Zoning Board of Adjustment
Meeting Agenda

City Council Chambers
1311 Chestnut Street
Bastrop, TX 78602

BASTROPTX
Heart of the Lost Pines / Est. 1832

October 6, 2021 at 6:00 P.M.

City of Bastrop Zoning Board of Adjustment meetings are available to all persons regardless of disability. If you require special assistance, please contact the Board Secretary at (512) 332-8840 or write 1311 Chestnut Street, 78602, or by calling through a T.D.D. (Telecommunication Device for the Deaf) to Relay Texas at 1-800-735-2989 at least 48 hours in advance of the meeting.

As authorized by Section 551.071 of the Texas Government Code, this meeting may be convened into closed Executive Session for the purposes of seeking confidential legal advice from the City Attorney on any item on the agenda at any time during the meeting.

The City of Bastrop reserves the right to reconvene, recess, or realign the Regular Session or called Executive Session or order of business at any time prior to adjournment.

1. CALL TO ORDER

2. CITIZEN COMMENTS

At this time, comments will be taken from the audience on any topic.

In accordance with the Texas Open Meetings Act, if a citizen discusses any item not on the agenda, the Board cannot discuss issues raised or make any decision at this time. Instead, city Boards are limited to making a statement of specific information or a recitation of existing policy in response to the inquiry. Issues may be referred to the Staff Liaison for research and possible future action.

It is not the intention of the City of Bastrop to provide a public forum for the embarrassment or demeaning of any individual or group. Neither is it the intention of the Board to allow a member of the public to slur the performance, honesty, and/or integrity of the Board, as a body or any member or members of the Board, individually or collectively, nor any members of the city's staff. Accordingly, profane, insulting, or threatening language directed toward the Board and/or any person in the Board's presence will not be tolerated.

3. ITEMS FOR INDIVIDUAL CONSIDERATION

3A. Introduction of new Board member Scott Long.

3B. Consider action to appoint board officers for the Zoning Board of Adjustments.

3C. Consider action to approve meeting minutes from the September 7, 2021 Zoning Board of Adjustment Meeting

3D. Public hearing and consider action on an appeal of a Grandfathered Development Status Determination and request for a variance to be exempt from the Bastrop Building Block (B3) Code for Bastrop Grove Section 5 (previously called Section 2) Proposed Preliminary Plat, being 25.9 acres out of the Nancy Blakey Survey, Abstract 98, located east of SH 304 in the 600 Block west of SH 71, within the city limits of the City of Bastrop, Texas.

4. ADJOURNMENT

I, the undersigned authority, do hereby certify that this Notice of Meeting as posted in accordance with the regulations of the Texas Open Meetings Act on the bulletin board located at the entrance to the City of Bastrop City Hall, a place of convenient and readily accessible to the general public, as well as to the City's website, www.cityofbastrop.org and said Notice was posted on the following date and time: Friday, October 1, 2021 at 5:00 p.m. and remained posted for at least two hours after said meeting was convened.

Allison Land, Senior Planner

STAFF REPORT

MEETING DATE: October 6, 2021 **AGENDA ITEM:** 3A

TITLE:
Introduction of new Board member Scott Long.

STAFF REPRESENTATIVE:
Nicole Peterson, Planning Technician

ATTACHMENTS:
None

STAFF REPORT

MEETING DATE: October 6, 2021 **AGENDA ITEM:** 3B

TITLE:
Consider action to appoint board officers for the Zoning Board of Adjustments.

STAFF REPRESENTATIVE:
Allison Land, Senior Planner and GIS Coordinator

ATTACHMENTS:
None

STAFF REPORT

MEETING DATE: October 6, 2021 **AGENDA ITEM:** 3C

TITLE:
Consider action to approve meeting minutes from the September 7, 2021 Zoning Board of Adjustment Meeting.

STAFF REPRESENTATIVE:
Nicole Peterson, Planning Technician

ATTACHMENTS:
Meeting Minutes

Zoning Board of Adjustments
September 7, 2021 Meeting Minutes

The City of Bastrop Zoning Board of Adjustments met Tuesday, September 7, 2021 at 6:00 p.m. in the Council Chambers located at 1311 Chestnut Street, Bastrop, Texas 78602.

1. CALL TO ORDER

Patrick Connell called the meeting to order at 6:01 p.m.

Patrick Connell	Present
Gary Moss	Present
Scot Robichaud	Present – Arrived at 6:13 p.m.
Jeff Haladyna	Present
Richard Smarzik	Present

2. CITIZEN COMMENTS

There were no comments from citizens.

3. ITEMS FOR INDIVIDUAL CONSIDERATION

3A. Introduction of new Board member Richard Smarzik.

Patrick Connell introduced Richard Smarzik and asked him if he had anything he would like to share. Richard Smarzik introduced himself and stated that him and his wife own a downtown business called Relics.

3B. Consider action to approve meeting minutes from the August 4, 2021 Zoning Board of Adjustment Meeting

Jeff Haladyna made a motion to approve the August 4, 2021 Zoning Board of Adjustment Meeting Minutes. Gary Moss seconded the motion and the motion carried unanimously.

3C. Public hearing and consider action on an appeal of a Grandfathered Development Status Determination and request for a variance to be exempt from the Bastrop Building Block (B3) Code for Bastrop Grove Section 3, Lots 8 and 9 Preliminary Plat, being 19.46 acres out of the Nancy Blakey Survey, Abstract 98, located east of SH 304 in the 600 Block west of SH 71, within the city limits of the City of Bastrop, Texas.

Jennifer Bills presented the history of Bastrop Grove to the Board, applicable requirements from the Texas Local Government Code for this development, and the applications which have been submitted to the City of Bastrop by the Applicant for this project.

She stated the applicant is requesting an appeal of a Grandfathered Development Status Determination and request for a variance to be exempt from the Bastrop Building Block (B3) Code for Bastrop Grove Section 3, Lots 8 and 9 that is adjacent from the Seton Hospital.

She stated the Applicant was requesting to repeal the City Manager's determination to uphold Staff's recommendation for the Grandfathering date to be May 22, 2017, and for the Grandfathering status to be applied to the Subdivision Ordinance (Chapter 10) that was in place at that time, along with any specific regulations that informed the subdivision standards based on the submission of the Preliminary Plat

Jennifer Bills stated the Zoning Board of Adjustment would need to determine at this time did the City Manager make a mistake regarding the Grandfathered development status, and if so the Zoning Board of Adjustment could remand the matter back to the City Manager to re-evaluate; or the Zoning Board of Adjustment could determine to issue a ruling regarding the Grandfathering status at this time. Jennifer Bills stated furthermore, the applicant was requesting the Zoning Board of Adjustment entertain the request to a variance from the entire B3 Code for the development if the Grandfathering Appeal was going to be denied by the Zoning Board of Adjustment.

Discussion commenced between the Board and Staff. Richard Smarzik asked what development standards were in place when Seton was built. Jennifer stated it was the subdivision code but that predated the B3 Code development standards.

Douglas McMahan, an owner of the Bastrop Grove Project, read aloud a letter for the record.

The Zoning Board of Adjustment convened into closed executive session at 6:29 pm.

The Zoning Board of Adjustment adjourned from their closed executive session and reconvened into their meeting at 7:16 pm.

Patrick Connell opened the public hearing.

There were no comments from the public.

Patrick Connell closed the public hearing.

Discussion commenced amongst the Board members regarding the merit of the applicant's request that included the following topics:

1. Grandfathering to the May 22, 2017, date and what standards should be applied from the codes that were in place at that time;
2. Storm water drainage development standards for the site;
3. And compliance with the current 2018IBC for the site

Brendan McEntee, CBD Engineer spoke about the drainage issues for this project and stated at the time of development Bastrop Grove would comply with any current drainage standards in place.

Jeff Haladyna made a motion to alter the City Manager's decision to exempt the determination back to Chapter 10 (Subdivision) and Chapter 14 (Zoning) that was in effect on May 22, 2017 with the exception of drainage, and building construction code requirements passed after said May 22, 2017 date. No action taken on the variance request. Gary Moss seconded the motion and the motion carried unanimously.

3D. Public hearing and consider action on an appeal of a Grandfathered Development Status Determination and request for a variance to be exempt from the Bastrop Building Block (B3) Code for Bastrop Grove Section 5 (previously called Section 2) Proposed Preliminary Plat, being 25.9 acres out of the Nancy Blakey Survey, Abstract 98, located east of SH 304 in the 600 Block west of SH 71, within the city limits of the City of Bastrop, Texas.

Jennifer Bills presented to the Board an appeal of a Grandfathered Development Status Determination and request for a variance to be exempt from the Bastrop Building Block (B3) Code for Bastrop Grove Section 5.

Jennifer Bills stated Staffs contention on this matter is the applicant did not meet the requirements to continue moving forward in the two-year timeframe as required in Chapter 245.

She stated the Applicant was requesting to repeal the City Manager's determination to uphold Staff's recommendation for the Grandfathering date to be January 22, 2019. There request is to remand back to the City manager for reconsideration.

Jennifer Bills stated the Zoning Board of Adjustment would need to determine at this time did the City Manager make a mistake regarding the Grandfathered development status, and if so the Zoning Board of Adjustment could remand the matter back to the City Manager to re-evaluate; or the Zoning Board of Adjustment could determine to issue a ruling regarding the Grandfathering status at this time. Jennifer Bills stated furthermore, the applicant was requesting the Zoning Board of Adjustment entertain the request to a variance from the B3 Code for the development if the Grandfathering Appeal was going to be denied by the Zoning Board of Adjustment.

Discussion commenced with Staff for clarity on the mortarium and the application process.

Douglas McMahan, an owner of the Bastrop Grove Project, read aloud a letter for the record. He provided other documentation he would like recorded in the minutes.

Gary Moss asked applicant what he is trying to accomplish? Doug stated he would like to plat and develop the property.

Patrick Connell opened the public hearing.

Shawna Byler, owner of Chad Byler Dentist, spoke in favor of the applicants petition to the Zoning Board of Adjustment stating her practice been under contract for 3 years on one of the lots within the development. The purpose of relocating to this site is to increase the size of their practice to accommodate more employees and bring relief to the current burden on her Staff due to limited bandwidth.

Patrick Connell closed the public hearing.

Patrick Connell stated he would like to postpone making a decision on the appeal and so the Board could receive more information on the timeline of the dates of submittal and correspondence.

Gary Moss made a motion was to postpone the decision on the City Manager's determination until the next meeting to allow for the Applicant and City Staff to provide additional documentation for the record on the submissions and correspondence on such in the case herein. Jeff Haladyna seconded the motion and the motion carried unanimously.

4. ADJOURNMENT

Jeff Haladyna made a motion to adjourn the meeting at 8:14 pm. Gary Moss seconded the motion and the motion carried unanimously.

____
Chair

____
Vice-Chair

STAFF REPORT

MEETING DATE: October 6, 2021 **AGENDA ITEM:** 3D

TITLE:
Public hearing and consider action on an appeal of a Grandfathered Development Status Determination and request for a variance to be exempt from the Bastrop Building Block (B3) Code for Bastrop Grove Section 5 (previously called Section 2) Proposed Preliminary Plat, being 25.9 acres out of the Nancy Blakey Survey, Abstract 98, located east of SH 304 in the 600 Block west of SH 71, within the city limits of the City of Bastrop, Texas.

AGENDA ITEM SUBMITTED BY:
Trey Job, Assistant City Manager of Community Development

ITEM DETAILS:

Site Address:	East of SH 304 in the 600 Block west of SH 71 (Attachment 1)
Total Acreage:	25.9 acres
Legal Description:	25.9 acres of land out of the Nancy Blakey Survey, Abstract 98
Property Owner:	MC Bastrop 71 LP/Douglas MacMahon
Agent Contact:	Carlson, Brigance, and Doering/Brendan McEntee
Existing Use:	Vacant/Undeveloped
Existing Zoning:	P-5, Place Type 5 – Core
Future Land Use:	General Commercial

BACKGROUND/HISTORY:
As requested at the September 7, 2021 meeting, correspondence (Attachment 8) included the following:

- August 14, 2018 – Temporary drainage moratorium enacted.
- January 22, 2019 – Preliminary Plat for Bastrop Grove Section 2 (now Section 5) Application Submitted
    - Not accepted for review due to the drainage moratorium adopted under Emergency Ordinance No. 2018-1-A
- January 23, 2019 – Email from applicant requesting a pre-application meeting for Bastrop Grove Section 2
- January 23, 2019 – Email from applicant confirming pre-application meeting date was scheduled for February 5, 2019.
- February 5, 2019 – Pre-application meeting held discussing requirements of the moratorium and path forward.

- April 4, 2019 – Exemption Application submitted

- April 23, 2019 – Email from Jennifer Bills communicating moratorium exemption information submitted is incomplete.

- April 23, 2019 – Email from Trey Job confirming that the moratorium exemption information submitted is incomplete.

- April 23, 2019 – First reading of Stormwater Drainage Manual ordinance for adoption at City Council Meeting.

- May 14, 2019 – Emergency Ordinance for temporary drainage moratorium repealed and Stormwater Drainage Manual ordinance adopted and effective.

- January 27, 2020 – Memo issued detailing Bastrop Grove Phase 2 submittal does not meet initial completeness check.

- March 19, 2020 – Pre-application meeting held discussing path forward for business interesting in developing a 1.5-acre portion of the development (Byler)

The Texas Local Government Code Chapter 245 contains specific language about projects and permits that have been filed with a municipality and establishes the intent of the development projects. Below is the information provided by the applicant.

With the project information provided to this date, the City determined that the project is not considered Grandfathered to the previous codes in effect on January 22, 2019 as claimed by the applicant, as the project has not continued to move forward by submitting permits that can be approved by the city. Additionally, the applicant has provided and has filed a competing application following the adopted Bastrop Building Block (B^3) Code process.

Documents Provided by the Applicant:

- October 1, 2018 - Bastrop Grove Drainage Improvements Application Submitted
    - A construction plans and drainage plan for a regional drainage channel to provide direct discharge from the area owned by Retail 71 Partners and MC Bastrop 71. Plans specifically show Bastrop Grove Section 1-3 Preliminary Plat. Does not provide any information for the layout of lots south of Agnes.

- January 22, 2019 – Preliminary Plat for Bastrop Grove Section 2 (now Section 5) Application Submitted
    - Not accepted for review due to the drainage moratorium adopted under Emergency Ordinance No. 2018-1-A

- April 4, 2019 – Drainage Moratorium Exemption Application Submitted
    - Drainage Moratorium was lifted May 14, 2019

Grandfathering Appeal

The applicant is appealing three aspects of this determination (Attachment 7).

1. The Original Application gave fair notice to the City of the Project;

2. MC 71 made progress towards completion of the Project as required by LGC 245.005 (c); and

3. The Project is vested as of the Original Application on January 22, 2019.

The applicant is requesting that the ZBA remand the determination back to the City Manager for review.

Planning Staff recommends upholding the City Manager's Determination. While fair notice may have been provided, staff disputes that any progress has been made to further the completion of any permits within the two years after submittal, because permits submitted have not met the code requirements, first of the drainage moratorium, and then of the Stormwater Drainage Manual and the B³ Codes.

Request for Variance
If the appeal is denied, the applicant is requesting a variance for the Project to be exempt from the B³ Code, and more specifically the requirements of the Code to complete a Neighborhood Regulating Plan, the requirements of the Development Patterns in Chapter 5, and compliance with the Building Placement requirements of Chapter 6, any building size regulation (or regulations that affect building size, including without limitation the Built-to-line and building to land ratio), and minimum or maximum setbacks and any other B³ Code requirements which affects the Project's Vested Rights.

Planning Staff does not recommend a blanket variance to the B³ Codes without review of a specific project outlining how the variances would affect each site.

POLICY EXPLANATION:
V.T.C.A. Local Government Code Chapter 245 ("LGC 245"), provides an opportunity for landowners or developers to lock-in certain government regulations that apply to a particular development by filing a specific permit application. are regulated under Section 212.172 of the Texas Local Government Code.

Bastrop adopted Article 1.20 – Uniformity of Requirements, commonly referred to as the "Grandfathering Development Status Ordinance". This provides standards and procedures to determine possible grandfathered development status of development projects.

Procedure:

1. Applicant submission of Grandfathering Request with documentation
    a. April 19, 2021 (Attachment 4)

2. Grandfathering Review Committee (Director of Planning, City Engineer, and Public Works Director) makes determination within 15 business days.
    a. The Committee determination was made and sent on May 4, 2021. (Attachment 5)

3. Applicant can request reconsideration of the determination by the Grandfathering Review Committee within 15 business days of determination.
    a. Submitted May 25, 2021 (Attachment 6)

4. Grandfathering Review Committee can either affirm or reverse the determination within 15 business days of request.
    a. Decision upheld – June 15, 2021 (Attachment 7)

5. If the determination reconsideration is denied, the request is automatically forwarded to the City Manager for determination, which must be completed within 15 business days of reconsideration determination.
    a. Forwarded on June 16, 2021
    b. Determination on July 7, 2021 (Attachment 2)

6. Applicant can appeal the City Manager's determination to the Zoning Board of Adjustment within 15 business days of determination.
    a. Appeal submitted on July 28, 2021 (Attachment 3)

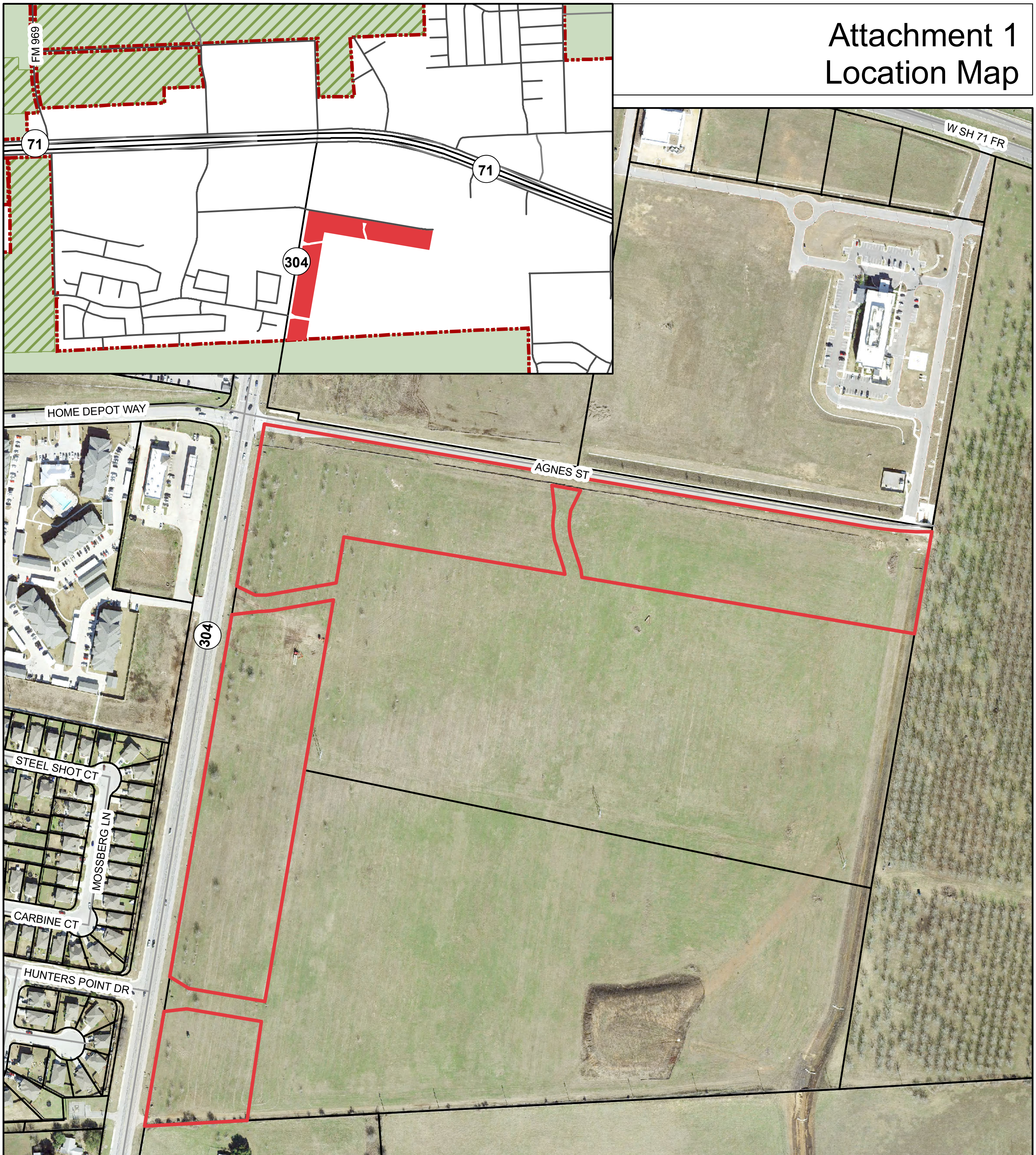
7. The ZBA must be convened within 30 days after the appeal has been received (or the City Manager, at the request of the appellant can postpone to a date certain), or the appeal is deemed to have automatically been denied.
    a. Meeting called for September 7, 2021.

8. Should the appellant be dissatisfied with the actions of the ZBA, the appellant may pursue all legal remedies to review the ZBA's decision as set forth in LGC Section 211.011.

RECOMMENDATION:
Hold public hearing and consider action on an appeal of a Grandfathered Development Status Determination and request for a variance to be exempt from the Bastrop Building Block (B3) Code for Bastrop Grove Section 5 (previously called Section 2) Proposed Preliminary Plat, being 25.9 acres out of the Nancy Blakey Survey, Abstract 98, located east of SH 304 in the 600 Block west of SH 71, within the city limits of the City of Bastrop, Texas.

ATTACHMENTS:
- Attachment 1 – Location Map
- Attachment 2 – City Manager Reconsideration Determination July 7, 2021
- Attachment 3 – Applicant Appeal to Zoning Board of Adjustment July 28, 2021
- Attachment 4 – Applicant Grandfathering Request for Bastrop Grove, Section 5 April 19, 2021
- Attachment 5 – Grandfathering Review Committee Determination May 4, 2021
- Attachment 6 – Applicant GRC Reconsideration Request April 14, 2021
- Attachment 7 – GRC Reconsideration Determination April 22, 2021
- Attachment 8 – Correspondence between City and Applicant
- Attachment 9 – Applicant Supplemental Material for October 6, 2021 Meeting

Attachment 1
Location Map



BASTROPTX
Heart of the Lost Pines
Est. 1832

Bastrop Grove
Section 5

0 135 270 540
Feet

1 inch = 400 feet

Date: 8/13/2021

N

The accuracy and precision of this cartographic data is limited and should be used for information /planning purposes only. This data does not replace surveys conducted by registered Texas land surveyors nor does it constitute an "official" verification of zoning, land use classification, or other classification set forth in local, state, or federal regulatory processes. The City of Bastrop, nor any of its employees, do not make any warranty of merchantability and fitness for particular purpose, or assumes any legal liablity or responsibility for the accuracy, completeness or usefullness of any such information, nor does it represent that its use would not infringe upon privately owned rights.

July 7, 2021

71 Retail Partners LP
C/O Douglas MacMahon
8214 Westchester Drive, Suite 550
Dallas, TX 75225

Dear Mr. MacMahon,

I have reviewed the documents that have been submitted and the previous determinations of the Grandfathering Committee issued by Trey Job, Assistant City Manager (Acting Director of Planning & Development).

This request is to determine if the city has had fair notice of a project and that a series of permits have been submitted that have moved the project forward towards completion. The determination under review is for Bastrop Grove Section 5 (previously submitted as Section 2). The first application for this specific project was submitted on April 4, 2019, more than two years before the request for Grandfathering on April 19, 2021. This submittal and other subsequent submittals were not complete and are considered expired. Additionally, a Neighborhood Regulating Plan for this section was submitted on November 6, 2020, was reviewed by staff, and sent to the Planning & Zoning Commission for the February 25, 2021, meeting. The item was not heard due to a request by the applicant to withdraw the application on February 24, 2021. Due to this submittal, the City has received notice of multiple projects on this property none of which have moved forward.

In consideration of these facts, it is my determination that this project does not qualify as grandfathered.

Sincerely,

Paul A. Hofmann
City Manager

CC: Trey Job, Assistant City Manager
Jennifer Bills, Assistant Planning Director

MC BASTROP 71, L.P.
8214 Westchester Drive, Ste 550
Dallas, TX 75225

July 28th, 2021

City of Bastrop
Zoning Board of Adjustment
1311 Chestnut Street
Bastrop, TX 78602

Request for Appeal

Dear Sir or Madam,

The determination by the City Manager dated July 7, 2021 that the Project is not grandfathered is incorrect, since the City mistakenly states that our plat *application* expired and that a later withdrawn application is relevant. The Project is vested by the original 2019 *application*, which application gave the City *fair notice* of the Project and the requested plan approval. The Project has progressed with numerous later filings, none of which have yet to be approved by the City, so this appeal has nothing to do with any issued permit. We have the right to withdraw any application and thereafter that withdrawn application is irrelevant. The City is twisting the facts because it doesn't want the Project to be vested from the application of its new B3 Unified Development Code.

MC BASTROP 71, L.P. ("**MC 71**") filed a Grandfathering Development Status Application on April 19th, 2021 under City Code Art. 1.20 (the "**Ordinance**"). The Grandfathering Review Committee (the "**GRC**") issued a determination (the "**GRC Determination**") on May 4th, 2021. MC 71 requested reconsideration of the GRC Determination pursuant to the Ordinance on May 25th, 2021. The GRC declined to reconsider on June 15th, 2021. The GRC Determination was automatically appealed to the City Manager, who issued his determination (the "**CM Determination**") on July 7th, 2021. This is an appeal of the prior determinations, and, in the alternative a request for variance.

The GRC Determination is required by the City for the City to make its own determination of its position on the application of Texas Local Government Code Chapter 245 ("**LGC 245**"), which provides protections from changes in local regulation as to an ongoing development project (such protections being commonly known as "**Vested Rights**"). Only LGC 245 determines the applicable Vested Rights, and to the extent the Ordinance seeks to limit Vested Rights or to give the City control over the interpretation process (such as, but not limited to, establishing standards and burdens), we protest, and submit this appeal under protest. The GRC Determination, the CM Determination, and interim administrative appeals are for the benefit of the City and are not binding on MC 71 as to the nature or extent of vested rights. MC 71 reserves all its rights under LGC 245.

For this appeal, the relevant LGC 245 provisions are **highlighted** below:

Sec. 245.002. UNIFORMITY OF REQUIREMENTS. (a) Each regulatory agency shall consider the approval, disapproval, or conditional approval of an application for a permit solely on the basis of any orders, regulations, ordinances, rules, expiration dates, or other properly adopted requirements in effect at the time:

(1) **the original application for the permit is filed for review for any purpose, including review for administrative completeness;** or

(2) a plan for development of real property or **plat application is filed with a regulatory agency.**

(a-1) **Rights to which a permit applicant is entitled under this chapter accrue on the filing of an original application or plan for development or plat application that gives the regulatory agency fair notice of the project and the nature of the permit sought.** An application or plan is considered filed on the date the applicant delivers the application or plan to the regulatory agency or deposits the application or plan with the United States Postal Service by certified mail addressed to the regulatory agency. A certified mail receipt obtained by the applicant at the time of deposit is prima facie evidence of the date the application or plan was deposited with the United States Postal Service.

(b) If a series of permits is required for a project, the orders, regulations, ordinances, rules, expiration dates, or other properly adopted requirements in effect **at the time the original application for the first permit in that series is filed** shall be the sole basis for consideration of all subsequent permits required for the completion of the project. All permits required for the project are considered to be a single series of permits. **Preliminary plans and related**

subdivision plats, site plans, and all other development permits for land covered by the preliminary plans or subdivision plats are considered collectively to be one series of permits for a project.

…(e) **A regulatory agency may provide that a permit *application* expires** on or after the 45th day after the date the application is filed if:

(1) the applicant fails to provide documents or other information necessary to comply with the agency's technical requirements relating to the form and content of the permit application;

(2) **the agency provides to the applicant not later than the 10th business day after the date the application is filed written notice of the failure that specifies the necessary documents or other information and the date the application will expire if the documents or other information is not provided;** and

(3) the applicant fails to provide the specified documents or other information within the time provided in the notice.

Sec. 245.005. DORMANT PROJECTS. (a) After the first anniversary of the effective date of this chapter, a regulatory agency may enact an ordinance, rule, or regulation that places an **expiration date on a permit** if as of the first anniversary of the effective date of this chapter: (i) the **permit** does not have an expiration date; and (ii) no progress has been made towards completion of the project. Any ordinance, rule, or regulation enacted pursuant to this subsection shall place an expiration date of no earlier than the fifth anniversary of the effective date of this chapter.

(b) A regulatory agency may enact an ordinance, rule, or regulation that places an expiration date of not less than two years on an individual **permit** if no progress has been made towards completion of the project. **Notwithstanding any other provision of this chapter, any ordinance, rule, or regulation enacted pursuant to this section shall place an expiration date on a project of no earlier than the fifth anniversary of the date the first permit application was filed for the project if no progress has been made towards completion of the project.** Nothing in this subsection shall be deemed to affect the timing of a **permit** issued solely under the authority of Chapter 366, Health and Safety Code, by the Texas Commission on Environmental Quality or its authorized agent.

(c) Progress towards completion of the project shall include any one of the following:

(1) an application for a final plat or plan is submitted to a regulatory agency;

(2) **a good-faith attempt is made to file with a regulatory agency an application for a permit necessary to begin or continue towards completion of the project;**

(3) costs have been incurred for developing the project including, without limitation, costs associated with roadway, utility, and other infrastructure facilities designed to serve, in whole or in part, the project (but exclusive of land acquisition) in the aggregate amount of five percent of the most recent appraised market value of the real property on which the project is located;

(4) fiscal security is posted with a regulatory agency to ensure performance of an obligation required by the regulatory agency; or

(5) utility connection fees or impact fees for the project have been paid to a regulatory agency.

APPEAL OF GRANDFATHERING DETERMINATIONS

MC 71 hereby appeals to Zoning Board of Adjustment (the "**ZBA**") pursuant to the Ordinance, which requires the following:

1. A statement that the appellant sought an appeal from the City Manager, and that the appeal:
    a. Was denied;
    b. Yielded an erroneous determination regarding the project's eligibility for grandfathered development status.
2. A statement of the reasons why the determination should be reversed or modified;
3. An explanation of the legal and factual grounds of the appeal; and
4. Payment of the appeal fee established by the City Council, as codified in the city's fee schedule.

For purposes of this appeal request, the word "Project" refers to the development of the 25.902 acres owned by MC 71 as shown in the Preliminary Plat Application dated 1-22-2019 (the "**Original Application**") discussed below, inclusive of the creation of the lots and related infrastructure and the construction of buildings thereon. Both the land development and the building development are entitled to vested rights.

The CM Determination relied on an interpretation of LGC 245 that contradicts the plain language of the statute as well as the applicable case law and therefore yielded an erroneous determination regarding the Project's eligibility for grandfathered development status. An analysis of the CM Determination's shortcomings is included as Exhibit "A" to this appeal.

In order to determine whether the Project is entitled to Vested Rights under LGC 245 as of the date of the Original Application, we are asking that the ZBA review this appeal and make the following determinations:

1. The Original Application gave fair notice to the City of the Project;
2. MC 71 made progress towards completion of the Project as required by LGC 245.005(c); and, therefore
3. The Project is vested as of the Original Application on January 22, 2019.

<u>It Is Undisputed the MC 71 Properly Filed the Original Application on January 22nd, 2019</u>

MC 71 properly filed the Original Application on January 22nd, 2019. Following the submittal, MC 71 representatives met with the City staff to discuss the Original Application on February 5th, 2019. The City issued a memo (the "**Meeting Memo**") to MC 71 dated February 13th, 2019 attached as Exhibit "B" in which the City states "Previously have submitted – Plat, grading, utility, engineering report discussing access, etc." Therefore, there is no dispute as to whether MC 71 filed the Original Application.

LGC 245.002 only requires filing (not acceptance, approval nor completeness):

> "...the original application for the permit is filed for review for any purpose, including review for administrative completeness "

"...the original application for the first permit in that series is filed...."

These statements in the CM Determination are incorrect:

- "This submittal and other subsequent submittals were not complete and are considered expired."
- "Due to this [NRP] submittal, the City has received notice of multiple projects on this property none of which have been moved forward."

The Original Application Was Sufficient to Give the City "fair notice" of the Project

Further, it is clear from an objective review of the Original Application that it is sufficient to give the City fair notice of the Project and the nature of the permit sought as required by Texas LGC 245.022 (a-1). In addition, the Project was discussed in detail between MC 71 and the City staff at February 5th, 2019 Meeting and the Meeting Memo shows the City had a clear understanding of the Project:

- The Meeting Memo refers to the Project as "Grove Commercial"
- The Meeting Memo describes the Meeting Goal as "Discuss commercial development"
- The Meeting Memo states that MC 71 "Wants to do preliminary plat for all commercial parcels"

Lastly, as detailed in the Meeting Memo, MC 71 was instructed to file an Exemption Application, which MC 71 did on April 14th, 2019. Included in the Exemption Application is a "Project Description Letter", which was a requirement of the submittal. This letter is attached as Exhibit "C". The Project Description Letter thoroughly details the Project and further demonstrates that the City had fair notice of the Project.

The Neighborhood Regulating Plan ("NRP") application referenced in the CM Determination was for the same Project. Further, it is irrelevant as it was *affirmatively withdrawn* by MC 71. Only MC 71 has the right to define its Project. The NRP application was filed by MC 71 as a result of statements by City Staff which were inconsistent with the City Staff Report for the that application, therefore it was withdrawn, as is MC 71's right to do.

The CM Determination statement: "Due to this [NRP] submittal, the City has received notice of multiple projects on this property none of which have been moved forward." is incorrect.

The term "fair notice" is not defined in the statute, but should be interpreted to simply require the applicant to reasonably identify the project and the requested permit so the City understands what is asked. This occurred. The City and its staff understand that the project is commercial reserves and the permit is a plat. This is very simple and clear. For the City to say that it does not have fair notice is disingenuous.

In fact, the CM Determination is *silent* on the issue of fair notice, therefore we request the ZBA hold that there is NO fair notice issue.

MC 71 Received No LGC 245.005(e) Notice, Thus its Application Never Expired

The only way an application (contrasted to a permit) may expire is if the City provides the detailed notice required by LGC 245.005(e). The City never provided that notice to MC 71. The Meeting Memo does not satisfy the requirements for LGC 245.005(e).

The CM Determination statement "This submittal and other subsequent submittals were not complete and are considered expired." is incorrect.

Only Permits sre Subject to Required "Progress", but no Permit was Issued

LGC 245.005 only applies to issued permits and limits the City's ability to limit the term of an issued permit to no less than a period equal to the later of (i) 2 years from permit issuance, or (ii) 5 years from project vesting. "Progress" as defined in LGC 245.005 does not apply to applications for a permit, nor the issue of whether a project is vested.

The CM Determination does not use the work "progress", but "continuation". It does not state that there is a lack of progress. Therefore, the ZBA should hold that there is no impact of LGC 245.005 to this matter.

Even if LGC 245.005 applies, MC 71 made progress, as follows:

- Attached as Exhibit "D" is a list of the applications submitted by MC 71 for the Project. Since filing the Original Application, MC 71 has continued to submit applications required by City staff.
- In fact, MC 71 made seventeen separate submittals to the City for the Project, including four preliminary plat applications on the following dates:
    - January 22, 2019
    - January 13, 2020
    - June 1, 2020
    - June 15, 2020
- Each submittal was made for the same Project.
- Each preliminary plat application is virtually identical:
    - Each application is for the exact same land
    - Each application shows the exact same number of lots
    - Each application shows the exact same size of the individual lots
    - Each application shows the exact same access road configuration
- An objective review of Exhibit "D" and the various submittals made by MC 71 leaves no doubt that MC 71 has made a good faith attempt to file with the City for a permit to begin the Project.

<u>The Project has Vested Rights Under LGC 245 as of the Date of the Original Application</u>

As detailed above, MC 71 has met the requirements of LGC 245 for Vested Rights. MC 71 properly submitted the Original Application. MC 71 has continued to make progress towards completion of the Project. Therefore, the Project has Vested Rights under LGC 245.

<u>The ZBA Should Remand This Appeal Back to the City Manager Following its Determination that the Project has Vested Rights Under LGC 245.</u>

The CM Determination did not reach all of the issues related to Vested Rights for the Project. If the ZBA reverses the CM Determination and finds that a vesting event occurred, then MC 71 requests this appeal be remanded back to the City Manager to make a determination as to the extent of the Project's Vested Rights, following which MC 71 will have the opportunity to review that determination and have a separate opportunity to appeal such determination to the ZBA.

<u>Alternative Remedy - REQUEST FOR VARIANCE</u>

The Ordinance permits the ZBA to grant a variance from the regulations at issue under the same standards governing variances for other matters.

<u>If the appeal is denied, in the alternative, MC 71 requests a variance for the Project</u> to be exempt from the B3 Code, particularly the requirements for a NRP, the requirements to develop in accordance with the TND or VCD Development Patterns in Chapter 5, compliance with the Building Placement requirements in Chapter 6, any building size regulation (or regulations that affect building size, including without limitation the Build-To-Line and building to land ratio), any minimum or maximum building setback (or "Build-to" requirement), and any other B3 Code requirement which affects the Project's Vested Rights. All of the information, documentation and discussion in the City file and in this letter are incorporated as part of the record for this variance.

This variance is based upon hardship, and is not adverse to the public interest (or the interest of any neighboring property), promotes economic development, will promote the availability of market driven providers of goods and services to Bastrop, is due to the unique circumstances of the Project, is consistent with intent of City Code to encourage reasonable development, and meets the requirements for a variance under state law and city ordinance.

The Project is an inverted "L" configuration located in a suburban area of Bastrop impacted by the existence of FM 304, a major, heavily trafficked highway along its western frontage. The Project has been shown on plats, plans and schemes to be "commercial reserves" or "pad sites" as far back as 2019. These reserves/sites are locations for single owners or tenants with commercial uses who wish to be located on high traffic roadways in front of other developments, sometimes commercial and sometimes residential. Users are typically single story and require ample parking, and often a drive-through window (1 or more). An example is the Medtail project along SH 71 to the north. In almost all instances, the user requires that vehicles can circle the building, and that there are parking spaces immediately at the entrance of the building, for customer convenience.

There are 12 lots planned in the Project. These lots are shown on the Original Application as well as each subsequent plat submittal. Directly to the east and south is a residential development, which has been developed pursuant to a "PD". The residential development does not face the Project, but rather the Project fronts the rear fence of the residential homes with no direct access to the Project.

The following factors are a hardship for Lot 7:

- The size and lot dimensions in the Project vary significantly from the 330' x 330' preferred block size for a TND making development under the B3 Code impractical.
- FM 304 is not conducive to a pedestrian oriented development and there is no access to the residential development along the shared border between the residential development and the Project. It is doubtful that pedestrians would walk down FM 304 or the rear fence of the residential "PD" to access the Project.
- There are no sidewalks as part of the existing development immediately to the north or south along FM 304, which could lead to a potentially dangerous situation if the Project were forced to develop along the highway frontage. There are also no sidewalks on the rear of the residential "PD".
- The development conditions of the "PD" approved for the Lennar project around which the Project wraps makes it impossible to achieve the goals of B3.

71 RP requests a variance in accordance with the foregoing.

<u>Legal Ground for this Appeal</u>

The Ordinance requests legal grounds and seems to want a legal brief on this matter, when MC 71 is simply trying to comply with a City requirement to help it determine its own conclusion on the Project's Vested Rights, and the City has no authority to adjudicate Vested Rights that are binding on MC 71. Nonetheless, we attach an addendum as Exhibit "E" with reference to LGC 245 and relevant case law. Our primary reliance is on the text of LGC 245, as cited herein and available online to the City.

I look forward to presenting this appeal at the upcoming hearing. I would like to request the ZBA hearing for this appeal take place on 8/23, 8/25, 8/26 or 8/27 so that I can personally appear. I will need to make travel plans to attend so any advance notice would be much appreciated. If it is not possible to meet on any of those dates, MC 71 would be willing to extend the timeline prescribed for the hearing by the Ordinance to facilitate my attendance.

Sincerely,

Douglas M. MacMahon
Manager of the General Partner of MC Bastrop 71, L.P.

Exhibit "A"

An Analysis of the CM Determination's Interpretation of LGC 245

The CM Determination relied on an interpretation of LGC 245 that contradicts the plain language of the statute as well as the applicable case law and therefore yielded an erroneous determination regarding the Project's eligibility for grandfathered development status. Below are **bolded** excerpts from the CM Determination along with an analysis of the CM's interpretation of LGC 245:

"This request is to determine if the city has had fair notice of a project and that a series of permits have been submitted that have moved the project towards completion."

- After stating that "fair notice" is part of the appeal, the CM Determination does not further address fair notice.
- LGC 245.005 applies only to permits, not applications.

- LGC 245.005 (C)(2) provides that "a good faith attempt is made to file with a regulatory agency an *application for a permit* necessary to begin or continue towards completion of the project" (*emphasis added*), so even if LGC 245.005 applies, it was satisfied by numerous later applications.
- LGC 245 is clear that "an application for a permit" demonstrates progress towards completion of a project

"The first application for this specific project was submitted on April 4, 2019, more than two years before the request for Grandfathering on April 19, 2021. This submittal and other subsequent submittals were not complete and are considered expired."

- The statement is factually inaccurate as the Original Application was submitted on January 22nd, 2019
- First, LGC 245 does not require the City to "accept" a filing. See, LGC 245.002(a), (a-1) and (b), none of which require an "accepted" or "complete" application, and mention only an "original application." The Ordinance, particularly Sec. 1.20.010(g) is not consistent with LGC 245.
- Second, LGC 245.002 (e) is the <u>only</u> section of LGC 245 that provides for the expiration of a permit application and it details specific requirements, none of which occurred for the submittals.
    - MC 71 did not receive written notice within 10 business days after the filing of the Original Application that it failed to provide documents or other information necessary to comply the City's technical requirements relating to the form and content of the permit application.

- Rather MC 71 received the Meeting Memo on February 13th, 2019 instructing MC 71 to submit the Exemption Application as the next step in the Project, which MC 71 did on April 14th, 2019.
- After filing the Exemption Application, MC 71 did not receive written notice within 10 business days that it failed to provide documents or other information necessary to comply the City's technical requirements relating to the form and content of the Exemption Application.
- The Meeting Memo states that "After the submittal is deemed complete, Staff will take to the next available City Council meeting for approval to move forward with the Checklist option chosen and the development process". As such, the Exemption Application is pending action by the City.
- Given the above, the City does not have the ability under LGC 245 to deem the applications filed by MC 71 as incomplete or expired.

- Third, LGC 245.005 only applies to *permits* and provides limited situations for permits to expire.
  - LGC 245.005 (b) does provide the City the ability to set expiration dates for *permits* if no progress has been made towards completion of the project as follows, "A regulatory agency may enact an ordinance, rule, or regulation that places an expiration date of not less than two years on an individual *permit* if no progress has been made towards completion of the project." (*emphasis added*).
  - LGC 245.001 (1) provides a very specific definition of the word "Permit" as follows, ""Permit" means a license, certificate, approval, registration, consent, permit, contract or other agreement for construction related to, or provision of, service from a water or wastewater utility owned, operated, or controlled by a regulatory agency, or other form of authorization required by law, rule, regulation, order, or ordinance that a person must obtain to perform an action or initiate, continue, or complete a project for which the permit is sought."
    - The word "application" is nowhere in this definition.
    - An "application" and a "permit" are different.
    - The difference between a "permit" and an "application" has been further validated by the court in *City of San Antonio v. Rogers Shavano Ranch, Ltd.*, which provided that a "request" for a Permit is an application.
- Fourth, LGC 245.005 (b) provides specific limitations on the City's ability to place expiration dates on the Project as follows, "Notwithstanding any other provision of this chapter, any ordinance, rule, or regulation enacted pursuant to this section shall place an expiration date on a project of no earlier than the fifth anniversary of the date the first permit application was filed for the project if no progress has been made towards completion of the project."
  - The Original Application was submitted on January 22, 2019. Therefore, even if you were to accept the City's position that no progress had been made towards completion of the Project (which MC 71 denies as detailed in this appeal), the earliest possible expiration date for the Project would be January 22, 2024.

- Fifth, if the City's position is that the application lapsed under its internal requirements, then that is an inequitable result since it was the City which was refusing to process the filed applications, thus impeding the progress of the Project.

"Additionally a Neighborhood Regulating Plan for this section was submitted on November 6, 2020, was reviewed by staff, and sent to the Planning & Zoning Commission for the February 25, 2021 meeting. This item was not heard due to a request by the applicant to withdraw the application on February 24, 2021. Due to this submittal, the City has received notice of multiple projects on this property none of which have moved forward."

- This statement is factually inaccurate.
    - The City has not received notice of multiple projects.
    - LGC 245.001 defines Project as "an endeavor over which a regulatory agency exerts its jurisdiction and for which one or more permits are required to initiate, continue, or complete the endeavor."
    - Each and every submittal MC 71 made was for the same project as such word is defined by LGC 245 and has been further defined by the courts in the cases cited in Exhibit "E", including without limitation *Anderson v. City of Cedar Hill.*
- Further, the submittal of the Neighborhood Regulating Plan was made for the same Project as was every prior submittal and was an attempt to follow the process dictated by the City staff to move the Project forward.
    - MC 71 *withdrew* the submittal because the City staff requirements for approval of the Neighborhood Regulating Plan were in violation of the Project's Vested Rights.
- MC 71 has not withdrawn any other submittal for the Project, including without limitation the Original Application or the Exemption Application. In fact, MC 71's engineer routinely followed up with the City about the status of these items. In essence, the City seems to have stonewalled the Original Application and Exemption Application.

Exhibit “B”

The Meeting Memo

MEMO

To: Brendan McEntee

From: Allison Land

cc: Staff

Date: February 13, 2019

Re: Pre-Application Meeting – Grove Commercial

City staff has generated notes from the meeting on February 5, 2019. The information discussed and comments made by staff during this meeting are not intended to constitute a formal review of your project. This meeting *does not substitute* for the formal review that will take place in the event you file a development application with the City. Information provided and comments made by staff during the meeting are based solely on the information provided by you prior to or during the meeting.

Upon submittal of the appropriate application(s), additional comments are to be expected that may or may not be discussed in this meeting. More detailed information provided by you concerning your project during staff's review of a formal application may alter comments made during the meeting depending on the situation.

Property Information

Address: TBD

R Number:

Jurisdiction: City Limits

Platted: No

In floodplain: partial

Water, Wastewater available: Nearby

Electricity available: Nearby

Toad Habitat Area: No

Current Zoning: General Retail with restrictions

Meeting Goal

Discuss commercial development

Items Discussed:

Drainage channel

- Needs to establish good vegetation
- Anticipated 9 to 10 feet/second eventually

Exemption:

- Requires pre-submission meeting (this one)
- Requires submittal of the Exemption Application and an associated Checklist: Planned Development District, Alternative Site Design, ETJ Agreement, or Waiver. A checklist and all items listed on the checklist must accompany the Application
- After the submittal is deemed complete, Staff will take to the next available City Council meeting for approval to move forward with the Checklist option chosen and the development process
- **Engineer Certification required. See Emergency Ordinance 2018-2-A Section 5b - link**
- Note: Documentation provided with the Exemption Application does NOT constitute a submittal for any required permits after the Exemption is granted
- This project could use either Planned Development or Alternative Design Standards
- Alternative Design Standards
  - Use new rainfall totals and Atlas 14 data
  - Add some water quality infrastructure
- Need to run the channel and anticipated development against Atlas 14 data to show that it works and that the new development tying in is accounted for
- If you can live with the setbacks, use Alternative Design Standards
- If not, use the Planned Development
  - Can keep high level, call out uses, driveway spacing
  - Need to show a concept plan
  - If you choose to address water quality, address the first 1.5 inches
  - Pervious pavers are allowed under this
  - Leave GR as the base zoning
  - Change setbacks (could be flexible, min/max), drainage standards, landscaping, etc. Get creative

Zoning

- Two story development will have a 60-foot building setback from the residential lots
  - To change: need either a zoning variance (no financial hardship) or a planned development
  - Variances are hard to justify and hard to support

Platting

- Lot of Record Verification or Platting is required before permits may be issued
- All lots must have public road frontage and utility access. Access easements and/or driveways across other lots does not provide public road frontage.
- Wants to do preliminary plat for all commercial parcels
- Channel sized for 50% cover of Nixon and 80% cover on the other side
- Preliminary plat:
  - Previously have submitted - Plat, grading, utility, engineering report discussing access, etc.
  - Checklist is the same now. Additional details are needed for the Exemption before the prelim can be submitted
- Note: still need to record Agnes St ROW by separate instrument

Utilities

- Lift station: does it have capacity for the south side of Agnes?
    - Stantec for capacity

Moving Forward

Action Items

- City
    - Send copy of PD to Brendan
- Applicant

Process Overview

What steps the project attendees need to follow to move forward in the project, in order of recommended completion.

- Exemption and Exception applications and checklists are available on the Building Bastrop website.
- Building/Permitting and Planning applications and checklists are available on the Planning & Development Department's website via the menu on the left.

1. Exemption Application with Planned Development Checklist
    a. This will go to P&Z and Council like a normal PD
2. Planning Application with Preliminary Plat Checklist
3.

City of Bastrop

"Where Preservation of the Past Combined with Progress for the Future Encourages Opportunities to Grow"

Pre-Application Meeting Sign-in Sheet (Staff):

Project & Location: Grove Commercial

Date: February 5, 2019

	Name	Title/Organization	Phone	Email
☐	Lynda Humble	City Manager	(512)-332-8800	lhumble@cityofbastrop.org
☒	Jerry Palady, PE	Director of Engineering	(512) 332-8846	jpalady@cityofbastrop.org
☐	James McCann, PE	Engineering Consultant		
☐	Matt Jones, AICP	Director of Planning	(512) 332-8840	mjones@cityofbastrop.org
☒	Jennifer C. Bills, AICP, LEED AP	Assistant Planning Director	(512) 332-8845	jbills@cityofbastrop.org
☐	Matt Lewis, CNU	Planning Consultant		
☒	Trey Job	Director of Water/Wastewater and Public Works	(512) 332-8932	tjob@cityofbastrop.org
☐	Curtis Hancock	Assistant Director of Water/Wastewater and Public Works	(512) 332-8964	chancock@cityofbastrop.org
☒	Allison Land	Planner/GIS Coordinator	(512) 332-8843	aland@cityofbastrop.org
☐	Kimberly Hanly (Tap & Impact Fees)	Coordinator, Water & Wastewater Department	(512) 332-8960	khanly@cityofbastrop.org
☐	Tim Goetz	Electric Superintendent, Bastrop Power & Light	(512) 332-8900	tgoetz@cityofbastrop.org
☐	Cheryl Renfro	Project Coordinator Bastrop Power & Light	(512) 332-8901	crenfro@cityofbastrop.org
☐	Andres Rosales	Fire Chief	(512) 332-8670	arosales@cityofbastrop.org
☐	Rod Stradling	Assistant Fire Chief	(512) 332-8670	rstradling@cityofbastrop.org
☐	David Brasich	Building Official	(512) 332-8847	Dbrasich@cityofbastrop.org
☐	Jean Riemenschneider	Bastrop Economic Development Corp.	(512) 332-8873	jean@bastropedc.org
☐	Carolyn Dill, PE	County Engineer, Bastrop County	(512) 581-7180	carolyn.dill@co.bastrop.tx.us
☐	Cari Croft (contact for Houston toad)	Lost Pines HCP Administrator, Bastrop County	(512) 332-7284	Cari.croft@co.bastrop.tx.us

City of Bastrop

"Where Preservation of the Past Combined with Progress for the Future Encourages Opportunities to Grow"

Pre-Application Meeting Sign-in Sheet (Project Attendees):

Project & Location: Grove Commercial

Date: February 5, 2019

Name	Title/Organization	Phone	Email*
Brendan McEntee			

*Email address will be used to send a copy of notes taken at this meeting, and as a further correspondence option as needed

Exhibit "C"

The Project Description Letter

CBD Project Number: 4879
Date: April 4, 2019

City of Bastrop, TX
Planning and Development Department
1311 Chestnut Street
Bastrop, TX 78602

RE: Exemption Application Submittal for Bastrop Grove Section 2
Project Description Letter

The proposed project consists of developing 12 lots, encompassing an overall acreage of 25.882 acres, located along the south side of Agnes Road and the east side of SH 304. This development is anticipated to consist of individual developments consisting of office, retail, commercial, medical and/or other uses allowed within the current GR zoning. This project is being submitted for approval of an Exemption Application based on an Alternative Drainage Plan to allow for the development to proceed with submittal of Preliminary Plans, Final Plats, and construction drawings for the various developments.

The stormwater drainage system for this area was recently enhanced with the construction of the Bastrop Grove Channel Improvement project. That project, jointly funded by the Bastrop Economic Development Corporation, Ascension (Seton) Hospital, and the Bastrop Grove developer, provided for the conveyance of stormwater from the fully developed areas that contribute to the channel. The Bastrop Grove Channel Improvement project was designed and permitted prior to the Drainage Moratorium and was based on the codes and ordinances of the City of Bastrop. Since that time, Atlas 14 has been issued by the NWS and updated precipitation values were issued for Central Texas areas. Attached to this Exemption Application is an updated Drainage Report for the Bastrop Grove Channel Improvement project with all precipitation values updated to reflect the higher current values of Atlas 14. A review of the report demonstrates that the constructed channel adequately conveys the fully developed conditions (including development of the Bastrop Grove Section 2 area at 75% impervious cover) up to and including a 100-year event. These improvements, coupled with updated calculations for Atlas 14 precipitation, result in a stormwater system that exceeds the current standards in the Code of Ordinances.

Please contact me should you have any questions or require any additional information.

Sincerely,

Carlson, Brigance and Doering, Inc.
(TX Firm #F3791)

Brendan P. McEntee

Brendan P. McEntee, P.E.
Branch Manager

Exhibit "D"

MC 71 has made the following applications in good faith to secure a permit necessary to begin or continue towards completion of the Project. All applications for permits have been for the same Project since filing the Original Application:

- Application dated 10-01-2018 for Bastrop Grove Drainage Improvements
- Application dated 01-22-2019 for Preliminary Plat Bastrop Grove, Section 2
- Application dated 01-22-2019 for Plat Details and Drainage Improvements Report
- Application dated 04-14-2019 for Bastrop Grove Section 2 Exemption Application
- Application dated 01-13-2020 for Preliminary Plat, Bastrop Grove, Section 5
- Application dated 01-13-2020 for Preliminary Drainage, Bastrop Grove, Section 5
- Application dated 01-13-2020 for Preliminary Infrastructure, Bastrop Grove, Section 5
- Application Resubmittal dated 06-01-2020 for Preliminary Plat, Bastrop Grove, Section 5
- Application Resubmittal dated 06-01-2020 for Preliminary Drainage, Bastrop Grove, Section 5
- Application Resubmittal dated 06-01-2020 for Preliminary Infrastructure Submittal, Bastrop Grove, Section 5
- Application dated 06-08-2020 for Preliminary Plat Application Bastrop Grove, Section 5
- Application Resubmittal dated 06-15-2020 for Preliminary Plat, Bastrop Grove, Section 5
- Application Resubmittal dated 06-15-2020 for Preliminary Drainage, Bastrop Grove, Section 5
- Application Resubmittal dated 06-15-2020 for Preliminary Infrastructure Submittal, Bastrop Grove, Section 5
- Application dated 11-06-2020 for Bastrop Grove Neighborhood Regulating Plan, North and South of Agnes
- Application dated 11-09-2020 for Bastrop Grove B3 Warrant Request
- Application dated 03-16-2021 for Bastrop Grove Neighborhood Regulating Plan, South of Agnes

Exhibit "E"

<u>Relevant Vested Rights Caselaw Supporting this Appeal</u>

Hatchett v. West Travis County Public Utility Agency, 598 S.W.3d 744, (Tex. App—Austin, 2020, pet denied)- Summary of the current state of vested rights under LGC 245.

FLCT, Ltd. v. City of Frisco, 49 S.W.3d 238 (Tex. App.—Fort Worth 2016, pet. den.)- The exceptions to the "municipal zoning regulations" except to vested rights under LGC 245.004 is determined on an "as applied" basis to any regulations which "have an effect" on the listed exception issues. The exception for "property classification" means the permissible uses under the regulator scheme when vesting occurs. A project is entitled to all uses permitted when vesting occurs. "Fair notice" of a project incorporates all the city actual knows about the project, not just what the applicate documents. The definition of a "project" is broad.

City of San Antonio v. Greater San Antonio Builders Ass'n, 419 S.W.3d 597 (Tex. App.—San Antonio 2013, pet. den.)- A city may not add local limits to vested rights, only LGC 245 determines vested rights.

Harper Park Two, LP v. City of Austin, 359 S.W.3d 247 (Tex. App.—Austin 2011, pet. den.)- The entirety of a development project is considered in a "project", not components or phases. The definition of "permit" is very broad. The vesting is considered in the context of the regulatory scheme at the time to determine the scope of the project.

Hartsell v. Town of Talty, 130 S.W.3d 325, 326 (Tex. App.—Dallas 2004, pet. denied)- Vested rights extend to the entire development project, land and buildings.

Anderson v. City of Cedar Hill, 447 S.W.3d 84 (Tex. App.—Dallas 2014, pet. den.)- • Broad definition of "Endeavor" = "the action of endeavoring; effort, or pains, directed to attain an object" (citing AG OP. No. JC-0425 (2001)), "a systematic or continuous effort to attain some goal", "to exert physical or intellectual strength toward the attainment of an object of goal"

Date: April 19th, 2021

Trey Job, Assistant City Manager
City of Bastrop, TX
Planning and Development Department
1311 Chestnut Street
Bastrop, TX 78602

RE: Grandfather Development Status - Bastrop Grove Section 2 (South of Agnes)
Project Description Letter

Bastrop Grove Section 2 is a multi-lot commercial land development with frontage along SH 304 and Agnes Road in the City of Bastrop. It includes 12 outparcels with frontage on SH 304 or Agnes as well as provides for the dedication of the southern portion of Agnes Road. As discussed in earlier meetings with staff regarding this project, it is my belief that the project has vested rights, based on the earlier applications and the continued nature of this commercial land development project, and therefore we are submitting this letter and the accompanying documentation for a Grandfathering Determination Status.

The "Project" is described in the following Project related applications for permits required for the Project, and has been the same Project since inception in 2018:

- Application dated 10-01-2018 for Bastrop Grove Drainage Improvements
- Application dated 01-22-2019 for Preliminary Plat Bastrop Grove, Section 2
- Application dated 04-14-2019 for Bastrop Grove Section 2 Exemption Application

It is my understanding that the Project is not subjected to any City of Bastrop regulations except those described in Tx. Loc. Gov't Code Section 245.004, being those in effect 01-22-2019 (date of first accepted development application) and any which are exempt from vesting.

Furthermore, I understand that the zoning provisions of the City's Bastrop Building Block Code (B3) relating to the following are not applicable to the project (as being within the exemptions for the general exception from vested rights as to municipal zoning ordinances), which are all zoning provisions which affect (have an effect on):

- Landscaping or tree preservation
- Open space or park dedication
- Property classification (permitted uses)
- Lot size, dimensions or coverage
- Building size.

Our view is that the B3 isn't zoning so no portion of B3 is exempt from vesting, but to the extent the City says that portions are zoning, then the foregoing are vested.

It is my belief that all provisions in the Bastrop Building Block Technical Manual and the City of Bastrop Development Manual are subject to vesting, and not applicable to the Project. Only the City regulation in effect as of initial January 22, 2019 plat application apply to the Project, including the City Subdivision Ordinance

Based on the above vesting, the following provisions of the City Zoning Ordinance as of April 13th, 1991 (1991 Zoning Ord.) apply to the Project, as vested rights:

The permitted uses allowed for GR (General Retail) listed in the following exhibits.

Exhibit A - Use Regulations Chart, City of Bastrop, 1991,

The permitted lot size, dimensions or coverage for the Project under Section 25.4 - Area Regulations.

Size of Lot:

- Minimum Lot Area - Twelve thousand (12,000) square feet.
- Minimum Lot Width - One hundred feet (100').
- Minimum Lot Depth - One hundred ten feet (110').
- Maximum Lot Coverage: Fifty percent (50%).

The permitted building size under Section 25 (including the related regulations which affect Building Size, such as:

- Setback- Section 25.4
- Height- Section 25.3
- Required Parking- Section 38

Other Regulations: As established in the Development Standards, Sections 37 through 45

Required landscaping or tree preservation in Section 39.5, 39.6 & 39.7

The Project is also vested from changes in flood regulations effective outside the FEMA flood plain.

The Project is not dormant, as progress has been made towards completion of the original contemplated project as follows:

- Construction of the offsite Drainage Channel to the Colorado River- Project Name: Bastrop Grove Drainage Improvements *(Approval Date: 10-01-2018)*
- Cost have been incurred for development the project with CBD Engineering, and other professional and legal firms

This application is not intended to waive any vested rights, under Tex. Loc. Gov't Code Ch. 245 or otherwise. My client protests any idea that the City can legally determine or limit the vested rights for the Project, and submits this application only to aid the City is coming to its own internal decision as to the appropriate vested rights for the Project. All rights are reserved.

Should you have any questions or require any additional information, please feel free to call/email.

Sincerely,

Carlson, Brigance & Doering, Inc.
F-3791

Brendan P. McEntee, P.E.
Branch Manager

Grandfathered Development Status Application

Project Information

Legal Description: ABS A98 BLAKEY, NANCY, ACRES 145.697

Project Address(es): Not Addressed

Total Acreage: 25.882 BCAD Property ID: 78736, 8712472, and 8712473

Was the Project in progress on or after September 1, 1997? After

Property Owner

Name/Entity/Trustee: MC BASTROP 71, LP

Mailing Address: 8214 WESTCHESTER DR, STE 550, DALLAS, TX 75225

Phone & Fax Numbers: 214-622-6525 E-mail Address dm@morancap.com

Applicant

Name/Entity/Trustee: Brendan P. McEntee, P.E. - Carlson, Brigance & Doering, Inc.

Mailing Address: 12129 Ranch Road 620 North, Suite 600, Austin, Texas 78750

Phone & Fax Numbers: (512) 280-5160 E-mail Address bmcentee@cbdeng.com

Permit Identification

First Permit

Name: Preliminary Plat Bastrop Grove, Section 2		Application Date: 01/22/2019
Approval Date:	Expiration Date:	Volume and Page No.:

Additional Permit

Name: **Please see the attached supplement document**		Application Date:
Approval Date:	Expiration Date:	Volume and Page No.:

Additional Permit

Name:		Approval Date:
Expiration Date:	Volume No.:	Page No.:

Additional Permit

Name:		Approval Date:
Expiration Date:	Volume No.:	Page No.:

BASTROPTX
Heart of the Lost Pines / Est. 1832

Grandfathered Development Status Application

Additional Permit		
Name:		Approval Date:
Expiration Date:	Volume No.:	Page No.:

Additional Permit		
Name:		Approval Date:
Expiration Date:	Volume No.:	Page No.:

APPLICANT:			OFFICIAL USE ONLY	
Included in Submittal	Per Ordinance 2019-10, Additional Submittal Items are:		Meets Standard	Does Not Meet Standard
✓	1	Identification of the "Project," as that term is defined in LGC 245.001(3), as may be amended. Example: Residential Subdivision		
✓	2	Narrative description of the development/construction Project or proposed land use for which the Permit is being sought. Describe which Permits have been completed and which are remaining.		
✓	3	Layout of the site, including locations of buildings, streets, utilities, fences, drives, sidewalks, drainage facilities, and any other permanent or temporary structures which may be present at the time of application		
✓	4	Identification of each City regulation in effect at the time of the original application for the Permit filed that applies to the Project and that the Applicant contends: A. Is grandfathered B. Controls the approval, disapproval, or conditional approval of an application for a Permit, pursuant to LGC 245.002(a), as may be amended		
✓	5	Identification of each current City regulation for which the Applicant seeks an exemption due to the grandfathered development status provided the property owner by LGC 245 or other applicable vesting laws		
✓	6	Explanation of the applicability of any approval expirations and related requests for extension of approvals		
✓	7	Photographs, drawings, maps, and previous approvals that would assist the Grandfathering Review Committee in making its determination		
✓	8	Certified land survey of topography showing existing drainage patterns and structures		
✓	9	Any other information or supportive materials deemed necessary and requested in writing by the Director of Planning and Development		

Signature and Certification

The applicant certifies that the facts stated herein and exhibits attached hereto are true, correct, and complete.

B. Dean P McCarter Project Engineer and Agent — 04-18-2021

Signature and Title — Date

Grandfathered Development Status Application

Process Overview

1. Complete Application, which includes: Application, Permit Identification, and Additional Submittal Items
    a. Incomplete submittals will not be accepted.
2. Director of Planning & Development will promptly forward to the Grandfathering Review Committee.
3. Determination made by Grandfathering Review Committee.
    a. Within 15 days of Application filing, the Committee will issue a written administrative determination approving the application, disapproving the application, or requesting more information.
    b. Determination shall identify the date the original Permit was filed, which claims have been recognized, and which claims have been rejected.
4. Reconsideration: must be requested in writing within 15 days of the Determination
5. Appeal to City Manager: must be requested in writing within 15 days of the date that the Committee declined to reconsider the Application.
6. Appeal to Zoning Board of Adjustment: must be requested in writing within 15 days of the City Manager's Determination.

Determination Standards

1. Date of first application
2. Fair notice
3. Consistency
4. Subsequent development
5. Prior vested rights determinations
6. Regulations
7. Expiration of prior applications
8. Exemptions in LGC 245.004
9. Expiration of Project
10. City Code
11. State Law

Staff Use Only

☐ Received By: Date:

Fees Paid $

Comments:

Carlson, Brigance & Doering, Inc.

Civil Engineering ❖ Surveying

Bastrop Grove Section 2 (South of Agnes)

Grandfathered Development Status Application

Supplement Document-Permit Identification

First Project Related Development Permit
Name: Bastrop Grove Drainage Improvements
Approval Date: 10-01-2018
Volume No:
Page No:

First Development Application
Name: Preliminary Plat Bastrop Grove, Section 2
Application Date: 1-22-2019
Volume No:
Page No:

Additional Development Application
Name: Bastrop Grove Section 2 Exemption Application
Approval Date: 04-04-2019
Volume No:
Page No:

12129 Ranch Road 620 North, Suite 600* Austin, Texas 78750 * (512) 280-5160

Bastrop Grove Section 2 (South of Agnes)
Grandfathered Development Status Application
Checklist Supplement

1. Identification of the "Project," as that term is defined in LGC 245.001(3), as may be amended. Example: Residential Subdivision

   Please see the attached project narrative

2. Narrative description of the development/construction Project or proposed land use for which the Permit is being sought. Describe which Permits have been completed and which are remaining.

   Please see the attached project narrative

3. Layout of the site, including locations of buildings, streets, utilities, fences, drives, sidewalks, drainage facilities, and any other permanent or temporary structures which may be present at the time of application

   Please see the attached Preliminary Plat Bastrop Grove, Section 2 submittal. No structures or improvements exist on the lots.

4. Identification of each City regulation in effect at the time of the original application for the Permit filed that applies to the Project and that the Applicant contends:
   a. Is grandfathered
   b. Controls the approval, disapproval, or conditional approval of an application for a Permit, pursuant to LGC 245.002(a), as may be amended

   Provided in the attached project narrative

5. Identification of each current City regulation for which the Applicant seeks an exemption due to the grandfathered development status provided the property owner by LGC 245 or other applicable vesting laws

   Provided in the attached project narrative

6. Explanation of the applicability of any approval expirations and related requests for extension of approvals

   Explained in the attached project narrative

7. Photographs, drawings, maps, and previous approvals that would assist the Grandfathering Review Committee in making its determination

   Previously submitted plans that are listed in the 'Permit Identification' section have been attached.

8. Certified land survey of topography showing existing drainage patterns and structures

   Please see the Preliminary Plat Bastrop Grove, Section 2 submittal attached.

9. Any other information or supportive materials deemed necessary and requested in writing by the Director of Planning and Develop
   N/A.

SECTION 36 - USE REGULATIONS (CHARTS)

36.1 - USE CHART ORGANIZATION/UNLISTED USES

A. The use of land and/or buildings shall be in accordance with those listed in the following Use Charts. No land or building shall hereafter be used and no building or structure shall be erected, altered, or converted other than for those uses specified in the zoning district in which it is located. The legend for interpreting the permitted uses in the Schedule of Uses is:

 X Designates use is permitted in the zoning district indicated

 ____ Designates use is prohibited in district indicated

 C Designates use may be approved by a Conditional Use Permit (also see Section 33)

 See Definitions in the Appendix (A-3) for further description of uses identified with an asterisk (*).

B. If a use is not listed, it is not allowed in any zoning district.

C. *Use Chart Organization:*

 1. Primary Residential Uses (Use Chart 36.2)
 2. Accessory and Incidental Uses (Use Chart 36.3)
 3. Utility and Service Uses (Use Chart 36.4)
 4. Recreational and Entertainment Uses (Use Chart 36.5)
 5. Education, Institutional, Public, and Special Uses (Use Chart 36.6)
 6. Transportation Related Uses (Use Chart 36.7)
 7. Automobile and Related Uses (Use Chart 36.8)
 8. Office and Professional Uses (Use Chart 36.9)
 9. Retail and Related Service Uses (Use Chart 36.10)
 10. Commercial Uses (Use Chart 36.11)
 11. Light Industrial and Related Uses (Use Chart 36.12)

D. *Classification of New/Unlisted Uses:* It is recognized that new types of land use will develop and forms of land use not presently anticipated may seek to locate in the City of Bastrop. In order to provide for such changes and contingencies, a determination as to the appropriate classification of any new or unlisted form of land use in the Use Charts (Sections 36.2 through 36.12) shall be made as follows:

 1. *Initiation*

  a. A person, City department, the Planning and Zoning Commission, or City Council may propose zoning amendments to regulate new and previously unlisted uses.

  b. A person requesting the addition of a new or unlisted use shall submit to the Director of Planning all information necessary for the classification of the use, including but not limited to:

   (1) The nature of the use and whether the use involves dwelling activity, sales, services, or processing;

   (2) The type of product sold or produced under the use;

   (3) Whether the use has enclosed or open storage and the amount and nature of the storage;

   (4) Anticipated employment typically anticipated with the use;

   (5) Transportation requirements;

   (6) The nature and time of occupancy and operation of the premises;

   (7) The off-street parking and loading requirements;

   (8) The amount of noise, odor, fumes, dust, toxic materials and vibration likely to be generated; and

   (9) The requirements for public utilities such as sanitary sewer and water and any special public services that may be required.

 2. The Director of Planning shall refer the question concerning any new or unlisted use to the Planning and Zoning Commission with a recommendation as to the zoning classification into which such use should be placed. The referral of the use interpretation question shall be accompanied by the statement of facts in "b" above. An amendment to this ordinance shall be required as prescribed by Section 10.

 3. The Planning and Zoning Commission shall consider the nature and described performance of the proposed use and its compatibility with the uses permitted in the various districts and determine the zoning district or districts within which such use is most similar and should be permitted.

 4. The Planning and Zoning Commission shall transmit its findings and recommendations to the City Council as to the classification proposed for any new or unlisted use. The City Council shall approve or disapprove the recommendation of the Planning and Zoning Commission or make such determination concerning the classification of such use as is determined appropriate based upon its findings. If approved, the new or unlisted use shall be amended in the Use Charts of the Zoning Ordinance according to Section 10.

 5. Standards for new and unlisted uses may be interpreted by the Director of Planning as those of a similar use. When a determination of the appropriate zoning district cannot be readily ascertained, the same criteria outlined above ("b") shall be followed for determination of the appropriate district. The decision of the Director of Planning may be appealed according to the process outlined in "2" through "4" above.

(Ord. No. 2002-8, § 2, 3-26-02)

USE CHART
ZONING ORDINANCE
CITY OF BASTROP, TX

SECTION 36.2

Legend for interpreting the Schedule of Uses

 X Designated use permitted in District

 ____ Designated use prohibited in District

 C Use may be allowed with a Conditional Use Permit

Primary Residential Uses	AOS	SF20	SF9	SF8	SF7	2F	SFA	MF1	MF2	MH	O	NS	GR	CBD	CF	CT	C-1	C-2	IP	LI	PD	MHO
Bed and Breakfast Inn or Facility	X	C	C	C	C	C	C	X	X		X	X	X	X		X	X	X			X	
Boarding or Rooming House								X	X		X	X	X	X							X	
Community Home (per State Statue)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fraternity or Sorority House								X	X		X	X	X	X								
Housing for the Elderly/Senior								X	X		X	X	X	X							X	
Manufactured/HUD-Code Mobile Home	C	C	C	C	C					X											X	X
Manufactured Home Park										X											X	X
Mobile Home Subdivision										X											X	X
Multiple-Family Dwelling (Apartment)									X		X	X	X	X							X	
Multiple-Family Dwelling (Quadraplex)								X	X		X	X	X	X								
Patio Home (Zero Lot Line Dwelling)																					X	
Single-Family Dwelling Attached						C	X	X	X					X							X	
Single-Family Dwelling Detached		X	X	X	X	X	X	X	X	X				X		X					X	X
Two-Family Dwelling (Duplex)						X	X	X	X												X	

(Ord. No. 2010-1, 1-12-10)

USE CHART
ZONING ORDINANCE
CITY OF BASTROP, TX

SECTION 36.3:

Legend for interpreting the Schedule of Uses

__X__Designated use permitted in District

_____Designated use prohibited in District

C Use may be allowed with a Conditional Use Permit

Accessory and Incidental Uses	AOS	SF20	SF9	SF8	SF7	2F	SFA	MF1	MF2	MH	O	NS	GR	CBD	CF	CT	C-1	C-2	IP	LI	PD	MHO
Accessory Building (Residential) +240 s	X	C	C	C	C	C	C	C	X		X	X	X	X	X	X	X	X		X	X	
Accessory Building (Residential) -240 s.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X
Accessory Building Non Residential (Bus/Ind)											X	X	X	X	X	X	X	X	X	X	X	
Caretaker's or Guard's Residence	X	C						X	X		X	X	X	X	X	X	X	X	X	X	X	X
Garage/Accessory Dwelling (See Sec 40.4)	X	X	C	C	C	C	C	X	X		X	X	X	X	X	X	X	X		X	X	
Home Occupation	See Definitions A-3, Home Occupation (123)																			See Def.		
	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X
Off-street Parking Incidental to Main Use	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Swimming Instruction as Home Occupation	C	C	C	C	C	C	C	C	C	C	X	X	X	X		X	X	X		X	X	C
Swimming Pool (Private)	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X		X	X	
Temp Field Office/Const. Yard or Office Subject to Permit issued by Building Official																						
Tennis Court (Lighted)	C	C							C		X	X	X	X	X	X	X	X		X	X	C
Tennis Court (Private) (No Lights)	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X		X	X	X

(Ord. No. 2010-1, 1-12-10; Ord. No. 2013-24, 11-12-13)

USE CHART
ZONING ORDINANCE
CITY OF BASTROP, TX

SECTION 36.4:

Legend for interpreting the Schedule of Uses

X Designated use permitted in District

_____ Designated use prohibited in District

__C__ Use may be allowed with a Conditional Use Permit

Utility, Service and Other Uses	AOS	SF20	SF9	SF8	SF7	2F	SFA	MF1	MF2	MH	O	NS	GR	CBD	CF	CT	C-1	C-2	IP	LI	PD	MHO
Antenna (Commercial) See Section 43	C																			C		
Antenna (Non Commercial)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Electrical Energy Generating Plant	C																		C	C	X	
Electrical Substation (High Volt. Bulk Power)	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
Electrical Transmission Line (High Voltage)	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
Farm, Ranch, Crops or Orchard (Commercial)	X																					
Fire, Police, Public Health, Municipal Bldgs/Fac	X	C	C	C	C	C	C	C	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Franchised Private Utility (not listed)	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
Garden or Orchard (Non Commercial)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Gas Line and Regulating Station	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
Local Utility Line	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Public Building with Shop/Yard of Local, State or Federal Agency (Outside Storage)	C													C	C	C	C	X	C	X	X	
Radio or Television Transmitting Station	C											C	C	C	C	C	C	X	C	X	X	
Sewage Pumping Station (Public)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Telephone Business Office											X	X	X	X		X	X	X	X	X	X	
Telephone Exchange/ Switching/Relay or Transmitting Station	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Utility Shop/ Storage Yards/Buildings	C																	X	C	X	X	
Water Reservoir Well/Pumping Station	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Water stand Pipe/Elevated Water Stora [Storage]	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Water Treatment Plant	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

USE CHART
ZONING ORDINANCE
CITY OF BASTROP, TX

SECTION 36.5:

Legend for interpreting the Schedule of Uses

__X__ Designated use permitted in District

_____ Designated use prohibited in District

__C__ Use may be allowed with a Conditional Use Permit

Recreational and Entertainment Uses	AOS	SF20	SF9	SF8	SF7	2F	SFA	MF1	MF2	MH	O	NS	GR	CBD	CF	CT	C-1	C-2	IP	LI	PD	MHO
Amusement Arcade													C	C	C		X	X		X	X	
Amusement Arcade (Indoor)													C	C	C		X	X		X	X	
Amusement Arcade (Outdoor)																	C	C		X	X	
Ballroom Dancing														X	X		X	X			X	
Carnival, Circus or Tent Services (Temp) See City of Bastrop Code of Ordinances																						

Country Club (Private)	X	C	C	C	C	C	C	C	C	C	X	X	X	X		C	X	X		X	X	X
Day Camp for Children	C							C	C	C	C	C	X	X	X	C	X	X			X	C
Golf Course (Commercial)	C	C	C	C	C	C	C	C	C	C	C		C	C		C	X	X		X	X	C
Park/Playground (Private) Non Commercial	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Playfield/Stadium (Public)	C										C	C	X	X	X		X	X	X	X	X	C
Private Club (See Article 4.100 [Art. 4.02])																						
R.V Park																		X		X	X	
Rodeo Grounds	C																			X	X	
Roller/Ice Rink																	X	X		X	X	
Stable (Commercial)	C																			X	X	
Stable (Private)	X	C	C	C	C															X	X	
Swim/Tennis or Handball Club	C	C	C	C	C	C	C	C	C	C	C	C	X	X		X	X	X		X	X	C
Swimming Pool (Commercial)											C	C	C	C	X		X	X		X	X	
Theater (Open Drive-In)																				X	X	
Theater/Playhouse (Indoor)											X	X	X	X	X		X	X		X	X	
Zoo (Private)	C																			C	X	
Zoo (Public)	C																			X	X	

USE CHART
ZONING ORDINANCE
CITY OF BASTROP, TX

SECTION 36.6:

Legend for interpreting the Schedule of Uses

__X__Designated use permitted in District

_____Designated use prohibited in District

__C__Use may be allowed with a Conditional Use Permit

Educational, Institutional and Special Uses	AOS	SF20	SF9	SF8	SF7	2F	SFA	MF1	MF2	MH	O	NS	GR	CBD	CF	CT	C-1	C-2	IP	LI	PD	MHO
Art Gallery/ Museum											X	X	X	X	X	X	X	X			X	
Assisted Living Facility								C	X		X	X	X	X							X	
Cemetery/ Mausoleum	C										C	C	C	C			C	C		C	X	
Cemetery, Animal	C																				X	
Child Care Center w/Church	C	C	C	C	C	C	C	C	C		X	X	X	X	X		X	X			X	
Child Care Center/Day Care Center									C		X	X	X	X	X		X	X	C	C	X	
Church, Rectory or Temple	C	C	C	C	C	C	C	C	X	X	X	X	X	X	X	X	X	X		X	X	X
College/ University	C	C	C	C	C	C	C	C	C	C	X	X	X	X		X	X	X	X	X	X	C
Community Center (Public)	X										X	X	X	X	X	X	X	X			X	X
Continuing Care Retirement Community									C		X	X	X	X			X	X			X	
Convent/Monastery	C	C	C	C	C	C	C	C	C	C	X	X	X	X			X	X			X	C
Fairgrounds/Exhibition Area	C																			C	X	
Family Home (Child Care)	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X			X	X
Fraternal/Lodge/Union/Hall/Civic Cente [Center]	C										C	C	X	X			X	X		X	X	
Group Daycare Center	C							C	C	C	X	X	X	X			X	X			X	C
Hospital, Acute Care	C										X	X	X	X			X	X			X	C
Hospital, Chronic Care	C										C	C	X	X			X	X			X	
Institution for Alcoholic, Narcotic, Psychiatric	C										C	C	C	C			C	C			X	
Institution for Religious, Charitable or Philanthropic Nature	C								C	C	X	X	X	X			X	X			X	
Kindergarten/ Nursery School (Private)	C							C	C	C	C	X	X	X			X	X			X	C
Non Profit Activities by a Church	C							X	X	X	X	X	X	X	X	X	X	X			X	X
Rehab Care Facility (Halfway House)								C	C		C	C	C	C			C	C			X	
Retirement Housing for the Elderly							X	X	X		X	X	X	X							X	
School Driving/Defensive Driving													X	X			X	X		X	X	

School Private (Primary/ Secondary)	C							C	C	C	C	X	X	X			X	X			X	
School, Business													C	C			X	X	C	C	X	
School, Commercial Trade													C	C			X	X	C	C	X	
School, Federally Funded Preschool Pgrm.	C	C	C	C	C	C	C	C	X		X	X	X	X			X	X		X		
School, Public/Parochial	X	C	C	C	C	C	C	C	X	X	X	X	X	X		X	X	X		X	X	X
Seasonal Uses (Temporary)	C										C	C	C	C	C	C	C	C		C	C	
Skilled Nursing Facility									C		X	X	X	X		C	X	X			X	

USE CHART
ZONING ORDINANCE
CITY OF BASTROP, TX

SECTION 36.7:

Legend for interpreting the Schedule of Uses

__X__Designated use permitted in District

_____Designated use prohibited in District

__C__Use may be allowed with a Conditional Use Permit

Transportation Related Uses	AOS	SF20	SF9	SF8	SF7	2F	SFA	MF1	MF2	MH	O	NS	GR	CBD	CF	CT	C-1	C-2	IP	LI	PD	MHO
Airport/Landing Field	C																			C	X	
Bus Station/Other Terminal of Similar Nature														C		C	X	X		X	X	
Hauling/Storage Co w/outside Storage																		X		X	X	
Heliport	C																	C		C	X	
Helistop	C														C		C	C	C	C	C	
Motor Freight Company																		X	C	X	X	
Parking Lot/Structure Commercial-Auto													C	C	X	C	X	X		X	X	
Parking Lot, Truck/Trailers															X			X		X	X	
Tractor Sales																		X		X	X	

USE CHART

ZONING ORDINANCE

CITY OF BASTROP, TX

SECTION 36.8:

Legend for interpreting the Schedule of Uses

X Designated use permitted in District

_____ Designated use prohibited in District

C Use may be allowed with a Conditional Use Permit

Automobile and Related Uses	AOS	SF20	SF9	SF8	SF7	2F	SFA	MF1	MF2	MH	O	NS	GR	CBD	CF	CT	C-1	C-2	IP	LI	PD	MHO
Auto Accessory Installation, Minor														C			C	X		X	X	
Auto Financing/Leasing (No outdoor lot/display)											C	C	X	X			X	X		X	X	
Auto Glass/Seat Cover/Upholstery/ Muffler Shop																	C	X		X	X	
Auto Laundry/Car Wash																	C	X		X	X	
Auto Painting/Body Rebuilding Shop																		X		X	X	
Auto Parts/Accessory Sales (Indoor)													C	X			X	X		X	X	
Auto Rental														C			C	X		X	X	
Auto Repair, Major																		X		X	X	
Auto Repair, Minor														C			C	X		X	X	
Auto Storage/Auto Auction																					X	
Automotive Gasoline/Motor Fuel Service Station														C			C	X		X	X	
Boat Sales																	C	X		X	X	
Motorcycle Sales/Repair																	C	X		X	X	
New/Used Auto Sales																	C	X		X	X	
RV/Camper Sales																	C	X		X	X	
Tire Dealership														C			C	X		X	X	

Trailer/Heavy Load Vehicle Repair																		X		X	X	
Trailer/Truck Rental																		C		X	X	
Used Auto Sales																		X		X	X	
Window Tinting, Auto																	C	X		X	X	

USE CHART
ZONING ORDINANCE
CITY OF BASTROP, TX

SECTION 36.9:

Legend for interpreting the Schedule of Uses

__X__Designated use permitted in District

_____Designated use prohibited in District

__C__Use may be allowed with a Conditional Use Permit

Office and Professional Uses	AOS	SF20	SF9	SF8	SF7	2F	SFA	MF1	MF2	MH	O	NS	GR	CBD	CF	CT	C-1	C-2	IP	LI	PD	MHO
Accountant/Bookkeeping Office											X	X	X	X	X	X	X	X			X	
Architect's Office											X	X	X	X	X	X	X	X			X	
Armed Services Recruiting Center											X	X	X	X		X	X	X			X	
Bank/Savings & Loan/Credit Union/Brokerage											C	C	X	X		X	X	X			X	
Check Cashing Service/Loan Agency												C	C	C		C	X	X			X	
Dental Clinic/ Laboratory/Office											X	X	X	X		X	X	X			X	
Medical Clinic or Office											X	X	X	X		X	X	X			X	
Medical Laboratory												C	C	C		C	X	X			X	
Minor Medical Emergency Clinic											C	C	X	X		X	X	X			X	
Mortgage/Loan Agency											C	X	X	X		X	X	X			X	
Offices, General Business/ Professional											X	X	X	X		X	X	X			X	
Optician/Optometrist											X	X	X	X		X	X	X			X	
Radio/TV Broadcasting w/o Tower											C	X	X	X		X	X	X			X	

Real Estate Office											X	X	X	X		X	X	X			X	
Telemarketing Agency											C	C	C	C		C	C	C			X	

USE CHART
ZONING ORDINANCE
CITY OF BASTROP, TX

SECTION 36.10:

Legend for interpreting the Schedule of Uses

__X__ Designated use permitted in District

_____ Designated use prohibited in District

__C__ Use may be allowed with a Conditional Use Permit

Retail and Service Type Uses	AOS	SF20	SF9	SF8	SF7	2F	SFA	MF1	MF2	MH	O	NS	GR	CBD	CF	CT	C-1	C-2	IP	LI	PD	MHC
Animal Humane Society	C																	C		X	X	
Antique Shop/Sales Indoor												C	X	X		X	X	X			X	
Appliance Rental													X	X			X	X			X	
Art Supply Store												X	X	X		X	X	X			X	
Bakery/Confectionery Shop (Retail)											X	X	X	X		X	X	X			X	
Banking, Automatic Teller Only											X	X	X	X	X	X	X	X			X	
Barber Shop/Hair Salon											X	X	X	X		X	X	X				
Book/Stationery/Newsstand Shop												X	X	X	X	X	X	X			X	
Building Material/Hardware/Home Improvement (Indoor)																	X	X		X	X	
Building Material/Hardware/Home Improvement (Outdoor)																	C	X		X	X	
Cellular Phone/Pager Sales (Indoor)												C	X	X		X	X	X		X	X	
Cleaning Plant (Commercial/ Wholesale)																		X		X	X	
Cleaning Shop/Laundry Pick-up Self-Service (Small Shop)												X	X	X		X	X	X			X	
Computer Sales												C	X	X		X	X	X			X	
Consignment Store												C	X	X		X	X	X			X	
Copy Shop											C	C	X	X		X	X	X			X	
Custom Personal Service Shop											C	C	X	X		X	X	X			X	
Discount/Department Store													X	X		X	X	X			X	
Donut Shop												X	X	X		X	X	X			X	

Drapery/Needlework/Weaving Shop													X	X		X	X	X			X	
Drug Store/Pharmacy											C	X	X	X		X	X	X			X	
Florist Shop											C	X	X	X	X	X	X	X			X	
Food/Beverage Sales Store w/Gasoline												C		C			X	X		X	X	
Food/Beverage Sales Store w/o Gasoline												X	X	X		C	X	X		X	X	
Food Store												C	X	X	X	X	X	X		X	X	
Funeral Home/Mortuary												C	C	X			X	X			X	
Furniture, Home Furnishings/ Appliance														X		X	X	X			X	
Garden Shop												C	C	X		X	X	X			X	
Greenhouse/Plant Nursery w/Outside Display of Plants (Retail)														X		X	X	X			X	
Handicraft/Art Object Sales Shop												C	X	X	X	X	X	X			X	
Hardware Shop/Store													C	X		X	X	X			X	
Hobby Shop												C	X	X		X	X	X			X	
Household Appliance Service/Repair														X		X	X	X			X	
Ice Cream/Yogurt Sales												X	X	X	X	X	X	X			X	
Incidental/Accessory Retail/Service Uses												X	X	X	X	X	X	X			X	
Key Shop												X	X	X		X	X	X			X	
Kiosk											C	C	C	C	X	C	C	C			X	
Laundromat/Self Service Washateria												C	X	X		C	X	X			X	
Medical Appliances, Fitting, Sales/Rental											X	X	X	X		C	X	X			X	
Metal Recycling Center																		C		C	X	
Mini-Warehouse																		C		X	X	
Off-Premises Sales Office													X	X		X	X	X				
Pawn Shop																		X		X		
Pet Shop/ Grooming												C	X	X		C	X	X			X	
Restaurant/Drive Thru													C			C	X	X			X	
Restaurant/Cafeteria (Not a Drive Thru)												C	X	X	X	X	X	X			X	

Restaurant/Eating Place (Drive In Service)													X	X		X	X	X			X	
Retail Shop/Apparel/Gift/Accessory Similar												X	X	X	X	X	X	X			X	
Security Systems Installation Company													X	X		X	X	X			X	
Silk Screening Studio/Tee-Shirt Shop													X	X		X	X	X			X	
Studio/Decorator/Artist/Photographer											C	X	X	X	X	X	X	X			X	
Studio/Health/Reducing Service (or Similar)											C	X	X	X	X	X	X	X			X	
Studio/Music/ Dance/Drama											C	X	X	X	X	X	X	X			X	
Temp Outdoor Retail Sales Commercial													C	X	X	X	X	X			X	
Tool/Light Equipment Rental (Indoor)													C	X		C	X	X			X	
Travel Bureau/Travel Consultant											X	C	X	X	X	X	X	X			X	
Trophy Sales/Engraving													X	X		C	X	X			X	
Used Merchandise/Second Hand Thrift														C		C	X	X			X	
Used Merchandise/Second Hand (non profit)														C		C	X	X			X	
Vacuum Cleaner Sales and Repair													C	X		C	X	X			X	
Variety Store/Similar Retail Outlet													X	X		X	X	X			X	
Vet Hospital (Inside Animal Pens Only)	C												X	X		C	X	X			X	
Vet Hospital (Outside Animal Pens Only	C																C	X		X	X	
Veterinarian Office (No Animal Hospital)	C										C	X	X	X		C	X	X			X	
Wallpaper/Flooring/Carpet Store													C	X		C	X	X			X	

(Ordinance 2010-1 adopted 1/12/10)

USE CHART
ZONING ORDINANCE
CITY OF BASTROP, TX

SECTION 36.11:

Legend for interpreting the Schedule of Uses

__X__Designated use permitted in District

_____Designated use prohibited in District

__C__Use may be allowed with a Conditional Use Permit

Commercial Type Uses	AOS	SF20	SF9	SF8	SF7	2F	SFA	MF1	MF2	MH	O	NS	GR	CBD	CF	CT	C-1	C-2	IP	LI	PD	MHO
Alcoholic Beverage Establishments (Beer Wine) See Bastrop Code 4.100 [Art. 4.02]																						
Alcoholic Beverage Establishments (Liquor) See Bastrop Code 4.100 [Art. 4.02]																						
Ambulance Service																	X	X			X	
Bakery/Confectionery Shop (Commercial)														C			X	X		X	X	
Bakery/Confectionary Ship (Wholesale)														C			X	X	X	X	X	
Book Binding																		X	X	X	X	
Bottling Works																		X	X	X	X	
Breweries														C				C		C		
Cabinet Shop														C				X	X	X	X	
Clothing/Similar Light Manufacturing																		X	X	X	X	
Contractor Shop w/Outside Storage Yard																		C		C	X	
Distilleries														C				C		C		
Distribution Center																			X	X	X	
Drapery/ Furniture Upholstery Shop														C			X	X	X	X	X	
Dyeing/Laundry Plant (Commercial)																		X	X	X	X	
Equipment Rental (Heavy)																		C		X	X	
Equipment Sales (New/Used)																		C		X	X	
Feed/Grain Store																	X	X		X	X	
Flea Market (Indoor)																	C	X		X	X	
Food Processing Plant																		C		X	C	

Furniture Manufacture/ Refinishing Shop														C				X		X	X	
Heating/AC Sales																	X	X		X	X	
Heavy Machinery Sales Storage																		X		X	X	
Kennel (Indoor Pens)	C																X	X		X	X	
Kennel (Outdoor Pens)	C																	C		X	X	
Laboratory Equipment Manufacturing																		X	X	X	X	
Laboratory Scientific/Research																		X	X	X	X	
Landscaping Service/ Construction																		X		X	X	
Light Manufacturing/ Assembly Processes																		X	X	X	X	
Lithorgraphic/ Print Shop														C			X	X	X	X	X	
Maintenance/ Repair Service for Buildings																		X		X	X	
Manufactured or Lt. Industrialized Home New																		C		X	X	
Manufactured or Lt. Industrialized Home Used																		C		X	X	
Milk Depot, Dairy/Ice Cream Plant																		X	X	X	X	
Motel/Hotel (Less than 75 Rooms)													C	C		X	X	X			X	
Motel/Hotel (More than 75 Rooms)														C		C	X	X			X	
Newspaper Printing																		C	X	X	X	
Office Showroom														C		C	C	X	C	X	X	
Office Warehouse																		X	X	X	X	

Open Storage/Display/ Work Area for Merchandise or Machinery																		X		X	X	
Paint Shop														C			C	C	C	X	X	
Palm Reader/Card Reader																		X		X	X	
Plumbing Shop																		X		X	X	
Portable Building Sales (Outdoor Display)																		C		X	X	
Printing Company														C			C	X		X	X	
Propane Sales (Retail)																	C	X		X	X	
Taxidermist																	X	X		X	X	
Tinsmith/Sheet Metal Shop																		X		X	X	
Welding/Machine Shop																		X		X	X	
Wineries														C				C		C		

(Ord. No. 2010-1, 1-12-10; Ord. No. 2014-17, pt. 2, 9-23-14)

USE CHART
ZONING ORDINANCE
CITY OF BASTROP, TX

SECTION 36.12:

Legend for interpreting the Schedule of Uses

__X__ Designated use permitted in District

_____ Designated use prohibited in District

__C__ Use may be allowed with a Conditional Use Permit

Industrial and Related Uses	AOS	SF20	SF9	SF8	SF7	2F	SFA	MF1	MF2	MH	O	NS	GR	CBD	CF	CT	C-1	C-2	IP	LI	PD	MHO
Animal Rendering Plant																				C		
Any Use Which Could Potentially Create A Problem To The Environment Due To Emissions, Odor, Noise, Etc																				C		

Cement/Hydrated Lime Plant																				C		
Concrete/Asphalt Batching Plant (Perm)																				C		
Concrete/Asphalt Batching Plant (Temp) With 6 Month, With One Extension																		C		C		
Grain Elevator	C																			C		
Hatcheries	C																			C		
High Risk/Hazardous Industrial Mnfctrng. Wholly Enclosed Within a Bldg See 31.2																				C		
High Risk/Hazardous Industrial Mnfctrng. Not Wholly Enclosed Within Building																						
Light Manufacturing/ Industrial Use as Defined in Appendix A-3																			X	X	X	
Livestock Auction Facilities	C																			C		
Low Risk Industrial Manufacturing Not Wholly Enclosed Within a Building																				C	X	
Low Risk Industrial Manufacturing Wholly Enclosed Within A Building																			C	C	X	
Petroleum Storage/ Collection Facilities																				C		

Sand/Topsoil/ Gravel/Stone/ Petroleum Extraction or Storage	C																			C	X	
Sexually Oriented Business (See [Sec.] 43.9)																				C		
Slaughtering Facilities																				C		
Smelter/Refinery/ Chemical Plant																				C		
Storage/ Wholesale Warehouse																				X	X	
Wrecking Yard																				C		

(Ord. No. 2010-1, 1-12-10)

BASTROP GROVE

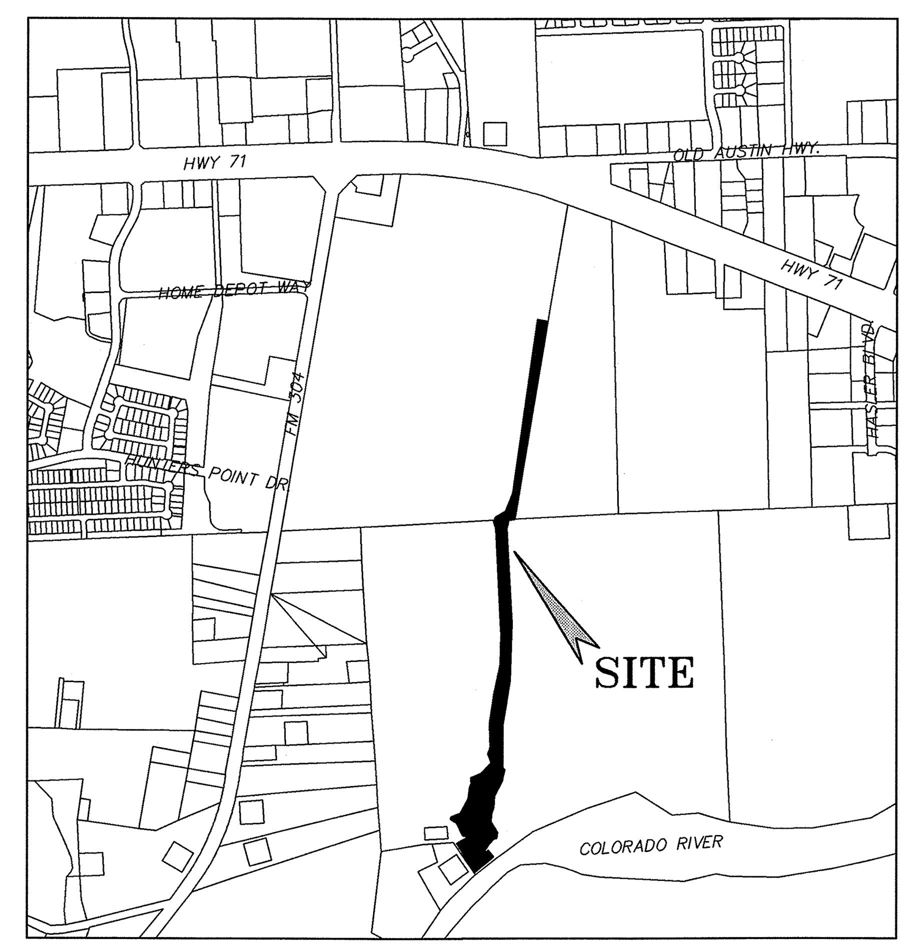
DRAINAGE IMPROVEMENTS
AGNES ROAD TO COLORADO RIVER
BASTROP COUNTY, TEXAS

SUBMITTED BY:

Madeline Burkhart 09/28/2018
CARLSON, BRIGANCE, & DOERING, INC.

REVIEWED BY: 10/1/2018
CITY OF BASTROP ENGINEER

SHEET INDEX



LOCATION MAP
N.T.S.

MAPSCO PAGE #:	MAPSCO GRID #:
468S	Q34
468N	Q35
468P	Q35

811
Know what's below.
Call before you dig.

OWNER: 71 RETAIL PARTNERS, L.P.
DOUGLAS MACMAHON
8214 WESTCHESTER DRIVE
DALLAS, TEXAS 75225
(214) 622–6565

ENGINEER: CARLSON, BRIGANCE & DOERING, INC.
CIVIL ENGINEERING & SURVEYING
MR. BRENDAN P. MCENTEE, P.E.
5501 WEST WILLIAM CANNON
AUSTIN, TEXAS 78749
(512) 280–5160

UTILITY PROVIDERS:

ELECTRIC:	BLUEBONNET ELECTRIC	(979) 542–3151
GAS:	CENTER POINT ENERGY	(830) 643–6936
PHONE:	AT&T	(512) 870–1450
WATER:	CITY OF BASTROP	(512) 332–8960
WASTEWATER:	CITY OF BASTROP	(512) 332–8960
CABLE:	SPECTRUM	(800) 418–8848

NOTES:

THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY AND HAVE NOT BEEN INDEPENDENTLY VERIFIED BY THE OWNER OR ITS REPRESENTATIVE. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK, AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE ASSOCIATED BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.

ALL RESPONSIBILITY FOR THE ADEQUACY OF THESE PLANS REMAINS WITH THE ENGINEER WHO PREPARED THEM. IN REVIEWING THESE PLANS, THE CITY OF BASTROP MUST RELY UPON THE ADEQUACY OF THE DESIGN ENGINEER.

THIS PROJECT IS LOCATED IN THE COLORADO RIVER WATERSHED AND WITHIN THE BOUNDARIES OF THE 100–YEAR FLOOD PLAIN AS PER FEDERAL FLOOD INSURANCE ADMINISTRATION FIRM MAP NO. 48021C0335E, DATED JANUARY 19, 2006, BASTROP COUNTY, TEXAS. BASTROP COUNTY COMMUNITY NO. 481193.

NO.	DESCRIPTION	REVISE (R) ADD (A) VOID (V)	CITY OF BASTROP APPROVAL/DATE	APPROVED BY

FILE PATH: J:\AutoCad 2004 Land Projects\4697\dwg\Channel\4697 - COVER.dwg - May 15, 2018 - 1:31pm

STATE OF TEXAS
BRENDAN P. McENTEE
96200
LICENSED PROFESSIONAL ENGINEER
CARLSON, BRIGANCE & DOERING, INC.
ID# F3791
Brendan McEntee
09/28/2018

DESIGNED BY:	DRAFTED BY:
BM	JW

DATE	REVISION

Carlson, Brigance & Doering, Inc.
FIRM ID #F3791
Civil Engineering ◆ Surveying
5501 West William Cannon Dr. ◆ Austin, Texas 78749
Phone No. (512) 280-5160 ◆ Fax No. (512) 280-5165

SHEET NAME: COVER
JOB NAME: BASTROP GROVE
PROJECT: DRAINAGE IMPROVEMENTS

DATE: APRIL 2018
JOB NUMBER: 4697
SHEET: 1 OF 14
SHEET NO.: 1

GENERAL NOTES:

1. ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE CITY OF BASTROP DESIGN AND CONSTRUCTION STANDARDS MANUAL.

2. ANY EXISTING UTILITIES, PAVEMENT, CURBS, SIDEWALKS, STRUCTURES, TREES, ETC., NOT PLANNED FOR DEMOLITION THAT ARE DAMAGED OR REMOVED SHALL BE REPAIRED OR REPLACED AT THE APPLICANT'S EXPENSE.

3. THE CONTRACTOR SHALL VERIFY ALL DEPTHS AND LOCATIONS OF EXISTING UTILITIES PRIOR TO ANY CONSTRUCTION. ANY DISCREPANCIES WITH THE CONSTRUCTION PLANS FOUND IN THE FIELD SHALL BE BROUGHT IMMEDIATELY TO THE ATTENTION OF THE ENGINEER WHO SHALL BE RESPONSIBLE FOR REVISING THE PLANS ARE APPROPRIATE.

4. ALL AREAS DISTURBED OR EXPOSED DURING CONSTRUCTION SHALL BE RE–VEGETATED IN ACCORDANCE WITH THE PLANS AND SPECIFICATIONS. RE–VEGETATION IS TO TAKE PLACE WITHIN 14 DAYS OF CONSTRUCTION INACTIVITY. RE–VEGETATION OF ALL DISTURBED OR EXPOSED AREAS SHALL CONSIST OF SODDING OR SEEDING, AT THE CONTRACTOR'S OPTION. HOWEVER, THE TYPE OF RE–VEGETATION MUST EQUAL OR EXCEED THE TYPE OF VEGETATION PRESENT BEFORE CONSTRUCTION

5. PRIOR TO ANY CONSTRUCTION, THE APPLICANT'S ENGINEER SHALL CONVENE A PRECONSTRUCTION CONFERENCE BETWEEN HIMSELF, THE CITY OF BASTROP, THE CONTRACTOR, UTILITY COMPANIES, ANY AFFECTED PARTIES AND ANY OTHER ENTITY THE CITY OR THE ENGINEER MAY REQUIRE. REFERENCE DEVELOPMENT PACKET FOR GUIDANCE ON HOW TO SCHEDULE A PRECONSTRUCTION CONFERENCE.

6. THE CONTRACTOR AND THE ENGINEER SHALL KEEP ACCURATE RECORDS OF ALL CONSTRUCTION THAT DEVIATES FROM THE PLANS. THE ENGINEER SHALL FURNISH THE CITY OF BASTROP ACCURATE "AS–BUILT" DRAWINGS FOLLOWING COMPLETION OF ALL CONSTRUCTION.

7. WHEN CONSTRUCTION IS BEING CARRIED OUT WITHIN EASEMENTS, THE CONTRACTOR SHALL CONFINE HIS WORK TO WITHIN THE PERMANENT AND ANY TEMPORARY EASEMENTS. PRIOR TO FINAL ACCEPTANCE, THE CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVING ALL TRASH AND DEBRIS WITHIN THE PERMANENT AND TEMPORARY EASEMENTS.

8. PRIOR TO ANY CONSTRUCTION, THE CONTRACTOR SHALL APPLY FOR AND SECURE ALL PROPER PERMITS FROM THE APPROPRIATE AUTHORITIES.

9. ALL STORM SEWER FITTINGS MUST BE PRE–CAST.

11. AVAILABLE BENCHMARKS THAT MAY BE UTILIZED FOR THE CONSTRUCTION OF THIS PROJECT ARE DESCRIBED AS FOLLOWS:

BENCHMARKS:

BM #1: SOUTHWEST CORNER OF CONCRETE OF ELECTRIC TRANSFORMER
10015646.4860 N, 3239451.2111 E
ELEVATION: 368.42'

BM #2: 1/2" IRON ROD AT THE NORTHEASTERN CORNER 145.691 ACRE TRACT OUT OF THE NANCY BLAKEY SURVEY (ABSTRACT NO. 98) CONVEYED TO MC BASTROP 71, LP. (V 2097, P 241, O.P.R.B.C.TX.), AND THE SOUTHEASTERN CORNER OF 52.684 ACRES TRACT CONVEYED TO 71 RETAIN PARTNERS, PL. (V 2245, P 878, O.P.R.B.C.TX.). WITHIN WESTERN BOUNDARY LINE OF 43.112 ACRE TRACT CONVEYED TO JOHN ALAN NIXON AND TINA TINER NIXON (V 2289, P 294, O.P.R.B.C.TX.). THIS IS THE NORTHEASTERN CORNER OF THE 3.653 ACRE DRAINAGE EASEMENT.
10015318.2455 N, 3241663.8667 E
ELEVATION: 361.00'

BM #3: 1/2" CAPPED IRON ROD WITHIN NORTHERN BOUNDARY OF 194.92 ACRE TRACT IN DEED TO JO ANN GRIESENBECK CANTRELL (V 445, P 684, O.P.R.B.C.TX.) OUT OF THE MAZEA ROUSSEAU SURVEY NO. 56. AT THE SOUTHEAST CORNER OF 145.697 ACRE TRACT IN DEED TO BASTROP GROVE PARTNERS, LTD. (V 1698, P 245, O.P.R.B.C.TX), AND SOUTHWEST CORNER OF 43.112 ACRE TRACT IN DEED TO CHP PROPERTIES, LTD. (V 1413, P 857, O.P.R.B.C.TX.).
10013530.9814 N, 3241359.4032 E
ELEVATION: 360.03'

CONSTRUCTION SEQUENCE:

NO CLEARING OR ROUGH GRADING MAY BE DONE UNTIL THE APPROVED EROSION AND SEDIMENTATION CONTROLS ARE IN PLACE.

1. HOLD PRE–CONSTRUCTION CONFERENCE.

2. INSTALL TEMPORARY EROSION AND SEDIMENTATION CONTROLS AND STABILIZED CONSTRUCTION ENTRANCE AS SHOWN ON THE PLANS.

3. WITH THE APPROVAL OF ALL AFFECTED PARTIES, THE CONTRACTOR MAY BEGIN CLEARING AND GRUBBING.

4. COMPLETE ALL ROUGH GRADING AND UNDERGROUND INSTALLATION WITHIN THE LIMITS OF CONSTRUCTION.

5. COMPLETE FINAL GRADING WITHIN LIMITS OF CONSTRUCTION ALONG AREAS DESIGNATED. RESTORE CONSTRUCTION SPOILS & STAGING AREA TO NATURAL GRADE.

6. COMPLETE PERMANENT EROSION CONTROL AND RESTORATION OF SITE VEGETATION.

7. PROJECT ENGINEER OBSERVES CONSTRUCTION AND WRITES CONCURRENCE LETTER TO THE CITY OF BASTROP.

8. AFTER FINAL INSPECTION AND ACCEPTANCE OF CONSTRUCTION, COMPLETE ANY NECESSARY FINAL DRESS UP OF DISTURBED AREAS AND REMOVE/ DISPOSE OF TEMPORARY EROSION CONTROLS IN AN APPROVED MANNER.

EROSION AND SEDIMENTATION CONTROL:

1. THE CONTRACTOR SHALL INSTALL EROSION/SEDIMENTATION CONTROLS AND FENCING FOR AREAS OUTSIDE OF THE CONSTRUCTION AREA PRIOR TO ANY SITE PREPARATION WORK (CLEARING, GRUBBING OR EXCAVATION).
2. THE CONTRACTOR IS REQUIRED TO INSPECT THE CONTROLS AND FENCES AT WEEKLY INTERVALS, AND AFTER SIGNIFICANT RAINFALL EVENTS TO INSURE THAT THEY ARE FUNCTIONING PROPERLY. THE PERSON(S) RESPONSIBLE FOR MAINTENANCE OF CONTROLS AND FENCES SHALL IMMEDIATELY MAKE ANY NECESSARY REPAIRS TO DAMAGED AREAS. SILT ACCUMULATION AT CONTROLS MUST BE REMOVED WHEN THE DEPTH REACHES SIX (6) INCHES.
3. PRIOR TO FINAL ACCEPTANCE, HAUL ROADS AND WATERWAY CROSSINGS CONSTRUCTED FOR TEMPORARY CONTRACTOR ACCESS MUST BE REMOVED, ACCUMULATED SEDIMENT REMOVED FROM THE WATERWAY AND THE AREA RESTORED TO THE ORIGINAL GRADE AND REVEGETATED. ALL LAND CLEARING DEBRIS SHALL BE DISPOSED OF IN APPROVED SPOIL DISPOSAL SITES.
4. ANY METHODS, STREET MARKINGS AND SIGNAGE NECESSARY FOR WARNING MOTORISTS, WARNING PEDESTRIANS OR DIVERTING TRAFFIC DURING CONSTRUCTION SHALL CONFORM TO THE TEXAS MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS, LATEST EDITION.
5. ALL PAVEMENT MARKINGS, MARKERS, PAINT, TRAFFIC BUTTONS, TRAFFIC CONTROLS AND SIGNS SHALL BE INSTALLED IN ACCORDANCE WITH THE TEXAS DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR CONSTRUCTION OF HIGHWAYS. STREETS, BRIDGES, AND THE TEXAS MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS, LATEST EDITIONS.
6. EROSION CONTROL MEASURES, SITE WORK AND RESTORATION WORK SHALL BE IN ACCORDANCE WITH THE CITY OF BASTROP CODE OF ORDINANCES.
7. ALL SLOPES SHALL BE SODDED OR SEEDED WITH APPROVED GRASS, GRASS MIXTURES OR GROUND COVER SUITABLE TO THE AREA AND SEASON IN WHICH THEY WERE APPLIED.
8. SILT FENCES, ROCK BERMS, SEDIMENTATION BASINS AND SIMILARLY RECOGNIZED TECHNIQUES AND MATERIALS SHALL BE EMPLOYED DURING CONSTRUCTION TO PREVENT POINT SOURCE SEDIMENTATION LOADING OF DOWNSTREAM FACILITIES. SUCH INSTALLATION SHALL BE REGULARLY INSPECTED BY THE CITY OF BASTROP FOR EFFECTIVENESS. ADDITIONAL MEASURES MAY BE REQUIRED IF, IN THE OPINION OF THE CITY ENGINEER, THEY ARE WARRWNTED.
9. ALL TEMPORARY EROSION CONTROL MEASURES SHALL NOT BE REMOVED UNTIL FINAL INSPECTION AND APPROVAL OF THE PROJECT BY THE CITY INSPECTOR. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO MAINTAIN ALL TEMPORARY EROSION CONTROL STRUCTURES AND TO REMOVE EACH STRUCTURE AS APPROVED BY THE CITY INSPECTOR.
10. ALL MUD, DIRT, ROCKS, DEBRIS, ETC., SPILLED, TRACKED OR OTHERWISE DEPOSITED ON EXISTING PAVED STREETS. DRIVES AND AREAS USED BY THE PUBLIC SHALL BE CLEANED UP IMMEDIATELY.
11. PERMANENT EROSION CONTROL: ALL DISTURBED AREAS SHALL BE RESTORED AS NOTED BELOW:
   A. A MINIMUM OF FOUR (4) INCHES OF TOPSOIL SHALL BE PLACED IN ALL DRAINAGE CHANNELS (EXCEPT ROCK), AND BETWEEN THE CURB AND RIGHT–OF–WAY.
   B. THE SEEDING FOR PERMANENT EROSION CONTROL SHALL BE APPLIED OVER AREAS DISTURBED BY CONSTRUCTION AS FOLLOWS:

   BROADCAST SEEDING:

   (I) FROM OCTOBER TO FEBRUARY, SEEDING SHALL BE WITH ONE (1) POUND PER 1,000 SQUARE FEET OF UNHULLED BERMUDA OR THREE (3) POUNDS PER

   (II) FROM MARCH TO SEPTEMBER, SEEDING SHALL BE WITH HULLED BERMUDA AT A RATE OF ONE (1) POUND PER 1,000 SQUARE FEET, WITH A PURITY OF 95% WITH 85% GERMINATION.

   FERTILIZER SHALL BE SLOW RELEASE GRANULAR OR PALETTE TYPE, AND SHALL HAVE AN ANALYSIS OF 15–15–15, AND SHALL BE APPLIED AT THE RATE OF ONE (1) POUND PER 1,000 SQUARE FEET, ONCE AT THE TIME OF PLANTING, AND AGAIN ONCE DURING THE TIME OF ESTABLISHMENT.

   MULCH TYPE USED SHALL BE STRAW OR HAY APPLIED AT A RATE OF 45 POUNDS PER 1,000 SQUARE FEET.

   HYDRAULIC SEEDING:

   (I) FROM OCTOBER TO FEBRUARY, SEEDING SHALL BE WITH ONE (1) POUND PER 1,000 SQUARE FEET OF UNHULLED BERMUDA, OR THREE (3) POUNDS PER 1,000 SQUARE FEET OF WINTER RYE, WITH A PURITY OF 95% WITH 90 % GERMINATION.

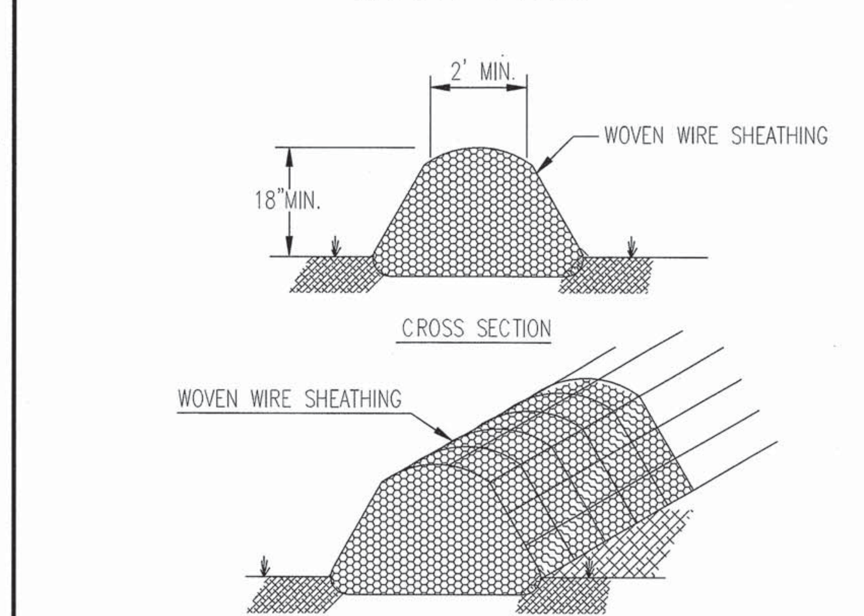
   (II) FROM MARCH TO SEPTEMBER, SEEDING SHALL BE WITH HULLED BERMUDA AT A RATE OF ONE (1) POUND PER 1,000 SQUARE FEET WITH A PURITY OF 95% WITH 95% GERMINATION.

   FERTILIZER SHALL BE A WATER SOLUBLE FERTILIZER WITH AN ANALYSIS OF 15–15–15 AT A RATE OF 1.5 POUNDS PER 1,000 SQUARE FEET.

   MULCH TYPE SHALL BE HAY, STRAW OR MULCH APPLIED AT A RATE OF 45 POUNDS PER 1,000 SQUARE FEET, WITH A SOIL TACKIFIER AT A RATE OF 1.4 POUNDS PER 1,000 SQUARE FEET.

   C. THE PLANTED AREA SHALL BE IRRIGATED OR SPRINKLED IN A MANNER THAT WILL NOT ERODE THE TOPSOIL, BUT WILL SUFFICIENTLY SOAK TO A DEPTH OF SIX (6) INCHES. THE IRRIGATION SHALL OCCUR AT 10–DAY INTERVALS DURING THE FIRST TWO (2) MONTHS. RAINFALL OCCURRENCES OF 1/2 INCH OR MORE SHALL POSTPONE THE WATERING SCHEDULE FOR TEN (10) DAYS.
   D. RESTORATION SHALL BE ACCEPTABLE WHEN THE GRASS HAS GROWN AT LEAST 1 INCH HIGH WITH 85% COVERAGE, PROVIDED NO BARE SPOTS LARGER THAN 20 SQUARE FEET EXIST.

ROCK BERM

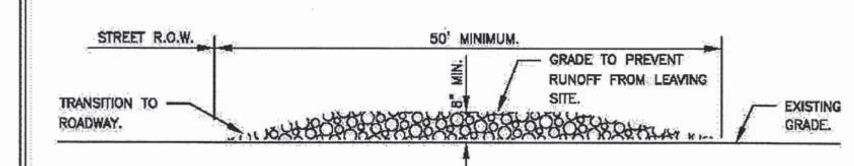


GENERAL NOTES

1. USE ONLY OPEN GRADED ROCK 4–8 INCH DIAMETER FOR STREAMFLOW CONDITIONS, USE OPEN GRADED ROCK 3–5 INCHES DIAMETER FOR OTHER CONDITIONS.
2. THE ROCK BERM SHALL BE SECURED WITH A WOVEN WIRE SHEATHING HAVING MAXIMUM 1 INCH OPENING AND MINIMUM WIRE DIAMETER OF 20 GAUGE.
3. THE ROCK BERM SHALL BE INSPECTED WEEKLY OR AFTER EACH RAIN, AND THE STONE AND/OR FABRIC CORE–WOVEN WIRE SHEATHING SHALL BE REPLACED WHEN THE STRUCTURE CEASES TO FUNCTION AS INTENDED, DUE TO SILT ACCUMULATION AMONG THE ROCKS, WASHOUT, CONSTRUCTION TRAFFIC DAMAGE, ETC.
4. WHEN SILT REACHES A DEPTH EQUAL TO ONE–THIRD THE HEIGHT OF THE BERM OR ONE FOOT, WHICHEVER IS LESS, THE SILT SHALL BE REMOVED AND DISPOSED OF IN AN APPROVED SITE AND IN A MANNER AS TO NOT CREATE A SILTRATION PROBLEM.
5. DAILY INSPECTION SHALL BE MADE ON SERVE SERVICE ROCK BERMS; SILT SHALL BE REMOVED WHEN ACCUMULATION REACHES 6 INCHES.
6. WHEN THE SITE IS COMPLETELY STABILIZED, THE BERM AND ACCUMULATED SILT SHALL BE REMOVED AND DISPOSED OF IN AN APPROVED MANNER.

STANDARD SYMBOL RB

SOURCE: COA



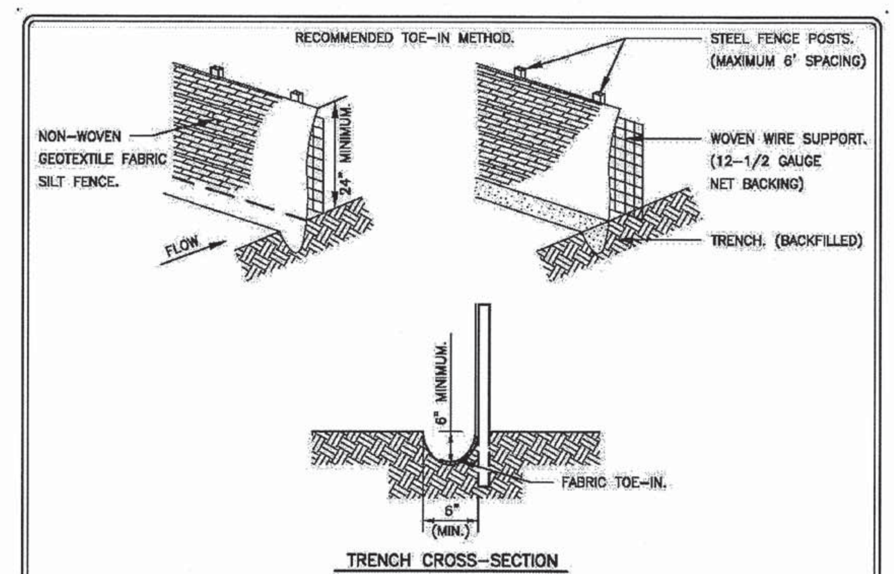
NOTES:

1. A STABILIZED CONSTRUCTION ENTRANCE APPLIES TO ALL POINTS OF CONSTRUCTION INGRESS AND EGRESS TO A PUBLIC RIGHT OF WAY, STREET, ALLEY, SIDEWALK, OR PARKING AREA.
2. STONE SIZE SHALL BE 4" – 8" OPEN GRADED ROCK.
3. THICKNESS OF CRUSHED STONE PAD TO BE NOT LESS THAN 8".
4. LENGTH SHALL BE A MINIMUM OF 50' FROM ACTUAL ROADWAY, AND WIDTH NOT LESS THAN FULL WIDTH OF INGRESS/EGRESS.
5. ENTRANCE SHALL BE PROPERLY GRADED TO PREVENT RUNOFF FROM LEAVING THE CONSTRUCTION SITE.

THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS OF WAY. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHTS OF WAY MUST BE REMOVED IMMEDIATELY BY CONTRACTOR.

AS NECESSARY, WHEELS MUST BE CLEANED TO REMOVE SEDIMENT PRIOR TO ENTRANCE ONTO PUBLIC RIGHT OF WAY. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH CRUSHED STONE WHICH DRAINS INTO AN APPROVED SEDIMENT TRAP OR SEDIMENT BASIN. ALL SEDIMENT SHALL BE PREVENTED FROM ENTERING ANY STORM DRAIN, DITCH OR WATERCOURSE USING APPROVED METHODS.

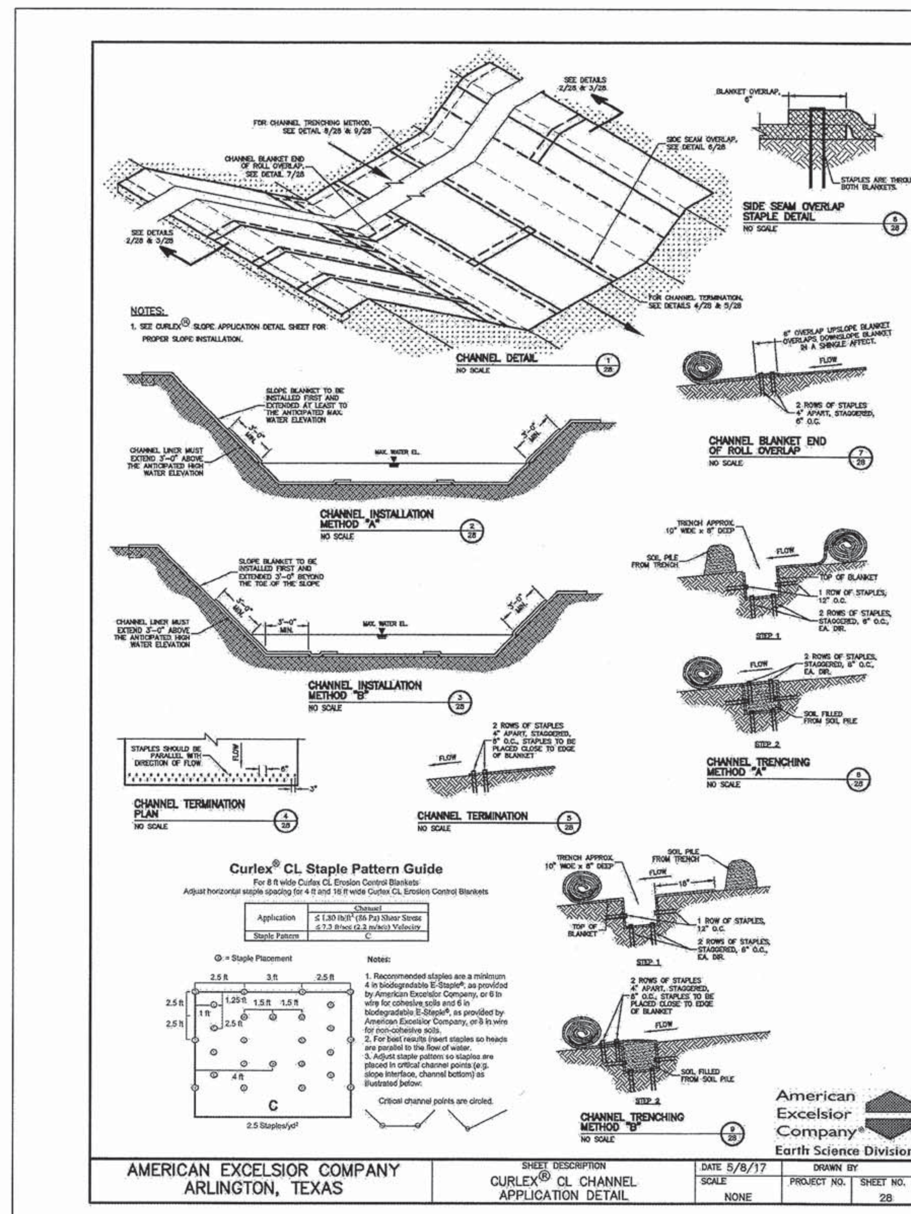
RECORD SIGNED COPY ON FILE AT PUBLIC WORKS APPROVED MAY 24, 2011 DATE THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR THE APPROPRIATE USE OF THIS DETAIL.	CITY OF BASTROP STABILIZED CONSTRUCTION ENTRANCE DETAIL	DRAWING NO: EC–01 CITY OF BASTROP

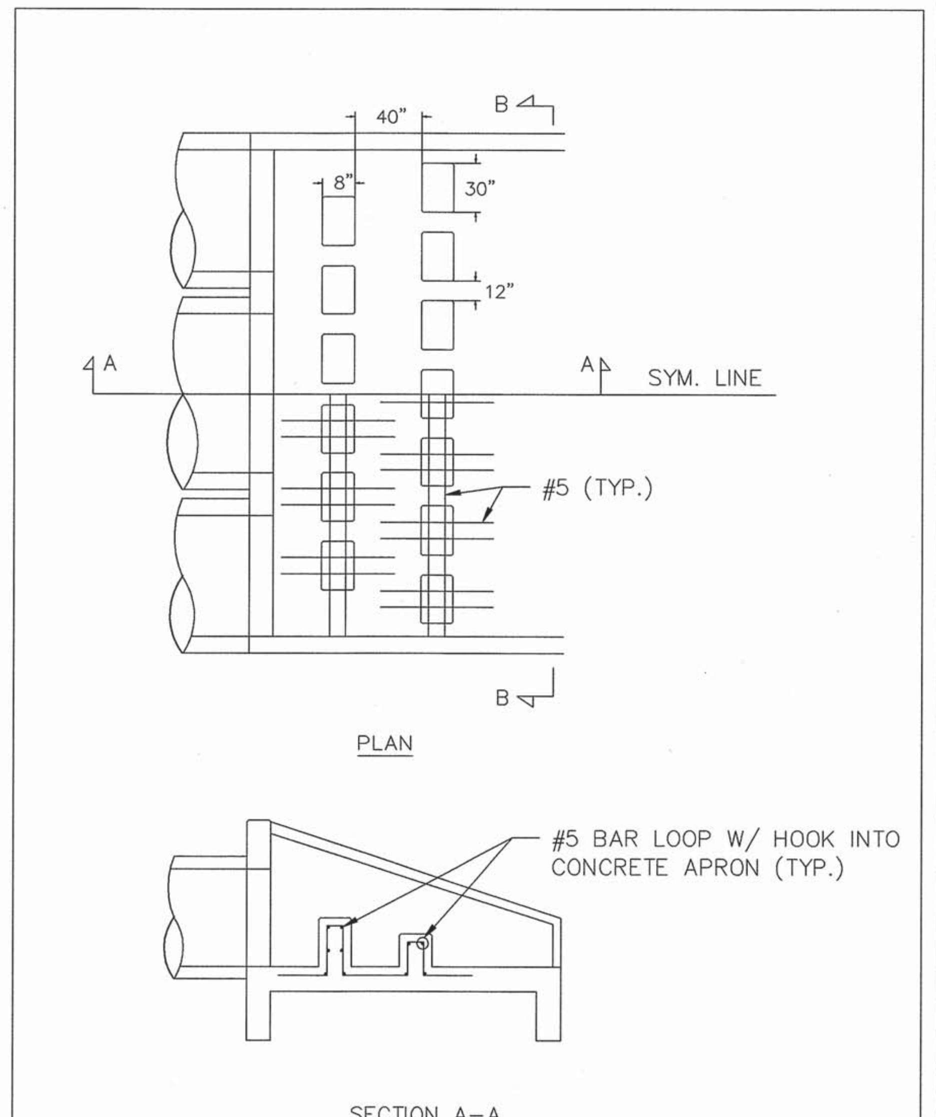


NOTES:

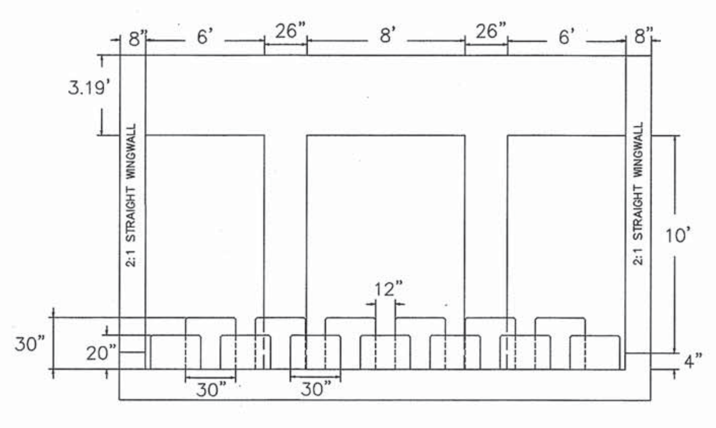
1. SILT FENCE SHALL CONFORM TO CITY OF BASTROP SPECIFICATION 642.
2. STEEL POSTS WHICH SUPPORT THE SILT FENCE SHALL BE INSTALLED ON A SLIGHT ANGLE TOWARD THE ANTICIPATED RUNOFF SOURCE. POST MUST BE EMBEDDED A MIN. OF ONE (1') FOOT.
3. THE TOE OF THE SILT FENCE SHALL BE TRENCHED IN WITH A SPADE OR MECHANICAL TRENCHER, SO THAT THE DOWNSLOPE FACE OF THE TRENCH IS FLAT AND PERPENDICULAR TO THE LINE OF FLOW. WHERE FENCE CANNOT BE TRENCHED IN (E.G. PAVEMENT) WEIGHT FABRIC FLAP WITH WASHED GRAVEL ON UPHILL SIDE TO PREVENT FLOW UNDER FENCE.
4. THE TRENCH MUST BE A MINIMUM OF 6 INCHES DEEP AND 6 INCHES WIDE TO ALLOW FOR THE SILT FENCE FABRIC TO BE LAID IN THE GROUND AND BACKFILLED WITH COMPACTED MATERIAL.
5. SILT FENCE SHALL BE SECURELY FASTENED TO EACH STEEL SUPPORT POST OR TO WOVEN WIRE, WHICH IN TURN IS SECURELY FASTENED TO THE STEEL FENCE POSTS.
6. INSPECTION SHALL BE MADE WEEKLY OR AFTER EACH RAINFALL EVENT AND REPAIR OR REPLACEMENT SHALL BE MADE PROMPTLY AS NEEDED.
7. SILT FENCE SHALL BE REMOVED WHEN THE SITE IS COMPLETELY STABILIZED SO AS NOT TO BLOCK OR IMPEDE STORM FLOW OR DRAINAGE.
8. ACCUMULATED SILT SHALL BE REMOVED WHEN IT REACHES A DEPTH OF 6 INCHES. THE SILT SHALL BE DISPOSED OF IN AN APPROVED SITE AND IN SUCH A MANNER AS TO NOT CONTRIBUTE TO ADDITIONAL SILTATION.

RECORD SIGNED COPY ON FILE AT PUBLIC WORKS APPROVED MAY 24, 2011 DATE THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR THE APPROPRIATE USE OF THIS DETAIL.	CITY OF BASTROP SILT FENCE DETAIL	DRAWING NO: EC–02 CITY OF BASTROP





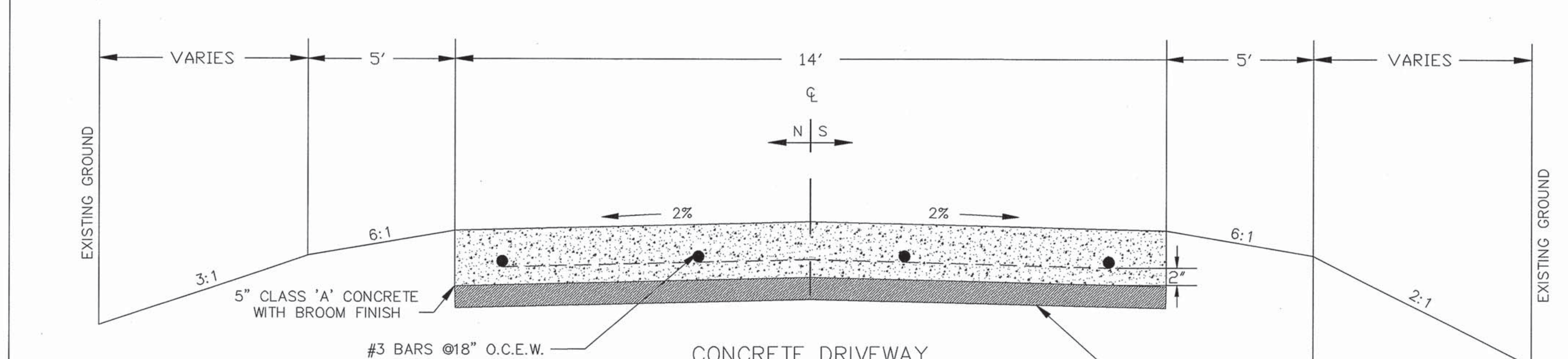
ENERGY DISSIPATORS



NOTES:

1. ALL CONCRETE SHALL BE CLASS A.
2. CHAMFER ALL EXTERNAL VISIBLE CORNERS.
3. DISSIPATOR BLOCKS REQUIRED ON DISCHARGE HEADWALLS ONLY.

ENERGY DISSIPATORS



CONCRETE DRIVEWAY
TYPICAL PAVEMENT DESIGN
N.T.S.

STATE OF TEXAS
BRENDAN P. McENTEE
96200
LICENSED PROFESSIONAL ENGINEER
CARLSON, BRIGANCE & DOERING, INC.
ID# F3791
05/15/2018

DESIGNED BY:	DRAFTED BY:
BM	JW

REVISION	DATE

Carlson, Brigance & Doering, Inc.
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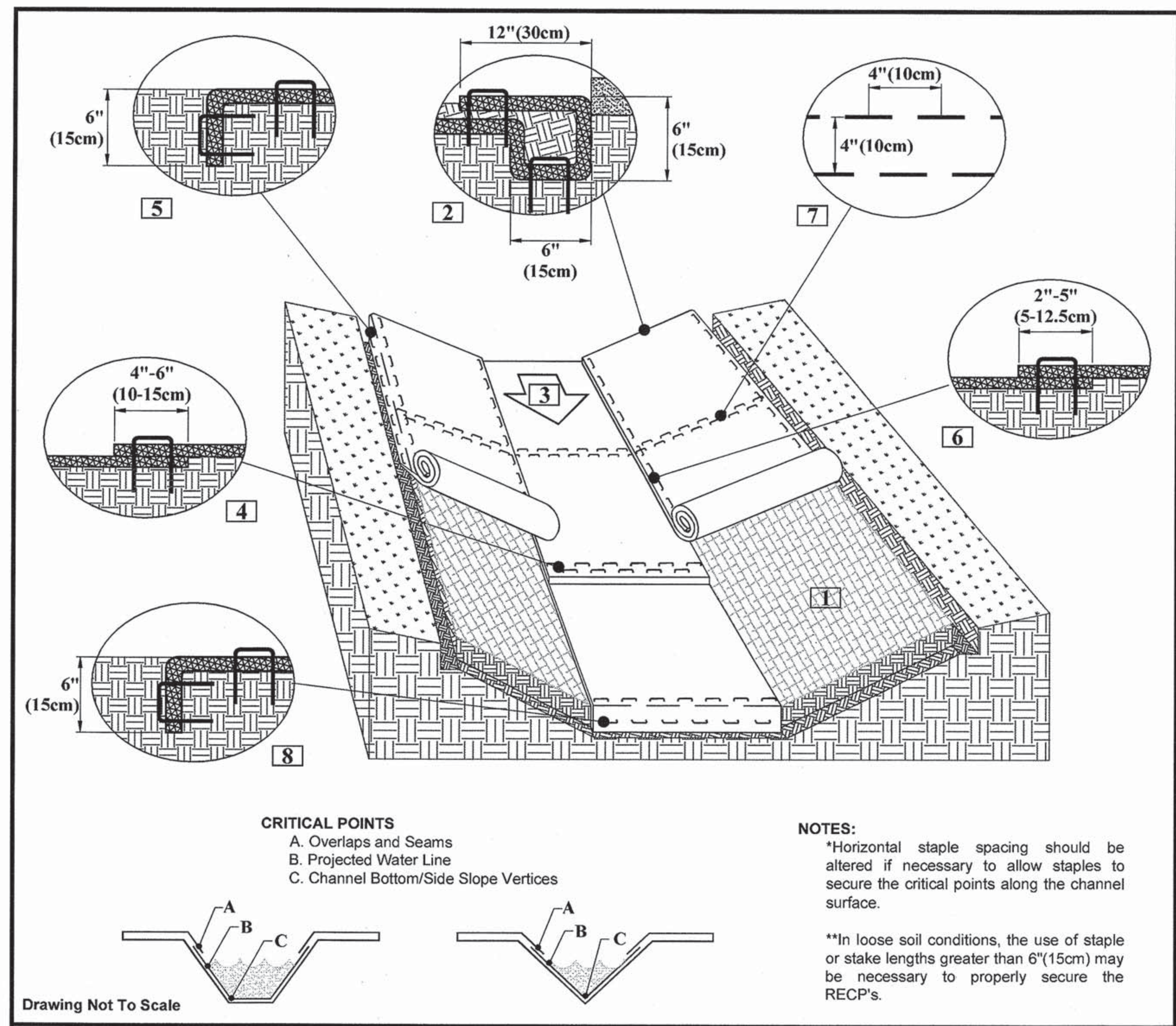
Civil Engineering ◆ Surveying
5501 West William Cannon Dr. ◆ Austin, Texas 78749
Phone No. (512) 280-5160 ◆ Fax No. (512) 280-5165

SHEET NAME: GENERAL NOTES & DETAILS
JOB NAME: BASTROP GROVE
PROJECT: DRAINAGE IMPROVEMENTS

DATE: APRIL 2018
JOB NUMBER: 4697
SHEET 2 OF 14
SHEET NO. 2



CHANNEL INSTALLATION DETAIL

1. Prepare soil before installing rolled erosion control products (RECPs), including any necessary application of lime, fertilizer, and seed.
2. Begin at the top of the channel by anchoring the RECPs in a 6"(15cm) deep X 6"(15cm) wide trench with approximately 12"(30cm) of RECPs extended beyond the up-slope portion of the trench. Use ShoreMax mat at the channel/culvert outlet as supplemental scour protection as needed. Anchor the RECPs with a row of staples/stakes approximately 12"(30cm) apart in the bottom of the trench. Backfill and compact the trench after stapling. Apply seed to the compacted soil and fold the remaining 12"(30cm) portion of RECPs back over the seed and compacted soil. Secure RECPs over compacted soil with a row of staples/stakes spaced approximately 12" apart across the width of the RECPs.
3. Roll center RECPs in direction of water flow in bottom of channel. RECPs will unroll with appropriate side against the soil surface. All RECPs must be securely fastened to soil surface by placing staples/stakes in appropriate locations as shown in the staple pattern guide.
4. Place consecutive RECPs end-over-end (Shingle style) with a 4"-6" overlap. Use a double row of staples staggered 4" apart and 4" on center to secure RECPs.
5. Full length edge of RECPs at top of side slopes must be anchored with a row of staples/stakes approximately 12"(30cm) apart in a 6"(15cm) deep X 6"(15cm) wide trench. Backfill and compact the trench after stapling.
6. Adjacent RECPs must be overlapped approximately 2"-5" (5-12.5cm) (Depending on RECPs type) and stapled.
7. In high flow channel applications a staple check slot is recommended at 30 to 40 foot (9 -12m) intervals. Use a double row of staples staggered 4"(10cm) apart and 4"(10cm) on center over entire width of the channel.
8. The terminal end of the RECPs must be anchored with a row of staples/stakes approximately 12" (30cm) apart in a 6"(15cm) deep X 6"(15cm) wide trench. Backfill and compact the trench after stapling.

CRITICAL POINTS
A. Overlaps and Seams
B. Projected Water Line
C. Channel Bottom/Side Slope Vertices

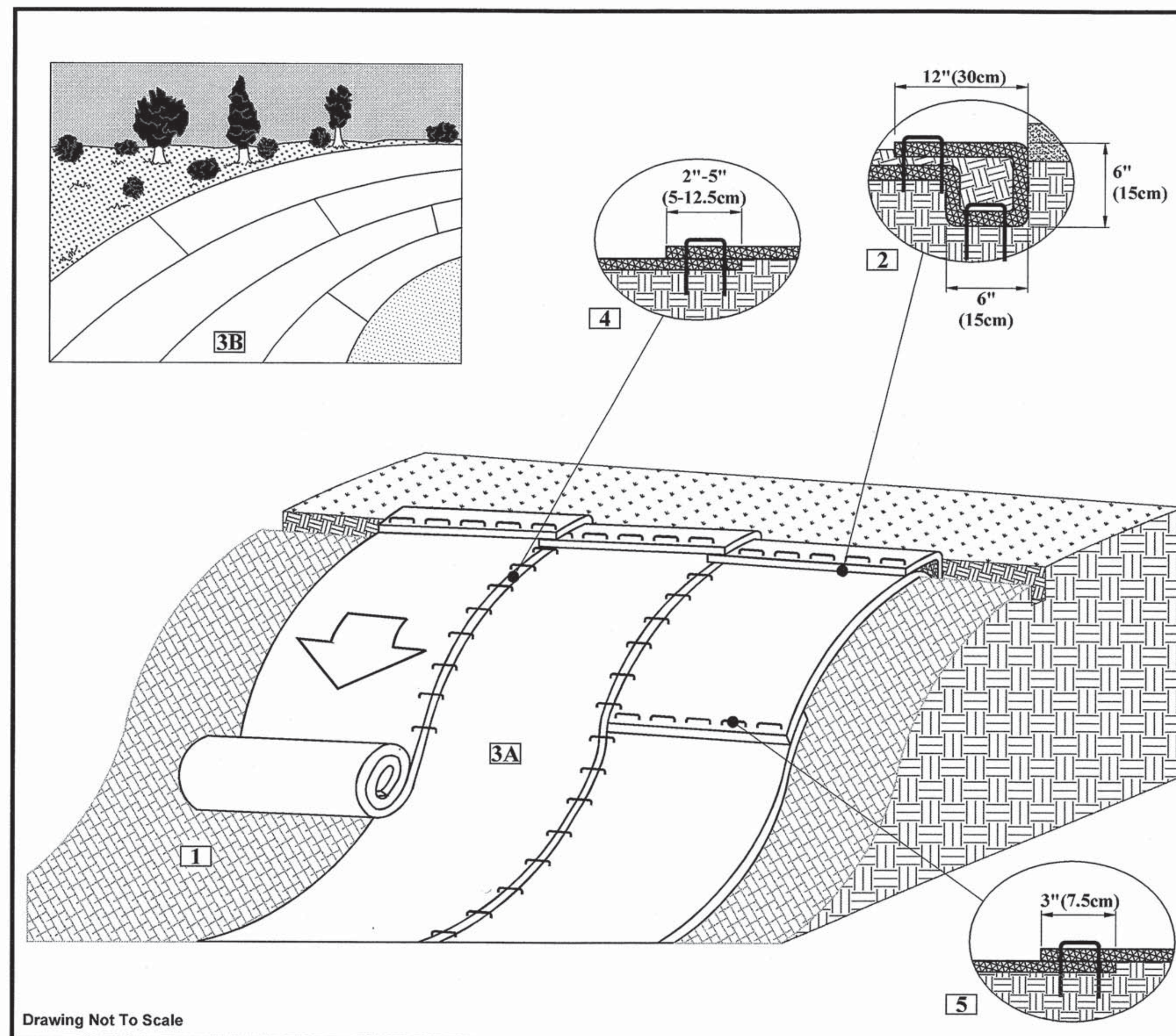
NOTES:
*Horizontal staple spacing should be altered if necessary to allow staples to secure the critical points along the channel surface.

**In loose soil conditions, the use of staple or stake lengths greater than 6"(15cm) may be necessary to properly secure the RECP's.

Drawing Not To Scale

NORTH AMERICAN GREEN
5401 St. Wendel - Cynthiana Rd. PH: 800-722-2040
Poseyville, IN 47633 www.nagreen.com

Drawn on: 5-4-17



SLOPE INSTALLATION DETAIL

1. Prepare soil before installing rolled erosion control products (RECPs), including any necessary application of lime, fertilizer, and seed.
2. Begin at the top of the slope by anchoring the RECPs in a 6"(15cm) deep X 6"(15cm) wide trench with approximately 12" (30cm) of RECPs extended beyond the up-slope portion of the trench. Anchor the RECPs with a row of staples/stakes approximately 12" (30cm) apart in the bottom of the trench. Backfill and compact the trench after stapling. Apply seed to the compacted soil and fold the remaining 12"(30cm) portion of RECPs back over the seed and compacted soil. Secure RECPs over compacted soil with a row of staples/stakes spaced approximately 12"(30cm) apart across the width of the RECPs.
3. Roll the RECPs (A) down or (B) horizontally across the slope. RECPs will unroll with appropriate side against the soil surface. All RECPs must be securely fastened to soil surface by placing staples/stakes in appropriate locations as shown in the staple pattern guide.
4. The edges of parallel RECPs must be stapled with approximately 2" - 5" (5-12.5cm) overlap depending on the RECPs type.
5. Consecutive RECPs spliced down the slope must be end over end (Shingle style) with an approximate 3"(7.5cm) overlap. Staple through overlapped area, approximately 12"(30cm) apart across entire RECPs width.

*NOTE:
In loose soil conditions, the use of staple or stake lengths greater than 6"(15cm) may be necessary to properly secure the RECP's.

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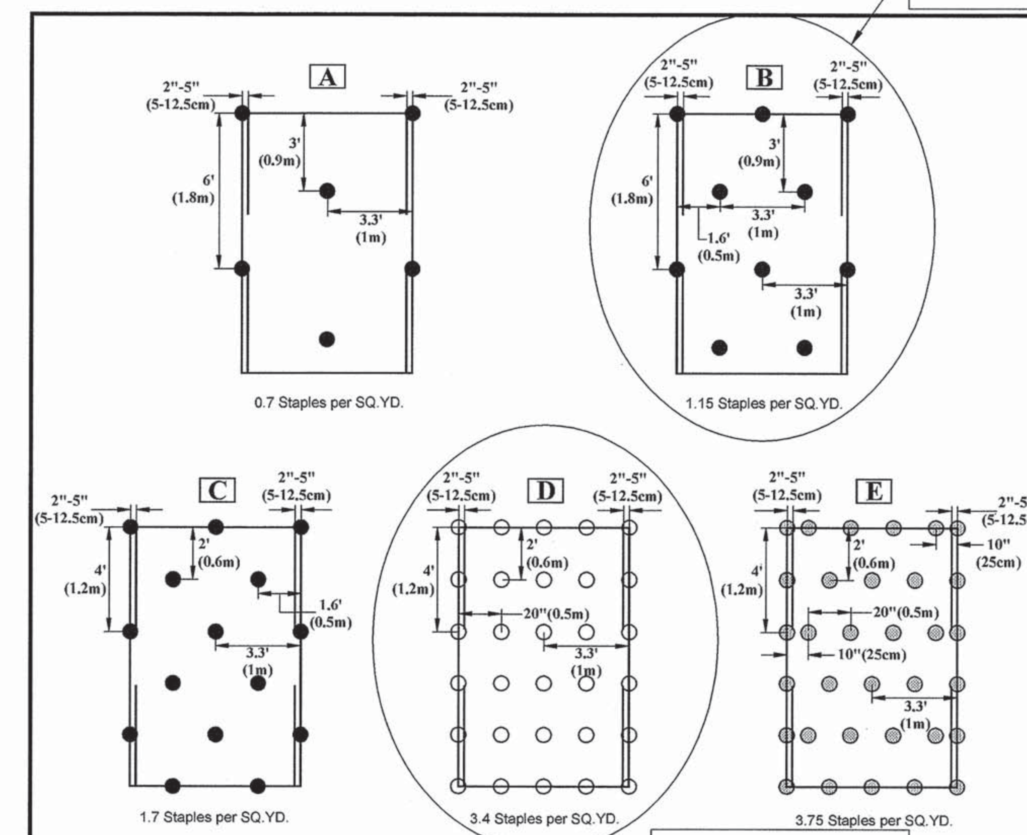
SIDE SLOPE RECP/TRM PATTERN



CHANNEL BOTTOM RECP/TRM PATTERN

STAPLE PATTERN GUIDE

- 4:1 Slopes (A)
- 3:1 Slopes (B)
- 2:1 Slopes (C)
- 1:1 & Steeper Slopes (D)
- Medium/High Flow Channel (D)
- High Flow Channel And Shoreline (E)

NOTES:
* Use ECMDS® for more accurate staple pattern selection.

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Figure 1. Minimum Anchor Pattern

Maximum Design Conditions			Anchor Pattern
Shear Stress	Velocity	Wave Heigth	
<= 6 lbs/ft2	<= 14 ft/s	6 in.	F
> 6-8 lbs/ft2	> 14-18 ft/s	12 in.	G
> 8 lbs/ft2	> 18 ft/s	18 in.	H

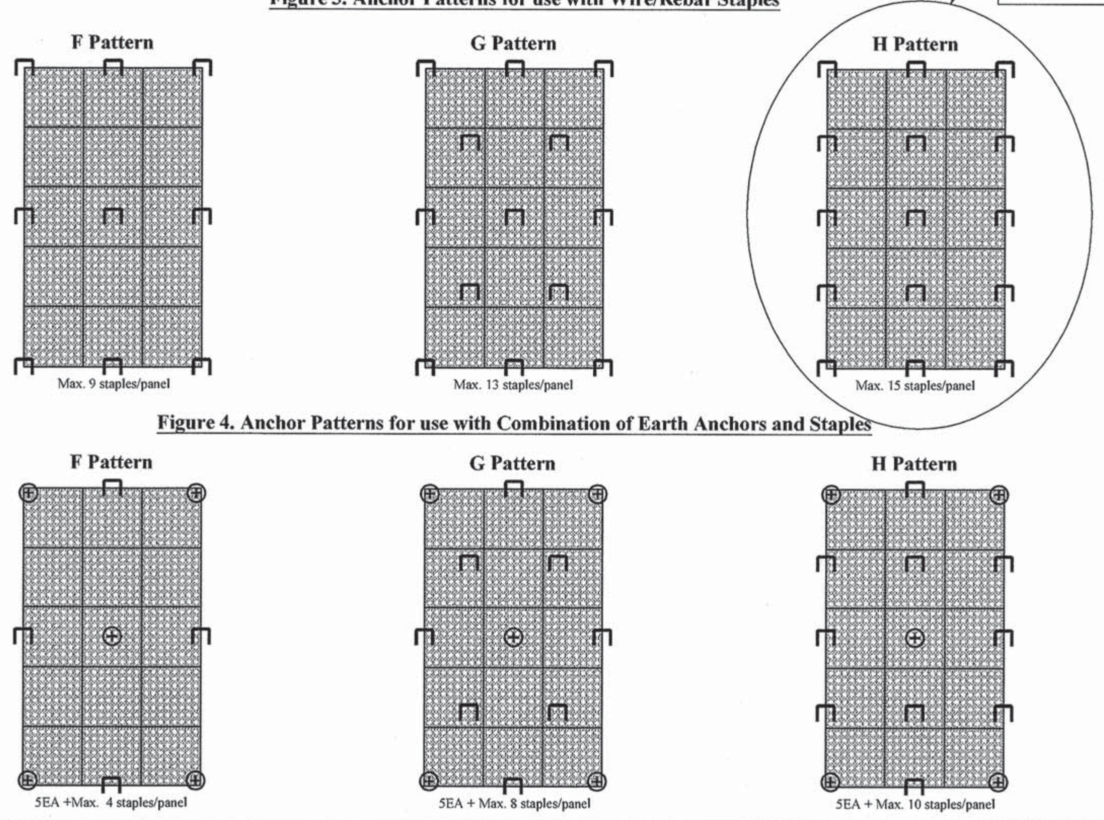
Figure 2. Minimum Anchor Type

Soil Type	Anchor Type
Clay-Clay Loam	10 in Wire Staple
Silt Loam - Loam	10 in Wire Staple
Sandy Loam	12 in Wire Staple
Sand / Muck <= 6 in	12in Rebar Staple
Sand / Muck 6-12 in	18 in Rebar Staple
Sand / Muck 12-18 in	24 in Earth Anchor + 12 in Rebar Staple
Sand / Muck > 18 in	36 in Earth Anchor = 18 in Rebar Staple

SHOREMAX SIDE & BOTTOM PATTERN

Figure 3. Anchor Patterns for use with Wire/Rebar Staples

Figure 4. Anchor Patterns for use with Combination of Earth Anchors and Staples



ShoreMax

ANCHORING GUIDE

1. When installing ShoreMax mat, the anchor pattern (figure 3 or 4) should be selected based on the expected maximum design conditions (shear stress, velocity, or wave impact) (figure 1).
2. Anchor selection should be based on the soil type and pull-out strength required (figure 2). In soft, highly erodible soils percussion earth anchors may be necessary. Earth anchors can be installed in conjunction with rebar staples (figure 4).
3. When using percussion earth anchors, position anchors in each corner and the center of the panel. Place staples in the appropriate pattern through remainder of mat. Staples can be shared between two adjacent panels.

*Note:
Number of staples used per panel can be reduced by 30-40% when sharing staples between panels.

- Wire/Rebar Staple

- Percussion Earth Anchor

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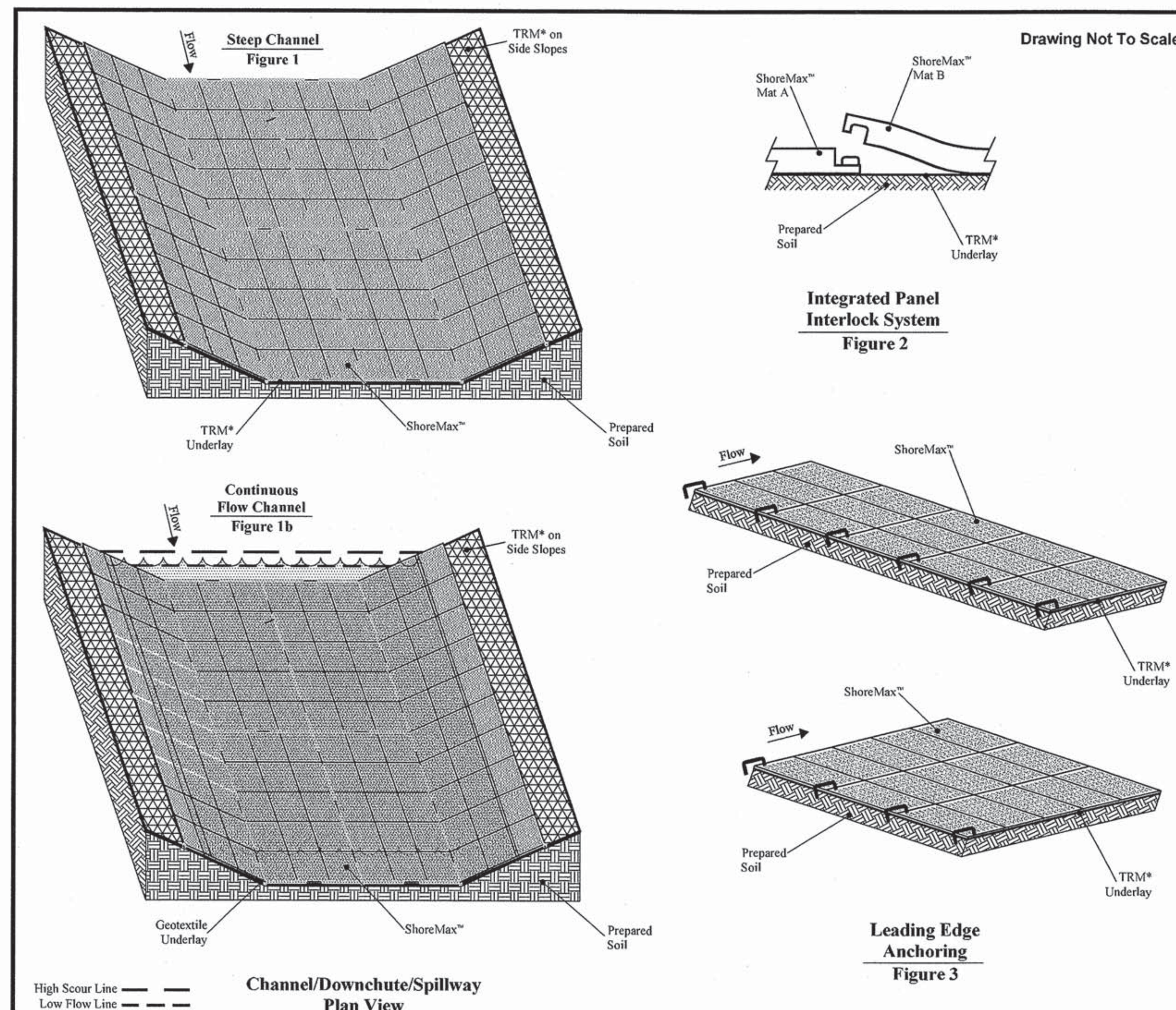

ShoreMax

STEEP CHANNEL/ CHUTE/SPILLWAY DETAIL

* ShoreMax mats can be installed over a variety of underlayments including: sod, turf reinforcement mats (TRMs), geotextiles, and in some cases erosion control blankets (ECBs).

1. Prepare soil before installing erosion control products, including any necessary application of lime, fertilizer, and seed (when installing TRM or ECB underlayment).
2. Install turf reinforcement mat (TRM) over prepared soils according to manufacturer's recommendations.
3. Place ShoreMax mat in the bottom of the channel over the installed TRM (figure 1). The ShoreMax mat should be installed up to the appropriate elevation on the side slope as determined by the engineer. When using multiple panels, connect the panels using the Integrated Panel Interlock System (figure 2). ShoreMax mat can be laid in either direction.
4. For channels carrying continuous water flows, an appropriate geotextile should be placed under the ShoreMax mat for submerged applications (figure 1b).
5. Place staples/anchors in the appropriate pattern. Perimeter staples can be shared between two adjacent panels. In soft or highly erodible soils, percussion earth anchors may be required. View ShoreMax Anchoring Guide, for additional details.
6. At beginning of channel and areas where significant concentrated flows are directed onto the ShoreMax mat, place 1 staple/pin per linear foot along the leading edge of the ShoreMax system, resulting in 1 staple/pin on each corner and gridline (figure 3).

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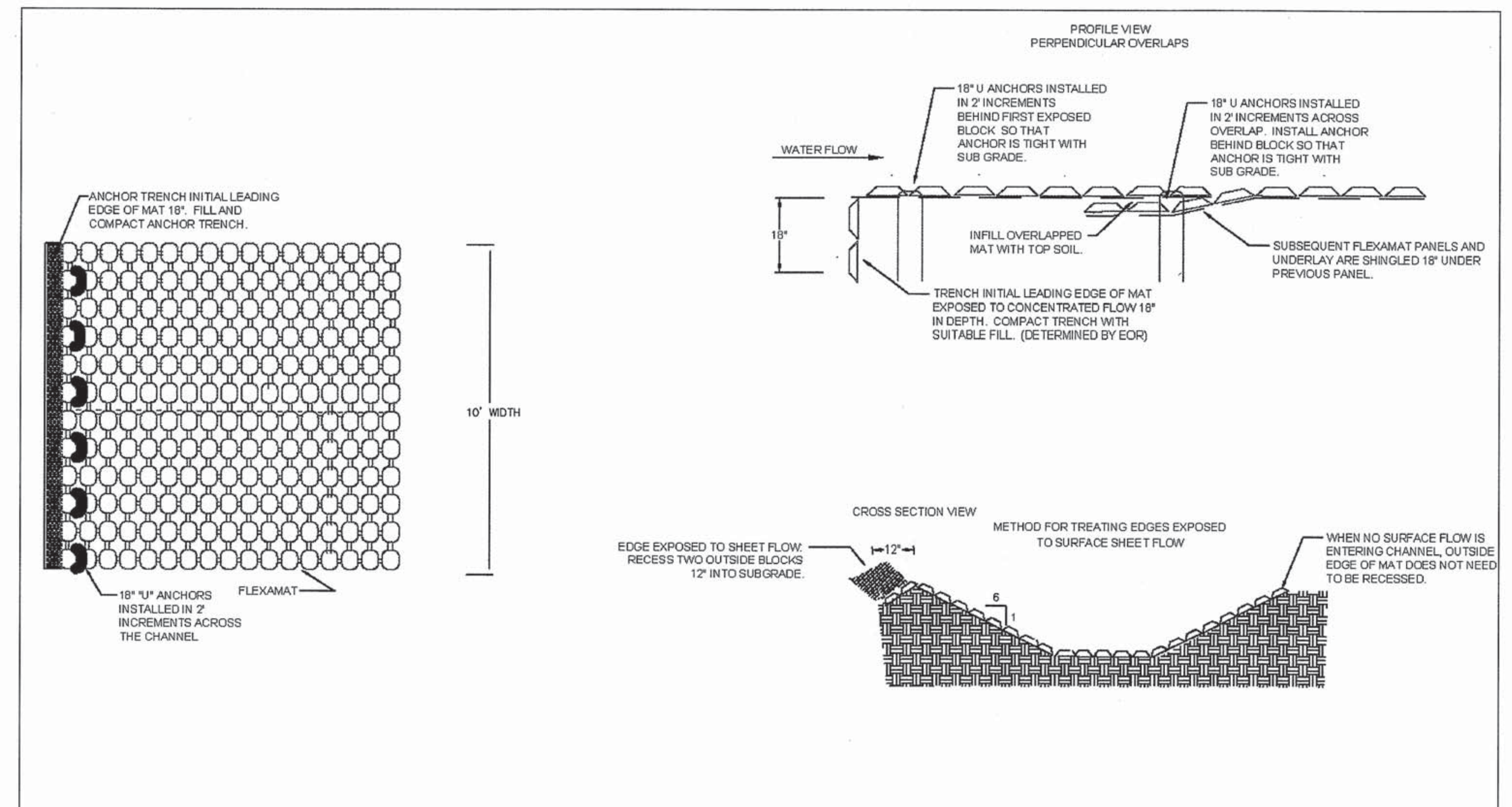
Drawn on: 5-4-17



FLEXAMAT INFORMATION

Manufacturer:	Motz Enterprises, Inc.
Product Name:	Flexamat®
Address:	3153 Madison Road Cincinnati, Ohio 45209
Telephone:	513-772-MOTZ (6689)
Fax:	513-772-6690
Contact:	Matt Motz
Email:	Matt@Flexamat.com
Website:	www.Flexamat.com

CONSTRUCTION NOTES:

1. GRADE CHANNEL SO THAT WATER WILL FLOW DOWN THE CENTER OF THE CHANNEL AND BE CONTAINED TO THE CHANNEL. ALL SUBGRADE SURFACES PREPARED FOR PLACEMENT OF MATS SHALL BE SMOOTH AND FREE OF ALL ROCKS, STICKS, ROOTS, OTHER PROTRUSIONS, OR DEBRIS OF ANY KIND. THE PREPARED SURFACE SHALL PROVIDE A FIRM UNYIELDING FOUNDATION FOR THE MATS.
2. APPLY SEED DIRECTLY TO THE PREPARED SOIL PRIOR TO FLEXAMAT INSTALLATION. USE SEED PER PROJECT SPECIFICATIONS.
3. INSTALL FLEXAMAT ROLLS. AVAILABLE WIDTHS ARE 4', 5.5', 8', 10', 12', & 16' AVAILABLE IN CUSTOM LENGTHS.
4. AT THE TOP OF THE CHANNEL, THE INITIAL LEADING EDGE OF FLEXAMAT EXPOSED TO CONCENTRATED FLOWS SHALL BE EMBEDDED 18" VERTICALLY INTO THE SUBGRADE TO SERVE AS AN ANCHOR TRENCH. THE TRENCH SHALL BE FILLED AND COMPACTED WITH SUITABLE FILL.
5. AT THE END OF THE ARMORED CHANNEL, EMBED THE MAT 18" IN A TERMINATION TRENCH. FILL AND COMPACT TERMINATION TRENCH WITH SUITABLE FILL.

FLEXAMAT ® CHANNEL DETAIL – LOW WATER CROSSING

STATE OF TEXAS
BRENDAN P. McENTEE
96200
LICENSED
PROFESSIONAL ENGINEER
CARLSON, BRIGANCE & DOERING, INC.
ID# F3791
Brendan P. McEntee
05/15/2018

DESIGNED BY:	DRAFTED BY:
BM	JW

DATE
REVISION

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SHEET NAME: DETAILS - EROSION CONTROL MATTING
JOB NAME: BASTROP GROVE
PROJECT: DRAINAGE IMPROVEMENTS

DATE: APRIL 2018
JOB NUMBER: 4697
SHEET: 3 OF 14
SHEET NO.: 3

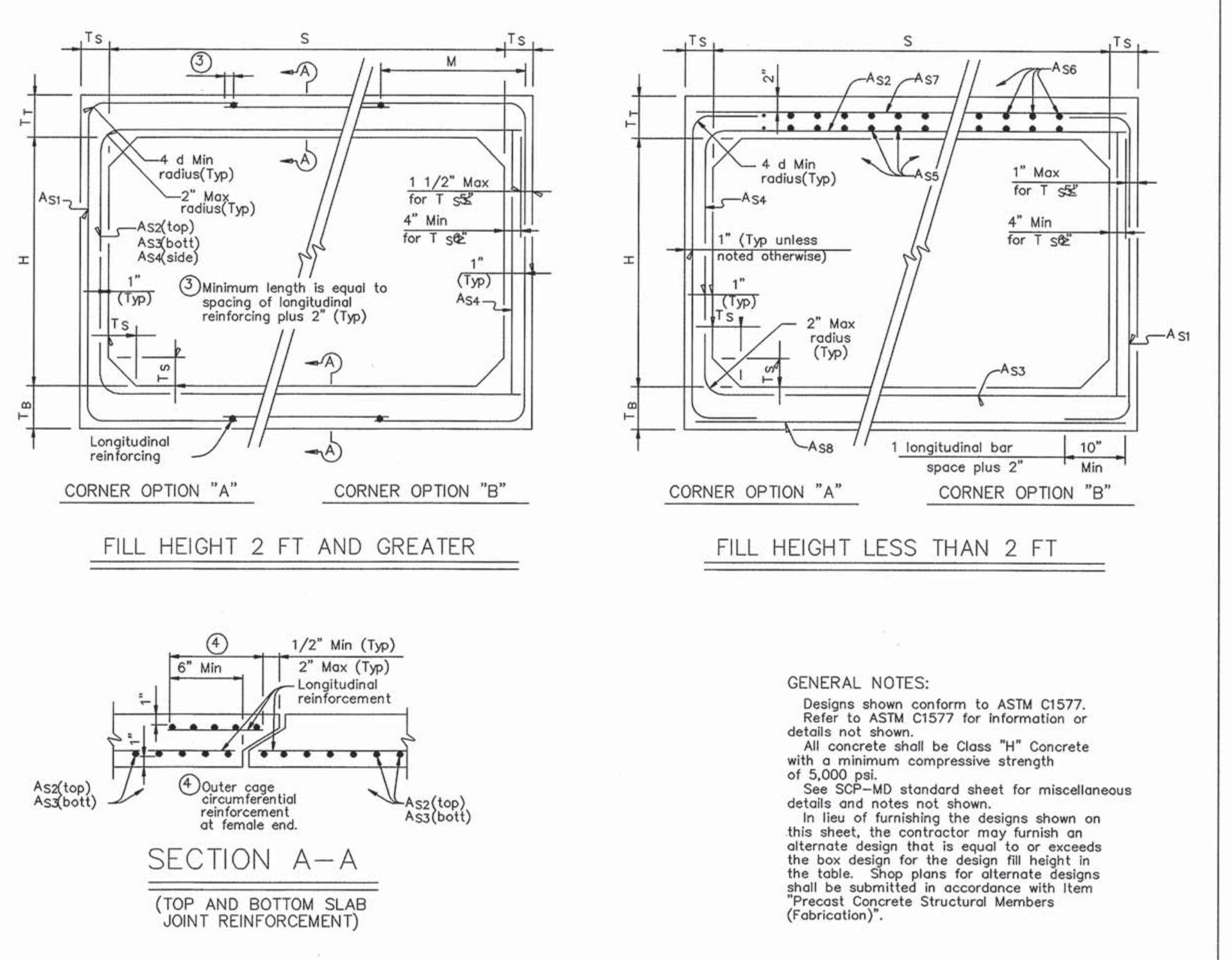
FILE PATH:J:\AutoCad 2004 Land Projects\4697\dwg\Channel\4697 - GENERAL NOTES.dwg - May 15, 2018 - 9:12am

BOX DATA

S (ft)	H (ft)	T_T (in)	T_B (in)	T_S (in)	Fill Height (ft)	M (Min) (in)	A_{S1}	A_{S2}	A_{S3}	A_{S4}	A_{S5}	A_{S6}	A_{S7}	A_{S8}	Lift Weight (Tons) (1)
							REINFORCING (in ²/ft) (2)								
10	5	10	10	10	<2	–	0.30	0.36	0.30	0.24	0.24	0.24	0.24	0.24	17.5
10	5	10	10	10	2<3	58	0.35	0.39	0.34	0.24	–	–	–	–	17.5
10	5	10	10	10	3–5	53	0.28	0.31	0.30	0.24	–	–	–	–	17.5
10	5	10	10	10	10	52	0.33	0.35	0.36	0.24	–	–	–	–	17.5
10	5	10	10	10	15	47	0.42	0.46	0.47	0.24	–	–	–	–	17.5
10	5	10	10	10	20	47	0.55	0.59	0.61	0.24	–	–	–	–	17.5
10	5	10	10	10	25	47	0.68	0.73	0.75	0.24	–	–	–	–	17.5
10	6	10	10	10	<2	–	0.28	0.38	0.33	0.24	0.24	0.24	0.24	0.24	18.5
10	6	10	10	10	2<3	58	0.32	0.42	0.37	0.24	–	–	–	–	18.5
10	6	10	10	10	3–5	52	0.26	0.34	0.33	0.24	–	–	–	–	18.5
10	6	10	10	10	10	52	0.30	0.38	0.39	0.24	–	–	–	–	18.5
10	6	10	10	10	15	47	0.39	0.49	0.51	0.24	–	–	–	–	18.5
10	6	10	10	10	20	47	0.50	0.63	0.65	0.24	–	–	–	–	18.5
10	6	10	10	10	25	47	0.61	0.78	0.80	0.24	–	–	–	–	18.5
10	7	10	10	10	<2	–	0.25	0.40	0.36	0.24	0.24	0.24	0.24	0.24	19.5
10	7	10	10	10	2<3	58	0.30	0.45	0.40	0.24	–	–	–	–	19.5
10	7	10	10	10	3–5	58	0.24	0.36	0.35	0.24	–	–	–	–	19.5
10	7	10	10	10	10	52	0.28	0.40	0.42	0.24	–	–	–	–	19.5
10	7	10	10	10	15	47	0.36	0.52	0.54	0.24	–	–	–	–	19.5
10	7	10	10	10	20	47	0.46	0.67	0.69	0.24	–	–	–	–	19.5
10	7	10	10	10	25	47	0.56	0.82	0.85	0.24	–	–	–	–	19.5
10	8	10	10	10	<2	–	0.24	0.41	0.38	0.24	0.24	0.24	0.24	0.24	20.5
10	8	10	10	10	2<3	64	0.27	0.47	0.43	0.24	–	–	–	–	20.5
10	8	10	10	10	3–5	58	0.24	0.38	0.38	0.24	–	–	–	–	20.5
10	8	10	10	10	10	52	0.26	0.42	0.44	0.24	–	–	–	–	20.5
10	8	10	10	10	15	47	0.34	0.54	0.57	0.24	–	–	–	–	20.5
10	8	10	10	10	20	47	0.43	0.69	0.72	0.24	–	–	–	–	20.5
10	9	10	10	10	<2	–	0.24	0.42	0.41	0.24	0.24	0.24	0.24	0.24	21.5
10	9	10	10	10	2<3	70	0.26	0.50	0.46	0.24	–	–	–	–	21.5
10	9	10	10	10	3–5	64	0.24	0.40	0.40	0.24	–	–	–	–	21.5
10	9	10	10	10	10	58	0.25	0.43	0.46	0.24	–	–	–	–	21.5
10	9	10	10	10	15	52	0.32	0.56	0.59	0.24	–	–	–	–	21.5
10	9	10	10	10	20	47	0.40	0.71	0.75	0.24	–	–	–	–	21.5
10	10	10	10	10	<2	–	0.24	0.44	0.44	0.24	0.24	0.24	0.24	0.24	22.5
10	10	10	10	10	2<3	79	0.25	0.52	0.48	0.24	–	–	–	–	22.5
10	10	10	10	10	3–5	70	0.24	0.42	0.43	0.24	–	–	–	–	22.5
10	10	10	10	10	10	64	0.24	0.44	0.48	0.24	–	–	–	–	22.5
10	10	10	10	10	15	52	0.30	0.57	0.61	0.24	–	–	–	–	22.5
10	10	10	10	10	20	52	0.38	0.73	0.77	0.24	–	–	–	–	22.5

(1) For Box Length = 8'-0"

(2) A_{S1} thru A_{S4}, A_{S5} and A_{S6} are minimum required areas of reinforcement per linear foot of box length. A_{S7} and A_{S8} are minimum required areas of reinforcement per linear foot of box width.



GENERAL NOTES:

Designs shown conform to ASTM C1577.

Refer to ASTM C1577 for information or details not shown.

All concrete shall be Class "H" Concrete with a minimum compressive strength of 5,000 psi.

See SCP-MD standard sheet for miscellaneous details and notes not shown.

In lieu of furnishing the designs shown on this sheet, the contractor may furnish an alternate design that is equal to or exceeds the box design for the design fill height in the table. Shop plans for alternate designs shall be submitted in accordance with Item "Precast Concrete Structural Members (Fabrication)".

HL93 LOADING

Texas Department of Transportation — Bridge Division Standard

SINGLE BOX CULVERTS PRECAST 10'-0" SPAN

SCP-10

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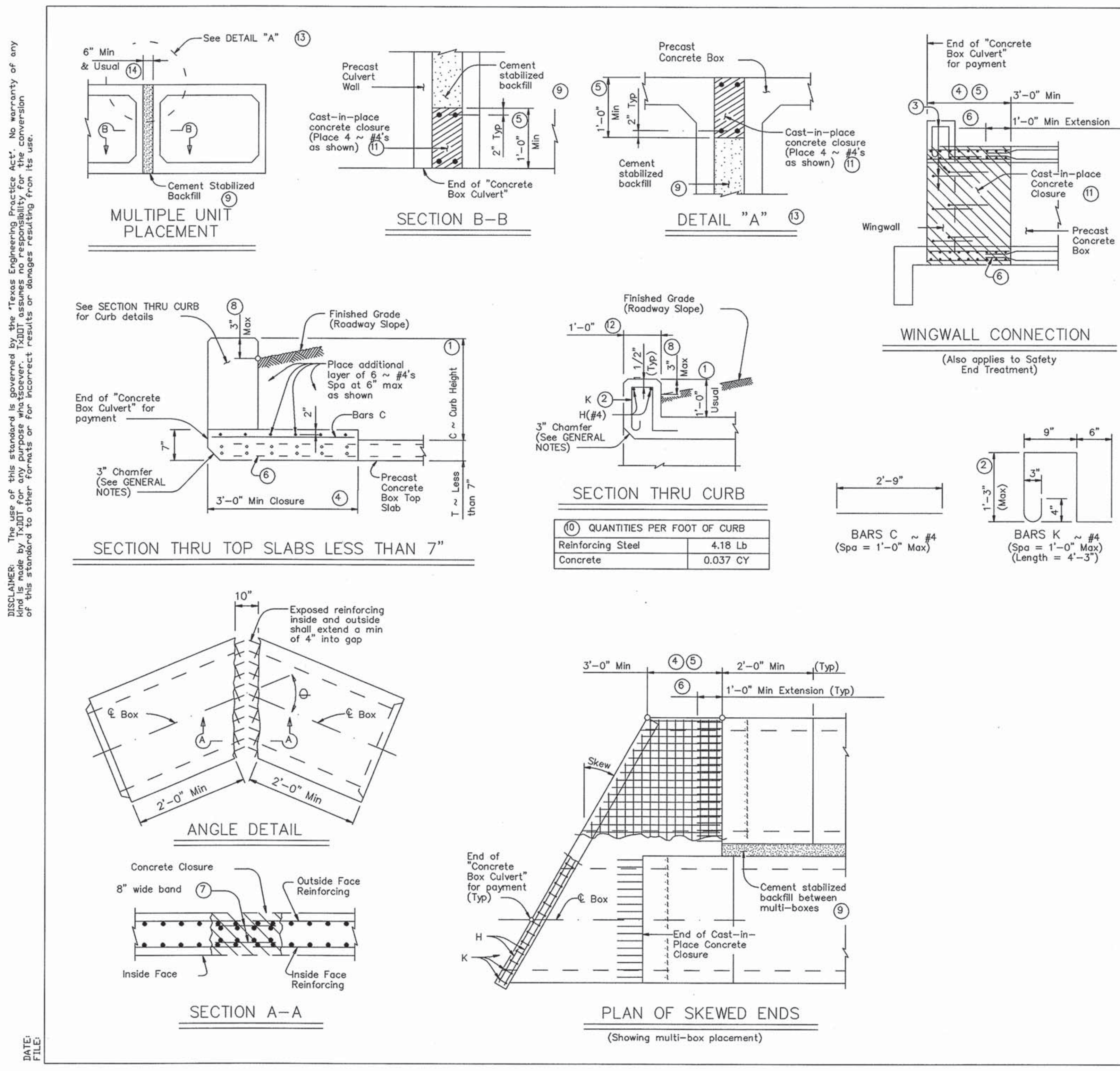


(1) 0" min to 5'-0" max. Estimated curb heights are shown elsewhere in the plans. For structures with pedestrian rail, bicycle rail or curbs taller than 1'-0", refer to ECD standard. For structures with T6 traffic rail, refer to T6-CM standard. For structures with traffic rail, other than T6, refer to RAC standard.

(2) For curbs less than 1'-0" high, tilt Bars K or reduce bar height as necessary to maintain cover. For curbs less than 3" high, Bars K may be omitted.

(3) Curb, Wingwall or Safety End Treatment reinforcing shall extend into concrete closure. Any reinforcing that does not fit into the closure shall be bent or trimmed as necessary.

(4) Cast-in-place concrete closure shall be 3'-0" min. Boxes shall be cast short or broken back in the field. All reinforcing in the closure shall be the same size and spacing as in the precast box section. Except where shown otherwise, the cast-in-place closure shall be flush with the inside and outside faces of the precast box section.

(5) For multiple unit placements the length of the closure for the interior walls may be adjusted as necessary. The length of the top slab, bottom slab, and exterior wall closure shall not be less than 3'-0". See Section B-B detail when interior walls are cast full length.

(6) Precast box reinforcing shall extend a minimum of 1'-0" into concrete closure (Typ).

(7) Bands of reinforcing matching the inside and outside face reinforcing shall be placed in the gaps of the top and bottom slabs. A band matching the outside face reinforcing of the wall shall be placed in the gaps of the walls (placed in the outside face only). The bands shall be tack welded to the exposed reinforcing at each point of contact.

(8) For vehicle safety, the following requirements must be met:
- For structures without bridge rail, curbs shall project no more than 3" above finished grade.
- For structures with bridge rail, curbs shall be flush with finished grade.

Curb heights shall be reduced, if necessary, to meet the above requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.

(9) Cement Stabilized Backfill between boxes is considered part of the Box Culvert for payment.

(10) All curb concrete and reinforcing is considered part of the Box Culvert for payment.

(11) Any additional concrete and reinforcing required for the closures shall be considered as subsidiary to the Concrete Box Culvert.

(12) 1'-0" typical. 2'-0" when RAC standard is referred to elsewhere in the plans.

(13) For multiple unit placement with overlay, with 1 to 2 course surface treatment, or with the top slab as the final riding surface, provide wall closure as shown in DETAIL "A".

(14) This dimension may be increased with approval of the Engineer to allow the precast boxes to be tunneled or jacked in accordance with Item 476, "Jacking, Boring, or Tunneling Pipe or Box". No payment will be made for any additional material in the gap between adjacent boxes.

GENERAL NOTES:

Designed according to AASHTO LRFD Specifications.

All closure concrete shall be Class "C" with a minimum compressive strength of 3600 psi and shall be placed according to the Item, "Concrete Substructures".

Any additional concrete required for the closures shall be considered as subsidiary to the Concrete Box Culvert.

Refer to the Single Box Culverts Precast standard for details not shown.

The bottom edge of the top slab closure shall be chamfered 3 inches at the entrance.

HL93 LOADING

Texas Department of Transportation — Bridge Division Standard

BOX CULVERTS PRECAST MISCELLANEOUS DETAILS

SCP-MD

TABLE OF DIMENSIONS & REINFORCING STEEL (Wings for One Structure End)

Maximum Wingwall Height Hw	W	X	Y	Z	Bars J1 Size	Bars J1 Spa	Bars J2 Size	Bars J2 Spa	Reinf (Lb/Ft)	Conc (CY/Ft)
	Dimensions				Variable Reinforcing				Estimated Quantities per ft of wing length (2~Wings) (3)	
2'-6"	2'- 5"	1'- 0"	9"	7"	#4	1'-0"	#4	1'-0"	33.73	0.248
3'-0"	2'- 5"	1'- 0"	9"	7"	#4	1'-0"	#4	1'-0"	37.07	0.261
3'-6"	2'- 5"	1'- 0"	9"	7"	#4	1'-0"	#4	1'-0"	37.74	0.273
4'-0"	2'- 5"	1'- 0"	9"	7"	#4	1'-0"	#4	1'-0"	38.41	0.285
4'-6"	3'- 2"	1'- 6"	1'- 0"	7"	#4	1'-0"	#4	1'-0"	41.75	0.330
5'-0"	3'- 2"	1'- 6"	1'- 0"	7"	#4	1'-0"	#4	1'-0"	45.09	0.343
5'-6"	3'- 2"	1'- 6"	1'- 0"	7"	#4	1'-0"	#4	1'-0"	45.75	0.355
6'-0"	3'- 2"	1'- 6"	1'- 0"	7"	#4	1'-0"	#4	1'-0"	46.42	0.367
7'-0"	3'- 8"	1'- 9"	1'- 3"	7"	#4	1'-0"	#4	1'-0"	52.77	0.414
8'-0"	4'- 2"	2'- 0"	1'- 6"	8"	#5	1'-0"	#4	1'-0"	60.19	0.486
9'-0"	4'- 8"	2'- 3"	1'- 9"	8"	#4	6"	#4	6"	81.49	0.535
10'-0"	5'- 2"	2'- 6"	2'- 0"	8"	#5	6"	#4	6"	97.25	0.584
11'-0"	5'- 8"	2'- 9"	2'- 3"	8"	#6	6"	#5	6"	133.65	0.634
12'-0"	6'- 2"	3'- 0"	2'- 6"	9"	#7	6"	#5	6"	162.29	0.721
13'-0"	6'- 8"	3'- 3"	2'- 9"	11"	#7	6"	#5	6"	178.80	0.856
14'-0"	7'- 2"	3'- 6"	3'- 0"	1'- 0"	#8	6"	#5	6"	216.78	0.959
15'-0"	7'- 8"	4'- 0"	3'- 0"	1'- 1"	#9	6"	#6	6"	283.06	1.068
16'-0"	8'- 2"	4'- 6"	3'- 0"	1'- 3"	#9	6"	#6	6"	297.02	1.234

TABLE OF WINGWALL REINFORCING (2~Wings)

Bar	Size	No.	Spa
D	#5	~	1'-0"
E	#4	~	1'-0"
F	#4	~	1'-0"
G	#6	4	~
M	#4	4	~
P	#4	~	1'-0"
R	#5	6	~
V	#4	~	1'-0"

TABLE OF ESTIMATED CULVERT TOEWALL QUANTITIES

Bar	Size	No.	Spa
L	#4	~	1'-6"
Q	#4	1	~
Reinf (Lb/Ft)			2.45
Conc (CY/Ft)			0.037

WING DIMENSION CALCULATIONS:

Formulas: (All values are in Feet)
Hw = H + T + C − 0.250'
A = (Hw − 0.333') (SL)
B = (A) Tangent (30°)
Lw = (A) ÷ Cosine (30°)
For Cast-in-place culverts:
Ltw = (N) (S) + (N − 1) (U)
For Precast culverts:
Ltw = (N) (2U + S) + (N − 1) (0.500')
Total Wingwall Area (Two Wings ~ S.F.) = (Hw − 0.333') (Lw)

Hw = Height of Wingwall
SL:1 = Side Slope Ratio (Horizontal:1 Vertical)
Lw = Length of Wingwall
Ltw = Culvert Toewall Length
N = Number of Culvert Spans

See applicable box culvert standard for H, S, T, and U values.

(1) Extend Bars P 3'-0" minimum into bottom slab of Box Culvert.

(2) Adjust to fit as necessary to maintain 1 1/4" clear cover and 4" minimum between bars.

(3) Quantities shown are based on an average wing height for two wings (one structure end). To determine total quantities for two wings multiply the tabulated values by Lw.

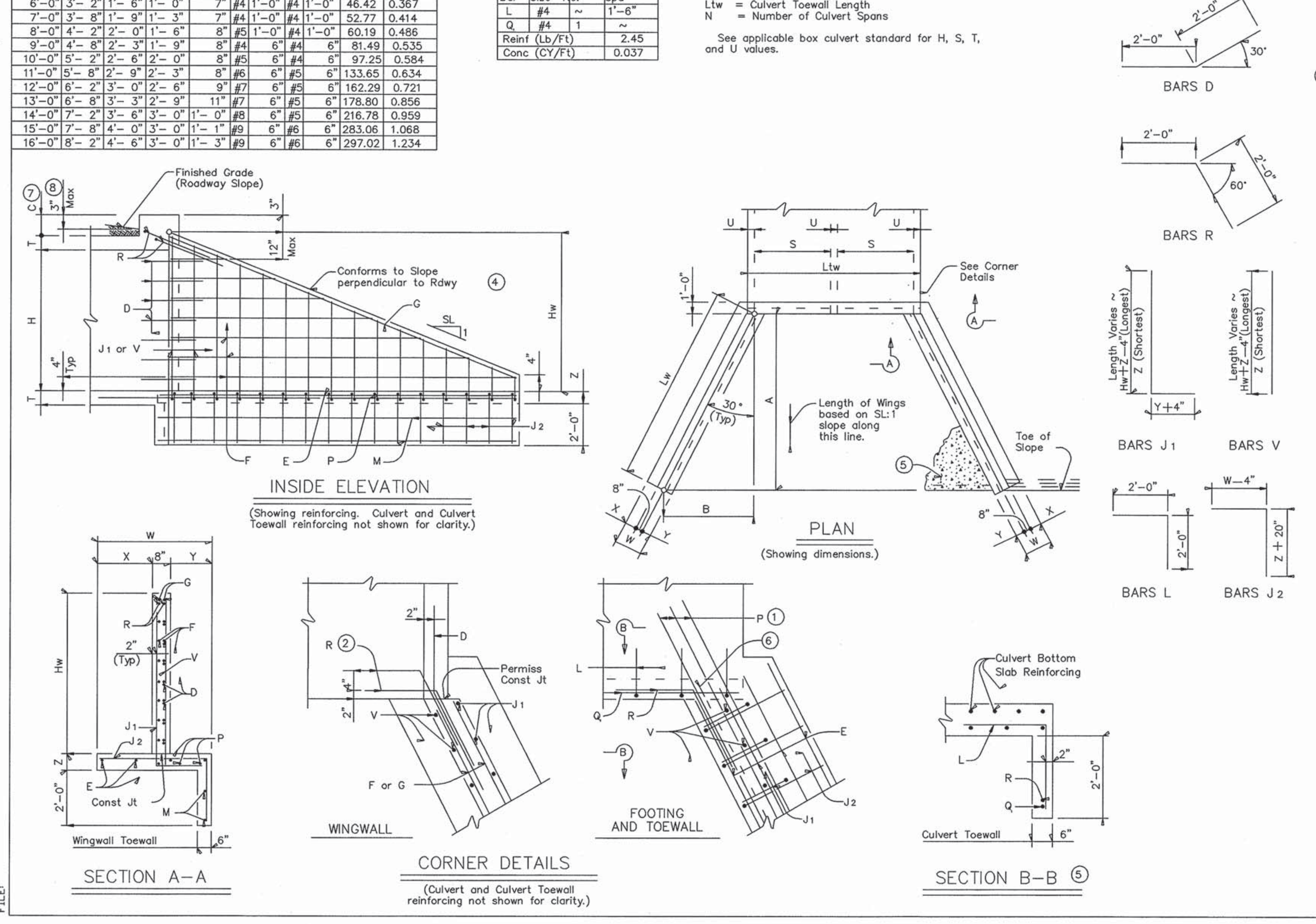
(4) Recommended values of Slope are: 2:1, 3:1, 4:1, & 6:1.

(5) When shown elsewhere on the plans, a 5" deep concrete riprap shall be constructed. Payment for riprap shall be as required by Item 432, "Riprap". Unless otherwise shown on the plans or directed by the Engineer, the riprap shall have a 6" wide by 1'-6" deep reinforced concrete toewall along all edges adjacent to natural ground; the toewall shall be reinforced by extending typical riprap reinforcing into the toewall; construction joints or grooved joints, oriented in the direction of flow, shall extend across the full distance of the riprap, at intervals of approximately 20'. When such riprap is provided, the culvert toewall shown in SECTION B-B will not be required.

(6) At Contractor's option, Culvert Toewall may be ended flush with Wingwall Toewall. Adjust reinforcing from that shown as necessary.

(7) 0" min to 5'-0" max. Estimated curb heights are shown elsewhere in the plans. For structures with pedestrian rail, bicycle rail or curbs taller than 1'-0", refer to ECD standard. For structures with T6 bridge rail, refer to T6-CM standard. For structures with traffic rail, other than T6, refer to RAC standard.

(8) For vehicle safety, curb heights and wall heights shall be reduced, if necessary, to provide a maximum 3" projection above finished grade. No changes will be made in quantities and no additional compensation will be allowed for this work.



GENERAL NOTES:

Designed according to AASHTO LRFD Specifications.

All reinforcing steel shall be Grade 60.

Synthetic fibers listed on the "Fibers for Concrete" Material Producer List (MPL) may be used in lieu of steel reinforcing in riprap concrete unless noted otherwise.

All concrete shall be Class "C" and shall have a minimum compressive strength of 3600 psi.

All reinforcing bars shall be adjusted to provide a minimum of 1 1/4" clear cover.

When structure is founded on solid rock, depth of toewalls for culverts and wingwalls may be reduced or eliminated as directed by the Engineer.

See BCS sheet for additional dimensions and information.

The quantities for concrete and reinforcing steel resulting from the formulas given on this sheet are for Contractor's information only.

Texas Department of Transportation — Bridge Division Standard

CONCRETE WINGWALLS WITH FLARED WINGS FOR 0° SKEW BOX CULVERTS

FW-0

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TABLE OF DIMENSIONS & REINFORCING STEEL (Wings for One Structure End) — TABLE OF WINGWALL REINFORCING (2~Wings) — TABLE OF ESTIMATED CULVERT TOEWALL QUANTITIES (same values as above)

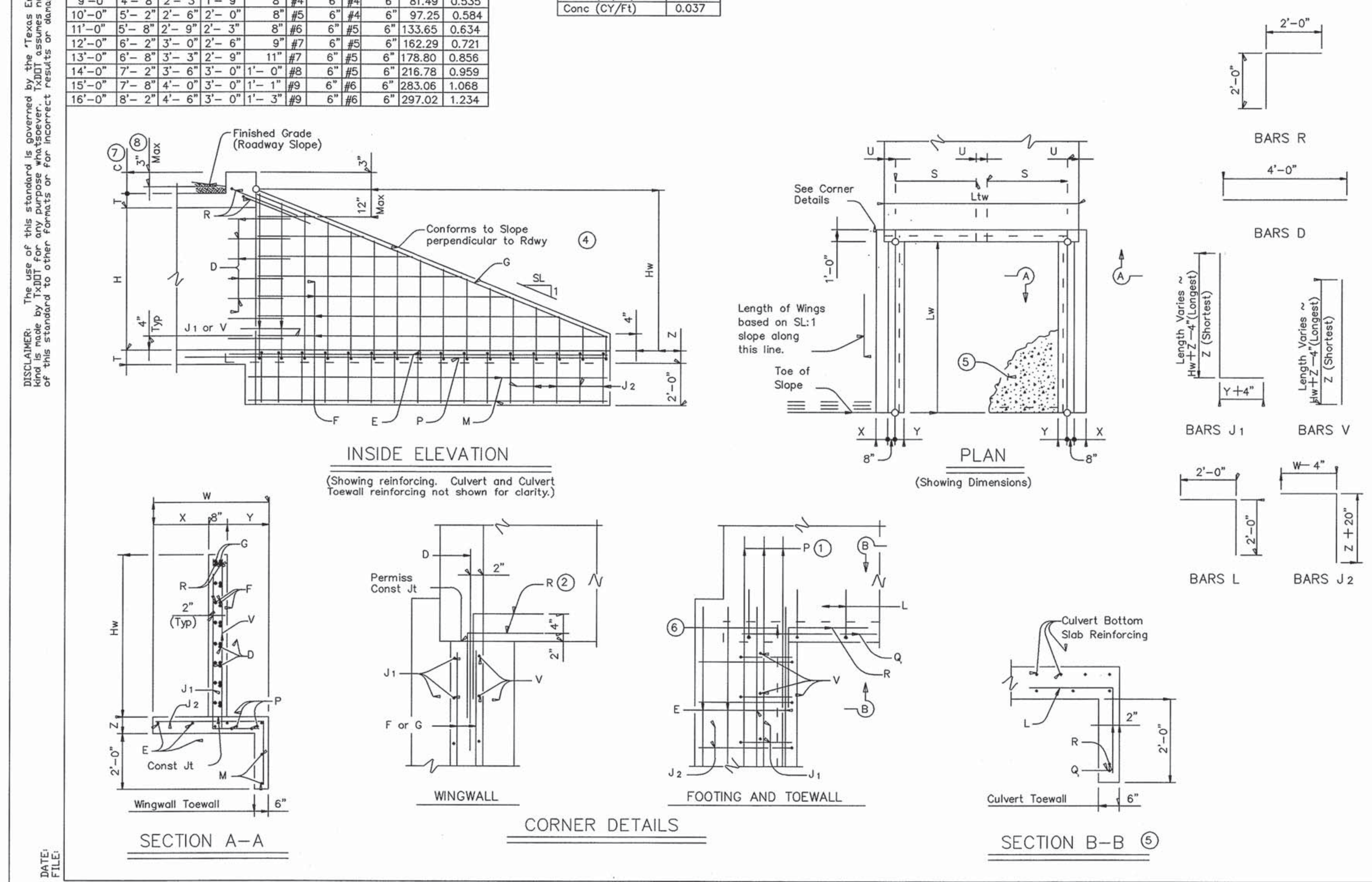
WING DIMENSION CALCULATIONS:

Formulas: (All values are in Feet)
Hw = H + T + C − 0.250'
Lw = (Hw − 0.333') (SL)
For Cast-in-place culverts:
Ltw = (N) (S) + (N − 1) (U)
For Precast culverts:
Ltw = (N) (2U + S) + (N − 1) (0.5')
Total Wingwall Area (Two Wings ~ S.F.) = (Hw − 0.333') (Lw)

Hw = Height of Wingwall
SL:1 = Side Slope Ratio (Horizontal:1 Vertical)
Lw = Length of Wingwall
Ltw = Culvert Toewall Length
N = Number of Culvert Spans

See applicable box culvert standard for H, S, T, and U values.

(1)–(8) notes and GENERAL NOTES as above.



Texas Department of Transportation — Bridge Division Standard

CONCRETE WINGWALLS WITH STRAIGHT WINGS FOR 0° SKEW BOX CULVERTS

SW-0

CARLSON, BRIGANCE & DOERING, INC.
ID# F3791
05/15/2018

DESIGNED BY: BM
DRAFTED BY: JW

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Phone No. (512) 280-5160 ◆ Fax No. (512) 280-5165

SHEET NAME: DETAILS - BOX CULVERTS

JOB NAME: BASTROP GROVE

PROJECT: DRAINAGE IMPROVEMENTS

DATE: APRIL 2018

JOB NUMBER: 4697

SHEET 4 OF 14

SHEET NO. 4

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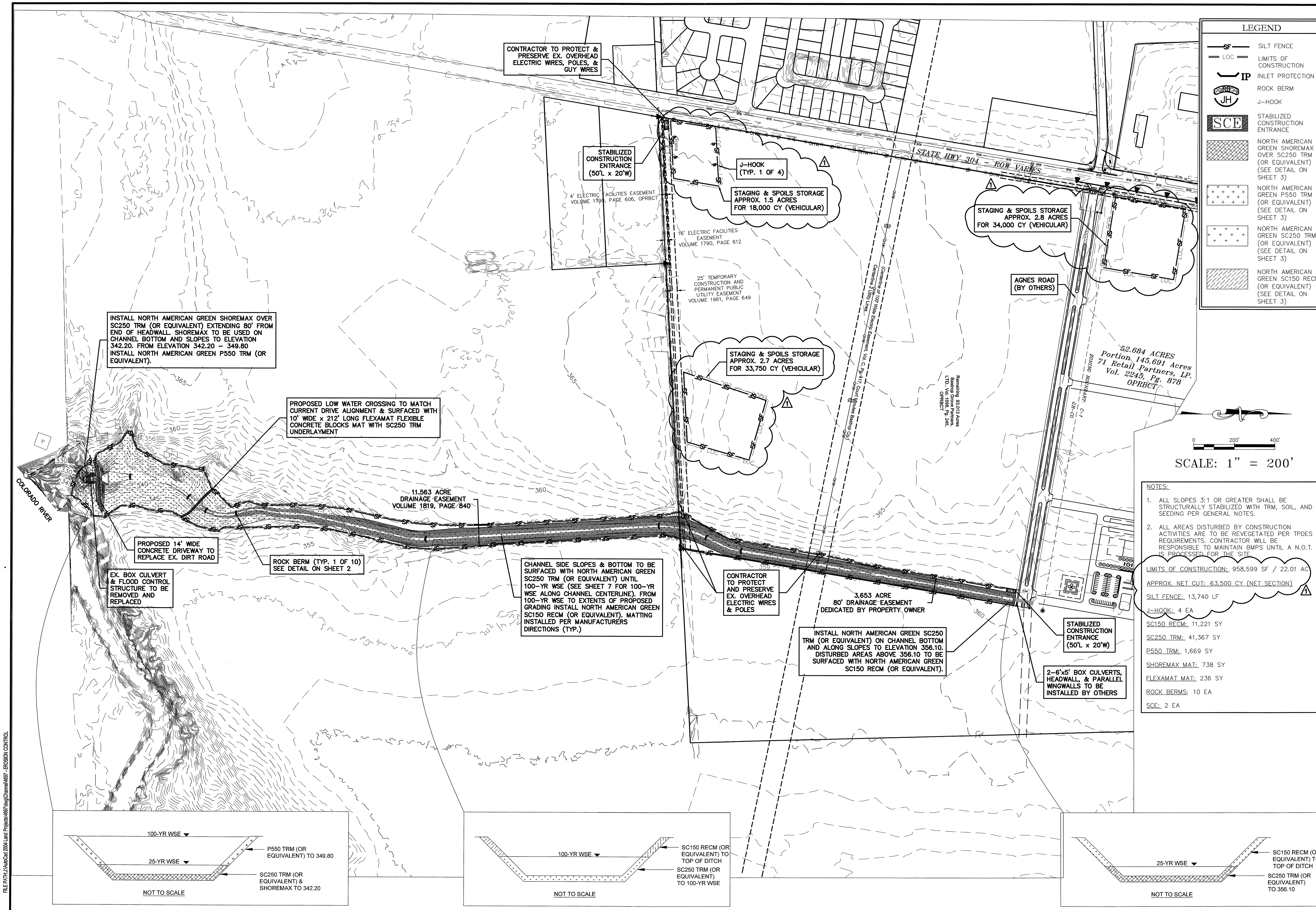

10/18/2018

STATE OF TEXAS
BRENDAN P. McENTEE
96200
LICENSED PROFESSIONAL ENGINEER

CARLSON, BRIGANCE & DOERING, INC.
ID# F3791

DESIGNED BY:	DRAFTED BY:
BM	JW

	DATE	REVISION
1	10/18/18	RELOCATED SPOIL PILES

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Phone No. (512) 280-5160 ❖ Fax No. (512) 280-5165

SHEET NAME: EROSION CONTROL PLAN
JOB NAME: BASTROP GROVE
PROJECT: DRAINAGE IMPROVEMENTS

DATE: APRIL 2018
JOB NUMBER: 4697
SHEET: 5 OF 14
SHEET NO. 5

FILE PATH:J:\AutoCad 2004 Land Projects\4697\dwg\Channel\4697 - EROSION CONTROL

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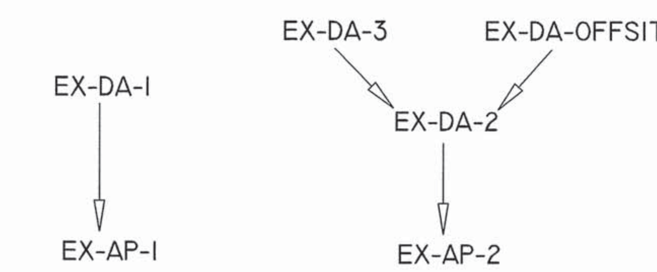
SCALE: 1" = 300'

LEGEND

- DRAINAGE EASEMENT BOUNDARY
- DRAINAGE BOUNDARY LINE
- AI — DRAINAGE AREA LABEL
- ANALYSIS POINT (AP)
- 940 — EXISTING CONTOUR MAJOR
- EXISTING CONTOUR MINOR
- FLOW ARROW
- TcFP — TIME OF CONCENTRATION FLOW PATH

HYDROLOGY FLOW CHART



TIME OF CONCENTRATION CALCULATIONS EXISTING CONDITIONS

Drainage Area #	Sheet Flow				Shallow Conc. Flow				Channel Flow						Tc (Min.)
	n	Slope	L	Tc	Paved/ Unpaved	Slope	L	Tc	n	Slope	L	$A_{x\text{-sect}}$	WP	Tc	
EX-DA-1	0.15	0.30%	100	19.73	U	0.19%	3154.97	74.77							94.5
DA-OFFSITE	0.011	0.50%	100	1.99	U	0.50%	2336	34.13	0.013	0.50%	1793	18	18	3.69	39.8
EX-DA-2	0.15	0.56%	100	15.37	U	0.34%	3712.93	65.78	0.026	1.58%	2631.64	200	60	2.72	83.9
EX-DA-3	0.15	0.36%	100	18.34	U	0.76%	1684.2	19.96							38.3

RESULTS TABLE - EXISTING CONDITIONS

SUB-BASIN	AREA (AC.)	% IC	CN	Q_{10} (CFS)	Q_{25} (CFS)	Q_{100} (CFS)
EX-DA-1 / EX-AP-1	101.79	0	57	59.56	97.12	167.35
DA-OFFSITE	69.84	28	71	127.94	181.31	273.3
EX-DA-2	193.08	0	60	140.32	219.91	366.23
EX-DA-3	50.91	0	52	36.56	64.3	117.99
EX-AP-2				257.24	395.87	648.66

NOTES:

- SCS WAS USED AS DRAINAGE CALCULATION METHOD
- RAINFALL INTENSITY DATA FOR DESIGN STORMS WERE PROVIDED BY BASTROP COUNTY'S CODE OF ORDINANCES (10.1.40 & 10.5.90)
- CN's ARE BASED ON EXISTING TYPE A & B SOILS AND REFLECT VALUES PER THE USDA WEB SOIL SURVEY
- TOC CALCULATIONS ARE BASED ON ASSUMED EXISTING CONDITIONS & TR-55
- MANNING'S N VALUES FROM TR-55:
  - PIPE/CHANNEL FLOW
    - PIPES - REINFORCED CONCRETE = 0.013
    - NATURAL CHANNELS - EARTH, STRAIGHT, SOME GRASS = 0.026
  - OVERLAND FLOW
    - SMOOTH SURFACE (CONCRETE, ASPHALT, BARE SOIL) = 0.011
    - SHORT GRASS = 0.015
- OFFSITE IMPERVIOUS COVERS ARE APPROXIMATE BASED ON AERIAL IMAGERY

STATE OF TEXAS
BRENDAN P. McENTEE
96200
LICENSED
PROFESSIONAL ENGINEER

CARLSON, BRIGANCE & DOERING, INC.
ID# F3791
05/15/2018

DESIGNED BY:	DRAFTED BY:
BM	FW

DATE

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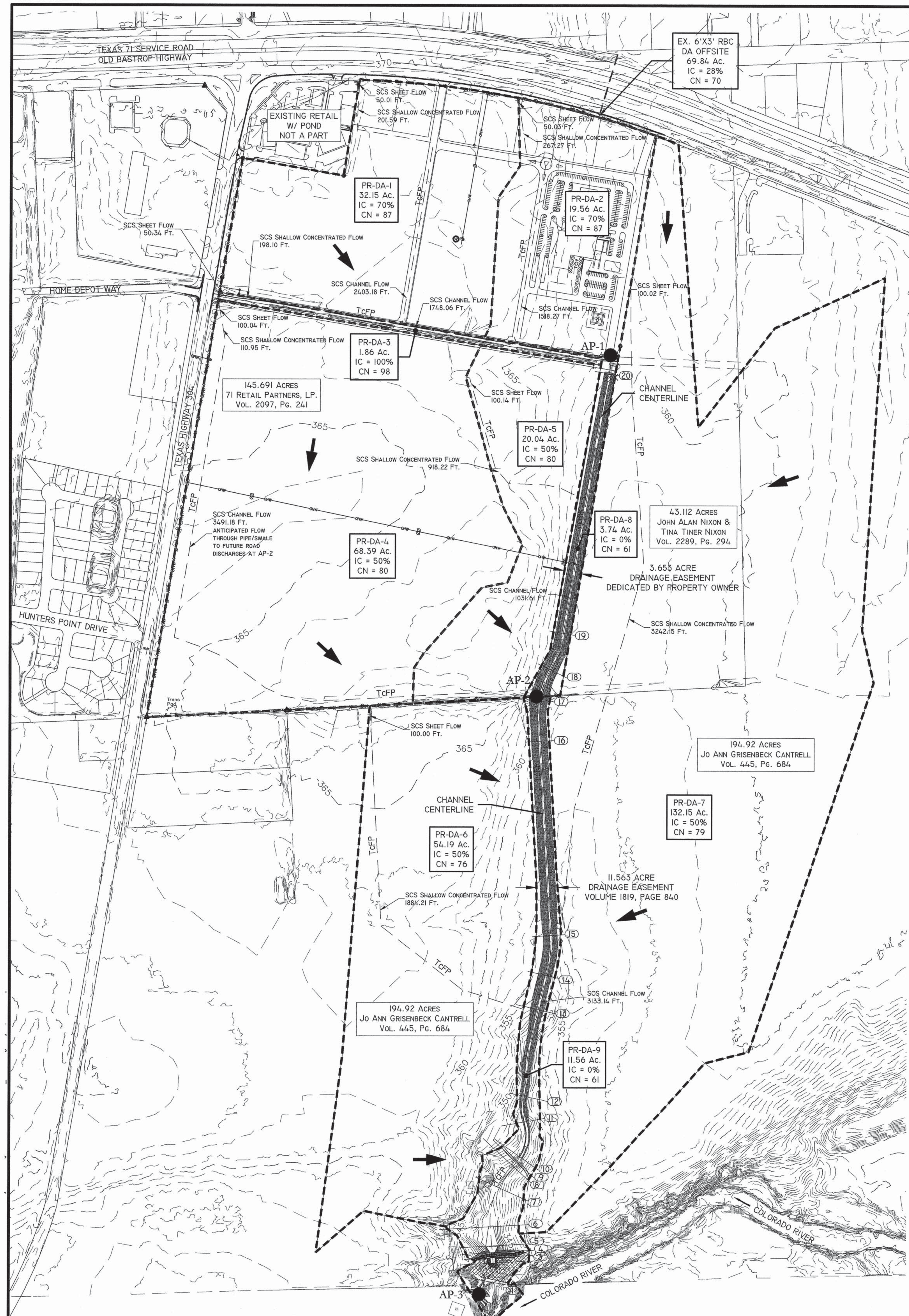
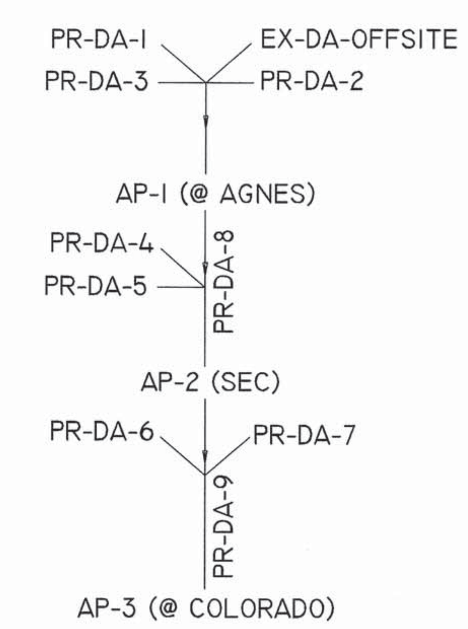
CBD

SHEET NAME: EXISTING DRAINAGE AREA MAP
JOB NAME: BASTROP GROVE
PROJECT: DRAINAGE IMPROVEMENTS

DATE: APRIL 2018
JOB NUMBER: 4697
SHEET: 6 OF 14
SHEET NO. 6



HYDROLOGY FLOW CHART



0 300' 600'

SCALE: 1" = 300'

LEGEND

	DRAINAGE EASEMENT BOUNDARY
	DRAINAGE BOUNDARY LINE
A1	DRAINAGE AREA LABEL
	ANALYSIS POINT (AP)
940	EXISTING CONTOUR MAJOR
	EXISTING CONTOUR MINOR
	FLOW ARROW
TcFP	TIME OF CONCENTRATION FLOW PATH

TIME OF CONCENTRATION CALCULATIONS PROPOSED CONDITIONS

Area #	Sheet Flow				Shallow Conc. Flow				Channel Flow						Tc (Min.)
	n	Slope	L	Tc	Paved/ Unpaved	Slope	L	Tc	n	Slope	L	Ax-sect	WP	Tc	
DA-OFFSITE	0.011	0.50%	100	1.99	U	0.50%	2336	34.13	0.013	0.50%	1793	18	18	3.69	39.8
PR-DA-1	0.011	0.50%	100	1.99	U	0.50%	202	2.22	0.013	0.50%	2403	27.58	15.88	3.41	7.6
PR-DA-2	0.011	0.50%	100	1.99	U	0.50%	217.47	3.18	0.013	0.50%	1518.01	19.15	13.23	2.44	7.6
PR-DA-3	0.011	2.00%	50	0.66	P	1.00%	198	1.62	0.013	0.50%	1748.06	27.58	15.88	2.48	4.8
PR-DA-4	0.011	0.50%	100	1.99	U	0.50%	110.95	1.62	0.013	0.50%	3491.18	37.54	18.53	4.47	8.1
PR-DA-5	0.011	0.50%	100	1.99	U	0.50%	918.22	13.41	0.026	0.30%	1031.61	86.78	34.61	2.96	18.4
PR-DA-6	0.011	0.50%	100	1.99	U	0.74%	1884.2	22.63							24.6
PR-DA-7	0.011	0.50%	100	1.99	U	0.23%	3242.18	69.83							71.8
PR-DA-8									0.026	0.30%	1715.36	86.78	34.61	4.92	4.9
PR-DA-9									0.026	0.30%	3133	320	65.25	5.73	5.7

MAXIMUM POTENTIALOUTFALL CONDITIONS FOR 100-YR AND 25-YR STORM EVENTS

					MAX POTENTIAL TW WITH COINCIDING PEAKS				ANTICIPATED TW WITH NON-COINCIDING PEAKS				TW WITH GRAVITY OUTFALL			
FLOWLINE STATION	RIVER STATION	PROFILE	Q (cfs)	n	WSE (ft)	dF (ft)	V (fps)	Sf	WSE (ft)	dF (ft)	V (fps)	Sf	WSE (ft)	dF (ft)	V (fps)	Sf
50+49.7	20	25-YR	414.96	0.026	356.13	3.13	3.31	0.000888	356.13	3.13	3.31	0.000888	356.13	3.13	3.31	0.000888
		100-YR	587.02	0.026	356.87	3.87	3.79	0.000918	356.87	3.87	3.79	0.000918	356.87	3.87	3.79	0.000918
37+04.1	19	25-YR	414.96	0.026	353.33	5.24	3.34	0.000782	353.33	5.24	3.34	0.000782	353.33	5.24	3.34	0.000782
		100-YR	587.02	0.026	354.36	6.27	3.49	0.000694	354.35	6.26	3.5	0.000698	354.35	6.26	3.5	0.000698
35+04.1	18	25-YR	414.96	0.026	353.24	5.76	2.85	0.000513	353.24	5.76	2.85	0.000513	353.24	5.76	2.85	0.000513
		100-YR	587.02	0.026	354.28	6.80	3.04	0.00048	354.27	6.79	3.05	0.000483	354.27	6.79	3.05	0.000483
33+44.97	17	25-YR	868.31	0.026	352.39	5.39	6.66	0.003008	352.39	5.39	6.66	0.003008	352.39	5.39	6.66	0.003008
		100-YR	1234.19	0.026	353.34	6.34	7.2	0.002937	353.32	6.32	7.24	0.002981	353.32	6.32	7.24	0.002981
31+29.1	16	25-YR	868.31	0.026	351.75	5.40	6.65	0.002991	351.75	5.40	6.65	0.002991	351.75	5.40	6.65	0.002991
		100-YR	1234.19	0.026	352.72	6.37	7.14	0.00285	352.68	6.33	7.22	0.002935	352.68	6.33	7.22	0.002935
21+35.45	15	25-YR	868.31	0.026	349.34	6.01	5.56	0.001849	349.34	6.01	5.56	0.001849	349.34	6.01	5.56	0.001849
		100-YR	1234.19	0.026	350.75	7.42	5.5	0.001418	350.43	7.10	5.93	0.001734	350.43	7.10	5.93	0.001734
19+29.1	14	25-YR	868.31	0.026	349.06	6.35	5.05	0.001429	349.06	6.35	5.05	0.001429	349.06	6.35	5.05	0.001429
		100-YR	1234.19	0.026	350.55	7.84	4.99	0.001095	350.18	7.47	5.43	0.001371	350.18	7.47	5.43	0.001371
17+48.37	13	25-YR	1151.75	0.026	348.21	6.05	7.26	0.003155	348.21	6.05	7.26	0.003155	348.21	6.05	7.26	0.003155
		100-YR	1662.89	0.026	350.09	7.93	6.28	0.001586	349.23	7.07	7.96	0.003064	349.23	7.07	7.96	0.003064
13+04.1	12	25-YR	1151.75	0.026	346.61	5.80	7.44	0.004251	346.61	5.80	7.44	0.004251	346.61	5.80	7.44	0.004251
		100-YR	1662.89	0.026	349.70	8.89	4.78	0.000681	347.22	6.41	8.83	0.004786	347.22	6.41	8.83	0.004786
11+68.3	11	25-YR	1151.75	0.026	345.46	5.06	9.46	0.005489	345.46	5.06	9.46	0.005489	345.46	5.06	9.46	0.005489
		100-YR	1662.89	0.026	349.71	9.31	4.44	0.000416	346.47	6.07	9.83	0.004214	346.47	6.07	9.83	0.004214
9+75.01	10	25-YR	1151.75	0.026	344.75	4.94	9.18	0.004232	344.75	4.94	9.18	0.004232	344.75	4.94	9.18	0.004232
		100-YR	1662.89	0.026	349.75	9.94	3.11	0.000166	346.54	6.73	6.94	0.001482	346.54	6.73	6.94	0.001482
9+45.00	9	25-YR	1151.75	0.026	344.84	5.12	4.55	0.00111	344.84	5.12	4.55	0.00111	344.84	5.12	4.55	0.00111
		100-YR	1662.89	0.026	349.76	10.04	2.16	0.000081	346.70	6.98	3.99	0.000497	346.70	6.98	3.99	0.000497
9+15.76	8	25-YR	1151.75	0.026	344.35	4.72	7.99	0.002899	344.35	4.72	7.99	0.002899	344.35	4.72	7.99	0.002899
		100-YR	1662.89	0.026	349.77	10.14	2.63	0.000106	346.63	7.00	5.43	0.000759	346.63	7.00	5.43	0.000759
7+80.74	7	25-YR	1151.75	0.026	344.22	5.00	7.39	0.002116	344.22	5.00	7.39	0.002116	344.22	5.00	7.39	0.002116
		100-YR	1662.89	0.026	349.74	10.52	2.89	0.000117	346.55	7.33	5.45	0.00068	346.55	7.33	5.45	0.00068
5+71.60	6	25-YR	1151.75	0.026	344.36	6.39	2.86	0.000215	344.36	6.39	2.86	0.000215	344.36	6.39	2.86	0.000215
		100-YR	1662.89	0.026	349.76	11.79	1.36	0.000021	346.62	8.65	2.47	0.000107	346.62	8.65	2.47	0.000107
4+70.67	5	25-YR	1151.75	0.011	344.36	7.29	2.11	0.000017	344.36	7.29	2.11	0.000017	344.36	7.29	2.11	0.000017
		100-YR	1662.89	0.011	349.74	12.67	1.55	0.000004	346.59	9.52	2.22	0.000013	346.59	9.52	2.22	0.000013
4+35.67	4	25-YR	1151.75	0.011	343.31	6.95	8.09	0.00053	343.31	6.95	8.09	0.00053	343.31	6.95	8.09	0.00053
		100-YR	1662.89	0.011	349.70	13.34	2.6	0.000032	345.33	8.97	8.89	0.000525	345.33	8.97	8.89	0.000525
4+09.67	3	25-YR	1151.75	0.011	340.81	4.97	11.41	0.001431	340.48	4.64	12.22	0.001747	340.48	4.64	12.22	0.001747
		100-YR	1662.89	0.011	348.66	12.82	5.86	0.000198	341.76	5.92	13.81	0.0018	341.76	5.92	13.81	0.0018
3+82.88	2	25-YR	1151.75	0.026	341.88	6.57	5.71	0.000868	339.04	3.73	10.76	0.006582	339.04	3.73	10.76	0.006582
		100-YR	1662.89	0.026	348.97	13.66	2.81	0.000079	340.02	4.71	12	0.00599	340.02	4.71	12	0.00599
2+67.52	1	25-YR	1151.75	0.026	342.19	25.89	0.67	0.000006	332.04	15.74	1.97	0.000084	325.16	8.86	6.07	0.001823
		100-YR	1662.89	0.026	349.02	32.72	0.54	0.000003	338.64	22.34	1.38	0.000031	326.69	10.39	6.36	0.001551

RESULTS TABLE - PROPOSED CONDITIONS

SUB-BASIN	AREA (AC.)	%IC	CN	Q_{10} (CFS)	Q_{25} (CFS)	Q_{100} (CFS)
DA-OFFSITE	69.84	28	71	127.94	181.31	273.3
PR-DA-1	32.15	70	87	149.45	192.56	263.76
PR-DA-2	19.56	70	87	90.92	117.15	160.47
PR-DA-3	1.86	100	98	9.76	12.14	16.10
PR-DA-4	68.39	50	80	275.24	367.46	521.27
PR-DA-5	20.05	50	80	66.42	88.96	126.64
PR-DA-6	54.19	50	76	142.77	195.94	285.88
PR-DA-7	132.15	50	79	213.43	288.18	413.80
PR-DA-8	3.74	0	61	7.88	12.16	19.88
PR-DA-9	11.56	0	61	24.36	37.58	61.45
AP-1 (CHANNEL SOUTH OF AGNES)				312.95	414.96	587.02
AP-2 (CHANNEL AT SOUTHEAST PROPERTY CORNER)				650.57	868.31	1234.19
AP-3 (CHANNEL AT COLORADO RIVER)				850.01	1151.75	1662.89

NOTES:

- SCS WAS USED AS DRAINAGE CALCULATION METHOD
- RAINFALL INTENSITY DATA FOR DESIGN STORMS WERE PROVIDED BY BASTROP COUNTY'S CODE OF ORDINANCES (10.1.40 & 10.5.90)
- CN's ARE BASED ON EXISTING TYPE A & B SOILS AND REFLECT VALUES PER THE USDA WEB SOIL SURVEY
- TOC CALCULATIONS ARE BASED ON ASSUMED FUTURE DEVELOPMENT & TR-55
- MANNING'S N VALUES FROM TR-55:
  - PIPE/CHANNEL FLOW
    - PIPES - REINFORCED CONCRETE = 0.013
    - NATURAL CHANNELS - EARTH, STRAIGHT, SOME GRASS = 0.026
  - OVERLAND FLOW
    - SMOOTH SURFACE (CONCRETE, ASPHALT, BARE SOIL) = 0.011
    - SHORT GRASS = 0.015
- OFFSITE IMPERVIOUS COVERS ARE APPROXIMATE BASED ON AERIAL IMAGERY
- ONSITE IMPERVIOUS COVERS REFLECT ASSUMED FUTURE DEVELOPMENT AS FOLLOWS:
  - SINGLE-USE RESIDENTIAL = 50%
  - COMMERCIAL = 70%
  - ROADWAY = 100%

NOTES:

- GIVEN MAXIMUM TAILWATERS, THE PROPOSED DRAINAGE CHANNEL PROVIDES AT LEAST ONE FOOT OF FREEBOARD AT DESIGN FLOWS AND THE PROPOSED CULVERT HAS CAPACITY TO CONVEY 100-YR STORM RUNOFF WITHOUT EXCEEDING THE MINIMUM ROAD SURFACE ELEVATION OF AGNES ROAD AT 359.50', AS PER DESIGN REQUIREMENTS BY BASTROP COUNTY'S CODE OF ORDINANCES (10.1.40 & 10.5.90).
- FLOW RATE, TIME TO PEAK, AND WATER SURFACE DATA FOR THE COLORADO RIVER ARE BASED ON FEMA MAP 48021C0355E AND THE DRAINAGE TECHNICAL MEMORANDUM FOR THE PECAN PARK DEVELOPMENT DATED FEBRUARY 22, 2010, BY ESPEY CONSULTANTS, INC., WHICH UTILIZED THE USGS GAGE 08159200 LOCATED AT STATE HIGHWAY 71 APPROXIMATELY 2 MILES UPSTREAM OF THE PROPOSED CHANNEL'S OUTFALL. JUSTIFICATION FOR TAILWATER ASSUMPTIONS ARE PROVIDED BELOW:

MAXIMUM POTENTIAL TAILWATER ASSUMING COINCIDING PEAKS:

- CALCULATIONS UTILIZE TAILWATERS OF 349.00' AND 342.17' FOR THE 100-YR AND 25-YR STORM EVENTS, RESPECTIVELY.
- ACCORDING TO FEMA MAP 48021C0355E, THE EXISTING 100-YR BFE AT THE SITE IS 349' MSL.
- THE COLORADO RIVER'S PEAK 25-YR WSE AT THE SITE IS ESTIMATED AT 342.17'. THIS WSE WAS EXTRAPOLATED FROM A LOGARITHMIC TREND OF BFE's FOR VARIOUS ANNUAL CHANCE FLOODS USING DATA FROM THE FEMA FLOOD INSURANCE STUDY 48021CV000B AT STATION 'AW'.
- ACCORDING TO THE MEMORANDUM, TIME TO PEAK OF THE COLORADO RIVER IS APPROXIMATED AT 31:45 HOURS FOR THE 100-YR EVENT, WHEREAS THE PROPOSED CHANNEL'S TIME TO PEAK IS MODELED AT APPROXIMATELY 12:06 HOURS. THESE PEAKS ARE NON-COINCIDING AND THEREFORE THESE WSE's OVERESTIMATE EXPECTED FLOODING FOR THE 100-YR AND 25-YR EVENTS.
- MAXIMUM POTENTIAL WSE USED TO DESIGN EXTENTS OF EROSION CONTROL MEASURES.

ANTICIPATED TAILWATER ASSUMING NON-COINCIDING PEAKS:

- CALCULATIONS UTILIZE TAILWATERS OF 338.59' AND 331.96' FOR THE 100-YR AND 25-YR STORM EVENTS, RESPECTIVELY.
- SINCE THE COLORADO RIVER AND PROPOSED CHANNEL PEAKS ARE NON-COINCIDING, AN ESTIMATED REDUCTION OF 10.41' IS EXPECTED TO BE REALIZED IN ACTUAL WSE AT 12:06 HOURS. THE 100-YR WSE IS ESTIMATED AT 338.59'. THIS REDUCED WSE IS BASED ON GRAPHICAL INTERPOLATIONS OF THE MEMORANDUM'S COLORADO RIVER 1% ANNUAL CHANCE HYDROGRAPH AND HYDRAULIC RATING CURVE.
- THE ACTUAL 25-YR WSE OF THE COLORADO RIVER REALIZED AT 12:06 HOURS AT THE PROPOSED CHANNEL'S OUTFALL IS ESTIMATED AT 331.96'. THIS REDUCED WSE WAS CALCULATED USING A PROPORTIONAL REDUCTION EQUIVALENT TO THE CHANGE IN 100-YR WSE's REALIZED AT A TIME TO PEAK OF 31:45 HOURS AS COMPARED TO 12:06 HOURS.

TAILWATER ASSUMING GRAVITY OUTFALL:

- CALCULATIONS UTILIZE A TAILWATER OF 0' FOR BOTH THE 100-YR AND 25-YR STORM EVENTS.
- GRAVITY OUTFALL CALCULATIONS DEPICT MAXIMUM VELOCITIES WHICH ARE USED FOR DESIGN OF OUTFALL PROTECTION.
- FLOW CHARACTERISTICS ARE THE SAME AS THOSE WITH THE ANTICIPATED TAILWATER ASSUMING NON-COINCIDING PEAKS AT EVERY STATION EXCEPT STATION 1.

STATE OF TEXAS
BRENDAN P. McENTEE
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LICENSED
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ID# F3791
Brendan P McEntee
05/15/2018

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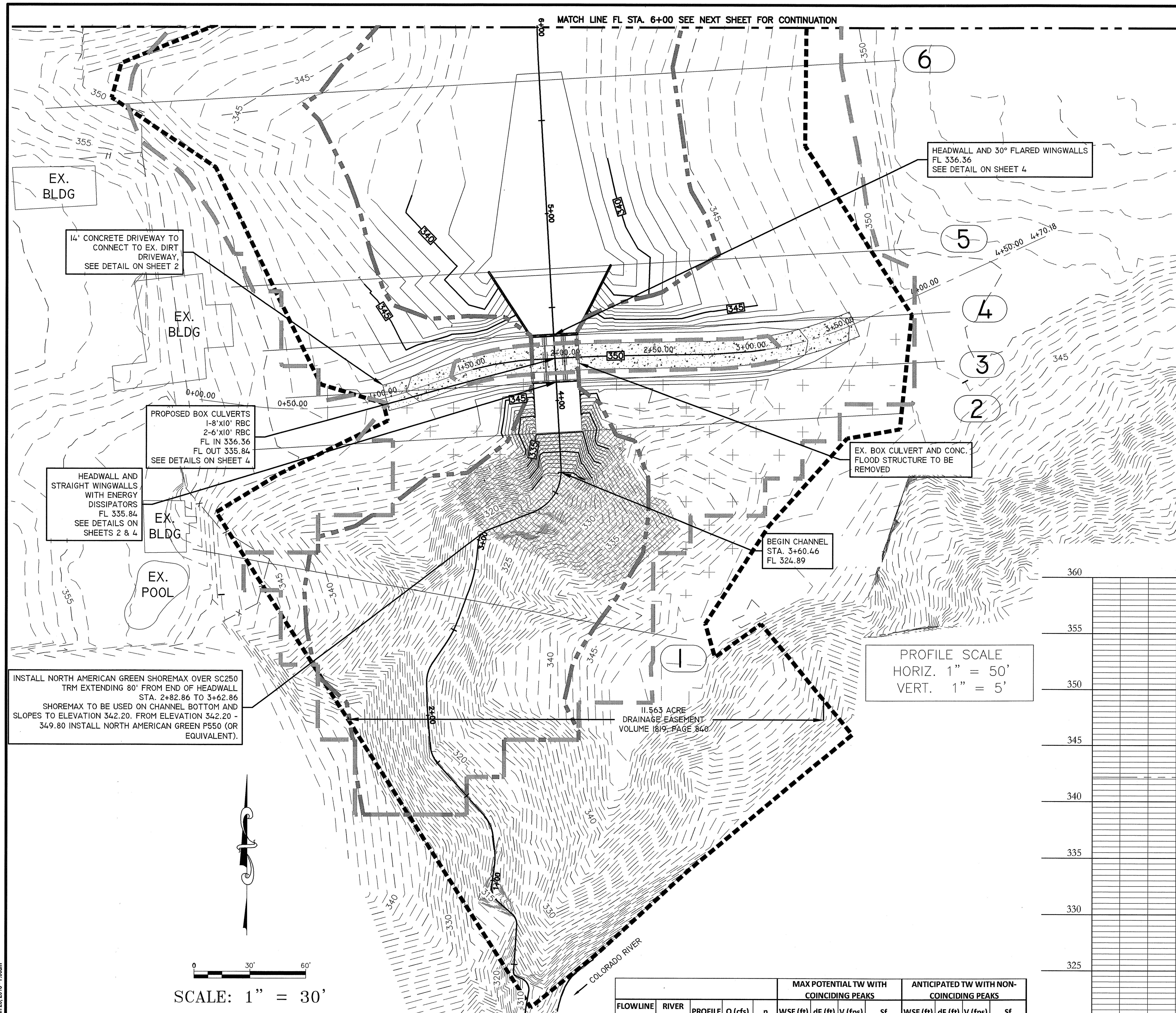
SHEET NAME: PROPOSED DRAINAGE AREA MAP
JOB NAME: BASTROP GROVE
PROJECT: DRAINAGE IMPROVEMENTS

DATE: APRIL 2018
JOB NUMBER: 4697
SHEET: 7 OF 14
SHEET NO.: 7



LEGEND

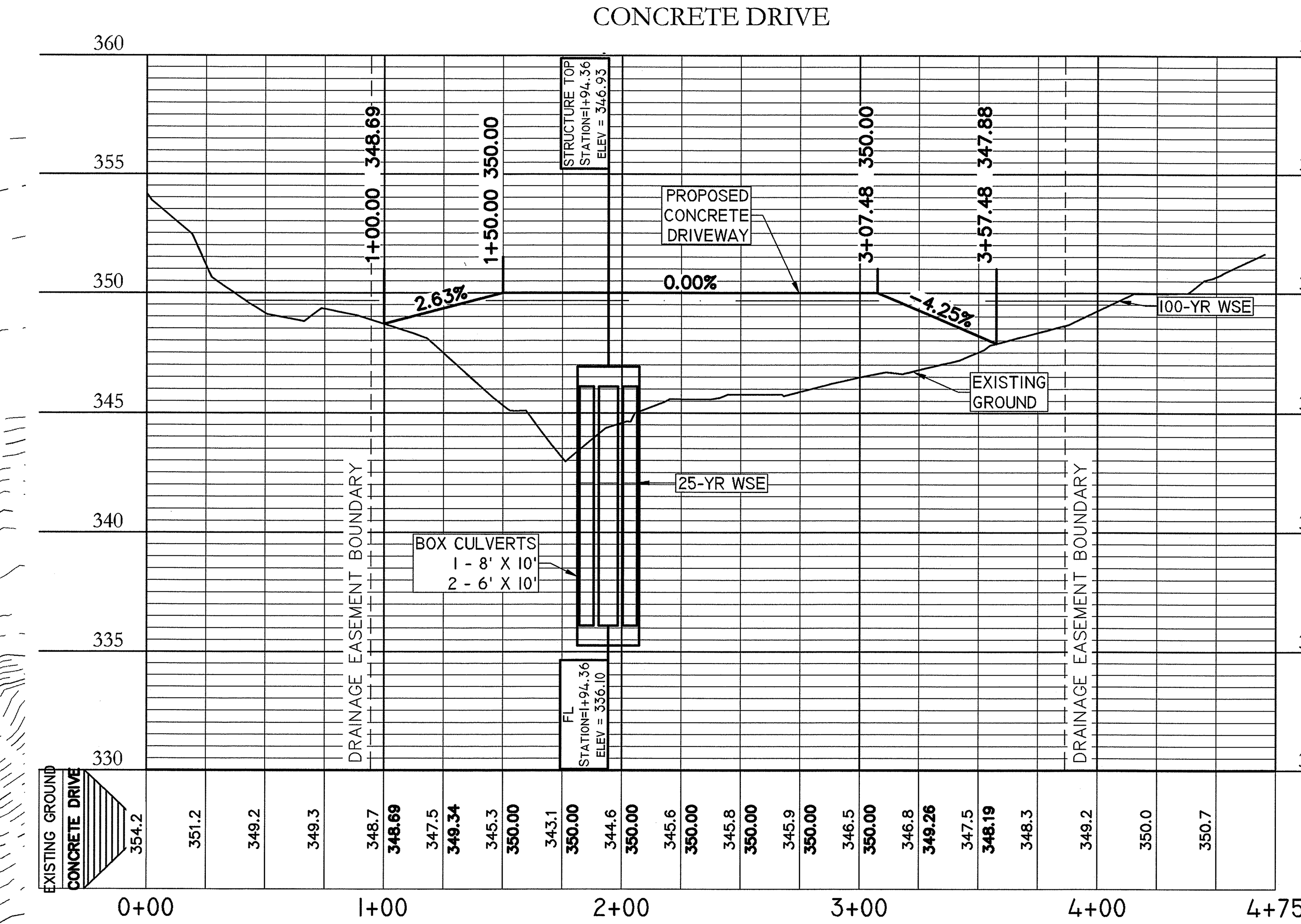
	DRAINAGE EASEMENT BOUNDARY
	ANALYSIS POINT (AP)
— — 350 — —	EXISTING CONTOUR MAJOR
	EXISTING CONTOUR MINOR
350	PROPOSED CONTOUR MAJOR
	PROPOSED CONTOUR MINOR
	25–YEAR WATER SURFACE
	100–YEAR WATER SURFACE

					MAX POTENTIAL TW WITH COINCIDING PEAKS				ANTICIPATED TW WITH NON-COINCIDING PEAKS			
FLOWLINE STATION	RIVER STATION	PROFILE	Q (cfs)	n	WSE (ft)	dF (ft)	V (fps)	Sf	WSE (ft)	dF (ft)	V (fps)	Sf
5+71.60	6	25-YR	1151.75	0.026	344.36	6.39	2.86	0.000215	344.36	6.39	2.86	0.000215
		100-YR	1662.89	0.026	349.76	11.79	1.36	0.000021	346.62	8.65	2.47	0.000107
4+70.67	5	25-YR	1151.75	0.011	344.36	7.29	2.11	0.000017	344.36	7.29	2.11	0.000017
		100-YR	1662.89	0.011	349.74	12.67	1.55	0.000004	346.59	9.52	2.22	0.000013
4+35.67	4	25-YR	1151.75	0.011	343.31	6.95	8.09	0.00053	343.31	6.95	8.09	0.00053
		100-YR	1662.89	0.011	349.70	13.34	2.6	0.000032	345.33	8.97	8.89	0.000525
4+09.67	3	25-YR	1151.75	0.011	340.81	4.97	11.41	0.001431	340.48	4.64	12.22	0.001747
		100-YR	1662.89	0.011	348.66	12.82	5.86	0.000198	341.76	5.92	13.81	0.0018
3+82.88	2	25-YR	1151.75	0.026	341.88	6.57	5.71	0.000868	339.04	3.73	10.76	0.006582
		100-YR	1662.89	0.026	348.97	13.66	2.81	0.000079	340.02	4.71	12	0.00599
2+67.52	1	25-YR	1151.75	0.026	342.19	25.89	0.67	0.000006	332.04	15.74	1.97	0.000084
		100-YR	1662.89	0.026	349.02	32.72	0.54	0.000003	338.64	22.34	1.38	0.000031

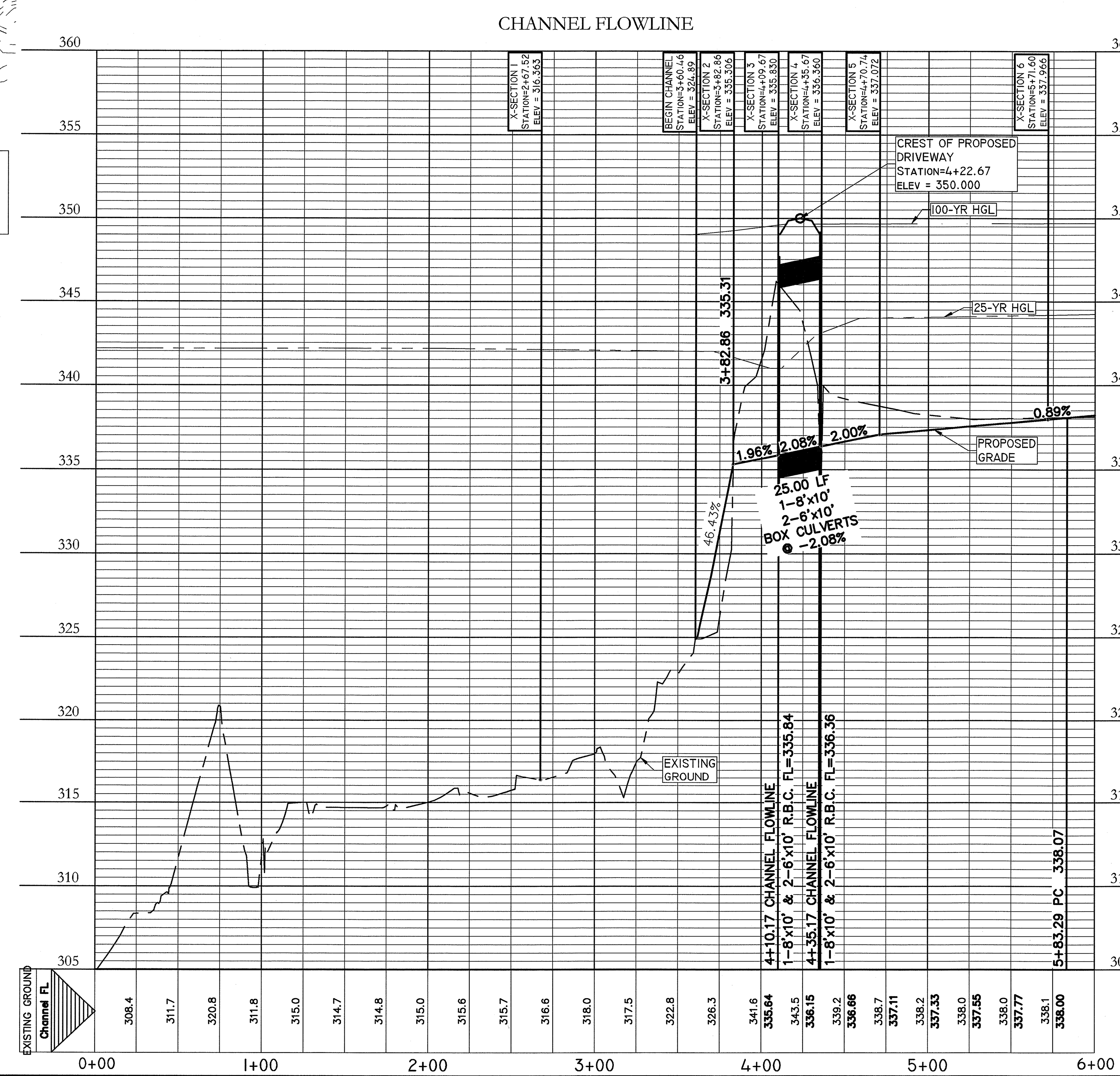
NOTES:

- HGL CALCULATIONS IN PROFILE VIEWS AND WATER SURFACE BOUNDARIES IN PLAN VIEW DEPICT MAXIMUM POTENTIAL TAILWATER ELEVATION ASSUMING COINCIDING PEAKS, WHICH ARE USED TO DETERMINE EXTENTS OF PROPOSED EROSION CONTROL MEASURES.
- ANTICIPATED TW FLOW VELOCITIES ARE USED TO EVALUATE PROPOSED EROSION CONTROL MEASURES.

CONCRETE DRIVE



CHANNEL FLOWLINE



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ID# 3791
09/28/2018

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BM	JW

DATE

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SHEET NAME: CHANNEL - STA. 0+00 TO 6+00

JOB NAME: BASTROP GROVE

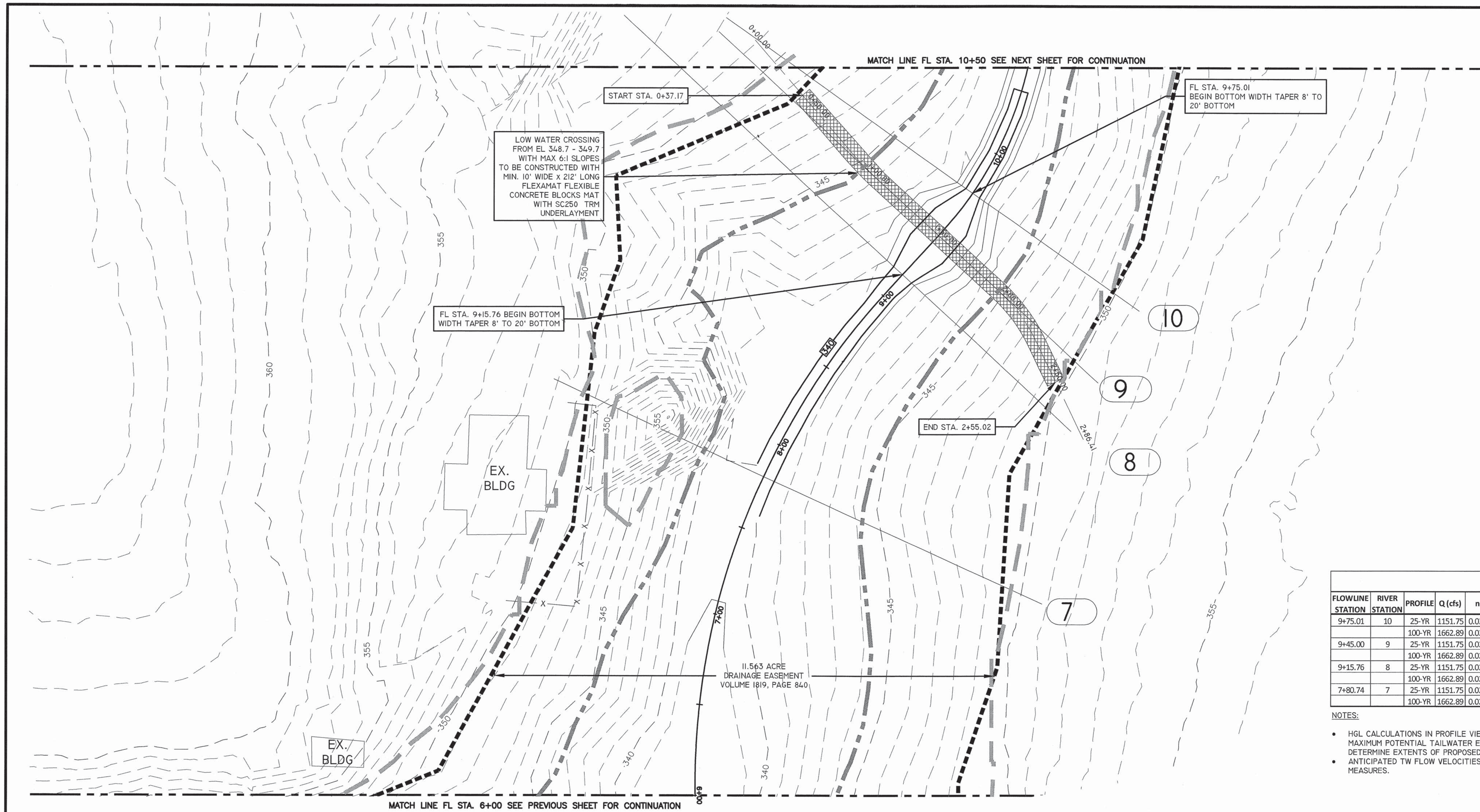
PROJECT: DRAINAGE IMPROVEMENTS

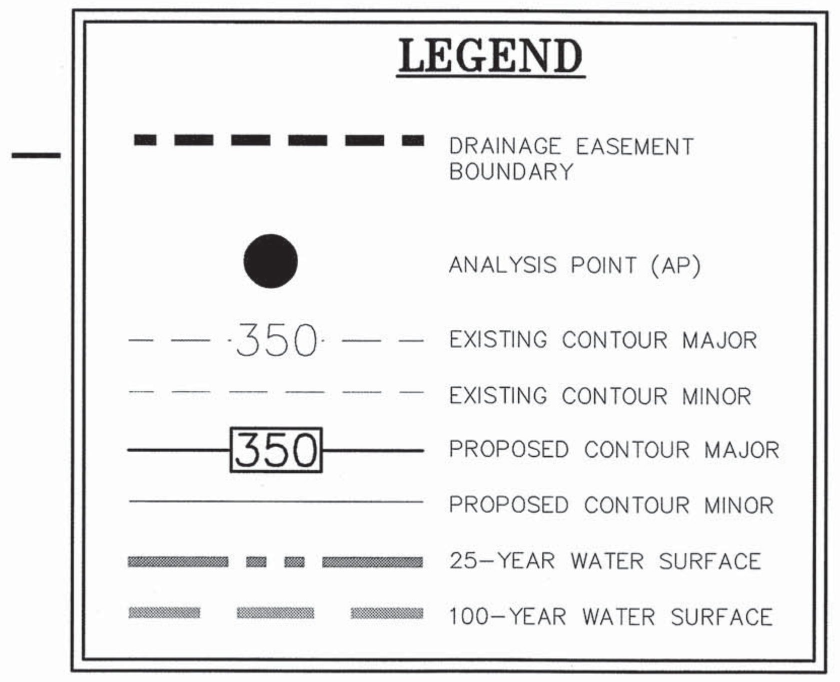
DATE: APRIL 2018

JOB NUMBER: 4697

SHEET: 8 OF 14

SHEET NO.: 8





SCALE: 1" = 30'

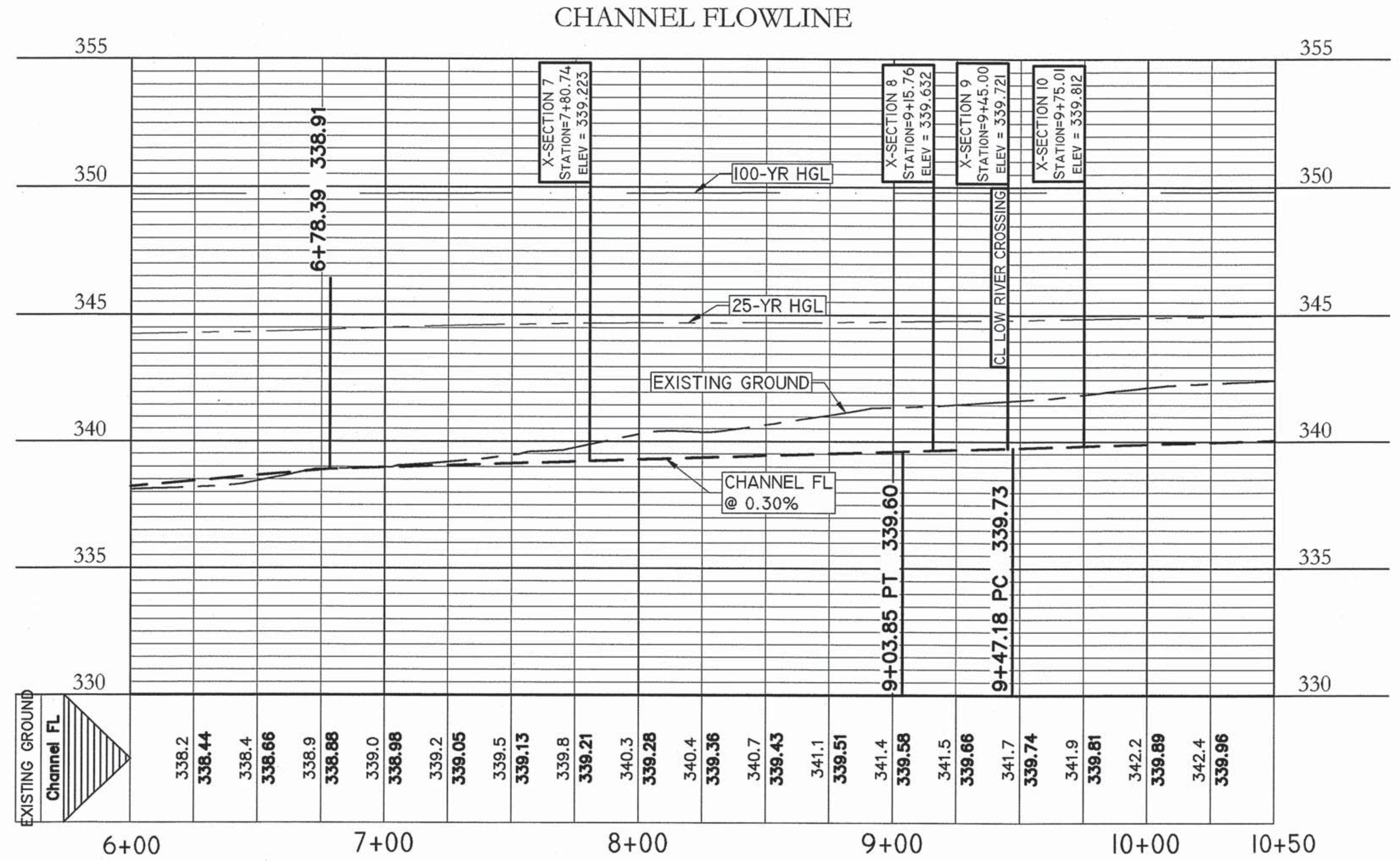
					MAX POTENTIAL TW WITH COINCIDING PEAKS				ANTICIPATED TW WITH NON-COINCIDING PEAKS			
FLOWLINE STATION	RIVER STATION	PROFILE	Q (cfs)	n	WSE (ft)	dF (ft)	V (fps)	Sf	WSE (ft)	dF (ft)	V (fps)	Sf
9+75.01	10	25-YR	1151.75	0.026	344.75	4.94	9.18	0.004232	344.75	4.94	9.18	0.004232
		100-YR	1662.89	0.026	349.75	9.94	3.11	0.000166	346.54	6.73	6.94	0.001482
9+45.00	9	25-YR	1151.75	0.026	344.84	5.12	4.55	0.00111	344.84	5.12	4.55	0.00111
		100-YR	1662.89	0.026	349.76	10.04	2.16	0.000081	346.70	6.98	3.99	0.000497
9+15.76	8	25-YR	1151.75	0.026	344.35	4.72	7.99	0.002899	344.35	4.72	7.99	0.002899
		100-YR	1662.89	0.026	349.77	10.14	2.63	0.000106	346.63	7.00	5.43	0.000759
7+80.74	7	25-YR	1151.75	0.026	344.22	5.00	7.39	0.002116	344.22	5.00	7.39	0.002116
		100-YR	1662.89	0.026	349.74	10.52	2.89	0.000117	346.55	7.33	5.45	0.00068

NOTES:

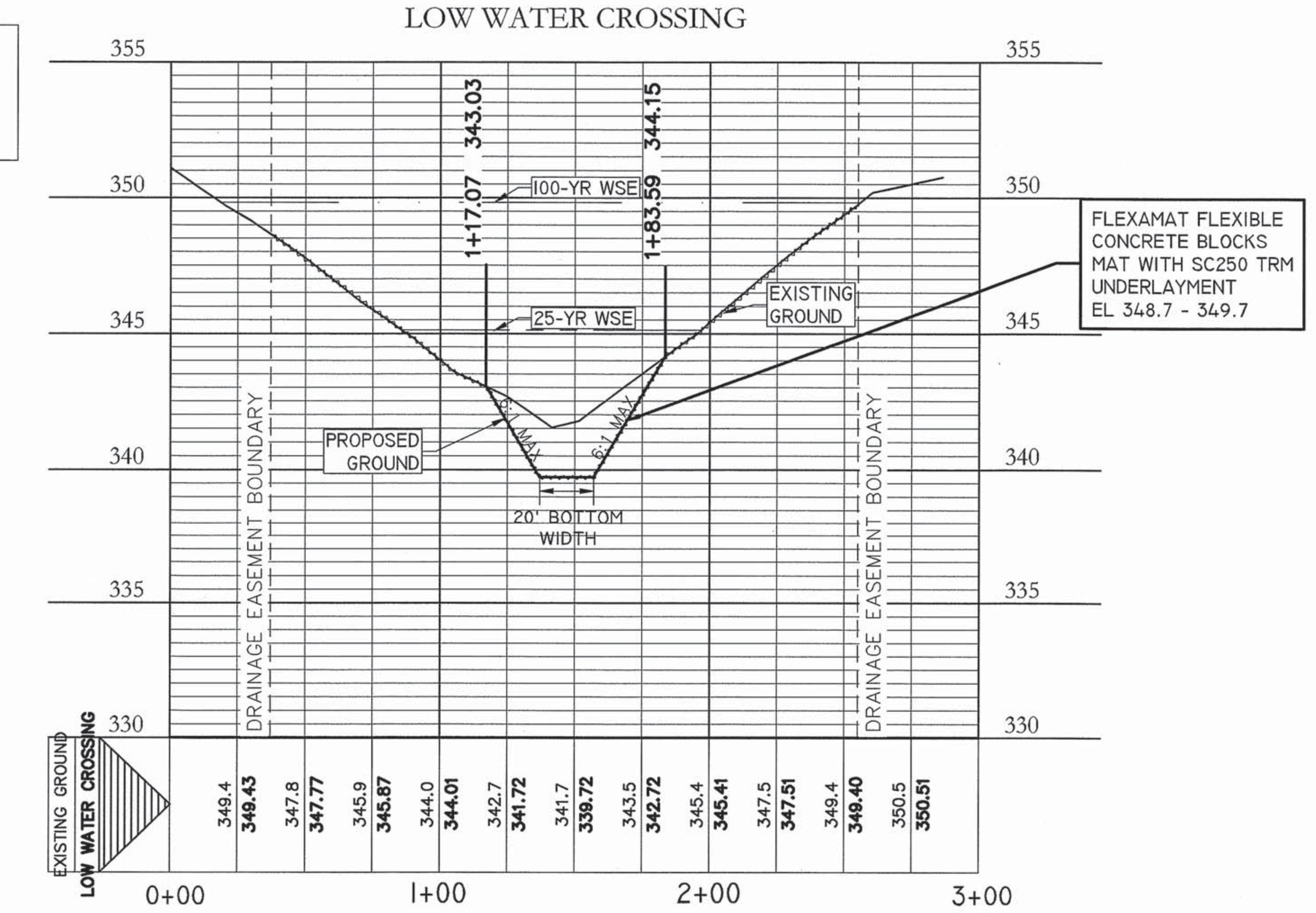
- HGL CALCULATIONS IN PROFILE VIEWS AND WATER SURFACE BOUNDARIES IN PLAN VIEW DEPICT MAXIMUM POTENTIAL TAILWATER ELEVATION ASSUMING COINCIDING PEAKS, WHICH ARE USED TO DETERMINE EXTENTS OF PROPOSED EROSION CONTROL MEASURES.
- ANTICIPATED TW FLOW VELOCITIES ARE USED TO EVALUATE PROPOSED EROSION CONTROL MEASURES.

PROFILE SCALE
HORIZ. 1" = 50'
VERT. 1" = 5'

CHANNEL FLOWLINE



LOW WATER CROSSING



STATE OF TEXAS
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SHEET NAME: CHANNEL - STA. 6+00 TO 10+50
JOB NAME: BASTROP GROVE
PROJECT: DRAINAGE IMPROVEMENTS

DATE: APRIL 2018
JOB NUMBER: 4697
SHEET: 9 OF 14
SHEET NO. 9

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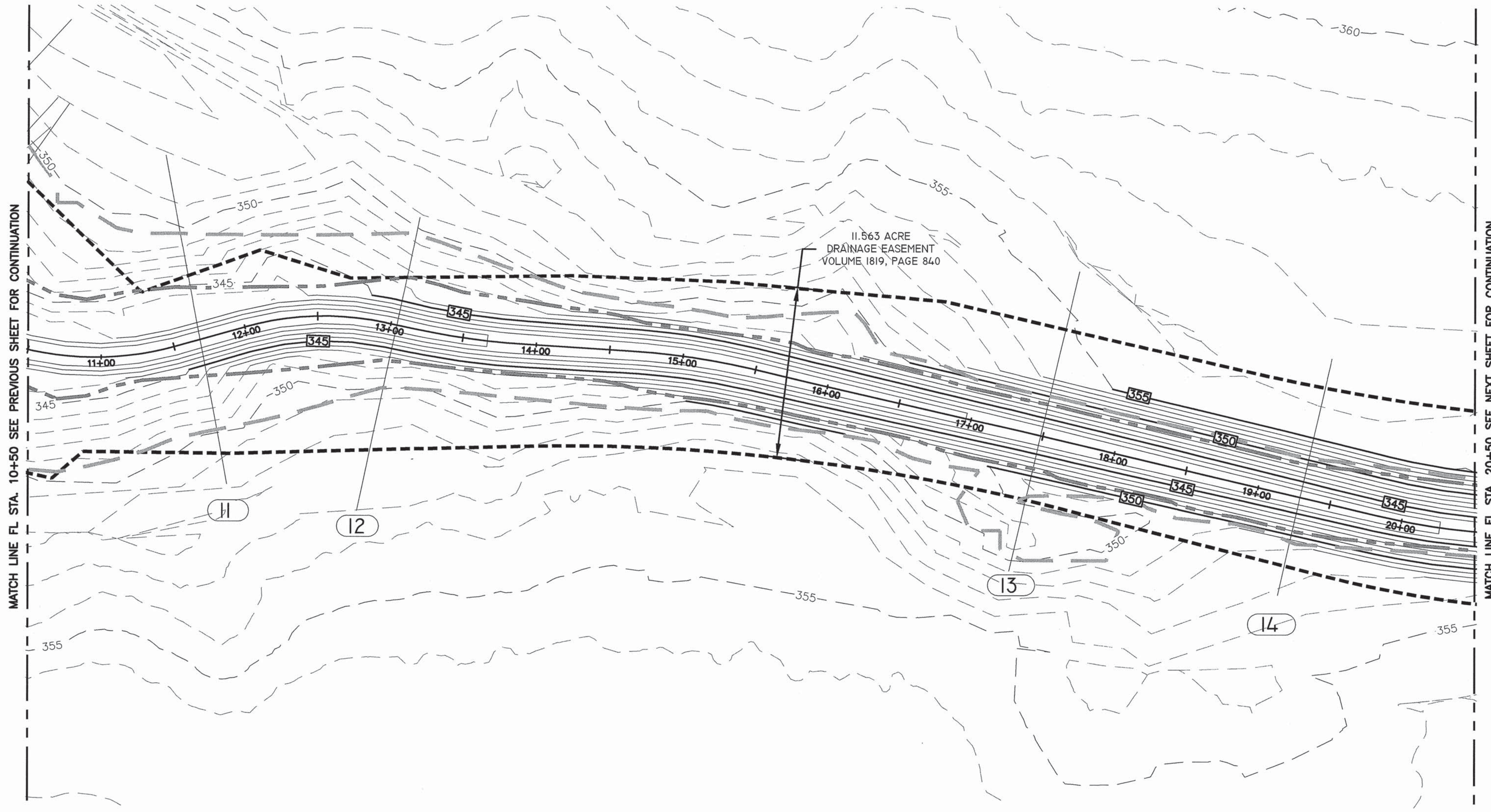
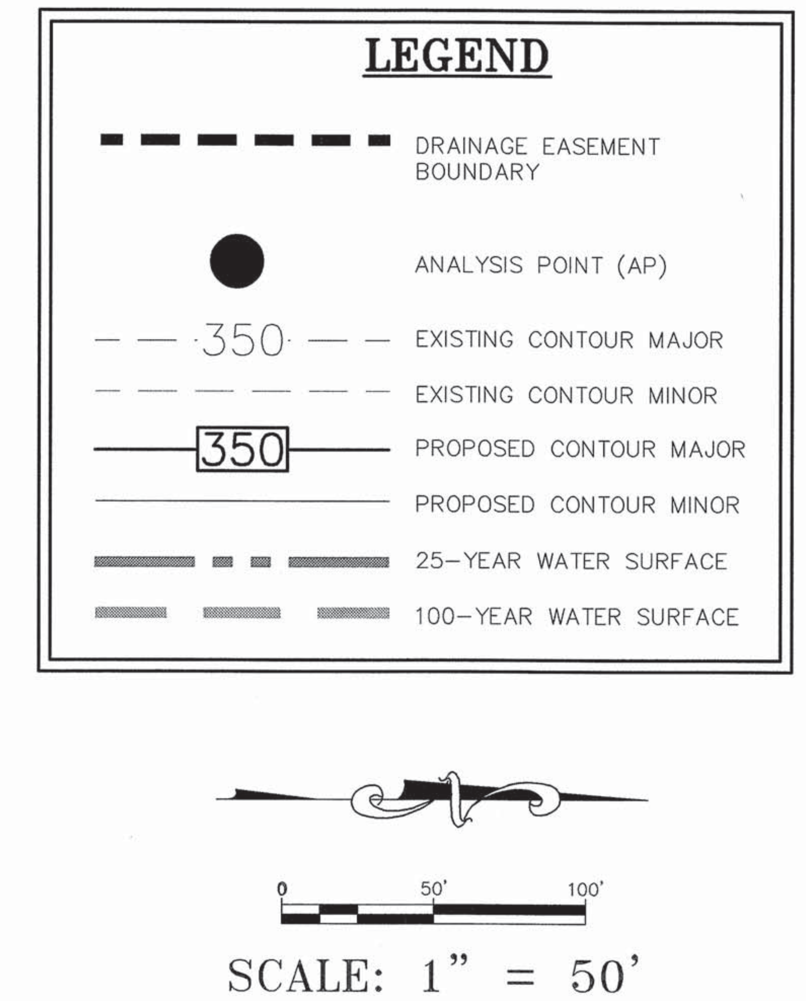




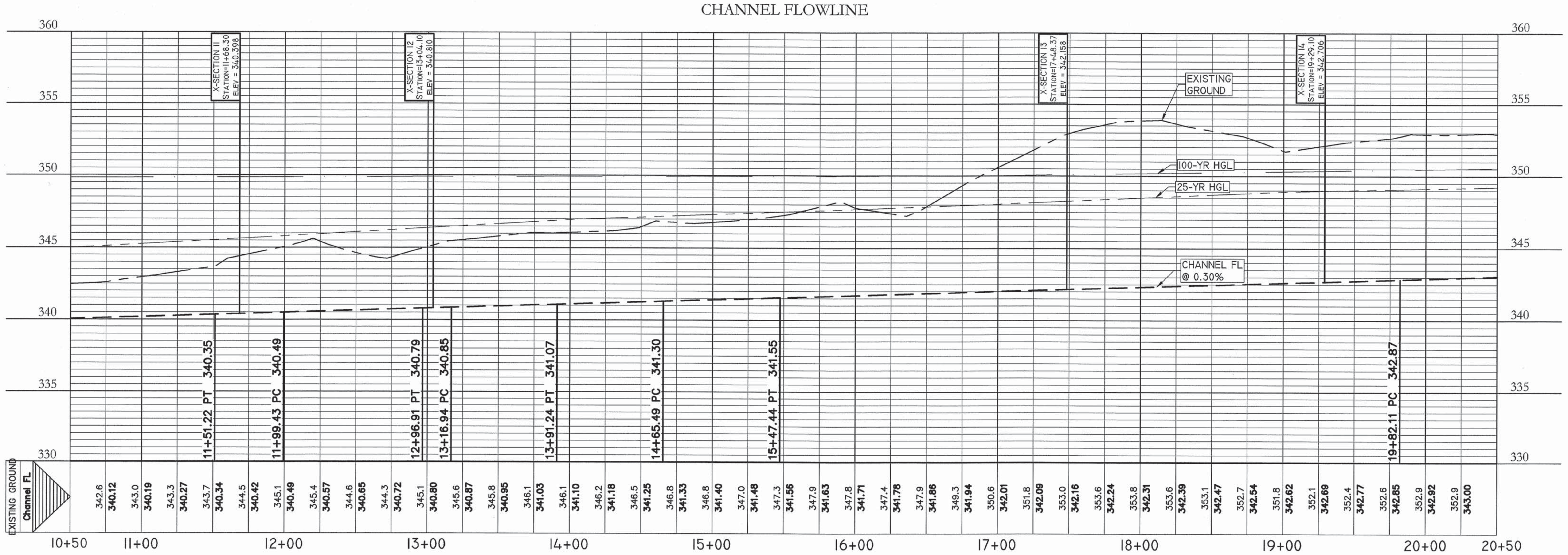
					MAX POTENTIAL TW WITH COINCIDING PEAKS				ANTICIPATED TW WITH NON-COINCIDING PEAKS			
FLOWLINE STATION	RIVER STATION	PROFILE	Q (cfs)	n	WSE (ft)	dF (ft)	V (fps)	Sf	WSE (ft)	dF (ft)	V (fps)	Sf
19+29.1	14	25-YR	868.31	0.026	349.06	6.35	5.05	0.001429	349.06	6.35	5.05	0.001429
		100-YR	1234.19	0.026	350.55	7.84	4.99	0.001095	350.18	7.47	5.43	0.001371
17+48.37	13	25-YR	1151.75	0.026	348.21	6.05	7.26	0.003155	348.21	6.05	7.26	0.003155
		100-YR	1662.89	0.026	350.09	7.93	6.28	0.001586	349.23	7.07	7.96	0.003064
13+04.1	12	25-YR	1151.75	0.026	346.61	5.80	7.44	0.004251	346.61	5.80	7.44	0.004251
		100-YR	1662.89	0.026	349.70	8.89	4.78	0.000681	347.22	6.41	8.83	0.004786
11+68.3	11	25-YR	1151.75	0.026	345.46	5.06	9.46	0.005489	345.46	5.06	9.46	0.005489
		100-YR	1662.89	0.026	349.71	9.31	4.44	0.000416	346.47	6.07	9.83	0.004214

NOTES:

- HGL CALCULATIONS IN PROFILE VIEWS AND WATER SURFACE BOUNDARIES IN PLAN VIEW DEPICT MAXIMUM POTENTIAL TAILWATER ELEVATION ASSUMING COINCIDING PEAKS, WHICH ARE USED TO DETERMINE EXTENTS OF PROPOSED EROSION CONTROL MEASURES.
- ANTICIPATED TW FLOW VELOCITIES ARE USED TO EVALUATE PROPOSED EROSION CONTROL MEASURES.

PROFILE SCALE
HORIZ. 1" = 50'
VERT. 1" = 5'

CHANNEL FLOWLINE



STATE OF TEXAS
BRENDAN P. McENTEE
96200
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PROFESSIONAL ENGINEER
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ID# F3791
05/15/2018

DESIGNED BY:	DRAFTED BY:
BM	JW

DATE
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SHEET NAME: CHANNEL - STA.10+50 TO 20+50
JOB NAME: BASTROP GROVE
PROJECT: DRAINAGE IMPROVEMENTS

DATE: APRIL 2018
JOB NUMBER: 4697
SHEET: 10 OF 14
SHEET NO.: 10

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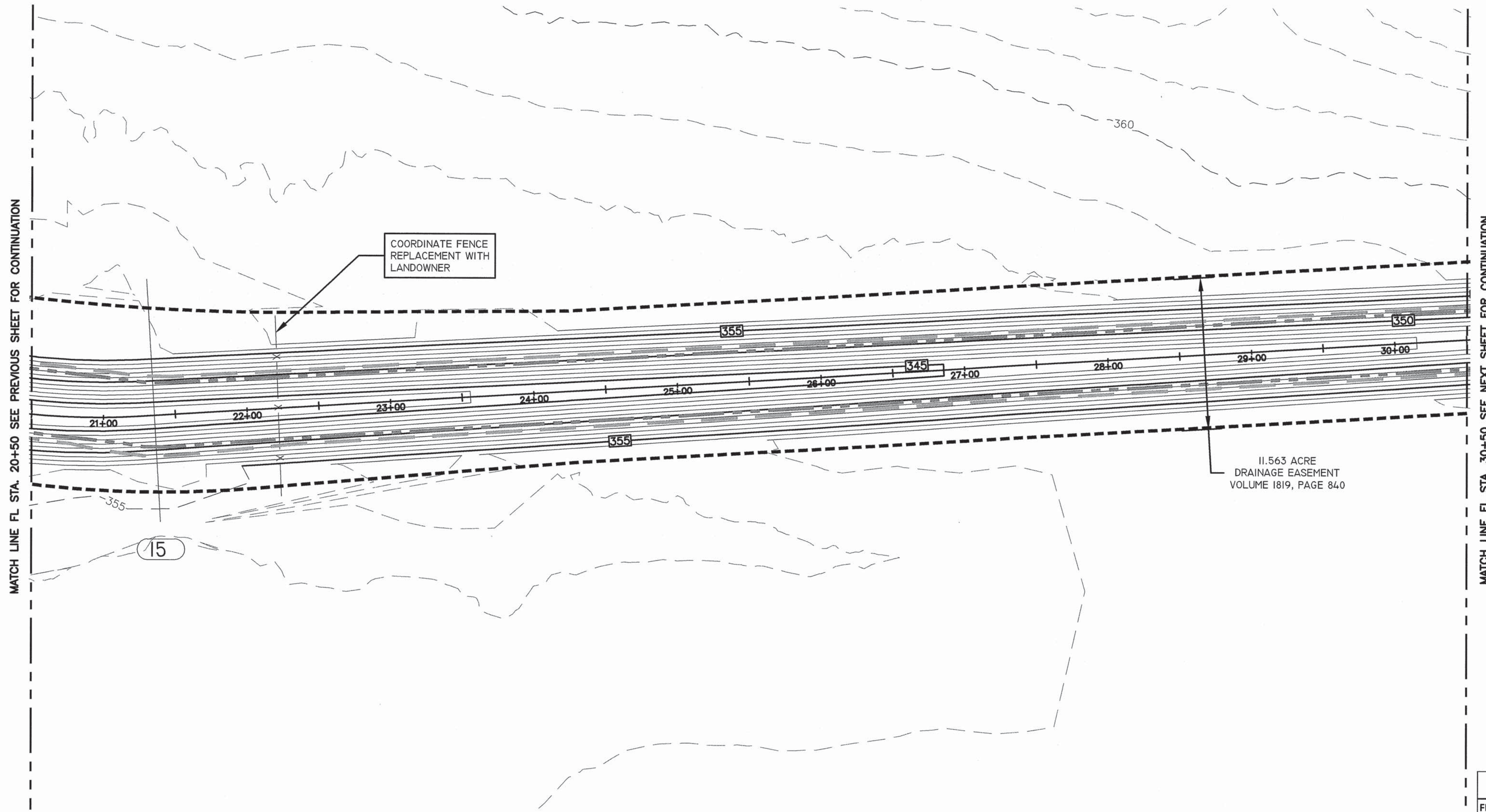


LEGEND

- DRAINAGE EASEMENT BOUNDARY
- ANALYSIS POINT (AP)
- 350 — EXISTING CONTOUR MAJOR
- EXISTING CONTOUR MINOR
- 350 — PROPOSED CONTOUR MAJOR
- PROPOSED CONTOUR MINOR
- 25-YEAR WATER SURFACE
- 100-YEAR WATER SURFACE

0 50' 100'

SCALE: 1" = 50'

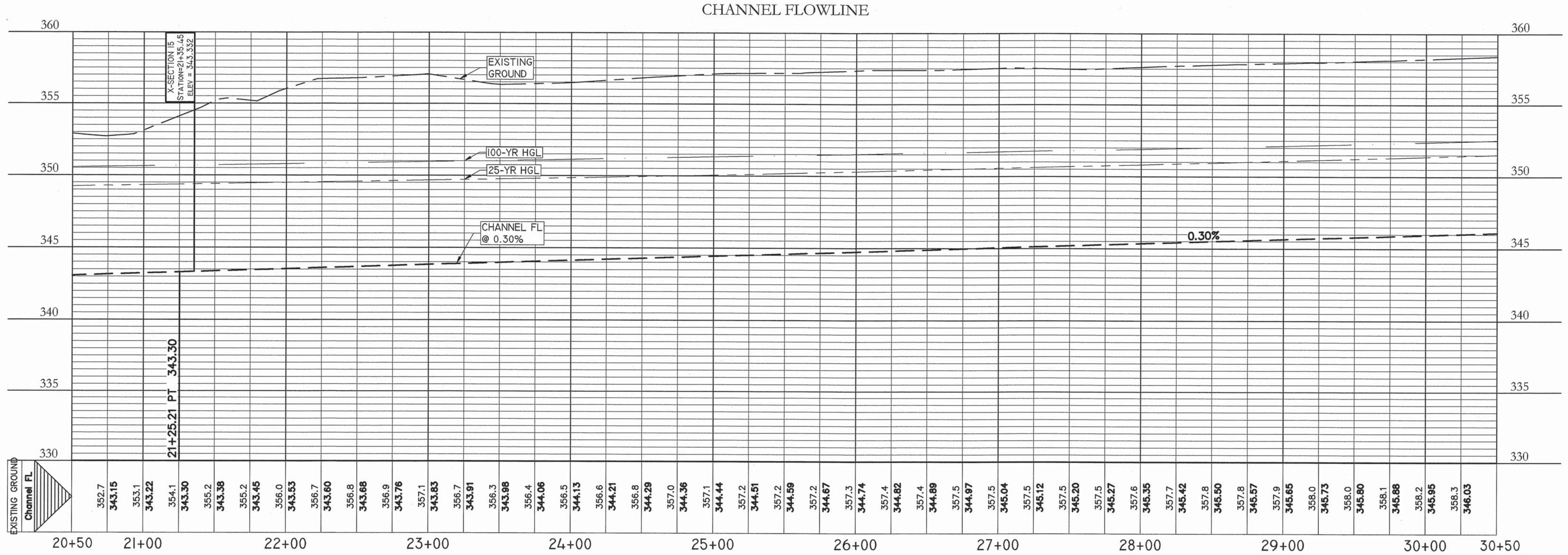
PROFILE SCALE
HORIZ. 1" = 50'
VERT. 1" = 5'

					MAX POTENTIAL TW WITH COINCIDING PEAKS				ANTICIPATED TW WITH NON-COINCIDING PEAKS			
FLOWLINE STATION	RIVER STATION	PROFILE	Q (cfs)	n	WSE (ft)	dF (ft)	V (fps)	Sf	WSE (ft)	dF (ft)	V (fps)	Sf
21+35.45	15	25-YR	868.31	0.026	349.34	6.01	5.56	0.001849	349.34	6.01	5.56	0.001849
		100-YR	1234.19	0.026	350.75	7.42	5.5	0.001418	350.43	7.10	5.93	0.001734

NOTES:

- HGL CALCULATIONS IN PROFILE VIEWS AND WATER SURFACE BOUNDARIES IN PLAN VIEW DEPICT MAXIMUM POTENTIAL TAILWATER ELEVATION ASSUMING COINCIDING PEAKS, WHICH ARE USED TO DETERMINE EXTENTS OF PROPOSED EROSION CONTROL MEASURES.
- ANTICIPATED TW FLOW VELOCITIES ARE USED TO EVALUATE PROPOSED EROSION CONTROL MEASURES.

CHANNEL FLOWLINE



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CARLSON, BRIGANCE & DOERING, INC.
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Brendan P. McEntee
05/15/2018

DESIGNED BY:	DRAFTED BY:
BM	JW

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SHEET NAME: CHANNEL - STA. 20+50 TO 30+50

JOB NAME: BASTROP GROVE

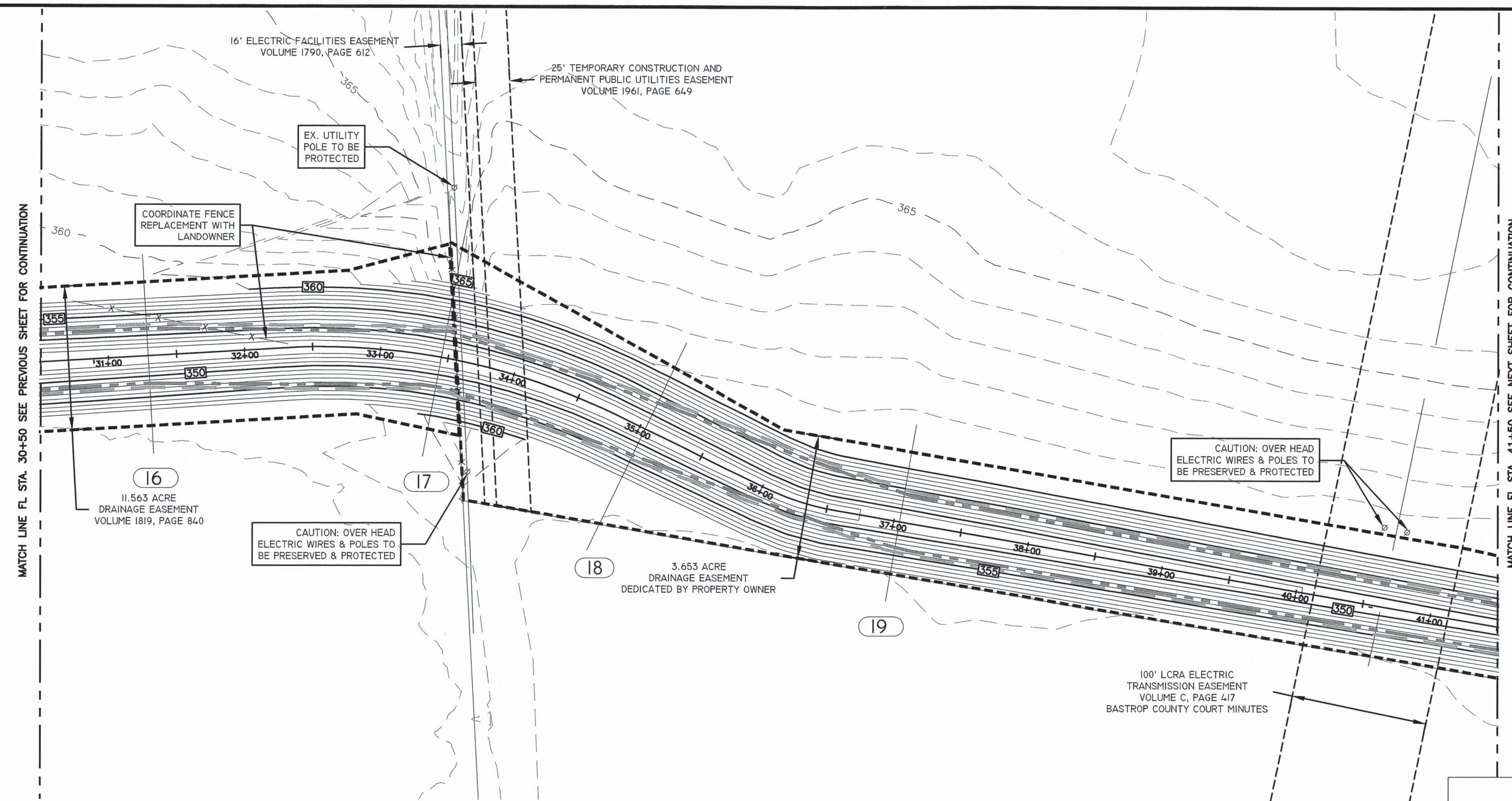
PROJECT: DRAINAGE IMPROVEMENTS

DATE
APRIL 2018

JOB NUMBER
4697

SHEET
11 OF 14

SHEET NO.
11



LEGEND

- DRAINAGE EASEMENT BOUNDARY
- ANALYSIS POINT (AP)
- 350 EXISTING CONTOUR MAJOR
- EXISTING CONTOUR MINOR
- 350 PROPOSED CONTOUR MAJOR
- PROPOSED CONTOUR MINOR
- 25-YEAR WATER SURFACE
- 100-YEAR WATER SURFACE

0 50' 100'

SCALE: 1" = 50'

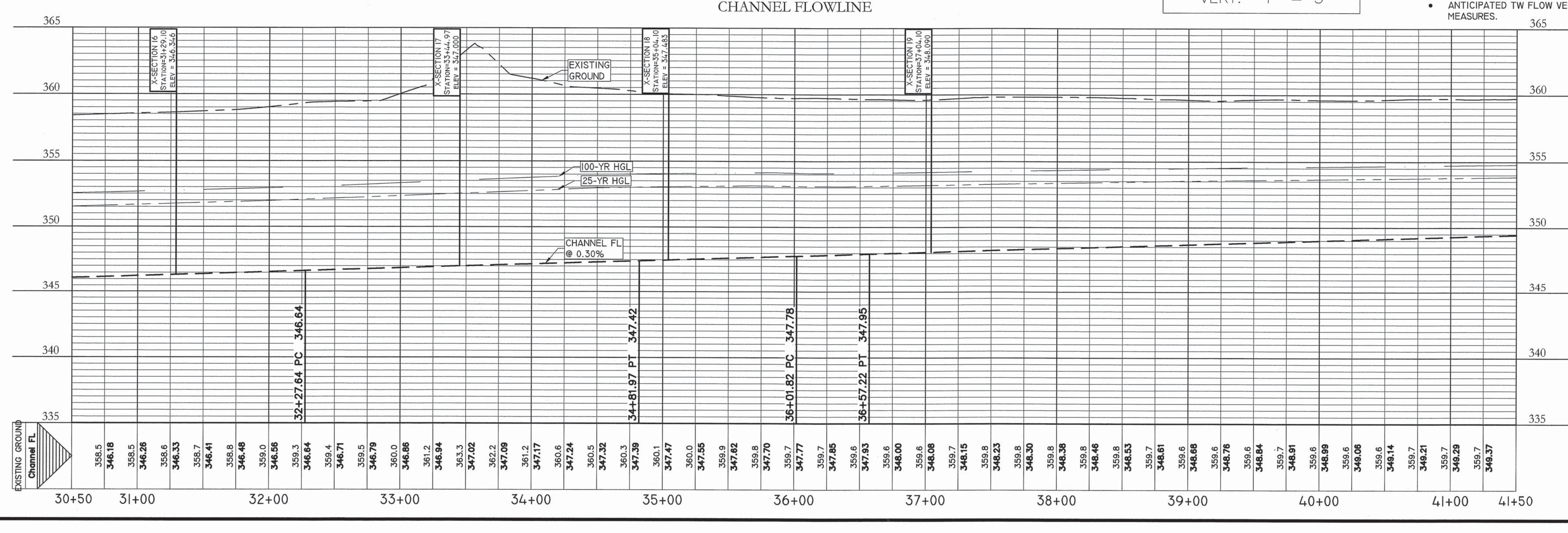
					MAX POTENTIAL TW WITH COINCIDING PEAKS				ANTICIPATED TW WITH NON-COINCIDING PEAKS			
FLOWLINE STATION	RIVER STATION	PROFILE	Q (cfs)	n	WSE (ft)	dF (ft)	V (fps)	Sf	WSE (ft)	dF (ft)	V (fps)	Sf
37+04.1	19	25-YR	414.96	0.026	353.33	5.24	3.34	0.000782	353.33	5.24	3.34	0.000782
		100-YR	587.02	0.026	354.36	6.27	3.49	0.000694	354.35	6.26	3.5	0.000698
35+04.1	18	25-YR	414.96	0.026	353.24	5.76	2.85	0.000513	353.24	5.76	2.85	0.000513
		100-YR	587.02	0.026	354.28	6.80	3.04	0.00048	354.27	6.79	3.05	0.000483
33+44.97	17	25-YR	868.31	0.026	352.39	5.39	6.66	0.003008	352.39	5.39	6.66	0.003008
		100-YR	1234.19	0.026	353.34	6.34	7.2	0.002937	353.32	6.32	7.24	0.002981
31+29.1	16	25-YR	868.31	0.026	351.75	5.40	6.65	0.002991	351.75	5.40	6.65	0.002991
		100-YR	1234.19	0.026	352.72	6.37	7.14	0.00285	352.68	6.33	7.22	0.002935

NOTES:

- HGL CALCULATIONS IN PROFILE VIEWS AND WATER SURFACE BOUNDARIES IN PLAN VIEW DEPICT MAXIMUM POTENTIAL TAILWATER ELEVATION ASSUMING COINCIDING PEAKS, WHICH ARE USED TO DETERMINE EXTENTS OF PROPOSED EROSION CONTROL MEASURES.
- ANTICIPATED TW FLOW VELOCITIES ARE USED TO EVALUATE PROPOSED EROSION CONTROL MEASURES.

PROFILE SCALE
HORIZ. 1" = 50'
VERT. 1" = 5'

CHANNEL FLOWLINE



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SHEET NAME: CHANNEL - STA. 30+50 TO 41+50

JOB NAME: BASTROP GROVE

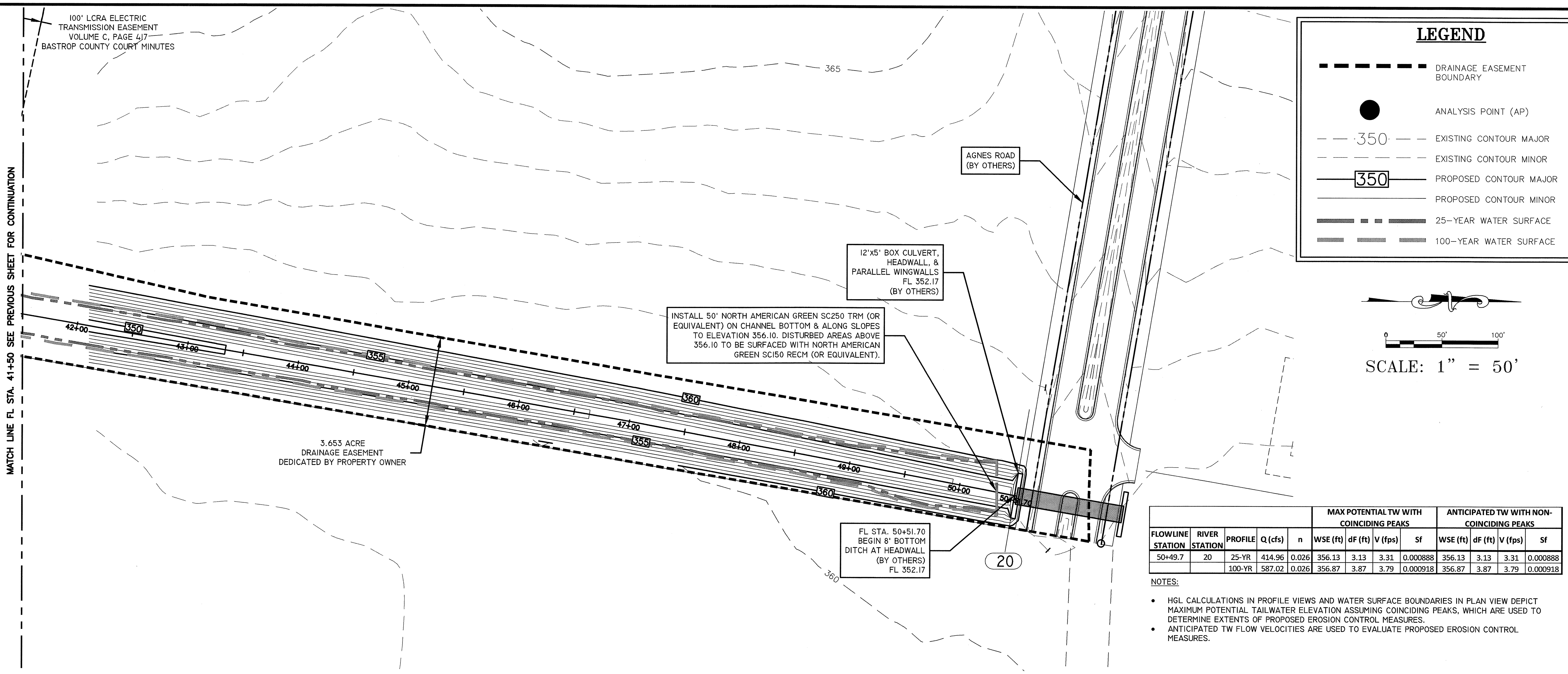
PROJECT: DRAINAGE IMPROVEMENTS

DATE: APRIL 2018

JOB NUMBER: 4697

SHEET: 12 OF 14

SHEET NO. 12



					MAX POTENTIAL TW WITH COINCIDING PEAKS				ANTICIPATED TW WITH NON-COINCIDING PEAKS			
FLOWLINE STATION	RIVER STATION	PROFILE	Q (cfs)	n	WSE (ft)	dF (ft)	V (fps)	Sf	WSE (ft)	dF (ft)	V (fps)	Sf
50+49.7	20	25-YR	414.96	0.026	356.13	3.13	3.31	0.000888	356.13	3.13	3.31	0.000888
		100-YR	587.02	0.026	356.87	3.87	3.79	0.000918	356.87	3.87	3.79	0.000918

NOTES:

- HGL CALCULATIONS IN PROFILE VIEWS AND WATER SURFACE BOUNDARIES IN PLAN VIEW DEPICT MAXIMUM POTENTIAL TAILWATER ELEVATION ASSUMING COINCIDING PEAKS, WHICH ARE USED TO DETERMINE EXTENTS OF PROPOSED EROSION CONTROL MEASURES.
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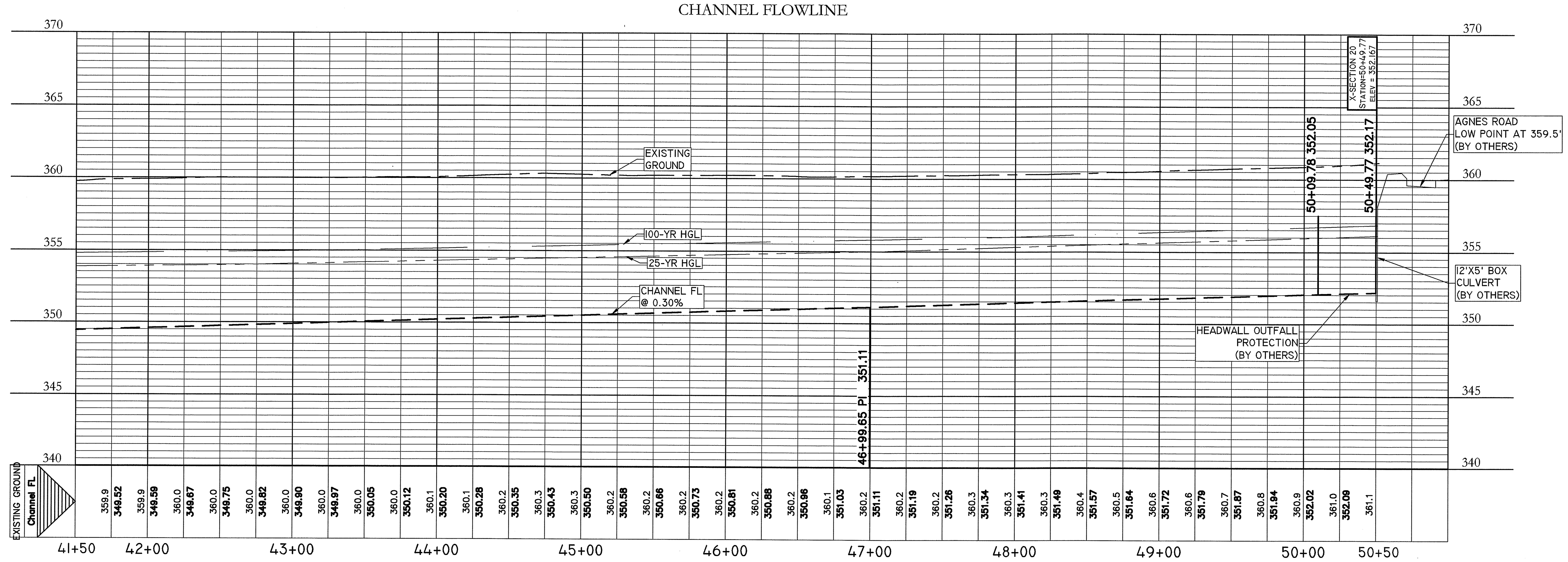
PROFILE SCALE
HORIZ. 1" = 50'
VERT. 1" = 5'

CHANNEL FLOWLINE



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STATE OF TEXAS
BRENDAN P. McENTEE
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09/28/2018

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BM	JW

DATE | REVISION

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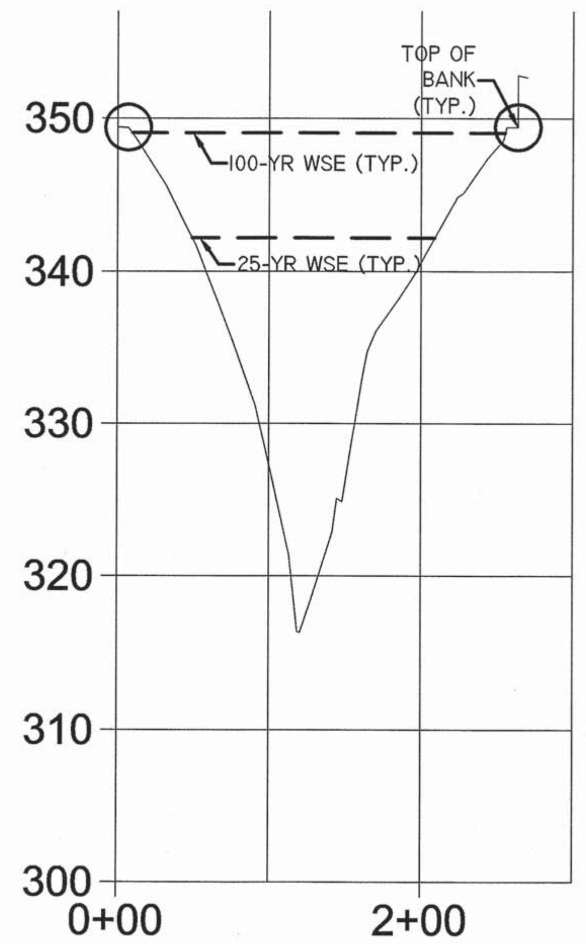
SHEET NAME: CHANNEL - STA. 41+50 TO END
JOB NAME: BASTROP GROVE
PROJECT: DRAINAGE IMPROVEMENTS

DATE: APRIL 2018
JOB NUMBER: 4697
SHEET: 13 OF 14
SHEET NO.: 13



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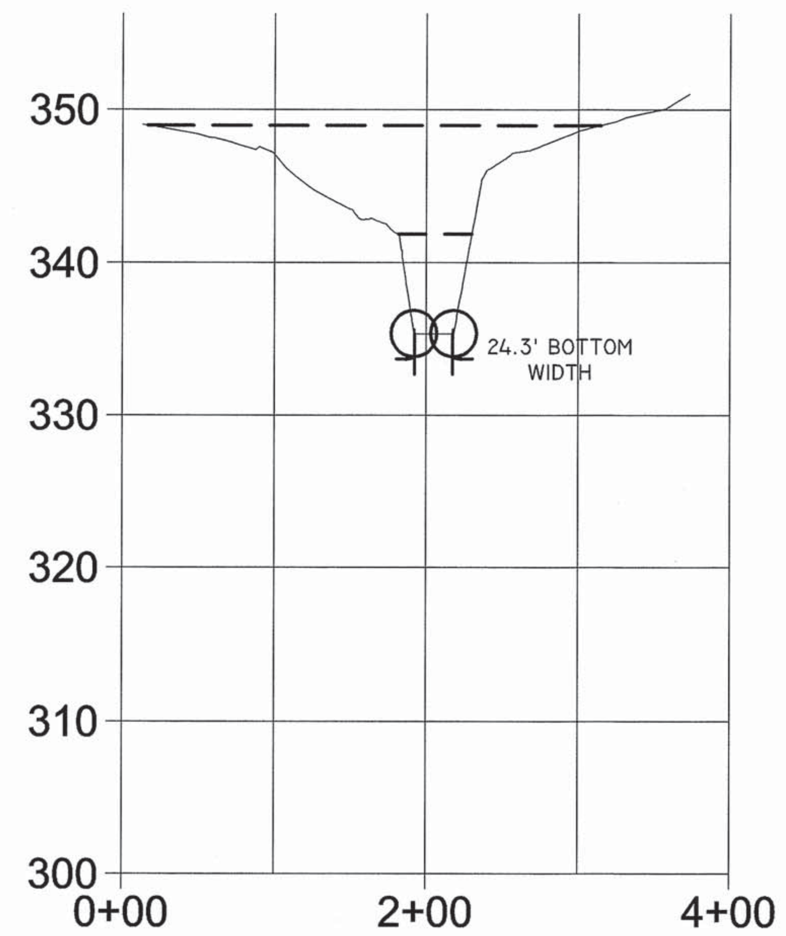

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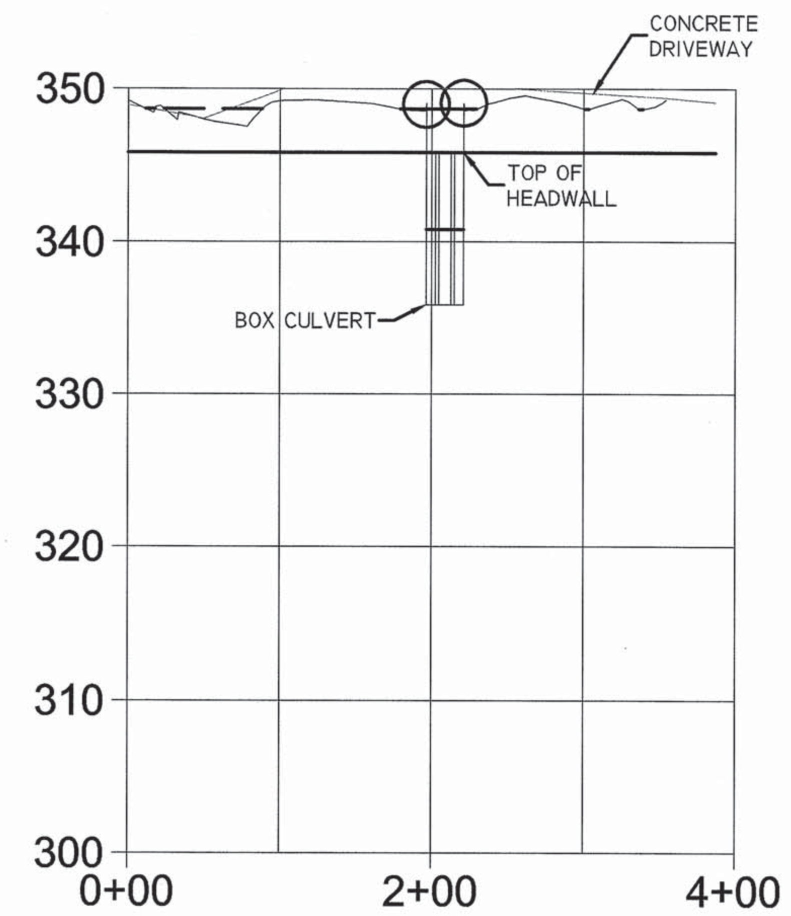

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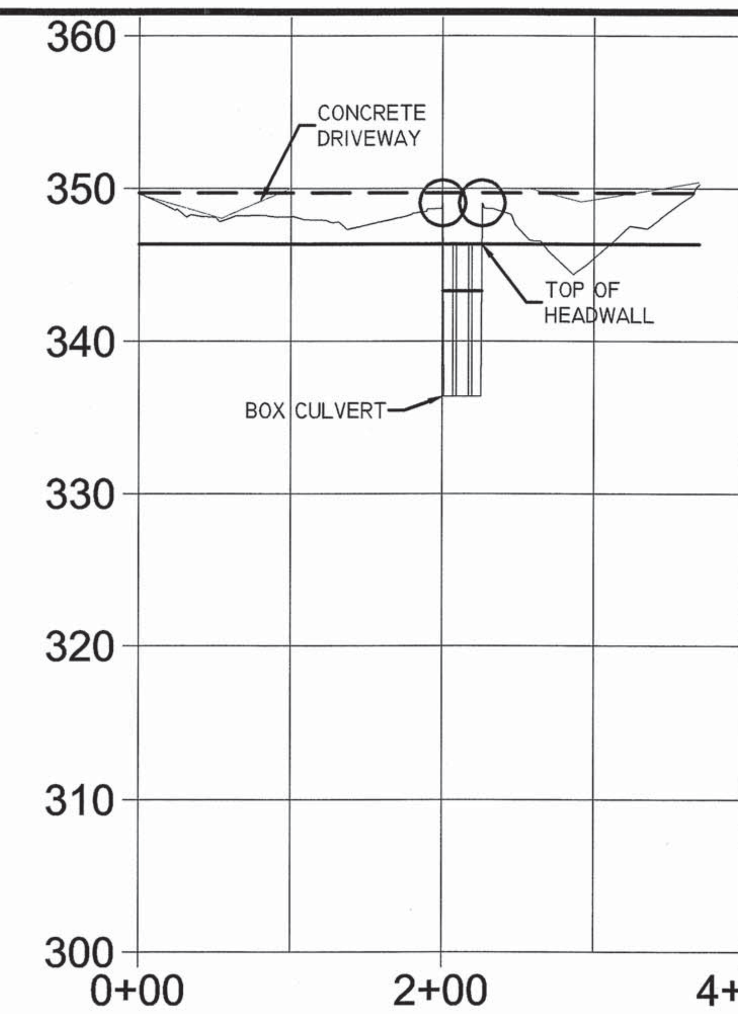

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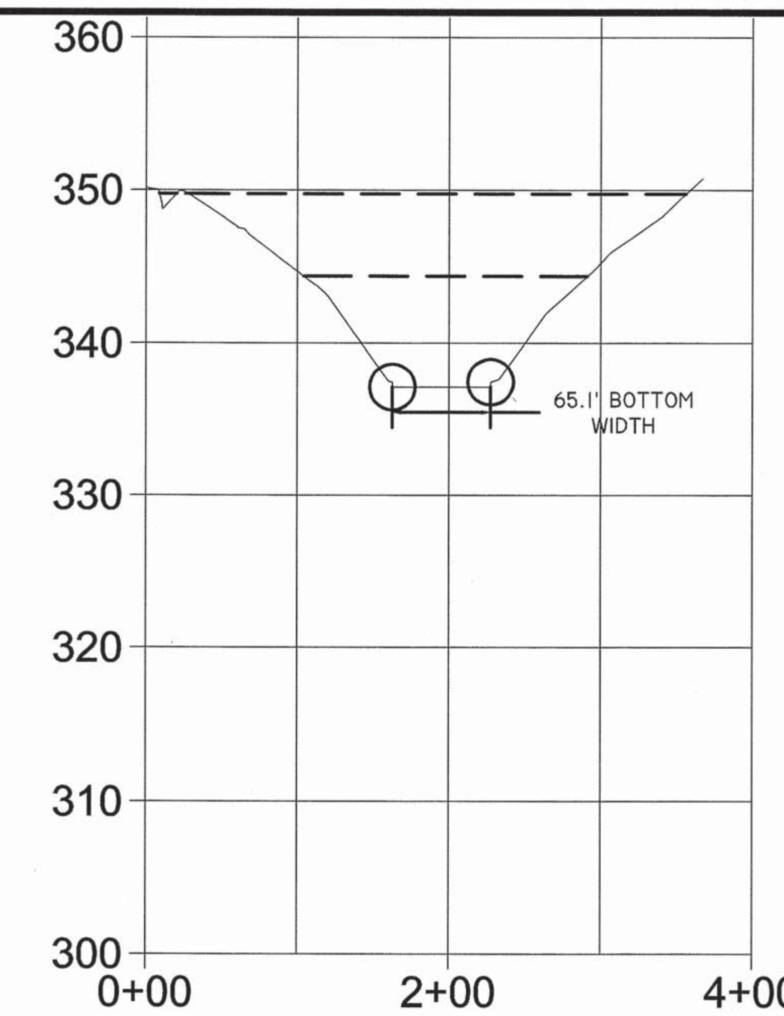

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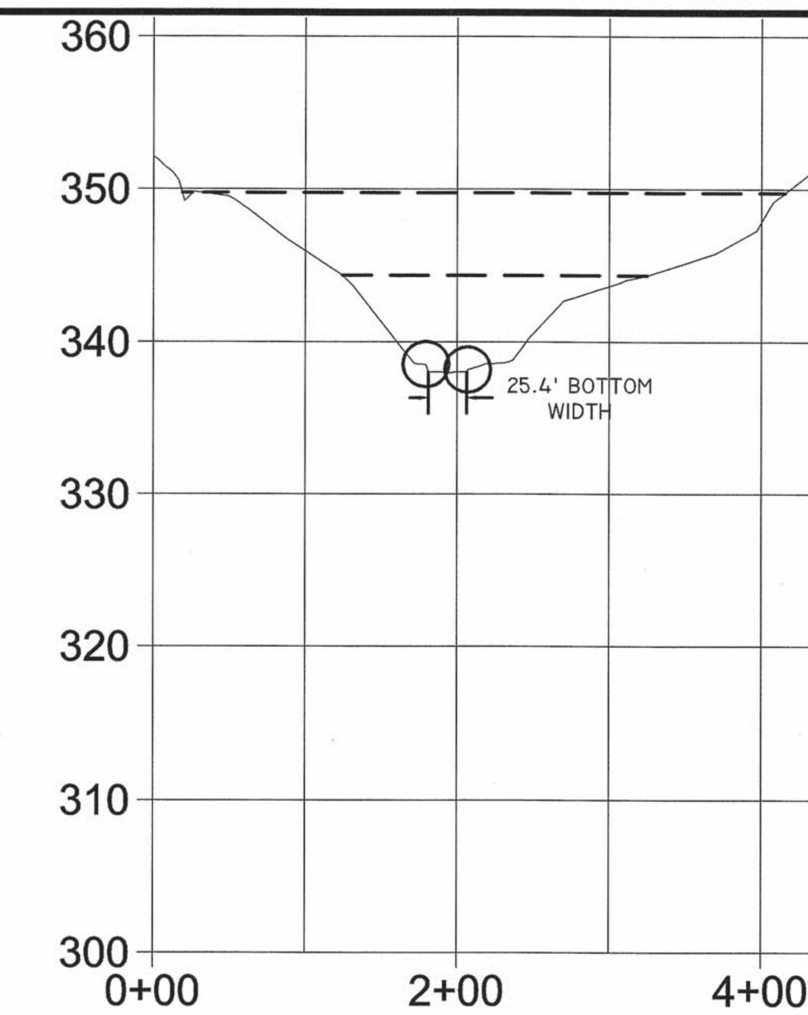

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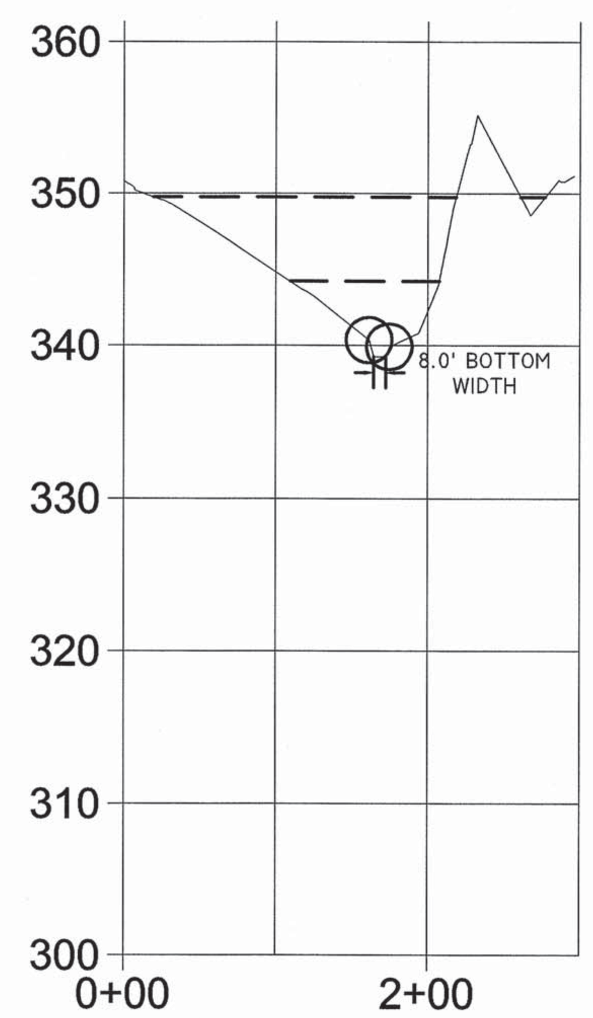

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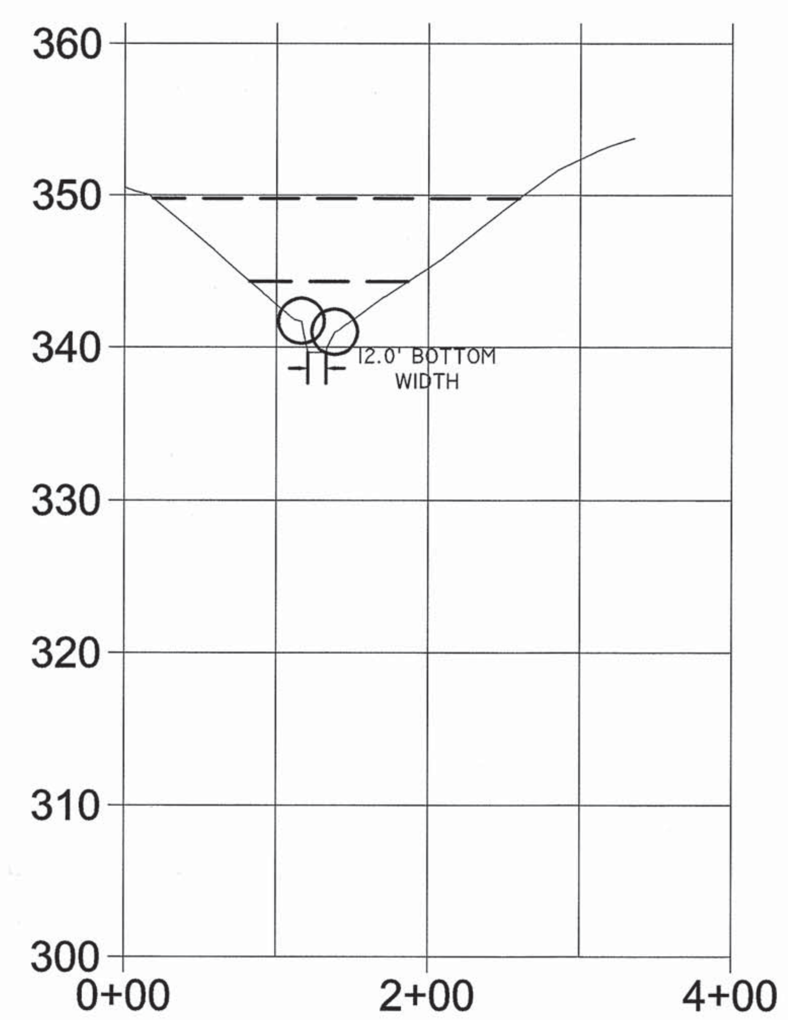

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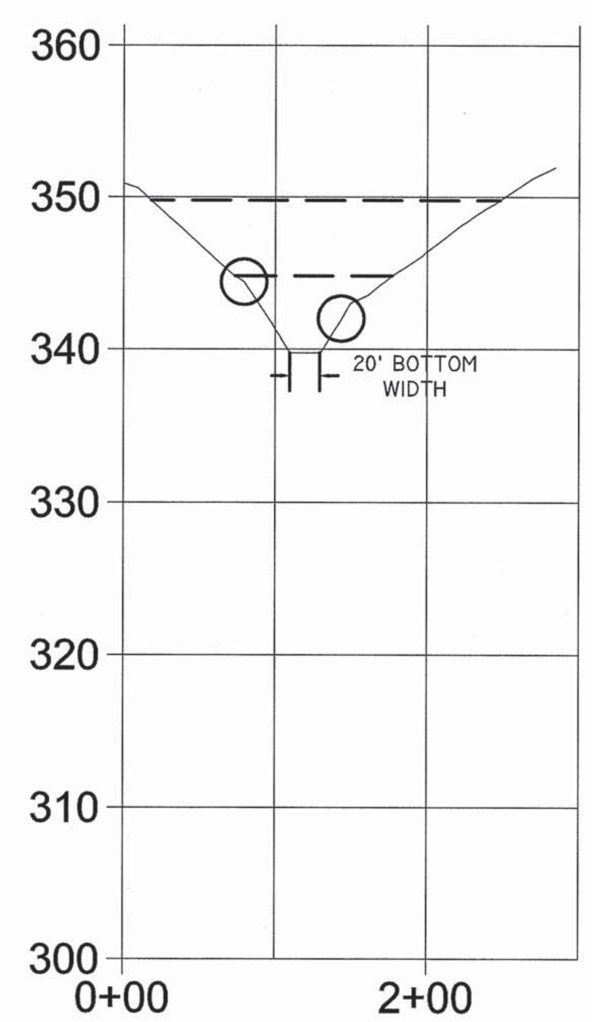

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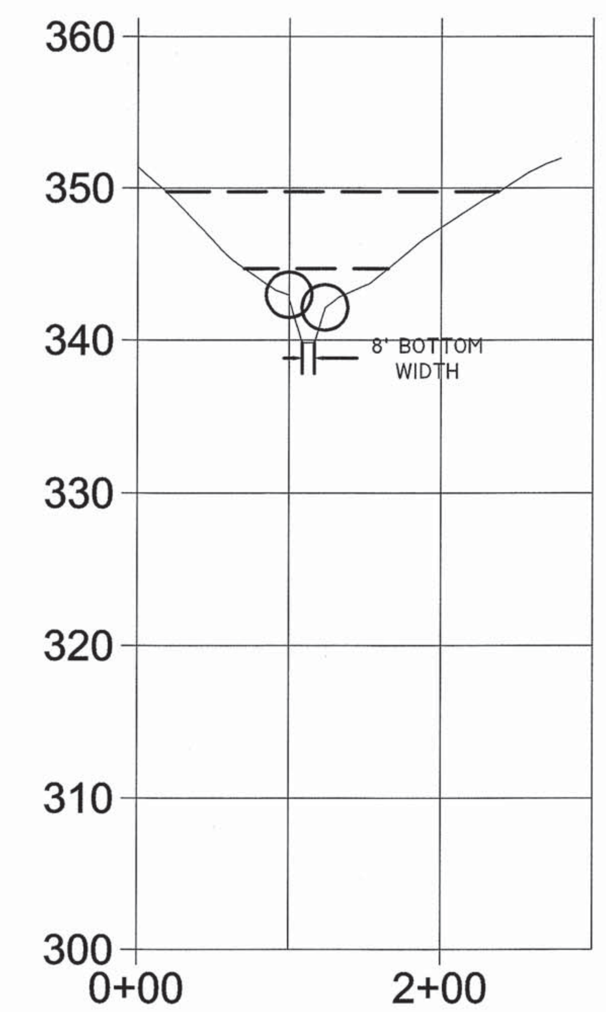

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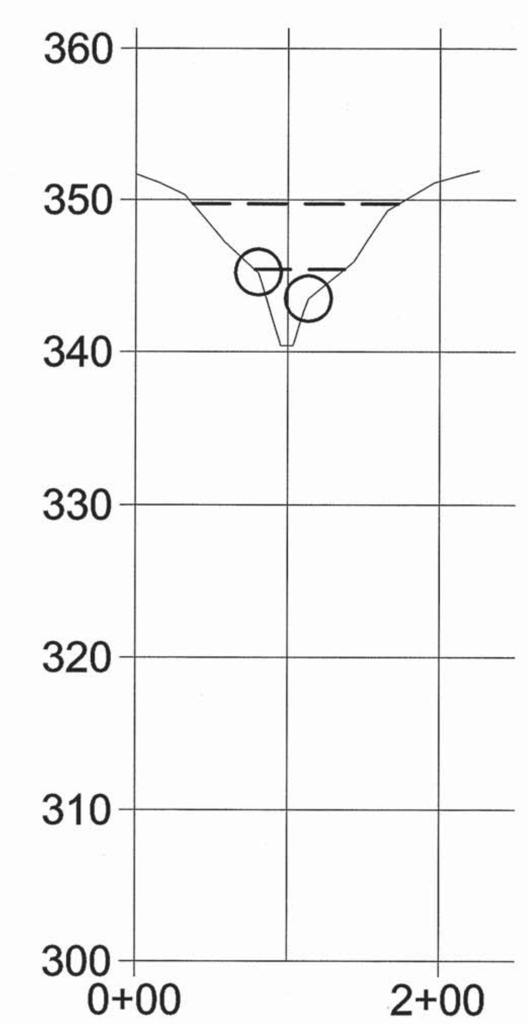
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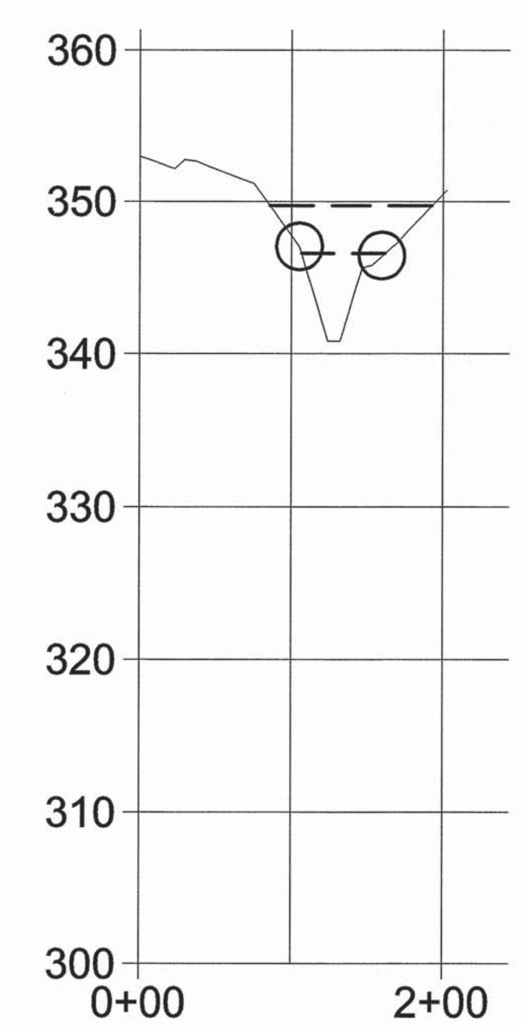
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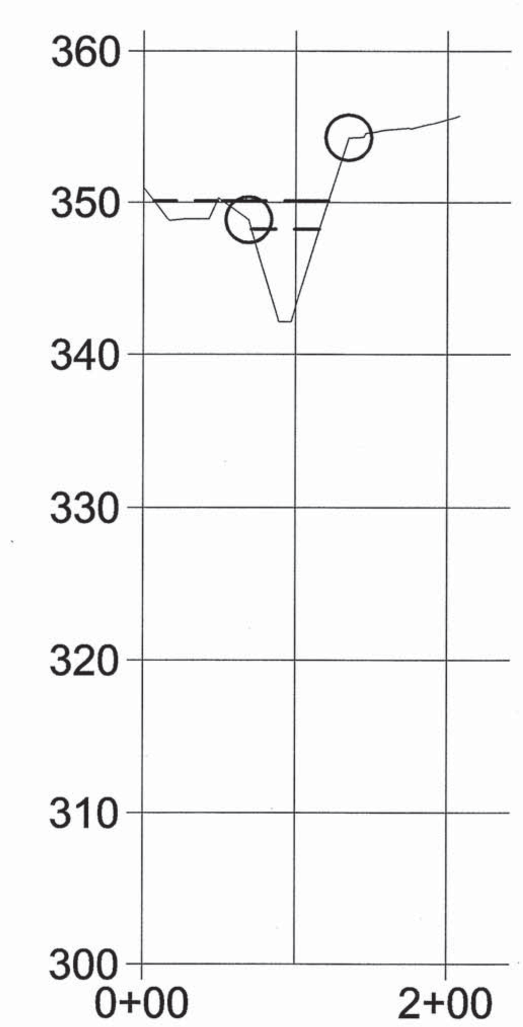
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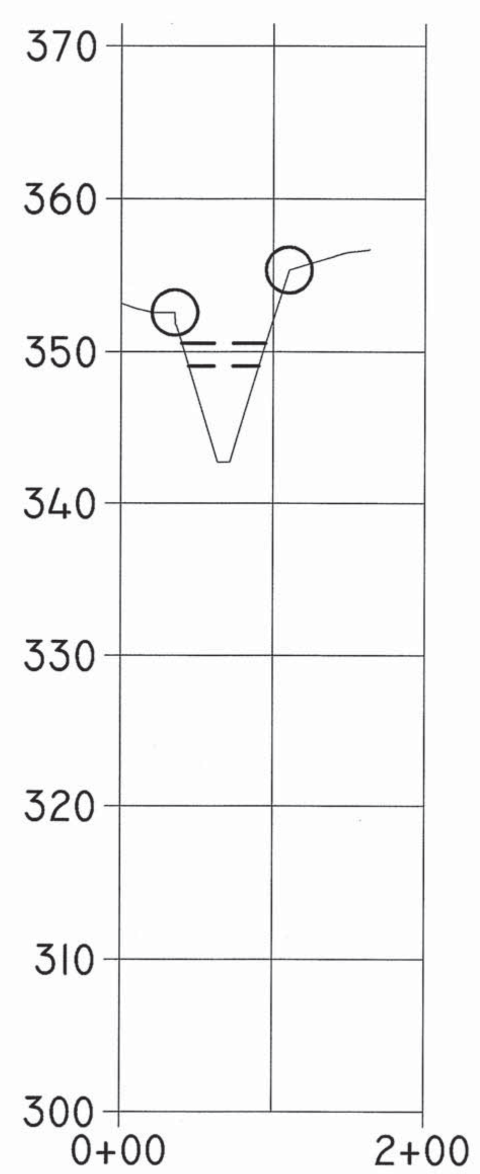
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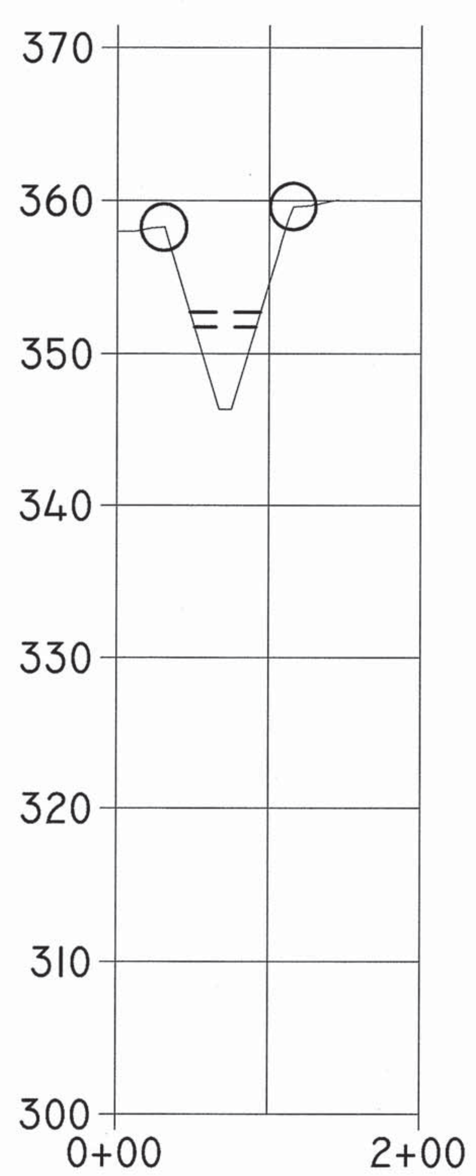
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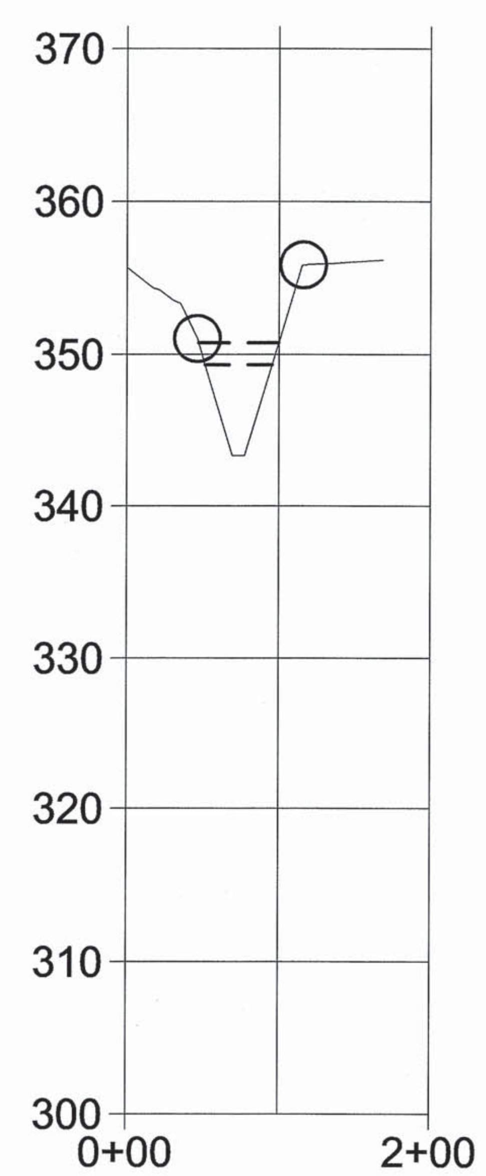
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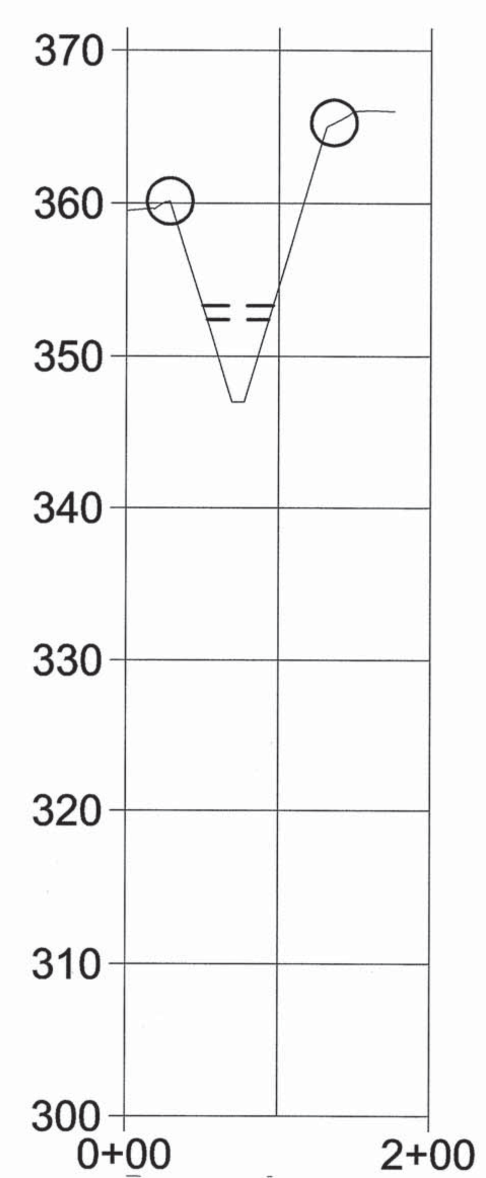
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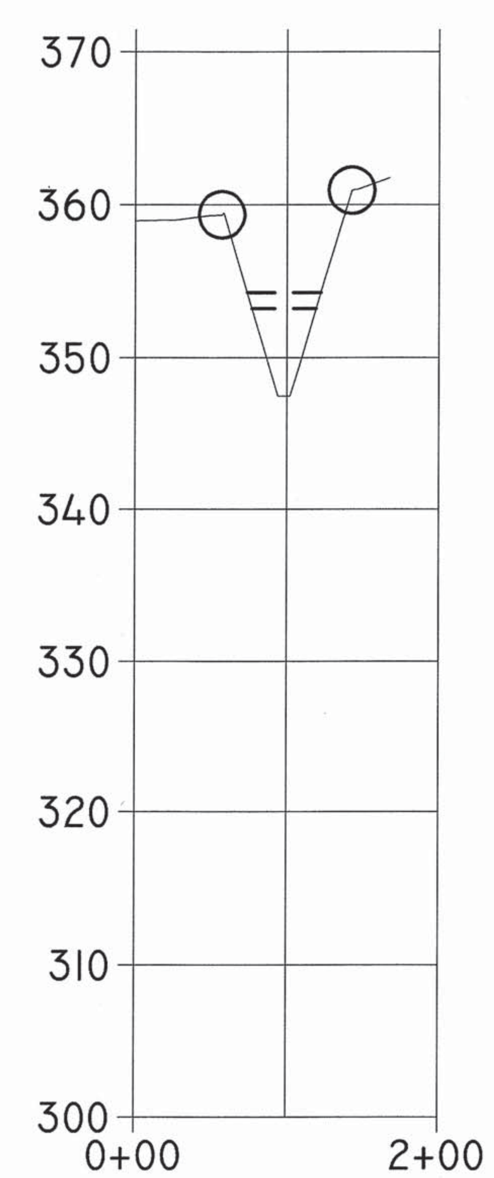
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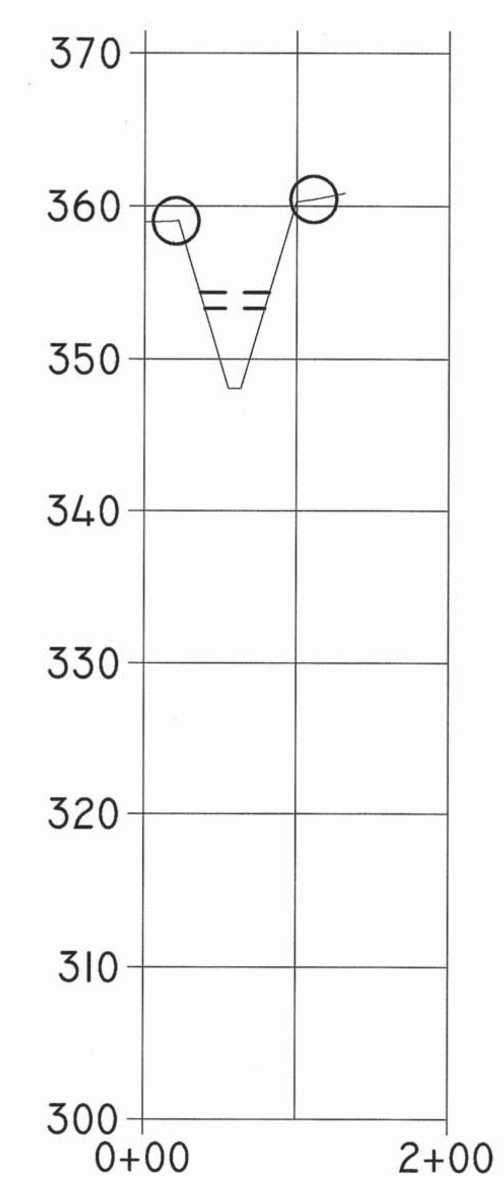
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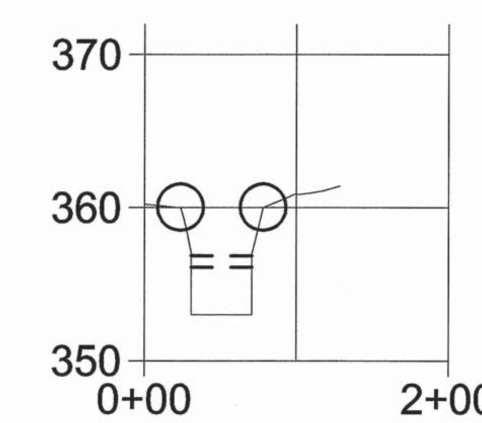
X-SECTION 20

PROFILE SCALE
HORIZ. 1" = 100'
VERT. 1" = 10'

LEGEND

- MAX POTENTIAL WSE ASSUMING COINCIDING PEAKS
- OVERBANK STATION
- PROPOSED DRIVEWAY

NOTES:

- OVERBANK STATIONS DESIGNATE THE BOUNDARY BETWEEN CHANNEL AND OVERBANK MANNING'S N VALUES ACCORDING TO THE FOLLOWING DESCRIPTIONS:
  MAIN CHANNEL - CLEAN, STRAIGHT, FULL, NO RIFTS OR DEEP POOLS = 0.026
  FLOOD PLAIN - PASTURE, NO BRUSH, SHORT GRASS = 0.035
  CONCRETE CHANNEL - TROWEL FINISH = 0.011
  (MANNING'S N VALUES ACCORDING TO HEC-RAS)
- CROSS-SECTIONS CREATED USING THE AUTODESK RIVER AND FLOOD ANALYSIS MODULE

FILE PATH: J:\AutoCad 2004\Land Projects\4697\dwg\Channel\4697 - DRAINAGE.dwg - May 14, 2018 - 5:35pm

STATE OF TEXAS
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05/15/2018

DESIGNED BY: BM
DRAFTED BY: JW

DATE
REVISION

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SHEET NAME: CHANNEL X-SECTIONS
JOB NAME: BASTROP GROVE
PROJECT: DRAINAGE IMPROVEMENTS

DATE: APRIL 2018
JOB NUMBER: 4697
SHEET: 14 OF 14
SHEET NO. 14

BASTROP GROVE
DRAINAGE IMPROVEMENTS
ENGINEERING REPORT

PREPARED FOR:

71 Retail Partners LP
8214 Westchester Drive, Suite 550
Dallas, TX 75225

PREPARED BY:

CARLSON, BRIGANCE & DOERING, INC.
(TX Firm F-3791)
Mr. Brendan P. McEntee, P.E.
5501 West William Cannon
Austin, Texas 78749

05/17/2018

STATE OF TEXAS
BRENDAN P. McENTEE
96200
LICENSED
PROFESSIONAL ENGINEER

CBD NO. 4697
May 2018

BASTROP GROVE
TABLE OF CONTENTS

I. PROJECT SUMMARY

1.0 GENERAL

Bastrop Grove is a 145.70 Acre site, located within City of Bastrop at the intersection of Texas Highway 304 and Texas 71 Service Road. This engineering report details the proposed drainage improvements intended to convey storm runoff from upstream Seton Hospital and 71 Retail Partners LP developments to the Colorado River without ponding. Drainage improvements include construction of a 4,691-foot long earthen drainage ditch beginning south of Agnes Road and discharging into an existing channel that outfalls at the Colorado River, stabilization of an existing low water crossing, and replacement of a washed-out driveway, culvert, and flood control structure. The proposed culvert contains one 8’x10’ and two 6’x10’ box culverts and was designed to mimic the site’s existing hydrology by matching the conveyance provided by the existing flood control structure that currently regulates flow to the Colorado River. The proposed channel was designed to contain upstream storm runoff and the Colorado River’s 100-year flood without inundating Agnes Road.

2.0 ORDINANCE STATUS

This project is subject to the City of Bastrop Code of Ordinances.

3.0 DRAINAGE

Storm water runoff from the developed sites north of Agnes Road flow to the southeast corner of the 52.68-acre site, where it flows through a 12’x5’ box culvert (designed by others) underneath Agnes Road. An existing 6’x3’ box culvert conveys storm water runoff from approximately 69.84 acres north of Texas 71 Service Road. The ultimate drainage plan for the 145.70-acre development includes construction of a drainage channel to the Colorado River within an existing Drainage Easement recorded in Volume 1819, Page 840 in the Official Public Records of Bastrop County. The following engineering report presents design assumptions and justifications for the proposed channel, low water crossing, box culvert, and driveway. The report also evaluates the proposed channel’s capacity to contain and convey the 25-year and 100-year storm events under different tailwater conditions. The model demonstrates that the channel will have sufficient capacity to convey runoff from these storm events given maximum possible tailwater at the Colorado River without flooding Agnes Road. Final channel design and details are found in the Bastrop Grove Drainage Improvement plans.

4.0 CERTIFICATION

I hereby certify that this report complies with the Bastrop Code of Ordinances where applicable and the information contained hereon is true and correct to the best of my knowledge.

Brendan P McEntee	05-17-2018
Brendan P. McEntee, P.E.	Date

II. DESIGN NARRATIVE & ANALYSIS

A. Hydrological Analysis

METHODOLOGY & INPUT VARIABLES

Hydraflow Hydrographs Extension for AutoCAD Civil 3D 2018 version 12 was used to model the hydrologic characteristics of existing and proposed conditions.

The proposed channel's drainage area is greater than 200 acres and thus the Soil Conservation Service unit hydrograph method was used to determine storm runoff. The modeled rainfall event was a 24-hour SCS Type III storm with a 3-minute time interval and the following rainfall depths:

Table A.1 – Bastrop County 24-hr SCS Rainfall Depths

	2-YR	5-YR	10-YR	25-YR	100-YR
24-HOUR DEPTH (IN)	3.6	5.1	6.2	7.7	10.2

Source: Chapter 10, Section 1.40.3(2) of Bastrop County Code of Ordinances

The site contains hydrologic soil groups A and B, as per the USDA Web Soil Survey. The site's soils map and data have been included in Section B. The curve numbers and Manning's n values found in Tables A.2 & A.3 below were taken from "Technical Release 55 – Urban Hydrology for Small Urban Watersheds".

Table A.2 – Curve Numbers

Cover Type	Hydrologic Condition	Hydrologic Soil Group	Curve Number
Agricultural lands			
Pasture, grassland, or range – continuous forage for grazing	Good Grass cover > 75% & lightly grazed	A	39
		B	61
Fully developed urban areas			
Open space	Good Grass cover > 75%	A	39
		B	61
Impervious areas		ALL	98

Source: Soil Conservation Service TR-55

Table A.3 - Manning's N-Values

Surface Description	N
Sheet Flow & Shallow Overland Flow	
Smooth surfaces - concrete, asphalt, gravel, or bare soil	0.011
Grass – short grass prairie	0.15
Channel Flow	
Natural channels – earth, straight, some grass	0.026

Source: Soil Conservation Service TR-55

All time of concentration calculations were generated using the formulas given in "Technical Release 55 – Urban Hydrology for Small Urban Watersheds" for sheet, shallow concentrated, and channel flow. A maximum of 100 feet was used for sheet flow calculations.

EXISTING DRAINAGE CONDITIONS

Four drainage basins and two confluence points were used to model and evaluate existing site drainage conditions. An impervious cover of 28% was determined using aerial imagery for the 69.84 acres of drainage basin EX-OFFSITE. There was an assumed 0% impervious cover on the remaining existing drainage basins. EX-DA-1 drains to the roadside ditch along State Highway 304 marked EX-AP-1. EX-OFFSITE contributes to EX-DA-2 as sheet flow after discharging from existing 6'x3' box culvert running underneath Texas 71 Service Road. EX-DA-3 is the southwestern basin contributing to the existing channel flowing into the Colorado River. EX-DA-2 includes overland flow contributing to the existing channel flowing into the Colorado River and drains to the southern analysis point EX-AP-2. See the Existing Drainage Area Map in Section C.

PROPOSED DRAINAGE CONDITIONS

Nine drainage basins and three confluence points were used to model and evaluate proposed site drainage conditions. Proposed drainage basin impervious covers were assumed based on future development as shown in the table below:

Land Use	Impervious Cover %
Single-Use Residential	50
Commercial	70
Roadway	100

PR-DA-1 and PR-DA-2 will be commercially developed. PR-DA-3 will be the proposed Agnes Drive, which is currently a 30' R.O.W. PR-DA-4 through PR-DA-7 will potentially be developed as single-use residential. PR-DA-8 models the northern part of the proposed drainage channel within the boundaries of the 3.653-acre drainage easement dedicated by MC Bastrop 71, LP. PR-DA-9 models the southern part of the proposed drainage channel within the boundaries of the 11.563-acre drainage easement (Volume 1819, Page 840, O.P.R.B.C.TX.). Three analysis points were selected along the length of the proposed channel. AP-1 represents the initial channel flow from EX-DA-OFFSITE, PR-DA-1, PR-DA-2, and PR-DA-3. AP-2 marks the border of the two dedicated drainage easements and the junction of the upstream drainage areas and PR-DA-4, PR-DA-5, and PR-DA-8. AP-3 is the final confluence point of all upstream drainage basins before flow is released into the Colorado River. See the Proposed Drainage Area Map in Section D.

Flows at proposed analysis points were used to model the capacity of the proposed channel in the Autodesk River and Flood Analysis Module. See Hydraulic Analysis in Section G.

B. Hydrologic Soil Group Summary

Map Scale: 1:14,700 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 200, 400, 800, 1200

Feet: 0, 500, 1000, 2000, 3000

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 14N WGS84

MAP LEGEND

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

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

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:
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: Bastrop County, Texas
Survey Area Data: Version 15, Nov 7, 2017

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

Date(s) aerial images were photographed: Feb 8, 2015—Mar 14, 2017

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.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Bo	Bosque loam, 0 to 1 percent slopes, occasionally flooded	300.1	56.0%
DeC	Robco-Tanglewood complex, 1 to 5 percent slopes	46.8	8.7%
SeD2	Shep clay loam, 3 to 8 percent slopes, eroded	21.8	4.1%
Sm	Smithville fine sandy loam, 0 to 1 percent slopes	167.4	31.2%
Totals for Area of Interest		**536.1**	**100.0%**

Bastrop County, Texas

Bo—Bosque loam, 0 to 1 percent slopes, occasionally flooded

Map Unit Setting

National map unit symbol: f67c
Elevation: 200 to 1,400 feet
Mean annual precipitation: 28 to 40 inches
Mean annual air temperature: 64 to 70 degrees F
Frost-free period: 220 to 275 days
Farmland classification: Not prime farmland

Map Unit Composition

Bosque and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bosque

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium of holocene age derived from mixed sources

Typical profile

H1 - 0 to 24 inches: loam
H2 - 24 to 58 inches: clay loam
H3 - 58 to 75 inches: clay loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum in profile: 20 percent
Available water storage in profile: High (about 10.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B
Ecological site: Loamy Bottomland (R086AY012TX)
Hydric soil rating: No

Minor Components

Unnamed

Percent of map unit: 5 percent
Hydric soil rating: No

Data Source Information

Soil Survey Area: Bastrop County, Texas
Survey Area Data: Version 15, Nov 7, 2017

Bastrop County, Texas

DeC—Robco-Tanglewood complex, 1 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2wg9h
Elevation: 220 to 610 feet
Mean annual precipitation: 35 to 45 inches
Mean annual air temperature: 67 to 69 degrees F
Frost-free period: 252 to 275 days
Farmland classification: Farmland of statewide importance, if drained

Map Unit Composition

Robco and similar soils: 46 percent
Tanglewood and similar soils: 25 percent
Minor components: 29 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Robco

Setting

Landform: Ridges
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Sandy, clayey, and loamy residuum weathered from sandstone, claystone, and shale of eocene age

Typical profile

A - 0 to 11 inches: loamy fine sand
E - 11 to 26 inches: loamy fine sand
Btg1 - 26 to 31 inches: sandy clay loam
Btg2 - 31 to 39 inches: sandy clay loam
Bt/C - 39 to 80 inches: sandy clay loam

Properties and qualities

Slope: 1 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 18 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Gypsum, maximum in profile: 1 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 8.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: A
Ecological site: Sandy (R087AY234TX)
Hydric soil rating: No

Description of Tanglewood

Setting

Landform: Ridges
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Sandy, clayey, and loamy residuum weathered from sandstone, claystone, and shale of eocene age

Typical profile

A - 0 to 5 inches: loamy fine sand
E - 5 to 23 inches: loamy fine sand
Btg1 - 23 to 33 inches: sandy clay loam
Btg2 - 33 to 68 inches: clay
Btg3 - 68 to 80 inches: sandy clay loam

Properties and qualities

Slope: 1 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 20 to 46 inches
Frequency of flooding: None
Frequency of ponding: None
Gypsum, maximum in profile: 1 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 8.0 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C/D
Ecological site: Sandy (R087AY234TX)
Hydric soil rating: No

Minor Components

Edge

Percent of map unit: 5 percent
Landform: Ridges, ridges
Landform position (two-dimensional): Summit, shoulder, backslope

Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: Claypan Savannah (R087AY221TX)
Hydric soil rating: No

Rader

Percent of map unit: 5 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Sandy Loam (R087AY237TX)
Hydric soil rating: No

Straber

Percent of map unit: 5 percent
Landform: Ridges
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: Sandy (R087AY234TX)
Hydric soil rating: No

Silstid

Percent of map unit: 5 percent
Landform: Ridges
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: Sandy (R087AY234TX)
Hydric soil rating: No

Tabor

Percent of map unit: 5 percent
Landform: Ridges
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: Sandy Loam (R087AY237TX)
Hydric soil rating: No

Padina

Percent of map unit: 2 percent
Landform: Ridges
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: Deep Sand (R087AY225TX)
Hydric soil rating: No

Gasil

Percent of map unit: 2 percent
Landform: Ridges
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: Sandy Loam (R087AY237TX)
Hydric soil rating: No

Data Source Information

Soil Survey Area: Bastrop County, Texas
Survey Area Data: Version 15, Nov 7, 2017

Bastrop County, Texas

SeD2—Shep clay loam, 3 to 8 percent slopes, eroded

Map Unit Setting

National map unit symbol: f68m
Elevation: 1,200 to 2,300 feet
Mean annual precipitation: 21 to 34 inches
Mean annual air temperature: 64 to 70 degrees F
Frost-free period: 210 to 230 days
Farmland classification: Not prime farmland

Map Unit Composition

Shep and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Shep

Setting

Landform: Stream terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Loamy alluvium of pleisticene age

Typical profile

H1 - 0 to 20 inches: clay loam
H2 - 20 to 60 inches: clay loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 40 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 9.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: Southern Clay Loam (R086AY007TX)
Hydric soil rating: No

Minor Components

Unnamed, hydric

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Bastrop County, Texas
Survey Area Data: Version 15, Nov 7, 2017

Bastrop County, Texas

Sm—Smithville fine sandy loam, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: f68q
Elevation: 150 to 500 feet
Mean annual precipitation: 35 to 42 inches
Mean annual air temperature: 66 to 70 degrees F
Frost-free period: 260 to 290 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Smithville and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Smithville

Setting

Landform: Flood-plain steps
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium of quaternary age derived from mixed sources

Typical profile

H1 - 0 to 6 inches: fine sandy loam
H2 - 6 to 16 inches: loam
H3 - 16 to 50 inches: sandy clay loam
H4 - 50 to 62 inches: fine sandy loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 20 percent
Available water storage in profile: High (about 9.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: B
Ecological site: Loamy Upland (F133BY005TX)

Hydric soil rating: No

Minor Components

Unnamed, hydric

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Bastrop County, Texas
Survey Area Data: Version 15, Nov 7, 2017

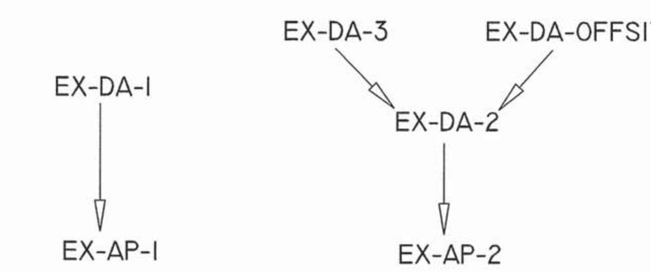
C. <u>Existing Conditions Drainage Area Map</u>

SCALE: 1" = 300'

LEGEND

- DRAINAGE EASEMENT BOUNDARY
- DRAINAGE BOUNDARY LINE
- A1 — DRAINAGE AREA LABEL
- ANALYSIS POINT (AP)
- 940 — EXISTING CONTOUR MAJOR
- EXISTING CONTOUR MINOR
- FLOW ARROW
- TcFP — TIME OF CONCENTRATION FLOW PATH

HYDROLOGY FLOW CHART



TIME OF CONCENTRATION CALCULATIONS EXISTING CONDITIONS

Drainage Area #	Sheet Flow				Shallow Conc. Flow				Channel Flow						Tc (Min.)
	n	Slope	L	Tc	Paved/ Unpaved	Slope	L	Tc	n	Slope	L	$A_{x\text{-}sect}$	WP	Tc	
EX-DA-1	0.15	0.30%	100	19.73	U	0.19%	3154.97	74.77							94.5
DA-OFFSITE	0.011	0.50%	100	1.99	U	0.50%	2336	34.13	0.013	0.50%	1793	18	18	3.69	39.8
EX-DA-2	0.15	0.56%	100	15.37	U	0.34%	3712.93	65.78	0.026	1.58%	2631.64	200	60	2.72	83.9
EX-DA-3	0.15	0.36%	100	18.34	U	0.76%	1684.2	19.96							38.3

RESULTS TABLE - EXISTING CONDITIONS

SUB-BASIN	AREA (AC.)	% IC	CN	Q_{10} (CFS)	Q_{25} (CFS)	Q_{100} (CFS)
EX-DA-1 / EX-AP-1	101.79	0	57	59.56	97.12	167.35
DA-OFFSITE	69.84	28	71	127.94	181.31	273.3
EX-DA-2	193.08	0	60	140.32	219.91	366.23
EX-DA-3	50.91	0	52	36.56	64.3	117.99
EX-AP-2				257.24	395.87	648.66

NOTES:

- SCS WAS USED AS DRAINAGE CALCULATION METHOD
- RAINFALL INTENSITY DATA FOR DESIGN STORMS WERE PROVIDED BY BASTROP COUNTY'S CODE OF ORDINANCES (10.1.40 & 10.5.90)
- CN's ARE BASED ON EXISTING TYPE A & B SOILS AND REFLECT VALUES PER THE USDA WEB SOIL SURVEY
- TOC CALCULATIONS ARE BASED ON ASSUMED EXISTING CONDITIONS & TR-55
- MANNING'S N VALUES FROM TR-55:
  - PIPE/CHANNEL FLOW
    - PIPES - REINFORCED CONCRETE = 0.013
    - NATURAL CHANNELS - EARTH, STRAIGHT, SOME GRASS = 0.026
  - OVERLAND FLOW
    - SMOOTH SURFACE (CONCRETE, ASPHALT, BARE SOIL) = 0.011
    - SHORT GRASS = 0.015
- OFFSITE IMPERVIOUS COVERS ARE APPROXIMATE BASED ON AERIAL IMAGERY

STATE OF TEXAS
BRENDAN P. McENTEE
96200
LICENSED
PROFESSIONAL ENGINEER
CARLSON, BRIGANCE & DOERING, INC.
ID# F3791
05/15/2018

DESIGNED BY:	DRAFTED BY:
BM	JW

DATE

REVISION

Carlson, Brigance & Doering, Inc.
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Civil Engineering ❖ Surveying
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Phone No. (512) 280-5160 ❖ Fax No. (512) 280-5165

SHEET NAME: EXISTING DRAINAGE AREA MAP

JOB NAME: BASTROP GROVE

PROJECT: DRAINAGE IMPROVEMENTS

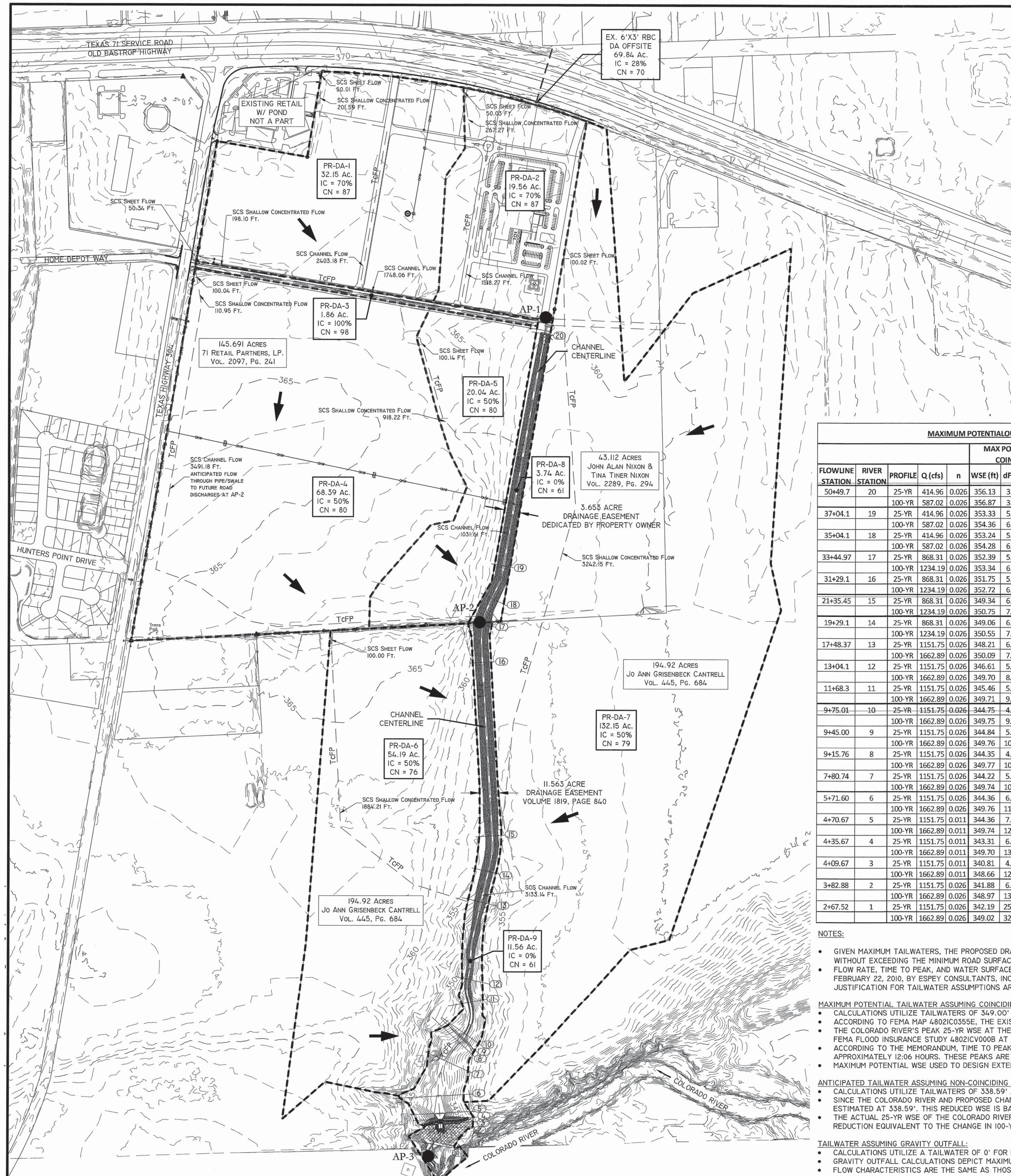
DATE: APRIL 2018

JOB NUMBER: 4697

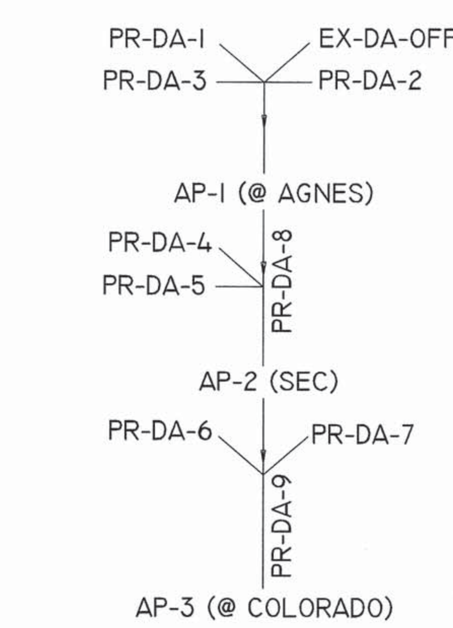
SHEET: 6 OF 14

SHEET NO. 6

D. Proposed Conditions Drainage Area Map



HYDROLOGY FLOW CHART



0 300' 600'

SCALE: 1" = 300'

LEGEND

- DRAINAGE EASEMENT BOUNDARY
- DRAINAGE BOUNDARY LINE
- A1 — DRAINAGE AREA LABEL
- ANALYSIS POINT (AP)
- 940 — EXISTING CONTOUR MAJOR
- EXISTING CONTOUR MINOR
- FLOW ARROW
- TcFP — TIME OF CONCENTRATION FLOW PATH

TIME OF CONCENTRATION CALCULATIONS PROPOSED CONDITIONS

Area #	Sheet Flow				Shallow Conc. Flow				Channel Flow						Tc (Min.)
	n	Slope	L	Tc	Paved/ Unpaved	Slope	L	Tc	n	Slope	L	$A_{x\text{-sect}}$	WP	Tc	
DA-OFFSITE	0.011	0.50%	100	1.99	U	0.50%	2336	34.13	0.013	0.50%	1793	18	18	3.69	39.8
PR-DA-1	0.011	0.50%	100	1.99	U	0.50%	202	2.22	0.013	0.50%	2403	27.58	15.88	3.41	7.6
PR-DA-2	0.011	0.50%	100	1.99	U	0.50%	217.47	3.18	0.013	0.50%	1518.01	19.15	13.23	2.44	7.6
PR-DA-3	0.011	2.00%	50	0.66	P	1.00%	198	1.62	0.013	0.50%	1748.06	27.58	15.88	2.48	4.8
PR-DA-4	0.011	0.50%	100	1.99	U	0.50%	110.95	1.62	0.013	0.50%	3491.18	37.54	18.53	4.47	8.1
PR-DA-5	0.011	0.50%	100	1.99	U	0.50%	918.22	13.41	0.026	0.30%	1031.61	86.78	34.61	2.96	18.4
PR-DA-6	0.011	0.50%	100	1.99	U	0.74%	1884.2	22.63							24.6
PR-DA-7	0.011	0.50%	100	1.99	U	0.23%	3242.18	69.83							71.8
PR-DA-8									0.026	0.30%	1715.36	86.78	34.61	4.92	4.9
PR-DA-9									0.026	0.30%	3133	320	65.25	5.73	5.7

MAXIMUM POTENTIALOUTFALL CONDITIONS FOR 100-YR AND 25-YR STORM EVENTS

					MAX POTENTIAL TW WITH COINCIDING PEAKS				ANTICIPATED TW WITH NON-COINCIDING PEAKS				TW WITH GRAVITY OUTFALL			
FLOWLINE STATION	RIVER STATION	PROFILE	Q (cfs)	n	WSE (ft)	dF (ft)	V (fps)	Sf	WSE (ft)	dF (ft)	V (fps)	Sf	WSE (ft)	dF (ft)	V (fps)	Sf
50+49.7	20	25-YR	414.96	0.026	356.13	3.13	3.31	0.000888	356.13	3.13	3.31	0.000888	356.13	3.13	3.31	0.000888
		100-YR	587.02	0.026	356.87	3.87	3.79	0.000918	356.87	3.87	3.79	0.000918	356.87	3.87	3.79	0.000918
37+04.1	19	25-YR	414.96	0.026	353.33	5.24	3.34	0.000782	353.33	5.24	3.34	0.000782	353.33	5.24	3.34	0.000782
		100-YR	587.02	0.026	354.36	6.27	3.49	0.000694	354.35	6.26	3.5	0.000698	354.35	6.26	3.5	0.000698
35+04.1	18	25-YR	414.96	0.026	353.24	5.76	2.85	0.000513	353.24	5.76	2.85	0.000513	353.24	5.76	2.85	0.000513
		100-YR	587.02	0.026	354.28	6.80	3.04	0.00048	354.27	6.79	3.05	0.000483	354.27	6.79	3.05	0.000483
33+44.97	17	25-YR	868.31	0.026	352.39	5.39	6.66	0.003008	352.39	5.39	6.66	0.003008	352.39	5.39	6.66	0.003008
		100-YR	1234.19	0.026	353.34	6.34	7.2	0.002937	353.32	6.32	7.24	0.002981	353.32	6.32	7.24	0.002981
31+29.1	16	25-YR	868.31	0.026	351.75	5.40	6.65	0.002991	351.75	5.40	6.65	0.002991	351.75	5.40	6.65	0.002991
		100-YR	1234.19	0.026	352.72	6.37	7.14	0.00285	352.68	6.33	7.22	0.002935	352.68	6.33	7.22	0.002935
21+35.45	15	25-YR	868.31	0.026	349.34	6.01	5.56	0.001849	349.34	6.01	5.56	0.001849	349.34	6.01	5.56	0.001849
		100-YR	1234.19	0.026	350.75	7.42	5.5	0.001418	350.43	7.10	5.93	0.001734	350.43	7.10	5.93	0.001734
19+29.1	14	25-YR	868.31	0.026	349.06	6.35	5.05	0.001429	349.06	6.35	5.05	0.001429	349.06	6.35	5.05	0.001429
		100-YR	1234.19	0.026	350.55	7.84	4.99	0.001095	350.18	7.47	5.43	0.001371	350.18	7.47	5.43	0.001371
17+48.37	13	25-YR	1151.75	0.026	348.21	6.05	7.26	0.003155	348.21	6.05	7.26	0.003155	348.21	6.05	7.26	0.003155
		100-YR	1662.89	0.026	350.09	7.93	6.28	0.001586	349.23	7.07	7.96	0.003064	349.23	7.07	7.96	0.003064
13+04.1	12	25-YR	1151.75	0.026	346.61	5.80	7.44	0.004251	346.61	5.80	7.44	0.004251	346.61	5.80	7.44	0.004251
		100-YR	1662.89	0.026	349.70	8.89	4.78	0.000681	347.22	6.41	8.83	0.004786	347.22	6.41	8.83	0.004786
11+68.3	11	25-YR	1151.75	0.026	345.46	5.06	9.46	0.005489	345.46	5.06	9.46	0.005489	345.46	5.06	9.46	0.005489
		100-YR	1662.89	0.026	349.71	9.31	4.44	0.000416	346.47	6.07	9.83	0.004214	346.47	6.07	9.83	0.004214
9+75.01	10	25-YR	1151.75	0.026	344.75	4.94	9.18	0.004232	344.75	4.94	9.18	0.004232	344.75	4.94	9.18	0.004232
		100-YR	1662.89	0.026	349.75	9.94	3.11	0.000166	346.54	6.73	6.94	0.001482	346.54	6.73	6.94	0.001482
9+45.00	9	25-YR	1151.75	0.026	344.84	5.12	4.55	0.00111	344.84	5.12	4.55	0.00111	344.84	5.12	4.55	0.00111
		100-YR	1662.89	0.026	349.76	10.04	2.16	0.000081	346.70	6.98	3.99	0.000497	346.70	6.98	3.99	0.000497
9+15.76	8	25-YR	1151.75	0.026	344.35	4.72	7.99	0.002899	344.35	4.72	7.99	0.002899	344.35	4.72	7.99	0.002899
		100-YR	1662.89	0.026	349.77	10.14	2.63	0.000106	346.63	7.00	5.43	0.000759	346.63	7.00	5.43	0.000759
7+80.74	7	25-YR	1151.75	0.026	344.22	5.00	7.39	0.002116	344.22	5.00	7.39	0.002116	344.22	5.00	7.39	0.002116
		100-YR	1662.89	0.026	349.74	10.52	2.89	0.000117	346.55	7.33	5.45	0.00068	346.55	7.33	5.45	0.00068
5+71.60	6	25-YR	1151.75	0.026	344.36	6.39	2.86	0.000215	344.36	6.39	2.86	0.000215	344.36	6.39	2.86	0.000215
		100-YR	1662.89	0.026	349.76	11.79	1.36	0.000021	346.62	8.65	2.47	0.000107	346.62	8.65	2.47	0.000107
4+70.67	5	25-YR	1151.75	0.011	344.36	7.29	2.11	0.000017	344.36	7.29	2.11	0.000017	344.36	7.29	2.11	0.000017
		100-YR	1662.89	0.011	349.74	12.67	1.55	0.000004	346.59	9.52	2.22	0.000013	346.59	9.52	2.22	0.000013
4+35.67	4	25-YR	1151.75	0.011	343.31	6.95	8.09	0.00053	343.31	6.95	8.09	0.00053	343.31	6.95	8.09	0.00053
		100-YR	1662.89	0.011	349.70	13.34	2.6	0.000032	345.33	8.97	8.89	0.000525	345.33	8.97	8.89	0.000525
4+09.67	3	25-YR	1151.75	0.011	340.81	4.97	11.41	0.001431	340.48	4.64	12.22	0.001747	340.48	4.64	12.22	0.001747
		100-YR	1662.89	0.011	348.66	12.82	5.86	0.000198	341.76	5.92	13.81	0.0018	341.76	5.92	13.81	0.0018
3+82.88	2	25-YR	1151.75	0.026	341.88	6.57	5.71	0.000868	339.04	3.73	10.76	0.006582	339.04	3.73	10.76	0.006582
		100-YR	1662.89	0.026	348.97	13.66	2.81	0.000079	340.02	4.71	12	0.00599	340.02	4.71	12	0.00599
2+67.52	1	25-YR	1151.75	0.026	342.19	25.89	0.67	0.000006	332.04	15.74	1.97	0.000084	325.16	8.86	6.07	0.001823
		100-YR	1662.89	0.026	349.02	32.72	0.54	0.000003	338.64	22.34	1.38	0.000031	326.69	10.39	6.36	0.001551

NOTES:

- GIVEN MAXIMUM TAILWATERS, THE PROPOSED DRAINAGE CHANNEL PROVIDES AT LEAST ONE FOOT OF FREEBOARD AT DESIGN FLOWS AND THE PROPOSED CULVERT HAS CAPACITY TO CONVEY 100-YR STORM RUNOFF WITHOUT EXCEEDING THE MINIMUM ROAD SURFACE ELEVATION OF AGNES ROAD AT 359.50', AS PER DESIGN REQUIREMENTS BY BASTROP COUNTY'S CODE OF ORDINANCES (10.1.40 & 10.5.90).
- FLOW RATE, TIME TO PEAK, AND WATER SURFACE DATA FOR THE COLORADO RIVER ARE BASED ON FEMA MAP 48021C0355E AND THE DRAINAGE TECHNICAL MEMORANDUM FOR THE PECAN PARK DEVELOPMENT DATED FEBRUARY 22, 2010, BY ESPEY CONSULTANTS, INC., WHICH UTILIZED THE USGS GAGE 08159200 LOCATED AT STATE HIGHWAY 71 APPROXIMATELY 2 MILES UPSTREAM OF THE PROPOSED CHANNEL'S OUTFALL. JUSTIFICATION FOR TAILWATER ASSUMPTIONS ARE PROVIDED BELOW:

MAXIMUM POTENTIAL TAILWATER ASSUMING COINCIDING PEAKS:

- CALCULATIONS UTILIZE TAILWATERS OF 349.00' AND 342.17' FOR THE 100-YR AND 25-YR STORM EVENTS, RESPECTIVELY.
- ACCORDING TO FEMA MAP 48021C0355E, THE EXISTING 100-YR BFE AT THE SITE IS 349' MSL.
- THE COLORADO RIVER'S PEAK 25-YR WSE AT THE SITE IS ESTIMATED AT 342.17'. THIS WSE WAS EXTRAPOLATED FROM A LOGARITHMIC TREND OF BFE's FOR VARIOUS ANNUAL CHANCE FLOODS USING DATA FROM THE FEMA FLOOD INSURANCE STUDY 48021CV000B AT STATION 'AW'.
- ACCORDING TO THE MEMORANDUM, TIME TO PEAK OF THE COLORADO RIVER IS APPROXIMATED AT 31:45 HOURS FOR THE 100-YR EVENT, WHEREAS THE PROPOSED CHANNEL'S TIME TO PEAK IS MODELED AT APPROXIMATELY 12:06 HOURS. THESE PEAKS ARE NON-COINCIDING AND THEREFORE THESE WSE's OVERESTIMATE EXPECTED FLOODING FOR THE 100-YR AND 25-YR EVENTS.
- MAXIMUM POTENTIAL WSE USED TO DESIGN EXTENTS OF EROSION CONTROL MEASURES.

ANTICIPATED TAILWATER ASSUMING NON-COINCIDING PEAKS:

- CALCULATIONS UTILIZE TAILWATERS OF 338.59' AND 331.96' FOR THE 100-YR AND 25-YR STORM EVENTS, RESPECTIVELY.
- SINCE THE COLORADO RIVER AND PROPOSED CHANNEL PEAKS ARE NON-COINCIDING, AN ESTIMATED REDUCTION OF 10.41' IS EXPECTED TO BE REALIZED IN ACTUAL WSE AT 12:06 HOURS. THE 100-YR WSE IS ESTIMATED AT 338.59'. THIS REDUCED WSE IS BASED ON GRAPHICAL INTERPOLATIONS OF THE MEMORANDUM'S COLORADO RIVER 1% ANNUAL CHANCE HYDROGRAPH AND HYDRAULIC RATING CURVE.
- THE ACTUAL 25-YR WSE OF THE COLORADO RIVER REALIZED AT 12:06 HOURS AT THE PROPOSED CHANNEL'S OUTFALL IS ESTIMATED AT 331.96'. THIS REDUCED WSE WAS CALCULATED USING A PROPORTIONAL REDUCTION EQUIVALENT TO THE CHANGE IN 100-YR WSE's REALIZED AT A TIME TO PEAK OF 31:45 HOURS AS COMPARED TO 12:06 HOURS.

TAILWATER ASSUMING GRAVITY OUTFALL:

- CALCULATIONS UTILIZE A TAILWATER OF 0' FOR BOTH THE 100-YR AND 25-YR STORM EVENTS.
- GRAVITY OUTFALL CALCULATIONS DEPICT MAXIMUM VELOCITIES WHICH ARE USED FOR DESIGN OF OUTFALL PROTECTION.
- FLOW CHARACTERISTICS ARE THE SAME AS THOSE WITH THE ANTICIPATED TAILWATER ASSUMING NON-COINCIDING PEAKS AT EVERY STATION EXCEPT STATION 1.

RESULTS TABLE - PROPOSED CONDITIONS

SUB-BASIN	AREA (AC.)	%IC	CN	Q_{10} (CFS)	Q_{25} (CFS)	Q_{100} (CFS)
DA-OFFSITE	69.84	28	71	127.94	181.31	273.3
PR-DA-1	32.15	70	87	149.45	192.56	263.76
PR-DA-2	19.56	70	87	90.92	117.15	160.47
PR-DA-3	1.86	100	98	9.76	12.14	16.10
PR-DA-4	68.39	50	80	275.24	367.46	521.27
PR-DA-5	20.05	50	80	66.42	88.96	126.64
PR-DA-6	54.19	50	76	142.77	195.94	285.88
PR-DA-7	132.15	50	79	213.43	288.18	413.80
PR-DA-8	3.74	0	61	7.88	12.16	19.88
PR-DA-9	11.56	0	61	24.36	37.58	61.45
AP-1 (CHANNEL SOUTH OF AGNES)				312.95	414.96	587.02
AP-2 (CHANNEL AT SOUTHEAST PROPERTY CORNER)				650.57	868.31	1234.19
AP-3 (CHANNEL AT COLORADO RIVER)				850.01	1151.75	1662.89

NOTES:

- SCS WAS USED AS DRAINAGE CALCULATION METHOD
- RAINFALL INTENSITY DATA FOR DESIGN STORMS WERE PROVIDED BY BASTROP COUNTY'S CODE OF ORDINANCES (10.1.40 & 10.5.90)
- CN's ARE BASED ON EXISTING TYPE A & B SOILS AND REFLECT VALUES PER THE USDA WEB SOIL SURVEY
- TOC CALCULATIONS ARE BASED ON ASSUMED FUTURE DEVELOPMENT & TR-55
- MANNING'S N VALUES FROM TR-55:
  - PIPE/CHANNEL FLOW
    - PIPES - REINFORCED CONCRETE = 0.013
    - NATURAL CHANNELS - EARTH, STRAIGHT, SOME GRASS = 0.026
  - OVERLAND FLOW
    - SMOOTH SURFACE (CONCRETE, ASPHALT, BARE SOIL) = 0.011
    - SHORT GRASS = 0.015
- OFFSITE IMPERVIOUS COVERS ARE APPROXIMATE BASED ON AERIAL IMAGERY
- ONSITE IMPERVIOUS COVERS REFLECT ASSUMED FUTURE DEVELOPMENT AS FOLLOWS:
  - SINGLE-USE RESIDENTIAL = 50%
  - COMMERCIAL = 70%
  - ROADWAY = 100%

STATE OF TEXAS
BRENDAN P. McENTEE
96200
LICENSED
PROFESSIONAL ENGINEER

CARLSON, BRIGANCE & DOERING, INC.
ID# F3791

03/13/2018

DESIGNED BY:	DRAFTED BY:
BM	JW

DATE

REVISION

Carlson, Brigance & Doering, Inc.
FIRM ID #F3791
Civil Engineering ◆ Surveying
5501 West William Cannon Dr. ◆ Austin, Texas 78749
Phone No. (512) 280-5160 ◆ Fax No. (512) 280-5165

SHEET NAME: PROPOSED DRAINAGE AREA MAP

JOB NAME: BASTROP GROVE

PROJECT: DRAINAGE IMPROVEMENTS

DATE: APRIL 2018

JOB NUMBER: 4697

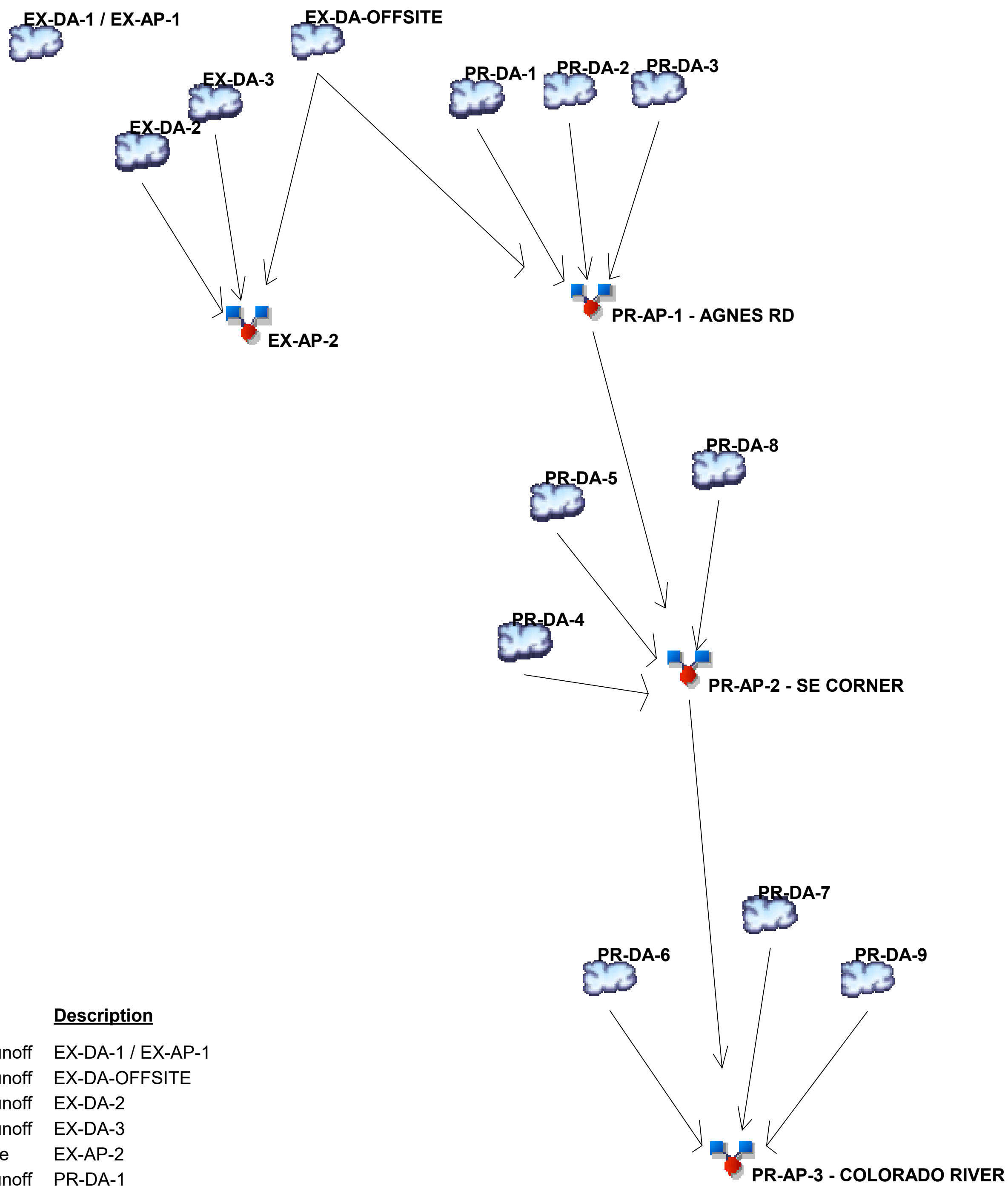
SHEET: 7 OF 14

SHEET NO. 7

E. <u>Hydraflow Report</u>

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12



Legend

Hyd.	Origin	Description
1	SCS Runoff	EX-DA-1 / EX-AP-1
2	SCS Runoff	EX-DA-OFFSITE
3	SCS Runoff	EX-DA-2
4	SCS Runoff	EX-DA-3
5	Combine	EX-AP-2
6	SCS Runoff	PR-DA-1
7	SCS Runoff	PR-DA-2
8	SCS Runoff	PR-DA-3
9	SCS Runoff	PR-DA-4
10	SCS Runoff	PR-DA-5
11	SCS Runoff	PR-DA-6
12	SCS Runoff	PR-DA-7
13	SCS Runoff	PR-DA-8
14	SCS Runoff	PR-DA-9
15	Combine	PR-AP-1 - AGNES RD
16	Combine	PR-AP-2 - SE CORNER
17	Combine	PR-AP-3 - COLORADO RIVER

Project: CHANNEL (05-16-18).gpw

Wednesday, 05 / 16 / 2018

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	-------	10.98	-------	35.60	59.56	97.12	-------	167.35	EX-DA-1 / EX-AP-1
2	SCS Runoff	------	-------	44.36	-------	90.58	127.94	181.31	-------	273.30	EX-DA-OFFSITE
3	SCS Runoff	------	-------	30.77	-------	87.97	140.32	219.91	-------	366.23	EX-DA-2
4	SCS Runoff	------	-------	3.938	-------	19.58	36.56	64.30	-------	117.99	EX-DA-3
5	Combine	2, 3, 4	-------	63.75	-------	165.26	257.24	395.87	-------	648.66	EX-AP-2
6	SCS Runoff	------	-------	74.29	-------	117.66	149.45	192.56	-------	263.76	PR-DA-1
7	SCS Runoff	------	-------	45.20	-------	71.58	90.92	117.15	-------	160.47	PR-DA-2
8	SCS Runoff	------	-------	5.631	-------	8.018	9.764	12.14	-------	16.10	PR-DA-3
9	SCS Runoff	------	-------	119.75	-------	208.26	275.24	367.46	-------	521.27	PR-DA-4
10	SCS Runoff	------	-------	28.56	-------	50.07	66.42	88.96	-------	126.64	PR-DA-5
11	SCS Runoff	------	-------	56.40	-------	104.79	142.77	195.94	-------	285.88	PR-DA-6
12	SCS Runoff	------	-------	89.62	-------	159.57	213.43	288.18	-------	413.80	PR-DA-7
13	SCS Runoff	------	-------	1.724	-------	5.024	7.881	12.16	-------	19.88	PR-DA-8
14	SCS Runoff	------	-------	5.329	-------	15.53	24.36	37.58	-------	61.45	PR-DA-9
15	Combine	2, 6, 7, 8,	-------	142.63	-------	239.42	312.95	414.96	-------	587.02	PR-AP-1 - AGNES RD
16	Combine	9, 10, 13, 15	-------	286.68	-------	493.34	650.57	868.31	-------	1234.19	PR-AP-2 - SE CORNER
17	Combine	11, 12, 14, 16	-------	354.73	-------	634.13	850.01	1151.75	-------	1662.89	PR-AP-3 - COLORADO RIVER

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	10.98	3	804	168,807	------	------	------	EX-DA-1 / EX-AP-1
2	SCS Runoff	44.36	3	750	281,463	------	------	------	EX-DA-OFFSITE
3	SCS Runoff	30.77	3	792	392,306	------	------	------	EX-DA-2
4	SCS Runoff	3.938	3	765	50,899	------	------	------	EX-DA-3
5	Combine	63.75	3	759	724,668	2, 3, 4	------	------	EX-AP-2
6	SCS Runoff	74.29	3	726	248,636	------	------	------	PR-DA-1
7	SCS Runoff	45.20	3	726	151,270	------	------	------	PR-DA-2
8	SCS Runoff	5.631	3	726	21,261	------	------	------	PR-DA-3
9	SCS Runoff	119.75	3	726	399,398	------	------	------	PR-DA-4
10	SCS Runoff	28.56	3	732	128,801	------	------	------	PR-DA-5
11	SCS Runoff	56.40	3	738	275,703	------	------	------	PR-DA-6
12	SCS Runoff	89.62	3	771	788,659	------	------	------	PR-DA-7
13	SCS Runoff	1.724	3	729	7,870	------	------	------	PR-DA-8
14	SCS Runoff	5.329	3	729	24,325	------	------	------	PR-DA-9
15	Combine	142.63	3	726	702,631	2, 6, 7, 8,	------	------	PR-AP-1 - AGNES RD
16	Combine	286.68	3	726	1,238,700	9, 10, 13, 15	------	------	PR-AP-2 - SE CORNER
17	Combine	354.73	3	726	2,327,386	11, 12, 14, 16	------	------	PR-AP-3 - COLORADO RIVER

Hydrograph Report

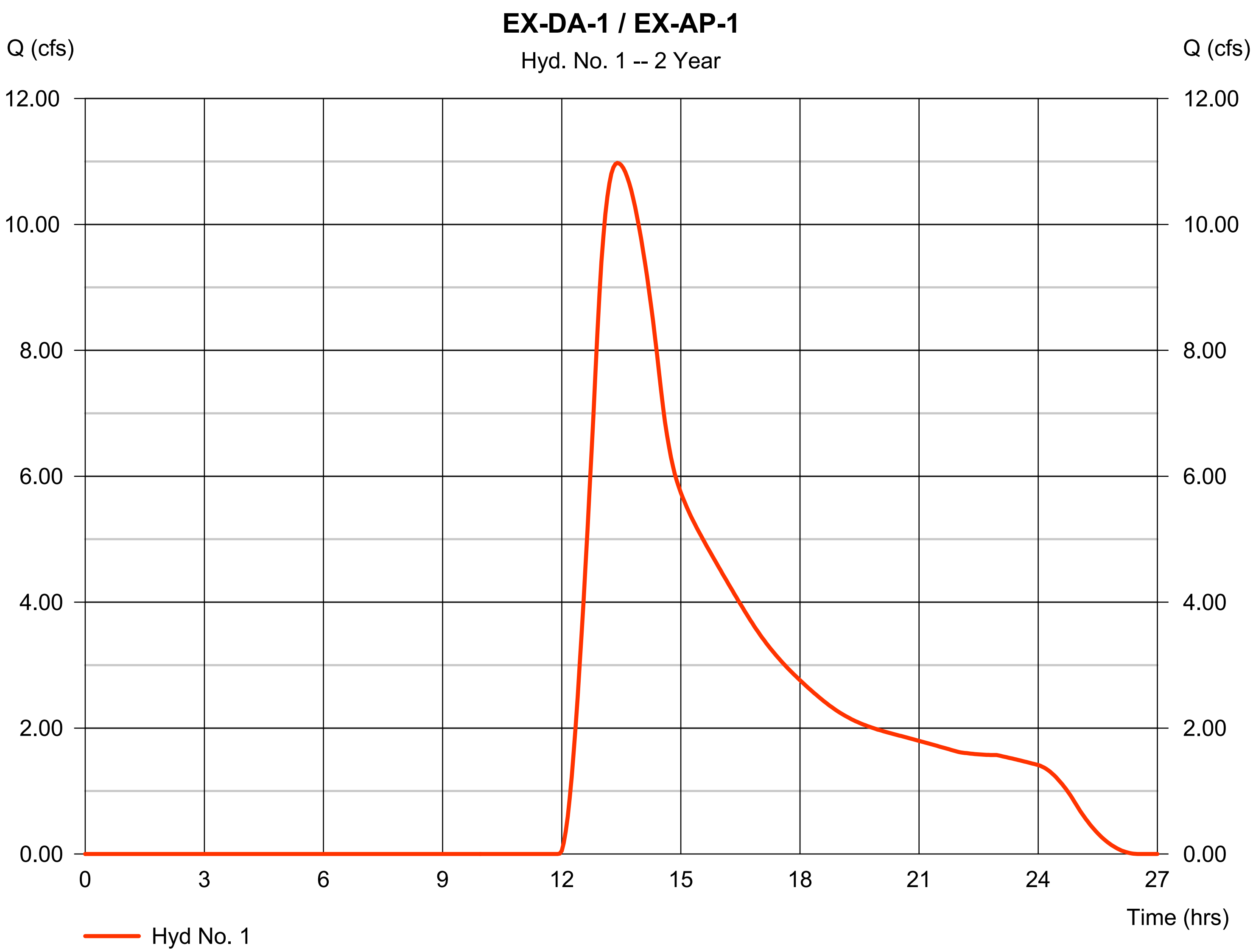
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 | Wednesday, 05 / 16 / 2018

Hyd. No. 1

EX-DA-1 / EX-AP-1

Hydrograph type	= SCS Runoff	Peak discharge	= 10.98 cfs
Storm frequency	= 2 yrs	Time to peak	= 13.40 hrs
Time interval	= 3 min	Hyd. volume	= 168,807 cuft
Drainage area	= 101.790 ac	Curve number	= 57*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 94.50 min
Total precip.	= 3.60 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(84.000 x 61) + (17.790 x 39)] / 101.790



TR55 Tc Worksheet

Hyd. No. 1

EX-DA-1 / EX-AP-1

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.150		0.011		0.011		
Flow length (ft)	=	100.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	3.60		0.00		0.00		
Land slope (%)	=	0.30		0.00		0.00		
Travel Time (min)	**=**	**19.73**	**+**	**0.00**	**+**	**0.00**	**=**	**19.73**
Shallow Concentrated Flow								
Flow length (ft)	=	3154.97		0.00		0.00		
Watercourse slope (%)	=	0.19		0.00		0.00		
Surface description	=	Unpaved		Paved		Paved		
Average velocity (ft/s)	=0.70			0.00		0.00		
Travel Time (min)	**=**	**74.77**	**+**	**0.00**	**+**	**0.00**	**=**	**74.77**
Channel Flow								
X sectional flow area (sqft)	=	0.00		0.00		0.00		
Wetted perimeter (ft)	=	0.00		0.00		0.00		
Channel slope (%)	=	0.00		0.00		0.00		
Manning's n-value	=	0.015		0.015		0.015		
Velocity (ft/s)	=0.00							
				0.00				
						0.00		
Flow length (ft)	({0})0.0			0.0		0.0		
Travel Time (min)	**=**	**0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc .... 94.50 min

Hydrograph Report

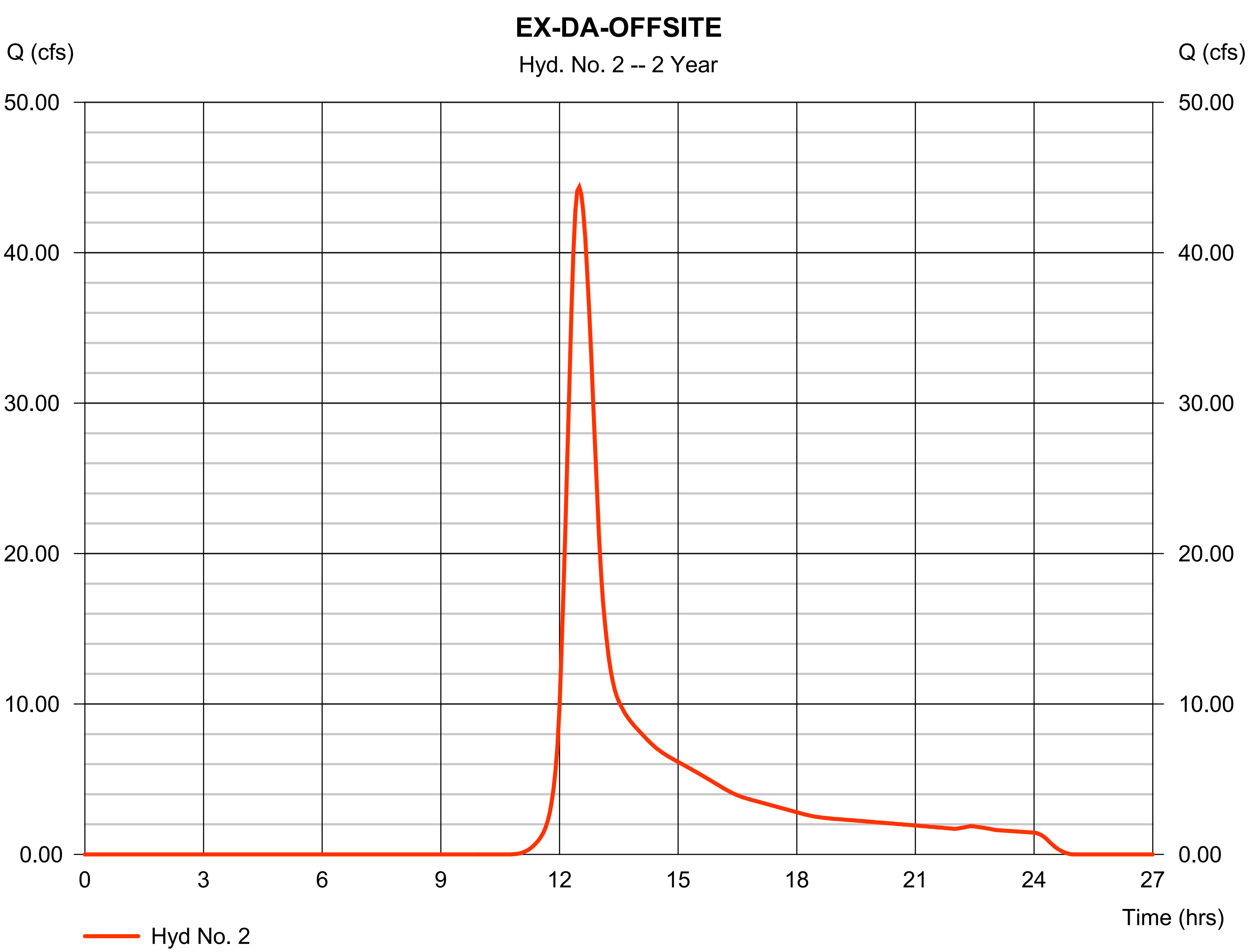
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 05 / 16 / 2018

Hyd. No. 2

EX-DA-OFFSITE

Hydrograph type	= SCS Runoff	Peak discharge	= 44.36 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.50 hrs
Time interval	= 3 min	Hyd. volume	= 281,463 cuft
Drainage area	= 69.840 ac	Curve number	= 71*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 39.80 min
Total precip.	= 3.60 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(19.230 x 98) + (50.610 x 61)] / 69.840



TR55 Tc Worksheet

Hyd. No. 2

EX-DA-OFFSITE

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.011		0.011		0.011		
Flow length (ft)	=	100.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	3.60		0.00		0.00		
Land slope (%)	=	0.50		0.00		0.00		
Travel Time (min)	**=**	**1.99**	**+**	**0.00**	**+**	**0.00**	**=**	**1.99**
Shallow Concentrated Flow								
Flow length (ft)	=	2336.00		0.00		0.00		
Watercourse slope (%)	=	0.50		0.00		0.00		
Surface description	=	Unpaved		Paved		Paved		
Average velocity (ft/s)	=	1.14		0.00		0.00		
Travel Time (min)	**=**	**34.13**	**+**	**0.00**	**+**	**0.00**	**=**	**34.13**
Channel Flow								
X sectional flow area (sqft)	=	18.00		0.00		0.00		
Wetted perimeter (ft)	=	18.00		0.00		0.00		
Channel slope (%)	=	0.50		0.00		0.00		
Manning's n-value	=	0.013		0.015		0.015		
Velocity (ft/s)	=	8.10		0.00		0.00		
Flow length (ft)		({0})1793.0		0.0		0.0		
Travel Time (min)	**=**	**3.69**	**+**	**0.00**	**+**	**0.00**	**=**	**3.69**

Total Travel Time, Tc .... 39.80 min

Hydrograph Report

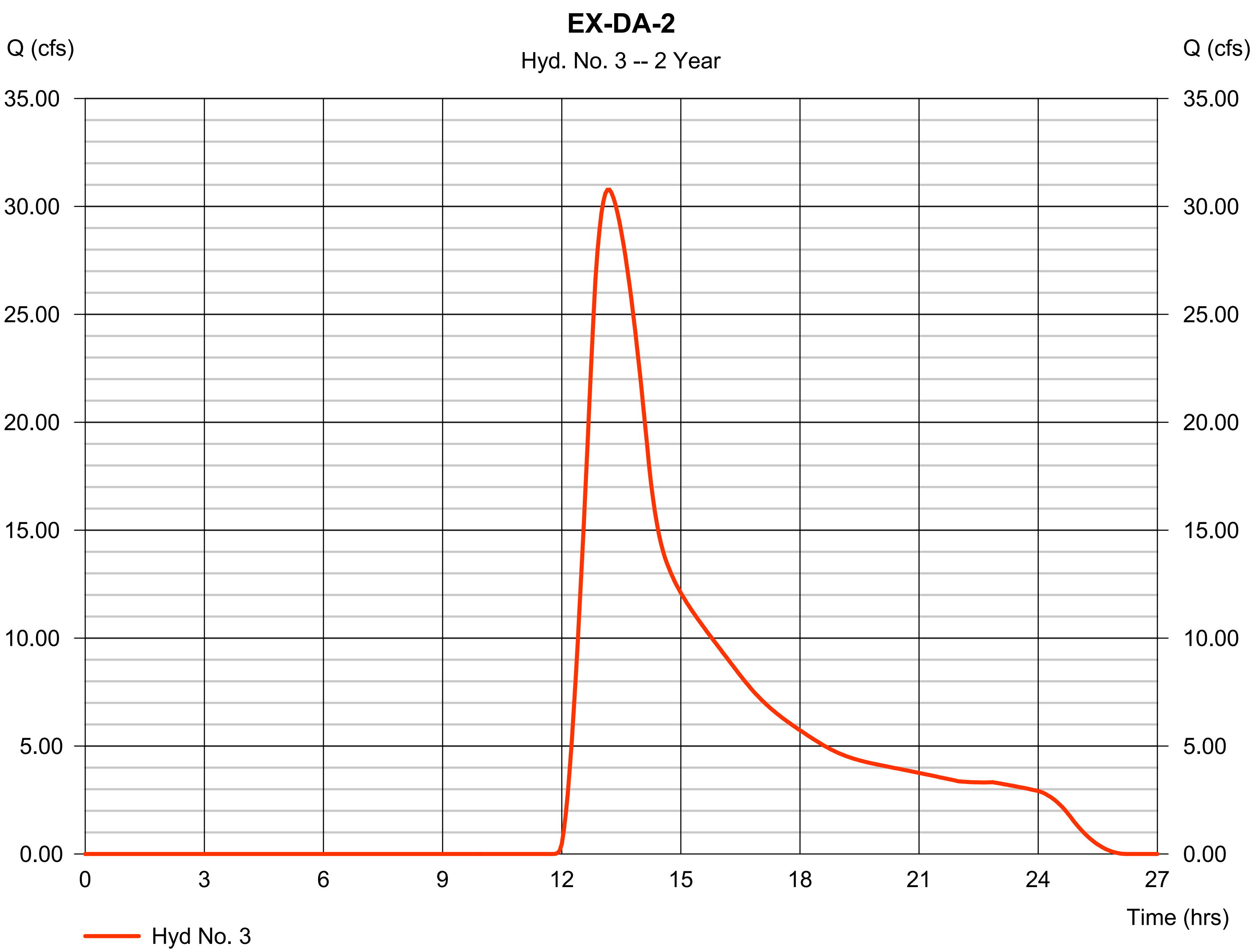
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 3

EX-DA-2

Hydrograph type	= SCS Runoff	Peak discharge	= 30.77 cfs
Storm frequency	= 2 yrs	Time to peak	= 13.20 hrs
Time interval	= 3 min	Hyd. volume	= 392,306 cuft
Drainage area	= 189.310 ac	Curve number	= 60*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 83.86 min
Total precip.	= 3.60 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(183.470 x 61) + (5.840 x 39)] / 189.310



TR55 Tc Worksheet

Hyd. No. 3

EX-DA-2

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.150		0.011		0.011		
Flow length (ft)	=	100.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	3.60		0.00		0.00		
Land slope (%)	=	0.56		0.00		0.00		
Travel Time (min)	**=**	**15.37**	**+**	**0.00**	**+**	**0.00**	**=**	**15.37**
Shallow Concentrated Flow								
Flow length (ft)	=	3712.93		0.00		0.00		
Watercourse slope (%)	=	0.34		0.00		0.00		
Surface description	=	Unpaved		Paved		Paved		
Average velocity (ft/s)	=	0.94		0.00		0.00		
Travel Time (min)	**=**	**65.78**	**+**	**0.00**	**+**	**0.00**	**=**	**65.78**
Channel Flow								
X sectional flow area (sqft)	=	200.00		0.00		0.00		
Wetted perimeter (ft)	=	60.00		0.00		0.00		
Channel slope (%)	=	1.58		0.00		0.00		
Manning's n-value	=	0.026		0.015		0.015		
Velocity (ft/s)	=	16.14		0.00		0.00		
Flow length (ft)		({0})2631.6		0.0		0.0		
Travel Time (min)	**=**	**2.72**	**+**	**0.00**	**+**	**0.00**	**=**	**2.72**
Total Travel Time, Tc								**83.86 min**

Hydrograph Report

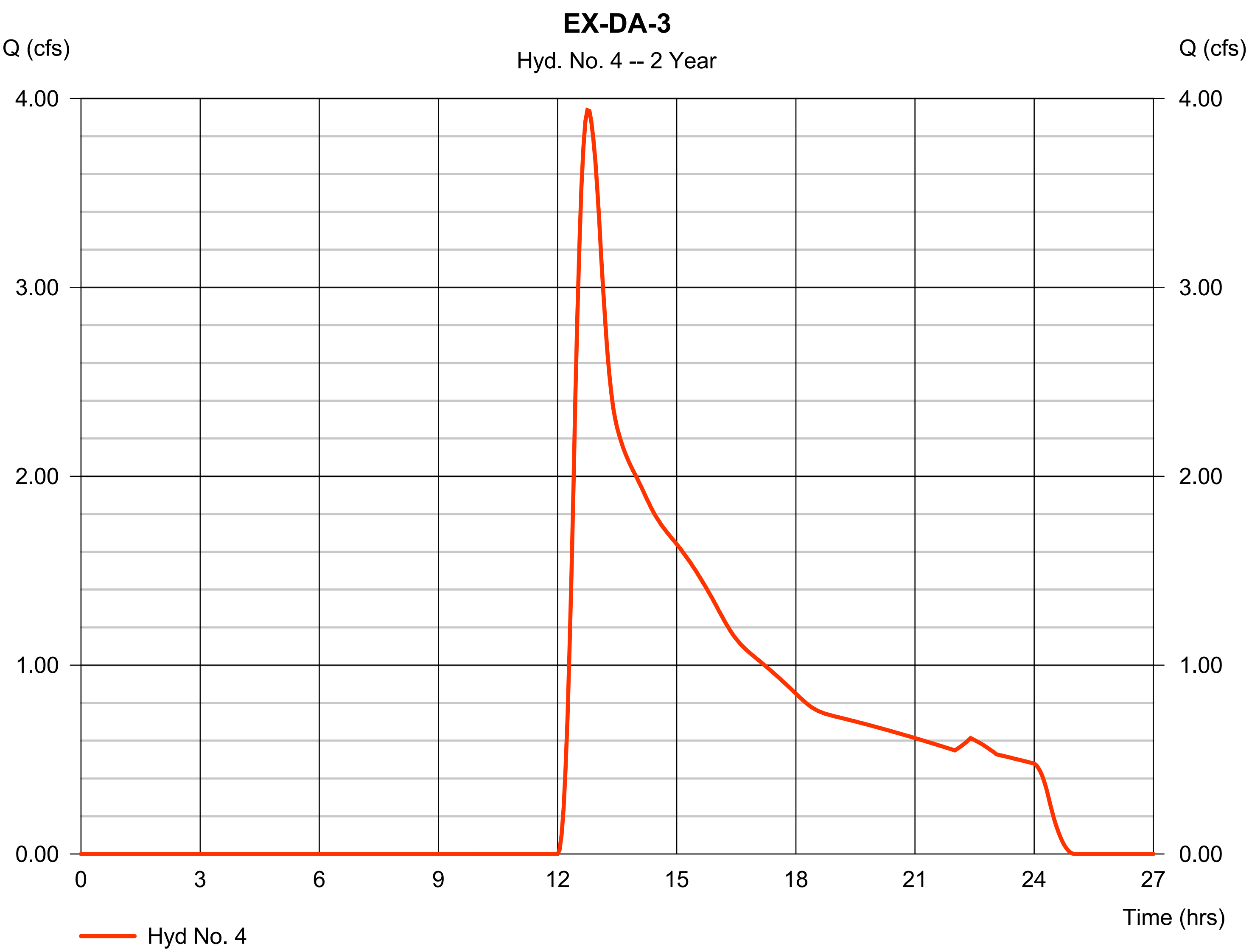
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 4

EX-DA-3

Hydrograph type	= SCS Runoff	Peak discharge	= 3.938 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.75 hrs
Time interval	= 3 min	Hyd. volume	= 50,899 cuft
Drainage area	= 50.910 ac	Curve number	= 52*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 38.30 min
Total precip.	= 3.60 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(30.546 x 61) + (20.364 x 39)] / 50.910



TR55 Tc Worksheet

Hyd. No. 4

EX-DA-3

Description		**A**		**B**		**C**		**Totals**
Sheet Flow								
Manning's n-value	=	0.150		0.011		0.011		
Flow length (ft)	=	100.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	3.60		0.00		0.00		
Land slope (%)	=	0.36		0.00		0.00		
Travel Time (min)	**=**	**18.34**	**+**	**0.00**	**+**	**0.00**	**=**	**18.34**
Shallow Concentrated Flow								
Flow length (ft)	=	1684.20		0.00		0.00		
Watercourse slope (%)	=	0.76		0.00		0.00		
Surface description	=	Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.41			0.00		0.00		
Travel Time (min)	**=**	**19.96**	**+**	**0.00**	**+**	**0.00**	**=**	**19.96**
Channel Flow								
X sectional flow area (sqft)	=	0.00		0.00		0.00		
Wetted perimeter (ft)	=	0.00		0.00		0.00		
Channel slope (%)	=	0.00		0.00		0.00		
Manning's n-value	=	0.015		0.015		0.015		
Velocity (ft/s)	=0.00			0.00		0.00		
Flow length (ft)	({0})0.0			0.0		0.0		
Travel Time (min)	**=**	**0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc .... 38.30 min

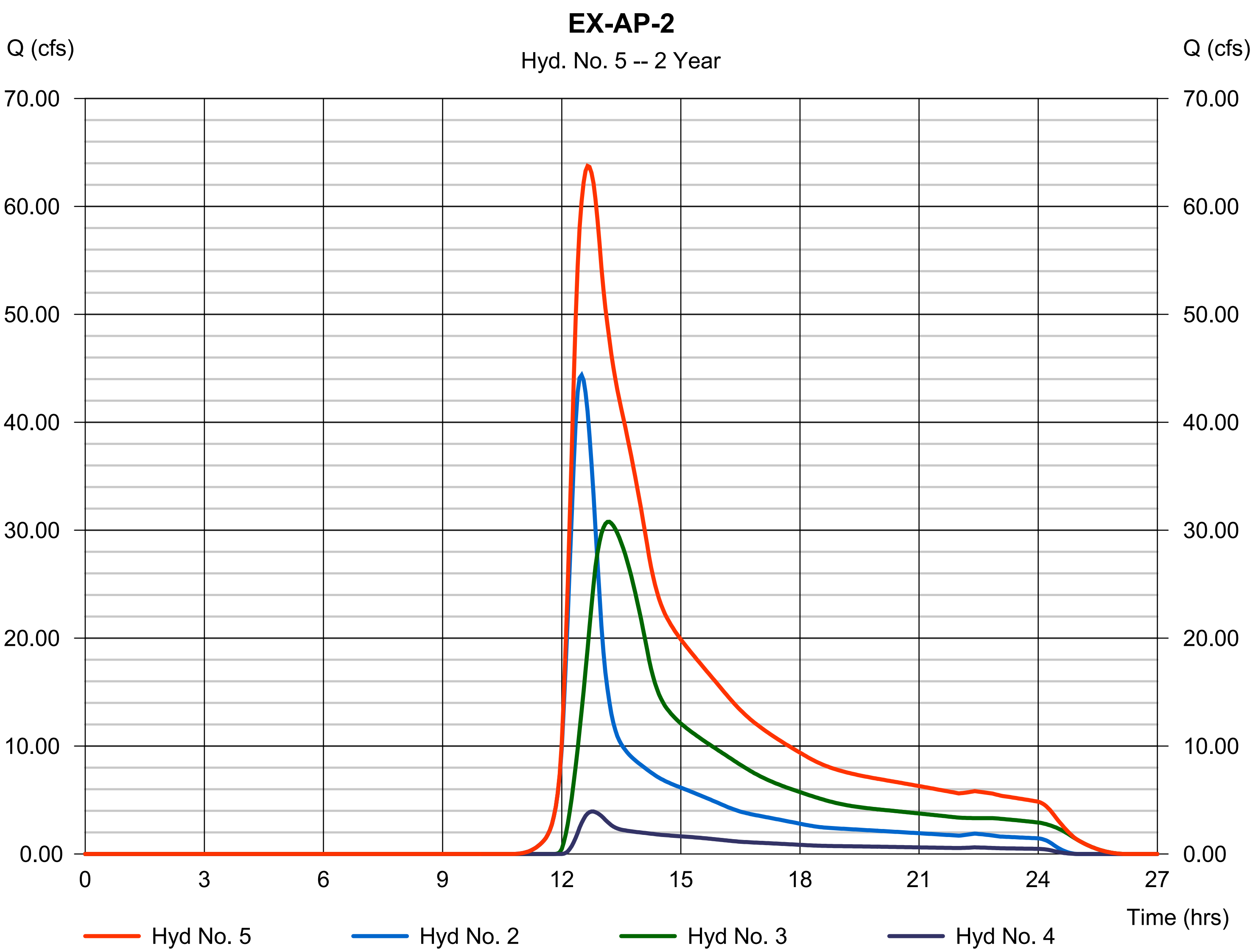
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 | Wednesday, 05 / 16 / 2018

Hyd. No. 5

EX-AP-2

Hydrograph type	= Combine	Peak discharge	= 63.75 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.65 hrs
Time interval	= 3 min	Hyd. volume	= 724,668 cuft
Inflow hyds.	= 2, 3, 4	Contrib. drain. area	= 310.060 ac



Hydrograph Report

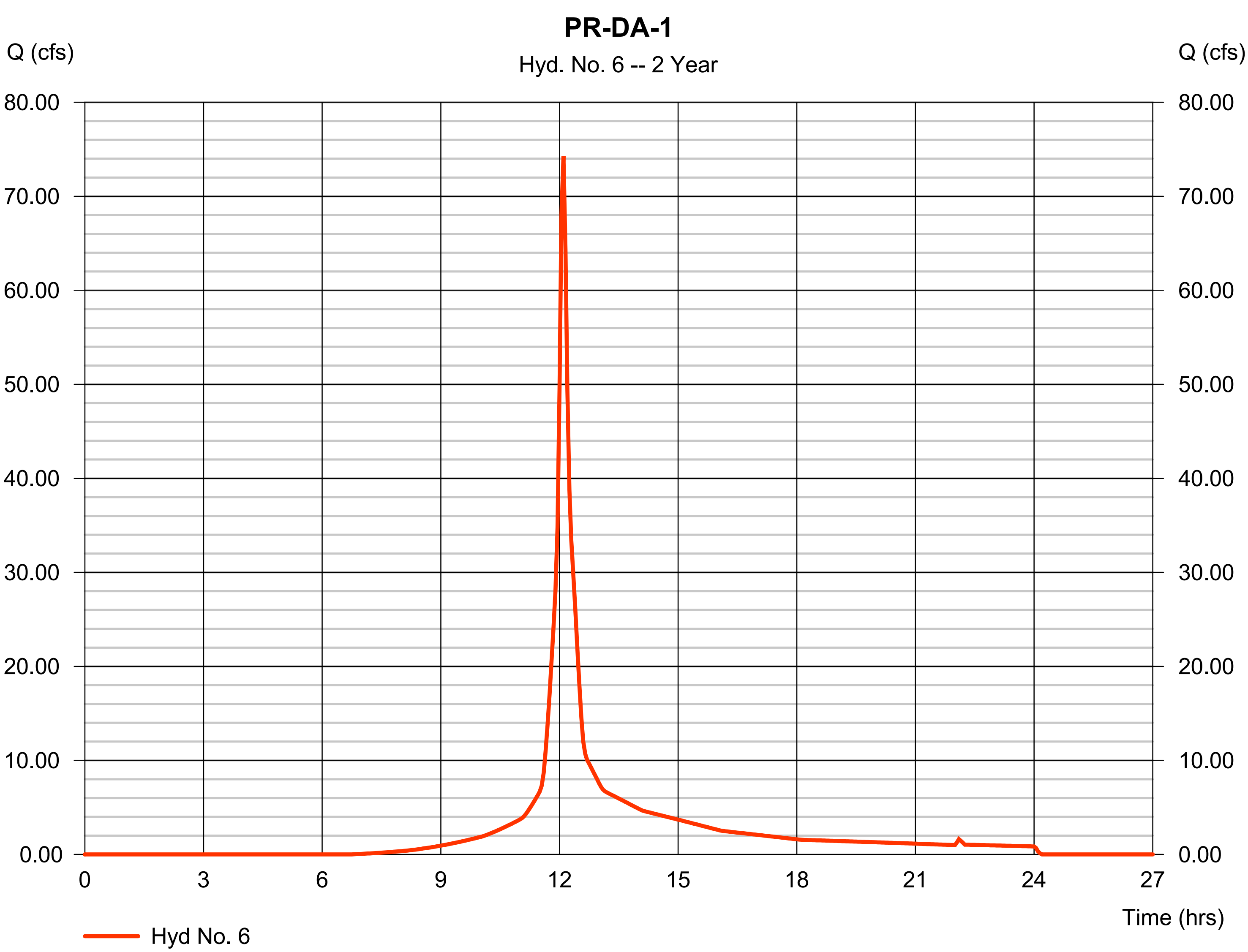
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 05 / 16 / 2018

Hyd. No. 6

PR-DA-1

Hydrograph type	= SCS Runoff	Peak discharge	= 74.29 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 248,636 cuft
Drainage area	= 32.150 ac	Curve number	= 87*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 7.60 min
Total precip.	= 3.60 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(22.300 x 98) + (9.560 x 61)] / 32.150



TR55 Tc Worksheet

Hyd. No. 6

PR-DA-1

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.011	0.011	0.011	
Flow length (ft)	= 100.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.60	0.00	0.00	
Land slope (%)	= 0.50	0.00	0.00	
Travel Time (min)	**= 1.99**	**+ 0.00**	**+ 0.00**	**= 1.99**
Shallow Concentrated Flow				
Flow length (ft)	= 152.00	0.00	0.00	
Watercourse slope (%)	= 0.50	0.00	0.00	
Surface description	= Unpaved	Unpaved	Paved	
Average velocity (ft/s)	=1.14	0.00	0.00	
Travel Time (min)	**= 2.22**	**+ 0.00**	**+ 0.00**	**= 2.22**
Channel Flow				
X sectional flow area (sqft)	= 27.58	0.00	0.00	
Wetted perimeter (ft)	= 15.88	0.00	0.00	
Channel slope (%)	= 0.50	0.00	0.00	
Manning's n-value	= 0.013	0.015	0.015	
Velocity (ft/s)	=11.73	0.00	0.00	
Flow length (ft)	({0})2403.0	0.0	0.0	
Travel Time (min)	**= 3.41**	**+ 0.00**	**+ 0.00**	**= 3.41**

Total Travel Time, Tc .... 7.60 min

Hydrograph Report

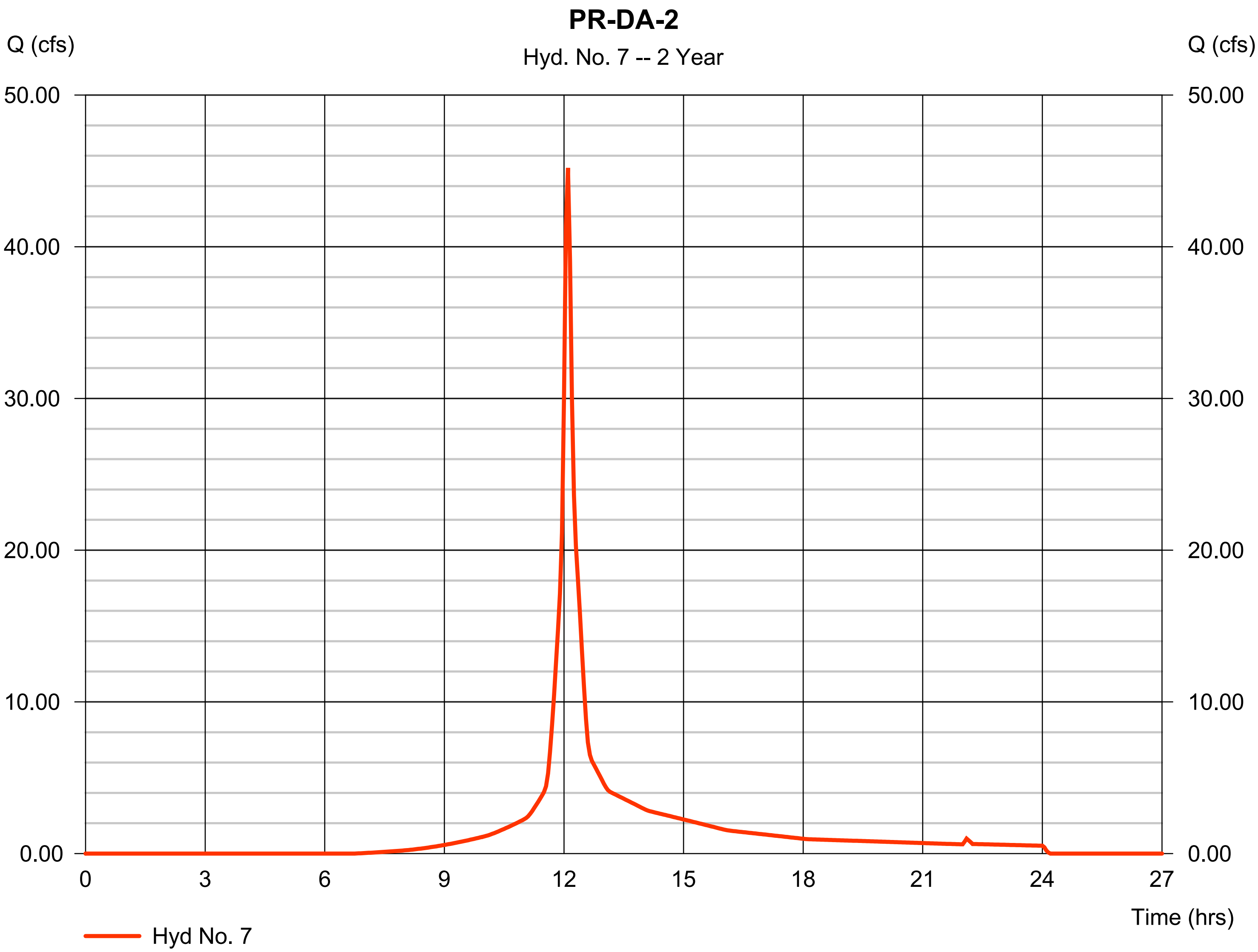
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 05 / 16 / 2018

Hyd. No. 7

PR-DA-2

Hydrograph type	= SCS Runoff	Peak discharge	= 45.20 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 151,270 cuft
Drainage area	= 19.560 ac	Curve number	= 87*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 7.60 min
Total precip.	= 3.60 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(13.580 x 98) + (5.820 x 61)] / 19.560



TR55 Tc Worksheet

Hyd. No. 7

PR-DA-2

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.011		0.011		0.011		
Flow length (ft)	=	100.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	3.60		0.00		0.00		
Land slope (%)	=	0.50		0.00		0.00		
Travel Time (min)	**=**	**1.99**	**+**	**0.00**	**+**	**0.00**	**=**	**1.99**
Shallow Concentrated Flow								
Flow length (ft)	=	217.47		0.00		0.00		
Watercourse slope (%)	=	0.50		0.00		0.00		
Surface description	=	Unpaved		Unpaved		Paved		
Average velocity (ft/s)	=	1.14		0.00		0.00		
Travel Time (min)	**=**	**3.18**	**+**	**0.00**	**+**	**0.00**	**=**	**3.18**
Channel Flow								
X sectional flow area (sqft)	=	19.15		0.00		0.00		
Wetted perimeter (ft)	=	13.23		0.00		0.00		
Channel slope (%)	=	0.50		0.00		0.00		
Manning's n-value	=	0.013		0.015		0.015		
Velocity (ft/s)	=	10.38		0.00		0.00		
Flow length (ft)		({0})1518.0		0.0		0.0		
Travel Time (min)	**=**	**2.44**	**+**	**0.00**	**+**	**0.00**	**=**	**2.44**

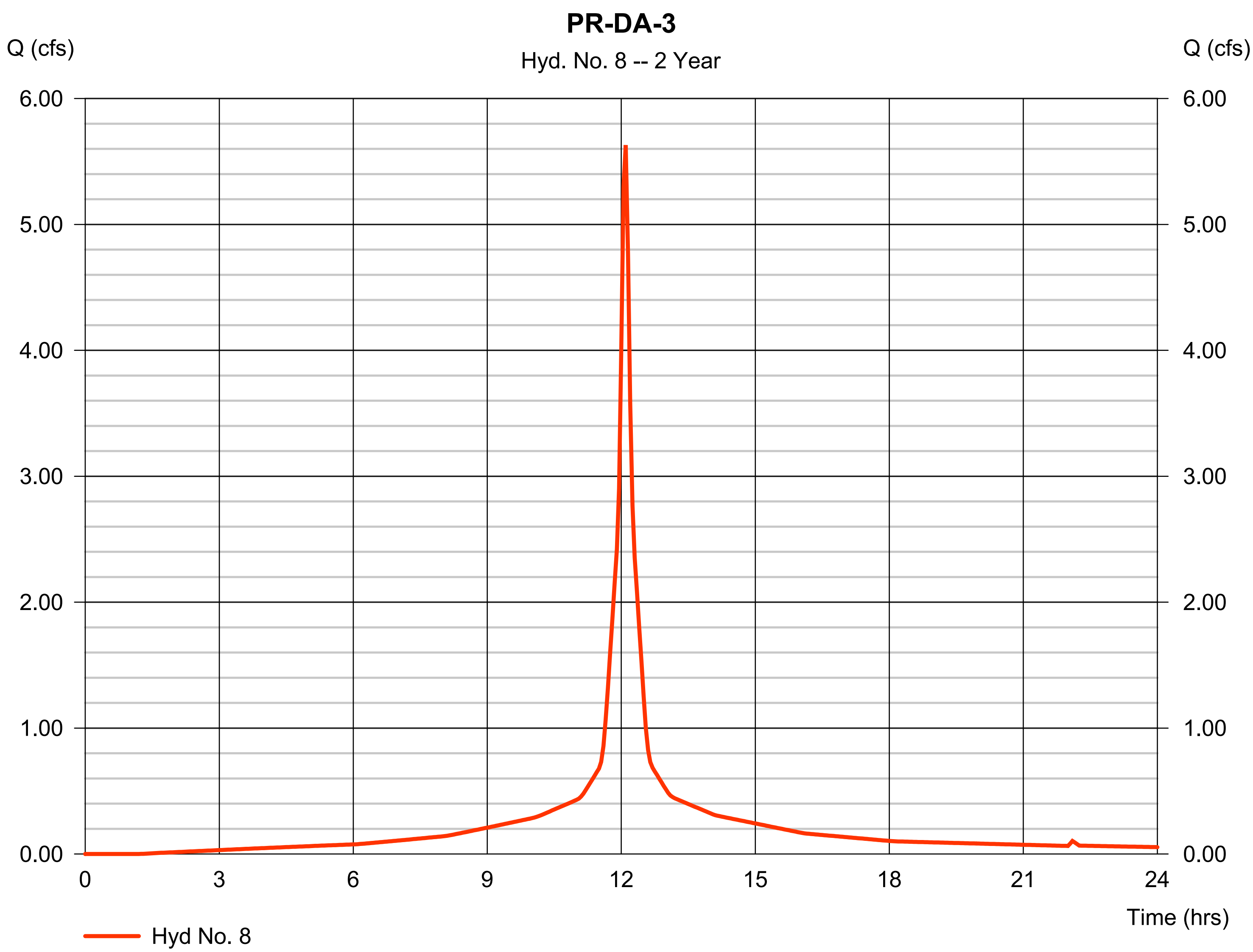
Total Travel Time, Tc .... 7.60 min

Hydrograph Report

Hyd. No. 8

PR-DA-3

Hydrograph type	= SCS Runoff	Peak discharge	= 5.631 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 21,261 cuft
Drainage area	= 1.856 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 4.80 min
Total precip.	= 3.60 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 8

PR-DA-3

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.011		0.011		0.011		
Flow length (ft)	=	50.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	3.60		0.00		0.00		
Land slope (%)	=	2.00		0.00		0.00		
Travel Time (min)	**=**	**0.66**	**+**	**0.00**	**+**	**0.00**	**=**	**0.66**
Shallow Concentrated Flow								
Flow length (ft)	=	198.00		0.00		0.00		
Watercourse slope (%)	=	1.00		0.00		0.00		
Surface description	=	Paved		Paved		Paved		
Average velocity (ft/s)	=	2.03		0.00		0.00		
Travel Time (min)	**=**	**1.62**	**+**	**0.00**	**+**	**0.00**	**=**	**1.62**
Channel Flow								
X sectional flow area (sqft)	=	27.58		0.00		0.00		
Wetted perimeter (ft)	=	15.88		0.00		0.00		
Channel slope (%)	=	0.50		0.00		0.00		
Manning's n-value	=	0.013		0.015		0.015		
Velocity (ft/s)	=	11.73		0.00		0.00		
Flow length (ft)		({0})1748.1		0.0		0.0		
Travel Time (min)	**=**	**2.48**	**+**	**0.00**	**+**	**0.00**	**=**	**2.48**

Total Travel Time, Tc .... 4.80 min

Hydrograph Report

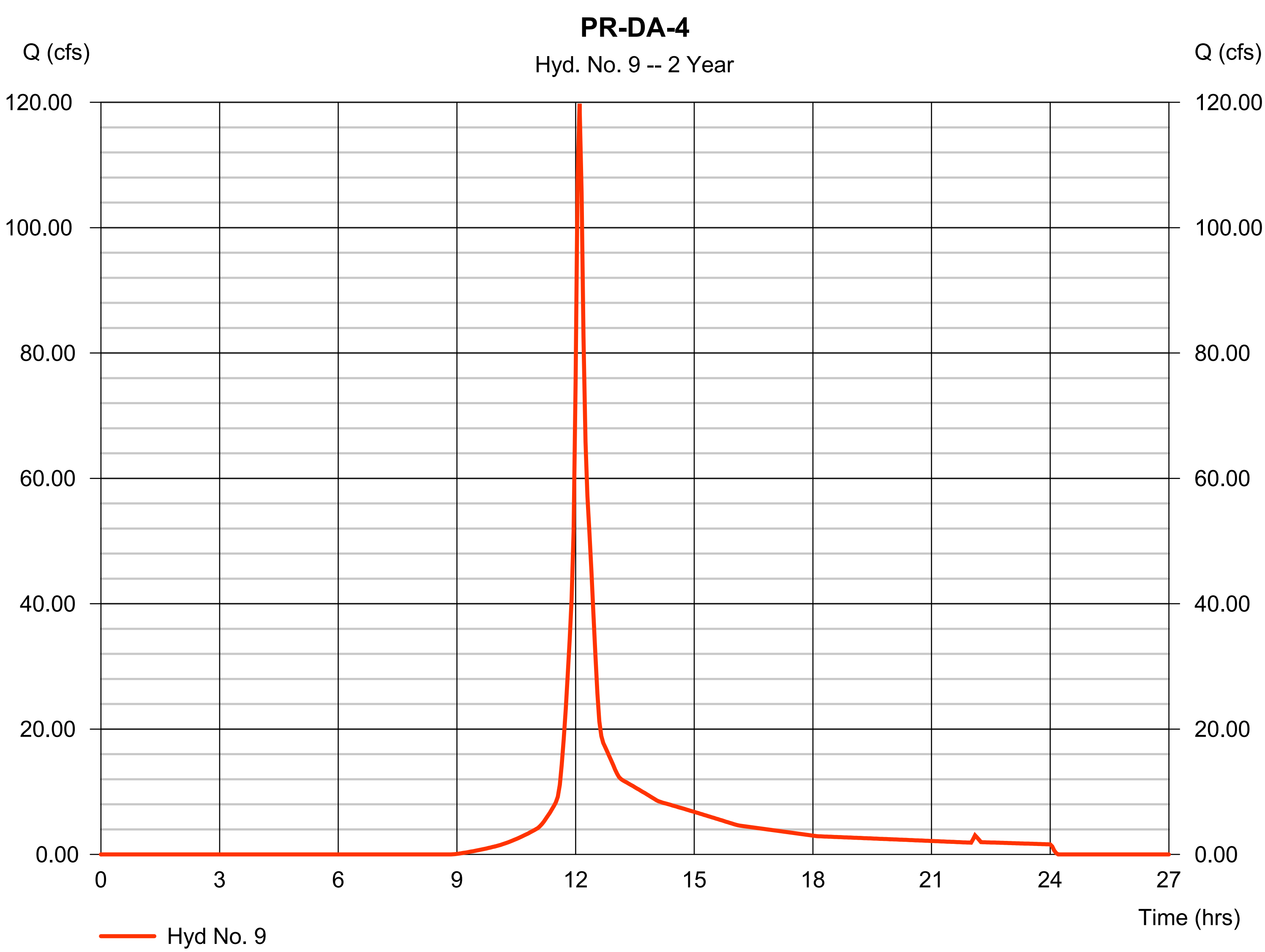
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 9

PR-DA-4

Hydrograph type	= SCS Runoff	Peak discharge	= 119.75 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 399,398 cuft
Drainage area	= 68.390 ac	Curve number	= 80*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.10 min
Total precip.	= 3.60 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(34.190 x 98) + (34.200 x 61)] / 68.390



TR55 Tc Worksheet

Hyd. No. 9

PR-DA-4

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.011		0.011		0.011		
Flow length (ft)	=	100.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	3.60		0.00		0.00		
Land slope (%)	=	0.50		0.00		0.00		
Travel Time (min)	**=**	**1.99**	**+**	**0.00**	**+**	**0.00**	**=**	**1.99**
Shallow Concentrated Flow								
Flow length (ft)	=	110.95		0.00		0.00		
Watercourse slope (%)	=	0.50		0.00		0.00		
Surface description	=	Unpaved		Paved		Paved		
Average velocity (ft/s)	=	1.14		0.00		0.00		
Travel Time (min)	**=**	**1.62**	**+**	**0.00**	**+**	**0.00**	**=**	**1.62**
Channel Flow								
X sectional flow area (sqft)	=	37.54		0.00		0.00		
Wetted perimeter (ft)	=	18.53		0.00		0.00		
Channel slope (%)	=	0.50		0.00		0.00		
Manning's n-value	=	0.013		0.015		0.015		
Velocity (ft/s)	=	13.01		0.00		0.00		
Flow length (ft)		({0})3491.2		0.0		0.0		
Travel Time (min)	**=**	**4.47**	**+**	**0.00**	**+**	**0.00**	**=**	**4.47**

Total Travel Time, Tc .... 8.10 min

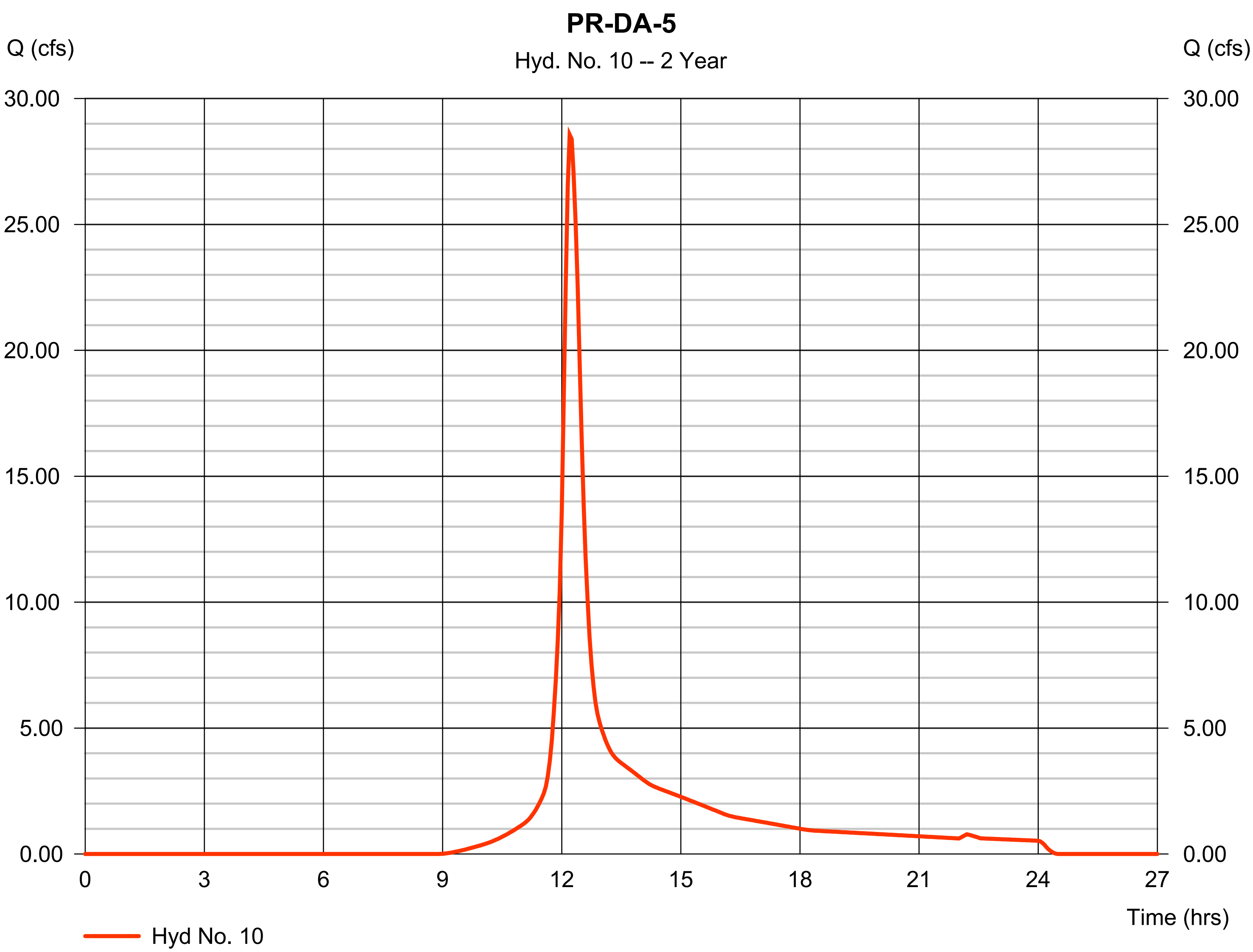
Hydrograph Report

Hyd. No. 10

PR-DA-5

Hydrograph type	= SCS Runoff	Peak discharge	= 28.56 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.20 hrs
Time interval	= 3 min	Hyd. volume	= 128,801 cuft
Drainage area	= 20.050 ac	Curve number	= 80*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18.40 min
Total precip.	= 3.60 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(10.167 x 98) + (10.167 x 61)] / 20.050



TR55 Tc Worksheet

Hyd. No. 10

PR-DA-5

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.011		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.60		0.00		0.00		
Land slope (%)	= 0.50		0.00		0.00		
Travel Time (min)	**= 1.99**	**+**	**0.00**	**+**	**0.00**	**=**	**1.99**
Shallow Concentrated Flow							
Flow length (ft)	= 918.22		0.00		0.00		
Watercourse slope (%)	= 0.50		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.14		0.00		0.00		
Travel Time (min)	**= 13.41**	**+**	**0.00**	**+**	**0.00**	**=**	**13.41**
Channel Flow							
X sectional flow area (sqft)	= 86.78		0.00		0.00		
Wetted perimeter (ft)	= 34.61		0.00		0.00		
Channel slope (%)	= 0.30		0.00		0.00		
Manning's n-value	= 0.026		0.015		0.015		
Velocity (ft/s)	=5.81						
			0.00				
					0.00		
Flow length (ft)	({0})1031.6		0.0		0.0		
Travel Time (min)	**= 2.96**	**+**	**0.00**	**+**	**0.00**	**=**	**2.96**

Total Travel Time, Tc .... 18.40 min

Hydrograph Report

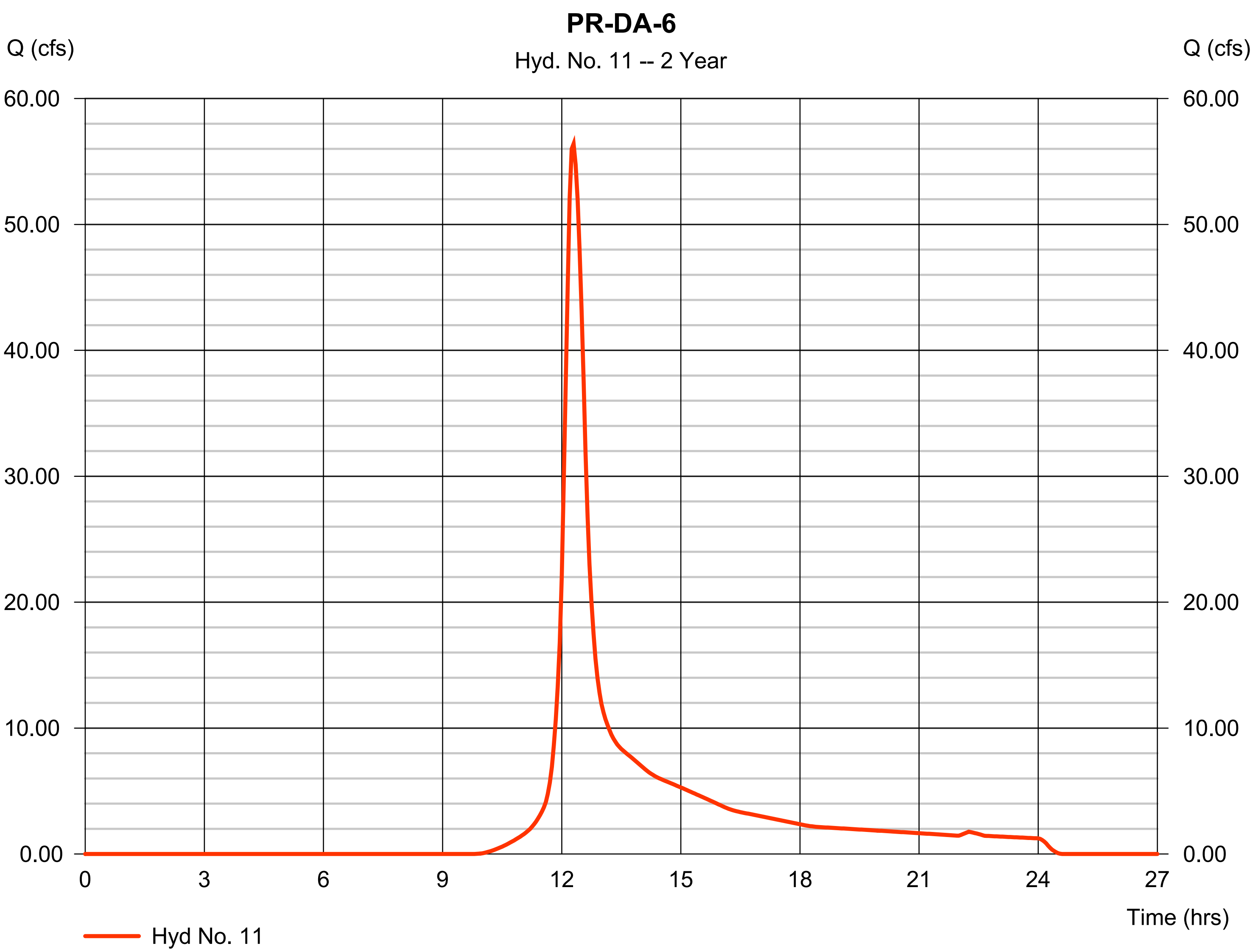
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 11

PR-DA-6

Hydrograph type	= SCS Runoff	Peak discharge	= 56.40 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.30 hrs
Time interval	= 3 min	Hyd. volume	= 275,703 cuft
Drainage area	= 54.160 ac	Curve number	= 76*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 24.60 min
Total precip.	= 3.60 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(19.630 x 61) + (7.450 x 39) + (27.080 x 98)] / 54.160



TR55 Tc Worksheet

Hyd. No. 11

PR-DA-6

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.011		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.60		0.00		0.00		
Land slope (%)	= 0.50		0.00		0.00		
Travel Time (min)	**= 1.99**	**+**	**0.00**	**+**	**0.00**	**=**	**1.99**
Shallow Concentrated Flow							
Flow length (ft)	= 1884.20		0.00		0.00		
Watercourse slope (%)	= 0.74		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.39		0.00		0.00		
Travel Time (min)	**= 22.63**	**+**	**0.00**	**+**	**0.00**	**=**	**22.63**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc .... **24.60 min**

Hydrograph Report

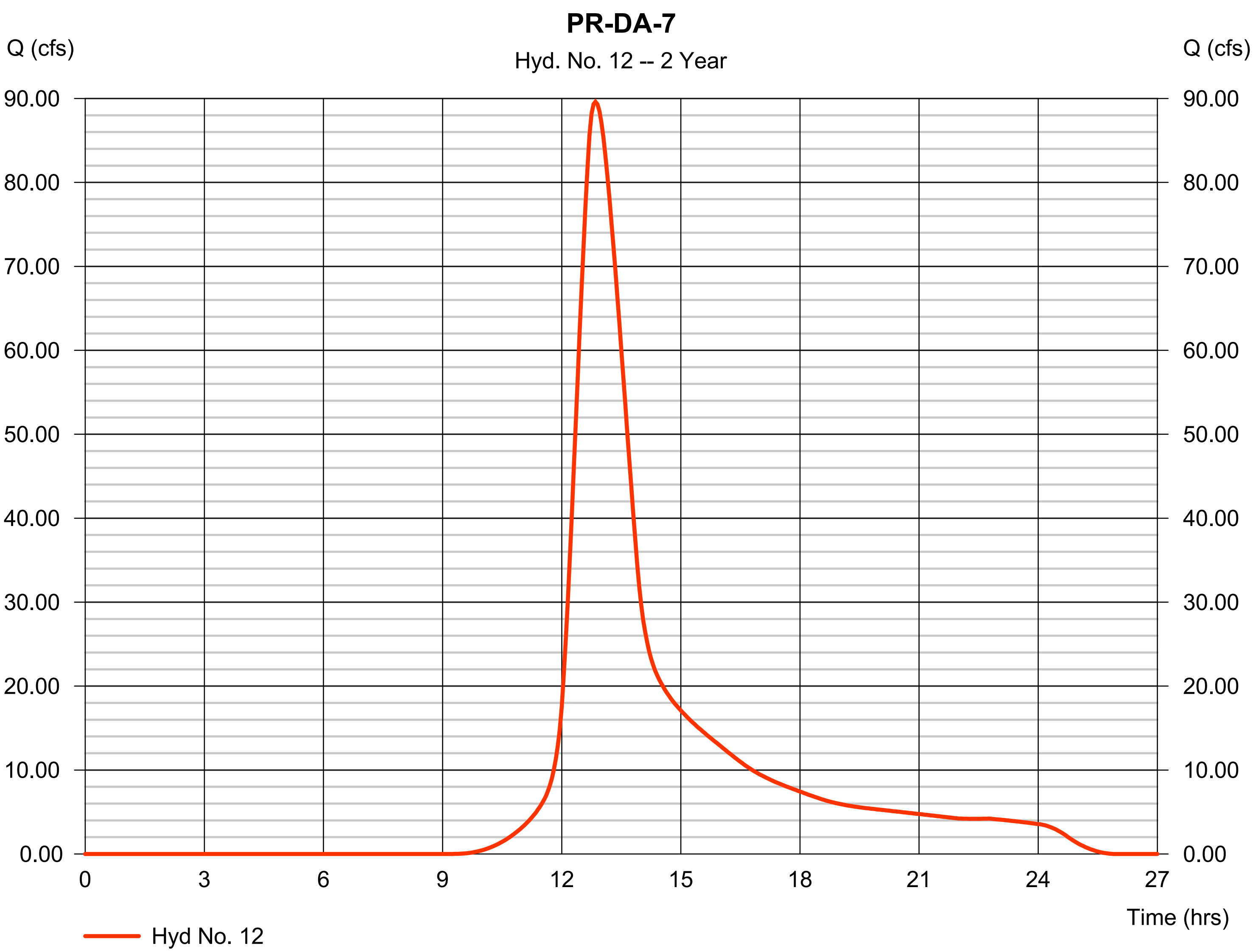
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 05 / 16 / 2018

Hyd. No. 12

PR-DA-7

Hydrograph type	= SCS Runoff	Peak discharge	= 89.62 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.85 hrs
Time interval	= 3 min	Hyd. volume	= 788,659 cuft
Drainage area	= 132.150 ac	Curve number	= 79*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 71.80 min
Total precip.	= 3.60 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(66.080 x 98) + (66.070 x 61)] / 132.150



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12

Hyd. No. 12

PR-DA-7

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.011		0.011		0.011		
Flow length (ft)	=	100.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	3.60		0.00		0.00		
Land slope (%)	=	0.50		0.00		0.00		
Travel Time (min)	**=**	**1.99**	**+**	**0.00**	**+**	**0.00**	**=**	**1.99**
Shallow Concentrated Flow								
Flow length (ft)	=	3242.18		0.00		0.00		
Watercourse slope (%)	=	0.23		0.00		0.00		
Surface description	=	Unpaved		Paved		Paved		
Average velocity (ft/s)	=	0.77		0.00		0.00		
Travel Time (min)	**=**	**69.83**	**+**	**0.00**	**+**	**0.00**	**=**	**69.83**
Channel Flow								
X sectional flow area (sqft)	=	0.00		0.00		0.00		
Wetted perimeter (ft)	=	0.00		0.00		0.00		
Channel slope (%)	=	0.00		0.00		0.00		
Manning's n-value	=	0.015		0.015		0.015		
Velocity (ft/s)	=	0.00		0.00		0.00		
Flow length (ft)	({0})	0.0		0.0		0.0		
Travel Time (min)	**=**	**0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc .... 71.80 min

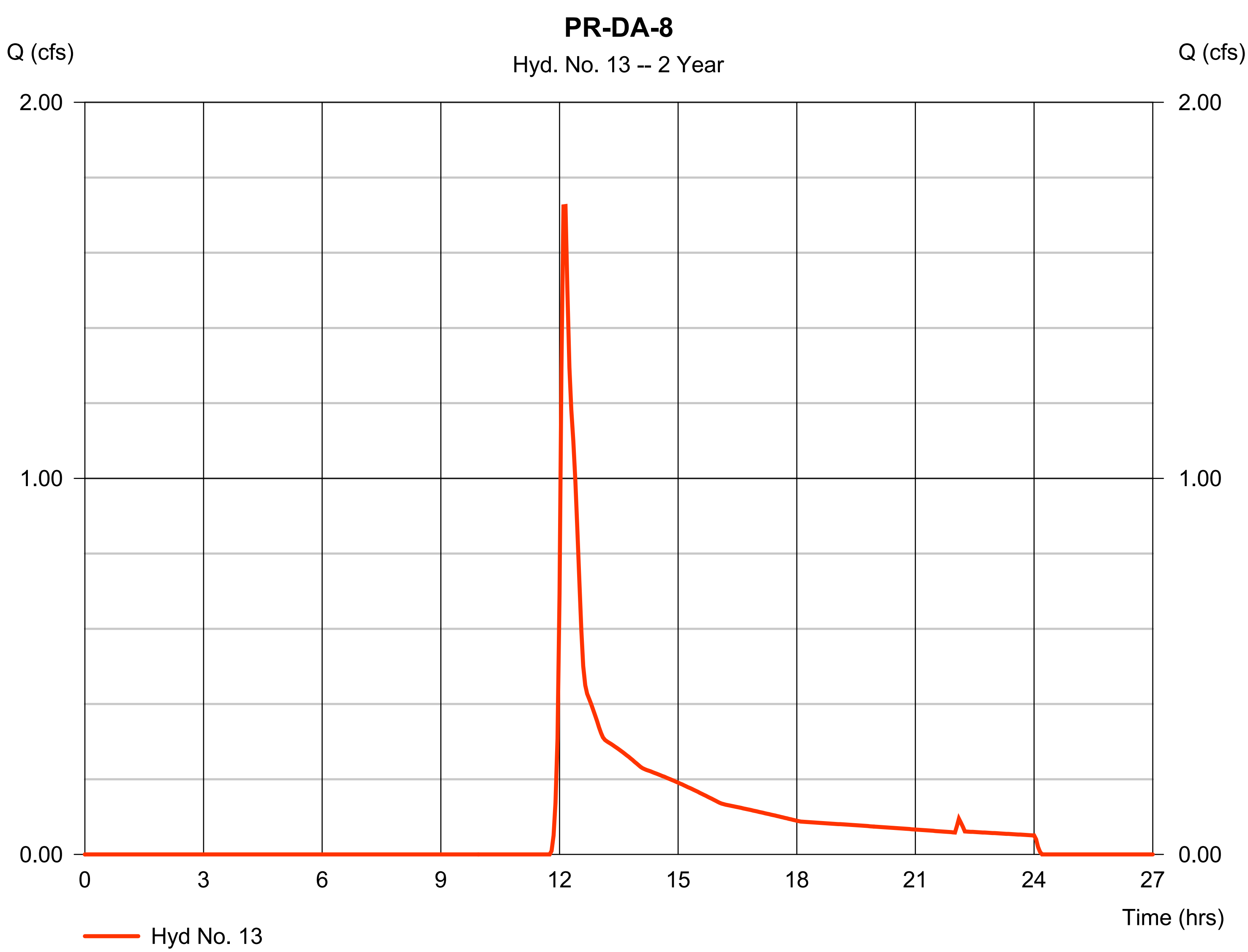
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 05 / 16 / 2018

Hyd. No. 13

PR-DA-8

Hydrograph type	= SCS Runoff	Peak discharge	= 1.724 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.15 hrs
Time interval	= 3 min	Hyd. volume	= 7,870 cuft
Drainage area	= 3.740 ac	Curve number	= 61
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 4.90 min
Total precip.	= 3.60 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 13

PR-DA-8

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.011		0.011		0.011		
Flow length (ft)	=	0.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	0.00		0.00		0.00		
Land slope (%)	=	0.00		0.00		0.00		
Travel Time (min)	**=**	**0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Shallow Concentrated Flow								
Flow length (ft)	=	0.00		0.00		0.00		
Watercourse slope (%)	=	0.00		0.00		0.00		
Surface description	=	Paved		Paved		Paved		
Average velocity (ft/s)	=	0.00		0.00		0.00		
Travel Time (min)	**=**	**0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Channel Flow								
X sectional flow area (sqft)	=	86.78		0.00		0.00		
Wetted perimeter (ft)	=	34.61		0.00		0.00		
Channel slope (%)	=	0.30		0.00		0.00		
Manning's n-value	=	0.026		0.015		0.015		
Velocity (ft/s)	=	5.81		0.00		0.00		
Flow length (ft)		({0})1715.4		0.0		0.0		
Travel Time (min)	**=**	**4.92**	**+**	**0.00**	**+**	**0.00**	**=**	**4.92**

Total Travel Time, Tc .... 4.90 min

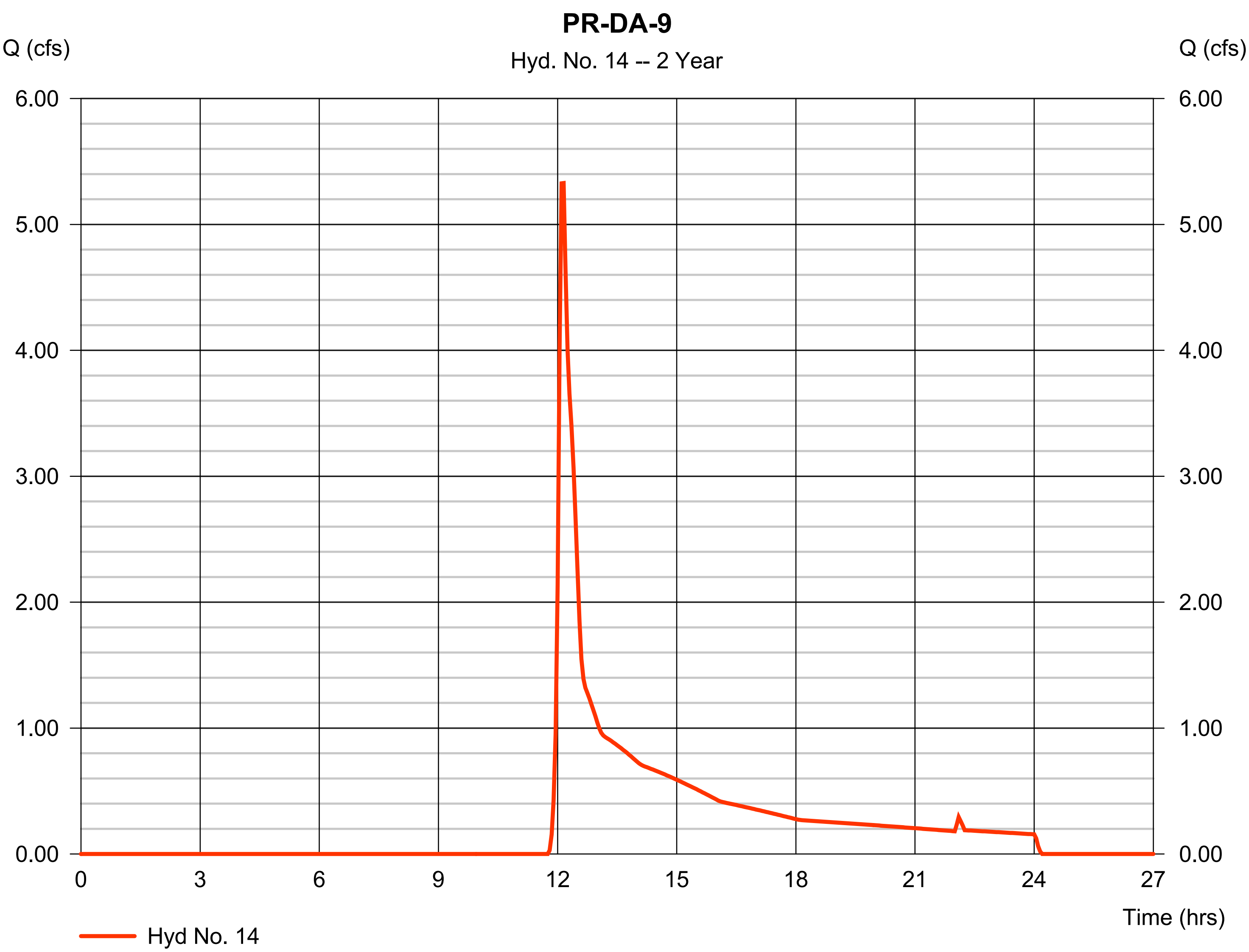
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 | Wednesday, 05 / 16 / 2018

Hyd. No. 14

PR-DA-9

Hydrograph type	= SCS Runoff	Peak discharge	= 5.329 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.15 hrs
Time interval	= 3 min	Hyd. volume	= 24,325 cuft
Drainage area	= 11.560 ac	Curve number	= 61
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.70 min
Total precip.	= 3.60 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 14

PR-DA-9

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.011		0.011		0.011		
Flow length (ft)	=	0.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	0.00		0.00		0.00		
Land slope (%)	=	0.00		0.00		0.00		
Travel Time (min)	**=**	**0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Shallow Concentrated Flow								
Flow length (ft)	=	0.00		0.00		0.00		
Watercourse slope (%)	=	0.00		0.00		0.00		
Surface description	=	Paved		Paved		Paved		
Average velocity (ft/s)	=	0.00		0.00		0.00		
Travel Time (min)	**=**	**0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Channel Flow								
X sectional flow area (sqft)	=	320.00		0.00		0.00		
Wetted perimeter (ft)	=	65.25		0.00		0.00		
Channel slope (%)	=	0.30		0.00		0.00		
Manning's n-value	=	0.026		0.015		0.015		
Velocity (ft/s)	=	9.11		0.00		0.00		
Flow length (ft)		({0})3133.0		0.0		0.0		
Travel Time (min)	**=**	**5.73**	**+**	**0.00**	**+**	**0.00**	**=**	**5.73**

Total Travel Time, Tc .... 5.70 min

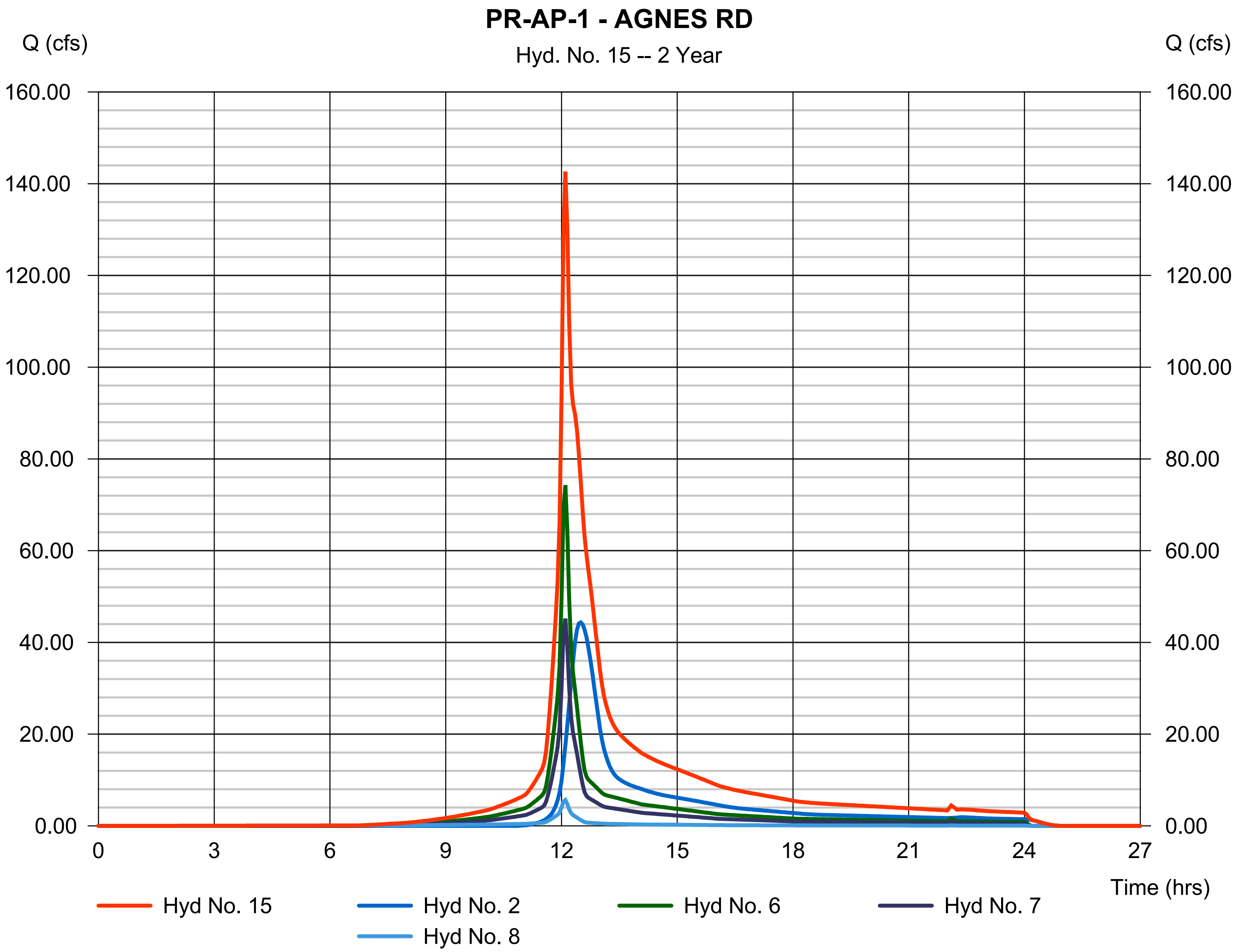
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 15

PR-AP-1 - AGNES RD

Hydrograph type	= Combine	Peak discharge	= 142.63 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 702,631 cuft
Inflow hyds.	= 2, 6, 7, 8	Contrib. drain. area	= 123.406 ac



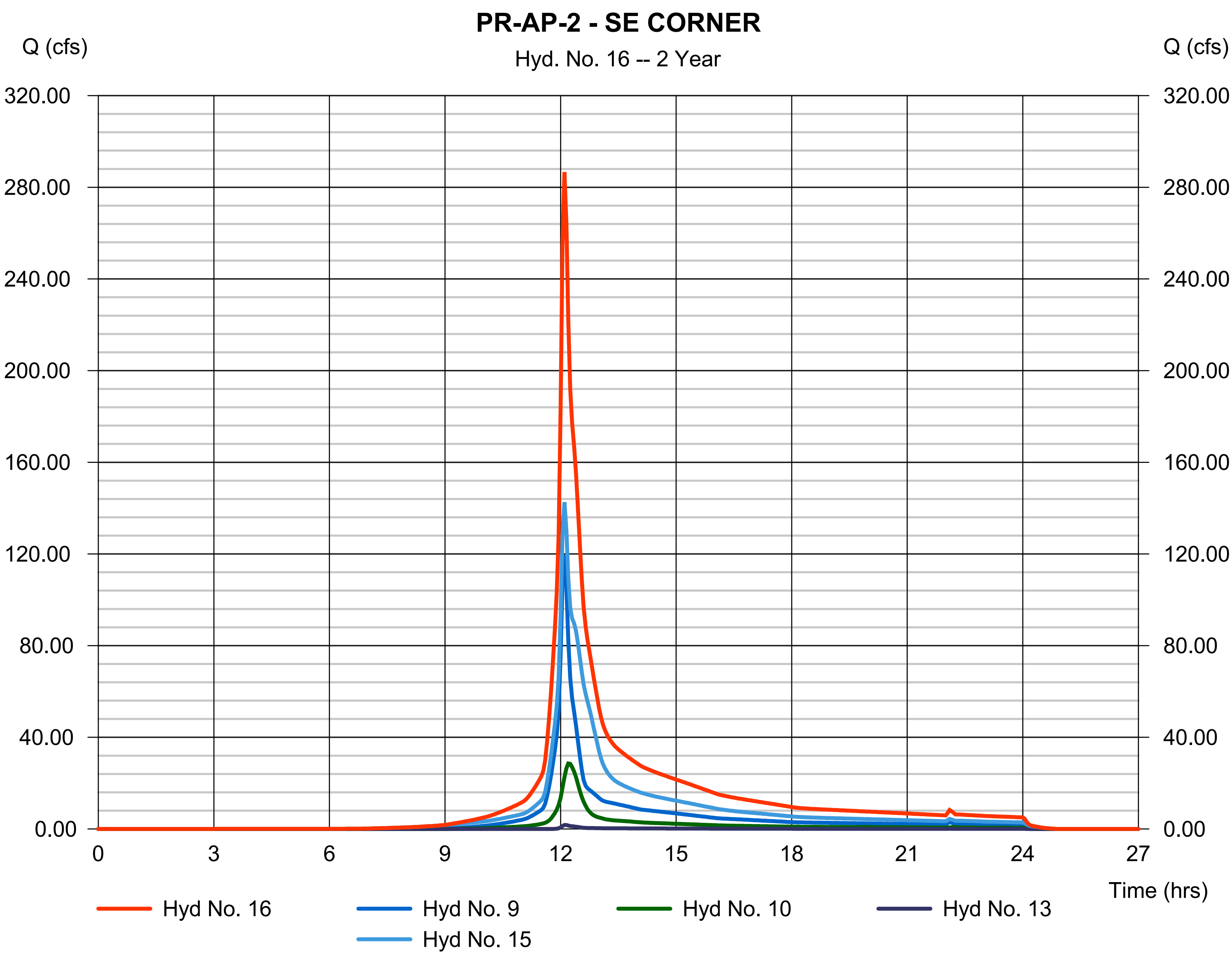
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12   Wednesday, 05 / 16 / 2018

Hyd. No. 16

PR-AP-2 - SE CORNER

Hydrograph type	= Combine	Peak discharge	= 286.68 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 1,238,700 cuft
Inflow hyds.	= 9, 10, 13, 15	Contrib. drain. area	= 92.180 ac



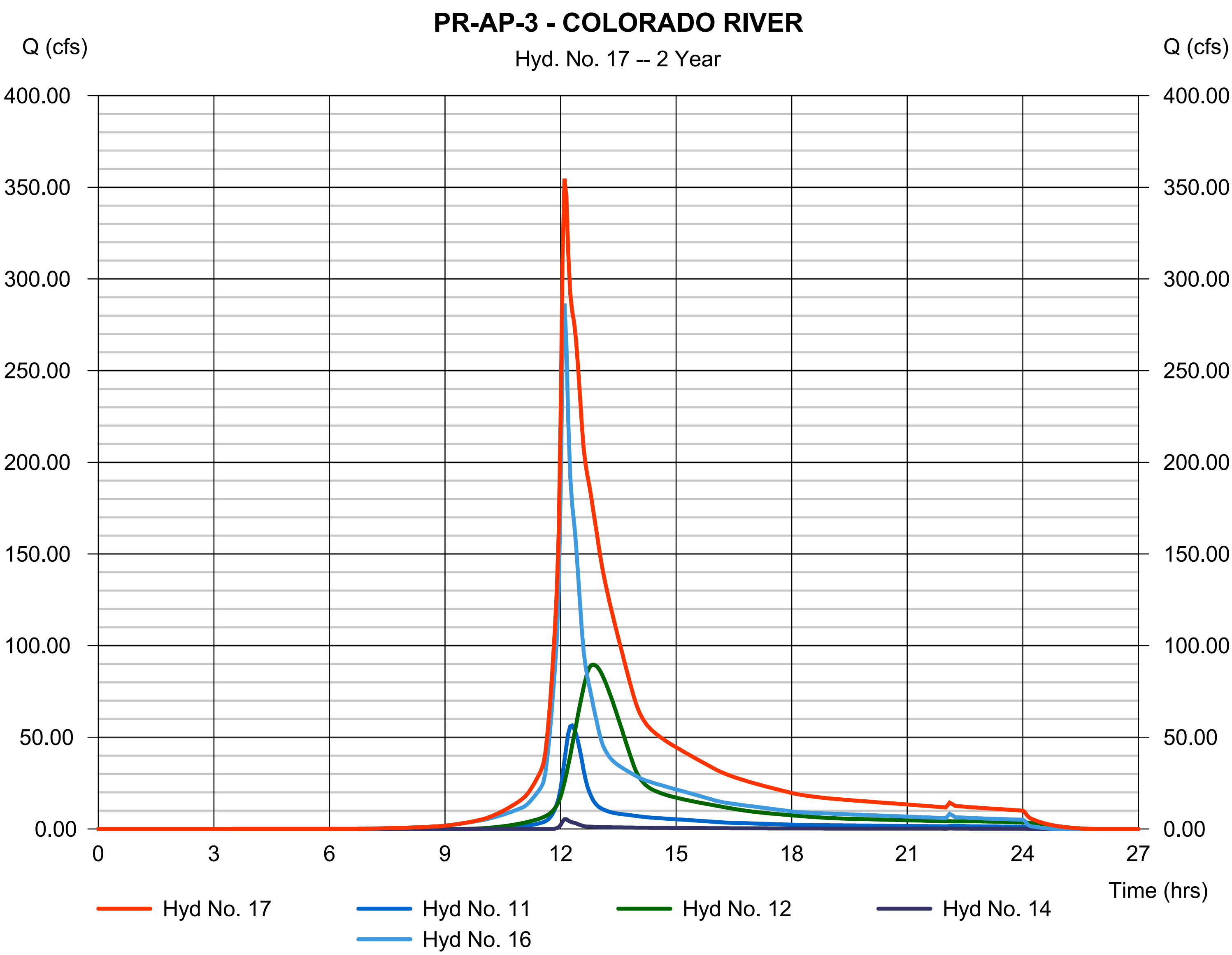
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 17

PR-AP-3 - COLORADO RIVER

Hydrograph type	= Combine	Peak discharge	= 354.73 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 2,327,386 cuft
Inflow hyds.	= 11, 12, 14, 16	Contrib. drain. area	= 197.870 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	35.60	3	792	430,770	------	------	------	EX-DA-1 / EX-AP-1
2	SCS Runoff	90.58	3	747	547,124	------	------	------	EX-DA-OFFSITE
3	SCS Runoff	87.97	3	783	927,611	------	------	------	EX-DA-2
4	SCS Runoff	19.58	3	756	154,249	------	------	------	EX-DA-3
5	Combine	165.26	3	759	1,628,986	2, 3, 4	------	------	EX-AP-2
6	SCS Runoff	117.66	3	726	400,613	------	------	------	PR-DA-1
7	SCS Runoff	71.58	3	726	243,732	------	------	------	PR-DA-2
8	SCS Runoff	8.018	3	726	30,716	------	------	------	PR-DA-3
9	SCS Runoff	208.26	3	726	693,630	------	------	------	PR-DA-4
10	SCS Runoff	50.07	3	732	223,688	------	------	------	PR-DA-5
11	SCS Runoff	104.79	3	735	501,861	------	------	------	PR-DA-6
12	SCS Runoff	159.57	3	768	1,385,353	------	------	------	PR-DA-7
13	SCS Runoff	5.024	3	726	18,195	------	------	------	PR-DA-8
14	SCS Runoff	15.53	3	726	56,238	------	------	------	PR-DA-9
15	Combine	239.42	3	726	1,222,186	2, 6, 7, 8,	------	------	PR-AP-1 - AGNES RD
16	Combine	493.34	3	726	2,157,699	9, 10, 13, 15	------	------	PR-AP-2 - SE CORNER
17	Combine	634.13	3	726	4,101,151	11, 12, 14, 16	------	------	PR-AP-3 - COLORADO RIVER

Hydrograph Report

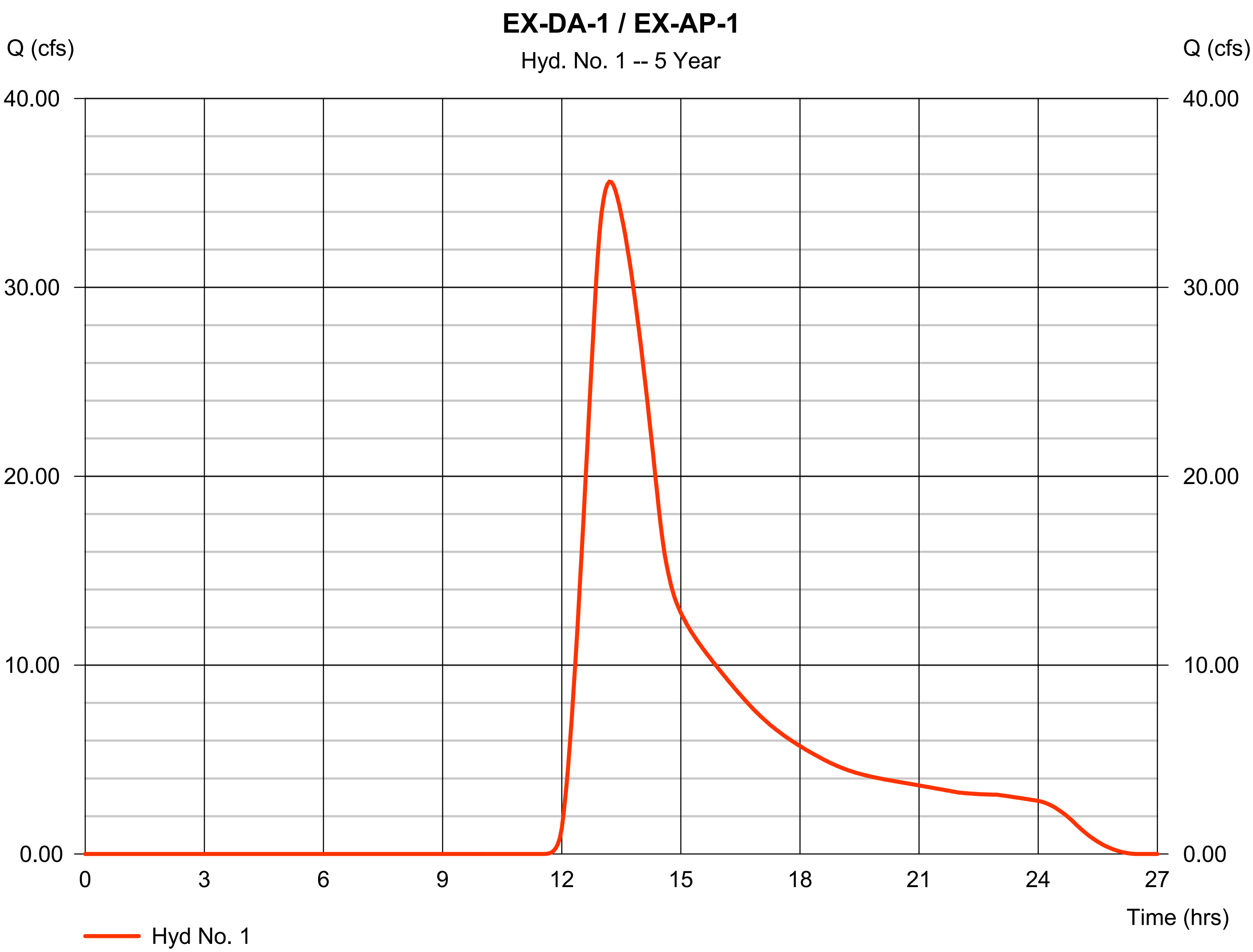
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 1

EX-DA-1 / EX-AP-1

Hydrograph type	= SCS Runoff	Peak discharge	= 35.60 cfs
Storm frequency	= 5 yrs	Time to peak	= 13.20 hrs
Time interval	= 3 min	Hyd. volume	= 430,770 cuft
Drainage area	= 101.790 ac	Curve number	= 57*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 94.50 min
Total precip.	= 5.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(84.000 x 61) + (17.790 x 39)] / 101.790



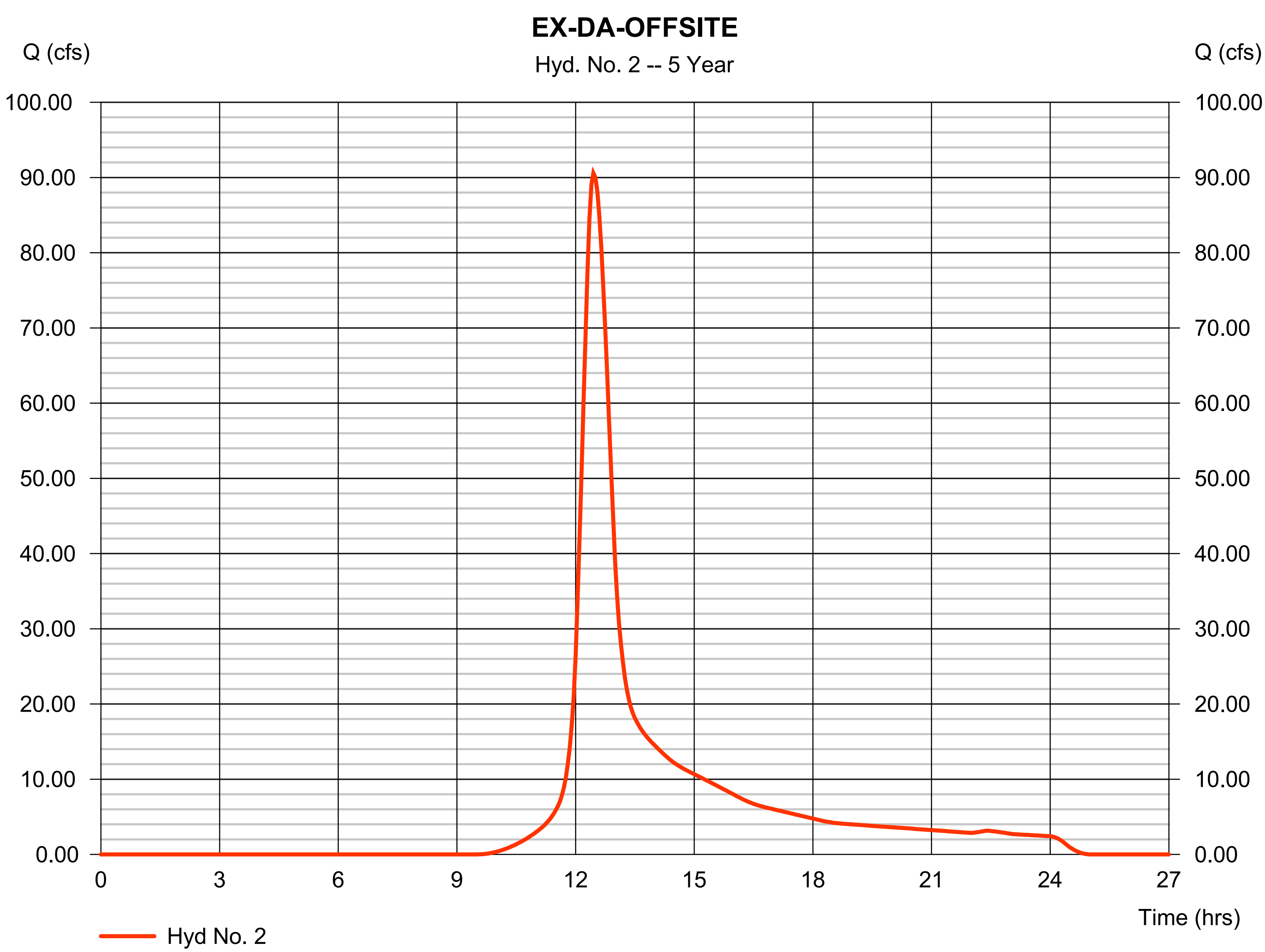
Hydrograph Report

Hyd. No. 2

EX-DA-OFFSITE

Hydrograph type	= SCS Runoff	Peak discharge	= 90.58 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.45 hrs
Time interval	= 3 min	Hyd. volume	= 547,124 cuft
Drainage area	= 69.840 ac	Curve number	= 71*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 39.80 min
Total precip.	= 5.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(19.230 x 98) + (50.610 x 61)] / 69.840



Hydrograph Report

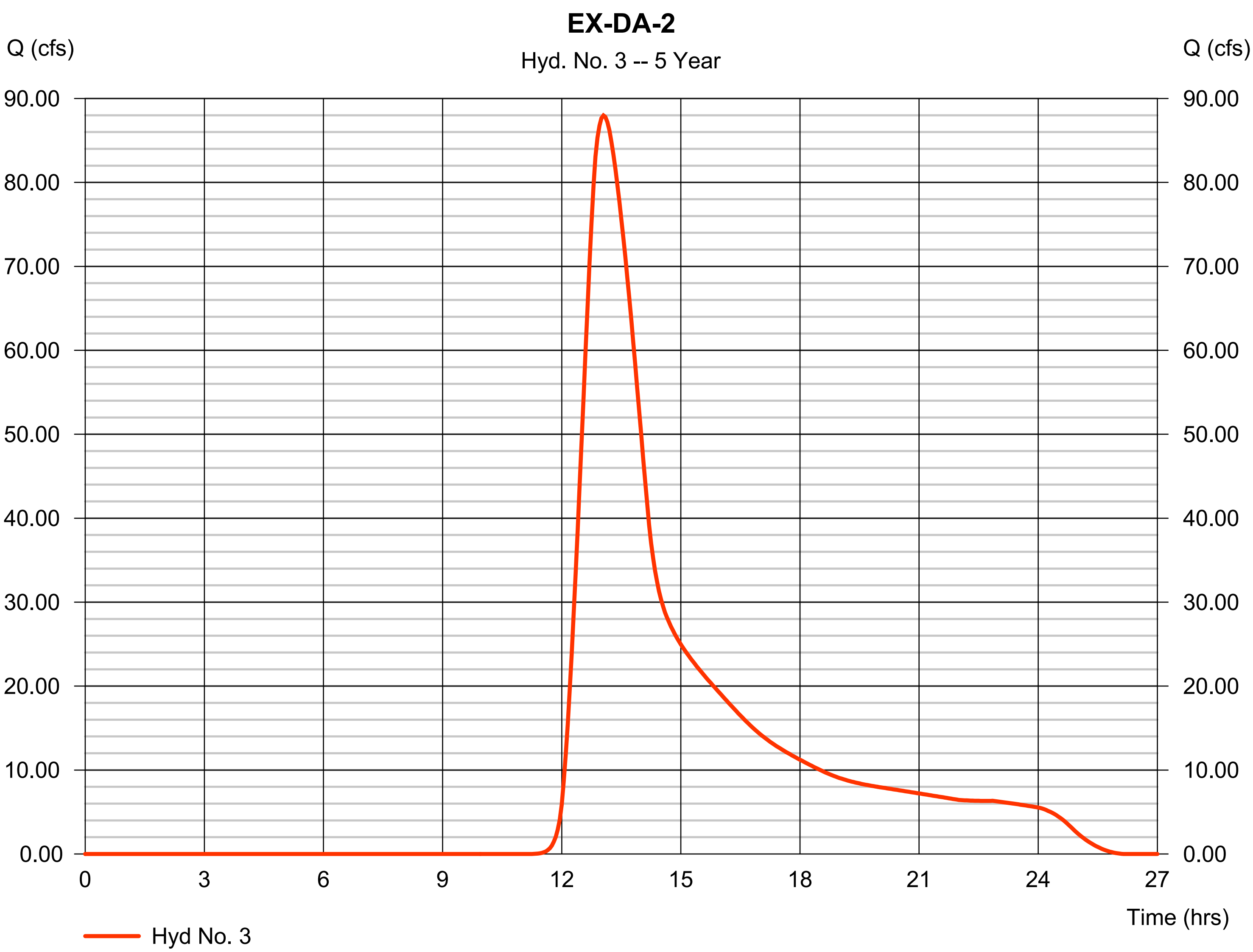
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 05 / 16 / 2018

Hyd. No. 3

EX-DA-2

Hydrograph type	= SCS Runoff	Peak discharge	= 87.97 cfs
Storm frequency	= 5 yrs	Time to peak	= 13.05 hrs
Time interval	= 3 min	Hyd. volume	= 927,611 cuft
Drainage area	= 189.310 ac	Curve number	= 60*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 83.86 min
Total precip.	= 5.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(183.470 x 61) + (5.840 x 39)] / 189.310



Hydrograph Report

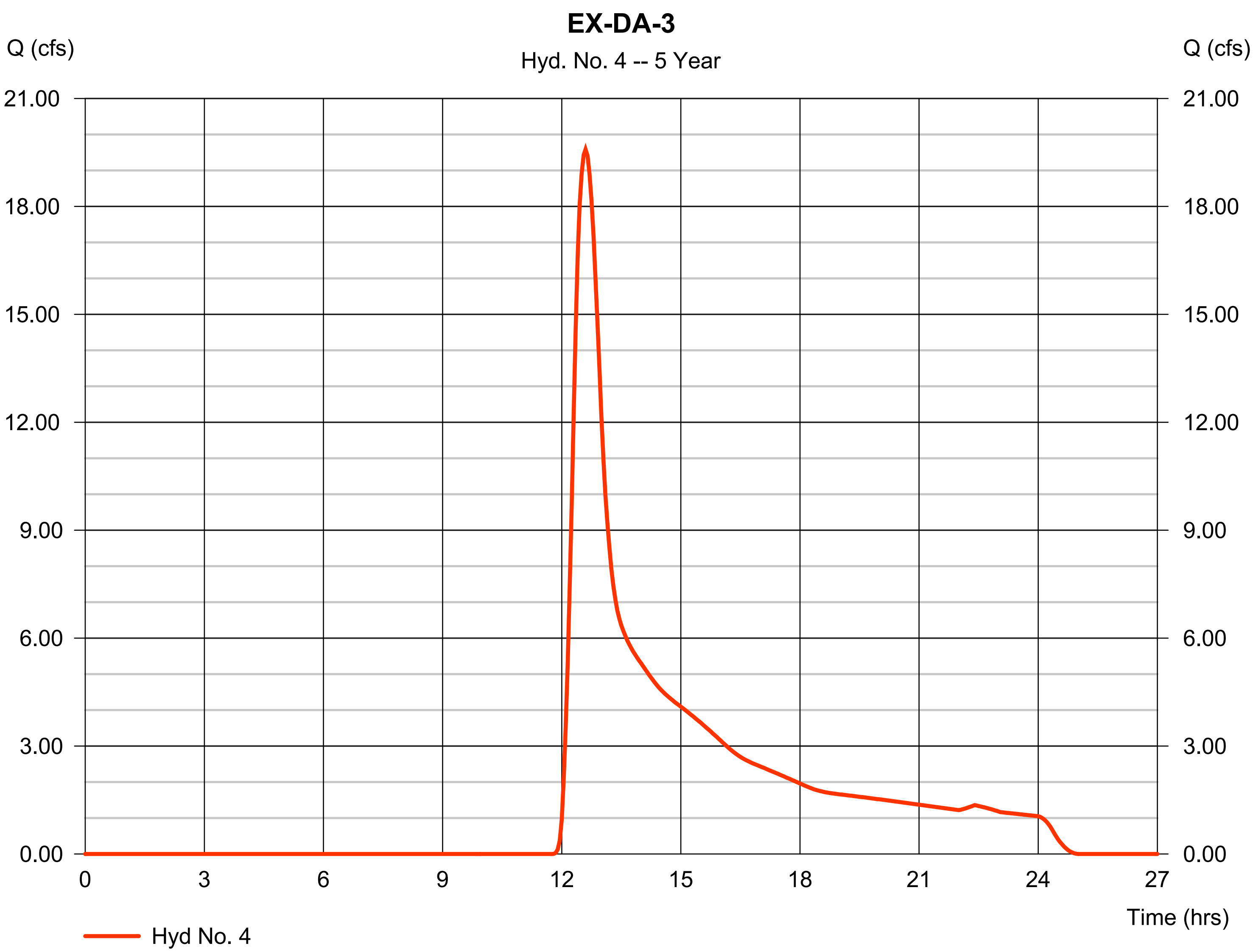
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 4

EX-DA-3

Hydrograph type	= SCS Runoff	Peak discharge	= 19.58 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.60 hrs
Time interval	= 3 min	Hyd. volume	= 154,249 cuft
Drainage area	= 50.910 ac	Curve number	= 52*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 38.30 min
Total precip.	= 5.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(30.546 x 61) + (20.364 x 39)] / 50.910



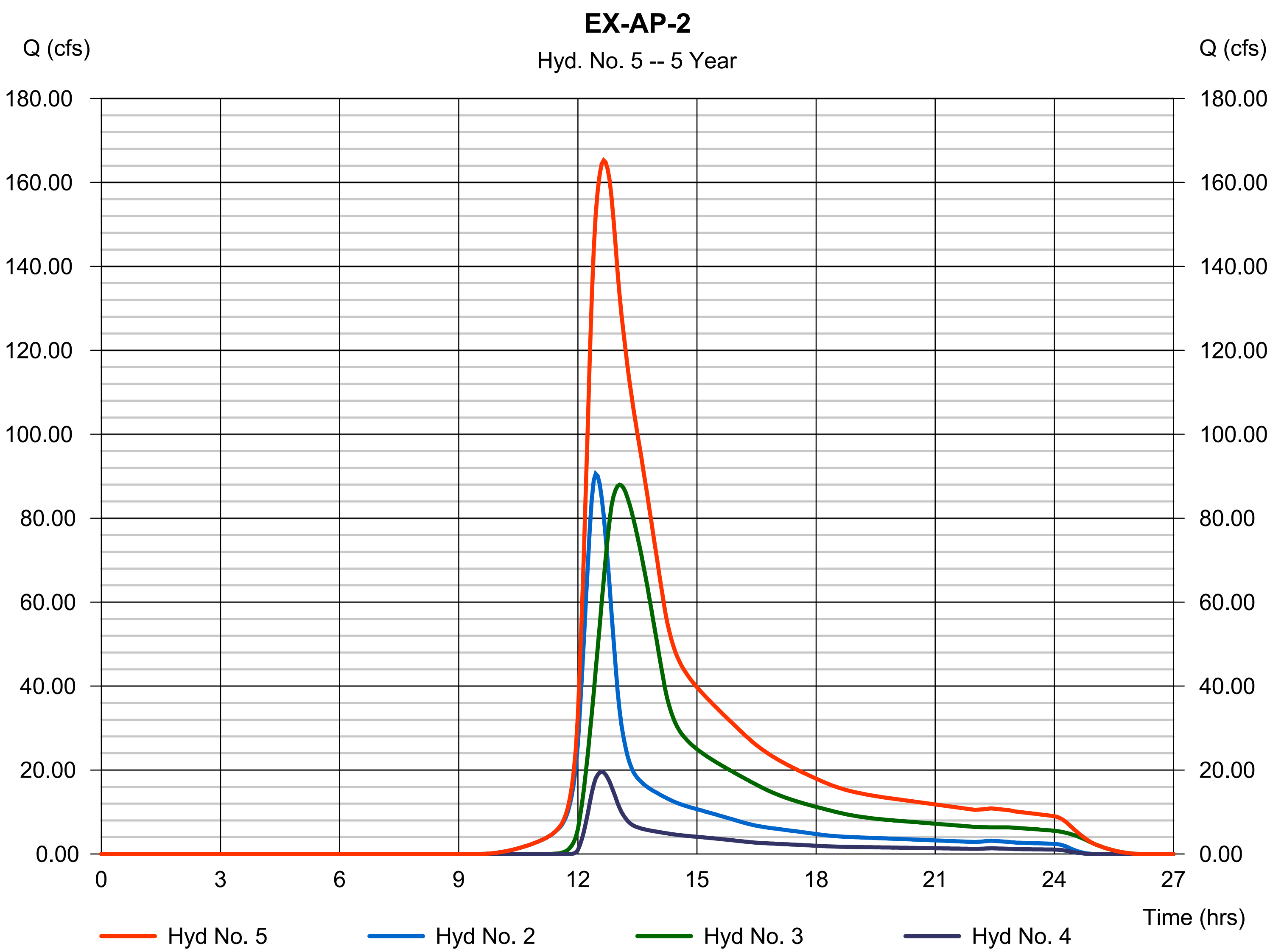
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 | Wednesday, 05 / 16 / 2018

Hyd. No. 5

EX-AP-2

Hydrograph type	= Combine	Peak discharge	= 165.26 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.65 hrs
Time interval	= 3 min	Hyd. volume	= 1,628,986 cuft
Inflow hyds.	= 2, 3, 4	Contrib. drain. area	= 310.060 ac



Hydrograph Report

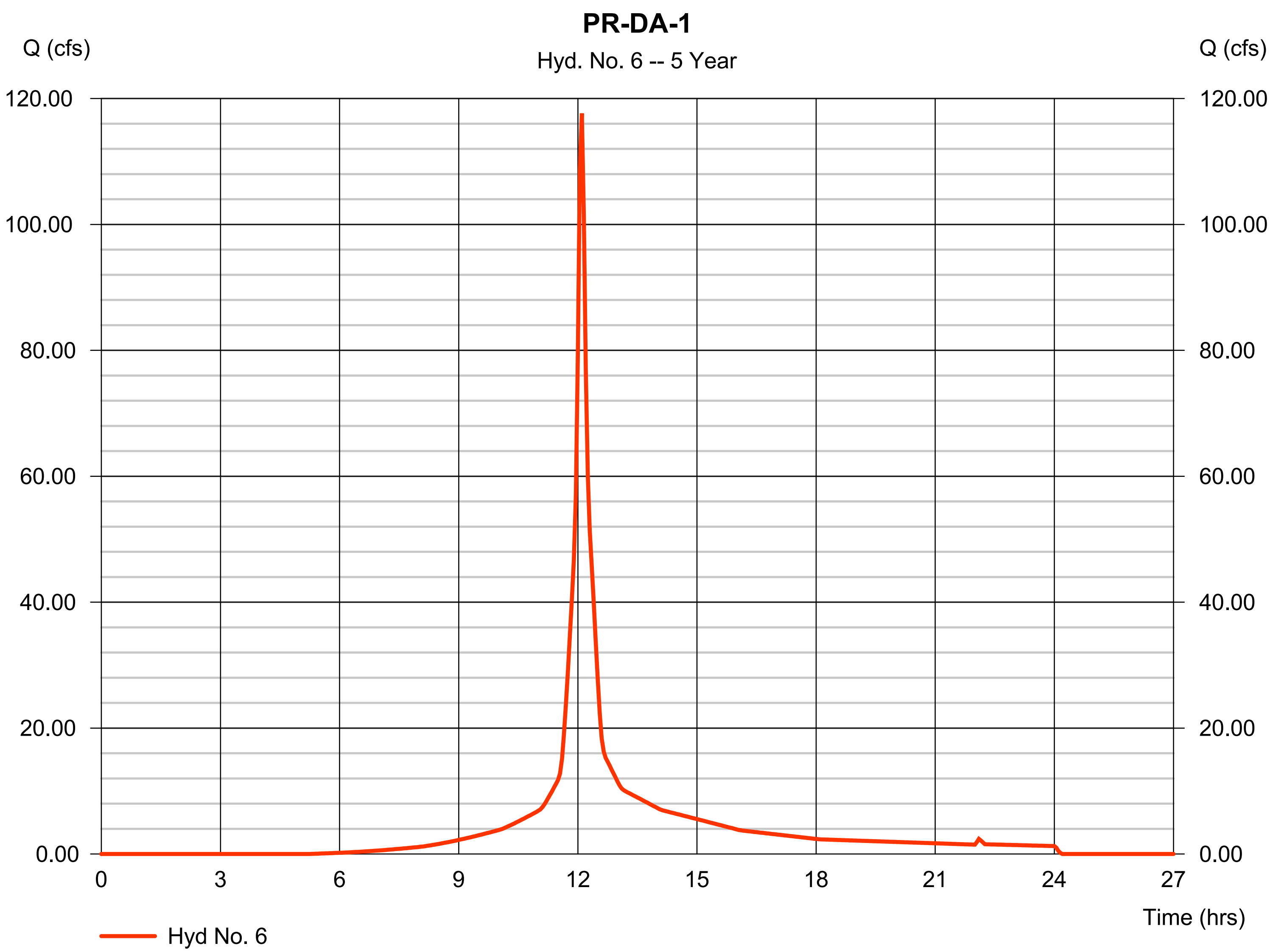
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 6

PR-DA-1

Hydrograph type	= SCS Runoff	Peak discharge	= 117.66 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 400,613 cuft
Drainage area	= 32.150 ac	Curve number	= 87*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 7.60 min
Total precip.	= 5.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(22.300 x 98) + (9.560 x 61)] / 32.150



Hydrograph Report

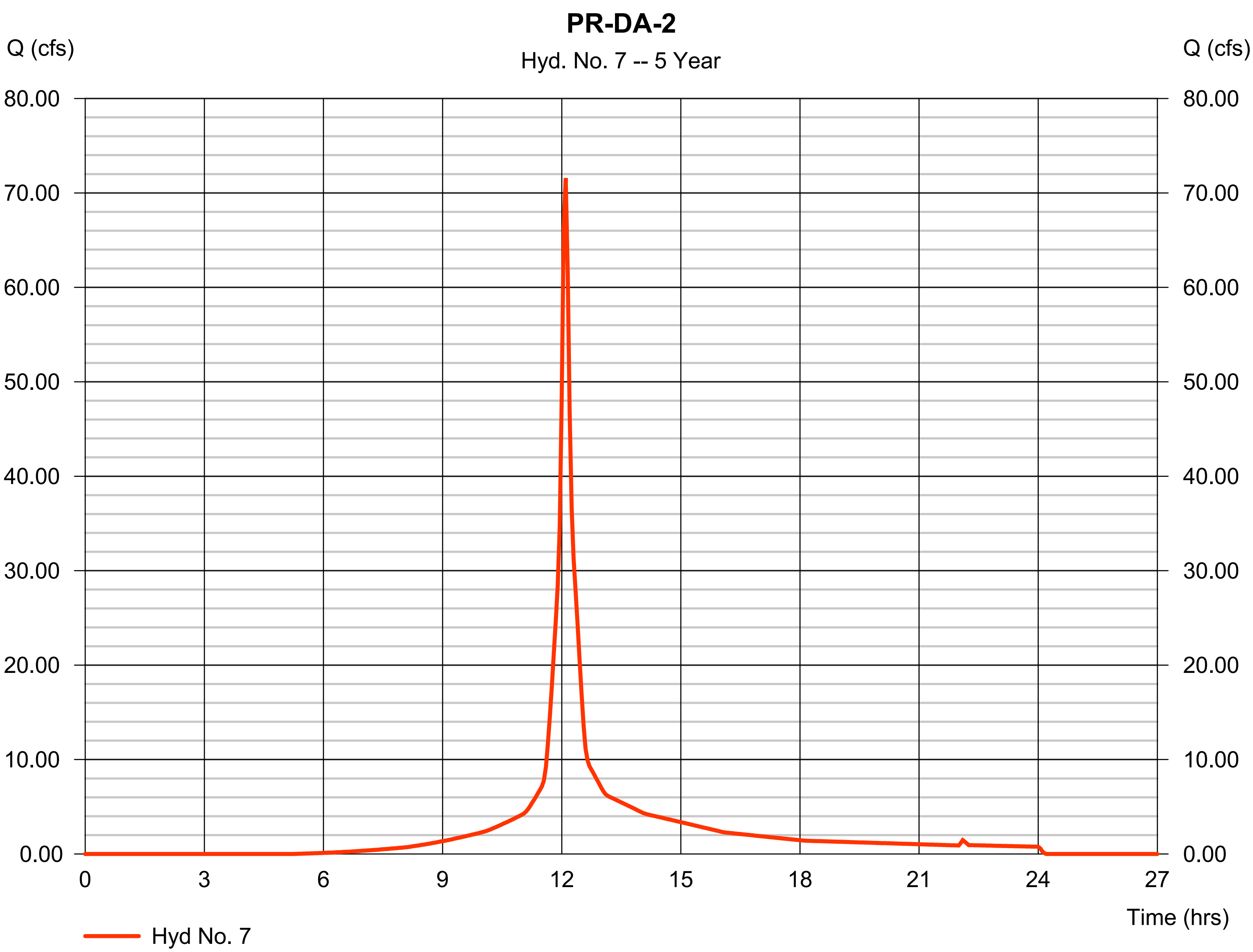
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 | Wednesday, 05 / 16 / 2018

Hyd. No. 7

PR-DA-2

Hydrograph type	= SCS Runoff	Peak discharge	= 71.58 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 243,732 cuft
Drainage area	= 19.560 ac	Curve number	= 87*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 7.60 min
Total precip.	= 5.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(13.580 x 98) + (5.820 x 61)] / 19.560



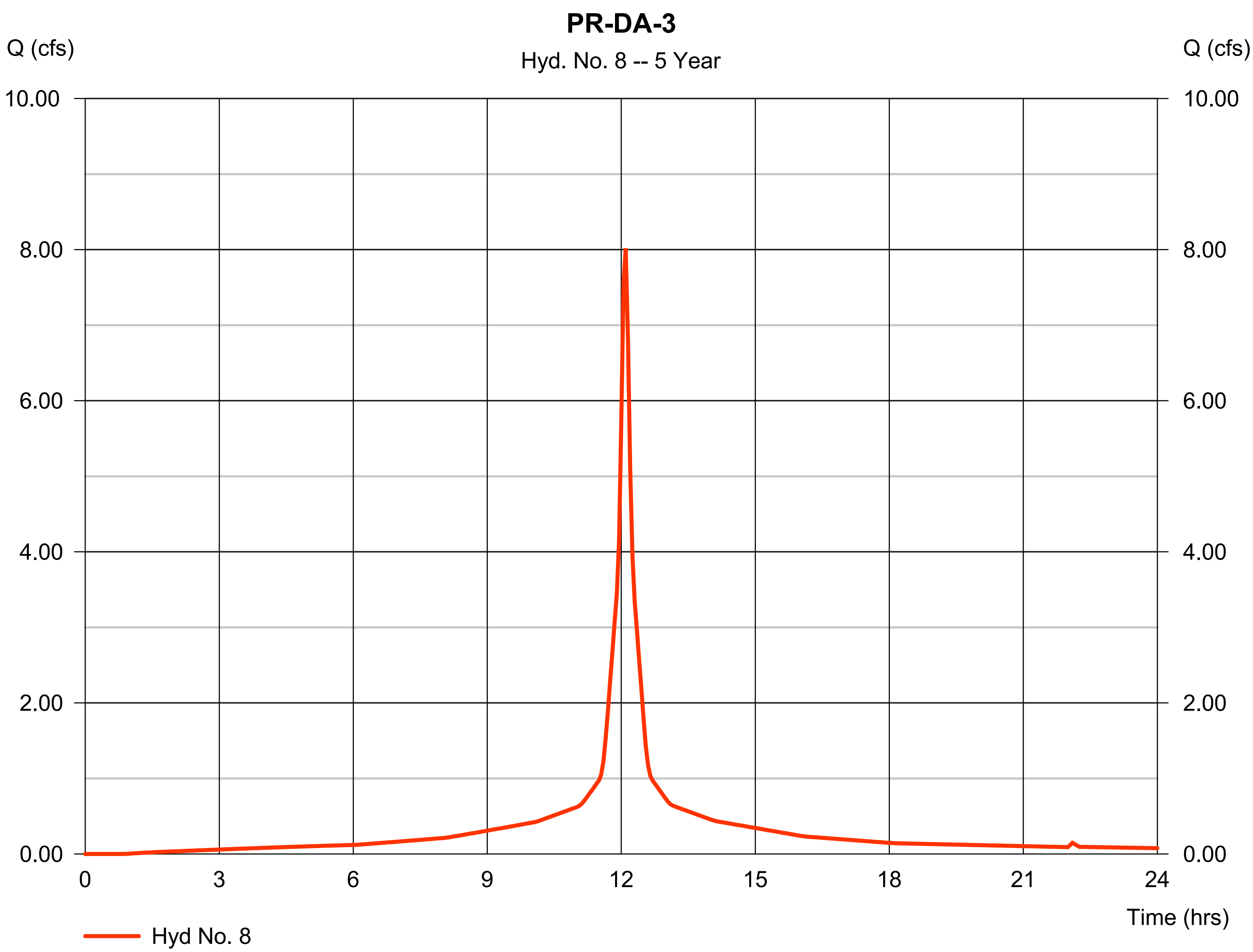
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 8

PR-DA-3

Hydrograph type	= SCS Runoff	Peak discharge	= 8.018 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 30,716 cuft
Drainage area	= 1.856 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 4.80 min
Total precip.	= 5.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

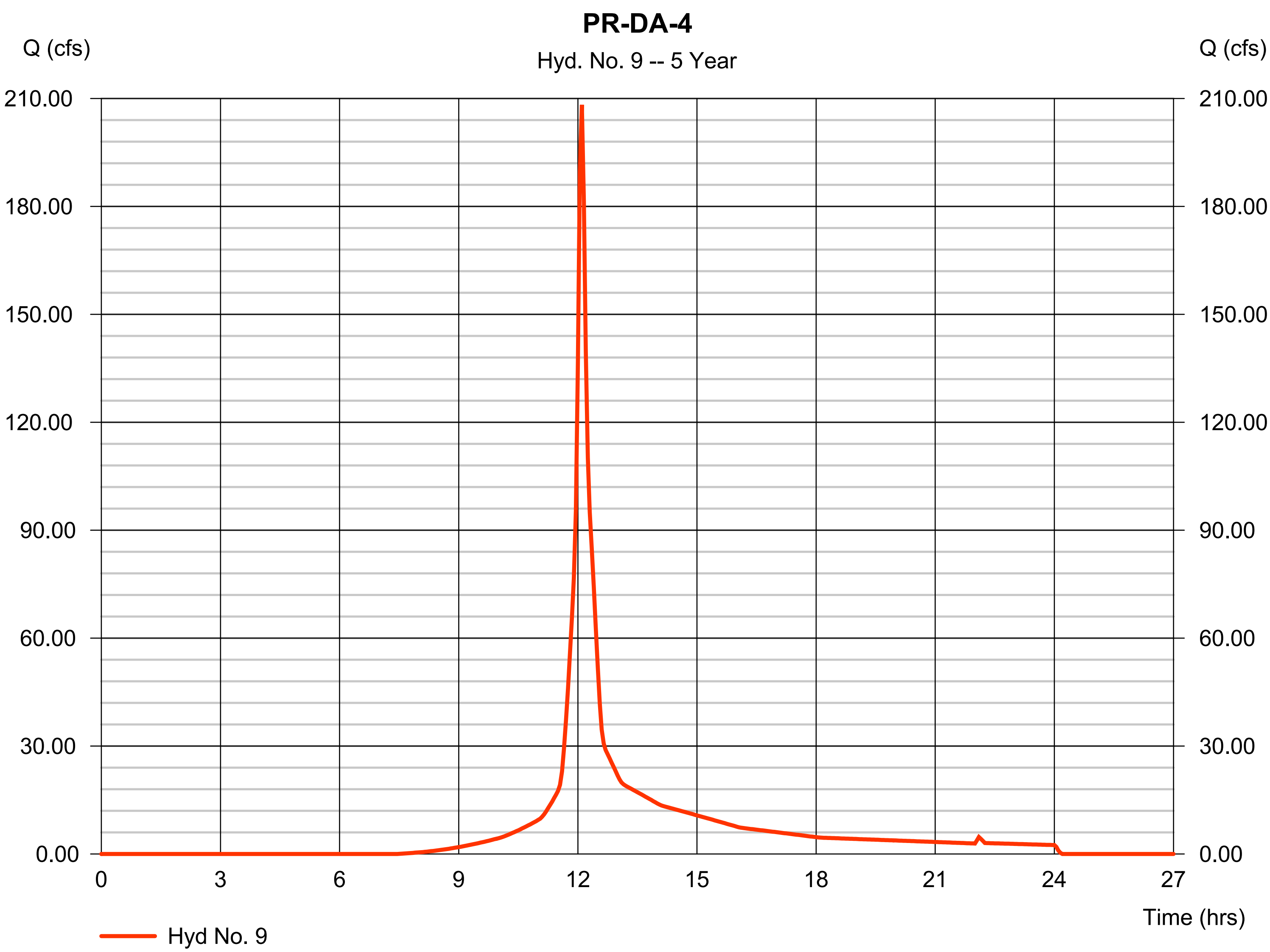
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 | Wednesday, 05 / 16 / 2018

Hyd. No. 9

PR-DA-4

Hydrograph type	= SCS Runoff	Peak discharge	= 208.26 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 693,630 cuft
Drainage area	= 68.390 ac	Curve number	= 80*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.10 min
Total precip.	= 5.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(34.190 x 98) + (34.200 x 61)] / 68.390



Hydrograph Report

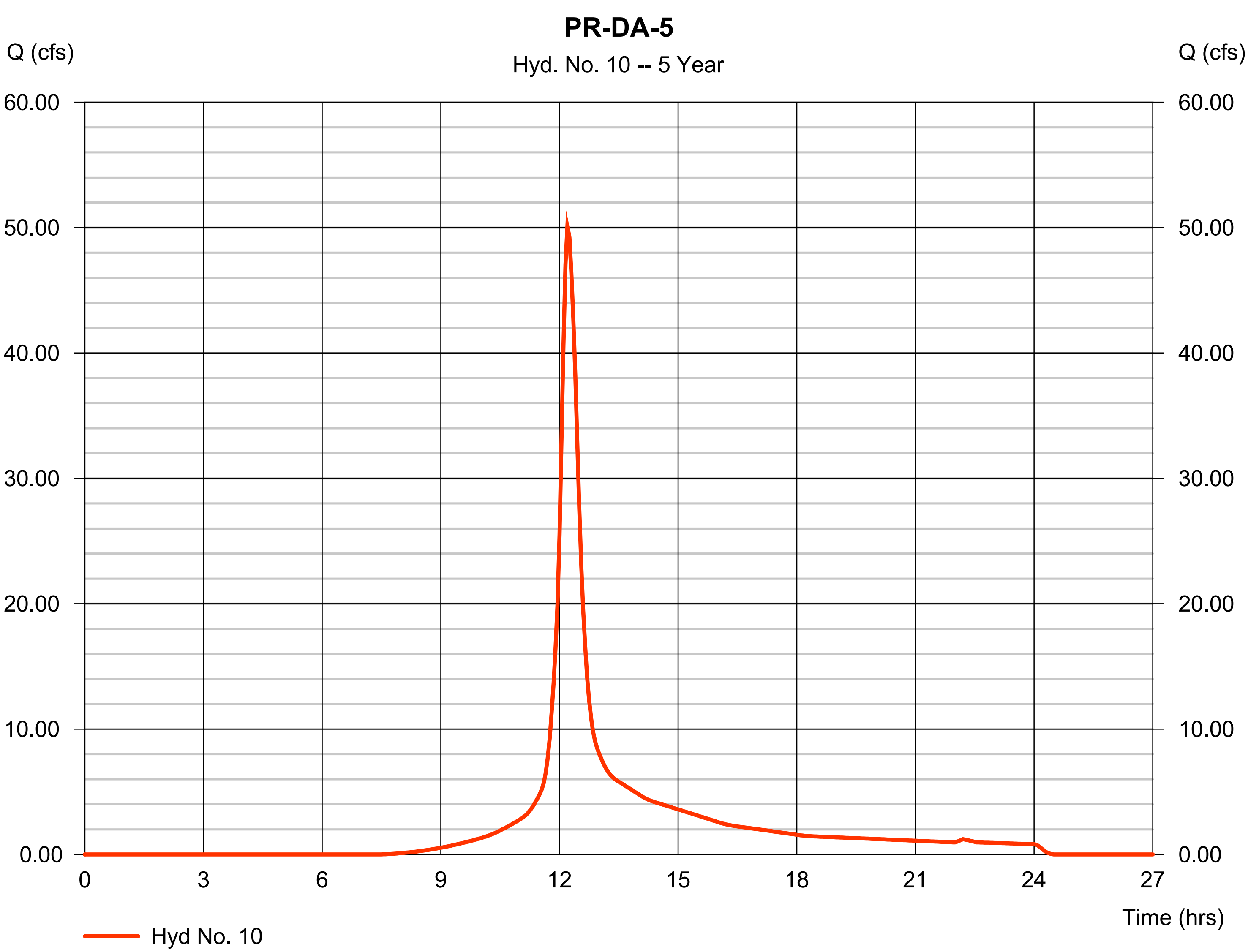
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 10

PR-DA-5

Hydrograph type	= SCS Runoff	Peak discharge	= 50.07 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.20 hrs
Time interval	= 3 min	Hyd. volume	= 223,688 cuft
Drainage area	= 20.050 ac	Curve number	= 80*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18.40 min
Total precip.	= 5.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(10.167 x 98) + (10.167 x 61)] / 20.050



Hydrograph Report

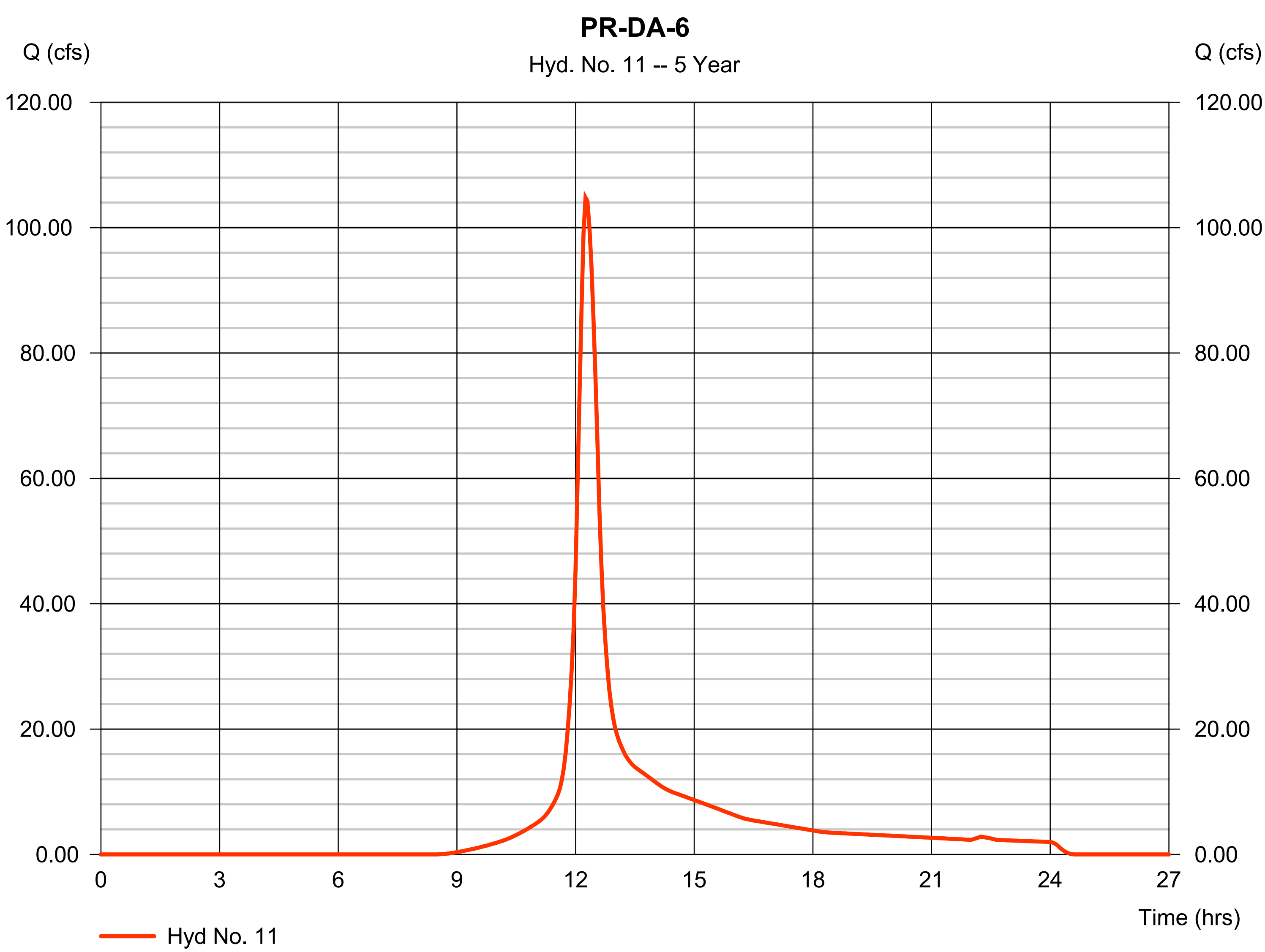
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 11

PR-DA-6

Hydrograph type	= SCS Runoff	Peak discharge	= 104.79 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.25 hrs
Time interval	= 3 min	Hyd. volume	= 501,861 cuft
Drainage area	= 54.160 ac	Curve number	= 76*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 24.60 min
Total precip.	= 5.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(19.630 x 61) + (7.450 x 39) + (27.080 x 98)] / 54.160



Hydrograph Report

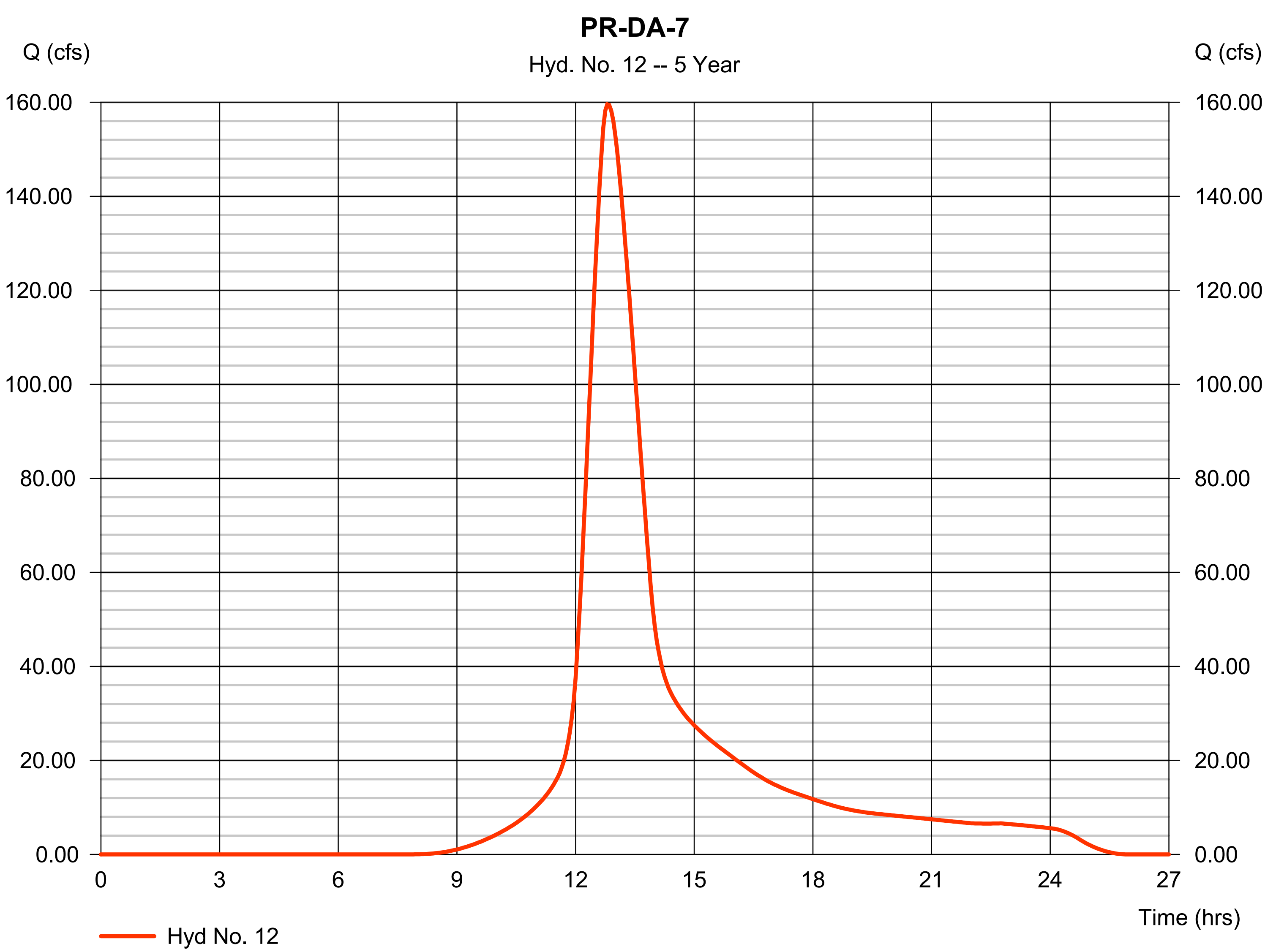
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 12

PR-DA-7

Hydrograph type	= SCS Runoff	Peak discharge	= 159.57 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.80 hrs
Time interval	= 3 min	Hyd. volume	= 1,385,353 cuft
Drainage area	= 132.150 ac	Curve number	= 79*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 71.80 min
Total precip.	= 5.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(66.080 x 98) + (66.070 x 61)] / 132.150



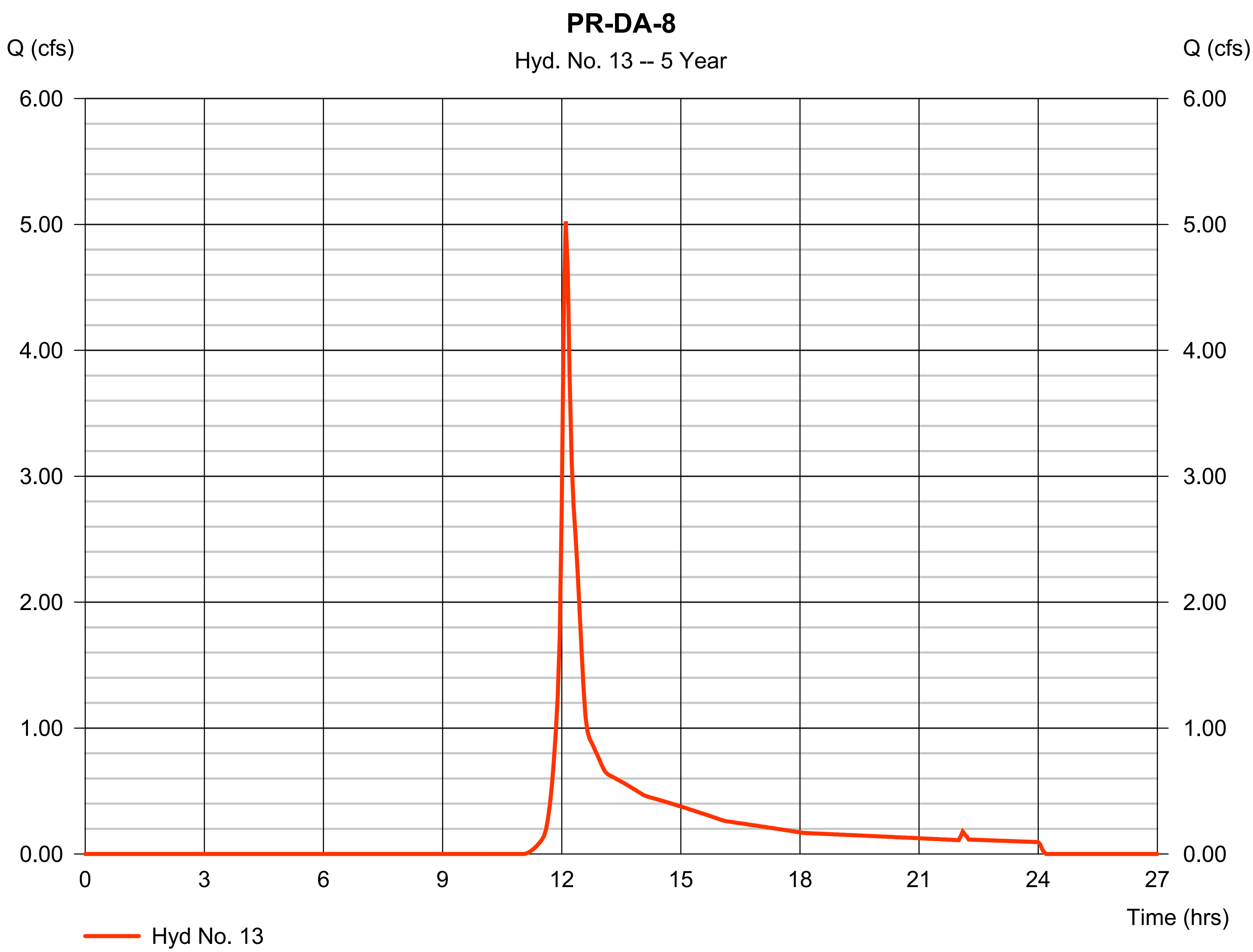
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 13

PR-DA-8

Hydrograph type	= SCS Runoff	Peak discharge	= 5.024 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 18,195 cuft
Drainage area	= 3.740 ac	Curve number	= 61
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 4.90 min
Total precip.	= 5.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



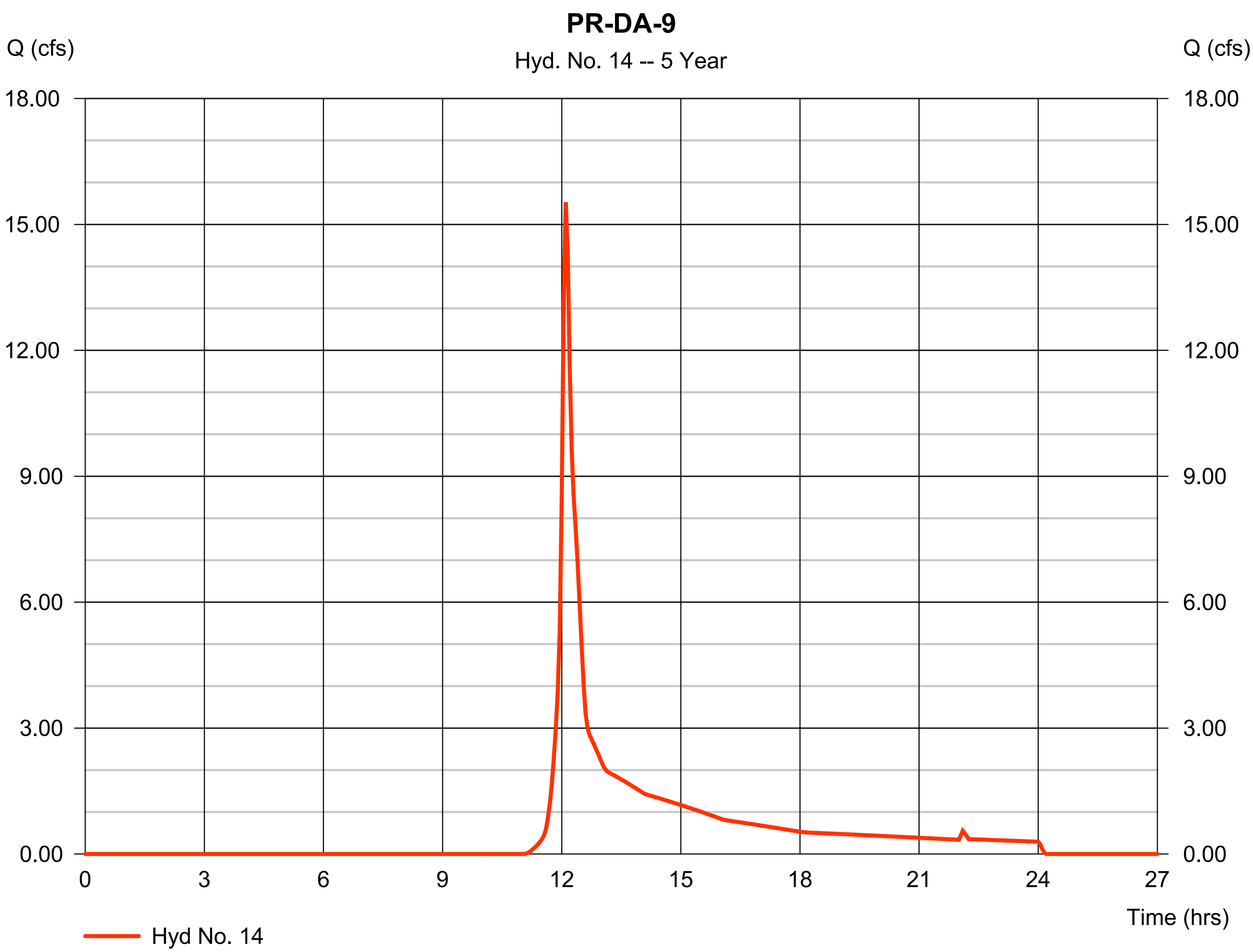
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 14

PR-DA-9

Hydrograph type	= SCS Runoff	Peak discharge	= 15.53 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 56,238 cuft
Drainage area	= 11.560 ac	Curve number	= 61
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.70 min
Total precip.	= 5.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



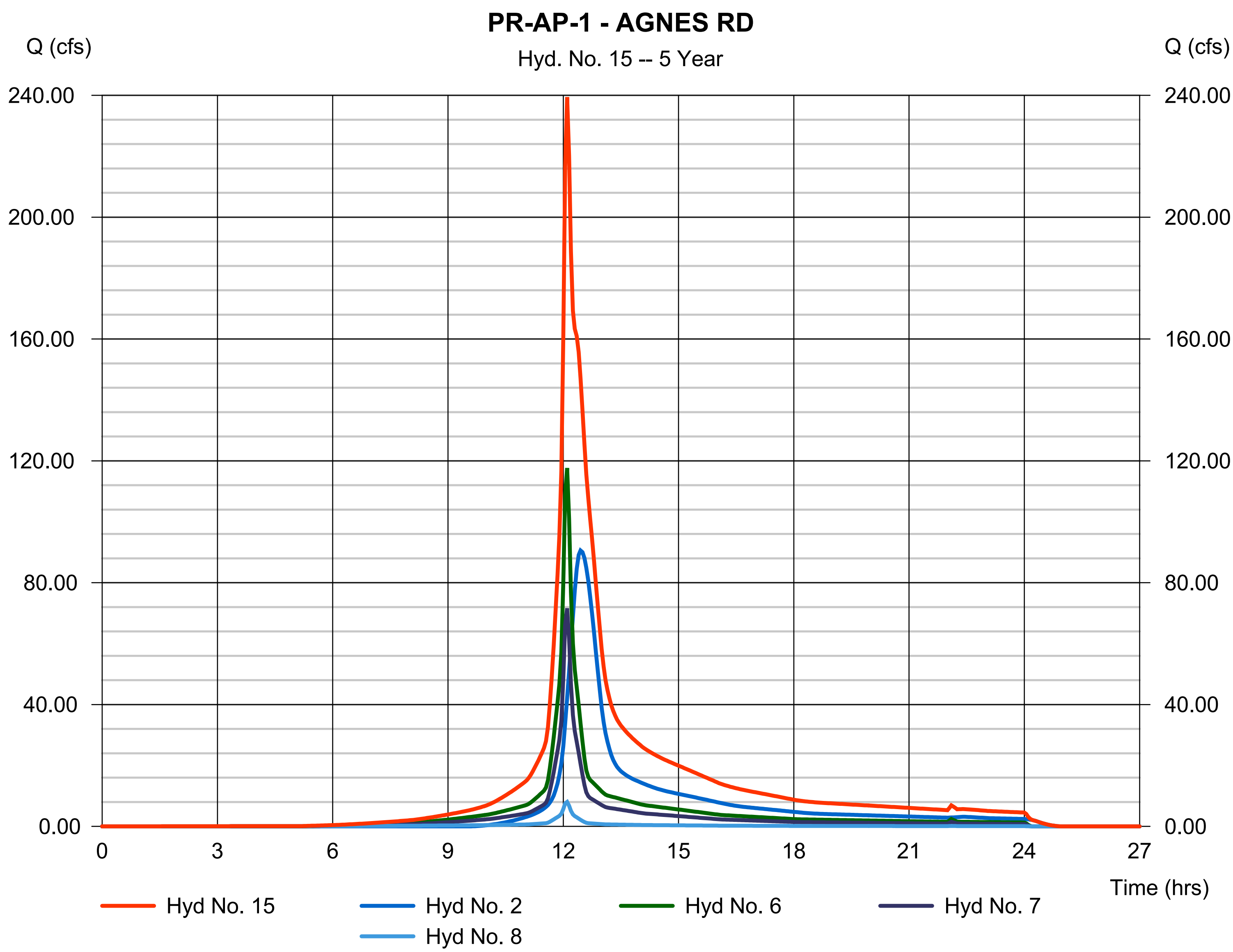
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 | Wednesday, 05 / 16 / 2018

Hyd. No. 15

PR-AP-1 - AGNES RD

Hydrograph type	= Combine	Peak discharge	= 239.42 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 1,222,186 cuft
Inflow hyds.	= 2, 6, 7, 8	Contrib. drain. area	= 123.406 ac



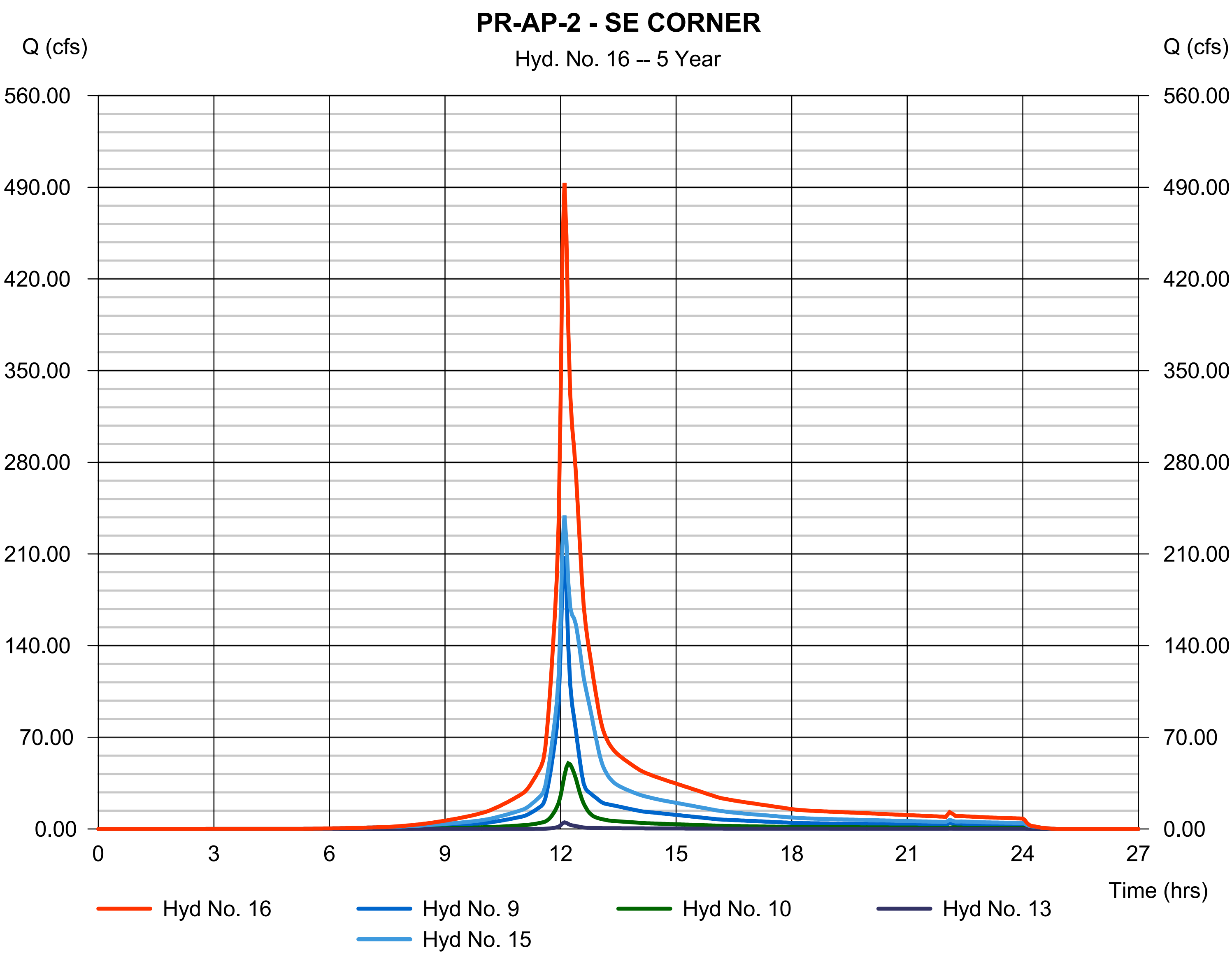
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 16

PR-AP-2 - SE CORNER

Hydrograph type	= Combine	Peak discharge	= 493.34 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 2,157,699 cuft
Inflow hyds.	= 9, 10, 13, 15	Contrib. drain. area	= 92.180 ac



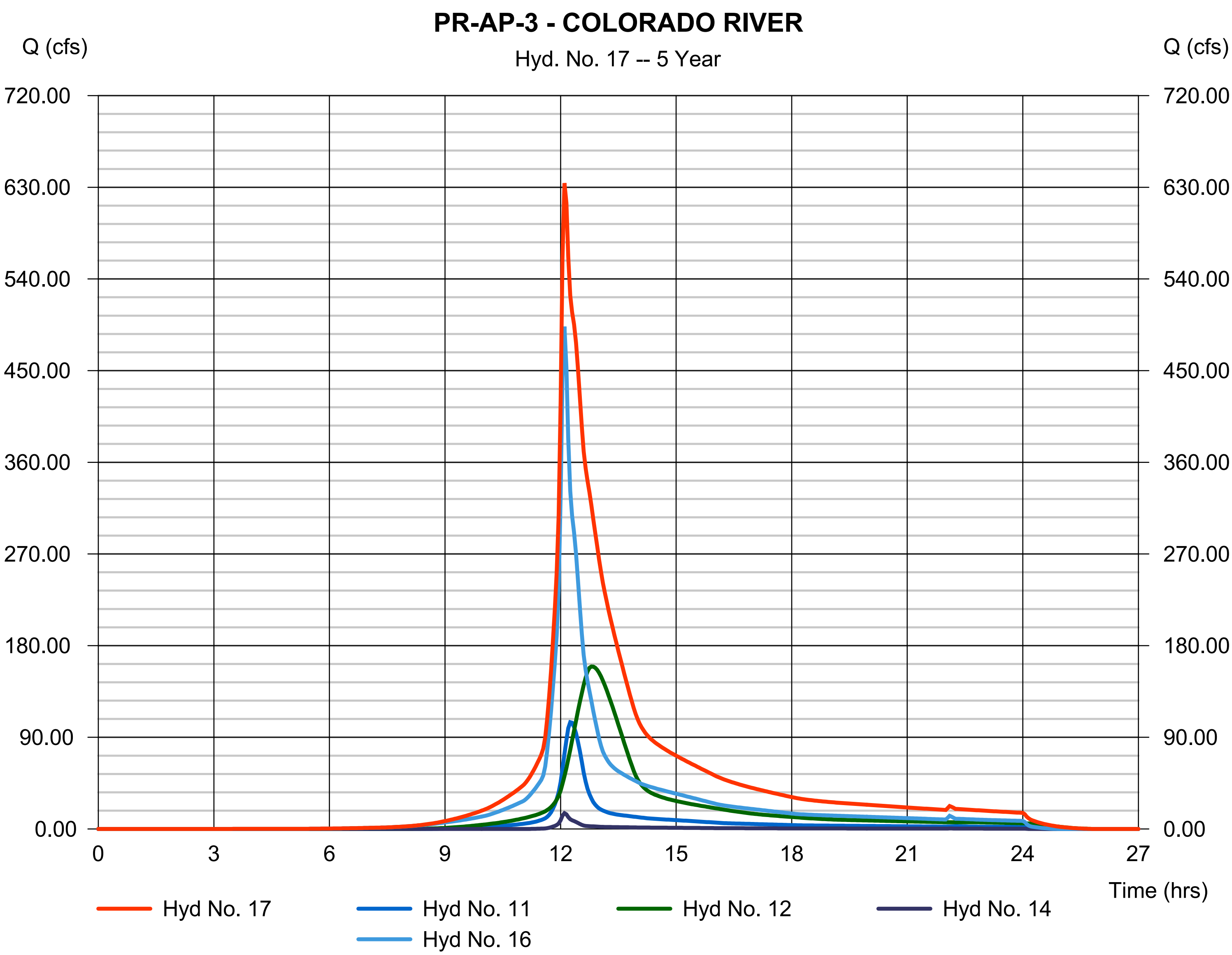
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 17

PR-AP-3 - COLORADO RIVER

Hydrograph type	= Combine	Peak discharge	= 634.13 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 4,101,151 cuft
Inflow hyds.	= 11, 12, 14, 16	Contrib. drain. area	= 197.870 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	59.56	3	789	668,998	------	------	------	EX-DA-1 / EX-AP-1
2	SCS Runoff	127.94	3	747	763,829	------	------	------	EX-DA-OFFSITE
3	SCS Runoff	140.32	3	780	1,400,815	------	------	------	EX-DA-2
4	SCS Runoff	36.56	3	753	253,845	------	------	------	EX-DA-3
5	Combine	257.24	3	759	2,418,488	2, 3, 4	------	------	EX-AP-2
6	SCS Runoff	149.45	3	726	515,193	------	------	------	PR-DA-1
7	SCS Runoff	90.92	3	726	313,443	------	------	------	PR-DA-2
8	SCS Runoff	9.764	3	726	37,655	------	------	------	PR-DA-3
9	SCS Runoff	275.24	3	726	922,160	------	------	------	PR-DA-4
10	SCS Runoff	66.42	3	732	297,386	------	------	------	PR-DA-5
11	SCS Runoff	142.77	3	735	681,119	------	------	------	PR-DA-6
12	SCS Runoff	213.43	3	768	1,851,061	------	------	------	PR-DA-7
13	SCS Runoff	7.881	3	726	27,244	------	------	------	PR-DA-8
14	SCS Runoff	24.36	3	726	84,207	------	------	------	PR-DA-9
15	Combine	312.95	3	726	1,630,120	2, 6, 7, 8,	------	------	PR-AP-1 - AGNES RD
16	Combine	650.57	3	726	2,876,911	9, 10, 13, 15	------	------	PR-AP-2 - SE CORNER
17	Combine	850.01	3	726	5,493,296	11, 12, 14, 16	------	------	PR-AP-3 - COLORADO RIVER

Hydrograph Report

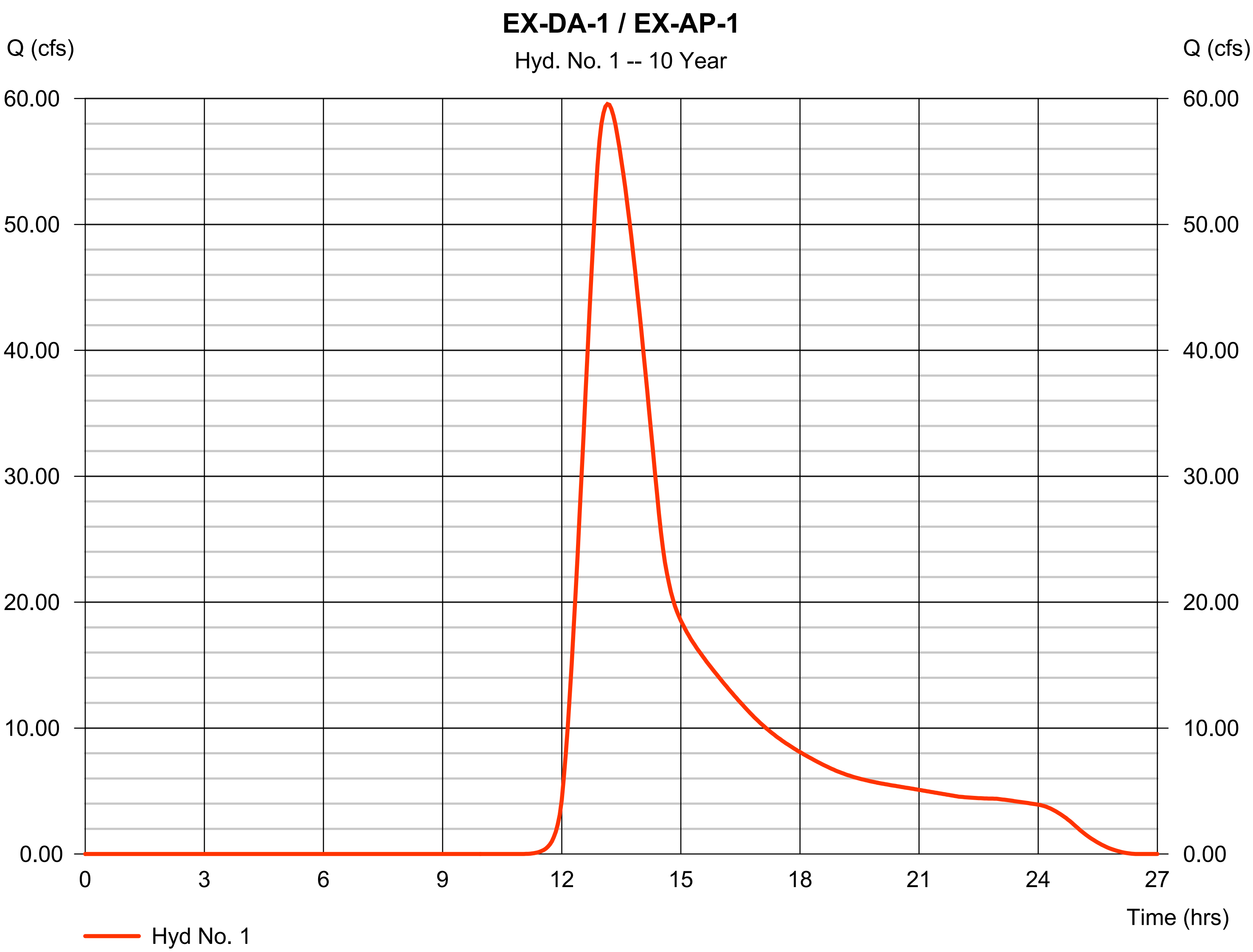
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 1

EX-DA-1 / EX-AP-1

Hydrograph type	= SCS Runoff	Peak discharge	= 59.56 cfs
Storm frequency	= 10 yrs	Time to peak	= 13.15 hrs
Time interval	= 3 min	Hyd. volume	= 668,998 cuft
Drainage area	= 101.790 ac	Curve number	= 57*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 94.50 min
Total precip.	= 6.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(84.000 x 61) + (17.790 x 39)] / 101.790



Hydrograph Report

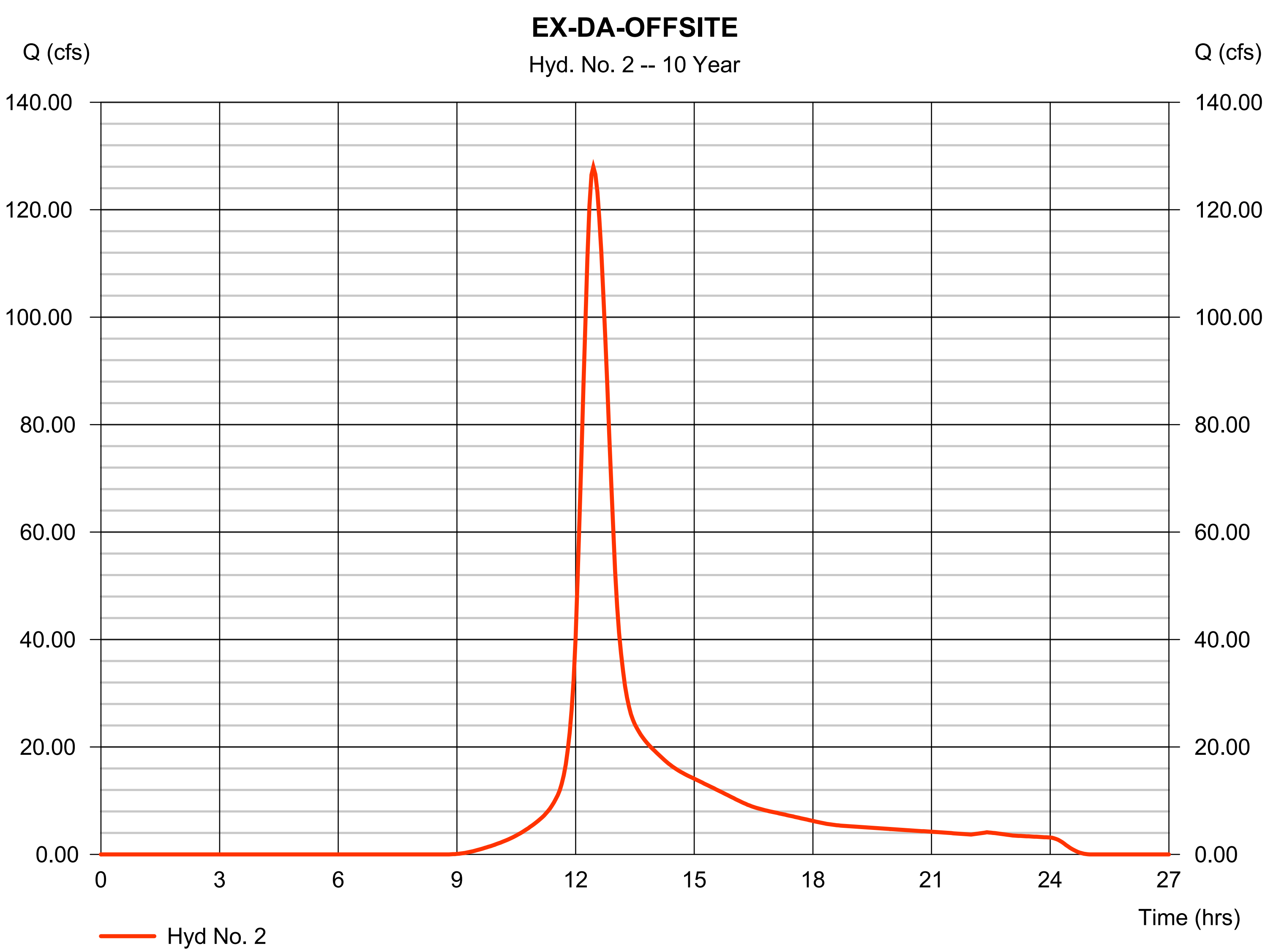
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 | Wednesday, 05 / 16 / 2018

Hyd. No. 2

EX-DA-OFFSITE

Hydrograph type	= SCS Runoff	Peak discharge	= 127.94 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.45 hrs
Time interval	= 3 min	Hyd. volume	= 763,829 cuft
Drainage area	= 69.840 ac	Curve number	= 71*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 39.80 min
Total precip.	= 6.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(19.230 x 98) + (50.610 x 61)] / 69.840



Hydrograph Report

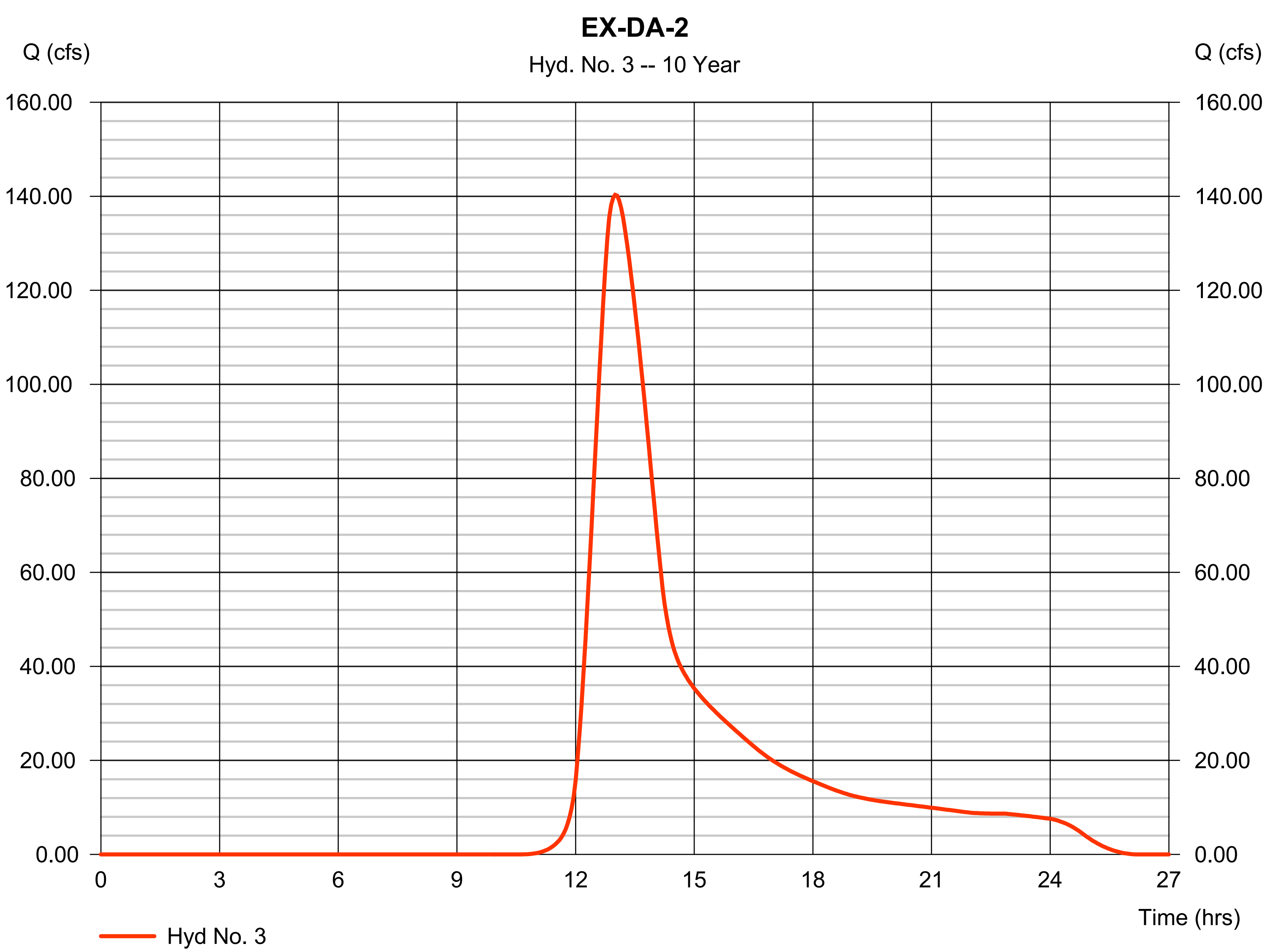
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 | Wednesday, 05 / 16 / 2018

Hyd. No. 3

EX-DA-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	140.32 cfs
Storm frequency	=	10 yrs	Time to peak	=	13.00 hrs
Time interval	=	3 min	Hyd. volume	=	1,400,815 cuft
Drainage area	=	189.310 ac	Curve number	=	60*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	83.86 min
Total precip.	=	6.20 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(183.470 x 61) + (5.840 x 39)] / 189.310



Hydrograph Report

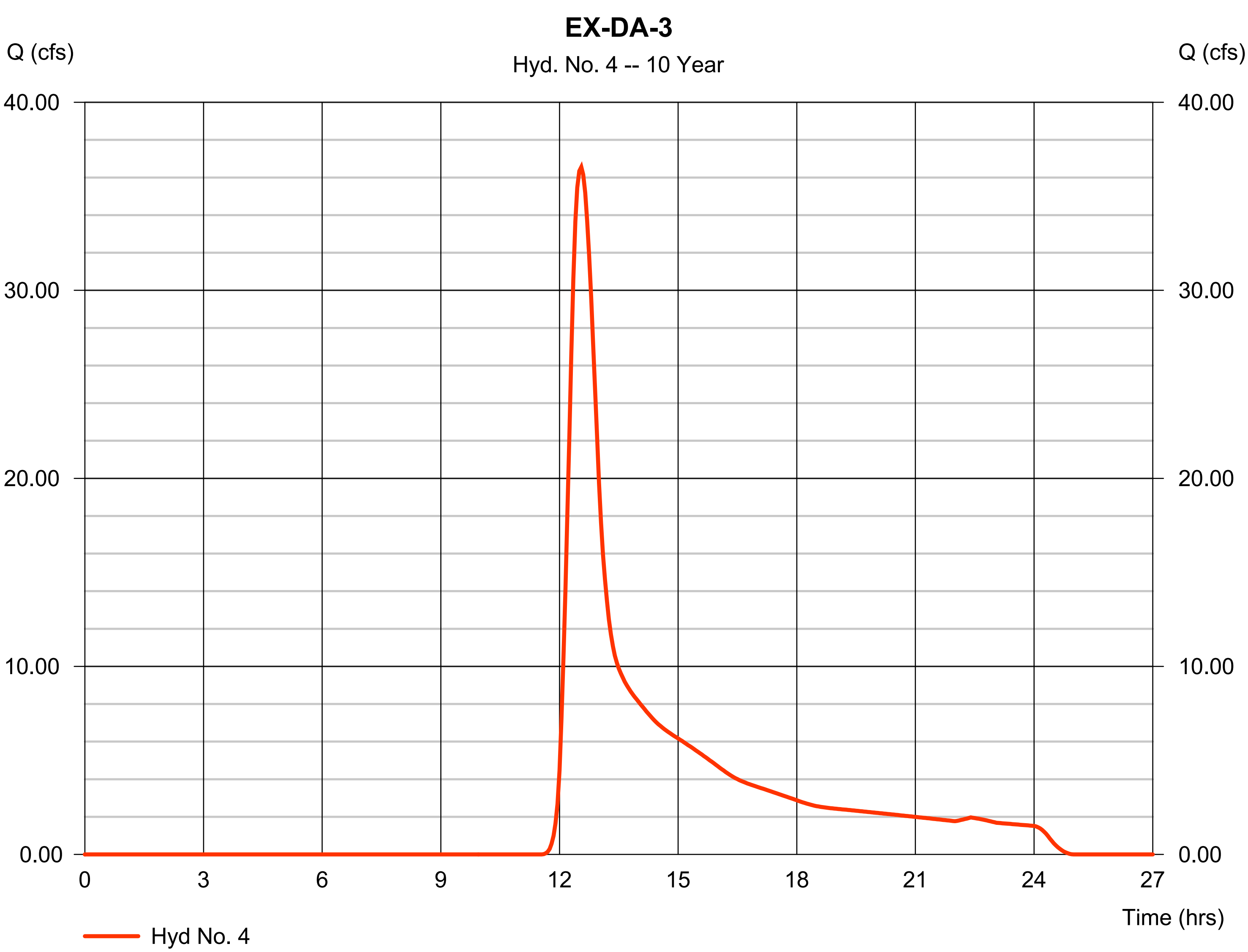
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 4

EX-DA-3

Hydrograph type	= SCS Runoff	Peak discharge	= 36.56 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.55 hrs
Time interval	= 3 min	Hyd. volume	= 253,845 cuft
Drainage area	= 50.910 ac	Curve number	= 52*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 38.30 min
Total precip.	= 6.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(30.546 x 61) + (20.364 x 39)] / 50.910

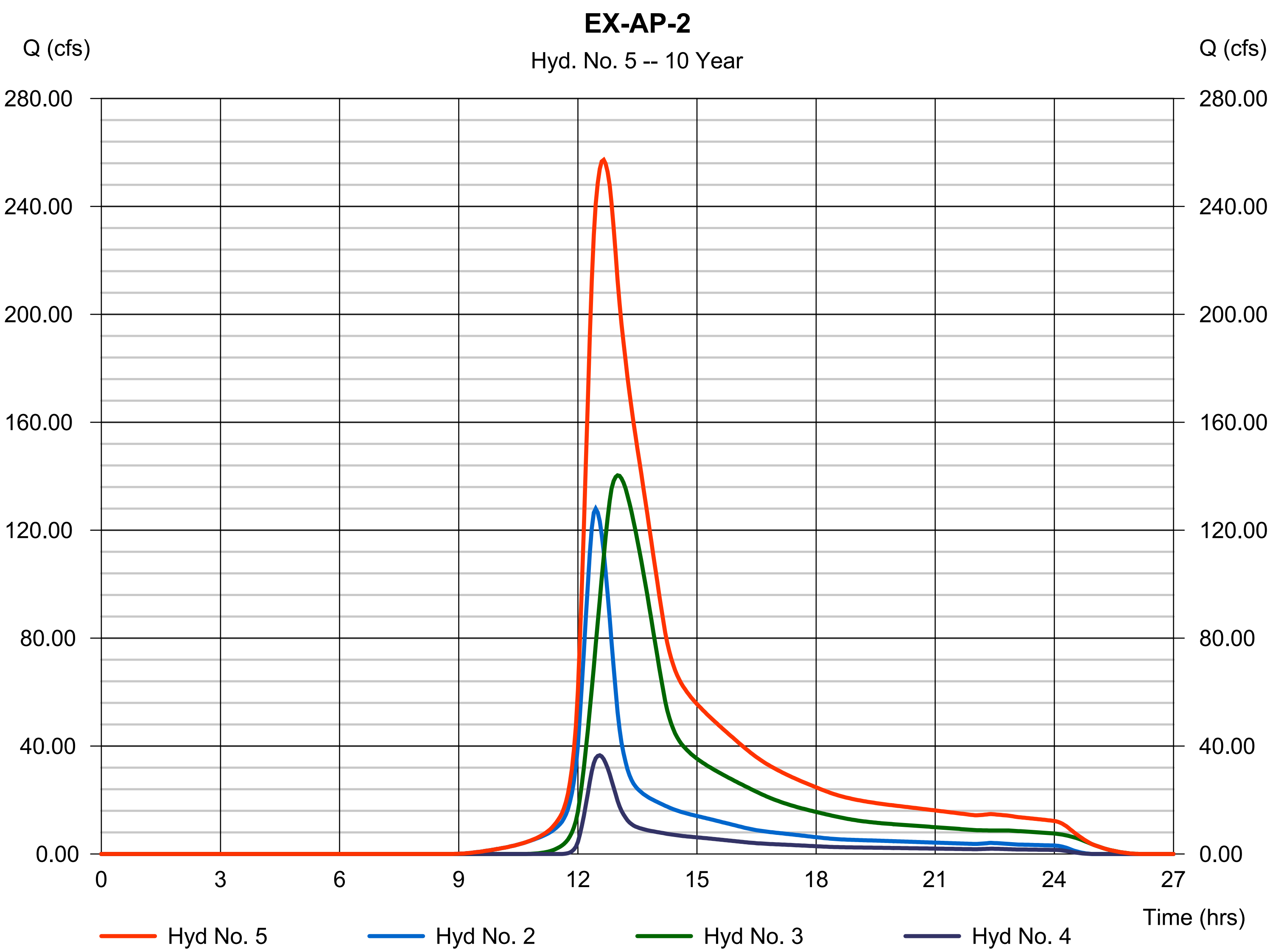


Hydrograph Report

Hyd. No. 5

EX-AP-2

Hydrograph type	= Combine	Peak discharge	= 257.24 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.65 hrs
Time interval	= 3 min	Hyd. volume	= 2,418,488 cuft
Inflow hyds.	= 2, 3, 4	Contrib. drain. area	= 310.060 ac



Hydrograph Report

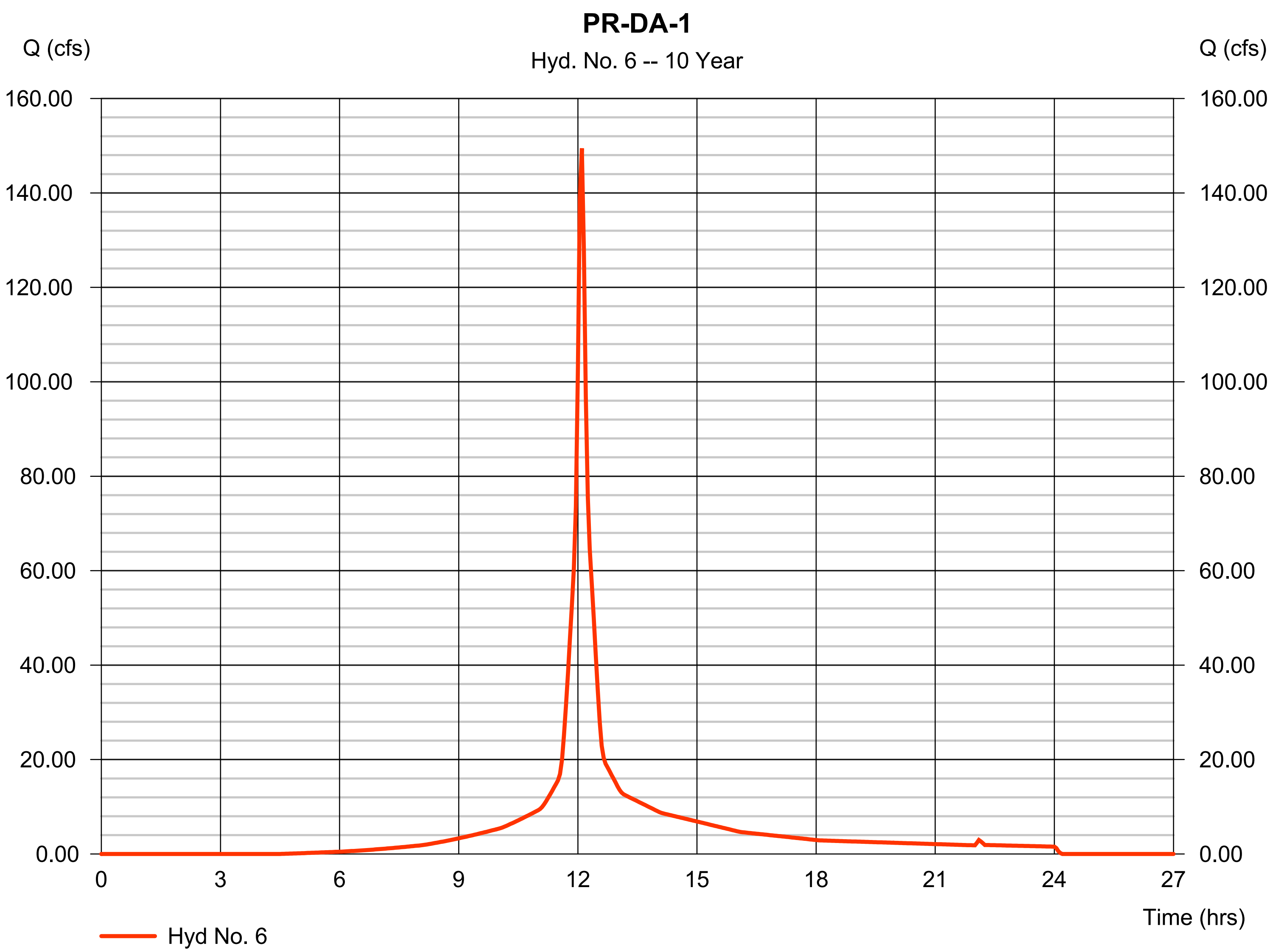
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 05 / 16 / 2018

Hyd. No. 6

PR-DA-1

Hydrograph type	= SCS Runoff	Peak discharge	= 149.45 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 515,193 cuft
Drainage area	= 32.150 ac	Curve number	= 87*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 7.60 min
Total precip.	= 6.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(22.300 x 98) + (9.560 x 61)] / 32.150



Hydrograph Report

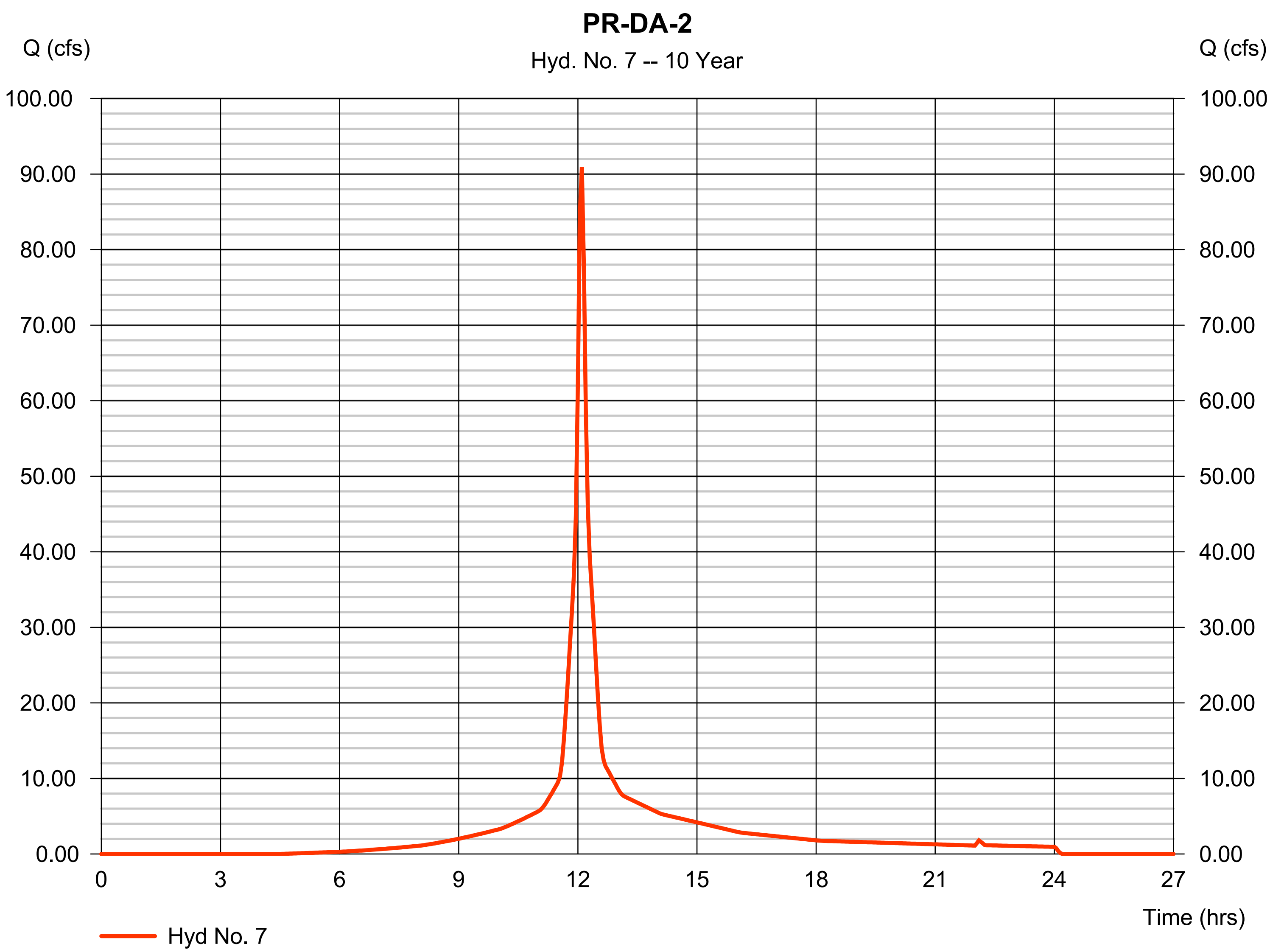
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 05 / 16 / 2018

Hyd. No. 7

PR-DA-2

Hydrograph type	= SCS Runoff	Peak discharge	= 90.92 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 313,443 cuft
Drainage area	= 19.560 ac	Curve number	= 87*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 7.60 min
Total precip.	= 6.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(13.580 x 98) + (5.820 x 61)] / 19.560



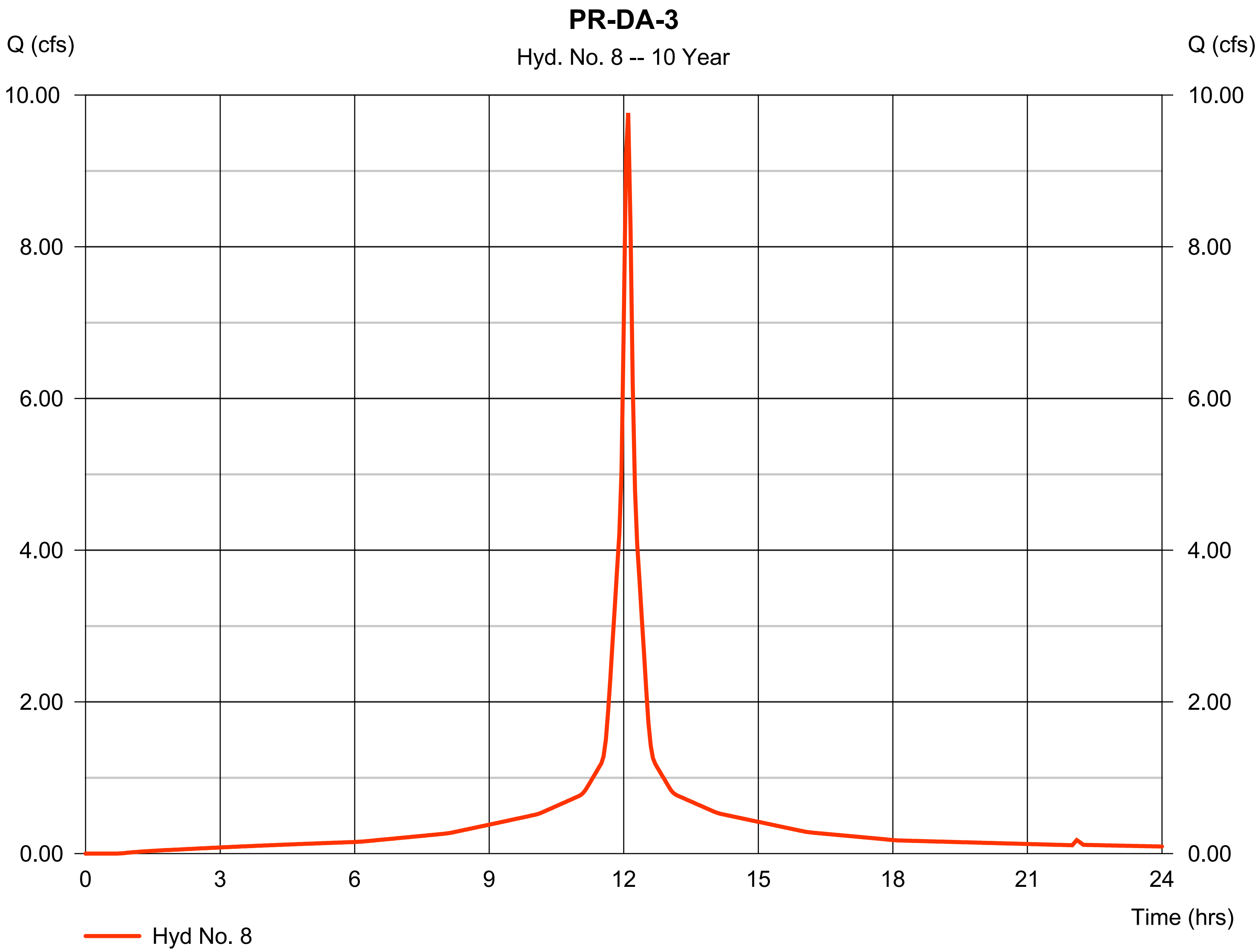
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 05 / 16 / 2018

Hyd. No. 8

PR-DA-3

Hydrograph type	= SCS Runoff	Peak discharge	= 9.764 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 37,655 cuft
Drainage area	= 1.856 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 4.80 min
Total precip.	= 6.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



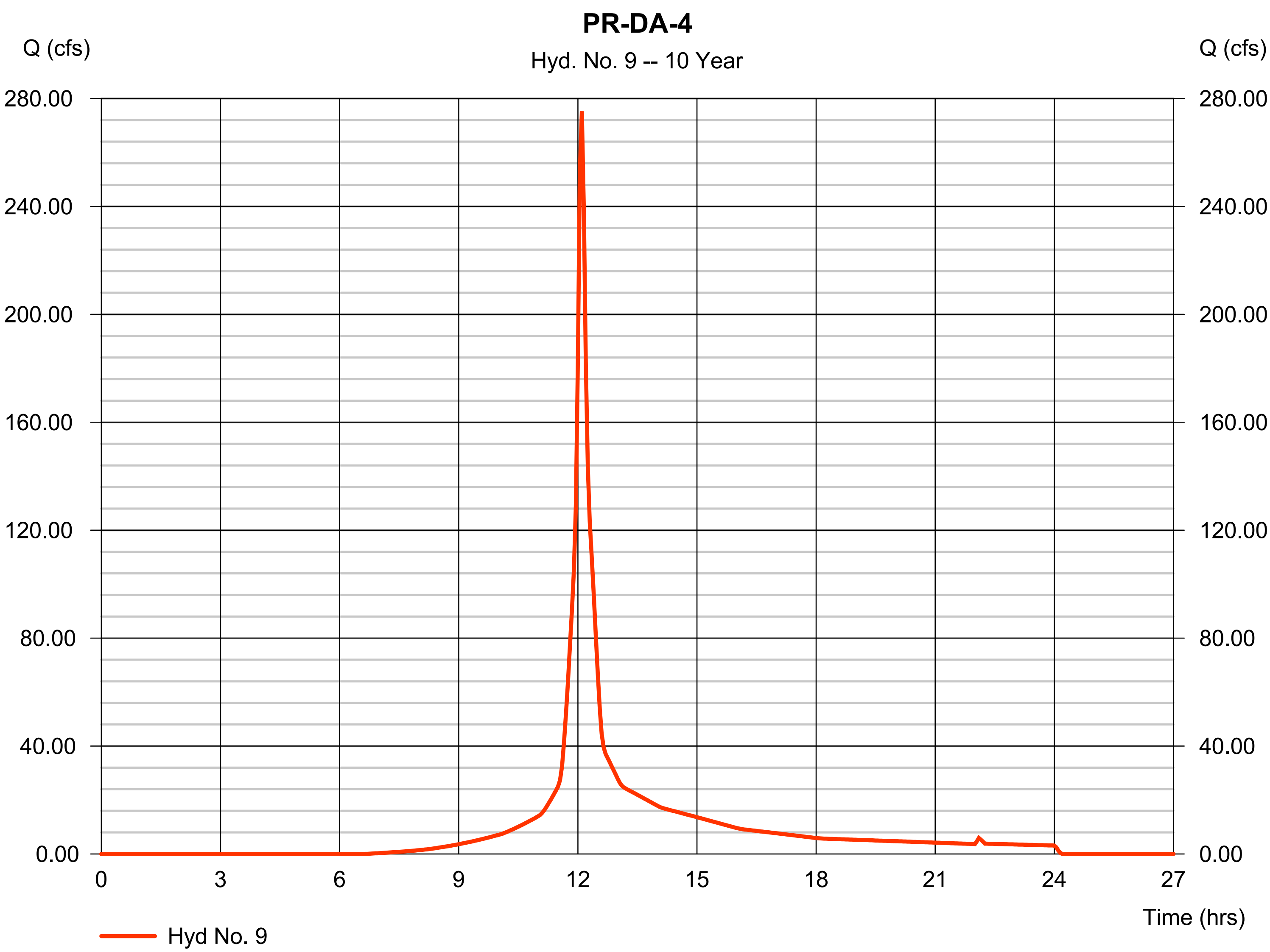
Hydrograph Report

Hyd. No. 9

PR-DA-4

Hydrograph type	= SCS Runoff	Peak discharge	= 275.24 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 922,160 cuft
Drainage area	= 68.390 ac	Curve number	= 80*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.10 min
Total precip.	= 6.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(34.190 x 98) + (34.200 x 61)] / 68.390



Hydrograph Report

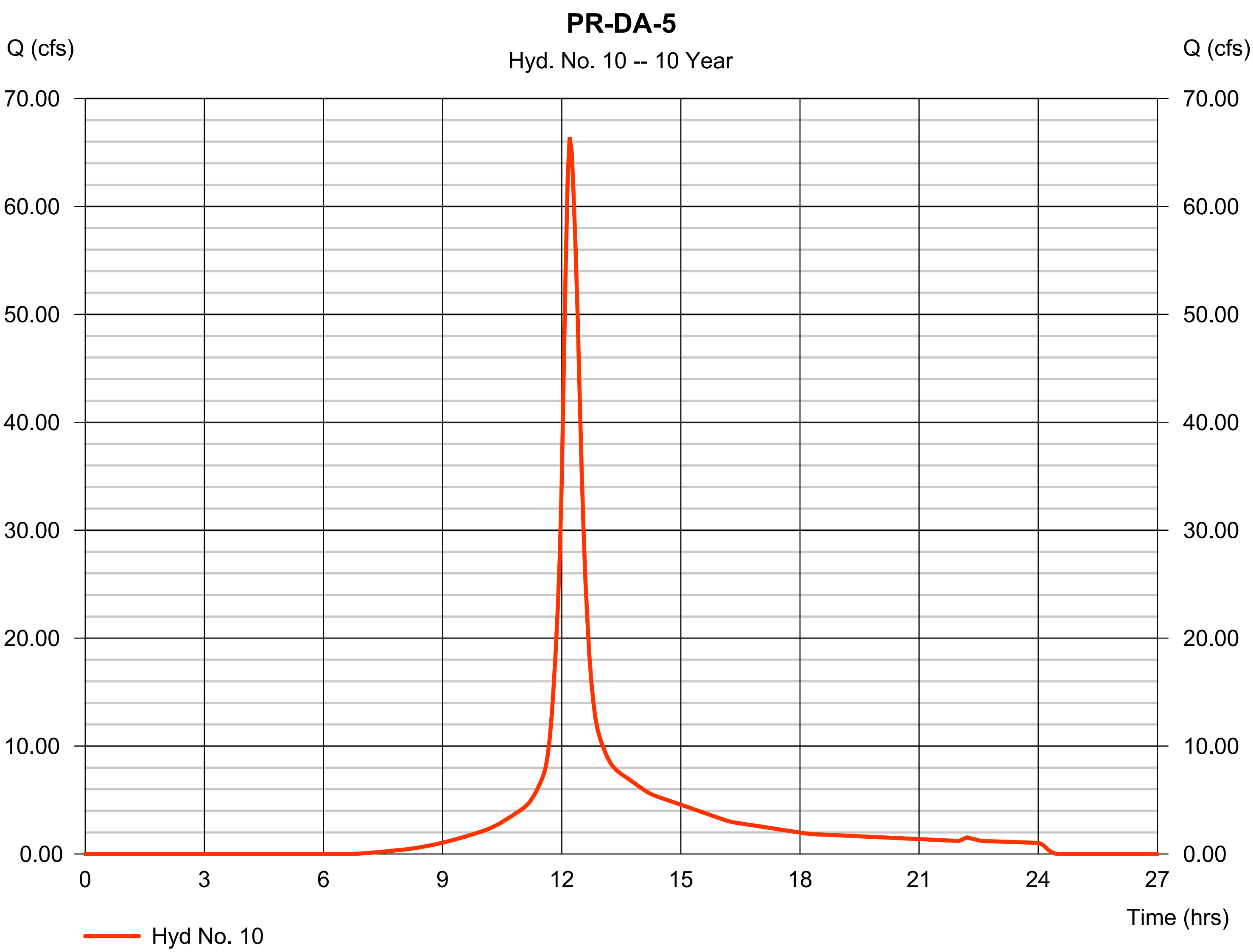
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 10

PR-DA-5

Hydrograph type	= SCS Runoff	Peak discharge	= 66.42 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.20 hrs
Time interval	= 3 min	Hyd. volume	= 297,386 cuft
Drainage area	= 20.050 ac	Curve number	= 80*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18.40 min
Total precip.	= 6.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(10.167 x 98) + (10.167 x 61)] / 20.050



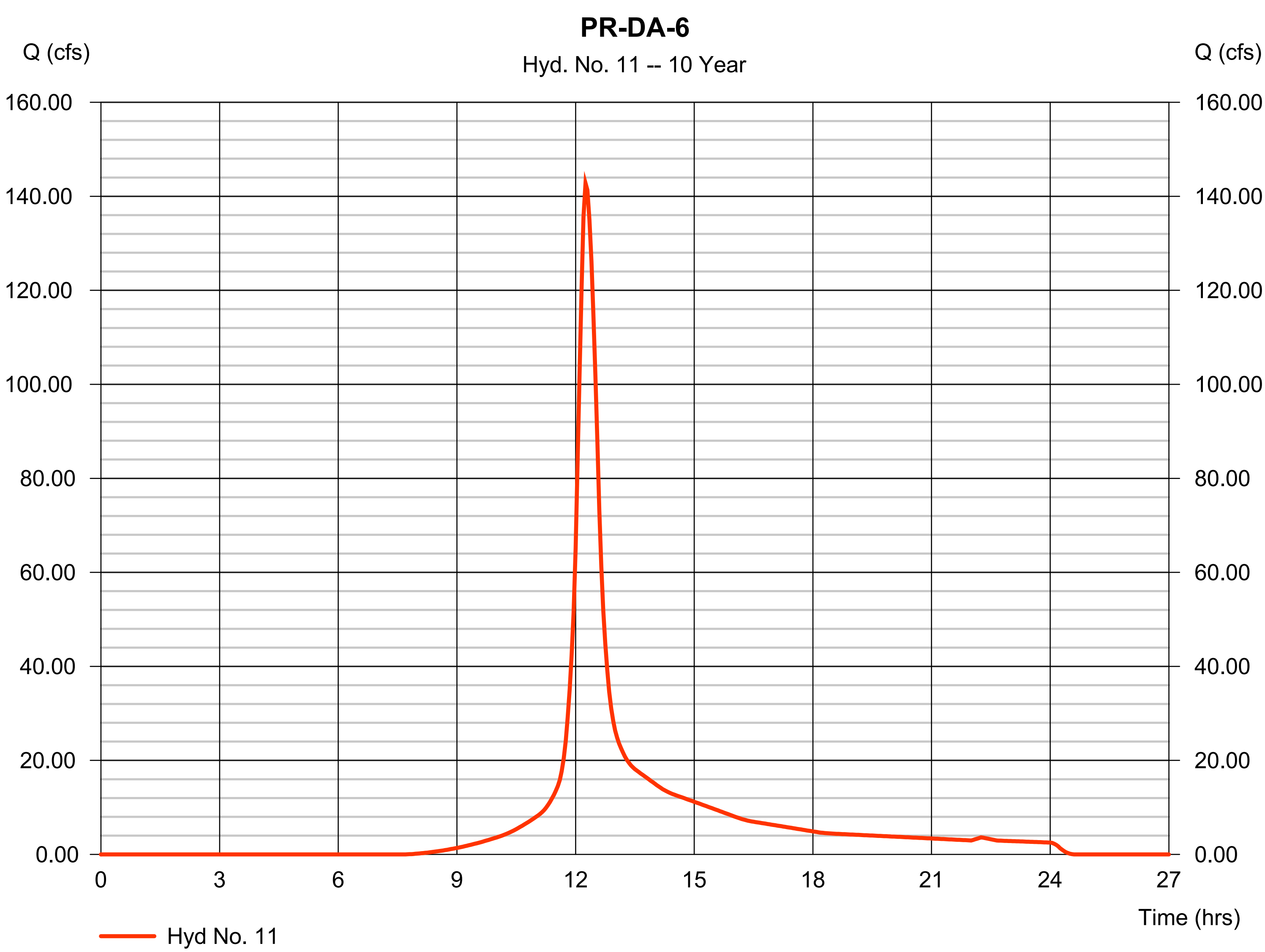
Hydrograph Report

Hyd. No. 11

PR-DA-6

Hydrograph type	= SCS Runoff	Peak discharge	= 142.77 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.25 hrs
Time interval	= 3 min	Hyd. volume	= 681,119 cuft
Drainage area	= 54.160 ac	Curve number	= 76*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 24.60 min
Total precip.	= 6.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(19.630 x 61) + (7.450 x 39) + (27.080 x 98)] / 54.160



Hydrograph Report

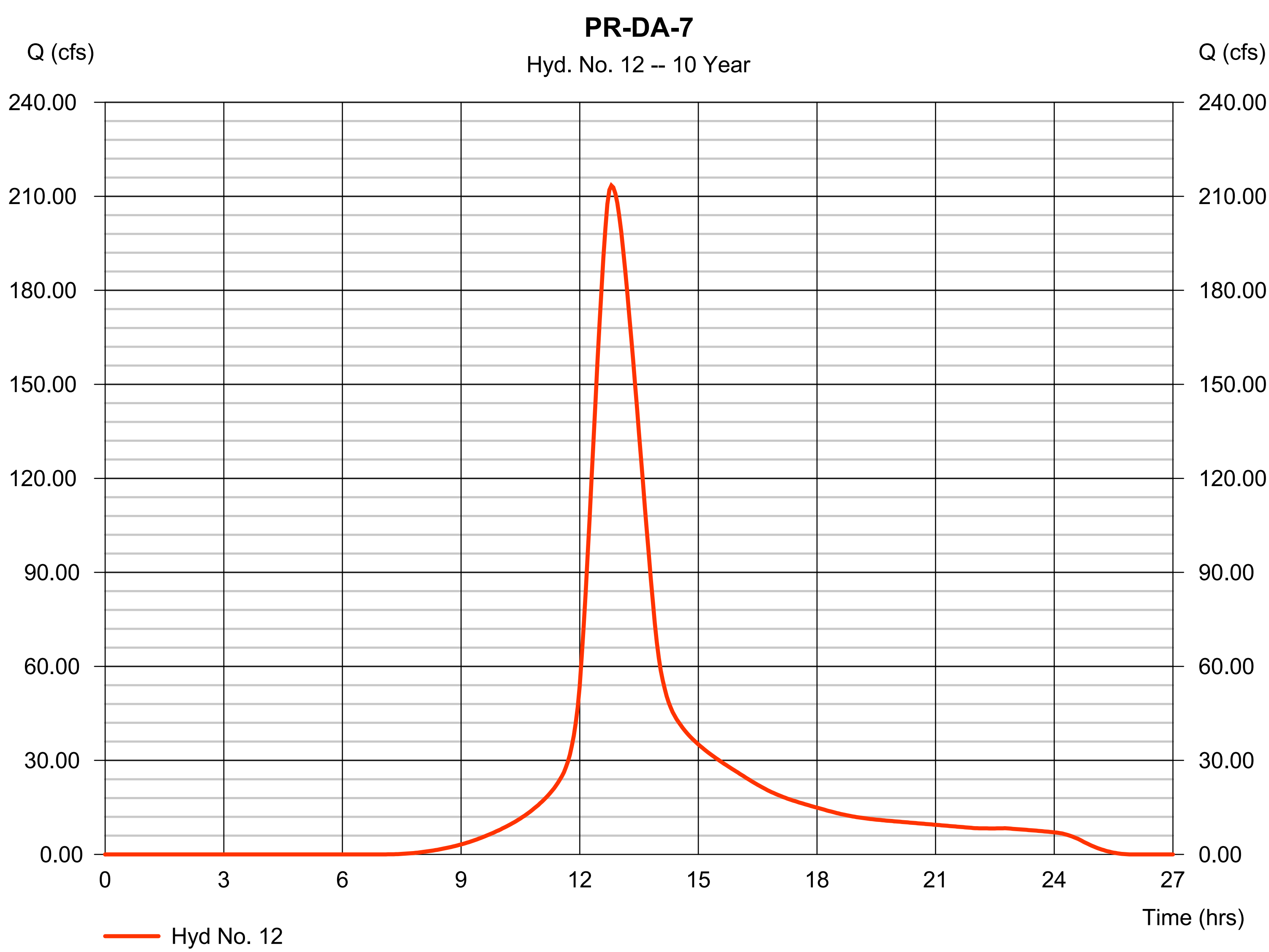
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 05 / 16 / 2018

Hyd. No. 12

PR-DA-7

Hydrograph type	= SCS Runoff	Peak discharge	= 213.43 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.80 hrs
Time interval	= 3 min	Hyd. volume	= 1,851,061 cuft
Drainage area	= 132.150 ac	Curve number	= 79*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 71.80 min
Total precip.	= 6.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(66.080 x 98) + (66.070 x 61)] / 132.150



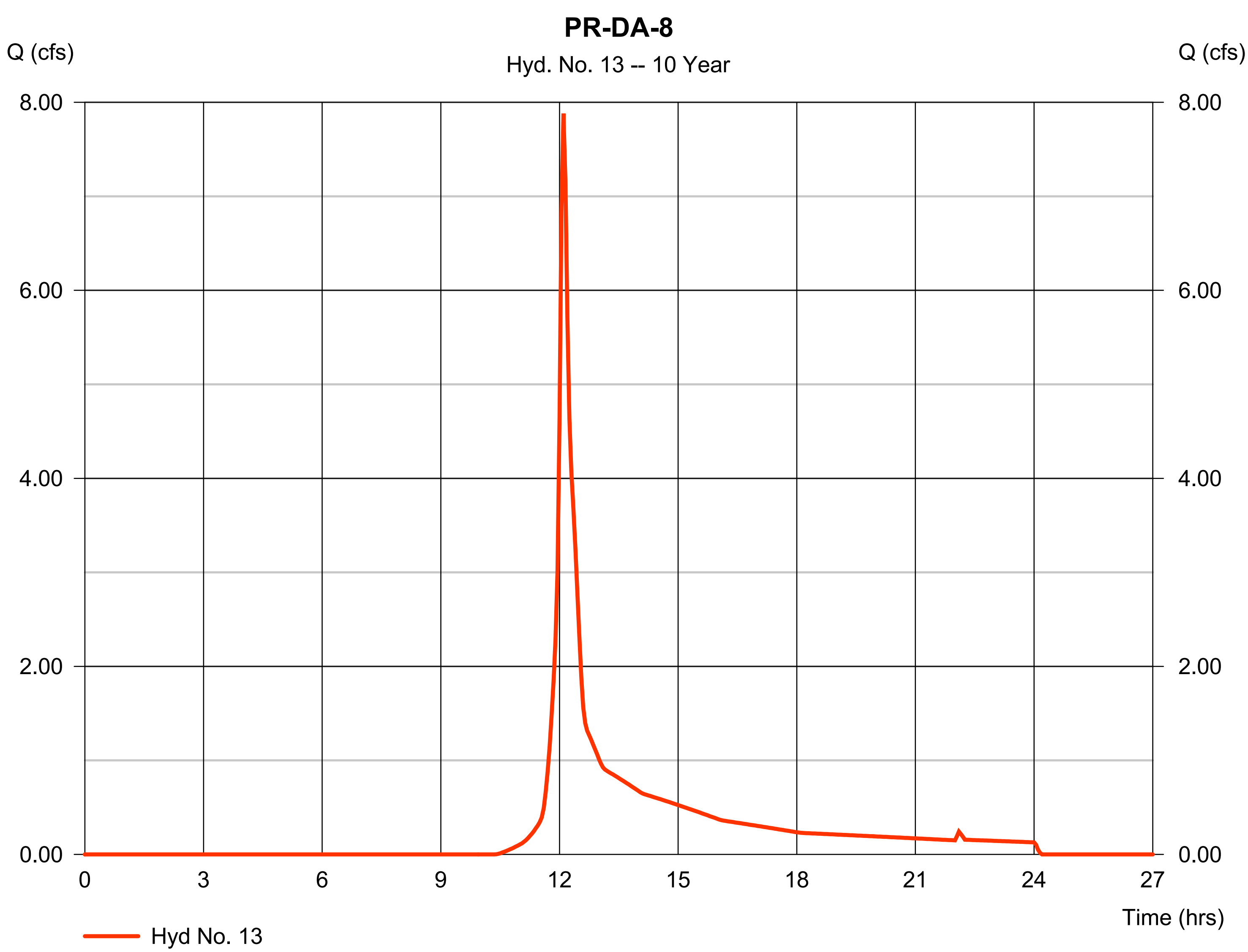
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 13

PR-DA-8

Hydrograph type	= SCS Runoff	Peak discharge	= 7.881 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 27,244 cuft
Drainage area	= 3.740 ac	Curve number	= 61
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 4.90 min
Total precip.	= 6.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

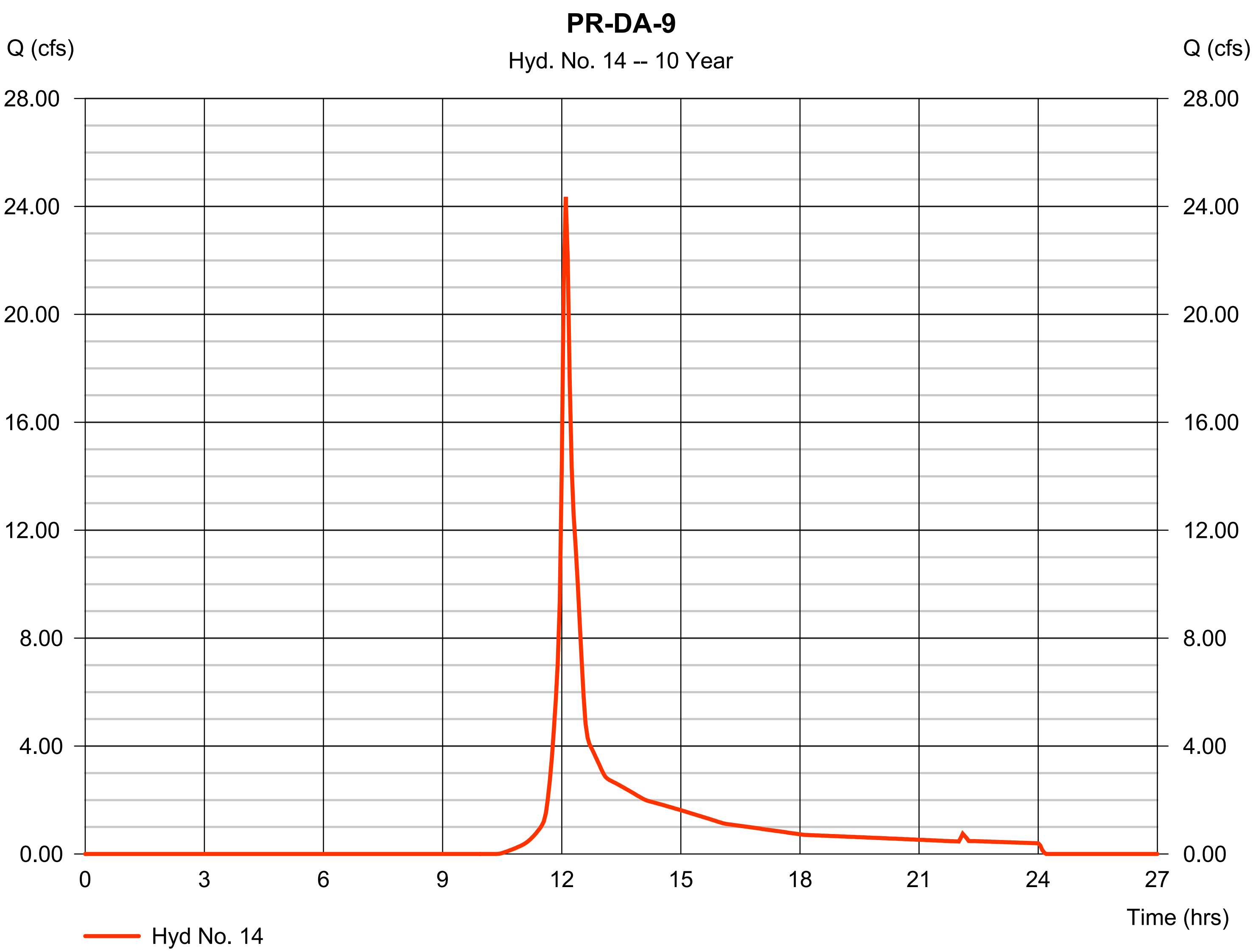


Hydrograph Report

Hyd. No. 14

PR-DA-9

Hydrograph type	= SCS Runoff	Peak discharge	= 24.36 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 84,207 cuft
Drainage area	= 11.560 ac	Curve number	= 61
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.70 min
Total precip.	= 6.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



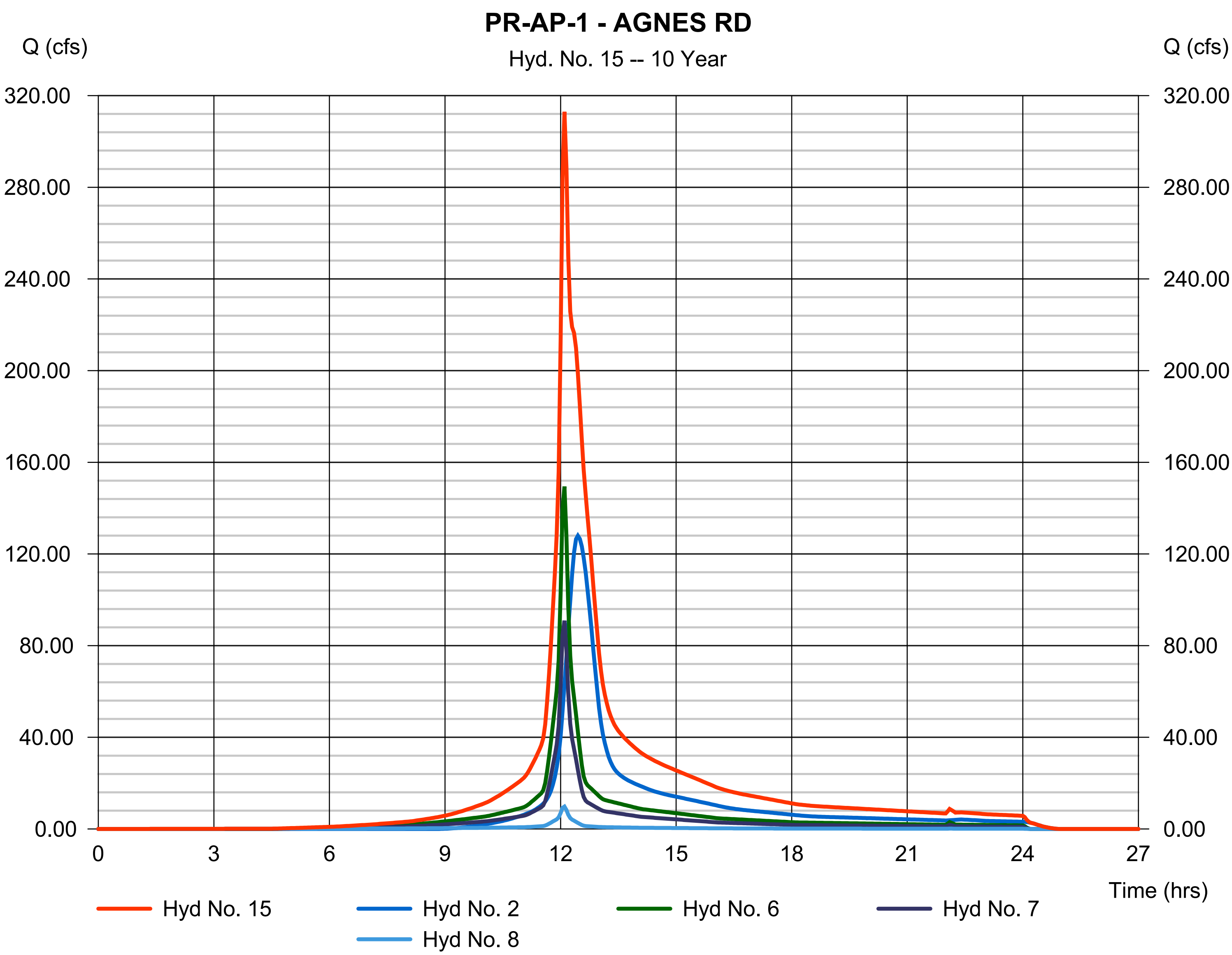
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 15

PR-AP-1 - AGNES RD

Hydrograph type	= Combine	Peak discharge	= 312.95 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 1,630,120 cuft
Inflow hyds.	= 2, 6, 7, 8	Contrib. drain. area	= 123.406 ac



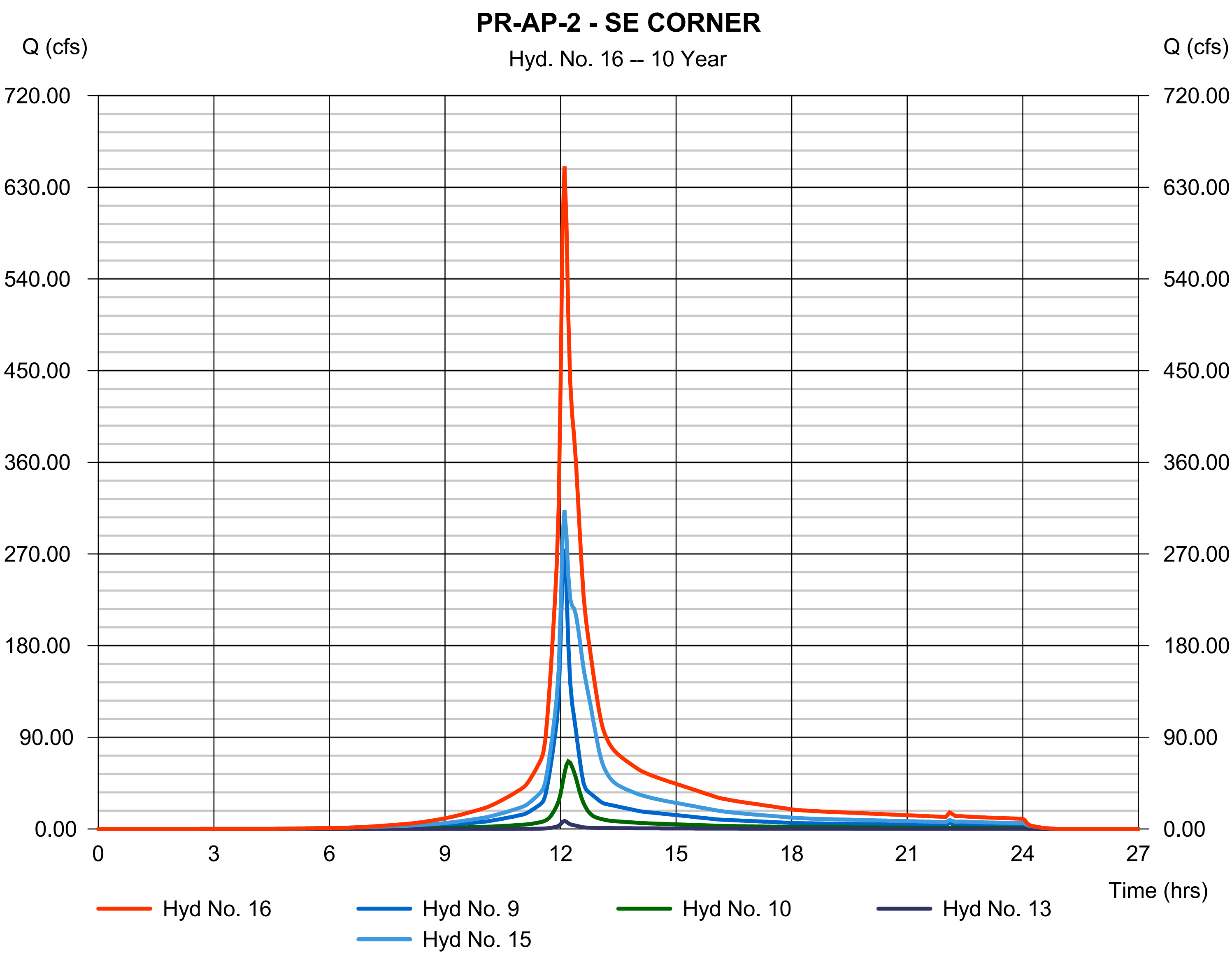
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 | Wednesday, 05 / 16 / 2018

Hyd. No. 16

PR-AP-2 - SE CORNER

Hydrograph type	= Combine	Peak discharge	= 650.57 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 2,876,911 cuft
Inflow hyds.	= 9, 10, 13, 15	Contrib. drain. area	= 92.180 ac



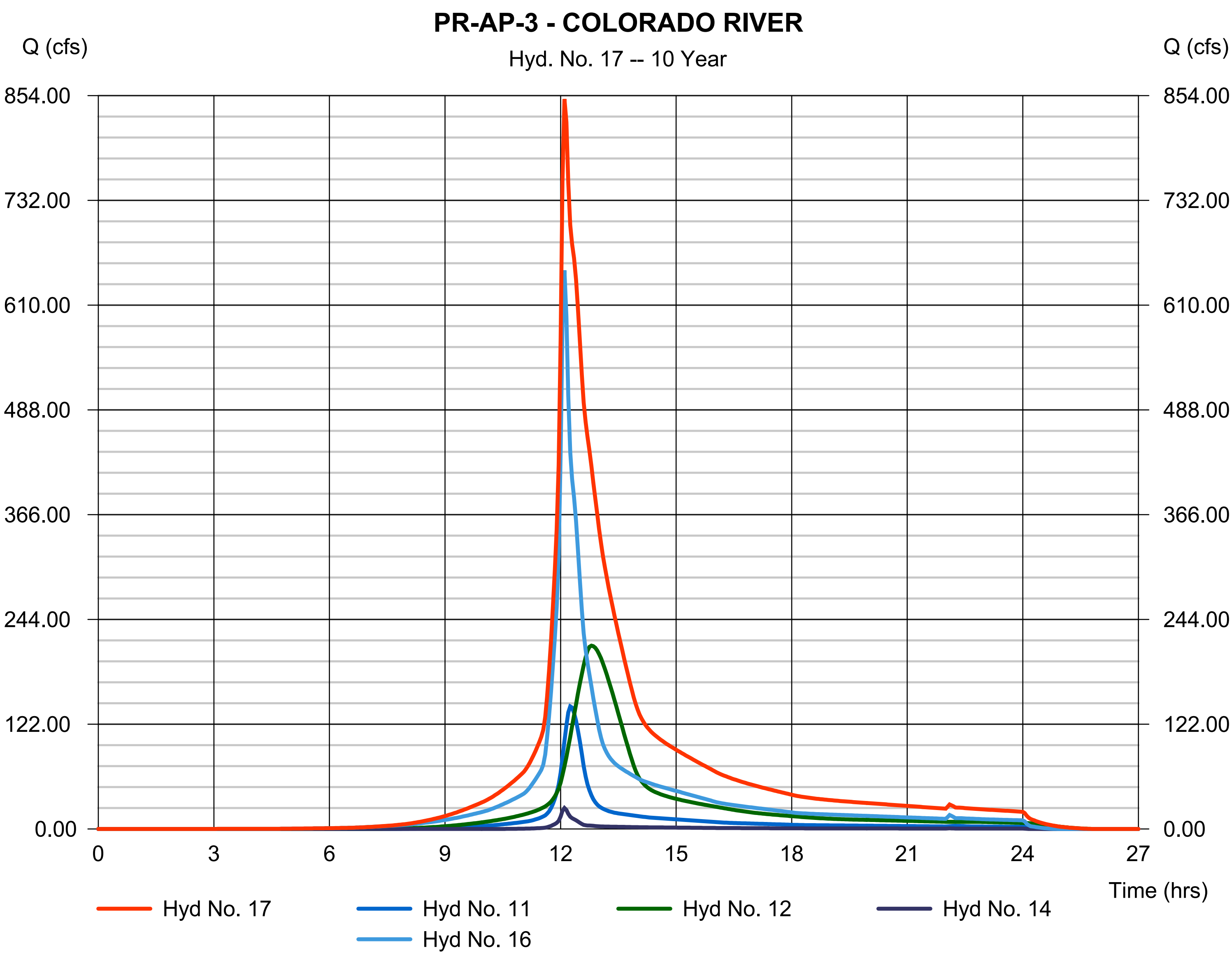
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 17

PR-AP-3 - COLORADO RIVER

Hydrograph type	= Combine	Peak discharge	= 850.01 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 5,493,296 cuft
Inflow hyds.	= 11, 12, 14, 16	Contrib. drain. area	= 197.870 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	97.12	3	786	1,037,961	------	------	------	EX-DA-1 / EX-AP-1
2	SCS Runoff	181.31	3	747	1,078,021	------	------	------	EX-DA-OFFSITE
3	SCS Runoff	219.91	3	780	2,121,502	------	------	------	EX-DA-2
4	SCS Runoff	64.30	3	750	413,255	------	------	------	EX-DA-3
5	Combine	395.87	3	756	3,612,778	2, 3, 4	------	------	EX-AP-2
6	SCS Runoff	192.56	3	726	673,739	------	------	------	PR-DA-1
7	SCS Runoff	117.15	3	726	409,901	------	------	------	PR-DA-2
8	SCS Runoff	12.14	3	726	47,121	------	------	------	PR-DA-3
9	SCS Runoff	367.46	3	726	1,243,838	------	------	------	PR-DA-4
10	SCS Runoff	88.96	3	732	401,124	------	------	------	PR-DA-5
11	SCS Runoff	195.94	3	735	936,516	------	------	------	PR-DA-6
12	SCS Runoff	288.18	3	768	2,508,478	------	------	------	PR-DA-7
13	SCS Runoff	12.16	3	726	40,953	------	------	------	PR-DA-8
14	SCS Runoff	37.58	3	726	126,582	------	------	------	PR-DA-9
15	Combine	414.96	3	726	2,208,784	2, 6, 7, 8,	------	------	PR-AP-1 - AGNES RD
16	Combine	868.31	3	726	3,894,697	9, 10, 13, 15	------	------	PR-AP-2 - SE CORNER
17	Combine	1151.75	3	726	7,466,272	11, 12, 14, 16	------	------	PR-AP-3 - COLORADO RIVER

Hydrograph Report

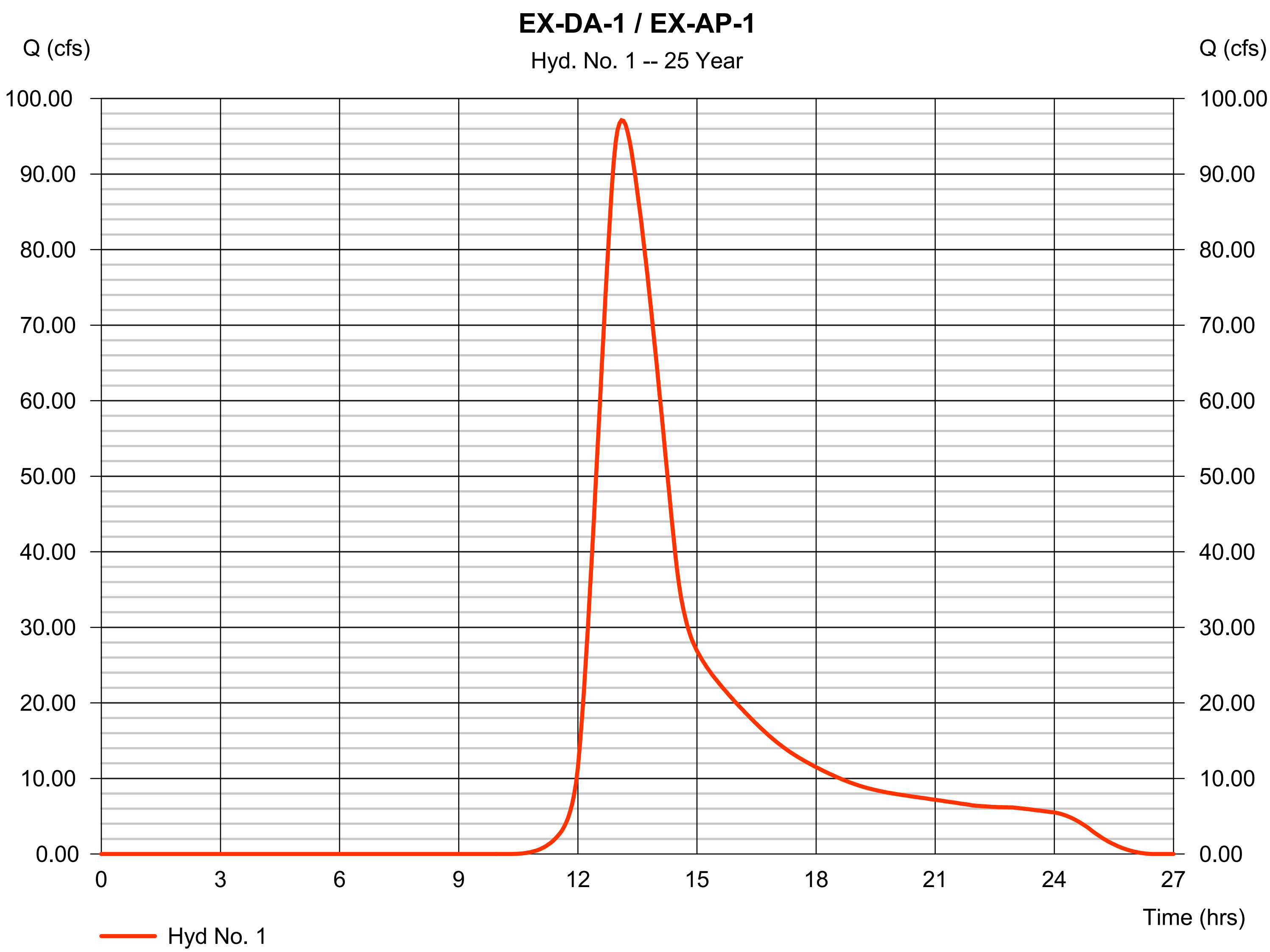
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 05 / 16 / 2018

Hyd. No. 1

EX-DA-1 / EX-AP-1

Hydrograph type	= SCS Runoff	Peak discharge	= 97.12 cfs
Storm frequency	= 25 yrs	Time to peak	= 13.10 hrs
Time interval	= 3 min	Hyd. volume	= 1,037,961 cuft
Drainage area	= 101.790 ac	Curve number	= 57*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 94.50 min
Total precip.	= 7.70 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(84.000 x 61) + (17.790 x 39)] / 101.790



Hydrograph Report

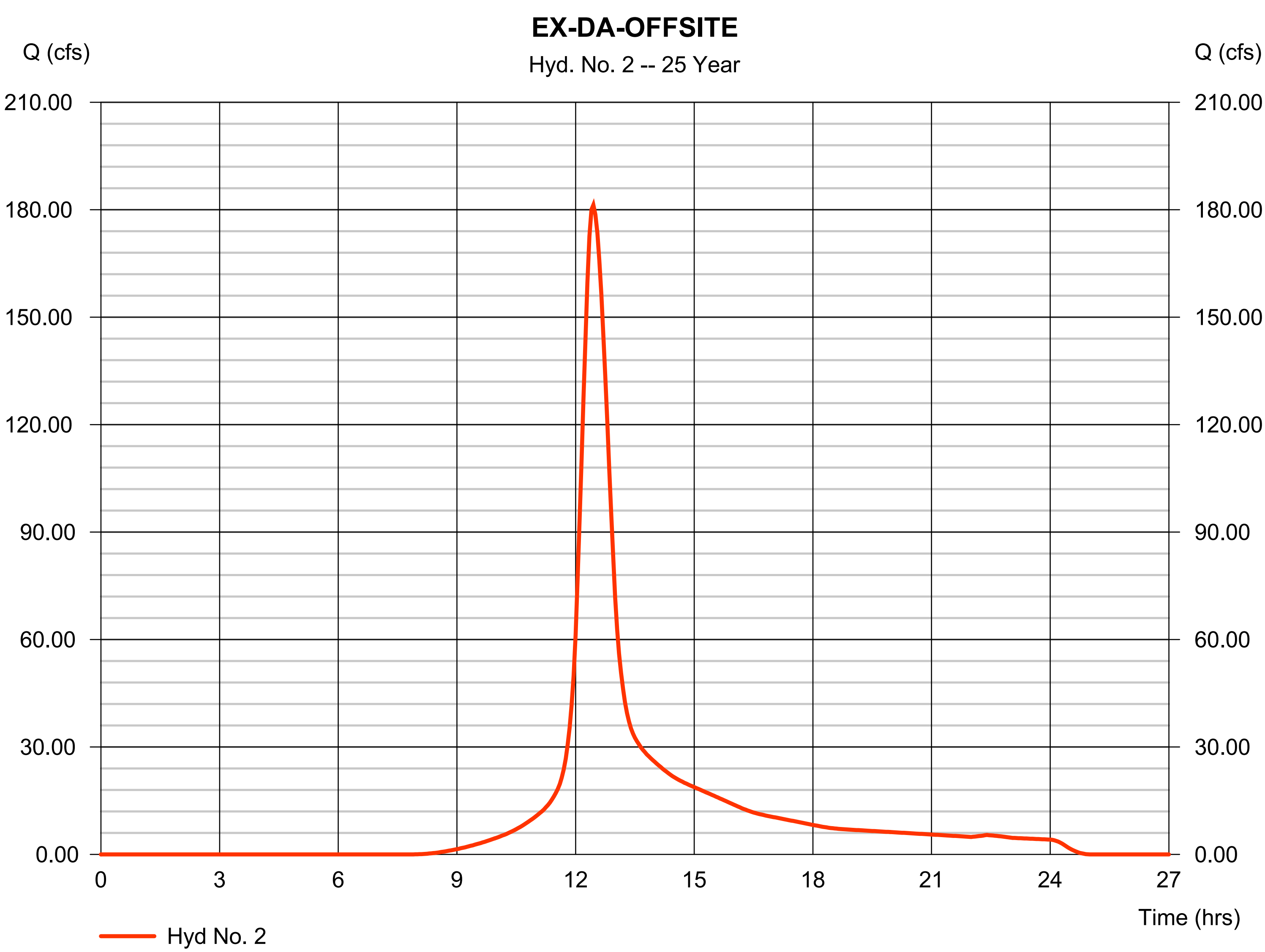
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 05 / 16 / 2018

Hyd. No. 2

EX-DA-OFFSITE

Hydrograph type	= SCS Runoff	Peak discharge	= 181.31 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.45 hrs
Time interval	= 3 min	Hyd. volume	= 1,078,021 cuft
Drainage area	= 69.840 ac	Curve number	= 71*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 39.80 min
Total precip.	= 7.70 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(19.230 x 98) + (50.610 x 61)] / 69.840



Hydrograph Report

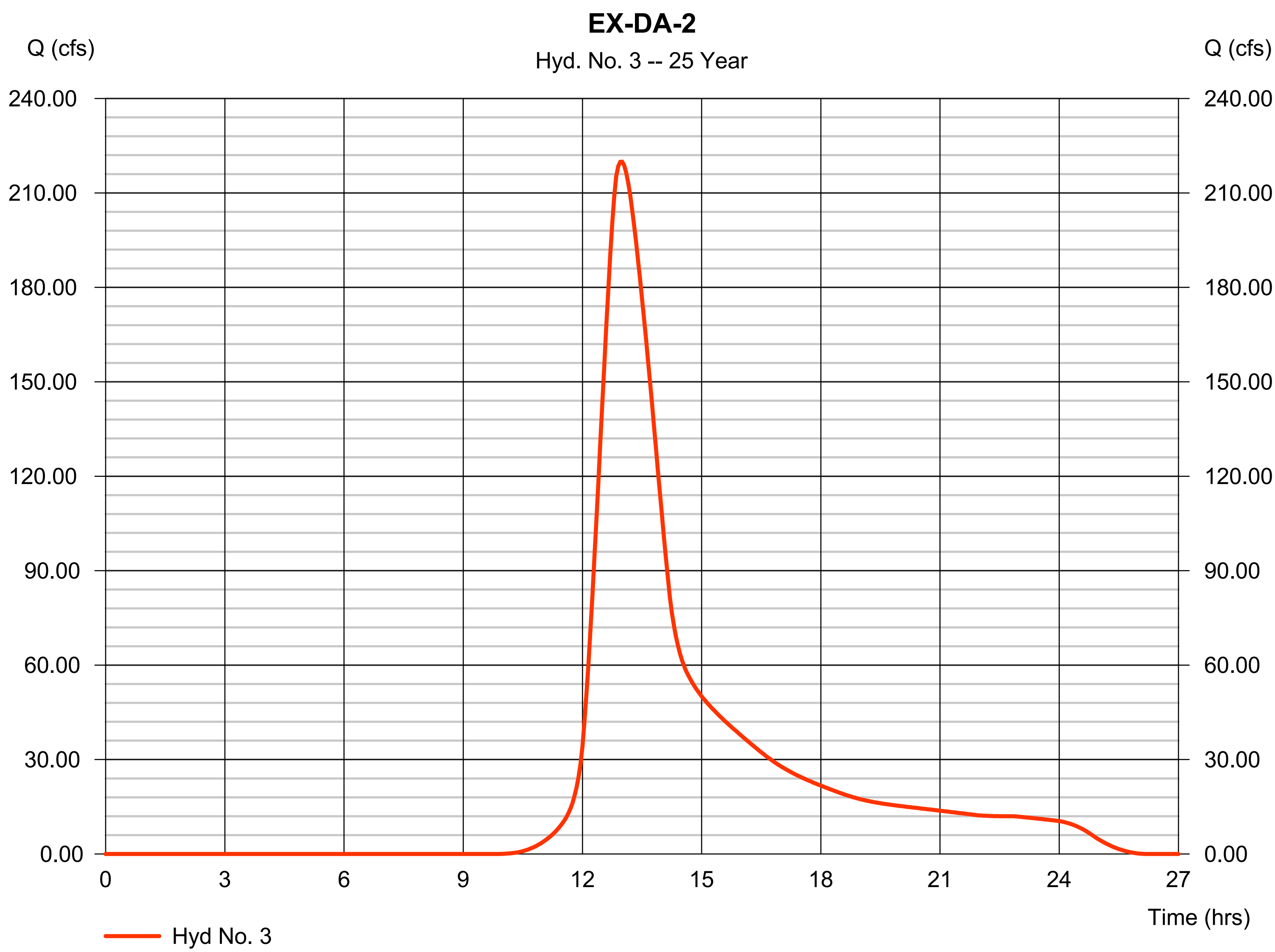
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 3

EX-DA-2

Hydrograph type	= SCS Runoff	Peak discharge	= 219.91 cfs
Storm frequency	= 25 yrs	Time to peak	= 13.00 hrs
Time interval	= 3 min	Hyd. volume	= 2,121,502 cuft
Drainage area	= 189.310 ac	Curve number	= 60*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 83.86 min
Total precip.	= 7.70 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(183.470 x 61) + (5.840 x 39)] / 189.310



Hydrograph Report

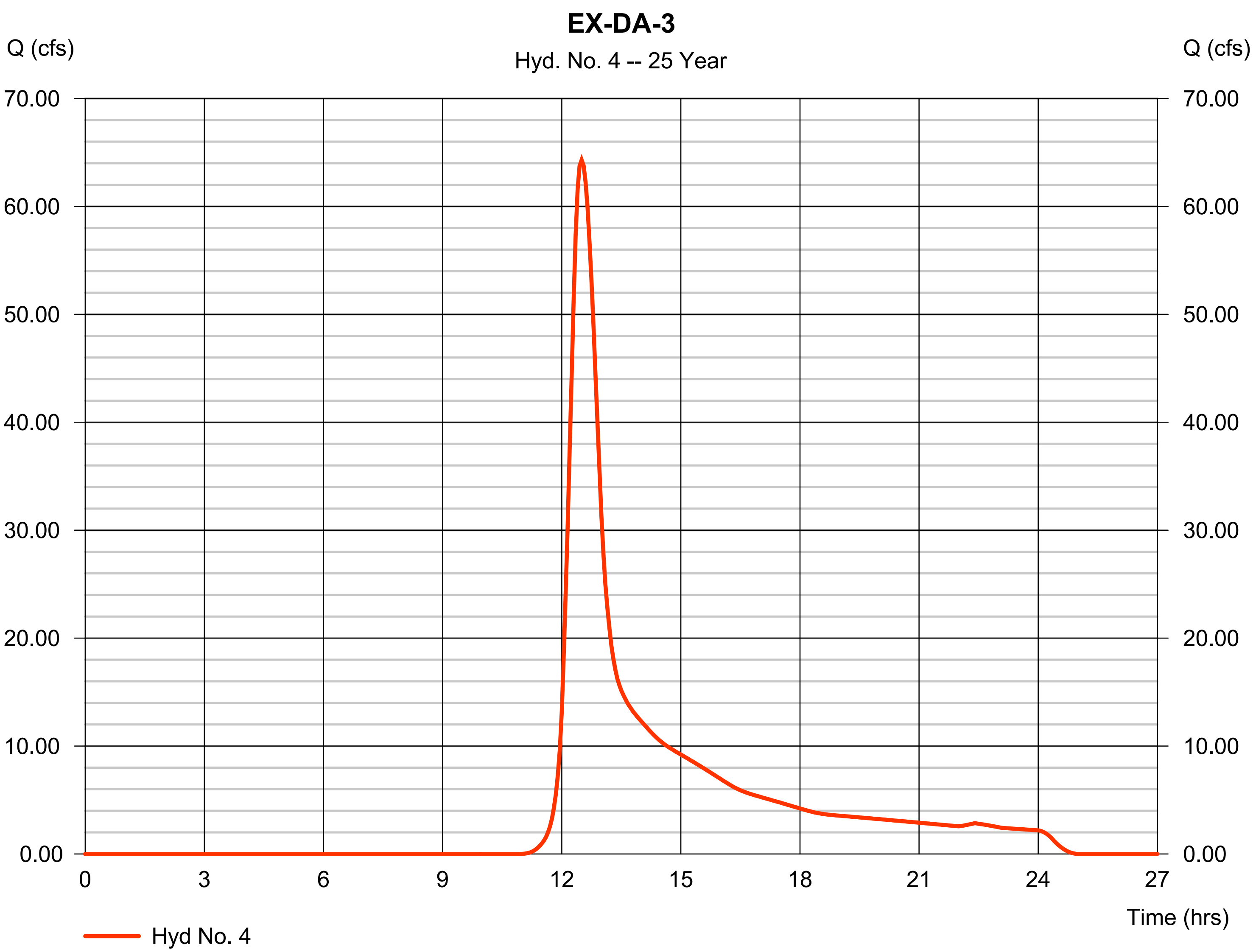
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 4

EX-DA-3

Hydrograph type	= SCS Runoff	Peak discharge	= 64.30 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.50 hrs
Time interval	= 3 min	Hyd. volume	= 413,255 cuft
Drainage area	= 50.910 ac	Curve number	= 52*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 38.30 min
Total precip.	= 7.70 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(30.546 x 61) + (20.364 x 39)] / 50.910



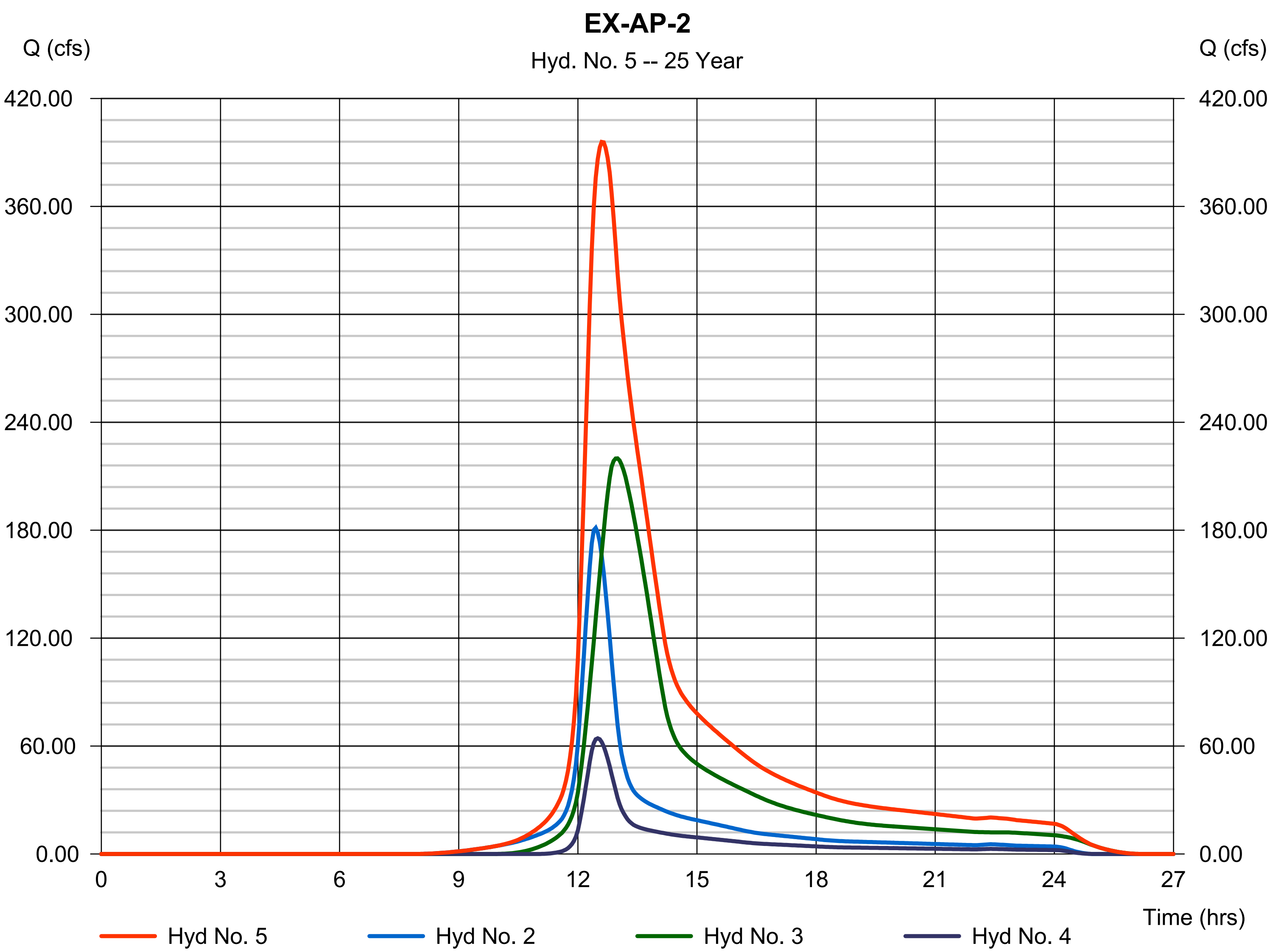
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 05 / 16 / 2018

Hyd. No. 5

EX-AP-2

Hydrograph type	= Combine	Peak discharge	= 395.87 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.60 hrs
Time interval	= 3 min	Hyd. volume	= 3,612,778 cuft
Inflow hyds.	= 2, 3, 4	Contrib. drain. area	= 310.060 ac



Hydrograph Report

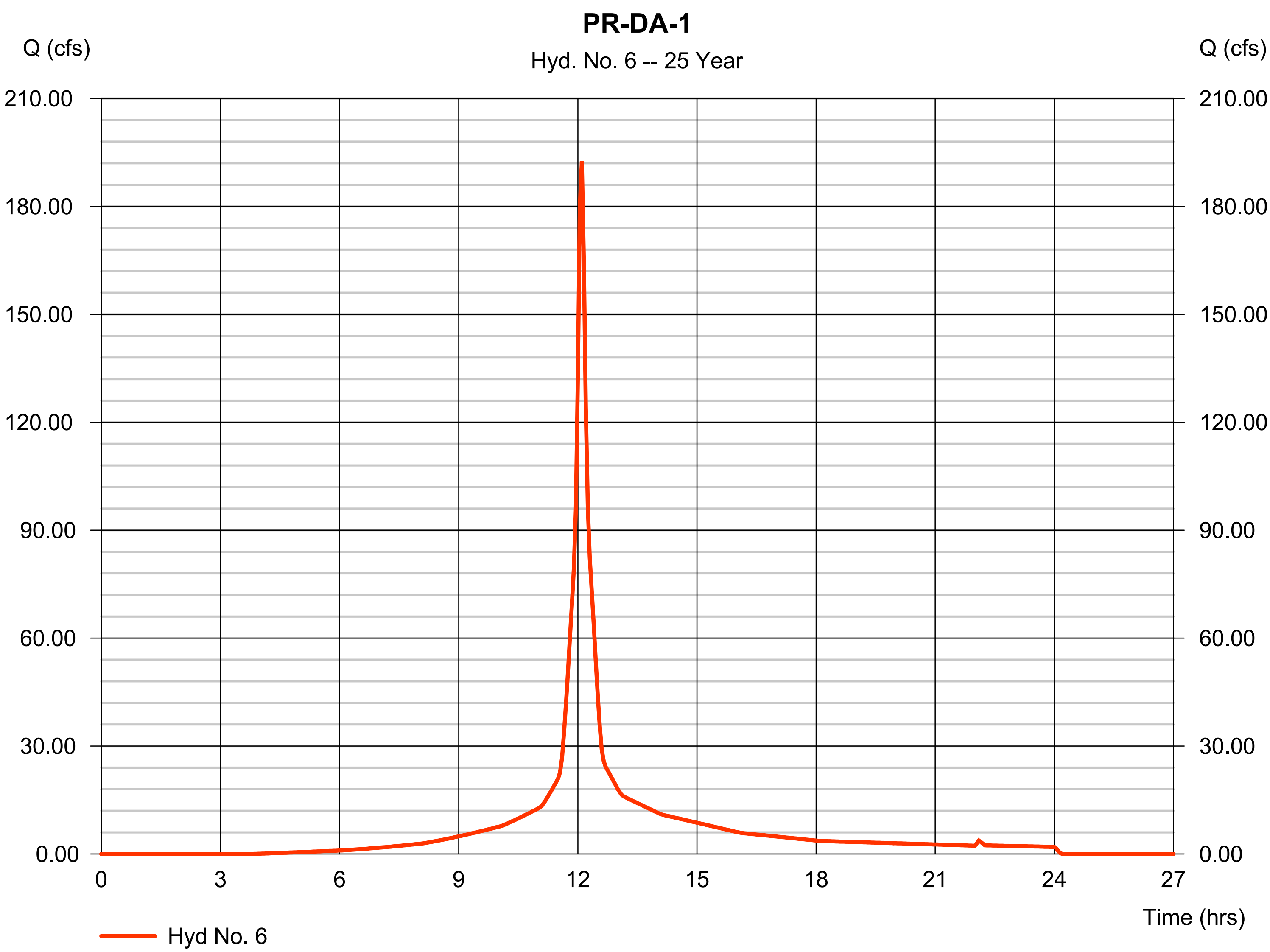
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 05 / 16 / 2018

Hyd. No. 6

PR-DA-1

Hydrograph type	= SCS Runoff	Peak discharge	= 192.56 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 673,739 cuft
Drainage area	= 32.150 ac	Curve number	= 87*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 7.60 min
Total precip.	= 7.70 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(22.300 x 98) + (9.560 x 61)] / 32.150



Hydrograph Report

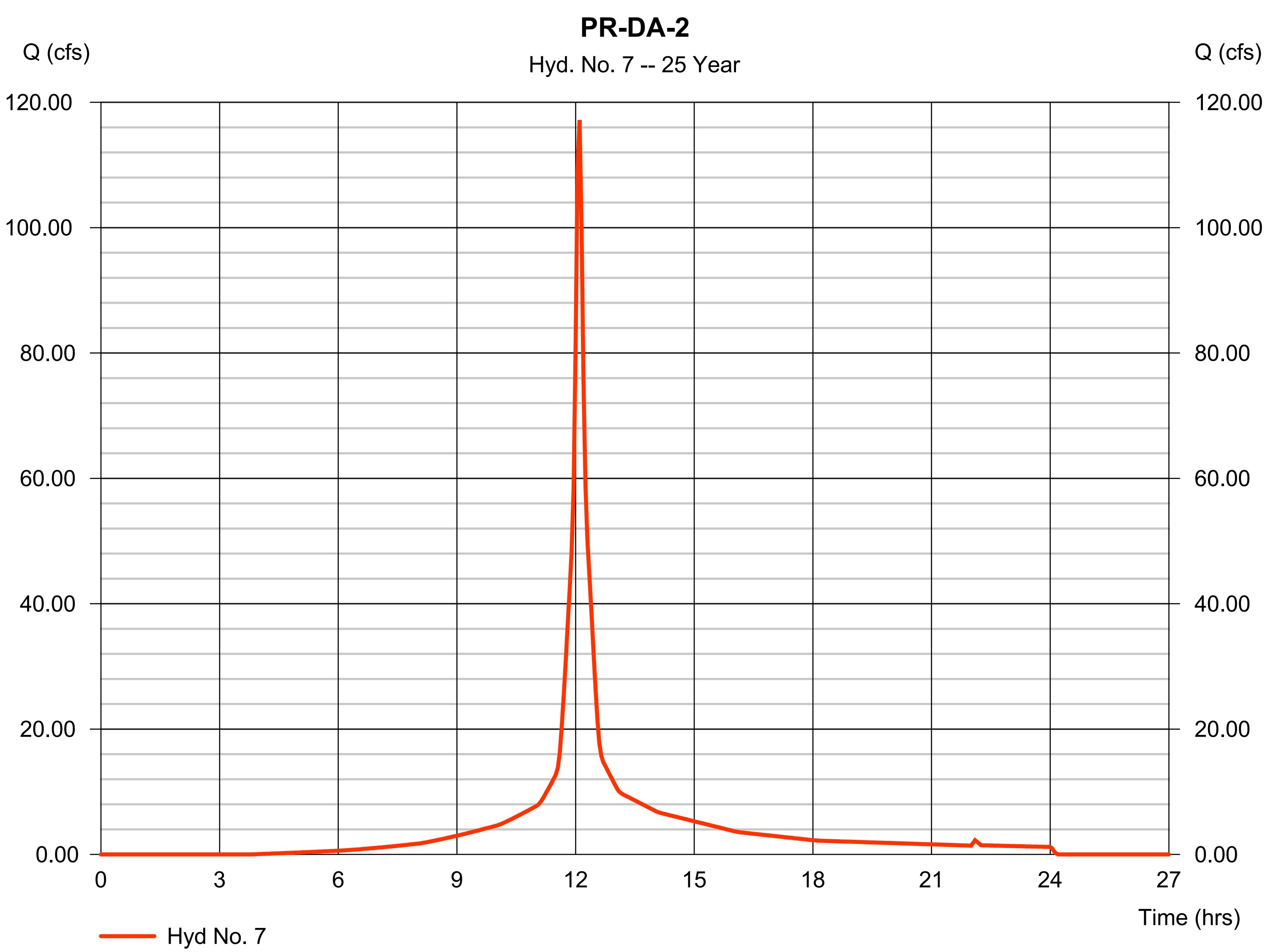
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 7

PR-DA-2

Hydrograph type	= SCS Runoff	Peak discharge	= 117.15 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 409,901 cuft
Drainage area	= 19.560 ac	Curve number	= 87*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 7.60 min
Total precip.	= 7.70 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(13.580 x 98) + (5.820 x 61)] / 19.560



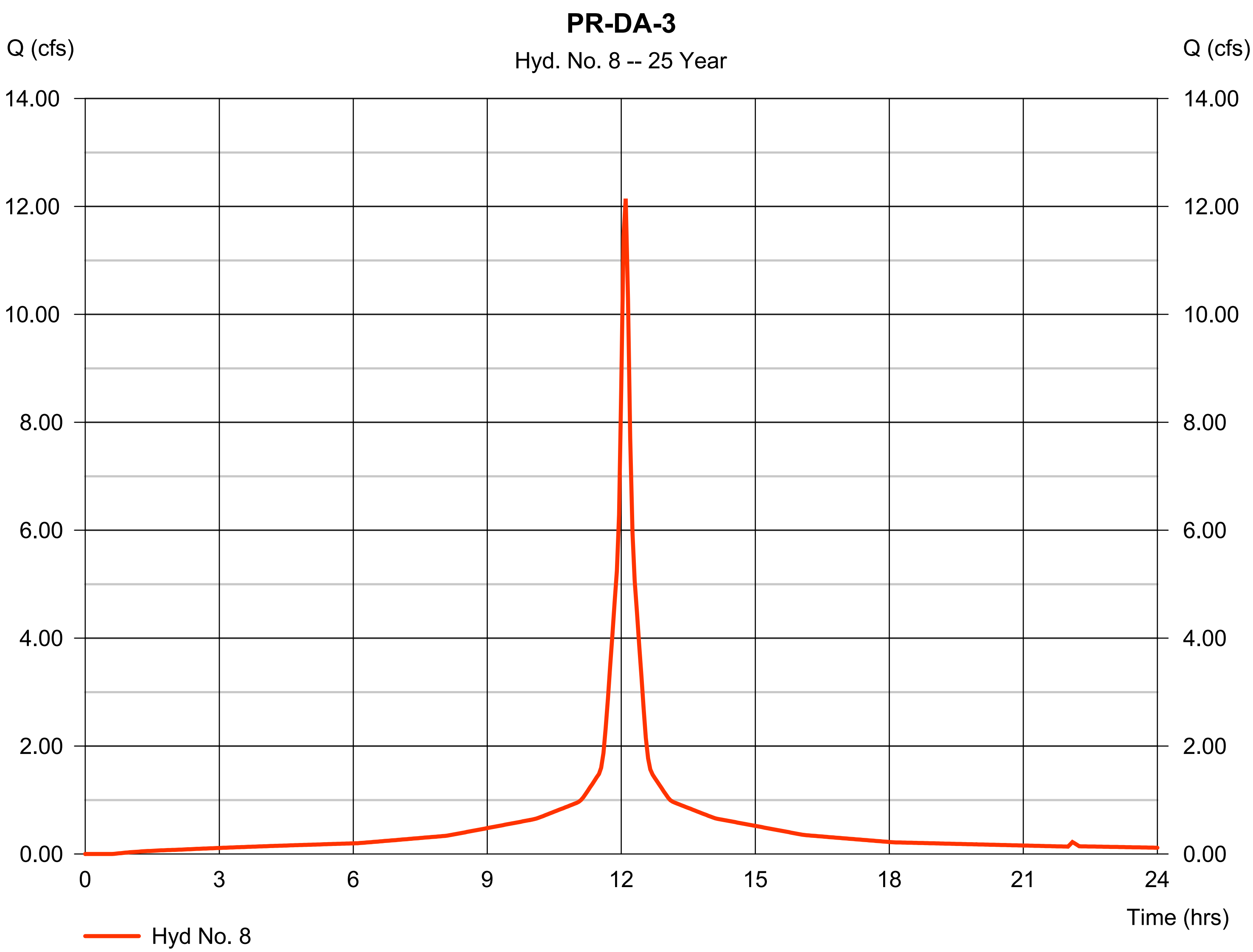
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 | Wednesday, 05 / 16 / 2018

Hyd. No. 8

PR-DA-3

Hydrograph type	= SCS Runoff	Peak discharge	= 12.14 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 47,121 cuft
Drainage area	= 1.856 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 4.80 min
Total precip.	= 7.70 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

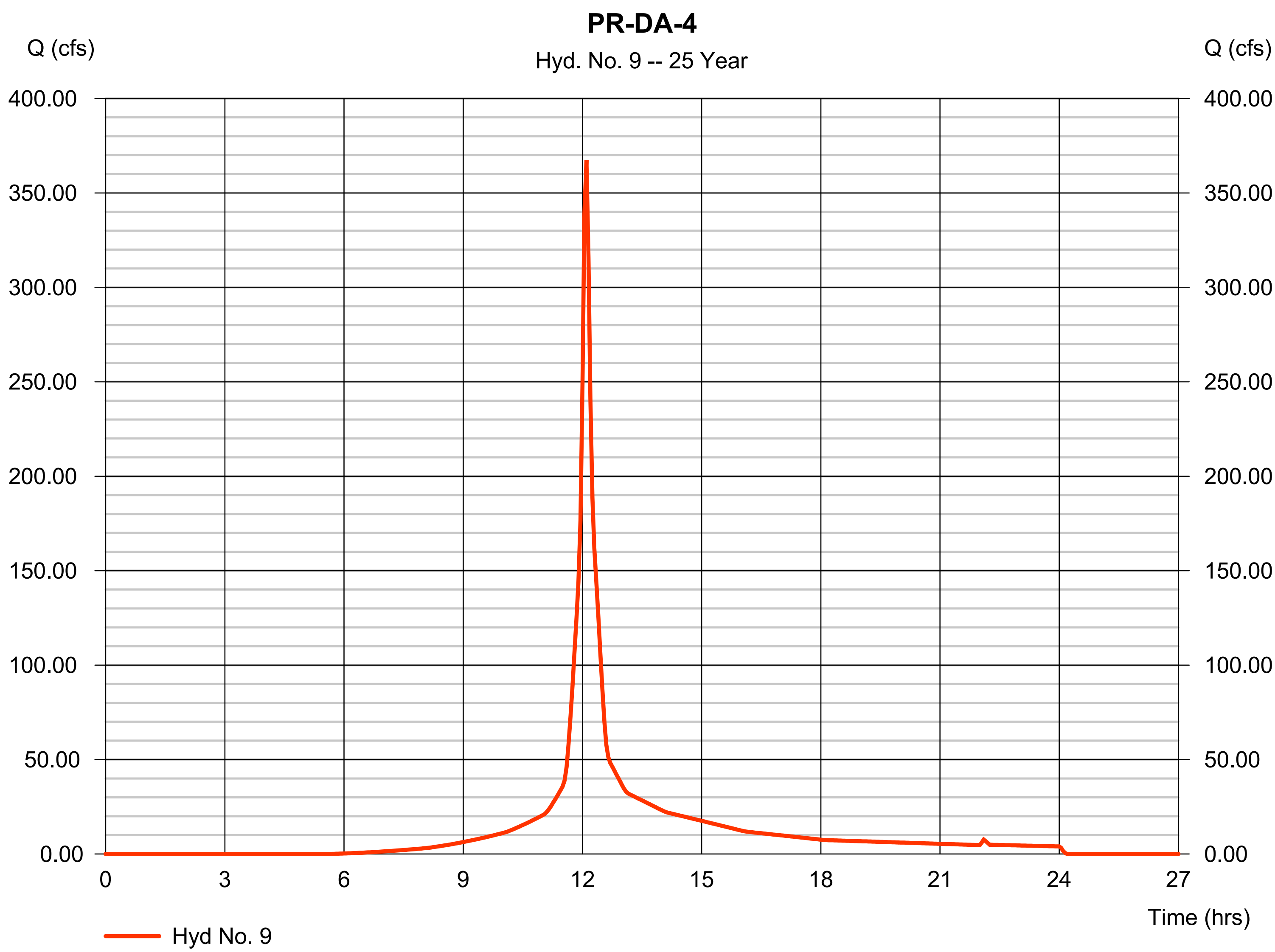
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 05 / 16 / 2018

Hyd. No. 9

PR-DA-4

Hydrograph type	= SCS Runoff	Peak discharge	= 367.46 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 1,243,838 cuft
Drainage area	= 68.390 ac	Curve number	= 80*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.10 min
Total precip.	= 7.70 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(34.190 x 98) + (34.200 x 61)] / 68.390



Hydrograph Report

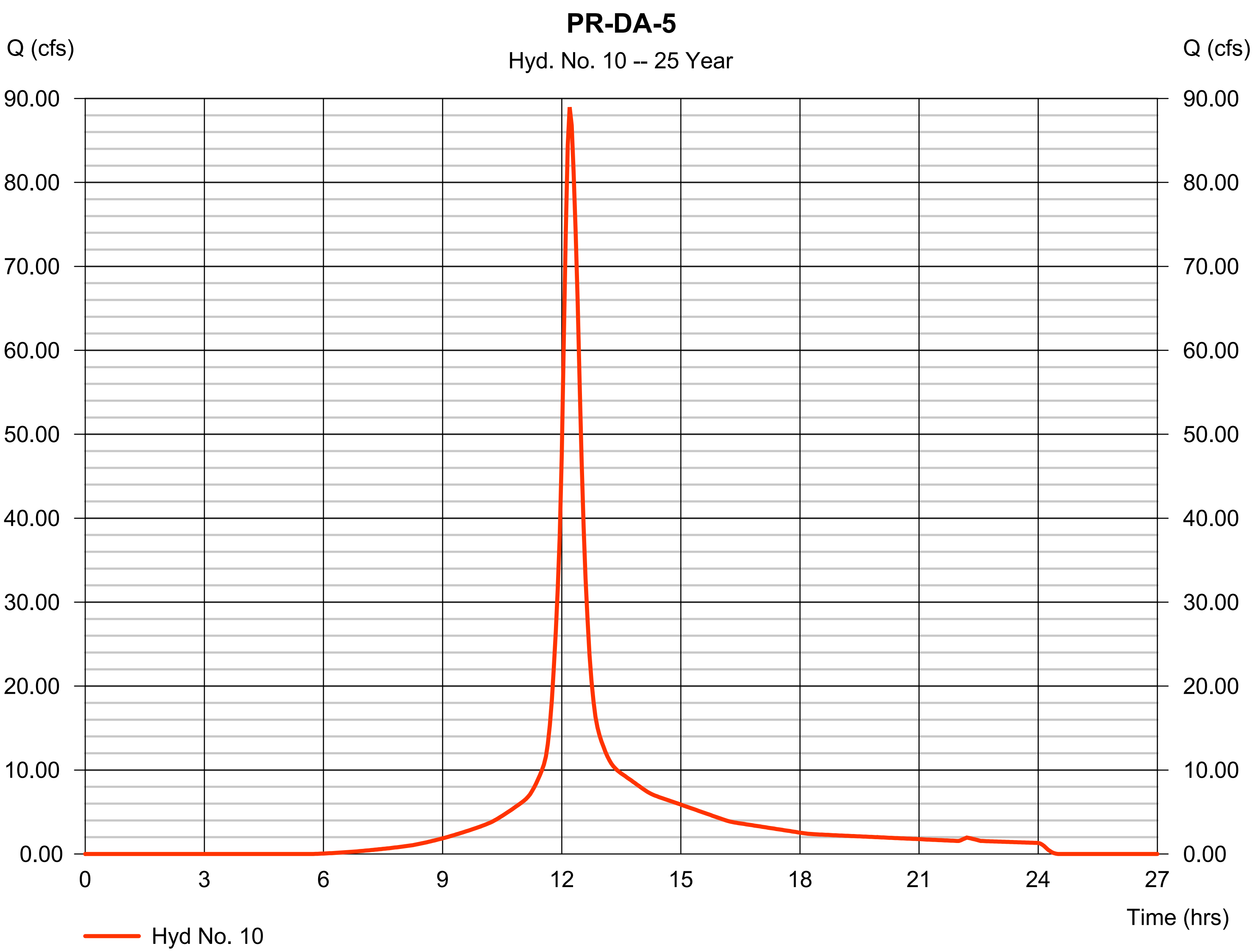
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 10

PR-DA-5

Hydrograph type	= SCS Runoff	Peak discharge	= 88.96 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.20 hrs
Time interval	= 3 min	Hyd. volume	= 401,124 cuft
Drainage area	= 20.050 ac	Curve number	= 80*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18.40 min
Total precip.	= 7.70 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(10.167 x 98) + (10.167 x 61)] / 20.050



Hydrograph Report

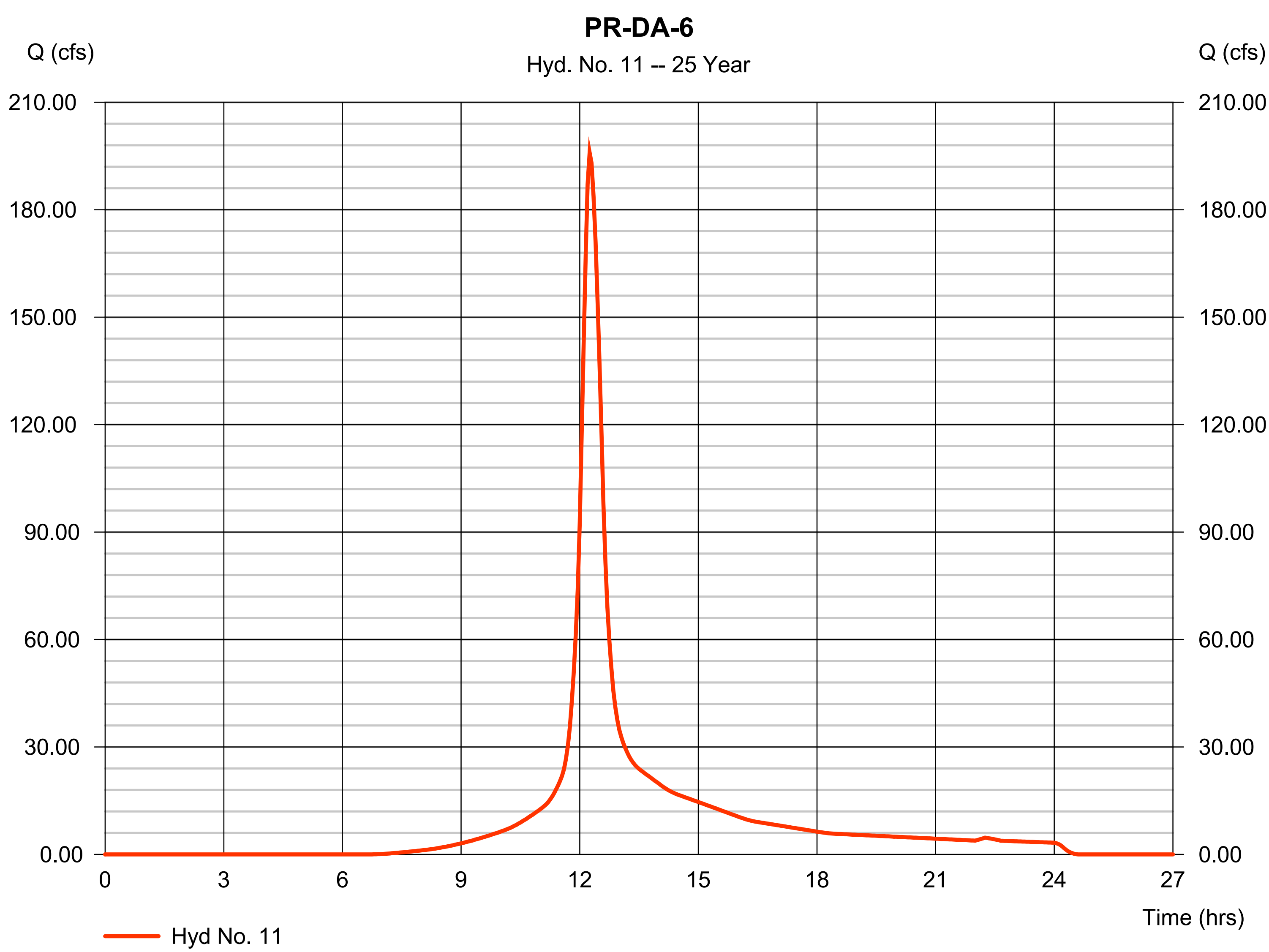
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 05 / 16 / 2018

Hyd. No. 11

PR-DA-6

Hydrograph type	= SCS Runoff	Peak discharge	= 195.94 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.25 hrs
Time interval	= 3 min	Hyd. volume	= 936,516 cuft
Drainage area	= 54.160 ac	Curve number	= 76*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 24.60 min
Total precip.	= 7.70 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(19.630 x 61) + (7.450 x 39) + (27.080 x 98)] / 54.160



Hydrograph Report

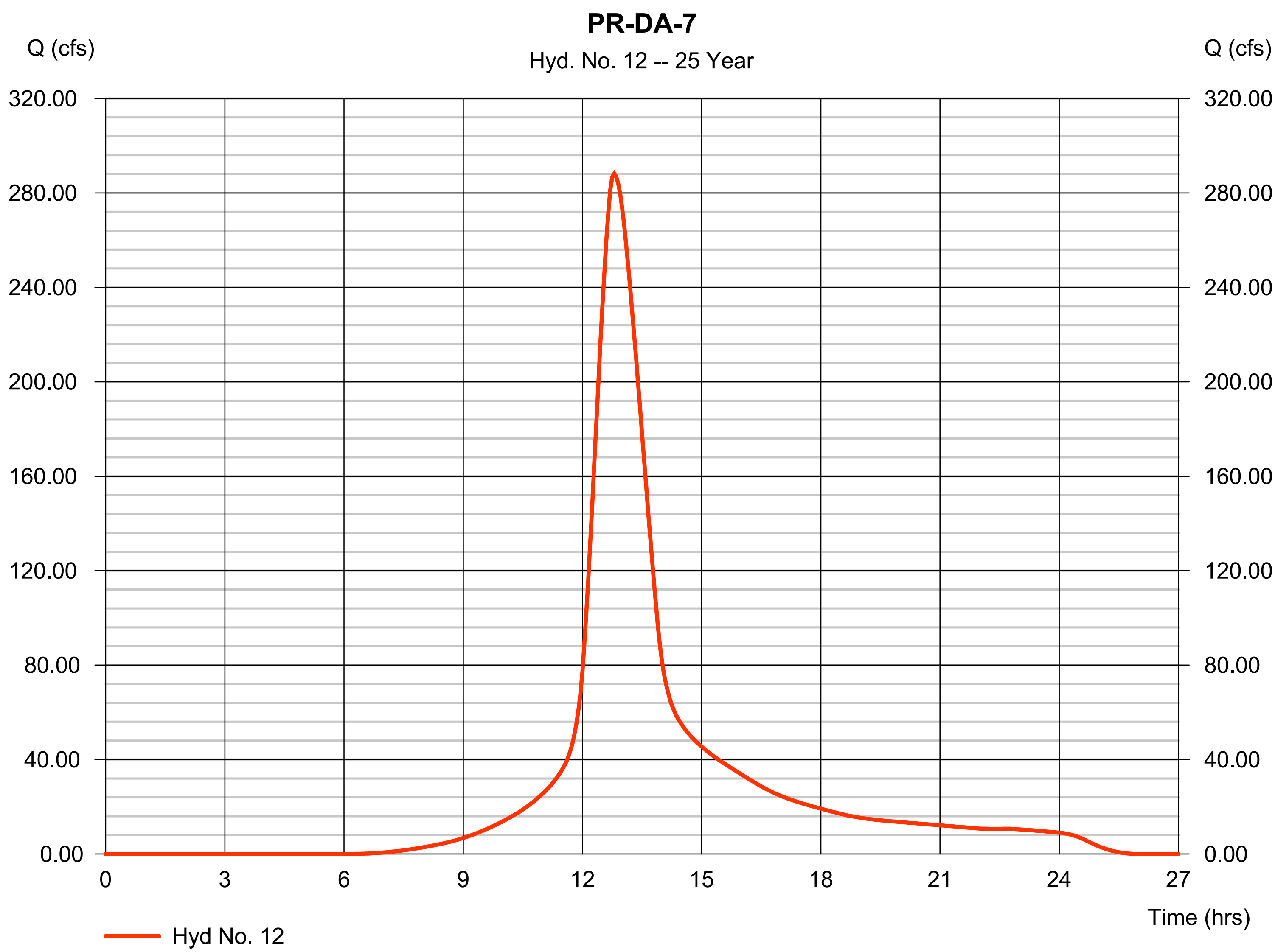
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 12

PR-DA-7

Hydrograph type	= SCS Runoff	Peak discharge	= 288.18 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.80 hrs
Time interval	= 3 min	Hyd. volume	= 2,508,478 cuft
Drainage area	= 132.150 ac	Curve number	= 79*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 71.80 min
Total precip.	= 7.70 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(66.080 x 98) + (66.070 x 61)] / 132.150



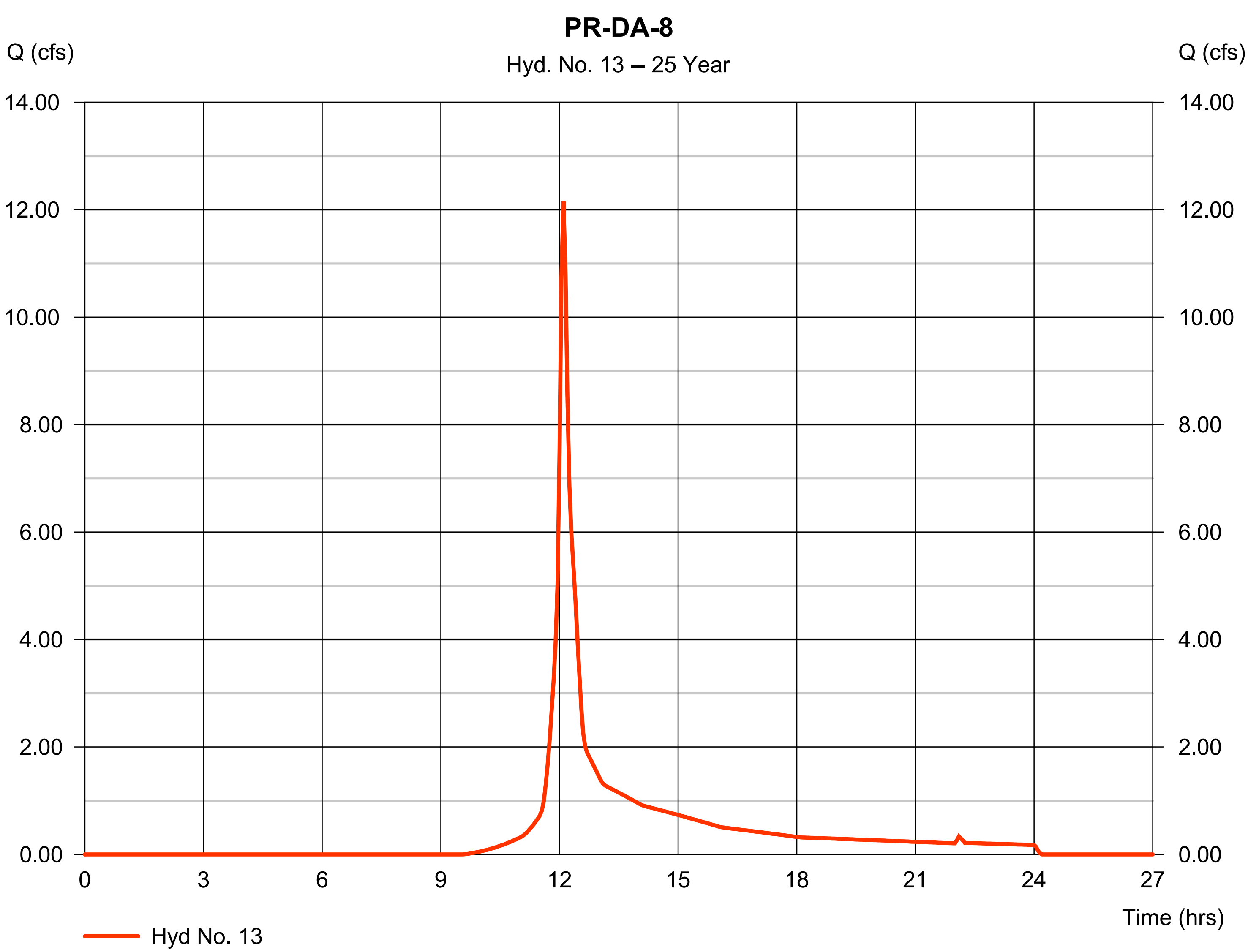
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 13

PR-DA-8

Hydrograph type	= SCS Runoff	Peak discharge	= 12.16 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 40,953 cuft
Drainage area	= 3.740 ac	Curve number	= 61
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 4.90 min
Total precip.	= 7.70 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



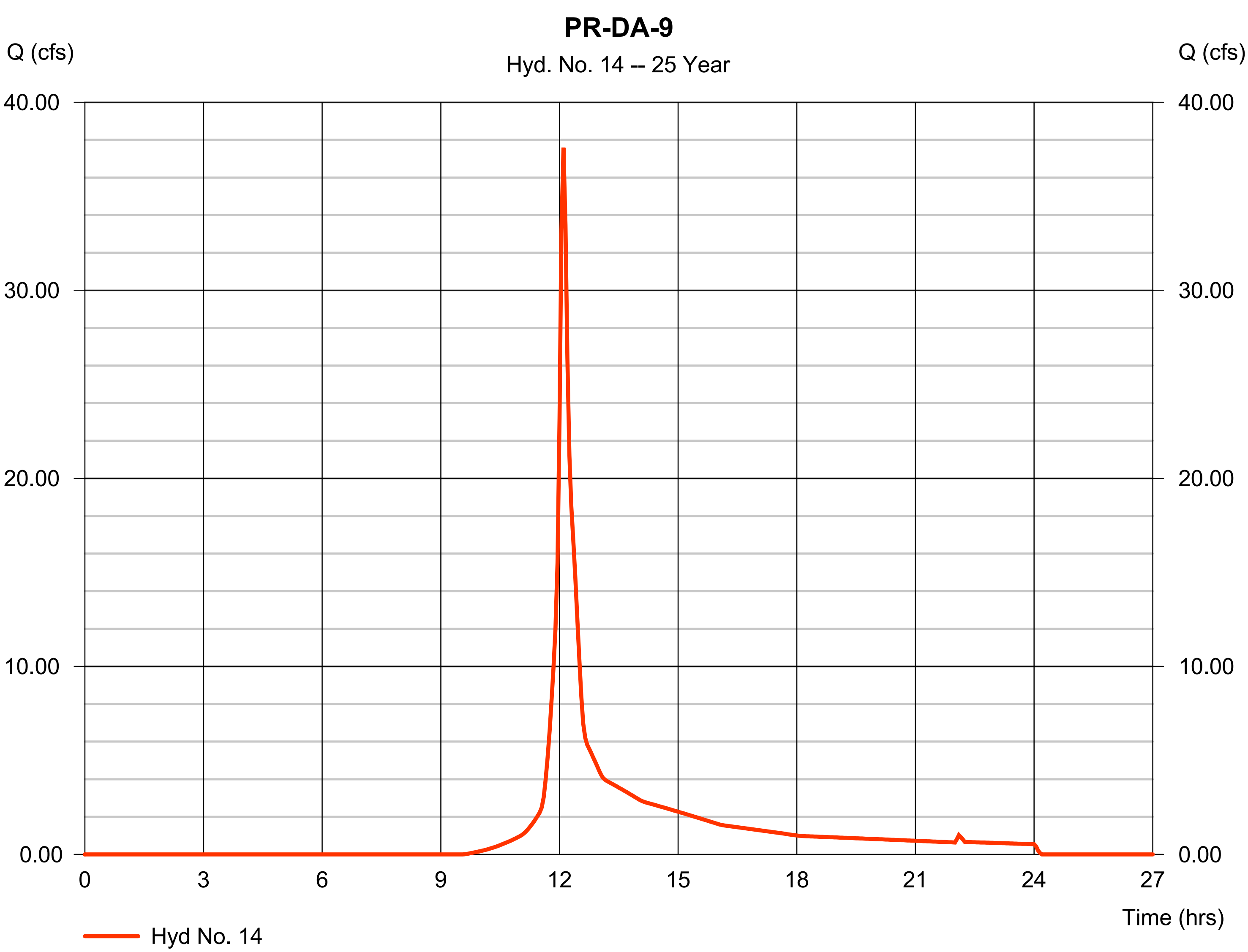
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 14

PR-DA-9

Hydrograph type	= SCS Runoff	Peak discharge	= 37.58 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 126,582 cuft
Drainage area	= 11.560 ac	Curve number	= 61
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.70 min
Total precip.	= 7.70 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



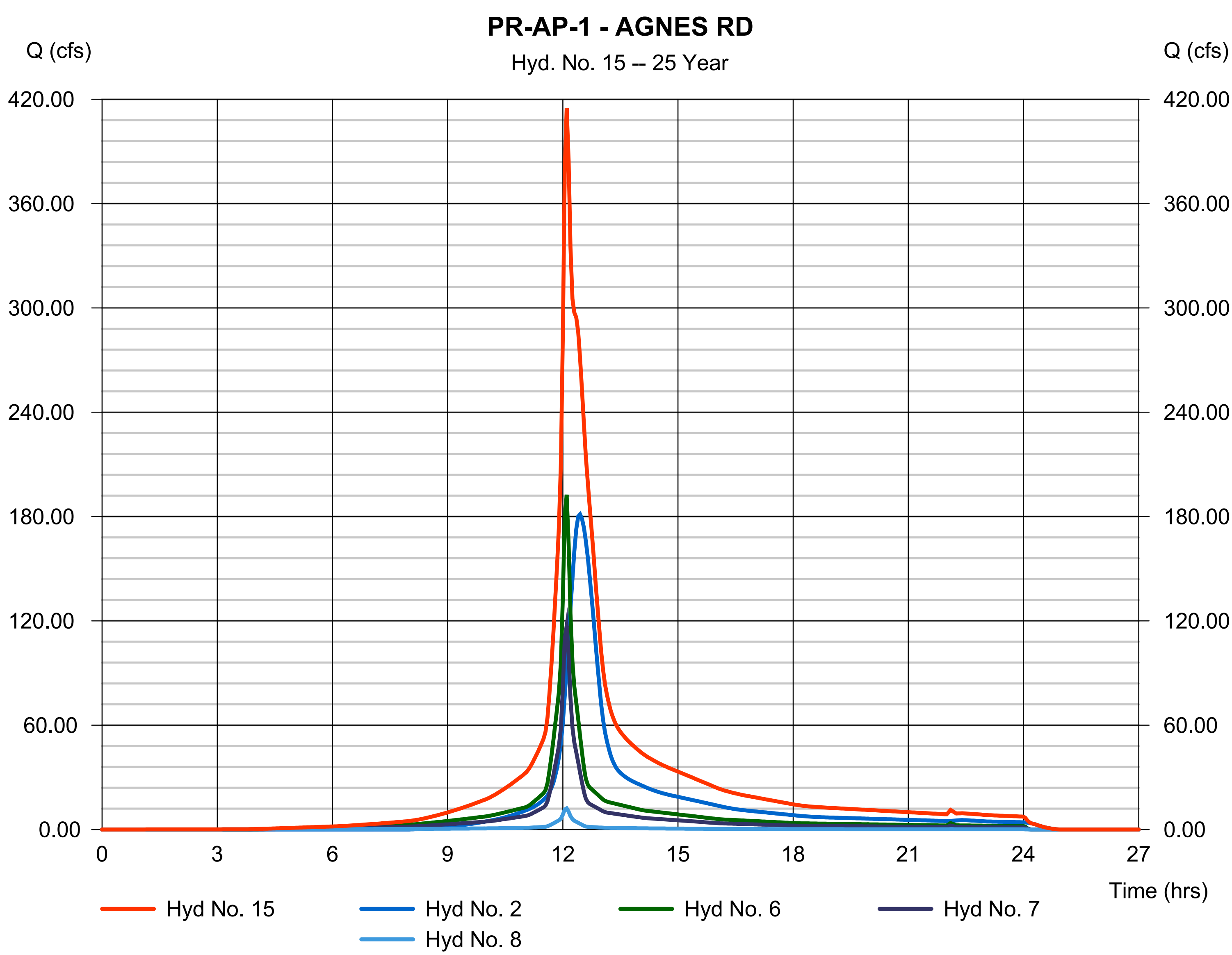
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 15

PR-AP-1 - AGNES RD

Hydrograph type	= Combine	Peak discharge	= 414.96 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 2,208,784 cuft
Inflow hyds.	= 2, 6, 7, 8	Contrib. drain. area	= 123.406 ac



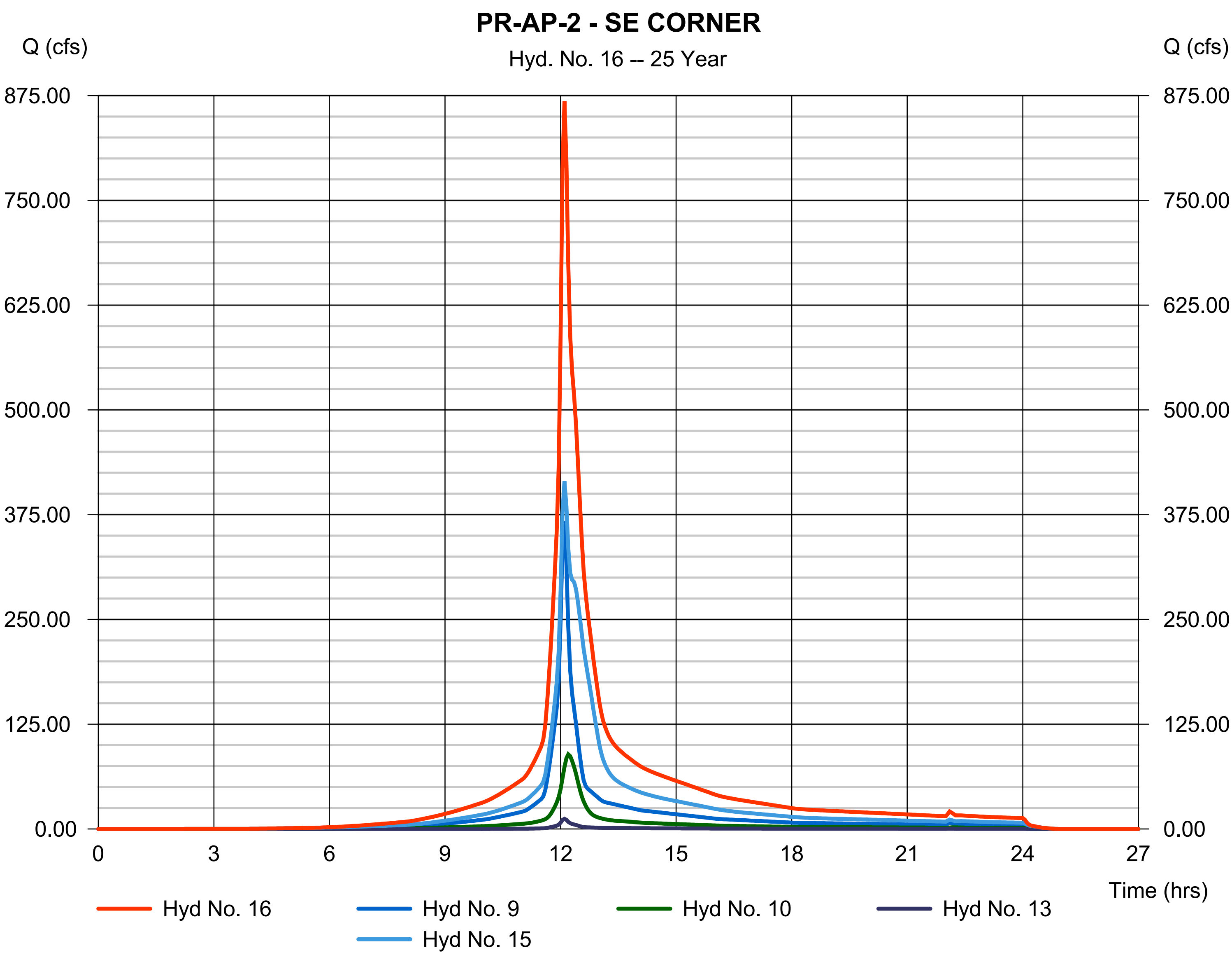
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 | Wednesday, 05 / 16 / 2018

Hyd. No. 16

PR-AP-2 - SE CORNER

Hydrograph type	= Combine	Peak discharge	= 868.31 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 3,894,697 cuft
Inflow hyds.	= 9, 10, 13, 15	Contrib. drain. area	= 92.180 ac



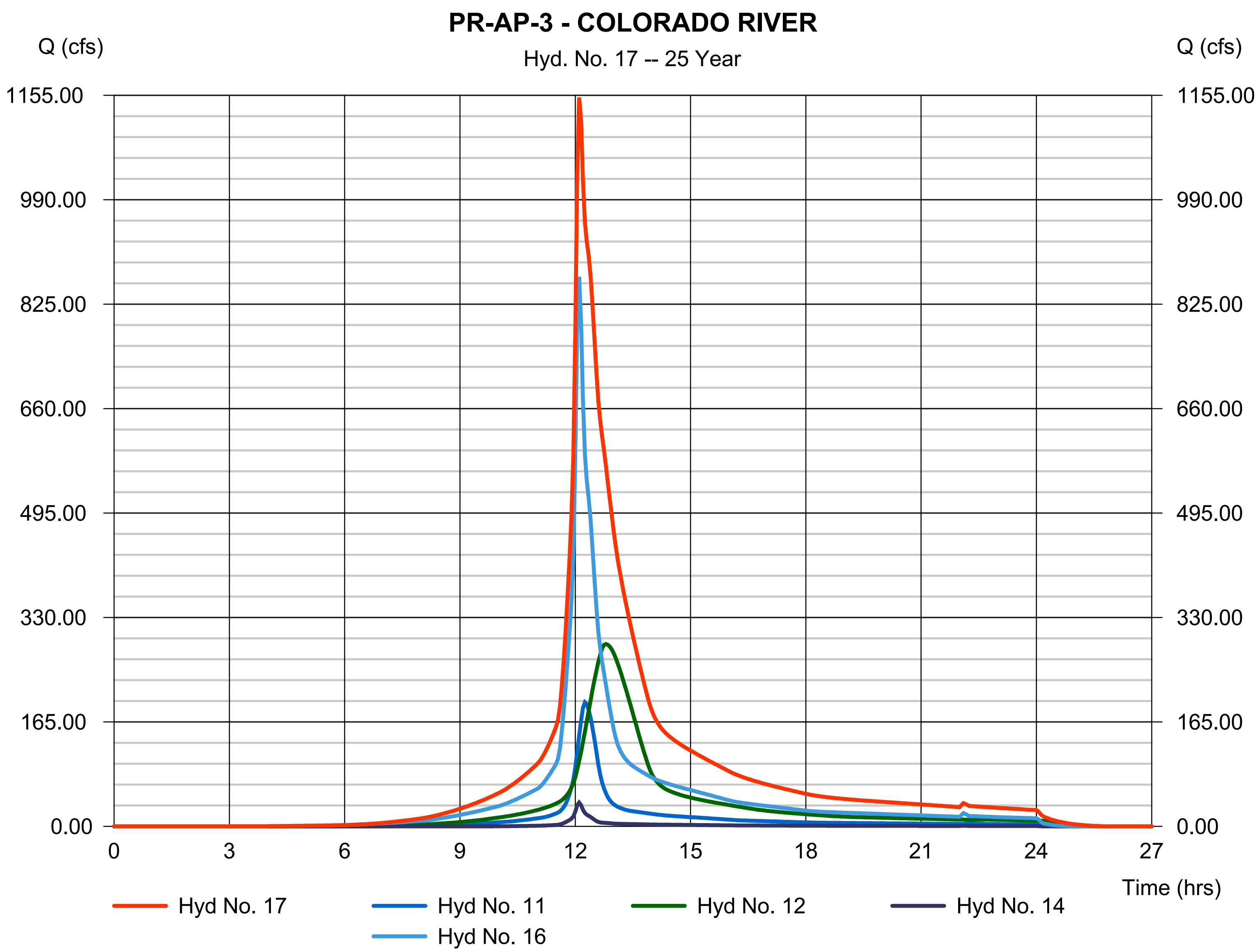
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 05 / 16 / 2018

Hyd. No. 17

PR-AP-3 - COLORADO RIVER

Hydrograph type	= Combine	Peak discharge	= 1151.75 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 7,466,272 cuft
Inflow hyds.	= 11, 12, 14, 16	Contrib. drain. area	= 197.870 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	167.35	3	783	1,730,482	------	------	------	EX-DA-1 / EX-AP-1
2	SCS Runoff	273.30	3	747	1,631,448	------	------	------	EX-DA-OFFSITE
3	SCS Runoff	366.23	3	777	3,452,475	------	------	------	EX-DA-2
4	SCS Runoff	117.99	3	747	721,955	------	------	------	EX-DA-3
5	Combine	648.66	3	756	5,805,873	2, 3, 4	------	------	EX-AP-2
6	SCS Runoff	263.76	3	726	941,240	------	------	------	PR-DA-1
7	SCS Runoff	160.47	3	726	572,648	------	------	------	PR-DA-2
8	SCS Runoff	16.10	3	726	62,904	------	------	------	PR-DA-3
9	SCS Runoff	521.27	3	726	1,794,956	------	------	------	PR-DA-4
10	SCS Runoff	126.64	3	732	578,854	------	------	------	PR-DA-5
11	SCS Runoff	285.88	3	735	1,379,011	------	------	------	PR-DA-6
12	SCS Runoff	413.80	3	768	3,637,777	------	------	------	PR-DA-7
13	SCS Runoff	19.88	3	726	66,145	------	------	------	PR-DA-8
14	SCS Runoff	61.45	3	726	204,448	------	------	------	PR-DA-9
15	Combine	587.02	3	726	3,208,240	2, 6, 7, 8,	------	------	PR-AP-1 - AGNES RD
16	Combine	1234.19	3	726	5,648,194	9, 10, 13, 15	------	------	PR-AP-2 - SE CORNER
17	Combine	1662.89	3	726	10,869,425	11, 12, 14, 16	------	------	PR-AP-3 - COLORADO RIVER

CHANNEL (05-16-18).gpw	Return Period: 100 Year	Wednesday, 05 / 16 / 2018

Hydrograph Report

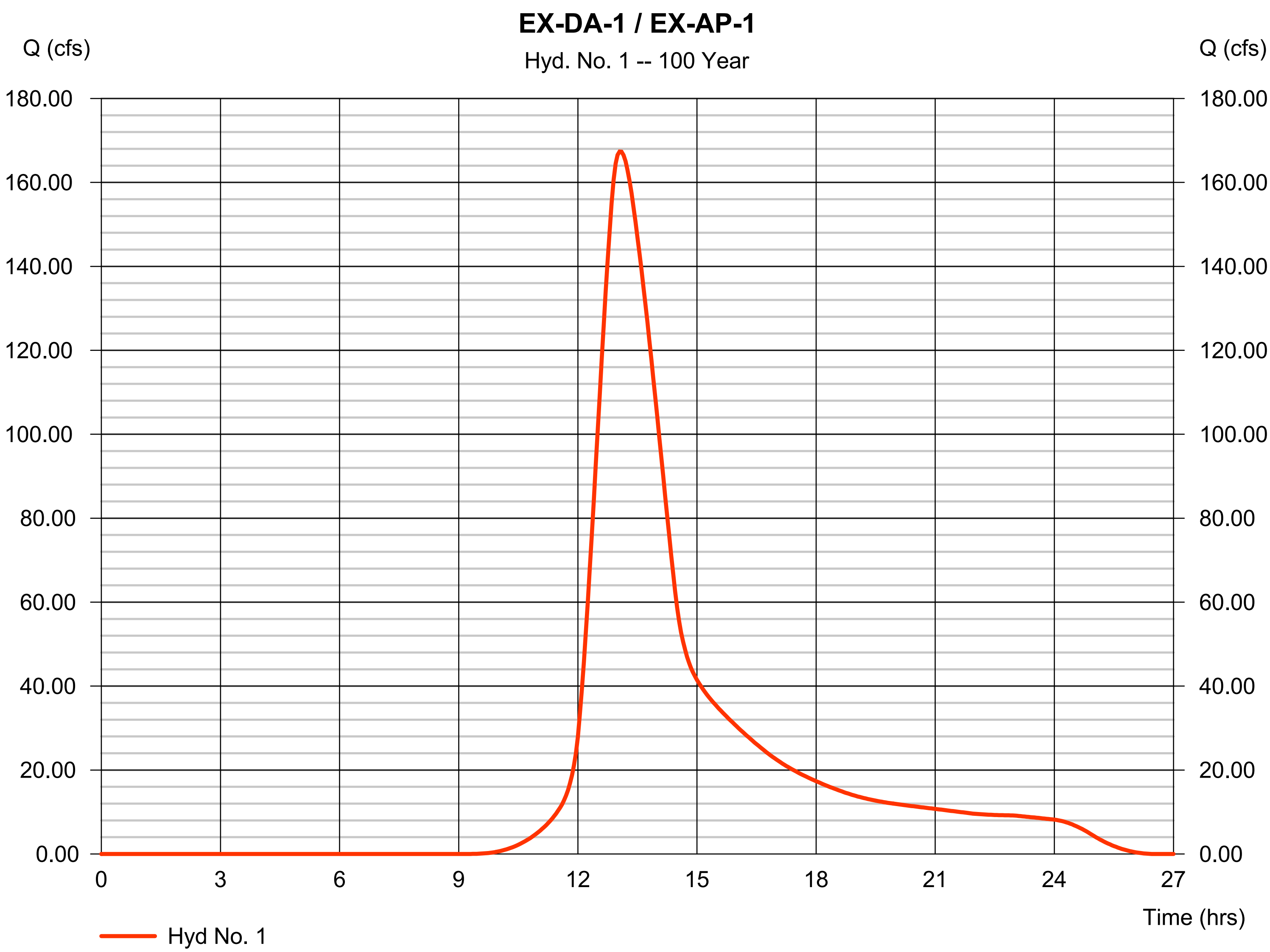
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 1

EX-DA-1 / EX-AP-1

Hydrograph type	= SCS Runoff	Peak discharge	= 167.35 cfs
Storm frequency	= 100 yrs	Time to peak	= 13.05 hrs
Time interval	= 3 min	Hyd. volume	= 1,730,482 cuft
Drainage area	= 101.790 ac	Curve number	= 57*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 94.50 min
Total precip.	= 10.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(84.000 x 61) + (17.790 x 39)] / 101.790



Hydrograph Report

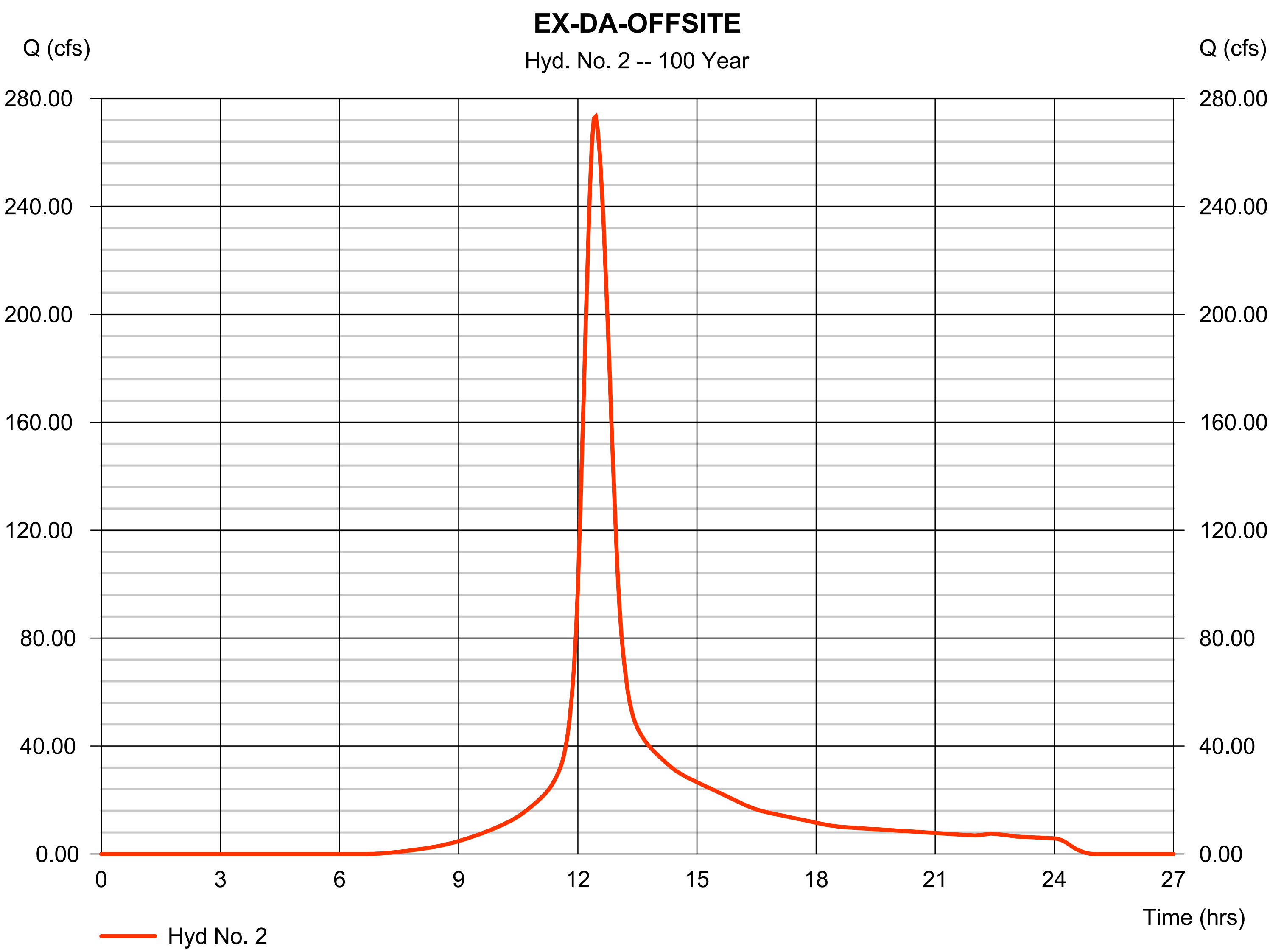
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 05 / 16 / 2018

Hyd. No. 2

EX-DA-OFFSITE

Hydrograph type	= SCS Runoff	Peak discharge	= 273.30 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.45 hrs
Time interval	= 3 min	Hyd. volume	= 1,631,448 cuft
Drainage area	= 69.840 ac	Curve number	= 71*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 39.80 min
Total precip.	= 10.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(19.230 x 98) + (50.610 x 61)] / 69.840



Hydrograph Report

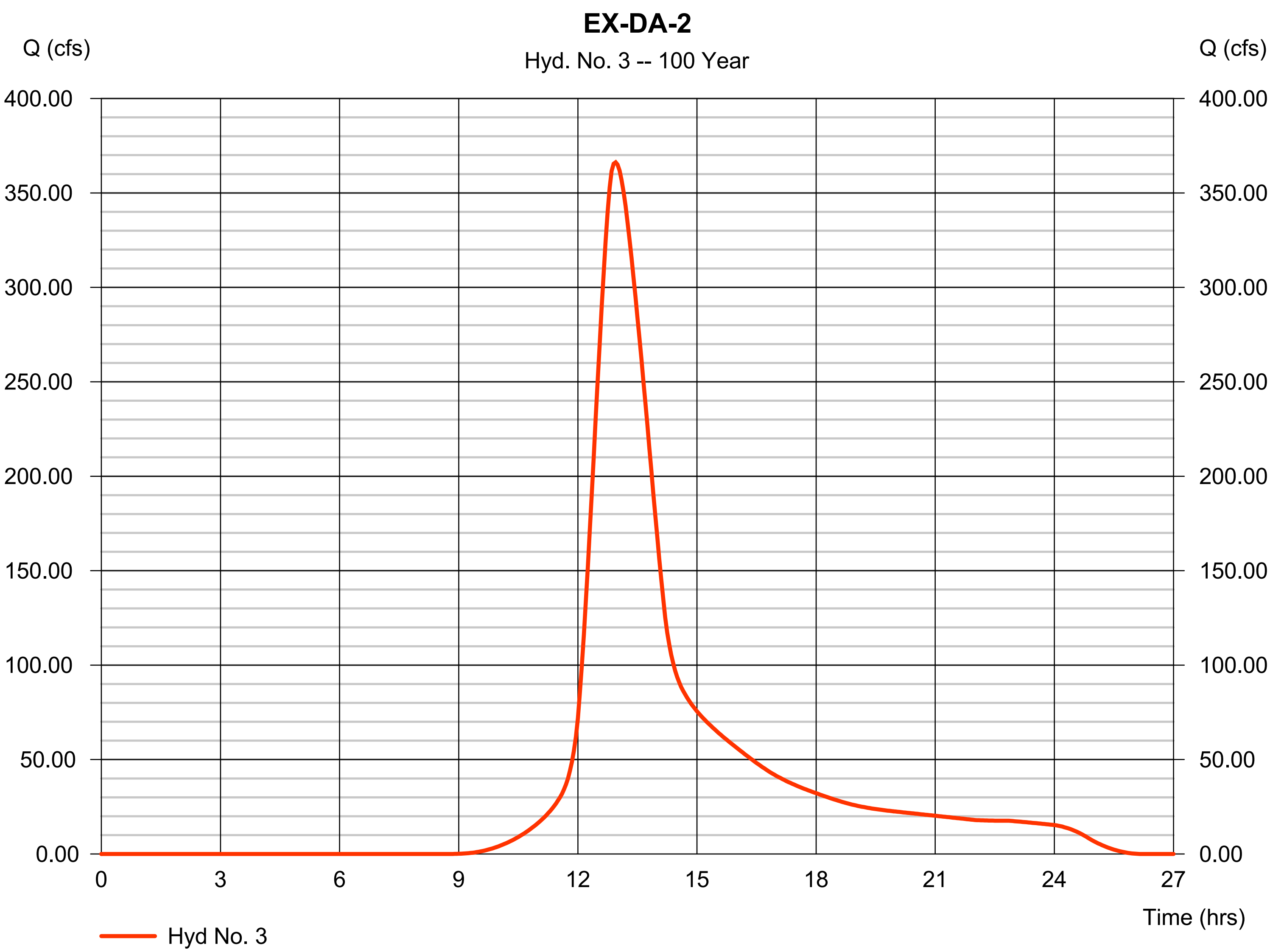
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 3

EX-DA-2

Hydrograph type	= SCS Runoff	Peak discharge	= 366.23 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.95 hrs
Time interval	= 3 min	Hyd. volume	= 3,452,475 cuft
Drainage area	= 189.310 ac	Curve number	= 60*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 83.86 min
Total precip.	= 10.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(183.470 x 61) + (5.840 x 39)] / 189.310



Hydrograph Report

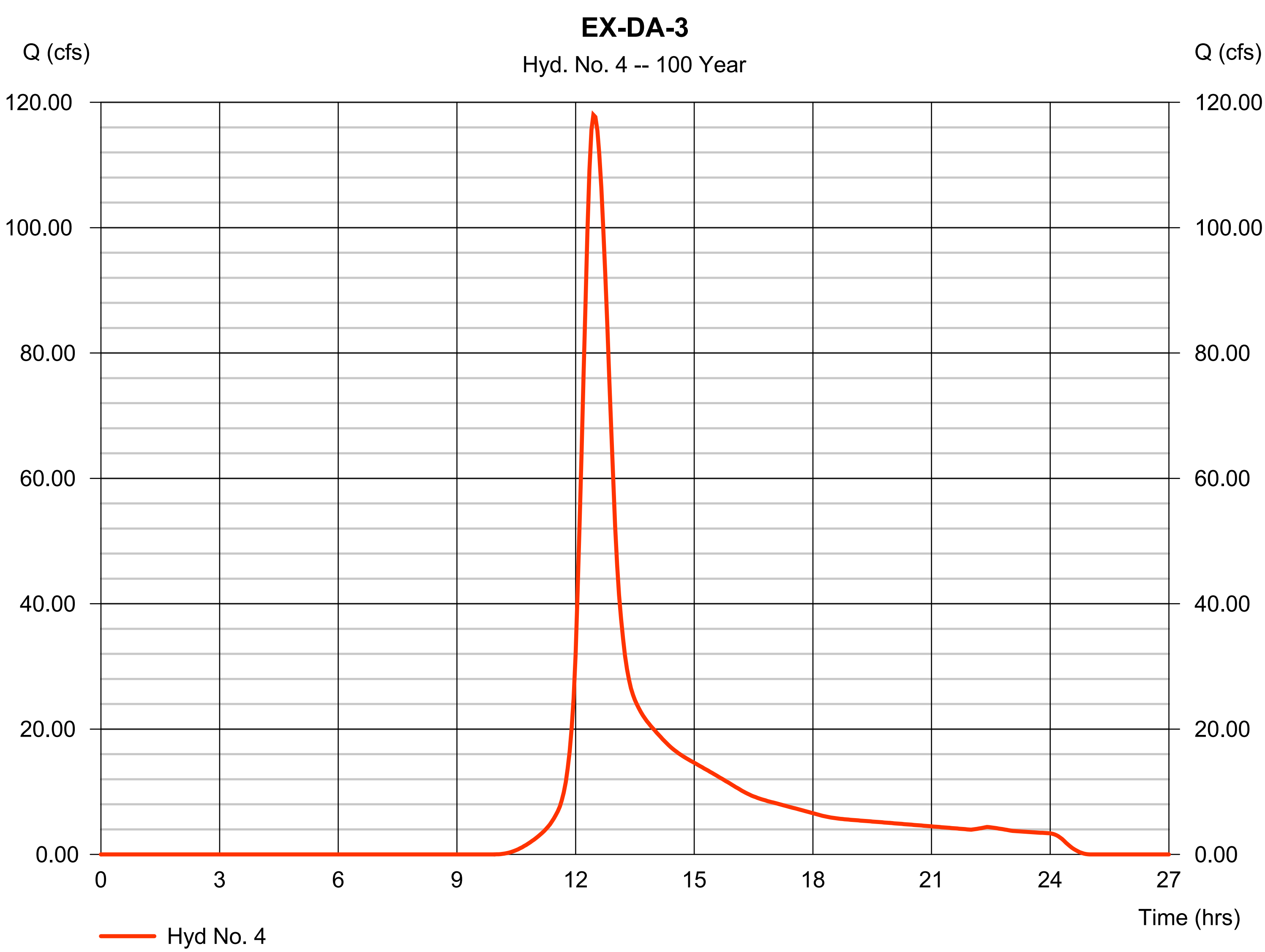
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 4

EX-DA-3

Hydrograph type	= SCS Runoff	Peak discharge	= 117.99 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.45 hrs
Time interval	= 3 min	Hyd. volume	= 721,955 cuft
Drainage area	= 50.910 ac	Curve number	= 52*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 38.30 min
Total precip.	= 10.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(30.546 x 61) + (20.364 x 39)] / 50.910



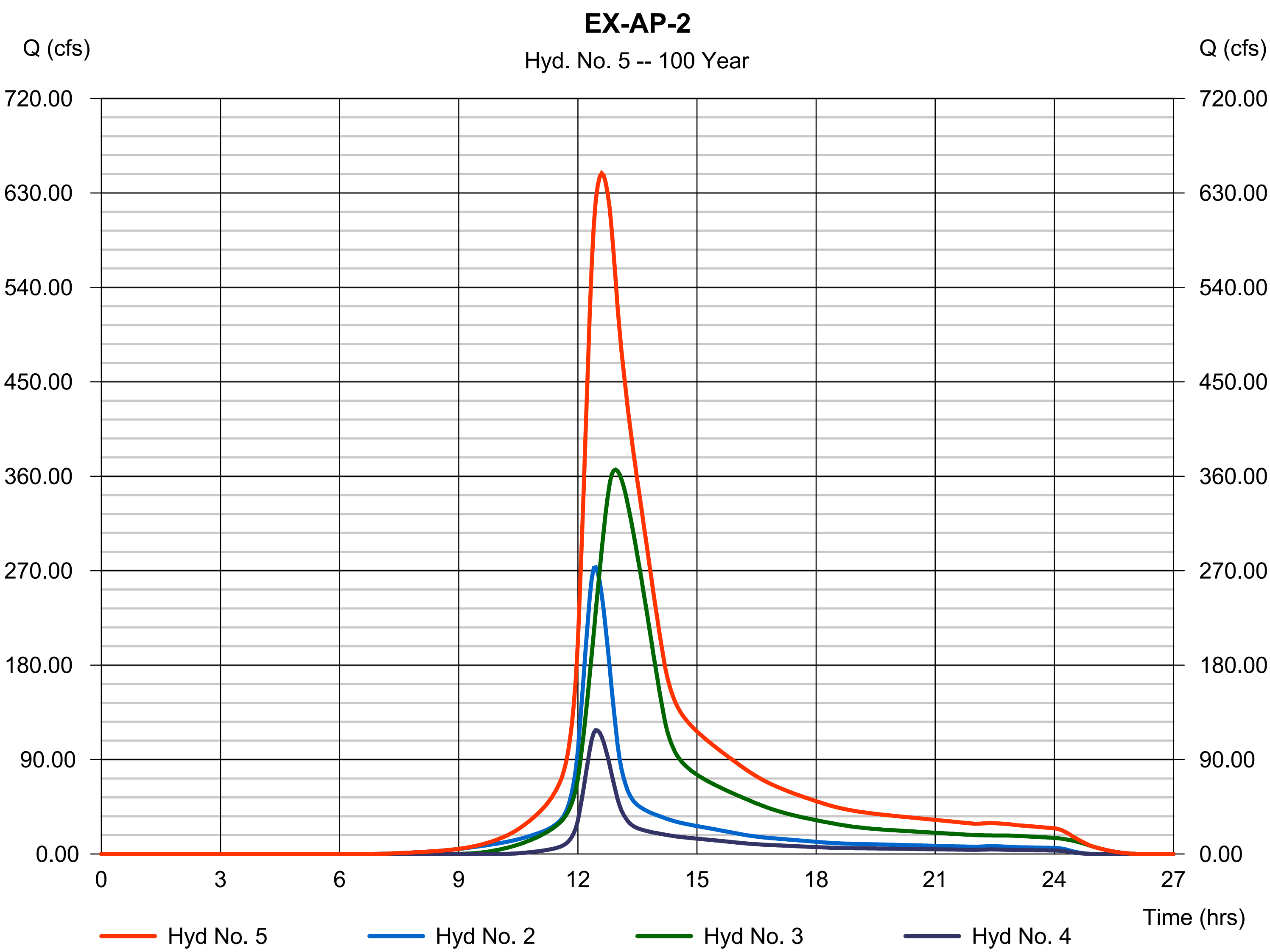
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 05 / 16 / 2018

Hyd. No. 5

EX-AP-2

Hydrograph type	= Combine	Peak discharge	= 648.66 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.60 hrs
Time interval	= 3 min	Hyd. volume	= 5,805,873 cuft
Inflow hyds.	= 2, 3, 4	Contrib. drain. area	= 310.060 ac



Hydrograph Report

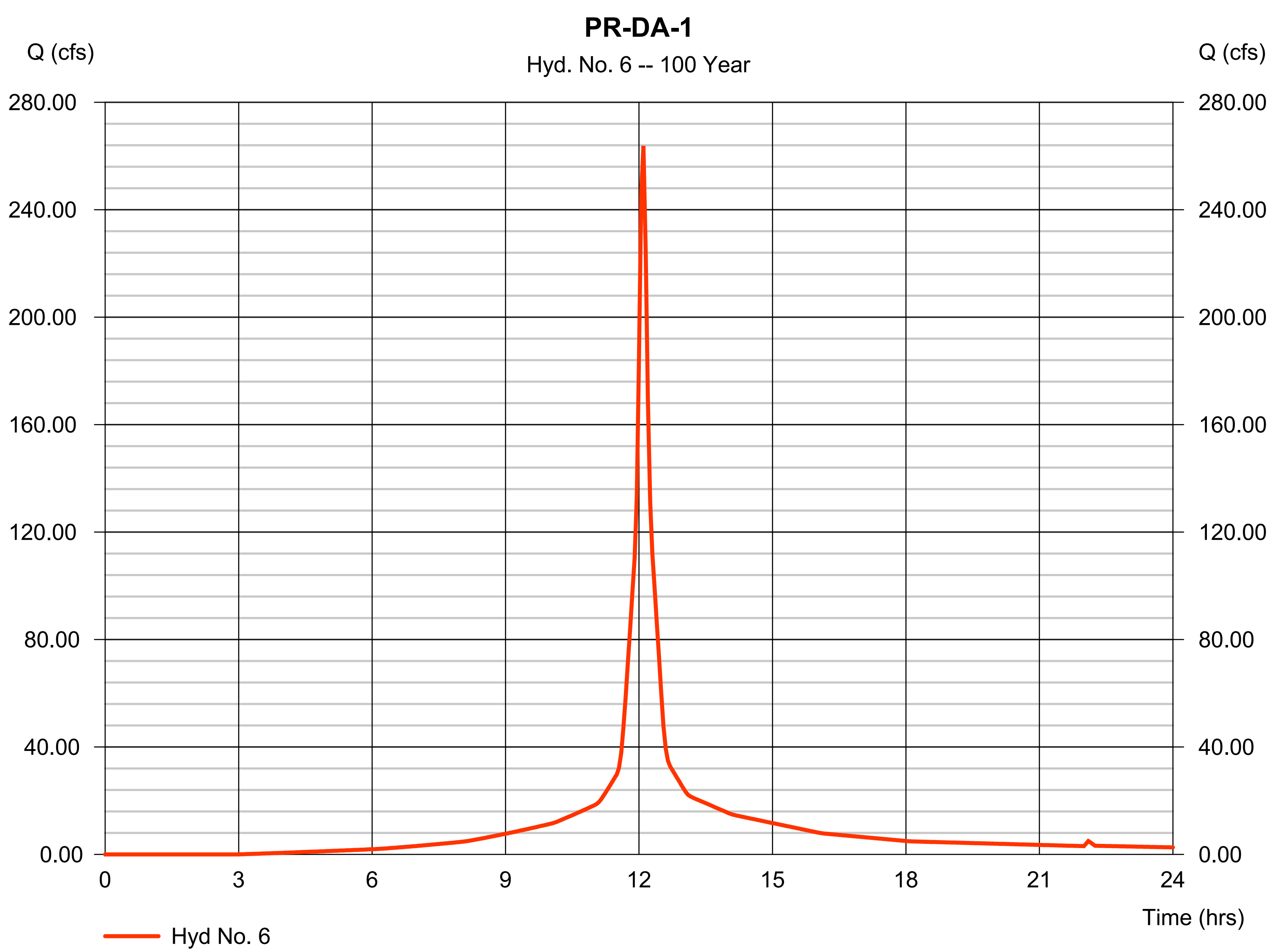
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 | Wednesday, 05 / 16 / 2018

Hyd. No. 6

PR-DA-1

Hydrograph type	= SCS Runoff	Peak discharge	= 263.76 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 941,240 cuft
Drainage area	= 32.150 ac	Curve number	= 87*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 7.60 min
Total precip.	= 10.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(22.300 x 98) + (9.560 x 61)] / 32.150



Hydrograph Report

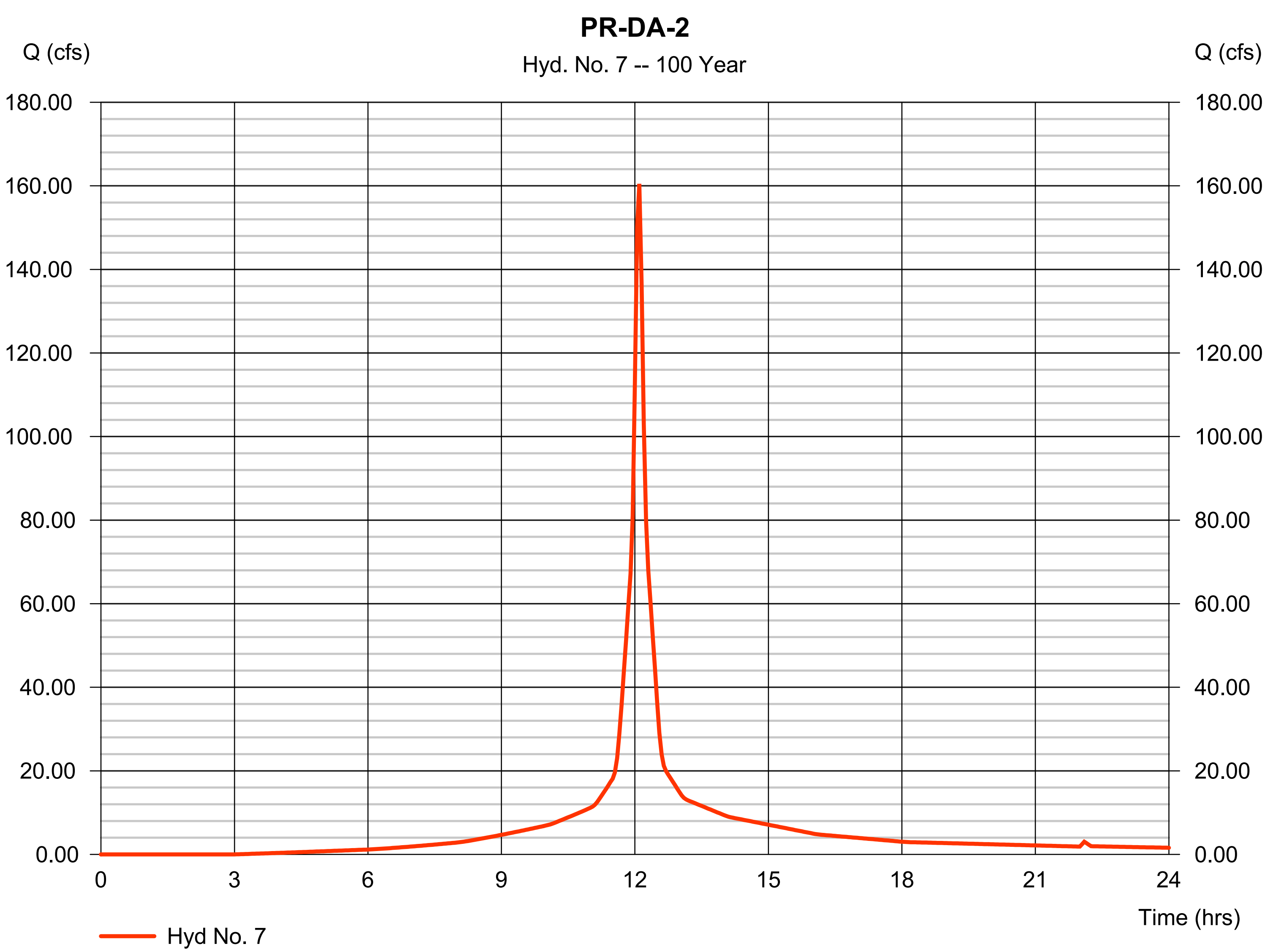
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 | Wednesday, 05 / 16 / 2018

Hyd. No. 7

PR-DA-2

Hydrograph type	= SCS Runoff	Peak discharge	= 160.47 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 572,648 cuft
Drainage area	= 19.560 ac	Curve number	= 87*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 7.60 min
Total precip.	= 10.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(13.580 x 98) + (5.820 x 61)] / 19.560



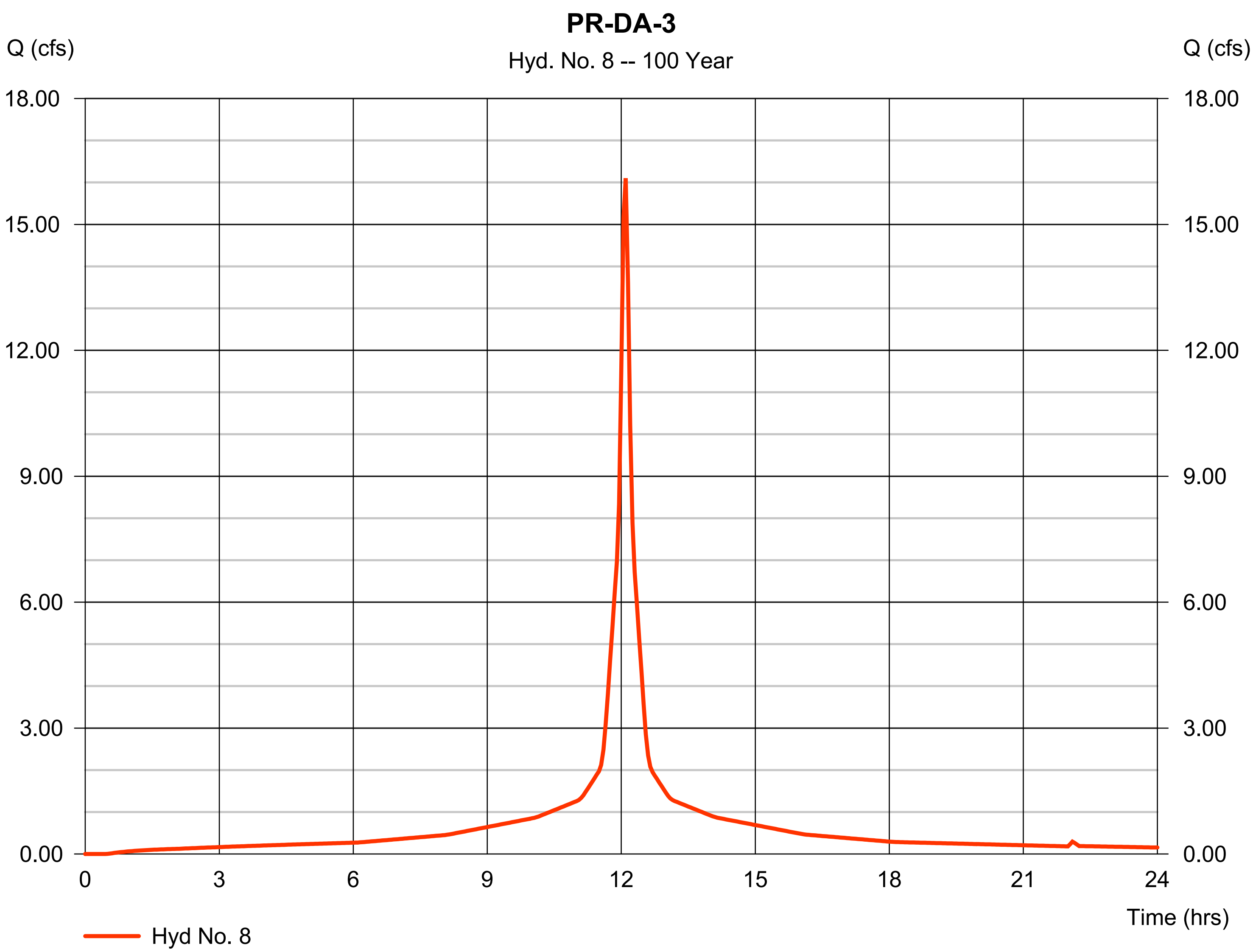
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 05 / 16 / 2018

Hyd. No. 8

PR-DA-3

Hydrograph type	= SCS Runoff	Peak discharge	= 16.10 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 62,904 cuft
Drainage area	= 1.856 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 4.80 min
Total precip.	= 10.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

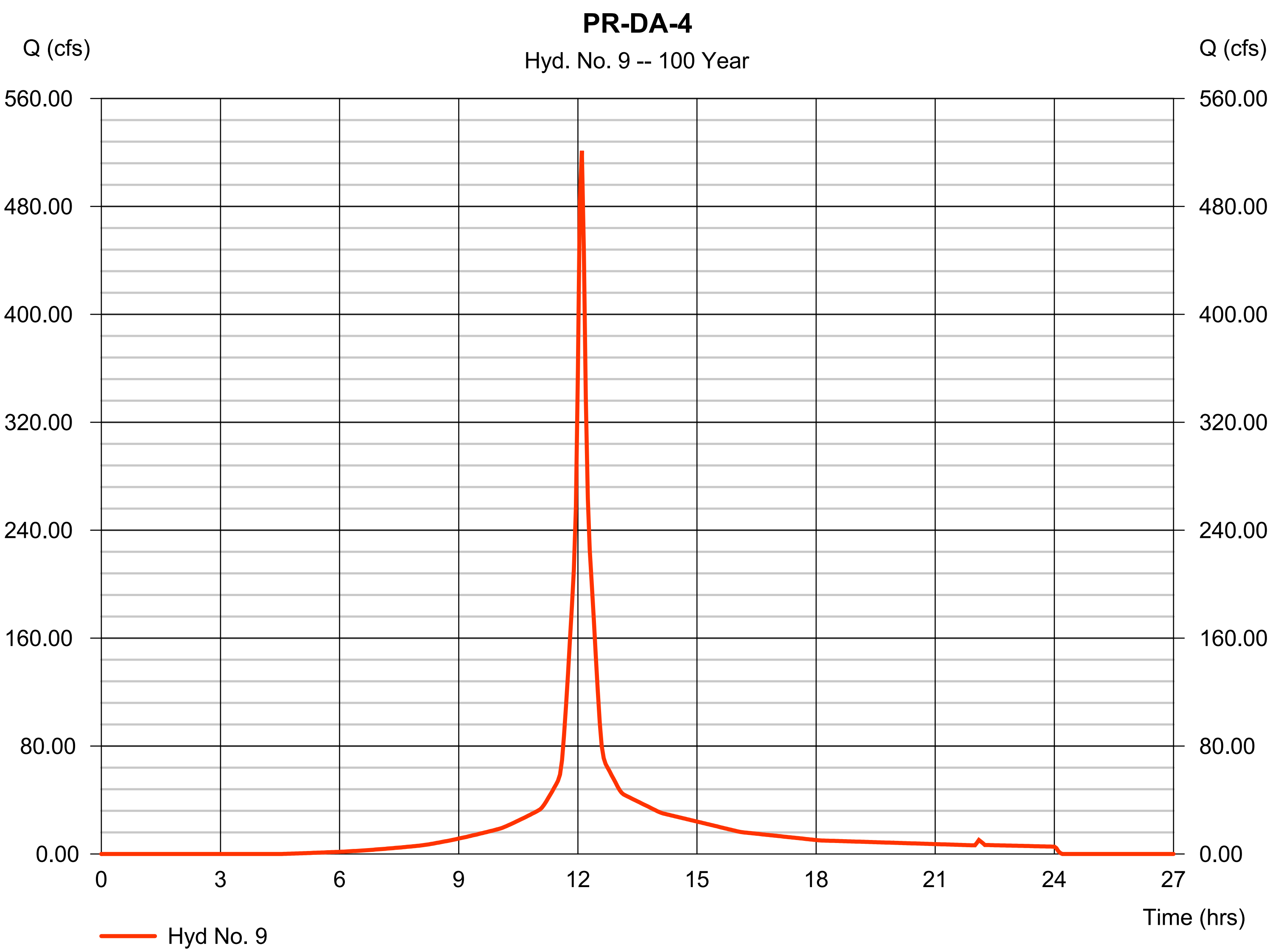
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 9

PR-DA-4

Hydrograph type	= SCS Runoff	Peak discharge	= 521.27 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 1,794,956 cuft
Drainage area	= 68.390 ac	Curve number	= 80*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.10 min
Total precip.	= 10.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(34.190 x 98) + (34.200 x 61)] / 68.390



Hydrograph Report

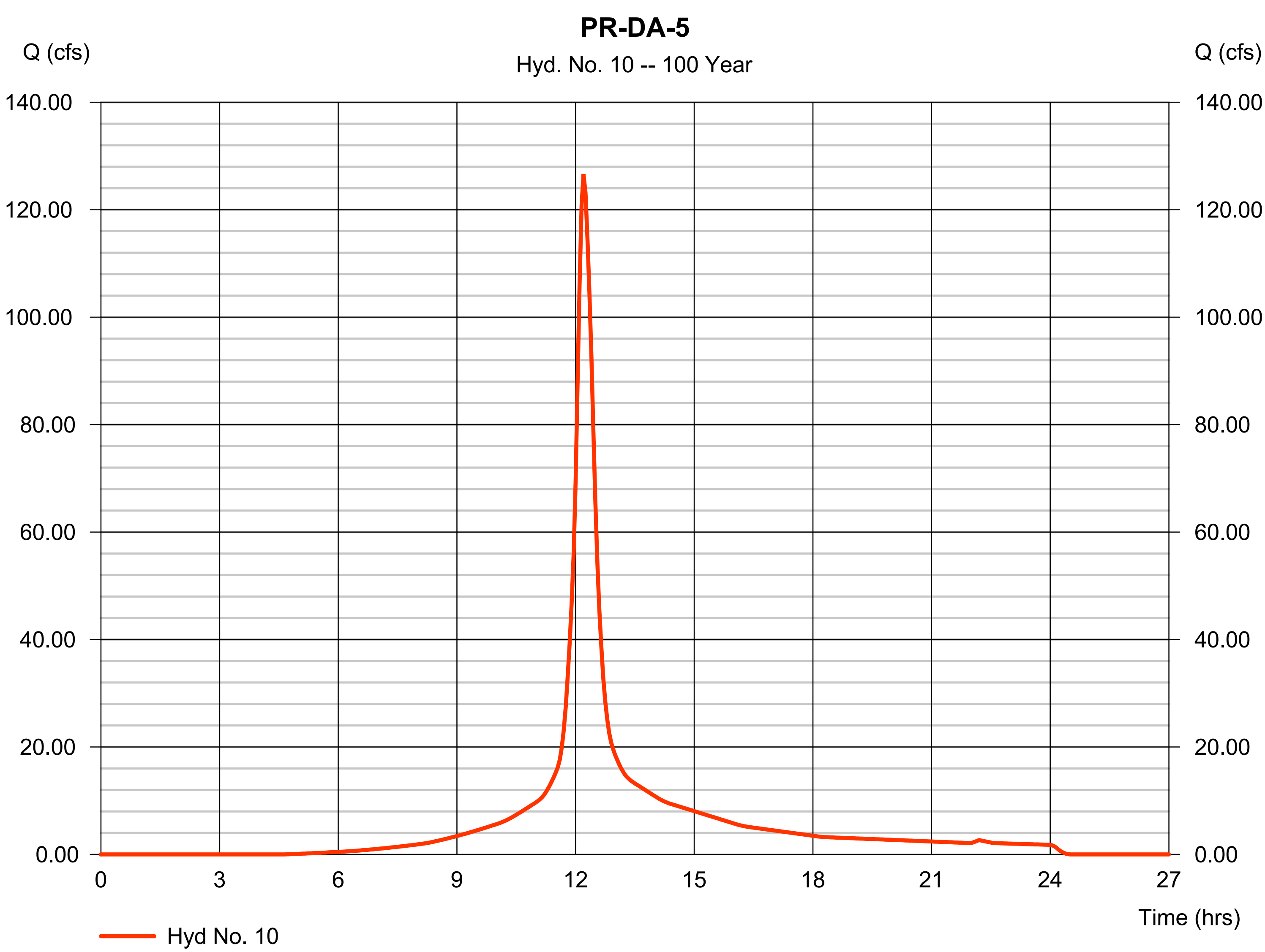
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 05 / 16 / 2018

Hyd. No. 10

PR-DA-5

Hydrograph type	= SCS Runoff	Peak discharge	= 126.64 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.20 hrs
Time interval	= 3 min	Hyd. volume	= 578,854 cuft
Drainage area	= 20.050 ac	Curve number	= 80*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18.40 min
Total precip.	= 10.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(10.167 x 98) + (10.167 x 61)] / 20.050



Hydrograph Report

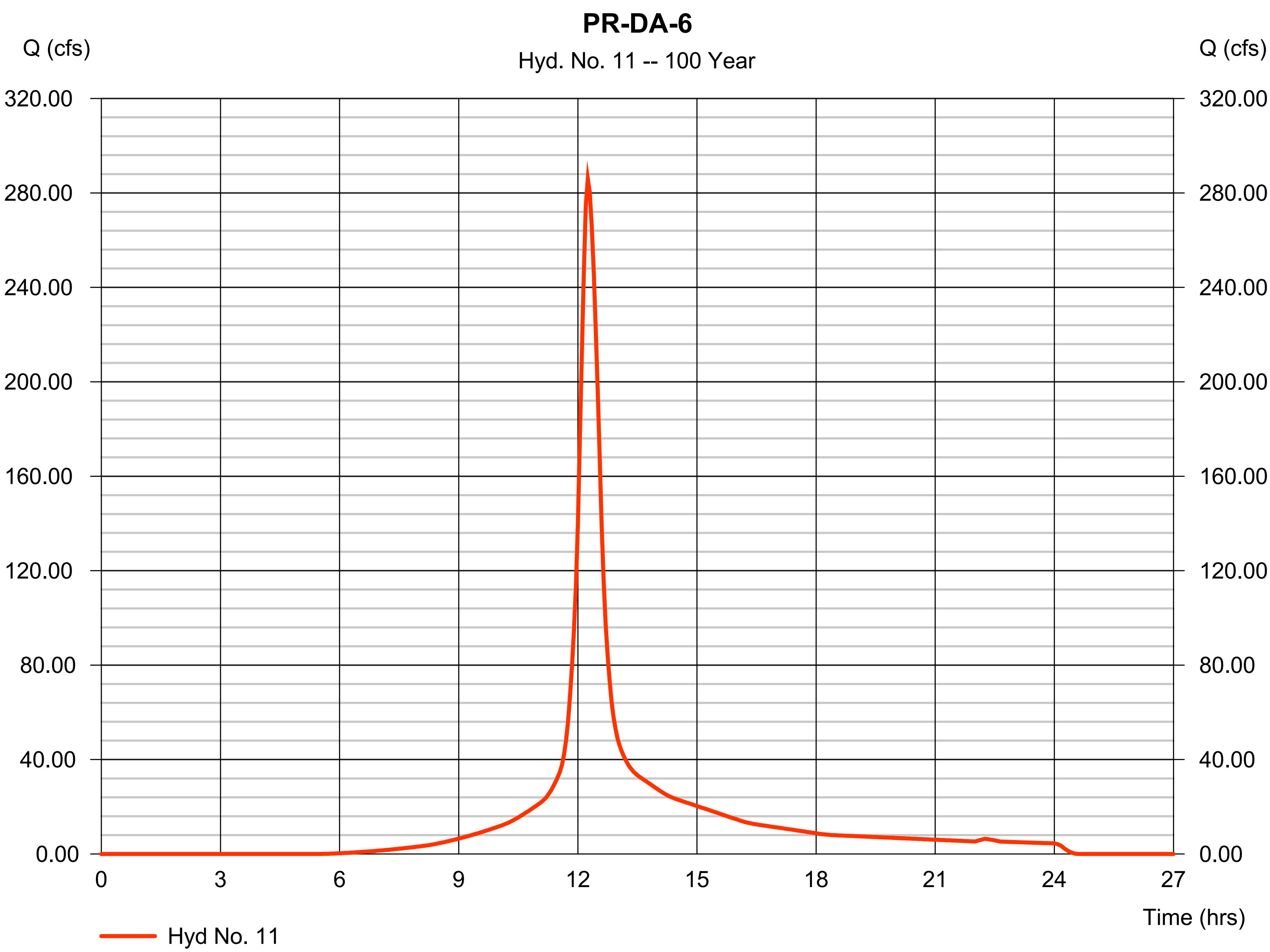
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 11

PR-DA-6

Hydrograph type	= SCS Runoff	Peak discharge	= 285.88 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.25 hrs
Time interval	= 3 min	Hyd. volume	= 1,379,011 cuft
Drainage area	= 54.160 ac	Curve number	= 76*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 24.60 min
Total precip.	= 10.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(19.630 x 61) + (7.450 x 39) + (27.080 x 98)] / 54.160



Hydrograph Report

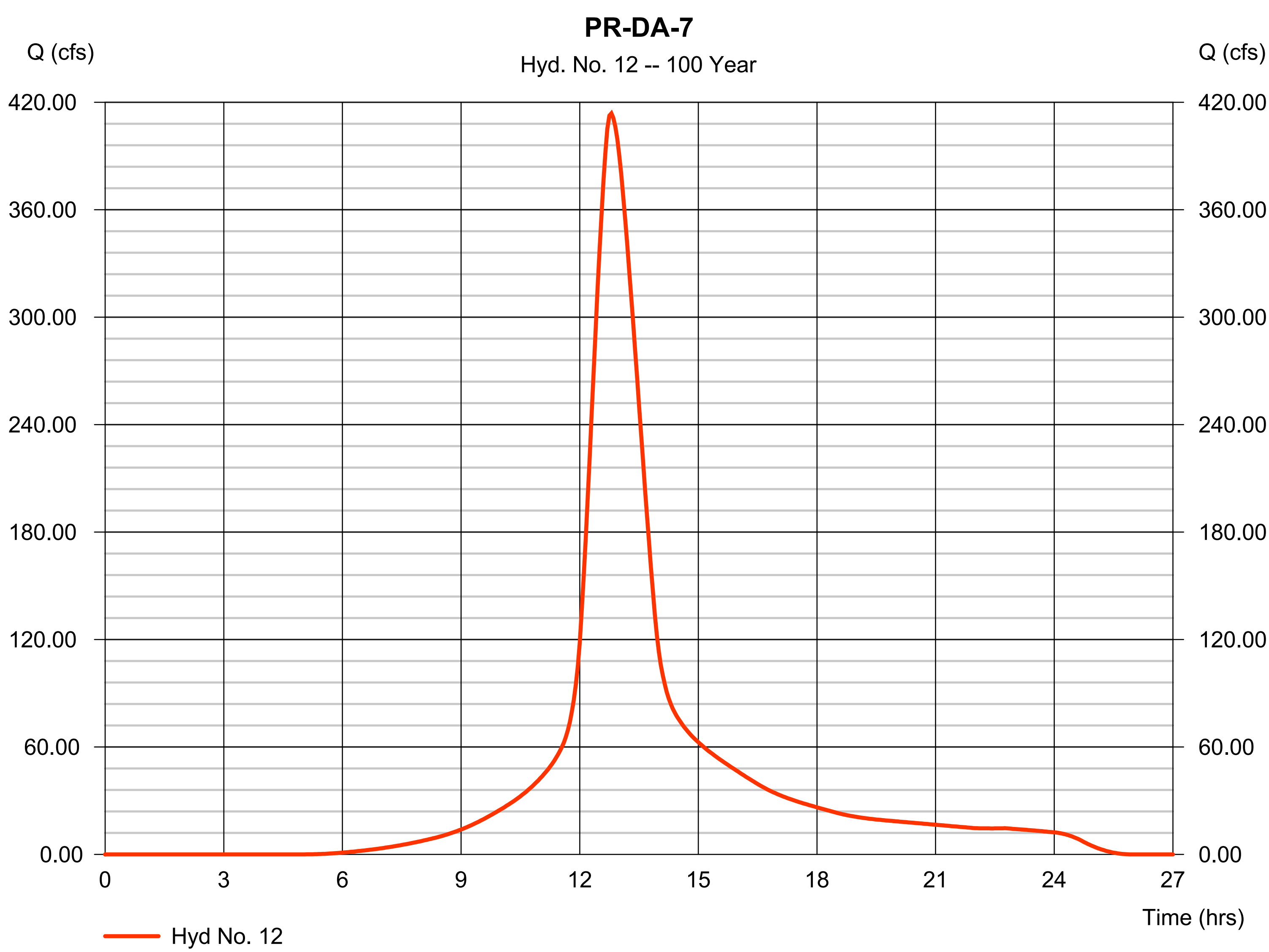
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 05 / 16 / 2018

Hyd. No. 12

PR-DA-7

Hydrograph type	= SCS Runoff	Peak discharge	= 413.80 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.80 hrs
Time interval	= 3 min	Hyd. volume	= 3,637,777 cuft
Drainage area	= 132.150 ac	Curve number	= 79*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 71.80 min
Total precip.	= 10.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(66.080 x 98) + (66.070 x 61)] / 132.150



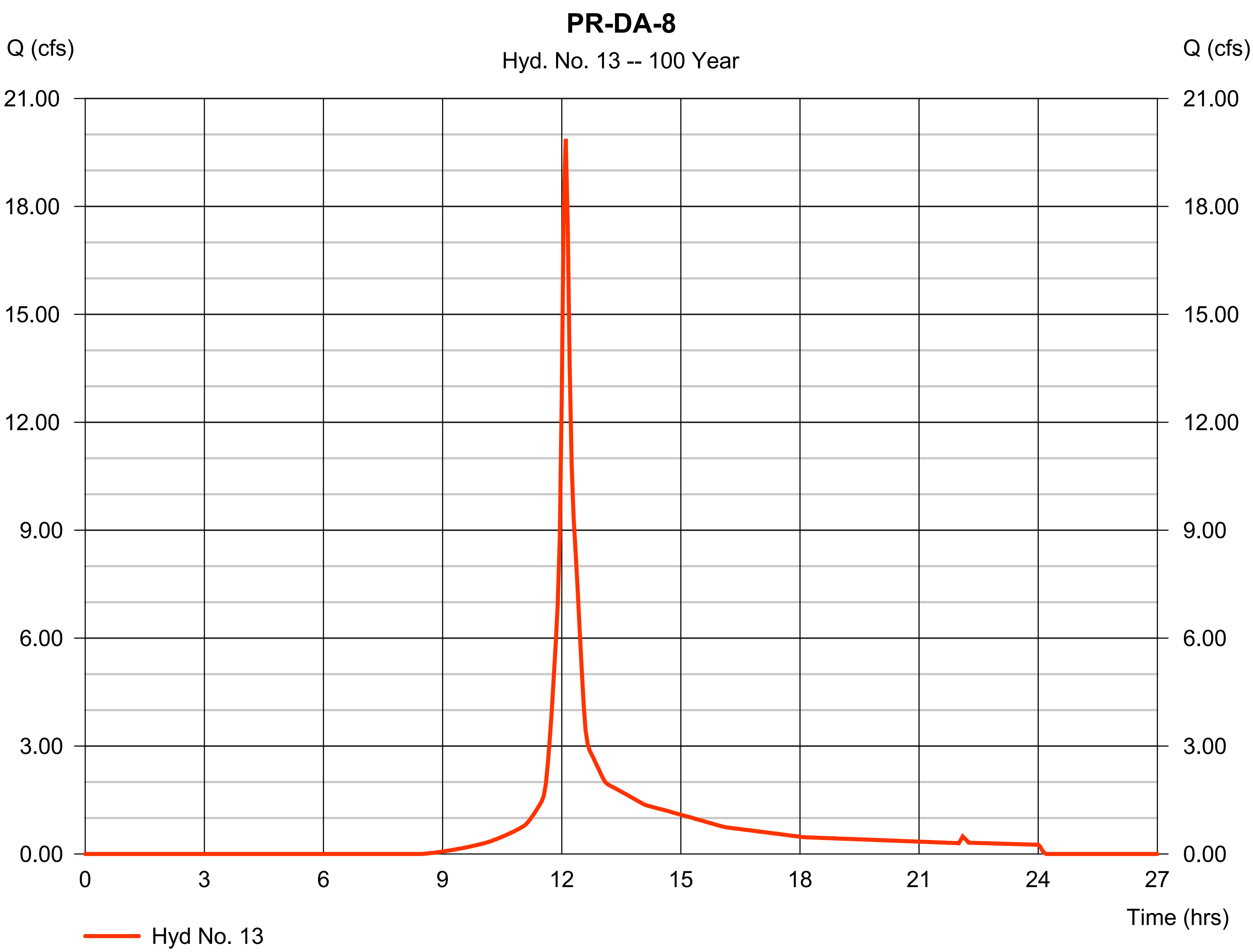
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 13

PR-DA-8

Hydrograph type	= SCS Runoff	Peak discharge	= 19.88 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 66,145 cuft
Drainage area	= 3.740 ac	Curve number	= 61
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 4.90 min
Total precip.	= 10.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



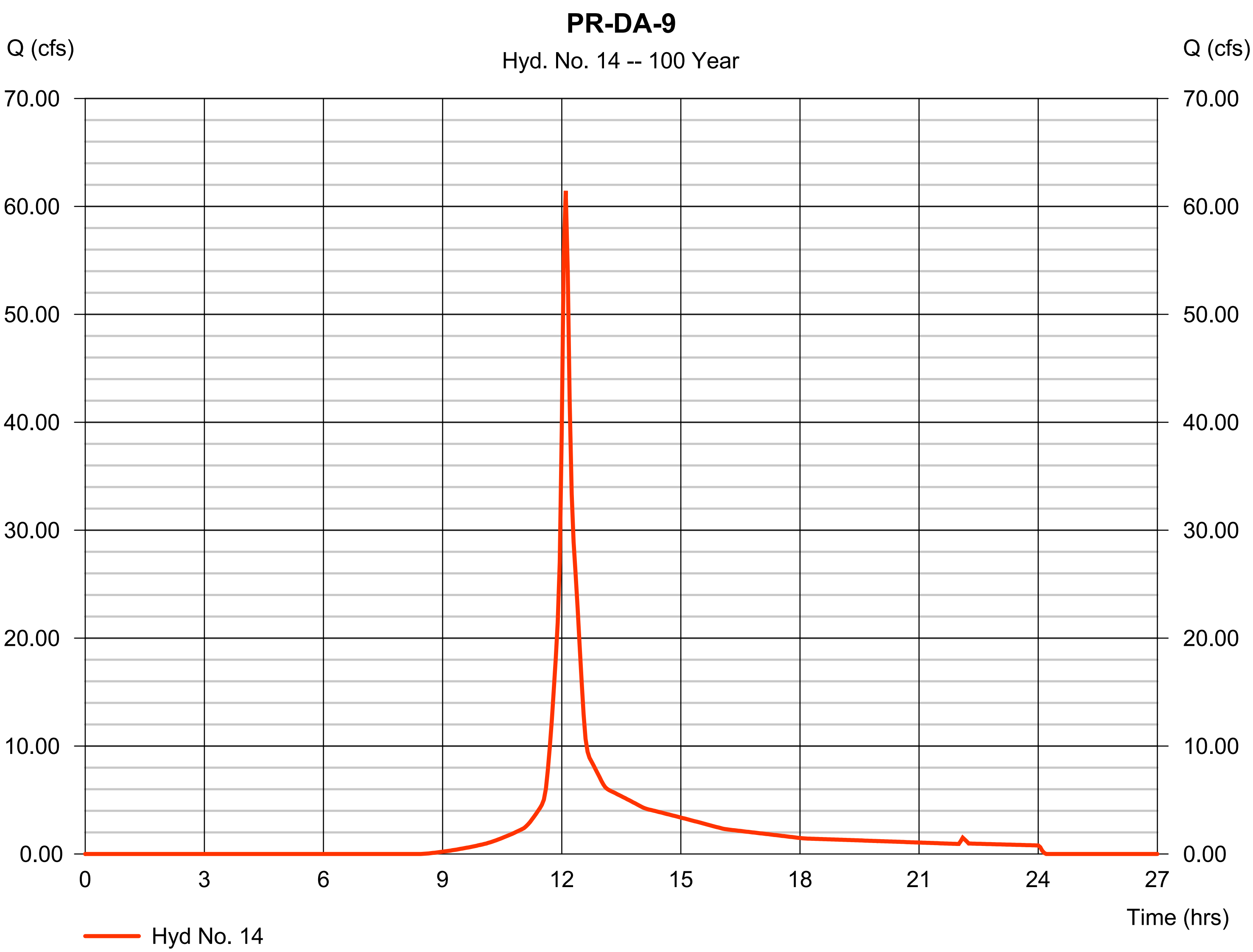
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 | Wednesday, 05 / 16 / 2018

Hyd. No. 14

PR-DA-9

Hydrograph type	= SCS Runoff	Peak discharge	= 61.45 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 204,448 cuft
Drainage area	= 11.560 ac	Curve number	= 61
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.70 min
Total precip.	= 10.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



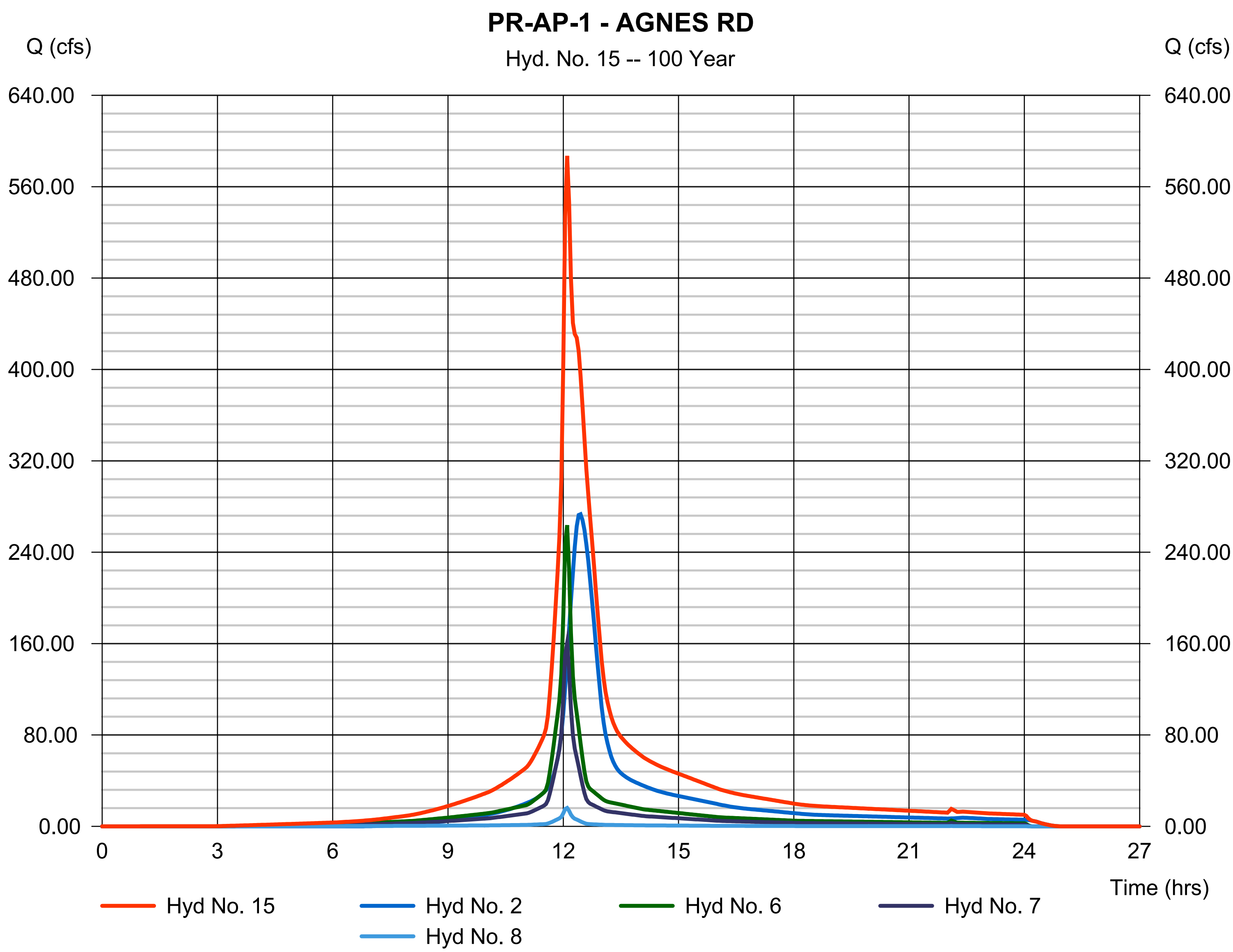
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 05 / 16 / 2018

Hyd. No. 15

PR-AP-1 - AGNES RD

Hydrograph type	= Combine	Peak discharge	= 587.02 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 3,208,240 cuft
Inflow hyds.	= 2, 6, 7, 8	Contrib. drain. area	= 123.406 ac



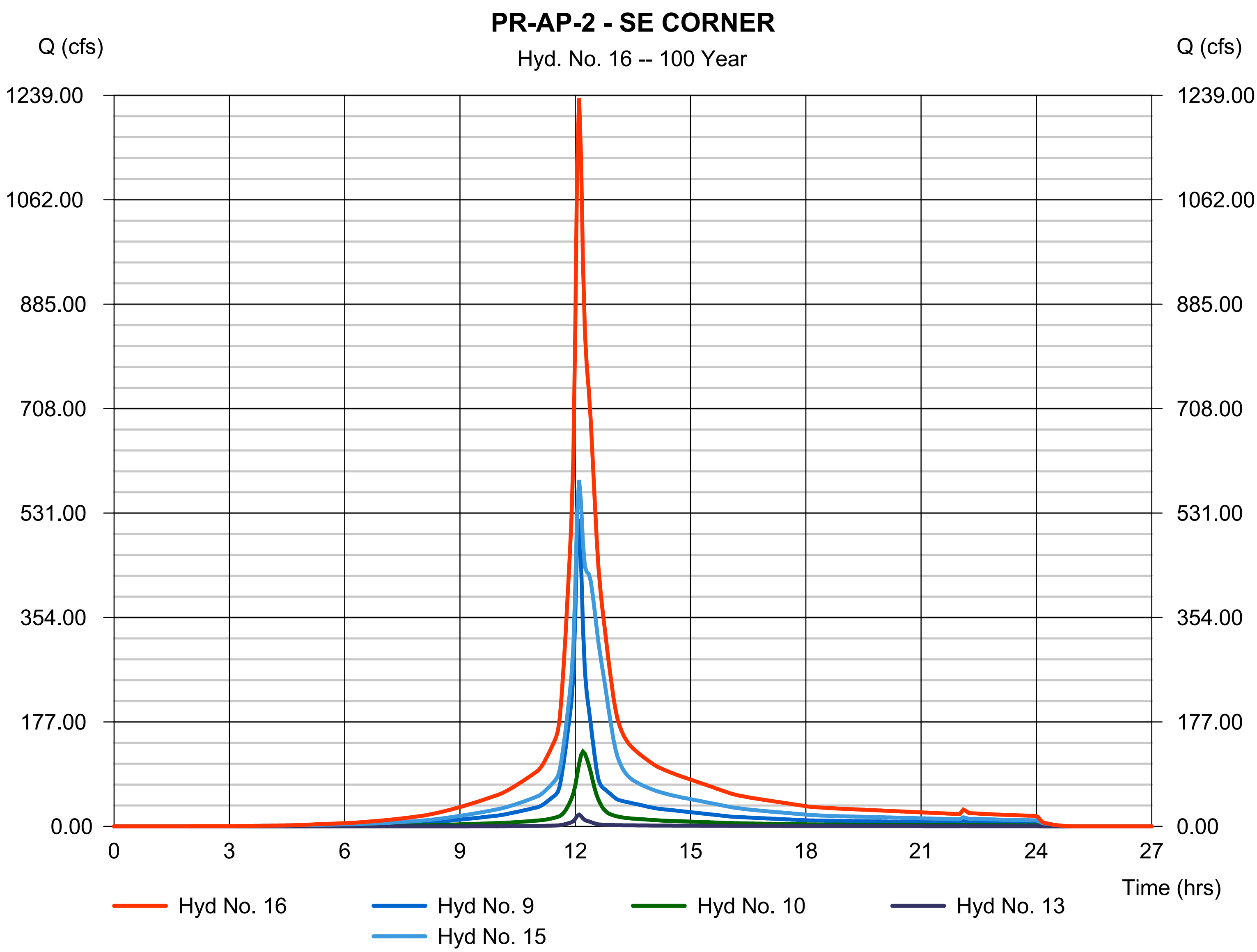
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 16

PR-AP-2 - SE CORNER

Hydrograph type	= Combine	Peak discharge	= 1234.19 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 5,648,194 cuft
Inflow hyds.	= 9, 10, 13, 15	Contrib. drain. area	= 92.180 ac



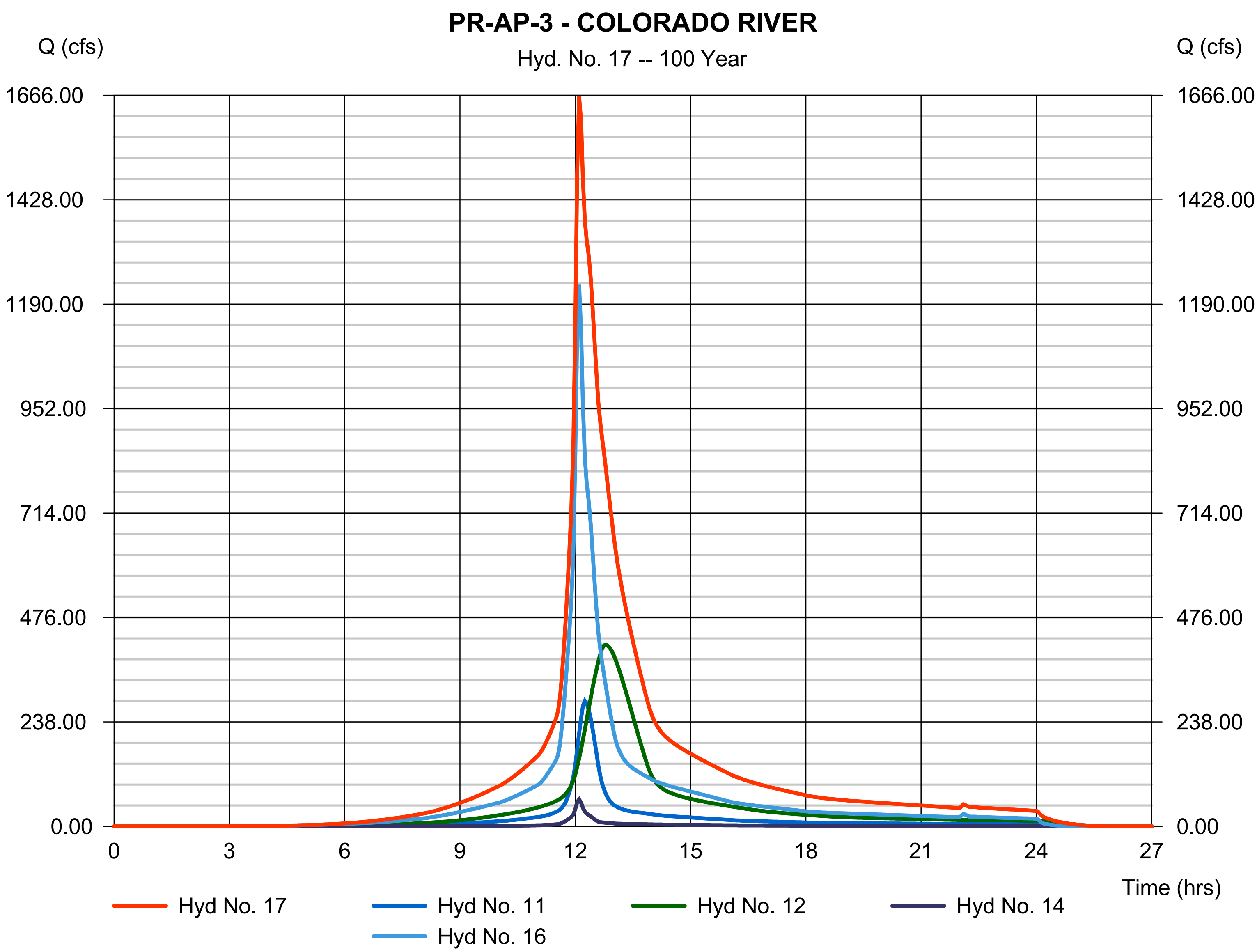
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 05 / 16 / 2018

Hyd. No. 17

PR-AP-3 - COLORADO RIVER

Hydrograph type	= Combine	Peak discharge	= 1662.89 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 10,869,425 cuft
Inflow hyds.	= 11, 12, 14, 16	Contrib. drain. area	= 197.870 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	--------
2	62.0000	8.4000	0.8020	--------
3	0.0000	0.0000	0.0000	--------
5	72.0000	8.4000	0.8000	--------
10	77.0000	8.4000	0.7650	--------
25	88.0000	8.4000	0.7620	--------
50	93.0000	8.4000	0.7480	--------
100	103.0000	8.2000	0.7470	--------

File name: COB IDF TABLE.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	7.73	6.00	4.95	4.23	3.72	3.32	3.01	2.76	2.55	2.38	2.22	2.09
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	9.03	7.01	5.78	4.95	4.35	3.89	3.53	3.23	2.99	2.78	2.60	2.45
10	10.57	8.30	6.90	5.95	5.26	4.73	4.30	3.96	3.67	3.43	3.22	3.04
25	12.18	9.57	7.96	6.87	6.07	5.46	4.97	4.58	4.25	3.97	3.73	3.52
50	13.35	10.53	8.80	7.61	6.74	6.07	5.54	5.11	4.75	4.44	4.17	3.94
100	14.99	11.79	9.84	8.50	7.53	6.78	6.18	5.70	5.29	4.95	4.65	4.40

Tc = time in minutes. Values may exceed 60.

Precip. file name: J:\AutoCad 2004 Land Projects\4697\Eng\Drainage\COB.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	0.00	3.60	0.00	5.10	6.20	7.70	0.00	10.20
SCS 6-Hr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

F. Channel Design

DESIGN BACKGROUND

The proposed channel design is supported by the previously approved Pecan Park Drainage Study by Espey Consultants, Inc. (Appendix B) and Pecan Crossing Offsite Drainage Improvements Report by Cunningham Allen, Inc. (Appendix C).

The Pecan Park Drainage Study was provided by the City of Bastrop and demonstrates the benefits of direct outfall to the Colorado without detention for developments that are proximal to the river. Efficient conveyance of the site's storm runoff will ensure non-coinciding peaks with the Colorado River and will lessen the on-site flooding potential due to upstream developments. See Section G for a discussion of the flooding potential under tailwater conditions assuming coinciding and non-coinciding peaks.

The Pecan Crossing Offsite Drainage Improvements Report provides the basis for the 11.563-acre drainage easement (Volume 1819, Page 840, O.P.R.B.C.TX.) established across the Cantrell Property. The channel and culvert improvements proposed by Cunningham Allen, Inc., are designed to contain the 100-year storm runoff from upstream developments. This report therefore established a baseline design for the proposed channel developed by CBD.

CHANNEL GEOMETRY

The proposed 4,691-foot long earthen drainage ditch begins south of Agnes Road and is fed by a 12'x5' box culvert with an outfall flowline at 352.17' (designed by others). The channel is designed with a bottom width of 8' and 3:1 side slopes extending to meet existing grade at a slope of 0.30% along the flowline of the existing channel within the designated drainage easements where possible. Approaching the low water crossing, the bottom width expands to 20' and side slopes flatten to 6:1. After the low water crossing the bottom width tapers to 8' and side slopes steepen to 3:1. When the proposed channel bottom is graded at approximately 338', a low point in the existing channel, the proposed channel shifts to a slope of 0.89% and transitions to a bottom width of 24' until the apron of the upstream headwall. The aprons and culvert are designed at approximately 2.0% slope. The culvert discharges onto a concrete apron with dissipater blocks and into the channel bed that shall be graded at approximately 2:1 until it intersects with the existing channel bed. This existing channel outfalls at the Colorado River.

CHANNEL SURFACING

The selected erosion matting to be installed along the channel effectively protects against scour due to the channelization of upstream runoff, 100-year flooding of the Colorado River, and vehicle traffic along the low river crossing. Permissible flow velocities and corresponding channel surfaces are presented in Table F.1.

Table F.1 – Erosion Control Matting Selection

Channel Location	Maximum Channel Velocity (fps)	Erosion Control Matting	Design Permissible Velocity (fps)
12'x5' Box Culvert Outfall	11.53 (by others)	North American Green ShoreMax Transition Mat[1]	18.0 (unvegetated & vegetated)
Low Water Crossing	4.55	Flexamat Flexible Concrete Blocks Mat[2]	20.0
1 – 8'x10' & 2 – 6'x10' Box Culverts	13.81	North American Green ShoreMax Transition Mat[1]	18.0 (unvegetated & vegetated)
Channel (before proposed box culverts)	9.83	North American Green SC250 TRM[3]	9.5 (unvegetated) 15.0 (vegetated)

[1] North American Green RevetMax Specification Sheet – ShoreMax Transition Mat
[2] Flexamat, Tied Concrete Block Mats Specification Sheet
[3] North American Green RollMax Product Selection Chart – SC250

LOW WATER CROSSING

The 212' long by 10' wide low water crossing is designed to provide a stabilized vehicular access route for the property owners adjacent to the dedicated drainage easement during low water conditions. This crossing is created by flattening the proposed channel side slopes to a maximum of 6:1, expanding the channel bottom to 20', and installing the Flexamat flexible concrete blocks mat. The Flexamat will be installed along the alignment of the existing low water crossing and shall intersect with existing ranch roads on either side of the dedicated drainage easement. The Flexamat will be installed from elevation 348.7' to 349.7' to protect against scour during the maximum potential flooding event while remaining within the dedicated drainage easement.

CULVERT

The existing drainage channel discharging the site's runoff into the Colorado River is regulated by a 4'x4' box culvert followed by a 10'x20' flood control structure on the downstream side of the dirt driveway. Survey data suggest that the flood control structure is broken and/or buried, and the upstream dirt road has experienced scour. CBD proposes to replace these structures with the intent of providing efficient drainage of runoff from proposed upstream developments into the Colorado River while mimicking existing channel hydrology. For this reason, a structure, containing one 8'x10' and two 6'x10' box culverts, is proposed along the alignment and within the footprint of the existing structures. The culvert outfalls to the existing channel bed as soon as possible while providing sufficient space for the proposed 14' concrete driveway and culvert wingwalls.

The culvert design is intended to minimize disturbance of existing ground cover within and around the channel.

The proposed culvert was designed to provide sufficient conveyance of design storms. A comparison of existing and proposed flows modeled at the culvert location can be found in Table F.1 below.

Table F.1 – Existing vs. Proposed Flows Discharging into Colorado River

	Flow (cfs)	
Storm Frequencies	**EX-AP-2**	**PR-AP-3**
25-year	395.87	1,115.75
100-year	648.66	1,662.89

Source: Hydraflow Report (Section E)

Hydraulic analyses, included in Section G, confirm that the culvert has sufficient capacity to convey runoff without causing flooding at Agnes Road. The minimum surface elevation of Agnes Road is estimated at 359.50'. Regardless of tailwater conditions utilized (see Section G), the realized water surface elevation within the proposed channel at Agnes Road is modeled at 356.87' for 100-year storm. Sufficient freeboard is thus provided to protect against flooding at Agnes Road.

DRIVEWAY

The proposed 258' long by 14' wide concrete driveway provides a vehicular access route across the proposed box culverts for the property owners adjacent to the dedicated drainage easement during flood events. To prevent against scour such as the existing dirt driveway experienced, the crest of the proposed driveway is designed at 1' above the existing 100-year base flood elevation as per FEMA Flood Map (see Part III). The beginning and end sections of the proposed driveway lower to meet existing grade while remaining within the dedicated drainage easement. The minimum driveway elevation is subject to approximately flooding due to the rise of the Colorado River during the 100-year storm; however, flooding with an anticipated tailwater (see Section G) due to the site's 100-year storm event is not expected to overtop the minimum surface elevation of the proposed driveway at 347.74'.

G. Hydraulic Analysis

METHODOLOGY & INPUT VARIABLES

The capacity and the proposed channel was evaluated using the Autodesk River and Flood Analysis Module and HEC-RAS. The proposed channel was modeled with 39 river stations between Agnes Road and the Colorado River, as shown on the cross-section map. Section lengths were generally extended beyond the dedicated drainage easements to evaluate the full extents of potential flooding. Overbank stations were selected at the boundary of proposed channel grading. The Manning's n-values in Table G.1 were selected as per the ranges provided in the HEC-RAS Reference Manual, version 5.0.

Table G.1 - Manning's N-Values

Surface Description	N
Main channel – clean straight, full, no rifts or deep pools	0.026
Floodplain – pasture, no brush, short grass	0.035
Lined channel – concrete, trowel finish	0.011

Source: HEC-RAS Reference Manual, version 5.0.

Flow inputs varied along the length of the proposed channel as per the proposed hydrology described by the Hydraflow report in Section E. The flow inputs utilized for the HEC-RAS model are found in Table G.2.

Table G.2 – HEC-RAS Flow Inputs at River Stations

	Flow (cfs)		
Storm Frequency	**Stations 1 to 28**	**Stations 23 to 30**	**Stations 31 to 39**
25-Year	414.96	868.31	1,151.75
100-Year	587.02	1,234.19	1,662.89

The 25-year and 100-year flows through the channel were evaluated under three different tailwater conditions as shown in Table G.3.

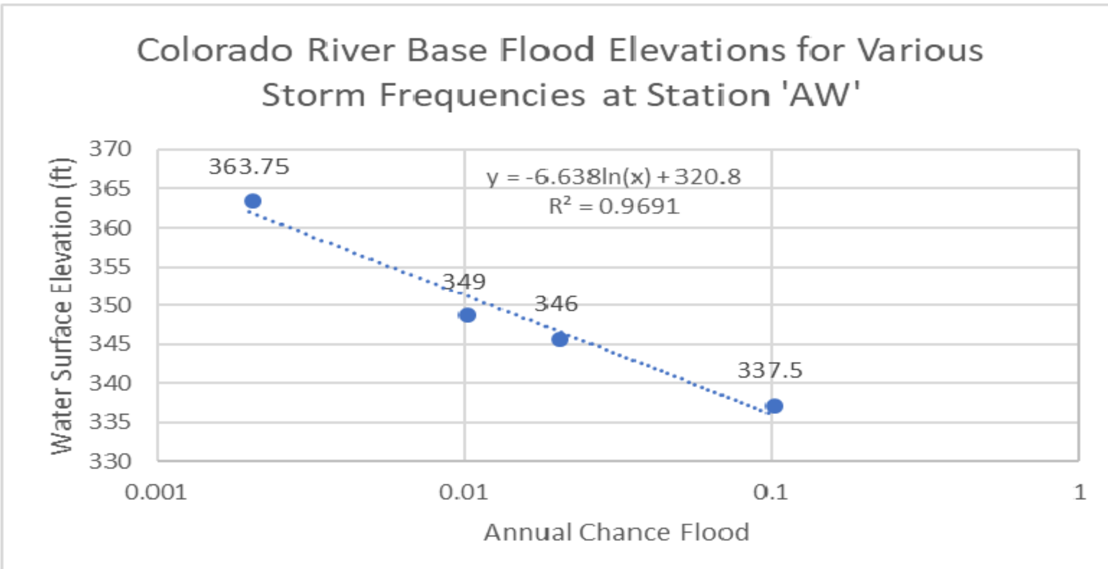
Table G.3 – Tailwater Conditions

Storm Frequency	Maximum Potential Tailwater Assuming Coinciding Peaks	Anticipated Tailwater Assuming Non-Coinciding Peaks	Tailwater Assuming Gravity Outfall
25-Year	342.17'	331.96'	0'
100-Year	349.00'	338.59'	0'

The 25-year and 100-year flows through the channel were evaluated under three different tailwater conditions as shown in Table G.3. Water surface elevation data and time to peak of the Colorado River are based on FEMA Flood Insurance Map & Study (Appendix A) and the Pecan Park Drainage Study (Appendix B), which utilizes the United States Geological Survey gage 08159200 located at State Highway 71 approximately two miles upstream of the proposed channel's outfall. Tailwater justifications and assumptions are provided below.

Maximum Potential Tailwater Assuming Coinciding Peaks

The existing 100-year base flood elevation is at 349.00' MSL (see Appendix A). The Colorado River's peak 25-yr water surface elevation is estimated at 342.17'. This water surface elevation was extrapolated from a logarithmic trend of base flood elevations for various annual chance floods in the graph below, which uses data from the FEMA Flood Insurance Study at Station 'AW'.



Data Source: FEMA Flood Insurance Study 48021CV000B (Appendix A)

Time to peak for the Colorado River is approximated at 31:45 hours for the 100-year event (see Appendix B), whereas the proposed channel's time to peak is modeled at approximately 12:06 hours (see Hydraflow report in Section E). These peaks are non-coinciding and therefore these water surface elevations overestimate expected flooding for the 100-year and 25-year events.

The maximum potential tailwater assuming coinciding peaks was used to design the extents of the proposed erosion control measures to ensure stability of the proposed channel during worst possible conditions of the 100-year storm event. As shown in the HEC-RAS report, under this tailwater condition, the proposed culvert and low points along the proposed concrete driveway are inundated only during the 100-year storm.

Anticipated Tailwater Assuming Non-Coinciding Peaks

As mentioned above, the Colorado River and proposed channel's peaks are non-coinciding; therefore, an estimated reduction of 10.41' is expected to be realized in actual water surface elevation at 12:06 hours. The 100-year water surface elevation is estimated at 338.59’. This reduced water surface elevation is based on graphical interpolations of Figures 1 and 2 in Appendix B. The anticipated 25-year water surface elevation of the Colorado River realized at 12:06 hours at the proposed channel’s outfall is estimated at 331.96’. This was calculated using a proportional reduction equivalent to the change in 100-year water surface elevations realized at a time to peak of 31:45 hours as compared to 12:06 hours, as shown below:

342.17’ / 349.00’ = x / 338.59’

The anticipated tailwater assuming non-coinciding peaks was used to evaluate the capacity of the channel and realistic site flooding. As shown in the HEC-RAS section drawings and profile tables, under this tailwater condition, the proposed culvert and concrete driveway are not inundated during for the 25-year or 100-year storms.

Tailwater Assuming Gravity Outfall

Gravity outfall calculations provide maximum velocities which are used for the appropriate material selection of erosion control matting downstream of the proposed culvert and across the low water crossing. Flow characteristics of this tailwater condition are the same as those using the anticipated tailwater assuming non-coinciding peaks at every station upstream of Station 5.

CROSS-SECTION MAP & GEOMETRIES

LEGEND

- DRAINAGE EASEMENT BOUNDARY
- 350 — EXISTING CONTOUR MAJOR
- EXISTING CONTOUR MINOR
- 350 — PROPOSED CONTOUR MAJOR
- PROPOSED CONTOUR MINOR
- # — CHANNEL CROSS-SECTION

0 200' 400'

SCALE: 1" = 200'

STATE OF TEXAS
BRENDAN P. McENTEE
96200
LICENSED
PROFESSIONAL ENGINEER
CARLSON, BRIGANCE & DOERING, INC.
ID# F3791

DESIGNED BY:	DRAFTED BY:
BM	JW

DATE

REVISION

Carlson, Brigance & Doering, Inc.
FIRM ID #F3791
Civil Engineering ◆ Surveying
5501 West William Cannon Dr. ◆ Austin, Texas 78749
Phone No. (512) 280-5160 ◆ Fax No. (512) 280-5165

SHEET NAME: CHANNEL CROSS-SECTION MAP

JOB NAME: BASTROP GROVE

PROJECT: DRAINAGE IMPROVEMENTS

DATE: APRIL 2018

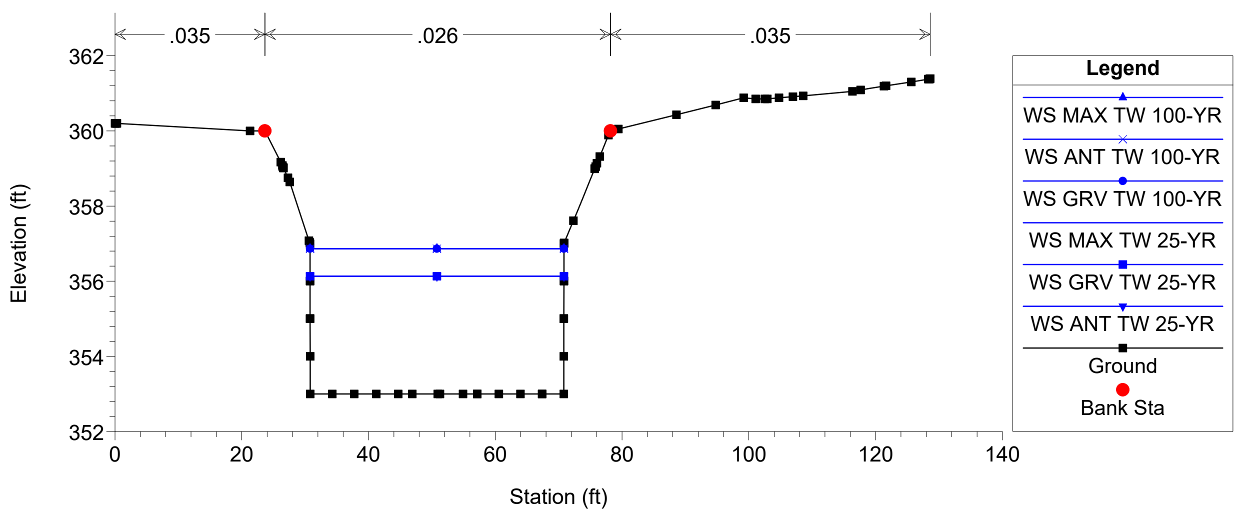
JOB NUMBER: 4697

SHEET: MAP

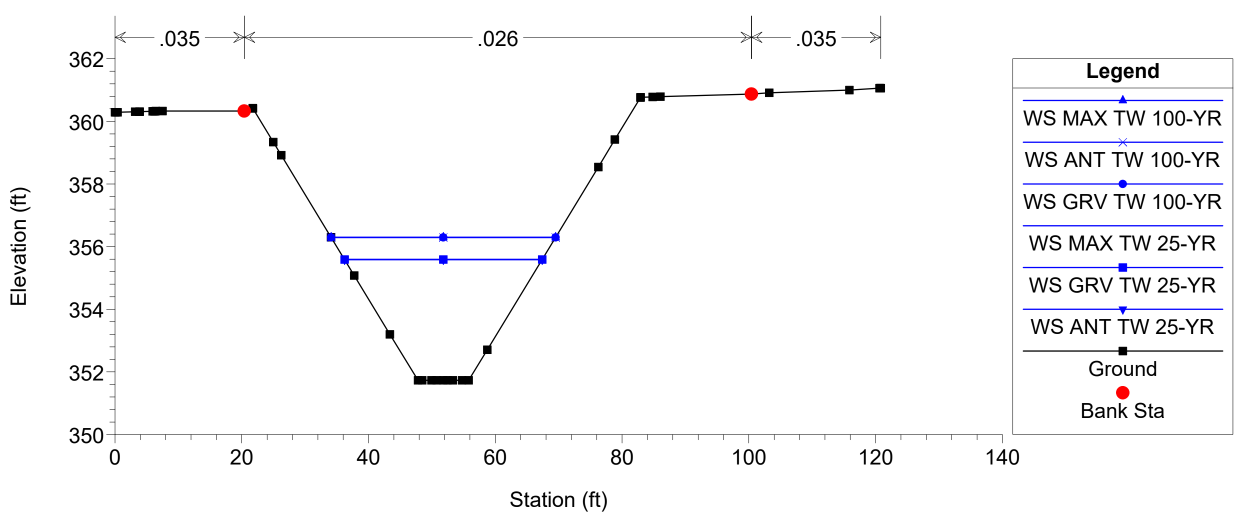
SHEET NO.:

FILE PATH: J:\AutoCad 2004 Land Projects\4697\dwg\Channel\4697 - HEC-RAS SECTION MAP.dwg - May 17, 2018 - 2:36pm

HEC-RAS model from Autodesk® River and Flood Analysis Module 2018 Plan: Plan 02 5/17/2018



HEC-RAS model from Autodesk® River and Flood Analysis Module 2018 Plan: Plan 02 5/17/2018



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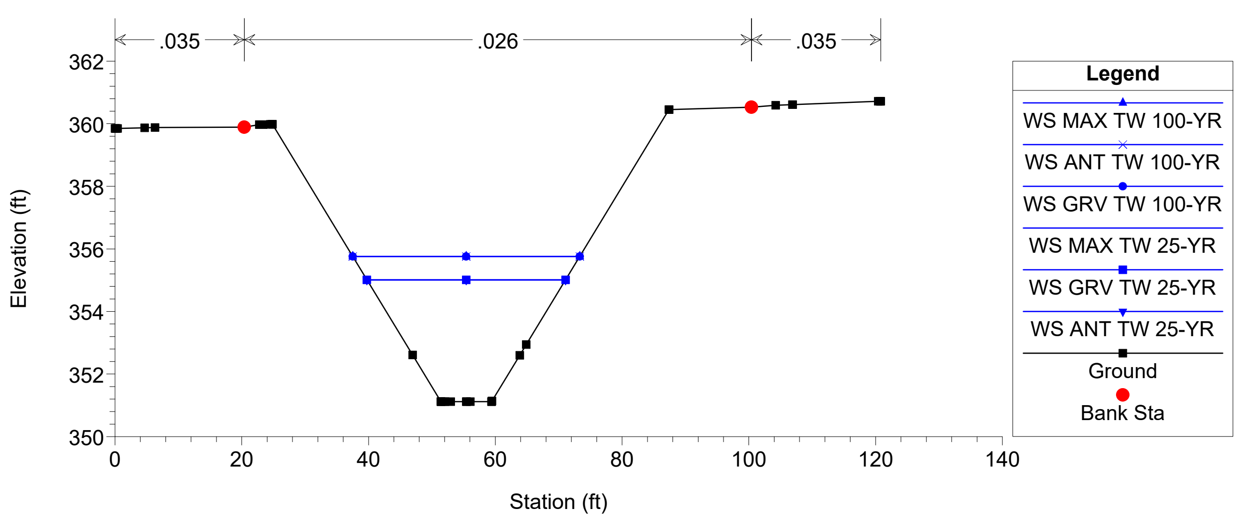
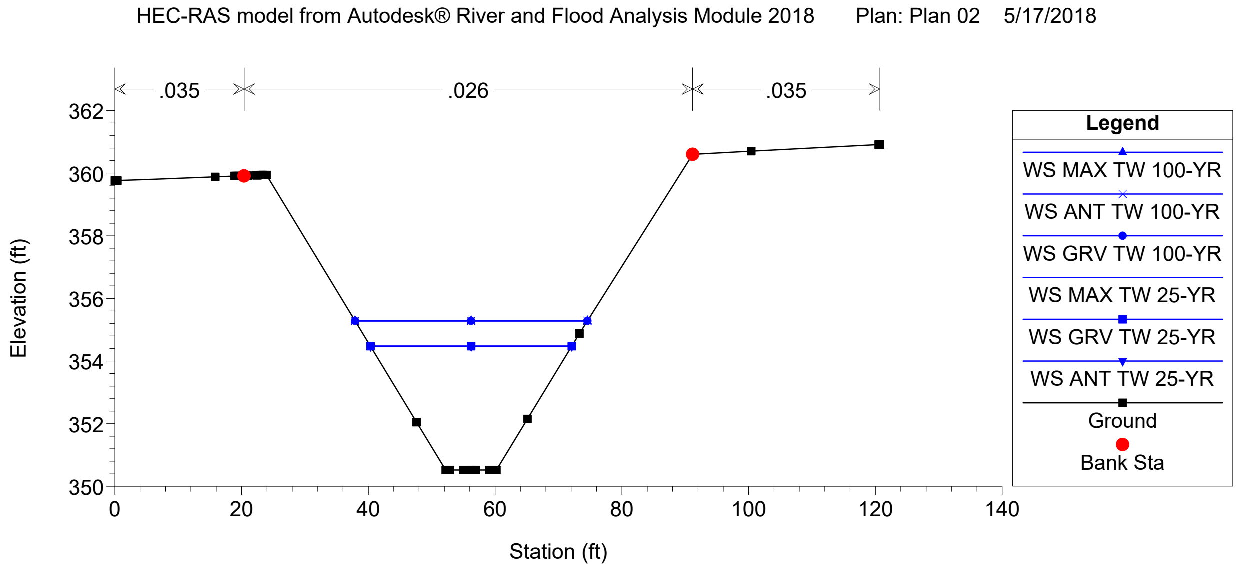
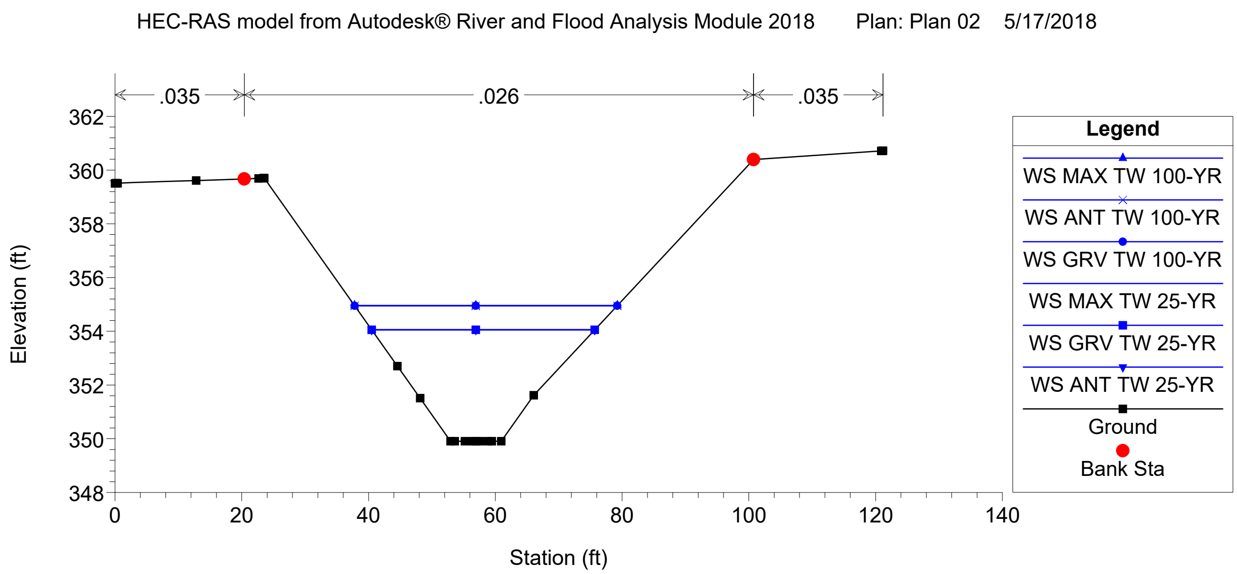



HEC-RAS model from Autodesk® River and Flood Analysis Module 2018 Plan: Plan 02 5/17/2018
.035
.026
.035
Elevation (ft)
Station (ft)
Legend
WS MAX TW 100-YR
WS ANT TW 100-YR
WS GRV TW 100-YR
WS MAX TW 25-YR
WS GRV TW 25-YR
WS ANT TW 25-YR
Ground
Bank Sta


HEC-RAS model from Autodesk® River and Flood Analysis Module 2018 Plan: Plan 02 5/17/2018
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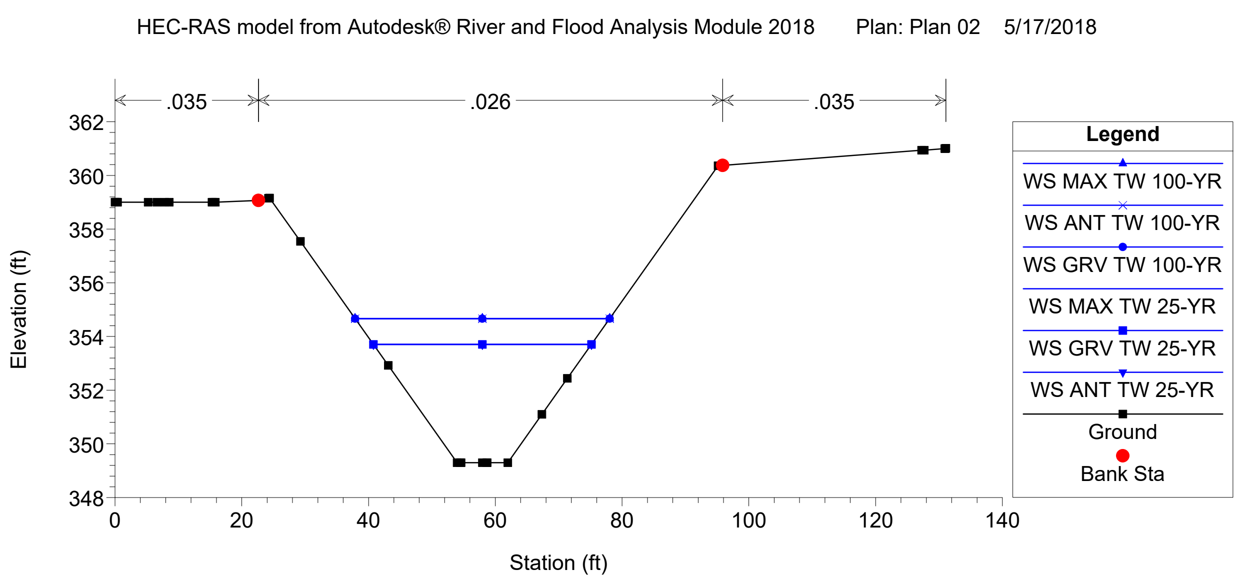
Elevation (ft)
Station (ft)
Legend
WS MAX TW 100-YR
WS ANT TW 100-YR
WS GRV TW 100-YR
WS MAX TW 25-YR
WS GRV TW 25-YR
WS ANT TW 25-YR
Ground
Bank Sta


HEC-RAS model from Autodesk® River and Flood Analysis Module 2018 Plan: Plan 02 5/17/2018
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Elevation (ft)
Station (ft)
Legend
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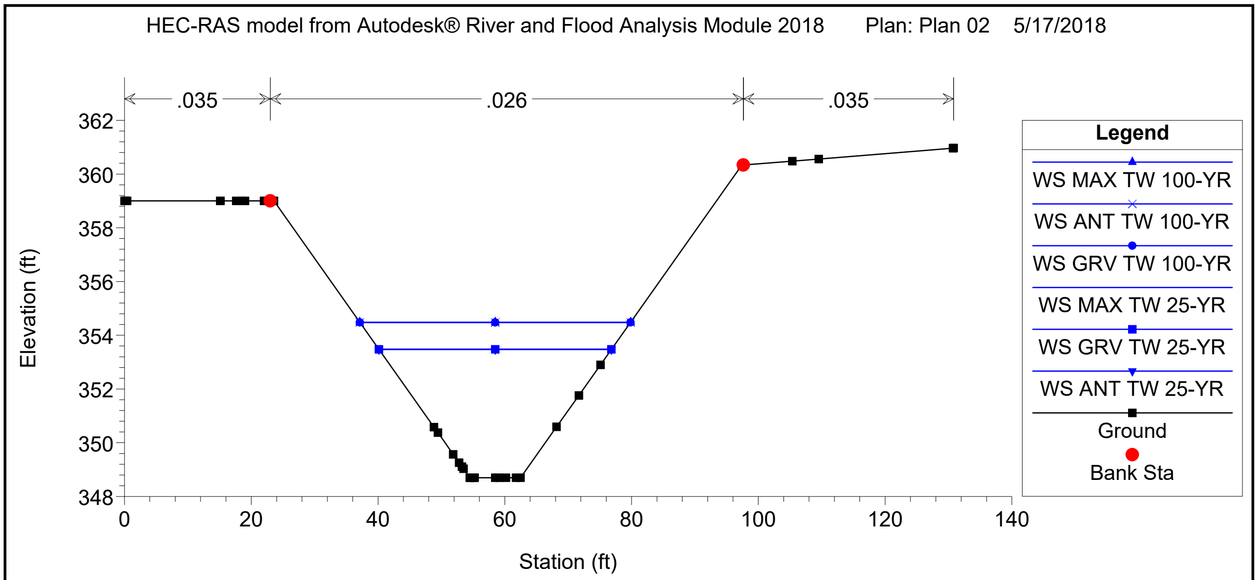
WS ANT TW 100-YR
WS GRV TW 100-YR
WS MAX TW 25-YR
WS GRV TW 25-YR
WS ANT TW 25-YR
Ground
Bank Sta


HEC-RAS model from Autodesk® River and Flood Analysis Module 2018 Plan: Plan 02 5/17/2018
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.026
.035
Elevation (ft)
Station (ft)
Legend
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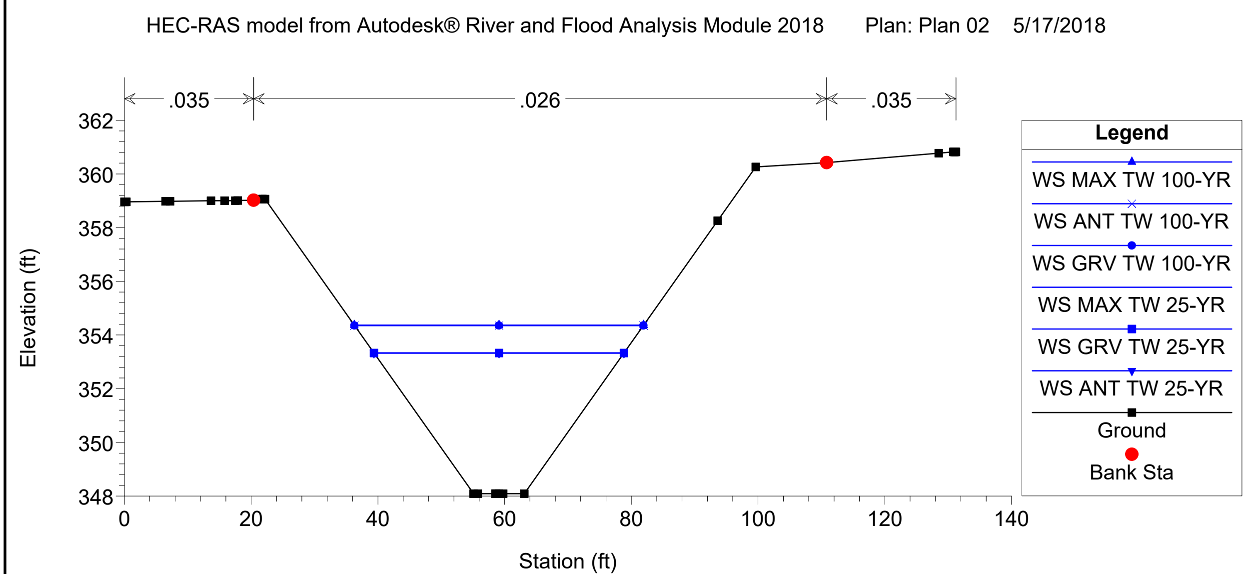
WS ANT TW 100-YR
WS GRV TW 100-YR
WS MAX TW 25-YR
WS GRV TW 25-YR
WS ANT TW 25-YR
Ground
Bank Sta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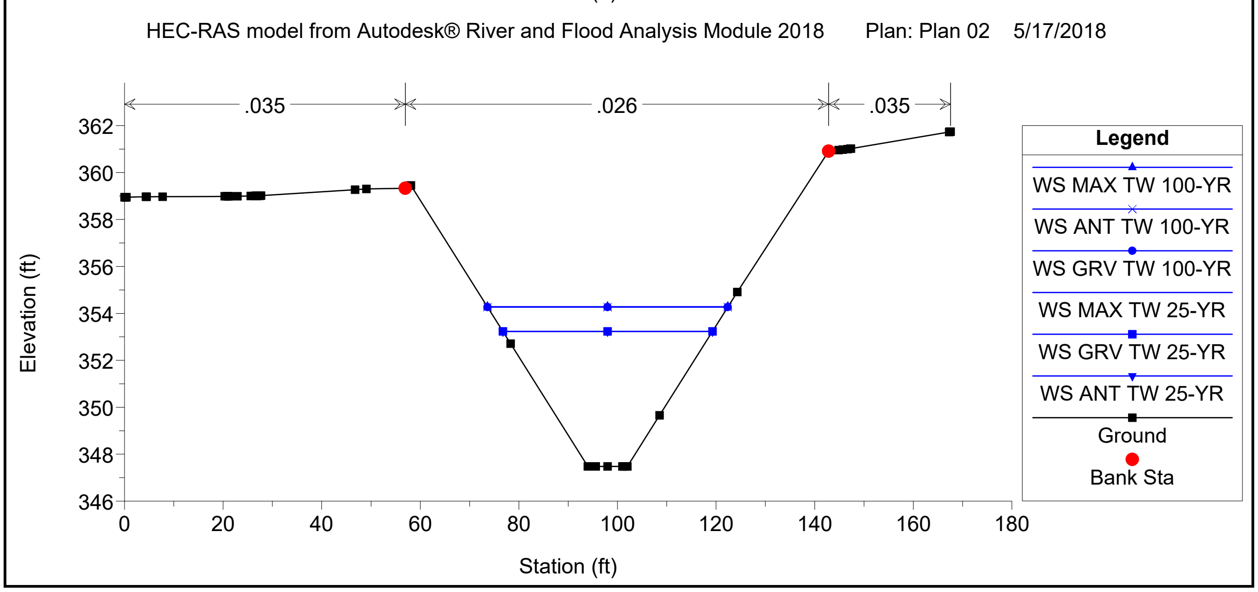
Elevation (ft)
Station (ft)
Legend
WS MAX TW 100-YR
WS ANT TW 100-YR
WS GRV TW 100-YR
WS MAX TW 25-YR
WS GRV TW 25-YR
WS ANT TW 25-YR
Ground
Bank Sta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Elevation (ft)
Station (ft)
Legend
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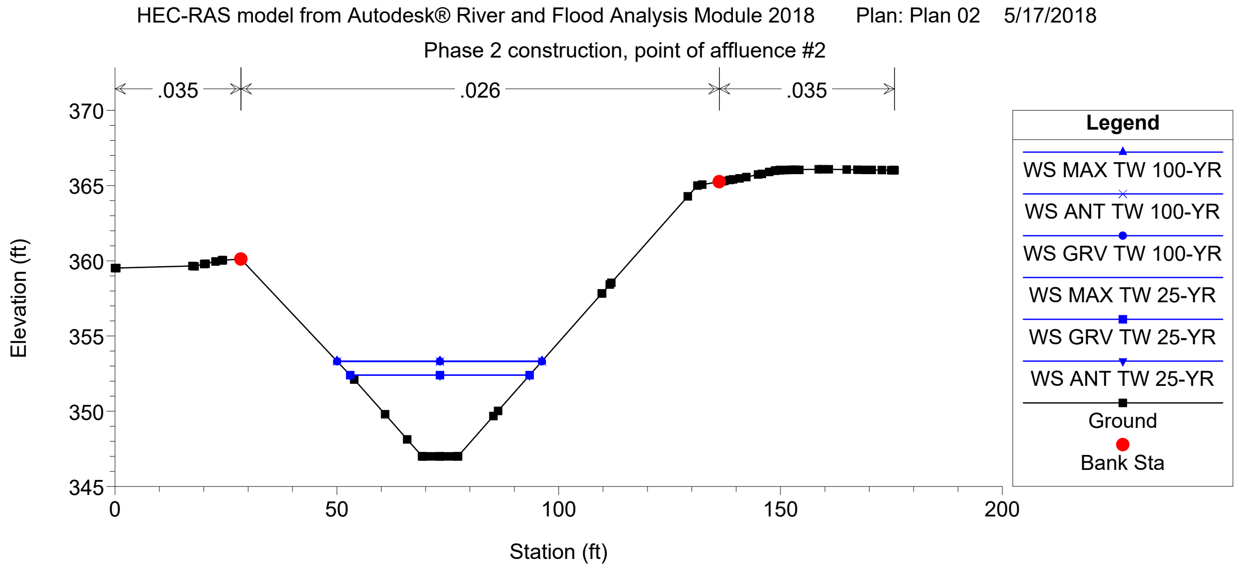
WS GRV TW 100-YR
WS MAX TW 25-YR
WS GRV TW 25-YR
WS ANT TW 25-YR
Ground
Bank Sta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Phase 2 construction, point of affluence #2
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Elevation (ft)
Station (ft)
Legend
WS MAX TW 100-YR
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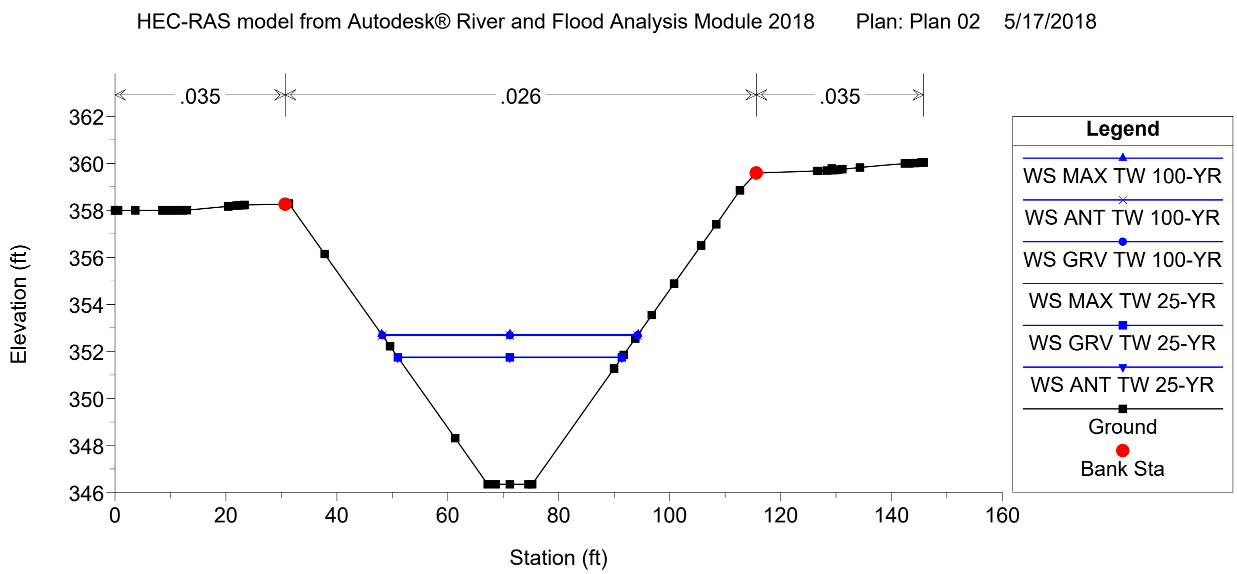
WS GRV TW 100-YR
WS MAX TW 25-YR
WS GRV TW 25-YR
WS ANT TW 25-YR
Ground
Bank Sta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Station (ft)
Legend
WS MAX TW 100-YR
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WS GRV TW 100-YR
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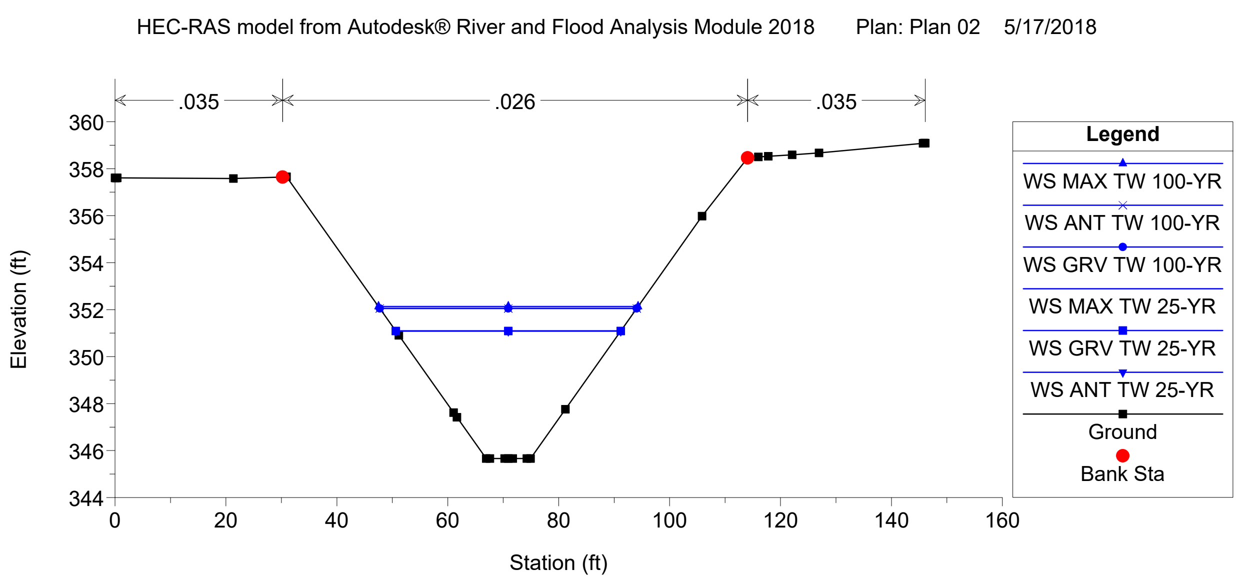
WS GRV TW 25-YR
WS ANT TW 25-YR
Ground
Bank Sta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WS ANT TW 25-YR
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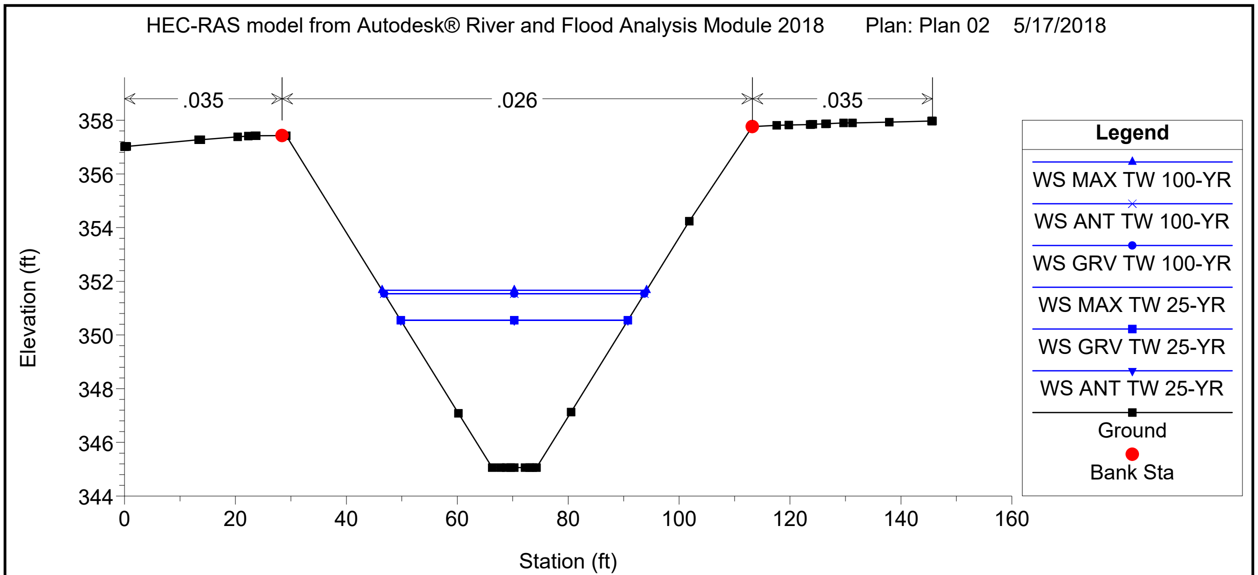
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Station (ft)
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WS ANT TW 25-YR
Ground
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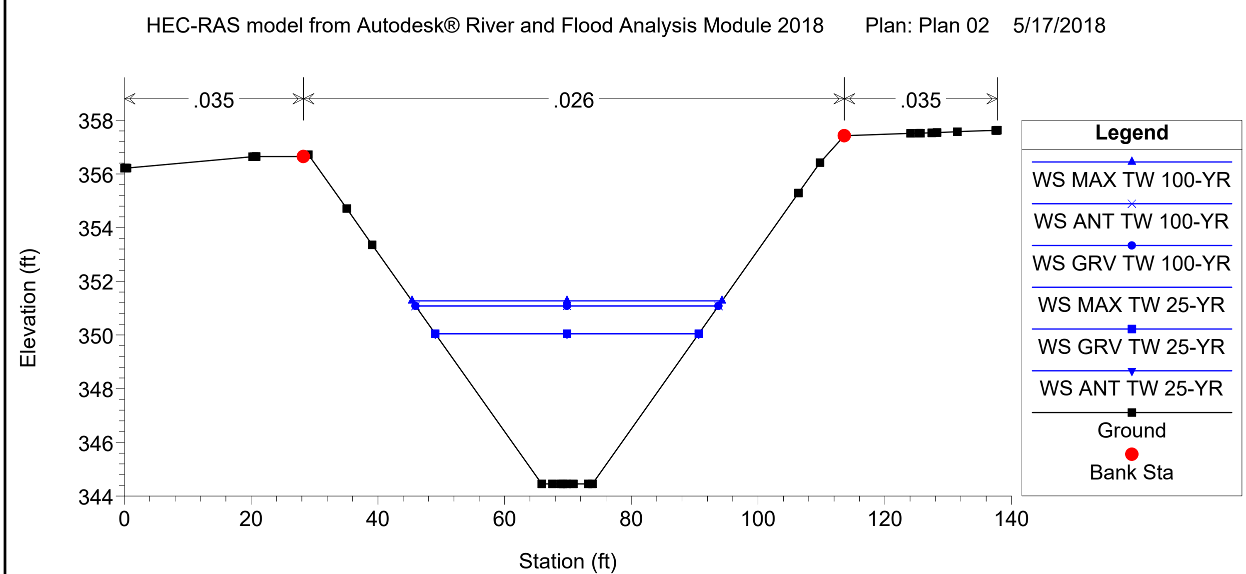
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Station (ft)
Legend
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WS GRV TW 100-YR
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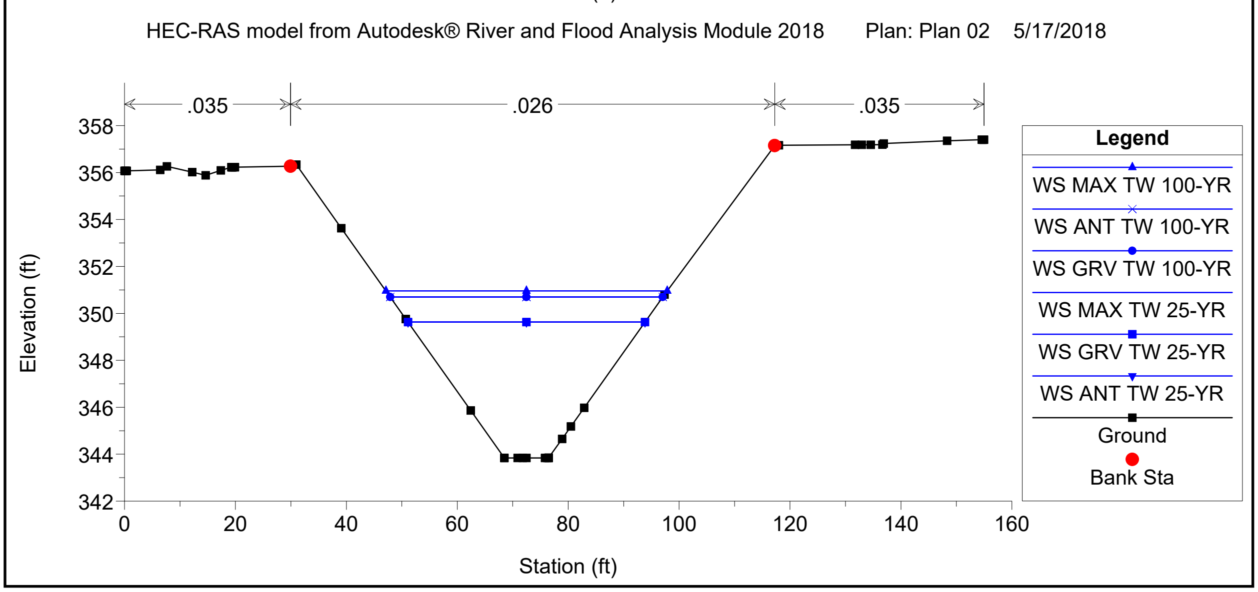
WS GRV TW 25-YR
WS ANT TW 25-YR
Ground
Bank Sta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Elevation (ft)
Station (ft)
Legend
WS MAX TW 100-YR
WS ANT TW 100-YR
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WS MAX TW 25-YR
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Ground
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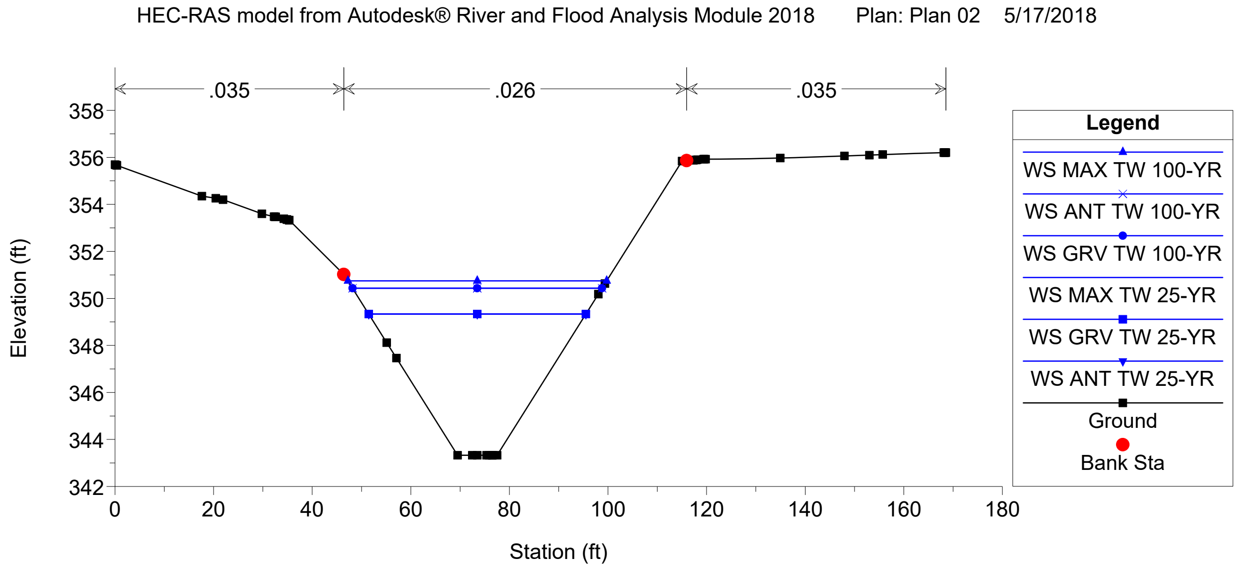
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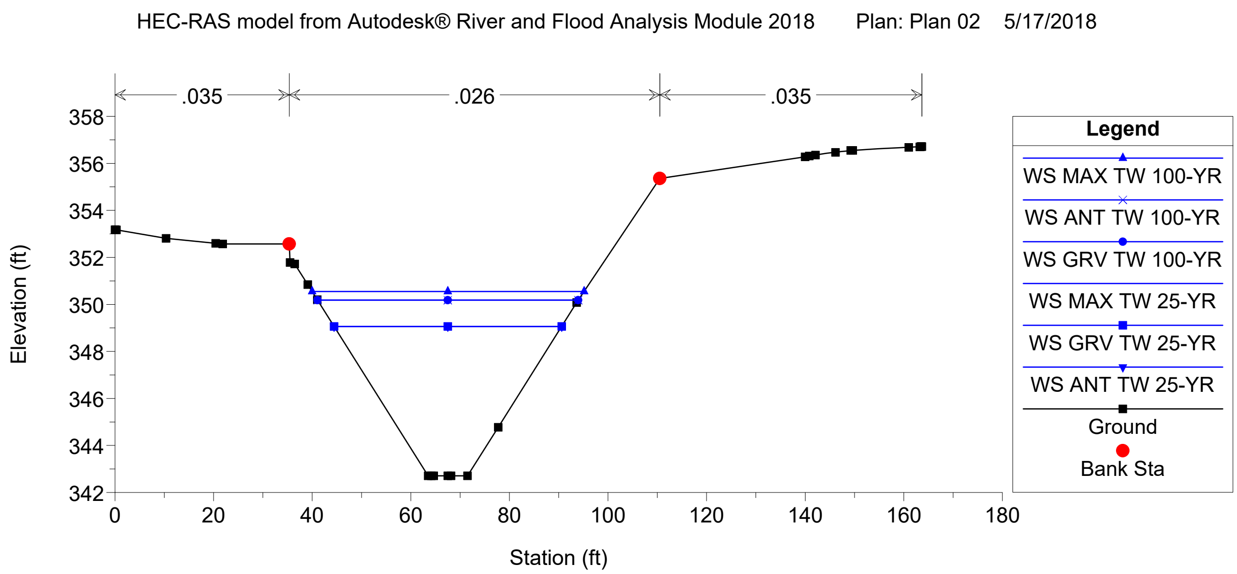
Elevation (ft)
Station (ft)
Legend
WS MAX TW 100-YR
WS ANT TW 100-YR
WS GRV TW 100-YR
WS MAX TW 25-YR
WS GRV TW 25-YR
WS ANT TW 25-YR
Ground
Bank Sta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Elevation (ft)
Station (ft)
Legend
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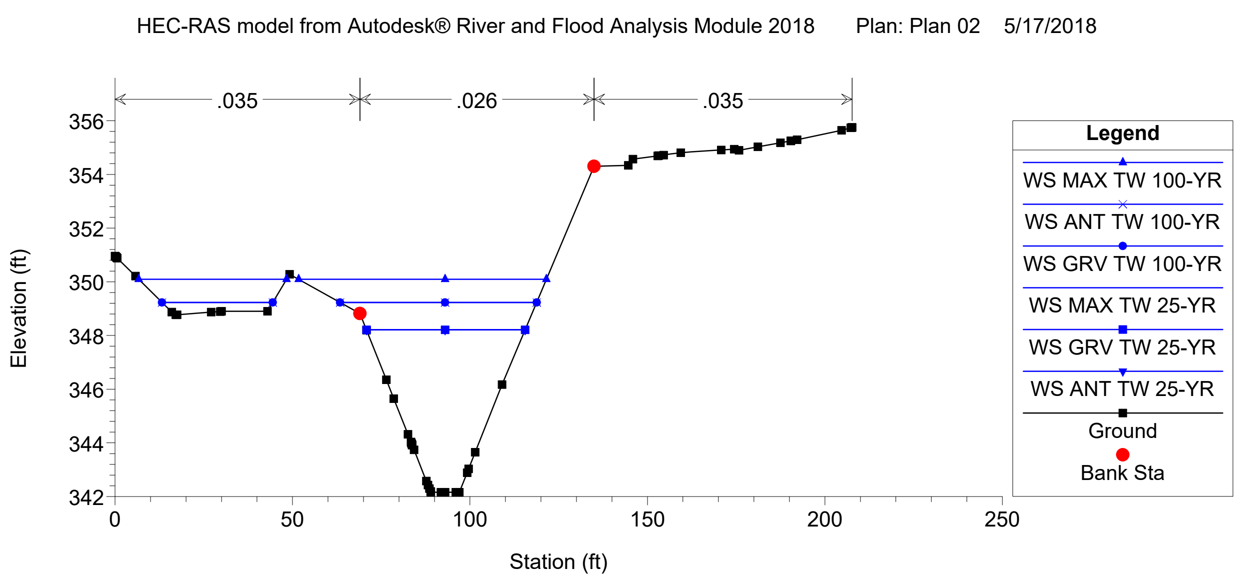
WS GRV TW 100-YR
WS MAX TW 25-YR
WS GRV TW 25-YR
WS ANT TW 25-YR
Ground
Bank Sta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Elevation (ft)
Station (ft)
Legend
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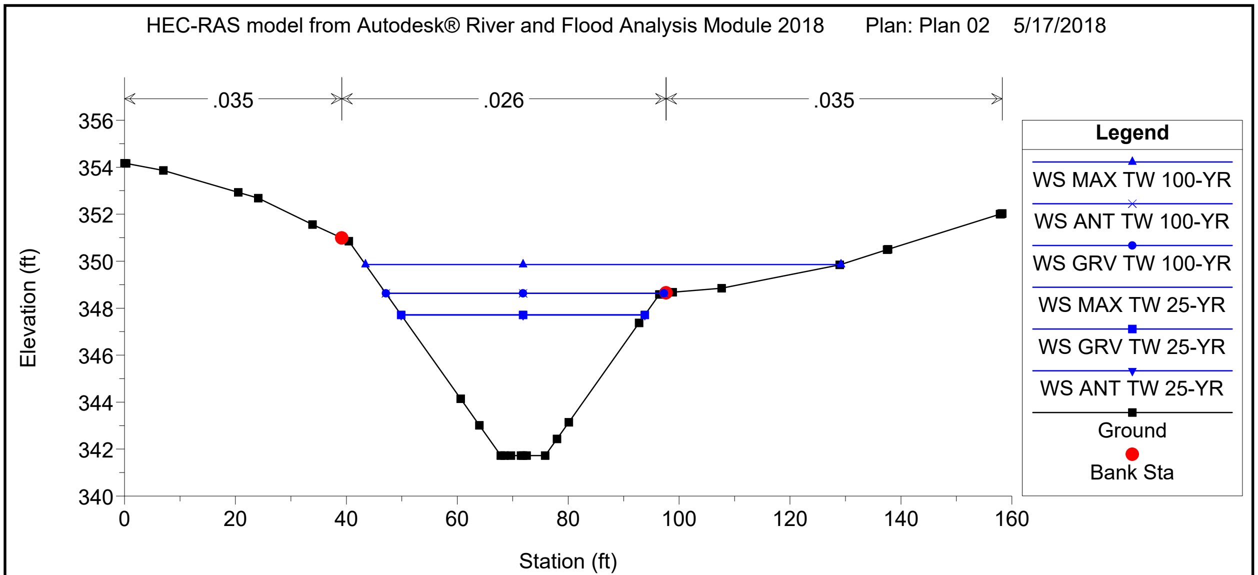
WS ANT TW 100-YR
WS GRV TW 100-YR
WS MAX TW 25-YR
WS GRV TW 25-YR
WS ANT TW 25-YR
Ground
Bank Sta



HEC-RAS model from Autodesk® River and Flood Analysis Module 2018 Plan: Plan 02 5/17/2018
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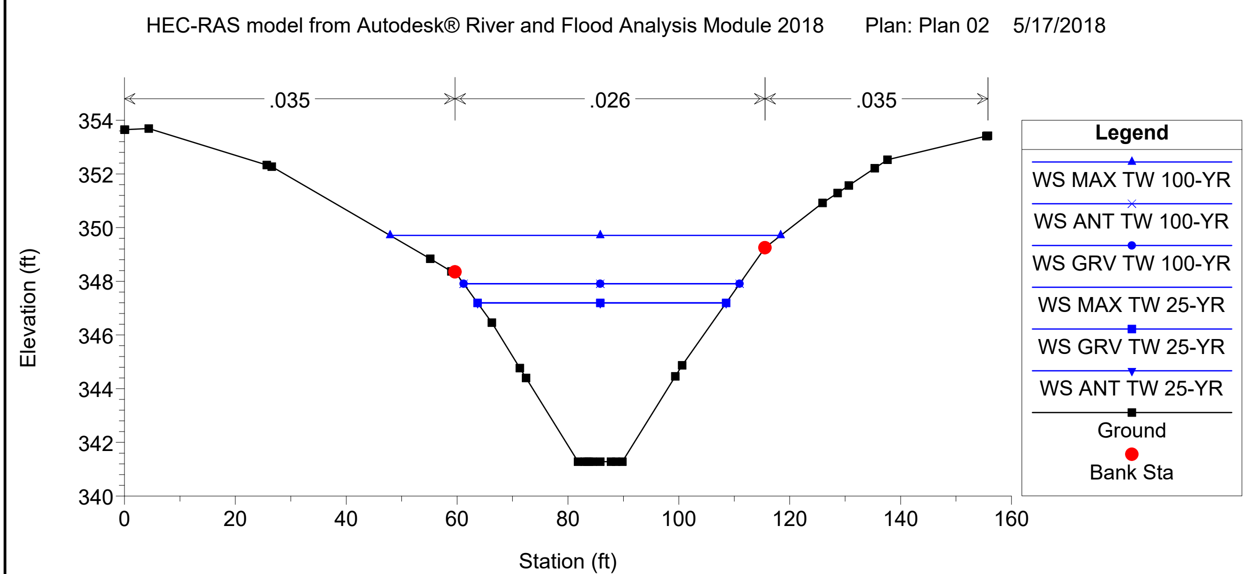
Elevation (ft)
Station (ft)
Legend
WS MAX TW 100-YR
WS ANT TW 100-YR
WS GRV TW 100-YR
WS MAX TW 25-YR
WS GRV TW 25-YR
WS ANT TW 25-YR
Ground
Bank Sta



HEC-RAS model from Autodesk® River and Flood Analysis Module 2018 Plan: Plan 02 5/17/2018
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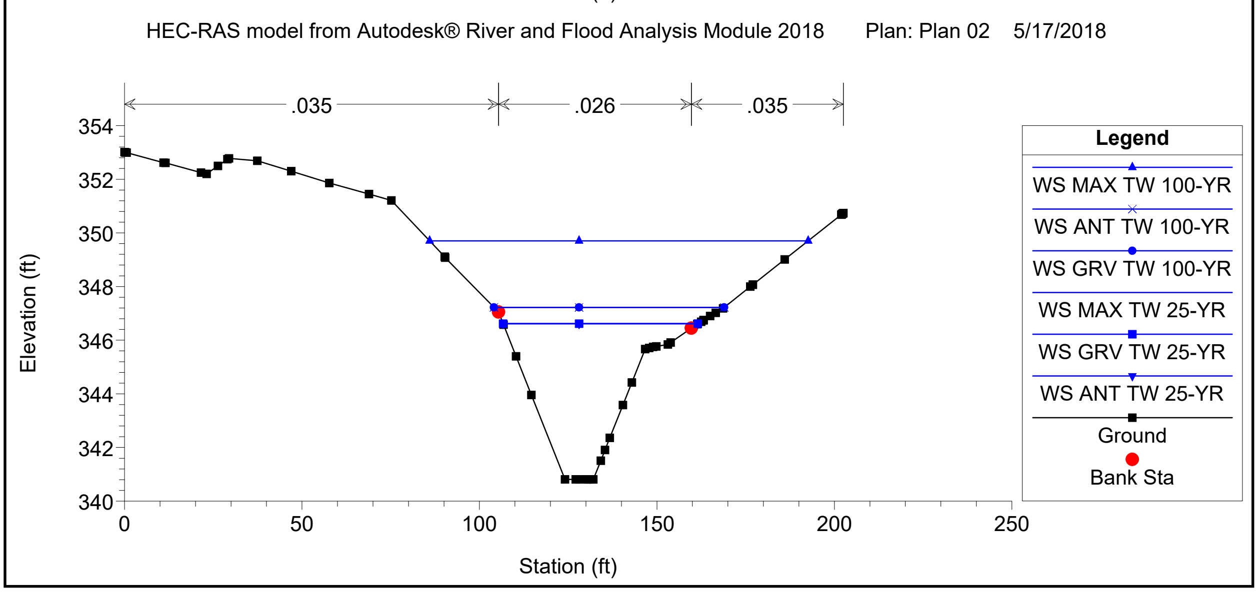
.035
Elevation (ft)
Station (ft)
Legend
WS MAX TW 100-YR
WS ANT TW 100-YR
WS GRV TW 100-YR
WS MAX TW 25-YR
WS GRV TW 25-YR
WS ANT TW 25-YR
Ground
Bank Sta



HEC-RAS model from Autodesk® River and Flood Analysis Module 2018 Plan: Plan 02 5/17/2018
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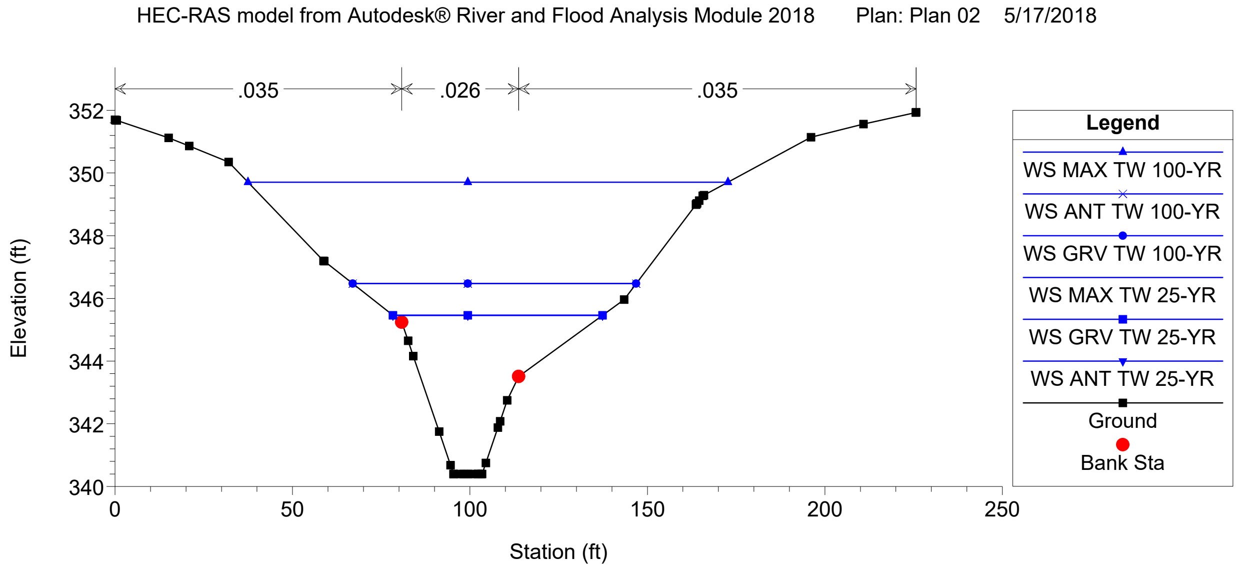
Elevation (ft)
Station (ft)
Legend
WS MAX TW 100-YR
WS ANT TW 100-YR
WS GRV TW 100-YR
WS MAX TW 25-YR
WS GRV TW 25-YR
WS ANT TW 25-YR
Ground
Bank Sta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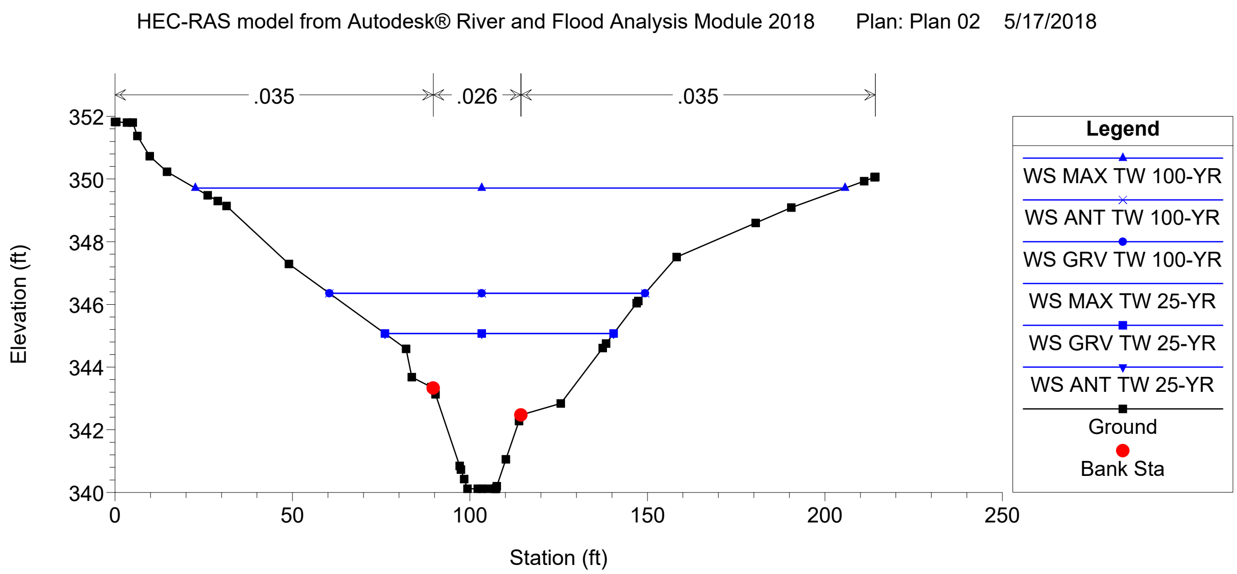
Elevation (ft)
Station (ft)
Legend
WS MAX TW 100-YR
WS ANT TW 100-YR
WS GRV TW 100-YR
WS MAX TW 25-YR
WS GRV TW 25-YR
WS ANT TW 25-YR
Ground
Bank Sta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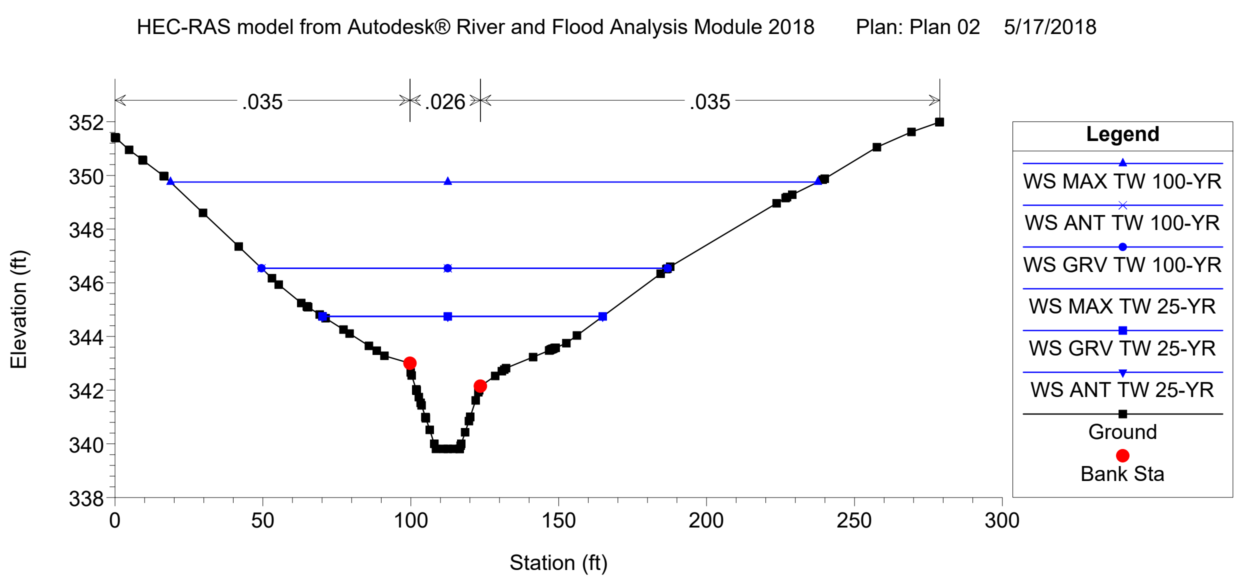
Elevation (ft)
Station (ft)
Legend
WS MAX TW 100-YR
WS ANT TW 100-YR
WS GRV TW 100-YR
WS MAX TW 25-YR
WS GRV TW 25-YR
WS ANT TW 25-YR
Ground
Bank Sta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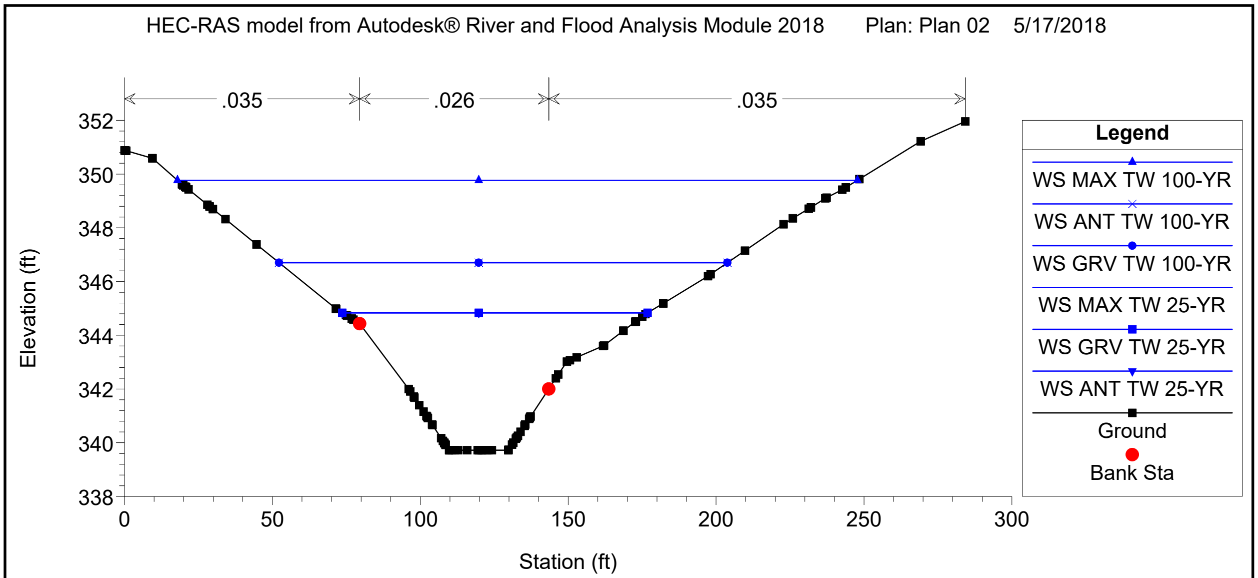
Elevation (ft)
Station (ft)
Legend
WS MAX TW 100-YR
WS ANT TW 100-YR
WS GRV TW 100-YR
WS MAX TW 25-YR
WS GRV TW 25-YR
WS ANT TW 25-YR
Ground
Bank Sta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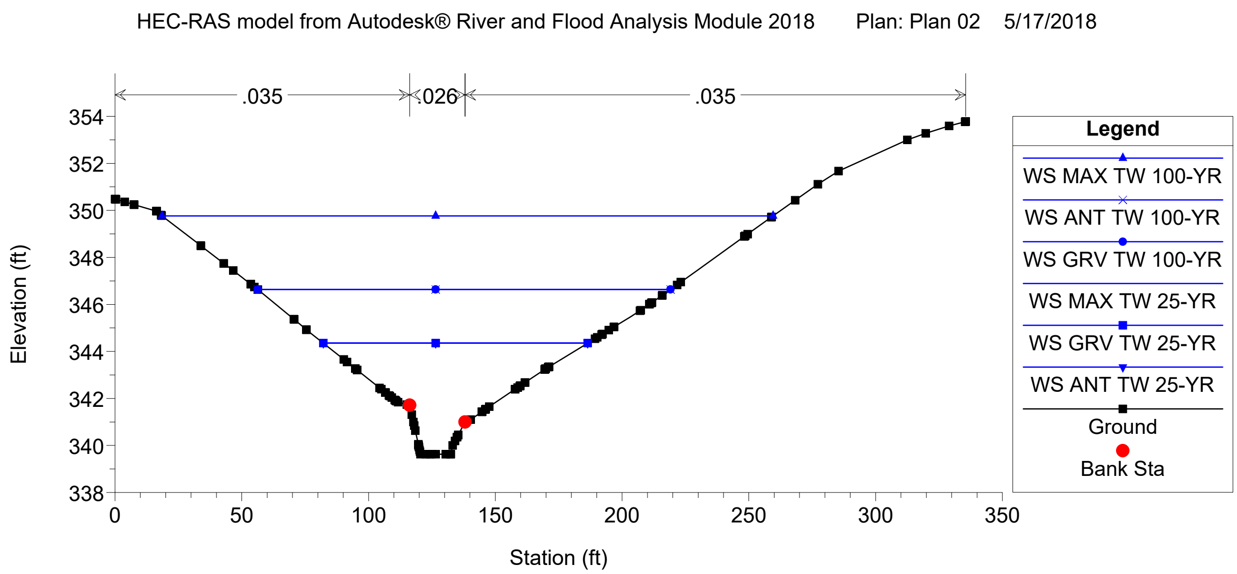
Elevation (ft)
Station (ft)
Legend
WS MAX TW 100-YR
WS ANT TW 100-YR
WS GRV TW 100-YR
WS MAX TW 25-YR
WS GRV TW 25-YR
WS ANT TW 25-YR
Ground
Bank Sta


HEC-RAS model from Autodesk® River and Flood Analysis Module 2018 Plan: Plan 02 5/17/2018
.035
.026
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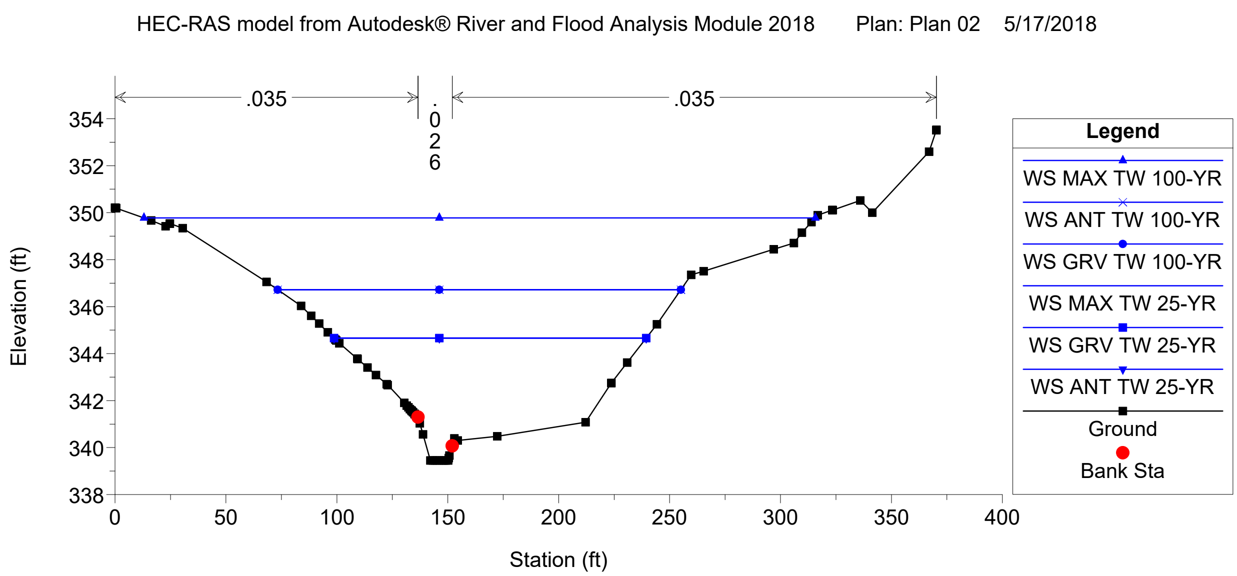
Elevation (ft)
Station (ft)
Legend
WS MAX TW 100-YR
WS ANT TW 100-YR
WS GRV TW 100-YR
WS MAX TW 25-YR
WS GRV TW 25-YR
WS ANT TW 25-YR
Ground
Bank Sta


HEC-RAS model from Autodesk® River and Flood Analysis Module 2018 Plan: Plan 02 5/17/2018
.035
.026
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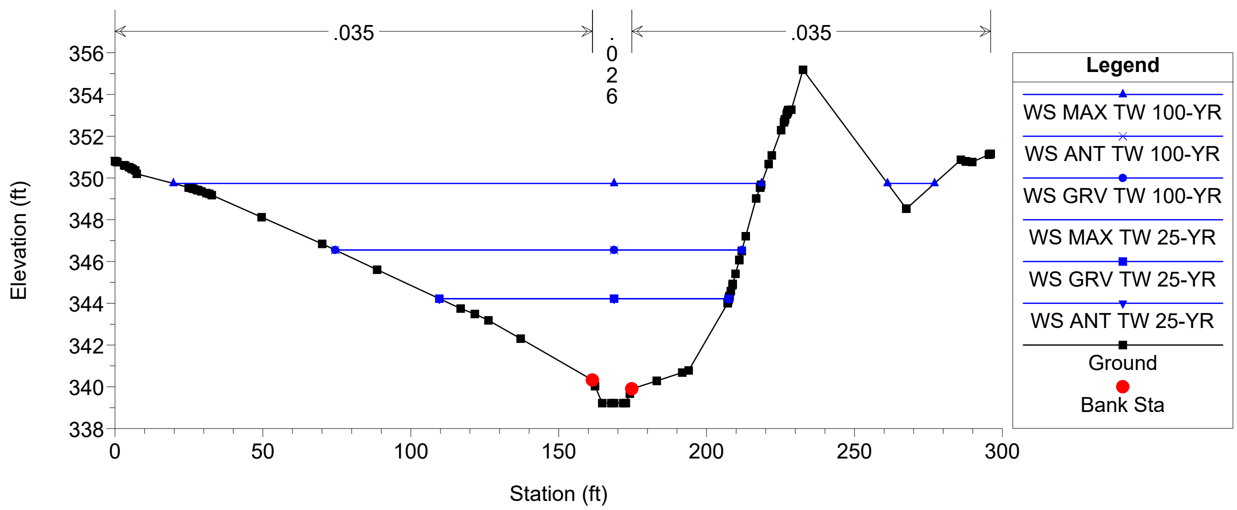
Elevation (ft)
Station (ft)
Legend
WS MAX TW 100-YR
WS ANT TW 100-YR
WS GRV TW 100-YR
WS MAX TW 25-YR
WS GRV TW 25-YR
WS ANT TW 25-YR
Ground
Bank Sta

HEC-RAS model from Autodesk® River and Flood Analysis Module 2018 Plan: Plan 02 5/17/2018



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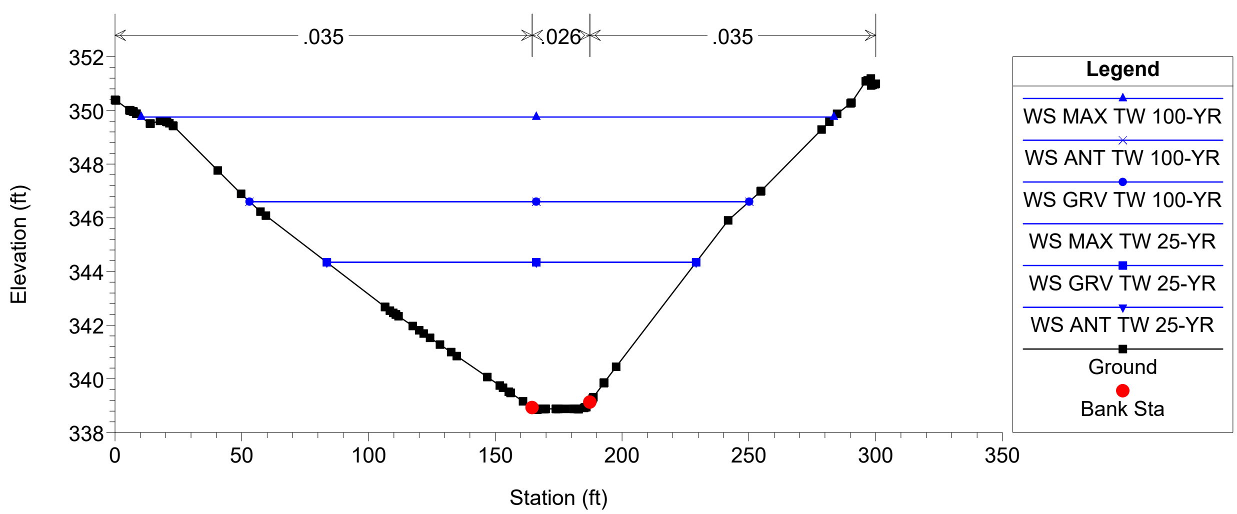

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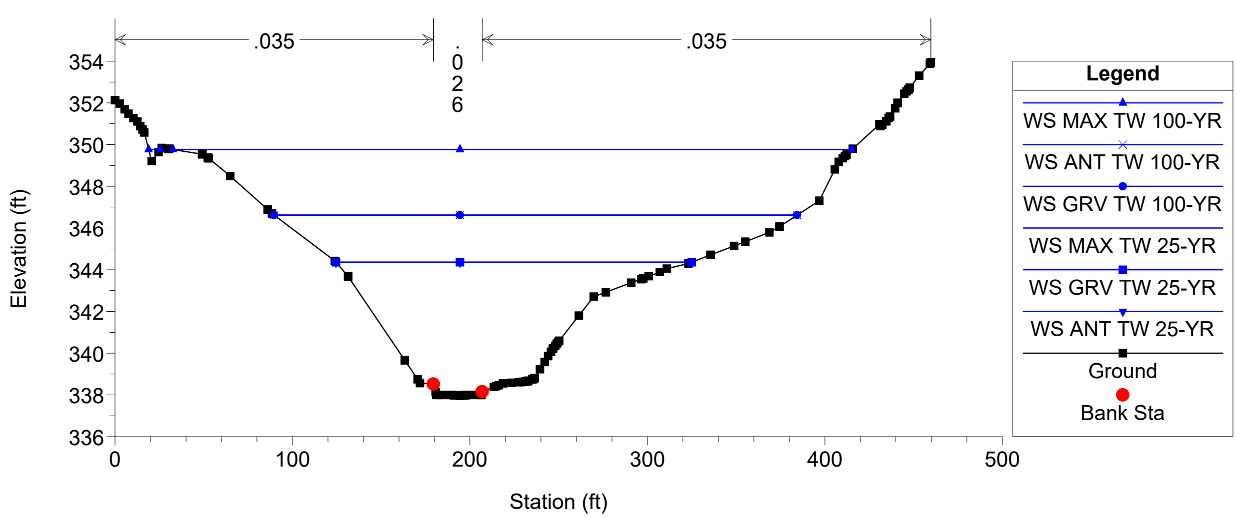
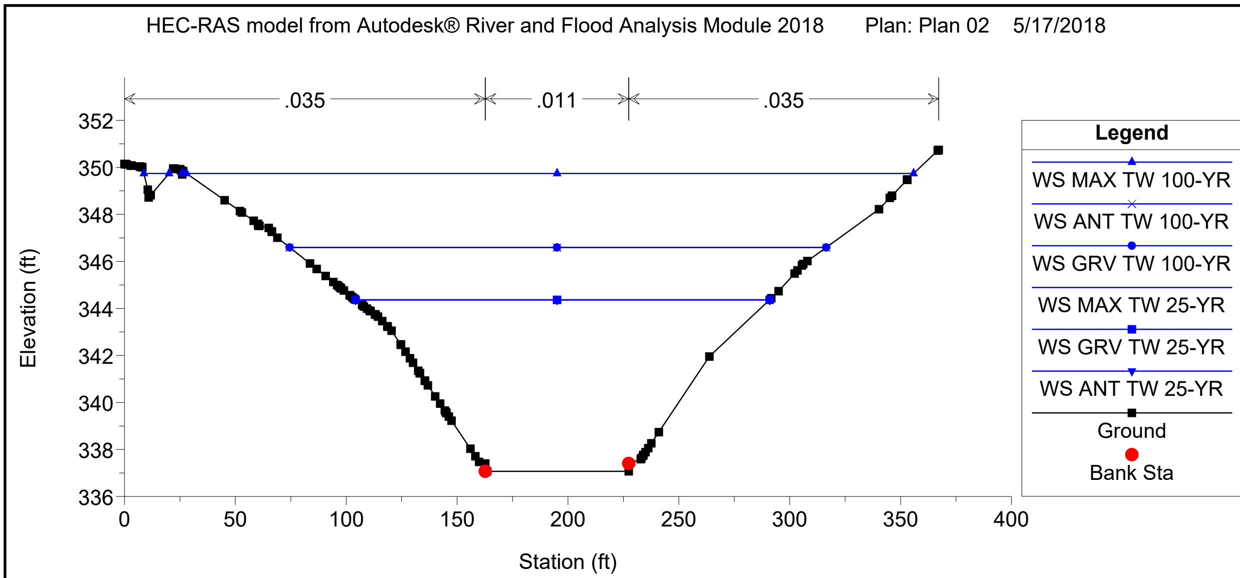
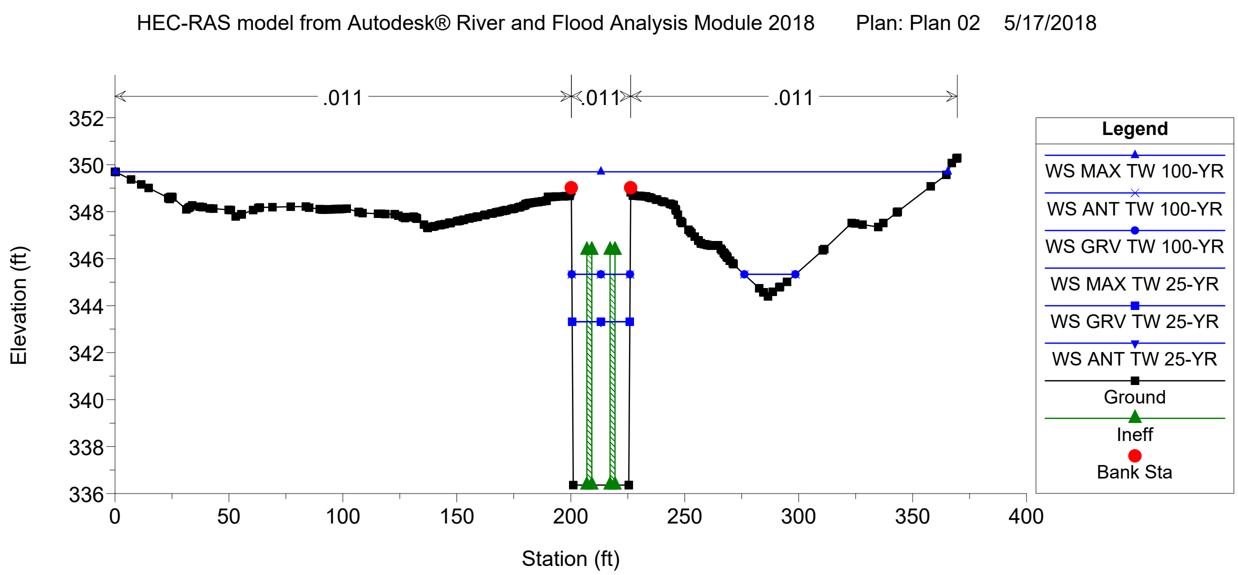
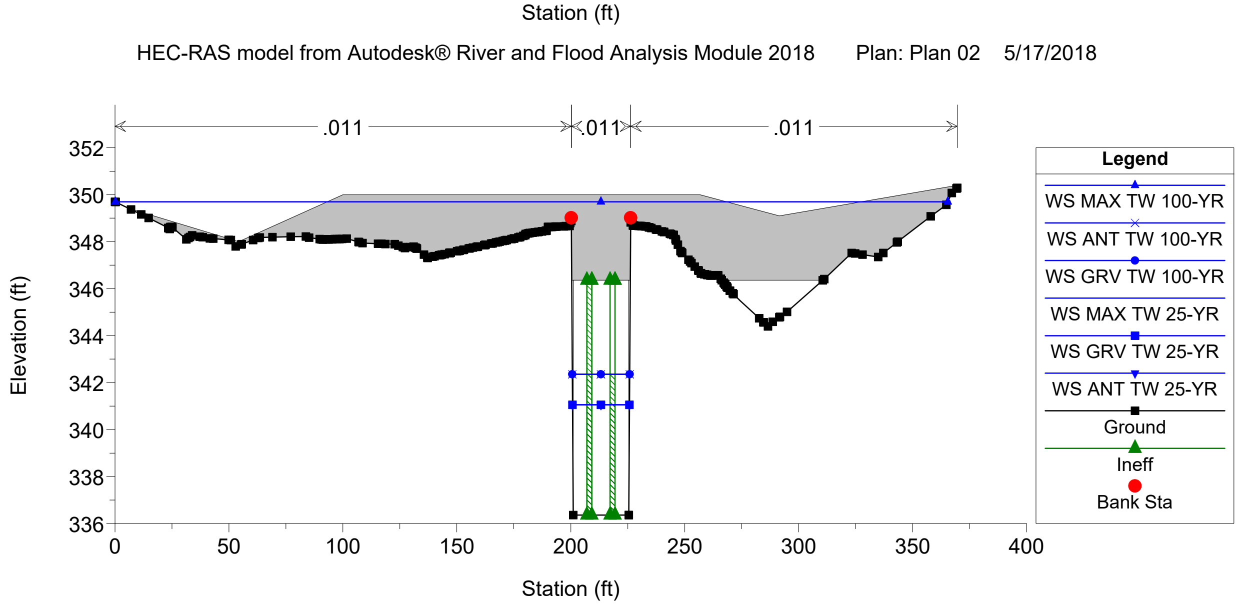
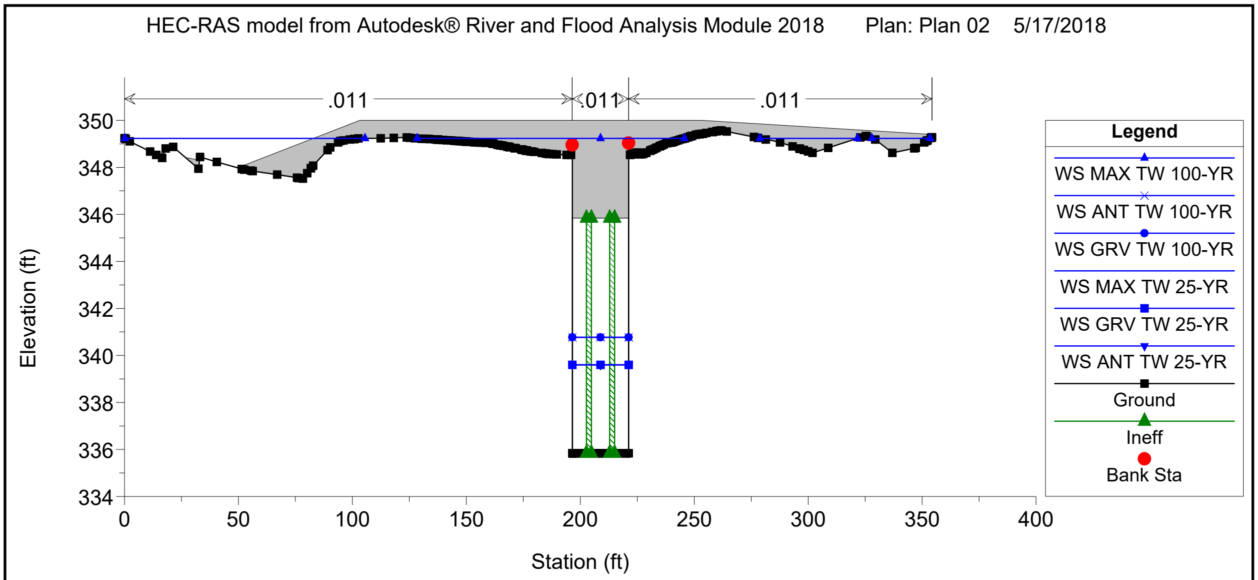
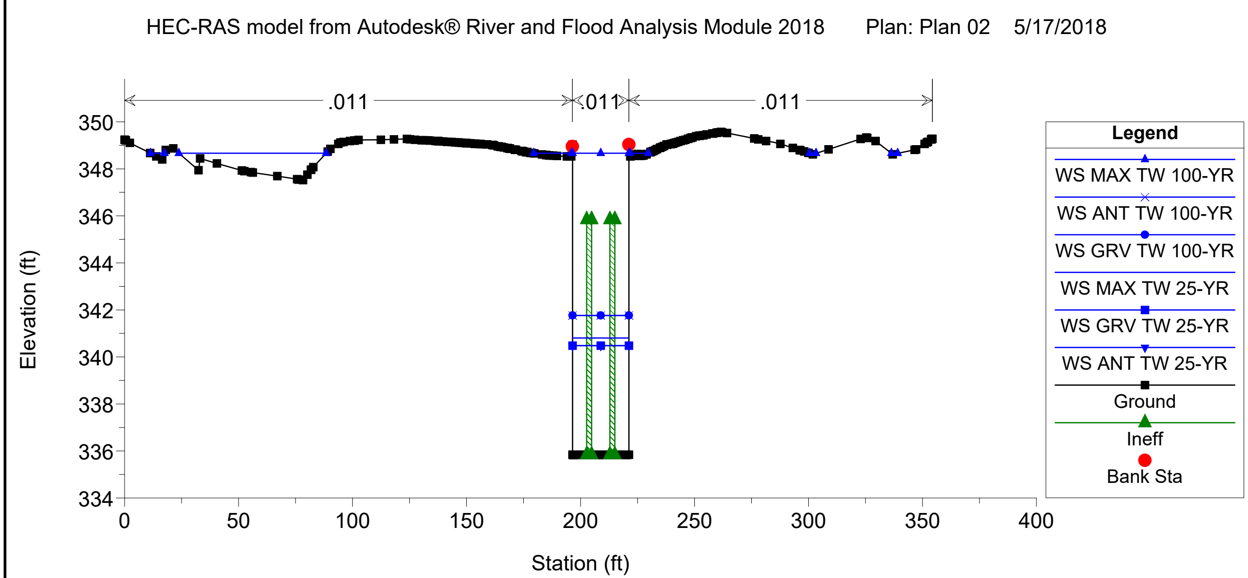


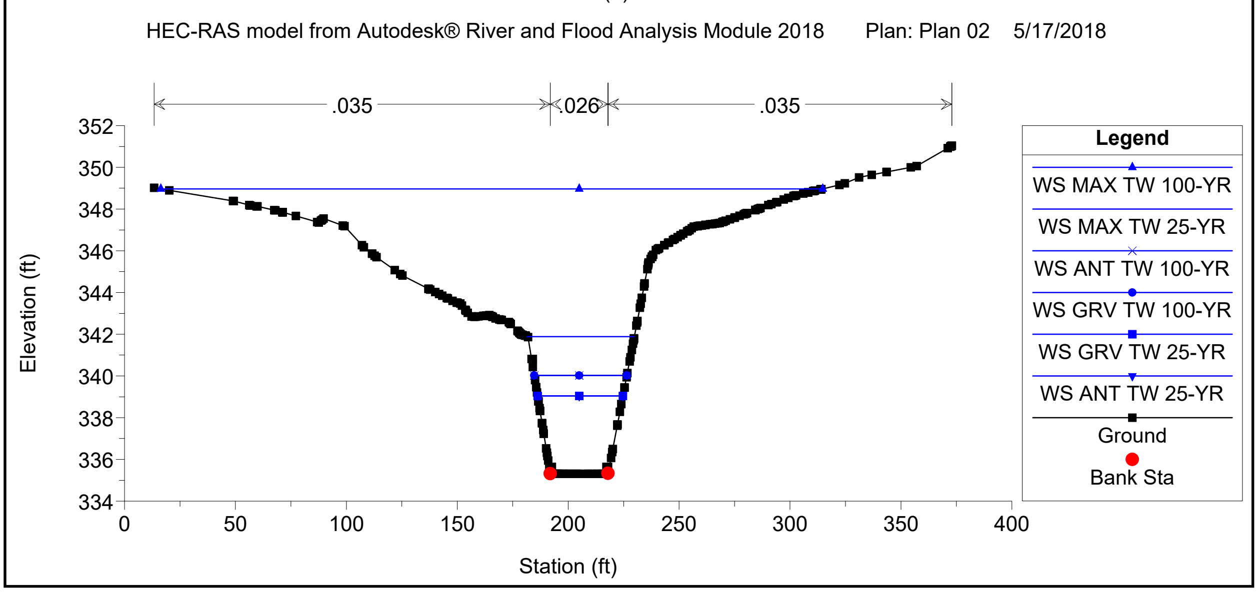

HEC-RAS model from Autodesk® River and Flood Analysis Module 2018 Plan: Plan 02 5/17/2018
.035
.011
.035
Elevation (ft)
Station (ft)
Legend
WS MAX TW 100-YR
WS ANT TW 100-YR
WS GRV TW 100-YR
WS MAX TW 25-YR
WS GRV TW 25-YR
WS ANT TW 25-YR
Ground
Bank Sta

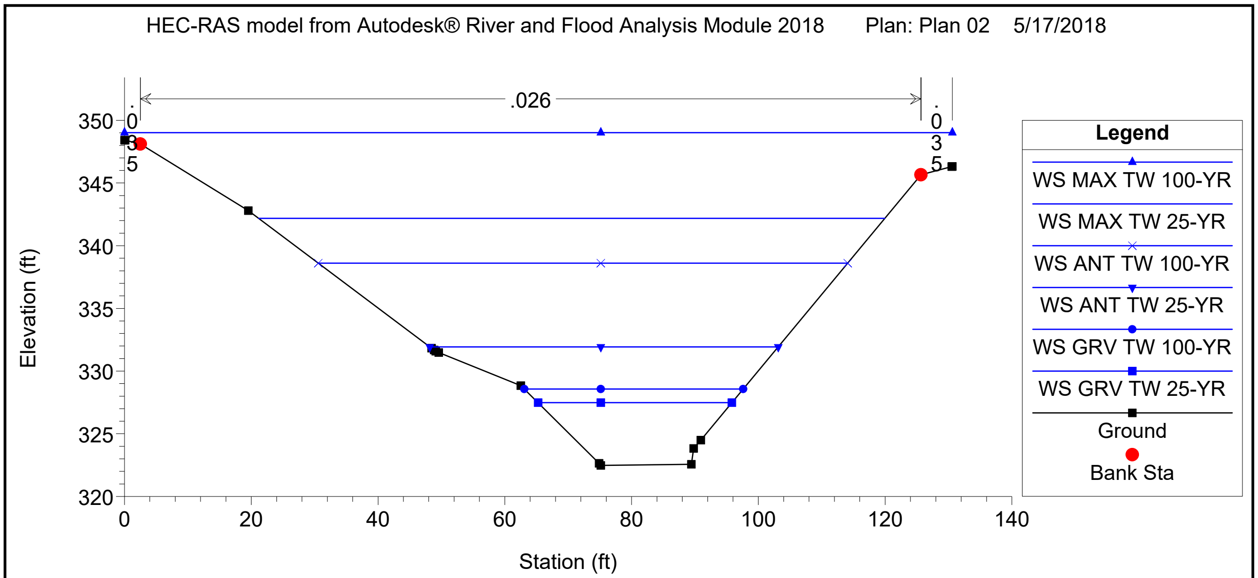

HEC-RAS model from Autodesk® River and Flood Analysis Module 2018 Plan: Plan 02 5/17/2018
.011
.011
.011
Elevation (ft)
Station (ft)
Legend
WS MAX TW 100-YR
WS ANT TW 100-YR
WS GRV TW 100-YR
WS MAX TW 25-YR
WS GRV TW 25-YR
WS ANT TW 25-YR
Ground
Ineff
Bank Sta

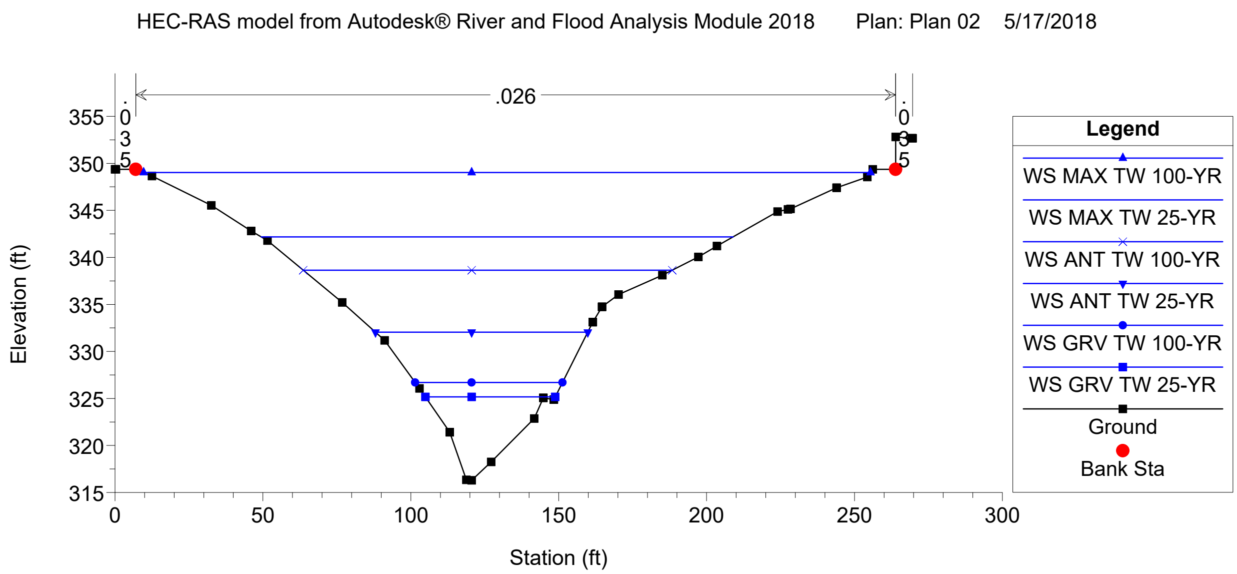

HEC-RAS model from Autodesk® River and Flood Analysis Module 2018 Plan: Plan 02 5/17/2018
.011
.011
.011
Elevation (ft)
Station (ft)
Legend
WS MAX TW 100-YR
WS ANT TW 100-YR
WS GRV TW 100-YR
WS MAX TW 25-YR
WS GRV TW 25-YR
WS ANT TW 25-YR
Ground
Ineff
Bank Sta

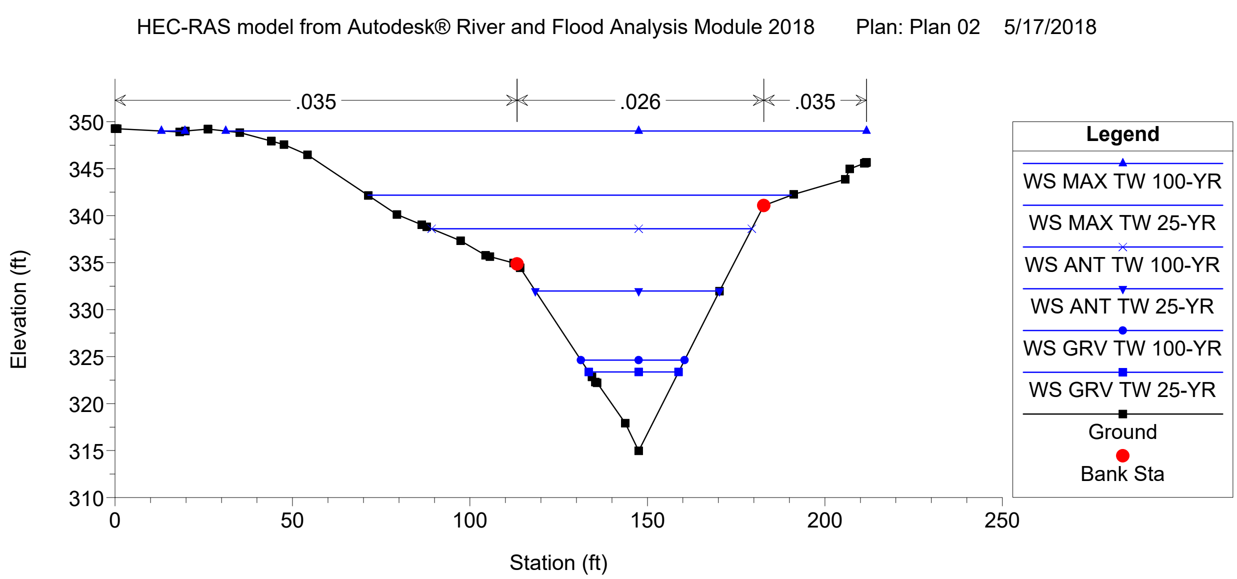

HEC-RAS model from Autodesk® River and Flood Analysis Module 2018 Plan: Plan 02 5/17/2018
.011
.011
.011
Elevation (ft)
Station (ft)
Legend
WS MAX TW 100-YR
WS ANT TW 100-YR
WS GRV TW 100-YR
WS MAX TW 25-YR
WS GRV TW 25-YR
WS ANT TW 25-YR
Ground
Ineff
Bank Sta

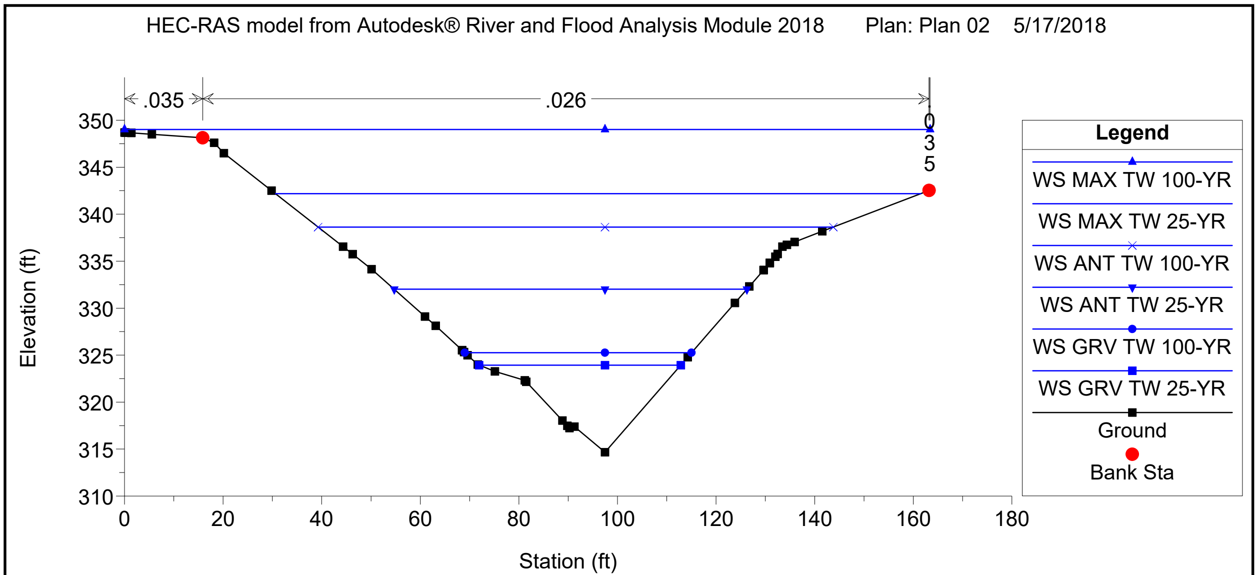

HEC-RAS model from Autodesk® River and Flood Analysis Module 2018 Plan: Plan 02 5/17/2018
.011
.011
.011
Elevation (ft)
Station (ft)
Legend
WS MAX TW 100-YR
WS ANT TW 100-YR
WS GRV TW 100-YR
WS MAX TW 25-YR
WS GRV TW 25-YR
WS ANT TW 25-YR
Ground
Ineff
Bank Sta

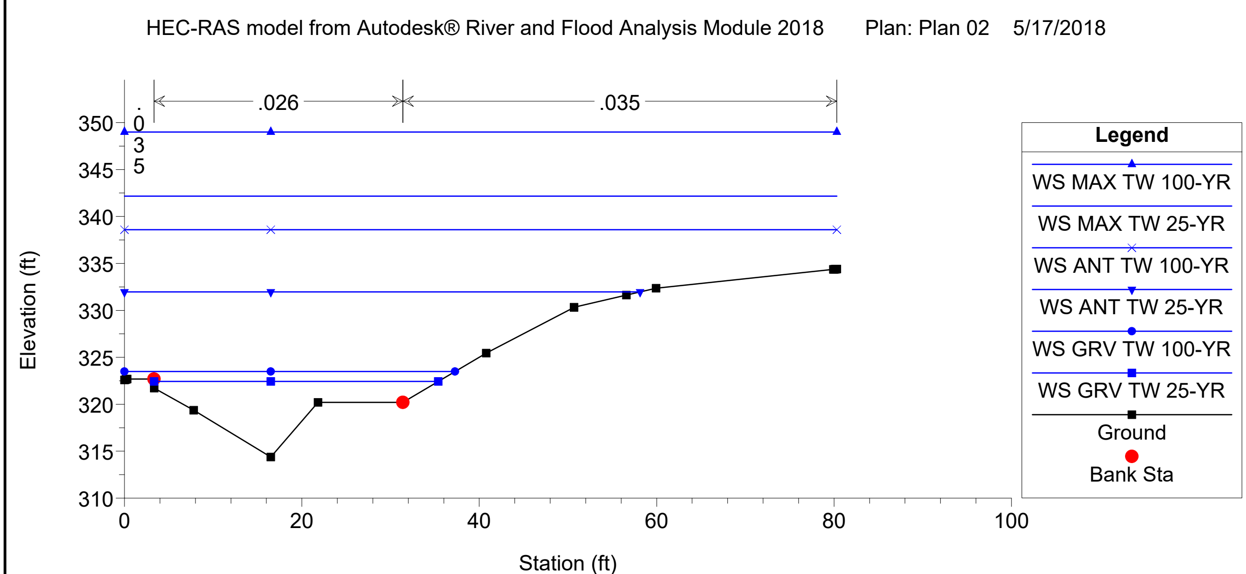

HEC-RAS model from Autodesk® River and Flood Analysis Module 2018 Plan: Plan 02 5/17/2018
.035
.026
.035
Elevation (ft)
Station (ft)
Legend
WS MAX TW 100-YR
WS MAX TW 25-YR
WS ANT TW 100-YR
WS GRV TW 100-YR
WS GRV TW 25-YR
WS ANT TW 25-YR
Ground
Bank Sta


HEC-RAS model from Autodesk® River and Flood Analysis Module 2018 Plan: Plan 02 5/17/2018
.026
.035
.035
Elevation (ft)
Station (ft)
350
345
340
335
330
325
320
0
20
40
60
80
100
120
140
Legend
WS MAX TW 100-YR
WS MAX TW 25-YR
WS ANT TW 100-YR
WS ANT TW 25-YR
WS GRV TW 100-YR
WS GRV TW 25-YR
Ground
Bank Sta


HEC-RAS model from Autodesk® River and Flood Analysis Module 2018 Plan: Plan 02 5/17/2018
.026
.035
.035
Elevation (ft)
Station (ft)
355
350
345
340
335
330
325
320
315
0
50
100
150
200
250
300
Legend
WS MAX TW 100-YR
WS MAX TW 25-YR
WS ANT TW 100-YR
WS ANT TW 25-YR
WS GRV TW 100-YR
WS GRV TW 25-YR
Ground
Bank Sta


HEC-RAS model from Autodesk® River and Flood Analysis Module 2018 Plan: Plan 02 5/17/2018
.035
.026
.035
Elevation (ft)
Station (ft)
350
345
340
335
330
325
320
315
310
0
50
100
150
200
250
Legend
WS MAX TW 100-YR
WS MAX TW 25-YR
WS ANT TW 100-YR
WS ANT TW 25-YR
WS GRV TW 100-YR
WS GRV TW 25-YR
Ground
Bank Sta


HEC-RAS model from Autodesk® River and Flood Analysis Module 2018 Plan: Plan 02 5/17/2018
.035
.026
0
3
5
Elevation (ft)
Station (ft)
350
345
340
335
330
325
320
315
310
0
20
40
60
80
100
120
140
160
180
Legend
WS MAX TW 100-YR
WS MAX TW 25-YR
WS ANT TW 100-YR
WS ANT TW 25-YR
WS GRV TW 100-YR
WS GRV TW 25-YR
Ground
Bank Sta


HEC-RAS model from Autodesk® River and Flood Analysis Module 2018 Plan: Plan 02 5/17/2018
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0
3
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Elevation (ft)
Station (ft)
350
345
340
335
330
325
320
315
310
0
20
40
60
80
100
Legend
WS MAX TW 100-YR
WS MAX TW 25-YR
WS ANT TW 100-YR
WS ANT TW 25-YR
WS GRV TW 100-YR
WS GRV TW 25-YR
Ground
Bank Sta

PROFILE TABLES

HEC-RAS Plan: Plan 02 River: Proposed Channel Reach: Proposed Channel

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Proposed Channel	39	MAX TW 25-YR	414.96	353.00	356.13		356.30	0.000887	3.31	125.39	40.06	0.33
Proposed Channel	39	MAX TW 100-YR	587.02	353.00	356.87		357.09	0.000917	3.79	154.79	40.08	0.34
Proposed Channel	39	ANT TW 25-YR	414.96	353.00	356.13		356.30	0.000887	3.31	125.39	40.06	0.33
Proposed Channel	39	ANT TW 100-YR	587.02	353.00	356.87		357.09	0.000918	3.79	154.77	40.08	0.34
Proposed Channel	39	GRV TW 25-YR	414.96	353.00	356.13		356.30	0.000887	3.31	125.39	40.06	0.33
Proposed Channel	39	GRV TW 100-YR	587.02	353.00	356.87		357.09	0.000918	3.79	154.77	40.08	0.34
Proposed Channel	38	MAX TW 25-YR	414.96	351.73	355.59		356.06	0.002979	5.49	75.63	31.17	0.62
Proposed Channel	38	MAX TW 100-YR	587.02	351.73	356.30		356.84	0.002875	5.92	99.12	35.41	0.62
Proposed Channel	38	ANT TW 25-YR	414.96	351.73	355.59		356.06	0.002979	5.49	75.63	31.17	0.62
Proposed Channel	38	ANT TW 100-YR	587.02	351.73	356.29		356.84	0.002878	5.92	99.08	35.40	0.62
Proposed Channel	38	GRV TW 25-YR	414.96	351.73	355.59		356.06	0.002979	5.49	75.63	31.17	0.62
Proposed Channel	38	GRV TW 100-YR	587.02	351.73	356.29		356.84	0.002878	5.92	99.08	35.40	0.62
Proposed Channel	37	MAX TW 25-YR	414.96	351.12	355.01		355.47	0.002875	5.42	76.62	31.35	0.61
Proposed Channel	37	MAX TW 100-YR	587.02	351.12	355.76		356.28	0.002685	5.77	101.65	35.82	0.60
Proposed Channel	37	ANT TW 25-YR	414.96	351.12	355.01		355.47	0.002875	5.42	76.62	31.35	0.61
Proposed Channel	37	ANT TW 100-YR	587.02	351.12	355.76		356.28	0.002690	5.78	101.59	35.81	0.60
Proposed Channel	37	GRV TW 25-YR	414.96	351.12	355.01		355.47	0.002875	5.42	76.62	31.35	0.61
Proposed Channel	37	GRV TW 100-YR	587.02	351.12	355.76		356.28	0.002690	5.78	101.59	35.81	0.60
Proposed Channel	36	MAX TW 25-YR	414.96	350.52	354.47		354.91	0.002687	5.28	78.60	31.76	0.59
Proposed Channel	36	MAX TW 100-YR	587.02	350.52	355.28		355.76	0.002385	5.52	106.32	36.67	0.57
Proposed Channel	36	ANT TW 25-YR	414.96	350.52	354.47		354.91	0.002687	5.28	78.60	31.76	0.59
Proposed Channel	36	ANT TW 100-YR	587.02	350.52	355.28		355.76	0.002392	5.53	106.20	36.65	0.57
Proposed Channel	36	GRV TW 25-YR	414.96	350.52	354.47		354.91	0.002687	5.28	78.60	31.76	0.59
Proposed Channel	36	GRV TW 100-YR	587.02	350.52	355.28		355.76	0.002392	5.53	106.20	36.65	0.57
Proposed Channel	35	MAX TW 25-YR	414.96	349.91	354.05		354.40	0.002142	4.74	87.49	35.19	0.53
Proposed Channel	35	MAX TW 100-YR	587.02	349.91	354.96		355.32	0.001759	4.81	122.11	41.47	0.49
Proposed Channel	35	ANT TW 25-YR	414.96	349.91	354.05		354.40	0.002142	4.74	87.49	35.19	0.53
Proposed Channel	35	ANT TW 100-YR	587.02	349.91	354.95		355.31	0.001766	4.82	121.90	41.44	0.49
Proposed Channel	35	GRV TW 25-YR	414.96	349.91	354.05		354.40	0.002142	4.74	87.49	35.19	0.53
Proposed Channel	35	GRV TW 100-YR	587.02	349.91	354.95		355.31	0.001766	4.82	121.90	41.44	0.49
Proposed Channel	34	MAX TW 25-YR	414.96	349.30	353.70		354.01	0.001689	4.45	93.33	34.40	0.48
Proposed Channel	34	MAX TW 100-YR	587.02	349.30	354.67		354.99	0.001403	4.54	129.40	40.20	0.45
Proposed Channel	34	ANT TW 25-YR	414.96	349.30	353.70		354.01	0.001689	4.45	93.33	34.40	0.48
Proposed Channel	34	ANT TW 100-YR	587.02	349.30	354.66		354.99	0.001411	4.55	129.14	40.16	0.45
Proposed Channel	34	GRV TW 25-YR	414.96	349.30	353.70		354.01	0.001689	4.45	93.33	34.40	0.48
Proposed Channel	34	GRV TW 100-YR	587.02	349.30	354.66		354.99	0.001411	4.55	129.14	40.16	0.45
Proposed Channel	33	MAX TW 25-YR	414.96	348.70	353.48		353.71	0.001177	3.89	106.73	36.69	0.40
Proposed Channel	33	MAX TW 100-YR	587.02	348.70	354.49		354.73	0.000998	4.00	146.91	42.75	0.38
Proposed Channel	33	ANT TW 25-YR	414.96	348.70	353.48		353.71	0.001177	3.89	106.73	36.69	0.40
Proposed Channel	33	ANT TW 100-YR	587.02	348.70	354.48		354.73	0.001005	4.00	146.57	42.71	0.38
Proposed Channel	33	GRV TW 25-YR	414.96	348.70	353.48		353.71	0.001177	3.89	106.73	36.69	0.40
Proposed Channel	33	GRV TW 100-YR	587.02	348.70	354.48		354.73	0.001005	4.00	146.57	42.71	0.38
Proposed Channel	32	MAX TW 25-YR	414.96	348.09	353.33		353.50	0.000782	3.34	124.27	39.44	0.33
Proposed Channel	32	MAX TW 100-YR	587.02	348.09	354.36		354.55	0.000694	3.49	168.28	45.65	0.32
Proposed Channel	32	ANT TW 25-YR	414.96	348.09	353.33		353.50	0.000782	3.34	124.27	39.44	0.33
Proposed Channel	32	ANT TW 100-YR	587.02	348.09	354.35		354.54	0.000698	3.50	167.88	45.60	0.32
Proposed Channel	32	GRV TW 25-YR	414.96	348.09	353.33		353.50	0.000782	3.34	124.27	39.44	0.33
Proposed Channel	32	GRV TW 100-YR	587.02	348.09	354.35		354.54	0.000698	3.50	167.88	45.60	0.32
Proposed Channel	31	MAX TW 25-YR	414.96	347.48	353.24		353.36	0.000513	2.85	145.40	42.52	0.27
Proposed Channel	31	MAX TW 100-YR	587.02	347.48	354.28		354.42	0.000480	3.04	193.07	48.79	0.27
Proposed Channel	31	ANT TW 25-YR	414.96	347.48	353.24		353.36	0.000513	2.85	145.40	42.52	0.27
Proposed Channel	31	ANT TW 100-YR	587.02	347.48	354.27		354.42	0.000483	3.05	192.62	48.73	0.27
Proposed Channel	31	GRV TW 25-YR	414.96	347.48	353.24		353.36	0.000513	2.85	145.40	42.52	0.27
Proposed Channel	31	GRV TW 100-YR	587.02	347.48	354.27		354.42	0.000483	3.05	192.62	48.73	0.27
Proposed Channel	30	MAX TW 25-YR	868.31	347.00	352.39		353.08	0.003008	6.66	130.46	40.41	0.65
Proposed Channel	30	MAX TW 100-YR	1234.19	347.00	353.34		354.14	0.002937	7.20	171.33	46.25	0.66
Proposed Channel	30	ANT TW 25-YR	868.31	347.00	352.39		353.08	0.003008	6.66	130.46	40.41	0.65
Proposed Channel	30	ANT TW 100-YR	1234.19	347.00	353.32		354.13	0.002981	7.24	170.38	46.13	0.66
Proposed Channel	30	GRV TW 25-YR	868.31	347.00	352.39		353.08	0.003008	6.66	130.46	40.41	0.65
Proposed Channel	30	GRV TW 100-YR	1234.19	347.00	353.32		354.13	0.002981	7.24	170.38	46.13	0.66
Proposed Channel	29	MAX TW 25-YR	868.31	346.35	351.75		352.43	0.002992	6.65	130.66	40.40	0.65
Proposed Channel	29	MAX TW 100-YR	1234.19	346.35	352.72		353.52	0.002850	7.14	172.93	46.26	0.65
Proposed Channel	29	ANT TW 25-YR	868.31	346.35	351.75		352.43	0.002992	6.65	130.66	40.40	0.65
Proposed Channel	29	ANT TW 100-YR	1234.19	346.35	352.68		353.49	0.002936	7.22	171.02	46.01	0.66
Proposed Channel	29	GRV TW 25-YR	868.31	346.35	351.75		352.43	0.002992	6.65	130.66	40.40	0.65
Proposed Channel	29	GRV TW 100-YR	1234.19	346.35	352.68		353.49	0.002936	7.22	171.02	46.01	0.66
Proposed Channel	28	MAX TW 25-YR	868.31	345.66	351.09		351.77	0.002917	6.58	131.89	40.57	0.64
Proposed Channel	28	MAX TW 100-YR	1234.19	345.66	352.13		352.88	0.002669	6.97	177.19	46.79	0.63
Proposed Channel	28	ANT TW 25-YR	868.31	345.66	351.09		351.77	0.002917	6.58	131.89	40.57	0.64
Proposed Channel	28	ANT TW 100-YR	1234.19	345.66	352.05		352.84	0.002822	7.11	173.53	46.32	0.65
Proposed Channel	28	GRV TW 25-YR	868.31	345.66	351.09		351.77	0.002917	6.58	131.89	40.57	0.64
Proposed Channel	28	GRV TW 100-YR	1234.19	345.66	352.05		352.84	0.002822	7.11	173.53	46.32	0.65

HEC-RAS Plan: Plan 02 River: Proposed Channel Reach: Proposed Channel (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Proposed Channel	27	MAX TW 25-YR	868.31	345.06	350.55		351.20	0.002774	6.46	134.39	40.96	0.63
Proposed Channel	27	MAX TW 100-YR	1234.19	345.06	351.67		352.37	0.002414	6.71	183.97	47.67	0.60
Proposed Channel	27	ANT TW 25-YR	868.31	345.06	350.55		351.20	0.002774	6.46	134.39	40.96	0.63
Proposed Channel	27	ANT TW 100-YR	1234.19	345.06	351.54		352.29	0.002640	6.94	177.92	46.90	0.63
Proposed Channel	27	GRV TW 25-YR	868.31	345.06	350.55		351.20	0.002774	6.46	134.39	40.96	0.63
Proposed Channel	27	GRV TW 100-YR	1234.19	345.06	351.54		352.29	0.002640	6.94	177.92	46.90	0.63
Proposed Channel	26	MAX TW 25-YR	868.31	344.45	350.05		350.66	0.002537	6.25	138.93	41.61	0.60
Proposed Channel	26	MAX TW 100-YR	1234.19	344.45	351.27		351.90	0.002087	6.35	194.24	48.95	0.56
Proposed Channel	26	ANT TW 25-YR	868.31	344.45	350.05		350.66	0.002537	6.25	138.93	41.61	0.60
Proposed Channel	26	ANT TW 100-YR	1234.19	344.45	351.08		351.77	0.002378	6.67	184.99	47.80	0.60
Proposed Channel	26	GRV TW 25-YR	868.31	344.45	350.05		350.66	0.002537	6.25	138.93	41.61	0.60
Proposed Channel	26	GRV TW 100-YR	1234.19	344.45	351.08		351.77	0.002378	6.67	184.99	47.80	0.60
Proposed Channel	25	MAX TW 25-YR	868.31	343.84	349.63		350.17	0.002192	5.92	146.72	42.72	0.56
Proposed Channel	25	MAX TW 100-YR	1234.19	343.84	350.96		351.50	0.001722	5.91	208.76	50.72	0.51
Proposed Channel	25	ANT TW 25-YR	868.31	343.84	349.63		350.17	0.002192	5.92	146.72	42.72	0.56
Proposed Channel	25	ANT TW 100-YR	1234.19	343.84	350.70		351.31	0.002043	6.30	195.81	49.14	0.56
Proposed Channel	25	GRV TW 25-YR	868.31	343.84	349.63		350.17	0.002192	5.92	146.72	42.72	0.56
Proposed Channel	25	GRV TW 100-YR	1234.19	343.84	350.70		351.31	0.002043	6.30	195.81	49.14	0.56
Proposed Channel	24	MAX TW 25-YR	868.31	343.33	349.34		349.82	0.001849	5.56	156.31	44.05	0.52
Proposed Channel	24	MAX TW 100-YR	1234.19	343.33	350.75		351.22	0.001418	5.50	224.34	52.49	0.47
Proposed Channel	24	ANT TW 25-YR	868.31	343.33	349.34		349.82	0.001849	5.56	156.31	44.05	0.52
Proposed Channel	24	ANT TW 100-YR	1234.19	343.33	350.43		350.98	0.001734	5.93	208.14	50.61	0.52
Proposed Channel	24	GRV TW 25-YR	868.31	343.33	349.34		349.82	0.001849	5.56	156.31	44.05	0.52
Proposed Channel	24	GRV TW 100-YR	1234.19	343.33	350.43		350.98	0.001734	5.93	208.14	50.61	0.52
Proposed Channel	23	MAX TW 25-YR	868.31	342.71	349.06		349.46	0.001428	5.04	172.12	46.15	0.46
Proposed Channel	23	MAX TW 100-YR	1234.19	342.71	350.55		350.94	0.001095	4.99	247.36	55.17	0.42
Proposed Channel	23	ANT TW 25-YR	868.31	342.71	349.06		349.46	0.001428	5.04	172.12	46.15	0.46
Proposed Channel	23	ANT TW 100-YR	1234.19	342.71	350.18		350.64	0.001370	5.43	227.30	52.86	0.46
Proposed Channel	23	GRV TW 25-YR	868.31	342.71	349.06		349.46	0.001428	5.04	172.12	46.15	0.46
Proposed Channel	23	GRV TW 100-YR	1234.19	342.71	350.18		350.64	0.001370	5.43	227.30	52.86	0.46
Proposed Channel	22	MAX TW 25-YR	1151.75	342.16	348.21		349.03	0.003155	7.26	158.64	44.70	0.68
Proposed Channel	22	MAX TW 100-YR	1662.89	342.16	350.09		350.68	0.001586	6.28	304.27	111.44	0.51
Proposed Channel	22	ANT TW 25-YR	1151.75	342.16	348.21		349.03	0.003155	7.26	158.64	44.70	0.68
Proposed Channel	22	ANT TW 100-YR	1662.89	342.16	349.23		350.21	0.003063	7.96	219.16	86.58	0.69
Proposed Channel	22	GRV TW 25-YR	1151.75	342.16	348.21		349.03	0.003155	7.26	158.64	44.70	0.68
Proposed Channel	22	GRV TW 100-YR	1662.89	342.16	349.23		350.21	0.003063	7.96	219.16	86.58	0.69
Proposed Channel	21	MAX TW 25-YR	1151.75	341.72	347.71		348.56	0.003293	7.40	155.58	43.93	0.69
Proposed Channel	21	MAX TW 100-YR	1662.89	341.72	349.86		350.45	0.001530	6.22	284.80	85.75	0.50
Proposed Channel	21	ANT TW 25-YR	1151.75	341.72	347.71		348.56	0.003293	7.40	155.58	43.93	0.69
Proposed Channel	21	ANT TW 100-YR	1662.89	341.72	348.63		349.72	0.003642	8.38	198.44	50.16	0.74
Proposed Channel	21	GRV TW 25-YR	1151.75	341.72	347.71		348.56	0.003293	7.40	155.58	43.93	0.69
Proposed Channel	21	GRV TW 100-YR	1662.89	341.72	348.63		349.72	0.003642	8.38	198.44	50.16	0.74
Proposed Channel	20	MAX TW 25-YR	1151.75	341.28	347.19		348.07	0.003524	7.50	153.53	44.83	0.71
Proposed Channel	20	MAX TW 100-YR	1662.89	341.28	349.71		350.23	0.001245	5.81	293.47	70.45	0.45
Proposed Channel	20	ANT TW 25-YR	1151.75	341.28	347.19		348.07	0.003524	7.50	153.53	44.83	0.71
Proposed Channel	20	ANT TW 100-YR	1662.89	341.28	347.91		349.13	0.004348	8.88	187.37	49.78	0.81
Proposed Channel	20	GRV TW 25-YR	1151.75	341.28	347.19		348.07	0.003524	7.50	153.53	44.83	0.71
Proposed Channel	20	GRV TW 100-YR	1662.89	341.28	347.91		349.13	0.004348	8.88	187.37	49.78	0.81
Proposed Channel	19	MAX TW 25-YR	1151.75	340.81	346.61	346.01	347.47	0.004248	7.44	154.91	54.86	0.77
Proposed Channel	19	MAX TW 100-YR	1662.89	340.81	349.70		350.03	0.000681	4.78	404.02	106.66	0.35
Proposed Channel	19	ANT TW 25-YR	1151.75	340.81	346.61	346.01	347.47	0.004248	7.44	154.91	54.86	0.77
Proposed Channel	19	ANT TW 100-YR	1662.89	340.81	347.22	346.84	348.43	0.004791	8.84	191.20	64.87	0.84
Proposed Channel	19	GRV TW 25-YR	1151.75	340.81	346.61	346.01	347.47	0.004248	7.44	154.91	54.86	0.77
Proposed Channel	19	GRV TW 100-YR	1662.89	340.81	347.22	346.84	348.43	0.004791	8.84	191.20	64.87	0.84
Proposed Channel	18	MAX TW 25-YR	1151.75	340.40	345.46	345.41	346.77	0.005489	9.46	137.52	59.03	0.90
Proposed Channel	18	MAX TW 100-YR	1662.89	340.40	349.71		349.93	0.000416	4.44	553.00	135.23	0.28
Proposed Channel	18	ANT TW 25-YR	1151.75	340.40	345.46	345.41	346.77	0.005489	9.46	137.52	59.03	0.90
Proposed Channel	18	ANT TW 100-YR	1662.89	340.40	346.47	346.34	347.81	0.004208	9.82	208.53	79.85	0.82
Proposed Channel	18	GRV TW 25-YR	1151.75	340.40	345.46	345.41	346.77	0.005489	9.46	137.52	59.03	0.90
Proposed Channel	18	GRV TW 100-YR	1662.89	340.40	346.47	346.34	347.81	0.004208	9.82	208.53	79.85	0.82
Proposed Channel	17	MAX TW 25-YR	1151.75	340.12	345.07	344.92	346.27	0.004626	9.55	154.74	64.45	0.84
Proposed Channel	17	MAX TW 100-YR	1662.89	340.12	349.71		349.88	0.000328	4.25	687.95	183.07	0.26
Proposed Channel	17	ANT TW 25-YR	1151.75	340.12	345.07	344.92	346.27	0.004626	9.55	154.74	64.45	0.84
Proposed Channel	17	ANT TW 100-YR	1662.89	340.12	346.36	345.82	347.39	0.003005	9.27	253.20	88.96	0.71
Proposed Channel	17	GRV TW 25-YR	1151.75	340.12	345.07	344.92	346.27	0.004626	9.55	154.74	64.45	0.84
Proposed Channel	17	GRV TW 100-YR	1662.89	340.12	346.36	345.82	347.39	0.003005	9.27	253.20	88.96	0.71
Proposed Channel	16	MAX TW 25-YR	1151.75	339.81	344.75	344.75	345.79	0.004228	9.18	181.19	94.68	0.80
Proposed Channel	16	MAX TW 100-YR	1662.89	339.81	349.75		349.83	0.000166	3.11	960.60	218.89	0.18
Proposed Channel	16	ANT TW 25-YR	1151.75	339.81	344.75	344.75	345.79	0.004228	9.18	181.19	94.68	0.80
Proposed Channel	16	ANT TW 100-YR	1662.89	339.81	346.54		347.02	0.001479	6.93	390.70	137.36	0.51
Proposed Channel	16	GRV TW 25-YR	1151.75	339.81	344.75	344.75	345.79	0.004228	9.18	181.19	94.68	0.80

HEC-RAS Plan: Plan 02   River: Proposed Channel   Reach: Proposed Channel (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Proposed Channel	16	GRV TW 100-YR	1662.89	339.81	346.54		347.02	0.001479	6.93	390.70	137.36	0.51
Proposed Channel	15	MAX TW 25-YR	1151.75	339.72	344.84		345.14	0.001109	4.55	281.34	103.19	0.42
Proposed Channel	15	MAX TW 100-YR	1662.89	339.72	349.76		349.82	0.000081	2.16	1101.46	229.87	0.13
Proposed Channel	15	ANT TW 25-YR	1151.75	339.72	344.84		345.14	0.001109	4.55	281.34	103.19	0.42
Proposed Channel	15	ANT TW 100-YR	1662.89	339.72	346.70		346.92	0.000496	3.99	519.87	151.59	0.30
Proposed Channel	15	GRV TW 25-YR	1151.75	339.72	344.84		345.14	0.001109	4.55	281.34	103.19	0.42
Proposed Channel	15	GRV TW 100-YR	1662.89	339.72	346.70		346.92	0.000496	3.99	519.87	151.59	0.30
Proposed Channel	14	MAX TW 25-YR	1151.75	339.63	344.35		345.05	0.002893	7.98	223.65	104.30	0.68
Proposed Channel	14	MAX TW 100-YR	1662.89	339.63	349.77		349.82	0.000106	2.63	1161.89	241.03	0.15
Proposed Channel	14	ANT TW 25-YR	1151.75	339.63	344.35		345.05	0.002893	7.98	223.65	104.30	0.68
Proposed Channel	14	ANT TW 100-YR	1662.89	339.63	346.64		346.89	0.000757	5.42	530.14	162.89	0.37
Proposed Channel	14	GRV TW 25-YR	1151.75	339.63	344.35		345.05	0.002893	7.98	223.65	104.30	0.68
Proposed Channel	14	GRV TW 100-YR	1662.89	339.63	346.64		346.89	0.000757	5.42	530.14	162.89	0.37
Proposed Channel	13	MAX TW 25-YR	1151.75	339.45	344.66		344.81	0.000732	4.35	423.78	140.72	0.35
Proposed Channel	13	MAX TW 100-YR	1662.89	339.45	349.78		349.80	0.000068	2.15	1486.98	302.60	0.12
Proposed Channel	13	ANT TW 25-YR	1151.75	339.45	344.66		344.81	0.000732	4.35	423.78	140.72	0.35
Proposed Channel	13	ANT TW 100-YR	1662.89	339.45	346.72		346.82	0.000325	3.67	754.41	181.74	0.25
Proposed Channel	13	GRV TW 25-YR	1151.75	339.45	344.66		344.81	0.000732	4.35	423.78	140.72	0.35
Proposed Channel	13	GRV TW 100-YR	1662.89	339.45	346.72		346.82	0.000325	3.67	754.41	181.74	0.25
Proposed Channel	12	MAX TW 25-YR	1151.75	339.22	344.22		344.69	0.002111	7.38	258.47	97.88	0.59
Proposed Channel	12	MAX TW 100-YR	1662.89	339.22	349.74		349.79	0.000117	2.89	1072.22	214.75	0.16
Proposed Channel	12	ANT TW 25-YR	1151.75	339.22	344.22		344.69	0.002111	7.38	258.47	97.88	0.59
Proposed Channel	12	ANT TW 100-YR	1662.89	339.22	346.55		346.77	0.000679	5.45	532.44	137.58	0.36
Proposed Channel	12	GRV TW 25-YR	1151.75	339.22	344.22		344.69	0.002111	7.38	258.47	97.88	0.59
Proposed Channel	12	GRV TW 100-YR	1662.89	339.22	346.55		346.77	0.000679	5.45	532.44	137.58	0.36
Proposed Channel	11	MAX TW 25-YR	1151.75	338.86	344.34		344.49	0.000545	4.13	456.95	145.68	0.31
Proposed Channel	11	MAX TW 100-YR	1662.89	338.86	349.75		349.78	0.000048	1.94	1572.27	273.25	0.10
Proposed Channel	11	ANT TW 25-YR	1151.75	338.86	344.34		344.49	0.000545	4.13	456.95	145.68	0.31
Proposed Channel	11	ANT TW 100-YR	1662.89	338.86	346.60		346.69	0.000235	3.42	843.09	197.11	0.22
Proposed Channel	11	GRV TW 25-YR	1151.75	338.86	344.34		344.49	0.000545	4.13	456.95	145.68	0.31
Proposed Channel	11	GRV TW 100-YR	1662.89	338.86	346.60		346.69	0.000235	3.42	843.09	197.11	0.22
Proposed Channel	10	MAX TW 25-YR	1151.75	337.97	344.36		344.43	0.000214	2.86	684.97	200.54	0.20
Proposed Channel	10	MAX TW 100-YR	1662.89	337.97	349.76		349.77	0.000021	1.36	2298.87	389.15	0.07
Proposed Channel	10	ANT TW 25-YR	1151.75	337.97	344.36		344.43	0.000214	2.86	684.97	200.54	0.20
Proposed Channel	10	ANT TW 100-YR	1662.89	337.97	346.62		346.66	0.000107	2.47	1250.07	294.65	0.15
Proposed Channel	10	GRV TW 25-YR	1151.75	337.97	344.36		344.43	0.000214	2.86	684.97	200.54	0.20
Proposed Channel	10	GRV TW 100-YR	1662.89	337.97	346.62		346.66	0.000107	2.47	1250.07	294.65	0.15
Proposed Channel	9	MAX TW 25-YR	1151.75	337.07	344.37		344.43	0.000017	2.11	875.62	186.70	0.14
Proposed Channel	9	MAX TW 100-YR	1662.89	337.07	349.74		349.77	0.000004	1.55	2256.71	339.58	0.08
Proposed Channel	9	ANT TW 25-YR	1151.75	337.07	344.37		344.43	0.000017	2.11	875.62	186.70	0.14
Proposed Channel	9	ANT TW 100-YR	1662.89	337.07	346.59		346.66	0.000013	2.22	1351.09	241.98	0.13
Proposed Channel	9	GRV TW 25-YR	1151.75	337.07	344.37		344.43	0.000017	2.11	875.62	186.70	0.14
Proposed Channel	9	GRV TW 100-YR	1662.89	337.07	346.59		346.66	0.000013	2.22	1351.09	241.98	0.13
Proposed Channel	8	MAX TW 25-YR	1151.75	336.36	343.31	341.02	344.33	0.000530	8.09	142.42	25.29	0.55
Proposed Channel	8	MAX TW 100-YR	1662.89	336.36	349.70	342.31	349.76	0.000032	2.60	990.46	365.32	0.13
Proposed Channel	8	ANT TW 25-YR	1151.75	336.36	343.31	341.02	344.33	0.000530	8.09	142.42	25.29	0.55
Proposed Channel	8	ANT TW 100-YR	1662.89	336.36	345.33	342.31	346.54	0.000525	8.89	195.47	47.96	0.53
Proposed Channel	8	GRV TW 25-YR	1151.75	336.36	343.31	341.02	344.33	0.000530	8.09	142.42	25.29	0.55
Proposed Channel	8	GRV TW 100-YR	1662.89	336.36	345.33	342.31	346.54	0.000525	8.89	195.47	47.96	0.53
Proposed Channel	7.5		Culvert									
Proposed Channel	7	MAX TW 25-YR	1151.75	335.84	340.81	340.46	342.83	0.001433	11.41	100.90	24.66	0.90
Proposed Channel	7	MAX TW 100-YR	1662.89	335.84	348.66		349.18	0.000198	5.86	318.95	125.55	0.31
Proposed Channel	7	ANT TW 25-YR	1151.75	335.84	340.48	340.48	342.80	0.001746	12.22	94.26	24.66	1.00
Proposed Channel	7	ANT TW 100-YR	1662.89	335.84	341.77	341.77	344.73	0.001798	13.81	120.42	24.66	1.00
Proposed Channel	7	GRV TW 25-YR	1151.75	335.84	340.48	340.48	342.80	0.001746	12.22	94.26	24.66	1.00
Proposed Channel	7	GRV TW 100-YR	1662.89	335.84	341.77	341.77	344.73	0.001798	13.81	120.42	24.66	1.00
Proposed Channel	6	MAX TW 25-YR	1151.75	335.31	341.88		342.33	0.000868	5.71	242.60	48.25	0.39
Proposed Channel	6	MAX TW 100-YR	1662.89	335.31	348.97		349.04	0.000079	2.81	1191.18	298.39	0.13
Proposed Channel	6	ANT TW 25-YR	1151.75	335.31	339.04	339.04	340.71	0.006578	10.76	120.02	38.49	0.98
Proposed Channel	6	ANT TW 100-YR	1662.89	335.31	340.02	340.02	342.05	0.005985	12.00	159.35	41.76	0.98
Proposed Channel	6	GRV TW 25-YR	1151.75	335.31	339.04	339.04	340.71	0.006578	10.76	120.02	38.49	0.98
Proposed Channel	6	GRV TW 100-YR	1662.89	335.31	340.02	340.02	342.05	0.005985	12.00	159.35	41.76	0.98
Proposed Channel	5	MAX TW 25-YR	1151.75	322.48	342.18		342.20	0.000016	1.06	1081.73	98.78	0.06
Proposed Channel	5	MAX TW 100-YR	1662.89	322.48	349.01		349.02	0.000007	0.89	1873.82	130.60	0.04
Proposed Channel	5	ANT TW 25-YR	1151.75	322.48	331.93		332.17	0.000566	3.92	293.88	54.97	0.30
Proposed Channel	5	ANT TW 100-YR	1662.89	322.48	338.61		338.69	0.000089	2.20	756.67	83.54	0.13
Proposed Channel	5	GRV TW 25-YR	1151.75	322.48	327.48	327.48	329.25	0.007396	10.67	107.94	30.58	1.00
Proposed Channel	5	GRV TW 100-YR	1662.89	322.48	328.57	328.57	330.66	0.007048	11.58	143.58	34.55	1.00
Proposed Channel	4	MAX TW 25-YR	1151.75	316.30	342.19		342.19	0.000006	0.67	1707.90	159.60	0.04
Proposed Channel	4	MAX TW 100-YR	1662.89	316.30	349.02		349.02	0.000003	0.54	3078.07	245.75	0.03

HEC-RAS Plan: Plan 02 River: Proposed Channel Reach: Proposed Channel (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Proposed Channel	4	ANT TW 25-YR	1151.75	316.30	332.04		332.10	0.000084	1.97	584.07	71.75	0.12
Proposed Channel	4	ANT TW 100-YR	1662.89	316.30	338.64		338.67	0.000031	1.38	1203.81	124.76	0.08
Proposed Channel	4	GRV TW 25-YR	1151.75	316.30	325.16		325.74	0.001821	6.06	189.93	43.89	0.51
Proposed Channel	4	GRV TW 100-YR	1662.89	316.30	326.70		327.32	0.001550	6.36	261.60	49.78	0.49
Proposed Channel	3	MAX TW 25-YR	1151.75	314.97	342.18		342.19	0.000010	1.01	1252.89	119.28	0.05
Proposed Channel	3	MAX TW 100-YR	1662.89	314.97	349.01		349.02	0.000005	0.91	2285.71	187.15	0.03
Proposed Channel	3	ANT TW 25-YR	1151.75	314.97	331.98		332.09	0.000162	2.66	433.60	51.87	0.16
Proposed Channel	3	ANT TW 100-YR	1662.89	314.97	338.61		338.66	0.000051	1.97	882.79	90.21	0.10
Proposed Channel	3	GRV TW 25-YR	1151.75	314.97	323.36	323.36	325.38	0.008034	11.39	101.11	25.31	1.00
Proposed Channel	3	GRV TW 100-YR	1662.89	314.97	324.62	324.62	326.97	0.007635	12.28	135.43	29.19	1.01
Proposed Channel	2	MAX TW 25-YR	1151.75	314.67	342.18		342.19	0.000006	0.72	1610.67	130.89	0.04
Proposed Channel	2	MAX TW 100-YR	1662.89	314.67	349.01		349.02	0.000003	0.65	2582.57	163.42	0.03
Proposed Channel	2	ANT TW 25-YR	1151.75	314.67	332.01		332.07	0.000067	1.84	626.83	71.54	0.11
Proposed Channel	2	ANT TW 100-YR	1662.89	314.67	338.62		338.65	0.000027	1.39	1192.05	104.50	0.07
Proposed Channel	2	GRV TW 25-YR	1151.75	314.67	323.94		324.63	0.002310	6.67	172.57	40.93	0.57
Proposed Channel	2	GRV TW 100-YR	1662.89	314.67	325.25		326.06	0.002170	7.24	229.78	45.99	0.57
Proposed Channel	1	MAX TW 25-YR	1151.75	314.38	342.17	322.44	342.19	0.000008	1.20	1326.58	80.31	0.04
Proposed Channel	1	MAX TW 100-YR	1662.89	314.38	349.00	323.48	349.02	0.000006	1.24	1875.09	80.31	0.04
Proposed Channel	1	ANT TW 25-YR	1151.75	314.38	331.96	322.44	332.06	0.000087	2.65	535.90	58.13	0.13
Proposed Channel	1	ANT TW 100-YR	1662.89	314.38	338.59	323.48	338.65	0.000034	2.19	1039.07	80.31	0.09
Proposed Channel	1	GRV TW 25-YR	1151.75	314.38	322.43	322.43	324.21	0.007630	10.78	109.83	32.04	0.98
Proposed Channel	1	GRV TW 100-YR	1662.89	314.38	323.48	323.48	325.65	0.006817	11.95	147.31	37.27	0.96

OUTPUT REPORT

```
                        HEC-RAS HEC-RAS 5.0.3 September 2016
                          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
```

PROJECT DATA
Project Title: HEC-RAS model from Autodesk® River and Flood Analysis Module 2018
Project File : 4697 - FLOOD MAP2.prj
Run Date and Time: 5/17/2018 8:58:10 AM

Project in English units

PLAN DATA

Plan Title: Plan 02
Plan File : j:\AutoCad 2004 Land Projects\4697\dwg\Channel\4697 - FLOOD MAP2.p02

```
           Geometry Title: Base Conditions Geometry
           Geometry File : j:\AutoCad 2004 Land Projects\4697\dwg\Channel\4697 - FLOOD
MAP2.G01

           Flow Title    : 6 Flow Profiles
           Flow File     : j:\AutoCad 2004 Land Projects\4697\dwg\Channel\4697 - FLOOD
MAP2.f02
```

```
Plan Summary Information:
Number of:  Cross Sections =   39    Multiple Openings  =    0
            Culverts       =    1    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: 6 Flow Profiles
Flow File : j:\AutoCad 2004 Land Projects\4697\dwg\Channel\4697 - FLOOD MAP2.f02

Flow Data (cfs)

River	Reach	RS	MAX TW 25-YR	MAX TW 100-YR	ANT TW 25-YR	ANT TW 100-YR	GRV TW 25-YR	GRV TW 100-YR
Proposed Channel	Proposed Channel	39	414.96	587.02	414.96	587.02	414.96	587.02
Proposed Channel	Proposed Channel	30	868.31	1234.19	868.31	1234.19	868.31	1234.19
Proposed Channel	Proposed Channel	22	1151.75	1662.89	1151.75	1662.89	1151.75	1662.89

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Proposed Channel	Proposed Channel	MAX TW 25-YR		Known WS = 342.17
Proposed Channel	Proposed Channel	MAX TW 100-YR		Known WS = 349
Proposed Channel	Proposed Channel	ANT TW 25-YR		Known WS = 331.96
Proposed Channel	Proposed Channel	ANT TW 100-YR		Known WS = 338.59
Proposed Channel	Proposed Channel	GRV TW 25-YR		Known WS = 0
Proposed Channel	Proposed Channel	GRV TW 100-YR		Known WS = 0

GEOMETRY DATA

Geometry Title: Base Conditions Geometry
Geometry File : j:\AutoCad 2004 Land Projects\4697\dwg\Channel\4697 - FLOOD MAP2.G01

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel   RS: 39

INPUT
Description:
Station Elevation Data   num=   73

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	360.2	.1	360.2	.2	360.2	.3	360.2	21.3	360
23.65	360	26.16	359.17	26.4	359.08	26.49	359.04	26.53	359.03
26.55	359.02	26.57	359.01	27.28	358.75	27.57	358.64	30.59	357.08
30.72	357.03	30.76	357	30.77	356.01	30.77	356	30.78	355.01
30.78	355	30.79	354	30.8	353	34.27	353	37.74	353
41.21	353	44.68	353	46.9	353	50.91	353	51.27	353
54.91	353	57.14	353	57.15	353	60.56	353	63.97	353
67.38	353	67.39	353	70.8	353	70.81	354	70.82	355
70.82	355.01	70.83	356	70.83	356.01	70.84	357	70.85	357.01
70.87	357.02	72.31	357.61	75.67	358.99	75.69	359	75.82	359.05
76.04	359.14	76.48	359.32	77.85	359.89	78.19	360	79.42	360.05
88.59	360.43	94.76	360.69	99.18	360.88	101.08	360.85	102.51	360.85
102.91	360.85	104.76	360.88	106.95	360.91	108.58	360.93	116.34	361.05
117.64	361.09	121.31	361.19	121.66	361.2	125.64	361.3	128.31	361.38
128.41	361.38	128.51	361.38	128.61	361.39				

Manning's n Values   num=   3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	23.65	.026	78.19	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
23.65	78.19	145.12	144.81	144.93	.1	.3

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel   RS: 38

INPUT
Description:
Station Elevation Data   num=   43

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	360.29	.1	360.29	.2	360.29	.4	360.29	3.17	360.31
3.83	360.31	3.86	360.31	3.89	360.31	5.93	360.32	6.17	360.32
6.3	360.32	6.43	360.33	7.5	360.33	20.4	360.33	21.74	360.42
21.77	360.41	24.96	359.34	26.23	358.92	34.09	356.3	37.75	355.08
43.38	353.2	47.8	351.73	48.47	351.73	49.93	351.73	50.75	351.73
51.8	351.73	52.46	351.73	53.29	351.73	54.75	351.73	55.8	351.73
58.75	352.71	76.25	358.54	78.87	359.42	82.91	360.76	82.92	360.77
84.83	360.78	86.05	360.79	100.41	360.87	103.23	360.91	115.86	361
120.61	361.06	120.71	361.06	120.81	361.06				

Manning's n Values   num=   3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	20.4	.026	100.41	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
20.4	100.41	200	200	200	.1	.3

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel   RS: 37

INPUT
Description:
Station Elevation Data   num=   36

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	359.85	.1	359.85	.2	359.85	.4	359.85	4.67	359.87
6.32	359.88	20.4	359.89	22.77	359.97	23.4	359.97	24.52	359.98
24.82	359.98	24.85	359.98	46.95	352.61	51.41	351.12	51.42	351.12
51.48	351.12	51.71	351.12	52.08	351.12	52.96	351.12	55.42	351.12
55.48	351.12	56.07	351.12	59.41	351.12	59.42	351.12	59.48	351.14
63.86	352.6	64.88	352.94	87.4	360.45	87.43	360.45	100.41	360.53
104.24	360.59	106.88	360.61	106.91	360.61	120.41	360.72	120.71	360.72
120.81	360.72								

Manning's n Values   num=   3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	20.4	.026	100.41	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
20.4	100.41	200	200	200	.1	.3

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel   RS: 36

INPUT
Description:
Station Elevation Data   num=   35

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	359.76	.1	359.76	.3	359.76	.4	359.76	15.85	359.88
18.89	359.91	19.05	359.91	19.26	359.91	19.57	359.91	20.4	359.91
20.46	359.92	21.02	359.92	22.36	359.93	22.52	359.93	23.08	359.94
23.37	359.94	23.38	359.94	23.92	359.94	47.61	352.05	52.21	350.52
52.86	350.52	54.98	350.52	56.2	350.52	56.21	350.52	56.86	350.52
56.98	350.52	59.06	350.52	60.21	350.52	65.11	352.15	73.31	354.88
91.17	360.6	100.41	360.7	120.51	360.91	120.61	360.91	120.71	360.91

Manning's n Values   num=   3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	20.4	.026	91.17	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
20.4	91.17	200	200	200	.1	.3

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel   RS: 35

INPUT
Description:
Station Elevation Data   num=   26

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	359.5	.1	359.51	.2	359.51	.4	359.51	12.79	359.61
20.4	359.67	22.65	359.69	23.42	359.7	23.56	359.7	44.56	352.7
48.13	351.51	52.93	349.91	53.59	349.91	55.21	349.91	56.36	349.91
56.93	349.91	57.59	349.91	58.89	349.91	59.45	349.91	60.93	349.91
66.06	351.62	100.75	360.39	120.88	360.71	120.98	360.71	121.08	360.72
121.18	360.72								

Manning's n Values   num=   3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	20.4	.026	100.75	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
20.4	100.75	200	200	200	.1	.3

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel   RS: 34

INPUT
Description:
Station Elevation Data   num=   33

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	359	.1	359	.2	359	.3	359	.4	359
5.22	359	6.61	359	7.85	359	8.55	359	15.3	359
15.53	359	15.84	359	22.65	359.07	24.2	359.15	24.39	359.16
29.25	357.54	43.12	352.92	53.96	349.3	54.48	349.3	54.61	349.3
57.96	349.3	58.61	349.3	58.72	349.3	61.96	349.3	67.34	351.1
71.37	352.44	95.13	360.36	95.88	360.37	127.25	360.94	127.68	360.94
130.91	361	130.98	361	131.08	361.01				

Manning's n Values   num=   3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	22.65	.026	95.88	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
22.65	95.88	200	200	200	.1	.3

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel   RS: 33

INPUT

Description:
Station Elevation Data   num=   40

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	359	.1	359	.2	359	.3	359	.4	359
15.09	359	15.14	359	17.62	359	18.49	359	19.02	359
22	359	22.2	359	23	359	23.33	359	23.51	359
23.57	359	48.82	350.58	49.44	350.38	51.86	349.57	52.78	349.26
53.23	349.11	53.5	349.03	54.48	348.7	54.62	348.7	55.14	348.7
55.22	348.7	58.48	348.7	59.14	348.7	60.18	348.7	61.77	348.7
62.48	348.7	68.16	350.59	71.68	351.76	75.1	352.9	97.39	360.33
97.65	360.34	105.37	360.48	109.53	360.56	130.71	360.96	130.81	360.97

Manning's n Values   num=   3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	23	.026	97.65	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
23	97.65	200	200	200	.1	.3

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel   RS: 32

INPUT
Description:
Station Elevation Data   num=   30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	358.96	.1	358.96	.2	358.96	.3	358.96	6.49	358.98
7.19	358.98	13.66	359	15.8	359	17.5	359	17.87	359.01
20.4	359.02	21.67	359.06	21.89	359.06	22.18	359.06	55.11	348.09
55.77	348.09	58.54	348.09	58.7	348.09	59.11	348.09	59.77	348.09
63.11	348.09	93.63	358.26	99.63	360.26	110.84	360.42	128.52	360.77
130.84	360.82	130.94	360.82	131.04	360.82	131.14	360.82	131.24	360.82

Manning's n Values   num=   3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	20.4	.026	110.84	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
20.4	110.84	210.32	198.97	186.62	.1	.3

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel   RS: 31

INPUT
Description:
Station Elevation Data   num=   46

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	358.95	.1	358.95	.2	358.95	.3	358.95	.4	358.95

4.36	358.97	4.48	358.97	7.74	358.97	20.33	358.99	20.79	358.99
21.12	358.99	21.22	358.99	22.92	358.99	25.61	359	26.39	359
26.46	359	26.69	359	26.73	359	26.84	359	26.95	359.01
27.48	359.01	27.69	359.02	46.76	359.27	49.06	359.3	56.97	359.33
57.72	359.44	58.1	359.45	78.33	352.71	94	347.48	95.57	347.48
98	347.48	100.99	347.48	101.35	347.48	102	347.48	108.54	349.66
124.29	354.91	142.83	360.91	144.86	360.96	145.71	360.98	146.69	361
147.24	361.02	147.34	361.02	167.28	361.73	167.38	361.74	167.48	361.74
167.58	361.74								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	56.97	.026	142.83	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
56.97	142.83	148.65	159.48	174.49	.1	.3

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel RS: 30

INPUT
Description: Phase 2 construction, point of affluence #2
Station Elevation Data num= 74

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	359.52	.1	359.52	.2	359.52	.3	359.52	17.44	359.66
17.91	359.63	20.1	359.78	20.4	359.8	22.64	359.95	24.13	360.03
24.19	360.04	24.24	360.04	24.3	360.04	28.37	360.11	53.93	352.11
60.86	349.8	65.86	348.13	69.22	347.01	69.26	347	69.32	347
70.07	347	71.75	347	73.22	347	73.26	347	74.06	347
75.86	347	77.22	347	77.26	347	77.31	347.01	85.3	349.68
86.32	350.02	109.71	357.82	109.79	357.84	111.52	358.42	111.88	358.54
129.1	364.28	131.27	365	132.33	365.06	136.22	365.25	136.8	365.28
137.35	365.31	138.57	365.37	139.32	365.41	140.74	365.48	142.29	365.56
144.94	365.73	145.81	365.78	147.45	365.9	148.75	365.99	148.88	366
149.75	366.02	149.79	366.02	149.91	366.03	150.47	366.03	151.44	366.03
152.13	366.04	152.67	366.05	153.43	366.05	154.17	366.04	154.23	366.04
158.6	366.08	159.36	366.08	160.86	366.08	164.92	366.06	167.31	366.05
169.22	366.04	170.53	366.04	172.84	366.03	174.93	366.02	175.29	366.02
175.39	366.02	175.49	366.02	175.59	366.02	175.69	366.02		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	28.37	.026	136.22	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
28.37	136.22	203.91	215.5	230.32	.1	.3

CROSS SECTION

RIVER: Proposed Channel

REACH: Proposed Channel   RS: 29

INPUT
Description:
Station Elevation Data   num=   67

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	358	.1	358	.2	358	.3	358	.4	358
.56	358	3.67	358	8.54	358	8.68	358	9.26	358
10.24	358	10.37	358	11.32	358	11.92	358.01	12.16	358.01
12.28	358.01	12.95	358.01	20.4	358.17	20.46	358.17	21.82	358.2
22.23	358.21	23.18	358.22	23.32	358.23	23.38	358.23	30.7	358.26
30.91	358.29	31.35	358.29	37.8	356.14	49.59	352.22	61.32	348.31
67.2	346.35	68.62	346.35	71.2	346.35	74.55	346.35	75.2	346.35
89.98	351.27	91.71	351.85	93.82	352.55	96.8	353.55	100.8	354.88
105.67	356.5	108.41	357.41	112.7	358.85	115.62	359.59	126.59	359.68
126.78	359.68	128.37	359.69	129.26	359.78	129.42	359.71	129.96	359.72
130.15	359.72	130.4	359.73	131.14	359.75	134.32	359.82	142.43	360
142.72	360	142.74	360	142.9	360	143.04	360	143.12	360
143.24	360	144.27	360.01	145.4	360.03	145.5	360.03	145.6	360.04
145.7	360.04	145.8	360.04						

Manning's n Values   num=   3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	30.7	.026	115.62	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
30.7	115.62	224.36	224.72	224.36	.1	.3

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel   RS: 28

INPUT
Description:
Station Elevation Data   num=   31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	357.61	.1	357.61	.2	357.61	.3	357.61	.4	357.61
21.35	357.58	30.24	357.64	30.43	357.65	30.93	357.66	51.18	350.91
61.06	347.62	61.64	347.42	66.92	345.66	67.6	345.66	70.26	345.66
70.92	345.66	71.73	345.66	74.26	345.66	74.92	345.66	81.2	347.76
105.86	355.98	114.06	358.46	116	358.5	117.78	358.53	122.09	358.59
126.95	358.67	145.7	359.08	145.8	359.09	145.9	359.09	146	359.09
146.1	359.09								

Manning's n Values   num=   3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	30.24	.026	114.06	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
30.24	114.06	199.82	197.88	198.18	.1	.3

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel   RS: 27

INPUT
Description:
Station Elevation Data   num=   40

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	357.01	.1	357.02	.2	357.02	.3	357.02	.4	357.02
13.37	357.27	13.75	357.27	20.4	357.38	22.34	357.41	23.52	357.42
23.73	357.42	28.41	357.43	28.63	357.42	29.18	357.42	60.22	347.08
66.29	345.06	67.79	345.06	68.8	345.06	69.63	345.06	70.29	345.06
72.21	345.06	73.05	345.06	73.63	345.06	74.29	345.06	80.52	347.13
101.84	354.24	113.22	357.76	117.59	357.81	119.79	357.82	123.61	357.84
123.8	357.84	124.12	357.85	126.38	357.86	126.6	357.87	129.66	357.9
131.27	357.9	137.91	357.93	145.51	357.97	145.6	357.97	145.7	357.97

Manning's n Values   num=   3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	28.41	.026	113.22	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
28.41	113.22	200.46	198.55	198.87	.1	.3

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel   RS: 26

INPUT
Description:
Station Elevation Data   num=   39

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	356.21	.1	356.22	.2	356.22	.3	356.22	.4	356.22
20.23	356.64	20.4	356.64	20.47	356.64	20.49	356.64	20.5	356.64
20.78	356.65	20.79	356.65	28.25	356.65	29.03	356.72	35.09	354.71
39.11	353.36	65.85	344.45	67.55	344.45	68.87	344.45	69.2	344.45
69.85	344.45	70.87	344.45	73.2	344.45	73.85	344.45	106.38	355.29
109.78	356.42	113.61	357.42	124.06	357.51	125.4	357.52	125.63	357.52
127.41	357.53	127.48	357.53	128.22	357.54	128.26	357.54	131.46	357.57
137.49	357.62	137.59	357.62	137.69	357.62	137.79	357.63		

Manning's n Values   num=   3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	28.25	.026	113.61	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
28.25	113.61	199.32	197.75	200.13	.1	.3

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel   RS: 25

INPUT
Description:
Station Elevation Data   num=   49

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	356.07	.1	356.07	.2	356.07	.3	356.07	.4	356.07
6.44	356.11	7.65	356.26	12.2	356.02	14.62	355.88	17.37	356.09
19.26	356.23	19.33	356.22	19.49	356.22	19.83	356.23	19.89	356.23
19.92	356.23	29.96	356.27	30.45	356.34	30.98	356.34	39.1	353.63
50.73	349.76	62.43	345.86	68.48	343.84	68.5	343.84	70.89	343.84
71.82	343.84	72.48	343.84	75.82	343.84	76.22	343.84	76.47	343.84
76.48	343.84	76.48	343.85	78.89	344.65	80.48	345.18	82.89	345.98
97.36	350.8	117.25	357.15	117.99	357.16	131.73	357.18	132.95	357.18
134.55	357.18	136.65	357.19	136.89	357.24	148.33	357.35	154.58	357.4
154.68	357.4	154.78	357.4	154.88	357.4	154.98	357.4		

Manning's n Values   num=   3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	29.96	.026	117.25	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
29.96	117.25	168.67	167.76	167.64	.1	.3

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel   RS: 24

INPUT
Description:
Station Elevation Data   num=   50

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	355.69	.1	355.68	.2	355.68	.3	355.67	.4	355.66
17.62	354.35	20.44	354.26	21.92	354.2	29.81	353.6	32.27	353.48
32.5	353.47	32.58	353.47	34.24	353.39	34.82	353.36	34.91	353.35
35.3	353.33	35.35	353.33	46.42	351.02	55.11	348.12	57.1	347.46
69.49	343.33	72.47	343.33	73.49	343.33	75.37	343.33	75.84	343.33
76.47	343.33	76.6	343.33	77.49	343.33	98.04	350.18	99.38	350.63
115.02	355.84	115.95	355.86	117.3	355.88	117.33	355.88	117.35	355.88
117.8	355.89	117.9	355.89	118.15	355.9	119.38	355.92	119.5	355.92
119.79	355.92	134.96	355.97	147.98	356.06	153.02	356.09	155.72	356.12
168.13	356.2	168.23	356.2	168.33	356.2	168.43	356.2	168.53	356.2

Manning's n Values   num=   3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	46.42	.026	115.95	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
46.42	115.95	213	204.72	192.9	.1	.3

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel   RS: 23

INPUT
Description:
Station Elevation Data   num=   31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	353.18	.2	353.17	.3	353.17	10.35	352.81	20.4	352.6
21.84	352.57	35.34	352.57	35.51	351.78	36.46	351.72	39.1	350.84
41.04	350.2	63.51	342.71	64.17	342.71	64.65	342.71	67.51	342.71
68.17	342.71	71.51	342.71	77.72	344.77	93.65	350.08	110.52	355.36
139.97	356.28	140.83	356.31	142.1	356.35	146.16	356.47	149.22	356.55
149.64	356.55	161	356.68	163.26	356.7	163.46	356.71	163.56	356.71
163.66	356.71								

Manning's n Values   num=   3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	35.34	.026	110.52	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
35.34	110.52	180.58	180.39	178.93	.1	.3

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel   RS: 22

INPUT
Description:
Station Elevation Data   num=   63

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	350.96	.1	350.95	.23	350.93	.36	350.92	.49	350.9
.62	350.88	5.79	350.21	16	348.87	17.13	348.77	17.5	348.77
27.1	348.87	29.64	348.89	30	348.9	42.95	348.9	49.18	350.28
69.03	348.82	70.87	348.2	76.44	346.35	78.51	345.65	82.53	344.32
83.38	344.03	83.5	343.99	83.6	343.96	83.71	343.92	83.72	343.92
84.24	343.74	87.74	342.58	88.18	342.43	88.59	342.3	88.92	342.19
88.93	342.18	89	342.16	91.82	342.16	92.74	342.16	93	342.16
96.02	342.16	96.75	342.16	97	342.16	99.2	342.89	99.63	343.03
101.49	343.65	109.04	346.17	134.96	354.3	144.59	354.34	145.9	354.57
152.92	354.69	153.21	354.7	154.55	354.72	159.41	354.81	170.8	354.91
174.46	354.94	175.81	354.9	181.12	355.03	187.47	355.18	190.4	355.25
190.41	355.25	192.15	355.29	204.68	355.64	207.3	355.74	207.34	355.74
207.43	355.74	207.56	355.75	207.69	355.75				

Manning's n Values   num=   3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	69.03	.026	134.96	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
69.03	134.96	144.57	143.8	144.85	.1	.3

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel RS: 21

INPUT
Description:
Station Elevation Data num= 32

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	354.17	.3	354.16	7.02	353.86	20.51	352.93	24.12	352.68
33.9	351.56	39.17	350.99	40.46	350.85	60.61	344.14	63.98	343.01
67.85	341.72	68.51	341.72	69.67	341.72	71.49	341.72	71.85	341.72
72.51	341.72	75.85	341.72	77.99	342.43	80.12	343.14	92.79	347.37
96.43	348.58	97.65	348.65	98.83	348.68	107.67	348.85	128.95	349.84
137.51	350.49	137.67	350.5	157.86	352	157.96	352	158.06	352.01
158.16	352.02	158.26	352.03						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	39.17	.026	97.65	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
39.17	97.65	137.33	145.29	153.36	.1	.3

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel RS: 20

INPUT
Description:
Station Elevation Data num= 32

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	353.65	.1	353.65	4.38	353.69	25.67	352.33	26.57	352.27
55.16	348.84	58.97	348.37	59.62	348.35	66.26	346.46	71.33	344.77
72.43	344.4	81.82	341.28	82.97	341.28	83.5	341.28	83.77	341.28
84.47	341.28	85.82	341.28	87.75	341.28	88.69	341.28	89.82	341.28
99.36	344.46	100.61	344.87	115.53	349.25	125.94	350.92	128.64	351.29
130.66	351.57	135.33	352.21	137.65	352.53	155.46	353.41	155.56	353.41
155.66	353.42	155.76	353.42						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	59.62	.026	115.53	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
59.62	115.53	164.3	152.27	149.67	.1	.3

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel   RS: 19

INPUT
Description:
Station Elevation Data   num=   61

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	353.01	.1	353.01	.23	353	.35	353	.48	352.99
.6	352.99	11.02	352.62	11.54	352.61	21.55	352.25	23.12	352.2
26.34	352.5	29	352.75	29.42	352.78	37.42	352.69	46.95	352.3
57.69	351.86	68.89	351.45	75.2	351.21	90.18	349.11	90.34	349.08
105.37	347.05	106.77	346.58	110.31	345.4	114.64	343.96	124.08	340.81
127.12	340.81	128.08	340.81	130.38	340.81	130.39	340.81	131.12	340.81
132.08	340.81	134.18	341.51	135.39	341.91	136.74	342.36	140.4	343.58
142.93	344.42	146.66	345.67	147.8	345.71	148.95	345.75	149.83	345.77
153.09	345.84	153.87	345.91	159.72	346.45	161.36	346.6	161.47	346.61
162.46	346.69	163.14	346.74	163.15	346.75	164.99	346.9	166.54	347.02
168.65	347.19	176.32	348	177.01	348.07	177.02	348.07	185.99	349.01
201.95	350.68	202.07	350.69	202.2	350.71	202.32	350.72	202.45	350.73
202.55	350.74								

Manning's n Values   num=   3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	105.37	.026	159.72	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
105.37	159.72	125.2	136.45	142.49	.1	.3

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel   RS: 18

INPUT
Description:
Station Elevation Data   num=   44

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	351.7	.1	351.69	.2	351.69	.3	351.69	.4	351.68
.5	351.68	15.09	351.12	20.9	350.86	31.99	350.35	58.74	347.2
58.95	347.19	80.77	345.24	80.81	345.23	82.57	344.65	84.04	344.16
91.31	341.75	94.53	340.68	95.38	340.4	95.39	340.4	97.23	340.4
98.25	340.4	99.4	340.4	100.48	340.4	102.28	340.4	102.33	340.4
103.04	340.4	103.42	340.4	104.48	340.75	107.88	341.88	108.48	342.08
110.5	342.75	113.74	343.51	143.42	345.96	163.67	348.99	163.77	349
163.87	349.02	163.97	349.03	164.58	349.12	165.55	349.27	165.91	349.29
196.08	351.14	210.86	351.56	225.61	351.93	225.71	351.94		

Manning's n Values   num=   3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	80.77	.026	113.74	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
80.77	113.74	98.1	92.44	88.69	.1	.3

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel   RS: 17

INPUT
Description:
Station Elevation Data   num=   45

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	351.82	.1	351.82	.22	351.82	.34	351.82	3.38	351.8
4.99	351.8	6.33	351.37	9.79	350.73	14.66	350.23	26.11	349.48
28.92	349.3	31.43	349.14	49.02	347.29	82	344.58	83.6	343.68
89.14	343.36	89.67	343.33	90.27	343.13	97.1	340.85	97.48	340.73
98.35	340.43	99.31	340.12	102.21	340.12	103.31	340.12	104.82	340.12
106.98	340.12	107.17	340.12	107.31	340.12	107.38	340.14	107.57	340.2
110.13	341.06	113.81	342.28	114.37	342.47	125.59	342.84	137.4	344.61
138.33	344.75	146.97	346.04	147.45	346.11	158.22	347.51	180.48	348.6
190.56	349.09	211.07	349.93	214	350.06	214.13	350.06	214.23	350.07

Manning's n Values   num=   3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	89.67	.026	114.37	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
89.67	114.37	107.38	99.59	92.13	.1	.3

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel   RS: 16

INPUT
Description:
Station Elevation Data   num=   93

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	351.42	.1	351.41	.2	351.4	.3	351.39	4.78	350.95
9.29	350.58	9.49	350.56	16.47	349.98	16.68	349.97	29.75	348.6
41.79	347.35	53.08	346.17	55.33	345.93	62.95	345.25	64.84	345.12
64.98	345.11	65.02	345.11	65.1	345.1	65.27	345.09	69.16	344.82
70.13	344.75	71.19	344.68	77.24	344.26	79.29	344.11	85.84	343.65
88.49	343.47	91.09	343.28	99.73	343	99.96	342.66	100.3	342.55
101.87	342.03	101.87	342.02	101.9	342	101.92	341.99	101.97	341.98
101.98	341.98	102.7	341.74	103.31	341.53	103.63	341.43	104.92	341
104.97	340.99	105.09	340.95	106.38	340.52	107.94	340	107.96	340
108.51	339.81	111.11	339.81	112.51	339.81	114.41	339.81	116.51	339.81
116.52	339.81	116.86	339.93	117.08	340	118.38	340.43	119.63	340.85
120.07	341	120.1	341.01	121.95	341.62	122.84	341.92	123.09	342
123.53	342.15	128.55	342.53	130.79	342.71	131.6	342.77	132.2	342.82
141.36	343.23	146.76	343.48	147.03	343.49	147.29	343.51	147.51	343.52
147.8	343.53	147.86	343.53	147.93	343.54	148.24	343.55	148.62	343.57
148.98	343.58	152.6	343.75	156.17	344.04	184.47	346.34	186.43	346.51

186.8	346.53	187.71	346.6	223.7	348.96	226.7	349.16	227.17	349.19
228.97	349.28	239.25	349.84	239.94	349.88	257.57	351.05	269.3	351.62
278.67	351.98	278.77	351.99	278.87	351.99				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	99.73	.026	123.53	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
99.73	123.53	32.36	29.69	29.39	.1	.3

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel RS: 15

INPUT
Description:
Station Elevation Data num= 109

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	350.88	.1	350.88	.2	350.88	.3	350.87	.4	350.87
.6	350.87	9.42	350.59	9.47	350.59	19.4	349.62	19.65	349.6
19.83	349.58	20.54	349.53	20.6	349.52	20.85	349.5	21.62	349.43
28.03	348.86	28.75	348.8	28.76	348.79	29.84	348.7	29.85	348.7
34.12	348.32	44.62	347.38	71.47	344.99	71.57	344.98	74.89	344.75
75.23	344.73	76.83	344.62	77.4	344.58	79.51	344.43	96.08	342
96.61	341.91	97.78	341.72	98.02	341.68	99.66	341.4	101.11	341.16
102.08	341	102.28	340.97	102.54	340.92	103.99	340.68	104.11	340.66
107.06	340.17	107.67	340.07	108.08	340	108.2	339.98	108.51	339.93
108.56	339.92	109.75	339.72	109.77	339.72	109.86	339.72	110.62	339.72
111.7	339.72	112.82	339.72	115.86	339.72	119.36	339.72	119.75	339.72
119.78	339.72	120.59	339.72	120.85	339.72	121.4	339.72	122.57	339.72
123.06	339.72	124.19	339.72	129.75	339.72	129.76	339.72	129.85	339.74
130.99	339.93	131.43	340	132.31	340.15	132.63	340.2	132.99	340.26
133.87	340.41	135.22	340.63	135.27	340.64	135.49	340.68	136.78	340.89
137.02	340.93	137.2	340.96	137.31	340.98	143.43	342	145.83	342.4
146.67	342.54	149.55	343.02	150.61	343.07	152.88	343.18	161.81	343.6
162.14	343.62	168.66	344.17	168.67	344.17	172.68	344.5	172.83	344.51
172.9	344.52	175.06	344.7	176.12	344.79	182.14	345.19	182.2	345.19
197.27	346.2	198.13	346.27	209.79	347.15	222.8	348.13	225.94	348.35
231.3	348.71	232.06	348.76	236.93	349.1	237.34	349.12	242.67	349.42
243.84	349.5	248.47	349.81	269.17	351.22	284.24	351.96		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	79.51	.026	143.43	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
79.51	143.43	29.84	29.08	29.9	.1	.3

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel   RS: 14

INPUT
Description:
Station Elevation Data   num=   142

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	350.48	.1	350.48	.2	350.47	.3	350.47	.4	350.47
3.87	350.36	7.47	350.25	7.57	350.24	16.29	349.97	16.44	349.97
18.18	349.8	18.38	349.78	33.82	348.5	33.92	348.49	42.82	347.75
42.92	347.74	46.62	347.44	53.51	346.86	53.61	346.86	54.96	346.74
56.33	346.63	70.54	345.37	70.66	345.36	75.48	344.93	75.5	344.92
90.24	343.66	91.51	343.55	94.77	343.27	94.78	343.27	95.5	343.21
95.51	343.21	104.3	342.45	105.07	342.39	106.59	342.26	106.68	342.25
106.69	342.25	108.05	342.13	108.44	342.1	109.18	342.04	110.32	341.94
110.44	341.93	110.71	341.91	110.89	341.89	111.66	341.84	115.11	341.74
116.12	341.71	116.18	341.71	116.25	341.71	117.07	341.31	117.69	341
117.99	340.85	118.45	340.63	119.63	340.05	119.68	340.03	119.73	340
119.78	339.98	119.79	339.97	119.89	339.92	120.12	339.81	120.26	339.74
120.48	339.63	122.47	339.63	122.48	339.63	124.07	339.63	124.17	339.63
125.03	339.63	126.48	339.63	130.47	339.63	130.49	339.63	131.93	339.63
132.42	339.63	132.48	339.63	133.13	340	134.1	340.19	134.89	340.35
134.9	340.36	135.34	340.44	135.35	340.45	138.07	341	138.1	341
140.31	341.1	144.68	341.43	144.71	341.43	144.78	341.44	144.81	341.44
146.03	341.53	146.14	341.54	146.24	341.55	147.61	341.65	157.75	342.39
157.85	342.39	158.75	342.46	158.85	342.46	159.64	342.52	159.77	342.53
159.83	342.54	159.84	342.54	161.67	342.67	161.75	342.68	169.43	343.23
169.5	343.24	169.55	343.24	169.76	343.26	169.78	343.26	169.91	343.27
170.86	343.33	170.91	343.33	171.01	343.34	171.23	343.35	189.3	344.54
190.19	344.6	191.91	344.71	192.01	344.72	192.3	344.74	194.78	344.91
196.76	345.04	196.85	345.04	207.08	345.73	207.36	345.75	210.78	346.01
210.79	346.01	211.51	346.06	211.67	346.07	211.77	346.08	215.77	346.38
215.87	346.39	221.7	346.83	223.17	346.95	248.2	348.89	248.57	348.92
249.52	348.99	258.89	349.71	258.99	349.72	268.28	350.43	277.21	351.11
285.37	351.67	312.52	353	319.79	353.28	328.96	353.59	335.32	353.77
335.42	353.77	335.52	353.78						

Manning's n Values   num=   3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	116.25	.026	138.07	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
116.25	138.07	58.57	59.23	59.39	.1	.3

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel   RS: 13

INPUT
Description:
Station Elevation Data   num=   76

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

0	350.21	.1	350.21	.2	350.2	.3	350.2	.4	350.2
.5	350.19	16.32	349.67	22.8	349.42	24.65	349.53	24.75	349.54
30.51	349.34	68.32	347.05	83.88	346.03	88.43	345.61	92	345.28
95.96	344.91	99.35	344.6	99.74	344.56	101.15	344.44	109.19	343.79
109.36	343.77	113.82	343.41	117.65	343.09	122.5	342.7	122.89	342.66
130.43	341.9	131.49	341.79	132.3	341.71	132.92	341.64	133.57	341.58
133.86	341.55	134.35	341.5	135.01	341.43	135.07	341.43	135.13	341.42
136.06	341.36	136.08	341.36	136.35	341.33	136.61	341.3	137.42	341.03
138.83	340.56	142.16	339.45	143.21	339.45	144.07	339.45	145.11	339.45
146.16	339.45	147.67	339.45	148.39	339.45	149.09	339.45	150.16	339.45
150.46	339.55	150.77	339.66	152.03	340.07	152.96	340.39	154.47	340.3
172.27	340.48	212.09	341.08	223.71	342.75	223.76	342.75	230.87	343.62
244.29	345.25	259.72	347.35	265.35	347.51	296.93	348.44	306	348.71
309.63	349.15	313.96	349.6	316.8	349.89	323.34	350.11	323.44	350.11
323.54	350.11	335.96	350.52	341.39	350	366.97	352.6	370.2	353.51
370.3	353.53								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	136.61	.026	152.03	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
136.61	152.03	71.67	74.84	71.63	.1	.3

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel RS: 12

INPUT
Description:
Station Elevation Data num= 98

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	350.81	.1	350.8	.2	350.79	.46	350.78	.8	350.76
3.1	350.61	3.51	350.59	4.75	350.52	4.82	350.51	5.52	350.46
5.97	350.42	6.89	350.36	7.38	350.2	24.87	349.55	24.91	349.55
25.03	349.54	26	349.51	26.64	349.48	27.72	349.43	27.84	349.42
28.18	349.41	29.23	349.36	30.89	349.28	31.85	349.24	32.75	349.18
49.54	348.12	70.05	346.84	88.59	345.61	116.84	343.75	121.65	343.49
126.25	343.18	137.11	342.31	161.42	340.32	162.29	340.03	164.72	339.22
167.79	339.22	168.72	339.22	171.79	339.22	172.72	339.22	174.06	339.67
174.74	339.9	183.16	340.28	183.18	340.28	191.77	340.68	193.95	340.78
207.1	344	207.12	344.02	207.33	344.13	207.47	344.2	207.49	344.21
207.51	344.22	207.55	344.24	207.59	344.26	207.71	344.32	207.76	344.35
208.21	344.58	208.74	344.86	208.87	344.93	209.79	345.41	211.06	346.07
211.09	346.08	211.9	346.5	213.26	347.21	216.74	349.02	218.09	349.54
218.1	349.55	218.17	349.57	218.22	349.59	218.44	349.68	220.99	350.67
222.04	351.08	225.17	352.29	226.14	352.67	226.4	352.77	226.52	352.82
227.1	353.04	227.26	353.1	227.29	353.11	227.43	353.17	227.44	353.18
227.5	353.2	227.64	353.25	227.65	353.26	228.63	353.27	232.61	355.18
267.49	348.54	267.56	348.53	285.97	350.87	287.63	350.8	287.64	350.8
287.78	350.79	289.83	350.77	295.43	351.12	295.6	351.13	295.73	351.14
295.86	351.15	295.96	351.15	296.06	351.16				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	161.42	.026	174.74	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
161.42	174.74	105.29	105.72	114.8	.1	.3

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel RS: 11

INPUT
Description:
Station Elevation Data num= 107

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	350.39	.1	350.39	.3	350.37	.4	350.37	5.69	350.01
5.9	350	6.15	349.99	7.06	349.97	7.14	349.97	7.33	349.95
8.47	349.88	8.48	349.88	13.84	349.51	13.85	349.51	13.98	349.51
17.76	349.61	20.24	349.58	20.49	349.57	21.46	349.52	22.84	349.44
23.02	349.42	40.52	347.76	49.72	346.89	57.39	346.23	59.52	346.08
106.51	342.68	106.52	342.68	108.44	342.54	109.72	342.46	110.78	342.4
110.79	342.4	111.85	342.33	117.47	341.97	119.99	341.81	121.76	341.69
124.28	341.53	128.15	341.28	132.57	341	134.77	340.85	146.88	340.07
151.8	339.75	153.05	339.67	155.32	339.52	156.03	339.48	156.04	339.48
160.95	339.16	164.24	338.95	164.54	338.93	165.37	338.88	165.64	338.86
166.2	338.86	166.62	338.86	166.7	338.86	166.75	338.88	166.83	338.88
168.66	338.88	168.67	338.88	169.22	338.88	169.44	338.88	169.71	338.88
169.74	338.88	169.89	338.88	173.87	338.88	174.03	338.88	174.04	338.88
174.76	338.88	174.79	338.88	177.64	338.88	180.91	338.88	180.92	338.88
182.23	338.88	182.77	338.88	182.81	338.87	182.82	338.87	185.01	338.92
185.57	338.94	185.58	338.94	185.9	338.95	187.28	339.13	187.88	339.21
188.38	339.27	188.72	339.32	192.77	339.84	192.86	339.85	192.88	339.86
192.91	339.86	197.66	340.45	241.86	345.9	254.65	346.98	254.84	347
278.67	349.29	281.75	349.58	284.81	349.87	290.1	350.26	290.46	350.29
296.08	351.08	296.86	351.12	298.14	351.19	298.26	350.93	298.87	350.95
299.63	350.98	299.64	350.98	299.72	350.98	299.82	350.98	299.91	350.99
300.01	350.99	300.11	350.99						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	164.54	.026	187.28	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
164.54	187.28	96.08	103.13	116.02	.1	.3

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel RS: 10

INPUT
Description:
Station Elevation Data num= 162

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	352.13	.1	352.13	2.67	351.97	5.38	351.69	7.59	351.49
10.36	351.27	12.62	351.11	14.24	350.88	15.48	350.72	16.49	350.58
20.63	349.21	24.56	349.64	26.36	349.84	29.92	349.79	30.02	349.79
30.13	349.79	30.24	349.79	30.36	349.79	49.08	349.54	49.27	349.53
52.29	349.37	52.3	349.37	52.49	349.36	52.81	349.34	64.95	348.49
85.98	346.89	85.99	346.88	88.41	346.7	123.91	344.42	123.92	344.42
131.35	343.68	131.36	343.68	163.24	339.66	163.25	339.66	170.46	338.75
171.83	338.57	179.43	338.52	180.7	338.14	180.71	338.14	181.09	338
181.12	338	182.86	338	183.06	338	185.4	338	185.6	338
189.44	338	189.45	338	189.54	338	190.84	337.99	191.14	337.98
193.73	337.97	194.44	337.97	194.5	337.97	194.97	337.97	195.03	337.97
195.29	337.98	195.43	337.98	196.37	337.98	196.38	337.98	196.42	337.98
196.82	337.99	196.91	337.99	196.92	337.99	196.98	337.99	197.26	337.99
197.27	337.99	197.28	337.99	197.45	337.99	197.49	337.99	198.18	338
198.19	338	198.5	338	200.73	338	202.3	338	204.58	338
206.28	338	206.46	338	206.49	338	206.91	338.15	213.51	338.38
214.83	338.42	216.15	338.47	218.61	338.55	223.38	338.58	227.57	338.61
228.92	338.62	228.93	338.62	228.94	338.62	229.92	338.63	231.24	338.64
231.98	338.65	232.23	338.66	232.28	338.66	232.36	338.66	232.42	338.66
232.58	338.67	232.83	338.67	232.87	338.68	234.99	338.74	235.15	338.75
235.49	338.76	235.5	338.76	235.9	338.77	236.22	338.78	236.23	338.78
236.44	338.81	239.47	339.23	242.08	339.58	244.07	339.86	245.65	340.07
246.66	340.21	246.92	340.24	247.98	340.35	248.86	340.45	249.62	340.53
250.27	340.6	261.34	341.8	269.78	342.71	276.6	342.92	290.86	343.38
296.48	343.55	297.71	343.59	300.65	343.69	307	343.89	310.93	344.05
323.09	344.3	335.56	344.71	335.57	344.71	348.8	345.14	355.09	345.34
355.1	345.34	368.7	345.79	374.37	346.07	374.38	346.07	396.87	347.31
405.65	348.81	407.73	349.17	409.99	349.35	411.29	349.45	412.2	349.52
415.69	349.8	430.74	350.97	430.75	350.97	431.33	350.89	432.36	350.95
434.59	351.12	434.6	351.12	435.89	351.28	436.75	351.35	439.57	351.74
440.92	352	440.93	352	444.7	352.44	446.01	352.55	446.98	352.63
447.37	352.67	447.83	352.73	453.13	353.3	459.2	353.88	459.48	353.92
459.58	353.94	459.68	353.95						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	179.43	.026	206.91	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
179.43	206.91	101.74	100.81	109.13	.1	.3

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel RS: 9

INPUT
Description:
Station Elevation Data num= 122

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	350.14	.1	350.14	.2	350.14	.3	350.14	.4	350.14
.95	350.13	2.74	350.08	2.75	350.08	3.22	350.07	6.93	350.03
7.04	350.03	7.49	350.02	7.77	350.02	8.06	350	10.51	349.05
10.87	348.72	11.77	348.82	11.81	348.82	21.97	349.94	22.22	349.94
22.3	349.94	22.37	349.94	23.19	349.93	25.12	349.92	25.58	349.86
26.04	349.7	26.47	349.84	45.14	348.6	52.06	348.14	52.94	348.08
58.25	347.73	60.21	347.6	60.26	347.52	60.84	347.51	65.06	347.42
66.38	347.28	66.51	347.26	68.97	347.01	83.69	345.91	86.66	345.68
90.76	345.38	94.2	345.12	95.93	344.99	96.54	344.94	97.22	344.89
97.23	344.89	97.72	344.85	98.96	344.76	101.58	344.56	101.86	344.54
102.67	344.48	103.43	344.42	103.77	344.4	107.25	344.14	107.26	344.14
108	344.08	109.33	343.99	110.46	343.91	111	343.88	112.92	343.75
113.21	343.73	114.34	343.65	116.3	343.46	118.57	343.24	118.58	343.23
118.71	343.22	120.44	343.05	124.54	342.47	124.68	342.45	126.71	342.16
128.71	341.88	130.09	341.69	132.48	341.35	133.21	341.25	133.21	341.24
135.43	340.93	135.5	340.92	136.82	340.73	140.15	340.26	142.38	339.95
144.43	339.66	144.9	339.59	145.17	339.55	146.24	339.4	147.52	339.22
155.97	338.03	158.22	337.71	159.92	337.47	162.71	337.4	162.72	337.07
162.74	337.07	163.58	337.07	227.42	337.07	227.43	337.4	232.84	337.59
233.09	337.63	233.84	337.73	234.05	337.77	234.95	337.89	236.18	338.06
237.57	338.26	240.96	338.74	263.76	341.95	291.64	344.43	294.99	344.73
302.21	345.48	303.51	345.62	305.51	345.83	306.09	345.89	307.95	346.01
340.28	348.22	345.12	348.7	346.09	348.79	346.1	348.79	352.94	349.47
352.95	349.47	352.98	349.48	366.76	350.71	366.86	350.72	366.97	350.73
367.07	350.74	367.17	350.74						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	162.74	.011	227.43	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
162.74	227.43	40.29	34.96	40.34	.1	.3

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel RS: 8

INPUT
Description:
Station Elevation Data num= 225

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	349.7	.1	349.7	.3	349.69	7.05	349.37	11.54	349.16
14.77	349.01	23.35	348.58	23.36	348.58	24.03	348.54	24.32	348.62
24.37	348.62	24.94	348.63	25.2	348.61	31.33	348.1	32.24	348.16
32.93	348.2	33.87	348.27	37.15	348.21	38.46	348.19	41.63	348.14
43.12	348.13	49.87	348.08	50.8	348.07	52.95	347.8	55.38	347.88
55.6	347.89	60.59	348.07	62.93	348.16	63.54	348.18	69.09	348.19
77.1	348.21	83.77	348.22	85.17	348.17	89.78	348.11	90.56	348.1
91.2	348.09	91.48	348.1	92.56	348.1	93.68	348.1	93.84	348.1
95.38	348.1	96.44	348.11	97.29	348.11	98.54	348.11	99.7	348.12
101.67	348.13	106.89	347.99	107.09	347.98	108.61	347.94	115.42	347.91

116.89	347.91	118.68	347.9	122.7	347.89	122.73	347.89	124.38	347.83
126.31	347.77	127.24	347.73	129.58	347.77	130.99	347.79	131.73	347.75
132.06	347.73	132.28	347.72	132.52	347.7	135.58	347.45	137.05	347.32
137.2	347.31	139.36	347.36	140.19	347.38	142.2	347.42	142.71	347.43
143.39	347.45	144.62	347.47	146.66	347.52	146.76	347.52	146.86	347.52
146.92	347.52	147.08	347.53	147.1	347.53	147.33	347.53	150.1	347.59
150.93	347.61	151.28	347.62	152.8	347.65	153.1	347.66	155.24	347.71
155.74	347.72	157.08	347.75	158.67	347.78	159.08	347.79	159.21	347.79
162.07	347.85	162.46	347.86	162.61	347.87	165.06	347.92	165.7	347.93
167.17	347.97	168.05	347.98	168.77	348	170.14	348.03	171.04	348.05
171.17	348.05	171.85	348.07	173.97	348.11	174.94	348.13	175.18	348.14
177.01	348.18	177.74	348.2	177.81	348.2	179.21	348.25	179.99	348.28
180.03	348.28	180.23	348.33	181.14	348.35	181.64	348.36	182.15	348.37
183.26	348.38	184.25	348.4	185.47	348.41	185.94	348.42	187.33	348.44
187.37	348.44	188.91	348.46	189.3	348.47	189.39	348.47	190	348.63
190.49	348.63	191.42	348.63	191.87	348.63	193.12	348.64	193.64	348.64
196.93	348.65	197.8	348.66	199.45	348.67	199.72	348.79	200.24	349.02
200.24	348.88	201.08	336.36	225.43	336.36	225.44	336.36	226.27	348.82
226.27	349.02	227.13	348.91	227.28	348.69	227.32	348.69	227.52	348.69
227.59	348.69	228.06	348.68	229.7	348.67	230.61	348.67	231.15	348.66
232.52	348.65	233.14	348.65	234.29	348.61	234.51	348.61	235.32	348.58
237.42	348.52	237.78	348.51	237.91	348.51	239.96	348.44	240.82	348.42
240.95	348.41	243.49	348.34	243.98	348.32	244.98	348.29	245.19	348.29
245.94	348.11	246.18	348.05	246.98	347.87	248.11	347.6	248.62	347.55
248.89	347.52	251.61	347.23	252.35	347.16	252.95	347.09	254.38	346.94
255.9	346.78	256.14	346.76	257.07	346.66	257.23	346.64	258.62	346.61
258.85	346.61	259.81	346.59	259.98	346.58	261.17	346.56	261.78	346.56
262.87	346.57	263.87	346.57	264.65	346.57	264.7	346.56	265.83	346.42
266.27	346.36	267.12	346.26	267.43	346.22	267.81	346.17	268.35	346.1
268.47	346.08	268.8	346.04	269.76	345.92	269.9	345.91	271.11	345.8
271.42	345.77	282.69	344.74	284.5	344.57	284.72	344.56	286.54	344.39
288.67	344.59	291.54	344.78	291.81	344.8	294.92	345.01	310.58	346.35
311.25	346.41	323.26	347.52	324.77	347.5	328.06	347.45	334.93	347.35
337.15	347.52	343.14	347.97	343.47	348	357.97	349.08	364.82	349.57
367.18	350.07	369.28	350.26	369.38	350.27	369.48	350.28	369.58	350.29

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.011	200.24	.011	226.27	.011

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
200.24	226.27	26	26	26	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
207.08	209.25	346.36	T
217.25	219.42	346.36	F

CULVERT

RIVER: Proposed Channel
REACH: Proposed Channel RS: 7.5

INPUT

Description:
Distance from Upstream XS = 1
Deck/Roadway Width = 14
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 6

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	349.6	346.36	54.27	348	346.36	100.01	350	346.36
256.77	350	346.36	291.52	349.1	346.36	369.58	350.4	346.36

Upstream Bridge Cross Section Data
Station Elevation Data num= 225

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	349.7	.1	349.7	.3	349.69	7.05	349.37	11.54	349.16
14.77	349.01	23.35	348.58	23.36	348.58	24.03	348.54	24.32	348.62
24.37	348.62	24.94	348.63	25.2	348.61	31.33	348.1	32.24	348.16
32.93	348.2	33.87	348.27	37.15	348.21	38.46	348.19	41.63	348.14
43.12	348.13	49.87	348.08	50.8	348.07	52.95	347.8	55.38	347.88
55.6	347.89	60.59	348.07	62.93	348.16	63.54	348.18	69.09	348.19
77.1	348.21	83.77	348.22	85.17	348.17	89.78	348.11	90.56	348.1
91.2	348.09	91.48	348.1	92.56	348.1	93.68	348.1	93.84	348.1
95.38	348.1	96.44	348.11	97.29	348.11	98.54	348.11	99.7	348.12
101.67	348.13	106.89	347.99	107.09	347.98	108.61	347.94	115.42	347.91
116.89	347.91	118.68	347.9	122.7	347.89	122.73	347.89	124.38	347.83
126.31	347.77	127.24	347.73	129.58	347.77	130.99	347.79	131.73	347.75
132.06	347.73	132.28	347.72	132.52	347.7	135.58	347.45	137.05	347.32
137.2	347.31	139.36	347.36	140.19	347.38	142.2	347.42	142.71	347.43
143.39	347.45	144.62	347.47	146.66	347.52	146.76	347.52	146.86	347.52
146.92	347.52	147.08	347.53	147.1	347.53	147.33	347.53	150.1	347.59
150.93	347.61	151.28	347.62	152.8	347.65	153.1	347.66	155.24	347.71
155.74	347.72	157.08	347.75	158.67	347.78	159.08	347.79	159.21	347.79
162.07	347.85	162.46	347.86	162.61	347.87	165.06	347.92	165.7	347.93
167.17	347.97	168.05	347.98	168.77	348	170.14	348.03	171.04	348.05
171.17	348.05	171.85	348.07	173.97	348.11	174.94	348.13	175.18	348.14
177.01	348.18	177.74	348.2	177.81	348.2	179.21	348.25	179.99	348.28
180.03	348.28	180.23	348.33	181.14	348.35	181.64	348.36	182.15	348.37
183.26	348.38	184.25	348.4	185.47	348.41	185.94	348.42	187.33	348.44
187.37	348.44	188.91	348.46	189.3	348.47	189.39	348.47	190	348.63
190.49	348.63	191.42	348.63	191.87	348.63	193.12	348.64	193.64	348.64
196.93	348.65	197.8	348.66	199.45	348.67	199.72	348.79	200.24	349.02
200.24	348.88	201.08	336.36	225.43	336.36	225.44	336.36	226.27	348.82
226.27	349.02	227.13	348.91	227.28	348.69	227.32	348.69	227.52	348.69
227.59	348.69	228.06	348.68	229.7	348.67	230.61	348.67	231.15	348.66
232.52	348.65	233.14	348.65	234.29	348.61	234.51	348.61	235.32	348.58
237.42	348.52	237.78	348.51	237.91	348.51	239.96	348.44	240.82	348.42
240.95	348.41	243.49	348.34	243.98	348.32	244.98	348.29	245.19	348.29
245.94	348.11	246.18	348.05	246.98	347.87	248.11	347.6	248.62	347.55
248.89	347.52	251.61	347.23	252.35	347.16	252.95	347.09	254.38	346.94
255.9	346.78	256.14	346.76	257.07	346.66	257.23	346.64	258.62	346.61
258.85	346.61	259.81	346.59	259.98	346.58	261.17	346.56	261.78	346.56
262.87	346.57	263.87	346.57	264.65	346.57	264.7	346.56	265.83	346.42
266.27	346.36	267.12	346.26	267.43	346.22	267.81	346.17	268.35	346.1
268.47	346.08	268.8	346.04	269.76	345.92	269.9	345.91	271.11	345.8
271.42	345.77	282.69	344.74	284.5	344.57	284.72	344.56	286.54	344.39

288.67	344.59	291.54	344.78	291.81	344.8	294.92	345.01	310.58	346.35
311.25	346.41	323.26	347.52	324.77	347.5	328.06	347.45	334.93	347.35
337.15	347.52	343.14	347.97	343.47	348	357.97	349.08	364.82	349.57
367.18	350.07	369.28	350.26	369.38	350.27	369.48	350.28	369.58	350.29

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.011	200.24	.011	226.27	.011

Bank Sta: Left	Right	Coeff Contr.	Expan.
200.24	226.27	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
207.08	209.25	346.36	T
217.25	219.42	346.36	F

Downstream Deck/Roadway Coordinates
num= 6

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	348.9	345.84	50	348	345.84	103.29	350	345.84
253.18	350	345.84	354.33	349.4	345.84	387	349.1	345.84

Downstream Bridge Cross Section Data
Station Elevation Data num= 286

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	349.24	.1	349.24	.19	349.23	.56	349.21	2.35	349.11
11.22	348.67	13.87	348.53	16.49	348.4	18.01	348.8	21.34	348.87
32.44	347.94	33.12	348.44	40.54	348.23	51.49	347.93	52.51	347.9
55.48	347.86	56.27	347.84	66.99	347.69	75.71	347.56	76.42	347.54
78.31	347.52	80.2	347.75	81.81	347.96	81.82	347.96	82.76	348.07
89.1	348.73	90.32	348.85	93.71	349.06	94.7	349.12	96.05	349.14
98.87	349.18	100.74	349.2	100.98	349.2	102.62	349.23	112.41	349.24
118.17	349.25	123.88	349.27	125.19	349.26	127.45	349.24	130.23	349.22
131.61	349.22	132.43	349.21	133.02	349.21	133.91	349.2	136.43	349.18
137.54	349.18	137.63	349.18	137.75	349.17	139.74	349.16	141.4	349.15
141.68	349.15	141.89	349.15	143.28	349.14	144.77	349.13	144.9	349.13
145.07	349.13	146.16	349.12	146.17	349.12	146.63	349.12	147.7	349.11
147.71	349.11	148.32	349.11	148.61	349.1	149.56	349.1	149.93	349.1
150.05	349.09	151.05	349.09	151.41	349.09	151.96	349.08	153.55	349.07
153.65	349.07	153.72	349.07	154.33	349.07	154.75	349.06	155.27	349.06
155.61	349.06	155.62	349.06	156.43	349.05	158.3	349.04	158.86	349.04
159	349.04	161.38	349.01	161.54	349.01	162.05	349	163.67	348.96
164.05	348.96	164.76	348.94	165.15	348.94	165.49	348.93	166.34	348.91
167.91	348.88	168.15	348.88	168.84	348.86	168.85	348.86	168.99	348.86
169.01	348.86	171.14	348.82	171.34	348.81	171.57	348.81	171.77	348.81
174.12	348.76	174.3	348.76	174.53	348.75	174.59	348.75	175.01	348.74
176.01	348.72	176.02	348.72	176.09	348.72	176.12	348.72	176.14	348.72
176.15	348.72	176.37	348.71	176.38	348.71	176.67	348.71	178.02	348.68
178.49	348.68	178.69	348.67	179.73	348.66	183.19	348.61	184.8	348.59
185.18	348.58	186.13	348.57	186.42	348.57	186.44	348.57	188.04	348.56
189.65	348.55	194.03	348.53	194.81	348.53	195.59	348.53	195.88	348.53
195.88	348.54	196.44	348.95	196.55	349.03	196.55	335.84	196.57	335.84
196.69	335.84	196.71	335.84	196.78	335.84	196.79	335.84	196.8	335.84
196.82	335.84	196.85	335.84	196.86	335.84	196.87	335.84	196.88	335.84

196.9	335.84	196.91	335.84	196.92	335.84	196.94	335.84	199.68	335.84
199.69	335.84	199.89	335.84	200.01	335.84	201.89	335.84	202.55	335.84
202.57	335.84	203.21	335.84	203.48	335.84	204.42	335.84	204.44	335.84
204.84	335.84	205.35	335.84	206.23	335.84	206.88	335.84	206.94	335.84
207.1	335.84	207.25	335.84	207.88	335.84	208.2	335.84	208.87	335.84
208.88	335.84	209.15	335.84	210.57	335.84	211.09	335.84	211.97	335.84
212.17	335.84	213.91	335.84	214.01	335.84	214.69	335.84	214.7	335.84
216.98	335.84	217.18	335.84	219.52	335.84	219.57	335.84	220.32	335.84
220.33	335.84	220.39	335.84	220.42	335.84	220.43	335.84	221.21	335.84
221.21	349.03	221.88	348.54	221.88	348.53	221.95	348.53	222.05	348.54
223.55	348.58	223.76	348.59	224.48	348.61	225.08	348.63	225.31	348.61
225.78	348.55	226.49	348.56	226.83	348.56	226.84	348.56	227.22	348.57
227.72	348.57	228.8	348.62	229.05	348.63	230.7	348.71	230.75	348.71
230.8	348.71	231.32	348.74	231.96	348.76	232.79	348.8	233.58	348.84
234.82	348.89	235.11	348.91	235.81	348.94	236.6	348.97	237.74	349.03
238.11	349.03	238.12	349.03	239.48	349.05	239.49	349.05	240.03	349.06
240.39	349.07	240.4	349.07	240.66	349.08	241.27	349.1	241.89	349.12
242.89	349.15	243.88	349.18	245.04	349.21	245.06	349.22	246	349.24
247.05	349.28	247.31	349.28	248.28	349.31	248.42	349.32	248.45	349.32
248.51	349.32	249.09	349.34	250.76	349.39	251.94	349.41	252.25	349.41
252.26	349.41	253.62	349.43	253.89	349.43	255.3	349.46	257.82	349.5
258.22	349.5	259.69	349.54	259.86	349.54	260.46	349.55	261.52	349.57
262.07	349.56	264.26	349.52	276.23	349.29	278	349.25	281.4	349.18
287.66	349.06	293.17	348.89	296.16	348.8	296.45	348.79	298.11	348.74
299.98	348.68	299.99	348.68	301.88	348.62	308.77	348.83	322.81	349.27
325.35	349.33	325.8	349.31	329.44	349.18	336.93	348.62	346.58	348.81
347.18	348.83	350.95	349.06	351.92	349.12	352.42	349.15	353.77	349.25
353.86	349.25	353.95	349.26	354.13	349.27	354.14	349.27	354.23	349.28
354.33	349.28								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.011	196.44	.011	221.21	.011

Bank Sta: Left	Right	Coeff Contr.	Expan.
196.44	221.21	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
202.71	204.88	345.84	T
212.88	215.05	345.84	T

Upstream Embankment side slope = 3 horiz. to 1.0 vertical
Downstream Embankment side slope = 2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins = 350
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Culverts = 2

Culvert Name	Shape	Rise	Span
CULVERT#1	Box	10	8

FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet

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FHWA Scale # 1 - Inlet edges chamfered 3/4 inch
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef   Exit
Loss Coef
                  0      26     .011     .011        0                  .4                1
Upstream   Elevation =  336.36
           Centerline Station =  213.25
Downstream Elevation =  335.84
           Centerline Station =  208.88

Culvert Name     Shape      Rise    Span
CULVERT#2            Box      10       6
FHWA Chart # 8 - flared wingwalls
FHWA Scale # 3 - Wingwall flared 0 deg. (sides extended straight)
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef   Exit
Loss Coef
                  0      26     .011     .011        0                  .4                1
Number of Barrels =  2
Upstream   Elevation =  336.36
Centerline Stations
    Sta.    Sta.
  204.08  222.42
Downstream Elevation =  335.84
Centerline Stations
    Sta.    Sta.
  199.71  218.05

CULVERT OUTPUT  Profile #MAX TW 25-YR  Culv Group:  CULVERT#1

  Q Culv Group (cfs)        460.07    Culv Full Len (ft)
  # Barrels                      1    Culv Vel US (ft/s)         12.28
  Q Barrel (cfs)            460.07    Culv Vel DS (ft/s)         15.44
  E.G. US. (ft)             344.33    Culv Inv El Up (ft)       336.36
  W.S. US. (ft)             343.31    Culv Inv El Dn (ft)       335.84
  E.G. DS (ft)              342.83    Culv Frctn Ls (ft)          0.00
  W.S. DS (ft)              340.81    Culv Exit Loss (ft)         0.44
  Delta EG (ft)               1.50    Culv Entr Loss (ft)         0.94
  Delta WS (ft)               2.51    Q Weir (cfs)
  E.G. IC (ft)              344.03    Weir Sta Lft (ft)
  E.G. OC (ft)              344.32    Weir Sta Rgt (ft)
  Culvert Control           Outlet    Weir Submerg
  Culv WS Inlet (ft)        341.04    Weir Max Depth (ft)
  Culv WS Outlet (ft)       339.57    Weir Avg Depth (ft)
  Culv Nml Depth (ft)         2.33    Weir Flow Area (sq ft)
  Culv Crt Depth (ft)         4.68    Min El Weir Flow (ft)     350.00


Note:    The flow in the culvert is entirely supercritical.

CULVERT OUTPUT  Profile #MAX TW 100-YR  Culv Group:  CULVERT#1

  Q Culv Group (cfs)        562.67    Culv Full Len (ft)         26.00
  # Barrels                      1    Culv Vel US (ft/s)          7.03
```

Q Barrel (cfs)	562.67	Culv Vel DS (ft/s)	7.03
E.G. US. (ft)	349.77	Culv Inv El Up (ft)	336.36
W.S. US. (ft)	349.70	Culv Inv El Dn (ft)	335.84
E.G. DS (ft)	349.18	Culv Frctn Ls (ft)	0.02
W.S. DS (ft)	348.66	Culv Exit Loss (ft)	0.25
Delta EG (ft)	0.59	Culv Entr Loss (ft)	0.31
Delta WS (ft)	1.04	Q Weir (cfs)	256.66
E.G. IC (ft)	345.14	Weir Sta Lft (ft)	0.00
E.G. OC (ft)	349.76	Weir Sta Rgt (ft)	331.44
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	346.36	Weir Max Depth (ft)	1.76
Culv WS Outlet (ft)	345.84	Weir Avg Depth (ft)	0.68
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	109.47
Culv Crt Depth (ft)	5.36	Min El Weir Flow (ft)	350.00

CULVERT OUTPUT Profile #ANT TW 25-YR Culv Group: CULVERT#1

Q Culv Group (cfs)	460.10	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	12.28
Q Barrel (cfs)	460.10	Culv Vel DS (ft/s)	15.44
E.G. US. (ft)	344.33	Culv Inv El Up (ft)	336.36
W.S. US. (ft)	343.31	Culv Inv El Dn (ft)	335.84
E.G. DS (ft)	342.80	Culv Frctn Ls (ft)	0.02
W.S. DS (ft)	340.48	Culv Exit Loss (ft)	0.47
Delta EG (ft)	1.53	Culv Entr Loss (ft)	0.94
Delta WS (ft)	2.83	Q Weir (cfs)	
E.G. IC (ft)	344.03	Weir Sta Lft (ft)	
E.G. OC (ft)	344.32	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	341.04	Weir Max Depth (ft)	
Culv WS Outlet (ft)	339.57	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	2.33	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	4.68	Min El Weir Flow (ft)	350.00

Note: The flow in the culvert is entirely supercritical.

CULVERT OUTPUT Profile #ANT TW 100-YR Culv Group: CULVERT#1

Q Culv Group (cfs)	664.38	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	13.88
Q Barrel (cfs)	664.38	Culv Vel DS (ft/s)	16.99
E.G. US. (ft)	346.54	Culv Inv El Up (ft)	336.36
W.S. US. (ft)	345.33	Culv Inv El Dn (ft)	335.84
E.G. DS (ft)	344.73	Culv Frctn Ls (ft)	0.02
W.S. DS (ft)	341.77	Culv Exit Loss (ft)	0.48
Delta EG (ft)	1.81	Culv Entr Loss (ft)	1.20
Delta WS (ft)	3.56	Q Weir (cfs)	
E.G. IC (ft)	346.17	Weir Sta Lft (ft)	
E.G. OC (ft)	346.53	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	342.34	Weir Max Depth (ft)	
Culv WS Outlet (ft)	340.73	Weir Avg Depth (ft)	

Culv Nml Depth (ft)	3.03	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	5.98	Min El Weir Flow (ft)	350.00

Note: The flow in the culvert is entirely supercritical.

CULVERT OUTPUT Profile #GRV TW 25-YR Culv Group: CULVERT#1

Q Culv Group (cfs)	460.10	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	12.28
Q Barrel (cfs)	460.10	Culv Vel DS (ft/s)	15.44
E.G. US. (ft)	344.33	Culv Inv El Up (ft)	336.36
W.S. US. (ft)	343.31	Culv Inv El Dn (ft)	335.84
E.G. DS (ft)	342.80	Culv Frctn Ls (ft)	0.02
W.S. DS (ft)	340.48	Culv Exit Loss (ft)	0.47
Delta EG (ft)	1.53	Culv Entr Loss (ft)	0.94
Delta WS (ft)	2.83	Q Weir (cfs)	
E.G. IC (ft)	344.03	Weir Sta Lft (ft)	
E.G. OC (ft)	344.32	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	341.04	Weir Max Depth (ft)	
Culv WS Outlet (ft)	339.57	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	2.33	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	4.68	Min El Weir Flow (ft)	350.00

Note: The flow in the culvert is entirely supercritical.

CULVERT OUTPUT Profile #GRV TW 100-YR Culv Group: CULVERT#1

Q Culv Group (cfs)	664.38	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	13.88
Q Barrel (cfs)	664.38	Culv Vel DS (ft/s)	16.99
E.G. US. (ft)	346.54	Culv Inv El Up (ft)	336.36
W.S. US. (ft)	345.33	Culv Inv El Dn (ft)	335.84
E.G. DS (ft)	344.73	Culv Frctn Ls (ft)	0.02
W.S. DS (ft)	341.77	Culv Exit Loss (ft)	0.48
Delta EG (ft)	1.81	Culv Entr Loss (ft)	1.20
Delta WS (ft)	3.56	Q Weir (cfs)	
E.G. IC (ft)	346.17	Weir Sta Lft (ft)	
E.G. OC (ft)	346.53	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	342.34	Weir Max Depth (ft)	
Culv WS Outlet (ft)	340.73	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	3.03	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	5.98	Min El Weir Flow (ft)	350.00

Note: The flow in the culvert is entirely supercritical.

CULVERT OUTPUT Profile #MAX TW 25-YR Culv Group: CULVERT#2

Q Culv Group (cfs)	691.68	Culv Full Len (ft)	
# Barrels	2	Culv Vel US (ft/s)	12.29

Q Barrel (cfs)	345.84	Culv Vel DS (ft/s)	15.34
E.G. US. (ft)	344.33	Culv Inv El Up (ft)	336.36
W.S. US. (ft)	343.31	Culv Inv El Dn (ft)	335.84
E.G. DS (ft)	342.83	Culv Frctn Ls (ft)	0.00
W.S. DS (ft)	340.81	Culv Exit Loss (ft)	0.42
Delta EG (ft)	1.50	Culv Entr Loss (ft)	0.94
Delta WS (ft)	2.51	Q Weir (cfs)	
E.G. IC (ft)	344.25	Weir Sta Lft (ft)	
E.G. OC (ft)	344.34	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	341.05	Weir Max Depth (ft)	
Culv WS Outlet (ft)	339.60	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	2.46	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	4.69	Min El Weir Flow (ft)	350.00

Note: The flow in the culvert is entirely supercritical.

CULVERT OUTPUT Profile #MAX TW 100-YR Culv Group: CULVERT#2

Q Culv Group (cfs)	843.55	Culv Full Len (ft)	26.00
# Barrels	2	Culv Vel US (ft/s)	7.03
Q Barrel (cfs)	421.78	Culv Vel DS (ft/s)	7.03
E.G. US. (ft)	349.77	Culv Inv El Up (ft)	336.36
W.S. US. (ft)	349.70	Culv Inv El Dn (ft)	335.84
E.G. DS (ft)	349.18	Culv Frctn Ls (ft)	0.03
W.S. DS (ft)	348.66	Culv Exit Loss (ft)	0.25
Delta EG (ft)	0.59	Culv Entr Loss (ft)	0.31
Delta WS (ft)	1.04	Q Weir (cfs)	256.66
E.G. IC (ft)	345.40	Weir Sta Lft (ft)	0.00
E.G. OC (ft)	349.77	Weir Sta Rgt (ft)	331.44
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	346.36	Weir Max Depth (ft)	1.76
Culv WS Outlet (ft)	345.84	Weir Avg Depth (ft)	0.68
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	109.47
Culv Crt Depth (ft)	5.36	Min El Weir Flow (ft)	350.00

CULVERT OUTPUT Profile #ANT TW 25-YR Culv Group: CULVERT#2

Q Culv Group (cfs)	691.65	Culv Full Len (ft)	
# Barrels	2	Culv Vel US (ft/s)	12.29
Q Barrel (cfs)	345.83	Culv Vel DS (ft/s)	15.34
E.G. US. (ft)	344.33	Culv Inv El Up (ft)	336.36
W.S. US. (ft)	343.31	Culv Inv El Dn (ft)	335.84
E.G. DS (ft)	342.80	Culv Frctn Ls (ft)	0.03
W.S. DS (ft)	340.48	Culv Exit Loss (ft)	0.46
Delta EG (ft)	1.53	Culv Entr Loss (ft)	0.94
Delta WS (ft)	2.83	Q Weir (cfs)	
E.G. IC (ft)	344.25	Weir Sta Lft (ft)	
E.G. OC (ft)	344.34	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	341.05	Weir Max Depth (ft)	
Culv WS Outlet (ft)	339.60	Weir Avg Depth (ft)	

Culv Nml Depth (ft)	2.46	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	4.69	Min El Weir Flow (ft)	350.00

Note: The flow in the culvert is entirely supercritical.

CULVERT OUTPUT Profile #ANT TW 100-YR Culv Group: CULVERT#2

Q Culv Group (cfs)	998.51	Culv Full Len (ft)	
# Barrels	2	Culv Vel US (ft/s)	13.89
Q Barrel (cfs)	499.26	Culv Vel DS (ft/s)	16.88
E.G. US. (ft)	346.54	Culv Inv El Up (ft)	336.36
W.S. US. (ft)	345.33	Culv Inv El Dn (ft)	335.84
E.G. DS (ft)	344.73	Culv Frctn Ls (ft)	0.03
W.S. DS (ft)	341.77	Culv Exit Loss (ft)	0.47
Delta EG (ft)	1.81	Culv Entr Loss (ft)	1.20
Delta WS (ft)	3.56	Q Weir (cfs)	
E.G. IC (ft)	346.51	Weir Sta Lft (ft)	
E.G. OC (ft)	346.55	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	342.35	Weir Max Depth (ft)	
Culv WS Outlet (ft)	340.77	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	3.24	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	5.99	Min El Weir Flow (ft)	350.00

Note: The flow in the culvert is entirely supercritical.

CULVERT OUTPUT Profile #GRV TW 25-YR Culv Group: CULVERT#2

Q Culv Group (cfs)	691.65	Culv Full Len (ft)	
# Barrels	2	Culv Vel US (ft/s)	12.29
Q Barrel (cfs)	345.83	Culv Vel DS (ft/s)	15.34
E.G. US. (ft)	344.33	Culv Inv El Up (ft)	336.36
W.S. US. (ft)	343.31	Culv Inv El Dn (ft)	335.84
E.G. DS (ft)	342.80	Culv Frctn Ls (ft)	0.03
W.S. DS (ft)	340.48	Culv Exit Loss (ft)	0.46
Delta EG (ft)	1.53	Culv Entr Loss (ft)	0.94
Delta WS (ft)	2.83	Q Weir (cfs)	
E.G. IC (ft)	344.25	Weir Sta Lft (ft)	
E.G. OC (ft)	344.34	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	341.05	Weir Max Depth (ft)	
Culv WS Outlet (ft)	339.60	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	2.46	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	4.69	Min El Weir Flow (ft)	350.00

Note: The flow in the culvert is entirely supercritical.

CULVERT OUTPUT Profile #GRV TW 100-YR Culv Group: CULVERT#2

Q Culv Group (cfs)	998.51	Culv Full Len (ft)	
# Barrels	2	Culv Vel US (ft/s)	13.89

Q Barrel (cfs)	499.26	Culv Vel DS (ft/s)	16.88
E.G. US. (ft)	346.54	Culv Inv El Up (ft)	336.36
W.S. US. (ft)	345.33	Culv Inv El Dn (ft)	335.84
E.G. DS (ft)	344.73	Culv Frctn Ls (ft)	0.03
W.S. DS (ft)	341.77	Culv Exit Loss (ft)	0.47
Delta EG (ft)	1.81	Culv Entr Loss (ft)	1.20
Delta WS (ft)	3.56	Q Weir (cfs)	
E.G. IC (ft)	346.51	Weir Sta Lft (ft)	
E.G. OC (ft)	346.55	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	342.35	Weir Max Depth (ft)	
Culv WS Outlet (ft)	340.77	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	3.24	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	5.99	Min El Weir Flow (ft)	350.00

Note: The flow in the culvert is entirely supercritical.

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel RS: 7

INPUT
Description:
Station Elevation Data num= 286

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	349.24	.1	349.24	.19	349.23	.56	349.21	2.35	349.11
11.22	348.67	13.87	348.53	16.49	348.4	18.01	348.8	21.34	348.87
32.44	347.94	33.12	348.44	40.54	348.23	51.49	347.93	52.51	347.9
55.48	347.86	56.27	347.84	66.99	347.69	75.71	347.56	76.42	347.54
78.31	347.52	80.2	347.75	81.81	347.96	81.82	347.96	82.76	348.07
89.1	348.73	90.32	348.85	93.71	349.06	94.7	349.12	96.05	349.14
98.87	349.18	100.74	349.2	100.98	349.2	102.62	349.23	112.41	349.24
118.17	349.25	123.88	349.27	125.19	349.26	127.45	349.24	130.23	349.22
131.61	349.22	132.43	349.21	133.02	349.21	133.91	349.2	136.43	349.18
137.54	349.18	137.63	349.18	137.75	349.17	139.74	349.16	141.4	349.15
141.68	349.15	141.89	349.15	143.28	349.14	144.77	349.13	144.9	349.13
145.07	349.13	146.16	349.12	146.17	349.12	146.63	349.12	147.7	349.11
147.71	349.11	148.32	349.11	148.61	349.1	149.56	349.1	149.93	349.1
150.05	349.09	151.05	349.09	151.41	349.09	151.96	349.08	153.55	349.07
153.65	349.07	153.72	349.07	154.33	349.07	154.75	349.06	155.27	349.06
155.61	349.06	155.62	349.06	156.43	349.05	158.3	349.04	158.86	349.04
159	349.04	161.38	349.01	161.54	349.01	162.05	349	163.67	348.96
164.05	348.96	164.76	348.94	165.15	348.94	165.49	348.93	166.34	348.91
167.91	348.88	168.15	348.88	168.84	348.86	168.85	348.86	168.99	348.86
169.01	348.86	171.14	348.82	171.34	348.81	171.57	348.81	171.77	348.81
174.12	348.76	174.3	348.76	174.53	348.75	174.59	348.75	175.01	348.74
176.01	348.72	176.02	348.72	176.09	348.72	176.12	348.72	176.14	348.72
176.15	348.72	176.37	348.71	176.38	348.71	176.67	348.71	178.02	348.68
178.49	348.68	178.69	348.67	179.73	348.66	183.19	348.61	184.8	348.59
185.18	348.58	186.13	348.57	186.42	348.57	186.44	348.57	188.04	348.56
189.65	348.55	194.03	348.53	194.81	348.53	195.59	348.53	195.88	348.53

195.88	348.54	196.44	348.95	196.55	349.03	196.55	335.84	196.57	335.84
196.69	335.84	196.71	335.84	196.78	335.84	196.79	335.84	196.8	335.84
196.82	335.84	196.85	335.84	196.86	335.84	196.87	335.84	196.88	335.84
196.9	335.84	196.91	335.84	196.92	335.84	196.94	335.84	199.68	335.84
199.69	335.84	199.89	335.84	200.01	335.84	201.89	335.84	202.55	335.84
202.57	335.84	203.21	335.84	203.48	335.84	204.42	335.84	204.44	335.84
204.84	335.84	205.35	335.84	206.23	335.84	206.88	335.84	206.94	335.84
207.1	335.84	207.25	335.84	207.88	335.84	208.2	335.84	208.87	335.84
208.88	335.84	209.15	335.84	210.57	335.84	211.09	335.84	211.97	335.84
212.17	335.84	213.91	335.84	214.01	335.84	214.69	335.84	214.7	335.84
216.98	335.84	217.18	335.84	219.52	335.84	219.57	335.84	220.32	335.84
220.33	335.84	220.39	335.84	220.42	335.84	220.43	335.84	221.21	335.84
221.21	349.03	221.88	348.54	221.88	348.53	221.95	348.53	222.05	348.54
223.55	348.58	223.76	348.59	224.48	348.61	225.08	348.63	225.31	348.61
225.78	348.55	226.49	348.56	226.83	348.56	226.84	348.56	227.22	348.57
227.72	348.57	228.8	348.62	229.05	348.63	230.7	348.71	230.75	348.71
230.8	348.71	231.32	348.74	231.96	348.76	232.79	348.8	233.58	348.84
234.82	348.89	235.11	348.91	235.81	348.94	236.6	348.97	237.74	349.03
238.11	349.03	238.12	349.03	239.48	349.05	239.49	349.05	240.03	349.06
240.39	349.07	240.4	349.07	240.66	349.08	241.27	349.1	241.89	349.12
242.89	349.15	243.88	349.18	245.04	349.21	245.06	349.22	246	349.24
247.05	349.28	247.31	349.28	248.28	349.31	248.42	349.32	248.45	349.32
248.51	349.32	249.09	349.34	250.76	349.39	251.94	349.41	252.25	349.41
252.26	349.41	253.62	349.43	253.89	349.43	255.3	349.46	257.82	349.5
258.22	349.5	259.69	349.54	259.86	349.54	260.46	349.55	261.52	349.57
262.07	349.56	264.26	349.52	276.23	349.29	278	349.25	281.4	349.18
287.66	349.06	293.17	348.89	296.16	348.8	296.45	348.79	298.11	348.74
299.98	348.68	299.99	348.68	301.88	348.62	308.77	348.83	322.81	349.27
325.35	349.33	325.8	349.31	329.44	349.18	336.93	348.62	346.58	348.81
347.18	348.83	350.95	349.06	351.92	349.12	352.42	349.15	353.77	349.25
353.86	349.25	353.95	349.26	354.13	349.27	354.14	349.27	354.23	349.28
354.33	349.28								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.011	196.44	.011	221.21	.011

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
196.44	221.21	26.79	26.79	26.79	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
202.71	204.88	345.84	T
212.88	215.05	345.84	T

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel RS: 6

INPUT
Description:
Station Elevation Data num= 303

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

13.35	349.02	20.2	348.9	48.88	348.39	49.24	348.38	56.26	348.19
56.69	348.17	59.47	348.13	59.93	348.13	67.5	347.95	68.04	347.94
71.22	347.85	71.23	347.85	71.24	347.85	71.25	347.85	71.26	347.85
71.27	347.85	77.21	347.67	86.87	347.38	87.54	347.36	88.6	347.45
89.04	347.49	89.73	347.55	98.41	347.21	99.16	347.18	107.04	346.27
107.88	346.17	111.61	345.86	111.62	345.86	112.71	345.76	113.6	345.69
121.84	345.07	124.28	344.89	125.25	344.81	137.06	344.18	137.07	344.18
137.08	344.18	137.8	344.14	140.06	344.02	141.79	343.93	143.25	343.85
145.26	343.74	145.27	343.74	145.78	343.72	147.86	343.6	149.76	343.52
150.19	343.51	151.38	343.47	152.09	343.37	153.62	343.17	153.74	343.15
153.92	343.13	154.69	343.03	156.41	342.86	156.51	342.85	157.63	342.84
157.76	342.84	157.77	342.84	158.38	342.84	159.64	342.86	161.74	342.88
161.75	342.88	162.98	342.9	163.07	342.9	163.15	342.9	164.36	342.91
164.44	342.91	165.26	342.87	165.27	342.87	165.73	342.84	166.06	342.83
167.24	342.76	168.91	342.71	169.69	342.69	169.7	342.69	170.09	342.68
173.25	342.58	173.67	342.54	174.13	342.49	177.13	342.17	177.41	342.14
177.95	342.08	177.96	342.08	178.35	342.04	178.83	341.99	179.47	341.97
180.46	341.94	180.59	341.94	180.9	341.93	181.89	341.86	183.49	340.81
184.07	340.81	184.08	340.43	185.05	339.8	185.56	339.46	185.95	339.21
186.59	338.79	186.6	338.78	186.61	338.78	187.1	338.46	187.31	338.33
187.31	338.32	188.2	337.74	188.21	337.73	188.22	337.73	188.72	337.41
188.98	337.23	188.99	337.23	190.06	336.53	190.38	336.32	190.63	336.16
190.95	335.95	191.47	335.61	191.91	335.32	191.94	335.31	191.94	335.64
192.19	335.64	192.46	335.64	192.61	335.64	192.61	335.31	192.9	335.31
192.91	335.31	192.94	335.31	193.72	335.31	193.96	335.31	194.35	335.31
194.36	335.31	195.28	335.31	195.48	335.31	195.82	335.31	196.42	335.31
196.64	335.31	196.77	335.31	197.33	335.31	197.6	335.31	199.7	335.31
200.17	335.31	200.26	335.31	200.3	335.31	200.84	335.31	203.68	335.31
203.71	335.31	203.72	335.31	204.43	335.31	204.56	335.31	207.68	335.31
208.79	335.31	208.8	335.31	209.67	335.31	210.75	335.31	211.92	335.31
212.86	335.31	213.22	335.31	213.23	335.31	214.84	335.31	215.42	335.31
215.52	335.31	216.19	335.31	216.94	335.31	217.27	335.31	217.27	335.64
217.58	335.64	217.69	335.64	217.94	335.64	217.94	335.31	217.95	335.31
217.99	335.33	219.33	336.07	219.83	336.35	220.09	336.5	222.12	337.62
222.21	337.67	222.22	337.67	223.32	338.28	223.98	338.65	225.41	339.44
225.42	339.45	226.31	339.94	226.67	340.14	227.68	340.7	228.05	340.9
228.68	341.25	229.21	341.55	229.5	341.71	229.63	341.78	229.66	341.8
229.67	341.8	230.76	342.41	231.06	342.57	231.16	342.63	231.17	342.63
231.18	342.63	232.32	343.27	232.67	343.46	233.18	343.75	234.17	344.29
234.42	344.43	234.43	344.44	235.67	345.12	236	345.3	236.13	345.38
236.24	345.44	237.16	345.61	237.77	345.7	237.78	345.71	237.78	345.72
237.8	345.72	237.81	345.72	237.85	345.73	238.3	345.81	239.54	346.03
240.3	346.08	240.59	346.1	240.95	346.12	243.34	346.27	243.35	346.27
245.02	346.38	245.4	346.4	245.41	346.4	247.26	346.52	247.96	346.57
249.34	346.65	250.61	346.74	250.67	346.74	251.86	346.82	253.58	346.93
253.95	346.95	254.65	346.99	254.68	347	255.7	347.08	256.64	347.16
258.37	347.18	258.38	347.18	259.28	347.2	260.23	347.21	261.85	347.24
261.86	347.24	263.92	347.27	264.96	347.28	266.22	347.3	267.34	347.32
268.27	347.33	269.46	347.38	270.02	347.4	270.03	347.4	270.95	347.44
272.93	347.51	274.99	347.59	275	347.59	275.15	347.6	277.27	347.68
279.18	347.75	279.87	347.78	279.96	347.78	279.97	347.78	280.54	347.81
280.55	347.81	284.36	347.95	284.37	347.96	285.46	348	286.07	348.02
286.08	348.02	286.67	348.05	290.26	348.19	291.62	348.24	293.74	348.32
294.23	348.34	297.17	348.46	299.27	348.54	301.56	348.63	301.71	348.63

302.17	348.64	302.67	348.66	305.93	348.74	308.13	348.8	308.14	348.8
308.17	348.8	308.18	348.8	308.2	348.8	308.21	348.8	310.4	348.86
310.77	348.87	311.24	348.88	313.71	348.94	313.72	348.94	313.88	348.95
314	348.95	314.07	348.95	314.13	348.95	322.26	349.16	324.72	349.23
331.15	349.52	336.79	349.64	343.5	349.78	343.51	349.78	354.39	350
357.09	350.06	371.11	350.92	372.22	350.99	372.46	351.01	372.59	351.02
372.73	351.02	372.82	351.03	372.92	351.04				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
13.35	.035	191.91	.026	217.99	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
191.91	217.99	91.04	35.85	21.93	.1	.3

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel RS: 5

INPUT
Description:
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	348.42	.1	348.41	2.51	348.11	19.53	342.8	48.43	331.83
48.85	331.69	49.1	331.58	49.58	331.48	62.54	328.84	74.88	322.65
75.15	322.48	89.44	322.57	89.79	323.83	90.93	324.49	125.66	345.66
130.5	346.31	130.6	346.32						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	2.51	.026	125.66	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
2.51	125.66	70.97	79.09	147.51	.1	.3

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel RS: 4

INPUT
Description:
Station Elevation Data num= 43

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	349.37	.1	349.37	.2	349.37	.3	349.37	7.04	349.36
12.49	348.65	32.58	345.54	46.06	342.81	51.54	341.78	76.81	335.22
91.12	331.18	102.95	326.07	113.17	321.42	113.17	321.41	118.79	316.34
120.58	316.3	127.18	318.26	141.7	322.87	144.82	325.06	144.83	325.06
148.35	324.87	148.36	324.87	161.53	333.11	161.53	333.12	161.54	333.12
164.65	334.74	164.65	334.75	170.23	336.04	185.07	338.11	197.22	340.05
203.52	341.21	223.98	344.86	227.49	345.1	228.37	345.16	243.94	347.4

243.95	347.4	254.35	348.54	256.21	349.37	263.91	349.37	263.92	352.81
269.46	352.67	269.56	352.67	269.66	352.67				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	7.04	.026	263.91	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
7.04	263.91	54.16	63.01	122.53	.1	.3

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel RS: 3

INPUT
Description:
Station Elevation Data num= 37

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	349.26	.1	349.26	.37	349.26	.65	349.25	18.19	348.91
19.84	349.02	26.2	349.21	26.21	349.21	35.17	348.85	44.02	347.94
44.03	347.94	47.58	347.57	54.22	346.47	71.38	342.15	79.42	340.13
86.43	339.03	87.82	338.82	97.37	337.33	104.41	335.78	105.6	335.65
112.29	334.96	113.28	334.86	114.13	334.45	134.37	322.84	135.31	322.3
135.83	322.21	143.74	317.91	147.53	314.97	170.29	331.97	182.79	341.07
191.22	342.27	205.75	343.87	207.01	344.98	211.1	345.57	211.38	345.61
211.65	345.65	211.75	345.67						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	113.28	.026	182.79	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
113.28	182.79	37.13	64.73	76.92	.1	.3

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel RS: 2

INPUT
Description:
Station Elevation Data num= 45

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	348.69	.2	348.69	.3	348.68	1.37	348.65	1.38	348.65
5.54	348.5	15.86	348.12	18.18	347.6	20.14	346.5	29.84	342.51
44.32	336.54	46.27	335.74	50.12	334.15	60.95	329.11	63.12	328.11
68.47	325.53	68.47	325.52	68.87	325.33	69.59	324.98	71.65	323.99
75.14	323.27	81.22	322.31	81.49	322.15	88.83	318.04	89.84	317.47
90.27	317.23	91.26	317.39	97.45	314.67	114.25	324.78	123.82	330.55
126.73	332.3	129.64	334.05	129.65	334.06	130.89	334.8	130.89	334.81
130.9	334.81	132.02	335.48	132.5	335.77	133.46	336.55	134.36	336.73

135.93	337.04	141.55	338.18	163.22	342.52	163.32	342.56	163.42	342.58

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	15.86	.026	163.22	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
15.86	163.22	96.24	79.9	64.17	.1	.3

CROSS SECTION

RIVER: Proposed Channel
REACH: Proposed Channel RS: 1

INPUT
Description:
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	322.59	.1	322.62	.2	322.65	.3	322.68	3.34	322.69
3.35	321.71	7.81	319.37	16.49	314.38	21.82	320.2	31.39	320.2
40.78	325.45	50.68	330.32	50.68	330.33	56.59	331.62	59.94	332.36
79.91	334.36	80.01	334.37	80.11	334.38	80.21	334.39	80.31	334.4

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	3.34	.026	31.39	.035

Bank Sta: Left	Right	Coeff Contr.	Expan.
3.34	31.39	.1	.3

SUMMARY OF MANNING'S N VALUES

River:Proposed Channel

Reach	River Sta.	n1	n2	n3
Proposed Channel	39	.035	.026	.035
Proposed Channel	38	.035	.026	.035
Proposed Channel	37	.035	.026	.035
Proposed Channel	36	.035	.026	.035
Proposed Channel	35	.035	.026	.035
Proposed Channel	34	.035	.026	.035
Proposed Channel	33	.035	.026	.035
Proposed Channel	32	.035	.026	.035
Proposed Channel	31	.035	.026	.035
Proposed Channel	30	.035	.026	.035
Proposed Channel	29	.035	.026	.035
Proposed Channel	28	.035	.026	.035
Proposed Channel	27	.035	.026	.035
Proposed Channel	26	.035	.026	.035
Proposed Channel	25	.035	.026	.035

Proposed Channel	24	.035	.026	.035
Proposed Channel	23	.035	.026	.035
Proposed Channel	22	.035	.026	.035
Proposed Channel	21	.035	.026	.035
Proposed Channel	20	.035	.026	.035
Proposed Channel	19	.035	.026	.035
Proposed Channel	18	.035	.026	.035
Proposed Channel	17	.035	.026	.035
Proposed Channel	16	.035	.026	.035
Proposed Channel	15	.035	.026	.035
Proposed Channel	14	.035	.026	.035
Proposed Channel	13	.035	.026	.035
Proposed Channel	12	.035	.026	.035
Proposed Channel	11	.035	.026	.035
Proposed Channel	10	.035	.026	.035
Proposed Channel	9	.035	.011	.035
Proposed Channel	8	.011	.011	.011
Proposed Channel	7.5	Culvert		
Proposed Channel	7	.011	.011	.011
Proposed Channel	6	.035	.026	.035
Proposed Channel	5	.035	.026	.035
Proposed Channel	4	.035	.026	.035
Proposed Channel	3	.035	.026	.035
Proposed Channel	2	.035	.026	.035
Proposed Channel	1	.035	.026	.035

SUMMARY OF REACH LENGTHS

River: Proposed Channel

Reach	River Sta.	Left	Channel	Right
Proposed Channel	39	145.12	144.81	144.93
Proposed Channel	38	200	200	200
Proposed Channel	37	200	200	200
Proposed Channel	36	200	200	200
Proposed Channel	35	200	200	200
Proposed Channel	34	200	200	200
Proposed Channel	33	200	200	200
Proposed Channel	32	210.32	198.97	186.62
Proposed Channel	31	148.65	159.48	174.49
Proposed Channel	30	203.91	215.5	230.32
Proposed Channel	29	224.36	224.72	224.36
Proposed Channel	28	199.82	197.88	198.18
Proposed Channel	27	200.46	198.55	198.87
Proposed Channel	26	199.32	197.75	200.13
Proposed Channel	25	168.67	167.76	167.64
Proposed Channel	24	213	204.72	192.9
Proposed Channel	23	180.58	180.39	178.93
Proposed Channel	22	144.57	143.8	144.85
Proposed Channel	21	137.33	145.29	153.36

Proposed Channel	20	164.3	152.27	149.67
Proposed Channel	19	125.2	136.45	142.49
Proposed Channel	18	98.1	92.44	88.69
Proposed Channel	17	107.38	99.59	92.13
Proposed Channel	16	32.36	29.69	29.39
Proposed Channel	15	29.84	29.08	29.9
Proposed Channel	14	58.57	59.23	59.39
Proposed Channel	13	71.67	74.84	71.63
Proposed Channel	12	105.29	105.72	114.8
Proposed Channel	11	96.08	103.13	116.02
Proposed Channel	10	101.74	100.81	109.13
Proposed Channel	9	40.29	34.96	40.34
Proposed Channel	8	26	26	26
Proposed Channel	7.5	Culvert		
Proposed Channel	7	26.79	26.79	26.79
Proposed Channel	6	91.04	35.85	21.93
Proposed Channel	5	70.97	79.09	147.51
Proposed Channel	4	54.16	63.01	122.53
Proposed Channel	3	37.13	64.73	76.92
Proposed Channel	2	96.24	79.9	64.17
Proposed Channel	1			

III.

APPENDIX A

FEMA FLOOD INSURANCE MAP & STUDY

NOTES TO USERS

This 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. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures.** Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures in this jurisdiction.

The **projection** used in the preparation of this map was State Plane Central zone (FIPS zone 4203). The **horizontal datum** was NAD 83, GRS80 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

Spatial Reference System Division
National Geodetic Survey, NOAA
Silver Spring Metro Center
1315 East-West Highway
Silver Spring, Maryland 20910
(301) 713-3191

To obtain current elevation, description, and/or location information about the **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at www.ngs.noaa.gov.

Base map information shown on this FIRM was provided in digital format by Texas Department of Transportation. This information was digitized from USGS 7.5 minute quadrangle maps at a scale of 1:15840.

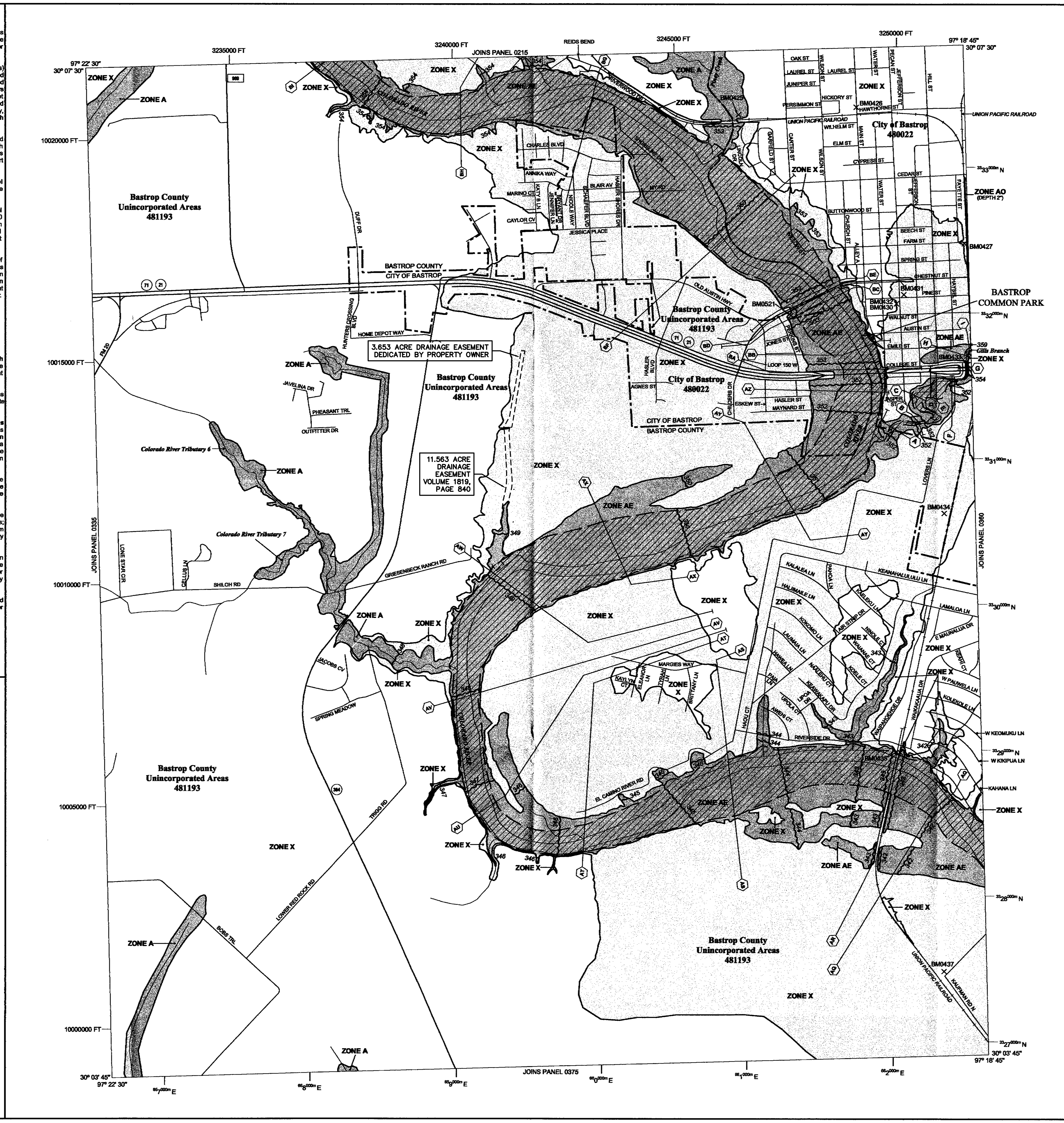
This map reflects more detailed up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and their website at www.fema.gov/msc.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1- 877- FEMA MAP** (1-877-336-2627) or visit the FEMA website at www.fema.gov.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

	Floodplain boundary
	Floodway boundary
	Zone D boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
~~ 513 ~~~	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

(A)———(A)	Cross section line
(23)- - - - -(23)	Transect line
45° 02' 08", 93° 02' 12"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
498900 FT	5000-foot grid ticks: Texas State Plane coordinate system, Central zone (FIPS Zone 4203), Transverse Mercator Projection
4689000m N	1000-meter Universal Transverse Mercator grid values, zone 14
ML5510 X	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

MAP REPOSITORIES
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP

August 19, 1991

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

December 8, 1998 - to change Base Flood Elevations, to add Base Flood Elevations, to change Special Flood Hazard Areas, and to change zone designations.
January 19, 2006 - to decrease Base Flood Elevations, toadd Base Flood Elevations, floodway, roads and road names; to change Special Flood Hazard Areas, floodway and zone designations; to update corporate limits; to incorporate previously issued Letters of Map Revision; and to reflect updated topographic information.

For Community map revision history prior to countywide mapping, refer to the community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET
300 0 300 600 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0355E

FIRM
FLOOD INSURANCE RATE MAP

BASTROP COUNTY, TEXAS
AND INCORPORATED AREAS

PANEL 355 OF 625

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BASTROP, CITY OF	480022	0355	E
BASTROP COUNTY	481193	0355	E

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

MAP NUMBER
48021C0355E

MAP REVISED
JANUARY 19, 2006

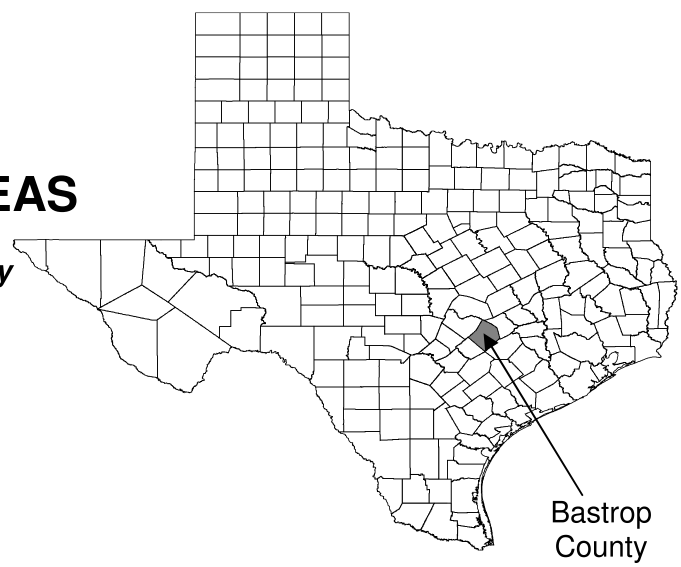
Federal Emergency Management Agency

FLOOD INSURANCE STUDY

BASTROP COUNTY, TEXAS

AND INCORPORATED AREAS

Community Name	*Community Number*
BASTROP, CITY OF	480022
BASTROP COUNTY (UNINCORPORATED AREAS)	481193
ELGIN, CITY OF	480023
SMITHVILLE, CITY OF	480024



Revised: January 6, 2016

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER

48021CV000B

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) report may not contain all data available within the Community Map Repository. Please contact the Community Map Repository for any additional data.

The Federal Emergency Management Agency (FEMA) may revise and republish part or all of this FIS report at any time. In addition, FEMA may revise part of this FIS report by the Letter of Map Revision process, which does not involve republication or redistribution of the FIS report. Therefore, users should consult with community officials and check the Community Map Repository to obtain the most current FIS report components.

This FIS report was revised on January 6, 2016. Users should refer to Section 10.0, Revisions Description, for further information. Section 10.0 is intended to present the most up-to-date information for specific portions of this FIS report. Therefore, users of this report should be aware that the information presented in Section 10.0 supersedes information in Sections 1.0 through 9.0 of this FIS report.

Initial Countywide FIS Effective Date: August 19, 1991

Revised Countywide FIS Date(s): December 8, 1998
January 19, 2006
January 6, 2016

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FLOOD INSURANCE STUDY
BASTROP COUNTY AND INCORPORATED AREAS, TEXAS

1.0 INTRODUCTION

1.1 Purpose of Study

This countywide-format Flood Insurance Study investigates the existence and severity of flood hazards in, or revises previous Flood Insurance Studies/Flood Insurance Rate Maps for the geographic area of Bastrop County, Texas, including: the Cities of Bastrop, Elgin, and Smithville; and the unincorporated areas of Bastrop County (hereinafter referred to collectively as Bastrop County). This study aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound floodplain management. This information will also be used by Bastrop County to update existing floodplain regulations as part of the regular phase of the National Flood Insurance Program (NFIP). Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for Cedar Creek, Gills Branch, and the Colorado River were prepared by Lockwood, Andrews & Newnam, Inc. for the Federal Emergency Management Agency (FEMA), under Contract No. EMT-87-C-0156. This work was completed in July 1989. The hydrologic and hydraulic analyses for Dry Creek South were taken from the Flood Insurance Study for the unincorporated areas of Travis County.

1.3 Coordination

On October 9, 1986, an Initial Consultation Coordination Officer's (CCO) meeting was held with representatives of FEMA, the City of Bastrop, Bastrop County, and Lockwood, Andrews & Newnam, Inc. (the study contractor) to identify the streams to be studied by detailed methods.

On August 27, 1990, a final CCO meeting was with representatives of FEMA, the communities, and the study contractor to review the results of the study.

2.0 AREA STUDIED

2.1 Scope of Study

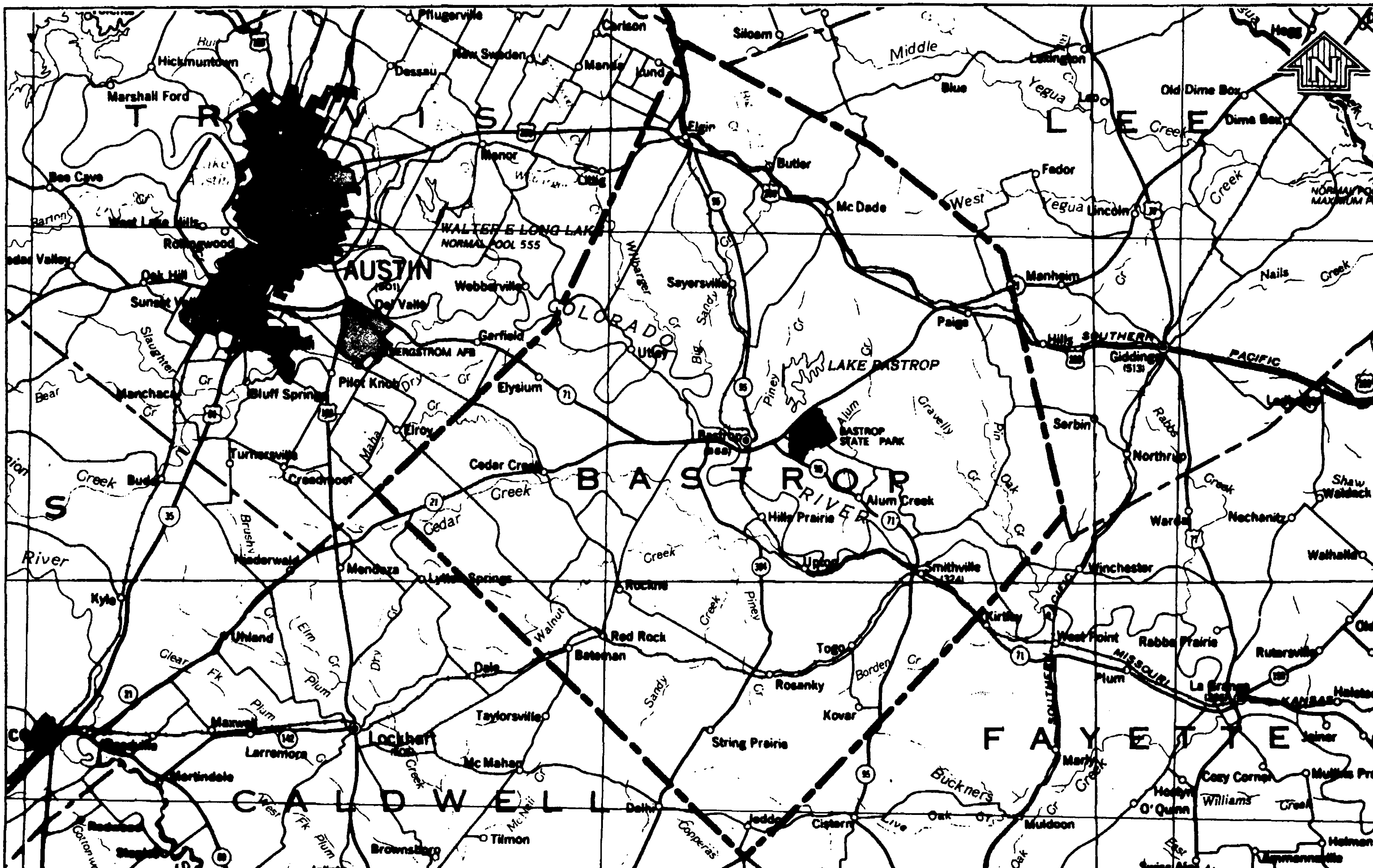
This Flood Insurance Study covers the geographic area of Bastrop County, Texas. The area of study is shown on the Vicinity Map (Figure 1).

The following tabulation shows the limits of study for the streams studied by detailed methods.

Stream	Limits of Detailed Study
Colorado River	From approximately 4.2 miles downstream of the Kansas-Missouri-Texas Railroad to a point approximately 9.5 miles upstream of Loop 150
Gills Branch	From its confluence with the Colorado River to a point just downstream of State Route 95
Cedar Creek	From approximately 1.1 miles downstream of FM 535 to a point approximately 3.7 miles upstream of FM 535
Dry Creek South	From a point approximately 2.0 miles upstream of the confluence with the Colorado River to a point approximately 3.6 miles upstream of the confluence with the Colorado River.

The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction through July 1994.

All or portions of the following flooding sources were studied by approximate methods: Long Hollow, Lytton Spring Creek, Maha Creek, Cottonwood Creek, Red Gully Creek, Moss Creek, Dry Creek, Coleman Branch, Wilbargers Creek, Little Sandy Creek, Elm Creek, Dogwood Creek, Burlson Creek, Big Sandy Creek, Lytton Creek, Walnut Creek, Town Creek, Little Alum Creek, Alum Creek, Cedar Hollow Creek, Habbs Creek, Long Branch, Lake Bastrop, McLaughlin Creek, Piney Creek, West Yegua Creek, Rocky Creek, Paint Creek, Marshy Branch, Upper Elm



FEDERAL EMERGENCY MANAGEMENT AGENCY	APPROXIMATE SCALE
BASTROP COUNTY, TX AND INCORPORATED AREAS	8 0 8 16 24 MILES
	VICINITY MAP

FIGURE 1

Creek, Lower Elm Creek, Brushy Creek, Sandy Creek, Lentz Branch, Waterhole Branch, Little Piney Creek, Copperas Creek, Pigeonroost Hollow, Reeds Creek, Mill Creek, Line Creek, Wolf Creek, Puss Hollow, JD Creek, Hunt Brook, Price Creek, West Fork Gravelly Creek, East Fork Gravelly Creek, Sprawling Branch, Pin Oak Creek, Spring Creek, Bluff Creek, Orts Branch, Little Copperas Creek, Peach Creek, Rocky Creek, Hickory Creek, Bartons Creek, Buckners Creek, Pricklypear Creek, Gazley Creek, Willow Creek, Lake Creek, Stagners Lake, Shipps Lake, Gravelly Creek, Grassy Creek, Alum Branch, Little Pin Oak Creek, Dreissner Branch, Long Prairie Branch, Live Oak Branch, Spicey Creek, Trigg Lake, Bee Creek, Buescher Lake, Turner Creek, the Colorado River, and Cedar Creek.

2.2 Community Description

Bastrop County is located in central Texas, approximately 30 miles southeast of the City of Austin. It is bordered by Lee County to the east, Fayette County to the southeast, Caldwell County to the southwest, Travis County to the Northwest, and Williamson County to the North.

Bastrop County is primarily an agricultural community with a population of approximately 24,726. The City of Bastrop is the county seat and has a population of approximately 3,789 (Reference 1). Recent development in both communities is mainly residential in nature.

The physical features of the county include rolling hills, alluvial and sandy loam soils, and the Colorado River bisecting the county. The City of Bastrop is located on the eastern bank of the Colorado River and is relatively flat in the interior regions of the urbanized area. The city lies in a large depression, which drains poorly.

The primary drainage system in the City of Bastrop consists of Piney Creek to the north, Gills Branch to the south, and the Colorado River to the west. A majority of the storm runoff contributes to Piney Creek or Gills Branch. A relatively small drainage area immediately adjacent to the river contributes directly to the Colorado River.

The climate of the county is reasonably mild. The average annual precipitation is approximately 37 inches. The largest storm events are usually the result of tropical systems which move inland from the Gulf of Mexico. However, major thunderstorms can also be generated from frontal systems which typically approach from the northwest. The mean maximum and minimum temperatures for July and January are 96 degrees Fahrenheit (^{o}F) and 40^{o}F, respectively (Reference 1).

2.3 Principal Flood Problems

The City of Bastrop can experience some local flooding due to Piney Creek and Gills Branch. However, due to the lack of gage records, no frequency information is available. The Colorado River can experience significant increases in stage. Some of the more significant storms on record include those of May 1975, June 1981, and October 1961. These were approximately 10-year, 10-year, and 20-year storms respectively. These storms have all occurred since the construction of Lake Travis, approximately 80 river miles upstream, in the early 1940's. Lake Travis, Buchanan, and other reservoirs in the Highland Lake System provide a significant amount of flood protection for the Colorado River near the City of Bastrop. Prior to the construction of Lake Travis, extremely large floods were experienced in July 1869, June 1935, and December 1913. These events exceeded the stage of the October 1961 flood of 34.4 feet by 25.9 feet, 22.6 feet, and 18.9 feet respectively. If events such as these were to occur today, without the upstream control provided by the Highland Lakes as discussed above, widespread flooding and property damage would result.

2.4 Flood Protection Measures

As residential development continues to occur, the demand for aesthetically pleasing stream or riverfront property will increase. However, the adoption of local regulations concerning floodplain management, as a part of the requirements for NFIP participation, and the determination of floodways, will help alleviate storm-related losses. The construction of Lakes Travis and Buchanan, discussed in the previous section, provided Bastrop County with a significant reduction in flood magnitude. No other major structural flood protection measures exist or are currently planned for the county.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the county, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term <u>average</u> period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied in detail affecting the county.

Flow frequencies for the Colorado River were based on a statistical analysis of USGS streamflow gage data. The Colorado River analysis was performed in accordance with criteria outlined in the Water Resources Council Bulletin No. 17B (Reference 2). The U. S. Army Corps of Engineers computer model, HECWRC was used to develop the frequency-discharge relationships (Reference 3). The analysis was based on a systematic record of 26 years and a generalized skew coefficient of -0.26 as shown on Plate 1 in Bulletin No. 17B. With the concurrence of FEMA, the expected probability values were used in the hydraulic analysis rather than the computed values normally used. These values account for some of the uncertainty encountered in this previously unstudied reach of the stream.

There exists a series of seven reservoirs upstream of the study location. This reservoir system provides a substantial amount of flood regulation. The primary control for the Colorado River in this lake system is Lake Travis, which is approximately 80 river miles upstream of the City of Bastrop. Although there exists some regulation of flood flows in the Colorado River basin, flood frequency analysis of the Bastrop gage records provides a reliable estimate of the frequency-discharge relationship at the City of Bastrop.

The Gills Branch hydrology was performed using the Soil Conservation Service (SCS) computer program TR-20 (Reference 4). This program allows ponding, basin storage, and diversion of flow to be modeled as a part of the hydrologic system. The program uses the procedures described in Section 4 of the National Engineering Handbook to develop synthetic flood hydrographs and determine peak flows at selected locations. Hydrologic data required for the model includes storm rainfall frequency information and drainage basin characteristics such as basin size, time of concentration and SCS runoff curve numbers.

The hydrologic analysis for Cedar Creek was performed using the USGS Publication 77-110 previously referenced for the 10-, 50-, and 100-year storm events. The 500-year discharge was determined graphically from an extrapolation of 10-, 50-, and 100-year events on log-probability paper.

The hydrologic analyses for Dry Creek South were taken from the Flood Insurance for Travis County (Reference 5). The SCS method was used in determining peak flood flows for Dry Creek South. The SCS method of estimating direct runoff from storm rainfall is based on procedures developed by SCS hydrologists over the last three decades. Time of travel, peak flows, and accumulated runoff ratios from SCS dimensionless hydrographs were used to tabulate the design flood hydrographs and peak discharges for the 10-, 50-, and 100-year storms. The 500-year discharge was determined by a log-normal extrapolation of the 10-, 50-, and 100-year flows.

A summary of the drainage area-peak discharge relationships for the streams studied by detailed methods is shown in Table 1, "Summary of Discharges."

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross-section data for the Colorado River were obtained from aerial surveys. Typical subsurface streambed geometry was obtained by field survey. The three bridges within the study reach were surveyed to obtain elevation data. Bridge geometry was taken from construction drawings. Cross-section data for Gills Branch were obtained from field surveys in conjunction with USGS topographic

Table 1 – Summary of Discharges

Flooding Source and Location	Drainage Area (sq. miles)	Peak Discharges (cubic feet per second) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
Cedar Creek					
Downstream of Maha Creek	88.0	11,490	22,230	28,290	46,760
Upstream of Maha Creek	49.0	7,390	15,400	20,100	34,910
Colorado River					
Bastrop Gage (USGS Gage No. 08159200)	39,980.0	71,975	120,920	142,020	319,352
Dry Creek South					
At confluence with the Colorado River	57.3	11,379	17,292	19,813	25,719
Gills Branch					
At confluence with the Colorado River	2.8	2,300	3,221	3,873	5,000
At State Route 71	2.3	1,525	2,013	2,215	2,750
At Loop 150	1.2	850[1]	850[1]	850[1]	850[1]
At State Route 95	1.0	1,076	1,700	1,981	2,700
Piney Creek					
At confluence of Sandy Creek	17.7	8,499	12,821	16,360	19,599
Approximately 4 miles upstream of the confluence with Sandy Creek	3.0	8,078	12,078	15,388	18,297
Sandy Creek					
At confluence with Piney Creek	39.9	20,650	30,916	39,539	46,887
Approximately 4 miles upstream of the confluence with Piney Creek	31.7	15,091	22,906	29,365	35,207

[1]Approximate capacity of upstream channel

maps (Reference 6). All bridges and culverts were surveyed to obtain elevation data and structural geometry. Cross-section data for Cedar Creek was obtained from aerial surveys. The FM 535 bridge was field surveyed to obtain elevation and geometry data. Cross section data for Dry Creek South was taken from the Travis County Flood Insurance Study (Reference 5). These cross sections were obtained from field surveys.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross-section locations are also shown on the Flood Insurance Rate Map (Exhibit 2). Along certain portions of streams, a profile base line is shown on the maps to represent channel distances as indicated on the flood profiles and floodway data tables.

Water-surface elevations of floods of the selected recurrence intervals were computed using the COE HEC-2 step-backwater computer program (Reference 7). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. Starting water-surface elevations for the analysis were determined by the slope-area method. However, the Colorado River backwater was considered in the floodplain mapping for Gills Branch. For Dry Creek South, the water-surface elevations were computed using the Slope-Area Method as outlined in the Travis County Flood Insurance Study (Reference 5).

Channel and overbank roughness factors (Manning's "n") used in the hydraulic computations were chosen based on field observations or model calibration of the stream and floodplain areas. The following tabulation lists Channel and overbank "n" values for the streams studied by detailed methods.

Stream	Channel "n"	Overbank "n"
Colorado River	0.0365	0.060-0.120
Gills Branch	0.015-0.060	0.070-0.100
Cedar Creek	0.060	0.050-0.010
Dry Creek South	0.032-0.055	0.045-0.092

Several unique circumstances were encountered while analyzing and mapping the floodplains for Gills Branch. After reviewing the hydraulic model results, the energy grade line elevation was determined to be more representative of the actual water-surface elevations at two cross sections along Gills Branch where weir flow occurs. At these two locations, the flow can be categorized as being in the transition range between pressure flow and as a combination of pressure and weir flow. In the case of these two bridges, this approach provides the more correct solution. Therefore, the water-surface elevations at the upstream face of the Marion Street Bridge and the Pine Street Bridge were set equal to the energy grade line at these locations.

Along the west bank of Gills Branch north of Chestnut Street, the 100-year and 500-year floodplain boundaries correspond to the west channel bank location. This location represents the highest point west of the channel.

A broad area of 100-year shallow flooding is located west of Gills Branch due to the overflow from this channel north of Chestnut Street. The majority of the shallow flooding consists of sheet flow across the sloping terrain of the west overbank eventually ponding along the eastern side of the Missouri Kansas and Texas railroad tracks. Cross section and slope information for those areas outside the limits of the surveys was obtained from the USGS topographic maps (Reference 6). Delineation of the ponded areas and the base flood elevations along the railroad tracks was based on site reconnaissance and interpretation of the USGS maps.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study, and their descriptions, are shown on the maps.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For the streams studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24,000 with contour intervals of 10 and 20 feet (Reference 6).

For the streams studied by approximate methods, 100-year floodplain boundaries were delineated using the Flood Hazard Boundary Maps for the City of Bastrop, and the unincorporated areas of Bastrop County

(References 8 and 9); and the previously printed Flood Insurance Studies for the Cities of Elgin and Smithville (References 10 and 11).

The 100- and 500-year floodplain boundaries are shown on the Flood Insurance Rate Map (Exhibit 2). On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE), and the 500-year floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 100-year floodplain boundary is shown on the Flood Insurance Rate Map (Exhibit 2).

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as a minimum standard that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections (Table 2). The computed floodways are shown on the Flood Insurance Rate Map (Exhibit 2). In cases where the floodway and 100-year floodplain boundaries are either close together or collinear, only the floodway boundary is shown. For Gills Branch, the water-surface elevation at the upstream face of the Marion Street Bridge and the Pine Street Bridge

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
CEDAR CREEK								
A	0	833	9,913	2.9	411.0	411.0	412.0	1.0
B	400	1,000	10,886	2.6	412.1	412.1	413.1	1.0
C	5,608	900	6,895	4.1	415.6	415.6	416.6	1.0
D	7,200	1,400	8,300	2.4	417.5	417.5	418.5	1.0
E	9,050	1,100	5,923	3.4	419.5	419.5	420.5	1.0
F	9,900	1,400	8,581	2.3	420.5	420.5	421.5	1.0
G	16,050	1,600	9,327	2.2	422.2	422.2	423.2	1.0
H	17,350	900	6,672	3.0	423.3	423.3	424.2	0.9
I	18,850	975	6,740	3.0	424.4	424.4	425.4	1.0
J	20,400	660	4,390	4.6	426.4	426.4	427.4	1.0
K	21,450	450	3,929	5.1	428.1	428.1	429.0	0.9
L	22,500	500	3,735	5.4	430.0	430.0	430.9	0.9
M	24,500	1,050	8,918	2.3	431.5	431.5	432.5	1.0
N	25,100	500	3,167	6.3	432.1	432.1	432.9	0.8
O	25,330	550	3,242	6.2	432.8	432.8	433.6	0.8
P	26,300	600	4,672	4.3	435.1	435.1	436.1	1.0
Q	27,400	1,226	7,155	2.8	436.7	436.7	437.7	1.0
R	30,000	1,000	8,303	2.4	438.9	438.9	439.8	0.9
S	33,500	880	9,099	2.2	441.6	441.6	442.5	0.9

[1] Feet above limit of detailed study located approximately 5,808 feet downstream of FM 535

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

BASTROP COUNTY, TX
AND INCORPORATED AREAS

FLOODWAY DATA

CEDAR CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
CEDAR CREEK (CONTINUED)								
T	35,200	1,243	8,087	2.5	443.6	443.6	444.4	0.8
U	38,700	1,500	8,430	2.4	447.1	447.1	448.1	1.0
V	39,800	1,500	8,860	2.3	448.4	448.4	449.4	1.0
W	40,800	948	4,502	4.5	451.1	451.1	452.1	1.0

[1] Feet above limit of detailed study located approximately 5,808 feet downstream of FM 535

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

BASTROP COUNTY, TX
AND INCORPORATED AREAS

FLOODWAY DATA

CEDAR CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
COLORADO RIVER								
A	1,085,903	1,679	33,099	4.38	297.7	297.7	298.2	0.5
B	1,087,867	2,098	40,747	3.55	298.5	298.5	299.0	0.5
C	1,091,987	1,304	36,949	3.92	299.4	299.4	300.0	0.6
D	1,097,080	2,600	54,564	2.65	300.4	300.4	301.2	0.8
E	1,101,892	2,500	52,857	2.74	301.1	301.1	301.9	0.8
F	1,106,195	5,900	96,112	1.51	301.6	301.6	302.4	0.8
G	1,110,142	6,300	73,119	1.98	301.9	301.9	302.8	0.9
H	1,115,026	1,600	35,142	4.15	302.9	302.9	303.8	0.9
I	1,117,254	2,500	37,910	3.86	303.8	303.8	304.6	0.8
J	1,118,198	1,175	26,744	5.47	304.1	304.1	305.1	1.0
K	1,118,345	1,175	26,992	5.43	304.2	304.2	305.2	1.0
L	1,119,744	925	21,899	6.69	304.6	304.6	305.4	0.8
M	1,120,708	840	21,494	6.83	305.2	305.2	306.1	0.9
N	1,121,886	750	20,423	7.20	305.9	305.9	306.8	0.9
O	1,123,511	1,060	29,466	5.00	307.4	307.4	308.3	0.9
P	1,127,754	2,380	45,287	3.25	309.0	309.0	309.8	0.8
Q	1,130,204	2,800	51,755	2.85	309.5	309.5	310.3	0.8
R	1,133,016	2,010	39,221	3.76	310.0	310.0	310.9	0.9

[1] Feet above mouth at Matagorda Bay

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

BASTROP COUNTY, TX
AND INCORPORATED AREAS

FLOODWAY DATA

COLORADO RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
COLORADO RIVER (CONTINUED)								
S	1,135,961	1,772	40,768	3.62	310.7	310.7	311.7	1.0
T	1,138,769	1,505	23,578	6.26	311.4	311.4	312.3	0.9
U	1,143,510	3,833	51,525	2.87	313.9	313.9	314.7	0.8
V	1,146,181	5,310	65,537	2.26	314.6	314.6	315.3	0.7
W	1,148,519	3,712	44,578	3.32	314.9	314.9	315.6	0.7
X	1,151,455	5,442	61,682	2.40	315.5	315.5	316.4	0.9
Y	1,154,267	6,275	57,531	2.58	316.3	316.3	317.2	0.9
Z	1,158,495	5,800	79,859	1.87	317.3	317.3	318.3	1.0
AA	1,162,642	3,160	43,754	3.42	318.1	318.1	319.1	1.0
AB	1,167,120	3,739	53,262	2.83	319.4	319.4	320.4	1.0
AC	1,171,513	3,755	39,383	3.83	320.6	320.6	321.4	0.8
AD	1,176,755	4,550	72,538	2.09	322.1	322.1	322.9	0.8
AE	1,178,498	5,450	80,945	1.87	322.3	322.3	323.1	0.8
AF	1,181,045	5,400	75,519	2.01	322.5	322.5	323.4	0.9
AG	1,184,092	4,600	53,638	2.83	322.9	322.9	323.9	1.0
AH	1,186,865	4,310	49,004	3.11	323.6	323.6	324.7	1.1
AI	1,190,104	3,313	31,859	4.80	325.0	325.0	325.9	0.9
AJ	1,196,209	1,560	23,189	6.08	329.1	329.1	329.7	0.6
AK	1,203,862	646	22,116	6.38	333.4	333.4	334.1	0.7

[1] Feet above mouth at Matagorda Bay

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

BASTROP COUNTY, TX
AND INCORPORATED AREAS

FLOODWAY DATA

COLORADO RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
COLORADO RIVER (CONTINUED)								
AL	1,206,494	1,197	24,824	5.68	334.2	334.2	335.0	0.8
AM	1,211,260	1,124	31,796	4.44	336.4	336.4	337.1	0.7
AN	1,215,066	1,080	25,045	5.64	337.6	337.6	338.2	0.6
AO	1,219,159	818	25,750	5.49	339.4	339.4	339.9	0.5
AP	1,223,050	753	23,256	6.08	340.7	340.7	341.2	0.5
AQ	1,226,009	648	20,706	6.83	342.0	342.0	342.5	0.5
AR	1,227,473	898	23,341	6.06	342.6	342.6	343.2	0.6
AS	1,231,270	1,277	31,365	4.51	344.6	344.6	345.5	0.9
AT	1,235,031	618	19,910	7.11	345.6	345.6	346.4	0.8
AU	1,237,640	485	18,456	7.68	346.8	346.8	347.5	0.7
AV	1,240,216	612	20,708	6.84	347.8	347.8	348.5	0.7
AW	1,243,238	1,375	32,779	4.32	349.0	349.0	349.7	0.7
AX	1,246,272	1,336	34,501	4.11	349.6	349.6	350.3	0.7
AY	1,250,328	927	23,080	6.15	350.6	350.6	351.2	0.6
AZ	1,253,864	1,064	26,572	3.08	352.3	352.3	352.8	0.5
BA	1,254,380	923	25,824	3.17	352.3	352.3	352.8	0.5
BB	1,254,927	984	26,218	3.12	352.4	352.4	352.9	0.5
BC	1,256,293	1,172	29,545	2.77	352.6	352.6	353.1	0.5
BD	1,256,462	1,083	29,658	2.76	352.6	352.6	353.1	0.5

[1] Feet above mouth at Matagorda Bay

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

BASTROP COUNTY, TX
AND INCORPORATED AREAS

FLOODWAY DATA

COLORADO RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
COLORADO RIVER (CONTINUED)								
BE	1,256,595	1,070	28,885	2.84	352.7	352.7	353.2	0.5
BF	1,259,200	1,720	51,553	1.70	353.0	353.0	353.4	0.4
BG	1,263,864	1,180	24,318	3.60	353.2	353.2	353.6	0.4
BH	1,267,038	860	23,264	3.76	353.6	353.6	353.9	0.3
BI	1,270,548	910	25,321	3.45	354.0	354.0	354.2	0.2
BJ	1,272,597	1,250	36,869	2.59	354.3	354.3	354.5	0.2
BK	1,275,058	715	18,649	5.11	354.4	354.4	354.6	0.2
BL	1,277,251	700	20,152	4.92	354.7	354.7	354.9	0.2
BM	1,282,305	1,615	23,965	5.71	355.5	355.5	356.1	0.6
BN	1,290,762	1,025	25,148	5.43	357.3	357.3	358.3	1.0
BO	1,295,024	645	18,482	7.38	358.4	358.4	359.3	0.9
BP	1,297,534	910	17,285	7.89	358.8	358.8	359.7	0.9
BQ	1,301,763	2,255	24,402	5.35	361.1	361.1	362.1	1.0
BR	1,304,422	965	20,183	6.47	361.6	361.6	362.6	1.0
BS	1,309,137	500	15,203	8.58	362.7	362.7	363.7	1.0
BT	1,311,372	675	18,675	6.99	363.8	363.8	364.8	1.0
BU	1,317,217	520	15,267	8.55	365.4	365.4	366.4	1.0
BV	1,321,274	6,050	47,265	2.36	367.6	367.6	368.6	1.0
BW	1,325,899	6,000	60,485	1.84	368.2	368.2	369.1	0.9

[1] Feet above mouth at Matagorda Bay

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

BASTROP COUNTY, TX
AND INCORPORATED AREAS

FLOODWAY DATA

COLORADO RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
COLORADO RIVER (CONTINUED)								
BX	1,328,438	5,950	49,640	2.24	368.3	368.3	369.2	0.9
BY	1,333,143	3,300	41,060	2.71	368.9	368.9	369.8	0.9
BZ	1,335,504	1,746	16,839	6.62	368.9	368.9	369.8	0.9
CA	1,336,204	1,870	21,075	5.29	369.2	369.2	370.1	0.9
CB	1,337,188	2,075	22,355	5.00	369.6	369.6	370.5	0.9
CC	1,343,300	1,359	15,674	7.19	371.5	371.5	372.3	0.8
CD	1,346,839	705	18,876	6.01	373.7	373.7	374.6	0.9
CE	1,350,669	460	13,782	8.25	375.0	375.0	375.8	0.8
CF	1,352,843	695	19,165	5.94	375.9	375.9	376.8	0.9
CG	1,355,282	530	15,457	7.37	376.5	376.5	377.4	0.9
CH	1,357,639	740	19,315	5.90	377.3	377.3	378.2	0.9
CI	1,358,984	715	16,923	6.73	377.7	377.7	378.5	0.8
CJ	1,360,952	605	15,617	7.30	378.2	378.2	379.1	0.9
CK	1,362,079	640	16,244	7.02	378.9	378.9	379.8	0.9
CL	1,365,260	610	16,847	6.77	379.8	379.8	380.6	0.8
CM	1,367,983	785	16,894	6.75	381.1	381.1	382.0	0.9
CN	1,371,605	555	16,555	6.89	382.3	382.3	383.2	0.9
CO	1,374,089	550	13,548	8.42	382.7	382.7	383.7	1.0
CP	1,375,883	620	16,050	7.11	383.5	383.5	384.4	0.9

[1] Feet above mouth at Matagorda Bay

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

BASTROP COUNTY, TX
AND INCORPORATED AREAS

FLOODWAY DATA

COLORADO RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
COLORADO RIVER (CONTINUED)								
CQ	1,379,366	995	20,052	5.69	385.0	385.0	385.9	0.9
CR	1,381,622	1,368	15,150	7.53	385.3	385.3	386.2	0.9
CS	1,383,693	1,110	17,992	6.34	385.9	385.9	386.8	0.9
CT	1,386,708	1,243	19,181	5.95	386.9	386.9	387.9	1.0
CU	1,389,663	4,805	67,999	1.68	388.0	388.0	388.9	0.9
CV	1,393,376	4,980	69,757	1.57	388.2	388.2	389.1	0.9
CW	1,396,157	3,270	26,521	4.15	388.4	388.4	389.3	0.9
CX	1,399,205	2,786	25,943	4.26	389.3	389.3	390.1	0.8
CY	1,400,662	1,761	22,350	4.97	389.7	389.7	390.6	0.9
CZ	1,407,078	2,935	54,369	2.06	391.1	391.1	392.0	0.9

[1] Feet above mouth at Matagorda Bay

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

BASTROP COUNTY, TX
AND INCORPORATED AREAS

FLOODWAY DATA

COLORADO RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
DRY CREEK EAST								
A	11,556	340	5,266	3.3	396.8	396.8	397.6	0.8
B	15,679	275	4,042	4.2	400.2	400.2	401.1	0.9
C	20,325	290	2,702	6.2	402.1	402.1	403.1	1.0

[1]Feet above confluence with Colorado River

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

BASTROP COUNTY, TX
AND INCORPORATED AREAS

FLOODWAY DATA

DRY CREEK EAST

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
DRY CREEK SOUTH								
A	10,930	720	8,197	2.4	392.8	392.8	393.7	0.9
B	13,880	281	3,934	5.0	397.3	397.3	398.3	1.0
C	19,110	302	4,048	4.5	404.2	404.2	405.1	0.9

[1] Feet above confluence with Colorado River

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

BASTROP COUNTY, TX
AND INCORPORATED AREAS

FLOODWAY DATA

DRY CREEK SOUTH

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
GILLS BRANCH								
A	750	112	746	5.2	353.0	327.4[2]	327.5	0.1
B	1,550	53	427	9.1	353.0	331.9[2]	331.9	0.0
C	2,888	293	1,099	3.5	353.0	342.3[2]	342.3	0.0
D	3,274	284	34	5.3	353.0	344.4[2]	344.4	0.0
E	3,573	474	1,100	3.5	353.0	346.9[2]	346.9	0.0
F	3,888	50	285	13.6	353.0	349.4[2]	349.4	0.0
G	4,550	53	290	13.4	353.7	353.7	353.7	0.0
H	4,800	72	683	5.7	357.4	357.4	358.1	0.2
I	4,900	69	572	3.9	358.7	358.7	358.7	0.0
J	5,880	68	387	5.7	364.4	364.4	394.4	0.0
K	6,611	52	303	5.7	366.0	366.0	366.6	0.6
L	7,021	96	258	3.3	370.0	370.0	370.3	0.3
M	7,540	113	294	2.9	372.7	372.7	372.8	0.1
N	8,000	24	174	4.9	375.4	375.4	375.5	0.1
O	8,686	39	174	4.9	380.1	380.1	380.4	0.3
P	9,236	53	254	7.8	394.8	394.8	395.1	0.3
Q	9,634	65	392	5.0	397.2	397.2	397.7	0.5

[1] Feet above confluence with Colorado River
[2] Elevation computed without consideration of backwater effects from Colorado River

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

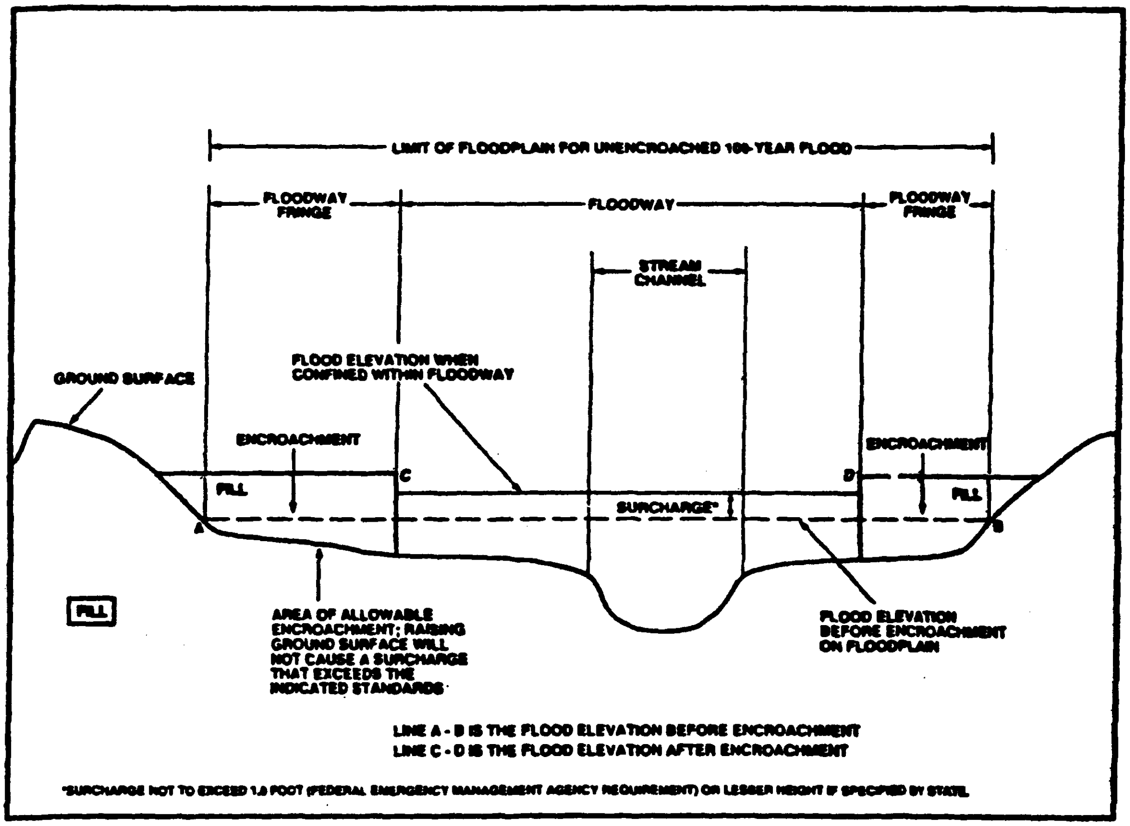
BASTROP COUNTY, TX
AND INCORPORATED AREAS

FLOODWAY DATA

GILLS BRANCH

were set equal to the energy grade line (as described in Section 3.2). Consistent with that approach, the water-surface elevation rise resulting from the floodway encroachment was maintained at a maximum of one foot greater than the energy grade line at these locations.

The area between the floodway and 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.



FLOODWAY SCHEMATIC Figure 2

Near the mouths of streams studied in detail, floodway computations are made without regard to flood elevations on the receiving water body. Therefore, "Without Floodway" elevations presented in Table 2 for certain downstream cross sections of Gills Branch are lower than the regulatory flood elevations in that area, which must take into account the 100-year flooding due to backwater from other sources.

5.0 INSURANCE APPLICATIONS

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. The zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. In most instances, whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-depths derived from the detailed hydraulic analyses are shown within this zone.

Zone A99

Zone A99 is the flood insurance rate zone that corresponds to areas of the 100-year floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or depths are shown within this zone.

Zone V

Zone V is the flood insurance rate zone that corresponds to the 100-

year coastal floodplains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no base flood elevations are shown within this zone.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain, and to areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

Zone D

Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 100- and 500-year floodplains. Floodways and the locations of selected cross sections used in the hydraulic analyses and floodway computations are shown where applicable.

The current Flood Insurance Rate Map (FIRM) presents flooding information for the entire geographic area of Bastrop County, Texas. Previously, separate Flood Hazard Boundary Maps and/or FIRMs were prepared for each identified flood-prone incorporated community and the unincorporated areas of the county. This countywide FIRM also includes flood hazard information that was presented separately on Flood Boundary and Floodway Maps, where applicable. Historical data relating to the maps prepared for each community are presented in Table 3, "Community Map History."

7.0 OTHER STUDIES

Flood Insurance Studies have been prepared for the unincorporated areas of Travis, Caldwell, and Fayette Counties, Texas (References 5, 12, and 13).

Because it is based on more up-to-date and detailed analysis, this study supersedes the Flood Hazard Boundary Maps for the City of Bastrop and the unincorporated areas of Bastrop County (References 8 and 9); and the previously printed Flood Insurance Studies for the Cities of Elgin and Smithville (Reference 10 and 11).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting FEMA, Mitigation Division, Federal Regional Center, Room 206, 800 North Loop 288, Denton, Texas 76201-3698.

9.0 BIBLIOGRAPHY AND REFERENCES

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3. U. S. Army Corps of Engineers, Computer Program, HECWRC, Users Manual, Flood Flow Frequency Analysis, Hydrologic Engineering Center, Davis, California, February 1982.

4. U. S. Department of Agriculture, Soil Conservation Service, Technical Release No. 20, Computer Program, Project Formulation, Hydrology, Washington, D. C., 1965.

5. U. S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, Unincorporated Areas of Travis County, Texas, Washington, D. C., September 27, 1985.

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE(S)	FLOOD INSURANCE RATE MAP EFFECTIVE DATE	FLOOD INSURANCE RATE MAP REVISION DATE(S)
Bastrop, City of	March 19, 1976	None	August 19, 1991	
Bastrop County (Unincorporated Areas)	August 9, 1977	June 3, 1980	August 19, 1991	
Elgin, City of	June 21, 1974	February 27, 1976	July 1, 1988	
Smithville, City of	April 5, 1974	May 21, 1976	January 16, 1979	

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

BASTROP COUNTY, TX
AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

6. U. S. Department of the Interior, Geological Survey, 7.5-Minute Series Topographic Maps, Scale 1:24,000, Contour Intervals 10 and 20 Feet: Smithville NW, Texas, 1982; Lake Bastrop, Texas, 1982; Bastrop, Texas, 1982; Red Rock, Texas 1964, Photorevised 1981; Cistern, Texas, 1965, Photorevised, 1981; Couplano, Texas, 1982; Creedmoor, Texas, 1968, Photorevised 1973; Dale, Texas, 1964, Photorevised 1981; Delhi, Texas, 1964, Photorevised, 1981; Fedor, Texas, 1982; Jeddo, Texas, 1964, Photorevised, 1981; McDade, Texas, 1982; Paige, Texas, 1982; Rosanky, Texas, 1964, Photorevised 1981; Structure, Texas, 1982; Utley, Texas, 1982; Webberville, Texas, 1987; West Point, Texas, 1958, Photorevised 1981; Winchester, Texas, 1982; Lytton Springs, Texas, 1968, Photorevised 1994; Elgin West, Texas, 1982; Elgin East, Texas, 1982; Bastrop SW, Texas, 1982; Togo, Texas, 1964, Photorevised, 1981.

7. U. S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water Surface Profiles, Generalized Computer Program, Davis, California, April 1984.

8. U. S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, City of Bastrop, Bastrop County, Texas, March 19, 1976.

9. U. S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, Unincorporated Areas of Bastrop County, Texas, June 3, 1980.

10. Federal Emergency Management Agency, Flood Insurance Study, City of Elgin, Bastrop County, Texas, Washington, D. C., July 1, 1988.

11. Federal Emergency Management Agency, Federal Insurance Administration, Flood Insurance Study, City of Smithville, Bastrop County, Texas, Washington, D. C., January 16, 1979.

12. Federal Emergency Management Agency, Flood Insurance Study, Unincorporated Areas of Caldwell County, Texas, Washington, D. C., March 15, 1982.

13. Federal Emergency Management Agency, Flood Insurance Study, Unincorporated Areas of Fayette County, Texas, Washington, D. C., June 1, 1987.

14. Schroeder, E. E. and Massey, B. C., U. S. Department of the Interior, Geological Survey, Water Resources Investigations Report 77-11, Techniques for Estimating the Magnitude and Frequency of Floods in Texas, 1977.

15. Jennings, M. E., Thomas, W. O., and Riggs, H. C., U. S. Department of the Interior, Geological Survey, Water Resources Investigations Report 94-4002, 1994 Nationwide Summary of U.S. Geological Survey Regional Regression Equations for Estimating Magnitude and Frequency of Floods for Ungaged Sites, 1993.

16. U. S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water-Surface Profiles, Generalized Computer Program, Davis, California, 1991.

10.0 REVISION DESCRIPTIONS

This section has been added to provide information regarding significant revisions made since the original Flood Insurance Study was printed. Future revisions may be made that do not result in the republishing of the Flood Insurance Study report. To assure that any user is aware of all revisions, it is advisable to contact the community repository of flood-hazard data located at the City of Bastrop City Hall, Bastrop, Texas; the City of Elgin City Hall, Elgin, Texas; the City of Smithville City Hall, Smithville, Texas; or the Bastrop County Courthouse, 804 Pecan, Bastrop, Texas.

10.1 First Revision

This restudy was revised on December 8, 1998, to show modifications to flood hazards along Cedar Creek from approximately 1.1 miles downstream of FM 535 to the upstream FM 812. This restudy includes a complete revision of the reach previously studied along Cedar Creek. The previous study reach extended from the same downstream beginning of detailed study to approximately 3.7 miles upstream of FM 535.

The hydrologic and hydraulic analyses for this revision were performed for FEMA by the U.S. Geological Survey (USGS), under Interagency Agreement No. EMW-95-E-4757, Project Order No. 3.

The results of this revision were reviewed at a final CCO meeting held on September 30, 1997, and attended by representatives of FEMA, Bastrop County, the USGS, and the TNRCC. All problems raised at that meeting have been addressed in this restudy.

Equations from USGS Water Resources Investigations Report 77-11, "Techniques for Estimating the Magnitude and Frequency of Floods in Texas" (Reference 14), were used to estimate the 10-, 50-, and 100-year- flood peak discharges for Cedar Creek. The 500-year-flood peak discharges were estimated using USGS Water Resources Investigations Report 94-4002, "1994 Nationwide Summary of U.S. Geological Survey Regional Regression Equations for Estimating Magnitude and Frequency of Floods for Ungaged Sites" (Reference 15). The study reach was divided into two subreaches, below and above the confluence with Maha Creek (just above FM 535). While the two watersheds may peak at different times, a conservative direct arithmetic sum of the two peaks was used in estimating the flood peak discharges downstream from the confluence. The flood peak discharges calculated for Cedar Creek above the confluence were used for the entire subreach above the confluence because no substantial single tributary exists in that subreach.

Cross-section data from the previous Cedar Creek study were retained for use in this revision. Additional upstream cross-section data were field surveyed by the USGS. All USGS-surveyed cross sections were referenced to RM1 of the previous study.

Water-surface elevations of the floods for the selected recurrence intervals were computed using the U.S. Army Corps of Engineers HEC-2 computer program (Reference 16). Between cross sections, the floodplain and floodway boundaries were interpolated using topographic mapping at a scale of 1:24,000, with a contour interval of 10 feet (Reference 6).

Roughness values (Manning's "n") for cross sections from the previous study were retained for those sections. Channel and overbank roughness values for the additional upstream cross sections were chosen based on field observations and photographs of Cedar Creek and ranged from 0.05 to 0.07 and 0.04 to 0.10, respectively.

Table 1, "Summary of Discharges," Table 2, "Floodway Data," Table 3, "Community Map History," and Exhibit 1, "Flood Profiles," were also revised to reflect changes as a result of the restudy.

10.2 Second Revision
Colorado River (January 19, 2006)

a. Purpose of Revision

This revision updates and revises the previous Flood Insurance Study (FIS) report and Flood Insurance Rate Map (FIRM) for Bastrop County, Texas, including the cities of Bastrop, Elgin, and Smithville. This information will be used by the communities to update existing floodplain regulations as part of the Regular Phase of the National Flood Insurance Program (NFIP). The information will also be used by local and regional planners to further promote sound land use and floodplain development

b. Authority and Acknowledgements

The Colorado River revision was completed and submitted to FEMA on March 17, 2003, by Halff Associates, Inc., on behalf of the Lower Colorado River Authority under Contract No. EMT-2001-CO-0029. The revision to the streams studied by limited detail methods was submitted to FEMA on August 3, 2004, by Watershed Concepts, under Contract No. TA-04, Task Order 1.

c. Coordination

The Initial Consultation and Coordination Officer's (CCO) meeting was held on June 20, 2002, and attended by representatives of Bastrop County, City of Bastrop, City of Smithville, City of Elgin, the Lower Colorado River Authority, and the study contractors. All comments and concerns raised at the CCO meeting have been addressed. A final CCO meeting was held on October 26, 2004, to review the revised report with representatives of Halff Associates, Inc., Watershed Concepts, LCRA, FEMA, and officials of incorporated communities.

d. Scope of Revision

The Colorado River was restudied by detailed hydrologic and hydraulic methods for a total of approximately 60.5 miles from the Bastrop County-Travis County line to the Bastrop County-Fayette County line. The streams studied by limited detail methods, approximate Zone A, were divided into 10 sub-basins: Bartons Creek, Cedar Creek, Lower Pin-Oak, North Piney-Alum, Sandy Creek, Southeast Tributaries, South Piney-Sandy, Upper Pin-Oak, Walnut Creek and Willbarger Creek. This revision also converts the vertical datum reference for the entire county to the North American Vertical Datum of 1988 (NAVD 88).

This revision also incorporates the following Letters of Map Revision (LOMRs) that affect the 1-percent-annual-chance floodplain delineation:

Case No.	Effective Date	Project Identifier
01-06-1939P	08/15/2002	Elgin Wastewater Treatment Plant Channel Improvement
01-06-1169P	12/05/2002	La Reata Subdivision
04-06-1182P	07/08/2004	Hunter's Crossing
04-06-1736P	02/02/2005	Highway 290 to Brenham Street

e. Hydrologic Analysis

For this revision, the peak discharges for the Colorado River were developed by a flood frequency analysis of the annual peak floods for the stream flow data recorded over a 70-year period of record (Reference 17). The USACE HEC-HMS computer program (Reference 18) was used to create hydrographs for each of the resulting peaks. The peak discharge-drainage area relationship for the Colorado River is shown Table 1.

Peak flood discharges for streams restudied by limited detail methods were estimated following the regional regression approach described in USGS Water Resource Investigation (WRI) report 98-4015 (Reference 19). Drainage area and main channel slope were found to be the two parameters significant to the regression equation development. The basin delineations and drainage areas were determined using a 50' x 50' grid size digital elevation model (DEM) generated from a USGS topographic map with a 10-foot contour interval.

f. Hydraulic Analysis

For this revision, cross section data for the Colorado River was taken from 2-foot contour interval topographic maps of Bastrop County and 1-foot contour interval topographic maps for the City of Bastrop (Reference 17). The mapping was supplemented with field surveys conducted in the summer of 2001 as a part of the Lower Colorado River Basin-wide study (Reference 17) as well as Texas Department of Transportation roadway and bridge construction plans.

The water surface elevations (WSEL) for the Colorado River were computed using the USACE HEC-RAS step-backwater computer program unsteady flow option (Reference 20). Starting downstream boundary conditions (stage hydrographs) were determined in the Lower Colorado River Basin-Wide Study (Reference 17).

For the streams studied by limited detail methods, topographic data for the floodplain models were developed using USGS topographic maps with a 10-foot contour interval, field measurements of structures, and updated hydrologic information.

The floodplain models were generated through use of the USACE HEC-RAS step-backwater computer program (Reference 21). The starting WSELs for the hydraulic models were set to normal depth by estimating the slope of the energy grade line from USGS topographic maps with a 10-foot contour interval or, where applicable, derived from the water surface profile of existing effective flood elevations.

Channel roughness factors (Manning's "n") for the hydraulic computations were assigned on the basis of visual inspection and analysis of aerial photographs. The Manning's "n" values for the Colorado River ranged from 0.03-0.046 for the channel, and 0.040-0.10 for the overbank. The Manning's "n" values for the limited detail streams ranged from 0.030-0.060 for channels and 0.070 to 1.0 for overbank areas.

The Floodway Data Tables and Flood Profiles for the Colorado River have been updated as a part of the revised hydrologic and hydraulic analysis.

All FIS reports and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum in use for newly created or revised FIS reports and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD29). With the finalization of the North American Vertical Datum of 1988 (NAVD88), many FIS reports, and FIRMs are being prepared using NAVD88 as the referenced vertical datum.

All flood elevations shown in this FIS report and on the FIRM are referenced to NAVD88. Structure and ground elevations in the community must, therefore, be referenced to NAVD88. It is important to note that adjacent communities may be referenced to NGVD29. This may result in differences in BFEs across the corporate limits between the communities. The average conversion of +0.2 feet was applied to convert all effective Base Flood Elevations (BFEs). The Floodway Data Tables and Flood Profiles for Cedar Creek, Gills Branch, and Dry Creek South have been updated to reflect the new vertical datum reference (NAVD 88).

g. Floodplain Boundaries

For this revision, the boundaries for the Colorado River, Cedar Creek, Gills Branch, and Dry Creek South were interpolated between cross sections using orthophotography flown in 1998 and 1999. The orthophotography consists of 4-foot contour interval topographic mapping that was interpolated to 2-foot contours in rural areas and 1-foot contours in the City of Bastrop (Reference 17). Floodplain boundaries for streams studied by limited detail methods were also redelineated based on this topographic data.

h. Bibliography and References

17. Halff Associates, Incorporated, Mapping the Colorado River, Technical Support Data Notebook, Fort Worth, Texas, September 2002.

18. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-HMS Hydrologic Modeling System Version 2.0, Davis, California, March 1990.

19. U.S. Geological Survey, Water Resources Investigations Report 98-4015, Peak Flow Frequency for Tributaries of the Colorado River Downstream of Austin, Texas, USGS, 1998.

20. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-RAS River Analysis System Version 3.1, Davis, California, November 2002.

21. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-RAS River Analysis System Version 3.0, Davis, California, 2001.

10.3 Third Revision (January 6, 2016)

a. Authority and Acknowledgments

The hydrologic and hydraulic analyses, for Dry Creek East, were performed by Halff and Associates for FEMA, under Contract No. EMT-2010-CA-011. The work was completed in August 2013.

b. Coordination

No initial meeting was held. A final meeting was held on June 18, 2014, and was attended by representatives of Bastrop County, FEMA Region VI, and Atkins. All issues raised at the meeting were addressed.

c. Scope of Study

As part of this revised countywide FIS, updated analyses were performed for Dry Creek East.

The following tabulation lists streams that have names in this revised countywide FIS other than those used in the previously printed FIS reports for the communities in which they are located.

Old Name	New Name
Dry Creek South	Dry Creek East

Figure 4 presents important considerations for using the information contained in this FIS report and the FIRM and is provided in response to changes in format and content.

d. Hydrologic Analyses

Flow data for Dry Creek East was based on aerially reduced peak discharges. Peak discharges at key locations along the study streams were placed approximately one-half to one-third upstream of the reach between the key flow break locations.

Peak discharge-drainage area relationships for the 10-, 4-, 2-, 1-, and 0.2-percent-annual-chance floods are presented in Table 4.

Table 4 – Revised Summary of Discharges

		Peak Discharges (cubic feet per second)				
Flooding Source and Location	Drainage Area (square miles)	10-Percent-Annual-Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
Dry Creek East						
At confluence with Colorado River	55.660	11,200	14,100	15,900	19,200	28,900
Just downstream of confluence of Moss Branch	54.850	11,200	14,100	15,800	19,000	28,600
Approximately 700 feet upstream of confluence of Moss Branch	52.730	11,100	13,900	15,700	17,900	27,300
Just downstream of confluence of Red Gully Creek	52.140	11,100	13,900	15,700	17,500	26,800
Approximately 0.35 miles upstream of confluence of Red Gully Creek	45.280	10,800	13,500	15,100	16,800	20,700
Approximately 0.59 miles downstream of Empedrado Lane	44.370	10,800	13,500	15,100	16,800	20,600
Approximately 0.28 miles downstream of Empedrado Lane	44.130	10,800	13,500	15,100	16,800	20,600
Approximately 385 feet downstream of Travis/Bastrop County Line	43.790	10,800	13,500	15,100	16,700	20,600
Approximately 0.57 miles upstream of Tucker Hill Lane	42.990	12,900	17,400	20,500	23,500	29,800

e. Hydraulic Analyses

Field surveys of bridges, culverts, cross sections, and the channel of Dry Creek East were conducted. HEC-RAS 3.1.3 was used to calculate water surface elevations (Reference 22). Bridges and culverts were modeled using field surveys, field measurements, and State Highway 130 construction plans. Manning's "n" values were assigned by visual inspection and analysis of digital orthophotos.

The Manning's "n" values for all streams newly studied, for this countywide revision, are presented in the following table.

Stream Name	Channel "n" values	Overbank "n" values
Dry Creek East	0.050-0.070	0.040-0.150

f. Floodplain Boundaries

Floodplain boundaries for Dry Creek East were delineated between cross-sections using 2-foot contour interval topographic data based on LiDAR (Reference 23).

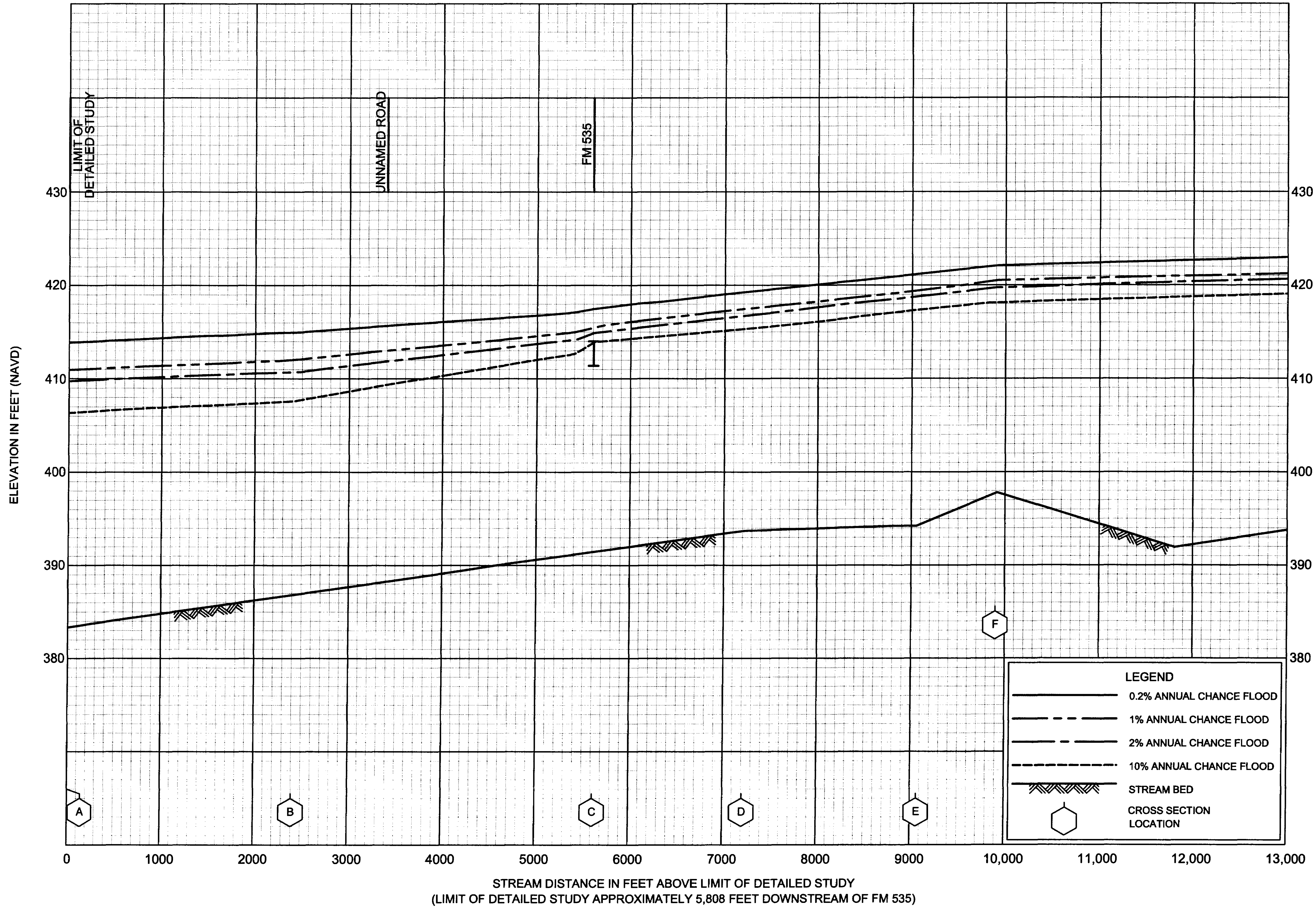
g. Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 1-percent-annual-chance floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 1-percent-annual-chance flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

h. Bibliography and References

22. Hydrologic Engineering Center, HEC-RAS River Analysis System, Version 3.1.3, U.S. Army Corps of Engineers, Davis, California, May 2005.

23. The Sanborn Map Company, Inc., Topographic Maps Compiled from LiDAR, Contour Interval 2-Feet, City of Austin and Travis County, Texas, January 2003.



FLOOD PROFILES

CEDAR CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BASTROP COUNTY, TX

AND INCORPORATED AREAS

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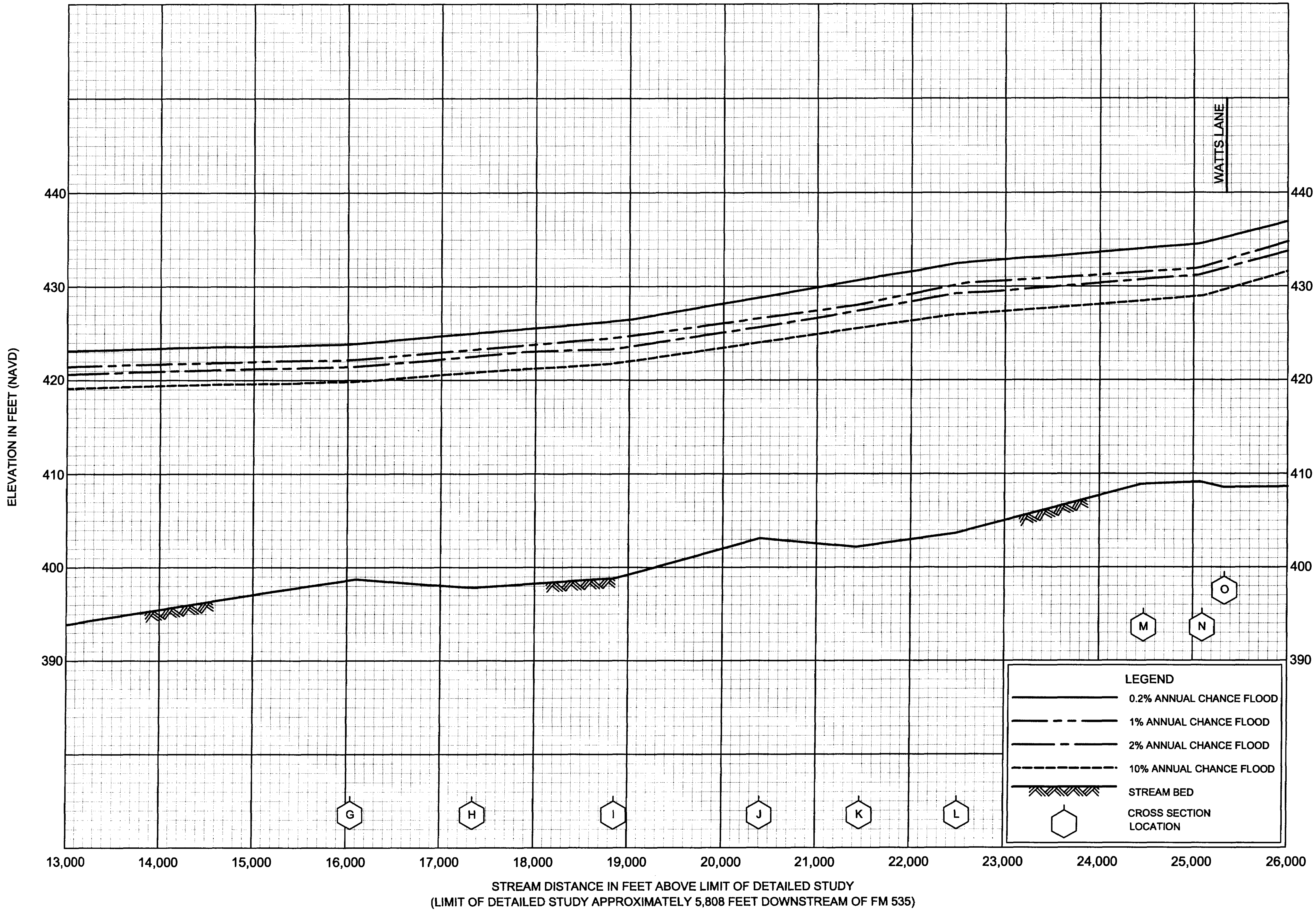


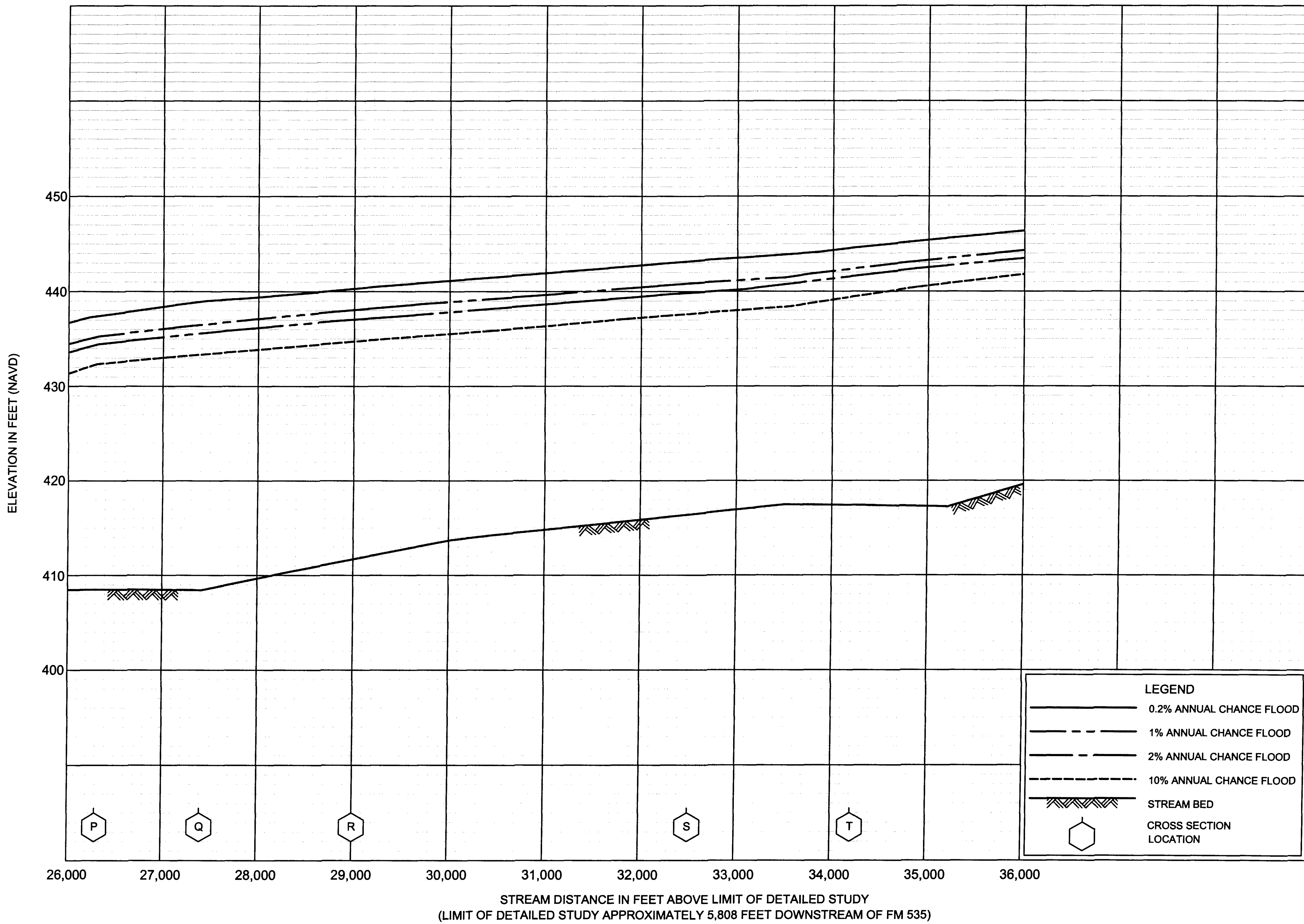
FLOOD PROFILES

CEDAR CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BASTROP COUNTY, TX

AND INCORPORATED AREAS



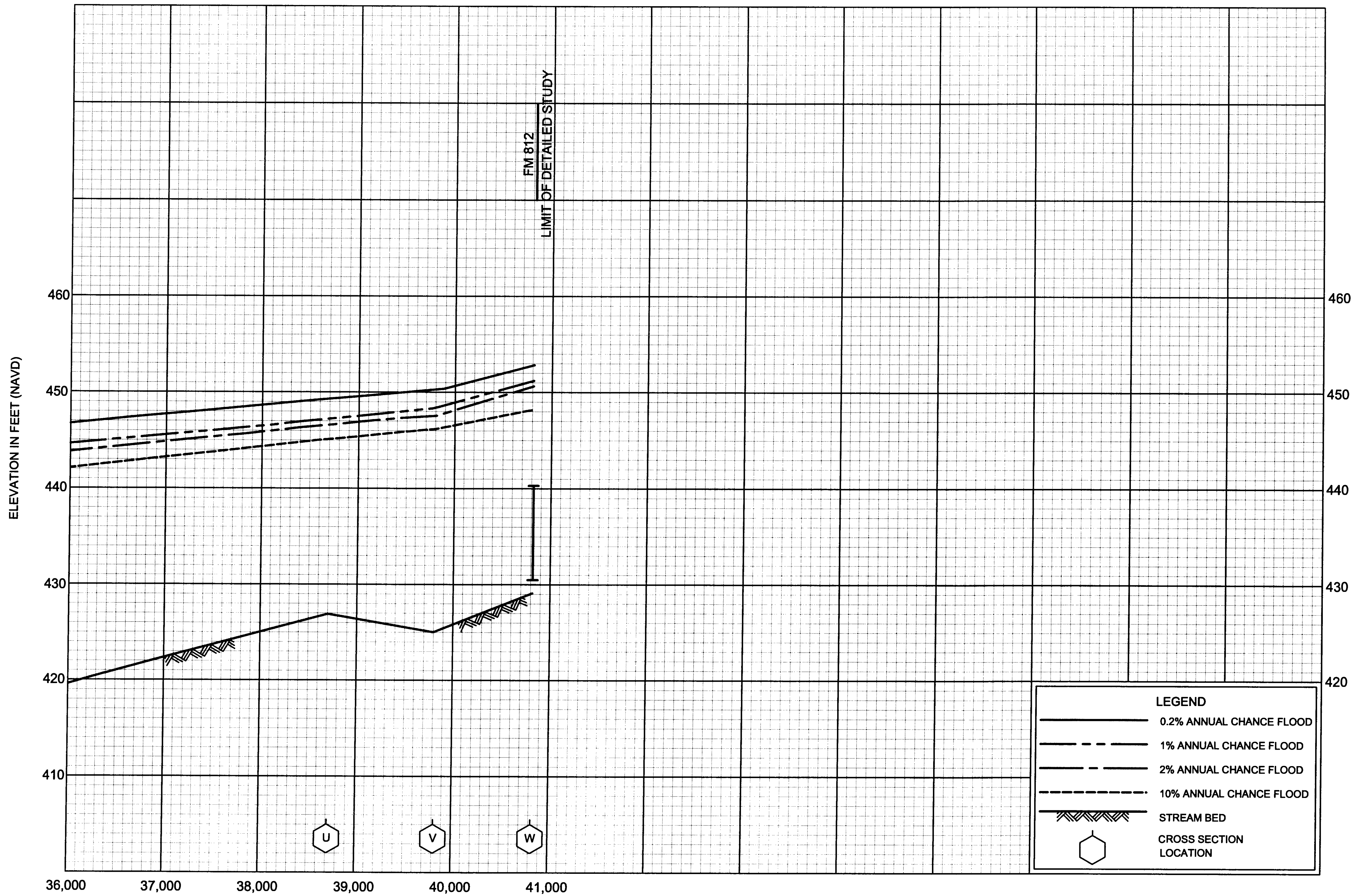
FLOOD PROFILES

CEDAR CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BASTROP COUNTY, TX

AND INCORPORATED AREAS



STREAM DISTANCE IN FEET ABOVE LIMIT OF DETAILED STUDY
(LIMIT OF DETAILED STUDY APPROXIMATELY 5,808 FEET DOWNSTREAM OF FM 535)

FLOOD PROFILES

CEDAR CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BASTROP COUNTY, TX

AND INCORPORATED AREAS

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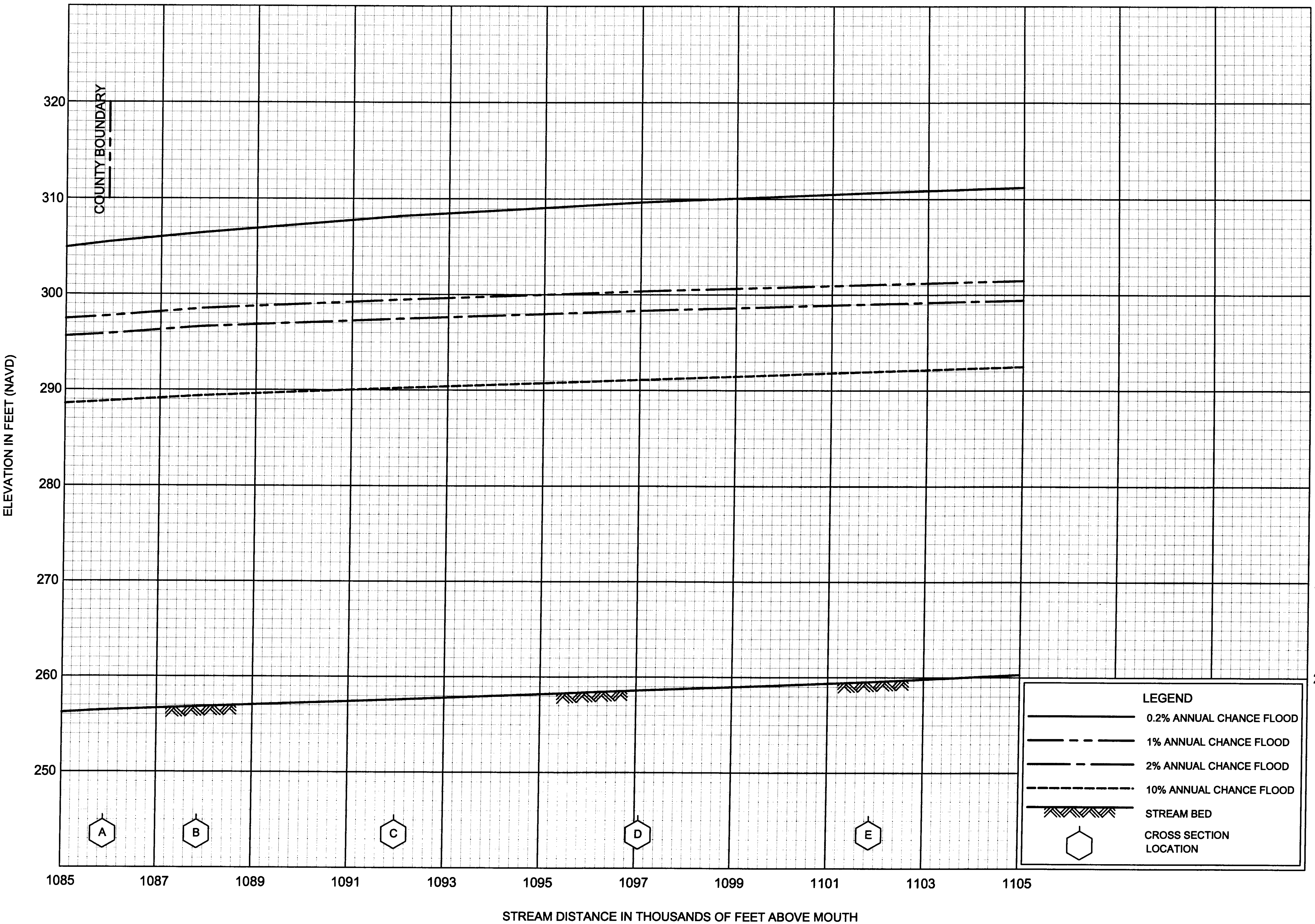

FLOOD PROFILES

COLORADO RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BASTROP COUNTY, TX
AND INCORPORATED AREAS

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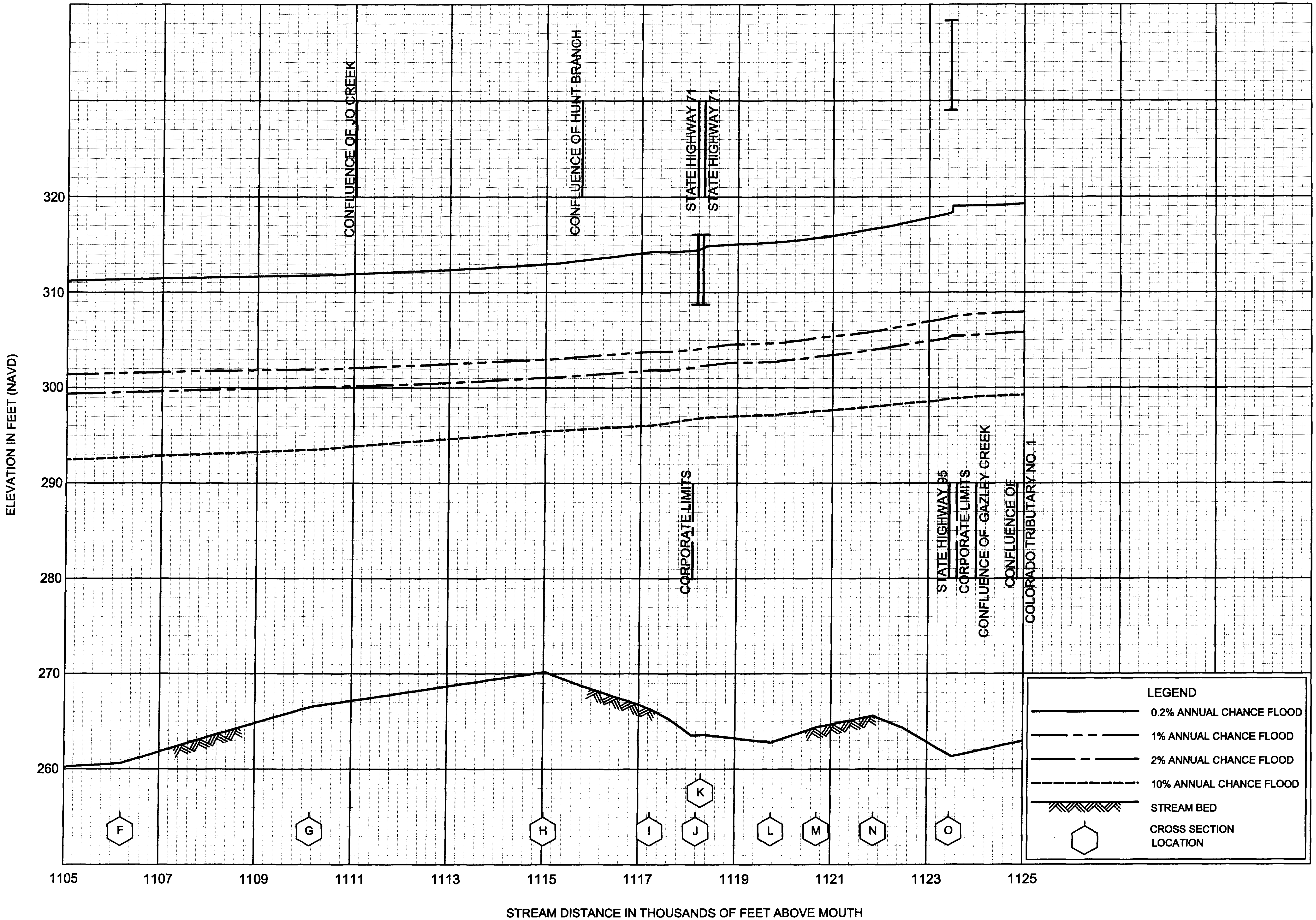

FLOOD PROFILES

COLORADO RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BASTROP COUNTY, TX

AND INCORPORATED AREAS

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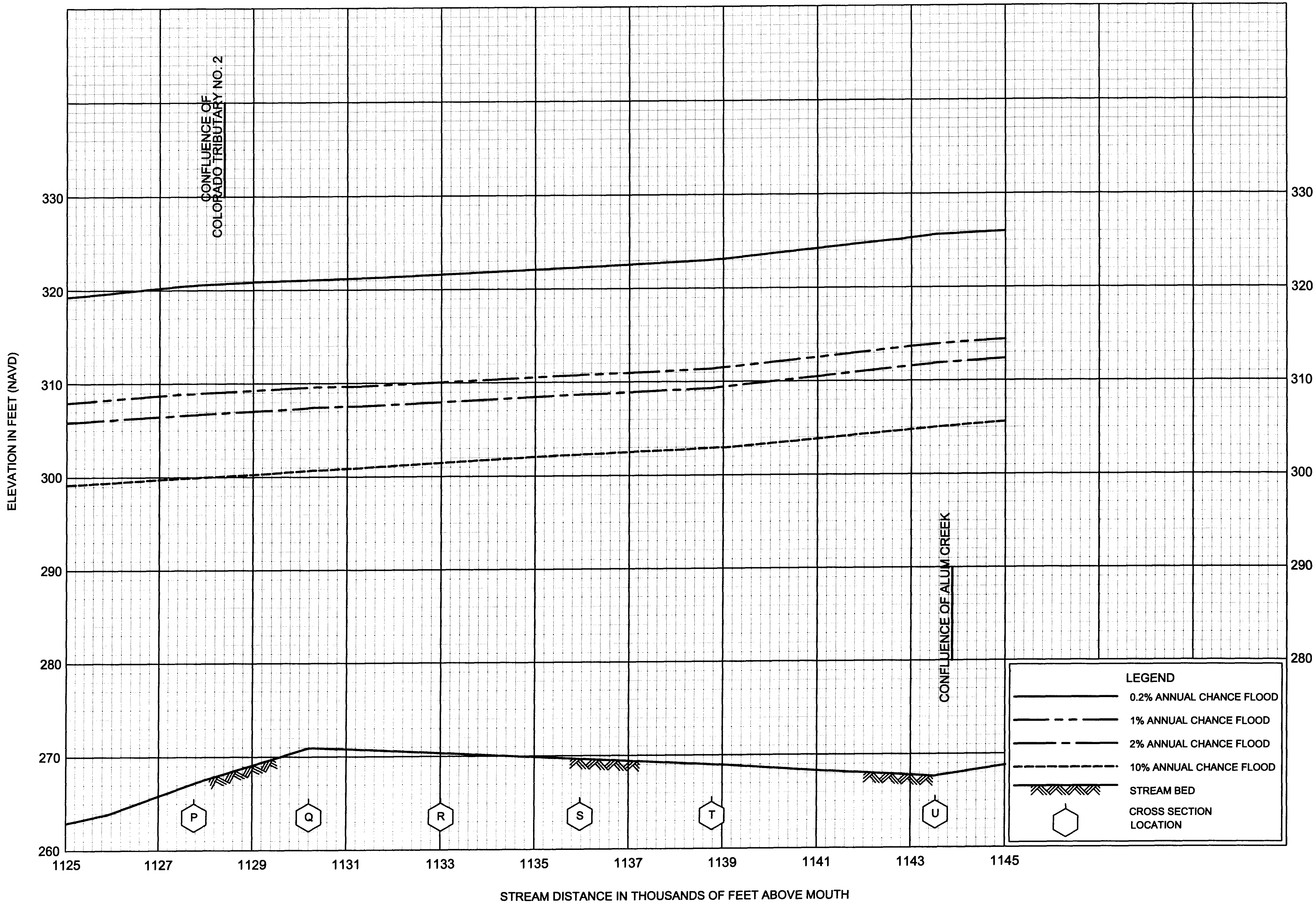

FLOOD PROFILES

COLORADO RIVER

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BASTROP COUNTY, TX
AND INCORPORATED AREAS

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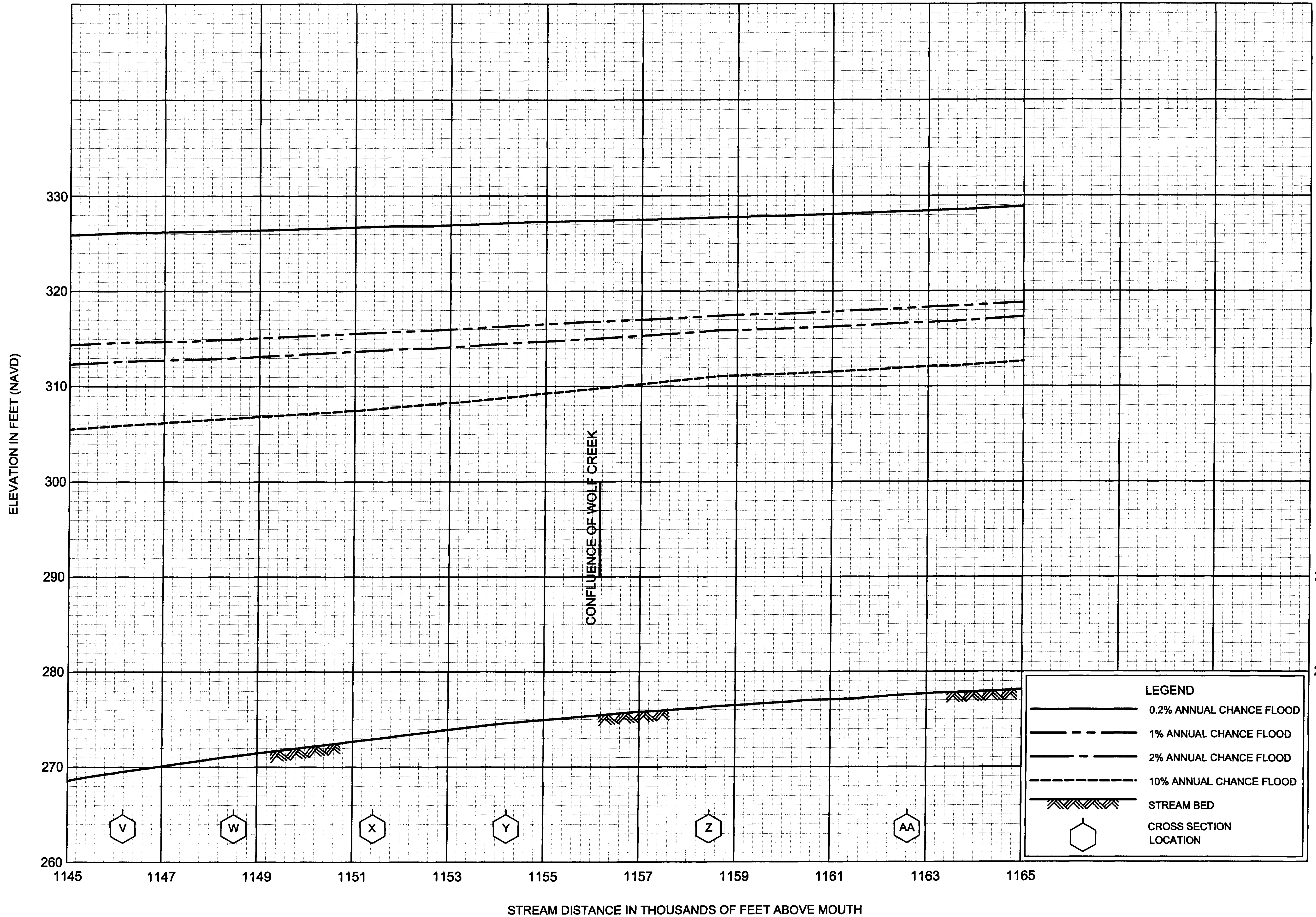


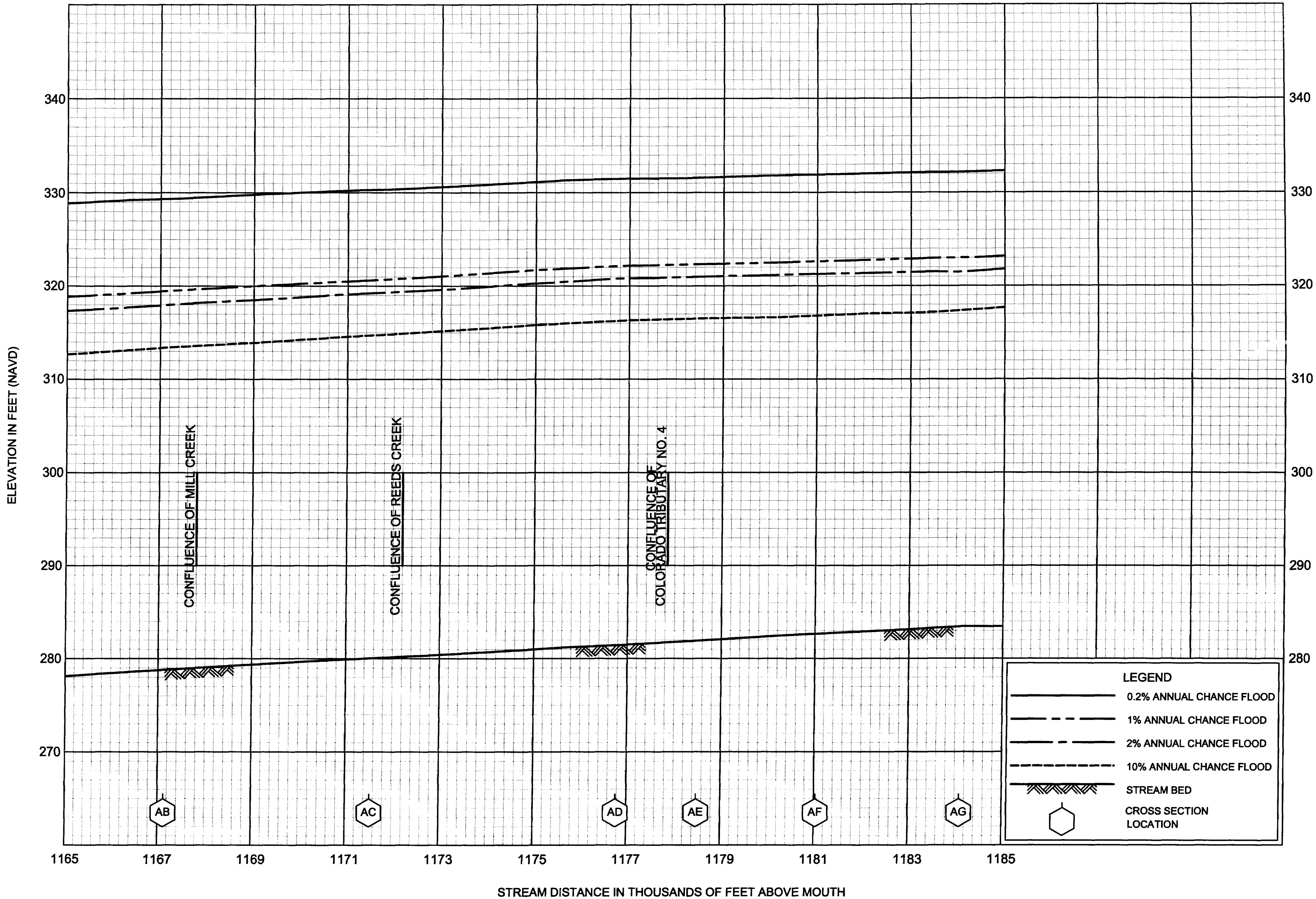
FLOOD PROFILES

COLORADO RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BASTROP COUNTY, TX

AND INCORPORATED AREAS



FLOOD PROFILES

COLORADO RIVER

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BASTROP COUNTY, TX

AND INCORPORATED AREAS

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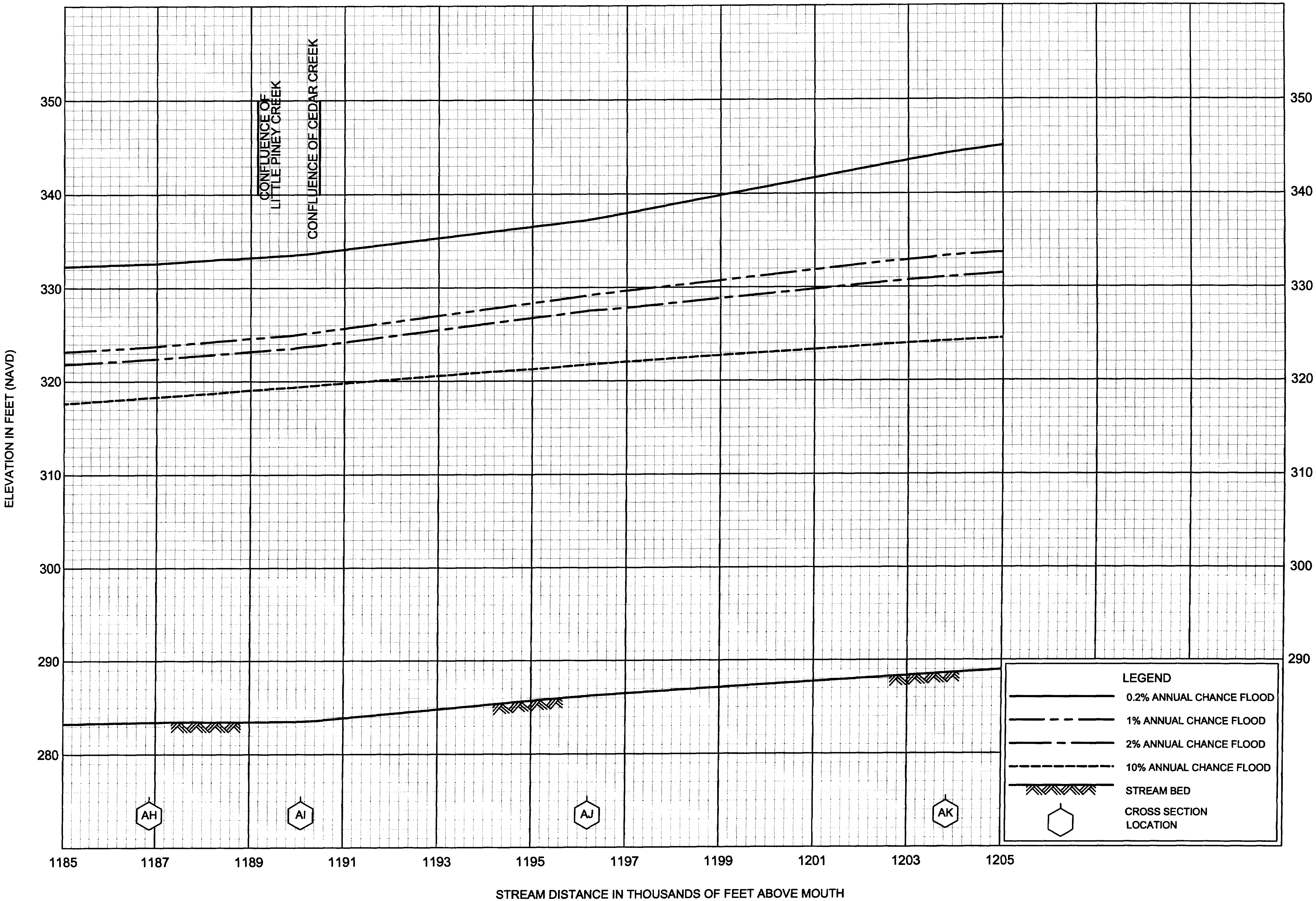

FLOOD PROFILES

COLORADO RIVER

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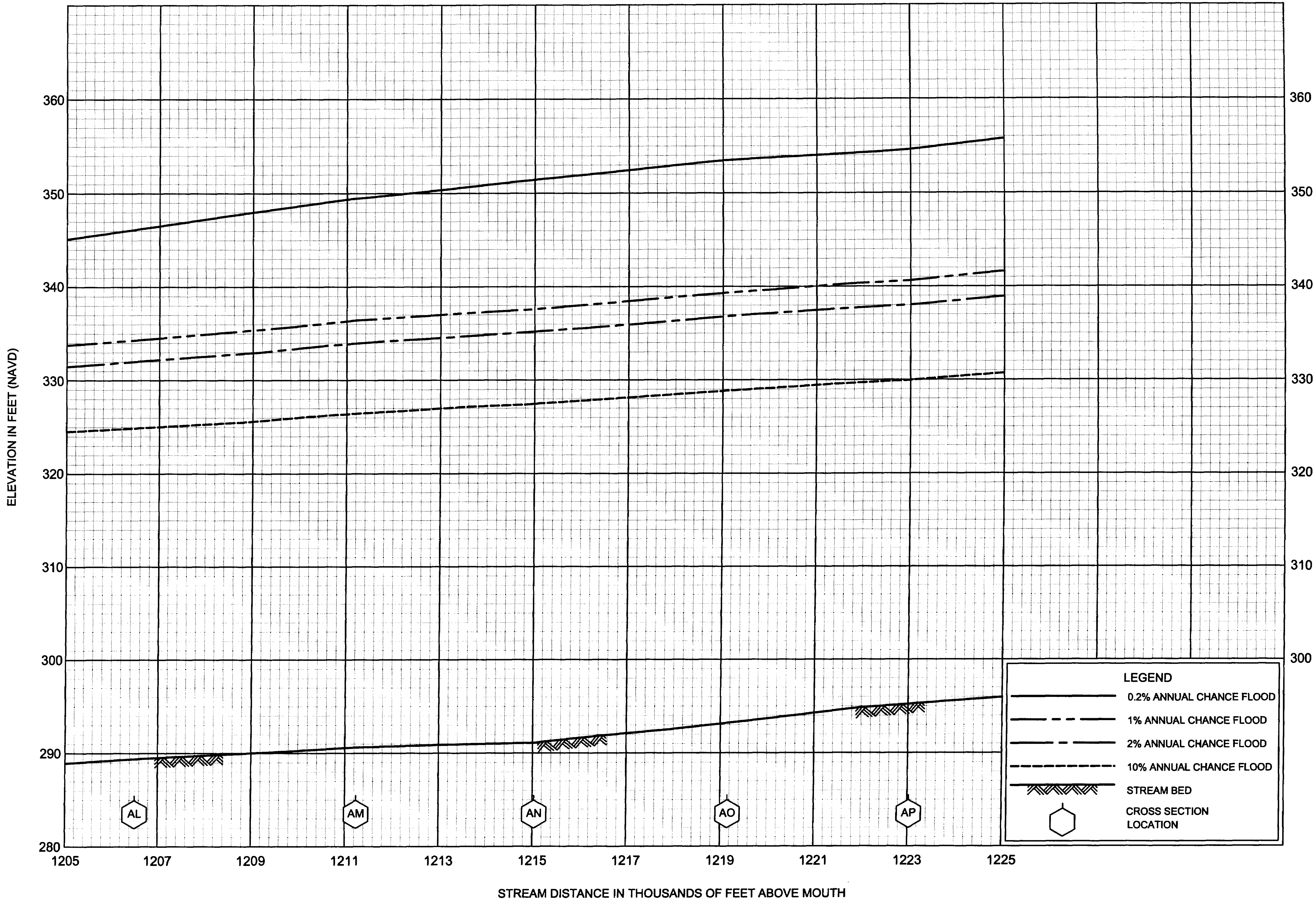
BASTROP COUNTY, TX

AND INCORPORATED AREAS



FLOOD PROFILES

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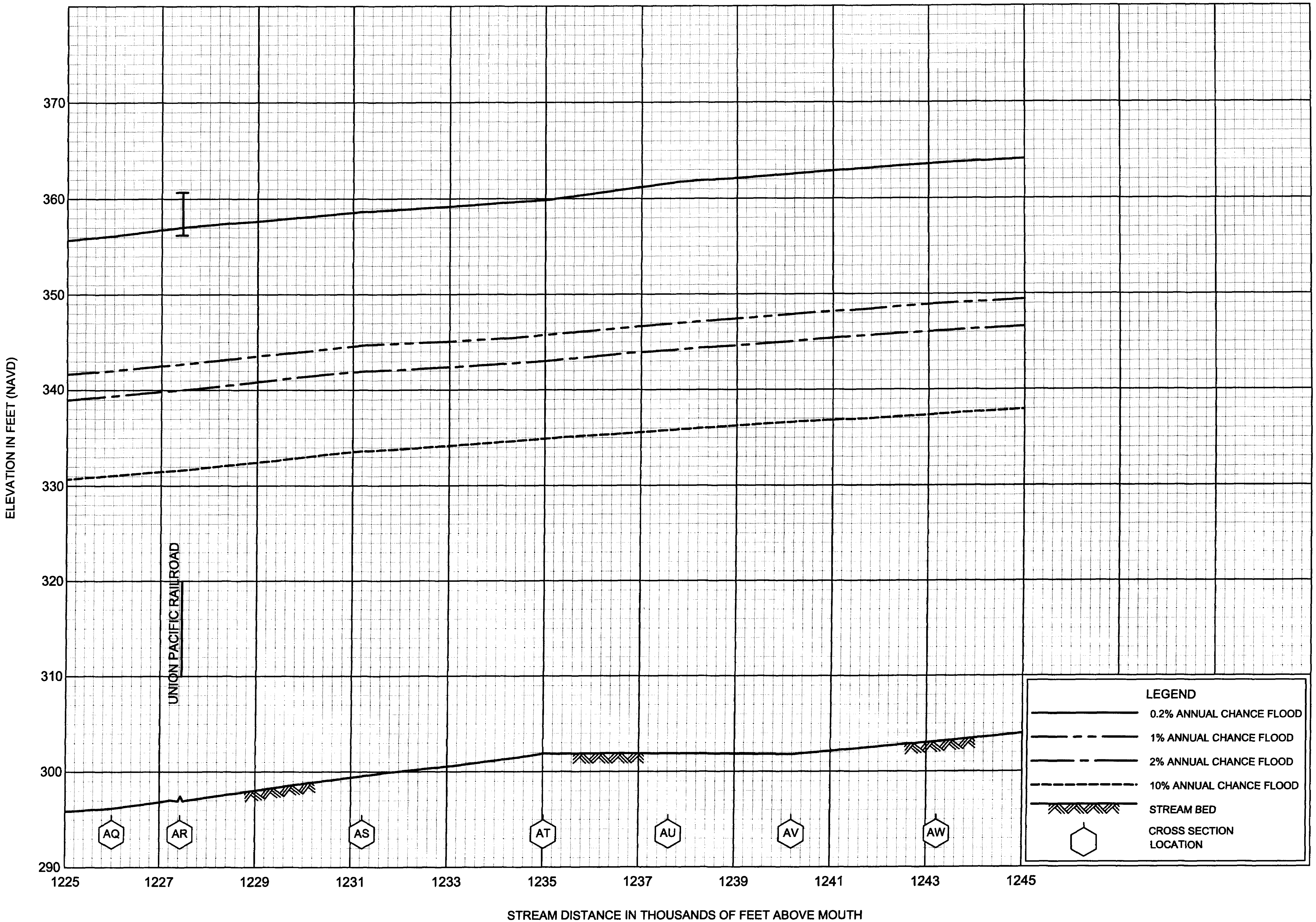

FLOOD PROFILES

COLORADO RIVER

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AND INCORPORATED AREAS

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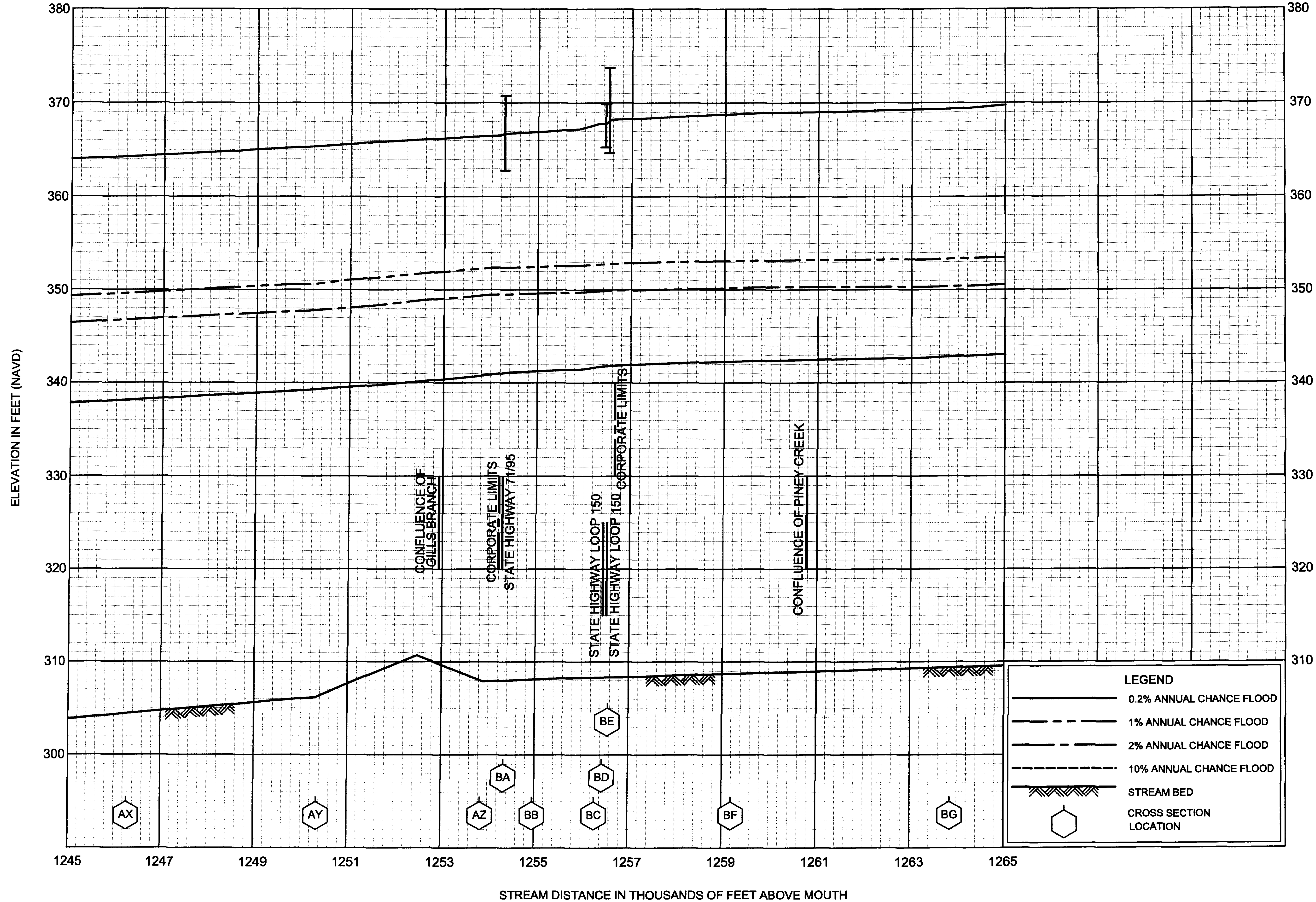

FLOOD PROFILES

COLORADO RIVER

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BASTROP COUNTY, TX

AND INCORPORATED AREAS

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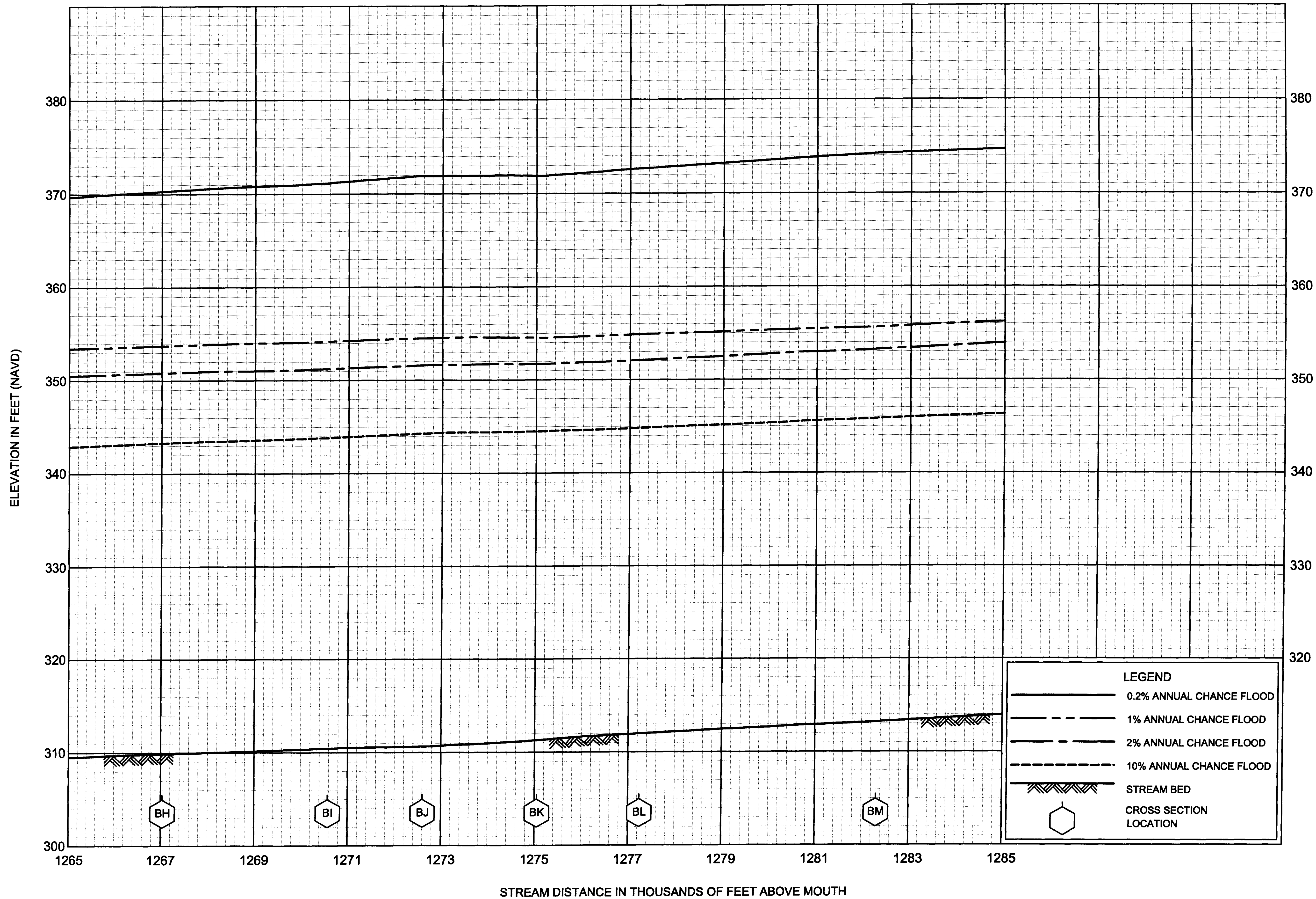

FLOOD PROFILES

COLORADO RIVER

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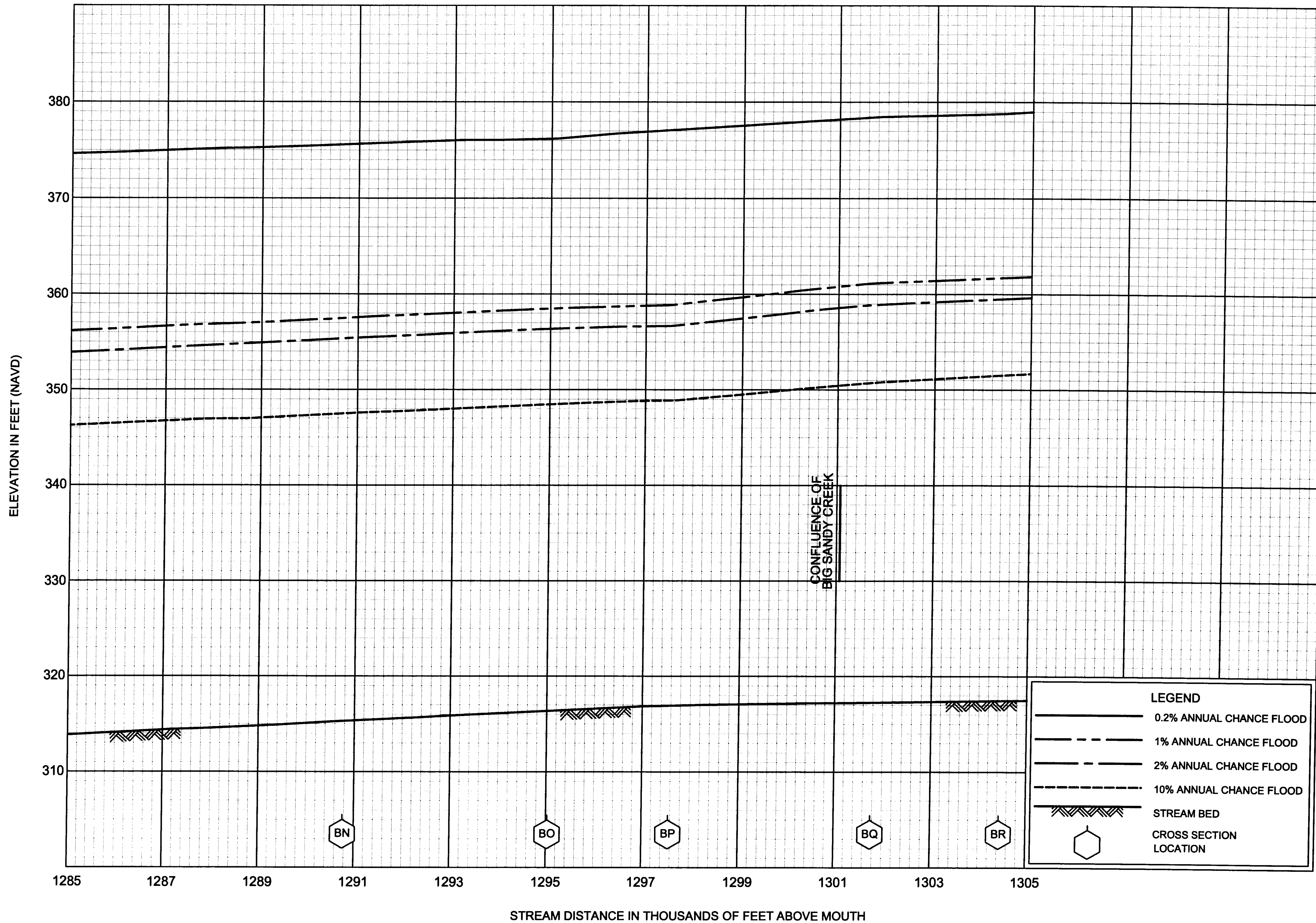
BASTROP COUNTY, TX

AND INCORPORATED AREAS



FLOOD PROFILES

COLORADO RIVER

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BASTROP COUNTY, TX

AND INCORPORATED AREAS

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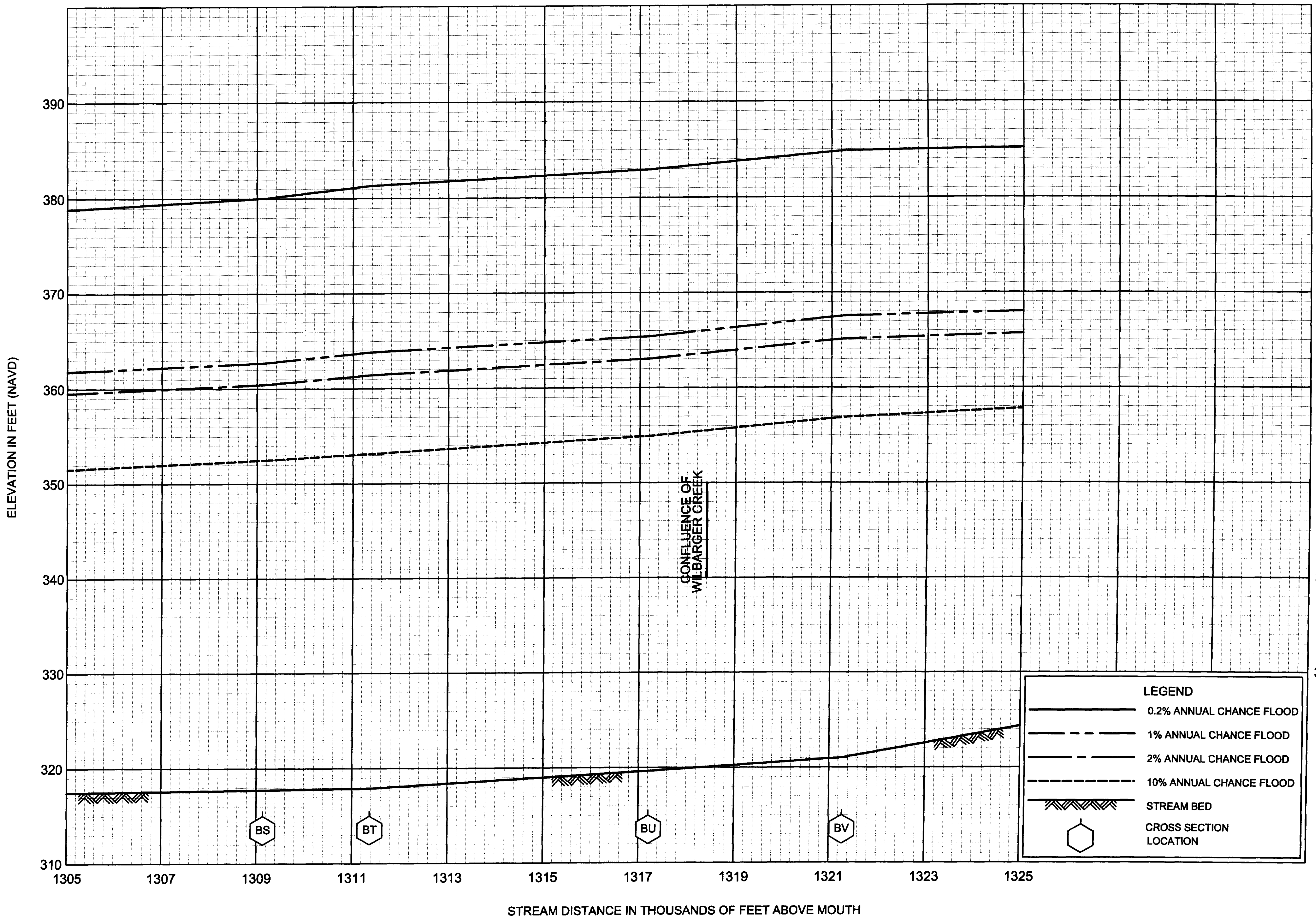

FLOOD PROFILES

COLORADO RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BASTROP COUNTY, TX

AND INCORPORATED AREAS

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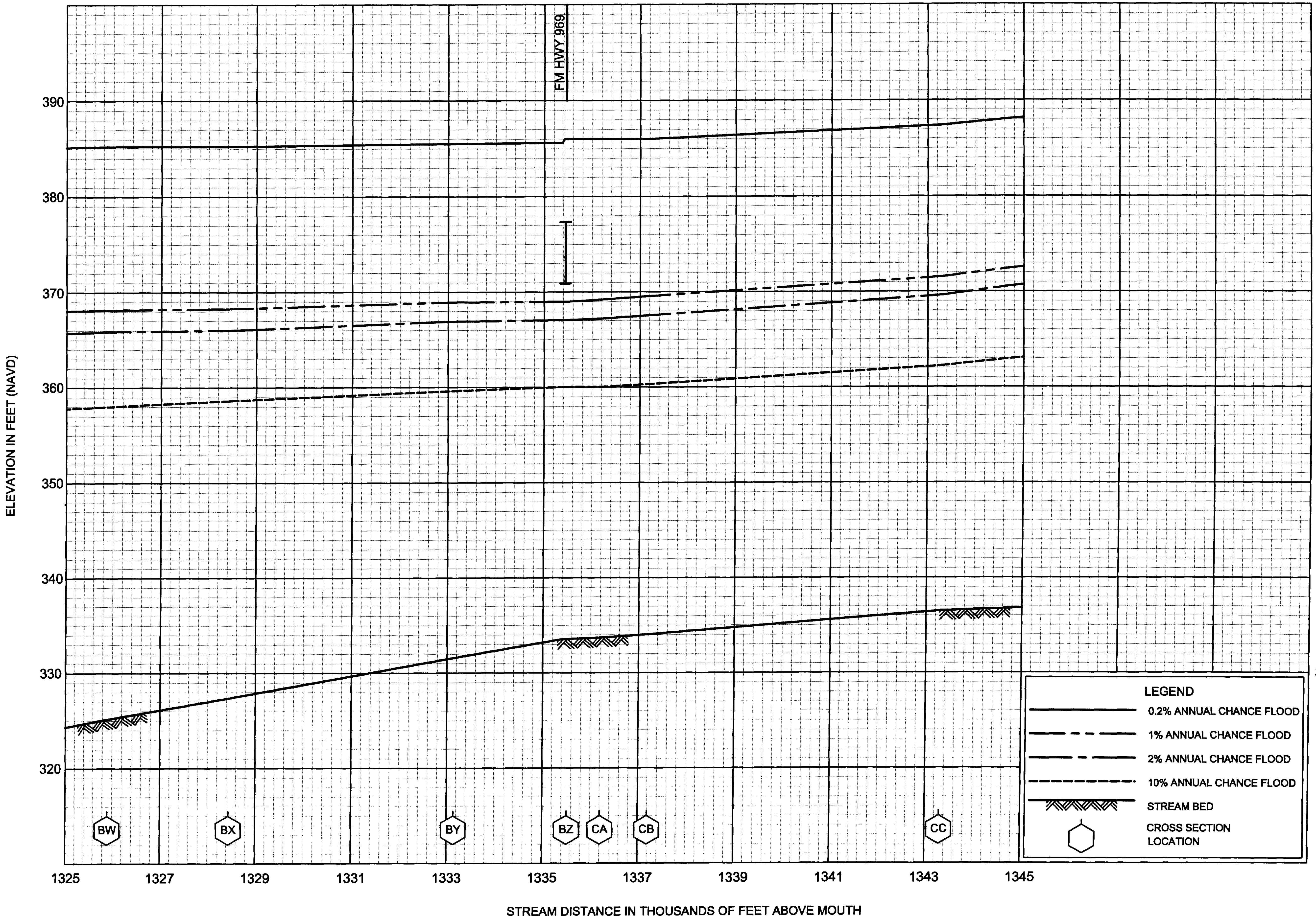

FLOOD PROFILES

COLORADO RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BASTROP COUNTY, TX

AND INCORPORATED AREAS

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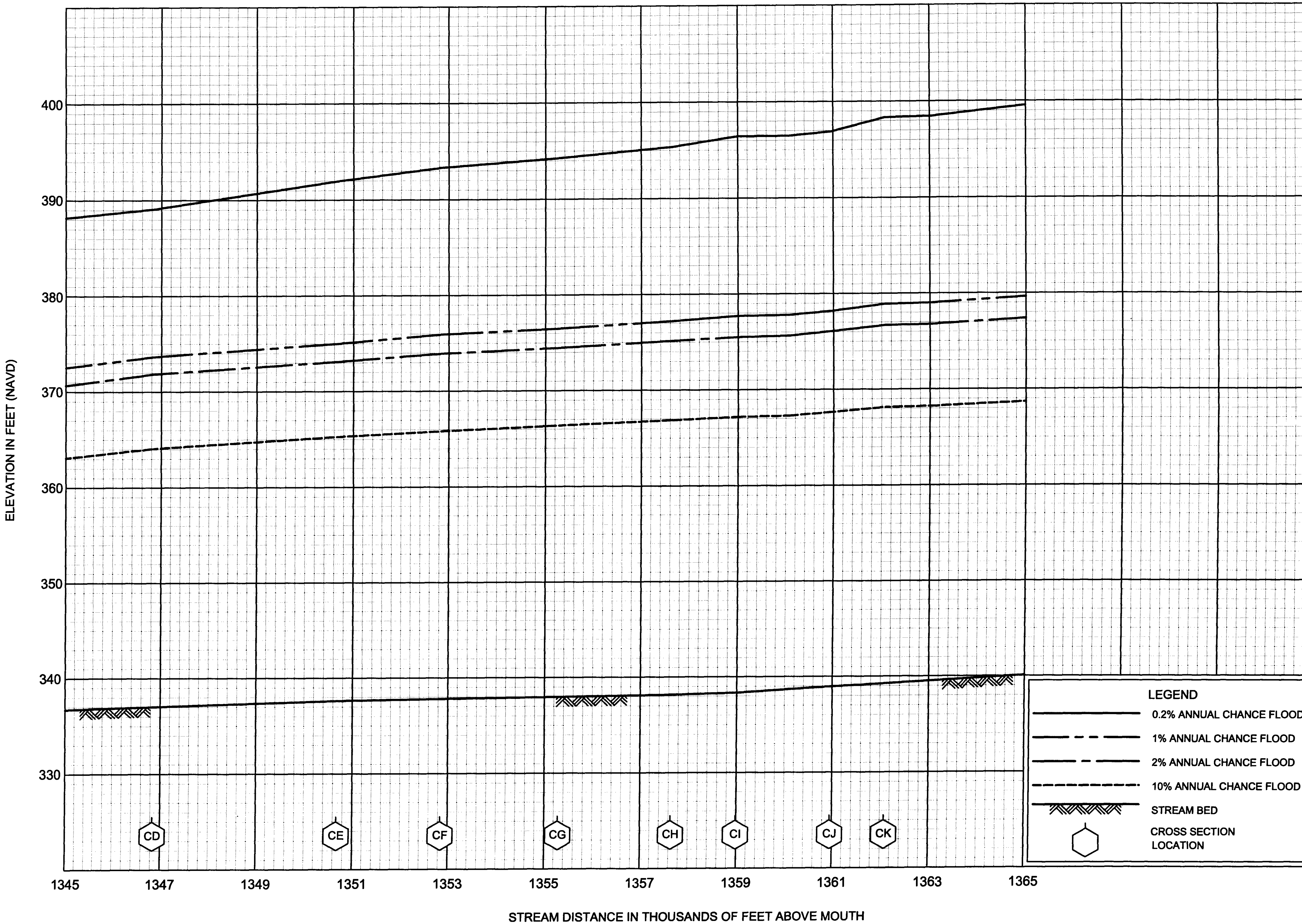

FLOOD PROFILES

COLORADO RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BASTROP COUNTY, TX

AND INCORPORATED AREAS

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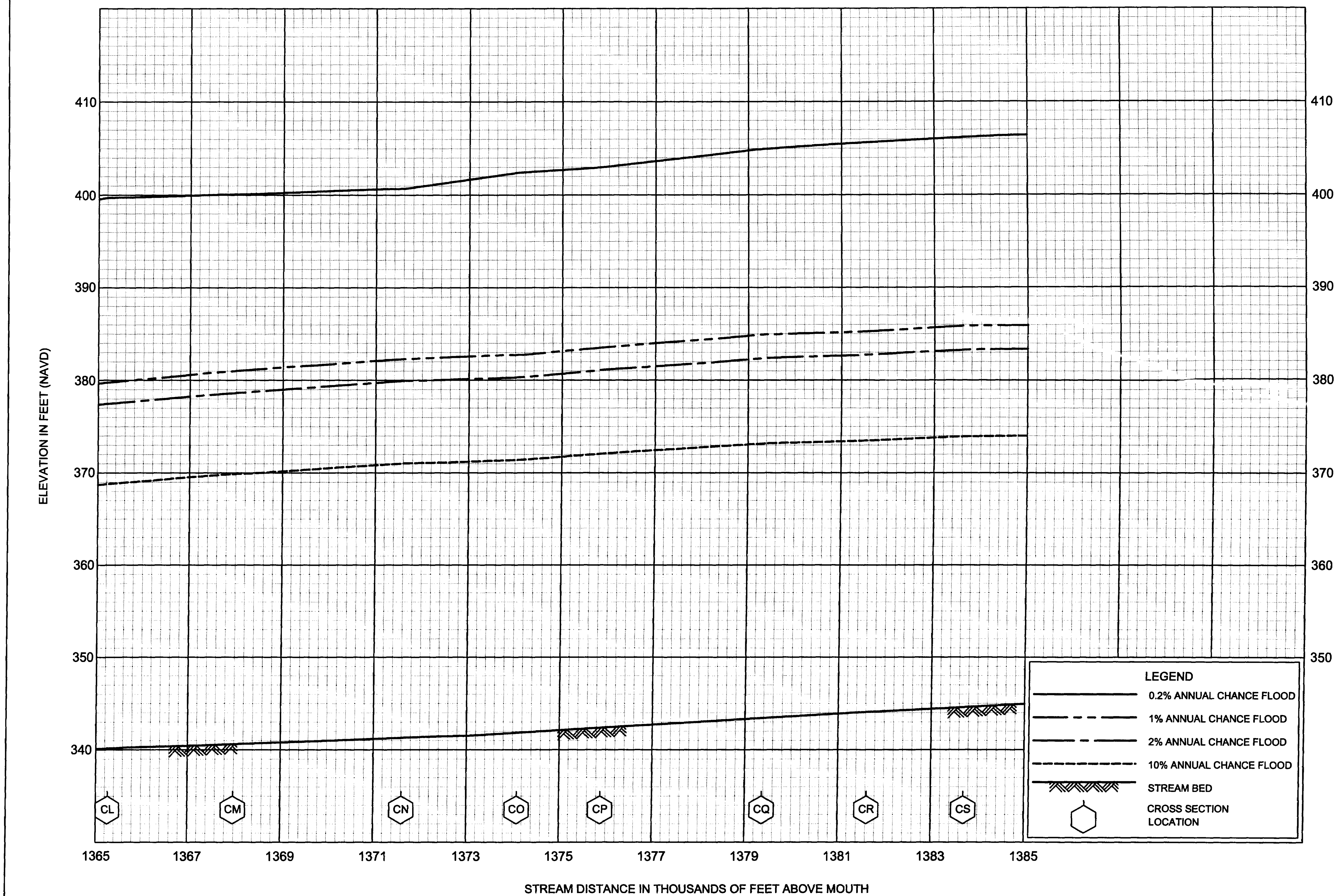

FLOOD PROFILES

COLORADO RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BASTROP COUNTY, TX

AND INCORPORATED AREAS

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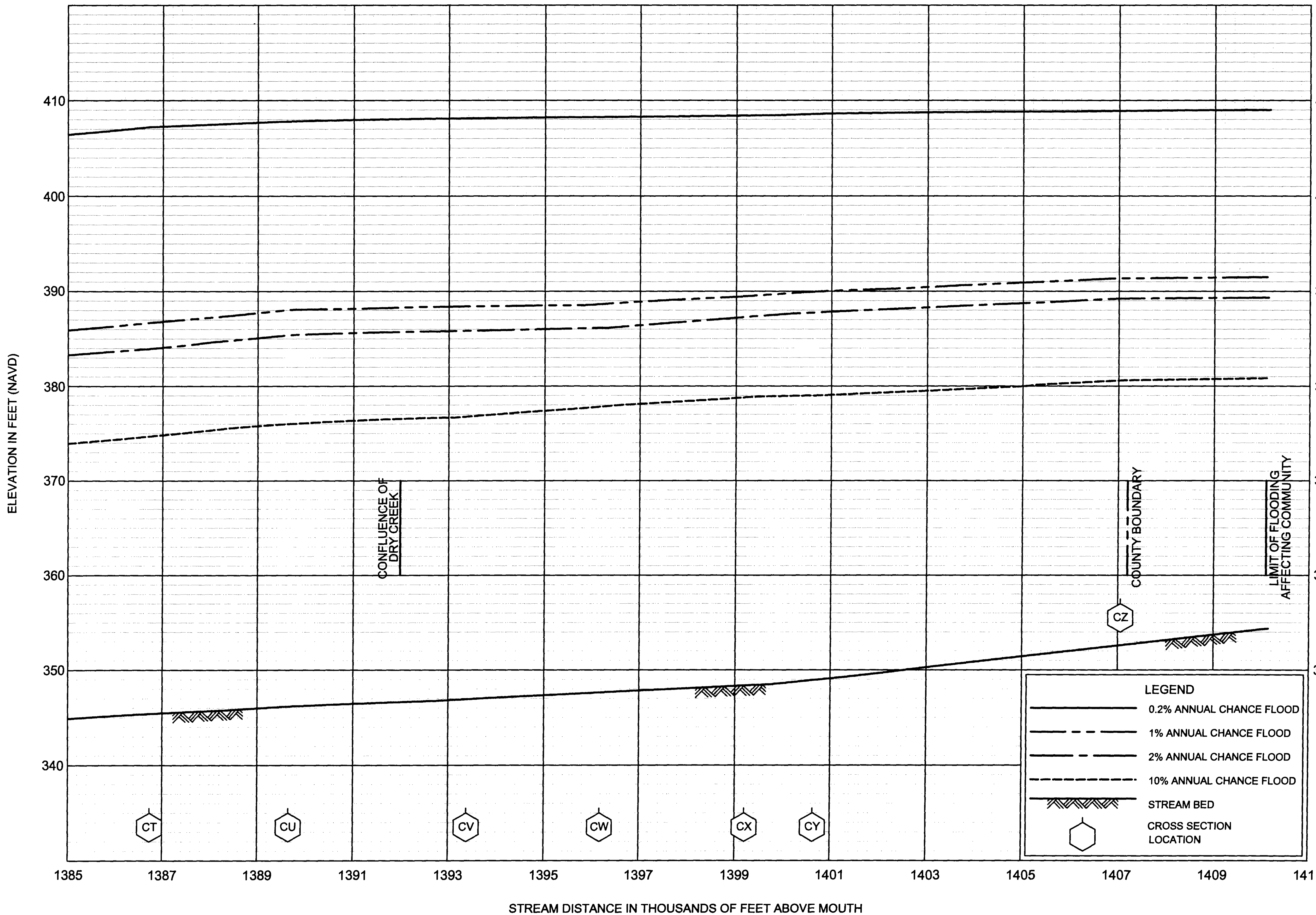

FLOOD PROFILES

COLORADO RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BASTROP COUNTY, TX

AND INCORPORATED AREAS

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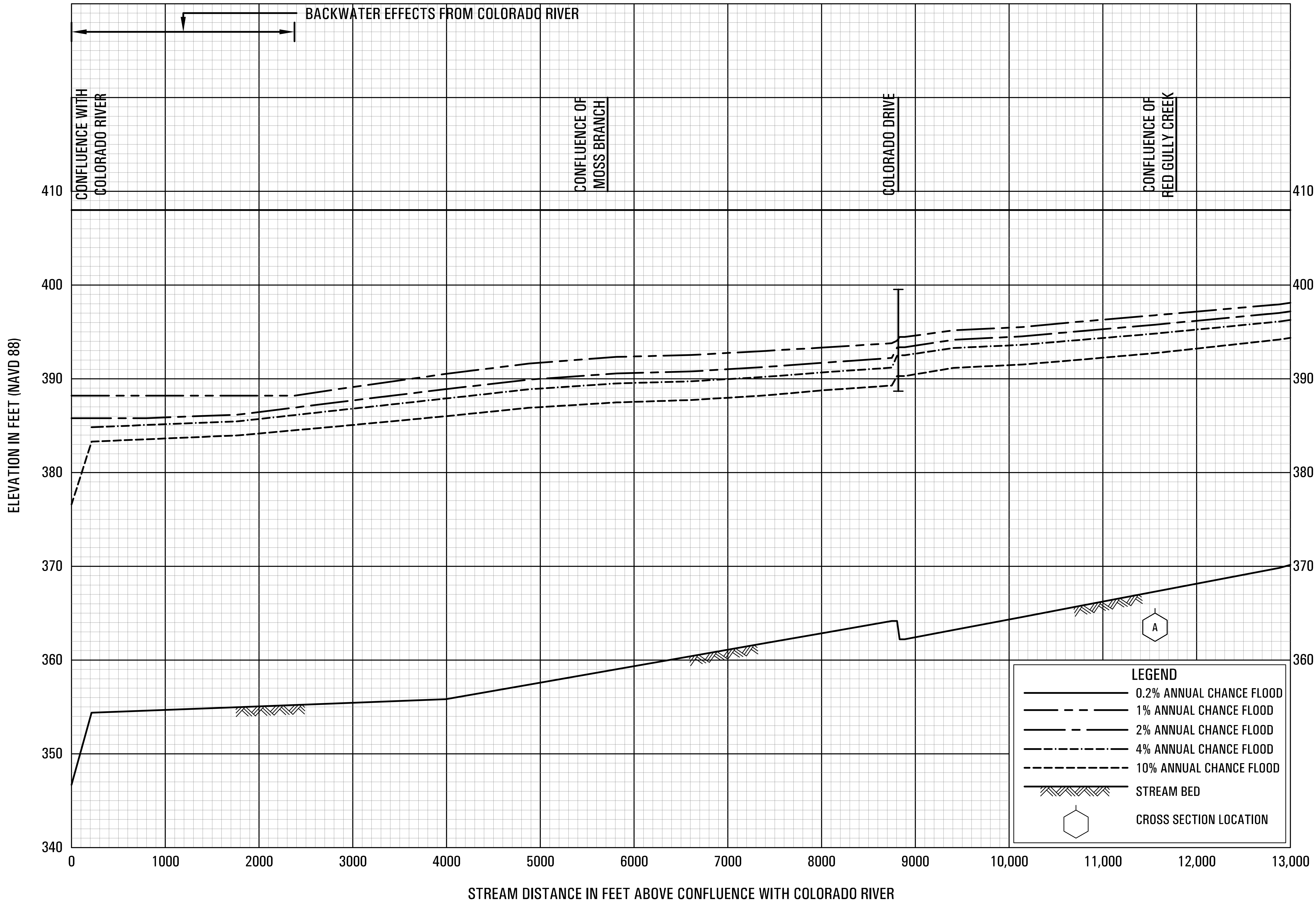


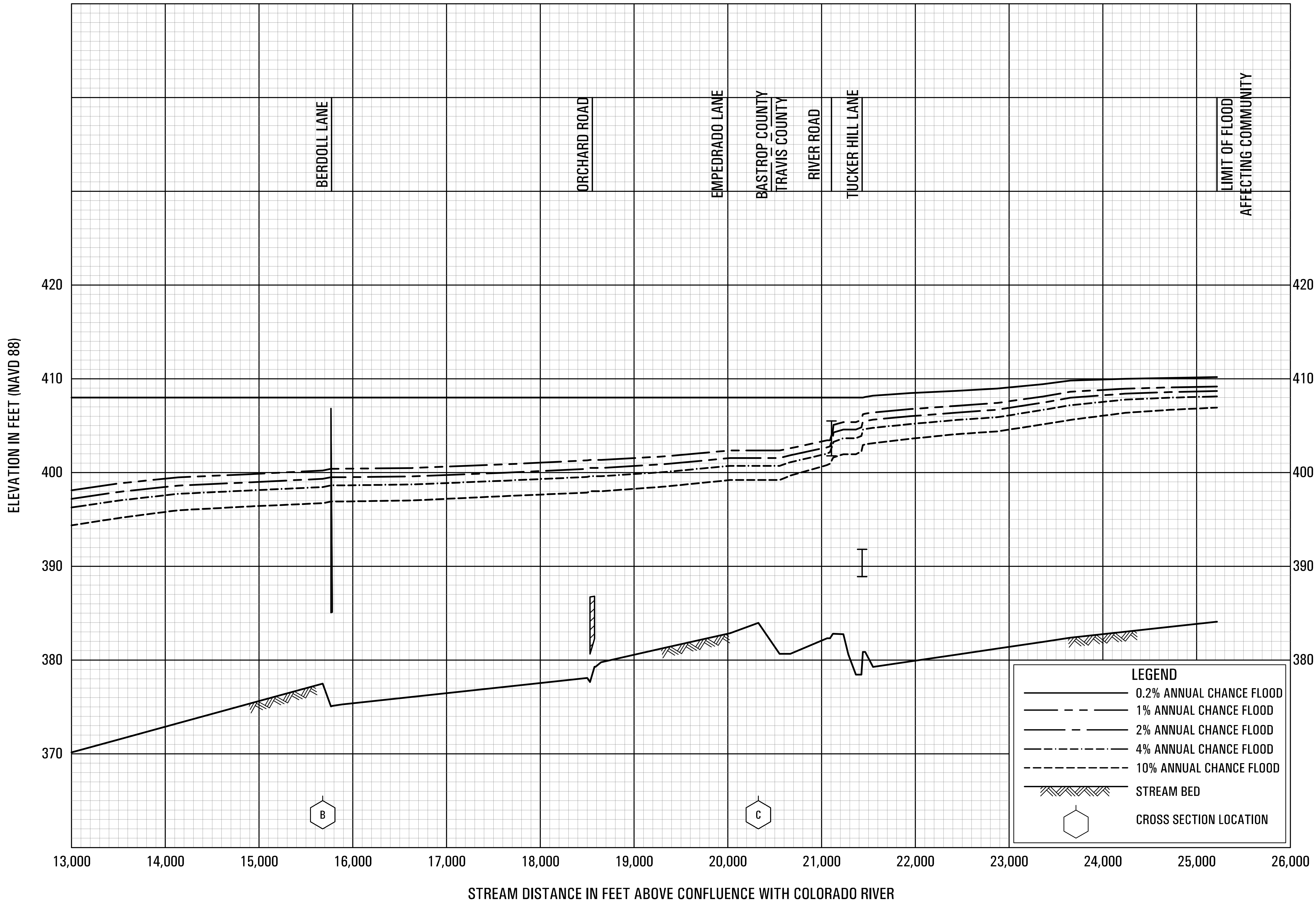
FLOOD PROFILES

DRY CREEK EAST

FEDERAL EMERGENCY MANAGEMENT AGENCY

BASTROP COUNTY, TX

AND INCORPORATED AREAS



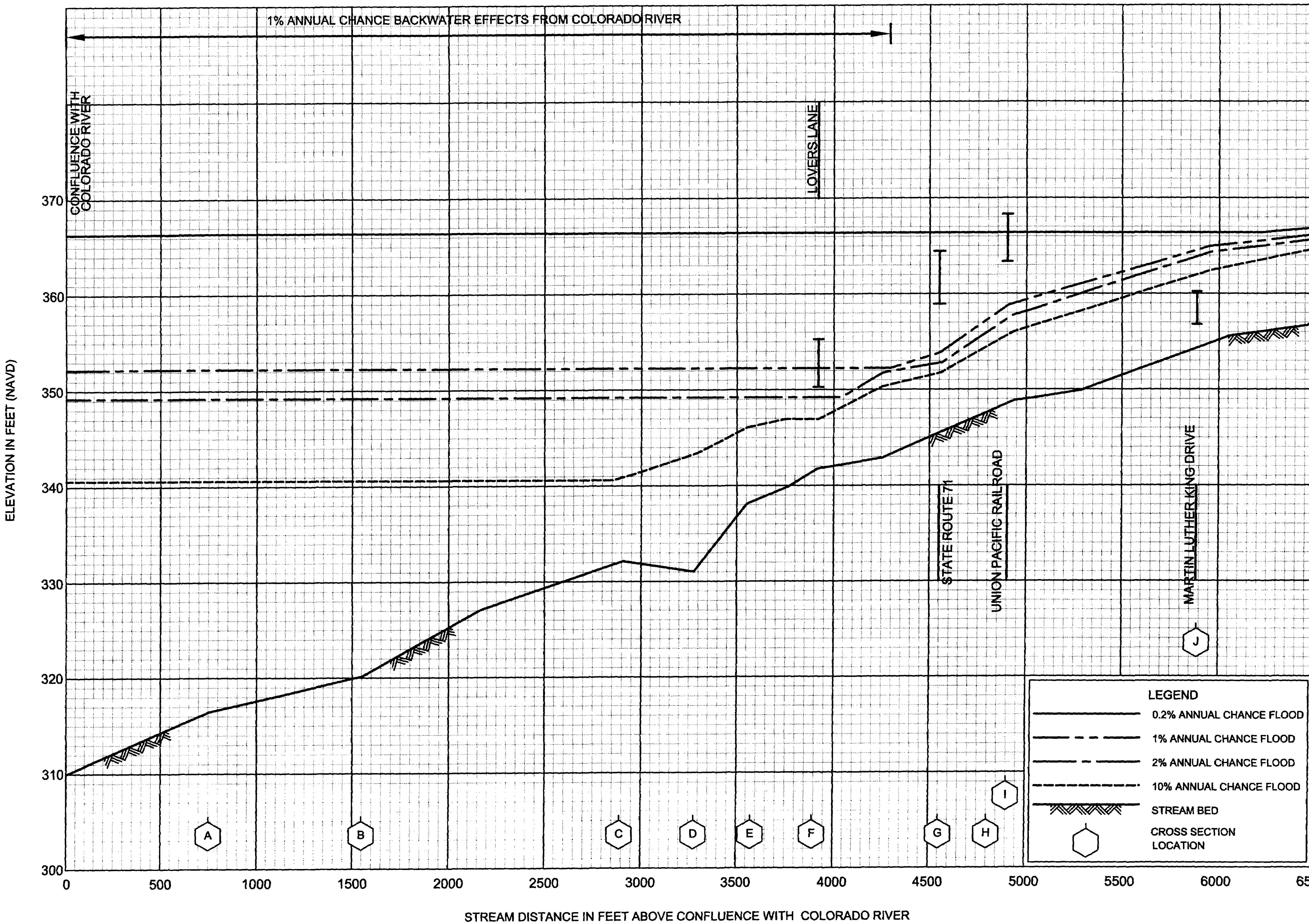
FLOOD PROFILES

DRY CREEK EAST

FEDERAL EMERGENCY MANAGEMENT AGENCY

BASTROP COUNTY, TX

AND INCORPORATED AREAS



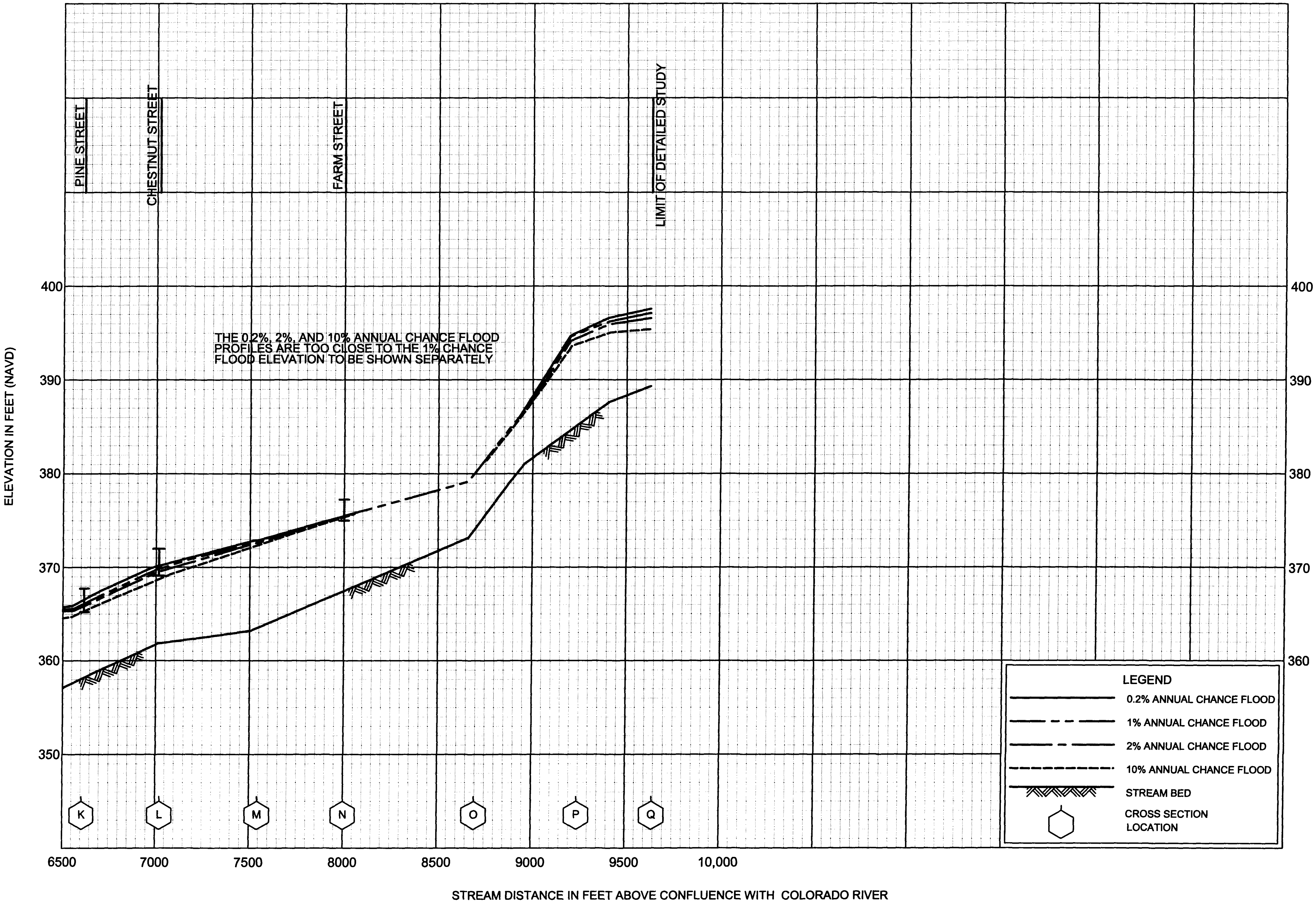
FLOOD PROFILES

GILLS BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

BASTROP COUNTY, TX

AND INCORPORATED AREAS



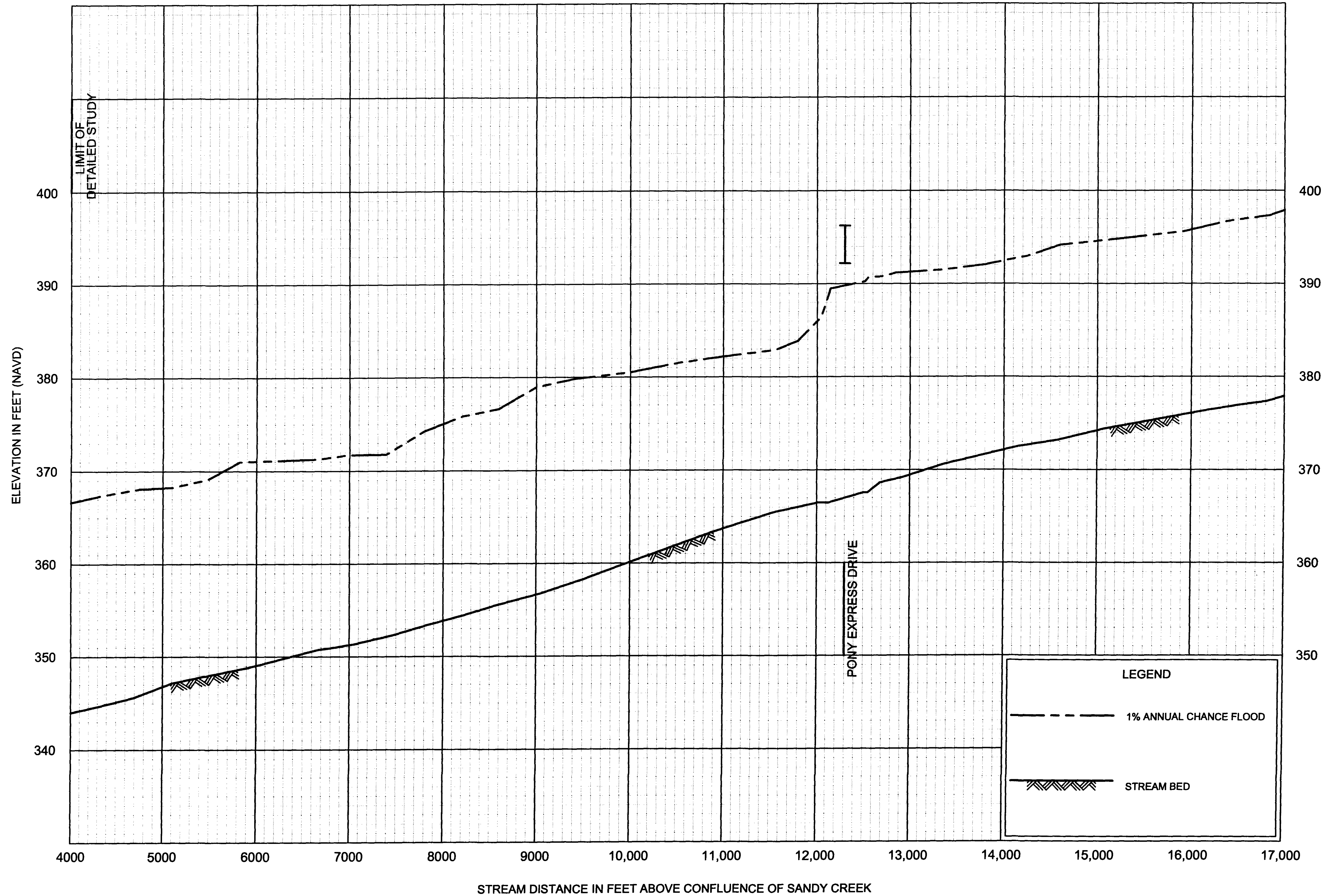
FLOOD PROFILES

GILLS BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

BASTROP COUNTY, TX

AND INCORPORATED AREAS



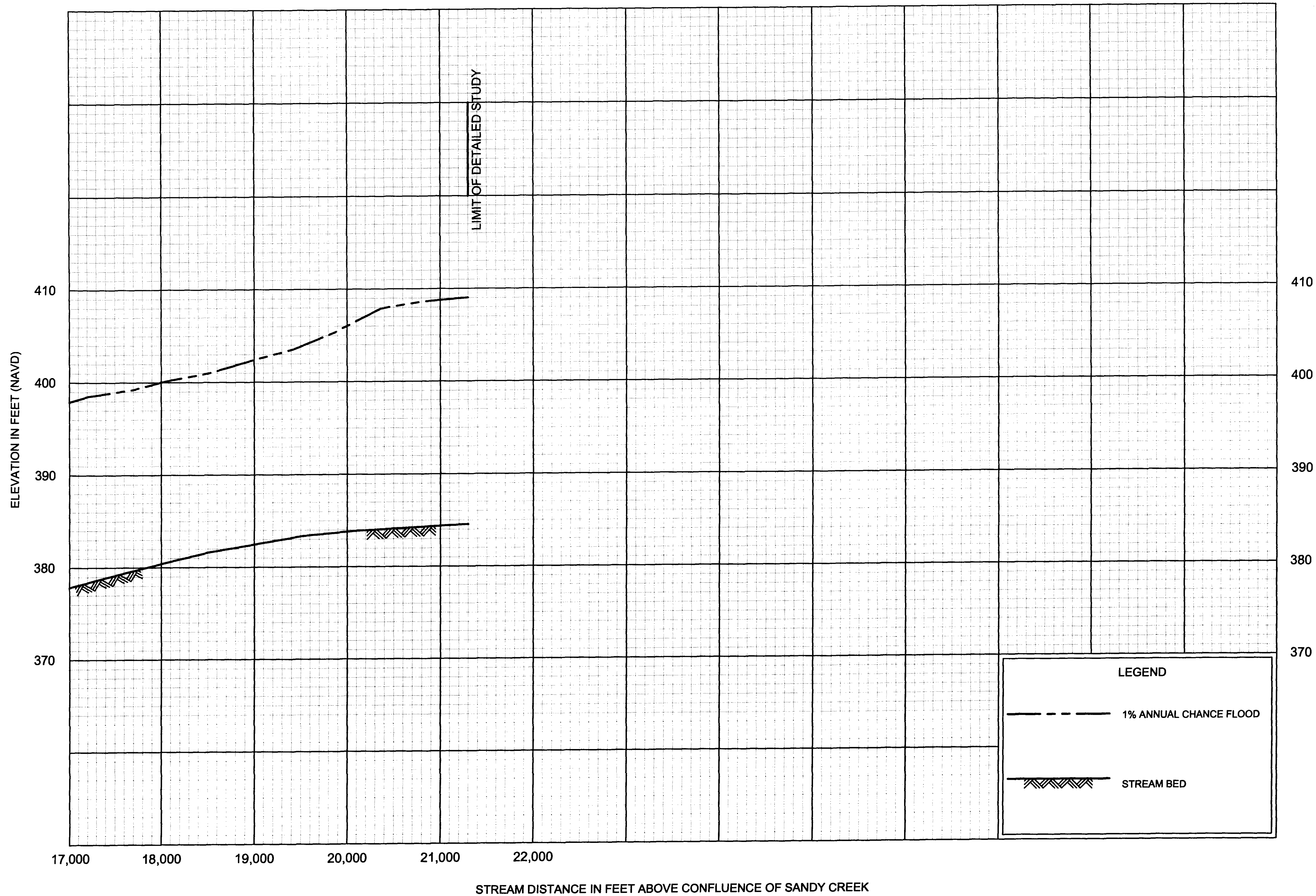
FLOOD PROFILES

PINEY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BASTROP COUNTY, TX

AND INCORPORATED AREAS



FLOOD PROFILES

PINEY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BASTROP COUNTY, TX

AND INCORPORATED AREAS

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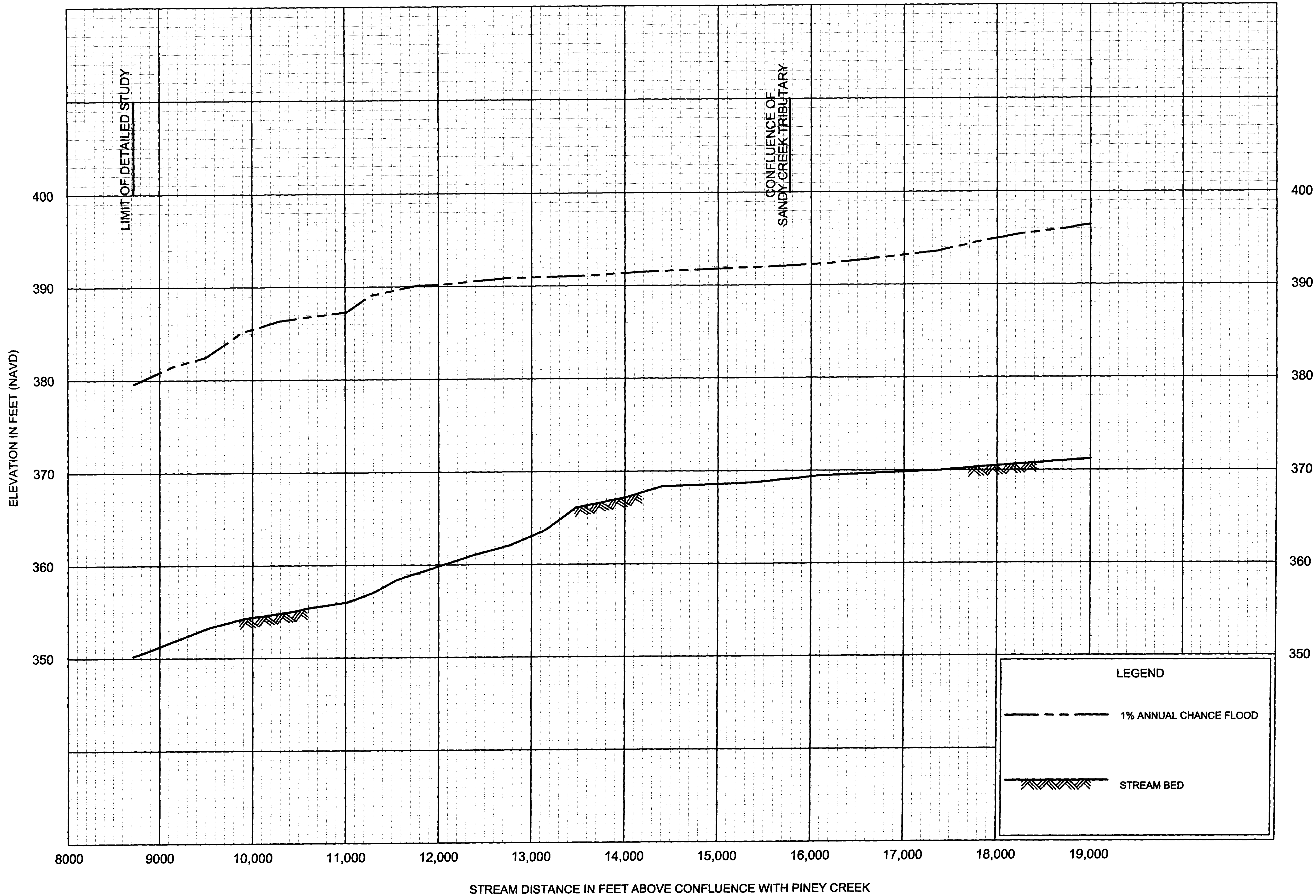
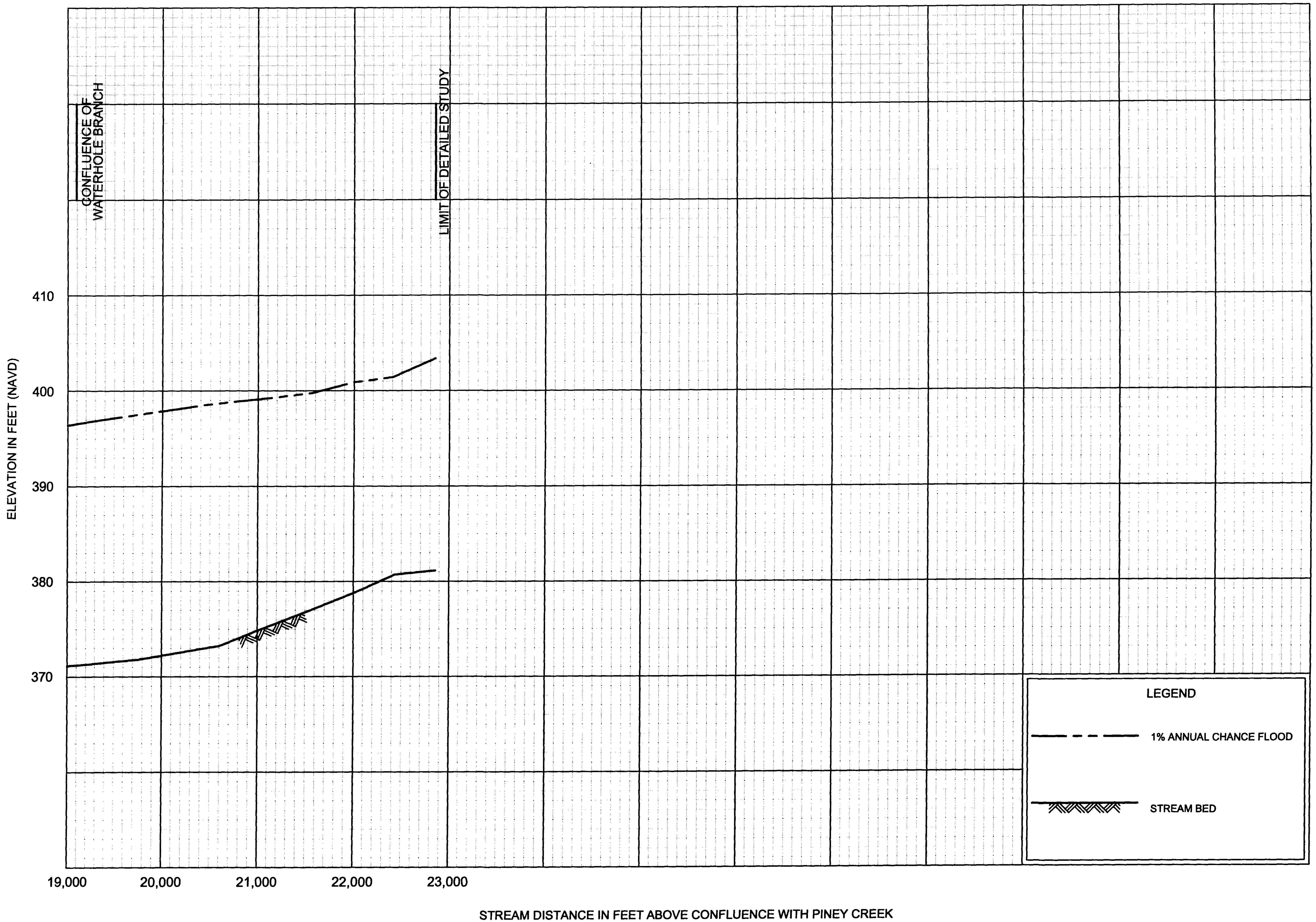


FLOOD PROFILES

SANDY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BASTROP COUNTY, TX
AND INCORPORATED AREAS



FLOOD PROFILES

SANDY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BASTROP COUNTY, TX

AND INCORPORATED AREAS

IV.

APPENDIX B

DRAINAGE TECHNICAL MEMORANDUM FOR PECAN PARK DEVELOPMENT

Espey Consultants, Inc.
Environmental & Engineering Services

TECHNICAL MEMORANDUM

Date: February 22, 2010

To: Lynn Alderson, P.E. – Alderson Group, Inc.

From: J. Travis Wilson, P.E., C.F.M.

Re: Drainage Technical Memorandum
Pecan Park Development
Bastrop, Bastrop County, Texas
EC Project No. 09080.00

cc: Dale W. Gray, P.E., Vice President – Espey Consultants, Inc.

Attachments:
1 – Site Location Map
2 – Floodplain Map
3 – Time of Concentration Computations
4 – Existing and Proposed Conditions 1% Annual Chance Hydrologic Model

STATE OF TEXAS
J. TRAVIS WILSON
97307
LICENSED
PROFESSIONAL ENGINEER
22 FEB 2010

Espey Consultants, Inc. (EC) is pleased to submit this technical memorandum documenting the results of the hydrologic and hydraulic analysis of the proposed Pecan Park Development located adjacent to the Colorado River along State Highway 71 (SH 71) in the City of Bastrop, Bastrop County, Texas. Specifically, the Pecan Park Development is located on 311 acres of land as shown on the Site Location Map attached with this memorandum. A portion of the site lies within the 1% annual chance (100-year) floodplain of the Colorado River as shown on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) 48021C0355E dated January 19, 2006. The site is not impacted by any floodplain or creek systems other than the Colorado River. An exhibit showing the regulatory floodplain relative to the Pecan Park site is included with this memorandum as Attachment 2.

The intent of this memorandum is to demonstrate that development of the Pecan Park property does not adversely impact the regulatory floodplain of the Colorado River. This memorandum does not include an analysis of the internal (local) drainage system of the Pecan Park site. The sections that follow present a drainage analysis of Pecan Park and the drainage relationship of Pecan Park to the Colorado River.

1.0 DRAINAGE ANALYSIS OF PECAN PARK

The Pecan Park Development is a 311-acre site located along the Colorado River. The City of Bastrop Drainage Design Ordinance states that the 1% annual chance event be used to evaluate flooding impacts; therefore, this analysis only considers the 1% annual chance event. Existing conditions and developed conditions flows for the 1% annual chance storm event for the site are calculated using the United States Army Corps of Engineers (USACE) HEC-1 computer program utilizing the NRCS unit hydrograph method. This analysis only pertains to on-site flows—off-site flows are assumed to convey through or around the property and do not affect the premise of this analysis.

1.1 PRECIPITATION AND RAINFALL DISTRIBUTION

The precipitation depth of 10.2 inches for the 1% annual chance event is taken from the City of Bastrop Drainage Design Ordinance. This precipitation depth is distributed as a hyetograph assuming a 24-hour NRCS Type III rainfall distribution.

1.2 INFILTRATION LOSSES

The U.S. Department of Agriculture Natural Resource Conservation Service (NRCS, formerly the Soil Conservation Service, SCS) has developed a rainfall runoff index called the runoff curve number (CN), which takes into account such factors as soil characteristics, land use/land condition, and antecedent soil moisture to derive a generalized rainfall/runoff relationship for a given area. A description of these components and the equations for calculating runoff depth from rainfall are provided below.

The NRCS classifies soils into four hydrologic soil groups: A, B, C, and D. These groups indicate the runoff potential of a soil, ranging from a low runoff potential (group A) to a high runoff potential (group D). The NRCS provides runoff curve numbers for three Antecedent Moisture Conditions (AMC): I, II and III. AMC I represents dry soil conditions and AMC III represents saturated soil conditions. AMC II is normally considered to be the average soil condition; however, studies have indicated that AMC II is not the average throughout Texas. Investigations have shown that the average condition ranges from AMC I in west Texas to between AMC II and III for east Texas. Runoff curve numbers vary from 0 to 100, with the smaller values representing soils with lower runoff potential and the larger values representing soils with higher runoff potential. This study assumes an AMC II to represent average conditions.

For this analysis, curve numbers are evaluated independently of imperious cover (i.e., these curve numbers reflect good condition range land). According to the soil survey of Bastrop County, Texas, most of the soils within the study area are classified as NRCS Group B soils with a smaller portion of the site near the Colorado River classified as NRCS Group A soils. A runoff curve number (CN) of 57 is representative for the study area.

HEC-HMS computes 100 percent runoff from impervious areas, while runoff from pervious areas is computed using the selected CN value and the following equations:

$$Q = (P - 0.2\times S)^2 / (P + 0.8\times S) \qquad \text{Equation 1}$$

And

$$CN = 1000 / (10 + S) \qquad \text{Equation 2}$$

Where:

Q	=	depth of runoff (in),
P	=	depth of precipitation (in),
S	=	potential maximum retention after runoff begins (in)[1], and
CN	=	runoff curve number.

Land use (impervious cover) is another key component of the infiltration losses in the hydrologic model. Most of the existing land area of the study area is undeveloped land with no impervious cover. Under proposed conditions, the impervious cover for the project site is increased to reflect proposed usage. The assumed proposed impervious cover for this tract is 80 percent. The actual impervious cover will be determined as part of the proposed site design and does not affect the premise of this technical memorandum.

1.3 UNIT HYDROGRAPH METHOD

1.3.1 Background

A rainfall/runoff transformation is required to convert rainfall excess (total rainfall minus infiltration losses) into runoff from a particular subarea. The NRCS unit hydrograph option in HEC-1 is used in this analysis to generate a runoff hydrograph for the defined subarea. The unit hydrograph method represents a hydrograph for one unit [inch] of direct runoff and is a nationally accepted, standard engineering practice approach.

The dimensionless unit hydrograph developed by the NRCS (figure below) was developed by Victor Mockus and presented in *National Engineering Handbook, Section 4, Hydrology*. The dimensionless unit hydrograph has its ordinate values expressed in a dimensionless ratio, q/qp, and its abscissa values as t/Tp. This unit hydrograph has a point of inflection approximately 1.7 times the time to peak (Tp), and the time-to-peak 0.2 of the time-of-base (Tb) (NRCS 1985).

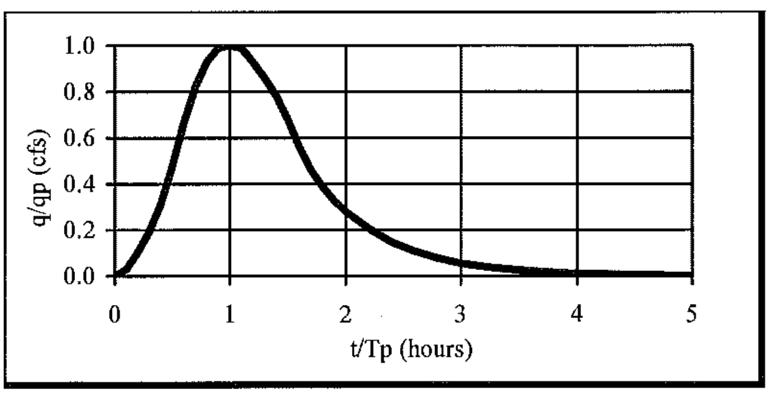


Figure 2. NRCS Unit Graph

In HEC-1, input data for this method consists of a single input parameter, T_{LAG}, which is equal to the time (hours) between the center of mass of rainfall excess and the peak of the unit hydrograph (NRCS 1985). In other words, there is a delay in time after a rain event before the runoff reaches it maximum peak. This delay is known as lag.

[1] Solve for S based on known CN

The time to peak is computed using the following equation:

$$T_{PEAK} = \Delta t/2 + T_{LAG} \qquad \text{Equation 3}$$

Where:

T_{PEAK} = time to peak of the unitgraph (hours),
Δt = computation interval or duration of unit excess (hours), and
T_{LAG} = watershed lag (hours).

The peak flow rate of the unit graph is computed using the following equation:

$$qp = 484A/T_{PEAK} \qquad \text{Equation 4}$$

Where:

qp = peak flow rate of the unit graph (cubic feet per second [cfs] / inch),
A = watershed area (square miles), and
484 = peak rate factor (dimensionless)[2]

1.3.2 Time of Concentration

The NRCS method assumes that the lag time of a watershed is 60 percent of the watershed's time of concentration. The time of concentration is the time for runoff to travel from the hydraulically most distant point of the watershed to a point of interest within the watershed (NRCS 1985). The time of concentration may be estimated by calculating and summing the travel time defined by the flow type: sheet flow, shallow concentrated flow, and channelized flow (including roadways, storm sewers, and natural/manmade channels). The methods prescribed in the NRCS' Technical Release 55 (TR-55) are used to determine the times of concentration for each flow segment in this analysis. Attachment 3 shows the results of the calculations for this analysis utilizing each typical flow segment presented below.

Sheet Flow (≤ 300 feet)

Sheet flow is flow over plane surfaces. It usually occurs in the headwater of streams. With sheet flow, the friction value (Manning's n) is an effective roughness coefficient that includes the effect of raindrop impact, of drag over the plane surface and obstacles such as litter, crop ridges, and rocks, and of erosion and transportation of sediment. These n values are for very shallow flow depths of approximately 0.1 foot. Assuming sheet flow of less than or equal to 300 feet, travel time is computed as follows:

$$Tt = (0.007 \times (n \times L)^{0.8}) / (P_2^{0.5} \times s^{0.4}) \qquad \text{Equation 5}$$

Where:

Tt = travel time (hr),
n = Manning's roughness coefficient,
L = flow length (ft),
P_2 = 2-year, 24-hour rainfall (in), and
s = slope of hydraulic grade line (land slope, ft/ft).

[2] The peak rate factor of 484 has been known to vary from 600 in steep terrain to 300 in very flat, swampy terrain. The 484 value is standard engineering practice and is utilized in this analysis.

Shallow Concentrated Flow

After a maximum of 300 feet, sheet flow usually becomes shallow concentrated flow. The average velocity for this flow can be determined from the following figure in which average velocity is a function of watercourse slope and type of channel (TR-55). The flow is still considered shallow in depth and flows in a swale or gutter instead of a channel, which has greater depth.

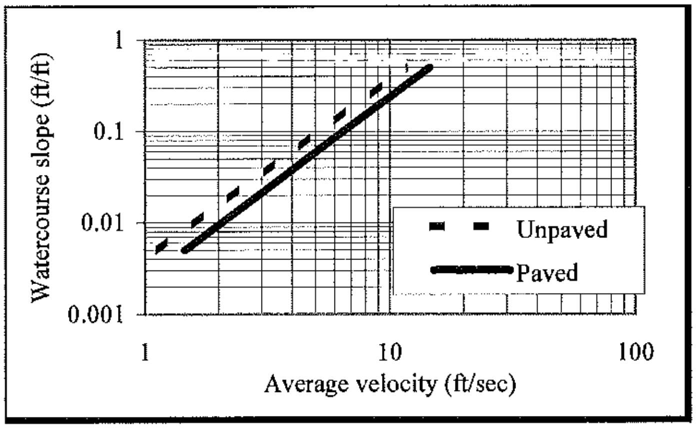


Figure 3. Avg. Velocities for Estimating Travel Time in Shallow Concentrated Flow Segments

After determining the average velocity, the following equation is used to compute travel time:

$$Tt = L / (3600 \times V) \qquad \text{Equation 6}$$

Where:

Tt	=	travel time (hr),
L	=	flow length (ft),
V	=	average velocity (ft/sec), and
3,600	=	conversion factor from seconds to hours.

Channelized Flow

As the depth of concentrated flow increases, the shallow concentrated flow evolves into channelized flow. Open channels are assumed to begin where surveyed cross section information has been obtained, where channels are visible on aerial photographs, or where blue lines (indicating streams) appear on United States Geological Survey (USGS) quadrangle maps. Under proposed conditions, shallow concentrated flow is assumed to evolve more quickly into channel flow than under existing conditions.

1.4 HYDROGRAPH ROUTING

This analysis includes one drainage area and does not include any stormwater management facilities. There is no hydrograph routing (stream routing, storage routing, diversion routing, or the like) associated with this analysis.

1.5 HYDROLOGIC ANALYSIS RESULTS

The table shown below summarizes the existing conditions and proposed conditions results obtained from HEC-1 for the Pecan Park Development. The results of this analysis are compared to the drainage characteristics of the Colorado River later in this memorandum for the purpose of evaluating the potential runoff impact from the Pecan Park Development on the Colorado River. The existing and proposed hydrologic models are included with this technical memorandum as Attachment 4.

Table 6. Computed Peak Flow Rates from Pecan Park Development

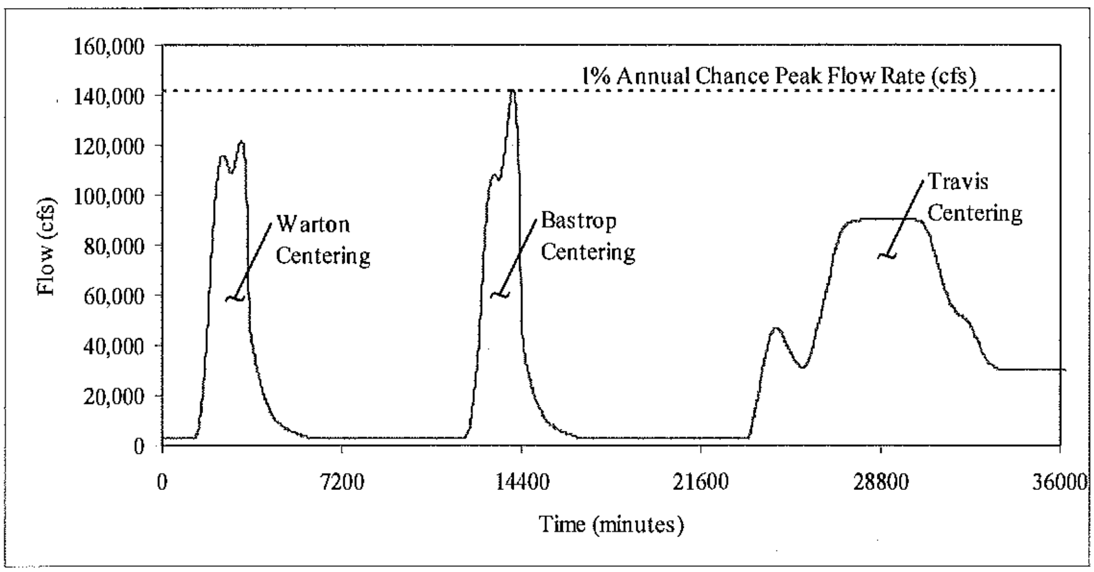
HEC-1 Node	Area (acres)	1% Annual Chance Peak Flow Rate (cfs)	
		Existing	Proposed
Site	314	535	1,670

2.0 DRAINAGE CHARACTERISTICS OF THE COLORADO RIVER

The Colorado River is adjacent to the Pecan Park property and accepts the runoff from the site. According to the Bastrop County Flood Insurance Study (FIS) dated January 19, 2006, the Colorado River has a drainage area of approximately 39,980 square miles at USGS gage 08159200 located at SH 71 just upstream of the Pecan Park site. Of the 39,980 square miles of drainage area, approximately 11,403 square miles is estimated to be non-contributing according to the United States Geological Survey (USGS). Flow in the Bastrop County section of the Colorado River is also heavily influenced by the Highland Lakes as well as other flow control structures upstream.

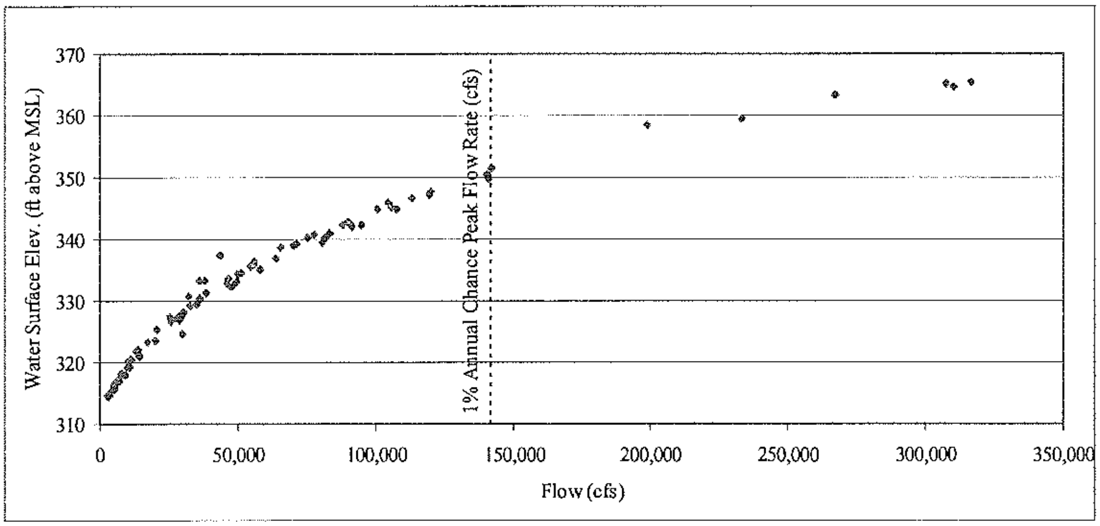
According to the FIS, the 1% annual chance peak at the USGS gage near the site is 142,020 cfs, which was derived by a flood frequency analysis of the annual peak flow rates at this gage location over a 70-year period of record. The USACE HEC-HMS computer program was then used to create a hydrograph of this peak flow rate. This hydrograph is then input into the unsteady hydraulic model for this section of the Colorado River using the USACE HEC-RAS computer program. The figure below presents the resulting hydrograph that is input into the hydraulic model at SH 71 just upstream of the Pecan Park site. This is a three-peak hydrograph to represent centering the storm simulation at three points of interest. The first peak represents centering over the Warton County point of interest, the second peak represents centering over the Bastrop County point of interest, and the third represents centering over the Travis County point of interest. The highest of the three peaks, and thus the regulatory 1% annual chance peak flow rate, is represented by centering over the Bastrop County point of interest.

Figure 1. Colorado River 1% Annual Chance Hydrograph at SH 71 near Pecan Park Site



The hydraulic model for Bastrop County is divided into two sections including 1) from Lady Bird Lake to the USGS gage at Bastrop and 2) from the USGS gage at Bastrop to the USGS gage at La Grange. The Pecan Park site lies near the upstream end of the Bastrop – La Grange section of the Colorado River hydraulic model near Cross Section 12503+28 (FEMA Lettered Cross Section AY). This hydraulic model was developed as a one-dimensional unsteady flow model as part of the Lower Colorado River Basin-Wide Study in 2002. The regulatory floodplain elevation adjacent to the Pecan Park site is 350.60 feet above mean sea level (MSL) and corresponds to the peak flow rate from centering the simulation at the Bastrop County point of interest. The figure below presents the hydraulic rating curve on the Colorado River at the Pecan Park site.

Figure 2. Hydraulic Rating Curve for Cross Section 12503+28 near Pecan Park Site



3.0 RELATIONSHIP OF PECAN PARK SITE TO COLORADO RIVER

The sections above describe the drainage characteristics of the Pecan Park site and the Colorado River near the site. The 1% annual chance flood event for the site is statistically independent of the 1% annual chance flood event for the Colorado River—the events are non-coincident. This rationale is consistent with FEMA's *Guidelines and Specifications for Flood Hazard Mapping Partners*, which states that the assumption of coincident peaks (peak-on-peak scenario) may be appropriate if all of the following are true:

- The ratio of drainage areas lies between 0.6 and 1.4.
    - The drainage area ratio of the Pecan Park site to the Colorado River is 0.00001. The figure shown below is a graphical relationship of the site relative to the overall Colorado River watershed (within the State of Texas).

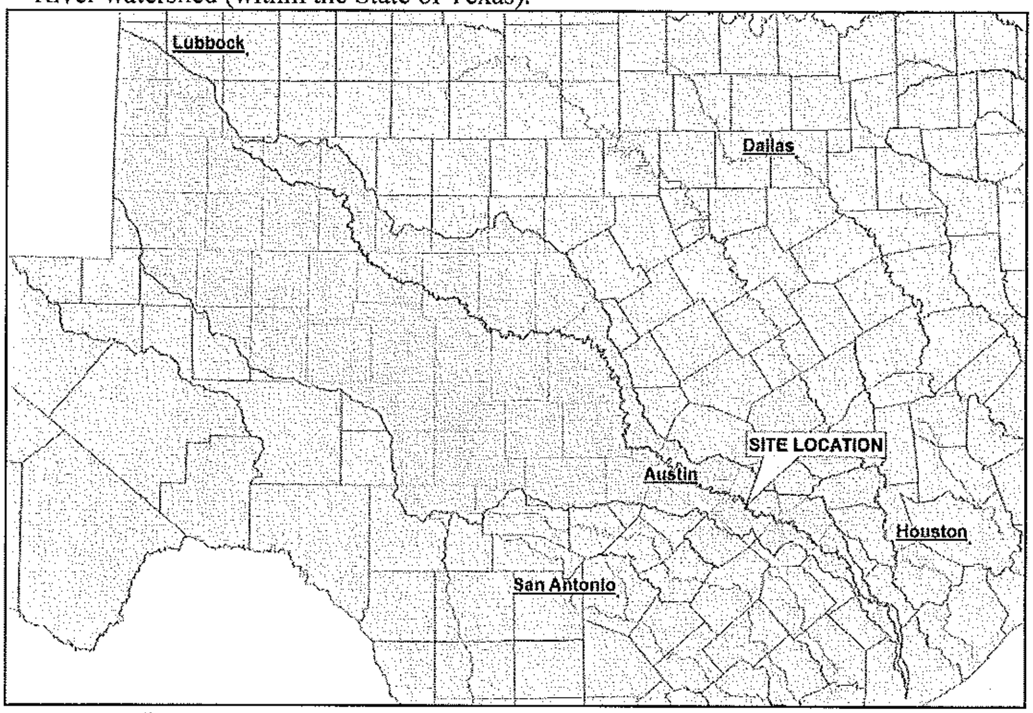


Figure 3. Pecan Park Site Location within Colorado River Watershed

- The times of peak flow are similar for the two combining watersheds.
    - The time of peak for the Colorado River is at approximately 31:45 hours as measured from the beginning of the Bastrop-centered simulation described earlier in this memorandum.
    - The Pecan Park site drainage is simulated based on a 24-hour design storm as described in the City of Bastrop Drainage Design Ordinance and is not directly comparable to the time of peak for the Colorado River. Based on a 24-hour design storm, the time of peak for the site is at approximately 12:20 under proposed conditions as measured from the beginning of the simulation.

- The likelihood of both watersheds being covered by the storm event being modeled is high.
    - The likelihood of the Pecan Park site experiencing a 100-year event as modeled above is a 1% annual chance. The likelihood of the Colorado River experiencing a 100-year event as described above is a 1% annual chance. However, the likelihood of both events

occurring simultaneously in a peak-on-peak scenario is less than a 1% annual chance, and therefore, does not qualify as a 100-year event.

None of the above conditions are met; therefore, the assumption of coincident peaks is not appropriate for the Pecan Park site relative to the Colorado River. Given the conditions outlined above and the drainage characteristics of the Pecan Park site relative to the Colorado River, increases in runoff from the development of the Pecan Park site will not adversely impact the 1% annual chance peak flow rate or regulatory floodplain elevation on the Colorado River. Therefore, site detention for the development of the Pecan Park site is not necessary to mitigate any impacts to peaks flow rates along the Colorado River. This rationale is consistent with the City of Austin drainage criteria for development that discharges into and is immediately adjacent to the Colorado River (reference Austin *Drainage Criteria Manual* §1.2.2(F).

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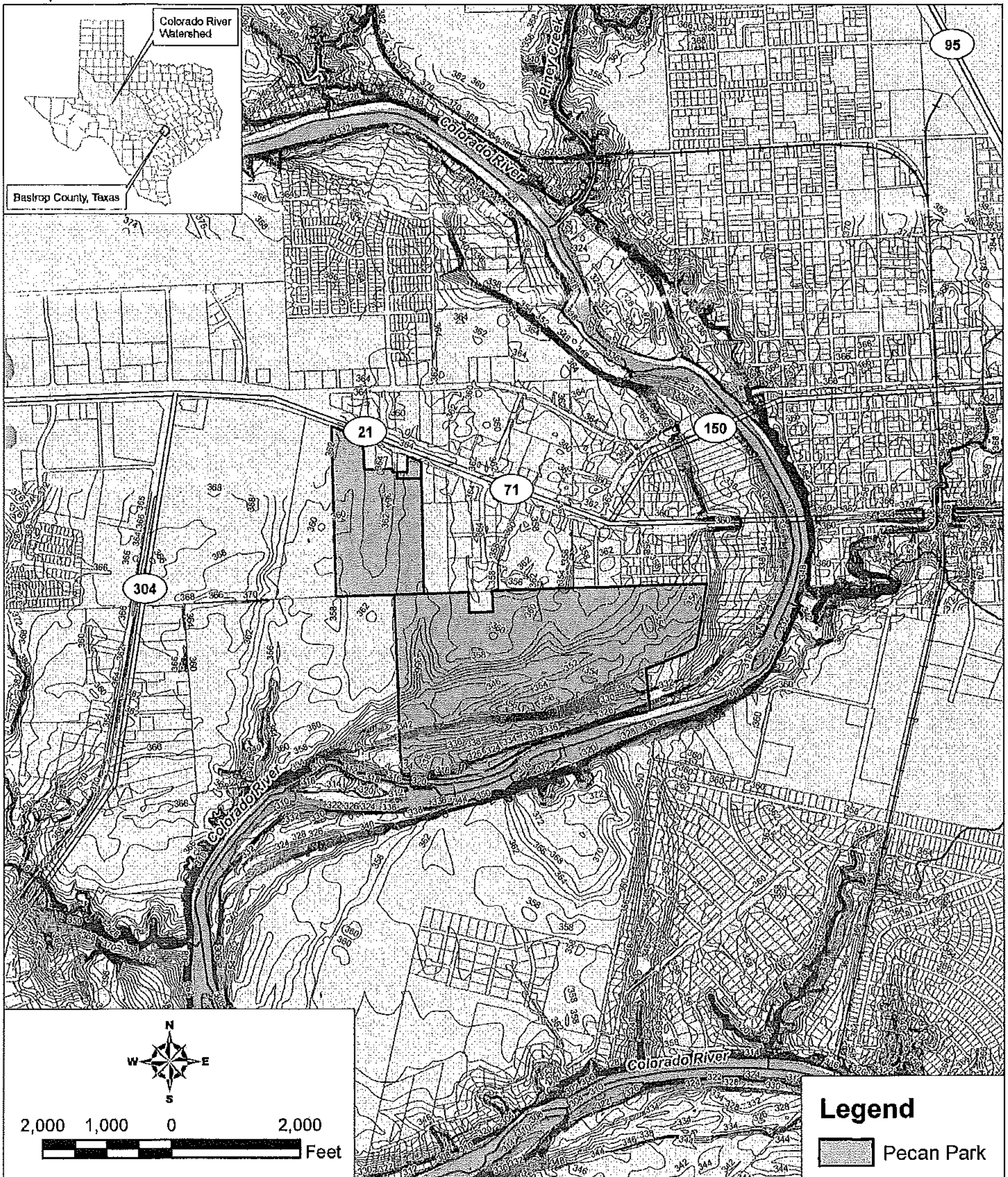


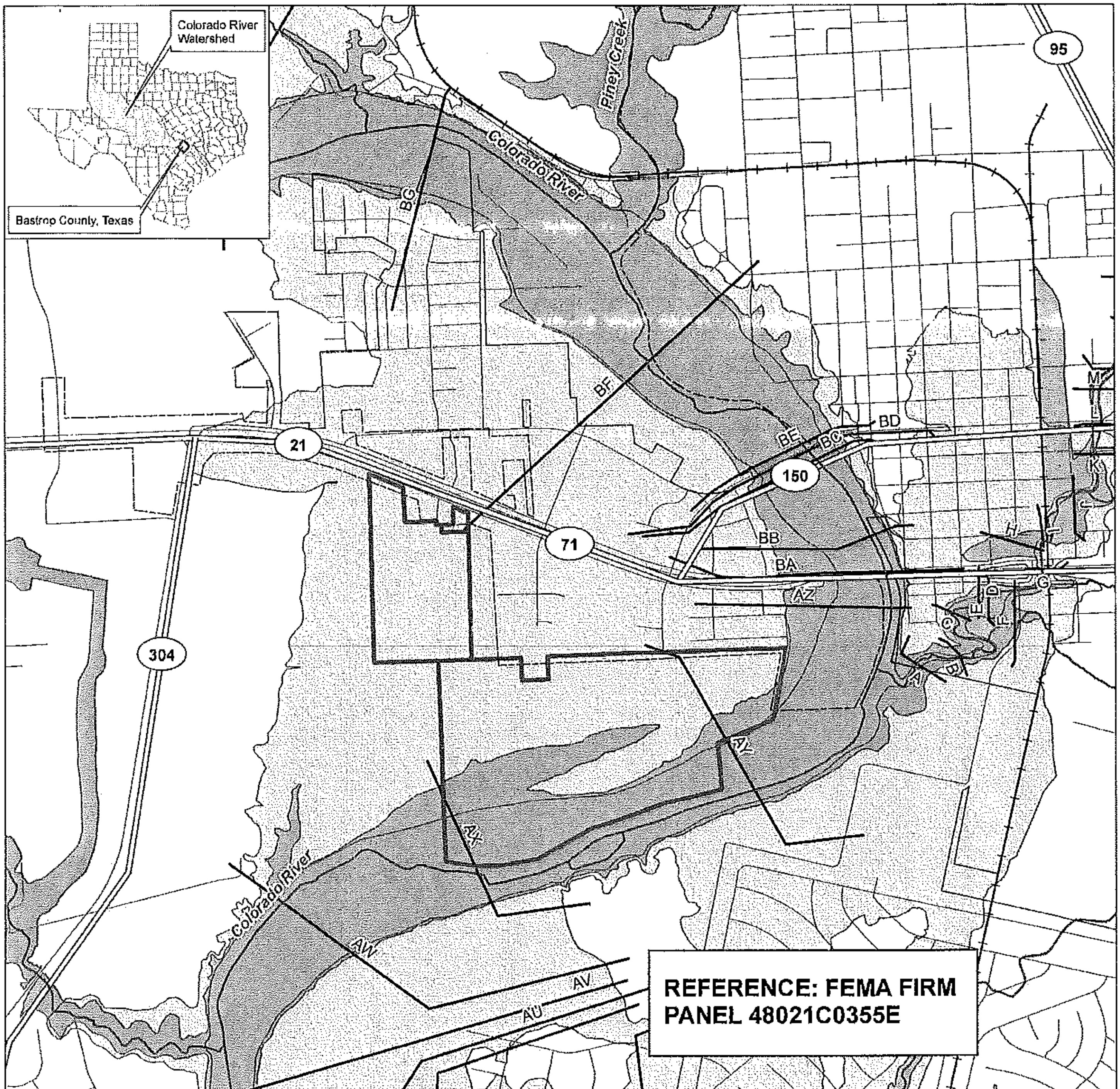
Espey Consultants, Inc.
Environmental & Engineering Services

ATTACHMENT 1
SITE LOCATION MAP
PECAN PARK DEVELOPMENT

FEBRUARY 2010

PROJECT NUMBER 09080.00

Monday, February 15, 2010 10:20:55 AM; P:\Active\09080.00_Pecan_Park_Dev\GIS\Exh\Site_Location_Map_20092009.mxd



N
W E
S

2,000 1,000 0 2,000
Feet

Legend

- Pecan Park
- AX — FEMA LETTERED CROSS SECTION
- 0.2 % ANNUAL CHANCE FLOODPLAIN (SHADED ZONE X)
- 1 % ANNUAL CHANCE FLOODPLAIN (ZONE AE)

Espey Consultants, Inc.
Environmental & Engineering Services

ATTACHMENT 2
FLOODPLAIN MAP

FEBRUARY 2010

PROJECT NUMBER 09080.00

PECAN PARK DEVELOPMENT
TIME OF CONCENTRATION CALCULATIONS

ATTACHMENT 3

EXISTING CONDITIONS

TR-55 Method of Computing the Time of Concentration

			Site
Sheet Flow	variable	units	
Manning's roughness coef.	n	n/a	0.24
Flow Length	L	feet	300
2-year, 24-hour rainfall	P2	inches	3.6
Slope	s	ft/ft	0.0110
Travel time (equation 3-3)	Tt	hours	0.686
Shallow Concentrated Flow		min.	41.2
Flow Length	L	feet	2,000
Slope	s	ft/ft	0.003
Surface (1=paved or 2=unpaved)		n/a	2
Velocity (figure 3-1)	V	ft/sec	0.89
Travel time	Tt	hours	0.626
Manning's Equation		min.	37.6
Flow Length	L	feet	2,750
Slope	S	ft/ft	0.0130
roughness	n	n/a	0.08
Open Channel			
Bottom Width	BW	feet	10
Side Slopes (H:1)	H	feet	3
Depth	d	feet	4
...or Closed Conduit			
Rise / Diameter	R / D	feet	
Span (0 if circular)	S	feet	
Cross-Sectional Area	X-A	feet^2	88.00
Flow Rate	Q	cfs	342.66
Velocity (figure 3-1)	V	ft/sec	3.89
Travel time	Tt	hours	0.196
Flow Length	L	feet	
Slope	S	ft/ft	
roughness	n	n/a	
Open Channel			
Bottom Width	BW	feet	
Side Slopes (H:1)	H	feet	
Depth	d	feet	
...or Closed Conduit			
Rise / Diameter	R / D	feet	
Span (0 if circular)	S	feet	
Cross-Sectional Area	X-A	feet^2	0.00
Flow Rate	Q	cfs	n/a
Velocity (figure 3-1)	V	ft/sec	n/a
Travel time	Tt	hours	-
Total Travel Time	TC	hours	1.508
	TC	min.	90.5
Lag Time	TL	hours	0.9049
	TL	min.	54.3

PECAN PARK DEVELOPMENT
TIME OF CONCENTRATION CALCULATIONS

ATTACHMENT 3

PROPOSED CONDITIONS

TR-55 Method of Computing the Time of Concentration

			Site
Sheet Flow	variable	units	
Manning's roughness coef.	n	n/a	0.24
Flow Length	L	feet	50
2-year, 24-hour rainfall	P2	inches	3.6
Slope	s	ft/ft	0.0110
Travel time (equation 3-3)	Tt	hours	0.164
Shallow Concentrated Flow		min.	9.8
Flow Length	L	feet	500
Slope	s	ft/ft	0.003
Surface (1=paved or 2=unpaved)		n/a	1
Velocity (figure 3-1)	V	ft/sec	1.13
Travel time	Tt	hours	0.123
Manning's Equation		min.	7.4
Flow Length	L	feet	4,500
Slope	S	ft/ft	0.0130
roughness	n	n/a	0.04
Open Channel			
Bottom Width	BW	feet	10
Side Slopes (H:1)	H	feet	3
Depth	d	feet	4
...or Closed Conduit			
Rise / Diameter	R / D	feet	
Span (0 if circular)	S	feet	
Cross-Sectional Area	X-A	feet^2	88.00
Flow Rate	Q	cfs	685.33
Velocity (figure 3-1)	V	ft/sec	7.79
Travel time	Tt	hours	0.161
Flow Length	L	feet	
Slope	S	ft/ft	
roughness	n	n/a	
Open Channel			
Bottom Width	BW	feet	
Side Slopes (H:1)	H	feet	
Depth	d	feet	
...or Closed Conduit			
Rise / Diameter	R / D	feet	
Span (0 if circular)	S	feet	
Cross-Sectional Area	X-A	feet^2	0.00
Flow Rate	Q	cfs	n/a
Velocity (figure 3-1)	V	ft/sec	n/a
Travel time	Tt	hours	-
Total Travel Time	TC	hours	0.447
	TC	min.	26.8
Lag Time	TL	hours	0.2683
	TL	min.	16.1

ATTACHMENT 4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1****************************************                    ***************************************
 *                                      *                    *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                    *   U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                    *   HYDROLOGIC ENGINEERING CENTER     *
 *            VERSION 4.1               *                    *         609 SECOND STREET           *
 *                                      *                    *      DAVIS, CALIFORNIA 95616        *
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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


1                                            HEC-1 INPUT                                          PAGE  1

          LINE       ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

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            2        ID  Existing Conditions.......................February 2010
            3        ID  100-Year Event (1% Event).................File name:  E_100.IH1
            4        ID  NRCS Type III Distribution (24-HR Dnration)
            5        ID  Project No. 09080.00......................Espey Consultants
                     *
            6        IT       5 01JAN10       0     300
            7        IO       5
                     *

            8        KK    DA_1
            9        BA   0.491
           10        PB    10.2
                     * SCS Type 3 Rainfall Pattern
           11        IN       5 01JAN10       0
           12        PC       0  0.0008  0.0017  0.0025  0.0033  0.0042   0.005  0.0058  0.0067  0.0075
           13        PC  0.0083  0.0092    0.01  0.0108  0.0117  0.0125  0.0133  0.0142   0.015  0.0158
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           15        PC  0.0252  0.0261   0.027  0.0279  0.0289  0.0298  0.0308  0.0317  0.0327  0.0337
           16        PC  0.0347  0.0357  0.0367  0.0377  0.0388  0.0398  0.0408  0.0419   0.043  0.0441
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           19        PC  0.0693  0.0707   0.072  0.0733  0.0747  0.0761  0.0776  0.0791  0.0806  0.0822
           20        PC  0.0838  0.0854  0.0871  0.0887  0.0905  0.0922  0.0941  0.0959  0.0978  0.0997
           21        PC  0.1016  0.1036  0.1056  0.1076  0.1097  0.1118   0.114  0.1163  0.1185  0.1208
           22        PC  0.1233  0.1258  0.1284  0.1311  0.1339  0.1367  0.1397  0.1427  0.1458   0.149
           23        PC  0.1522  0.1555  0.1589  0.1624  0.1659  0.1696  0.1733  0.1771   0.181   0.185
           24        PC   0.189  0.1931  0.1975   0.202  0.2067  0.2115  0.2165  0.2216   0.227  0.2325
           25        PC  0.2382   0.244    0.25  0.2564  0.2634  0.2711  0.2795  0.2884   0.298  0.3111
           26        PC  0.3298  0.3559  0.3848  0.4273     0.5  0.5727  0.6152  0.6441  0.6702  0.6889
           27        PC   0.702  0.7116  0.7205  0.7289  0.7366  0.7436    0.75   0.756  0.7618  0.7675
           28        PC   0.773  0.7784  0.7835  0.7885  0.7933   0.798  0.8025  0.8069   0.811   0.815
           29        PC   0.819  0.8229  0.8267  0.8304  0.8341  0.8376  0.8411  0.8445  0.8478  0.8511
           30        PC  0.8543  0.8573  0.8603  0.8633  0.8661  0.8689  0.8716  0.8742  0.8767  0.8792
           31        PC  0.8815  0.8837   0.886  0.8882  0.8903  0.8924  0.8944  0.8964  0.8984  0.9003
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           34        PC  0.9332  0.9346  0.9358   0.937  0.9383  0.9396  0.9408  0.9421  0.9433  0.9445
           35        PC  0.9456  0.9468   0.948  0.9491  0.9503  0.9515  0.9526  0.9537  0.9548  0.9559
           36        PC   0.957  0.9581  0.9592  0.9603  0.9613  0.9623  0.9634  0.9644  0.9654  0.9664
           37        PC  0.9674  0.9684  0.9694  0.9704  0.9714  0.9723  0.9733  0.9743  0.9752  0.9762
           38        PC  0.9771   0.978   0.979  0.9799  0.9808  0.9816  0.9825  0.9834  0.9843  0.9852
           39        PC   0.986  0.9868  0.9877  0.9885  0.9893  0.9902  0.9909  0.9917  0.9925  0.9933
           40        PC  0.9941  0.9948  0.9956  0.9964  0.9971  0.9979  0.9986  0.9992       1
                     *
           41        LS       0      57       0
           42        UD     0.9
                     *
           43        ZZ
1
             SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE     (V) ROUTING         (--->) DIVERSION OR PUMP FLOW

  NO.      (.) CONNECTOR       (<---) RETURN OF DIVERTED OR PUMPED FLOW
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    8         DA_1

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
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 *          VERSION 4.1                  *
 *                                       *
 *  RUN DATE   15FEB10  TIME  13:11:40   *
 *                                       *
 *****************************************

 ***************************************
 *                                     *
 *   U.S. ARMY CORPS OF ENGINEERS      *
 *   HYDROLOGIC ENGINEERING CENTER     *
 *        609 SECOND STREET            *
 *     DAVIS, CALIFORNIA 95616         *
 *        (916) 756-1104               *
 *                                     *
 ***************************************

                    Pecan Park Development....................Bastrop, Bastrop County, TX
                    Existing Conditions.......................February 2010
                    100-Year Event (1% Event).................File name:  E_100.IH1
                    NRCS Type III Distribution (24-HR Duration)
                    Project No. 09080.00......................Espey Consnltants

   7 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE     1JAN10  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE     2JAN10  ENDING DATE
                     NDTIME       0055  ENDING TIME
                      ICENT         19  CENTURY MARK

                COMPUTATION INTERVAL     .08 HOURS
                     TOTAL TIME BASE   24.92 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT
1
                                              RUNOFF SUMMARY
                                         FLOW IN CUBIC FEET PER SECOND
                                       TIME IN HOURS,  AREA IN SQUARE MILES

                                    PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD     BASIN    MAXIMUM    TIME OF
         OPERATION      STATION     FLOW    PEAK                                            AREA     STAGE    MAX STAGE
+                                                     6-HOUR      24-HOUR     72-HOUR

         HYDROGRAPH AT
+                          DA_1     535.   13.00       199.         61.         59.        .49

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 *             JUN   1998               *                                   *  HYDROLOGIC ENGINEERING CENTER      *
 *           VERSION 4.1                *                                   *        609 SECOND STREET            *
 *                                      *                                   *    DAVIS, CALIFORNIA 95616          *
 * RUN DATE   17FEB10  TIME  11:45:58   *                                   *        (916) 756-1104               *
 *                                      *                                   *                                     *
****************************************                                   ***************************************


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                          X     X  X        X               X
                          XXXXXXX  XXXX     X       XXXXX   X
                          X     X  X        X               X
                          X     X  X        X     X         X
                          X     X  XXXXXXX   XXXXX         XXX


        THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

        THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
        THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
        NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
        DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
        KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                           HEC-1 INPUT                                            PAGE  1

          LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

                      *DIAGRAM
            1         ID  Pecen Park Development....................Bastrop, Bastrop County, TX
            2         ID  Proposed Conditions.......................February 2010
            3         ID  100-Year Event (1% Event).................File name:  P_100.IH1
            4         ID  NRCS Type III Distribution (24-HR Duration)
            5         ID  Project No. 09080.00......................Espey Consultants
                      *
            6         IT       5 01JAN10       0     300
            7         IO       5
                      *

            8         KK    DA_1
            9         BA   0.491
           10         PB    10.2
                      * SCS Type 3 Rainfall Pattern
           11         IN       5 01JAN10       0
           12         PC       0  0.0008  0.0017  0.0025  0.0033  0.0042   0.005  0.0058  0.0067  0.0075
           13         PC  0.0083  0.0092    0.01  0.0108  0.0117  0.0125  0.0133  0.0142   0.015  0.0158
           14         PC  0.0167  0.0175  0.0183  0.0192    0.02  0.0208  0.0217  0.0225  0.0234  0.0243
           15         PC  0.0252  0.0261   0.027  0.0279  0.0289  0.0298  0.0308  0.0317  0.0327  0.0337
           16         PC  0.0347  0.0357  0.0367  0.0377  0.0388  0.0398  0.0408  0.0419   0.043  0.0441
           17         PC  0.0452  0.0463  0.0474  0.0485  0.0497  0.0509   0.052  0.0532  0.0544  0.0555
           18         PC  0.0567  0.0579  0.0592  0.0604  0.0617   0.063  0.0642  0.0654  0.0668   0.068
           19         PC  0.0693  0.0707   0.072  0.0733  0.0747  0.0761  0.0776  0.0791  0.0806  0.0822
           20         PC  0.0838  0.0854  0.0871  0.0887  0.0905  0.0922  0.0941  0.0959  0.0978  0.0997
           21         PC  0.1016  0.1036  0.1056  0.1076  0.1097  0.1118   0.114  0.1163  0.1185  0.1208
           22         PC  0.1233  0.1258  0.1284  0.1311  0.1339  0.1367  0.1397  0.1427  0.1458   0.149
           23         PC  0.1522  0.1555  0.1589  0.1624  0.1659  0.1696  0.1733  0.1771   0.181   0.185
           24         PC   0.189  0.1931  0.1975   0.202  0.2067  0.2115  0.2165  0.2216   0.227  0.2325
           25         PC  0.2382   0.244    0.25  0.2564  0.2634  0.2711  0.2795  0.2884   0.298  0.3111
           26         PC  0.3298  0.3559  0.3848  0.4273     0.5  0.5727  0.6152  0.6441  0.6702  0.6889
           27         PC   0.702  0.7116  0.7205  0.7289  0.7366  0.7436    0.75   0.756  0.7618  0.7675
           28         PC   0.773  0.7784  0.7835  0.7885  0.7933   0.798  0.8025  0.8069   0.811   0.815
           29         PC   0.819  0.8229  0.8267  0.8304  0.8341  0.8376  0.8411  0.8445  0.8478  0.8511
           30         PC  0.8543  0.8573  0.8603  0.8633  0.8661  0.8689  0.8716  0.8742  0.8767  0.8792
           31         PC  0.8815  0.8837   0.886  0.8882  0.8903  0.8924  0.8944  0.8964  0.8984  0.9003
           32         PC  0.9022  0.9041  0.9059  0.9078  0.9095  0.9113  0.9129  0.9146  0.9162  0.9178
           33         PC  0.9194  0.9209  0.9224  0.9239  0.9253  0.9267   0.928  0.9293  0.9307  0.9319
           34         PC  0.9332  0.9346  0.9358   0.937  0.9383  0.9396  0.9408  0.9421  0.9433  0.9445
           35         PC  0.9456  0.9468   0.948  0.9491  0.9503  0.9515  0.9526  0.9537  0.9548  0.9559
           36         PC   0.957  0.9581  0.9592  0.9603  0.9613  0.9623  0.9634  0.9644  0.9654  0.9664
           37         PC  0.9674  0.9684  0.9694  0.9704  0.9714  0.9723  0.9733  0.9743  0.9752  0.9762
           38         PC  0.9771   0.978   0.979  0.9799  0.9808  0.9816  0.9825  0.9834  0.9843  0.9852
           39         PC   0.986  0.9868  0.9877  0.9885  0.9893  0.9902  0.9909  0.9917  0.9925  0.9933
           40         PC  0.9941  0.9948  0.9956  0.9964  0.9971  0.9979  0.9986  0.9992       1
                      *
           41         LS       0      57      80
           42         UD    0.27
                      *
           43         ZZ
1
             SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE     (V) ROUTING         (--->) DIVERSION OR PUMP FLOW

   NO.     (.) CONNECTOR       (<---) RETURN OF DIVERTED OR PUMPED FLOW
```

```
    8         DA_1

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *              JUN   1998               *
 *            VERSION 4.1                *
 *                                       *
 *  RUN DATE   17FEB10  TIME  11:45:58   *
 *                                       *
 *****************************************

 ***************************************
 *                                     *
 *   U.S. ARMY CORPS OF ENGINEERS      *
 *   HYDROLOGIC ENGINEERING CENTER     *
 *        609 SECOND STREET            *
 *      DAVIS, CALIFORNIA 95616        *
 *          (916) 756-1104             *
 *                                     *
 ***************************************



                    Pecan Park Development....................Bastrop, Bastrop County, TX
                    Proposed Conditions.......................February 2010
                    100-Year Event (1% Event).................File name:  P_100.IH1
                    NRCS Type III Distribution (24-HR Duration)
                    Project No. 09080.00......................Espey Consultants

   7 IO         OUTPUT CONTROL VARIABLES
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                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT         HYDROGRAPH TIME DATA
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                      ITIME       0000  STARTING TIME
                         NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE     2JAN10  ENDING DATE
                     NDTIME       0055  ENDING TIME
                      ICENT         19  CENTURY MARK

                  COMPUTATION INTERVAL     .08 HOURS
                       TOTAL TIME BASE   24.92 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT
1
                                                         RUNOFF SUMMARY
                                                  FLOW IN CUBIC FEET PER SECOND
                                               TIME IN HOURS,  AREA IN SQUARE MILES

                                      PEAK    TIME OF      AVERAGE FLOW FOR MAXIMUM PERIOD       BASIN    MAXIMUM     TIME OF
         OPERATION        STATION     FLOW     PEAK                                              AREA      STAGE     MAX STAGE
+                                                         6-HOUR       24-HOUR      72-HOUR

         HYDROGRAPH AT
+                           DA_1      1670.   12.33         343.         120.         116.        .49


 *** NORMAL END OF HEC-1 ***
```

V.

APPENDIX C

ENGINEERING REPORT FOR PECAN CROSSING OFFSITE DRAINAGE IMPROVEMENTS

ENGINEERING REPORT

FOR

PECAN CROSSING
OFFSITE
DRAINAGE IMPROVEMENTS

MAY 2007

Prepared By:

Cunningham | Allen

Engineers • Surveyors

ENGINEERING REPORT

FOR

PECAN CROSSING
OFFSITE
DRAINAGE IMPROVEMENTS

MAY 2007

STATE OF TEXAS
5-18-2007
RUBEN LOPEZ, JR.
93745
LICENSED
PROFESSIONAL ENGINEER

Cunningham | Allen, Inc.

Engineers • Surveyors

3103 Bee Cave Road, Suite 202
Austin, Texas 78746-6819
Tel.: (512) 327-2946 • Fax: (512) 327-2973
www.cunningham-allen.com

TABLE OF CONTENTS

PECAN CROSSING
DRAINAGE IMPROVEMENTS

INTRODUCTION

This report outlines the proposed improvements required to convey run-off generated by the 100 year storm event across the Cantrell Property as outlined in the *"OPTION AGREEMENT FOR SALE AND PURCHASE OF DRAIANGE EASMENT"*. The area that was included for sizing the improvements consists of what is considered the Bastrop Grove Partners (BGP) Property and The Cantrell Property. The tracts that are included in the study are outlined in exhibit B. The tracts are depicted as "Drainage Areas" in the following manner:

Drainage Area 1 – the Cantrell Tract
Drainage Area 2, 3 and 4 – the BGP Tract
Drainage Area 5 – Offsite Area conveyed to BGP tract by the Texas Department of Transportation TXDOT

The National Weather Service Maps based on the Hydro-35 and TP-40 data and were used to determine the 24 hour rainfall in inches for the county of Bastrop, Texas. This rainfall was used in the SCS (soils conservation service) 24 hour rainfall storm duration - type III rainfall distribution.

The Drainage Areas are assumed to be fully developed in order to size the proposed channel accordingly. Assumptions in terms of time of concentration are based on "redirecting" flows to the proposed channel. The CN value for the drainage areas is based on the SCS soils conservation survey for Bastrop County, Texas. The CN value was based on a type B soil as a majority of the area is Smithville or Bosque soil classification. The generated fully developed flows as assumed in exhibit B (the Drainage Area Map) were calculated using the U.S. Army Corp of Engineers' Hydrologic Engineering Center hydrology program HEC-1. The report is included in exhibit C.

One of the parameters of the analysis was the existing Federal Emergency Management Agency (FEMA) floodplain for the Colorado River. This existing floodplain inundates the southern portion of the Cantrell Tract (referred to Drainage Area 1 on exhibit B). The current FEMA map 48021C0355E, dated January 19, 2006 for Bastrop County, Texas is included as exhibit A. The limit of the floodplain as it affects the channel design is identified on exhibit D (elevation 349 ft mean sea level). It extends into the limit of the proposed channel improvements (between cross sections 10 and 11).

Other constraints are outlined by the agreement and requirements of the City of Bastrop for channel design. Thus the channel is both grass lined and maintains side slopes of 3ft vertical to 1ft horizontal and a bottom width of 6 ft for the majority of the improvements. The proposed channel design also has provisions for a low water crossing with a maximum slope of 6 ft vertical to 1ft horizontal. This low water crossing is proposed between cross sections 9 and 8 (on exhibit D). The channel was designed with a slope of 0.3%. The channel widens/transitions to a bottom width of 6ft to 24 ft from cross section 7 to 6 (as identified on exhibit D) to minimize the abrupt change and connectivity to the proposed culverts. Based on visual observations of the Cantrell tract and the type of vegetation that exists, the n value for the proposed channel was assumed to be 0.35.

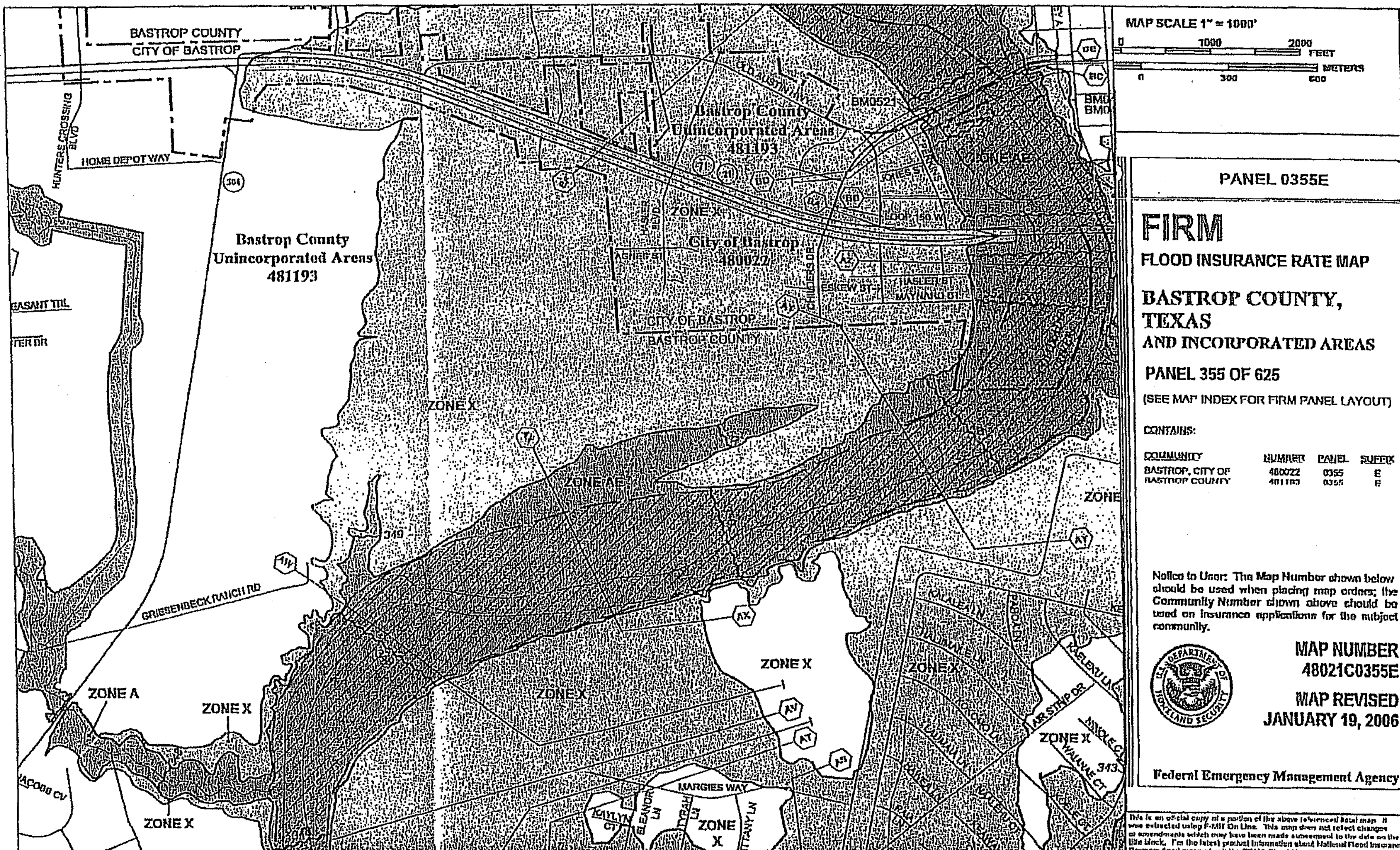
The proposed culverts were designed by utilizing the U.S. Army Corp of Engineers' Hydrologic Engineering Center - River Analysis system (HEC-RAS). These culverts were included to preserve the existing dam/crossing structure located on the southern portion of the Cantrell Tract. In it's current condition, the crossing is submerged during the 100 year flood according to FEMA. On average it is submerged by 2 ft.

In fully developed conditions, the channel was designed to have the least amount of impact on the existing 100 year floodplain elevation of 349 ft msl (mean sea level). With the known water surface elevation of 349, the porpoed improvements raised the floodplain in this area by a depth no greater than 0.2 ft (approximately 2.4 inches). The HEC-RAS analysis for the design of the channel is provided in exhibit E.

Though the 100 yr floodplain elevation impacts are minimized, erosion measures will be proposed at the existing crossing. This will be achieved by rock rip rap (24" diameter minimum) on the downstream side of the embankment and culvert outlet. The extents are outline in exhibit D. In the same manner, the existing 10 ft dirt road crossing will be improved to a 14 ft wide concrete road. This will be achieve within the same embankment extents and is also depicted in exhibit D.

EXHIBIT A

FEMA FLOOD INSURANCE RATE MAP



MAP SCALE 1" = 1000'
0
1000
2000
FEET
0
300
600
METERS
PANEL 0355E
FIRM
FLOOD INSURANCE RATE MAP
BASTROP COUNTY, TEXAS
AND INCORPORATED AREAS
PANEL 355 OF 625
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
BASTROP, CITY OF 480022 0355 E
BASTROP COUNTY 481193 0355 E
Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.
MAP NUMBER
48021C0355E
MAP REVISED
JANUARY 19, 2006
Federal Emergency Management Agency
BASTROP COUNTY
CITY OF BASTROP
HUNTERS CROSSING BLVD
HOME DEPOT WAY
Bastrop County
Unincorporated Areas
481193
City of Bastrop
480022
CITY OF BASTROP
BASTROP COUNTY
ZONE X
ZONE AE
ZONE A
GRIESENBECK RANCH RD
MARGIES WAY
ZONE X

EXHIBIT B

DRAINAGE AREA MAP

HYDROLOGIC SUMMARY								
CONFLUENCE POINT	A		B			C		D
DRAINAGE AREA NUMBER	5	4	5–4	3	2	5–2	1	5–1
DRAINAGE AREA (AC)	81.0	120	201	82	40.8	323.8	169	492.8
CN NUMBER	73	73		73	73		73	73
% IMPERVIOUS COVER	25	90		45	45		45	
TC (HRS)	0.5833	0.2200		0.5700	0.3900		0.6000	
100 YEAR DISCHARGE (CFS)	373	893	1161	395	328	1465	1116	2458

Cunningham | Allen
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Austin, Texas 78746-681
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Fax: (512) 327-297

STATE OF TEXAS
RUBEN LOPEZ JR.
93745
LICENSED
PROFESSIONAL ENGINEER

PECAN CROSSING SHOPPING CENTER
BASTROP, TEXAS
EXHIBIT
PROPOSED OVERALL DRAINAGE AREA MAP FOR FLOODPLAIN STUDY

PROJECT No. 277.2001
DESIGN RL
DRAWN ST, PT
CAD FILE

SHEET 1 OF 1

EXHIBIT C

HEC-1 ANALYSIS – 100 YR

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*          VERSION 4.0.1E              *
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*                                      *
*     U.S. ARMY CORPS OF ENGINEERS     *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
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X      X  X        X     X        XX
X      X  X        X               X
XXXXXXX   XXXX     X       XXXXX   X
X      X  X        X               X
X      X  X        X     X         X
X      X  XXXXXXX   XXXXX         XXX
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::::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::::
:::                                      :::
:::   Full Microcomputer Implementation  :::
:::                 by                   :::
:::         Haestad Methods, Inc.        :::
:::                                      :::
::::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::::
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37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
                                         HEC-1 INPUT                                          PAGE  1

 LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   1           ID
   2           IT       5                     300
   3           IO       5       0

   4           KK  DA 5
   5           KM  Offsite Drainage Area 40 from TxDot Federal Project
   6           KO                                            22
   7           BA  0.1266
   8           PB    10.5
   9           IN       5
  10           PC       0  0.0008  0.0017  0.0025  0.0033  0.0042   0.005  0.0058  0.0067  0.0075
  11           PC  0.0083  0.0092    0.01  0.0108  0.0117  0.0125  0.0133  0.0142   0.015  0.0158
  12           PC  0.0167  0.0175  0.0183  0.0192    0.02  0.0208  0.0217  0.0225  0.0234  0.0243
  13           PC  0.0252  0.0261   0.027  0.0279  0.0289  0.0298  0.0308  0.0317  0.0327  0.0337
  14           PC  0.0347  0.0357  0.0367  0.0377  0.0388  0.0398  0.0408  0.0419   0.043  0.0441
  15           PC  0.0452  0.0463  0.0474  0.0485  0.0497  0.0509   0.052  0.0532  0.0544  0.0555
  16           PC  0.0567  0.0579  0.0592  0.0604  0.0617   0.063  0.0642  0.0654  0.0668   0.068
  17           PC  0.0693  0.0707   0.072  0.0733  0.0747  0.0761  0.0776  0.0791  0.0806  0.0822
  18           PC  0.0838  0.0854  0.0871  0.0887  0.0905  0.0922  0.0941  0.0959  0.0978  0.0997
  19           PC  0.1016  0.1036  0.1056  0.1076  0.1097  0.1118   0.114  0.1163  0.1185  0.1208
  20           PC  0.1233  0.1258  0.1284  0.1311  0.1339  0.1367  0.1397  0.1427  0.1458   0.149
  21           PC  0.1522  0.1555  0.1589  0.1624  0.1659  0.1696  0.1733  0.1771   0.181   0.185
  22           PC   0.189  0.1931  0.1975   0.202  0.2067  0.2115  0.2165  0.2216   0.227  0.2325
  23           PC  0.2382   0.244    0.25  0.2564  0.2634  0.2711  0.2795  0.2884   0.298  0.3111
  24           PC  0.3298  0.3559  0.3848  0.4273     0.5  0.5727  0.6152  0.6441  0.6702  0.6889
  25           PC   0.702  0.7116  0.7205  0.7289  0.7366  0.7436    0.75   0.756  0.7618  0.7675
  26           PC   0.773  0.7784  0.7835  0.7885  0.7933   0.798  0.8025  0.8069   0.811   0.815
  27           PC   0.819  0.8229  0.8267  0.8304  0.8341  0.8376  0.8411  0.8445  0.8478  0.8511
  28           PC  0.8543  0.8573  0.8603  0.8633  0.8661  0.8689  0.8716  0.8742  0.8767  0.8792
  29           PC  0.8815  0.8837   0.886  0.8882  0.8903  0.8924  0.8944  0.8964  0.8984  0.9003
  30           PC  0.9022  0.9041  0.9059  0.9078  0.9095  0.9113  0.9129  0.9146  0.9162  0.9178
  31           PC  0.9194  0.9209  0.9224  0.9239  0.9253  0.9267   0.928  0.9293  0.9307  0.9319
  32           PC  0.9332  0.9346  0.9358   0.937  0.9383  0.9396  0.9408  0.9421  0.9433  0.9445
  33           PC  0.9456  0.9468   0.948  0.9491  0.9503  0.9515  0.9526  0.9537  0.9548  0.9559
  34           PC   0.957  0.9581  0.9592  0.9603  0.9613  0.9623  0.9634  0.9644  0.9654  0.9664
  35           PC  0.9674  0.9684  0.9694  0.9704  0.9714  0.9723  0.9733  0.9743  0.9752  0.9762
  36           PC  0.9771   0.978   0.979  0.9799  0.9808  0.9816  0.9825  0.9834  0.9843  0.9852
  37           PC   0.986  0.9868  0.9877  0.9885  0.9893  0.9902  0.9909  0.9917  0.9925  0.9933
  38           PC  0.9941  0.9948  0.9956  0.9964  0.9971  0.9979  0.9986  0.9992       1
  39           LS              73      25
  40           UD    0.35

  41           KK  DA 4
  42           KM  Site
  43           KO                                            22
  44           BA  0.1876
  45           PB    10.5
  46           IN       5
  47           PC       0  0.0008  0.0017  0.0025  0.0033  0.0042   0.005  0.0058  0.0067  0.0075
```

```
 48        PC  0.0083  0.0092    0.01  0.0108  0.0117  0.0125  0.0133  0.0142   0.015  0.0158
 49        PC  0.0167  0.0175  0.0183  0.0192    0.02  0.0208  0.0217  0.0225  0.0234  0.0243
 50        PC  0.0252  0.0261   0.027  0.0279  0.0289  0.0298  0.0308  0.0317  0.0327  0.0337
 51        PC  0.0347  0.0357  0.0367  0.0377  0.0388  0.0398  0.0408  0.0419   0.043  0.0441
 52        PC  0.0452  0.0463  0.0474  0.0486  0.0497  0.0509   0.052  0.0532  0.0544  0.0555
 53        PC  0.0567  0.0579  0.0592  0.0604  0.0617   0.063  0.0642  0.0654  0.0668   0.068

                                          HEC-1 INPUT                                             PAGE  2

LINE       ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 54        PC  0.0693  0.0707   0.072  0.0733  0.0747  0.0761  0.0776  0.0791  0.0806  0.0822
 55        PC  0.0838  0.0854  0.0871  0.0887  0.0905  0.0922  0.0941  0.0959  0.0978  0.0997
 56        PC  0.1016  0.1036  0.1056  0.1076  0.1097  0.1118   0.114  0.1163  0.1185  0.1208
 57        PC  0.1233  0.1258  0.1284  0.1311  0.1339  0.1367  0.1397  0.1427  0.1458   0.149
 58        PC  0.1522  0.1555  0.1589  0.1624  0.1659  0.1696  0.1733  0.1771   0.181   0.185
 59        PC   0.189  0.1931  0.1975   0.202  0.2067  0.2115  0.2165  0.2216   0.227  0.2325
 60        PC  0.2382   0.244    0.25  0.2564  0.2634  0.2711  0.2795  0.2884   0.298  0.3111
 61        PC  0.3298  0.3559  0.3848  0.4273     0.5  0.5727  0.6152  0.6441  0.6702  0.6889
 62        PC   0.702  0.7116  0.7205  0.7289  0.7366  0.7436    0.75   0.756  0.7618  0.7675
 63        PC   0.773  0.7784  0.7835  0.7885  0.7933   0.798  0.8025  0.8069   0.811   0.815
 64        PC   0.819  0.8229  0.8267  0.8304  0.8341  0.8376  0.8411  0.8445  0.8478  0.8511
 65        PC  0.8543  0.8573  0.8603  0.8633  0.8661  0.8689  0.8716  0.8742  0.8767  0.8792
 66        PC  0.8815  0.8837   0.886  0.8882  0.8903  0.8924  0.8944  0.8964  0.8984  0.9003
 67        PC  0.9022  0.9041  0.9059  0.9078  0.9095  0.9113  0.9129  0.9146  0.9162  0.9178
 68        PC  0.9194  0.9209  0.9224  0.9239  0.9253  0.9267   0.928  0.9293  0.9307  0.9319
 69        PC  0.9332  0.9346  0.9358   0.937  0.9383  0.9396  0.9408  0.9421  0.9433  0.9445
 70        PC  0.9456  0.9468   0.948  0.9491  0.9503  0.9515  0.9526  0.9537  0.9548  0.9559
 71        PC   0.957  0.9581  0.9592  0.9603  0.9613  0.9623  0.9634  0.9644  0.9654  0.9664
 72        PC  0.9674  0.9684  0.9694  0.9704  0.9714  0.9723  0.9733  0.9743  0.9752  0.9762
 73        PC  0.9771   0.978   0.979  0.9799  0.9808  0.9816  0.9825  0.9834  0.9843  0.9852
 74        PC   0.986  0.9868  0.9877  0.9885  0.9893  0.9902  0.9909  0.9917  0.9925  0.9933
 75        PC  0.9941  0.9948  0.9956  0.9964  0.9971  0.9979  0.9986  0.9992       1
 76        LS              73      90
 77        UD   0.132

 78        KK  DA 5-4
 79        KM
 80        KO                                      22
 81        HC       2

 82        KK  DA 3
 83        KM
 84        KO                                      22
 85        BA  0.1281
 86        PB    10.5
 87        IN       5
 88        PC       0  0.0008  0.0017  0.0025  0.0033  0.0042   0.005  0.0058  0.0067  0.0075
 89        PC  0.0083  0.0092    0.01  0.0108  0.0117  0.0125  0.0133  0.0142   0.015  0.0158
 90        PC  0.0167  0.0175  0.0183  0.0192    0.02  0.0208  0.0217  0.0225  0.0234  0.0243
 91        PC  0.0252  0.0261   0.027  0.0279  0.0289  0.0298  0.0308  0.0317  0.0327  0.0337
 92        PC  0.0347  0.0357  0.0367  0.0377  0.0388  0.0398  0.0408  0.0419   0.043  0.0441
 93        PC  0.0452  0.0463  0.0474  0.0485  0.0497  0.0509   0.052  0.0532  0.0544  0.0555
```

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 94    PC  0.0567  0.0579  0.0592  0.0604  0.0617   0.063  0.0642  0.0654  0.0668   0.068
 95    PC  0.0693  0.0707   0.072  0.0733  0.0747  0.0761  0.0776  0.0791  0.0806  0.0822
 96    PC  0.0838  0.0854  0.0871  0.0887  0.0905  0.0922  0.0941  0.0959  0.0978  0.0997
 97    PC  0.1016  0.1036  0.1056  0.1076  0.1097  0.1118   0.114  0.1163  0.1185  0.1208
 98    PC  0.1233  0.1258  0.1284  0.1311  0.1339  0.1367  0.1397  0.1427  0.1458   0.149
 99    PC  0.1522  0.1555  0.1589  0.1624  0.1659  0.1696  0.1733  0.1771   0.181   0.185
100    PC   0.189  0.1931  0.1975   0.202  0.2067  0.2115  0.2165  0.2216   0.227  0.2325
101    PC  0.2382   0.244    0.25  0.2564  0.2634  0.2711  0.2795  0.2884   0.298  0.3111
102    PC  0.3298  0.3559  0.3848  0.4273     0.5  0.5727  0.6152  0.6441  0.6702  0.6889
103    PC   0.702  0.7116  0.7205  0.7289  0.7366  0.7436    0.75   0.756  0.7618  0.7675
104    PC   0.773  0.7784  0.7835  0.7885  0.7933   0.798  0.8025  0.8069   0.811   0.815
105    PC   0.819  0.8229  0.8267  0.8304  0.8341  0.8376  0.8411  0.8445  0.8478  0.8511
106    PC  0.8543  0.8573  0.8603  0.8633  0.8661  0.8689  0.8716  0.8742  0.8767  0.8792
```

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                                     HEC-1 INPUT                                          PAGE  3

LINE   ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

107    PC  0.8815  0.8837   0.886  0.8882  0.8903  0.8924  0.8944  0.8964  0.8984  0.9003
108    PC  0.9022  0.9041  0.9059  0.9078  0.9095  0.9113  0.9129  0.9146  0.9162  0.9178
109    PC  0.9194  0.9209  0.9224  0.9239  0.9253  0.9267   0.928  0.9293  0.9307  0.9319
110    PC  0.9332  0.9346  0.9358   0.937  0.9383  0.9396  0.9408  0.9421  0.9433  0.9445
111    PC  0.9456  0.9468   0.948  0.9491  0.9503  0.9515  0.9526  0.9537  0.9548  0.9559
112    PC   0.957  0.9581  0.9592  0.9603  0.9613  0.9623  0.9634  0.9644  0.9654  0.9664
113    PC  0.9674  0.9684  0.9694  0.9704  0.9714  0.9723  0.9733  0.9743  0.9752  0.9762
114    PC  0.9771   0.978   0.979  0.9799  0.9808  0.9816  0.9825  0.9834  0.9843  0.9852
115    PC   0.986  0.9868  0.9877  0.9885  0.9893  0.9902  0.9909  0.9917  0.9925  0.9933
116    PC  0.9941  0.9948  0.9956  0.9964  0.9971  0.9979  0.9986  0.9992       1
117    LS              73      45
118    UD   0.352

119    KK  DA 2
120    KM
121    KO                                   22
122    BA  0.0638
123    PB    10.5
124    IN       5
125    PC  0.0000 0.00101 0.00202 0.00305 0.00408 0.00513 0.00618 0.00725 0.00832 0.00941
126    PC  0.0105 0.01161 0.01272 0.01385 0.01498 0.01613 0.01728 0.01845 0.01962 0.02081
127    PC  0.0220 0.02321 0.02442 0.02565 0.02688 0.02813 0.02938 0.03065 0.03192 0.03321
128    PC  0.0345 0.03581 0.03712 0.03845 0.03978 0.04113 0.04248 0.04385 0.04522 0.04661
129    PC  0.0480 0.04941 0.05084 0.05229 0.05376 0.05525 0.05676 0.05829 0.05984 0.06141
130    PC  0.0630 0.06461 0.06624 0.06789 0.06956 0.07125 0.07296 0.07469 0.07644 0.07821
131    PC  0.0800 0.08181 0.08364 0.08549 0.08736 0.08925 0.09116 0.09309 0.09504 0.09701
132    PC  0.0990 0.10101 0.10304 0.10509 0.10716 0.10925 0.11136 0.11349 0.11564 0.11781
133    PC  0.1200 0.12225 0.12460 0.12705 0.12960 0.13225 0.13500 0.13785 0.14080 0.14385
134    PC  0.1470 0.15020 0.15340 0.15660 0.15980 0.16300 0.16628 0.16972 0.17332 0.17708
135    PC  0.1810 0.18512 0.18948 0.19408 0.19892 0.20400 0.20940 0.21520 0.22140 0.22800
136    PC  0.2350 0.24268 0.25132 0.26092 0.27148 0.28300 0.30684 0.35436 0.43079 0.56786
137    PC  0.6630 0.68196 0.69864 0.71304 0.72516 0.73500 0.74344 0.75136 0.75876 0.76564
138    PC  0.7720 0.77796 0.78364 0.78904 0.79416 0.79900 0.80360 0.80800 0.81220 0.81620
139    PC  0.8200 0.82367 0.82726 0.83079 0.83424 0.83763 0.84094 0.84419 0.84736 0.85047
140    PC  0.8535 0.85647 0.85936 0.86219 0.86494 0.86763 0.87024 0.87279 0.87526 0.87767
```

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 141          PC  0.8800 0.88229 0.88455 0.88679 0.88900 0.89119 0.89335 0.89549 0.89760 0.89969
 142          PC  0.9018 0.90379 0.90580 0.90779 0.90975 0.91169 0.91360 0.91549 0.91735 0.91919
 143          PC  0.9210 0.92279 0.92455 0.92629 0.92800 0.92969 0.93135 0.93299 0.93460 0.93619
 144          PC  0.9377 0.93929 0.94080 0.94229 0.94375 0.94519 0.94660 0.94799 0.94935 0.95069
 145          PC  0.9520 0.95330 0.95459 0.95588 0.95716 0.95844 0.95971 0.96098 0.96224 0.96350
 146          PC  0.9647 0.96600 0.96724 0.96848 0.96971 0.97094 0.97216 0.97338 0.97459 0.97580
 147          PC  0.9770 0.97820 0.97939 0.98058 0.98176 0.98294 0.98411 0.98528 0.98644 0.98760
 148          PC  0.9887 0.98990 0.99104 0.99218 0.99331 0.99444 0.99556 0.99668 0.99779 0.99890
 149          PC  1.0000 1.00000 1.00000 1.00000 1.00000
 150          LS              73      45
 151          UD   0.234

 152          KK  DA 5-2
 153          KM
 154          KO                                      22
 155          HC        3

                                 HEC-1 INPUT                                                        PAGE  4

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 156          KK  DA 1
 157          KM  Catrell Tract
 158          KO                                      22
 159          BA  0.3766
 160          PB    10.5
 161          IN       5
 162          PC       0  0.0008  0.0017  0.0025  0.0033  0.0042   0.005  0.0058  0.0067  0.0075
 163          PC  0.0083  0.0092    0.01  0.0108  0.0117  0.0125  0.0133  0.0142   0.015  0.0158
 164          PC  0.0167  0.0175  0.0183  0.0192    0.02  0.0208  0.0217  0.0225  0.0234  0.0243
 165          PC  0.0252  0.0261   0.027  0.0279  0.0289  0.0298  0.0308  0.0317  0.0327  0.0337
 166          PC  0.0347  0.0357  0.0367  0.0377  0.0388  0.0398  0.0408  0.0419   0.043  0.0441
 167          PC  0.0452  0.0463  0.0474  0.0485  0.0497  0.0509   0.052  0.0532  0.0544  0.0555
 168          PC  0.0567  0.0579  0.0592  0.0604  0.0617   0.063  0.0642  0.0654  0.0668   0.068
 169          PC  0.0693  0.0707   0.072  0.0733  0.0747  0.0761  0.0776  0.0791  0.0806  0.0822
 170          PC  0.0838  0.0854  0.0871  0.0887  0.0905  0.0922  0.0941  0.0959  0.0978  0.0997
 171          PC  0.1016  0.1036  0.1056  0.1076  0.1097  0.1118   0.114  0.1163  0.1185  0.1208
 172          PC  0.1233  0.1258  0.1284  0.1311  0.1339  0.1367  0.1397  0.1427  0.1458   0.149
 173          PC  0.1522  0.1555  0.1589  0.1624  0.1659  0.1696  0.1733  0.1771   0.181   0.185
 174          PC   0.189  0.1931  0.1975   0.202  0.2067  0.2115  0.2165  0.2216   0.227  0.2325
 175          PC  0.2382   0.244    0.25  0.2564  0.2634  0.2711  0.2795  0.2884   0.298  0.3111
 176          PC  0.3298  0.3559  0.3848  0.4273     0.5  0.5727  0.6152  0.6441  0.6702  0.6889
 177          PC   0.702  0.7116  0.7205  0.7289  0.7366  0.7436    0.75   0.756  0.7618  0.7675
 178          PC   0.773  0.7784  0.7835  0.7885  0.7933   0.798  0.8025  0.8069   0.811   0.815
 179          PC   0.819  0.8229  0.8267  0.8304  0.8341  0.8376  0.8411  0.8445  0.8478  0.8511
 180          PC  0.8543  0.8573  0.8603  0.8633  0.8661  0.8689  0.8716  0.8742  0.8767  0.8792
 181          PC  0.8815  0.8837   0.886  0.8882  0.8903  0.8924  0.8944  0.8964  0.8984  0.9003
 182          PC  0.9022  0.9041  0.9059  0.9078  0.9095  0.9113  0.9129  0.9146  0.9162  0.9178
 183          PC  0.9194  0.9209  0.9224  0.9239  0.9253  0.9267   0.928  0.9293  0.9307  0.9319
 184          PC  0.9332  0.9346  0.9358   0.937  0.9383  0.9396  0.9408  0.9421  0.9433  0.9445
 185          PC  0.9456  0.9468   0.948  0.9491  0.9503  0.9515  0.9526  0.9537  0.9548  0.9559
 186          PC   0.957  0.9581  0.9592  0.9603  0.9613  0.9623  0.9634  0.9644  0.9654  0.9664
```

```
 187        PC  0.9674  0.9684  0.9694  0.9704  0.9714  0.9723  0.9733  0.9743  0.9752  0.9762
 188        PC  0.9771   0.978   0.979  0.9799  0.9808  0.9816  0.9825  0.9834  0.9843  0.9852
 189        PC   0.986  0.9868  0.9877  0.9885  0.9893  0.9902  0.9909  0.9917  0.9925  0.9933
 190        PC  0.9941  0.9948  0.9956  0.9964  0.9971  0.9979  0.9986  0.9992       1
 191        LS              73      32
 192        UD   0.360

 193        KK  DA 5-1
 194        KM
 195        KO                                      22
 196        HC       2
 197        ZZ

HEC1 S/N: 1343001909        HMVersion: 6.33     Data File: C:\WINDOWS\TEMP\~vbh0878.TMP

*****************************************                     ***************************************
*                                       *                     *                                     *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *                     *    U.S. ARMY CORPS OF ENGINEERS     *
*             MAY   1991                *                     *    HYDROLOGIC ENGINEERING CENTER    *
*         VERSION 4.0.1E                *                     *         609 SECOND STREET           *
*                                       *                     *      DAVIS, CALIFORNIA 95616        *
* RUN DATE  05/04/2007  TIME  12:52:13  *                     *          (916) 756-1104             *
*                                       *                     *                                     *
*****************************************                     ***************************************


  3 IO        OUTPUT CONTROL VARIABLES
                    IPRNT          5  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT        HYDROGRAPH TIME DATA
                     NMIN          5  MINUTES IN COMPUTATION INTERVAL
                    IDATE      1   0  STARTING DATE
                    ITIME       0000  STARTING TIME
                       NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE      2   0  ENDING DATE
                   NDTIME       0055  ENDING TIME
                    ICENT         19  CENTURY MARK

                COMPUTATION INTERVAL    0.08 HOURS
                     TOTAL TIME BASE   24.92 HOURS

      ENGLISH UNITS
          DRAINAGE AREA          SQUARE MILES
          PRECIPITATION DEPTH    INCHES
          LENGTH, ELEVATION      FEET
```

```
            FLOW                CUBIC FEET PER SECOND
            STORAGE VOLUME      ACRE-FEET
            SURFACE AREA        ACRES
            TEMPERATURE         DEGREES FAHRENHEIT

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

          **************
          *            *
  4 KK    *    DA 5    *
          *            *
          **************

  6 KO        OUTPUT CONTROL VARIABLES
                    IPRNT          5  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE
                    IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                     IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                    ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                    ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                   TIMINT      0.083  TIME INTERVAL IN HOURS

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

          **************
          *            *
 41 KK    *    DA 4    *
          *            *
          **************

 43 KO        OUTPUT CONTROL VARIABLES
                    IPRNT          5  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE
                    IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                     IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                    ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                    ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                   TIMINT      0.083  TIME INTERVAL IN HOURS

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
              IPLOT           0  PLOT CONTROL
              QSCAL          0.  HYDROGRAPH PLOT SCALE
              IPNCH           0  PUNCH COMPUTED HYDROGRAPH
               IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
              ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
              ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
             TIMINT       0.083  TIME INTERVAL IN HOURS


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

         **************
         *            *
 152 KK  *   DA 5-2   *
         *            *
         **************

 154 KO      OUTPUT CONTROL VARIABLES
              IPRNT           5  PRINT CONTROL
              IPLOT           0  PLOT CONTROL
              QSCAL          0.  HYDROGRAPH PLOT SCALE
              IPNCH           0  PUNCH COMPUTED HYDROGRAPH
               IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
              ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
              ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
             TIMINT       0.083  TIME INTERVAL IN HOURS

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

         **************
         *            *
 156 KK  *   DA 1     *
         *            *
         **************

 158 KO      OUTPUT CONTROL VARIABLES
              IPRNT           5  PRINT CONTROL
              IPLOT           0  PLOT CONTROL
              QSCAL          0.  HYDROGRAPH PLOT SCALE
              IPNCH           0  PUNCH COMPUTED HYDROGRAPH
               IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
              ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
              ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
             TIMINT       0.083  TIME INTERVAL IN HOURS

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
                ***************
                *             *
193 KK          *   DA 5-1    *
                *             *
                ***************

195 KO          OUTPUT CONTROL VARIABLES
                    IPRNT           5  PRINT CONTROL
                    IPLOT           0  PLOT CONTROL
                    QSCAL          0.  HYDROGRAPH PLOT SCALE
                    IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                     IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                    ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                    ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                   TIMINT       0.083  TIME INTERVAL IN HOURS
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	DA 5	373.	12.42	83.	27.	26.	0.13		
HYDROGRAPH AT	DA 4	893.	12.17	146.	51.	49.	0.19		
2 COMBINED AT	DA 5-4	1161.	12.17	228.	78.	75.	0.31		
HYDROGRAPH AT	DA 3	395.	12.42	88.	30.	29.	0.13		
HYDROGRAPH AT	DA 2	328.	10.08	46.	15.	14.	0.06		
3 COMBINED AT	DA 5-2	1465.	12.17	360.	123.	118.	0.51		
HYDROGRAPH AT	DA 1	1116.	12.42	251.	83.	80.	0.38		
2 COMBINED AT	DA 5-1	2458.	12.33	609.	205.	198.	0.88		

*** NORMAL END OF HEC-1 ***

EXHIBIT D

HEC-RAS CROSS SECTION WITH 100 YR DELINEATION


GRAPHIC SCALE
(IN FEET)
1 inch = 100 ft.
APPROXIMATE DEED LINE
Jo Ann Griesenbeck Cantrell (115.00 acres) 445/684
ULTIMATE 100 YR FLOODPLAIN
PROPOSED DRAINAGE EASEMENT DOC #
CHANNEL SIDE SLOPES @ 3:1 BOTH SIDES (UNLESS NOTED)
CANTRELL REACH
10' WIDE CONC. DRIVE
24" DIA. ROCK
(1) - 8' WIDE x 10' HIGH
(2) - 6' WIDE x 10' HIGH CONC. CULVERTS @ 17.92%
FL= 336.44
FL= 323.00
SECTION A-A
CONTOUR ELEVATION 349' APPROXIMATE LOCATION OF FEMA 100-YR FLOODPLAIN
CHANNEL CROSSING W/6:1 CHANNEL SIDE SLOPES (BOTH SIDES)
(CROSS SECTION-7) 6' FLAT BOTTOM CHANNEL WIDENS TO 24' FLAT BOTTOM CHANNEL
TREES TO BE REMOVED #1615, #1617, AND #1618
LIMITS OF PROPOSED 14' WIDE CONCRETE DRIVE
APPROXIMATE DRAINAGE EASEMENT AREA = ±11.28 AC.
FEMA 100 YR FLOODPLAIN
COLORADO RIVER
APPROXIMATE LOCATION OF 24" DIA. ROCK
TREE LIST
* TREES TO BE REMOVED
STATE OF TEXAS
RUBEN LOPEZ, JR.
LICENSED
PROFESSIONAL ENGINEER
BEGIN (1) - 8' WIDE x 10' HIGH (2) - 6' WIDE x 10' HIGH CLUVERTS @ HEADWALL, FL= 336.44
PROPOSED 14' WIDE CONCRETE DRIVE
END (1) - 8' WIDE x 10' HIGH (2) - 6' WIDE x 10' HIGH CLUVERTS @ HEADWALL WITH 24" DIA. ROCK FL= 323.00
24" DIA. ROCK TO FLOWLINE OF RAVINE (24.5' WIDE CENTERED ON CULVERT)

EXHIBIT E

HEC-RAS ANALYSIS

HEC-RAS Plan: Plan 03 River: Unnamed-Trib-Col Reach: Cantrell Reach Profile: 100 yr

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Cantrell Reach	24	100yr	1465.00	345.15	353.86		354.28	0.002001	5.24	279.73	58.25	0.42
Cantrell Reach	23	100yr	1465.00	344.85	353.68		354.08	0.001871	5.11	286.86	58.98	0.41
Cantrell Reach	22	100yr	1465.00	344.25	353.36		353.72	0.001604	4.82	303.88	60.69	0.38
Cantrell Reach	21	100yr	1465.00	343.65	353.10		353.42	0.001343	4.51	324.80	62.73	0.35
Cantrell Reach	20	100yr	1465.00	343.05	352.89		353.16	0.001104	4.19	349.51	65.05	0.32
Cantrell Reach	19	100yr	1465.00	342.45	352.72		352.95	0.000896	3.88	377.96	67.62	0.29
Cantrell Reach	18	100yr	2458.00	341.85	351.83		352.66	0.002900	6.85	358.72	65.90	0.52
Cantrell Reach	17	100yr	2458.00	341.40	351.40		352.12	0.002872	6.83	359.98	65.99	0.52
Cantrell Reach	16	100yr	2458.00	341.00	351.02		351.74	0.002848	6.81	361.12	65.10	0.51
Cantrell Reach	15	100yr	2458.00	340.64	350.70		351.41	0.002804	6.75	363.95	65.64	0.51
Cantrell Reach	14	100yr	2458.00	340.17	350.27		350.97	0.002738	6.71	366.49	65.59	0.50
Cantrell Reach	13	100yr	2458.00	339.75	349.89		350.58	0.002682	6.66	369.33	66.84	0.50
Cantrell Reach	12	100yr	2458.00	339.46	349.64		350.32	0.002634	6.61	371.87	67.08	0.49
Cantrell Reach	11	100yr	2458.00	339.15	349.38		350.05	0.002568	6.55	375.39	67.39	0.49
Cantrell Reach	10	100yr	2458.00	338.75	349.06		349.66	0.003025	6.22	395.04	87.56	0.52
Cantrell Reach	9	100yr	2458.00	338.25	349.17		349.33	0.000527	3.22	790.06	183.70	0.25
Cantrell Reach	8	100yr	2458.00	337.79	349.21		349.26	0.000132	1.89	1451.82	278.44	0.12
Cantrell Reach	7	100yr	2458.00	337.50	349.20		349.24	0.000095	1.75	1585.15	264.88	0.10
Cantrell Reach	6	100yr	2458.00	337.21	349.19		349.23	0.000105	1.86	1534.11	271.07	0.11
Cantrell Reach	5	100yr	2458.00	336.90	349.19		349.22	0.000071	1.68	1840.00	321.61	0.09
Cantrell Reach	4	100yr	2458.00	336.64	349.18	341.43	349.21	0.000067	1.62	1866.82	312.31	0.09
Cantrell Reach	3.25		Culvert									
Cantrell Reach	3	100yr	2458.00	322.02	349.02		349.03	0.000037	0.67	3398.78	316.12	0.03
Cantrell Reach	2	100yr	2458.00	315.59	349.01		349.02	0.000090	0.95	2547.10	230.83	0.04
Cantrell Reach	1	100yr	2458.00	314.76	349.00	324.75	349.02	0.000069	0.95	2459.91	151.69	0.03

```
HEC-RAS Version 4.0 Beta
U.S. Army Corp 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
```

PROJECT DATA
Project Title: Proposed Pecan Crossing channel
Project File : HecRas100yrUltimate.prj
Run Date and Time: 5/18/2007 11:49:13 AM

Project in English units

Project Description:
Ultimate 100 year flood plain with proposed channel - Ccrall Reach Unnamed Tributary Colorado R.

PLAN DATA

Plan Title: Plan 03
Plan File : e:\2772001_Eng_Documents\HecRas-4-11-07\HecRas100yrUltimate.p03

Geometry Title: Add topo 1-10
Geometry File : e:\2772001_Eng_Documents\HecRas-4-11-07\HecRas100yrUltimate.g01

Flow Title : 100 YR
Flow File : e:\2772001_Eng_Documents\HecRas-4-11-07\HecRas100yrUltimate.f02

Plan Summary Information:

Number of:				
Cross Sections	= 24	Multiple Openings	=	0
Culverts	= 1	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: 100 YR
Flow File : e:\2772001_Eng_Documents\HecRas-4-11-07\HecRas100yrUltimate.f02

Flow Data (cfs)

River	Reach	RS	100 yr
Unnamed-Trib-Col	Cantrell Reach	24.	1465
Unnamed-Trib-Col	Cantrell Reach	18.	2458

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Unnamed-Trib-Col	Cantrell Reach	100 yr		Known WS = 349

GEOMETRY DATA

Geometry Title: Add topo 1-10
Geometry File : e:\2772001_Eng_Documents\HecRas-4-11-07\HecRas100yrUltimate.g01

CROSS SECTION

RIVER: Unnamed-Trib-Col
REACH: Cantrell Reach RS: 24.

INPUT
Description:
Station Elevation Data num= 23

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	358.23	5.72	358.27	9.04	358.32	15.87	358.31	64.55	358.51
77.3	358.59	120.62	359.42	124.19	360.45	127.97	360.48	133.4	359.65
137.13	359.65	140.78	359.66	152.77	359.66	153.17	359.86	155.03	359.14
170	354.15	197	345.15	203	345.15	254.27	362.24	257.16	363.2
262.37	363.34	266.17	363.4	315.78	364.82				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	155.03	.035	254.27	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
155.03	254.27	100.04	100	100.17	.1	.3

CROSS SECTION

RIVER: Unnamed-Trib-Col
REACH: Cantrell Reach RS: 23.

INPUT
Description:
Station Elevation Data num= 29

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	357.96	37.43	357.97	61.46	357.85	82.81	358.09	87.49	358.17
96.21	358.15	152.59	358.57	153.39	358.58	153.43	358.72	153.57	358.69
153.7	358.66	154.11	358.6	154.46	358.61	155.6	358.63	168.59	354.3
169.95	353.85	196.95	344.85	202.95	344.85	249.01	360.2	251.03	360.65
255.74	360.85	271.49	360.7	271.61	360.7	272.1	360.72	272.48	360.73
272.58	360.72	274.93	360.78	322.67	362.26	331.61	362.5		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	155.6	.035	251.03	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
155.6	251.03	200	200	200.01	.1	.3

CROSS SECTION

RIVER: Unnamed-Trib-Col
REACH: Cantrell Reach RS: 22.

INPUT
Description:
Station Elevation Data num= 23

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
11.77	357.36	69.7	357.71	127.06	357.84	129.7	357.77	150.04	357.93
151.67	358.09	155.16	358.18	168.56	353.71	169.95	353.25	196.95	344.25
202.95	344.25	245.25	358.35	246.86	358.86	247.85	358.76	248.6	358.86
249.53	358.85	249.79	358.84	254.31	359.21	255.14	359.28	256.98	359.15
297.59	359.81	305.96	360.03	365.04	361.51				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
11.77	.035	155.16	.035	246.86	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
155.16	246.86	200.01	200	200	.1	.3

CROSS SECTION

RIVER: Unnamed-Trib-Col
REACH: Cantrell Reach RS: 21.

INPUT
Description:
Station Elevation Data num= 29

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
32.81	356.93	73.53	357.23	84.04	357.34	89.82	357.35	144.27	357.6
147.3	357.62	147.9	357.63	148.88	357.63	154.97	357.66	168.58	353.12
170	352.65	197	343.65	203	343.65	245.28	357.74	246.89	358.28
249.42	358.29	258	356.35	278.17	358.53	288.11	358.65	290.15	358.75
294.45	359.01	306.97	359.68	327.36	359.76	337.19	359.76	346.95	359.85
363.45	360.17	370.84	360.34	378.59	360.47	382.46	360.58		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
32.81	.035	154.97	.035	246.89	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
154.97	246.89	200.01	200	200.01	.1	.3

CROSS SECTION

RIVER: Unnamed-Trib-Col
REACH: Cantrell Reach RS: 20.

INPUT
Description:
Station Elevation Data num= 26

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
49.61	356.69	76.37	356.76	87.84	356.76	105.53	356.86	153.22	357.27
154.32	357.27	155.81	356.78	172.55	351.2	197	343.05	203	343.05
230	352.05	231.63	352.59	247.29	357.81	247.68	357.81	249.05	357.83
279.45	358.07	284.66	358.1	286.93	358.12	288.17	358.12	288.57	358.13
290.29	358.14	339.53	358.54	351.11	358.65	356.45	359.02	358.22	359.12
390.41	359.51								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
49.61	.035	154.32	.035	247.68	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
154.32	247.68	199.95	200	199.71	.1	.3

CROSS SECTION

RIVER: Unnamed-Trib-Col
REACH: Cantrell Reach RS: 19.

INPUT
Description:
Station Elevation Data num= 26

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
41.3	356.95	81.83	355.94	95.16	355.58	147.95	356.33	148.56	356.34
148.69	356.37	148.96	356.38	149.45	356.4	150.61	356.45	155.27	356.64
170.84	351.45	174	350.39	197.84	342.45	203.84	342.45	207	343.51
246.27	356.59	248.33	357.28	251.84	357.28	252.69	357.29	253.15	357.31
253.33	357.29	254.35	357.27	262.87	357.39	307.57	357.88	323.96	358.11
363.37	358.6								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
41.3	.035	155.27	.035	248.33	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
155.27	248.33	199.97	200	200.17	.1	.3

CROSS SECTION

RIVER: Unnamed-Trib-Col
REACH: Cantrell Reach RS: 18.

INPUT
Description:
Station Elevation Data num= 24

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
29.38	357.4	58.42	356.95	67.62	356.7	71.98	356.56	94.34	355.64
117.31	354.84	125.33	354.96	128.97	355.07	134.03	355.42	153.83	356.24
155.76	355.59	194.01	342.85	197	341.85	203	341.85	227.19	349.91
249.43	357.32	249.59	357.33	249.89	357.42	250.17	357.42	260.74	357.5
267.73	357.54	318.02	358.35	321.37	358.38	375.64	358.61		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
29.38	.035	153.83	.035	250.17	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
153.83	250.17	157.85	150	141.26	.1	.3

CROSS SECTION

RIVER: Unnamed-Trib-Col
REACH: Cantrell Reach RS: 17.

INPUT
Description:
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
19.31	361.17	80.78	360.98	83.23	360.83	124.94	359.58	138.7	359.05
140.23	358.92	143.99	359.07	167.67	351.18	170	350.4	172.62	349.53
197	341.4	203	341.4	227.52	349.57	230	350.4	232.98	351.39
233.03	351.41	260.67	360.62	263.63	360.66	290.39	360.85	333.73	361.81

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
19.31	.035	143.99	.035	260.67	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
143.99	260.67	142.15	134.6	125.25	.1	.3

CROSS SECTION

RIVER: Unnamed-Trib-Col
REACH: Cantrell Reach RS: 16.

INPUT
Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
47.76	359.2	.75	359.02	94.78	358.51	136.18	357.3	142.99	357.27
146.31	357.2	148.15	357.1	148.36	357.09	148.8	357.07	197.01	341
203.01	341	247.43	355.81	260.12	360.13	260.34	360.2	260.44	360.24
261.05	360.44	261.6	360.63	261.71	360.72				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
47.76	.035	148.8	.035	247.43	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
148.8	247.43	114.96	115.4	117.45	.1	.3

CROSS SECTION

RIVER: Unnamed-Trib-Col
REACH: Cantrell Reach RS: 15.

INPUT
Description:
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
20.13	358.79	47.4	357.86	55.73	357.77	76.93	357.43	83.25	357.41
84.37	357.36	86.95	357.1	105.87	355.71	113.53	354.78	125.22	354.75
148.78	354.36	150.81	354.24	150.91	354.24	151.19	354.23	151.25	354.22
151.81	354.23	152.96	355.17	153.23	355.16	167.1	350.51	168.82	350.02
169.36	349.86	170.01	349.64	171.19	349.25	197.01	340.64	203.01	340.64
233.09	350.67	235.74	351.53	262.98	360.6	263.29	360.47	272.17	360.6

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
20.13	.035	153.23	.035	235.74	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
153.23	235.74	158.4	158.35	157.45	.1	.3

CROSS SECTION

RIVER: Unnamed-Trib-Col
REACH: Cantrell Reach RS: 14.

INPUT
Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
76.23	359.44	116.96	356.83	117.64	356.8	136.62	355.15	137.13	355.11
156.89	352.72	157.03	352.71	157.34	352.69	158.58	352.6	159.3	352.55
159.96	352.5	196.96	340.17	202.96	340.17	254.86	357.47	256.95	357.54
262.34	357.7	268.95	357.91	281.91	357.75				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
76.23	.035	136.62	.035	254.86	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
136.62	254.86	135.07	141.65	149.54	.1	.3

CROSS SECTION

RIVER: Unnamed-Trib-Col
REACH: Cantrell Reach RS: 13.

INPUT
Description:
Station Elevation Data num= 23

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
115.49	359	131.61	358.35	133.62	358.22	137.85	358.01	137.92	357.88
138.7	357.79	139.43	357.91	139.56	357.92	143.38	357.63	145.83	356.8
170	348.75	172.48	347.92	197	339.75	203	339.75	205.48	340.58
248.18	354.81	248.38	354.89	248.68	355.48	248.73	355.49	253.89	356.14
254.63	356.24	258.68	356.56	296.45	359.23				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
115.49	.035	145.83	.035	248.38	.035

```
Bank Sta: Left    Right      Lengths: Left Channel   Right      Coeff Contr.   Expan.
        145.83   248.38              92.29   97.78  103.06               .1       .3

CROSS SECTION


RIVER: Unnamed-Trib-Col
REACH: Cantrell Reach        RS: 12.

INPUT
Description:
Station Elevation Data       num=       23
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
  108.84   358.35      125   357.96   137.38   357.22   138.19   357.18   138.34   357.16
  139.82   357.01   141.29   357.17   146.28   356.36      197   339.46      203   339.46
  249.11   354.83   249.49   354.67   249.72   354.89   250.11   354.93   250.71    355.3
  251.77   355.62   253.32   355.26   255.77   355.79   257.32   355.68   273.25   356.39
  286.92   356.43   303.14   357.22   303.66   357.06

Manning's n Values           num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
  108.84     .035   146.28     .035   249.49     .035

Bank Sta: Left    Right      Lengths: Left Channel   Right      Coeff Contr.   Expan.
        146.28   249.49             102.36  102.22  102.49               .1       .3

CROSS SECTION


RIVER: Unnamed-Trib-Col
REACH: Cantrell Reach        RS: 11.

INPUT
Description:
Station Elevation Data       num=       15
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
  106.07   357.79   114.08   357.59   143.18   356.94   143.79   356.79   144.12   356.77
     197   339.15      203   339.15   238.84    351.1   243.35   351.31   244.29   350.61
  244.36   350.61   257.56   352.17   277.79    354.2   289.67      355      318    356.8

Manning's n Values           num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
  106.07     .035   143.79     .035   238.84     .035

Bank Sta: Left    Right      Lengths: Left Channel   Right      Coeff Contr.   Expan.
        143.79   238.84             131.27  131.31  131.28               .1       .3

CROSS SECTION


RIVER: Unnamed-Trib-Col
REACH: Cantrell Reach        RS: 10.

INPUT
Description:
Station Elevation Data       num=       19
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
  102.62   356.55   122.64   355.91   156.23   355.34      205   339.09      206   338.75
     212   338.75      213   339.09   240.28   348.16   242.53    348.1   242.66   348.09
  245.94   347.97    249.5   348.23   254.78   348.37   262.86   349.08   279.49   351.69
  293.89   354.08   301.03   353.09   311.03   355.04   331.86   357.03

Manning's n Values           num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
  102.62     .035   156.23     .035   279.49     .035

Bank Sta: Left    Right      Lengths: Left Channel   Right      Coeff Contr.   Expan.
        156.23   279.49             181.57  168.69  158.11               .1       .3
```

CROSS SECTION

RIVER: Unnamed-Trib-Col
REACH: Cantrell Reach RS: 9.

INPUT
Description:
Station Elevation Data num= 24

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-5.75	356	68.91	352.73	86.94	351.53	104.82	350.51	134.66	346.72
151.39	344.84	162.42	343.87	164.91	343.81	170.21	343.88	171.19	343.82
190.71	343.35	205.91	338.28	206.01	338.25	212.01	338.25	212.91	338.55
213.01	338.58	225.76	342.83	227.24	343.29	230.26	343.49	255.51	346.36
275.34	347.95	298.62	349.1	309.57	350.76	386.87	354		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-5.75	.035	134.66	.035	275.34	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
134.66	275.34	161.36	152.96	141.6	.1	.3

CROSS SECTION

RIVER: Unnamed-Trib-Col
REACH: Cantrell Reach RS: 8.

INPUT
Description:
Station Elevation Data num= 22

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	355.5	163.5	346	181.5	346	205	338.12	206	337.79
212	337.79	213	338.12	218.5	340	231.03	341.02	231.68	340.99
243.14	340.56	257.14	340.49	285.1	340.73	285.84	340.75	288.97	340.95
304.07	341.78	309.13	342.22	316.85	343.17	329.08	344.77	334.75	345.25
347.32	346.6	444.15	353						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	163.5	.035	316.85	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
163.5	316.85	97.08	97.04	97.05	.1	.3

CROSS SECTION

RIVER: Unnamed-Trib-Col
REACH: Cantrell Reach RS: 7.

INPUT
Description:
Station Elevation Data num= 26

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	354.25	171.9	343	185.54	338.48	187.5	337.83	188.4	337.53
188.5	337.5	212.5	337.5	213.4	337.8	213.5	337.83	214.27	338.09
223.51	340.53	223.59	340.52	223.75	341.2	237.82	339.82	249.42	339.55
255.49	339.61	272.37	341.25	301.54	343.54	311.73	345.14	331.59	347.83
333.17	348.04	344.23	349.49	350.97	350.36	355.36	351.35	360.61	351.66
403.46	353.6								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	171.9	.035	311.73	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
171.9	311.73	97.39	97.21	97.35	.1	.3

CROSS SECTION

RIVER: Unnamed-Trib-Col
REACH: Cantrell Reach RS: 6.

INPUT
Description:
Station Elevation Data num= 25

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-42.29	353.5	88.4	346.41	114.18	344.46	127.2	343.06	151.06	341.59
175.34	340.28	179.46	340.05	187	337.54	188	337.21	212	337.21
213	337.54	217.27	336.96	218.85	339.03	218.94	339.04	221.29	339.33
234.38	340.98	235.97	340.96	238.57	341.48	255.6	343.51	283.89	346.43
286.63	346.78	293.79	347.59	311.14	349.5	367.92	353	367.92	356

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-42.29	.035	127.2	.035	255.6	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
127.2	255.6	91.28	102.79	114.33	.1	.3

CROSS SECTION

RIVER: Unnamed-Trib-Col
REACH: Cantrell Reach RS: 5.

INPUT
Description:
Station Elevation Data num= 34

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-48.65	352	49.59	347.23	81.48	345.85	85.9	345.61	87.13	345.52
125.97	341.58	135.24	340.64	144.34	340.25	145.71	340.29	148.92	340.06
170.54	338.41	170.89	338.48	173.34	338.19	174.8	338.22	178.08	338.3
183.43	338.42	186.67	337.34	186.99	337.23	187.08	337.2	187.99	336.9
211.99	336.9	212.89	337.2	212.99	337.23	221.62	340.11	222.23	340.17
226.43	340.55	228.48	340.68	229.75	340.79	230.56	340.87	230.92	340.78
243.77	341.3	262.55	344.2	341.95	350	384.95	358		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-48.65	.035	135.24	.035	243.77	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
135.24	243.77	105.32	120.08	132.36	.1	.3

CROSS SECTION

RIVER: Unnamed-Trib-Col
REACH: Cantrell Reach RS: 4.

INPUT
Description:
Station Elevation Data num= 27

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-90.43	350.5	-70.7	350	-29.43	349	-9.02	348	18.3	347
62.91	343.43	68.16	343.04	78.03	342.26	113.34	340.19	145.91	339.4
156.41	339.08	163.76	339.53	165.07	339.14	168.9	339.28	174.12	340.15
180.34	339.34	180.93	338.89	185.47	340.63	186.99	336.87	187.08	336.84
187.99	336.54	211.99	336.54	212.99	336.87	214.32	337.32	216.91	343.09
273.9	349	350.07	358						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-90.43	.035	68.16	.035	216.91	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
68.16	216.91	104.3	104	106	.1	.3

CULVERT

RIVER: Unnamed-Trib-Col
REACH: Cantrell Reach RS: 3.25

INPUT
Description: proposed culvert
Distance from Upstream XS = 45
Deck/Roadway Width = 10
Weir Coefficient = 3

Upstream Deck/Roadway Coordinates
num= 13

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
-166.91	352	336.41	-129.8	351	336.41	-63.91	350	336.41
-34.85	349	336.41	-6.19	348	336.41	22.99	347	336.41
200	347	336.41	209.36	348	336.41	241.24	349	336.41
273.31	350	336.41	300.24	351	336.41	321.89	352	336.41
348.35	353	336.41						

Upstream Bridge Cross Section Data
Station Elevation Data num= 27

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-90.43	350.5	-70.7	350	-25.43	349	-9.02	348	18.3	347
62.91	343.43	68.16	343.04	78.03	342.26	113.34	340.19	145.91	339.4
156.41	339.08	163.76	339.53	165.07	339.14	168.9	339.28	174.12	340.15
180.34	339.34	180.93	336.89	185.47	340.63	186.99	336.87	187.08	336.84
187.99	336.54	211.99	336.54	212.99	336.87	214.32	337.32	216.91	343.09
273.9	349	350.07	358						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-90.43	.035	68.16	.035	216.91	.035

Bank Sta: Left	Right	Coeff Contr.	Expan.
68.16	216.91	.1	.3

Downstream Deck/Roadway Coordinates
num= 14

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
-166.91	352	322	-129.8	351	322	-63.91	350	322
-34.85	349	322	-6.19	348	322	22.99	347	322
200	347	322	209.36	348	322	241.24	349	322
273.31	350	322	300.24	351	322	321.89	352	322
348.35	353	322	357.82	353	322			

Downstream Bridge Cross Section Data
Station Elevation Data num= 43

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
17.17	349	46.08	346	66.17	345.23	68.31	345.18	101.7	343.33
104.94	343.06	115.85	337.5	116.08	337.39	129.65	330.48	136.17	328.82
138.15	326.26	142.27	325.37	144.83	325.57	150.87	322.14	153.1	322.75
161.65	322.6	161.76	322.49	161.92	322.47	162.33	322.5	175.94	323.1
185.54	322.02	188.92	322.52	198.72	327.25	215.02	337.23	215.46	337.49
215.84	337.84	216.05	337.86	217.14	337.93	259.39	341.06	277.47	342.06
283.14	342.29	290.32	341.87	306.97	344.36	321.14	347.03	323.89	347.57
324.79	347.61	326.68	347.71	332.51	348.91	350.32	351.41	354.01	352
357.82	353	389.25	354	401.81	354.5				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
17.17	.035	116.06	.1	217.14	.035

Bank Sta: Left	Right	Coeff Contr.	Expan.
116.08	217.14	.1	.3

E.G. OC (ft)	349.21	Weir Sta Rgt (ft)	248.02
Culvert Control	Outlet	Weir Submerg	0.90
Culv WS Inlet (ft)	346.54	Weir Max Depth (ft)	2.21
Culv WS Outlet (ft)	333.00	Weir Avg Depth (ft)	1.74
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	495.14
Culv Crt Depth (ft)	2.81	Min El Weir Flow (ft)	347.01

CROSS SECTION

RIVER: Unnamed-Trib-Col
REACH: Cantrell Reach RS: 3.

INPUT
Description:
Station Elevation Data num= 43

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
17.17	349	46.08	346	66.17	345.23	68.31	345.16	101.7	343.33
104.94	343.06	115.85	337.5	116.08	337.39	129.65	330.48	136.17	328.82
138.15	326.26	142.27	325.37	144.83	325.57	150.87	322.14	153.1	322.75
161.65	322.6	161.76	322.49	161.92	322.47	162.33	322.5	175.94	323.1
185.54	322.02	188.92	322.52	198.72	327.25	215.02	337.23	215.46	337.49
215.84	337.84	216.05	337.86	217.14	337.93	259.39	341.06	277.47	342.06
283.14	342.29	290.32	341.87	306.97	344.36	321.14	347.03	323.89	347.57
324.79	347.61	326.68	347.71	332.51	348.91	350.32	351.41	354.01	352
357.82	353	389.25	354	401.81	354.5				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
17.17	.035	116.08	.1	217.14	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
116.08	217.14	90.79	77.86	64.21	.1	.3

CROSS SECTION

RIVER: Unnamed-Trib-Col
REACH: Cantrell Reach RS: 2.

INPUT
Description:
Station Elevation Data num= 41

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
42.41	347.85	46.54	348.57	48.92	348.82	49.33	348.91	58.99	349.22
71.14	349.36	79.86	348.95	85.12	348.4	103.34	346.25	107.75	345.52
123.54	341.86	127.47	341.13	140.7	338.81	144.15	338.1	146.68	337.49
147.15	337.42	149.93	336.92	156.11	334.04	159.97	332.18	177.2	320.65
181.82	315.59	183.06	315.82	185.34	315.88	186.86	316.29	188.73	316.79
196.34	319.72	200.61	321.87	204.71	324.6	213	330.04	218.81	332.73
226.36	337.17	238.45	339.36	240.99	339.95	246.41	341.01	257.8	342.62
282.15	346.71	294.4	348.36	297.17	348.76	304.06	349.52	311.09	349.69
315.8	350.36								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
42.41	.035	140.7	.1	246.41	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
140.7	246.41	58.27	99.43	111.65	.1	.3

CROSS SECTION

RIVER: Unnamed-Trib-Col
REACH: Cantrell Reach RS: 1

INPUT
Description:
Station Elevation Data num= 21

Cantrell Reach	10.	181.57	168.69	158.11
Cantrell Reach	9.	161.36	152.96	141.6
Cantrell Reach	8.	97.08	97.04	97.05
Cantrell Reach	7.	97.39	97.21	97.35
Cantrell Reach	6.	91.28	102.79	114.33
Cantrell Reach	5.	105.32	120.08	132.36
Cantrell Reach	4.	104.3	104	106
Cantrell Reach	3.25	Culvert		
Cantrell Reach	3.	90.79	77.86	64.21
Cantrell Reach	2.	58.27	99.43	111.65
Cantrell Reach	1	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Unnamed-Trib-Col

Reach	River Sta.	Contr.	Expan.
Cantrell Reach	24.	.1	.3
Cantrell Reach	23.	.1	.3
Cantrell Reach	22.	.1	.3
Cantrell Reach	21.	.1	.3
Cantrell Reach	20.	.1	.3
Cantrell Reach	19.	.1	.3
Cantrell Reach	18.	.1	.3
Cantrell Reach	17.	.1	.3
Cantrell Reach	16.	.1	.3
Cantrell Reach	15.	.1	.3
Cantrell Reach	14.	.1	.3
Cantrell Reach	13.	.1	.3
Cantrell Reach	12.	.1	.3
Cantrell Reach	11.	.1	.3
Cantrell Reach	10.	.1	.3
Cantrell Reach	9.	.1	.3
Cantrell Reach	8.	.1	.3
Cantrell Reach	7.	.1	.3
Cantrell Reach	6.	.1	.3
Cantrell Reach	5.	.1	.3
Cantrell Reach	4.	.1	.3
Cantrell Reach	3.25	Culvert	
Cantrell Reach	3.	.1	.3
Cantrell Reach	2.	.1	.3
Cantrell Reach	1	.1	.3

BUILDING BASTROP

HONORING OUR AUTHENTIC PAST.
PLANNING FOR OUR SUSTAINABLE FUTURE.

Waiver Checklist

Process Overview

1. Pre-Application Meeting
    a. Discuss your project with staff prior to submitting an application. Staff can help identify opportunities and constraints on the proposed project, as well as provide more information on the process and code requirements.
2. Complete Submittal Package*, which includes: Application and all Checklist Items
3. Staff review, with comments issued as needed
4. City Council meeting for approval by Resolution or Ordinance

*Incomplete submittals will not be accepted

Submittal Package Checklist Items

Staff	Applicant	Item
☐	☐	Completed and signed Application
☐	☐	Agent Authorization Form
☐	☐	Project Description Letter listing the following: • Type of improvements proposed • Scope of improvements • How the project will affect areas within the scope of work
☐	☐	A signed, sealed and dated letter from a registered engineer certifying that they have personally reviewed the topography and completed a field investigation of the existing and proposed flow patterns for stormwater runoff from the subject development to the main stem of all creeks that may impact the project, and build-out conditions allowable by zoning, restrictive covenant or plat note, that the stormwater flows from the subject development will not cause any additional adverse flooding impacts for storms of magnitude up through the one-hundred (100) year event.
☐	☐	Map of Affected Area and/or Concept Plan as requested by Staff
☐	☐	Detailed plans of proposed drainage improvements signed, sealed, and dated by a registered engineer
☐	☐	Digital Submittal – Provide pdf copies of all documents listed above via email, CD, or flash drive

Carlson, Brigance & Doering, Inc.
Civil Engineering ✣ Surveying

5501 West William Cannon Drive
Austin, Texas 78749
(512) 280-5160 Office (512) 583-0903 Fax

Delivery Receipt & Letter of Transmittal

DATE:	April 4, 2019
ATTENTION:	Vivianna Nicole Hamilton
REFERENCE:	Bastrop Grove Section 2 ***Exemption Application***
CBD PROJECT NO:	4697

TO: City of Bastrop
Planning & Development Dept.
ATTN: Vivianna Nicole Hamilton
City Hall, 1311 Chestnut Street
Bastrop, TX 78602

SENT BY: Christine Methvin
christine@cbdeng.com
(512) 280-5160 x175 office (512) 484-6591 cell

THESE ITEMS ARE TRANSMITTED AS INDICATED BELOW:

- [ ] **For Action**
- [ ] **For Signature(s)**
- [ ] **For Approval**
- [X] **For Information/Files**
- [X] **For Review & Comment**
- [ ] **Other** ____________
- [ ] **Contact Christine Methvin for pick up when processed**
- [ ] **Submit** ____ **copies for distribution**
- [ ] **Other** ____________
- [ ] **Other** ____________

REMARKS:

NO.	COPIES	DATE	DESCRIPTION
1	1	4/2/19	Alternate Design Standards Checklist
2	1	4/2/19	Exemption Application (Alternative Drainage Plan)
3	1	1/7/2019	Owner Agent Authorization Form
4	1	4/4/2019	Project Description Letter
5	1	4/4/2019	Certification Letter
6	1	1/22/2019	Proposed Preliminary Plat
7	1	Feb. 2019	Drainage Improvement Plan
8	1	2/13/2019	Copy of Pre-Application Meeting Minutes
9	1	Feb-19	Drainage Improvements Report: Developed Conditions Hydrology Revision Report
10	1	May-19	Bastrop Grove Drainage Improvements Engineering Report

Received by: [signature]

Date: 4/4/19

Owner's Agent Authorization

Property Owner's Information

Owner's Name(s): MC BASTROP 71, LP

Property Address(s): PARCEL #R78736

Owner's Email Address: DM@MORANCAP.COM

Owner's Phone Number: ( ) (214) 622-6525

The individuals listed below are hereby authorized to apply for, sign for, and conduct business for permits, plan, and/or other legal documents with the City of Bastrop Planning and Development Department on behalf of the above identified property owner(s).

The City of Bastrop Planning and Development Department may retain a copy of this form for our records and maintain a file as a courtesy. The form with the most recent date shall supersede all previous authorizations on file and **remain in effect for one (1) year, or until a new form is filed by the property owners, whichever is shorter**.

All signatories understand that it is the property owner's responsibility to provide a copy of this form every time they would like to add or remove authorized agents, and that this form expires one (1) year after it is signed. The property owner's signature designates the agent as the official contact person for projects and the single point of contact. All correspondence and communication will be conducted with the agent.

Print full name(s) and title(s) of authorized agent(s):

1. ANY EMPLOYEE OF
2. CARLSON, BRIGANCE & DOERING, INC.

X [signature]
Signature(s) of Property Owner(s)

X 1-7-19
Date

Signature(s) of Property Owner(s)

Date

[signature]
Signature(s) of Agent(s)

1/3/19
Date

Signature(s) of Agent(s)

Date

BUILDING BASTROP
HONORING OUR AUTHENTIC PAST.
PLANNING FOR OUR SUSTAINABLE FUTURE.

Waiver Checklist

Process Overview

1. Pre-Application Meeting
   a. Discuss your project with staff prior to submitting an application. Staff can help identify opportunities and constraints on the proposed project, as well as provide more information on the process and code requirements.
2. Complete Submittal Package*, which includes: Application and all Checklist Items
3. Staff review, with comments issued as needed
4. City Council meeting for approval by Resolution or Ordinance

*Incomplete submittals will not be accepted

Submittal Package Checklist Items

Staff	Applicant	Item
☐	☒ X	Completed and signed Application
☐	☒ X	Agent Authorization Form
☐	☒ X	Project Description Letter listing the following: • Type of improvements proposed • Scope of improvements • How the project will affect areas within the scope of work
☐	*	A signed, sealed and dated letter from a registered engineer certifying that they have personally reviewed the topography and completed a field investigation of the existing and proposed flow patterns for stormwater runoff from the subject development to the main stem of all creeks that may impact the project, and build-out conditions allowable by zoning, restrictive covenant or plat note, that the stormwater flows from the subject development will not cause any additional adverse flooding impacts for storms of magnitude up through the one-hundred (100) year event.
☐	*	Map of Affected Area and/or Concept Plan as requested by Staff
☐	*	Detailed plans of proposed drainage improvements signed, sealed, and dated by a registered engineer
☐	☒ X	Digital Submittal – Provide pdf copies of all documents listed above via email, CD, or flash drive

(*) SEE BASTROP GROVE DRAINAGE IMPROVEMENTS ENGINEERING REPORT DATED MAY 2018 AND BASTROP GROVE DRAINAGE IMPROVEMENTS PLANS DATED APRIL 2018

BUILDING BASTROP
HONORING OUR AUTHENTIC PAST.
PLANNING FOR OUR SUSTAINABLE FUTURE.

Exception Application

Process Overview

1. Complete Submittal Package*, which includes: Application and associated Checklist Items
2. Staff review, with comments issued as needed
3. Exception Determination Letter issued by Planning Director
   a. If determined the project DOES qualify as an Exception, submit permit application for project
   b. If determined the project DOES NOT qualify as an Exception by the Planning Director, the City Manager will make determination, followed by a City Council determination if needed.

*Incomplete submittals will not be accepted

Select your Exception

☐ No Impact Project
■ Ongoing Project
☐ Grandfathered Project

Property Owner

Name: MC BASTROP 71, LP

Address: 2828 ROUTH STREET, SUITE 500

City, State Zip: DALLAS, TX 75201

Phone Number: 214-622-6525 E-mail Address DM@MORANCAP.COM

Applicant

Name: Christine Methvin Role (i.e. developer, agent, etc.): Agent

Company Name: Carlson, Brigance & Doering, Inc.

Address: 5501 W. William Cannon Drive, Austin, TX 78749

Phone Number: 512-280-5160 X175 E-mail Address CHRISTINE@CBDENG.COM

Project Information

Project Name: BASTOP GROVE, SECTION 2

Property Address: ______ BCAD Property ID: R78736

Legal Description: A98 BLAKEY, NANCY, ACRES 93.013

Current Use(s) of the Property: UNDEVELOPED

Nature of the Project: 12 LOT COMMERCIAL SUBDIVISION

Existing Zoning District: GENERAL RETAIL

Exception Application

Total Property Area (sq ft): 1,127,419.92 SF (25.882 ACRES) Total Number Lots: 12

Total Area of Impervious Surface (sq ft): Existing: 0 Proposed:

Total Number of Buildings: Existing: 0 Proposed:

Footprint of Each Building (sq ft):
Existing: n/a
Proposed: n/a

Total Number of Dwelling Units by Type (single family, duplex, multi-family, etc.):
Existing: 0
Proposed: 0

Amount of Non-Residential Square Footage (ground floor building footprint only) by Type (office, retail, commercial, industrial, warehouse, etc.). If project is mixed-use (mix of uses on same lot, please specify):
Existing: n/a
Proposed: n/a

Number of Phases of Development: 1 PHASE

Explain the current drainage pattern on the site (submit attachment if needed):
See Bastrop Grove Drainage Improvements Engineering Report dated May 2018

Explain the drainage pattern of the site after the project is complete (submit attachment if needed): See Bastrop Grove Drainage Improvements Engineering Report dated May 2018

No Impact Projects: N/A

☐ Yes ☐ No Will the project increase density on site?
☐ Yes ☐ No Will the project increase or impact impervious cover?
☐ Yes ☐ No Will the project expand the footprint of an existing structure?
☐ Yes ☐ No Will the project alter the current drainage pattern on the property?

Ongoing Projects:

List of Permit(s) and Numbers (if available): LAND-1291-2018 "BASTROP GROVE DRAINAGE IMPROVEMENTS"

Applicant Certification

The applicant certifies that the facts stated herein and exhibits attached hereto are true, correct, and complete. Signature below also authorizes the City of Bastrop and its agents to visit and inspect the property for which this application is being submitted.

Project Coordinator 1/19/19

Signature and Title Date

BASTROPTX
Heart of the Lost Pines / Est. 1832

Exception Application

Additional Information Required for Grandfathered Projects N/A

1. **Please indicate permits or development approvals received that are the basis to establish rights to complete the Project.** *Please specify all that may be applicable and include copies of the permit.*

CONSENT AGREEMENT/DEVELOPMENT AGREEMENT/MEMORANDUM OF UNDERSTANDING		
Name:		Approval Date:
Expiration Date:	Volume No.:	Page No.:
PLANNED DEVELOPMENT DISTRICT (PDD) PLAN		
PDD Name:		Ordinance No.:
Approval Date:	Last Revision Date:	Acreage:
PLAT APPLICATION *Note: Plat must be approved within 24 months of application submittal date*		
Plat Name:		
Legal Description:		
Submittal Date:	Expiration Date:	Acreage:
APPROVED/RECORDED PLAT *Note: If plat is not recorded within 2 years of plat approval permit rights will expire*		
Plat Name:		
Legal Description:		
Approval Date:	Expiration Date:	Acreage:
Recording Date:	Volume No.:	Page No.:
OTHER PERMIT		
Type of Permit:		Submittal Date:
Permit No.:	Date Issued:	Expiration Date:

2. Date establishing claim of rights for this Project: ______________________________

3. Describe any construction or related actions that have taken place on the property since that date: *Include the date, nature and extent of each physical improvement to the property including structures, utilities, roads, driveways, etc.*

____

____

____

____

____

____

4. Describe how the Project has addressed drainage: *Include the standards and assumptions used, impact to this property and adjacent properties, stormwater flows from the Project, etc.*

____

____

____

____

____

____

BASTROPTX
Heart of the Lost Pines / Est. 1832

Exception Application

5. Authorization from Property Owner

I, Douglas MacMahon, swear and affirm that I am the owner of property at Parcel #R78736, as shown in the records of Bastrop County, Texas, which is the subject of this application.

I, Douglas MacMahon, the owner of the property subject to this Grandfathered Project Exception Application, authorize to submit the application and serve as my representative for this request.

X [signature] X 1-7-19

Property owner's signature | Date

6. Sworn statement:

I, the undersigned, hereby certify that all information contained herein and the attached documents are true and correct and that it is my belief that the property owner is entitled to the requested rights for this Project and, during the pending time of this determination, I understand my continuing obligation to notify the Development Services Director in writing of the inaccuracy of any statement or representation which was incorrect when made or which becomes incorrect by virtue of changed circumstances.

Christine M. Methvin	CM Methvin	1/3/19
Applicant's Name	Applicant's signature	Date

Sworn to and subscribed before me by SUSAN O. MARTIN on this 3rd day of January in the year 2019, to certify which witness my hand and seal of office.

Susan O. Martin

Notary Public, State of Texas

SUSAN O. MARTIN
NOTARY PUBLIC
ID# 13049238-6
State of Texas
Comm. Exp. 01-11-2020

Owner's Agent Authorization

Property Owner's Information

Owner's Name(s): MC BASTROP 71, LP

Property Address(s): PARCEL #R78736

Owner's Email Address: DM@MORANCAP.COM

Owner's Phone Number: ( ) (214) 622-6525

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Print full name(s) and title(s) of authorized agent(s):

1. ANY EMPLOYEE OF
2. CARLSON, BRIGANCE & DOERING, INC.

x [signature]
Signature(s) of Property Owner(s)

x 1-7-19
Date

Signature(s) of Property Owner(s)

Date

[signature]
Signature(s) of Agent(s)

1/3/19
Date

Signature(s) of Agent(s)

Date

Pre-Application Meeting Request Form

Pre-application meetings are required prior to starting any project in the City of Bastrop. They allow applicants to learn more about the City of Bastrop's code, application process, and to provide answers to questions. Representatives from various departments may be present depending on the project and associated questions.

Pre-application meeting are held on Tuesday afternoons by appointment. Staff suggests scheduling a meeting as soon as possible because requests are processed in the order in which they are received, and appointment times fill quickly. To reserve an appointment, complete this form, attach a location map of the property of interest, and return to Staff. You may return the application in person or by mail to 1311 Chestnut St. Bastrop, TX 78602 or by email to plan@cityofbastrop.org. Staff will contact you to confirm an appointment date and time.

Property Information

Property Address: ______________ Tax ID: R78736

Legal Description: A98 BLAKEY, NANCY, ACRES 93.013

Land Use Category: ______________ Acreage: 25.882

Existing Zoning District: GENERAL RETAIL (If rezone) Proposed Zoning District: N/A

Name of Overarching Regulation (PD, MUD, DA, etc.): N/A

Project Details

Project Name: BASTOP GROVE, SECTION 2

What is the primary purpose for the meeting?

☐ Due Diligence/Fact Finding ☐ Project Feasibility ☐ Project Design ■ Ready to Submit App ■ Other

If other, please explain: POSSIBLE EXCEPTION & FUTURE PRELIMINARY PLAT

Briefly describe your project: Proposed 12 lot, commercial subdivision.

Have you spoken to City Staff about this project? ■ Yes ☐ No If yes, name: Jennifer Bills

Have there been previous meetings about this project? ■ Yes ☐ No If yes, date: ______________

Meeting Details

Requested Meeting Date (must be a Tuesday): First availble Tuesday

Backup Meeting Date (must be a Tuesday): Next available Tuesday

Pre-Application Meeting Request Form

Contact Information

Name: MC BASTROP 71, LP Role (i.e. developer, agent, etc): Agent

Company Name: Carlson, Brigance & Doering, Inc.

Address: 2828 ROUTH STREET, SUITE 500

Phone Number: 214-622-6525 Email: bmcentee@cbdeng.com

Additional Contact Information

Name: Christine Methvin Role (i.e. engineer, architect, etc):

Company Name:

Address: 5501 W. William Cannon Drive, Austin, TX 78749

Phone Number: 512-280-5160 X175 Email:

By submitting this request form, the applicant understands that the pre-application meeting is for informational purposes and any preliminary analysis provided by staff during this meeting does not constitute a formal review of the project, imply subsequent approval, nor preclude future comments. It is the responsibility of the applicant to read and comply with all applicable ordinances and requirements in effect on the submittal date.

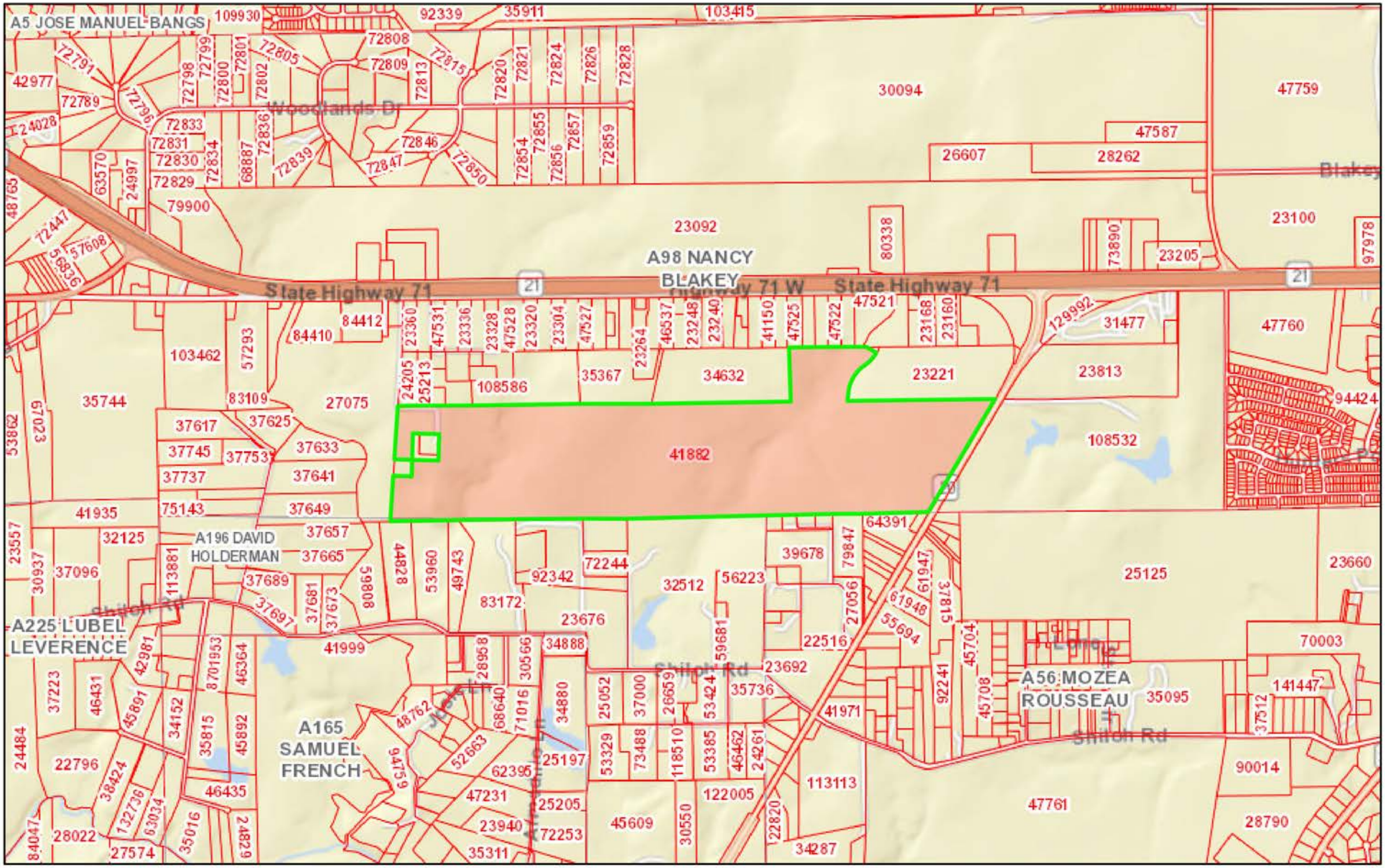
Staff Use Only

Date Received: By:

Meeting Date: Meeting Time:

Staff to Attend:

BASTROP VILLAGE WEST



January 18, 2019

Parcels

Abstracts

1:24,525

0 0.2 0.4 0.8 mi

0 0.33 0.65 1.3 km

Esri, HERE, Garmin, INCREMENT P, NGA, USGS

Bastrop County Appraisal District & BIS Consulting - www.bisconsultants.com

BASTROPTX
Heart of the Lost Pines / Est. 1832

Planning Application

Select your Plan

Subdivision
☐ Amending Plat
☐ Minor Plat
☐ Replat
■ Preliminary Plat
☐ Final Plat
☐ Plat Vacation
☐ Subdivision Variance
☐ Public Improvement Construction Plans

Zoning & Development
☐ Zoning Map Amendment (Rezone)
☐ New Planned Development (PD)
☐ Conditional Use Permit (CUP)
☐ Zoning Variance
☐ Site Development Plan
☐ Site Work (On-Site Infrastructure)
☐ New Agreement: ________________
☐ Alternative Plan: ________________
☐ Agreement/PD Amendment

Other
☐ Abandonment – Easement
☐ Abandonment – ROW
☐ License to Encroach
☐ Nonconforming Structure
☐ Nonconforming Use
☐ Planning Appeal
☐ Voluntary Annexation
☐ Land Disturbance
☐ Work in the ROW

See associated checklists to ensure a complete application.

Project Information

Project Name: BASTOP GROVE, SECTION 2

Property Address: ______________________ Tax ID: R78736

Legal Description: A98 BLAKEY, NANCY, ACRES 93.013

Land Use Category: ______________________

Existing Zoning District: GENERAL RETAIL (If rezone) Proposed Zoning District: N/A

Name of Overarching Regulation (PD, MUD, DA, etc.): N/A

Total Acreage: 25.882 ACRES Total Lots: 12

Acreage Not Designated as Lots: 1.853 AC ROW Lots Subject to Parkland Fee: 0

Property Owner

Name: MC BASTROP 71, LP

Company: MC BASTROP 71, LP

Address: 2828 ROUTH STREET, SUITE 500

City, State Zip: DALLAS, TX 75201

Phone Number: 214-622-6525 E-mail Address DM@MORANCAP.COM

BASTROPTX
Heart of the Lost Pines / Est. 1832

Planning Application

Applicant

Name: Christine Methvin Role (i.e. developer, agent, etc.): Agent

Company Name: Carlson, Brigance & Doering, Inc.

Address: 5501 W. William Cannon Drive, Austin, TX 78749

Phone Number: 512-280-5160 X175 E-mail Address CHRISTINE@CBDENG.COM

Additional Contact (Optional)

Name: Brendan P. McEntee, P.E. Role (i.e. engineer, architect, etc.): ____________

Company Name: ____________

Address: 5501 W. William Cannon Drive, Austin, TX 78749

Phone Number: (512) 280-5160 X106 E-mail Address bmcentee@cbdeng.com

The applicant certifies that the facts stated herein and exhibits attached hereto are true, correct, and complete. **If this application is filed by anyone other than the property owner, an Agent Authorization form signed by all property owners must accompany this application.** Signature below also authorizes the City of Bastrop and its agents to visit and inspect the property for which this application is being submitted.

CM Methvin Christine M. Methvin
Project Coordinator

Signature and Title ____________ Date ____________

Staff Use Only

☐ Received By: Date:

Fees Paid $

Comments:

Administratively Complete Date:

Paper: Prop. Owner Notification: P&Z: City Council:

Project Name BASTROP GROVE SEC. 2
Project # ____________

Bastrop CAD

Property Search

Property Search Results > 78736 MC BASTROP 71 LP for Year 2019

Property

Account

Property ID:	78736	Legal Description:	ABS A98 Blakey, Nancy,15.3100 ACRES
Geographic ID:	R78736	Agent Code:	A0216794
Type:	Real		
Property Use Code:			
Property Use Description:			

Location

Address:		Mapsco:	
Neighborhood:	BASTROP CITY 006	Map ID:	9-11
Neighborhood CD:	NBHD0206		

Owner

Name:	MC BASTROP 71 LP	Owner ID:	758572
Mailing Address:	8214 WESTCHESTER DR STE 550 DALLAS, TX 75225	% Ownership:	100.0000000000%
		Exemptions:	

Values

(+) Improvement Homesite Value:	+	N/A	
(+) Improvement Non-Homesite Value:	+	N/A	
(+) Land Homesite Value:	+	N/A	
(+) Land Non-Homesite Value:	+	N/A	Ag / Timber Use Value
(+) Agricultural Market Valuation:	+	N/A	N/A
(+) Timber Market Valuation:	+	N/A	N/A

(=) Market Value:	=	N/A	
(–) Ag or Timber Use Value Reduction:	–	N/A	

(=) Appraised Value:	=	N/A	
(–) HS Cap:	–	N/A	

(=) Assessed Value:	=	N/A	

Taxing Jurisdiction

Owner: MC BASTROP 71 LP

% Ownership: 100.0000000000%

Total Value: N/A

Entity	Description	Tax Rate	Appraised Value	Taxable Value	Estimated Tax
C04	CITY OF BASTROP	N/A	N/A	N/A	N/A
CAD	APPRAISAL DISTRICT	N/A	N/A	N/A	N/A
G01	BASTROP COUNTY	N/A	N/A	N/A	N/A
RD1	COUNTY ROAD	N/A	N/A	N/A	N/A
S04	BASTROP ISD	N/A	N/A	N/A	N/A
	Total Tax Rate:	N/A			
				Taxes w/Current Exemptions:	N/A
				Taxes w/o Exemptions:	N/A

Improvement / Building

No improvements exist for this property.

Land

#	Type	Description	Acres	Sqft	Eff Front	Eff Depth	Market Value	Prod. Value
1	IP	IMPROVED PASTURE	15.3100	666903.60	0.00	0.00	N/A	N/A

Roll Value History

Year	Improvements	Land Market	Ag Valuation	Appraised	HS Cap	Assessed
2019	N/A	N/A	N/A	N/A	N/A	N/A
2018	$0	$2,668,310	8,836	8,836	$0	$8,836
2017	$0	$2,668,310	9,115	9,115	$0	$9,115
2016	$0	$2,668,310	9,952	9,952	$0	$9,952
2015	$0	$2,628,296	10,231	10,231	$0	$10,231
2014	$0	$2,628,296	50,599	50,599	$0	$50,599
2013	$0	$3,664,417	50,785	50,785	$0	$50,785
2012	$0	$5,740,000	77,802	77,802	$0	$77,802
2011	$0	$6,156,864	41,961	41,961	$0	$41,961
2010	$0	$6,156,864	41,961	41,961	$0	$41,961
2009	$0	$4,104,576	41,669	41,669	$0	$41,669
2008	$0	$4,104,576	0	0	$0	$0
2007	$0	$4,104,576	40,941	40,941	$0	$40,941

Deed History - (Last 3 Deed Transactions)

#	Deed Date	Type	Description	Grantor	Grantee	Volume	Page	Deed Number
1	10/5/2011	SWD	SPECIAL WARRANTY DEED	BASTROP GROVE PARTNERS LTD	MC BASTROP 71 LP	2097	241	0
2	11/29/2006	SWD	SPECIAL WARRANTY DEED	BRUNDAGE BASTROP LTD	BASTROP GROVE PARTNERS LTD	1698	245	0

3	5/10/2001	CONV	CONVERSION	BECK, MARVIN E & ANNE P	BRUNDAGE BASTROP LTD	1130	014	0

Tax Due

Property Tax Information as of 01/03/2019

Amount Due if Paid on:

Year	Taxing Jurisdiction	Taxable Value	Base Tax	Base Taxes Paid	Base Tax Due	Discount / Penalty & Interest	Attorney Fees	Amount Due

NOTE: Penalty & Interest accrues every month on the unpaid tax and is added to the balance. Attorney fees may also increase your tax liability if not paid by July 1. If you plan to submit payment on a future date, make sure you enter the date and RECALCULATE to obtain the correct total amount due.

Questions Please Call (512) 303-1930

This year is not certified and ALL values will be represented with "N/A".

Website version: 1.2.2.14 Database last updated on: 1/2/2019 8:49 PM

Carlson, Brigance & Doering, Inc.
Civil Engineering ✣ Surveying

5501 West William Cannon Drive
Austin, Texas 78749
(512) 280-5160 Office

Fee Request Form

DATE:	January 3, 2019
ATTENTION:	Douglas MacMahon
REFERENCE:	Bastrop Grove Section 2 ***Preliminary Plat*** ***APPLICATION FEE***
CBD PROJECT NO:	4697

TO: Douglas MacMahon
MC Bastrop 71, LP
2828 Routh Street, Suite 500
Dallas, TX 75201
dm@morancap.com
214-622-6525

SENT BY: Christine Methvin
christine@cbdeng.com
(512) 280-5160 x117 office (512) 484-6591 cell

REASON FOR FEE REQUEST: Preliminary Plat Application Fee

[X] **See excerpt from City of Bastrop Fee Schedule published 10/1/18 & calculations below**

Preliminary Plat	$1,050 + $25 per lot + $25 per acre of right-of-way $1,200 minimum

Application Fee			**$1,050.00**
12 Lots *		$25.00	**$300.00**
1.853 Acres		$25.00	**$46.33**
TOTAL FEES DUE			**$1,396.33**

AMOUNT: **$1,396.33**

Make Check Payable to: City of Bastrop

REMARKS:

[ ] **Contact Christine Methvin for pick up when processed**

[ ] **Please forward via regular mail**

[X] **Please forward payment to Christine Methvin at your earliest convenience**

Owner's Agent Authorization

Property Owner's Information

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Property Address(s): PARCEL #R78736

Owner's Email Address: DM@MORANCAP.COM

Owner's Phone Number: ( ) (214) 622-6525

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Print full name(s) and title(s) of authorized agent(s):

1. ANY EMPLOYEE OF
2. CARLSON, BRIGANCE & DOERING, INC.

x [signature] — x 1-7-19

Signature(s) of Property Owner(s) — Date

Signature(s) of Property Owner(s) — Date

[signature] — 1/3/19

Signature(s) of Agent(s) — Date

Signature(s) of Agent(s) — Date

Owner's Agent Authorization

BASTROPTX
Heart of the Lost Pines / Est. 1832

Property Owner's Information

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Owner's Phone Number: ( ) (214) 622-6525

The individuals listed below are hereby authorized to apply for, sign for, and conduct business for permits, plan, and/or other legal documents with the City of Bastrop Planning and Development Department on behalf of the above identified property owner(s).

The City of Bastrop Planning and Development Department may retain a copy of this form for our records and maintain a file as a courtesy. The form with the most recent date shall supersede all previous authorizations on file and **remain in effect for one (1) year, or until a new form is filed by the property owners, whichever is shorter**.

All signatories understand that it is the property owner's responsibility to provide a copy of this form every time they would like to add or remove authorized agents, and that this form expires one (1) year after it is signed. The property owner's signature designates the agent as the official contact person for projects and the single point of contact. All correspondence and communication will be conducted with the agent.

Print full name(s) and title(s) of authorized agent(s):

1. ANY EMPLOYEE OF
2. CARLSON, BRIGANCE & DOERING, INC.

X	X
Signature(s) of Property Owner(s)	Date
Signature(s) of Property Owner(s)	Date
CM Mettri	1/3/19
Signature(s) of Agent(s)	Date
Signature(s) of Agent(s)	Date

Exception Application

5. Authorization from Property Owner

I, Douglas MacMahon, swear and affirm that I am the owner of property at Parcel #R78736, as shown in the records of Bastrop County, Texas, which is the subject of this application.

I, Douglas MacMahon, the owner of the property subject to this Grandfathered Project Exception Application, authorize to submit the application and serve as my representative for this request.

X ______________________ X ____________

Property owner's signature Date

6. Sworn statement:

I, the undersigned, hereby certify that all information contained herein and the attached documents are true and correct and that it is my belief that the property owner is entitled to the requested rights for this Project and, during the pending time of this determination, I understand my continuing obligation to notify the Development Services Director in writing of the inaccuracy of any statement or representation which was incorrect when made or which becomes incorrect by virtue of changed circumstances.

Christine M. Methvin	CM Methvin	1/3/19
Applicant's Name	Applicant's signature	Date

Sworn to and subscribed before me by Susan O. Martin on this 3rd day of January in the year 2019, to certify which witness my hand and seal of office.

Susan O. Martin

Notary Public, State of Texas

SUSAN O. MARTIN
NOTARY PUBLIC
ID# 13049238-6
State of Texas
Comm. Exp. 01-11-2020

Office of Linda Harmon Tax Assessor-Collector
Bastrop County Tax Office
PO Box 579
Bastrop, TX 78602
(512) 581-7161
(512) 581-7167

2018 Tax Statement

Date	QuickRef ID
1/21/2019	R78736
CAD ID	**Owner ID**
78736	O0103331

Property Description

Legal

A98 BLAKEY, NANCY, ACRES 93.013

Property Location

Property ID: R78736

R78736
MC BASTROP 71 LP
8214 WESTCHESTER DR
STE 550
DALLAS, TX 75225

County Taxes Reduced By Additional Sales Tax 6.96

Property Values	
Land	0
Improvement	0
AG Market	2,668,310
AG Use	8,836
Timber Market	0
Timber Use	0
Cap Adjustment	0
Assessed	8,836
Exemptions	
AG	

Tax Breakdown

Tax Year	Taxing Unit	Tax Rate	Exemptions	Taxable	Tax	Tax Paid	Tax Due
2018	Bastrop County	0.474900	0	8,836	41.96	41.96	0.00
2018	Bastrop Isd	1.441000	0	8,836	127.32	127.32	0.00
2018	City Of Bastrop	0.564000	0	8,836	49.83	49.83	0.00
2018	County Road	0.105000	0	8,836	9.28	9.28	0.00
		TOTAL			228.39	228.39	See TOTAL DUE

TOTAL DUE IF PAID BY January 31, 2019 0.00

Pay by	%	P&I	Total Due
Jan 2019		0.00	0.00
Feb 2019		0.00	0.00
Mar 2019		0.00	0.00
Apr 2019		0.00	0.00
May 2019		0.00	0.00
Jun 2019		0.00	0.00
Jul 2019		0.00	0.00
Aug 2019		0.00	0.00
Sep 2019		0.00	0.00
Oct 2019		0.00	0.00

IF YOU ARE 65 YEARS OF AGE OR OLDER OR ARE DISABLED, AND YOU OCCUPY THE PROPERTY DESCRIBED IN THIS DOCUMENT AS YOUR RESIDENCE HOMESTEAD, YOU SHOULD CONTACT THE APPRAISAL DISTRICT REGARDING ANY ENTITLEMENT YOU MAY HAVE TO A POSTPONEMENT IN THE PAYMENT OF THESE TAXES

------------detach and return bottom portion with payment ------------

Property ID
R78736
Owner ID
O0103331
Property Location

Make check payable to:
Office of Linda Harmon Tax Assessor-Collector
Bastrop County Tax Office
PO Box 579
Bastrop, TX 78602
(512) 581-7161
(512) 581-7167

TOTAL DUE IF PAID BY January 31, 2019 0.00

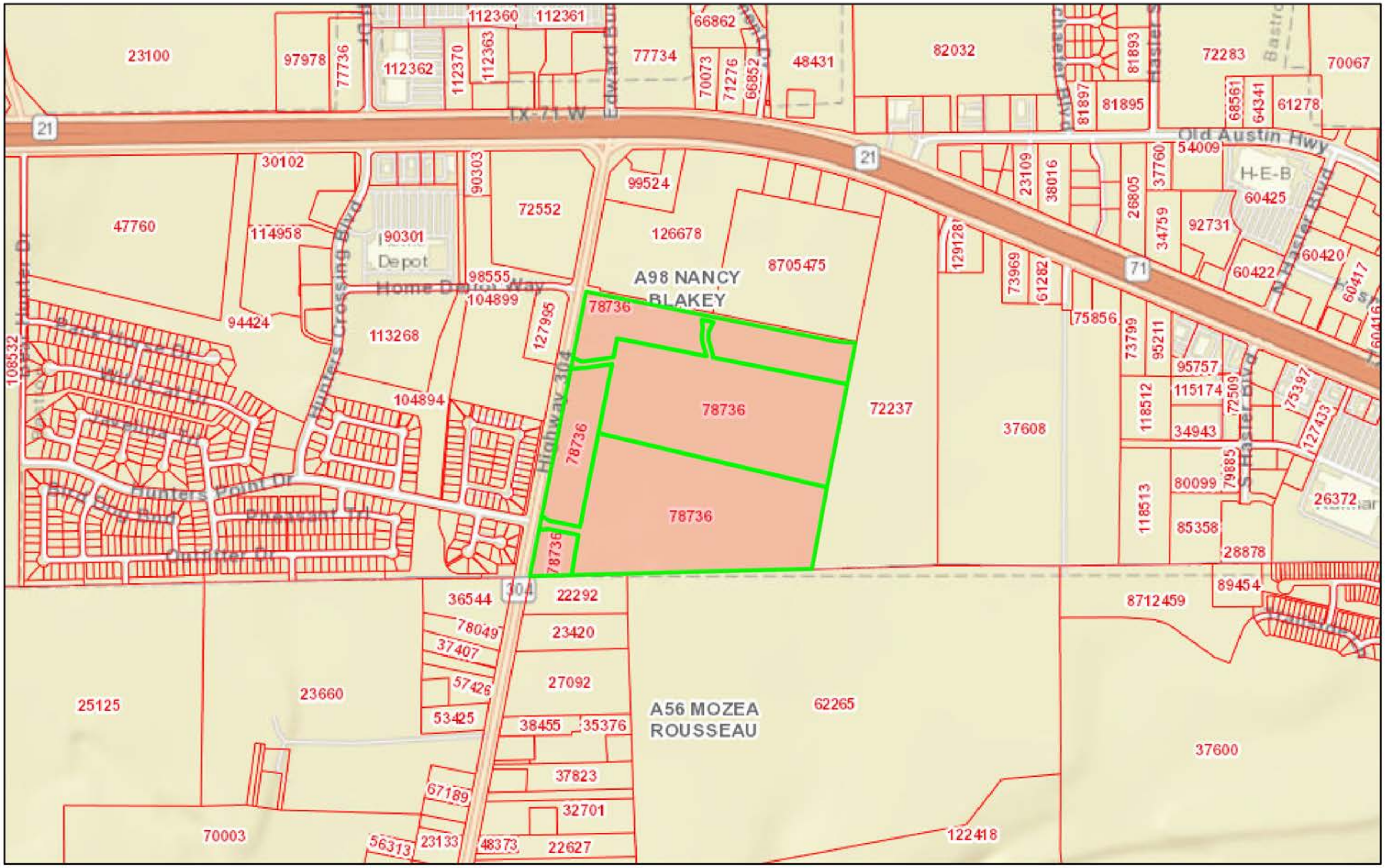
%000000220603C0000059266

R78736
MC BASTROP 71 LP
8214 WESTCHESTER DR
STE 550
DALLAS, TX 75225

20180000R78736000000000000

IF THE PROPERTY DESCRIBED IN THIS DOCUMENT IS YOUR RESIDENCE HOMESTEAD, YOU SHOULD CONTACT THE OFFICE OF LINDA HARMON TAX ASSESSOR-COLLECTOR REGARDING A RIGHT YOU MAY HAVE TO ENTER INTO AN INSTALLMENT AGREEMENT DIRECTLY WITH THE OFFICE OF LINDA HARMON TAX ASSESSOR-COLLECTOR FOR THE PAYMENT OF THESE TAXES.

BASTROP GROVE SECTION 2



January 21, 2019

Parcels

Abstracts

1:12,507

0 0.1 0.2 0.4 mi

0 0.15 0.3 0.6 km

Esri, HERE, Garmin, INCREMENT P, NGA, USGS

Bastrop County Appraisal District & BIS Consulting - www.bisconsultants.com

This product is for informational purposes and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. It does not represent an on-the-ground survey and represents only the approximate relative location of property boundaries.

Preliminary Plat Checklists

BASTROPTX
Heart of the Lost Pines / Est. 1832

Process Overview

1. Pre-Application Meeting
   a. Discuss your project with staff prior to submitting an application. Staff can help identify opportunities and constraints on the proposed project, as well as provide more information on the process and code requirements.
2. Complete Submittal Package, which includes: Application, Supplemental Forms, and Checklist Items
   a. Incomplete submittals will not be accepted
3. Staff review, with comments issued as needed
4. Notification of property owners within 200 feet and in newspaper
5. Planning and Zoning (P&Z) Commission review and recommendation to City Council
6. City Council review and action – one meeting
   a. Approval expires after 180 days; Council may extend up to 180 days in response to written request
7. Signed and sealed mylar, certified tax certificate showing taxes have been paid and remaining fees are submitted to the Planning department.
8. Copies of recorded plat returned to applicant.

Submittal Package Checklist Items

Check items included in the Applicant column before submitting documents with the project application and supplemental forms. If all checklist items are not present, the submittal will not be accepted.

Staff	Applicant	Item
☐	☒	Completed and signed Application
☐	☐	Agent Authorization Letter
☐	☐	Copy of Exception Determination Letter or proof of Exemption
☐	☐	Project Description Letter explaining proposed project, including number of lots existing and proposed, and if those lots are residential or commercial
☐	☐	Tax map highlighting the subject property
☐	☐	Copy of deed showing current ownership
☐	☐	Copy of current tax statement showing taxes have been paid
☐	☐	Preliminary Plat prints, collated and folded: One (1) 11”x17”; Eight (8) 24”x36”
☐	☐ 5	~~Three (3)~~ prints of a drainage study
☐	☐ 5	~~Three (3)~~ prints of the utility schematic/plan
☐	☐	Three (3) copies of letter outlining Planned Development requirements and how those requirements are addressed on the plat. **If not applicable, check this box:** ☒
☐	☒	Digital Submittal – See requirements below. Application will not be accepted if not in the specified format listed in requirements.
☐	☒	Preliminary Plat fee
	☒	Engineering Reports (3 copies)

Project Name____________________
Project #____________________

Preliminary Plat Checklists

Preliminary Plat Details Required

These details shall be provided in accordance with Section 4.10.2 of the adopted Subdivision Ordinance, unless otherwise approved by the Planning and Development Director in coordination with the City Manager. These details may reference other applicable sections of the Code of Ordinances. Please contact the Planning and Development Department with any questions. A plat that does not contain this information is not considered administratively complete. Additional information may be deemed necessary by staff.

Staff	Applicant	Item
☐	☒	Name of the subdivision, which shall not duplicate an existing or pending subdivision
☐	☐	Total acreage and the proposed total number of lots and blocks within the subdivision, total acreage of rights-of-way
☐	☐	Name of the licensed public surveyor and licensed engineer (when required) responsible for preparing the plat
☐	☐	Scale: 1" = 100'
☐	☐	North arrow, north to be at top of sheet if possible, located beside the plat sketch
☐	☐	Legend, depicting all symbols, located beside the plat sketch
☐	☐	Date, revision block, and each revision shall bear a new date
☐	☐	Applicable Plat Notes (see Standard Plat Notes)
☐	☐	Ownership boundaries shall be drawn in very heavy lines and shall include overall dimensions and bearings
☐	☐	Adjacent boundary lines and adjacent right-of-way lines of the proposed subdivision drawn with dashed lines.
☐	☐	A tie to an original corner of the tract of land of which subdivision is a part
☐	☐	Name and location of adjacent subdivisions, streets, easements, pipelines, water courses, etc., and the property lines and name of all adjoining property owners
☐	☐	Existing and proposed topographic and planimetric features within the subdivision, including water courses and ravines, high banks, width of existing and proposed easements and any other physical features pertinent to the subdivision. Contour lines at two (2) foot intervals in terrain with a slope of two (2) percent or less and five (5) foot intervals in terrain with slope greater than two (2) percent.
☐	☐	Existing transportation features within the subdivision including the location and width of right-of-way, streets, alleys and easements
☐	☐	Proposed features including location, right-of-way and pavement width, surfacing and name of streets; approximate width and depth of all lots; location of building lines, alleys and public utility easements; and schematic plans for drainage, sanitary facilities, and utilities
☐	☐	Designation of any sites for special uses including churches, sewage disposal plants, water storage/pumping facilities, wells or plants, business, industry or other special land uses. If proposed use is unknown, designate as unrestricted
☐	☐	Regulatory flood elevations and boundaries of flood prone areas, including floodways
☐	☐	A preliminary plan sheet showing proposed on-site sewage disposal systems, or sanitary sewers with grade, pipe size and location of points of discharge or connection to existing collection lines
☐	☐	A preliminary plan of the drainage system, indicating inlet locations, with grade, pipe size and location of points of discharge

Project Name Bastrop Grove Section 2
Project #

☐	☒	A preliminary plan for proposed fills or other structure elevating techniques, levees, channel modifications, and other methods to overcome flood or erosion related hazards

Staff	Applicant	Item
☐	☒	Location of City limits line, the outer border of the City's extraterritorial jurisdiction and zoning district boundaries, if they traverse the subdivision, form part of the subdivision, or are contiguous to such boundary
☐	☐	Key Map. A key map showing relation of subdivision to well-known streets in all directions to a distance of at least one (1) mile
☐	☐	Master Plan Submission. When the subdivision is a portion of a tract later to be subdivided in its entirety, a general development plan of the entire subdivision, showing a schematic layout of the entire subdivision, in the entire tract, shall be submitted with the preliminary plan of the portion first to be subdivided. Acceptance or approval of the said Master Plan does not release the subdivider from submitting a preliminary plat for each section to be developed to compare against Master Plan. The Master Plan may be required by the City to show and provide continuous public utility easements for the construction of future utilities through the subdivision for service to adjoining property. Such easements shall have sufficient setback requirements to accommodate construction of future utility
☐	☐	A Blanket Temporary Access and Construction Easement for the construction of Electric Facilities will be required ***before*** final platting. (Contact Bastrop Power & Light for Easement documents.)

Digital Submittal

Digital submittals shall be provided on a **labeled** CD/DVD or flash drive in the format specified below in addition to the hard copy submittal. The CD/DVD or flash drive will not be returned to the applicant.

PDF 1 – Main Application Materials

- Title should be Application-Project Name
- Combine Application, Agent Authorization Form, Waiver Letter, and Project Description Letter into one document

PDF 2 – Plat & Utilities

- Title should be Plat Details-Project Name
- Combine plat(s), drainage study, and utility schematics into one document

PDF 3 – Remaining Checklist Items

- Title should be Checklist Items-Project Name
- Combine tax map, deed(s), tax certificate, and Planned Development information (if applicable) into one document

GIS or AutoCAD files

- Files that show new parcel layout and easements
- GIS geodatabase file or shape file; AutoCAD dwg file
    - o Spatially referenced using NAD_1983_StatePlane_Texas_Central_FIPS_4203_Feet
- Titles should be Parcels_ProjectName and Easements_ProjectName

Signature Blocks

These signature blocks shall be used as appropriate.

City Council Approval Format:

Approved this day ____________ of ____________, 2018 A.D. by the City Council of the City of Bastrop, Texas.

Approved: Attest:

___________________________ ___________________________

Mayor, Connie Schroeder City Secretary

The certificate of the licensed public surveyor:

THE STATE OF TEXAS §
COUNTY OF BASTROP §

KNOW ALL MEN BY THESE PRESENTS

That I, ____________ do hereby certify that I prepare this plat from an actual and accurate on-the-ground survey of the land and that the corner monuments shown thereon were properly placed under my personal supervision, in accordance with the subdivision regulations of the City of Bastrop, Texas.

____

Signature and Seal of Registered Public Surveyor with date

Owner's Signature Block:

THE STATE OF TEXAS §
COUNTY OF BASTROP §

KNOW ALL MEN BY THESE PRESENTS

That we, ___, being the owners of ___ acre out of (legal description), according to the map or plat recorded in plat cabinet __, Page __, plat records of Bastrop County, Texas and as conveyed to us by deeds recorded in Instrument no. ___ of the official public records of said county do hereby subdivide said land with the plat shown hereon, to be known as:

(Subdivision Name)

Subject to easements and restrictions heretofore granted and not released and do hereby dedicate any streets and/or easements shown hereon to the public.

Witness my hand this the __ day of ___, 2018, A.D.

____

Property owner name
Property owner address

County Clerk Signature Block:

THE STATE OF TEXAS §

COUNTY OF BASTROP §

I, Rose Pietsch, County Clerk of Bastrop County, Texas, do hereby certify that the foregoing instrument of writing and its certificate of authentication was filed for record in my office on the ___ day of ____, 2018, A.D. at ___ o'clock __M., in the plat records of Bastrop County, Texas in plat cabinet ___, page ___.

Filed for record on the ___ day of ___, 2018, A.D.

___________________________	___________________________
Deputy	Rose Pietsch County Clerk Bastrop County, Texas

Signed and sealed certification of the licensed engineer who prepared the plat:

THE STATE OF TEXAS §
COUNTY OF BASTROP §

KNOW ALL MEN BY THESE PRESENTS:

That I, _______ ,do hereby certify that the information contained on this plat complies with the subdivision regulations for the City of Bastrop, Texas and that the 100 year flood plain is as shown and will be contained within the drainage easement and or drainage right-of-way, as shown hereon.

____
Signature and Seal of Registered Engineer with date

ELECTRONICALLY RECORDED
OFFICIAL PUBLIC RECORDS
Rose Pietsch
10/6/2011 11:21 AM
FEE: $68.00 BOOK: 2097 PAGE: 241
ROSE PIETSCH, County Clerk
Bastrop, Texas
DEED 201111002

NOTICE OF CONFIDENTIALITY: IF YOU ARE A NATURAL PERSON, YOU MAY REMOVE OR STRIKE ANY OR ALL OF THE FOLLOWING INFORMATION FROM THIS INSTRUMENT BEFORE IT IS FILED FOR RECORD IN THE PUBLIC RECORDS: YOUR SOCIAL SECURITY NUMBER OR YOUR DRIVER'S LICENSE NUMBER.

SPECIAL WARRANTY DEED

Date: October 6, 2011

Grantor: BRUNDAGE GROVE PARTNERS, LTD.,
a Texas limited partnership

Grantor's Mailing Address:

254 Spencer Lane
San Antonio, Texas 78201

Grantee: MC BASTROP 71, LP
a Texas limited partnership

Grantee's Mailing Address:

2828 Routh Street, Suite 500
Dallas, Texas 75201

Consideration:

The sum of Ten and No/100 Dollars ($10.00) and other good and valuable consideration paid from Grantee to Grantor, the receipt and sufficiency of which are hereby acknowledged.

Property (including any improvements):

Being all of that certain tract of land containing 145.697 acres, more or less, situated in the Nancy Blakey Survey No. A-98, Bastrop, County, Texas, said tract being more particularly described in Exhibit "A" attached hereto and made a part hereof (the "*Land*"), together with (i) all, fixtures, structures and improvements thereon including any wells and trees located on the Land; (ii) all right, title and interest, if any, of Grantor in and to any land lying in the bed of any street, road or access way, opened or proposed, in front of, at a side of or adjoining the Land, to the centerline of such street, road or access way, and to all strips and gores; (iii) all rights in and to roads, rights-of-way and ingress and egress easements benefiting the Land, if any, whether surface, subsurface or otherwise; (iv) all rights in and to other easements, including, without limitation, that one certain drainage easement estate described in Drainage Easement Agreement dated August 13, 2008, recorded in Volume 1819, Page 840 of the Official Records of Bastrop County, Texas, by and between Jo Ann Griesenbeck Cantrell and William Cantrel, Grantors and Bastrop Grove Partners, Ltd., Grantee, said easement being more particularly described in Exhibit "B" attached hereto and made a part hereof (the "*Cantrell Easement*"); (v) all governmental or quasi-governmental permits and approvals of any kind or character pertaining to the Land, if any, including, without limitation, any permits to withdraw water from wells on the Land; (vi) all permits, contracts and rights of any kind or character to receive utilities services for the Land, if any; (vii) any water rights belonging or pertaining to the Land owned by Grantor; (viii) any minerals in, on or under the Land or interests therein owned by Grantor including any executive rights owned by Grantor; (ix) all other rights, privileges and appurtenances belonging or in any way pertaining to the Land (the Land together with the aforesaid improvements, rights and appurtenances being hereinafter referred to as the "*Property*").

Reservations from and Exceptions to Conveyance and Warranty:

This conveyance and the warranties of title herein are expressly made subject to the exceptions, easements, restrictive covenants, conditions and encumbrances set forth in Exhibit "C" which is attached hereto and incorporated herein by reference for all purposes.

Ad valorem taxes have been paid through the year 2010, and ad valorem taxes for the year 2011 have been prorated and Grantee, by acceptance of this Special Warranty Deed, assumes the obligation to pay such taxes and all taxes and assessments imposed subsequent to this conveyance, including any rollback taxes incurred as a result of a change in use of the Property upon or subsequent to this conveyance.

Conveyance:

Grantor, for the consideration and subject to the above reservations from and exceptions to conveyance and warranty, grants, bargains, sells and conveys to Grantee the Property, together with all and singular the rights and appurtenances thereto in any wise belonging, to have and to hold it to Grantee, Grantee's successors and assigns forever. Grantor binds Grantor and Grantor's successors to warrant and forever defend all and singular the Property to Grantee and Grantee's successors and assigns against every person whomsoever lawfully claiming or to claim the same or any part thereof when the claim is by, through, or under Grantor but not otherwise, except as to the Reservations from and Exceptions to Conveyance and Warranty.

[SIGNATURE APPEARS ON FOLLOWING PAGE.]

EXECUTED to be EFFECTIVE as of the date first indicated above.

GRANTOR:

BASTROP GROVE PARTNERS, LTD.,
a Texas limited partnership

By: Bastrop Management Company, L.L.C.
a Texas limited liability company,
its General Partner

By: Thomas O. Brundage
Thomas O. Brundage, Manager

ACKNOWLEDGMENT

STATE OF TEXAS §
§
COUNTY OF BEXAR §

This instrument was acknowledged before me on the 5 day of October 2011, by Thomas O. Brundage, Manager of Bastrop Management Company, L.L.C., a Texas limited liability company, the General Partner of Bastrop Grove Partners, Ltd., a Texas limited partnership, on behalf of said limited partnership.

ALMA J. LARGE
Notary Public State of Texas
My Commission Expires
December 21, 2012

Alma J Large
Notary Public, State of Texas
Alma J Large
(Name - Typed or Printed)
December 21, 2012
(My Commission Expires)

AFTER RECORDING RETURN TO:
Wright, Ginsberg Brusilow
Attention: Michael H. Saks, Esq.
14755 Preston Road, Suite 600
Dallas, Texas 75254

M:\5000\5200\5202\5202.077\Special Warranty Deed\Special Warranty Deed.004.DOC

EXHIBIT "A"

STATE OF TEXAS
COUNTY OF BASTROP

145.691 ACRES
NANCY BLAKEY SURVEY,
A-98

DESCRIPTION

DESCRIPTION OF A 145.691 ACRE TRACT OF LAND OUT OF THE NANCY BLAKEY SURVEY, A-98, BASTROP COUNTY, TEXAS, AND BEING ALL OF THAT CERTAIN TRACT OF LAND CALLED TO BE 145.697 ACRES, DESCRIBED IN A DEED TO BASTROP GROVE PARTNERS, LTD., OF RECORD IN VOLUME 1698, PAGE 245, OF THE OFFICIAL PUBLIC RECORDS OF BASTROP COUNTY, TEXAS, SAID 145.691 ACRES BEING MORE PARTICULARLY DESCRIBED BY METES AND BOUNDS AS FOLLOWS:

BEGINNING at a nail found in concrete in the east line of F.M. Highway 304, at the northwest corner of a tract of land called to be 5.0 acres, described in a deed to Codie Smith Wyatt, of record in Volume 165, Page 772, of the Deed Records of Bastrop County, Texas, said nail being the southwest corner of said 145.697 acre tract, and the southwest corner of the herein described tract;

THENCE, N 09° 40' 25" E, with the east right-of-way line of said F. M. 304, at 446.94 feet passing a 5/8 inch iron rod with cap set October 1, 2010, at 2184.81 feet, passing a 5/8 inch iron rod with cap set October 1, 2010, at 2281.29 feet, passing a ½ inch iron rod found, and continuing for a total distance of 2901.81 to a ½ inch iron rod found at the southwest corner of Lot 1A, Block A, *Resubdivision of Lot 1, Block A, Center of Woodland Village Bastrop*, a subdivision of record in Cabinet 4, Page 160-A, of the Plat Records of Bastrop County, Texas, said iron rod being the most westerly northwest corner of said 145.697 acre tract and the most westerly northwest corner of the herein described tract;

THENCE, S 80° 19' 00" E, with a northerly line of said 145.697 acre tract, and the southerly line of said Lot 1A, 525.56 feet to a ½ inch iron rod found at the southeast corner of said Lot 1A, for an ell corner of said 145.697 acre tract, and an ell corner of the herein described tract;

THENCE, N 09° 41' 29" E, with a westerly line of said 145.697 acre tract, and the easterly line of said Lot 1A, 492.23 feet to an iron rod with cap marked "property corner" found in the southerly right-of-way line of State Highway 71, at the northeast corner of said Lot 1A, said iron rod being the most northerly northwest corner of said 145.697 acre tract, and the most northerly northwest corner of the herein described tract;

THENCE, with the southerly right-of-way line of said State Highway 71, the following two (2) courses:

1) N 87° 45' 43" E, 2.05 feet to a calculated point in a large hole (a concrete TXDOT monument with brass cap found disturbed);
2) A curve to the right having a radius of 5058.89 feet, an arc distance of 1554.38 feet, a central angle of 17° 36' 16", and a chord which bears S 79° 29' 26" E, 1548.27 feet to an iron rod with cap marked "property corner" found at the northwest corner of a tract of land called to be 43.112 acres, described in a deed to John Alan Nixon, of record in Volume 1908, Page 825, of the Official Public Records of Bastrop County, Texas, said iron rod being the northeast corner of said 145.697 acre tract, and the northeast corner of the herein described tract;

THENCE, S 09° 40' 03" W, with the east line of said 145.697 acre tract, and the west line of said 43.112 acre tract, at 1090.61 feet, passing a ½ inch iron rod found, at 1168.33 feet, passing a 5/8 inch iron rod with cap set October 1, 2010, at 2821.99 feet, passing a 5/8 inch iron rod with cap set October 1, 2010, and continuing for a total distance of 2903.99 feet to a ½ inch iron rod found in the north line of a tract of land called to be 194.916 acres, described in a deed to Jo Ann Cantrell, of record in Volume 445, Page 684, of the Deed Records of Bastrop County, Texas, at the southwest corner of said 43.112 acre tract, said iron rod being the southeast corner of said 145.697 acre, and the southeast corner of the herein described tract;

THENCE, S 86° 58' 32" W, with the south line of said 145.697 acre tract, at 1406.79 feet, passing a mag nail found 0.89 feet left near the northwest corner of said 194.916 acre tract, and the northeast corner of said 5.0 acre Wyatt tract, and continuing for a total distance of 2128.20 feet to the POINT OF BEGINNING containing 145.961 acres of land within these metes and bounds.

Description accompanied by plat.

Surveyed by: *Staudt Surveying, Inc.*
P.O. Box 1273
Dripping Springs, Texas 78620
512-858-2236

STATE OF TEXAS
REGISTERED PROFESSIONAL LAND SURVEYOR
THOMAS E. STAUDT
3984

6/22/11

Thomas E. Staudt — Registered Professional Land Surveyor No. 3984 — Date

EXHIBIT "B"

DESCRIPTION

DESCRIPTION OF 11.563 ACRES OF LAND SITUATED IN THE MAZEA ROUSSEAU SURVEY NO. 56, IN BASTROP COUNTY, TEXAS, BEING A PORTION OF THAT CERTAIN TRACT OF LAND SAID TO CONTAION 194.92 ACRES OF LAND, DESCRIBED IN DEED TO JO ANN GRIESENBECK CANTRELL OF RECORD IN VOLUME 445, PAGE 684 OF THE OFFICIAL RECORDS OF BASTROP COUNTY, TEXAS; SAID 11.563 ACRES OF LAND BEING MORE PARTICULARLY DESCRIBED BY METES AND BOUNDS AS FOLLOWS:

COMMENCING at a 1/2 inch iron rod with cap found in the north line of said Cantrell tract, for the southeast corner of that certain tract of land said to contain 145.697 acres of land described in deed to Bastrop Grove Partners, Ltd., of record in Volume 1698, Page 245 of the Official Records of Bastrop County, Texas, and the southwest corner of that certain tract of land said to contain 43.112 acres of land described in deed to CHP Properties, Ltd., of record in Volume 1413, Page 857 of the Official Records of Bastrop County, Texas, from which a 1/2 inch iron rod with cap (Property Corner) found for the southeast corner of said CHP Properties, Ltd., tract, bears N86°58'42"E a distance of 953.42 feet;

THENCE with the north line of said Cantrell tract and the south line of said Bastrop Grove Partners, Ltd., tract, S86°58'42"W a distance of 48.19 feet to a point for the northeast corner and POINT OF BEGINNING of the herein described tract;

THENCE over and across said Cantrell tract, the following, twenty-two (22) courses and distances:

1. S11°42'54"W a distance of 77.13 feet to a point;
2. S03°16'34"E a distance of 853.40 feet to a point;
3. S04°42'31"E a distance of 222.80 feet to a point at the beginning of a curve to the right;
4. With said curve to the right an arc distance of 261.06 feet, having a radius of 800.00 feet, a central angle of 18°41'51", and a chord which bears S04°38'23"W a distance of 259.91 feet to a point;
5. S13°59'18"W a distance of 189.30 feet to a point at the beginning of a curve to the

left;

6. With said curve to the left an arc distance of 363.58 feet, having a radius of 1350.00 feet, a central angle of 15°25'51", and a chord which bears S06°16'23"W a distance of 362.48 feet to a point;
7. S01°26'33"E a distance of 197.06 feet to a point;
8. S00°37'50"W a distance of 100.41 feet to a point;
9. S40°08'24"E a distance of 27.70 feet to a point;
10. S11°59'14"W a distance of 112.49 feet to a point;
11. S29°36'57"W a distance of 147.88 feet to a point;
12. S03°28'22"W a distance of 106.26 feet to a point;
13. S18°37'19"W a distance of 67.03 feet to a point;
14. S00°30'59"W a distance of 70.47 feet to a point;
15. S32°30'41"E a distance of 106.60 feet to a point;
16. S05°47'43"W a distance of 61.84 feet to a point;
17. S79°48'16"W a distance of 28.72 feet to a point;
18. S41°49'29"W a distance of 62.67 feet to a point;
19. S33°08'04"W a distance of 62.47 feet to a point;
20. S15°58'58"E a distance of 18.81 feet to a point;
21. N53°57'26"E a distance of 30.57 feet to a point;
22. S39°34'27"E a distance of 76.96 feet to a point on the north bank of the Colorado River, for the easternmost southeast corner of the herein described tract;

THENCE with the meanders of the north bank of said Colorado River, the following three (3) courses and distances:

1. S50°25'33"W a distance of 114.99 feet to a point;
2. S47°42'18"W a distance of 64.37 feet to a point;
3. S50°50'58"W a distance of 46.53 feet to a point for the southeast corner of that certain tract of land said to contain 3.994 acres of land described in deed to Jack A. Griesenbeck of record in Volume 184, Page 231 of the Official Records of Bastrop County, Texas, and for the south corner of the herein described tract;

THENCE with the east line of said 3.994 acre tract, N32°38'15"W a distance of 314.02 feet to a point, from which a 1/2 inch iron rod found for an interior ell corner of said 3.994 acre tract and an exterior ell corner of that certain tract of land said to contain 10.090 acres of land described in deed to Jack A. Griesenbeck of record in Volume 184, Page 231 of the Official Records of Bastrop County, Texas, bears N32°38'15"W a distance of 28.13 feet to a calculated point for the northeast corner of said 3.994 acre tract, S85°09'07"W a distance of 205.83 feet to a calculated point for the northernmost northwest corner of said 3.994 acre tract and the northeast corner of said 10.090 acre tract, and S17°30'59"W a distance of 166.37 feet;

THENCE over and across said Cantrell tract, the following, twenty-four (24) courses and distances:

1. N58°46'12"E a distance of 39.85 feet to a point;
2. N63°48'18"E a distance of 64.50 feet to a point;
3. N14°02'29"W a distance of 9.70 feet to a point;
4. N73°33'52"W a distance of 34.96 feet to a point;
5. N26°00'20"W a distance of 129.24 feet to a point;
6. N56°14'37"W a distance of 67.28 feet to a point;
7. N15°37'06"E a distance of 19.22 feet to a point;
8. N68°07'33"E a distance of 87.95 feet to a point;
9. N28°58'56"E a distance of 152.26 feet to a point;
10. N06°19'30"E a distance of 107.74 feet to a point;
11. N19°18'13"E a distance of 42.37 feet to a point;
12. N02°58'19"W a distance of 46.42 feet to a point;
13. N67°25'44"E a distance of 102.32 feet to a point;
14. N43°57'41"E a distance of 133.93 feet to a point;
15. N19°43'55"W a distance of 85.62 feet to a point;
16. N17°20'35"E a distance of 64.34 feet to a point;
17. N00°45'36"W a distance of 150.96 feet to a point;
18. N02°02'28"E a distance of 103.11 feet to a point;
19. N05°05'47"E a distance of 150.36 feet to a point;
20. N12°57'30"E a distance of 202.21 feet to a point at the beginning of a curve to the left;
21. With said curve to the left an arc distance of 350.12 feet, having a radius of 1500.00 feet, a central angle of 13°22'25", and a chord which bears N06°16'17"E a distance of 349.33 feet to a point;
22. N00°24'56"W a distance of 187.14 feet to a point;
23. N03°16'34"W a distance of 853.40 feet to a point;
24. N14°32'22"W a distance of 76.60 feet to a point in the north line of said Cantrell tract and the south line of said Bastrop Grove Partners, Ltd., tract, for the northwest corner of the herein described tract, from which a PK nail found in concrete in the

east right-of-way line of F.M. No. 304 (R.O.W. varies) for the southwest corner of said Bastrop Grove Partners, Ltd., tract, and the northwest corner of that certain tract of land said to contain 5.00 acres of land described in deed to Clodie S. Wyatt of record in Volume 165, Page 772 of the Official Records of Bastrop County, Texas, bears S86°58'42"W a distance of 1940.04 feet;

THENCE with the north line of said Cantrell tract and the south line of said Bastrop Grove Partners, Ltd, tract, N86°58'42"E a distance of 139.91 feet to the POINT OF BEGINNING, containing 11.563 acres of land more or less within these metes and bounds.

Reference is herein made to the sketch accompanying this metes and bounds description.

Bearing basis: Grid North, Texas State Plane Coordinate System NAD83 (CORS) Central Zone.

I hereby certify that this description was prepared from a survey made on the ground under my supervision.

CUNNINGHAM-ALLEN, INC.

David A. McDow

David A. McDow
Registered Professional Land Surveyor No. 5908
State of Texas
Date: 05/18/07

STATE OF TEXAS
REGISTERED
DAVID A. MCDOW
5908
PROFESSIONAL
LAND SURVEYOR

SKETCH TO ACCOMPANY DESCRIPTION

DRAINAGE EASEMENT
SHEET 1 OF 3

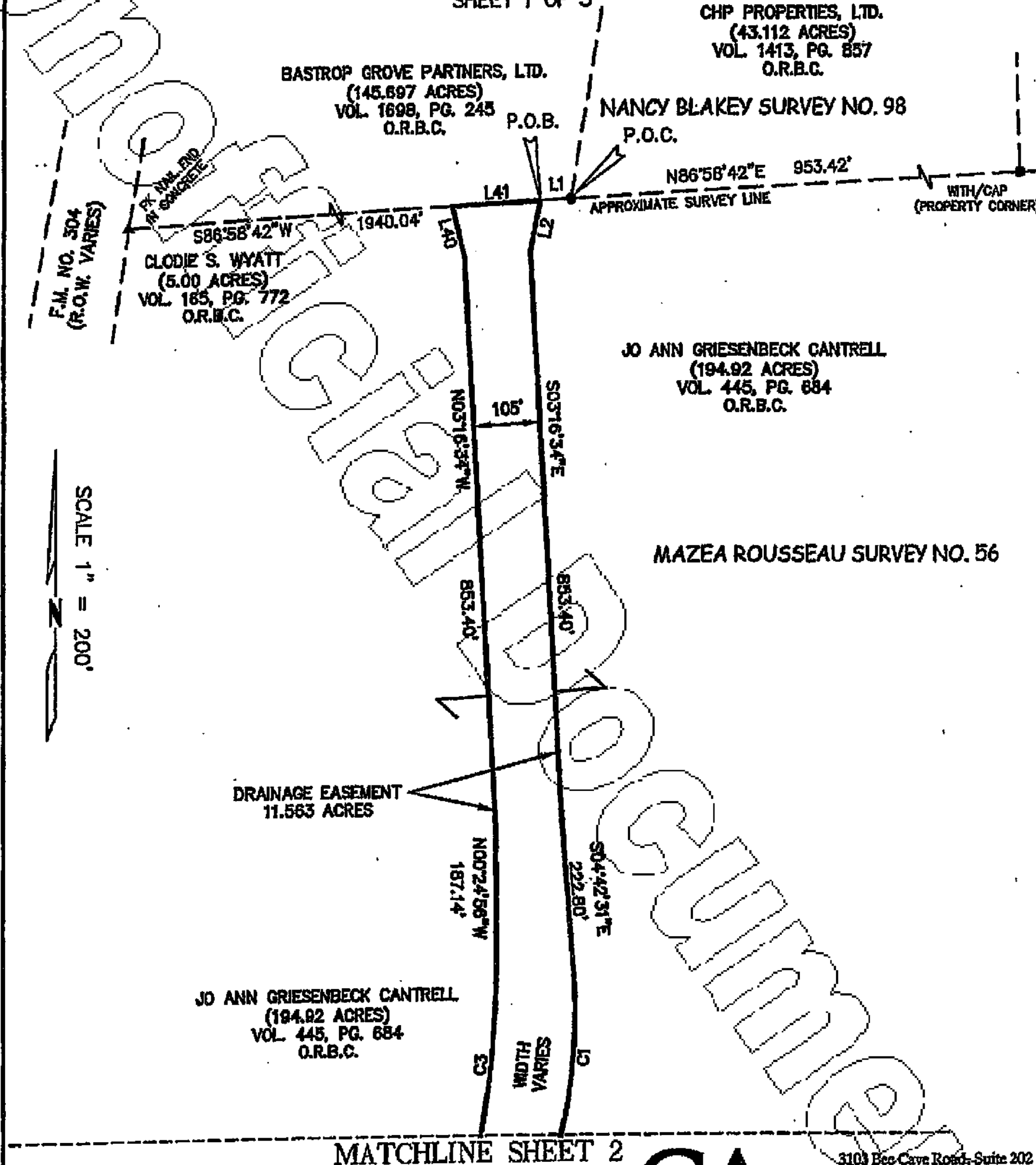
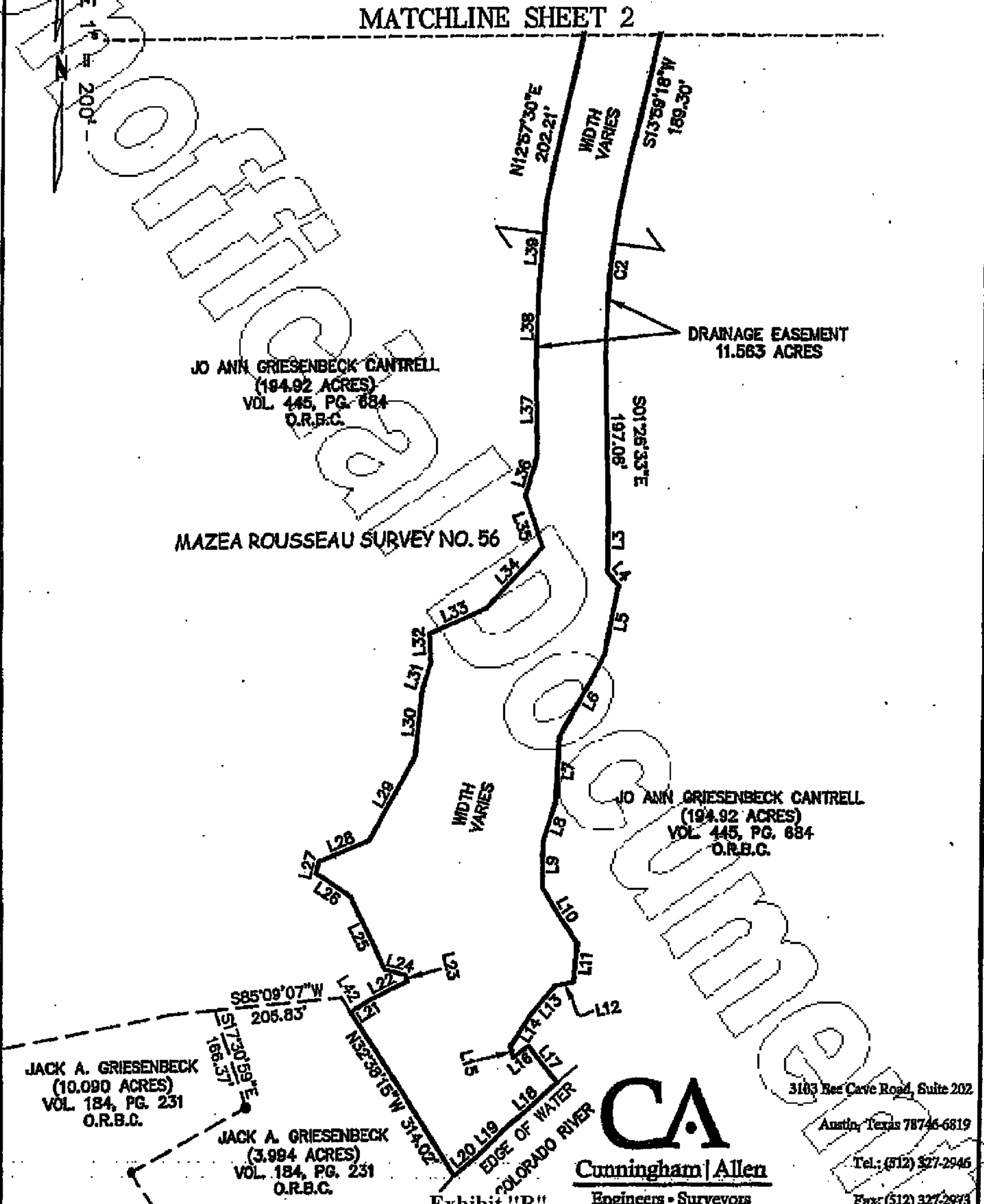


Exhibit "B"
Page 5 of 7

Cunningham | Allen
Engineers • Surveyors
3103 Bee Cave Road, Suite 202
Austin, Texas 78746-6819
Tel.: (512) 327-2946
Fax: (512) 327-2973

SKETCH TO ACCOMPANY DESCRIPTION

DRAINAGE EASEMENT
SHEET 2 OF 3



SKETCH TO ACCOMPANY DESCRIPTION

DRAINAGE EASEMENT
SHEET 3 OF 3

LINE TABLE		
LINE	BEARING	DISTANCE
L1	S86°58'42"W	48.19'
L2	S11°42'54"W	77.13'
L3	S00°37'50"W	100.41'
L4	S40°08'24"E	27.70'
L5	S11°59'14"W	112.49'
L6	S29°36'57"W	147.88'
L7	S03°28'22"W	106.28'
L8	S18°37'19"W	67.03'
L9	S00°36'59"W	70.47'
L10	S32°30'41"E	106.60'
L11	S05°47'43"W	61.84'
L12	S79°48'16"W	28.72'
L13	S41°49'29"W	62.67'
L14	S33°08'04"W	62.47'
L15	S15°58'58"E	18.81'
L16	N53°57'26"E	30.57'
L17	S39°34'27"E	76.96'
L18	S50°25'33"W	114.99'
L19	S47°42'18"W	64.37'
L20	S50°50'58"W	46.53'
L21	N58°46'12"E	39.85'
L22	N63°48'18"E	64.50'
L23	N14°02'29"W	9.70'
L24	N73°33'52"W	34.96'
L25	N26°00'20"W	129.24'
L26	N56°14'37"W	67.28'
L27	N15°37'06"E	19.22'
L28	N68°07'33"E	87.95'
L29	N28°58'56"E	152.26'
L30	N06°19'30"E	107.74'
L31	N19°18'13"E	42.37'
L32	N02°58'19"W	46.42'
L33	N87°25'44"E	102.32'
L34	N43°57'41"E	133.93'
L35	N19°43'55"W	85.62'
L36	N17°20'35"E	64.34'
L37	N00°45'36"W	150.96'
L38	N02°02'28"E	103.11'
L39	N05°05'47"E	150.36'
L40	N14°32'22"W	76.60'
L41	N86°58'42"E	139.91'
L42	N32°38'15"W	28.13'

BEARING BASIS: GRID NORTH, TEXAS STATE PLANE COORDINATE SYSTEM NAD83 (CORS) CENTRAL ZONE.

REFERENCE IS HEREIN MADE TO THE METES AND BOUND DESCRIPTION TO ACCOMPANY THIS SKETCH.

CURVE TABLE					
CURVE	RADIUS	LENGTH	DELTA	CHORD BRG.	CHORD
C1	800.00'	261.08'	18°41'51"	S04°38'23"W	259.91
C2	1350.00'	363.58'	15°25'51"	S06°16'23"W	362.48
C3	1500.00'	350.12'	13°22'25"	N06°16'17"E	349.33

LEGEND

●	½" IRON ROD FOUND (UNLESS STATED)
▲	PK NAIL FOUND IN CONCRETE
O.R.B.C.	OFFICIAL RECORDS OF BASTROP COUNTY
P.O.B.	POINT OF BEGINNING
P.O.C.	POINT OF COMMENCEMENT

SURVEYED BY:

David A. McDow

DAVID A. MCDOW
REG. PROF. LAND SURVEYOR
NO. 5908
DATE: 05/18/07

STATE OF TEXAS
REGISTERED
DAVID A. MCDOW
5908
PROFESSIONAL
LAND SURVEYOR

Exhibit "B"

CA
Cunningham | Allen
Engineers • Surveyors
3103 Bee Cave Road, Suite 202
Austin, Texas 78746-6819
Tel.: (512) 327-2946
Fax: (512) 327-2973

EXHIBIT "C"
Exceptions, Easements, Restrictive Covenants, Conditions and Encumbrances

Applicable to the Land Described in Exhibit "A":

1. Electric transmission line easement granted to the Lower Colorado River Authority by instrument dated September 19, 1941, recorded in Volume C, Page 417 of the Minutes of County Court of Bastrop County, Texas;

2. Electric transmission and/or distribution lines and systems easement granted to Lower Colorado River Authority by instrument dated September 13, 1961, recorded in Volume 155, Page 209 of the Deed Records of Bastrop County, Texas.

3. Wastewater easement granted to the City of Bastrop by instrument dated July 17, 1993, recorded in Volume 684, Page 718 of the Official Records of Bastrop County, Texas. The aforesaid Water and Wastewater Easement is recorded at Volume 684, Pages 744-750 of the Official Public Records of Bastrop County, Texas as Exhibit "D" of that one certain Agreement between the City of Bastrop and Hal Berdoll and Lisa Berdoll recorded at Volume 684, Pages 737-752 of the Official Records of Bastrop County, Texas, as Exhibit "F" of that one certain Petition Requesting Annexation recorded at Volume 684, Pages 718-752 of the Official Records of Bastrop County, Texas;

4. An undivided 1/16th non-participating royalty interest in all oil, gas and other minerals reserved by The Federal Land Bank of Houston in instrument recorded in Volume 102, Page 162 of the Deed Records of Bastrop County, Texas;

5. One-half (1/2) interest (without executive rights) in all water, oil, gas, sand, gravel, coal, lignite and any other minerals reserved by Hal Berdoll and wife, Lisa Berdoll, in instrument recorded in Volume 842, Page 103 of the Official Records of Bastrop County, Texas;

6. Release and Relinquishment of Access Rights to Highway Facility dated January 13, 2005, executed by Brundage Bastrop, Ltd. to State of Texas, recorded in Volume 1544, Page 774 of the Official Records of Bastrop County, Texas;

7. Electric distribution line or system telecommunications systems and equipment or other services and systems easement granted to Bluebonnet Electric Cooperative, Inc., recorded in Volume 1790, Page 606 of the Official Records of Bastrop County, Texas;

8. Terms, Conditions and Stipulations of the Drainage Easement Agreement dated March 13, 2008 by and between Jo Ann Griesenbeck Cantrell and William Cantrell as Grantors, and

Bastrop Grove Partners, Ltd., as Grantee, recorded in Volume 1819, Page 840 of the Official Records of Bastrop County, Texas;

9. Terms, Conditions and Stipulations of the Temporary Construction Easement and Permanent Public Utility Easement dated December 8, 2009, by and between Tom Brundage, Bastrop Grove Partners, Ltd., as Grantors, and the City of Bastrop as Grantee, recorded in Volume 1961, Page 649 of the Official Records of Bastrop County, Texas;

10. 16 foot electric distribution line or system telecommunications systems and equipment or other services and systems easement granted to Bluebonnet Electric Cooperative, Inc., recorded in Volume 1790, Page 612 of the Official Records of Bastrop County, Texas;

Applicable to the Cantrell Easement Tract Described in Exhibit "B":

11. Terms, Conditions and Stipulations of the Drainage Easement Agreement dated March 13, 2008 by and between Jo Ann Griesenbeck Cantrell and William Cantrell as Grantors, and Bastrop Grove Partners, Ltd., as Grantee, recorded in Volume 1819, Page 840 of the Official Records of Bastrop County, Texas;

12. Underground electric facilities and overhead electric facilities easement traversing north property line(s), by and between Jo Ann Cantrell as Grantor, and Bluebonnet Electric Cooperative, Inc., as Grantee, recorded in Volume 1790, Page 632 of the Official Records of Bastrop County, Texas;

13. All interest in oil, gas and other minerals reserved by J.P. Fitzwilliams in instrument recorded in Volume 121, Page 433 of the Deed Records of Bastrop County, Texas.

11-GF# 20110/334 BKH
RETURN TO: HERITAGE TITLE
401 CONGRESS, SUITE 1500
AUSTIN, TEXAS 78701

EXHIBIT "C"
PAGE 2 OF 2

BASTROPTX
Heart of the Lost Pines / Est. 1832

Owner's Agent Authorization

Property Owner's Information

Owner's Name(s): MC BASTROP 71, LP

Property Address(s): PARCEL #R78736

Owner's Email Address: DM@MORANCAP.COM

Owner's Phone Number: ( ) (214) 622-6525

The individuals listed below are hereby authorized to apply for, sign for, and conduct business for permits, plan, and/or other legal documents with the City of Bastrop Planning and Development Department on behalf of the above identified property owner(s).

The City of Bastrop Planning and Development Department may retain a copy of this form for our records and maintain a file as a courtesy. The form with the most recent date shall supersede all previous authorizations on file and **remain in effect for one (1) year, or until a new form is filed by the property owners, whichever is shorter**.

All signatories understand that it is the property owner's responsibility to provide a copy of this form every time they would like to add or remove authorized agents, and that this form expires one (1) year after it is signed. The property owner's signature designates the agent as the official contact person for projects and the single point of contact. All correspondence and communication will be conducted with the agent.

Print full name(s) and title(s) of authorized agent(s):

1. ANY EMPLOYEE OF
2. CARLSON, BRIGANCE & DOERING, INC.

x [signature] — x 1-7-19

Signature(s) of Property Owner(s) — Date

Signature(s) of Property Owner(s) — Date

[signature] — 1/3/19

Signature(s) of Agent(s) — Date

Signature(s) of Agent(s) — Date

BASTROPTX
Heart of the Lost Pines / Est. 1832

Exception Application

5. Authorization from Property Owner

I, Douglas MacMahon, swear and affirm that I am the owner of property at Parcel #R78736, as shown in the records of Bastrop County, Texas, which is the subject of this application.

I, Douglas MacMahon, the owner of the property subject to this Grandfathered Project Exception Application, authorize to submit the application and serve as my representative for this request.

X [signature] X 1-7-19

Property owner's signature Date

6. Sworn statement:

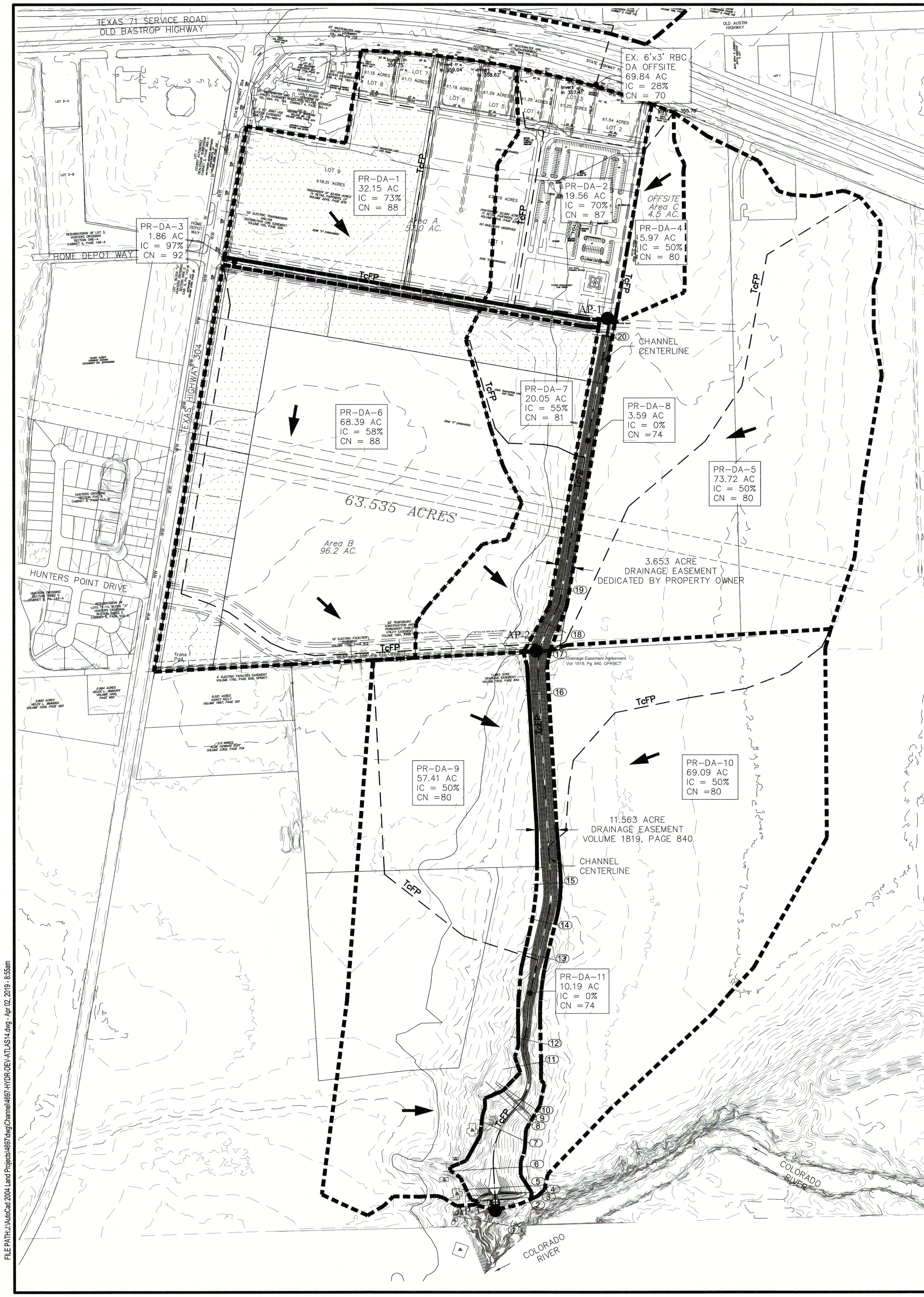
I, the undersigned, hereby certify that all information contained herein and the attached documents are true and correct and that it is my belief that the property owner is entitled to the requested rights for this Project and, during the pending time of this determination, I understand my continuing obligation to notify the Development Services Director in writing of the inaccuracy of any statement or representation which was incorrect when made or which becomes incorrect by virtue of changed circumstances.

Christine M. Methvin	CM Methvin	1/3/19
Applicant's Name	Applicant's signature	Date

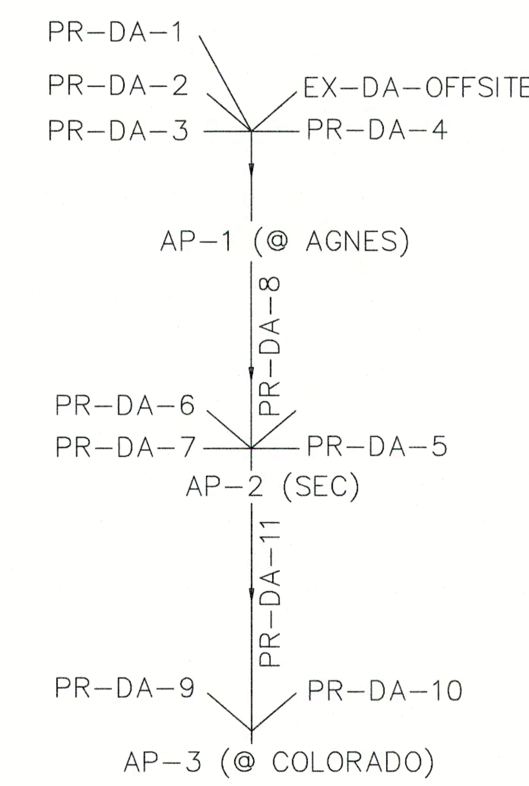
Sworn to and subscribed before me by SUSAN O. MARTIN on this 3rd day of January in the year 2019, to certify which witness my hand and seal of office.

Susan O. Martin
Notary Public, State of Texas

SUSAN O. MARTIN
NOTARY PUBLIC
ID# 13049238-6
State of Texas
Comm. Exp. 01-11-2020



HYDROLOGY FLOW CHART



0 300' 600'

SCALE: 1" = 300'

LEGEND

- DRAINAGE EASEMENT BOUNDARY
- DRAINAGE BOUNDARY LINE
- A1 DRAINAGE AREA LABEL
- ANALYSIS POINT (AP)
- 940 EXISTING CONTOUR MAJOR
- EXISTING CONTOUR MINOR
- FLOW ARROW
- TcFP TIME OF CONCENTRATION FLOW PATH
- COMMERCIAL LOTS AT 75% IMPERVIOUS COVER

TIME OF CONCENTRATION CALCULATIONS - SCS METHOD

Drainage Area	Sheet Flow $Tc = (0.007 x (n x L)^.8) / (P2^0.5 x S^0.4)$				Shallow Concentrated Flow $Tc = L / (3600V)$					Channel Flow $Tc = L / (3600V)$					Time of Concentration	Lag Time
	n	L	Slope	Tc (min)	Paved/ Unpaved	L	Slope	V (fps)	Tc (min)	n	L	Slope	V (fps)	Tc (min)	Tc (min)	TL (min)
DA-OFFSITE	0.011	100	0.50%	1.85	U	2,336	0.50%	1.141	34.13	0.013	1,793	0.50%	8.0	3.735	**39.71**	**23.83**
PR-DA-1	0.011	100	0.50%	1.85	P	200	0.50%	1.437	2.32	0.013	2,405	0.50%	8.0	5.010	**9.18**	**5.51**
PR-DA-2	0.011	100	0.50%	1.85	P	200	0.50%	1.437	2.32	0.013	1,535	0.50%	8.0	3.198	**7.36**	**4.42**
PR-DA-3	0.011	100	2.00%	1.06	P	200	0.50%	1.437	2.32	0.013	1,746	0.50%	8.0	3.638	**7.02**	**4.21**
PR-DA-4	0.011	100	0.50%	1.85	P	200	0.50%	1.437	2.32	0.013	868	0.50%	6.0	2.411	**6.58**	**3.95**
AP-1 to AP-2										0.026	1,774	0.30%	6.0	4.928	**4.93**	**2.96**
PR-DA-5	0.011	100	0.50%	1.85	P	200	0.50%	1.437	2.32	0.013	2,729	0.50%	8.0	5.685	**9.85**	**5.91**
PR-DA-6	0.011	100	0.50%	1.85	P	200	0.50%	1.437	2.32	0.013	3,402	0.50%	8.0	7.088	**11.25**	**6.75**
PR-DA-7	0.011	100	0.50%	1.85	P	200	0.50%	1.437	2.32	0.013	1,750	0.50%	6.0	4.861	**9.03**	**5.42**
PR-DA-8	0.011	20	0.50%	0.51	P	50	0.50%	1.437	0.58	0.026	1,715	0.30%	6.0	4.764	**5.85**	**3.51**
AP-2 to AP-3										0.026	3,004	0.30%	6.0	8.344	**8.34**	**5.01**
PR-DA-9	0.011	100	0.50%	1.85	P	200	0.50%	1.437	2.32	0.013	1,759	0.50%	8.0	3.665	7.83	4.70
										0.026	1,376	0.30%	7.0	3.276	**11.11**	**6.66**
PR-DA-10	0.011	100	0.50%	1.85	P	200	0.50%	1.437	2.32	0.013	1,789	0.50%	8.0	3.727	7.89	4.74
										0.026	1,980	0.30%	7.0	4.714	**12.61**	**7.57**
PR-DA-11	0.011	20	0.50%	0.51	U	50	0.50%	1.141	0.73	0.026	2,934	0.30%	7.0	6.986	**8.23**	**4.94**

RESULTS TABLE - PROPOSED CONDITIONS

HYDROLOGIC ELEMENT	AREA (AC.)	%IC	CN	Tc (min)	Q_{10} (CFS)	Q_{25} (CFS)	Q_{100} (CFS)
DA-OFFSITE	69.84	28	71	39.71	149.39	221.84	362.99
PR-DA-1	32.15	73	92	9.18	178.20	234.33	339.79
PR-DA-2	19.56	70	87	7.36	101.60	136.44	201.68
PR-DA-3	1.86	97	92	7.02	10.31	13.56	19.66
PR-DA-4	5.97	50	80	6.58	27.29	38.04	58.32
AP-1 (CHANNEL SOUTH OF					392.31	538.92	819.37
AP-1 to AP-2				4.93	347.81	485.27	750.03
PR-DA-5	73.72	50	80	9.85	305.25	426.32	654.92
PR-DA-6	68.39	58	88	11.25	327.91	438.75	646.40
PR-DA-7	20.05	55	81	9.03	93.59	129.69	197.66
PR-DA-8	3.59	0	74	5.85	14.23	20.62	32.86
AP-2 (CHANNEL AT SOUTHEAST					1063.08	1467.49	2236.82
AP-2 to AP-3				8.34	941.24	1320.95	2047.90
PR-DA-9	57.41	50	80	11.11	237.72	332.00	510.02
PR-DA-10	69.09	50	80	12.61	286.08	399.55	613.78
PR-DA-11	10.19	0	74	8.23	40.40	58.52	93.26
AP-3 (CHANNEL AT COLORADO					1413.58	1991.19	3099.38

MAXIMUM POTENTIAL OUTFALL CONDITIONS FOR 100-YR AND 25-YR STORM EVENTS

					MAX POTENTIAL TW WITH COINCIDING PEAKS				ANTICIPATED TW WITH NON-COINCIDING PEAKS				TW WITH GRAVITY OUTFALL			
FLOWLINE STATION	RIVER STATION	PROFILE	Q (cfs)	n	WSE (ft)	dF (ft)	V (fps)	Sf	WSE (ft)	dF (ft)	V (fps)	Sf	WSE (ft)	dF (ft)	V (fps)	Sf
50+49.7	20	25-YR	538.92	0.026	356.74	3.74	3.6	0.000856	356.74	3.74	3.6	0.000856	356.74	3.74	3.6	0.000856
		100-YR	819.37	0.026	357.89	4.89	4.15	0.000895	357.89	4.89	4.14	0.000893	357.89	4.89	4.14	0.000893
37+04.1	19	25-YR	538.92	0.026	354.91	6.82	2.78	0.000399	354.91	6.82	2.78	0.000399	354.91	6.82	2.78	0.000399
		100-YR	819.37	0.026	356.47	8.38	2.95	0.000353	356.48	8.39	2.94	0.00035	356.48	8.39	2.94	0.00035
35+04.1	18	25-YR	538.92	0.026	354.86	7.38	2.42	0.000277	354.86	7.38	2.42	0.000277	354.86	7.38	2.42	0.000277
		100-YR	819.37	0.026	356.43	8.95	2.63	0.000259	356.44	8.96	2.62	0.000257	356.44	8.96	2.62	0.000257
33+44.97	17	25-YR	1467.49	0.026	353.79	6.79	7.63	0.003024	353.79	6.79	7.63	0.003024	353.79	6.79	7.63	0.003024
		100-YR	2236.82	0.026	355.15	8.15	8.46	0.002998	355.18	8.18	8.4	0.002948	355.18	8.18	8.4	0.002948
31+29.1	16	25-YR	1467.49	0.026	353.13	6.78	7.63	0.003033	353.13	6.78	7.63	0.003033	353.13	6.78	7.63	0.003033
		100-YR	2236.82	0.026	354.51	8.16	8.44	0.002985	354.56	8.21	8.35	0.002896	354.56	8.21	8.35	0.002896
21+35.45	15	25-YR	1467.49	0.026	350.12	6.79	7.62	0.003018	350.12	6.79	7.62	0.003018	350.12	6.79	7.62	0.003018
		100-YR	2236.82	0.026	351.83	8.50	7.86	0.002468	352.24	8.91	7.23	0.001976	352.24	8.91	7.23	0.001976
19+29.1	14	25-YR	1467.49	0.026	349.50	6.79	7.62	0.003015	349.50	6.79	7.62	0.003015	349.50	6.79	7.62	0.003015
		100-YR	2236.82	0.026	351.39	8.68	7.56	0.002222	351.91	9.20	6.81	0.001773	351.91	9.20	6.81	0.001773
17+48.37	13	25-YR	1467.49	0.026	348.96	6.80	7.6	0.003	348.96	6.80	7.6	0.003	348.96	6.80	7.6	0.003
		100-YR	2236.82	0.026	351.31	9.15	6.24	0.001406	351.91	9.75	5.36	0.00093	351.91	9.75	5.36	0.00093
13+04.1	12	25-YR	1467.49	0.026	347.81	7.00	7.1	0.002055	347.81	7.00	7.1	0.002055	347.81	7.00	7.1	0.002055
		100-YR	2236.82	0.026	350.91	10.10	5.5	0.000631	351.63	10.82	4.82	0.00043	351.63	10.82	4.82	0.00043
11+68.3	11	25-YR	1467.49	0.026	347.92	7.52	5.01	0.000845	347.92	7.52	5.01	0.000845	347.92	7.52	5.01	0.000845
		100-YR	2236.82	0.026	350.97	10.57	4.21	0.000329	351.67	11.27	3.79	0.000239	351.67	11.27	3.79	0.000239
9+75.01	10	25-YR	1467.49	0.026	347.93	8.12	4.16	0.000396	347.93	8.12	4.16	0.000396	347.93	8.12	4.16	0.000396
		100-YR	2236.82	0.026	351.02	11.21	3.27	0.000153	351.71	11.90	2.89	0.000109	351.71	11.90	2.89	0.000109
9+45.00	9	25-YR	1467.49	0.026	347.97	8.25	2.62	0.000164	347.97	8.25	2.62	0.000164	347.97	8.25	2.62	0.000164
		100-YR	2236.82	0.026	351.03	11.31	2.33	0.00008	351.72	12.00	2.09	0.000058	351.72	12.00	2.09	0.000058
9+15.76	8	25-YR	1467.49	0.026	347.96	8.33	3.4	0.000234	347.96	8.33	3.4	0.000234	347.96	8.33	3.4	0.000234
		100-YR	2236.82	0.026	351.03	11.40	2.8	0.000103	351.72	12.09	2.47	0.000074	351.72	12.09	2.47	0.000074
7+80.74	7	25-YR	1467.49	0.026	347.93	8.71	3.47	0.000217	347.93	8.71	3.47	0.000217	347.93	8.71	3.47	0.000217
		100-YR	2236.82	0.026	351.01	11.79	3.09	0.000114	351.71	12.49	2.71	0.000082	351.71	12.49	2.71	0.000082
5+71.60	6	25-YR	1467.49	0.026	347.97	10.00	1.1	0.000022	347.97	10.00	1.1	0.000022	347.97	10.00	1.1	0.000022
		100-YR	2236.82	0.026	351.03	13.06	1.08	0.000014	351.73	13.76	0.99	0.000011	351.73	13.76	0.99	0.000011
4+70.67	5	25-YR	1467.49	0.011	347.95	10.90	1.67	0.000006	347.95	10.90	1.67	0.000006	347.95	10.90	1.67	0.000006
		100-YR	2236.82	0.011	351.00	13.95	1.83	0.000006	351.70	14.65	1.69	0.000004	351.70	14.65	1.69	0.000004
4+35.67	4	25-YR	1991.19	0.011	346.40	10.04	9.63	0.000581	346.40	10.04	9.63	0.000581	346.40	10.04	9.63	0.000581
		100-YR	3099.38	0.011	348.36	12.00	12.54	0.000878	349.49	13.13	11.45	0.000676	349.49	13.13	11.45	0.000676
4+09.67	3	25-YR	1991.19	0.011	342.45	6.62	14.6	0.001819	342.45	6.62	14.6	0.001821	342.45	6.62	14.6	0.001821
		100-YR	3099.38	0.011	347.17	11.34	13.26	0.001018	344.70	8.87	16.96	0.001966	344.70	8.87	16.96	0.001966
3+82.88	2	25-YR	1991.19	0.026	341.33	6.02	9.19	0.003735	340.38	5.07	11.43	0.006983	340.38	5.07	11.43	0.006983
		100-YR	3099.38	0.026	348.94	13.63	3.94	0.00022	341.87	6.56	12.81	0.006616	341.89	6.58	12.76	0.006537
2+67.52	1	25-YR	1991.19	0.026	342.21	25.91	1.39	0.000014	332.32	16.02	3.28	0.000209	328.32	12.02	5.65	0.000959
		100-YR	3099.38	0.026	349.05	32.75	1.39	0.000009	338.78	22.48	2.8	0.000074	330.69	14.39	6.24	0.000911

NOTES:

- SCS METHODOLOGY WAS USED FOR DRAINAGE ANALYSIS
- 24-HOUR RAINFALL DEPTH DATA FOR DESIGN STORMS WERE SELECTED FROM THE NOAA ATLAS 14 PRECIPITATION FREQUENCY DATA SERVER FOR BASTROP, TX
  - 2-YR = 4.17 IN
  - 5-YR = 5.52 IN
  - 10-YR = 6.81 IN
  - 25-YR = 8.81 IN
  - 100-YR = 12.6 IN
- EXISTING CURVE NUMBERS REFLECT HYDROLOGIC SOIL GROUP DATA FOR TYPE A & B SOILS AS PER THE USDA WEB SOIL SURVEY
- DEVELOPED CNs REFLECT HSGs FOR TYPE B & C SOILS, ASSUMING FILL CONDITIONS RESEMBLE HSG C SOILS
- TOC CALCULATIONS ASSUME FUTURE DEVELOPMENT & USE TR-55 METHODOLOGY
- MANNING'S N VALUES FROM TR-55:
  - PIPE/CHANNEL FLOW
    - PIPES – REINFORCED CONCRETE = 0.013
    - NATURAL CHANNELS – EARTH, STRAIGHT, SOME GRASS = 0.026
  - OVERLAND FLOW
    - SMOOTH SURFACE (CONCRETE, ASPHALT, BARE SOIL) = 0.011
    - SHORT GRASS = 0.15
- OFFSITE IMPERVIOUS COVERS ARE APPROXIMATE BASED ON AERIAL IMAGERY
- ONSITE IMPERVIOUS COVERS REFLECT ASSUMED FUTURE DEVELOPMENT AS FOLLOWS:
  - SINGLE-USE RESIDENTIAL = 50%
  - COMMERCIAL = 70-75%
  - ROW = 97%

NOTES:

- GIVEN MAXIMUM TAILWATERS, THE PROPOSED DRAINAGE CHANNEL PROVIDES AT LEAST ONE FOOT OF FREEBOARD AT DESIGN FLOWS AND THE PROPOSED CULVERT HAS CAPACITY TO CONVEY 100-YR STORM RUNOFF WITHOUT EXCEEDING THE MINIMUM ROAD SURFACE ELEVATION OF AGNES ROAD AT 359.50', AS PER DESIGN REQUIREMENTS BY BASTROP COUNTY'S CODE OF ORDINANCES (10.1.40 & 10.5.90).
- FLOW RATE, TIME TO PEAK, AND WATER SURFACE DATA FOR THE COLORADO RIVER ARE BASED ON FEMA MAP 48021C0355E AND THE DRAINAGE TECHNICAL MEMORANDUM FOR THE PECAN PARK DEVELOPMENT DATED FEBRUARY 22, 2010, BY ESPEY CONSULTANTS, INC., WHICH UTILIZED THE USGS GAGE 08159200 LOCATED AT STATE HIGHWAY 71 APPROXIMATELY 2 MILES UPSTREAM OF THE PROPOSED CHANNEL'S OUTFALL. JUSTIFICATION FOR TAILWATER ASSUMPTIONS ARE PROVIDED BELOW:

MAXIMUM POTENTIAL TAILWATER ASSUMING COINCIDING PEAKS:

- CALCULATIONS UTILIZE TAILWATERS OF 349.00' AND 342.17' FOR THE 100-YR AND 25-YR STORM EVENTS, RESPECTIVELY.
- ACCORDING TO FEMA MAP 48021C0355E, THE EXISTING 100-YR BFE AT THE SITE IS 349' MSL.
- THE COLORADO RIVER'S PEAK 25-YR WSE AT THE SITE IS ESTIMATED AT 342.17'. THIS WSE WAS EXTRAPOLATED FROM A LOGARITHMIC TREND OF BFE's FOR VARIOUS ANNUAL CHANCE FLOODS USING DATA FROM THE FEMA FLOOD INSURANCE STUDY 48021CV000B AT STATION 'AW'.
- ACCORDING TO THE MEMORANDUM, TIME TO PEAK OF THE COLORADO RIVER IS APPROXIMATED AT 31:45 HOURS FOR THE 100-YR EVENT, WHEREAS THE PROPOSED CHANNEL'S TIME TO PEAK IS MODELED AT APPROXIMATELY 12:06 HOURS. THESE PEAKS ARE NON-COINCIDING AND THEREFORE THESE WSE's OVERESTIMATE EXPECTED FLOODING FOR THE 100-YR AND 25-YR EVENTS.
- MAXIMUM POTENTIAL WSE USED TO DESIGN EXTENTS OF EROSION CONTROL MEASURES.

ANTICIPATED TAILWATER ASSUMING NON-COINCIDING PEAKS:

- CALCULATIONS UTILIZE TAILWATERS OF 338.59' AND 331.96' FOR THE 100-YR AND 25-YR STORM EVENTS, RESPECTIVELY.
- SINCE THE COLORADO RIVER AND PROPOSED CHANNEL PEAKS ARE NON-COINCIDING, AN ESTIMATED REDUCTION OF 10.41' IS EXPECTED TO BE REALIZED IN ACTUAL WSE AT 12:06 HOURS. THE 100-YR WSE IS ESTIMATED AT 338.59'. THIS REDUCED WSE IS BASED ON GRAPHICAL INTERPOLATIONS OF THE MEMORANDUM'S COLORADO RIVER 1% ANNUAL CHANCE HYDROGRAPH AND HYDRAULIC RATING CURVE.
- THE ACTUAL 25-YR WSE OF THE COLORADO RIVER REALIZED AT 12:06 HOURS AT THE PROPOSED CHANNEL'S OUTFALL IS ESTIMATED AT 331.96'. THIS REDUCED WSE WAS CALCULATED USING A PROPORTIONAL REDUCTION EQUIVALENT TO THE CHANGE IN 100-YR WSE's REALIZED AT A TIME TO PEAK OF 31:45 HOURS AS COMPARED TO 12:06 HOURS.

TAILWATER ASSUMING GRAVITY OUTFALL:

- CALCULATIONS UTILIZE A TAILWATER OF 0' FOR BOTH THE 100-YR AND 25-YR STORM EVENTS.
- GRAVITY OUTFALL CALCULATIONS DEPICT MAXIMUM VELOCITIES WHICH ARE USED FOR DESIGN OF OUTFALL PROTECTION.
- FLOW CHARACTERISTICS ARE THE SAME AS THOSE WITH THE ANTICIPATED TAILWATER ASSUMING NON-COINCIDING PEAKS AT EVERY STATION EXCEPT STATION 1.

STATE OF TEXAS
BRENDAN P. McENTEE
96200
LICENSED PROFESSIONAL ENGINEER

CARLSON, BRIGANCE & DOERING, INC.
ID# F3791

04-02-2019

DESIGNED BY: BM
DRAFTED BY: JW

DATE
REVISION

Carlson, Brigance & Doering, Inc.
FIRM ID #F3791
Civil Engineering • Surveying
5501 West William Cannon Dr. • Austin, Texas 78749
Phone No. (512) 280-5160 • Fax No. (512) 280-5165

SHEET NAME: DEVELOPED HYDROLOGY REVISION MAP

JOB NAME: BASTROP GROVE

PROJECT: DRAINAGE IMPROVEMENTS

DATE: FEBRUARY 2019

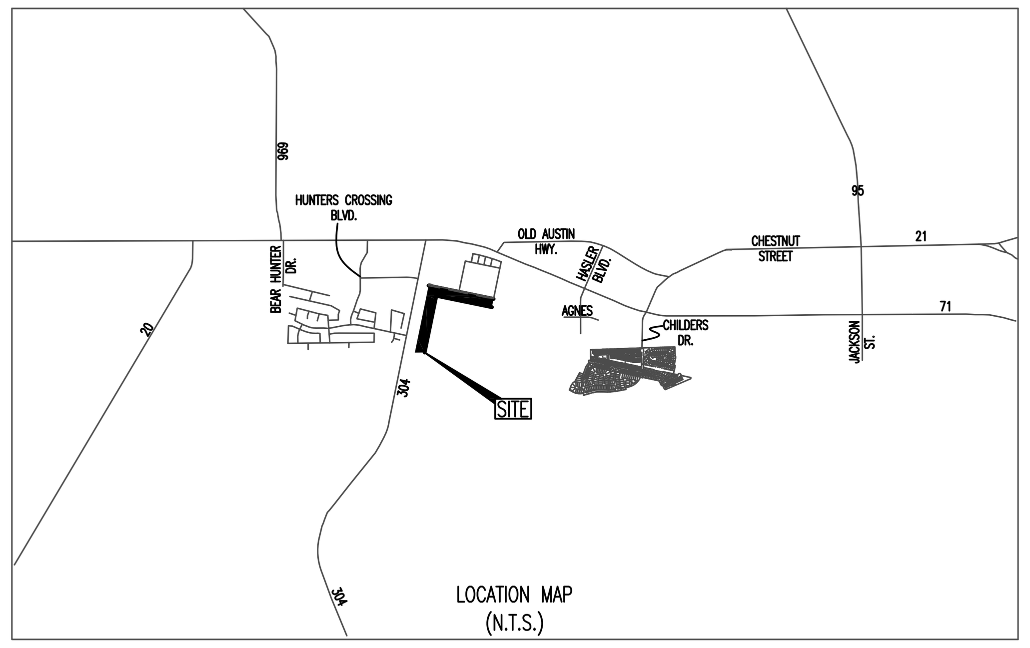
JOB NUMBER: 4697

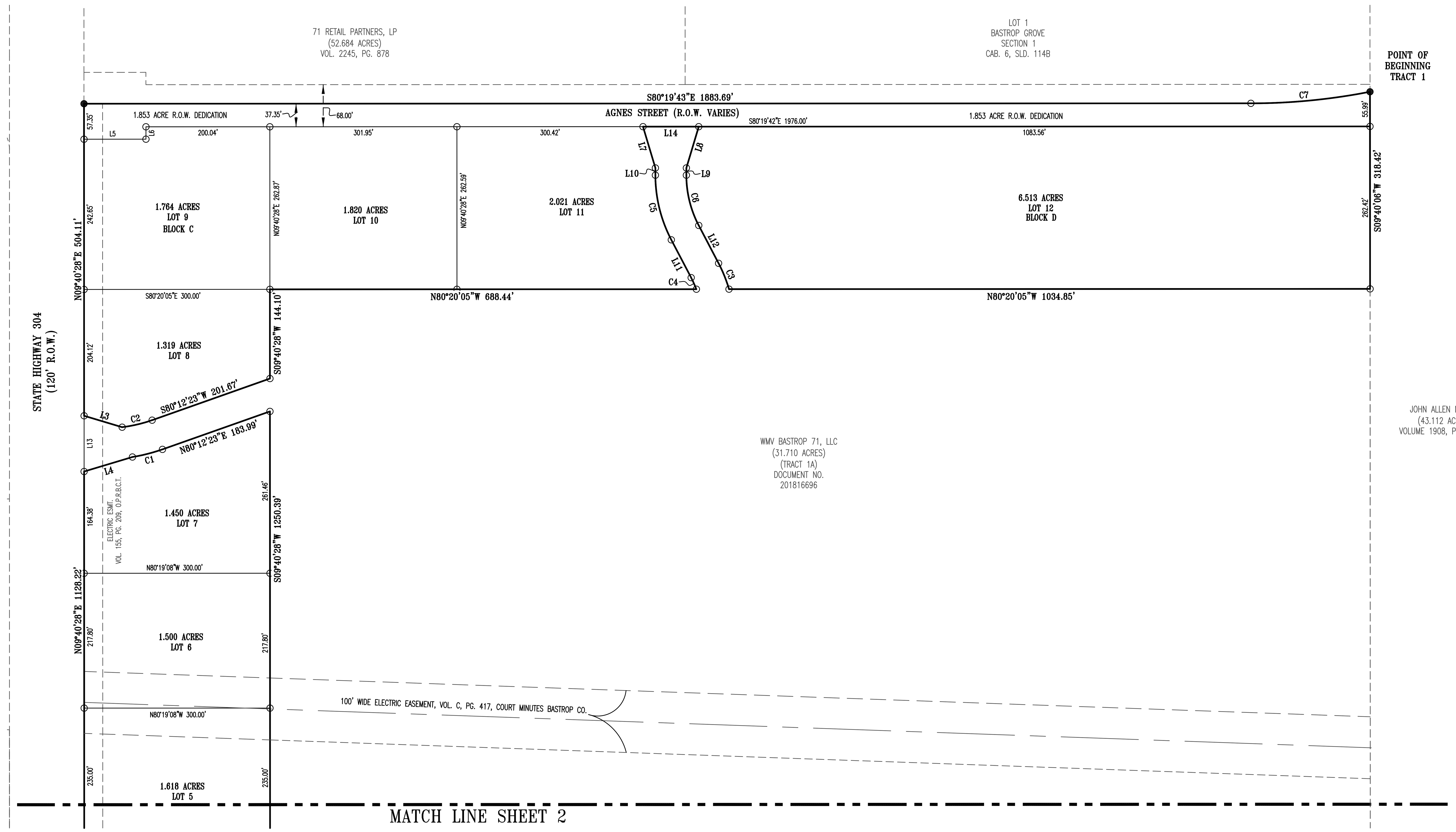
SHEET OF 14

SHEET NO.

FILE PATH: J:\AutoCad 2004 Land Projects\4697\dwg\Channel\4697-HYDR-DEV-ATLAS14.dwg - Apr 02, 2019 - 8:55am

PRELIMINARY PLAT
BASTROP GROVE, SECTION 2





LEGEND

- ● 1/2" IRON ROD FOUND
- ○ 1/2" CAPPED IRON ROD SET
- ▲ MAG NAIL FOUND

SCALE: 1" = 100'
GRAPHIC SCALE
(IN FEET)
1 inch = 100 ft.

Curve Table						
Curve #	Length	Radius	Chord Direction	Chord Length	Tangent	DELTA
C1	50.15	275.00	N85°25'49"E	50.08	25.14	10°26'55"
C2	49.78	225.00	S86°32'41"W	49.68	24.99	12°40'36"
C3	45.11	225.00	N12°12'59"W	45.04	22.63	11°29'17"
C4	20.42	175.00	S14°37'05"E	20.41	10.22	6°41'10"
C5	108.55	225.00	S04°08'23"E	107.50	55.35	27°38'31"
C6	84.43	175.00	N04°08'23"W	83.61	43.05	27°38'30"
C7	193.46	1000.00	S85°51'51"E	193.16	97.03	11°05'04"

Line Table		
Line #	Length	Direction
L1	69.82	N82°59'00"E
L2	67.53	N58°31'01"W
L3	64.18	N63°38'06"W
L4	81.42	N82°57'59"E
L5	99.95	S80°19'42"E
L6	20.00	S09°40'18"W
L7	69.64	S07°01'06"E
L8	69.66	N26°22'49"E
L9	11.70	N09°40'53"E
L10	11.70	S09°40'53"W
L11	69.01	S17°57'38"E
L12	69.01	N17°57'38"W
L13	90.02	N09°40'28"E
L14	90.03	N80°19'42"W
L15	105.16	N09°40'28"E

TOTAL ACREAGE: 25.882 ACRES
SURVEY: NANCY BLAKEY SURVEY, ABSTRACT No. 98

COMMERCIAL LOTS	12	TOTAL:	24.029 ACRES
R.O.W. DEDICATION	1	TOTAL:	1.853 ACRES
NO. OF BLOCKS:	4		
R.O.W.:		TOTAL:	25.882 ACRES

DATE: JANUARY 22, 2019

OWNER:
MC BASTROP 71, LP
2828 ROUTH STREET, SUITE 500
DALLAS, TEXAS 75201

ENGINEER & SURVEYOR:
CARLSON, BRIGANCE & DOERING, Inc.
5501 WEST WILLIAM CANNON
AUSTIN, TX 78749
(512) 280-5160
(512) 280-5165 fax

F.E.M.A. MAP NO. 48021 C 0355E
BASTROP COUNTY, TEXAS DATED: JANUARY 19, 2006

Carlson, Brigance & Doering, Inc.
FIRM ID #F3791 ◆ REG. # 10024900
Civil Engineering ◆ Surveying
5501 West William Cannon ◆ Austin, Texas 78749
Phone No. (512) 280-5160 ◆ Fax No. (512) 280-5165

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PRELIMINARY PLAT
BASTROP GROVE, SECTION 2

FLOOD PLAIN NOTE:

NO PORTION OF THIS TRACT LIES WITHIN A DESIGNATED FLOOD HAZARD AREA, AS SHOWN ON THE FEDERAL FLOOD INSURANCE ADMINISTRATION RATE MAP NO. 48021 C 0355E, FOR BASTROP COUNTY TEXAS, DATED JANUARY 19, 2006.

GENERAL NOTES:

1. ALL SUBDIVISION PERMITS SHALL CONFORM TO THE CITY OF BASTROP CODE OF ORDINANCES, CONSTRUCTION STANDARDS, AND GENERALLY ACCEPTED ENGINEERING PRACTICES.
2. CONSTRUCTION PLANS AND SPECIFICATIONS FOR ALL SUBDIVISION IMPROVEMENTS SHALL BE REVIEWED AND ACCEPTED BY THE CITY OF BASTROP PRIOR TO ANY CONSTRUCTION WITHIN THE SUBDIVISION.
3. EROSION AND SEDIMENTATION CONTROLS CONSTRUCTED WITH THE SUBDIVISION ORDINANCE OF THE CITY OF BASTROP ARE REQUIRED FOR ALL CONSTRUCTION ON EACH LOT.
4. ALL WORK, INCLUDING SIGNS, SHALL COMPLY WITH THE CITY OF BASTROP ORDINANCES,
5. CITY ACCEPTANCE OF SUBDIVISION INFRASTRUCTURE OR FISCAL SURETY FOR SUBDIVISION CONSTRUCTION, IN A FORM ACCEPTABLE TO THE CITY OF BASTROP, SHALL BE PROVIDED PRIOR TO FINAL PLAT RECORDATION BY THE CITY.
6. BY APPROVING THIS PRELIMINARY PLAT, THE CITY OF BASTROP ASSUMES NO OBLIGATION TO CONSTRUCT ANY INFRASTRUCTURE IN CONNECTION WITH THIS SUBDIVISION. ANY SUBDIVISION INFRASTRUCTURE REQUIRED FOR THE DEVELOPMENT OF THE LOTS IN THIS SUBDIVISION IS THE SOLE RESPONSIBILITY OF THE DEVELOPER AND/OR THE OWNERS OF THE LOTS. FAILURE TO CONSTRUCT ANY REQUIRED INFRASTRUCTURE TO THE CITY STANDARDS MAY BE JUST CAUSE FOR THE CITY TO DENY APPLICATIONS FOR CERTAIN DEVELOPMENT PERMITS INCLUDING BUILDING PERMITS, SITE PLAN APPROVALS AND/OR CERTIFICATE OF OCCUPANCY.
7. NO LOT OR STRUCTURE SHALL BE OCCUPIED PRIOR TO THE APPLICANT SUBMITTING TO THE CITY OF BASTROP DOCUMENTATION OF SUBDIVISION/SITE REGISTRATION WITH THE TEXAS DEPARTMENT OF LICENSING AND REGULATIONS (TDLR) AND PROVIDE DOCUMENTATION OF REVIEW AND COMPLIANCE OF THE SUBDIVISION CONSTRUCTION PLANS WITH TEXAS ARCHITECTURAL BARRIERS ACT (TABA).
8. WATER IS PROVIDED BY THE CITY OF BASTROP.
9. WASTEWATER SERVICE IS PROVIDED BY THE CITY OF BASTROP.
10. ELECTRIC SERVICE WILL PROVIDED BY BLUEBONNET ELECTRIC.
11. GAS SERVICE WILL BE PROVIDED BY CENTERPOINT ENERGY.
12. CABLE SERVICE IS PROVIDED BY SPECTRUM.
13. NO LOT IN THIS SUBDIVISION SHALL BE OCCUPIED UNTIL CONNECTED TO THE APPROVED WATER DISTRIBUTION AND WASTEWATER COLLECTION FACILITIES
14. WASTEWATER AND WATER SYSTEMS SHALL CONFORM TO TCEQ (TEXAS COMMISSION ON ENVIRONMENTAL QUALITY).
15. DEVELOPER/OWNER SHALL BE SOLELY RESPONSIBLE FOR ALL RELOCATIONS AND MODIFICATIONS TO EXISTING UTILITIES.
16. FLOOD WARNING: THE DEGREE OF FLOOD WATER PROTECTION REQUIRED BY THE CITY OF BASTROP FLOOD DAMAGE PREVENTION ORDINANCE IS CONSIDERED REASONABLE FOR THE REGULATORY PURPOSES AND IS BASED ON SCIENTIFIC AND ENGINEERING CONSIDERATIONS. ON RARE OCCASIONS, GREATER FLOODS CAN AND WILL OCCUR AND FLOOD HEIGHTS MAY BE INCREASED BY MAN-MADE OR NATURAL CAUSES. ACCEPTANCE OF THIS PRELIMINARY PLAT BY THE CITY COUNCIL DOES NOT IMPLY THAT LAND OUTSIDE OF THE AREA OF SPECIAL FLOOD HAZARDS OR USES PERMITTED IN SUCH AREAS WILL BE FREE FROM FLOODING OR FLOOD DAMAGES. NOR SHALL ACCEPTANCE OF THIS PRELIMINARY PLAT CREATE LIABILITY ON THE PART OF THE CITY OF BASTROP OR ANY OFFICIAL OR EMPLOYEE THEREOF FOR ANY FLOOD DAMAGES THAT RESULT FROM RELIANCE ON THE INFORMATION CONTAINED WITHIN THIS PRELIMINARY PLAT OR ANY ADMINISTRATION DECISION LAWFULLY MADE HEREUNDER.
17. ALL DRAINAGE EASEMENTS, STORM WATER FACILITIES / FEATURE SHALL BE MAINTAINED BY THE PROPERTY OWNER OR HIS OR HER ASSIGNS.
18. TEMPORARY OR PERMANENT EASEMENTS ARE TO BE PROVIDED AS REQUIRED AT THE CITY'S SOLE DISCRETION FOR OFF-SITE WATER, WASTEWATER AND DRAINAGE IMPROVEMENTS.
19. PROPERTY OWNERS SHALL PROVIDE FOR ACCESS TO ALL EASEMENTS AS MAY BE NECESSARY AND SHALL NOT PROHIBIT ACCESS BY GOVERNMENTAL AUTHORITIES.
20. IT IS THE RESPONSIBILITY OF EACH BUILDER TO DESIGN AND CONSTRUCT A SUITABLE GRADING AND DRAINAGE SCHEME WHICH WILL CONVEY SURFACE WATER WITHOUT PONDING IN OR AROUND THE LOT, FROM ITS STRUCTURE TO THE DRAINAGE SYSTEM CONSTRUCTED BY THE SUBDIVISION DEVELOPER.
21. PUBLIC UTILITY AND DRAINAGE EASEMENTS WHERE SHOWN HEREON ARE INTENDED TO INDICATE AN EASEMENT FOR CONSTRUCTION, OPERATIONS AND MAINTENANCE OF PUBLIC UTILITIES AND DRAINAGE WAYS; INCLUDING BUT NOT LIMITED TO SANITARY SEWERS, FORCE MAINS, WATER LINES, TELEPHONE SIGNAL CONDUITS, ELECTRIC CONDUCTORS, DRAINAGE PIPES AND NATURAL GAS LINES.

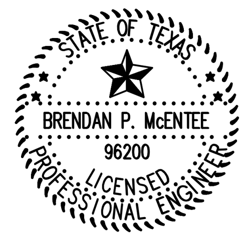
THIS FLOOD STATEMENT, AS DETERMINED BY A H.U.D.-F.I.A. FLOOD INSURANCE RATE MAP, DOES NOT IMPLY THAT THE PROPERTY OR THE IMPROVEMENTS THEREON WILL BE FREE FROM FLOODING OR FLOOD DAMAGE. ON RARE OCCASIONS, GREATER FLOODS CAN AND WILL OCCUR, AND FLOOD HEIGHTS MAY INCREASE BY MAN-MADE OR NATURAL CAUSES.

THIS STATEMENT SHALL NOT CREATE LIABILITY ON THE PART OF ENGINEER OR SURVEYOR.

STATE OF TEXAS)(
COUNTY OF TRAVIS)(KNOW ALL MEN BY THESE PRESENTS:

I, BRENDAN P. McENTEE, P.E. DO HEREBY CERTIFY THAT THE STREETS AND DRAINAGE DESIGN, AS SHOWN HEREON, COMPLIES WITH THE SUBDIVISION REGULATIONS FOR THE CITY OF BASTROP, AND THAT THE 100 YEAR FLOOD PLAIN IS AS SHOWN AND WILL BE CONTAINED WITHIN THE DRAINAGE EASEMENT AND OR DRAINAGE RIGHT-OF-WAY, AS SHOWN HEREON.

ENGINEERING BY: ______________________ DATE ____________
BRENDAN P. McENTEE, P.E. NO. 96200
CARLSON, BRIGANCE & DOERING, INC.
5501 WEST WILLIAM CANNON DRIVE
AUSTIN, TEXAS 78749



CARLSON, BRIGANCE & DOERING, INC.
ID# F3791

STATE OF TEXAS)(
COUNTY OF TRAVIS)(KNOW ALL MEN BY THESE PRESENTS:

THAT I, AARON V. THOMASON, DO HEREBY CERTIFY THAT I PREPARED THIS PLAT FROM AN ACTUAL AND ACCURATE ON-THE-GROUND SURVEY OF THE LAND AND THAT THE CORNER MONUMENTS SHOWN THEREON WERE PROPERLY PLACED UNDER MY PERSONAL SUPERVISION, IN ACCORDANCE WITH THE SUBDIVISION REGULATION OF THE CITY OF BASTROP, BASTROP COUNTY, TEXAS. ALL EASEMENTS OF RECORD HAVE BEEN IDENTIFIED ON THIS PLAT TO THE BEST OF MY KNOWLEDGE.

SURVEYED BY: ______________________ DATE ____________
AARON V. THOMASON ~ R.P.L.S. NO. 6214
CARLSON, BRIGANCE & DOERING, INC.
5501 WEST WILLIAM CANNON DRIVE
AUSTIN, TEXAS 78749

APPROVED ON THIS ____ DAY OF ____________, 20____ A.D., BY THE CITY COUNCIL OF THE CITY OF BASTROP.

APPROVED:

____
CONNIE SCHROEDER, MAYOR OF THE
CITY OF BASTROP, TEXAS

ATTEST:

____
CITY SECRETARY, CITY OF
BASTROP, TEXAS

FIELD NOTES – TRACT 1

BEING ALL OF THAT CERTAIN 15.290 ACRE TRACT OR PARCEL OF LAND OUT OF AND PART OF THE NANCY BLAKEY SURVEY, ABSTRACT NUMBER 98, SITUATED IN BASTROP COUNTY, TEXAS, BEING MORE PARTICULARY DESCRIBED AS BEING A PORTION OF THAT CALLED 145.691 ACRE TRACT CONVEYED TO MC BASTROP 71, LP., IN VOLUME 2097, PAGE 241, OFFICIAL PUBLIC RECORDS OF BASTROP COUNTY, TEXAS, SAID 15.290 ACRE TRACT OF LAND BEING MORE FULLY DESCRIBED BY METES AND BOUNDS AS FOLLOWS:

BEGINNING, AT A 1/2 INCH IRON ROD FOUND IN THE EAST LINE OF SAID 145.691 ACRE TRACT OF LAND, BEING AT THE SOUTHEAST CORNER OF BASTROP GROVE, SECTION 1, A SUBDIVISION RECORDED IN CABINET 6, SLIDE 114B, PLAT RECORDS OF BASTROP COUNTY, TEXAS, SAME BEING AT THE SOUTHEAST CORNER OF THAT 1.479 ACRE PORTION OF AGNES STREET (R.O.W. VARIES) DEDICATED IN SAID BASTROP GROVE, SECTION 1, ALSO BEING IN THE WEST LINE OF A CALLED 43.112 ACRE TRACT OF LAND CONVEYED TO JOHN ALLEN NIXON IN VOLUME 1908, PAGE 825, OFFICIAL PUBLIC RECORDS OF BASTROP COUNTY, TEXAS, FOR THE NORTHEAST CORNER AND THE POINT OF BEGINNING OF THE HEREIN DESCRIBED TRACT,

THENCE, S09°40'06"W, WITH THE EAST LINE OF SAID 145.691 ACRE TRACT OF LAND AND THE WEST LINE OF SAID 43.112 ACRE TRACT OF LAND, A DISTANCE OF 318.42 FEET TO A CAPPED 1/2 INCH IRON ROD SET STAMPED "CBD SETSTONE" FOR THE SOUTHEAST CORNER OF THE HEREIN DESCRIBED TRACT OF LAND,

THENCE, OVER AND ACROSS SAID 145.691 ACRE TRACT OF LAND, THE FOLLOWING SEVENTEEN (17) COURSES AND DISTANCES, NUMBERED 1 THROUGH 17,

1) N80°20'05"W, A DISTANCE OF 1034.85 FEET TO A CAPPED 1/2 INCH IRON ROD SET STAMPED "CBD SETSTONE" FOR CORNER AT THE BEGINNING OF A CURVE TO THE LEFT,
2) ALONG SAID CURVE TO THE LEFT, HAVING A RADIUS OF 225.00 FEET, AN ARC LENGTH OF 45.11 FEET, AND A CHORD THAT BEARS N12°12'59"W, A DISTANCE OF 45.04 FEET TO A CAPPED 1/2 INCH IRON ROD SET STAMPED "CBD SETSTONE" FOR CORNER,
3) N17°57'38"W, A DISTANCE OF 69.01 FEET TO A CAPPED 1/2 INCH IRON ROD SET STAMPED "CBD SETSTONE" FOR CORNER AT THE BEGINNING OF A CURVE TO THE RIGHT,
4) ALONG SAID CURVE TO THE RIGHT, HAVING A RADIUS OF 175.00 FEET, AN ARC LENGTH OF 84.43 FEET, AND A CHORD THAT BEARS N04°08'23"W, A DISTANCE OF 83.61 FEET TO A CAPPED 1/2 INCH IRON ROD SET STAMPED "CBD SETSTONE" FOR CORNER,
5) N09°40'53"E, A DISTANCE OF 11.70 FEET TO A CAPPED 1/2 INCH IRON ROD SET STAMPED "CBD SETSTONE" FOR CORNER,
6) N26°22'49"E, A DISTANCE OF 69.66 FEET TO A CAPPED 1/2 INCH IRON ROD SET STAMPED "CBD SETSTONE" FOR CORNER,
7) N80°19'42"W, A DISTANCE OF 90.03 FEET TO A CAPPED 1/2 INCH IRON ROD SET STAMPED "CBD SETSTONE" FOR CORNER,
8) S07°01'09"E, A DISTANCE OF 69.64 FEET TO A CAPPED 1/2 INCH IRON ROD SET STAMPED "CBD SETSTONE" FOR CORNER,
9) S09°40'53"W, A DISTANCE OF 11.70 FEET TO A CAPPED 1/2 INCH IRON ROD SET STAMPED "CBD SETSTONE" FOR CORNER AT THE BEGINNING OF A CURVE TO THE LEFT,
10) ALONG SAID CURVE TO THE LEFT, HAVING A RADIUS OF 225.00 FEET, AN ARC LENGTH OF 108.55 FEET, AND A CHORD THAT BEARS S04°08'23"E, A DISTANCE OF 107.50 FEET TO A CAPPED 1/2 INCH IRON ROD SET STAMPED "CBD SETSTONE" FOR CORNER,
11) S17°57'38"E, A DISTANCE OF 69.01 FEET TO A CAPPED 1/2 INCH IRON ROD SET STAMPED "CBD SETSTONE" FOR CORNER AT THE BEGINNING OF A CURVE TO THE RIGHT,
12) ALONG SAID CURVE TO THE RIGHT, HAVING A RADIUS OF 175.00 FEET, AN ARC LENGTH OF 20.42 FEET, AND A CHORD THAT BEARS S14°37'05"E, A DISTANCE OF 20.41 FEET TO A CAPPED 1/2 INCH IRON ROD SET STAMPED "CBD SETSTONE" FOR CORNER,
13) N80°20'05"W, A DISTANCE OF 688.44 FEET TO A CAPPED 1/2 INCH IRON ROD SET STAMPED "CBD SETSTONE" FOR CORNER,
14) S09°40'28"W, A DISTANCE OF 144.10 FEET TO A CAPPED 1/2 INCH IRON ROD SET STAMPED "CBD SETSTONE" FOR CORNER,
15) S80°12'23"W, A DISTANCE OF 201.67 FEET TO A CAPPED 1/2 INCH IRON ROD SET STAMPED "CBD SETSTONE" FOR CORNER AT THE BEGINNING OF A CURVE TO THE RIGHT,
16) ALONG SAID CURVE TO THE RIGHT, HAVING A RADIUS OF 225.00 FEET, AN ARC LENGTH OF 49.78 FEET, AND A CHORD THAT BEARS S86°32'41"W, A DISTANCE OF 49.68 FEET TO A CAPPED 1/2 INCH IRON ROD SET STAMPED "CBD SETSTONE" FOR CORNER, AND
17) S63°38'06"W, A DISTANCE OF 64.18 FEET TO A CAPPED 1/2 INCH IRON ROD SET STAMPED "CBD SETSTONE" FOR THE SOUTHWEST CORNER OF THE HEREIN DESCRIBED TRACT OF LAND, BEING IN THE WEST LINE OF SAID 145.961 ACRE TRACT OF LAND, SAME BEING IN THE EAST LINE OF STATE HIGHWAY 304 (120' R.O.W.)

THENCE, N09°40'28"E, WITH THE EAST LINE OF SAID STATE HIGHWAY 304 AND THE WEST LINE OF SAID 145.961 ACRE TRACT OF LAND, A DISTANCE OF 504.11 FEET TO A CALCULATED POINT FOR THE NORTHWEST CORNER OF THE HEREIN DESCRIBED TRACT OF LAND, BEING AT THE SOUTHWEST CORNER OF SAID BASTROP GROVE, SECTION 1,

THENCE, WITH THE SOUTH LINE OF SAID BASTROP GROVE, SECTION 1, THE FOLLOWING TWO (2) COURSES AND DISTANCES, NUMBERED 1 AND 2,

1) S80°19'43"E, A DISTANCE OF 1883.69 FEET TO A CAPPED 1/2 INCH IRON ROD SET STAMPED "CBD SETSTONE" FOR CORNER AT THE BEGINNING OF A CURVE TO THE LEFT, AND
2) ALONG SAID CURVE TO THE LEFT, HAVING A RADIUS OF 1000.00 FEET, AN ARC LENGTH OF 193.46 FEET, AND A CHORD THAT BEARS S85°51'51"E, A DISTANCE OF 193.16 FEET TO THE POINT OF BEGINNING AND CONTAINING 15.290 ACRES OF LAND.

FIELD NOTES – TRACT 2

BEING ALL OF THAT CERTAIN 8.242 ACRE TRACT OR PARCEL OF LAND OUT OF AND PART OF THE NANCY BLAKEY SURVEY, ABSTRACT NUMBER 98, SITUATED IN BASTROP COUNTY, TEXAS, BEING MORE PARTICULARY DESCRIBED AS BEING A PORTION OF THAT CALLED 145.691 ACRE TRACT CONVEYED TO MC BASTROP 71, LP., IN VOLUME 2097, PAGE 241, OFFICIAL PUBLIC RECORDS OF BASTROP COUNTY, TEXAS, SAID 8.242 ACRE TRACT OF LAND BEING MORE FULLY DESCRIBED BY METES AND BOUNDS AS FOLLOWS:

COMMENCING AT A MAG NAIL FOUND IN CONCRETE AT THE SOUTHWEST CORNER OF SAID 145.691 ACRE TRACT OF LAND, BEING IN THE EAST LINE OF STATE HIGHWAY 304 (120' R.O.W.), SAME BEING AT THE NORTHWEST CORNER OF A CALLED 5.021 ACRE TRACT OF LAND CONVEYED TO NANCY KELLY IN DOCUMENT NUMBER 201004563, OFFICIAL PUBLIC RECORDS OF BASTROP COUNTY, TEXAS,

THENCE, N09°40'28"E, WITH THE EAST LINE OF SAID HIGHWAY 304 AND THE WEST LINE OF SAID 145.691 ACRE TRACT OF LAND, A DISTANCE OF 462.32 FEET TO A CAPPED 1/2 INCH IRON ROD SET STAMPED "CBD SETSTONE" FOR THE SOUTHWEST CORNER AND THE POINT OF BEGINNING OF THE HEREIN DESCRIBED TRACT,

THENCE, S09°40'28"E, CONTINUING WITH THE WEST LINE OF SAID 145.691 ACRE TRACT OF LAND AND THE EAST LINE OF SAID HIGHWAY 304, A DISTANCE OF 1128.22 FEET TO A CAPPED 1/2 INCH IRON ROD SET STAMPED "CBD SETSTONE" FOR THE NORTHWEST CORNER OF THE HEREIN DESCRIBED TRACT OF LAND,

THENCE, OVER AND ACROSS SAID 145.691 ACRE TRACT OF LAND, THE FOLLOWING SIX (6) COURSES AND DISTANCES, NUMBERED 1 THROUGH 6,

1) N82°57'59"E, A DISTANCE OF 81.42 FEET TO A CAPPED 1/2 INCH IRON ROD SET STAMPED "CBD SETSTONE" FOR CORNER AT THE BEGINNING OF A CURVE TO THE LEFT,
2) ALONG SAID CURVE TO THE LEFT, HAVING A RADIUS OF 275.00 FEET, AN ARC LENGTH OF 50.15 FEET, AND A CHORD THAT BEARS N85°25'49"E, A DISTANCE OF 50.08 FEET TO A CAPPED 1/2 INCH IRON ROD SET STAMPED "CBD SETSTONE" FOR CORNER,
3) N80°12'23"E, A DISTANCE OF 183.99 FEET TO A CAPPED 1/2 INCH IRON ROD SET STAMPED "CBD SETSTONE" FOR CORNER,
4) S09°40'28"W, A DISTANCE OF 1250.39 FEET TO A CAPPED 1/2 INCH IRON ROD SET STAMPED "CBD SETSTONE" FOR THE SOUTHEAST CORNER OF THE HEREIN DESCRIBED TRACT OF LAND,
5) N80°19'03"W, A DISTANCE OF 237.30 FEET TO A CAPPED 1/2 INCH IRON ROD SET STAMPED "CBD SETSTONE" FOR THE SOUTHEAST CORNER OF THE HEREIN DESCRIBED TRACT OF LAND, AND
6) N58°31'01"W, A DISTANCE OF 67.53 FEET TO THE POINT OF BEGINNING AND CONTAINING 8.242 ACRES OF LAND.

FIELD NOTES – TRACT 3

BEING ALL OF THAT CERTAIN 2.350 ACRE TRACT OR PARCEL OF LAND OUT OF AND PART OF THE NANCY BLAKEY SURVEY, ABSTRACT NUMBER 98, SITUATED IN BASTROP COUNTY, TEXAS, BEING MORE PARTICULARY DESCRIBED AS BEING A PORTION OF THAT CALLED 145.691 ACRE TRACT CONVEYED TO MC BASTROP 71, LP., IN VOLUME 2097, PAGE 241, OFFICIAL PUBLIC RECORDS OF BASTROP COUNTY, TEXAS, SAID 2.350 ACRE TRACT OF LAND BEING MORE FULLY DESCRIBED BY METES AND BOUNDS AS FOLLOWS:

BEGINNING AT A MAG NAIL FOUND IN CONCRETE AT THE SOUTHWEST CORNER OF SAID 145.691 ACRE TRACT OF LAND, BEING IN THE EAST LINE OF STATE HIGHWAY 304 (120' R.O.W.), SAME BEING AT THE NORTHWEST CORNER OF A CALLED 5.021 ACRE TRACT OF LAND CONVEYED TO NANCY KELLY IN DOCUMENT NUMBER 201004563, OFFICIAL PUBLIC RECORDS OF BASTROP COUNTY, TEXAS, FOR THE SOUTHWEST CORNER AND THE POINT OF BEGINNING OF THE HEREIN DESCRIBED TRACT,

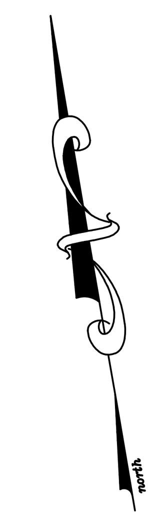
THENCE, N09°40'28"E, WITH THE EAST LINE OF SAID HIGHWAY 304 AND THE WEST LINE OF SAID 145.691 ACRE TRACT OF LAND, A DISTANCE OF 357.16 FEET TO A CAPPED 1/2 INCH IRON ROD SET STAMPED "CBD SETSTONE" FOR THE NORTHWEST CORNER OF THE HEREIN DESCRIBED TRACT OF LAND,

THENCE, OVER AND ACROSS SAID 145.691 ACRE TRACT OF LAND, THE FOLLOWING THREE (3) COURSES AND DISTANCES, NUMBERED 1 THROUGH 3,

1) N82°59'00"E, A DISTANCE OF 69.82 FEET TO A CAPPED 1/2 INCH IRON ROD SET STAMPED "CBD SETSTONE" FOR CORNER,
2) S80°19'14"E, A DISTANCE OF 233.12 FEET TO A CAPPED 1/2 INCH IRON ROD SET STAMPED "CBD SETSTONE" FOR THE NORTHEAST CORNER OF THE HEREIN DESCRIBED TRACT OF LAND, AND
3) S09°40'28"W, A DISTANCE OF 309.60 FEET TO A CAPPED 1/2 INCH IRON ROD SET STAMPED "CBD SETSTONE" FOR THE SOUTHEAST CORNER OF THE HEREIN DESCRIBED TRACT OF LAND, BEING IN THE NORTH LINE OF SAID 5.021 ACRE TRACT OF LAND, SAME BEING IN THE SOUTH LINE OF SAID 145.691 ACRE TRACT OF LAND,

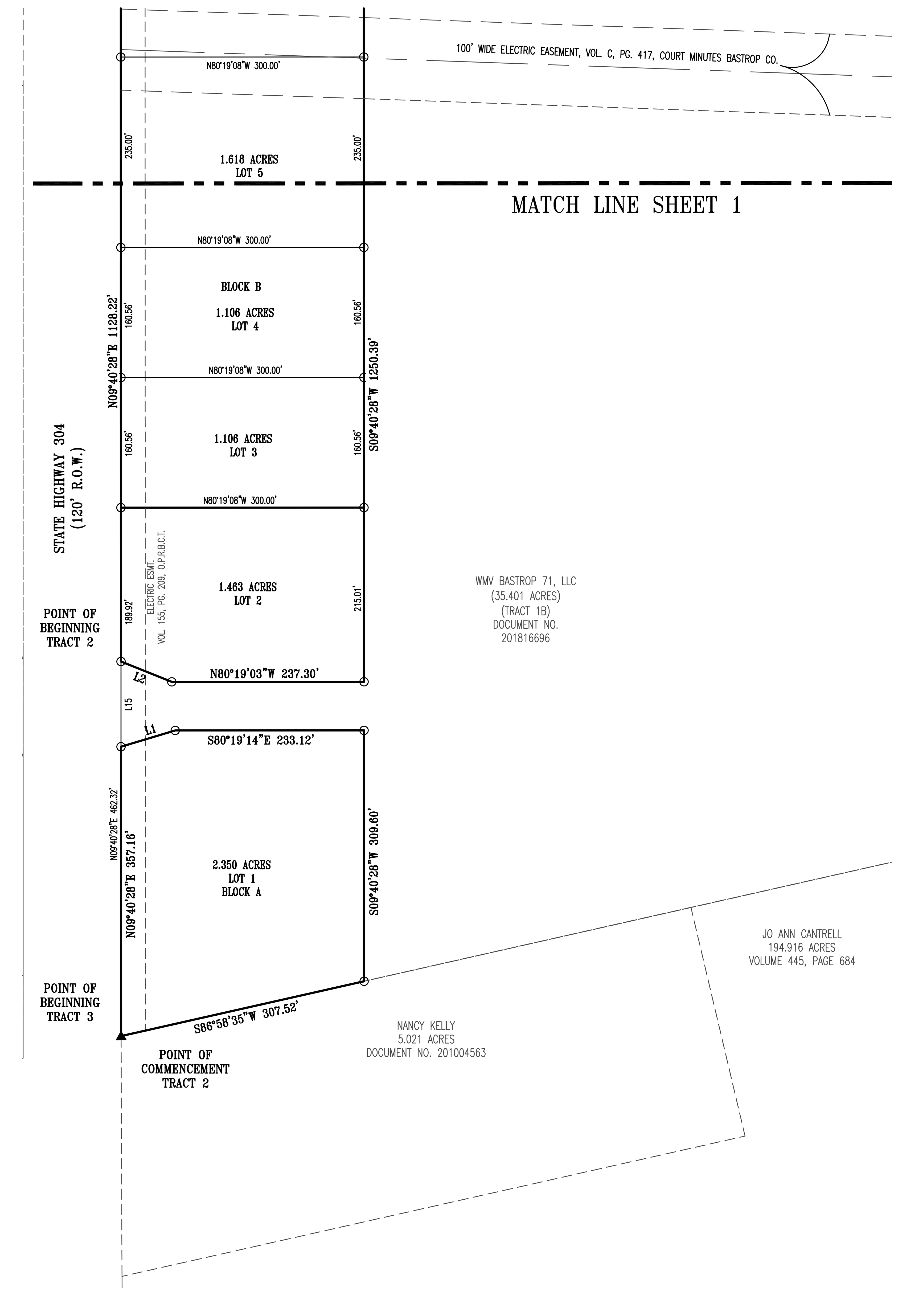
THENCE, S86°58'35"W, WITH THE SOUTH LINE OF SAID 145.691 ACRE TRACT AND THE NORTH LINE OF SAID 5.021 ACRE TRACT OF LAND, A DISTANCE OF 307.52 FEET TO THE POINT OF BEGINNING AND CONTAINING 2.350 ACRES OF LAND.

LEGEND
- ● 1/2" IRON ROD FOUND
- ○ 1/2" CAPPED IRON ROD SET
- ▲ MAG NAIL FOUND



SCALE: 1" = 100'
GRAPHIC SCALE

(IN FEET)
1 inch = 100 ft.



Carlson, Brigance & Doering, Inc.
FIRM ID #F3791 ◆ REG. # 10024900
Civil Engineering ◆ Surveying
5501 West William Cannon ◆ Austin, Texas 78749
Phone No. (512) 280-5160 ◆ Fax No. (512) 280-5165

PATH-J: AC2004LP\4697\SURVEY\PRELIMINARY PLAT – BASTROP GROVE.DWG

Grandfathering Review Committee

Date of Decision – May 4, 2021

Applicant: **Carlson, Brigance, and Doering, Inc.**
71 Retail Partners LP

Project: **#21-000090 – Bastrop Grove Section 2 Grandfathering Request**

Members:
Director of Planning & Development
City Engineer
Director of Public Works

DETERMINATION

The Grandfathering Review Committee has evaluated the above referenced project and this project is not Grandfathered due to expiration of the last submitted document from 4/04/2019.

BASIS OF DETERMINATION AND CLAIMS RECOGNIZED / REJECTED

The original lot layout and dimensions for Section 2 can be found in the Bastrop Grove Drainage Improvement. However, it appears a deed division of property inconsistent with State Law took place sometime between 10-01-2018 and 01-22-2019 as shown on the Proposed Preliminary Plat from 1-22-2019. In addition to the lot layout on the Propose Preliminary Plat an additional Exemption Application was submitted to the City of Bastrop on 04-04-2019 during a drainage moratorium. Unfortunately, all the applications were submitted over two years ago and have exceeded the time that allows for an exemption under the Local Government Code Chapter 245, Sec. 245.004.

SIGNED:

Trey Job

Trey Job, Assistant City Manager for Community Development

MC BASTROP 71, L.P.
8214 Westchester Drive, Ste 550
Dallas, TX 75225

May 25, 2021

Trey Job, Assistant City Manager
City of Bastrop, TX
Planning and Development Department
1311 Chestnut Street
Bastrop, TX 78602

Request for Reconsideration

Dear Trey,

MC BASTROP 71, L.P. ("MC 71") filed a Grandfathering Development Status Application on April 19, 2021 under City Code Art. 1.20 (the "Ordinance"). The Grandfathering Review Committee (the "GRC") issued a determination (the "GRC Determination") on May 4, 2021. MC 71 hereby requests reconsideration of the GRC Determination pursuant to the Ordinance.

The GRC Determination is required by the City for the City to make its own determination of its position on the application of Texas Local Government Code ("LGC") Chapter 245 ("LGC 245"), which provides protections from changes in local regulation as to an ongoing development project (such protections being commonly known as "vested rights"). Only LGC 245 determines the applicable vested rights, and to the extent the Ordinance seeks to limit vested rights or give the City control over the interpretation process (such as, but not limited to, establishing standards and burdens), <u>we protest, and submit this application under protest</u>. The GRC Determination is for the benefit of the City only and is not binding on MC 71 as to the nature or extent of vested rights. MC 71 reserves all its rights under LGC 245.

Vested Rights defined (emphasis added):

- "If a series of permits is required for a project, the orders, regulations, ordinances, rules, expiration dates, or other properly adopted requirements *in effect at the time the original application for the first permit in that series is filed shall be the sole basis for consideration of all subsequent permits required for the completion of the project*. All permits required for the project are considered to be a single series of permits. Preliminary plans and related subdivision plats, site plans, and all other development permits for land covered by the preliminary plans or subdivision plats are considered collectively to be one series of permits for a project." LGC 245.002(b)

- "Rights to which a permit applicant is entitled under this chapter *accrue on the filing of an original application or plan for development or plat application* that gives the regulatory agency fair notice of the project and the nature of the permit sought." LGC 245.002(a-1)

The Ordinance requires the following:

1. Filing with the Director of Planning and Development in writing within fifteen (15) business days of the date of the Grandfathering Review Committee's previous determination or the date of automatic denial;
2. State the reasons why the previous determination should be reversed or modified;
3. Present information that has not previously been presented for consideration by the Grandfathering Review Committee;
4. Provide an explanation of the legal and factual grounds of the request; and
5. Be accompanied by payment of the reconsideration fee established by the City Council, as codified in the city's fee schedule.

The GRC Determination states:

> "The Grandfathering Review Committee has evaluated the above referenced project and this project is not Grandfathered due to expiration of the last submitted document from 4/4/2019... Unfortunately, all the applications were submitted over two years ago and have exceeded the time that allows for an exemption under the Local Government Code Chapter 245, Sec 245.004."

This statement leaves MC 71 confused as to the specific basis for denial.

For purposes of this letter, the term "Project" shall refer to 25.882 acres owned by MC 71, shown in the Preliminary Plat Application dated 1-22-2019 (the "PP Application"), inclusive of the creation of the lots and related infrastructure and the construction of buildings thereon. Both the land development and the building development are entitled to vested rights. MC 71 has continuously pursued this Project since the filing of the PP Application. The scope and nature of the Project is well known to the City, as suburban retail/commercial pad site development for buildings consistent with surrounding developments such as the Medtail facility located on Highway 71 in the Bastrop Grove Project of 71 Retail Partners, L.P. The elements of the contemplated retail/commercial pad sites are relatively small buildings (usually 1 story), typically centered in each lot, with ample, surface parking surrounding the building, and cross access easements shared among the other pad sites. These lots are typically call "commercial reserves".

MC 71 asserts the following reasons the previous determination should be reversed:

- Texas LGC 245.004 does not contain an applicable time limit for exemption for the applications submitted for the Project, but only for building permits (LGC 245.004(1)).

- MC 71 properly filed the PP Application consistent with the requirements of LGC 245 with the City on 1-22-2019. This is the proper vesting date for the Project. Since 2005, LGC 245 does not require the City to "accept" a filing. See, LGC 245.002(a), (a-1) and (b), none of which required an "accepted" or "complete" application, and mention only an "original application." The Ordinance, particularly Sec. 1.20.010(g) is not consistent with LGC 245.

- While Texas LGC 245 does contain certain time limits under various provisions, none of those time limits are applicable for the Project. If the City's position is that the application lapsed under its internal requirements, then that is an inequitable result since it was the City which was refusing to process the filed applications, thus impeding the progress of the Project.

- Following the submission of the PP Application, MC 71 representatives held a meeting with Allison Land and the City Planning staff to review and discuss the PP Application. MC 71 received a memo from Allison Land containing a summary of that meeting (attached hereto as Exhibit "A"). That memo inaccurately characterizes the meeting as a "Pre-Application Meeting", but it was a meeting to discuss the application previously filed. But for the receipt of the PP Application, there would have been no meeting and as such the filing prompted the meeting. That memo directed MC 71 to submit an exemption application (the "Exemption Application"), which MC 71 properly did on 4-14-2019. The memo states that "After the submittal is deemed complete, Staff will take to the next available City Council meeting for approval to move forward with the Checklist option chosen and the development process". As such, the Exemption Application is pending action by the City.

- MC 71 has not withdrawn the PP Application or Exemption Application. In fact, MC 71's engineer routinely followed up with the City about the status of these items. In essence, the City seems to have stonewalled MC 71.

Because MC 71 properly filed applications for the Project consistent with the requirements of LGC 245 and those applications are still pending action by the City, and MC 71 is not aware of any legally enforceable limits on the relevant applications, the Project should be vested as of the filing of the PP Application under LGC 245.

MC 71 hereby presents new information that has not previously been presented for consideration by the Grandfathering Review Committee in this letter and attached hereto as "Exhibit A".

MC 71's request is based on the following legal and factual grounds:

- Texas LGC 245.002(a-1) states:
  "Rights to which a permit applicant is entitled under this chapter accrue *on the filing of an original application or plan for development or plat application* that gives the regulatory agency fair notice of the project and the nature of the permit sought." *emphasis added*

  - MC 71 did file the PP Application on 1-22-2019 properly and as required.
  - The PP Application was of sufficient detail to give fair notice of the Project and the nature of the permit sought.

- Texas LGC 245.002(2)(e) requires the City to provide notice within 45 days of filing if "the applicant fails to provide documents or other information necessary to comply with the agency's technical requirements relating to the form and content of the permit application". MC 71 did not receive any notice from the City regarding the PP Application or the Exemption Application of any deficiency in either application.

- Texas LGC 245.004(1) provides an exemption to LGC 245 for "a permit that is at least two years old, is issued for construction of a building or structure intended for human occupancy, or habitation, and is issued under laws, ordinances, procedures, rules, or regulations adopting only (A) uniform building, fire, electrical, plumbing, or mechanical codes adopted by a recognized national code organization; or (B) local amendments to those codes enacted solely to address imminent threats of destruction of property or injury to persons;".
  - This section is not applicable to the Project because the PP Application and Exemption Applications are not building permits as contemplated by LGC 245.004(1).

- Texas LGC 245.005 addresses "Dormant Projects". The Project is not a Dormant Project under Texas LGC 245.005 due to the following:
  - The PP Application and the Exemption Applications are not permits for the purpose of this section.
  - Even if they were, the time limits in Texas LGC 245.005 are not applicable because MC 71 has made progress towards completion of the Project in accordance with Texas LGC 245.005 (2) through MC 71's (i) filing the PP Application, (ii) filing the Exemption Application, and (iii) good faith attempt

to file with a regulatory agency an application for a permit necessary to begin or continue towards completion of the Project.

- Even if no progress towards completion of the Project had been made by MC 71, LGC 245.005 (b) states "Notwithstanding any other provision of this chapter, any ordinance, rule, or regulation enacted pursuant to this section shall place an expiration date on a project of no earlier than the fifth anniversary of the date the first permit application was filed for the project if no progress has been made towards completion of the project." The expiration of the PP Application and Exemption Application could be no earlier than 4-14-2024.

The City's decision did not reach all issues relating to vested rights for the Project. <u>If the City reverses its determination and finds that a vesting event occurred, then MC 71 requests the opportunity to review that decision and have a separate opportunity for reconsideration on the merits of that decision</u>.

The Ordinance requests legal grounds and seems to want a legal brief on this matter, when MC 71 is simply trying to comply with a City requirement to help it determine its own conclusion on vested rights, and the City has no authority to adjudicate vested rights that are binding on MC 71. Nonetheless, we attach an addendum with reference to LGC 245 and relevant case law. Our primary reliance is on the text of LGC 245, as cited herein and available online to the City.

MC Bastrop 71, L.P. and its representatives look forward to your reconsideration. Should any further information or clarification be required, please do not hesitate to contact us.

Sincerely,

Douglas M. MacMahon
Manager of the General Partner of MC Bastrop 71, L.P.

Addendum

Relevant Vested Rights Caselaw Supporting this Reconsideration Request

Hatchett v. West Travis County Public Utility Agency, 598 S.W.3d 744, (Tex. App—Austin, 2020, pet denied)- Summary of the current state of vested rights under LGC 245.

FLCT, Ltd. v. City of Frisco, 49 S.W.3d 238 (Tex. App.—Fort Worth 2016, pet. den.)- The exceptions to the "municipal zoning regulations" except to vested rights under LGC 245.004 is determined on an "as applied" basis to any regulations which "have an effect" on the listed exception issues. The exception for "property classification" means the permissible uses under the regulator scheme when vesting occurs. A project is entitled to all uses permitted when vesting occurs. "Fair notice" of a project incorporates all the city actual knows about the project, not just what the applicate documents. The definition of a "project" is broad.

City of San Antonio v. Greater San Antonio Builders Ass'n, 419 S.W.3d 597 (Tex. App.—San Antonio 2013, pet. den.)- A city may not add local limits to vested rights, only LGC 245 determines vested rights.

Harper Park Two, LP v. City of Austin, 359 S.W.3d 247 (Tex. App.—Austin 2011, pet. den.)- The entirety of a development project is considered in a "project", not components or phases. The definition of "permit" is very broad. The vesting is considered in the context of the regulatory scheme at the time to determine the scope of the project.

Hartsell v. Town of Talty, 130 S.W.3d 325, 326 (Tex. App.—Dallas 2004, pet. denied)- Vested rights extend to the entire development project, land and buildings.

Exhibit “A”

BASTROPTX
Heart of the Lost Pines / Est. 1832

MEMO

To: Brendan McEntee

From: Allison Land

cc: Staff

Date: February 13, 2019

Re: Pre-Application Meeting – Grove Commercial

City staff has generated notes from the meeting on February 5, 2019. The information discussed and comments made by staff during this meeting are not intended to constitute a formal review of your project. This meeting *does not substitute* for the formal review that will take place in the event you file a development application with the City. Information provided and comments made by staff during the meeting are based solely on the information provided by you prior to or during the meeting.

Upon submittal of the appropriate application(s), additional comments are to be expected that may or may not be discussed in this meeting. More detailed information provided by you concerning your project during staff's review of a formal application may alter comments made during the meeting depending on the situation.

Property Information

Address: TBD

R Number:

Jurisdiction: City Limits

Platted: No

In floodplain: partial

Water, Wastewater available: Nearby

Electricity available: Nearby

Toad Habitat Area: No

Current Zoning: General Retail with restrictions

Meeting Goal

Discuss commercial development

Items Discussed:

Drainage channel

- Needs to establish good vegetation
- Anticipated 9 to 10 feet/second eventually

Exemption:

- Requires pre-submission meeting (this one)
- Requires submittal of the Exemption Application and an associated Checklist: Planned Development District, Alternative Site Design, ETJ Agreement, or Waiver. A checklist and all items listed on the checklist must accompany the Application
- After the submittal is deemed complete, Staff will take to the next available City Council meeting for approval to move forward with the Checklist option chosen and the development process
- **Engineer Certification required. See Emergency Ordinance 2018-2-A Section 5b - link**
- Note: Documentation provided with the Exemption Application does NOT constitute a submittal for any required permits after the Exemption is granted
- This project could use either Planned Development or Alternative Design Standards
- Alternative Design Standards
  - Use new rainfall totals and Atlas 14 data
  - Add some water quality infrastructure
- Need to run the channel and anticipated development against Atlas 14 data to show that it works and that the new development tying in is accounted for
- If you can live with the setbacks, use Alternative Design Standards
- If not, use the Planned Development
  - Can keep high level, call out uses, driveway spacing
  - Need to show a concept plan
  - If you choose to address water quality, address the first 1.5 inches
  - Pervious pavers are allowed under this
  - Leave GR as the base zoning
  - Change setbacks (could be flexible, min/max), drainage standards, landscaping, etc. Get creative

Zoning

- Two story development will have a 60-foot building setback from the residential lots
  - To change: need either a zoning variance (no financial hardship) or a planned development
  - Variances are hard to justify and hard to support

Platting

- Lot of Record Verification or Platting is required before permits may be issued
- All lots must have public road frontage and utility access. Access easements and/or driveways across other lots does not provide public road frontage.
- Wants to do preliminary plat for all commercial parcels
- Channel sized for 50% cover of Nixon and 80% cover on the other side
- Preliminary plat:
  - Previously have submitted - Plat, grading, utility, engineering report discussing access, etc.
  - Checklist is the same now. Additional details are needed for the Exemption before the prelim can be submitted
- Note: still need to record Agnes St ROW by separate instrument

Utilities

- Lift station: does it have capacity for the south side of Agnes?
  - Stantec for capacity

Moving Forward

Action Items

- City
  - Send copy of PD to Brendan
- Applicant

Process Overview

What steps the project attendees need to follow to move forward in the project, in order of recommended completion.

- Exemption and Exception applications and checklists are available on the Building Bastrop website.
- Building/Permitting and Planning applications and checklists are available on the Planning & Development Department's website via the menu on the left.

1. Exemption Application with Planned Development Checklist
   a. This will go to P&Z and Council like a normal PD
2. Planning Application with Preliminary Plat Checklist
3.

City of Bastrop

"Where Preservation of the Past Combined with Progress for the Future Encourages Opportunities to Grow"

Pre-Application Meeting Sign-in Sheet (Staff):

Project & Location: Grove Commercial

Date: February 5, 2019

	Name	Title/Organization	Phone	Email
☐	Lynda Humble	City Manager	(512)-332-8800	lhumble@cityofbastrop.org
☒	Jerry Palady, PE	Director of Engineering	(512) 332-8846	jpalady@cityofbastrop.org
☐	James McCann, PE	Engineering Consultant		
☐	Matt Jones, AICP	Director of Planning	(512) 332-8840	mjones@cityofbastrop.org
☒	Jennifer C. Bills, AICP, LEED AP	Assistant Planning Director	(512) 332-8845	jbills@cityofbastrop.org
☐	Matt Lewis, CNU	Planning Consultant		
☒	Trey Job	Director of Water/Wastewater and Public Works	(512) 332-8932	tjob@cityofbastrop.org
☐	Curtis Hancock	Assistant Director of Water/Wastewater and Public Works	(512) 332-8964	chancock@cityofbastrop.org
☒	Allison Land	Planner/GIS Coordinator	(512) 332-8843	aland@cityofbastrop.org
☐	Kimberly Hanly (Tap & Impact Fees)	Coordinator, Water & Wastewater Department	(512) 332-8960	khanly@cityofbastrop.org
☐	Tim Goetz	Electric Superintendent, Bastrop Power & Light	(512) 332-8900	tgoetz@cityofbastrop.org
☐	Cheryl Renfro	Project Coordinator Bastrop Power & Light	(512) 332-8901	crenfro@cityofbastrop.org
☐	Andres Rosales	Fire Chief	(512) 332-8670	arosales@cityofbastrop.org
☐	Rod Stradling	Assistant Fire Chief	(512) 332-8670	rstradling@cityofbastrop.org
☐	David Brasich	Building Official	(512) 332-8847	Dbrasich@cityofbastrop.org
☐	Jean Riemenschneider	Bastrop Economic Development Corp.	(512) 332-8873	jean@bastropedc.org
☐	Carolyn Dill, PE	County Engineer, Bastrop County	(512) 581-7180	carolyn.dill@co.bastrop.tx.us
☐	Cari Croft (contact for Houston toad)	Lost Pines HCP Administrator, Bastrop County	(512) 332-7284	Cari.croft@co.bastrop.tx.us

City of Bastrop

"Where Preservation of the Past Combined with Progress for the Future Encourages Opportunities to Grow"

Pre-Application Meeting Sign-in Sheet (Project Attendees):

Project & Location: Grove Commercial

Date: February 5, 2019

Name	Title/Organization	Phone	Email*
Brendan McEntee			

*Email address will be used to send a copy of notes taken at this meeting, and as a further correspondence option as needed

June 15, 2021

71 Retail Partners LP
C/O Douglas MacMahon
8214 Westchester Drive, Suite 550
Dallas, TX 75225

Dear Mr. MacMahon,

I have reviewed the documents that have been submitted and the previous determination the Grandfathering Committee issued.

The Committee does not agree with your interpretation of LGC 245 and has determined that the original application (permit) was not complete and did not continue to move forward. This puts the permits beyond the two-year time frame for applying for a grandfathered status, per Local Government Code Chapter 245, Section 245.004.

Sincerely,

Trey Job

Trey Job
Acting Director of Planning
Assistant City Manager of Community Development

CC: Jennifer Bills, Assistant Planning Director

From:	Christine Methvin
To:	Vivianna Nicole Hamilton; Jennifer Bills; Allison Land
Cc:	Douglas Rummel; Brendan McEntee
Subject:	RE: Pre-Application Meeting Requests (4)
Date:	Wednesday, January 23, 2019 4:29:52 PM
Attachments:	image002.png image003.png image004.png image005.png

To all –

And…I was just informed that Bastrop Grove Pre-Application meeting was scheduled by Launa for Tuesday February 5 at 2:30 pm.

Christine

From: Christine Methvin
Sent: Wednesday, January 23, 2019 4:12 PM
To: 'Vivianna Nicole Hamilton' <vhamilton@cityofbastrop.org>; Jennifer Bills <jbills@cityofbastrop.org>; 'Allison Land' <aland@cityofbastrop.org>
Cc: Douglas Rummel <dougjr@cbdeng.com>; Brendan McEntee <bmcentee@cbdeng.com>
Subject: RE: Pre-Application Meeting Requests (4)

Thank you. I believe Allison has already scheduled Hunters Crossing for Tuesday, Deb., 5 with Doug. She can contact him and Brendan McEntee directly with other potential appointment dates.

Christine

From: Vivianna Nicole Hamilton <vhamilton@cityofbastrop.org>
Sent: Wednesday, January 23, 2019 3:46 PM
To: Christine Methvin <christine@cbdeng.com>; Jennifer Bills <jbills@cityofbastrop.org>
Cc: Douglas Rummel <dougjr@cbdeng.com>; Brendan McEntee <bmcentee@cbdeng.com>
Subject: RE: Pre-Application Meeting Requests (4)

Christine,

These have all been forwarded to our Planner Allison Land who will re reaching out to schedule a meeting with you.

Thanks!

Vivianna Nicole Hamilton
Planning Technician and GIS Specialist
Planning and Development Services
City of Bastrop, Texas

BASTROPTX
Heart of the Lost Pines
Est. 1832
Main 512-332-8840 | Fax 512-332-8829
vhamilton@cityofbastrop.org | www.cityofbastrop.org
P.O. Box 427 - 1311 Chestnut Street, Bastrop, Texas 78602

From: Christine Methvin <christine@cbdeng.com>
Sent: Wednesday, January 23, 2019 9:09 AM
To: Jennifer Bills <jbills@cityofbastrop.org>
Cc: Vivianna Nicole Hamilton <vhamilton@cityofbastrop.org>; Douglas Rummel <dougjr@cbdeng.com>; Brendan McEntee <bmcentee@cbdeng.com>
Subject: FW: Pre-Application Meeting Requests (4)
Importance: High

Good morning, Jennifer –

Please let us know when we might be able to get these 4 Pre-Application meetings scheduled:

Bastrop Grove Section 2
Double Eagle Ranch
Bastrop Village West
Hunters Crossing Commercial Tract

Thank you for your assistance.

All the best,

Christine M. Methvin
Project Coordinator

Carlson, Brigance & Doering, Inc.
Civil Engineering ✣ Surveying

Carlson, Brigance & Doering, Inc.
Firm ID# F3791
5501 West William Cannon Dr.

Austin, TX 78749
Email: christine@cbdeng.com
Office: 512-280-5160 x175
Cell: 512-484-6591
Website: www.cbdeng.com

From: Christine Methvin
Sent: Friday, January 18, 2019 10:25 AM
To: jbills@cityofbastrop.org
Cc: Vivianna Hamilton (vhamilton@cityofbastrop.org) <vhamilton@cityofbastrop.org>; Douglas Rummel <dougjr@cbdeng.com>
Subject: Pre-Application Meeting Requests (3)

Good morning, Jennifer –

Attached for consideration, please find 3 Pre-Application Meeting Requests for the following projects:

Double Eagle Ranch
Bastrop Village West
Hunters Crossing Commercial Tract

Coordination of appointment times should be directed to Doug Rummel. Please let us know if you have any concerns.

All the best,

Christine M. Methvin
Project Coordinator

Carlson, Brigance & Doering, Inc.
Civil Engineering ❖ Surveying

Carlson, Brigance & Doering, Inc.
Firm ID# F3791
5501 West William Cannon Dr.
Austin, TX 78749
Email: christine@cbdeng.com
Office: 512-280-5160 x175
Cell: 512-484-6591
Website: www.cbdeng.com

From:	Jennifer Bills
To:	Brendan McEntee
Cc:	Allison Land
Subject:	RE: Pre application meetings
Date:	Monday, February 4, 2019 4:12:49 PM

The appointments I see are:

You - Feb 5 (tomorrow) at 2:30 for Bastrop Grove Commercial
Doug - Feb 12 at 2:30 for Hunters Crossing PD

We are still working on scheduling West Bastrop Village and Double Eagle as they are/may be MUDs and have prior approvals/agreement so we need legal to attend.

Jennifer C. Bills, AICP, LEED AP
Assistant Planning Director

-----Original Message-----
From: Brendan McEntee <bmcentee@cbdeng.com>
Sent: Monday, February 4, 2019 4:04 PM
To: Jennifer Bills <jbills@cityofbastrop.org>
Cc: Allison Land <aland@cityofbastrop.org>
Subject: Pre application meetings

Jennifer

I think we have a couple pre application meetings scheduled for tomorrow. Can you confirm the times? Thanks.

Brendan

Sent from my iPhone

MEMO

To: Brendan McEntee

From: Allison Land

cc: Staff

Date: February 13, 2019

Re: Pre-Application Meeting – Grove Commercial

City staff has generated notes from the meeting on February 5, 2019. The information discussed and comments made by staff during this meeting are not intended to constitute a formal review of your project. This meeting *does not substitute* for the formal review that will take place in the event you file a development application with the City. Information provided and comments made by staff during the meeting are based solely on the information provided by you prior to or during the meeting.

Upon submittal of the appropriate application(s), additional comments are to be expected that may or may not be discussed in this meeting. More detailed information provided by you concerning your project during staff's review of a formal application may alter comments made during the meeting depending on the situation.

Property Information

Address: TBD

R Number:

Jurisdiction: City Limits

Platted: No

In floodplain: partial

Water, Wastewater available: Nearby

Electricity available: Nearby

Toad Habitat Area: No

Current Zoning: General Retail with restrictions

Meeting Goal

Discuss commercial development

Items Discussed:

Drainage channel
- Needs to establish good vegetation
- Anticipated 9 to 10 feet/second eventually

Exemption:
- Requires pre-submission meeting (this one)
- Requires submittal of the Exemption Application and an associated Checklist: Planned Development District, Alternative Site Design, ETJ Agreement, or Waiver. A checklist and all items listed on the checklist must accompany the Application
- After the submittal is deemed complete, Staff will take to the next available City Council meeting for approval to move forward with the Checklist option chosen and the development process
- **Engineer Certification required. See Emergency Ordinance 2018-2-A Section 5b - link**
- Note: Documentation provided with the Exemption Application does NOT constitute a submittal for any required permits after the Exemption is granted
- This project could use either Planned Development or Alternative Design Standards
- Alternative Design Standards
    - Use new rainfall totals and Atlas 14 data
    - Add some water quality infrastructure
- Need to run the channel and anticipated development against Atlas 14 data to show that it works and that the new development tying in is accounted for
- If you can live with the setbacks, use Alternative Design Standards
- If not, use the Planned Development
    - Can keep high level, call out uses, driveway spacing
    - Need to show a concept plan
    - If you choose to address water quality, address the first 1.5 inches
    - Pervious pavers are allowed under this
    - Leave GR as the base zoning
    - Change setbacks (could be flexible, min/max), drainage standards, landscaping, etc. Get creative

Zoning

- Two story development will have a 60-foot building setback from the residential lots
    - To change: need either a zoning variance (no financial hardship) or a planned development
    - Variances are hard to justify and hard to support

Platting

- Lot of Record Verification or Platting is required before permits may be issued
- All lots must have public road frontage and utility access. Access easements and/or driveways across other lots does not provide public road frontage.
- Wants to do preliminary plat for all commercial parcels
- Channel sized for 50% cover of Nixon and 80% cover on the other side
- Preliminary plat:
    - Previously have submitted - Plat, grading, utility, engineering report discussing access, etc.
    - Checklist is the same now. Additional details are needed for the Exemption before the prelim can be submitted
- Note: still need to record Agnes St ROW by separate instrument

Utilities

- Lift station: does it have capacity for the south side of Agnes?
  - Stantec for capacity

Moving Forward

Action Items

- City
  - Send copy of PD to Brendan
- Applicant

Process Overview

What steps the project attendees need to follow to move forward in the project, in order of recommended completion.

- Exemption and Exception applications and checklists are available on the Building Bastrop website.
- Building/Permitting and Planning applications and checklists are available on the Planning & Development Department's website via the menu on the left.

1. Exemption Application with Planned Development Checklist
   a. This will go to P&Z and Council like a normal PD
2. Planning Application with Preliminary Plat Checklist
3.

City of Bastrop

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Pre-Application Meeting Sign-in Sheet (Staff):

Project & Location: Grove Commercial

Date: February 5, 2019

	Name	Title/Organization	Phone	Email
☐	Lynda Humble	City Manager	(512)-332-8800	lhumble@cityofbastrop.org
☒	Jerry Palady, PE	Director of Engineering	(512) 332-8846	jpalady@cityofbastrop.org
☐	James McCann, PE	Engineering Consultant		
☐	Matt Jones, AICP	Director of Planning	(512) 332-8840	mjones@cityofbastrop.org
☒	Jennifer C. Bills, AICP, LEED AP	Assistant Planning Director	(512) 332-8845	jbills@cityofbastrop.org
☐	Matt Lewis, CNU	Planning Consultant		
☒	Trey Job	Director of Water/Wastewater and Public Works	(512) 332-8932	tjob@cityofbastrop.org
☐	Curtis Hancock	Assistant Director of Water/Wastewater and Public Works	(512) 332-8964	chancock@cityofbastrop.org
☒	Allison Land	Planner/GIS Coordinator	(512) 332-8843	aland@cityofbastrop.org
☐	Kimberly Hanly (Tap & Impact Fees)	Coordinator, Water & Wastewater Department	(512) 332-8960	khanly@cityofbastrop.org
☐	Tim Goetz	Electric Superintendent, Bastrop Power & Light	(512) 332-8900	tgoetz@cityofbastrop.org
☐	Cheryl Renfro	Project Coordinator Bastrop Power & Light	(512) 332-8901	crenfro@cityofbastrop.org
☐	Andres Rosales	Fire Chief	(512) 332-8670	arosales@cityofbastrop.org
☐	Rod Stradling	Assistant Fire Chief	(512) 332-8670	rstradling@cityofbastrop.org
☐	David Brasich	Building Official	(512) 332-8847	Dbrasich@cityofbastrop.org
☐	Jean Riemenschneider	Bastrop Economic Development Corp.	(512) 332-8873	jean@bastropedc.org
☐	Carolyn Dill, PE	County Engineer, Bastrop County	(512) 581-7180	carolyn.dill@co.bastrop.tx.us
☐	Cari Croft (contact for Houston toad)	Lost Pines HCP Administrator, Bastrop County	(512) 332-7284	Cari.croft@co.bastrop.tx.us

City of Bastrop

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Pre-Application Meeting Sign-in Sheet (Project Attendees):

Project & Location: Grove Commercial

Date: February 5, 2019

Name	Title/Organization	Phone	Email*
Brendan McEntee			

*Email address will be used to send a copy of notes taken at this meeting, and as a further correspondence option as needed

Jennifer Bills

From: Trey Job
Sent: Tuesday, April 23, 2019 4:07 PM
To: Brendan McEntee; Jennifer Bills
Cc: Jerry Palady; Maddy Brehaut
Subject: RE: Bastrop Grove Section 2 Exemption

Brendan, I have been following your emails back and forth with Jennifer and the group. Jennifer, Jerry and I have had multiple discussion on the drainage related to the Grove section 2.

After due consideration of your request to move the exemption process forward it is apparent we will require more information. You have provided basic general drainage information about the overall subdivision but the information you have provided is in sufficient and does not provide a level of detail in which the entire Development Review Committee is comfortable. We are going to place your item on a later agenda after we have a meeting with you, and the neighboring property owner (Waymaker) so we can discuss the drainage and any other issues caused by the prior deed division of the parent tract. Are you available on May 7, 2019.

As always we look forward to seeing you,

Thanks, Trey

Trey Job, CPM
Managing Director of
Public Works & Leisure Services
City of Bastrop, Texas

Main 512-332-8800 | Fax 512-321-1313
tjob@cityofbastrop.org | www.cityofbastrop.org
P.O. Box 427 - 1209 Linden Street, Bastrop, Texas 78602

From: Brendan McEntee [mailto:bmcentee@cbdeng.com]
Sent: Tuesday, April 23, 2019 12:51 PM
To: Jennifer Bills <jbills@cityofbastrop.org>
Cc: Jerry Palady <jpalady@cityofbastrop.org>; Trey Job <tjob@cityofbastrop.org>; Maddy Brehaut <mbrehaut@cbdeng.com>
Subject: RE: Bastrop Grove Section 2 Exemption

Jennifer,

It is our intention to obtain the approvals that can be obtained as there are underlying land deals that are ready to proceed into development plan and final plat preparation. If I understand your earlier emails, staff can support the Exemption as it relates to the Preliminary Plan with a note that further development and platting must comply with the appropriate regulations. This approval would allow the project to proceed to Planning and Zoning consideration of the Preliminary Plan. Assuming my understanding is correct then please place us on the agenda and I will see you tonight. Alternatively, please clarify any misunderstandings. Thanks and take care.

Brendan

From: Jennifer Bills <jbills@cityofbastrop.org>
Sent: Tuesday, April 23, 2019 11:46 AM
To: Brendan McEntee <bmcentee@cbdeng.com>
Cc: Jerry Palady <jpalady@cityofbastrop.org>; Trey Job <tjob@cityofbastrop.org>; Maddy Brehaut <mbrehaut@cbdeng.com>
Subject: RE: Bastrop Grove Section 2 Exemption

Brendan,

At this time, staff does not have enough drainage design information for the new lots that will be created by the preliminary plat to recommend the Exemption to City Council. The property owners may have an agreement for drainage easements and conveyance, but none of that has been reviewed by staff. These are the kind of issues that the moratorium was put in place to address.

While the drainage ordinance has not been approved, City Council has already seen the regulations and I am confident that the new regulations will be fully approved on May 14th.

If you want this on tonight's agenda, we can take it forward, however staff will recommend that the project needs to wait for the new stormwater drainage regulations.

Jennifer C. Bills, AICP, LEED AP
Assistant Planning Director

From: Brendan McEntee <bmcentee@cbdeng.com>
Sent: Tuesday, April 23, 2019 7:21 AM
To: Jennifer Bills <jbills@cityofbastrop.org>
Cc: Jerry Palady <jpalady@cityofbastrop.org>; Trey Job <tjob@cityofbastrop.org>; Maddy Brehaut <mbrehaut@cbdeng.com>
Subject: RE: Bastrop Grove Section 2 Exemption

Jennifer,

Good morning and thanks for the email. While I appreciate the recognition that the submittal meets the Exemption requirements I am concerned with that Exemption then requiring development compliance with the still under review Stormwater Drainage Manual. This seems to obviate the vesting provided in approving the Exemption and allowing the project to continue under current codes (of which it demonstrably should proceed). Additionally, the underlying land deals require the adjoiners (the Waymaker tract which is currently in for permitting) provide stormwater conveyance from the tracts within the Preliminary to the Bastrop Grove Drainage channel which completes the full collection, conveyance, discharge typically associated with stormwater. Based on the above it seems reasonable for the Exemption to be approved as submitted and for the projects to proceed. Please let me know your thoughts or if you would like to discuss further. Thanks and take care.

Brendan P. McEntee, P.E.
Branch Manager

Carlson, Brigance & Doering, Inc.
North Austin Office
12129 RR 620 N, Ste. 600
Austin, Texas 78750
Office: 512.280.5160
Cell: 512.599.0592

From: Jennifer Bills <jbills@cityofbastrop.org>
Sent: Monday, April 22, 2019 12:09 PM
To: Brendan McEntee <bmcentee@cbdeng.com>
Cc: Jerry Palady <jpalady@cityofbastrop.org>; Trey Job <tjob@cityofbastrop.org>
Subject: Bastrop Grove Section 2 Exemption

Hello Brendan,

We've reviewed your Exemption Application for Bastrop Grove Section 2. The drainage plan utilizing the channel for the region with Atlas 14 used for the calculations shows that they system will work on a regional level for the entire development.

What we don't know at this point is how the drainage is getting from Section 2 back to the channel. Without this information at this time, my recommendation to City Council would be accept the Exemption for the Preliminary Plat, that there is enough proof of concept that it will work, but that the application after that point will need to follow the new Stormwater Drainage Manual (Construction Plans, Final Plat, Site Development Plans). Let me know what you think about this. The new drainage ordinance will be going to City Council tomorrow night (4/23) for first reading, with the second on May 14th.

Jennifer C. Bills, AICP, LEED AP
Assistant Planning Director
City of Bastrop
Office: 512-332-8845

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Jennifer Bills

From: Alan Bojorquez <alan@texasmunicipallawyers.com>
Sent: Tuesday, April 23, 2019 3:34 PM
To: Jennifer Bills
Cc: Matt Jones; Trey Job; Jerry Palady; Eileen Youens
Subject: RE: Bastrop Grove Section 2 Exemption

Jennifer:

I can get a gist of the situation from the email exchanges below.

If necessary, staff could recommend that the City Council ***table*** the matter. They don't have to hear it tonight. They're not obligated to. We could postpone. No need to even bring it up and discuss it. Mayor could just announce at the beginning that it will not be heard tonight.

Note that the Temporary Moratorium (Emergency Ord. 2018-1, as amended) does not provide a deadline for decisions on Exemptions/ Exceptions.

First of all, if an application is ***incomplete***, it should not go forward. If the applicant has failed to submit vital information prior to the meeting, the application simply isn't ripe for consideration. That's not a judgment on the merits, it's merely procedural.

Second, if an application is ***complete*** but the data presented is insufficient to meet the standards as either an Exemption, or an Exception, it should go forward (in a timely manner, at some point) with a staff recommendation for denial.

Point of clarification:

(a) Exception: If a project is No Impact, or already permitted and Ongoing, or Grandfathered/ vested under LGC 245, it is an exception.

(b) Exemption: If a project wants to move forward despite the moratorium, it can (e.g., through Alternative Design Standards) but I doubt staff would recommend approval or the council would greenlight it unless the applicant was agreeing to (obligated to) comply with the new Drainage Manual.

    I'd be very reluctant to approve an exemption at this late stage if they were seeking to avoid the new Drainage Manual.

    If the city council were inclined to approve a project now, it would be within its purview to expressly condition that approval on compliance with Ordinance 2019-17 (the new Drainage Manual, as incorporated into Chapter 16 of the Bastrop Code of Ordinances).

Alan

Alan Bojorquez
Bastrop City Attorney
Bojorquez Law Firm, PC

12325 Hymeadow Dr. Ste. 2-100
Austin, Texas 78750
Work: (512) 250-0411
Fax: (512) 250-0749
Email: Alan@TexasMunicipalLawyers.com

BOJORQUEZ LAW FIRM, PC
TexasMunicipalLawyers.com

From: Jennifer Bills <jbills@cityofbastrop.org>
Sent: Tuesday, April 23, 2019 11:46 AM
To: Brendan McEntee <bmcentee@cbdeng.com>
Cc: Jerry Palady <jpalady@cityofbastrop.org>; Trey Job <tjob@cityofbastrop.org>; Maddy Brehaut <mbrehaut@cbdeng.com>
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Brendan,

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Assistant Planning Director

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Brendan P. McEntee, P.E.
Branch Manager

Carlson, Brigance & Doering, Inc.
North Austin Office
12129 RR 620 N, Ste. 600
Austin, Texas 78750
Office: 512.280.5160
Cell: 512.599.0592

From: Jennifer Bills <jbills@cityofbastrop.org>
Sent: Monday, April 22, 2019 12:09 PM
To: Brendan McEntee <bmcentee@cbdeng.com>
Cc: Jerry Palady <jpalady@cityofbastrop.org>; Trey Job <tjob@cityofbastrop.org>
Subject: Bastrop Grove Section 2 Exemption

Hello Brendan,

We've reviewed your Exemption Application for Bastrop Grove Section 2. The drainage plan utilizing the channel for the region with Atlas 14 used for the calculations shows that they system will work on a regional level for the entire development.

What we don't know at this point is how the drainage is getting from Section 2 back to the channel. Without this information at this time, my recommendation to City Council would be accept the Exemption for the Preliminary Plat, that there is enough proof of concept that it will work, but that the application after that point will need to follow the new Stormwater Drainage Manual (Construction Plans, Final Plat, Site Development Plans). Let me know what you think about this. The new drainage ordinance will be going to City Council tomorrow night (4/23) for first reading, with the second on May 14th.

Jennifer C. Bills, AICP, LEED AP
Assistant Planning Director
City of Bastrop
Office: 512-332-8845

Jennifer Bills

From: Jennifer Bills
Sent: Tuesday, April 23, 2019 11:46 AM
To: Brendan McEntee
Cc: Jerry Palady; Trey Job; Maddy Brehaut
Subject: RE: Bastrop Grove Section 2 Exemption

Brendan,

At this time, staff does not have enough drainage design information for the new lots that will be created by the preliminary plat to recommend the Exemption to City Council. The property owners may have an agreement for drainage easements and conveyance, but none of that has been reviewed by staff. These are the kind of issues that the moratorium was put in place to address.

While the drainage ordinance has not been approved, City Council has already seen the regulations and I am confident that the new regulations will be fully approved on May 14th.

If you want this on tonight's agenda, we can take it forward, however staff will recommend that the project needs to wait for the new stormwater drainage regulations.

Jennifer C. Bills, AICP, LEED AP
Assistant Planning Director

From: Brendan McEntee <bmcentee@cbdeng.com>
Sent: Tuesday, April 23, 2019 7:21 AM
To: Jennifer Bills <jbills@cityofbastrop.org>
Cc: Jerry Palady <jpalady@cityofbastrop.org>; Trey Job <tjob@cityofbastrop.org>; Maddy Brehaut <mbrehaut@cbdeng.com>
Subject: RE: Bastrop Grove Section 2 Exemption

Jennifer,

Good morning and thanks for the email. While I appreciate the recognition that the submittal meets the Exemption requirements I am concerned with that Exemption then requiring development compliance with the still under review Stormwater Drainage Manual. This seems to obviate the vesting provided in approving the Exemption and allowing the project to continue under current codes (of which it demonstrably should proceed). Additionally, the underlying land deals require the adjoiners (the Waymaker tract which is currently in for permitting) provide stormwater conveyance from the tracts within the Preliminary to the Bastrop Grove Drainage channel which completes the full collection, conveyance, discharge typically associated with stormwater. Based on the above it seems reasonable for the Exemption to be approved as submitted and for the projects to proceed. Please let me know your thoughts or if you would like to discuss further. Thanks and take care.

Brendan P. McEntee, P.E.
Branch Manager

Carlson, Brigance & Doering, Inc.
North Austin Office
12129 RR 620 N, Ste. 600

Austin, Texas 78750
Office: 512.280.5160
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Jennifer C. Bills, AICP, LEED AP
Assistant Planning Director
City of Bastrop
Office: 512-332-8845

MEMO

To: Kelly Cloud

From: Allison Land

cc: Staff

Date: March 29, 2019

Re: Pre-Application Meeting – 1.5 acres of The Grove retail section

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City staff has generated notes from the meeting on March 19, 2019. The information discussed and comments made by staff during this meeting are not intended to constitute a formal review of your project. This meeting *does not substitute* for the formal review that will take place in the event you file a development application with the City. Information provided and comments made by staff during the meeting are based solely on the information provided by you prior to or during the meeting.

Upon submittal of the appropriate application(s), additional comments are to be expected that may or may not be discussed in this meeting. More detailed information provided by you concerning your project during staff's review of a formal application may alter comments made during the meeting depending on the situation.

Property Information

Address: TBD

R Number: TBD

Jurisdiction: City Limits

Platted: No

In floodplain: No

Water, Wastewater available: Nearby-City

Electricity available: Nearby-Bluebonnet

Toad Habitat Area: No

Current Zoning: General Retail with Conditions

Meeting Goal

Discuss developing a 1.5 acres tract out of The Grove retail section

Processes Discussed:

Exemption:
- Requires pre-submission meeting (this one)
- Requires submittal of the Exemption Application and an associated Checklist: Planned Development District, Alternative Site Design, ETJ Agreement, or Waiver. A checklist and all items listed on the checklist must accompany the Application
- After the submittal is deemed complete, Staff will take to the next available City Council meeting for approval to move forward with the Checklist option chosen and the development process
- **Engineer Certification required. See Emergency Ordinance 2018-2-A Section 5b - link**
- Note: Documentation provided with the Exemption Application does NOT constitute a submittal for any required permits after the Exemption is granted
- Brendan should be taking care of this with the planned development

Zoning

- Engineers/Developer needs to apply for a Planned Development for the area
- The Planned Development will establish setbacks and other zoning standards
- A perfect submittal would take almost three months, but usually they are over four months
- The preliminary plat is contingent on the zoning being approved
- Brendan will need to submit the channel maintenance plan and HOA/POA documents to ensure maintenance will be planned

Platting

- Preliminary plat will need to include all the retail along SH 304 and Agnes St
- Regional drainage channel is designed to accept water from the entire site, but need to see how the water will convey across
    - Part of the channel maintenance plan is an overarching document for all property owners/businesses to participate
- Need to show preliminary utility plans, streets, driveways and access easements, etc.
- Review of utilities will require information about the residentially-planned tract. Review will require the retail and residential sections to work together for a comprehensive and cohesive design

Public Improvement Construction Plans

- This is where the utility system and infrastructure will be engineered and installed
    - Requires coordination with all the utility providers
- Once this is complete, a final plat can be done
- Hunters Point (public road extension) is technically part of the residential neighborhood

Final Plat

- This is where the contract will convey sale
- This establishes the final lot line placement and easements

Site Development:

- TxDOT Jurisdiction: Yes-SH 304
- Exterior building materials, landscaping, parking, etc will be established here
- Driveway placements are going to be tricky

    - Because of how the owner subdivided the residential center of the property with road access, no driveways will be permitted on SH 304
    - There will need to be access easements to connect all the retail/commercial sites
    - For this property, the driveway would need to come off of the proposed Hunters Point road extension, as far from the intersection with SH 304 as possible

Building Permits:

- End product planned:
    - Medical office and higher end retail
    - One story, masonry exterior, pitched roof
- The 2018 building codes will be adopted by the end of 2019

Moving Forward

Action Items

- City
  - Better checklists for all the processes coming soon
- Applicant
  - Follow up with sellers
  - Need a preliminary plat before a final plat can be applied for
  - Need to work out timeline with residential section since it is where Hunters Point will be constructed
  - Check with Brendan to ensure the planned development will work with the project concept and uses

Process Overview

What steps the project attendees need to follow to move forward in the project, in order of recommended completion.

- Exemption and Exception applications and checklists are available on the Building Bastrop website.
- Building/Permitting and Planning applications and checklists are available on the Planning & Development Department's website via the menu on the left.

1. Exemption and Planned Development District
2. Preliminary Plat
3. Public Improvement Construction Plans
4. Final Plat
5. Site Development Plan
6. Building Plans and associated trade permits

City of Bastrop

“Where Preservation of the Past Combined with Progress for the Future Encourages Opportunities to Grow”

Pre-Application Meeting Sign-in Sheet (Staff):

Project & Location:

Date:

	Name	Title/Organization	Phone	Email
☐	Lynda Humble	City Manager	(512)-332-8800	lhumble@cityofbastrop.org
☒	Jerry Palady, PE	Director of Engineering	(512) 332-8846	jpalady@cityofbastrop.org
☐	James McCann, PE	Engineering Consultant		
☐	Matt Jones, AICP	Director of Planning	(512) 332-8840	mjones@cityofbastrop.org
☒	Jennifer C. Bills, AICP, LEED AP	Assistant Planning Director	(512) 332-8845	jbills@cityofbastrop.org
☐	Matt Lewis, CNU	Planning Consultant		
☒	Trey Job	Director of Water/Wastewater and Public Works	(512) 332-8932	tjob@cityofbastrop.org
☐	Curtis Hancock	Assistant Director of Water/Wastewater and Public Works	(512) 332-8964	chancock@cityofbastrop.org
☒	Allison Land	Planner/GIS Coordinator	(512) 332-8843	aland@cityofbastrop.org
☐	Kimberly Hanly (Tap & Impact Fees)	Coordinator, Water & Wastewater Department	(512) 332-8960	khanly@cityofbastrop.org
☐	Tim Goetz	Electric Superintendent, Bastrop Power & Light	(512) 332-8900	tgoetz@cityofbastrop.org
☐	Cheryl Renfro	Project Coordinator Bastrop Power & Light	(512) 332-8901	crenfro@cityofbastrop.org
☐	Andres Rosales	Fire Chief	(512) 332-8670	arosales@cityofbastrop.org
☐	Rod Stradling	Assistant Fire Chief	(512) 332-8670	rstradling@cityofbastrop.org
☐	David Brasich	Building Official	(512) 332-8847	Dbrasich@cityofbastrop.org
☐	Jean Riemenschneider	Bastrop Economic Development Corp.	(512) 332-8873	jean@bastropedc.org
☐	Carolyn Dill, PE	County Engineer, Bastrop County	(512) 581-7180	carolyn.dill@co.bastrop.tx.us
☐	Cari Croft (contact for Houston toad)	Lost Pines HCP Administrator, Bastrop County	(512) 332-7284	Cari.croft@co.bastrop.tx.us

City of Bastrop

“Where Preservation of the Past Combined with Progress for the Future Encourages Opportunities to Grow”

Pre-Application Meeting Sign-in Sheet (Project Attendees):

Project & Location:

Date:

Name	Title/Organization	Phone	Email*

*Email address will be used to send a copy of notes taken at this meeting, and as a further correspondence option as needed

From: Vivianna Nicole Hamilton
To: Brendan McEntee (bmcentee@cbdeng.com)
Cc: Jennifer Bills; Allison Land
Subject: Bastrop Grove Phase 2 Memo - Incomplete Submittal
Date: Monday, January 27, 2020 1:08:15 PM
Attachments: 20200127130032303.pdf
image010.png
image011.png
image012.png

Brendan,

Please see the attached memo from Staff stating why the Preliminary Plat for Bastrop Grove Phase 2 cannot be accepted at this time.

Please contact Allison or Jennifer with any other questions you might have.

Thanks!

BASTROPTX
Heart of the Lost Pines
Est. 1832

Vivianna Nicole Hamilton
Planning Technician and GIS Specialist
Planning and Development Services
City of Bastrop, Texas

Main 512-332-8840 | Fax 512-332-8829
vhamilton@cityofbastrop.org | www.cityofbastrop.org
P.O. Box 427 - 1311 Chestnut Street, Bastrop, Texas 78602

BASTROPTX
Heart of the Lost Pines
Est. 1832

Date: January 27, 2020

To: Brendan McEntee

From: Jennifer C. Bills, Assistant Planning Director

Re: **Bastrop Grove Phase 2 Submittal – Does not meet initial Completeness Check**

Mr. McEntee,

We cannot accept the Bastrop Grove Phase 2 Preliminary Plat for the following reasons:

- A Preliminary Drainage Plan must first be approved and included in the submittal.
- Review fee check was not included.

If you have any questions, please contact the Planning Department.

Thanks,

Jennifer C. Bills

Jennifer C. Bills

MC BASTROP 71, L.P.
8214 Westchester Drive, Ste 550
Dallas, TX 75225

September 29th, 2021

City of Bastrop
Zoning Board of Adjustment
1311 Chestnut Street
Bastrop, TX 78602

Request for Appeal – Second Meeting

Dear Members of the Zoning Board of Adjustment,

As requested in our meeting on September 7th, we have reviewed the submittals for the development of Section 5 of Bastrop Grove (the "Project") and related correspondence with City staff.

In summary:

- We submitted the Original Application for the Project on January 22, 2019.
- The original application **was complete**.
- We did not receive any correspondence from the City staff, written or otherwise, that the Original Application was incomplete.
    - We note that LGC 245 requires written notice within ten business days if the City staff contends an application is incomplete.
- Following the submission of the Original Application, we attended a meeting with City staff on February 5th, 2019 to discuss the Project.
- At that meeting, we were instructed to file an Exemption Application as a next step, which we did on April 4, 2019.
    - These instructions were documented in a memo from Allison Land on February 13, 2019, which summarized the meeting.
- The exemption application **was complete**.
- We did not receive any correspondence from the City staff, written or otherwise, that the Exemption Application was incomplete.
- These applications have never been withdrawn.
- We continued to submit additional applications in an attempt to move the project forward as shown in the attached timeline labeled as Exhibit "A".

Attached as Exhibit "B" and Exhibit "C" are signed affidavits from myself and Brendan McEntee, our engineer, confirming the above facts. I look forward to seeing you on October 6th.

Sincerely,

Douglas M. MacMahon
Manager, MC Bastrop 71 GP, LLC

Exhibit "A"
Submittal Timeline

MC 71 has made the following applications in good faith to secure a permit necessary to begin or continue towards completion of the Project. All applications for permits have been for the same Project since filing the Original Application:

- Application dated 10-01-2018 for Bastrop Grove Drainage Improvements
- Application dated 01-22-2019 for Preliminary Plat Bastrop Grove, Section 2
- Application dated 01-22-2019 for Plat Details and Drainage Improvements Report
- Application dated 04-14-2019 for Bastrop Grove Section 2 Exemption Application
- Application dated 01-13-2020 for Preliminary Plat, Bastrop Grove, Section 5
- Application dated 01-13-2020 for Preliminary Drainage, Bastrop Grove, Section 5
- Application dated 01-13-2020 for Preliminary Infrastructure, Bastrop Grove, Section 5
- Application Resubmittal dated 06-01-2020 for Preliminary Plat, Bastrop Grove, Section 5
- Application Resubmittal dated 06-01-2020 for Preliminary Drainage, Bastrop Grove, Section 5
- Application Resubmittal dated 06-01-2020 for Preliminary Infrastructure Submittal, Bastrop Grove, Section 5
- Application dated 06-08-2020 for Preliminary Plat Application Bastrop Grove, Section 5
- Application Resubmittal dated 06-15-2020 for Preliminary Plat, Bastrop Grove, Section 5
- Application Resubmittal dated 06-15-2020 for Preliminary Drainage, Bastrop Grove, Section 5
- Application Resubmittal dated 06-15-2020 for Preliminary Infrastructure Submittal, Bastrop Grove, Section 5
- Application dated 11-06-2020 for Bastrop Grove Neighborhood Regulating Plan, North and South of Agnes
- Application dated 11-09-2020 for Bastrop Grove B3 Warrant Request
- Application dated 03-16-2021 for Bastrop Grove Neighborhood Regulating Plan, South of Agnes

Exhibit "B"
Affidavit of Brendan McEntee

AFFIDAVIT OF BRENDAN MCENTEE, P.E.

STATE OF TEXAS)
)
COUNTY OF TRAVIS)

BEFORE ME, the undersigned authority, on this day personally appeared Brendan McEntee, P.E., who being upon his oath, deposed and said:

1. "My name is Brendan McEntee. I am capable of making this affidavit. The facts stated in this affidavit are within my personal knowledge and are true and correct. I am a professional engineer licensed to practice in Texas since 2005. I have practiced civil engineering with the Austin-based firm Carlson, Brigance & Doering, Inc. ("CBD") since June 2016. I have been a professional engineer for more than 20 years.

2. A significant part of my engineering practice deals with subdivision platting. I have been involved in hundreds of plats in my engineering career and consider myself as proficient in platting. I have been active in real estate development in the City of Bastrop since 2016 and have handled many plats filed with the City of Bastrop. Furthermore, I believe that CBD has been one of the top engineering firms handling commercial and residential community plats in the City of Bastrop for decades. I am and have been familiar with the subdivision platting regulations of the City of Bastrop throughout my time working with the City of Bastrop on subdivision

platting matters. I am also familiar with the platting-application process in the Greater Austin area and have experience with many other small cities like Bastrop.

3. I prepared the original application for Preliminary Plat and related materials that MC Bastrop 71, L.P. filed on January 22, 2019 (the "Original Application") with the City of Bastrop for its development along Agnes Road. The City of Bastrop recently alleged that the Original Application filed by MC Bastrop 71, L.P. was incomplete.

4. I did not receive—and I am not aware of—any written notice from the City of Bastrop asserting that the applications were incomplete, and specifically none within ten business days of the date the application materials were filed.

5. I believe the Original Application to be complete based on my experience preparing and submitting applications in the City of Bastrop and for similar developments in Central Texas. Any minor discrepancies, errors, or omissions do not make a plat application incomplete. It is common for a plat application to result in several resubmissions as a developer works with City Staff to refine issues as part of a cooperative review and approval process. There is room for disagreement on the interpretation of certain aspects of subdivision platting rules and regulations, and simply because a

city doesn't like your plat application doesn't make it incomplete.

FURTHER AFFIANT SAITH NOT.

Brendan McEntee, P.E.

SWORN TO AND SUBSCRIBED BEFORE ME, a Notary Public, on September 22, 2021, to certify which witness my hand and official seal of office.

NOTARY PUBLIC STATE OF TEXAS
MATTHEW SYNATSCHK
Notary Public, State of Texas
My Commission Expires
June 03, 2025
NOTARY ID 13313659-6

[SEAL]

Notary Public, State of Texas

Exhibit "C"
Affidavit of Douglas MacMahon

AFFIDAVIT OF DOUGLAS MACMAHON

STATE OF TEXAS)
)
COUNTY OF DALLAS)

BEFORE ME, the undersigned authority, on this day personally appeared Douglas MacMahon, Manager of the General Partner for MC Bastrop 71, L.P., who being upon his oath, deposed and said:

1. "My name is Douglas MacMahon. I am capable of making this affidavit. The facts stated in this affidavit are within my personal knowledge and are true and correct. I am an experienced real estate developer in the State of Texas, familiar with the planning and government-application process for real estate development, specifically including platting. I have been involved in many plats throughout the State of Texas. I assisted in the application and platting process relating to real property MC Bastrop 71, L.P. owns along Agnes Road in Bastrop County, Texas. I am providing this affidavit to the Board of Adjustment of the City of Bastrop for consideration in MC Bastrop 71, L.P.'s grandfathering application.
2. I have read the original application for Preliminary Plat and related materials that MC Bastrop 71, L.P. filed on January 22, 2019 (the "Original Application") with the City of Bastrop for its development along Agnes Road and the applicable subdivision platting ordinances of the City of Bastrop.
3. The City of Bastrop recently alleged that the Original Application filed by MC Bastrop 71, L.P. was incomplete.

4. I have not received—and I am not aware of—any written notice that MC Bastrop 71, L.P.'s platting applications were incomplete, and specifically none within ten business days of the date the application materials were filed.

5. I believe the Original Application and related materials to be complete based on my experience in the real estate development business.

6. I hired a local, qualified, and experienced engineering firm to prepare and file the plat application with the intent to file a complete plat application.

7. If I had notice of any incomplete aspect of the plat application, I would have immediately caused them to be cured so that the plat application was complete, but because I had no such notice, I was denied that opportunity."

FURTHER AFFIANT SAITH NOT.

Manager of the General Partner
for MC Bastrop 71, L.P.

SWORN TO AND SUBSCRIBED BEFORE ME, a Notary Public, on September 22, 2021, to certify which witness my hand and official seal of office.

[SEAL]

ANDREW SAMPLES
Notary Public, State of Texas
Comm. Expires 01-20-2026
Notary ID 132879580

Andrew Samples

Notary Public, State of Texas