7015 3430 0001 1569 7903

U.S. Postal Service™
CERTIFIED MAIL® RECEIPT
Domestic Mail Only

For delivery information, visit our website at www.usps.com®.

OFFICIAL USE

Certified Mail Fee $3.35
Extra Services & Fees (check box, add fee as appropriate)
☑ Return Receipt (hardcopy) $2.75
☐ Return Receipt (electronic) $
☐ Certified Mail Restricted Delivery $
☐ Adult Signature Required $
☐ Adult Signature Restricted Delivery $
Postage $.49
Total Postage and Fees $6.59

WEST UNION, WV Postmark Here AUG - 8 2017 USPS 26456-9998

Sent To Michael + Michelle DeVinney
Street and Apt. No., or PO Box No. 22 Miletus Rd.
City, State, ZIP+4® Salem, WV. 26426 (17-478)

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

7015 3430 0001 1569 7897

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Certified Mail Fee $3.35
Extra Services & Fees (check box, add fee as appropriate)
☑ Return Receipt (hardcopy) $2.75
☐ Return Receipt (electronic) $
☐ Certified Mail Restricted Delivery $
☐ Adult Signature Required $
☐ Adult Signature Restricted Delivery $
Postage $.49
Total Postage and Fees $6.59

WEST UNION, WV Postmark Here AUG - 8 2017 USPS 26456-9998

Sent To Caroly Chumley
Street and Apt. No., or PO Box No. 4186 Greenbriar Rd.
City, State, ZIP+4® Salem, WV. 26426 (17-478)

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

7015 3430 0001 1569 7880

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OFFICIAL USE

Certified Mail Fee $3.35
Extra Services & Fees (check box, add fee as appropriate)
☑ Return Receipt (hardcopy) $2.75
☐ Return Receipt (electronic) $
☐ Certified Mail Restricted Delivery $
☐ Adult Signature Required $
☐ Adult Signature Restricted Delivery $
Postage $.49
Total Postage and Fees $6.59

WEST UNION, WV Postmark Here AUG - 8 2017 USPS 26456-9998

Sent To Lola Bolen Et Al
Street and Apt. No., or PO Box No. Route 1, Box 332
City, State, ZIP+4® Salem, WV. 26426 (17-478)

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

7015 3430 0001 1569 7873

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OFFICIAL USE

Certified Mail Fee $3.35
Extra Services & Fees (check box, add fee as appropriate)
☑ Return Receipt (hardcopy) $2.75
☐ Return Receipt (electronic) $
☐ Certified Mail Restricted Delivery $
☐ Adult Signature Required $
☐ Adult Signature Restricted Delivery $
Postage $.49
Total Postage and Fees $6.59

WEST UNION, WV Postmark Here AUG - 8 2017 USPS 26456-9998

Sent To Gary + Rebecca Martin (Surv.)
Street and Apt. No., or PO Box No. 4294 Greenbriar Rd.
City, State, ZIP+4® Salem, WV. 26426 (17-478)

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

7015 3430 0001 1569 7866

U.S. Postal Service™
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For delivery information, visit our website at www.usps.com®.

OFFICIAL USE

Certified Mail Fee $3.35
Extra Services & Fees (check box, add fee as appropriate)
☑ Return Receipt (hardcopy) $2.75
☐ Return Receipt (electronic) $
☐ Certified Mail Restricted Delivery $
☐ Adult Signature Required $
☐ Adult Signature Restricted Delivery $
Postage $.49
Total Postage and Fees $6.59

WEST UNION, WV Postmark Here AUG - 8 2017 USPS 26456-9998

Sent To D+M Powell LLC
Street and Apt. No., or PO Box No. 304 Stuart St.
City, State, ZIP+4® West UNION, WV. 26456 (17-476)

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

7015 3430 0001 1569 7859

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OFFICIAL USE

Certified Mail Fee $3.35
Extra Services & Fees (check box, add fee as appropriate)
☑ Return Receipt (hardcopy) $2.75
☐ Return Receipt (electronic) $
☐ Certified Mail Restricted Delivery $
☐ Adult Signature Required $
☐ Adult Signature Restricted Delivery $
Postage $.49
Total Postage and Fees $6.59

WEST UNION, WV Postmark Here AUG - 8 2017 USPS 26456-9998

Sent To Galena Carder
Street and Apt. No., or PO Box No. 6134 Rt 18 S
City, State, ZIP+4® West UNION, WV 26456 (17-477)

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

7015 3430 0001 1569 7941

U.S. Postal Service™
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For delivery information, visit our website at www.usps.com.

OFFICIAL USE

Certified Mail Fee	$3.35
Extra Services & Fees (check box, add fee as appropriate)	
☑ Return Receipt (hardcopy)	$2.75
☐ Return Receipt (electronic)	$
☐ Certified Mail Restricted Delivery	$
☐ Adult Signature Required	$
☐ Adult Signature Restricted Delivery	$
Postage	$.49
Total Postage and Fees	$6.59

WEST UNION, WV Postmark Here AUG - 8 2017 USPS 26456-9998

Sent To: Richard Francesco, Trustee of Solomon Trust
Street and Apt. No., or PO Box No.: RR1 Box 92 1-A
City, State, ZIP+4®: New Milton, WV. 26411 (17-475)

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

7015 3430 0001 1569 7934

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Certified Mail Fee	$3.35
Extra Services & Fees (check box, add fee as appropriate)	
☑ Return Receipt (hardcopy)	$2.75
☐ Return Receipt (electronic)	$
☐ Certified Mail Restricted Delivery	$
☐ Adult Signature Required	$
☐ Adult Signature Restricted Delivery	$
Postage	$.49
Total Postage and Fees	$6.59

WEST UNION, WV Postmark Here AUG - 8 2017 USPS 26456-9998

Sent To: Gilbert + Judy Neeley
Street and Apt. No., or PO Box No.: 761 Central Station Rd
City, State, ZIP+4®: West Union, WV. 26456 (17-475)

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

7015 3430 0001 1569 7910

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CERTIFIED MAIL® RECEIPT
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OFFICIAL USE

Certified Mail Fee	$3.35
Extra Services & Fees (check box, add fee as appropriate)	
☑ Return Receipt (hardcopy)	$2.75
☐ Return Receipt (electronic)	$
☐ Certified Mail Restricted Delivery	$
☐ Adult Signature Required	$
☐ Adult Signature Restricted Delivery	$
Postage	$.49
Total Postage and Fees	$6.59

WEST UNION, WV Postmark Here AUG - 8 2017 USPS 26456-9998

Sent To: Alice Elizabeth Myer
Street and Apt. No., or PO Box No.: 690 Central Station Rd
City, State, ZIP+4®: West Union, WV 26456 (17-475)

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

7015 3430 0001 1569 7927

U.S. Postal Service™
CERTIFIED MAIL® RECEIPT
Domestic Mail Only

For delivery information, visit our website at www.usps.com.

OFFICIAL USE

Certified Mail Fee	$3.35
Extra Services & Fees (check box, add fee as appropriate)	
☑ Return Receipt (hardcopy)	$2.75
☐ Return Receipt (electronic)	$
☐ Certified Mail Restricted Delivery	$
☐ Adult Signature Required	$
☐ Adult Signature Restricted Delivery	$
Postage	$.49
Total Postage and Fees	$6.59

WEST UNION, WV Postmark Here AUG - 8 2017 USPS 26456-9998

Sent To: Gregory + DoNNa Oliver
Street and Apt. No., or PO Box No.: 699 Central Station Rd.
City, State, ZIP+4®: West Union, WV. 26456 (17-475)

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Michael & Michelle DeVinney
22 Miletus Rd.
Salem, WV 26426

9590 9402 2859 7069 5445 06

2. Article Number (Transfer from service label)

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X [signature] ☐ Agent ☒ Addressee

B. Received by (Printed Name): Mi DeVinney
C. Date of Delivery: 8/11/17

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
- ☐ Adult Signature
- ☐ Adult Signature Restricted Delivery
- ☐ Certified Mail®
- ☐ Certified Mail Restricted Delivery
- ☐ Collect on Delivery
- ☐ Collect on Delivery Restricted Delivery
- ☐ Insured Mail
- ☐ Insured Mail Restricted Delivery (over $500)
- ☐ Priority Mail Express®
- ☐ Registered Mail™
- ☐ Registered Mail Restricted Delivery
- ☐ Return Receipt for Merchandise
- ☐ Signature Confirmation™
- ☐ Signature Confirmation Restricted Delivery

PS Form 3811, July 2015 PSN 7530-02-000-9053 Domestic Return Receipt

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Lola Bowen
Route 1, Box 332
Salem, WV 26426

9590 9402 2859 7069 5445 20

2. Article Number *(Transfer from service label)*

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X Tammy Foley ☐ Agent ☒ Addressee

B. Received by *(Printed Name)* Tammy Foley
C. Date of Delivery 8/10/17

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☒ No

3. Service Type
- ☐ Adult Signature
- ☐ Adult Signature Restricted Delivery
- ☐ Certified Mail®
- ☐ Certified Mail Restricted Delivery
- ☐ Collect on Delivery
- ☐ Collect on Delivery Restricted Delivery
- ☐ Insured Mail
- ☐ Insured Mail Restricted Delivery (over $500)
- ☐ Priority Mail Express®
- ☐ Registered Mail™
- ☐ Registered Mail Restricted Delivery
- ☐ Return Receipt for Merchandise
- ☐ Signature Confirmation™
- ☐ Signature Confirmation Restricted Delivery

PS Form 3811, July 2015 PSN 7530-02-000-9053 Domestic Return Receipt

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Carolyn Chumley
4186 Greenbriar Rd.
Salem, WV 26426

9590 9402 2859 7069 5445 13

2. Article Number *(Transfer from service label)*

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X Carolyn Chumley ☐ Agent ☒ Addressee

B. Received by *(Printed Name)* C. Chumley
C. Date of Delivery 8/10/17

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☒ No

3. Service Type
- ☐ Adult Signature
- ☐ Adult Signature Restricted Delivery
- ☐ Certified Mail®
- ☐ Certified Mail Restricted Delivery
- ☐ Collect on Delivery
- ☐ Collect on Delivery Restricted Delivery
- ☐ Insured Mail
- ☐ Insured Mail Restricted Delivery (over $500)
- ☐ Priority Mail Express®
- ☐ Registered Mail™
- ☐ Registered Mail Restricted Delivery
- ☐ Return Receipt for Merchandise
- ☐ Signature Confirmation™
- ☐ Signature Confirmation Restricted Delivery

PS Form 3811, July 2015 PSN 7530-02-000-9053 Domestic Return Receipt

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Gary&Rebecca Martin (Surv)
4294 Greenbriar Rd.
Salem, WV 26426

9590 9402 2859 7069 5445 37

2. Article Number *(Transfer from service label)*

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X Rebecca Martin ☐ Agent ☒ Addressee

B. Received by *(Printed Name)* R. Martin
C. Date of Delivery 8/10/17

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☒ No

3. Service Type
- ☐ Adult Signature
- ☐ Adult Signature Restricted Delivery
- ☐ Certified Mail®
- ☐ Certified Mail Restricted Delivery
- ☐ Collect on Delivery
- ☐ Collect on Delivery Restricted Delivery
- ☐ Insured Mail
- ☐ Insured Mail Restricted Delivery (over $500)
- ☐ Priority Mail Express®
- ☐ Registered Mail™
- ☐ Registered Mail Restricted Delivery
- ☐ Return Receipt for Merchandise
- ☐ Signature Confirmation™
- ☐ Signature Confirmation Restricted Delivery

PS Form 3811, July 2015 PSN 7530-02-000-9053 Domestic Return Receipt

Floodplain Development Permit

Doddridge County, WV Floodplain Management

This permit gives approval for the development/ project listed that impacts the FEMA-designated floodplain and/or floodway of Doddridge County, WV, pursuant to the rules and regulations established by all applicable Federal, State and local laws and ordinances, including the Doddridge County Floodplain Ordinance. This permit must be posted at the site of work as to be clearly visible, and must remain posted during entirety of development.

Permit #: 17-478

Date Approved: September 4, 2017 **Expires: September 4, 2018**

Issued to: Antero Resources **POC: Rachel Grzybek**

Company Address: 535 White Oaks Blvd Bridgeport, WV 26330

Project Address: 4294 Greenbriar Rd.

Firm: 54017C0255C **Lat/Long: 39.242092 N, -80.615944 W**

Purpose of development: NLS 23 Permanent Bridge

Issued by: George C. Eidel, CFM Doddridge County FPM (*or designee*)

George C. Eidel

Date: September 4, 2017

For additional information regarding this permit, please contact Doddridge County Floodplain Manager at 304.873.2631, or via email at doddridgecountyfpm@gmail.com
118 East Court Street; West Union, WV 26456

ANTERO WATER
1615 WYNKOOP STREET
DENVER, COLORADO 80202

Vendor Name	Vendor No.	Date	Check Number	Check Total
DODDRIDGE COUNTY COMMISSION	43312	Aug-03-2017	100552	$500.00

INV #	INV DATE	DESCRIPTION	AMOUNT	DISCOUNTS	NET AMOUNT
MR080117	08/01/17	FLOODPLAIN PERMIT - NLS 23 PERMANEN	500.00	0.00	500.00

FP #17-478

TOTAL INVOICES PAID ====>	500.00	0.00	500.00

DETACH AND RETAIN FOR TAX PURPOSES

ANTERO WATER
1615 WYNKOOP STREET
DENVER, COLORADO 80202

Wells Fargo
Denver, CO

Check No. 100552

11-24
412

810 - AP ACCT WELLS FARGO

Void After 90 Days

CHECK NUMBER	DATE	PAY EXACTLY
100552	Aug-03-2017	$500.00

PAY EXACTLY $500dols00cts
Five Hundred Dollars and Zero Cents

TO THE ORDER OF
DODDRIDGE COUNTY COMMISSION
BETH A ROGERS, CLERK~118 EAST COURT STREET~ROOM 10
2
WEST UNION, WV 26456

⑈100552⑈ ⑆041203824⑆ 9671451749⑈

ANTERO WATER
1615 WYNKOOP STREET
DENVER, COLORADO 80202

Vendor Name	Vendor No.	Date	Check Number	Check Total
DODDRIDGE COUNTY COMMISSION	43312	Aug-03-2017	100552	$500.00

INV #	INV DATE	DESCRIPTION	AMOUNT	DISCOUNTS	NET AMOUNT
MR080117	08/01/17	FLOODPLAIN PERMIT - NLS 23 PERMANEN	500.00	0.00	500.00

FP - #17-478

Doddridge County, West Virginia

RECEIPT NO: 9488 DATE: 2017/08/11

FROM: ANTERO WATER **AMOUNT:** $ 500.00

FIVE HUNDRED DOLLARS AND 00 CENTS

FOR: #17-478 NLS 23 PERMANEN

00000100552 FP-BUILDING PERMITS 020-318 **TOTAL:** $500.00

MICHAEL HEADLEY
SHERIFF &TREASURER

MEC
CLERK

Customer Copy

TOTAL INVOICES PAID ====>	500.00	0.00	500.00

DETACH AND RETAIN FOR TAX PURPOSES

FLOODPLAIN PERMIT #17-478

Antero Resources Corp.-NLS 23 Permanent Bridge

TASK	COMPLETE (DATE)	NOTES
CHECK RECEIVED	8/7/17	
US ARMY CORP. ENGINEERS (USACE)	8/30/17	
US FISH & WILDLIFE SERVICES (USFWS)	8/30/17	
WV DEPT. NATURAL RESOURCES (WVDNR)	8/30/17	
WV DEPT. ENVIROMENTAL PROTECTION (WVDEP)		
STATE HISTORIC & PRESERVATION OFFICE (SHPO)		
OFFICE of LAND & STREAM (OLS)		
DATE OF COMMISSION READING	8/15/17	
DATE AVAILABLE TO BE GRANTED	9/4/17	
PERMIT GRANTED	9/4/17	
COMPLETE		

7015 3430 0001 1569 7873

7015 3430 0001 1569 7897

7015 3430 0001 1569 7880

7015 3430 0001 1569 7903

Doddridge County Floodplain Permits

(Week of August 7, 2017)

Please take notice that on the **7th** day of **August, 2017**, **Antero Resources** filed an application for a Floodplain Permit **(#17-478)** to develop land located at or about **4294 Grenbriar Rd. Coordinates 39.242092 N, -80.615944 W**. The Application is on file with the Clerk of the County Court and may be inspected or copied during regular business hours. Any interested persons who desire to comment shall present the same in writing by **September 4, 2017** (20 calendar days after the announcement at the regularly scheduled Doddridge County Commission Meeting) delivered to the Clerk of the County Court at 108 Court Street Ste. 1, West Union, WV 26456. **This project is NLS 23 Permanent Bridge**

Antero Resources
535 White Oaks Blvd.
Bridgeport, WV 26330
Office 304.842.4100
Fax 304.842.4102

July 24, 2017

Doddridge County Commission
Attn: George Eidel, Doddridge County Floodplain Manager
108 Court Street, Suite 1
West Union, WV 26456

Mr. Eidel:

Antero Resources Corporation would like to submit a Doddridge County Floodplain permit application for our ***NLS 23 Permanent Bridge***. Our project is located in Doddridge County where the replacement is located at coordinates 39.242092N, 80.615944W. Per the FIRM Map #54017C0255C, this location is **in** the floodplain.

Attached you will find the following:

- Doddridge County Floodplain Permit Application
- No-Rise Certificate
- WV Flood Tool Map
- FIRM Map
- Design Plans

If you have any questions please feel free to contact me at (304) 842-4008.

Thank you in advance for your consideration.

Sincerely,

Rachel Grzybek
Environmental Specialist II
Antero Resources Corporation

Enclosures

Permit# 17-478

Project Name: NLS 23 Permanent Bridge

Permittees Name: Antero Resources

Doddridge County, WV

Floodplain Development Permit Application

This document is to be used for projects that impact/potentially impact the FEMA---designated floodplain and/or floodway of Doddridge County, WV pursuant to the rules and regulations established by all applicable Federal, State and local laws and ordinances, including the Doddridge County Floodplain Ordinance.

SECTION 1: GENERAL PROVISIONS (APPLICANT TO READ AND SIGN)

1. No work may start until a permit is issued.
2. The permit may be revoked if any false statements are made herein.
3. If revoked, all work must cease until permit is re-issued.
4. Development shall not be used or occupied until a Certificate of Compliance is issued.
5. The permit will expire if no work is commenced within six months of issuance.
6. Applicant is hereby informed that other permits may be required to fulfill local, state, and federal requirements.
7. Applicant hereby gives consent to the Floodplain Administrator/Manager or his/her representative to make inspections to verify compliance.
8. I THE APPLICANT CERTIFY THAT ALL STATEMENTS HEREIN AND IN ATTACHMENTS TO THIS APPLICATION ARE, TO THE BEST OF MY KNOWLEDGE, TRUE AND ACCURATE.

APPLICANT'S SIGNATURE _____

DATE 8/1/17

Doddridge County Commercial/Industrial
Floodplain Development Permit Application

Applicant Information:

Please provide all pertinent data.

Applicant Information		
Responsible Company Name: Antero Resources Corporation		
Corporate Mailing Address: 1615 Wynkoop Street		
City: Denver	**State: CO**	**Zip: 80202**
Corporate Point of Contact (POC):		
Corporate POC Title:		
Corporate POC Primary Phone:		
Corporate POC Primary Email:		
Corporate FEIN:	**Corporate DUNS:**	
Corporate Website: www.anteroresources.com		
Local Mailing Address: 535 White Oaks Blvd		
City: Bridgeport	**State: WV**	**Zip: 26330**
Local Project Manager (PM):		
Local PM Primary Phone:		
Local PM Secondary Phone:		
Local PM Primary Email:		
Person Filing Application: Rachel Grzybek		
Applicant Title: Environmental Specialist II		
Applicant Primary Phone: (304) 842-4008		
Applicant Secondary Phone: (304) 641-2396		
Applicant Primary Email: rgrzybek@anteroresources.com		

Doddridge County Commercial/Industrial
Floodplain Development Permit Application

Project Narrative:

Describe in detail the proposed development including project name/title, type of development, estimated start and completion timeline, and its potential impact on the floodplain. Use additional copies of this page as needed.

Project Narrative:
The NLS 23 Permanent Bridge replacement project is located on the south side of Doddridge
County Route 17 approximately 0.3 miles east of the junction of County Route 15 in the
Greenbrier/Miletus area. The proposed work will replace a timber mat bridge with a precast
12' x 6' concrete box culvert with wingwalls and inlet and outlet protection. The project is
located in the Greenbrier Creek Zone AE Flood Hazard area, according to the Flood Insurance Rate
Map for Doddridge County, map panel 54017C0255C with a map revised date of October 4, 2011.
Based on the results of the hydraulic study, the installation of the proposed 12' x 6' box culvert
will not result in an increase in water levels and will not adversely affect the base flood
elevation of Greenbrier Creek. Please see the attached hydraulic report.

Proposed Development:

Please check all elements of the proposed project that apply.

DESCRIPTION OF WORK (CHECK ALL APPLICABLE BOXES)

A. STRUCTURAL DEVELOPMENT

	ACTIVITY		STRUCTURAL TYPE
[]	New Structure	[]	Residential (1 – 4 Family)
[]	Addition	[]	Residential (more than 4 Family)
[]	Alteration	[]	Non-residential (floodproofing)
[]	Relocation	[]	Combined Use (res. & com.)
[]	Demolition	[]	Replacement
[]	Manufactured/Mobil Home		

B. OTHER DEVELOPLMENT ACTIVITIES:

[] Fill [] Mining [] Drilling [] Pipelining
[] Grading
[X] Excavation (except for STRUCTURAL DEVELOPMENT checked above)
[] Watercourse Alteration (including dredging and channel modification)
[x] Drainage Improvements (including culvert work)
[] Road, Street, or Bridge Construction
[] Subdivision (including new expansion)
[] Individual Water or Sewer System
[] Other (please specify)

Doddridge County Commercial/Industrial
Floodplain Development Permit Application

Development Site/Property Information:

Please provide physical description of the site/property, along with pertinent ownership (surface and mineral rights) data as applicable. Attach appropriate maps from the WV Flood Tool showing location of proposed development. Use additional copies of this page if development spans multiple property boundaries. Designate each property by number (i.e. Property 1 of 1, Property 2 of 7, etc.)

Property Designation: __1__ of __1__

Site/Property Information:		
Legal Description: BUCKEYE 70.74 AC SUR		
Physical Address/911 Address: Route 17		
Decimal Latitude/Longitude: 39.242099 N, -80.616005 W		
DMS Latitude/Longitude: 39°14'31.56"N 80°36'57.62"W		
District: 04	**Map: 4**	**Parcel: 21**
Land Book Description:		
Deed Book Reference: Deed Book 247, Page 273		
Tax Map Reference: 09 04 0004 0021 0000 0000		
Existing Buildings/Use of Property: House, Building, Driveway		

Floodplain Location Data: ***(to be completed by Floodplain Manager or designee)***			
Community:	**Number:**	**Panel:**	**Suffix:**
Location (Lat/Long):		**Approximate Elevation:** **Estimated BFE:**	
Is the development in the floodway? ☐ **Yes** ☐ **No**		**Is the development in the floodplain?** ☐ **Yes** ☐ **No** **Zone: _____**	
Notes:			

Doddridge County Commercial/Industrial
Floodplain Development Permit Application

Property Owner Data:

Please provide data on current site/property landowner(s), both surface and mineral rights (as applicable). Use additional copies of this page as needed. Designate each page in relation to each property listed above.

Property Designation: _1__ of _1__

Property Owner Data:		
Name of Primary Owner (PO): MARTIN GARY D SR & REBECCA M (SURV)		
PO Address: 4294 GREENBRIER ROAD		
City: SALEM	**State: WV**	**Zip: 26426**
PO Primary Phone:		
PO Secondary Phone:		
PO Primary Email:		

Surface Rights Owner Data:		
Name of Primary Owner (PO):		
PO Address:		
City:	**State:**	**Zip:**
PO Primary Phone:		
PO Secondary Phone:		
PO Primary Email:		

Mineral Rights Owner Data: ***(As Applicable)***		
Name of Primary Owner (PO):		
PO Address:		
City:	**State:**	**Zip:**
PO Primary Phone:		
PO Secondary Phone:		
PO Primary Email:		

Doddridge County Commercial/Industrial
Floodplain Development Permit Application

Contractor Data:

Please provide all pertinent data for contractors and sub---contractors that may be participating in this project. Use additional copies of this page as needed. Designate each page in relation to each property listed above.

Property Designation: ____ of ____

Contractor/Sub-Contractor (C/SC) Information:		
C/SC Company Name:		
C/SC WV License Number:		
C/SC FEIN:	**C/SC DUNS:**	
Local C/SC Point of Contact (POC):		
Local C/SC POC Title:		
C/SC Mailing Address:		
City:	**State:**	**Zip-Code:**
Local C/SC Office Phone:		
Local C/SC POC Phone:		
Local C/SC POC E-Mail:		

Engineer Firm Information:		
Engineer Firm Name:		
Engineer WV License Number:		
Engineer Firm FEIN:	**Engineer Firm DUNS:**	
Engineer Firm Primary Point of Contact (POC):		
Engineer Firm Primary POC Title:		
Engineer Firm Mailing Address:		
City:	**State:**	**Zip-Code:**
Engineer Firm Office Phone:		
Engineer Firm Primary POC Phone:		
Engineer Firm Primary POC E-Mail:		

Adjacent and/or Affected Landowners Data

Please provide data for all adjacent and/or affected surface owners (both up and down stream) whose property may be impacted by proposed development as demonstrated by a floodplain study or survey. Use additional copies of this page as needed.

Adjacent Property Owner Data: Upstream		
Name of Primary Owner (PO): BOWEN, LOLA ET AL		
Physical Address: ROUTE 1, BOX 332		
City: SALEM	State: WV	Zip: 26426
PO Primary Phone:		
PO Secondary Phone:		
PO Primary Email:		

Adjacent Property Owner Data: Upstream		
Name of Primary Owner (PO):		
Physical Address:		
City:	State:	Zip:
PO Primary Phone:		
PO Secondary Phone:		
PO Primary Email:		

Adjacent Property Owner Data: Downstream		
Name of Primary Owner (PO): CHUMLEY, CAROLYN		
Physical Address: 4186 GREENBRIER RD		
City: SALEM	State: WV	Zip: 26426
PO Primary Phone:		
PO Secondary Phone:		
PO Primary Email:		

Adjacent Property Owner Data: Downstream		
Name of Primary Owner (PO): DEVINNEY, MICHAEL K & MICHELLE L (SURV)		
Physical Address: 22 MILETUS ROAD		
City: SALEM	State: WV	Zip: 26426
PO Primary Phone:		
PO Secondary Phone:		
PO Primary Email:		

Site Plan

A Site Plan is an accurate and detailed map of the proposed development for this project. It shows the size, shape, location and special features of the project property, and the size and location of any development planned to the property, especially as that development will impact the floodplain and/or floodway. Site plans show what currently exists on the project property, and any changes or improvements you are proposing to make. **A certified and licensed engineering firm should complete site plans.**

A SITE PLAN MUST CONTAIN THE FOLLOWING INFORMATION:

1. Legal description of the parcel, north arrow and scale
2. All property lines and their dimensions
3. Names of adjacent roads, location of driveways
4. Location of sloughs, tributaries, streams, rivers, wetlands, ponds, and lakes, with setbacks indicated, and including FEMA floodplain data based on most updated FIRM.
5. Location, size, shape of all buildings, existing and proposed, with elevation of lowest floor indicated.
6. Location and dimensions of existing or proposed on-site sewage systems.
7. Location of all propane tanks, fuel tanks or other liquid storage tanks whether above ground or below ground level.
8. Location and dimensions of any proposed pipeline placement(s) into floodplain/floodway.
9. Location and dimensions of any roadway development into floodplain/floodway. *(Includes initial development access roads)*
10. Location and dimensions of any bridge and/or culvert development into floodplain/floodway.
11. Location and dimensions of any storage yard or facility into the floodplain/floodway.
12. Location of any existing utilities and/or proposed utility placement and/or displacement.
13. Location, dimensions and depth of any existing or proposed fill on site.
14. A survey showing the **existing ground elevations** of at least location on the building site. **ELEVATION NOTE**: All vertical datum will reference either NGVD 29 or NAVD 88. Assumed datum will not be acceptable unless the property is located in an area where vertical datum has not been published. For those areas where vertical datum has not been established, a site plan with contours, elevations using assumed datum, high water marks and existing water levels of sloughs, rivers, lakes or streams and proposed lowest floor elevation.

Applicant

Please read print name, sign and date below:

- I certify that I am authorized to submit this application for the primary project developer.
- I certify that the information included in this application is to the best of my knowledge true and complete.
- I certify that all required Federal, State, and local permits required by law and/or ordinance for the above described development of this project have been properly attained, are current and valid, and must be presented with this application before a Doddridge County Floodplain Permit may be issued.
- I understand that if in the course of the development project additional permits become required that were not needed during the initial proposal, the primary developer must notify the Doddridge County Floodplain Manager within 48 hours of such need, and that a "Stop Work" order may be issued for all project work directly impacting the floodplain or floodway, until such time the required additional permits are acquired.
- I understand that once the floodplain permit is submitted, the application will be entered into official public record at the next regularly scheduled Doddridge County Commission meeting after the date of submittal.
- I understand that from the date of submittal of the fully completed permit application, the Doddridge County Floodplain Manager has ninety (90) days to make a determination to either grant or deny said permit application. During this approval period, the Doddridge County Floodplain Manager may, at his or her discretion, conduct a review and/or additional study of provided documentation by means of an independent engineering firm. All costs associated with said review and/or study must be reimbursed to the County before issuance of approved permit.
- I understand that during the approval period, the Doddridge County Floodplain Manager of designee may at his or her discretion conduct site visits and document conditions of proposed development pursuant to the permit application.
- I understand that once the Floodplain Permit is granted, the permit will be entered into official public record at the next scheduled Doddridge County Commission meeting after the date of issuance. Appeals to the permit may be made no later than twenty (20) days after said issuance. If a valid appeal is submitted, as determined by the Doddridge County Floodplain Manager, a "Stop Work" order will be issued for all project development directly involving the floodplain or floodway. A public hearing by the Doddridge County Appeals Board will be scheduled no less than ten (10) days after the next regularly scheduled Doddridge County Commission meeting.
- I understand that all decisions of the Doddridge County Appeals Board shall be final.
- **I understand issuance of a Floodplain Permit authorizes me to proceed with construction as proposed. A Certificate of Compliance is required upon substantial completion of the project.**
- In signing this application, the primary developer hereby grants the Doddridge County Floodplain Manager or designee the right to enter onto the above---described location to inspect the development work proposed, in progress, and/or completed.
- I understand that if I do not follow exactly the site---plan submitted and approved by this permit that a "Stop Work" order may be issued by the Wirt County Floodplain Manager and that I must stop all construction immediately until discrepancies of actual work vs. proposed work is resolved.

Applicant Signature: _____ Date: 8/1/17

Applicant Printed Name: Randy Kloverdanz

DEPARTMENT OF THE ARMY
HUNTINGTON DISTRICT, CORPS OF ENGINEERS
502 EIGHTH STREET
HUNTINGTON, WEST VIRGINIA 25701-2070

REPLY TO
ATTENTION OF

AUG 08 2017

Regulatory Division
Energy Resource Branch
LRH-2017-00638-OHR-Greenbrier Creek

NATIONWIDE PERMIT NO. 14 VERIFICATION

AUG30 17 10:12AM

Wyatt Webster
Antero Resources Corporation
1615 Wynkoop Street
Denver, Colorado 80202

Dear Mr. Webster:

I refer to the Pre-Construction Notification (PCN) received in this office on July 24, 2017 concerning a proposal to discharge dredged and/or fill material into approximately 51 linear feet of one (1) stream (S1), at one (1) single and complete location, in association with the NLS 23 Permanent Bridge project. The proposed project is located near Salem in Doddridge County, West Virginia. Greenbrier Creek is indirect tributary to the Ohio River, a traditional navigable water of the United States. Your PCN has been assigned the following file number: LRH-2017-00638- OHR-Greenbrier Creek. Please reference this number on all future correspondence related to this project.

The United States Army Corps of Engineers' (Corps) authority to regulate waters of the United States is based on the definitions and limits of jurisdiction contained in 33 CFR 328 and 33 CFR 329. Section 404 of the Clean Water Act (Section 404) requires a Department of the Army (DA) permit be obtained prior to discharging dredged or fill material into waters of the United States, including wetlands. Section 10 of the Rivers and Harbors Act of 1899 (Section 10) requires a DA permit be obtained for any work in, on, over or under a navigable water.

The proposed project, as described in the submitted information, has been reviewed in accordance with Section 404 and Section 10. Based on your description of the proposed work, and other information available to us, it has been determined that this project will not involve activities subject to the requirements of Section 10. However, this project will include the discharge of dredged or fill material into waters of the United States subject to the requirements of Section 404.

In the submitted PCN materials received in this office on July 24, 2017, you have requested a DA authorization for the discharge dredged and/or fill material into approximately 51 linear feet of one (1) stream (S1), at one (1) single and complete location, in association with the NLS 23 Permanent Bridge project. We have determined these proposed discharges of dredged and/or fill material into waters of the United States meet the criteria for Nationwide Permit Number (NWP)

No. 14 under the January 6, 2017, Federal Register, Issuance of NWPs (82 FR 1860) provided you comply with all terms and conditions of the enclosed material, the enclosed special conditions, and the 401 Water Quality Certification (WQC) issued by the West Virginia Department of Environmental Protection. Please be aware this NWP verification does not obviate the requirement to obtain any local, state or federal assent required by law for the activities.

This verification is valid until the expiration date of the NWPs, unless the NWP authorization is modified, suspended, or revoked. The verification will remain valid if the NWP authorization is reissued without modification or the activity complies with any subsequent modification of the NWP authorization. All of the existing NWPs are scheduled to be modified, reissued, or revoked on March 18, 2022. Prior to this date, it is not necessary to contact this office for re-verification of your project unless the plans for the proposed activity are modified. Furthermore, if you commence or under contract to commence this activity before March 18, 2022, you will have twelve (12) months from the date of the modification or revocation of the NWP to complete the activity under the present terms and conditions of this NWP.

Enclosed is a copy of the NWPs and the 401 WQC to be kept at the project site during construction. You shall supply a copy of these documents to your project engineer responsible for construction activities.

Upon completion of the work, the enclosed certification must be signed and returned to this office. If you have any questions concerning the above, please contact Rachel Klug of the Energy Resource Branch at 304-399-5858, by mail at the above address, or by email at: rachel.a.klug@usace.army.mil.

Sincerely,

Teresa D. Spagna
Chief, North Branch

Enclosures

SPECIAL CONDITIONS FOR THE NATIONWIDE PERMIT NO. 14 VERIFICATION FOR NLS 23 Permanent Bridge Project LRH-2017-00638-OHR-Greenbrier Creek

1 of 2

1. Enclosed is a copy of Nationwide Permit 14, which will be kept at the site during construction. A copy of the nationwide permit verification, special conditions, and the enclosed construction plans must be kept at the site during construction. The permittee will supply a copy of these documents to their project engineer responsible for construction activities.

2. Upon completion of the activity authorized by this nationwide permit verification, the enclosed certification must be signed and returned to this office along with as-built drawings showing the location and configuration, as well as all pertinent dimensions and elevations of the activity authorized under this nationwide permit verification.

3. Construction activities will be performed during low flow conditions to the greatest extent practicable. Additionally, appropriate site specific best management practices for sediment and erosion control will be fully implemented during construction activities at the site.

4. No area for which grading has been completed will be unseeded or unmulched for longer than 14 days. All disturbed areas will be seeded and/or revegetated with native species and approved seed mixes (where practicable) after completion of construction activities for stabilization and to help preclude the establishment of non-native invasive species

5. Should new information regarding the scope and/or impacts of the project become available that was not submitted to this office during our review of the proposal, the permittee must submit written information concerning proposed modification(s) to this office for review and evaluation, as soon as practicable.

6. In the event any previously unknown historic or archaeological sites or human remains are uncovered while accomplishing the activity authorized by this nationwide permit authorization, the permittee must cease all work in waters of the United States immediately and contact local, state and county law enforcement offices (only contact law enforcement on findings of human remains), the Corps at 304-399-5210 and West Virginia State Historic Preservation Office at 304-558-0220. The Corps will initiate the Federal, state and tribal coordination required to comply with the National Historic Preservation Act and applicable state and local laws and regulations. Federally recognized tribes are

SPECIAL CONDITIONS FOR THE
NATIONWIDE PERMIT NO. 14 VERIFICATION FOR
NLS 23 Permanent Bridge Project
LRH-2017-00638-OHR-Greenbrier Creek

2 of 2

afforded a government-to-government status as sovereign nations and consultation is required under Executive Order 13175 and 36 CFR Part 800.

7. Section 7 obligations under Endangered Species Act must be reconsidered if new information reveals impacts of the project that may affect federally listed species or critical habitat in a manner not previously considered, the proposed project is subsequently modified to include activities which were not considered during Section 7 consultation with the United States Fish and Wildlife Service, or new species are listed or critical habitat designated that might be affected by the subject project.

COMPLETION OF WORK FORM

Permit: LRH-2017-00638-OHR
NLS 23 Permanent Bridge Project
Section 404

Name of Permittee: Wyatt Webster
Antero Resources Corporation
1615 Wynkoop Street
Denver, Colorado 80202

Date of Issue: August 8, 2017

Upon completion of the activity authorized by this permit and any mitigation required by the permit, sign this certification and return it to the following address:

Huntington District
U.S. Army Corps of Engineers
502 8th Street
Huntington, WV 25701-2070
Attn: Rachel A. Klug

Please note that your permitted activity is subject to a compliance inspection by an U.S. Army Corps of Engineers representative. If you fail to comply with this permit you are subject to permit suspension, modification, or revocation.

I hereby certify that the work authorized by above referenced permit has been completed in accordance with the terms and conditions of the said permit, and required mitigation was completed in accordance with the permit conditions.

Signature of Permittee Date

DIVISION OF NATURAL RESOURCES
Wildlife Resources Section
Operations Center
P.O. Box 67
Elkins, West Virginia 26241-3235
Telephone (304) 637-0245
Fax (304) 637-0250

Jim Justice
Governor

Stephen S. McDaniel
Director

July 19, 2017

Mr. Wyatt Webster
Antero Resources Corporation
1615 Wynkoop Street
Denver, CO 80202

AUG30 17 10:12AM

Dear Mr. Webster:

We have reviewed Natural Heritage Program files for information on rare, threatened and endangered (RTE) species and sensitive habitats for the area of the proposed NLS 23 Permanent Bridge project in Doddridge County, WV (CEC Project 170-760).

We have no known records of any RTE species or sensitive habitats within the project area. The Wildlife Resources Section knows of no surveys that have been conducted in the area for rare species or rare species habitat. Consequently, this response is based on information currently available and should not be considered a comprehensive survey of the area under review. This response is valid for two years.

The information provided above is the product of a database search and retrieval. This information does not satisfy other consultation or permitting requirements for disturbances to the natural resources of the state, and further consultation may be required. Additionally, any concurrence requirements for federally listed species must come from the US Fish and Wildlife Service.

Thank you for your inquiry, and should you have any questions please feel free to contact me at the above number, or barbara.d.sargent@wv.gov. Enclosed please find an invoice.

Sincerely,

Barbara Sargent
Environmental Resources Specialist
Environmental Coordination
Operations Unit

enclosure

cc: Andrew Kielaszek

S:\Monthly\BSargent\Invoices\Antero.doc

United States Department of the Interior

FISH AND WILDLIFE SERVICE

West Virginia Field Office
694 Beverly Pike
Elkins, West Virginia 26241

AUG30 17 10:12AM

Contact Name: Wyatt Webster

Email Address or Fax Number: wwebster@anteroresources.com

FWS File #2017-i-0806 **All future correspondence should clearly reference this FWS File #.**

Project: NLS 23 Permanent Bridge, Doddridge County, West Virginia

Date of Letter Request: July 12, 2017

This is in response to your letter requesting threatened and endangered species information in regard to the proposed project listed above. These comments are provided pursuant to the Endangered Species Act (ESA) (87 Stat. 884, as amended; 16 U. S. C. 1531 *et seq.*).

Two federally listed species could occur in the project area: the endangered Indiana bat (*Myotis sodalis*) and the threatened northern long-eared bat (*Myotis septentrionalis*) (NLEB).

The Indiana bat and NLEB may use the project area for foraging and roosting between April 1 and November 15. Indiana bat summer foraging habitats are generally defined as riparian, bottomland, upland forest, and old fields or pastures with scattered trees. Roosting/maternity habitat consists primarily of live or dead hardwood tree species which have exfoliating bark that provides space for bats to roost between the bark and the bole of the tree. Tree cavities, crevices, splits, or hollow portions of tree boles and limbs also provide roost sites. In West Virginia, the U.S. Fish and Wildlife Service (Service) considers all forested habitat containing trees greater than or equal to 5 inches in diameter at breast height to be potentially suitable as summer roosting and foraging habitat for the Indiana bat.

Indiana bats feed on emerged aquatic and terrestrial flying insects. Moths, caddisflies, flies, mosquitoes, and midges are major prey items. Aquatic insects that have concentrated emergences or that form large mating aggregations above or near water appear to be preferred prey items. As a result, streams, wetlands, and associated riparian forests are often preferred foraging habitats for pregnant and lactating Indiana bats. Indiana bats also forage within the canopy of upland forests, over clearings with early successional vegetation (e.g., old fields), along the borders of croplands, along wooded fencerows, and over farm ponds in pastures. Increased erosion and sedimentation of streams reduces diversity and biomass of benthic invertebrates, i.e. insects. Some projects propose impacts to aquatic features such as streams or wetlands, which could result in a decrease in insects available to both bat species for foraging.

DIVISION OF NATURAL RESOURCES
324 Fourth Avenue, Room 200
South Charleston WV 25303-1228
TDD (304) 558-1439
TDD 1-800-354-6087
Fax (304) 558-6048
Telephone (304) 558-3225

Jim Justice
Governor

Stephen S. McDaniel
Director

July 21, 2017
Division of Natural Resources
RIGHT OF ENTRY

Re: LS-17-VI/09-1313

Antero Water LLC
Wyatt Webster
c/o Civil & Environmental Consultants, Inc.
Attention: Andrew Kielaszek
250 Old Wilson Bridge Road, Suite 250
Columbus, OH 43085-

Dear Mr. Webster:

The Division of Natural Resources hereby grants to you for a period of ten (10) years from the date hereof, a Right of Entry for the purpose of installing and maintaining eighteen foot by fourteen foot by eight foot (18'x14'x8') precast concrete box culvert in the streambed (NLS 23 Bridge) with additional rip rap inlet/outlet protection; installing four concreate wingwalls; and temporarily dewatering the stream for twenty feet (20') along Greenbrier Creek near Salem in Doddridge County, West Virginia.

This Right of Entry is subject to the following terms and conditions:

1. No in stream work during the fish-spawning season (April 1-June 30).
2. Work should be completed as quickly as possible during low flows in designated work areas only.
3. Any stream bed disturbance should be restricted to the immediate area. In stream use of equipment should be kept to a minimum.
4. All shore areas disturbed by this operation must be reshaped, seeded and mulched immediately upon completion of work. The prompt establishment of vegetative cover will reduce future damage from high water levels.
5. Green concrete must not be put in the stream (highly toxic to aquatic life).
6. Guidance should be obtained from NRCS (formerly SCS) and a registered engineer for the design and construction. Must allow for passage of at least ten-year flood flow.

7. Best management practices should be followed; measures such as hay bales must be used to reduce downstream siltation.

8. River gravel may not be used to stabilize bank

9. Applicant is responsible for removing debris from in and around the installation periodically to prevent stream flow obstruction.

10. Durable head walls of logs, rock, or concrete shall be constructed at both the upstream and downstream ends of crossing to prevent erosion of fill material into the stream.

11. The State's issuance of this Right-of-Entry does not provide for the applicant to work outside the requested boundaries nor does the State assume any liability for the applicant's/landowner's construction activities. By accepting this Right-of-Entry, the applicant/landowner assumes liability for any/all damages caused by this activity to both upstream and downstream landowners.

Guidelines of Best Management Practices for Sediment and Erosion Control as outlined by the Section of Water Resources, Division of Environmental Protection must be followed. Copies of those guidelines are available from the Section of Water Resources, 601 57th Street S.E., Charleston, West Virginia 25304-2345, Telephone No. (304) 926-0440.

The issuance of this Right of Entry by the Division of Natural Resources does not preclude the necessity to obtain a permit from the Corps of Engineers or any other state or federal permits which may be required by law, nor does this Right of Entry negate the need to comply with the West Virginia Water Pollution Control Act and/or the State Environmental Quality Board's administrative regulations, applicant is also responsible for determining if the proposed activity is located within an identified flood plain and it is the applicant's responsibility for contacting the local governmental agency in charge of that program and obtaining a flood plain development permit for it. This Right of Entry does not grant any rights or privileges, or permission to enter upon or to cross the property of any other person, nor is permission granted to remove any material that lies upon the property of any other persons. Work should be completed in as brief a period as possible and within one year from the date of this letter. In the event you fail or refuse to comply with any of the terms or conditions herein, this Right of Entry will be canceled and considered null and void and the Division will reject further applications.

Your payment is now due and payable in the amount of $100.00 to the Division of Natural Resources covering the first year's annual fee of this agreement. Your agreement will be effective upon receipt of your payment in full. You must notify this office in writing when this installation has been removed.

Sincerely,

Joe T. Scarberry, Supervisor
Office of Land and Streams

JTS: cb
pc: DNR Fish Biologist
Jeremy Bandy, Environmental Enforcement
DNR Conservation Officers

July 18, 2017

Doddridge County Commission
Attn: George Eidel, Doddridge County Floodplain Manager
118 East Court Street, Room 102
West Union, WV 26456

Subject: Antero Resources Corporation
NLS 23 Permanent Bridge
No-Rise Certificate
Doddridge County, West Virginia
CEC Project 170-812

Civil & Environmental Consultants, Inc. (CEC) is pleased to evaluate the potential floodplain impacts for the above referenced project on behalf of Antero Resources Corporation, 535 White Oaks Blvd, Bridgeport, WV 26330. Antero Resources Corporation proposes to replace a timber mat bridge with a precast 12' x 6' concrete box culvert with wingwalls and inlet and outlet protection. The project is located within the Greenbrier Creek Zone AE Flood Hazard area, according to the Flood Insurance Rate Map (FIRM) for Doddridge County, map panel 54017C0255C with a map revised date of October 4, 2011. Based on the results of the hydraulic study, the installation of the proposed 12' x 6' box culvert will not result in an increase in water levels and will not adversely affect the base flood elevation of Greenbrier Creek. Please see the attached hydraulic report.

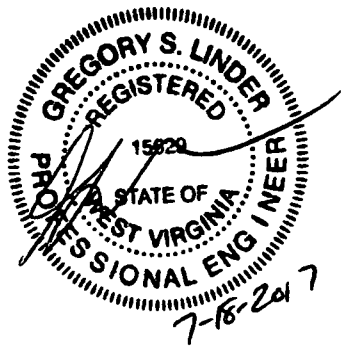
This no-rise certificate is provided in support of the floodplain development permit application. Your time and effort in reviewing this floodplain development permit application is appreciated. Please feel free to contact me at 304-933-3119 or via e-mail at glinder@cecinc.com or contact Ms. Rachel Grzybek at 304-842-4008 or via e-mail at rgrzybek@anteroresources.com if you have questions or need additional information.

Respectfully submitted,

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.

Andrew P. Darnell, E.I.
Assistant Project Manager

Greg S. Linder, P.E.
Senior Project Manager



United States Department of the Interior

FISH AND WILDLIFE SERVICE

West Virginia Field Office
694 Beverly Pike
Elkins, West Virginia 26241

AUG30 17 10:12AM

Contact Name: Wyatt Webster

Email Address or Fax Number: wwebster@anteroresources.com

FWS File #2017-i-0806 **All future correspondence should clearly reference this FWS File #.**

Project: NLS 23 Permanent Bridge, Doddridge County, West Virginia

Date of Letter Request: July 12, 2017

This is in response to your letter requesting threatened and endangered species information in regard to the proposed project listed above. These comments are provided pursuant to the Endangered Species Act (ESA) (87 Stat. 884, as amended; 16 U. S. C. 1531 *et seq.*).

Two federally listed species could occur in the project area: the endangered Indiana bat (*Myotis sodalis*) and the threatened northern long-eared bat (*Myotis septentrionalis*) (NLEB).

The Indiana bat and NLEB may use the project area for foraging and roosting between April 1 and November 15. Indiana bat summer foraging habitats are generally defined as riparian, bottomland, upland forest, and old fields or pastures with scattered trees. Roosting/maternity habitat consists primarily of live or dead hardwood tree species which have exfoliating bark that provides space for bats to roost between the bark and the bole of the tree. Tree cavities, crevices, splits, or hollow portions of tree boles and limbs also provide roost sites. In West Virginia, the U.S. Fish and Wildlife Service (Service) considers all forested habitat containing trees greater than or equal to 5 inches in diameter at breast height to be potentially suitable as summer roosting and foraging habitat for the Indiana bat.

Indiana bats feed on emerged aquatic and terrestrial flying insects. Moths, caddisflies, flies, mosquitoes, and midges are major prey items. Aquatic insects that have concentrated emergences or that form large mating aggregations above or near water appear to be preferred prey items. As a result, streams, wetlands, and associated riparian forests are often preferred foraging habitats for pregnant and lactating Indiana bats. Indiana bats also forage within the canopy of upland forests, over clearings with early successional vegetation (e.g., old fields), along the borders of croplands, along wooded fencerows, and over farm ponds in pastures. Increased erosion and sedimentation of streams reduces diversity and biomass of benthic invertebrates, i.e. insects. Some projects propose impacts to aquatic features such as streams or wetlands, which could result in a decrease in insects available to both bat species for foraging.

Similar to the Indiana bat, NLEB foraging habitat includes forested hillsides and ridges, and small ponds or streams. NLEB are typically associated with large tracts of mature, upland forests with more canopy cover than is preferred by Indiana bats. NLEB seem to be flexible in selecting roosts. They choose roost trees based on suitability to retain bark or provide cavities or crevices, and this species is known to use a wider variety of roost types than the Indiana bat. Males and non-reproductive females may also roost in cooler places like caves and mines. Although rare, this bat has also been found roosting in structures like barns and sheds.

Indiana bats and NLEB use caves or mine portals for winter hibernation between November 15 and March 31. These species also use the hibernacula and the areas around them for fall-swarming and spring-staging activity (August 15 to November 14 and April 1 to May 14, respectively). Some males have been known to stay close to the hibernacula during the summer and may use the hibernacula as summer roosts. There may be other landscape features being used as hibernacula by NLEB during the winter that have yet to be documented.

The Service has reviewed the number of acres of potentially suitable foraging and roosting habitat on the West Virginia landscape available to each Indiana bat, versus the total acreage of forest. On that basis, we have determined that small projects, more than 10 miles from a known priority 1 or 2 Indiana bat hibernaculum, more than 5 miles from a known priority 3 or 4 Indiana bat hibernaculum, or more than 2.5 miles from any known maternity roost, or more than 5 miles from summer detection sites where no roosts were identified, that affect less than 17 acres of forested habitat, and will not affect any potential hibernacula, will have a very small chance of resulting in direct or indirect effects to the Indiana bat, and therefore these effects are considered discountable. **Please note that the Service may review and update this assessment at any time as new information becomes available.**

The Service does not anticipate that this project is likely to adversely affect the Indiana bat because your project: 1) will affect less than 17 acres of potential Indiana bat foraging or roosting habitat; 2) is not within any of the Indiana bat hibernacula or summer use buffers described above; 3) will not affect any potential caves or mines that could be used as hibernacula for this species; and 4) effects to aquatic features used for foraging habitat will be insignificant.

The NLEB may occur within the range of the proposed project, and may be affected by the proposed construction and operation of this project. Any take of NLEB occurring in conjunction with these activities that complies with the conservation measures (as outlined in the 4(d) rule), as necessary, is exempted from section 9 prohibitions by the 4(d) rule and does not require site specific incidental take authorization. Note that the 4(d) rule does not exempt take that may occur as a result of adverse effects to hibernacula and that no conservation measures are required as part of the 4(d) rule unless the proposed project: 1) involves tree removal within 0.25 miles of known NLEB hibernacula; or 2) cuts or destroys known, occupied maternity roost trees or any other trees within a 150-foot radius around known, occupied maternity tree during the pup season (June 1 to July 31). This proposed project is not located within any of these radii around known hibernacula or roost trees and will not affect any known NLEB hibernacula, therefore any take of NLEB associated with this project is exempted under the 4(d) rule and no conservation measures are required.

This letter provides technical assistance only and does not serve as a completed section 7 consultation document. If there is a Federal nexus for the project (e.g., Federal funding provided, Federal permits required to construct), no tree clearing or any project construction activities on any portion of the parcel should occur until consultation under section 7 of the ESA, between the Service and the Federal action agency, is completed. Section 7 consultation is not complete until the Federal action agency submits a determination of effects to this office, the Service concurs with the Federal action agency's determination, and the Federal action agency agrees to limit tree clearing to under 17 acres as a mandatory condition for any permit decision rendered for this project. All measures must be implemented as proposed. If there is no Federal nexus associated with this project, then no further coordination with this office is required.

Should project plans change or amendments be proposed that we have not considered in your proposed action, or if additional information on listed and proposed species becomes available, or if new species become listed or critical habitat is designated, this assessment may be reconsidered.

If you have any questions regarding these comments, please contact the biologist listed below at (304) 636-6586 or at the letterhead address.

Amanda Selvia Date: 7/26/2017
Biologist

Barbara Douglas for Date: 07/31/2017
Field Supervisor

WV Flood Map

User Notes:
Antero Resources Corporation
NLS 23 Permanent Bridge

Flood Hazard Zone

Flood Point of Interest

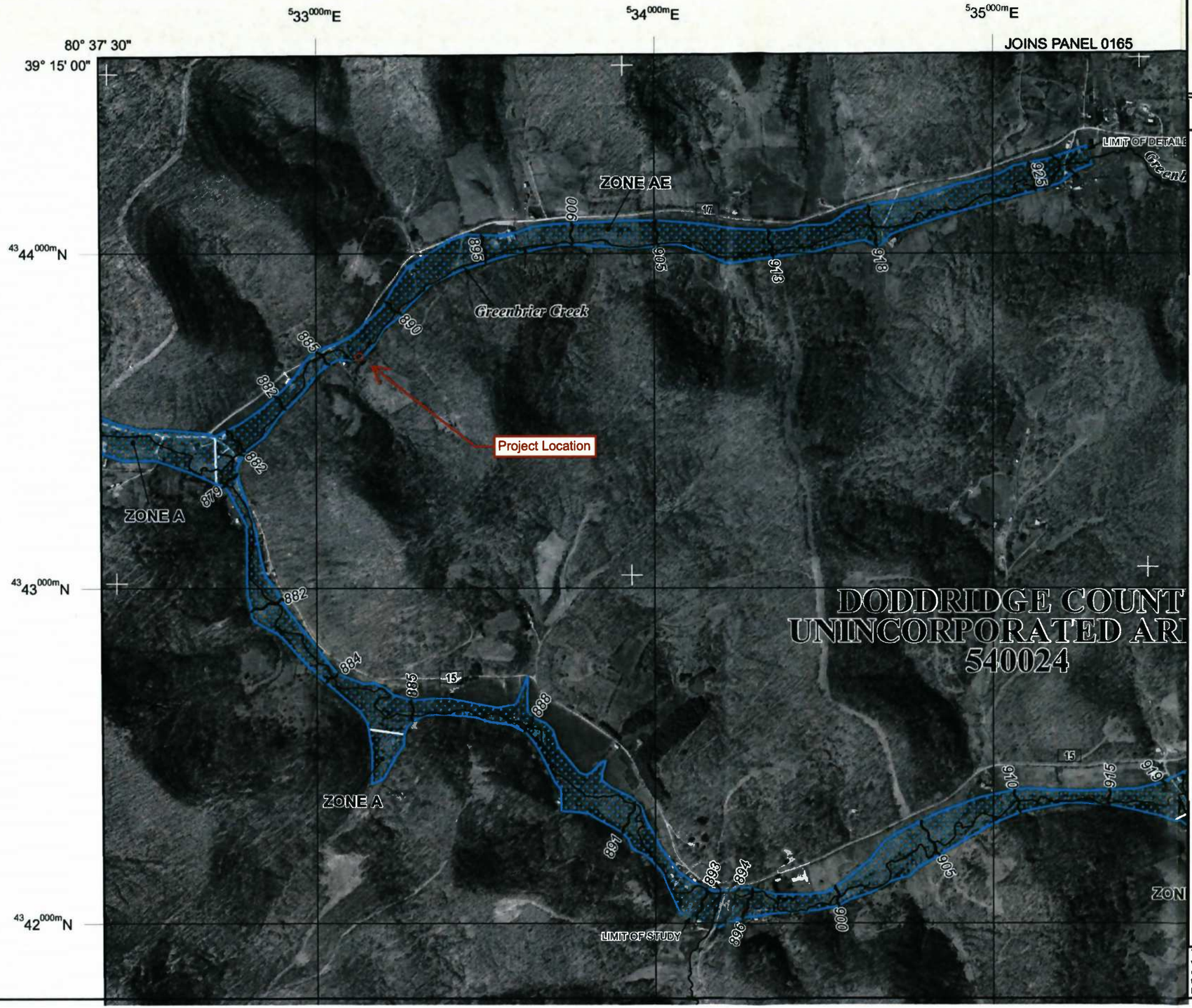
Disclaimer:
The online map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. To obtain more detailed information in areas where Base Flood Elevations have been determined, users are encouraged to consult the latest Flood Profile data contained in the official flood insurance study. These studies are available online at www.msc.fema.gov.
WV Flood Tool (http://www.MapWV.gov/flood) is supported by FEMA, WV NFIP Office, and WV GIS Technical Center.

Map created on July 17, 2017

Flood Hazard Area:
Flood Hazard Area: Location is WITHIN the FEMA 100-year floodplain.

FEMA Issued Flood Map: 54017C0255C

Watershed (HUC8):	Little Musringum-Middle Island (5
Elevation:	N/A
Location (long, lat):	(80.616005 W,39.242099 N)
Location (UTM 17N):	(533138, 4343713)
Contacts:	Doddridge
CRS Information:	N/A
Parcel Number:	No Parcel



MAP SCALE 1" = 1000'

500 0 1000 2000

FEET

METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0255C

FIRM

FLOOD INSURANCE RATE MAP

DODDRIDGE COUNTY, WEST VIRGINIA AND INCORPORATED AREAS

PANEL 255 OF 325

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

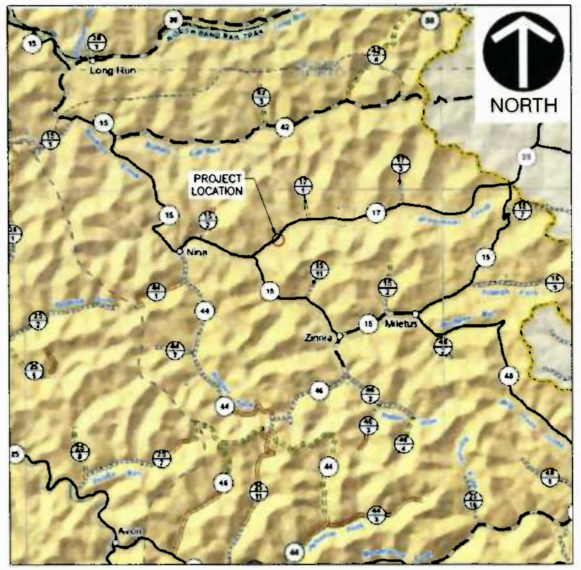
COMMUNITY	NUMBER	PANEL	SUFFIX
DODDRIDGE COUNTY	540024	0255	C

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
54017C0255C

MAP REVISED
OCTOBER 4, 2011

Federal Emergency Management Agency



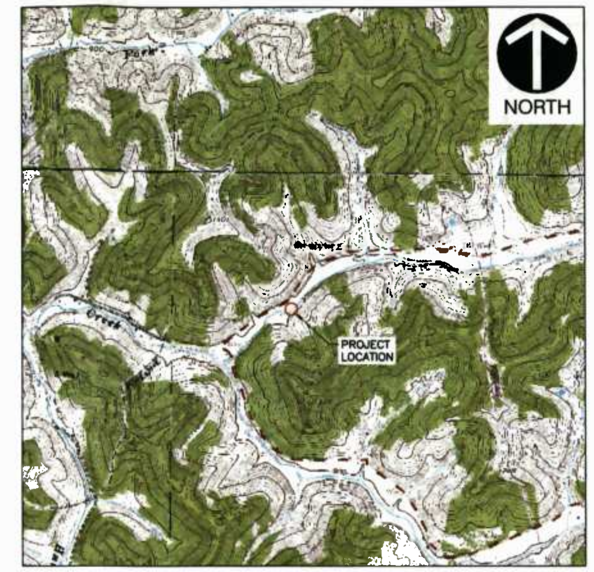
VICINITY MAP
SCALE: 1 INCH = 1 MILE

ANTERO RESOURCES CORPORATION
NLS 23 PERMANENT BRIDGE

CONSTRUCTION PLANS

DODDRIDGE COUNTY, WEST VIRGINIA

PROJECT LOCATION: 39° 14' 31.53" N, 80° 36' 57.40" W



LOCATION MAP
USGS 7.5 MINUTE TOPOGRAPHIC MAPS
BIG ISAAC, NEW MILTON, SALEM, AND SMITHBURG QUADRANGLES
SCALE: 1 INCH = 2000 FEET

UTILITY CONTACTS

WEST VIRGINIA 811 LOCATE REQUEST
TICKET NUMBER 171749015

FRONTIER COMMUNICATIONS
428 W MAIN ST
CLARKSBURG, WV 26301
PH: 304-624-0659

HARRISON RURAL ELECTRIFICATION ASSOCIATION
600 MARKETPLACE AVENUE, SUITE 104
BRIDGEPORT, WV 26330
PH: 304-624-6365

FIRSTENERGY CORP
1310 FAIRMONT AVE
FAIRMONT, WV 26554
PH: 800-686-0022

DOMINION HOPE
213 S 3RD ST.
CLARKSBURG, WV 26301
PH: 304-623-8000

COLUMBIA GAS TRANSMISSION - CLARKSBURG
27470 SHORTLINE HWY
SMITHFIELD, WV 26437
PH: 304-334-5300

LAYOUT
SCALE: 1 INCH = 200 FEET

FLOOD PANEL INFORMATION
BY GRAPHICAL PLOTTING ONLY, THE PROJECT IS LOCATED IN A FEMA DESIGNATED SPECIAL FLOOD HAZARD AREA, ZONE AE, ACCORDING TO THE FLOOD INSURANCE RATE MAP FOR DODDRIDGE COUNTY, MAP # 54017C0255C WITH A MAP REVISED DATE OF 10/4/2011.

DISTURBED AREA = 0.253 ACRES

PERMITS

UNITED STATES ARMY CORPS OF ENGINEERS NATIONWIDE PERMIT 14 (PERMIT NO. PENDING)

OFFICE OF LAND AND STREAMS STREAM ACTIVITY APPLICATION (PERMIT NO. PENDING)

INDEX TO SHEETS

STREAM IMPACTS

STREAM	CLASSIFICATION	TOTAL IMPACT	PERMANENT IMPACT		TEMPORARY IMPACT		EXISTING CULVERT	PROPOSED CULVERT
1		51 LF	31 LF	465 SF	20 LF	315 SF	N/A	18 LF

WEST VIRGINIA 811
CALL BEFORE YOU DIG!

GREGORY S. LINDER
REGISTERED
STATE OF WEST VIRGINIA
PROFESSIONAL ENGINEER
7-14-2017

REFERENCE
1. TOPOGRAPHIC INFORMATION BASED ON FIELD SURVEY PERFORMED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. ON 3/13/2017 AND 4/3/2017.

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Consultants, Inc.
600 Marketplace Ave · Suite 200 · Bridgeport, WV 26330
Ph: 304.933.3119 · 855.488.9539 · Fax: 304.933.3327
www.cecinc.com

ANTERO RESOURCES CORPORATION
NLS 23 PERMANENT BRIDGE
DODDRIDGE COUNTY, WV

TITLE SHEET

DATE:	JULY 2017	DRAWN BY:	DSP
DWG SCALE:	AS SHOWN	CHECKED BY:	GSL
PROJECT NO:	170-812		
APPROVED BY:			GSL

DRAWING NO.: 1

SHEET 1 OF 9

GOVERNING SPECIFICATIONS
THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION, DIVISION OF HIGHWAYS, STANDARD SPECIFICATIONS ROADS AND BRIDGES, ADOPTED 2017, THE CONTRACT DOCUMENTS, AND THE CONTRACT PLANS ARE THE GOVERNING PROVISIONS APPLICABLE TO THIS PROJECT.

DRAINAGE
THE CONTRACTOR SHALL MAINTAIN WORKING STORM DRAINAGE SYSTEMS THROUGH THE WORK AREAS AT ALL TIMES DURING CONSTRUCTION. THE WORKING SYSTEM MAY CONSIST OF THE EXISTING STORM DRAINAGE SYSTEM, THE PROPOSED STORM DRAINAGE SYSTEM OR A COMBINATION THEREOF.

BENCH MARKS
THE CONTRACTOR SHALL BE RESPONSIBLE FOR HOLDING BENCH MARK LOCATIONS THROUGHOUT THE LIFE OF THE PROJECT. IN THE EVENT THAT A BENCH MARK IS DISTURBED, THE CONTRACTOR, AS DIRECTED BY THE ENGINEER, SHALL RELOCATE OR REESTABLISH THE BENCH MARK.

VERIFICATIONS OF DIMENSIONS
THE CONTRACTOR IS RESPONSIBLE FOR VERIFICATION OF ALL PLAN AND ELEVATION DIMENSIONS PRIOR TO ORDERING MATERIALS FOR THE CONSTRUCTION OF THE VARIOUS ITEMS IN THIS CONTRACT.

EXISTING PIPE REMOVAL
ANY EXISTING PIPES, WINGWALLS OR INLETS THAT ARE REMOVED DURING CONSTRUCTION SHALL BECOME THE PROPERTY OF THE CONTRACTOR. THE COST OF THE REMOVAL SHALL BE INCLUDED IN THE UNIT PRICE BIDS FOR "CLEARING AND GRUBBING", AND IS TO INCLUDE REMOVAL, DISPOSAL AND BACKFILL WITH SUITABLE MATERIAL.

UTILITIES
THE LOCATIONS OF KNOWN UTILITIES ARE SHOWN ON THE CONTRACT PLANS AND FIELD INFORMATION. IT IS THE CONTRACTOR'S RESPONSIBILITY TO ASCERTAIN THE STATUS AND LOCATION OF EACH UTILITY WHEN PERFORMING WORK WHICH MAY AFFECT THESE FACILITIES, INCLUDING PROBING, EXCAVATION, OR ANY OTHER PRECAUTION REQUIRED TO CONFIRM LOCATION. THE CONTRACTOR WILL BE RESPONSIBLE FOR ANY DAMAGE OR DISRUPTION TO UTILITY LINES WHICH ARE KNOWN ACTIVE AND ARE TO REMAIN IN OPERATION.

CONTRACTOR IS ADVISED TO USE EXTREME CAUTION WHEN WORKING IN CLOSE PROXIMITY TO THE EXISTING GAS LINES AND TO CONTACT THE OWNER OF EACH LINE PRIOR TO COMMENCING CONSTRUCTION ACTIVITY TO VERIFY DEPTHS AND REQUIREMENTS FOR WORK AROUND THEIR RESPECTIVE UTILITY.

EROSION AND SEDIMENT CONTROL
DETAILS NOT SHOWN IN THE PLANS SHALL BE IN ACCORDANCE WITH THE WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICE MANUAL, DATED 2006.

THE FIRST ORDER OF WORK FOR THE CONTRACTOR IS TO INSTALL SEDIMENT CONTROL STRUCTURES, FILTER SOCK, ETC. TO ESTABLISH EROSION CONTROL AT THE EARLIEST POSSIBLE DATE. INITIAL CLEARING AND GRUBBING SHALL BE LIMITED TO WHAT IS NECESSARY IN ORDER TO ACCOMPLISH THESE OPERATIONS.

CONTRACTOR IS ADVISED TO REFERENCE THE SITE EROSION AND SEDIMENT CONTROL PLAN AND THE STORMWATER POLLUTION PREVENTION PLAN FOR MORE DETAILED INFORMATION.

ELEVATIONS
ALL ELEVATIONS SHOWN REFER TO THE NATIONAL GEODETIC VERTICAL DATUM OF 1988 (NGVD 88).

COORDINATES
THE PROJECT DATUM ON THESE PLANS ARE BASED UPON THE NORTH ZONE OF THE WEST VIRGINIA STATE PLANE SYSTEM. THE HORIZONTAL DATUM IS BASED ON THE NORTH AMERICAN DATUM OF 1983 (NAD 83).

ACCESS
CONTRACTOR SHALL MAINTAIN ACCESS TO ALL DRIVEWAYS AND INTERSECTING PUBLIC ROADWAYS LOCATED IN THE CONSTRUCTION AREA AT ALL TIMES.

WORKING HOURS
THE CONTRACTOR SHALL BE PROHIBITED FROM WORKING BETWEEN THE HOURS OF 7:00 PM AND 7:00 AM. ALL CONSTRUCTION EQUIPMENT POWERED BY AN INTERNAL COMBUSTION ENGINE SHALL BE EQUIPPED WITH A PROPERLY MAINTAINED MUFFLER.

STANDARD DETAILS
THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION, DIVISION OF HIGHWAYS, STANDARD DETAILS BOOK, VOLUME I, DATED MAY 1, 2016 & VOLUME II, DATED JANUARY 1, 1994 SHALL APPLY TO THIS PROJECT.

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION, DIVISION OF HIGHWAYS, EROSION AND SEDIMENT CONTROL MANUAL, DATED MARCH 1, 2003, AND AS AMENDED BY ADDENDUM 1 DATED OCTOBER 1, 2004 SHALL APPLY TO THIS PROJECT.

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION, DIVISION OF HIGHWAYS, TRAFFIC ENGINEERING DIVISION, SIGN FABRICATION DETAILS, DATED SEPTEMBER 2005 SHALL APPLY TO THIS PROJECT.

ALL MANUALS LISTED ABOVE CAN BE FOUND AT:
http://www.transportation.wv.gov/highways/engineering/pages/publications.aspx

DRIVEWAYS
THE CONTRACTOR SHALL PROVIDE A SMOOTH AND GRADUAL TRANSITION BETWEEN THE PROPOSED ROADWAY SURFACE AND ALL EXISTING DRIVEWAYS.

DESIGN OF PRECAST BOX CULVERT

GENERAL

THIS WORK IS THE DESIGN AND PREPARATION OF CONSTRUCTION PLANS FOR A CULVERT OF THE TYPE INDICATED ON THE PLANS. THE PRECAST CONCRETE BOX CULVERT SHALL BE DESIGNED AND PROVIDED BY THE CONTRACTOR IN ACCORDANCE WITH THE CRITERIA AND MINIMUM DIMENSIONS SHOWN ON THE DRAWINGS.

PROVIDE A COMPLETE SET OF COMPUTATIONS FOR THE CULVERT AND ADDITIONAL CALCULATIONS AS REQUESTED BY THE OWNER OR THE ENGINEER, TO EVALUATE ANY DETAILS THROUGHOUT THE LIFE OF THE CONTRACT.

COMPLY WITH THE FOLLOWING:
- LONGITUDINAL JOINTS IN PRECAST END SECTIONS ARE NOT ALLOWED.
- PERFORM THE DESIGN UTILIZING LRFD METHODOLOGY.

ALLOWABLE CHANGES TO GEOMETRY
- CHANGES ARE NOT PERMITTED IN THE HORIZONTAL OR VERTICAL ALIGNMENT.
- CHANGES ARE NOT PERMITTED IN THE OPENING SIZE OR LENGTH OF THE CULVERT.
- CHANGES TO THE CULVERT WALL AND SLAB THICKNESS ARE ALLOWED.

DESIGN OF PRECAST BOX CULVERT AND PRECAST WINGWALLS CONTINUED

DESIGN SPECIFICATIONS

AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 7TH EDITION, 2014 AND AS SUPPLEMENTED BY INTERIM REVISIONS.

DESIGN IN ACCORDANCE WITH THE LOAD AND RESISTANCE FACTOR DESIGN (LRFD) METHOD FOR THE BOX CULVERT.

DESIGN LIVE LOADS:

THE CULVERT SHALL BE DESIGNED FOR AN HL-93 LIVE LOAD.

DESIGN DEAD LOADS:

VERTICAL BITUMINOUS OVERLAY PRESSURE – 150 PCF.
LATERAL EARTH LOAD EQUIVALENT FLUID PRESSURE – 45 PCF

VERTICAL BITUMINOUS FILL PRESSURE – 150 PCF
LATERAL EARTH LOAD EQUIVALENT FLUID PRESSURE – 70 PCF

DIMENSIONS AND BOUNDARIES:

VERIFY ALL DIMENSIONS, ELEVATIONS AND GEOMETRY IN THE FIELD AS NECESSARY FOR PROPER FIT OF THE PROPOSED CONSTRUCTION.
ALL DIMENSIONS SHOWN HORIZONTAL, EXCEPT AS NOTED.

CONSTRUCTION OF PRECAST CULVERT AND CAST-IN-PLACE WINGWALLS

GENERAL

PROVIDE MATERIALS AND PERFORM WORK IN ACCORDANCE WITH THE CONTRACT DOCUMENTS AND THE WEST VIRGINIA DIVISION OF HIGHWAYS, STANDARD SPECIFICATIONS, ROADS AND BRIDGES.

PROVIDE CONCRETE COVER ON REINFORCEMENT BARS AS INDICATED.

USE CLASS B CONCRETE IN CUTOFF WALLS AND WINGWALLS.

USE CEMENT CONCRETE WITH A MINIMUM 28-DAY DESIGN COMPRESSIVE STRENGTH OF 5000 PSI IN ALL PRECAST MEMBERS.

A HIGHER CLASS CONCRETE MAY BE SUBSTITUTED FOR A LOWER CLASS AT NO ADDITIONAL COST TO THE OWNER, IF APPROVED BY THE ENGINEER.

PROVIDE GRADE 60 REINFORCING STEEL BARS THAT MEET THE REQUIREMENTS OF ASTM A615 OT ATSM A706. DO NOT WELD GRADE 60 REINFORCING STEEL BARS UNLESS SPECIFIED.

USE EPOXY-COATED STEEL REINFORCEMENT BARS IN THE PRECAST BOX CULVERT. USE BLACK STEEL REINFORCEMENT BARS IN CAST-IN-PLACE WINGWALLS AND CUTOFF WALLS AS INDICATED.

RAKE FINISH ALL HORIZONTAL CONSTRUCTION JOINTS, EXCEPT AS INDICATED.

CHAMFER EXPOSED CONCRETE EDGES 1"X1", EXCEPT AS NOTED.

PROVIDE MINIMUM EMBEDMENT AND SPLICE LENGTHS AS INDICATED.

DO NOT EXCEED A 2-FOOT DIFFERENCE IN FILL ELEVATION ON THE SIDES DURING PLACEMENT OF BACKFILL. DO NOT ALLOW THE WHEELS OF ROLLERS TO COME CLOSER THAN 1 FOOT TO THE FACE OF THE STRUCTURE DURING COMPACTION OF THE BACKFILL.

USE EPOXY BONDING COMPOUND WHEREVER CAST-IN-PLACE CEMENT CONCRETE COMES IN CONTACT WITH PRECAST CEMENT CONCRETE. PROVIDE TYPE 2, GRADE 2, EPOXY BONDING COMPOUND AS DESCRIBED IN ASTM-C881-90. EPOXY BONDING COMPOUND SHALL BE INCIDENTAL TO THE BID ITEM "CAST-IN-PLACE CONCRETE".

PROVIDE A MINIMUM 1'-0" DEPTH OF AASHTO NO. 8 COARSE AGGREGATE UNDER THE CULVERT. EXTEND THE COARSE AGGREGATE 2'-0" BEYOND EACH SIDE OF THE BOX CULVERTS WALLS. PRIOR TO PLACING THE COARSE AGGREGATE, REMOVE ANY PROJECTING ROCKS, BOULDERS, OR COBBLES.

FABRICATOR MAY ADJUST THE BOX CULVERT SECTION LENGTHS AS DESIRED. MINIMUM SECTION LENGTH IS 5'-0".

FOUNDATION PREPARATION NOTES:

EXCAVATE TO REMOVE SOIL OR ROCK WITHIN THE FOOTPRINT OF THE BOX CULVERT AND FOUNDATION FOR THE WINGWALLS.

TWO DAYS BEFORE COMPLETING THE EXCAVATION FOR THE CULVERT AND WINGWALLS, NOTIFY THE OWNER THAT THE EXCAVATIONS WILL BE READY FOR INSPECTION. OBTAIN APPROVAL FROM THE OWNER OF THE EXCAVATED BEARING SURFACES PRIOR TO PLACING CULVERT BEDDING TO ENSURE THE DESIGN BEARING CAPACITY IS ACHIEVED.

WINGWALL FOUNDATIONS HAVE BEEN DESIGNED FOR AN ALLOWABLE BEARING CAPACITY OF 2,000 PSF.

SUBMIT TEMPORARY SHORING DESIGN TO THE ENGINEER FOR REVIEW PRIOR TO CONSTRUCTION (IF USED). IF TEMPORARY SHORING IS USED, THE COST SHALL BE INCIDENTAL TO THE BID ITEM "UNCLASSIFIED EXCAVATION".

SUMMARY OF QUANTITIES

WVDOH SPEC. NUMBER	ANTERO ITEM NUMBER	DESCRIPTION	UNIT	QUANTITY
204	RUC010	MOBILIZATION	LS	1
201	RUC015	CLEARING AND GRUBBING	AC	0.1
203	RUC145	REMOVAL OF EXISTING STRUCTURE	LS	1
307		CLASS 3 AGGREGATE	TN	50
207	RUC207	UNCLASSIFIED EXCAVATION	CY	50
607	RUC580	GUARDRAIL	LF	132
607		BUFFER END SECTION	EA	4
604	RUC150	12' x 6' REINFORCED CONCRETE BOX CULVERT	LF	18
601	RUC140	CAST-IN-PLACE CONCRETE	CY	15
602	RUC140	REBAR REINFORCEMENT	LB	2,300
703		AASHTO #8 STONE	TN	30
218	RUC550	RIPRAP (D50 = 12")	CY	30
642		PUMP AROUND	LS	1
642	RUC020	12 INCH COMPOST FILTER SOCK	LF	200
642	RUC815	TEMPORARY SEEDING	AC	0.1
652	RUC620	HAND SEED AND MULCH	AC	0.1
703	RUC232	AASHTO #57 STONE	TN	8
207	RUC720	FABMC FOR SEPARATION (WOVEN US-250)	SY	100
639	RUC015	CONSTRUCTION LAYOUT STAKES	LS	1
207	PDC213	BORROW EXCAVATION	CY	90

NOTES:

1. THE PUMP AROUND BID ITEM SHALL INCLUDE THE COST OF ALL MATERIALS AND LABOR NECESSARY TO INSTALL, OPERATE, AND MAINTAIN THE PUMPING SYSTEM, SUCH AS PUMPS, SANDBAGS, COFFERDAMS, GEOTEXTILE FILTER BAGS, FUEL, PIPING, ETC.

EARTHWORK QUANTITIES
(FOR INFORMATION ONLY)

DESCRIPTION	UNIT	QUANTITY
UNCLASSIFIED EXCAVATION	CY	50
FILL MATERIAL	CY	90
BORROW EXCAVATION	CY	40

- THE EARTHWORK QUANTITIES REPRESENTED ABOVE REPRESENT THE DIFFERENCE BETWEEN THE EXISTING CONDITIONS AND PROPOSED CONDITIONS MODELS. NO SHRINK/SWELL FACTORS ARE INCLUDED IN THE QUANTITIES.
- THE QUALITY OF MATERIAL IN THE EXCAVATION IS UNKNOWN. IF SUITABLE MATERIAL IS ENCOUNTERED, IT SHALL BE USED IN THE ROADWAY EMBANKMENT.
- THE COST OF WASTING MATERIAL IN THE DESIGNATED WASTE AREA SHALL BE INCLUDED IN THE UNCLASSIFIED EXCAVATION BID ITEM.

GREGORY S. LINDER REGISTERED STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER
7-14-2017

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Consultants, Inc.
600 Marketplace Ave · Suite 200 · Bridgeport, WV 26330
Ph: 304.933.3119 · 855.488.9539 · Fax: 304.933.3327
www.cecinc.com

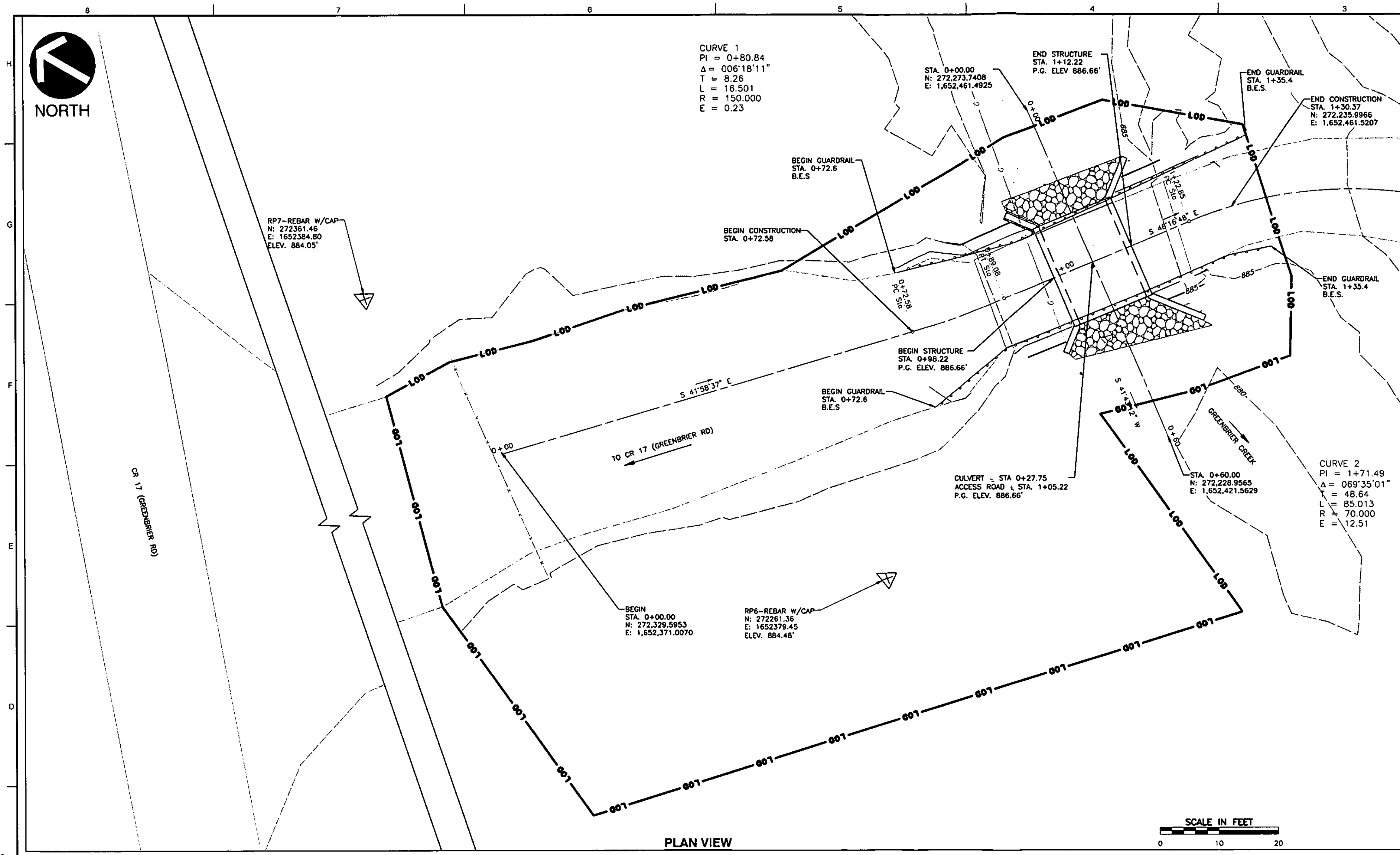
ANTERO RESOURCES CORPORATION
NLS 23 PERMANENT BRIDGE
DODDRIDGE COUNTY, WV

GENERAL NOTES AND SUMMARY OF QUANTITIES

DATE:	JULY 2017	DRAWN BY:	DSP
DWG SCALE:	AS SHOWN	CHECKED BY:	GSL
PROJECT NO:	170-812	APPROVED BY:	GSL

DRAWING NO.: 2

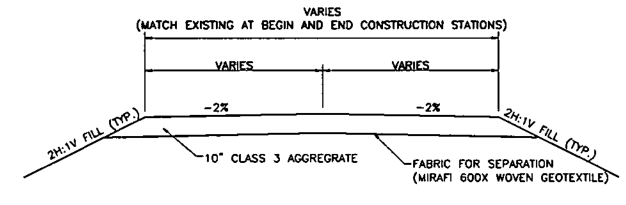
SHEET 2 OF 9



PLAN VIEW

LEGEND

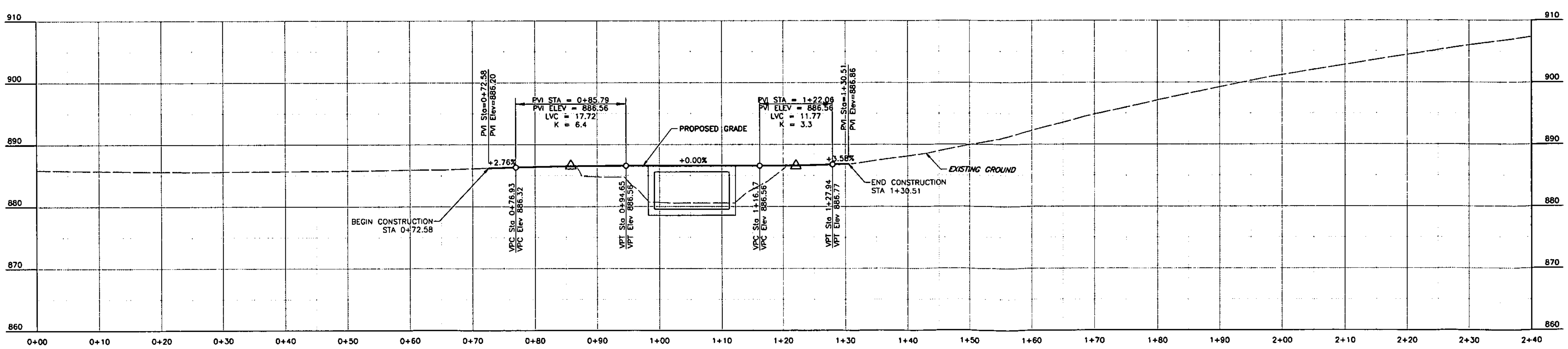
—850—	EXISTING INDEX CONTOUR
	EXISTING CONTOUR (INTER)
	EXISTING ROAD (UNPAVED)
	EXISTING UTILITY POLE
	EXISTING STREET SIGN
—OH-E—	EXISTING OVERHEAD ELECTRIC LINE
—T—	EXISTING OVERHEAD TELEPHONE LINE
—FO—	EXISTING UNDERGROUND FIBER-OPTIC LINE
	EXISTING RIGHT-OF-WAY
—850—	PROPOSED INDEX CONTOUR
	PROPOSED INTERMEDIATE CONTOUR
	PROPOSED ROAD
	PROPOSED CLASS V GUARDRAIL
	PROPOSED DITCH
—LOD—	PROPOSED LIMITS OF DISTURBANCE



TYPICAL ROAD SECTION

TYPICAL SECTION

NOT TO SCALE



ACCESS ROAD CENTERLINE PROFILE

ABBREVIATIONS
STA. – DENOTES STATION
W.S.E. – DENOTES WATER SURFACE ELEVATION
EX. – DENOTES EXISTING
PROP. – DENOTES PROPOSED
INV. – DENOTES INVERT
EL. – DENOTES ELEVATION
TYP. – DENOTES TYPICAL
PVI – DENOTES POINT OF VERTICAL INTERSECTION
VPC – DENOTES VERTICAL POINT OF CURVATURE
VPT – DENOTES VERTICAL POINT OF TANGENCY
P.G. – DENOTES PROPOSED GRADE
T/WALL – DENOTES TOP OF WALL
EX R/W – DENOTES EXISTING RIGHT-OF-WAY
R/W – DENOTES PROPOSED RIGHT-OF-WAY
TCE – DENOTES TEMPORARY CONSTRUCTION EASEMENT
B.E.S. – DENOTES BUFFER END SECTION
PDE – DENOTES PERMANENT DRAINAGE EASEMENT

REFERENCE

1. TOPOGRAPHIC INFORMATION BASED ON FIELD SURVEY PERFORMED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. ON 3/13/2017 AND 4/3/2017.

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ANTERO RESOURCES CORPORATION
NLS 23 PERMANENT BRIDGE
DODDRIDGE COUNTY, WV

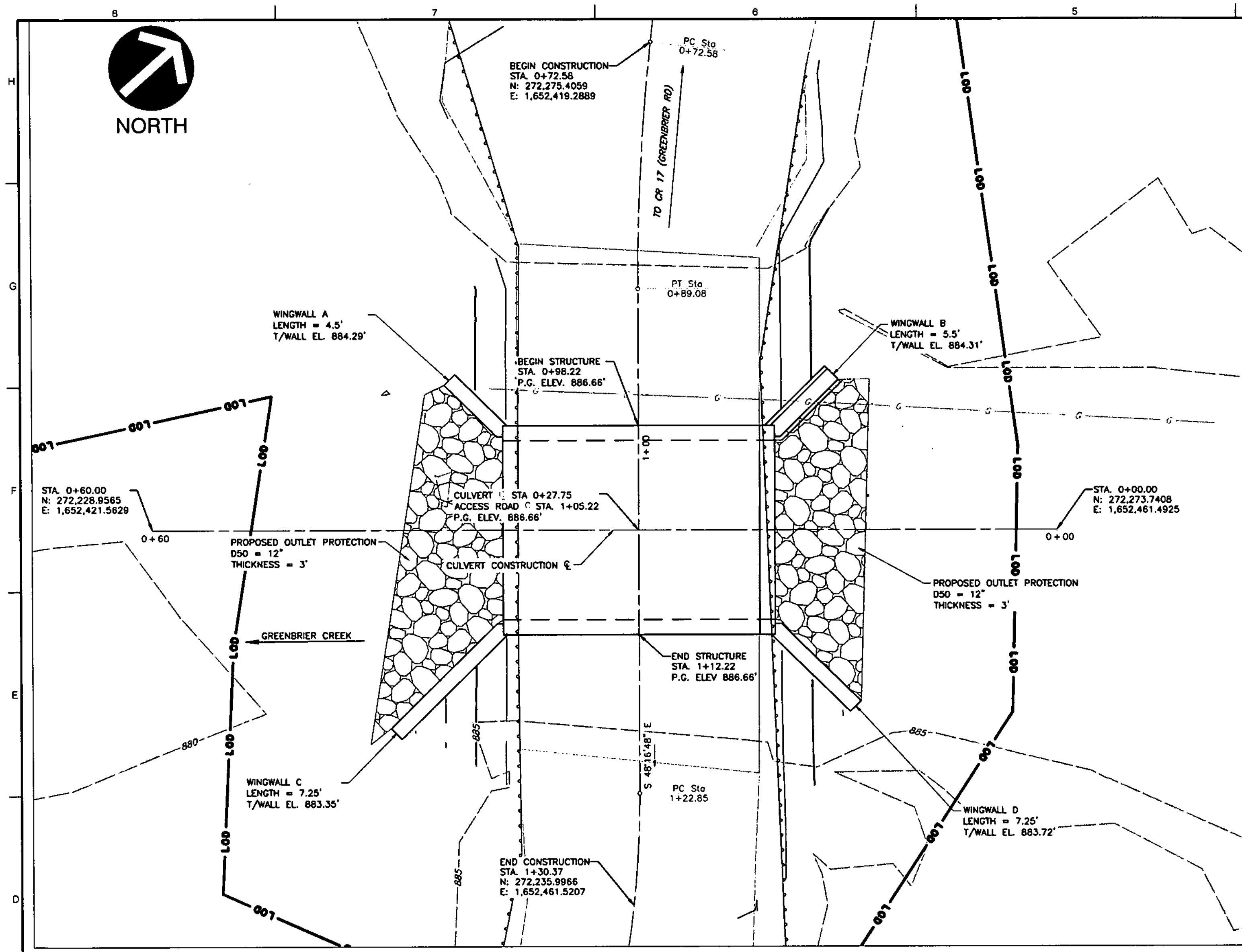
ROADWAY SITE PLAN

DATE:	JULY 2017	DRAWN BY:	DSP
DWG SCALE:	AS SHOWN	CHECKED BY:	GSL
PROJECT NO:	170-812		
APPROVED BY:	GSL		

GREGORY S. LINDER REGISTERED STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER 7-14-2017

DRAWING NO.: 3

SHEET 3 OF 9



PLAN VIEW

SCALE IN FEET
0 20 40

ABBREVIATIONS

STA. – DENOTES STATION
W.S.E. – DENOTES WATER SURFACE ELEVATION
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R/W – DENOTES PROPOSED RIGHT-OF-WAY
TCE – DENOTES TEMPORARY CONSTRUCTION EASEMENT
B.E.S. – DENOTES BUFFER END SECTION
PDE – DENOTES PERMANENT DRAINAGE EASEMENT

LEGEND

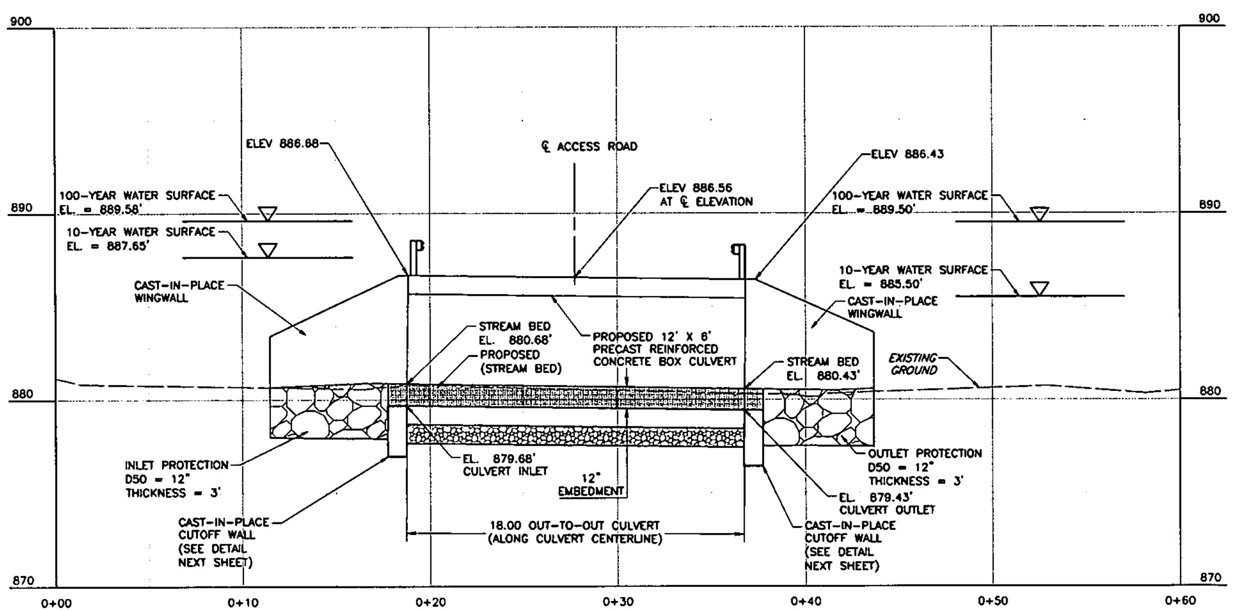
850 — EXISTING INDEX CONTOUR
EXISTING CONTOUR (INTER)
EXISTING ROAD (UNPAVED)
EXISTING UTILITY POLE
EXISTING STREET SIGN
OH-E — EXISTING OVERHEAD ELECTRIC LINE
T — EXISTING OVERHEAD TELEPHONE LINE
FO — EXISTING UNDERGROUND FIBER-OPTIC LINE
EXISTING RIGHT-OF-WAY

850 — PROPOSED INDEX CONTOUR
PROPOSED INTERMEDIATE CONTOUR
PROPOSED ROAD
PROPOSED CLASS V GUARDRAIL
PROPOSED DITCH
LOD — PROPOSED LIMITS OF DISTURBANCE

HYDRAULIC DATA
DRAINAGE AREA = 1,734.40 ACRES
10-YEAR, 24-HOUR DISCHARGE = 984 CFS
100-YEAR, 24-HOUR DISCHARGE = 1,880 CFS

EXISTING CONDITIONS
10-YEAR HEADWATER SURFACE ELEVATION = 887.54'
10-YEAR OUTLET VELOCITY = 8.04 FT/S
100-YEAR HEADWATER SURFACE ELEVATION = 889.64'
100-YEAR OUTLET VELOCITY = 4.01 FT/S

PROPOSED CONDITIONS
10-YEAR HEADWATER SURFACE ELEVATION = 887.65'
10-YEAR OUTLET VELOCITY = 11.96 FT/S
100-YEAR HEADWATER SURFACE ELEVATION = 889.58'
100-YEAR OUTLET VELOCITY = 4.01 FT/S

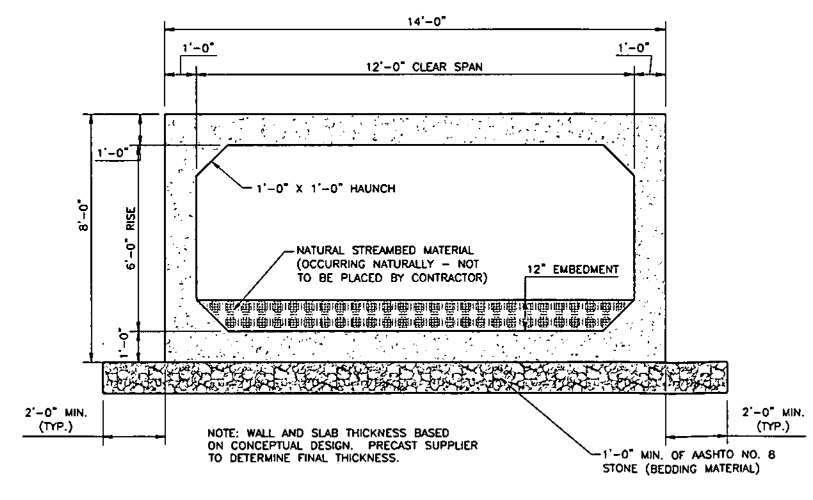


LONGITUDINAL SECTION ALONG CULVERT CENTERLINE

SCALE IN FEET
0 10 20

REFERENCE

1. TOPOGRAPHIC INFORMATION BASED ON FIELD SURVEY PERFORMED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. ON 3/13/2017 AND 4/3/2017.



TYPICAL BOX CULVERT SECTION
NOT TO SCALE

REVISION RECORD
NO | DATE | DESCRIPTION

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www.cecinc.com

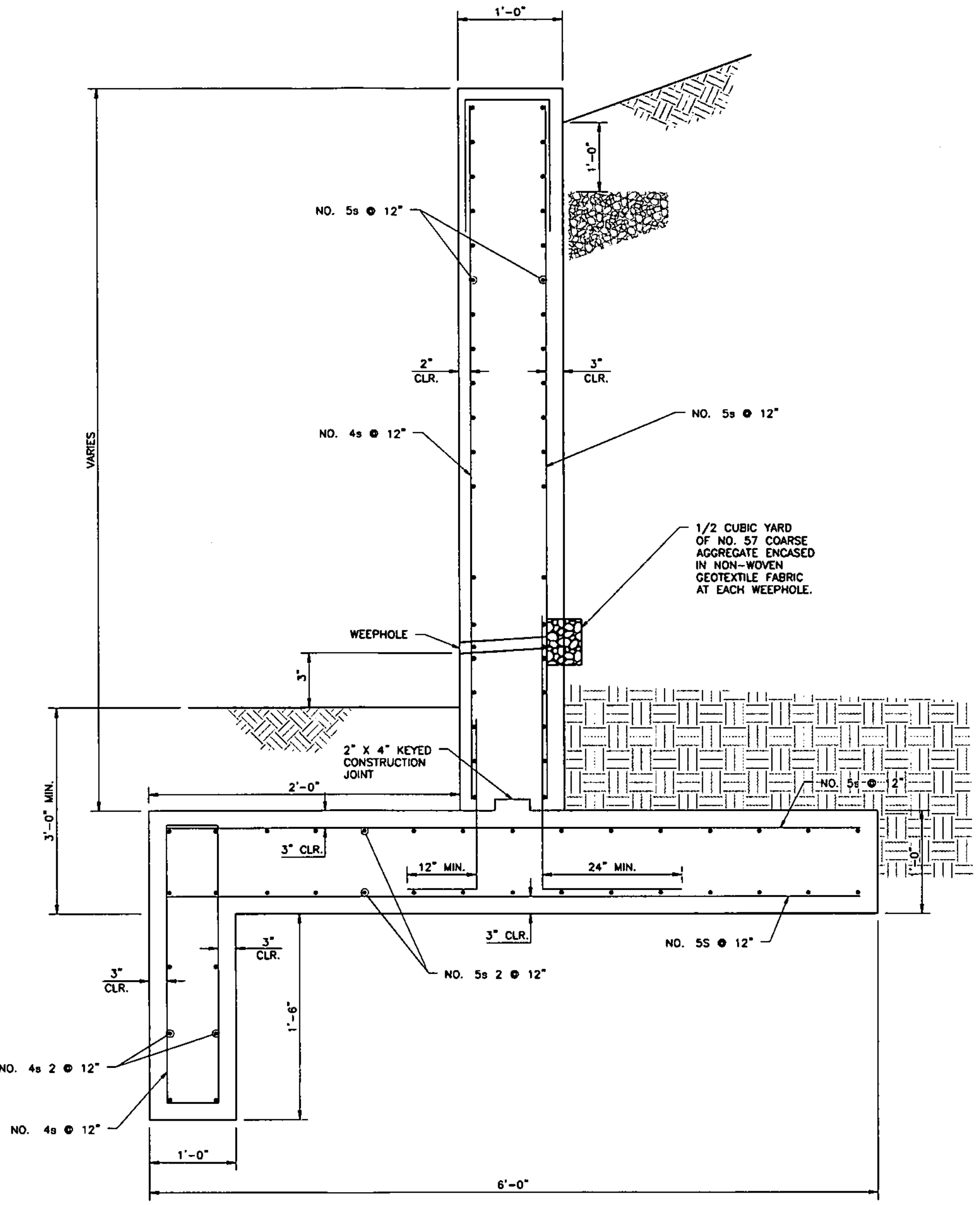
ANTERO RESOURCES CORPORATION
NLS 23 PERMANENT BRIDGE
DODDRIDGE COUNTY, WV

CULVERT SITE PLAN

DATE:	JULY 2017	DRAWN BY:	DSP
DWG SCALE:	AS SHOWN	CHECKED BY:	GSL
PROJECT NO:	170-812	APPROVED BY:	GSL

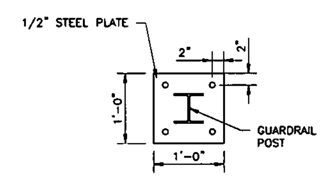
GREGORY S. LINDER REGISTERED PROFESSIONAL ENGINEER STATE OF WEST VIRGINIA 7-18-2017

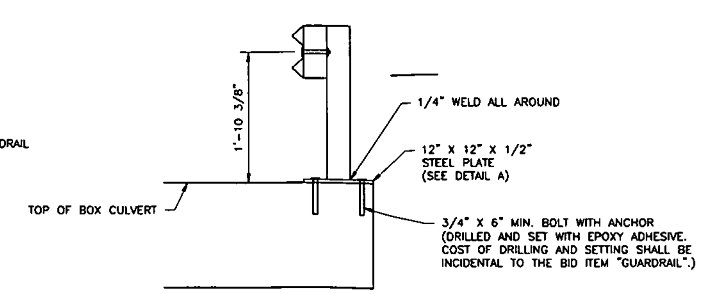
DRAWING NO.: 4
SHEET 4 OF 9



TYPICAL WINGWALL FOUNDATION DRAIN

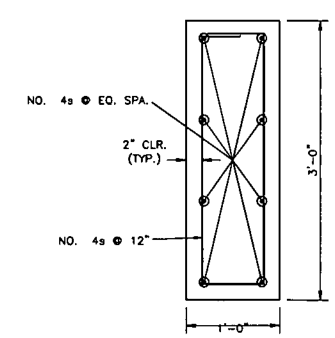
SCALE: 3/4 INCH = 1 FOOT





TYPICAL GUARDRAIL DETAIL

SCALE: 3/4 INCH = 1 FOOT



TYPICAL CUTOFF DETAIL

SCALE: 1 INCH = 1 FOOT

MINIMUM LAP LENGTH FOR REINFORCEMENT

NO. 3	1'-11"
NO. 4	2'-7"
NO. 5	3'-3"
NO. 6	4'-1"

REVISION RECORD

NO	DATE	DESCRIPTION

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ANTERO RESOURCES CORPORATION
NLS 23 PERMANENT BRIDGE
DODDRIDGE COUNTY, WV

CULVERT AND WINGWALL DETAILS

DATE:	JULY 2017	DRAWN BY:	DSP
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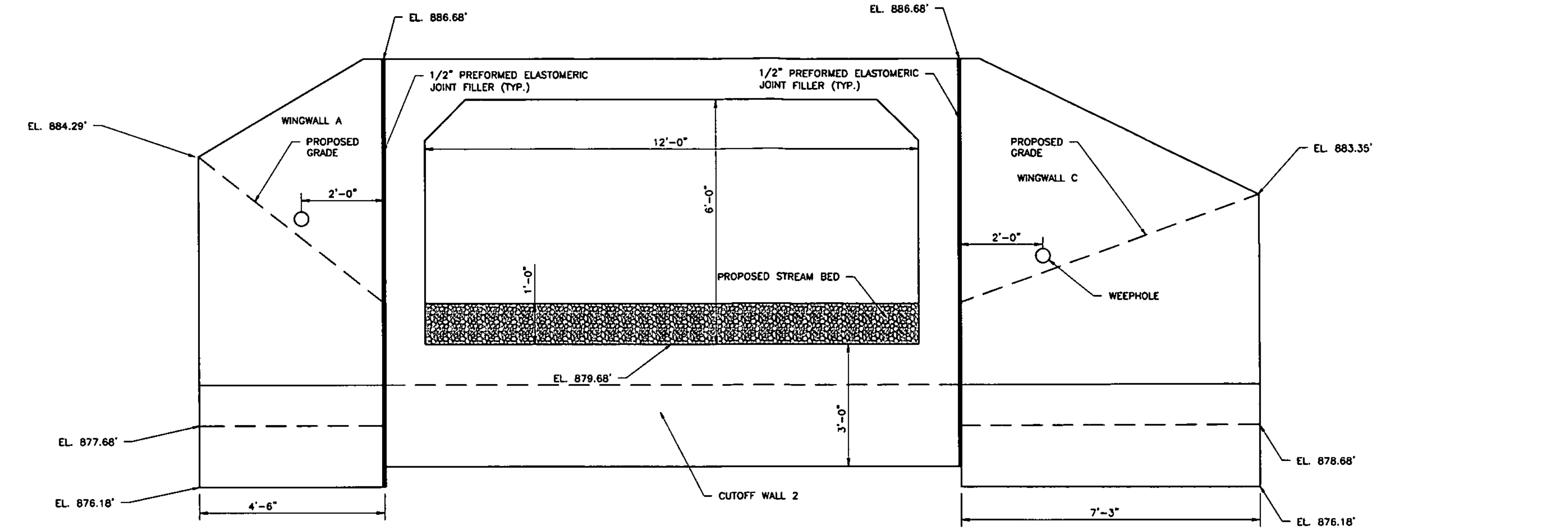
GREGORY S. LINDER REGISTERED STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER 7-19-2017

DRAWING NO.: 5

SHEET 5 OF 9

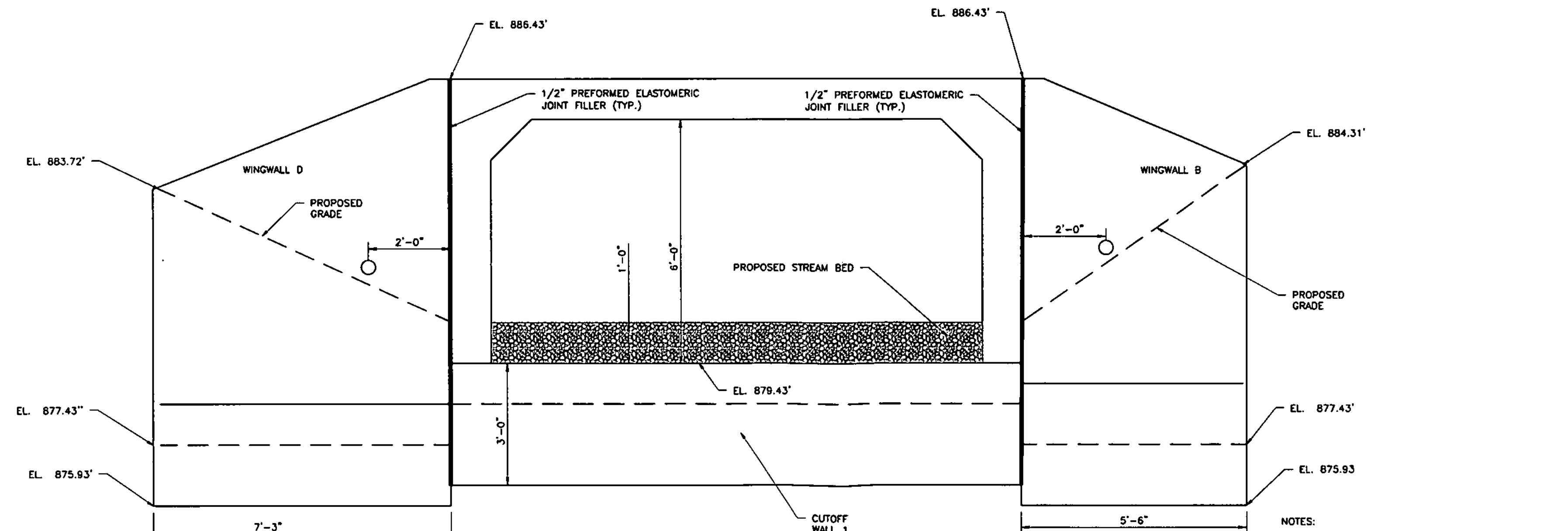


NOTES:

1. PREFORMED ELASTOMERIC JOINT FILLER SHALL BE INCIDENTAL TO THE BID ITEM "CAST-IN-PLACE CONCRETE".

WEST ELEVATION

SCALE: 1/4 INCH = 1 FOOT



NOTES:

1. PREFORMED ELASTOMERIC JOINT FILLER SHALL BE INCIDENTAL TO THE BID ITEM "CAST-IN-PLACE" CONCRETE

EAST ELEVATION

SCALE: 1/4 INCH = 1 FOOT

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CULVERT AND WINGWALL DETAILS

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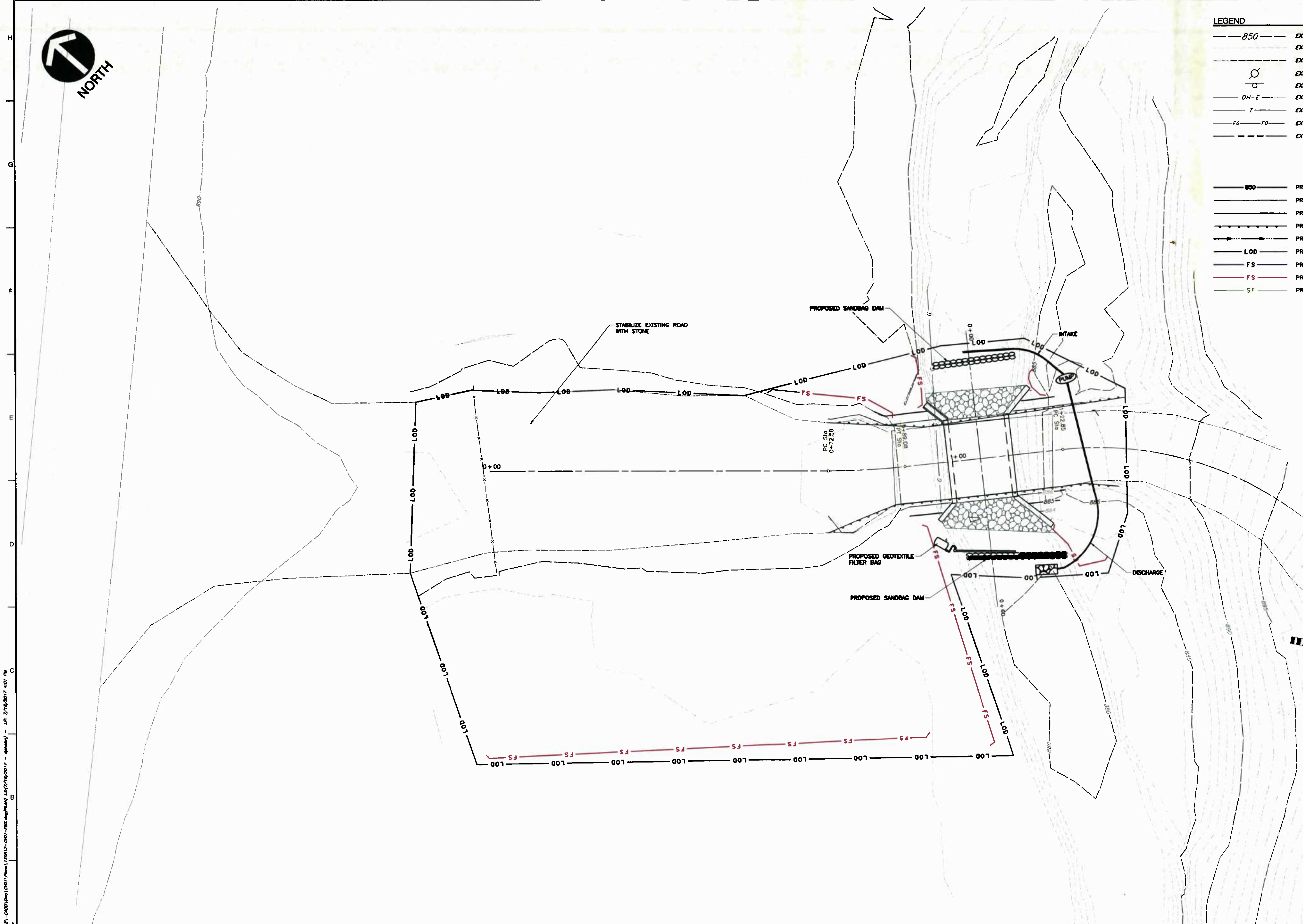
PROJECT NO:	170-812	APPROVED BY:	GSL

GREGORY S. LINDER REGISTERED STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER
7-19-2017

DRAWING NO.: 6

SHEET 6 OF 9



PLAN VIEW

SCALE IN FEET: 0 10 20

LEGEND

Symbol	Description
850	EXISTING INDEX CONTOUR
	EXISTING CONTOUR (INTER)
	EXISTING ROAD (UNPAVED)
	EXISTING UTILITY POLE
	EXISTING STREET SIGN
OH-E	EXISTING OVERHEAD ELECTRIC LINE
T	EXISTING OVERHEAD TELEPHONE LINE
FO	EXISTING UNDERGROUND FIBER-OPTIC LINE
	EXISTING RIGHT-OF-WAY
850	PROPOSED INDEX CONTOUR
	PROPOSED INTERMEDIATE CONTOUR
	PROPOSED ROAD
	PROPOSED CLASS V GUARDRAIL
	PROPOSED DITCH
LOD	PROPOSED LIMITS OF DISTURBANCE
FS	PROPOSED 8" FILTER SOCK
FS	PROPOSED 12" FILTER SOCK
SF	PROPOSED DROP INLET PROTECTION

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ANTERO RESOURCES CORPORATION
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DODDRIDGE COUNTY, WV

EROSION AND SEDIMENT CONTROL PLAN

DATE:	JULY 2017	DRAWN BY:	DSP
DWG SCALE:	AS SHOWN	CHECKED BY:	GSL
PROJECT NO:	170-812	APPROVED BY:	GSL

GREGORY S. LINDER REGISTERED STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER 7-17-2017

DRAWING NO.: 7

SHEET 7 OF 9

EROSION & SEDIMENT CONTROL PROGRAM

A COPY OF THE STORMWATER POLLUTION PREVENTION PLAN (SWPPP) SHALL BE KEPT ON SITE AT ALL TIMES DURING WORKING HOURS AND SHALL BE STRICTLY ADHERED TO.

EROSION & SEDIMENT CONTROL SHALL BE MAXIMIZED THROUGH RAPID STABILIZATION OF THE DISTURBED AREAS AND BY THE INSTALLATION OF BEST MANAGEMENT PRACTICES (BMPs), AS SHOWN ON THE CONSTRUCTION PLANS.

VEGETATIVE PRACTICES

FERTILIZING, SEEDING, AND MULCH SHALL BE APPLIED TO ALL DISTURBED AREAS WHERE CONSTRUCTION IS NOT TO BE CONDUCTED FOR A PERIOD OF 7 DAYS OR MORE AND TO ALL AREAS WHERE FINAL GRADE HAS BEEN REACHED. WHERE CONSTRUCTION ACTIVITY WILL RESUME ON A PORTION OF THE SITE WITHIN 14 DAYS FROM WHEN ACTIVITIES CEASED, THE STABILIZATION MEASURES DO NOT HAVE TO BE INITIATED ON THAT PORTION OF THE SITE BY THE 7TH DAY AFTER CONSTRUCTION ACTIVITIES HAVE TEMPORARILY CEASED. REVEGETATION ACTIVITIES SHALL BE PERFORMED IN AN AGGRESSIVE MANNER THROUGHOUT THE CONSTRUCTION PROCESS.

1. SURFACE ROUGHENING – AREAS TO BE SEEDED SHALL BE LIGHTLY ROUGHENED AND LOOSE TO A DEPTH OF 2" TO 4" PRIOR TO SEEDING. AREAS, WHICH HAVE BEEN GRADED AND WILL NOT BE STABILIZED IMMEDIATELY, MAY BE ROUGHENED TO REDUCE VELOCITY UNTIL SEEDING TAKES PLACE.

2. TOP SOILING (STOCKPILE) – TOPSOIL WILL BE STRIPPED FROM AREAS TO BE GRADED AND STOCKPILED FOR LATER USE. STOCKPILE LOCATION SHALL BE LOCATED ON-SITE IN A DESIGNATED AREA AND SHALL BE STABILIZED WITH TEMPORARY VEGETATION. ONCE THE AREAS OF STOCKPILE HAVE BEEN REMOVED, THE AREAS SHALL BE GRADED/RESTORED & PERMANENTLY SEEDED.

3. TEMPORARY SEEDING & MULCHING – SELECTION OF THE SEED MIXTURE WILL DEPEND ON THE TIME OF THE YEAR IT IS APPLIED AND SHALL BE DONE WITH TEMPORARY SEEDING MEASURES SPECIFIED IN THE SWPPP (AS RECOMMENDED BY THE WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION). MULCHING SHALL BE APPLIED AT A RATE OF TWO TONS OF STRAW PER ACRE. FERTILIZER SHALL BE APPLIED AT A RATE OF 800 LBS/ACRE. LIME SHALL BE APPLIED AT 1.5 TON/ACRE.

PERMANENT STABILIZATION

EXCEPT AS NOTED BELOW, STABILIZATION MEASURES SHALL BE INITIATED AS SOON AS PRACTICABLE IN PORTIONS OF THE SITE WHERE CONSTRUCTION ACTIVITIES HAVE TEMPORARILY OR PERMANENTLY CEASED, BUT IN NO CASE MORE THAN 7 DAYS AFTER THE CONSTRUCTION ACTIVITY IN THAT PORTION OF THE SITE HAS PERMANENTLY CEASED. WHERE THE INITIATION OF STABILIZATION MEASURES BY THE SEVENTH DAY AFTER CONSTRUCTION ACTIVITY TEMPORARILY OR PERMANENTLY CEASES IS PRECLUDED BY SNOW COVER, STABILIZATION MEASURES SHALL BE INITIATED AS SOON AS CONDITIONS ALLOW. WHERE CONSTRUCTION ACTIVITY WILL RESUME ON A PORTION OF THE SITE WITHIN 14 DAYS FROM WHEN ACTIVITIES CEASED, (E.G., THE TOTAL TIME PERIOD THAT CONSTRUCTION ACTIVITY IS TEMPORARILY HALTED IS LESS THAN 14 DAYS) THEN STABILIZATION MEASURES DO NOT HAVE TO BE INITIATED ON THAT PORTION OF THE SITE BY THE SEVENTH DAY AFTER CONSTRUCTION ACTIVITIES HAVE TEMPORARILY CEASED. AREAS WHERE THE SEED HAS FAILED TO GERMINATE ADEQUATELY (UNIFORM PERENNIAL VEGETATIVE COVER WITH A DENSITY OF 70%) WITHIN 30 DAYS AFTER SEEDING AND MULCHING MUST BE RESEEDED IMMEDIATELY, OR AS SOON AS WEATHER CONDITIONS ALLOW.

TEMPORARY AND PERMANENT SEED MIXTURES:

TABLE 652.5-SEED MIXTURES

Variety of Seed	Type B	Type C		Type D	Type L
		C-1	C-2		
	Medians. Shoulders (Ditch Slope) Waterways. and Mowable Areas of Interchange	Coarse Lawn Grass ---------- For Use in Urban and Rest Area Locations	Fine Lawn Grass ---------- For Use where a Fine Lawn is Desired	Cut and Fill Slopes ---------- (Including Benches and Bifurcated Median)	All areas
	Lb. per acre (kg per ha)	Lb. per acre (kg per ha)	Lb. per acre (kg per ha)	Lb. per acre (kg per ha)	Lb. per acre (no. per hr.)
Kentucky 31 Fescue	65 (72.9)	45 (50.4)		20 (22.4)	
Red Fescue (Pennlawn)	20 (22.4)	20 (22.4)	20 (22.4)	20 (22.4)	41 (46.0)
Kentucky Bluegrass		25 (28.0)	40 (44.8)		
Merion Bluegrass			30 (33.6)		
Crown Vetch				20 (22.4)	
Hard Fescue Mixture***					63 (70.6)
White Dutch Clover	3 (3.4)				
Annual Ryegrass Aug 1 to May 15	7 (7.8)	7 (7.8)	7 (7.8)	7 (7.8)	12 (13.5)
or Weeping Lovegrass May 15 to Aug 1	3 (3.4)	3 (3.4)		(3.4)	5 (5.6)

* Areas will be considered mowable when slopes are 3 to 1 or flatter. Type C-1 and C-2 seed mixtures shall be used in all urban, suburban, and rest areas where lawn type turf is desired with mowing maintenance intended. C-2 lawn mixture shall be used along sidewalks, adjacent to private lawns.

*** A combination of approved certified varieties with no one variety exceeding 50% of the total hard fescue component.

NOTE: SEED MIXES SHALL NOT BE MODIFIED WITHOUT APPROVAL OF ENGINEER

GENERAL NOTES

1. PERMANENT VEGETATION SHALL NOT BE CONSIDERED ESTABLISHED UNTIL A GROUND COVER IS ACHIEVED THAT IS UNIFORM, MATURE ENOUGH TO SURVIVE, AND WILL INHIBIT EROSION. 70% VEGETATIVE COVER SHALL BE CONSIDERED STABILIZED.

2. ALL TEMPORARY SEDIMENT CONTROL MEASURES SHALL REMAIN IN PLACE UNTIL VEGETATION IS WELL ESTABLISHED ON ALL AREAS TO WHICH THE STRUCTURE IS BEING UTILIZED. ALL CONTROLS SHALL STRICTLY ADHERE TO REQUIREMENTS SET FORTH BY THE DEPARTMENT OF ENVIRONMENTAL PROTECTION.

3. PROPERTIES AND WATERWAYS DOWNSTREAM FROM DEVELOPMENT SITES SHALL BE PROTECTED FROM SEDIMENT DEPOSITION, EROSION AND DAMAGE DUE TO INCREASES IN VOLUME, VELOCITY AND PEAK FLOW RATE OF STORMWATER RUNOFF.

4. ALL MEASURES USED TO PROTECT PROPERTIES AND WATERWAYS SHALL BE EMPLOYED IN A MANNER WHICH MINIMIZES IMPACTS ON THE PHYSICAL, CHEMICAL, AND BIOLOGICAL INTEGRITY OF RIVERS, STREAMS, AND OTHER WATERS OF THE STATE.

5. STABILIZATION MEASURES SHALL BE APPLIED IMMEDIATELY TO ALL AREAS UPON REACHING FINAL GRADE.

MAINTENANCE PROGRAM

ALL PERSONNEL MEETINGS AND MAINTENANCE INSPECTIONS SHALL BE DOCUMENTED IN WRITTEN FORMAT AND MAINTAINED ON SITE AS PART OF THE REQUIREMENTS OF THIS PERMIT. A COPY OF THE BMP INSPECTION CHECKLIST IS INCLUDED IN THE SWPPP FOR THE CONTRACTOR TO USE AS A GUIDELINE FOR INSPECTION REQUIREMENTS.

ALL PERSONNEL INVOLVED IN THE INSTALLATION OF THE TEMPORARY EROSION AND SEDIMENT CONTROL STRUCTURES SHALL BE PROPERLY INSTRUCTED ON THE CORRECT INSTALLMENT PROCEDURES OF EACH MEASURE. ON-THE-JOB TRAINING SHALL BE CONDUCTED TO ENSURE THOSE PERSONNEL PERFORMING CONSTRUCTION ACTIVITIES ON THE PROJECT SITE ARE AWARE OF THE COMPONENTS, METHODS, AND EXPECTED PERFORMANCE OF THE EROSION & SEDIMENT CONTROL PLAN.

AT A MINIMUM, ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSPECTED AT LEAST ONCE EVERY SEVEN CALENDAR DAYS AND WITHIN 24 HOURS AFTER ANY STORM EVENT OF GREATER THAN 0.5 INCHES OF RAIN PER 24 HOUR PERIOD.

ALL STRUCTURES ARE TO BE REPAIRED OR REPLACED IMMEDIATELY UPON THE FINDING OF ANY DEFICIENCY.

ONCE THE CAPACITY OF A STRUCTURE HAS BEEN REDUCED BY 50 PERCENT (50%), THE ACCUMULATED SEDIMENT IS TO BE REMOVED AND DISPOSED OF PROPERLY BY THE CONTRACTOR.

PERMANENT SEEDING: SEEDED AREAS SHALL BE CHECKED REGULARLY TO ENSURE A GOOD STAND OF GRASS IS BEING MAINTAINED. AREAS THAT FAIL TO ESTABLISH VEGETATIVE COVER ADEQUATE TO PREVENT RILL EROSION SHALL BE RE-SEEDED AS SOON AS THEY ARE IDENTIFIED.

DEVICES SHOWN ARE TO BE CONSIDERED AS MINIMUM EROSION AND SEDIMENTATION CONTROLS. ADDITIONAL CONTROLS MAY BE NECESSARY DUE TO CONTRACTOR'S PHASING OR OTHER UNANTICIPATED CONDITIONS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO PROVIDE ADDITIONAL DEVICES AS NECESSARY IN ORDER TO CONTROL EROSION AND SEDIMENTATION. EROSION AND SEDIMENTATION MEASURES SHALL BE INSTALLED AND MAINTAINED IN ACCORDANCE WITH THE POLICIES AND REQUIREMENTS OF THE WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION (DEP) BEST MANAGEMENT PRACTICES MANUAL. CONTROLS MAY BE REMOVED AFTER THE AREAS ABOVE THEM HAVE BEEN STABILIZED.

CONSTRUCTION SEQUENCE

1. INSTALL PERIMETER SEDIMENT CONTROL BMPS AS INDICATED PRIOR TO PERFORMING WORK THAT WILL RESULT IN GROUND DISTURBANCE.

2. PERFORM CLEARING AND GRUBBING OPERATIONS.

3. INSTALL PUMP AROUND.

4. INSTALL REINFORCED CONCRETE BOX CULVERT AND WINGWALLS. PERFORM ROADWAY CONSTRUCTION.

5. REMOVE EROSION AND SEDIMENT CONTROL STRUCTURES AFTER SITE GRADING IS COMPLETED AND SITE STABILIZATION HAS OCCURRED. THE SITE WILL NOT BE CONSIDERED STABILIZED UNTIL A 70 PERCENT UNIFORM COVER OF PERENNIAL VEGETATION IS ACHIEVED OR THE SITE IS STABILIZED WITH STONE.

REVISION RECORD

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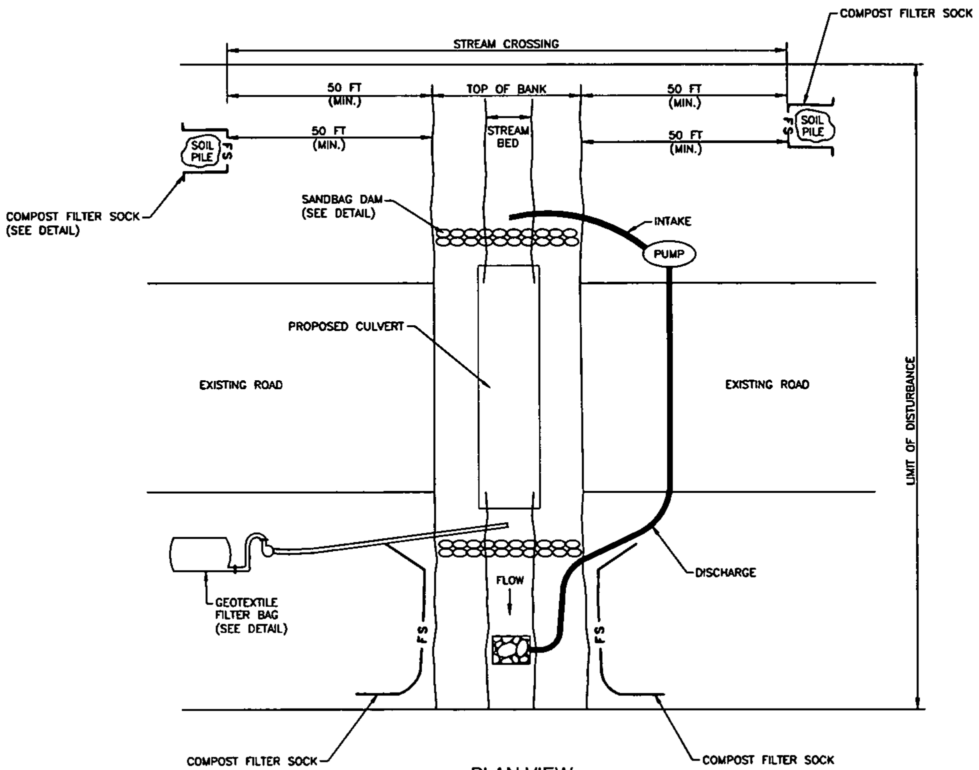
ANTERO RESOURCES CORPORATION
NLS 23 PERMANENT BRIDGE
DODDRIDGE COUNTY, WV

EROSION AND SEDIMENT CONTROL NOTES

DATE:	JULY 2017	DRAWN BY:	DSP
DWG SCALE:	AS SHOWN	CHECKED BY:	GSL
PROJECT NO:	170-812		
APPROVED BY:	GSL		

GREGORY S. LINDER REGISTERED STATE OF WEST VIRGINIA PROFESSIONAL ENGINEER 7-19-2017

DRAWING NO.: 8

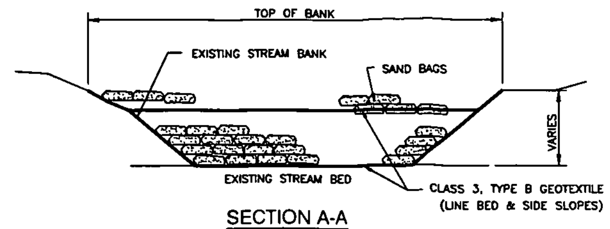


PLAN VIEW

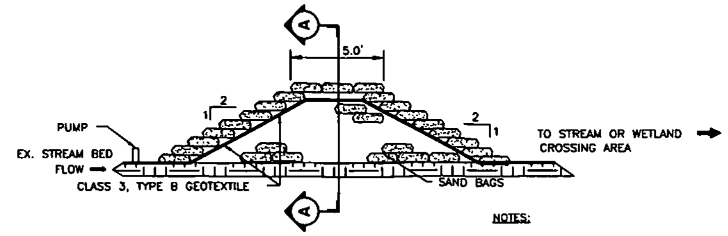
NOTES:

1. ALL RUNOFF FROM DISTURBED UP SLOPE AREAS WITHIN LIMIT OF DISTURBANCE MUST BE TREATED FOR SEDIMENT BEFORE IT REACHES STREAM.
2. INSTALL COMPOST FILTER SOCK, PUMP, ENERGY DISSIPATER, AND DAMS BEFORE REPLACING EXISTING CULVERT.
3. PUMP MUST BE OF SUFFICIENT CAPACITY TO CONVEY NORMAL AND/OR EXISTING STREAM FLOW. A BACK-UP PUMP OF EQUAL CAPACITY MUST BE AVAILABLE ON-SITE DURING EXCAVATION.
4. PLACE SPOIL PILES A MINIMUM OF 50 FEET FROM TOP OF BANK.
5. INSTALL COMPOST FILTER SOCK ALONG STREAM BANKS.
6. PUMP INTAKE SHALL HAVE AN ANTI-AQUATIC IMPEDIMENT SCREEN.

DETAIL 1
INSTALLATION OF INSTREAM CULVERTS - PUMP AROUND
NOT TO SCALE



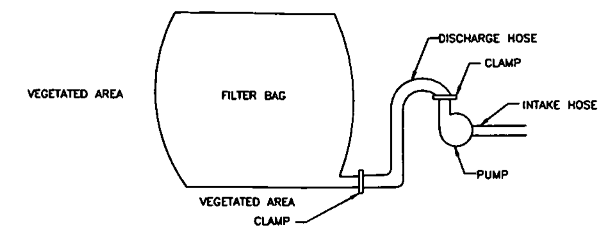
SECTION A-A



DETAIL 2
SANDBAG DAM
NOT TO SCALE

NOTES:

1. PUMP OUTLET PIPE TO BE LOCATED AT APPROXIMATE LOCATION SHOWN ON THE PLAN. R-2 STONE TO BE PLACED AT OUTLET.
2. ADDITIONAL SAND BAGS SHALL BE PLACED AS NEEDED TO PREVENT LEAKAGE.

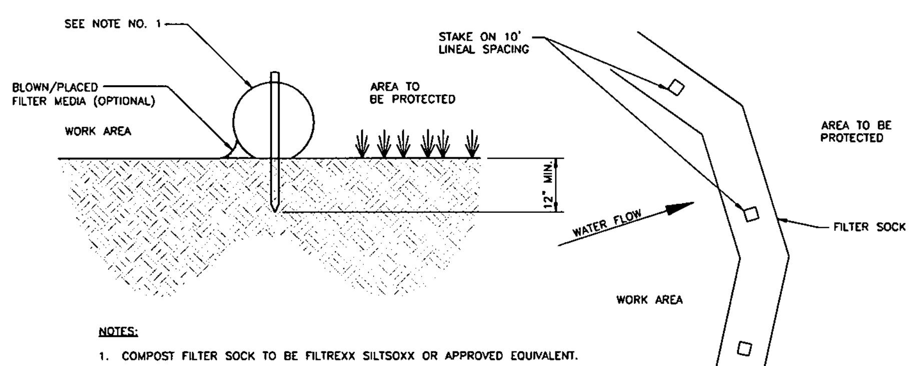


PLAN VIEW

NOTES:

1. FILTER BAGS MAY BE USED TO FILTER WATER PUMPED FROM DISTURBED AREAS SUCH AS UTILITY TRENCHES AND FOOTERS.
2. FILTER BAGS SHALL BE MADE FROM NON-WOVEN GEOTEXTILE MATERIAL SEWN WITH HIGH STRENGTH DOUBLE STITCHED "J" TYPE SEAMS. THEY SHALL BE CAPABLE OF TRAPPING PARTICLES LARGER THAN 150 MICRONS.
3. FILTER BAGS SHALL BE REPLACED WHEN THEY BECOME 1/2 FULL. SPARE BAGS SHALL BE KEPT AVAILABLE FOR REPLACEMENT OF THOSE FILLED OR FAILED. FILTER BAGS WILL BE DISPOSED OF AT A WVDEP APPROVED FACILITY.
4. BAGS SHALL BE LOCATED IN WELL VEGETATED (GRASSY) AREAS, AND DISCHARGE ONTO STABLE, EROSION RESISTANT AREAS. WHERE THIS IS NOT POSSIBLE, A GEOTEXTILE LINED FLOW PATH SHALL BE PROVIDED. BAGS SHALL NOT BE PLACED ON SLOPES GREATER THAN 5 PERCENT.
5. THE PUMP RATE SHALL BE NO GREATER THAN 750 GPM OR 1/2 THE MAXIMUM SPECIFIED BY THE MANUFACTURER, WHICHEVER IS LESS. PUMP INTAKES SHOULD BE FLOATING AND SCREENED.
6. FILTER BAGS SHALL BE INSPECTED DAILY AND ANY CORRECTIVE ACTION REQUIRED SHALL BE DONE IMMEDIATELY.

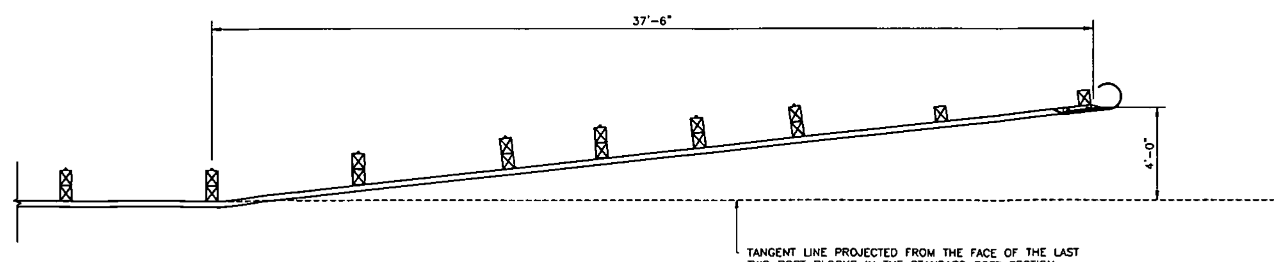
DETAIL 3
GEOTEXTILE FILTER BAG
NOT TO SCALE



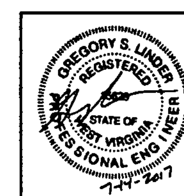
NOTES:

1. COMPOST FILTER SOCK TO BE FILTREXX SILTSOXX OR APPROVED EQUIVALENT.
2. 8" AND 12" COMPOST FILTER SOCK TO BE USED.
3. ACCUMULATED SEDIMENT SHALL BE REMOVED AND DISPOSED OF WHEN IT REACHES ½ THE ABOVE GROUND HEIGHT OF THE COMPOST FILTER SOCK.
4. COMPOST FILTER SOCK SHALL BE INSPECTED WEEKLY AND AFTER EACH RUNOFF EVENT. DAMAGED COMPOST FILTER SOCK SHALL BE REPAIRED ACCORDING TO MANUFACTURER'S SPECIFICATIONS OR REPLACED WITHIN 24 HOURS OF INSPECTION.
5. COMPOST FILTER SOCK SHALL BE INSTALLED ON THE CONTOUR, PERPENDICULAR TO FLOW.

DETAIL 4
COMPOST FILTER SOCK
NOT TO SCALE



DETAIL 5
GUARDRAIL TERMINAL FLARE DETAIL
NOT TO SCALE



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DODDRIDGE COUNTY, WV

MISCELLANEOUS DETAILS

DATE:	JULY 2017	DRAWN BY:	DSP
DWG SCALE:	AS SHOWN	CHECKED BY:	GSL
PROJECT NO:	170-812	APPROVED BY:	GSL

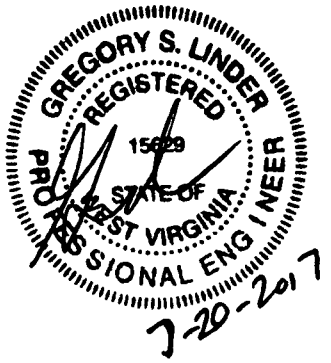
DRAWING NO.: 9
SHEET 9 OF 9

HYDRAULIC STUDY

NLS 23 Permanent Bridge Recommendation
Doddridge County, West Virginia

Prepared For:

Antero Resources Corporation
Bridgeport, West Virginia



July 2017

Civil & Environmental Consultants, Inc.

TABLE OF CONTENTS

I. PROJECT DESCRIPTION

A. Narrative

The project site is located in Doddridge County, West Virginia, off of County Route 17 (CR 17), approximately 0.3 miles northeast of the intersection of CR 17 and CR 15, 4.2 miles southwest of Salem, WV. This preliminary hydrologic and hydraulic study is for the recommendation of the proposed permanent bridge crossing of Greenbrier Creek. There is an existing temporary timber bridge that spans Greenbrier Creek at the location of the proposed permanent bridge crossing. The proposed permanent bridge crossing is recommended to be a 12-feet span by 6-feet high, 4-sided concrete box culvert. According to the Federal Emergency Management Agency (FEMA), the site is located in Zone AE Floodplain Without Floodway as designated on the Doddridge County Flood Insurance Rate Map (FIRM) Panel 54017C0255C, revised October 4, 2011. The purpose of this hydraulic study is not to investigate the existence or severity of flood hazards in the study area. The purpose of this hydraulic study is to make a recommendation on permanent bridge crossing size within the regulatory criteria.

See Figure 1 – Site Location Map.

B. Field Observations

1. High Water Marks

There are no established landmarks in the project vicinity to determine a historic high water mark for Greenbrier Creek.

2. Features Relevant to the Hydraulic Analysis

There is an existing bridge crossing serving a private residence across Greenbrier Creek approximately 400 feet downstream of the project area. This bridge crossing was not field located or field surveyed and bridge deck geometry and span have been approximated based on the 2003 United States Geological Survey National Elevation Dataset (U.S. Geological Survey [USGS] National Elevation Dataset [NED]).

3. Verification of Manning's "n" Values

Manning's roughness coefficients were determined based on photographs of the project site and checked against values used in the FEMA Flood Insurance Study Number 54017CV000A for Doddridge County. Manning's N values for Greenbrier Creek were not provided in the report. However, they were provided for Buckeye Creek which is located approximately 0.4 miles downstream of the project site.

From Table 3.1 of the HEC-RAS Hydraulic Reference Manual:

Greenbrier Creek Main Channel:
Clean, winding, some pools, shoals, and weeds, lower stages, ineffective slopes and sections, and stones: 'n' value 0.050.

Greenbrier Creek Floodplain:
Heavy stand timber, few down tree, little undergrowth, flow below branches: 'n' value range 0.080 (winter) to 0.120 (summer), lower value of 0.080 used based on project site photographs and 'n' value used for Buckeye Creek floodplains.

C. Pictures

Greenbrier Creek channel and floodplain looking upstream (northeast) from project site.

Greenbrier Creek channel and floodplain looking downstream (southwest) from project site.

II. SUMMARY OF RESULTS

A. Analyses Performed:

Two analyses were performed in this study: an existing conditions analysis (Ex_Conditions_TimberBridge), and a proposed conditions analysis with a 12x6-feet 4-sided box culvert (12x6_Box_Culvert). Existing channel geometry of Greenbrier Creek was field surveyed throughout the area of the proposed permanent bridge crossing to provide an accurate representation of the existing stream channel and floodplains. Outside of the proposed permanent bridge crossing area, field cross sections were surveyed approximately every 100-feet and utilized for the channel geometry of the hydraulic model, with floodplain geometry determined from the 2003 USGS NED. In the proposed conditions model, the proposed crossing was added with no modifications to the channel or floodplain geometry elsewhere in the study limits. The purpose of this study is to determine if the effects of the proposed permanent bridge crossing are within the regulatory limits set forth in the Doddridge County Floodplain Ordinance, dated May 2013.

By comparing the results from the Proposed Model with the Existing model, the effects of the proposed permanent bridge crossing on the 10, 25, and 100-year water levels of Greenbrier Creek were determined.

B. Compliance with FEMA and Doddridge County Criteria

Based on the HEC-RAS results, the Proposed 12x6 Box conditions will decrease the 100-year flood elevation of the Existing conditions by a maximum of 0.08 feet. Therefore, the proposed permanent bridge geometry results satisfy the regulatory criteria.

C. Recommendation

The results of the hydraulic study indicate that the construction of the proposed 12x6 box culvert will decrease the 100-year water surface elevation of Greenbrier Creek by a maximum of 0.08 feet. Therefore, it is recommended that the permanent bridge crossing be the 12x6 box geometry that is included in this report.

D. Signature Block, Consultant, or In-House Designers

1. Preparer

   Maxwell Bailey

2. Reviewer

   Gregory S. Linder, P.E. (West Virginia Registered Professional Engineer No. 15629)

3. Date

   July 18, 2017

4. Engineer's Seal on Final Report

   Gregory S. Linder, P.E. (West Virginia Registered Professional Engineer No. 15629)

III. AVAILABLE DATA

A. Flood Insurance Study

The countywide FIS for Doddridge County has an effective date of October 4, 2011. Greenbrier Creek was included as a part of the FIS to determine the Zone AE Without Floodway.

See Appendix A – FEMA FIRMette.

B. Existing Hydrologic Data

A hydrologic analysis was performed as a part of the FIS listed above. The peak discharge for the 1-Percent-Annual-Chance storm was utilized in the hydraulic model for the 100-year event flow.

C. Existing Hydraulic Model from FEMA, USACE, NRCS, others

No existing hydraulic model was obtained for this project site.

IV. HYDROLOGY

A. Rainfall Depth

Since detailed hydrology has been performed only for the 100-year storm within the boundaries of this project, the rainfall depth of the 10-year and 25-year 24-hour storms were obtained from the National Oceanic and Atmospheric Administration Atlas (NOAA) 14 Precipitation Frequency Data Server. The 100-year rainfall depth was obtained in order to check calculated values against the values published in the FIS. The rainfall depths obtained are as follows:

	10-Yr (in)	25-Yr (in)	100-Yr (in)
Rainfall Depth	3.55	4.16	5.17

See Appendix B – NOAA Rainfall Data.

B. Design Discharge Based on USGS TR-55

Since no detailed hydrology has been performed within the boundaries of this project for the 10 and 25-year storms, associated discharges were calculated using the USGS Technical Release 55 (TR-55) Curve Number Method. The 100-year discharge was calculated as a check against the values published in the FIS. The watershed was delineated using HEC-GeoHMS software. See Figure 2 – Hydrologic Watershed Map. The results of the watershed delineation were input into HydroCAD software to determine the 10, 25, and 100-year storm discharges. The hydraulic analysis was performed for the 10 and 25-year discharges, while the FIS published 100-year discharge was used for the hydraulic study.

See Appendix C – Design Discharge Calculations.

Subcatchment	Drainage Area (sq mi)	Curve No.	Hydraulic Length (lf)	Average Watershed Slope (%)	Tc (minutes)	Total Tc (minutes)	10-Yr Discharge (cfs)	25-Yr Discharge (cfs)	100-Yr Discharge (cfs)
Greenbrier Creek @ Proposed Permanent Bridge Crossing	2.71	74	7,951	34.68	70.2	70.2	984	1,360	2,030 (1,880 from FIS utilized for hydraulic study)
			8,425	0.005	36.3				

V. HYDRAULIC MODELING

A. Source of Model

GeoHECRAS Version 1.4.0.12170 was used to perform a hydraulic analysis to determine if adverse effects will be caused by the permanent bridge crossing, as well as the potential impacts to the water levels and floodplain of Greenbrier Creek. See Figure 3 – HEC-RAS Geometry Map.

B. Explanation of Data and Methods

1. Manning's Values

   Manning's roughness coefficients were determined based on photographs of the project site as well as the FEMA FIS. See Section I.B.3. for a detailed description of the Manning's values used.

2. Bridge Modeling Approach

   The Bridge Modeling Approach used was Energy (Standard Step).

3. Ineffective Flow Areas

   Ineffective flow areas were incorporated to account for areas in the cross-sectional geometry where ponded water will not be actively conveyed downstream.

4. Boundary Conditions

   The boundary condition applicable to this hydraulic analysis is the Normal Depth slope at Cross-Section 647, which is approximately 0.005 ft/ft for both the existing geometry and proposed geometry.

5. Any Unusual Circumstances

   There are no unusual circumstances specified in correlation with the hydraulic analysis of this project.

C. HEC-RAS Generated Tables

1. Results Summary with Existing and Proposed Conditions

   See Appendix D – HEC-RAS Results Summary Tables.

2. Detailed Output Tables

   See Appendices E & F – HEC-RAS Cross-Section Plots & HEC-RAS Profile Plots.

FIGURES

REFERENCE

1. USGS TOPOGRAPHIC MAP/ARCGIS MAP SERVICE: HTTP://SERVICES.ARCGISONLIN.COM/ARCGIS/REST/SERVICES/USA_TOPO_MAPS/MAPSERVER, ACCESSED 05/10/2017.

SCALE IN FEET

0 2000 4000

* HAND SIGNATURE ON FILE

Civil & Environmental Consultants, Inc.
600 Marketplace Ave · Suite 200 · Bridgeport, WV 26330
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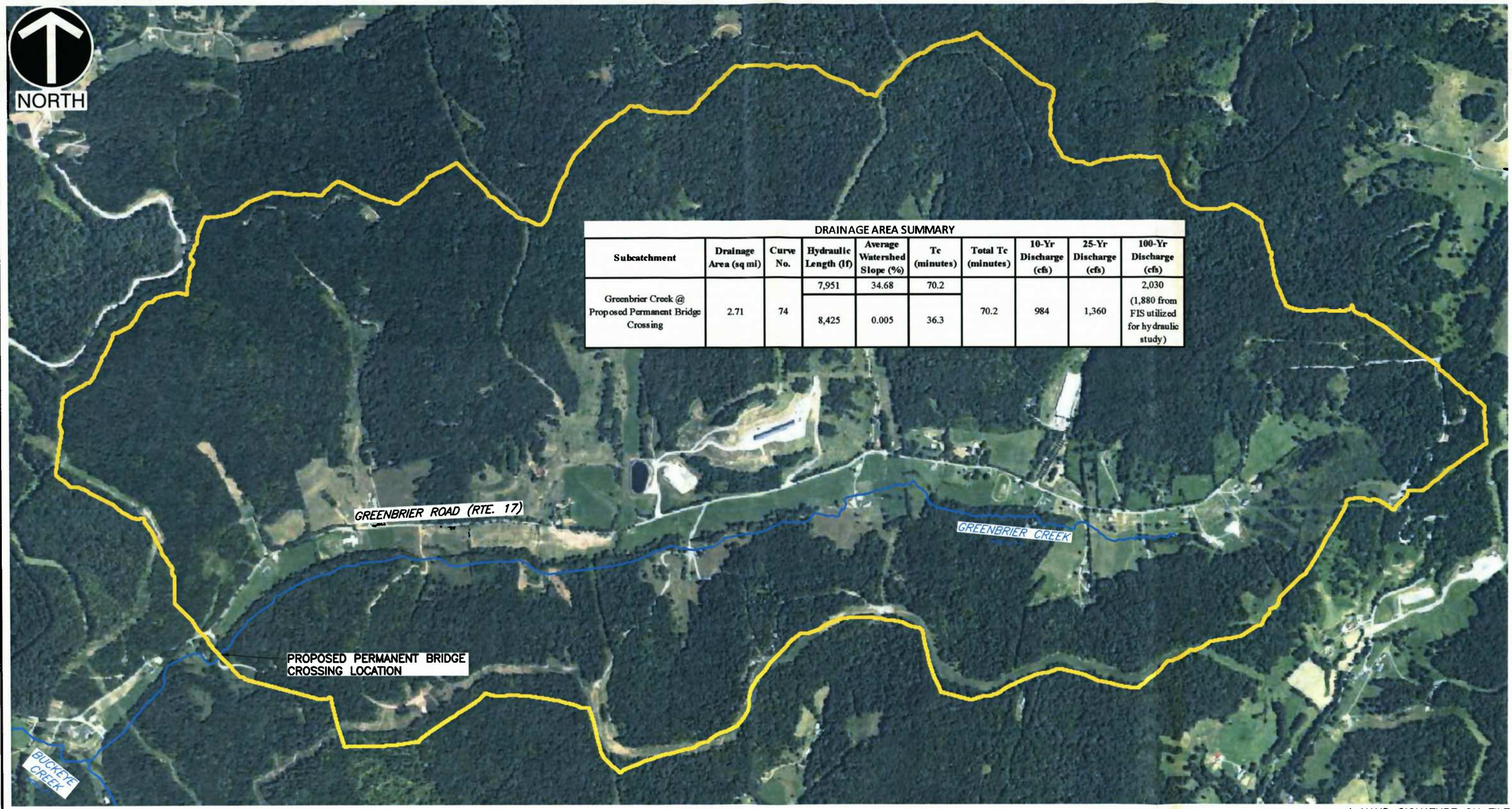
www.cecinc.com

ANTERO RESOURCES CORPORATION
NLS 23 PERMANENT BRIDGE
GREENBRIER CREEK
DODDRIDGE COUNTY, WEST VIRGINIA

SITE LOCATION MAP

DRAWN BY: MLB	CHECKED BY:	GSL	APPROVED BY:	GSL*	FIGURE NO.:	1
DATE: 05/10/2017	DWG SCALE:	1" = 2000'	PROJECT NO:	170-812		

C:\Share\CEC Offices\Bridgeport\-170-812\-CADD\H&H_Report\170812-SiteLoc.dwg{8X11P} LS:(5/10/2017 - mbailey) - LP: 5/10/2017 2:43 PM



DRAINAGE AREA SUMMARY

Subcatchment	Drainage Area (sq mi)	Curve No.	Hydraulic Length (lf)	Average Watershed Slope (%)	Tc (minutes)	Total Tc (minutes)	10-Yr Discharge (cfs)	25-Yr Discharge (cfs)	100-Yr Discharge (cfs)
Greenbrier Creek @ Proposed Permanent Bridge Crossing	2.71	74	7,951	34.68	70.2	70.2	984	1,360	2,030 (1,880 from FIS utilized for hydraulic study)
			8,425	0.005	36.3				

LEGEND:

STREAM CENTERLINE

WATERSHED BOUNDARY

SCALE IN FEET

0 1000 2000

REFERENCE

1. AERIAL IMAGERY FROM HTTP://SERVICES.ARCGISONLINE.COM/ARCGIS/REST/SERVICES/WORLD_IMAGERY/MAPSERVER, ACCESSED 05/10/2017. AERIAL PHOTOGRAPHY DATED 01/21/2016.

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Civil & Environmental Consultants, Inc.
600 Marketplace Ave · Suite 200 · Bridgeport, WV 26330
Ph: 304.933.3119 · Fax: 304.933.3327
www.cecinc.com

DRAWN BY:	MLB	CHECKED BY:	GSL	APPROVED BY:	GSL*	FIGURE NO.:	2
DATE:	05/10/2017	DWG SCALE:	1" = 1,000'	PROJECT NO:	170-812		

ANTERO RESOURCES CORPORATION
NLS 23 PERMANENT BRIDGE
GREENBRIER CREEK
DODDRIDGE COUNTY, WEST VIRGINIA

HYDROLOGIC WATERSHED MAP

LEGEND:

- STREAM CENTERLINE
- HEC-RAS CROSS-SECTION
- BRIDGE CROSSING LOCATIONS

SCALE IN FEET

0 200 400

REFERENCE

1. AERIAL IMAGERY FROM HTTP://SERVICES.ARCGISONLINE.COM/ARCGIS/REST/SERVICES/WORLD_IMAGERY/MAPSERVER, ACCESSED 05/10/2017. AERIAL PHOTOGRAPHY DATED 01/21/2016.

\\mbailey\Share\CEC Offices\Bridgeport\-170-812\-CADD\170812-P-HYDRAULIC STUDY.dwg[3_RAS] LS:(5/10/2017 - mbailey) - LP: 5/10/2017 2:43 PM

* HAND SIGNATURE ON FILE

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www.cecinc.com

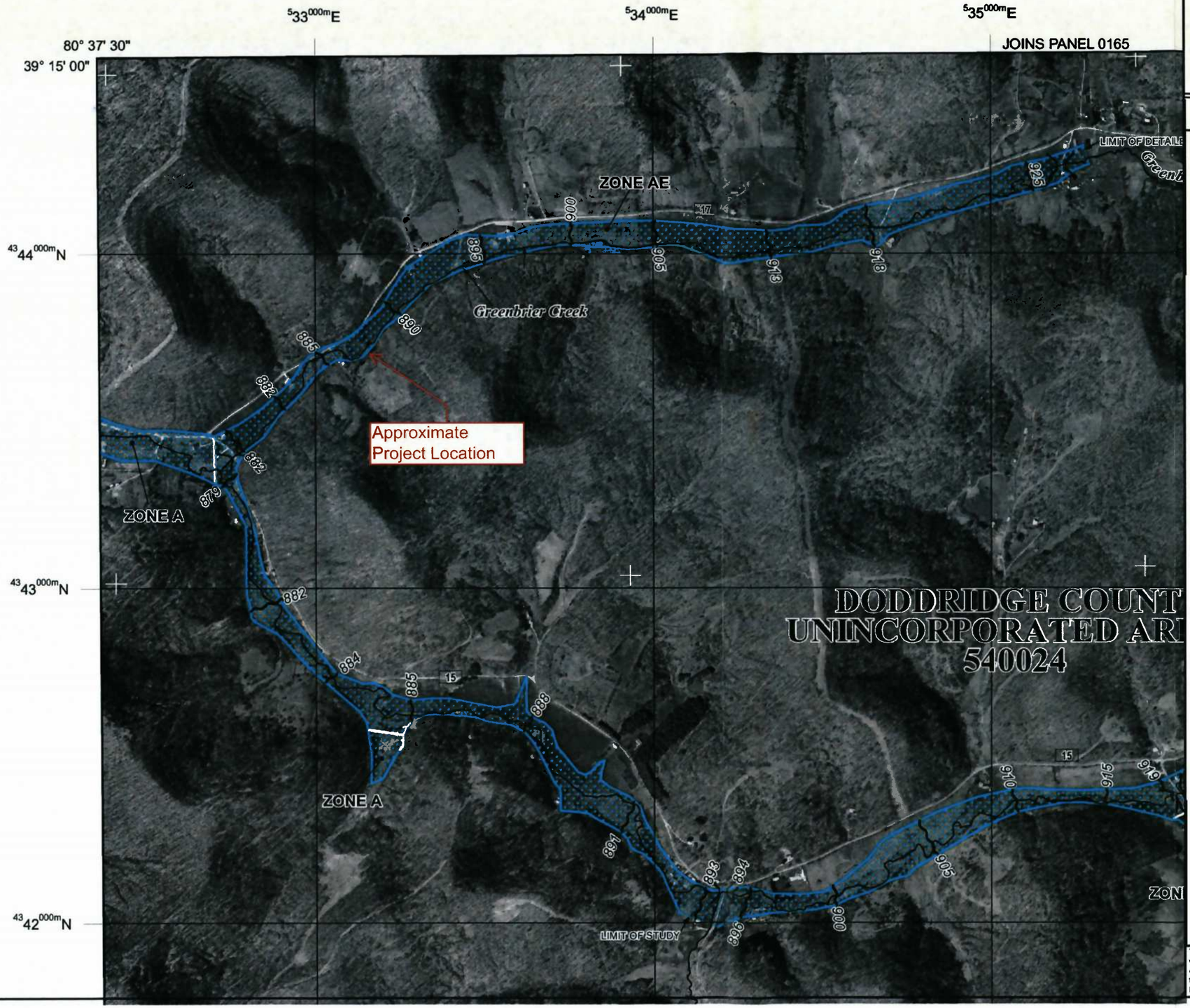
ANTERO RESOURCES CORPORATION
NLS 23 PERMANENT BRIDGE
GREENBRIER CREEK
DODDRIDGE COUNTY, WEST VIRGINIA

HEC-RAS GEOMETRY MAP

DRAWN BY:	MLB	CHECKED BY:	GSL	APPROVED BY:	GSL*	FIGURE NO.:	3
DATE:	05/10/2017	DWG SCALE:	1" = 200'	PROJECT NO:	170-812		

APPENDIX A

FEMA FIRMETTE



MAP SCALE 1" = 1000'

500 0 1000 2000

FEET

METERS

NFIP

PANEL 0255C

FIRM

FLOOD INSURANCE RATE MAP

DODDRIDGE COUNTY, WEST VIRGINIA AND INCORPORATED AREAS

PANEL 255 OF 325

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
DODDRIDGE COUNTY	540024	0255	C

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
54017C0255C

MAP REVISED
OCTOBER 4, 2011

Federal Emergency Management Agency

NATIONAL FLOOD INSURANCE PROGRAM

APPENDIX B

NOAA RAINFALL DATA

NOAA Atlas 14, Volume 2, Version 3
Location name: Salem, West Virginia, USA*
Latitude: 39.2448°, Longitude: -80.6107°
Elevation: 897.91 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.329 (0.298-0.363)	0.393 (0.357-0.435)	0.471 (0.428-0.520)	0.531 (0.481-0.585)	0.606 (0.546-0.666)	0.662 (0.596-0.727)	0.716 (0.642-0.785)	0.770 (0.688-0.843)	0.840 (0.746-0.918)	0.891 (0.788-0.974)
10-min	0.512 (0.464-0.564)	0.614 (0.558-0.679)	0.732 (0.665-0.808)	0.819 (0.742-0.903)	0.926 (0.836-1.02)	1.00 (0.903-1.10)	1.08 (0.966-1.18)	1.15 (1.03-1.26)	1.24 (1.10-1.35)	1.30 (1.15-1.42)
15-min	0.627 (0.568-0.691)	0.751 (0.682-0.830)	0.899 (0.816-0.992)	1.01 (0.913-1.11)	1.14 (1.03-1.26)	1.24 (1.12-1.36)	1.34 (1.20-1.47)	1.43 (1.28-1.57)	1.54 (1.37-1.69)	1.62 (1.43-1.77)
30-min	0.830 (0.752-0.915)	1.00 (0.913-1.11)	1.23 (1.12-1.36)	1.40 (1.27-1.54)	1.62 (1.46-1.78)	1.78 (1.60-1.95)	1.93 (1.73-2.12)	2.09 (1.86-2.29)	2.28 (2.03-2.50)	2.43 (2.15-2.66)
60-min	1.01 (0.918-1.12)	1.23 (1.12-1.36)	1.54 (1.40-1.71)	1.78 (1.61-1.96)	2.10 (1.89-2.31)	2.34 (2.11-2.57)	2.58 (2.32-2.83)	2.83 (2.53-3.10)	3.16 (2.81-3.45)	3.42 (3.02-3.73)
2-hr	1.18 (1.06-1.31)	1.43 (1.29-1.59)	1.79 (1.62-1.99)	2.06 (1.86-2.29)	2.44 (2.19-2.70)	2.74 (2.45-3.02)	3.05 (2.71-3.35)	3.36 (2.98-3.69)	3.79 (3.33-4.15)	4.12 (3.60-4.51)
3-hr	1.26 (1.14-1.40)	1.52 (1.37-1.70)	1.90 (1.72-2.12)	2.20 (1.98-2.45)	2.61 (2.34-2.89)	2.94 (2.62-3.24)	3.28 (2.90-3.61)	3.63 (3.19-3.99)	4.11 (3.58-4.50)	4.49 (3.89-4.91)
6-hr	1.51 (1.37-1.68)	1.82 (1.65-2.02)	2.26 (2.04-2.50)	2.61 (2.35-2.88)	3.10 (2.78-3.41)	3.49 (3.13-3.83)	3.91 (3.48-4.28)	4.34 (3.84-4.74)	4.95 (4.33-5.38)	5.44 (4.73-5.91)
12-hr	1.80 (1.64-1.99)	2.15 (1.96-2.38)	2.64 (2.40-2.91)	3.03 (2.75-3.35)	3.60 (3.25-3.96)	4.07 (3.65-4.46)	4.55 (4.07-4.98)	5.07 (4.50-5.53)	5.80 (5.09-6.30)	6.39 (5.56-6.93)
24-hr	2.16 (1.98-2.36)	2.57 (2.36-2.81)	3.10 (2.85-3.40)	3.55 (3.25-3.88)	4.16 (3.81-4.54)	4.66 (4.25-5.07)	5.17 (4.70-5.62)	5.71 (5.17-6.19)	6.45 (5.81-6.98)	7.03 (6.31-7.60)
2-day	2.54 (2.35-2.75)	3.01 (2.79-3.26)	3.60 (3.33-3.90)	4.08 (3.77-4.42)	4.74 (4.37-5.13)	5.26 (4.85-5.69)	5.80 (5.33-6.27)	6.35 (5.81-6.84)	7.09 (6.46-7.65)	7.67 (6.97-8.27)
3-day	2.74 (2.54-2.95)	3.24 (3.01-3.50)	3.87 (3.59-4.17)	4.36 (4.05-4.70)	5.03 (4.66-5.42)	5.56 (5.14-5.98)	6.10 (5.62-6.55)	6.64 (6.11-7.12)	7.37 (6.75-7.90)	7.93 (7.24-8.49)
4-day	2.93 (2.74-3.15)	3.47 (3.24-3.73)	4.13 (3.85-4.43)	4.64 (4.32-4.98)	5.33 (4.95-5.71)	5.86 (5.43-6.27)	6.40 (5.92-6.84)	6.94 (6.40-7.40)	7.65 (7.03-8.15)	8.19 (7.51-8.72)
7-day	3.59 (3.37-3.82)	4.23 (3.97-4.50)	4.96 (4.66-5.28)	5.52 (5.18-5.87)	6.25 (5.86-6.65)	6.81 (6.37-7.23)	7.35 (6.86-7.81)	7.88 (7.34-8.37)	8.56 (7.96-9.09)	9.07 (8.41-9.62)
10-day	4.16 (3.92-4.41)	4.89 (4.61-5.19)	5.68 (5.35-6.02)	6.28 (5.91-6.65)	7.05 (6.62-7.46)	7.62 (7.15-8.07)	8.17 (7.66-8.65)	8.70 (8.14-9.21)	9.37 (8.74-9.92)	9.85 (9.18-10.4)
20-day	5.91 (5.59-6.24)	6.92 (6.55-7.32)	7.91 (7.49-8.36)	8.65 (8.19-9.14)	9.59 (9.06-10.1)	10.3 (9.70-10.8)	10.9 (10.3-11.5)	11.5 (10.8-12.1)	12.2 (11.5-12.9)	12.7 (12.0-13.5)
30-day	7.50 (7.10-7.91)	8.76 (8.29-9.24)	9.90 (9.38-10.4)	10.8 (10.2-11.3)	11.8 (11.2-12.4)	12.6 (11.9-13.2)	13.2 (12.5-13.9)	13.9 (13.1-14.6)	14.6 (13.8-15.4)	15.2 (14.3-16.0)
45-day	9.66 (9.18-10.1)	11.2 (10.7-11.8)	12.6 (11.9-13.2)	13.6 (12.9-14.2)	14.7 (14.0-15.5)	15.6 (14.8-16.4)	16.4 (15.5-17.2)	17.0 (16.1-17.9)	17.8 (16.9-18.7)	18.4 (17.4-19.3)
60-day	11.7 (11.2-12.2)	13.6 (13.0-14.2)	15.0 (14.4-15.8)	16.1 (15.4-16.9)	17.4 (16.6-18.3)	18.4 (17.5-19.2)	19.2 (18.3-20.1)	19.9 (19.0-20.8)	20.7 (19.7-21.7)	21.3 (20.3-22.3)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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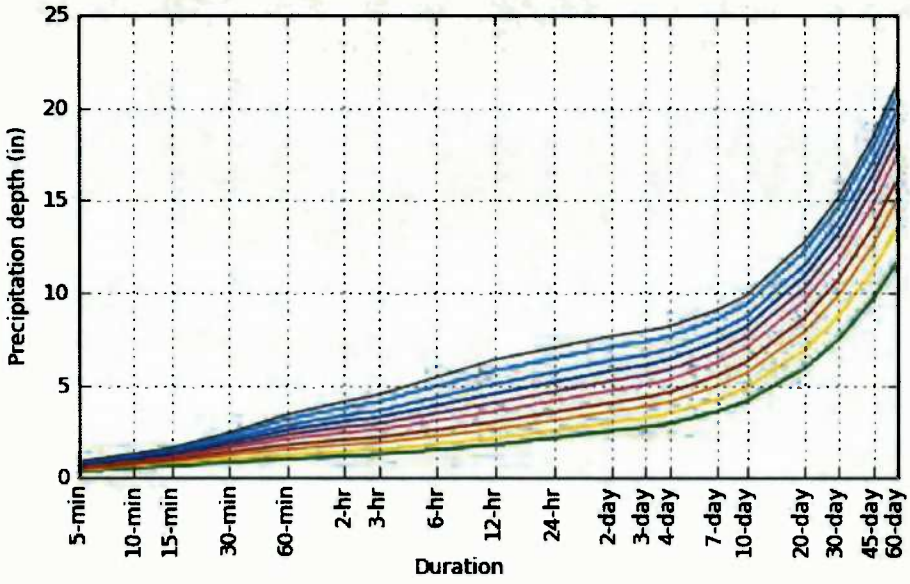
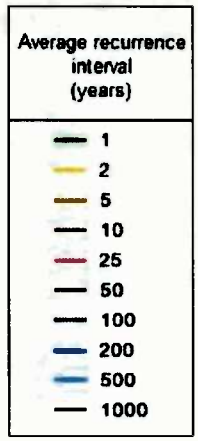
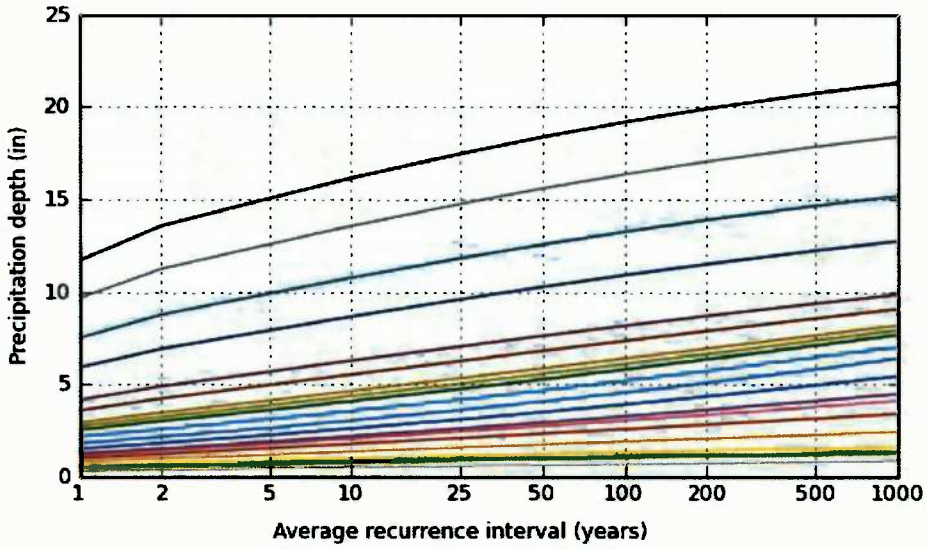
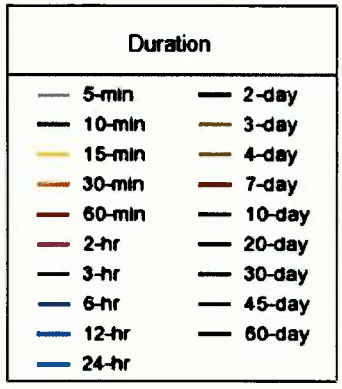
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 39.2448°, Longitude: -80.6107°









NOAA Atlas 14, Volume 2, Version 3

Created (GMT): Wed Apr 26 13:21:33 2017

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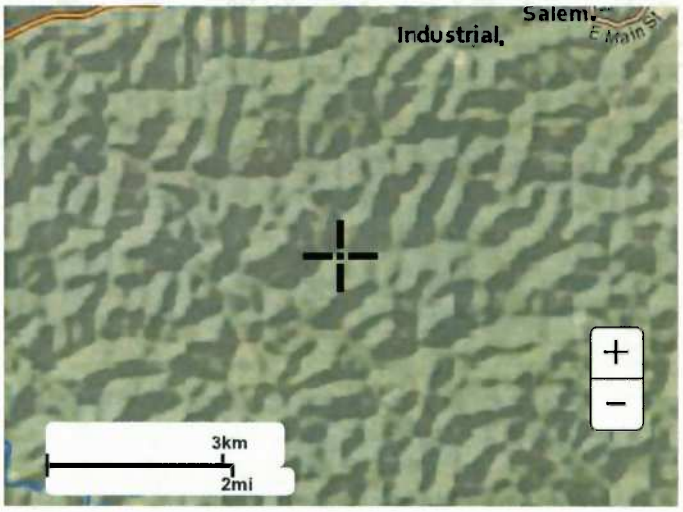
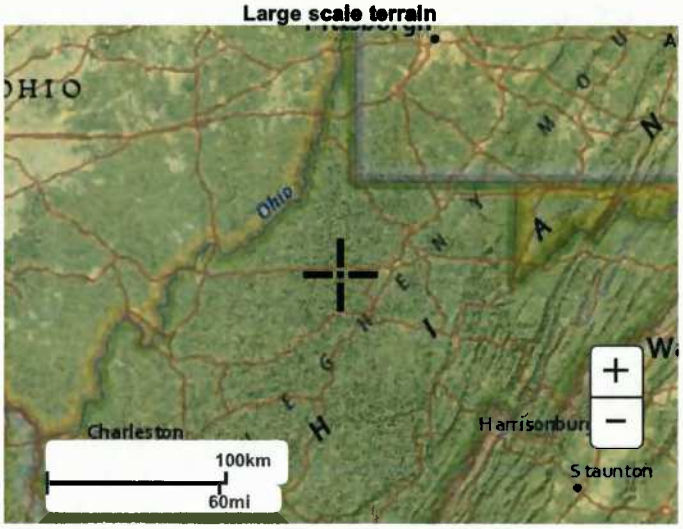
Maps & aerials

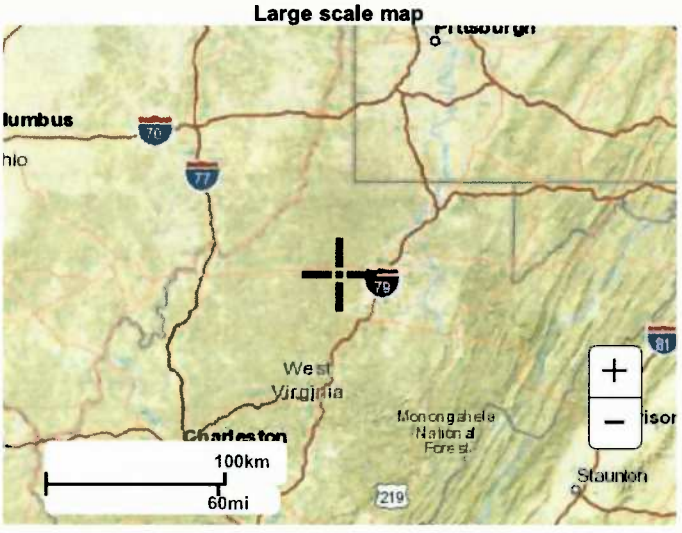
Small scale terrain



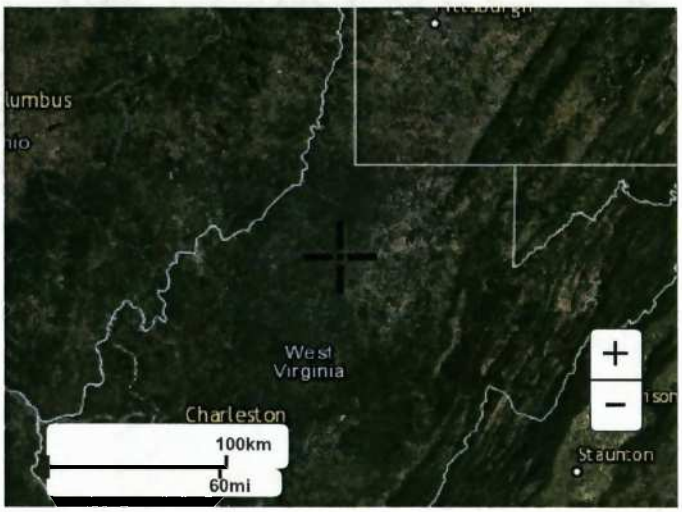
Large scale terrain



Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

APPENDIX C

DESIGN DISCHARGE CALCULATIONS

Summary for Subcatchment 3S: Greenbriar Creek_DS

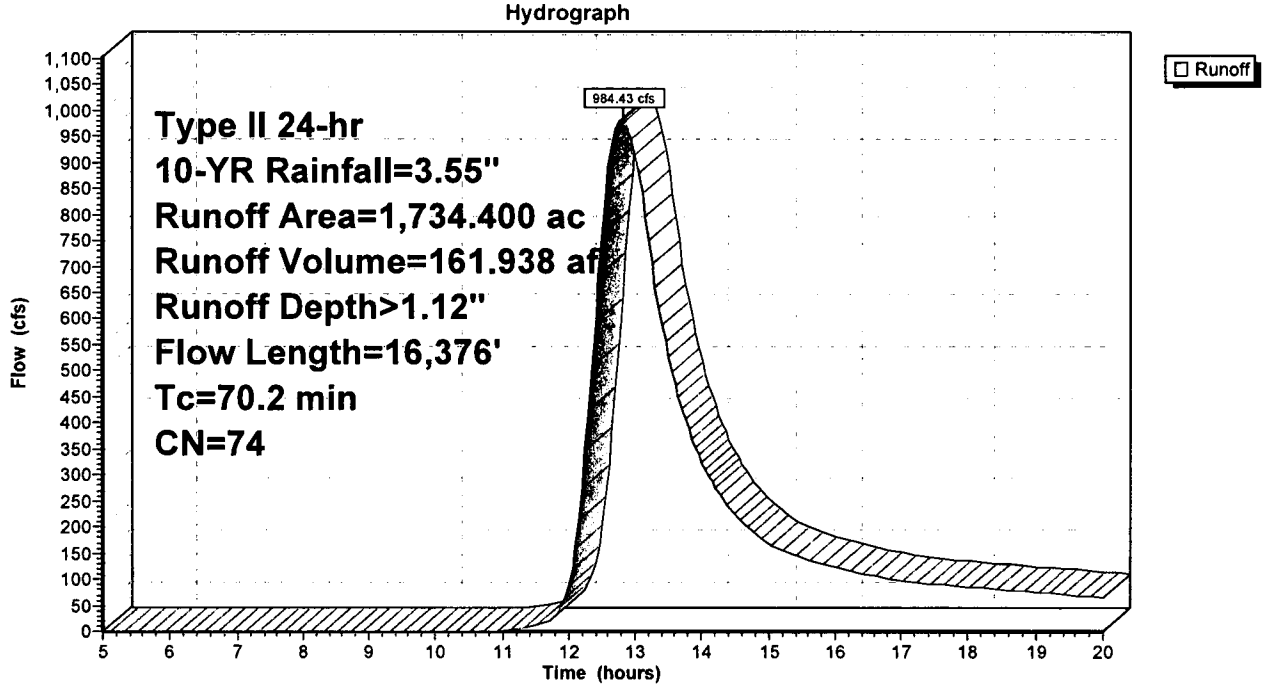
Runoff = 984.43 cfs @ 12.81 hrs, Volume= 161.938 af, Depth> 1.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-YR Rainfall=3.55"

	Area (ac)	CN	Description
*	514.560	75	Woods
*	647.040	74	Woods
*	572.800	74	Woods
	1,734.400	74	Weighted Average
	1,734.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.9	7,951	0.3468	3.91		**Lag/CN Method, W140+W120+W110**
36.3	8,425	0.0050	3.87	387.10	**Channel Flow,** Area= 100.0 sf Perim= 40.0' r= 2.50' n= 0.050
70.2	16,376	Total			

Subcatchment 3S: Greenbriar Creek_DS



Summary for Subcatchment 3S: Greenbriar Creek_DS

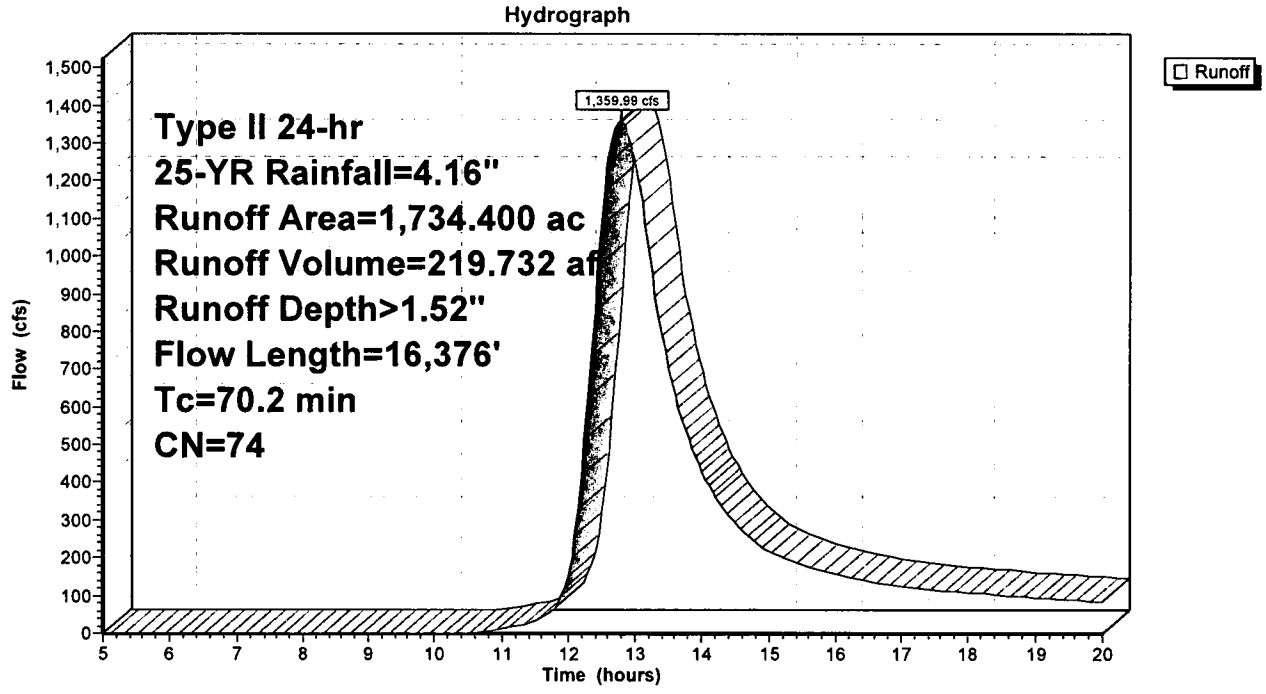
Runoff = 1,359.99 cfs @ 12.79 hrs, Volume= 219.732 af, Depth> 1.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-YR Rainfall=4.16"

	Area (ac)	CN	Description
*	514.560	75	Woods
*	647.040	74	Woods
*	572.800	74	Woods
	1,734.400	74	Weighted Average
	1,734.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.9	7,951	0.3468	3.91		**Lag/CN Method, W140+W120+W110**
36.3	8,425	0.0050	3.87	387.10	**Channel Flow,** Area= 100.0 sf Perim= 40.0' r= 2.50' n= 0.050
70.2	16,376	Total			

Subcatchment 3S: Greenbriar Creek_DS



Summary for Subcatchment 3S: Greenbriar Creek_DS

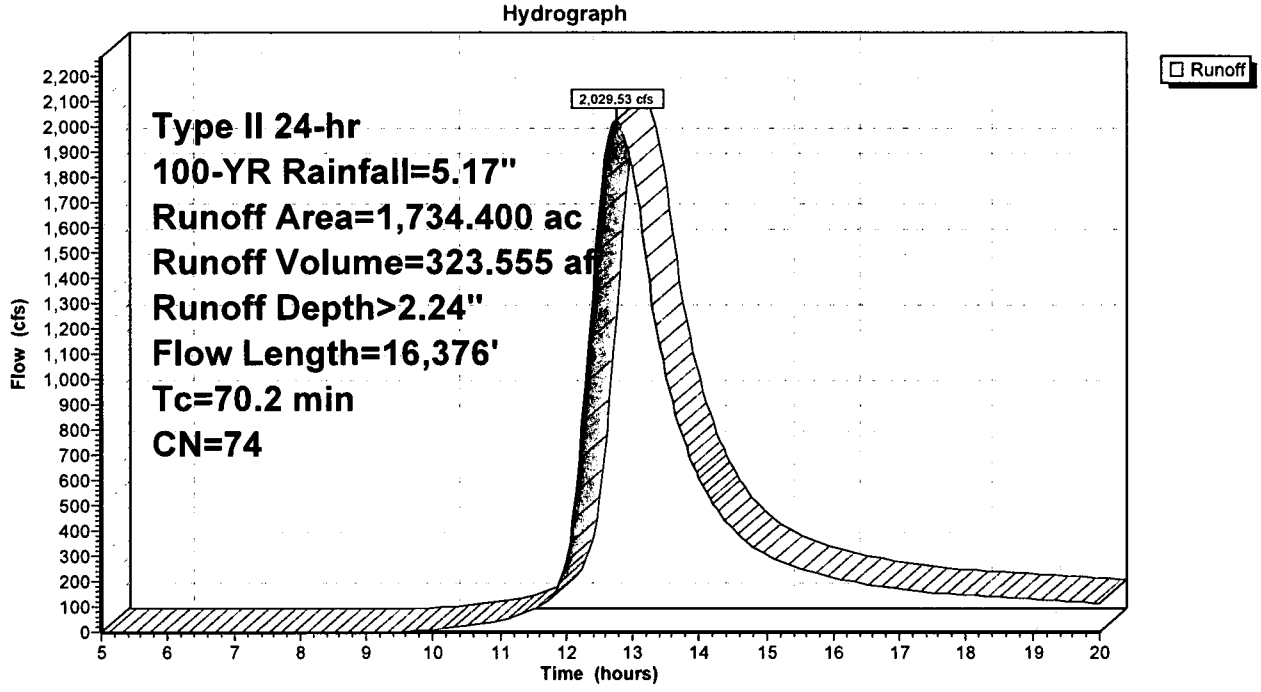
Runoff = 2,029.53 cfs @ 12.77 hrs, Volume= 323.555 af, Depth> 2.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-YR Rainfall=5.17"

	Area (ac)	CN	Description
*	514.560	75	Woods
*	647.040	74	Woods
*	572.800	74	Woods
	1,734.400	74	Weighted Average
	1,734.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.9	7,951	0.3468	3.91		**Lag/CN Method, W140+W120+W110**
36.3	8,425	0.0050	3.87	387.10	**Channel Flow,** Area= 100.0 sf Perim= 40.0' r= 2.50' n= 0.050
70.2	16,376	Total			

Subcatchment 3S: Greenbriar Creek_DS



APPENDIX D

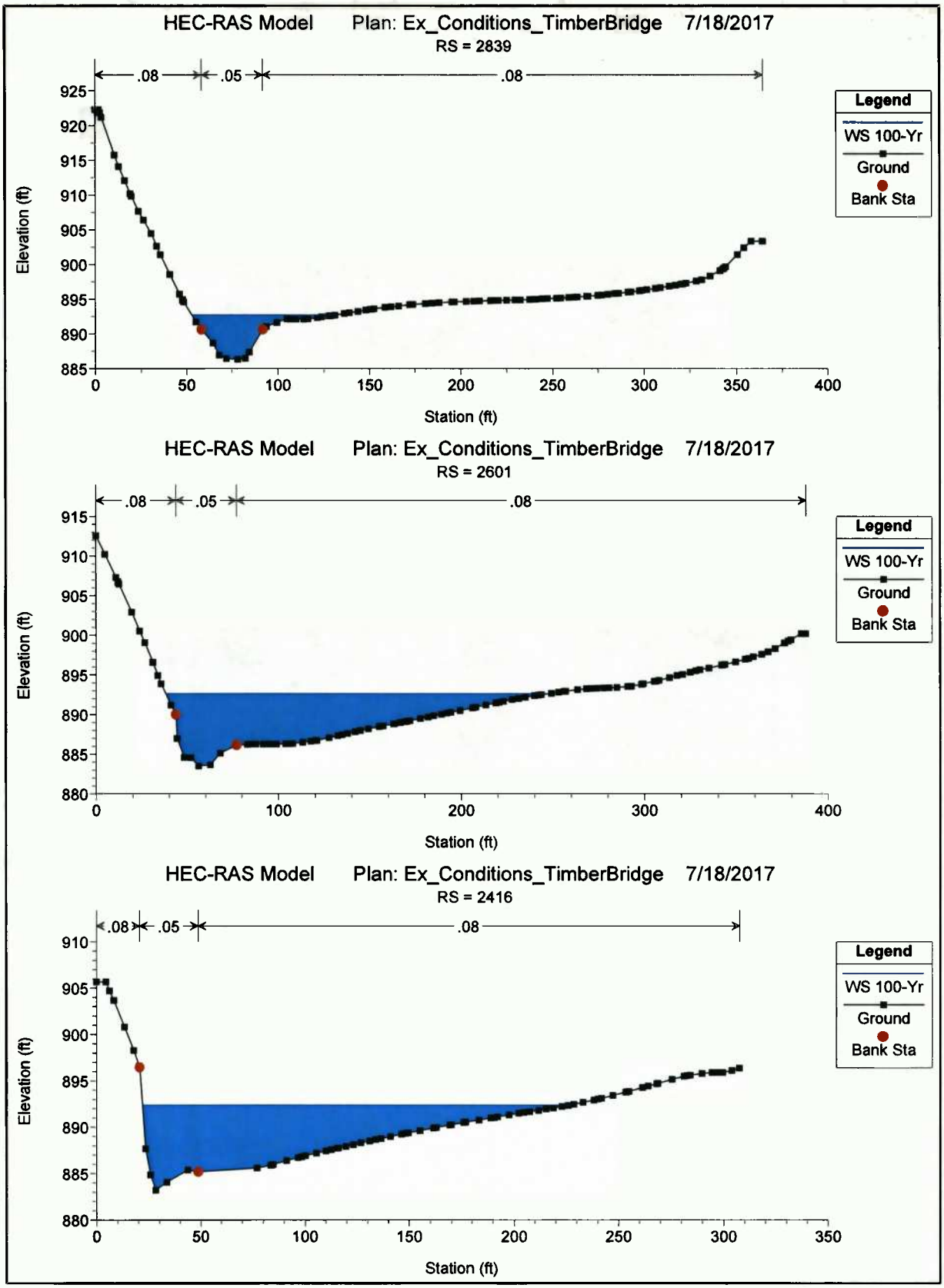
HEC-RAS RESULTS SUMMARY TABLES

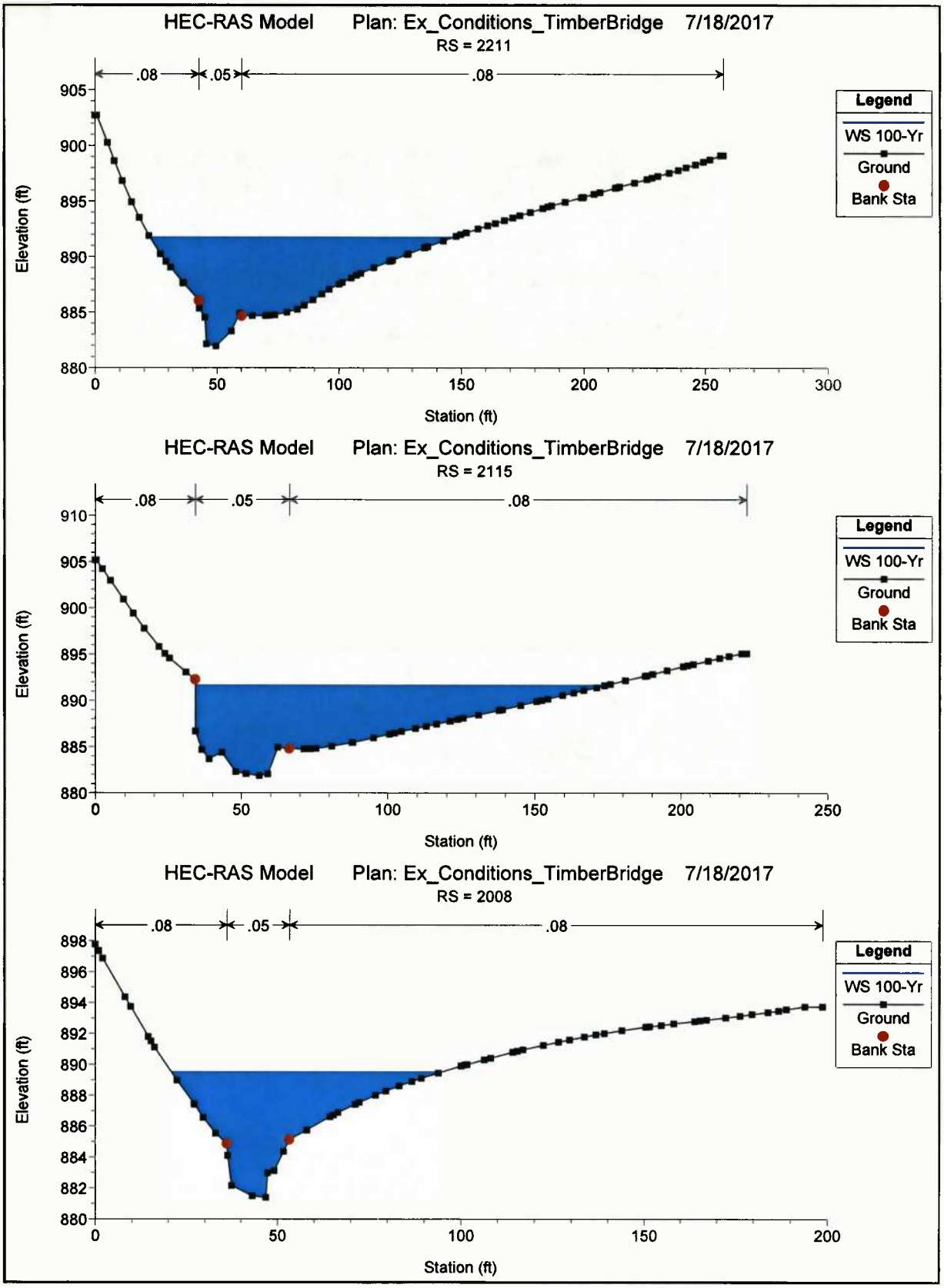
HEC-RAS River: Greenbrier Creek Reach: Antero Profile: 100-Yr

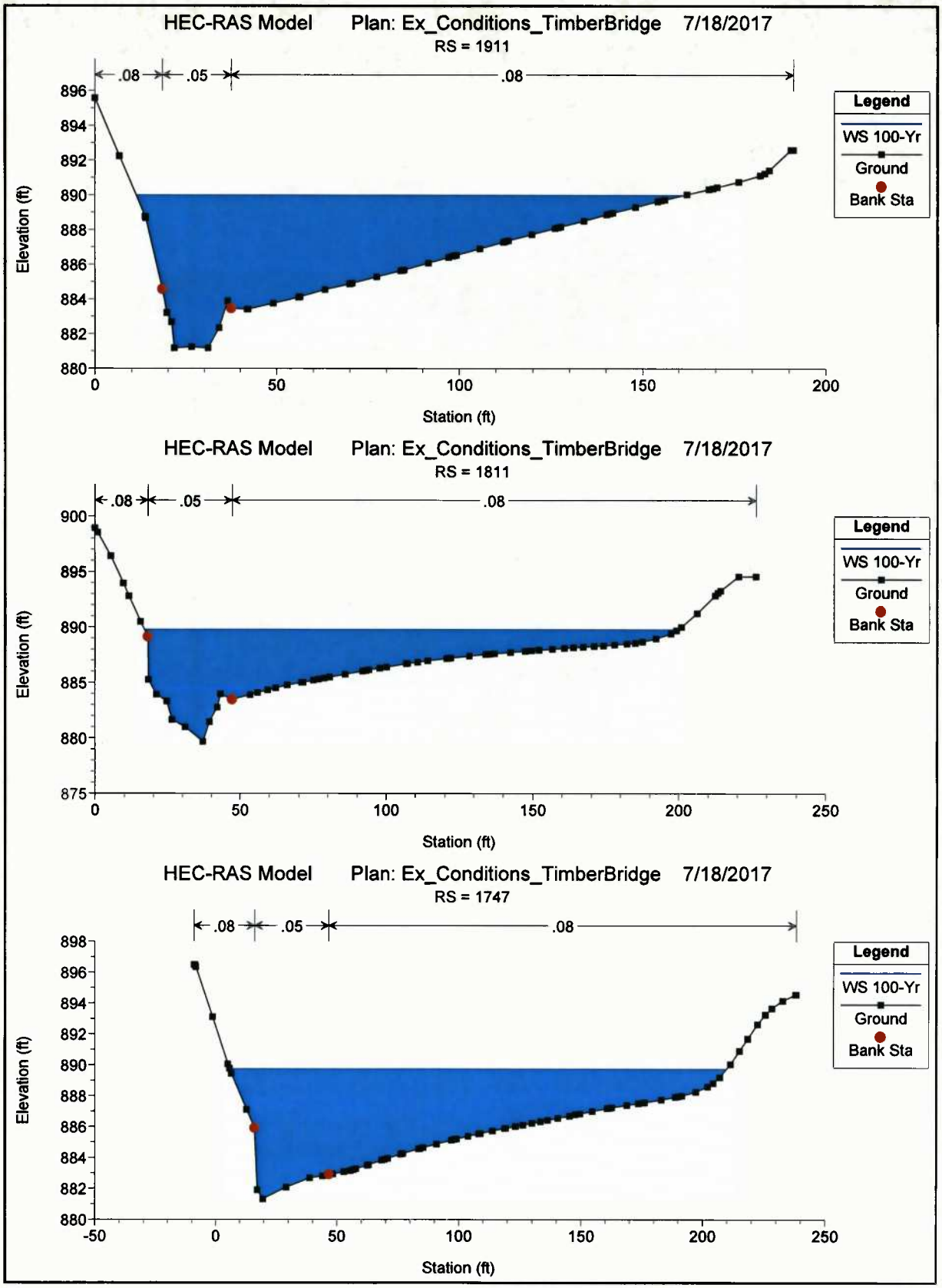
Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Antero	2839	100-Yr	Ex_TimberBr	1880.00	886.32	892.72	892.72	894.51	0.017062	10.91	199.56	78.97	0.87
Antero	2839	100-Yr	12x6	1880.00	886.32	892.72	892.72	894.51	0.017062	10.91	199.56	78.97	0.87
Antero	2601	100-Yr	Ex_TimberBr	1880.00	883.50	892.61		892.73	0.001090	3.62	900.11	209.16	0.23
Antero	2601	100-Yr	12x6	1880.00	883.50	892.62		892.74	0.001087	3.62	901.18	209.34	0.23
Antero	2416	100-Yr	Ex_TimberBr	1880.00	883.19	892.38		892.50	0.001461	3.82	858.73	205.03	0.25
Antero	2416	100-Yr	12x6	1880.00	883.19	892.39		892.51	0.001455	3.81	859.94	205.17	0.25
Antero	2211	100-Yr	Ex_TimberBr	1880.00	881.94	891.75		892.07	0.002890	5.98	553.98	124.38	0.36
Antero	2211	100-Yr	12x6	1880.00	881.94	891.76		892.08	0.002877	5.97	555.03	124.51	0.36
Antero	2115	100-Yr	Ex_TimberBr	1880.00	881.88	891.64		891.83	0.001611	4.23	679.63	140.05	0.26
Antero	2115	100-Yr	12x6	1880.00	881.88	891.65		891.84	0.001604	4.22	680.90	140.17	0.26
Antero	2008	100-Yr	Ex_TimberBr	1880.00	881.40	889.51	889.42	891.28	0.015750	12.04	237.32	73.94	0.81
Antero	2008	100-Yr	12x6	1880.00	881.40	889.43	889.42	891.27	0.016529	12.25	231.93	72.71	0.82
Antero	1911	100-Yr	Ex_TimberBr	1880.00	881.17	889.99		890.29	0.002866	5.88	593.96	150.24	0.37
Antero	1911	100-Yr	12x6	1880.00	881.17	889.94		890.25	0.002952	5.94	586.61	149.15	0.37
Antero	1811	100-Yr	Ex_TimberBr	1880.00	879.67	889.77		890.01	0.002378	4.88	659.83	182.81	0.31
Antero	1811	100-Yr	12x6	1880.00	879.67	889.71		889.96	0.002485	4.97	648.83	182.38	0.32
Antero	1747	100-Yr	Ex_TimberBr	1880.00	881.31	889.73		889.87	0.001333	3.88	850.39	204.03	0.25
Antero	1747	100-Yr	12x6	1880.00	881.31	889.67		889.81	0.001390	3.94	837.78	203.57	0.26
Antero	1664	100-Yr	Ex_TimberBr	1880.00	880.98	889.70		889.77	0.000756	2.99	1071.55	213.00	0.19
Antero	1664	100-Yr	12x6	1880.00	880.98	889.63		889.71	0.000785	3.03	1058.07	212.63	0.19
Antero	1634	100-Yr	Ex_TimberBr	1880.00	880.69	889.64	886.59	889.74	0.001041	3.53	963.41	209.09	0.22
Antero	1634	100-Yr	12x6	1880.00	880.69	889.58	886.69	889.67	0.001084	3.58	949.67	208.56	0.22
Antero	1616			Bridge									
Antero	1600	100-Yr	Ex_TimberBr	1880.00	880.28	889.50	886.73	889.63	0.001286	4.01	854.35	189.41	0.24
Antero	1600	100-Yr	12x6	1880.00	880.28	889.50	886.72	889.63	0.001286	4.01	854.35	189.41	0.24
Antero	1545	100-Yr	Ex_TimberBr	1880.00	879.82	889.49		889.55	0.000589	2.86	1158.77	207.20	0.17
Antero	1545	100-Yr	12x6	1880.00	879.82	889.49		889.55	0.000589	2.86	1158.77	207.20	0.17
Antero	1470	100-Yr	Ex_TimberBr	1880.00	879.35	889.42		889.50	0.000905	3.11	1048.70	230.21	0.21
Antero	1470	100-Yr	12x6	1880.00	879.35	889.42		889.50	0.000905	3.11	1048.70	230.21	0.21
Antero	1347	100-Yr	Ex_TimberBr	1880.00	877.20	889.27		889.39	0.000794	3.55	964.70	228.12	0.20
Antero	1347	100-Yr	12x6	1880.00	877.20	889.27		889.39	0.000794	3.55	964.70	228.12	0.20
Antero	1265	100-Yr	Ex_TimberBr	1880.00	877.87	889.12		889.31	0.001110	3.97	729.89	162.51	0.24
Antero	1265	100-Yr	12x6	1880.00	877.87	889.12		889.31	0.001110	3.97	729.89	162.51	0.24
Antero	1218	100-Yr	Ex_TimberBr	1880.00	877.29	888.45	885.21	889.16	0.004025	7.13	304.29	143.42	0.42
Antero	1218	100-Yr	12x6	1880.00	877.29	888.45	885.21	889.16	0.004025	7.13	304.29	143.42	0.42
Antero	1204			Bridge									
Antero	1192	100-Yr	Ex_TimberBr	1880.00	877.20	885.46	883.78	886.57	0.009683	8.46	222.18	42.00	0.63
Antero	1192	100-Yr	12x6	1880.00	877.20	885.46	883.78	886.57	0.009683	8.46	222.18	42.00	0.63
Antero	1140	100-Yr	Ex_TimberBr	1880.00	877.01	885.19		886.01	0.006780	7.97	360.05	136.02	0.56
Antero	1140	100-Yr	12x6	1880.00	877.01	885.19		886.01	0.006780	7.97	360.05	136.02	0.56
Antero	1103	100-Yr	Ex_TimberBr	1880.00	876.85	885.42		885.69	0.002773	5.09	575.42	144.75	0.35
Antero	1103	100-Yr	12x6	1880.00	876.85	885.42		885.69	0.002773	5.09	575.42	144.75	0.35
Antero	1000	100-Yr	Ex_TimberBr	1880.00	876.12	885.18		885.41	0.002387	5.00	653.57	169.34	0.32
Antero	1000	100-Yr	12x6	1880.00	876.12	885.18		885.41	0.002387	5.00	653.57	169.34	0.32
Antero	877	100-Yr	Ex_TimberBr	1880.00	877.46	884.77		885.07	0.003101	5.99	612.78	178.26	0.40
Antero	877	100-Yr	12x6	1880.00	877.46	884.77		885.07	0.003101	5.99	612.78	178.26	0.40
Antero	803	100-Yr	Ex_TimberBr	1880.00	876.38	884.81		884.91	0.000711	3.23	982.48	192.53	0.20
Antero	803	100-Yr	12x6	1880.00	876.38	884.81		884.91	0.000711	3.23	982.48	192.53	0.20
Antero	647	100-Yr	Ex_TimberBr	1880.00	876.30	883.94	882.03	884.62	0.005008	7.80	414.86	163.59	0.51
Antero	647	100-Yr	12x6	1880.00	876.30	883.94	882.03	884.62	0.005008	7.80	414.86	163.59	0.51

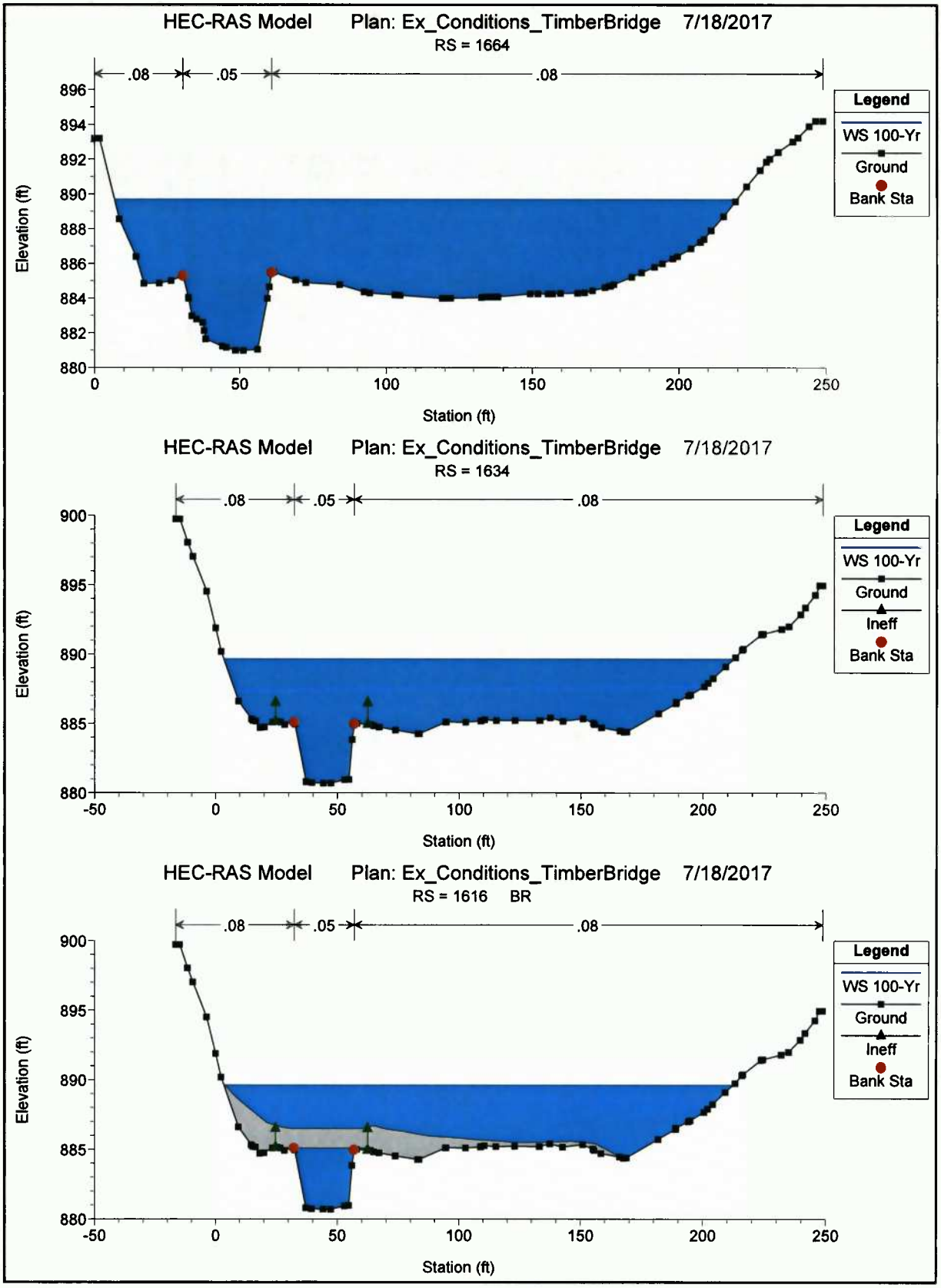
APPENDIX E

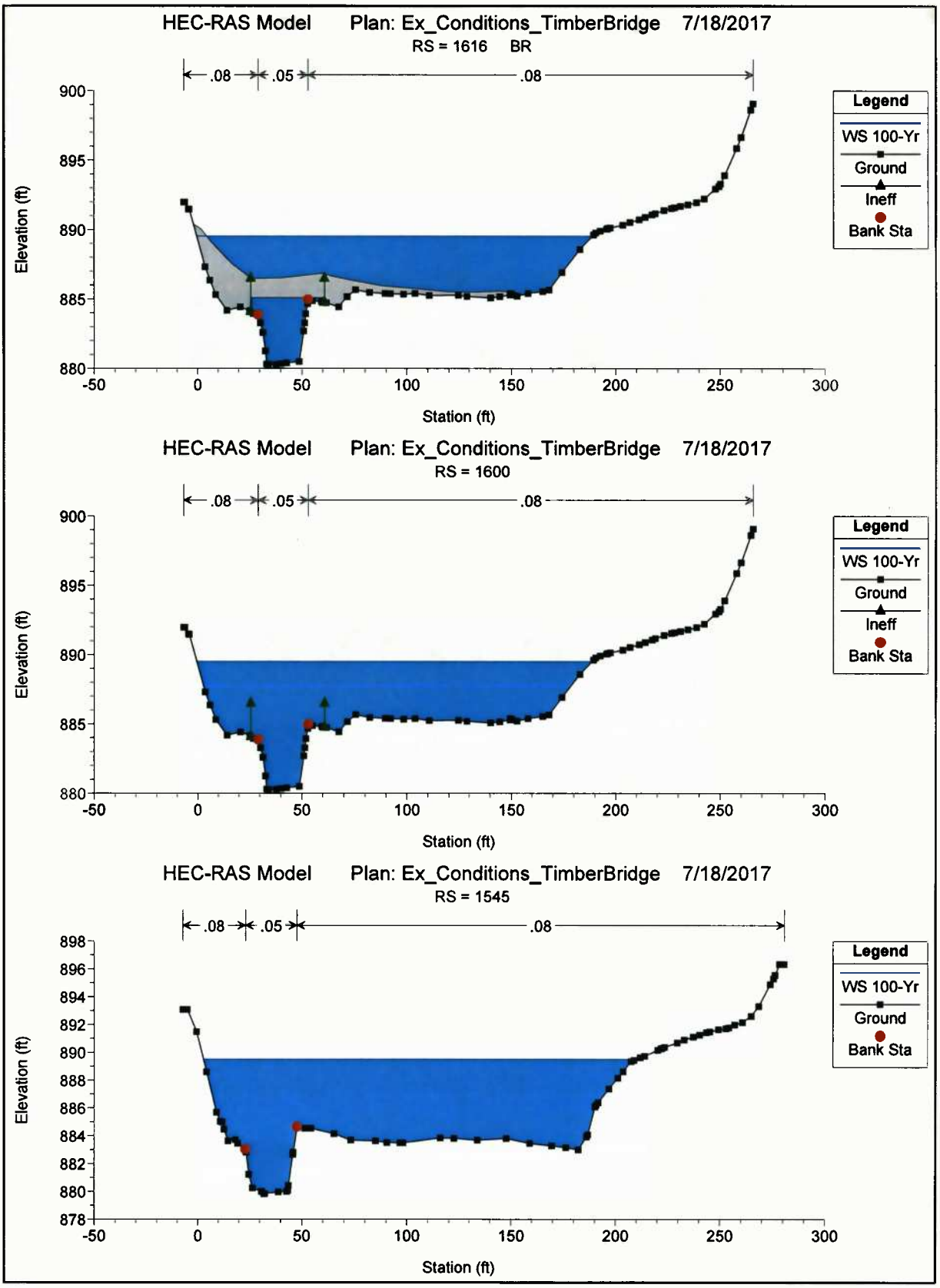
HEC-RAS CROSS-SECTION PLOTS

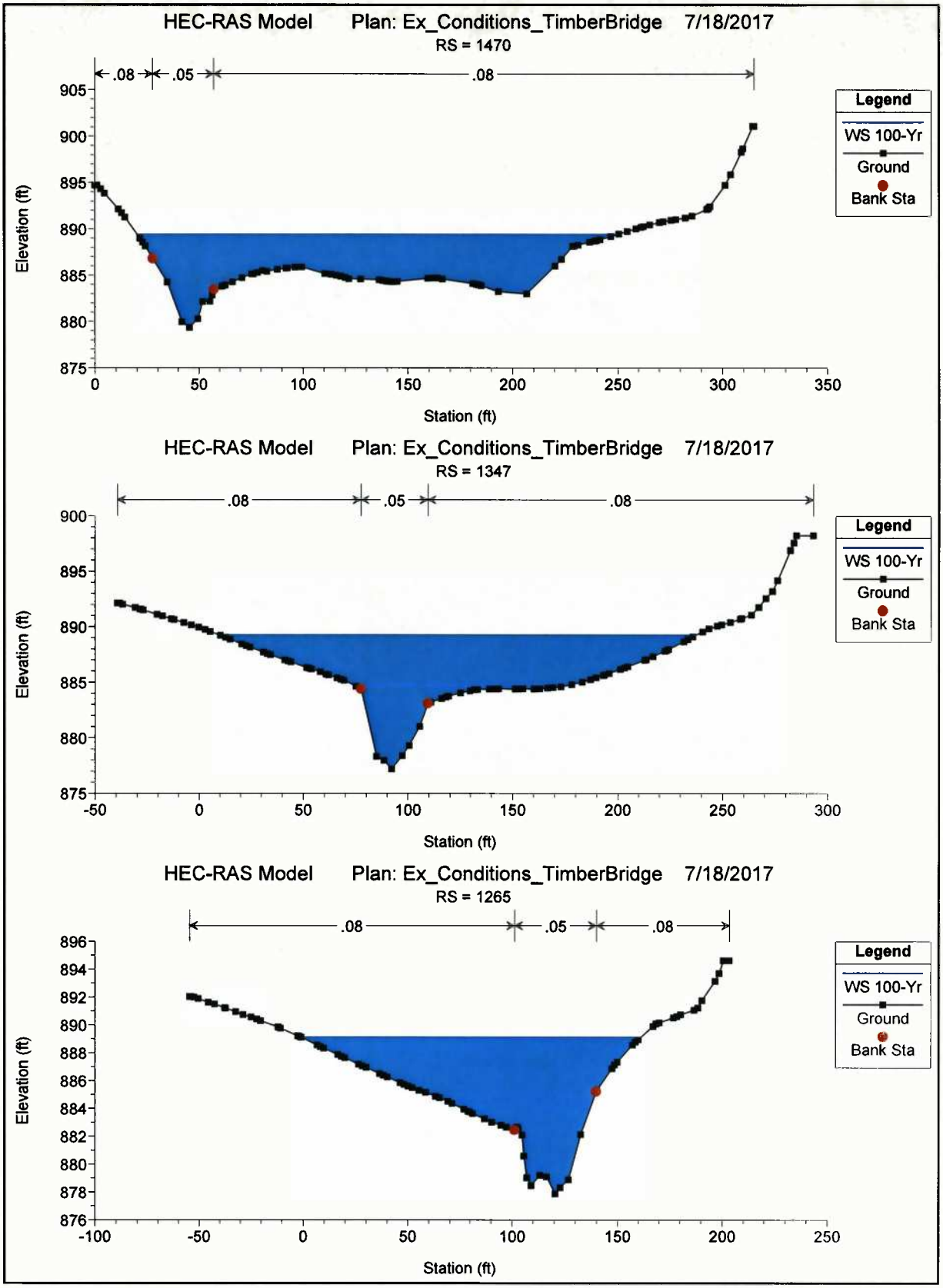

HEC-RAS Model Plan: Ex_Conditions_TimberBridge 7/18/2017
RS = 2839
.08
.05
.08
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
HEC-RAS Model Plan: Ex_Conditions_TimberBridge 7/18/2017
RS = 2601
.08
.05
.08
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
HEC-RAS Model Plan: Ex_Conditions_TimberBridge 7/18/2017
RS = 2416
.08
.05
.08
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

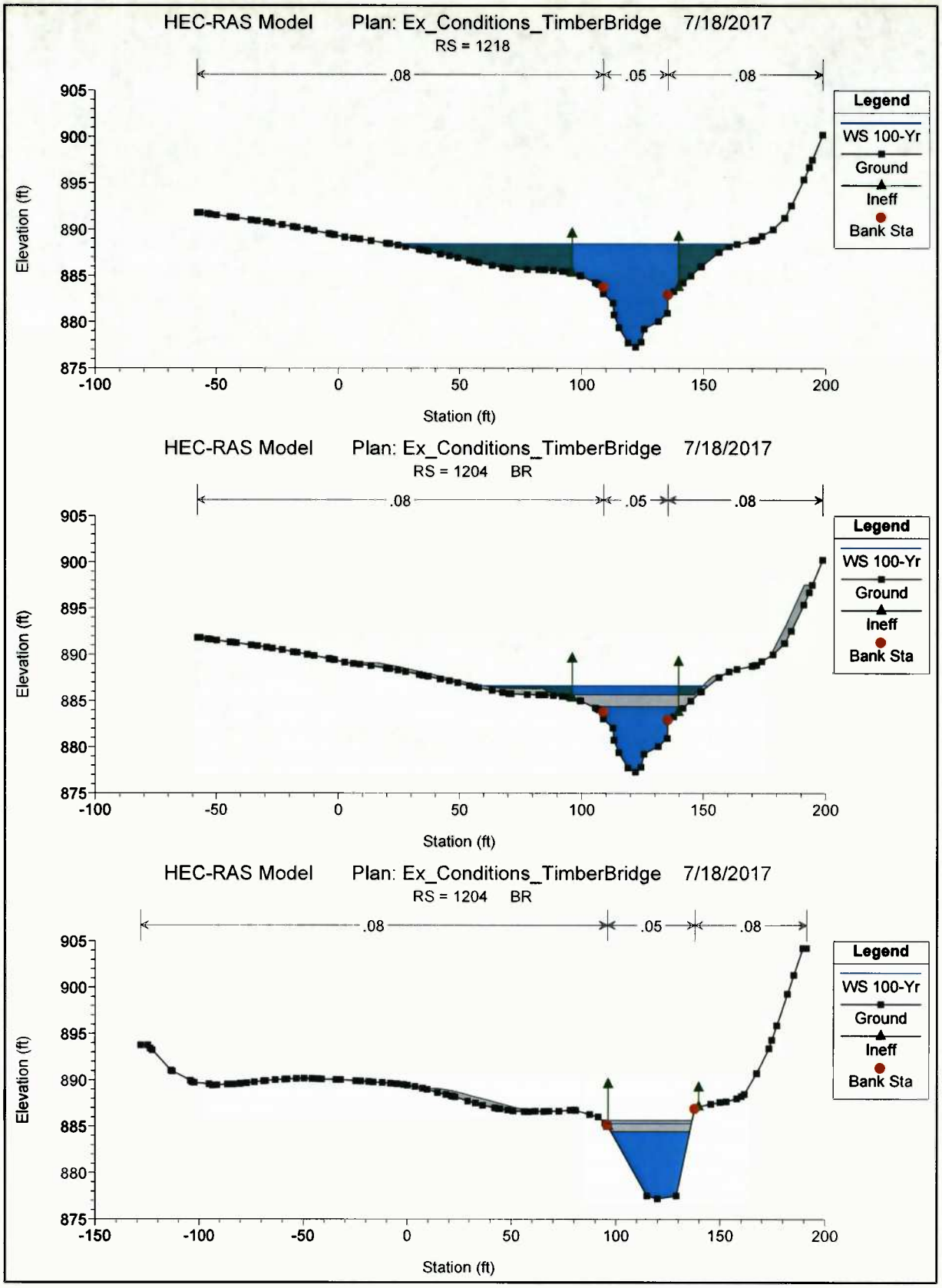

HEC-RAS Model Plan: Ex_Conditions_TimberBridge 7/18/2017
RS = 2211
.08
.05
.08
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
905
900
895
890
885
880
0
50
100
150
200
250
300
Station (ft)
HEC-RAS Model Plan: Ex_Conditions_TimberBridge 7/18/2017
RS = 2115
.08
.05
.08
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
910
905
900
895
890
885
880
0
50
100
150
200
250
Station (ft)
HEC-RAS Model Plan: Ex_Conditions_TimberBridge 7/18/2017
RS = 2008
.08
.05
.08
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
898
896
894
892
890
888
886
884
882
880
0
50
100
150
200
Station (ft)

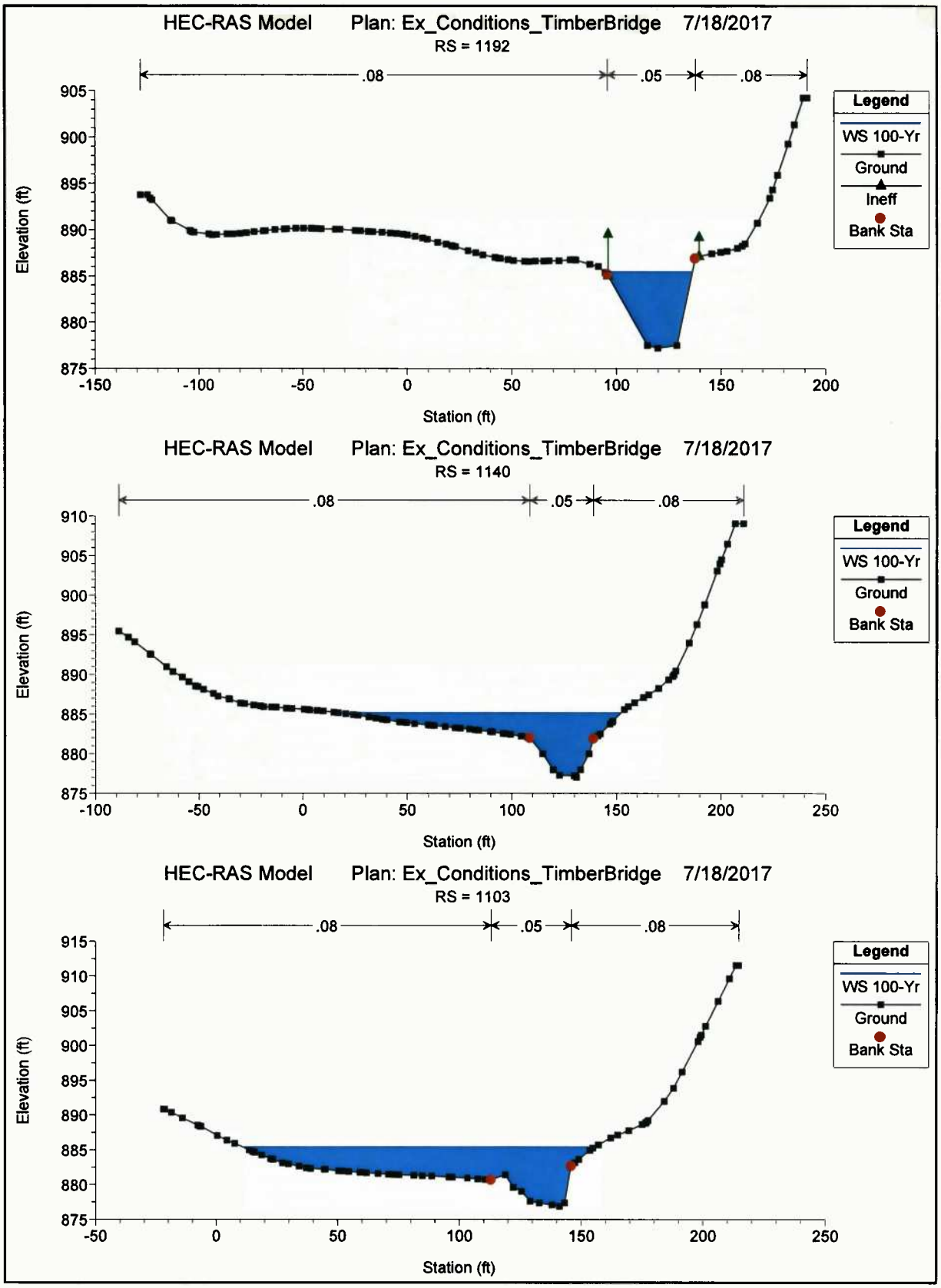

HEC-RAS Model Plan: Ex_Conditions_TimberBridge 7/18/2017
RS = 1911
.08
.05
.08
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta
HEC-RAS Model Plan: Ex_Conditions_TimberBridge 7/18/2017
RS = 1811
.08
.05
.08
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta
HEC-RAS Model Plan: Ex_Conditions_TimberBridge 7/18/2017
RS = 1747
.08
.05
.08
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta

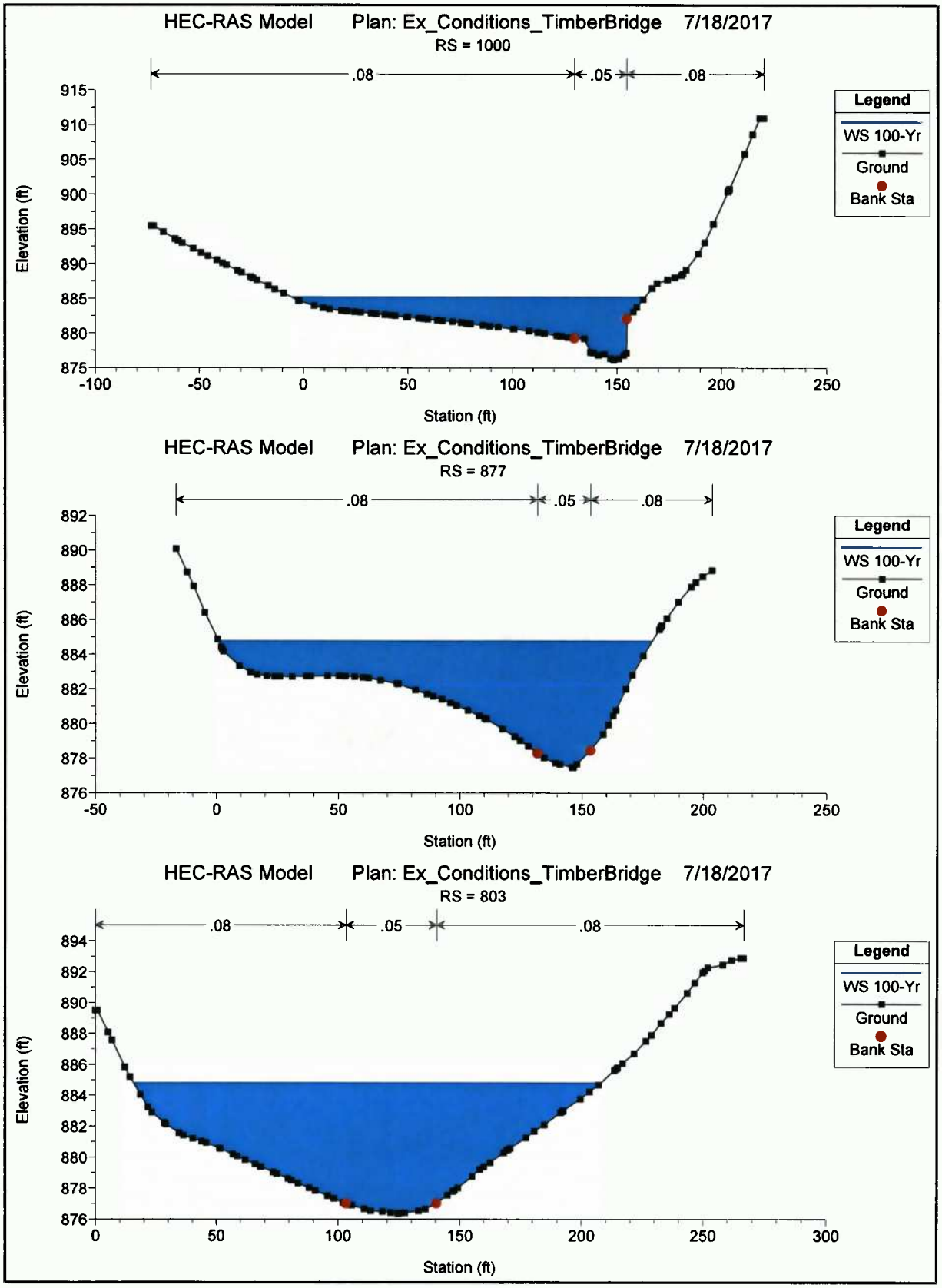

HEC-RAS Model Plan: Ex_Conditions_TimberBridge 7/18/2017
RS = 1664
.08
.05
.08
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta
HEC-RAS Model Plan: Ex_Conditions_TimberBridge 7/18/2017
RS = 1634
.08
.05
.08
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
HEC-RAS Model Plan: Ex_Conditions_TimberBridge 7/18/2017
RS = 1616 BR
.08
.05
.08
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta

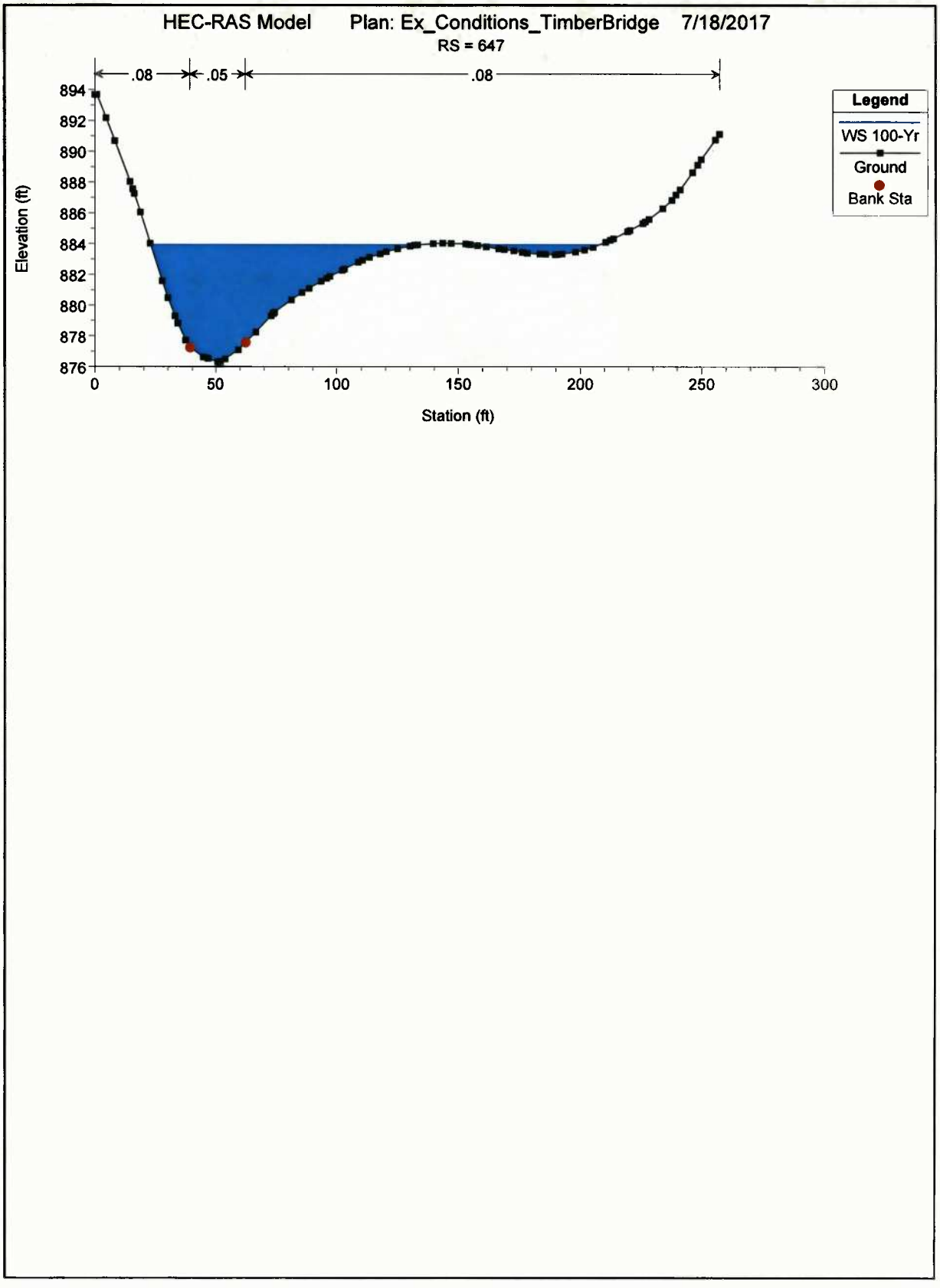

HEC-RAS Model Plan: Ex_Conditions_TimberBridge 7/18/2017
RS = 1616 BR
.08
.05
.08
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
HEC-RAS Model Plan: Ex_Conditions_TimberBridge 7/18/2017
RS = 1600
.08
.05
.08
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
HEC-RAS Model Plan: Ex_Conditions_TimberBridge 7/18/2017
RS = 1545
.08
.05
.08
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

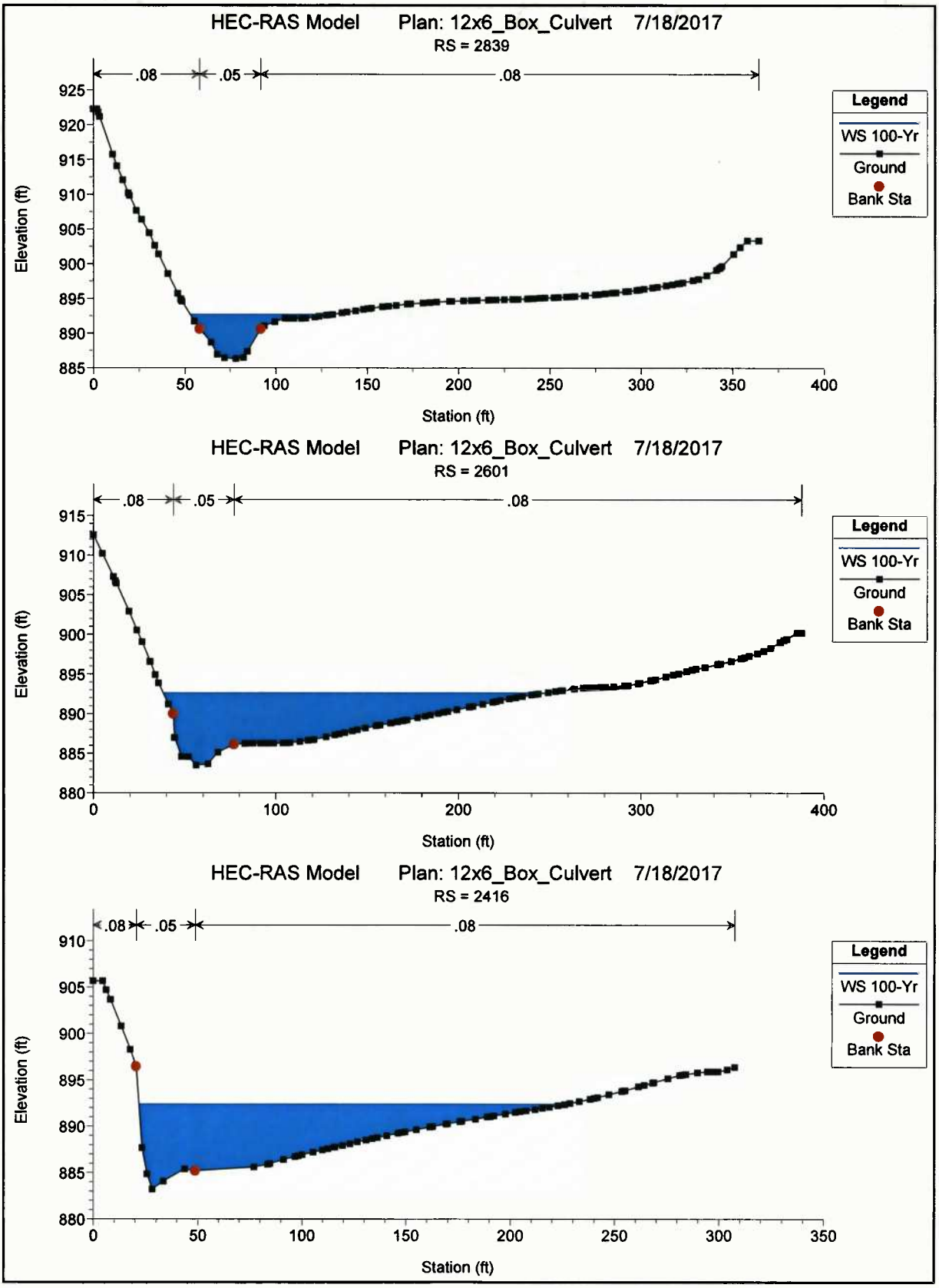

HEC-RAS Model Plan: Ex_Conditions_TimberBridge 7/18/2017
RS = 1470
.08
.05
.08
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta
HEC-RAS Model Plan: Ex_Conditions_TimberBridge 7/18/2017
RS = 1347
.08
.05
.08
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta
HEC-RAS Model Plan: Ex_Conditions_TimberBridge 7/18/2017
RS = 1265
.08
.05
.08
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta

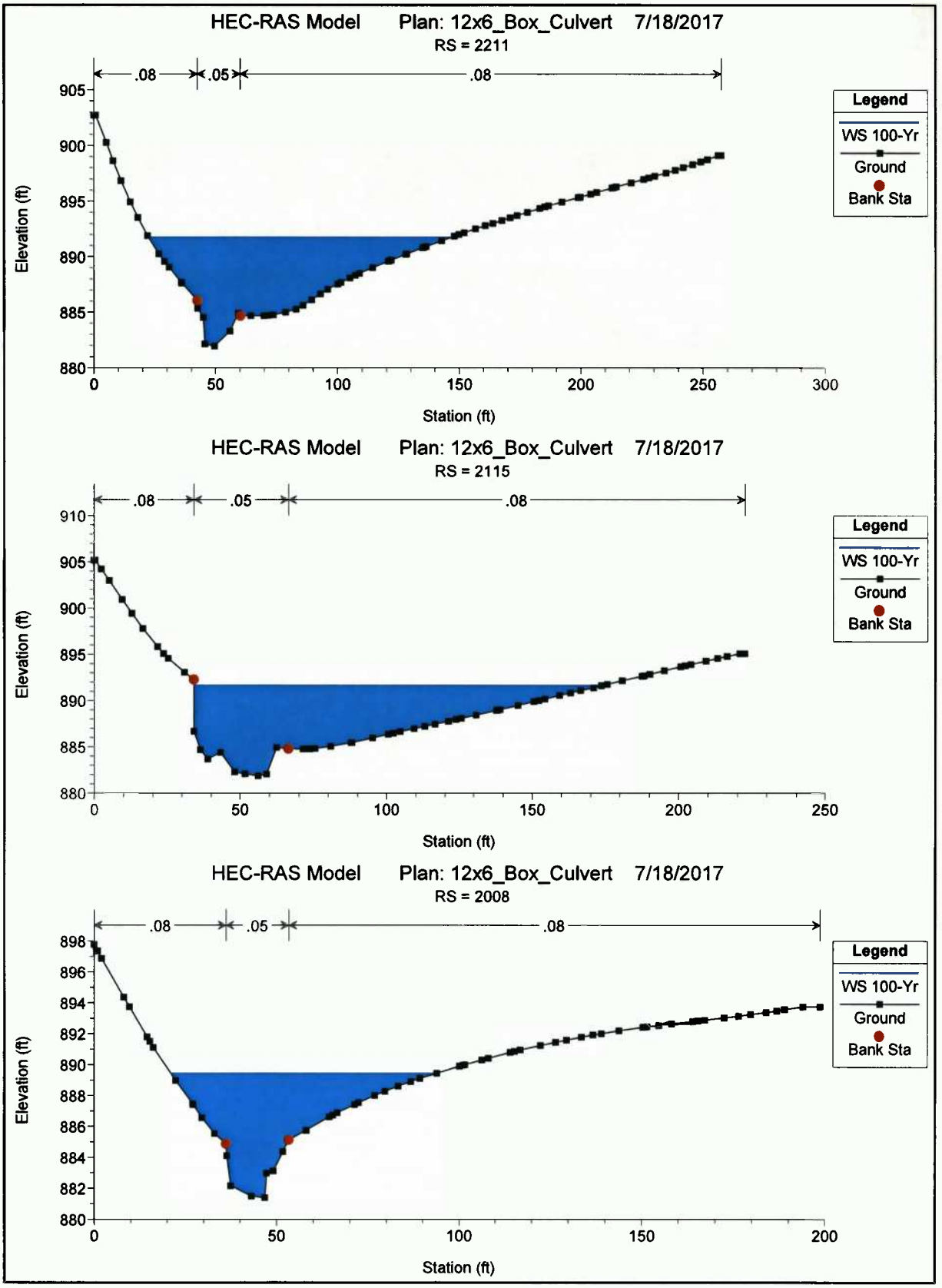

HEC-RAS Model Plan: Ex_Conditions_TimberBridge 7/18/2017
RS = 1218
.08
.05
.08
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
Elevation (ft)
905
900
895
890
885
880
875
-100
-50
0
50
100
150
200
Station (ft)
HEC-RAS Model Plan: Ex_Conditions_TimberBridge 7/18/2017
RS = 1204 BR
.08
.05
.08
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
Elevation (ft)
905
900
895
890
885
880
875
-100
-50
0
50
100
150
200
Station (ft)
HEC-RAS Model Plan: Ex_Conditions_TimberBridge 7/18/2017
RS = 1204 BR
.08
.05
.08
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
Elevation (ft)
905
900
895
890
885
880
875
-150
-100
-50
0
50
100
150
200
Station (ft)

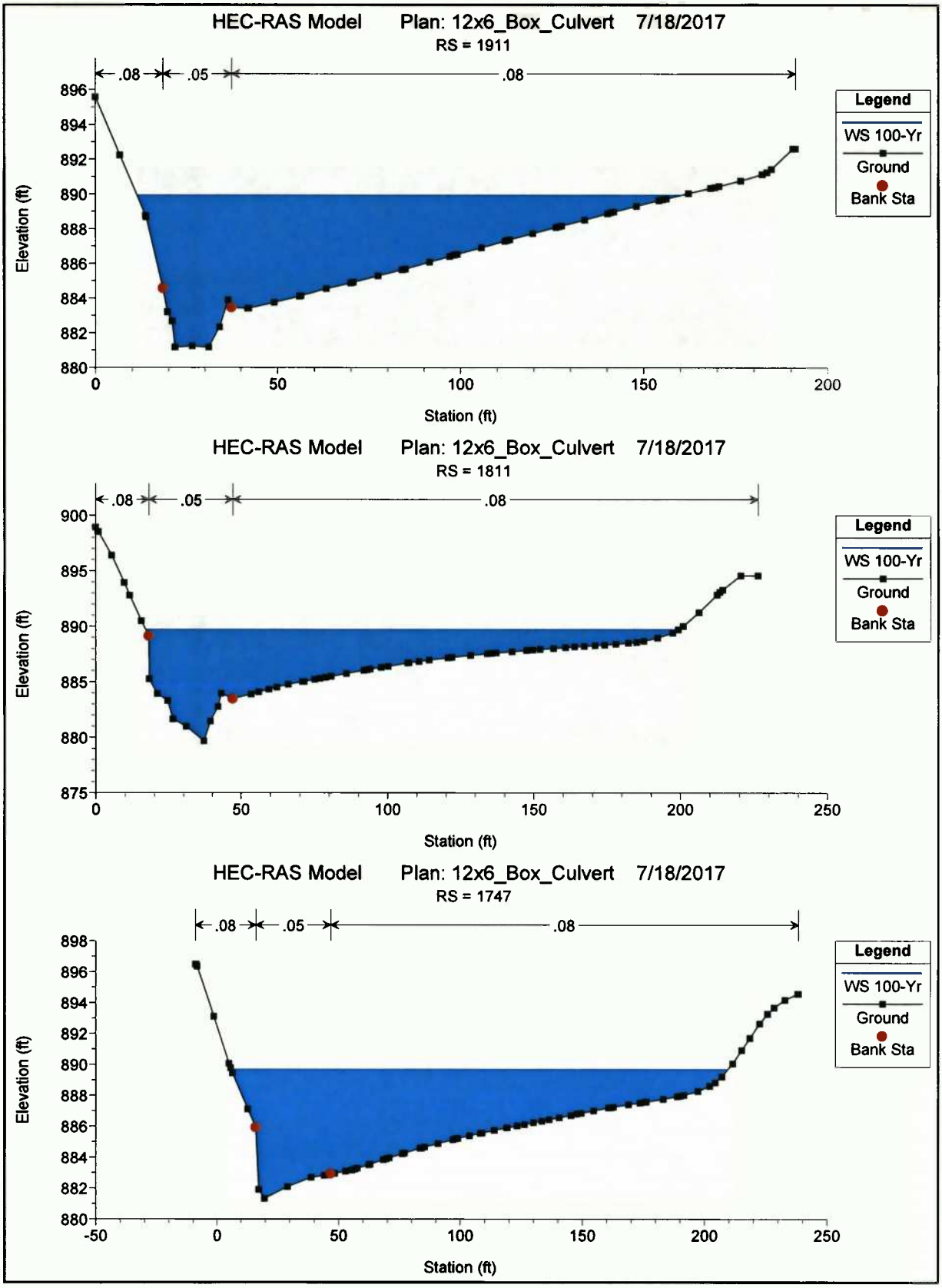

HEC-RAS Model Plan: Ex_Conditions_TimberBridge 7/18/2017
RS = 1192
.08
.05
.08
Elevation (ft)
905
900
895
890
885
880
875
-150
-100
-50
0
50
100
150
200
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
HEC-RAS Model Plan: Ex_Conditions_TimberBridge 7/18/2017
RS = 1140
.08
.05
.08
Elevation (ft)
910
905
900
895
890
885
880
875
-100
-50
0
50
100
150
200
250
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta
HEC-RAS Model Plan: Ex_Conditions_TimberBridge 7/18/2017
RS = 1103
.08
.05
.08
Elevation (ft)
915
910
905
900
895
890
885
880
875
-50
0
50
100
150
200
250
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta

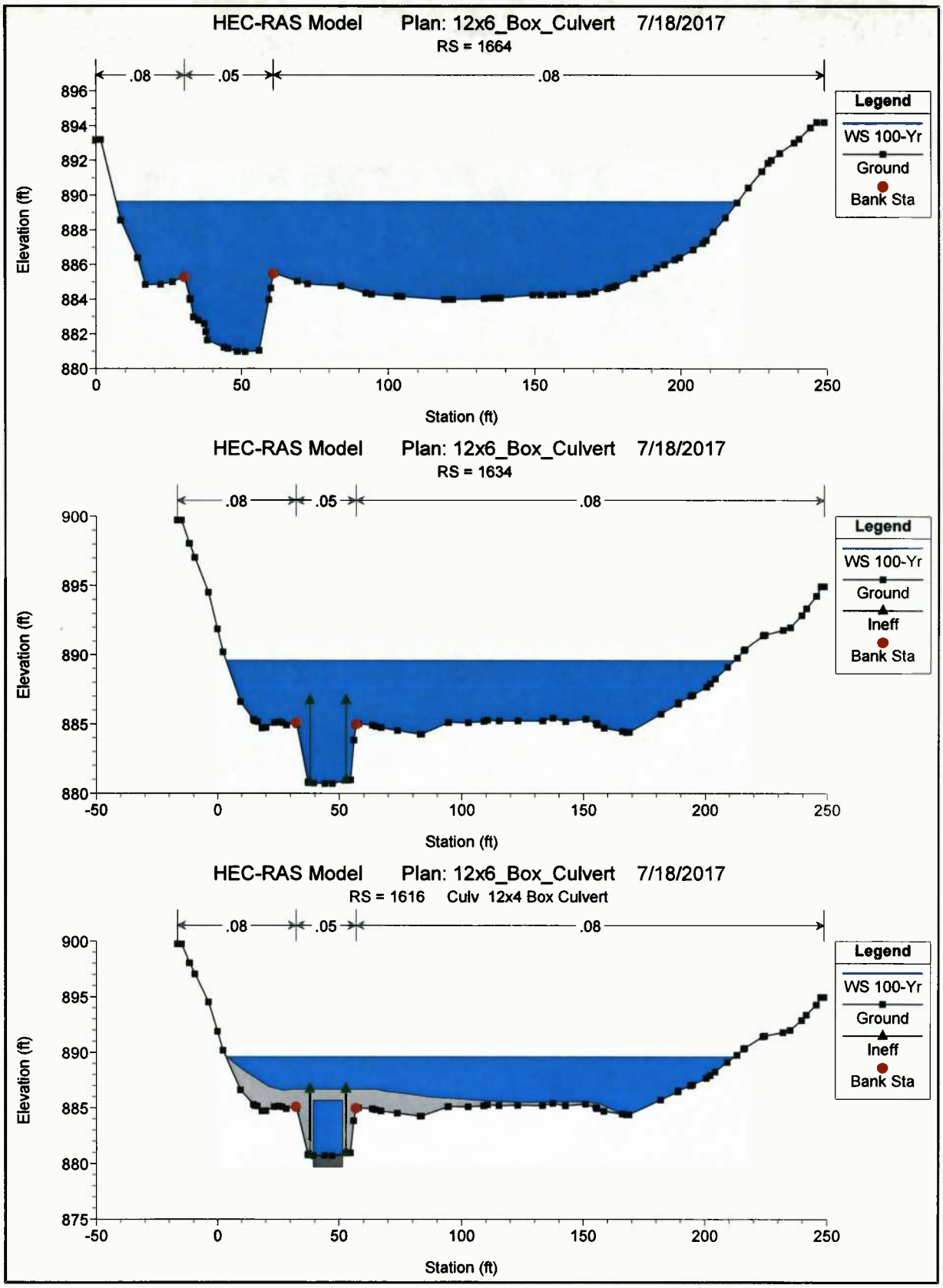

HEC-RAS Model Plan: Ex_Conditions_TimberBridge 7/18/2017
RS = 1000
.08
.05
.08
Elevation (ft)
915
910
905
900
895
890
885
880
875
-100
-50
0
50
100
150
200
250
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta
HEC-RAS Model Plan: Ex_Conditions_TimberBridge 7/18/2017
RS = 877
.08
.05
.08
Elevation (ft)
892
890
888
886
884
882
880
878
876
-50
0
50
100
150
200
250
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta
HEC-RAS Model Plan: Ex_Conditions_TimberBridge 7/18/2017
RS = 803
.08
.05
.08
Elevation (ft)
894
892
890
888
886
884
882
880
878
876
0
50
100
150
200
250
300
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta

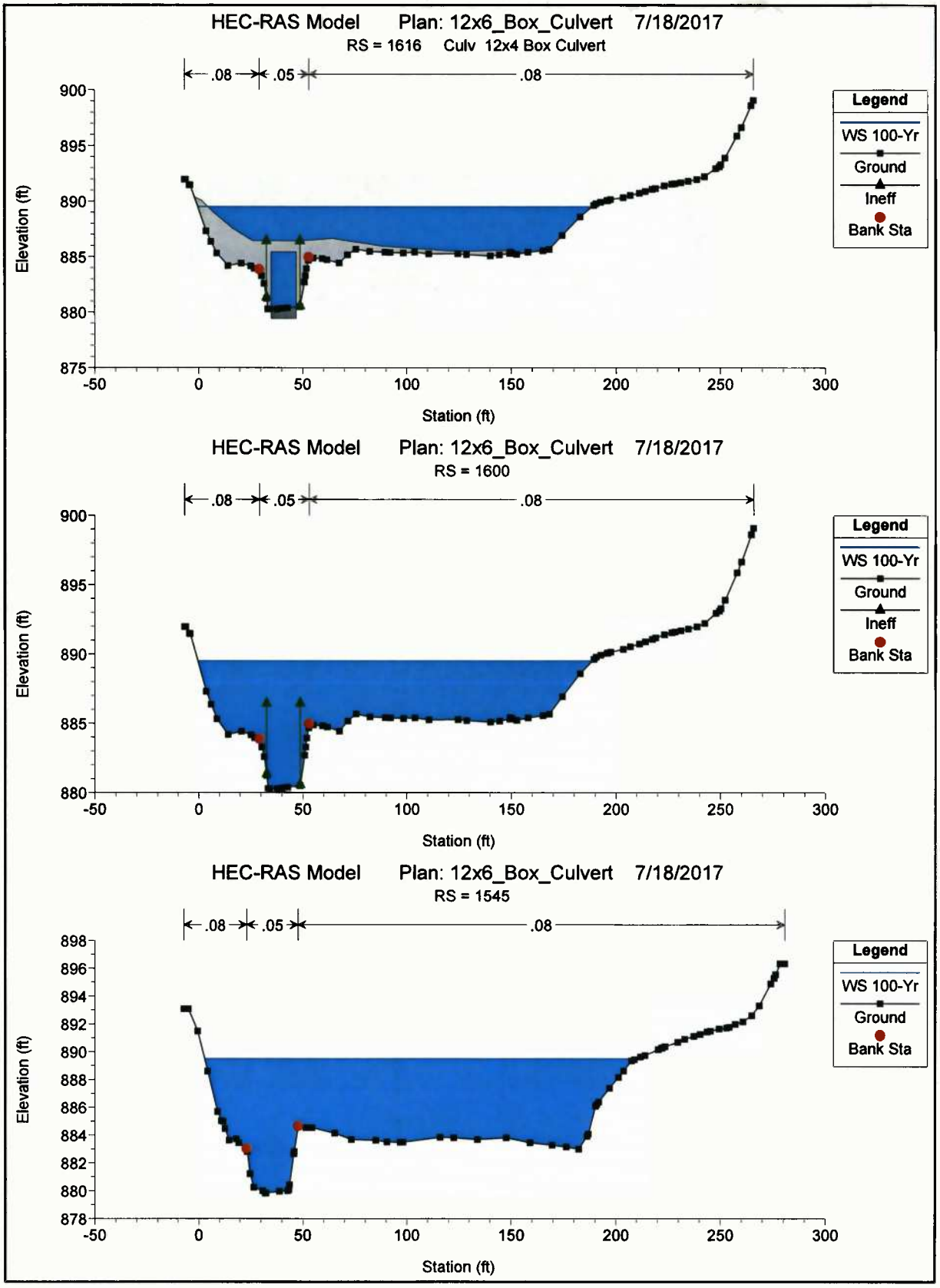

HEC-RAS Model
Plan: Ex_Conditions_TimberBridge
7/18/2017
RS = 647
.08
.05
.08
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
894
892
890
888
886
884
882
880
878
876
0
50
100
150
200
250
300
Station (ft)

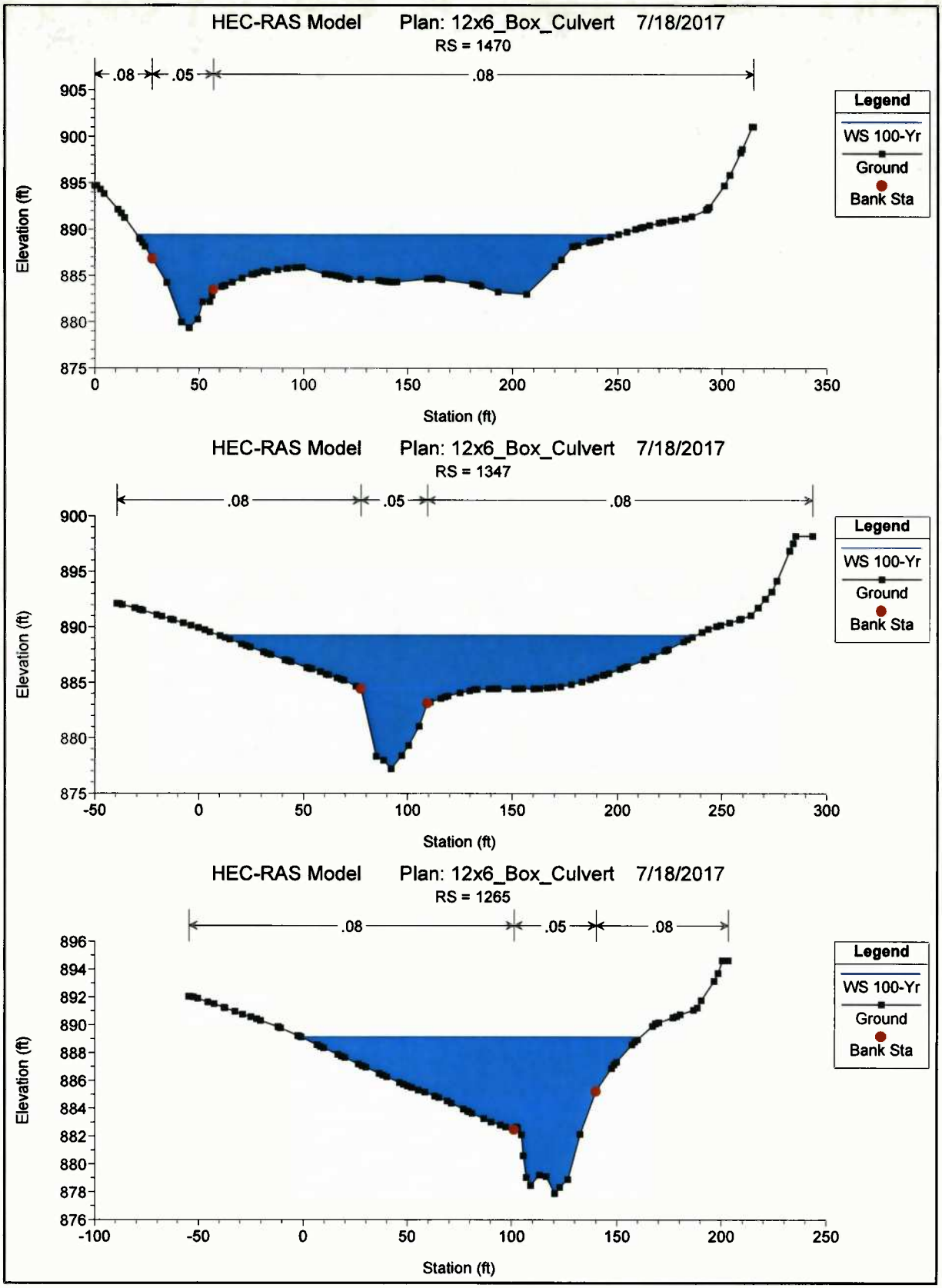

HEC-RAS Model Plan: 12x6_Box_Culvert 7/18/2017
RS = 2839
.08
.05
.08
Elevation (ft)
925
920
915
910
905
900
895
890
885
0
50
100
150
200
250
300
350
400
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta
HEC-RAS Model Plan: 12x6_Box_Culvert 7/18/2017
RS = 2601
.08
.05
.08
Elevation (ft)
915
910
905
900
895
890
885
880
0
100
200
300
400
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta
HEC-RAS Model Plan: 12x6_Box_Culvert 7/18/2017
RS = 2416
.08
.05
.08
Elevation (ft)
910
905
900
895
890
885
880
0
50
100
150
200
250
300
350
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta

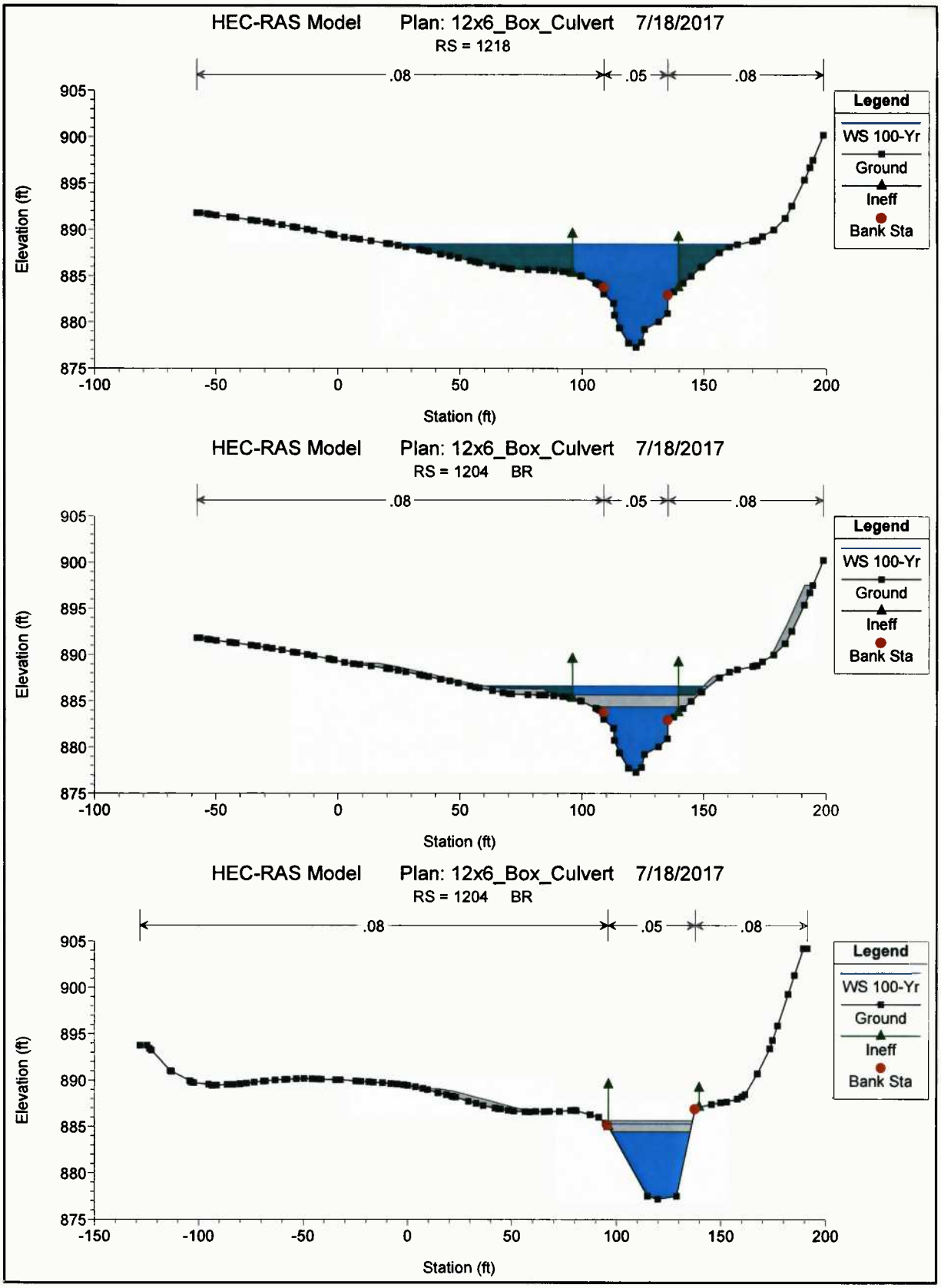

HEC-RAS Model Plan: 12x6_Box_Culvert 7/18/2017
RS = 2211
.08
.05
.08
Elevation (ft)
905
900
895
890
885
880
0
50
100
150
200
250
300
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta
HEC-RAS Model Plan: 12x6_Box_Culvert 7/18/2017
RS = 2115
.08
.05
.08
Elevation (ft)
910
905
900
895
890
885
880
0
50
100
150
200
250
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta
HEC-RAS Model Plan: 12x6_Box_Culvert 7/18/2017
RS = 2008
.08
.05
.08
Elevation (ft)
898
896
894
892
890
888
886
884
882
880
0
50
100
150
200
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta

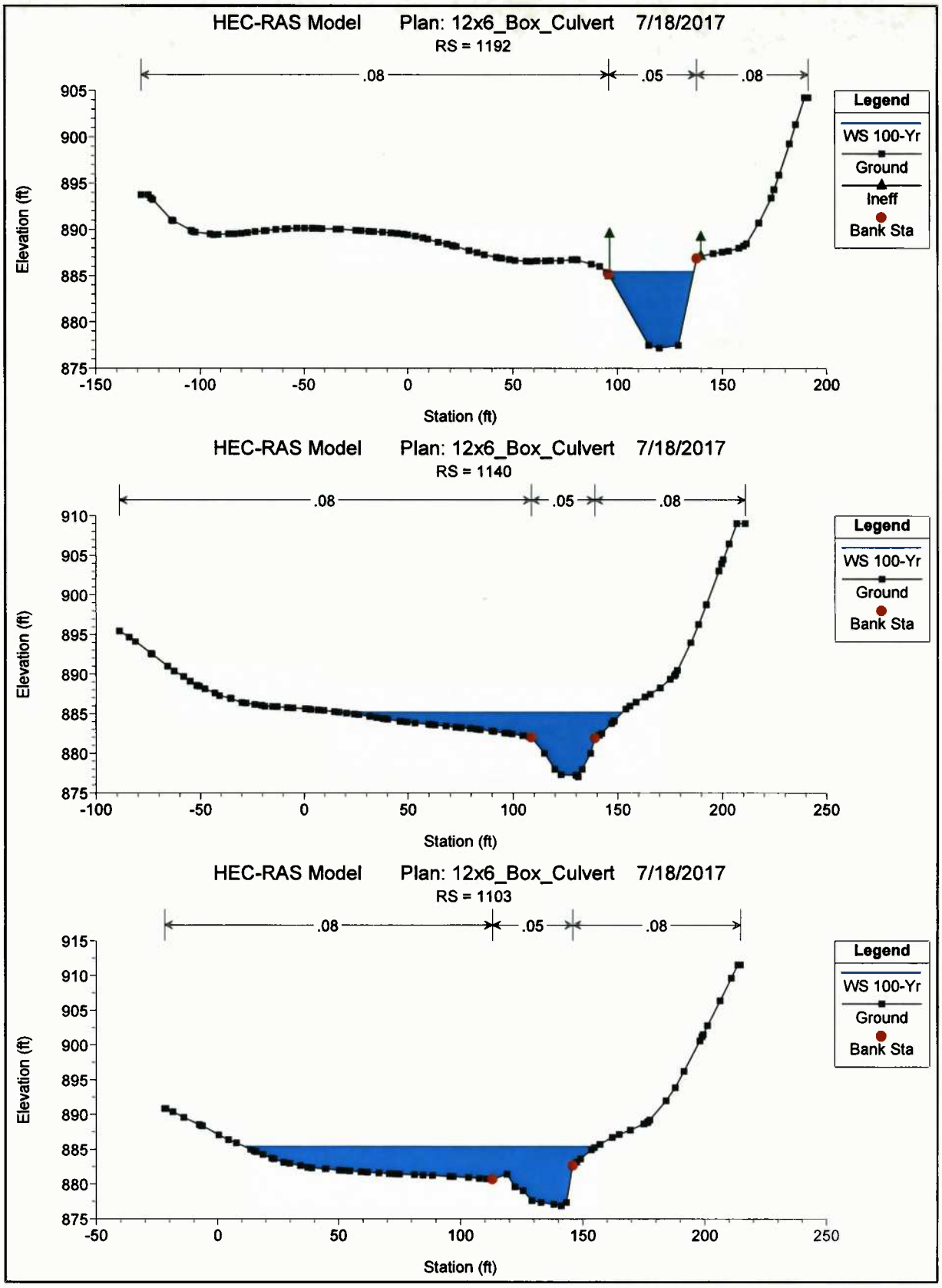

HEC-RAS Model Plan: 12x6_Box_Culvert 7/18/2017
RS = 1911
.08
.05
.08
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta
HEC-RAS Model Plan: 12x6_Box_Culvert 7/18/2017
RS = 1811
.08
.05
.08
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta
HEC-RAS Model Plan: 12x6_Box_Culvert 7/18/2017
RS = 1747
.08
.05
.08
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta

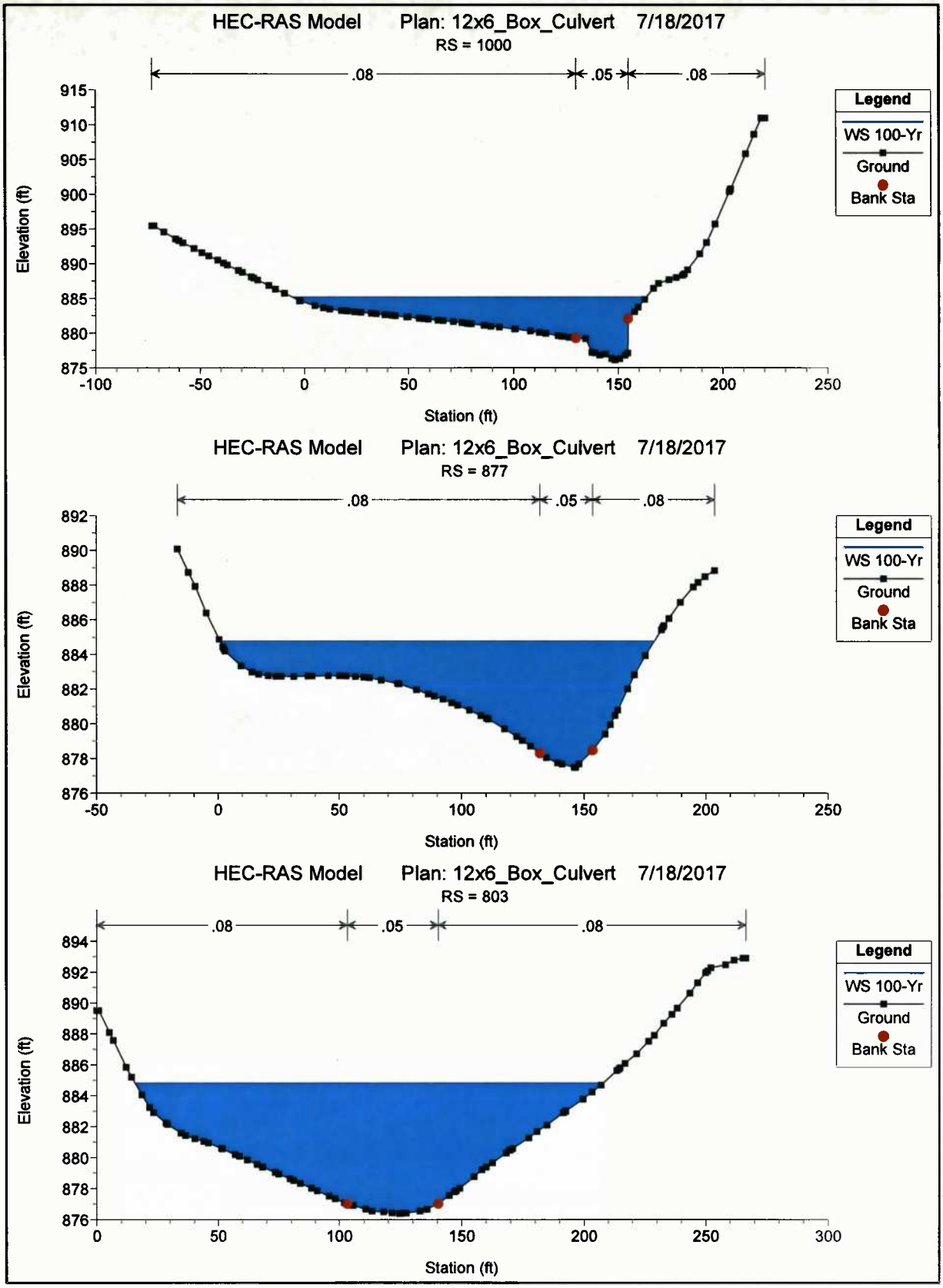

HEC-RAS Model Plan: 12x6_Box_Culvert 7/18/2017
RS = 1664
.08
.05
.08
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta
HEC-RAS Model Plan: 12x6_Box_Culvert 7/18/2017
RS = 1634
.08
.05
.08
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
HEC-RAS Model Plan: 12x6_Box_Culvert 7/18/2017
RS = 1616 Culv 12x4 Box Culvert
.08
.05
.08
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta

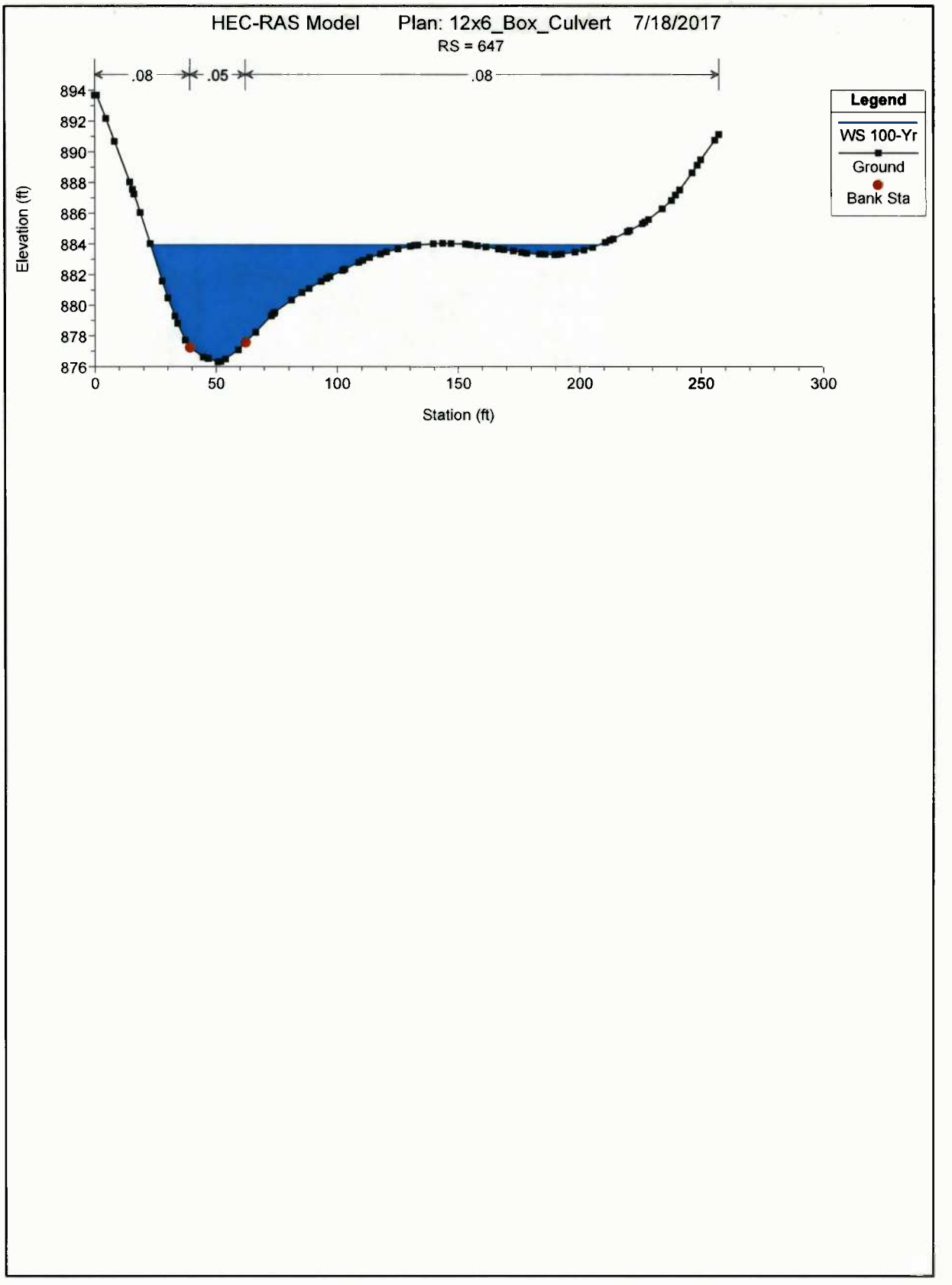

HEC-RAS Model Plan: 12x6_Box_Culvert 7/18/2017
RS = 1616 Culv 12x4 Box Culvert
.08
.05
.08
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
HEC-RAS Model Plan: 12x6_Box_Culvert 7/18/2017
RS = 1600
.08
.05
.08
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
HEC-RAS Model Plan: 12x6_Box_Culvert 7/18/2017
RS = 1545
.08
.05
.08
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


HEC-RAS Model Plan: 12x6_Box_Culvert 7/18/2017
RS = 1470
.08
.05
.08
Elevation (ft)
905
900
895
890
885
880
875
0
50
100
150
200
250
300
350
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta
HEC-RAS Model Plan: 12x6_Box_Culvert 7/18/2017
RS = 1347
.08
.05
.08
Elevation (ft)
900
895
890
885
880
875
-50
0
50
100
150
200
250
300
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta
HEC-RAS Model Plan: 12x6_Box_Culvert 7/18/2017
RS = 1265
.08
.05
.08
Elevation (ft)
896
894
892
890
888
886
884
882
880
878
876
-100
-50
0
50
100
150
200
250
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta


HEC-RAS Model Plan: 12x6_Box_Culvert 7/18/2017
RS = 1218
.08
.05
.08
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
Elevation (ft)
905
900
895
890
885
880
875
-100
-50
0
50
100
150
200
Station (ft)
HEC-RAS Model Plan: 12x6_Box_Culvert 7/18/2017
RS = 1204 BR
.08
.05
.08
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
Elevation (ft)
905
900
895
890
885
880
875
-100
-50
0
50
100
150
200
Station (ft)
HEC-RAS Model Plan: 12x6_Box_Culvert 7/18/2017
RS = 1204 BR
.08
.05
.08
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
Elevation (ft)
905
900
895
890
885
880
875
-150
-100
-50
0
50
100
150
200
Station (ft)

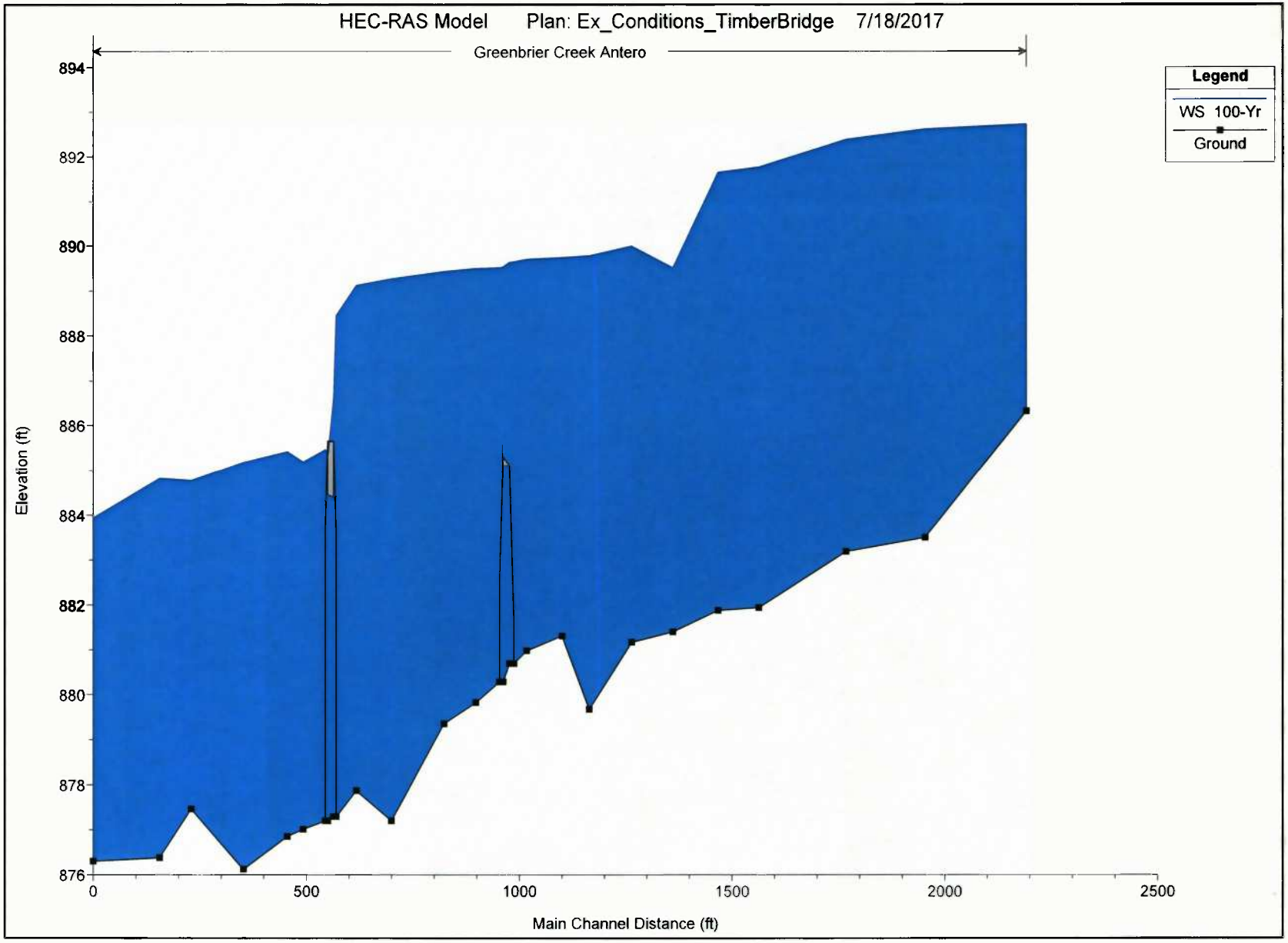

HEC-RAS Model Plan: 12x6_Box_Culvert 7/18/2017
RS = 1192
.08
.05
.08
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
Elevation (ft)
905
900
895
890
885
880
875
-150
-100
-50
0
50
100
150
200
Station (ft)
HEC-RAS Model Plan: 12x6_Box_Culvert 7/18/2017
RS = 1140
.08
.05
.08
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
910
905
900
895
890
885
880
875
-100
-50
0
50
100
150
200
250
Station (ft)
HEC-RAS Model Plan: 12x6_Box_Culvert 7/18/2017
RS = 1103
.08
.05
.08
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
915
910
905
900
895
890
885
880
875
-50
0
50
100
150
200
250
Station (ft)

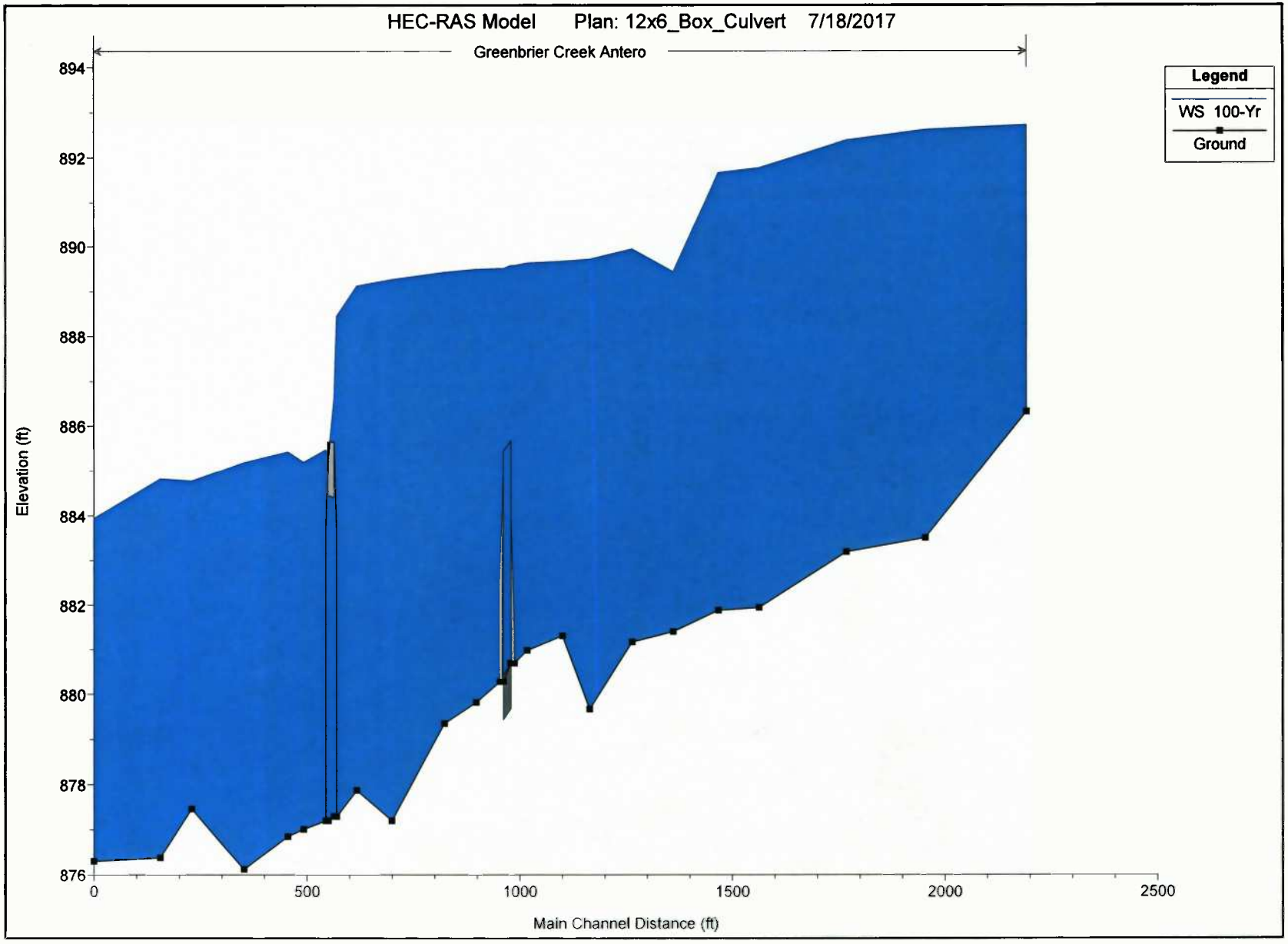

HEC-RAS Model Plan: 12x6_Box_Culvert 7/18/2017
RS = 1000
.08
.05
.08
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
915
910
905
900
895
890
885
880
875
-100
-50
0
50
100
150
200
250
Station (ft)
HEC-RAS Model Plan: 12x6_Box_Culvert 7/18/2017
RS = 877
.08
.05
.08
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
892
890
888
886
884
882
880
878
876
-50
0
50
100
150
200
250
Station (ft)
HEC-RAS Model Plan: 12x6_Box_Culvert 7/18/2017
RS = 803
.08
.05
.08
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
894
892
890
888
886
884
882
880
878
876
0
50
100
150
200
250
300
Station (ft)


HEC-RAS Model Plan: 12x6_Box_Culvert 7/18/2017
RS = 647
.08
.05
.08
894
892
890
888
886
884
882
880
878
876
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta

APPENDIX F

HEC-RAS PROFILE PLOTS


HEC-RAS Model Plan: Ex_Conditions_TimberBridge 7/18/2017
Greenbrier Creek Antero
Legend
WS 100-Yr
Ground
Elevation (ft)
894
892
890
888
886
884
882
880
878
876
0
500
1000
1500
2000
2500
Main Channel Distance (ft)


HEC-RAS Model Plan: 12x6_Box_Culvert 7/18/2017
Greenbrier Creek Antero
Legend
WS 100-Yr
Ground
Elevation (ft)
894
892
890
888
886
884
882
880
878
876
0
500
1000
1500
2000
2500
Main Channel Distance (ft)