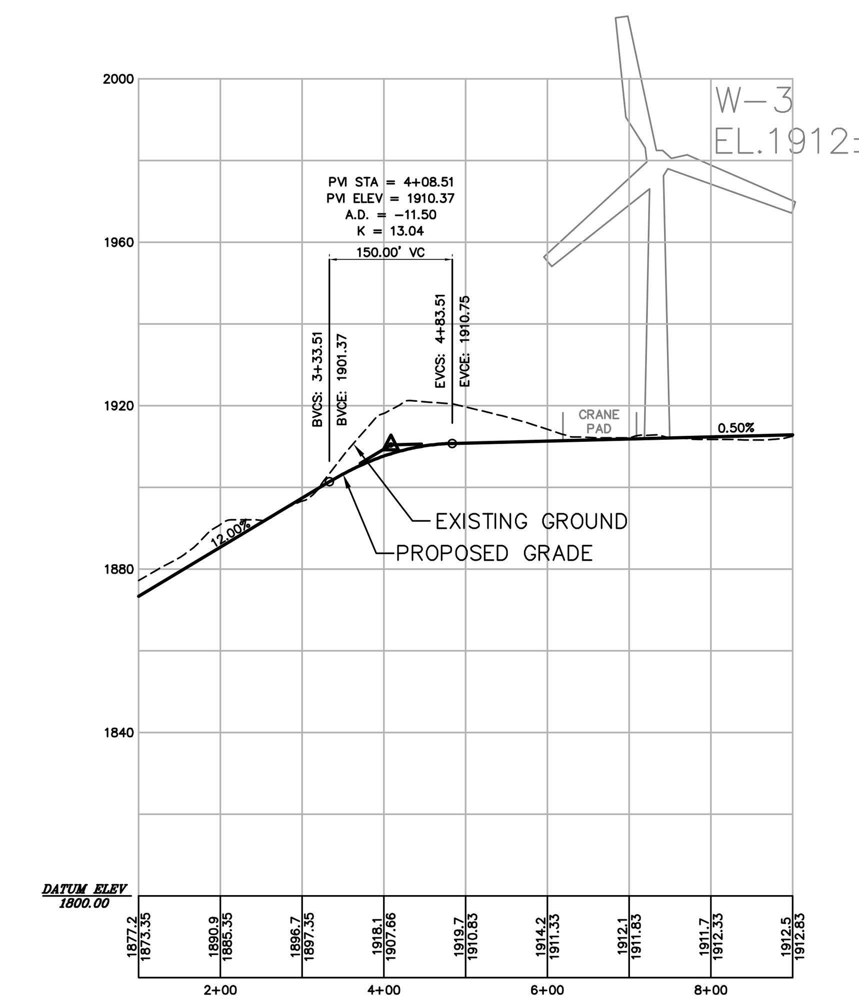
Sheet 65 of 68

Project Number
52036.00

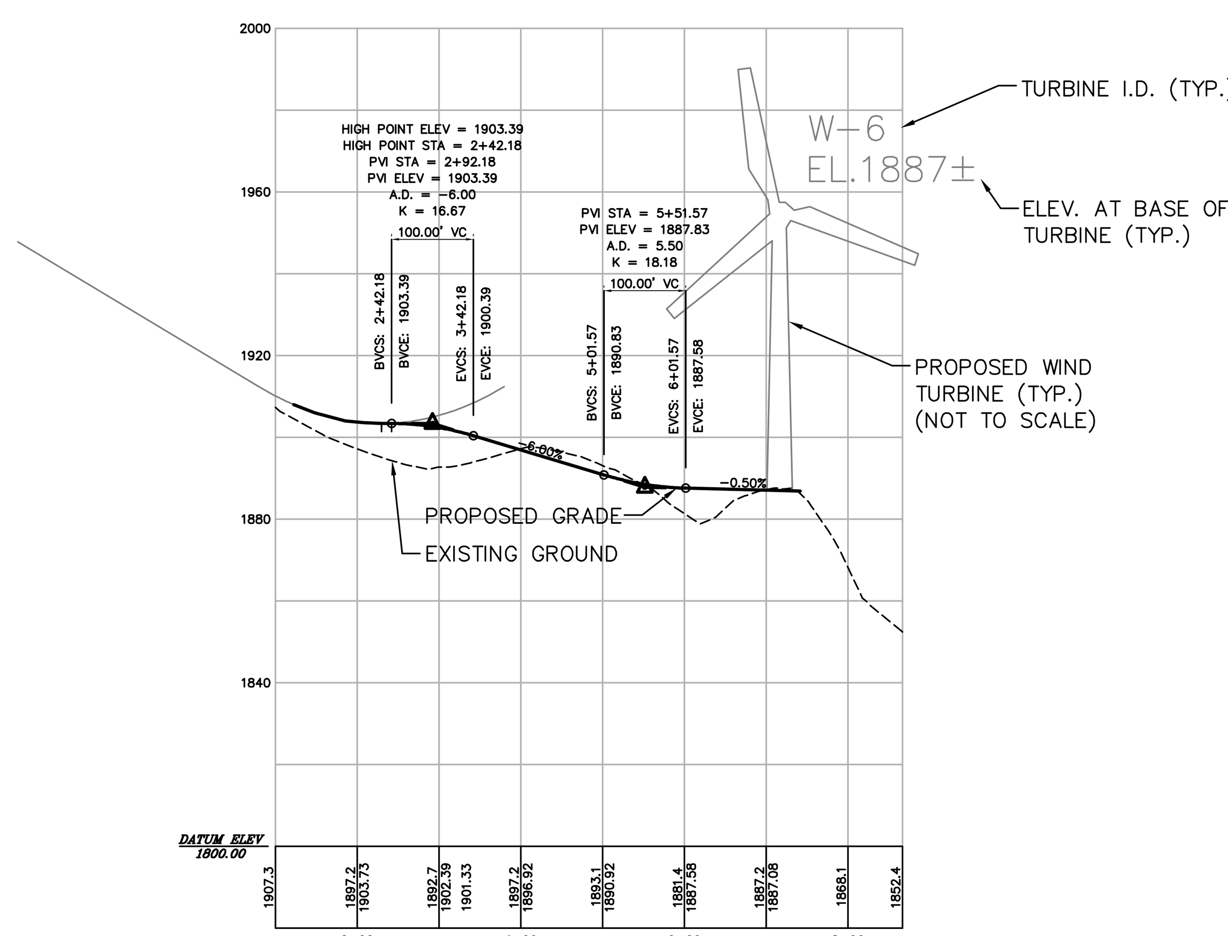
52036-PF.DWG



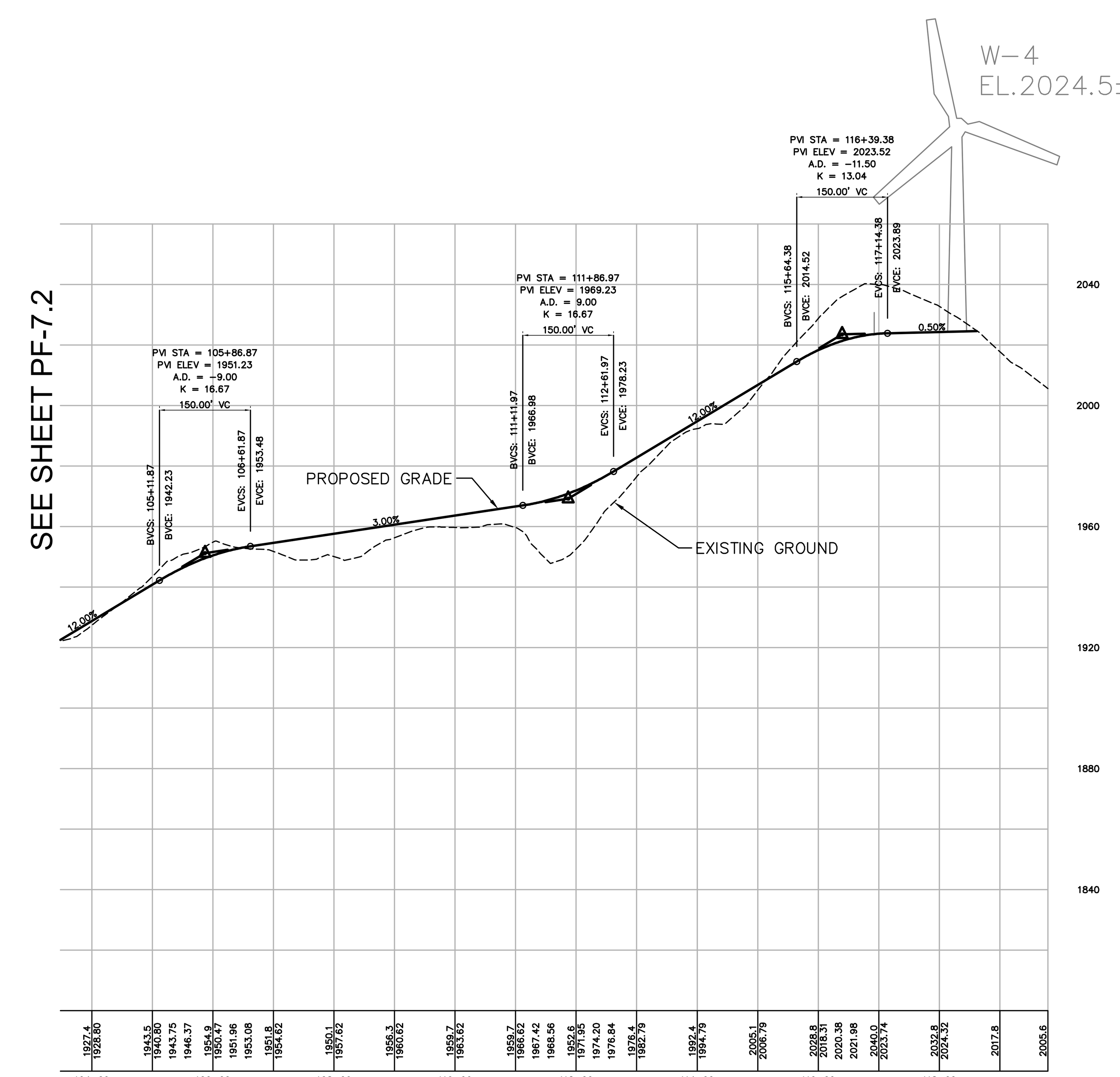
W-2 Crane Road



W-3 Crane Road



W-5 Crane Road



West Crane Road

HORIZONTAL
200 0 200 400
40 0 40 80
VERTICAL
SCALE IN FEET

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Project Title

Groton Wind Farm

Groton Hollow Road
Groton, New Hampshire

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Drawing Title

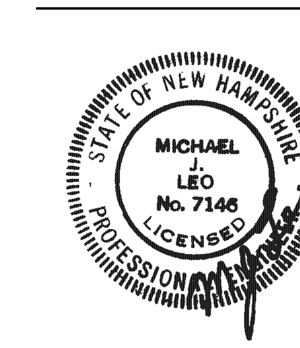
Roadway Profile
West Crane Road

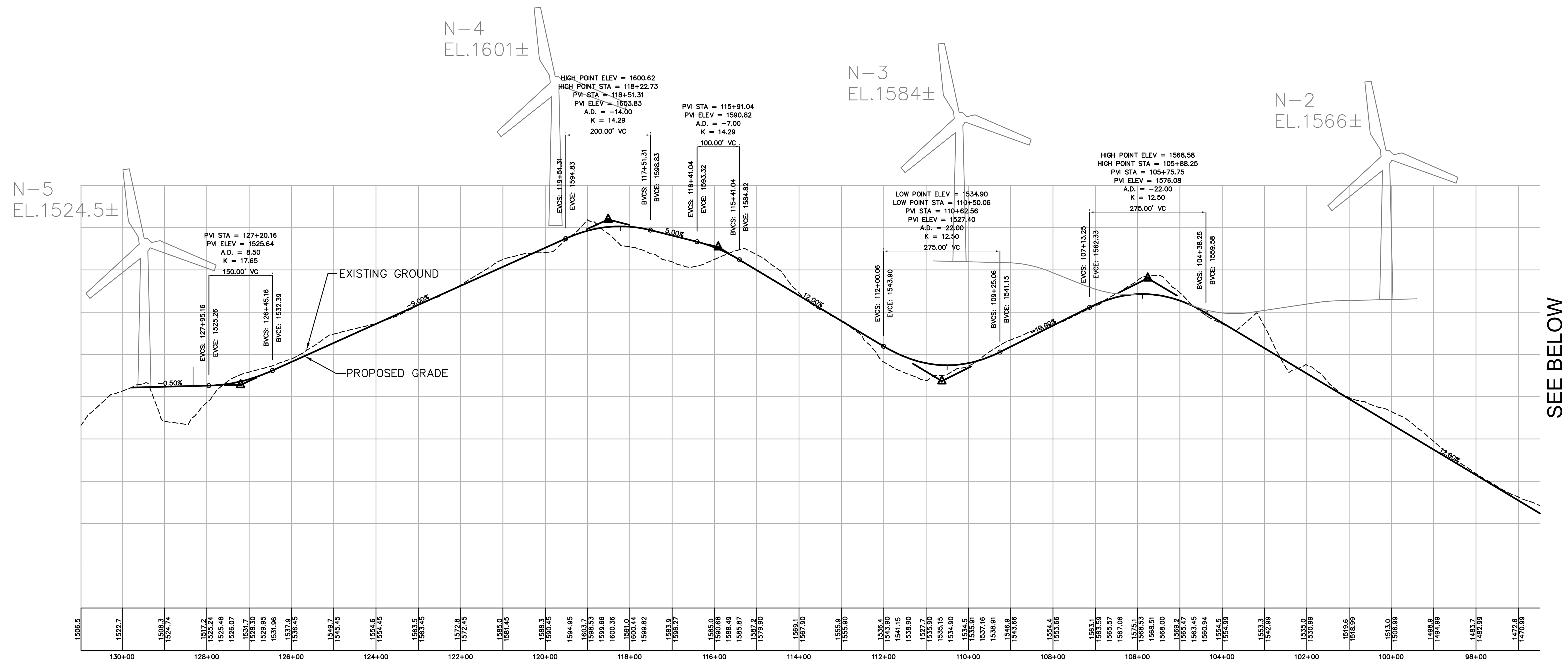
Drawing Number

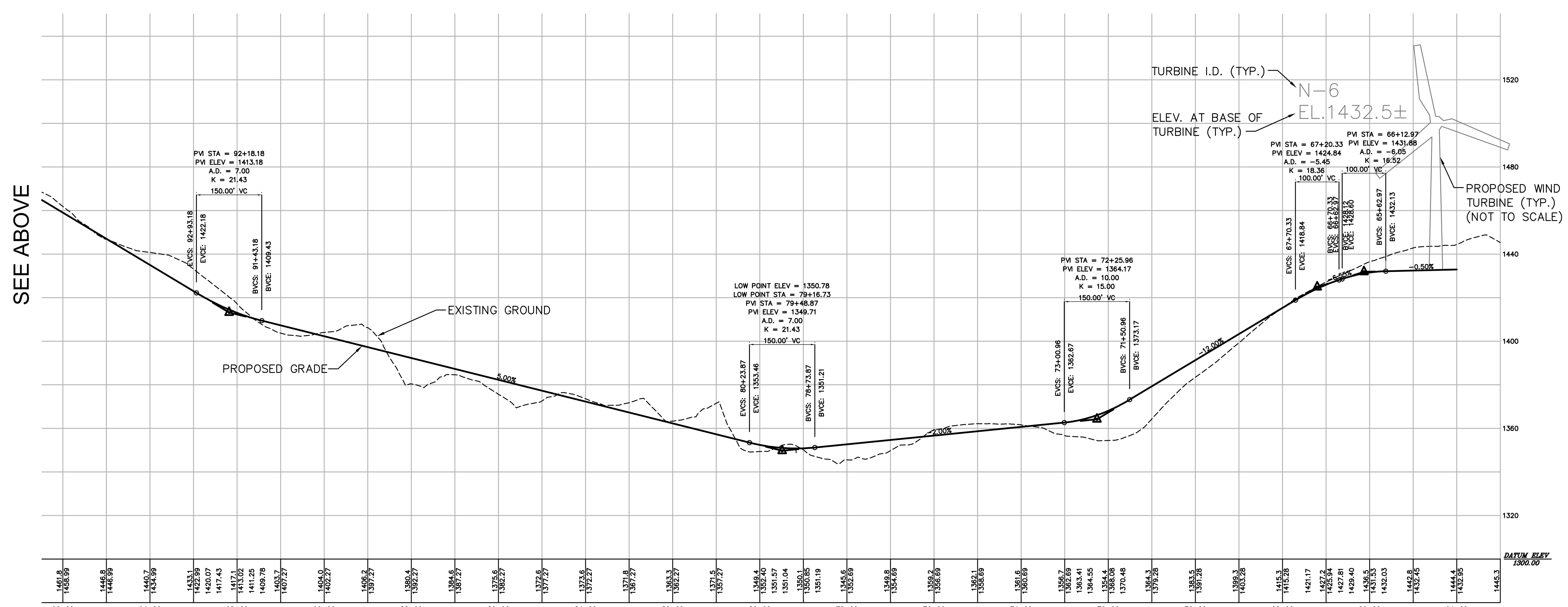
PF-7.3

Sheet 66 of 68

Project Number 52036.00







North Access Road

HORIZONTAL
200 0 200 400
40 0 40 80
VERTICAL
SCALE IN FEET

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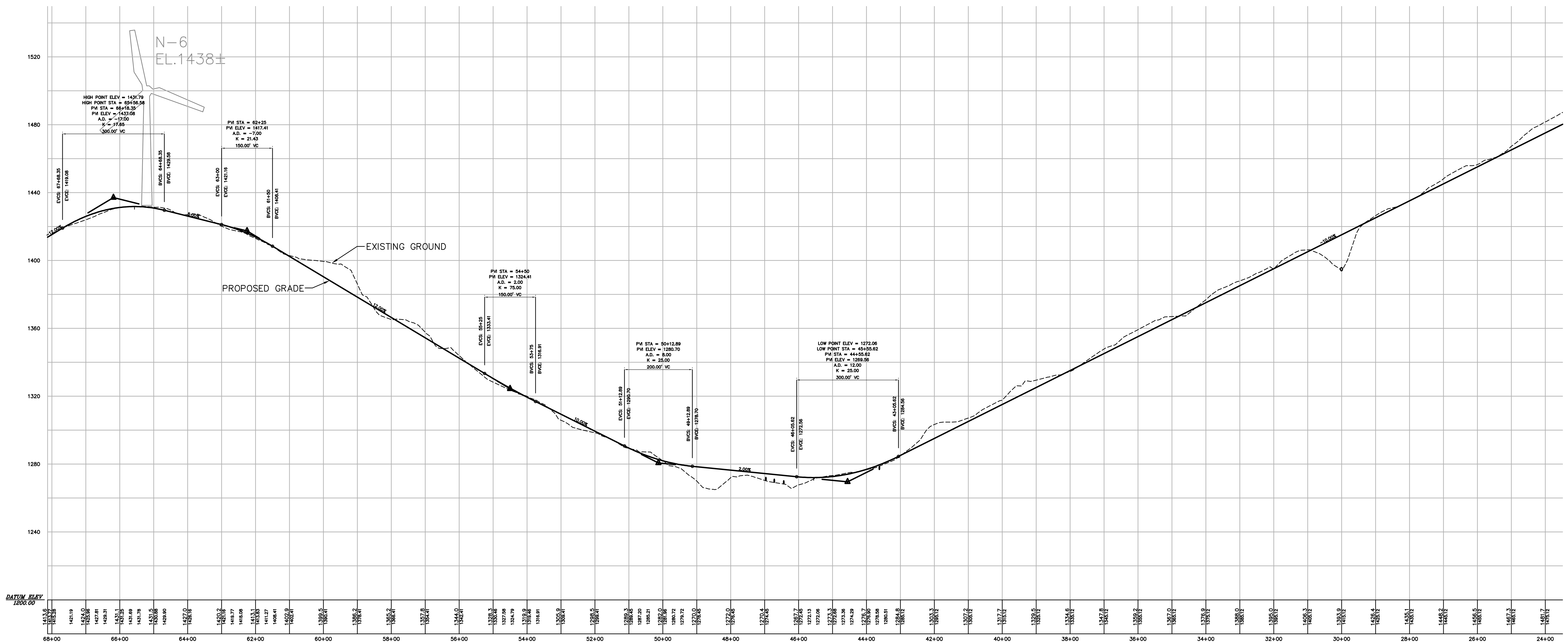
Drawing Title
Roadway Profile
North Access Road

STATE OF NEW HAMPSHIRE MICHAEL J. LEO No. 7146 LICENSED PROFESSIONAL ENGINEER

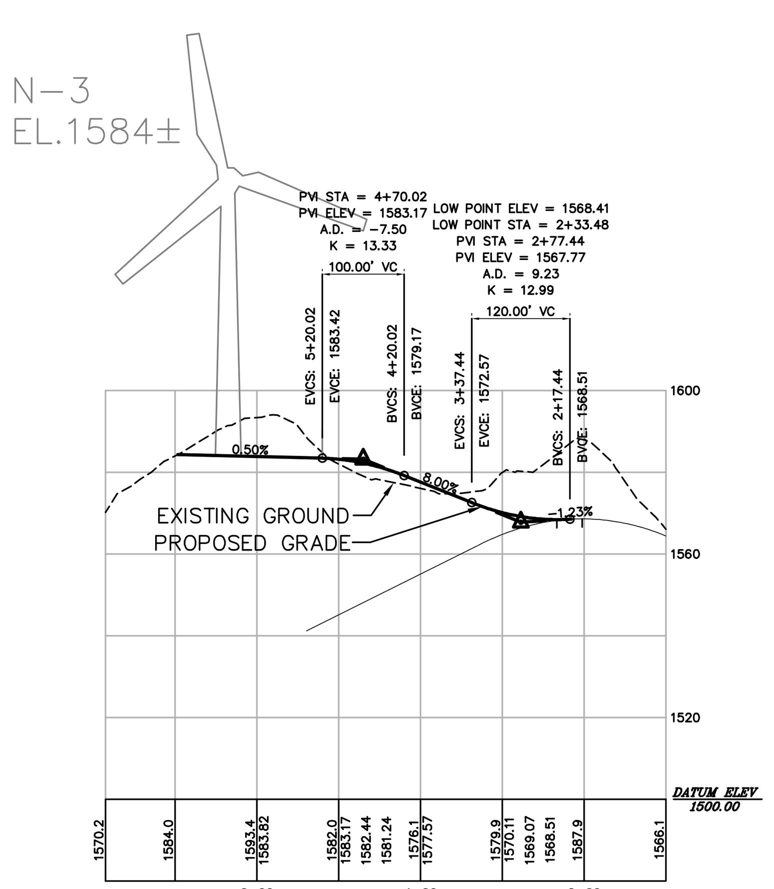
Drawing Number
PF-8.1

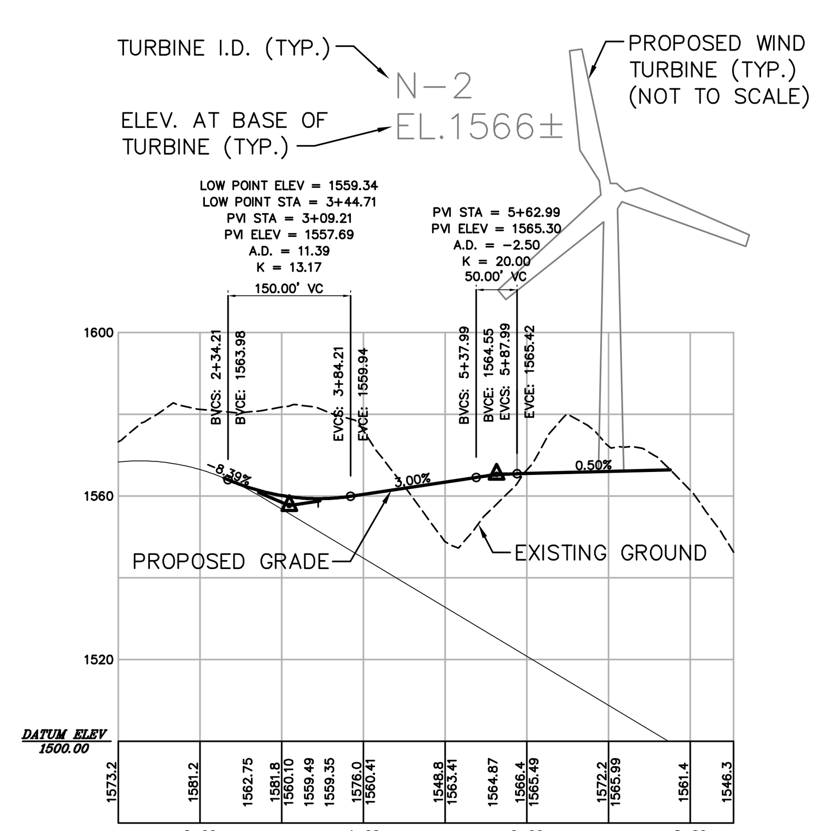
Sheet 67 of 68

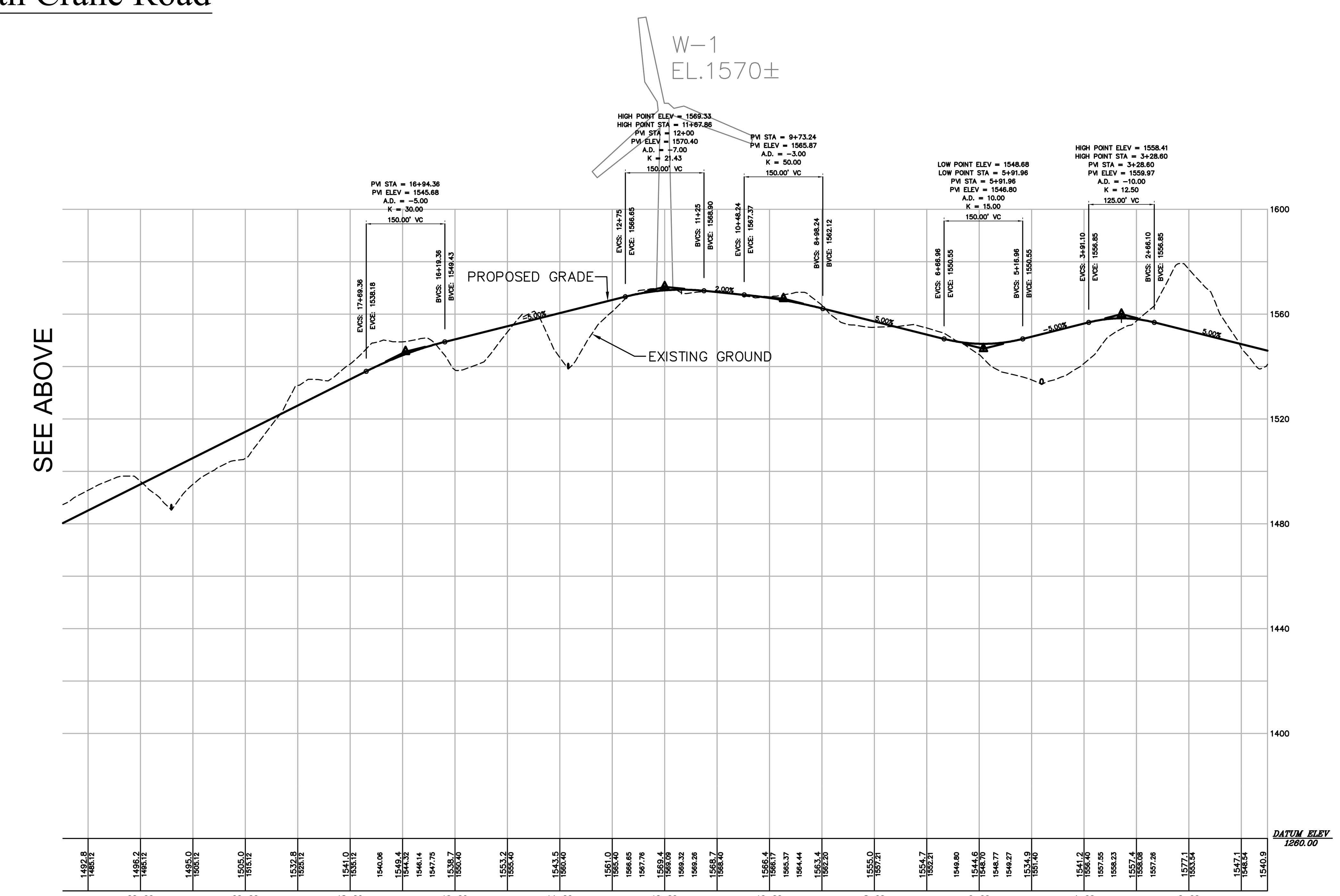
Project Number
52036.00



North Crane Road







North Crane Road

HORIZONTAL
200 0 200 400
40 0 40 80
VERTICAL
SCALE IN FEET

VHB

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Drawing Title

Roadway Profile
North Crane Road

Drawing Number

PF-8.2

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Sheet 68 of 68

Project Number
52036.00