CERTIFIED MAIL™

Dan Wellings
Doddridge Co Flood Plain MGT
Room 102
118 East Court St.
West Union, WV 26456

7011 0470 0000 8523 2983

HASLER
015H14112420
$6.11
12/20/13
Mailed From 26456
US POSTAGE

A
C
S
☐ INSUFFICIENT ADDRESS
☐ ATTEMPTED NOT KNOWN
☐ NO SUCH NUMBER/ STREET
☐ NOT DELIVERABLE AS ADDRESSED - UNABLE TO FORWARD
☐ OTHER

RTS
RETURN TO SENDER

DECEASED

26456970025

PLACE STICKER AT TOP OF ENVELOPE TO THE RIGHT

SENDER: *COMPLETE THIS SECTION*

- **Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.**
- **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: #13-105

Ronna J Lipscomb
Rt 1, Box 325 C
West Union, WV 26456

COMPLETE THIS SECTION ON DELIVERY

A. Signature

X ☐ Agent ☐ Addressee

B. Received by *(Printed Name)* | C. Date of Delivery

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

3. Service Type
☒ Certified Mail ☐ Express Mail
☐ Registered ☐ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? *(Extra Fee)* ☐ Yes

2. Article Number
(Transfer from service label) 7011 0470 0000 8523 2983

PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M-1540

2013 DEC 23 AM 11:32
BETH A. ROGERS
COUNTY CLERK
DODDRIDGE COUNTY, WV

Legal Advertisement:

Doddridge County

Floodplain Permit Application

Please take notice that on the 20th day of December, 2013

EQT – SATURN COMPRESSOR STATION PHASE IV

#13-105

filed an

application for a Floodplain Permit to develop land located at or about: **SURFACE OWNERS: EQUITRANS INC, CENTRAL DISTRICT 12.231 AC, D/B: 87 AND TAX MAP 92, CENTRAL STATION AREA.**

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 **January 9th, 2014.**

Delivered to the:

Clerk of the County Court

118 E. Court Street, West Union, WV 26456.

Beth A Rogers, Doddridge County Clerk

Dan Wellings, Doddridge County Flood Plain Manager

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- 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: #13-105

Jonathan Davis
Rt. 1 Box 271
West Union WV 26456

COMPLETE THIS SECTION ON DELIVERY

A. Signature: X Jonathan Davis ☐ Agent ☐ Addressee

B. Received by (Printed Name) | C. Date of Delivery: 12-21-13

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

3. Service Type
☒ Certified Mail ☐ Express Mail
☐ Registered ☐ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

2. Article Number (Transfer from service label) 7011 0470 0000 8523 2969

PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M-1540

U.S. Postal Service™
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(Domestic Mail Only; No Insurance Coverage Provided)

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

OFFICIAL USE

Postage	$ .46
Certified Fee	3.10
Return Receipt Fee (Endorsement Required)	2.55
Restricted Delivery Fee (Endorsement Required)	
Total Postage & Fees	$ 6.11

Postmark Here: DEC 20 2013 WEST UNION WV USPS 26456
#13-105

Sent To: Howard Eakles
Street, Apt. No.; or PO Box No.: Rt 1, Box 325 C
City, State, ZIP+4: West Union, WV 26456

PS Form 3800, August 2006 See Reverse for Instructions

7011 0470 0000 8523 2976

U.S. Postal Service™
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Postage	$ .46
Certified Fee	3.10
Return Receipt Fee (Endorsement Required)	2.55
Restricted Delivery Fee (Endorsement Required)	
Total Postage & Fees	$ 6.11

Postmark Here: DEC 20 2013 WEST UNION WV USPS 26456
#13-105

Sent To: William P Seahorn III
Street, Apt. No.; or PO Box No.: Box 1483
City, State, ZIP+4: Ozona, Tx 76943

PS Form 3800, August 2006 See Reverse for Instructions

7011 0470 0000 8523 2990

U.S. Postal Service™
CERTIFIED MAIL™ RECEIPT
(Domestic Mail Only; No Insurance Coverage Provided)

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OFFICIAL USE

Postage	$ .46
Certified Fee	3.10
Return Receipt Fee (Endorsement Required)	2.55
Restricted Delivery Fee (Endorsement Required)	
Total Postage & Fees	$ 6.11

Postmark Here: DEC 20 2013 USPS 26456 WEST UNION WV
#13-105

Sent To: George & Donna Lambert
Street, Apt. No.; or PO Box No.: 12 Townridge AC
City, State, ZIP+4: Mullens, WV 25882

PS Form 3800, August 2006 See Reverse for Instructions

7011 0470 0000 8523 3003

U.S. Postal Service™
CERTIFIED MAIL™ RECEIPT
(Domestic Mail Only; No Insurance Coverage Provided)

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

OFFICIAL USE

Postage	$ .46
Certified Fee	3.10
Return Receipt Fee (Endorsement Required)	2.55
Restricted Delivery Fee (Endorsement Required)	
Total Postage & Fees	$ 6.11

Postmark Here: DEC 20 2013 USPS 26456 WEST UNION WV
#13-105

Sent To: Terry & Jo Ann Ross
Street, Apt. No.; or PO Box No.: Box 141
City, State, ZIP+4: West Union, WV 26456

PS Form 3800, August 2006 See Reverse for Instructions

7011 0470 0000 8523 3010

SENDER: *COMPLETE THIS SECTION*

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- 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: #13-105

Terry & Jo Ann Ross
Box 141
West Union, WV 26456

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X [signature] ☐ Agent ☐ Addressee

B. Received by *(Printed Name)*

C. Date of Delivery 12-23-13

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

3. Service Type
☒ Certified Mail ☐ Express Mail
☐ Registered ☐ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? *(Extra Fee)* ☐ Yes

2. Article Number *(Transfer from service label)* 7011 0470 0000 8523 3010

PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M-1540

UNITED STATES POSTAL SERVICE

First-Class Mail
Postage & Fees Paid
USPS
Permit No. G-10

• Sender: Please print your name, address, and ZIP+4 in this box •

Dan Wellings
Doddridge Co Flood Plain MGT
Room 102
118 E Court St
West Union, WV 26456

FILED
2013 DEC 27 PM 2:44
BETH A. ROGERS
COUNTY CLERK
DODDRIDGE COUNTY, WV

SENDER: *COMPLETE THIS SECTION*

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- 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: #13-105

Howard Eakles
Rt. 1 Box 325 C
West Union, WV 26456

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X Betty Eakles ☒ Agent ☐ Addressee

B. Received by *(Printed Name)* Betty Eakles
C. Date of Delivery 12/31/13

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

3. Service Type
☒ Certified Mail ☐ Express Mail
☐ Registered ☐ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? *(Extra Fee)* ☐ Yes

2. Article Number *(Transfer from service label)* 7011 0470 0000 8523 2976

PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M-1540

UNITED STATES POSTAL SERVICE

First-Class Mail
Postage & Fees Paid
USPS
Permit No. G-10

• Sender: Please print your name, address, and ZIP+4 in this box •

FILED
2014 JAN -2 AM 11:37
BETH A. ROGERS
COUNTY CLERK
DODDRIDGE COUNTY, WV

Dan Wellings
Doddridge Co Flood Plain MGT
Room 102
118 E Court St
West Union, WV 26456

SENDER: *COMPLETE THIS SECTION*

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- 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: #13-105

George & Donna Lambert
12 Townridge AC
Mullens, WV 25882

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X Donna Lambert ☐ Agent ☐ Addressee

B. Received by *(Printed Name)*

C. Date of Delivery 12-24-13

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

3. Service Type
☒ Certified Mail ☐ Express Mail
☐ Registered ☐ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? *(Extra Fee)* ☐ Yes

2. Article Number
(Transfer from service label) 7011 0470 0000 8523 3003

PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M-1540

UNITED STATES POSTAL SERVICE

First-Class Mail
Postage & Fees Paid
USPS
Permit No. G-10

• Sender: Please print your name, address, and ZIP+4 in this box •

FILED
2013 DEC 27 PM 2:44
BETH ARRIGHS
DODDRIDGE COUNTY CLERK
DODDRIDGE COUNTY, WV

Jan Wellings
Doddridge Co Flood Plain MGT
Rm 102
118 Court St
West Union, WV 26456

7011 0470 0000 8523 2943

U.S. Postal Service™
CERTIFIED MAIL™ RECEIPT
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OFFICIAL USE

Postage	$ .46
Certified Fee	3.10
Return Receipt Fee (Endorsement Required)	2.55
Restricted Delivery Fee (Endorsement Required)	
Total Postage & Fees	$ 6.11

Postmark Here
DEC 20 2013
USPS 26456
INC#13-105

Sent To: Ronna J. Lipscomb
Street, Apt. No.; or PO Box No.: Rt. 1 Box 325 C
City, State, ZIP+4: West Union, WV 26456

PS Form 3800, August 2006 — See Reverse for Instructions

7011 0470 0000 8523 2929

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

OFFICIAL USE

Postage	$ .46
Certified Fee	3.10
Return Receipt Fee (Endorsement Required)	2.55
Restricted Delivery Fee (Endorsement Required)	
Total Postage & Fees	$ 6.11

Postmark Here
DEC 20 2013
USPS 26456
WEST UNION WV
#13-105

Sent To: Jonathan Davis
Street, Apt. No.; or PO Box No.: Rt 1, Box 271
City, State, ZIP+4: West Union, WV 26456

PS Form 3800, August 2006 — See Reverse for Instructions

11020

EQT GATHERING, LLC
455 RACETRACK ROAD
SUITE 101
WASHINGTON, PA 15301

60-160/433

DATE 12/18/2013

PAY TO THE ORDER OF DODDRIDGE COUNTY CLERK $ 2,500.00

TWO THOUSAND FIVE HUNDRED DOLLARS AND NO CENTS DOLLARS

Security Features Included Details on Back

THE BANK OF NEW YORK MELLON
PITTSBURGH, PA
FLOODPLAIN PERMIT - SATURN COMPRESSOR

FOR

MP

⑈011020⑈ ⑆043301601⑆ 022⑈5699⑈

FILED
2013 DEC 19 AM 8:32
BETH A. ROGERS
COUNTY CLERK
DODDRIDGE COUNTY, WV

EQT Gathering, LLC
13-105
Saturn Compressor Station Phase IV

By: BH - MEH - AML
Asst. Chief Tax Deputy

Michael Headley
Sheriff of Doddridge County

The Person paying Money into the Treasury shall forthwith file one of these Receipts with the County Clerk

Doddridge County, West Virginia

No. 1145

Date: December 23, 2013
Customer copy

Received: #13-105 eqt gathering saturn compressor IV station phase $2,500.00

In Payment For: 318 Building Permits (LP)

For: 12-Flood Plain Ordinance #20 Fund

By: BH - MEH - AML
Asst. Chief Tax Deputy

Michael Headley
Sheriff of Doddridge County

Doddridge County Sheriff
Flood Plain Ordinance Fund

1070
69-217/515

DATE January 7, 2014

PAY TO THE ORDER OF THE HERALD RECORD $ 120.86

One Hundred Twenty Dollars and 86/100---------- 0 DOLLARS

Security features included. Details on back.

CORNERSTONE BANK
West Union, WV 26456

Ralph Sandom Jr.
Betty A. Rogers
Sheriff

MEMO Inv#3017/#3018/#3023/#3024/#3031/#3032
#13-101/#13-102/#13-105/#13-104/#13-089/#13-107

⑈001070⑈ ⑆051502175⑆ 11-9649-9⑈

BLUE TRADITIONAL

Legal Advertisement:

Doddridge County

Floodplain Permit Application

Please take notice that on the 20th day of December, 2013

EQT – SATURN COMPRESSOR STATION PHASE IV

#13-105

filed an

application for a Floodplain Permit to develop land located at or about: **SURFACE OWNERS: EQUITRANS INC, CENTRAL DISTRICT 12.231 AC, D/B: 87 AND TAX MAP 92, CENTRAL STATION AREA.**

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 **January 9th, 2014.**

Delivered to the:

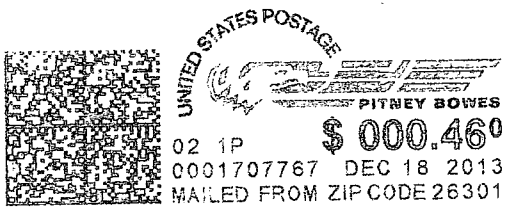
Clerk of the County Court

118 E. Court Street, West Union, WV 26456.

Beth A Rogers, Doddridge County Clerk

Dan Wellings, Doddridge County Flood Plain Manager

Hormor
Since 1902 Bros. Engineers
MAIN & THIRD STREETS • POST OFFICE BOX 386
CLARKSBURG, WEST VIRGINIA 26302



Mr. Dan Wellings
Doddridge County Flood Manager
HC 68 Box 5
West Union, WV 26456

26456890C9

Hornor
Since 1902 **Bros. Engineers** *Incorporated in 1923 • Civil, Environmental & Consulting Engineering*

Post Office Box 386 • Clarksburg, West Virginia 26302 • (304) 624-6445 • Fax (304) 624-6448 • www.HornorBrosEng.com

December 13, 2013

Mr. Dan Wellings
Doddridge County Flood Manager
HC 68 Box 5
West Union, WV 26456

RE: HEC-RAS Floodplain Analysis for EQT Gathering, LLC
Saturn Compressor Station Phase VI Site Improvements

Dear Mr. Wellings:

It was concluded that the proposed improvements near Arnold Creek will be out of the flood plain with a proposed pad elevation of 790, therefore all compressor station activities shall be out of the floodplain. A minor increase in flood elevation to the upstream adjoining land owners, with a maximum increase of 0.23' for approximately 2000' upstream of the site, was found based on the HEC-RAS model. The flood elevation in the area of the improvements is 789.62 and no change in flood elevation was found for the downstream area.

Based on this study the proposed activities are within the 1' allowable increase in flood elevation and upstream adjoining land owners will need to be contact per advisement of the floodplain manager.

Sincerely,

HORNOR BROTHERS ENGINEERS

Joseph D. Robinson, P.E.
DESIGN ENGINEER

JDR/jmh
Enclosure
cc: Megan Landfried (w/Floodpain Analysis and Letter)
File: ASI 2013-288 Correspondence 1

Hornor
Since 1902 **Bros. Engineers** *Incorporated in 1923 • Civil, Environmental & Consulting Engineering*

Post Office Box 386 • Clarksburg, West Virginia 26302 • (304) 624-6445 • Fax (304) 624-6448 • www.HornorBrosEng.com

December 18, 2013

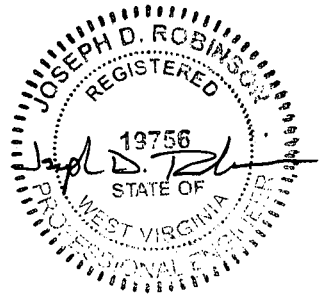
Mr. Dan Wellings
Doddridge County Flood Manager
HC 68 Box 5
West Union, WV 26456

RE: HEC-RAS Floodplain Analysis for EQT Gathering, LLC
Saturn Compressor Station Phase VI Site Improvements

Dear Mr. Wellings:

It was concluded that the proposed improvements near Arnold Creek will be out of the flood plain with a proposed pad elevation of 790, therefore all compressor station activities shall be out of the floodplain. A minor increase in flood elevation to the upstream adjoining land owners, with a maximum increase of 0.23' for approximately 2000' upstream of the site, was found based on the HEC-RAS model. The flood elevation in the area of the improvements is 789.62 and no change in flood elevation was found for the downstream area.

Based on this study the proposed activities are within the 1' allowable increase in flood elevation and upstream adjoining land owners will need to be contact per advisement of the floodplain manager.



Sincerely,

HORNOR BROTHERS ENGINEERS

Joseph D. Robinson, P.E.
DESIGN ENGINEER

JDR/jmh
Enclosures
cc: Megan Landfried (w/Floodpain Analysis and Letter)
File: ASI 2013-288 Correspondence 1

Please include this WV flood plain tool map which you requested with the original documents that were mailed to you on December 13, 2013.

Thank you.

PERMIT NO. 13-105

DODDRIDGE COUNTY

FLOODPLAIN DEVELOPMENT

PERMIT

PURPOSE FOR PERMIT: SATURN COMPRESSOR STATION PHASE ~~II~~ VI SITE IMPROVEMENTS

ISSUED TO EQT

115 PROFESSIONAL PLACE

ADDRESS: BRIDGEPORT, WV 26330

PROJECT ADDRESS: CENTRAL STATION

ISSUED BY: Dan Wellings

DATE: 01/09/2014

CONSTRUCTION MUST START WITHIN 180 DAYS FROM ISSUED DATE. PERMIT EXPIRES IN 12 MONTHS FROM ISSUED DATE. IF EXTENTION IS NEEDED A REQUEST MUST BE MADE IN WRITING STATING A REASON FOR THE EXTENTION.

THIS PERMIT MUST BE POSTED ON THE PREMISES IN A CONSPICUOUS PLACE SO AS TO BE CLEARLY VISIBLE FROM THE STREET.

13-105
EQT - Saturn Compressor Station Phase IV

DODDRIDGE COUNTY
FLOODPLAIN DEVELOPMENT PERMIT APPLICATION

FILED
2013 DEC 16 PM 12:59
BETH A. ROGERS
COUNTY CLERK
DODDRIDGE COUNTY, WV

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 12/12/13

SECTION 2: PROPOSE DEVELOPMENT (TO BE COMPLETED BY APPLICANT).

IF THE APPLICANT IS NOT A NATURAL PERSON, THE NAME, ADDRESS, AND TELEPHONE NUMBER OF A NATURAL PERSON WHO SHALL BE APPOINTED BY THE APPLICANT TO RECEIVE NOTICE PURSUANT TO ANY PROVISION OF THE CURRENT DODDRIDGE COUNTY FLOODPLAIN ORDINANCE.

APPLICANT'S NAME: Equitrans, Inc
ADDRESS: 115 Professional Place, Bridgeport, WV 26330
TELEPHONE NUMBER: 304-848-0061

BUILDER'S NAME: Equitrans, Inc
ADDRESS: 115 Professional Place, Bridgeport, WV 26330
TELEPHONE NUMBER: 304-848-0061

ENGINEER'S NAME: POTESTA & Associates, Inc
ADDRESS: 7012 MacCorkle Ave., SE, Charleston, WV 25304
TELEHONE NUMBER: 304-342-1400

PROJECT LOCATION:

NAME OF SURFACE OWNER/OWNERS (IF NOT THE APPLICANT) EQUITRANS INC
100 ALLEGHENY CENTER MALL, PITTSBURGH, PA 15212
ADDRESS OF SURFACE OWNER/OWNERS (IF NOT THE APPLICANT)_____

DISTRICT: CENTRAL
DATE/FROM WHOM PROPERTY PURCHASED: N/A
LAND BOOK DESCRIPTION: CENTRAL STATION 12.231 AC ASSESSED
DEED BOOK REFERENCE: 87
TAX MAP REFERENCE: 92
EXISTING BUILDINGS/USES OF PROPERTY: Class 3
NAME OF AT LEAST ONE ADULT RESIDING IN EACH RESIDENCE LOCATED UPON THE SUBJECT PROPERTY N/A
ADDRESS OF AT LEAST ONE ADULT RESIDING IN EACH RESIDENCE LOCATED UPON THE SUBJECT PROPERTY N/A

To avoid delay in processing the application, please provide enough information to easily identify the project location.

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)
[X]	Alteration	[X]	Non-residential (floodproofing)
[]	Relocation	[]	Combined Use (res. & com.)
[]	Demolition	[]	Replacement
[)	Manufactured/Mobil Home		

B. OTHER DEVEOPLMENT ACTIVITIES:

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

_____

C. STANDARD SITE PLAN OR SKETCH

1. **SUBMIT ALL STANDARD SITE PLANS, IF ANY HAVE BEEN PREPARED.**
2. **IF STANDARD SITE PLANS HAVE NOT BEEN PREPARED:**
   SKETCH ON A SEPARATE 8 ½ X 11 INCH SHEET OF PAPER THE SHAPE AND LOCATION OF THE LOT. SHOW THE LOCATION OF THE INTENDED CONSTRUCTION OR LAND USE INDICATING BUILDING SETBACKS, SIZE & HEIGHT. IDENTIFY EXISTING BUILDINGS, STRUCTURES OR LAND USES ON THE PROPERTY.
3. **SIGN AND DATE THE SKETCH.**

ACTUAL TOTAL CONSTRUCTION COSTS OF THE COMPLETE DEVELOPMENT IRRESPECTIVE OF WHETHER ALL OR ANY PART OF THE SUBJECT PROPOSED CONSTRUCTION PROJECT IS WITHIN THE FLOODPLAIN ~~$4,000,000.00~~ $400,000.00

D. ADJACENT AND/OR AFFECTED LANDOWNERS:

1. **NAME AND ADDRESS OF ALL OWNERS OF SURFACE TRACTS ADJACENT TO THE AREA OF THE SURFACE TRACT (UP & DOWN STREAM) UPON WHICH THE PROPOSED ACTIVITY WILL OCCUR AND ALL OTHER SURFACE OWNERS UP & DOWN STREAM) WHO OWN PROPERTY THAT MAY BE AFFECTED BY FLOODING AS IS DEMONSTRATED BY A FLOODPLAIN STUDY OR SURVEY (IF ONE HAS BEEN COMPLETED).**

NAME: DAVIS JONATHAN L
ADDRESS: RT 1 BOX 271
WEST UNION, WV 26456

NAME: SEAHORN WILLIAM PONDER III
ADDRESS: BOX 1483
OZONA, TX 76943

NAME: EAKLES HOWARD
ADDRESS: RT 1 BOX 325C
WEST UNION, WV 26456

NAME: LAMBERT GEORGE D & DONNA (SURV)
ADDRESS: 12 TOWNRIDGE AC
MULLENS, WV 25882

NAME: LIPSCOMB RONNA J
ADDRESS: RT 1 BOX 270A
WEST UNION, WV 26456

NAME: ROSS TERRY K & JO ANN (SURV)
ADDRESS: BOX 141
WEST UNION, WV 26456

1. **NAME AND ADDRESS OF AT LEAST ONE ADULT RESIDING IN EACH RESIDENCE LOCATED UPON ANY ADJACENT PROPERTY AT THE TIME THE FLOODPLAIN PERMIT APPLICATION IS FILED AND THE NAME AND ADDRESS OF AT LEAST ONE ADULT RESIDING IN ANY HOME ON ANY PROPERTY THAT MAY BE AFFECTED BY FLOODING AS IS DEMONSTRATED BY A FLOODPLAIN STUDY OR SURVEY.**

NAME: N/A
ADDRESS:_____

NAME: N/A
ADDRESS:_____

NAME: N/A
ADDRESS:_____

NAME: N/A
ADDRESS:_____

E. CONFIRMATION FORM

THE APPLICANT ACKNOWLEDGES, AGREES, AND CONFIRMS THAT HE/IT WILL PAY WITHIN 30 DAYS OF RECEIPT OF INVOICE BY THE COUNTY FOR ALL EXPENSES RELATIVE TO THE PERMIT APPLICATION PROCESS GREATER THAN THE REQUIRED DEPOSIT FOR EXPENSES INCLUDING:

(A) PERSONAL SERVICE OF PROCESS BY THE DODDRIDGE COUNTY SHERIFF AT THE RATES PERMITTED BY LAW FOR SUCH SERVICE.

(B) SERVICE BY CERTIFIED MAIL RETURN RECEIPT REQUESTED.

(C) PUBLICATION.

(D) COURT REPORTING SERVICES AT ANY HEARINGS REQUESTED BY THE APPLICANT.

(E) CONSULTANTS AND/OR HEARING EXPERTS UTILIZED BY DODDRIDGE COUNTY FLOODPLAIN ADMINISTRATOR/MANAGER OR FLOODPLAIN APPEALS BOARD FOR REVIEW OF MATERIALS AND/OR TESTIMONY REGARDING THE EFFICACY OF GRANTING OR DENYING THE APPLICANT'S FLOODPLAIN PERMIT.

NAME (PRINT): Megan E. Landfried

SIGNATURE: Megan E. Landfried **DATE:** 12/12/13

After completing SECTION 2, APPLICANT should submit form to Floodplain Administrator/Manager or his/her representative for review.

SECTION 3: FLOODPLAIN DETERMINATION (to be completed by Floodplain Administrator/Manager or his/her representative)

THE PROPOSED DEVELOPMENT:

THE PROPOSED DEVELOPMENT IS LOCATED ON:

FIRM Panel: 115

Dated: 10/04/2011

( ) Is **NOT** located in a Specific Flood Hazard Area (Notify applicant that the application review is complete and **NO FLOOPLAIN DEVELOPMENT PERMIT IS REQUIRED**).

(X) Is located in Special Flood Hazard Area.

FIRM zone designation A or AE (real close to line)

100-Year flood elevation is: 789.62 NGVD ~~(MSL)~~

+ 0.23 increase for ~2,000 ft. upstream

[] Unavailable

[] The proposed development is located in a floodway.
FBFM Panel No._____ Dated_____

[] See section 4 for additional instructions.

SIGNED Dan Wellings DATE 01/09/2014

SECTION 4: ADDITIONAL INFORMATION REQUIRED (To be completed by Floodplain Administrator/Manager or his/her representative)

The applicant must submit the documents checked below before the application can be processed.

[] A plan showing the location of all existing structures, water bodies, adjacent roads, lot dimensions and proposed development.

[] Development plans, drawn to scale, and specifications, including where applicable: details for anchoring structures, storage tanks, proposed elevation of lowest floor, (including basement or crawl space), types of water resistant materials used below the first floor, details of flood proffing of utilities located below the first floor and details of enclosures below the first floor. Also_____

_____

[] Subdivision or other development plans (If the subdivision or development exceeds 50 lots or 5 acres, whichever is the lesser, the applicant must provide 100-year flood elevations if they are not otherwise available).

[] Plans showing the extent of watercourse relocation and/or landform alterations.

[] Top of new fill elevation_____Ft. NGVD (MSL).

For floodproofing structures applicant must attach certification from registered engineer or architect.

[] Certification from a registered engineer that the proposed activity in a regulatory floodway will not result in any increase in the height of the 100-year flood. A copy of all data and calculations supporting this finding must also be submitted.

[] Manufactured homes located in a floodplain area must have a West Virginia Contractor's License and a Manufactured Home Installation License as required by the Federal Emergency Management Agency (FEMA).

[] Other:

_____

_____

_____

SECTION 5: PERMIT DETERMINATION (To be completed by Floodplain Administrator/Manager or his/her representative)

I have determined that the proposed activity **(type is or is not)** in conformance with provisions of the Floodplain Ordinance adopted by the County Commission of Doddridge County on May 21, 2013. The permit is issued subject to the conditions attached to and made part of this permit.

SIGNED_____DATE_____

If the Floodplain Administrator/Manager found that the above was not in conformance with the provisions of the Doddridge County Floodplain Ordinance and/or denied that application, the applicant may complete an appealing process below.

APPEALS: Appealed to the County Commission of Doddridge County? [] Yes {} No
Hearing Date:_____
County Commission Decision - Approved [] Yes [] No

CONDITIONS:_____

_____

SECTION 6: AS-BUILT ELEVATIONS (To be submitted by APPLICANT before Certificate of Compliance is issued).

The following information must be provided for project structures. This section must be completed by a registered professional engineer or a licensed land surveyor (or attach a certification to this application).

COMPLETE 1 OR 2 BELOW:

1 Actual (As-Built) Elevation of the top of the lowest floor (including basement or crawl space is_____FT. NGVD (MSL)

2 Actual (As Built) elevation of floodproofing is_____FT. NGVD (MSL)

Note: Any work performed prior to submittal of the above information is at risk of the applicant.

SECTION 7: COMPLIANCE ACTION (To be completed by the Floodplain Administrator/Manager or his/her representative).

The Floodplain Administrator/Manager or his/her representative will complete this section as applicable based on inspection of the project to ensure compliance with the Doddridge County Floodplain Ordinance.

INSPECTIONS:

DATE:_____ **BY:**_____

DEFICIENCIES ? Y/N

COMMENTS_____

_____

_____

_____

SECTION 8: CERTIFICATE OF COMPLIANCE (To be completed by Floodplain Administrator/Manager or his/her representative).

Certificate of Compliance issued: **DATE:**_____ BY:_____

CERTIFICATE OF COMPLIANCE
FOR DEVELOPMENT IN SPECIAL FLOOD HAZARD AREA
(OWNER MUST RETAIN)

PERMIT NUMBER:_____
PERMIT DATE:_____

PURPOSE –

CONSTRUCTION LOCATION:_____

OWNER'S ADDRESS:_____

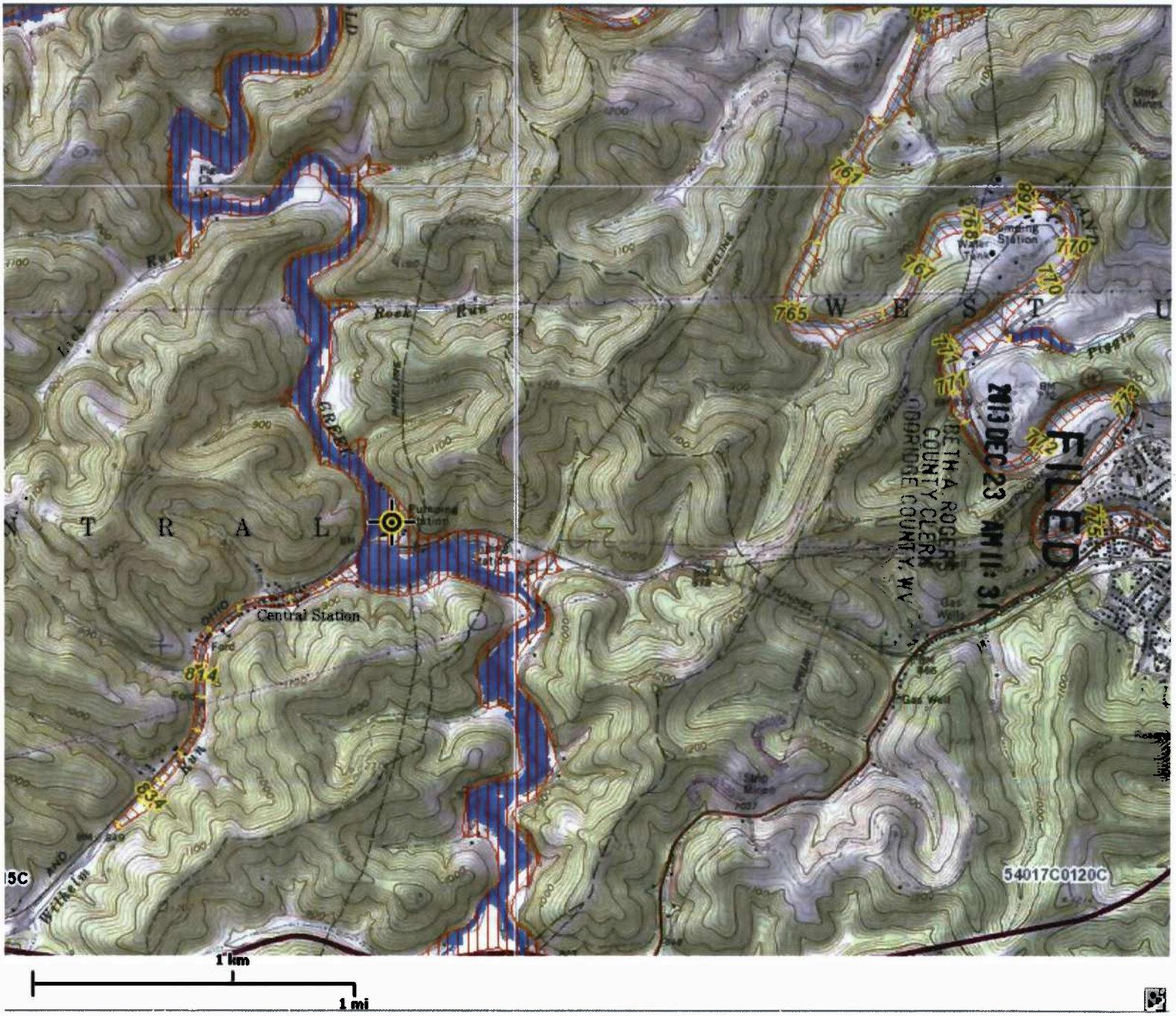
_____

_____

THE FOLLOWING MUST BE COMPLETED BY THE FLOODPLAIN ADMINISTRATOR/MANAGER OR HIS/HER AGENT.

COMPLIANCE IS HEREBY CERTIFIED WITH THE REQUIREMENT OF THE FLOODPLAIN ORDINANCE ADOPTED BY THE COUNTY COMMISSION OF DODDRIDGE COUNTY ON MAY 21, 2013.

SIGNED_____**DATE**_____



This map is not the official regulatory FIRM or DFIRM. Its purpose is to assist with determining potential flood risk for the selected location.

Map Created on 12/18/2013

Location of the mouse click

Approximate Study (Zone A)

Detailed Study (Zone AE, AH, AO)

Floodway

Flood Water Depth (HEC-RAS)

K—K **Cross Section Line**

810 **Base Flood Elevation Line**

DFIRM Panel (Map) Index

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.

Flood Hazard Area: Selected site is **WITHIN** the FEMA 100-year floodplain.

Flood Zone: A

Advisory Flood Height: About 789 feet

Water Depth: About 1.59 feet (Source: HEC_RAS)

Elevation: About 788 feet

Location (long, lat): 80.819665 W, 39.297240 N

Location (UTM 17N): (515550, 4349778)

FEMA Issued Flood Map: 54017C0115C

Contacts: Doddridge County

CRS Information: No CRS information available

Flood Profile: No Profile

HEC-RAS Model: No Model

FLOODPLAIN ANALYSIS

for the

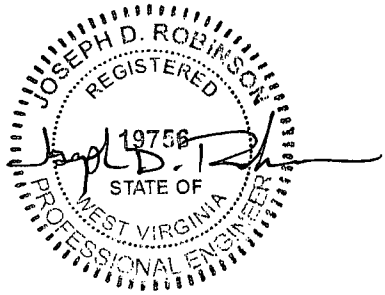
Saturn Compressor Station Phase VI

Located along the County Route 11
Doddridge County, WV

Prepared for:

EQT Gathering, LLC

December 2013



Prepared by:

HORNOR BROTHERS ENGINEERS
140 South Third Street
Clarksburg, WV 26302
PHONE: (304) 624-6445
FAX: (304) 624-6448

TABLE OF CONTENTS

INTRODUCTION

This analysis has been prepared to provide documentation for the upstream drainage area hydraulics and the on-site flood elevations near the county road and surrounding properties of the Saturn Compressor Station Site Phase VI along County Route 11 in Doddridge County, West Virginia as requested for the sole use of EQT Gathering, LLC. EQT Gathering, LLC requested that a flood analysis be completed for the evaluation of proposed compressor station improvements that may be found within the flood elevation. This report provides information for the existing site conditions of the 100-year frequency storm event. The study reach is identified as a "Zone A" on FEMA's flood insurance rate map 54017C0115C. The purpose of this analysis is to delineate the one percent flood hazard area and show that the proposed activities will not increase the flood elevation more than 1' in elevation.

EXISTING SITE INFORMATION

The site is bordered on the west and south by County Route 11 and the nearest town is West Union to the east. The topography was field collected for the Saturn Compressor Site. The surrounding upslope drainage area (13,240 ac) data was based on a combination of Google Earth images for the land use and a USGS map for the topology, for a combined drainage area of 13,240 ac. The current land use was found to be developed with homes, meadows and woods upstream. The soil types found on the site are described as Chagrin, Sensabaugh and Sensabaugh-Urban (Hydrologic Group B); Cotaco, Gilpin-Peabody 15-35% slopes, very stony and Gilpin-Peabody 35-70% slopes, very stony (Hydrologic Group C); Gilpin-Peabody 25-35% slopes, Gilpin-Upshur 8-15% slopes, Gilpin-Upshur 15-25% slopes and Vandalia (Hydrologic Group D), which can be seen in Figure 2.2.

Existing elevations within the analysis area were determined through on-site section features survey using survey grade GPS.

STORMWATER CALCULATIONS

A USGS Hydrological model was used to calculate the runoff based on the Scientific Investigations Report 2010-5033. In running the calculations, the runoff amount determined for the 100-year frequency storm was calculated to be 4446 cfs under existing conditions.

The HEC-RAS (v4.1.0) rainfall model was used to analyze the onsite drainage channel to calculate the flood elevation for the 100-year storm event.

MANNING'S COEFFICIENTS

The Manning's roughness coefficients were determined based on aerial photography of the site and the values presented in the HEC-RAS Hydraulic Manual Table 3-1.

Main channel:

1.b Clean, straight, full, no rifts or deep pools, some stones and weeds: Value = 0.035

Floodplain:

2.a.2 Pasture - High grass: Value = 0.050

The maximum value was used for the possibility of brush and debris in the floodplain.

BOUNDARY CONDITIONS

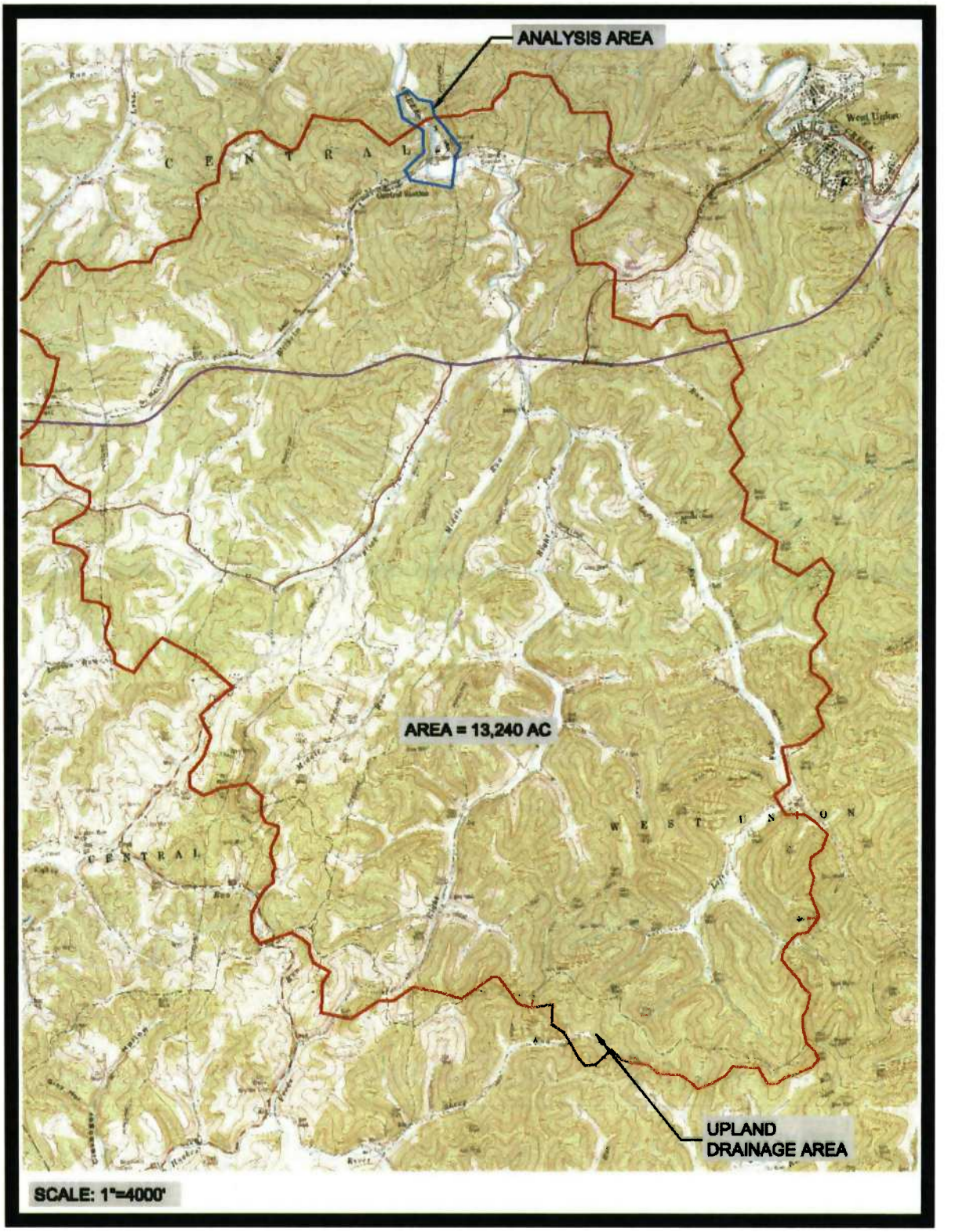
FEMA has not performed a detailed hydraulic study of Arnolds Creek near the project site. Therefore, a channel slope of 0.0022 was used as the normal depth boundary condition in the hydraulic model.

RESULTS

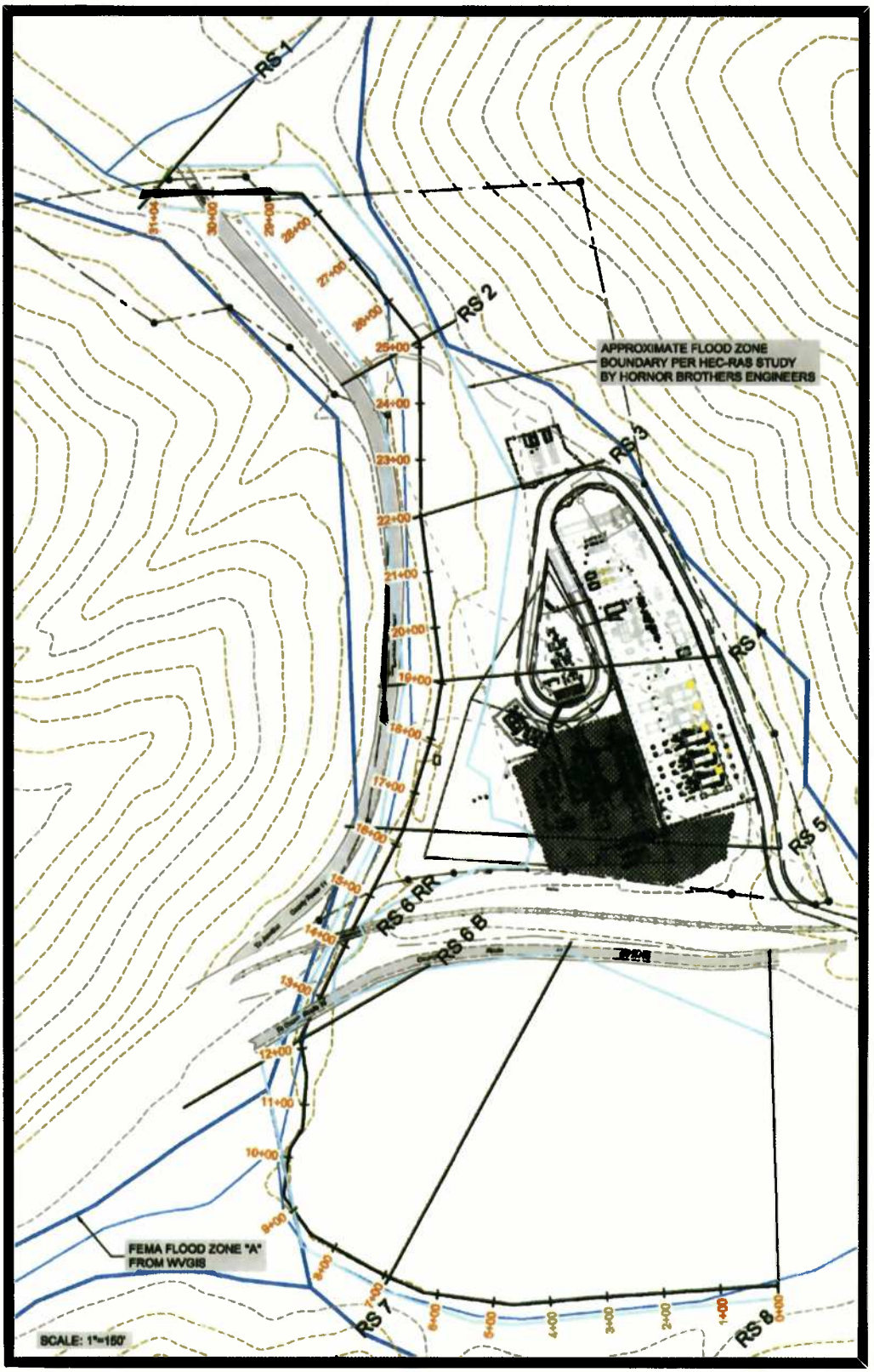
By analyzing the results from the calculations and the HEC-RAS model, the following flood elevations have been determined for the 100-yr frequency storm upstream and downstream respectively: 790.09 and 785.93 for the existing conditions scenario and 790.32 and 785.93 for the proposed developed scenario. Based on the findings of this analysis the base flood elevation would be modified by the proposed construction improvements for the upstream land owners and would not be modified for the downstream land owners.

CONCLUSION

According to the methods utilized in this analysis, the proposed grading improvements would create a minor increased flood water elevation (0.23') to the upstream adjoining land owners for a distance of approximately 2000' and no increased flood water elevation downstream of the proposed construction. The maximum flood elevation of the proposed improvement area shall be 789.62 based on sections 3-5. Proposed grading for the improvements has been set to an elevation of 790 minimum, therefore all compressor station activities shall be out of the floodplain.


ANALYSIS AREA
AREA = 13,240 AC
UPLAND
DRAINAGE AREA
SCALE: 1"=4000'


ANALYSIS AREA
Hugle Run
Long Run
Cabin Run
Sheep Run
UPLAND
DRAINAGE AREA
SCALE: 1"=4000'


RS 1
RS 2
RS 3
RS 5
RS 6 RR
RS 6 B
RS 7
RS 8
APPROXIMATE FLOOD ZONE
BOUNDARY PER HEC-RAS STUDY
BY HORNOR BROTHERS ENGINEERS
FEMA FLOOD ZONE "A"
FROM WVGIS
SCALE: 1"=150'

F.

295000 FT

290000 FT

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0115C

FIRM

FLOOD INSURANCE RATE MAP

DODDRIDGE COUNTY, WEST VIRGINIA AND INCORPORATED AREAS

PANEL 115 OF 325

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
DODDRIDGE COUNTY	540024	0115	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
54017C0115C

MAP REVISED
OCTOBER 4, 2011

Federal Emergency Management Agency

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

5.

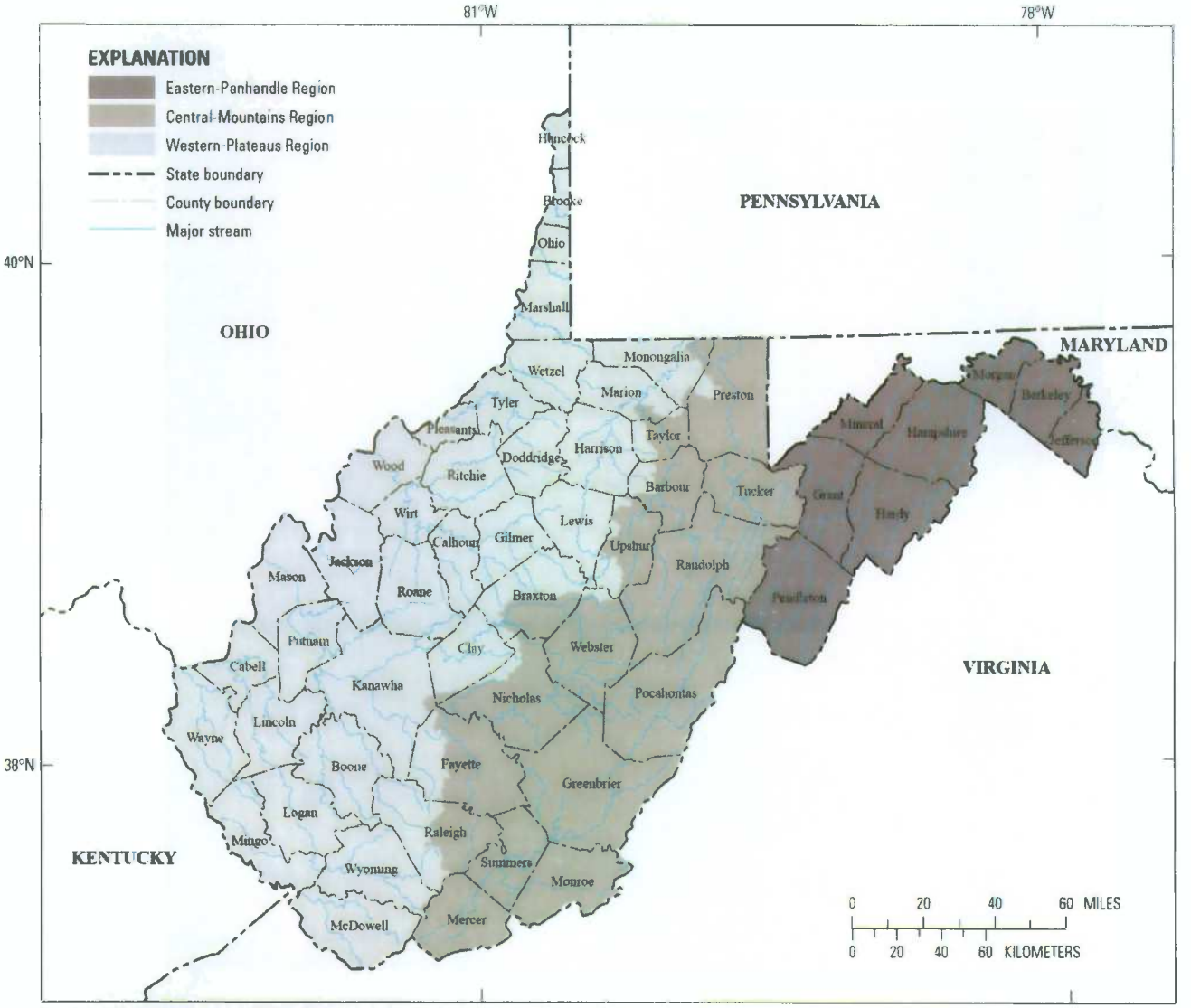
Figure 3.1 Floodplain area looking east

Figure 3.2 Floodplain area looking north

Figure 3.3 Arnolds Creek looking north (typical stream section & CR bridge)

Figure 3.4 Arnolds Creek looking south (typical stream section & RR bridge)

APPENDIX



Base from U.S. Geological Survey 1:100,000 digital line graphics for state boundaries and streams and from the West Virginia Department of Environmental Protection 1:24,000 digital data for county boundaries. Universal Transverse Mercator projection, zone 17, NAD 83

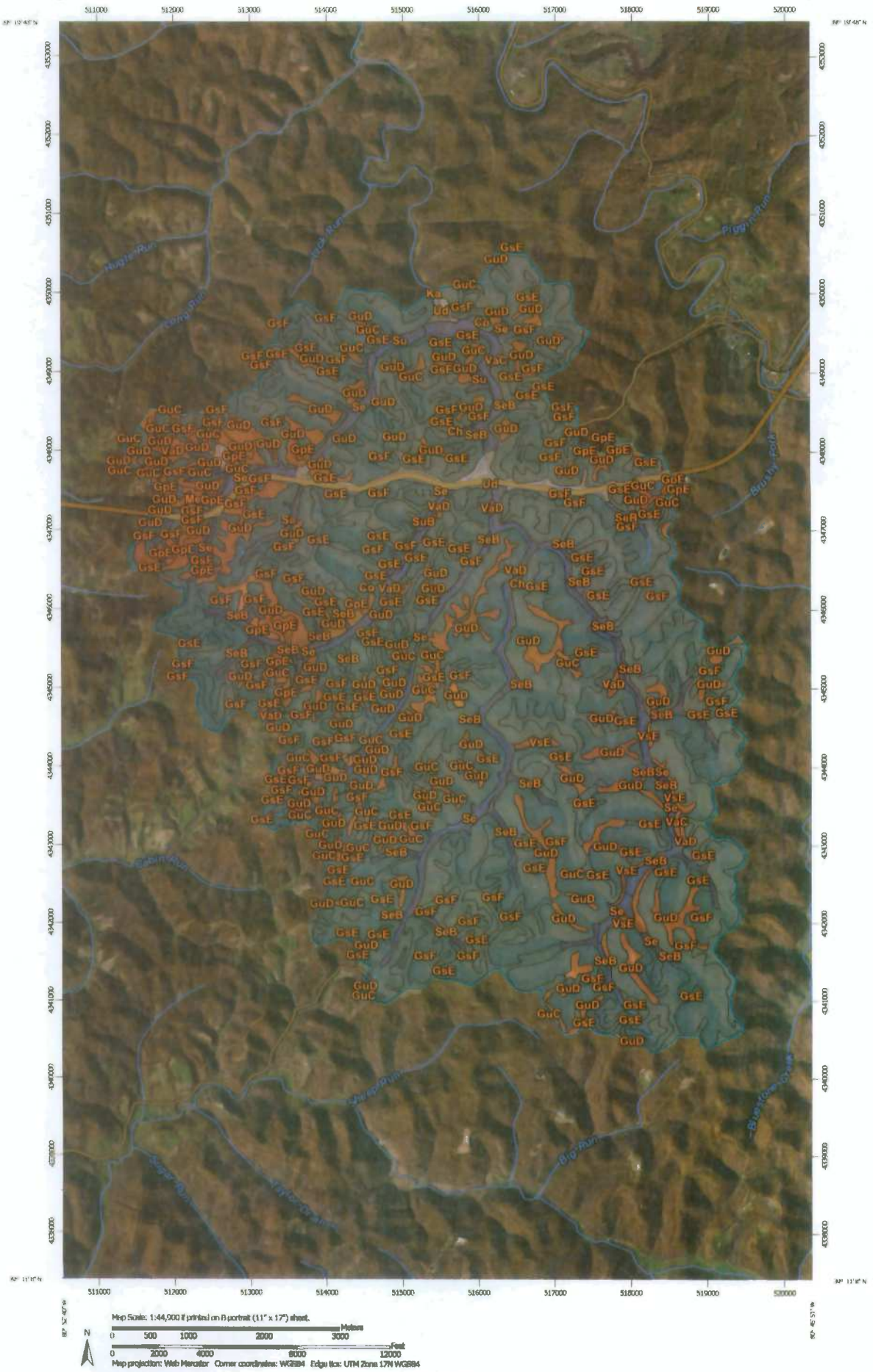
Figure 4. The Eastern Panhandle, Central Mountains, and Western Plateaus Regions of West Virginia for which equations for estimation of flood frequency discharges were developed in this study.

Table 4. Equations used to estimate selected flood-frequency discharges for streams in the Eastern Panhandle, Central Mountains, and Western Plateaus Regions of West Virginia.

[PK(n_n), peak discharge in cubic feet per second for the (n.n)-year recurrence interval; PK(n), peak discharge in cubic feet per second for the (n)-year recurrence interval; %, percent; AOP, annual-occurrence probability; DRNAREA, drainage area in square miles]

Equation	Standard error of the model, in percent	Average standard error of sampling, in percent	Average prediction error, in percent	Equivalent years of record, unitless
Eastern Panhandle Region (Range in DRNAREA from 0.21 to 1,461 for 57 streamgage stations)				
PK1_1(90%AOP) = 29.6 DRNAREA $^{0.818}$	43.4	10.3	44.8	3.4
PK1_5(67%AOP) = 46.4 DRNAREA $^{0.828}$	35.7	8.9	36.9	3.3
PK2(50%AOP) = 59.8 DRNAREA $^{0.832}$	32.1	8.6	33.4	4.1
PK5(20%AOP) = 105 DRNAREA $^{0.838}$	25.6	8.9	27.2	10.6
PK10(10%AOP) = 145 DRNAREA $^{0.842}$	22.5	9.5	24.5	19.1
PK25(4%AOP) = 204 DRNAREA $^{0.848}$	19.7	10.3	22.4	34.1
PK50(2%AOP) = 254 DRNAREA $^{0.852}$	18.6	11.1	21.7	46.1
PK100(1%AOP) = 307 DRNAREA $^{0.855}$	18.3	11.6	21.7	56.7
PK200(0.5%AOP) = 365 DRNAREA $^{0.859}$	18.4	12.4	22.4	64.7
PK500(0.2%AOP) = 447 DRNAREA $^{0.864}$	19.4	13.5	23.8	70.9
Central Mountains Region (Range in DRNAREA from 0.10 to 1,619 for 83 streamgage stations)				
PK1_1(90%AOP) = 33.4 DRNAREA $^{0.914}$	40.0	8.3	41.0	2.4
PK1_5(67%AOP) = 53.8 DRNAREA $^{0.887}$	34.6	7.3	35.4	2.0
PK2(50%AOP) = 69.4 DRNAREA $^{0.873}$	33.4	7.3	34.2	2.1
PK5(20%AOP) = 116 DRNAREA $^{0.845}$	34.1	8.0	35.1	3.2
PK10(10%AOP) = 153 DRNAREA $^{0.831}$	36.3	8.6	37.4	4.0
PK25(4%AOP) = 206 DRNAREA $^{0.816}$	39.9	9.8	41.2	4.8
PK50(2%AOP) = 250 DRNAREA $^{0.807}$	42.9	10.6	44.4	5.3
PK100(1%AOP) = 297 DRNAREA $^{0.800}$	46.2	11.3	47.9	5.6
PK200(0.5%AOP) = 347 DRNAREA $^{0.793}$	49.7	12.0	51.5	5.9
PK500(0.2%AOP) = 420 DRNAREA $^{0.785}$	54.3	13.1	56.3	6.1
Western Plateaus Region (Range in DRNAREA from 0.13 to 1,516 for 106 streamgage stations)				
PK1_1(90%AOP) = 56.9 DRNAREA $^{0.763}$	38.2	7.6	39.1	3.8
PK1_5(67%AOP) = 97.8 DRNAREA $^{0.741}$	33.4	6.5	34.1	2.8
PK2(50%AOP) = 129 DRNAREA $^{0.730}$	31.6	6.1	32.2	2.8
PK5(20%AOP) = 221 DRNAREA $^{0.710}$	29.3	6.5	30.0	4.4
PK10(10%AOP) = 292 DRNAREA $^{0.699}$	28.9	6.5	29.7	5.9
PK25(4%AOP) = 391 DRNAREA $^{0.688}$	29.4	7.3	30.3	7.9
PK50(2%AOP) = 472 DRNAREA $^{0.681}$	30.2	7.6	31.3	9.1
PK100(1%AOP) = 557 DRNAREA $^{0.674}$	31.4	8.0	32.5	10.1
PK200(0.5%AOP) = 647 DRNAREA $^{0.668}$	32.7	8.3	33.9	10.8
PK500(0.2%AOP) = 775 DRNAREA $^{0.661}$	34.8	8.9	36.1	11.4

Hydrologic Soil Group—Doddridge County, West Virginia
(288-13-AOI)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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

Soil Survey Area: Doddridge County, West Virginia
Survey Area Data: Version 8, Apr 2, 2009

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 7, 2011—May 11, 2012

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Doddridge County, West Virginia (WV017)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
Ch	Chagrin silt loam	B	186.4	1.4%
Co	Cotaco silt loam	C	18.1	0.1%
GpE	Gilpin-Peabody complex, 25 to 35 percent slopes	D	201.1	1.5%
GsE	Gilpin-Peabody complex, 15 to 35 percent slopes, very stony	C	3,104.7	23.4%
GsF	Gilpin-Peabody complex, 35 to 70 percent slopes, very stony	C	7,029.0	53.1%
GuC	Gilpin-Upshur complex, 8 to 15 percent slopes	D	192.4	1.5%
GuD	Gilpin-Upshur complex, 15 to 25 percent slopes	D	1,229.7	9.3%
Ka	Kanawha loam	B	2.4	0.0%
Me	Melvin silt loam	D	4.9	0.0%
Se	Sensabaugh silt loam	B	478.0	3.6%
SeB	Sensabaugh silt loam, 3 to 8 percent slopes, rarely flooded	B	326.7	2.5%
Su	Sensabaugh-Urban land complex	B	53.7	0.4%
SuB	Sensabaugh-Urban land complex, 3 to 8 percent slopes, rarely flooded	B	16.1	0.1%
Ud	Udorthents, smoothed		280.2	2.1%
VaC	Vandalia silt loam, 8 to 15 percent slopes	D	9.2	0.1%
VaD	Vandalia silt loam, 15 to 25 percent slopes	D	39.1	0.3%
VsE	Vandalia silt loam, 15 to 35 percent slopes, very stony	D	69.4	0.5%
Totals for Area of Interest			**13,241.4**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

HEC-RAS Version 4.1.0 Jan 2010
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X      X   X     X  X    X
X     X  X        X           X   X    X    X   X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X           X  X     X    X        X
X     X  X        X    X      X   X    X    X        X
X     X  XXXXXX    XXXX       X    X   X    X   XXXXX
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Project File : 288-13-FA-FINAL.prj
Run Date and Time: 12/3/2013 10:18:21 AM

Project in English units

PLAN DATA

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Plan File : m:\HBE PROJECTS\2013\ASI 2013\ASI 288-13 SATURN PHASE 6\HEC-RAS\288-13-FA-FINAL.p02

Geometry Title: 288-13-FA-FINAL
Geometry File : m:\HBE PROJECTS\2013\ASI 2013\ASI 288-13 SATURN PHASE 6\HEC-RAS\288-13-FA-FINAL.g03

Flow Title : 288-13-FA-FINAL
Flow File : m:\HBE PROJECTS\2013\ASI 2013\ASI 288-13 SATURN PHASE 6\HEC-RAS\288-13-FA-FINAL.f02

Plan Summary Information:

Number of:	Cross Sections	= 9	Multiple Openings	=	0
	Culverts	= 0	Inline Structures	=	0
	Bridges	= 0	Lateral Structures	=	0

Computational Information

Water surface calculation tolerance	= 0.01
Critical depth calculation tolerance	= 0.01
Maximum number of iterations	= 20
Maximum difference tolerance	= 0.3
Flow tolerance factor	= 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: 288-13-FA-FINAL
Flow File : m:\HBE PROJECTS\2013\ASI 2013\ASI 288-13 SATURN PHASE 6\HEC-RAS\288-13-FA-FINAL.f02

Flow Data (cfs)

River	Reach	RS	100 YR
ARNOLD CREEK	1	8	4446

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
ARNOLD CREEK	1	100 YR	Normal S = 0.0022	Normal S = 0.0022

GEOMETRY DATA

Geometry Title: 288-13-FA-FINAL
Geometry File : m:\HBE PROJECTS\2013\ASI 2013\ASI 288-13 SATURN PHASE 6\HEC-RAS\288-13-FA-FINAL.g03

CROSS SECTION

RIVER: ARNOLD CREEK
REACH: 1 RS: 8

INPUT
Description: RS8 STA0
Station Elevation Data num= 22

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	803	9.57	786.89	12.55	781.86	31.8	780.55	50.42	781.86
56.25	786.89	65.8	786.97	101.97	787.26	126.81	786.25	213.03	789.15
247.23	789.56	388.52	789.79	444.7	789.83	518.07	791.23	562.4	793.52
568.58	794.8	571.72	796.42	585.72	797.29	608.68	806.42	610.58	807.08
614.01	807.54	629.42	801.17						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	9.57	.035	56.25	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
9.57	56.25	699	691	345	.1	.3

CROSS SECTION OUTPUT Profile #100 YR

E.G. Elev (ft)	791.04	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.94	Wt. n-Val.	0.050	0.035
0.050				
W.S. Elev (ft)	790.09	Reach Len. (ft)	699.00	691.00

345.00					
Crit W.S. (ft)	788.90	Flow Area (sq ft)	3.05	387.03	
529.69					
E.G. Slope (ft/ft)	0.002938	Area (sq ft)	3.05	387.03	
529.69					
Q Total (cfs)	4446.00	Flow (cfs)	4.30	3416.80	
1024.91					
Top Width (ft)	450.88	Top Width (ft)	1.90	46.68	
402.30					
Vel Total (ft/s)	4.83	Avg. Vel. (ft/s)	1.41	8.83	
1.93					
Max Chl Dpth (ft)	9.54	Hydr. Depth (ft)	1.60	8.29	
1.32					
Conv. Total (cfs)	82022.3	Conv. (cfs)	79.3	63035.0	
18908.0					
Length Wtd. (ft)	528.62	Wetted Per. (ft)	3.73	51.51	
402.38					
Min Ch El (ft)	780.55	Shear (lb/sq ft)	0.15	1.38	
0.24					
Alpha	2.60	Stream Power (lb/ft s)	629.42	0.00	
0.00					
Frctn Loss (ft)	0.46	Cum Volume (acre-ft)	4.48	36.02	
34.65					
C & E Loss (ft)	0.26	Cum SA (acres)	1.58	4.03	
13.40					

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: ARNOLD CREEK
REACH: 1 RS: 7

INPUT
Description: RS7 STA 691
Station Elevation Data num= 24

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	803.44	10.04	787.5	13.76	781.6	35.1	780.7	52.21	782.01
57.27	787.5	71.62	787.23	83.06	787.98	93.74	788.06	100.94	786.5
103.74	786.69	111.63	789.37	117.4	787.94	216.45	787.02	259.91	786.49
297.59	785.96	339.87	786.57	482.24	786.62	519.56	785.41	564.06	785.9
613.01	785.96	672.45	786.87	693.46	790.56	711.37	791.08		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	10.04	.035	57.27	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
10.04	57.27	475	528	252	.1	.3

CROSS SECTION OUTPUT Profile #100 YR

E.G. Elev (ft)	790.32	Element	Left OB	Channel	
Right OB					
Vel Head (ft)	0.07	Wt. n-Val.	0.050	0.035	

0.050				
W.S. Elev (ft)	790.25	Reach Len. (ft)	475.00	528.00
252.00				
Crit W.S. (ft)		Flow Area (sq ft)	2.37	395.18
2252.15				
E.G. Slope (ft/ft)	0.000410	Area (sq ft)	2.37	395.18
2252.15				
Q Total (cfs)	4446.00	Flow (cfs)	1.16	1296.53
3148.31				
Top Width (ft)	683.36	Top Width (ft)	1.73	47.23
634.40				
Vel Total (ft/s)	1.68	Avg. Vel. (ft/s)	0.49	3.28
1.40				
Max Chl Dpth (ft)	9.55	Hydr. Depth (ft)	1.37	8.37
3.55				
Conv. Total (cfs)	219688.7	Conv. (cfs)	57.3	64064.8
155566.6				
Length Wtd. (ft)	367.44	Wetted Per. (ft)	3.24	52.96
635.56				
Min Ch El (ft)	780.70	Shear (lb/sq ft)	0.02	0.19
0.09				
Alpha	1.61	Stream Power (lb/ft s)	711.37	0.00
0.00				
Frctn Loss (ft)	0.17	Cum Volume (acre-ft)	4.44	29.82
23.64				
C & E Loss (ft)	0.01	Cum SA (acres)	1.55	3.28
9.30				

CROSS SECTION

RIVER: ARNOLD CREEK
REACH: 1 RS: 6.2

INPUT
Description: RS6B STA 1219
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-161.43	800	0	790.16	69.48	793.87	136.12	791.8	197.63	787.46
213.87	781.19	240.24	780.2	255.96	780.11	272.01	785.1	369.86	785.46
436.55	785.73	502.02	785.44	622.74	800				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-161.43	.05	197.63	.035	272.01	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
197.63	272.01	388	204	131	.1	.3

CROSS SECTION OUTPUT Profile #100 YR

E.G. Elev (ft)	790.14	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.15	Wt. n-Val.	0.050	0.035
0.050				
W.S. Elev (ft)	789.99	Reach Len. (ft)	388.00	204.00
131.00				
Crit W.S. (ft)		Flow Area (sq ft)	45.19	609.88
1126.90				
E.G. Slope (ft/ft)	0.000534	Area (sq ft)	45.19	609.88

1126.90					
Q Total (cfs)	4446.00	Flow (cfs)	36.21	2392.59	2017.21
Top Width (ft)	377.86	Top Width (ft)	35.79	74.38	267.69
Vel Total (ft/s)	2.49	Avg. Vel. (ft/s)	0.80	3.92	1.79
Max Chl Dpth (ft)	9.88	Hydr. Depth (ft)	1.26	8.20	4.21
Conv. Total (cfs)	192308.1	Conv. (cfs)	1566.1	103489.3	87252.6
Length Wtd. (ft)	188.19	Wetted Per. (ft)	35.88	76.33	267.97
Min Ch El (ft)	780.11	Shear (lb/sq ft)	0.04	0.27	0.14
Alpha	1.56	Stream Power (lb/ft s)	622.74	0.00	0.00
Frctn Loss (ft)	0.12	Cum Volume (acre-ft)	4.18	23.73	13.86
C & E Loss (ft)	0.03	Cum SA (acres)	1.35	2.54	6.69

CROSS SECTION

RIVER: ARNOLD CREEK
REACH: 1 RS: 6.1

INPUT
Description: RS 6RR STA 1423
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	806.55	.5	785.05	1	778.05	36	778.05	73	778.05
73.5	785.05	74	806.55						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	.5	.035	73.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
.5	73.5	206	208	747	.1	.3

CROSS SECTION OUTPUT Profile #100 YR

E.G. Elev (ft)	789.99	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.44	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	789.55	Reach Len. (ft)	206.00	208.00	747.00
Crit W.S. (ft)		Flow Area (sq ft)	0.24	835.96	0.24
E.G. Slope (ft/ft)	0.000757	Area (sq ft)	0.24	835.96	0.24
Q Total (cfs)	4446.00	Flow (cfs)	0.03	4445.95	0.03
Top Width (ft)	73.21	Top Width (ft)	0.10	73.00	0.10
Vel Total (ft/s)	5.32	Avg. Vel. (ft/s)	0.11	5.32	0.11

Max Chl Dpth (ft)	11.50	Hydr. Depth (ft)	2.25	11.45	2.25
Conv. Total (cfs)	161603.9	Conv. (cfs)	1.0	161602.0	1.0
Length Wtd. (ft)	247.04	Wetted Per. (ft)	4.50	86.04	4.50
Min Ch El (ft)	778.05	Shear (lb/sq ft)	0.00	0.46	0.00
Alpha	1.00	Stream Power (lb/ft s)	74.00	0.00	0.00
Frctn Loss (ft)	0.21	Cum Volume (acre-ft)	3.98	20.34	12.17
C & E Loss (ft)	0.01	Cum SA (acres)	1.19	2.20	6.28

CROSS SECTION

RIVER: ARNOLD CREEK
REACH: 1 RS: 5

INPUT
Description: RS5 STA 1631
Station Elevation Data num= 22

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	790.53	16.45	805.22	44.51	804.56	68.52	783.9	71.09	783.62
74.04	779.99	102.28	779.64	130.74	779.61	148.01	786.36	189.87	787.05
334.07	787.85	405.78	788.35	476.88	789.54	540.4	790.19	604.6	790.54
670.08	790.77	701.8	806.67	733.86	820.42	739.82	822.77	752.83	822.9
758.88	822.69	766.56	825.75						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	68.52	.035	148.01	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
68.52	148.01	256	274	358	.1	.3

CROSS SECTION OUTPUT Profile #100 YR

E.G. Elev (ft)	789.77	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	789.37	Reach Len. (ft)	256.00	274.00	358.00
Crit W.S. (ft)		Flow Area (sq ft)	17.40	694.29	511.03
E.G. Slope (ft/ft)	0.000959	Area (sq ft)	17.40	694.29	511.03
Q Total (cfs)	4446.00	Flow (cfs)	26.03	3775.91	644.06
Top Width (ft)	404.65	Top Width (ft)	6.36	79.49	318.80
Vel Total (ft/s)	3.64	Avg. Vel. (ft/s)	1.50	5.44	1.26
Max Chl Dpth (ft)	9.76	Hydr. Depth (ft)	2.74	8.73	1.60
Conv. Total (cfs)	143587.1	Conv. (cfs)	840.6	121946.1	20800.3

Length Wtd. (ft)	280.81	Wetted Per. (ft)	8.39	82.51	318.82
Min Ch El (ft)	779.61	Shear (lb/sq ft)	0.12	0.50	0.10
Alpha	1.92	Stream Power (lb/ft s)	766.56	0.00	0.00
Frctn Loss (ft)	0.33	Cum Volume (acre-ft)	3.94	16.69	7.78
C & E Loss (ft)	0.03	Cum SA (acres)	1.17	1.84	3.55

CROSS SECTION

RIVER: ARNOLD CREEK
REACH: 1 RS: 4

INPUT
Description: RS4 STA 1905
Station Elevation Data num= 25

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	791.35	9.59	802.22	13.33	802.58	24.34	802.49	29.82	801.69
43.39	788.96	56.76	785.73	70.55	782.78	84.47	783.13	91.91	778.75
111.7	777.62	131.95	778.74	138.59	783.12	142.1	785.45	207.03	789.15
275.97	788.93	375.17	789.59	429.08	789.86	497.25	790.18	567.87	791.07
576.45	796.47	579.31	797.53	592.6	797.63	597.304	796.34	603.51	801.16

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	84.47	.035	138.59	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
84.47	138.59	284	295	403	.1	.3

CROSS SECTION OUTPUT Profile #100 YR

E.G. Elev (ft)	789.41	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.70	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	788.70	Reach Len. (ft)	284.00	295.00	403.00
Crit W.S. (ft)		Flow Area (sq ft)	159.60	530.56	108.29
E.G. Slope (ft/ft)	0.001456	Area (sq ft)	159.60	530.56	108.29
Q Total (cfs)	4446.00	Flow (cfs)	450.15	3816.55	179.30
Top Width (ft)	154.71	Top Width (ft)	40.01	54.12	60.58
Vel Total (ft/s)	5.57	Avg. Vel. (ft/s)	2.82	7.19	1.66
Max Chl Dpth (ft)	11.08	Hydr. Depth (ft)	3.99	9.80	1.79
Conv. Total (cfs)	116528.7	Conv. (cfs)	11798.3	100031.0	4699.4
Length Wtd. (ft)	307.00	Wetted Per. (ft)	40.68	56.69	61.37
Min Ch El (ft)	777.62	Shear (lb/sq ft)	0.36	0.85	0.16

Alpha	1.46	Stream Power (lb/ft s)	603.51	0.00	0.00
Frctn Loss (ft)	0.45	Cum Volume (acre-ft)	3.42	12.84	5.24
C & E Loss (ft)	0.06	Cum SA (acres)	1.04	1.42	1.99

CROSS SECTION

RIVER: ARNOLD CREEK
REACH: 1 RS: 3

INPUT
Description: RS3 STA 2200
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	791.63	5.43	786.97	8.94	787.88	19.64	787.78	25.34	787.24
31.76	782.76	39.32	781.59	46.42	778.51	65.11	778.04	84.77	777.75
92.96	787.8	167.91	783.4	249.95	788.9	322.39	791.2	388.67	791.72
401.61	798.7								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	25.34	.035	92.96	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
25.34	92.96	263	312	373	.1 .3

CROSS SECTION OUTPUT Profile #100 YR

E.G. Elev (ft)	788.90	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.51	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	788.39	Reach Len. (ft)	263.00	312.00	373.00
Crit W.S. (ft)		Flow Area (sq ft)	15.65	569.58	395.38
E.G. Slope (ft/ft)	0.001453	Area (sq ft)	15.65	569.58	395.38
Q Total (cfs)	4446.00	Flow (cfs)	14.03	3576.26	855.71
Top Width (ft)	238.63	Top Width (ft)	21.57	67.62	149.44
Vel Total (ft/s)	4.53	Avg. Vel. (ft/s)	0.90	6.28	2.16
Max Chl Dpth (ft)	10.64	Hydr. Depth (ft)	0.73	8.42	2.65
Conv. Total (cfs)	116628.0	Conv. (cfs)	368.0	93812.8	22447.2
Length Wtd. (ft)	313.47	Wetted Per. (ft)	22.24	74.54	149.73
Min Ch El (ft)	777.75	Shear (lb/sq ft)	0.06	0.69	0.24
Alpha	1.59	Stream Power (lb/ft s)	401.61	0.00	0.00
Frctn Loss (ft)	0.56	Cum Volume (acre-ft)	2.85	9.11	2.91
C & E Loss (ft)	0.04	Cum SA (acres)	0.84	1.00	

1.02

CROSS SECTION

RIVER: ARNOLD CREEK
REACH: 1 RS: 2

INPUT
Description: RS2 STA 2512
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	795.96	6.57	790.56	10.78	791.27	24.59	791.6	31.04	791.58
44.26	787.89	76.19	785.45	112.75	782.47	136.84	778.53	159.68	777.38
176.2	779.65	195.23	788.22	234.18	800				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	136.84	.035	176.2	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
136.84	176.2	473	592	547	.1	.3

CROSS SECTION OUTPUT Profile #100 YR

E.G. Elev (ft)	788.30	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.90	Wt. n-Val.	0.050	0.035
0.050				
W.S. Elev (ft)	787.41	Reach Len. (ft)	473.00	592.00
547.00				
Crit W.S. (ft)		Flow Area (sq ft)	317.42	362.76
66.80				
E.G. Slope (ft/ft)	0.002214	Area (sq ft)	317.42	362.76
66.80				
Q Total (cfs)	4446.00	Flow (cfs)	1053.78	3175.43
216.79				
Top Width (ft)	142.84	Top Width (ft)	86.25	39.36
17.22				
Vel Total (ft/s)	5.95	Avg. Vel. (ft/s)	3.32	8.75
3.25				
Max Chl Dpth (ft)	10.03	Hydr. Depth (ft)	3.68	9.22
3.88				
Conv. Total (cfs)	94492.7	Conv. (cfs)	22396.5	67488.7
4607.5				
Length Wtd. (ft)	575.04	Wetted Per. (ft)	86.77	39.54
18.89				
Min Ch El (ft)	777.38	Shear (lb/sq ft)	0.51	1.27
0.49				
Alpha	1.63	Stream Power (lb/ft s)	234.18	0.00
0.00				
Frctn Loss (ft)	1.27	Cum Volume (acre-ft)	1.84	5.77
0.93				
C & E Loss (ft)	0.02	Cum SA (acres)	0.51	0.62
0.31				

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the

need for additional cross sections.

CROSS SECTION

RIVER: ARNOLD CREEK
REACH: 1 RS: 1

INPUT
Description: RS1 STA 3104
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-11.95	800	0	789.34	12.87	780.49	19.07	776.24	41.1	775.49
58.17	776.52	64.7	780.49	94.12	785.84	103.91	786.3	117.44	786.3
141.5	786.54	205.61	788.86	274.62	791.01	307.86	800.69		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-11.95	.05	12.87	.035	64.7	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
12.87	64.7	0	0	.1	.3

CROSS SECTION OUTPUT Profile #100 YR

E.G. Elev (ft)	787.02	Element	Left OB	Channel
Right OB				
Vel Head (ft)	1.08	Wt. n-Val.	0.050	0.035
0.050				
W.S. Elev (ft)	785.93	Reach Len. (ft)		
Crit W.S. (ft)	782.77	Flow Area (sq ft)	21.53	486.63
81.49				
E.G. Slope (ft/ft)	0.002201	Area (sq ft)	21.53	486.63
81.49				
Q Total (cfs)	4446.00	Flow (cfs)	51.43	4182.06
212.51				
Top Width (ft)	91.11	Top Width (ft)	7.91	51.83
31.37				
Vel Total (ft/s)	7.54	Avg. Vel. (ft/s)	2.39	8.59
2.61				
Max Chl Dpth (ft)	10.44	Hydr. Depth (ft)	2.72	9.39
2.60				
Conv. Total (cfs)	94759.1	Conv. (cfs)	1096.1	89133.7
4529.3				
Length Wtd. (ft)		Wetted Per. (ft)	9.60	54.30
31.86				
Min Ch El (ft)	775.49	Shear (lb/sq ft)	0.31	1.23
0.35				
Alpha	1.23	Stream Power (lb/ft s)	307.86	0.00
0.00				
Frctn Loss (ft)		Cum Volume (acre-ft)		
C & E Loss (ft)		Cum SA (acres)		

SUMMARY OF MANNING'S N VALUES

River:ARNOLD CREEK

Reach	River Sta.	n1	n2	n3
1	8	.05	.035	.05
1	7	.05	.035	.05
1	6.2	.05	.035	.05
1	6.1	.05	.035	.05
1	5	.05	.035	.05
1	4	.05	.035	.05
1	3	.05	.035	.05
1	2	.05	.035	.05
1	1	.05	.035	.05

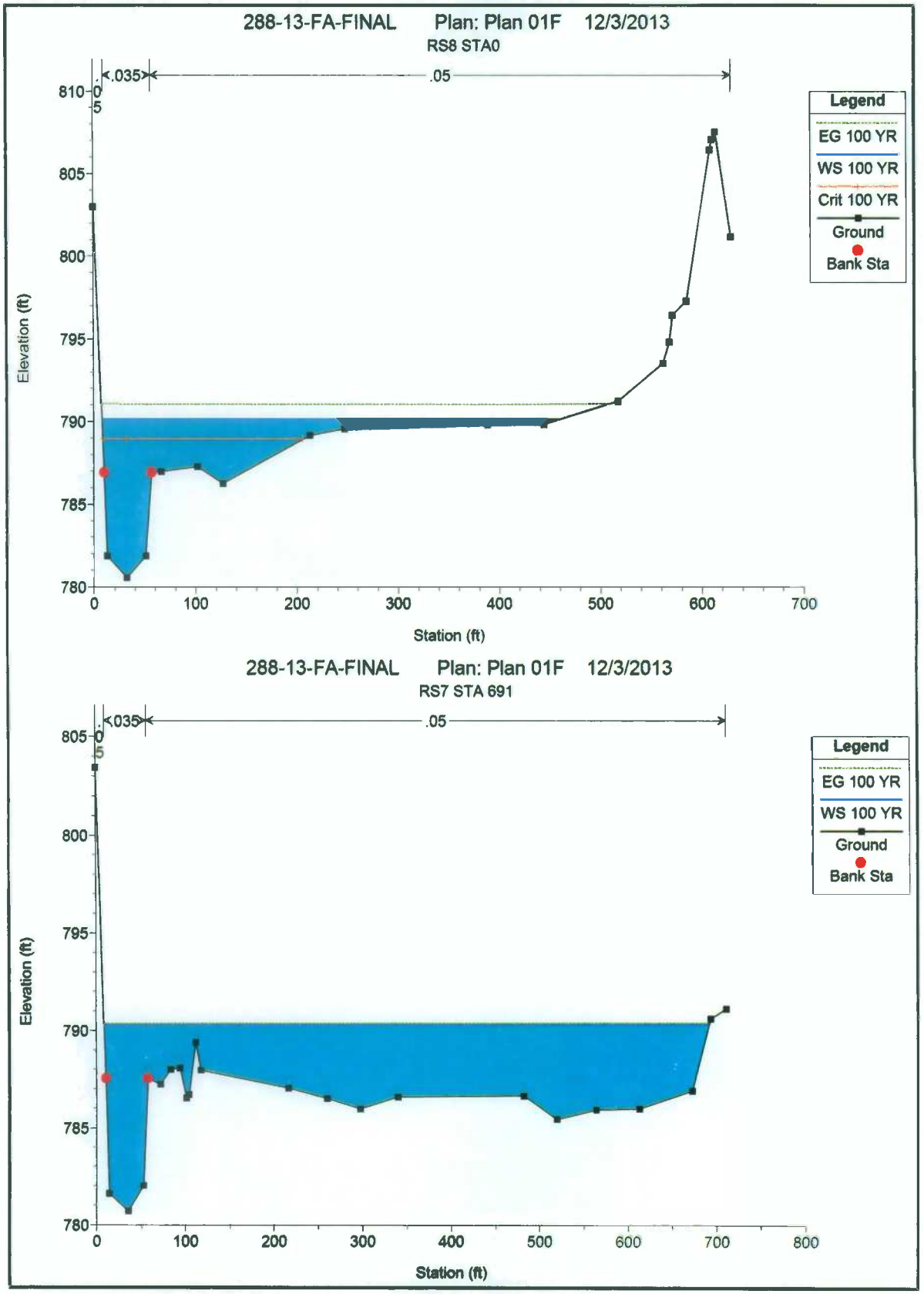
SUMMARY OF REACH LENGTHS

River: ARNOLD CREEK

Reach	River Sta.	Left	Channel	Right
1	8	699	691	345
1	7	475	528	252
1	6.2	388	204	131
1	6.1	206	208	747
1	5	256	274	358
1	4	284	295	403
1	3	263	312	373
1	2	473	592	547
1	1	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: ARNOLD CREEK

Reach	River Sta.	Contr.	Expan.
1	8	.1	.3
1	7	.1	.3
1	6.2	.1	.3
1	6.1	.1	.3
1	5	.1	.3
1	4	.1	.3
1	3	.1	.3
1	2	.1	.3
1	1	.1	.3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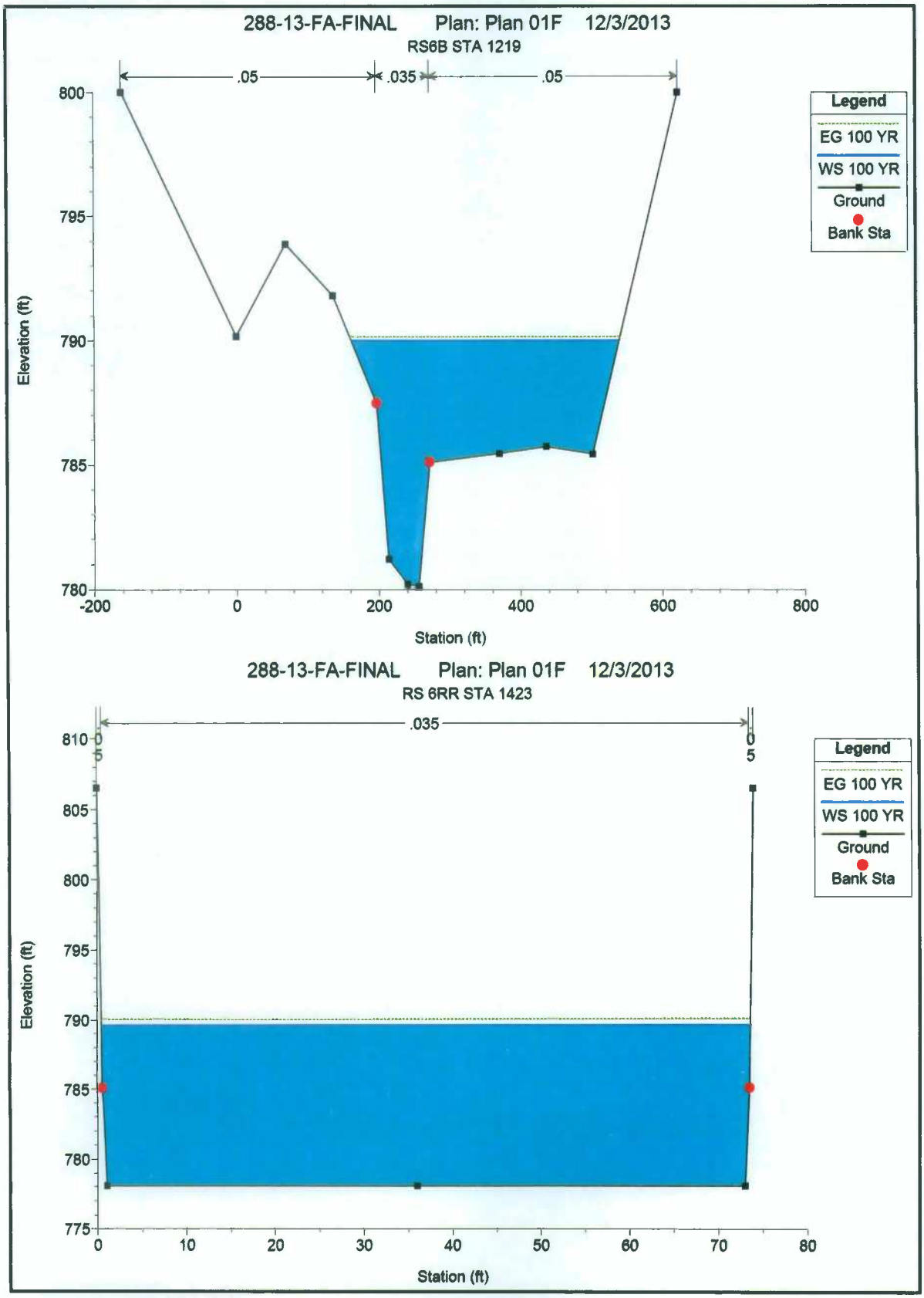
.05
Legend
EG 100 YR
WS 100 YR
Crit 100 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
288-13-FA-FINAL Plan: Plan 01F 12/3/2013
RS7 STA 691
.035
.05
Legend
EG 100 YR
WS 100 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)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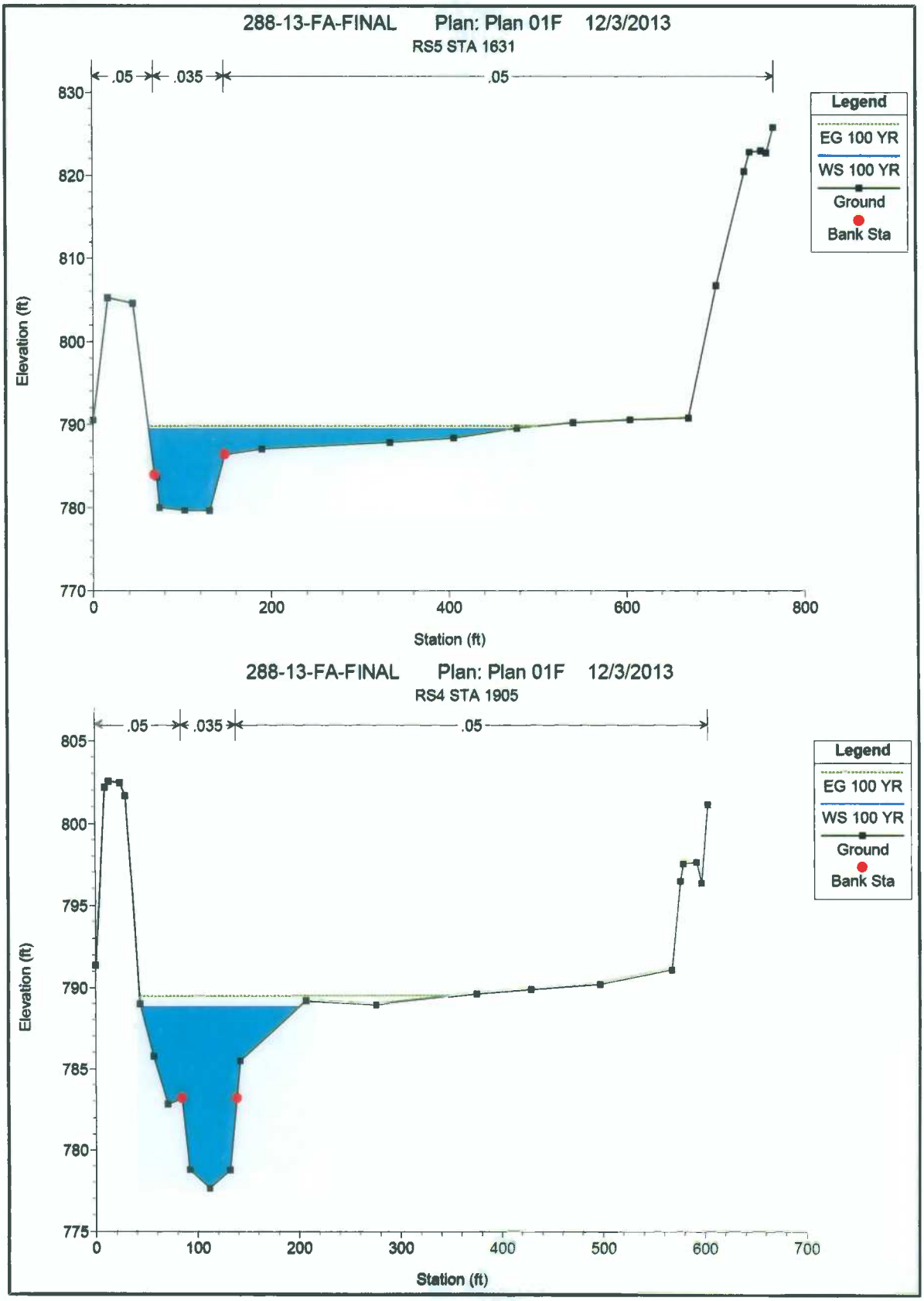
Legend
EG 100 YR
WS 100 YR
Ground
Bank Sta
Elevation (ft)
800
795
790
785
780
-200
0
200
400
600
800
Station (ft)
288-13-FA-FINAL Plan: Plan 01F 12/3/2013
RS 6RR STA 1423
.035
.05
.05
Legend
EG 100 YR
WS 100 YR
Ground
Bank Sta
Elevation (ft)
810
805
800
795
790
785
780
775
0
10
20
30
40
50
60
70
80
Station (ft)


288-13-FA-FINAL Plan: Plan 01F 12/3/2013
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Legend
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WS 100 YR
Ground
Bank Sta
Elevation (ft)
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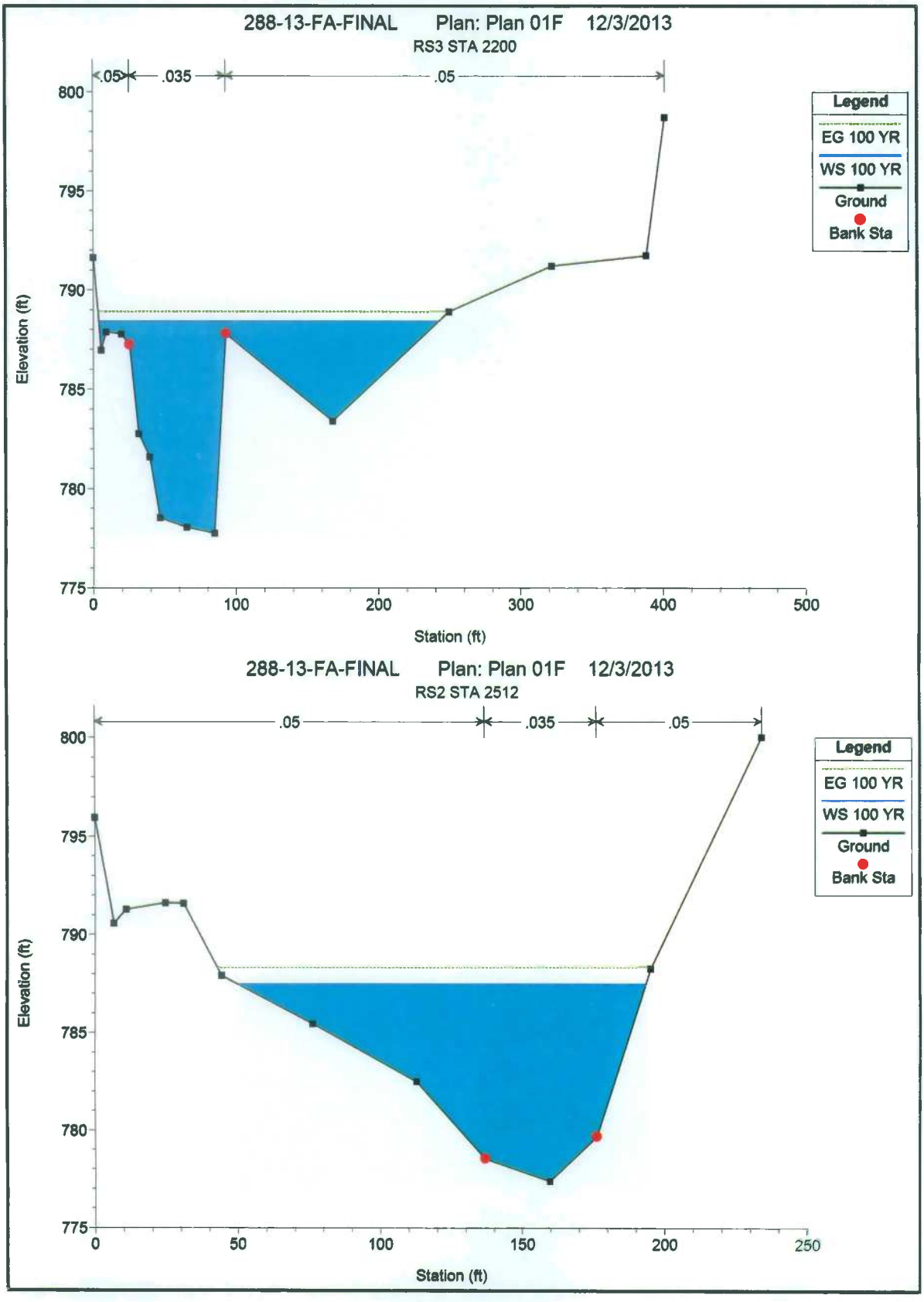
820
810
800
790
780
770
0
200
400
600
800
Station (ft)
288-13-FA-FINAL Plan: Plan 01F 12/3/2013
RS4 STA 1905
.05
.035
.05
Legend
EG 100 YR
WS 100 YR
Ground
Bank Sta
Elevation (ft)
805
800
795
790
785
780
775
0
100
200
300
400
500
600
700
Station (ft)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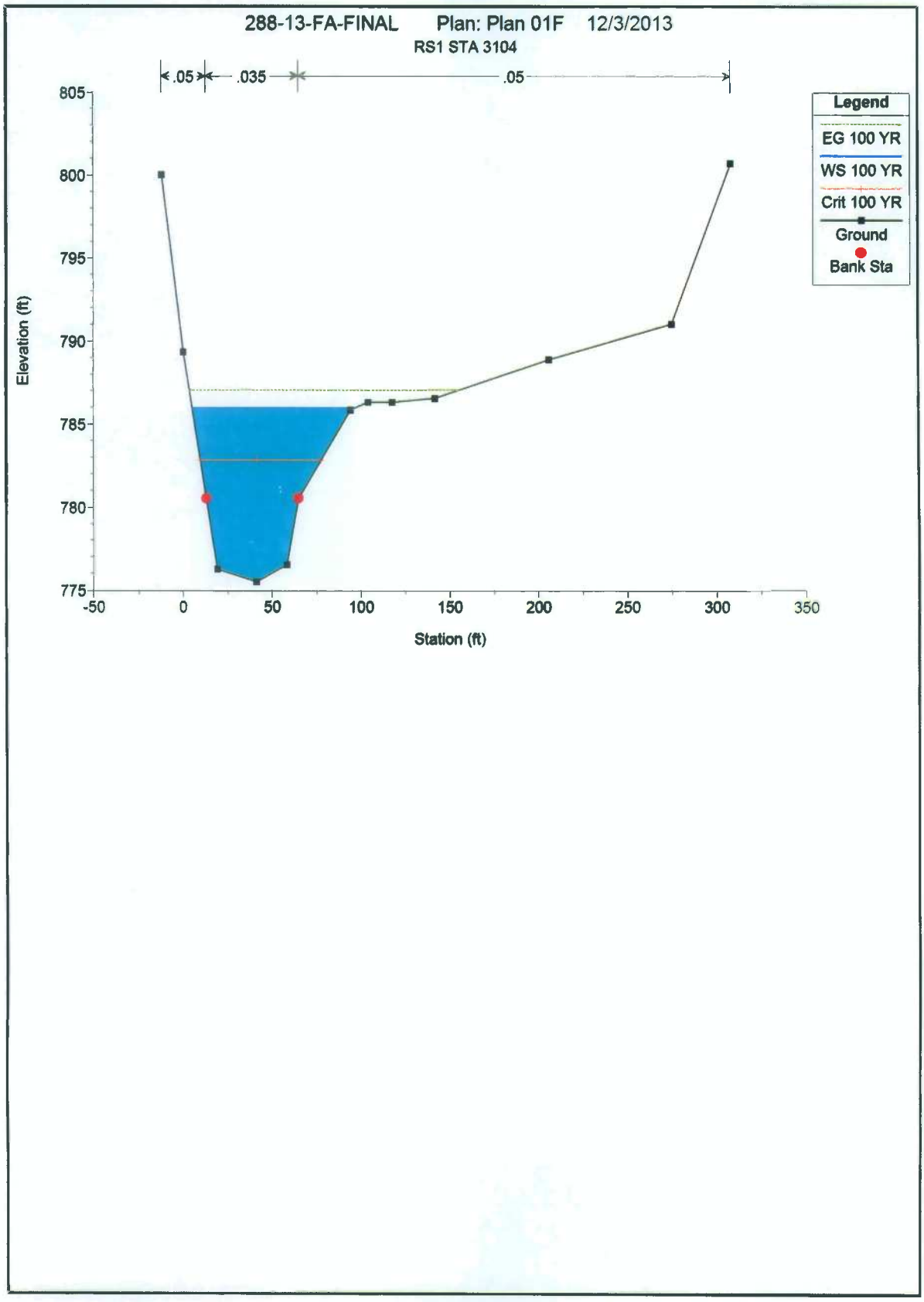
RS3 STA 2200
.05
.035
.05
Legend
EG 100 YR
WS 100 YR
Ground
Bank Sta
Elevation (ft)
800
795
790
785
780
775
0
100
200
300
400
500
Station (ft)
288-13-FA-FINAL Plan: Plan 01F 12/3/2013
RS2 STA 2512
.05
.035
.05
Legend
EG 100 YR
WS 100 YR
Ground
Bank Sta
Elevation (ft)
800
795
790
785
780
775
0
50
100
150
200
250
Station (ft)


288-13-FA-FINAL Plan: Plan 01F 12/3/2013
RS1 STA 3104
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.035
.05
Legend
EG 100 YR
WS 100 YR
Crit 100 YR
Ground
Bank Sta
Elevation (ft)
805
800
795
790
785
780
775
-50
0
50
100
150
200
250
300
350
Station (ft)

Plan: 1F ARNOLD CREEK 1 RS: 8 Profile: 100 YR

E.G. Elev (ft)	791.04	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.94	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	790.09	Reach Len. (ft)	699.00	691.00	345.00
Crit W.S. (ft)	788.90	Flow Area (sq ft)	3.05	387.03	529.69
E.G. Slope (ft/ft)	0.002938	Area (sq ft)	3.05	387.03	529.69
Q Total (cfs)	4446.00	Flow (cfs)	4.30	3416.80	1024.91
Top Width (ft)	450.88	Top Width (ft)	1.90	46.68	402.30
Vel Total (ft/s)	4.83	Avg. Vel. (ft/s)	1.41	8.83	1.93
Max Chl Dpth (ft)	9.54	Hydr. Depth (ft)	1.60	8.29	1.32
Conv. Total (cfs)	82022.3	Conv. (cfs)	79.3	63035.0	18908.0
Length Wtd. (ft)	528.62	Wetted Per. (ft)	3.73	51.51	402.38
Min Ch El (ft)	780.55	Shear (lb/sq ft)	0.15	1.38	0.24
Alpha	2.60	Stream Power (lb/ft s)	629.42	0.00	0.00
Frctn Loss (ft)	0.46	Cum Volume (acre-ft)	4.48	36.02	34.65
C & E Loss (ft)	0.26	Cum SA (acres)	1.58	4.03	13.40

Plan: 1F ARNOLD CREEK 1 RS: 7 Profile: 100 YR

E.G. Elev (ft)	790.32	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.07	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	790.25	Reach Len. (ft)	475.00	528.00	252.00
Crit W.S. (ft)		Flow Area (sq ft)	2.37	395.18	2252.15
E.G. Slope (ft/ft)	0.000410	Area (sq ft)	2.37	395.18	2252.15
Q Total (cfs)	4446.00	Flow (cfs)	1.16	1296.53	3148.31
Top Width (ft)	683.36	Top Width (ft)	1.73	47.23	634.40
Vel Total (ft/s)	1.68	Avg. Vel. (ft/s)	0.49	3.28	1.40
Max Chl Dpth (ft)	9.55	Hydr. Depth (ft)	1.37	8.37	3.55
Conv. Total (cfs)	219688.7	Conv. (cfs)	57.3	64064.8	155566.6
Length Wtd. (ft)	367.44	Wetted Per. (ft)	3.24	52.96	635.56
Min Ch El (ft)	780.70	Shear (lb/sq ft)	0.02	0.19	0.09
Alpha	1.61	Stream Power (lb/ft s)	711.37	0.00	0.00
Frctn Loss (ft)	0.17	Cum Volume (acre-ft)	4.44	29.82	23.64
C & E Loss (ft)	0.01	Cum SA (acres)	1.55	3.28	9.30

Plan: 1F ARNOLD CREEK 1 RS: 6.2 Profile: 100 YR

E.G. Elev (ft)	790.14	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.15	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	789.99	Reach Len. (ft)	388.00	204.00	131.00
Crit W.S. (ft)		Flow Area (sq ft)	45.19	609.88	1126.90
E.G. Slope (ft/ft)	0.000534	Area (sq ft)	45.19	609.88	1126.90
Q Total (cfs)	4446.00	Flow (cfs)	36.21	2392.59	2017.21
Top Width (ft)	377.86	Top Width (ft)	35.79	74.38	267.69
Vel Total (ft/s)	2.49	Avg. Vel. (ft/s)	0.80	3.92	1.79
Max Chl Dpth (ft)	9.88	Hydr. Depth (ft)	1.26	8.20	4.21
Conv. Total (cfs)	192308.1	Conv. (cfs)	1566.1	103489.3	87252.6
Length Wtd. (ft)	188.19	Wetted Per. (ft)	35.88	76.33	267.97
Min Ch El (ft)	780.11	Shear (lb/sq ft)	0.04	0.27	0.14
Alpha	1.56	Stream Power (lb/ft s)	622.74	0.00	0.00
Frctn Loss (ft)	0.12	Cum Volume (acre-ft)	4.18	23.73	13.86
C & E Loss (ft)	0.03	Cum SA (acres)	1.35	2.54	6.69

Plan: 1F ARNOLD CREEK 1 RS: 6.1 Profile: 100 YR

E.G. Elev (ft)	789.99	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.44	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	789.55	Reach Len. (ft)	206.00	208.00	747.00
Crit W.S. (ft)		Flow Area (sq ft)	0.24	835.96	0.24
E.G. Slope (ft/ft)	0.000757	Area (sq ft)	0.24	835.96	0.24
Q Total (cfs)	4446.00	Flow (cfs)	0.03	4445.95	0.03
Top Width (ft)	73.21	Top Width (ft)	0.10	73.00	0.10
Vel Total (ft/s)	5.32	Avg. Vel. (ft/s)	0.11	5.32	0.11
Max Chl Dpth (ft)	11.50	Hydr. Depth (ft)	2.25	11.45	2.25
Conv. Total (cfs)	161603.9	Conv. (cfs)	1.0	161602.0	1.0
Length Wtd. (ft)	247.04	Wetted Per. (ft)	4.50	86.04	4.50
Min Ch El (ft)	778.05	Shear (lb/sq ft)	0.00	0.46	0.00
Alpha	1.00	Stream Power (lb/ft s)	74.00	0.00	0.00
Frctn Loss (ft)	0.21	Cum Volume (acre-ft)	3.98	20.34	12.17
C & E Loss (ft)	0.01	Cum SA (acres)	1.19	2.20	6.28

Plan: 1F ARNOLD CREEK 1 RS: 5 Profile: 100 YR

E.G. Elev (ft)	789.77	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.39	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	789.37	Reach Len. (ft)	256.00	274.00	358.00
Crit W.S. (ft)		Flow Area (sq ft)	17.40	694.29	511.03
E.G. Slope (ft/ft)	0.000959	Area (sq ft)	17.40	694.29	511.03
Q Total (cfs)	4446.00	Flow (cfs)	26.03	3775.91	644.06
Top Width (ft)	404.65	Top Width (ft)	6.36	79.49	318.80
Vel Total (ft/s)	3.64	Avg. Vel. (ft/s)	1.50	5.44	1.26
Max Chl Dpth (ft)	9.76	Hydr. Depth (ft)	2.74	8.73	1.60
Conv. Total (cfs)	143587.1	Conv. (cfs)	840.6	121946.1	20800.3
Length Wtd. (ft)	280.81	Wetted Per. (ft)	8.39	82.51	318.82
Min Ch El (ft)	779.61	Shear (lb/sq ft)	0.12	0.50	0.10
Alpha	1.92	Stream Power (lb/ft s)	766.56	0.00	0.00
Frctn Loss (ft)	0.33	Cum Volume (acre-ft)	3.94	16.69	7.78
C & E Loss (ft)	0.03	Cum SA (acres)	1.17	1.84	3.55

Plan: 1F ARNOLD CREEK 1 RS: 4 Profile: 100 YR

E.G. Elev (ft)	789.41	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.70	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	788.70	Reach Len. (ft)	284.00	295.00	403.00
Crit W.S. (ft)		Flow Area (sq ft)	159.60	530.56	108.29
E.G. Slope (ft/ft)	0.001456	Area (sq ft)	159.60	530.56	108.29
Q Total (cfs)	4446.00	Flow (cfs)	450.15	3816.55	179.30
Top Width (ft)	154.71	Top Width (ft)	40.01	54.12	60.58
Vel Total (ft/s)	5.57	Avg. Vel. (ft/s)	2.82	7.19	1.66
Max Chl Dpth (ft)	11.08	Hydr. Depth (ft)	3.99	9.80	1.79
Conv. Total (cfs)	116528.7	Conv. (cfs)	11798.3	100031.0	4699.4
Length Wtd. (ft)	307.00	Wetted Per. (ft)	40.68	56.69	61.37
Min Ch El (ft)	777.62	Shear (lb/sq ft)	0.36	0.85	0.16
Alpha	1.46	Stream Power (lb/ft s)	603.51	0.00	0.00
Frctn Loss (ft)	0.45	Cum Volume (acre-ft)	3.42	12.84	5.24
C & E Loss (ft)	0.06	Cum SA (acres)	1.04	1.42	1.99

Plan: 1F ARNOLD CREEK 1 RS: 3 Profile: 100 YR

E.G. Elev (ft)	788.90	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.51	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	788.39	Reach Len. (ft)	263.00	312.00	373.00
Crit W.S. (ft)		Flow Area (sq ft)	15.65	569.58	395.38
E.G. Slope (ft/ft)	0.001453	Area (sq ft)	15.65	569.58	395.38
Q Total (cfs)	4446.00	Flow (cfs)	14.03	3576.26	855.71
Top Width (ft)	238.63	Top Width (ft)	21.57	67.62	149.44
Vel Total (ft/s)	4.53	Avg. Vel. (ft/s)	0.90	6.28	2.16
Max Chl Dpth (ft)	10.64	Hydr. Depth (ft)	0.73	8.42	2.65
Conv. Total (cfs)	116628.0	Conv. (cfs)	368.0	93812.8	22447.2
Length Wtd. (ft)	313.47	Wetted Per. (ft)	22.24	74.54	149.73
Min Ch El (ft)	777.75	Shear (lb/sq ft)	0.06	0.69	0.24
Alpha	1.59	Stream Power (lb/ft s)	401.61	0.00	0.00
Frctn Loss (ft)	0.56	Cum Volume (acre-ft)	2.85	9.11	2.91
C & E Loss (ft)	0.04	Cum SA (acres)	0.84	1.00	1.02

Plan: 1F ARNOLD CREEK 1 RS: 2 Profile: 100 YR

E.G. Elev (ft)	788.30	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.90	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	787.41	Reach Len. (ft)	473.00	592.00	547.00
Crit W.S. (ft)		Flow Area (sq ft)	317.42	362.76	66.80
E.G. Slope (ft/ft)	0.002214	Area (sq ft)	317.42	362.76	66.80
Q Total (cfs)	4446.00	Flow (cfs)	1053.78	3175.43	216.79
Top Width (ft)	142.84	Top Width (ft)	86.25	39.36	17.22
Vel Total (ft/s)	5.95	Avg. Vel. (ft/s)	3.32	8.75	3.25
Max Chl Dpth (ft)	10.03	Hydr. Depth (ft)	3.68	9.22	3.88
Conv. Total (cfs)	94492.7	Conv. (cfs)	22396.5	67488.7	4607.5
Length Wtd. (ft)	575.04	Wetted Per. (ft)	86.77	39.54	18.89
Min Ch El (ft)	777.38	Shear (lb/sq ft)	0.51	1.27	0.49
Alpha	1.63	Stream Power (lb/ft s)	234.18	0.00	0.00
Frctn Loss (ft)	1.27	Cum Volume (acre-ft)	1.84	5.77	0.93
C & E Loss (ft)	0.02	Cum SA (acres)	0.51	0.62	0.31

Plan: 1F ARNOLD CREEK 1 RS: 1 Profile: 100 YR

E.G. Elev (ft)	787.02	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.08	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	785.93	Reach Len. (ft)			
Crit W.S. (ft)	782.77	Flow Area (sq ft)	21.53	486.63	81.49
E.G. Slope (ft/ft)	0.002201	Area (sq ft)	21.53	486.63	81.49
Q Total (cfs)	4446.00	Flow (cfs)	51.43	4182.06	212.51
Top Width (ft)	91.11	Top Width (ft)	7.91	51.83	31.37
Vel Total (ft/s)	7.54	Avg. Vel. (ft/s)	2.39	8.59	2.61
Max Chl Dpth (ft)	10.44	Hydr. Depth (ft)	2.72	9.39	2.60
Conv. Total (cfs)	94759.1	Conv. (cfs)	1096.1	89133.7	4529.3
Length Wtd. (ft)		Wetted Per. (ft)	9.60	54.30	31.86
Min Ch El (ft)	775.49	Shear (lb/sq ft)	0.31	1.23	0.35
Alpha	1.23	Stream Power (lb/ft s)	307.86	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

HEC-RAS Version 4.1.0 Jan 2010
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
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PROJECT DATA
Project Title: 288-13-FA-FILL-FINAL
Project File : 288-13-FA-FILLFINAL.prj
Run Date and Time: 12/3/2013 1:10:01 PM

Project in English units

PLAN DATA

Plan Title: Plan 03
Plan File : m:\HBE PROJECTS\2013\ASI 2013\ASI 288-13 SATURN PHASE 6\HEC-RAS\288-13-FA-FILLFINAL.p03

Geometry Title: 288-13-FA-FILL-FINAL
Geometry File : m:\HBE PROJECTS\2013\ASI 2013\ASI 288-13 SATURN PHASE 6\HEC-RAS\288-13-FA-FILLFINAL.g04

Flow Title : 288-13-FA-FINAL
Flow File : m:\HBE PROJECTS\2013\ASI 2013\ASI 288-13 SATURN PHASE 6\HEC-RAS\288-13-FA-FILLFINAL.f02

Plan Summary Information:

Number of:	Cross Sections	= 10	Multiple Openings	=	0
	Culverts	= 0	Inline Structures	=	0
	Bridges	= 0	Lateral Structures	=	0

Computational Information

Water surface calculation tolerance	= 0.01
Critical depth calculation tolerance	= 0.01
Maximum number of iterations	= 20
Maximum difference tolerance	= 0.3
Flow tolerance factor	= 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: 288-13-FA-FINAL
Flow File : m:\HBE PROJECTS\2013\ASI 2013\ASI 288-13 SATURN PHASE 6\HEC-RAS\288-13-FA-FILLFINAL.f02

Flow Data (cfs)

River	Reach	RS	100 YR
ARNOLD CREEK	1	8	4446

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
ARNOLD CREEK	1	100 YR	Normal S = 0.0022	Normal S = 0.0022

GEOMETRY DATA

Geometry Title: 288-13-FA-FILL-FINAL
Geometry File : m:\HBE PROJECTS\2013\ASI 2013\ASI 288-13 SATURN PHASE 6\HEC-RAS\288-13-FA-FILLFINAL.g04

CROSS SECTION

RIVER: ARNOLD CREEK
REACH: 1 RS: 8

INPUT
Description: RS8 STA0
Station Elevation Data num= 22

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	803	9.57	786.89	12.55	781.86	31.8	780.55	50.42	781.86
56.25	786.89	65.8	786.97	101.97	787.26	126.81	786.25	213.03	789.15
247.23	789.56	388.52	789.79	444.7	789.83	518.07	791.23	562.4	793.52
568.58	794.8	571.72	796.42	585.72	797.29	608.68	806.42	610.58	807.08
614.01	807.54	629.42	801.17						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	9.57	.035	56.25	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
9.57	56.25	699	691	345	.1	.3

CROSS SECTION OUTPUT Profile #100 YR

			Left OB	Channel	Right OB
E.G. Elev (ft)	791.09	Element			
Vel Head (ft)	0.77	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	790.32	Reach Len. (ft)	699.00	691.00	

345.00				
Crit W.S. (ft)		Flow Area (sq ft)	3.49	397.56
621.86				
E.G. Slope (ft/ft)	0.002427	Area (sq ft)	3.49	397.56
621.86				
Q Total (cfs)	4446.00	Flow (cfs)	4.68	3247.61
1193.71				
Top Width (ft)	462.85	Top Width (ft)	2.04	46.68
414.13				
Vel Total (ft/s)	4.35	Avg. Vel. (ft/s)	1.34	8.17
1.92				
Max Chl Dpth (ft)	9.77	Hydr. Depth (ft)	1.72	8.52
1.50				
Conv. Total (cfs)	90247.2	Conv. (cfs)	95.1	65921.7
24230.5				
Length Wtd. (ft)	520.40	Wetted Per. (ft)	3.99	51.51
414.21				
Min Ch El (ft)	780.55	Shear (lb/sq ft)	0.13	1.17
0.23				
Alpha	2.63	Stream Power (lb/ft s)	629.42	0.00
0.00				
Frctn Loss (ft)	0.39	Cum Volume (acre-ft)	5.10	39.27
36.66				
C & E Loss (ft)	0.21	Cum SA (acres)	1.76	4.31
12.50				

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: ARNOLD CREEK
REACH: 1 RS: 7

INPUT
Description: RS7 STA 691
Station Elevation Data num= 24

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	803.44	10.04	787.5	13.76	781.6	35.1	780.7	52.21	782.01
57.27	787.5	71.62	787.23	83.06	787.98	93.74	788.06	100.94	786.5
103.74	786.69	111.63	789.37	117.4	787.94	216.45	787.02	259.91	786.49
297.59	785.96	339.87	786.57	482.24	786.62	519.56	785.41	564.06	785.9
613.01	785.96	672.45	786.87	693.46	790.56	711.37	791.08		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	10.04	.035	57.27	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
10.04	57.27	475	528	252	.1	.3

CROSS SECTION OUTPUT Profile #100 YR

E.G. Elev (ft)	790.49	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.06	Wt. n-Val.	0.050	0.035

0.050					
W.S. Elev (ft)	790.43	Reach Len. (ft)	475.00	528.00	252.00
Crit W.S. (ft)		Flow Area (sq ft)	2.70	403.85	2368.67
E.G. Slope (ft/ft)	0.000356	Area (sq ft)	2.70	403.85	2368.67
Q Total (cfs)	4446.00	Flow (cfs)	1.28	1253.93	3190.78
Top Width (ft)	684.52	Top Width (ft)	1.84	47.23	635.44
Vel Total (ft/s)	1.60	Avg. Vel. (ft/s)	0.48	3.10	1.35
Max Chl Dpth (ft)	9.73	Hydr. Depth (ft)	1.46	8.55	3.73
Conv. Total (cfs)	235516.0	Conv. (cfs)	68.1	66424.0	169023.9
Length Wtd. (ft)	364.98	Wetted Per. (ft)	3.46	52.96	636.62
Min Ch El (ft)	780.70	Shear (lb/sq ft)	0.02	0.17	0.08
Alpha	1.57	Stream Power (lb/ft s)	711.37	0.00	0.00
Frctn Loss (ft)	0.15	Cum Volume (acre-ft)	5.05	32.92	24.82
C & E Loss (ft)	0.01	Cum SA (acres)	1.73	3.56	8.35

CROSS SECTION

RIVER: ARNOLD CREEK
REACH: 1 RS: 6.2

INPUT
Description: RS6B STA 1219
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-161.43	800	0	790.16	69.48	793.87	136.12	791.8	197.63	787.46
213.87	781.19	240.24	780.2	255.96	780.11	272.01	785.1	369.86	785.46
436.55	785.73	502.02	785.44	622.74	800				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-161.43	.05	197.63	.035	272.01	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
197.63	272.01	388	204	131	.1	.3

CROSS SECTION OUTPUT Profile #100 YR

E.G. Elev (ft)	790.33	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	790.20	Reach Len. (ft)	388.00	204.00	131.00
Crit W.S. (ft)		Flow Area (sq ft)	53.11	625.65	1183.82
E.G. Slope (ft/ft)	0.000474	Area (sq ft)	53.11	625.65	

1183.82					
Q Total (cfs)	4446.00	Flow (cfs)	42.27	2350.77	
2052.97					
Top Width (ft)	383.93	Top Width (ft)	40.10	74.38	
269.45					
Vel Total (ft/s)	2.39	Avg. Vel. (ft/s)	0.80	3.76	
1.73					
Max Chl Dpth (ft)	10.09	Hydr. Depth (ft)	1.32	8.41	
4.39					
Conv. Total (cfs)	204232.3	Conv. (cfs)	1941.6	107985.4	
94305.4					
Length Wtd. (ft)	188.02	Wetted Per. (ft)	40.19	76.33	
269.74					
Min Ch El (ft)	780.11	Shear (lb/sq ft)	0.04	0.24	
0.13					
Alpha	1.55	Stream Power (lb/ft s)	622.74	0.00	
0.00					
Frctn Loss (ft)	0.11	Cum Volume (acre-ft)	4.75	26.68	
14.54					
C & E Loss (ft)	0.03	Cum SA (acres)	1.50	2.83	
5.73					

Warning: Divided flow computed for this cross-section.

CROSS SECTION

RIVER: ARNOLD CREEK
REACH: 1 RS: 6.1

INPUT
Description: RS 6RR STA 1423

Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	806.55	.5	785.05	1	778.05	36	778.05	73	778.05
73.5	785.05	74	806.55						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	.5	.035	73.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
.5	73.5	206	208	747	.1	.3

CROSS SECTION OUTPUT Profile #100 YR

E.G. Elev (ft)	790.20	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.42	Wt. n-Val.	0.050	0.035
0.050				
W.S. Elev (ft)	789.78	Reach Len. (ft)	206.00	208.00
747.00				
Crit W.S. (ft)		Flow Area (sq ft)	0.26	852.48
0.26				
E.G. Slope (ft/ft)	0.000709	Area (sq ft)	0.26	852.48
0.26				
Q Total (cfs)	4446.00	Flow (cfs)	0.03	4445.94
0.03				
Top Width (ft)	73.22	Top Width (ft)	0.11	73.00
0.11				

Vel Total (ft/s)	5.21	Avg. Vel. (ft/s)	0.11	5.22	0.11
Max Chl Dpth (ft)	11.73	Hydr. Depth (ft)	2.36	11.68	2.36
Conv. Total (cfs)	166963.6	Conv. (cfs)	1.1	166961.4	1.1
Length Wtd. (ft)	248.36	Wetted Per. (ft)	4.73	86.04	4.73
Min Ch El (ft)	778.05	Shear (lb/sq ft)	0.00	0.44	0.00
Alpha	1.00	Stream Power (lb/ft s)	74.00	0.00	0.00
Frctn Loss (ft)	0.19	Cum Volume (acre-ft)	4.51	23.22	12.76
C & E Loss (ft)	0.02	Cum SA (acres)	1.32	2.48	5.32

CROSS SECTION

RIVER: ARNOLD CREEK
REACH: 1 RS: 5

INPUT
Description: RS5 STA 1631
Station Elevation Data num= 23

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	790.53	16.45	805.22	44.51	804.56	68.52	783.9	71.09	783.62
74.04	779.99	102.28	779.64	130.74	779.61	148.01	786.36	189.87	787.05
334.07	787.85	335	790	405.78	790	476.88	790	540.4	790.19
604.6	790.54	670.08	790.77	701.8	806.67	733.86	820.42	739.82	822.77
752.83	822.9	758.88	822.69	766.56	825.75				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	68.52	.035	148.01	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
68.52	148.01	362	398	566	.1	.3

CROSS SECTION OUTPUT Profile #100 YR

E.G. Elev (ft)	789.99	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.37	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	789.62	Reach Len. (ft)	362.00	398.00	566.00
Crit W.S. (ft)		Flow Area (sq ft)	19.01	714.09	435.71
E.G. Slope (ft/ft)	0.000862	Area (sq ft)	19.01	714.09	435.71
Q Total (cfs)	4446.00	Flow (cfs)	27.79	3752.37	665.84
Top Width (ft)	272.96	Top Width (ft)	6.65	79.49	186.83
Vel Total (ft/s)	3.80	Avg. Vel. (ft/s)	1.46	5.25	1.53
Max Chl Dpth (ft)	10.01	Hydr. Depth (ft)	2.86	8.98	2.33

Conv. Total (cfs)	151420.6	Conv. (cfs)	946.6	127797.2	22676.8
Length Wtd. (ft)	412.25	Wetted Per. (ft)	8.77	82.51	188.00
Min Ch El (ft)	779.61	Shear (lb/sq ft)	0.12	0.47	0.12
Alpha	1.64	Stream Power (lb/ft s)	766.56	0.00	0.00
Frctn Loss (ft)	0.44	Cum Volume (acre-ft)	4.46	19.48	9.02
C & E Loss (ft)	0.03	Cum SA (acres)	1.30	2.12	3.72

CROSS SECTION

RIVER: ARNOLD CREEK
REACH: 1 RS: 4.1

INPUT
Description: RS4.1 STA 1830
Station Elevation Data num= 26

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	791.35	9.59	802.22	13.33	802.58	24.34	802.49	29.82	801.69
43.39	788.96	56.76	785.73	70.55	782.78	84.47	783.13	91.91	778.75
111.7	777.62	131.95	778.74	138.59	783.12	142.1	785.45	207.03	789.15
208	790	275.97	790	375.17	790	429.08	790	497.25	790.18
567.87	791.07	576.45	796.47	579.31	797.53	592.6	797.63	597.304	796.34
603.51	801.16								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	84.47	.035	138.59	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
84.47	138.59	75	75	.1	.3

CROSS SECTION OUTPUT Profile #100 YR

E.G. Elev (ft)	789.52	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.67	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	788.84	Reach Len. (ft)	75.00	75.00	75.00
Crit W.S. (ft)		Flow Area (sq ft)	165.24	538.13	116.94
E.G. Slope (ft/ft)	0.001373	Area (sq ft)	165.24	538.13	116.94
Q Total (cfs)	4446.00	Flow (cfs)	458.68	3794.55	192.77
Top Width (ft)	157.74	Top Width (ft)	40.59	54.12	63.03
Vel Total (ft/s)	5.42	Avg. Vel. (ft/s)	2.78	7.05	1.65
Max Chl Dpth (ft)	11.22	Hydr. Depth (ft)	4.07	9.94	1.86
Conv. Total (cfs)	120005.0	Conv. (cfs)	12380.5	102421.4	5203.2
Length Wtd. (ft)	75.00	Wetted Per. (ft)	41.28	56.69	

63.83				
Min Ch El (ft)	777.62	Shear (lb/sq ft)	0.34	0.81
0.16				
Alpha	1.48	Stream Power (lb/ft s)	603.51	0.00
0.00				
Frctn Loss (ft)	0.11	Cum Volume (acre-ft)	3.70	13.76
5.43				
C & E Loss (ft)	0.00	Cum SA (acres)	1.11	1.51
2.10				

CROSS SECTION

RIVER: ARNOLD CREEK
REACH: 1 RS: 4

INPUT
Description: RS4 STA 1905
Station Elevation Data num= 25

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	791.35	9.59	802.22	13.33	802.58	24.34	802.49	29.82	801.69
43.39	788.96	56.76	785.73	70.55	782.78	84.47	783.13	91.91	778.75
111.7	777.62	131.95	778.74	138.59	783.12	142.1	785.45	207.03	789.15
275.97	788.93	375.17	789.59	429.08	789.86	497.25	790.18	567.87	791.07
576.45	796.47	579.31	797.53	592.6	797.63	597.304	796.34	603.51	801.16

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	84.47	.035	138.59	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
84.47	138.59	284	295	403	.1 .3

CROSS SECTION OUTPUT Profile #100 YR

E.G. Elev (ft)	789.41	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.70	Wt. n-Val.	0.050	0.035
0.050				
W.S. Elev (ft)	788.70	Reach Len. (ft)	284.00	295.00
403.00				
Crit W.S. (ft)		Flow Area (sq ft)	159.60	530.56
108.29				
E.G. Slope (ft/ft)	0.001456	Area (sq ft)	159.60	530.56
108.29				
Q Total (cfs)	4446.00	Flow (cfs)	450.15	3816.55
179.30				
Top Width (ft)	154.71	Top Width (ft)	40.01	54.12
60.58				
Vel Total (ft/s)	5.57	Avg. Vel. (ft/s)	2.82	7.19
1.66				
Max Chl Dpth (ft)	11.08	Hydr. Depth (ft)	3.99	9.80
1.79				
Conv. Total (cfs)	116528.7	Conv. (cfs)	11798.3	100031.0
4699.4				
Length Wtd. (ft)	307.00	Wetted Per. (ft)	40.68	56.69
61.37				
Min Ch El (ft)	777.62	Shear (lb/sq ft)	0.36	0.85
0.16				
Alpha	1.46	Stream Power (lb/ft s)	603.51	0.00

0.00					
Frctn Loss (ft)	0.45	Cum Volume (acre-ft)	3.42	12.84	5.24
C & E Loss (ft)	0.06	Cum SA (acres)	1.04	1.42	1.99

CROSS SECTION

RIVER: ARNOLD CREEK
REACH: 1 RS: 3

INPUT
Description: RS3 STA 2200
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	791.63	5.43	786.97	8.94	787.88	19.64	787.78	25.34	787.24
31.76	782.76	39.32	781.59	46.42	778.51	65.11	778.04	84.77	777.75
92.96	787.8	167.91	783.4	249.95	788.9	322.39	791.2	388.67	791.72
401.61	798.7								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	25.34	.035	92.96	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
25.34	92.96	263	312	373	.1 .3

CROSS SECTION OUTPUT Profile #100 YR

E.G. Elev (ft)	788.90	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.51	Wt. n-Val.	0.050	0.035
0.050				
W.S. Elev (ft)	788.39	Reach Len. (ft)	263.00	312.00
373.00				
Crit W.S. (ft)		Flow Area (sq ft)	15.65	569.58
395.38				
E.G. Slope (ft/ft)	0.001453	Area (sq ft)	15.65	569.58
395.38				
Q Total (cfs)	4446.00	Flow (cfs)	14.03	3576.26
855.71				
Top Width (ft)	238.63	Top Width (ft)	21.57	67.62
149.44				
Vel Total (ft/s)	4.53	Avg. Vel. (ft/s)	0.90	6.28
2.16				
Max Chl Dpth (ft)	10.64	Hydr. Depth (ft)	0.73	8.42
2.65				
Conv. Total (cfs)	116628.0	Conv. (cfs)	368.0	93812.8
22447.2				
Length Wtd. (ft)	313.47	Wetted Per. (ft)	22.24	74.54
149.73				
Min Ch El (ft)	777.75	Shear (lb/sq ft)	0.06	0.69
0.24				
Alpha	1.59	Stream Power (lb/ft s)	401.61	0.00
0.00				
Frctn Loss (ft)	0.56	Cum Volume (acre-ft)	2.85	9.11
2.91				
C & E Loss (ft)	0.04	Cum SA (acres)	0.84	1.00
1.02				

CROSS SECTION

RIVER: ARNOLD CREEK
REACH: 1 RS: 2

INPUT
Description: RS2 STA 2512
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	795.96	6.57	790.56	10.78	791.27	24.59	791.6	31.04	791.58
44.26	787.89	76.19	785.45	112.75	782.47	136.84	778.53	159.68	777.38
176.2	779.65	195.23	788.22	234.18	800				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	136.84	.035	176.2	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
136.84	176.2	473	592	547	.1	.3

CROSS SECTION OUTPUT Profile #100 YR

E.G. Elev (ft)	788.30	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.90	Wt. n-Val.	0.050	0.035
0.050				
W.S. Elev (ft)	787.41	Reach Len. (ft)	473.00	592.00
547.00				
Crit W.S. (ft)		Flow Area (sq ft)	317.42	362.76
66.80				
E.G. Slope (ft/ft)	0.002214	Area (sq ft)	317.42	362.76
66.80				
Q Total (cfs)	4446.00	Flow (cfs)	1053.78	3175.43
216.79				
Top Width (ft)	142.84	Top Width (ft)	86.25	39.36
17.22				
Vel Total (ft/s)	5.95	Avg. Vel. (ft/s)	3.32	8.75
3.25				
Max Chl Dpth (ft)	10.03	Hydr. Depth (ft)	3.68	9.22
3.88				
Conv. Total (cfs)	94492.7	Conv. (cfs)	22396.5	67488.7
4607.5				
Length Wtd. (ft)	575.04	Wetted Per. (ft)	86.77	39.54
18.89				
Min Ch El (ft)	777.38	Shear (lb/sq ft)	0.51	1.27
0.49				
Alpha	1.63	Stream Power (lb/ft s)	234.18	0.00
0.00				
Frctn Loss (ft)	1.27	Cum Volume (acre-ft)	1.84	5.77
0.93				
C & E Loss (ft)	0.02	Cum SA (acres)	0.51	0.62
0.31				

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: ARNOLD CREEK
REACH: 1 RS: 1

INPUT
Description: RS1 STA 3104
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-11.95	800	0	789.34	12.87	780.49	19.07	776.24	41.1	775.49
58.17	776.52	64.7	780.49	94.12	785.84	103.91	786.3	117.44	786.3
141.5	786.54	205.61	788.86	274.62	791.01	307.86	800.69		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-11.95	.05	12.87	.035	64.7	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
12.87	64.7	0	0	.1	.3

CROSS SECTION OUTPUT Profile #100 YR

E.G. Elev (ft)	787.02	Element	Left OB	Channel
Right OB				
Vel Head (ft)	1.08	Wt. n-Val.	0.050	0.035
0.050				
W.S. Elev (ft)	785.93	Reach Len. (ft)		
Crit W.S. (ft)	782.77	Flow Area (sq ft)	21.53	486.63
81.49				
E.G. Slope (ft/ft)	0.002201	Area (sq ft)	21.53	486.63
81.49				
Q Total (cfs)	4446.00	Flow (cfs)	51.43	4182.06
212.51				
Top Width (ft)	91.11	Top Width (ft)	7.91	51.83
31.37				
Vel Total (ft/s)	7.54	Avg. Vel. (ft/s)	2.39	8.59
2.61				
Max Chl Dpth (ft)	10.44	Hydr. Depth (ft)	2.72	9.39
2.60				
Conv. Total (cfs)	94759.1	Conv. (cfs)	1096.1	89133.7
4529.3				
Length Wtd. (ft)		Wetted Per. (ft)	9.60	54.30
31.86				
Min Ch El (ft)	775.49	Shear (lb/sq ft)	0.31	1.23
0.35				
Alpha	1.23	Stream Power (lb/ft s)	307.86	0.00
0.00				
Frctn Loss (ft)		Cum Volume (acre-ft)		
C & E Loss (ft)		Cum SA (acres)		

SUMMARY OF MANNING'S N VALUES

River:ARNOLD CREEK

Reach	River Sta.	n1	n2	n3
1	8	.05	.035	.05
1	7	.05	.035	.05
1	6.2	.05	.035	.05
1	6.1	.05	.035	.05
1	5	.05	.035	.05
1	4.1	.05	.035	.05
1	4	.05	.035	.05
1	3	.05	.035	.05
1	2	.05	.035	.05
1	1	.05	.035	.05

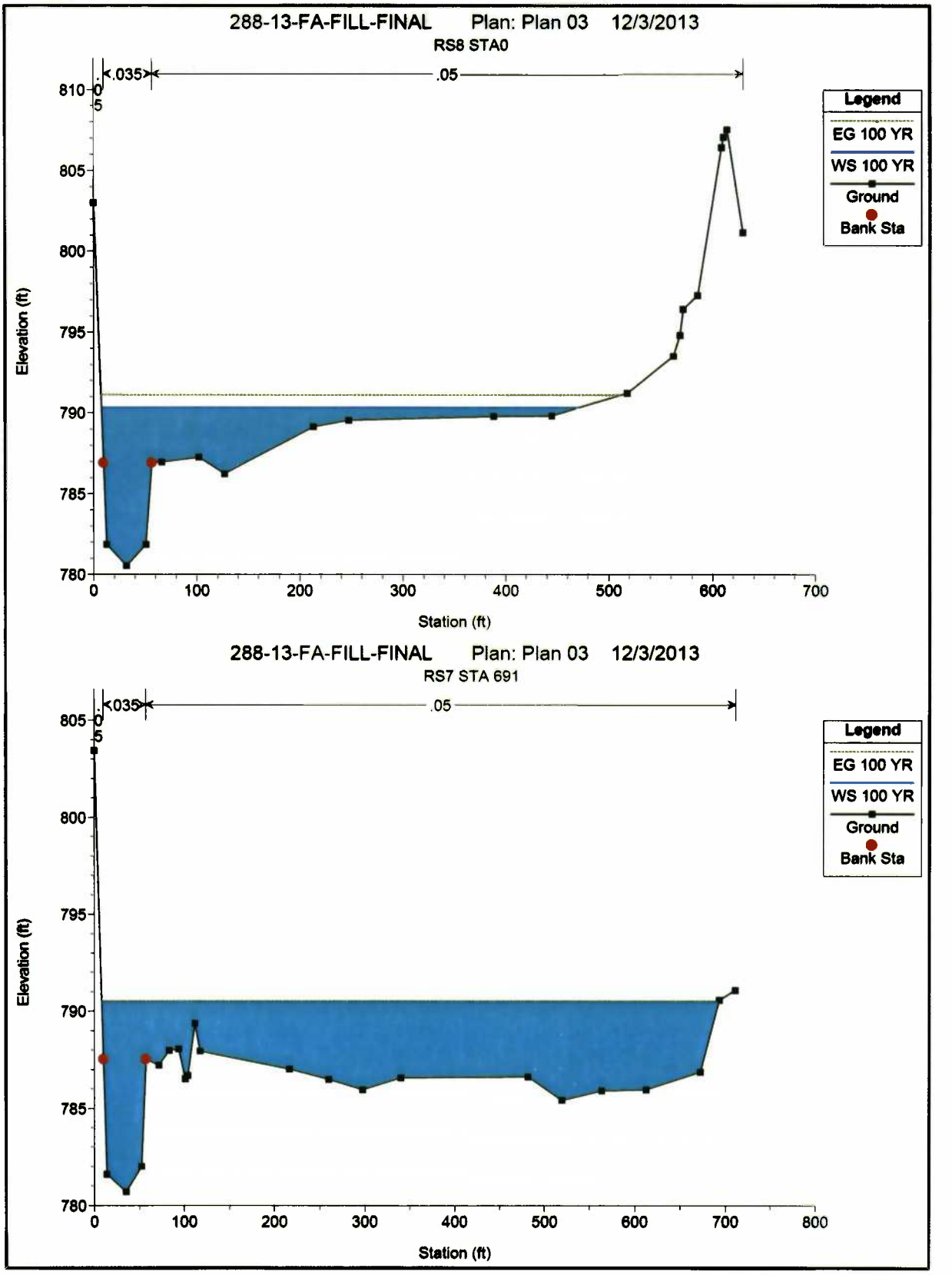
SUMMARY OF REACH LENGTHS

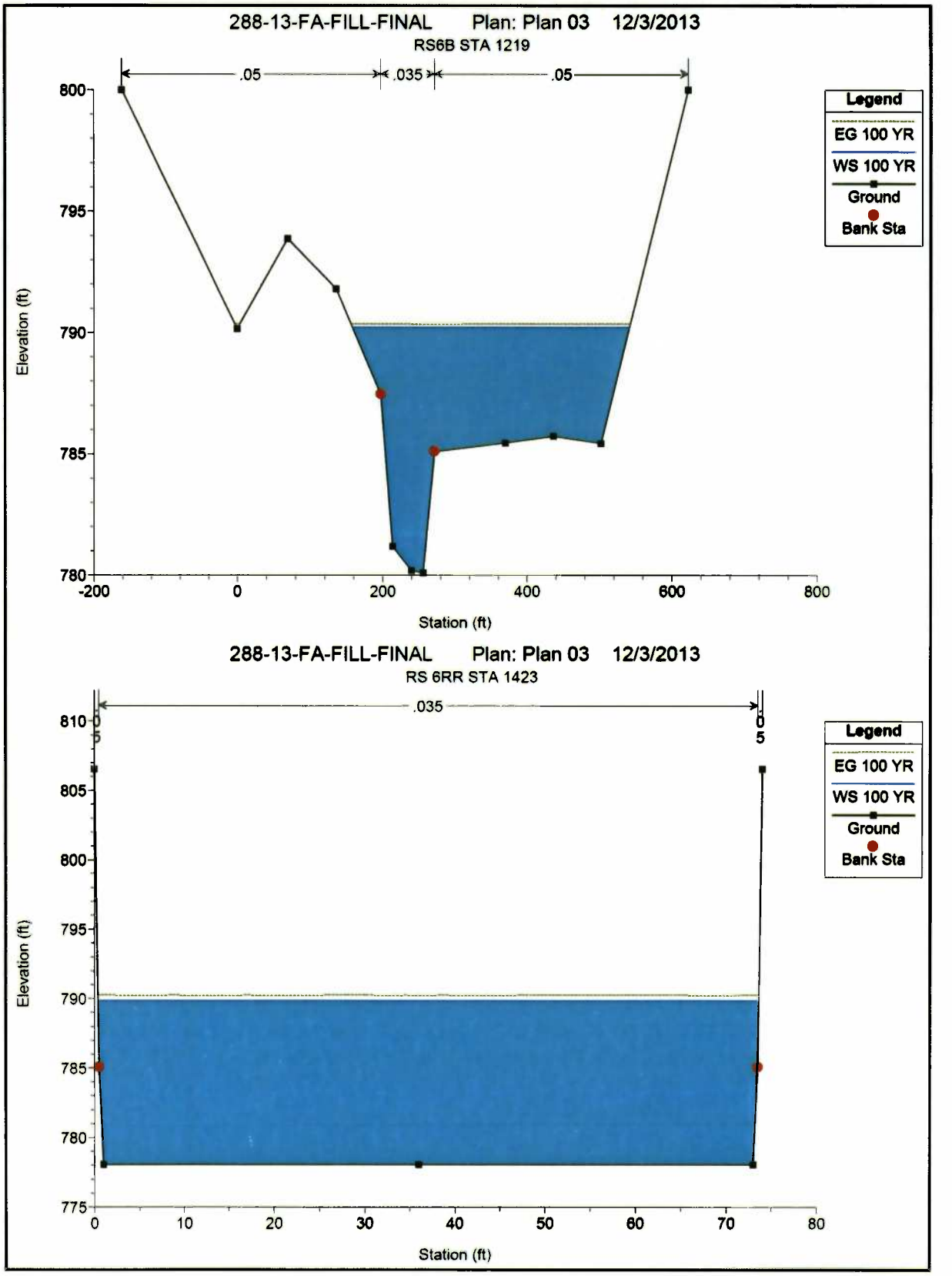
River: ARNOLD CREEK

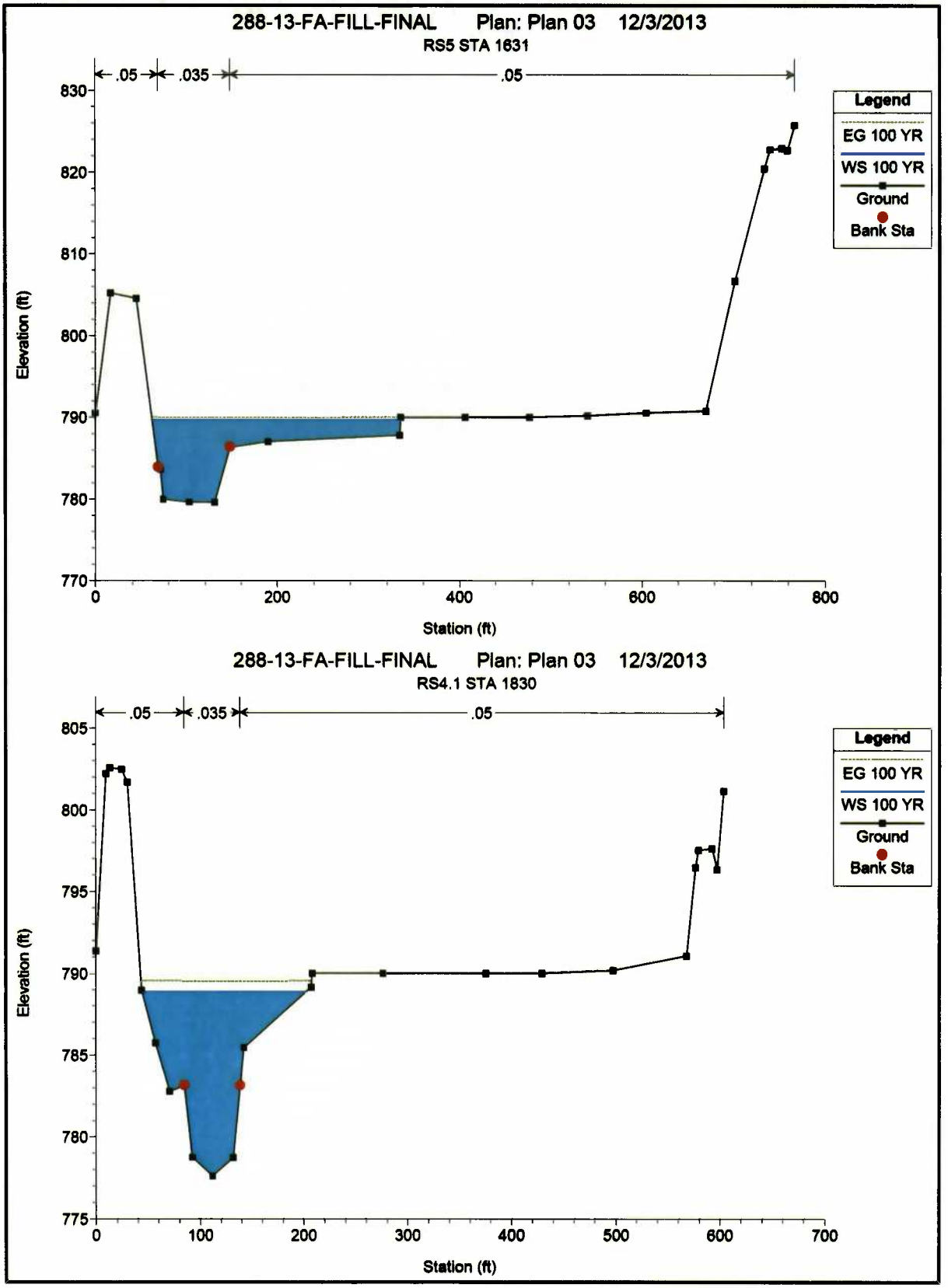
Reach	River Sta.	Left	Channel	Right
1	8	699	691	345
1	7	475	528	252
1	6.2	388	204	131
1	6.1	206	208	747
1	5	362	398	566
1	4.1	75	75	75
1	4	284	295	403
1	3	263	312	373
1	2	473	592	547
1	1	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: ARNOLD CREEK

Reach	River Sta.	Contr.	Expan.
1	8	.1	.3
1	7	.1	.3
1	6.2	.1	.3
1	6.1	.1	.3
1	5	.1	.3
1	4.1	.1	.3
1	4	.1	.3
1	3	.1	.3
1	2	.1	.3
1	1	.1	.3


288-13-FA-FILL-FINAL Plan: Plan 03 12/3/2013
RS8 STA0
.035
.05
.5
Legend
EG 100 YR
WS 100 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
288-13-FA-FILL-FINAL Plan: Plan 03 12/3/2013
RS7 STA 691
.035
.05
.5
Legend
EG 100 YR
WS 100 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)


288-13-FA-FILL-FINAL Plan: Plan 03 12/3/2013
RS6B STA 1219
.05
.035
.05
Legend
EG 100 YR
WS 100 YR
Ground
Bank Sta
Elevation (ft)
800
795
790
785
780
-200
0
200
400
600
800
Station (ft)
288-13-FA-FILL-FINAL Plan: Plan 03 12/3/2013
RS 6RR STA 1423
.035
.05
.05
Legend
EG 100 YR
WS 100 YR
Ground
Bank Sta
Elevation (ft)
810
805
800
795
790
785
780
775
0
10
20
30
40
50
60
70
80
Station (ft)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Legend
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WS 100 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
288-13-FA-FILL-FINAL Plan: Plan 03 12/3/2013
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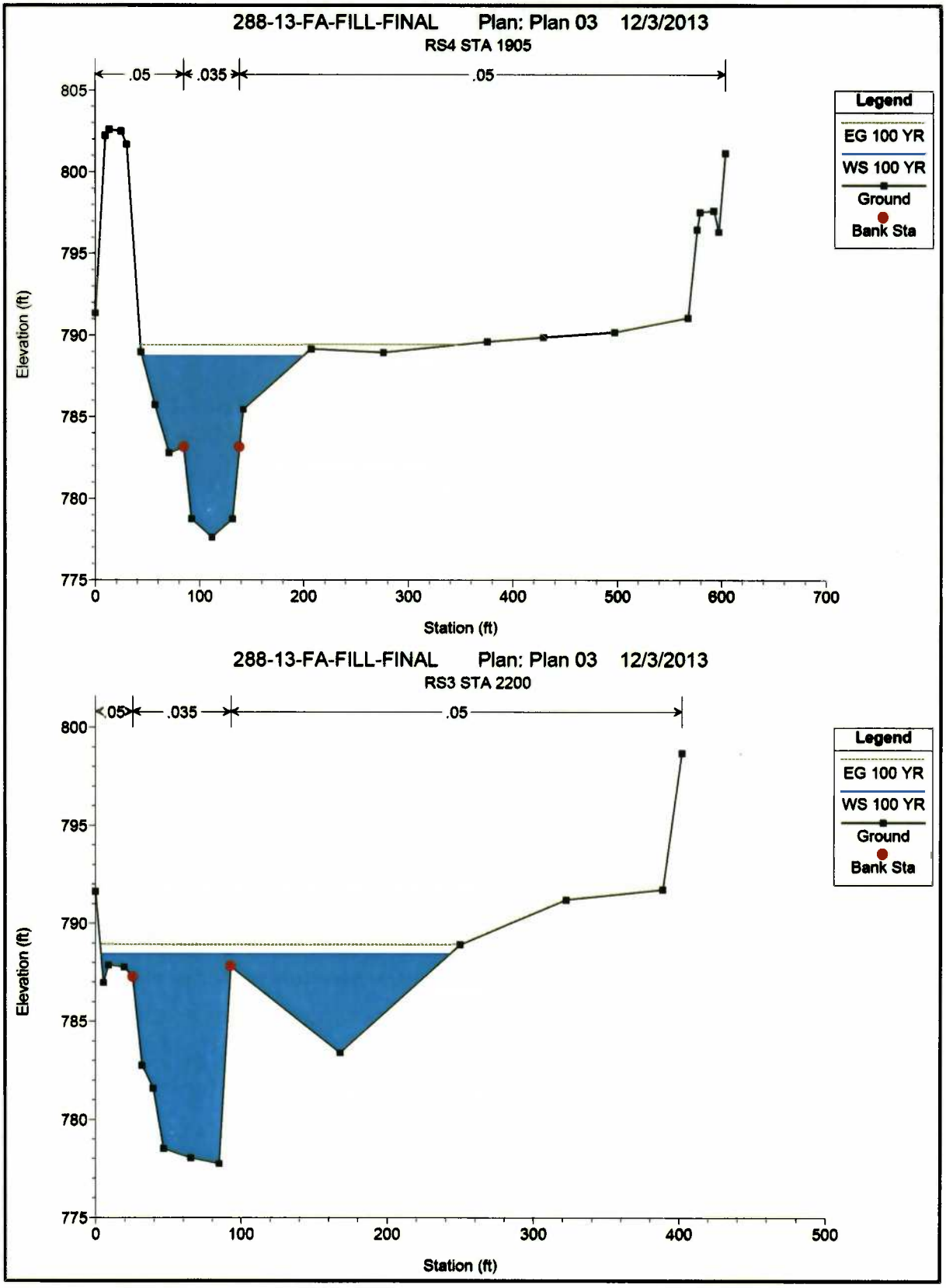
WS 100 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)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Ground
Bank Sta
Elevation (ft)
Station (ft)
288-13-FA-FILL-FINAL Plan: Plan 03 12/3/2013
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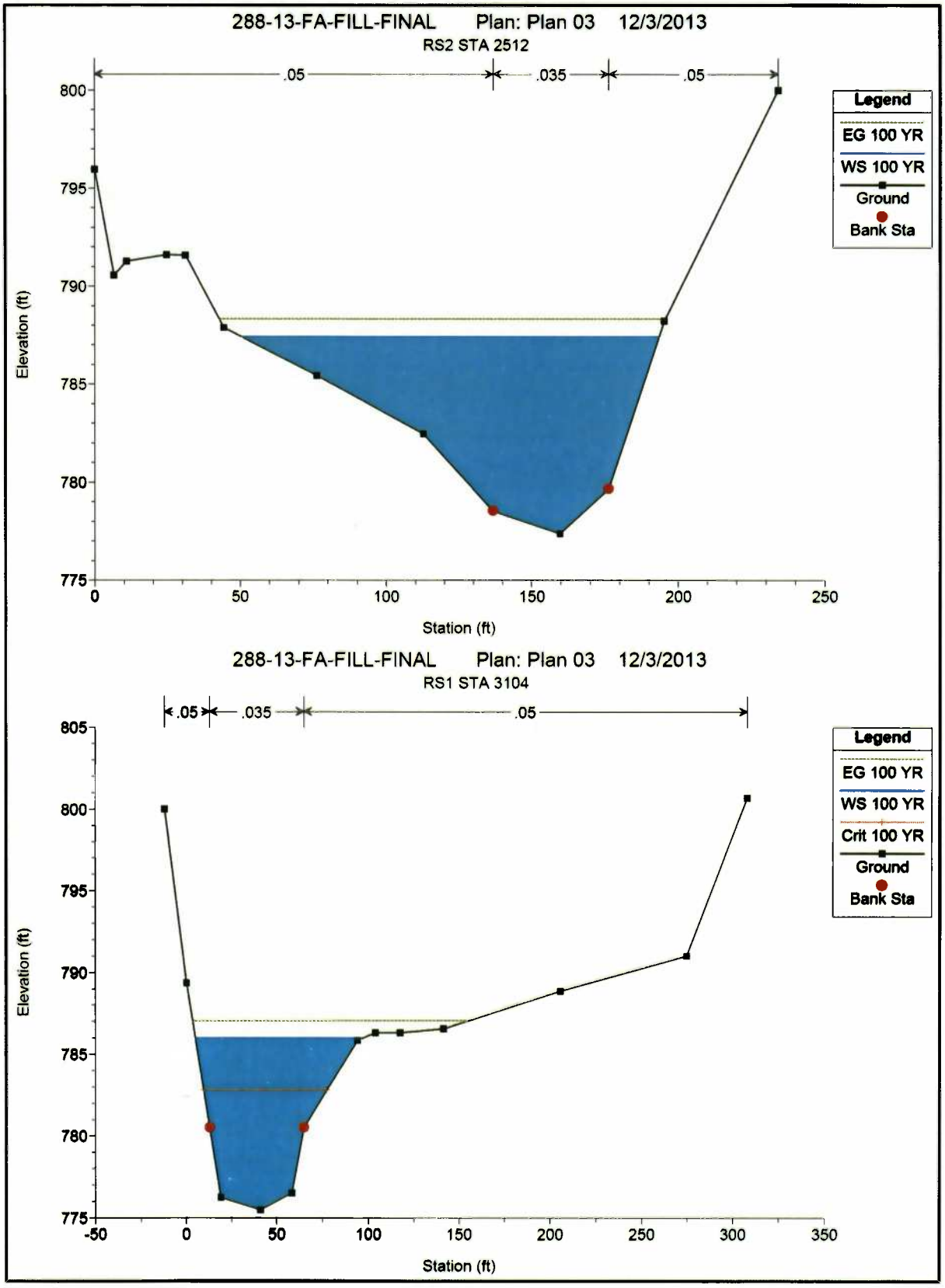
Legend
EG 100 YR
WS 100 YR
Ground
Bank Sta
Elevation (ft)
Station (ft)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RS2 STA 2512
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Legend
EG 100 YR
WS 100 YR
Ground
Bank Sta
Elevation (ft)
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795
790
785
780
775
0
50
100
150
200
250
Station (ft)
288-13-FA-FILL-FINAL Plan: Plan 03 12/3/2013
RS1 STA 3104
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.035
.05
Legend
EG 100 YR
WS 100 YR
Crit 100 YR
Ground
Bank Sta
Elevation (ft)
805
800
795
790
785
780
775
-50
0
50
100
150
200
250
300
350
Station (ft)

Plan: 1FF ARNOLD CREEK 1 RS: 8 Profile: 100 YR

E.G. Elev (ft)	791.09	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.77	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	790.32	Reach Len. (ft)	699.00	691.00	345.00
Crit W.S. (ft)		Flow Area (sq ft)	3.49	397.56	621.86
E.G. Slope (ft/ft)	0.002427	Area (sq ft)	3.49	397.56	621.86
Q Total (cfs)	4446.00	Flow (cfs)	4.68	3247.61	1193.71
Top Width (ft)	462.85	Top Width (ft)	2.04	46.68	414.13
Vel Total (ft/s)	4.35	Avg. Vel. (ft/s)	1.34	8.17	1.92
Max Chl Dpth (ft)	9.77	Hydr. Depth (ft)	1.72	8.52	1.50
Conv. Total (cfs)	90247.2	Conv. (cfs)	95.1	65921.7	24230.5
Length Wtd. (ft)	520.40	Wetted Per. (ft)	3.99	51.51	414.21
Min Ch El (ft)	780.55	Shear (lb/sq ft)	0.13	1.17	0.23
Alpha	2.63	Stream Power (lb/ft s)	629.42	0.00	0.00
Frctn Loss (ft)	0.39	Cum Volume (acre-ft)	5.10	39.27	36.66
C & E Loss (ft)	0.21	Cum SA (acres)	1.76	4.31	12.50

Plan: 1FF ARNOLD CREEK 1 RS: 7 Profile: 100 YR

E.G. Elev (ft)	790.49	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.06	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	790.43	Reach Len. (ft)	475.00	528.00	252.00
Crit W.S. (ft)		Flow Area (sq ft)	2.70	403.85	2368.67
E.G. Slope (ft/ft)	0.000356	Area (sq ft)	2.70	403.85	2368.67
Q Total (cfs)	4446.00	Flow (cfs)	1.28	1253.93	3190.78
Top Width (ft)	684.52	Top Width (ft)	1.84	47.23	635.44
Vel Total (ft/s)	1.60	Avg. Vel. (ft/s)	0.48	3.10	1.35
Max Chl Dpth (ft)	9.73	Hydr. Depth (ft)	1.46	8.55	3.73
Conv. Total (cfs)	235516.0	Conv. (cfs)	68.1	66424.0	169023.9
Length Wtd. (ft)	364.98	Wetted Per. (ft)	3.46	52.96	636.62
Min Ch El (ft)	780.70	Shear (lb/sq ft)	0.02	0.17	0.08
Alpha	1.57	Stream Power (lb/ft s)	711.37	0.00	0.00
Frctn Loss (ft)	0.15	Cum Volume (acre-ft)	5.05	32.92	24.82
C & E Loss (ft)	0.01	Cum SA (acres)	1.73	3.56	8.35

Plan: 1FF ARNOLD CREEK 1 RS: 6.2 Profile: 100 YR

E.G. Elev (ft)	790.33	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	790.20	Reach Len. (ft)	388.00	204.00	131.00
Crit W.S. (ft)		Flow Area (sq ft)	53.11	625.65	1183.82
E.G. Slope (ft/ft)	0.000474	Area (sq ft)	53.11	625.65	1183.82
Q Total (cfs)	4446.00	Flow (cfs)	42.27	2350.77	2052.97
Top Width (ft)	383.93	Top Width (ft)	40.10	74.38	269.45
Vel Total (ft/s)	2.39	Avg. Vel. (ft/s)	0.80	3.76	1.73
Max Chl Dpth (ft)	10.09	Hydr. Depth (ft)	1.32	8.41	4.39
Conv. Total (cfs)	204232.3	Conv. (cfs)	1941.6	107985.4	94305.4
Length Wtd. (ft)	188.02	Wetted Per. (ft)	40.19	76.33	269.74
Min Ch El (ft)	780.11	Shear (lb/sq ft)	0.04	0.24	0.13
Alpha	1.55	Stream Power (lb/ft s)	622.74	0.00	0.00
Frctn Loss (ft)	0.11	Cum Volume (acre-ft)	4.75	26.68	14.54
C & E Loss (ft)	0.03	Cum SA (acres)	1.50	2.83	5.73

Plan: 1FF ARNOLD CREEK 1 RS: 6.1 Profile: 100 YR

E.G. Elev (ft)	790.20	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.42	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	789.78	Reach Len. (ft)	206.00	208.00	747.00
Crit W.S. (ft)		Flow Area (sq ft)	0.26	852.48	0.26
E.G. Slope (ft/ft)	0.000709	Area (sq ft)	0.26	852.48	0.26
Q Total (cfs)	4446.00	Flow (cfs)	0.03	4445.94	0.03
Top Width (ft)	73.22	Top Width (ft)	0.11	73.00	0.11
Vel Total (ft/s)	5.21	Avg. Vel. (ft/s)	0.11	5.22	0.11
Max Chl Dpth (ft)	11.73	Hydr. Depth (ft)	2.36	11.68	2.36
Conv. Total (cfs)	166963.6	Conv. (cfs)	1.1	166961.4	1.1
Length Wtd. (ft)	248.36	Wetted Per. (ft)	4.73	86.04	4.73
Min Ch El (ft)	778.05	Shear (lb/sq ft)	0.00	0.44	0.00
Alpha	1.00	Stream Power (lb/ft s)	74.00	0.00	0.00
Frctn Loss (ft)	0.19	Cum Volume (acre-ft)	4.51	23.22	12.76
C & E Loss (ft)	0.02	Cum SA (acres)	1.32	2.48	5.32

Plan: 1FF ARNOLD CREEK 1 RS: 5 Profile: 100 YR

E.G. Elev (ft)	789.99	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.37	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	789.62	Reach Len. (ft)	362.00	398.00	566.00
Crit W.S. (ft)		Flow Area (sq ft)	19.01	714.09	435.71
E.G. Slope (ft/ft)	0.000862	Area (sq ft)	19.01	714.09	435.71
Q Total (cfs)	4446.00	Flow (cfs)	27.79	3752.37	665.84
Top Width (ft)	272.96	Top Width (ft)	6.65	79.49	186.83
Vel Total (ft/s)	3.80	Avg. Vel. (ft/s)	1.46	5.25	1.53
Max Chl Dpth (ft)	10.01	Hydr. Depth (ft)	2.86	8.98	2.33
Conv. Total (cfs)	151420.6	Conv. (cfs)	946.6	127797.2	22676.8
Length Wtd. (ft)	412.25	Wetted Per. (ft)	8.77	82.51	188.00
Min Ch El (ft)	779.61	Shear (lb/sq ft)	0.12	0.47	0.12
Alpha	1.64	Stream Power (lb/ft s)	766.56	0.00	0.00
Frctn Loss (ft)	0.44	Cum Volume (acre-ft)	4.46	19.48	9.02
C & E Loss (ft)	0.03	Cum SA (acres)	1.30	2.12	3.72

Plan: 1FF ARNOLD CREEK 1 RS: 4.1 Profile: 100 YR

E.G. Elev (ft)	789.52	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.67	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	788.84	Reach Len. (ft)	75.00	75.00	75.00
Crit W.S. (ft)		Flow Area (sq ft)	165.24	538.13	116.94
E.G. Slope (ft/ft)	0.001373	Area (sq ft)	165.24	538.13	116.94
Q Total (cfs)	4446.00	Flow (cfs)	458.68	3794.55	192.77
Top Width (ft)	157.74	Top Width (ft)	40.59	54.12	63.03
Vel Total (ft/s)	5.42	Avg. Vel. (ft/s)	2.78	7.05	1.65
Max Chl Dpth (ft)	11.22	Hydr. Depth (ft)	4.07	9.94	1.86
Conv. Total (cfs)	120005.0	Conv. (cfs)	12380.5	102421.4	5203.2
Length Wtd. (ft)	75.00	Wetted Per. (ft)	41.28	56.69	63.83
Min Ch El (ft)	777.62	Shear (lb/sq ft)	0.34	0.81	0.16
Alpha	1.48	Stream Power (lb/ft s)	603.51	0.00	0.00
Frctn Loss (ft)	0.11	Cum Volume (acre-ft)	3.70	13.76	5.43
C & E Loss (ft)	0.00	Cum SA (acres)	1.11	1.51	2.10

Plan: 1FF ARNOLD CREEK 1 RS: 4 Profile: 100 YR

E.G. Elev (ft)	789.41	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.70	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	788.70	Reach Len. (ft)	284.00	295.00	403.00
Crit W.S. (ft)		Flow Area (sq ft)	159.60	530.56	108.29
E.G. Slope (ft/ft)	0.001456	Area (sq ft)	159.60	530.56	108.29
Q Total (cfs)	4446.00	Flow (cfs)	450.15	3816.55	179.30
Top Width (ft)	154.71	Top Width (ft)	40.01	54.12	60.58
Vel Total (ft/s)	5.57	Avg. Vel. (ft/s)	2.82	7.19	1.66
Max Chl Dpth (ft)	11.08	Hydr. Depth (ft)	3.99	9.80	1.79
Conv. Total (cfs)	116528.7	Conv. (cfs)	11798.3	100031.0	4699.4
Length Wtd. (ft)	307.00	Wetted Per. (ft)	40.68	56.69	61.37
Min Ch El (ft)	777.62	Shear (lb/sq ft)	0.36	0.85	0.16
Alpha	1.46	Stream Power (lb/ft s)	603.51	0.00	0.00
Frctn Loss (ft)	0.45	Cum Volume (acre-ft)	3.42	12.84	5.24
C & E Loss (ft)	0.06	Cum SA (acres)	1.04	1.42	1.99

Plan: 1FF ARNOLD CREEK 1 RS: 3 Profile: 100 YR

E.G. Elev (ft)	788.90	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.51	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	788.39	Reach Len. (ft)	263.00	312.00	373.00
Crit W.S. (ft)		Flow Area (sq ft)	15.65	569.58	395.38
E.G. Slope (ft/ft)	0.001453	Area (sq ft)	15.65	569.58	395.38
Q Total (cfs)	4446.00	Flow (cfs)	14.03	3576.26	855.71
Top Width (ft)	238.63	Top Width (ft)	21.57	67.62	149.44
Vel Total (ft/s)	4.53	Avg. Vel. (ft/s)	0.90	6.28	2.16
Max Chl Dpth (ft)	10.64	Hydr. Depth (ft)	0.73	8.42	2.65
Conv. Total (cfs)	116628.0	Conv. (cfs)	368.0	93812.8	22447.2
Length Wtd. (ft)	313.47	Wetted Per. (ft)	22.24	74.54	149.73
Min Ch El (ft)	777.75	Shear (lb/sq ft)	0.06	0.69	0.24
Alpha	1.59	Stream Power (lb/ft s)	401.61	0.00	0.00
Frctn Loss (ft)	0.56	Cum Volume (acre-ft)	2.85	9.11	2.91
C & E Loss (ft)	0.04	Cum SA (acres)	0.84	1.00	1.02

Plan: 1FF ARNOLD CREEK 1 RS: 2 Profile: 100 YR

E.G. Elev (ft)	788.30	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.90	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	787.41	Reach Len. (ft)	473.00	592.00	547.00
Crit W.S. (ft)		Flow Area (sq ft)	317.42	362.76	66.80
E.G. Slope (ft/ft)	0.002214	Area (sq ft)	317.42	362.76	66.80
Q Total (cfs)	4446.00	Flow (cfs)	1053.78	3175.43	216.79
Top Width (ft)	142.84	Top Width (ft)	86.25	39.36	17.22
Vel Total (ft/s)	5.95	Avg. Vel. (ft/s)	3.32	8.75	3.25
Max Chl Dpth (ft)	10.03	Hydr. Depth (ft)	3.68	9.22	3.88
Conv. Total (cfs)	94492.7	Conv. (cfs)	22396.5	67488.7	4607.5
Length Wtd. (ft)	575.04	Wetted Per. (ft)	86.77	39.54	18.89
Min Ch El (ft)	777.38	Shear (lb/sq ft)	0.51	1.27	0.49
Alpha	1.63	Stream Power (lb/ft s)	234.18	0.00	0.00
Frctn Loss (ft)	1.27	Cum Volume (acre-ft)	1.84	5.77	0.93
C & E Loss (ft)	0.02	Cum SA (acres)	0.51	0.62	0.31

Plan: 1FF ARNOLD CREEK 1 RS: 1 Profile: 100 YR

E.G. Elev (ft)	787.02	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.08	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	785.93	Reach Len. (ft)			
Crit W.S. (ft)	782.77	Flow Area (sq ft)	21.53	486.63	81.49
E.G. Slope (ft/ft)	0.002201	Area (sq ft)	21.53	486.63	81.49
Q Total (cfs)	4446.00	Flow (cfs)	51.43	4182.06	212.51
Top Width (ft)	91.11	Top Width (ft)	7.91	51.83	31.37
Vel Total (ft/s)	7.54	Avg. Vel. (ft/s)	2.39	8.59	2.61
Max Chl Dpth (ft)	10.44	Hydr. Depth (ft)	2.72	9.39	2.60
Conv. Total (cfs)	94759.1	Conv. (cfs)	1096.1	89133.7	4529.3
Length Wtd. (ft)		Wetted Per. (ft)	9.60	54.30	31.86
Min Ch El (ft)	775.49	Shear (lb/sq ft)	0.31	1.23	0.35
Alpha	1.23	Stream Power (lb/ft s)	307.86	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Gmail by Google

Dan Wellings <wellingsd8@gmail.com>

Floodplain Application - EQT Gathering, LLC Saturn Compressor Station Phase VI Site improvements

1 message

Dan Wellings <wellingsd8@gmail.com> Mon, Dec 16, 2013 at 11:10 AM
To: joseph@hbe1902.com

Hello Joseph,
I received the above said Floodplain Permit application for EQT.
In the future send all applications to the Clerk of the County Court at 118 E. Court Street, West Union, WV 26456, not my home address.

1. FEMA requires that all cover pages be signed and sealed by the licensed engineer, how about sending me a copy of the cover letter with your seal also.
2. I need a cost breakdown of the part of the project located within the determined floodplain. For $4,000,000.00 the fee would be $1,000.00 flat fee for the first $100,000.00 of construction cost, plus $5.00 per $1,000.00 for the additional construction cost or $5.00 x 3,999 = $19,995.00. Total fee due would be $20,995.00.
3. FEMA requires a copy of all other permits required from other agencies.
4. Locate the project on the appropriate FIRM panel 115 at a scale I can see and better yet is a map from the WV FLOOD TOOL with project location identified.

We will begin processing the above said floodplain permit application upon receiving this information.

I will be out of town for a few days, so communication by email will be spotty.

Dan Wellings, PS
Doddridge County Floodplain Manager

FILED
2013 DEC 16 PM 12:59
BETH A. ROGERS
COUNTY CLERK
DODDRIDGE COUNTY, WV

Gmail by Google

Dan Wellings <wellingsd8@gmail.com>

Floodplain Application - EQT Gathering, LLC Saturn Compressor Station Phase VI Site improvements

3 messages

Dan Wellings <wellingsd8@gmail.com> Mon, Dec 16, 2013 at 11:10 AM
To: joseph@hbe1902.com

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Dan Wellings, PS
Doddridge County Floodplain Manager

FILED
2013 DEC 23 AM 11:32
BETH A. ROGERS
COUNTY CLERK
DODDRIDGE COUNTY, WV

Joseph Robinson <joseph@hbe1902.com> Wed, Dec 18, 2013 at 1:48 PM
To: Dan Wellings <wellingsd8@gmail.com>
Cc: Megan Landfried <MLandfried@eqt.com>, Trey Hornor <trey@hbe1902.com>

Dan:

I have re-mailed the cover letter with my seal and added a WV flood map as requested. Megan is sending the check based on $400,000 construction there was an error on the application for the cost. A NOI permit is currently being processed and will be forwarded to you once it is obtained.

Joseph

From: Dan Wellings [mailto:wellingsd8@gmail.com]
Sent: Monday, December 16, 2013 11:10 AM
To: joseph@hbe1902.com
Subject: Floodplain Application - EQT Gathering, LLC Saturn Compressor Station Phase VI Site improvements

[Quoted text hidden]

Dan Wellings <wellingsd8@gmail.com> Mon, Dec 23, 2013 at 10:48 AM
To: Joseph Robinson <joseph@hbe1902.com>

Joseph,

Got your sealed cover letter and WV Flood Tool Map, looks good. However the info was again sent to my home address. You need to send documents to the County Clerk's office in the future. I will be resigning as Floodplain Manager as of Feb. 07, 2014 to return to my land surveying business. I will check to see if Megan has sent right application fee.

Merry Christmas,
Dan Wellings, PS
Doddridge County Floodplain Manager
[Quoted text hidden]

FILED
2013 DEC 23 AM 11:32
BETH A. ROGERS
COUNTY CLERK
DODDRIDGE COUNTY, WV